SMART system 5

Operation Manual

600141
Rev.3

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MANUFACTURED IN THE
UNITED STATES OF AMERICA

This instrument complies with United States Code of Federal Regulations (CFR) Title 21, Part 1030 for microwave leakage. A verification report is on file.

This instrument complies with United States Code of Federal Regulations (CFR) Title 47, Federal Communications Commission (FCC) Part 18 – Industrial, Scientific and Medical (ISM) Equipment – emissions requirements. A verification report is on file.

NOTICE

The following precautions should be observed to avoid possible exposure to excessive microwave energy:

- Do not tamper with the safety interlocks. The SMART System^5 is equipped with three safety interlocks which prevent the instrument from producing microwave power if the cover is open.

- Do not place any object between the microwave cavity and the cover or allow soil or cleaner residue to accumulate on sealing surfaces.

- Do not operate the instrument if it is damaged. It is particularly important that the instrument cover close properly and that there is no damage to the cover (bent), hinges and latch (broken or loosened), or sealing surfaces.

- The instrument should be adjusted or repaired only by qualified service personnel.

The following precautions should be observed to avoid instrument-induced electromagnetic interference:

- The possibility of instrument-induced electromagnetic interference (EMI) is minimal if precautions outlined above are followed.

- The instrument should not be placed close to any electrical device susceptible to EMI. It is suggested that the user post a sign warning pacemaker wearers that a microwave device is in operation.

- If the instrument is suspected of inducing EMI, the cover should be carefully inspected. A microwave leakage measurement should be performed as outlined in the Troubleshooting, Maintenance and Service section of this manual. Leakage measured above the legal limit of 5 mW/cm^2 should be reported to the CEM Service Department.

This instrument utilizes high voltages and microwave radiation. Instrument service and repair should be performed only by those trained in repair and maintenance of high voltage and microwave power systems.

To the best of our knowledge, the information contained herein is accurate. However, CEM cannot accept liability of any kind for the accuracy or completeness of the information contained in this manual. The final determination of the suitability and proper use of the instrument described herein, the accuracy of the information and data obtained from such use, and whether such use infringes any patents or the legal safeguards of others are the sole responsibility of the user.

Warnings, Cautions and Notes

Warnings, cautions and notes are included throughout this manual and should be read thoroughly and strictly followed.

WARNING: A warning is inserted for essential information used to emphasize dangerous or hazardous conditions to the operation, cleaning and maintenance of the instrument which may result in personal injury.

CAUTION: A caution is inserted for essential information used to emphasize procedures which, if not strictly followed, may result in damage or destruction to the instrument or improper instrument operation.

NOTE: A note is inserted for emphasis of procedures or conditions which may otherwise be misinterpreted or overlooked and to clarify possible confusing situations.

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Introduction

The CEM SMART System^{5}™ Moisture/Solids Analyzer is designed to provide a rapid moisture/solids analysis on a broad range of products. The patented weighing technology provides continuous weighing of the sample during the drying process. The system determines the precise time the sample is dry, and the moisture or solids content of the sample is then automatically calculated based on weight loss.

Microwave energy is used to dry the samples. Polar compounds such as water, polar organic solvents such as alcohols or ketones, and ions in the solution will absorb microwave energy and volatilize. Once water and/or other solvents have volatilized, the remaining solid material does not usually absorb microwave energy and will remain relatively cool. Thus, the weight loss is due only to the volatile solvents present in the sample. “Moisture” is used throughout this manual to refer to any volatile substance for which the system can measure weight loss after drying the sample.

The SMART System^{5} delivers 150 - 300 watts of microwave energy when programmed for 100 percent power. Voltage of the incoming electrical service is measured and the microwave power is adjusted by the power control system in order to normalize the power and provide repeatable power conditions. Magnetron power automatically adjusted to deliver appropriate wattage to the instrument cavity. The magnetron fan remains on for 15 minutes after the end of the specified drying time to cool the instrument.

System components consist of a microwave drying chamber, an electronic balance, a 1/4” VGA black and white screen, an infrared temperature controller, a microprocessor and an internal impact printer. The Octawave™ cavity is designed to effectively deliver the microwave energy directly to the sample to achieve rapid test times. The 50 gram four-place analytical balance has a ±0.1 mg sensitivity. Infrared temperature measurement permits automatic adjustment of microwave power based on user defined temperature setpoint. The microprocessor controls and monitors system operations, automatically calculates sample results and enables interface with external printers, external balances and/or computers.

The system is equipped with three safety interlock switches to monitor the mating of the cavity cover and floor and one safety interlock switch to monitor the cavity cover latch. A flame detector with an infrared feedback automatically turns off the microwave power if excessive burning is detected.

The SMART System^{5} software is user friendly and easy to operate. It is capable of storing up to 100 methods and 300 test results, and is multilingual (English, German, Spanish, and French).

System Installation

1. Following the instructions provided in the packing carton, carefully remove the SMART System^5 from its shipping carton and place it on a vibration-free workbench or laboratory table in a location that:

   a. provides at least 8 in (20 cm) open space on each side and 6 in. (15 cm) open space in the rear of the instrument for ventilation.

   b. is free from vibration of large equipment and/or excessive walk-through traffic.

   c provides a temperature range of 41 °F (5 °C) to 104 °F (40 °C) and a humidity range of 10-85 percent relative humidity.

   d. provides adequate bench space for sample handling.

   e. allows the instrument to be connected to a dedicated, grounded 120 or 240 VAC outlet. The SMART System$^{5™}$ should be operated on a stabilized, constant voltage AC power supply. To operate properly, the voltage must be within ±10% of the specified level.

2. Retain all packing materials.

3. Inspect the instrument for cracks, dents or warping.

4. Remove the tape from the instrument cover. Inspect the top cover for proper alignment. The cover must open and close freely with no binding or restriction of movement.

   WARNING

   If damage is noted, do not attempt instrument operation.

   AVERTISSEMENT

   Ne pas mettre en marche si l'instrument est endommagé.

5. If the instrument has been damaged in shipping, contact the freight carrier to report the damage and to file a damage report. Contact the CEM Service Department or the nearest subsidiary or distributor (page 4) to request service information.

6. Verify that all accessories illustrated and listed in figure 1 are included.

7. Lift the instrument cover. Install the balance stem into the balance stem retainer in the opening of the cavity floor, ensuring that the balance stem is firmly seated. Install the balance pan onto the stem.

Note: If the balance stem requires removal, lift the stem straight up from its installed position. Moving the balance stem from side to side can cause damage to the balance assembly.

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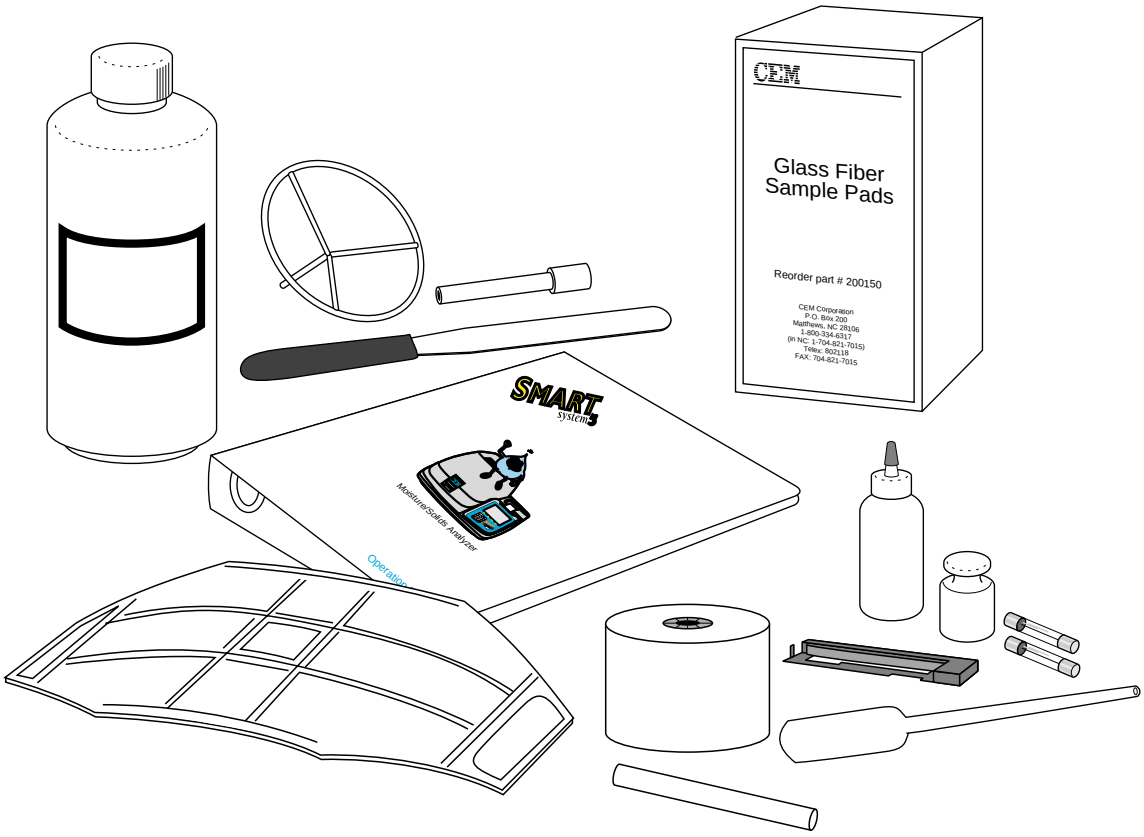


- Starter Accessory Kit containing:
  - Balance Stem (159600) (2)
  - Balance Pan (004120) (2)
  - Air Shield (568055M) (Installed in Instrument)
  - Standard Solution (302600)
  - Dispensing Bottle (230230)
  - Spatula (302001)
  - Disposable Pipette (302150)
  - Glass Fiber Sample Pads (200150)
  - 10 g Weight (260111)
  - Fuses, 10AMP (2) (188340) and 5AMP (2) (188331)
  - Operation Manual (600140)
  - Printer Paper Holder (159065)
  - Printer Ribbon (315122) (Installed in Instrument)
  - Printer Paper (1 Roll) (315120)

Figure 1. Accessories

8. Using a voltage meter, measure the voltage of the dedicated power outlet to verify voltage (120 VAC, 60 Hz or 220/240 VAC, 50 Hz).

9. Facing the back of the instrument, use a small screwdriver to pry the dual voltage supply from the power module.

10. Install the voltage slide switch in the proper direction for the measured voltage (120V, 60Hz or 220/240V, 50Hz).

11. Based on the voltage selected in step 9, install the proper fuses in the dual voltage supply – 10 AMP (60 Hz) or 5 AMP (50 Hz).

12. Install the dual voltage supply with the appropriate fuses and the properly installed voltage slide switch in the power module.

13. If applicable, install the exhaust hose.

14. Plug the power cord into the power cord receptacle in the rear of the instrument and into a grounded, dedicated electrical outlet. Note: If using external components such as a printer, computer or balance, install these components as outlined in this manual.

15. Position the power switch located in the rear of the instrument above the power cord receptacle in the "on" position.

CAUTION

Permit the SMART System5™ to warm up (power switch on, microwaves not being produced) for at least 45 minutes prior to operation. If the instrument is switched off for an extended period of time (weekend, holidays, etc.), ensure that warmup time is permitted prior to use.

Mise en garde

Permettre une période de 45 minutes de réchauffement du SMART System5 avant l'utilisation (interrupteur de courant en marche, aucune micro-onde n'est émise). Lorsque l'instrument est en mode fermé pour un temps prolongé (fin de semaine, vacances, etc. . .) il est important que la période de réchauffement de 45 minutes soit observée.

16. Refer to the "Maintenance, Troubleshooting And Service" section of this manual and perform the Standard Solution Test at least five times.

Note: CEM Corporation recommends that the power cord be connected to an AC power outlet and the power switch remain in the "on" position at all times. After 15 minutes of idle time, the SMART System5 assumes a "sleep" mode.

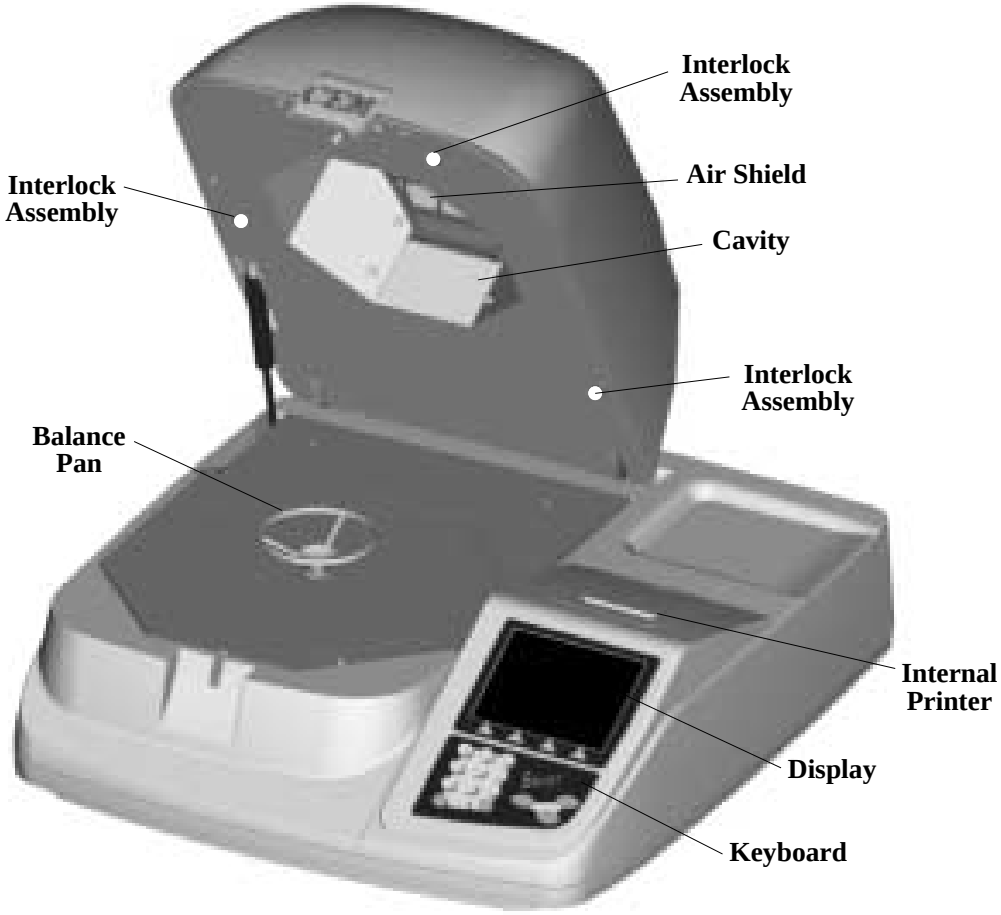


Figure 2. Smart System^5 Front View

Instrument Description

Display – displays menu choices, instructional messages and analysis results on a 1/4 VGA black and white screen

Keyboard – controls operation of the SMART System^5. Temperature, time, or other numeric data may be entered with the numeric keys as requested on the display.

Internal Printer – provides printout of methods, data and results.

Cavity – decreases test times due to its patented compact Octawave™ design.

Air Shield – prevents air flow within the microwave cavity from affecting weight measurements.

Balance Pan – holds sample and sample pads during analysis.

Interlock Assembly – monitors mating of cavity cover and instrument skirt.

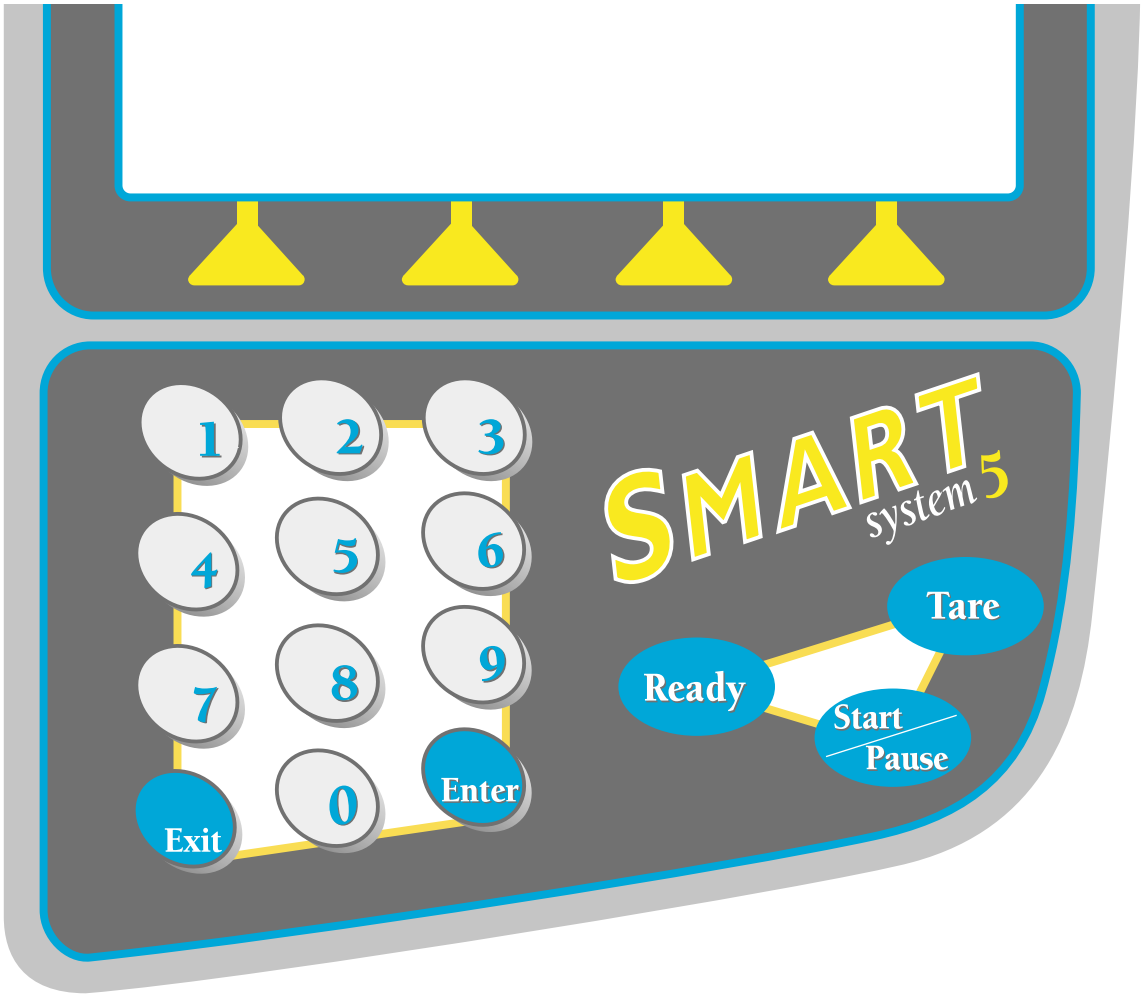


Figure 3. Smart System^5 Keyboard

Enter – Press to store entered parameters and data in the computer memory.

Exit – Press to exit screen.

Ready – Press to initiate current method for a test or to reset method for next test.

Start/Pause – Press to begin or pause sample analysis. Microwave heating begins when the Start/Pause button is pressed unless the cavity cover is open. Operation will continue through the analysis unless the Start/Pause button is pressed to interrupt the analysis or the operation key indicating "Stop Test" is pressed.

Tare – Press to tare or zero the weight of the sample pads prior to sample analysis.

0 - 9 – Press to select items from menus such as the Main Menu, setup screens, etc. and to select values for parameters such as time and power.

▲ **Operation Keys** – Press to select specific operation options such as "Stop Test," "Print," "Main Menu," Prev. Page," etc.

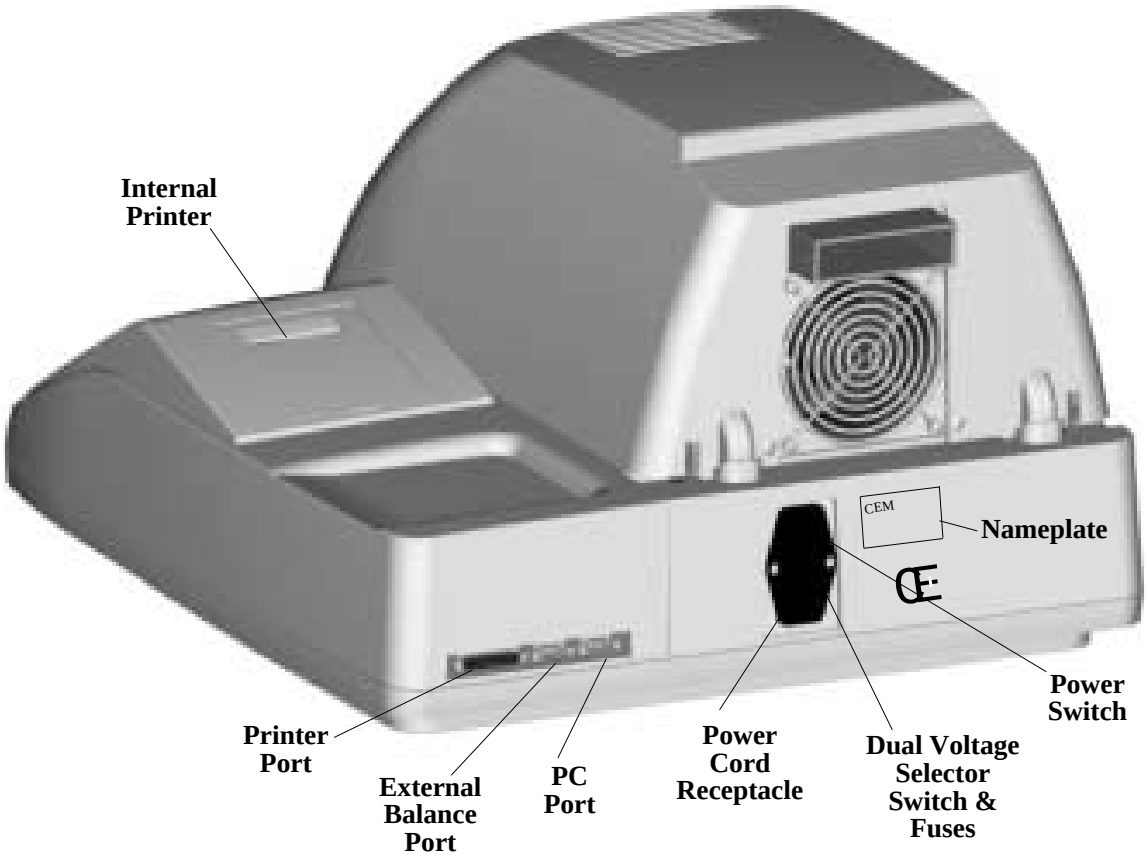


Figure 4. Smart System[5] Rear View

Fuses – prevent electrical power overload.

Power Cord Receptacle – receives the female end of the power cord.

Power Switch – turns electrical power to the instrument on and off.

Nameplate – lists model and serial number.

Dual Voltage Selector Switch - permits electrical voltage for the instrument to be switched from 110 VAC to 220 VAC.

PC Port – permits connection and communication with a personal computer for data storage, etc.

Printer Port – permits connection and communication with an external printer.

External Balance Port – permits connection and communication with an external balance for specific applications.

Sample Analysis

Proper sample preparation and testing are critical to obtaining accuracy and precision. Each sample has a specific characteristic composition; therefore, each sample may require an individual method of analysis. However, guidelines can be established for analysis of general sample types.

- **Sampling –** A representative sample is critical to obtain proper analysis.
- **Preparation** – As with any chemical analysis, a homogeneous sample is critical to obtaining precision and accuracy.
- **Weight** – A consistent sample size helps ensure precision and accuracy. Most CEM applications specify a sample size of 2-5 grams, emphasizing the importance of a homogeneous sample.
- **Holders** – Absorbent pads to which a sample can be applied are used for most analyses. Glass fiber pads are recommended because glass fibers do not absorb microwaves. Other holders include Teflon coated glass fiber mesh, a drying basket and a thermapad.
- **Application** – Most samples should be spread smoothly, avoiding lumps, peaks or any uneven areas. Sample spread must be consistent.
- **Drying Time** – The drying time is determined by the type of sample and its microwave absorbency. Constant weight drying permits drying of a sample until a constant weight is achieved. Set time drying permits the control of the sample analysis by entering a specified time and power level.
- **Infrared Temperature** – The infrared temperature measurement may be used to operate at temperatures used in standard or vacuum oven procedures.
- **Microwave Power** – The power necessary to dry a sample is determined by sample composition. A sample should be tested at the highest possible power without burning or degradation of the sample.

Sampling

Proper sampling of a product or process is critical in achieving proper moisture/ solids analysis. A representative sample is required to ensure that the test results are representative of the entire batch or lot of material.

Many standard procedures such as AOAC, USDA and ASTM methods reference sampling techniques. It is extremely important to follow techniques outlined in these procedures for a particular sample type.

Proper handling and storage of the sample prior to analysis is also critical in achieving accurate and representative results. Samples should not be exposed to the air for long intervals prior to analysis. Proper storage also ensures that no moisture is lost.

Preparation

Sample preparation is critical to achieving precise and accurate test results. The sample should be properly prepared to achieve repeatable moisture results between duplicate analyses of the same sample. Sample preparation is either a physical or chemical modification of the sample. Physical modification may be as simple as stirring or shaking the sample to ensure homogeneity or more complex such as particle size reduction, dilution or deaeration.

Chemical modification is the addition of an enzyme to hydrolyze chemically bound fat. The objective is to create a homogeneous sample and to improve the correlation of the test method to standard methods. Some products, such as a beef emulsion or comminuted poultry, may require no additional preparation. Other materials will require particle size reduction, dilution or dearation prior to testing. Samples should be kept cool and in sealed containers to prevent loss of moisture. If repeatable results cannot be obtained on the same sample, re-blend the sample to improve the homogeneity and repeat tests. Sample preparation methods include:

1. **Mixing of Sample** – Thoroughly stir or shake sample to ensure homogeneity.

