TECHPRO II™

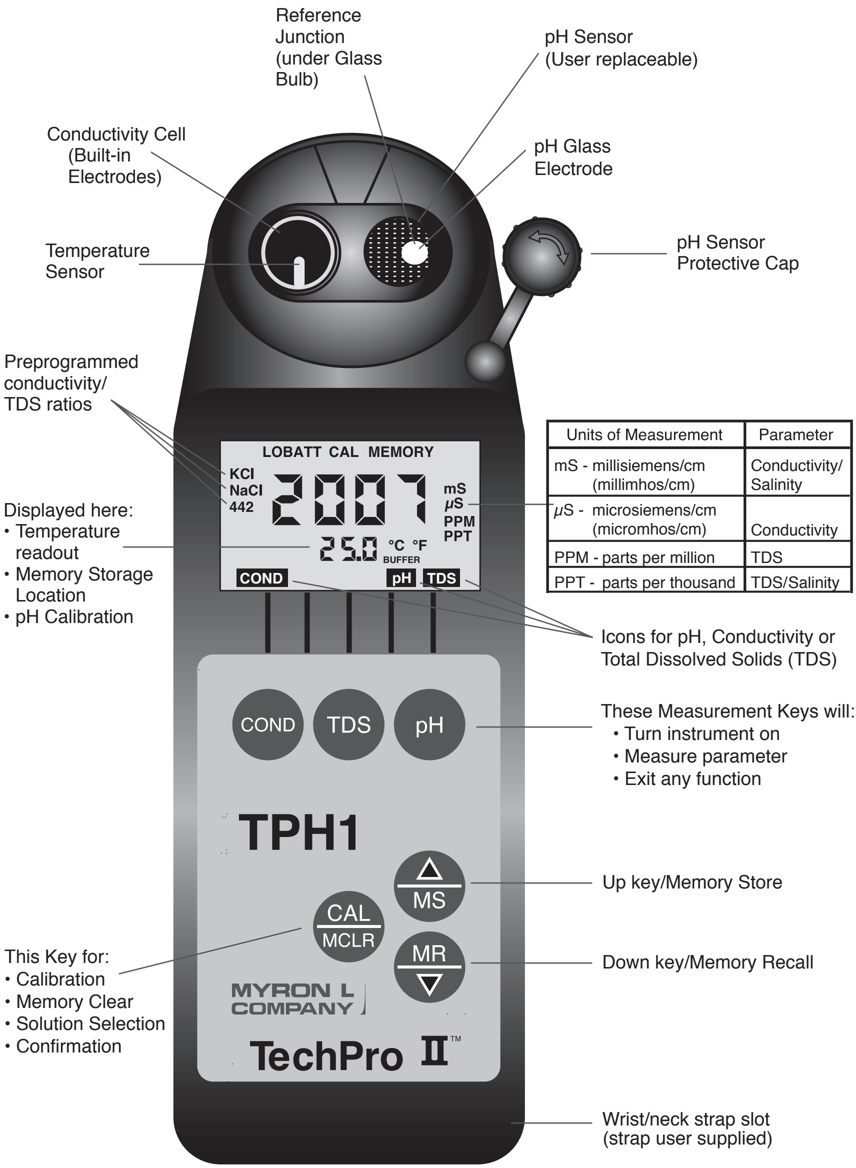
Operation Manual

MODELS TPH1, TP1 & TH1

MYRON L COMPANY
Water Quality Instrumentation
Accuracy • Reliability • Simplicity

06 January 10

Instrument Illustration



Units of Measurement	Parameter
mS - millisiemens/cm (millimhos/cm)	Conductivity/ Salinity
µS - microsiemens/cm (micromhos/cm)	Conductivity
PPM - parts per million	TDS
PPT - parts per thousand	TDS/Salinity

MODEL TPH1 Shown

For detailed explanations, see Table of Contents

06 jan 10

CE

I. INTRODUCTION

Thank you for selecting the feature-packed TechPro II™, one of the Myron L Company's latest in an increasing line of instruments utilizing advanced microprocessor-based circuitry and SMT manufacturing processes. This circuitry makes the instrument extremely accurate, reliable and very easy to use.

The TechPro II incorporates several new features including: waterproof enclosure, keypad calibration, FULL 4 digit LCD, the addition of a 20 location memory storage, and enhanced performance to name just some of the improvements. Additionally, "salinity" units may be selected. See Features and Specifications on pages 2 & 3.

For your convenience, on the bottom side of your TechPro II is a brief set of instructions.

Special note ... For the TPH1 & TP1 models, conductivity and TDS require mathematical correction to 25°C values (ref. Temperature Compensation, pg. 25). On the left of the TechPro II's liquid crystal display is shown an indicator of the salt solution characteristic used to model temperature compensation (Tempco) of conductivity and its TDS conversion. The indicator may be KCl, NaCl, or 442™. Selection affects the temperature correction of conductivity, and the calculation of TDS from compensated conductivity (ref. Conductivity Conversion to Total Dissolved Solids (TDS), pg. 28).

The selection can affect the reported conductivity of hot or cold solutions, and will change the reported TDS of a solution. Generally, using KCl for conductivity, and 442™ (Natural Water characteristic) for TDS will reflect present industry practice for standardization. This is how your instrument, as shipped from the factory, is set to operate. For use in sea water desalination for example, both the CONDuctivity and TDS may easily be changed to NaCl.

II. FEATURES and SPECIFICATIONS

A. Features

- Ranges:
  Conductivity/TDS — 0-20,000 μS/ppm (TPH1 & TP1)
  pH — 0-14 (TPH1 & TH1)
- Superior resolution four (4) digit LCD
- Conductivity/TDS accuracy of ±1% of reading
- pH accuracy of ±.01 pH units (TPH1 & TH1)
- All electrodes are internal for maximum protection
- Waterproof to 1 meter/3 feet
- Memory storage (20 readings)
- Autoranging Conductivity/TDS (TPH1 & TP1)
- Easy keypad calibration
- Prompts for simple pH calibration (TPH1 & TH1)
- Factory calibrations stored in microprocessor
- User selectable Conductivity/TDS modes (TPH1 & TP1)
- 3 "User Selectable" solution conversions (tempcos) (TPH1 & TP1)
- User Selectable "Salinity" units (TPH1 & TP1)
- Temperature accuracy of ±0.1°C/F
- Automatic Temperature Compensation to 25°C
- Temperature Compensation disable feature

B. General Specifications

Display	4 Digit LCD
Dimensions (LxWxH)	196 x 68 x 64 mm 7.7 x 2.7 x 2.5 in.
Weight	320 g/11.2 oz.
Case Material	ABS
Cond/TDS Cell Material	ABS
Cond/TDS Electrodes	316 Stainless Steel
Cond/TDS Cell Capacity	5 ml/0.2 oz.
pH Sensor Well Capacity	1,2 ml/0.04 oz. (TPH1 & TH1)
Power	9V Alkaline Battery
Battery Life	>100 Hours/5000 Readings
Operating/Storage Temperature	0-55°C/32-132°F
Protection Ratings	IP67/NEMA 6 (waterproof to 1 meter/3 feet)

