

Pavement Quality Indicator™ Model 300 Operator's Handbook



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TransTech Systems Inc.
Pavement Quality Indicator™
Operating Instruction Handbook
4/10/00 Rev. 1
By TB Bailey Consulting
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1.0 Introduction

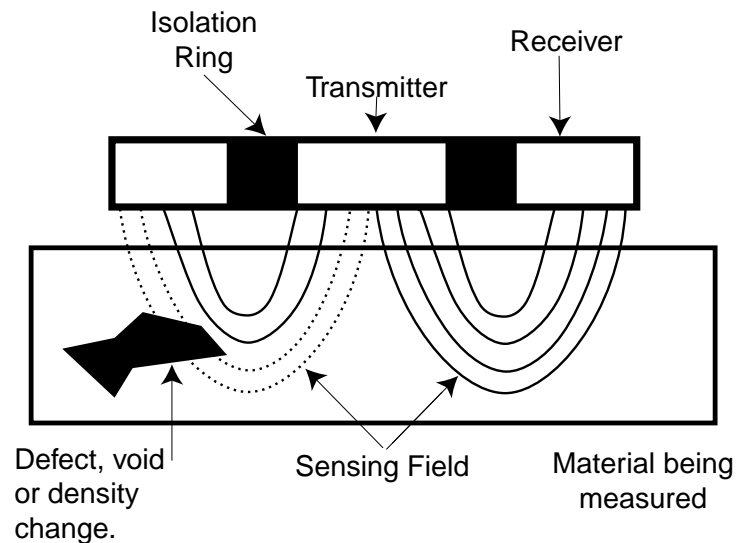
1.1 Asphalt Pavement Quality Indicator™ Features

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 printer/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 thicknesses 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

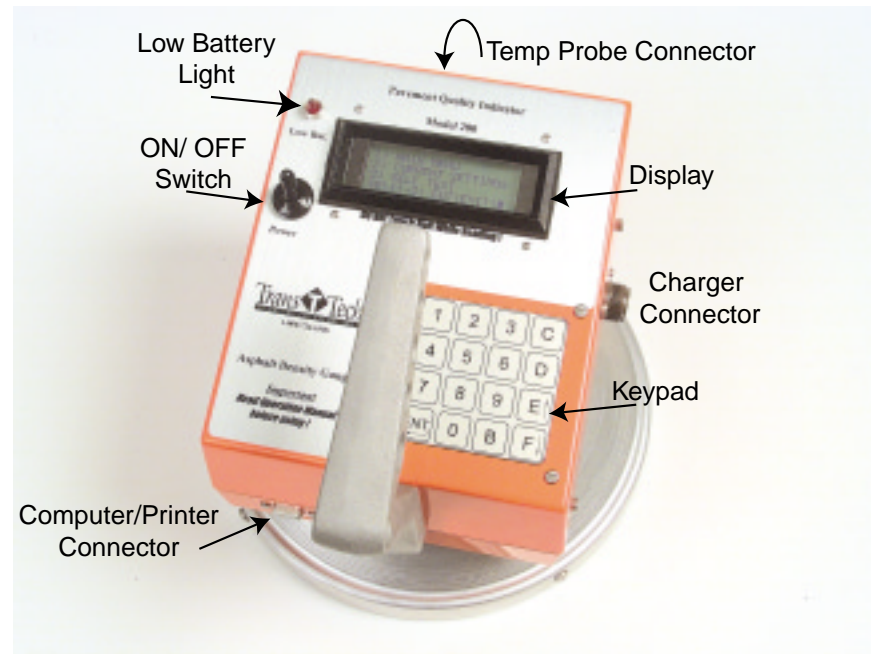
Turn the unit off when not in use and during transport.

Caution

Unauthorized disassembly of the unit will void the warranty.

2.0 Controls and Components

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.



2.1 External Controls and Components

Figure 2.1 - PQI External Controls and Components

The light flashes when the battery charge is getting low.

