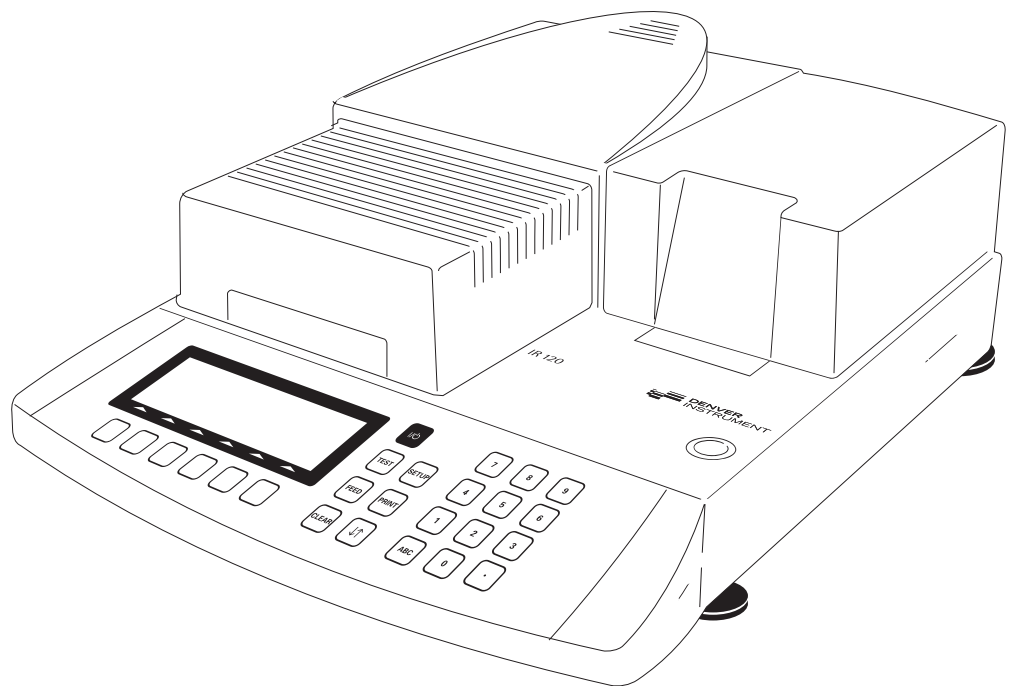# Denver Moisture Analyzer

Model IR120
Electronic Moisture Analyzer

Operating Instructions

Intended Use

The IR120 Moisture Analyzer can be used for quick and reliable determination of the moisture content of materials of liquid, pasty and solid substances according to the method of thermogravimetry.

The moisture analyzer saves work and speeds up your routine procedures through the following features:

– Fast analysis time, gentle and uniform sample drying due to the round ceramic IR heating element

– Setting the fully automatic end-point recognition parameter for an analysis only requires that you enter the drying temperature

– Optimal adjustment of the moisture analyzer to other methods of analysis and adaptation to difficult samples due to the semi-automatic end-point recognition

– Quick drying without the risk of scorching the sample and pre-heating adapted to the sample's heat sensitivity by selecting an adequate heating program

– High flexibility for analyzing the widest variety of samples and storable programs to save time when changing to different types of samples

– User-definable printouts that can be customized before moisture analysis runs

– Brief instructions on the moisture analyzer provide quick answers to frequently asked questions

The moisture analyzer is ideal as a measuring and test instrument for incoming inspection, in-process control and quality control due to the following features:

– Convenient and reliable control of the accuracy of the moisture analyzer according to the DIN/ISO standards by using the internal calibration weight

– reproTEST for quick determination of the standard deviation

– ISO/GLP-compliant recording capability; printouts can also be generated with an (optional) internal printer

– Optimal process control and quality monitoring due to the statistical evaluation of up to 9,999 analyses/programs

– Password-protected drying parameters

The moisture analyzer meets the highest requirements placed on the accuracy and reliability of weighing results through the following features:

– High repeatability by limiting the exposure of the weighing system to vibration during the start of an analysis and better access to the sample chamber due to the motorized heating unit

– Excellent readability under any lighting conditions and backlit display for minimization of reading errors

– Removable sample chamber base plate for easy cleaning of the sample chamber and protection of the weighing system from debris

Symbols
The following symbols are used in these instructions:

● indicates steps you must perform

○ indicates steps you must perform only under certain conditions

> describes what happens after you have performed a certain step

– indicates that a list will follow

⚠ indicates a hazard

2

Contents

Warning and Safety Information

This moisture analyzer complies with the European Council Directives as well as international regulations and standards for electrical equipment, electromagnetic compatibility, and the stipulated safety requirements. Improper use or handling, however, can result in damage and/or injury.

Read these operating instructions thoroughly before using your moisture analyzer to prevent damage to the equipment. Keep these instructions in a safe place.

Follow the instructions below to ensure safe and trouble-free operation of your moisture analyzer:

⚠ Use the moisture analyzer only for performing moisture analysis of samples. Any improper use of the analyzer can endanger persons and may result in damage to the analyzer or other material assets

⚠ Do not weigh any samples or vessels, such as glass beakers or flasks, that prevent the sample chamber from being closed completely.

⚠ 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.

⚠ Do not use this moisture analyzer in a hazardous area/location; operate it only under the ambient conditions specified in these instructions

– The moisture analyzer may be operated only by qualified persons who are familiar with the properties of the sample to be analyzed

⚠ Make sure before getting started that the voltage rating printed on the manufacturer's label is identical to your local line voltage (see the section on "Connecting the Moisture Analyzer to AC Power" in the chapter entitled "Getting Started")

– The device comes with a power supply that has a grounding conductor

– The only way to switch the power off completely is to unplug the power cord

– Position the power cable so that it cannot touch any hot areas of the moisture analyzer
– Use only extension cords that meet the applicable standards and have a protective grounding conductor
– Disconnecting the ground conductor is prohibited
– Connect only Denver Instrument accessories and options, as these are optimally designed for use with your moisture analyzer
– Note on Installation:
The operator shall be repsponsible for any modificatoins to Denver Instrument equipment and for any connections of cables or equipment not supplied by Denver Instrument and must check and, if necessary, correct these modifications and connections. On request, Denver Instrument will provide information on the minimum operating specifications (in accordance with the Standard for defined immunity to interference).
– Protect the moisture analyzer from contact with liquid
– If there is visible damage to the moisture analyzer or power cord: unplug the equipment and lock it in a secure place to ensure that it cannot be used for the time being

⚠ Clean your moisture analyzer according to the cleaning instructions only (see "Care and Maintenance")

Do not open the analyzer housing. If the seal is broken, this will result in forfeiture of all claims under the manufacturer's warranty.

In case you have any problems with your moisture analyzer:

○ contact your local Denver Instrument office, dealer or service center

⚠

Warning: Severe Burns!

– When setting up the moisture analyzer, leave enough space to prevent heat from building up and to keep your analyzer from overheating:
– leave 20 cm (about 8 inches) around the moisture analyzer
– 1 m (3 ft.) above the device
– Do not put any flammable substances on, under or near the moisture analyzer, because the area around the heating unit will heat up

– Be careful when removing the sample from the chamber: the sample itself, the heating unit and the sample pan used can still be extremely hot
– Do not remove the heating unit during operation: the heating element and its protective glass panels can get extremely hot!
– Prevent excess heat build-up around the analyzer

Hazards for persons or equipment posed by using specific samples:

⚠ **Fire**   ⚠ **Explosion**

– Flammable or explosive substances
– Substances that contain solvents
– Substances that release flammable or explosive gases or vapors during the drying process

In some cases, it is possible to operate the moisture analyzer in an enclosed nitrogen atmosphere to prevent the vapor released during drying from coming in contact with oxygen in the surrounding atmosphere. Check on a case-to-case basis whether this method can be used, because installation of the analyzer in too small an enclosed space can affect its functions (for instance through excessive heat build-up within the analyzer). When in doubt, perform a risk analysis.

The user shall be liable and responsible for any damage that arises in connection with this moisture analyzer.

⚠ **Poisoning**   ⚠ **Caustic burns**

– Substances containing toxic or caustic or corrosive substances: These may be dried only under a fume hood. The value for the "lower toxic limit" in a work area must not be exceeded.

Corrosion:
– Substances that release aggressive vapors during the heating process (such as acids): In this case we recommend that you work with small sample quantities. Otherwise, vapors can condense on cold housing parts and cause corrosion. The user shall be liable and responsible for any damage that arises in connection with this moisture analyzer.

Getting Started

The moisture analyzer consists of a heating unit, a weighing system, a display and control unit and a printer. In addition to the socket for AC power (mains supply), it also has an interface port for connecting peripheral devices, such as a PC, an external printer, etc.

Storage and Shipping Conditions
Allowable storage temperature:
0°C ...+40°C
+32°F...+104°F

Do not expose the moisture analyzer unnecessarily to extreme temperatures, moisture, shocks, blows or vibration.

Unpacking the Moisture Analyzer
● After unpacking the moisture analyzer, check it immediately for any visible damage as a result of rough handling during shipment

○ If this is the case, proceed as directed in the chapter entitled "Care and Maintenance," under the section on "Safety Inspection"

It is a good idea to save the box and all parts of the packaging until you have successfully installed your moisture analyzer. Only the original packaging provides the best protection for shipment. Before packing your moisture analyzer, unplug all connected cables to prevent damage.

Instructions for Recycling the Packaging
To ensure adequate protection for safe shipment, your moisture analyzer has been packaged to the extent necessary using environmentally friendly materials. After successful installation of the moisture analyzer, you should return this packaging for recycling because it is a valuable source of secondary raw material. For information on recycling options, including recycling of old weighing equipment,
contact your municipal waste disposal center or local recycling depot.

Warranty
This product is warranted for three years from the date of purchase against defects of material and/or workmanship.

This warranty is void if the product is damaged by accident or through unreasonable use, neglect, improper service, or other causes not arising out of defects in material or workmanship.

During the three-year warranty period, if the moisture analyzer fails to work properly when used under normal conditions we will repair or replace the moisture analyzer free of charge. You must cover the cost of shipping when sending the device to us; we will bear the shipping costs when returning the moisture analyzer to you.

Equipment Supplied
The equipment supplied includes the components listed below:

– Moisture analyzer
– Power cord
– Pan support
– Shield disk
– Dust cover for keypad
– Internal printer
– 80 disposable aluminum sample pans
– 1 pair of forceps
– 3 cards with brief instructions in 6 different languages

Installation Instructions
The moisture analyzer is designed to provide reliable results under normal ambient conditions in the laboratory and in industry. When choosing a location to set up your moisture analyzer, observe the following so that you will be able to work with added speed and accuracy:
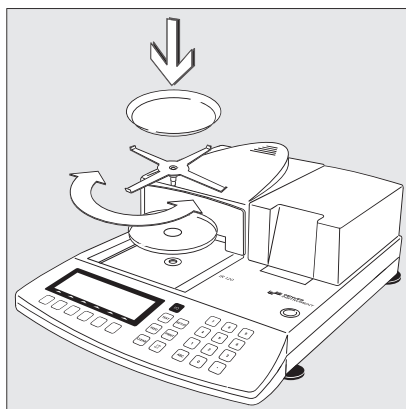
– Set up the moisture analyzer on a stable, even surface that is not exposed to vibrations

– Avoid placing the analyzer in close proximity to a heater or otherwise exposing it to heat or direct sunlight

– Avoid exposing the moisture analyzer to extreme temperature fluctuations

– Protect the moisture analyzer from drafts that come from open windows or doors

– Keep the moisture analyzer protected from dust, whenever possible

– Protect the moisture analyzer from aggressive chemical vapors

– Do not expose the analyzer to extreme moisture

– Make sure to choose a place where excessive heat cannot build up. Leave enough space between the moisture analyzer and materials that are affected by heat.

Conditioning the Moisture Analyzer
Moisture in the air can condense on the surfaces of a cold moisture analyzer whenever it is brought into a substantially warmer place. 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 from AC power. Afterwards, if you keep the moisture analyzer connected to AC 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.

Setting up the Moisture Analyzer
● Position the components listed below in the order given:

– Dust cover over the keypad

– Shield disk

– Pan support; turn to the left or right, press slightly until it stops and snaps into place

– Disposable sample pan

5

General View of the Moisture Analyzer
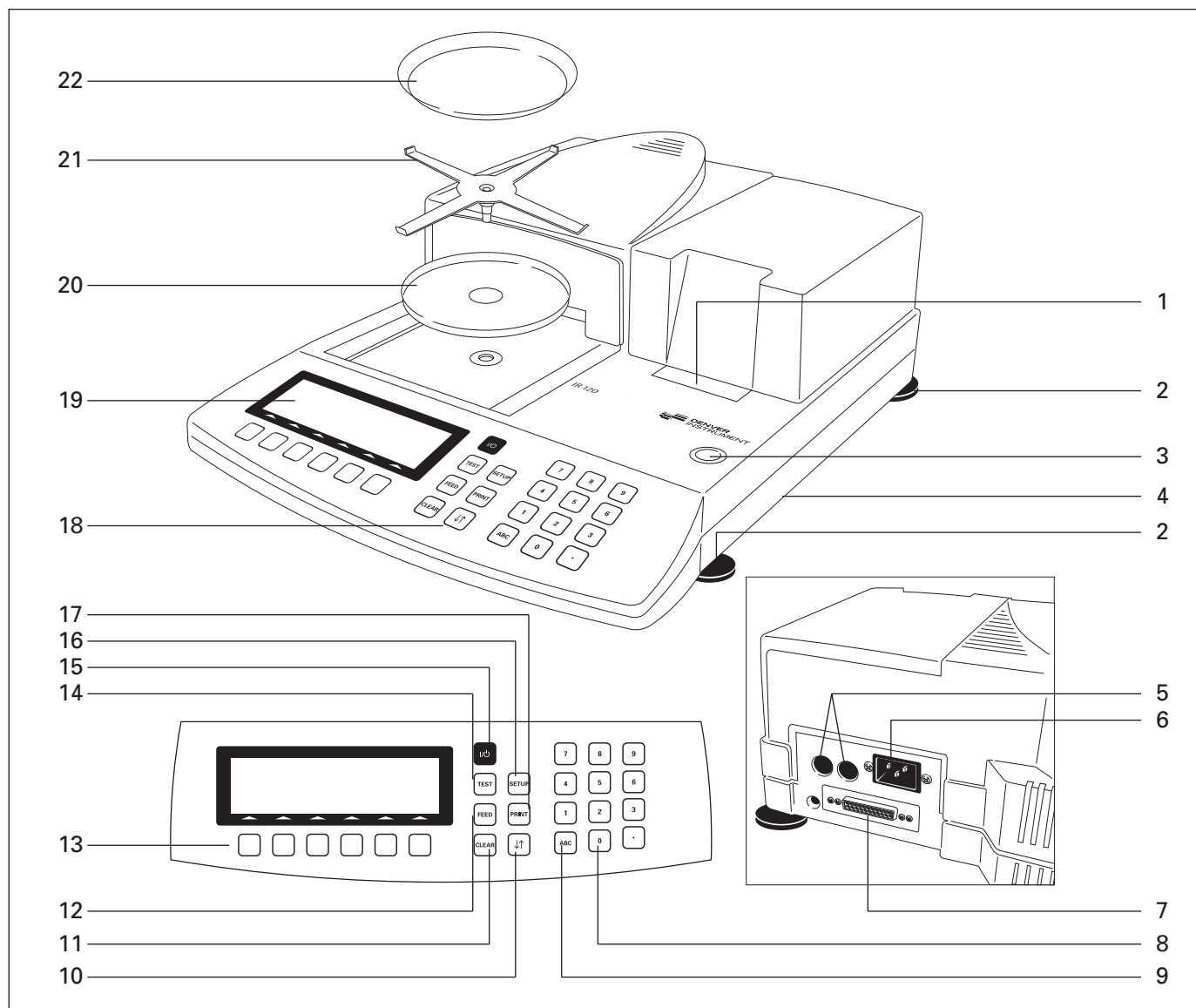
No.	Designation	No.	Designation
1	Internal printer (option)	14	"isoTEST" key (calibration/adjustment functions)
2	Leveling foot	15	On/off key
3	Level indicator	16	"Setup" key
4	Brief instructions	17	Print key
5	Fuse	18	Keypad
6	Power socket	19	Display
7	Interface port	20	Shield disk
8	Keys for numeric input	21	Pan support
9	Toggle key for alphabetic input	22	Disposable sample pan
10	Key for opening and closing the sample chamber by the heating unit		
11	CF key (clear function)		
12	Line feed; press the key to advance the paper by one blank line		
13	6 function keys (soft keys)		
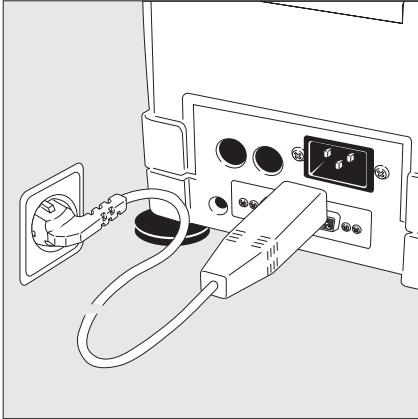
● Check the voltage rating and the plug design

○ The heating unit of the moisture analyzer has been factory-set to 230 or
115 volts for technical reasons. The voltage has been set as specified on
your order. The voltage setting is indicated on the manufacturer's label
(see the bottom of the analyzer), for example:
– 230 volts: IR120Q-...**230**..
– 115 volts: IR120Q-...**115**..

⚠ If they do not match: To have the voltage setting changed, contact your local
Denver Instrument office or dealer, and do not operate your moisture analyzer
in the meantime!

Use only
– Original power cords
– Power cords approved by a certified electrician/Denver Instrument service
technician
– If you need to connect an extension cord:
Use only a cable with a protective grounding conductor

● Connecting the moisture analyzer, rated to Class 1, to AC power (mains supply):
The moisture analyzer must be plugged into a properly installed wall outlet
which has a protective grounding conductor (PE)

Safety Precautions
If you use an electrical outlet that does not have a protective grounding con-
ductor, make sure to have an equivalent protective conductor installed by
a certified electrician as specified in the applicable regulations for installation in
your country.
The protective effect must not be negated by using an extension cord without a
protective grounding conductor.

Information on Radio Frequency Interference
Note: 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. This 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 equipment in a resi-
dential area is likely to cause harmful interference in which case the user will be
required to correct the interference at his own expense. Changes or modifica-
tions not expressly approved by Denver Instrument AG could void the user's
authority to operate the equipment.
The AC adapter rated to Class 2 can be plugged into any wall outlet without
requiring any additional safety precautions. The ground or earth terminal is
connected to the housing, which can be additionally grounded, if required.
The data interface is also electrically connected to the scale housing (ground).

