User's Manual

FLXA402T
Liquid Analyzer for Turbidity and Chlorine
Operation of pH

IM 12A01G02-01EN

YOKOGAWA
Yokogawa Electric Corporation

IM 12A01G02-01EN
4th Edition

Introduction

Thank you for purchasing the FLXA™402T Liquid Analyzer for Turbidity and Chlorine.
This User's Manual contains all essential information for the user to make full use of FLXA402T.
Please read the following respective documents before installing and using the FLXA402T.
The related documents are listed as follows.

General Specifications

Contents	Document number	Note
FC800D Non-reagent type Free Available Chlorine Analyzer	GS 12F05B10-01EN	Online manual
RC800D Reagent Type Residual Chlorine Analyzer	GS 12F04B10-01EN	Online manual
TB820D Right Angle Scattered Light Turbidity Analyzer	GS 12E01B30-01EN	Online manual
TB830D Surface Scattered Light Turbidity Analyzer	GS 12E04B40-01EN	Online manual

"EN" in the document number is the language code.

User's Manual

Contents	Document number	Note
FLXA402T Liquid Analyzer for Turbidity and Chlorine Start-up and Safety Precautions	IM 12A01G01-01EN	Attached to the product (printed manual)
FLXA402T Liquid Analyzer for Turbidity and Chlorine Installation and Wiring	IM 12A01G01-02EN	Online manual
FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of Converter	IM 12A01G01-03EN	Online manual
FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of pH	IM 12A01G02-01EN	Online manual (This manual)
FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of SC	IM 12A01G03-01EN	Online manual

"EN" in the document number is the language code.

An exclusive User's Manual might be attached to the products whose suffix codes or option codes contain the code "Z" (made to customers' specifications). Please read it along with this manual.

Technical Information

Contents	Document number	Note
FLXA402T Liquid Analyzer for Turbidity and Chlorine MODBUS communication	TI 12A01G01-62EN	Online manual

"EN" in the document number is the language code.

You can download the latest documents from our website. Scan QR code.
http://www.yokogawa.com/an/flxa402t/download/

Please read the individual user's manuals for sensors/detectors and other related products.

Notes on Handling User's Manuals

- Please provide the user's manuals to your end users so that they can keep the user's manuals for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user's manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
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Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

Some screen images depicted in the user's manual may have different display positions or character types (e.g., the upper / lower case). Also note that some of the images contained in this user's manual are display examples.

Composition of this User's Manual

FLXA402T Liquid Analyzer for Turbidity and Chlorine provides converter function to realize the following measurement according to user's specification.

FC (Free chlorine analyzer), RC (Residual chlorine analyzer),
TB (Turbidity Analyzer), pH, Conductivity (SC).

This manual describes the operation (equipment setting, calibration) as a PH converter. For the parts common to the converter, refer to the other related documents that are separated as shown in the table below.

Contents	FC800D	RC800D	TB820D	TB830D	pH	Conductivity (SC)
Introduction and general description	IM 12A01G01-02EN					
Wiring and installation						
Converter operation (Setting, Maintenance, Troubleshooting)	IM 12A01G01-03EN					
Sensor operation (Setting, Calibration)	IM 12F05B10-02EN	IM 12F04B10-02EN	IM 12E01B30-02EN	IM 12E04B40-02EN	IM 12A01G02-01EN (This manual)	IM 12A01G03-01EN

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Terminology

sensor(s): sensor, sensor unit, sensor module, SA11 + sensor

SENCOM: 1st (2nd) input "-CL" (SENCOM for Chlorine) or "-TB (SENCOM for Turbidity)"

analog sensor (module) selectable sensors when "-P1", "-C1" is specified for 2nd input.
e.g. PH8E□P, PH4□, SC4AJ, SC210G

sensor connection number. : identifies connected sensors to 1st or 2nd input. 1-1 refers to sensor connected for 1st input. 2-1 refers to sensor connected for 2nd input.

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Operation of pH

IM 12A01G02-01EN 4th Edition

CONTENTS

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1. Sensor Menu Outline

Main/Home screen > MENU "Sensor menu". > "Detail" / "Calibration" / "Setting"

The operation is secured by password. See the section 5.4 in IM 12A01G01-03EN Operation of Converter.

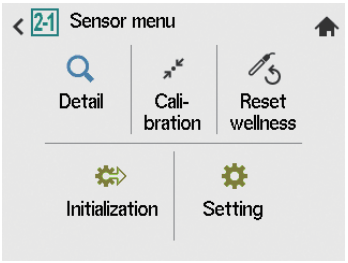


Figure 1.1 Sensor menu

Details

On Sensor menu, tap "Detail". Read 2.1.

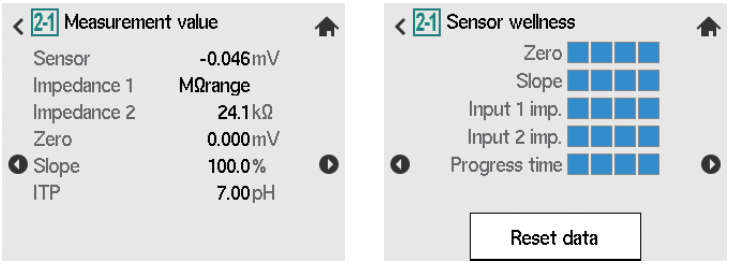


Figure 1.2 Sample image of Sensor details

On Sensor details screen, sensor status is displayed. turns the page to show the sensor status, maintenance information, PH module information or logbook.

Calibration

On Home/Main screen, tap CAL. On Sensor menu, tap for calibration of sensors.

