



PCE Americas Inc.  
711 Commerce Way  
Suite 8  
Jupiter  
FL-33458  
USA  
From outside US: +1  
Tel: (561) 320-9162  
Fax: (561) 320-9176  
info@pce-americas.com

PCE Instruments UK Ltd.  
Units 12/13  
Southpoint Business Park  
Ensign way  
Hampshire / Southampton  
United Kingdom, SO31 4RF  
From outside UK: +44  
Tel: (0) 2380 98703 0  
Fax: (0) 2380 98703 9  
info@industrial-needs.com

[www.pce-instruments.com/english](http://www.pce-instruments.com/english)  
[www.pce-instruments.com](http://www.pce-instruments.com)

## User Manual

### Digital Refractometers PCE-DR Series



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## 1. Introduction

PCE-DR series Portable Digital Refractometers are microprocessor-based with laboratory accuracy to be able to accurately and instantly measure the refractive index(RI) , concentration and other parameters for many kinds of liquids, which also have a friendly operation pattern and display field as well as an automatically temperature compensation system, comparing with the traditional hand held ones they are much faster, more accurately, and clearly in measurements, as to the details for series and models please refer to the Appendix 2.

### 1.1 Panel descriptions



P1.1

- |                                 |                       |           |          |
|---------------------------------|-----------------------|-----------|----------|
| 1. Stainless Steel Sample Plate | 2. LCD Display Screen | 3. Keypad | 4. Prism |
| 5. Battery Compartment          | 6. Removable Shell    | 7. Cover  |          |

### 1.2 Host and the spare parts

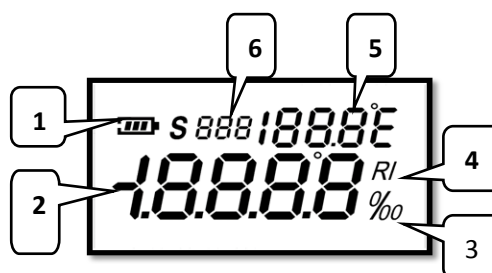
This instrument includes 1 set of host, 1 dropper, 1 removable shell, 1 Covers and 1 AAA 1.5v battery.

**Before operating your instrument, please read this manual properly.**

## 2. Display Areas and Buttons

### 2.1 Display

This LCD screen has three main display areas, which are host display area, temperature display area, and multi-function display area and others, please see the P2.1 and the following description:



P 2.1

1. Battery volume unit
2. Host display area
3. % or ‰ unit
4. Refractive index (RI) unit
5. Temperature display area
6. Multi-function display area

Note: the battery volume signs' table:

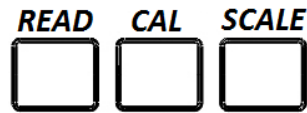
| Battery Volume | Battery Volume Signs |
|----------------|----------------------|
| 80%-100%       |                      |
| 50%-80%        |                      |
| 20%-50%        |                      |
| ↓20%           |                      |

## 2.2 The buttons

D series has three buttons, respectively is:

1. The "Read" button: for booting / measuring.
2. The "Cal" button: for entering the model of calibrating "Zero Point"
3. The "Scale" button: for converting different scales / converting temperature systems between Celsius and Fahrenheit.

All the details please refer to the P2.2.1.

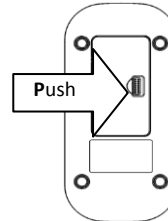


P2.2.1

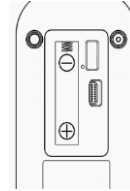
## 3. Preparations before operating

### 3.1 Install the battery

1. Open the battery cabin by pushing the cover's lock key along the direction of arrow showing, please see the P3.1.1
2. Refer to the P3.1.2 to put 1 piece of 1.5v battery into the cabin in a proper electrode side and recover the cabin again.