2. **Particle Size Reduction** – Many products require particle size reduction prior to being applied to the glass fiber pad. Reduction, based on product sample, can be accomplished with a meat grinder, either an industrial or consumer grade food processor, a coffee mill or a cheese grater. The meat grinder is the best choice for all meat products. USDA procedure specifies three to four passes through a 1/8" or 5/64" blade with mixing between grinds. A USDA inspector or outside laboratory can make recommendations. An industrial grade food processor is a good alternative for grinding meat products. A consumer grade food processor is ideal for grinding frozen potatoes, breaded products, or "dry" snack foods such as cookies, crackers, and chips. A coffee mill can be used to grind or mix "dry" snack foods. A cheese grater can be used to grate small quantities of hard cheese samples or soap.

3. **Dilution** – Products with a high carbohydrate content are strong microwave absorbers and have a tendency to burn. These samples may require either a water or salt dilution.

    A. Water Dilution – A specified amount of sample is diluted with a specified amount of water and mixed in a blender. Typical samples include doughs, cheese powders, corn syrups, dried meat bases and sauces. An external balance and a blender are required for this procedure.

        (1) Interface an external balance with the SMART System5.

        (2) Tare the blender cup on the external balance.

        (3) Add product sample to the blender cup.

(4) Add water to the product sample in the blender cup.

(5) Blend until a homogeneous mixture is obtained.

(6) Use the diluted sample to perform analysis.

B. Salt Dilution – A specified amount of salt is added to the product sample prior to analysis. Typical samples include frozen potatoes and frozen breaded products. This procedure requires a teflon basket and dry table salt (sodium chloride).

(1) Line a teflon basket (CEM p.n. 200090) with two square glass fiber pads.

(2) Place the lined basket on the balance of the Moisture/Solids Analyzer. Press "Tare."

(3) Place approximately 8g of salt in the lined basket. Press "Tare."

(4) Place the product sample on top of the salt. Press "Start" to record the initial weight.

(5) Press "Stop."

(6) Thoroughly mix the salt and sample in the basket.

(7) Return the basket to the balance of the Moisture/Solids Analyzer. Press "Start" to continue the sample analysis.

4. **Deaeration** – Frozen dairy and imitation dairy products must be deaerated to remove the excess air in order to provide reproducible test results. This procedure requires a 125 mL Erlenmeyer flask, a 1 liter beaker, a magnetic stirrer, a $1\frac{1}{2}$" x $\frac{3}{8}$ magnetic stirring bar, and a #5 rubber stopper.

(A) Place 100 mL of sample in a 125 mL Erlenmeyer flask.

(B) Place a $1\frac{1}{2}$" x $\frac{3}{8}$" magnetic stirring bar in the flask. Using a #5 rubber stopper, loosely cap the flask.

(C) Place flask in a 1 liter beaker containing 250 mL of water which has been heated to 70°C.

(D) Place beaker with flask on a magnetic stirrer. Mix for 5 - 7 minutes.

(E) Cool sample to ambient temperature and thoroughly mix sample prior to testing.

5. **Enzymatic Hydrolysis** – The fat in processed cheese and dairy products is often tightly bound to the protein. In order to achieve accurate test results, the fat must be released from the protein prior to the fat extraction process. This can be accomplished by a protease enzymatic hydrolysis of the sample. Note: The sample must be in a liquid or "pourable" state for the enzymatic hydrolysis to be effective.

   (A) Thoroughly mix approximately 100g of sample. Heat sample in a water bath at 60°C (± 5°C) for five minutes.

   (B) Add eight (8) drops of CEM Enzyme (p.n. 302630) and mix well.

   (C) Return sample to water bath for five minutes.

Weight

Sample weight can be very critical to the final test result. As with most analytical procedures, a consistent sample size helps ensure precision and accuracy. Sample sizes can vary, based on type of sample, from 1 gram on the low end (high percent solids level) to 10-15 grams on the high end (very low percent solids level). Test procedures documented by CEM and included in this manual, are for specific sample types and suggested sample size. Sample size should remain within the weight guidelines. CEM has determined that the suggested sample size results in the most consistent drying and test results. Heavier sample weights may cause sample degradation or burning, resulting in high moisture results. Lower sample weights may result in under-drying of the sample.

Holders

Sample holders should be transparent to microwave energy.

CEM Square Sample Pad – The square pad is the most commonly used sample holder. Typically, two (2) pads are used with the sample "sandwiched" between the pads. For heat sensitive samples, only one pad is recommended to minimize heat buildup. For low solids samples, three or four pads are used for absorption.

CEM Round Sample Pad – The round pad is used as a collection pad for fat extraction and is recommended, but not required, for thermapad applications.

Sample Pads – CEM glass fiber pads are designed to provide optimum conditions for rapid, thorough and repeatable drying. CEM Corporation follows strict specifications in the manufacture of sample pads. Specifications include low moisture content and optimum absorbency, density, porosity, and strength for microwave drying.

- *Moisture Content* – Excessive moisture in sample pads will cause moisture or solids values to be incorrect. Controlling the moisture ensures that residual moisture is maintained to very close tolerances.

- *Absorbency* – The pad material must be absorbent enough to form a wick for a liquid sample and to be a sample holder for more viscous type samples.

- *Density* – The sample medium must have uniform density to guarantee that the moisture will volatilize rapidly and evenly, without causing residual heating.

- *Porosity* – Correct porosity of the pad material ensures maximum surface area for liquid samples in order to increase volatilization of moisture. Correct porosity helps prevent sample degradation or burning.

- *Strength* – The tensile strength of the medium has a direct effect on the ability of the sample pad to withstand the stress imposed during sample application.

Teflon Coated Glass Fiber Mesh – The mesh is used as a holder for fiber samples or as a "spacer" between multiple sheets of paper samples.

Drying Basket – The basket is made of Teflon coated glass fiber mesh. It is typically lined with two square pads. It is used to hold large samples and for salt dilutions.

Application

The viscosity of the sample plays an important role in determining how the sample is spread onto the pad for analysis. If a sample is thin, it can be pipetted onto the pad and can be tested at high power levels. A thin sample spread over a large area permits moisture to evaporate rapidly with little residual heat buildup. Glass fiber pads may be stacked for increased absorbency.

High viscosity samples (samples that do not flow well) require a different technique. If the sample can be easily spread across the glass fiber pad, no dilution is required. A thick sample will tend to puddle and form a crust, sometimes trapping volatiles within the bubble. Overheating or burning can also occur on thick samples. If repeatable results cannot be obtained by spreading the sample, a dilution may be necessary. The sample must be soluble in the diluting agent, and the diluting agent must be a microwave absorber.

To generate the appropriate amount of heat and achieve optimum moisture results, different types of samples must be spread to different thicknesses over different areas of the glass fiber sample pad. As a general guideline, the sample will generate heat in direct proportion to the thickness of the sample layer on the pad. A sample spread too thickly can cause sample burning; a sample spread too thinly can cause insufficient drying. The prepared sample should be applied to a glass fiber sample pad. Once the sample is properly applied to the sample pad, it should be covered with a second glass fiber pad to ensure heat retention and to eliminate splattering.

Liquid samples should be pipetted onto the pad. Solids samples should be spread onto a pad placed on the edge of a clean, flat surface, such as a countertop. The spatula should be held level with the pad when spreading the sample to ensure a smooth, uniform application of sample to the pad surface.

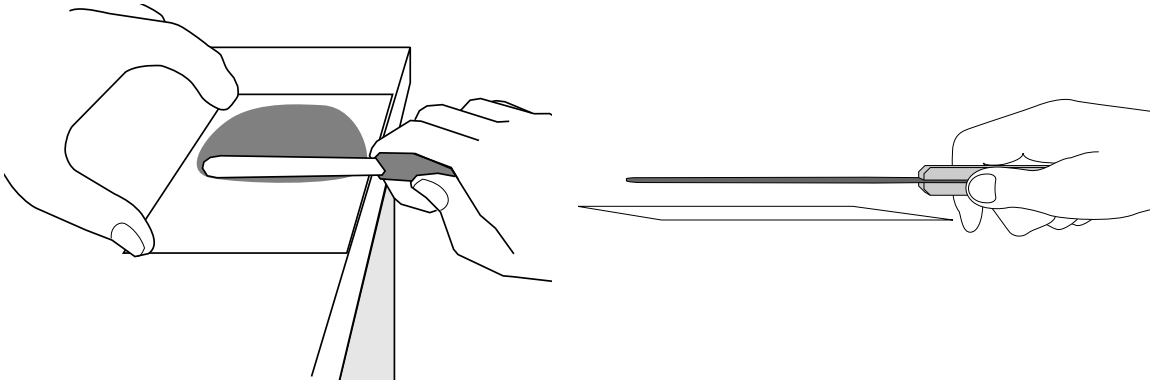
If the sample is an organic solvent-based liquid, special handling is required. Equipment and method modification may be required. CEM recommends using the SMART System^5 Exhaust Kit when analyzing solvent based samples.

Non-polar organic solvents do not absorb microwave energy; therefore, samples containing this type of solvent will not dry unless they are mixed with a diluent which absorbs microwave energy and has a higher boiling point than the non-polar solvent.

If the sample is a polar organic solvent-based liquid, samples will absorb microwave energy and dry as readily as a water-based liquid. If the organic solvent is an alcohol, a ketone, or an ester, samples should be tested with water-based techniques.

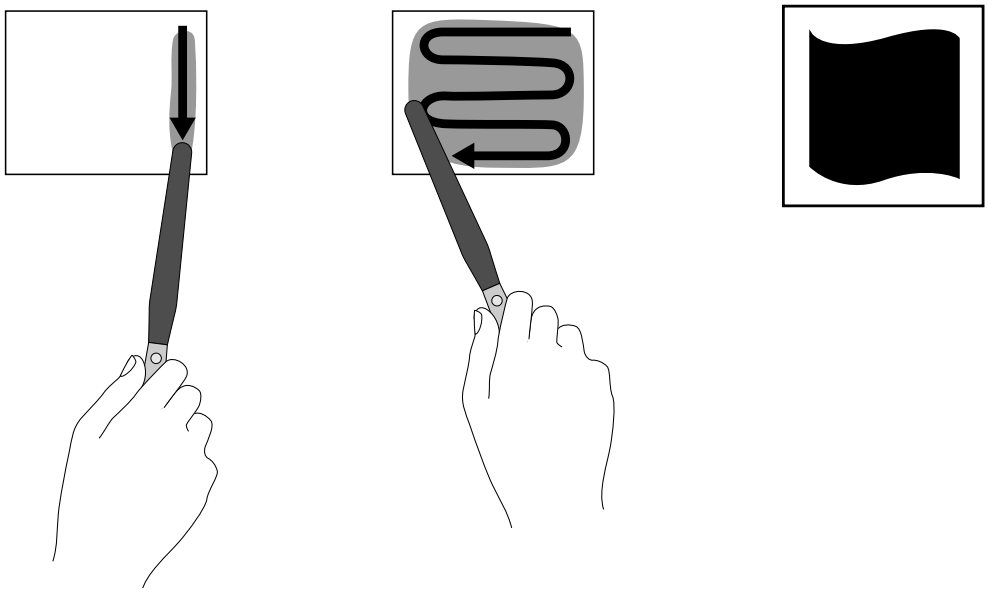
Some base resins are microwave absorbers. Polyester is a known base resin that is an absorber of microwaves. Titanium dioxide and calcium carbonate have also been found to be microwave absorbent. If these materials are present in a sample, usually enough heat is generated to remove most high boiling non-polar solvents and any other volatiles. Oils become very hot when placed in the microwave field. Some metal based samples can be tested. If carbon black is present in a sample, it will heat very quickly and possibly burn even at low power levels.

It is recommended that CEM Corporation or a local distributor be consulted prior to testing any solvent based sample.



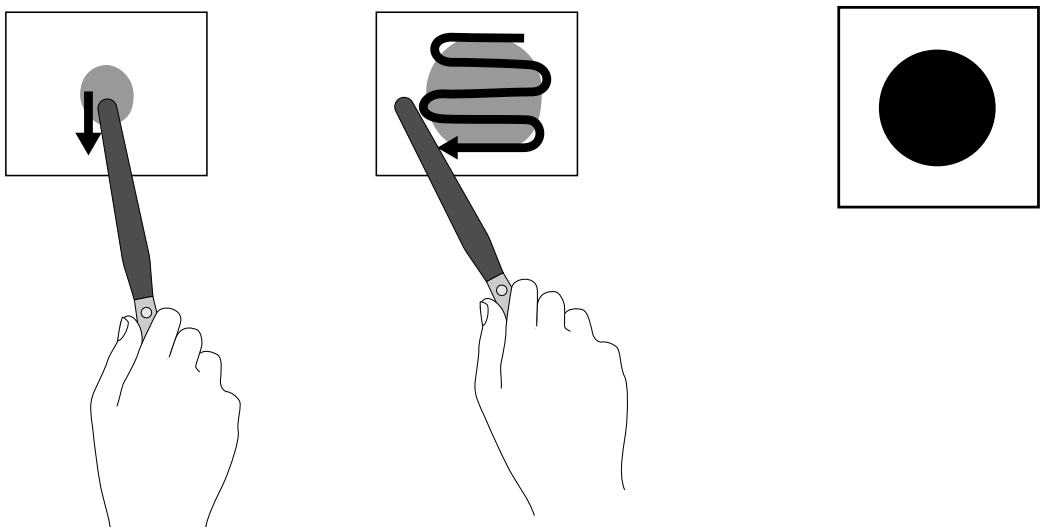
General Sample Application Technique

If the sample is in a paste, semi-solid, or crumb form or a raw or skeletal meat product such as fresh pork, ground beef, or chicken, place the sample on the end of a spatula and spread it across one end of the pad. Then spread the sample to a uniform thickness covering approximately 90% of the pad surface area.



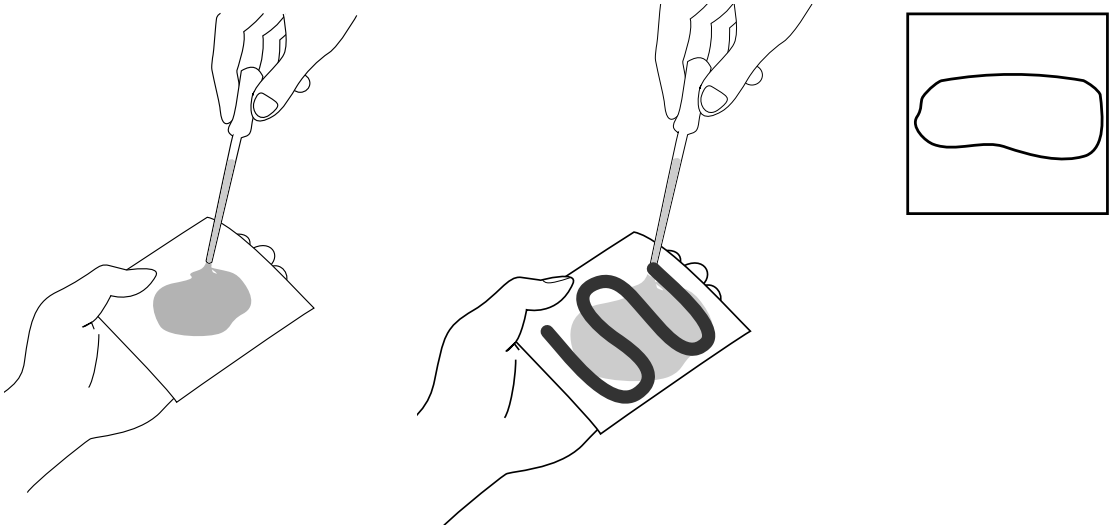
1 Spread Thin Layer Across 90% of Pad

If the sample contains bound water such as an all-meat emulsion, cooked all-meat sausage, sausage with extenders, semi-dry sausage, or ham, place the sample on the end of the spatula and apply the sample to the middle of the pad. Then spread the sample around the pad in a circle to generate thermal heat.



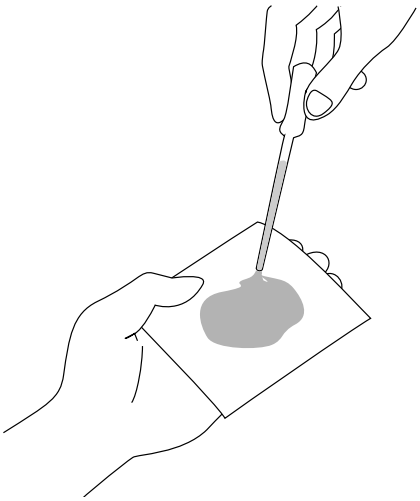
2 Spread Layer on Pad

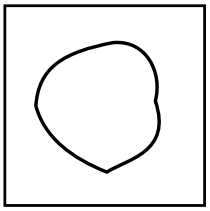
If the sample is a heat sensitive sample such as a water-based or solvent-based liquid, use a pipette to dispense the sample onto the pad(s). Sample size should be 2-5 grams, based on solid content of the sample – 2-3 grams for high solids samples, 4-5 grams for samples containing less than 15 percent solids. Samples containing less than two percent solids may require as much as 10 grams for analysis. Large quantity samples should be pipetted onto the pads in a thin even layer. Additional glass fiber pads may be used for increased absorbency. A sufficient number of pads should be used to ensure that liquid samples do not drip onto the floor of the instrument cavity.



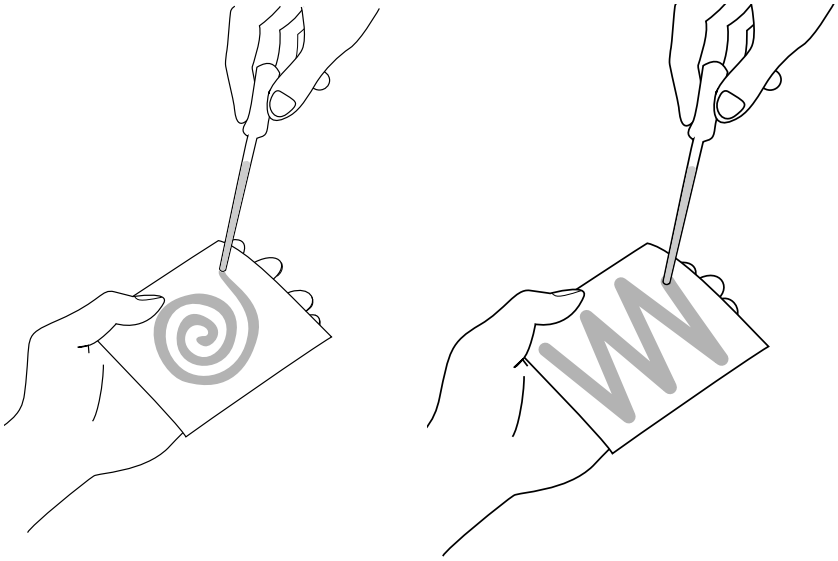
3 Puddle, Spread with Pipette and Cover

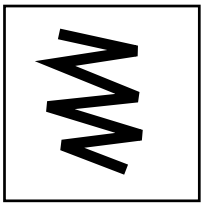
If the sample is a water-based liquid or solvent-based chemical, use a pipette to puddle the sample onto the pad(s). Cover the sample with an additional pad. A sufficient number of pads should be used to ensure that liquid samples do not drip onto the floor of the instrument cavity.





4 Puddle and Cover





5 Swirl or Zig-Zag Pattern, No Cover

Standard application used for heat sensitive samples if sample burns when using the puddle and spread technique.

Method Information

Most water based samples should achieve constant weight settings in 1 - 3 minutes.

The microwave power and temperature settings should be appropriate to the sample. The standard oven or vacuum oven temperature recommended in a reference method for the sample should be followed. If no reference method is available, a starting temperature of 100 °C should be programmed. Because the power level in the instrument is adjusted based on temperature feedback, most samples can be dried using a 100% power level setting. If a sample contains a strong microwave absorber such as carbohydrates, the power level will likely need to be adjusted. In most instances, a 10% power change will be sufficient to prevent overheating.

During the initial testing of a new sample, the weight display should be monitored to ensure that the sample does not ignite and that a stable weight reading is displayed. Sharp declines in weight indicate excessive sample heating. If ignition occurs, the flame detection sensor will abort the analysis.

Samples that are strong absorbers of microwave energy should be diluted or tested at reduced power levels. These products usually contain simple carbohydrates or tightly held moisture that will not readily escape, causing overheating and/or burning and non-reproducible results. These samples should be tested at a low power. Examples of heat sensitive samples include powders, paper fibers, candy and black liquor.

Bias Identification

Most samples can be analyzed for percent moisture content with a CEM drying method, and results will compare precisely with the standard test method. Occasionally, however, all volatiles in a particular sample cannot be removed with microwave power. Different spread techniques can be used to eliminate the need for a moisture bias in most samples. Sometimes browning of the sample in the same manner as in the air oven will also produce test results comparable to the standard test.

If microwave moisture test results are repeatable, but not comparable to the standard test results, a bias can be identified. With most samples, the bias will amount to only a few tenths of a percent. To determine a moisture bias, prepare a sample for testing, ensuring that the sample is homogeneous. Test this sample by both a standard method and the CEM microwave method. Perform at least ten tests by each method to check repeatability, then figure an average of the ten results. Subtract the average of the microwave test results from the average of the standard test results. Enter the resulting number (moisture bias) into the CEM moisture/ solids instrument. Corrected moisture test results will be displayed and printed. If the difference in the average test results is a negative number, the power level should be reduced and the tests should be repeated.

Some meat and poultry products, whether raw or cooked, show a fat bias when analyzed with the CEM instruments. Less fat is extracted by a short solvent extraction than by the longer ether extraction of the traditional Soxhlet technique. The bias will be a constant for a given product and should be considered when generating data.

Cooked sausage (i.e. wieners, bolognas, etc. with extenders) and other cooked products tend to bind fat in the carbohydrate/protein structure of the cooked product and will generally yield a lower fat value when extracted in the CEM instrument than when extracted with the Soxhlet.

For proper determination and use of biases, results from the CEM instrument should be compared with the results from traditional “long” or standard methods used by USDA laboratories for compliance testing. Standard methods consist of an air oven (four hours, 125°C) for moisture and Soxhlet (four hour ether extraction) for fat. USDA recommends correlation of rapid fat and moisture methods with these long methods.

USDA Processed Products Inspection Division encourages the use of rapid methods for fat and moisture analysis to assist in better process control and compliance. USDA recommends periodic back-up analysis (one in every 10 - 20 analyses) by standard long methods when rapid methods are used in approved Total and Partial QC (TQC/PQC) Programs. Backup checks can be performed less frequently as laboratories gain confidence in the established biases. CEM Corporation also recommends a Quality Assurance Program for establishing and maintaining biases and to ensure USDA compliance.

Prior to establishing a fat bias for the Fat Analysis System, a laboratory should be confident of obtaining the best possible results for moisture, since precision of the fat results will depend on the moisture results. Moisture results should have repeatability between duplicate analyses of the same sample and a mean or

”average” moisture values that are close to the values being generated on the same samples by standard oven. To obtain the best possible results for moisture, and thus for fat, there are three factors to consider: 1) sample preparation, 2) sample application technique and 3) power and time parameters.

After establishing moisture repeatability and achieving moisture results as close to standard ”long” methods as possible, use the following procedure to identify fat biases for different product categories.

1. Select three or more samples (approximately two pounds each) from different lots of the same product.
2. Prepare each sample according to standard procedures (3 - 4 passes through a 5/64” blade, with mixing between grinds, or equivalent).
3. Divide each ground sample in half and package and label sub-samples in two separate, air-tight containers.
4. Analyze one set of the sub-samples (from step 3) in duplicate by standard ”long” methods – oven for moisture, Soxhlet for fat. If facilities and/or personnel are not available for these tests, use an independent laboratory. Request raw data (individual tests) from the laboratory, not the mean or ”average” value.
5. After obtaining the results from the standard ”long” methods, analyze the other set of subsamples in the CEM Moisture/Solids Analyzer for moisture only. Adjust power and spread technique until acceptable moisture repeatability is achieved.
6. After obtaining acceptable moisture repeatability, use the Fat Analysis System and perform 3 - 5 moisture and fat analyses for each sample. As with moisture, fat results should be repeatable. To obtain optimum fat results, use a sufficient redry time. Two minutes is typical, although some samples may require more time. The sample weight should be stable (<0.2 mg weight change in the last five seconds). An insufficient redry time will yield artificially low fat results since the true dry, extracted weight will not be reached.
7. Subtract values obtained from the SMART System 5 from Soxhlet values. Average the differences to identify the average bias for a specific product or product group.

Sample	A	B	C
Average Soxhlet fat	xx	xx	xx
- Average CEM fat	xx	xx	xx
= Bias	xx	xx	xx

(A + B + C)/3 = Average Fat Bias

8. The bias should be relatively less than 2.0% and must be added to the fat results from the SMART System 5 to produce results that correlate closely with official methods. Repeat this process on a regular basis to confirm that the bias is consistent. Raw meats and blends will produce smaller biases than cooked products with extenders.

Determining Ash/COH for Processed Meats

For samples that contain salt, sugar, spice, cure or other added components, ash/carbohydrate (COH) values must be determined by analysis. For purposes of calculating the protein by difference, the specific amount of each component (salt, spice, bone, etc.) is not important, only the total amount.

To determine ash/COH values for finished products or blends with sugar, salt, spice, etc., use the following procedure:

1. Collect and prepare three (3) samples from different lots of the same product. Store the samples in airtight containers until tested.

