User's Manual

EXAxt TB

# Model TB750G
# Right Angle Scattered Light Turbidimeter
# Quick Start Manual

IM 12E01A06-02E

vigilantplant.™

YOKOGAWA
Yokogawa Electric Corporation

IM 12E01A06-02E
1st Edition

# ◆ INTRODUCTION

## ■ Structure of this Manual

This is a supplementary manual to TB750G Right Angle Scattered Light Turbidimeter for User's Manual IM 12E01A06-01E. This manual describes the specifications, installation, operation, maintenance, and troubleshooting. To use this instrument correctly, read this manual and User's Manual IM 12E01A06-01E thoroughly.

## ■ Before Measurement

The TB750G turbidimeter is preset with defaults prior factory shipment. Before measurement, verify that these factory default settings meet the operating conditions and if necessary, reconfigure parameters.

# ◆ Symbol and Notations Used in this Manual

## ■ Symbol

The following symbol is used in this manual.


CAUTION

Indicates that damage to software or hardware, or system failures could occur if instructions are not followed.

## ■ Notations

In this manual, operation keys, display messages, indicators, and LED lamps on the instrument are denoted in the following manner.

1. Operation keys are denoted by brackets [ ] – for example:

   
   
   : [YES] key

2. Indicators, messages, and numerical data on the display are denoted as follows:
   Message display: {*WASH}
   Data display: {2.05} (when lit), {2.05} (when flashing)

1st Edition: Apr. 2006 (YK)

# ◆ Notice

## ■ About this Manual

- ●This manual should be passed on to the end user.
- ●This manual should be read thoroughly before operating the instrument.
- ●This manual explains the functions contained in this product, but does not warrant that they will suit the particular purpose of the user.
- ●The contents of this manual shall not be reproduced or copied, in part or in whole, without permission.
- ●The contents of this manual are subject to change without prior notice.
- ●Every effort has been made to ensure the accuracy in the preparation of this manual. However, if any errors or omissions are noticed, please contact the nearest Yokogawa representative or sales office.

## ■ Protection, Safety, and Modification of the Product

- ●The safety instructions described in this manual should be strictly observed to ensure safety both of the product and the system controlled by the product.
- ●A protection or safety circuit should be installed externally, if needed. Do not attempt to modify or add such circuit to the inside of the equipment.

## ■ Limitation of Liability

- ●Yokogawa grants no warranties other than the express warranty set forth under the warranty provisions.
- ●Yokogawa shall not be liable to you or any third party for any damage, including consequential or incidental damages, arising out of or in connection with the use of this equipment, defects beyond our knowledge, or any other contingency beyond our control.

# Contents

**Contents**

# 1. OVERVIEW

## 1.1 Features

The TB750G is a process turbidimeter employing the right angle light scattering method, and has the following features.

- Highly reliable measurement with excellent linearity and repeatability
  - Linearity: ±2% of reading or ±0.01 NTU, whichever is greater
  - Repeatability: ±1% of reading or ±0.002 NTU, whichever is greater
  - Display resolution: 0.001 NTU
- Easy-to-clean measurement cell
- Compact, lightweight converter and detector
- User configurable analog output range
  - Analog output range: 0-0.2 NTU to 0-100 NTU
- Analog output range switching (2 or 3 ranges)
- Enhanced self-diagnostic function as standard
  - Light source failure, input element failure, calibration failure, various circuit failures, etc.
- Detector designed to remove influence of air bubbles
- A wide range of measurement conditions
  - Low flow rate: 0.05 to 20 l/min {0.8 to 317 gal/h}
  - High pressure: Up to 500 kPa {72 psi}
  - Sample temperature: 0 to 50°C {32 to 122°F}
- Detector can be connected for in-line analysis
- 2 analog outputs, 3 relay contact outputs, and 1 serial communication
- Many options available upon request
- Ultrasonic transducer and oscillator for ultrasonic cleaning
- Various head tanks to accommodate application requirements

## 1.2 Measurement Principle

The measuring system of the TB750G turbidimeter, comprised of a detector and a converter, complys with USEPA 180.1.

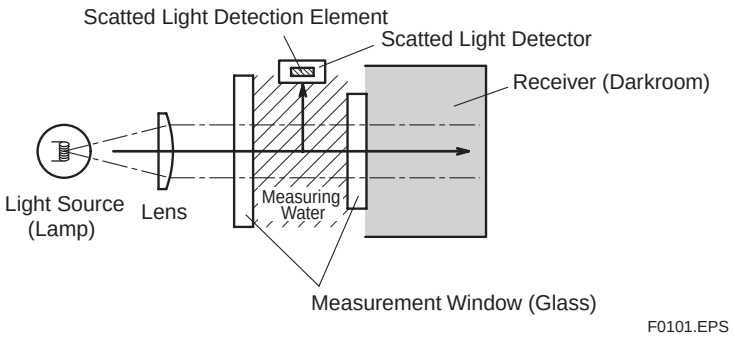



**Figure 1.1 Measurement Principle**

# 2. PIPING AND WIRING

## 2.1 Piping

Piping methods depend on the application, select the appropriate system configuration, and install pipes accordingly following examples.

### 2.1.1 System Using Open Head Tank and Zero Turbidity Filter

This is a typical system. A piping diagram is shown in Figure 2.1. Air bubbles in a water sample are removed by an open head tank and the water sample is introduced into the detector at a stable flow rate.

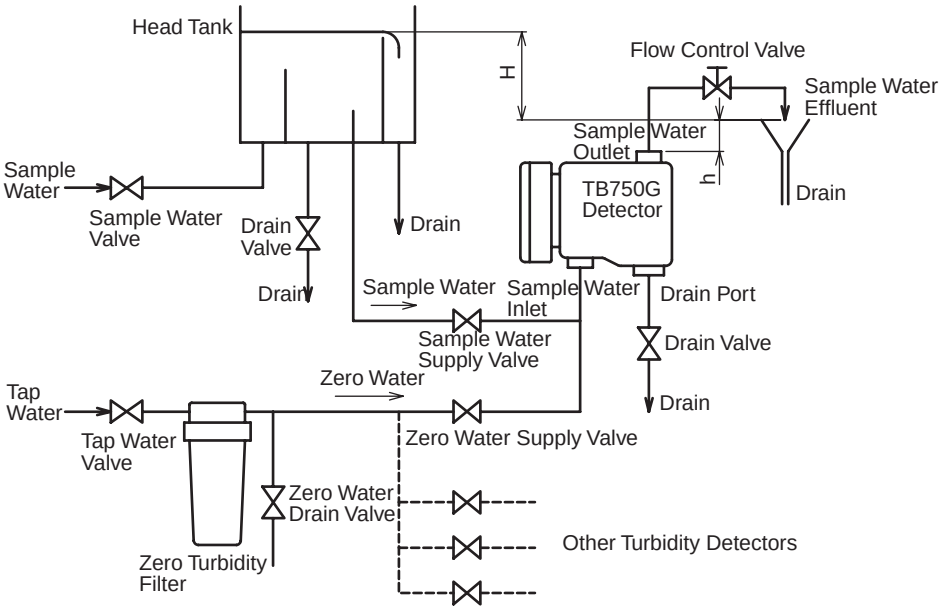



**Figure 2.1 Piping Diagram**

- To prevent corrosion of water inside the zero turbidity filter, allow water to flow through the filter and flow out from the zero water drain valve continuously at a flow rate of approximately 10 ml/min.
- When using filtered water as zero reference, install a filter with the appropriate pore size depending on the measuring range.

  Measuring range of less than 2 NTU: 0.2 μm
  Measuring range of 2 NTU or greater: 1 μm

### 2.1.2 System without Head Tank and Zero Turbidity Filter

This is a simple system where a water sample is taken from the process and directly introduced into the detector. This system configuration can be used when a water sample contains a negligible amount of air bubbles or when the turbidity of a water sample is high and the effect of air bubbles is nonsignificant.

## CAUTION

Sample water conditions and ambient temperature must meet the specifications: maximum pressure: 500 kPa; sample temperature: 0 to 50°C; ambient temperature: -5 to 50°C.

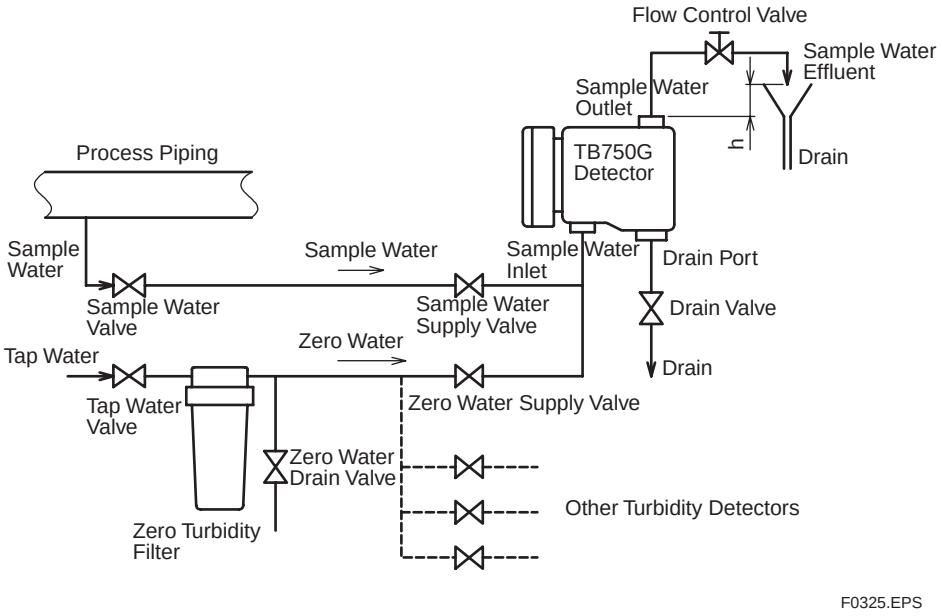
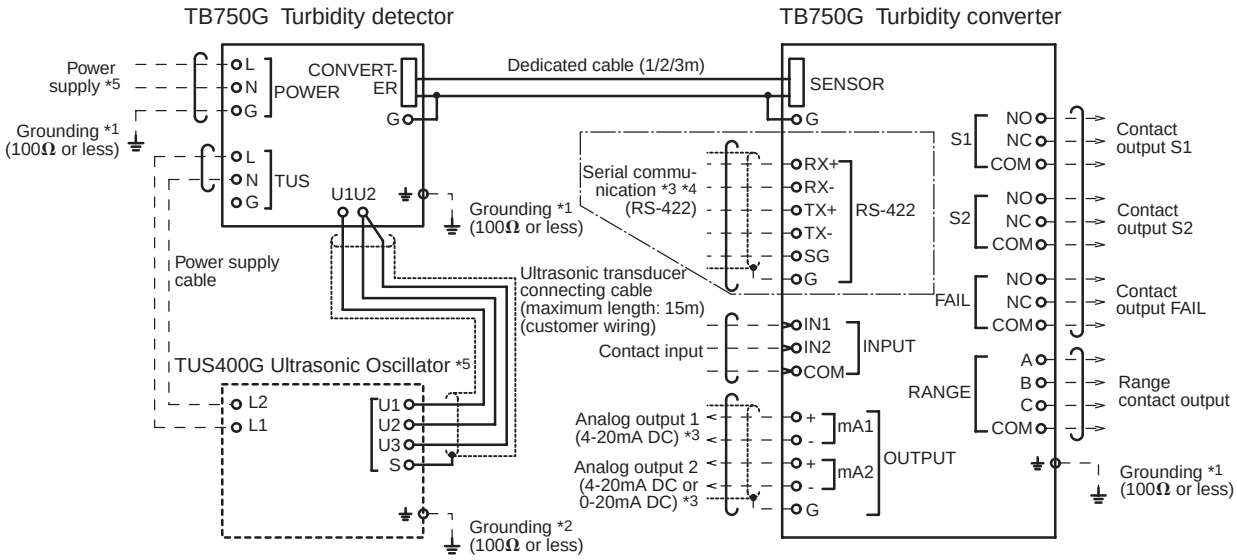