2.2 Receipt and Preparation

2.2.1 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 and temperature probe.
- One battery charger: 120 V AC to 12 VDC Fast Charge

2.3.2 Preparation

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 maximum 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 hours, using the 120 volt 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 and connected to the charger connector located on the side of the unit.



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 120 V AC outlet.
4. When charging is complete, unplug the charger from the power source first then from the connector on the PQI unit.

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.

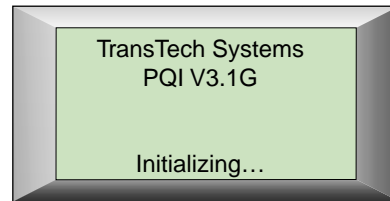


Figure 3.1 First or “bootup” screen display.

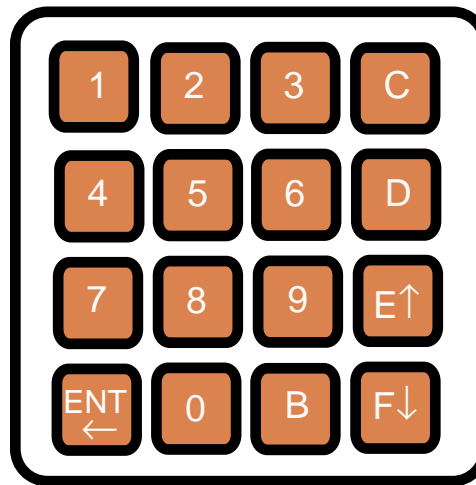


Figure 3.2 Keypad

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.

Keypad Functions	
Key	Function
1-9	The number keys have different settings depending upon the menu display.
B	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. Used as a "Hot Key" to switch among the three measurement modes.
C	Used as a "Hot Key" to display the CHANGE OFFSET screen during calibration when in one of the measurement modes.
D	Used as a "Hot Key" to display the DIAGNOSTICS screen when in one of the measurement mode. Works as a decimal point when entering values.
E↑	The up arrow scrolls the display in the MAIN MENU. This key also brings the unit back to the start up menu after taking a density measurement.
F↓	The Down scrolls the display in the MAIN MENU. Used as a "Hot Key" to toggle between Deep (D) and Shallow (S) penetration when in one of the measurement modes.
ENT ←	The ENTER key functions like a return key in that it tells the PQI unit to accept information or to take a density measurement.

3.2 Starting and Self Test

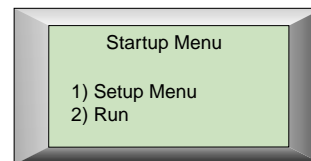
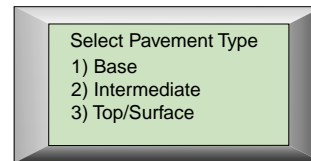
Important

Before using the unit for the first time the internal battery must be fully charged.

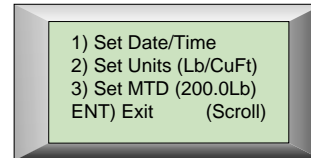
Follow the setup instructions in Section 2.2 above.

3.2.1 Starting the PQI unit for the first time.

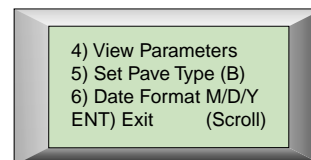
- A. Turn the PQI on by flipping the POWER switch. After a few seconds the display will show the TransTech boot up screen. After the boot up screen clears the PQI will display the SELECT PAVEMENT TYPE screen. From the main menu option #5 also allows changing of this setting. The selection of a "Pavement Type" which the PQI is going to be used on is required as part of the initial calibration of the unit.



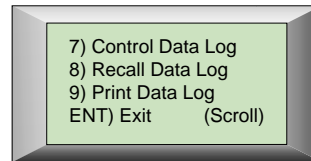
- B. Press the number 1 to show the first page of the MAIN MENU (also called setup menu).



- C. Press the Down arrow to show the second MAIN MENU page.



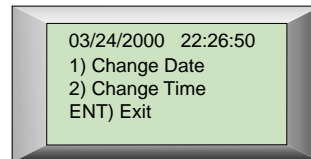
D. Press the Down arrow to show the third MAIN MENU page.



