Introduction

Thank you for purchasing the FLXA™402 4-Wire Converter.
This Instructor's Manual contains all essential information for the user to make full use of FLXA402.

Please read the following respective documents before installing and using the FLXA402.
The related documents are listed as follows.

General Specifications

<table>
<thead>
<tr>
<th>Contents</th>
<th>Document number</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLXA402 4-Wire Converter</td>
<td>GS 12A01F01-01EN</td>
<td>Online manual</td>
</tr>
</tbody>
</table>

“EN” in the document number is the language code.

User’s Manual

<table>
<thead>
<tr>
<th>Contents</th>
<th>Document number</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLXA402 4-Wire Converter</td>
<td>IM 12A01F01-01EN</td>
<td>Attached to the product (printed manual)</td>
</tr>
<tr>
<td>Start-up and Safety Precautions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLXA4024-Wire Converter Installation and Wiring</td>
<td>IM 12A01F01-02EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>FLXA402 4-Wire Converter Operation of Converter</td>
<td>IM 12A01F01-03EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>FLXA402 4-Wire Converter Operation of pH/ORP</td>
<td>IM 12A01F02-01EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>FLXA402 4-Wire Converter Operation of SC</td>
<td>IM 12A01F03-01EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>FLXA402 4-Wire Converter Operation of ISC</td>
<td>IM 12A01F04-01EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>FLXA402 4-Wire Converter Operation of DO</td>
<td>IM 12A01F05-01EN</td>
<td>Online manual (This manual)</td>
</tr>
</tbody>
</table>

“EN” in the document number is the language code.

Technical Information

<table>
<thead>
<tr>
<th>Contents</th>
<th>Document number</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLXA402 4-Wire Converter</td>
<td>TI 12A01F01-61EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>HART communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLXA402 4-Wire Converter</td>
<td>TI 12A01F01-62EN</td>
<td>Online manual</td>
</tr>
<tr>
<td>Modbus communication</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“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.

You can download the latest documents from our website. Scan QR code.
http://www.yokogawa.com/an/flxa402/download/
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.
- No part of the user’s manuals may be transferred or reproduced without prior written consent from YOKOGAWA.
- YOKOGAWA reserves the right to make improvements in the user’s manuals and product at any time, without notice or obligation.
- If you have any questions, or you find mistakes or omissions in the user’s manuals, please contact our sales representative or your local distributor.

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

FLXA402, a modular-designed converter, is a multi-parameter instrument offering a wide range of measurement choices; such as: pH/ORP (oxidation-reduction potential), Resistivity/Conductivity (SC), Inductive conductivity (ISC), Dissolved Oxygen (DO) – with the respective sensor module.

For specification of DO, see GS 12A01F01-01EN.

This user’s manual contains general description and precautions of the instrument.

The table below shows user’s manuals to read concerning the instrument’s operation, configuration, or calibration, which vary depending on its installation, wiring, and specification of each instrument.

<table>
<thead>
<tr>
<th>Contents</th>
<th>pH/ORP SENCOM™</th>
<th>Contacting conductivity (SC) SENCOM SA</th>
<th>Inductive conductivity (ISC)</th>
<th>Dissolved oxygen (DO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and general description</td>
<td></td>
<td></td>
<td>IM 12A01F01-02EN</td>
<td></td>
</tr>
<tr>
<td>Wiring and installation</td>
<td></td>
<td></td>
<td>IM 12A01F01-02EN</td>
<td></td>
</tr>
<tr>
<td>Converter operation (Setting, Calibration)</td>
<td></td>
<td></td>
<td>IM 12A01F01-03EN</td>
<td></td>
</tr>
<tr>
<td>Maintenance, Troubleshooting</td>
<td>IM 12A01F02-01EN</td>
<td>IM 12A01F03-01EN</td>
<td>IM 12A01F04-01EN</td>
<td>IM 12A01F05-01EN</td>
</tr>
<tr>
<td>Sensor operation (Setting, Calibration)</td>
<td>IM 12A01F02-01EN</td>
<td>IM 12A01F03-01EN</td>
<td>IM 12A01F04-01EN</td>
<td>IM 12A01F05-01EN</td>
</tr>
</tbody>
</table>

Trademark Acknowledgments

- FLEXA, FLXA, SENCOM and FieldMate are trademarks or registered trademarks of Yokogawa Electric Corporation.
- All other company and product names mentioned in this user’s manual are trademarks or registered trademarks of their respective companies.
- We do not use TM or ® mark to indicate those trademarks or registered trademarks in this user’s manual.
## Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>sensor(s)</td>
<td>sensors, sensors with SA11, sensor module(s)</td>
</tr>
<tr>
<td>SENCOM SA</td>
<td>SA11, SENCOM Smart Adapter or &quot;-S5&quot; (SENCOM SA) of 1st or 2nd input</td>
</tr>
<tr>
<td>analog sensor (module)</td>
<td>selectable sensors when -P1/-C1/-C5/-D1 is specified for 1st or 2nd input, e.g. DO30G.</td>
</tr>
<tr>
<td>Optical DO Sensor, DO70G</td>
<td>&quot;-D5&quot; (Digital sensor”) for 1st input</td>
</tr>
<tr>
<td>NE107:</td>
<td>NAMUR NE107</td>
</tr>
</tbody>
</table>

See the section 4.7 Error settings in IM 12A01F01-03EN

Operation of Converter
Model FLXA402
4-Wire Converter
Operation of DO

CONTENTS

◆ Introduction.............................................................................................................i