Additional information is available on our website at:

www.myronl.com

CE

C. Specification Chart

	pH (TPH1 & TH1)	Conductivity	TDS	Temperature
Ranges	0-14 pH	0-9999 μS/cm 10-20 mS/cm in 3 autoranges	0-9999 ppm 10-20 ppt in 3 autoranges	0-71°C 32-160°F
Resolution	0.01 pH	0.1 (<1000 μS) 1.0 (<10 mS) 0.01 (>10 mS)	0.1 (<1000 ppm) 1.0 (<10 ppt) 0.01 (>10 ppt)	0.1°C/F
Accuracy	±0.01 pH	±1% of reading		±0.1°C/F
Auto Temperature Compensation	0-71°C 32-160°F	0-71°C 32-160°F		
Conductivity or TDS Ratios		KCl, NaCl, or 442™		

D. Warranty/Service

The Myron L TechPro II™, excluding the pH sensor (TPH1 & TH1), has a Two (2) Year Limited Warranty. The pH sensor (TPH1 & TH1) has a Six (6) Month Limited Warranty. If an instrument fails to operate properly, see Troubleshooting Chart, pg. 22. The battery and pH sensor (TPH1) are user-replaceable. For other service, return the instrument prepaid to the Myron L Company.

MYRON L COMPANY
2450 Impala Drive
Carlsbad, CA 92010-7226 USA
+1-760-438-2021
E-Mail: info@myronl.com
techquestions@myronl.com
www.myronl.com

If, in the opinion of the factory, failure was due to materials or workmanship, repair or replacement will be made without charge. A reasonable service charge will be made for diagnosis or repairs due to normal wear, abuse or tampering. This warranty is limited to the repair or replacement of the TechPro II only. The Myron L Company assumes no other responsibility or liability.

E. TechPro II™ Series Models

TechPro II Models	TH1	TP1	TPH1
Parameters	pH & Temperature	Conductivity, TDS & Temperature	Conductivity, TDS, pH & Temperature

MADE IN USA

TABLE OF CONTENTS

III. RULES of OPERATION

A. Operation

Using the instrument is simple:

- Individual or multiple parameter readings may be obtained by filling individual sensors or entire cell cup area.
- Rinse the conductivity cell or pH sensor well (TPH1 &TH1) with test solution 3 times and refill. Temperature and/or measurement extremes will require additional rinses for maximum accuracy.
- Press the desired measurement key to start measurement. Pressing the key again restarts the 20 second auto "off" timer.
- Note the value displayed or press the MS key to store the reading (ref. Memory Storage, pg. 16). It's that simple!

B. Characteristics of the Keys

- Though your TechPro II has a variety of sophisticated options, it is designed to provide quick, easy, accurate measurements by simply pressing one key.
- All functions are performed one key at a time.
- There is no "off" key. After 20 seconds of inactivity the instrument turns itself off (60 seconds in CAL mode).
- Rarely is it necessary to press and *hold* a key (as in Procedure to Select a Solution, pg. 9; or Cond. or TDS Calibration, pg. 11).

C. Operation of the Keys (See Instrument Illustration on pg. i)

1. Measurement Keys in General

The measurement keys turn on the instrument in the mode selected. The parameter is shown at the bottom of the display, and the measurement units appear at the right. Pressing a measurement key does this even if you are in a calibration sequence and also serves to cancel a change (ref. Leaving Calibration, pg. 11).

2. COND and TDS Keys (TPH1 & TP1)

These keys are used with solution in the Conductivity Cell.

Precautions:

- While filling cell cup ensure no air bubbles cling on the cell wall.
- If the proper solution is not selected (KCl, NaCl or 442), (ref. Why Solution Selection is Available, pg. 9).

a. COND Key

Solution to be tested is introduced into the conductivity cell and a press of (COND) displays conductivity with units on the right. On the left is shown the solution type selected for conductivity.

b. TDS Key

A press of TDS displays Total Dissolved Solids with units on the right.

This is a display of the concentration of material calculated from compensated conductivity using the characteristics of a known material. On the left is shown solution type selected for TDS (ref. Solution Selection, pg. 9).

3. pH Key (TPH1 & TH1)

Measurements are made on the solution contained in the pH sensor well (ref. pH Measurement, pg. 29). The protective cap is removed, and the sensor well is filled and rinsed with the sample enough times to completely replace the pH Sensor Storage Solution.
After use, the pH sensor well must be refilled with Myron L pH Sensor Storage Solution, and the protective cap reinstalled securely (ref. Maintenance of the pH Sensor, pg. 8 and pH, pg. 20).

A press of pH displays pH readings. No units are displayed.

4. CAL/MCLR Key

A press of CAL/MCLR allows you to enter the calibration mode while measuring conductivity, TDS or pH. Once in CAL mode, a press of this key accepts the new value. If no more calibration options follow, the instrument returns to measuring (ref. Leaving Calibration, pg. 11).

If CAL/MCLR is held down for 3 seconds, CAL mode is not entered, but "**SEL**" appears to allow Solution Selection (ref. pg. 9) with the Up or Down keys. As in calibration, the CAL key becomes an "accept" key.
While reviewing stored records, the MCLR side of the key is active to allow clearing records (ref. Clearing a Record/Memory Clear, pg. 16).

5. UP or DOWN Keys

While measuring in any parameter, the ▲/MS or MR/▼ keys activate the Memory Store and Memory Recall functions.
While in CAL mode, the keys step or scroll the displayed value up or down. A single press steps the display and holding either key scrolls the value rapidly.
While in Memory Recall, these keys scroll the display up and down through the stack of records (ref. Memory Recall, pg. 16).

IV. AFTER USING the TechPro II

A. Maintenance of the Conductivity Cell (TPH1& TP1)

Rinse out the cell cup with clean water. Do not scrub the cell. For oily films, squirt in a foaming non-abrasive cleaner and rinse. (ref. Conductivity or TDS, pg. 20). Even if a very active cbhemical discolors the electrodes, this does not affect the accuracy; leave it alone.

B. Maintenance of the pH Sensor (TPH1 & TH1)

The sensor well must be kept wet with a solution. Before replacing the rubber cap, rinse and fill the sensor well with Myron L pH Sensor Storage Solution. If unavailable, use an almost saturated KCl solution, pH 4 buffer (ref. pH Buffer Solutions, pg. 24) or a saturated solution of table salt and tap water. NEVER USE DISTILLED WATER (ref. pH, pg. 20).

V. SPECIFIC RECOMMENDED MEASURING PROCEDURES

Verify proper solution setting (KCl, NaCl, or 442), (ref. Solution Selection, pg. 9).

NOTE: *After sampling high concentration solutions or temperature extremes, more rinsing may be required. When sampling low conductivity solutions, be sure the pH cap is well seated so that no solution washes into the conductivity cell from around the pH cap.*

A. Measuring Conductivity & Total Dissolved Solids (TDS)

1. Rinse cell cup 3 times with sample to be measured. (This conditions the temperature compensation network and prepares the cell.)

