SPECIFICATION SHEET

TURBIDITY ANALYSER TUF-1600

Turbidity analyser suitable for a wide range of applications including municipal water treatment, sewage, industrial process and environmental monitoring of rivers. 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 reliably and performance.

Wall Mount Version

Free Standing Frame Version (Option)

Features

○Three measurement range versions are available for single, dual and triple ranges. Available ranges from minimum 0 to 2 to maximum of 0 to 2000. For multi range versions, range selection is available by manual key pad operation, automatic or remote signal.

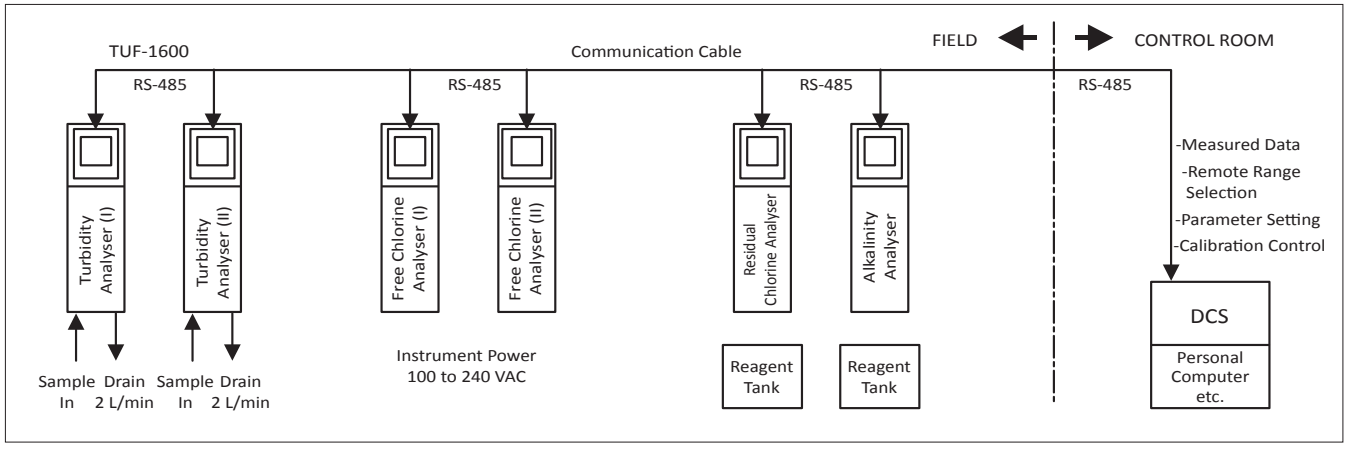
○LED (white light) provides extended life of light source. This is combined with a new optical system designed to minimise stray light interference and provides an enhanced S/N ratio. The measuring cell also contains an anti-condensation heater and receiving tank for debubbling and maintaining constant 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.

○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..
Please consult separately about the detailed production specifications.

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

Example of MODBUS Communication System



Common Specifications

Product Name : Turbidity Analyser
Model Code : TUF-1600
Measurement Object : Process water in water purification process (including river water)
Measurement Method : Surface light scattering
Measurement Range : 0 to 2000
Output Range : Selectable ;

1 Range	0 to 2, 0 to 5, 0 to 10, 0 to 20, 0 to 50, 0 to 100, 0 to 200, 0 to 500, 0 to 1000, 0 to 2000
2 Ranges	0 to 2/20, 0 to 5/50, 0 to 10/100, 0 to 20/200, 0 to 50/500, 0 to 100/1000, 0 to 200/2000
3 Ranges	0 to 2/5/10, 0 to 5/10/50, 0 to 20/100/500, 0 to 50/200/2000

Measurement Units : mg/L, ppm, degree, or FTU
Display : Digital, LCD (with back light)
Minimum Display : Range 0 to 10 (or less); 0.01
Range 0 to 20 (or more, max 100); 0.1
Range 0 to 200 (or more); 1
Range Switching : Manual, automatic or from remote signal
Analogue Output Signal : 4 to 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 (option)
- Analyser 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

(volt free contacts, 100 mS or greater width)

External output port : RS-485 1 point (max. cable length 100m)
Protocol; Modbus/RTU
Address; 8 × n (n=1 to 30)
Use continuous 3 addresses
Terminal block; 2 sets (for parallel connection)
Analogue signal input : Converts 4 to 20mA DC input to a preset scale.
Number of inputs; 1 point
Concentration conversion; 4 significant digits, fixed at any decimal point position
Operating Power : 100 to 240 VAC +/− 10%, 50/60 Hz
Power Consumption : Approx. 15VA
Approx. 60VA (with auto cleaning, auto calibration)
Sample Conditions :
- No flow stoppage or stagnation
- Temperature; 0 to 40 degC (no freezing)
- Pressure; 0.02 to 0.3 MPa
- Sample consumption; 1 to 4 L/min (+/− 1 L/min)

City Water Conditions : Required for zero calibration
- Temperature; 2 to 30 degC (no freezing)
- Pressure; 0.1 to 0.5 MPa
- Consumption; 1 to 4 L/min at constant flowrate

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 to 12mm diameter cable, G1/2 threaded connections when gland removed
Ambient Temperature : −5 to 50 degC (no freezing)
Ambient Humidity : Max 85% RH (no condensation)
Weight : Approx 15 kg
: Approx 30 kg (free standing version)

Performance

Linearity : Within +/− 3% FS (with standard solution)
Within +/− 5% FS (for 0 to 2000 range)
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 : When max range is 50; City water passed through zero filter.
When max range is 100; City water
Carry out simple zero calibration in a light source lamp off.
Span Calibration : Kaolin standard solution (mg/L or ppm)
Polystyrene standard solution (degree)
Formazine standard solution (degree or FTU)
(use one solution from above or scatter plate).

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

DC 4 to 20mA

● 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	91	90
PULSE		PULSE		−		NO	C	NC	−	a CONTACT		a CONTACT		a CONTACT		a CONTACT		−		INTERNAL WIRING							E	N	L

Auto−zero Calibration Start Signal Input
Auto−cleaning Start Signal Input
Spare Input
Power Failure Alarm Contact Switching Output
Analyser 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 to 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	91	90
PULSE		PULSE		STATUS		NO	C	NC	−	a CONTACT		a CONTACT		a CONTACT		a CONTACT		a CONTACT		INTERNAL WIRING							E	N	L

Auto−zero Calibration Start Signal Input
Auto−cleaning Start Signal Input
Range Selection Command Signal
Power Failure Alarm Contact Switching Output
Analyser 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 to 240 VAC, 50/60 Hz

Range Selection Input Signal	54 • 55	Open	Range #1	Closed	Range #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	91	90
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
Analyser 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 to 240 VAC, 50/60 Hz

Range Selection Input Signal	52 • 53	Open	54 • 55	Open	Range #1
		Closed		Open	Range #2
		Open		Closed	Range #3
Range Indication Input Signal	40 • 41	Open	42 • 43	Open	Range #1
		Closed		Open	Range #2
		Open		Closed	Range #3

[Input 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 to 240 VAC, 50/60 Hz

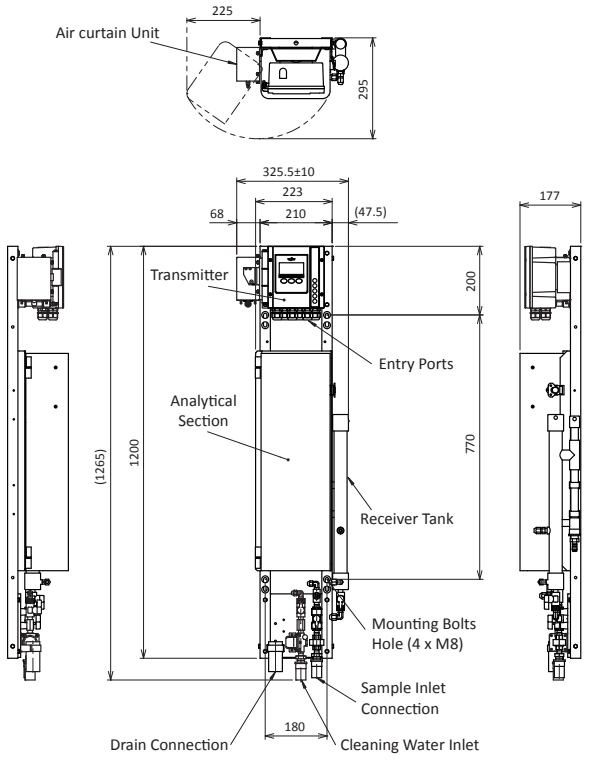
Options

- Zero Filter: Filter for converting city water into zero calibration standard. Required for calibration when using instrument for low range applications (measurement ranges up to 50).
- 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.
- Free Standing Frame (indoor mounting): Analyser system pre assembled on a free standing frame with floor mounting base suitable for fixing with anchor bolts.
- Auto-Cleaning Unit: Flushing of measuring cell at regular intervals in order to automatically clean the flow paths and measuring cell. Cleaning function is started by internal timer setting or by remote start signal.
  Cleaning cycle: 1 to 24 hours (initial setting 12 hours).
  Cleaning duration: 1 to 5 minutes (initial setting is 5 minutes).
  Standby time: 0 to 30 minutes (initial setting is 15 minutes).
- Auto-Zero Calibration Unit: After automatic cleaning, zero calibration is performed and regular intervals. Zero calibration methods include simply turning off the light source lamp or introducing zero calibration solution (city water) into the measuring cell. This function is started by internal timer setting or by remote start signal. Automatic zero calibration is included with automatic calibration option.
  Calibration cycle: 1 to 31 days (initial factory setting is 10 days).
  Calibration duration: Approx 60 minutes (fixed).
  Stand by time: 0 to 30 minutes (initial factory setting is 15 minutes).

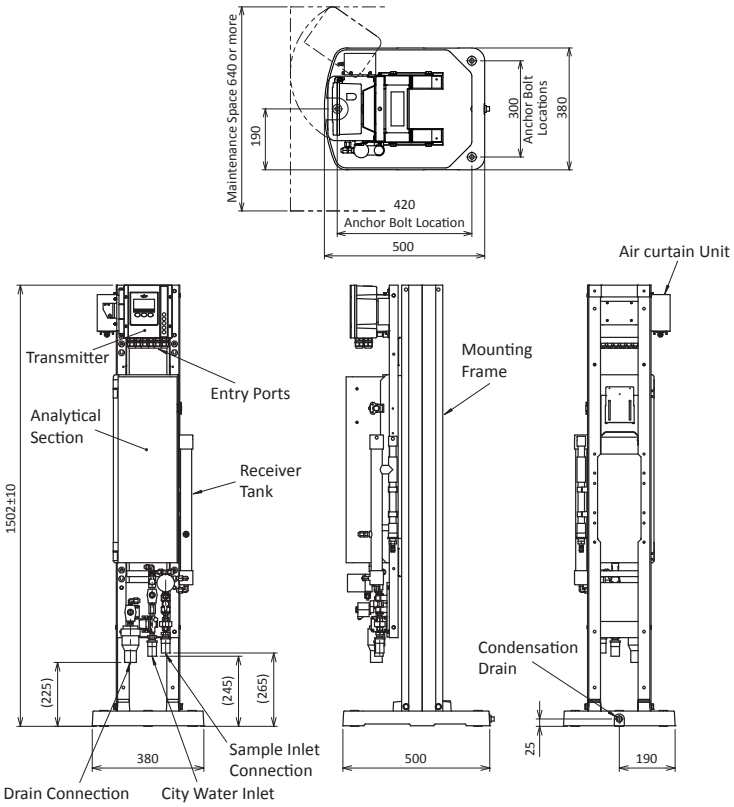
Dimensions

Unit : mm

● Wall or Rack Mounting Version

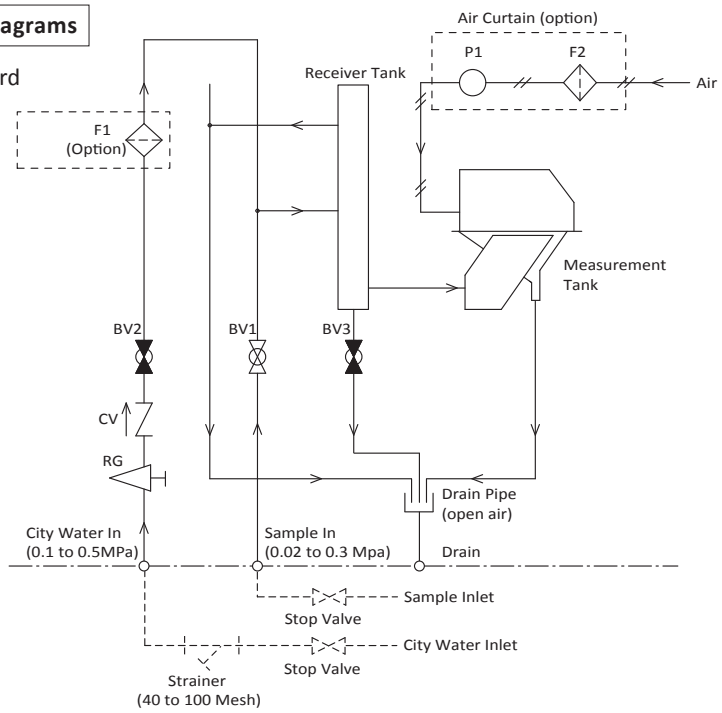


● Free Standing Frame Mounted Version (Option)



Flow Diagrams

● Standard



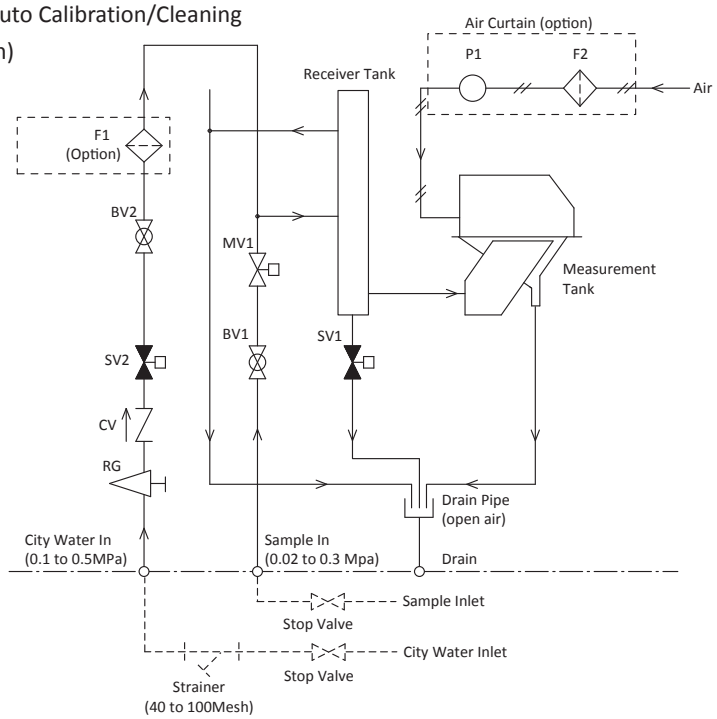
Key	Description	Remarks
BV1	Sample Flow Control Valve	1 to 4L/min
BV2	City Water Control Valve	1 to 4L/min
BV3	Drain Valve	
RG	Pressure Regulator	Set at 200 kPa
CV	Check Valve	
F1	Zero Filter	
F2	Air Filter	
P1	Air Pump	

Function	BV1	BV2	BV3
Measurement	O	C	C
Cleaning	C	O	O/C
Zero Calib	C	O	C

⋈ Normally Open

⋈ Normally Closed

● With Auto Calibration/Cleaning (Option)



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

Function	BV1	BV2	MV1	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

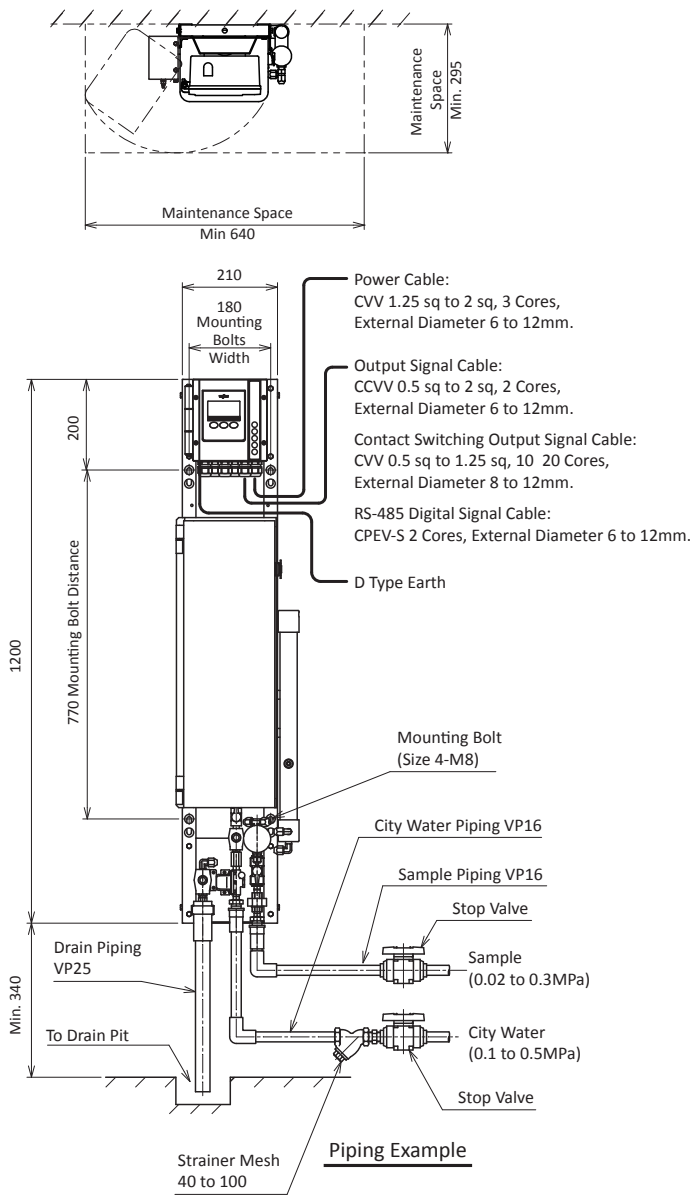
⋈ Normally Closed

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 adjust valve (BV1) where bubbles are expelled. The sample then enters the measuring 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.

Installation

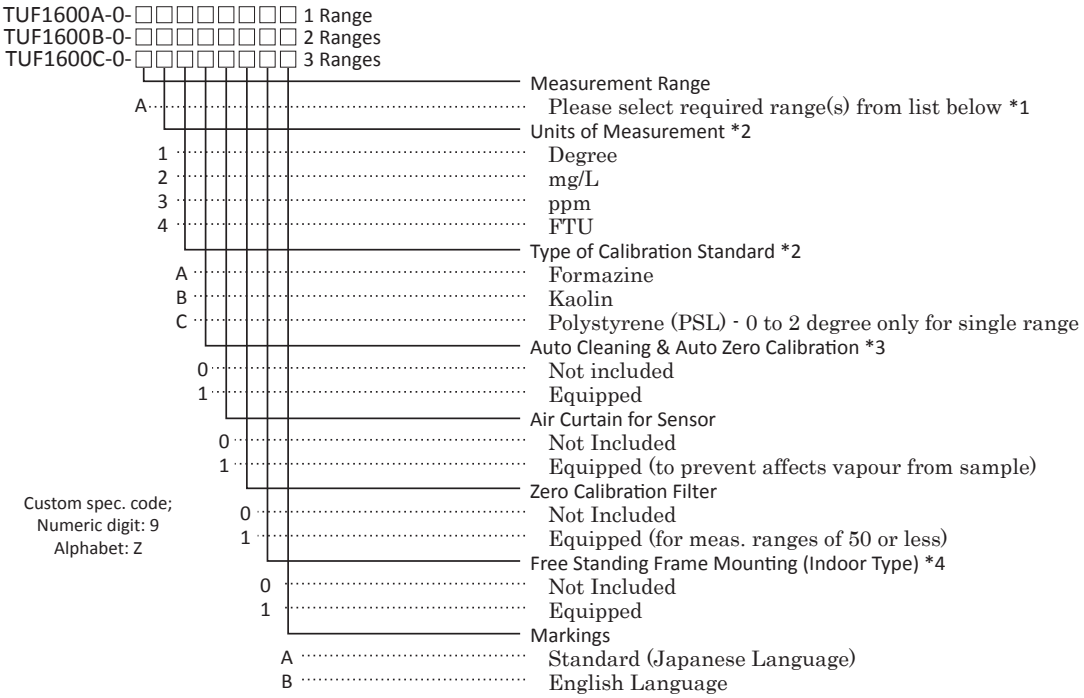


1. Analyser Installation Conditions
   The instrument should be installed in a location that meets the following conditions:
   a. Protect from the elements (no wind, rain, direct sunlight).
   b. Supply a sample that meets the sample conditions specified herein.
   c. In a vibration free location.
   d. Away from equipment that is the source of strong electrical noise.
   e. 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
   a. Provide a stop valve as shown in the drawing.
   b. We recommend good quality corrosion resistant tubing such as PVC pressure resistant tubing (VP16) for field pipe work.
4. Drain Plumbing
   a. Provide an open air drain pipe directing the exiting sample into a pit or other open air receiving device etc..
   b. Corrosion resistant PVC pressure resistant tubing (VP25) is recommended for drainage pipe work.
5. City Water Supply Pipe
   a. Provide a stop valve strainer (40 to 100 mesh) as shown in the figure.Install a union near the equipment so that the piping can be disconnected from the equipment.
   b. Use hard PVC (VP16) or PVC pressure resistance hose (equivalent VP16 diameter) or other highly corrosion resistant material for the piping.
6. Wiring
   a. Please refer to the drawing showing cable standards.
   b. 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.
   c. Signal cable should be isolated from power cable.
   d. When using cable conduit, remover the cable glands and connect directly to the G1/2 threaded connections.
7. Sample Conditions
   Temperature: 0 to 40 degC.
   Pressure: 0.02 to 0.3 MPa.
   Flowrate: 1 to 4 L/min (+/− 1 L/min).
8. City Water Conditions (Zero Calibration Solution)
   Temperature: 2 to 30 deg C.
   Pressure: 0.1 to 0.5 MPa.
   Flowrate: 1 to 4 L/min (+/− 1 L/min).
   Quality: Turbidity level of 2 or less, Colour level of 5 or less.

Cautions & Notes for Operation

1. It is recommended to run the sample continuously. Stopping and restarting sample flow can cause measurement instability.
2. 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.
3. If the sample flow is subject to large fluctuations or there are many bubbles in the sample, we recommended that a header tank is installed above the analyser to provide a regular flow of sample to the instrument with bubbles removed.
4. 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.

Product code



Notes:

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

Product Code	TUF1600A-0-		TUF1600B-0-		TUF1600C-0-	
Range Configuration	1 Range		2 Ranges		3 Ranges	
First Spec.	A	0 to 2	A	0 to 2 / 20	A	0 to 2 / 5 / 10
	B	0 to 5	B	0 to 5 / 50	B	0 to 5 / 10 / 50
	C	0 to 10	C	0 to 10 / 100	C	0 to 20 / 100 / 500
	D	0 to 20	D	0 to 20 / 200	D	0 to 50 / 200 / 2000
	E	0 to 50	E	0 to 50 / 500		
	F	0 to 100	F	0 to 100 / 1000		
	G	0 to 200	G	0 to 200 / 2000		
	H	0 to 500				
	J	0 to 1000				
	K	0 to 2000				

*2. Standard calibration materials for calibration type, units of measurement and application are shown in the table below:

Calibration Standard	Units of Measurement	City Water	Sewage, Effluent etc.
Formazine	FTU or Degree	X	O
Kaolin	mg/L, ppm, Degree	O	X
Polystyrene	Degree	O	X

[FTU] units are normally used internationally while Polystyrene is typically the standard material for domestic Japan city water treatment plant applications.

*3. Auto calibration is applicable to zero calibration only (not applicable to span calibration).

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

DKK-TOA CORPORATION

CAUTION Please read the operation manual carefully before using producuts.

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Information and specifications are subject to change without notice.

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