

**Pavement Quality Indicator  
Model 301  
Operators Handbook**

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# 1.0 Introduction

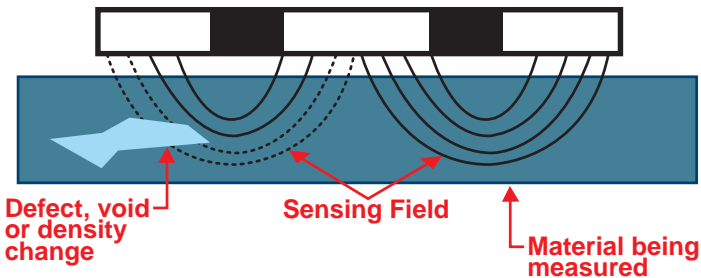
## 1.1 Asphalt Pavement Quality Indicator™ Features

TransTech's third generation Pavement Quality Indicator™ (PQI) utilizes state of the art technology to get accurate asphalt pavement density readings. It's primary features are:

- No special license or radioactive materials required.
- Light weight and easy to use.
- 12 hours of portable operation.
- Measures density in common units (Lb/CuFt and Kg/M3)
- Measures and compensates for asphalt temperature and surface moisture.
- Stores 99 readings on internal Data Logger.
- Optional Download to computer.

### How Does it Work?

The density of asphalt pavement is directly proportional to the measured dielectric constant of the material. TransTech's Pavement Quality Indicator™ uses electrical waves to measure dielectric constant using an innovative, toroidal electrical sensing field established by the sensing plate. The electronics in the PQI convert the field signals into material density readings and displays the results. Once calibrated direct density readings can be consistently obtained.



## 1.2 Purpose of this Handbook

This handbook is intended to be both a training manual and a reference source for the operation, care and maintenance of the TransTech Pavement Quality Indicator. You must read through the entire manual completely to familiarize yourself with the unit's features, controls and operating modes before starting to take readings and analyze data.

## 1.3 Application Summary

The PQI is intended primarily for use on newly-laid asphalt pavements with lift thickness ranging from 1 inch to 6 inches. Once calibrated the PQI will provide reliable and consistent density measurements.

## 1.4 Safety

Every effort has been made to make the Pavement Quality Indicator convenient to use and inherently safe. The PQI uses no nuclear elements, and is instead based on a safe, low-voltage direct current electrical measurement techniques. Like any instrument, however, the user should exercise care and common sense in its use to prevent mishaps.

### Take careful note of the following:

**Warning-** Do not use the unit on or near exposed electrical wiring. A shock hazard potential exists if contact is made with the exposed wiring.

**Warning-** Use care in handling the unit. Personal injury can occur through improper handling. Take proper precautions to prevent accidental dropping of the unit.

**Caution-** Turn the unit off when not in use and during transport.

**Caution-** Unauthorized disassembly of the unit will void the warranty.

## 2.0 Controls and Components

### 2.1 External Controls and Components

Prior to learning how to operate the PQI, we recommend that you familiarize yourself with the PQI unit's operating controls and components. Illustrations and listing of the main components and their basic functions are shown below.



## 2.2 Receipt

The PQI shipment package includes the items listed below. Report any shipping damage to the carrier. Contact TransTech Systems Inc. Customer Service if any of the parts are missing.

- One storage case
- Operating handbook.
- One PQI unit .
- One battery charger: 120/220V AC to 12 VDC - Fast Charge

## 2.3 Charging The Battery

**Important-** Before using the unit for the first time the internal battery must be fully charged. Follow the unpacking and setup instructions below.

The third generation PQI unit is powered by nickel metal hydride batteries which weigh less and are smaller than equivalent lead-acid cells. The new microprocessor controlled battery charger will usually charge the PQI unit in a couple of hours. For first use and after a fully discharged battery pack a minimum of 5 hours should be allowed for charging.

Under normal operation, the PQI unit can operate in excess of 13 hours at full charge. The internal 12 volt battery is designed to be recharged in approximately 2-4 hours, using the 120/220 V AC battery charger

**Warning-** Attempting to recharge the unit in any other way than with the recharger supplied with the unit can result in damage to the unit and can present a safety hazard. Use of any charging means other than the recharger supplied with the unit will void the unit's warranty.

The figure below shows the battery charger supplied with the PQI.



## To charge the unit, proceed as follows:

1. Turn the PQI unit OFF.
2. Connect the charger to the charger connector located on the side of the PQI unit.
3. Plug the charger into a standard AC outlet.
4. When charging is complete, unplug the charger from the power source first then from the connector on the PQI unit.

Battery Voltage is displayed on the Continuous Reading Mode Screen. A fully charged battery will read approximately 12.9-13 volts. The battery voltage will go down as the PQI is used. At 11.5 volts, it is time to get the PQI re-charged. When the PQI voltage gets to 11.0 volts, the PQI will display a “low battery warning” and will not take any further readings. It is important to re-charge the battery after each use.

## 3.0 Operation of the PQI Unit

### 3.1 General Operation Overview

The Pavement Quality Indicator is designed to be an extremely flexible unit, with several useful modes of operation. Each mode of operation is accessed through the keypad controls. The number, letter and arrow keys have several functions. The immediate function is shown by the text in the display panel. The display can show four lines of text at a time called a page. The display tells the operator what the PQI unit is ready to do or indicates that a reading is being taken or that more key setting information is needed from the operator. Pressing a key causes the PQI to beep indicating that the keystroke has been entered.

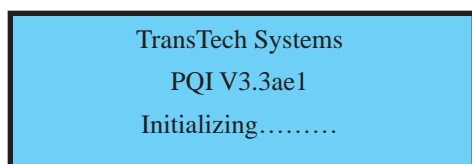


Figure 3.1 first or “bootup” screen display.



**Figure 3.2 Keypad**

A summary of the keypad codes used to set date and time, change measurement modes, enter values for the Maximum Theoretical Density (MTD) value and enter data are shown below. Each key function is discussed in more detail in the following sections of this handbook.

