INSTRUCTION MANUAL **MODEL: DN 1000**

DIGITAL TURBIDITY METER

- **Highly stable and Accurate**
- **High Indencity 7 Segment LED Display**
- **30 mm Flat bottom Test tube**
- **Range from 0-20/200 NTU**
- **Resolution 0.01/0.1 NTU**
- **Repeatability ±1%**
- **Accuracy ±2% FS**
- **3V LED Light Source**
- **Calibration with formazine solution**
- **Photo Diode Detector**
- **Ideal Instrument for testing of Drinking water,Sewage Water etc.,**

CONTENTS

SECTION I

INTRODUCTION

1.1 INTRODUCTION

It is Possible to prepare some insoluble compounds in a state of aggregation such that a stable suspension is obtained.The optical properties of the suspension will vary with the concentration of the dispersed phase. Such suspension when viewed at right angle to the direction of irradiation,the system appears opalescent due to reflection of light from the particals in the suspension.Infact,it is from the Greek word **"NEPHELE**" meaning cloud,that we get the name used to designate the measurement of scattered light.

Thus the measurement of the intensity of the scattered light as a function of the concentration of dispersed phase is the basis of a Nephelometric determination.In general,Nephelometric measurements are used for dilute suspensions.

Construction of a calibration curve is recommended in Nephelometeric determinations as the relationship between the optical properties of the suspension and the concentration of dispersed phase is empirical.Mixed solvents and ions are sometimes added as peptizing agents,So that stable and reproducible suspensions are made.

Digital Nepholometer Model DN 1000 is a sophesicated,rugged&reliable instrument designed on Tyndall effect, for measurements of dilute suspensions.It consists of a light source focused on a test tube containing sample solution under test.The light reflected at right angle to the focused light by the suspension of the solution in the test tube is detected by Photoelectric Detector,amplified and displayed on a 3 ½ digit LED display.

1.2 SPECIFICATIONS

Range	:	0 to 19.99 NTU F.S
Accuracy	:	±2% F.S ± 1 Digit
Resolution	:	0.1NTU
Reproducibility	:	±1%
Detector	:	Selenium photocell/photodiode
Calibration	:	With formazine solution
Test Tube Holde	:	30mm dia clear glass test tube
Light Source	:	6V,0.3A Tungsten Lamo/3V LED DC
Display	:	3 ½ Digit bright red LED display
Power	:	230V ±10% A.C. 50Hz
Dimensions	:	220LX200Bx105H mm

1.3 STANDARD ACCESSORIES

Test tubes 30mm dia	1 Set
Dust Cover	1 No
Instruction Manual	1 No

SECTION II
CONTROLS&SERVICES

2.1 USER CONTROLS&DISPLAY

DISPLAY : 3 ½ digit bright Red LED display for accurate reading of turbidity in NTU.

TEST TUBE HOLDER : The Test Tube holder keeps the test tube containing solution to be tested.

RANGE SWITCH : This control selects the desired sensitivities of 20.00 and 200.00 NTU respectively.

SET ZERO KNOB : This control is used to set zero of the instrument when a blank solution(say,distilled water) in the test tube is kept in the test tube holder.

CALIBRATE KNOB : This control is a 10 turn pot for calibration of the instrument

ON/OFF SWITCH : This is a two position toggle switch used to switch ON the power to the instrument at the time of its use.The instrument must be Switched OFF when not in use.

TEST TUBE HOLDER COVER: The cover of the test tube holder prevents external light to enter the solution.

SECTION III

CALIBRATION

3.1 METHOD OF CALIBRATION

Calibration of Digital Nephelometer Model DN 1000 must be carried out using standard turbidity solutions of formazine.It is a substance which has particals of uniform size and shape to prepare ideal standard solutions within 1% accuracy when properly mixed.Stock turbidity suspensions can be prepared as given below in section 3.3.

3.2 TURBIDITY FREE WATER

Take distilled water and pass it thrugh a membrane filter of very fine pour size.Whatman Filter paper No.42 is most suitable.If the filtered water shows a turbidity lower than that of distilled water,discard first 200ml collected.If filteration does not reduce turbidity,use distilled water.

3.3 STOCK TURBIDITY SUSPENSION

(a) **SOLUTION A:** Dissolve 1.0gm of Hydrazine sulphate $(NH_2)_2H_2SO_4$(Laboratory grade) in distilled Water and dilute to 100ml in a volumetric flask.