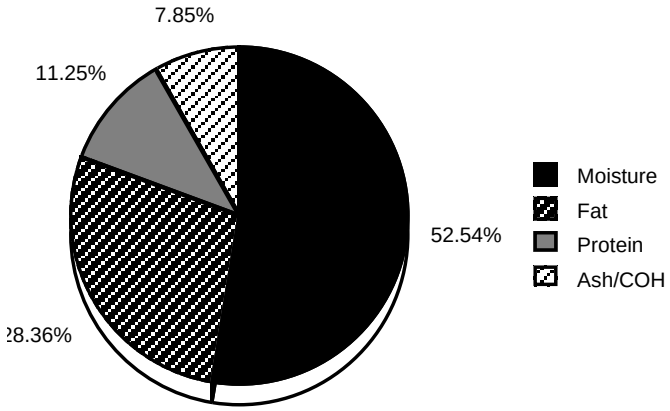
2. Analyze the 3 samples in duplicate for fat and moisture in the SMART System 5 and Fat Analysis System and for protein using "long" methods (Kjeldahl). If necessary, an independent laboratory can provide this analysis.

3. Average the results of the duplicate analyses for each sample, then total the % Protein + % Fat + % Moisture for each sample.

4. Subtract the sum from 100% to get an Ash/Carbohydrate factor. For example, if the composition of a sample is:

Moisture	52.54%
Fat	28.36%
Protein	11.25%
Total	92.15%

Ash/COH = 100% - 92.15%
Ash/COH = 7.85%



5. Calculate an average of the the ash/COH values for each of the 3 samples and program that factor into the SMART System 5.

Check samples periodically to verify the ash/COH values. Variations in the amount of added constituents (salt, sugar, spice, extenders, etc.) can cause the ash/COH factor to vary.

Ash Content Of Meats

The following values should be helpful in establishing ash/carbohydrate factors for raw meats. Since the carbohydrate values for these meats are so low, the ash alone is usually adequate. Obviously, for meats with added salt, spice, cure, sugars, soy, etc., the ash/COH values will vary.

The following values are estimates since composition may vary due to individual differences in the the meat sources, seasonal variations, processing, etc.

	Moisture	Protein	Fat	**Ash**
Green Beef Material				
Bull Meat	67.90	19.40	11.70	**1.00**
Ship Boneless Beef	64.00	16.20	19.00	**.80**
Regular Boneless Beef	70.00	20.00	9.00	**1.00**
Boneless Beef Pad. for Ck.	65.70	18.30	15.00	**1.00**
Boneless Bull Chux	72.50	19.80	7.20	**.50**
Boneless Chux C. & C.	70.00	19.30	9.70	**1.00**
Boneless Ship Chux	62.10	17.55	19.35	**1.00**
Shank Meat	72.60	19.80	6.60	**1.00**
Clods	72.30	20.18	6.90	**.62**
Sirloin Butts	66.60	19.40	13.00	**1.00**
Star Beef (Dry Saus.)	70.00	20.00	9.00	**1.00**
Spcl. Beef	69.00	19.00	11.00	**1.00**
Spcl. Bf. Trmgs.	52.50	14.60	31.90	**1.00**
Reg. Bf. Trmgs.	64.60	19.40	15.00	**1.00**
Bnls. Plates	43.60	13.40	42.00	**1.00**
Bnls. Flanks	41.90	13.10	44.00	**1.00**
Bnls. Plate Trmgs.	40.30	12.70	46.00	**1.00**
Beef Fat	11.80	5.10	82.90	**.20**
Beef Fat from Old Cow	22.20	5.60	71.80	**.40**
Brains	77.40	11.40	9.80	**1.40**
Cheeks	70.00	19.30	9.70	**1.00**
Diaphragm Meat	65.79	18.21	15.60	**.50**
Gullet Meat	73.20	16.80	9.00	**1.00**
Head Meat	68.45	18.96	11.59	**1.00**
Hearts	72.40	16.55	9.80	**1.25**
Lips	59.40	17.07	22.53	**1.00**
Lungs	78.00	18.80	2.20	**1.00**
Tongues	64.25	17.75	17.00	**1.00**
Tongue Trmgs.	69.40	19.17	10.43	**1.00**
Tripe, Cooked	81.90	15.50	2.10	**.50**

Ash Content Of Meats (Continued)

	Moisture	Protein	Fat	**Ash**
Green Pork Material				
Spiced Ham Trmgs.	61.10	16.90	21.00	**1.00**
Lean Ham Trmgs.	63.80	17.70	17.50	**1.00**
Hamette	66.40	18.40	14.20	**1.00**
Corned Pk. Shldr. Mt.	61.80	15.00	20.00	**3.20**
A Shoulder Trmgs.	61.80	17.10	20.10	**1.00**
B Shoulder Trmgs.	45.40	12.70	40.90	**1.00**
B & F Shldrs. 1/2" Fat	49.20	13.80	36.00	**1.00**
B & F Shldrs. 1" Fat	45.30	12.70	41.00	**1.00**
Lean Picnic Trmgs.	59.90	16.60	22.50	**1.00**
C.T. Butts	57.90	16.10	25.00	**1.00**
Boneless Boston Butts	47.30	13.20	38.50	**1.00**
Bnls. Packer Side Mt. 124-55	41.10	11.30	46.60	**1.00**
Skd. Belly Mt.	24.80	7.00	67.50	**.70**
Reg. Pk. Trmgs.	34.30	9.70	55.00	**1.00**
Neck Bone Trmgs.	51.50	14.40	33.10	**1.00**
Spec. Lean Trim.	58.10	15.90	25.00	**1.00**
A Pk. Trmgs.	68.80	22.50	8.00	**.60**
Blade Meat	73.10	18.00	7.80	**1.10**
Picnic Shank Meat	65.30	18.90	15.00	**.80**
Ham Shank Meat	62.60	17.60	19.00	**.80**
Pk. Trmgs. Pad for Ck.	64.00	15.00	20.00	**1.00**
Neck Fat Skin Off	13.00	2.60	84.00	**.40**
Skd. Jowls	22.10	5.70	71.70	**.50**
Belly Fat Skin Off	6.40	1.30	92.20	**.10**
Ham Fat Skin Off	11.80	3.10	84.90	**.20**
Back Fat Skin Off	5.70	1.30	92.90	**.10**
Gelatin Skins 10% Fat	47.50	22.80	28.50	**1.20**
Brains	77.40	11.80	9.80	**1.00**
Cheeks	67.25	15.75	16.00	**1.00**
Cheeks Pad. for Ck.	67.25	15.75	16.00	**1.00**
Diaphragm Meat	68.20	17.00	13.65	**1.15**
Gullet Mt.	74.60	16.20	8.00	**1.20**
Head Mt.	58.00	15.25	25.00	**1.75**
Head Skins	32.40	9.25	57.37	**.98**
Hearts	74.40	17.50	7.00	**1.10**
Jaw Mt	69.00	18.73	11.27	**1.00**
Livers	69.80	23.50	3.85	**2.85**
Melts	79.30	17.70	1.80	**1.20**
Snouts	52.25	14.61	32.14	**1.00**
Snout Mt.	59.00	16.43	23.57	**1.00**
Stomachs	70.25	13.85	13.50	**1.90**
Tongues	58.35	16.25	24.50	**1.00**
Tongue Trmgs.	26.50	8.65	64.85	**.10**

Ash Content Of Meats (Continued)

	Moisture	Protein	Fat	**Ash**
Cured Pork Material				
Clear Fat	18.10	2.30	78.10	**1.50**
DS Fat Backs	9.20	1.80	85.00	**4.00**
Smoked Pk. Skins	12.80	38.00	46.50	**2.70**
Bacon Ends and Pcs.	14.50	7.70	76.00	**2.50**
High Fat Cracklings	6.00	19.00	74.00	**0.00**
Med. Fat Cracklings	5.00	43.00	51.00	**0.00**
Low Fat Cracklings	8.00	84.50	6.50	**0.00**
Green Calf Material				
Reg. Bnls. Veal	72.25	19.80	6.95	**1.00**
Cheeks	74.50	17.21	7.21	**1.00**
Gullet Mt.	76.50	15.20	7.30	**1.25**
Hearts	71.70	19.67	7.63	**1.00**
Tripe	87.30	9.00	3.20	**.50**
Green Sheep Material				
Reg. Boneless Mutton	69.40	19.17	10.43	**1.00**
Cheeks	67.90	18.84	12.26	**1.00**
Gullett Mt.	75.00	15.40	9.10	**.50**
Hearts	67.20	14.90	14.40	**3.50**
Tripe	90.05	8.07	1.40	**.48**

Methods Development

The CEM Applications Laboratory has developed procedures for various types of samples. These procedures include parameters (program, power, time, sample preparation, etc.) needed to program the SMART System^{5}™ and analyze samples in the SMART System^{5} and Fat Analysis System. CEM sample analysis procedures can be requested from the CEM Applications Laboratory.

If a procedure for a particular sample is not included in the applications list, review all information in this chapter relating to sample preparation, sample spread technique, time and power parameters, redry time, and bias identification to develop an application method. If necessary, call the CEM Applications Laboratory for additional information and assistance (800) 726-3331.

1. Begin testing at 100% power and 100 °C.

2. If the sample has high solids content (approximately 75% solids), begin testing with a low sample weight (1 - 2 grams).

3. Use Quick Test, Constant Weight for testing.

4. Observe weight change closely. The weight should steadily decline. If weight is erratic (±1 mg), the test should be stopped because the sample is probably burning. Reduce the power to 50% and perform the test again. If the sample continues to burn, adjust the power in 5 degree increments.

5. Record final weight result and time.

6. Perform multiple sample tests with determined power and time. Results should be within ±0.2%.

7. For fat content results, the re-dry power setting should be no higher than the power setting used to remove moisture.

Quick Test

Quick Test permits entry of parameters for a one-time analysis or method development. The Quick Test method permits two sample analysis procedures – Constant Weight and Set Time.

Constant Weight

Constant weight permits the operator to dry a sample until a constant weight is achieved. Dryness is specified by defining a maximum acceptable weight loss over a specified time interval. During the specified time, when the weight loss is equal to or less than that which was specified, the analysis stops and results are calculated.

1. With the CEM Main Menu displayed, press "1" to activate Quick Test.

2. Press "1" to select and enter power.

3. Using the numeric keys, enter the power level (1 - 100%).

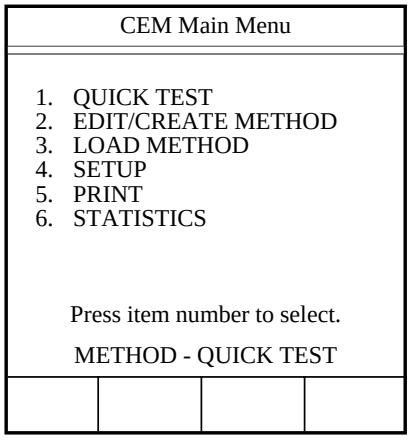
4. Press ENTER.

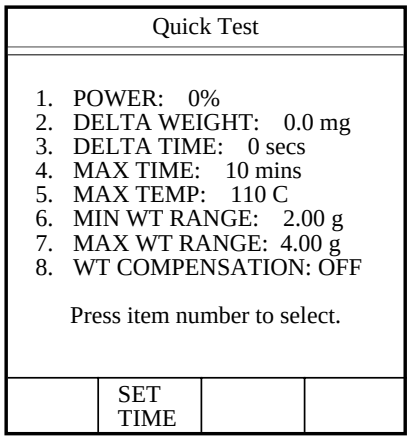
5. Press "2" to select and enter delta weight.

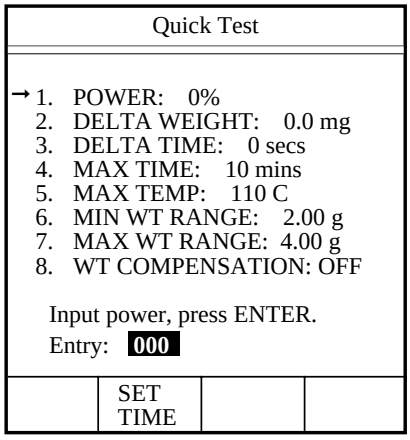
Note: To edit any of the parameters, press the numeric key of the parameter to be edited and use the numeric keys to enter the new parameter. Then, press ENTER.

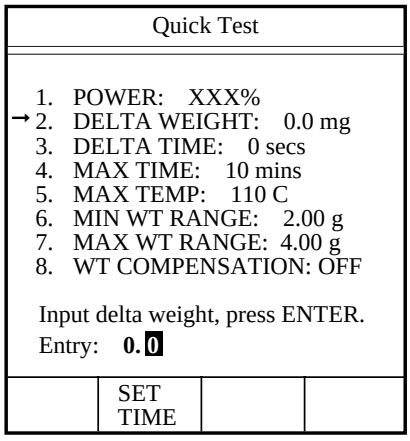
6. Using the numeric keys, enter the delta weight (.1 - .9). Normally a weight loss differential of 0.2 - 0.5 mg is used.

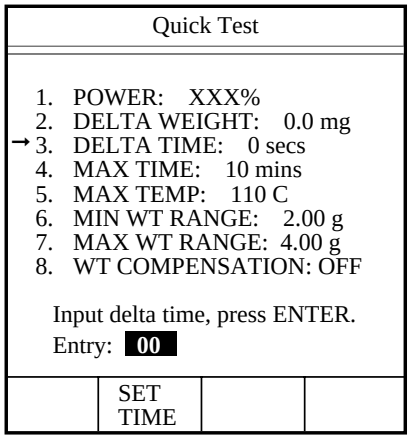
7. Press ENTER.







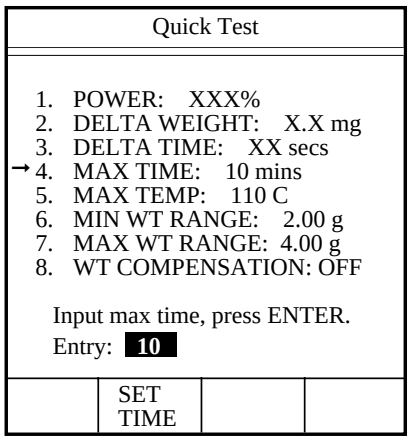




8. Press “3” to select and enter delta time.

9. Using the numeric keys, enter the delta time (1 - 60 seconds). Normally a differential time interval of 10 - 15 seconds is used.

10. Press ENTER.

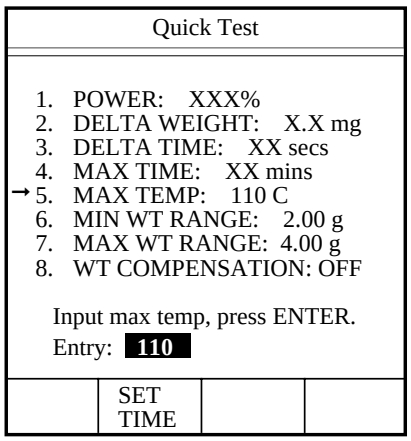


Note: Maximum run time is the amount of time the instrument will operate prior to shutdown if a constant weight has not been reached. A maximum run time must be entered or the program will be invalid. If the instrument shuts down due to maximum run time, parameters should be adjusted prior to repeating the analysis.

11. Press “4” to select and enter maximum run time. If using the default value of 10 minutes, omit step 12.

12. Using the numeric keys, enter the maximum run time (1 - 60 minutes).

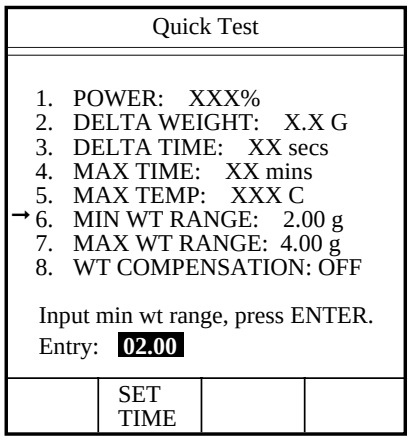
13. Press ENTER.



14. Press “5” to select and enter maximum temperature. If using the default value of 110°C, omit step 15.

15. Using the numeric keys, enter the maximum temperature (0 - 300 °C) of the instrument during the analysis.

16. Press ENTER.



17. Press “6” to enter a minimum weight range. If using the default minimum weight range of 2.00 g, omit step 18.

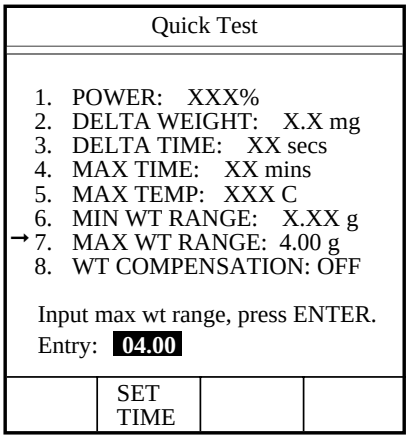
18. Using the numeric keys, enter the minimum weight range of the sample (0 - 50 g).

19. Press ENTER.

20. Press “7” to enter a maximum weight range. If using the default maximum weight range of 4.00 g, omit step 21.

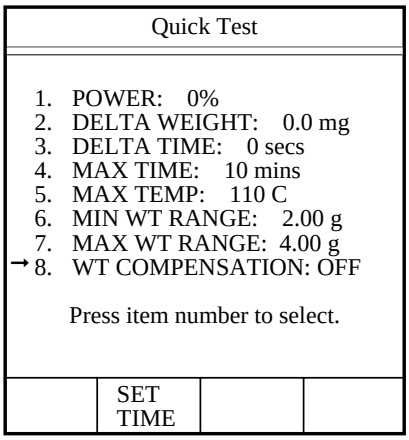
21. Using the numeric keys, enter the maximum weight range of the sample (0 - 50 g).

22. Press ENTER.



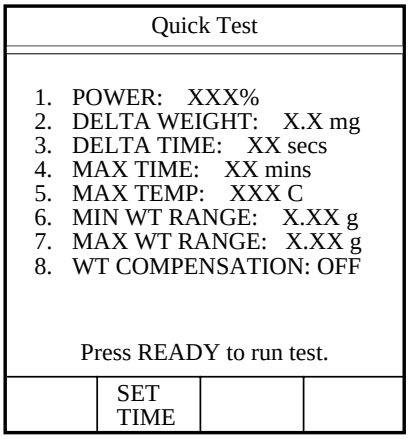
Note: Weight compensation is designed for use with samples having a buoyancy effect created by heat. It should be used (turned on) for samples, such as milk, margarine, condiments, etc., which have a higher temperature when the final weight is calculated than at the beginning of the test.

23. Press “8” to toggle weight compensation “on” or “off.”



Note: To edit any of the parameters, press the numeric key of the parameter to be edited and use the numeric keys to enter the new parameter. Then, press ENTER.

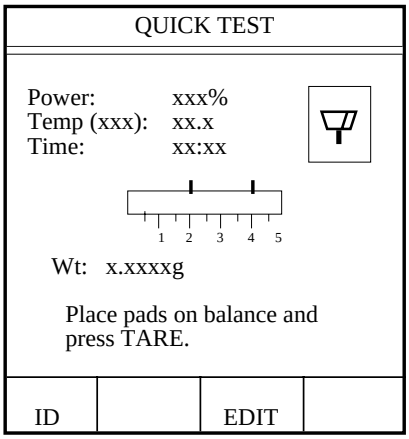
24. Press READY to begin the analysis.

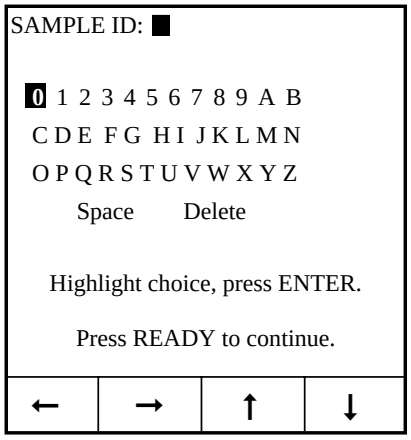


Note: The Quick Test screen appears indicating the power, temperature and time.

Note: Press the operation key below EDIT to return to the Quick Test parameter screen to edit method parameters.

25. If Autotrack is turned off, a sample identification is required. Press the operation key below ID.

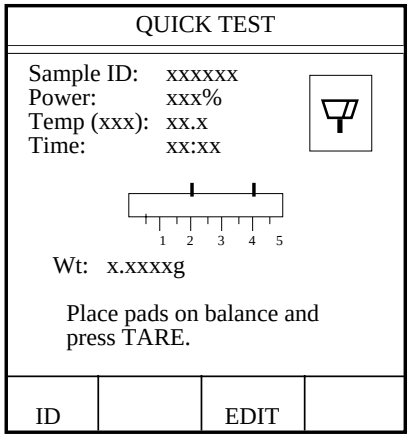




26. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

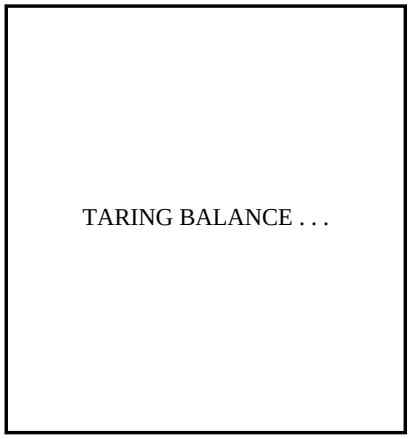
Note: If using an identification number only, use the numeric keys to enter the number.

27. Press READY to return to the Quick Test screen.

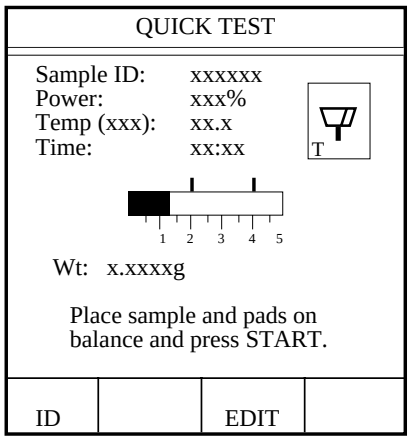


28. Lift the top cover of the SMART System 5™. Place two glass fiber sample pads on the balance pan. Close the top cover.

29. Press TARE.



30. Wait for the instrument to tare the weight of the sample pads. The Quick Test screen will reappear when the tare function is complete.

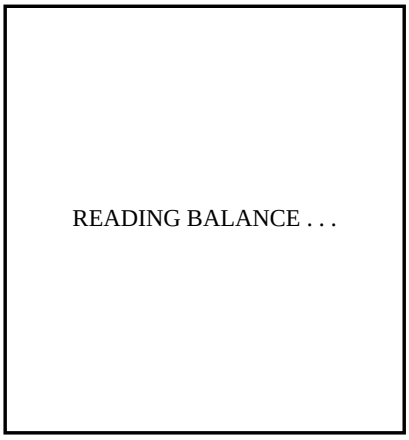


Note: The “T” in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

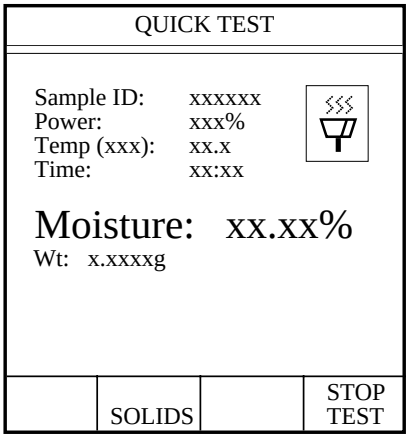
31. Lift the instrument cover. Apply the sample in a thin, even layer to one of the sample pads. Quickly and gently place the sample pads back on the balance pan. Close the top cover.

32. Press START.

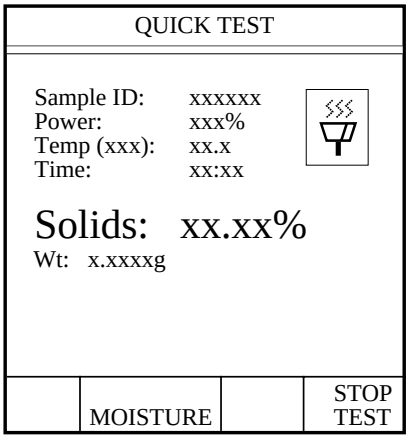
The instrument reads and records the initial weight of the sample prior to beginning the analysis.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting upward. The sample weight decreases as the moisture is removed.



During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

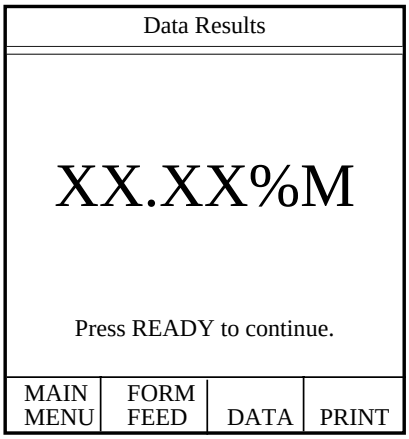


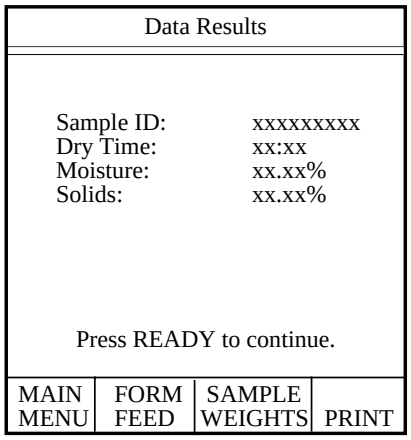
When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

Note: Press READY to analyze additional samples using the same method.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

33. Press the operation key below DATA to display the analysis data.

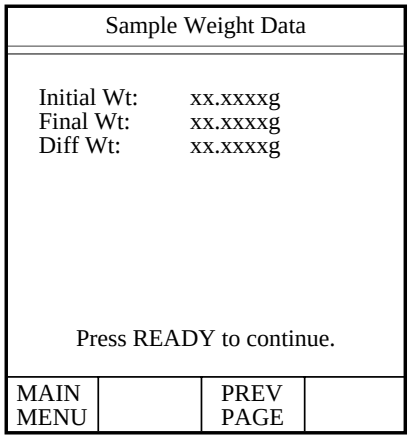




34. Press the operation key below SAMPLE WEIGHTS to view sample weight information.

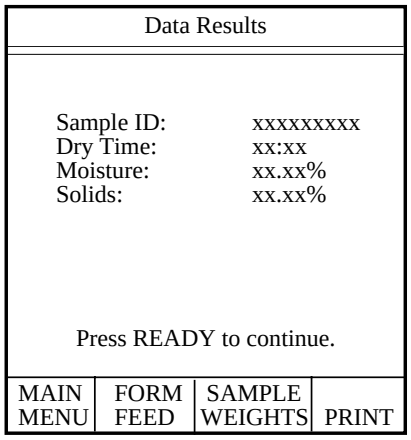
The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

35. Press the operation key below PREV PAGE to return to the Data Results screen.

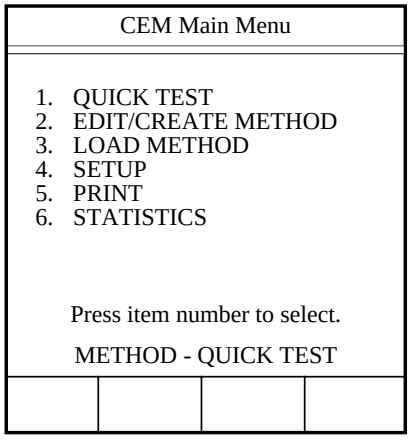


36. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to analyze additional samples using the same method.



