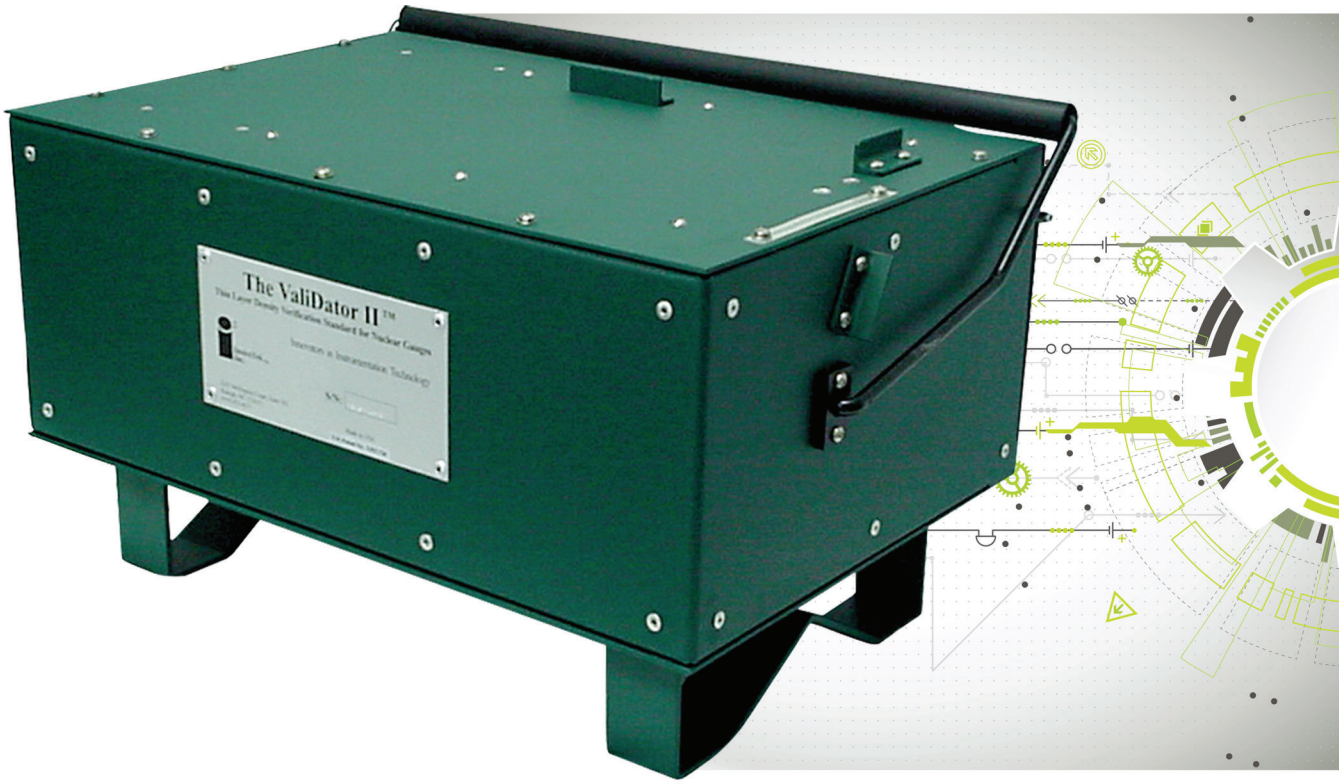
InstroTek® Inc.

innovators in instrumentation technology

the ValiDator II®

Nuclear Gauge Calibration and Verification System



OPERATING MANUAL

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ValiDator II™ ThinPave™ Calibration System
Manual Revision 3

1. Table of Contents

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1. Introduction

We are happy and proud to share the future in Thinlayer Gauge calibration technology with you by introducing the first field portable system of its kind. InstroTek, Inc. would like to thank you for selecting the *ValiDator II* as your field verification and calibration device.

We value your input and would like to hear from you with comments and suggestions on how we can better serve you with this or other products. InstroTek also offers complete gauge maintenance and calibration services.

This guide is designed as a reference for the operation of the *Validation and Calibration System*. A thorough understanding of the operation and application of Nuclear Moisture/Density gauges is necessary.

Please follow the nuclear gauge manufacturer's recommendations with regard to operation and safety concerns of these devices. All ValiDator II operations should be done from the end opposite the gauge source, stepping away three feet while the source rod is in the measure position.

Why the ValiDator II?
Thinlayer gauge users have all experienced the sometimes sudden variability in density results. The Thinlayer gauge has a total of five GM counters that make up two independent systems within this gauge. Due to relatively high counting rates on one system and hot test material temperature, there is a tendency for these tubes to go out of synchronization more often than conventional gauges. The ValiDator II is specifically designed to conveniently verify and re-calibrate your gauge at your facility or in the field. Eliminate down time, reduce shipping hassles and improve your measurement performance.

