

IR-200 Moisture Analyzer

Operation Manual

You have purchased a quality precision weighing instrument that requires handling with care.

*Read entire contents of this **Operation Manual** prior to operating your new Denver Instrument moisture analyzer.*

Disclaimer Notice

“Calibrate your balance using the internal calibration weight or a reference weight of the appropriate tolerance (class). An instrument can be no more accurate than the standard to which it has been compared. For assistance in the selection of reference weights, please contact the factory”.

Class A Digital Devices:

Notice: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this device in a residential area is likely to cause harmful interference in which the user will be required to correct the interference at his own expense.



Caution!

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

Manufactured in the U.S.A. by:



Denver Instrument Company

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(303) 431-7255 • (800) 321-1135 • Fax(303) 423-4831

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Declaration Of Conformity

Denver Instrument Company declares that the following products:

IR-200 Moisture Analyzer

conform to the European Union Council Directives and other standards listed below:

73/23/EEC, "Low Voltage Directive"

EN 61010-1, "Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1. General requirements"

89/336/EEC, "Electromagnetic Compatibility Directive"

EN 55011, Group 1, Class A, "Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, and medical (ISM) radio-frequency equipment"

EN 50082-1, "Electromagnetic compatibility - Generic immunity standard; Part 1: Residential, commercial, and light industry"

Further information may be obtained from the manufacturer, or from the manufacturer's representative:

manufacturer:

Denver Instrument Company
6542 Fig Street
Arvada, CO 80004 USA

manufacturer's European representative:

Denver Instrument Company, Ltd.
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Trafalgar Business Park
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Norfolk, UK PE38 9SW

Cautions and Warnings



Warning! - Prior to attempting to operate, read all accompanying documents.



Risk of Shock! - Due to the electrical nature of this instrument, do not attempt to disassemble unit. Contact Denver Instrument Company Technical Support with any problems that arise.



High Temperature Parts - During operation use caution around exhaust areas of the instrument.

Introduction

Thank you for choosing the Denver Instrument Company IR-200 Moisture Analyzer as your rapid moisture determination system. This state-of-the-art, microprocessor based moisture/solids analyzer using the principle of LOD (Loss On Drying). Samples are heated using infrared heat to liberate moisture or other volatiles while continuously weighing the sample with an integral precision electronic balance until endpoint conditions are met. This unique product combines the performance and sophistication of modern laboratory instrumentation in an analyzer designed for plant floor operation.

Unpacking Instructions

Denver Instrument moisture analyzers are supplied in a boxed container. Both the analyzer and the supplied accessories package are contained in the box.

- Carefully unpack the carton.
- Check the contents of the box and verify that you have received the following:
 - IR-200 Moisture Analyzer
 - Operation Manual
 - Pan Support
 - Pan Shield
 - Tweezers
 - Disposable Sample Pans (1 pkg/50)
 - Glass Sample Pads (1 pkg/25)

Lift up the printer over and you will find a roll of printer paper already installed. Keep all parts of the packaging in a safe place. This packaging guarantees the best possible protection for the transport of your moisture analyzer. See instructions for repacking.



Except as noted in this manual, this analyzer contains no user serviceable parts. Do not disassemble this unit. Unauthorized repair attempts may void the warranty. For service or technical assistance, call your distributor listed on the back cover of this manual.

Selecting the Location

Select a suitable work area which will allow your analyzer to work with accuracy and dependability:

- This product is intended for indoor use.
- Area should be relatively free from drafts and vibrations.
- Surface should be rigid and level.
- Allow adequate ventilation (at least one inch of free space on all four sides of the analyzer).
- Do not locate near magnetic materials, or near equipment which incorporate magnets in their design.
- Avoid areas which have variations in room temperature or have excessive room temperature. Room temperature above 40°C/104°F or below 15°C/59°F could affect the operation and accuracy of the moisture analyzer.

Safety Precautions



Warning!

Use of this product in a manner not specified by the manufacturer may impair any safety protection provided by the equipment!

Every attempt has been made to make this analyzer safe and easy to use. However, like any laboratory instrument respect must be given to the operation of the analyzer due to environmental conditions, the nature of samples being tested and of the chemicals which might be near the analyzer. To avoid personal injury or damage to the analyzer, please observe the following precautions:

- Read all instructions in this Operations Manual prior to operating your moisture analyzer.



Always use tweezers or tongs to remove the sample pan after completion of an analysis. The test sample and the pan are hot.

Do not touch the metal surfaces inside the drying chamber while removing or placing a sample into the analyzer since the surfaces are very hot.

Do not touch the heater hood ventilation dome at any time because it will be very hot during and after the analysis.

- Do not test flammable or toxic materials.
- Use the analyzer in a fume hood if the samples emit fumes which could be toxic, an irritant or corrosive.
- Know where the fire extinguisher is located. Use only an extinguisher rated for use with electrical fires.
- Keep the analyzer clean. Always unplug the analyzer and cool it thoroughly before cleaning or servicing.
- Wear safety glasses, protective clothing and gloves.
- Do not block the ventilation dome on top of the heater hood.
- If necessary, press the TEST key during a test to abort the test. The analyzer will return to the Standby temperature and STANDBY screen.
- Locate the unit away from flammable materials. Allow at least 1" of space around the unit.

Technical Specifications

Measurement method	Infrared radiation and detection of weight loss
Heat source	Four parallel quartz infrared heaters
Temperature setting	30-210°C (86-410°F) in one degree increments of Celsius
Temperature control	Platinum temperature sensor, +/- 1°C with calibration
Temperature steps	Programmable one or two
Weighing pan (dia.)	100 mm (4 inches)
Balance capacity	100 grams
Balance readability	1 mg
Readability of results	0.01%
Working range	0.10 - 99.90 %
Units of results	Percent moisture, solids, volatiles, moisture dry, ppm and mg/l
End of analysis modes	Time-out (max. 198 mins.), automatic slope
Display	Backlit liquid crystal display, 30 characters by 8 lines
Controls	Test, Zero, Paper Feed, Help, Enter and numeric keypad
Program storage	99 programs with alphanumeric naming
Data storage	255 last results with statistical evaluation
Integral printer	Thermal, 40 character graphical
External I/O	One serial 25-pin bidirectional RS232C, and One serial 9-pin uni-directional RS232C
Input Power	100 to 250 VAC 50/60 Hz 600 watts self adjusting power supply
Fuse specifications	Input - 2560V, 5A time-lag, type 3AG, 6.5mm diameter x 31.75mm length Power Supply- 250V, 2A, quick acting, 5mm diameter x 20mm length

Help Feature

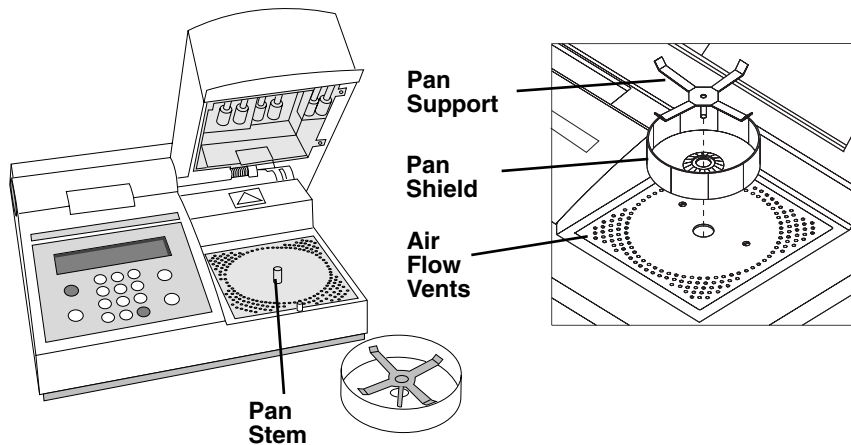
The analyzer incorporates a Help feature unique to moisture analyzer instrumentation. Help offers the user immediate, context-specific advice on setup and operation. While lacking the level of detail possible in the operating instructions, help is conveniently available at the touch of a key and is always "on the right page". While becoming familiar with the analyzer operation, the user is urged to explore and use the broad range of help information offered.

Pressing the **Help** key produces a full-screen help message, with a maximum of eight lines of text and thirty characters per line. If a help message is being displayed, pressing any key immediately returns the analyzer to its status when the **Help** key was pressed.

Installation

Pan Shield and Pan Support

Install the pan shield and pan support into the drying chamber. Lift up the heater hood with the handle. Place the pan shield so that the center hole fits over the center ring in the base. Next, slip the stem of the pan support through the center ring and into the pan receiver hole. The pan support which holds the sample during testing should be level. This can be checked by spinning the pan support.

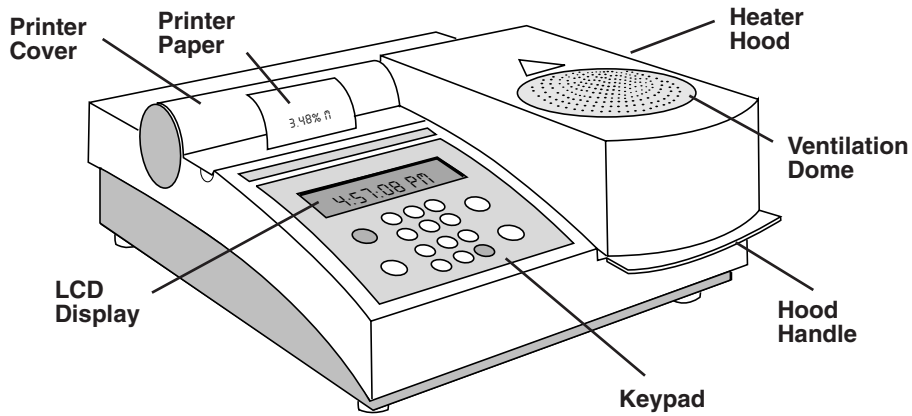


Connecting to a Power Source

The moisture analyzer contains a universal self-adjusting power supply rated from 100-250 VAC 50/60 Hz. Check that this voltage matches your local line voltage. If your voltage is not within this rating, do not connect the power cord to the power supply then contact your local distributor.

To connect the analyzer to a power source:

1. First insert the appropriate power cord into the power input on the rear panel of the analyzer.
2. Then plug the power cord into a convenient wall socket.
3. To turn the analyzer ON, place the ON/OFF switch on the back of the analyzer into the ON position (marked "1" on the switch). The analyzer will proceed through a self-diagnostic routine and then display the STANDBY Screen. If the analyzer displays any diagnostic warning, consult the troubleshooting section of this manual, or your local distributor.



Connectors

Power - Accepts the universal female end of the appropriate power cord.

Serial 1 - This input/output port supports a bi-directional RS232 interface via a 25 pin, DB-25P type connector for intercommunication between two moisture analyzers for the purpose of transferring drying procedures through the PRG XMIT subroutine.

Serial 2 -This input/output port supports an uni-directional RS232 interface via a 9 pin, DE-9S type connector. Any RS232 compatible device such as an external printer can be connected to the analyzer.

Serial Characteristics

Connector: Serial bidirectional RS232C, 9 pin male subminiature D plug, DE-9P uni-directional and a 25-pin bi-directional male subminiature D plug DB-25P (unspecified pins have no connectors)..

