

Automatic Potentiometric Titrator

Karl Fischer Moisture Titrator

Density/Specific Gravity Meter

► **Refractometer**

EMS Viscometer

Gas Volume Analyzer

Alcohol Meter

Thermal Measuring Instrument

# ***Refractometer***

## ***RA-620/-600***

**Touchscreen operation**

**Low profile of 192 x 281mm (under A4 size)**

**Comes with KEM Refractive Index Standard Liquid**

**Ready to use out-of-the-box**

**Short warm-up time**

**Customizable display and sounds**

**Easy operation & maintenance-free**

ASTM : D1218

D1569

D1992

D2140

D4056

D4095

ICUMSA : GS4/3-13

SPS-3

ISO : 1743

OIML : R124



KYOTO ELECTRONICS  
MANUFACTURING CO., LTD.

# Refractometer

## RA-620/-600

### Why Choose Our Refractometers?

#### 1 World-class Accuracy<sup>\*1</sup>

Refractive Index :  $\pm 0.00002$  nD

(Repeatability :  $\pm 0.00001$  nD)

(Testing performed under KEM's strict conditions)

Brix :  $\pm 0.014\%$

(Calculated based on the accuracy of the refractive index)

#### 2 Compact Size Benchtop Refractometer (With Built-in Temperature Control)

Space-saving profile, taking up less bench space than a sheet of A4 paper, coming in at 192 x 281mm (2/3 the size of our previous model).

With aluminium die cast housing, it is half the weight of our previous model.

Great even for labs with limited space!

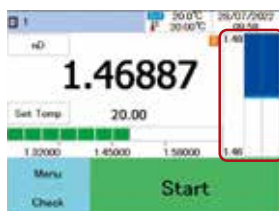
#### 3 Comes with Refractive Index Standard Liquid (Pure Water)

KEM also provides standard liquids that are produced in-house by our accredited laboratory.

Our standard is used to evaluate instrument reliability with confidence.

#### 4 Image of Critical Angle

An image of the Abbe measurement scale can be viewed on the right side of the display. It provides a visual indication of the detection point of the refractive index. Samples such as unclear, colloidal substances may result in a relatively uneven border line indicating a variation in results.



Fresh olive oil  
(The border line is clear)



Used olive oil  
(The border line is unclear)

<sup>\*1</sup> : RA-620





## Features

### ■ 4.7-inch TFT Colour LCD Touch Screen



Normal Mode



Simple Mode

Information presented in an easy-to-view format. Straightforward operation via the touch screen. Display colours can be changed.

### ■ Sample Cover Fitted with Anti-volatilization Cap



#### Anti-volatilization Cap

Fitted to the underside of the sample cover to prevent sample liquid volatilization.

#### Splash Protection

When opened, the sample cover shields the LCD screen from splashes.

#### Safe Measurement

The Start function is disabled while the sample container is open.

### ■ Wide Temperature Control Range

Temperature control range :

RA-620 : 5 - 75°C (41 - 167°F)

RA-600 : 5 - 75°C (41 - 167°F) / 5 - 100°C (41 - 212°F)(Option)

Suitable for measurement of high-melting-point petroleum or oil and fat.  
(Lower limit subject to ambient temperatures.)

### ■ Easy-to-clean Sample Stage



The sample stage is located towards the front of the device for easy access and its shape has been improved making it easy to wipe off sample material.

### ■ Calibration Navigator



Convenient and easy-to-follow navigator for calibration.

### ■ Indicator



Concentration range can visually be recognized.

### ■ Equipped with USB Port



For data save and transfer to PC.  
(Saved as a CSV file)

### ■ LAN & Browser Controls

Easy connection to PC with LAN.

Control and data transfer possible through browser in your PC.

No special software required.

### ■ Conversion to Concentration

Up to 100 conversion tables can be stored.

