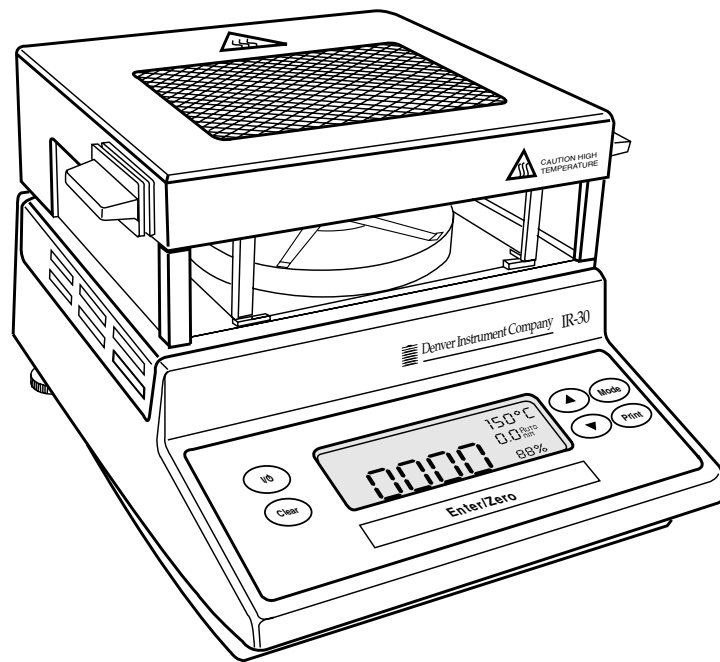
 Denver Instrument Company

IR-30 Moisture Analyzer



Operation Manual

Rev. A
901908.1

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

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

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 may 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.

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.

Ship to:

**Denver Instrument Company
6542 Fig Street
Arvada, Colorado 80004**

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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.



Combustible Materials - The IR-30 must not be used to analyze products which release flammable or explosive substances.



Toxic Material -- Care should be taken when testing samples that create poisonous or toxic gases.

Storage and Shipping Conditions

Storage temperature: 40°C to +70°C (44°F to 158°F)

After unpacking the moisture analyzer, please check it immediately for any visible damage as a result of rough handling during shipment. If this is the case, proceed as directed in Safety Inspection, under "Care and Maintenance", page 10. Save all parts of the packaging and the box in case you may need to ship your moisture analyzer again. Before you pack the moisture analyzer to ship it, unplug all connected cables to prevent damage. Do not expose the moisture analyzer unnecessarily to extreme temperatures, moisture, shocks, blows or vibrations.

Installation Instructions

Please choose a suitable place to set up your moisture analyzer. It should not be exposed to vibrations or strong drafts. The IR 30 may not be used in hazardous areas/locations, since it has not been approved for these areas/locations and a Certificate of Conformity has not been issued for this unit. Do not expose the moisture analyzer to extreme moisture over long periods. If a cold moisture analyzer is brought to a substantially warmer place, moisture in the air can condense on its surfaces. If you transfer the moisture analyzer to a warmer area, make sure to condition it for about 2 hours at room temperature, leaving it unplugged. Afterwards, if you keep the moisture analyzer connected to line power, the continuous positive difference in temperature between the inside of the moisture analyzer and the outside will practically rule out the effects of moisture condensation.



High Temperature Parts

When the moisture analyzer is being used, it gives off heat through the mesh on the hood. For this reason, the mesh must remain uncovered when the unit is in the standby mode and during operation. After prolonged use, the components of the moisture analyzer can be very hot to touch. Therefore, please be careful as you operate the unit to avoid burns.



