

EXA PH200/400 and EXA PH202/402 Troubleshooting and Error Code Guide



Introduction

The EXA Series of Instruments (EXA PH200, PH400, PH202, PH402) provide much more than just a measurement. They are also a *tool*, providing both *on-line* and *off-line* diagnostics of the components making up the measurement loop (sensors, cabling and Analyzer or Transmitter). These diagnostics serve two key functions:

- 1) *Status Information:* In the **DISP** (display) section of the Message Display, information concerning the status of key components is available. As an example, the Impedance value of the Reference Electrode can be checked by using the YES/NO keys and stepping through the **DISP** section until the **RZ** value is reached.
- 2) *Failure Alarm:* The diagnostic program continually checks key functions and components of the measurement loop for problems and provides information to the operator via Error Codes on the dual LCD display. These Error Codes are designed to lead the operator to the source of the problem as quickly as possible and offer suggestions for correction.

To properly utilize the information provided by these Error Codes the user should first determine the following:

- 1) *Under what circumstances the Fault occurred:* Was it at start-up, or had the unit been on-line for awhile? This will help determine if the problem is related to a new installation or whether an electrode has been on-line long enough that it may need replacement.
- 2) *What Sensor mounting assembly and specific electrodes are being used:* Is the best electrode for the application being used? Often an electrode that works fine in one application, is moved to an entirely different one for which it was not designed and consequently does not perform well. The misapplication is the problem, but the equipment is incorrectly blamed and often replaced unnecessarily.
- 3) *The Process Parameters, including temperature, chemical make up and whether it is a batch or continuous operation:* Sometimes the actual process is changed. When this happens problems often begin to occur with pH equipment. By redefining the process, it is usually a simple matter to discover the reason for the current problems. By changing to different electrodes, modifying the installation or moving to a different measuring point will resolve the problem.

Start-Up Problems

The majority of problems experienced by new EXA users are a result of not taking enough time during the initial installation to go through the Instruction Manual completely before setting up their unit and important steps may be omitted causing Error Codes which are mistakenly attributed to defective equipment.

As an example, if an EXA user does not make sure the correct Temperature Electrode is selected (programmed) an **E7** or **E8** code may be displayed. For pH users, if the Measuring and Reference Electrode wiring are accidentally switched, an **E4** and an **E6** code will be displayed simultaneously. Therefore, the diagnostics (and subsequent Error Codes) can assist a new user in determining that the unit has not been properly set up and in which area the problem can be found.

Routine Maintenance Error Codes

The EXA give users two key maintenance tools. First, they provide status information about the health of the Temperature or Measuring electrodes. This information is found under *DISP* in the Second Display area. The EXA display's the Asymmetry Potential (Reference Electrode) and Slope value (Glass Electrode) measured at the last 2-point calibration. In addition, the Impedance of the Glass (202/402 only) and the Reference Electrode Junction (dynamic value) is displayed. Utilizing this Diagnostic information allows the user to change an aging electrode *before* it actually fails, or adjust the maintenance routine (cleaning) to assure an accurate measurement.

The following pages list the "Probable Causes" for each Error Code in order from most common possibility for the Error to the least probable cause. Note in all but a few cases the error codes used by the EXA 200 and 400 are the same as used by the EXA202 and the 402. However since the newer EXA202 and 402 has enhanced sensor diagnostics, there are some Error Codes used by the EXA202 and 402 which are different from the EXA 200 and 400. These unique to the EXA202 and 402 Error Codes are so identified to remove any confusion for the reader.

E0: Temperature of Buffer is outside the range of 0° - 50°C - (Calibration Error)

Description

This code occurs only when an *Auto Cal* is being done. The EXA compares the measured temperature of the buffer being used to the acceptable limits of 0 - 50°C (this is the range of the Buffer Tables used for Auto Cal). If the buffer temperature is outside these limits an error code of **E0** is displayed in the second display area and the calibration will not be accepted.

Possible Cause(s) of Error

- 1) Buffer temperature outside acceptable range.
- 2) EXA set up for wrong Temperature Electrode (set for Pt 100 but is actually a Pt 1000).
- 3) Improper wiring or Temperature Electrode Cable defective.
- 4) Temperature Electrode defective.