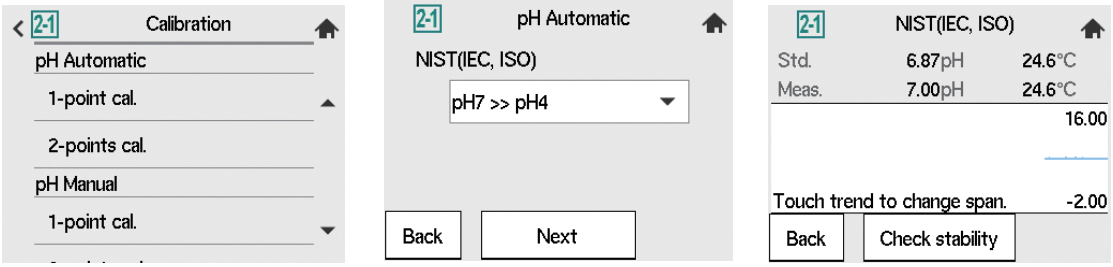


Figure 1.3 Sample images of pH Calibration

For further information on sensor calibration, read chapter 4.

Reset wellness

Go to Sensor menu> tap . Read 2.3 Reset wellness

Initialization

On Sensor menu, tap . Read 2.4 Initialization.

Configure sensor

Converter menu or Sensor menu > ⚙ “Setting”

Go to Converter menu to configure the setting of converter such as mA output, display setting.

Go to Sensor menu to configure the sensor setting such as calibration setting.

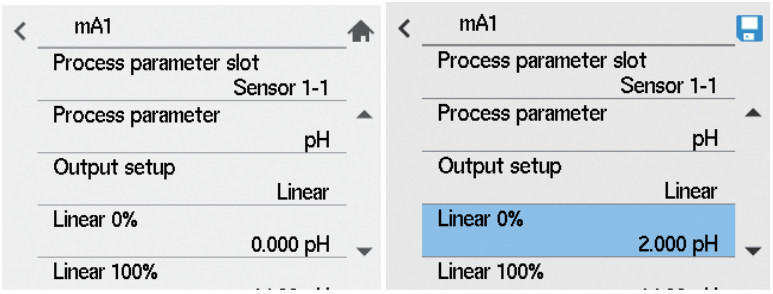


Figure 1.4 Left; before configuration Right; after configuration

When you change parameter, the changed parameter becomes highlighted. To save and overwrite the data, tap 💾

Read 3. Sensor setting about sensor configuration.

2 Sensor menu

Main screen > Sensor menu

The following operation are available.

Detail (details on sensors), Calibration (sensor calibration), Setting (sensor setting), etc.

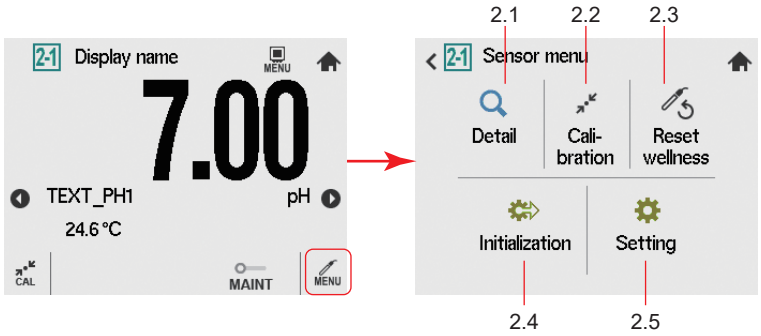
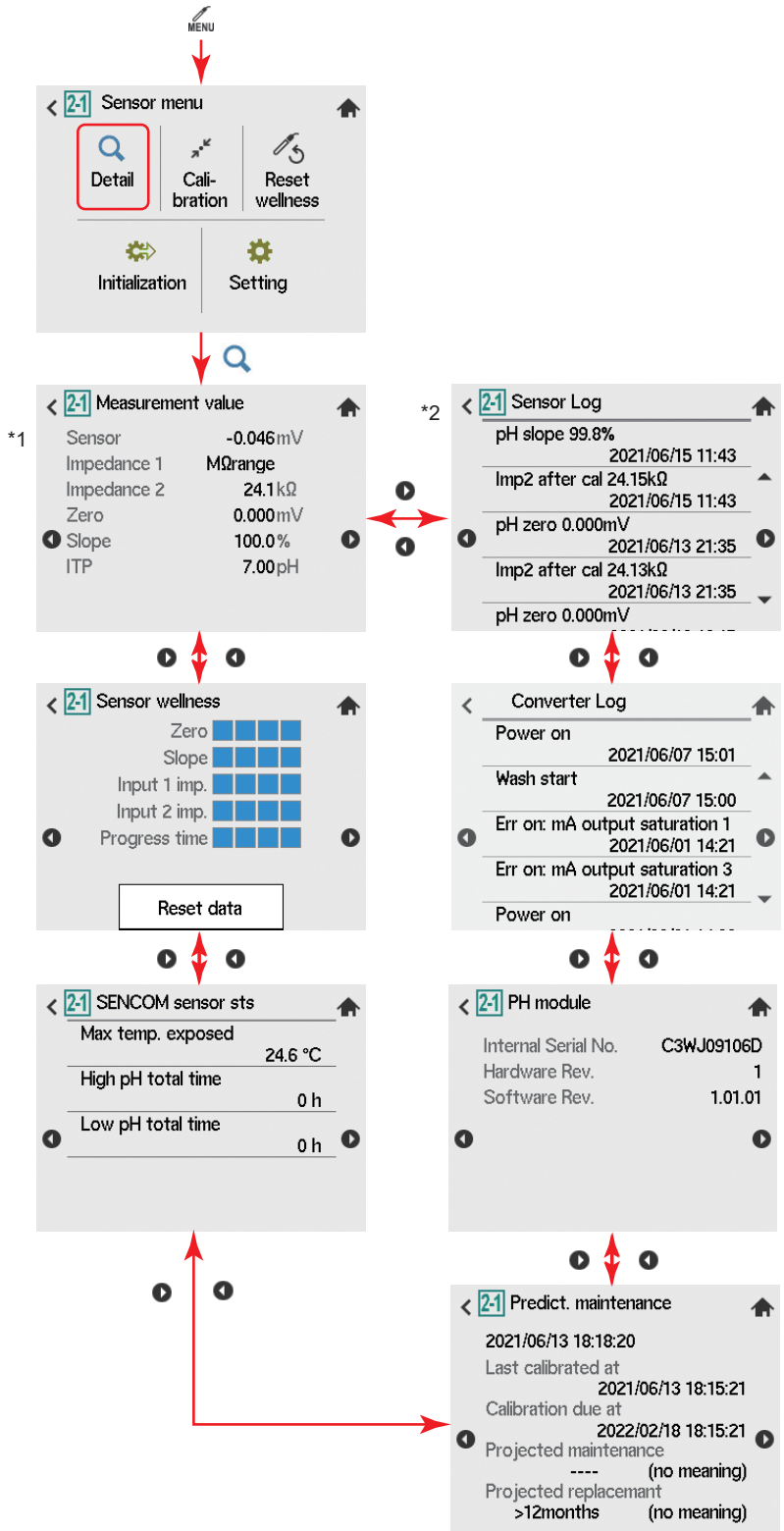