Gauge owners have never had the option before of performing the verification and re-calibration in the field. The *ValiDator II* from InstroTek, Inc. is designed to optimize the management of your gauge resources and help reduce inconsistencies when multiple gauges are on-site. Multiple gauges calibrated on the same device will reduce conflicts between results.

How to use the ValiDator II?
As easy as taking a field measurement, just place your Thinlayer gauge on the ValiDator II device and take a reading. Compare the gauge density to the pass/fail range on the ValiDator II Calibration Sheet and your verification is complete.

Even if the gauge Verification fails, the ThinPave Calibration option would allow

you to eliminate the present delay in calibration turn-around-time. Calibrate your gauge in minutes.

Please reference Chapter 1 page 4 under "Validation Procedures" for a detailed description of gauges presently supported by the ValiDator II system.

Validation Procedures

Gauge Evaluation

- The gauge should be free of dirt and debris, no other nuclear gauges near-by, 3 ft (1 m) from any vertical structure, on a stable surface.
- Pass the manufacturer's statistical stability test,
- Complete and pass a four (4) minute standard count in the area of Validation.

Refer to the gauge operator's manual for gauge cleaning and evaluation procedures.

Site Preparation

- Select a flat, level and dry surface with a density greater than 100 lb/ft3 (1602 Kg/m3) three (3) feet from any vertical structure. Note: Soil, asphalt or concrete are good examples of the surface to place the ValiDator II for testing. Parking lots or open fields are recommended locations for testing.
- Remove the ValiDator II from the shipping case, place the unit on a selected area, and position handle at bottom stop.
- Take a Daily or Calibration Standard Count (see page 7 for difference) and Record on the ValiDator II Evaluation Form. Do not take the Standard Count on the ValiDator II.
- Align the density gauge on the top of the ValiDator II using the guides on top of the unit.
- Select the specific thickness for the 4640-B gauge under test, or the Backscatter density for the supported gauges. The following are supported gauges.

Supported Nuclear Gauges

It is important when you verify or calibrate your gauge that the correct chart and values are selected. If there are gauges in your fleet that are not supported on this list, you may establish guidelines for Verification of these gauges. (Reference Verification Procedures for Gauges Not Supported page 21)

CPN

MC3 New, MC1 DR New: Gauges manufactured with two GM detectors. Standard counts are generally between 30000 & 40000 counts. These gauges are supported for verification only.

MC3, MC1 DR: Gauges manufactured before approximately 1996 with one GM detector. InstroTek currently does not support these gauges. Standard counts are generally between 10000 & 20000. Please contact InstroTek for more information on these gauge models or reference Verification Procedures for Gauges Not Supported page 21.

MC1: InstroTek currently does not support verification of this gauge. Please contact InstroTek for more information on this gauge model or reference Verification Procedures for Gauges Not Supported page 21.

MC2: InstroTek currently does not support verification of this gauge. Please contact InstroTek for more information on this gauge model or refer to manual section Verification Procedures for Gauges Not Supported page 21.

MC3 and MC1 Elite:
These gauges are supported.

Humboldt
5001 B, 5001C, 5001P, 5001 EZ are supported for verification only.

Troxler
4640-B: are supported for verification and calibration**.**
4640-A: are not supported, please follow procedures for gauges not supported found below.

3401 & 3411: These gauges are only different in electronic functionality. Both these gauges are supported by the ValiDator II for verification only.

3430 & 3440: These gauges are only different in electronic functionality. Both these gauges are supported by the ValiDator II for verification only.

3411 New (Gauges with serial number above 18000), 3450: contact InstroTek for information on these gauges.

3450: These gauges are supported for verification and calibration. However, to calibrate the 3450 gauge "DualSpec" program has to be used. Contact your InstroTek representative for more information.

User Guide Information

ValiDator II: Device used to verify and calibrate nuclear gauges.

Validation: Utilizing the ValiDator II device to evaluate gauge calibration accuracy at multiple depths, at an assigned density.

Verification: The process of using the Validation System to verify the calibration accuracy of a nuclear density gauging device.

Calibration: The process of re-establishing the calibration parameters for a nuclear density gauging device.

Calibration Constants: Parameters established by the calibration program and used by a density gauge to calculate density and moisture.

ValiDator II Density: Factory established densities assigned to a specific ValiDator II device for each measurement depth 0-12.

The ValiDator II calibration reports are not exchangeable between different ValiDator II units.

Safety

- Always operate in accordance with the nuclear gauge manufacturer recommendations.
- Stand opposite the source rod when operating the ValiDator II Device.
- Move three feet (one meter) back when the source rod is extended into the measurement position.
- Use proper lifting techniques when loading and unloading the ValiDator II.
- Be aware of heavy machinery operating in the area of testing.

Important: Follow the requirements of your nuclear materials license when operating, maintaining and using nuclear gauges.