Press the Down arrow to return the display to the first page of the MAIN MENU as above.

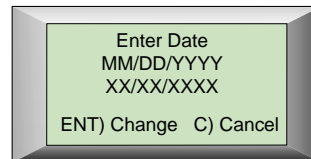
3.3 Setting the Date and Time

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 Set Date and Time mode.



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 ENT key to return to the MAIN MENU.



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.

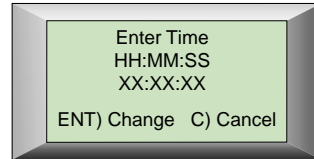
- B. Notice the flashing cursor beneath the MM letters. Using number keys enter the value for the current month, 01, 02, etc. At this time using the B (backspace) key will move the cursor between the two MM spaces so that the month value can be changed.
- C. See that the underline cursor has moved to the DD position. Using number keys enter a two digit value for the current day of the month, 01, 02, etc. Using the B (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 B (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 “c” key cancels and returns the PQI to the change date or the time screen without making any changes to the current date.

- E. From the Main Menu option #6 “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).



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

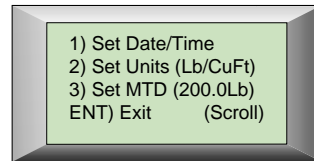
The SS is the seconds portion of the time also with a range of 00 to 59 seconds.

- 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 B (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 B (backspace) key will move the cursor between the two spaces 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 B (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 the ENT sets the new time. Pressing the “C” key cancels and returns the PQI to the change date or time screen without making any changes to the current time.

3.4 Setting the Measurement Units and MTD

3.4.1 Setting the Measurement Units

A. From the MAIN MENU.

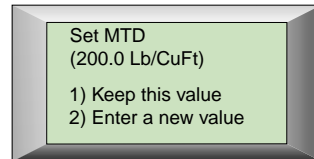


- B. Press the 2 key to alternate between the English (Lb/CuFt) and Metric (Kg/Cum) system of density units. For example set the PQI to English units.
- C. The PQI is set to read and display these density units for all subsequent operations.

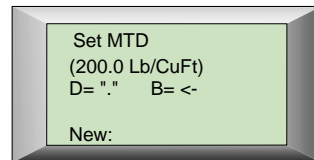
3.4.2 Setting the MTD value

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

A. Pressing the 3 key prepares the PQI unit to accept or change the current MTD value.



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



- C. At this display, if the ENT 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 B key can be used to back space and change any of the digits. When the new MTD value is set pressing the ENT key sets the new MTD value in the PQI. The display will return to the Main Menu. **The "D" key is used to enter the decimal point.**

3.5 Calibration

Calibration is necessary for accurate and consistent readings. The PQI must be calibrated for each asphalt mat at each job site. Readings for the PQI are recorded and compared to lab tests on core samples taken from the same location. Be sure that the PQI has been charged at least 2 hours. Use the sample table in the back of this handbook for recording the readings from the PQI and the lab results of the core samples.

3.5.1 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. 3.5.1.

3.5.2 Calibration Readings

- A. Turn the PQI on. Select the type of pavement you will be calibrating the PQI from the menu choices. A “B”, “I” or “T” will be displayed with in [].
- B. Choose #2 (run) from the startup menu.
- C. Using the “B” key, press the key until “Single Mode” appears on the screen.
- D. Using the “F” key, press it to select shallow or deep penetration mode. An S or D will be displayed within brackets [].
- E. 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.

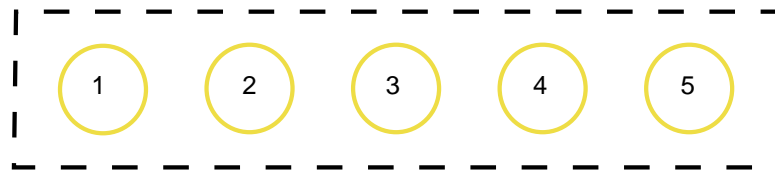


Figure 3.5.1 Reading Location Layout

- F. 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.