Figure 2.1 Sensor menu

2.1 Detail

Go to Sensor menu > “Detail” to check details (setup, sensor wellness, calibration, and module production number).

In case of trouble, when you contact Yokogawa service, please inform us of the module and FLXA402T software revision displayed on the Detail and module production number, revision number indicated on the nameplate attached to the instrument.



*1: "----"is displayed, depending on a calibration or sensor configuration that a user implements.
*2: The number of log page goes as many as the connected sensors.

Figure 2.2 Sensor menu flow chart

Measurement value

Sensor

Represents the measured electromotive force of sensor.

Impedance 1

For a PH sensor, “Impedance” shows electrical resistance of the glass electrode. The FLXA402T checks the impedance to know damage of the electrode.

In case of “Input Impedance setting” is “High” and the measured input-1 impedance value is higher than 100 kΩ, the display shows “MΩ RANGE”. If the measured input-1 impedance value is lower than 100 kΩ, the display shows “BAD”. If impedance is set to “Low”, the measured impedance value is displayed.

If Impedance measurement(A) is set to “Disabled”, “----”is displayed. You can change the setting of Impedance measurement (A) only when PH sensor module is in use.

Impedance 2

Impedance shows the electrical resistance of the reference electrode liquid junction. The liquid junction forms the electrolytic contact between the reference electrode and the measuring electrode. Therefore, it must be kept clean and filled with conductive electrolyte. Otherwise the measurement will suffer from instability, drift and measuring errors.

In case of “Input Impedance setting” is “High” and the measured impedance 2 value is higher than 100 kΩ, the display shows “MΩ RANGE”. The measured impedance 2 value is lower than 100 kΩ, display shows “BAD”. If Impedance is set to “Low”, the measured impedance value is displayed.

If Impedance measurement(A) is set to “Disabled”, “----”is displayed. See 3.4.1 Impedance settings for the details.

Zero

Theoretically, pH_Zero is 0 mV in a buffer solution of pH 7. The ZERO value indicates the condition of the sensor. The trend of ZERO drift of the sensor is used to predict the lifetime of the sensor.

ZERO can also be displayed in pH units and then it represents the pH value where the sensor output is 0 mV at 25ºC.

To set directly, go to Sensor menu> “Measure setting”> “Calibration setting”> “Zero/Slope/ITP”> “Zero”. Read 3.3.1 for the details.

Slope

Slope indicates the sensor sensitivity. It is expressed as % of the theoretical value of the electromotive force characteristics of the sensor

The theoretical value of the electromotive force characteristic (100% slope) is 59.16 mV / pH (at 25° C) according to the NERNST equation. The slope can only be calibrated by two-point calibration using two pH solutions. A low slope indicates that the sensor is not clean or it indicates a bad sensor.

The SLOPE can also be displayed as mV/pH value at 25 ºC if the user has defined this variable as mV/pH in user setting.

To set directly, go to Sensor menu> “Measure setting”> “Calibration setting”> “Zero/Slope/ITP”> “Slope”. Read 3.3.1 for the details.

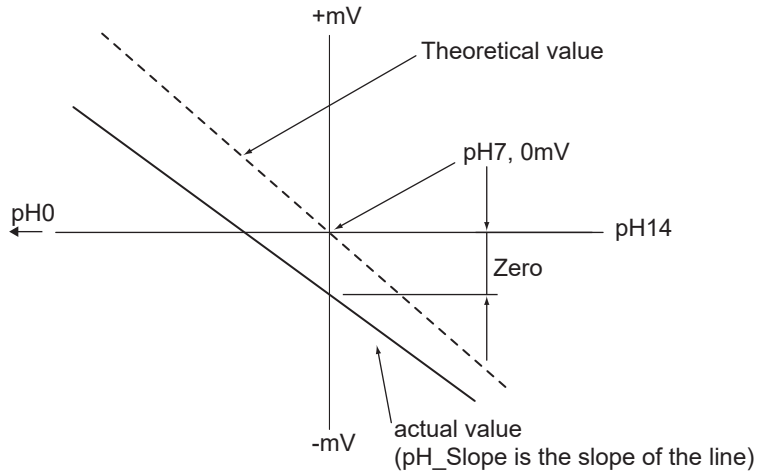


Figure 2.3 Zero/Slope

- **ITP**

  ITP represents a pH value where the electromotive force of the sensor does not change with temperature.