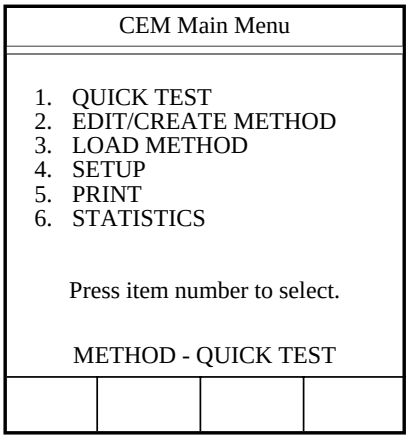
37. Press the operation key below MAIN MENU to return to the CEM Main Menu screen.



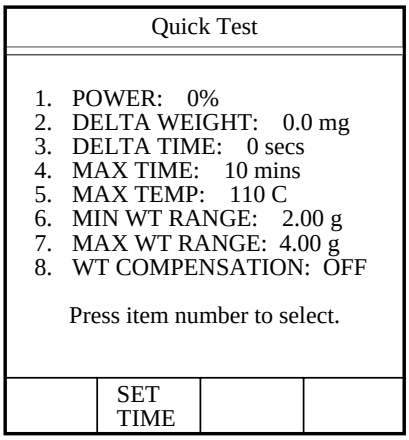
Set Time

Set time permits the operator to control the sample analysis by entering a specified analysis time and power level. At the end of the specified time, the percent solids and/or moisture of the sample is calculated and displayed.

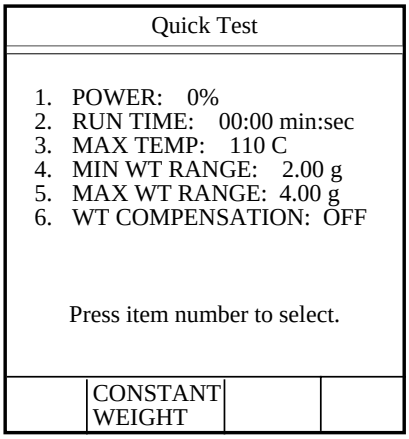
1. With the CEM Main Menu displayed, press "1" to activate Quick Test.



2. Press the operation key below SET TIME.

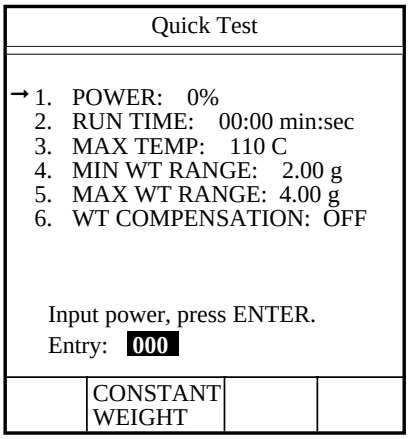


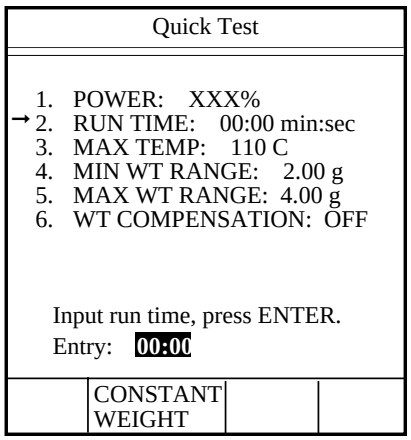
3. Press "1" to enter power.



4. Using the numeric keys, enter the power level (1 - 100%).

5. Press ENTER.

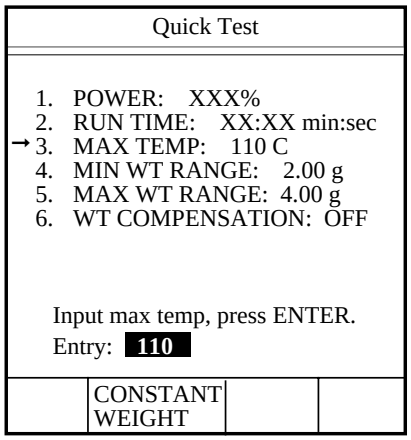




6. Press “2” to select and enter the sample drying time.

7. Using the numeric keys, enter the run time (1 sec. - 99 min. 59 sec.).

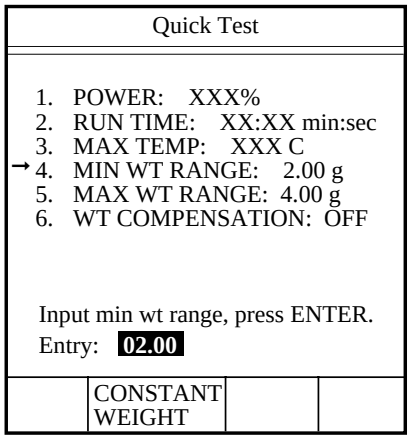
8. Press ENTER.



9. Press “3” to select and enter maximum temperature. If using the default value of 110°C, omit step 10.

10. Using the numeric keys, enter the maximum temperature (0 - 300 °C) of the instrument during the analysis.

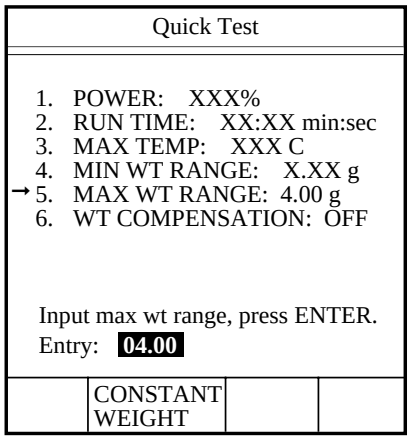
11. Press ENTER.



12. Press “4” to enter a minimum weight range. If using the default minimum weight range of 2.00 g, omit step 13.

13. Using the numeric keys, enter the minimum weight range of the sample (0 - 50 g).

14. Press ENTER.



15. Press “5” to enter a maximum weight range. If using the default maximum weight range of 4.00 g, omit step 16.

16. Using the numeric keys, enter the maximum weight range of the sample (0 - 50 g).

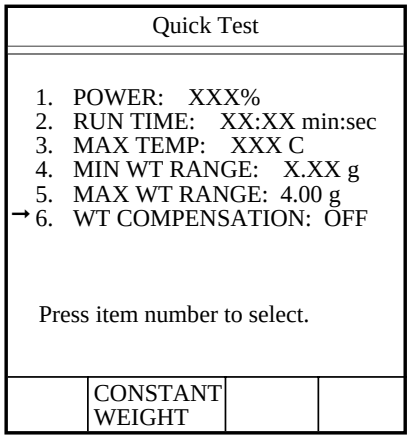
17. Press ENTER.

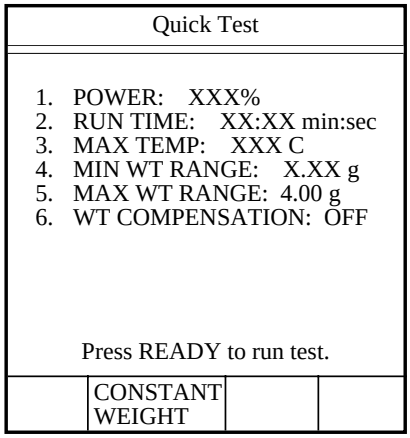
Note: Weight compensation is designed for use with samples having a buoyancy effect created by heat. It should be used (turned on) for samples, such as milk, margarine, condiments, etc., which have a higher temperature when the final weight is calculated than at the beginning of the test.

18. Press “6” to toggle Weight Compenstaion “on” or “off.”

Note: To edit any of the parameters, press the numeric key of the parameter to be edited and use the numeric keys to enter the new parameter. Then, press ENTER.

19. Press READY to begin the analysis.





Note: The Quick Test screen appears indicating the power, temperature and time.

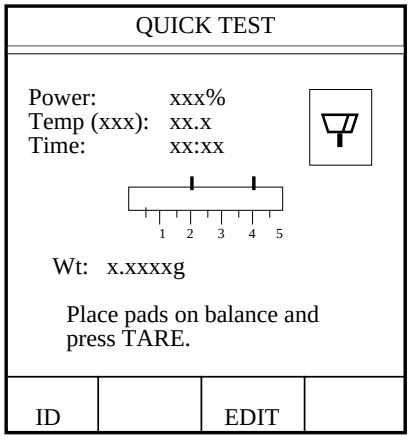
Note: Press the operation key below EDIT to return to the Quick Test parameter screen to edit method parameters.

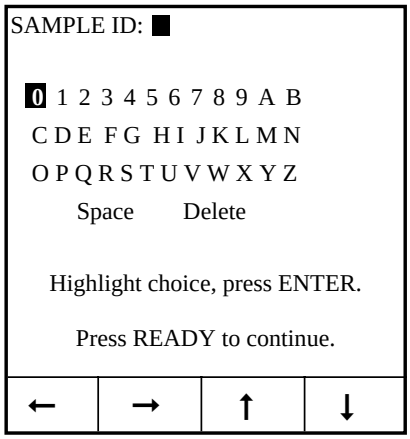
20. If Autotrack is turned off, a sample identification name or number is required. Press the operation key below ID.

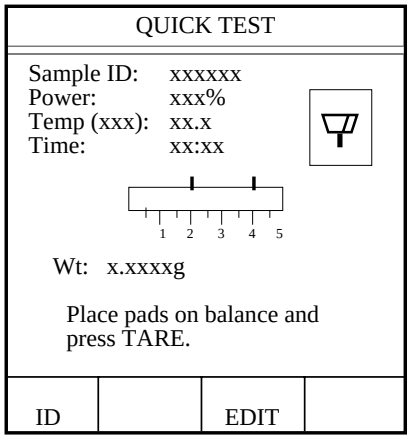
21. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

Note: If using an identification number only, use the numeric keys to enter the number.

22. Press READY to return to the Quick Test screen.

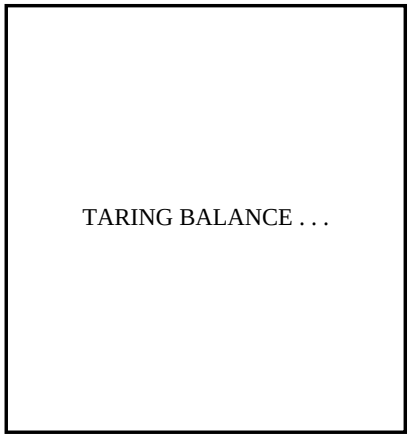




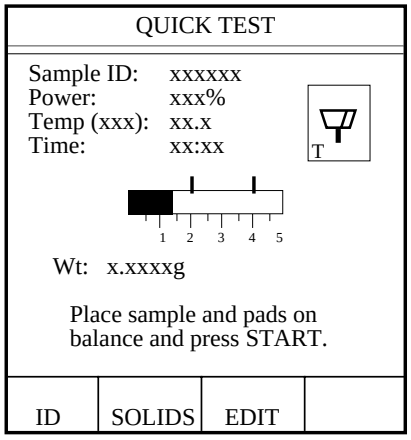


23. Lift the top cover of the SMART System 5™. Place two glass fiber sample pads on the balance pan. Close the top cover.

24. Press TARE.



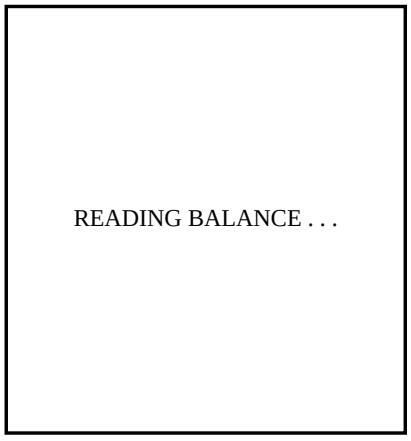
25. Wait for the instrument to zero the weight of the sample pads. The Quick Test screen will reappear when the tare function is complete.



Note: The “T” in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

26. Lift the top cover. Remove the sample pads from the balance pan. Apply the sample in a thin, even layer to one of the sample pads. Quickly and gently place the sample pads back on the balance pan. Close the top cover.

27. Press START.

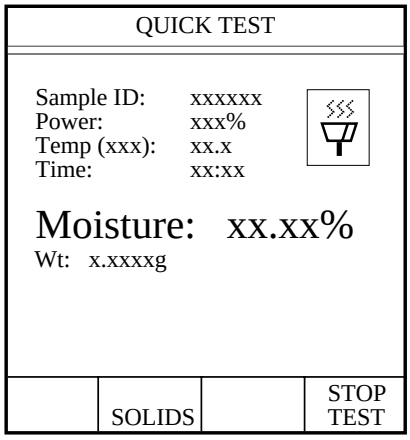


The instrument reads and records the initial weight of the sample prior to beginning the analysis.

As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting down. The sample weight decreases as the moisture is removed.

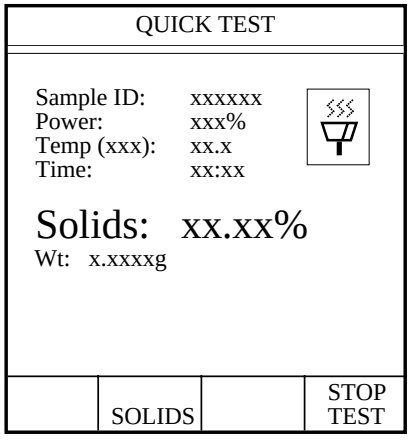
During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

Note: Press the operation key below STOP TEST to stop the method test.



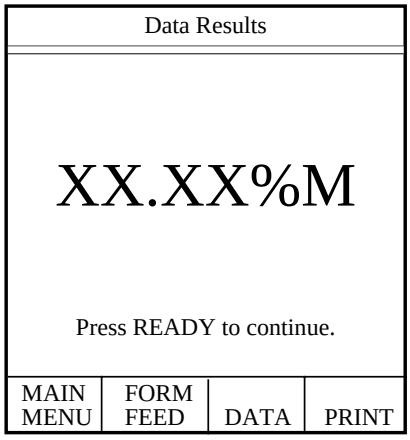
When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

Note: Press READY to analyze additional samples using the same method.

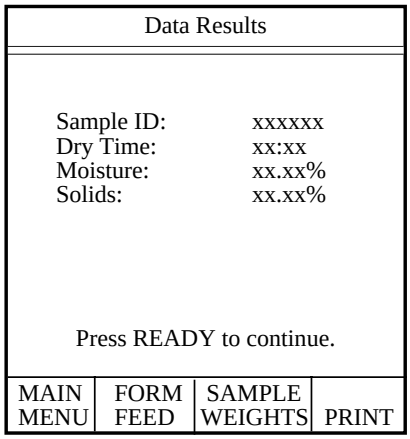


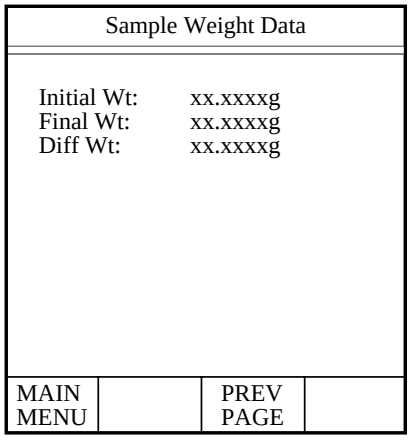
Note: Press the operation key below FORM FEED to advance blank paper from the internal printer.

28. Press the operation key below DATA to display the analysis data.



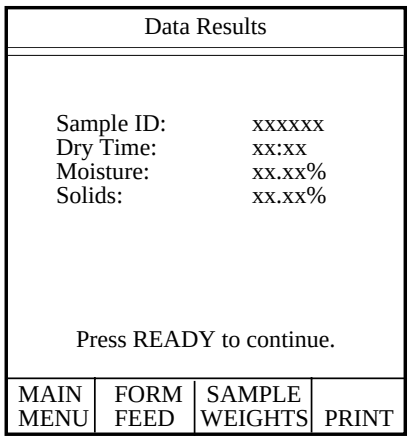
29. Press the operation key below SAMPLE WEIGHTS to view sample weight information.





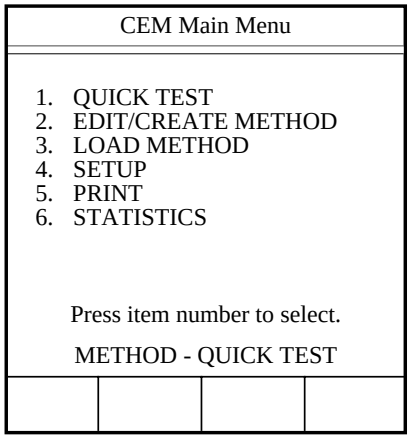
The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

30. Press the operation key below PREV PAGE to return to the Data Results screen.



31. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to analyze additional samples using the same method.



32. Press the operation key below MAIN MENU to return to the CEM Main Menu screen.

Edit/Create Method

The SMART System 5™ permits a variety of analysis programs, based on sample type.

Moisture/Solids – The instrument performs a moisture/solids determination.

Moisture/Fat – The instrument performs a moisture/fat determination.

Dilution – The sample is diluted, and a dilution factor is used for the diluted sample result; therefore, an accurate moisture/solids value for the undiluted sample is obtained. An interfaced external balance is required. The dilution program should be used with samples that burn easily, viscous samples or samples which dry unevenly.

Syringe Weigh – Syringe Weigh is utilized when the moisture/solids instrument cannot accurately record the initial sample weight due to rapid evaporation. The rapid evaporation can be caused by the sample being warmer than room temperature or containing a solvent that evaporates quickly. The instrument internal balance or an interfaced external balance can be used to calculate the weight of the syringe.

Ash – The moisture/solids instrument performs a standard analysis on the sample. The sample is then transferred into an ashing furnace. The ashed sample is returned to the moisture/solids instrument for calculation of the ash content.

Wastewater Total Suspended Solids (TSS) – A filter is utilized for samples with low solids concentration. The instrument dries and weighs the solids obtained on a tared filter from the filtration of a known volume of sample which is manually entered into the system.

Wastewater Total Volatile Suspended Solids (TSS/TVSS) – The moisture/solids instrument performs a standard analysis on the sample. The dried sample is then transferred to an ashing furnace. The ashed sample is returned to the moisture/solids instrument for weighing of the ashed sample. Total Suspended Solids and Total Volatile Suspended Solids are calculated.

Moisture/Fat Modified – The fat is extracted from one sample while another sample is dried for moisture analysis, permitting analysis of fat content of samples in which initial drying may bind the fat molecules.

Methods can be created in the following modes in either constant weight or set time:

- **Moisture/Solids**
  - Standard
  - Wastewater
  - Dilution
  - Syringe Weigh
  - Ash
- **Moisture/Fat**
  - Standard
  - Dilution
  - Modified Fat
- **Moisture/Fat/Protein**
  - Standard
  - Dilution
  - Modified Fat

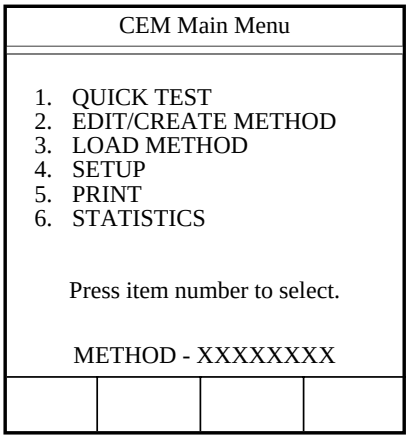
CEM Corporation has preprogrammed several methods into the SMART System^5 which can be used as programmed or edited for a specific sample. Preprogrammed methods include:

- Latex
- Water Based Chemical
- Meat (Raw)
- Cheese
- Milk
- Tomato Paste
- Butter
- Mayonnaise
- Eggs
- Salad Dressing
- Pet Food
- Yogurt
- Meat (Processed)

To use a CEM preprogrammed method, refer to the Load Method section of this manual. To Edit a preprogrammed method, refer to the Edit Method section of this manual.

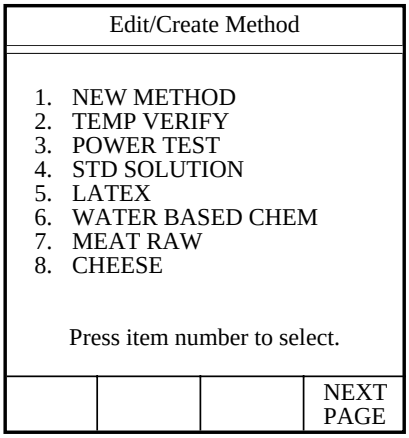
Edit Method

1. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



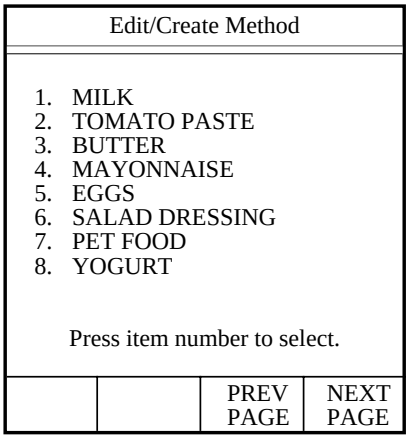
2. Press the item number of the method to be edited.

Note: If the method to be edited is not displayed on the screen, press the operation key below NEXT PAGE to access additional methods. Continue to press the operation key below NEXT PAGE until the desired method is displayed.



CEM preprogrammed methods include:

- Temp Verify (cannot be edited)
- Power Test (cannot be edited)
- Standard Solution (cannot be edited)
- Latex
- Water Based Chemical
- Meat Raw
- Cheese
- Milk
- Tomato Paste
- Butter
- Mayonnaise
- Eggs
- Pet Food
- Yogurt
- Meat Processed



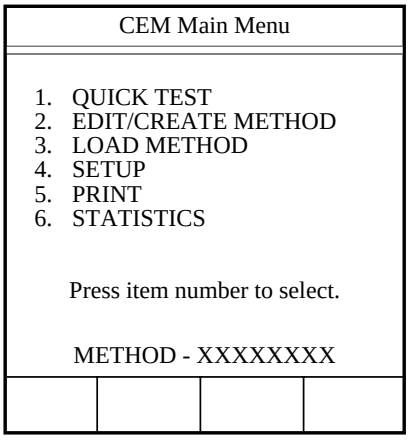
3. Refer to the CREATE METHOD section of this manual for specific instructions for entering method information to edit desired modes and/or parameters.

CAUTION

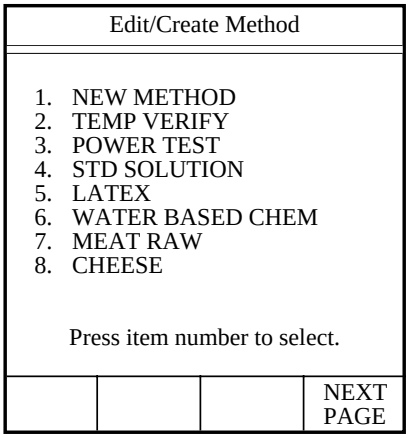
If a CEM preprogrammed method is edited, new parameters will be saved. To prevent elimination of the preprogrammed method, refer to the preprogrammed method and create a new method with the desired parameters.

Moisture/Solids - Standard

1. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



2. Press "1" to create a new method.



3. Using the operation keys below the arrows, select the first letter or number of the method name.

4. Press ENTER.

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

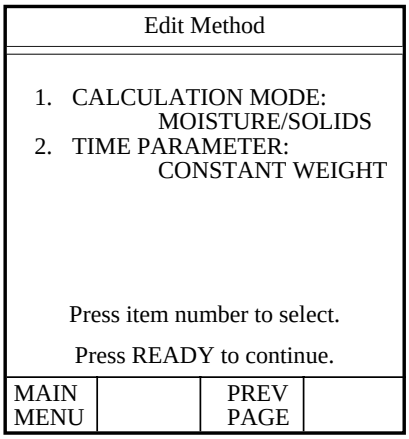
5. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected.

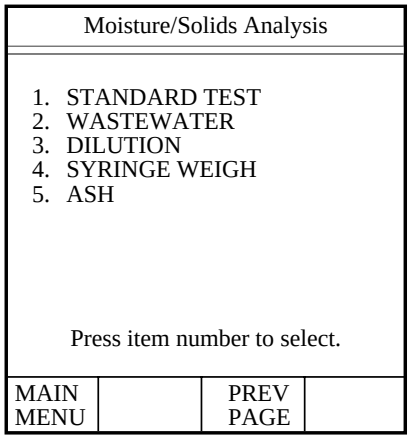
6. Press READY.