Quick Start Instructions

The quick start instructions will benefit the new and the experienced operators using the ValiDation System. The System Operation portion of this manual contains detailed information about all aspects of the ValiDator II system. The Validation system is designed for use with the Troxler 4640-B Thin layer gauge and various nuclear gauges manufactured by CPN (MC3 & MC1-DR), Humboldt (5001 Series), and Troxler (3401, 3411, 3430, 3440 and 3450). Please refer to Supported Nuclear Gauges on page 4. Precautions should be reviewed on the following page.

Important: Observe manufacturers recommendations regarding safety precautions when operating density gauges. Stand opposite the source rod at a distance of three feet or 1 meter when measurements are being taken. Follow the requirements of your nuclear materials license.

Standard Counts for Daily or Rapid Verification: If you are evaluating your gauges frequently for Quality Assurance, or will not be calibrating on-site, a daily 4 minute standard count may be used for the Standard counts on the Evaluation Form for Verification. Take one 4-minute count at all other depths. Standard count should be taken on a solid surface such as soil, asphalt or concrete base. Do not take standard counts with the standard block on the ValiDator II, second floor, or the tailgate of a truck.

Standard Counts for Combination Verification and Calibration: If you will be performing a scheduled Verification or Calibration and would like to optimize the data collection process, perform an Extended Standard Count. (For Troxler 4640-B, perform a Stat Test and Drift test and record the average of System 1 and 2 counts on the Evaluation form.) Record the Standard Counts on the Evaluation form. Five (5) four (4) minute counts should be taken on the ValiDator II and averaged for the calibration process.

I. Validation Process

A. Align gauge on the ValiDator II. (See Gauge Placement page 9)
B. Set count time for four (4) minutes.
C. Complete a four (4) minute reading and record the gauge results, DT (Density), DC, on the ValiDator II Evaluation Form (Page 11). Make additional blank copies of this form for future use.
D. The Density (DT) readings from the gauge should fall between the range indicated on the ValiDator II Calibration Data Table for the gauge model under test.

E. If the resulting densities indicate the gauge passes, consider the verification process complete. The gauge is now verified for field use.
F. If the gauge fails Validation, review precautions and repeat Validation steps A-G.
G. A second failure would indicate that a calibration is needed.

II. Calibration Process

Note: Gauge Calibration is a sophisticated process and should only be attempted by advanced and trained users. Please refer to the Calibration Section of the Manual for calibrating gauges.

Precautions before You Begin

Nuclear gauge: ***Note: Do not take a Standard Count on the ValiDator II.***

- Clean Base
- Record the Current passing standard count in the field location where Validation is to be performed.
- Count time set to four (4) minute counts
- Stable Gauge Electronics (Run the manufacturer recommended diagnostics if field results are questionable.)
- No other gauges should be within 30ft (10 meters) of the testing area.
- When taking measurements stand opposite the source side of the unit a distance of three feet (1 meter) away.
- Gauge positioned correctly on the ValiDator II. (Refer to Gauge Placement page 9)
- Gauges meet the requirements for supported gauges. (Refer to User Guide page 6)

ValiDator II Device:

- Top surface free of debris
- Placed on solid level surface, three feet from any vertical structure.
- Tailgates, Carpeted floors, upper floors of buildings, trailers, and uneven surfaces are not acceptable.

Equipment

Items required for Verification and Calibration include: ValiDator II Device, ValiDator II Calibration Data (In shipping case), ValiDator II Evaluation Form (page 11 of user guide), stable nuclear gauge, and current gauge calibration data (for calibration option).

Gauge Placement

Two stops are provided to be used to align the gauge. The diagram below illustrates the gauge measurement position. All supported gauges would be aligned with these guides.

Backscatter & Moisture Readings

All Backscatter (Depth 0) and Moisture readings should be taken with the gauge flush with the stop at the top and on the left as shown below.

Direct Transmission (Depths 2-12) Readings

Direct Transmission (Depths 2-12) readings require the gauge to be positioned such that the void between the source rod and the inside of the ValiDator II block is minimized. Slide the gauge back until you can drop the source rod in the hole on top of the ValiDator II. Once the source rod drops in the hole, make sure to keep the gauge flush with the left stop and slide the gauge back away from the top stop until it can't be moved any further.

ValiDator II Evaluation Form

ValiDator II S/N _____ Date: _____

Gauge S/N _____ Operator _____

Gauge Model _____

Daily Standard Counts DS1_____ DS2_____

Count Time 15 sec 30 sec 1min 4 (Recommended) Circle one

Verification Counts

Depth	Pass **DT/WD** Fail	**DC1**	**DC2**
1 inch	P _____ F	_____	_____
1.25	P _____ F	_____	_____
1.50	P _____ F	_____	_____
1.75	P _____ F	_____	_____
2.00	P _____ F	_____	_____
2.25	P _____ F	_____	_____
2.50	P _____ F	_____	_____
2.75	P _____ F	_____	_____
3.00	P _____ F	_____	_____
3.25	P _____ F	_____	_____
3.50	P _____ F	_____	_____
3.75	P _____ F	_____	_____
4.00	P _____ F	_____	_____

Calibration Standard

	System 1	System 2
A) Stat Test Results		
B)Drift Test Results		
Calibration Standard Average (A+B/2)		

The Calibration Standard and Average Counts will be entered in the *ThinPave* software to calculate new calibration constants.

