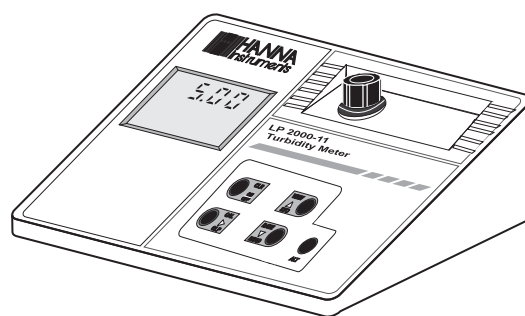


Instruction Manual

LP2000-11

Precision Bench Turbidity Meter with PC Communication



Dear Customer,

Thank you for choosing a Hanna Product. Please read this instruction manual carefully before using the instrument. It will provide you with the necessary information for the correct use of the instrument, as well as a precise idea of its versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.

These instruments are in compliance with the **CE** directives.

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PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it to make sure that no damage has occurred during shipping. If there is any damage, notify your Dealer.

LP2000-11 is supplied with:

- Glass cuvet with cap
- AMCO-EPA-1 turbidity calibration solutions (**HI 93703-0** @0 FTU and **HI 93703-10** @10 FTU), 30 mL each
- 12 Vdc power adapter and instruction manual

Note: Save all packing material until you are sure that the instrument functions correctly. Any defective item must be returned in its original packaging with the supplied accessories.

GENERAL DESCRIPTION

LP2000-11 turbidity meter is a bench top, microprocessor-based instrument used to determine the turbidity of water and wastewater. The meter covers a 0-1000 FTU range in two scales: 0.00 to 50.00 FTU and 50 to 1000 FTU. The autoranging feature sets the appropriate range for the measurement.

The serial interface is supported connecting any available serial port on your PC and a 5-pin socket on the meter.

Note: **LP2000-11** has been designed according to the ISO 7027 International Standard, consequently the turbidity measurement units are expressed in FTU (Formazine Turbidity Unit). FTU is identical to the other internationally recognized unit NTU (Nephelometric Turbidity Unit).

LP2000-11 is housed in a rugged and lightweight case, with an easy-to-read LCD.

The meter is simply to use. All operations can be carried out with only five keys and troubleshooting functions can be performed with displayed error code guides. A positive-locking system guarantees that the cuvet is firmly placed in the cell. The keypad is water-resistant and can be wiped with a moist cloth for quick cleanups.

Two or three points calibration (0, 10, 500 FTU*) can be easily performed using available standards.

* 1 FTU = 1 NTU

In addition, **LP2000-11** automatically stores the last calibration date, that may be retrieved by a single key touch.

10 FTU* was chosen as the standard calibration point because its value best fits the water turbidity measurements in a wide range of applications, from drinking water to wastewater treatment.

Hanna uses the primary standard AMCO-AEPA-1 to avoid all formazine-related problems. In fact formazine is a toxic, unstable substance, which requires particular care. Its standards have to be prepared only a few minutes before performing the calibration, and cannot be reused because of their short life.

Hanna standards are extremely stable, can be reused, and last up to six months, if free from contaminations.

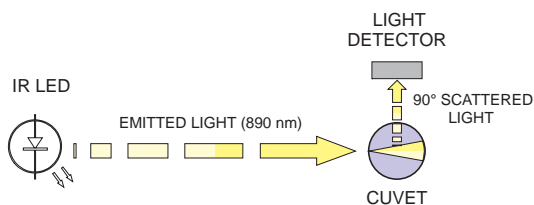
LP2000-11 can be used with both standards.

PRINCIPLE OF OPERATION

LP2000-11 has been designed to perform measurements according to the ISO 7027 International Standards.

The instrument works by passing a beam of infrared light through a vial containing the sample to be measured.

The light source is a High Emission Infrared LED with a wavelength peaking at 890 nm, which reduces interferences caused by colored samples to a minimum.



A sensor, positioned at 90° with respect to the direction of light, detects the amount of light scattered by the undissolved particles present in the sample. The microprocessor converts such readings into FTU values.