**Figure 2.2 Piping Diagram**

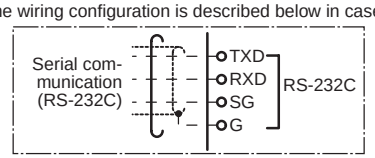
- The flow control should not be done on the inlet side of the detector.
- To prevent corrosion inside the zero turbidity filter, allow water to flow through the filter and flow out from the zero water drain valve continuously at a flow rate of approximately 10 ml/min.

# 2.2 Wiring

## 2.2.1 Wiring Required for TB750G




(Note) Dotted wiring is external wiring. Use cable with 6 to 12 mm OD for wiring.
*1 Power terminal "G" on detector, detector case, and converter case must be grounded (ground resistance: 100Ω or less).
*2 External grounding terminal of ultrasonic oscillator must be grounded (ground resistance: 100Ω or less).
*3 Use 2-conductor shielded cable for analog output wiring and serial communication wiring.
*4 The wiring configuration is described below in case that RS-232C serial communication is selected.




*5 When option code "/US" is specified, TUS400G should be purchased separately.
When TUS400G is used in system, the power supply to TB750G should be the same as the supply voltage specified in the MS Code of TUS400G.

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**Figure 2.3 Connection Diagram**

## 2.2.2 Wiring for Detector

Wire for connections to the following terminals:

(1) Power supply terminals;
(2) Power supply terminals for ultrasonic oscillator (when option code "/US" is specified); and,
(3) External grounding terminal.

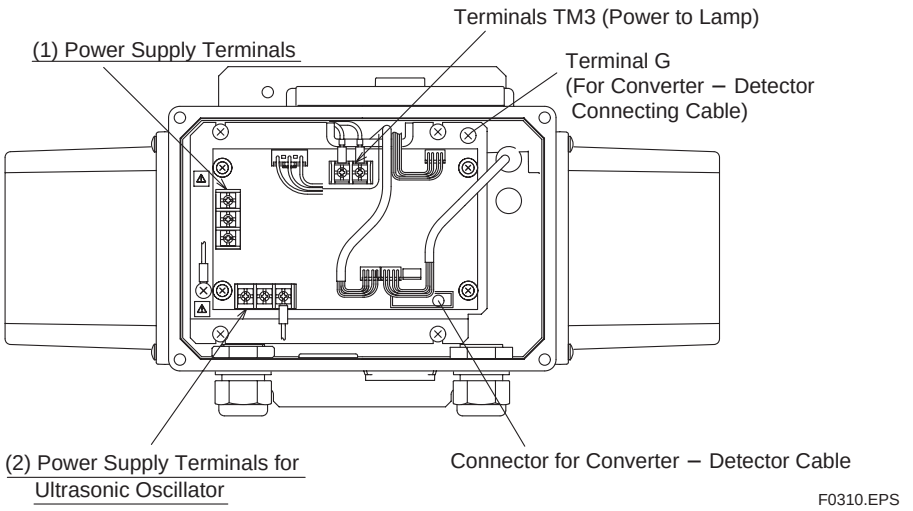



**Figure 2.4 Internal View of Detector**

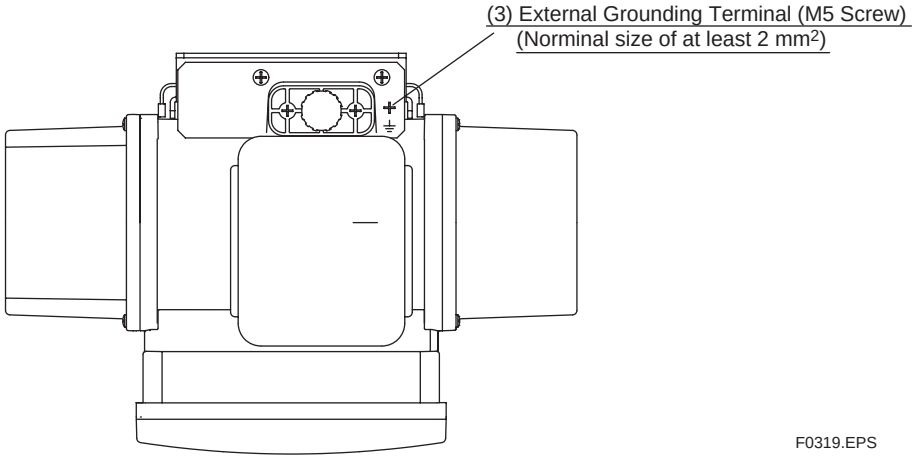
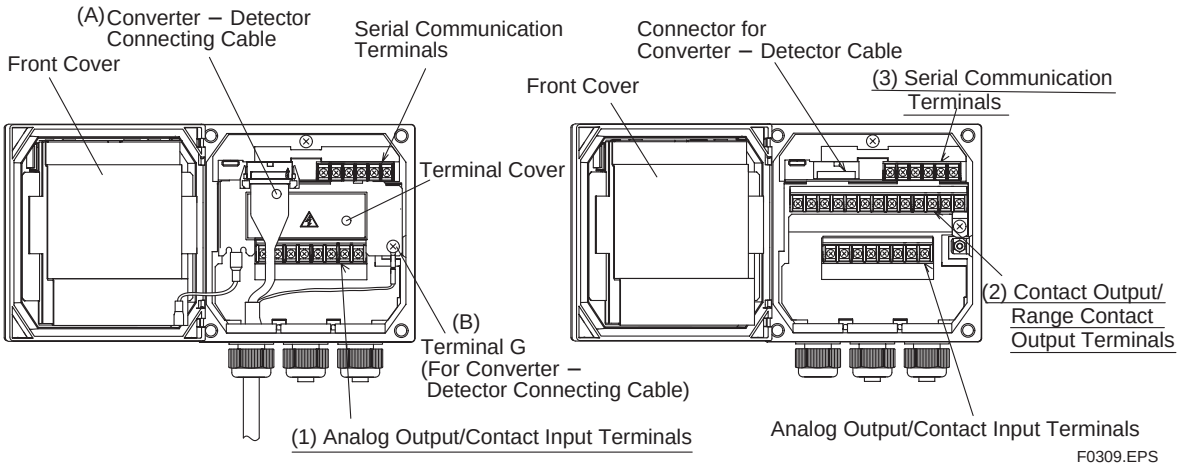



**Figure 2.5 Grounding Terminal of Detector**

### 2.2.3 Wiring for Converter

Wire for connections to the following terminals:

(1) Analog output/contact input terminals;
(2) Contact output/range contact output terminals;
(3) Serial communication terminals (when in use); and,
(4) Grounding terminal.




**How to Remove the Terminal Cover**

Disconnect the converter-detector connecting cable (A) and its grounding wire (B) from the converter. Remove the terminal cover by sliding it slightly to the left and pulling it forward.

**Figure 2.6 Internal View of Converter**

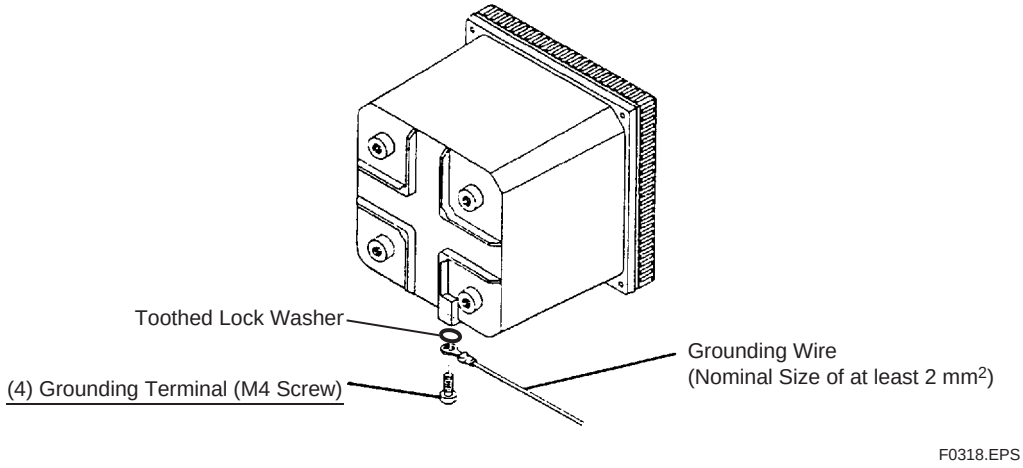



**Figure 2.7 Grounding Terminal of Converter**

## Contact Output (S1, S2 and FAIL) Wiring

- Be sure to use the contacts meeting the conditions below.
- Functions of contact outputs S1 and S2 should be set in Codes 40 and 41 at service level. Refer to section 4.3.

