

## TURBIDITY ANALYZER

Model: TUH-1600

This high sensitivity turbidity analyzer (0~0.2 measuring range) is specially designed for municipal water treatment applications. The measurement method is based on the principle of surface light scattering. A unique feature of this instrument is that the light source and light receiver do not come into direct contact with the sample. This reduces cell window fouling and ensures long term reliability and performance.

### Features

- Three measurement range versions are available for single, dual and triple ranges. Available ranges from minimum 0~0.2 to maximum of 0~2.0. For multi range versions, range selection is available by manual key pad operation, automatic or remote signal.
- Auto cleaning and auto zero calibration are included in the standard configuration. Repeated sample inlet and drain cleaning function ensures measurement line is maintained in a clean condition. Zero calibration can be performed by simply turning light source off.
- LED (white light) provides extended life of light source. This is combined with a new optical system designed to minimise stray light interference and provides an enhanced S/N ratio. The measuring cell also contains an anti-condensation heater and receiving tank for debubbling and maintaining constant sample flow. All these features contribute to providing long term reliability and performance.
- The sample consumption flow rate has been reduced by 50% compared to previous model by the use of reduced size tank and simplified flow path (approx. 2 L/min).
- Compact, lightweight design suitable for wall or rack mounting. All access for pipe and cable connections is from the front minimising installation space requirements. Options are available for indoor free standing rack mounting and for systems installed in weatherproof cabinets etc..



Wall Mount Version

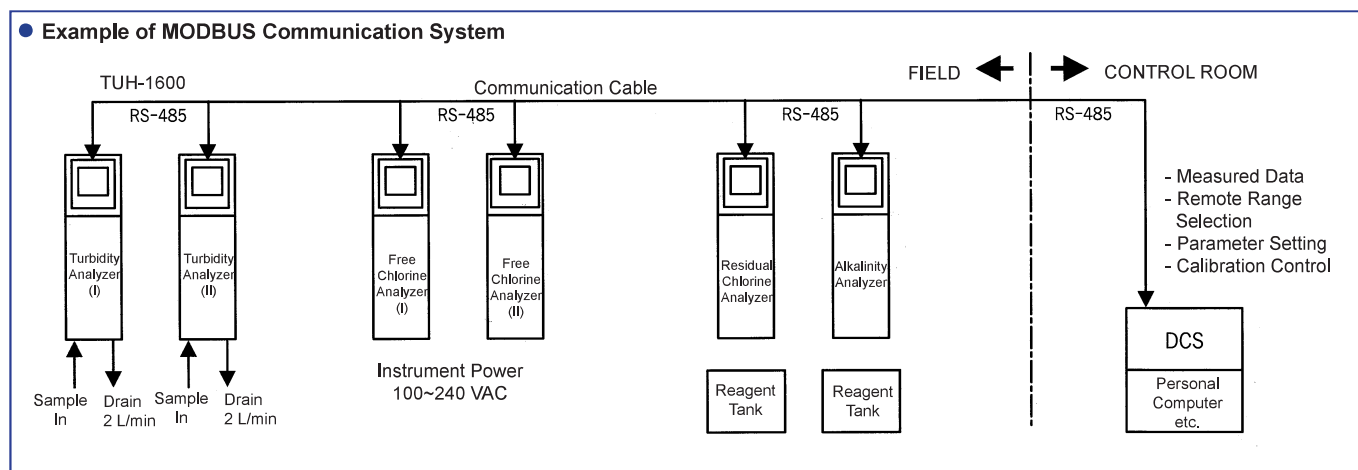


Free Standing Frame Version (Option)

- Modbus Communication Interface. RS-485 digital interface is available in addition to analogue 4~20mA. This allows Modbus format data exchange with data receiving devices such as DCS etc..

