

STANDARD ACCESSORIES

DR-A1 Test piece 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Allen wrench for detaching/attaching prism 1 pc Lighting adapter for solid sample 1 pc Tube band 10 pcs AC adapter (AD-13) 1 pc AC cable 1 pc Instruction manual 1 pc	DR-A1-Plus Test piece 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Allen wrench for detaching/attaching prism 1 pc Lighting adapter for solid sample 1 pc Tube band 10 pcs AC adapter (AD-13) 1 pc AC cable 1 pc Instruction manual 1 pc	NAR-1T LIQUID Digital thermometer 1 pc AC power cable 1 pc Lamp cable 1 pc LED lamp 3 pcs Special screwdriver for calibration 1 pc Tube band 10 pcs Instruction manual 1 pc
NAR-1T SOLID Digital thermometer 1 pc AC power cable 1 pc Lamp cable 1 pc LED lamp 3 pcs Test piece 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Special screwdriver calibration 1 pc Milky white reflector 1 pc Tube band 10 pcs Instruction manual 1 pc	NAR-2T Digital thermometer 1 pc AC power cable 1 pc Lamp cable 1 pc LED lamp 3 pcs Test piece 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Special screwdriver calibration 1 pc Tube band 10 pcs Instruction manual 1 pc	NAR-3T Digital thermometer 1 pc AC power cable 1 pc Lamp cable 1 pc LED lamp 3 pcs Allen wrench for calibration 1 pc Test piece 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Air purger for dehumidification 1 pc Tube band 10 pcs Instruction manual 1 pc
NAR-4T Digital thermometer 1 pc AC power cable 1 pc Lamp cable 1 pc LED lamp 3 pcs Test piece 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Contact liquid [methylene iodide containing sulfur solution] (4mL) 1 pc Special screwdriver calibration 1 pc Milky white reflector 1 pc Tube band 10 pcs Instruction manual 1 pc	DR-M2 DR-M4 Test piece 1 pc Allen wrench 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Contact liquid [methylene iodide containing sulfur solution] (4mL) * 1 pc Interference filter, 589nm 1 pc Lighting glass for film measurement 1 pc Spare bulb 1 pc Tube band 10 pcs Instruction manual 1 pc *For DR-M4 only	DR-M2/1550 DR-M4/1550 Near infrared ray viewer 1 pc Mounting adapter 1 pc Monochromatic light source device 1 set Test piece 1 pc Allen wrench 1 pc Contact liquid [monobromonaphthalene] (4mL) 1 pc Contact liquid [methylene iodide containing sulfur solution] (4mL) * 1 pc Interference filter, 589nm 1 pc Interference filter frame for 589nm 1 pc Tube band 10 pcs Lighting glass for film measurement 1 pc Instruction manual 1 pc *For DR-M4/1550 only

OPTIONAL PARTS

- For measuring solid samples (excluding the NAR-1T LIQUID)
 - Eyepiece For Polarizing Parts No. RE-1146
 - Test Piece
 - Test Piece D For Measurement of Film (nD 1.74) Parts No. RE-1498
 - Test Piece E For Measurement of Film (nD 1.92) Parts No. RE-1499
 - Adapter For Film Sample (for DR-A1) Parts No. RE-1581
 - Contact Liquid
 - Contact Liquid - monobromonaphthalene nD 1.65 (4mL) Parts No. RE-1196
 - Contact Liquid nD 1.78 (4mL) Parts No. RE-1199
 - Contact Liquid LJ nD 1.80 (7mL) Parts No. RE-99080
 - Test Piece with monobromonaphthalene as contact liquid
 - Test Piece A (nD=1.516) with M-Naphthalene with monobromonaphthalene as contact liquid Parts No. RE-1195
 - Test Piece C (nD=1.620) with M-Naphthalene with monobromonaphthalene as contact liquid Parts No. RE-1197
- For connecting to a computer (for DR-A1/DR-A1-Plus only)
 - RS-232C Cable For Personal Computer (D-Sub 9 Pin) Parts No. RE-15305
- Interference Filters for MULTI-WAVELENGTH ABBE REFRACTOMETERS (Standard accessory only 589nm)
 - for DR-M2/DR-M4

589(D)nm	Parts No. RE-3520	546(e)nm	Parts No. RE-3523
486(F)nm	Parts No. RE-3521	480(F)nm	Parts No. RE-3524
656(C)nm	Parts No. RE-3522	644(C)nm	Parts No. RE-3525
Any wavelength Parts No. RE-3526 (450 to 539nm, 540 to 680nm, 681 to 799nm, 800 to 1100nm)			
 - for DR-M2/1550, DR-M4/1550