■ Sensor wellness

Sensor wellness shows the soundness of a sensor. The larger number of ■ appears in each gauge, the sounder the parameter concerned is. A gauge is indicated for only those parameters whose sensor wellness setting is “enabled, “while a bar (----) is displayed if the sensor wellness setting is “disabled.”

When analog sensor module is in use, if Impedance measurement (A) is set to “Disabled”, “----”is displayed, even if Impedance wellness is “Enabled”.

For Sensor wellness, go to Sensor menu > Configure sensor > Wellness settings

See 3.4 for the details.

When a sensor or an electrode is exchanged or replaced, sensor wellness data should be reset. Use Reset wellness in Sensor menu. See 2.3Reset wellness

■ SENCOM Sensor status

The status of the sensor is displayed.

- **Max temp. exposed**

  Displays the maximum temperature, which is automatically updated every time a higher temperature is measured.

- **High pH total time/Low pH total time**

  Displays the total time during which the pH value remains above the upper pH limit or below the lower pH limit.
  Up to 10 years (87600 hours) can be counted, after which the time is no longer updated.
  To set the parameters of High/Low pH value, go to Sensor menu > Configure sensor > Wellness settings > Define Sencom status

■ Predict. maintenance

- **Last calibrated at**

  Date on which the last sensor calibration was performed. The displayed value of the Zero is the result of this calibration. The displayed value of Slope was calibrated on this date only if the last calibration was a 2-point calibration.

Calibration due at

Date when the calibration must be done next according to the settings of the calibration interval. To set the calibration intervals, go to Sensor menu > Calibration settings > Limits and timing > Calib. interval.

Projected maintenance

The projected maintenance function predicts the date when the sensor unit will need recalibrating for maintaining measurement accuracy. The function checks the input-2 impedance (reference impedance) every 24 hours.

The function predicts the date when the input-2 impedance will cross the upper or lower limits, and indicates the date and its status (the status is displayed in parentheses).

As shown in the figure below, the date is predicted based on the intersection point of the upper or lower limits and the extrapolated line of the values obtained by the least squares method.

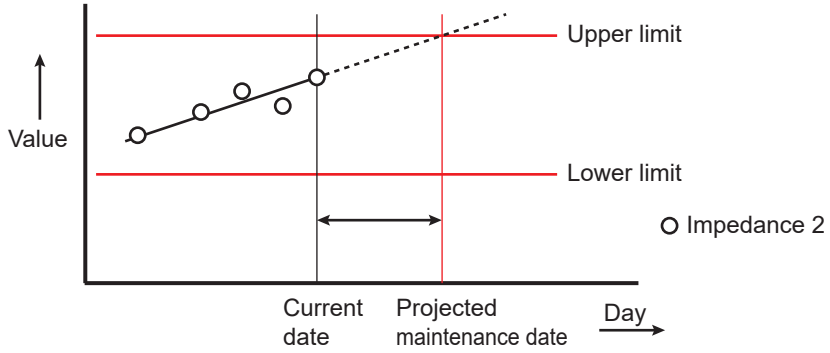


Figure 2.5 Projected maintenance

The status shows the certainty of the projected maintenance date in terms of the correlation coefficient R. Table 2.1, Table 2.2 shows pattern of the projected maintenance date, status.

Table 2.1 Display pattern of the projected maintenance date

Projected date	----	0-1 month	1-3 months	3-6 months	6-12 months	Over 1 year

- - : not predictable due to insufficient data

Table Display pattern of the status

Status	(- - - - -)	(Poor)	(Reasonable)	(Excellent)
Criteria	(R < 0.50)	(0.50 ≤ R < 0.70)	(0.70 ≤ R < 0.85)	(0.85 ≤ R < 1.00)

Projected replacement

The projected replacement function predicts the date when the sensor will need replacing for maintaining the measurement accuracy, based on the pH zero and pH slope on each calibration, and Impedance 2 after each calibration. The projected replacement date is predicted based on these parameters stored upon calibration, and displayed the same as that of projected maintenance. For details, see the description about the projected maintenance. Since three parameters (pH zero, pH slope, and Impedance 2 after calibration) are used for this projection, the nearest coming day is selected as the projected replacement date from the extrapolated line of the values obtained by the least squares method.

PH module

This screen enables operators to check the module Serial No., Hardware Rev, Software Rev.

Converter log, Sensor log

Same display as on the converter “Detail”.

See 3.1 in IM 12A01G01-03EN Operation of Converter.

2.2 Calibration

Sensor menu > Calibration . See Chapter 4.

Figure 2.6 Calibration selection

If you have a password, a prompt dialog box appears to input your password. After the password is verified, the page shifts to Calibration.

For password, see 5.4 in IM 12A01G01-03EN Operation of Converter.

2.3 Reset wellness

Sensor menu > Reset wellness

A dialog box appears to ask if you want to reset sensor wellness data.

Yes: the wellness is reset

No: the reset will not take place. The page returns to Sensor menu.

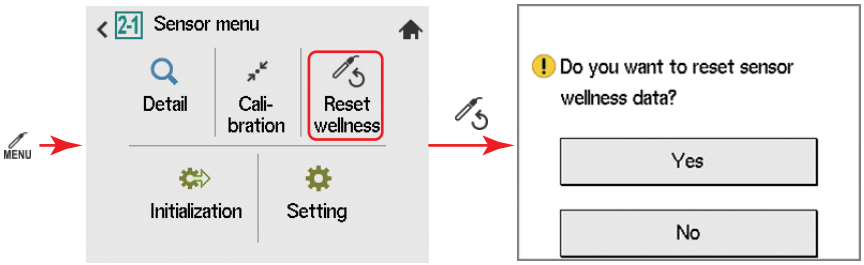


Figure 2.7 Reset wellness and dialog

If you created a password, a prompt dialog box appears to input your password. After the password is verified, a dialog appears to confirm if you want to reset.