Suggested Remedy

- 1) Correct Buffer Temperature (cool or heat buffer to acceptable value).
- 2) Go to *Service Section* (Code 03) and enter code for correct Temperature Electrode.
- 3) Check wiring connections and replace Electrode Cable if needed.
- 4) Replace Temperature Electrode.

E1: Measurement has not stabilized during calibration - (Calibration Error)**Description**

This code occurs after an *Auto Cal* or *Man Cal* has been attempted. The EXA compares the programmable values for (1) allowable stabilization time (*Factory Default* is 5 seconds) and (2) allowable variance of the measured value (*Factory Default* is .02 pH) to those of the electrodes being calibrated. If the buffer pH value does not stabilize within the acceptable range within the time allotted, an error code **E1** will be displayed in the second display area and the calibration will not be accepted.

Possible Cause(s) of Error

- 1) Contaminated or old buffer, or dirty electrodes.
- 2) Programmed Stabilization is too short, or Programmed Range is too narrow. As electrodes age they become sluggish and slower to respond to pH changes. If an older electrode is being used, the EXA will need to be reprogrammed with a longer allowable response time or an **E1** error will continue to occur.
- 3) Measuring Electrode (Glass) is too old and slow to respond.
- 4) Improper wiring or one or more Electrode Cables are faulty causing noise on the measurement signal.

Suggested Remedy

- 1) Get fresh buffer and clean pH electrodes in 5 - 10% HCl solution or Muratic Acid.
- 2) Reprogram Stabilization Time *ONLY* if an aged electrode *must* be used. Otherwise change the aged electrode for new faster responding one.
- 3) Replace Measuring Electrode.
- 4) Check wiring connections and replace Electrode Cable if needed.

E2: Calculated Asymmetry Potential is outside acceptable range: -120 to +120 mV - (Calibration Error)**Description**

This code occurs after an *Auto Cal* or *Man Cal* has been attempted. The EXA compares the calculated Asymmetry value against the acceptable limits of -120 mV to +120 mV. Asymmetry is the mV offset value required to get back to 0 mV. The closer to 0 mV a Reference Electrode is, the better it is. New electrodes have values of ± 15 mV. As they age and are affected by the

process this value will move further away from zero in either a positive or negative direction. As this occurs, response becomes slower and more frequent calibration will be required. If the electrode is outside the designated -120 mV to +120 mV range, an error code **E2** is displayed in the second display area and the calibration will not be accepted.

Possible Cause(s) of Error

- 1) Bad Buffer 7 (zero buffer).
- 2) Reference Electrode is too old and out of acceptable limits.
- 3) Reference Electrode is poisoned or damaged.
- 4) Bad wiring or Electrode Cable is faulty (bad isolation).
- 5) Solution Ground Electrode (Post) is coated, dirty or connection is faulty.

Suggested Remedy

- 1) Clean pH electrodes in 5 - 10% HCl solution or Muratic Acid.
- 2) Replace Reference Electrode.
- 3) Replace Reference Electrode
- 4) Check wiring connections and replace Electrode Cable if needed.
- 5) Clean Solution Ground, check wiring connection and replace if faulty.

E3: Calculated Slope is outside acceptable theoretical range: 70% to 110% - (Calibration Error)

Description

This code occurs when either *Auto Cal* or *Man Cal* is being done. The EXA compares the calculated Slope value against the acceptable theoretical Slope values of 70% to 110%. New Measuring Electrodes have a Slope value between 95 and 99%. As they age this value decreases and the response of the electrode becomes slower. An error code **E3** is displayed in the second display area and the calibration will not be accepted if the electrode is outside the designated 70 to 110% range. If no Error code is displayed, but the electrode is sluggish and slow to respond, checking the *SL* value in the Second Display after a 2-point calibration should indicate a value below 90%.

Possible Cause(s) of Error

- 1) Coated or dirty Measuring Electrode.
- 2) Measuring Electrode (Glass) is too old and slow to respond.
- 3) Measuring Electrode (Glass) is damaged.
- 4) Bad wiring or Electrode Cable is faulty (bad isolation).
- 5) Solution Ground Electrode (Post) is coated, dirty or connection is faulty.