Connecting Electronic Devices (Peripherals)
● Make absolutely sure to unplug the moisture analyzer from AC power before
you connect or disconnect a peripheral device (printer or PC) to or from the
interface port.
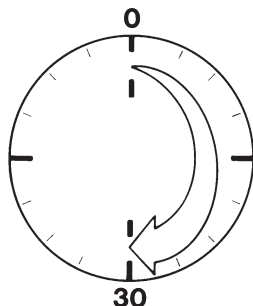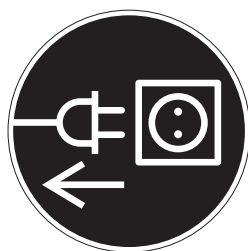
Warmup Time
To deliver exact results, the moisture analyzer must warm up for at least
30 minutes after initial connection to AC power or after a relatively long power
outage. Only after this time will the moisture analyzer have reached the
required operating temperature.

Charging the Built-in Rechargeable Battery
Before initial operation, leave the moisture analyzer connected to the line
current (mains supply) for at least 10 hours to charge the built-in rechargeable
battery. When the analyzer is disconnected from line current, the analysis
data is retained in memory for approximately three months.
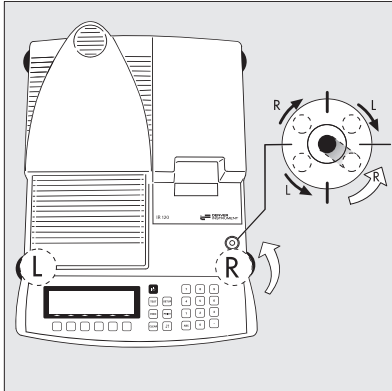
Leveling the Moisture Analyzer
Purpose:

– To compensate for unevenness at the place of installation

– To achieve perfectly horizontal positioning of the moisture analyzer for consistent repeatability

– This is necessary especially for testing liquid samples that need to be at a uniform level in the disposable sample pan

  Always level the moisture analyzer again any time it is moved to a different location.

  Only the 2 front feet are used for leveling.

● Retract the both rear feet

● Turn the 2 front feet as shown in the illustration until the air bubble is centered within the circle of the level indicator

> Several leveling steps are usually required

● Extend the 2 rear feet until they touch the surface on which the moisture analyzer rests

Selecting the Brief Instructions
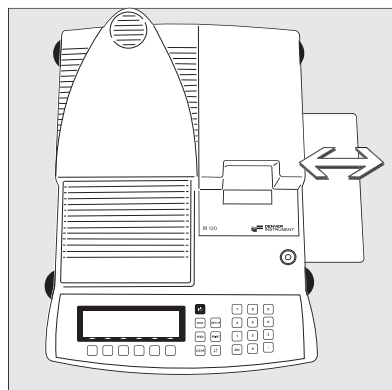The moisture analyzer has separate cards with brief instructions on its most important functions. The following languages are included:
– English/Dutch
– German/Italian
– French/Spanish

To exchange the brief instruction card:
● Pull out the brief instruction card on the right (you need to use a little force to overcome the resistance which is used to keep the card in place)

To insert the card:

● Slide the selected card into the slot

○ Pull out the card on the right to remove it, if necessary
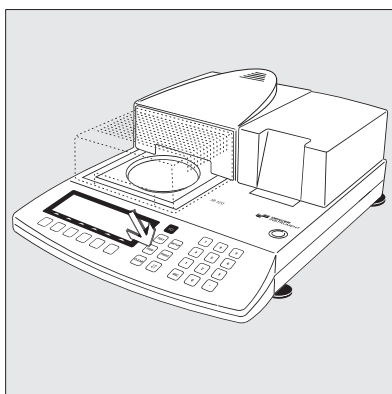
Turning On the Analyzer; Opening and Closing the Sample Chamber

● To turn on the analyzer: Press the ⌊I/⏻⌉ key

● To open or close the sample chamber: Press the ⌊↓↑⌉ key

> The motor opens or closes the sample chamber

Setting the Language
– See the section on "Setting the Language" in the chapter entitled "Configuring the Moisture Analyzer"

Setting the Date and Time
– See the section on "Entering User Data" in the chapter entitled "Configuring the Moisture Analyzer"

Operating Design

Operation of the moisture analyzer follows a standardized "philosophy" which is described below.

Keys
The moisture analyzer is operated either using the keys on the display and control unit or via a connected PC. Operation using the keys is described in the following.

Labeled Keys
These keys always have the function indicated, but are not available at all times. Availability of these functions depends on the current operating status of the moisture analyzer and its menu settings.
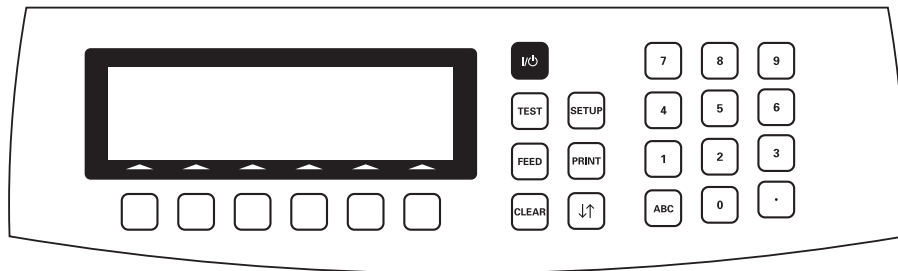
The keys have the following functions:

I/⏻ On/off key
Turns the moisture analyzer on/off. The moisture analyzer remains in standby mode

TEST isoTEST
Calibration/adjustment of the weighing system and hardware tests can be carried out

SETUP Configuring the moisture analyzer
Access to the Setup menu; exit Setup

FEED Line Feed
(Optional) printer advances the paper by one line

PRINT Data Output
Press this key to output displayed data via the interface port or to generate printouts using the (optional) printer

CLEAR Clear Function
Deletes keypad input
Interrupts calibration/adjustment routines

↓↑ Arrow Key
Opens or closes the sample chamber

0 ... 9 · Numeric Keys
see the section entitled "Text Input"

ABC Alphabetic Keys
see the section entitled "Text Input"

Numeric Input
To enter numbers:
Press the [0] [1] … [9] [·] keys

To store numbers entered:
Press the corresponding soft key

To interrupt/cancel numeric input digit by digit: Press the [CLEAR] key

Text Input
● To enter numbers: See the section entitled "Numeric Input"

● To enter letters or characters: Press the [ABC] key

> Letters are displayed in the bottom line for selection

● To select a different letter: Press the corresponding soft key to change the letter shown

● To select the letter/character shown: Press the corresponding soft key

> The selected letter is shown on the display

○ Enter the next letter/character, if desired, as above

○ To exit the letter input mode (i.e. if the last character entered is a letter): Press the [ABC] key

● To store a word: Press the corresponding soft key (e.g., ID)

● To delete an input or character: Press [CLEAR] key

● To delete user data: Enter [·] "decimal point" or a space " " and confirm by pressing Enter

Function Keys (Soft Keys)
The current function of a soft key is indicated in the bottom line of the display (footer).

Texts (as abbreviations) or symbols can be displayed in the example shown below.

Texts (Examples)

`Info:`
Information about the "Phase Drying" program

`Prog.:`
Select/configure the drying program

`Stat.:`
Statistics display/delete

`ID:`
Enter the ID number

`Mode:`
Change the parameters

`Tare:`
Tare the sample pan
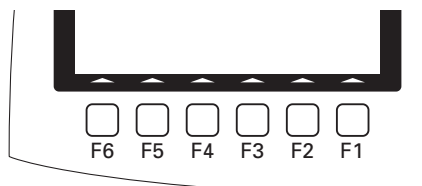
The function keys are numbered (F1) through (F6), from right to left.

Symbols
The bottom line shows the following symbols:

`<<` Return to Setup menu (in the Setup menu: exit the Setup program)
`<` Go back to the higher selection level
`>` Show sub-items under the active item
`^` Move upward in the input/output window
`v` Move downward in the input/output window
`↵` Set the selected menu parameter

There are two fundamentally different types of display:

– display for analysis and test functions

– display for menu parameter settings (e.g., SETUP, Mode, ID) and final results (Info, Statistics)

Operation

Analysis and Test Functions
This display is divided into nine sections.
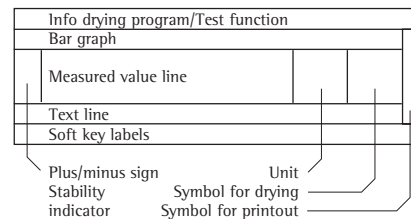
Example: Moisture Analysis

Info Drying Program Line

The following information is displayed here:

– Program name with 10 characters max. (factory setting), e.g. BUT-TER or
– Number of the selected drying program, e.g. P1 (Configuration: Drying parameter: Mea. No. # with automatic Counter: On)
– Temperature settings
– End of measurement criteria

Bar Graph:
The bar graph indicates the percentage by which the weighing system's capacity is "used up" by the current sample on the pan

The bar graph is shown if you have selected `minimum and maximum initial weight` or `target value, tolerance in %`.

The following symbols may be displayed here:

`0%` Lower load limit for initial sample weight

`100%` Upper load limit for initial sample weight

`▄▄▄▄▄` Bar graph showing 10% intervals

`−` Minimum tolerance

`=` Target value

`+` Maximum tolerance

Plus/Minus Sign:
A plus or minus sign (**+** or **−**) is shown here for a weight value (e.g., a calculated value, when weighing in percent).

Measured Value Line:
This section shows the weighed or calculated value or alphanumeric input.

Unit and Stability:
When the weighing system reaches stability, the weight unit or calculation unit is displayed here.

Symbol for Drying:
During the drying program, the following symbol is displayed here:

Drying in progress

Symbol for Printout:
During the printout of the analysis results and other data, the following symbols appear in this column:

Print

Text Line:
Additional information is displayed here (e.g.,operating state, operator guidance prompts, analysis temperature and measuring time, etc.)
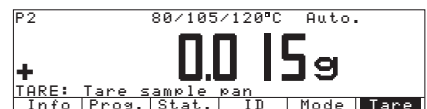
Text line example for operator guidance (e.g., "TARE: Tare sample pan")

Soft Key Labels:
The current functions (abbreviations) of the arrow keys (soft keys) are indicated here. Please note that when we say "press the X soft key," we are referring to the actual key indicated below the soft key label displayed.

Menu Operation and Drying Results
This display is divided into three sections.

```
┌─────────────────────────────────┐
│ Line for Operating State        │
│                                 │
│ Input and Output Window         │
│                                 │
│ Soft key labels                 │
└─────────────────────────────────┘
```
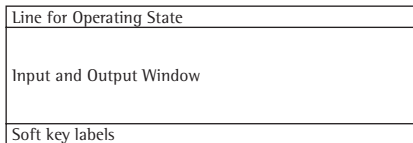
Line for Operating State:

The line for operating state indicates the function of the current screen page.
In the Setup menu, the current menu path is shown here.

Example for Setup, Language:

```
┌─────────────────────────────────┐
│ SETUP      LANGUAGE             │
│                                 │
│                                 │
│                                 │
│                                 │
│                                 │
└─────────────────────────────────┘
```

Input and Output Window:
This window contains either detailed information (e.g., on the active application) or a pick list. A selected item is displayed inversely (white letters on a black background). You can also enter information in an active field in this window using the alphanumeric keys.

Example for Setup, Parameter Settings:

```
┌─────────────────────────────────┐
│ o Normal vibration             │
│   Strong vibration             │
│                                 │
│                                 │
│                                 │
└─────────────────────────────────┘
```
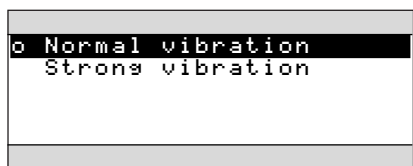
The following symbol in the input or output window indicates:

○ this symbol marks the saved menu setting

Soft Key Labels:

See the "Function Keys (Soft Keys)" on the previous page

Parameter Settings

The parameters are configured in menus. These menus have several levels.

Example of the Setup Menu:
● To select a parameter:
Press the [SETUP] key

● To move within a menu level:
Press the ⌃ or ⌄ soft keys

● To select a menu item (submenu):
Press the ⋗ soft key

To set a parameter:
● Press the ⌃ or ⌄ soft keys repeatedly until the desired setting is selected (displayed inversely)

● Confirm your selection by pressing the ↵ soft key

To change the numeric value of a parameter:
● Press the ⌃ or ⌄ soft keys repeatedly until the desired setting is selected (displayed inversely)

● Enter the desired number using the [0] [1] … [9] [·] keys or the [ABC] soft key and enter the desired letters

● Confirm your selection by pressing the ↵ soft key

To exit Setup: Press [SETUP] or the ⋖⋖ soft key

Data Output
You can choose between:

– internal printer (option)

– interface port for:
  – Denver Instrument printer (such as the YOP03-01)

  – computer (PC)

  – process logic controller (PLC)

  – universal remote control switch

(Internal/External) Printer
You can configure the print functions to meet your individual requirements by selecting the corresponding menu code in Setup. The printouts can be generated as standard or ISO/GLP-compliant printouts.

ISO: International Organization for Standardization

GLP: Good Laboratory Practice

You can have printouts generated automatically, or by pressing [PRINT]; printout generation can be dependent on or independent of the stability or time parameters (for example, automatic when a drying program starts, at specific time intervals, at the end of a drying program).

See the section on "Data Output Functions" in the chapter entitled "Operating the Moisture Analyzer" for a detailed description of data output options.

Interface Port

You may choose to connect a different peripheral device, such as one of the following, to the interface port instead of or in addition to the internal printer:

– external printer

– status indicators with digital input ports

– process logic controller with digital input/output port

– a computer (PC) with a communications port

The moisture analyzer can be monitored and remote-controlled via the interface port.

For a detailed description, see the section on "Data Output Functions" in the chapter entitled "Operating the Moisture Analyzer."

Error Codes

If you press a key that has no function, or which is blocked at a certain point in an application program, this error is indicated as follows:

– a double-beep is sounded as an acoustic signal if the key has no function

– invalid input is indicated by an error message

– incorrect operation is indicated by an error code or error message

The response to an operator error is identical for all operating modes. See the chapter entitled "Error Codes" for a detailed description.

Saving Data

Storing Parameter Settings

The parameter settings in the Setup menu and for drying programs are active when you switch on the moisture analyzer. The parameter settings, selected with the Mode soft key during an analysis, are not saved (exception: limits for the control function).
In addition, the factory settings can be restored.

Saving Parameter Settings

You can assign passwords in order to block access to:

– user-configured drying programs

– setting mode for device parameters

– printout configuration

If no password has been assigned, anyone can access drying programs, "SETUP: Device parameters" and "Printout configuration" without entering a password.

If you assign a password and then forget what the word is, you can use the General Password (see Appendix) to access these menus.

Configuring the Moisture Analyzer

Purpose

You can configure your moisture analyzer to meet individual requirements by entering user data and setting selected menu parameters in the Setup menu.

The Setup menu is divided into the sections:
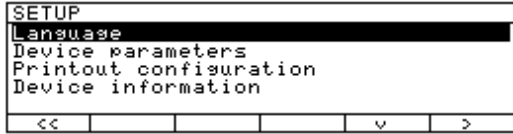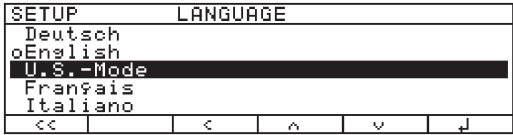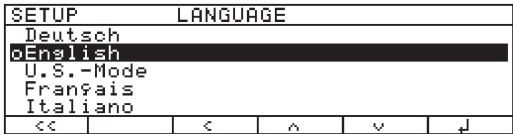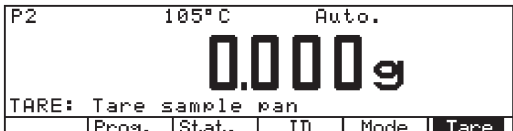
– Language

– Device parameters

– Printout configuration

– Device information

Setting the Language

You can choose from 5 languages for the information display:

– German

– English

– English with U.S. date/time format (factory setting)

– French

– Italian

– Spanish

Example: Selecting the language: "English"

Step	Key (or Instruction)	Display/Printout
1. Select Setup menu	[SETUP]	SETUP **Language** Device parameters Printout configuration Device information `<<` `∨` `>`
2. Confirm the language	`>` soft key	SETUP LANGUAGE Deutsch English **oU.S.-Mode** Français Italiano `<<` `<` `∧` `∨` `↵`
3. Set the language "English"	`∧` soft key	SETUP LANGUAGE Deutsch oEnglish **U.S.-Mode** Français Italiano `<<` `<` `∧` `∨` `↵`
4. Store the language	`↵` soft key	SETUP LANGUAGE Deutsch **oEnglish** U.S.-Mode Français Italiano `<<` `<` `∧` `∨` `↵`
5. Exit Setup	`<<` soft key	P2 105°C Auto. **0.000 g** TARE: Tare sample pan Prog. Stat. ID Mode **Tare**

13

Setting the Device Parameters (DEVICE)

Purpose
Device configuration, i.e., to meet individual requirements by selecting predefined menu parameters in the Setup menu. You can block access to the menu by assigning a password.

Features
The device parameters are combined in the following groups:
– Password to the Setup menu
– User ID
– Weighing parameters
– Interface
– Internal printer
– Keypad
– Display
– Clock
– Extra functions
– Factory settings

You can view, enter or change the following parameters:
Password
– Password for access to the SETUP menu: "Device parameters," "Printout configuration" and "Drying programs" (8 characters max.)

User ID
– ID codes:
  User ID (20 characters max.)

```
SETUP      DEVICE     USER ID
User ID:              SMITH2345

  <<        <
```

Weighing parameters
– Adjustment to the ambient conditions

– Weight set number for calibration/adjustment:
  W ID (weight ID; 14 characters max.)

– Exact calibration weight value for calibration/adjustment of the analyzer, such as for adjustment according to a DKD certificate (see the section on "Calibration/Adjustment" in the chapter entitled "Operating the Moisture Analyzer")

Interface
– SBI operating mode
  Simple record of analysis results for PC or external printer, factory setting for 901042-1 printers
  Format: baud rate, number of data bits, parity, stop bits, handshake

– xBPI operating mode Function-oriented interface with clear data transmission
  Network address: enter a number from 0 to 31; factory setting: 0

Keys
– CF function: delete entire input or last character

– Block key functions

Display
– Background

– Contrast/angle of the display (enter a number from 0 to 4; factory setting: 2)

Clock
– Time (hh.mm.ss; hh can be entered without a preceding zero)

– Date (dd.mm.yy or mm.dd.yy when you select "English with U.S. date/time" as the language")

Extra Functions
– Acoustic signal on or off

– Functions for external universal remote control switch, extra keyboard or bar code scanner

Factory Settings
Parameters: The factory-set configurations are identified by an "o" in the list starting on page 18.