**Table 2.1 Contact Rating**

| | AC | DC |
|---|---|---|
| Contact maximum permissible voltage | 250 V | 30 V |
| Contact maximum permissible current | 2 A | 3 A |
| Contact maximum permissible power (resistance load) | 125 VA | 60 W |

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**Table 2.2 Contact Operation**

| | Contact S1, S2 | | | Contact FAIL | | |
|---|---|---|---|---|---|---|
| Status | LED | NO | NC | LED | NO | NC |
| In action | ON | Closed | Open | ON | Open | Closed |
| Not in action | OFF | Open | Closed | OFF | Closed | Open |
| Power OFF | OFF | Open | Closed | OFF | Open | Closed |

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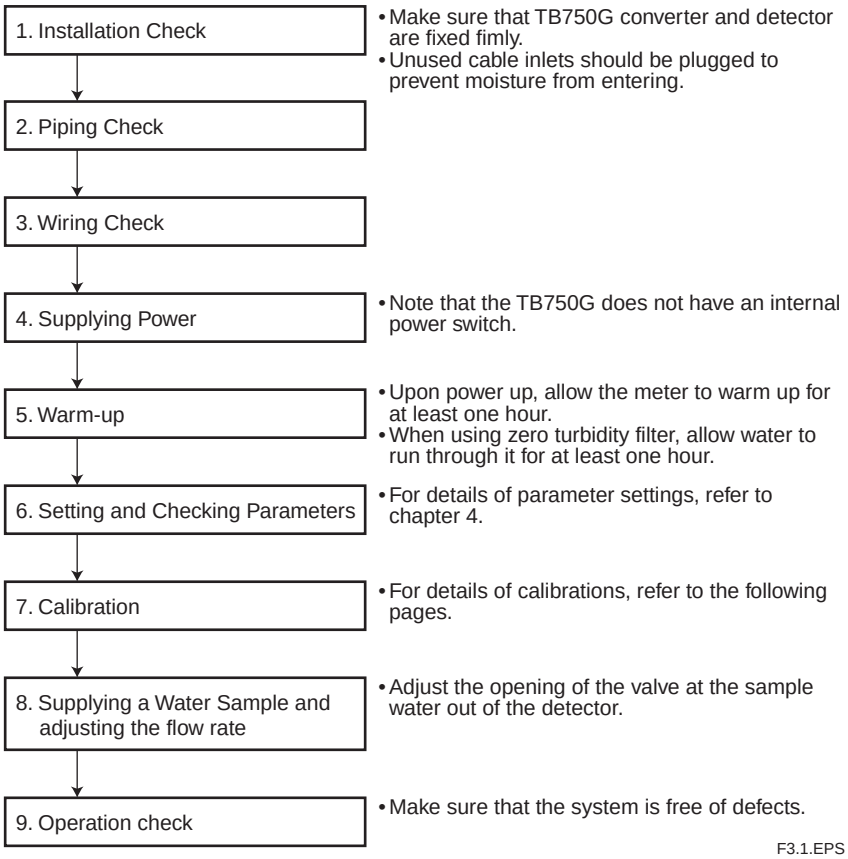
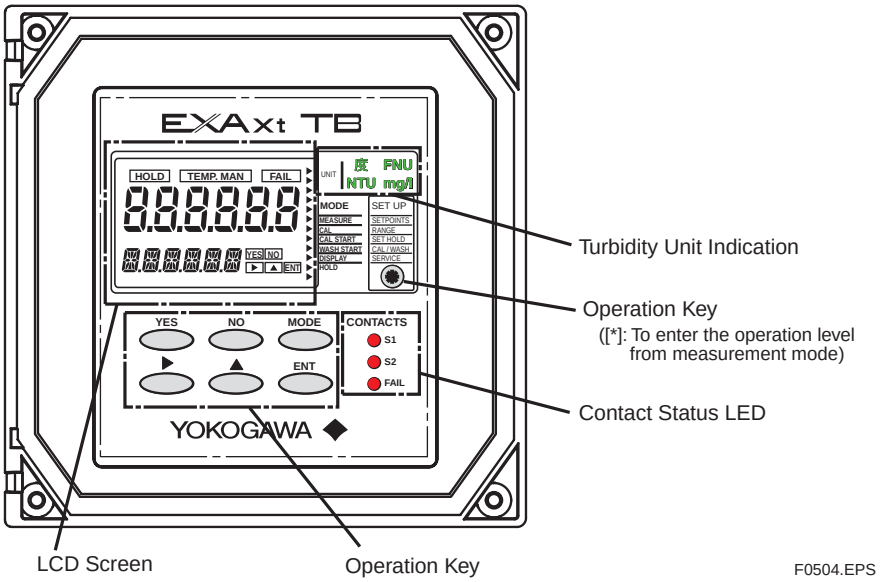
# 3. OPERATION

## 3.1 Preparation

### 3.1.1 Outline



## 3.1.2 Converter Operation Panel

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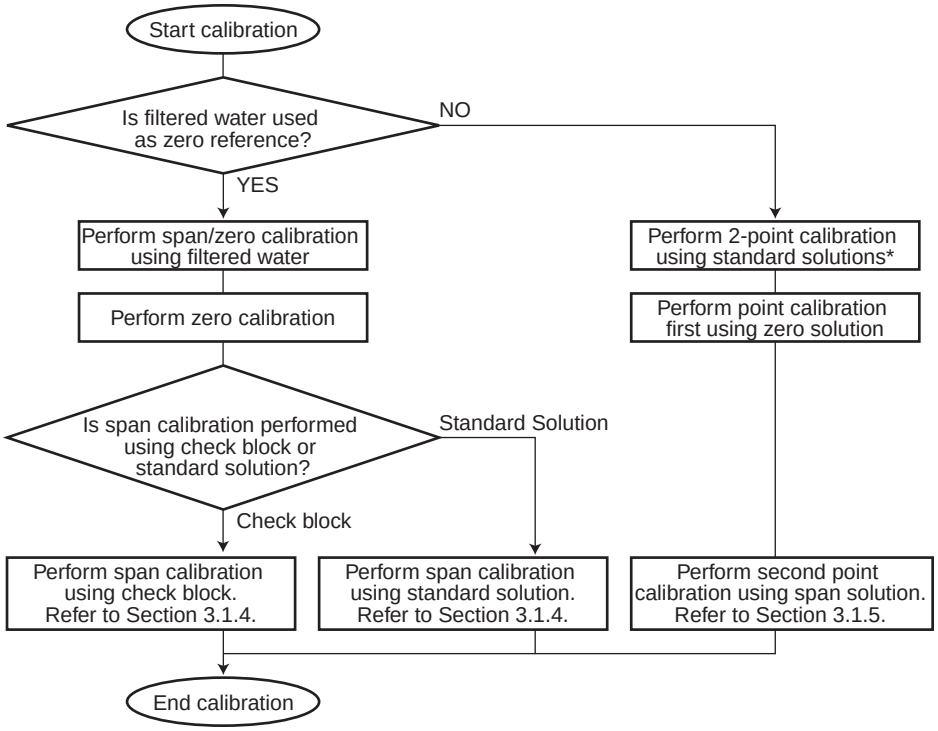
## 3.1.3 Calibration

(1) When performing a calibration using 0.2 or 1.0 µm filtered water as zero reference, refer to section 3.1.4.
(2) When performing a 2-point calibration using standard solutions, refer to section 3.1.5. Use this method to perform a calibration complying with EPA 180.1.

Note: The instrument has been pre-calibrated using 0.2 µm filtered water as zero reference at the factory before shipment.

**Calibration Flow Chart**




* Calibration complying with EPA Method 180.1.