2. Refill cell cup with sample.

3. Press COND or TDS.

4. Note value displayed.

B. Measuring pH (TPH1 & TH1)

1. Remove protective cap by squeezing its flat sides and pulling up.

2. Rinse sensor well 3 times with sample to be measured. Shake out each sample to remove any residual liquid.

3. Refill both sensor wells with sample.

4. Press pH.

5. Note value displayed.

6. **IMPORTANT:** After use, fill pH sensor well with Myron L pH Sensor Storage Solution and replace protective cap. If Myron L pH Sensor Storage Solution is unavailable, use a strong KCl solution, a pH 4 buffer, or a saturated solution of table salt and tap water (ref. Cleaning Sensors, 2. pH, pg. 20). *Do not allow pH sensor to dry out.*

VI. <u>SOLUTION SELECTION (TPH1 & TP1)</u>

A. <u>Why Solution Selection is Available</u>

Conductivity and TDS require temperature correction to 25°C values (ref. Standardized to 25°C, pg. 25). Selection determines the temperature correction of conductivity and calculation of TDS from compensated conductivity (ref. Cond. Conversion to TDS, pg. 28).

B. <u>The 3 Solution Types</u>

On the left side of the display is the salt solution characteristic used to model temperature compensation of conductivity and its TDS conversion. Generally, using KCl for conductivity, and 442 (Natural Water characteristic) for TDS will reflect present industry practice for standardization. This is how your instrument is shipped from the factory (ref. Solution Characteristics, pg. 28). NaCl may be user selected for either.

C. <u>Calibration of Each Solution Type</u>

There is a separate calibration for each of the 3 solution types. Note that calibration of a 442 solution does not affect the calibration of a NaCl solution. For example: Calibration (ref. Conductivity or TDS Calibration, pg. 11) is performed separately for each type of solution one wishes to measure (ref. Conductivity/TDS Standard Solutions, pg. 24).

D. <u>Procedure to Select a Solution</u>

NOTE: Check display to see if solution displayed (KCl, NaCl or 442) is already the type desired. If not:

1. Press (COND) or (TDS) to select the parameter on which you wish to change the solution type.

2. Press and hold (CAL/MCLR) key for 3 seconds. "**SEL**" will be displayed (see Figure 1). For demonstration purposes, all 3 solution types are shown simultaneously.

Figure 1

3. Use the ▲/MS or MR/▼ key to select type of solution desired (ref. Solution Characteristics, pg. 28). The selected solution type will be displayed: KCl, NaCl or 442.

4. Press CAL/MCLR to accept new solution type.

> **In the first six sections, you have learned all you need to take accurate measurements. The following sections contain calibration, advanced operations and technical information.**

VII. CALIBRATION

A. Calibration Intervals

Generally, calibration is recommended about once per month with Conductivity or TDS solutions. Calibration with pH solutions should be checked twice a month. (ref. CALIBRATION INTERVALS, pg. 14).

B. Rules for Calibration of the TechPro II

1. Calibration Steps

a. Starting Calibration

Calibration is begun by pressing CAL/MCLR while measuring Conductivity, TDS or pH. Measuring continues, but the CAL icon is on, indicating calibration is now changeable.

The reading is changed with the ▲/MS and MR/▼ keys to match the known value. The calibration for each of the 3 solution types may be performed in either conductivity or TDS mode.

Depending on what is being calibrated, there may be 1, 2 or 3 steps to the calibration procedures.

Once in “CAL” mode, the CAL/MCLR key becomes an “ACCEPT” key. At each point, pressing CAL/MCLR accepts the new calibration value and steps you to the next adjustment (or out of CAL mode if there are no more steps).

To bypass a calibration step, simply press CAL/MCLR to accept the present value as is.

b. Leaving Calibration

Calibration is complete when the "**CAL**" icon goes out. Pressing any measurement key cancels changes not yet accepted and exits calibration mode.

Leaving pH after the 2nd buffer results in the same gain being entered in place of the 3rd buffer.

2. Calibration Limits

There are calibration limits. A nominal "FAC" value is an ideal value stored by the factory. Attempts to calibrate too far, up or down, from there will cause the displayed value to be replaced with "FAC". If you accept it (press the "Cal" key) you will have the original default factory calibration for this measurement. The need to calibrate so far out that "FAC" appears indicates a procedural problem, incorrect standard solution, a very dirty cell cup or an aging pH sensor (ref. Troubleshooting Chart, pg. 22).

C. Calibration Procedures

1. Conductivity or TDS Calibration (TPH1 & TP1)

a. Rinse conductivity cell three times with proper standard (KCl, NaCl, or 442) (ref. Cond/TDS Standard Solutions, pg. 24).

b. Refill conductivity cell with same standard. KCl-7000 used in Figure 2, pg. 11.

c. Press COND or TDS, then press CAL/MCLR, "**CAL**" icon will appear on the display (see Figure 2).

d. Press ▲/MS to MR/▼ step the displayed value toward the standard's value (7032 >7000) or hold a key down to scroll rapidly through the reading.

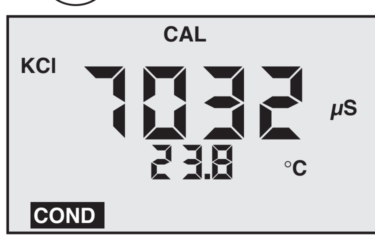


Figure 2

e. Press CAL/MCLR once to confirm new value and end the calibration sequence for this particular solution type. If another solution type is also to be measured, change solution type now and repeat this procedure.

2. <u>Reloading Factory Calibration (Cond or TDS)</u>

If calibration is suspect or known to be incorrect, and no standard solution is available, the calibration value can be replaced with the original factory value for that solution. This “FAC” value is the same for all TechPro IIs, and returns you to a known state without solution in the cell. The “FAC” internal electronics calibration (which bypasses the electrodes and cell) is not intended to replace calibration with conductivity standard solutions. If another solution type requires resetting, change solution type and repeat this procedure.

a. Press COND or TDS .

b. Press CAL/MCLR .

c. Press ▲/MS key until “**FAC**” appears and release.

d. Press CAL/MCLR to accept the factory calibration setting.

3. <u>pH Calibration (TPH1 & TH1)</u>

Important: Always “zero” your TechPro II with a pH 7 buffer solution before adjusting the gain with acid or base buffers, i.e., 4 and/or 10.

a. <u>pH Zero Calibration (TPH1 & TH1)</u>

1. Rinse sensor well 3 times with 7 buffer solution.

2. Refill both sensor wells with 7 buffer solution.

3. Press pH to verify the pH calibration. If the display shows 7.00, skip the pH Zero Calibration and proceed to section b. pH Gain Calibration.

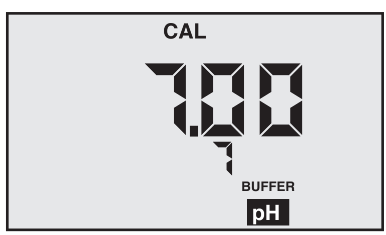


Figure 3

4. Press CAL/MCLR to enter calibration mode. The “**CAL**”, “**BUFFER**” and “**7**” annunciators will appear (see Figure 3). Displayed value will be the uncalibrated sensor.