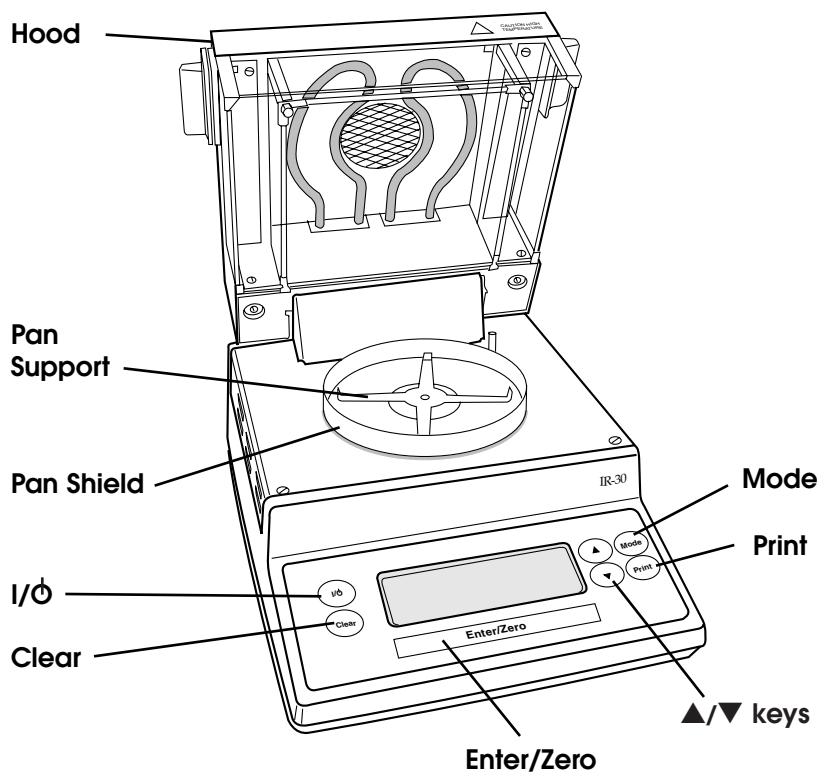
Risk of Shock

Connecting Electronic Devices (Peripherals)

Unplug the moisture analyzer before you connect or disconnect devices to or from the interface port.

Startup

Raise the hood on the moisture analyzer and position the pan shield and the pan support on the unit.



The moisture analyzer has been factory-set to the appropriate designated voltage. To change the voltage setting move the voltage selector to the setting indicated on the manufacturer's label.

Whenever you change the operating voltage, make sure to exchange both installed fuses: the T 50 mA fuse for the T 100 mA that comes with the moisture analyzer and, in addition, the F 2 A fuse for the F 3.5 A fuse in the fuse holder above the power socket.

220/240 V — T 50 mA, F 2 A
100/120 V — T 100 mA, F 3.5 A

The moisture analyzer, rated to Class 1, must be plugged into a properly installed wall outlet that has a protective grounding conductor (PE).

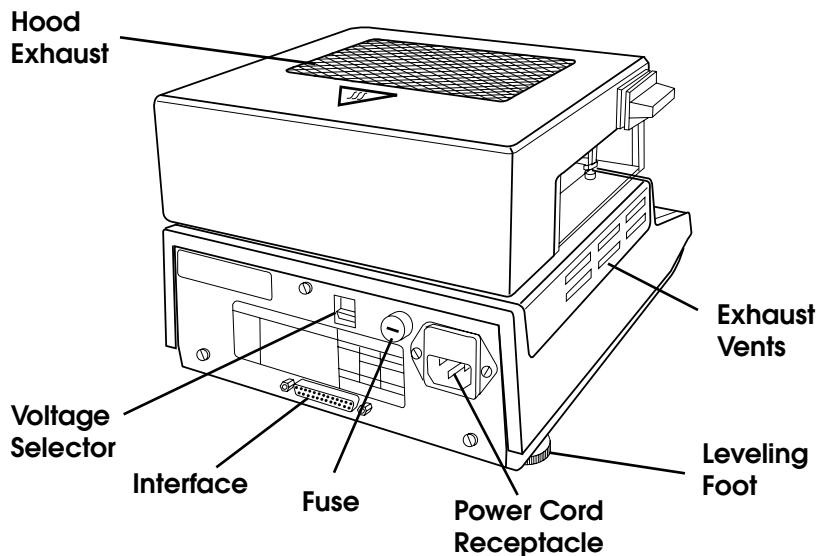
Safety Precautions

If you attach an extension cord without a protective grounding conductor, it may inhibit the protection provided by the moisture analyzer. If you use an electrical outlet that does not have a protective grounding conductor, make sure to have an equivalent protective conductor installed by a certified electrician as specified in the applicable regulations for installation in your country.