* 1 FTU = 1 NTU

As noted above, FTU is equal to the NTU. However, other known measurements include: Jackson Turbidity Unit or JTU (based on the old method of Jackson's candle), and Silica Unit in mg/L of SiO₂. See the conversion table below for these units:

	JTU	FTU/NTU	SiO ₂ (mg/L)
JTU	1	19	2.5
FTU/NTU	0.053	1	0.13
SiO ₂ (mg/L)	0.4	7.5	1

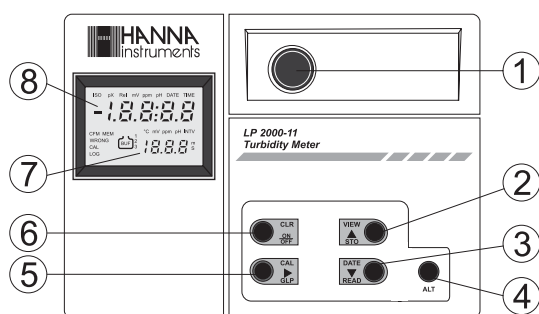
SPECIFICATIONS

Range	0.00 to 50.00 FTU* 50 to 1000 FTU*
Resolution	0.01 / 1 FTU*
Accuracy (@ 20°C/68°F)	±0.5 FTU* ±5% of reading (whichever greater)
Calibration	3 points (0, 10 and 500 FTU*)
Light Source	High-emission infrared LED
Light Source Life	Life of the instrument
Light Detector	Silicon photocell
Power Supply	12 Vdc power adapter (included)
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	230 x 170 x 70 mm (9.1 x 6.7 x 2.7")
Weight	600 g (1.3 lb.)

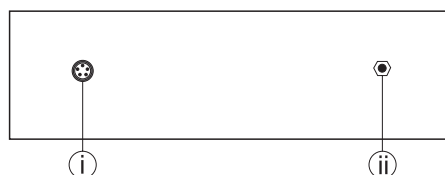
* 1 FTU = 1 NTU

FUNCTIONAL DESCRIPTION

FRONT PANEL



REAR PANEL



1. Measurement cell
2. STO/VIEW key, to store sample after reading and view log memory
3. READ/DATE key, to perform measurements and display (toggle) current date/time
4. ALT key, to activate the ALT functions (orange keys)
5. GLP/CAL key, to display (toggle) last calibration date/time and enter the calibration mode
6. ON/OFF/CLR key to switch the meter ON and OFF, and clear log memory
7. Secondary LCD (displays the year when date is on the primary level, the sample index when storing a value or viewing the log memory)
8. Primary LCD (Liquid Crystal Display)

- i. 5-pin RS232 connector
- ii. Power supply socket

OPERATIONAL GUIDE

POWER CONNECTION

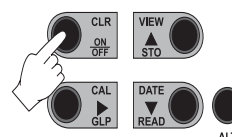
Plug the supplied 12 Vdc adapter into the proper instrument socket and to the mains.

Note: Insure the main line is fuse protected.

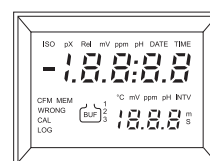
Note: Always turn the meter off before unplugging it to ensure no data is lost.

MEASUREMENT PROCEDURE

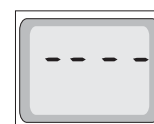
- Turn the meter on by pressing the ON/OFF key.



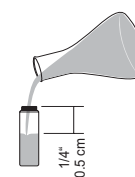
- The meter will carry out a self-test by displaying a full set of figures.



- When the LCD displays "----" the meter is ready to take measurements.



- Fill a clean cuvet up to 0.5 cm (one quarter inch) from its rim with the thoroughly agitated sample.



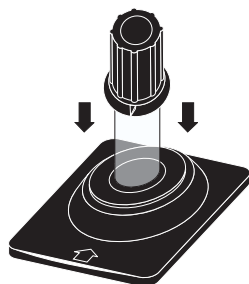
- Allow sufficient time for bubbles to escape before securing the cap.

Note: Do not overtighten the cap.

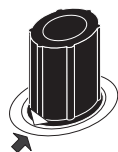
Note: Wipe the cuvet thoroughly with **HI 93703-70** or a lint-free tissue before inserting it into the measurement cell. The cuvet must be completely free of fingerprints and other oil or dirt, particularly in the area where the light goes through (approx. the bottom 2 cm/1").



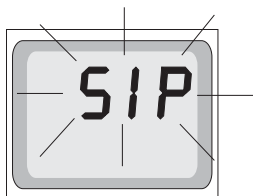
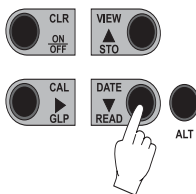
- Place the cuvet into the cell and check that the notch on the cap is positioned securely into the groove.



- The mark on the cuvet cap should point towards the keyboard.



- Press the READ key and the LCD will display a blinking "SIP" (Sampling in Process). The turbidity value will appear after approximately 20 seconds.



- Even though **LP2000-11** covers a wide turbidity range, highly accurate readings exceeding 40 FTU* require dilution as recommended by the Standard Methods.