### System Configuration

#### • Example of MODBUS Communication System



# Specifications

Product Name: Turbidity Analyzer  
 Model Code: TUH-1600  
 Measurement Object: Turbidity of water samples in municipal water treatment plants  
 Measurement Method: Surface light scattering  
 Measurement Range: 0~2.0  
 Output Range: Selectable :

Single Range	0~0.2, 0~0.5, 0~1.0, 0~2.0
Dual Range	0~0.2/0.5, 0~0.5/1.0, 0~1.0/2.0
Triple Range	0~0.2/0.5/1.0, 0~0.5/1.0/2.0

Measurement Units: mg/L, ppm, degree, or FTU  
 Display: Digital, LCD (with back light)  
 Minimum Display: 0.001  
 Range Switching: Manual, automatic or from remote signal  
 Analogue Output Signal: 4~20mA DC, isolated, max load 600 Ohm  
 Contact Switching Outputs: - Range indication....(contact switching signal to indicate measuring range)  
 - High concentration  
 - Under maintenance....when STAND BY mode is selected  
 - Under auto-cleaning/calibration  
 - Analyzer fault.....communication error, setting value error, zero calibration error, hardware failure  
 - Power failure....closed contact during power failure (contact rating: 30 VDC, 0.1A)  
 Contact Switching Inputs: - Range selection.....contact switching signal to select measurement range  
 - Cleaning command.....starts auto cleaning  
 - Calibration command.....starts auto zero calibration (voltage free contacts, 100 mS or greater width)  
 Digital Communication System: - Based on RS-485 (isolated)  
 - Available Baud rates: 1200, 2400, 4800, 9600, 19200, 38400, 57600  
 - Protocol: MODBUS/RTU  
 - Data length: 8 bits  
 - Parity: select from None, Odd, Even  
 - Stop bits: 1 Bit  
 - Data order: Big Endian  
 Analogue Signal Input: 4~20mA DC for external meter, adjustable span range for onward transmission by Modbus interface  
 Operating Power: 100~240 VAC +/- 10%, 50/60 Hz  
 Power Consumption: Approx. 15VA  
 Approx. 60VA (with auto calibration)

Sample Conditions: - No flow stoppage or stagnation  
 - Temperature: 0~40 °C (no freezing)  
 - Pressure: 0.02~0.3 MPa  
 - Sample consumption: 1~4 L/min (+/- 1 L/min)

Auto Cleaning: Repeated sample filling and draining at regular intervals ensures tubing and measuring cell are kept clean. Cleaning cycle can be initiated by internal timer or by external command signal.

Cycle setting: 1~24 hours (initial setting: 12 hours)  
 (or from external start signal if this is set to 0 hours)  
 Cleaning period: 1~5 minutes as per setting, (initial setting: 5 minutes)  
 Standby time after cleaning: 0~30 minutes as per setting, (initial setting: 15 minutes)

Auto Zero Calibration: After automatic cleaning cycle has been completed, zero calibration is performed. This is achieved by simply turning off the light source lamp. The calibration cycle can be initiated by internal timer or by external command signal.

Cycle setting: : 1~31 days (initial setting: 10 days)  
 (or from external start signal if this is set to 0 days)  
 Calibration period: Approx. 60 minutes (fixed)  
 Standby time after calibration: 0~30 minutes as per setting, (initial setting: 20 minutes)

Construction: Suitable for indoor installation  
 Requires weather protection if installed outdoors. Transmitter: IP-65, analytical section: IP-52

Mounting: Suitable for wall or rack mounting

Materials: Transmitter: die cast aluminium  
 Analytical section: aluminium plate

Surface Finish: Metallic silver

Piping Connections: Sample inlet: VP16 socket  
 Drain: VP25 socket  
 Tap Water inlet: VP 16 socket

Electrical Connections: Six cable glands for 6~12mm diameter cable, G1/2 threaded connections when gland removed

Ambient Temperature: -5~50 °C (no freezing)

Ambient Humidity: Max 85% RH (no condensation)

Weight: Approx. 15kg  
 Approx. 30 Kg (free standing version)

## Performance

Linearity: Within +/-2% FS (with standard solution)  
 Repeatability: Within +/-1% FS (using scatter plate)  
 Response Time: 90% response within 2 minutes (from introduction of standard solution)  
 Zero Drift: +/- 1% FS/month (for zero calibration solution)  
 Span Drift: +/- 2% FS/month (with scatter plate)

## Calibration Method

**Zero Calibration:**  
 Zero calibration can be performed by simply turning off the light source lamp or by using city water passed through a zero filter