To prevent electric shock, use a properly grounded outlet.

To ensure safety, the data interface (see "Interfacing Devices" on page 8) is separated from line power by a transformer with a Class 1 design.



Leveling the Moisture Analyzer

You can level the moisture analyzer using the leveling feet. This is only necessary if you are testing samples of low viscosity which need to be at a uniform level in the disposable sample dish.

How to Operate the Moisture Analyzer

Turning the Moisture Analyzer On and Off

After the moisture analyzer has been plugged into a wall outlet, the standby symbol "⏻" will appear in the LCD when the moisture analyzer is off. This means it is ready to operate without requiring warmup. Press the **I/O** key to turn the moisture analyzer on or off.

Self-Test

After the unit is turned on, an automatic self-test of the electronic circuitry is run, during which all LCD segments will briefly appear. This self-test ends with a readout of the parameters set for moisture determination.

Warm-Up

Before the initial moisture determination routine, allow the IR-30 to warm up as follows:

- Raise the hood.
- Tare without a sample dish.
- Place a sample pan in the IR-30.
- Lower the hood.
- Press "Enter/Zero".
- After approximately 5 minutes you can stop the warmup phase by raising the hood.

You can determine moisture content and dry weight with the IR 30 as soon as you have turned it on. At the factory, we have adjusted the moisture analyzer so that you can begin determination immediately with the following default parameters:

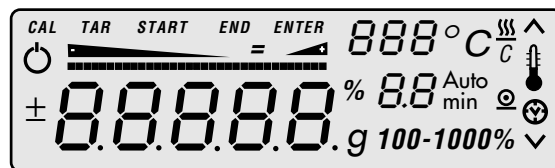
Temperature: 130°C (266°F)

Auto start: Lower the hood

Drying time: Automatic shutoff

Result (mode): 0—100% (% moisture)

Data output: by pressing function key



Starting a Test

When "TAR" appears in the LCD, operation, and you may begin your moisture determination/dry weight determination routine.

Place the disposable sample dish on the dish retainer and press the **Enter/Zero** key. "TAR" will now go out in the LCD, and the weight readout 0.000 g will appear.



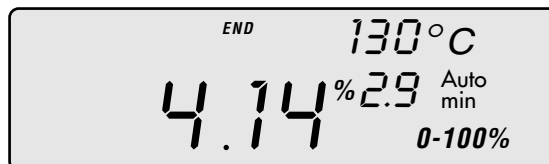
If a different readout appears, the unit must be retared:
Press the **Clear** key (TAR appears) and then press the **Enter/Zero** key.
Now place your sample on the disposable dish, making sure that it is spread evenly. Lower the hood.

The determination procedure will now start automatically. If you have selected the code for manual start, you must press the **Enter/Zero** key to start the procedure.

The moisture determination routine can only begin after the moisture analyzer has been tared and a sample weight of >96 mg has been placed on the unit.

The start of the routine is indicated by an acoustic signal and the drying symbol "sss" in the LCD. During operation, the time and results corresponding to the mode you have selected will be continuously updated in the LCD.

You can interrupt the moisture or dry weight determination routine ahead of time by raising the hood or by pressing the Clear key. If the procedure is interrupted, a "B" will appear at the beginning of the last line in the printout.



The result of the test will remain in the LCD until the Clear key is pressed. In addition, "END" will be displayed.

Once the **Clear** key has been pressed, the moisture analyzer is ready for the next moisture determination routine.

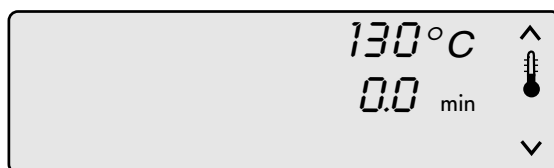
Changing Parameters

Setting the Temperature

Select this mode with the "▲" key.