Calibration Counts

Record the Density Count (DC) from the average of five (5) four minute counts. These are the counts taken on the ValiDator II

	System 1 (DC)	System 2 (DC)
Cnt 1		
Cnt 2		
Cnt 3		
Cnt 4		
Cnt 5		
Average		

Example of Gauge Calibration Report

Gauge Manufacturer

CALIB. DATE: 7-24-99 **GAUGE MODEL:4640-B**
GAUGE SERIAL: 1776

BAY #: 45 STD. COUNT 1: 7463 STD. COUNT2: 2362

4640-B CALIBRATION CONSTANTS

A1= XXXXXXXXXXX
B1= XXXXXXXXXXX
C1= XXXXXXXXXXX

A11= XXXXXXXXXXX
A12= XXXXXXXXXXX
A13= XXXXXXXXXXX

A2= XXXXXXXXXXX
B2= XXXXXXXXXXX
C2= XXXXXXXXXXX

A21= XXXXXXXXXXX
A22= XXXXXXXXXXX
A23= XXXXXXXXXXX

Example Gauge Calibration Report Key

1) Make (CPN, Humboldt, InstroTek or Troxler)

2) Model

3) Serial Number

4) Calibration Standard Counts

5) Calibration Date

6) Factory Density Constants (A, B, C Parameters)

7) Calibration Block Densities lb. /ft3 or kg/m3

8) Calibration Block Counts

9) Factory Moisture Constants
(E & F or A & B for CPN gauges)

2. ValiDator II Accessories and Application

Before using the ValiDator II, it is recommended that the user read this manual and understand the operation of this system.

List of Equipment & Accessories

User Guide
ValiDator II (Calibration Box)
ValiDator II Density Data (Laminated Sheets)
Quick Start Instructions

List of Optional Accessories

Optional ThinPave Software (USB Flash Drive)

Note: Small scratches should be expected on the ValiDator II working surface due to extensive quality control process utilizing measurements with multiple gauges.

Application Overview

Verification & Calibration Process

There are several steps necessary to accomplish a gauge verification and calibration. Gauge calibration verification is the most fundamental use of the ValiDator II device. Position a density gauge on top of the ValiDator II device, take a four (4) minute density reading and evaluate the resulting density using the gauge manufacturer specific ValiDator II Calibration Data Table.

Density gauge data is required by the *ThinPave* Software and should reflect the most recent calibration. If not available, this data may be obtained from the organization that completed this calibration.

The ValiDator II Verifies and Calibrates Troxler 4640-B Thinlayer gauges. The ValiDator II will also verify the backscatter readings, but not calibrate; CPN MC3,

MC1 DR, Humboldt 5001 Series, and Troxler 3411, 3430, 3440 gauges. Troxler 3450 gauges can also be verified and calibrated using the ValiDator II. Contact your InstroTek representative for information concerning 3450 calibrations. For calibrating and verifying the direct transmission depths of these gauges, InstroTek offers the *ValiDator.*

Calibration constants are used by the gauges to perform the calculations necessary to process raw count data into a density. Calibration constants may be entered into a 4640-B gauge using the operator keypad.

3. Software Installation

Computer Requirements: Windows operating system

Installing *ThinPave* Software on a PC

Object: Allow the operator to access the software and re-calibrate a nuclear gauge.

Support: Before loading any software, consult with your organization PC Manager or operating system manuals.

Locate your flash drive included with your *ValiDator II* system. Please read license agreement before opening software package. This software should only be loaded on one computer. Access codes will be needed to complete installation. InstroTek's hours of operation are 8:30am-5:00pm EST M-F.

Place the software flash drive into the appropriate USB port and select 'Setup". Follow the prompts to install the software. After installation, call InstroTek to obtain installation codes and user password.

NOTE: **ValiDator II and its' associated software is licensed to a single user. Use of the ValiDator II and its' associated software is not allowed for calibration of gauges from other organizations.**

Upgrading Software Version

You may load the new software version directly over the existing version and not lose your existing data.

- Close all Windows programs.
- Follow the Install instructions.
- Follow prompts.

Moving Software

- ThinPave software may only be installed on one computer, unless a multiple site license was purchased.
- Moving to another computer is possible. Please contact InstroTek for procedures and access codes.

4. System Operation

Calibration Accuracy Verification & Calibration Process

Verification Process

Verification of the gauge is necessary to determine the status of the gauge calibration. Gauges are calibrated when they are shipped from the manufacturer. Without performing periodic verification, it is not possible to assess the accuracy of your gauge calibration. Due to the detector system contained in the 4640-B verification may be required more frequently when compared to conventional nuclear density gauges.

Validation

Definition: Is a sub-process of Gauge Verification that uses the reference densities assigned to a ValiDator II device for evaluating the calibration accuracy of a density gauge.