**Span Calibration:**  
 Polystyrene standard solution (degree)  
 Formazine standard solution (degree or FTU)  
 (use one solution from above or scatter plate)

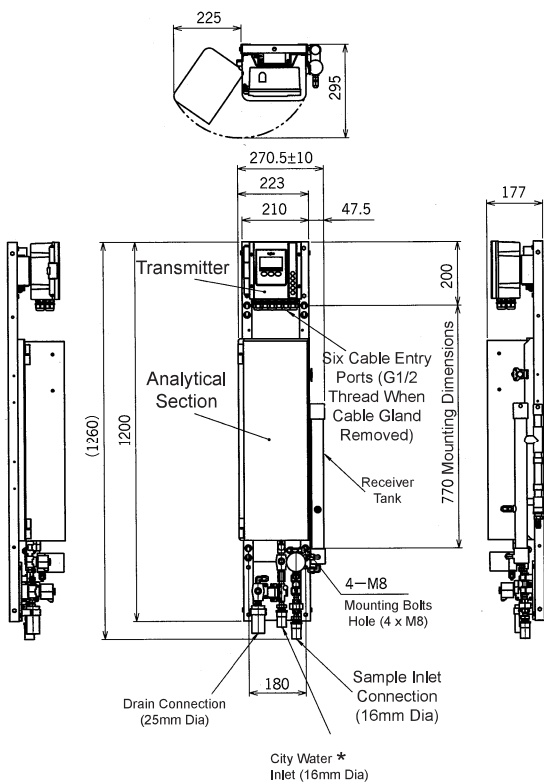
# Options

- Air Curtain:** This blows air onto to the water surface inside the measuring cell. Its purpose is to prevent interference caused by rising mist from the water surface and/or condensation. It is also required when the instrument is installed in locations where there is a possibility of corrosive vapours being present in the atmosphere.
- Free Standing Frame (indoor mounting):** Analyzer system pre assembled on a free standing frame with floor mounting base suitable for fixing with anchor bolts.
- Auto-Zero Calibration Unit:** After automatic cleaning, zero calibration is performed at regular intervals. Zero calibration methods include introducing zero calibration solution (filtered city water) into the measuring cell. Required city water conditions are as follows:
  - Turbidity: 2 degree or less
  - Colour: 5 degree or less
  - Temperature: 2~30 °C
  - Pressure: 0.1~0.5 MPa
  - Consumption: 1~4 L/min (fixed)