NOTES: *If a wrong buffer is added (outside of 6-8 pH), “**7**” and “**BUFFER**”* *will flash, and the TechPro II will not adjust. The uncalibrated pH value displayed in step 4 will assist in determining the accuracy of the pH sensor. If the pH reading is above 8 with pH 7 buffer solution, the sensor well needs additional rinsing or the pH sensor is defective and needs to be replaced*.

5. Press ▲/MS or MR/▼ until the display reads 7.00.

NOTE: *Attempted calibration of >1 pH point from factory calibration will cause "**FAC**" to appear. This indicates the need for sensor replacement (ref. Troubleshooting pg. 22) or fresh buffer solution. <u>The "FAC" internal electronic calibration is not intended to replace calibration with pH buffers. It assumes an ideal pH sensor.</u> Each "FAC" indicates a factory setting for that calibration step (i.e., 7, acid, base).*

You may press CAL/MCLR to accept the preset factory value, or you may reduce your variation from factory setting by pressing ▲/MS or MR/▼.

6. Press CAL/MCLR to accept the new value. The pH Zero Calibration is now complete. You may continue with pH Gain Calibration or exit by pressing any measurement key.

b. <u>pH Gain Calibration (TPH1 & TH1)</u>

Important: Always calibrate or verify your TechPro II with a pH 7 buffer solution before adjusting the gain with acid or base buffers, i.e., 4 and/or 10, etc. Either acid or base solution can be used for the 2nd point "Gain" calibration and then the opposite for the 3rd point. The display will verify that a buffer is in the sensor well by displaying either "Acd" or "bAS".

1. The pH calibration mode is initiated by either completion of the pH Zero Calibration, or verifying 7 buffer and pressing the CAL/MCLR key twice while in pH measurement mode.

2. At this point the "**CAL**", "**BUFFER**" and "**Acd**" or "**bAS**" annunciators will be displayed (see Figures 4 and 5).

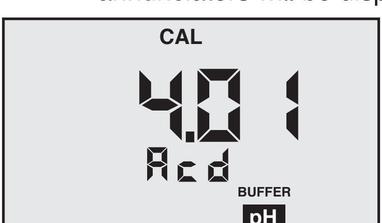


Figure 4

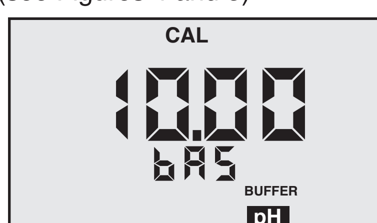


Figure 5

NOTE: *If the "**Acd**" and "**bAS**" indicators are blinking, the unit is indicating an error and needs either an acid or base solution present in the sensor well.*

3. Rinse sensor well 3 times with acid or base buffer solution.

4. Refill sensor well again with same buffer solution.

5. Press ▲/MS or MR/▼ until display agrees with buffer value.

6. Press CAL/MCLR to accept 2nd point of calibration. Now the display indicates the next type of buffer to be used.

Single point Gain Calibration is complete. You may continue for the 3rd point of Calibration (2nd Gain) or exit by pressing any measurement key. Exiting causes the value accepted for the buffer to be used for both acid and base measurements.
To continue with 3rd point calibration, use base buffer if acid buffer was used in the 2nd point, or vice-versa. Again, match the display to the known buffer value as in step 2 and continue with the following steps:

7. Repeat steps 3 through 5 using opposite buffer solution.

8. Press CAL/MCLR to accept 3rd point of calibration, which completes the Calibration procedure. Fill sensor well with Myron L pH Sensor Storage Solution and replace protective cap.

VIII. CALIBRATION INTERVALS

There is no simple answer as to how often one should calibrate an instrument. The TechPro II is designed to not require frequent recalibration. The most common sources of error were eliminated in the design, and there are no mechanical adjustments. Still, to ensure specified accuracy, any instrument must be checked against chemical standards occasionally.

A. Suggested Intervals

On the average, we expect calibration need only be checked monthly for the Conductivity or TDS functions. The pH (TPH1 & TH1) function should be checked every 2 weeks to ensure accuracy. Measuring some solutions will require more frequent intervals.

B. Calibration Tracking Records

To minimize your calibration effort, keep records. If adjustments you are making are minimal for your application, you can check less often. Changes in conductivity calibration should be recorded in percent. Changes in pH calibration (TPH1 & TH1) are best recorded in pH units.

Calibration is purposely limited in the TechPro II to ±10% for the conductivity cell, as any change beyond that indicates damage, not drift. Likewise, calibration changes are limited to ±1 pH unit (TPH1 & TH1), as any change beyond that indicates the end of the sensor's lifetime and replacement is recommended.

C. Conductivity, RES, TDS Practices to Maintain Calibration

1. Clean oily films or organic material from the cell electrodes with foaming cleaner or mild acid. Do not scrub inside the cell.

2. Calibrate with solutions close to the measurements you make. Readings are compensated for temperature based on the type of solution. If you choose to measure tap water with a KCl compensation, which is often done (ref. Temperature Compensation, pg. 25), and you calibrate with 442 solution because it is handy, the further away from 25°C you are, the more error you have. Your records of calibration changes will reflect temperature changes more than the instrument's accuracy.

3. Rinse out the cell with pure water after taking measurements. Allowing slow dissolving crystals to form in the cell contaminates future samples.

4. For maximum accuracy, keep the pH sensor cap on tight so that no fluid washes into the conductivity cell.

D. pH Practices to Maintain Calibration (TPH1 & TH1)

1. Keep the sensor wet with Myron L pH Sensor Storage Solution.

2. Rinse away caustic solutions immediately after use.

IX. MEMORY

This feature allows up to 20 readings with their temperatures to be stored simultaneously for later recall.

A. Memory Storage

1. While displaying a measurement, press ▲ MS to record the displayed value.

2. "**MEMORY**" will appear and the temperature display will be momentarily replaced by a number (1-20) showing the position of the record. Figure 6 shows a reading of 1806 μS stored in memory record #4.

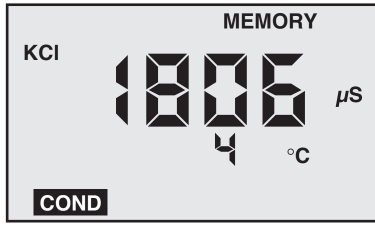


Figure 6

B. Memory Recall

1. Press any measurement key.

2. Press MR ▼, "**MEMORY**" will appear, and the display will show the last record stored.

3. Press ▲ MS or MR ▼ to scroll to the record location desired (the temperature display alternates between temperature recorded and location number).

4. Press any measurement key to leave memory recall or allow to automatically turn off.

C. Clearing a Record/Memory Clear

After recalling a certain record location, press CAL/MCLR to clear that memory. This space will be the place for the next memory record, unless you scroll to another empty position before ending the recall sequence. The next memory stored will go into the next highest available memory location.
Example: You have locations 1-7 filled, and wish to clear the conductivity reading stored in record location #**3** and replace it with a pH reading.