(b) **SOLUTION B:**Dissolve 10.0gm of Hexamethylene tetramine $(CH_2)_6N_4$ in distilled water and dilute to 100ml in Volumetric flask.

(c) In a 100ml volumetric flask,mix 5.0ml solution A with 5.0ml of solution B.Allow to stand for 24 hours at 25^0C, $\pm 3^0C$,then dilute to the mark(100ML), and mix.The turbidity of this suspension is 400 NTU.

3.4 STANDARD TURBIDITY SUSPENSIONS

(a) Dilute 25ml. of stock turbidity suspension to 100ml with distilled water.The turbidity of this
suspension is 100NTU.Prepare this solution weekly.

(b) Dilute 10ml of 100 NTU solution to 100ml with distilled water.The turbidity of this suspensions is 10NTU

Similarly, linear dilutions of any other value can be Prepared.

SECTION IV
OPERATION

INSTRUCTIONS

Take out your Digital Nephelometer Model DN 1000 and accessories from the cardboard box. Check all the accessories as per list given below:-

Digital Nephelometer	1No
Test Tubes	1 Set
Dust Cover	1 No
Instruction Manual	1 No

If there is any damage during transit, please report to the company or the dealer at the earliest.

During installation of the instrument, the following precautions must be taken into consideration:-

1. Ensure that an power supply of 220V,50Hz AC is available. If the voltage is erratic, automatic Voltage stabilizer of 0.5 KVA is necessary Ensure proper grounding for smooth operation of the Instrument and safety of the operator.
2. Connect 3 pin plugs in 5 amp. AC voltage supply socket
3. Ensure that the instrument is placed on a strong vibration free working bench.
4. Ensure that the environment is free from dust.
5. Room Temp should be between 5^0C to 45^0C
6. Humidity should not be more than 90%
7. Switch ON the instrument
8. Now the instrument is ready for use.

OPERATION

1. Allow sufficient warm up period after switching ON the instrument.
2. Take the test tube with distilled water or blank solution,Place it in the test tube holder and close the test tube holder cover.Make sure that the mark on the test tube coincides with the mark on the panel.
3. Adjust the display to 00.0 by adjusting the 'Set Zero' knob.
4. Now in another test tube,take standard suspension prepared as in section 3.4.Put the Range switch to appropriate range.For 0-20 NTU range,use 10 NTU solution and for higher range(0-200 NTU),use 100 NTU solution as standard.Put the test tube in the test tube holder.
5. Take its measurement and set the display to the value of the standard suspension with the 'Calibrate' knob.
6. Again check the display zero with the test tube containing distilled water.
7. For measurements of Turbidity less than 20 NTU thoroughly shake the sample,wait until bubbles Disappear. put range switch on 20 NTU & Put the sample into the test tube.Take the reading directly from the Digital display.
8. For measurement of turbidity above 200 NTU,put the Range switch to 200 NTU,dilute the sample with known volumes of turbidity free water until the turbidity fails within 200 NTU.Then compute the turbidity of the original sample from the turbidity of the diluted sample and dilution factor.

PRECAUTIONS

1. Sample test tube must be thoroughly cleaned both inside and outside in case the test tube gets Scratched or etched, discard it.

2. Hold the test tube only at the top end. Do not touch the test tube where the light strikes.

3. Fill the test tube with samples or standards, which have been thoroughly agitated. Allow sufficient
   Time for the air bubbles to escape, otherwise the reading will slowly come down. When the readings are taken in the agitated state with air bubbles, the readings will be higher.

4. Make sure that the mark on the test tube coincides with the mark on the instrument panel while Taking the readings.

SECTION V
NEPHELOMETRIC DETERMINATIONS

5.1 PHOSPHATE DETERMINATION

Phosphate ion is determined by formation of sterydinine phosphomylodate.This solution is white in colour with extremely fine particles.The precipitate should not be agitated as it tends to agglomerate easily.It is also some what sensitive to temperature changes

PREPARATION OF REAGENT

1.PHOSPHATE SOLUTION: Dissolve 1.7205 gm of A.R.Potassium dihydrozen phosphate(dried at 110^0C) in 1 liter of water n a volumetric flask and dilute it to the mark.The resulting dilute solution contains 0.01mg.Phosphorus pent oxide per ml.