Pin	Call Out	Function
1		case ground
2		serial data in
3		serial data out
4		CTS (Clear to Send)
5		RTS (Request to Send)
6		no connection
7		signal ground
8		no connection
9		no connection

Bidirectional Communication

Key stroke assignments:

Start/Stop	"R"
Zero	"Z"
Help	"H"
Enter	"Esc"
Screen Status	"*"
Numeric:	"1", "2", "3", "4", "5", "6", "7", "8", "9", "0", "."
Paper Feed	"p"

Number and alphanumeric entry

require "Esc"

Example:
 a) To enter Sample #: 1234,
 enter on command line: 1234, Enter, Esc., Enter
 b) To enter Program name: CORN,
 enter on command line: Esc., CORN, Esc., Enter

Controls

The following paragraphs briefly describe the location and functions of all the analyzer controls. More detailed descriptions are provided in the operations section of this manual.

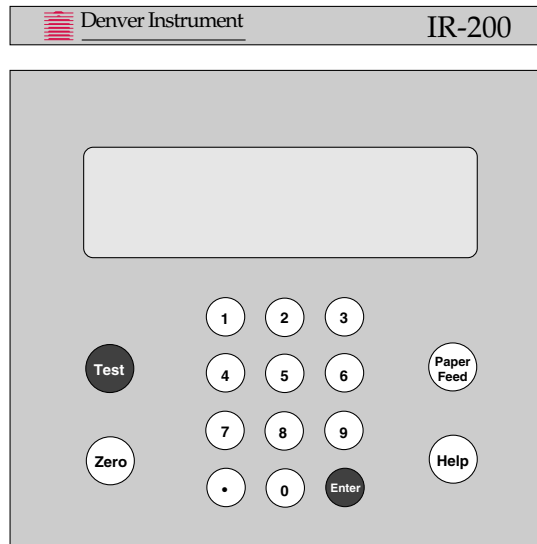
Display

The moisture analyzer features a 1.5" x 5.25" (8 line by 30 character) back lit liquid crystal display (LCD). This large, dot addressable LCD allows the analyzer to convey a rich variety of detailed information in plain English descriptive prompts, menus or help messages. There are four different types of screens which will be displayed: STANDBY, TEST, SETUP and setup entry screens. A title line on the top of every screen identifies the specific screen displayed along with the date and time.

STANDBY - This screen will be displayed before and after a test. The STANDBY Screen provides access to the Setup, Recall and Test modes.

TEST - This is a set of screens which prompt the operator through testing a sample including zeroing the balance, adding sample, getting the initial weight, testing and printing the result.

SETUP - Two setup menu screens, SETUP 1 and SETUP 2, provide menu options of all the available setup subroutines for customizing the analyzer to the specific application.



Setup entry Screens -

These screens which are sub-screens to the setup subroutines, guide the operator through the entry or selection of specific desired choices. At any point in these screens, pressing the "Help" key produces a full-screen, context-sensitive help message supplying additional details and guidance.

Keypad

The analyzer features a sealed membrane keypad with numeric and function keys as shown in the figure below. The keypad is best operated with a firm button press in the center of the key. With the beeper setup option turned ON to either short (factory default) or long, an audible beep will sound whenever a key has been pressed correctly.

Function keys include the following:

- Zero**
 - In the Standby mode allows the balance to be used as a stand-alone 100 gram capacity to 1 mg resolution balance.
 - In the Test mode, it can be used to rezero the balance if necessary.
 - On any screen which prompts for a numeric entry, it serves as an erase key.
 - In the Recall mode, it returns the screen to the first page of programs.
- Test**
 - Initiates the test cycle to begin analyzing a sample.
 - During a test, it serves as a stop key to abort a test in progress.
 - In the Recall subroutine, advances to the next page.
- Paper**
 - Key will feed the paper through the printer one line at a time.
- Feed**
 - In STATISTICS screen showing calculations, pressing this key will print calculations.
 - In the *Recall* mode, this key will activate a printout of all stored programs.
 - In the *System* subroutine, this key will print the system information on the display.
- Help**
 - Causes display of context-sensitive "Help" messages providing details of current options available for the screen which the key was pressed.
- Enter**
 - Causes the analyzer to accept entry of data keyed in by the user in a setup entry screen.
 - Used to accept the conditions on the screen when parameter variables are present. The screen will then return to the proceeding screen.
 - Used to return to the proceeding screen when the display shows a list of options.
 - In the STATISTICS PRINT subroutine or *Recall* mode, this key will stop the printing.
- “.”**
 - Used to enter numbers with a decimal point.
 - In the *Recall* and STATISTICS subroutine, it advances to the next page of choices.

Analyzer Operation

Standby Mode

After the self-diagnostic routine has been completed on power-up or after a sample test has been completed, the analyzer goes into the *Standby* mode. (Factory default is 60°C.) During standby, the temperature will go to the set standby temperature. The standby temperature is set for each drying procedure in the Develop subroutine. While in the *Standby* mode, the analyzer will display the STANDBY Screen. The analyzer will stay at the standby temperature until the Conserve mode activates, turning OFF the heaters. The factory default for the Conserve mode to turn OFF the heaters, is 60 minutes after the test. This can be changed in the Conserve subroutine section described on page 33. The STANDBY Screen will change to the CLOCK Screen when the standby temperature turns off. The backlight of the LCD display will also turn OFF automatically. The backlight OFF setting can be changed in the Conserve subroutine. The default setting is 5 minutes.

The bottom line of the STANDBY Screen indicates the routines available to the operator. In addition, the operator can always choose to test a sample by pressing the **Test** key.

- **Test** - This routine is used to analyzer samples. On initial installation it will use the Factory 1 program as the drying procedure. Otherwise, it will use the last program which has been recalled in the *Recall* routine.
- **Recall** - This routine allow the operator to recall a stored drying procedure which has previously been saved. On initial delivery the unit will have five factory default programs stored in program # one through five. See Factory Default Settings screen on the following page.
- **Setup** - This routine allows the operator to make changes to the analyzer including editing or developing new drying procedures, accessing stored data for printout or statistical evaluation, changing serial interface parameters, setting date and time, formatting the results printout, and many other parameters to customize the analyzer specific to an application or particular usage.
- **Operator** - This routine provides access for the user to select their name from a list and will be included on the printout under operator. Specific operator names must first be entered in the SETUP PRINTER, CUSTOM subroutine.

10:00 AM	STANDBY	15NOV00
PRG# 01	FACTORY 1	TEMP:60C
DENVER INSTRUMENT COMPANY		
IR-200 MOISTURE ANALYZER		
1>RECALL	2>SETUP	3>OPERATOR

Standby Screen

In addition, several other functions are available from the STANDBY Screen. Pressing the **0** key displays the last test result on the TEST DONE Screen. Pressing the **Paper Feed** key will print the last result and pressing the **Zero** key displays the BALANCE screen.

Test Mode

Analyzing a sample on the moisture analyzer is intended to be simple and rapid. However, to take full advantage of the performance and versatility of the moisture analyzer the drying procedure should be optimized for the sample material being tested and the analyzer settings established for your conditions and objectives. To establish an optimized drying procedure, see the Applications section of this manual or contact your local distributor for assistance. To set up the analyzer to your specific requirements, refer to the Setup Menus section, page 13.

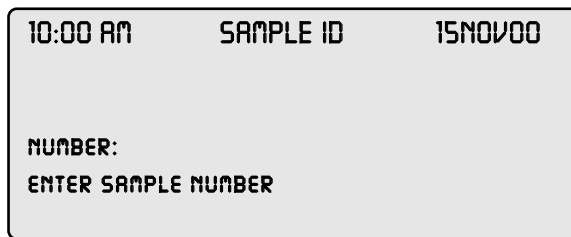
Most samples can be tested for moisture using the Factory 1 default program with reasonable results. However, if your distributor has tested your sample and has developed an optimized drying procedure, you will first want to establish a new program with these conditions as described in the Develop subroutine section.

TEMP1 = 105C
TIME1 = OFF
TEMP2 = OFF
TIME2 = OFF
SLOPE = 0.05%/1.0 MINUTE
UNITS = MOISTURE
STANDBY TEMPERATURE = 60C

Factory 1 Default Settings

A. To test a sample, perform the following:

- 1). Open the heater hood using the handle on the front and place one pan onto the pan support. Then close the heater hood.
- 2). At the STANDBY Screen, press the **Test** key. The display will change to the SAMPLE ID Screen. (The Sample # prompt maybe turned OFF in the Printer subroutine.)



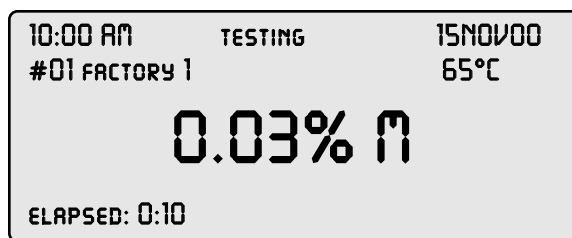
Sample ID Entry Screen

- 3). Enter a sample ID with the number keys up to 16 digits and then press the **Enter** key. (If a mistake is made on entry, pressing the **Zero** key will erase the entry and allow a new entry.) The display will change to the ZERO Screen showing zero grams and then prompt for the heater hood to be opened and to add sample to the pan. (The Zero key is functional if the balance should need re-zeroing.)



Weight Screen

- 4). Open the heater hood. Begin adding sample. The display will show the sample weight in grams. Close the heater hood when your desired sample weight is reached. As the heater hood is closed, the test will begin automatically and the display will change to the Test screen. The TEST Screen will display the percent weight loss in the selected units, the program # and name, the temperature and the elapsed time. The printer will also begin printing the result report.



Test Screen

- 5). The analyzer will process in determining the moisture in the sample using the set drying procedure. When the endpoint condition is met, the test will stop automatically. The Testing display will show the drying chamber temperature equilibrate at the set temperature.



To stop the test during analysis, press the **Test** key.

At the end of the test, the screen will change to the PRINT RESULT Screen. After the result printout is completed, the display will return to the STAND-BY Screen.

- 6). Raise the heater hood and carefully remove the hot sample with tweezers or tongs.



Warning

The sample during and after analysis is hot. Remove sample with care. Do not touch any internal part of the drying chamber or the dark grey circular dome on the top of the drying chamber due to excessive heat.

Recall

Drying procedures can be stored as programs and then recalled to provide easy access to a procedure which is used frequently. This eliminates having to reenter the test parameters to run a test. Up to 99 drying procedures can be stored. Creating and storing a new drying procedure is described under the *Develop* subroutine. Each program is stored by number, 1-99, and an alphanumeric program name (max. 19 characters). On initial setup, there will be 5 default programs stored under the programs named Factory 1-5. Any or all of these programs can be deleted by overwriting each with a newly developed program as described in the *Develop* section.

A. To recall a stored program, perform the following steps:

- 1). From the STANDBY Screen, press the **1** key for Recall to access the Recall routine. The screen will change and show the first page of stored programs as shown below. Up to four programs are shown on each screen.