## Application



### Food & Beverages

### To check Brix.

- |  |   |  |  |
|--|---|--|--|
| <ul style="list-style-type: none"> <li>▪ Honey</li> <li>▪ Starch syrup</li> <li>▪ Liquid sugar</li> <li>▪ Isomerized sugar</li> <li>▪ Glucose</li> <li>▪ Sweeteners</li> <li>▪ Beet sugar</li> <li>▪ Jam, marmalade</li> <li>▪ Fat &amp; oil</li> <li>▪ Cooking oil</li> <li>▪ Cottonseed oil</li> <li>▪ Sesame oil</li> </ul> | <ul style="list-style-type: none"> <li>▪ Canola oil</li> <li>▪ Olive oil</li> <li>▪ Palm oil</li> <li>▪ Coconut oil</li> <li>▪ Condiments &amp; seasonings</li> <li>▪ Ketchup</li> <li>▪ Vinegar</li> <li>▪ Purée</li> <li>▪ Soy sauce</li> <li>▪ Alcoholic drinks</li> <li>▪ Beer</li> <li>▪ Wine</li> </ul> | <ul style="list-style-type: none"> <li>▪ Japanese sake (rice wine)</li> <li>▪ Whisky</li> <li>▪ Soft drinks</li> <li>▪ Carbonated drinks</li> <li>▪ Fruit drinks</li> <li>▪ Coffee drinks</li> <li>▪ English tea</li> <li>▪ Milk</li> <li>▪ Soy milk</li> <li>▪ Lactic acid drinks</li> <li>▪ Fruits</li> <li>▪ Oranges</li> </ul> | <ul style="list-style-type: none"> <li>▪ Grapes</li> <li>▪ Pears</li> <li>▪ Watermelons</li> <li>▪ Melons</li> <li>▪ Lemons</li> <li>▪ Apples</li> <li>▪ Grapefruit</li> <li>▪ Pineapples</li> <li>▪ Peaches</li> <li>▪ Limes</li> <li>▪ Tomatoes</li> </ul> |
|--|---|--|--|

### Standards

ICUMSA : GS4/3-13  
SPS-3  
ISO : 1743  
OIML : R124



### Petroleum, Chemicals

### To check concentration.

- |  |  |   |   |
|--|--|---|---|
| <ul style="list-style-type: none"> <li>▪ Light oil</li> <li>▪ Kerosene</li> <li>▪ Gasoline</li> <li>▪ Cyclohexane</li> <li>▪ Styrene</li> <li>▪ Benzene</li> </ul> | <ul style="list-style-type: none"> <li>▪ Toluene</li> <li>▪ Xylene</li> <li>▪ Quenching oils</li> <li>▪ Cutting oils (cutting fluids)</li> <li>▪ Lubricants</li> <li>▪ Water-soluble lubricants</li> </ul> | <ul style="list-style-type: none"> <li>▪ Insulating oils</li> <li>▪ Water-soluble hydraulic oils</li> <li>▪ Water-soluble metal working oils</li> <li>▪ Rust preventive oils</li> <li>▪ Antifreeze</li> </ul> | <ul style="list-style-type: none"> <li>▪ Ethylene glycol</li> <li>▪ Propylene glycol</li> <li>▪ Surfactants</li> <li>▪ Water-soluble quenching oils</li> <li>▪ Electronic components</li> </ul> |
|--|--|---|---|

### Standards

ASTM: D1218  
D1569  
D1992  
D2140  
D4056  
D4095



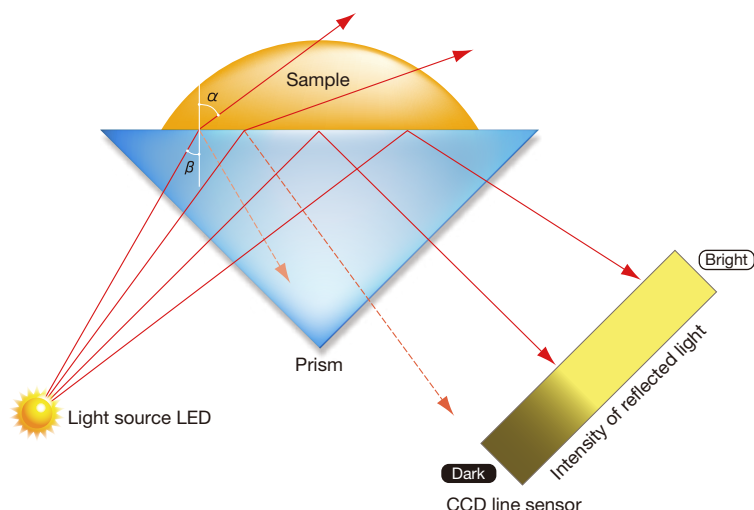
### Pharmaceuticals, Flavours & Fragrances, Cosmetics