2.MOLYBDATE :STRYCHINE REAGENT

The reagent is prepared in two parts.These are mixed just before use.Since the adition of acid molybdate solution to strychnine sulphate solution produces a precepiate after 24 hours.

SOLUTION A. Acid Molybdate solution.Put 30gm of A.R Molybdate trioxide in 500ml flask.Add 10 gm of A.R sodium carbonate. Mix these in 200ml of water boil the mixture until clear solution is obtained. Filter the hot solution if necessary.Now dilute it to 500ml.

SOLUTION B.STRYCHNINE SULPHATE SOLUTION

Dissolve 1.6gm of strychnine sulphate(bisulphate) in 100ml of warm water(distilled) cool and dilute it to 500ml.

Now add solution B rapidly to an equal volume of solution A.Shake this mixture thoroughly.Filter off the bluish white precipitate through a whatman No.42 filter paper.This clear solution may be kept for about 24 hours.Solution A&B separately may be kept for an indefinite period.

3. SATURATE SODIUM SULPHATE SOLUTION:-

Prepare a Saturated aqueous solution at 50^0C and cool it to room temperature.Filter it before use.

4. SULPHURIC ACID

Dilute 27ml of A.R concentrated sulphuric acid to 500ml ina volumetric flask.

5. PROCEDURE

(i) Take 1,2,4,6,8 and 10ml of standard phosphate solution from a calibrated burette in separate 100ml Volumetric flasks.

(ii) Add 10ml of 1 M-sulphuric acid in each flask

(iii) Put 16ml of saturated sodium sulphate in the above flask.

(iv) Now dilute the solutions in ech flsk to 95ml by adding distilled water.

(v) Add 2.0ml of molybdate trychnine reagent prepared already

(vi) Dilute it to 100ml

(vii) Mix the contents of Each flask by gently inverting several times.Do not shake please.

(viii) Allow the solution to stand for 20 minutes to permit turbidity to develop before taking the measurement.

BLANK SOLUTIONS

(i) Prepare the blank solution by repeating the steps from(ii) to (viii) described above.

(ii) Do not add phosphate solution thus omitting first step in the PROCEDURE.

(iii) Put distilled water instead of phosphate solution.

(iv) Now the blank solution is ready.

CALIBRATION CURVES

Construct the calibration curves between concentrations and display readings and find out the phosphate determinations.

5.2 SULPHATE DETERMINATION

For Nephelometric determination of sulphate,it is very difficult to reproduce the dilute barium sulphate suspension.Therefore experimental procedure should be followed very carefully.Pure solid barium chloride of definite grain size is used which helps in controlling the velocity of precipitation and concentration of reagents.

Formation of microcrystals of barium sulphate is inhibited by the addition of sodium in the precipitation It also helps to optimize the pH and to minimize the effect of other electrolytes of the sample on the size of the barium sulphate particles.

Glycerol Alcohol solution helps to stabilize the turbidiy of the solution.

PREPARATION OF REAGENTS

1. STANDARD SULPHATE SOLUTION

Dissolve 1.8141gmof dry A.R Potassium sulphate in distilled water and dilute to 1 litre in a volumetric flask.This solution contains 1mg of sulphate per liter.

2. SODIUM CHLORIDE HYDROCHLORIC ACID

Take 200ml of distilled water and add 5ml of pure concentrated hydrocholoric acid.Dissolve 60gm of A.R Sodium chloride.Now dilute it to 500ml.

3. BARIUM CHLORIDE

Use crystals of Barium chloride.Before use,pass these crystals thorough a 20 mesh sieve.Use only the crystals which are retained by the sieve.

4.GLYCEROL-ALCOHOL SOLUTION

Dissolve 1 Part of pure glycerol in 2 parts of absolute othanel.

5. PROCEDURE

(i) Take 0.5,1.0,1.5,2.0,2.5&3.0 ml of standard potassium sulphate solution into 100ml volumetric flasks.

(ii) Add 10ml of sodium chloride-hydrochloric acid reagent in each flask.

(iii) Add 20ml of glycerol alcohol solution in each flask

(iv) Dilute solution in each flask to 100ml with distilled water.

(v) Add 0.3g of sieved barium chloride in each flask once per second till all the barium chloride is dissolved.

(vi) Allow each solution to stand for 2-3 minutes

(vii) Measure the turbidity of each solution by Digital Nephelometer.

