



r²i300

REFRACTOMETER

USER GUIDE

Introduction

Congratulations on the purchase of your new Reichert *r²i300* reflected light refractometer.

This manual describes the proper operation and care of this state of the art instrument. The purpose of this instrument is to aid quality control personnel in food and beverage, pharmaceutical, industrial fluids, chemical and petrochemical applications. The *r²i300*'s simple, yet advanced features, make it a well suited and widely used instrument.

The *r²i300* refractometer is a high precision optical instrument. To obtain the best possible accuracy, it is absolutely necessary to maintain the instrument. The precision and accuracy of a refractive index measurement is largely dependent upon operator skill, cleaning practices, temperature control, accuracy of calibration standards, chemical stability and the physical characteristics of the sample. Use of good laboratory practice is essential. Reichert recommends that daily calibration with distilled water be performed as a minimum requirement. To assure the longest life of your *r²i300*, always store the instrument with the prism surfaces and instrument clean and dry to prevent premature failure of the prisms and seals due to any harmful effects from sample residue.

The instrument is programmed to read out directly the refractive Index, percent solids and the temperature of samples. The percent solids scale is based upon the ICUMSA conversion tables relating refractive index to percent solids concentration for sucrose solutions. For non-sucrose solutions, they may be read directly in the refractive index mode (non-temperature corrected), or in the percent solids mode provided that the conversion value is known.

For product specific measurement, custom channels also may be programmed into the *r²i300*. Custom channels allow the instrument to read out directly in refractive index or percent solids temperature compensated values. For more information regarding custom channel programming, contact Reichert Analytical Instruments Technical Service.

Product Registration

Please visit our web site at www.reichert.com to register your new Refractometer. Click on Analytical Instruments, Support, Register your Reichert product.

In doing so Reichert Analytical Instruments will be able to provide you with technical support and information updates as they become available.



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Warnings and Cautions

Caution: In order to insure that correct operation of the *r2i300* instrument is maintained, any repair or service must be performed by experienced personnel that are trained by Reichert Inc.

Caution ESDS: The internal circuitry of the *r2i300* contains electrostatic discharge sensitive devices (ESDS). Such components may be sensitive to high voltages produced by static discharge.

Caution: Do not use strong solvents or strong cleaning solutions on any part of the *r2i300* or damage to the unit may occur.

Warning: Do not remove or defeat the earth ground connection on the *r2i300* power input connector or the unit's power cord. Damage to the *r2i300* instrument and/or injury to the operator may occur.

Warning: The *r2i300* should be used in strict accordance with the instructions outlined in this users guide. The safety of the operator and the performance of the instrument cannot be guaranteed if used in a manner not specified by Reichert Inc.

Symbol Information

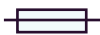
The following symbols may appear on the instrument.



CAUTION: Risk of Electrical Shock



CAUTION: Indicates that important operating and maintenance instructions are included in this user guide



CAUTION: Replace with the same type and rating fuse



Date of Manufacture



Waste of Electrical and Electronic Equipment

SN

Serial Number

[REF]

Catalog Number



Ground



On - Off



Conformity with mandatory European safety requirements

Environmental Conditions

- Indoor use only
- Operating temperature Range: 10°C – 45°C
- Maximum Relative Humidity: 80% for temperatures to 31°C decreasing linearly to 50% (relative humidity at 40°C)
- Pollution Degree 2
- Altitude up to 2,000 meters