### To check concentration.

- |  |   |  |   |   |
|--|---|--|---|---|
| <ul style="list-style-type: none"> <li>▪ Injection solutions</li> <li>▪ Chinese herbal remedies</li> <li>▪ Eyedrops</li> <li>▪ Toiletries</li> </ul> | <ul style="list-style-type: none"> <li>▪ Shampoos</li> <li>▪ Hair conditioners</li> <li>▪ Detergents</li> <li>▪ Skin toner</li> </ul> | <ul style="list-style-type: none"> <li>▪ Hair tonic</li> <li>▪ Medicines</li> <li>▪ Serum</li> </ul> | <ul style="list-style-type: none"> <li>▪ Urine</li> <li>▪ Ascites</li> <li>▪ Bodily fluids</li> </ul> | <ul style="list-style-type: none"> <li>▪ Disinfectants</li> <li>▪ Ethyl alcohol</li> <li>▪ Hydrogen peroxide</li> </ul> |
|--|---|--|---|---|

## Refractive Index Measurement Principle

The direction of a beam of light changes as it passes through mediums of differing refractive index (RI). Snell's law teaches us that the ratio of the angle of incidence (in this diagram, " $\beta$ ") and the angle of refraction (in this diagram, " $\alpha$ ") is equal to the ratio of the refractive indices of the two media. When the angle of refraction  $\alpha$  surpasses the critical angle ( $90^\circ$ ), total internal reflection will occur. The internal structure of our refractometers is represented in the figure to the right, showing the location of the light source, the prism ( $n_D=1.768$ ) and the CCD line sensor. The intensity of light reflected by the sample is detected along the CCD line sensor. The CCD address data generated at the boundary of the "dark" and "light" area of the sensor is used to determine the critical angle, which in turn is used to determine the refractive index.



## Operation Guide & Tips


1

### Make sure to properly wipe the sample stage and prism clean.

 Traces of remaining sample and/or foreign materials will affect measurement accuracy.

2


### Add a sufficient amount of sample to cover the prism properly.

 The minimum volume of sample required is approx. 0.2mL. Some samples may be immeasurable at too small a volume, so add sufficient sample for correct measurement. Keep in mind though, that adding too much will cause temperature stabilization time to increase.



3


### Make sure the sample cover is closed.

 Properly closing the sample cover prevents external light from interfering with measurement.



4

### Press “Start”

 The Start button is located in the bottom-right of the touchscreen display.



5

### “Measuring...” message

“Measuring...” will be displayed during measurement and the green “Start” button will turn into the yellow “Reset” button, for use if you want to stop measurement.



6

### Display of the measurement result

When measurement is completed, the result will be displayed. You should then immediately wipe off the sample from the sample stage and prism. If left for too long, it may become difficult to clean.





## FAQ

- 1 **Q What amount of sample is required for measurement?**  
**A** At least 0.2mL of sample is required.
- 2 **Q What should I do after measurement?**  
**A** If the sample is an aqueous solution, wipe it off with water and ethanol using tissues or a soft cloth.  
 If the sample is an organic solvent such as toluene, wipe it off with ethanol or acetone.
- 3 **Q Are there any consumables?**  
**A** Consumables consist of printer accessories (optional), filters and refractive index liquid standards (see page 7 for more details).
- 4 **Q How can I confirm measurement accuracy?**  
**A** We recommend that our Refractive Index Standard Liquids be used to check the accuracy.
- 5 **Q What materials are used to make the prism and sample stage?**  
**A** The prism is made from artificial sapphire and the sample stage is made from stainless steel.

## Optional Accessories & Reagents



### Sampler

#### Auto Clean and Sampling Unit DCU-551N

- Precision sampling & sample retrieval option for reuse of precious samples (e.g. flavors, fragrances etc.)
- Automatic measurement of a single sample in a 20mL vial.
- Viscosity up to 50,000mPa · s.
- Flow cell unit 12-03018\*, Connection cables 12-02012 & 64-00625 required.



#### Multiple Sample Changer CHD-502N

- Automatically cleans and dries prism and connecting tubes.
- Measurement of up to 30 samples in 20mL vials.
- Viscosity up to 50,000mPa · s.
- Flow cell unit 12-03018\*, Connection cables 12-02012 & 64-00625 required.