1. Sensor Menu Outline ......................................................................................... 1-1

2 Sensor menu.......................................................................................................... 2-1
   2.1 Detail ................................................................................................................ 2-2
   2.2 Calibration ..................................................................................................... 2-7
   2.3 Reset wellness ............................................................................................... 2-7
   2.4 Reset ................................................................................................................ 2-8
   2.5 Sensor settings .............................................................................................. 2-9

3. Sensor setting.................................................................................................... 3-1
   3.1 Configure sensor ............................................................................................ 3-2
      3.1.1 Sensor type ............................................................................................ 3-2
      3.1.2 Temperature settings .......................................................................... 3-2
      3.1.3 Others .................................................................................................. 3-2
   3.2 Measure setting .............................................................................................. 3-3
      3.2.1 DO Unit ................................................................................................. 3-3
      3.2.2 Temperature settings .......................................................................... 3-3
      3.2.3 Temp compensation ............................................................................ 3-3
      3.2.4 Salinity comp. ....................................................................................... 3-4
      3.2.5 Pressure comp. (Measure) .................................................................... 3-4
      3.2.6 High/Low alarm setting ........................................................................ 3-5
   3.3 Calibration settings ....................................................................................... 3-6
      3.3.1 Cal. Set others ...................................................................................... 3-7
      3.3.2 Cal. set temperature ............................................................................ 3-7
   3.4 Wellness settings ............................................................................................ 3-8
      3.4.1 Define SENCOM status ........................................................................ 3-8

4. Calibration DO .................................................................................................. 4-1
   4.1 Air Calibration ............................................................................................... 4-2
   4.2 Water Calibration ........................................................................................... 4-3
   4.3 Manual slope calibration .............................................................................. 4-4
   4.4 Manual Offset Cal. ........................................................................................ 4-5
   4.5 Temperature Cal. ......................................................................................... 4-5

Appendix For DO (Dissolved Oxygen) ................................................................. App.-1

Revision Record .................................................................................................. i
1. Sensor Menu Outline

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

The operation is secured by password. See the section 5.4 in IM 12A01F01-03EN Operation of Converter.

![Sensor menu]

Figure 1.1 Sample image of “Sensor menu”

### Sensor detail

On Sensor menu, tap “Detail”. Read 2.1.

![Sensor detail]

Figure 1.2 Sample image of “Detail”(Sensor menu>Detail)

### Calibration

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

![Calibration]

Figure 1.3 Sample images of pH Calibration

For further information read chapter 4.

### Wellness reset

Go to Sensor menu> tap 🔄. Read 2.3.

### Sensor reset

On Sensor menu, tap 🔄. Read 2.4.
**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.

Select a parameter to change. The parameter becomes highlighted. To overwrite the data, tap ⬤

Read Chapter 3 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 (sample)

When Optical DO Sensor is used, “Reset wellness” is not available.
2.1 Detail

Go to Sensor menu > “Detail” to check details (setup, sensor diagnosis, calibration, and module production number). (Figure 2.2)

In case of trouble, when you contact Yokogawa service, please inform us of the module and FLXA402 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 process or sensor configuration when Optical DO Sensor is used.
*2: The number of log page goes as many as the connected sensors.

Figure 2.2 Sensor menu flow chart
NOTE
When Optical DO Sensor is used, “Sensor wellness”, “SENCOM sensor sts.”, “Predict maintenance” are not available.

■ Measurement value

- **Zero Current**
  
The offset value of a calibrated sensor. This is the offset of the sensor and sensor circuit in the zero oxygen condition. When Optical DO Sensor is used, the value is 0 (fixed).

- **Slope**
  
  This parameter indicates the sensitivity of the sensor after calibration. It is indicated as a percentage of the reference sensitivity based on the selection of the sensor or that has been entered. When Optical DO Sensor is used, the value is 100 (fixed).

- **Sensor Current**
  
The raw output of the sensor before it is calibrated and temperature compensated. When Optical DO Sensor is used, “----” is displayed.

- **Polarization volt**
  
  Appears only when “Sensor type” is “Polarographic”. To set, go to sensor menu > Sensor configure > Polarographic > Polarization Voltage

- **Available KOH**
  
  For the parameter, go to Sensor menu > Configure sensor > Wellness settings > Check KOH residue > Sensor type: DO30G (for “Others” “ a bar (----) is displayed.)

  This parameter indicates the amount of available KOH remaining in the sensor. This amount is calculated from the amount of KOH consumed by dissolved oxygen measurements.

  When replacing the solution in the sensor, calibration should be made to reset (clear) diagnostic sensor data.

- **Compensation**
  
  For compensation of measured value, salinity compensation, Pressure comp. (measure), and Pressure Comp. (Cal) are available. The salinity compensation shows the current setting. When Pressure comp. (measure) is set to “manual”, Pressure level (process) calculates, when Pressure comp. (measure) is set to “External input”, mA input and low/high limit value calculates the pressure. As for Pressure comp. (Cal), a setting value is displayed.
## Sensor wellness

Sensor wellness shows the soundness of a module. The larger number of ■ appears in each gauge, the more sound 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.”

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

See 3.4 for the details.

When a sensor or an electrode is replaced, sensor wellness data should be reset. Use Reset wellness in Sensor menu. See 2.3. When Optical DO Sensor is used, this function is not available and a bar (----) is displayed.
### SENCOM Sensor status

The status of the sensor is displayed. When Optical DO Sensor is used, this function is not available.

