PROGRAMMABLE REFRACTOMETER

300037

SOFTWARE INSTRUCTION MANUAL
# Table of Contents

## COMPUTER INTERFACE

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232 Cable Connection</td>
<td>3</td>
</tr>
<tr>
<td>Software Installation</td>
<td>3</td>
</tr>
<tr>
<td>Serial Port Configuration</td>
<td>3</td>
</tr>
</tbody>
</table>

## OPERATING YOUR REFRACTOMETER VIA THE SOFTWARE

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Test Parameters</td>
<td>5</td>
</tr>
<tr>
<td>Calibration</td>
<td>5</td>
</tr>
<tr>
<td>Measurement Procedure</td>
<td>6</td>
</tr>
</tbody>
</table>

## CUSTOM SCALES

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Your Key-Values</td>
<td>8</td>
</tr>
<tr>
<td>Enter Your Key-Values into the Software</td>
<td>9</td>
</tr>
<tr>
<td>Load and manage Custom Scales</td>
<td>14</td>
</tr>
<tr>
<td>Search within a Custom Scale</td>
<td>16</td>
</tr>
<tr>
<td>Print a Custom Scale Graph</td>
<td>16</td>
</tr>
<tr>
<td>Transfer Custom Scales to Your Refractometer</td>
<td>17</td>
</tr>
<tr>
<td>Measure with a Custom Scale</td>
<td>17</td>
</tr>
<tr>
<td>Modify Custom Scales</td>
<td>19</td>
</tr>
</tbody>
</table>
COMPUTER INTERFACE
This section will guide you through the process of connecting Programmable Refractometer 300037 to your PC.

RS232 Cable Connection
CAUTION – DO NOT CONNECT OR DISCONNECT THE RS232 CABLE WHILE THE REFRACTOMETER IS ON!
1. Turn your Refractometer off.
2. Connect the male-end of the provided RS232 cable to the refractometer and the female-end to your PC’s serial port.
3. For continuous use, connect the AC power adapter to the refractometer (or use the internal 9V battery for portability).

Software Installation
4. Please review this documentation before starting the software installation and configuration.
5. Insert the 300037 software CD into your PC’s CD-ROM drive. The software should auto-run. If it does not please navigate to “My Computer” and open your CD ROM drive then double-click on the SETUP.EXE file.
6. Press the yellow ON/OFF button to turn on the refractometer. The refractometer will momentarily display “PC,” before reverting to the standard display. Please note that the refractometer’s keypad is now disabled and remains so while connected to the software.
7. Locate and double-click on the Refractometer icon on your desktop to start the software application.

Serial Port Configuration
8. Browse to the Setting menu and click on Serial Port Setting OR click on the Serial Port Setting icon located on the Toolbar.
9. The software will automatically attempt to detect the available Serial (COM) Ports on your PC. The default **Baud Rate, Data bit, Parity Check** and **Stop bit** are shown in Figure 1.

10. Click ▼ to select the appropriate **Serial Port** (COM 1-8). If you are not sure which serial (COM) port to use consult either the Microsoft Window’s Device Manager or your system administrator.

11. Next check that the software can obtain a measurement from the refractometer using the serial (COM) port you selected.

12. Place any test solution on the refractometer prism and close the black cover.

13. Browse to the **Function** menu and click on **Measurement** OR click on the Measurement icon located on the Toolbar.

At this point you should see a **Value** and **Temperature** displayed in the Refractometer software application. (See Figure 4)
OPERATING YOUR REFRACTOMETER VIA THE SOFTWARE

The following section will explain how you may use the software in place of the Refractometer's keypad to calibrate and operate with your Refractometer. If you have not already done so, you need to select several parameter settings prior to operating your Refractometer.

Set Test Parameters

1. Browse to the Setting menu and click on the Parameter Setting OR click on the Parameter Setting icon located on the Toolbar.

2. Choose to enable or disable **Automatic Temperature Compensation**, Fahrenheit or Celsius **Temperature** readings, **high** and **low alarms** and **Record** data. Figure 2 shows the default settings.

![Figure 2](image)

3. If you have enabled a high or low alarm limit, enter the values in the space provided. When your alarm limit is exceeded the appropriate indicator on your computer will flash red and yellow:

   ![High Limit Alarm Value](image)

   ![Low Limit Alarm Value](image)

**Calibration**

Check calibration status by clicking the Zero Status icon.

