INSTRUCTION MANUAL

HI7660-28

Low Range Turbidity Probe



HI510 & HI520 Process Controller Compatible

Hanna Instruments is committed to developing and deploying digital solutions with a positive impact on the environment and climate.

Please scan the QR code or follow the link to download the controller user manual.

https://manuals.hannainst.com/HI510

https://manuals.hannainst.com/HI520

Dear Customer,

Thank you for choosing a Hanna Instruments® product.

Please read this instruction manual carefully before using this instrument as it provides the necessary information for correct use of this instrument, and a precise idea of its versatility.

This release of the product manual contains information that applies to configuration, specification, installation, and calibration of Hanna Instruments low range turbidity probe.

The HI510 and HI520 controllers are sold separately. Please refer to each controller manual for details on system configurations.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.
Visit www.hannainst.com for more information about Hanna Instruments and our products.

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1. PRELIMINARY EXAMINATION

Remove the probe and accessories from the packing and examine it carefully.

Each HI7660-28 probe is supplied with:

- Quick reference guide
- Probe quality certificate

***Note**: Save all packing material until you are sure that the probe works correctly.*
Any damaged or defective item must be returned in its original packing material with the supplied accessories.

2. SAFETY MEASURES

General Safety & Installation Recommendations

- Electrical connection, installation, operation, and maintenance must be carried out by specialized personnel only.
  The specialized personnel must read, understand, and adhere to the instructions in this manual.
- Before connecting the probe to the process controller, disconnect the controller from the power line.
- User serviceable connections are all accessible inside controller's enclosure.
- Before powering the controller, verify the probe wiring has been done following the instructions detailed in this manual. See section 8. Wiring the Probe to the HI5X0 Controller.

3. GENERAL DESCRIPTION & INTENDED USE

The HI7660-28 are nephelometric turbidity probes designed for use with Hanna Instruments® HI510 or HI520 Universal Process Controller. The system is designed to measure low turbidity values according to the nephelometric method (ISO 7027 – EN 27027).

An integral temperature sensor measures water temperature and adjusts the probe signal for temperature-related changes over the range of 0 to 50 °C (32 to 122 °F).

The controller displays both measurements simultaneously.

Turbidity is a key indicator of water quality and effectiveness of water filtration.
The system is suitable for applications in drinking water, municipal and industrial water treatment, desalination and water quality monitoring.

The majority of low-measurement applications using the HI7660-28 probe require installation in a pressurized flow cell. The HI7676602 flow cell is designed to eliminate ambient light effects and maintain sample pressure inside the flow cell. This minimizes sample out-gassing, a common problem in many turbidity systems that can cause measurement errors.

4. PRINCIPLE OF OPERATION

Turbidity is a term that defines the opaqueness or cloudiness of water.

The HI7660-28 are optical probes that follow ISO 7027 – EN 27027 standards.

The unit of measure is FNU.

A light beam from an infrared source is sent through an optical window of the probe into the sample.

The light is scattered by suspended particles in the sample. The 90° scattered light is reflected through a second window where it is converted to an electrical signal proportional to the turbidity of the standard or sample.

5. MAIN FEATURES

- Digital probe stores model, firmware version, and serial number
- Built-in temperature sensor for measurement and compensation
- Stored calibration data includes: calibration date and time, turbidity calibration standard, offset, and slope
- ISO 7027 sensors use a near infrared light-emitting diode (LED) to eliminate color interference
- Factory calibrated turbidity probe
- Adheres to ISO 7027 – EN 27027 standards

SERIES CONFIGURATION

HI7660 –	2	8	z	z

2	Turbidity sensor
8	**Smart probe** with RS485 connection
zz	**02**, **05**, **10** fixed cable length (dimension expressed in meters)

6. SPECIFICATIONS

6.1. MEASURE SPECIFICATIONS

Turbidity	Range	0.000 to 4.000 FNU 0.00 to 40.00 FNU 0.0 to 400.0 FNU
	Resolution	0.001 FNU 0.01 FNU 0.1 FNU
	Accuracy	0.000 to 4.000 FNU 0.05 ± 2% reading 0.00 to 40.00 FNU 0.3 ± 2% reading 0.0 to 400.0 FNU 2.0 ± 2% reading
	Calibration*	Factory calibration (default) Single solution (determine slope) Two points (determine slope and offset)
	Calibration timeout	Off (default) 1 to 99 days
Averaging samples		1 to 60 samples (default,1 sample)
Automatic Temperature Compensation		0.0 to 50.0 °C (32 to 122 °F)
Temperature source		Automatic (from probe)
Operating temperature		−5 to 50 °C (23 to 122 °F)
Temperature accuracy**		± 0.6 °C (1 °F)
Repeatability		2%
Protocols		MODBUS RTU

* The probe is shipped factory calibrated (zero and slope).