Preparation
Display existing "Device parameters"
● Select the Setup menu:
  Press the SETUP key

> SETUP is displayed:

```
SETUP
Language
Device parameters
Printout configuration
Device information

  <<              v      >
```

● Select "Device parameters":
  Press the v and > soft keys

If no password has been assigned, anyone can access "SETUP: Device parameters" and "Printout configuration" without entering a password

If you have already assigned a password:

> The password prompt is displayed

○ If access is blocked by a password: enter the password using the alphanumeric keys

○ If the last character of the password is a letter: conclude input by pressing ABC

● Confirm the password and display "Device parameters":
  Press the ↵ soft key

> Device parameters are displayed:

```
SETUP      DEVICE
Password
User ID
Weigh. parameters
Interface
Internal printer
  <<        <      v      >
```

Entering or Changing the Password
– Password for access to the following functions, entered with 8 characters max.:

  – SETUP parameters

  – Data record configuration

  – Edit or copy drying program

● Select the Setup menu:
  Press the ⓈⒺⓉⓊⓅ soft key

> SETUP is displayed

● Select parameters:
  Press the ⌄ und ⌐ soft keys

  If you have already assigned a password:
> The password prompt is displayed:

```
SETUP      PASSW. CHECK

Enter password:         ▬▬▬▬

   <<        <
```
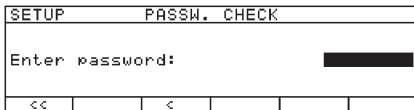
○ Enter the password

○ Confirm the password and display the parameters:
  Press the ↵ soft key

● Write down the password here for easy reference:
  Password = ...

  If you assign a password and then forget what the word is:
○ Enter the General Password (see Appendix)

○ Confirm the password and display the parameters:
  Press the ↵ soft key

> Parameters are displayed

● Select the password-setting function:
  Press the ⌄ or ⌃ soft key repeatedly and ⌐ soft key until

> Password: and any existing password are displayed:

```
SETUP    DEVICE    PASSWORD
Password:              ABC123



  ESC                      ↵
```
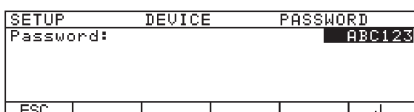
● New password: Enter the numbers and/or letter of the new password (8 characters max.)

If "none" is displayed as a password: this means no password has been assigned
To delete the user password:
Enter ⌐·⌐ and confirm

● To confirm your entry:
  Press the ↵ soft key

● Exit the Setup menu:
  Press the ⌂⌂ soft key

> Restart the application

Extra Functions
● Exit the Setup menu:
  Press the ⌂⌂ soft key

> Restart the application

● Printout the parameter setting:
– If "Device parameters" are displayed:
  Press the ⓅⓇⒾⓃⓉ soft key

> Printout (example)
  Lines with more than 20 characters are truncated

```
--------------------
SETUP
        DEVICE
--------------------
 User ID
  User ID:
          ABC123456
 Weighing parameters
  Adapt filter
    Normal vibration
  Calibration/Adjust
   Wt.ID (W ID):
              123
   Cal./Adj. wt.:
        50.000 g
 Interface
  SBI
   Baudrate
          1200 baud
   Number of data bit
            7 bit
   Parity
              Odd
   Number of stop bit
       1 stop bit
   Handshake mode
   Hardware 1 char
```
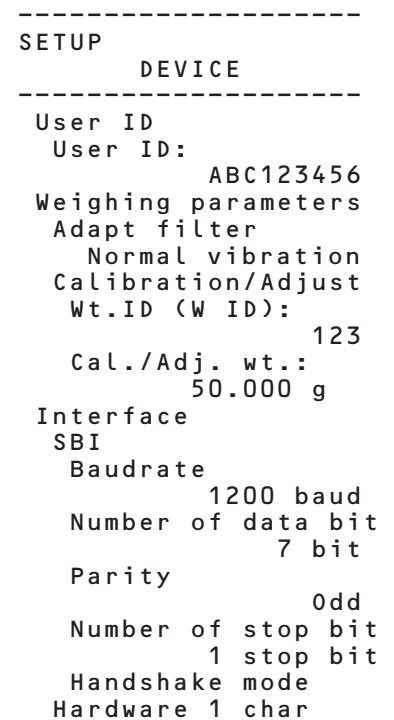
  etc.

● Reset the device parameters to the factory settings:
  See the section on selecting the factory settings in the chapter entitled "Device Parameters (Overview)"

15

Example 1:
Adapt filter to the ambient condition: "Strong vibration"

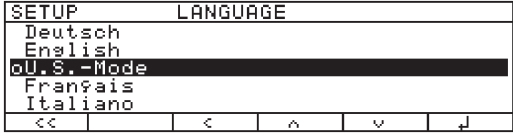| Step	Key (or Instruction)	Display/Printout
1. Select Setup menu	SETUP	SETUP **Language** Device parameters Printout configuration Device information `<<` ⌄ `>`
2. Select and confirm "Device parameters"	⌄ soft key, then the `>` soft key	SETUP DEVICE **Password** User ID Weigh. parameters Interface Internal printer `<<` `<` ⌄ `>`
3. Select and confirm "Weigh. parameters"	⌄ soft key twice, then the `>` soft key	SETUP DEVICE WGH. PARAM. **Adapt filter** Calibration/adjustment `<<` `<` ⌄ `>`
4. Confirm menu item "Adapt filter" and select next menu level	`>` soft key	DEVICE WGH. PARAM. ADAPT FILT **oNormal vibration** Strong vibration `<<` `<` ⌄ ↵
5. Select menu item "Strong vibration"	⌄ soft key	DEVICE WGH. PARAM. ADAPT FILT oNormal vibration **Strong vibration** `<<` `<` ⌃ ↵
6. Confirm menu item "Strong vibration"	↵ soft key	DEVICE WGH. PARAM. ADAPT FILT Normal vibration **oStrong vibration** `<<` `<` ⌃ ↵
7. Select other menu items, if desired	⌄ ⌃ soft key(s)	
8. Store the setting and exit Setup menu	`<<` soft key	

16

Example 2:
Set time and date

Step	Key (or Instruction)	Display/Printout
1. Select Setup menu; select "Device parameters"	SETUP, then ⌄ and > soft keys	```SETUP DEVICE ``` Password / User ID / Weigh. parameters / Interface / Internal printer ``<< < ⌄ >``
2. Set clock	⌄ and > soft keys repeatedly	```SETUP DEVICE CLOCK``` Time: 15.06.10 / Date: 12.09.97 ``<< < ⌄``
3. Enter the time	[1][1][·][1][2] [·][3][0]	```SETUP DEVICE CLOCK``` Time: 11.12.30 / Date: 12.09.97 ``ESC ↵``
4. Set the time according to your local clock	↵ soft key	
5. Enter the date	[1][3][·][0][3] [·][0][4]	```SETUP DEVICE CLOCK``` Time: 11.12.42 / Date: 13.03.04 ``<< < ^``
6. Store the date	↵ soft key	
7. Enter other date, if desired	⌄ ^ soft key(s)	
8. Exit Setup menu	<< soft key	

Device Parameters (Overview)
o factory setting
√ user-defined setting

```
Setup –        Password ———— empty   Enter 8
Device                                characters max.
parameters     User ID ————— empty   Enter 20
                                      characters max.

               Weighing              Adapt filter ——— o  Normal vibration
               parameters                               Strong vibration

                                     Calibration/        Weight set number ——— None    Enter 14
                                     adjustment          (weight ID)                    characters max.

                                                         Calibration/adjustment — 50.000g   Enter exact
                                                         weight value                        weight value

               Interface            SBI                 Baud rate                           150 baud
                                                                                            300 baud
                                                                                    o       1200 baud
                                                                                            2400 baud
                                                                                            4800 baud
                                                                                            9600 baud
                                                                                            19200 baud

                                                         Number of data bits ——— o          7 bit 1)
                                                                                            8 bit

                                                         Parity                             None 2)
                                                                                    o       Odd
                                                                                            Even

                                                         Number of stop bits ——— o          1 stop bit
                                                                                            2 stop bits

                                                         Handshake                          Software handshake
                                                         mode                       o       Hardware handshake
                                                                                            1 character after CTS

                                    xBPI                 Network address ——— 0              Enter any number
                                                                                            from 0 through 31

               For keys, display and clock see next page
```

1) not if "None" parity is selected
2) only if 8 data bits selected

Setup –
Device
parameters

- Internal printer (option)
  - o Off
  - On

- Keys
  - CF function for input
    - Delete entire input
    - o Delete last character
  - Block key functions
    - o All keys unblocked
    - All keys blocked except for SETUP, I/⏻
    - Alphanumeric keys blocked

- Display
  - Background
    - o White
    - Black
  - Contrast
    - Contrast (0 to 4)
      - Selection: 0
      - 1
      - o 2
      - 3
      - 4

- Clock
  - Time:
    - Enter hh.mm.ss
  - Date:
    - Enter dd.mm.yy or mm.dd.yy (01.01.97)

- Extra functions
  - Acoustic signal
    - o On
    - Off
  - Function: external switch
    - o PRINT key
    - F1 function key (right-hand soft key)
    - CLEAR key
    - Open or close sample chamber
    - Bar code scanner / Extra keyboard

- Factory settings
  - No
  - Yes

Configuring the Printout
(CONFIG)

Purpose
You can configure individual printout formats for each application.
All analysis printouts have basic factory settings.

You can block access to the "Printout configuration" data by assigning a password.

Features
– Maximum items in a data record: 30

– Header, footer, intermediate results, statistics and information records can be configured separately

– Printout header is output when starting moisture analysis

– Intermediate records are output during the moisture analysis runs by pressing PRINT or at each printout interval

– Footer printed out at the end of a moisture analysis

– Statistics are printed out while the statistics are displayed by pressing PRINT

– Information on phase drying is printed by pressing PRINT while the information is displayed

– Printout items can be deleted individually

– "Form feed" in a printout footer: Select the print mode to configure automatic form feed up to the beginning of the next label

Extra Functions
● Exit "Printout configuration": Press the ≪ soft key

> Restart the application

Printout LIST or SELECT
– L I S T: Output of the current printout list
  S E L E C T: Print currently selectable items

● When the select bar is on L I S T or S E L E C T: Press PRINT

> Printout (example)

```
PRINT HEADER
         LIST
====================
Blank line
GLP header
Program name
Heating param.
Standby temp.
Start parameter
End parameter
Initial weight
--------
====================

etc.
```

Output of All Printout Settings:
– When the select bar is on printout overview
  (SETUP CONFIG.):
  Press PRINT

> Printout (example)

```
--------------------
13.07.2004      13:08
Mod.          IR120Q
Ser. no.    90706913
Ver. no.    01-38-20
ID
--------------------
SETUP
       CONFIG.
--------------------
  Printout header
    Blank line
    GLP header
    Program name
    Heating param.
    Standby temp.
    Start parameter
    End parameter
    Initial weight
    --------
  Intermediate result
    Analysis time
    Analysis result
  Printout footer
    --------
    Ending time
    Final weight
    Final result
    --------

etc.
```

● Reset "Printout Configuration" to the factory settings:
  See "Printout configuration"
  Set Printouts to Factory Settings and confirm with YES.

Data Items for the Printout:

Parameter	Display text	Print-out header	Inter-mediate result	Print-out footer	Statistics	Info	Printout (Example)
Blank line [1]	Blank line	×*	×	×*	×*	×*	
Dotted line [1]	--------	×*	×	×*	×*	×*	--------------------
GLP header	GLP header	×*			×*	×*	-------------------- 13.07.2004 13:06 Mod. IR120Q Ser. no. 90706913 Ver. no. 01-38-20 ID WORKSTAT 234 --------------------
GLP footer	GLP footer				×*	×*	13.07.2004 14:06 Name: --------------------
Date/time	Date/time	×	×	×	×	×	13.07.2004 13:06
Time with seconds	Time	×	×	×	×	×	13:06:45
User ID (from Setup: Device)	User ID	×			×	×	ID WORKSTAT 234
Identification code 1	ID1	×	×	×	×	×	ID1 DENVER INST.
Identification code 2	ID2	×	×	×	×	×	ID2 GOETTINGEN
Identification code 3	ID3	×	×	×	×	×	ID3 ARVADA, COLORADO
Identification code 4	ID4	×	×	×	×	×	ID4 LOT 15
Name in program memory	Program name	×*			×*	×*	P1 BUTTER
Heating program with parameters	Heating param.	×*					Heating STANDARD Fin.temp 105 'C
Standby temperature	Standby temp.	×*					Stdby temp. OFF
Start parameter	Start parameter	×*					Start W/STABIL.
End parameter	End parameter	×*					End AUTOMATIC
Preset tare weight	Preset tare	×					PTare 0.000 g
Initial weight	Initial weight	×*					IniWt + 5.712 g
Number of current analysis	Analys no.	×					# 1
Current weight	CurrWt		×				CurrWt+ 5.1357 g
Analysis time according to current display	Analysis time		×		×*		Time 1.0 min
Analysis result according to current display	Analys. res.		×		×*		Res + 0.91 %M
Analysis time and result according to current display	Analys time/res.		×				1.0 + 0.91 %M
Space for signature, ID	Name			×	×	×	Name:
Final weight	Final weight			×*			FinWt + 5.1357 g
Time at end of analysis	Ending time			×			Time 15.0 min
Final result according to current display	Final result			×			Res + 9.85 %M
Analysis time and result according to current display	Final time/res.			×*			15.0 + 9.85 %M
Phase drying intermediate results	Phase results			×		×*	Res1 + 4.45 %M Res2 + 3.15 %M Res3 + 2.25 %M

* Factory setting
[1]) Print items can be selected more than once

Parameter	Display text	Print-out header	Inter-mediate result	Print-out footer	Statistics Info	Printout (Example)		
Text line "Statistics"	Statistics ID				×			STATISTICS
Number of analyses	Number of analys.				×*	n		5
Mean value	Mean value				×*	Avg.	+	4.84 %M
Standard deviation	Std. deviation				×*	s		0.05 %M
Minimum	Minimum				×*	Min	+	4.80 %M
Maximum	Maximum				×*	Max	+	4.90 %M
Text line "ANALYSIS INFO"	Info ID				×*			ANALYS.INFO

* Factory setting

Example:
Adding the Item "Phase Results" to Configure the Printout Footer

Step	Key (or Instruction)	Display/Printout

1. Select Setup menu;
   Select "Printout configuration"

   [SETUP], then
   ˅ soft key twice,
   then ˃ soft key

   ```
   SETUP      CONFIG.
   Printout header
   Intermediate results printout
   Printout footer
   Statistics printout
   Info printout
    <<        <          v      >
   ```

2. Select printout footer

   ˅ soft key twice,
   then ˃ soft key

   ```
    LIST      PRT.FOOTER   SELECTION
   --------          Blank line
   Ending time       --------
   Final weight      Form feed
   Final result      Date/time
   --------          Time
    <<  Delete   <          v      >
   ```

3. Use the select bar to define
   the position for printout items
   "Phase results" on the L I S T

   ˅ soft key repeatedly

   ```
    LIST      PRT.FOOTER   SELECTION
   --------          Blank line
   Ending time       --------
   Final weight      Form feed
   Final result      Date/time
   --------          Time
    <<  Delete   <     ^    v      >
   ```

4. Change to S e l e c t

   ˃ soft key

   ```
    LIST      PRT.FOOTER   SELECTION
   --------          Blank line
   Ending time       --------
   Final weight      Form feed
   Final result      Date/time
   --------          Time
    <<           <          v      ↵
   ```

5. Select "Phase results"

   ˅ soft key repeatedly

   ```
    LIST      PRT.FOOTER   SELECTION
   --------          ID3
   Ending time       ID4
   Final weight      Name
   Final result      Ending time/res.
   --------          Phase results
    <<           <     ^           ↵
   ```

6. Include phase results

   ↵ soft key
   in the list

   ```
    LIST      PRT.FOOTER   SELECTION
   --------          ID2
   Ending time       ID3
   Final weight      ID4
   Phase results     Name
   Final result      Ending time/res.
    <<           <     ^           ↵
   ```

7. Select or delete other
   printout items, if desired

   ˅ ^ ↵ soft key
   or
   ˂ ˅ ^ D e l e t e soft key(s)

8. Configure other analysis
   printouts, if desired

   ˂ ˅ ^ ˃ soft key(s)

9. Exit Setup menu

   ˂ ˂ soft key

10. Perform moisture analysis
    and press

    [PRINT]

    ```
    --------------------
    Time         15.0 min
    FinWt  +     9.5819 g
    Res1   +      12.05 %M
    Res2   +       7.12 %M
    Res3   +       4.96 %M
    C-Res  +      24.13 %M
    --------------------
    ```

Device Information

Purpose
Display of device information

Display Device Information
● Select Setup menu:
  Press the SETUP soft key

> "SETUP" is displayed:

```
SETUP
Language
Device parameters
Printout configuration
Device information

  <<                        v      >
```

● Select "INFO:
  Device information":
  Press v soft key three times,
  then > soft key

> Device information is displayed:

```
SETUP      INFO
Versions No:             01-38-20
Wgh.sys. ver. #:         00-25-03
Model:                     IR120Q
Serial no.:              90706913

  <<              <
```

● Printout information:
  Press PRINT

> Printout (example)

```
-------------------
13.07.2004       13:02
Mod.           IR120Q
Ser. no.      90706913
Ver. no.      01-38-20
(Operating program version)
ID          BECKER123
(User ID)
-------------------
SETUP
        INFO
-------------------
 Versions No:
           01-38-20
 (Operating program version)
 Wgh.sys ver.
           00-25-03
 (Wgh.sys.program version)
 Model:
             IR120Q
 Serial no.:
           90706913
-------------------
```

● Reset to SETUP Overview:
  Press the < soft key

● Exit SETUP:
  Press the << soft key

> Previous status is restored

Weighing Function

Purpose
The IR120 moisture analyzer can be used for quick and reliable determination of the moisture content of materials of liquid, pasty and solid substances according to the method of thermogravimetry.

Basics
The moisture of a material is often mistakenly equated with its water content. In fact, the moisture of a material includes of all the volatile components which are given off when the sample is heated, resulting in a decrease in sample weight. Among such volatile substances are:
– water
– fats
– oils
– alcohols
– organic solvents
– flavorings
– products of decomposition
  (when a sample is overheated)

There are many methods to determine the moisture content of a substance. Basically, these methods can be divided into two categories:

When absolute methods are used, the moisture content is directly determined (for example, as a weight loss registered during the drying routine). These methods include oven drying, infrared drying, and microwave drying. All three of these methods are thermogravimetric.

When deductive methods are used, the moisture content is indirectly determined. A physical property, which is related to the moisture in the substance, is measured (e.g., absorption of electromagnetic rays). These methods include Karl-Fischer titration, infrared spectroscopy, microwave spectroscopy, etc.