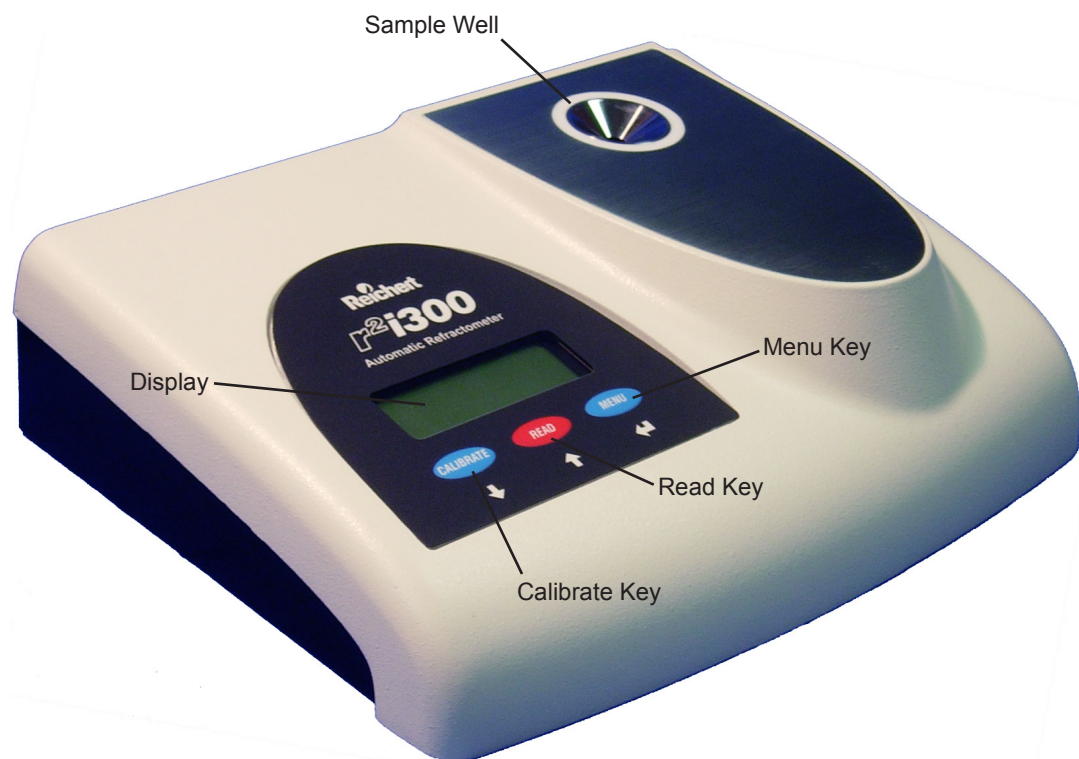
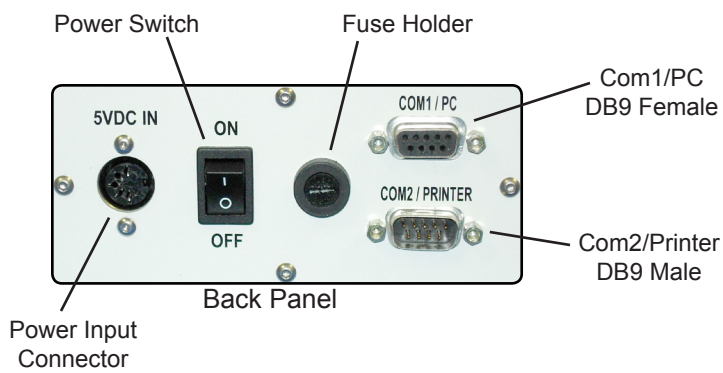
Electrical Ratings/Specifications

The Reichert *r²i300* refractometer incorporates an auto sensing, switching AC power supply. Never use an adapter between the power cord and the power source which will interrupt the protective grounding of the instrument.