## Key Pad Functions

Key	Function
1-9	The number keys have different settings depending upon the menu display.
Mode/ Used as	Used as to switch among the four measurement modes or to scroll in the up direction.
Diag/	Used to display the DIAGNOSTICS screen when in one of the measurement modes. Also used to scroll in the down direction.
Menu/ This key	This key brings the unit back to the MAIN MENU. Works as a back space key when it's necessary to delete and replace a single digit of information that was just entered by mistake.
Enter	The ENTER key functions like a return key in that it tells the PQI unit to accept information or to take a density measurement.
CAL	Used to enter calibration mode when in one of the measurement modes.
“.”	Works as a decimal point when entering values.

## 3.2 Starting and Self Test

### Important

Before using the unit for the first time the internal battery must be fully charged. Follow the setup instructions in Section 2.2 above.

### 3.2.1 Starting the PQI unit for the first time.

- A. Turn the PQI on by flipping the POWER switch. After a few seconds the display will show the TransTech boot up screen. After the boot up screen clears the PQI will display the SELECT PAVEMENT TYPE screen. From the main menu option #2 also allows changing of this setting. The selection of a “Pavement Type” / stone size in the mix which the PQI is going to be used on is required as part of the initial calibration of the unit.

Select Pavement Type

- 1) 25-35 mm (Base )
- 2) 16-24 mm (Inter.)
- 3) 9-15 mm (Top)

- B. The PQI will prompt the user for the correct unit of measurement either inches or mm. The PQI 301 asks the user to input the depth of the pavement being laid out by the paver.

Lift Thickness  
Enter Units

- 1) inches
- 2) mm

Lift Thickness  
Enter Thickness ( in or mm)  
“Press Enter after entering depth”

Startup Menu

- 1) Setup Menu
- 2) Run

- C. Press the number 1 to show the first page of the MAIN MENU (also called setup menu). Press 2 to return to an operating mode if setup was performed earlier in the day.



1) Date/Time  
 2) Mix Information  
 3) Displayed Units  
 ENT) Exit (Scroll)

**D.** Press the Down arrow to show the second MAIN MENU page.

4) Data Log  
 5) View Parameters  
 6) Remote Menu  
 ENT) Exit (Scroll)

**E.** Press ENT) Exit or (Scroll) Press the Down arrow to return the display to the first page of the MAIN MENU as above.

### 3.3 Setting the Date and Time

The following steps check the date and time of the clock inside the PQI. At the first screen of the MAIN MENU, pressing the 1 key enters the Date and Time mode.

1) Date (02/21/2002) “current date”  
 2) Time (20:02:37) “current time”  
 3) Date Format (MDY)  
 ENT) Exit

#### 3.3.1 Setting the Date

A. Pressing the 1 key prepares the PQI for setting the month, day and year. The first line of the display indicates the date presently stored in the PQI. If this date check is correct then press the “.” key to cancel and return to the Date/Time MENU.

Enter Date  
 MM/DD/YYYY  
 XX/XX/XXXX  
 ENT) OK “.” ) Cancel

The MM is the first portion of a two digit month representing the 12 months of the year. For example 01 is January.

The DD is the second portion of a two digit day indication with a value from 01 to 31.

The YYYY is the third portion of the date representing a four digit year. For example, 1999, 2000 or 2001.

**B.** Notice the flashing cursor beneath the MM letters. Using number keys enter the value for the current month, 01, 02, etc. At this time using the (backspace) key will move the cursor between the two MM spaces so that the month value can be changed.

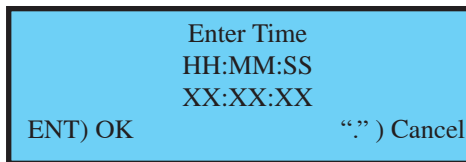
**C.** See that the underline cursor has moved to the DD position. Using number keys enter a two digit value for the current day of the month, 01, 02, etc. Using the (backspace) key will move the cursor between the two DD spaces so that the day value can be changed if a mistake is made.

**D.** The underline cursor has moved to the YYYY position. Using number keys, enter a four digit value for the year. Using the (backspace) key will move the cursor between the four spaces so that the year value can be changed if a mistake is made. Pressing the ENT key sets the new date. Pressing the “.” key cancels and returns the PQI to the change date or the time screen without making any changes to the current date.

Option #3 “Date Format” allows the date format to be changed from M/D/Y to D/M/Y.

### 3.3.2 Setting the Time

A. From the Main Menu press the 1 key. Press the 2 key and the PQI is ready to have the time set. The HH is the hour portion of the time in a 24 hour format (midnight is 00 and 1 PM is 1300).



Enter Time  
HH:MM:SS  
XX:XX:XX  
ENT) OK      “.”) Cancel

The MM is the minute portion of the time display with a range of 00 to 59 minutes.

The SS is the seconds portion of the time also with a range of 00 to 59 seconds.

**B.** See that the underline cursor is under one of the HH letters. Use number keys to enter the new hour of the day. Using the (backspace) key will move the cursor between the four spaces so that the year value can be changed if a mistake is made.

- C. The underline cursor has moved to the MM letters. Use the number keys to enter a new minute value. Using the (backspace) key will move the cursor between the two paces so that the minute value can be changed if a mistake is made.
- D. The underline cursor has moved to the SS letters. Use the number keys to enter the new seconds values. Using the (backspace) key will move the cursor between the two spaces so that the seconds value can be changed if a mistake is made.
- E. Pressing ENTER sets the new time. Pressing the “.” key cancels and returns the PQI to the change date or time screen without making any changes to the current time. Pressing Enter returns the PQI to the Main Menu Screen

1) Date/Time  
 2) Mix Information  
 3) Displayed Units  
 ENT) Exit (Scroll)

### 3.4 Setting the Mix Information

- A. From the MAIN MENU press the 2 key.