Thermogravimetry is the process of determining the loss of mass that occurs when a substance is heated. In this process, the sample is weighed before and after being heated, and the difference between the two weights is calculated.

In a conventional drying oven, circulating hot air warms the sample from the outside to the inside. Efficiency is lost during drying because as the moisture evaporates, it cools the sample surface.

By contrast, infrared rays (IR rays) penetrate a sample without being impeded. Having reached the interior of a sample, they are converted into heat energy, which stimulates evaporation, thus drying the sample. A small part of the IR rays is reflected from the surface of the substance.

IR-rays

thermal energy
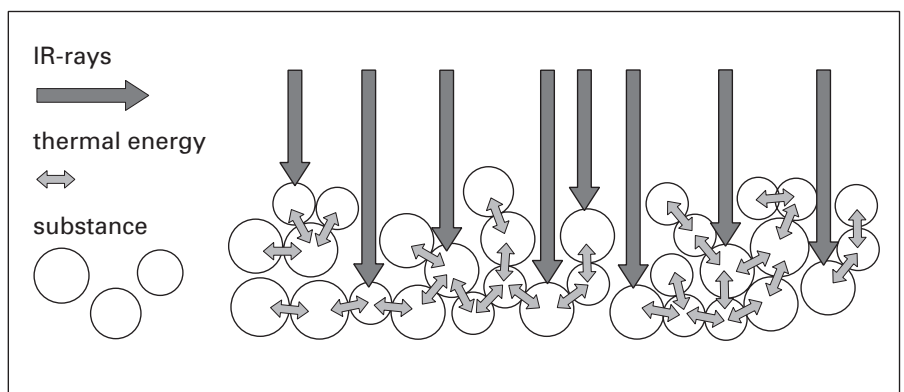
substance

The quantity of reflected IR rays depends to a great extent on whether the substance is light or dark-colored.

Dark Substance
Low Reflection

Light Substance
High Reflection
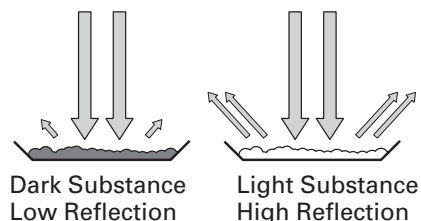
How the rays penetrate the sample depends on the sample's degree of light-transmitting capacity. If the degree of light-transmitting capacity is low, the rays can penetrate only the uppermost layers of the sample. The heat conductivity of the sample dictates the degree to which the heat can be transmitted to the underlying layers. The higher the conductivity, the faster and more uniformly the substance is heated.

The substance should be applied to the sample pan in a thin, even layer. A height of approximately 2–5 mm for 5–15 g substance weight has proved to be ideal. Otherwise, the sample will not be dried completely or the analysis time will be unnecessarily extended, a crust/skin will form on the surface of the sample or the sample will scorch, and the analysis results obtained will not be reproducable, and therefore, cannot be used.
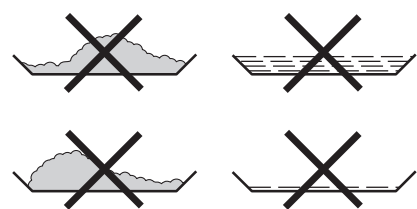
Incorrect Application of a Sample

When preparing a substance for analysis, you should use methods that do not generate heat so that the sample does not lose moisture before it is analyzed.

Perform initial analysis of a new substance to test how the IR rays are absorbed by the sample and converted into heat. The printout of the intermediate values of the drying process provides you with this information at an early stage.

Experience has shown that the temperature setting selected during the infrared drying is usually lower than the temperature setting used when working with a drying oven.

In many cases, the fully automatic shutoff mode will meet your requirements. If the final result is higher or lower than expected, try varying the temperature setting before resorting to a different shutoff parameter.

When analyzing samples that lose their moisture only very slowly or when operating a cold moisture analyzer, the fully automatic mode may end the drying routine too early, if it does not detect any analyzable progress in the drying routine under these conditions. In this case, preheat the moisture analyzer for 2–3 minutes before starting the drying routine or select a different shutoff parameter.

Preparation

Before drying a sample, you must carry out the following preparations:

– Adjustment to the available measuring system (if required)

– Sample preparation

– Setting the parameters for drying program

Adjustment to an Existing Measuring System

A moisture analysis method often replaces another drying method (e.g., the oven drying method), because it is simple to use and requires shorter analysis time. In this case, you should adapt this method to that of the moisture analyzer in order to obtain values comparable to those yielded by your standard reference method.

● Perform parallel measurements: take a fresh sample and divide it in half

● Determine the moisture content of the first half using your standard method of analysis

● Analyze the second half of the sample in the moisture analyzer.
  Use the following settings:
    – fully automatic mode for the shutoff parameter
    – lower temperature settings than for the oven drying method
    – temperature setting for organic substances: 80 – 100°C
    – temperature setting for inorganic substances: 140 – 160°C

○ If the result for the second part does not correspond to that of the first:
    – first, repeat the analysis using a different temperature setting
    – then use the semi-automatic mode for the shutoff parameter (such as 5 mg/30 s)

○ Vary the shutoff parameter, if required:
    – Increase end-point recognition:
      set the parameter to 2 mg/30 s or 5 mg/60 s
    – Decrease end-point recognition:
      set the parameter to 10 mg/30 s or 5 mg/10 s

Preparing a Sample

Selecting a Sample

● Select a representative part of the whole substance as a sample
 – a representative number of individual samples for quality control
 – samples which indicate a trend are sufficient for in-process control

○ Homogenize the product before a sample is taken, if required, by:
 – mixing or stirring
 – taking several samples from different areas of the product
 – taking several samples at defined intervals

● Take only one sample at a time for a given analysis and prepare it as quickly as possible. In this way, it will not lose or gain moisture as a result of the ambient conditions.

○ If you need to analyze several samples at a time, the samples must be sealed in air-tight containers, in order to be sure that the storage conditions do not alter the state or condition of the samples:
 – Warm or highly volatile substances lose their moisture very quickly.
 – If you store the samples in a container, the moisture can condense on the walls of the container.
 – If the container is too big and not filled completely, the sample can exchange its moisture with the air remaining in the container.

○ Mix condensed moisture back in with a sample, if necessary.

Preparing a sample

● When crushing a sample, avoid any contact with heat:
 heat results in moisture loss.

● Crush a sample with
 – a pestle
 – a shredder (see below)

 For liquids containing solids, use
 – a glass stirrer
 – a spoon or
 – a magnetic stirrer.

○ Use an appropriately designed tool for shredding a sample.

Using disposable sample pans

● Use only Denver Instrument disposable sample pans (order no. 900274-1, inner diameter = 92 mm). Reusing sample pans leads to poor reproducibility of results:

 – after cleaning, sample residues can still remain on the pan

 – residues from cleaning agents can evaporate during the next moisture analysis

 – scratches and grooves inflicted during cleaning provide surfaces on which the rising hot air produced during the drying process can act, resulting in a more pronounced buoyancy

Applying a Sample to the Sample Pan

● Apply the sample to the sample pan in a thin, even layer (height: 2 to 5 mm, weight: 5 to 15 g); otherwise:
  – a sample applied unevenly will result in a nonuniform distribution of heat
  – a sample will not be dried completely
  – the analysis time will be unnecessarily extended
  – the sample burns or a crust/ skin forms on its surface as a result of a very thick layer
  – the crust makes it difficult or impossible for moisture to escape from the sample during the drying process
  – uncertain and unknown quantity of moisture remains in the sample
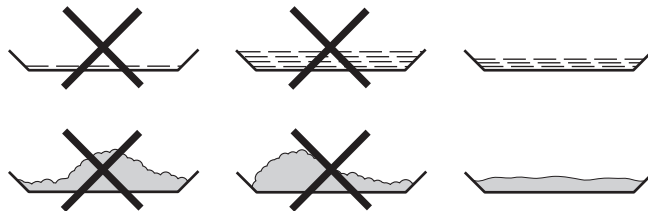
● Apply liquid samples, pasty samples or samples that can melt to a glass fiber filter (order no. 900298-1); you will obtain the following advantages:
  – uniform distribution due to the capillary effect
  – prevents liquids from beading together and forming drops
  – with larger surfaces, the moisture can evaporate faster
  – considerably more convenient than the "sea-sand method"

When drying samples containing sugar, a crust or skin can form and seal the surface. A glass fiber filter is especially helpful in such cases. The moisture can evaporate downwards through the surface of the filter. You can avoid or limit the crust/skin formation if you place the glass fiber filter on top of the sample.

● Cover solid, heat-sensitive samples with a glass fiber filter (order no. 900298-1); you will obtain the following advantages:
  – gentle heating, because the sample surface is shielded from excessive heat
  – higher temperature setting can be selected
  – uniformity of the sample surface
  – fast evaporation of the moisture
  – excellent reproducibility for samples containing fat

Avoiding the Formation of Crust/Skin

You can add "solvents" to the sample to prevent the formation of crust/skin during the analysis runs. The weight of a solvent you apply to the sample will not influence the final result of an analysis.

● Once you have closed the sample chamber, open it again within 2 seconds after you hear a beep tone.

● Apply a solvent to the sample

● Close the sample chamber and start the analysis run as usual

Setting the Drying Parameters

Purpose
Adapt the moisture analyzer to the special requirements of products.
Parameters can be configured individually for every program.

Drying Parameters (Overview)
o Factory setting
√ User-defined setting

Program memory (Prog.)				Factory setting	Factory setting
	Program name			None	
	Heating program	o Standard drying		105°C	40 to 210°C
		Quick drying		105°C	40 to 200°C
		Gentle drying*	Temperature:	105°C	40 to 200°C,
			Time:	3.0 min.	1st phase 1.0 to 20 minutes
		Phase drying*	Temperature 1:	80°C	40 to 200°C,
			Time 1:	5.0 min.	0.0 to 99.9 minutes
			Temperature 2:	105°C	2nd phase: 40 to 200°C,
			Time 2:	5.0 min.	0.0 to 99.9 minutes
			Temperature 3:	120°C	3rd phase: 40 to 200
	Standby temperature	o Off			
		On	Temperature:	40°C	40 to 100°C
	Initial weight	o Off			
		Minimum and maximum initial weight	Max. init.wt.:	5 g	1 mg to 108 g
			Min. init.wt.:	0.1 g	1 mg to 108 g
		Target weight Tolerance in %	Target weight:	5 g	1 mg to 108 g
			Tolerance:	10%	1 to 50%
	Start analysis	o With stability + auto close	Time delay:	2 sec.	0 to 99 seconds
		With stability, manual close	Time delay:	2 sec.	0 to 99 seconds
		Without stability, auto close	Time delay:	2 sec.	0 to 99 seconds
		Without stability, manual close	Time delay:	2 sec.	0 to 99 seconds
		Fully automatic, With stability	No time delay		
		Fully automatic, Without stability	No time delay		
	End of analysis	o Fully automatic			
		Semi-auto: absolute weight loss	Loss:	10 mg	1 to 50 mg
			Time interval:	60 sec.	5 to 300 seconds
		Semi-auto: weight loss in percent	Loss:	1.0 %	0.1 to 50 %
			Time interval:	60 sec.	5 to 300 seconds
		Time	Time:	15.0 min.	0.1 to 999.9 minutes
		Manual			

Program memory (Prog.)
- Display mode
  - o Moisture (%M)
    - Number of decimal places
      - 1 decimal place
      - o 2 decimal places
      - 3 decimal places
    - Conversion factor — 1.0000 factor 0.5000 to 2.0000
  - Dry weight (%S)
    - Number of decimal places
      - 1 decimal place
      - o 2 decimal places
      - 3 decimal places
  - Ratio (%MS)
    - Number of decimal places
      - 1 decimal place
      - o 2 decimal places
      - 3 decimal places
  - Weight loss (mg)
  - Residue (g)
  - Residue (g/kg)
  - Grams/liter (g/l) Sample 1.0000 l Liter (s) 0.0001–9.9999 l
- Print intermediate results
  - o Off
  - On — Print interval: 0.1 min. 0.1 to 60.0 minutes
- Analysis ID. # with auto numbering
  - o Off
  - On
- Analysis w/former sample (100%-fct.)
  - o Off
  - On
- Identification (ID)
  - ID1: ID1 20 characters
  - ID2: ID2 20 characters
  - ID3: ID3 20 characters
  - ID4: ID4 20 characters
- Factory setting
  - No
  - Yes

Features

Number of Drying Programs:
– 100 programs

Individual names with a maximum of 15 characters as user identification in program selection and for the moisture analysis printouts

All programs are listed according to the program number.

Heating Programs
To perform a moisture analysis of a substance, you can choose among four heating programs:

– Standard drying

– Quick drying

– Gentle drying

– Phase drying

Standard drying:
For the standard program, you need to enter the final temperature.
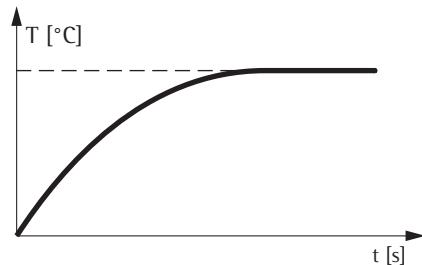
If you enter a target temperature of over 200°C, the moisture analyzer heats to the target and then adjusts to 200°C in 5 phases, from the 10th to the 30 th minute.
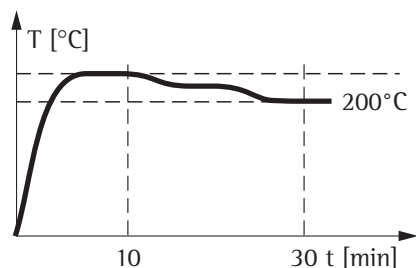
Quick drying:
For quick drying, you need to enter the final temperature. The heat output is higher.
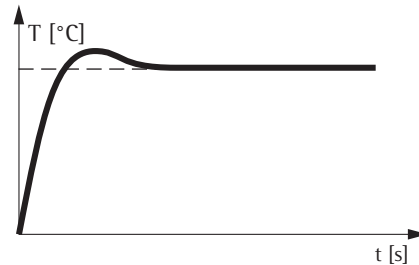
Gentle drying:
For gentle drying, you need to enter the final temperature and time required to achieve the final temperature.
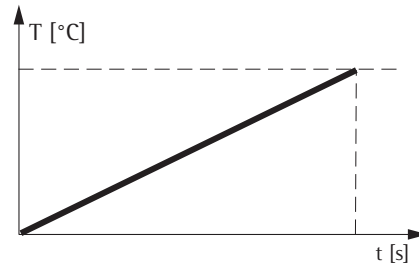
Phase drying:
Phase drying comprises three drying phases. You need to enter the temperature for each phase, including the time for the first and second drying phases. The shutoff parameters will be activated only in the 3rd phase.
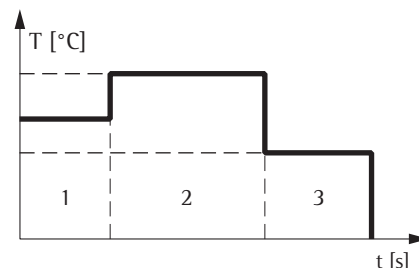
Standby Temperature
– Temperature set to defined value when the sample chamber is closed

Weighing-in
You can enter the weight limits for the initial weight of your sample (minimum and maximum or target weight with tolerance in percent)

Start of Analysis
– Confirm initial weight with or without stability after pressing the Start soft key (time delay: selectable)

– With "Manual or automatic close" for the sample chamber (By pressing the Start soft key; time delay: selectable)

– Fully automatic control:
  For remote control of an analysis using the universal remote control switch (F1 key functions: Tare, Start, Next)
  – close the sample chamber
  – with or without stability
  – time delay: 0 seconds
  – open after the analyzer is activated or after pressing the Next soft key
  – close after pressing the Tare soft key
  – open after taring

For using time delay: open the sample chamber during the selected time delay to apply the solvents

End of Analysis with Shutoff Parameters
– fully automatic mode
– semi-automatic, absolute
– semi-automatic, in percent
– time
– manual

Fully Automatic Mode:
The analysis will end according to the calculated point of inflection on the analysis curve.
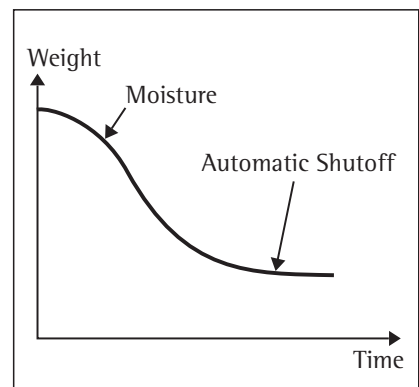
Semi-automatic, absolute:
The analysis ends as soon as the weight loss of a selectable time unit is less than the defined limit, which can be selected in milligrams. You will need to enter the time unit and the weight loss.

Semi-automatic, in percent:
The analysis ends as soon as the weight loss during a specified time period is less than the defined limit, which can be selected in percent of the initial weight. You will need to enter the time unit and the weight loss with reference to the initial weight.
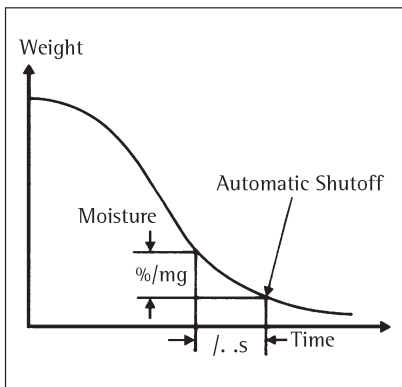
Time:
The analysis ends as soon as the entered time has elapsed.

Manual:
You must press the Stop key to end an analysis.

Display Mode
The following units can be selected for displaying analysis results:
– Moisture   %M
  decimal places, selectable
  (with conversion factor)
– Dry weight   %S
  decimal places, selectable
– Ratio   %MS
  decimal places, selectable
– Weight loss   mg
– Residue   g
– Residue   g/kg
– Grams/liter   g/l

Intermediate Results Printout
Intermediate results can be printed either at user-definable time intervals or by pressing the PRINT key.

Analysis Number for Automatic Consecutive Counting
– The analysis number can be counted automatically for all analyses performed in sequence:
– Press the Next soft key to save this number
– The number is set to 1 automatically each time the analyzer is activated
– Numbers are printed out in the header for each analysis

Analysis with Former Sample (100% function)
The sample weight of the last analysis is calculated as 100% for the next analysis

4 Identification Codes (IDs)
Identification codes can be entered for each drying program (such as Dairy Farm, Berlin, powdered milk, Lot 1):
– For user-defined printouts
– Maximum of 20 characters for the "Name" of 4 identification codes (first part)
– The related values (last part) can be entered after pressing the ID soft key during the analysis runs

Factory Settings
The drying programs can be reset to the factory settings.

