KOEHLER
INSTRUMENT COMPANY, INC.

K955XX Digital Penetrometer and Data acquisition Software

Operation and Instruction Manual
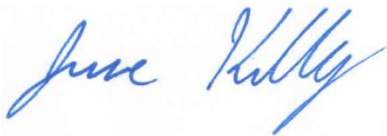
REV D

CERTIFICATE OF CONFORMANCE

Digital Penetrometer
K955XX-00000

This certificate verifies that part number K955XX-00000, Digital Penetrometer, was manufactured in conformance with the applicable standards set forth in this certification.

Specifications:

ASTM D5
ASTM D217
ASTM D937
ASTM D1321
ASTM D1403
ASTM D2884
ASTM D4950
ASTM D5329
IP 49
IP 50
IP 179
IP 310
ISO 2137

This unit is tested before it leaves the factory, to ensure total functionality and compliance to the above specifications and ASTM standards. Test and inspection records are on file for verification.

Jesse Kelly
Application Engineer
Koehler Instrument Company

Declaration of Conformity

EC Declaration of Conformity
according to EC Directive of Electromagnetic Compatibility 89/336/EEC
and EC Low Voltage Directive 73/23/EEC

Application of Council Directive(s):	89/336/EEC, 73/23/EEC
Standard(s) to which conformity is Declared:	**EMC:** EN 55011 Class A
	EN 50081-1
	EN 50082-2
	EN 61000-4-2
	EN 61000-4-3
	EN 61000-4-4
	Low Voltage: EN 60204 & EN 60950
Manufacturer's Name:	**Koehler Instrument Company, Inc.**
Manufacturer's Address:	**1595 Sycamore Avenue**
	Bohemia, NY 11716
Type of Equipment:	**Digital Penetrometer**
Model Number:	**K95590**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Signature Agent:	_____	Signature Mfg: _____
Name:	_____	Name: *JOSEPH R. RUSSO*
Title:	_____	Title: *DIRECTOR OF MFG.*
Location:	_____	Location: *BOHEMIA, NY. 11716*

WEEE Directive Compliance Statement

Background

The goal of the WEEE Directive is to encourage design of environment-friendly products that increase reuse, recycling and other forms of recovery to reduce waste streams and applies to listed Electronic and Electrical Equipment (EEE) and Koehler's equipment falls broadly into Appendix 1A; Section 9 Monitoring and Control Equipment: Measuring, weighing or adjusting appliances for household or as laboratory equipment.

Any associated non-embedded equipment such as Lighting (Saybolt Color) and PCs/Printers also fall under WEEE. If provided with an order these ancillary items must be WEEE compliant. For these and other reasons (printer cartridges are regionalized) the equipment must be supplied through a third party supplier in Europe.

The WEEE Directive applies to electrical and electronic equipment falling under the categories set out in Annex IA provided that the equipment concerned is not part of another type of equipment that does not fall within the scope of this Directive. Annex IB contains a list of products which fall under the categories set out in Annex IA.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:en:PDF

We do not qualify for any of the 10 exemption categories.
http://www.dpa-system.dk/en/WEEE/Products/Exemptions

Professional use

For equipment defined for 'professional use' local authorities have no role to play. Producers and importers are basically responsible for collection of WEEE recyclables from the professional user and for subsequent management. A separate statement is given cataloging the items that require separation from the equipment along with basic information on subsequent processing or recycling prior to disposal of the equipment.
http://www.dpa-system.dk/en/WEEE/Products/Private-or-professional-use

Responsibility for Registration and Annual Reporting:

Koehler will not sell directly to end users in the EU and so has no responsibility to register within each EU state and to make annual reports. Koehler declares that this responsibility is born by the importer who is the first level of the distribution chain and is subject to producer responsibility. We will communicate this in writing to our distributor/importers in the EU stating they are responsible to satisfy WEEE registration and reporting requirements in the EU states where they conduct sales activities.

It is illegal to market electrical and electronic equipment covered by producer responsibility without being registered.

http://www.dpa-system.dk/en/WEEE/Producers/Whoissubjecttoproducerresponsibility

Product Design

Koehler's designs allow for complete disassembly to a modular level which usually allows for standard recycling. A qualified refrigeration system technician must be consulted when disassembling and de-commissioning any equipment with refrigeration systems.

Koehler's scientific testing equipment is robustly designed to function over a long service life and are typically repaired many times over the course of years rather than being replaced. We believe that re-use and refurbishment is the very best form of re-cycling.

All batteries must be readily removable not soldered in place.

Recycling instructions

In the event that replacement becomes necessary, we will include instructions, particularized to each instrument that informs the customer of their recycling responsibilities and giving them guidance in doing this. All Koehler equipment has been placed on the market since 13th August 2005 and so Koehler is

defined as a "new WEEE producer". As such we must provide information on refurbishment, treatment, and re-use.

Our instrument manual will include this compliance statement and indicate that any collection of materials will be handled by their authorized distributor. In the event that the distributor is unreachable or is no longer a distributor for Koehler Instrument, Co., other arrangements may be made including accepting the materials directly.

Recycling is free of charge. Shipping is the responsibility of the end users. Whether shipping to a distributor or to Koehler directly, safe, properly declared, and labeled packaging and shipping expenses are the sole responsibility of the end user.

WEEE Marking

Since Koehler products are subject to the WEEE Directive we must display the WEEE symbol shown above in accordance with European Standard EN 50419 on the equipment. It must be indelible, at least 5mm in height, and clearly legible. If the equipment is too small the mark must be in the product literature, guarantee certificate, or on the packaging. Rules on marking are established in section 49 of the WEEE Order.

Koehler Instrument Company, Inc.
c/o RECYCLING
1595 Sycamore, Ave.
Bohemia, NY 11716

As a minimum the following substances, preparations and components have to be removed from any separately collected WEEE:
- Mercury containing components, such as switches or backlighting lamps (compact fluorescent lamps, CFL),
- Batteries
- Printed circuit boards if the surface of the printed circuit board is greater than 10 square centimeters (about 4 sq in.),
- Toner cartridges, liquid and pasty, as well as color toner,
- Chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or hydrofluorocarbons (HFC), hydrocarbons (HC)
- Liquid crystal displays (together with their casing where appropriate) of a surface greater than 100 square centimeters and all those back-lighted with gas discharge lamps,
- External electric cables
- Components containing refractory ceramic fibers as described in Commission Directive 97/69/EC of 5 December 1997 adapting to technical progress Council Directive 67/548/EEC relating to the classification, packaging and labeling of dangerous substances (2),
- Electrolyte capacitors containing substances of concern (height > 25 mm, diameter > 25 mm or proportionately similar volume)

2. The following components of WEEE that is separately collected have to be treated as indicated:
- Equipment containing gases that are ozone depleting or have a global warming potential (GWP) above 15, such as those contained in foams and refrigeration circuits: the gases must be properly extracted and properly treated. Ozone-depleting gases must be treated in accordance with Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer (4).

Table of Contents

1 Introduction

The K955XX Digital Penetrometer is designed to measure the consistency of a wide range of semi-solid and solid products with maximum precision and convenience. Used with appropriate plungers, cones, needles, and accessories, these penetrometers provide repeatable penetration values in tenths of a millimeter for greases, waxes, asphalts, petrolatum, creams, food products and many other products.