7. Press "1" to toggle and select "Moisture/ Solids."

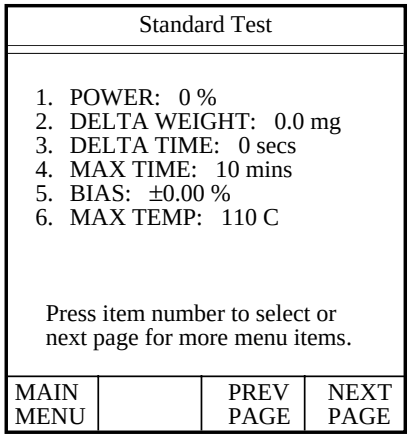
8. Press "2" to toggle and select "Constant Weight" or "Set Time."

9. Press READY.





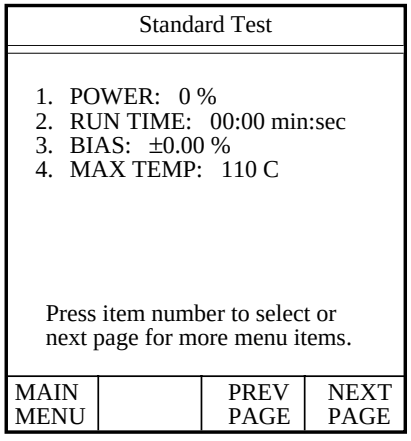
10. Press “1” to select “Standard Test.”



CONSTANT WEIGHT

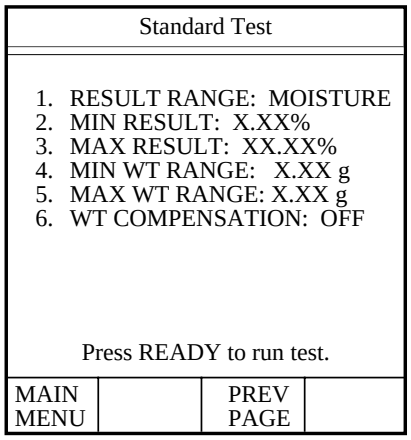
11. Press the numbers (1 - 5 Constant Weight or 1 - 3 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

12. Press the operation key below NEXT PAGE to access additional method parameters.

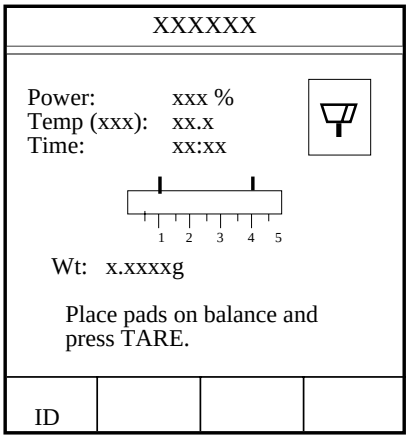


13. Press the numbers (1 - 6) and enter the appropriate method parameters.

Note: Weight compensation is designed for use with samples having a buoyancy effect created by heat. It should be used (turned on) for samples, such as milk, margarine, condiments, etc., which have a higher temperature when the final weight is calculated than at the beginning of the test.

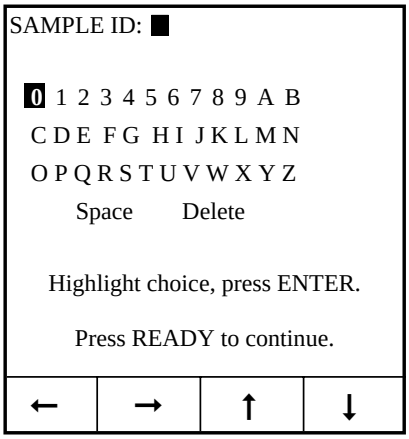
14. After the final method parameter is entered, press READY to begin the analysis.

Note: The method test screen appears indicating the power, temperature and time.



15. If Autotrack is turned off, a method identification name or number is required. Press the operation key below ID.

16. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

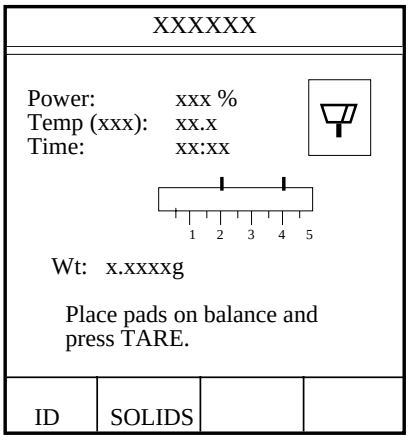


Note: If using an identification number only, use the numeric keys to enter the number.

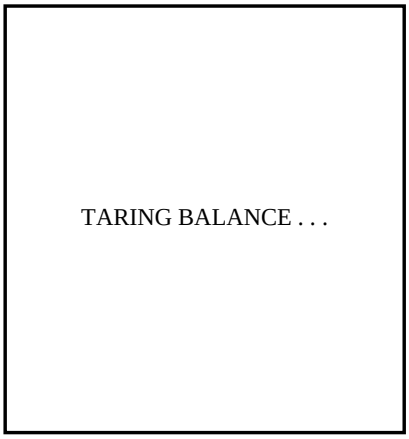
17. Press READY to return to the method screen.

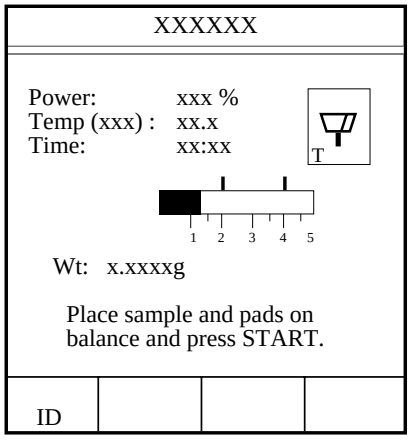
18. Lift the top cover of the SMART System 5™. Place two glass fiber sample pads on the balance pan. Close the top cover.

19. Press TARE.



20. Wait for the instrument to tare the weight of the sample pads. The method test screen will reappear when the tare function is complete.

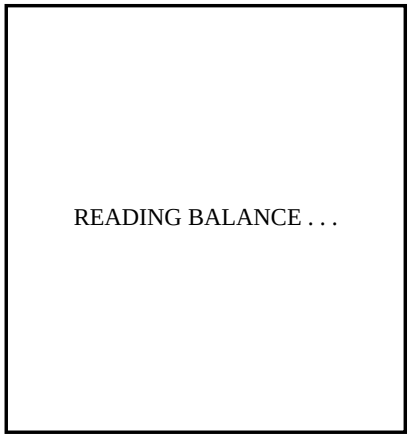




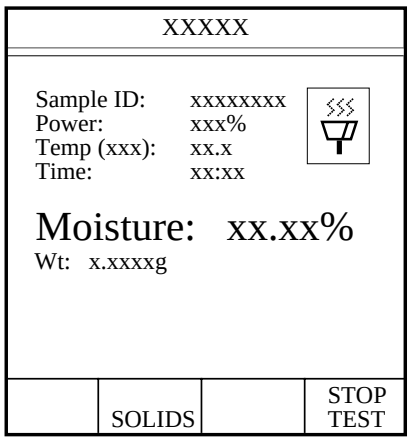
Note: The “T” in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

21. Lift the instrument cover. Apply the sample in a thin, even layer to one of the sample pads. Quickly and gently place the sample pads back on the balance pan. Close the top cover.

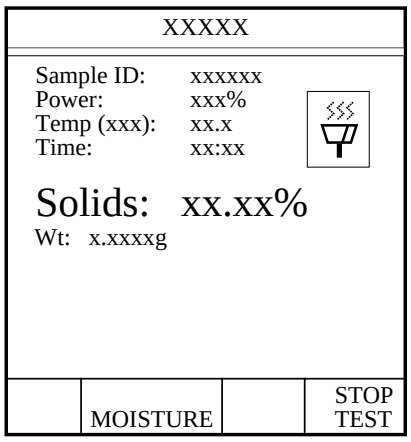
22. Press START.



The instrument reads and records the initial weight of the sample prior to beginning the analysis.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time). The sample weight decreases as the moisture is removed.



During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

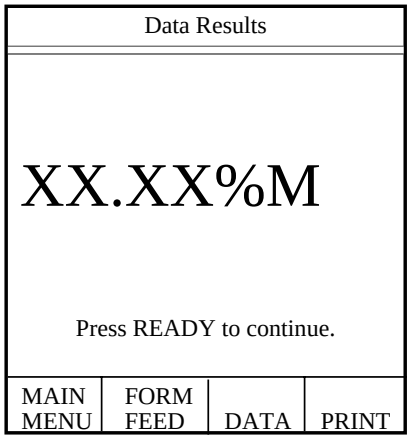
When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

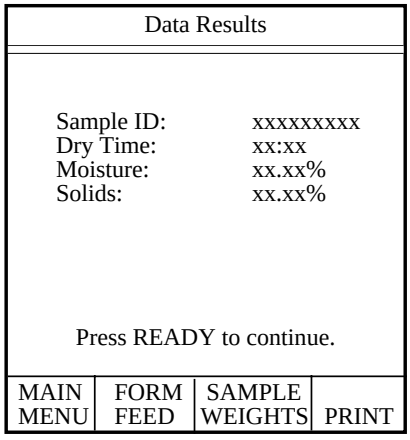
Note: Press READY to analyze additional samples using the same method.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

23. Press the operation key below DATA to display the analysis data.

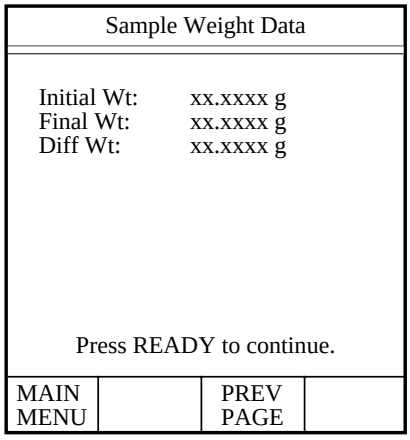
24. Press the operation key below SAMPLE WEIGHTS to view sample weight information.





The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

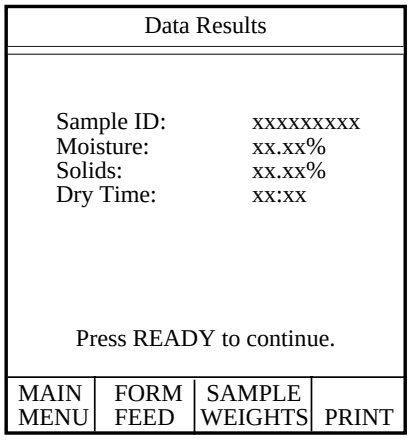
25. Press the operation key below PREV PAGE to return to the Data Results screen.



26. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

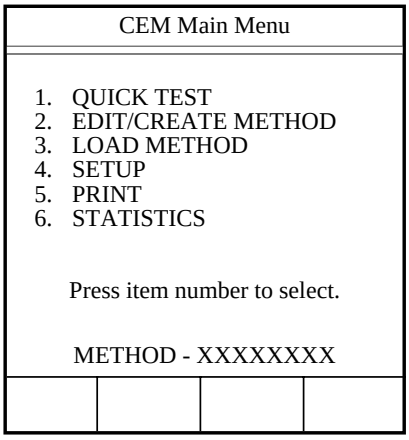
Note: Press READY to analyze additional samples using the same method.

27. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

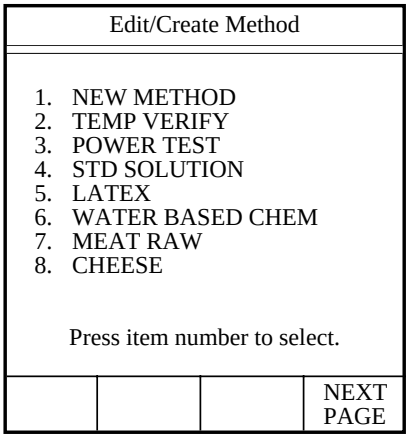


Moisture/Solids - Wastewater - TSS

1. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



2. Press "1" to create a new method.



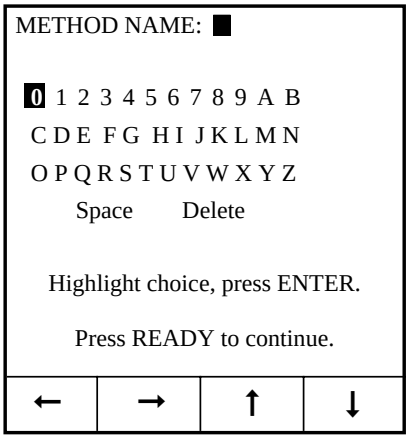
3. Using the operation keys below the arrows, select the first letter or number of the method name.

4. Press ENTER.

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

5. Continue using the operation keys below the arrows to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected.

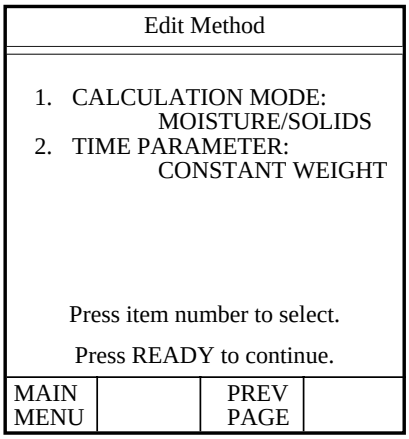
6. Press READY.

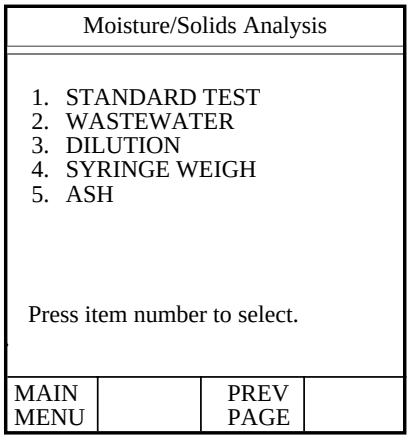


7. Press "1" to toggle and select "Moisture/ Solids."

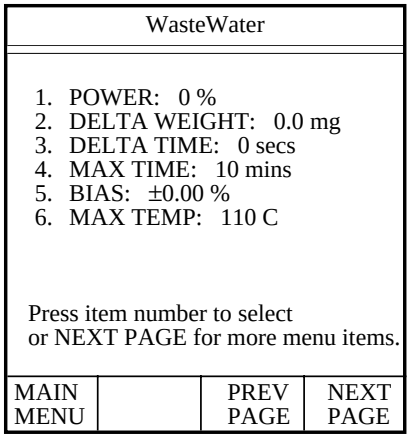
8. Press "2" to toggle and select "Constant Weight" or "Set Time."

9. Press READY.





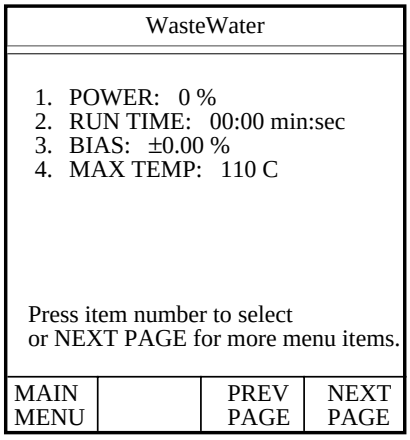
10. Press “2” to select “Wastewater.”



CONSTANT WEIGHT

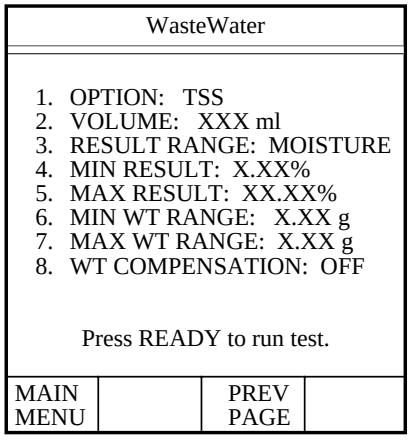
11. Press the numbers (1 - 6 Constant Weight or 1 - 4 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

12. Press the operation key below NEXT PAGE to access additional method parameters.

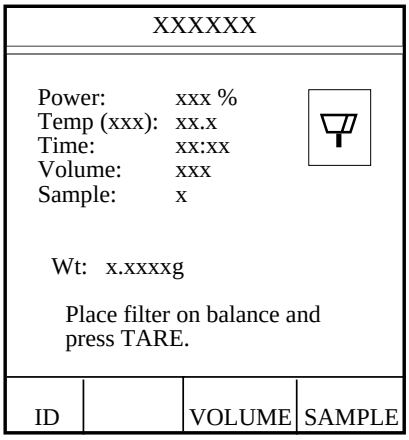


13. Press “1” to toggle and select “TSS.”

14. Press the numbers (2 - 8) and enter the appropriate method parameters.

15. Press READY to begin the method analysis.

Note: The method test screen appears indicating the power, temperature and time.

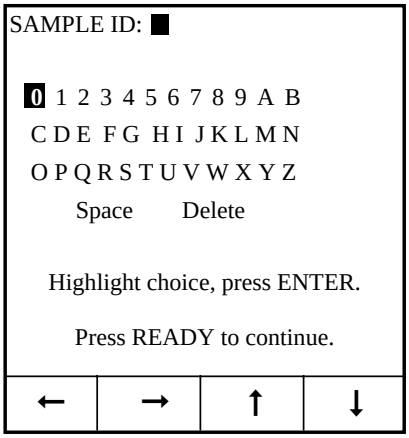


16. If Autotrack is turned off, a sample identification name or number is required. Press the operation key below ID.

17. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

Note: If using an identification number only, use the numeric keys to enter the number.

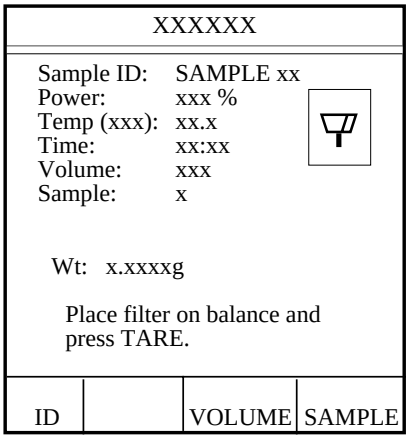
18. Press READY to return to the method screen.



Note: If analyzing only one sample, proceed to step 29.

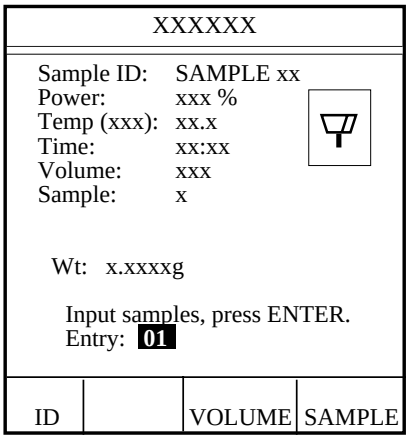
19. For multiple samples, press the operation key below SAMPLE.

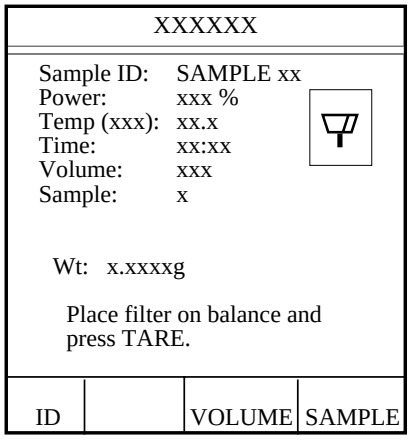
Note: Press the operation key below VOLUME to edit the sample volume.



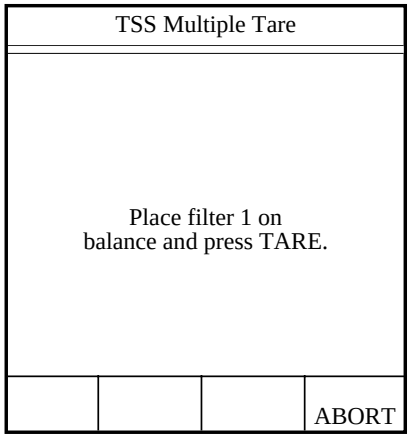
20. Using the numeric keys, enter the number of samples to be analyzed.

21. Press ENTER.





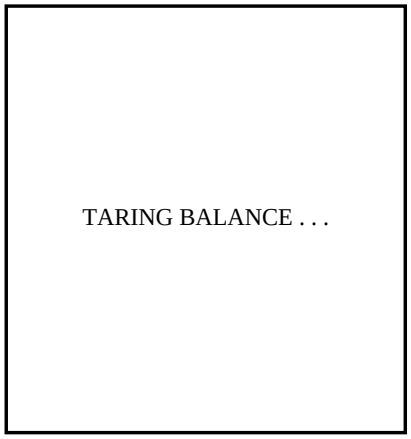
22. Press TARE.



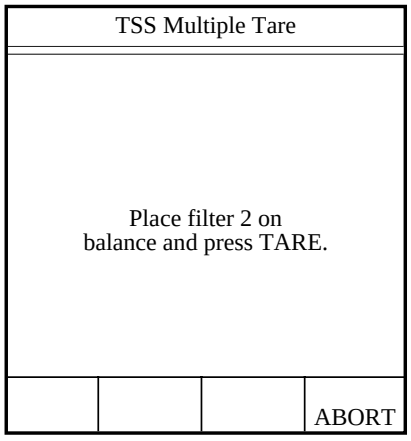
23. Lift the instrument cover. Place filter #1 on the balance pan. Close the instrument cover.

24. Press TARE.

Note: Press the operation key below ABORT to abort the analysis.



25. Wait for the instrument to tare the weight of filter #1.

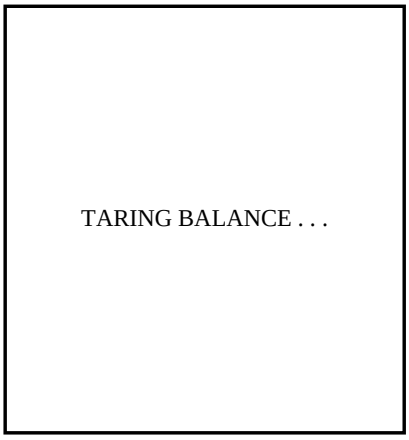


26. Lift the instrument cover. Remove filter #1 from the balance pan. Place filter #2 on the balance pan. Close the instrument cover.

27. Wait for the instrument to tare the weight of filter #2.

28. Continue the tare process until the filters for the total number of samples to be analyzed have been tared.

Note: Filters must be kept in the order in which they are tared for proper sample analysis.



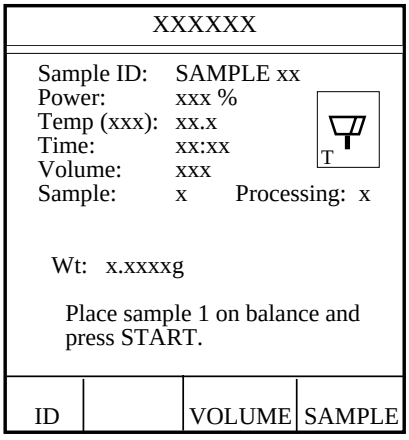
Note: The "T" in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

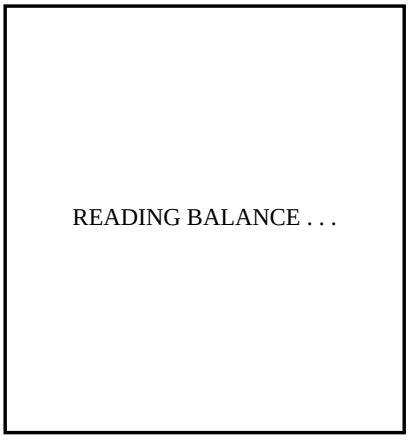
29. Place the first tared filter in the funnel. With the vacuum source operating, pour the sample into the funnel. When all the sample has been filtered, remove the filter from the funnel.

30. Lift the instrument cover. Place the wet filter on the balance pan. Close the cover.

31. Press START.

The instrument reads and records the initial weight of the sample prior to beginning the analysis.

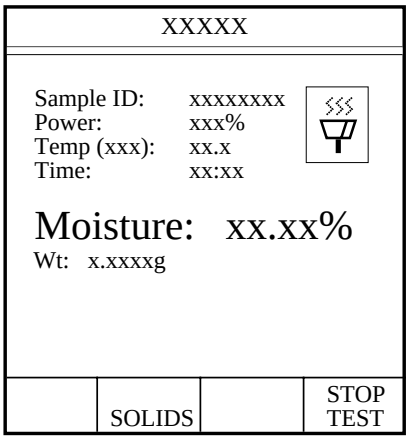


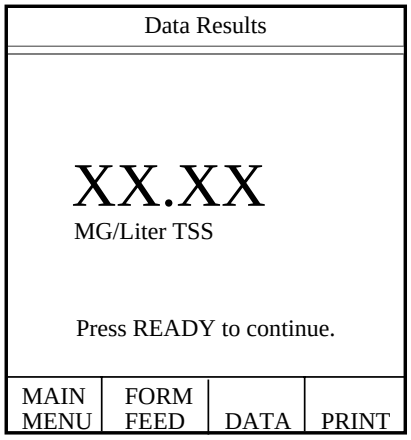


As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time).

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

Note: Press the operation key below STOP TEST to abort the analysis.