Searching for Programs
In the program memory (after pressing the Prog. soft key):
– Soft key ∨ and ∧
– Enter the desired program number and press the Number soft key
– Enter the first or all characters of the desired program number and press the Name soft key
– Statistics included (statistically valid data are displayed)

Before activating the function "TARE: Tare the sample pan":
– Enter the desired program number and press the Prog. soft key

Printout of the Analysis Parameters

– When the desired program is displayed:
Press the [PRINT] key

> Printout (see example on the right)
Texts with more than 20 characters are truncated.

Extra Functions

The following functions are available in the program memory:

– Display programs

– Change the settings

– Copy or rewrite the programs by pressing the Copy soft key

– Load the programs by pressing the Load soft key

– Print out the list with program numbers and names

```
--------------------
13.07.2004      13:06
Mod          IR120Q
Ser. no.   90706913
Ver. no.   01-38-20
ID
--------------------
SETUP
        ANALYSIS
--------------------
Prg.              1
--------------------
 Program name
  Program name:
                  RYE
 Heating program
  Standard drying
   Temperature:
              105 'C
 Standby temperature
                  Off
 Bar graph for weigh
          Inactivated
 Start of analysis
  With stability + a
   Time delay:
                2 sec
 End of analysis
     Fully automatic
 Display mode
  Moisture        (%
   Number of decimal
    2 decimal places
   Conversion factor
    Factor:
           1.0000
   Print intermediate
                  Off
 Analysis ID # with
                  No
 Analysis w/formers
                  No
 Identification #
  ID1:
           COMPANY:
  ID2:
             CITY:
  ID3:
              LOT:
  ID4:
             NAME:
--------------------
```

Function Keys (Soft Keys)

Info	Intermediate results for phase drying
Prog.	Parameter setting for drying programs
Stat.	Statistics on the analyses of the selected drying program
ID	Data input for 4 identification codes (IDs)
Mode	Parameter settings: "Decimal places," "Weighing result," "Display mode," "Intermediate results printout"
Tare	Tare sample pan
Load	Load the selected drying program as the current program
Copy	Store the current parameter settings in the selected program location

Displaying Analysis Data

Overview

```
Moisture ———————— Info ——————————— Display intermediate and final results
analyzer is      (Analysis information)   for phase drying
on
(I/O key)        Prog. ————————————— see page 30,
                 (Drying programs)       "Setting the Drying
                                         Parameters"

                 Stat. ————————————— Display statistics

                 ID ——————— ID1  20 characters
                 (Identification codes;  ID2  20 characters
                 IDs)                    ID3  20 characters
                                        ID4  20 characters

                 Mode ——————— Display mode ——— o  moisture (%M) ——— 1 decimal place
                                                                     o  2 decimal places
                                                                        3 decimal places
                                               Dry weight (%S) ——— 1 decimal place
                                                                     o  2 decimal places
                                                                        3 decimal places
                                               Ratio (%MS) ——— 1 decimal place
                                                                     o  2 decimal places
                                                                        3 decimal places

                                               Weight loss (mg)
                                               Residue (g)
                                               Residue (g/kg)
                                               Grams/liter (g/l)

                              Intermediate ——— o  Off
                              results printout      On
                              Internal printer ——— Off
                                                 o  On
                              Limits for ——————— Lower limit       0.00   0.00 to 99.99
                              control function    Upper limit    100.00   0.01 to 100.00
```

Factory setting (column 1)
Factory setting (column 2)

o = Factory setting

Identification Codes (IDs)
You can use codes to identify current analyses, and can enter 4 IDs for each analysis.

Every ID consists of a generic name and a specific name, both of which are user-definable. The generic ID name (left part) is normally a proper name and can be entered during the respective drying program (such as the company, city, etc.).
The specific ID names are entered for the current analysis and exist only once.

Features:

Enter, change and delete function for all 4 IDs (ID soft key)

Enter the first identification code (ID1) directly using the numeric keys

Maximum of 20 characters for every generic ID name

Maximum of 20 characters for every specific ID name

Each ID is printed once in any place on the printout.

The generic name printout is left-justified; the specific name printout, right-justified. A specific name is printed in the next line if the generic and specific names exceed the character line limit. The identification line is skipped if generic and specific names contain no characters at all.

```
ID
COMPANY:                DAIRY FARM
CITY:                       BERLIN
LOT:            POWDERED MILK NO 1C5
NAME:                    JOHN MEYER

<<                            v
```

Entering Specific ID Names

```
COMPANY:  DAIRY FARM
CITY:       BERLIN
LOT:
POWDERED MILK NO 1C5
NAME:     JOHN MEYER
```

ID line printout

Mode

Parameters listed in the overview (see previous page) under the `Mode` item can be temporarily changed. Each time the moisture analyzer is turned on and off or after parameters are changed in the Program or Setup menu, the temporarily changed parameters are deleted and overwritten by the parameters of the currently loaded drying program (except for the limits for control function).

Features:

Display parameters

Change parameters

```
MODE
Weight resolution for analysis
Display mode
Print intermediate results
Internal printer
Limits for control function
   <<    |      |      |      |  v   |  >
```

Example for Mode: Temporarily Changing the Unit for the Display Mode
You can temporarily change the unit for the display mode.

● Select `MODE`: press the `Mode` soft key

● Select `Display mode`: press the `v` soft key

● Confirm `Display mode`: press the `>` soft key

> Display mode appears

● Select the desired unit: press the `v` soft key repeatedly

● Confirm the desired unit: press the `>` soft key

> Decimal places are displayed

● Select the number of decimal places: press the `v` soft key repeatedly

● Confirm the number of decimal places: press the `↵` soft key

● Exit `MODE`: press the `<<` soft key

Info

During the drying program with phase drying as the heating program, intermediate results of the drying phases can be displayed after the respective analysis time has elapsed. The final result is displayed at the end of the analysis.

Features:
Displays drying phases including time and moisture loss

Displays final results at the end of analysis

If the display mode is set to weight loss (mg), values are displayed in mg; otherwise, as moisture (%M)

```
MESS-INFO
1:   2.0min    Res1  +     2.00 %M
2:   3.0min    Res2  +     5.54 %M
3:   4.0min
----------    ------------------

   <<    |      |      |      |      |
```

Displays information on an analysis run after drying phase 2

Statistics

Statistics are listed for each drying program. The following values can be displayed:
– Last analysis result
– Last analysis time
– Number of analyses
– Average (mean value)
– Standard deviation
– Lowest value (minimum)
– Highest value (maximum)

Features:
Statistics on the moisture analysis results for up to 9999 analyses

Statistics stored as a part of the data record for moisture analysis parameters

Update at the end of analysis routine

No update after 10,000 analyses, analysis cancel, analysis with former sample (100% function), at the end of a asap analysis

Delete the last analysis result by pressing the `M–` soft key

Delete the statistics data with the `Delete` soft key after you are prompted for confirmation

Use-defined printout of statisics data by using the `PRINT` key

```
PROG. 1      STATISTICS
Last Result   Res    +      16.30 %M
Last Time     Time           1.8 min
No. of analys. n                  3
Mean value    Mittel+       16.42 %M
Std. deviation s            0.22 %M
   <<  | Delete |    |    |  v   |
```

Display of statistics data

```
--------------------
      STATISTICS
--------------------
P1                          1
--------------------
Res     +      7.411  %M
Time           4.3   min
n                2
Avg.    +      8.705  %M
s              1.830  %M
Min     +      7.411  %M
Max     +      9.999  %M
--------------------
```

Display of statistics (also available with GLP header and footer)
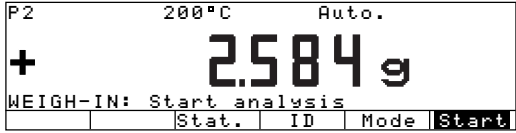
Example 1: Standard Drying with Fully Automatic Shutoff Mode
The moisture content of 2 g of corn starch is to be analyzed. The sample can scorch if overheated, but it is not overly heat sensitive. The analysis is to be ended automatically as soon as a constant weight is reached.
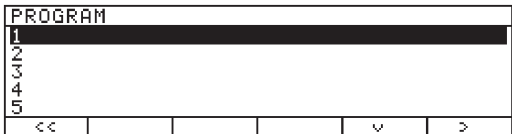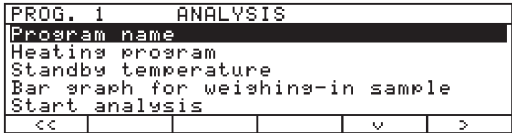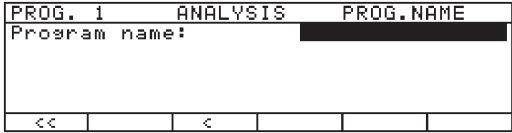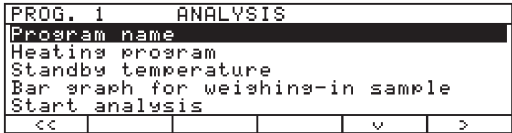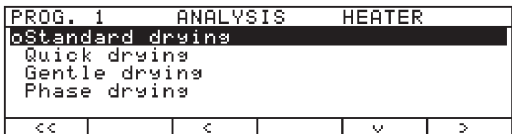
Settings (factory setting):
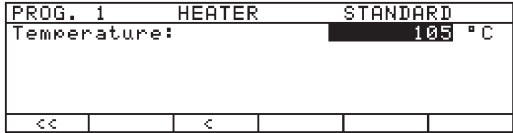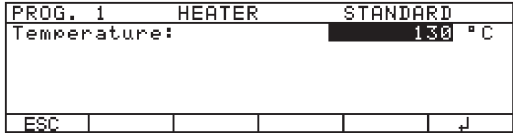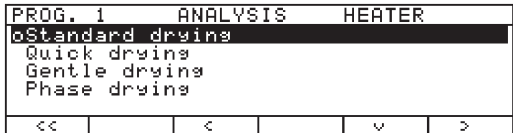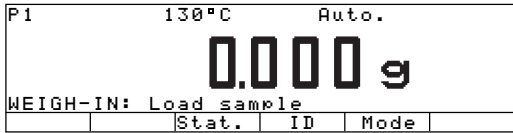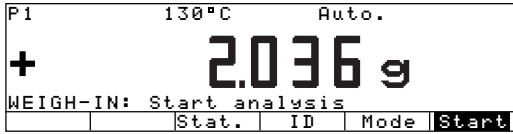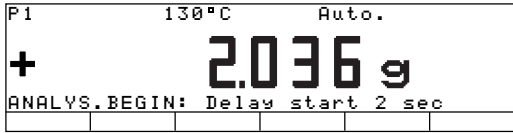
Program number: 1

Program name: corn starch
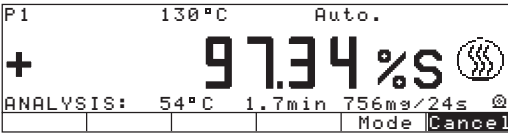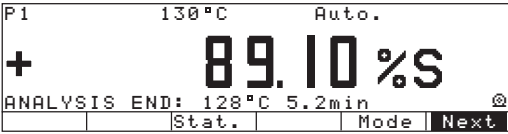
Final temperature: 130°C

End of analysis: automatic (different from the factory settings)

Step	Key (or instruction)	Display/Printout
1. Turn on the moisture analyzer	⌷ I/⏻ ⌷ key	Self-test runs
2. Enter the parameters for drying program	Prog. soft key	PROGRAM 1 2 3 4 5 `<<` ⌄ >
3. Select program "1"	> soft key	PROG. 1 ANALYSIS Program name Heating program Standby temperature Bar graph for weighing-in sample Start analysis `<<` ⌄ >
4. Select "Program name"	> soft key	PROG. 1 ANALYSIS PROG.NAME Program name: `<<` <
5. Enter the program name (e.g,. corn starch)	⌷ABC⌷ ⌷0⌷ ... ⌷9⌷ keys ABCDEF ... soft keys A B C D ... soft keys	PROG. 1 ANALYSIS PROG.NAME Program name: CORN STARCH ABCDEF|GHIJKL|MNOPQR|STUVWX|YZ/=-?|:#*"&
6. Confirm your input and exit the program	⌷ABC⌷ key ↵ soft key < soft key	PROG. 1 ANALYSIS Program name Heating program Standby temperature Bar graph for weighing-in sample Start analysis `<<` ⌄ >
7. Select the heating program	⌄ soft key > soft key	PROG. 1 ANALYSIS HEATER oStandard drying Quick drying Gentle drying Phase drying `<<` < ⌄ >

Step	Keys (or instruction)	Display/Printout

8. Select "Standard drying" program

`>` soft key

```
PROG.  1      HEATER      STANDARD
Temperature:               105 °C


   <<           <
```

9. Enter new final temperature (in this case: 130°C)

`1` `3` `0` soft keys

```
PROG.  1      HEATER      STANDARD
Temperature:               130 °C


 ESC                              ↵
```

10. Confirm the temperature and exit the input mode

`↵` soft key
`<` soft key

```
PROG.  1     ANALYSIS     HEATER
oStandard drying
 Quick drying
 Gentle drying
 Phase drying
   <<          <         ∨      >
```

11. Exit input mode for drying parameters

`< <` soft key twice

```
P1         130°C      Auto.
+        0.035 g
TARE: Tare sample pan
          Prog. Stat.   ID   Mode  Tare
```

12. Prepare the sample: not necessary for corn starch

13. Open the sample chamber

`⇅` key

Position the new sample pan

14. Tare the sample pan

`Tare` soft key

```
P1         130°C      Auto.
         0.000 g
WEIGH-IN: Load sample
                Stat.   ID   Mode
```

15. Spread approx. 2 g of corn starch uniformly on the sample pan
Close the sample chamber

`⇅` key

```
P1         130°C      Auto.
+        2.036 g
WEIGH-IN: Start analysis
                Stat.   ID   Mode  Start
```

16. Start the drying program

`Start` soft key

```
P1         130°C      Auto.
+        2.036 g
ANALYS.BEGIN: Delay start 2 sec
```

After 2 seconds' delay the header for the moisture analysis is printed

see next page

Step	Key (or instruction)	Display/Printout

The header for the moisture analysis is printed

```
P1         130°C      Auto.
+          2.036 g
ANALYS.BEGIN:                    ⌾
                         Mode  Cancel
```

```
--------------------
14.07.2004       13:10
Mod.           IR120Q
Ser. no.     90805355
Ver. no.     01-38-20
ID
--------------------
P1         CORN STARCH
Heating      STANDARD
Fin. temp.    130 'C
Stdby temp.      OFF
Start      W/STABIL.
End        AUTOMATIC
IniWt +    2.036 g
--------------------
```

The current moisture loss is displayed afterwards

```
P1         130°C      Auto.
+          0.05 %M  ⟨⟩
ANALYSIS:  37°C   0.8min ----mg/24s
                         Mode  Cancel
```

17. Set the display mode to dry weight display — Mode soft key

```
MODE
Display mode
Print intermediate results
Internal printer

   <<                        v      >
```

18. Confirm display mode — > soft key

```
MODE        DISPL. MODE
oMoisture        (%M)
 Dry weight      (%S)
 Ratio           (%MS)
 Weight loss     (mg)
 Residue         (g)
   <<          <           v      >
```

19. Select dry weight and confirm — v soft key / > soft key

```
MODE        DISPL. MODE DRY WEIGHT
 1 decimal place
o2 decimal places
 3 decimal places

   <<          <      ^      v      ┘
```

20. Leave decimal places unchanged — < soft key

```
MODE        DISPL. MODE
 Moisture        (%M)
oDry weight      (%S)
 Ratio           (%MS)
 Weight loss     (mg)
 Residue         (g)
   <<          <      ^      v      >
```
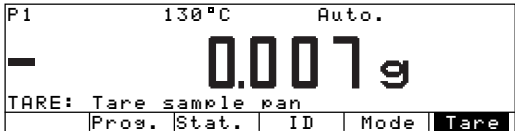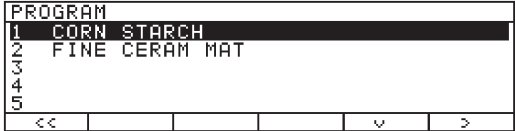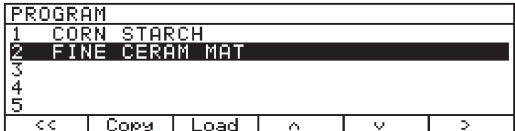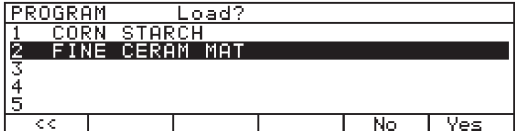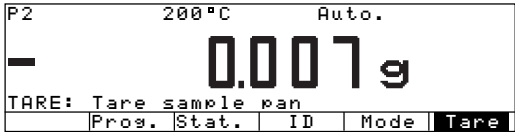
Step	Key (or instruction)	Display/Printout

21. Exit the parameter display
The residual dry weight
is displayed as a percentage
of the initial weight

       < < soft key

```
┌──────────────────────────────┐
│P1          130°C      Auto.   │
│                               │
│+       97.34 %S  ⌇⌇⌇         │
│ANALYSIS:  54°C  1.7min 756mg/24s  @│
│                    Mode Cancel│
└──────────────────────────────┘
```

Fully automatic shutoff of the drying
process, if no further weight
loss is registered
(in this case: after 5.2 minutes)

```
┌──────────────────────────────┐
│P1          130°C      Auto.   │
│                               │
│+       89.10 %S              │
│ANALYSIS END: 128°C 5.2min    @│
│          Stat.       Mode Next│
└──────────────────────────────┘
```

The footer for the moisture
analysis is printed

```
--------------------
Analys.Time  5.2 min
FinWt +     1.814 g
Res   +    89.10 %S
--------------------
```
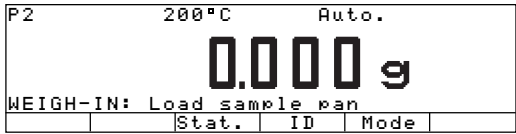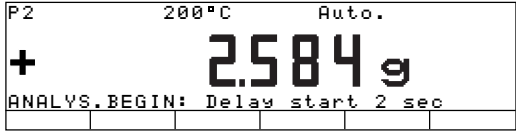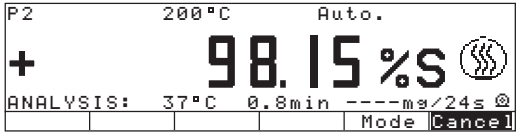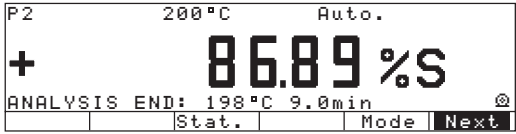
Example 2: Quick Drying with Fully Automatic Shutoff Mode
The moisture content of 2.5 g of fine ceramic material is to be determined. This non-heat-sensitive sample is to be analyzed as soon quickly possible. The analysis is to be ended automatically as soon as a constant weight is reached.