589(D)nm	Parts No. RE-16501	546(e)nm	Parts No. RE-16504
486(F)nm	Parts No. RE-16502	480(F)nm	Parts No. RE-16505
656(C)nm	Parts No. RE-16503	644(C)nm	Parts No. RE-16506
Any wavelength Parts No. RE-16507 (450 to 539nm, 540 to 680nm, 681 to 799nm, 800 to 1550nm)			
- Near-infrared Ray Viewer for MULTI-WAVELENGTH ABBE REFRACTOMETERS
 - Near-infrared Ray Viewer (With Adapter) Parts No. RE-9119

Measurement of Birefringent Samples

Measurement of birefringent (double refraction) materials requires an optional Polarizing Eyepiece (Part No. RE-1146). Double refraction measurements are available at wavelengths between 450 and 680nm. Contact us for more details.

Special Order Option

The sample stage height can be customized.



All ATAGO refractometers are designed and manufactured in Japan.

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HACCP GMP GLP

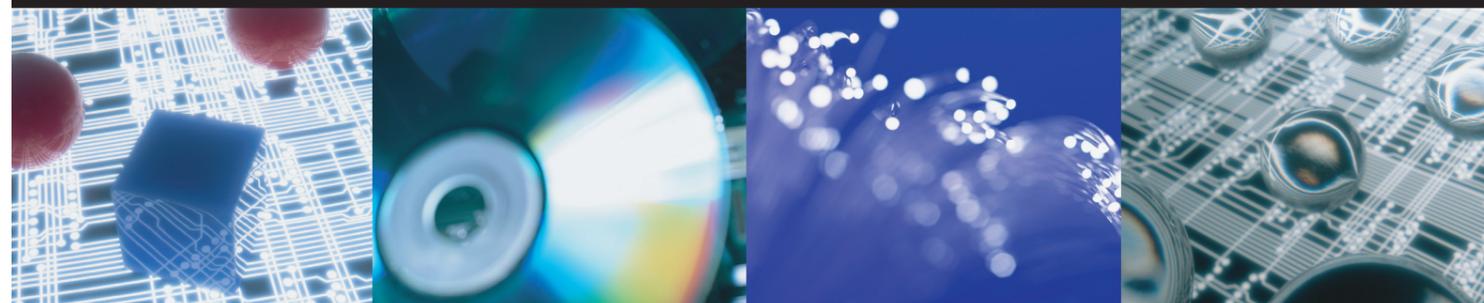
ATAGO products comply with HACCP, GMP, and GLP system standards.

* Specifications and appearance are subject to change without notice.

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ABBE REFRACTOMETERS



Abbe Refractometers

- ▶ Page 2 **DR-A1 <DIGITAL>**
- DR-A1-Plus <DIGITAL>**
- ▶ Page 3 **NAR-1T LIQUID**
- NAR-1T SOLID**
- NAR-2T <HIGH TEMPERATURE MODEL>**
- ▶ Page 4 **NAR-3T <PRECISION MODEL>**
- NAR-4T <HIGH REFRACTIVE INDEX MODEL>**

Multi-Wavelength Abbe Refractometers

- ▶ Page 5 **DR-M2**
- DR-M4**
- ▶ Page 6 **DR-M2 / 1550**
- DR-M4 / 1550**



ATAGO®

■ Uses and Applications of the Abbe Refractometers

ATAGO's Abbe Refractometers are widely used in a variety of fields; from basic research to product management.

Uses and Applications

For measuring the refractive index (nD) of liquid samples between 5 to 50°C:	DR-A1, DR-A1-Plus, and NAR-1T LIQUID. We recommend the NAR-3T for high-accuracy measurements.
For measuring the refractive index (nD) of liquid samples up to 120°C:	NAR-2T
For measuring the refractive index (nD) of solid samples (glass, plastics, films, etc.):	NAR-1T SOLID, DR-A1, and DR-A1-Plus. The NAR-3T is also capable of measuring clear, translucent glass or plastics.
For measuring liquid or solid samples with a high refractive index (1.47 to 1.87):	NAR-4T
For measuring and determining the refractive index or Abbe number of liquid or solid samples at different wavelengths:	DR-M Series: DR-M2, DR-M2/1550, DR-M4, and DR-M4/1550 (For high refractive index measurements.)
For determining average dispersion values or abbe numbers:	NAR-1T SOLID, NAR-2T, and NAR-3T
For measuring Brix (%):	DR-A1, DR-A1-Plus, and NAR-1T LIQUID. We recommend the NAR-3T for high-accuracy measurements.
For connecting to a printer:	DR-A1, DR-A1-Plus, and DR-M Series
For measuring birefringent (double refraction) samples (plastics, films) that have different refractive indices depending on their orientation, or for measuring the ordinary ray (n subscript null) or extraordinary ray (n subscript exponential) of liquid crystals (LCs):	DR-A1, DR-A1-Plus, NAR-1T SOLID, NAR-2T, NAR-4T, and DR-M Series