Resources: ValiDator II Device, Gauge Field Evaluation Form, ValiDator II Calibration Tables, *Density Gauge, **Stable surface.

Important: Follow the requirements of your nuclear materials license when operating, maintaining and using your gauge.

Calibration

Calibration is a process of calculating new parameters for the nuclear gauge. Only advanced users with a high degree of experience and understanding of gauge measurement and operations should perform this process. It is recommended that one individual in an organization be responsible for the calibration process. The ThinPave Software with counts taken on the ValiDator II can be used to generate new calibration constants for the 4640-B gauge.

Resources: InstroTek ThinPave Software, PC, Completed Evaluation Form, *Density Gauge, Gauge Calibration Constants, **Stable surface

Note: The ThinPave Software used for calibrating your gauge assumes that the current gauge calibration information is obtained and entered accurately. Also, it is important that the gauge is serviced and maintained according to the manufacturer's recommendations. Re-

calibration does not guarantee proper operation of the gauge, if the gauge is not properly maintained.

Moisture Calibration

*Density Gauge: A gauge qualified for evaluation should meet the requirements below:

- Gauge base should be free of asphalt or debris that would cause the unit to rock,
- Pass the manufacturers recommended statistical stability and drift tests, and
- Pass a standard count at the evaluation site.
- No other nuclear gauges should be within thirty (30) feet.

**Stable Surface:

- Be at least three (3) feet (1M) from any vertical structure.
- Dry and level,
- Have a density of greater than100pcf (1602 Kg/m3).
- Parking lots and construction sites are ideal surfaces for testing.

Unacceptable surfaces would be as follows: trailer floors, truck tailgates, second-story floors, wet surfaces with standing water or carpeted floors.

Validation Procedures

Gauge Evaluation

- The gauge base should be free of dirt and debris, no other nuclear gauges near-by, 3 ft. (1 m) from any vertical structure, and on a stable surface.
- Pass the manufacturer's statistical stability test.
- Complete and pass a four (4) minute standard count in the area where validation tests are being conducted.

Refer to the gauge operator's manual for gauge cleaning, routine maintenance and evaluation procedures.

Site Preparation and Gauge Placement

- Select a flat, level and dry surface with a density greater than 100 lb/ft3 (1602 Kg/m3) three (3) feet from any vertical structure. Note: Soil, asphalt or concrete are good examples of the surface to place the ValiDator II for testing. Parking lots or open fields are recommended locations for testing.
- Remove ValiDator II from shipping case, place unit on selected area, and position handle at bottom stop.
- Take a Daily or Calibration Standard Count and record on ValiDator II Evaluation Form.
- Align the density gauge on the top of the ValiDator II using the specific guides on top of the ValiDator II device. (See Gauge Placement page 9)
- Select the specific thickness for the 4640-B gauge under test, or the Backscatter density for the supported gauges.

NOTE: Do not take standard counts on top of the ValiDator II.

Verification Procedure for Gauges Not Supported by the ValiDator II

For gauges not supported you can establish a history and determine when each individual gauge falls outside a ±1% limit. Observe the following procedure to establish a verification process for gauges not supported, such as MC1 and MC2.

Example:

Depth	A	B	C	D	E	F
Date	12/7/2017	6/7/2018		12/7/2017	6/7/2018	
	S/N 7022	S/N 7022	Difference PCF *B - A*			Dif. *E - D*
BS	150.2	150.6	0.4	5.6	5.7	0.1

1. Send your gauge to a calibration facility for a calibration.
2. When you receive the gauge, take a four-minute Standard Count. Use the following form or generate your own spread-sheet program.
3. Take four minute WD and M readings on the ValiDator II at each depth and enter in column ***A*** and ***D*** as baseline readings.
4. At a later date, for example, every six months take readings and store in ***B*** and ***E***.
5. Compare ***A*** to ***B*** and ***D*** to ***E***, and place in ***C*** and ***F***.
6. If any of the WD numbers are outside of ±1 lb/ft^3 (±16 Kg/m^3) difference or M outside ± 0.5 lb/ft^3 (±8 Kg/m^3), take readings again. If it fails again, the gauge needs to be considered for a stability check and/or calibration.

Note: This procedure assumes that the Calibration received is accurate. For re-calibrating these gauges contact InstroTek.

Gauges Not Supported
Verification History Profile

Gauge Model _____ Date: _____
Gauge S/N: _____ Operator: _____
ValiDator II
S/N: _____

Date	Depth	(A) Baseline Density	(B) Test Density	(C) % Diff. *B - A*	(D) Baseline Moisture	(E) Test Moisture	(F) Diff. *E - D*

Verification Measurements and Data Evaluation

1. Complete a Standard count following the manufacturer's procedures. Do not take the standard count on the ValiDator II. Record the DS1 and DS2 results on the ValiDator II Evaluation Form.

2. Place the gauge under test on the ValiDator II and align with the gauge source rod side touching the upper stop. Set the count time to four minutes and complete a test at the desired depth. Record the DT/WD and DC1 (Density Count System 1), DC2 (Density Count 2) on the evaluation form for the selected depth and in the Calibration counts section if a calibration is anticipated. If a calibration is expected take four more readings and record on the evaluation form. The average of these results will be used for calibration.

3. Use the ValiDator II Calibration Table to evaluate the DT (Density) at the depth being tested for the pass/fail range. If the DT (Density) is within this range the gauge passes the verification process.

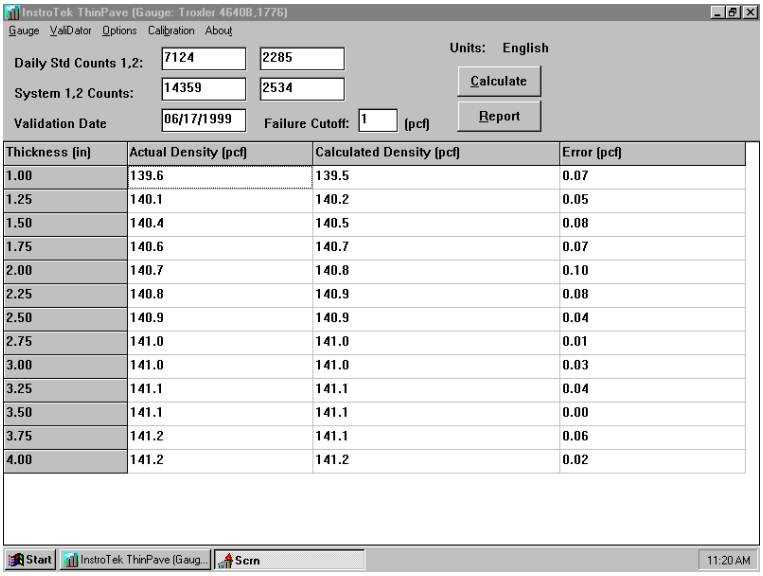
4. If a failure is indicated repeat the testing process reviewing the precautions listed in the Introduction, page 8.

5. Failing a second time would indicate an inaccuracy in the gauge calibration and the need for calibration.

6. Before moving on to Calibration, complete a statistical analysis using manufacturer recommendations. Record this information on the ValiDator II Evaluation Form in the Introduction section, page 11. The Analysis is commonly referred to as a Statistical Stability Test or Stat Test. If this test passes, run a Drift test in the same area at the end of the calibration process and record the average of the results on the ValiDator II Evaluation form.

7. Utilize the ThinPave Software (if available), to perform a new calibration. The ThinPave default screen may be used to enter count data and print reports to document gauges that pass ValiDation. Enter the results from the evaluation form and print the report.

8. Calibration data and ValiDator II assigned densities are required to be entered before calculating densities. Specific procedures covering entering the ValiDator II densities, reports and calibration follow.



ThinPave Default Screen

Calibration Procedures

The calibration process utilizes the optional *ThinPave* Software. Contact InstroTek to obtain your specific password for operating this program.
Note: Calibrations should be performed by qualified and experienced users only.

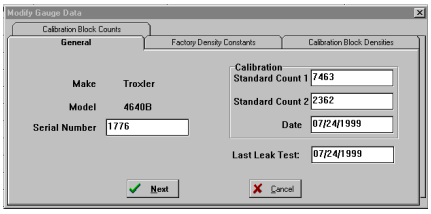
The nuclear gauge's current calibration data is necessary to complete the calibration process. If not available at your organization, contact the gauge calibration facility that performed this calibration for a copy.

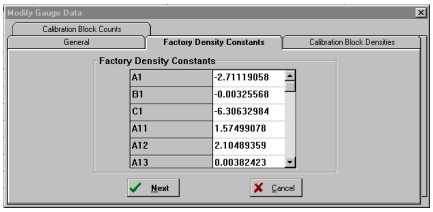
For loading the *ThinPave* Software see Chapter 3: Software Installation.

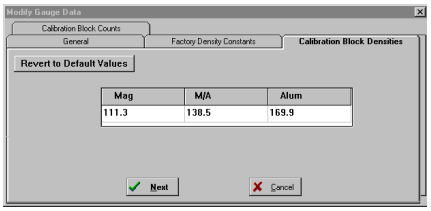
Note: If the gauge is not maintained nor has service problems, Calibration is not going to resolve any service or maintenance problems. Contact your service center to address any service issues with the gauge.

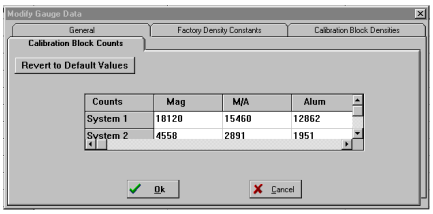
Step I: Entering Gauge Calibration Data

(An example of the Gauge Calibration Sheet may be found on page 12)









1. From the **Gauge** pull down menu, select **New** if this is the first time this gauge data is being entered.
2. Enter Password. (This was obtained from InstroTek on installation. Please contact InstroTek if lost.)
3. Enter Gauge General Information; Make, Model (Select the model defined on page 3), Serial Number, Factory Calibration Standard Count (This is the Calibration Standard Count on the Gauge Calibration Sheet of the Gauge under test.)
4. Enter Gauge Calibration Data.