- Caution: Risk of electrical shock exists if any cover of the *r²i300* is or its power supply is removed. Hazardous voltages will be exposed which can cause injury or death. Refer service to a Reichert trained service technician.
- Supply Voltage: 100 - 240VAC 47/63HZ, 1.35A.
- Power Output: 40W max.
- Fuse Rating: 500mA, 250V, 5 x 20mm quick acting.
- Power Cords: US, EU, UK supplied.
- Dimensions: 12" L x 8.75" W x 3.25" H (30.9cm x 22.5cm x 8.4cm).
- Net Weight: 7.0 pounds (3.18 Kg).
- Display: LCD, 2.9"W x .9"H (73.6 mm x 22.9 mm).
- Illumination: 589 nm LED.
- Prism Assembly: Glass prism sealed with solvent resistant epoxy to stainless steel well.
- Range, Channel 1: 1.3320 - 1.5600 nD; 0 to 95% Brix per ICUMSA.
- Channel Options: Channel 1 Refractive Index, Brix per ICUMSA.
- Channel 2 - 8 User Defined (Numerous scales provided)
- Temperature Compensation Range: 15° – 40°C
- Sample Types: Homogenous transparent, translucent and opaque liquid and paste.
- Data Input/Output: Two 9 pin RS232 serial ports.
- Software Interface CD Included.
- Custom Channel CD Included with 32 custom channels.
- Serial Cable: Included.

Intrument Features



Calibration Oil

Set Up

- Unpack the instrument from shipping carton. Retain packing material for future storage/protection/shipping.
- Note the following accessories:
 - User Guide
 - PC Interface Software Disk
 - Custom Channel CD
 - Serial Cable
 - Power Supply
 - Calibration Oil



Fig 1

- Place the instrument indoors on a solid surface in an environment where the temperature is stable. Be certain that the instrument is not subjected to direct discharge from heating or air conditioning vents, or water bath circulator exhaust. Drafts can have an adverse affect on temperature stability.
- Insert the appropriate plug end into the power supply and connect the plug from the power supply into the back of the instrument where it is labeled "5 VDC IN" (Fig 1). Supply voltage: 100 - 240VAC 47/63HZ.
- Turn the r^2i300 on by activating the power switch located on the instruments back panel located next to the power input connector (Fig 1).
- Allow the instrument to reach a stable operating temperature in the on position for a minimum of one hour before attempting calibration or to measure samples.

Sample Analysis

Cleanliness, sample quality and sample temperature equilibration are essential to obtain the greatest possible accuracy from the r^2i300 refractometer. Highly viscous samples that may contain trapped air bubbles can adversely affect accuracy. In these cases applying the sample using a rubber spatula or other soft applicator to squeeze out the trapped air is required. The following are the steps to properly analyze samples.

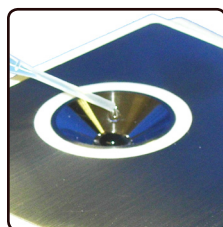
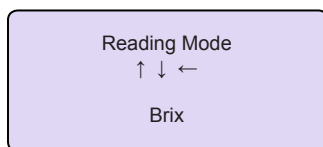


Fig 2

Apply the sample to the measuring surface (Fig 2).

Allow the sample to reach temperature equilibration with the instrument.

Press **READ** and note the displayed value.



To change the reading mode press the **MENU** key and advance to the "Reading Mode" option screen. To enter press **MENU**. Press either **CALIBRATE** or **READ** to advance through the available reading mode options. When the desired reading mode is displayed press **MENU** to accept.

Examples of reading modes are:

- "Brix - TC" = % Solids - Temperature Compensated.
- "Brix" = % Solids.
- "nD" = Refractive Index.
- "nD - TC" = Refractive Index - Temperature Compensated.

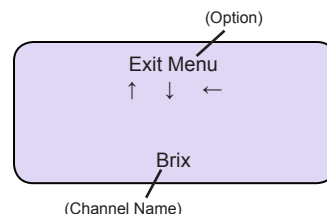
Menu Options Overview

- Exit Menu
- Print Reading Log
- Delete Reading Log
- Calibration
- Contrast
- PC Com Linkup
- Set Clock
- Select Channel
- Reading Mode

Fig 3

Shown in (Fig 3) are the available menu options. While many of these options are not required to operate the instrument, they have been made available to enhance the functionality of the *r²i300* refractometer.

To access the menu options press **MENU** until "Exit Menu" is displayed. Advance to the desired option by pressing **CALIBRATE** or **READ** and press **MENU** to accept and enter those option choices. To exit this screen and return to the reading mode press **MENU**.