Suggested Remedy

- 1) Clean pH electrodes in 5 - 10% HCl solution or Muratic Acid.
- 2) Replace Measuring Electrode.
- 3) Replace Measuring Electrode.
- 4) Check wiring connections and replace Electrode Cable if needed.
- 4) Clean Solution Ground Post, check wiring and replace if faulty.

Programming and Operating Error Codes

E4: Impedance of Glass Electrode is too LOW

E4.1 Impedance of Glass Electrode is too LOW (PH202 and PH402 only)

Description

The Impedance of a Glass Electrode will increase as it ages. Therefore, if an Error Code **E4** or **E4.1** occurs, it is not due to an aging electrode, but to an electrode failure. The EXA compares the measured impedance value of the electrode to an acceptable minimum limit. If that limit is exceeded, an **E4** or **E4.1** will be displayed in the second display area. When this Error Code appears, the pH value shown on the Main Display is usually near 7 pH. This is because a shorted Glass Electrode has a 0 mV potential which is the millivolt value generated at 7 pH.

Possible Cause(s) of Error

- 1) Cracked Measuring Electrode.
- 2) Bad wiring or Electrode Cable is faulty (bad isolation).

Suggested Remedy

- 1) Replace Measuring Electrode.
- 2) Check wiring connections and replace Electrode Cable if needed.

E4.2 Impedance of Reference Electrode is too LOW (PH202 and PH402 only)

Description

The Impedance of a Reference Electrode can decrease from damage or deterioration. Therefore, if an Error Code **E4.2** occurs, it is due to failure. The EXA compares the measured impedance value of the electrode to an acceptable minimum limit. If that limit is exceeded, an **E4.2** will be displayed in the second display area.

Possible Cause(s) of Error

- 1) Cracked Reference Electrode.
- 2) Reference junction is loose or missing
- 3) Bad wiring or Electrode Cable is faulty (bad isolation).

Suggested Remedy

- 1) Replace Reference Electrode.
- 2) Replace Reference Electrode
- 3) Check wiring connections and replace Electrode Cable if needed.

E5: Impedance of Glass Electrode is too HIGH

E5.1: Impedance of Glass Electrode is too HIGH (PH202 and PH402 only)

Description

The Impedance of a New Glass Electrode varies depending on the type of electrode (SM21-AG4 = 50-100 megohms; SM21 -AL6 = 600-900 megohms). As an electrode ages, or is coated by the

process, its impedance value will increase and its responsiveness will decrease. The EXA compares the measured impedance value of the electrode to an acceptable maximum limit. If that limit is exceeded, an **E5** or **E5.1** will be displayed in the second display area.

Possible Cause(s) of Error

- 1) Coated or dirty Measuring Electrode.
- 2) Measuring Electrode (Glass) is too old and slow to respond.
- 3) Bad wiring or Electrode Cable is faulty (bad isolation).
- 4) Solution Ground Electrode (Post) is coated, dirty or connection is faulty.
- 5) Electrodes not fully immersed in the process or buffer.

Suggested Remedy

- 1) Clean pH electrodes in 5 - 10% HCl solution or Muratic Acid.
- 2) Replace Measuring Electrode.
- 3) Check wiring connections and replace Electrode Cable if needed.
- 4) Clean Solution Ground Post, check wiring and replace if faulty.
- 5) Assure Electrodes are properly immersed in solution.

E5.2: Impedance of the Reference Electrode is too HIGH (PH202 and PH402 only)

E6: Impedance of the Reference Electrode is too HIGH

Description

The Impedance of a New Reference Electrode is usually be 5K ohms or less. If the process coats the electrode, the impedance value will increase. The EXA compares the measured impedance value of the reference electrode to an user programmable (50K to 9999K ohms) minimum limit. The factory default value is 100K ohms. If that limit is exceeded **E5.2** or **E6** will be displayed in the second display area.

Possible Cause(s) of Error

- 1) Dirty Reference Electrode, or plugged Reference Junction.
- 2) Faulty Reference Electrode.
- 3) Bad wiring or Electrode Cable is faulty (bad isolation).
- 4) Dirty or coated Solution Ground Electrode.
- 5) Electrodes not fully immersed in the process or buffer.