This manual provides important information regarding safety, technical reference, installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the Digital Penetrometer. This manual should also be used in conjunction with applicable published laboratory procedures. Information on these procedures is given in section 1.2.

1.1 Koehler's Commitment to our Customers

Providing quality testing instrumentation and technical support services for research and testing laboratories has been our specialty for more than 50 years. At Koehler, the primary focus of our business is providing you with the full support of your laboratory testing needs. Our products are backed by our staff of technically knowledgeable, trained specialists who are experienced in both petroleum products testing and instrument service to better understand your requirements and provide you with the best solutions. You can depend on Koehler for a full range of accurate and reliable instrumentation as well as support for your laboratory testing programs. Please do not hesitate to contact us at any time with your inquiries about equipment, tests, or technical support.

Toll Free: 1-800-878-9070 (US only)
Tel: +1 631 589 3800
Fax: +1 631 589 3815
Email: info@koehlerinstrument.com
http://www.koehlerinstrument.com

1.2 Recommended Resources and Publications

1. American Society for Testing and Materials (ASTM)
   100 Barr Harbor Drive
   West Conshohocken, Pennsylvania 19428-2959, USA
   Tel: +1 610 832 9500
   Fax: +1 610 832 9555
   http://www.astm.org
   email: service@astm.org

   ASTM Publication:
   - ASTM D5: Penetration of Bituminous Materials
   - ASTM D217: Cone Penetration of Lubricating Grease
   - ASTM D937: Cone Penetration of Petroleum
   - ASTM D1321: Needle Penetration of Petroleum Waxes
   - ASTM D1403: Cone Penetration of Lubricating Grease Using One-Quarter and One-Half Scale Cone Equipment
   - ASTM D2884: Yield Stress of Heterogeneous Propellants by the Cone Penetration Method
   - ASTM D4950: Classification of and Specification for Automotive Service Greases

2. International Organization for Standardization (ISO)
   1, rue de Varembé
   Case postale 56
   CH-1211 Geneva 20, Switzerland
   Tel: 41 22 749 01 11
   Fax: 41 22 733 34 30
   http://www.iso.org
   ISO Publication:
   - ISO 2137

3. Energy Institute (IP)
   61 New Cavendish Street
   London, WIM 8AR, United Kingdom
   Tel: 44 (0)20 7467 7100
   Fax: 44 (0)20 7255 1472
   http://www.energyinstpubs.org.uk/

   IP Publication:
   - IP 49: Determination of Needle Cone Penetration of Bituminous Material

- IP 50: Determination of Cone Penetration of Lubricating Grease
- IP 179: Determination of Cone Penetration of Grease: One-Quarter and One-Half Scale Cone Method

4. Deutsche International Norm (DIN)
   http://www.din.de
   DIN Publication:
   - DIN 51804
   - DIN 51580

   - DIN 51579

5. Federal Test Method (FTM)

FTM Publications:
- FTM 791-311
- FTM 791-312
- FTM 791-313

1.3   Instrument Specifications

Part	Dimensions l x w x h (cm)	Weight (Kg)	Voltage	Frequency	Amps	Line Cord
Penetrometer (K955XX-00000)	33 x 36 x 47	8.5	12.6 VAC Single phase	50 or 60 Hz	4.0 Amps	-
Power Adapter (K95500-11001)	13 x 13 x 10 (excluding cable)	1	115 ± 10% VAC Single phase	60 Hz	0.5 Amps	Nema 5-15
Power Adapter (K95590-11001)	8 x 7 x 10 (excluding cable)	1.6	230 ± 10% VAC Single phase	50 or 60 Hz	0.25 Amps	IEC 320 Class 1

1.4 Software Specifications

PC Processor:	Intel® Pentium II or similar (minimum)
Processor Speed:	500 MHz or higher
Operating System:	Windows ® 98 SE, 2000, NT, ME, XP
Memory (RAM):	64 Mb RAM (128 Mb RAM recommended)
Disk Space:	Hard 15 Mb free space (minimum)
Communication Ports:	one RS232 port
Other Software:	Microsoft ® Excel (97 or above)

2 Safety Information and Warnings

Safety Considerations. The use of this equipment may involve *hazardous* materials and operations. This manual does not purport to address all of the safety problems associated with the use of this equipment. It is the responsibility of any user of this equipment to investigate, research, and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Equipment Modifications and Replacement Parts. Any modification or alteration of this equipment from that of factory specifications is not recommended voids the manufacturer warranty, product safety, performance specifications, and/or certifications whether specified or implied, and may result in personal injury and/or property loss. Replacement parts must be O.E.M. exact replacement equipment.

Unit Design. This equipment is specifically designed for use in accordance with the applicable standard test methods listed in section 1.2 of this manual. The use of this equipment in accordance with any other test procedures, or for any other purpose, is not recommended and may be extremely hazardous.

Chemical Reagents Information. Chemicals and reagents used in performing the test may exhibit potential hazards. Any user must be familiarized with the possible dangers before use. We also recommend consulting the Material Data and Safety Sheet (MSDS) on each chemical reagent for additional information. MSDS information can be easily located on the internet at http://siri.uvm.edu or http://www.sigma-aldrich.com.

⚠️ **NOTE: Light Petroleum Naphtha** is used as a cleaning solvent for the penetrometer and its accessories. Do not operate the penetrometer in the presence of Light Petroleum Naphtha.

- Extremely flammable. Vapors or spray mist harmful if inhaled.
- Vapors may cause flash fire.
- Keep away from heat, speak, open flames, or any other ignition sources.
- Keep container closed.
- Prevent build-up of vapors by opening all windows and doors to achieve cross ventilation. Also, use under a hood to ensure proper ventilation.
- Avoid contact with eyes, skin and clothing.
- Do not smoke near the area.
- Beware of static discharges.
- Turn off all stoves, heaters, motors and pilot lights during use and until all vapors are gone.
- Wash hands thoroughly after each use.
- Always wear safety clothing (eye protection, gloves, lab coat, etc.)

3 Getting Started

The instructions for preparing the equipment assume that the user is aware of the contents of this document, which lists the warranty conditions and important precautions.
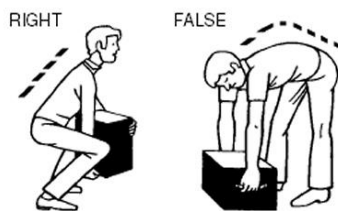
3.1 Packing List

- Digital Pentrometer
- Digital Penetrometer Manual
- 47.5-g Plunger
- Two Weights (50g & 100g)
- Power Adaptor
- Conductivity Probe

3.2   Unpacking

1. Check Shock Watch Label on Cardboard Boxes for indication of rough handling and possible damage.

2. This unit comes packed in two pieces in a double-walled corrugated carton. Remove the penetrometer head and the base from the foam inserts and place on a firm, level table in a room free from drafts.