- **Max temp. exposed**
  Displays the maximum temperature, which is automatically updated every time a higher temperature is measured.

- **Sterilization**
  Displays the number of times the temperature remains above the preset value for at least the prescribed time period (min.). (Figure 2.4)
  Go to Sensor menu > Configure sensor > Wellness settings > Define SENCOM status

  ![Figure 2.4 Sterilization](image-url)

  - a: does not count, because the length of time that the temperature exceeds the sterilization temperature is shorter than the length of sterilization time.
  - b: counts, because the length of time that the temperature exceeds the sterilization temperature is longer than the length of sterilization time.
  - c: counts, because the length of time that the temperature exceeds the sterilization temperature is longer than the length of sterilization time.

  If the temperature exceeds the sterilization temperature longer than the length of sterilization time consecutively, the event counts as one.

  The last time when the event counts is displayed as a last sterilization date/time.
  Counter indicates a maximum of 9999. After the counter reaches the maximum, if the requirements to count is satisfied, the data of last sterilization date and time is updated.

- **High temp 1 total, Last date of High temp1, High temp 2 total**
  To define the temperature of “High temp 1” and “High temp 2”, go to Sensor menu > Configure sensor > Wellness settings > Define SENCOM status

  The total length of time that the measured temperature exceeds the defined High temp 1 or High temp 2.

  Displays the total time during which the temperature remains over the high temperature 1 or 2.
  The last date and time (the end of high-temperature condition) is displayed as the “last date.” Up to 10 years (87600 hours) can be counted. Even after that, the “last date” is updated if the event meets the conditions.
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. For details see 3.3.3.

DO module

The screen enables operators to check the module serial number and hardware/software rev. of installed analog sensor module.

**NOTE**

When Optical DO Sensor is used, Device no. is displayed in place of serial number, and you cannot check the serial number. Among software revisions of Optical DO Sensor, only the version of ODOUM042 or greater is supported. Neither ODOUM040 nor ODOUM041 is supported.

Converter log, Sensor log

Same display as on the converter “Detail”.
See 3.1 in [IM 12A01F01-03EN](#) Operation of Converter.
2.2 Calibration

Sensor menu > Calibration. See Chapter 4.

![Calibration selection](image)

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 12A01F01-03EN 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.

![Reset wellness and dialog](image)

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 12A01F01-03EN Operation of Converter.

When Optical DO Sensor is used, this function is not available.
2.4 Reset

Sensor menu > Reset

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

While Wash is in progress, “Reset” is invalid. Even if you tap the icon, you will not jump to the sensor reset screen.

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 reset screen appears.

For password, see 5.4 in [IM 12A01F01-03EN Operation of Converter].

If you go to Sensor reset screen, mA output becomes HOLD, and contact output keeps the current status.
2.5 Sensor settings

Sensor menu > Setting 🌟 > Sensor setting

When Wash is in progress, the character row is displayed in color. You cannot move to Sensor settings.

For further information on sensor settings, read chapter 3.

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 12A01F01-03EN Operation of Converter.

If you go to Sensor setting, the mA output becomes HOLD, and contact output keeps the current status.
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/flxa402/download/

Configure sensor setting

Go to Main screen > Sensor menu > Sensor setting

You can confirm or edit the setting. When you go to Sensor setting, mA output becomes HOLD, and contact output keeps the current status.

![Sensor menu to Sensor setting](image)

To know how to confirm or edit the settings with parameters, refer [IM 12A01F01-03EN](#) Operation of Converter.

In the parameter list of Sensor setting, parameters with (A) or (S) represent (A) for Analog sensor module, (S) for exclusively SENCOM SA.

You cannot configure parameters which do not apply to the sensors to be used.

**CAUTION**

Only parameters with *(asterisk) apply Optical DO Sensor.

Some of these parameters may set to high/low limit when a fail value that exceeds high/low limit is entered instead of issuing an alarm.

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 parameter list, and if fail, a fail dialog appears.
3.1 Configure sensor

Configure the setting of sensors (analog sensors, Optical Do Sensor).

3.1.1 Sensor type

Only for analog sensors.

- **Sensor type**
  
  Select a sensor type from Galvanic or Polarographic. Care about which one is compatible with sensors being connected.

- **Galvanic**
  
  Select a Sensor sensitivity among “0.45µA/ppm” / “0.90µA/ppm” / “Others.”
  
  If you select “Others”, enter a numeric value on “Sensor sensitivity (User defined)”.

- **Polarographic**
  
  Enter a numeric value of sensor sensitivity. You can define a polarization voltage recommended for the sensor.

3.1.2 Temperature settings

Only for analog sensors.

- **Temp. element (A)**
  
  Select the temperature element used for compensation from among Pt1000, NTC2k. Select the same type of temperature element as is actually connected.

3.1.3 Others

- **MODBUS address (S)**
  
  You can change MODBUS address only when SENCOM SA is in use.
3.2 Measure setting
Set parameters for measurement.

3.2.1 DO Unit
Select DO unit from "mg/L" / "ppm" / "ppb" / "%SAT".

3.2.2 Temperature settings

■ Unit
Displays the unit for temperature. You cannot change the setting here.
To change the setting, go to
Converter menu > Setting > Advanced setting > Other

3.2.3 Temp compensation

■ Compensation
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 specification of the device to use as an external input.

NOTE
When Manual is selected on the Temperature compensation, a process temperature should be set in the "Manual temp. Home/Main screen displays the temperature you set here.