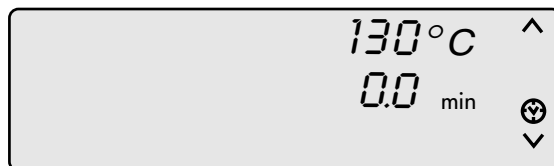
Temperatures between 40° – 160°C (104° – 320°F) can be selected. You can adjust the temperature setting in increments of five degrees; use the "▲" key to increase the temperature or the "▼" key to decrease it.

Press **Enter/Zero** to accept new setting.



Setting the Analysis Time

Select this timer mode with the "▼" key.



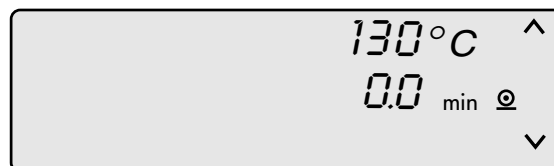
The drying time can be set between 0.0 and 99 min. To increase the time, use the "▲" key; to decrease the time, use the "▼" key. If you would like to increase the time by single digits, press the key briefly for each increment; by holding down the key, you can increase the time in increments of ten.

Press **Enter/Zero** to accept new setting.

The moisture determination routine ends when the set time is up (for settings starting with 0.1 min.). If you set the time to 0.0 min., the unit will turn itself off automatically.

Setting the Print Interval

Select this mode with the **Print** key.



Intermediate readings of the moisture determination routine can be output at intervals of 0.1 to 10 minutes. Use the "▲" key to increase the interval or the "▼" key to decrease it. If you would like to increase or decrease the interval by whole numbers, hold down the appropriate key.

Press **Enter/Zero** to accept new setting.

If the interval is set at 0.0 min., the data will only be printed out at the beginning and end of a test or when you press the Print key.

Setting Readout Display

The results in the different readout modes can be cycled in the display by pressing the Mode key:

Symbol on Display	Units	Symbol on printout
0—100% =	%Moisture	L
100—0% =	% Solids	R
0—1000% =	% Moisture/dry	LR
100—1000% =	% Solids/dry	OR
	Weight	W

where:

Moisture (%) = (Initial weight — Final weight)/Initial weight x 100

Solids (%) = Final weight/Initial weight x 100

Moisture/dry (%) = (Initial weight — Final weight)/ Final weight x 100

Solids/dry (%) = Initial weight/ Final weight x 100

Weight = total remaining weight in grams

Start Parameter

To select this parameter, turn on the moisture analyzer while simultaneously holding down the **MODE** key.

To change the setting, select the "▲" or "▼" key.

Start with **Enter/Zero** (manual start), press the "▲"

Start by lowering the hood (automatic start), press the "▼" key.

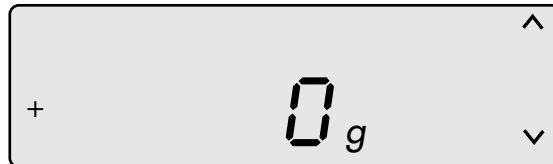


Convenience Feature for Weighing in Samples

As a convenience feature, the display will show a bar graph to guide you with your sample weight if a target weight has been set. To set a target weight, turn on the moisture analyzer while simultaneously holding down the **Enter/Zero** key.

The target weight can be set between 0 and 25 g. The bar graph is not activated for "0 g" (factory setting).

To increase the target weight, press the "▲" key;
to decrease the target weight, press the "▼" key. The target weight
will increase or decrease in single-digit increments.
Press **Enter/Zero** to accept new setting.



If the initial sample weight is between 85.8% and 114.4% of the preset
value, the display will prompt you to start the moisture determination
routine.

Saving Parameters

To store selected parameter(s) until the unit is turned off, press the
Enter/Zero key. If you would like to store parameters permanently in
the non-volatile memory of the moisture analyzer, hold down the
Enter/Zero key. At this point, the unit will automatically turn itself off.

When turned on again, it will operate according to the parameters
that you have previously selected and stored. To leave the parame-
ter selection mode without changing parameters, press the **Clear**
key.

Calibration

During calibration, the sensitivity of the built-in weighing system is
adjusted to an accurate weight. For calibration you will need a 30 g
calibration weight.