3. Check labeling for correct orientation of instrument. (e.g. This Side Up)

4. Carefully open top of box with box cutter and remove packing foam.

5. Make two additional vertical cuts, using box cutter, along length of two sides of the box and remove packing foam.

6. Extract instrument and place on suitable cart for transportation to work area / lab bench.

 WARNING: Be sure two or more individuals are available for extracting and lifting instrument from box to cart and from cart to bench. Individuals must lift in accordance to proper technique. See Figure below.

7. Lift instrument from cart and place on bench.

8. Ensure that all parts listed on the packing list are present. Inspect the unit and all accessories for damage. If any damage is found, keep all packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment. Do not return goods to Koehler without written authorization.

3.3   Installation

Equipment Placement. Place the base on a firm, level table in an area with adequate ventilation or in a hood. The unit may be leveled by making minor turning adjustments to the feet located at the base of the unit. Please note that Koehler does not supply a level with this equipment.

Environmental Conditions: The instrument environment must comply with the following conditions for proper setup:

- No / Low Dust
- No direct sunlight
- Not near heating or AC ventilation ducts
- No Vibrations
- Clearance from other instruments
- Temperature Range: 5 to 40°C
- Elevation to 2000 meters
- Relative Humidity: < 80%

Power. Connect the line cords to properly fused and grounded receptacles with the correct voltage as indicated in section 1.3 or on the back of the unit.

 WARNING: For safety, disconnect the power when performing any maintenance and/or cleaning. Do **NOT** turn the power on unless the bath is filled with the proper medium; otherwise, damage may occur to the unit and the warranty will be void.

Install Penetrometer Head into the Base:

1. To have the penetrometer head facing forward on the base, place the penetrometer head screws into the corresponding holes as indicated by the shaded dots on the diagram below. Make sure the bellow (black covering) is tucked in. Then tighten the nuts with a 3/8" socket wrench.
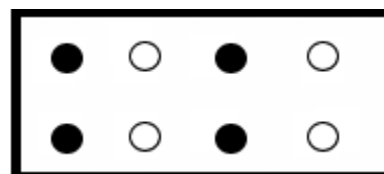
2. Make minor leveling adjustments by turning the adjustable feet and observing the leveling indicator located on top of the unit head. Incorrect measurements will result if the unit is not properly leveled.

3. Connect the power adapter (male) prong into the correct holes of the corresponding female counterpart on the penetrometer. Warning: Be sure to properly align the prongs into the holes or severe damage may occur to your penetrometer. DO NOT FORCE THE PRONGS INTO THE HOLES. Then connect the line cord of the power adapter into the appropriate mains supply source.

4. Select the appropriate penetration cones, needles, plungers and accessories for the sample to be tested. Refer to applicable test methods.

3.4 Using the Penetrometer with a Constant Temperature Bath

The K955XX Digital Penetrometers can be used together with a constant temperature bath to maintain sample temperature within applicable specified limits.

To Perform Penetration Tests Using a Bath:

1. The penetrometer head assembly must be removed from the base, turned around, and then reattached so that it can be suspended over the sample in the bath. To turn the head assembly around, lay the penetrometer on its side so the Koehler name is facing up and away from the operator.

2. Unscrew the nuts using a 3/8" socket wrench and turn the penetrometer head around, but this time insert the penetrometer head screws into the corresponding holes as indicated by the shaded dots on the diagram below. Now that the head assembly is reversed, make sure that the bellows (black covering) is tucked in. Again, tighten the screws with the 3/8" socket wrench.
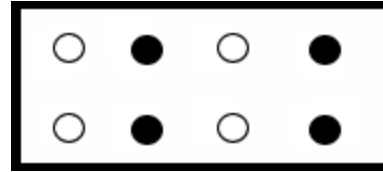
3.5 Using the Penetrometer with Battery Power

Backup Power Supply: The penetrometer is equipped with a built in 12V rechargeable battery. The battery serves as a back up in the event of a power interruption when the penetrometer is being used on AC power (plugged in). If a power interruption occurs, the operating parameters selected by the operator (penetration interval, penetration limits, etc.) and the last test result will be retained in memory. The penetrometer may also be operated on battery power until AC power is restored or until the battery's charge is depleted.

Operation on Battery Power (Field Use): The battery permits the penetrometer be used in the field when AC power is not available. The amount of available operating time on each charge will vary depending on the number of tests performed. To conserve the battery's charge, the penetrometer will automatically shut itself off if it is not used for fifteen minutes. All operating parameters and the last test result will be retained, however, the unit can be operated again by depressing the Power Key.

To Charge the Battery: The battery is pre-charged at the factory and is ready for use. It is continually charged while the penetrometer is being operated on AC power. If the battery indicator lamp begins blinking while the penetrometer is being operated on battery power, the charge is running low and the battery will soon need to be recharged. To recharge the battery, simply plug the penetrometer into a suitable source of AC power for a period of 3-4 hours. If the battery becomes fully drained, the unit will not be damaged. It will simply cease operating and the operating parameters of the last test result will not be retained in memory. The penetrometer can be operated again on battery power after it is fully charged.

3.6   Attaching the Penetrometer to PC/Printer

<u>**PC:**</u> (using RS-232 Interface)

Parts Required (can be ordered locally or from printer manufacturer)
- Adapter: 25 pin female- 9 pin male
- Serial Interface Cable

Data Transfer Communicator Setup
Baud Rate: 9600
Data: 8 bits
Stop: 1 bit
Parity: None

Physical Interface
1. Plug adaptor (25 pin female side) into appropriate com port.
2. Connect serial interface cable female side into one end of the adapter and the male side into the penetrometer.
3. Setup Data Transfer as specified above.
4. Data will be transmitted from the penetrometer as each test is run and consists of similar format as the printer configuration.

<u>**Printer:**</u>

Parts Required (Can be ordered locally or from printer manufacturer)
If using parallel printer:
- Serial Interface Card
- 25 pin-9 pin male adapter

If using series printer:
- 25 pin-9 pin male adapter
- Serial interface Cable

Physical Interface

1. Plug an adapter into the printer port.
2. Connect female side of the interface cable (9 pin serial) into the appropriate adapter and the male side into the penetrometer.

The penetrometer can now operate in conjunction with a PC/Printer. Results will adhere to the following formats:

<u>**PC Results:**</u>

Date:
Sample #:
Operator:

Delay Time: Off
Cond Test: Off
Penetration Time: 5.0 s
Penetration Result: 31.7 mm
High Limit: 50mm/10
Low Limit: 11mm/10
Limit Error: Test Passed
Notes:

<u>**Printer Results:**</u>

Date: _____
Sample #:   _____
Operator: _____
Delay Time: Off
Cond Test: Off
Penetration Time: 5.0 s
Penetration Result: 31.7 mm/10
High Limit: 50 mm/10
Low Limit: 11 mm/10
Limit Error: Test Passed
Notes: _____

4   Software Installation

1. Installation. Insert the CD-ROM into the CD tray of the PC. The CD should automatically display the setup screen. If this does not happen within 10 seconds, browse the files on the CD-ROM and double click on the setup file (setup.exe) to start the installation. Follow the instructions on the screen to setup the software. The software is ready to run once the installation has been completed.