Calibration

To properly maintain the accuracy of the *r²i300* refractometer, calibration of the instrument on a routine basis is recommended. Prior to calibration it is extremely important to completely clean the sample well and the measuring surface so no sample residue is present. Any residue on the sample well or the measuring surface will adversely affect the accuracy of the instrument.

Calibration options are either Set Point calibration using distilled water or Multipoint calibration using distilled water and up to four additional calibration standards. While it is not essential to calibrate at every available point. Calibration with distilled water and at least one calibration standard is recommended to ensure accuracy across the entire reading range of the instrument. Calibration standards can be chosen to closely match the reading range of the product being analyzed.

Set Point Calibration

Apply water
CAL = Calibration
MENU = Cancel
Brix

Set point cal
successful
Brix

- Begin by pressing the **CALIBRATE** key.
- Follow the displayed instructions to apply distilled water or press **MENU** to cancel.
- Allow the distilled water to temperature equilibrate to the temperature of the instrument and press **CALIBRATE**.
- Note the displayed result.
- Press **READ** to continue.

Multi Point Calibration

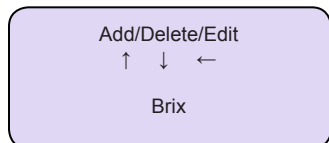
Calibration
↑ ↓ ←
Brix

1.xxxx Cal
successful
Brix

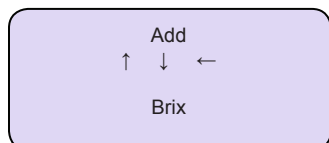
- Access the Calibration Menu by pressing **MENU** and advancing to the Calibration menu by pressing **CALIBRATE** or **READ**. Press **MENU** to accept and enter this option.
- When *Set (Water)* appears press **MENU** and follow the displayed instructions to Apply distilled water. Allow adequate time for the sample to temperature equilibrate and press **CALIBRATE**.
- Clean and dry the sample surface and well and access additional calibration points by repeating above steps.
- When *Set (Water)* appears again press **READ** several times to advance to a desired stored span point value such as 1.51432. Note that this value is given as an example and may not match one of the stored values. Press **MENU** to accept.
- Follow the on screen instructions to apply the 1.51432 standard. Allow standard to equilibrate and press **CALIBRATE**.
- To perform calibration using any additional points follow the procedure outlined above being certain that you always start with the lowest refractive index standard and move up to the highest refractive index standard.
- Clean and dry the prism surfaces before using to read samples.

Add/Delete/Edit Calibration Points

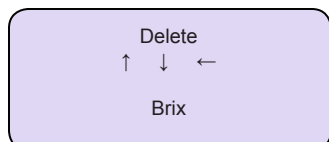
Calibration fluid values may change from one lot to the next. It is also possible to use alternate fluids to calibrate this instrument. As a result, it will become necessary to edit the stored values to match any new calibration standard through the “Calibration” option menu.



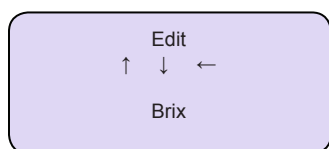
To access these options from the Calibration menu press **READ** to advance to the Add/Delete/Edit option. Press **MENU** to accept and enter the following option choices.



Add - To add a point or turn a stored calibration point into an active point advance to “Add” and press **MENU**. Advance through the available options by pressing **READ**. Once the optional point is identified press **MENU** to accept.



Delete - To delete a point or turn a calibration point into an inactive point advance to “Delete” and press **MENU**. Advance through the available options by pressing **READ**. Once the optional point is identified press **MENU** to accept.



Edit - To edit a point press **READ** until desired point is displayed and press **MENU** to accept. Change values by pressing **CALIBRATE** or **READ** to increase or decrease the value of the highlighted numeral. Once the value is correct press **MENU** menu to accept. Repeat this process until all highlighted values match that of the standard that will be used for calibration.