Recall Program Screen

- 2). To display programs on the next pages, press the “.” (decimal) key for more. The next page of programs will be displayed each time the “.” key is pressed.
- 3). If desired, press the **Zero** key to return to the first page of programs.
- 4). Press the number key next to the program to be recalled, then press the **Enter** key. The analyzer will proceed to the STANDBY Screen and use this program for the next test. The drying chamber temperature will change to the newly recalled programs standby temperature.



Note

As a shortcut, it is not necessary to have the program desired listed on the display to recall it. Simply enter the desired program number from the first page of listed programs and press the **Enter** key.

B. To print a list of all stored drying procedures with the drying parameters, perform the following:

- 1). From PROGRAMS Screen, press the **Paper Feed** key. The list of programs will be printed.



Note

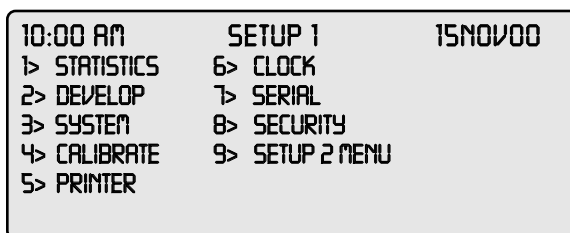
Pressing the **Enter** key will stop the printing.

Setup Menus

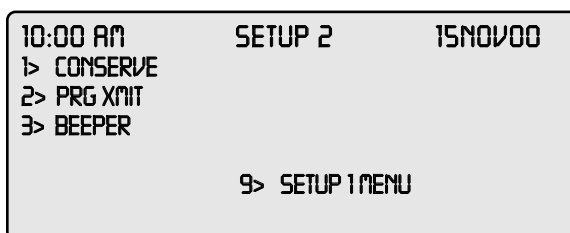
All changes to the analyzer are made in the Setup routine. Setup options consist of two setup menus, SETUP 1 and SETUP 2, which lists the various Setup options.

A. To enter the SETUP routine, perform the following:

1. From the Standby routine, press the **2** key for SETUP. The display will change to the SETUP 1 Screen as shown below.



Setup 1 Menu Screen



Setup 2 Menu Screen

An overview of each setup subroutine is described below:

- **Statistics** - A database of results which the operator can review stored results, print all or selected results or perform statistical calculations of all or selected results.
- **Develop** - Drying procedures can be developed by optimizing the drying parameters for specific applications.
- **System** - Provides a display or printout of important analyzer information such as serial number, model and last calibration dates for both the balance and heater.
- **Calibrate** - Procedure to calibrate the balance using a 50 gram weight.
- **Printer** - Allows customizing of the result printout including the activation or deactivation of Operator, Sample ID and Custom 3 line alphanumeric Header.
- **Clock** - For setting the time and date.

- **Serial** - Allows set up of communication parameters for both serial ports.
- **Security** - For activating or deactivating security protection of the analyzer.
- **Conserve** - Lets the operator control when the standby temperature and backlight of the LCD display turn OFF.
- **Prg Xmit** - Allows the transfer of stored programs from one analyzer to another.
- **Beeper** - Allows setting the audible tone to long, short or OFF.

B. To select a setup subroutine from the SETUP 1 menu, perform the following:

- 1). Press the number key next to the setup subroutine to be selected. The analyzer will proceed to the selected subroutine.

C. To select a setup subroutine from SETUP 2 menu, perform the following:

- 1). From the SETUP 1 Screen, press the **9** key for SETUP 2 menu. The display will change to SETUP 2 menu.

D. To exit either SETUP 1 menu or SETUP 2 menu, perform the following:

- 1). Press the **Enter** key to exit. The analyzer will return to the STANDBY Screen.

Statistics

The Statistics subroutine allows the analyzer to store the last 255 results and to print or perform statistical calculations on all or selected results. Data can be selected manually or automatically by date range, unit or program #. Statistics include the count, average, standard deviation (SD), relative standard deviation (RSD) and minimum and maximum values.

When the result memory is at full capacity (255 results), the analyzer will automatically delete the oldest result as a new test is completed. Only completed tests are added into the data storage. Therefore, a test which has been stopped during analysis, will not be added to the data storage. The Statistics subroutine is ON in the default factory setup. However, statistics can be turned OFF, preventing data from being stored. Statistics can be turned back ON when needed.

Definition of Statistics:

Count = the number of test results selected for statistical evaluation

Average = Sum of test results/Count

Standard Deviation (SD) =
$$\sqrt{\frac{\sum(\bar{X} - X_i)^2}{N-1}}$$

Relative Standard

Deviation (RSD) = Standard Deviation/Average x 100

Minimum = the smallest value of the selected test results

Maximum = the largest value of the selected test results

A. To enter the STATISTICS subroutine, perform the following:

1). Press the **1** key for STATISTICS from SETUP 1 menu. The screen will display the Statistics menu as shown:

```
10:00 AM    STATISTICS    15NOV00
1> SELECT    6> MANUAL
2> CALCULATE
3> PRINT SELECTED DATA
4> EXPORT DATA
5> STATISTICS: ON
DATA ENTRIES: 45
```

Statistics Menu Screen

B. To select results for statistical evaluation or printing of data, perform the following:

1). Press the **1** key for SELECT. The screen will display the Select menu.

```
10:00 AM    SELECT    15NOV00
1> ALL    6> MANUAL
2> NONE
3> UNITS
4> DATE RANGE    9> CLEAR DATA
5> PRG #
```

Select Menu Screen

2). Press the number key adjacent to the desired option:

- 1 key - for ALL to select all data results or
- 2 key - for NONE to deselect all data or
- 3 key - for UNITS to select data results by moisture, solids, etc. or
- 4 key - for DATE RANGE to select data tested between two dates or
- 5 key - for PRG # to select data tested using a particular program.
- 6 key - for MANUAL to selected data from the SELECT LIST Screen.

- 3). For ALL or NONE, the screen will immediately show the selecting screen. For UNITS, DATE RANGE or PRG #, the screen will change to an entry or selection screen to enter the desired selection criteria. The display will return to the STATISTICS screen.
- 4). For MANUAL, the screen will show selection of number, status, sequence number, date and result. Press the selection number to toggle at ON or OFF. Use the "." key to the next page or the **Zero** key to return to page 1. Pressing the **9** key will toggle to the sample number field. After selecting data, press the **Enter** key to return to the STATISTICS Screen.

C. To perform statistical calculations of selected results, perform the following:

- 1). Press the **2** key for CALCULATE from the Statistics menu. The display will change to STATS Screen showing the statistical calculations for the selected results.
- 2). To print the statistical calculations, press the **Paper Feed** key, then press the **Enter** key to return to the Statistics menu.

D. To print selected results, perform the following:

- 1). Press the **3** key from the Statistics Menu. The screen will show the PRINT Screen and results will begin printing.
- 2). To stop the printing, press the **Enter** key.

E. To clear stored data results, perform the following:

- 1). Press the **1** key for STATISTICS from SETUP 1 menu. The screen will display the Statistics menu.
- 2). Press the **9** key for CLEAR DATA. The display will change to confirm the selection.
- 3). Press the **1** key to CLEAR ALL DATA or press the **2** key to escape to the Select menu without clearing data.

F. To turn statistics ON or OFF, perform the following:

- 1). Press the **5** key for STATISTIC ON (or OFF). This prompt will change depending if STATISTIC is OFF or ON. The screen will return to the SETUP 1 menu.

Develop

The Develop subroutine is used for creating new drying procedures for editing a stored program. All parameters related to testing a sample are set in the Develop subroutine.

A. To select Develop, perform the following:

- 1). Press the **2** key for DEVELOP from the SETUP 1 menu. The display will change to the DEVELOP Screen. A single screen conveniently shows all the parameters for the last drying program to be recalled.

```

10:00 AM    DEVELOP    15NOV00
1> UNITS: MOISTURE
2> TEMP 1: 105C    7> STDBY: 60C
3> TIME 1: OFF
4> TEMP 2: OFF
5> TIME 2: OFF
6> WIN:1.0%      IW:0.050
    
```

Develop Screen

The following chart shows the complete set of drying program parameters and the acceptable range of variables for each.

Parameter	Variables	Explanation
Units	Moisture	Initial Wt-Final Wt/Initial Wt x 100
	Solids	Final Wt/Initial Wt x 100
	Volatiles	Initial Wt-Final Wt/Initial Wt x 100
	Moisture/dry	Initial Wt-Final Wt/Final Wt x 100
	mg/l	Final Wt x 1000 /volume in mls
	ppm moisture	% moisture x 10,000
	ppm solids	% solids x 10,000
Temperature 1	weight	Initial Wt - Final Wt
	Maximum 210°C	Set temperature or OFF
Time 1	0.1 - 99.9 minutes	Set time or OFF
	Maximum 210°C	Set temperature or OFF
Temperature 2	0.1 - 99.9 minutes	Set time or OFF
	Maximum 210°C	Set temperature or OFF
Time 2	0.1 - 99.9 minutes	Set time or OFF
	Window	0.1 - 99.9 minutes
Slope	% Initial Weight	0.010 - 9.990
	Maximum 165°C	Set temperature
Standby	Maximum 165°C	Set temperature
Temperature		

Units

The analyzer will calculate the test result in a variety of units of measure depending on your specific application.

A. To select or change the UNITS, perform the following:

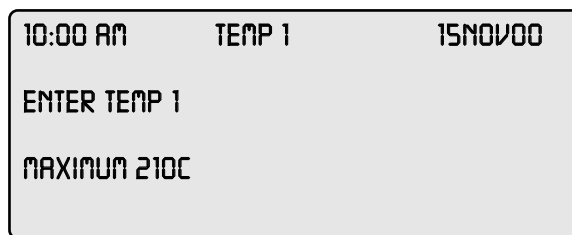
- 1). Press the number **1** key for UNITS, the display will change to the list of units.
- 2). Press the number key next to the unit to be selected. The display will return to the DEVELOP Screen showing the new unit selected.

Temperature 1 and 2

The analyzer will heat the sample being tested at one or two temperatures which are set in degrees Celsius. See APPLICATIONS section for a description of when to use two-step drying.

A. To set or change TEMPERATURE 1 or 2, perform the following:

- 1). Press the number key **2** or **4**, respectively, for TEMP 1 or TEMP 2. The display will change showing a set temperature prompt.



Temperature Screen 1

- 2). Key in the desired temperature in Celsius using the numeric keys between ambient and 210°C, then press the **Enter** key.

Select desired Ramp Rate by pressing corresponding key. "1" standard. "2" Rapid. If Rapid Ramp is selected, an "R" will appear to the right of the temperature display in the DEVELOP Screen and Program printout.

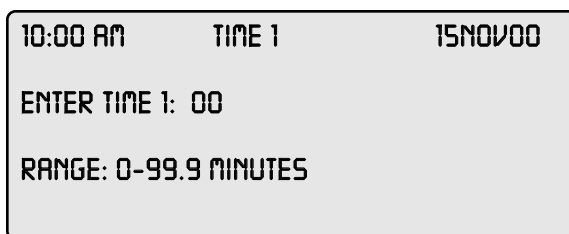
- 3). If TEMP 1 and TEMP 2 is not being used, press the **0** key for OFF and then press the **Enter** key. The display will return to the DEVELOP Screen showing the new selections.