■ ATAGO Products Conform to ASTM Standards

Please contact ATAGO for further details.

- D542 STM for Index of Refraction of Transparent Organic Plastics
- D1045 STM for Sampling and Testing Plasticizers Used in Plastics
- D1218 STM for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids
- D1416 STM for Rubber from Synthetic Sources--Chemical Analysis
- D1747 STM for Refractive Index of Viscous Materials
- D3321 STM for Use of the Refractometer for Field Test Determination of the Freezing Point of Aqueous Engine Coolants
- D4095 STM for Use of the Refractometer for Determining Nonvolatile Matter (Total Solids) in Floor Polishes
- D5006 STM for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels
- D5775 STM for Rubber from Synthetic Sources-Bound Styrene in SBR

■ Sucrose Solution (for Brix confirmation)

Sucrose solutions for Brix confirmation are now available by ATAGO. Please choose the most suitable sucrose solution for your application.



Part No.	Part Name	Brix Concentration	Contents
RE-110010	10% Sucrose	10.00 ±0.03%	Approx. 5mL
RE-110020	20% Sucrose	20.00 ±0.03%	Approx. 5mL
RE-110030	30% Sucrose	30.00 ±0.03%	Approx. 5mL
RE-110040	40% Sucrose	40.00 ±0.04%	Approx. 5mL
RE-110050	50% Sucrose	50.00 ±0.05%	Approx. 5mL
RE-110060	60% Sucrose	60.00 ±0.05%	Approx. 5mL

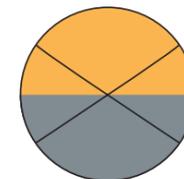
* Warranty period for these solutions is 6 weeks.

Custom concentration sucrose solutions are now available. Accuracy and price will depend on the concentration; please contact ATAGO for more details.

DIGITAL ABBE REFRACTOMETERS

DR-A1

Cat.No.1310



Refraction view



Display

By simply aligning the boundary line of refraction at the cross hairs, this refractometer directly indicates a measurement value (in refractive index or Brix (%), selectable) together with the temperature on a digital display. This refractometer enables anyone to easily carry out measurements without reading analog graduation.

*Dispersion value cannot be measured with the DR-A1.

Choosing the Right Model for Your Sample Type

DR-A1

Stews
Ketchup
Curry
Salsa
Vinaigrettes
Opaque samples with undissolved solids

DR-A1-Plus

Milk
Yogurt
Puree
Grape juice
Soy sauce
Clear samples
Opaque samples with no undissolved solids

DR-A1-Plus

for Opaque Samples

Cat.No.1311



With the new prism, the field of view is brighter than the predecessor model (DR-A1), making it easier to measure inhomogeneous/opaque samples.

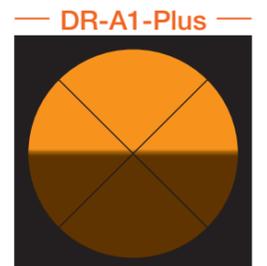
Common Specifications (DR-A1/DR-A1-Plus)

Measurement Range	Refractive Index (nD) 1.3000 to 1.7100, Brix 0.0 to 100.0% (ATC is executed at 5 to 50°C)
Resolution	Refractive Index (nD) 0.0001, Brix 0.1%
Measurement accuracy	Refractive Index (nD) ±0.0002, Brix ±0.1%
Measurement temperature	5 to 50°C (Circulating constant temperature bath range, as well as Brix temperature compensation range.)
Thermometer accuracy	±0.2°C
Ambient temperature	5 to 40°C
Indications	Refractive Index (nD), Brix (%), Temp (°C)
Display	LCD
Light source	LED Lamp (Approximating to wavelength of D-line)
Power supply	AC adapter (100 to 240V (50/60Hz) AC input)
Power consumption	16VA
Output	Printer DP-63(C) (Optional) PC (via RS-232C)
Dimensions and weight	13x29x31cm, 6.0kg (Main unit) 10.5x17.5x4cm, 0.7kg (AC adapter)

For Measuring Emulsions or Dark Samples



The DR-A1 has a slightly dimmer field of view, which makes it difficult to measure emulsions or dark samples.