Settings (factory setting):

Program number: 2

Program name: fine ceramic material

Heating program: quick drying

Final temperature: 200°C

End of analysis: automatic (different from the factory settings)

Result displayed: dry weight (%S)

Step		Key (or instruction)	Display/Printout
1.	Turn on the moisture analyzer	⏻ key	Self-test runs
	The above mentioned parameters for drying program 2 "fine ceramic material" have already been set	Enter the parameters: see Example 1	P1 130°C Auto. ━ **0.007** g TARE: Tare sample pan Prog. Stat. | ID | Mode | Tare
2.	Select program display	Prog. soft key	PROGRAM 1 CORN STARCH 2 FINE CERAM MAT 3 4 5 \<\< ∨ \>
3.	Select program "2"	∨ soft key	PROGRAM 1 CORN STARCH 2 FINE CERAM MAT 3 4 5 \<\< Copy Load ∧ ∨ \>
4.	Load program "fine ceramic material" as the current drying program	Load soft key	PROGRAM Load? 1 CORN STARCH 2 FINE CERAM MAT 3 4 5 \<\< No Yes
5.	Confirm load prompt	Yes soft key	P2 200°C Auto. ━ **0.007** g TARE: Tare sample pan Prog. Stat. | ID | Mode | Tare
6.	Prepare the sample: Cut the fine ceramic material into thin slices		
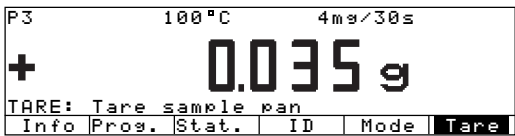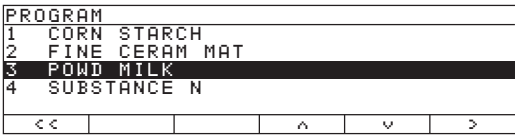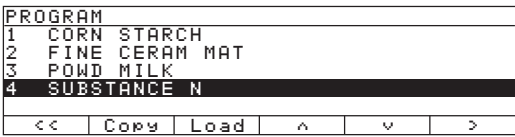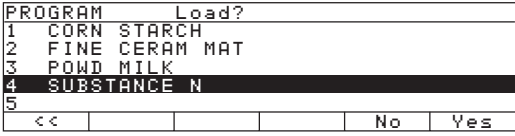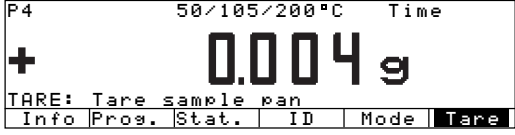
Step	Key (or instruction)	Display/Printout
7. Open the sample chamber	⏬ key	P2 200°C Auto. **0.000 g** WEIGH-IN: Load sample pan Stat. | ID | Mode
Position a new sample pan	_/	
8. Tare the sample pan	Tare soft key	
9. Distribute approx. 2.5 g of fine ceramic material uniformly on the sample pan Close the sample chamber	_/ ⏬ key	P2 200°C Auto. + **2.584 g** WEIGH-IN: Start analysis Stat. | ID | Mode | Start
10. Start the drying program	Start soft key	P2 200°C Auto. + **2.584 g** ANALYS.BEGIN: Delay start 2 sec
After 2 seconds' delay, the header for the moisture analysis will be printed		-------------------- 14.07.2004 14:10 Mod. IR120Q Ser. no. 90805355 Ver. no. 01-38-20 ID -------------------- P2 FINE CERAM MAT Heating QUICK Fin. temp. 200 'C Stdby temp. OFF Start W/STABIL. End AUTOMATIC IniWt + 2.584 g --------------------
The current moisture loss will be displayed afterwards		P2 200°C Auto. + **98.15 %S** ANALYSIS: 37°C 0.8min ----mg/24s @ Mode | Cancel
Fully automatic shutoff of the drying process, if no further weight loss is registered (in this case: after 9 minutes)		P2 200°C Auto. + **86.89 %S** ANALYSIS END: 198°C 9.0min @ Stat. | Mode | Next
The footer for the moisture analysis is printed		-------------------- Analys.Time 9.0 min FinWt + 2.246 g Res + 86.89 %S --------------------
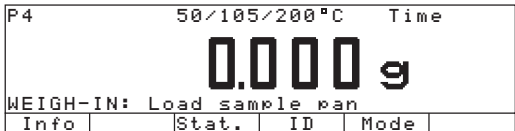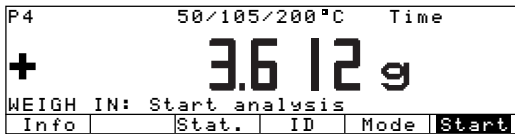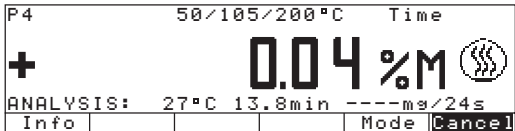
Example 3: Gentle Drying with Semi-automatic Shutoff Mode
The moisture content of 3.5 g of an unknown substance is to be determined. The sample to be analyzed is known to contain surface moisture and the moisture of two bound fractions. The three moisture contents are to be individually quantified by drying.

Settings (different from the factory settings):

Program number:	4
Program name:	substance N
Heating program:	phase drying
Termperature 1:	50°C
Time 1:	4 minutes
Temperature 2:	105°C
Time 2:	6 minutes
Final temperature:	200 °C
End of analysis:	Time: 4 minutes
Printout footer:	Phase results (for input sequence see the chapter entitled "Configuring the Moisture Analyzer")

Step	Key (or instruction)	Display/Printout
1. Turn on the moisture analyzer	[I/Ⓞ] key	Self-test runs
The above mentioned parameters for drying program 4 "Substance N" have already been set	Enter the parameters: see Example 1	```P3 100°C 4mg/30s``` ```+ 0.035 g``` ```TARE: Tare sample pan``` ```Info Prog. Stat. ID Mode Tare```
2. Select program display	Prog. soft key	```PROGRAM``` ```1 CORN STARCH``` ```2 FINE CERAM MAT``` ```3 POWD MILK``` ```4 SUBSTANCE N``` ```<< ^ v >```
3. Select program "4"	v soft key	```PROGRAM``` ```1 CORN STARCH``` ```2 FINE CERAM MAT``` ```3 POWD MILK``` ```4 SUBSTANCE N``` ```<< Copy Load ^ v >```
4. Load the program "Substance N"	Load soft key	```PROGRAM Load?``` ```1 CORN STARCH``` ```2 FINE CERAM MAT``` ```3 POWD MILK``` ```4 SUBSTANCE N``` ```5``` ```<< No Yes```
5. Confirm load prompt	Yes soft key	```P4 50/105/200°C Time``` ```+ 0.004 g``` ```TARE: Tare sample pan``` ```Info Prog. Stat. ID Mode Tare```

Step	Key (or instruction)	Display/Printout

6. Prepare the sample — see the section on "Preparing a Sample"

7. Open the sample chamber — ⬆⬇ key

Position a new sample pan — ⌣

```
P4           50/105/200°C    Time
       0.000 g
WEIGH-IN: Load sample pan
 Info        Stat.   ID   Mode
```

8. Tare the sample pan — Tare soft key

9. Apply approx. 3.5 g of the substance uniformly to the sample pan
Close the sample chamber — ⬆⬇ key

```
P4           50/105/200°C    Time
+      3.6 l2 g
WEIGH IN: Start analysis
 Info        Stat.   ID   Mode  Start
```

10. Start the drying program — Start soft key

```
P4           50/105/200°C    Time
+      3.6 l2 g
ANALY.BEGIN: Start delay 2sec
```

After 2 seconds' delay the header for moisture analysis is printed

```
--------------------
14.07.2004        16:10
Mod.             IR120Q
Ser. no.       90805355
Ver. no.       01-38-20
ID
--------------------
P4         SUBSTANCE N
Heating        PHASES
 Temp.1         50 'C
 Time1        4.0 min
 Temp.2        105 'C
 Time 2       6.0 min
 Fin.temp.    200 'C
Stdby temp.       OFF
Start       W/STABIL.
End              TIME
 Time        4.0 min
IniWt +     3.612 g
--------------------
```

The current moisture loss is displayed afterwards

```
P4           50/105/200°C    Time
+      0.04 %M (≋)
ANALYSIS:  27°C 13.8min ----mg/24s
 Info                    Mode  Cancel
```
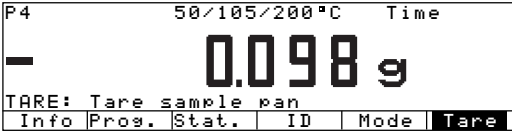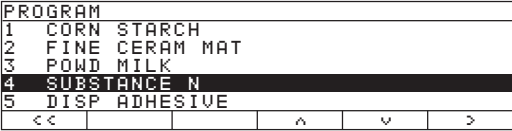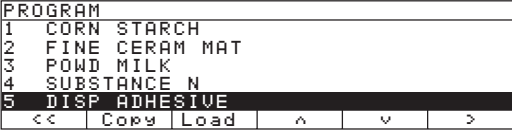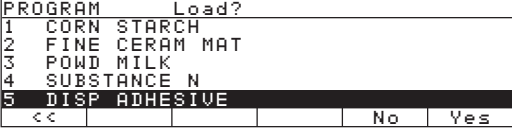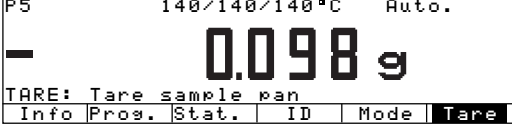
Step	Key (or instruction)	Display/Printout

The sample is preheated to 50°C. After 4 minutes, the sample is heated to 105°C.

11. Display the analysis information (The moisture loss during phase 1 is displayed; in this case, 2.00%M) — **Info** soft key

```
INFO
1:    4.0min    Res1  +      2.00 %M
2:    6.0min
3:    4.0min
----------        --------------------

   <<
```

12. Exit ANALYS. INFO display — **<<** soft key

After an additional 6 minutes, the sample is heated to 200°C.

```
P4           50/105/200°C   Time
+          2.8 I %M (((
ANALYSIS: 105°C   8.2min 20mg/24s
 Info                        Mode Cancel
```

13. Display the analysis information (The moisture loss during phase 2 is displayed; in this case: 5.54%M) — **Info** soft key

```
INFO
1:    4.0min    Res1  +      2.00 %M
2:    6.0min    Res2  +      5.54 %M
3:    4.0min
----------        --------------------

   <<
```

14. Exit ANALYS. INFO display — **<<** soft key

```
P4           50/105/200°C   Time
+          9.78 %M (((
ANALYSIS: 200°C   2.2min 46mg/24s
 Info                        Mode Cancel
```

After the analysis time has elapsed, the footer for moisture analysis is printed.

```
Analys.Time 14.0 min
FinWt +     3.040 g
--------------------

Res1  +      2.00 %M
Res2  +      5.54 %M
Res3  +      6.30 %M
--------------------

Res   +     13.84 %M
--------------------
```

13. Display the analysis information after the analysis time has elapsed (The moisture loss of phases 1, 2 and 3 and the final result are displayed) — **Info** soft key

```
INFO
1:    4.0min    Res1  +      2.00 %M
2:    6.0min    Res2  +      5.54 %M
3:    4.0min    Res3  +      6.30 %M
----------        --------------------
   14.0min    Res   +     13.84 %M
   <<
```
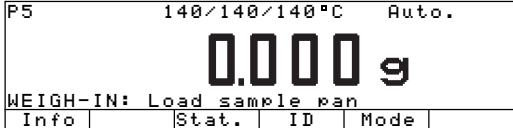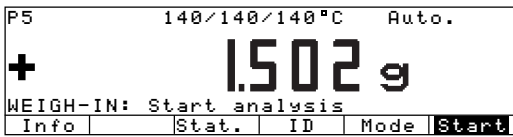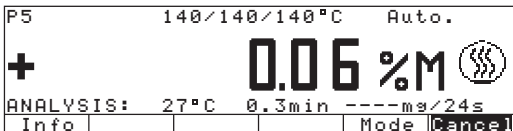
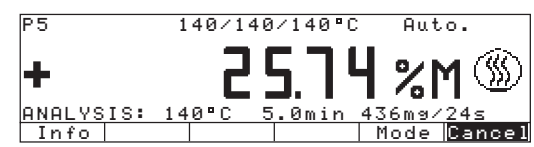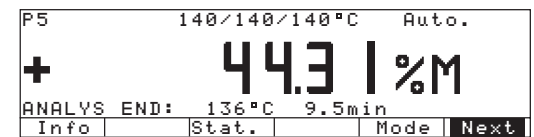**Example 4: Timer Shutoff Combined with Fully Automatic Shutoff Mode**
The moisture content of 1.5 g of dispersion adhesive is to be analyzed. While heating, the product forms a skin that makes it difficult for moisture to evaporate from the sample. Increased moisture loss causes this skin to crack, enabling the moisture to evaporate easily again from the sample. To prevent the moisture analyzer from shutting off too early during the initial phase, a minimum time for the drying procedure is entered. The analysis is to be ended automatically as soon as a constant weight is reached.

Settings (different from the factory settings):

Program number:	5
Program name:	dispersion adhesive (disp. adhesive)
Heating program:	phase drying
Termperature 1:	140°C
Time 1:	5 minutes
Temperature 2:	140°C
Time 2:	0 minutes
Final temperature:	140°C
End of analysis:	automatic (factory setting)
Printout footer:	Phase results (see also the chapter entitled "Configuring the Moisture Analyzer")

Step	Key (or instruction)	Display/Printout
1. Turn on the moisture analyzer	I/⏻ key	Self-test runs
The above-mentioned parameters for drying program 4 "Substance N" have already been set	Enter the parameters: see Example 1	P4 50/105/200°C Time **0.098 g** TARE: Tare sample pan Info Prog. Stat. ID Mode Tare
2. Select program display	Prog. soft key	PROGRAM 1 CORN STARCH 2 FINE CERAM MAT 3 POWD MILK 4 SUBSTANCE N 5 DISP ADHESIVE << ^ ∨ >
3. Select program "5"	∨ soft key	PROGRAM 1 CORN STARCH 2 FINE CERAM MAT 3 POWD MILK 4 SUBSTANCE N 5 DISP ADHESIVE << Copy Load ^ ∨ >
4. Load the program "Disp adhesive"	Load soft key	PROGRAM Load? 1 CORN STARCH 2 FINE CERAM MAT 3 POWD MILK 4 SUBSTANCE N 5 DISP ADHESIVE << No Yes
5. Confirm load prompt	Yes soft key	P5 140/140/140°C Auto. **0.098 g** TARE: Tare sample pan Info Prog. Stat. ID Mode Tare

Step	Key (or instruction)	Display/Printout

6. Prepare the sample: not necessary for dispersion adhesive

7. Open the sample chamber   [⇅] key

    Position a new sample pan   ___/

8. Tare the sample pan   T a r e soft key

```
P5            140/140/140°C    Auto.
         0.000 g
WEIGH-IN: Load sample pan
 Info        |Stat. | ID  | Mode |
```

9. Apply approx. 1.5 g of dispersion adhesive uniformly to the sample pan
Close the sample chamber   [⇅] key

```
P5            140/140/140°C    Auto.
+        1.502 g
WEIGH-IN: Start analysis
 Info        |Stat. | ID  | Mode |Start
```

10. Start the drying program   S t a r t soft key

```
P5            140/140/140°C    Auto.
+        1.502 g
ANALY.BEGIN: Start delay 2sec
```

After 2 seconds' delay the header for moisture analysis is printed

```
--------------------
14.07.2004       17:10
Mod.          IR120Q
Ser. no.    90805355
Ver. no.    01-38-20
ID
--------------------
P5      DISP ADHESIVE
Heating        PHASES
 Temp.1      140 'C
 Time1       5.0 min
 Temp.2      140 'C
 Time2       0.0 min
 Fin. temp.  140 'C
Stdby temp.      OFF
Start      W/STABIL.
End        AUTOMATIC
IniWt +    1.502 g
--------------------
```

The current moisture loss displayed afterwards

```
P5            140/140/140°C    Auto. (~)
+        0.06 %M
ANALYSIS:   27°C  0.3min ----mg/24s
 Info        |      |     | Mode |Cancel
```

Step	Key (or instruction)	Display/Printout

The sample is heated to
140°C and dried for at least
5 minutes (phase 1).

```
P5              140/140/140°C    Auto.
+        25.74 %M  ♨
ANALYSIS: 140°C   5.0min 436mg/24s
 Info |      |       |     Mode |Cancel|
```

If a constant weight has not been
reached after 5 minutes, the
drying process is continued
until a constant weight is reached
(in this case: after 9.5 minutes).

```
P5              140/140/140°C    Auto.
+        44.31 %M
ANALYS END:   136°C    9.5min
 Info |      |Stat. |     Mode | Next |
```

After the constant weight has been
reached, the footer for the
moisture analyzer is printed.

```
Analys.time  9.5 min
FinWt +     0.836 g
--------------------
Res1   +      25.74  %M
Res2   +       0.00  %M
Res3   +      18.57  %M
--------------------
C-Res  +      44.31  %M
--------------------
```

"isoTEST" Calibration/Adjustment Functions

The following functions are available:

[TEST] key
├─ Weighing system settings
│ ├─ Ext. cal./adj.: factory-defined weight
│ ├─ Ext. cal./adj.: user-defined weight
│ ├─ Internal cal./adjustment
│ ├─ "reproTEST"
│ └─ Weighing (only)
│
└─ Hardware tests
   ├─ Test interfaces
   ├─ Heater test
   └─ Heater adjustment

If the sample pan and the pan support are removed from the sample chamber, you can access the following functions:

[TEST] key
│
└─ Heater adjustment
   ├─ 2-point temperature adjustment
   └─ 1-point temperature adjustment

Heater Adjustment
Using 1-point and 2-point temperature adjustment and a temperature adjustment set (Accessories) you can calibrate and adjust temperature settings of the drying unit.

Weighing System Settings

Calibration, Adjustment

Purpose
Calibration is the determination of the difference between the weight readout and the true weight (mass) of a sample. Calibration does not entail making any changes within the weighing system.

Adjustment is the correction of the difference between the measured value displayed and the true weight (mass) of a sample, or the reduction of the difference to an allowable level within maximum permissible error limits.

Features
Calibration can be performed externally or internally.

External calibration can be performed:
– with a factory-defined weight
– with a user-defined weight

You can have calibration and adjustment results documented as a ISO/GLP-compliant printout; see the next page.

Selecting the Calibration/Adjustment Mode

After pressing the [TEST] key and selecting the menu item
Weighing System Settings

you can select one of the following modes:

– External calibration/adjustment with a factory-defined weight
   Ext.cal./adj.:
   factory-def.wt

– External calibration/adjustment with a user-defined weight
   Ext.cal./adj.:
   user-def.wt

– Internal calibration/adjustment
   Int.cal./adj.