Use the formula below to calculate the amount of **HI 93703-0** or turbidity-free water needed for accurate dilution.

The total volume = 100 mL.

$$V_{os} = 3000 / T$$

where:

V_{os} = volume of original sample (mL) to be added to HI 93703-0 to obtain the total diluted volume of 100 mL.

T = LP2000-11 reading (exceeding 40 FTU)

E.g.: LP2000-11 reading = 200 FTU*

$$3000 / 200 = 15 \text{ mL } (V_{os})$$

$$15 \text{ mL } (V_{os}) + 85 \text{ mL (HI 93703-0)} = 100 \text{ mL}$$

At this point, take a sample of this diluted solution and measure its turbidity.

The correct turbidity value of the original sample is derived by:

$$T_a = T_n \times 100 \text{ mL} / V_{os}$$

where:

T_a = actual turbidity value of the original sample

T_n = LP2000-11 reading of the diluted solution

E.g. If $T_n = 27$

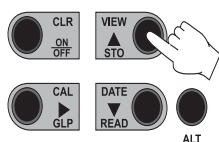
$$T_a = 27 \times 100 \text{ mL} / 15 \text{ mL} = 180 \text{ FTU}^*$$

Note: Any sample above 1000 FTU* will show out of range by blinking "1000".

* 1 FTU = 1 NTU

STORING SAMPLES IN MEMORY

- After taking a reading, press the STO button. The last sample read will be stored in memory and the display will also show on the bottom right hand corner the reference number of the stored sample.

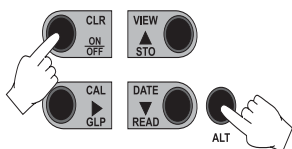


Note: When the maximum number of samples has been reached (500), the display will show "FULL". This is a warning that you will be overwriting the oldest sample recorded. To store the current sample, press the STO button again and this will overwrite the oldest sample in the memory. All samples are shifted and sample number one is always the oldest sample.



CLEARING LOGGED DATA

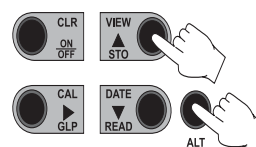
- Press the ALT & CLR buttons. The display will show "CLR" for confirmation. Press ALT & CLR again to clear memory or any other key to abort the operation.



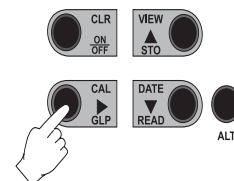
ALL SAMPLES PREVIOUSLY STORED WILL BE ERASED FROM MEMORY!

VIEWING LOGGED DATA

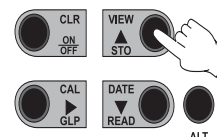
- Press the ALT & VIEW buttons. The last stored sample will be displayed.



- Press the right arrow to scroll between turbidity value, date and time sample was taken.



- Press the UP/DOWN arrows to scroll between samples taken.

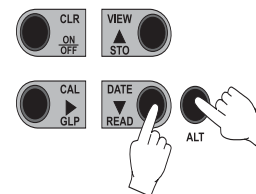


- Press ALT & VIEW buttons again to exit this mode.

DATE AND TIME SETUP

VIEWING:

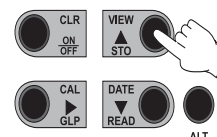
- Press ALT & DATE to toggle between date and time.



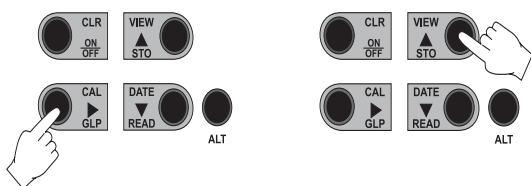
SETTING:

- Press and hold ALT & DATE for 3-4 seconds.

- Press UP/DOWN arrows to correct and set the year.



- Press right arrow to scroll to month and day, use UP/DOWN to set.
- Press right arrow again to scroll to time, use UP/DOWN to set.
- Press right arrow again to save and exit date and time setup.



Note: Press ALT & DATE to leave this mode without saving.

ERROR CODES

Every time the meter is switched on, the Real Time Clock and EEPROM are tested, and if an error is found the corresponding error code will be displayed. The list of error codes is as follows:

- NO cover error (check cuvet position)
- Calibration error
(check calibration standard value)
- RTC (Real Time Clock) error *
- EEPROM error*
- Serial communication error*



- Internal Bus error*



- Low LED Voltage*



* Contact the nearest HANNA Customer Service Center.