1) Set MTD (150.0Lb) **“current MTD”**  
 2) Lift (1.0 in) **“current setting”**  
 3) Set Pave Type (T) **“current Setting”**  
 ENT) Exit

#### 3.4.1 Setting the MTD value

The Maximum Theoretical Density (MTD) value is provided from the asphalt mix designer.

- A. Pressing the 1 key prepares the PQI unit to accept or change the current MTD value.

Set MTD  
 (150.0 Lb/CuFt) **“current setting”**  
 1) Keep this value  
 2) Enter a new value

- B. Pressing the 1 key will return the display to the Mix Information MENU without any change to the stored MTD value. Pressing the 2 key changes the display to the Set MTD menu.

Set MTD  
(150.0 Lb/CuFt)

New:

- C. At this display, if the ENTER key is pressed a 0.0 MTD value will occur and the display will return to the Main Menu.
- D. Use the keypad to enter a new 4 digit MTD value. At this time the ← key can be used to back space and change any of the digits. When the new MTD value is set pressing the ENTER key sets the new MTD value in the PQI. The display will return to the Mix Information Menu. The “.” key is used to enter the decimal point.

### 3.4.2 Setting the Lift Thickness

- A. Pressing the 2 key prepares the PQI unit to accept or change the current Lift thickness value.

Lift Thickness  
Enter Thickness (in)

At this display, if the ENTER key is pressed a 0.0 Lift Thickness value will occur and the display will return to the Mix Information Menu.

- B. Use the keypad to enter a new Lift thickness value. At this time the ← key can be used to back space and change any of the digits. When the new value is set pressing the ENTER key sets the new Lift value in the PQI. The display will return to the Mix Information Menu. The “.” key is used to enter the decimal point.

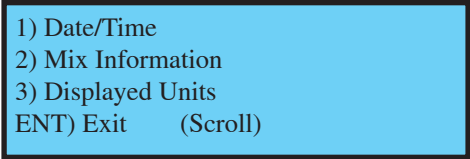
### 3.4.3 Setting Pavement Type

- A. Pressing the 3 key prepares the PQI unit to accept or change the current Pavement Type.

Select Pavement Type  
1) 25-35 mm (Base )  
2) 16-24 mm (Inter.)  
3) 9-15 mm (Top)

At this display, choose option 1,2, or 3 depending on the type of pavement/stone size being used. After choosing an option, the display will return to the Mix Information Menu.

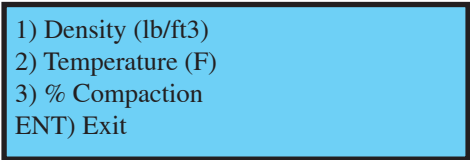
Pressing **ENTER** returns the PQI to the Main Menu Screen



1) Date/Time  
2) Mix Information  
3) Displayed Units  
ENT) Exit (Scroll)

### 3.5 Changing Displayed Units

A. From the MAIN MENU press the 3 key.



1) Density (lb/ft3)  
2) Temperature (F)  
3) % Compaction  
ENT) Exit

At this display, by pressing the corresponding #, the unit of measurement will be changed. For items 1 and 2 the units will switch from imperial to metric units. Item 3 allows you to set the PQI to read % compaction or % voids. depending on the type of pavement being used. After setting the units, pressing the ENTER Key will return the display to the Main Menu.

### Using the PQI on the road

Once the initial information has been entered into the PQI you are now ready to take it out onto the road and perform a simple calibration.

### 3.6 Calibration

Calibration is necessary for accurate and consistent readings. The PQI must be calibrated for each asphalt mat at each job site. The PQI determines HMA density by measuring a property of the HMA mat and comparing it to a measurement of that property at a known density. The property that the PQI measures varies for different HMA mixes. Therefore, to obtain accurate density readings, the PQI must be calibrated for the mix that is currently being measured. Once calibrated for a specific mix, the calibration factors (called slope and offset) will remain valid and can be reused at a later date if that mix is used again.

The PQI provides a number of different calibration methods which can be used under different circumstances. The following table briefly describes the different methods:

Method	Description
Normal	Convenient method for adjusting offset after PQI readings have been taken and cores have been obtained from those reading areas. Simply enter the amount that the PQI is reading too high or low relative to the core readings.
One Point Method (Factory Use Only)	Quick calibration estimate that can be used by taking a reading of the unrolled mat and entering the expected percent compaction at that point.
Two Point Method (Factory Use Only)	Quick calibration estimate that can be used by taking readings of the unrolled mat and a peaked area of the finished mat entering the expected percent compaction at those points.
Manual Slope (Factory Use Only)	Allows you to type in a numeric value for the slope calibration constant.

Calibration Menu
1) Normal
2) Special (Factory use only!)
ENT) Exit

To access the calibration methods, press the “CAL” key while the PQI is operating in one of its run modes. The following screen will appear:

# Normal Mode

## 3.6.1 Preparation

Pick a location on the asphalt that is dry. Designate an area approximate 10 feet long and 5 feet wide on the asphalt mat. Divide the area into five data locations. See Fig. 3.6.1.

## 3.6.2 Calibration Readings

Use the PQI in the Single Reading Mode.

Place the PQI in the first location on the asphalt mat. Using a crayon marker draw a circle around the PQI. The round sensor plate may be used as a guide. Press the ENT key, **(DO NOT TOUCH THE PQI)** and wait for a reading to complete. Record the density reading.

**HINT: Better readings are taken if no hands or objects are in contact with the PQI.**

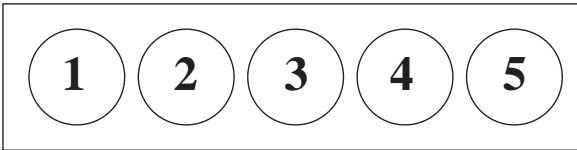


Figure 3.6.1 Reading Location Layout

Move the PQI approximately 2 inches up and to the right on the outside of the circle. Consider this position as the 2 o'clock location. Press the ENT key to take another reading and record it in the table given in the back of this manual.