1. Press MR ▼ and scroll to location #**3**.

2. Press CAL/MCLR to clear old record #**3**.

3. Fill pH sensor well with sample.

4. Press pH to measure sample and press ▲ MS to store reading in location #**3**.

5. The next memory stored will go into location #**8**.

6. To clear **<u>all</u>** records: After pressing MR ▼, scroll down. "**CLr ALL**" will be displayed (see Figure 7).

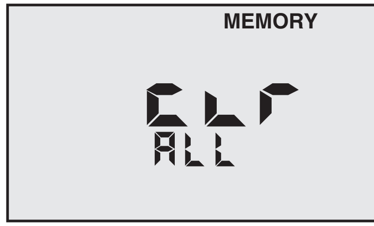


Figure 7

7. Press CAL MCLR. All records will be cleared.

X. <u>TEMPERATURE FORMAT "Centigrade & Fahrenheit"</u>

1. Press any measurement key.

2. Press MR ▼ repeatedly until either "**C**" or "**F**" is displayed. (see Figures 8 and 9).

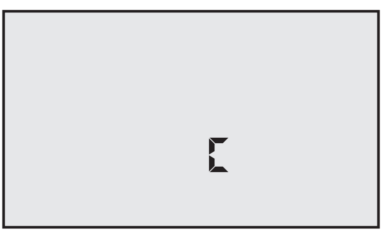


Figure 8

Figure 9

3. Press CAL MCLR to switch units.

4. Press any measurement key to accept unit preference for all temperature readings.

XI. <u>TEMPERATURE COMPENSATION (TC) DISABLE</u>

This feature allows the user to disable (turn <u>OFF</u>) the <u>TC</u> for specific applications requiring uncompensated conductivity and TDS measurements.

1. Press COND.

2. Press MR/▼ repeatedly until “**tc On**” is displayed (see Figures 10 and 11).

3. Press CAL/MCLR; the display will change to “**tc OFF**”.

4. Press COND; all conductivity and TDS measurements are now uncompensated.

Repeat steps 1-4 to reverse selection back to “**tc On**”.

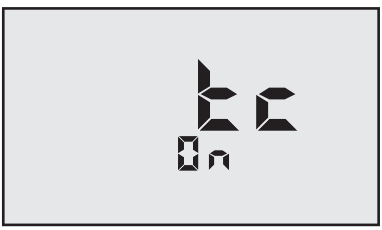


Figure 10

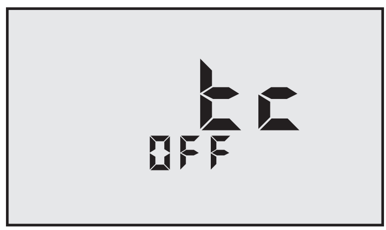


Figure 11

XII. <u>SALINITY UNITS (TPH1 & TP1)</u>

“Salinity” Units may be selected in either COND or TDS mode, and in ANY solution KCl, NaCl & 442. TDS 442 shown below, (ref. Solution Selection, pg. 9).

Salinity (S) - A parameter used in oceanography to describe the concentration of dissolved salts in seawater. It is defined in terms of <u>electrical conductivity</u> relative to a standard solution of KCl.
When expressed in units of <u>parts per thousand</u>, the salinity may be roughly equated to the concentration of dissolved material in <u>grams per kilogram</u> (grams/liter) of seawater (NaCl). HC&P 85th edition 2-55

Since most applications do not use seawater, which is predominately Sodium Chloride (NaCl), we highly recommend the solution of choice be 442™. 442 more closely matches the fresh natural water used in most applications (ref. Conductivity/TDS Standard Solutions, pg. 24).

1. Press COND or TDS.

Note: Choice will determine whether the units are displayed in mS or PPT. COND = mS or TDS = PPT.

Figure 12

2. Press MR ▼ repeatedly until **"SALt OFF"** is displayed (see Figure 12).

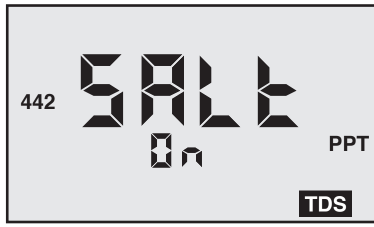


Figure 13

3. Press CAL/MCLR. The display will change from SALt OFF to "**SALt On**" (see Figure 13).

4. Press CAL/MCLR. All COND or TDS readings, as selected, are now displayed in Salinity units.

Either COND/mS units or TDS/PPT units are now selected. If you wish BOTH COND and TDS to be displayed in Salinity units, repeat with the other measurement key.

XIII. TOTAL RETURN to FACTORY SETTINGS "FAC SEL"

There may come a time when it would be desirable to quickly reset all the recorded calibration values in the instrument back to the factory settings. This might be to ensure all calibrations are set to a known value, or to give the instrument to someone else free of adjustments for a particular application. **NOTE: All stored data will be lost.**

1. Press any measurement key.

Figure 14

2. Press MR ▼ repeatedly until "**FAC SEL**" is displayed (see Figure 14).

3. Press CAL/MCLR to accept the resetting. Display will return to COND.

XIV. CARE and MAINTENANCE

Your TechPro II should be rinsed with clean water after each use.

Solvents should be avoided. Shock damage from a fall may cause instrument failure.

A. Temperature Extremes

Solutions in excess of 71°C/160°F should not be placed in the cell cup area; this may cause damage. The pH sensor (TPH1 & TH1) may fracture if the TechPro II temperature is allowed to go below 0°C/32°F. Care should be exercised not to exceed rated operating temperature. Leaving the TechPro II in a vehicle or storage shed on a hot day can easily subject the instrument to over 66°C/150°F.
This will void the warranty.

B. Battery Replacement (LO BATT)

Dry Instrument THOROUGHLY. Remove the four (4) bottom screws. Open instrument CAREFULLY. Carefully detach battery from circuit board. Replace with 9 volt alkaline battery. Replace bottom, ensuring the sealing gasket is installed in the groove of the top half of case. Re-install screws, tighten evenly and securely.

C. pH Sensor Replacement (TPH1 & TH1)

Order model RPG. When ordering, be sure to include the model and serial number of your instrument to ensure receipt of the proper type. Complete installation instructions are provided with each replacement sensor.

D. Cleaning Sensors

1. Conductivity or TDS

The cell cup should be kept as clean as possible. Flushing with clean water following use will prevent buildup on electrodes. However, if very dirty samples — particularly scaling types — are allowed to dry in the cell cup, a film will form. This film reduces accuracy. When there are visible films of oil, dirt, or scale in the cell cup or on the electrodes, use Isopropyl alcohol or a foaming non-abrasive household cleaner. Rinse out the cleaner, and your TechPro II is again ready for accurate measurements.

2. pH (TPH1 & TH1)

The unique pH sensor in your TechPro II is a nonrefillable combination type that features a porous liquid junction. *It should not be allowed to dry out.* However, if this occurs, the sensor may sometimes be rejuvenated by first cleaning the sensor well with Isopropyl alcohol or a liquid spray cleaner such as Windex™ or Fantastic™ and rinsing well. Do not scrub or wipe the pH sensor.