# Dimensions

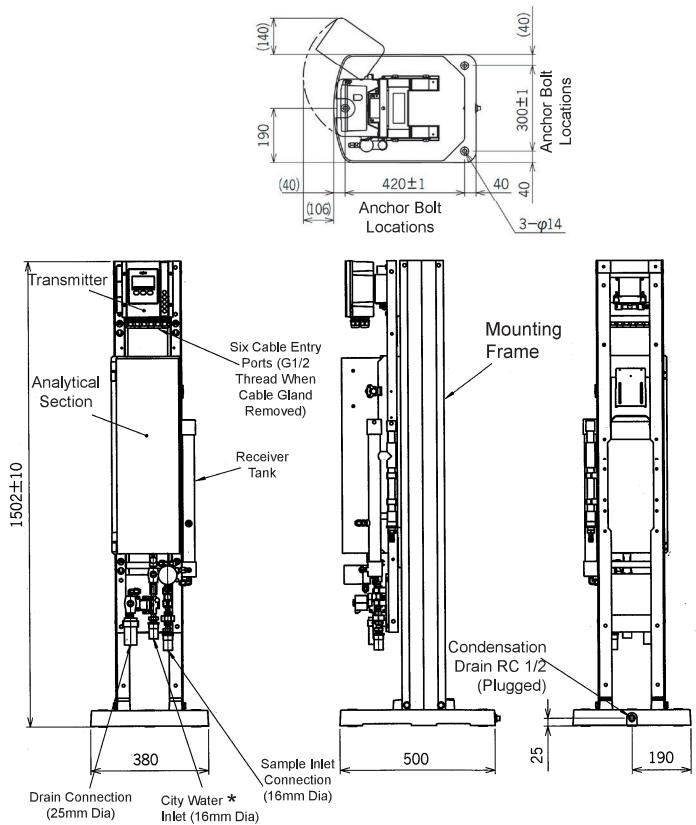
## Wall or Rack Mounting Version

Units: mm



## Free Standing Frame Mounted Version (Option)

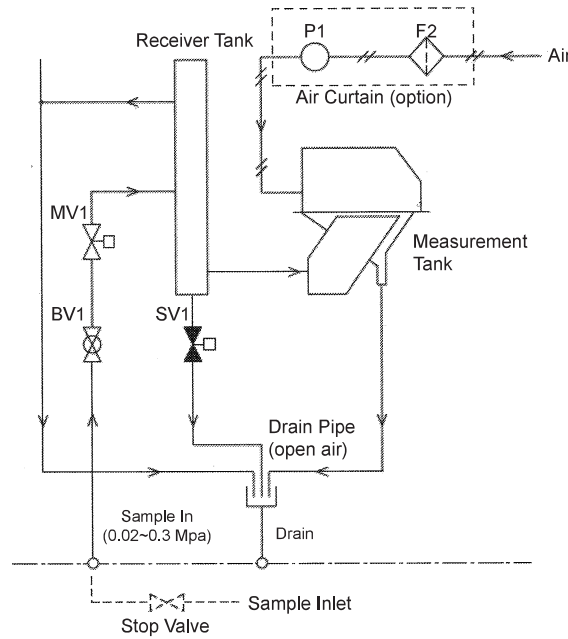
Units: mm



\* Optional (included with auto calibration configuration)

# Flow Diagrams

## ● Standard

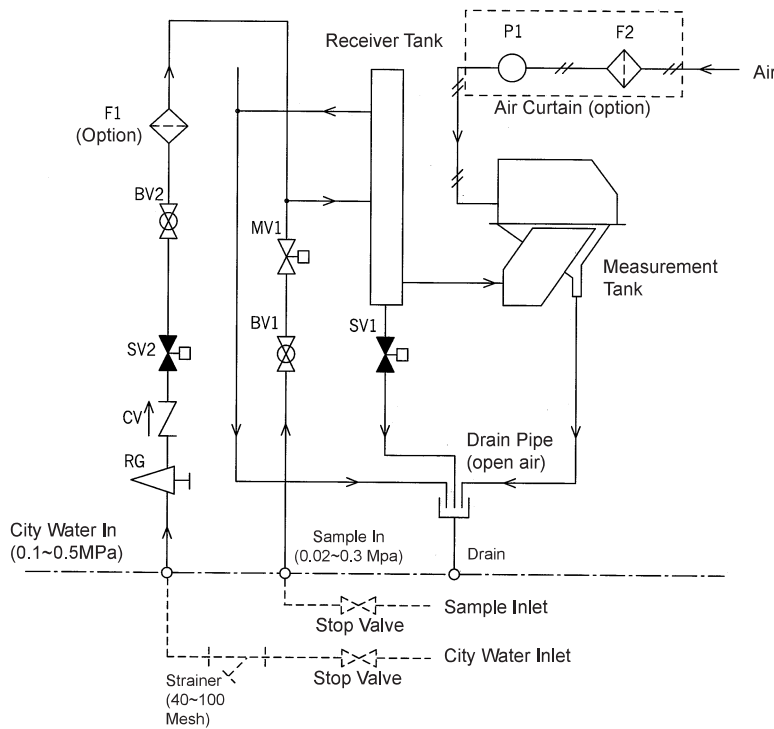


Key	Description	Remarks
BV1	Sample Flow Control Valve	1~4 L/min
SV1	Drain Solenoid Valve	
MV1	Sample Supplying Motor Valve	
F2	Air Filter	
P1	Air Pump	

Function	BV1	BV2	BV3
Measurement	O	O	C
Auto Cleaning	O	O/C	O/C
Manual Cleaning	O	O/C	O/C