For password, see 5.4 in IM 12A01G01-03EN Operation of Converter.

2.4 Initialization

Sensor menu > Initialization

The screen jumps to Load PH config. File, where you can initialize parameters of analog sensor module.

When Wash is in progress, text on the screen is grayed out and you cannot go to sensor Initialization screen even if you tap the icon.

Figure 2.8 Initialization in sensor menu

In the box of File name, name of defined sensor config. file to load is displayed, after sensors connected are automatically detected. You cannot change the file name.

If you tap “Execute”, the loading starts. When the loading ends, you will return to Sensor menu.

If you create a password, a prompt dialog box appears to enter the password. After the password is verified, Sensor initialization screen appears.

For password, see 5.4 in IM 12A01G01-03EN Operation of Converter.

If you go to Sensor initialization screen, maintenance contact becomes ON, and the other contact outputs keep the current status. When automatic HOLD function is enabled, mA output becomes HOLD.

2.5 Sensor settings

Sensor menu > Setting > Sensor setting

When Wash is in progress, text on the screen is grayed out. You cannot move to Sensor settings even if you tap the icon.

For further information on sensor settings, read chapter 3.

Figure 2.9 To Sensor setting

If you create a password, a prompt dialog box appears to enter the password. After the password is verified, Sensor setting is displayed.

For password, see 5.4 in IM 12A01G01-03EN Operation of Converter.

If you go to Sensor setting, the maintenance contact becomes ON, and the other contact outputs keep the current status. When automatic HOLD function is enabled, mA output becomes HOLD.

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3. Sensor setting

When you configure each setting, fill in User setting table we provide, and keep it in safe place.
Download the user setting table from our website below.
http://www.yokogawa.com/an/flxa402t/download/

To configure sensor setting, go to
Main screen “Menu” > Sensor menu > “Setting” > Sensor setting

In Sensor setting, maintenance contact turns ON and other contact output keeps the current status. When auto HOLD function is enabled, mA output becomes HOLD status.

Figure 3.1 Sensor menu to Sensor setting

To know how to confirm or edit the settings with parameters, refer to IM 12A01G01-03EN Operation of Converter.

In the parameter list of Sensor setting, parameters with (A) or (S) represent that (A) is exclusive for Analog sensor module, and (S) is exclusive for SENCOM SA. You cannot configure parameters which do not apply to the sensors to be used.

When you configure sensor setting and save the data, a dialog box appears to notify the operation is in progress. If you succeed the configuration, you will return to the setting menu, and if fail, a fail dialog appears.

3.1 Configure sensor

Configure the setting of sensors which connects to FLXA402T.

3.1.1 Temperature settings

■ Temp. element (A)

Select the temperature element used for compensation from among Pt1000, Pt100, 3kBalco, 8k55, PTC10k, 6k8, and 500Ω. Select the same type of temperature element as is actually connected.

3.1.2 Others

■ MODBUS address (S)

Don’t change.

3.2 Measure setting

Set parameters for measurement.

3.2.1 Temperature settings

Unit

Displays the unit for temperature, but you cannot change the setting here.

To change the setting, go to

Converter menu > Setting> Advanced setting > Other

3.2.2 Temp compensation

Compensation

This section describes the setup of the temperature compensation function that compensates temperature properties of the electromotive force of the pH sensor.

Methods: Automatic, Manual, External input

Automatic:	when a temperature element is used,
Manual:	when a manually set temperature is used.
External input:	when mA input to the converter is used. Go to Converter menu > Converter setting > mA input setting (Ad) > Temperature The setting must be matched to the specification of the device to use as an external input.

NOTE

When Manual is selected on the Temperature compensation, the process temperature shall be entered in the “Manual temp.” Home/Main screen displays the temperature you set.

Manual temp.

When you select Manual, you must enter process temperature to Manual temp.

Reference temp.

Set a reference temperature by/to which the measured pH value must be converted. Normally 25°C is used, so this temperature is chosen as the default value.

NOTE

Reference temperature here is used by the method “TC” on 2.2.3 Method (pH).

3.2.3 pH

Method (pH)

Select a temperature conversion method for pH measurement. “None” does not perform the temperature conversion.

Choose process temperature compensation from among “None”, “TC”.

Temp. coef

Temp. coef (TC pH)

This linear temperature coefficient is used for the conversion to a reference liquid temperature. It is possible to enter the temperature coefficient (TC) factor directly. If the temperature coefficient factor of the sample liquid is known from laboratory experiments or has been previously determined, it can be entered here.

This TC is a pH variation per °C (ΔpH/ΔT). Adjust the value between -0.1 to 0.1 pH/ºC. In combination with the Reference temp. setting, a linear compensation function is available, which is suitable for specific chemical solutions.

3.2.4 High/Low alarm setting

Alarms from sensors are sorted out to “Device fail”, “Device status”, “Measure alarm”, “Sensor status”. High/Low alarm setting defines High/low alarm limits of measurement values.

For details on alarms, see 4.7 in IM 12A01G01-03EN Operation of converter.

Parameter	Alarm description	Setting range	Default
Temp. warning high limit	Temperature too high	-30.0~140.0[˚C]	140.0[˚C]
Temp. warning low limit	Temperature too low	-30.0~140.0[˚C]	-30.0[˚C]
pH warning high limit	pH too high	-2.0~16.0[pH]	16.00[pH]
pH warning low limit	pH too low	-2.0~16.0[pH]	-2.00[pH]

3.3 Calibration settings

3.3.1 Cal. set pH

The screen flow differs depending on the combination of objects to be measured.
Calibration parameters for a pH converter involve slope (sensitivity), zero (Asymmetry potential), and ITP (isothermal point). Figure 3.2 shows the relations between pH value and the electromotive force of the sensor element.