Then use one of the following methods:

1. Pour a HOT salt solution ~60°C/140°F, preferably potassium

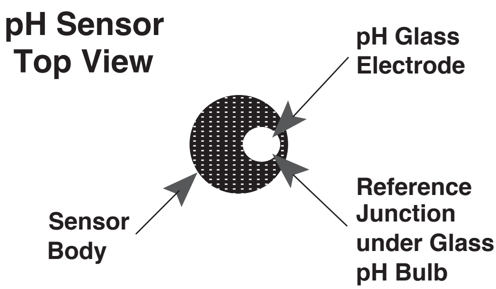
chloride (KCl) solution (Myron L pH Sensor Storage Solution) — HOT tap water with table salt (NaCl) will work fine — in the sensor well and allow to cool. Retest.

or

2. Pour DI water in the sensor well and allow to stand for no more than 4 hours (longer can deplete the reference solution and damage the glass bulb). Retest.

If neither method is successful, the sensor must be replaced.

“Drifting” can be caused by a film on the pH sensor bulb and/or reference junction. Use Isopropyl alcohol (IPA) or spray a liquid cleaner such as Windex™ or Fantastic™ into the sensor well to clean it. The sensor bulb is very thin and delicate. Do not scrub or wipe the pH sensor.



Leaving high pH (alkaline) solutions in contact with the pH sensor for long periods of time is harmful and will cause damage. Rinsing such liquids from the pH sensor well and refilling it with Myron L pH Sensor Storage Solution, a saturated KCl solution or a saturated solution of table salt and tap water, will extend the useful life.

Samples containing chlorine, sulfur, or ammonia can “poison” any pH electrode. If it is necessary to measure the pH of any such sample, thoroughly rinse the pH sensor well with clean water immediately after taking the measurement. Any sample element that reduces (adds an electron to) silver, such as cyanide, will attack the reference electrode.

Replacement pH sensors are available only from the Myron L Company or its authorized distributors.

XV. TROUBLESHOOTING CHART

Symptom	Possible Cause
No **display**, even though measurement key pressed	Battery weak or not connected
Inaccurate **pH** readings (TPH1)	1. pH calibration needed (ref. pH Cal, pg. 12). 2. Cross-contamination from residual pH buffers or samples in sensor well. 3. Calibration with expired pH buffers.
No response to **pH** changes (TPH1)	Sensor bulb is cracked or there is an electromechanical short caused by an internal crack.
Will not adjust down to **pH** 7 (TPH1)	pH sensor has lost KCl.
pH readings drift or respond slowly to changes in buffers/ samples (TPH1) *or* "FAC" is displayed repeatedly (TPH1)	1. Temporary condition due to "memory" of solution in pH sensor well for long periods 2. Bulb dirty or dried out 3. Reference junction is clogged or coated.
Unstable **Conductivity/TDS** readings	Dirty electrodes
Unable to calibrate **Conductivity/TDS**	Film or deposits on electrodes

Corrective Action
Check connections or replace battery (ref. Battery Replacement, pg. 20).
1. Recalibrate instrument. 2. Thoroughly rinse sensor well. 3. Recalibrate using fresh buffers (ref. pH Buffer Solutions, pg. 24).
Replace pH sensor (ref. pH Sensor Replacement, pg. 20).
Clean and rejuvenate sensor (ref. Cleaning Sensors, pg. 20) and recalibrate. If no improvement, replace pH sensor (ref. pH Sensor Replacement, pg. 20).
Clean and rejuvenate sensor (ref. Cleaning Sensors, pg. 20) and recalibrate. If no improvement, replace pH sensor (ref. pH Sensor Replacement, pg. 20).
Clean cell cup and electrodes (ref. Cleaning Sensors, pg. 20).
Clean cell cup and electrodes (ref. Cleaning Sensors, pg. 20).

XVI. ACCESSORIES

A. Conductivity/TDS Standard Solutions (TPH1 & TP1)

Your TechPro II has been factory calibrated with the appropriate Myron L Company NIST traceable KCl, NaCl, and our own 442™ standard solutions. Most Myron L conductivity standard solution bottles show three values referenced at 25°C: Conductivity in microsiemens/micromhos, the ppm/TDS equivalents (based on our 442 Natural Water™), and NaCl standards. All standards are within ±1.0% of reference solutions. *Available in 2 oz., quarts/liters, and gallon/~3.8 liter bottles.*

1. Potassium Chloride (KCl)

The concentrations of these reference solutions are calculated from data in the International Critical Tables, Vol. 6. The 7000 μS is the recommended standard. *Order KCL-7000*

2. 442 Natural Water™

442 Natural Water Standard Solutions are based on the following salt proportions: 40% sodium sulfate, 40% sodium bicarbonate, and 20% sodium chloride, which represent the three predominant components (anions) in freshwater. This salt ratio has conductivity characteristics approximating fresh natural waters and was developed by the Myron L Company over four decades ago. It is used around the world for measuring both conductivity and TDS in drinking water, ground water, lakes, streams, etc. 3000 ppm is the recommended standard.
Order 442-3000

3. Sodium Chloride (NaCl)

This is especially useful in sea water mix applications, as sodium chloride is the major salt component. Most Myron L standard solution labels show the ppm NaCl equivalent to the conductivity and to ppm 442 values. The 14.0 mS is the recommended standard. *Order NACL-14.0*

B. pH Buffer Solutions (TPH1 & TH1)

pH buffers are available in pH values of 4, 7 and 10. Myron L Company buffer solutions are traceable to NIST certified pH references and are color-coded for instant identification. They are also mold inhibited and accurate to within ±0.01 pH units @ 25°C. Order 4, 7 or 10 buffer.
Available in 2 oz., quarts/liters, and gallon/~3.8 liter bottles.

C. pH Sensor Storage Solution (TPH1 & TH1)

Myron L pH Sensor Storage Solution prolongs the life of the pH sensor.
Available in 2 oz., quarts/liters, and gallon/~3.8 liter bottles.

D. Soft Protective Carry Cases

Padded Nylon carrying case features a belt clip for hands-free mobility. Two colors to choose from;
Blue - Model #: UCC
Desert Tan - Model #: UCCDT

E. Hard Protective Carry Cases

Large case with 2 oz. bottles of calibration Standard Solutions (KCl-7000, 442-3000, 4, 7, & 10 pH buffers and pH storage solution) - *Model #: PKUU*
Small case (no calibration Standard Solutions) - *Model #: UPP*

F. Replacement pH Sensor (TPH1 & TH1)

pH sensor is gel filled and features a unique porous liquid junction. It is user-replaceable and comes with easy to follow instructions.
Model #: RPG

XVII. TEMPERATURE COMPENSATION (Tempco) of Aqueous Solutions (TPH1 & TP1)

Electrical conductivity indicates solution concentration and ionization of the dissolved material. Since temperature greatly affects ionization, conductivity measurements are temperature dependent and are normally corrected to read what they would be at 25°C.

A. Standardized to 25°C

Conductivity is measured with great accuracy in the TechPro II using a method that ignores fill level, electrolysis, electrode characteristics, etc., and features a unique circuit to perform temperature compensation. In simpler instruments, conductivity values are usually assigned an average correction similar to that of KCl solutions for correction to 25°C. The correction to an equivalent KCl solution is a standard set by chemists that standardizes the measurements and allows calibration with precise KCl solutions. In the TechPro II, this correction can be set to either KCl, NaCl or 442 to best match your applications.