Suggested Remedy

- 1) Clean Electrodes with 5-10% HCl or Muratic Acid.
- 2) Replace Reference Electrode.
- 3) Check wiring connections and replace Electrode Cable if needed.
- 4) Clean Electrodes with 5-10% HCl.
- 5) Assure Electrodes are properly immersed in solution.

E7: Measured Temperature is too HIGH (above 130°C)**E8: Measured Temperature is too LOW (above -10°C)****Description**

Either of these Error Codes (**E7** or **E8**) may be accompanied by **E9** as an error in the Temperature circuit can cause the measured value to be out of range. The EXA compares the resistance of the Temperature Electrode to acceptable values. If these values are exceeded (130°C) **E7**, or (-10°C) **E8** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Wrong Temperature Electrode programmed.
- 2) Bad wiring or Electrode Cable is faulty (bad isolation).
- 3) Temperature Electrode is faulty.
- 4) Process Temperature out of range.

Suggested Remedy

- 1) Reprogram for Temperature Electrode being used.
- 2) Check wiring connections and replace Electrode Cable if needed.
- 3) Replace faulty Temperature Electrode.
- 4) Correct Process Temperature.

E9: Measured pH value is outside acceptable range: -1 pH to +15 pH**Description**

The EXA has a measurement range of -1 pH to +15 pH. If the instrument sees a value outside this range Error Code **E9** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Solution Ground Electrode disconnected or faulty cable.
- 2) Measuring Electrode is faulty.
- 3) Wrong Temperature Electrode programmed or Electrode is faulty.
- 4) Incorrect wiring or faulty Electrode Cable.
- 5) Process pH value is outside acceptable measurement range.

Suggested Remedy

- 1) Check Solution Ground connection and replace wire if needed.
- 2) Replace Measuring Electrode.
- 3) Check programmed value and replace Temperature Electrode if faulty.
- 4) Check wiring connections and replace Electrode Cable if needed.
- 5) Correct process.

E10: Programming efforts to the Analyzer's EEPROM failed

Description

If efforts to program the EXA are not accepted by the EEPROM, Error Code **E10** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Power surge or interruption during programming.
- 2) EEPROM is damaged or internal wiring is faulty.

Suggested Remedy

- 1) Reprogram instrument.
- 2) CONTACT NEAREST YOKOGAWA SERVICE CENTER.

E11: User programmed values for *Response Time Check* for electrode *Wash Cycle* has not been achieved. (Does not apply to EXA200 or EXA202)

Description

After a Wash Cycle has been completed, if the measurement does not return to acceptable values within the programmed Response Time, Error Code **E11** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Wash was not effective, electrodes are still dirty.
- 3) Measuring Electrode is aged or faulty.

Suggested Remedy

- 1) Check volume of cleaning solution and manually initiate Wash again
- 2) Replace Measuring Electrode.

E12: Measured ORP/rH value is outside acceptable range: -1500mV to +1500mV (ORP) and 0 to 55 rH(rH). (PH202 and PH402 only)**Description**

The EXA202/402 has a measurement range of: -1500mV to +1500mV (ORP) and 0 to 55 rH(rH). If the instrument sees a value outside this range Error Code **E12** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Solution Ground Electrode disconnected or faulty cable.
- 2) ORP or Glass Electrode is faulty.
- 3) Incorrect wiring or faulty Electrode Cable.
- 4) Process ORP/rH value is outside acceptable measurement range.

Suggested Remedy

- 1) Check Solution Ground connection and replace wire if needed.
- 2) Replace ORP or Measuring Electrode.
- 3) Check wiring connections, replace Electrode Cable if needed.
- 4) Correct process.

E14: No valid calibration data. (PH202 and PH402 only)**Description**

If the EXA202/402 instrument is changed from pH to ORP(or rH) or is changed from ORP(or rH) Error Code **E14** will be displayed in the second display if the calibration values are lost

Possible Cause(s) of Error

- 1) Data has been lost

Suggested Remedy

- 1) Perform a new calibration

E15: Cable resistance of Temperature Electrode exceeds acceptable limit of 5K ohms**Description**

The EXA compensates for Temperature Measurement errors resulting from cable resistance up to 5K ohms. If the cable resistance exceeds this limit, Error Code **E15** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Temperature cable is too long, wrong gage wire, corroded or faulty.
- 2) Temperature Electrode is faulty or connector is corroded.