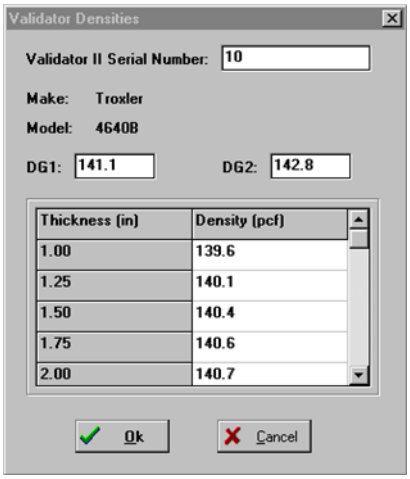
Caution: If this data is entered incorrectly, the gauge calibration may be inaccurate.

a) Calibration Constants: These are the values used by the gauge to calculate Density. See page 18.
b) Calibration Block Densities: ***Note: The calibration documentation provided by the manufacturer may not contain all listed information. Use default values in this case. ThinPave software calculates this data for you.***
c) Calibration Block Counts: These are the Density counts from the gauge calibration sheet. ***See note above.***

5. Change data or Select a Different Gauge:
   a) From the Gauge pull down menu, select **Modify** if the gauge data requires updating or correction.
   b) From the Gauge pull down menu, select **Pick** to review and select a specific gauge.

Step II: Entering ValiDator II Calibration Densities

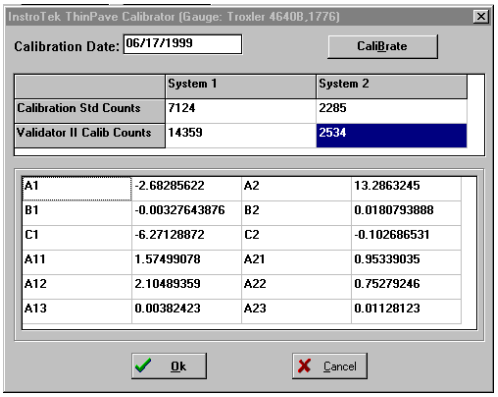
(Use the laminated ValiDator II Density Data sheets supplied with your ValiDator II. These sheets are manufacturer, model, and ValiDator II specific.)



1. Select **ValiDator II** from the pull down menu. Enter all the depths and densities found on your sheet. You may enter Pcf or Kg^3/m, but not both. The options menu allows you to change units.

Step III: Entering Calibration Counts

(This procedure will calculate new Calibration constants from the counts taken on the ValiDator II. It is extremely important to accurately input this data.)



1. From the Calibration pull down menu, select **CaliBrate** and enter the Password at the prompt. Contact InstroTek for a misplaced password.
2. Enter the Calibration Standard Counts for system 1 and System 2 that you established while collecting Verification data.
3. Enter the Calibration date. This is the date you collected the data on the ValiDator II for calibration.
4. Enter the Gauge count averages. These are the averages from system 1 and 2 Cnt. 1-5 from the ValiDator II Evaluation Form.

5. After the Gauge count data is entered, click on the Calibrate button, then Ok.

> *Note: If an error in the final calibration is noted you may revert back to the original by pressing* ***CTRL+E.***

Step IV: Programming New Constants in the Gauge

4640-B constants may be entered by Pressing shift, Special 1 then 9. Enter code 528 and select item 4 Calib. Const. from the special function menu. Use the 1and 2 Keys to choose +/-. Enter the constants as prompted.

Step VII: Quality Control

At any point that the Calibration is in error you may revert back to the old calibration by pressing ***Ctrl+E.***

To insure proper programming of the Calibration Constants into the gauge and the status of your calibration, the gauge should be Verified on the ValiDator II using the ValiDator II Evaluation Form. Place the gauge on the ValiDator II, and take readings at several different thicknesses. If the readings comply with the provided densities of the ValiDator II, your calibration process has been successful. Proceed to field use. If your gauge fails any of these readings, stop and check every step in your calibration process.

Additional Features:

Select **Gauge** from the pull down menu to access the functions described below.
Pick is used to choose another gauge from your database.
Modify is used to change or update the information for a specific gauge in the database.
New is for entering new gauge data.

Report

This displays the calibration constants for active calibration for a selected gauge. Select Calibrate from the pull down menus. Choose Report and print the Calibration data. This report should be printed and stored with each calibration. Using the Verifier default screen allows you to print a Verification Report from the data collected on the ValiDator II for your records.

Calculate Density

This functions as the processor of a gauge in calculating a density from a raw count. It calculates the count ratio and uses the calibration counts to calculate the density.