Normally Open      O: Open  
 Normally Closed      C: Closed

## ● With Auto Calibration/Cleaning (Option)



Key	Description	Remarks
BV1	Sample Flow Control Valve	1~4 L/min
BV2	City Water Control Valve	1~4 L/min
RG	Pressure Regulator	Set at 200 kPa
CV	Check Valve	
SV1	Drain Solenoid Valve	
SV2	City Water Solenoid Valve	
MV1	Sample Supplying Motor Valve	
F1	Zero Filter	
F2	Air Filter	
P1	Air Pump	

Function	BV1	BV2	NV1	SV1	SV2
Measurement	O	O	O	C	C
Auto Cleaning	O	O	O/C	O/C	C
Manual Cleaning	O	O	O/C	O/C	C
Auto Zero Calib.	O	O	O/C	O/C	O
Manual Zero Calib.	O	O	O/C	O/C	O

Normally Open      O: Open  
 Normally Closed      C: Closed

## Principle of Operation

This measurement method is based on the principle that light incident on the surface of the sample will be scattered. The amount of light scattering is proportional to the turbidity of the sample.

The sample enters the debubbling receiving tank via the sample flow control valve (BV1) where bubbles are expelled. The sample then enters the measurement tank at a constant flowrate and gently overflows. The measurement tank is designed to form a stable overflow surface with minimum

ripples. A sealed optical assembly is located above the measurement tank. This comprises an LED light source, dual light sensors (reference and light scattering), and a focusing lens. Light is directed on to the water surface and the scattered light is detected by the light sensors via the focusing lens. The electrical signal from the light detectors is then amplified and electronically processed to determine the turbidity value of the sample.

# Terminal Connections

## ● Measurement Value Output Signal (Common)

74	75	76	77	78	79
A	B	C	A	B	C
RS-485 #1			RS-485 #2		
TO OTHER INSTRUMENTS					

1	2	70	71	72	73
+	-	+	-	+	-
Input		Output 1		Output 2	
4~20mA DC					

## ● Single Measurement Range Configuration

50	51	52	53	54	55	30	31	32	33	34	35	36	37	38	39	40	41	42	43	60	61	62	63	92	93	E2	E1	90	91
PULSE	PULSE	—	—	NO	C	NC	—	a CONTACT	a CONTACT	a CONTACT	a CONTACT	—	INTERNAL WIRING						E	N	L								
Auto-Calibration Start Signal Input	Auto-cleaning Start Signal Input	Spare Input	Power Failure Alarm Contact Switching Output	Analyzer Fault Alarm Contact Switching Output	Under Maintenance Contact Switching Output	Under Cleaning / Under Calibration Contact Switching Output	High Concentration Alarm Contact Switching Output	Spare Input	D Type Earth	100~240 VAC, 50/60 Hz																			

## ● Dual Measurement Range Configuration

50	51	52	53	54	55	30	31	32	33	34	35	36	37	38	39	40	41	42	43	60	61	62	63	92	93	E2	E1	90	91	
PULSE	PULSE	STATUS	NO	C	NC	—	a CONTACT	a CONTACT	a CONTACT	a CONTACT	a CONTACT	—	INTERNAL WIRING						E	N	L									
Auto-Calibration Start Signal Input	Auto-cleaning Start Signal Input	Range Selection Command Signal	Power Failure Alarm Contact Switching Output	Analyzer Fault Alarm Contact Switching Output	Under Maintenance Contact Switching Output	Under Cleaning / Under Calibration Contact Switching Output	High Concentration Alarm Contact Switching Output	Range Indication Contact Switching Output	D Type Earth	100~240 VAC, 50/60 Hz																				
		*1	*1		*2																									
		*1	Range Selection Input Signal		54 • 55		Open		Range #1		Closed		Range #2																	
		*2	Range Indication Output Signal		42 • 43		Open		Range #1		Closed		Range #2																	