– Repeatability test reproTEST

– Weighing only Weighing

   Start the desired mode:
● Press the > soft key

● Press the Start soft key

External Calibration/Adjustment with a Factory-Defined Weight
Externally calibrate weighing system and adjust using factory-defined (standard) weight

Step	Key (or instruction)	Display/Printout
1. Select isoTEST function	TEST key	isoTEST **Weighing system settings** Hardware Tests `<<` `∨` `>`
2. Select "Weighing system settings"	> soft key	isoTEST WGH.SYS. **Ext. cal./adj.; factory-def. wt.** Ext. cal./adj.; user-defined wt. Internal cal./adjustment reproTEST Weighing `<<` `<` `∨` `>`
3. Select external calibration/adjustment with factory-defined weight (tare the weighing system, if necessary)	> soft key	**0.000 g** WGH.SYS: Ext. cal. factory-def. wt `<<` `Start` `Tare`
4. Start external calibration	Start soft key	**– 50.000 g** WGH.SYS: Ext. cal. factory-def. wt
5. Place standard weight (e.g., 50 g) on the analyzer Minus sign –: weight too low Plus sign +: weight too high No plus/minus sign: weight o.k. This is displayed after calibration:	Load standard weight	**50.000** WGH.SYS: Ext. cal. factory-def. wt **+ 0.001 g** WGH.SYS: Ext. adj. factory-def. wt `End` `Start`
6. If you do not need to adjust the weighing system	End soft key	-------------------- 07.09.2004 13:03 Mod. IR120Q Ser. no. 90805355 Ver. no. 01-38-20 ID -------------------- External calibration Nom. + 50.000 g Diff. + 0.001 g -------------------- 07.09.2004 13:03 Name: --------------------

Step	Key (or instruction)	Display/Printout

Otherwise, adjust the analyzer
This is displayed after adjustment:

Start soft key

```
+       50.000 g
WGH.SYS: Ext. cal. factory-def. wt
  <<                    |Start| Tare
```

```
--------------------
07.09.2004      13:04
Mod.         IR120Q
Ser. no.   90805355
Ver. no.   01-38-20
ID
--------------------
External calibration
W-ID
Nom.   +   50.000 g
Diff. +    0.001 g
External adjustment
           completed
Diff.      0.000 g
--------------------
07.09.2004      13:04
Name:
--------------------
```

7. Unload the device

**External Calibration/Adjustment
with a User-defined Weight**

You can define a weight for
calibration/adjustment. External
calibration/adjustment must be
performed with weights that are
traceable to a national standard and
that have error limits which are at
least 1/3 of the required tolerance of
the display accuracy. The defined
weight must equal at least 10% of the
maximum weighing capacity.

See page 50 for the external
calibration/adjustment sequence.
For this example, select "Ext. cal./adj.;
user-defined weight."

The moisture analyzer has a factory-
set calibration weight value (see
"Specifications").
Enter the factory-defined value manu-
ally:

● Select Setup menu:
  Press the SETUP key

● Select menu item
  Device parameters

● Select menu item
  Calibration/adjustment

● Change Cal./Adj. wt.

Internal Calibration/Adjustment
Inside the moisture analyzer is a built-in motorized calibration weight.

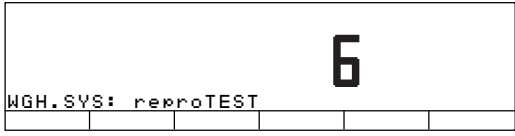| Step	Key (or instruction)	Display/Printout
1. Select isoTEST function	[TEST] key	isoTEST **Weighing system settings** Hardware Tests `<<` ‖ ‖ ‖ ‖ `v` ‖ `>`
2. Select "Weighing system settings" function	`>` soft key	isoTEST WGH.SYS. **Ext. cal./adj.; factory-def. wt.** Ext. cal./adj.; user-defined wt. Internal cal./adjustment reproTEST Weighing `<<` ‖ ‖ `<` ‖ `v` ‖ `>`
3. Select "Internal calibration/ adjustment"	`v` soft key twice `>` soft key	**+ 0.001 g** WGH.SYS: Internal calibration `<<` ‖ ‖ ‖ Start ‖ Tare
4. Start internal calibration sequence Internal calibration weight is applied automatically The weighing system is calibrated The internal calibration weight is removed from the weighing system This is displayed after calibration:	Start soft key	**+ 0.001 g** WGH.SYS: Internal adjustment End ‖ ‖ ‖ Start ‖
6. If you do not need to adjust the weighing system Otherwise, adjust the weighing system The weighing system is adjusted This is displayed after adjustment:	End soft key Start soft key	Calibration printout is generated ** 0.000 g** WGH.SYS: Internal calibration `<<` ‖ ‖ ‖ Start ‖ Tare Adjustment printout is generated

Repeatability Test "reproTEST"

Purpose
The "reproTEST" function automatically determines the repeatability of results (based on six individual measurements). In this way, the weighing system determines one of the most important quantities.

Definition
Repeatability is the ability of the weighing system in the moisture analyzer to display identical readouts when it is loaded several times with the same weight under constant ambient conditions.

The standard deviation for a given number of measurements is used to quantify the repeatability.

Testing the Weighing System Repeatability

Step	Key (or instruction)	Display/Printout
1. Select isoTEST function	TEST key	isoTEST Weighing system settings Hardware Tests `<<` ∨ >
2. Select "Weighing system settings" function	> soft key	isoTEST WGH.SYS. Ext. cal./adj.; factory-def. wt. Ext. cal./adj.; user-defined wt. Internal cal./adjustment reproTEST Weighing `<<` < ∨ >
3. Select "reproTEST" and confirm	∨ soft key three times > soft key	+ 0.00 l g WGH.SYS: reproTEST Start Tare
4. Start the repeatability test	Start soft key	
5. Number of measurements is displayed; 6 measurements will now be performed		6 WGH.SYS: reproTEST
The standard deviation is displayed		0.00 l g WGH.SYS: reproTEST End Start
6. End reproTEST or restart reproTEST	End soft key Start soft key	Report is printed.

Hardware Tests

Purpose
Hardware tests are performed to check whether the system communication with internal and external devices functions properly. These tests are not elementary hardware tests.

The following device elements can be tested:
– SBI communication
– Internal printer
– Digital I/O communications port
– Heater test
– Heater adjustment

Activating Hardware Tests

Step	Key (or instruction)	Display/Printout
1. Select isoTEST function	TEST key	isoTEST **Weighing system settings** Hardware Tests `<<` ∨ >
2. Select function hardware tests and confirm	∨ soft key > soft key	isoTEST HARDWARE **Test interfaces** Heater test Heater adjustment `<<` `<` ∨ >

Testing SBI Communication

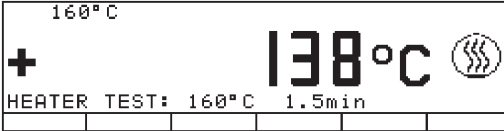| Step	Key (or instruction)	Display/Printout
1. Prepare the test connector for the RS-232 port (see "Pin Assignment Chart")	Connect T×D (pin 2) with R×D (pin 3)	
2. Select "Hardware tests"	see above	
3. Select "Test interfaces" function and confirm	> soft key	isoTEST HARDWARE INTERFACE **Test SBI communication** Internal printer test Digital I/O test `<<` `<` ∨ >
4. Confirm "SBI communication test" function	> soft key	HARDWARE Interface SBI Result: `<<`
At the end of the test, the result is displayed: Test error or: Test OK (in this case, Test error) (the test is repeated continuously)		HARDWARE Interface SBI Result: **Test error** `<<`
5. Exit "SBI communication test"	`<<` soft key	

Testing the Internal Printer

Step	Key (or instruction)	Display/Printout
1. Select "Hardware tests"	see above	
| 2. Select "Test interfaces" function and confirm | > soft key | ```
isoTEST     HARDWARE     INTERFACE
Test SBI communication
Internal printer test
Digital I/O test
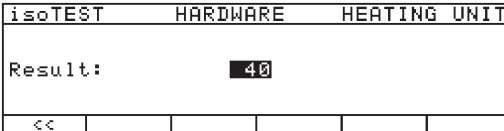
   <<           <           v       >
``` |
| 3. Select "Internal printer test" function and confirm | v soft key<br>> soft key | ```
HARDWARE     Interface     INT.PRINTER

Result:

   <<
``` |
| If the test is passed: | | All printable characters will be output on the internal printer |
| At the end of the test, the following result is displayed: Test error or: End of test (in this case: End of test) | | ```
HARDWARE     INTERFACE     INT.PRINTER

Result:              End of test

   <<
``` |
| 4. Exit internal printer test | << soft key | |

Testing Digital I/O Ports

Step	Key (or instruction)	Display/Printout
1. Prepare the test connector for the RS-232 port (see "Pin Assignment Chart")	Connect universal key (pin 15) with digital I/O port (pin 16 ... pin 19) to be tested	
2. Select "Hardware tests"	see the previous page	
| 3. Select "Test interfaces" function and confirm | > soft key | ```
isoTEST     HARDWARE     INTERFACE
Test SBI communication
Internal printer test
Digital I/O test

   <<           <           v       >
``` |
| 4. Select "Digital I/O port test" function and confirm | v soft key twice<br>> soft key | ```
HARDWARE     Interface     DIGITAL-I/O

Result:

   <<
``` |
| "Test error" or "Test OK" is displayed for each I/O port. The test starts over again with the first port once the last port has been tested. | | ```
HARDWARE     Interface     DIGITAL-I/O
                         1: Test error
                         2: Test ok
Result:                  3: Test error
                         4: Test error
   <<
``` |
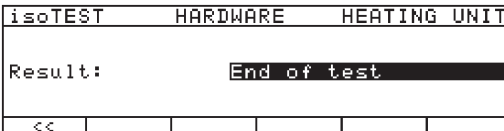| 5. Exit digital I/O port test | << soft key | |

Testing the Heater

Step	Key (or instruction)	Display/Printout
1. Select "Hardware tests"	see the previous page	
| 2. Select "Heater test" and confirm | ˅ soft key<br>˃ soft key | ```
  160°C
+           24°C
HEATER TEST:
                    Start
``` |
| 3. Start the heater test<br>After initialization, the current temperature (in this case: 138°C) and test time (in this case: 1.5 min) are displayed<br>If the sample chamber is opened, the test stops until the sample chamber is closed again.<br>After a brief time interval, the device reaches the nominal temperature. | Start soft key | ```
  160°C
+           138°C  (((
HEATER TEST: 160°C  1.5min
```<br>```
  160°C
+           160°C  (((
HEATER TEST: 160°C  1.7min
``` |
| 4. Exit the heater test | CLEAR soft key | |

Heating Unit Adjustment

Purpose
After transporting or replacing the heating unit:
Determine the parameters that allow gentle opening and closing of the heating unit.

Step	Key (or instruction)	Display/Printout
1. Select "Hardware tests"	see the previous page	
| 2. Select "Heater adjustment" and confirm<br><br>Open and close the sample chamber 20 times.<br><br>When the test is concluded, the result is displayed:<br>Either: Test Error or Test over | ˅ soft key twice<br>˃ soft key | ```
isoTEST   HARDWARE   HEATING UNIT

Result:          40

  <<
```<br>```
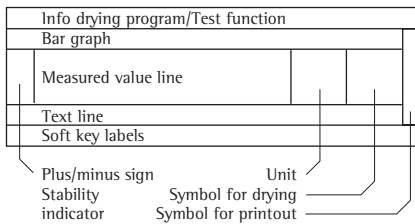isoTEST   HARDWARE   HEATING UNIT

Result:       End of test

  <<
``` |
| 3. Exit "Heater adjustment" | ˂˂ soft key | |

Data Output

There are three options for data output:

– Output to the moisture analyzer

– Output to an internal printer

– Output to a peripheral device (e.g., computer, external printer, PLC) via the interface port

Output to the Moisture Analyzer (Weights and Calculated Values)
The display is divided into 9 sections. Information about the weighing system, the application being used and the sample weighed is output in the following sections:

– Drying program info

– Bar graph

– Plus/ minus sign, stability symbol display

– Line for moisture analysis values

– Weight unit display

– Drying symbol

– Application symbol display

– Text line

Info drying program/Test function	
Bar graph	
Measured value line	
Text line	
Soft key labels	

Plus/minus sign   Unit
Stability   Symbol for drying
indicator   Symbol for printout

Drying Program Info
In this line, drying program data is displayed:

P3   – Program number

80/105/120°C   – Temperature data (for example: phase drying)

1.0%/60s   – Shutoff parameter

Bar Graph (Overview Display)
In the bar graph, weighing results are displayed either

0% ▮▪▪▪▪▪▪▪▪▪ ▪ ▪ ▪ ▪ ▪ ▪ ▮100% – as a percentage of the maximum weighing system capacity, or

▮▪▪▪▪▪▪▪▪▪▪▪▪ ▃▭▭▭▭ ▪▪ ▪   – in relation to a target value, with the tolerance limits indicated.

The bar graph is displayed if either "Minimum and maximum initial weight" or "Target weight, tolerance in %" for initial weight is selected in the drying program.

Plus/ Minus Sign, Stability Symbol
This section shows:

◈   – "Busy" symbol

＋ −   – Plus or minus sign

Line for Moisture Analysis Values
This line shows:

3.7482

– the current weight unit

7

– calculated values (e.g., % moisture)

35

– user-defined entries (e.g., preset tare)

Weight Unit Display
This section shows:

g

– the current weight unit (e.g., g)

$°C$

– the drying temperature unit

$\%M$

– the unit for calculated values (e.g., % moisture)

Drying Symbol
This section shows:

– the symbol for active heating

Application Symbol
This column shows:

– the symbol for current print job

Text Line
This line contains:

MESSUNG: 78°C 1.3min

– Explanatory text about the moisture analysis (e.g., temperature, time)

TDK-Abgleich fehlt

– Explanation of error codes

Soft Key Labels
This line shows:

Prog. Stat. ID Mode

– Texts (abbreviations) to indicate the function assigned to each arrow key

<< < ∧ ∨ > ↵

– Symbol for selecting and confirming parameter settings (see also the chapter entitled "Operating Design")

Interface Description

Purpose
The moisture analyzer has an interface port for connection to an external printer or computer (or other peripheral device).

External Printer
You can use an external printer to generate printouts and document settings.

Computer
Analyses and calculated values can be transmitted to a computer for further evaluation and recording. You can use a computer to monitor and remote-control the weighing system functions.

⚠ **Warning When Using Pre-wired RS-232 Connecting Cables!**
RS-232 cables purchased from other manufacturers often have incorrect pin assignments for use with Denver Instrument equipment! Be sure to check the pin assignments against the chart before connecting the cable and disconnect any lines marked "Internally Connected" (e.g., pin 6). Failure to do so may damage or even completely ruin your moisture analyzer and/or peripheral device.

Available Features

Type of interface:	Serial interface
Operating mode:	Full duplex
Standard:	RS-232
Transmission rates:	150; 300; 600; 1,200; 2,400; 4,800; 9,600; 19,200 baud
Number of data bits	7, 8 bit
Parity:	Space, odd, even
Number of stop bits:	1 or 2 stop bits
Handshake mode:	Software, hardware 1 character
Operating mode:	SBI, XBPI[1]
Network address[2]:	0, 1, 2, ..., 30, 31
Data output format of the weighing system:	22 characters + CR LF

[1] XBPI operating mode: 9,600 baud, 8 bits, odd parity, 1 stop bit
[2] Network address is only valid in the XBPI modes

Parameter Factory Settings for the Interface Port:

Transmission rate:	1,200 baud
Number of data bits	7 bits
Parity:	Odd
Stopbits:	1 stop bit
Handshake:	Hardware; 1 character
Operating mode:	SBI

Preparation
● See pages 64 and 65 for the pin assignment chart and cabling diagram.

Data Output Format

You can output the values, displayed in the corresponding line for moisture analysis values, and the weight unit with or without a data ID code.
Example: With data ID code
N   + 3.4253 g

The number of characters output per line depends on the moisture analyzer model:
– for an internal printer:
  24 characters per line

– SBI operating mode:
  20 characters per line

The output format described below is only valid for outputs of standard measured values(SBI: 20 characters + CR LF). If more characters are output, 2 spaces will be entered between the ID code I and plus/minus sign.

Output Format with 20 Characters + CR LF

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
I	I	I	I	I	I	+	*	D	D	D	D	D	D	D	D	*	U	U	U	CR	LF
	*	*	*	*	*	_		.	.	.	.	.	.	.	.		*	*	*		
								X	X	X	y	y	z	z							
							*		*	*	*	*	*	*	*	*					
								0	0	0	0	0	0								

I: ID code character[1]
*:   Space
D: Digit or letter
[1]   depends on the MA model

U: Unit symbol[1]
CR: Carriage return
LF: Line feed
XXX xx zz: Response to the query Esc ars_ ("Read Status")[2]

Error Codes

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S	t	a	t	*	*	*	*	*	E	R	R	*	#	#	#	*	*	*	*	CR	LF

*:   Space   # # #:   Error code number

ID code character I[1]

see page 21

Read Status: Active Application XXX[2]

M A N	Moisture analysis
S E T	Setup menu
T S T	isoTEST menu
C B A	Cal./adj. wgh.sys.
C H T	Heater adjustment
C M S	Analysis adjustment
T H W	Hardware test

Read Status:
Sample Chamber Status zz[2]

0	Sample chamber is completely opened
C	Sample chamber is completely closed
0 C	Sample chamber is being closed now
C 0	Sample chamber is being opened now
E	Undefined condition

Read Status: Application condition xx[2]

	Operating mode	Action	Display
1	TARE	Tare the sample pan	Display analysis value
2	WEIGH-IN	Load the sample	Display analysis value
3	WEIGH-IN	Start analysis	Display analysis value
4	TARE/ANALYS. BEGIN	Waiting for stability	Blank
5	TARE	Waiting for taring	Blank to be completed
6	ANALYS. BEGIN	Close the sample Time delay begins	Display analysis value chamber
7	ANALYSIS	Analysis in progress	Display mode
9	ANALYS. END/CANC'LD	End of analysis	Display mode
10	INFO	Info mode activated	Menu
11	MODE	Parameter mode	Menu activated
12	ID	ID input activated	Menu
13	STATISTICS	Statistics display	Menu activated
14	PROGRAM	Program memory	Menu activated
15	PAUSE	Wgh.sys error 50, 54, 53	ERR xxx

Data Input Format

You can connect a computer to your weighing system to send commands via the weighing system interface port to control functions and applications of the weighing system and the drying unit. SBI functions for remote control are only useful, if the current device/application mode can be read out any time.

The commands sent are control commands and may have different formats; e.g., control commands can have up to 26 characters. Each character must be transmitted according to the settings configured in the Setup menu for data transmission.

Format for Control Commands

Format 1:	Esc	!		CR	LF			
Format 2:	Esc	!	_	CR	LF			
Format 3:	Esc	!	#	_	CR	LF		
Format 4:	Esc	!	#	max. 20 &	_	CR	LF	

Esc: Escape
!: Command character
#: 1 or 2 digits
&: Digit or letter

_: Underline (ASCII 95)
CR: Carriage RETURN (optional)
LF: Line FEED (optional)
max. Depends on command character, i.e. parameter: once the max. length is attained, the input received cut off, rather than being rejected as with a keyboard input.

Format 1

!	Meaning
K	Weighing mode 1
L	Weighing mode 2
M	Weighing mode 3
N	Weighing mode 4
O	Block keys
P	Print
Q	Beep
R	Unblock keys
S	Restart

Format 2

!	Meaning
ars	Read status
acc	SBI commands only, no output to printer
acp	SBI commands with output to printer

Format 3

!#	Meaning
kF1	Soft key 1* Function depends
kF6	Soft key 6* on system state
kF7	Function key SETUP
kF8	Function key TEST
kF9	Function key FEED
kF10	Function key ↓↑
kF11	Function key CLEAR
x1	Print weighing system model
x2	Print serial number
x3	Print weighing system software version
x4	Print operating software version
x5	Print (GLP) weighing system ID number
x6	Print weight set ("inventory") number

Format 4

!#	Meaning
t	Alphanumeric input (max. character number depends on display)
z5	Input (GLP) ID number (20 characters max.)
z6	Input weight set number (14 characters max.)

* numbered from right to left

Synchronization

During data communication between the moisture analyzer and an on-line device (computer), messages consisting of ASCII characters are transmitted via the interface. For error-free data communication, the parameters for baud rate, parity, handshake mode and character format must be the same for both units.

You can adapt your moisture analyzer by setting corresponding parameters in the Setup menu.

If you do not plug a peripheral device into the analyzer's interface port, this will not generate an error message.

Handshake

The moisture analyzer interface SBI has transmit and receive buffers. You can define the handshake parameter in the Setup menu:

– Hardware handshake (CTS/DTR)

– Software handshake (XON, XOFF)

Hardware Handshake

With a hardware handshake, 1 more character can be transmitted after CTS (Clear to Send).

Software Handshake

The software handshake is controlled via XON and XOFF. When a device is switched on, XON must be transmitted to enable any connected device to communicate.

When the software handshake is configured in the Setup menu, the hardware handshake becomes active after the software handshake.

The data transmission sequence is as follows:

```
Moisture      —— byte ——> Computer
analyzer      —— byte ——> (receiving
(transmitting —— byte ——> device)
device)       —— byte ——>
              <—— XOFF ——
              —— byte ——>
              —— byte ——>
                 …
                (Pause)
                 …
              <—— XON ——
              —— byte ——>
              —— byte ——>
              —— byte ——>
              —— byte ——>
```

Transmitting Device:

Once XOFF has been received, it prevents further transmission of characters.
When XON in received, it re-enables the transmitting device to send data.

Receiving Device:

To prevent too many control commands from being received at one time, XON is not transmitted until the buffer is almost empty.

Activating Data Output

You can define the data output parameter so that output is activated either when a print command is received or automatically and synchronously with the analyzer display or at defined intervals (Program: Printout intermediate results: On: Print interval).

Data Output by Print Command

The print command can be transmitted by pressing PRINT or by a software command (Esc P).

Digital Input/Output Ports

Monitoring, Remote Control

You can monitor and remote-control the moisture analyzer. For this purpose, you should know the operating state of the unit.

The following external devices can be used here:
– Status display with digital input ports

– Process logic controllers

– Computer with communications port

Via the communications port, the status of the moisture analyzer and therefore the operating state of analysis can
be read out. The moisture analyzer is remote-controlled by the functions used to activate the key functions.

Functions for Remote Control (see also "Data Input Format" and "Data Output Format"):

Read out the moisture analyzer status:
ESCars_

Block/unblock the keys on the moisture analyzer:
ESCO / ESCR or on the moisture analyzer via Setup: Device

Activate key functions:
ESCP, ESCkF1_ to ESCkF11_

The respective operating state of the moisture analyzer will be transmitted to the digital output ports according to the chart "Operating State of Analysis" (see below).

The moisture limits for the control function at the ANALYSIS END (in tolerance, < min., > max.) are to be entered under soft key Mode: Limits for control function.

Remote control via the universal remote control switch input (pin 15):
● Set the universal remote control switch function to "Function key F1" ("Setup: Device: Extra functions: Ext. switch")

○ Block/unblock the keys on the moisture analyzer, if necessary ("Setup: Device: Keys: Block")

○ For complete control and analysis using the F1function key, set the analysis start mode to "Fully automatic, with (without) stability" (Prog.xx: Start analysis)

If a bar code scanner/additional keypad is set, remote control is no longer possible via the universal remote control switch input.

Operating State of Analysis

State	Pin 16	Pin 17	Pin 18	Pin 19	Description
No analysis in progress	0	0	0	0	No drying program (Mode e.g., Off, Standby, Setup, isoTEST, Prog., Err xxx)
TARE/ WEIGH-IN Menu display	0	0	0	1	Drying program before analysis runs, but no values displayed: Mode, Info, ID, Statistics
TARE pause	0	0	1	0	Waiting for Tare soft key
TARE Waiting for taring to be completed	0	0	1	1	Tare soft key pressed; waiting for stability
WEIGH-IN Place the sample	0	1	0	0	
WEIGH-IN start analysis	0	1	0	1	
ANALYSIS started	0	1	1	1	e.g., Start analysis, Mode, Info
ANALYSIS display	0	1	1	0	
ANALYSIS END (within tolerance)	1	0	0	0/1	Analysis value display/Mode, Info, Statistics
ANALYSIS END (< min.)	1	0	1	0/1	Analysis value display/Mode, Info, Statistics
ANALYSIS END (> max.)	1	1	0	0/1	Analysis value display/Mode, Info, Statistics
ANALYSIS CANCEL	1	1	1	0/1	Analysis value display/Mode, Info, Statistics

Pin Assignment Chart

Female Interface Connector:
25-position D-Submini, DB25S, with
screw lock hardware for cable gland

Male Connector Used:
**(please use connectors with the
same specifications):**
25-pin D-Submini, DB25S, with
integrated shielded cable clamp
assembly (Amp type 826 985-1C)
and fastening screws (Amp type
164 868-1)

Pin Assignment Chart:

Pin 1: Signal Ground

Pin 2: Data Output(T×D)

Pin 3: Data Input(R×D)

Pin 4: Signal Return(T×D/R×D)

Pin 5: Clear to Send (CTS)

Pin 6: Internally Connected

Pin 7: Internal Ground

Pin 8: Internal Ground

Pin 9: Reset _ In**)

Pin 10: − 12 V

Pin 11: + 12 V

Pin 12: Reset _ Out**)

Pin 13: + 5 V

Pin 14: Internal Ground

Pin 15: Universal Key/Keypad Data*

Pin 16: Digital I/O 1*

Pin 17: Digital I/O 2*

Pin 18: Digital I/O 3*

Pin 19: Digital I/O 4*/Clock Rate for Keypad

Pin 20: Data Terminal Ready (DTR)

Pin 21: Supply Voltage Ground "COM"

Pin 22: Not Connected

Pin 23: Not Connected

Pin 24: Supply Voltage Input + 15 ... 25 V

Pin 25: +5 V

*) = See Universal Key in the chapter entitled "Configuring the Moisture
Analyzer" for information on changing pin assignments, as well as
"Data Output: Digital Input/Output Ports".
**) = Hardware restart

Cabling Diagram
– Diagram for interfacing a computer or different peripheral device to the moisture analyzer using the RS-232/V24
standard and cables up to 15 m (50 ft.) long

Weighing System   **Peripheral Device**

V24

| | PC | |
25 pin	or	9 pin
2		3
20		4
3		2
5		8
6		6
7		5

RxD 3 → TxD
4
CTS 5 ← DTR
TxD 2 → RxD
DTR 20 → CTS
DSR
14
7

Type of cable: AWG 24 specification

65

Error Codes

Error Codes
Error codes are displayed in the main display or text line for 2 seconds.
The program then returns automatically to the previous status.

Display	Cause	Solution
No segments appear on the display	No AC power is available	Check the AC power supply
	The power cord is not plugged in	Plug in the power cord
	Fuses are defective	Replace the fuses
H	The load exceeds the weighing capacity	Unload the pan support
L or Err 54	The pan support is not in place	Place the pan support on the weighing system
Err 01 > Display range	Data output not compatible with output format	Change the configuration in the Setup menu
Err 02 Cal. n. possible	Calibration/adjustment condition not met, e.g., – not tared – the pan support is loaded	Calibrate only when zero is displayed Press the Tare soft key to tare Unload the moisture analyzer
Err 03 Cal./adj. interrupt	Calibration/adjustment could not be completed within a certain time	Allow the moisture analyzer to warm up again and repeat the adjustment process
Err 06 Int. wt. defective	Built-in calibration weight is defective	Contact your local Denver Instrument Service Center
Err 11 Tare2 blocked	Tare memory not allowed (Tare value exceeds the weighing range)	Check the tare value entered Unload the moisture analyzer and tare
Err 30 Print fct. blocked	Interface port for printer output is blocked	Contact your local Denver Instrument Service Center to have the port configured for printer output
Err 31 Print fct. blocked	External device not ready to send (interface handshake interrupted XOFF, CTS)	Transmit XON, then CTS
Err 101, 102, 103 or 104 "Checkerboard" pattern displayed continuously	Key is stuck Key pressed when switching on the moisture analyzer SETUP key was pressed when turning on the moisture analyzer, or is stuck	Release key or contact your local Denver Instrument Service Center
Err 320	Operating program memory is wrong	Contact your local Denver Instrument Service Center
Err 340	Operating parameter (EEPROM) is wrong	Contact your local Denver Instrument Service Center
Err 341	The built-in battery for drying programs is drained	Leave the analyzer connected to AC power for at least 10 hours
Err 342	Operating parameter (EEPROM) is wrong except for adjustment parameters	Contact your local Denver Instrument Service Center
No WP	Weighing system is defective	Contact your local Denver Instrument Service Center

Display	Cause	Solution
`Too many characters`	Input text too long	Allowable text lengths, incl. decimal point: – Password: 8 characters max. – User ID: 20 characters max. – Wt ID: 14 characters max.

`No num. value`
`xxxxx too low`
`xxxxx too high`
	Input wrong (with any application program), e.g., alphabetic input not allowed	Follow the instructions for the application programs

`Not found !`	Input wrong (e.g., no program with entered name available)	Enter correct name or program number
`blocked`	Function blocked	None
Built-in printer:	No printout	Activate printer in Setup menu; install ink ribbon and paper correctly
Problem ... :	Too high of a temperature is selected and the sample is oxidized; Sample boils or scorches and splashes continuously change weight	– Reduce the temperature – Put a glass fiber filter on top of the sample – Reduce the sample quantity or apply the sample more evenly – Select a semi-autom. shutoff parameter or select timer mode – Phase drying with decreasing temperature
	Analysis time is too long	– Increase the temperature – Reduce the sample quantity – Preheat the unit by running it for 2 or 3 minutes with an empty sample pan
	Sample loses weight before it is analyzed	– Remove the sample pan and apply the sample outside the sample chamber
	Sample is liquid or pasty	– Use a glass fiber filter
	Sample contains too little moisture	– Increase the sample quantity
	Insufficient heat output	– Clean the protective glass or temperature sensor
	Place of installation exposed to interfering factors (vibration, etc.)	– Change the place of installation

If any other errors occur, please contact your local Denver Instrument Service Center.

Repairs
Repair work must be performed
by trained service technicians.
Any attempt by untrained persons to
perform repairs may lead to hazards
for the user.

Cleaning
⚠ Make sure that no dust or liquid
enters the moisture analyzer
housing

⚠ Do not use any aggressive
cleaning agents (solvents, abrasive
cleaning agents, etc.); clean the
moisture analyzer using a piece
of cloth which has been wet with
a mild detergent (soap) only

● Unplug the power cord from the
wall outlet (mains supply)
If you have a cable connected to
the interface port, unplug it from
the moisture analyzer

○ The base plate of the sample
chamber, the shield disk and the
pan support can be removed for
cleaning

● Carefully remove any sample
residue /spilled powder by using
a brush or a hand-held vacuum
cleaner

● After cleaning, wipe down the
analyzer with a soft, dry cloth

**Cleaning the Heating Unit and
Temperature Sensor**

⚠ **Danger:** The terminals of the
heating unit are under live current

● **To disconnect from AC power,
unplug the power cord from the
wall outlet (mains)**
If you have a cable connected to
the interface port, disconnect it
from the moisture analyzer

● Slide out the heating unit to
remove

● Carefully remove any residue from
the temperature sensor

● Place the disassembled heating
unit on an even surface and use
a commercially available cleaning
agent for glassware to clean the
quartz heating element

Replacing the Fan Air Filter
○ Remove any dust from the fan air
inletlocated on the bottom of the
moisture analyzer

○ Check the air filter periodically and
replace it if necessary (see Acces-
sories)

● Place the moisture analyzer on its
left side

● Unscrew the cover plate

● Pull out the air filter holder

● Open the air filter holder and
remove the air filter

Replacing the Fuses
If no segments appear on the display after turning on the moisture analyzer, the fuses may be defective.

- Be sure to unplug the moisture analyzer from AC power before replacing the fuses

- Unscrew both fuse holders on the rear side of the moisture analyzer using the Allen wrench

- Check both fuses

○ Replace the defective fuses: T 6,3 A, 250 V, 5 x 20 mm

○ If the moisture analyzer still does not function, please contact your local Denver Instrument Service Center.

⚠ Do not use other fuses or shortcircuit the fuses!

Disassembling or Replacing the Heating Unit
A defective heating unit can be completely replaced. Also disassemble the heating unit before cleaning.

The following replacement work may only be performed by Denver Instrument service technicians (temperature adjustment required):
– To interchange heating units with a voltage rating of 230 volts or 115 volts

⚠ **Danger:** The terminals of the heating unit are under live current

- **Before disassembling the heating unit, make absolutely sure to disconnect the moisture analyzer from AC power (mains)** and allow the heating unit cool down for 10 minutes before removing it

- Slide out the heating unit to remove

- Install the new or cleaned heating unit in the moisture analyzer

Safety Inspection
If there is any indication that safe operation of the moisture analyzer is no longer warranted:

- Turn off the power and disconnect the equipment from the wall outlet immediately

> Lock the equipment in a secure place to ensure that it cannot be used for the time being

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

– there is visible damage to the moisture analyzer or power cable

– the moisture analyzer no longer functions properly

– the moisture analyzer has been stored for a relatively long period under unfavorable conditions

– the moisture analyzer has been exposed to rough handling during shipment

In this case, notify your nearest Denver Instrument Service Center. Maintenance and repair work may only be performed by service technicians who are authorized by Denver Instrument and who:

– have access to the required maintenance manuals

– have attended the relevant service traning courses

We recommend that the moisture analyzer be inspected according to the following checklist by a qualified Denver Instrument service technician:

– Resistance of the protective grounding conductor < 0.2 ohm measured with a commercially available multimeter

– Insulation resistance > 2 megohms measured with a constant voltage of at least 500 volts at a 500 kohm load

The duration and number of measurements should be determined by a qualified Denver Instrument service technician according to the particular ambient and operating conditions. However, such inspection must be performed at least once a year.

69

Overview

Specifications

Model	IR120Q
Dryer functions:	
Heating element	Quartz IR heater (coiled quartz radiator)
Temperature range	40 – 210°C 86 – 392°F
Temperature increments	adjustable in 1°C increments
Temperature adjustment	with temperature adjustment set
Weighing functions:	
Weighing capacity	120 g
Readability	1 mg 0.01%/0.001 % moisture content
Repeatability, average (%)	sample weight = 1 g: 0.1%, sample weight = 5 g: 0.02%
External calibration weight (of at least accuracy class...)	50 g (E2)
Sample pan dimensions	Ø 90 mm
Drying parameters:	
Drying programs	standard, quick, gentle, 3 temperature phases
Drying time	6 sec. to 999 min
Number of programs	100
Shutoff criteria	Fully automatic, semi-autom., time (3x 999 min.), manual
Display for analysis results	Moisture (calculated value), dry weight, RATIO, weight loss, residual weight (g or g/kg), Grams/liter (g/l)
Analyzer (hardware):	
Dimensions (L x W x H)	350 x 453 x 156 mm
Net weight, approx.	8 kg
Voltage	230 V or 115 V selectable by replacing the heating unit, –15% ... + 10%
Frequency	48 – 60 Hz
Fuses	2 (neutral conductor/phase), 6.3 AT, 5 x 20 mm
Operating temperature range	+10 ... +30°C (50°F – 86°F)
Power consumption	700 VA max.
Built-in interface Format: Parity: Transmission rates: Handshake:	RS-232C 7 or 8 bit ASCII, 1 start bit, 1 or 2 stop bits Space, odd or even 150 to 19,200 baud Software or hardware
Digital input: Digital outputs:	1, adjustable function 4, operating state of analysis

CE Marking

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:

Council Directive 89/336/EEC "Electromagnetic compatibility (EMC)"

1. Electromagnetic Compatibility
1.1 Reference to 89/336/EEC:

Official Journal of the European Communities, No. 2001/C 105/03

EN 61326-1 Electrical equipment for measurement, control and laboratory use EMC requirements

Part 1: General requirements Defined immunity to interference: Industrial areas, continuous non-monitored operation Limitation of emmissions: Residential areas, Class B

Important Note:
The operator shall be responsible for any modifications to Denver Instrument equipment and for any connections of cables or equipment not supplied by Denver Instrument and must check and, if necessary, correct these modifications and connections. On request, Denver Instrument 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.

Index

Entering the General Password

Enter/Change Password

● Select the Setup menu:
  Press the [SETUP] soft key

> SETUP is displayed

● Select the parameter:
  Press the ⌄ and ⌲ soft keys

> The password prompt
  is displayed:

```
┌─────────────────────────────┐
│SETUP      PASSW. CHECK       │
│                             │
│Enter password:     ████████ │
│                             │
│ <<  │   │  <  │   │   │     │
└─────────────────────────────┘
```

○ Enter the General Password
  (see below)

○ Confirm the password:
  Press the ↵ soft key

> Parameters are displayed

● Select password setting:
  Press the ⌄ or ⌃ soft keys
  repeatedly and ⌲, until

> Password is displayed, together
  with the current password setting

● Define a new password:
  Enter letters/numbers for the
  new password
  To delete the current password:
  Press the [·] key and store

● To confirm your entry:
  Press the ↵ soft key

● Exit the Setup menu:
  Press the ⌲ ⌲ soft key

> Restart your application

┌─────────────────────────────┐
│ **General Password:**   │
│ **40414243**   │
└─────────────────────────────┘

98648-012-97