Sample Temperature Effects on Readings

Refractive Index is a physical property of a material. Refractive index measurements, and the percent solids results derived from them, are very dependent upon temperature. For most samples, raising the temperature will lower the refractive index of a sample. Conversely, lowering the sample temperature will raise the refractive index. This change in refractive index, due to a change in temperature, will cause an apparent change in concentration unless the reading is temperature corrected (TC). Before a sample measurement can be temperature corrected however, the sample needs to reach thermal equilibrium with the instrument. Without temperature equilibration, the resulting value cannot be considered accurate for direct read values or temperature corrected (TC) values. This is the result of the sample being in a state of thermal transition while the refractive index value is captured by the instrument. This is common with all refractometers.

Automatic Temperature Correction (TC)

Automatic Temperature Correction (TC) is based upon three factors, refractive index, temperature and temperature coefficient. The relationship of these three factors are used to mathematically correct a value as though it was read at a specific temperature. The most common temperature corrected (TC) temperature is 20 degrees C but it can differ with individual requirements. The temperature corrected reading modes (TC) in the Mark III, are based upon sucrose temperature correction factors developed by ICUMSA. Non-sucrose solutions will have unique temperature correction factor.

Since most uses of a refractometer is to control concentration, it is useful to eliminate the temperature effects when viewing instrument readings. One standard method is to have programmed custom channels that calculate the correct reading at 20 degrees C for a sample that is being read at other temperatures. The use of a custom channel allows comparing readings to a formula or process specification at a predetermined temperature without doing complicated conversions. Please note, that custom channels to do temperature correction, are specific to the material that the channel was developed for, and most likely will provide poor readings if used for a different material.

Computer Interface

The *r²i300* PC communications package includes a software CD to enable communications with your PC. This software allows downloading of data or uploading of up to 7 custom channels. A second CD is also supplied containing 25 commonly used custom channels that you can upload or download to replace on your *r²i300*.

Requirements:

- PC running Windows 95 or higher with at least a 486/66 MHZ processor, 8 MB RAM and
- Two RS232 serial ports.

Installation:

- Connect the serial cable to the rear of the instrument at COM1/PC and to an appropriate port on your computer. The Com port should be configured to 38.4K BPS to match the instrument.
- Insert Disk into computer drive.
- Open appropriate CD window and click on setup.exe file to begin loading the interface software onto your PC. Follow the displayed instructions to complete the software loading.
- Begin by opening the interface window by clicking on the "PC Com" Icon that will be found under Programs.
- Access the PC Com Linkup option of the instrument through the Menu Options and activate that option.
- To complete the link between instrument and computer click on the "Connect PC Comm" pick found in the open software window. If successful the red light will turn green and the remaining operation picks will become active.
- You are now free to access the options that are present on the open window.

Computer Interface Options

PC Comm Connect/Disconnect - Enables or disables communications between instrument and PC.

Custom Channel - Allows for uploading or removing custom channels from the instrument. This option is covered in greater detail under Uploading and Deleting Custom Channels.

View Calibration - Reveals last calibration record and result.

Download All Reading Log - Downloads complete reading log, 1000 line items, from instrument to a file for later use. Also deletes the internal reading log once download is complete.

Download Last Reading Log - Similar to Above but will only download readings that exist within memory. For example, if only 20 readings have been taken since the last download and deletion of the reading log, only those 20 readings will be downloaded. The internal file will still be cleared once this process is complete.

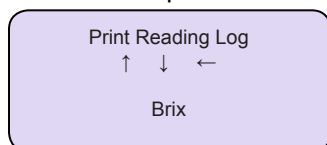
Delete Reading Log - Deletes the internal reading log.

Print Reading Log - Enables the reading log to print as long as the optional printer is connected.

CALIBRATE, READ, MENU BUTTONS - These can be used as they would directly on the instrument.