## ● Three Measurement Ranges Configuration

50	51	52	53	54	55	30	31	32	33	34	35	36	37	38	39	40	41	42	43	60	61	62	63	92	93	E2	E1	90	91	
PULSE	STATUS	STATUS	NO	C	NC	—	a CONTACT	a CONTACT	a CONTACT	a CONTACT	a CONTACT	—	INTERNAL WIRING						E	N	L									
Auto-Cleaning or Calibration Start Signal	Range Selection Command Signal	Range Selection Command Signal	Power Failure Alarm Contact Switching Output	Analyzer Fault Alarm Contact Switching Output	Under Cleaning / Under Calibration / Under Maintenance Contact Switching Output	High Concentration Alarm Contact Switching Output	Range Indication Contact Switching Output	Range Indication Contact Switching Output	D Type Earth	100~240 VAC, 50/60 Hz																				
		*1	*1		*2		*2																							
		*1	Range Selection Input Signal		52 • 53		Open		54 • 55		Open		Range #1																	
		*1					Closed				Open		Range #2																	
		*1					Open				Closed		Range #3																	
		*2	Range Indication Input Signal		40 • 41		Open		42 • 43		Open		Range #1																	
		*2					Closed				Open		Range #2																	
		*2					Open				Closed		Range #3																	

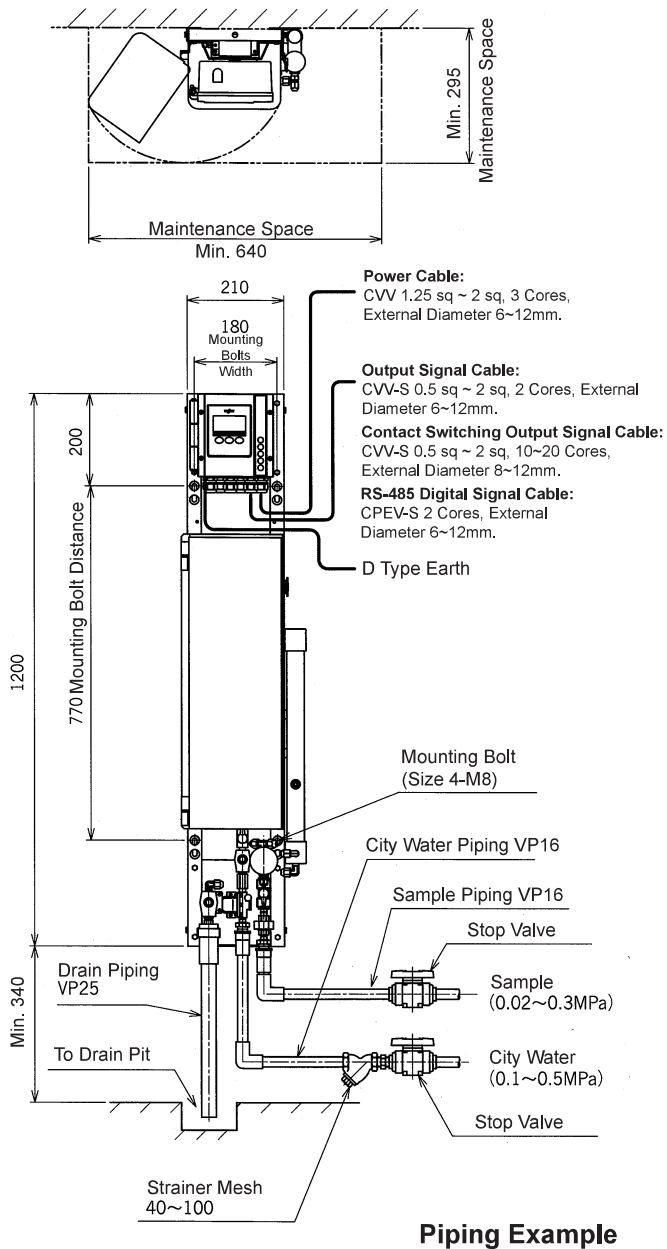
[ Status Contact Switching Specifications ] Volt Free Contacts/ Max Load 50 Ohms/ Current 10mA/ 24 VDC.

[ Pulse Signal Input Specifications ] 100 mS or greater

[ Output Contact Switching Specifications ] Contact rating: 30 VDC, 0.1A resistance load

[ Operating Power ] 100~240 VAC, 50/60 Hz

# Installation



## 1. Analyzer Installation Conditions

The instrument should be installed in a location that meets the following conditions:

- Protect from the elements (no wind, no rain, no direct sunlight).
- Supply a sample that meets the sample conditions specified herein.
- In a vibration free location.
- Away from equipment that is the source of strong electrical noise.
- In a location with adequate maintenance space surrounding the instrument.