The DR-A1-Plus features a brighter field of view, making it easier to measure dark, opaque samples.

*Samples containing undissolved solids may not produce measurement results.

NAR-1T LIQUID

For Measuring Liquid Samples Only Cat.No.1211

NAR-1T SOLID

For Measuring Solid Samples Cat.No.1212



The NAR-1T LIQUID is for liquid sample measurement only. This model has the Refractive Index scale and Brix scale, and operates with D line (589nm) light source. Calibration is performed using distilled water.

The NAR-1T SOLID Abbe Refractometer was designed for solid sample measurement (this model can also measure liquid samples). This model has the Refractive Index scale and Brix scale, and operates with D line (589nm) light source.

Specifications

Measurement Range	Refractive Index (nD) 1.3000 to 1.7000, Brix 0.0 to 95.0%
Minimum scale	Refractive Index (nD) 0.001, Brix 0.5%
Measurement accuracy	Refractive Index (nD) ±0.0002, Brix ±0.1%
Average dispersion value	nF-nC (to be calculated according to conversion table)*SOLID only
Measurement temperature	5 to 50°C (Temperature range regulated by circulating constant temperature water bath.)
Thermometer accuracy	±0.2°C
Ambient temperature	5 to 40°C
Light source	LED Lamp (Approximating to wavelength of D-line)
Power supply	AC100 to 240V, 50/60Hz
Power consumption	5VA
Dimensions and weight	13×18×23cm, 2.5kg (Main unit) 10×11×7cm, 0.5kg (Thermometer)

NAR-2T

High Temperature Model Cat.No.1220



Designed for use with compounds that require measurement at high temperatures (up to 120°C). Capable of measuring samples from 5 to 120°C, such as substances with a melting point higher than room temperature, or compounds containing substances with a transition temperature below 120°C. Aside from liquid samples, glass, films, plastics and other solid samples can also be measured.

*Optional accessories: Circulating constant temperature bath (up to 60°C). (Pg. 5) For a circulating constant temperature bath above 61°C, please purchase separately (not available through ATAGO).

Specifications

Measurement Range	Refractive Index (nD) 1.3000 to 1.7000, Brix 0.0 to 95.0%
Minimum scale	Refractive Index (nD) 0.001, Brix 0.5%
Measurement accuracy	Refractive Index (nD) ±0.0002, Brix ±0.1%
Average dispersion value	nF-nC (to be calculated according to conversion table)
Measurement temperature	5 to 120°C (Temperature range regulated by circulating constant temperature water bath.)
Thermometer accuracy	0 to 100°C...±0.2°C, 100 to 120°C...±0.5°C
Ambient temperature	5 to 40°C
Light source	LED Lamp (Approximating to wavelength of D-line)
Power supply	AC100 to 240V, 50/60Hz
Power consumption	5VA
Dimensions and weight	12×20×25cm, 5.8kg (Main unit) 10×11×7cm, 0.5kg (Thermometer)

NAR-3T

Precision Model Cat.No.1230



The NAR-3T is the unit with the highest degree of precision and accuracy among the Abbe Refractometers. It was developed to give improved measurement accuracy and ease of use. This was achieved by making fundamental improvements to the optical system and utilizing a larger scale, which allows for a refractive index scale measurements of up to 0.00005. Incorporating a high intensity lamp and using a double control knob gives quick and more accurate control.

Specifications

Measurement Range	Refractive Index (nD) 1.30000 to 1.71000, Brix 0.00 to 95.00%
Minimum scale	Refractive Index (nD) 0.0002, Brix 0.1%
Measurement accuracy	Refractive Index (nD) ±0.0001, Brix ±0.05%
Average dispersion value	nF-nC (to be calculated according to conversion table)
Measurement temperature	5 to 50°C (Temperature range regulated by circulating constant temperature water bath.)
Thermometer accuracy	±0.2°C
Ambient temperature	5 to 40°C
Light source	LED Lamp (Approximating to wavelength of D-line)
Power supply	AC100 to 240V, 50/60Hz
Power consumption	5VA
Dimensions and weight	12×31×34cm, 9.0kg (Main unit) 10×11×7cm, 0.5kg (Thermometer)

NAR-4T

High Refractive Index Model Cat.No.1240



Research and Development on new materials for modern technologies is being actively conducted in every industry. Many of these materials (especially polymer film and related materials) are of high refractive index - often too high for the existing Abbe refractometers. These can now be measured with the nD 1.4700 to 1.8700 range of the NAR-4T.