The characteristic of the electromotive force in pH measurement is represented by an offset also known as Asymmetry potential [mV] or zero [pH] and a Slope [%, mV/pH]. For an ideal sensor, the theoretical slope is 59.16 mV/pH at 25ºC. The slope can be entered in mV/pH or as a percentage of the theoretical slope (100% corresponds to 59.16 mV/pH).

ITP represents a pH value where the electromotive force of the element does not change with temperature. Note that slope and zero are defined at 25ºC.

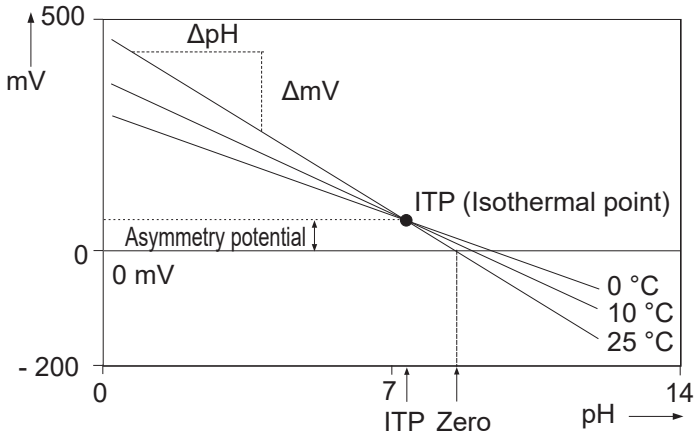

Figure 3.2 Calibration parameter

Unit

Zero unit/Slope unit

Zero is Asymmetry Potential. The method of zero (Asymmetry potential) unit conforms to the DIN standard for IEC 60746-2 instruments. Zero is defined in pH or mV.

The unit of Slope (sensitivity) is mV/pH or % (with the theoretical value as 100%).

Limits and timing

Zero high / low limit

Set the high and low limits of Zero (Asymmetry potential). During calibration, it is checked whether the new zero exceeds these high and low limits. Narrowing the band will prevent bad calibration procedures and calibration of bad sensors, which results in higher accuracy. The default values should be adjusted to suit the application and the “users” criterion.

Slope high/low limit

Set the high and low limits of Slope (sensitivity). During calibration, it is checked whether the new slope exceeds these high and low limits. Narrowing the band will prevent bad calibration procedures and calibration of bad sensors, which results in higher accuracy. The default values should be adjusted to suit the application and the “users” criterion.

Buffers (select set)

Buffers (select set)

Select a standard for calibration. Select one from “NIST (IEC,ISO)”, “DIN(DE)”, “US”. Yokogawa recommend “NIST (IEC, ISO, JIS equivalent)” standard buffer. Refer to Appendix for standard buffers.

Zero/Slope/ITP

You can enter Zero (Asymmetry potential), Slope (sensitivity), and ITP values directly in the screen displayed.

NOTE

It is not always necessary to enter this data. In most cases, the FLXA402T automatically does this while performing calibration. Direct input is used when special electrode systems are used or when the calibration in the process environment is not possible.

3.3.2 Cal. Set others

Set the parameters (stability width and stabilization time) used for the stability check during calibration and the calibration cycle used for updating the next date and time displayed on the sensor details screen.

Step range (pH)

Set the range over which the stability of a measured value is checked. If variations of a measured value over the stabilization time are within this range, the measured value is judged to have stabilized.

Stabilization time

During calibration, the stability of the measured value is constantly monitored. When variations of the measured value are within a value set in Step Range for a longer time than this stabilization time set here, the value is regarded as being stable. If the measured value does not stabilize within 10 minutes, calibration is aborted.

Calibr. interval

Set the interval in which a new calibration must be conducted. If the interval set here is exceeded, the instrument will be notified according to the setting in “Calib. time exceeded” in the error configuration.

3.3.3 Cal. set temperature

Temp.offset

You can enter directly Temp. offset value here.

Input the temperature-corrected offset value based on the next equation.

Temp.offset = actual value - (displayed temperature value- current temperature offset)

- Check actual value on other devices.
- Displayed temperature value is displayed on FLXA402T process measuring normally.
- Current temperature offset is confirmed on Temp. offset screen.

NOTE

Use this function when a calibration is disabled.

You don’t need to input directly Temp. offset when temp. offset is revised by calibration.

3.4 Wellness settings

This screen is used to set items relating to sensor diagnostics displayed on the sensor detail screen. Gauges are displayed for only parameters that have been enabled in Wellness settings.

Parameters set to Disable are indicated with a bar “----”.

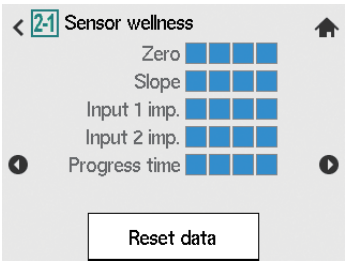

Figure 3.3 Sensor wellness

The setting parameters include “Impedance settings” “Impedance 1”, “Impedance 2”, “Progress Time”.

3.4.1 Impedance settings

This screen is used to set the impedance relating to an input impedance check. The setting affects the diagnostic screen on the sensor details screen and Impedance errors.

● Impedance measure (A)

Set Impedance measure to “Enabled” or “Disabled”.