■ Manual temp.
When you select Manual, you must enter process temperature.
3.2.4 Salinity comp.

This function is used to measure sample water containing salt such as sea water. The dissolved oxygen in a solution is affected by salinity. Therefore, to conduct accurate measurements, it is necessary to compensate the influence of the salinity of the sample solution. To make salinity compensation, select “Enabled” for “Compensation.” Calculate the saturated concentration value from the salinity and temperature of the actual sample water based on Table 1 of Appendix (Solubility of oxygen in water as a function of temperature and salinity) and enter the value.

NOTE
Set up the conductivity value (mS/cm) at 20 °C. Refer to Appendix.

3.2.5 Pressure comp. (Measure)

Dissolved oxygen concentration varies depending on changes in the process pressure or air pressure. To compensate this, enter a value of pressure (air pressure). Compensation has two options, “Manual” or “External input.”

To program freely selected pressure value, choose “Manual” and enter the pressure value on “Pressure level (process)”*. For further information, see Table 2, Table 3 on Appendix.

If you use mA input corresponding to measured value of pressure from external devices, select “External input”.

To use the mA input, go to Converter menu > Setting > mA input settings (Ad) > Type > Pressure. You can confirm the unit of pressure but not change the setup on this mode. To setup, go to Converter menu > Setting > Advanced setting > Other settings

NOTE
When Optical DO Sensor is used, this function is not available. To compensate pressure by the external input, instead of using this function, go to Converter menu,

Converter menu > Setting > mA input settings (Ad) > Pressure > Pressure Comp.* > select “Enable”.

If you select “Disable”, the compensation is implemented by the value on Pressure level (process) *
3.2.6 High/Low alarm setting

Alarms from sensors are sorted out to “Device fail”, “Device status”, “Measure alarm”, “Sensor status”. Setup High/Low alarm setting of main measurement value on Measure alarm.

For details on alarms, see 4.7 in IM 12A01F01-03EN Operation of converter.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reason for alarm</th>
<th>Setting range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. warning high limit</td>
<td>Temp. is too high.</td>
<td>-20.0 to 150.0 [°C]</td>
<td>150.0 [°C]</td>
</tr>
<tr>
<td>Temp. warning low limit</td>
<td>Temp. is too low.</td>
<td>-20.0 to 150.0 [°C]</td>
<td>-20.0 [°C]</td>
</tr>
<tr>
<td>DO warning high limit(mg/l)</td>
<td>DO is too high.</td>
<td>0.00 to 99.99 [mg/L]</td>
<td>99.99 [mg/L]</td>
</tr>
<tr>
<td>DO warning low limit(mg/l)</td>
<td>DO is too low.</td>
<td>0.00 to 99.99 [mg/L]</td>
<td>0.0 [mg/L]</td>
</tr>
<tr>
<td>DO warning high limit(ppm)</td>
<td>DO is too high.</td>
<td>0.00 to 99.99 [ppm]</td>
<td>99.99 [ppm]</td>
</tr>
<tr>
<td>DO warning low limit(ppm)</td>
<td>DO is too low.</td>
<td>0.00 to 99.99 [ppm]</td>
<td>0.00 [ppm]</td>
</tr>
<tr>
<td>DO warning high limit(%SAT)</td>
<td>DO is too high</td>
<td>0.0 to 9999 [ppb]</td>
<td>9999 [ppb]</td>
</tr>
<tr>
<td>DO warning low limit(%SAT)</td>
<td>DO is too low.</td>
<td>0.0 to 100.0 [%SAT]</td>
<td>100.0 [%SAT]</td>
</tr>
</tbody>
</table>

NOTE

When Optical DO Sensor is used, High/Low alarm is not issued and this setting is not available.

When measured temperature exceeds

- high limit: 60.0 [°C] or low limit: -20.0 [°C]

the value is recognized as fail of temperature element then issues

“temp. resistivity too high (fail)” or “temp. resistivity too low (fail)”

Temperature can be measured within the range of specification: -40.0 to 140.0 [°C] which is specification of Optical DO Sensors, but DO value is displayed as “----”.

When DO value exceeds

- high limit: 300.0 [%SAT] or low limit: 0.0 [%SAT]

the value is recognized as sensor fail, issuing

“mA input too high (fail)” or “mA input too low (fail)”.

If the version of Optical DO Sensor is ODOUM042, the alarms might not be detected depending on the situation.
3.3 Calibration settings

- **Limits and timing**
  
  Set limits and timing on every type of sensors, galvanic or polarographic respectively.

- **Zero high / low limit**
  
  Set the high and low limits of Zero (aspot). 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.

- **Zero/Slope**
  
  - **Zero/Slope**
    
    You can directly enter the value “Zero current”, “Slope”. You can configure each one on type of sensors, “Galvanic”, or “Polarographic” respectively.

  - **Pressure Comp. (Cal)**
    
    You can directly enter the value of “Pressure level” (Calibration). This parameter is used only for calibration. Enter the pressure at calibration. Neither Pressure Comp. (Measure) nor mA input does not apply to calibration.

- **Step range**
  
  You can define a step range. When a measured value fluctuates within the step range, it implies the measuring is stabilized. Define step range on each DO measuring unit of both zero and slope, “mg/L”, “ppm”, “ppb”, “%SAT” respectively.
3.3.1 Cal. Set others

- **Stabilization time**
  During calibration, the stability of the ORP value is constantly monitored. When variations of the measured value are within the preset Step Range, the value is regarded as being stable. If the measured value does not stabilize within 60 minutes, calibration is aborted.

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

3.3.2 Cal. set temperature

- **Temp. offset**
  You can enter directly Temp. offset value here.
  Input the temperature-corrected offset value based on the next equation.

  \[ Y = A - (B - C) \]

  where
  - \( Y \) = Temp. offset
  - \( A \) = actual value
  - \( B \) = displayed temperature value
  - \( C \) = current temperature offset

  Note
  - Check \( A \) (actual value) on other devices.
  - \( B \) is a value displayed on FLXA402 process.
  - \( C \) (current temperature offset) is confirmed on Temp. offset screen.

**NOTE**
When you renew Temp. offset value on FLXA402 by calibration, you don’t need to input Temp. offset value directly. Enter the value directly when calibration is not implementable.
3.4 Wellness settings

This screen is used to set items relating to sensor diagnostics displayed on the Sensor wellness.

Gauges are displayed for only parameters that have been enabled in “Wellness settings”.

“Parameters set to Disable are provided with a bar display.

![Figure 3.2 Sensor wellness]

The setting parameters include “Progress Time”, “Heat cycle” “Check KOH residue”.

Progress time: “Progress time”, and “BAD Limit”.  
To enable “Available KOH” appear on the sensor “Measurement value” screen, go to “Check KOH residue” > “Sensor type”

![Figure 3.3 Measurement value]

3.4.1 Define SENCOM status

The parameters are “Sterilized temp.”, “Sterilized time”, “High temp.1”, “High temp.2”. For further information on sensor status, see 2.1

![Figure 3.4 SENCOM sensor status]
4. Calibration DO

Calibration of the dissolved oxygen analyzer is performed in the following situations:

• When a new dissolved oxygen sensor is installed.
• When the membrane is replaced and/or the electrolyte solution is replaced

There are three methods for calibration: Air calibration, Water calibration and Manual calibration

- Air calibration: the most common and easiest method.
- Water calibration: features higher accuracy than the air calibration
- Manual calibration: a method whereby the sensor is calibrated by comparison with a reference method

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method</th>
<th>Sample</th>
<th>Analog sensors (galvanic, polarographic)</th>
<th>Optical DO Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>zero</td>
<td>sodium sulfite solution water or N₂ gas</td>
<td>air-zero water-zero rarely necessary (recommended for low conc. measurement)</td>
<td>(B) zero always required</td>
</tr>
<tr>
<td>span</td>
<td>air</td>
<td>the atmosphere (Humidity saturated atmosphere is best)</td>
<td>air-span common, easiest</td>
<td>B air easy, less accurate</td>
</tr>
<tr>
<td>water</td>
<td>air</td>
<td>saturated water</td>
<td>water-span highest accuracy</td>
<td>A air highest accuracy</td>
</tr>
<tr>
<td>sample</td>
<td>solution with known-value of concentration</td>
<td>manual-slope implement according to the necessity</td>
<td>N/A manual-slope implement according to the necessity</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Rate (*): Rating of recommendation. In alphabetical order, A is the most recommended. (highlighted field is recommended)

Figure 4.1 Sensor menu to Calibration (on display Zero: “0 %”, Span “100 %”)

For DO, Favorite Calibration is not available. Tap on Home/Main screen, then you switch to calibration screen.


When Optical DO Sensor is used, Automatic Calibration (Zero Calibration, Air Calibration), Manual calibration (Manual Slope Cal.) are available.

Follow steps to implement calibration being instructed on each screen. Each measuring point inspects stability of the calibration. After the value becomes stable, you can go to the next step.

**NOTE**

While “Checking stability” is on screen, the stability of current calibration value is being monitored automatically. When the inspection lasts longer than 60 minutes, the fail alarm occurs and the calibration is not implemented. If you need, edit “Stabilization time” and “Step range” and try again the calibration.

If FLXA402 detects any sensor fault such as damage on temperature electrode, no calibration is implemented.

**CAUTION**

When Optical DO Sensor is used, because no sensor status can be monitored, be sure that there is no damage on sensors before use.

**NOTE**

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

### 4.1 Air Calibration

Move the sensor to a maintenance site and wash off any dirt on the membrane. Lightly wipe off any remaining water from the membrane with a soft tissue.

Expose the sensor to the air in an environment where there is no temperature change and no wind. (A convenient way to accomplish this environment is to place the sensor in an empty bucket)

Oxygen partial pressure in the atmospheric gas is influenced by vapor saturation. The lower humidity drops, the higher the oxygen partial pressure rises. (influential rate of 2 to 3 % at maximum)

For suitable condition to perform calibration, the vapor level in the atmosphere requires approximately saturated (100 % of humidity) and the oxygen partial pressure should not fluctuate according to the change of humidity.
4.2 Water Calibration

Water calibration is a method of calibrating dissolved oxygen analyzers in a laboratory. Accurate results can be obtained if the span calibration is performed carefully in air-saturated water.

Although setting the Zero Calibration to “Enabled” allows 2-point calibration of Zero (0%) and Span (100%), the reading must have been stable before performing zero calibration. Therefore, zero calibration takes a relatively long time.

Conduct water calibration in fresh water. For zero calibration in salt water, perform it by manual calibration.

Set the sensor in the maintenance mode. Wash off any stain on the membrane and use a soft tissue to wipe off any remaining water from the membrane.