- Turn off the unit.
- Keep the "▲" key pressed while you turn the unit back on.
- While all segments of the display are indicated, simultaneously
keep both the "-" and Print keys pressed until a number and "C"
are displayed.
- If the disposable dish is on the support, remove it.
- Press "▲".
- As soon as 30.000 and "CAL" are displayed, place the 30- g cali-
bration weight on the pan support.

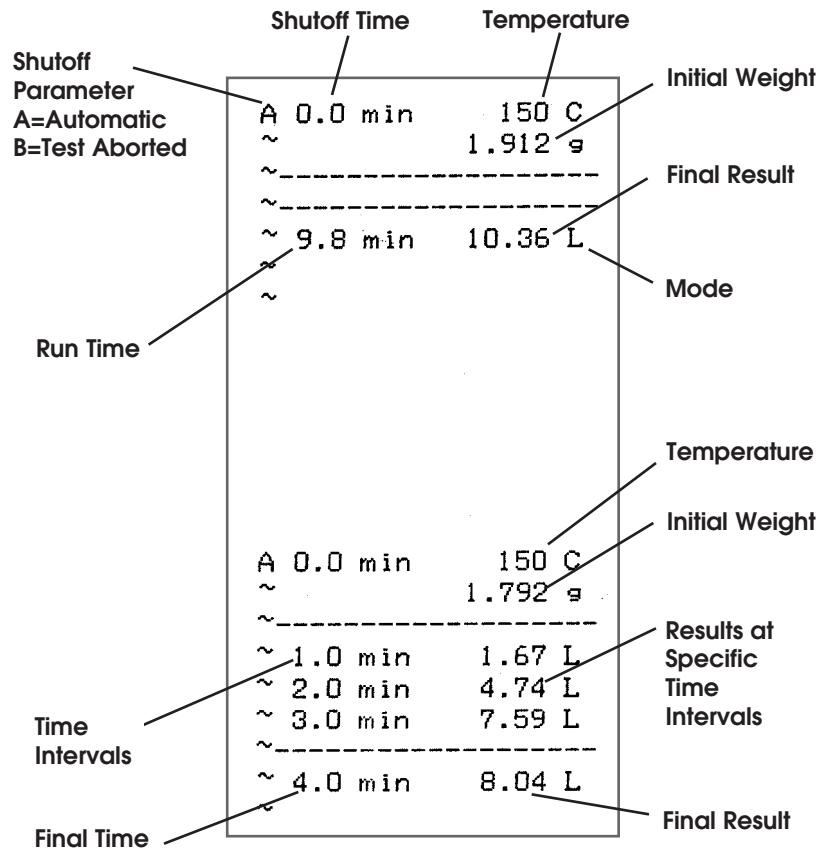
Once the calibration weight is stored, the unit will shut off automati-
cally. This indicates the end of the calibration procedure.

Interface for Data Output

General Specifications

Type of interface	Serial point-to-point connection
Operation	Asynchronous, simplex
Standard	V24-V28, RS 232 C-S
Handshake lines	Clear to Send (CTS)
Data Terminal Ready (DTR)	
Interface initialization	External (print key) or automatic print command
Character coding	7-bit ASCII
Transmission rate	1,200 baud
Parity	Odd
Synchronization	1 start bit, 1 stop bit
Data output format	22 characters: 21st and 22nd characters: CR and LF

Printouts



Print Command

Data is outputted each time the processor recognizes a software command.

Interfacing Devices with the Moisture Analyzer (RS Interface)

Make sure that the interface port is electrically connected to the protective grounding conductor of the moisture analyzer housing. The cabling supplied as accessory components is shielded and electrically connected on both ends to the cases of the connectors. This electrical connection may result in interference caused by cables scraping the floor or by transient currents if you have grounded the housing or connected the protective grounding conductor for line power. If necessary, connect an equipotential bonding conductor to the moisture analyzer.

Care and Maintenance

Cleaning

Please do not use any aggressive cleaning agents (solvents or similar agents). Instead, use a piece of cloth wet with a mild detergent to clean the moisture analyzer. Make sure that no liquid enters the moisture analyzer housing. After cleaning, wipe down the moisture analyzer with a soft, dry and lint-free piece of cloth.