** The probe temperature sensor monitors the LED temperature and compensates for LED's thermal behavior. The sensor does not give a direct measurement of water temperature.

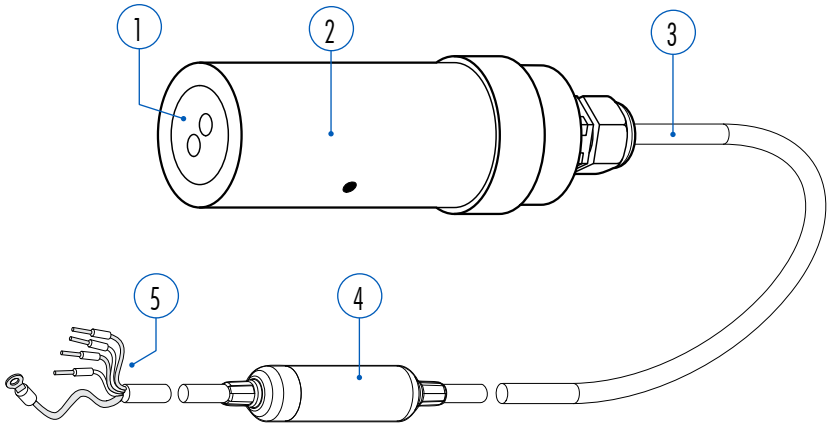
6.2. SENSOR SPECIFICATIONS

Sensor	Light source	Infrared LED
	Light detector	Photodiode for turbidity measuring

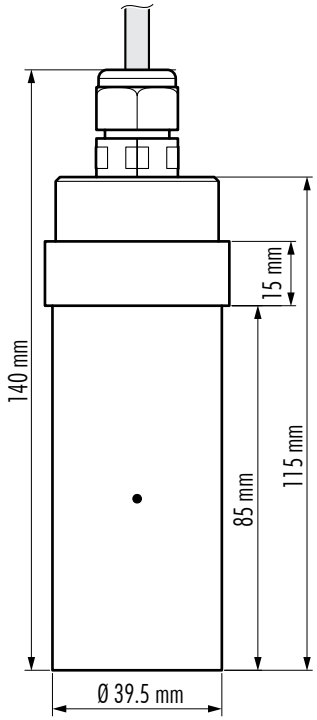
6.3. GENERAL SPECIFICATIONS

Body	Type	PVC
	Length	115 mm (without cable gland)
	Diameter	39.5 mm
	Probe weight	190 g
	Cable weight	10 m › 480 g
		5 m › 240 g
	Total weight	probe with 10 m cable › 670 g
		probe with 5 m cable › 430 g
Operating pressure	0 to 6 bar @ 25 °C (77 °F) 0 to 3 bar @ 50 °C (122 °F)	
Protection rating	IP68	
Cable length	zz, see Series Configuration	

7. PROBE DIMENSIONS & CABLE CONNECTION



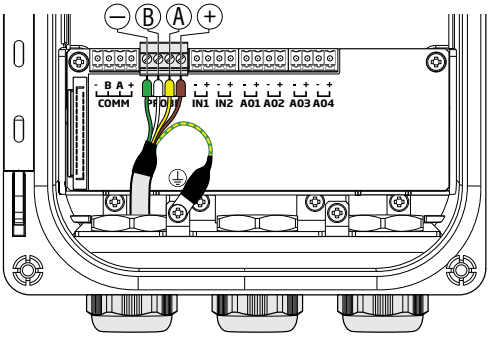
1. Optical window
2. Probe body
3. Connection cable
4. DC to DC power booster
5. Probe connectors