- **Air-saturated water**

  Pour water (without salt content) into a beaker or other container, and place it on a magnetic stirrer or other agitator. Put a stirring bar in it and agitate the water, and send air from a pump (bubbling). It takes 15 to 30 minutes until the water is fully saturated. Then put the sensor in this water which is still agitated and bubbling, and calibrate it. Keep the sensor at least 3 cm above the bottom of the beaker to prevent the membrane from directly contacting the air bubbles.

- **Water for zero calibration**

  Zero calibration takes a long time and normally there is no need to perform it. A clean sensor does not have a zero current and thus does not require zero calibration.

  For the zero calibration water, dissolve 20 to 30 grams of sodium sulfite in 1 liter of desalinated water.

  **NOTE**

  Dissolve sodium sulfite in the water and wait until the reading becomes stable before calibrating the sensor. Even a healthy sensor needs 40 to 50 minutes. Leave the sensor in the solution.

  **NOTE**

  When Optical DO Sensor is used, you can select Air calibration or Zero calibration from “Automatic calibration”.

  Air calibration adjust the span point (100%), Zero calibration adjust the zero point (0 %).

  Water calibration with saturated water enables you to gain an accurate result if you select Air calibration on screen and follow the calibration procedure of Water calibration.

  It takes some time for water calibration to become stable. If you perform Zero calibration, follow the process of Water calibration.
4.3 Manual slope calibration

Calibrate the sensitivity of the sensor with a solution of known oxygen concentration.

First, analyze the oxygen concentration of a sample solution and then calibrate the sensor sensitivity to adjust to this value. From the actual measurement of salinity and temperature, obtain the dissolved oxygen concentration by referring to Table 1 in Appendix 4 and enter it. When salinity must be considered, perform the calibration manually.

Note the following:

- Quickly analyze the sample water to prevent the dissolved oxygen concentration or temperature from changing.
- Before analyzing the sample water, analyze the reference with a calibrated laboratory instrument.
- To eliminate any discrepancies, the laboratory instrument must have been calibrated with the same calibration data as specified in ISO 5814.

Confirm that the reading of the instrument is stable and the sensor is clean. If the reading remains unstable, set the sensor in the maintenance mode and wash off any stain on the sensor membrane. Return the sensor to the sample water and leave it until the reading becomes stable.

Salinity compensation

To compensate salinity, select “Enabled” in “Measurement setup” – “Salinity compensation” – “Compensation”

Perform calibration by referring to Table 1 in Appendix 4.

Example:

When the atmospheric pressure is 101.325 kPa, the solution temperature is 20.0°C, and the salinity (conductivity) is 9.1 mS/cm,

(1) Calculate the salinity from the conductivity.
   According to Table 2 in Appendix 4, the salinity is 6 (%), 9.1 mS/cm

(2) Calculate the oxygen decrease by obtaining the difference of saturated dissolved oxygen level between two salinity points.
   According to the table 1 in Appendix 4,
   Salinity 0 at 20.0°C: 9.09 (mg/L), Salinity 9: 8.62 (mg/L)
   (9.09 – 8.62)/9 = 0.052 [mg/L]
   Therefore, the oxygen reduction per Salinity is 0.052 mg/L.

(3) Calculate the saturated concentration of the solution (for calibration) by subtracting the oxygen decrease value from the saturated oxygen concentration at Salinity0.
   9.09–(0.052 × 6)=8.8 [mg/L]
   Therefore, the saturated oxygen concentration of sea water (9.1 mS/cm) at 20.0°C is 8.8 (mg/L).
4.4 **Manual Offset Cal.**

Manual Offset calibration is to calibrate manually Zero Current of sensors. The measured value obtained in a laboratory is generally used as a reference.

4.5 **Temperature Cal.**

For the most accurate measurements, it is important to have a precise temperature measurement. Measure the temperature with a high-precision thermometer and adjust the sensor reading accordingly. For best accuracy, this should be done as near to the normal operating temperature as possible.
Appendix For DO (Dissolved Oxygen)

## Dissolved oxygen

Dissolved oxygen means the oxygen dissolved in water. Its concentration is expressed as the amount of oxygen per unit volume of water (mg/L or ppm). The solubility of oxygen in water varies depending on water temperature, salinity, atmospheric pressure, etc.

The sensors used in FLXA402 employ the membrane electrode method to measure the dissolved oxygen. Two methods are available: galvanic cell method and polarographic method.

## Compensation

There are three compensation methods for FLXA402: temperature compensation, salinity compensation, and process pressure compensation.

Salinity and temperature compensations meet ISO 5814 (see Table 1). There is no need to change the setting for normal usage. Use the salinity compensation when measuring a solution containing salt (see Section 13.2.4). For operation at high altitude, adjust the pressure value for the process pressure compensation (see Section 13.2.5).