## 2. Installation

The standard configuration instrument is suitable for wall or rack mounting. The instrument requires four M8 size holes. The meter should be mounted level. The mounting bolts need to be suitable for the instrument weight of 15kg.

## 3. Piping Connections (Sample Water)

- Provide a stop valve as shown in the drawing.
- We recommend good quality corrosion resistant tubing such as PVC pressure resistant tubing (VP16) for field pipe work.

## 4. Drain Plumbing

- Provide an open air drain pipe directing the exiting sample into a pit or other open air receiving device etc..
- Corrosion resistant PVC pressure resistant tubing (VP25) is recommended for drainage pipe work.

## 5. City Water Tubing

- Provide a stop valve and strainer (40~100 mesh size). In addition we recommend that a union is inserted close to the instrument to enable easy removal of the tubing.
- Corrosion resistant PVC pressure resistant tubing (VP25) is recommended for drainage pipe work.

## 6. Wiring

- Please refer to the drawing showing cable standards.
- Please ensure correct earthing of instrument. Earth connection should be D-Type (max resistance 100 Ohms) and connect to the Earth connection on the bottom of the transmitter case or to the E terminal on the internal terminal connections.
- Signal cable should be isolated from power cable.
- When using cable conduit, remove the cable glands and connect directly to the G1/2 threaded connections.

## 7. Sample Conditions

Temperature: 0~40 °C.  
Pressure: 0.02~0.3 MPa.  
Flowrate: 1~4 L/min (+/- 1 L/min).

## 8. City Water Conditions (Zero Calibration Solution)

Temperature: 2~30 deg C.  
Pressure: 0.1~0.5 MPa.  
Flowrate: 1~4 L/min (+/- 1 L/min).  
Quality: Turbidity level of 2 or less, Colour level of 5 or less.










# Cautions & Notes for Operation

- It is recommended to run the sample continuously. Stopping and restarting sample flow can cause measurement instability.
- In locations where the sample temperature could be higher than the ambient temperature, there is a possibility of the measuring cell being affected by vapours from the sample and interfering with the measurement. In these cases, we recommend that the optional air curtain is used or alternatively, heating of the installation area.
- If the sample flow is subject to large fluctuations or there are many bubbles in the sample, we recommend that a header

tank is installed above the analyzer to provide a regular flow of sample to the instrument with bubbles removed.
















- This instrument is calibrated using the selected standard and method. However depending on the characteristics of the sample (particulate distribution etc.) the measurement value may be different from an alternative measuring method (e.g. manual sampling and laboratory analysis). The reason for the difference is due to different measuring methods. In these cases we recommend that the differences are studied by the user and correlation data developed. The instrument can be aligned by the user to match the measurements from another instrument or method.

## Standard Accessories

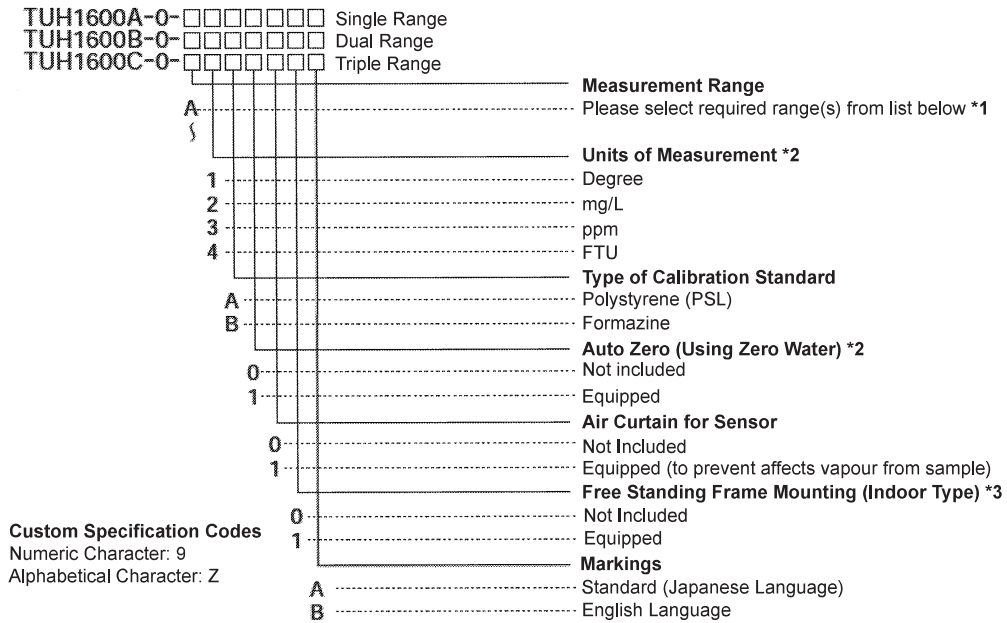
	Code No.	Description	Diagram	Qty	Remarks
1	—	Instruction Manual		1	
2	—	Factory Test Report		1	
3	135E002	Lens Cleaner		1	
4	7140130K	Scatter Board Assy (For checking / calibration)		1	
5	140G104	Brush		1	
6	146A005	Level		1	
7	136A022	Mini Trap Filter		3	Required for air curtain configuration
8	104A292	Tubular Fuse, 2A		1	For Transmitter
9	104A293	Tubular Fuse, 3,15A		1	For Sensor