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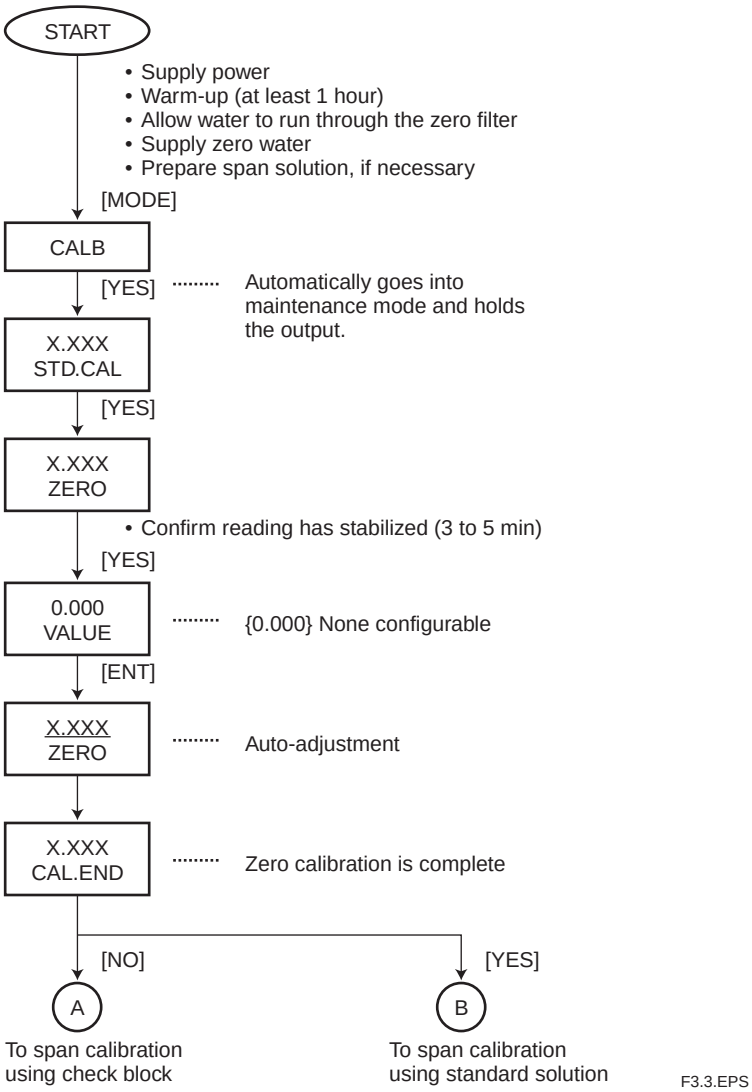
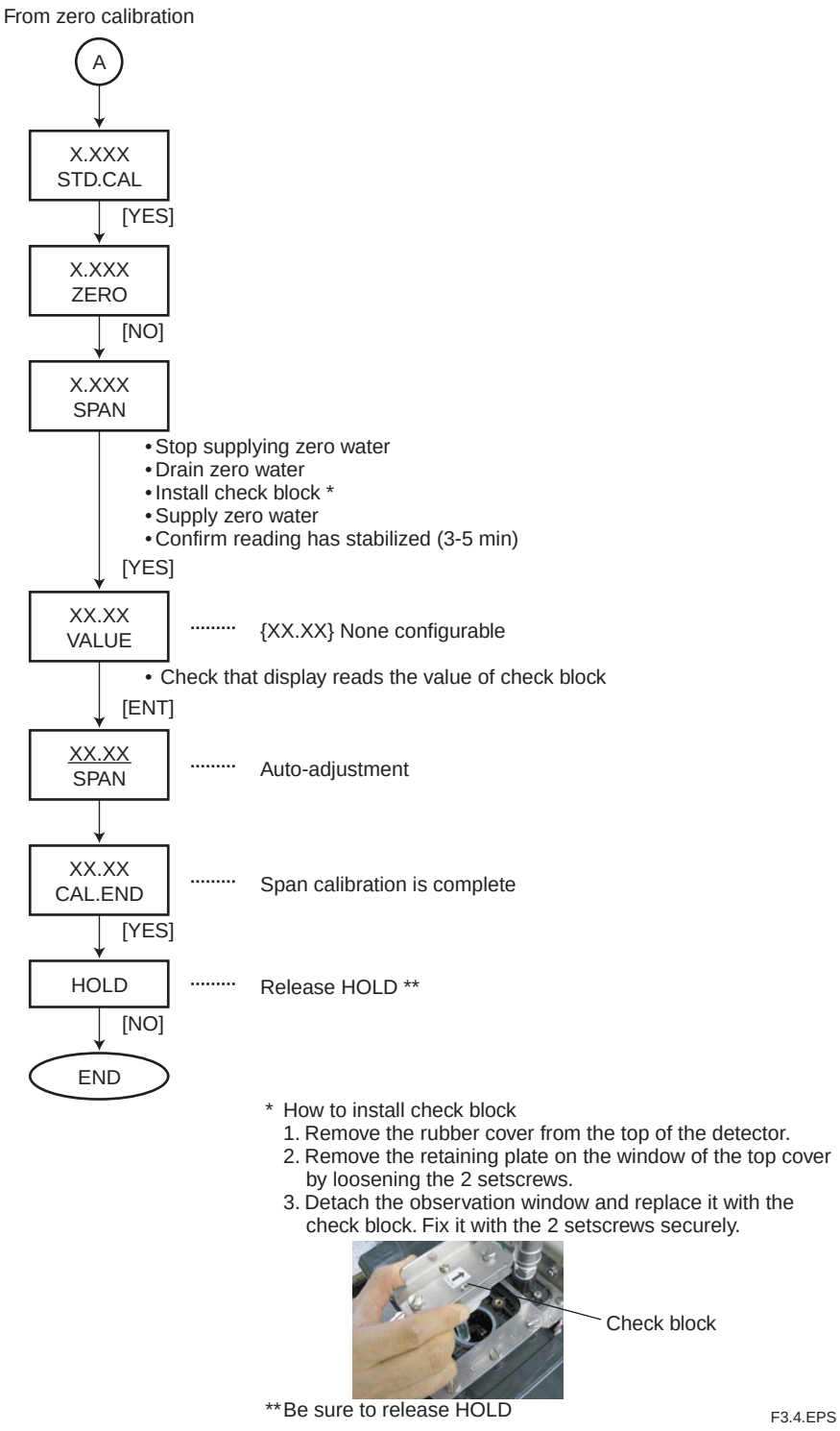
### 3.1.4 Performing Zero/span Calibration Using Filtered Water as Zero Reference

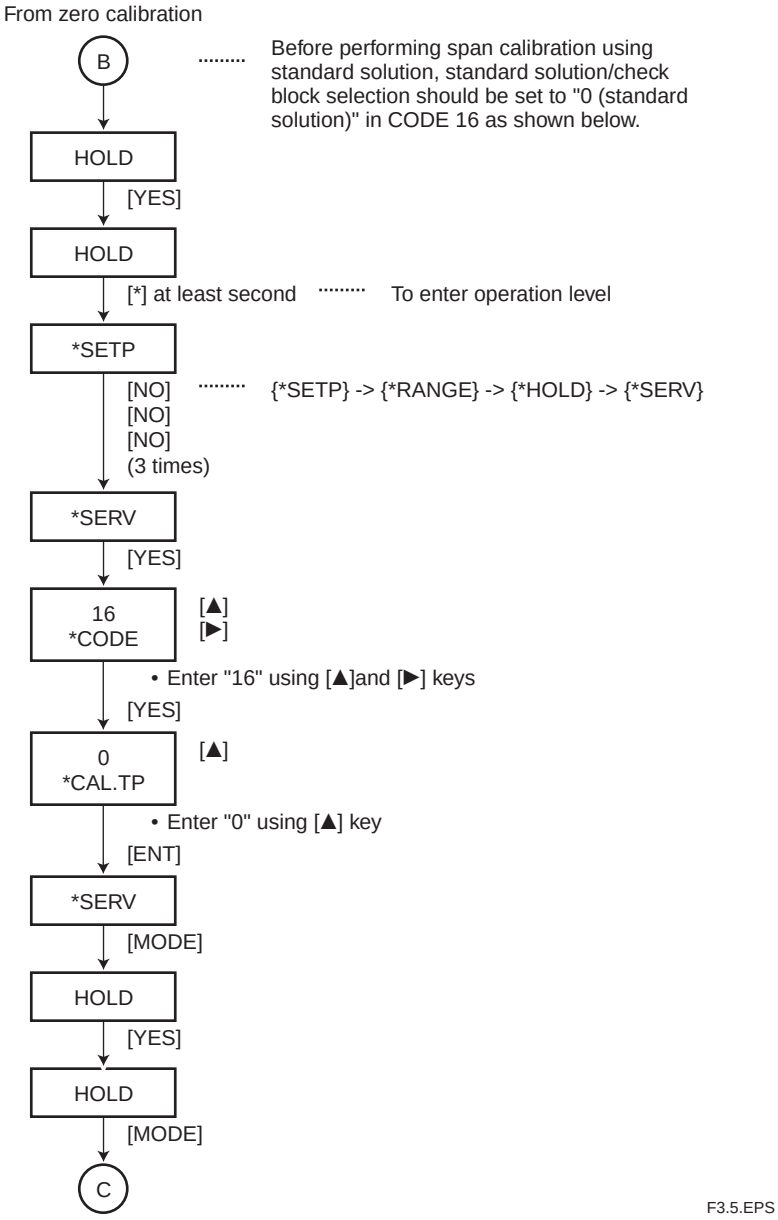


### Span calibration using check block

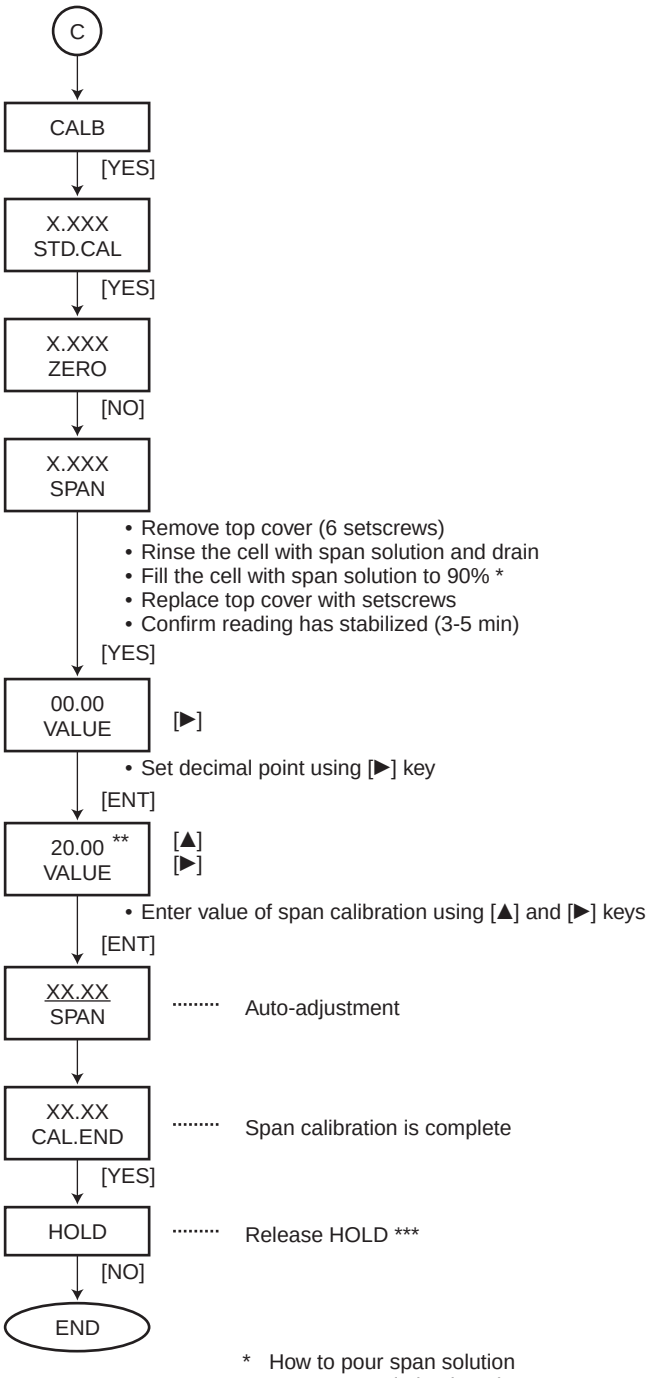
Note: For span calibration using standard solution, refer to next page.