This setting is related to the Impedance display on the sensor details screen, the sensor wellness gauge on the sensor diagnostic screen, and the Impedance error. When enabled, the pH sensor impedance measurement can be performed, checked, and monitored. When set to “Disabled”, the impedance measurement is not performed. The Impedance item on the sensor details screen and sensor wellness will be displayed as a bar “----”.

■ Impedance 1, Impedance 2

● Impedance 1, 2 (High, Low)

- When the setup value is “High”
  When the measured value of Impedance1 on the sensor details screen is 100 kΩ or more, “M Ω RANGE” is displayed, and when it is smaller than 100 kΩ, “BAD” is displayed.
  In the sensor wellness screen and Impedance error, the diagnostic criteria are determined by the worst value of 100 kΩ and the setting value of [Best value limit].
- When the set value is “Low”
  The measured impedance value is displayed on the sensor details screen.
  On the sensor diagnostic screen and Impedance error, the upper / lower limit settings are the diagnostic criteria.

● Impedance high limit, Impedance low limit, FINE

You can change the limit value of the diagnostic criteria, which is used according to the setting of Impedance 1,2 High/Low.

- **Impedance 1,2 (Enabled/Disabled)**

  You can set whether to display Impedance 1 and Impedance 2 on sensor wellness screen for each sensor.

  [Precautions regarding settings]

  Impedance 1 measures the pH glass film resistance, and Impedance 2 measures the resistance of the liquid junction of the reference electrode.
  Impedance can only be measured with a sensor that has a liquid earth electrode. The liquid earth electrode is a metal electrode other than the glass electrode and the reference electrode that comes into contact with the measurement liquid and transmits the potential of the liquid to the measurement circuit. When using a sensor that does not have a liquid earth electrode, disable Impedance measurement (A).

  Sensors with liquid earth electrode: PH8EFP, PH8ERP, etc.

  Sensors without liquid earth electrode: PH4P, PH4PT, PH4C, PH4CT, PH4F, etc.

  When pH is measured with water with extremely low conductivity, the impedance of the sample itself is high. In this case, in the “Error setting” of the converter setting of FLXA402T, set “Impedance 2 too high” to “Off”.

  [Errors in Impedance1, Impedance2]

  You can set the presence or absence of diagnosis and diagnostic criteria in this item, but you have to set whether or not to issue an Impedance error in the converter setting. Refer to the FLXA402T Operation of Converter IM 12A01G01-03EN for the setting.

3.4.2 Progress time

Set Progress time to enabled / disabled to be used on the sensor wellness screen. If it is disabled, a bar will be displayed. The time limit value is the reference value of the diagnostic gauge when the Progress time setting is enabled.

■ decreases as the operating time of the converter increases, and becomes zero when the usage limit value is reached.

3.4.3 Define SENCOM status

Configure settings related to status of sensors which are displayed on sensor detail screen.

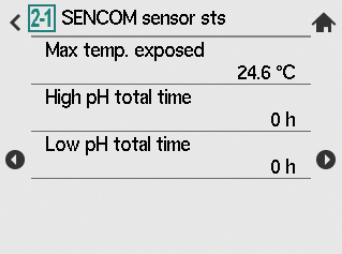

Figure 3.4 Sensor status

The setting parameters include “Low pH total time”, “High pH total time”. For each meaning of sensor status, see 2.1 Detail.

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4. Calibration pH

Before pH measurement, calibrate the pH sensor with the standard solution.

Figure 4.1 Sensor menu to Calibration

Go to Calibration as shown in Figure 4.1. You can go to Calibration by tapping CAL on Home or Main screen.

The calibration items include “pH” and “Temperature”.

The item to be calibrated is determined according to the settings made in the Configure sensor > Sensor type (A).

Calibration of “pH” with the measured value and its stability can be monitored on the calibration trend, thereby variation and stability can be checked graphically.

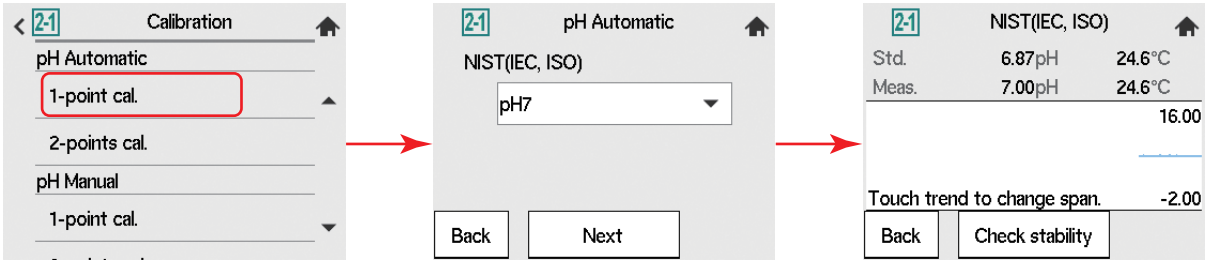

Figure 4.2 Sample of Calibration trend (manual calibration 1-point)

If FLXA402T detects any sensor fault, calibration cannot be conducted.

NOTE

Note the following when performing calibration with buffer solutions.

- Before starting a calibration, make sure the electrode system is properly cleaned and the electrodes are fully functional. They must be rinsed with clean water to avoid contamination of the calibration solution(s).
- Always use fresh buffer solution to avoid the risk of introducing errors from contaminated or old solutions. Buffers supplied as liquids have a limited shelf life, especially alkaline buffers, which absorb CO_2 from the air.
- Yokogawa recommends NIST(IEC,ISO) buffer standards for the best accuracy and buffer capacity.
- When the internal junction (Ag / AgCl) of the glass electrode is exposed to sunlight, the electromotive force changes due to the influence of ultraviolet rays. In this case, the pH value may be displayed higher than the actual pH value.
  When calibrating the pH sensor and measuring the process solution, keep the glass electrodes out of the sun.