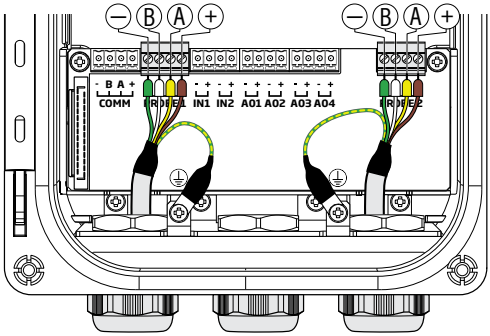
***Note**: Probe connection and probe wiring **must be** carried out with the controller **disconnected** from power.*

8. WIRING THE PROBE TO THE HI5X0 CONTROLLER

1. With the controller disconnected from power, run the probe cable through the conduit opening.
2. Connect the probe leads to the removable terminal connector marked PROBE.
   Follow the lead markings (positive/negative) to ensure correct wiring position.
3. Carefully put the wired terminal connector into place on the board.
4. Position excess cable through cable gland before tightening the nut.
5. Remove the ground screw and hardware located below the PROBE connector and attach ground lead (⏚).



HI510 turbidity probe wiring



HI520 turbidity probe wiring
with second probe connected to PROBE 2

***Note**: Ensure wiring regulations are correctly followed when controller unit is part of a larger industrial installation.*

Probe cabling color code

Marking	Attached cable
–	GREEN
B	WHITE
A	YELLOW
+	BROWN
⏚	GREEN/YELLOW PROTECTIVE GROUND CONNECTION

9. PROBE RECOGNITION AND RESTORING COMMUNICATIONS

- Power the HI5X0 controller.
- Enable the channel for the wired probe.
- Probe should be recognized by the controller.
- If the probe is not recognized follow procedure outlined below.

1. Scroll to **Technical Menu** and press **Setup**.



2. Scroll to **Restore HI7660-28XX** and press **Select**.



3. If using a HI520, choose the sensor channel that contains the HI7660-28 probe.



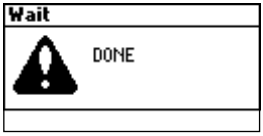




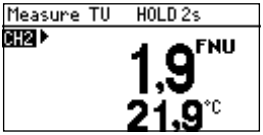








4. The controller will recognize the probe and begin displaying a turbidity reading.



10. CALIBRATION

The HI5X0 controller allows several methods of turbidity calibration.

- Use the factory calibration
- Single-point calibration to a grab sample measured on a reference turbidimeter
- One- or two-point calibration using formazin standards or deionized water

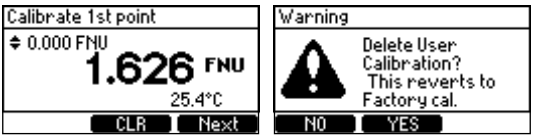
10.1. CALIBRATION RECOMMENDATIONS

- Follow local, state, or other regulatory authority regulations regarding turbidity calibration requirements.
- If permitted by regulations, calibrations can be periodically verified using HI7676604 dry turbidity standard.
- Use a soft cloth to clean the optical window prior to attempting a new calibration.
- During a solution calibration, air bubbles must be absent on the optical surfaces of the probe.
- HI7676603 calibration beaker accessory is suggested if doing a calibration in formazin.

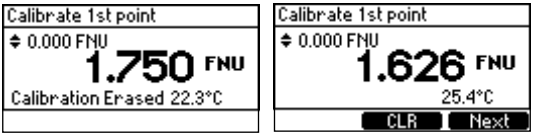
10.2. CALIBRATION SCREENS & FUNCTIONS

The calibration functions can be reached under the settings menu for the HI7660-28 probe.

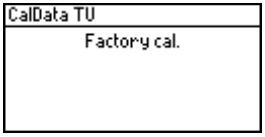
- Press [≡] (direct menu) key from the live reading display to access the top-level menu items.
- On the HI520, press [▲][▼] keys to highlight the channel (Channel 1 or Channel 2) to which the HI7660-28 probe is connected.
- Press **CAL**.
- "**Calibrate 1st point**" will be displayed in top bar.
  CLR and **Next** will be displayed on bottom bar.
  Select **CLR**. A warning message is displayed.



- Select **Yes**.
  "**Calibration Erased**" will be displayed briefly and the display will return to Calibrate 1st point.



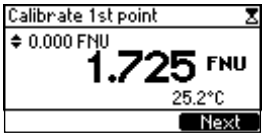
- Use the [↩] key to return to measurement.
  CalData screen will display "**Factory cal.**" message.