\* Contact your distributor in advance if your samples are highly viscous



### Printer

#### Thermal Printer (DP-600) Dot Matrix Printer (IDP-100) with Connection Cable 12-02618-0X



### Software

#### Data Acquisition Software SOFT-CAP

- Data transfer to PC in CSV format
- Connecting cables 12-02012 & 64-00625 required



### Cover for volatile samples

#### Measurement cell cover

- For volatile samples such as gasoline

Measurement date for acetone at 20°C

	With measurement cell cover	Without measurement cell cover
	nD	nD
n1	1.36432	1.36286
n2	1.36432	1.36300
n3	1.36431	1.36301
n4	1.36431	1.36321
n5	1.36431	1.36286
AVE	1.36431	1.36299
SD	0.001%	0.014%
RSD	0.000%	0.011%





## JCSS-accredited Refractive Index Standard Liquids

### Produced in-house by our accredited laboratory

Part number	Part Description	nD at 20°C	mL/bottle	Remarks
12-01610-01	Water/2 bottles (JCSSL Certif.)	1.33299	10	2 bottles/ set
12-04077-01	Iso-Octane/Water/ea. 1 bottle (JCSSL Certif.)*1	1.391**	10	Pure Water & Isooctane 1 bottle each
12-04078-01	Cyclohexane/Water/ea.1 bottle (JCSSL Certif.)*1	1.426**	10	Pure Water & Cyclohexane 1 bottle each
12-04080-01	Dichlorotoluene/Water/ea. 1 bottle (JCSSL Certif.)	1.546**	10	Pure Water & Dichlorotoluene 1 bottle each
12-04082-01	1-Bromonaphtalene/Water/ea. 1 bottle (JCSSL Certif.)*2	1.658**	10	Pure Water & 1-Bromonaphtalene 1 bottle each

The shelf life of the above listed standards is 12 months from the calibration date

\*1 These items are categorized as hazardous for the purpose of exportation. They require additional charges for packing and transportation.

\*2 1-Bromonaphtalene is out of the measurement range for RA-620



## Brix-converted Refractive Index Standard Liquids

### Produced in-house by our accredited laboratory

Part number	Part Description	Brix% nD at 20°C	mL/bottle	Remarks
12-04083-30	5% Brix Solution/2 bottles	5.** Brix% 1.340**	10	Equivalent to 5% Brix% 2 bottles/ set
12-04083-31	10% Brix Solution/2 bottles	10.** Brix% 1.347**	10	Equivalent to 10% Brix% 2 bottles/ set

The shelf life of 12-04083-30 and 12-04083-31 is one month from the calibration date



## Recommend Consumables and Parts

Part number	Part Description	Qty	Remarks
12-04260	Printing Roll RP5860 4rolls Set (for IDP-100)	1 set	For Dot Matrix Printer (IDP-100)
69-00719	Ribbon Cartridge IR-91B Black (for IDP-100)	1 pc	For Dot Matrix Printer (IDP-100)
12-04261	Ribbon Cartridge IR-91B Black (5pcs/set) (for IDP-100)	1 set	For Dot Matrix Printer (IDP-100)
69-00522-11	Thermal Roll Paper STH-215 (10 rolls)	1 set	For Thermal Printer (DP-600)
12-03678	Filter Set (5sheets)	1 set	5 filters/ set



## Package Contents

Part number	Part Description	Qty	Remarks
RA-600 or RA-620	Main Unit	1 unit	
_*1	AC Adapter Type2	1 pc	
69-00444	Touch Pen	1 pc	
-	Water/2 bottles	1 set	Refractive Index Standard Liquid (2 bottles/ set)
12-02918	RA-600 Series Operation Manual (CD-ROM)	1 pc	Incl. Operation Manual, Function Description, Operation Manual for RS-232C, Quick Manual, CE Declaration of conformity, etc.
59-00035-01	RA-600 Series Quick Manual	1 copy	
59-00405	Safety Instructions	1 copy	
20-05627	Inspection Certificate/Warranty	1 copy	
50-00761	Contact	1 copy	
59-00133	Package Contents List	1 copy	

\*1 Varies by power supply requirement.

		RA-620	RA-600
Measurement Method		Detection of Critical Angle of Optical Refraction	
Light Source		LED Na-D Line (589.3nm)	
Items of Measurement		Refractive Index, Brix, Other Concentrations	
Measurement Range	Refractive Index (nD)	1.32000 - 1.58000	1.3200 - 1.7000
	Brix	0.00 - 100.00%	
Accuracy <sup>*1</sup>	Refractive Index (nD)	±0.00002	±0.0001 <sup>*2</sup>
	Brix	±0.014% <sup>*3</sup> (0 - 85.0%)	±0.1%
Repeatability <sup>*4</sup>	Refractive Index (nD)	±0.00001	±0.0001
	Brix	±0.007% (<5%) ±0.01% (≥5%)	±0.1%
Resolution	Refractive Index (nD)	0.00001	0.0001
	Brix	0.001% (<5%) 0.01% (≥5%)	0.1%
Temperature Control <sup>*5*6</sup>		5 - 75°C (41 - 167°F)	5 - 75°C (41 - 167°F) 5 - 100°C (41 - 212°F) (Option) <sup>*7</sup>
Temperature Indication Resolution		0.01°C (0.02°F)	0.1°C (0.2°F)
Minimum Amount of Sample		0.2mL	
Display		4.7-inch colour TFT LCD	
Operation		Touchscreen (Comes with Stylus.)	
Security		Password Protection	
Data Storage	Number of Methods	100 methods	
	Measurement Results	300 data	
	Calibration Record	20 data	
	Check Record	20 data	
	External Storage	USB Flash Drive	
Temp. Compensation	Brix	5.00 - 75.00°C (41.00 - 167.00°F) (Automatic compensation by preprogrammed conversion table.)	
Concentration	By Conversion Table	100 data	
Interfaces	LAN	x 1; Personal computer (PC)	
	USB1.1	x 2; USB flash drive, keyboard, barcode reader, Epson inkjet printer <sup>*8</sup> , Thermal Printer (DP-600)	
	RS-232C	x 2; Dot Matrix Printer (IDP-100), Auto Clean and Sampling Unit (DCU-551N), Multiple Sample Changer (CHD-502N)	
Ambient Conditions	Temperature	5 - 35°C (41 - 95°F) <sup>*7</sup>	
	Humidity	85%RH or below (No condensation allowed.)	
Power Supply		AC 100 - 240V, 50/60Hz (Comes with AC adapter.)	
Power Consumption		20W (max. 50W, min. 10W)	
Dimensions		192 (W) x 281 (D) x 166 (H) mm (7.6 (W) x 11.1 (D) x 6.5 (H) inches)	
Weight		5kg (11.0 lbs)	
Export package size (Double Carton Box)		G/W 9.1kg (20.0 lbs); 560 (W) x 460 (D) x 330 (H)mm (22.0 (W) x 18.1 (D) x 13.0 (H) inches)(May vary in some cases.)	
Materials in Contact with Samples	Prism	Artificial Sapphire	
	Sample Stage	Stainless steel	
Optional Accessories	Printer	Thermal Printer, Dot Matrix Printer	
	Sampling Unit, Changer	DCU-551N, CHD-502N	
	Software	SOFT-CAP (Data acquisition software)	
Expandability	Barcode Reader	Reads sample name, measurement conditions, value of standard liquid	
	Battery	Yes <sup>*9</sup>	

\*1 : As determined under KEM's standard measurement conditions. \*2 : Accuracy is not guaranteed when the set temperature is above 75°C.

\*3 : Calculated from measurement accuracy of refractive index: nD 0.00002 = Brix 0.014%.

\*4 : As determined under KEM's standard measurement conditions. Subject to sample properties. \*5 : Peltier Thermostat. \*6 : Lower limit 12°C below ambient.

\*7 : When the set temperature is 75°C, reduce ambient temperature to 25°C or below. \*8 : Make an inquiry for applicable models. \*9 : Contact your distributor for details.

**KEM KYOTO ELECTRONICS**  
**MANUFACTURING CO., LTD.**  
<https://www.kem.kyoto/en/>

Overseas Division : 2-7-1, Ichigaya-sadohara-cho, Shinjuku-ku  
TOKYO, 162-0842 JAPAN  
Fax : +81-3-3268-5591 Phone : +81-3-5227-3156

Your Distributor