Uses: Calibrations may be verified before entering the calibration constants in the gauge. Verification of field readings may be accomplished with using the raw counts to check for operator induced errors, (i.e. source not in proper measurement position) plug in the standard counts and density count and calculate the density. This function requires activation of the appropriate gauge serial number in the Verifier software.

Gauge Management

Management: This option will allow you to manage your gauges more effectively. The software will report the last verification date, the last calibration date and the next leak test date. The data is sorted by the gauge's Next Leak Test date, and highlighted if the date is over six months for leak test and one year for calibration.

Leak Test: The software will allow you to enter the last leak test date for each gauge in the database. The software will keep up with this information and will alert you of the next leak test date (six months) under the *Management* report option. An overdue leak test will be highlighted in red.

Expected Standard Count: This calculation is based on the decay of the CS-137 gamma source. The limit on these standard counts is based on the gauge manufacturer's limit of ± 1% of the actual standard count. The software will automatically access the most recent calibration date and standard counts for the calculations. *Note: Gauge counts may change due to many different factors. Radioactive decay is the only variation that could be estimated accurately and does not necessarily correct for all deviations in the gauge.*

Notes: The notes function will allow you to document repairs and items used to identify service trends or any gauge related information.

5. Theory of Operation

Validation Theory

General Theory That Applies to ThinLayer and Conventional Nuclear Gauges

ASTM requirements dictate calibration verification at an interval of 12-18 months. The ValiDator II is a known and stable density reference that can be used for verification of gauge calibration accuracy. The ValiDator II device is calibrated by InstroTek, Inc., assigning reference densities to each of the measurement depths. Gauge measurements are taken on the ValiDator II and the results compared to the documented ValiDator II density range which indicates pass or fail. The ranges are based on a ±1.5% limit about the actual density of the ValiDator II. The limits are based on the combined errors in gauges due to precision, composition and surface roughness errors.

If a calibration is needed, the optional ThinPave Module may be used to calculate new calibration constants derived from the counts taken on the ValiDator II device. New calibration parameters are calculated using a fitting routine according to the gauge manufacturer's calibration method.

Gauge Calibration Theory

Nuclear density gauges utilize two systems that are used to calculate an in-place density and moisture content of construction materials. The density system generally uses Cesium 137 and detector tubes which output analog signals that are converted to counts by a micro-processor inside the gauge. The calibration process establishes a relationship between these raw counts and known densities. In the construction density range, the higher the density, the lower the counts.

Density Calibration

The final stage of the gauge manufacturing process is the calibration. The density calibration method used by most manufacturers utilizes an exponential equation that models the relationship between the known densities and the counts. CPN, Humboldt and Troxler use an equation such as:

$$CR = A\exp(-BD) - C$$

Where A, B and C are gauge parameters, CR is the count ratio and D is the material density. The A, B and C values are commonly known as calibration constants. In the field when a count is collected on the test material, the resulting wet density displayed on the screen is calculated by:

$$D = \frac{1}{B}\ln\left(\frac{A}{CR + C}\right)$$

3-Block Method or 5-Block Method:

Presently there are no authorities that certify nuclear gauge calibration. Therefore, gauge manufacturers and numerous other calibration facilities use a different number of blocks to facilitate the calibration process. The Validation and Calibration process simulate counts to replicate the number of blocks used in the most recent calibration. CPN, InstroTek and Troxler use the Three-block method and Humboldt uses the Five-block method.

6. Index

7. Warranty

InstroTek products are guaranteed against defective material and workmanship for a period of 12 months from the date of receipt by the customer.

InstroTek will replace, free of charge, any part found to be defective within the warranty period.

This warranty is void if inspection shows evidence of abuse, misuse or unauthorized repair.

This warranty covers replacement of defective materials and workmanship only. It does not cover shipping charges, duties or taxes in the transport to and from the factory or authorized service center.

If return of the product is necessary please include return shipping directions, contact name, phone & fax number and a description of the action needed.

Call InstroTek, Inc. for shipping details at (919) 875-8371.

Contact Information

InstroTek® Inc.
Innovators in Instrumentation Technology

Manufacturer's Recommended Recertification for ValiDator System:

InstroTek, Inc. recommends that the ValiDator be recertified every 5 years in accordance with established US standards, such as the AASHTO T310 specification. Recertification of the ValiDator ensures gauges verified and calibrated using the ValiDator produce the most accurate results.

Since ValiDator is a portable block and has the potential of being moved from one location to another, recertification provides the confidence to the users that the system continues to be reliable and in specification.

Recertification includes checking all components for compliance, performing hardware updates and establishing new density/moisture tables for all nuclear gauge models supported by the ValiDator.

For more information regarding recertification of the ValiDator please contact us at +1 919 875 8371 or email us at sales@instrotek.com

Contact us for top quality, best value and superior service!

email: **sales@instrotek.com** ✦ visit: **InstroTek.com**

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