<u>NOTE</u>: When first installed, the software is in demo mode, it must be registered in order for the software to work with the unit.

2. Registration. Start the program and then go to >> Help >> Register. A registration screen will appear with a registration number (Refer to Figure 1, below). E-mail Koehler at software@koehlerinstrument.com or call with the registration number for the unlock code. Once the software has been registered, it must be restarted before tests are run.
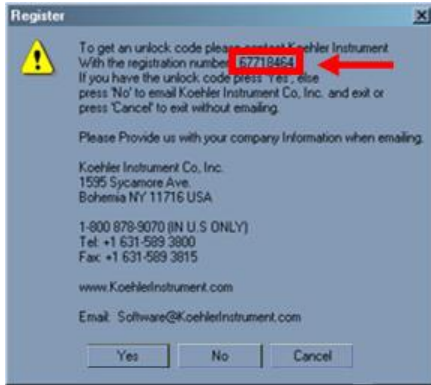
Figure 1: Registration Screen

3. **Communication Port Cables.** Using the Communication Port Cables supplied for the Digital Penetrometer connect the RS-232 port located on the on the rear of the K95500/K95590 to the communication port on the PC.

4.1 Software Operation

1. To begin, click on the Windows Start Button >> Koehler Instrument >> Penetrometer Software. A splash screen will appear with company information (Figure 2). Press any key or the mouse button to proceed.

Figure 2: Company Information Screen

2. The next screen will be the main screen used for operating the software as shown on Figure 3. Use the tabs to toggle between operations.

Figure 3: Main Screen

3. **Test Information.** The test information section is located on the main screen in the lower left hand corner. The User Name / ID and Date will default to the login name and date on the PC but any of these fields may be changed. Enter appropriate test information into each of the fields as appropriate for the test method being conducted. When a test method is selected from the pull down menu, the standard test parameters will be automatically entered into the remaining fields but can be changed.

4. **Communication Port Tab**. Select and initialize the communication port to be used for the Penetrometer as shown in Figure 4.
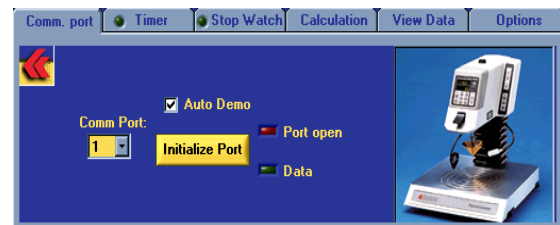

Figure 4: Communication Tab

5. **Timer Tab.** The timer is provided for the convenience of the user and can be used for any laboratory need such as the timing of sample heating or preparation. The timer tab is shown in Figure 5.
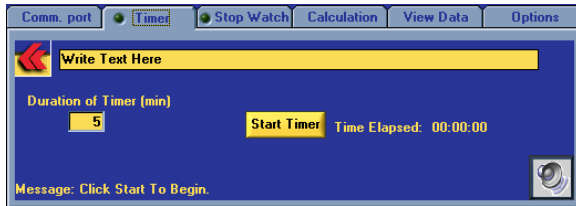

Figure 5: Timer Tab

6. **Calculation Tab.** This feature, shown in Figure 6, allows you to calculate the average and the standard deviation of up to three runs present on the main screen. This information can be useful when determining repeatability according the particular test method being conducted. Click on the "Append to File" button to add these calculations to the data file where the three runs are stored.
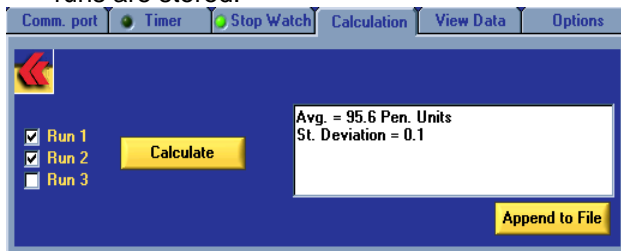

Figure 6: Calculation Tab

7. **View Data Tab.** This tab, shown in Figure 7, provides a quick way to view the contents of a series of test results in a file as well as to determine the average and standard deviation of the entire set of results in that file. Click on the "Append to File" button to add these calculations to the data file.
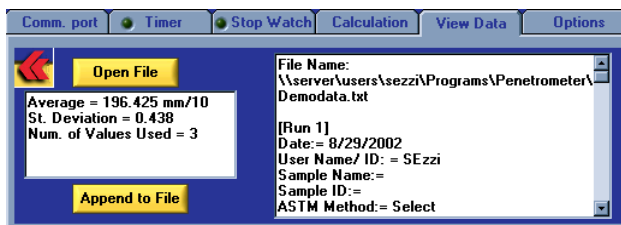

Figure 7: View Data Tab

8. **Options Tab.** The options tab is shown in Figure 8. Under normal operation, the first set of test results will be displayed in the "Run 1" tab on the main screen. Subsequent test results will cycle to the next tab, "Run 2". After "Run 3" the software will cycle back to the first tab, increment the run number to "Run 4" and will continue in this loop until the software program is reset. In the options tab, you may disable this automatic feature by un-checking the "Auto Increment" box. You can then manually select in which "Run Tab" to post the test results. Also in the options tab, you may disable the feature for automatic prompting to save the test data after each run. (Note: If the test data is not saved, the data will be lost and overwritten when the next test is performed).
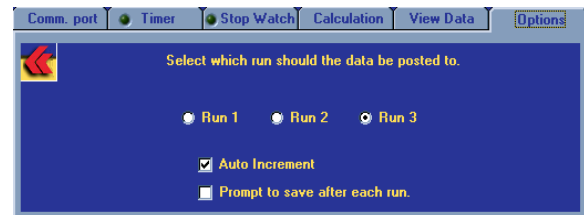
Figure 8: Options Tab

9. **Run Tabs.** These tabs are on the main screen and are used for acquiring test data from the Penetrometer. The data is automatically exported from the Penetrometer at the end of a penetration test into the white fields in the Run Tab. You may add any additional comments into the yellow comments box to be saved with the test data. Note: The data port must be initialized (Communication Port Tab) for the communication link between the software and the Penetrometer to be active and receive the data into the software program. At the end of the test, you will be prompted to save the test data only if the "Prompt to Save" feature is enabled in the Options Tab.

a. **Save.** Clicking on this button will open a "Save As" dialog. You may either choose a new filename or a file that already exists. If you choose a file that

already exists, then the current test will be added to the set of data in that file.

b. **Open.** This button will appear when a file has been loaded in the View Data Tab. By clicking on this button, a dialog box will appear where you may select a saved run to load into the current Run Tab as well as the Test Information Box. This is a useful feature in order to calculate the average and standard deviation for up to three loaded runs in the Calculation Tab or to reload the test parameters into the Text Information Box from a previously run test.

c. **Clear.** By clicking the button, the test data will be cleared from the current Run Tab only. Make sure that the previous test data has been saved before doing this function, otherwise test data may be lost.

d. **Print**. By clicking this button, the current test run will be printed along with test information. To print the entire three runs, click on >>File >>Print from the main screen. This will print three runs with calculations if performed.

e. **Reset All Runs.** By clicking this button, the test data in all three Run Tabs and the Test Information Box will be cleared. If test data has not been saved in any of the Run Tabs, then it will be lost when using this function. The Run Tabs will automatically reset and start with "Run 1" in the first tab.