Time 1 or 2

The analyzer has two time periods which correspond to the two temperatures.

A. To set or change TIME 1 or 2, perform the following:

- 1). Press the number key **3** or **5**, respectively for TIME 1 or TIME 2. The display will change showing a set time prompt.



Time 1 Screen

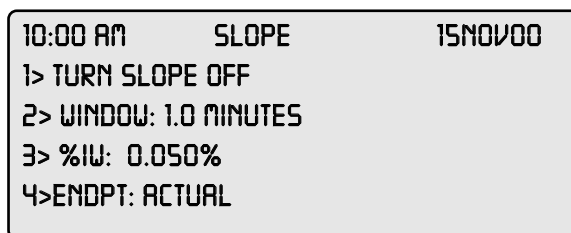
- 2). Key in the desired time using the numeric keys and the "." (decimal) key between 0.1 and 99.9 minutes, then press the **Enter** key.
- 3). If either or neither of the Time 1 or Time 2 are not being used, press the **0** key for OFF and then press the **Enter** key. The display will return to the DEVELOP screen showing the new selections.

Slope

The slope function provides an automatic endpoint to the test. The slope function consists of two variables, window of time and percent of initial weight (%IW) change. During the test, the weight loss of the sample is continuously monitored within the moving window of time. When the loss of weight within the window is less than the set percent of initial weight, the slope criteria has been met. The final weight is taken and the calculation is done to end the test. This slope is referred to as "actual slope" because endpoint is actually achieved. There are also three additional endpoint options called Calc 1, Calc 2 and Calc 3, which are algorithms that calculate the endpoint prior to achieving actual slope.

A. To set or change SLOPE, perform the following:

- 1). Press the **6** key for SLOPE. The display will change to the setup SLOPE Screen as shown on the next page.



Slope Setup Screen

B. To turn the SLOPE OFF, perform the following:

- 1). Press the **1** key to TURN THE SLOPE OFF. The display will return to the DEVELOP Screen.

C. To change the WINDOW of time, perform the following:

- 1). Press the **2** key for WINDOW. The display will change to the WINDOW Screen.
- 2). Key in the desired amount of time using the numeric keys and the "." (decimal) key between 0.1 and 99.9 minutes, then press the **Enter** key. The screen will return to the SLOPE Screen.

D. To change the percent of initial weight, perform the following:

- 1). Press the **3** key for %IW. The display will change to the set %IW Screen.
- 2). Key in the desired value for percent of initial weight using the numeric keys and the decimal key between 0.001 - 9.999, then press the **Enter** key. The screen will return to the SLOPE Screen.

E. To return to the DEVELOP Screen, perform the following:

- 1). Press the **Enter** key to exit. The screen will go to the DEVELOP Screen.

Standby Temperature

The standby temperature is the temperature, in Celsius, which the analyzer drying chamber will go to when the test is finished or on initial power up.

A. To change the STANDBY temperature, perform the following:

- 1). Press the **7** key for STDBY. The display will change to the STANDBY Screen.
- 2). Enter the desired temperature in Celsius for the standby temperature up to 165°C, using the numeric keys, then press the **Enter** key. The screen will return to the DEVELOP Screen.

Saving a Drying Procedure as a Program

When all the parameters have been set to the desired settings as shown on the DEVELOP Screen the operator has three options:

- 1). To exit the subroutine with the changes but without saving it as a program.
- 2). Or save the changes to the recalled program.
- 3). Or save the changes as a new drying program.

Exiting the Develop subroutine without saving, would be used to test a change made to an existing procedure or when no changes is made to a saved procedure.

A. To exit the Develop subroutine without saving, perform the following:

- 1). When the DEVELOP Screen shows all the desired parameters, press the **Enter** key. The display will change to the SAVE Screen as shown below.

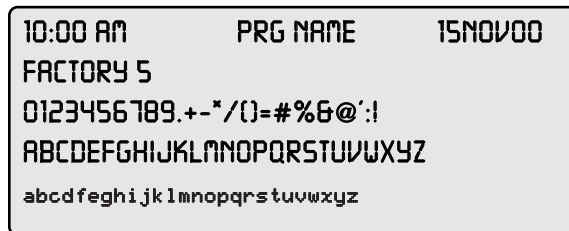


Save Screen

- 2). Press the **2** key for USE, NOT SAVED. The display will return to the STANDBY Screen and use the parameters for the next test.

B. To save the changes made in the Develop subroutine to the recalled program, perform the following:

- 1). When the DEVELOP Screen shows all the desired parameters, press the **Enter** key. The display will change to the SAVE Screen.
- 2). Press the **1** key for SAVE PROGRAM. The display will change to the PROGRAM Screen showing a list of saved programs and any blank programs.
- 3). Use the “ . ” (decimal) key to scroll through the pages if needed.
- 4). Key in the program number of the recalled program with the numeric keys and then press the **Enter** key. Since the program has already been stored under this number, you will be asked to confirm your selection by pressing the 1 key or to return to the program SAVE Screen by pressing the 2 key.

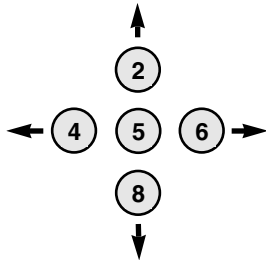


Alphanumeric Program Name Screen

- 5). The display will change to the alphanumeric PROGRAM NAME Screen to enter an alphanumeric program name. Press **Enter** to use the same program name.
- 6). To change the program name, use the chart below which describes the function of each key to select in sequence the desired characters of the program name. Key in the alphanumeric program name and then press the Enter key to save the program name. The display will return to the STANDBY Screen.

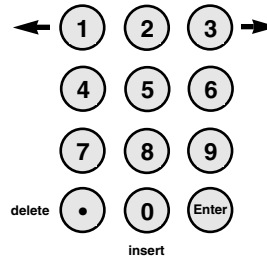
To move the cursor in the selection lines of characters:

- 2 - scrolls cursor upwards.
- 8 - scrolls cursor down.
- 6 - moves cursor to the right.
- 4 - moves cursor to the left.
- 5 - enters character at cursor.



To move the cursor in the entry line, press:

- 1 - to move cursor left.
- 3 - to move cursor right.
- 0 - inserts a space.
- - deletes the character on the left.
- 0 then 3 - inserts a space at the end of the string as in a space between words.



C. To store the changes made in the Develop subroutine as a new program, perform the following:

- 1). When the DEVELOP screen shows all the desired parameters, press the **Enter** key. The display will change to the SAVE Screen.
- 2). Press the 1 key for SAVE PROGRAM. The display will change to the PROGRAM NUMBER Screen showing a list of saved programs and blank program slots.
- 3). Use the "." (decimal) key to scroll through the pages if needed.
- 4). Key in the program number of a blank program with the numeric keys and then press the **Enter** key.
- 5). The display will change to the alphanumeric PROGRAM NAME Screen to enter an alpha-numeric program name using the instructions above. The screen will return to the STANDBY Screen.

System

The analyzer system subroutine provides access to important system information regarding the installed software version, analyzer serial number, analyzer model, the date and time of last calibration of both the heater temperature and balance. This information may also be printed.

A. To view the SYSTEM information, perform the following:

- 1). Press the **4** key for SYSTEM from Setup 2 menu. The display will change to the SYSTEM Screen as shown:

```
10:18 AM      SYSTEM      15NOV00
SOFTWARE: XXXXXXXXXXXXXXXX
SERIAL #: XXXXXXXXXXXXXXXX
MODEL: IR-200
LAST BAL CAL:  9:42:13AM 15NOV00
LAST TEMP CAL: 9:45:28AM 15NOV00
```

System Screen

- B. To exit the SYSTEM Screen, press the Enter key. The display will return to the SETUP 2 menu.

- C. To print the System information, press the Paper Feed key.

Calibrate

The Calibrate subroutine allows periodic calibration of the balance. Calibration should be performed whenever the analyzer is moved, especially if it will be used in the manual mode as a standard electronic balance. You will need a 50 gram weight to calibrate the analyzer.

A. To CALIBRATE the balance, perform the following:

- 1). Place a pan on the pan support.
- 2). Press the **4** key for CALIBRATE from the SETUP 1 menu, the display will change to the CALIBRATE Screen. The screen will indicate that zeroing of the balance has taken place and the screen will display 0.000.
- 3). Place a 50 gram weight on the pan when prompted by the display and close the heater hood. The weight will automatically be recognized as a 50 gram weight and adjust the weight display to 50.000 grams. The display will show CALIBRATION DONE if the calibration has been successful.

After a few seconds the screen will return to the SETUP 1 menu. If the calibration isn't successful, the display will stay on this screen. Press the **Test** key to abort. Try the procedure over again. If the calibration is still unsuccessful, refer to the troubleshooting section of this manual.



Unit will not calibrate if heater hood is open.

Printer

The Printer subroutine provides two setup options for selecting the printout style or generating a custom printout by selecting desired information, and configuring the analyzer for an external printer. The two printout settings are:

Standard Result Printout - Includes all information except operator.

Custom Result printout- Includes the choices of turning ON or OFF the header, analyzer ID and model, manufacturer line, program #, program parameters, weight information, Sample ID and operator.

The default printer settings are shown below. see pages 26 - 27 for examples of each of the available printouts.

10:18 AM	PRINTER	15NOV00
1>INTERNAL:	ON	6>COMPUTER: OFF
2>EXTERNAL:	OFF	
3>STANDARD:	ON	
4>CUSTOM:	OFF	
5>INTERNAL:	OFF	

Printer Screen

If an external printer is selected, the external device will receive data in the same format as the internal printer. the internal; printer can be turned OFF or both the internal and external printers can be turned ON to print simultaneous.

The external printer must be connected to serial two and the communication parameters set for both the printer and analyzer to the same communication parameters. refer to the serial setup section.



Note

A warning message will appear on the display (when a test is initiated), if the external (9 pin) and/or computer (25 pin) serial ports are turned ON and external devices are not connected.

A. To turn the INTERNAL PRINTER OFF, perform the following:

- 1). Press the **5** key for PRINTER from the SETUP 1 menu, the display will change to the Printer menu.
- 2). Press the **1** key for INTERNAL, to toggle to OFF.
- 3). Press the **Enter** key to return to SETUP 1 screen

B. To turn the EXTERNAL PRINTER ON, perform the following:

- 1). Press the **5** key for PRINTER, the display will change to the Printer menu.
- 2). Press the **2** key for EXTERNAL, to toggle to ON.
- 3). Press the **Enter** key to return to SETUP 1 menu.
- 4). Press the **7** key for SERIAL from SETUP 1 menu and proceed with setting the serial communication parameters for Serial 2. See Serial section.

C. To select the STANDARD printout style, perform the following:

- 1). Press the **5** key for PRINTER, the display will change to the Printer menu.
- 2). Press the **3** key for STANDARD, to toggle standard ON. (Note that in the standard printout, INTERVAL is OFF and therefore turning STANDARD OFF also turns INTERVAL OFF. To turn INTERVAL ON,)
- 3). Press the **Enter** key to return to SETUP 1 menu.