*Dispersion values cannot be measured with this unit.

Specifications

Measurement Range	Refractive Index (nD) 1.4700 to 1.8700
Minimum scale	Refractive Index (nD) 0.001
Measurement accuracy	Refractive Index (nD) ±0.0002
Measurement temperature	5 to 50°C (Temperature range regulated by circulating constant temperature water bath.)
Thermometer accuracy	±0.2°C
Ambient temperature	5 to 40°C
Light source	LED Lamp (Approximating to wavelength of D-line)
Power supply	AC100 to 240V, 50/60Hz
Power consumption	5VA
Dimensions and weight	13×18×23cm, 2.5kg (Main unit) 10×11×7cm, 0.5kg (Thermometer)

Custom Refractive Index Ranges Available by Special Order

- NAR-1T • LO Cat.No.1217 Measurement Range: Refractive Index (nD) 1.1500 to 1.4800, Measurement temperature: 5 to 50°C
- NAR-2T • LO Cat.No.1227 Measurement Range: Refractive Index (nD) 1.1500 to 1.4800, Measurement temperature: 5 to 120°C

Note: To obtain the refractive index value, simply refer to the conversion table that is provided with this unit. Dispersion values cannot be measured with this unit.

- NAR-2T • HI Cat.No.1228 Measurement Range: Refractive Index (nD) 1.4700 to 1.8700, Measurement temperature: 5 to 120°C
- NAR-2T • UH Cat.No.1229 Measurement Range: Refractive Index (nD) 1.7000 to 2.0800, Measurement temperature: 5 to 120°C

DR-M2

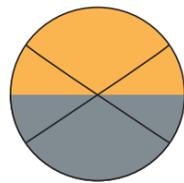
Cat.No.1410

DR-M4

High Refractive Index Model

Cat.No.1414

Customizable wavelength: 1100nm range supported



Refraction view



Display



Refractive Index or Abbe number (vd or ve) can be measured at different wavelengths ranging from 450 to 1,100nm. For measurement at wavelengths ranging from 681 to 1,100nm, the optional near infrared ray viewer (Part No.RE-9119) is required. The DR-M2/DR-M4 digitally displays the measurement results of refractive index or Abbe number on the LCD. Measurement can be achieved by

matching the boundary line at the intersection point of the cross hairs. These refractometers can be connected to the digital printer. The DR-M4 is a high refractive index version of the DR-M2, with a refractive index measurement range of 1.4700 to 1.8700 (at a wavelength of 589nm). The DR-M4 shares common appearance and features with the DR-M2.

Specifications

Measurement Range	Resolution	Refractive Index (nD) 0.0001, Abbe number 0.1
DR-M2	Measurement accuracy	Refractive Index (nD) ±0.0002 (With the attached test piece at 500 to 650nm)
Wavelength 450nm : Refractive Index 1.3278 to 1.7379	Wavelength range	From 450 to 1,100nm
Wavelength 589nm : Refractive Index 1.3000 to 1.7100	Measurement temperature range	5 to 50°C (Temperature range regulated by circulating constant temperature water bath.)
Wavelength 680nm : Refractive Index 1.2912 to 1.7011	Thermometer accuracy	±0.2°C
Wavelength 1,100nm : Refractive Index 1.2743 to 1.6840	Ambient temperature	5 to 40°C
DR-M4	Power consumption	160VA
Wavelength 450nm : Refractive Index 1.5219 to 1.9220	Output	For digital printer, DP-63(B) (optional), Conforming to Centronics standard
Wavelength 589nm : Refractive Index 1.4700 to 1.8700	Power supply	AC100 to 240V, 50/60Hz
Wavelength 680nm : Refractive Index 1.4545 to 1.8544	Dimensions and weight	13×29×31cm, 6.0kg (Main unit)
Wavelength 1,100nm : Refractive Index 1.4260 to 1.8259		15×33×11cm, 3.2kg (Power supply unit)

Optional Accessories

Circulating Constant Temperature Bath 60-C5

Cat.No.1923

A circulating water bath for precise temperature control of refractometers without Peltier. The temperature range can be set from 10 to 60°C and its compact, easy to use design makes it optimal for connecting to a refractometer.