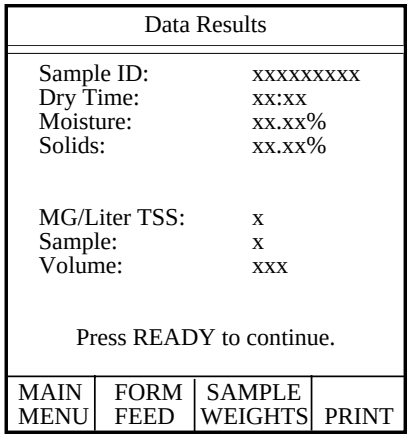


When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

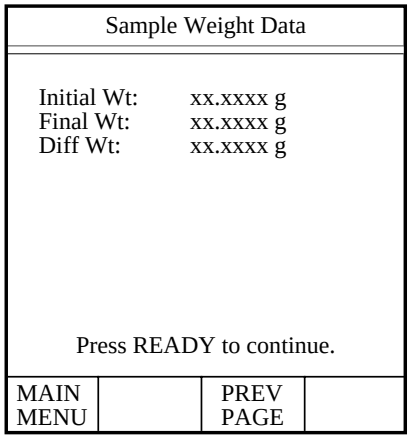
Note: Press READY to analyze additional samples using the same method.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

32. Press the operation key below DATA to display the analysis data.

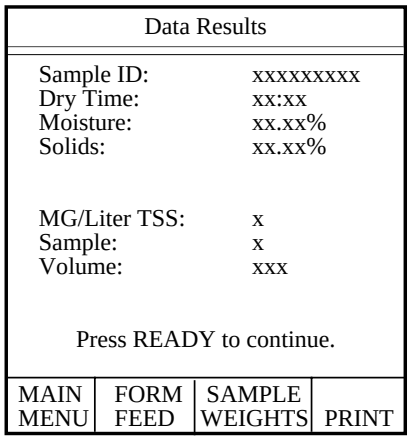


33. Press the operation key below SAMPLE WEIGHTS to view sample weight information.



The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

34. Press the operation key below PREV PAGE to return to the Data Results screen.



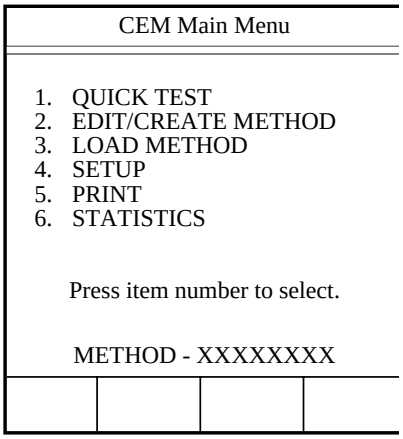
35. Press the operation key below “Print” to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to analyze additional samples using the same method.

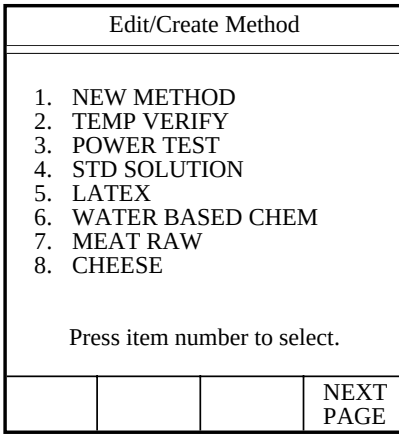
36. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

Moisture/Solids - Wastewater - TSS/TVSS

1. With the CEM Main Menu displayed, press “2” to activate the Edit/Create Method screen.



2. Press “1” to create a new method.

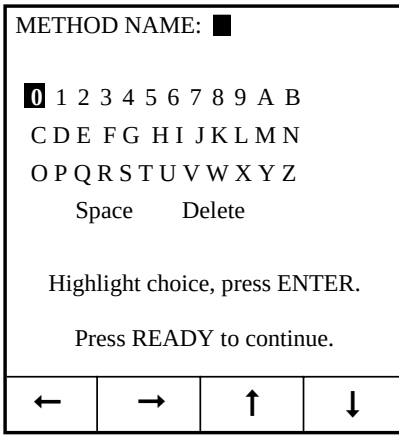


3. Using the operation keys below the arrows, select the first letter or number of the method name.

4. Press ENTER.

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

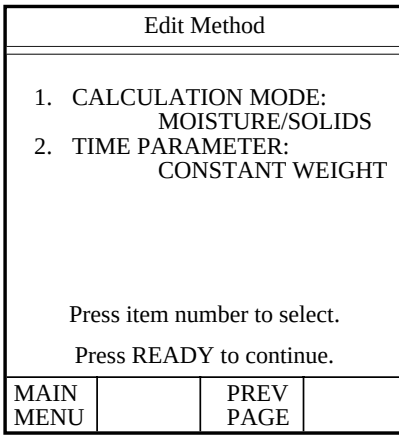
5. Continue using the operation keys below the arrows to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected.

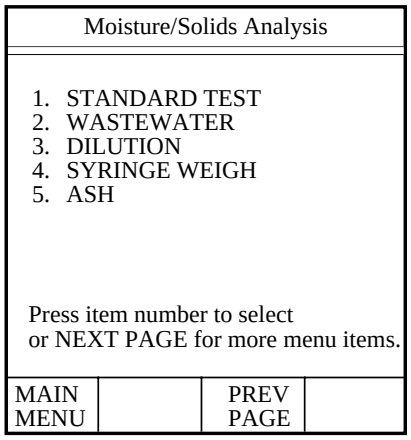


6. Press READY.

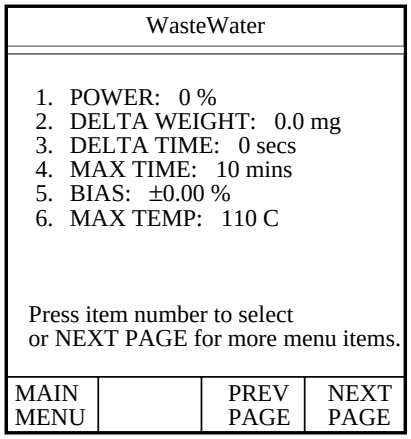
7. Press “1” to toggle and select “Moisture/Solids.”

8. Press “2” to toggle and select “Constant Weight” or “Set Time.”





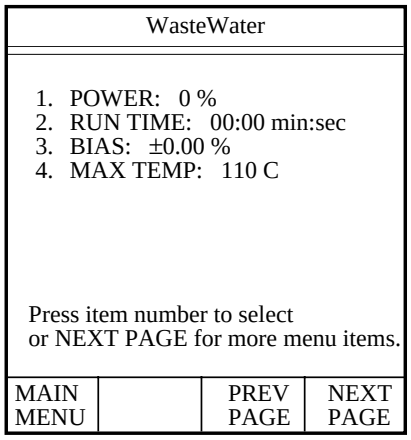
9. Press “2” to select “Wastewater.”



CONSTANT WEIGHT

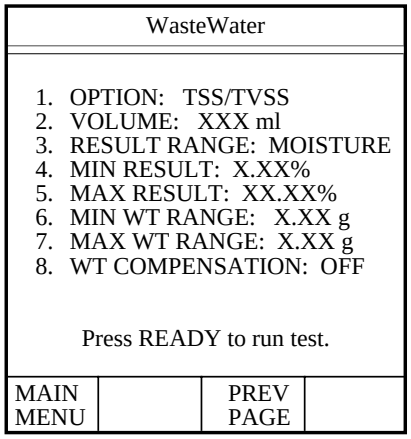
10. Press the numbers (1 - 6 Constant Weight or 1 - 4 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

11. Press the operation key below NEXT PAGE to access additional method parameters.

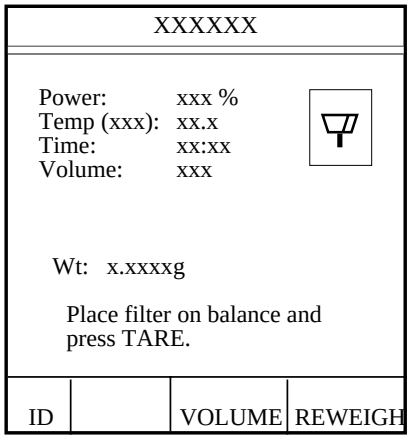


12. Press “1” to toggle and select “TSS/ TVSS.”

13. Press the numbers (2 - 8) and enter the appropriate method parameters.

14. Press “READY” to begin the analysis.

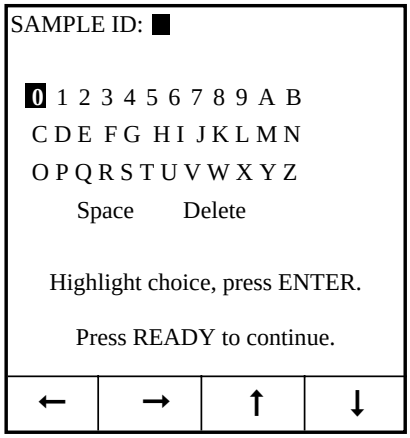
Note: The method test screen appears indicating the power, temperature, volume and time.



Note: Press the operation key below VOLUME to edit or enter a sample volume.

15. If Autotrack is turned off, a sample identification name or number is required. Press the operation key below ID.

16. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

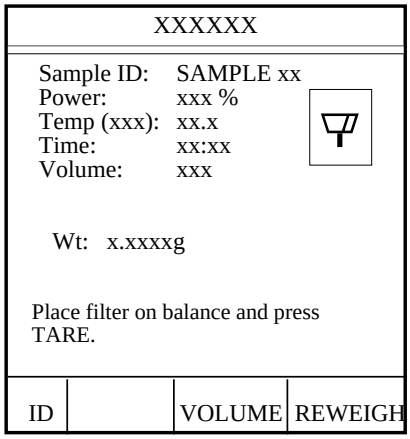


Note: If using an identification number only, use the numeric keys to enter the number

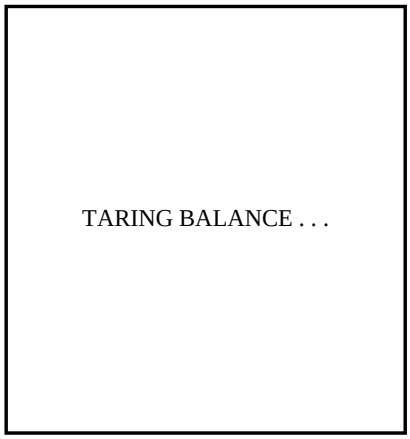
17. Press READY to return to the test screen.

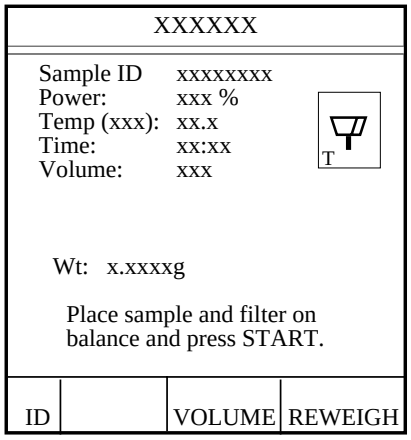
18. Lift the instrument cover. Place the filter on the balance pan. Close the instrument cover.

19. Press TARE.



20. Wait for the instrument to tare the weight of the filter.





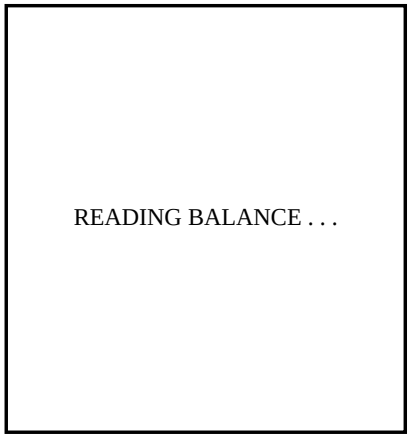
Note: The "T" in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

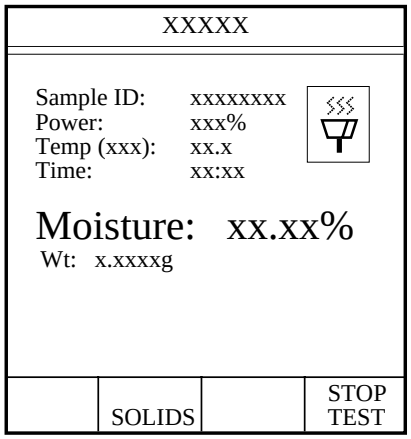
21. Place filter in the funnel. With the vacuum source operating, pour the sample into the funnel. When all the sample has been filtered, remove the filter from the funnel.

22. Lift the instrument cover. Place the wet filter on the balance pan. Close the cover.

23. Press START.

The instrument reads and records the initial weight of the sample prior to beginning the analysis.

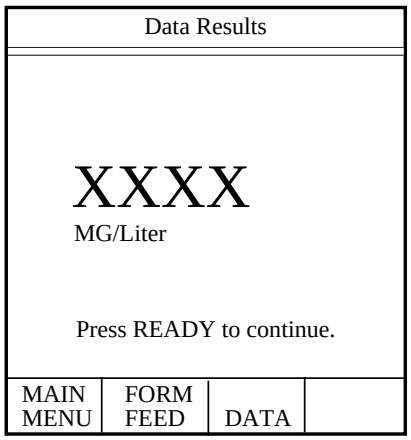




As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time).

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

Note: Press the operation key below STOP TEST to abort the analysis.



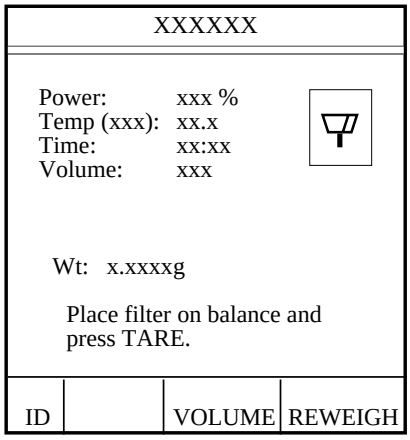
When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

24. To ash the dried sample, fold the filter; place it in an ashing crucible; and place the crucible in the ashing furnace. Ash the sample by the defined method.

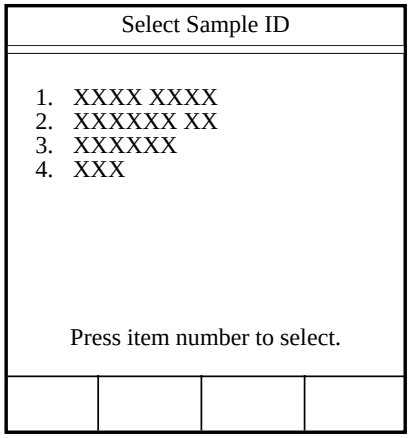
25. Press READY to reweigh the sample.

26. Press the operation key below REWEIGH.

Note: Press the operation key below VOLUME to edit the sample volume.



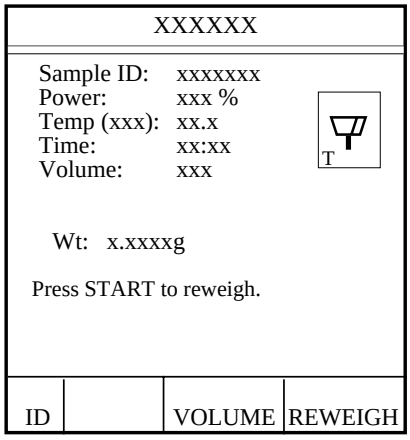
27. Press the numerical key to select the proper sample to be reweighed.



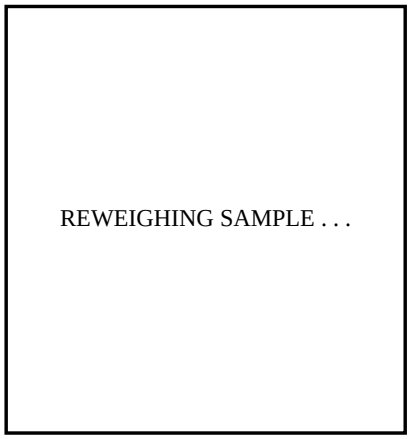
28. Lift the instrument cover. Place the ashed sample on the balance pan. Close the instrument cover.

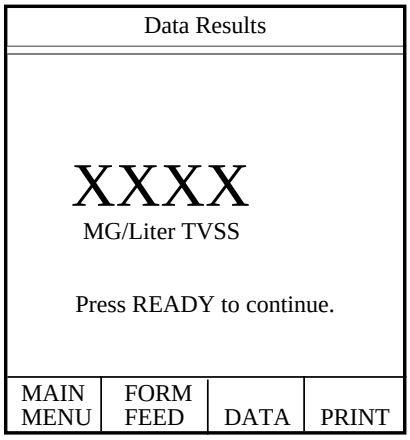
29. Press START.

Note: To reweigh additional samples, press READY and follow the steps outlined above.

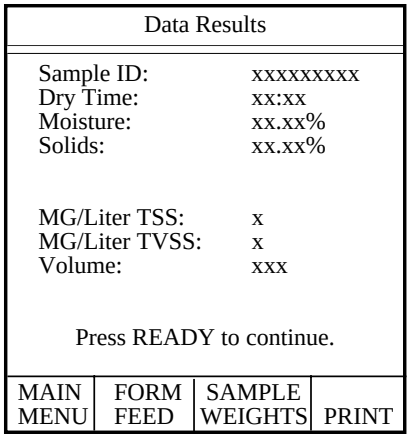


The instrument reweighs the ashed sample and calculates the data results.

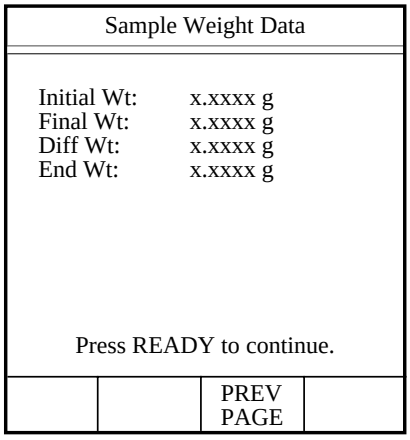




30. Press the operation key below DATA to display the analysis data.

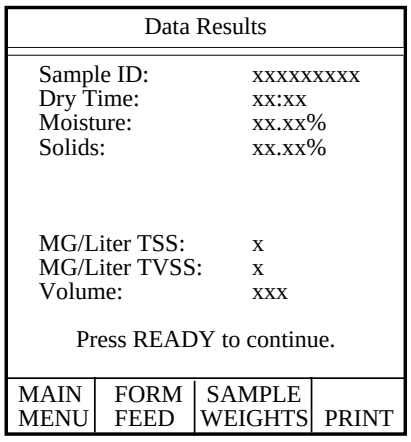


31. Press the operation key below SAMPLE WEIGHTS to view sample weight information.



The Sample Weight Data screen displays the initial weight, the final weight, the differential weight and the end weight.

32. Press the operation key below PREV PAGE to return to the Data Results screen.



33. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

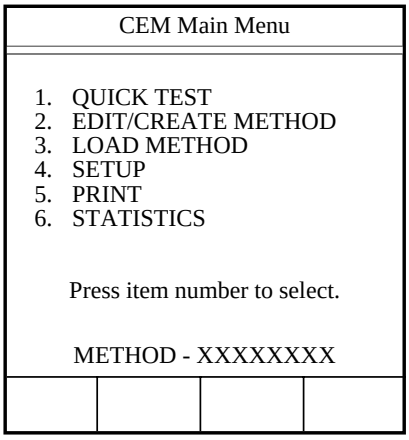
Note: Press READY to continue analysis using the same method.

34. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

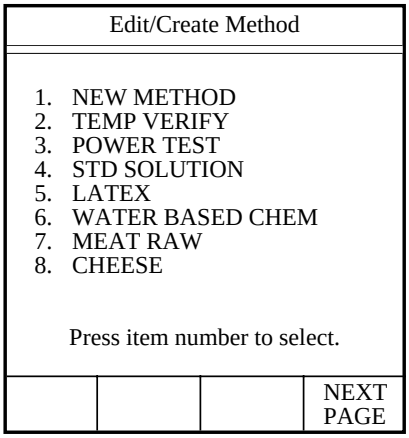
Moisture/Solids – Dilution

1. Refer to the SETUP section of this manual to ensure that the applicable external balance is selected.

2. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



3. Press "1" to create a new method.

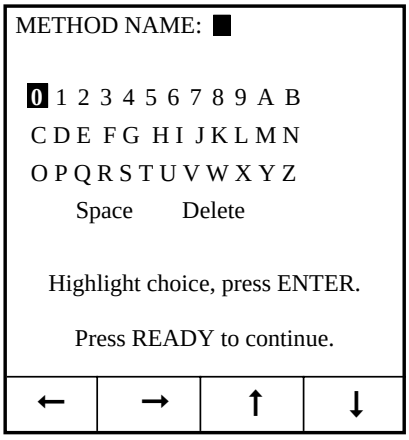


4. Using the operation keys below the arrows select the first letter or number of the method name.

5. Press ENTER.

6. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

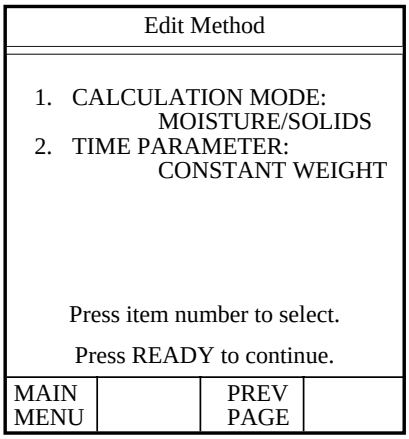


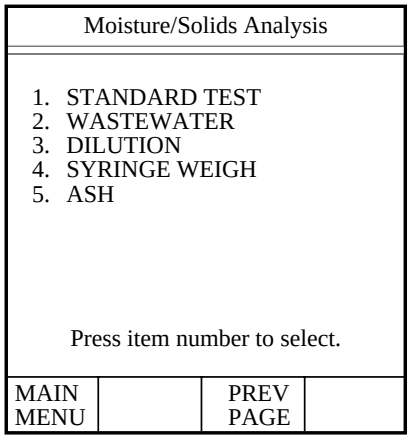
7. Press READY.

8. Press "1" to toggle and select "Moisture/ Solids."

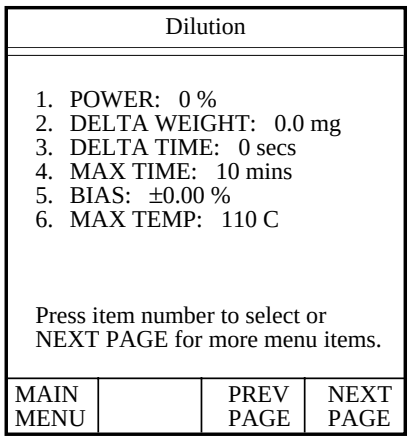
9. Press "2" to toggle and select "Constant Weight" or "Set Time."

10. Press READY.





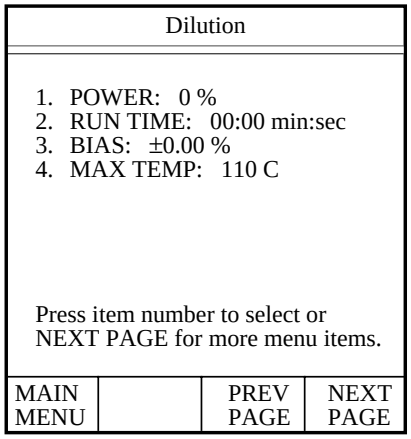
11. Press “3” to select “Dilution.”



CONSTANT WEIGHT

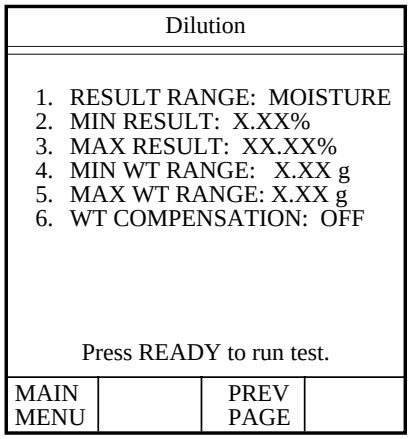
12. Press the numbers (1 - 6 Constant Weight or 1 - 4 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

13. Press the operation key below NEXT PAGE to access additional method parameters.



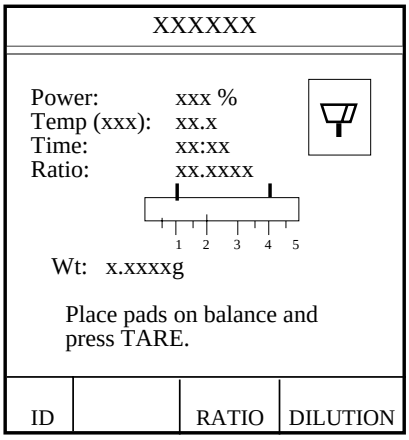
14. Press the numbers (1 - 6) and enter the appropriate method parameters.

15. Press READY to begin the method analysis.

Note: The method test screen appears indicating the power, temperature, time and ratio.

Note: Press the operation key below SOLIDS to display the solids data rather than the moisture data on the screen.

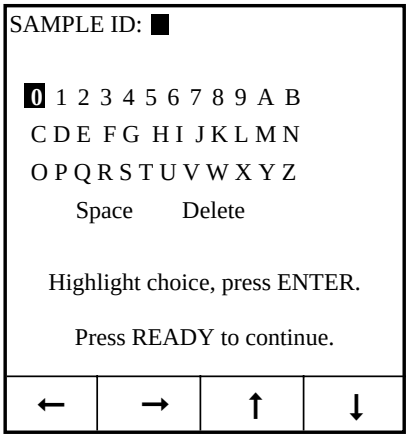
16. If Autotrack is turned off and a method identification name or number is required, press the operation key below ID.



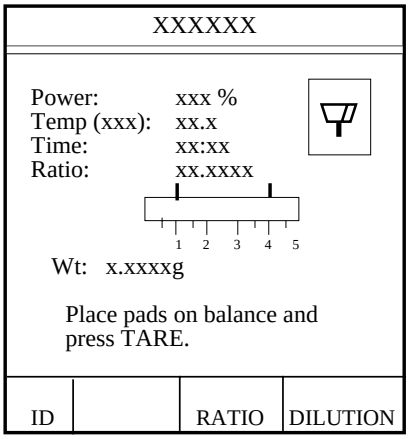
17. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

Note: If using an identification number only, use the numeric keys to enter the number.

18. Press READY to return to the method test screen.



Note: If sample and diluent are weighed on a balance not connected to the SMART System^5, press the operation key below RATIO to enter the dilution ratio.

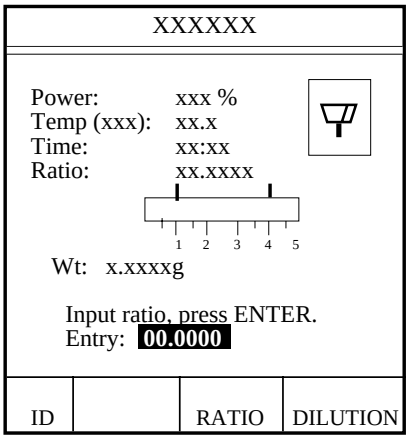


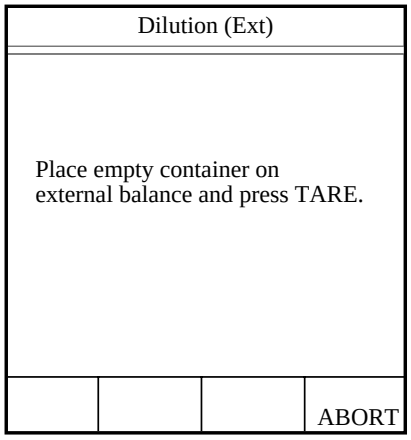
19. Using the numeric keys, enter the dilution ratio.

Note: The dilution ratio is the ratio between the amount of sample and the amount of diluent. The internal dilution ratio is calculated as the sample weight after the diluent is added divided by the initial sample weight.

20. Press ENTER.

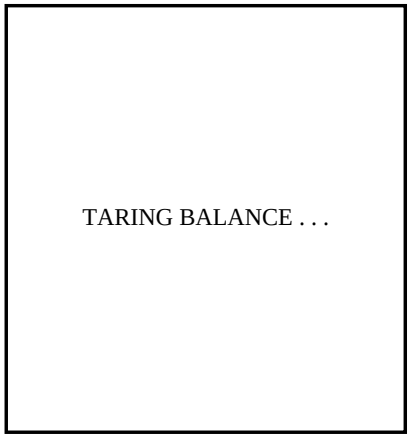
21. Press the operation key below DILUTION to engage the external balance and activate the dilution menu.



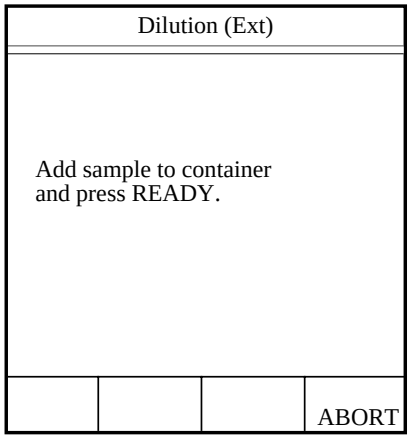


22. Place an empty container suitable for the sample and diluent on the external balance. Wait for the weight to stabilize.

23. Press TARE.



24. Wait for the SMART System[5] to tare the weight of the container.

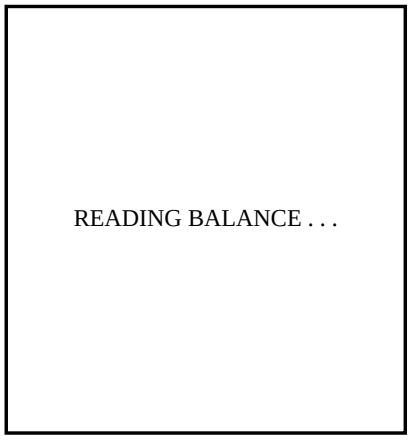


25. Place the sample in the container on the external balance pan.

26. Wait for the weight to stabilize.

27. Press READY.

Note: Press the operation key below ABORT to end the dilution analysis.

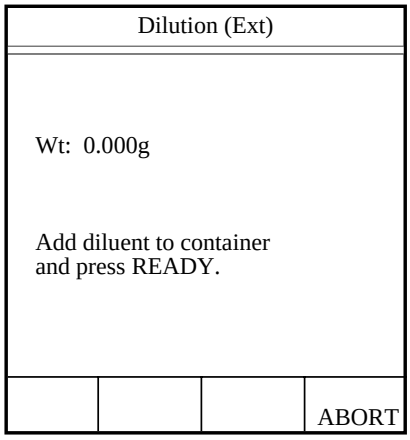


The instrument reads and records the weight of the sample.

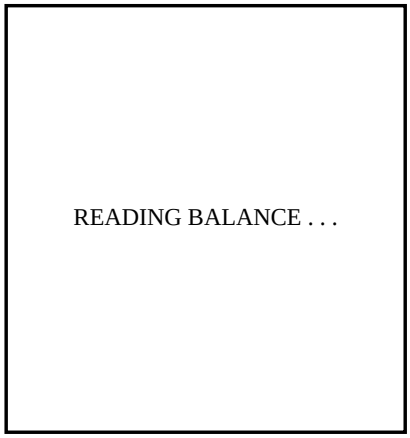
28. Add the diluent to the sample in the container on the external balance pan.

29. Wait for the weight to stabilize.

30. Press READY.

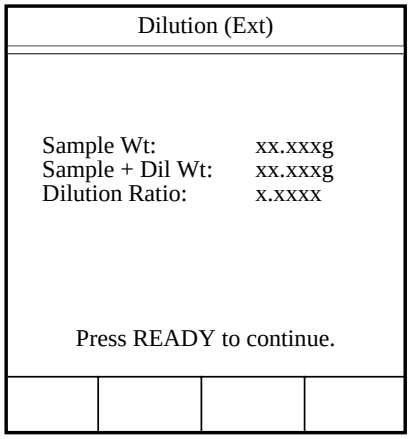


The instrument reads and records the weight of the sample and diluent.



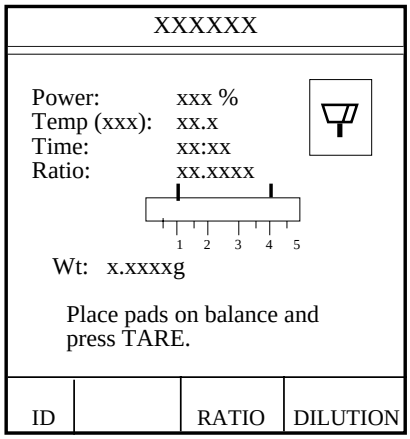
The instrument displays the weight of the sample, the weight of the sample and diluent, and the dilution ratio.

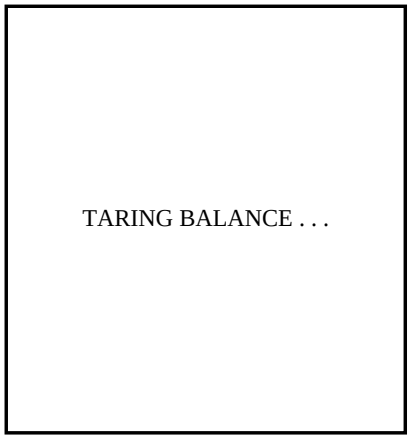
31. Press READY to continue the analysis.



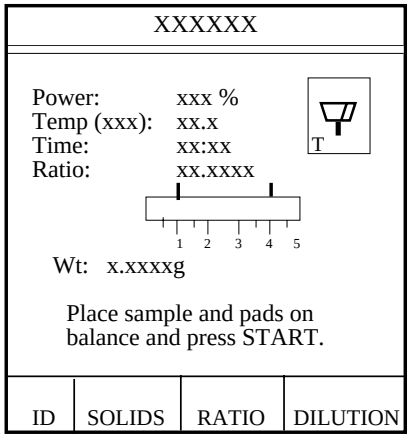
32. Lift the cover of the SMART System5. Place two glass fiber sample pads on the balance pan. Close the instrument cover.

33. Press TARE.





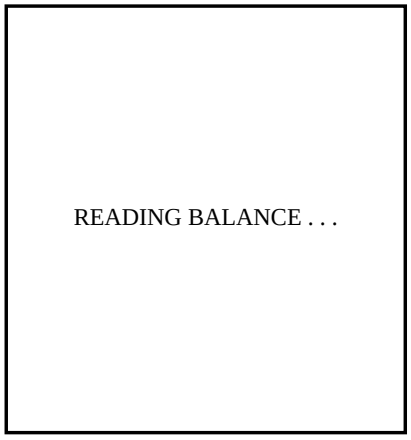
34. Wait for the instrument to tare the weight of the sample pads.



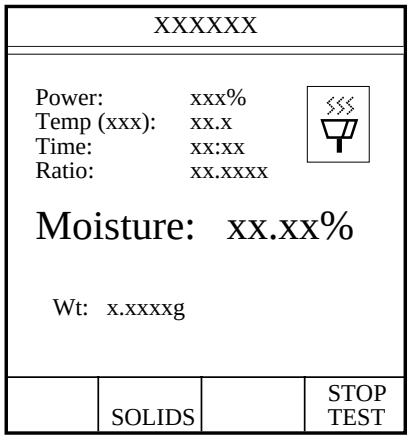
Note: The "T" in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

35. Lift the instrument cover. Apply the sample in a thin, even layer to one of the sample pads. Quickly and gently place the sample pads back on the balance pan. Close the top cover.

36. Press START.



The instrument reads and records the initial weight of the sample prior to beginning the analysis.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time). The sample weight decreases as the moisture is removed.

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

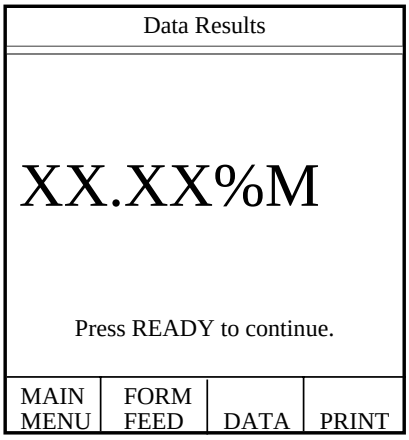
When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

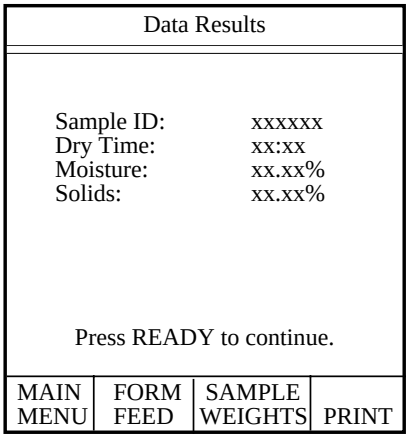
Note: Press READY to analyze additional samples using the same method.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

37. Press the operation key below DATA to display the analysis data.

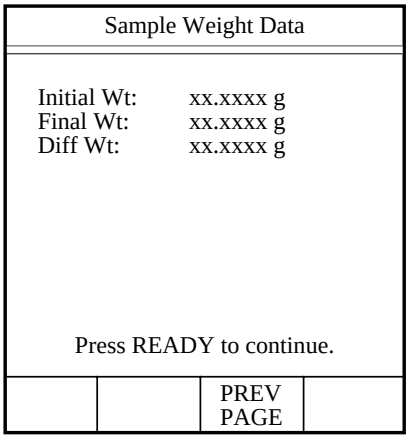
38. Press the operation key below SAMPLE WEIGHTS to view sample weight information.





The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

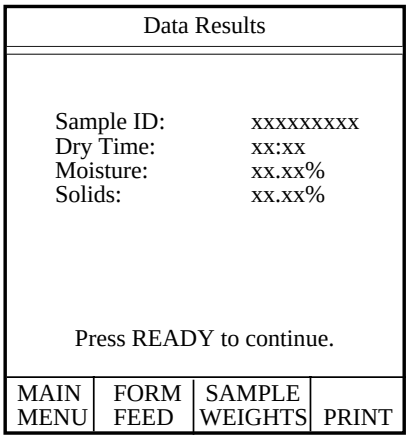
39. Press the operation key below PREV PAGE to return to the Data Results screen.



40. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

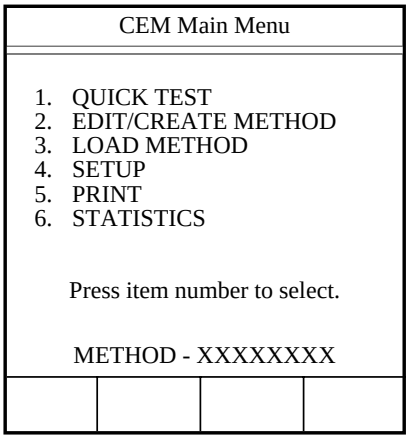
Note: Press READY to analyze additional samples using the same method.

41. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

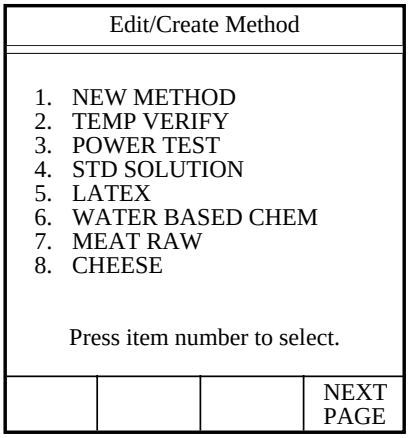


Moisture/Solids - Syringe Weigh - Internal Balance

1. With the CEM Main Menu displayed, press “2” to activate the Edit/Create Method screen.



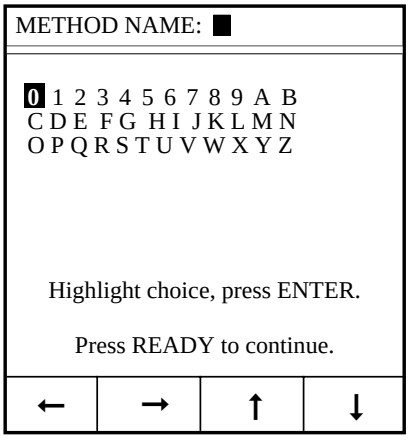
2. Press “1” to create a new method.



3. Using the operation keys below the arrows select the first letter or number of the method name.

4. Press ENTER.

5. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).



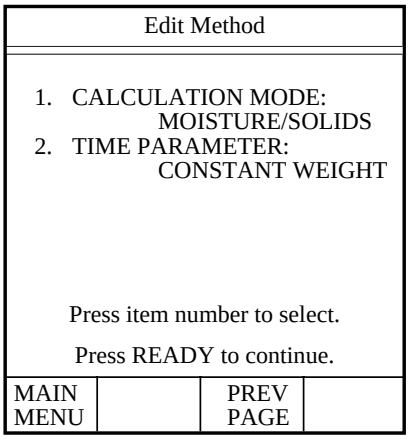
Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

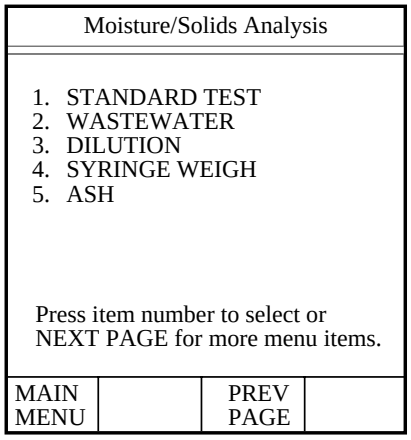
6. Press READY.

7. Press “1” to toggle and select “Moisture/ Solids.”

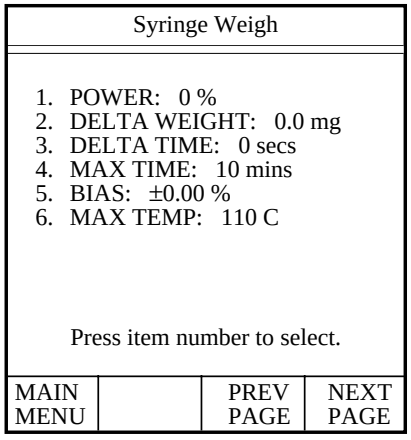
8. Press “2” to toggle and select “Constant Weight” or “Set Time.”

9. Press READY.





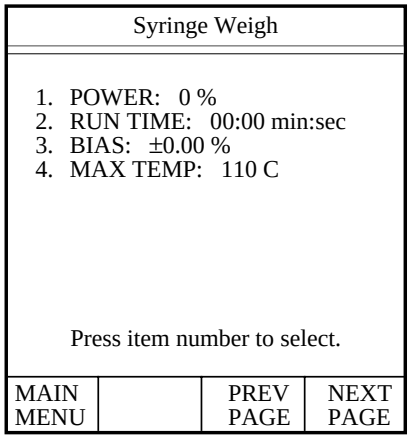
10. Press “4” to select “Syringe Weigh.”



CONSTANT WEIGHT

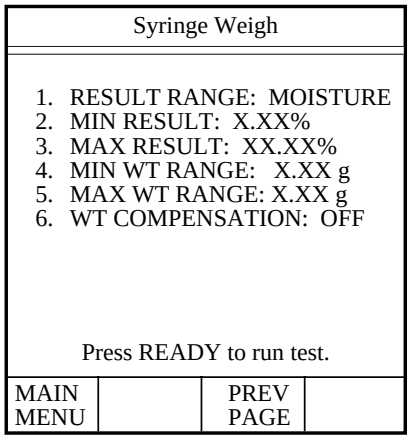
11. Press the numbers (1 - 6 Constant Weight or 1 - x Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

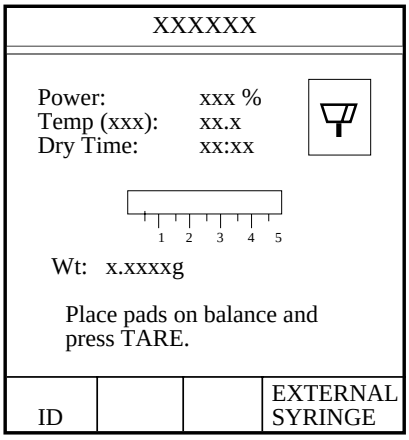
12. Press the operation key below NEST PAGE to access additional method parameters.



13. Press the numbers (1 - 6) and enter the appropriate method parameters.

14. Press READY to begin the method analysis.

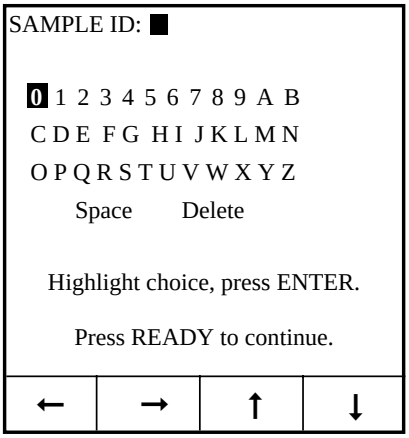
Note: The test screen appears indicating the power, temperature, and time.



15. If Autotrack is off and a method identification name or number is required, press the operation key below "ID."

16. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press "ENTER." Continue to position the cursor on each letter or number and press "ENTER" until the identification is complete.

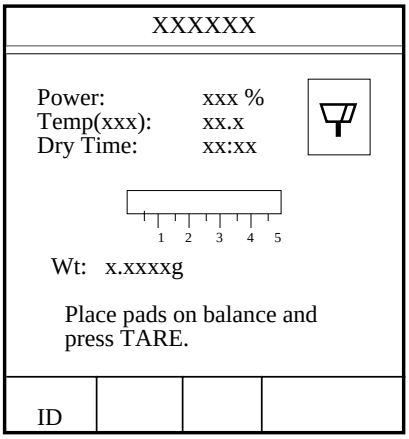
Note: If using an identification number only, use the numeric keys to enter the number.



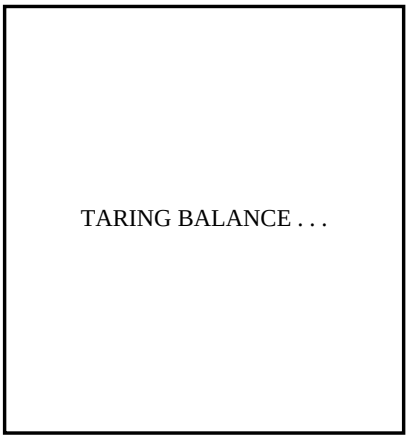
17. Press "READY" to return to the test screen.

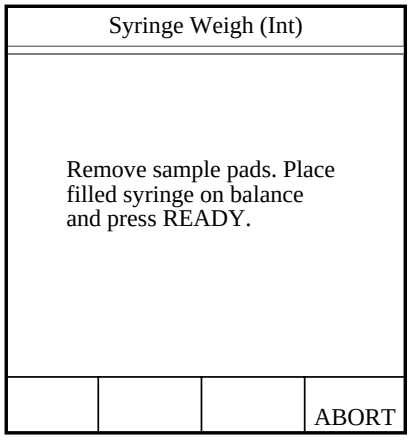
18. Lift the cover of the SMART System5. Place two glass fiber sample pads on the balance pan. Close the instrument cover.

19. Press "TARE."



20. Wait for the instrument to tare the weight of the sample pads.

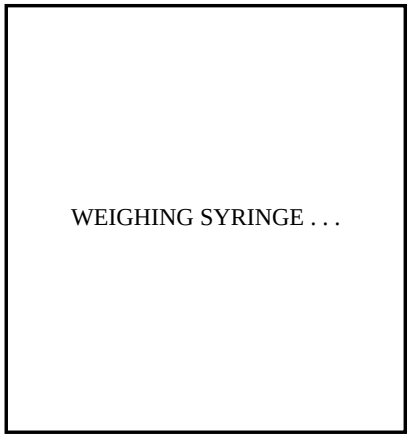




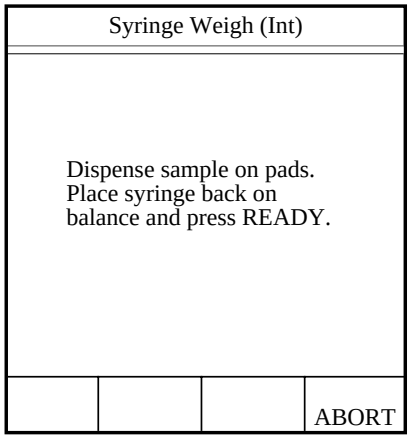
21. Lift the instrument cover. Remove the sample pads from the balance pan. Place the syringe containing the sample on the balance pan. Close the instrument cover.

22. Press “READY.”

Note: Press the operation key below “Abort” to end the analysis.



The instrument weighs the syringe containing the sample.



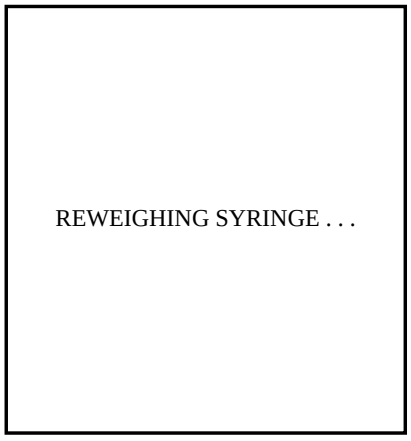
Note: Press the operation key below “Abort” to end the analysis.

23. Lift the instrument cover. Remove the syringe from the balance pan.

24. Dispense the sample from the syringe on the tared sample pads.

25. Place the empty syringe back on the balance pan. Close the instrument cover.

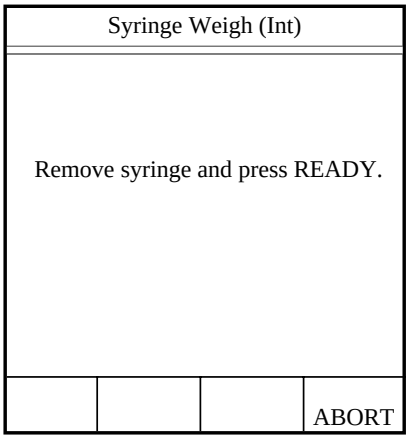
26. Press “READY.”



The instrument reweighs the syringe.

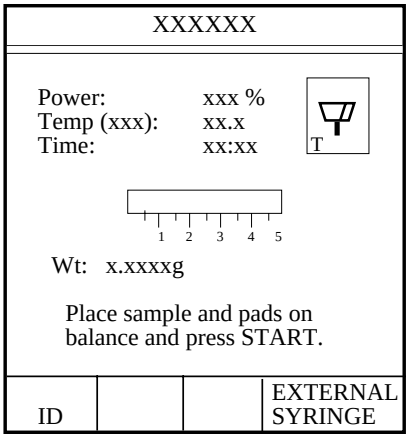
27. Lift the instrument cover. Remove the syringe from the balance pan.

28. Press READY.

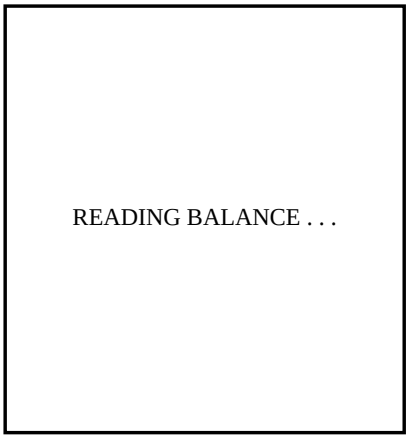


29. Place the sample pads with the sample on the balance pan. Close the instrument cover.

30. Press START.



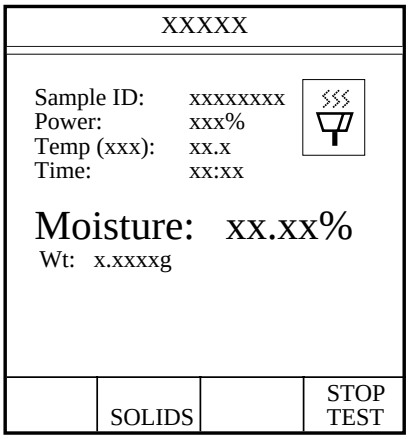
The instrument reads and records the initial weight of the sample prior to beginning the analysis.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time). The sample weight decreases as the moisture is removed.