B. Tempco Variation

Most conductivity instruments use an approximation of the temperature characteristics of solutions, perhaps even assuming a constant value. The value for KCl is often quoted simply as 2%/°C. In fact, KCl tempco varies with concentration and temperature in a non-linear fashion. Other solutions have more variation still. The TechPro II uses corrections that change with concentration and temperature instead of single average values. (see Chart 1 on pg. 26).

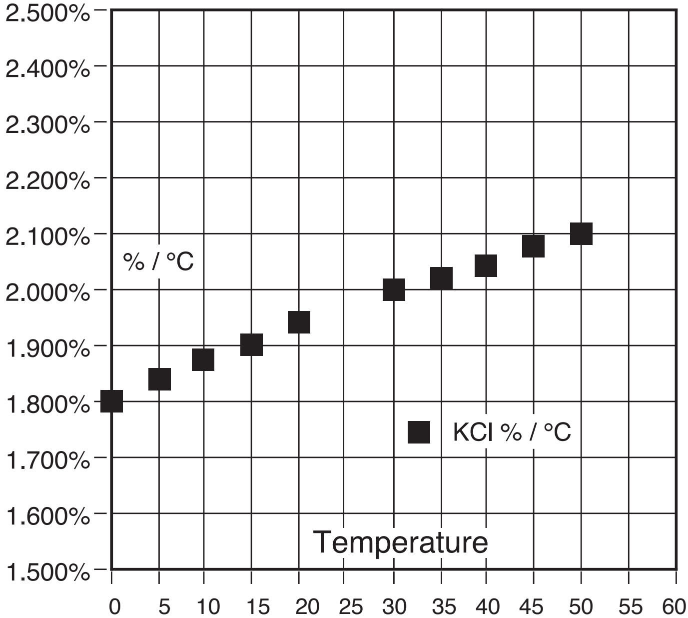


Chart 1

C. <u>An Example of 2 different solution selections and the resulting compensation</u>

How much error results from treating natural water as if it were KCl at 15°C?

A tap water solution should be compensated as 442 with a tempco of 1.68 %/°C, where the KCl value used would be 1.90 %/°C.

Suppose a measurement at 15°C/59°F is 900 microsiemens of true uncompensated conductivity.

Using a 442 correction of 10 (degrees below 25) x 1.68% indicates the solution is reading 16.8% low. For correction, dividing by (.832) yields 1082 microsiemens as a compensated reading.

A KCl correction of 10 (degrees below 25) x 1.9% indicates the solution is reading 19% low. Dividing by (.81) yields 1111 microsiemens for a compensated reading. The difference is 29 out of 1082, or 2.7%.

D. <u>A Chart of Comparative Error</u>

In the range of 1000 μS, the error using KCl on a solution that should be compensated as NaCl or as 442, is illustrated in Chart 2 on pg. 27.

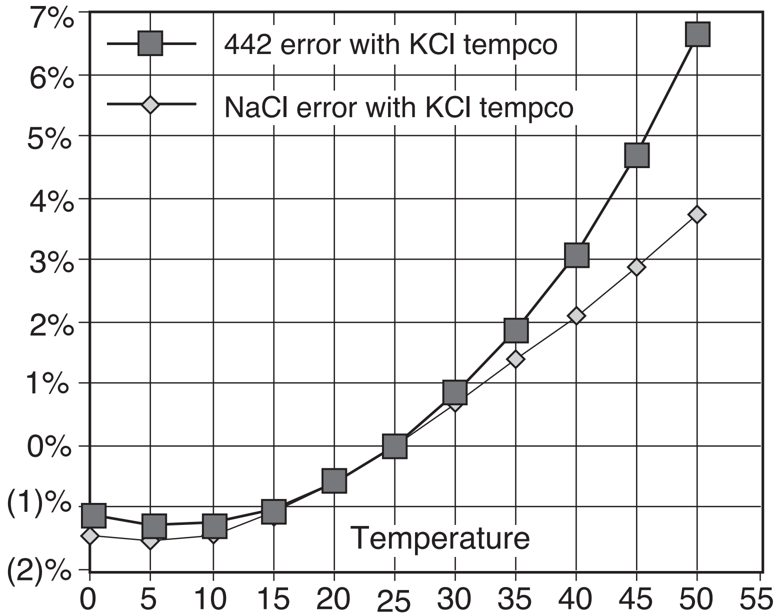


Chart 2

Users wanting to measure natural water based solutions to 1% would have to alter the internal compensation to the more suitable preloaded “442” values, or stay close to 25°C. Users who have standardized to KCl-based compensation may want to stick with it, regardless of increasing error as you get further from 25°C. The TechPro II will provide the repeatability and convertibility of data necessary for relative values for process control.

E. Other Solutions

A salt solution like sea water or liquid fertilizer acts like NaCl. An internal correction for NaCl can be selected for greatest accuracy with such solutions. Many solutions are not at all similar to KCl, NaCl or 442. A sugar solution, or a silicate, or a calcium salt at a high or low temperature may require a value peculiar to the application to provide readings close to the true compensated conductivity.

Clearly, the solution characteristics should be chosen to truly represent the actual water under test for rated accuracy of ±1%. Many industrial applications have historically used relative measurements seeking a number to indicate a certain setpoint or minimum concentration or trend. The TechPro II gives the user the capability to collect data in “KCl conductivity units” to compare to older published data, as in terms of NaCl or 442, or as appropriate.

XVIII. CONDUCTIVITY CONVERSION to TOTAL DISSOLVED SOLIDS (TDS) (TPH1 & TP1)

Electrical conductivity indicates solution concentration and ionization of the dissolved material. Since temperature greatly affects ionization, conductivity measurements are temperature dependent and are normally corrected to read what they would be at 25°C (ref. Temperature Compensation, pg. 25).

A. How it's Done

Once the effect of temperature is removed, the compensated conductivity is a function of the concentration (TDS). Temperature compensation of the conductivity of a solution is performed automatically by the internal processor with data derived from chemical tables. Any dissolved salt at a known temperature has a known ratio of conductivity to concentration. Tables of conversion ratios referenced to 25°C have been published by chemists for decades.

B. Solution Characteristics

Real world applications have to measure a wide range of materials and mixtures of electrolyte solutions. To address this problem, industrial users commonly use the characteristics of a standard material as a model for their solution, such as KCl, which is favored by chemists for its stability.

Users dealing with sea water, etc., use NaCl as the model for their concentration calculations. Users dealing with freshwater work with mixtures including sulfates, carbonates and chlorides, the three predominant components (anions) in freshwater that the Myron L Company calls "Natural Water". These are modeled in a mixture called "442™" which the Myron L Company markets for use as a calibration standard, as it does KCl and NaCl standard solutions.

The TechPro II contains algorithms for these 3 most commonly referenced compounds. The solution type in use is displayed on the left.

C. When does it make a lot of difference?

First, the accuracy of temperature compensation to 25°C determines the accuracy of any TDS conversion. Assume we have industrial process water to be pretreated by RO. Assume it is 45°C and reads 1500 μS uncompensated.

1. If NaCl compensation is used, an instrument would report 1035 μS compensated, which corresponds to 510 ppm NaCl.

2. If 442 compensation is used, an instrument would report 1024 μS compensated, which corresponds to 713 ppm 442.

   The difference in values is 40%.