Safety Inspection

Safe operation of the moisture analyzer is no longer ensured when:

- there is visible damage to the moisture analyzer
- the moisture analyzer no longer functions properly
- the moisture analyzer has been stored for relatively long periods under unfavorable conditions
- the moisture analyzer has been exposed to rough handling during shipment.

If there is any indication that safe operation of the moisture analyzer is no longer warranted, turn off the power and unplug the unit from the wall outlet immediately. Lock the moisture analyzer in a secure place to ensure that it cannot be used for the time being. Contact your distributor for service.

Troubleshooting Guide

Problem	Cause	Remedy
No segments appear in the display	No power available power cord not plugged in	Check the power supply Plug in the power cord
"L" appears in the LCD "H" appears in the LCD	Pan support is not in place Sample exceeds capacity	Insert the pan support Reduce the initial sample weight
The weight result changes constantly or the LCD does not light up	Unstable ambient conditions The sample pan or the pan support is touching the pan shield	Set up the moisture analyzer in another area Position the sample pan or pan support correctly, making sure that they do not touch the pan shield

Applications

Determination of % Moisture or Dry Weight

Both procedures are identical. For moisture determination, the amount of moisture lost is displayed as a percent. For determination of the dry weight a percent of the remaining weight is displayed as the result. Since moisture is analyzed more often than dry weight, only moisture determination is discussed in the following.

Exact and reproducible moisture determination, combined with gentle heating of samples, places high demands on the moisture analyzer and the procedure itself.

The duration of a routine and the selected temperature setting are decisive factors in determining the result. However, the result also depends on the type of sample and the way it is prepared. The IR 30 gives you a high degree of flexibility in selecting the parameters for moisture determinations that best accommodate your sample. Time and temperature are variables of the moisture determination procedure. You can ensure reproducible results if you maintain the determined, optimal values for the sample amount, time (automatic mode), and temperature during a moisture analysis routine. The preparation of samples also has a decisive influence on the result and should always be done carefully.

Heat Control and Temperature Regulation

The moisture analyzer features two infrared dark radiators (tubular heating elements) which provide the heat for moisture determination. Each heating element generates 180 watts of power (when the moisture analyzer is operated at the nominal voltage rating).

During a moisture determination routine, a temperature sensor monitors the temperature. A microprocessor evaluates and regulates the heat generated. At the beginning of moisture determination, the chamber is fully heated until the set temperature is reached. The heat intensity is monitored and readjusted to keep the temperature constant at the nominal setting. The power supplied to the heating elements is interrupted when the hood is raised.

Duration of a Moisture Determination Routine

There are two ways to set an endpoint for the test. With a preset time in the timer mode, as soon as the preset time is up, the moisture analyzer will automatically shut off. In this timer mode, you can constantly monitor the time left on the LCD.

While in the fully automatic mode the IR 30 recognizes when a considerable weight change is no longer observed and automatically ends the moisture determination routine.

As drying progresses, the moisture loss per unit of time continuously decreases and reaches zero as soon as the sample no longer contains moisture. The fully automatic shutoff function uses this as a basis to determine when the unit should shut off.

If the readout remains constant for a short time after a slight decrease in weight (as is the case with plastic granules), the automatic mode will not shut off. In this case, select the timer mode to have a moisture determination routine stop at a preset time.

How to Prepare and Apply Samples

- To homogenize solid samples, grind or use a pestle to crush.
- Spread your sample evenly on the dish
- To homogenize liquid samples, stir.
- For liquid samples, use glass fiber pads.
- For samples with unknown properties, use the automatic mode for the first analysis.