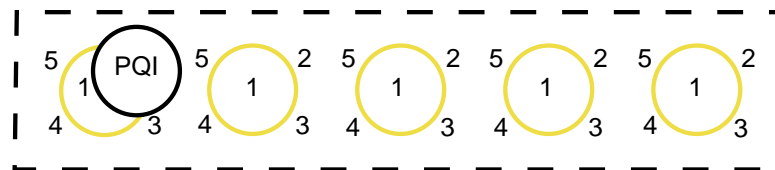


Figure 3.5.2 PQI Measurement Pattern

- G. 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.
- H. 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. 3.5.2, 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.

3.5.3 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.

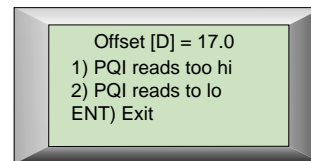
Example:

- The average of the PQI readings equals 145 Lbs/CuFt
- The average of the core densities from the lab equals 150 Lbs/CuFt.
- The difference is 5 Lbs/CuFt.

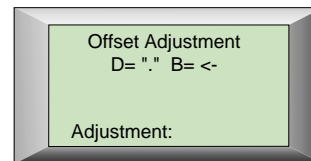
The PQI is reading lower, so that 5 Lbs/CuFt must be added to the current offset value stored in the PQI.

3.5.4 Calibration Offset Value

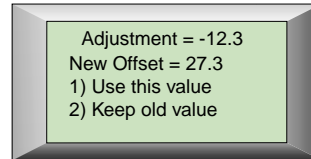
- A. From the "Single Read Mode" screen press the "C" key. The PQI will enter the calibration routine.



The current calibration value will be displayed along with two choices. Pressing 1 will confirm that the PQI is reading to high. Pressing 2 will confirm that the PQI is reading to low.



- B. An adjustment value is obtained from the comparison between the readings from the PQI and the density values from the core lab samples. Enter the adjustment value from the data sheet using the numbers on the key pad. Press the ENT key to set the new value.

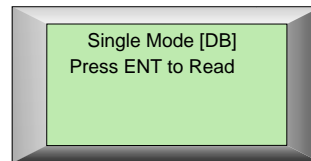


- C. Press 1 to store the new offset calibration value.
The PQI is now calibrated. Congratulations!

3.6 The Three Reading Modes

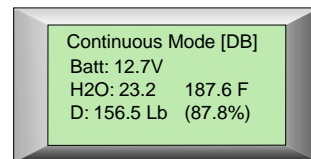
3.6.1 Single Reading Mode

The single reading mode is a more accurate way of measuring density. A reading can be made every five seconds. This mode is suggested for use during initial calibration.



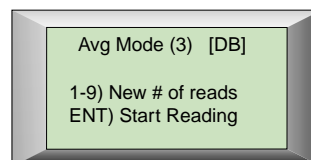
3.6.2 Continuous Reading Mode

The continuous reading mode provides for real time measuring of density. This mode allows the user to quickly scan the density of the asphalt mat. It can be useful to identify single reading and average mode sample locations.

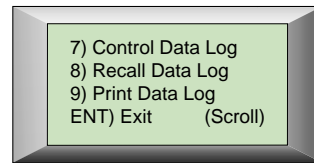


3.6.3 Average Reading Mode

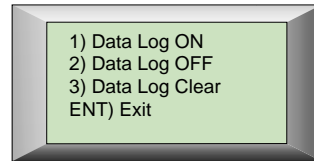
The average reading mode is the most accurate way to measure the density of a location in which the PQI performs the calculation to determine the average several readings. This mode allows for averaging of between 1 and 9 readings.



- A. The data memory logger stores data taken in the Average Mode only. From the MAIN MENU press the Down arrow until the screen below appears.

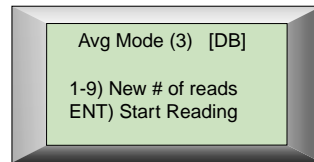


Press key 7 once to display the DATA LOG CONTROL screen.