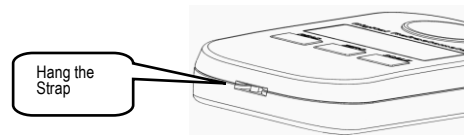
P3.1.1



P3.1.2

### 3.2 Install the wrist strap

Properly Install the wrist strap into the hole at the bottom of the instrument, referring to the figure P3.2.1.

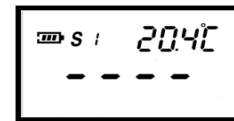


P3.2.1

## 4. Booting and Calibration

### 4.1 Booting

Press "Read" button for 1 second, the instrument would switching on and booting. Please see the P4.1.1.



P4.1.1

Note: 1. The multi-function display area would show the current scale number. for example: S01 is expressed for the first scale.

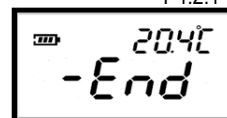
2. Before dripping into the sample liquid, please clean the sample plate and Prism with soft clean cloth or soft paper.
3. Please keep the instrument in a stable and still statement and position.
4. Please ensure instrument, environment and sample are in the same temperature level before measuring.

### 4.2 Calibration

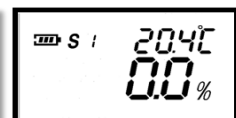
1. Drip 4 ~ 5 drops of distilled water in sample plate.
2. Press "CAL" button for 2-3 seconds till see the 'CAL' flashing, please see the P4.2.1 shows.
3. Press "CAL" button once again during the 'CAL' flashing, see the display as shown in the P4.2.2, the calibration is over, the value would be 0.0%, see the P4.2.3. If no any operations for 10seconds the instrument would return back to booting status.



P4.2.1



P4.2.2

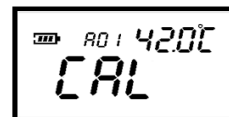


P4.2.3

If fail to complete the calibration, multi-function display area would show an error code. Please see the P4.2.4 shows.

Note: 1. If multi-function area shows code A01 that means calibration temperature exceeding the limitations, other error codes could be checked in the appendix error code page.

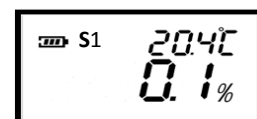
2. Instrument support only distilled water calibration.



P4.2.4

## 5. Measurement

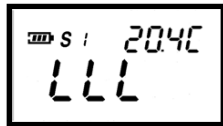
After the calibration, clear the distilled water and dry the sample plate, drip 4 ~ 5 drops of sample, press quickly 1 second the "Read" button, the instrument would give the current value accordingly, after automatic temperature compensation, please see the P5.1, If exceeding the measuring scope, 'HHH' or 'LLL' would show in the host display area, please see the P5.2 and P5.3.



P5.1

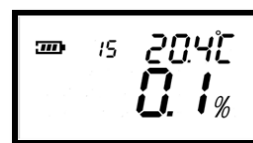


P5.2



P5.3

If press the "Read" button for 2 seconds, the instrument would make the automatic measurements upon programmed times (default 15 times), the final value is the average of 15 times' measurements, please see the P5.4. After measurements, the multi-function display area would return back to scale showing status.



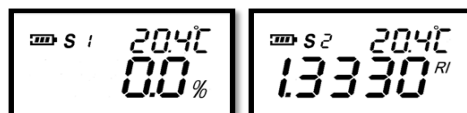
P5.4

Note: multi-function area would show the remaining times left during the automatic measurement.

## 6. Scales converting and temperature systems converting

### 6.1 Scales converting

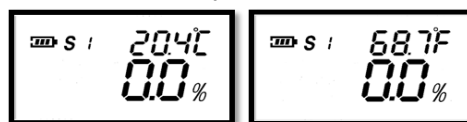
D series could support 10 scales in the largest: Pressing the 'Scale' Button each second can convert the scales and the values, please see as shown in figure P6.1.1.