10. **View Data File.** This feature is an alternative and useful option for viewing data files. From the main screen, go to the top menu bar and click on >> View >> View File. Once the View Data File screen appears, click on >> File >> Open from the top menu bar and select the file to view. By clicking on any "Run" folder, the test data will be displayed in the window on the right. In the status bar at the bottom of the screen, the number of tests and the average value and

standard deviation will be displayed. The view data file is shown in Figure 9 (on the following page).
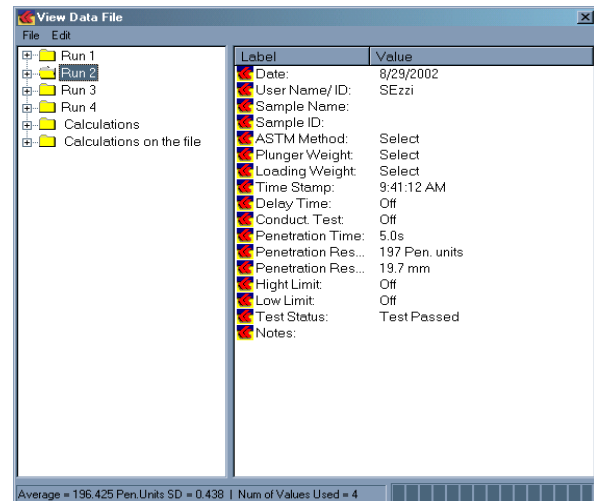
Figure 9: View Data File

11. Editing Test Data. In order to edit test data shown in the View Data File screen, click on >> Edit from the top menu bar in the View Data File screen and then follow the instructions on the screen for changing the following: Run #, labels, and the corresponding values as shown in Figure 10 below. You may also get this same menu by right-clicking on any of the labels.

NOTE: You may view any data file in Notepad. However, you may ONLY change the labels and the corresponding data values in the file. If the format of the file is changed, then it will not properly load back into the Penetrometer Software for further use.

Figure 10: Edit Values Screen

5 Operation

5.1 Instrument Controls

1. **Head Control:** Depressing these keys raises or lowers the penetrometer head in relation to the base. The **Coarse ▲** and **▼** keys move the head rapidly up and down. The **Fine ▼** key for three seconds activates the express return feature. The head a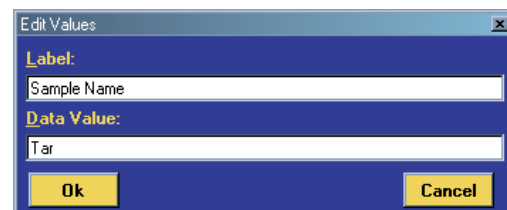utomatically returns to a fully raised position. To stop the head while the express return feature is in operation, press the **▲** key.

2. **Pen Limit:** The **Pen Limit** and the **Hi Set/Lo Set** keys are used to enter the upper and lower penetration value limits for a pass/fail test. When the penetration limit feature is activated, the indicator lamp above the **Pen Limit** key is illuminated.

3. **Power:** Provides the Digital Penetrometer with electricity. When the **Power** key is pushed on, the Digital Display is illuminated. If the head is not fully raised (at home position), it will automatically rise to the home position when the **Power** key is pressed.

4. **Light and Magnifier Arm:** A low voltage lamp and magnifying glass is mounted on a

movable stalk to facilitate penetrator placement on the sample surface. The **Light** key controls power to this lamp.

5. **Plunger Release Trigger:** This trigger button when **toggled UPWARD** allows the plunger to be inserted into the penetrometer head.
NOTE: Do not attempt to insert the plunger When **toggled DOWNWARD** this starts a programmed test.

6. **Prec Set:** Provides an additional decimal place for greater accuracy. The Precision Set key is used to change the penetration value reporting format from tenths of a millimeter to hundredths of a millimeter.

7. **Batt Power:** During field use, the battery power lamp indicates that the unit is operating on battery power. The lamp will blink continuously when the battery power is low.

8. **Time ▲ and ▼:** These keys are used to change the **Time Set**. They can also be used to enter a penetration delay time.

9. **Preset 1 to 4:** The **Preset** keys are used to activate the express penetrator placement feature. Each of the four keys can be used to preset the penetrator to a different specified height.

10. **Reset:** The **Reset** key is used to clear the prior test result in preparation for the next test. The **Reset** key is also used to interrupt a penetration delay countdown in progress.

11. **Time Set:** The **Time Set** key is used with the **Time** ▲ and ▼ to change the penetration interval.

12. **Delay Set:** The **Delay Key** is used together with the **Time** ▲ and ▼ keys to enter a penetration delay time. Using this setting provides a countdown prior to the test penetration interval.

13. **Cond Set:** The **Cond Set** key is used to activate the automatic penetrator tip placement feature for conductive samples. An error message indicates that the conductivity probe is not in place when the **Cond Set** key is pressed.

14. **Seconds:** The Digital Display shows the entered penetration interval and counts the interval down in tenths of a second during testing. This display is also used in conjunction with the **Delay Set** key to enter a pretest delay time.

15. **Penetration Value Display:** The Digital LED Display shows the penetration test result in tenths of a millimeter (the standard penetration value) or in hundredths of a millimeter. For pass/fail testing, this display can be used in conjunction with the **Pen Limit** key to enter desired upper and lower penetration value limits. The Penetration Value Display also shows an error message when test result is outside the entered limits. See the *Operating Instructions* for information about the audio visual alarm.

5.2 Basic Operating Procedure

1. Turn the power on by pressing the **Power** key located on the right side of the unit head.

2. Load the plunger by pushing up on the **Plunger Release Trigger** and then fully slide the plunger into the opening at the bottom of the penetrometer head.

⚠️ **IMPORTANT: Do NOT attempt to insert or remove the plunger without lifting the Plunger Release Trigger. Doing so may damage or break the mechanism inside the unit.**

3. Insert the penetrometer cone or needle into the plunger assembly and secure it by fastening the screw. Add any necessary loading weights.

4. Position the penetrometer head by depressing the **Coarse** ▼ key to move the head to within 0.5 inches of the sample's surface. Use the **Fine** ▼ key to position the head so that the tip just touches the surface.

5. Apply any of the programmed functions that are desired for the needed test (Conductivity, Penetration Time Interval, Penetration Limits, etc.).

6. To run a test, simply depress the **Plunger Release Trigger**. The plunger head will drop into the sample for a time of five seconds. The results will appear in the upper digital display after the five seconds (or however long the test is run). Analysis is complete.

7. To run another test, first press the **Reset** button. Next, raise the **Plunger Release Trigger** and manually lift the plunger head back to its initial position. Finally, depress the **Coarse** ▲ key to return the head high enough to clean off the cone or needle for the next sample.

5.3   Detailed Operating Instructions

1. **Turn the Power On**

⚠️ **IMPORTANT:** Once the power has been switched off, the operator must wait at least 30 seconds before switching it back on

again to allow the circuitry to fully reset. If the power is switched on too soon after having been switched off, the solenoid may begin clicking repeatedly. If this occurs, turn the power off and wait at least one minute before switching it on again.