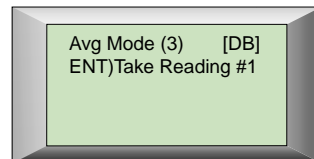
Press key 3 to Clear all the previous readings from the Data Logger. Press 1 to turn the Data Logger ON for the Average Reading mode. After readings are complete pressing 2 turns off the Data Logger.

- B. Once in this mode, the user is ready to take an average of a number of density readings (between 1 and 9)...**5 is recommended**



On the first line, [D] means that the PQI is set for deep penetration, the (3) means that 3 readings are to be averaged. The [B] means that the PQI is set for use on base. Pressing a number between 1 and 9 will set the number of readings to be averaged.

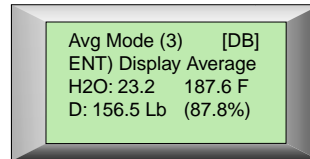
- C. The next screen indicates that the PQI is ready to take a reading at the first location.



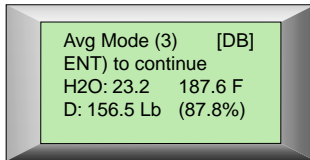
Press ENT and Do Not Touch the PQI while it takes a reading.

- D. Move the PQI and follow the instructions on the display for the next reading.

- E. After the last reading screen press ENT again for the PQI to calculate the current average.

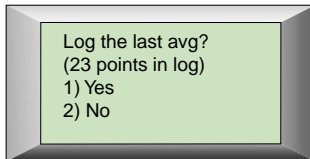


- F. The next screen indicates that the PQI is ready to be moved to a new location for the next density reading. Note any major change in the relative moisture on the H2O indicator.



Continue to move the PQI in the pattern of Fig. 3.5.2 and take readings at each location.

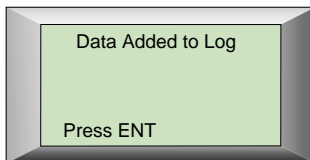
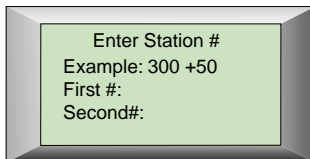
- G. At this time, if data logging is turned on, the user is allowed to log the last average.



- H. 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#, enter 50 as the second#. As before, the B key can be used to “backspace” and correct numbers. Put in the numbers for the current location then press ENT.

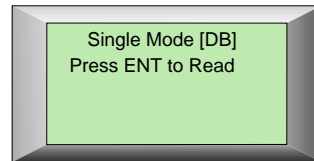
Bypass the Set Location screen by pressing ENT.



3.7 Shallow and Deep Penetration

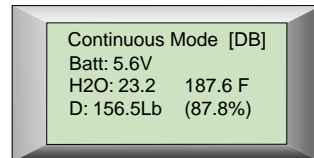
The third generation PQI has a shallow and deep range of asphalt pavement penetration. The preferred range of operation is the deep mode. This is because in the deep range, surface irregularities have a minimal effect on the density reading. In addition the deep range provides more depth and better volume averaging. The shallow mode should be selected for a thin lift measurement.

From any measuring mode pressing the F key will toggle between SHALLOW [S] and DEEP [D] penetration range. A click sound along with the key-stroke beep indicates that the PQI has changed depth modes. The display below shows that the PQI is set for deep penetration. Use the shallow mode for mat thickness of 3/4" to 1" compacted. Use the deep mode for 1" to 6" compacted.



3.8 Moisture

Excessive moisture can affect the accuracy of the PQI. DO NOT take a reading where there is signs of excessive surface moisture. However if the water (H2O) levels are low and relatively the same, then density readings can be considered very accurate. The Relative Water Level is displayed as "H2O" values in all measurement modes of the PQI.



The display shows H2O values in three digits.

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 mean standing surface moisture.