Suggested Remedy

- 1) Check cable and replace if required.
- 2) Check connection and Replace Temperature Electrode if required.

E16: Call for maintenance interval has been exceeded. (PH202 and PH402 only)

Description

The EXA202/402 instrument can be programmed (up to a 250 day interval) to call for a calibration. If the watchdog reminder alarm occurs, then the interval has been exceeded without being reset and a Error Code **E16** will be displayed in the second display.

Possible Cause(s) of Error

- 1) A calibration was not performed in the interval time set in Access Code 55.

Suggested Remedy

- 1) A calibration needs to be performed. Consider resetting the interval time set to a longer duration in Access Code 55.

E17: Incorrect Programming. Entered unacceptable values.

E19: Incorrect Programming. Entered unacceptable values.

Description

If values that are incorrect or outside acceptable limits of the EXA, Error Code **E17** or **E19** will be displayed in the second display.

Possible Cause(s) of Error

- 1) E17: Values outside minimum acceptable span values were programmed.
- 2) E19: programmed values are not accepted as valid.

Suggested Remedy

- 1) Check for acceptable limits and reenter values.
- 2) Follow prompts and reenter values.

E20: All Programmed values are lost.

Description

If all programmed values are lost, Error Code **E20** will be displayed in the second display. This instrument will have to be returned to the factory for repair and/or re-initialization.

Possible Cause(s) of Error

- 1) Severe EMF interference.
- 2) Failure of electronics.

Suggested Remedy

- 1) CONTACT NEAREST YOKOGAWA SERVICE CENTER.

E21: Checksum error. (PH202 and PH402 only)

Description

If a internal software failure occurs in the Check Sum function a Error Code **E20** will be displayed in the second display. This instrument will have to be returned to the factory for repair.

Possible Cause(s) of Error

- 1) Failure of electronics.

Suggested Remedy

- 1) CONTACT NEAREST YOKOGAWA SERVICE CENTER.

E22: Alarm activation time exceeded. (PH202 and PH402 only)

Description

If the EXA's process control function is being used and the user's programmed time interval for effective control action has expired a Error Code **E22** will be displayed in the second display.

Possible Cause(s) of Error

- 1) Too short a time interval has been programmed in Access Code 47
- 2) A failure of some nature has occurred in the control system and reagent addition has not occurred.

Suggested Remedy

- 1) Program a longer time interval in Access Code 47 before calling for assistance due to ineffective control.
- 2) Find the failure in the control system and fix the problem Example: Refill the reagent addition tank.

E23: Calculated Asymmetry Potential is outside acceptable range: -120 to +120 mV - (Calibration Error for PH202 and PH402 only)***Description***

This code occurs after an single point calibration has been attempted. The EXA compares the calculated Asymmetry value against the acceptable limits of -120 mV to +120 mV. Asymmetry is the mV offset value required to get back to 0 mV. The closer to 0 mV a Reference Electrode is, the better it is. New electrodes have values of ± 15 mV. As they age and are affected by the process this value will move further away from zero in either a positive or negative direction. As this occurs, response becomes slower and more frequent calibration will be required. If the electrode is outside the designated -120 mV to +120 mV range, an error code **E23** is displayed in the second display area and the calibration will not be accepted.

Possible Cause(s) of Error

- 1) Bad Buffer 7 (zero buffer).
- 2) Reference Electrode is too old and out of acceptable limits.
- 3) Reference Electrode is poisoned or damaged.
- 4) Bad wiring or Electrode Cable is faulty (bad isolation).
- 5) Solution Ground Electrode (Post) is coated, dirty or connection is faulty.

Suggested Remedy

- 1) Clean pH electrodes in 5 - 10% HCl solution or Muratic Acid.
- 2) Replace Reference Electrode.
- 3) Replace Reference Electrode.
- 4) Check wiring connections and replace Electrode Cable if needed.
- 5) Clean Solution Ground, check wiring connection and replace if faulty.