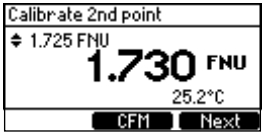
10.3. ILLUSTRATING USING FACTORY CALIBRATION FOR FIRST CALIBRATION POINT & SOLUTION FOR SECOND CALIBRATION POINT

Before starting calibration, restore factory calibration and set the probe measurement range to 0.000 to 4.000 FNU. See section 10.2. Calibration Screens & Functions.

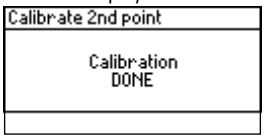
1. Clean and dry the probe.
   Ensure there is no dust, debris, or contaminants on the exterior of the probe.
2. Add the second calibration standard.
   Rinse with standard then discard.
3. Slowly add the second calibration standard. Avoid generating bubbles while pouring.
4. If using the calibration beaker, insert the probe into the beaker.
   Insert the probe slowly, at a 45-degree angle.
5. "**Calibrate 1st point**" will be displayed in top bar. **CLR** and **Next** will be displayed on bottom bar.
   Note: **CLR** *is only displayed for a few seconds.*
   Select **Next**.



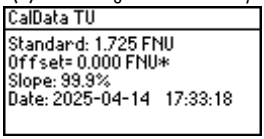
   The factory calibration for the first point will be used.
6. Proceed with second point calibration.



   Use the [▲] [▼] keys to adjust the value to agree with the standard value.
   Press **Next** when at "**Calibrate 2nd point**" and wish to return to the first point.
   Note*: The selected standard value must be within ± 30% of the live measurement for the calibration to be accepted.* ***CFM*** *button won't be displayed if the measurement is outside the range.*
7. Press **CFM** and confirmation screen will be displayed.



8. CalData screen will display the single point calibration.
   The Offset will display an asterisk (*) indicating that the factory calibration point was used.



Note*: CalData will be displayed with the resolution of the selected measurement range.*

10.4. TWO POINT CALIBRATION USING FORMAZIN PRIMARY STANDARD

Either a single- or two-point calibration may be made using formazin.
Formazin is considered a stable standard with universal particle size for consistent light scattering.
Calibration using either the HI7676603 calibration beaker or the HI7676602 flow cell is recommended.

1. Prepare the water (for offset) and standard prior to calibration.
   Standard should be prepared in the working range of use.

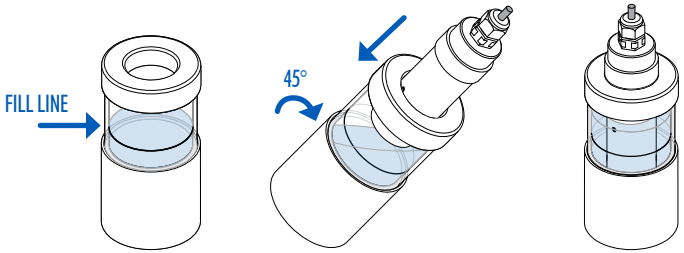
- Zero standard (first calibration point)
  - Deionized water should be used for the calibration of the zero (offset) value.
  - Filter the deionized water (0.45 μm) twice to achieve the best results.
- Standard (second calibration point)
  - Calibrate the slope near the midpoint of the selected range.
    E.g.: calibrate at 2.000 FNU for the 0.000 to 4.000 FNU range.
  - Alternatively, if a narrow range of measurements are expected, use a standard within this narrow region. However, accuracy outside of this region could become worse.

2. Prepare calibration beaker or flow cell for calibration.
3. Rinse and dry the probe.

CALIBRATE USING HI7676603 CALIBRATION BEAKER

***Note**: Never use a stir bar inside of the calibration beaker.*
Using a stir bar will greatly increase the noise of the measurement and reduce calibration accuracy.

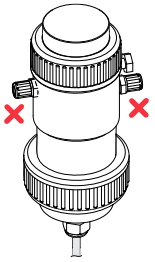
1. Start with a clean, dry calibration beaker free from dust and debris.
2. Rinse the calibration beaker at least two times with the desired calibration standard.
3. Discard rinses.
4. Fill the calibration beaker with calibration standard to the indicated fill line.
5. Slowly insert the probe into the calibration beaker while holding the beaker at a 45-degree angle.
   This will minimize bubble adhesion to the measurement surface of the probe.