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

3.8.2 Temperature Compensation

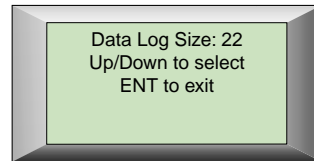
The third generation PQI comes equipped with an infrared temperature probe attached to the connector at the front of the PQI. Be sure that the temperature probe is pointing down toward the asphalt mat. It is recommended that the probe be attached to the PQI and used at all times except for storage. Temperature readings allow for internal offset adjustments due to extreme temperature changes on the asphalt mat.

- A. Temperature readings are displayed during all of the measurement modes.

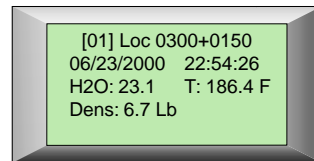
3.9 Data Recall and Printing

3.9.1 Data Recall

- A. From the MAIN MENU pressing key 8 will display the first RECALL DATA LOG screen.



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



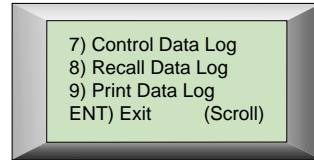
The first row displays the record number [1] and the location.
The second row displays the time and date the reading was made.
The third row displays the H2O and temperature.
The fourth row displays the average density reading.

- B. Pressing the ENT key returns the display to the MAIN MENU.

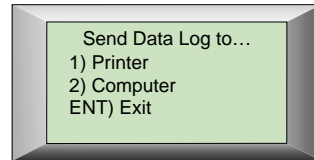
3.9.2 Printing Data

An optional printer can make a permanent record of all the readings at a particular job site and asphalt mix. The PQI record memory may be cleared and the PQI moved to another job site.

- A. Once the printer is connected, printing is started from the third screen of the MAIN MENU.



Pressing key 9 starts the transfer of data from the PQI to the printer.



- B. During printing the screen below is displayed:



- C. When all records are printed the PQI display will return to the MAIN MENU automatically.
(Optional device linking to a computer has been added for future use)

4.0 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. 3.5.2 and utilizing the Data Logger.

5.0 Maintenance and Trouble Shooting

5.1 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 black bottom. This material was chosen as it is resistant to adhesion of pavement particles. A thin coat of silicone spray, wiped on with a dry cloth will enhance its performance. If pavement materials begin to adhere to the bottom, a rag moistened with WD40 (kerosene) will clean it off.

5.2 Trouble Shooting

The chart below provides guidance to a few suspect conditions.

Trouble Shooting Chart	
Problem	Remedy
Incorrect Screen Display	Check Power switch Check battery charger
Incorrect Density Reading	Clean off probe Check calibration Check H2O reading
Incorrect Temperature	Check temp. probe connection Check that temp. probe is pointed down toward pavement Clean temp. probe head
Data is not being recorded	Review Data Logger procedure Turn unit off a few seconds then turn it on.

5.2.1 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 #4 "View Parameters" is a diagnostic tool for factory use.

6.0 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 - inquiry@transtechsys.com

Address: TransTech Systems Inc.
Customer Service
2469 Albany St.
Schenectady, NY 12304

Measurement Table

Company Name _____ Date _____

Job site _____

Asphalt Mix _____ MTD value _____

Calibration Work Sheet					
Position	Location 1	Location 2	Location 3	Location 4	Location 5
Center					
2 o'clock					
4 o'clock					
8 o'clock					
10 o'clock					
Total					
Average (÷ by 5)					

Core Sample _____

Difference _____

Suggested Calibration Offset value _____

Calibration Value Trend Sheet						
Calibration Values						
Mix Type						

TransTech Systems, Inc. - Pavement Quality Indicator™

Measurement Table

Company Name _____ Date _____

Job site _____

Asphalt Mix _____ MTD value _____

Calibration Work Sheet					
Position	Location 1	Location 2	Location 3	Location 4	Location 5
Center					
2 o'clock					
4 o'clock					
8 o'clock					
10 o'clock					
Total					
Average (÷ by 5)					

Core Sample _____

Difference _____

Suggested Calibration Offset value _____

Calibration Value Trend Sheet						
Calibration Values						
Mix Type						

TransTech Systems, Inc. - Pavement Quality Indicator™

Notes

Series of horizontal lines for notes.



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