Printer Interface

- Using the supplied Null modem cable connect the cable to the rear of the printer and the instrument where indicated by COM2/PRINTER on the back panel.
- Connect the power supply to the printer and connect to an appropriate power source.
- Turn printer on by positioning the switch to the ON position, switch is found on left side of printer.
- If the light on the front of the printer is not green, press the ON LINE button on the printer to activate the printer.



- To print, access the “Print Reading Log” option and press **MENU**.
- A formatted reading will be sent through the Com2/Printer port each time **READ** is pressed.

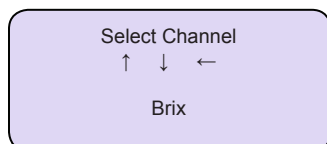
Custom Channels

The *r²i300* has the capabilities to measure additional products using custom channels. These channels represent scales that have been developed to measure a specific product. Optional channels can be selected only after they have been uploaded from a PC to the *r²i300* using the supplied PC interface software. The following describes the *r²i300* custom channel possibilities.

Channel 1 – ICUMSA BRIX

The *r²i300* is pre-programmed at the factory with channel 1 to read % Sucrose or the “Brix” scale per the International Commission for Uniform Methods of Sugar Analysis (ICUMSA). Temperature Corrected (TC) readings in channel 1 are valid for Brix Solutions only! This channel cannot be altered.

Channel 2 – 8, User Programmable



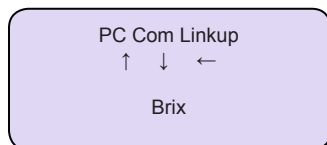
User programmable, or custom channels as they are commonly referred to may be programmed using your own refractive index, temperature and percent solids data. Custom channels can include definitions for units of measure such as specific gravity, % protein, g/ml, etc. Provided a custom channel has been uploaded to the *r²i300*, to access and activate a stored custom channel

advance to the “Select Channel” menu option and press **MENU**. Press **CALIBRATE** or **READ** to advance through the available custom channels and press **MENU** to activate.

To learn more about custom channel programming, request “Custom Channel Generation for Automatic Refractometer Line” from Reichert Analytical technical support.

Uploading Custom Channels

To upload a custom channel, begin by connecting the *r²i300* to a computer as described under Computer Interface and follow the steps below.



- Establish communications between the Computer and the *r²i300*. Press the “PC Com Connect” key found in the Reichert *r²i300* PC Interface window. To complete the link between the instrument and computer advance to the menu option “PC Com Linkup” and press **MENU** to activate. If successful the red light

in the software interface window will turn green and the remaining operation picks will become active.

- In the software interface window click on “Custom Channel”.
- Click on Upload Channel and select a channel location by clicking on one of the available channel locations and click on OK.
- Browse through your directories to locate the desired custom channel file to select it and select open to load file. If successful a message will appear stating “Custom Channel Upload Successful”.

Deleting Custom Channels

- Follow the steps above to establish communications between the instrument and the *r²i300*.
- In the software interface window click on “Download Last Reading Log” and create a txt file where the log will be recorded.
- Once the download is complete and successful click on “Custom Channel”.
- Click on “Delete Channel”, select the channel or channels that are to be deleted and click on Delete to complete the process.

Menu Options

Exit Menu – Pressing **MENU** when this is displayed will exit the menu mode.

Print Reading Log – Provided a printer is connected to the instrument, this feature allows the stored readings to be printed. When “Print Reading Log” is displayed and **MENU** is pressed the entire reading log will be printed, 1 to 1000 readings.

Delete Reading Log – Will delete stored values when **MENU** is pressed.

Calibration – (Covered in greater detail under calibration options) Displays options of:

1. Set (Water) - Pressing **MENU** will prompt to *Apply Water* then to press **CALIBRATE** or **MENU**.
2. Span 1.402XX – See above instructions but *Apply 1.402XX*, NIST certified calibration oil when prompted.
3. Span 1.514XX – See above instructions but *Apply 1.514XX*, NIST certified calibration oil when prompted.
4. Add/Delete/Edit – When selecting any of these modes a “Warning” will appear “Incorrect use of this function can corrupt the instrument”. When changing or adding a set value you must update the entire information string to assure that the instrument will calibrate with proper values. Refractive index, temperature and temperature coefficient information must be known and correct to prevent corruption.
5. Exit - Press **MENU** to exit the calibration options mode.