The display will indicate either **Zero Point Deviation** or **Zero Point Normal** as shown below.

![Zero Status](image)
If calibration is required:

4. Gently clean the prism with a soft cloth.

5. The refractometer is designed to be calibrated against pure distilled water. Place a few drops on the prism (enough to cover it) and close the black cover.

6. Browse to the **Function** menu and click on **Zero Calibration** OR click on the Zero Calibration icon located on the Toolbar.

   ![Function menu]

   The status bar will indicate when calibration is complete:
   ![Zero point calibration complete]

**Measurement Procedure**

Your refractometer software setup is now complete. The unit is configured and calibrated. You are now ready to take measurements.

7. Place the solution to be measured onto the refractometer prism (see Figure 3) and close the prism cover. (Outside light can affect measurement)

   ![Figure 3]

8. Browse to the **Function** menu and click on **Measurement** OR click on the Measurement icon located on the Toolbar.

   ![Function menu]
Figure 4 shows a typical display reading.
CUSTOMS SCALES
Your Programmable Refractometer comes preloaded with the commonly used Brix and nD (refractive index) scales. In addition you may purchase many application-specific scales from your Sper Scientific Ltd. dealer or create your own custom scales. An unlimited number of scales can be stored in the software’s database. Transfer these from your computer to the three numbered display positions on Programmable Refractometer using the built-in RS232 computer interface. Once a scale is loaded onto your refractometer you will be able to conduct measurements in it, independent of a computer. Scales can be loaded and unloaded from your database to your refractometer at any time.

Create Your Key-Values
Before creating your custom scale, you need to gather refractive index data for key-values. Generally, all custom scales start with a refractive index value of 1.3330 nD (refractive index) for the zero point. The nD at other points varies depending on the solution you wish to measure. Many refractive index charts are available for known concentrations of pure substances dissolved in water. Refer to the relative literature for the arithmetic used to convert these nD values to values for your solution. If you are unable to locate a chart for the solution you wish to measure you can create one by preparing solutions of known concentrations to acquire the nD of the zero point, mid-range, and maximum point. These three points are essential when generating a custom scale. Although only three key-values are necessary, you may use up to 21 key-values to define your custom scale. The more key-values entered, the greater the precision of your Custom Scale. We recommended entering values that are proportionally divided. Figure 6 illustrates sample key-values for a scale of 0-26% sodium chloride by weight.

<table>
<thead>
<tr>
<th>Refractive Index Value (nD) of NaCl (% by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%    = 1.3330</td>
</tr>
<tr>
<td>5%    = 1.3418</td>
</tr>
<tr>
<td>10%   = 1.3505</td>
</tr>
<tr>
<td>15%   = 1.3594</td>
</tr>
<tr>
<td>20%   = 1.3684</td>
</tr>
<tr>
<td>25%   = 1.3795</td>
</tr>
</tbody>
</table>

Figure 6
There are several available dimensions (units of measure) used for taking Refractometer measurements, depending on the application and type of substance being measured. A common unit of measure is percentage (%) by weight. Use a high resolution digital balance to produce solutions at various concentrations and equate them to the percentage of dissolved solids by weight. For example:

1ml of H₂O is weights approximately 1g. A solution of 9g of water and 1g dry solids produces a 10% concentration. Pure distilled water (0% dissolved solids) is 1.3330nD. A 10% solution (NaCl) is 1.3505nD.

After creating your concentrations, measure them with the nD scale, and collecting the results, the next step is to enter these key-values into the software.

**Enter Your Key-Values into the Software**

1. Click on the **Custom Scale** icon on the Toolbar.

Note: To open Custom Scale, the Refractometer must be connected to the computer and turned on. If errors occur, verify the serial port settings (see: Serial Port Configuration above)

2. The Custom Scale screen is divided into a functions and chart section.

![Figure 7](image)
Figure 8 shows the function side of the Custom Scale screen with an explanation of each function under the Parameter tab.

**Scale Name**: Choose the name you wish to appear in both the “Custom Scale Database” and “Switch Scale” lists.

**Select Dimensions (Unit of Measure)**: You may choose either % (Percentage) or ° (Degrees) symbol and under **Select Dimension** type in the name of the solution as you wish it to appear on your measurement results screen (see figure 4 above) i.e. Sodium Chloride. Under **Scale Name** type in the name of your solution as you wish it to appear in your scale database, i.e. NaCl.