D. To turn the COMPUTER ON, perform the following:

- 1). Press the **6** key for COMPUTER to toggle ON.
- 2). Press the **Enter** key to return to SETUP 1 screen
- 3). Press the **Enter** key again to return to the STDBY Screen.
- 4). Turn the power switch OFF and then back ON again.

Custom Printout

This routine allows the printout to be customized to your specific requirements including the following options to appear on the result printout:

10:18 AM	CUSTOM	15NOV00
1>HEADER:	ON	6>PRG#: ON
2>OIC:	ON	7>PROGRAM ON
3>MODE/ID:	ON	8>WEIGHTS ON
4>OPERATOR:	OFF	
5>SAMPLE#:	ON	

Custom Screen

1. Model and analyzer ID (includes analyzer model and serial number)
2. Operator name
3. Sample ID
4. Program name and number
5. Drying procedure parameters
6. Weight information (initial weight, final weight and weight loss)
7. 3 programmable alphanumeric custom header lines.

The CUSTOM Screen will show the status of each of the above as either ON or OFF. When turning ON OPERATOR, SAMPLE ID and custom lines, the display will go to an entry screen for setting these parameters. A unique setup screen provides access to letters (both upper and lower case), numerals and some symbols. Use the chart which describes the function of each key in order to create custom entries for operator name and custom header lines. The setup SAMPLE ID Screen will allow the selection of either a numeric ID number or a string of alphanumeric characters.

A. To select the CUSTOM printout style, perform the following:

- 1). Press the **5** key for PRINTER from the SETUP 1 menu, the display will change to the Printer menu.
- 2). Press the **4** key for CUSTOM, the display will change to the CUSTOM Screen.

Sample Printouts

Sample 1: Standard Printout

DENVER INSTRUMENT COMPANY
IR-200 MOISTURE ANALYZER
 INSTRUMENT ID: 000313
 SAMPLE #:
 PROGRAM 01: FACTORY 1
 TEMP 1: 105C TIME 1: OFF
 TEMP 2: OFF TIME 2: OFF
 SLOPE: WINDOW: 1.0 %IW: 0.050
 STANDBY: 60C
 RESULT ON 15 NOV 2000 AT 12:30:09 PM
 ELAPSED TIME: 4:00
 12.03% η
 INITIAL WEIGHT = 4.995 GRAMS
 FINAL WEIGHT = 4.394 GRAMS
 WEIGHT LOSS = 0.601 GRAMS

Program —————
 Result —————
 Weight —————

Sample 2: Custom Printout
(All ON including Interval ON)

DENVER INSTRUMENT COMPANY
IR-200 MOISTURE ANALYZER
 INSTRUMENT ID: 000313
 OPERATOR: _____
 SAMPLE #:
 PROGRAM 01: FACTORY 1
 TEMP 1: 105C TIME 1: OFF
 TEMP 2: OFF TIME 2: OFF
 SLOPE: WINDOW: 1.0 %IW: 0.050
 STANDBY: 60C

Time	TEMP	WEIGHT	DATA	UNITS
0:30	68C	4.990	0.10%	η
1:00	97C	4.785	4.20%	η
1:30	104C	4.632	7.27%	η
2:00	105C	4.52	9.43%	η
2:30	105C	4.43	11.05%	η
3:00	105C	4.403	11.85%	η
3:30	105C	4.495	12.01%	η

RESULT ON 15 NOV 2000 AT 12:30:09 PM
 ELAPSED TIME: 4:00
 12.03% η
 INITIAL WEIGHT = 4.995 GRAMS
 FINAL WEIGHT = 4.394 GRAMS
 WEIGHT LOSS = 0.601 GRAMS

Program —————
 Interval —————
 Result —————
 Weight —————

Sample 3: Custom Printout
(With header, Model/ID,
Operator, Sample # and
PRG # ON)

Line #1
DENVER INSTRUMENT COMPANY
IR-200 MOISTURE ANALYZER
INSTRUMENT ID: 000313
OPERATOR: _____
SAMPLE #: 2398881
PROGRAM 01: FACTORY 1
TEMP 1: 105C TIME 1: OFF
TEMP 2: OFF TIME 2: OFF
SLOPE: WINDOW: 1.0 %IW: 0.050
STANDBY: 60C
RESULT ON 15 NOV 2000 AT 12:30:09 PM
ELAPSED TIME: 4:00
12.03%M

Operator

Four operator names can be entered. A fifth choice is a blank entry which a name can be manually entered by hand to the result printout after the test is completed.

A. To turn ON or change operator names, perform the following:

- 1). Press the **4** key for OPERATOR. The display will change to the OPERATOR Screen as shown below:

10:18 AM OPERATOR 15NOV00
1> TURN OPERATOR OFF
2>
3>
4>
5>

Operator Screen

- 2). Select operator 1, 2, 3 or 4 by pressing the respective key. The display will change to the set OPERATOR Screen.
- 3). Key in the operator name using the chart which describes the function of each key and then press Enter. The display will return to the OPERATOR Screen.
- 4). Key in the remaining operator names using step 2 and 3 above.
- 5). To save and exit, press the **Enter** key. The display will return to the CUSTOM Screen.

Custom 3 Header Lines

The custom printout header consists of three line of 32 characters each.

A. To set or change printout 3 custom header lines, perform the following:

- 1). Press the **1** key for HEADER. The display will change to the set HEADER Screen.
- 2). Select line 1, 2 or 3 by pressing the respective key. The display will change to the appropriate set HEADER Screen.
- 3). Key in the printout custom header line using the chart on page OPRS-13 which describes the function of each key and then press **Enter**. The display will return to the HEADER Screen.
- 4). To exit and save the changes to the custom header lines, press **Enter** for exit. The display will return to the Custom menu.
- 5). Press the **Enter** key twice to exit to the SETUP 1 menu.

Sample Number

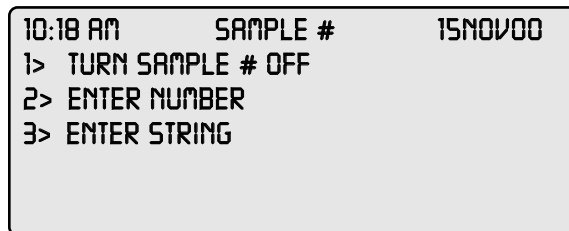
A sample number option is available when the operator desires to enter a unique sample number for each sample tested. There are two options:

- a). Numeric sample ID (16 characters).
- b). Or an alphanumeric string (19 characters).

The sample number may also be turned OFF. The numeric sample ID style is ON in the default setup. Upon testing a sample, a sample number screen will prompt the operator to key in a sample number.

A. To set or change the status of the sample number prompt, perform the following:

- 1). Press the **5** key for SAMPLE NUMBER. The display will change to the set SAMPLE NUMBER Screen.



Sample # Screen

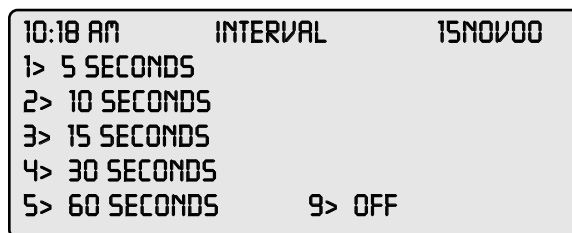
- 2). Press the **1** key to TURN SAMPLE #OFF. Or press the **2** key for ENTER NUMBER to turn sample # ON for the number style, Or press the **3** key for ENTER STRING to turn the sample # ON for the string style. The display will return to the CUSTOM Screen.
- 3). Press the **Enter** key to save the custom printer conditions and return to the SETUP 1 menu.

Interval

The printout can be set to print intermediate data including time, weight, temperature and intermediate result in the selected unit at various intervals. The printing of intermediate data can assist with methods development.

A. To select an INTERVAL style print, perform the following:

- 1). Press the **5** key for PRINTER from the SETUP 1 menu, the display will change to the PRINTER Screen.
- 2). Press the **5** key for INTERVAL, the display will change to the INTERVAL Screen with the available options as shown below.



Interval Screen

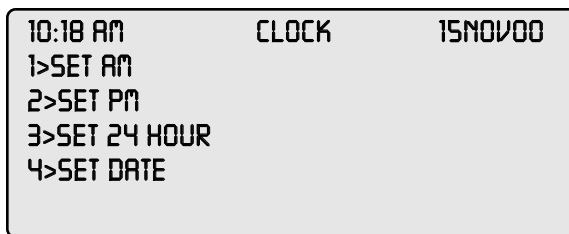
- 3). Press the number key adjacent to the desired interval. The display will return to the Printer menu.
- 4). Press the **Enter** key to exit to the SETUP 1 menu.

Clock

The analyzer features a clock chip which conveniently displays the time and date on most screens and on the result printouts. The setting of time and date are done in the Setup routine. The time and date are maintained in memory and preserved even if the analyzer power is turned OFF. The time is setup either in the 24 hour format, or either AM or PM. The date is setup in the month, day and year format. The printout shows the date as: (example 15 Nov 2000).

A. To set or change the time, perform the following:

- 1). Press the **6** key for CLOCK from the SETUP 1 menu, the display will change to the CLOCK Screen. The present time and date will be shown.
- 2). Select the 24 hour format or either AM or PM by pressing the corresponding number. The display will change to the enter TIME Screen.
- 3). Enter the time in order of hour, minute and seconds. Single digit hours must be entered with a preceding zero, (example 02 for two o'clock) then press the **Enter** key. The display will return to the CLOCK Screen.



Clock Screen

B. To set or change the date, perform the following:

- 1). Press the **6** key for CLOCK from the SETUP 1 menu. The display will change to the TIME/DATE Screen. The present time and date will be shown.
- 2). Press the **4** key for SET DATE. The display will change to the DATE Screen.
- 3). Enter the date in order of month, day and year. Single digit months must be entered with a preceding zero, (example: 02 for February), then press the **Enter** key. The display will return to the CLOCK Screen.
- 4). To exit the CLOCK Screen, press the **Enter** key. The display will return to the SETUP1 menu.

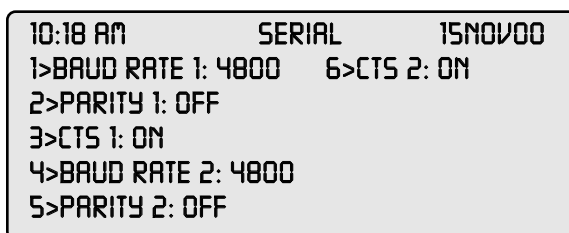
Serial

The analyzer contains two serial interface input/outputs to handle most any interface requirements.

- Serial 1, a 25 pin DB-25P, is designed for analyzer to analyzer transfer of programs. Serial 1 can be left at the default settings on both analyzers to communicate between the two analyzers. Use this port to communicate with a computer.
- Serial 2, a 9 pin DE-9S, is designed to be used for external communication to an external printer. Serial 2 must be set to the appropriate setup conditions to communicate to the desired external device.

A. To set or change Serial 1 or 2 communication parameters, perform the following:

- 1). Press the **7** key for SERIAL from the Setup 1 menu, the display will change to the SERIAL Screen showing the set conditions for the both Serial 1 and Serial 2:



Serial Screen



Serial 1 = 25 pin port/computer
Serial 2 = 9 pin port/external

B. To set or change the BAUD RATE, perform the following:

- 1). Press the **1** or **4** key for the BAUD RATE of Serial 1 or Serial 2. The display will change to the list of available baud rates.
- 2). Press the number key next to the baud rate to be selected. The display will return to the SERIAL Screen showing the selected baud rate.

C. To set or change PARITY, perform the following:

- 1). Press the **2** or **5** key for PARITY of Serial 1 or Serial 2. The display will change to the available parity selections.
- 2). Press the number key next to the parity to be selected. The display will return to the SERIAL Screen showing the selected parity.

D. To set or change COUNTS (CTS), perform the following:

- 1). Press the **3** or **6** key for COUNTS (CTS) of Serial 1 or Serial 2. The display will change to the available counts selections.
- 2). Press the number key next to the counts to be selected. The screen will return to the SERIAL Screen showing the selected counts.

E. To exit the SERIAL screen and to save the serial parameters, press the **Enter** key for exit. The display will return to the SETUP 1 menu.

Security

The Security subroutine of the analyzer prohibits unauthorized entry of selectable routines or subroutines. If security is turned ON, a numeric password is established which will need to be entered to access the secured routines. If the password is not entered, then the operator will be denied entry to this subroutine. In the Security subroutine, the security can be turned OFF or ON and allow setup of the specific subroutines which security will protect. When Security is turned OFF, all analyzer subroutines can be accessed without entering the password. The factory default setting for SECURITY is OFF, thus all routines can be accessed.

The following chart shows the subroutines which can be secured. On initial installation, all subroutines have SECURITY turned OFF.

- **Test** - If security is turned ON, a test can not be performed without entering the password.
- **Recall** - If security is turned ON, the operator must enter the password to recall a new program.
- **Statistics** - If security is turned ON, the operator must enter the password to enter the statistics subroutine from SETUP 1 menu.
- **Calibrate** - If security is turned ON, one must enter the password to calibrate the balance from the SETUP 1 menu.

- **Develop** - If security is turned ON, the password must be entered to access the Develop mode from the SETUP 1 menu.
- **Printer** - If security is turned ON, the operator must enter the password to enter the printer subroutine from the SETUP 1 menu.
- **Serial** - If security is ON, the operator must enter the password to enter the serial.
- **Clock** - If security is ON, the operator must enter the password to enter the clock subroutine from the SETUP 1 menu.
- **Setup 2** - If security is ON, one must enter the password to go to the SETUP 2 menu.

A. To turn SECURITY ON and to change the security access to any of the securable subroutines, perform the following:

- 1). Press the **8** key for SECURITY from SETUP 1 menu. The display will change to the SECURITY Screen as shown below.

```

10:18 AM      SECURITY      15NOV00
1>TURN SECURITY ON
2>TURN SECURITY OFF
3>CLEAR ALL PROGRAMS
4>CLEAR DATA
5>SORT PROGRAMS (+)

```

Security Screen

- 2). Press the **1** key for TURN SECURITY ON. The screen will change to the enter PASSWORD Screen.
- 3). Using the numeric keys, enter up to a 10 digit password and then press the **Enter** key. The screen will change to the set SECURITY Screen showing the present security status for each subroutine.
- 4). Press the number key adjacent to the desired subroutine to toggle the security status ON or OFF.
- 5). SETUP ON or OFF for each of the nine subroutines. When all selections are made, press the Enter key to save and exit to the Security menu. Press **Enter** again to return to the SETUP 1 menu.

B. To turn security OFF on a global basis perform the following:

- 1). Press the **8** key for SECURITY from SETUP 1 menu. The display will change to the SECURITY Screen.
- 2). Press the **2** key to TURN SECURITY OFF. The display will change to the enter PASSWORD Screen.
- 3). Enter the password with the numeric keys and then press the **Enter** key. SECURITY will now be OFF globally. The display will return to SETUP 1 menu.

Clear Programs

At sometime, you may desire to clear all your drying procedures and to reset the analyzer to the 5 factory default programs. If SECURITY has been turned ON, this clear routine will also be secured and require the password to clear all programs.

A. To CLEAR ALL PROGRAMS, perform the following:

- 1). Press the **8** key for SECURITY from SETUP 1 menu. The display will change to the SECURITY Screen.
- 2). Press the **3** key for CLEAR ALL PROGRAMS. The display will change for you to confirm your decision.
- 3). Press the **1** key for CLEAR ALL PROGRAMS or press the **2** key for ESCAPE WITHOUT CLEARING. If you selected 1 for CLEARING, the display will show a clearing message. In either case, the screen will return to SETUP 1 menu.

Clear Data

At sometime you may desire to clear all the data in the statistics database. If security has been turned ON, this clear routine will also be secured and require the password to clear all programs.

A. To CLEAR ALL DATA in the statistics database, perform the following:

- 1). Press the **8** key for SECURITY from SETUP 1 menu. The display will change to the SECURITY Screen.
- 2). Press the **2** key for CLEAR ALL DATA. The display will change for you to confirm your decision.
- 3). Press the **1** key for CLEAR ALL DATA or press the **2** key to ESCAPE WITHOUT CLEARING. If you select 1 for clearing, the display will show a clearing message. In either case, the screen will return to SETUP 1 menu.

Conserve

The analyzer can be customized to turn both the standby temperature off and the LCD display backlight off at separate times to conserve energy and to prolong the life of the quartz infrared heating tubes and the LCD backlight when the analyzer is not being used. The default setting for turning the standby temperature off is 60 minutes. The default setting for turning the LCD backlight off is 5 minutes. The STANDBY Screen will display the time when the standby temperature conserve is activated.

A. To set or change when the standby temperature is turned off, perform the following:

- 1). Press the **1** key for CONSERVE from SETUP 2 menu. The display will change to the CONSERVE Screen showing the current set value in minutes.
- 2). Press the **2** key for STANDBY OFF. The display will change to the set STANDBY Screen.
- 3). Key in the desired time in minutes between 0 and 60 using the numeric keys, then press the **Enter** key. The display will return to the CONSERVE Screen.

B. To set or change when the LCD backlight is turned off, perform the following:

- 1). Press the **1** key for CONSERVE subroutine from SETUP 2 menu. The display will change to the CONSERVE Screen showing the current set value in minutes.
- 2). Press the **2** key for BACKLIGHT OFF. The display will change to the BACKLIGHT Screen.
- 3). Key in the desired time in minutes between 0 and 60 using the numeric keys, press the **Enter** key. The display will return to the CONSERVE Screen.

To exit the CONSERVE subroutine, press the **Enter** key for exit. The display will return to the Setup 2 menu.

Prg. Xmit (Program transfer)

The analyzer provides a convenient program transfer mode for users with multiple instruments. Once the first analyzer has been programmed with stored drying procedures, these can then be transferred directly in additional units via each analyzer's Serial #1 port and the optional accessory cable. (See Accessories page). This subroutine may also be used to communicate to and from a computer via a communications software package and most any standard database program.

A. To transfer drying procedures from one analyzer to another, perform the following:

- 1). Connect the optional accessory cable to both analyzer's 25 pin sub-miniature D socket, DB-25P cap.
- 2). Enter the SERIAL subroutine from the SETUP 1 menu and verify or change the settings to the following on both analyzers:

Baud rate 1: 4800
Parity 1: OFF
CTS 1: OFF

- 3). Press the **2** key for PROG. XMIT from the SETUP 2 menu of both analyzers. The display will change to the PROG. XMIT Screen.
- 4). On the importing analyzer, press the **2** key for EXTERNAL INPUT.
- 5). On the exporting analyzer, press the **1** key for OUTPUT PROGRAMS.
- 6). Both screens will change showing that the programs are transferring.
- 7). On completion, the exporting analyzer will return to the PROG. XMIT menu. Press Enter on the exporting analyzer to return to the SETUP 1 menu.
- 8). Press the **Enter** key twice on the importing analyzer to return to the Setup 1 menu.

Beeper

The analyzer features an audible tone or beeper to assist with the operation of the analyzer. However, for your personal preference, the beeper may be turned OFF or set for a short or long tone. The beeper is ON short in the default setup.

A. To set or change the status of the beeper, perform the following:

- 1). Press the **3** key for BEEPER from SETUP 2 menu. The display will change to the set BEEPER Screen.
- 2). Press the **1** key for TURN BEEPER OFF.
Or press the **2** key for TURN BEEPER SHORT for a short beep. Or press the **3** key for TURN BEEPER LONG for a long beep. The display will return to SETUP 2 menu.

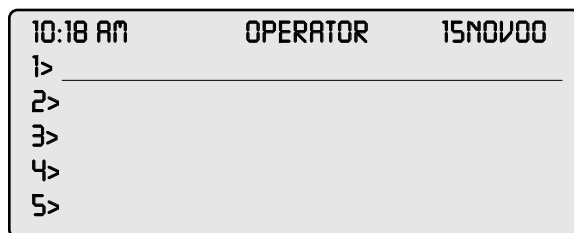
Operator

The analyzer provides a convenient feature for printing an operator's name on the result printout. Up to four operator names are first entered in the setup PRINTER routine. A user can then select their name from the Operator routine from the STANDBY Screen whenever Operator #3 is shown on the bottom line of the screen. A fifth option is available for selection which will show up as a blank line next to operator on the printout for manual entry. Once an operator selection is made, it will be printed on each report thereafter until either another operator selection is made or the operator is turned OFF in the Printer subroutine. The operator default setting is OFF and therefore OPERATOR #3 will not initially appear at the bottom of the STANDBY Screen until it is turned ON. To turn the operator prompt ON, refer to the printer, custom printout subroutine and follow the directions to turn the operator function ON and to enter operator names.

A. To select an OPERATOR name or blank line, perform the following:

- 1). Press the **3** key for OPERATOR whenever the display shows 3) Operator on the bottom line of the screen.

The select OPERATOR Screen will be displayed as:



Operator Selection Screen

- 2). Press the number key next to the operator to be selected or the **1** key for a blank line. The analyzer will return to the STANDBY Screen.

Applications

Moisture Analyzer is applicable to a wide variety of samples including powders, liquids, pastes, slurries and some solids. Application considerations include sample composition, sample preparation, sample presentation, sample size, drying parameters, desired precision, accuracy and analysis time.

Developing a drying procedure on the analyzer is relatively straight forward when a standard convection oven method has already been established for your sample material. In principle, it can be as easy as testing the sample at the same temperature and selecting the default automatic slope end point setting. However, the analyzer has several features which allow optimization of the drying procedure which you'll want to implement to take full advantage of the analytical performance available with your analyzer. In addition, the use of a proper sample presentation technique using glass pads or sand can not only improve analytical performance but may also make the difference between developing a successful procedure or not. Analytical performance improvements can result in more rapid analysis time, improved precision and better accuracy. Since speed of analysis is generally important for quality control applications of the analyzer, it is advantageous to take the extra steps described below to optimize the drying procedure.