In spite of such large error, some users will continue to take data in the NaCl mode because their previous data gathering and process monitoring was done with an older NaCl referenced device.

Selecting the correct Solution Type on the TechPro II will allow the user to attain true TDS readings that correspond to evaporated weight.

XIX. TEMPERATURE COMPENSATION (Tempco) and TDS DERIVATION (TPH1 & TP1)

When taking conductivity measurements, the Solution Selection determines the characteristic assumed as the instrument reports what a measured conductivity would be if it were at 25°C. The characteristic is represented by the tempco, expressed in %/°C. If a solution of 100 μS at 25°C increases to 122 μS at 35°C, then a 22% increase has occurred over this change of 10°C. The solution is then said to have a tempco of 2.2 %/°C.

Tempco always varies among solutions because it is dependent on their individual ionization activity, temperature and concentration. This is why the TechPro II features mathematically generated models for known salt characteristics that also vary with concentration and temperature.

XX. pH MEASUREMENT (TPH1 & TH1)

A. pH as an Indicator (TPH1 & TH1)

pH is the measurement of Acidity or Alkalinity of an aqueous solution. It is also stated as the Hydrogen Ion activity of a solution. pH measures the effective, not the total, acidity of a solution.

A 4% solution of acetic acid (pH 4, vinegar) can be quite palatable, but a 4% solution of sulfuric acid (pH 0) is a violent poison. pH provides the needed quantitative information by expressing the degree of activity of an acid or base.

In a solution of one known component, pH will indicate concentration indirectly. However, very dilute solutions may be very slow reading, just because the very few ions take time to accumulate.

B. pH Units (TPH1 & TH1)

The acidity or alkalinity of a solution is a measurement of the relative availabilities of hydrogen (H^+) and hydroxide (OH^-) ions. An increase in (H^+) ions increases acidity, while an increase in (OH^-) ions increases alkalinity. The total concentration of ions is fixed as a characteristic of water, and balance would be 10^{-7} mol/liter (H^+) and (OH^-) ions in a neutral solution (where pH sensors give 0 voltage).

pH is defined as the negative logarithm of hydrogen ion concentration. Where (H^+) concentration falls below 10^{-7}, solutions are less acidic than neutral, and therefore are alkaline. A concentration of 10^{-9} mol/liter of (H^+) would have 100 times less (H^+) ions than (OH^-) ions and be called an alkaline solution of pH 9.

C. pH Sensor (TPH1 & TH1)

The active part of the pH sensor is a thin glass surface that is selectively receptive to hydrogen ions. Available hydrogen ions in a solution will accumulate on this surface and a charge will build up across the glass interface. The voltage can be measured with a very high impedance voltmeter circuit; the dilemma is to connect the voltmeter to solution on each side.

The glass surface encloses a captured solution of potassium chloride holding an electrode of silver wire coated with silver chloride. This is the most inert connection possible from a metal to an electrolyte. It can still produce an offset voltage, but using the same materials to connect to the solution on the other side of the membrane causes the 2 equal offsets to cancel.

The problem is, on the other side of the membrane is an unknown test solution, not potassium chloride. The outside electrode, also called the Reference Junction, is of the same construction with a porous plug in place of a glass barrier to allow the junction fluid to contact the test solution without significant migration of liquids through the plug material.

Figure 15 shows a typical 2 component pair.
Migration does occur, and this limits the lifetime of a pH junction from depletion of solution inside the reference junction or from contamination. The junction may be damaged if dried out because insoluble crystals may form in a layer, obstructing contact with test solutions.
(ref. pH, pg. 20).

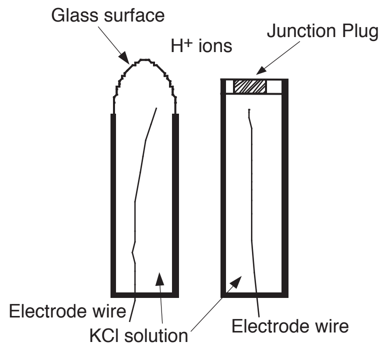


Figure 15

D. Myron L Integral pH Sensor (TPH1 & TH1)

The sensor in the TechPro II (see figure 16) is a single construction in an easily replaceable package. The sensor body holds an oversize solution supply for long life. The reference junction "wick" is porous to provide a very stable, low permeable interface, and is formed in a ring around the pH sensing electrode. This construction combines all the best features of any pH sensor known.

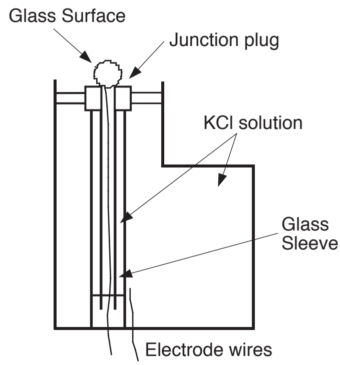


Figure 16

E. Sources of Error (TPH1 & TH1)

The basics are presented in pH, pg. 20.

1. Reference Junction

The most common sensor problem will be a clogged junction because a sensor was allowed to dry out. The symptom is a drift in the "zero" setting at 7 pH. This is why the TechPro II does not allow more than 1 pH unit of offset during calibration. At that point the junction is unreliable.

2. Sensitivity Problems

Sensitivity is the receptiveness of the glass surface. A film on the surface can diminish sensitivity and cause a long response time.

3. Temperature Compensation

pH sensor glass changes its sensitivity slightly with temperature, so the further from pH 7 one is, the more effect will be seen. A pH of 11 at 40°C would be off by 0.2 units. The TechPro II senses the sensor well temperature and compensates the reading.

XXI. SOFTWARE VERSION

Contact the Myron L Company to see if a software upgrade is available.

1. Press any measurement key.

2. Press 

key until three numbers are displayed as shown in Figure 17.

3. Press any measurement key, instrument will time out in ~20 seconds.

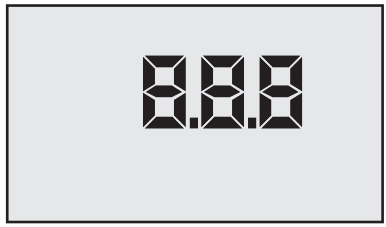


Figure 17

XXII. GLOSSARY

Anions Negatively charged ions.
See Solution Characteristics, pg. 28.

Algorithm A procedure for solving a mathematical problem.
See Temperature Compensation and TDS Derivation, pg. 28.

Logarithm An arithmetic function. See pH Units, pg. 30.

TDS Total Dissolved Solids or the Total Conductive Ions in a solution. See Conductivity Conversion to TDS, pg. 28.

Tempco Temperature Compensation
See Temperature Compensation, pg. 25.

For details on specific areas of interest refer to the Table of Contents.

XXIII. ADDENDUM

XXIV. NOTES

MYRON L COMPANY
2450 Impala Drive
Carlsbad, CA 92010-7226
USA
Tel: +1-760-438-2021
Fax: +1-760-931-9189

E-Mail: info@myronl.com
techquestions@myronl.com

www.myronl.com

Made In USA

TPIIOM 06JA10