**Scale Range Min**: The minimum nD value of your custom scale range. In the case of our example from Figure 1, 1.3330

**Scale Range Max**: The maximum nD value for your custom scale range. In this example, 1.5318

**Scale Value Min**: The minimum numeric user value for your custom scale range. In this example 0.

**Scale Value Max**: The maximum numeric user value for your custom scale range.

**Decimal Place**: Choose the resolution that your custom scale computes and displays.

**Display Position**: Specify Custom Scale 1, 2 or 3 display positions on your refractometer.
You will use the following concentration table to practice creating a custom sodium chloride (NaCl) scale.

<table>
<thead>
<tr>
<th>NaCl</th>
<th>% by weight</th>
<th>nD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0%</td>
<td>1.3330</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>1.3418</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>1.3505</td>
</tr>
<tr>
<td></td>
<td>15%</td>
<td>1.3594</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>1.3684</td>
</tr>
<tr>
<td></td>
<td>26%</td>
<td>1.3795</td>
</tr>
</tbody>
</table>

3. Type in the following information in the **Parameter** section for the sample Custom Scale using the values from the above table.

![Custom Scale software interface](image)

**Figure 9**

4. Click the **Next** button to continue to the **Input Data** section.
5. Enter the nD (refractive index) values and user values (in this case %) from our sample table above.

![Figure 10](image-url)
6. Click on the **OK** button and the software will plot the curve for your custom scale. Once the software has computed the curve you should see the following graph:

![Custom Scale Graph](image)

Figure 11

7. Click on the **Save** button to add the scale to your **Custom Scale Database**.

Now that you have created and saved a new custom scale to your database you can measure a solution with it via your computer, transfer it to your Refractometer, export it to a backup file, search on it for specific points or print out the graph.
Loading and Managing Custom Scales

The top section of the 'Parameter' tab provides buttons for loading, deleting, importing, and exporting your Custom Scale Database. The drop down menu lists the names of custom scales in your database. These will include all scales purchased and downloaded from a Sper Scientific Custom Scale Software 300038 disk, as well as those you created using this software. For purchased scales: Enter the serial number provided with your Custom Scales 300038 (see Figure 13). Serial numbers are not necessary for custom scales you have created.

Select a scale from the list and click Load (see Figure 14) to view the scale’s parameters, or Delete to remove it from your database. Export enables you to send a copy of your custom scales to a backup file you can create on your computers hard drive. Import enables you to import the custom scales back from your computer’s hard drive to Programmable Refractometer 300037 software, (should you, for example, need to reinstall the software on another computer). Import also enables you to bring new scales purchased on a Custom Scale 300038 disk into the software.
The **Scales** box (see Figure 15) contains a list of custom scales in your database. The box on the right box lists the scales you have selected for Import or Export. Use the [>] and [<<] buttons to transfer scales between the two boxes.

![Select Scales To Import](image)

Figure 15
Search within a Custom Scale

The Search tab (Figure 16) provides a tool for searching your custom scale for the equivalent User Value for a particular Refractive Index value of your solution. Enter an nD value (within the range of your custom scale) and the results will appear in the table on the left. All Search points are noted on the chart. To remove a search point from the data table, click on the Delete button.

Print a Custom Scale Graph

Configure your custom scale chart's orientation, margins, resolution and rendering, then click on Print.
Transfer Custom Scales to Your Refractometer

Click on the Transfer button to load your custom scale to your Refractometer. A status indicator will show the progress as the software transfers the Custom Scale.

Measure with a Custom Scale

Close the Custom Scale window, click on the X in the upper right corner.

Browse to the Function menu and click on Switch Scale.
Once the **Switch Scale** dialog box appears, select **NaCl** and click on **OK**. (See Figure 19)

Now that you have switched to the new Custom Scale, you can measure your test solution of 10% NaCl (by weight) by using the “MEASUREMENT PROCEDURE” (see Page 6) or measure directly on your Programmable Refractometer.
Modify Custom Scales

To **Modify** or to **Delete** custom scale data from the Refractometer, Browse to **File** menu and click on **Scale Data**.

Use the [◄] and [►] buttons (see Figure 21) to cycle through all scales including ‘Custom Scale’ display positions: 1, 2 or 3. The status indicator displays the progress of the **Delete** operation. Note: Only custom scales can be modified or deleted. Brix and nD scale data is permanent.

**CAUTION**: Do not turn off the Refractometer while transferring or deleting a Custom Scales.