Contrast – Press **MENU** to enter and either **CALIBRATE** or **READ** to adjust display contrast.

PC Com Linkup – Communications for this feature is at 38.4K BPS. The software must be installed on the PC that the refractometer is connected to and the “PC Com Connect” button must also be pressed on the PC Display for this function to operate. Reference Computer Interface section for greater detail.

Set Clock – Allows for setting of the time and the date in MDY format.

Select Channel – This feature is visible only when at least one custom channel has been uploaded to the *r²i300*. Reference the Custom Channels section for greater detail.

Reading Mode – Allows changing between available reading modes. TC modes are Temperature Compensated based upon Sucrose data in channel 1. Optional modes in channel 1 are nD, nD-TC, Brix or Brix-TC.

Care and Cleaning



Fig 4

Preparing the prism and well surfaces for samples is essential if consistent and accurate values are to be attained. Prior to and immediately after a sample is placed on the prism surface, those surfaces must be properly cleaned (Fig 4). It is imperative that these surfaces be cleaned to assure removal of any possible residue since this condition will have an adverse affect on resultant readings. Never allow a sample to dry on the prism or well surfaces.

Depending upon the sample, clean the prism and well using distilled water, diluted soapy water, isopropyl alcohol or methanol. Rinse with distilled water and gently dry using a lint free product like Kim Wipes® that will leave no residue.

To properly clean the body or display areas of the instrument simply wipe with a soft cloth and a mild soap and water solution. A typical house hold glass cleaning product works well.

Cleaning Precautions

The sealant used between the prism and stainless steel well may be attacked by certain chemicals. Reichert recommends avoiding strong solvents such as N,N-Dimethylformamide or N,N-Dimethylacetamide, Tetrahydrofuran, cresols, phenols, and other tar acids. Some lacquer thinners can also deteriorate the seal over time. To determine if your samples or solvents may attack this seal, please contact Reichert Analytical technical support.

Scratched optical surfaces can have an adverse effect on optical performance. In the case of a sample having been allowed to dry on the prism surface, never use abrasive materials to remove that sample. Instead redissolve the sample with an appropriate solvent to protect the prism surface from being scratched. Thick, sticky samples should be rinsed off with a suitable solvent to avoid possibly scratching the prism. Use caution when removing samples or drying the prism.

Accessories

Catalog No. 13981000
Catalog No. 13982000
Catalog No. 13981000-103

Printer, 110 VAC
Printer, 220 VAC
Paper, 5 Rolls

Catalog No. RFAG30002

Fuse, 500mA, 250V,
5x20mm Quick Acting

Catalog No. 13K41330
Catalog No. 13K41340
Catalog No. 13K41350
Catalog No. 13K41360

NIST Certified Calibration Oil, 1.514XX
NIST Certified Calibration Oil, 1.402XX
NIST Certified Calibration Oil, 1.457XX
NIST Certified Calibration Oil, 1.489XX

Above values will vary due to supplier of oil
and lot numbers, editing the stored values in
the refractometer may be required.

Warranty and Non-Warranty Service

The warranty period for this instrument is two years against manufacturing defects. Please visit our web site at www.reichertai.com and select "Terms and Conditions of Sale" for an explanation of the warranty.

The *r²i300* refractometer is a precision instrument. Only Reichert factory-trained service technicians should perform repairs to assure proper functionality and sustained precision. If service is required, please contact our Reichert Service Department at Reichert Analytical Division headquarters in Buffalo, New York, USA , 716-686-4500 (Country Code 001), or our service facility located in Seefeld Germany at +49-8152-993530.



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