- **Sample Composition** - The chemical composition of materials applicable to the analyzer include primarily aqueous based material or organic material with high flash points. Samples emitting toxic or corrosive fumes should be analyzed with the analyzer placed in a hood. Samples that present a concern of exploding or igniting should be avoided.
- **Sample Preparation** - Samples are generally prepared in the same manner as the standard oven method. Heterogeneous solid materials require finer grinding to improve representation which will result in better reproducibility. Increased surface area will also result in decreased analysis time. Liquid samples should be made homogeneous before sampling.
- **Sample Presentation** - Powder samples and solid sample which either release moisture easily or only surface moisture is desired are presented to the analyzer on an aluminum pan. Other material higher in moisture which are subject to crusting over during testing should be presented in conjunction with a dispersing agent to produce obtain full moisture recovery, prevent splattering and reduce analysis time. Typical dispersing agents include glass pads or sand.

1. **Glass pads** - Circular glass pads are generally used for liquids, pastes and slurries. Samples subject to crusting over should be placed between two glass pads. Less viscous material can generally be added to a single pad using a pipette. Typically, between a 1.0 to 2.0 grams of sample is used for testing and should be evenly spread across the pad in a thin layer. Care should be taken not to over work the sample trying to spread it on the pan. This can cause unwanted evaporation of the sample moisture.
2. **Sand** - Dried quartz sand can aid in drying samples which crust but are not suitable to being placed between two glass pads. The sample is generally imbedded into a bed of sand (ca. 20g) on an aluminum pan.

In either case, the dispersing agent is used with an aluminum pad. The dispersing agent with the aluminum pan is placed into the analyzer prior to testing and is automatically tared. Care should also be taken to dry the dispersing agent prior to using it for testing and keeping it in a desiccator so that it doesn't absorb unwanted atmospheric moisture.

- **Sample size** - The amount of sample analyzed is dependent on the sample homogeneity, percent of moisture in sample and the desired analysis time. Typically 2-10 grams of sample are analyzed, however more may be necessary to get sufficient sample representation or when testing low moisture material. In general, the larger the sample size the longer the analysis time and better analytical precision is experienced. When using the glass sample pad presentation technique approximately 1-2 grams of sample is used to minimize analysis time.
- **Drying Parameters** - The analyzer offers the versatility to program an optimized drying procedure specific to the sample material through the selection of the following parameters which are available to the user in the Setup mode:
 - 1). **Temperature 1** - Initial drying temperature (50 above ambient to 210°C maximum).
 - 2). **Time 1** - Used for time drying or to set a time period for Temperature 1 if two step drying is used (0.1 to 99.9 minutes).
 - 3). **Temperature 2** - Second drying temperature used for two step drying (210°C maximum).
 - 4). **Time 2** - Used for time drying of two step drying or normally not used if using the automatic slope endpoint (0.1 to 99.9 minutes).
 - 5). **Slope** - Used for automatic constant weight endpoint with either single or two step drying. Variables include the window of time and the percent of initial weight.
 - 6). **Standby Temperature** - Sets the temperature which the analyzer will equilibrate between tests (ambient to 165°C).
 - 7). **Units** - Sets the Calculation mode for percent moisture, solids, moisture-dry, volatiles or ppm or mg/l.

Analytical Performance

The analyzer performance is dependent on a good weighing environment, calibration of weight and temperature, and an optimized drying procedure. The performance of the analyzer can be measured through the statistical determination of precision, accuracy and analysis time for a given sample type. The three performance criteria are interrelated. Optimization of precision and accuracy will likely increase analysis time through the use of a larger sample size or a lower drying temperature. Therefore, it is necessary to establish methods development objectives before proceeding with the development of an optimized drying procedure most suitable for your application.

- 1). **Precision.** The precision of the analyzer is dependent on the material being tested considering the homogeneity of the sample, sample size and level of moisture. Precision improves with better sample homogeneity, finer particle size, larger sample size, and uniform sample height and distribution on the pan or pad.
- 2). **Accuracy.** Accuracy should be measured based on the correlation of the analyzer to the standard LOD reference oven method for the sample material.
- 3). **Analysis Time.** The analysis time is dependent on the choice of drying parameters when developing the optimized drying procedure. Analysis time can be reduced by drying at a higher temperature, using a two step drying procedure, using a smaller sample size, utilizing an appropriate dispersing agent and optimizing the slope parameters.

Steps to Developing a Drying Procedure

The following outlines the typical steps used in developing an optimized drying procedure. In general, the standard convection oven method is the basis for beginning to develop a method on the analyzer. Sequentially various parameters will be changed in order to meet your methods development objectives. Note that steps 3-7 below do not need to be done in order, but rather as necessary. Finally, the procedure will be verified for accuracy across the range of moisture typical for your samples.

It is suggested that a typical sample with a known moisture value be chosen to do most of the methods development work. Later the method should be verified and modified based on a larger sample set to improve method robustness.

DEVELOPMENT STEPS:

- 1). Sample preparation
- 2). Duplicating the standard convection oven method
- 3). Selecting the presentation technique
- 4). Optimizing sample weight
- 5). Choosing a standby temperature
- 6). Selecting the optimum endpoint
- 7). Optimizing the drying temperature
- 8). Developing a two step drying procedure

STEP 1 - Sample Preparation.

As discussed previously, a sample preparation technique should be chosen to:

- 1) Provide a representative sample testing.
- 2) And allow rapid moisture loss.

One would typically begin with a sample preparation the same as what is presently done for the standard method. Modification to sample presentation can be experimented with if one desires to simplify this step.

STEP 2 - Duplicating the Standard Oven Method.

The analyzer should be set to dry the sample at the same temperature as the standard oven method. Test results will be compared to the known value. Several replicates of the develop sample should be tested noting recovery, precision, sample appearance after testing and the time of analysis. Set the following drying parameters and begin testing:

- A). Set TEMP 1 to the drying temperature of the standard method.
- B). Use the default automatic slope endpoint setting (0.05%/1min).
- C). Select the appropriate units
- D). Use the default standby temperature (60°C).
- E). Use approximately 10 grams of sample for testing.

STEP 3 - Selecting the Presentation Technique.

As described above, if the sample material is a liquid or paste, a dispersing agent will be necessary. This will be noticeable if in step one the sample formed a crust during testing. The crust will prevent moisture from being liberated from the sample rapidly and likely cause a premature endpoint with the default slope setting. Choose one of the following sample presentation techniques and repeat testing at the same drying parameters as in step one above:

- *Single glass pad.* For free flowing liquids which do not form a crust. Use approximately one gram of sample.
- *Two glass pads.* For pastes and liquids which do form a crust. Use between 1-2 grams of sample spread evenly.
- *Sand.* For solid samples which crust or expand. Use approximately 20 grams of sand and 2-10 grams of sample.

STEP 4 - Optimizing Sample Weight.

A sample size should be chosen that is representative. However, a large sample size will increase the analysis time. At the same time, it may be necessary to get the desired reproducibility especially for low moisture samples. Experiment with a larger or smaller size to see the effect and measure this against the method development objectives. The following rules apply:

- For powder samples, generally 2-10 grams is sufficient.
- Liquid samples with a single sample pad general require greater than 0.5 grams but less than 2 grams.
- Pastes with two glass pads will need greater than 1 gram but less than 3 grams.
- Low moisture samples (less than 0.5%) will require a sample in excess of 10grams. The available large pan and pan support will hold up to 70 grams of sample of plastic pellets or sugar.
- The larger the sample size the longer the analysis time.
- The larger the sample size the better the reproducibility.

STEP 5 - Choosing a Standby Temperature.

The standby temperature is that which the heating chamber will equilibrate between tests. The default standby temperature is 60°C.

The reason to change the standby temperature is principally one of reducing analysis time. An elevated standby temperature allows the analyzer to achieve **TEMP 1** quicker than a lower standby temperature; thus, reducing analysis time. However, the determination of what the standby temperature to set at, is based on the nature of the sample. Samples containing light volatiles which will be readily lost with the exposure of heat, will need to be placed into a relatively cool heating chamber at the beginning of a test. Otherwise, a higher standby temperature should be used. It is recommended that a standby temperature of 5-10°C below **TEMP 1** is used, unless light volatile exist or for very low moisture samples. For low moisture samples, the standby temperature should be set at the same temperature as **TEMP 1**.

STEP 6 - Selecting the Optimum Endpoint.

The analyzer offers a variety of ways to end the analysis including time-out or automatic slope. The default value is the **automatic slope** with 0.05%/1 minute. It is recommended that the automatic Slope setting be used rather than **time-out**. This is primarily due to the fact that the Slope setting will compensate for varying sample size, varying moisture levels and varying temperature at the beginning of each test. All these will have an affect on the length of time it take for the moisture to be completely liberated from the sample. Whereas, the Slope will detect when the volatiles have be lost from the sample and immediately end the analysis, the time-out would have to be set for the worst case conditions to be accurate and, therefore, unnecessarily extend the analysis time for samples which could conceivably be done sooner.

The reason to change the slope variables of percent of initial weight and the window of time is basically one of accuracy and analysis time, and typically based on the level of moisture in the sample.

To achieve the most accurate results, the analyzer must permit the complete liberation of volatiles from the sample. This can be seen by the analyzer to a resolution of one milligram weight loss (over up to a 99.9 minute of time). A premature slope endpoint will end the analysis too soon, thus giving a false low recovery or low moisture value. The selection of the setting for the slope variables is somewhat experimental.

However, the following general rules apply:

- If the recovery of the sample is consistently low, then use a smaller percent of initial weight.
- If the recovery of the sample is consistently high, use a larger percent of initial weight.
- Samples with low moisture levels will use a lower percent of initial weight.
- Samples with high moisture levels will use a higher percent of initial weight.
- A lower percent of initial weight will likely increase analysis time.
- A longer window of time is necessary for samples with low moisture.
- A short window of time can be used for samples that liberate volatiles very rapidly.
- A longer window of time will increase analysis time.
- A shorter window of time will decrease analysis time.

STEP 7 - Optimizing the Drying Temperature.

The temperature which is chosen to dry the sample is based on the nature of the sample and the temperature which is needed to liberate volatiles. Changing the drying temperature to a higher temperature can dramatically decrease the analysis time.



Caution!

Care must be taken when selecting a higher temperature to prevent scorching or burning the sample.

One should systematically increase the drying temperature 5°C at a time from the standard oven method until accuracy is affected or the sample composition changes.

STEP 8 - Developing a Two Step Drying Procedure.

In some cases it may be advantageous to develop a two step drying procedure. This consists of two different drying temperatures for TEMP 1 and TEMP 2. One may go from a high temperature to a lower temperature, or from a low temperature to a higher temperature.

A). High to Low two step drying procedure.

The primary reason to develop a high to low two step drying procedure is to reduce analysis time. With this feature an initial TEMP 1 temperature can be selected to drive off much of the volatiles, however if the sample is kept at this temperature eventually scorching would occur. Therefore, it is possible to heat the sample at the higher temperature (TEMP 1) for a predetermined amount of time (TIME 1) and then decrease the temperature (TEMP 2) to a lower temperature for the determination of endpoint.



Caution!

If the sample is kept at a high temperature for an extended period of time, scorching may occur.

When developing a high to low two step drying procedure, it is important to use a consistent sample size since the length of time at the high temperature is set.