Sample	(g)	(°C)	(min)	(%)
Cream for making cheese	3.0	75	14.1	12.39 R
Margarine	2.5	80	14.0	56.70 L
Tea extract		80	2 - 3	3.16 L
Camomile extract	3.0	100	3 - 4	40.0 L
Coarsely ground sunflower seeds	3.0	95	5 - 6	12.63 L
Seasoning paste	5 - 8	100	5 - 6	10.7 L
Oil-bearing seeds	8.0	100	10 - 12	14.7 L
Waffle mix	5 - 8	95	6 - 9	14.5 L
Shredded sugar beets	10.0	105	10 - 15	75.0 L
Castor powder	10.0	120	5.0	10.0 L
Malt	4.0	80	4 - 8	4.7 L
Mushroom paste	15.0	90	20 - 25	93.6 L
Aged salami	3.0	100	15.0	26.08 L
Fresh salami	3.0	110	12.0	29.11 L
Sausage filling	3.0	100	10.0	55.83 L
Wheat flour	3.0	110	5 - 7	14.25 L
Noodle dough (moist)	5.0	130	10.0	25.28 L
Lysine calcium (amino acid derivative)	5.0	105	7.0	29.97 L
Cream of tomato soup flavoring	5.0	80	10.0	6.4 L
Beef bouillon	5.0	105	4 - 6	4.95 L
Coffee flavoring	5.0	80	5 - 7	3.63 L
Soybean meal	5.0	105	7 - 9	9.2 L
Maltodextrose	5.0	105	5.0	4.77 L
Wheat flakes	5.0	105	7 - 11	12.1 L
Vegetable soup	10.0	80	8.0	5.59 L
Corn starch	5.0	105	5 - 7	12.25 L
Ragomil (cocoa +granulated sugar)	5.0	80	3 - 4	3.01 L
Dried parsley (air-dried)	5.0	105	5.0	7.35 L
Edible starch	5.0	95	13.8	47.77 L
Butter	2.0	130	4.5	15.45 L
Cottage cheese	3.0	110	12.7	81.19 L
Cigarette tobacco	1.5	55	30.0	15.0 L
Raw tobacco	2.0	55	30.0	24.61 L
Cellulose pulp	5 - 8	100	6 - 8	60-80 L
Cardboard, 0.5 mm	5.0	105	6.3	6.81 L
Lithium tablets/pellets	10.0	110	5.0	2.52 L
Powder for tablets	5.0	80	12.5	3.29 L
Eutragit (coating for tablets)	5.0	105	4 - 7	29.97 L
Cleaning fluid for contact lenses	10.0	50	20.0	0.1 L
Cosmetic gel	1 - 2	105	7.7	6.23 R
Protein hydrolysate	5.0	80	3 - 6	4.79 L
Potassium hydrogenphosphate, dibasic form	5.0	125	5 - 8	3.69 L
Sodium caseinate	5.0	75	6 - 8	5.07 L
NaCl	5.0	105	8.0	0.06 L
Dishwashing liquid	3.0	130	8.0	19.09 R

Sample	(g)	(°C)	(min)	(%)
Liquid soap	3.0	120	8.0	16.94 R
Detergent for washing cars	1.5	110	11.0	15.46 R
Liquid scouring agent	5.0	120	8.0	70.0 L
Tensides	5 - 6	100	4 - 6	34.0 L
Plaster	10.0	160	30.0	26.87 L
Plaster	9.0	105	60	24.02 L
Calcium carbonate suspension	5.0	140	10 - 15	21.97 L
Fermented sludge	5.0	105	20.0	2.05 R
Sludge (filter cake)	10.0	120	20.0	41.0 R
Quartz sand	10.0	160	6 - 7	4.8 L
Water-based paints	7 - 9	105	5.0	4.6 L
Ink ribbons (inked)	2 - 3	100	4 - 5	4-8 L
Paint (colored)	1.5	90	9.0	40.8 L
Wood shavings, sawdust	5.0	140	15 - 20	70.0 L
Wood sizing	2.0	110	11.0	51.83 L
Solution of vulcanizing agents	4.0	105	6 - 7	59.0 L
Adhesive	5.0	90	8 - 10	28.0 R
Basic ingredients for wood adhesive	3.0	150	5.0	60.12 R
Mineral oxide	5-8	120	3-5	10.0 L