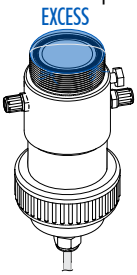
6. Allow 1 or 2 minutes for the measurement to stabilize prior to confirming calibration.
7. For turbidity values greater than 40 FNU, calibration must be confirmed within 5 minutes of pouring the formazin to avoid error from formazin settling.
   If needed, gently swirl the beaker contents to re-suspend the formazin.

CALIBRATE USING THE HI7676602 FLOW CELL

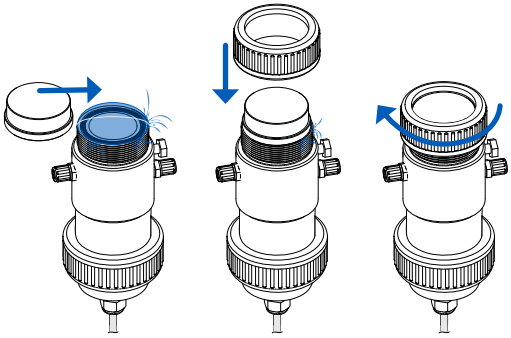
1. Shut off water flow through flow cell.
   Divert water to allow the flow cell to be removed from installation.



2. Close off the inlet, outlet, and the flow valve to prevent flow out of the flow cell.
3. Position the flow cell vertically.
   If needed, use a laboratory stand or the wall mount to hold the flow cell.
4. Rinse the flow cell at least two times with calibration standard.
5. Discard rinses prior to filling for calibration.
6. Flow cell must be filled to excess.
   There must not be room for an air pocket once the cap is replaced, to ensure accurate calibration.



7. Replace the flat cap, first by sliding it horizontally across the excess liquid.
   If done correctly, no air will be trapped.
   ***Note**: Some liquid will spill.*
   Lock the flat cap in place with the threaded cap prior to accepting the calibration point.



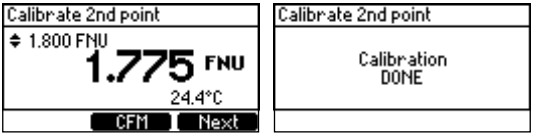
Procedure

1. Add the first calibration standard. Avoid generating bubbles while pouring.
2. Follow all recommendations for the chosen calibration vessel detailed previously.
3. Press [≡] (direct menu) key from the live reading display to access the top-level menu items.
4. On the HI520, press [▲][▼] keys to highlight the channel (Channel 1 or Channel 2) to which the HI7660-28 probe in connected.
5. "**Calibrate 1st point**" will be displayed in top bar.
   CLR and **Next** will be displayed on bottom bar.
   Note: **CLR** *is only displayed for a few seconds.*
6. 0.000 FNU will be displayed in upper left corner but can be changed if warranted.
   Use [▲][▼] keys to adjust the value of the calibration standard displayed to the value of the standard being used.

   Note: *The entered calibration standard value must be within ± 0.200 FNU of measured value.*
7. Confirm the calibration.

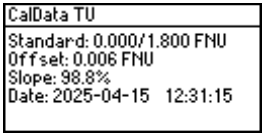


8. Rinse the calibration vessel with second standard then discard.
9. Slowly add the second calibration standard.
   Avoid generating bubbles while pouring.
   Follow all recommendations for the chosen calibration vessel above.
10. Wait for measurement stabilization.
11. Adjust the value of the calibration standard displayed to the value of the standard being used.
12. Confirm (select **CFM**) the calibration.



Note: *The selected standard value must be within ± 30% of the live measurement for the calibration to be accepted.* ***CFM*** *button won't be displayed if the measurement is outside the range.*

13. CalData will display the two point calibration details.



11. DRY TURBIDITY VALIDATION

Calibration of turbidity sensors is normally performed with the use of formazin as a primary turbidity standard according to ISO 7027. Formazin can be difficult to use due to preparation, storage, costs, and its short lifetime. Hanna Instruments® HI7676604 Dry Turbidity Standard can be used to execute performance evaluations on the HI7660-28 probe.

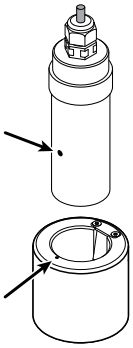
HI7676604 Dry Turbidity Standard can be used to quickly validate probe measurement and/or calibration by ensuring that there is no drift in measured values after a period of use.