(viii) Construct the calibration curve of concentration Vs display reading

6. BLANK SOLUTION

(i) Prepare the blank solution by repeating the steps from(ii) to (vii) described above

(ii) Do not add sulphate solutions thus omitting first step in the procedure

(iii) Put distilled water instead of sulphate solution

(iv) Now the blank solution is ready.

5.3 CHLORIDE ESTIMATION

For the true determination of traces of chlorides nephelometrically,as silver chloride,other ions forming insoluble silver slts such as bromides and iodides should not be in the sample..The error can be also by the absorption of ions by silver chloride during peptization and coagulation,difference in the coagulating action of the two precipitating agents and peptizing and coagulating effect of other compounds present.

Mixing is an important factor,slow mixing is better for reproducibility.Accuracy of 2 to 3% is obtained

1. SAMPLE PREPARATION

Select a sample solution containing about 0.2mg of chloride and dilute it to 20ml chloride free distilled water.

2. STANDARD SAMPLE

Take 10ml of solution containing 0.1mg of chloride.Dilute it to 20ml with chloride free distilled water.

3. PROCEDURE

(i) To sample and the standard,add ions of 0.1 N nitric acid in each.

(ii) Add 19ml of 0.005N silver nitrate solution

(iii) Mix the two and place in a water bath at 40^0C for 30 minutes or longer.

(iv) Cool rapidly to room temperature

(v) Within 30 minutes,compare in a Nephelometer

(vi) The Nephelometer test tubes must be rinsed first with distilled water then with respective solutions to be tested.

TEMPERATURE EFFECTS

If the samples are developed at 20^0C the opalescence increases slowly to an almost constant value in 1 hour.Heating at 60^0C gives full development in less time but results in greater opalescence,which falls off on continued heating.After 30 minutes at 60^0C coagulation begins.However no coagulation is there at 40^0C and constant opalescence is obtained after 30 minutes Exposure to diffused day light has a perceptible effect that is due to coloration of the white opalescence.If greater sensitivity is desired,developed sample and standard is diluted to 100ml With chloride free alcohol.

4. DUPLICATION PROCEDURE

(i) Transfer 20ml of sample containing about 0.2mg of chloride in a 50ml.Nessler tube and an equal volume of water.

(ii) Dilute each to about 30ml.

(iii) Add 5ml of concentrated nitric acid to each

(iv) Add 2l of 0.1% gelatin solution

(v) Dilute the sample to 49ml

(vi) Add 1ml of 0.1N silver Nitrate solution and mix

(vii) Add standard sodium chloride solution containing 0.02mg of chloride per ml. of this standard,with mixing unit the opalescence of standard matches that of sample comparing them against a blank.

(viii) Adjust the volumes by adding water to make up the volume of the lesser before final comparison.

STOCK SOLUTION OF SODIUM CHLORIDE

Dissolve 0.3297g of sodium chloride in distilled water and dilute it to 100ml.It contains 0.02mg/ml of chloride.

STANDARD SOLUTION OF SODIUM CHLORIDE

1) Take 10ml of stock sodium chloride solution

2) Dilute it to 100ml

3) It contains 0.002 mg/ml of chlorides

4) Any other dilution can be prepared if desired.

Take readings on the Digital Nephelometer within 30 minutes after the sample and standard are cooled at the room temperature.These readings are compared and exact chloride contents in the sample can be estimated.

SECTION VI
FAULT FINDING

6.1 FAULT FINDING GUIDE

The following table may be useful in correcting malfunctions and avoiding pit falls:-

	CAUSE		REMEDY
1.	**LED NOT GLOWING**		
	a)A.C supply is not present	:	Check A.C.supply,three pin plug may be loose.ON/OFF switch may be OFF.
2.	**UNSTABLE&INCONSISTANT-READINGS**		
	a) Instrument readings unstable	:	Check test tube position.It may not be properly Placed. Check the volume of the sample.It should not be less than 30ml.
	b) Inaccurate readings	:	Check that the appropriate range is selected.
	c)Readings not repeatable	:	Sample may be bad due to improper storage.

If the fault still exists,please contact the nearest dealer for repair by the engineer of the company.

NOTE : Do not play with the internal parts of the instrument. Warranty stands only if the seal of the printed circuit board fitted within the instrument is intact.

WARRNTY

The instrument is warranted off-site for a period of 12 months from the date of delivery against defect in material or workmanship other than lamp,photocell and glass parts.During warranty period,or liability is Limited to the repair of the instrument at our works at Panchkula.Data subject to change without notice.