- Turn on the unit by pressing the **Power** key located on the right side of the unit head.

- The unit will beep three times and the head will automatically rise to the home position.

- When the penetrometer is ready for operation, the Digital Display will read **zero (0)** and the **Seconds** display will read **5.0** seconds (set as default time interval).

2. **Loading the Plunger Assembly**

- Remove the plunger from the accessory box packed with the penetrometer.

- If loading weights are to be used (for waxes, asphalts, and special applications), slip the appropriate combination of weights over the top of the plunger assembly before inserting it in the penetrometer head.

- **Push UP** on the **Plunger Release Trigger** and fully slide the plunger all the way into the opening at the bottom of the penetrometer head**.**

⚠️ **IMPORTANT: Do NOT attempt to insert the plunger without lifting the Plunger Release Trigger. Doing so may damage or break the mechanism inside the unit.**

Accessory Plunger Assemblies: The standard plunger supplied with the Digital Penetrometer is suitable for standard penetration tests on greases, waxes, asphalts, petroleums and a wide range of special applications. For some applications, (quarter and half scale grease tests, grease micro-cone, etc.) 15 gram and 6.9 gram

plungers are substituted for the standard plunger.

3. **Loading the Penetrometer Cone or Needle**

- Insert the appropriate cone of needle into the plunger assembly and secure it by tightening the thumbscrew.
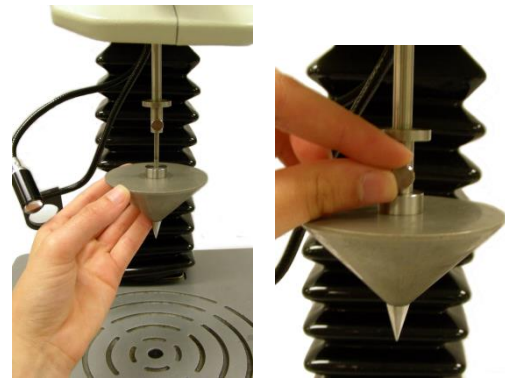
4. **To Correctly Position the Penetrator**

- Place the properly prepared sample container on the base of the unit and center it directly under the penetrator.

- Depress the **Coarse ▼** key to lower the penetrometer head. Move the tip of the penetrator to within approximately 0.5 inches of the sample surface.

- Position the **Light** directly behind the penetrator so that it's tip casts a shadow across the sample surface. Position the magnifier arm so it is adjacent to the surface of the sample so that the penetrator tip can be observed as it approaches the sample surface.

⚠️ *CAUTION: Do not place the light directly onto the surface of the sample due to heat. Heating samples may effect test results*

- Depress the **Fine ▼** key repeatedly until the tip of the penetrator just touches the sample. By holding down the **Fine ▼** key, the increments automatically increase.

Use the shadow of the penetrator tip to aid in correct placement.

5. Programmed Functions

A. *Using the Preset Keys to Position the Penetrator*

Each of the four **Preset** keys can be used to automatically lower the penetrator tip to a preset level. To use the preset keys:

- Place loaded sample cup in center of penetrometer base.

- Lower penetrator head until it is slightly above the sample surface using the **Coarse ▼** key and the **Fine ▼** key as described above.

- Press the desired **Preset** key (1 to 4). The penetrometer will return to the home (fully raised) position. The **Preset** key is now ready for use.

- Depressing the chosen **Preset** key again will cause the penetrometer head to lower to the preset position.

- Now, use the **Fine ▼** key to position tip on sample surface as described above.

B. *Select the Penetration Time Interval*

The Digital Penetrometer can be set to release the plunger-cone assembly into the sample for any period between 0.1 to 9999.9 seconds. The first time a new penetrometer is switched on, the operator will note that Koehler has preset the penetration time interval at five seconds; the **Seconds** display will read **5.0**. This is the standard penetration time interval for ASTM penetration tests for petroleum products. If the five second penetration time interval will be used, no time entry is needed. If the operator sets a different penetration time interval, this new penetration time interval will remain in memory even then when the penetrometer is turned off.

To Select a Different Penetration Time Interval:

- Press the **Time Set** key.
- When the lower display starts to blink, use the **Time ▲** and **Time ▼** keys to adjust.
- When the desired time is set, press the **Time Set** key again. This value will be placed in memory.

C. *Penetration Using Penetration Limits*

To use the **Penetration Limits** feature, follow the same procedure as for a simple penetration test. Immediately before or after setting the penetration time interval, set the penetration limits as follows:

To Set the High and Low Penetration Limit Values:

- Press the **Pen Limit** key once. The light above the **Pen Limit** key will illuminate yellow.

- Press **Hi Set** once. The value in the upper digital display will blink. Use the **Time ▲** and **Time ▼** keys to change it.

- Press **Hi Set** to fix selected value. The value will stop flashing, and it will enter into the penetrometers memory.

- Press **Lo Set** once. The value in the upper digital display will blink. Use the **Time ▲** and **Time ▼** keys to change it.

- Press **Lo Set** to fix selected value. The value will stop flashing, and it will enter into the penetrometer's memory.

- To check the values, press **Hi Set**. The value in the upper digital display will blink. Press **Hi Set** again. The Display will show **zero (0)**. Next, repeat to check the **Lo Set** value.

- Press the **Pen Limit** key to disable the penetration limit feature. The **Light** above the **Pen Limit** key will shut off.

D. *Penetration Using Delay Set*

To use the **Delay Set** feature, follow the same procedure as for a simple penetration test. Immediately before or after setting the penetration interval, set the delay interval as follows:

- Press the **Delay Set** key once. The value in the Digital Display will blink. Use **Time** ▲ and **Time** ▼ keys to obtain the desired value. Press **Delay Set** again to put the value into memory. The light above the **Delay Set** key will be illuminated. The light signifies that the delay set mode is in operation.

- To return to normal mode press **Delay Set**. The value in the upper digital display will blink. Next, press **Reset**. The light above the **Delay Set** will turn off. The unit is now set in normal mode.

E. *Penetration Using Conductivity Probe*

To use the conductivity probe, follow the same procedure as for a simple penetration test. When using the conductivity probe, a thin film of water can be used to increase the sample surface conductivity for non-conductive samples to enable conductive probe penetrometer placement. Also, the plunger can be used without and cone or needle tip. The plunger automatically lowers itself to the surface of the conductive sample and starts the test. To use the conductivity probe, attach the conductivity probe immediately before or after setting the penetration time interval, following these instructions:

- Press the Cond Set key. The light above the key will illuminate.

- Plug the probe into the penetrometer head.

- Place the free end of the probe into the sample cup.

- When the Plunger Release Trigger is pressed, the penetrator tip will automatically lower to the surface of the

sample. The plunger/penetrator assembly will be automatically released by the penetrometer into the sample as per the preset penetration time interval.

6. Sample Penetration Test

Set the appropriate penetration time intervals using the previous setup instructions.

- Depress the Plunger Release Trigger. The timer will count down to zero and the penetrometer will automatically re-lock the plunger assembly. The penetration depth will be displayed in tenths of a millimeter (or in hundredths of a millimeter if the parameter is altered by the operator.

Reading Test Results:

- Test results will appear in the upper digital display. Note the results. The test is now complete.

7. Printing Test Results on a Line Printer

- When the penetrometer is connected with a suitable line printer the test results will automatically be printed after each test.
- When the Penetration Limits feature is activated and the test result is outside of the limits, it is necessary to first depress the **Reset** key to silence the audible alarm. The test result will then be printed automatically.

8. To Run Another Test

To prepare the Digital Penetrometer to perform another test, press Reset. Then, wait several seconds for the penetrometer to carry out the reset command. Do not press any other key because additional commands may interfere with the reset process.

Raise the Penetrometer Head:

- **Depress the Coarse** ▲ key to raise the penetrometer head high enough to allow for convenient cleaning of the penetrometer cone or needle.

- Alternatively, depress the **Coarse ▲** key for a few seconds. The penetrometer head will automatically rise to the home position.

9. Error Messages

L ERR   When using preset penetration limits the operator will note that values falling above the highest limit and values falling below the lowest limit will cause the audio-visual alarm to sound. The penetrometer will beep, and the digital display will indicate **L ERR**. **L ERR** stands for *Limit Error.*

- Press the Reset key once to stop the alarm and to learn the penetration value.

- Press the Reset key a second time to reset the unit.

- Change the value of the limits to give a penetration value.

P ERR   When running a penetration test and the plunger falls out of the penetrometer head, the unit will beep and the digital display will indicate **P ERR. P ERR** stands for *Penetration Error.*

- Press the **Reset** key once to stop the alarm and to learn the penetration value. It will be outside of set **Hi Set** limit.

- Re-insert the plunger into the penetrometer head and fix the height of the sample container or change the **Hi Set** limit.

PLACE   During a conductivity test, if the plunger does not drop, the penetrometer head will bottom, the unit will beep and the digital display will indicate **PLACE**.

- Press the **Reset** key once to stop the alarm.

- Press the **Reset** key a second time to reset the unit.

Either the substance was not conductive or the needle or cone did not touch the sample to close the circuit.

6   Calibration

Your Digital Penetrometer has been calibrated at Koehler Instrument Company. Periodically, the penetrometer's calibration may be verified to ensure accurate test results. Penetration values within a range of ± 2 units indicate that the penetrometer is correctly calibrated. To verify calibration, remove any cone or needle attached to plunger and follow these steps:

- Toggle **UP** the **Plunger Release Trigger** and slide the plunger into the penetrometer head as far is it will go.

- Place the 1.000" gauge block on top of the 2.000" gauge black underneath the plunger assembly.

- Lower the penetrometer head until the plunger assembly is within approximately 1/16 inch of the top of the 1.000" block.

- Press **DOWN** on the **Plunger Release Trigger**. The plunger will drop onto the 1.000" block.

- After the test reading is displayed, press **Reset** and leave the plunger where it is.
- Remove the 1.000" gauge block by sliding it out from between the plunger and the 2.000" gauge block.

- Press down on the **Plunger Release Trigger**. Gently guide the plunger down onto the 2.000" gauge black. After the penetration interval has elapsed, the penetration value displayed should be 254 ± 2 units.

- Slide the plunger assembly back into the penetrometer head and repeat the above steps using the 2.000" gauge black on the top and the 1.000" gauge block as the base. If the penetrometer gives a **P ERR** during verification using the 2.000" gauge block, simply place the 1.000" gauge block so that the higher side is vertical under the 2.000" gauge block. It may be necessary to use a graduate support block as shown. Also, lower the penetrometer head as far down as

possible before beginning verification. The penetration value should be 508 ± 2 units.

7   Troubleshooting

7.1   Unit Does Not Turn On

Possible Reason
- Faulty power supply

- Not plugged in

Correction
- Change power supply

7.2   Unit Turns On but Battery Indicator Light Illuminates

Possible Reason
- Faulty power supply

- Not plugged in

Correction
- Plug in power supply unit to an AC outlet or replace faulty power supply unit if necessary

7.3   Battery Indicator Light Blinks Power-On

Possible Reason
- Low battery condition or faulty battery

Correction
- Verify proper operation of power supply.

- Allow battery to charge for four (4) hours.

- If condition does not change, replace battery.

8   Additional Accessories

The Koehler Instrument Company manufactures a wide assortment of attachments and accessories that can meet all of your testing needs for the K955XX Digital Penetrometer. All of the following accessories meet nearly all testing standards including ASTM, ISO, FTM. Some of the accessories are:

K95600 Penetrometer Bath
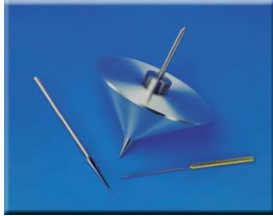
Penetrant Cones & Needles

K18100 Grease Worker

9   Maintenance

The following information is designed to provide basic maintenance instructions:

9.1   Changing the Light Bulb

Press the **Power** key and unplug the unit. Unscrew metal assembly at base of bulb. Bulb can then be unscrewed and changed.

9.2   Changing the Fuse

⚠️ **WARNING** To avoid the risk of personal injury and/property damage, fuse replacement must be made with a specified fuse only. These fuses (Part Number 278-004-001) can be purchased from Koehler Instrument Company.

Turn **OFF** and unplug the unit. The fuse is located at the back of the head assembly. To change the fuse, twist the fuse holder (black cap) counter-clockwise and pull out. Loosen the old fuse from the fuse holder and replace with a new fuse into the fuse holder. Twist the fuse holder with fuse clockwise into the socket.

9.3   Replacing the Battery

⚠️ **WARNING** During battery replacement, be sure not to reverse the battery polarity to avoid risk of personal injury and/or property damage.

Place the head in the home position. Turn off the unit and unplug the power pack from the wall outlet. Then, unplug the connector from the rear of the penetrometer. Remove the fuse from the rear of the unit (see changing the Fuse, above).

Remove the display panel as follows: Use a 5/64th hex key to remove the two 6/32 x ½ inch screws located under the head and to both sides of the **Plunger Release Trigger**. Turn the unit around so that the rear of the unit faces the operator. Remove the two screws located on the right side of the rear panel. While pressing down on the unit directly under the **Plunger Release Trigger**, pull the display panel straight out.

Remove the left side cover. Observe the battery located in the top of the unit under the leveling indicator. Remove the two leads from the battery while observing polarity (red wire to positive and black wire to negative of battery). It may be necessary to place something under the battery to help lift it up and out from the Velcro® that retains it. Install the new battery and wires being careful to observe the polarity as mentioned above. Reassemble the penetrometer following the above steps in reverse order.