### Table 1 Solubility of oxygen in water as a function of temperature and salinity (*1*)

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Salinity (mS/cm)</th>
<th>Solubility of oxygen in water (<em>2</em>) (mg/l)</th>
<th>Temperature (°C)</th>
<th>Salinity (mS/cm)</th>
<th>Solubility of oxygen in water (<em>2</em>) (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>14.62</td>
<td>23</td>
<td>0</td>
<td>8.58</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>13.73</td>
<td>24</td>
<td>9</td>
<td>8.14</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>12.89</td>
<td>25</td>
<td>18</td>
<td>7.73</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>12.11</td>
<td>26</td>
<td>27</td>
<td>7.34</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>11.37</td>
<td>27</td>
<td>36</td>
<td>6.97</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>14.22</td>
<td>28</td>
<td>0</td>
<td>8.42</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>13.36</td>
<td>29</td>
<td>9</td>
<td>8.00</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>12.55</td>
<td>30</td>
<td>18</td>
<td>7.99</td>
</tr>
<tr>
<td>8</td>
<td>27</td>
<td>11.79</td>
<td>31</td>
<td>27</td>
<td>7.63</td>
</tr>
<tr>
<td>9</td>
<td>36</td>
<td>11.08</td>
<td>32</td>
<td>36</td>
<td>7.34</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>13.46</td>
<td>33</td>
<td>0</td>
<td>8.11</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>12.66</td>
<td>34</td>
<td>9</td>
<td>7.71</td>
</tr>
<tr>
<td>12</td>
<td>18</td>
<td>11.91</td>
<td>35</td>
<td>18</td>
<td>7.33</td>
</tr>
<tr>
<td>13</td>
<td>27</td>
<td>11.20</td>
<td>36</td>
<td>27</td>
<td>6.97</td>
</tr>
<tr>
<td>14</td>
<td>36</td>
<td>10.54</td>
<td>37</td>
<td>36</td>
<td>6.62</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>13.03</td>
<td>38</td>
<td>0</td>
<td>8.42</td>
</tr>
<tr>
<td>16</td>
<td>9</td>
<td>12.19</td>
<td>39</td>
<td>9</td>
<td>8.00</td>
</tr>
<tr>
<td>17</td>
<td>18</td>
<td>11.34</td>
<td>40</td>
<td>18</td>
<td>7.99</td>
</tr>
<tr>
<td>18</td>
<td>27</td>
<td>10.55</td>
<td>41</td>
<td>27</td>
<td>7.63</td>
</tr>
<tr>
<td>19</td>
<td>36</td>
<td>9.89</td>
<td>42</td>
<td>36</td>
<td>7.34</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>12.65</td>
<td>43</td>
<td>0</td>
<td>8.11</td>
</tr>
<tr>
<td>21</td>
<td>9</td>
<td>11.84</td>
<td>44</td>
<td>9</td>
<td>7.71</td>
</tr>
<tr>
<td>22</td>
<td>18</td>
<td>11.08</td>
<td>45</td>
<td>18</td>
<td>7.33</td>
</tr>
</tbody>
</table>

*1: ISO 5814: 2012 (E)

*2: Solubility of oxygen in water in equilibrium with air at 101.325 kPa: unit at standard barometric pressure (normal atmospheric pressure at sea level): 101.325 kPa = 101.325 kN/m² = 1 atm = 760 mmHg
<table>
<thead>
<tr>
<th>Conductivity at 20 °C (mS/cm)</th>
<th>Salinity (%)*</th>
<th>Conductivity at 20 °C (mS/cm)</th>
<th>Salinity (%)*</th>
<th>Conductivity at 20 °C (mS/cm)</th>
<th>Salinity (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>20</td>
<td>13</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>21</td>
<td>14</td>
<td>36</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>22</td>
<td>15</td>
<td>37</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>23</td>
<td>15</td>
<td>38</td>
<td>27</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>24</td>
<td>16</td>
<td>39</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>25</td>
<td>17</td>
<td>40</td>
<td>29</td>
</tr>
<tr>
<td>11</td>
<td>7</td>
<td>26</td>
<td>18</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
<td>27</td>
<td>18</td>
<td>44</td>
<td>32</td>
</tr>
<tr>
<td>13</td>
<td>8</td>
<td>28</td>
<td>19</td>
<td>46</td>
<td>33</td>
</tr>
<tr>
<td>14</td>
<td>9</td>
<td>29</td>
<td>20</td>
<td>48</td>
<td>35</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
<td>30</td>
<td>21</td>
<td>50</td>
<td>37</td>
</tr>
<tr>
<td>16</td>
<td>10</td>
<td>31</td>
<td>22</td>
<td>52</td>
<td>38</td>
</tr>
<tr>
<td>17</td>
<td>11</td>
<td>32</td>
<td>22</td>
<td>54</td>
<td>40</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>33</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>13</td>
<td>34</td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Salinity is estimated from the conductivity at 20.0 °C
### Table 3 Solubility of oxygen in water as a function of temperature and pressure (**1**)