Always ensure that the sensors are properly conditioned, clean and filled with the correct electrolyte solution (if appropriate) before starting a calibration. Refer to the sensor instructions for details.

4.1 pH Calibration

There are “pH Manual”, “pH Auto”.

4.1.1 pH Manual

The measured value is adjusted to match the value of the buffer standards or a process solution with a known pH value (buffer solution).

Check pH value, temperature influence, and stability in advance and enter the calibration known value manually.

Select the calibration type from among [zero (1pt)], [zero/slope (2pt)].

Follow the prompts displayed on the screen. A stability check is conducted at each measurement point. Proceed to the next step only after the reading has stabilized.

At calibration, we advise leaving the sensors in the buffer solution for three to five minutes before proceeding to the check stability even when the reading has stabilized. This will give you reliable and accurate calibration results.

NOTE

When a sensor or an electrode is replaced, sensor wellness data should be reset.

- **Zero (1 pt)**

  This calibration is one-point calibration. Zero of the calibration parameter is updated.

- **Zero/slope (2 pts)**

  This calibration is two-point calibration with using two types of solution.

  Zero and slope of calibration parameter are updated.

4.1.2 Automatic Calibration

In Automatic Calibration menu, when a standard solution is selected, a calibration value according to the temperature is entered automatically. You can set the selectable standard solution in [Buffers (select set)] > Select Buffer.

“NIST (IEC, ISO) is recommended. Refer to Table 1 in Appendix to know the temperature and pH value of each solution.

In the same way as manual pH calibration, select the calibration type [Zero (1 pt)] or [zero/slope (2 pts)].

Follow the prompts displayed on the screen.

A stability check is conducted at each measurement point. Proceed to the next step only after the reading has stabilized.

When calibrating, even if a sensor is immersed in a buffer solution and the indicated value stabilizes, leave it as it is for 3 to 5 minutes before proceeding to the stability check to obtain an accurate and reliable result.

NOTE

When a sensor or an electrode is replaced, sensor wellness data should be reset.

- **Zero (1 pt)**

  Select one type of solution. Zero of the calibration parameter is updated.

Zero/slope (2 pts)

Specify two standard solutions with different pH each other. Select a sequence and the type of standard solution from the list shown in Table 4.1 Zero and slope of the calibration parameter are updated

Table 4.1 Automatic calibration menu

Buffer settings	Calibration point	Buffer, sequence menus
NIST/DIN19266	1	pH7
		pH4
		pH9
	2	pH7>>pH4
		pH7>>pH9
		pH4>>pH7
		pH9>>pH7
		pH4>>pH9
DIN (DE)	1	pH6.8
		pH4.7
		pH9.2
	2	pH6.8>>pH4.7
		pH6.8>>pH9.2
		pH4.7>>pH6.8
		pH9.2>>pH6.8
		pH4.7>>pH9.2
US	1	pH7
		pH4
		pH10
	2	pH7>>pH4
		pH7>>pH10
		pH4>>pH7
		pH10>>pH7
		pH4>>pH10

4.2 Temperature calibration

To provide accurate measurement, temperature measurement is critical. Temperature calibration is performed when the temperature is measured with a high-precision thermometer and the temperature reading of the output device is adjusted. To improve the calibration accuracy, perform temperature calibration at a temperature as close as possible to the normal operating temperature.

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Appendix References

Buffer tables

The following tables show the details of the buffer solutions selectable in Calibration settings of pH (Section 4.1 pH Calibration) (unit: pH).

Table 1 NIST (IEC, ISO)

	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	38°C	40°C	45°C	50°C	55°C	60°C	70°C	80°C	90°C	95°C
1.68 pH		1.668	1.670	1.672	1.675	1.679	1.683	1.688	1.691	1.694	1.700	1.707	1.715	1.723	1.743	1.766	1.792	1.806
4.01 pH	4.003	3.999	3.998	3.999	4.002	4.008	4.015	4.024	4.030	4.035	4.047	4.060	4.075	4.091	4.126	4.164	4.205	4.227
6.87 pH	6.984	6.951	6.923	6.900	6.881	6.865	6.853	6.844	6.840	6.838	6.834	6.833	6.834	6.836	6.845	6.859	6.877	6.886
9.18 pH	9.464	9.395	9.332	9.276	9.225	9.180	9.139	9.102	9.081	9.068	9.038	9.011	8.985	8.962	8.921	8.885	8.850	8.833

Table 2 DIN (DE) (German buffers) so called: technical buffer solutions

	0°C	10°C	20°C	25°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C
4.65 pH DIN	4.670	4.660	4.650	4.650	4.650	4.660	4.680	4.700	4.720	4.750	4.790
6.79 pH DIN	6.890	6.840	6.800	6.790	6.780	6.760	6.760	6.760	6.760	6.780	6.800
9.23 pH DIN	9.480	9.370	9.270	9.230	9.180	9.090	9.000	8.920	8.880	8.850	8.820

Table 3 US technical buffers

	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C	55°C	60°C
4.0 pH US	4.000	3.998	3.997	3.998	4.001	4.005	4.001	4.018	4.027	4.038	4.050	4.064	4.080
7.0 pH US	7.120	7.090	7.060	7.040	7.020	7.000	6.990	6.980	6.988	6.978	6.970	6.890	6.980
10.0 pH US	10.317	10.245	10.179	10.118	10.062	10.012	9.966	9.926	9.889	9.856	9.828	9.828	9.828

NOTE

Yokogawa recommend the use of NIST (primary buffer standards). NIST is an approved standard solution with the best buffer capacity (the ability to resist pH change with contamination).

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Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN
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