The steps to developing a high to low two step drying procedure are as follows:

- 1). Set the slope and standby temperature at the conditions established for an optimized single temperature drying procedure.
- 2). Set Temp1 20-40°C higher than the temperature of the single step drying procedure.
- 3). Test the sample at this higher temperature, however abort the test while noting the time at which approximately 80-85% recovery has been met.
- 4). Set up the two step procedure by setting TIME 1 with the time in minutes determined in STEP 3 and set TEMP 2 to the temperature of the single temperature optimized procedure.
- 5). Test the sample with this high to low two step drying procedure.
- 6). Optimize TIME 1 as necessary for samples with varying moisture contents.

B). Low to high two step drying procedure.

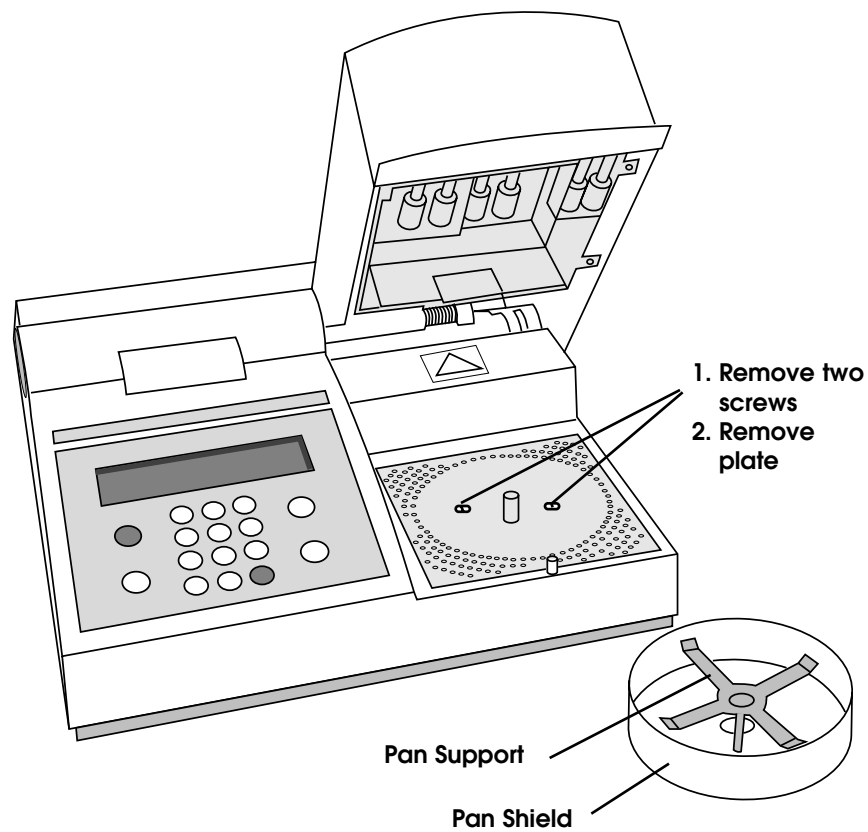
This procedure is advantageous when testing a material which has two diverse volatiles with dramatically different boiling points. One can develop a procedure where the sample is initially dried at a low temperature (TEMP 1) to liberate the lighter volatile and then after a predetermined time (TIME 1), raise to a higher temperature (TEMP 2) to drive off the heavier volatile.

Recommended Care

Your Moisture Analyzer is an integrated system designed to provide precise, fast determination of moisture content. Therefore, proper care and routine maintenance of the unit is required to prevent accidents, to ensure reliable results, and to avoid damage to the unit.

Before beginning the cleaning process:

- Unplug the unit.
- Allow the unit to cool down for 30 minutes.
- Use a mild detergent and a soft rag to clean the external surfaces of the unit.
- Do not immerse the unit in water or any other cleaning solution.



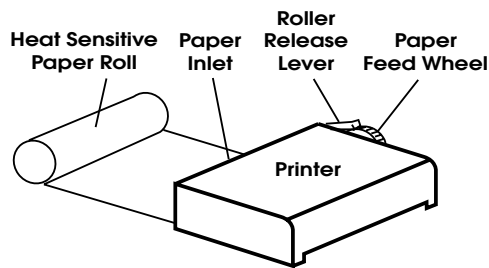
Your daily regimen should include the following:

- Carefully remove the Pan Support and Pan Shield to thoroughly clean them.
- Keep all warning labels clean.
- Wipe dust and dirt from the interior heater stainless steel shroud housing.
- Periodically we recommend cleaning the cavity below the air flow vents by using the following procedure:
 1. Remove the two screws that hold down the perforated plate and carefully remove the plate.
 2. Use extreme care in removing the accumulated residue in the chamber below the perforated plate with a vacuum or damp cloth.

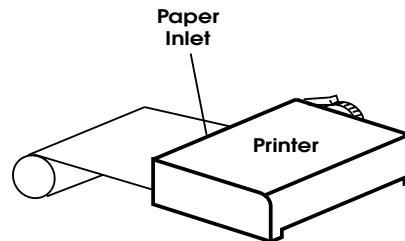
Printer Paper Installation

Installation of thermal printer paper using Denver Instrument Part No. 901121.1 is as follows:

1. Open the printer cover and remove any remaining paper from the printer mechanism by pulling the paper through the printer mechanism or pressing the **Paper Feed** key to advance the paper.
2. Cut a clean straight edge on the roll of new paper.
3. Insert the clean edge into the paper feed slot of the printer mechanism. The leading edge of the paper should unroll from the bottom.
4. Pull and hold lever forward to release the roller. The lever is located to the left of the feed wheel. Insert paper behind the roller. Turn the wheel to insert the paper under the roller. Release the lever and the paper will feed itself.
5. Press and hold the **Paper Feed** key until the paper protrudes (approximately two inches) through the opposite end of the paper feed slot.
6. Place the remaining roll of paper into the paper holder pocket.
7. Insert the leading edge of the paper through the slot in the printer cover and close the printer cover.



Correct Paper Roll Position



Incorrect Paper Roll Position

Troubleshooting

Many troubles you encounter may be the result of unintentional oversights. Such items as a changed or incorrect drying procedure, operator error and poor operating technique can result in seemingly poor analyzer operation. Therefore, it is advisable to consult the table below before you call your local distributor or Denver Instrument Company for technical assistance.

In the event of an electrical operational problem, the analyzer's built in system diagnostics will indicate the nature of the problem by displaying an error message on the Standby screen. Close attention should be paid to any error message. Please contact your local distributor or the manufacturer for technical assistance.

This product contains no user serviceable parts. Its' modular design however, allows for relatively easy isolation and replacement of modules under the direction of a qualified service technician. This approach may be a desired option when it's necessary to expedite the solution to an analyzer problem. Call your local distributor or the manufacturer for technical assistance.

General Checks

Trouble	Checks and Adjustments
NO DISPLAY	<ul style="list-style-type: none">• Check to make sure unit is plugged in and switch is in the "ON" position.• Make sure power cord is fully inserted into back of unit.• Check the wall receptacle to make sure it is "live" by plugging in something else.
NO PRINT OR INCORRECT PRINT	<ul style="list-style-type: none">• Make sure internal printer is selected in Setup menu.• Make sure desired print items are selected in the Custom Printer menu.• Check to make sure that printer paper is inserted correctly and not jammed in mechanism.
NO WEIGHT OR UNSTABLE WEIGHT READING UPON SAMPLE LOADING	<ul style="list-style-type: none">• Make sure pan support is centered grill hole.• Remove grill and make sure pan stem is free floating and is not making contact with the heat shield. Adjust constraint ring if necessary.• Check to make sure breeze shield is in correct position.
MOISTURE OR SOLIDS READING FALLS OUT OF RANGE	<ul style="list-style-type: none">• Verify correct program settings.• Make sure drying chamber is free of residue.• Verify true moisture content of sample using a reference method.

Factory Defaults

Program 1: Factory 1
UNITS: MOISTURE
TEMP1: 105C
TEMP2: OFF
SLOPE: WINDOW: 1.0
STANDBY: 60C
TIME1: OFF
TIME2: OFF
%IW: 0.050

Program 2: Factory 2
UNITS: MOISTURE
TEMP1: 110C
TEMP2: OFF
SLOPE: WINDOW: 2.0
STANDBY: 110C
TIME1: 2.0 MINUTES
TIME2: OFF
%IW: 0.010

Program 3: Factory 3
UNITS: SOLIDS
TEMP1: 135C
TEMP2: OFF
SLOPE: WINDOW: 1.0
STANDBY: 130C
TIME1: OFF
TIME2: OFF
%IW: 0.100

Program 4: Factory 4
UNITS: WEIGHT
TEMP1: 105C
TEMP2: 130C
SLOPE: WINDOW: 0.0
STANDBY: 60C
TIME1: 5.0 MINUTES
TIME2: 5.0 MINUTES
%IW: 0.00

Program 5: Factory 5
UNITS: MG/L
TEMP1: 135C
TEMP2: OFF
SLOPE: WINDOW: 1.0
STANDBY: 100C
TIME1: OFF
TIME2: OFF
%IW: 0.050

Accessories

Part Number	Description
820050.3	50 gram Calibration Weight (ASTM Type 1, Class 3)
900274.1	Disposable Pans. Pkg of 50
900298.1	Glass pads. Pkg of 200
901121.1	Printer Paper. Pkg. of 5
901309.1	Cable DE9S to DB25S
901310.1	Intercommunications Cable (2 @ DB25p)
901318.1	Temperature Calibration Kit
77811093.1	Cable DE9S to Blunt

All replacement parts should be obtained from the manufacturer or authorized distributor.

Maintenance

Maintenance is limited to periodic cleaning of the case with a damp cloth. A mild detergent may be used for a more thorough clean up. **NEVER** use a chemical solvent on the case.



Warning!

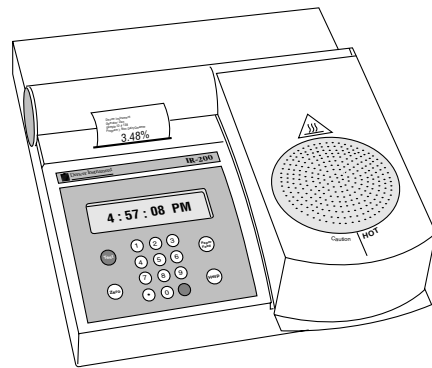
Secured access panels, overs and etc. should never be removed from this equipment by anyone other than experienced service personnel.

Warranty Instructions

1. Please return the prepaid, pre-addressed Purchase Registration Card to Denver Instrument Company promptly upon your purchase of the Denver Instrument product. the return of the card is not a condition precedent to warranty coverage.
2. If you have any questions about a Denver Instrument product, please call toll-free, 1-800-321-1135 (or FAX description of problem to (303) 423-4831) for technical assistance.
3. If it becomes necessary to return your Denver Instrument product for service, you must obtain a "Return Authorization Number". Please pack the product securely in its original approved packing carton or other suitable container and include your Return Authorization Number on the shipping label and as a precaution also a note inside the box. Shipping charges must be fully prepaid.

In the U.S. ship to:

Denver Instrument Company
6542 Fig Street
Arvada, Colorado 80004



 **Denver Instrument Company**

Precision laboratory instruments since 1880
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