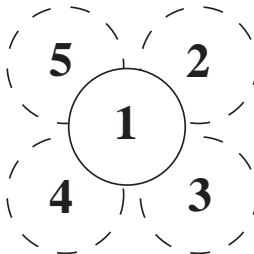


Figure 3.6.2 PQI Measurement Pattern

Move the PQI clockwise around the marked circle to about the 4 o'clock position. Press the ENT key to take another reading and record it in the table.

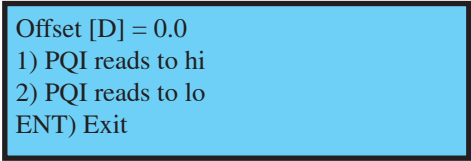
Continue to move the PQI in clockwise steps around the marked circle stopping at the 8 o'clock and 10 o'clock positions to take and record density readings.

Following the pattern in Fig. 3.6.2, move the PQI to the next circle location, record a density reading in the center and at each clock position, in turn, until the table is complete.

### 3.6.3 Calibration Comparison


- A. Arrange to have physical core samples taken from the center of each marked circle location in the 10 foot strip.
- B. Enter the density value from each core sample on the data table.
- C. Calculate the numeric difference between the average PQI readings and the core density lab reports. Add or subtract to obtain a small number which represents the difference between the density value that the PQI is reading versus the actual density values from the core samples. These numbers are used to adjust the calibration offset value stored in the PQI so that the unit can indicate readings that are very close to the actual density values for the asphalt mix at the job site.

From the Calibration Menu, press '1' to access the normal calibration function, which will display the following screen:



Offset [D] = 0.0  
1) PQI reads to hi  
2) PQI reads to lo  
ENT) Exit

The function is used when you have obtained a number of PQI readings, obtained a number of core readings, and calculated the average amount that the PQI is reading too high or low. The first step is to press a key to indicate whether the PQI is reading too high or low. After pressing the key, the following screen will appear:



Offset Adjustment

Adjustment:

At this point you should enter the difference in the PQI and core readings. For example, if the average core reading was 142.3 lb/ft<sup>3</sup> and the average PQI reading at those locations was 143.1 lb/ft<sup>3</sup>, then the PQI is reading 0.8 lb/ft<sup>3</sup> too high, relative to the cores and you would enter "0.8" or ".8" at the "Adjustment" prompt.

**Note that the calibration should be entered in the current density units. If the PQI is set to kg/m<sup>3</sup>, the adjustment should be entered in to kg/m<sup>3</sup>.**



After entering the adjustment, the following screen will be displayed to confirm your entry. The adjustment amount you entered will be shown (the value will be negative if you said that the PQI was reading too high), along with the new offset value.

Adjustment = -1.0  
New Offset = -1.0  
1) Use this value  
2) Keep old value

If you choose option #1 the new offset will be saved in the PQI.

**The PQI is now calibrated using this method.**

## One Point Method (Factory Use Only)

**Note: You must first enter the mix MTD before using this method.**

Many users have found that their screeds obtain a fairly uniform compaction. If this compaction is known, it can be used to perform a quick offset calibration of the PQI using the One Point Method. To use this method, first press '2' (Special) from the Calibration Menu. After displaying a message recommending that you first read this guide, the following menu will be displayed:

1) Manual Slope  
2) One Point Method  
3) Two Point Method  
ENT) Exit

After entering '2', to select the One Point Method, you will be prompted to enter the expected percent compaction as follows:

One Point Method  
Enter % Compaction  
Of Unrolled Mat  
%:

After entering the percent compaction you expect from the screed, you will be prompted as follows:

One Point Method  
Place PQI on  
Unrolled Mat  
& Press ENT

At this point, you should place the PQI on a fresh unrolled portion of the mat, press the ENT key, and remove your hand from the PQI. Follow the pattern in figure 3.6.2 in order to obtain 5 readings. After the 5th reading the PQI will compute the new offset and ask the user if they want to use the new offset or keep the old offset.

## Two Point Method (Factory Use Only)

The Two Point Calibration Method is similar to the One Point Method but it uses an additional measurement of the finished mat in order to obtain a slope calibration in addition to an offset calibration. A “PQI-301 Two Point Calibration Worksheet” is provided with this guide. The worksheet includes full instructions for performing the calibration and entering the readings.

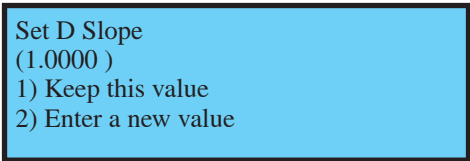
**Note:** The worksheet calls for a reading to be taken on a finished (or “peaked”) section of the mat. To “peak” the mat, the following instructions should be followed:

1. Reduce the water spray on the roller to the minimum setting
2. Allow the roller to pass by the sample location
3. Place the PQI on the mat in a visibly dry location and mark the location for reference
4. Take a PQI reading and record the density value
5. Pick up the PQI and check the probe bottom for signs of moisture
6. If moisture is present, wipe off the bottom of the probe
7. Have the roller roll back over the location and begin the next PQI measurement
8. Continue this process until the density reading on the PQI does not rise any further and has reached its peaked value.

## Manual Slope (Factory Use Only)

The Manual Slope Method allows you to type in a numeric value for the slope calibration constant. This is especially useful when reusing a mix that was previously calibrated because you can simply reenter the slope that was previously used.

Select '1' (Manual Slope) from the "Special" page of the Calibration Menu. A screen similar to the following will be displayed:



```
Set D Slope
(1.0000 )
1) Keep this value
2) Enter a new value
```

The first line will be either "Set D\_Slope" or "Set S\_Slope", depending on the lift thickness that you entered. The second line displays the current value of the slope setting. This value will usually be between 0.5 and 1.5 although it may be different on unusual mixes such as those containing significant amounts of steel slag.