Specifications

Tank capacity	1.0 L
Temperature setting range	10 to 60°C (water)
Minimum temperature indication	0.1°C
Constant-temperature accuracy	±0.2°C
Power consumption	250VA
Power supply	AC 100 to 240V, 50/60Hz
Dimensions and weight	20.4×33.6×28.9cm, 9.0kg (main unit only)

Digital Printer

DP-63(C)

for DR-A1 · DR-A1-Plus

Cat.No.3136

DP-63(B)

for DR-M2 · DR-M4 · DR-M2/1550 · DR-M4/1550

Cat.No.3135



Specifications

Printing method	Thermal dot
Power consumption	13VA
Power supply	AC adapter (Input voltage: AC100 to 240V)
Dimensions and weight	17×16×7cm 580g (main unit only)

DR-M2/1550

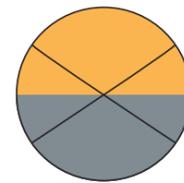
Cat.No.1412

DR-M4/1550

High Refractive Index Model

Cat.No.1415

Customizable wavelength: 1550nm range supported



Refraction view



Display



Refractive Index or Abbe number (vd or ve) can be measured at different wavelengths ranging from 450 to 1,550nm. Measurement at wavelengths of 1550nm has become more in demand with the recent development of materials for the IT communications field. The DR-M2/1550 and the DR-M4/1550 are suitable for measuring samples that require a refractive index in the near infrared range, such as fiber optics materials, optical glass, and plastics. These models are equipped with a power supply unit and a monochromatic light

source. They can be used with a near infrared ray viewer or interference filters. These refractometers digitally display the measurement result on the LCD. Measurement can be achieved by matching the boundary line at the intersection point of the cross hairs. These units can be connected to the digital printer. The DR-M4/1550 is a high refractive index version of the DR-M2/1550, with a refractive index measurement range of 1.4700 to 1.8700 (at a wavelength of 589nm). The DR-M4/1550 shares common appearance and features with the DR-M2/1550.

Specifications

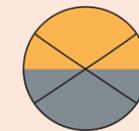
Measurement Range	Resolution	Refractive Index (nD) 0.0001, Abbe number 0.1
DR-M2/1550	Measurement accuracy	Refractive Index (nD) ±0.0002 (with the attached test piece at 500 to 650nm)
Wavelength 450nm : Refractive Index 1.3278 to 1.7379	Wavelength range	From 450 to 1,550nm
Wavelength 589nm : Refractive Index 1.3000 to 1.7100	Measurement temperature range	5 to 50°C (Temperature range regulated by circulating constant temperature water bath.)
Wavelength 680nm : Refractive Index 1.2912 to 1.7011	Thermometer accuracy	±0.2°C
Wavelength 1,100nm : Refractive Index 1.2743 to 1.6840	Ambient temperature	5 to 40°C
Wavelength 1,550nm : Refractive Index 1.2662 to 1.6759	Power consumption	160VA (Refractometer), 240VA (Monochromatic Light source)
DR-M4/1550	Output	For digital printer, DP-63(B) (optional), Conforming to Centronics standard
Wavelength 450nm : Refractive Index 1.5167 to 1.9166	Power supply	AC100 to 240V, 50/60Hz
Wavelength 589nm : Refractive Index 1.4700 to 1.8700	Dimensions and weight	13×29×31cm, 6.0kg (Main unit)
Wavelength 680nm : Refractive Index 1.4559 to 1.8557		15×33×11cm, 3.2kg (Power supply unit)
Wavelength 1,100nm : Refractive Index 1.4298 to 1.8296		22×30×20 to 30cm, 5.2kg (Light source)
Wavelength 1,550nm : Refractive Index 1.4211 to 1.8209		

Abbe number can be measured simply! (In the case of measurement of Abbe number "vd")

- Set the sample on the prism surface.
- Insert the 589nm interference filter (attached to the DR-M2 as a standard accessory). While looking through the eyepiece, match the boundary line with the intersection point of the cross hairs. Then, press the SET key.

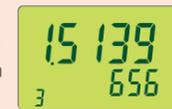


Display



Refraction view

- Replace the interference filter with the 486nm interference filter (an optional part). While looking through the eyepiece, match the boundary line with the intersection point of the cross hairs. Then, press the SET key.
- Replace the interference filter with the 656nm interference filter (of an optional part). While looking through the eyepiece, match the boundary line with the intersection point of the cross hairs.
- Press the SET key. The indication on the display at that time represents the Abbe number "vd".



* For optimum convenience, use an optional digital printer to print out the refractive index at each wavelength and Abbe number.