It is not intended to be used as a primary standard for calibration.

The dry standard should have an approximate value of 10.00 FNU according to Hanna Instruments recommendations. This value will vary across HI7660-28 probes.

The value measured by a user's HI7660-28 turbidity probe must be recorded to be used as a reference point for probe drift.
The HI7676604 contains a diffusive material that can simulate turbidity of a liquid due to the light diffusion.

PROCEDURE



- Set the probe range to 0.00 to 40.00 FNU.
- While aligning the index marks, insert a clean dry probe into the dry calibration standard.
- Return to measure mode and view reading on display.
- Date and record the turbidity and temperature values on the certification card.
- Refer to the certification card for recommended turbidity value limits.
  If limits are exceeded, recalibration is recommended.

MAINTENANCE



- Store in its case; in a cool, dry place.
- Keep away from direct sunlight and sources of dust.
- Ensure that the inside of the dry standard is free of debris.

DESIGN ELEMENTS

- Cylinder for probe insertion
- The dry optical element (housed at the bottom of the cylinder) produces a controlled light diffusion that simulates the turbidity of a liquid at value ≈ 10 FNU

12. INSTALLATION

The probe is typically installed in a flow cell using the locking nut provided.

12.1. GENERAL CONSIDERATIONS

- Do not unscrew or remove the cable gland fitting.
  Warranty can be voided if sensors are tampered with!
- Consider probe accessibility for maintenance when selecting placement.

12.2. INSTALLATION EXAMPLE WITH MOUNTING ACCESSORIES

Accessories are sold separately. See section 14. Accessories.

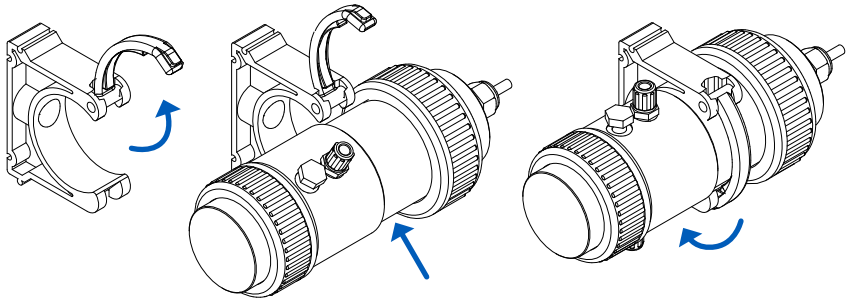
HI7676602 FLOW-CELL INSTALLATION

The cell is supplied complete with:

- locking collar
- probe adapter (with o-ring)
- wall mounting bracket
- inlet/outlet tube

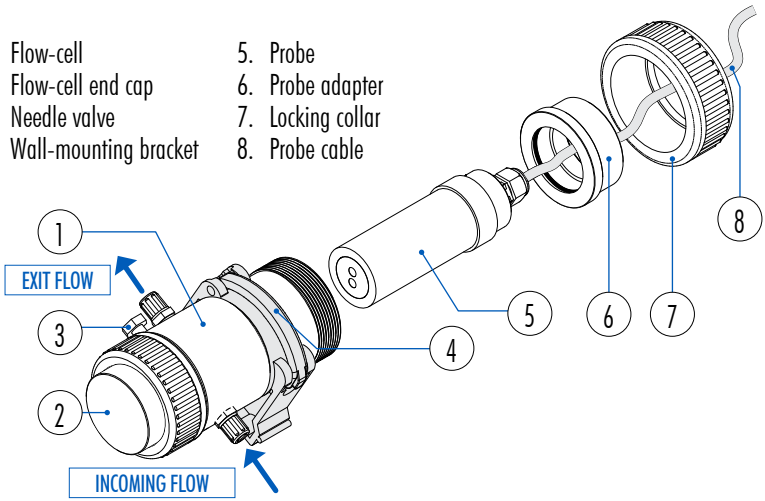
GUIDELINES

- Use supplied wall-mounting bracket to fix the cell horizontally, ensuring an upward flow direction.
- The system should be set up such that allows the cell to fill up fully.