P6.1.1

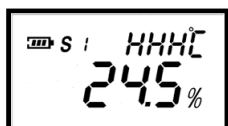
### 6.2 Temperature system converting

D series support two temperature units which Are Celsius (0.0 ~ 40.0 °C) and Fahrenheit (32.0 ~ 104.0 °F) Press "Scale" button for 2 seconds, temperature unit would be converted.

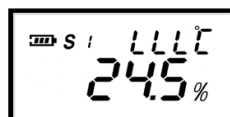


P6.2.1

If exceed the temperature limitations, the signs "HHH" or "LLL" would shows, please see the P6.2.2 and P6.2.3



P6.2.2



P6.2.3

## 7. Turn off the instrument

If without any operations for 1 minute, the instrument would automatically shut off.

## 8. Maintenance and preservation

1. Please clean and wash the sample plate with distilled water and dry it with soft cleaning cloth or paper towel after finishing the measurement of one kind sample.
2. Never leave the remains and residuals of samples in the sample plate for long time.
3. After finishing measurements of the corrosive liquid, please clean the sample plate as quick as possible to avoid the irreparable damage of the prism and metal surface of the plate.
4. Please use soft cleaning cloth or paper towel to clean the sample plate to avoid scribing the prism's glass,
5. Keep dropper and cleaning cloth to be clean and dry under the preservation.
6. If no using the instrument for a long time, please remove the battery and preserve it in a cool and dry place.

## Appendix 1

### Performance:

|             | Range                      | Accuracy | Resolution |
|-------------|----------------------------|----------|------------|
| Temperature | 0.0~40.0 °C                | ±0.5 °C  | 0.1 °C     |
|             | 32.0~104.0 °F              | ±0.9 °F  | 0.1 °F     |
| Dimensions  | 121 x 58 x 25 (mm)         |          |            |
| Net weight  | 90g (battery not included) |          |            |

### The error codes table:

| Error code | Instructions                                                |
|------------|-------------------------------------------------------------|
| A01        | Beyond the scope of calibration temperature. (0.0°C~40.0°C) |
| A02        | During calibration, no solution or solution wrong.          |
| <A03       | This instrument has a hardware failure.                     |