ENSURE ACCURATE MEASUREMENTS

- Each time the cuvet is used, tighten the cap to the same degree.
- Discard the sample immediately after reading to prevent permanent clouding of the glass.
- All glassware used to contain the standards and the samples should be kept clean, washed with **HI93703-50** cleaning solution and rinsed with **HI93703-0** or turbidity-free water.
- Samples should be collected in clean glass or plastic bottles with appropriate stoppers. Analysis should be performed shortly after. If the sample requires storage, it should be kept in a cool dark place. Stored samples should be restored to room temperature prior to the analysis. Samples may not be stored for longer than 24 hours.
- To obtain a representative sample, gently and thoroughly, stir the solution. To prevent air bubbles from forming do not shake or let the solution settle prior to sampling.
- It is recommended to calibrate the meter by using the supplied **HI93703-10** (10 FTU* standard), at least monthly or more frequently for greater accuracy.
- Before inserting cuvetts into the instrument, wipe them with **HI 93703-70** or a soft, lint-free tissue. Handle vials so that no fingerprints are left on the areas where light passes through (approx. the bottom 2cm / 3/4").

If you experience any problems in taking measurements, please contact your dealer or the nearest Hanna Customer Service Center.

SOURCES OF INTERFERENCE

- The presence of floating debris and coarse sediments which may settle out rapidly will give false readings.
- The infrared light source of LP2000-11 turbidity meter complies with the ISO 7027 International Standard and can effectively minimize errors due to colored dissolved substances. This effect, called "True Color", is a common interference for most commercially available instruments operating in the range of visible light.
- Air bubbles and the effect of vibrations that disturb the surface of the sample may produce false results and should be avoided.
- Dirty, scratched, or etched glassware could also affect readings.

CALIBRATION

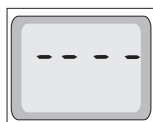
To check the date of last calibration, simply press the GLP key. Press again to toggle between date and time.

To make sure that the meter is calibrated, take a measurement of a standard solution.

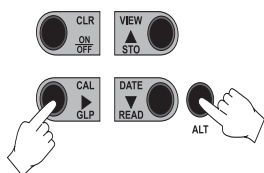
The instrument can be calibrated at two or three points and a monthly calibration is recommended.

CALIBRATION PROCEDURE

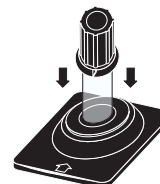
- Turn the meter on and wait for the display to show "----".



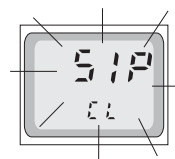
- Press the ALT & CAL buttons. The "CAL" message will blink on the display for 3 seconds. The meter then enters the calibration mode, displaying "0.00" and prompting the user to insert the 0.00 FTU standard.



- Place the 0.00 FTU standard in the cuvet holder.



- Press CAL; SIP and CL will start blinking.



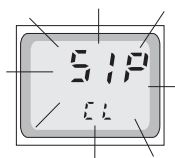
- If "ERR1" appears on the LCD, please check the standard solution.



- After approximately 30 seconds the meter will display "10.00", prompting the user to place the 10.00 FTU standard solution in the cuvet holder.



- Place the 10.00 FTU standard in the holder and press CAL. SIP and CL will start blinking.

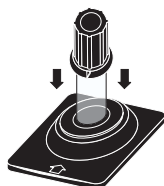


- After approximately 30 seconds the meter will display 500, asking the user to place the 500 FTU standard solution in the cuvet holder.

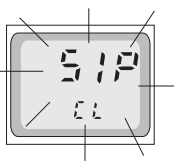


Note: At this point the user can save the two-point calibration setup and leave the calibration mode by pressing ALT & CAL buttons.

To perform a three point calibration, place the 500 FTU standard solution in the cuvet holder.

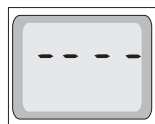


- Press CAL; SIP and CL will start blinking.



- After approximately 30 seconds the LCD will display "----".

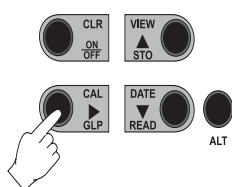
Now the instrument is calibrated and ready for use.



Note: If "ERR1" is displayed, the calibration data is maintained.

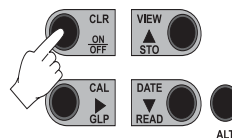
VIEWING CALIBRATION DATE

To display the last calibration time and date, press the GLP button. If display shows "FS", the instrument has factory calibration settings loaded and no date will be displayed.



VIEWING FIRMWARE VERSION

To display the firmware version, turn the meter on, then press and hold the ON/OFF key for approximately 10 seconds.