IR-30 Specifications

Measuring method	Heating by infrared rays, determination of weight loss
Sample weight	max. 30g, typical 5 - 10g
Readability (moisture content)	0.01%
Measuring accuracy (depends on sample)	0.05 (with an initial sample weight of approx. 5 - 10 g)
Temperature range	+40° - +160°C, 104° - 320°F
Temperature increments	5°C, 41°F
Permissible ambient temperature range	+10 to 40°C, 50 to 104 °F
Sample dish	3.5 in. (90 mm)
Housing dimensions (Wx Dx H)	8.5x11.1x 6.5 in. (217x 283x165 mm)
Net weight	approx. 12.1 lbs. (5.5 kg)
Power requirements (voltage+frequency)	115 or 230 V (selectable); 50 - 60 Hz
Allowable voltage fluctuation	-20% to +15%
Power consumption	max. 400 VA
Interface	RS 232 C-S/V24-V28; 7 data bits;(ASCII); 1,200 baud; odd parity



The CE marking affixed to the equipment indicates that the equipment meets the requirements of the following Directive(s) issued by the Council of the European Union: 89/336/EEC "Electromagnetic compatibility (EMC)"

Applicable European Standards:

Limitation of emissions:	EN 50081-1	Residential, commercial and light industry
	EN 50081-2	Industrial environment
Defined immunity to interference	EN 50082-1	Residential, commercial and light industry
	EN 50082-2	Industrial environment

Important Note:

The operator shall be responsible for any modifications to Denver Instrument Company equipment and for any connections of cables or equipment not supplied by Denver Instrument Company and must check and, if necessary, correct these modifications and connections. On request, Denver Instrument Company will provide information on the minimum operating specifications (in accordance with the Standards listed above for defined immunity to interference).

73/23/EU "Electrical equipment designed for use within certain voltage limits"

Applicable European Standards:






EN 60950	Safety of information technology equipment including electrical business equipment
EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use

Part 1: General requirements

If you use electrical equipment in installations and under ambient conditions requiring higher safety standards, you must comply with the provisions as specified in the applicable regulations for installation in your country.



Quick Start Guide


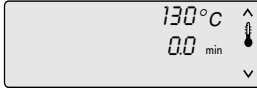



How to run a Routine:


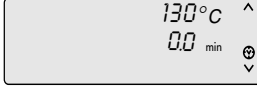



Turn on unit	
Select display mode	
Lift hood and position disposable pan or pad	
Zero the display	
Add sample to pan or pad; lower hood	
Routine starts automatically or when you press	
When "END" is displayed, read off result	
To start a new routine, press	


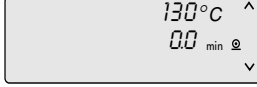



How to change Parameters:

After you press:

 display shows 

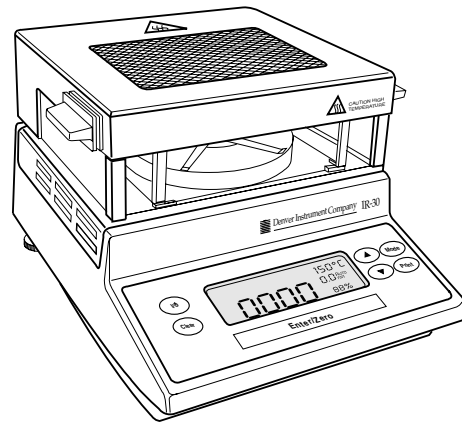
 temperature   higher +   lower

 shutoff time   increase +   decrease

 print interval   longer +   shorter

Accessories

<u>Item</u>	<u>Catalog No.</u>
Pan Shield <i>Replacement pan shield for IR-30 Moisture Analyzer.</i>	901921.1
Pan Support <i>Replacement pan support for IR-30 Moisture Analyzer.</i>	901915.1
Thermal Printer <i>Printer features 4" print area, 28k buffer, graphics capability, parallel and serial ports. Complete with interface cable and 1 roll of printer paper.</i>	901913.1
Printer Paper <i>Paper for thermal printer, 5 rolls/package.</i>	901550.1
Disposable Pans <i>Disposable 4" diameter aluminum pans, 50/package.</i>	900274.1
Glass Sample Pads <i>Disposable 4" glass pads, 200/package.</i>	900298.1
Interface Cable <i>Replacement interface cable RS232C for IR-30 Moisture Analyzer.</i>	901914.1
IR-30 Power Cord <i>Replacement power cord assembly for IR-30 Moisture Analyzer.</i>	36890535.1
Metal Hood Shield Inserts	901916.1
Temperature Calibration Kit	901912.1



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