## Span calibration using standard solution (1/2)



## Span calibration using standard solution (2/2)




* How to pour span solution
Pour span solution into the measurement cell very slowly, using a funnel or relevant equipment, taking care not to allow air bubbles to enter the cell.
** Number in the figure is an example.
*** Be sure to release HOLD

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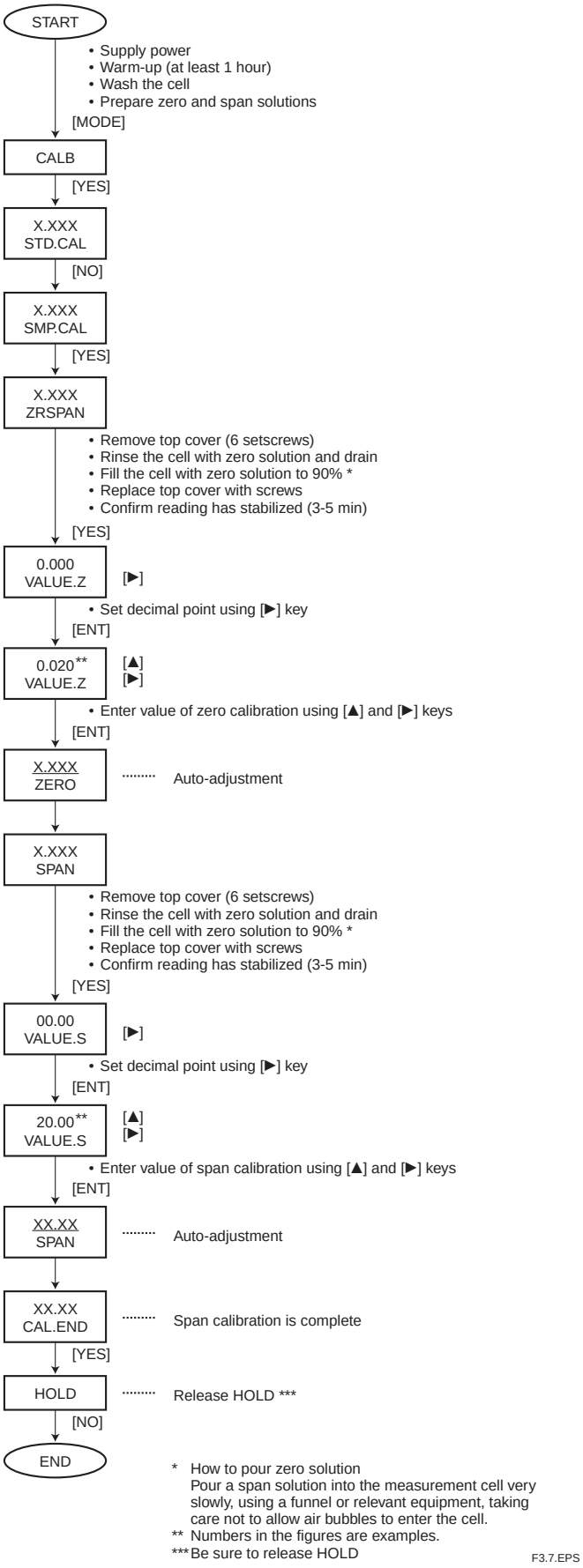
## 3.1.5 Performing 2-point Calibration Using Standard Solution



# 3.2 Normal Operation

The TB750G turbidimeter does not normally require any manual operations except when periodic cleaning/calibration is performed or when a failure occurs.

## 3.2.1 When Sample Water Supply is Cut Off

The turbidity measurement is not affected by temporary suspension of sample water supply, but long-term suspension may interfere with the accuracy of the instrument. Since the TB750G cannot detect whether the sample water supply is stopped or not, periodical check of the sample line is needed.

## 3.2.2 Shutdown

The parameter settings and other information set in the turbidimeter are retained even if power is turned off. If the instrument will be out of operation for a long period, power should be removed. Dirt and/or stains on the instrument should be washed off thoroughly when the turbidimeter is to be removed from the site. Rinse the inside of the measurement cell, and then empty the cell or keep zero water running through the cell.

## 3.2.3 Restart

When power is returned, the turbidimeter is put into the measurement state. It requires at least one hour for warm-up. Check that the reading stabilizes well, before performing calibration.

# 4. PARAMETER SETTING

## 4.1 Outline of Operation, Setting, and Service Levels

Parameters should be set in the relevant mode classified into three levels: operation, setting and service.

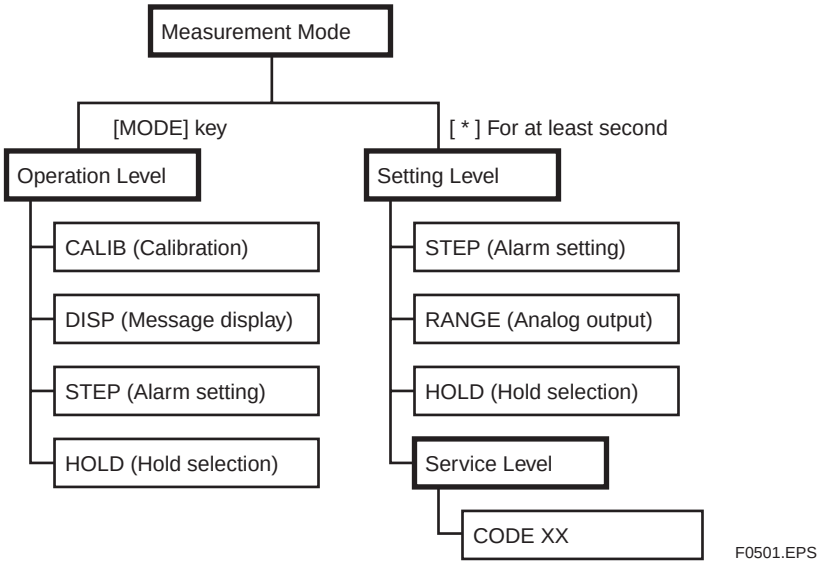
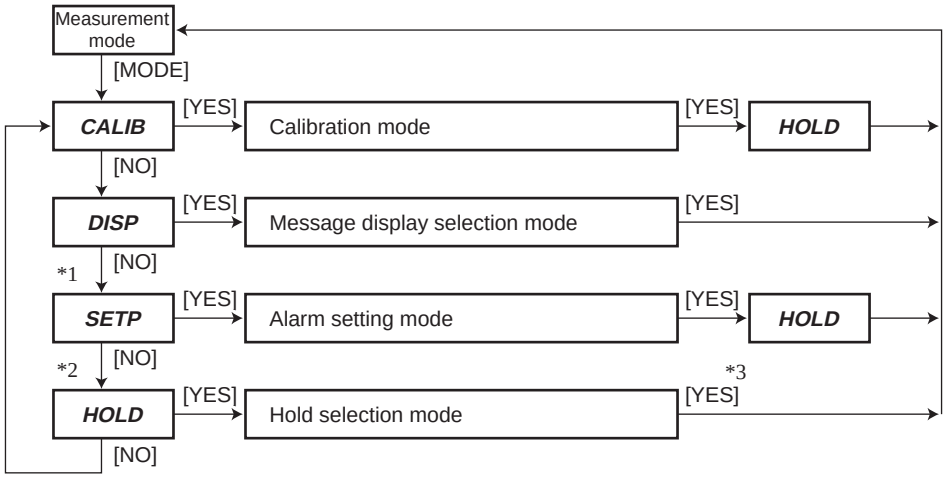



**Figure 4.1 Transition between Measurement Mode and Three Levels**

# 4.2 Operation Level

This is the level where, basically, operations regarding routine inspections and maintenance, such as calibration and manual cleaning, can be done. Also, the desired display item on the message display can be selected at this operation level.




*1: Skipped if alarm setting function is set to "0: Disabled" in Code 51 at service level, or unless either of functions of contact output S1 or S2 is set to "1: Alarm" in Code 40 or 41 at service level.
*2: Skipped if hold function is set to "*H.OFF: Disabled" in SET HOLD mode at setting level.
*3: If [YES] key is pressed, analog output is held in measurement mode.

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**Table 4.1 Setting Parameters at Operation Level**

| Mode | Setting Parameter | Display | Setting Range | Default |
|---|---|---|---|---|
| CAL | Calibration | ***CALIB*** | | |
| | Using turbidity standards, or using water sample | ***STD.CAL or SMP.CAL*** | | |
| | Start | ***ZERO or SPAN or ZRSPN*** | | |
| | Turbidity value | ***VALUE*** | 0.001 to 2000[NTU] *1 | |
| | Self-adjustment in process | ***ZERO or SPAN*** | | |
| | End | ***CAL.END*** | | |
| CAL START | | | Not available | |
| WASH START | | | Not available | |
| DISPLAY | Message display selection | ***DISP*** | | |
| | Analog output 1 current | ***XX.XmA1*** | | Output 1 current |
| | Analog output 2 current | ***XX.XmA2*** | | |
| | Switchable output range state | ***RNG1/2-A/B/C*** | *2 | |
| (No pointer at | Alarm setting | **** SETP*** | *3 | |
| mode display) | High alarm setpoint | **** S.TB-H*** | –010.0 to 2200.0[NTU] *1 | ***2200.0***(NTU) |
| | Low alarm setpoint | **** S.TB-L*** | –010.0 to 2200.0[NTU] *1 | ***-010.0***(NTU) |
| HOLD | Hold selection | ***HOLD*** | *4 | |
| | Hold selection | | | (Disabled) |

*1: Although setting range is up to 2000 NTU, measuring range is up to 100 NTU.
*2: Skipped if analog output range switching selection {*RNGPR} is set to "0: Fixed" in CODE 30 at service level.
*3: Skipped if alarm setting function is set to "0: Disabled" in Code 51 at service level, or if either function of contact output S1 or S2 is not set to "1: Alarm" in Code 40 or 41 at service level.
*4: Skipped if hold function is set to "*H.OFF: Disabled" in SET HOLD mode at setting level.