ENSURE ACCURATE CALIBRATION

The procedure below should be carefully followed during testing and calibration:

- All glassware that comes into contact with standards should be kept clean. Wash it with **HI93703-50** cleaning solution and rinse it with **HI93703-0** or turbidity free water.
- Rinse the cuvet twice with 5 ml of the liquid to be tested. This procedure removes the effect of any previous liquid and any dust or objects that may be inside. Gently pour the liquid down the side of the vial to reduce air bubbles (no mixing is required when **HI 93703-0** and **HI93703-10** AMCO-AEPA-1 standards are used).
- Before inserting the cuvet into the instrument, wipe it with **HI 93703-70** or a soft, lint-free tissue. Handle vials so that no fingerprints can get on the areas where light passes (approx. bottom 2 cm/1").

STANDARD SUSPENSION

Presently, there are only two recognized primary standards: AMCO-AEPA-1 and formazine.

Hanna supplies **LP2000-11** with the AMCO-AEPA-1 which has a much longer shelf life at all concentrations (approx. six months, if free from contamination). In addition, no special handling or disposal is required and a much higher stability of suspended particles has been observed. On the other hand, formazine is a toxic substance, generated by a carcinogen, with poor stability (particles flocculate and settle quickly). Low concentrations change value within a few days or hours after dilution. The consistency of **LP2000-11** readings by using both standards has been separately established by Advanced Polymer Systems and Hanna Instruments.

Additional documentation about the formazine standard and more complex calibration procedures is available upon request.

RS232 CONNECTION

To communicate with the instrument through the **HI92000** software, simply use **HI920011** (optional) cable to connect the 9-pin serial port of an IBM compatible computer and the 5 pin connector of the meter. A connected meter will fully maintain its functionality, being able to perform data transfer while the meter is operating.

Note: RS232 communication is not allowed while calibrating the meter.

ACCESSORIES

HI 710005	12 Vdc / 115 Vac power adapter, US plug
HI 710006	12 Vdc / 230 Vac power adapter, European plug
HI 731318	Tissue for wiping the cuvetts (4 pcs)
HI 731321	Glass cuvet (4 pcs)
HI 93703-0	0 FTU* AMCO-AEPA-1 calibration solution (30 mL)
HI 93703-05	500 FTU* AMCO-AEPA-1 calibration solution (30 mL)
HI 93703-10	10 FTU* AMCO-AEPA-1 calibration solution (30 mL)
HI 93703-50	Cuvet cleaning solution (230 mL)
HI 92000	Windows® compatible software
HI 920011	PC connection serial cable (5 to 9-pin)

* 1 FTU = 1 NTU

WARRANTY

All Hanna Instruments **meters are warranted for two years** against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. This warranty is limited to repair or replacement free of charge.

Damage due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. 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 number from the Customer Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

Recommendations for Users

Before using this product, make sure that it is entirely suitable for the environment in which it is used.

Operation of this instrument in residential area could cause unacceptable interferences to radio and TV equipments, requiring the operator to take all necessary steps to correct interferences.

Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance.

To avoid electrical shock, do not use this instrument when voltages at the measurement surface exceed 24VAC or 60VDC.

To avoid damages or burns, do not perform any measurement in microwave ovens.

SALES AND TECHNICAL SERVICE CONTACTS

Australia:

Tel. (03) 9769.0666 • Fax (03) 9769.0699

China:

Tel. (10) 88570068 • Fax (10) 88570060

Egypt:

Tel. & Fax (02) 2758.683

Germany:

Tel. (07851) 9129-0 • Fax (07851) 9129-99

Greece:

Tel. (210) 823.5192 • Fax (210) 884.0210

Indonesia:

Tel. (21) 4584.2941 • Fax (21) 4584.2942

Japan:

Tel. (03) 3258.9565 • Fax (03) 3258.9567

Korea:

Tel. (02) 2278.5147 • Fax (02) 2264.1729

Malaysia:

Tel. (603) 5638.9940 • Fax (603) 5638.9829

Singapore:

Tel. 6296.7118 • Fax 6291.6906

South Africa:

Tel. (011) 615.6076 • Fax (011) 615.8582

Taiwan:

Tel. 886.2.2739.3014 • Fax 886.2.2739.2983

Thailand:

Tel. 66.2619.0708 • Fax 66.2619.0061

United Kingdom:

Tel. (01525) 850.855 • Fax (01525) 853.668

USA:

Tel. (401) 765.7500 • Fax (401) 765.7575

MANIP2000-11

11/05

*For e-mail contacts and complete list of Sales and Technical offices, please see **www.hannainst.com***