To enter a new slope value, presumably a value that you recorded the last time the mix was used), press '2' and enter the new value as instructed. The new slope value will be used immediately when you return to one of the run modes.

### 3.7 The Operating Modes

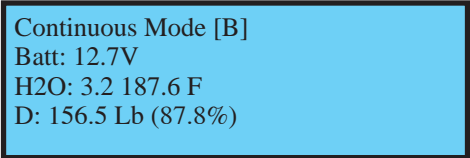
Your PQI can be used in four different measurement or run modes - Continuous, Average, Single, and Segregation. If the PQI is not in one of the run modes (e.g. it might be displaying the Setup Menu), you can switch to the last Run Mode used by pressing the 'Mode' key. If the PQI is already operating in one of the run modes, pressing the 'Mode' key will cause the PQI to switch to the next run mode.

The PQI also has a Diagnostics Mode, which is primarily used by factory personnel. You can switch to Diagnostics Mode by pressing the 'Diag' key.

Each of the run modes will be described in the following sections.

#### 3.7.1 Continuous Reading Mode

Continuous Mode is used to provide instantaneous density measurements for quality control purposes. When in continuous mode, the PQI will display a screen similar to the following and will update the values approximately every second.

A screenshot of a handheld device screen with a light blue background and a black border. The text on the screen is as follows:

Continuous Mode [B]  
Batt: 12.7V  
H2O: 3.2 187.6 F  
D: 156.5 Lb (87.8%)

### Example of Continuous Mode Screen

- Line 1:** Always reads “Continuous Mode”. [ ] Indicate pavement type selected.
- Line 2:** Displays the battery voltage. A fully charged battery will usually read approximately 13.8 V and the voltage will decrease as the battery is discharged. The PQI should be recharged if the battery voltage is less than 11.6 volts. If the battery voltage is less than 11.0 volts the PQI will stop operating and simply display a “Battery Low” message.
- Line 3:** Displays the moisture index and the mat temperature. The moisture index gives a relative indication of the amount of moisture in the mix or on the surface of the mat.
- Line 4:** Displays the density in actual units and in percent. The density will be displayed either in lbs/ft<sup>3</sup> or kg/m<sup>3</sup>. To change the units, go to the Setup Menu and select ‘Displayed Units’ and the select ‘Density’. The percent density will be displayed in either percent compaction or percent voids. If displaying percent compaction, the value will be enclosed in “( )”. If displaying percent voids, the value will be enclosed in “[ ]”. To change between these units, go to the Setup Menu and select ‘Displayed Units’ and the select ‘%’. Remember that the percentage values will not be accurate unless you have properly entered the MTD value of the mix you are currently measuring.

If the PQI is running in Continuous Mode and no keys have been pressed for the last 5 minutes, the PQI Mode will enter a Power Save Mode. Much of the electronics will be turned off to conserve battery life and the message “Power Save Mode – Type Key to Continue” will be displayed. To resume readings, simply press any key.

**Note: While the PQI will take continuous readings in Continuous Mode, the readings are only valid when the PQI is properly positioned and the operator is not touching the PQI.**

### 3.7.2 Single Reading Mode

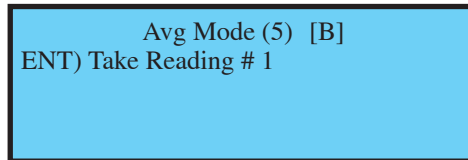
The single reading mode takes a density reading within five seconds. This mode requires the Enter key to be pressed to start each reading. When the PQI is not actually taking a reading, this mode helps to conserve the battery, by shutting down the signal amplifier. The information displayed in this mode is very similar to the Continuous Mode.



**Example of Single Mode Screen**

### 3.7.3 Average Reading Mode

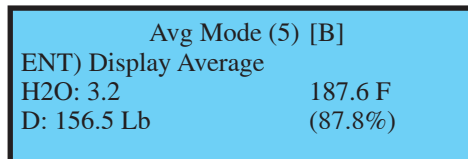
The average reading mode allows the PQI to perform calculations to determine the average density of five readings from one location on the mat. This mode allows the operator to select data logging of recorded averages. The unit will hold 99 average readings with station location information along with time and date. This information can be viewed on the PQI display or downloaded to a computer.



**Example of Average Mode Screen**

- A. Press **Enter** and Do Not Touch the PQI while it takes a reading.
- B. Move the PQI and follow the instructions on the display for the next reading.  
(Press Enter to start next reading)

After reading number 5 is complete press **Enter** to have the PQI calculate the average of the 5 readings.



The next screen displays the average of the 5 readings and indicates that the PQI is ready to be moved to a new location for the next density reading. The PQI will ask the operator if they would like to log the last average.

Avg Mode (5) [B]	
ENT) Continue	
H2O: 3.2	187.6 F
D: 155.5 Lb	(87.0%)

Log the last avg? (23 points in log)
1) Yes
2) No

Logging the average allows the user to enter a station location.

**For example;** the Station Number from a site map may be give as “300 + 050.” Enter 300 as the first# press **Enter**, enter 50 as the second#. As before, the ← key can be used to “backspace” and correct numbers. Put in the numbers for the current location then press **Enter**.

Bypass the Set Location screen by pressing **Enter twice**.

Enter Station #
Example: 300 +50
First #:
Second#:

Data Added to Log
Press any key

**Note: If you choose not to log an average the PQI returns to the first Average Mode screen and is ready to begin a new set of readings.**

### 3.7.4 Stored Data

From the MAIN MENU press the Down arrow until the screen below appears.

4) Data Log
5) View Parameters
6) Remote Menu
ENT) Exit (Scroll)

Press Key 4 once to display the DATA LOG CONTROL screen

1) Clear Data Log  
2) View Data Log  
  
ENT) Exit

**Warning!!!! Pressing key 1 will clear all the readings from the Data Logger**

Press key 2 to view all the data in the data log on the PQI display screen.

Data Log Size: 22  
Up/Down to select  
  
ENT to exit

Pressing the Up or Down arrow keys displays the previous or next set of readings.

[01]	Loc 0300+0150
06/23/2000	22:54:26
H2O: 3.1	T:186.4
DENS: 156.7Lb	

- The first row displays the record number [1] and the location.
- The second row displays the time and date the reading was made.
- The third row displays the H2O and temperature.
- The fourth row displays the average density reading.

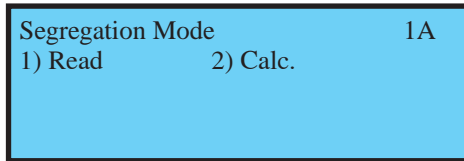
Pressing the **Enter** key returns the display to the previous menu.

### 3.7.5 Segregation Mode

Segregation is the separation of the coarse and fine aggregate particles in the asphalt mix. A segregated mix will usually result in density fluctuations in the finished mat. The PQI's Segregation Mode can be used to conveniently measure the density variations that result from mix segregation.

The operation of Segregation Mode is patterned after test procedures used by a number of testing organizations. The PQI is used to take a number of readings at predetermined location on the mat and the variations in the readings are calculated after all readings have been taken.

The first screen you will see in Segregation Mode appears as follows:

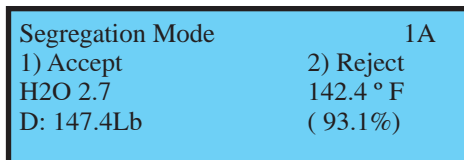


The code at the end of the first line tells which location and reading are about to be performed. For example, the “1A” on the previous screen indicates that you are at the first location and are taking the first, or ‘A’, reading there. Two readings (‘A’ and ‘B’) are taken at each location and the average value is used. Taking the average of two readings is required for nuclear gauges, which exhibit poor repeatability. The PQI has excellent repeatability so two readings should not be required, but two readings are taken for compatibility with existing nuclear test procedures.

**To start using Segregation Mode**

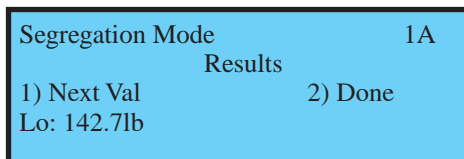
- 1) Place the PQI in the first desired location
- 2) Press ‘1’ to “Read”
- 3) Remove your hand from the gauge
- 4) Wait for the reading to be taken (this will take approximately 5 seconds).

After the reading has been taken, the screen will appear similar to the following (a description of each value is given in the Continuous Mode section):



You should press ‘1’ to accept the reading or ‘2’ if the reading looks suspicious and you want to retake it. If you accept the reading, the PQI will prompt you to take reading “1B”, the second reading at location #1. After accepting the reading at location “1B”, you should move the PQI to the next location, and take reading “2A”.

After you have taken all the readings, press ‘2’ to calculate the results. The results will be displayed on a screen similar to the following:





From this screen you can press ‘1’ to display the lowest density reading, highest density reading, average density, and each of the individual readings. (These readings can also be transferred to a personal computer using the PQI’s Remote Mode).

Pressing ‘2’ will complete the set of readings and display the starting screen with the location/reading reset to ‘1A’.

## 3.8 Automatic Moisture And Temperature Correction

### 3.8.1 Moisture correction

The third generation PQI has a built in moisture correcting formula. Care should still be used when taking PQI density readings in areas of the mat where there is standings surface moisture.

Excessive moisture can affect the accuracy of the PQI. DO NOT take a reading where there is signs of excessive surface moisture, ie puddles. The Relative Water Value is displayed as “H2O” in all measurement modes of the PQI.

The third generation PQI has a built in moisture correcting formula. Care should still be used when taking PQI density readings in areas of the mat where there is standings surface moisture.

Continuous Mode	[B]
Batt: 12.7V	
H2O: 3.2	187.6 F
D: 156.5 Lb	(87.8%)

**Example of H2O being displayed**

The PQI shows H2O values up to three digits.

**Hint: Always wipe the sensor disk with a clean dry cloth before taking another reading.**

### 3.8.2 Automatic Temperature Compensation

The third generation PQI comes equipped with an infrared temperature probe attached to the front of the PQI. Temperature readings allow for internal offset adjustments to be made to the readings, due to extreme temperature changes on the asphalt mat.

Temperature readings are displayed during all of the measurement modes.

Continuous Mode	[B]
Batt: 12.7V	
H2O: 3.2	187.6 F
D: 156.5 Lb	(87.8%)

**Example of temperature being displayed**

### 3.9 Power Save Mode/Auto Shutoff

The PQI Model 301 has a built in power saving mode when using the PQI in the Continuous Operating Mode, if no key is pressed after approximately 5 minutes the unit will go into a power saving mode. Pressing any key will “Wake” the PQI up for continued use. If the PQI is left “On” for an extended period of time without any keys being depressed, it will shut itself down, to conserve battery run time.

### 4.0 Remote Mode

The PQI has a remote mode which allows you to connect it to a personal computer in order to download the logged data and the last set of Segregation Mode readings. To enter Remote Mode, choose selection #6 on the Setup Menu. To exit Remote Mode, press any key on the PQI keypad.

Once in the Remote Mode, the PQI can communicate with a personal computer with a serial (COM) port and terminal emulation software, such as Windows HyperTerminal. Using a suitable nine-pin serial cable, you should first connect the PQI to one of your personal computer’s serial ports, making sure to note which port (e.g. COM1, COM2, etc.).