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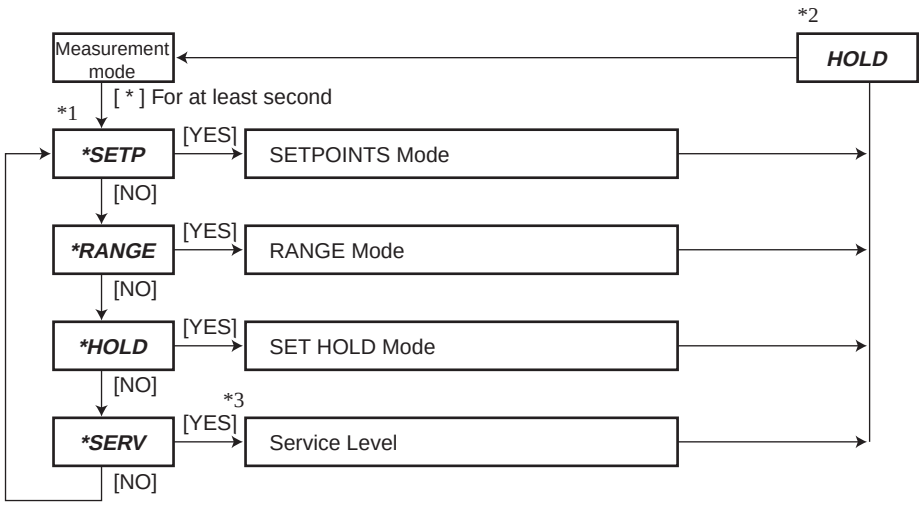
# 4.3 Setting Level

There are modes where parameters regarding output signals and contact outputs can be set.




*1: Skipped unless either of functions of contact output S1 or S2 is set to “1: Alarm” in Code 40 or 41 at service level.
*2: Skipped if hold function is set to “*H.OFF: Disabled” in SET HOLD mode at setting level.
*3: For service level, see Section 4.4.

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**Table 4.2 Setting Parameters at Setting Level**

| Mode | Setting Parameter | Display | Setting Range | Default |
|---|---|---|---|---|
| SETPOINTS | Alarm setting | ***SETP** | *1 | |
| | High alarm setpoint | ***S.TB-H** | –010.0 to 2200.0[NTU] *1 | ***2200.0***(NTU) |
| | Low alarm setpoint | ***S.TB-L** | –010.0 to 2200.0[NTU] *1 | ***-010.0***(NTU) |
| RANGE | Analog output range setting | ***RANGE** | | |
| | Fixed range for output 1, or fixed range for output 2 | ***FIXR.1 or *FIXR.2** | | |
| | Zero point | ***ZERO** | 0000.00 to 2000.00[NTU] | ***0000.00***(NTU) |
| | Span point | ***SPAN** | 0000.00 to 2000.00[NTU] | ***0100.00***(NTU) |
| | Local range selection | ***LOCAL** | | |
| | Local range for output 1, or local range for output 2 | ***LCL.1 or *LCL.2** | 0: Range A, 1: Range B, 2: Range C | ***0***:Range A |
| SET HOLD | Hold parameter setting | ***HOLD** | | |
| | Hold function enabled, or hold function disabled | ***H.ON or *H.OFF** | ***H.ON** (Enabled)<br>***H.OFF** (Disabled) | ***H.ON**:Enabled |
| | Last measured value, or fixed value | ***H.LST or *H.FIX** | ***H.LST** (Last measured value)<br>***H.FIX** (Fixed value) | ***H.LST**:Last measured value |
| | Fixed value for output 1 | ***H.mA1** | 02.0 to 22.0[mA] | ***22.0***(mA) |
| | Fixed value for output 2 | ***H.mA2** | 00.0 to 22.0[mA](0-20mA)<br>02.0 to 22.0[mA](4-20mA) | ***22.0***(mA) |
| CAL/WASH | | | Not available | |
| SERVICE | | | *2 | |

*1: Skipped if alarm setting function is set to "0: Disabled" in Code 51 at service level, or if either function of contact output S1 or S2 is not set to "1: alarm" in Code 40 or 41 at service level.
*2: For service level, see Section 4.4.

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# 4.4 Service Level

The TB750G turbidimeter has various functions. At this level there are modes where functions can be selected according to need for the operation.

**Table 4.3 Setting Parameters at Service Level (1/2)**

| Code | Setting Parameter | Display | Setting Range | Default |
|---|---|---|---|---|
| CODE02 | Input voltage display | | | |
| | Transmitted light detection element input display | ⁎ IN1 | | |
| | Scattered light detection element input display | ⁎ IN2 | | |
| | End | ⁎ END | | |
| CODE08 | Spike detection parameter setting | | | |
| | Spike detection function enabled or disabled | ⁎ SPIKE | 0: Disabled, 1: Enabled | 0:Disabled |
| | Limit value | ⁎ LIMIT | 000.000 to 999.999 | 999.999(NTU) |
| | Hold time | ⁎ HLD-T | 005 to 600[s] | 030(s) |
| | Sampling time | ⁎ SMP-T | 001 to 600[s] | 030(s) |
| CODE11 | Zero calibration factor display | | | |
| | Zero calibration factor display | *CAL.A | | Depends on MS Code |
| CODE12 | Slope display | | | |
| | Slope display | ⁎ SL | | 100.0(%) |
| CODE13 | Zero correction factor setting | | | |
| | Zero correction factor setting | *CAL.B | –9.000 to 09.000[NTU] | 00.000(NTU) |
| CODE14 | Sensitivity correction factor setting | | | |
| | Sensitivity correction factor setting | *CAL.K | 0.2500 to 4.0000 | 1.0000 |
| CODE16 | Standard solution/check block selection | | | |
| | Standard solution or check block | *CAL.TP | 0: Standard Solution, 1: Check Block | 1:Check Block |
| CODE17 | Check block turbidity setting | | | |
| | Check block turbidity | *PLATE | 0.001 to 2000[NTU] | |
| CODE30 | Analog output range switching parameter setting | | | |
| | Range switching output selection | ⁎ RNGPR | 0: Fixed, 1: AO1, 2: AO2 | 0:Fixed |
| | Range switching function selection | *RSET | 0: Local, 1: Automatic, 2: Remote 2RNG, 3: Remote 3RNG | 1:Automatic |
| | Range A setting | ⁎ RSET.A | | |
| | Zero point for range A | ⁎ ZERO | 0000.00 to 2000.00[NTU] | 0000.00(NTU) |
| | Span point for range A | *SPAN | 0000.00 to 2000.00[NTU] | 0010.00(NTU) |
| | Range B setting | ⁎ RSET.B | | |
| | Zero point for range B | *ZERO | 0000.00 to 2000.00[NTU] | 0000.00(NTU) |
| | Span point for range B | ⁎ SPAN | 0000.00 to 2000.00[NTU] | 0100.00(NTU) |
| | Range C setting | ⁎ RSET.C | | |
| | Zero point for range C | ⁎ ZERO | 0000.00 to 2000.00[NTU] | 0000.00(NTU) |
| | Span point for range C | ⁎ SPAN | 0000.00 to 2000.00[NTU] | 1000.00(NTU) |
| | Automatic range switching point | *AUTOR | 070 to 100[%] | 080(%) |
| CODE33 | Analog output 2 range selection | | | |
| | Range selection for output 2 | *mA2 | 0: 4.0-20.0mA, 1: 0.0-20.0mA | 0:4.0-20.0mA |
| | Fixed value for hold | *H.mA2 | 00.0 to 22.0[mA](0-20mA)<br>02.0 to 22.0[mA](4-20mA) | 22.0(mA) |
| | Fixed value for hold during failure | *FH.mA2 | 00.0 to 22.0[mA](0-20mA)<br>02.0 to 22.0[mA](4-20mA) | 22.0(mA) |

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## Table 4.3 Setting Parameters at Service Level (2/2)

| Code | Setting Parameter | Display | Setting Range | Default |
|---|---|---|---|---|
| CODE35 | Hold during failure parameter setting | | | |
| | Hold function enabled or disabled | ***FHOLD** | 0: Disabled, 1: Enabled | **1**: Enabled |
| | Last measured value, or | ***FH.LST /** | ***FH.LST**(Last measured value) | ***FH.FIX**:Fixed value |
| | fixed value | ***FH.FIX** | ***FH.FIX**(Fixed value) | |
| | Fixed value for output 1 | ***FH.mA1** | 02.0 to 22.0[mA] | **22.0**(mA) |
| | Fixed value for output 2 | ***FH.mA2** | 00.0 to 22.0[mA](0-20mA) | **22.0**(mA) |
| | | | 02.0 to 22.0[mA](4-20mA) | |
| CODE37 | Time constant setting | | | |
| | Time constant in measurement | ***TC** | 000 to 120[s] | **020**(s) |
| | Time constant in maintenance | ***TC-M** | 000 to 120[s] | **006**(s) |
| CODE40 | Contact output S1 function selection | | | |
| | Function of contact output S1 | ***S1** | 0:None , 1: Alarm, 2: Automatic calibration/washing, 3: Maintenance | **1**: Alarm |
| CODE41 | Contact output S2 function selection | | | |
| | Function of contact output S2 | ***S2** | 0:None , 1: Alarm, 2: Automatic calibration/washing, 3: Maintenance | **3**: Maintenance |
| CODE44 | Delay time/hysteresis setting | | | |
| | Delay time | ***D.TIME** | 000 to 199[s] | **000**(s) |
| | Hysteresis | ***HYST** | 000 to 100[%] | **002**(%) |
| CODE50 | Auto return function selection | | | |
| | Auto return function enabled or disabled | ***RET** | 0: Disabled, 1: Enabled | **0**: Disabled |
| CODE51 | Alarm setting function selection | | | |
| | Alarm setting function enabled or disabled | ***MODE** | 0: Disabled, 1: Enabled | **0**: Disabled |
| CODE52 | Password setting | | | |
| | Password | ***PASS** | 0:No password, 1:111, 2:333, 3:777, 4:888, 5:123, 6:957, 7:331, 8:546, 9:847 | **0.0.0** |
| CODE54 | Negative nondisplay/nonoutput selection | | | |
| | Negative nondisplay/nonoutput enabled or disabled | ***MINUS** | 0: Disabled, 1: Enabled | **0.0**: Disabled.Disabled |
| CODE61 | Turbidity unit selection | | | |
| | Turbidity unit | ***UNIT** | 0: NTU, 1: FNU, 2: mg/l | **0**: NTU |
| CODE64 | Software version display | | | |
| | Software version display | ***VER** | | **1.00** |
| CODE66 | Error “E2xx” error level selection | | | |
| | Error levels of errors “E201” to “E206” | ***201-6** | 0: Disable, 1: Level 1, 2: Level 2 | **1.1.2.2.2.2** |
| CODE67 | Error “E3xx” error detection selection | | | |
| | Error detection for “E301” to “E306” | ***301-6** | 0: Disabled, 1: Enabled | **1.1.1.1.1.1** |
| | Error detection for “E307” | ***307** | 0: Disabled, 1: Enabled | **1** |
| | Error detection for “E311” to “E316” | ***311-6** | 0: Disabled, 1: Enabled | **1.1.1.1.1.1** |
| | Error detection for “E317” | ***317** | 0: Disabled, 1: Enabled | **1** |
| CODE71 | Analog output test | | | |
| | Start test for output 1 | ***AO1.T** | | |
| | Test current flowing | | | |
| | End | ***END** | | |
| | Start test for output 2 | ***AO2.T** | | |
| | Test current flowing | | | |
| | End | ***END** | | |
| CODE72 | Contact output test | | | |
| | Test 1 | ***DO.T1** | 0: Non-action, 1: Action | Last measured value held |
| | Test 2 | ***DO.T2** | 0: Non-action, 1: Action | Last measured value held |
| CODE73 | Contact input test | | | |
| | Test | ***DI.T** | | |
| CODE79 | Initialization | | | |
| | Start | ***LOAD** | | |
| | Default loading | ***WAIT** | | |

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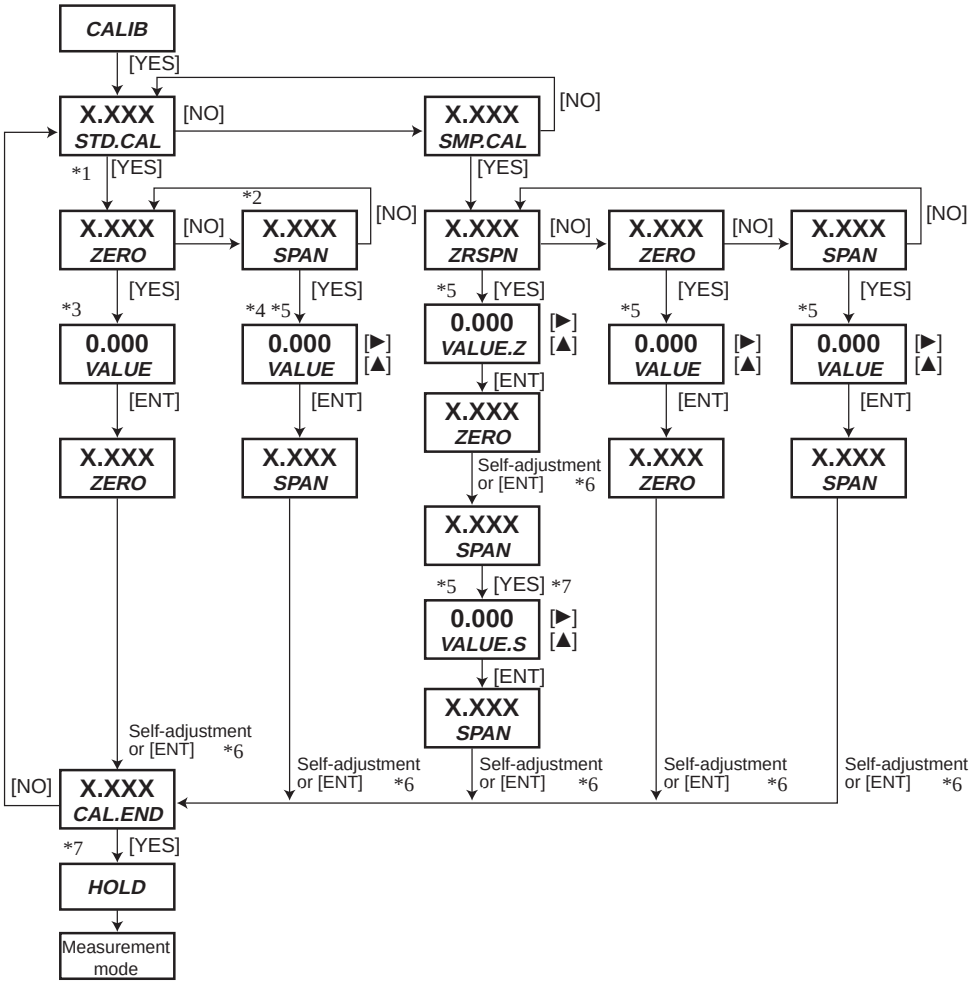
# 4.5 Procedures for Setting Parameters

An example for setting parameters, the procedures are described in following modes. For more detail on the other functions, refer to User's Manual IM 12E01A06-01E Section 6.

(1) CAL Mode: {CALIB}
(2) HOLD Mode: {HOLD}
(3) RANGE Mode: {*RANGE}

### (1) CAL Mode: {CALIB}




*1: During the time between [YES] key press on {STD.CAL} display and [YES] or [NO] key press on {CAL.END} display or on error code display or [MODE] key press to abort, data display shows turbidity based on sensitivity correction factor (K)=1 and zero correction factor (B)=0. (Value not affected by SMP.CAL: Display by T1={(S0/(SL/100)}*(V-A), not by T2=K(T1+B))
*2: Span calibration in {STD.CAL} is performed using turbidity standards or check block that has been selected in CODE16.
*3: In zero calibration, calibration value should be “0.000” and cannot be changed. Only [ENT] key is accepted to confirm.
*4: In span calibration using check block, calibration value cannot be changed. Only [ENT] key is accepted to confirm.
*5: First determine the decimal point using [>] key and then set value in the range of 0.000 to 20000 NTU.
*6: Pressing [ENT] key during self-adjustment will abort the procedure, and the turbidity when [ENT] key is pressed will be used for calibration factor calculation.
*7: Only [YES] key is accepted to confirm.

Note: Calibration factor will be updated when the calibration procedure is completed without cancellation or errors. If [YES]/[NO] key is pressed on error code display, the instrument goes to {CALIB} display. Error E203 or E204 appears after the instrument once returns to measurement display.

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**Figure 4.2 CAL Mode Flow Chart**

### (2) HOLD Mode: {HOLD}

In this mode whether the analog output is held or not in measurement mode, can be selected. This function is available when the hold function is set to “1: Enabled” in SET HOLD mode at the setting level. If the function is set to “0: Disabled,” this mode will be skipped.

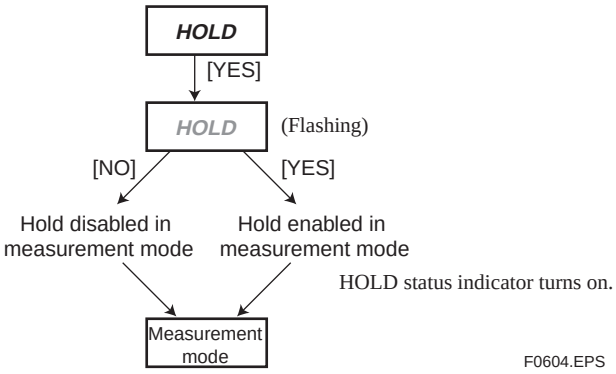
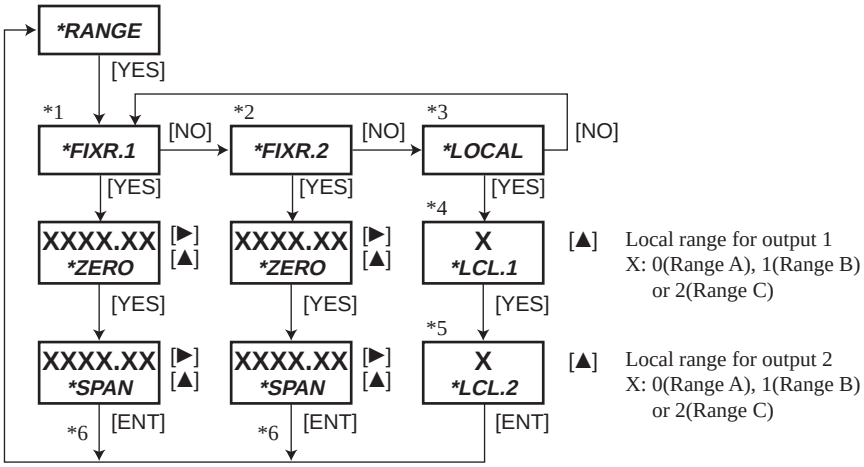



**Figure 4.3 HOLD Mode Flow Chart**

If the hold function has been set to “1: Enabled” in SET HOLD mode at the setting level, the instrument automatically goes into this HOLD mode when it returns from any level to measurement mode, with the exception of DISPLAY mode.

### (3) RANGE Mode: {*RANGE}

In this mode, an output range corresponding to analog output 1 and 2 can be set. Enter turbidity values corresponding to a 4 mA (or 0 mA) output signal (zero point) and a 20 mA output signal (span point).




*1: Skipped if analog output range switching selection {*RNGPR} is set to "1: Analog output 1" in CODE 30 at service level.
*2: Skipped if analog output range switching selection {*RNGPR} is set to "2: Analog output 2" in CODE 30 at service level.
*3: Displayed only if analog output range switching selection {*RNGPR} is set to "1: Analog output 1" or "2: Analog output 2" and range switching function selection {*RSET} is set to "0: Manual" in CODE 30 at service level.
*4: Displayed only if analog output range switching selection {*RNGPR} is set to "1: Analog output 1" in CODE 30 at service level.
*5: Displayed only if analog output range switching selection {*RNGPR} is set to "2: Analog output 2" in CODE 30 at service level.
*6: Zero and span points should be set together. Only after span point has been entered, both zero and span points are accepted. Cancellation by pressing [MODE] key during the procedure will not change either of the points.

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**Figure 4.4 RANGE Mode Flow Chart**

# 5. MAINTENANCE

## 5.1 Lamp Replacement

### CAUTION

Wait for some time to replace lamp assembly because lamp temperature is high just after lamp power was turned off.

Although the lamp has a normal service life of more than one year, it is recommended that the lamp be replaced at an interval of one year in terms of preventive maintenance. Some lamps may fail within one year.

The following describes how to replace the lamp.

(1) Remove power from the TB750G turbidimeter.
(2) Remove the cover of the light source unit on the left side of the detector by loosening the 4 setscrews.
(3) Disconnect the terminals for lamp from the terminal block. Remove the lamp assembly by loosening the 2 setscrews.
(4) Replace the lamp assembly with a new one. Mount the new lamp assembly with the 2 setscrews. Connect the terminals for lamp to the terminal block (LAMP).
(5) Supply power to the TB750G turbidimeter.
(6) Check that the lamp is lit. Replace and fix the cover of the light source unit by tightening the 4 setscrews.
(7) After the lamp replacement, allow the turbidimeter to warm up for at least one hour. Then, perform calibrations instructed in Sections 3.
(8) Lamp replacement is now complete.

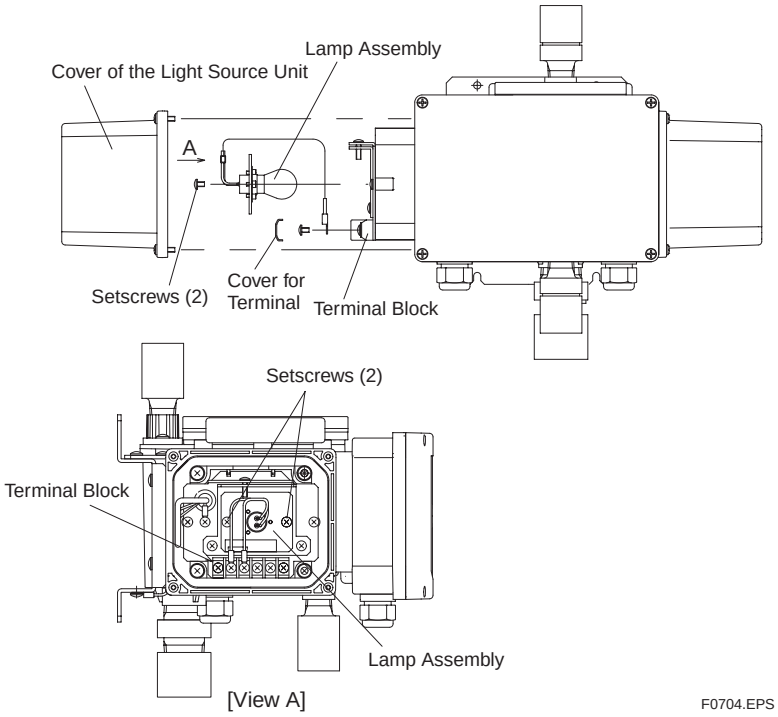


**Figure 5.1 Lamp Replacement**

# 5.2 Calibration

## 5.2.1 Outline

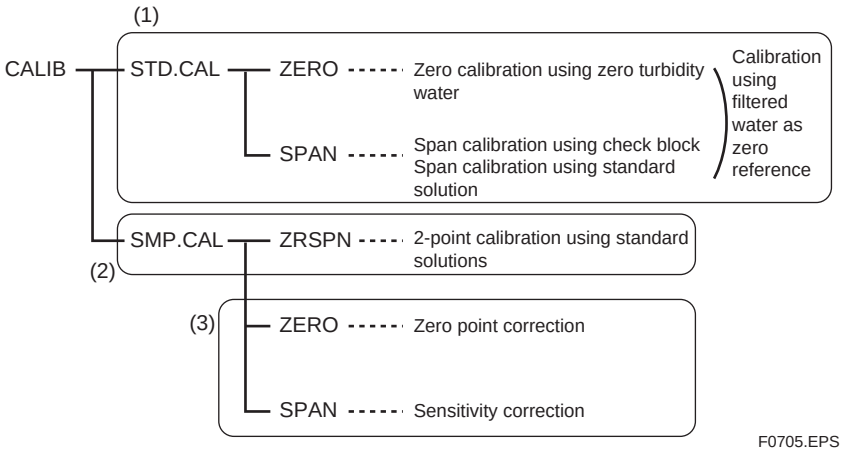


**Figure 5.2 Calibration Methods**

(1) Select when performing a calibration using 0.2 or 1.0 µm filtered water as zero reference.
(2) Select when performing a 2-point calibration using standard solutions. Use this method to perform a calibration complying with EPA 180.1.
(3) Select when performing a zero point or sensitivity correction after calibration (1) or (2). This method is used to adjust the meter reading to reflect the lab data in a grab sample calibration.

Note: The instrument has been pre-calibrated using 0.2 µm filtered water as zero reference at the factory before shipment.

## 5.2.2 2-point Calibration Using Turbidity Standard Solutions

A 2-point calibration of the TB750G is performed with turbidity standard solutions equivalent to zero solution and to span solution. After accepting both zero and span values, the meter calculates a calibration factor.

When user-prepared zero and span solutions are used for calibrations, the turbidity of diluting water for calibration should be measured with a calibrated lab turbidimeter in advance. Prepare a formazin standard solution as a span solution. If the turbidity of diluting water is high against the measurement accuracy, add the turbidity of diluting water to the nominal turbidity of the prepared formazin standard solution. Use diluting water as zero solution and a formazin solution as span solution for the calibration.

Refer to Section 3, “Operation” for concrete operating procedures.

# 6. TROUBLESHOOTING

**Table 6.1 Error Code List (1/2)**

| No. | Error | Occurrence | Problem | Return |
|---|---|---|---|---|
| E101 | Flash memory failure | When power is turned on. | SUM results of flash memory do not match programmed SUM values 5 consecutive times. | When power is turned off and then on again, and problem is eliminated. (Without [YES]/[NO] key press.) |
| E102 | EEPROM write failure | All modes | Data is written in EEPROM and verified, and write failure occurs 3 consecutive times. | |
| E103 | RAM failure | When power is turned on. | RAM area failure (3 consecutive times). | |
| E104 | AD converter failure | All modes | AD converter failure (3 consecutive times). | |
| E201 | Input voltage failure | All modes | Either IN1 or IN2 input voltage is outside the range of -0.15 to 1.2 V (fixed), including abnormal value 0x7FFF or 8000, for 5 consecutive seconds. | When problem is eliminated for 5 consecutive seconds. When [YES]/[NO] key is pressed, error code display disappears, at the same time during failure, error is once removed. |
| E202 | Disconnection or detection element failure | All modes | Either IN1 or IN2 input voltage is less than PD check voltage for 5 consecutive seconds. | |
| E203 | Lamp life expired | Zero calibration coefficient A rewriting timing. (excluding when E301 or E311 occurs.)*1 | During zero calibration self-adjustment, input voltage IN1 is less than lamp life check voltage for 5 consecutive seconds. (Not detected when E301 is occurring.) Rewriting of zero calibration coefficient A is performed. | |
| E204 | Lamp intensity failure | | | |
| E205 | Calibration failure | E301 to E307, E311 to E317, E321 during PC communication occurrence timing | Any of E301 to E307, E321 during PC communication is occurring. | When problem is eliminated. When [YES]/[NO] key is pressed, error code display disappears, at the same time during failure, error is once removed. |

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**Table 6.1 Error Code List (2/2)**

| No. | Error | Occurrence | Problem | Return |
|---|---|---|---|---|
| E301 | Turbidity zero calibration coefficient A failure | During zero calibration (zero water). | Turbidity zero calibration coefficient A newly determined after zero calibration (zero water or lamp OFF) is outside of the range of 0 to 5, or each coordinate value of newly determined linearized table is outside of the range of -99999 to 999999. | When problem is eliminated. When [YES]/[NO] key is pressed, error code display disappears, at the same time during failure, error is once removed. |
| E302 | Turbidity slope SL failure | During span calibration (standard solution) | Turbidity slope value SL newly determined after span calibration (standard solution) is outside of the range of 25 to 200%, or each coordinate value of newly determined linearized table is outside of the range of -99999 to 999999. | |
| E303 | Turbidity check block failure | During span calibration (check block) | Turbidity slope value SL newly determined after span calibration (check block) is outside of the range of 50 to 150%, or each coordinate value of newly determined linearized table is outside of the range of -99999 to 999999. | |
| E304 | Turbidity zero correction factor B failure | During zero shift calibration | Turbidity zero correction factor B newly determined after zero shift calibration is outside of the range of -9 to 9. | |
| E305 | Turbidity sensitivity correction factor K failure | During span calibration (sensitivity correction) | Turbidity sensitivity correction factor K newly determined after span calibration (sensitivity correction) is outside of the range of 0.25 to 4. | |
| E306 | Turbidity reference sensitivity SO failure | During turbidity reference sensitivity calibration | Turbidity reference sensitivity SO newly set after span calibration (check block) is outside of the tolerance of 0.0001 to 2000, or each coordinate value of newly determined linearized table is outside of the range of -99999 to 999999. | |
| E307 | Turbidity response time failure | All calibrations | Turbidity self-adjustment is not complete before self-adjustment time has elapsed. | |
| E321 | Communication error | During communication with PC | Any communication error during communication with PC. | When problem is eliminated in the next communication (only one time is OK). When [YES]/[NO] key is pressed, error code display disappears, at the same time during failure, error is once removed. (excluding RS signal during communication with calibration/cleaning controller.) |
| E351 | Analog output range setting failure | During parameter setting in RANGE mode or CODE 30. | Either of:<br>(1) Zero point ≥ span point, or<br>(2) Span point - zero point < 20% of span point or 0.20, whichever is greater (for turbidity) or ( span point - zero point < 5.00 (for color).<br>When automatic range is selected in CODE 30, also possible:<br>(3) At each span point, Range A ≥ Range B, or<br>(4) at each span point, Range B ≥ Range C | When [YES]/[NO] key is pressed, error code display disappears and error is removed. |
| E352 | Parameter setting failure | During parameter setting | Value outside the setting range is set in setting other than AO range setting. | |

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Refer to the user's manual IM 12E01A06-01E for details.

# Revision Record

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