## Appendix 2

### Models and specifications (continued)

| Material                    | Model        | Scale                                   | Scale No. | Measure Range   | Resolution | Precision |
|-----------------------------|--------------|-----------------------------------------|-----------|-----------------|------------|-----------|
|                             | PCE-DRB<br>1 | Brix                                    | S01       | 0-90.00%        | 0,10%      | ±0.2%     |
|                             |              | Refractive Index                        | S02       | 1.3330-1.5177nD | 0.0001nD   | ±0.0003nD |
|                             | PCE-DRB<br>2 | Dextran                                 | S01       | 0-10.6%         | 0,10%      | ±0.2%     |
|                             |              | Fructose                                | S02       | 0-68.9%         | 0,10%      | ±0.2%     |
|                             |              | Glucose                                 | S03       | 0-59.9%         | 0,10%      | ±0.2%     |
|                             |              | Lactose                                 | S04       | 0-16.5%         | 0,10%      | ±0.2%     |
|                             |              | Maltose                                 | S05       | 0-15.6%         | 0,10%      | ±0.2%     |
|                             |              | Refractive Index                        | S06       | 1.3330-1.5177nD | 0.0001nD   | ±0.0003nD |
| <b>Beer</b>                 | PCE-DRW<br>1 | Brix                                    | S01       | 0.0-50.0%       | 0.1%       | ±0.2%     |
|                             |              | Wort D20/20                             | S02       | 1.000-1.130     | 0.001      | ±0.002    |
| <b>Coffee</b>               | PCE-DRP<br>1 | Brix                                    | S01       | 0.0-50.0%       | 0,10%      | ±0.2%     |
|                             |              | Coffee p1                               | S02       | 0.0-25.0        | 0.1        | ±0.2      |
|                             |              | RI                                      | S03       | 1.3330-1.4200nD | 0.0001nD   | ±0.003nD  |
|                             | PCE-DRP<br>2 | Brix p2                                 | S01       | 0.00-30.00%     | 0.1%       | ±0.2%     |
|                             |              | Coffee p2                               | S02       | 0.00-25.00      | 0,01       | ±0.2      |
| <b>Salinity</b>             | PCE-DRS<br>1 | Salinity                                | S01       | 0-28.0%         | 0,10%      | ±0.2%     |
|                             |              | Salinity                                | S02       | 0-280‰          | 1‰         | ±2‰       |
|                             |              | Specific Gravity                        | S03       | 1.000-1.217     | 0,001      | ±0.002    |
|                             |              | Refractive Index                        | S04       | 1.3330-1.3900nD | 0.0001nD   | ±0.0003nD |
|                             | PCE-DRS<br>2 | Salinity                                | S01       | 0-100‰          | 1‰         | ±2‰       |
|                             |              | Chlorinity                              | S02       | 0-57‰           | 1‰         | ±2‰       |
|                             |              | Specific Gravity                        | S03       | 1.000-1.070     | 0,001      | ±0.002    |
|                             |              | Refractive Index                        | S04       | 1.3330-1.3530nD | 0.0001nD   | ±0.0003nD |
| <b>Honey</b>                | PCE-DRH<br>1 | Brix                                    | S01       | 0-90.00%        | 0,10%      | ±0.2%     |
|                             |              | Water                                   | S02       | 38.0-5.0%       | 0,10%      | ±0.2%     |
|                             |              | Bé                                      | S03       | 33.0-48.0       | 0,1        | ±0.2      |
|                             |              | Refractive Index                        | S04       | 1.3330-1.5177nD | 0.0001nD   | ±0.0003nD |
| <b>Wine</b>                 | PCE-DRW<br>2 | Brix                                    | S01       | 0-45.00%        | 0,10%      | ±0.2%     |
|                             |              | %VOL ap                                 | S02       | 0-22.00%        | 0,10%      | ±0.2%     |
|                             |              | Oe                                      | S03       | 3-150           | 1          | ±2%       |
|                             |              | KMW                                     | S04       | 0-25.00         | 0,1        | ±0.2      |
| <b>Urea</b>                 | PCE-DRU<br>1 | Urea (NH <sub>2</sub> ) <sub>2</sub> CO | S01       | 0-51.0%         | 0,10%      | ±0.2%     |
|                             |              | Refractive Index                        | S02       | 1.3330-1.4056nD | 0.0001nD   | ±0.0003nD |
| <b>Car /<br/>Antifreeze</b> | PCE-DRC<br>1 | Cleaner                                 | S01       | -40~0℃          | 0.1℃       | ±0.5℃     |
|                             |              | Ethylene Glycol                         | S02       | -50~0℃          | 0.1℃       | ±0.5℃     |
|                             |              | Propylene Glycol                        | S03       | -50~0℃          | 0.1℃       | ±0.5℃     |
|                             |              | Battery                                 | S04       | 1.000-1.500sg   | 0,001      | ±0.005sg  |
|                             | PCE-DRA<br>1 | Ethylene Glycol(V/V)                    | S01       | 0-60%           | 0,10%      | ±0.5%     |
|                             |              | Ethylene Glycol(℃)                      | S02       | -50~0℃          | 0.1℃       | ±0.5℃     |
|                             |              | Propylene Glycol(V/V)                   | S03       | 0-70%           | 0,10%      | ±0.5%     |
|                             |              | Propylene Glycol(℃)                     | S04       | -60~0℃          | 0.1℃       | ±0.5℃     |
| <b>Brake<br/>Fluid</b>      | PCE-DRF<br>1 | DOT3                                    | S01       | 121-260℃        | 1℃         | ±10℃      |
|                             |              | DOT3 HT                                 | S02       | 121-299℃        | 1℃         | ±10℃      |
|                             |              | DOT4                                    | S03       | 125-275℃        | 1℃         | ±10℃      |
|                             |              |                                         |           |                 |            |           |