After connecting the cable, start the communications program on your PC. The program should be configured to use the COM port that you connected to, with the following parameters:

<b>Baud Rate:</b>	<b>9600</b>
<b>Data Bits:</b>	<b>8</b>
<b>Parity:</b>	<b>None</b>
<b>Stop Bits:</b>	<b>1</b>

If you are configuring Windows HyperTerminal, you would first select “properties” on the “File” menu. Under the “Phone Number” tab, in the “Connect using” field, select “Direct to COMx”, where x is the COM port you have connected to. Then select “Configure” to display the remaining parameters. Once all parameters have been set, your PC should be connected to the PQI.

Once connected, you may press any of the following one-letter (upper or lower case) commands:

**C:** Clear (erase) the PQI's Data Log

**N:** Print the number of entries in the PQI's Data Log

**L:** Print all Data Log entries in a readable format

**X:** Print all Data Log entries in a spreadsheet-readable format so the data can be easily imported into a spreadsheet such as Microsoft Excel.

**G:** Print the last set of readings taken in Segmentation Mode.

**T:** Enter a new title for the PQI. The title is displayed on the PQI when power is first applied. To change the title, type 'T' and then type the title. This is a simple title entry function and backspacing is not allowed. If you make a mistake, you must reenter the correct title.

**H:** Print a list of all the commands

**E:** Instruct the PQI to exit Remote Mode.

## **5.0 Routine Operations**

Once calibrated the PQI is ready to be used at each job site and asphalt mix. It is suggested that 5 or more readings be taken at each site following the reading pattern of Fig. 3.6.2 .

### **Keep PQI bottom surface clean and dry**

For accurate readings, the PQI should have a clean, dry, smooth interface with the mat. Therefore, you should wipe the PQI probe surface dry and clean after each reading. Also, before placing the PQI on the mat, you should check the surface of the mat to make sure there is no loose material on the surface, which would prevent the PQI from seating properly. If a buildup of asphalt begins to form on the probe surface, clean the surface with WD-40.

### **Choose measurement spots that are dry**

While the PQI contains moisture correction algorithms, the most accurate readings will be obtained if areas with low moisture levels are measured. If a measurement area has noticeable surface moisture, you should either wait for the moisture to evaporate or remove the moisture with an absorbent cloth.

**Watch for suspicious readings**

If a reading seems unusual or suspicious, check for possible measurement errors (dirty surface, wet surface, low battery voltage) and retake the reading. Best results are obtained when moisture levels for a series of readings are kept relatively constant. If the moisture level for a reading is more than a percentage point higher or lower than the previous readings, the reading should be treated as suspicious

**Don't touch the PQI while it is making a measurement**

Touching any part of the PQI while it is performing a measurement can distort the reading.

**Choose measurement spots with a relatively smooth surface area (avoid rough, segregated areas)**

The PQI measures percentage of air voids in the area beneath the probe, including the voids on the surface of the mat, while the AASHTO T-166 specific gravity determination method ignores these voids. In order to better track what the AASHTO T-166 method is measuring, PQI readings should be taken on areas where there are relatively few surface voids. This is especially important when the PQI is used on mixes containing larger aggregate.

**Measurements should be made on the same day as paving**

While the PQI has corrections algorithm for surface moisture, embedded moisture which can occur after periods of rain, can adversely effect the PQI readings. If you need to take PQI readings at exact coring locations and the cores cannot be extracted until the day following paving, mark the spots and take the PQI readings on the day of paving.

# 6.0 Maintenance and Trouble Shooting

## 6.1 General Care and Maintenance

The PQI has been designed to require a minimum of maintenance or service. Normal care in use should insure long and trouble free operation. The bottom of the sensing probe is protected by a durable bottom. This material was chosen as it is resistant to adhesion of pavement particles. If pavement materials begin to adhere to the bottom, a rag moistened with WD40 (kerosene) will clean it off.

## 6.2 Trouble Shooting

The chart below provides guidance to a few suspect conditions.

### Trouble Shooting Chart :

Problem	Remedy
Incorrect Screen Display	Turn unit off and then back on (Reset)
Incorrect Density Reading Clean off probe	Check calibration Check H2O reading
Battery Problems Check charging procedure	Call Factory
Data is not being recorded Review Data Logger procedure	

### 6.2.1 Diagnostics

In the event that the PQI continues to malfunction an internal diagnostics mode can be activated to provide necessary technical information to the factory. In the event that a repair is required, it is strongly recommended that authorized factory service be obtained. Unauthorized repair or maintenance by the user during the warranty period will void the unit's warranty. From the **Main Menu option #5 “View Parameters”** is a diagnostic tool for factory use.

## 7.0 Warranty

The Company warrants to the Purchaser that the product delivered hereunder will be free from defects in material or workmanship and be the kind and quality designated or specified in the contract or purchase order. This warranty shall apply only to defects appearing within one (1) year from the date of shipment by the Company.

If the product delivered hereunder does not meet the above warranty and if the Purchaser promptly notifies the Company, the Company shall thereupon correct any defect, including nonconformance with the specifications, either (at the Company's option) by repairing any defective or damaged parts of the product, replacing the product, or by making available the necessary repaired or replacement parts.

The liability of the Company under this warranty, for any loss, whether the claim is based on contract or negligence, shall not in any case exceed the cost of correcting defects in the product as herein provided, and upon the expiration of the warranty period, all such liability shall terminate. The foregoing shall constitute the exclusive remedy of the Purchaser and the exclusive liability of the Company. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory.

**No warranty of merchantability or of fitness for purpose shall apply.  
Unauthorized service shall void this warranty.**

Factory authorized service and replacement items may be obtained directly from TransTech's factory or through an authorized representative.