This information is subject to change without notice. Please confirm current information with your sales representative prior to placing purchase order.

## Spare Parts List

	Code No.	Description	Diagram	Quantity			Replace Cycle	Remarks
				Consumables	Regular Replace	Spare Parts		
1	7140120K	Lamp Assy			1	1	1 Year	
2	136A270	Filter Cartridge			1		1 Year	For zero water (with auto cleaning & auto calibration)
3	7128030U	Varistor Unit			2		1 Year	For transmitter & sensor
4	116E033	Uni Tube #12			0.5m		1 Year	For receiver tank overflow line
5	116B151	Polyethylene Tube 6 x 8			1.5m		1 Year	For sample line and city water line
6	116E956	Rubber Tube 12 x17			0.5m		1 Year	For measurement tank overflow line
7	117B858	Sleeve for Z Union Dia 8mm PP			11		1 Year	Polyethylene Tube 6 x 8
8	7160700K	Solenoid Valve Assy				1	5 Years	SV1 (auto cleaning, auto calibration)
9	7160710K	Solenoid Valve Assy				1	5 Years	SV2 (auto cleaning, auto calibration)
10	7160720K	Motor Valve Assy			1		1 Year	MV1 (auto cleaning, auto calibration)
11	136A022	Mini Trap Filter		3	1		3 Months	Lower part of air pump (air curtain configuration)
12	125A284	Diaphragm Unit			1		1 Year	For air pump (air curtain configuration)
13	116E026	Uni Tube #4			1.5m		1 Year	For air pump (air curtain configuration)
14	104A292	Tubular Fuse, 2A				1		For transmitter
15	104A293	Tubular Fuse, 3,15A				1		For sensor

# Product Codes



## Notes:

\*1 Available measurement ranges are described in the table below:

Product Code	TUH1600A-0-		TUH1600B-0-		TUH1600C-0-	
Range Configuration	Single Range		Dual Range		Triple Range	
First Spec.	A	0~0.2	A	0~0.2/0.5	A	0~0.2/0.5/1.0
	B	0~0.5	B	0~0.5/1.0	B	0~0.5/1.0/2.0
	C	0~1.0	C	0~1.0/2.0		
	D	0~2.0				

\*2 After auto cleaning (standard equipment), zero calibration can be performed by simply turning off the light source lamp or by using city water passed through a zero filter.

\*3 If free standing frame is selected as " Equipped ", the frame will be aluminium with base requiring anchor bolts (as per design of previous models).



Always read the instruction manual before operation.

Due to continuous product improvement, specifications contained herein are subject to change without notice.

### International Operations:

DKK-TOA Corporation  
 29-10, 1-Chome, Takadanobaba, Shinjuku-ku, Tokyo 169-8648  
 Japan  
 Tel: +81-(0)3-3202-0225 Fax: +81-(0)3-3202-5685

### Local Representative: