

Turb 2000 Series:

Turb 2000

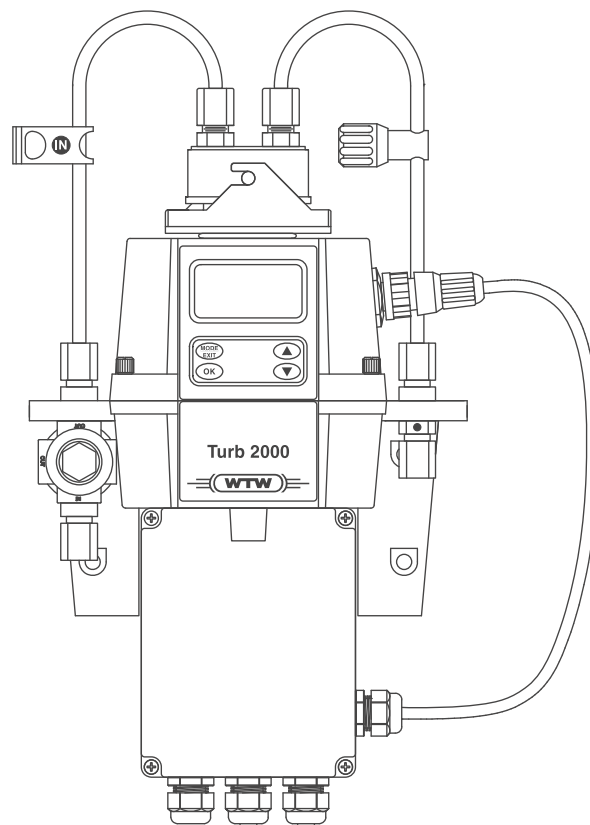
Turb 2020

Turb 2100

Turb 2110

Turb 2120

Process Turbidimeter



**Note**

The latest version of the present operating manual can be found on the Internet under www.WTW.com.

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1 Overview

The Turb 2000 Series process turbidimeter allows for the measurement of the turbidity of drinking water and process water on-line. The White Light Turb 2000 and 2020 has been designed to meet the design criteria specified by the US EPA 180.1 on turbidity measurement. The infrared Turb 2100 and 2120 was designed to meet the design criteria specified in ISO 7027 and DIN 27027 for the measurement of the turbidity of a sample. Both models have long life lamps.

Some models have ultrasonic cleaning. Refer to section ULTRASONIC CLEANING (TURB 2020 AND 2120) for more information.

1.1 The Turb 2000 Series

Model	Light source	Ultrasonic cleaning
Turb 2000	White light	No
Turb 2020	White light	Yes
Turb 2100	IR	No
Turb 2110	IR	No
Turb 2120	IR	Yes

1.2 Unpacking and inspection of the instrument and accessories

The table below indicates the items in the turbidimeter shipment.

Item	Flow
Turb 2000 series turbidimeter with field terminal box & flow through assembly	1
Operating manual	1
Desiccant pack	1
Spare flow-through cuvette (Turb 2000 and Turb 2100 only)	1
Tubing kit: 1 shutoff clamp 1 backpressure valve 2 connecting tubing with fittings for flow through assembly 1 drain vent screw (used in pressurized systems)	

Remove the instrument from the packing carton. Carefully inspect all items to ensure that no visible damage has occurred during shipment. If the items received do not match the order, please immediately contact the local distributor or the WTW Customer Service department.

1.3 The display

Figure 1 illustrates all the items that can appear on the display. The upper row of the display (1) is used for reporting the turbidity levels and to provide user guidance in the customer setting routine. The lower row of the display (2) is used to communicate error messages and provide user guidance. The display has two icons (3) that are used to indicate the use of access code and offset mode. In addition, mode arrows (4) are used to indicate the current instrument operating mode; AUTO (normal operation), CAL (calibration) and CONFIG (configuration).

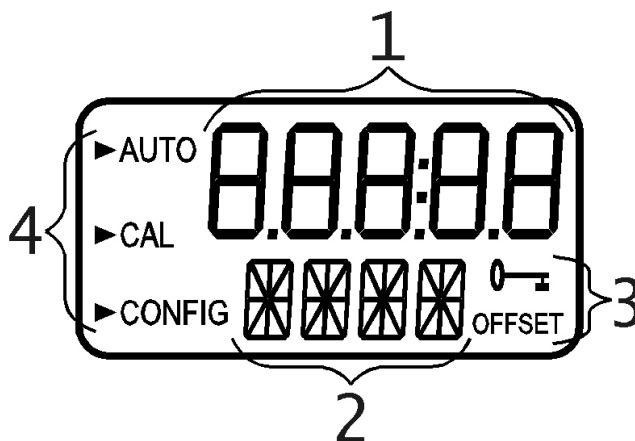


Figure 1 – Display used in the instrument.
All items used on the display are shown in this figure

1.4 Keypad

Figure 2 illustrates the touch pad. The touch pad has four buttons: **MODE/EXIT**, **OK**, **▲**, and **▼**. The **MODE/EXIT** button is used to cycle between the three operational modes of the instrument: **CAL**, **CONFIG**, and **AUTO** (Measurement) mode. The **OK** button enters the option (or mode) that is highlighted or chosen. The **▲** and **▼** buttons are used to change settings.

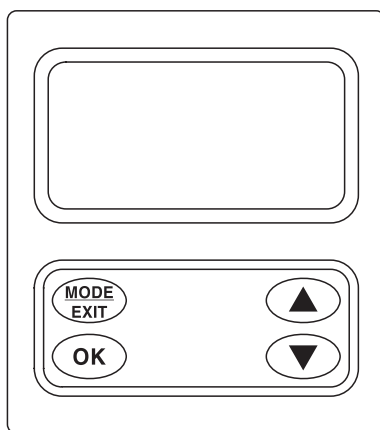


Figure 2: Keypad

1.5 Vapor purge

The Turb 2000 series is equipped with a continuous vapor purge system. A replaceable desiccant pouch in the lower portion of the instrument dries the air. System heat is used to warm the air. A fan inside the instrument continuously circulates heated dry air around the optical well and the flow through cuvette. This feature eliminates the need for a dry purge line.

The Turb 2000 series monitors the replaceable desiccant pouch condition continuously. The LCD display will show **DESC** on the lower line in the event that the desiccant pouch needs replacement. Replacement desiccant pouches are available from WTW or the local representative. Refer to section 9.2 REPLACING OR INSTALLING THE DESICCANT .

The desiccant can activate an alarm to notify the operator of a saturated desiccant. See section 6.15 DESICCANT ALARM.

2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the turbidimeter. Consequently, all responsible personnel must read this operating manual before working with the sampler.

The operating manual must always be available within the vicinity of the turbidimeter.

Target group

The turbidimeter was developed for use in online analysis. Thus, we assume that the operators are familiar with the necessary precautions to take when dealing with chemicals as a result of their professional training and experience.

General safety instructions

Safety instructions in this operating manual are indicated by **the** warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the danger level:



WARNING

indicates instructions that must be followed precisely in order to prevent serious dangers to personnel.



CAUTION

indicates instructions that must be followed precisely in order to avoid slight injuries to personnel or damage to the instrument or the environment.

Other labels



Note

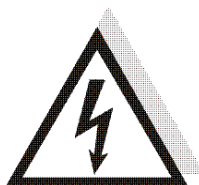
indicates notes or helpful hints that draw your attention to special features and give further clarification to the instructions. Refer to the *Table of Contents* to easily find specific topics and to learn about unfamiliar terms.

Authorized use

This instrument is authorized exclusively for online turbidity measurements in drinking water, swimming pool water and process water.

The technical specifications as given in chapter TECHNICAL DATA, must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized. Any other use is considered to be **unauthorized**.

Installation



WARNING

Only qualified electricians should be allowed to perform the installation of the instrument as it involves a line voltage that could endanger life.

Function and operating safety

This instrument left the factory in a safe and secure technical condition. The smooth functioning and operational safety of the turbidimeter can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the turbidimeter can only be guaranteed under the climatic conditions specified in the chapter

	Technical data.
Safe operation	<p>If safe operation is no longer possible, the instrument must be taken out of service and secured against inadvertent operation!</p> <p>Safe operation is no longer possible if the turbidimeter</p> <ul style="list-style-type: none">• has been damaged in transport• has been stored under adverse conditions for a lengthy period of time• is visibly damaged• no longer operates as described in this manual. <p>If you are in any doubt, please contact the supplier of the instrument.</p>
Obligations of the operator	<p>The purchaser of this turbidimeter must ensure that the following laws and guidelines are observed when using dangerous substances:</p> <ul style="list-style-type: none">• EEC directives for protective labor legislation• National protective labor legislation• Safety regulations

Installation and commissioning

Prior to use for the first time, the supplied desiccant pouch will need to be installed. Refer to section 9.2 REPLACING OR INSTALLING THE DESICCANT POUCH.

2.1 Mounting and site selection

The instrument is designed for wall mounting. If wall mounting is not practical, the instrument can be mounted on any suitable vertical surface. For ease of service there should be about 20 cm (8") free area above the instrument; this will ensure enough room for calibration and cuvette maintenance. Choose a location that is easily accessible for operation and service and ensure that the front display rests at eye level. The installation dimensions of the instrument are given in figure 3. The following screws are required for installation: M6 for the housing, M4 for the field terminal box. The Turb 2000 series is designed to have the field terminal box cradled under the sensor portion of the instrument. It is recommended that the field terminal box be mounted first, and then the rest of the instrument be mounted on top. The figure below may be used to establish mounting hole locations.



Note

Firmly tighten the slotted knurled screws on the housing flange with a screwdriver to make sure that the housing is sealed tightly.

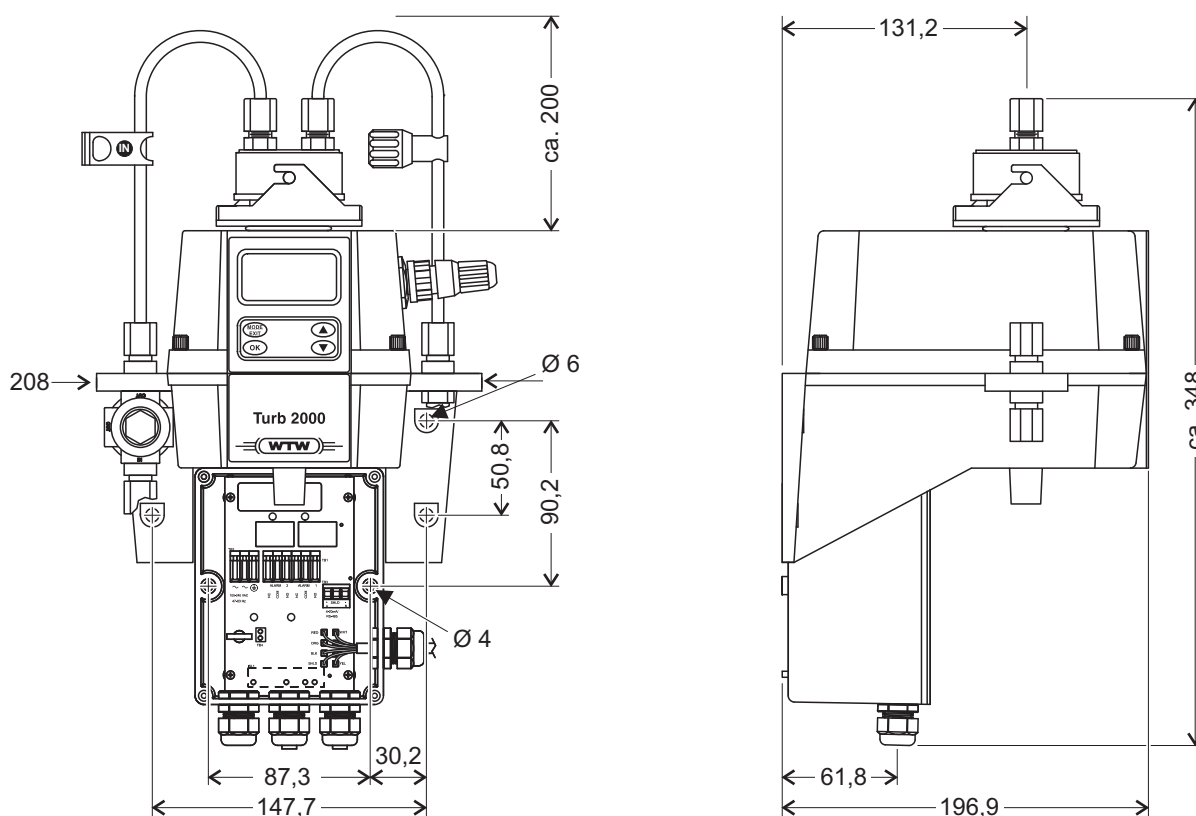


Figure 3: Overall mounting dimensions of the instrument

It is critical that the instrument be mounted as close as possible to the sampling point to ensure a quick response time (within 3 meters (10 ft) of the sampling point).

2.2 Plumbing

Figure 4 shows the plumbing recommended for the instrument. The instrument requires only a very low minimum pressure for operation. A flow controller and backpressure valve are integrated in the instrument. For details, see chapter Technical data.

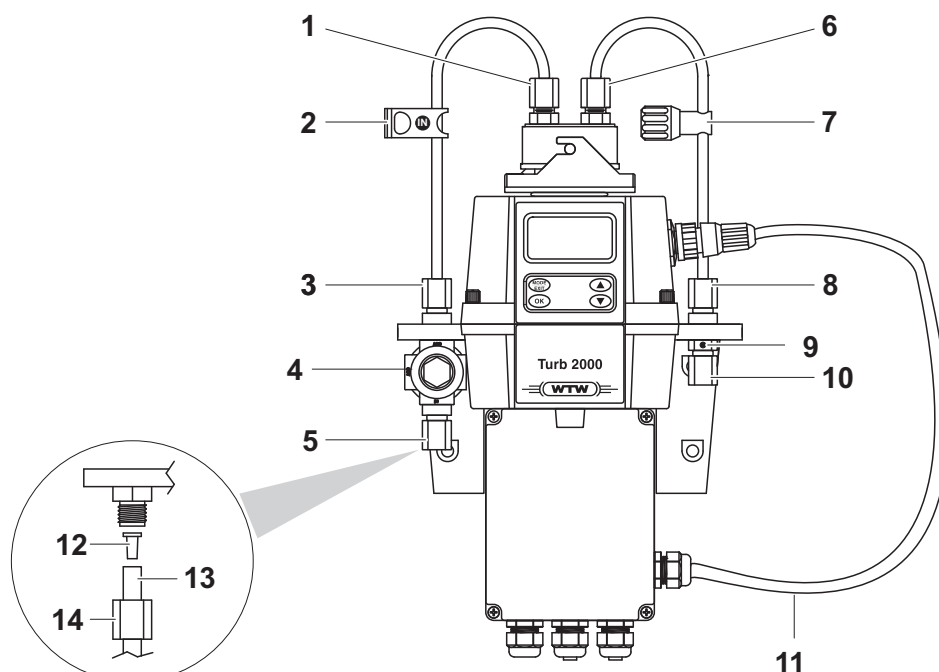


Figure 4: Recommended plumbing for the instrument

1	Feed tubing connection
2	Shutoff clamp
3	Feed tubing connection
4	Backpressure valve
5	Feed tubing connection
6	Drain tubing connection
7	Backpressure valve
8	Drain tubing connection
9	Drain vent
10	Drain tubing connection
11	Sensor connection cable
12	Insert
13	Tubing (not supplied)
14	Nut

The instrument is equipped to be plumbed using 4.75 mm (3/16") ID, 8 mm (5/16") OD flexible tubing. Opaque tubing should be used if the tubing will be exposed to sunlight, to prevent algae growth. For connecting we recommend the connection set with quick connector (A-Set-DW, siehe section 11).

In figure 4, there are three flow devices shown. On the inlet side there is a shutoff clamp (Pos. 2) used during cuvette maintenance, and the flow controller (Pos. 4). With the backpressure valve (Pos. 7) a back pressure is created in the cell. Backpressure may be required to prevent air from coming out of solution, which may be observed as tiny air bubbles.

2.2.1 Drain vent

The Turb 2000 series has been fitted with a drain vent (Pos.9) in the “OUT” bulkhead fitting. This fitting allows for atmospheric equalization, thus helping to alleviate bubble formation in the cuvette. Refer to Figure 4.

Upon initial flow minor leakage may occur through the drain vent. This will subside once normal flow is established.

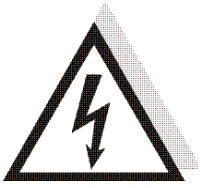
For some high pressure systems, where the vent hole continuously leaks, a seal screw is provided which should be inserted into the vent hole and tightened.

The sensor drain tubing should be routed to a suitable, pressure-free drain. It is not recommended to reintroduce the drain sample to the process stream.

2.2.2 Wetted materials

WTW accepts no responsibility for damage caused by the introduction of vapors, fluids or other materials into the instrument process stream which is not compatible with the instrument's wetted materials. A list of the wetted materials can be found in the technical data section of this manual.

2.3 Electrical connections



WARNING

- Only qualified electricians should be allowed to perform the installation of the instrument as it involves a line voltage that could endanger life.
- The electrician must have read and understood this manual and must follow the instructions in this manual.
- Before starting any installation work make sure all cables are voltage free.
- The instrument is equipped with a 100 ... 240 V AC, 47 ... 63 Hz switching power supply. Before connecting the instrument check whether the line power meets this specification.
- Install a circuit breaker prior to the power connection to allow for service.

All of the electrical connections to the instrument are made through the field terminal box, which should be located directly under the sensor portion of the instrument. The connections are labeled within the terminal box and are self-descriptive (see Figure 5). Please follow all local and government recommendations and methods for installation of electrical connections to and between the instrument and other peripheral devices.

Plugs are inserted into the alarm and 4-20mA/RS-485 cable bulkheads when shipped, to ensure a watertight seal. These plugs should be removed and discarded when cabling to either of these connections.

The power cable bulkhead will accept cable diameters from 5.8 mm (.230 in.) up to 10 mm (.395 in.). All terminals are designed to accept wires in the range of 0.08-2.08 mm² (28-14 AWG). All wires should be stripped to a length of 6 mm (¼") and fitted with wire end sleeves. A strain relief strap is provided to reduce tension on the power terminals.

It is the user's responsibility to assure that the watertight seal is maintained after the terminal box has been wired for operation.



WARNING

If any of the bulkheads are not tightened and sealed properly around a cable or plug, the ratings of the instrument will be jeopardized and there is a possibility of creating a shock hazard.

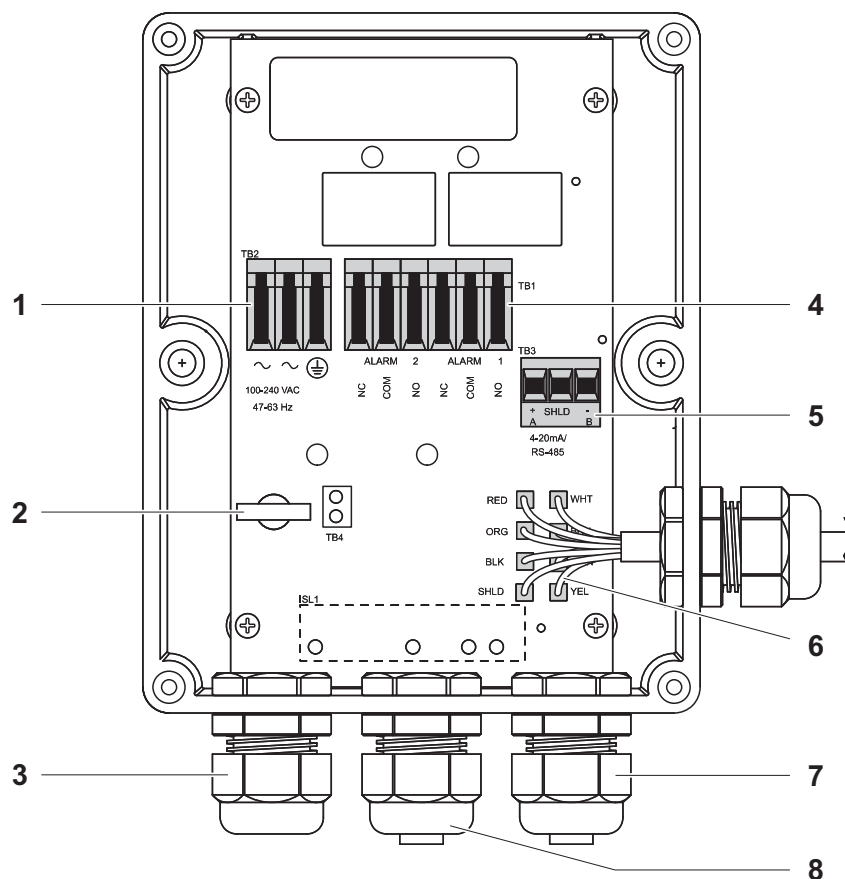


Figure 5: Electrical connections for the instrument

1	Power supply terminal block
2	Power cable strain relief
3	Power cable bulkhead
4	Alarms terminal block 240 V AC, 2A
5	4 – 20 mA / RS485 plug with screw terminals
6	Sensor wiring
7	4 – 20 mA / RS485 bulkhead
8	Alarm cable bulkhead

2.3.1 Power supply

Follow the safety instructions at the beginning of this section. Figure 5 shows the connections to be made. The scope of delivery does not include a power cable. If the instrument is to be used in the U.S. or Canada, the power cord must be UL Listed & CSA Certified. Please consult all local electrical codes for proper connection.

The terminal block is marked as follows: ~ for Neutral and Line, the third symbol indicates a secure earth ground. The green removable terminal block is suitable for wires 0.82 to 3.3 mm² (18 to 12 AWG).

Run the power cable through the strain relief and connect the wires to the terminal block. Then tighten the strain relief. The instrument is switched on by switching on the power.

2.3.2 4-20 mA

**CAUTION**

Do not run RS-485 cables in the same conduit as power. To prevent damage to the instrument, ensure that power is disconnected prior to connecting the 4-20 mA output.

For ease of connecting, remove the plug in terminal block. Polarities of the connections are labeled beneath this termination.

The 4-20 mA output is driven by a 15 V DC power source and can drive recorder loads up to 600 ohms. This 4-20 mA output is isolated from line power and earth ground. Operation of this output is covered in section 6.2 SETTING THE 4-20 MA.

**Note**

The installation of the 4-20 mA terminal block will render the RS-485 non-operational.

2.3.3 RS-485

The RS-485 half-duplex (2-wire) digital interface operates with differential levels that are not susceptible to electrical interferences. This is why cable lengths up to 3000 ft can be implemented. The last device on each bus may require terminating with a 120-ohm resistor to eliminate signal reflection on the line.

**CAUTION**

Do not run RS-485 cables in the same conduit as power. To prevent damage to the instrument, ensure that power is disconnected prior to making connections.

Pull the plug off the circuit board to make connecting easier. Connections are labeled beneath this termination.

**Note**

The installation of the RS-485 interface will render the 4-20 mA terminal block non-operational.

2.3.4 Relays

The Alarm 1 and Alarm 2 relays are mechanical relays rated at 240 V AC 2A. Please note that the relays are labeled NO (Normally Open), NC (Normally Closed) and C (Common). As these alarms are configured fail-safe, the normal condition is with power applied to the Turb 2000 series and in a non-alarm condition. Operation of these alarms is covered in section 6.5 CONFIGURING THE ALARMS.

3 Operation

This process turbidimeter allows for the on-line measurement of the turbidity of process water, swimming pool water and drinking water. The turbidity of the water is usually reported in Nephelometric Turbidity Units (NTU), but may be reported in Formazin Nephelometric Units (FNU). Readings above 1100 NTU will cause the display to flash indicating an over range condition. Readings above 1100 NTU will cause the display to flash indicating an over range condition.

During normal operation, the instrument will have the arrow beside AUTO highlighted. The current scale is displayed on the lower row of the display and the measured reading on the upper row of the display (see illustration below).



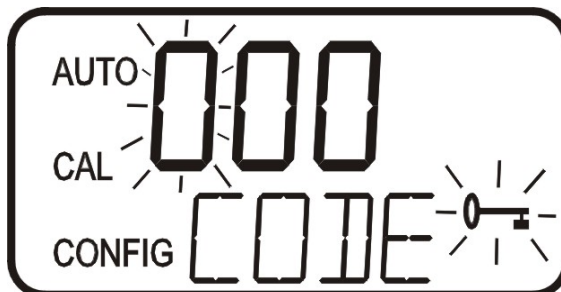
3.1 Routine measurement

The following steps describe how to measure the turbidity of a sample using this instrument:

1. Apply power to the instrument and allow the unit to warm up (typically 45 minutes – 1 hour on initial commissioning).
2. When a continuous process stream is flowing through the instrument, the instrument will display the measured turbidity level of the sample by displaying it on the LCD screen. In addition, the equivalent signal is provided on the analog (4-20 mA) or the digital output RS 485 - depending on the options selected.

3.2 Security access feature

The instrument is equipped with a security access code feature that can be activated in the configuration mode. If the security feature is enabled, the screen shown in the illustration below will appear when the **MODE/EXIT** button is pressed.



The security code (333) must be entered to gain access to CAL or CONFIG menus. Notice that the first number in the code is flashing; the flashing indicates that this is the number to be changed. Use the **▲** or **▼** arrows to select the first of the three numbers in the code and then press the **OK** button to accept the first number of the code. Now enter the second number in the code. Proceed as with the first number followed by **OK**. Then repeat the process for the third number in the access code, and finish with the **OK** button.

If the valid access code has been selected, the instrument will be directed to the calibration mode. If the wrong access code is selected, the instrument will return to the AUTO mode. Refer to section 6.7 ENABLING THE SECURITY ACCESS for more information.

4 Instrument calibration

The instrument was calibrated and tested prior to leaving the factory. Therefore, it is possible to use the instrument directly out of the box. Under normal conditions, recalibration is recommended at least once every three months¹.

Relay contacts are held at the last valid condition and will not change state while the instrument is in the calibration and/or in the configuration mode. While in the calibration mode, the instrument has a time-out feature that automatically returns the system operation to the AUTO mode after a fifteen (15) minute period of inactivity.

4.1 Calibration standards

If the Turb 2000 series will be used over the entire range of 0.02 to 1000 NTU a complete calibration as described below will be required.

If instrument accuracy is only required below 10 NTU (below 1 NTU for Turb 2110), such as potable water, a calibration may be performed using only a 10 NTU and a 0.02 NTU standard (1.0 NTU and 0.02 NTU for Turb 2110). To calibrate starting at the 10 NTU, press the ▼ button to bypass the 1000 NTU and proceed to section 4.2 CALIBRATION PROCEDURES, step 5.

We recommend that the following materials be used during calibration to achieve the full-scale accuracy stated in this manual:

- For Turb 2000/2020/2100/2120 (Kal Kit Turb/DW):

- 0.02 NTU Calibration Standard
- 10.0 NTU Calibration Standard
- 1000 NTU Calibration Standard

- For Turb 2110 (ProCal-Kit):

- 0.02 NTU Calibration Standard
- 1.0 NTU Calibration Standard
- 10.0 NTU Calibration Standard

See section 11 REPLACEMENT PARTS AND ACCESSORIES for ordering information.

It is well known that diluted Formazin is unstable. The WTW primary calibration standards are more long-term stable than Formazin and have a long shelf life. Prior to recalibration, review the expiration dates, to ensure that the standards have not expired.

Details on the handling of calibration standards see section 5.1.

¹ The EPA recommends that on-line turbidimeters be calibrated with a primary standard at least once every three months if they are to be used for EPA reporting.

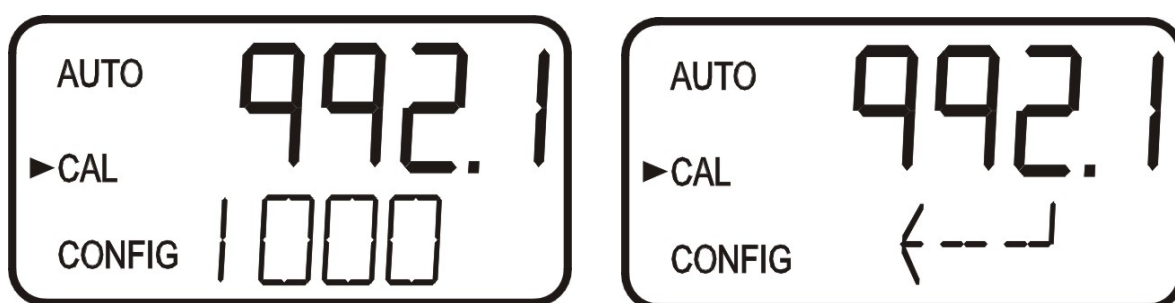
4.2 Calibration procedures



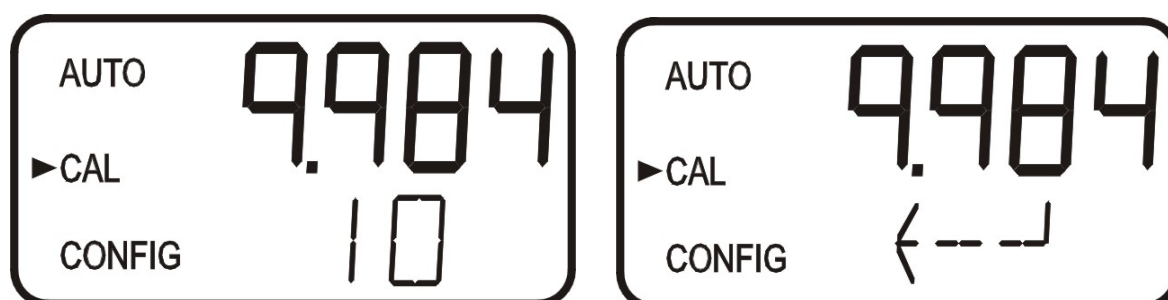
Note

The displays in this chapter demonstrate the calibration procedure for Turb 2000, Turb 2020, Turb 2100 and Turb 2120. When calibrating Turb 2110 the displays for the first two steps show the corresponding values for the 10.0 NTU and 1.0 NTU calibration standards.

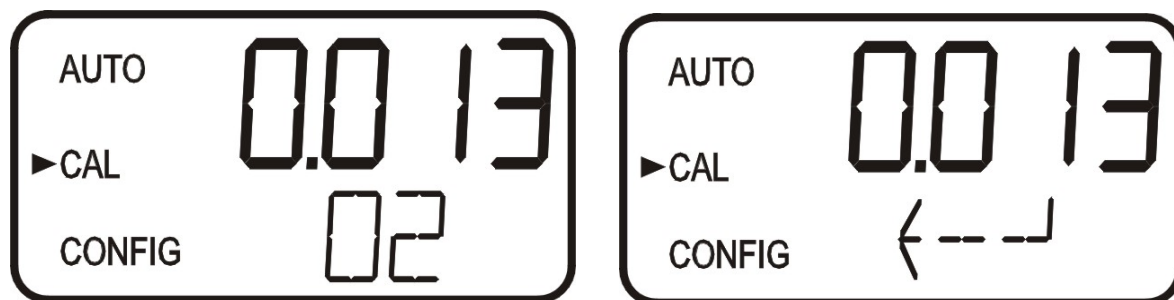
1. Select the calibration function of the instrument by pressing the **MODE/EXIT** button once. The arrow beside CAL will be illuminated on the display. The lower display shows alternating 1000 (the value of the standard that is requested, respectively 10 for Turb 2110) and \downarrow . The upper display shows the real-time reading to allow the standard to be indexed. Refer to section 5.1 for information on indexing cuvettes.



2. Remove the flow through unit.
3. Insert the requested 1000 NTU standard (10.0 NTU for Turb 2110). Index the standard to the lowest value on the upper display (see section 5.1 INDEXING CALIBRATION CUVETTES).
4. Press the **OK** button to accept the calibration.
5. The lower display will count down the progress of the calibration step.
6. The lower display will now change to show alternating 10 (1.0 NTU for Turb 2110) and \downarrow , requesting the 10.0 NTU standard (1.0 NTU for Turb 2110).



7. If the alternating 10 and \downarrow is not displayed, push the \uparrow or \downarrow until this display is shown.
8. Insert the requested 10.0 NTU standard (1.0 NTU for Turb 2110). Index the standard to the lowest value on the upper display.
9. Press the **OK** button to accept the calibration.
10. The lower display will count down the progress of the calibration step.
11. The lower display will now change to show alternating 02 and \downarrow , requesting the 0.02 NTU standard.



12. Insert the requested 0.02 NTU standard. Index the standard to the lowest value on the upper display.
13. Press the **OK** button to accept the calibration.
14. The lower display will count down the progress of the calibration step.
15. The instrument will return to AUTO mode at the end the calibration.

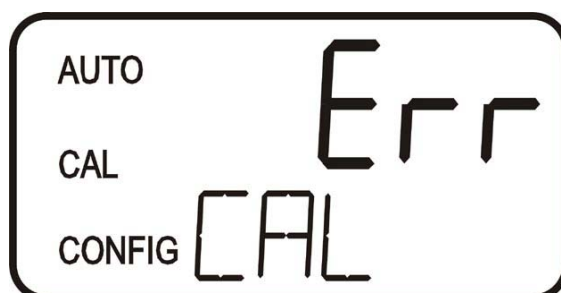


Note

During calibration, the fan inside the instrument is turned off to extend the life of the desiccant. The fan will be turned on during calibration countdowns and after returning to the AUTO mode or after five minutes, which ever comes first. It is recommended that the measurement chamber be kept covered during the calibration period and that the flow through cuvette be replaced immediately after the calibration to prevent premature saturation of the desiccant.

4.3 Calibration error

If the screen shown below, is displayed after calibration, the internal diagnostics have determined that the calibration standards were either bad or that they were inserted in the wrong order. Either check the standards and recalibrate or restore the factory calibration see section 5.2 RESTORING FACTORY SETTINGS. The instrument cannot be used without performing one of these operations.



To recalibrate press the MODE key and start the calibration sequence again. To restore the factory calibration, push and hold the **▲** button. Now push and release the **OK** button then release the **▲** button.

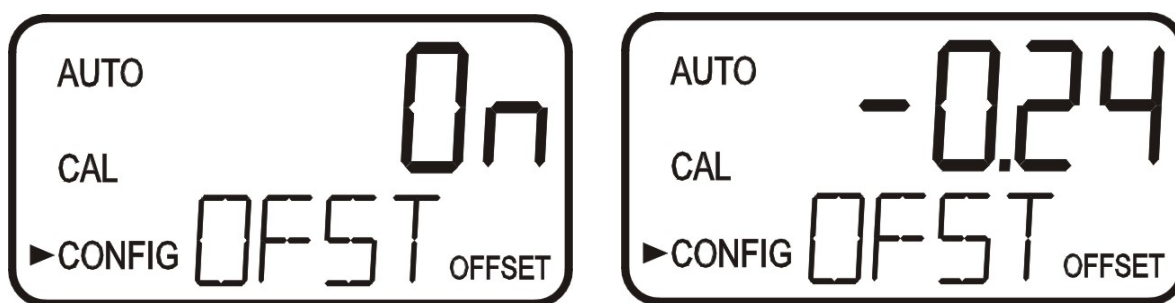
5 Instrument offset

In certain instances, it may be desirable to use an offset factor to calibrate the instrument rather than performing a physical calibration of the instrument (as described in section 4.2). This procedure is not recommended in lieu of regular instrument calibration but it can be used in situations where the number of instruments used makes regular calibration prohibitive.

This calibration technique will make the instrument accurate *only* at turbidity levels in the immediate vicinity of the grab sample and *not* in the full range of the instrument. Note that the OFFSET icon will be illuminated whenever an offset used. The maximum offset is ± 1.00 NTU. If instrument variation is greater than 1 NTU a full calibration is recommended.

The procedures are as follows:

1. Collect a grab sample of the process water that is being monitored by the instrument and record the turbidity reported by the instrument.
2. Take the grab sample and measure its turbidity using a laboratory turbidimeter (contact the WTW customer services department for examples of laboratory turbidimeters).
3. Compare the turbidity reported by the instrument to that obtained in the laboratory. If the readings are very close, then no offset adjustment or calibration is required and the procedure may be stopped at this step. However, if the readings are substantially different (but less than 1 NTU), continue on in this procedure to utilize the offset option to improve the turbidity reading of the instrument so that it will agree with the laboratory reading between calibrations.
4. Select the offset function of the instrument by pressing the **MODE/EXIT** button until the arrow beside CONFIG is illuminated on the display. Refer to the following screen.
5. Push the **OK** button until OFST is displayed on the lower row.
6. At this point, the lower row of the display will indicate the operational status of the offset function (On or OFF). Change this status by using the \blacktriangle and \blacktriangledown buttons. Once the desired operational status of the offset function has been set, press the **OK** button to accept it. If the option was turned off, return to AUTO mode by pressing **MODE/EXIT**.



7. If the option was turned On, the upper row will display the offset required. This will add or subtract the value of the offset to the measured NTU value. As an example if the Turb 2000 series measures the sample at 0.16 NTU but the laboratory instrument reads the sample at 0.12 NTU, adding an offset of -0.04 would result in the instrument displaying 0.12 NTU.

Select the desired offset level using the \blacktriangle and \blacktriangledown buttons. Once the desired level has been set, press the **OK** button to accept it.

8. This completes the offset configuration.
9. At this point, the instrument will remain in configuration mode (CONFIG). Press the **MODE/EXIT** key to return to operation mode, AUTO.

5.1 Indexing calibration cuvettes

To achieve the greatest accuracy, and account for normal scratches and aberrations in cuvette glass when calibrating, we recommend indexing the cuvettes.

Standards and standard kits purchased from WTW are supplied with indexing rings.

The following steps allow repeatable indexing of calibration standards:

1. With the instrument in AUTO mode insert the standard.
2. Slowly rotate the standard, inside the optical well, one complete revolution (360°). While rotating the standard slowly, observe the measured turbidity and locate the position of the cuvette having the lowest reading.
3. With the calibration standard positioned at the location having the lowest turbidity reading, install the indexing ring over the cap on the standard. While doing so, make sure the pointer of the indexing ring faces directly forward.

Indexing:

When using the standards in future, always insert the standard so that the pointer of the indexing ring faces forward. Slowly rotate the standard back and forth about 5° to find the lowest point. The standard is now indexed and ready for use.

5.2 Restoring factory settings

If the instrument is unable to perform a calibration due to a low lamp output or a calibration using the wrong standards, the instrument will display CAL on the lower row of the display and Err on the upper row. The operator has two choices to correct this problem. If the operator can determine whether a poor calibration or a low lamp caused the problem, he/she can remedy the problem and recalibrate. If the problem cannot be remedied, you can restore the factory settings. To do so, proceed as follows: Push and hold the **▲** button. Now push and release the **OK** button then release the **▲** button. Factory calibration and factory configuration have now been restored.



Note

Restoring the factory settings allows the use of the Turb 2000 series with reduced accuracy. The original problem still exists and must be determined and corrected before accurate operation of the instrument will be resumed.

6 Instrument configuration (CONFIG mode)

The instrument has been designed to provide the ability to customize the instrument according to needs at any time during normal operation. This mode has been split into submenus to facilitate instrument configuration. This section describes how to use each of the submenus to configure the instrument. While in the configuration mode, the instrument has a time-out feature that automatically returns the system operation to the AUTO mode after a fifteen (15) minute period.

Select the CONFIG mode of the instrument by pressing the **MODE/EXIT** button until the arrow beside CONFIG is illuminated on the display. Then press the **OK** button.

**Note**

To exit the CONFIG mode, press the MODE/EXIT button.

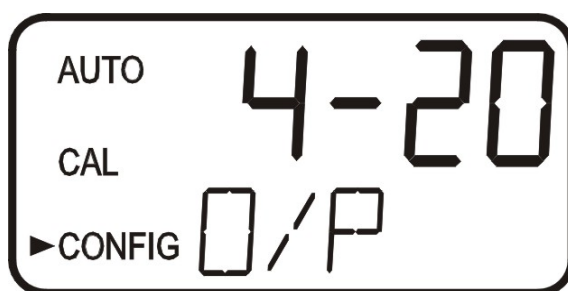
6.1 Selecting the output (O/P)

The first configuration selection is the O/P. The selections are 4-20 for the 4-20 mA output, 485 for the RS-485 and OFF if no outputs are required. Select the desired output by using the **▲** and **▼** buttons. Once the desired output has been set, press the **OK** button to accept it. The next prompts will depend on the output selected.

**Note**

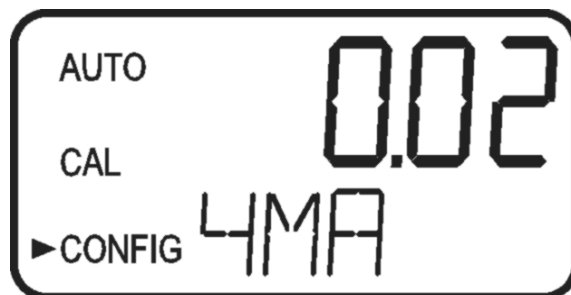
After one output has been selected the other output is rendered non-operable.

6.2 Setting the 4-20 mA output



To connect the output, see section 2.3.2. If the 4-20 mA output was turned on, prompts to set the 4 mA (4MA) and 20 mA (20MA) turbidity limits levels will be displayed. There is also a menu to adjust the error level (ERLV). The first prompt will be the turbidity limit assigned to the 4 mA output level:

Select the turbidity level to assign to the 4MA using the ▲ and ▼ buttons. The factory setting is 0.02 NTU.

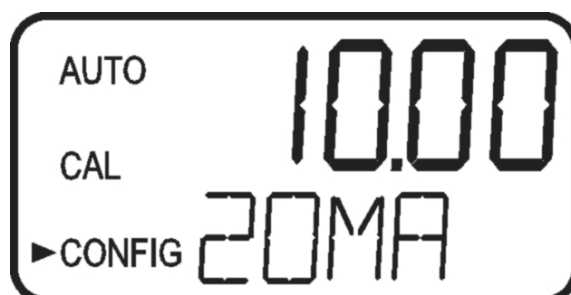


Once the desired level has been set, press the **OK** button to accept it.

**Note**

The 4MA can be set higher than the 20MA level to invert the output current if required. This may be required to control a dosing pump.

The next, prompt will be the turbidity level assigned to the 20 mA output level (20MA) on the lower row of the LCD display). Select the turbidity level to assign to the 20MA using the ▲ and ▼ buttons. Once the desired level has been set, press the **OK** button to accept it. The factory setting is 10.00 NTU.



6.3 Configuring the Error Level

In case of an error in the Turb 2000 series, the 4-20 mA reading can be used to indicate a problem by sending the current to either 4.00 mA, 2.00 mA or 0 mA or OFF. In the case of OFF, the 4-20 mA is unaffected by any error condition. Select the desired ERLV by using the ▲ and ▼ buttons then press the **OK** button to accept the desired error response.

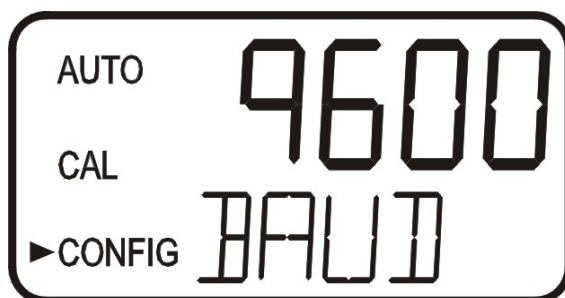
The factory default setting is OFF.



6.4 Configuring the RS 485 port

To connect the interface, see section 2.3.3. If the instrument is equipped with this option, and the I/O selection is changed to 485, prompts will appear for setting the baud rate and the address.

Select the correct baud rate (1200, 2400, 4800, 9600, or 19200) for operation of the I/O port by pressing the ▲ or ▼ buttons to change the displayed baud rate.



Press the **OK** button to continue on and select the desired instrument address using the ▲ or ▼ buttons. Once the selection is satisfactory, press the **OK** button.



To enable the Modbus mode, select ASCII or RTU. For more information refer to the Modbus manual in the appendix of this manual.

6.5 Configuring the alarms

To connect the relay, see section 2.3.4. Two relays are provided that are designed to operate as two independent programmable alarms. Three types of information must be input to fully program each alarm:

1. The alarm function (HI, LO, OFF or Error)
2. The alarm set point (level at which the alarm activates)
3. The delay time for the alarm (the time that the set point must be exceeded prior to alarm activation and the time before resetting the alarm)

These three items are described below:

Alarm function: The alarms can either be turned OFF or programmed to operate in one of two different manners:

- HI alarm: the relay changes state when the measured turbidity level is higher than the programmed alarm level for a prescribed amount of time.
- LO alarm: the relay changes state when the measured turbidity level is lower than the programmed alarm level for a prescribed amount of time.
- Error: the relay changes state when a system error occurs. If a system error occurs a message will appear on the lower row of the screen describing the problem.



Note

The relays automatically change state when an internal system failure is detected.

Alarm set point: The level at which an alarm activates is called the alarm set point. On the instrument, the alarm set point is designated as “S/P”. The set point is adjustable to any valid turbidity level over the range of the instrument in steps of 0.01 NTU.

Alarm delay time: The alarm delay times are used to prevent ringing of the alarm when the measured turbidity level is close to the set point. The function of the delay times is as follows:

Delay on:

The turbidity level must exceed the alarm set point continuously for at least this number of seconds before the alarm activates.

If the delay on time is set at 5 seconds and the process turbidity exceeds the set point continuously for only 4 seconds, the alarm will not be activated. However, process turbidity exceeds the set point continuously for 5 seconds or more, the instrument will activate the alarm.

Delay off:

The turbidity level must not exceed the alarm set point continuously for at least this number of seconds prior to deactivation of the alarm.

If the delay off time is set to 5 seconds and the process has exited out of the alarm condition, the alarm will be reset only if the process is out of the alarm condition for a continuous 5 seconds. Otherwise, the instrument will still signal an alarm condition.

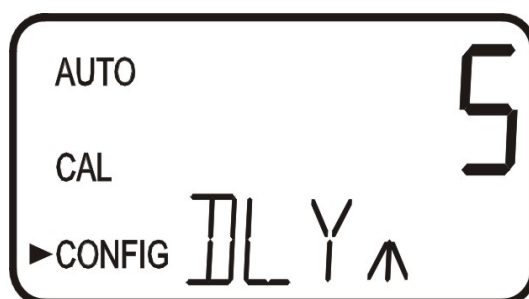
6.5.1 Alarm 1

Alarm 1 Function: The ALM1 is displayed and the display indicates the current function of alarm 1 (HI, LO, OFF or Error). Use the \blacktriangle or \blacktriangledown buttons to cycle through and select the desired function. Press the **OK** button to accept the selection.

If the alarm was turned OFF a prompt will appear to set up alarm 2 (go to section 6.5.2). If, on the other hand, one of the other functionalities was selected a prompt will appear to set the delay times.

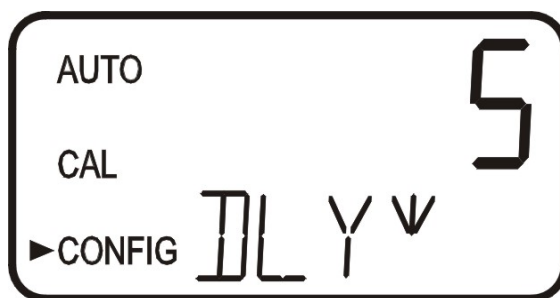
Alarm 1 set point: This prompt is used to select the set point for this alarm; this is indicated by "S/P" shown on the lower row of the display. Select the desired alarm level by using the \blacktriangle and \blacktriangledown buttons. Once the desired output has been set, press the **OK** button to accept it.

Alarm 1 delay times: *Delay on:* The following display will appear to allow to select the number of seconds currently set for the "delay on" time.



The current selected number of seconds will be shown. Select the desired number of seconds for the "delay on" time for this alarm using the \blacktriangle and \blacktriangledown buttons. Once the desired delay time has been set, press the **OK** button to accept it.

Delay off: Next, the following display will appear to select the number of seconds currently set for the "delay off" time.



The current selected number of seconds will be shown. Select the desired delay off time for this alarm using the \blacktriangle and \blacktriangledown buttons. Once the desired delay time has been set, press the **OK** button to accept it. After the settings for alarm 1 have been completed, prompts will allow for the set up of the information on Alarm 2.

6.5.2 Alarm 2

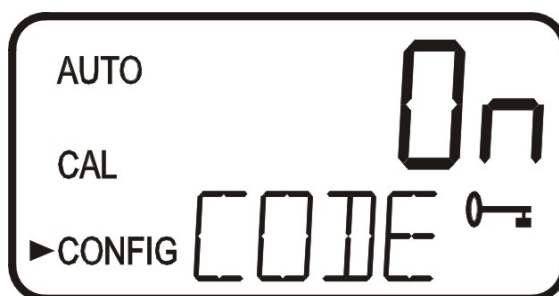
Repeat the procedure listed in section 6.5.1 to set up the parameters for alarm 2. If one of the other functionalities is selected, a prompt to set the delay times and the set point, as with Alarm 1, will be displayed.

6.6 Offset calibration

Refer to section 5 for more information on this selection.

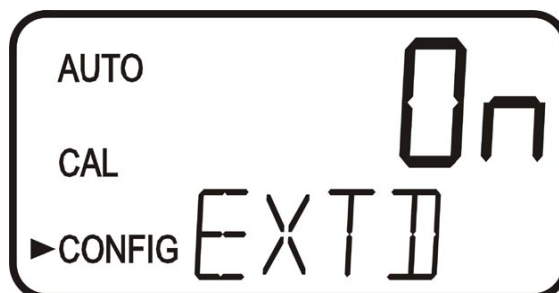
6.7 Enabling the security access

The instrument is equipped with a security access. If this option is turned on, the user is required to input the access code into the instrument to get to any mode other than AUTO. The only code is 333. This code may not be changed. See section 3.2 for more information on this security feature. The security key icon will be visible and flashing on the display whenever the access option is selected using the ▲ or ▼ buttons (on or off).



6.8 Extended settings

The last few settings are grouped together to prevent them from being adjusted by accident. To gain access to the extended settings, select On using the ▲ or ▼ buttons and press the **OK** button.



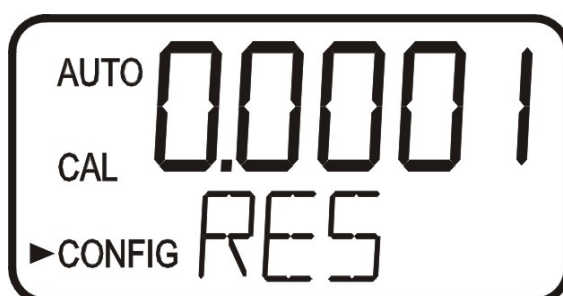
6.9 Speed of response

The speed of response for both displayed and output values of NTU can be adjusted in this menu. The default setting is 10, however 100 response speeds are available. Although the displayed number is a relative speed, the approximate response time, in seconds, is the displayed number multiplied by 5. Select the desired speed of response using the \blacktriangle and \blacktriangledown buttons. Press the **OK** button to accept it. To avoid reading air and other anomalies, select the slowest speed (highest number). Select the fastest response where monitoring of rapid changes is needed.



6.10 Displayed resolution

The instrument is equipped with the ability to display several levels of resolution. The instrument can display up to four digits to the right of the decimal place for turbidity readings below 10 NTU. The default setting is 0.01 NTU. If the last digit or two is not stable, adjust the resolution to hide these digits.



Change the resolution by pressing the \blacktriangle or \blacktriangledown button. Once the desired resolution has been set, press the **OK** button to accept it.

6.11 LCD Backlight brightness

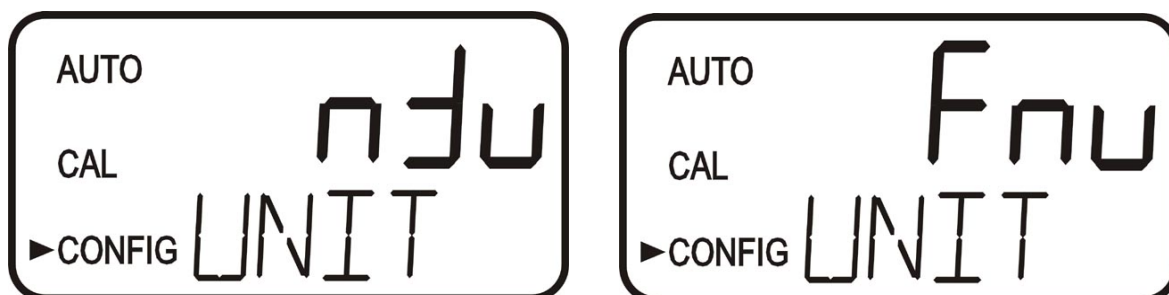
The LCD backlight brightness may need to be adjusted. This is of particular interest if multiple instruments are located in the same area and it is desired for the entire group to have the same appearance. Ten levels are available. The default brightness is 8.



Change the brightness by pressing the ▲ or ▼ button. Once the desired brightness has been set, press the **OK** button to accept it.

6.12 Setting the units

The most common unit is NTU (Nephelometric Turbidity Units) however the instrument can display in FNU (Formazin Nephelometric Units). All instruments are shipped from the factory set in NTU mode. Make a selection using the ▲ and ▼ buttons then press the **OK** button.



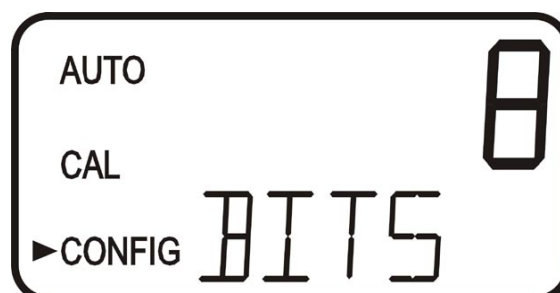
6.13 Ultrasonic cleaning (Turb 2020 and 2120)

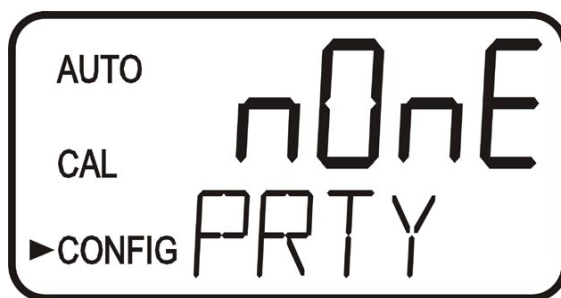
This allows for a selection menu to turn off the ultrasonic cleaning function if desired. The default mode is On. Make a selection using the ▲ and ▼ buttons then press the **OK** button.



6.14 RS-485 Parameters

The following menus can be used to modify the RS-485 parameters. These menus will only appear if the RS-485 is enabled (see 6.1). The default is 8 Bit, no (nOnE) Parity, 1 Stop Bit. Make selections using the ▲ and ▼ buttons then press the **OK** button to move to the next menu.





6.15 Desiccant alarm

When the humidity detector in the Turb 2000 series indicates that the internal environment is close to the point where humidity could cause condensation, the instrument will display DESC as a screen warning.

If desired, a desiccant warning can:

- Activate the alarms relays.
- Can activate an alarm condition on the 4-20mA.

To activate the alarm relays when the desiccant fails, select set one or both alarms to Error (see section 6.5 CONFIGURING THE ALARMS). To activate an alarm condition on the 4-20 mA set the ERLV to one of the three alarm states (see section 6.3 CONFIGURING THE ERROR LEVEL)

For either alarm modes to activate On must be selected in the DESC menu. The default for this menu is OFF. Make selections using the ▲ and ▼ buttons then press the **OK** button to move to 4-20 mA calibration.



6.16 4 mA Adjustment

If the 4-20 mA setting is turned ON (see section 6.2 SETTING THE 4-20 MA), the following two menus will appear. The first menu outputs a constant 4 mA while allowing for a small amount of adjustment. The adjustment can be made using the \blacktriangle and \blacktriangledown buttons. This adjustment will allow the operator to make the Turb 2000 series agree with a PLC or SCADA system. The adjustment limits are ± 200 counts or about ± 0.2 mA.

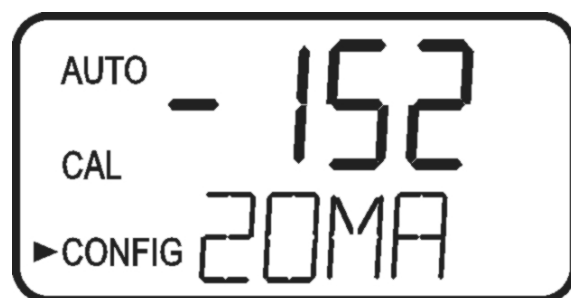
This setting will be slightly different on each instrument as each Turb 2000 series will be factory set to 4.00 mA. Press the **OK** button when adjustments are complete to save this setting and move on to the 20 mA adjustment.



6.17 20 mA Adjustment

This menu operates similar to the previous menu. This menu outputs a constant 20 mA while allowing for a small amount of adjustment. The adjustment can be made using the \blacktriangle and \blacktriangledown buttons. The adjustment limits are ± 1000 counts or about ± 1 mA.

This setting will be slightly different on each instrument as each Turb 2000 series will be factory set to 20.00 mA.



6.18 Saving configuration settings

If extended settings are set to OFF, pressing the **OK** button will save all settings and the instrument will automatically return to the normal AUTO mode of the instrument.

If extended settings are set to On, after the last menu of the extended settings, pressing the **OK** button will save all settings and the instrument will automatically return to the normal AUTO mode of the instrument.

The CONFIG menu may be used at any time to reset or change any of the parameters. The CONFIG menu may be exited at any point in the menu by using the **MODE/EXIT** key. Any features that have been modified will be saved.

7 Additional features and options

7.1 Ultrasonic cleaning (Turb 2020 and 2120)

This factory installed option is used to continuously keep clean the flow through cuvette. It is not intended to clean cuvettes that are already dirty, or replace manual cleaning entirely. The system will increase the time between cleanings dramatically. Please note that the system requires the use of a special cuvette. This cuvette must be used for the system to operate correctly.

The system works by sending an ultrasonic frequency through spring connections into a piezo transducer bonded to the bottom of a flow through cuvette (refer to figure 6).

The system can detect that an incorrect cuvette is installed, an error has occurred in the transducer or the transducer is not making contact with the spring connections. This error is indicated by CLN being posted to the lower screen. Since this is an error condition, this may affect the 4-20 mA and alarms depending in the setting of the ERLV (4-20 mA) and if an alarm is set up to Error.

If the correct cuvette is installed, and the error is still posted, try rotating the flow through unit slightly to improve the connection. If this fails to work, the cuvette may have to be replaced (see section 11 REPLACEMENT PARTS AND ACCESSORIES). The detection for this cuvette only operates in AUTO mode. If the system is operating correctly AUTO will flash on the display.



Note

The cuvette must be completely dry before it is inserted into the sensor. If there is any visible moisture present on the cuvette or transducer, there is a great risk of damaging the sensor electronics and the transducer. Be sure to clean and dry the cuvette completely just before inserting it into the sensor.

The vapor purge system can NOT remove large droplets of water, only residual moisture.



Note

For the vapor purge system to function properly, all instrument seals must be maintained and the desiccant pack must be in good condition (no DESC display).

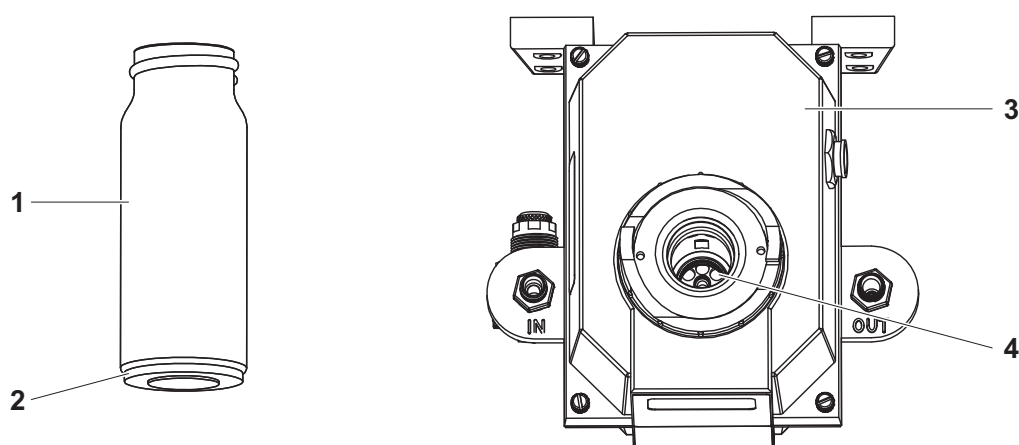


Figure 6: Operational parts of the ultrasonic cleaning system

1	Flow-through cuvette
2	Ultrasound transducer
3	Sensor (top view)
4	Ultrasonic spring connections

7.2 RS-485 outputs

The Turb 2000 series has the capability to operate in three different RS-485 modes for all models. A simple communication mode is included. Another operating mode is the Modbus communications. All modes will automatically configure and do not require any changes or selections.

7.2.1 Simple communication

The Turb 2000 series can provide basic communications over simple programs such as the Hilgraeve HyperTerminal that is included with most Microsoft Windows packages. The user could also use Visual Basic or other programs. The default communication parameters are 8 bits, no parity and 1 stop bit. These can be changed in the Extended CONFIG menus (section 6.14 RS-485 PARAMETERS).

The master computer will send out:

- Byte #1 the attention character ":" in ASCII or 3A Hex
- Byte #2 the address of the Turb 2000 instrument being queried
- Byte #3 & 4 CR LF or 0D 0A in hex

The Turb 2000 will respond with:

- The same attention character ":" in ASCII or 3A Hex
- The address of the Turb 2000 instrument
- The Reading
- The Unit (NTU)

A sample communication would look like this:

(Master computer requesting a report from address #1) : 1 CRLF

(Turb 2000 set to address #1 Response) :001 0.0249 NTU

7.2.2 Modbus communication

Modbus protocol communication is operational on all models. The Modbus information is covered in the appendix of this manual.

7.3 Flow alarm

The flow switch for the Turb 2000 series is a factory-installed option. This option indicates a "Low Flow" condition by switching both relays to the fail state and setting the 4-20 mA signal to 2 mA. There is also a screen indication of the low flow condition and a modbus register is set.

7.4 Flow controller

The flow controller limits the flow, in high-pressure systems, to safe flow limits of less than 1 liter/minute.

8 Error elimination

8.1 Trouble shooting

The Turb 2000 series performs continuous diagnostic monitoring. In the Turb 2000 series there are three levels of fault detection; warnings, errors and failures. Any faults are displayed in a queue form in the bottom row of the LCD. How these faults are indicated depends on the settings made in sections 6.3 CONFIGURING THE ERROR LEVEL and 6.5 CONFIGURING THE ALARMS. If ERLV is set to OFF and Alarms are not set to Error, there will be no remote indication of a problem.

If the desiccant alarm is turned off and the desiccant becomes saturated only a screen warning of DESC will appear and no alarms are activated. Another warning of ALM1 or ALM2 is displayed if an alarm is set and the threshold is exceeded.

An error indicates a failure or a problem that usually can be corrected by the operator. These errors are listed in section 8.3.

If any of these errors occur the instrument will still display readings, however the accuracy is not known and the instruments readings may not be reliable.

A failure is a system fault. This is NOT a problem that the operator can correct, and the unit must be returned to the factory for service. These failures consist of failures in the CPU, A/D, EEPROM or other devices internal to the instrument (FAIL). If a failure occurs, the instrument will not function properly and will display the word FAIL on the lower row.

If any fault conditions occur, the message indicating the fault will be shown on the lower row of the display.

8.2 System FAIL message

Normally, this condition indicates that the instrument will require servicing. Contact the WTW service department for this.

8.3 Error messages

Symptom	Cause	Remedy
Lower display shows CAL	Instrument cannot be calibrated	See sections 4.3 and 5.2
Lower display shows MA	4-20 mA loop open	Check wiring. See sections 2.3.2 and 6.2
Lower display shows CLN	No contact to ultrasonic cuvette	See section 7.1
Lower display shows DESC	Desiccant pouch bad	Change desiccant pouch. See section 9.2
Lower display shows LAMP	Lamp failed	The lamp has to be replaced. Refer to section 9.3
Lower display shows FLOW	Sample flow has stopped	Restore flow. Contact WTW about factory installed option
Lower display shows FAIL	System error	Refer to section 8.1 & 8.2
Readings are higher than expected	Bubbles in solution	Ensure that the drain vent is open and is not obstructed. See section 2.2.2 Apply backpressure. See section 2.2 and figure 4 For severe cases of bubbles a stilling chamber is available. Call WTW.
	Condensate or leaky cuvette	Check flow through cuvette for condensate or leaks.
	Flow through cuvette dirty	Clean the cell. See section 9.1
	Instrument out of calibration	Recalibrate. Refer to section 4
Readings are erratic	Bubbles in solution	See above
	Debris in flow through	Clean debris from cuvette
Readings are lower than expected	Instrument out of calibration	Recalibrate. Refer to section 4
Upper display flashes	Sample over-range	Check sample. Sample may be too high to read.

9 Routine maintenance

9.1 Cleaning the flow through cuvette

Measurement cuvettes used for both grab sample and the flow through should be clean and free of marks or scratches. Cleaning is accomplished by cleaning the interior and exterior with a detergent solution (5 % acetic acid in the case of lime residues, washing-up liquid in the case of greasy residues), and then rinsing several times with distilled or deionized water. The cuvette can be replaced by first shutting off the flow using the provided shutoff clamp on the turbidimeter; unscrewing the old cuvette and replacing with a fresh clean one.

9.2 Replacing or installing the desiccant pouch

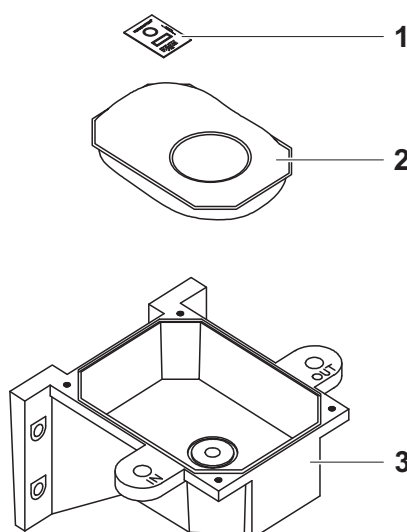


Figure 7: Desiccant pouch

1	Humidity indicator (Humonitor® card)
2	Replaceable desiccant pouch
3	Sensor bottom

For commissioning remove the transport protection (square-shaped plastic well with yellow flag) from the sensor bottom.

The Turb 2000 continuously checks the condition of the desiccant. Replace the desiccant if the instrument displays DESC in the lower display part (see section 6.14 DESCANT ALARM).

Proper use of the supplied desiccant is essential in maintaining the performance of the instrument. The desiccant has been designed to have a long life; however, replacement of the desiccant pouch will be required from time to time.

It is essential that all enclosure seals be maintained to ensure adequate desiccant life. Inspect these items each time the desiccant pouch is replaced. Replace any parts found to be defective.

The desiccant should be replaced when the instrument displays DESC. A new sealed desiccant pouch and indicator card are available from WTW. To initially install or remove the old desiccant, simply unscrew the four corner thumbscrews and remove the electronics half of the instrument.

Open the bag protecting the new desiccant pouch and replace it (or install for a new instrument) in the desiccant tray assembly. Each desiccant pouch is shipped with a HUMONITOR[®] humidity indicator. Make sure that the area inside the ring is blue and at least as dark as the rectangular reference field when opening the bag. If this is not the case, the desiccant pouch is not effective (e. g. because of an untight bag).



Figure 8: Humidity indicator

To speed up the recognition, by the instrument, of the new desiccant it will be necessary to reset the instrument. To do so, disconnect the sensor interconnect cable for 2 seconds and then reconnect it (see fig. 4).



Note

Once the bag is opened, install the desiccant pouch immediately to prevent premature degradation of the desiccant.

9.3 Replacing the source lamp

The source lamps in the Turb 2000 series are designed for very long life. If the lamp should need replacement, we recommend calling WTW service department for assistance.

10 Technical data

Measuring range	0 ... 1000,0 NTU (Turb 2000, Turb 2020, Turb 2100 and Turb 2120) 0 ... 10 NTU (Turb 2110)
Accuracy	±2 % of reading or ±0.02 NTU below 40 NTU whichever is greater ±5 % of reading above 40 NTU
Lamp working life	62.000 h
Resolution	0.0001 NTU (below 10 NTU)
Response time	Adjustable
Display	Multi-line liquid crystal backlit display
Alarms	Two programmable, 120-240 V AC, 2A form C relays
Analog output	Powered 4-20 mA, 600 Ω drive
Communications port	Bi-directional RS-485, Modbus
Minimum water pressure	6.9 kPa (0.069 bar or 1 psi)
Maximum water pressure	Integral pressure regulator rated , 1380 kPa (13.8 bar or 200 psi)
Flow rate	0.1 ... 1.0 Liter/min
Operating temperature	1 °C ... 50 °C
Wetted materials	Nylon, borosilicate glass, silicon, polypropylene, stainless steel
Sample temperature range	1 °C ... 50 °C
Power supply	100 – 240 V AC, 47 – 63 Hz, 80VA
Insulation rating	Double insulated, pollution degree 2, overvoltage category II
Ambient conditions	Not recommended for outdoor use. Altitude up to 2000 meters Up to 95 % RH (non-condensing)
Enclosure	Designed for IP 66 /NEMA 4X
Regulatory compliance and certifications	White light version compliant to U.S. EPA 180.1 Infrared version compliant to ISO 7027 CE approved, ETL listed to UL 61010B-1 ETL certified to CSA 22.2 No. 1010-1-92
Weight	2.5 kg

11 Replacement parts and accessories

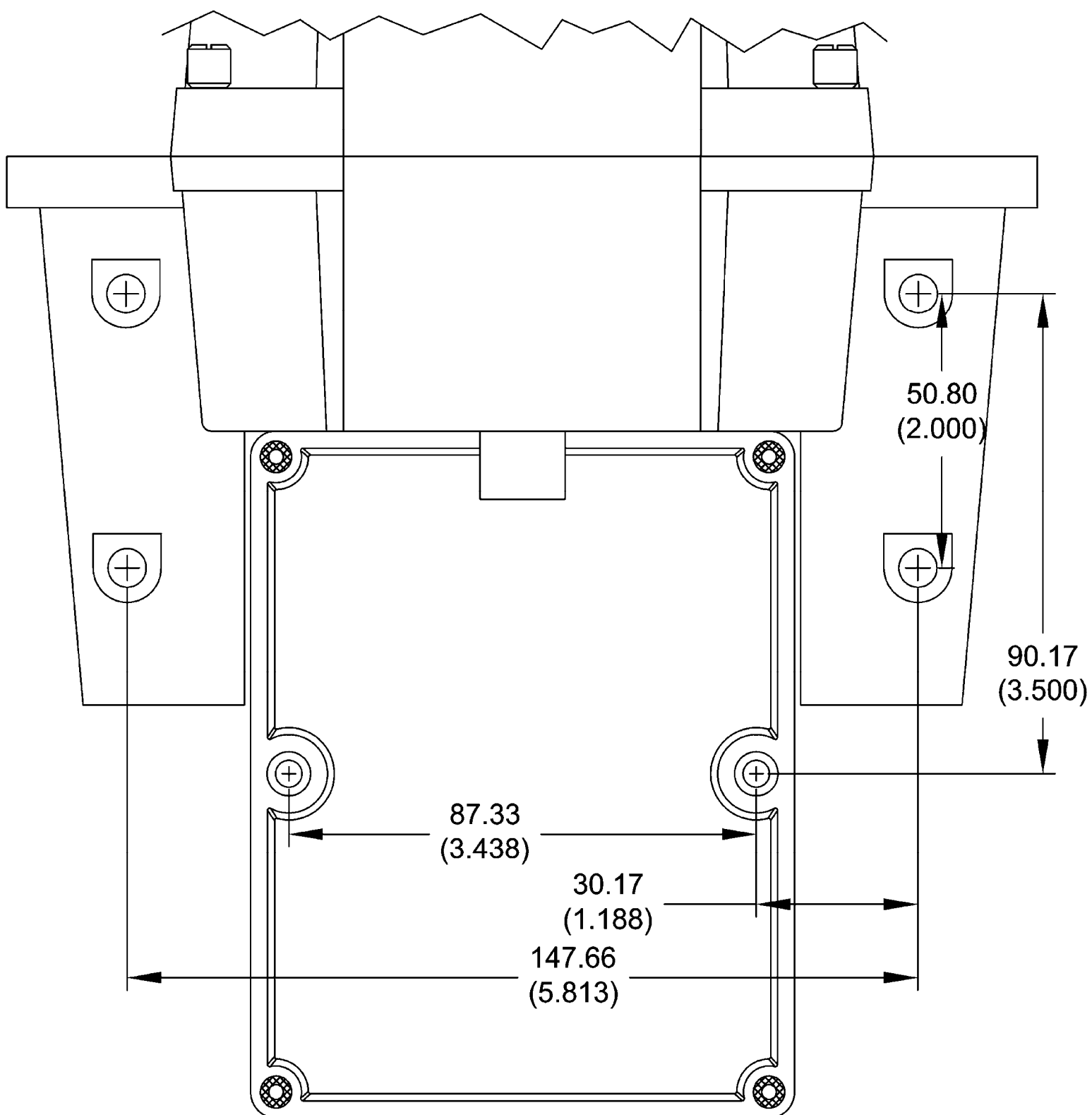
Here you find the recommended accessories and spare parts that can be ordered from WTW.

If for any reason technical assistance is needed regarding this instrument please do not hesitate to contact the WTW technical services department.

Accessory	Model	WTW order no.
Calibration kit for Turb 2000, Turb 2020, Turb 2100 and Turb 2120: primary standards 0.02 -10.0 -1000 NTU, cleaning tissues and indexing rings	Kal Kit Turb/DW	600 052
Calibration kit for Turb 2110: primary standards 0.02 -1.0 -10.0 NTU, cleaning tissues and indexing rings	ProCal-Kit	600 056
RS-485 communication cable	AK485-Turb/DW	600 042
Ultrasound flow through cuvette for Turb 2020 and 2120	FTC US-Turb/DW	600 047
Flow through cuvettes (3 pieces) for Turb 2000 and 2100	FTC 3-Turb/DW	600 046
Desiccant pack	DP-Turb/DW	600 048
Flow through assembly, Nylon (rotational quick release flow head), without cuvette/tubes	DF-Turb/DW	600 050
Tubing kit (tubes, fittings, clamp, backpressure valve, drain vent)	Tub Kit-Turb/DW	600 049
Connection set. Scope of delivery: 3 m PU-hose, 2 quick disconnect couplers for PU-hose with 1/4" NPT female screw thread	A-Set-DW	600 060
Stilling / bubble chamber	BC-Turb/DW	600 041
Power supply unit, 24 V DC	PS 24V-Turb/DW	600 044
Wide range power supply unit, 100 ... 240 V AC, 47/63 Hz	PS-Turb/DW	600 045

12 Mounting template

All dimensions are in mm (inches).



What can Xylem do for you?

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to xyleminc.com.



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