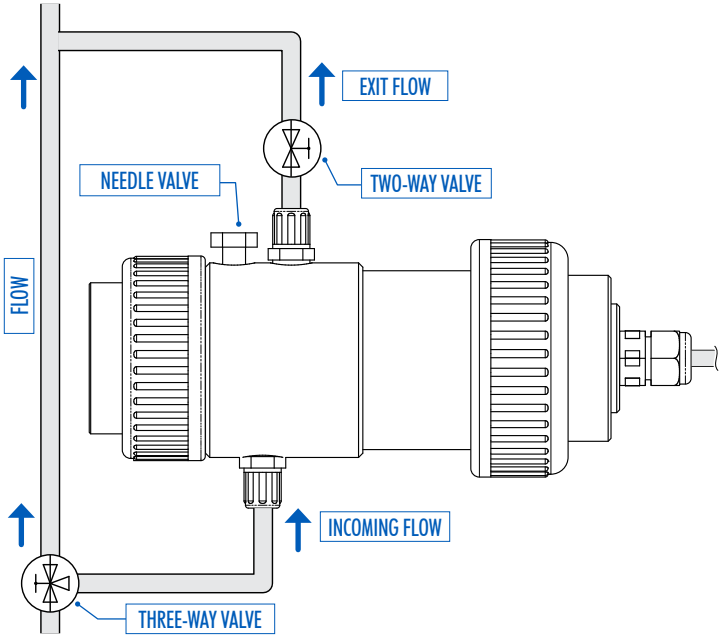


- The cell is equipped with a needle valve to regulate the flow in the cell and to keep the liquid under pressure. Pay attention not to fully unscrew the valve when regulating the flow!
- With high pressure liquid sampling, use the needle valve to purge the system and to maintain a constant flow rate.

1. Flow-cell
2. Flow-cell end cap
3. Needle valve
4. Wall-mounting bracket
5. Probe
6. Probe adapter
7. Locking collar
8. Probe cable



INSTALLATION RECOMMENDATION



13. MAINTENANCE

13.1. PROBE CLEANING

- Inspect, clean, and validate the probe at regular intervals.
- Rinse the probe with clean water.
  Blot the probe with a soft cloth or tissue.
  Handle the probe and the optical window carefully to avoid damage.
- Wipe probe's exterior with an aqueous soapy mixture.
  Rub persistent spots off.
  Rinse with clean water.

13.2. CLEANING OF THE OPTICAL WINDOWS

- Inspect and clean the two optical windows at the bottom of the probe periodically.
- Cleaning is recommended before calibration.
- Remove any deposits on the optical windows using a soft, damp cloth, taking care not to press on the surface to avoid scratching.
- If necessary, use a mild detergent or a very diluted acid to remove limestone-type deposits.
- The frequency of cleaning depends on the type of use, as well as the nature and concentration of the measuring sample.

***Note**: Do not unscrew or loosen the probe cable gland on the probe body during cleaning as it will void probe warranty.*

13.3. LONG TERM STORAGE

- Avoid prolonged exposure to direct sunlight.
- Store the product in a dry location.
- Use the carton box for packing and transport.

14. ACCESSORIES

Ordering Information	Product Description
Turbidity Standard	
HI7676604	Low range turbidity probe dry standard
Other Accessories	
HI7676602	Flow cell for **HI7660-28** probe
HI7676603	Low range turbidity probe calibration beaker

For additional accessories information contact your local sales office.

15. ABBREVIATIONS

FNU Formazin Nephelometric Units
LED Light Emitting Diode
PVC Polyvinyl Chloride
TU Turbidity
UL Underwriters Laboratories

CERTIFICATION

All Hanna® instruments conform to the **CE European Directives.**

CE RoHS compliant

Disposal of Electrical & Electronic Equipment.

The product should not be treated as household waste. Instead, hand it over to the appropriate collection point for the recycling of electrical and electronic equipment, which will conserve natural resources.

Ensuring proper product disposal prevents potential negative consequences for the environment and human health.

For more information, contact your city, your local household waste disposal service, or the place of purchase.

RECOMMENDATIONS FOR USERS

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade its performance. Do not use or store the product in hazardous environments.

WARRANTY

The probes are warrantied for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering, or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments® office.

If under warranty, report the model number, date of purchase, serial number, and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred.

If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid.

When shipping any product, make sure it is shipped back in compliance with shipping regulations, thoroughly cleaned and free of any chemicals, and is properly packaged for complete protection.