For further information contact TransTech Customer Service:

**Telephone.....(518) 370-5558 or  
Toll Free in the US.....1 (800) 724-6306  
Fax.....(518) 370-5538  
E-mail.....inquiries@transtechsys.com  
Address.....TransTech Systems Inc.  
1594 State St.  
Schenectady, NY 12304**

# 8.0 Measurement Tables

Company Name\_\_\_\_\_Date\_\_\_\_\_

Job Site\_\_\_\_\_

Asphalt Mix\_\_\_\_\_MTD Value\_\_\_\_\_

**Core Comparison Calibration Work Sheet**  
**PQI Readings**

Position	Location1	Location2	Location3	Location4	Location5
Center					
2 o'clock					
4 o'clock					
8 o'clock					
10 o'clock					
<b>Total</b>					
Average (÷ by 5)					

Core Sample Results\_\_\_\_\_

Avg. PQI Readings\_\_\_\_\_

Avg. Difference between cores &  
PQI readings (Calibration Adjustment) value\_\_\_\_\_

**PQI 301 Two Point Calibration Worksheet**  
**FACTORY USE ONLY!!!!**

1	<p>Enter MTD in PQI and record here</p> <ol style="list-style-type: none"> <li>Display the Setup Menu either by <ul style="list-style-type: none"> <li>* Pressing '1' for "Setup Menu" at the Startup Menu or</li> <li>* Pressing the 'Menu' key while in any Run Mode</li> </ul> </li> <li>Press '2' for "Mix Information"</li> <li>Press '1' for "Set MTD". The current MTD is displayed on the menu.</li> <li>Press '2' to "Enter a New Value"</li> <li>Enter the new value (followed by the 'Ent' key) at the prompt</li> <li>Press 'Ent' twice to go to an Operating Mode</li> </ol>	MTD
2	Use the PQI's Average Mode to obtain a low-density measurement from directly behind the paver. If you are unable to obtain a reading due to repeated "Density Mismatch" errors, switch the PQI to Continuous Mode (by pressing the 'Mode' key) and retake the reading. Record the reading here	Low Reading
3	Use the PQI's Average Mode to obtain a high-density measurement from a finished area of the mat. Record the reading here	High Reading
4	To compute slope, the PQI requires an estimate of the actual percent compaction behind the paver. This density is typically 82% of MTD but may vary with mix and with paver type. In the following table, enter your estimate of percentage of MTD you would expect behind the paver. <i>(Enter in percent, e.g. 82% should be recorded as 82, not 0.82)</i>	Low Estimate
5	To compute slope, the PQI also requires an estimate of the actual percent compaction of the finished mat where the finished reading above was taken. This density is typically 95% of MTD but may vary with mix. In the following table, enter your estimate of percentage of MTD you would expect in the finished mat. <i>(Enter in percent, e.g. 95% should be recorded as 95, not 0.95)</i>	High Estimate
6	<p>Use the PQI Slope Calibration Function</p> <ol style="list-style-type: none"> <li>From any PQI Run Mode, press 'CAL'</li> <li>Press '2' for "Special" Press "ENT"</li> <li>Press '3' for "Two PointMethod"</li> <li>Enter "Lo Reading", "Hi Reading", "Lo Estimate" and "Hi Estimate" values from above when prompted</li> <li>Record "New Slope" here</li> <li>Press '1' to "Use this value"</li> <li>Press 'Ent' twice to return to Run Mode</li> </ol>	New Slope



### Worksheet to Calculate MTD

Density Targets	Enter Maximum Theoretical, rice gravity in (A) Lab values are commonly in gcc ( i.e. 2.54)	(A)
	Convert to lbft <sup>3</sup> pounds per cubic foot ( i.e. 158.50) (A) x 62.4	(B)
	Enter Density Target (B) In PQI	“See Entering MTD in Manual”

# FAQ'S



- 1. Is the PQI orange carry case watertight?**  
No, the case is not watertight and should not be left out in the rain.
- 2. Can the battery be replaced in the field?**  
No, There are no user serviceable parts, it must be sent back to the factory.
- 3. Do you have to calibrate the PQI annually at the factory?**  
No, unless you experience a problem with the unit it does not need to be sent back.
- 4. Can I use the PQI 301 on soils, or stone base?**  
At this time the PQI 301 is only designed for use on Asphalt Pavement.
- 5. How can I charge the PQI 301 in my car?**  
We suggest that you purchase a 12 volt DC to 120 volt AC power inverter from a local retailer and plug the PQI charger into the inverter. Follow the inverter instructions.

## Replacement Parts

Order parts online at  
[www.transtechsys.com/opencart](http://www.transtechsys.com/opencart)



Scan QR with your  
mobile device to go  
directly to the store

<b>7500-0199</b> <b>PQI 301 AC Charger</b>	
<b>7500-0209</b> <b>PQI 301 DC Vehicle Charger</b>	
<b>7500-0142</b> <b>PQI 301 Old Style AC Charger</b>	

# Replacement Parts

Order parts online at  
[www.transtechsys.com/opencart](http://www.transtechsys.com/opencart)

<p><b>4000-0021</b>  <b>Thermal Printer DC</b>  <b>Vehicle Cord</b></p>	
<p><b>8000-0039</b>  <b>PQI 301 Mobile</b>  <b>Thermal Printer</b></p>	
<p><b>2000-0002</b>  <b>Thermal Printer Paper Ver1</b>  <b>5 Rolls</b></p>	
<p><b>2000-0027</b>  <b>Thermal Printer Paper Ver2</b>  <b>1 Roll</b></p>	
<p><b>1400-0028</b>  <b>SDG 200 StrongHold</b>  <b>Carry Case</b></p>	
<p><b>7500-0235</b>  <b>SDG 200 Extension</b>  <b>Handle Kit</b></p>	
<p><b>8000-0032</b>  <b>PQI 301 Test Block</b></p>	



**TRANSTECH SYSTEMS, INC.**

**900 Albany Shaker Road, Suite 2  
Latham, NY 12110**

**Phone: 518-370-5558**

**Toll Free: 1-800-724-6306**

**Fax: 518-370-5538**

**Email: [inquiries@transtechsys.com](mailto:inquiries@transtechsys.com)**

**Web: [www.transtechsys.com](http://www.transtechsys.com)**

**skype™ Toll Free: [TransTech.Systems.Inc01](https://www.trans-tech-systems.com)**

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