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Pressure kPa (atm)</th>
<th>Solubility (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10.56</td>
<td>11.04</td>
</tr>
<tr>
<td>1</td>
<td>10.27</td>
<td>11.24</td>
</tr>
<tr>
<td>2</td>
<td>9.98</td>
<td>10.91</td>
</tr>
<tr>
<td>3</td>
<td>9.72</td>
<td>10.65</td>
</tr>
<tr>
<td>4</td>
<td>9.46</td>
<td>10.33</td>
</tr>
<tr>
<td>5</td>
<td>9.21</td>
<td>10.06</td>
</tr>
<tr>
<td>6</td>
<td>8.98</td>
<td>9.81</td>
</tr>
<tr>
<td>7</td>
<td>8.75</td>
<td>9.56</td>
</tr>
<tr>
<td>8</td>
<td>8.54</td>
<td>9.33</td>
</tr>
<tr>
<td>9</td>
<td>8.33</td>
<td>9.1</td>
</tr>
<tr>
<td>10</td>
<td>8.13</td>
<td>8.88</td>
</tr>
<tr>
<td>11</td>
<td>7.94</td>
<td>8.68</td>
</tr>
<tr>
<td>12</td>
<td>7.76</td>
<td>8.48</td>
</tr>
<tr>
<td>13</td>
<td>7.58</td>
<td>8.29</td>
</tr>
<tr>
<td>14</td>
<td>7.41</td>
<td>8.09</td>
</tr>
<tr>
<td>15</td>
<td>7.25</td>
<td>7.89</td>
</tr>
<tr>
<td>16</td>
<td>7.1</td>
<td>7.6</td>
</tr>
<tr>
<td>17</td>
<td>6.94</td>
<td>7.47</td>
</tr>
<tr>
<td>18</td>
<td>6.8</td>
<td>7.2</td>
</tr>
<tr>
<td>19</td>
<td>6.66</td>
<td>7.01</td>
</tr>
<tr>
<td>20</td>
<td>6.52</td>
<td>6.8</td>
</tr>
<tr>
<td>21</td>
<td>6.39</td>
<td>6.59</td>
</tr>
<tr>
<td>22</td>
<td>6.26</td>
<td>6.38</td>
</tr>
<tr>
<td>23</td>
<td>6.14</td>
<td>6.17</td>
</tr>
<tr>
<td>24</td>
<td>6.02</td>
<td>5.99</td>
</tr>
<tr>
<td>25</td>
<td>5.91</td>
<td>5.92</td>
</tr>
<tr>
<td>26</td>
<td>5.8</td>
<td>5.84</td>
</tr>
<tr>
<td>27</td>
<td>5.69</td>
<td>5.78</td>
</tr>
<tr>
<td>28</td>
<td>5.58</td>
<td>5.63</td>
</tr>
<tr>
<td>29</td>
<td>5.48</td>
<td>5.51</td>
</tr>
<tr>
<td>30</td>
<td>5.38</td>
<td>5.59</td>
</tr>
<tr>
<td>31</td>
<td>5.28</td>
<td>5.74</td>
</tr>
<tr>
<td>32</td>
<td>5.18</td>
<td>5.96</td>
</tr>
<tr>
<td>33</td>
<td>5.1</td>
<td>6.13</td>
</tr>
<tr>
<td>34</td>
<td>5.01</td>
<td>6.31</td>
</tr>
<tr>
<td>35</td>
<td>4.92</td>
<td>6.54</td>
</tr>
<tr>
<td>36</td>
<td>4.83</td>
<td>6.75</td>
</tr>
<tr>
<td>37</td>
<td>4.75</td>
<td>6.94</td>
</tr>
<tr>
<td>38</td>
<td>4.67</td>
<td>7.16</td>
</tr>
<tr>
<td>39</td>
<td>4.58</td>
<td>7.34</td>
</tr>
<tr>
<td>40</td>
<td>4.47</td>
<td>7.52</td>
</tr>
<tr>
<td>41</td>
<td>4.37</td>
<td>7.71</td>
</tr>
<tr>
<td>42</td>
<td>4.28</td>
<td>7.91</td>
</tr>
<tr>
<td>43</td>
<td>4.22</td>
<td>8.12</td>
</tr>
<tr>
<td>44</td>
<td>4.21</td>
<td>8.33</td>
</tr>
<tr>
<td>45</td>
<td>4.2</td>
<td>8.55</td>
</tr>
</tbody>
</table>

**Note:**

- ISO 5814: 2012 (E)
- ISO 5814:1990(E)

**Reference:**

ISO 5814:1990(E)
Table 4 Variation of atmospheric pressure with respect to altitude(*1)

<table>
<thead>
<tr>
<th>Altitude (m)</th>
<th>Mean atmospheric pressure (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>101.3</td>
</tr>
<tr>
<td>150</td>
<td>99.5</td>
</tr>
<tr>
<td>300</td>
<td>97.9</td>
</tr>
<tr>
<td>450</td>
<td>96.0</td>
</tr>
<tr>
<td>600</td>
<td>94.3</td>
</tr>
<tr>
<td>750</td>
<td>92.6</td>
</tr>
<tr>
<td>900</td>
<td>91.0</td>
</tr>
<tr>
<td>1050</td>
<td>89.3</td>
</tr>
<tr>
<td>1200</td>
<td>87.7</td>
</tr>
<tr>
<td>1350</td>
<td>86.1</td>
</tr>
<tr>
<td>1500</td>
<td>84.6</td>
</tr>
<tr>
<td>1650</td>
<td>83.0</td>
</tr>
<tr>
<td>1800</td>
<td>81.5</td>
</tr>
<tr>
<td>1950</td>
<td>80.0</td>
</tr>
<tr>
<td>2100</td>
<td>78.5</td>
</tr>
<tr>
<td>2250</td>
<td>77.1</td>
</tr>
<tr>
<td>2400</td>
<td>75.6</td>
</tr>
<tr>
<td>2550</td>
<td>74.2</td>
</tr>
<tr>
<td>2700</td>
<td>72.8</td>
</tr>
<tr>
<td>2850</td>
<td>71.5</td>
</tr>
<tr>
<td>3000</td>
<td>70.1</td>
</tr>
<tr>
<td>3150</td>
<td>68.8</td>
</tr>
<tr>
<td>3300</td>
<td>67.5</td>
</tr>
</tbody>
</table>

*1: ISO 5814: 2012 (E)
Revision Record

- Manual Title: Model FLXA402 4-Wire Converter Operation of DO
- Manual No.: IM 12A01F05-01EN

July 2019/2nd Edition
   Revised (page. ii)

Nov. 2018/1st Edition
   Newly published