9.4   Replacement Parts and Accessories

Part Number	Description	Qty

K95500-03007	Leveling Foot	4
K95500-SFW	Penetrometer Software	1
K95500-02001	Light Assembly	1
279-014-001	Replacement Bulb	3
278-004-001	Fuse	3
277-001-001	Fuse Cup	1
459-012-001	Battery, 12V	1
K95500-12006	Magnifier Assembly	1
K95577	Plunger 47.5 grams (full)	1
K95574	Plunger 15 grams (half)	1
K95520	Plunger 6.9 grams (quarter)	1
250-000-64F	ASTM Thermometer 64F Range: 77 to 131°F	1
250-000-64C	ASTM Thermometer 64C Range: 25 to 55°C	1
K95500-03054	Cup Support	1
K95500-12019	Keypad Power/Light Assembly	1
K95500-22000	Keypad Head Assembly	1
K95500-02023	Motor Stepper Board	1
K450-0-20	Graduate Support Block	1
K95500-11001	Power Adapter 115 V	1
K95590-11001	Power Adapter 220 V	1
K19587	50 g Weight	1
K19588	100 g Weight	1
K95500-01001	Conductivity Probe	1

10   Wiring Diagram
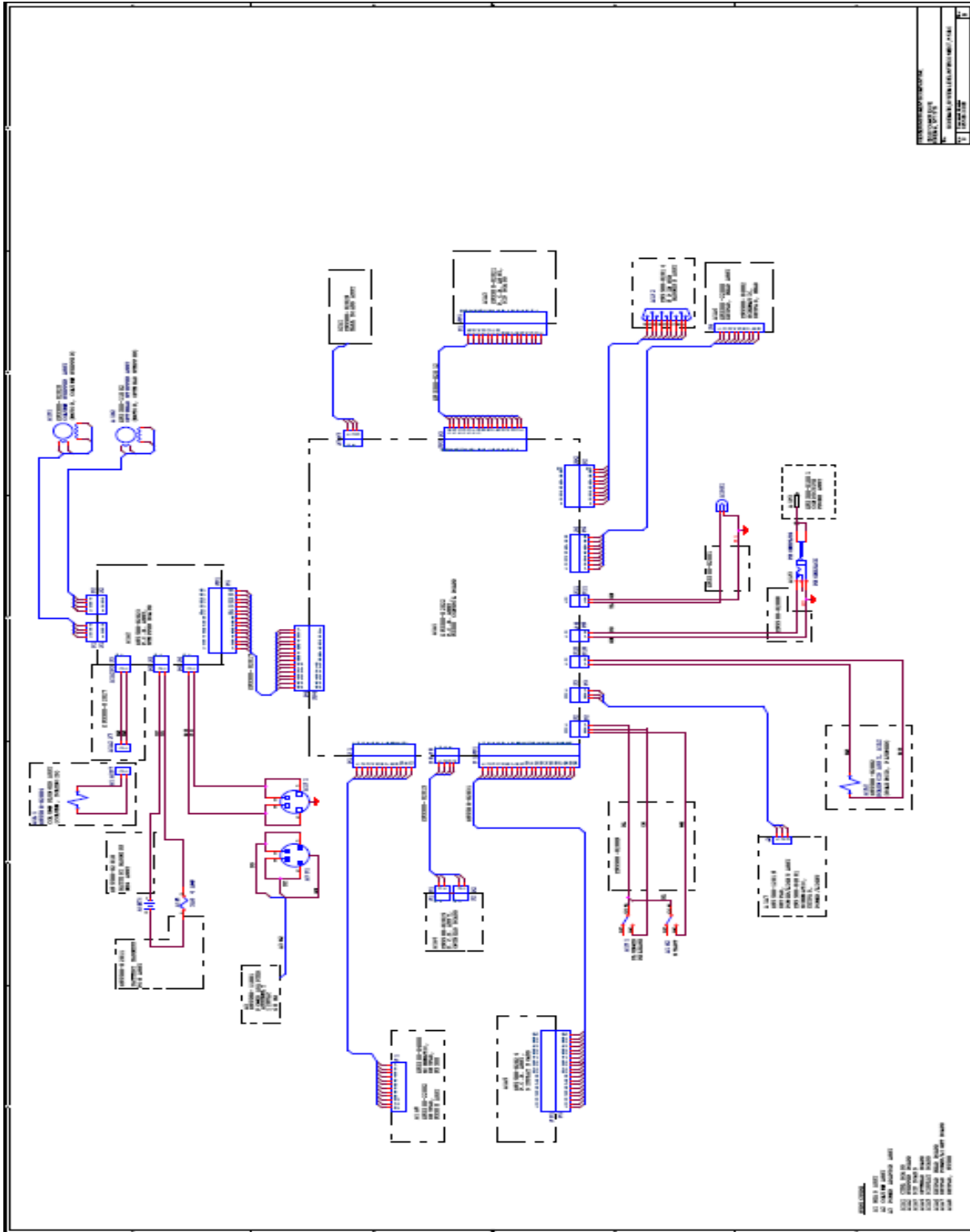
11 Service

Under normal operating conditions and with routine maintenance, the K955XX Digital Penetrometer should not require service. Any service problem can be quickly resolved by contacting Koehler's technical service department either by letter, phone, fax, or email. In order to assure the fastest possible service, please provide us with the following information.

Model Number: _____

Serial Number: _____

Date of Shipment: _____

12 Storage

This laboratory test instrument is equipped with electrical components. Storage facilities should be consistent with an indoor laboratory environment. This testing equipment should not be subjected to extremes of temperature and/or moisture.

This equipment was shipped from the factory in a corrugated cardboard container. If long term storage is anticipated, re-packing the instrument in a water-resistant container is recommended to ensure equipment safety and longevity.

13 Warranty

We, at Koehler, would like to thank you for your equipment purchase, which is protected by the following warranty. If within one (1) year from the date of receipt, but no longer than fifteen (15) months from the date of shipment, Koehler equipment fails to perform properly because of defects in materials or workmanship, Koehler Instrument Company, Inc. will repair or, at its sole discretion, replace the equipment without charge F.O.B. its plant, provided the equipment has been properly installed, operated, and maintained. Koehler Instrument Company must be advised in writing of the malfunction and authorize the return of the product to the factory. The sole responsibility of Koehler Instrument Company and the purchaser's exclusive remedy for any claim arising out of the purchase of any product is the repair or replacement of the product. In no event shall the cost of the purchaser's remedy exceed the purchase price,

nor shall Koehler Instrument Company be liable for any special, indirect, incidental, consequential, or exemplary damages. KOEHLER INSTRUMENT COMPANY, INC. DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. Please save the shipping carton in the event the equipment needs to be returned to the factory for warranty repair. If the carton is discarded, it will be the purchaser's responsibility to provide an appropriate shipping carton.

14 Returned Goods Policy

To return products for credit or replacement, please contact Koehler Customer Service with your purchase order number, our packing list/invoice number, the item(s) to be returned and the reason for the return. You will be issued a Returned Authorization (RA) number, which must be prominently displayed on the shipping container when you return the material to our plant. Shipping containers without an RA number prominently displayed with will be returned to the sender. Goods must be returned freight prepaid. Returns will be subject to a restocking charge, the application of which will depend upon the circumstances necessitating the return. Some returns cannot be authorized, including certain products purchased from outside vendors for the convenience of the customer, products manufactured on special order, products shipped from the factory past ninety (90) days, and products which have been used or modified in such a way that they cannot be returned to stock for future sale.

Notes

Notes