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

Note: Press the operation key below STOP TEST to end the analysis.

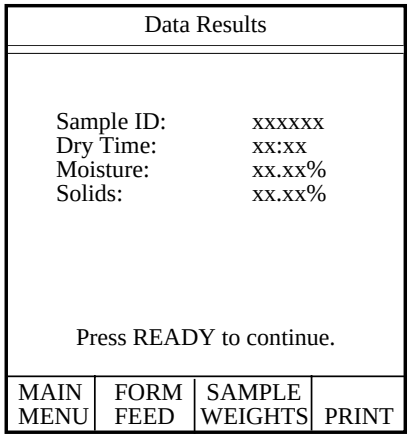


When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

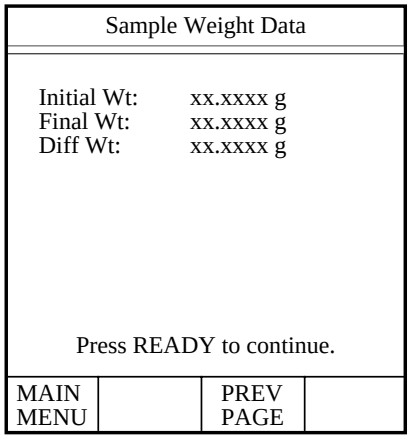
Note: Press READY to analyze additional samples using the same method.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

31. Press the operation key below DATA to display the analysis data.

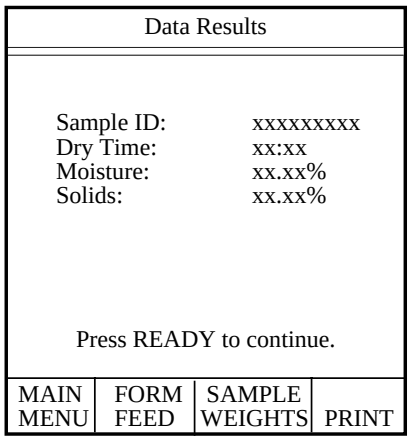


32. Press the operation key below SAMPLE WEIGHTS to view sample weight information.



The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

33. Press the operation key below PREV PAGE to return to the Data Results screen.



34. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

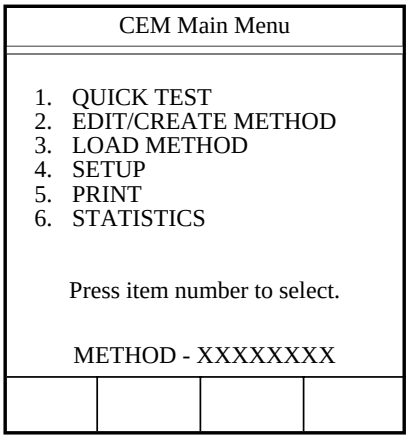
Note: Press READY to analyze additional samples using the same method.

35. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

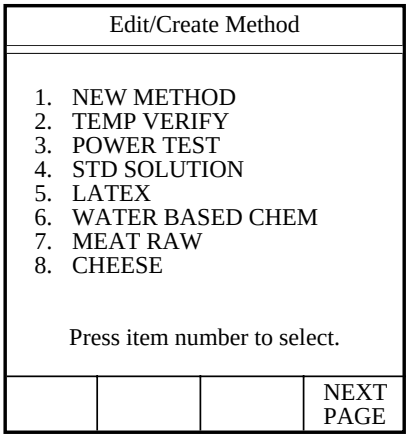
Moisture/Solids - Syringe Weigh - External Balance

1. Refer to the Setup section of this manual to ensure that the applicable external balance is selected.

2. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



3. Press "1" to create a new method.

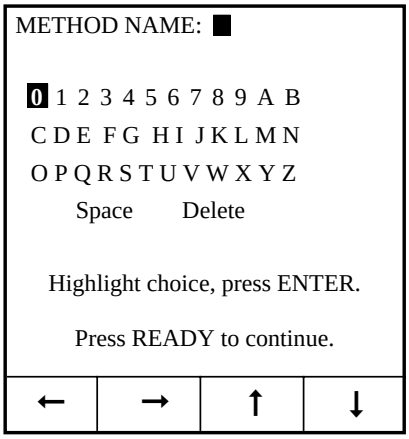


4. Using the operation keys below the arrows select the first letter or number of the method name.

5. Press ENTER.

6. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

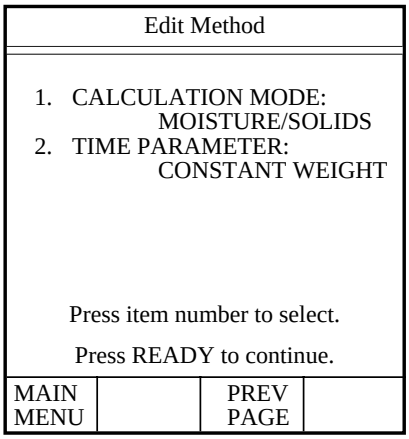


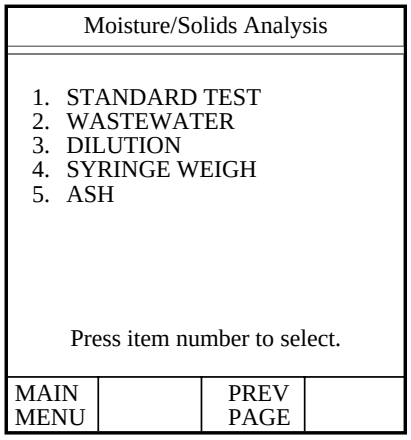
7. Press READY.

8. Press "1" to toggle and select "Moisture/ Solids."

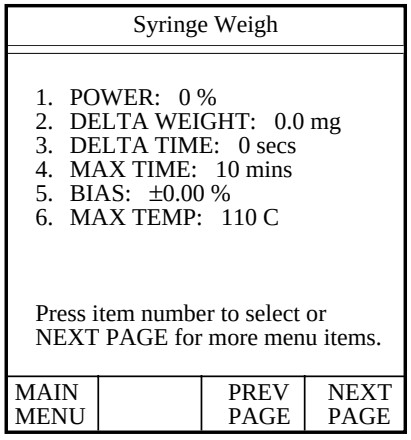
9. Press "2" to toggle and select "Constant Weight" or "Set Time."

10. Press READY.





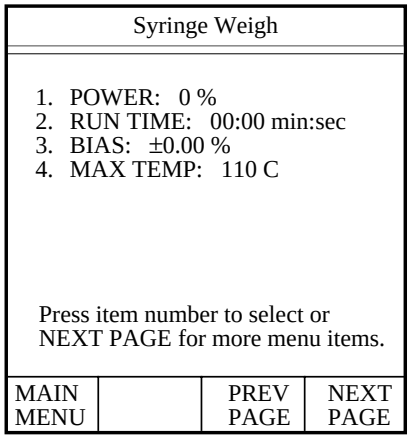
11. Press “4” to select “Syringe Weigh.”



CONSTANT WEIGHT

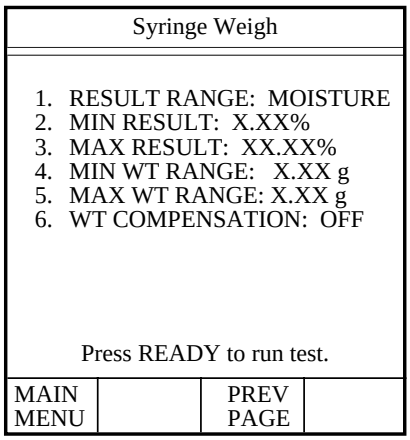
12. Press the numbers (1 - 6 Constant Weight or 1 - 4 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

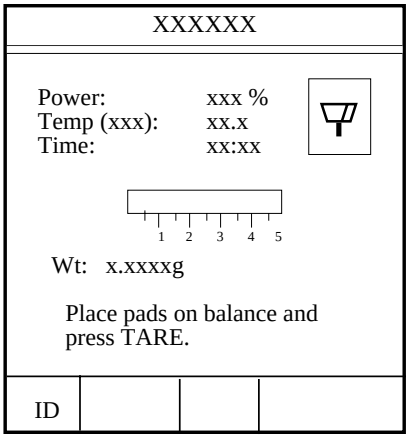
13. Press the operation key below NEXT PAGE to access additional method parameters.



14. Press the numbers (1 - 6) and enter the appropriate method parameters.

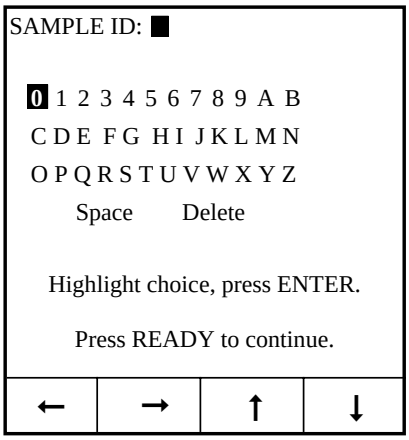
15. Press READY to begin the method analysis.

Note: The method test screen appears indicating the power, temperature, and time.



16. If Autotrack is turned off and a method identification name or number is required, press the operation key below ID.

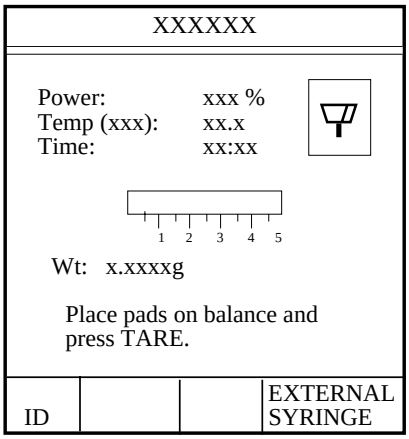
17. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.



Note: If using an identification number only, use the numeric keys to enter the number.

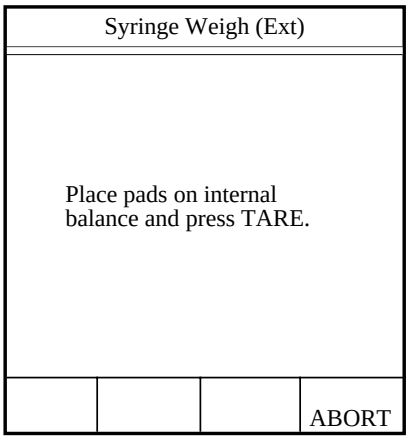
18. Press READY to return to the test screen.

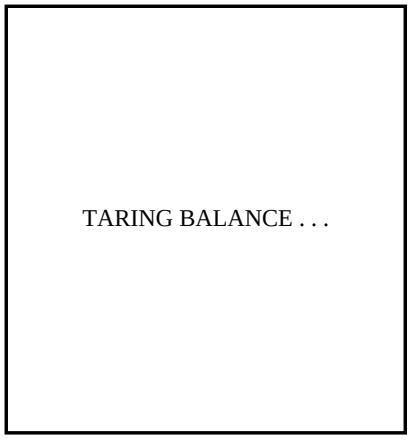
19. Press the operation key below EXTERNAL SYRINGE to engage the external balance and activate the external balance syringe weigh menu.



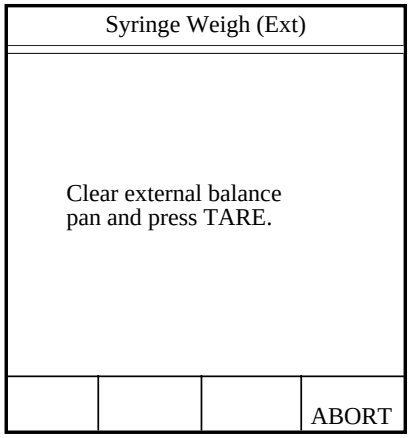
Note: If "External Balance" does not appear on the screen as an option, return to the Main Menu screen; press "4 - Setup"; press "1 - System Options";press "4 - External Balance"; then press the applicable number to select an external balance.

20. Lift the cover of the SMART System5. Place two glass fiber sample pads on the balance pan. Close the instrument cover. Press TARE.

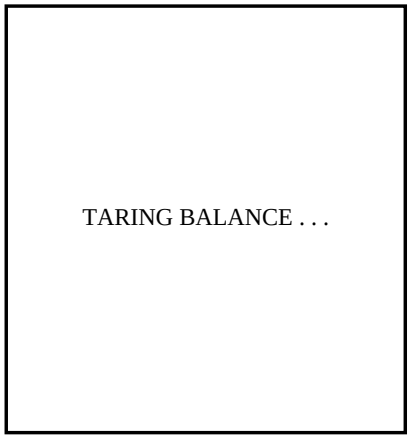




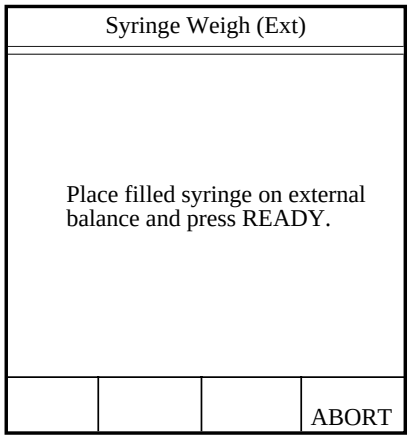
21. Wait for the instrument to tare the weight of the sample pads.



22. Ensure that the balance pan of the external balance is free of any weight. Press TARE on the SMART System[5].



23. Wait for the system to tare the external balance.

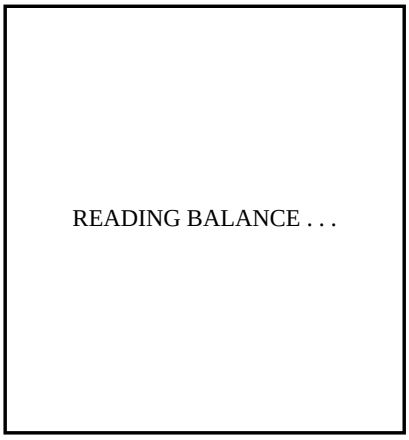


24. Place the syringe filled with sample on the external balance pan.

25. Press READY.

Note: Press the operation key below ABORT to end the analysis.

The instrument weighs the syringe and sample.



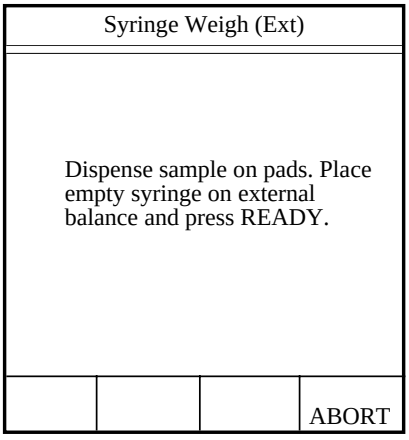
26. Lift the SMART System5 cover. Remove the pads from the balance pan.

27. Remove the syringe from the external balance pan.

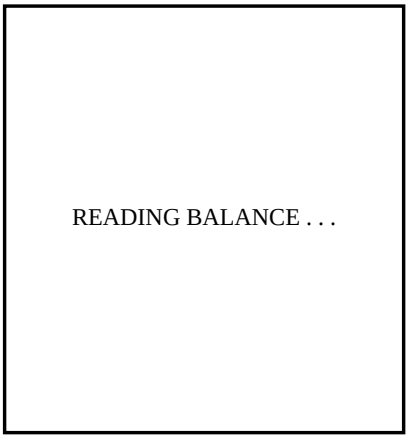
28. Dispense the sample from the syringe on the tared sample pads.

29. Place the empty syringe back on the external balance pan.

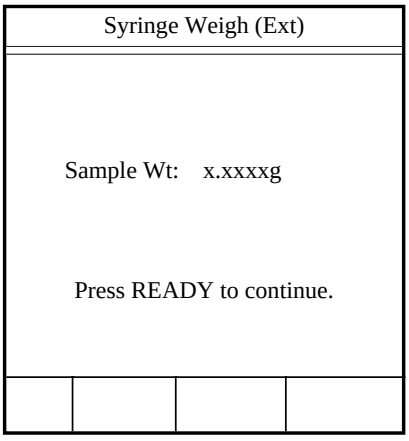
30. Press READY.

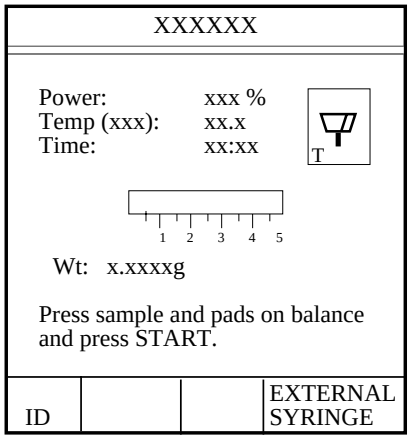


The instrument weighs the empty syringe.



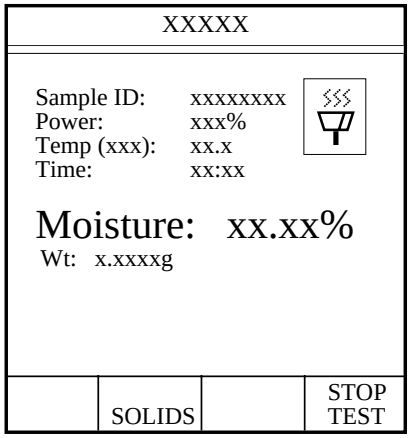
31. Press READY.





32. Place the sample pads with the sample on the balance pan. Close the instrument cover.

33. Press START.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time). The sample weight decreases as the moisture is removed.

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

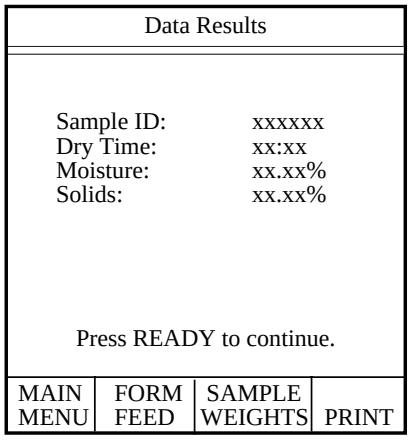
Note: Press the operation key below STOP TEST to end the analysis.

When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

Note: Press READY to analyze additional samples using the same method.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

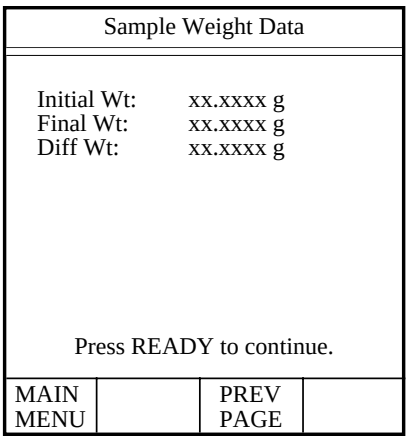
34. Press the operation key below DATA to display the analysis data.



35. Press the operation key below SAMPLE WEIGHTS to view sample weight information.

The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.

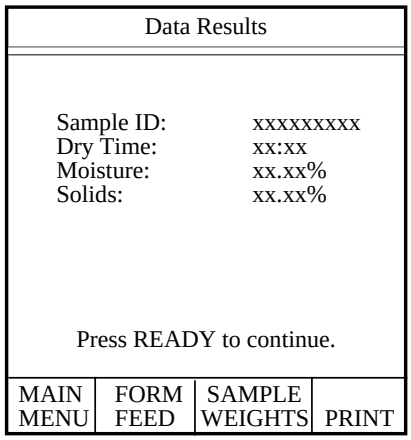
36. Press the operation key below PREV PAGE to return to the Data Results screen.

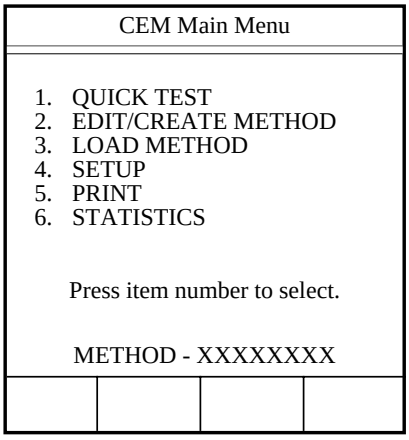


37. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to analyze additional samples using the same method.

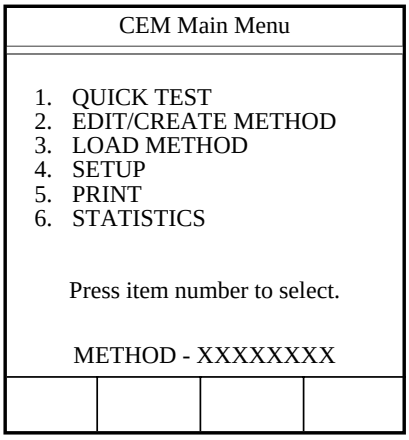
38. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.



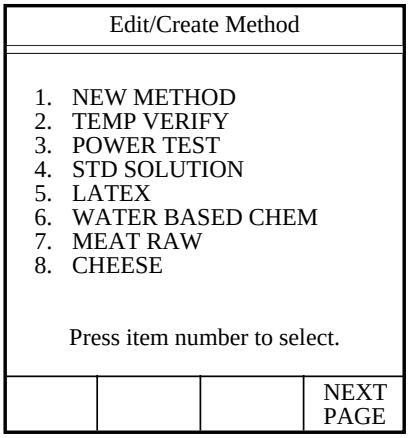


Moisture/Solids - Ash

1. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



2. Press "1" to create a new method.

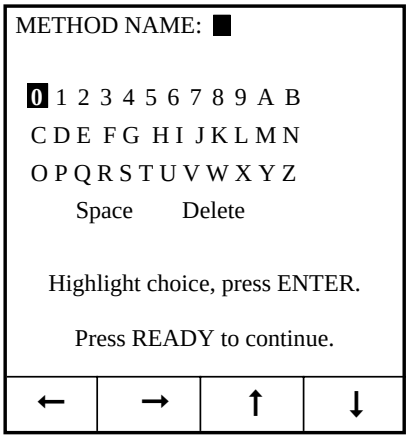


3. Using the operation keys below the arrows select the first letter or number of the method name.

4. Press ENTER.

5. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

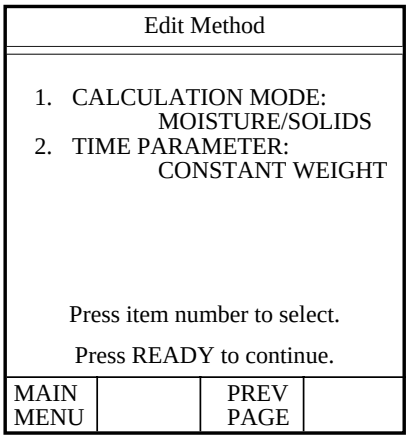


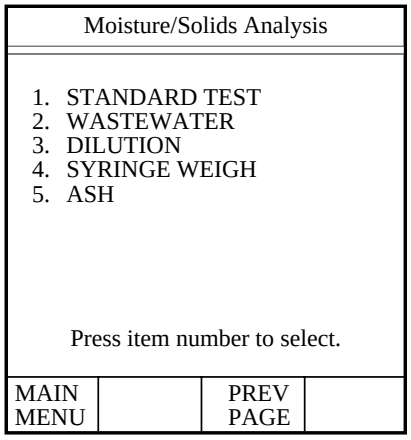
6. Press READY.

7. Press "1" to toggle and select "Moisture/ Solids."

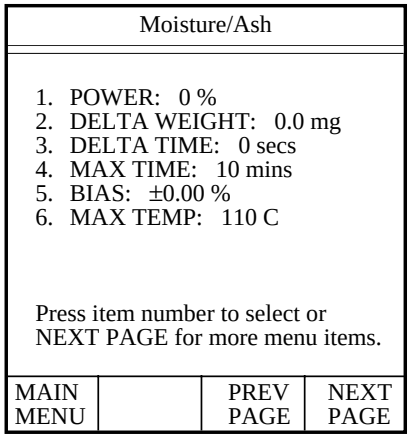
8. Press "2" to toggle and select "Constant Weight" or "Set Time."

9. Press READY.





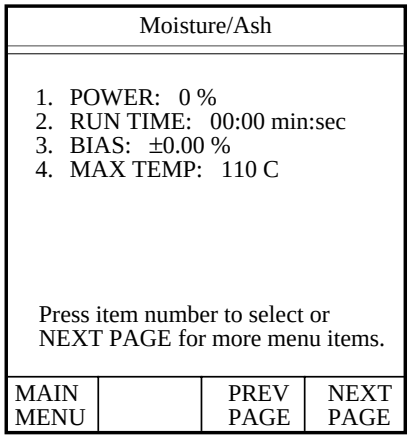
10. Press “5” to select “Ash.”



CONSTANT WEIGHT

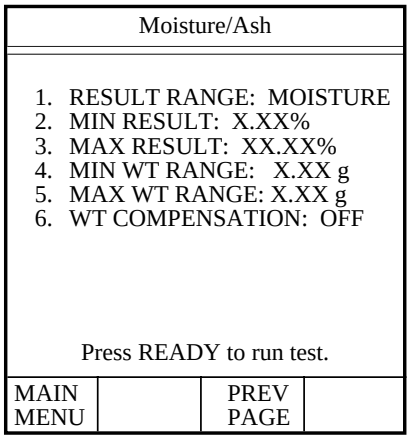
11. Press the numbers (1 - 6 Constant Weight or 1 - 4 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

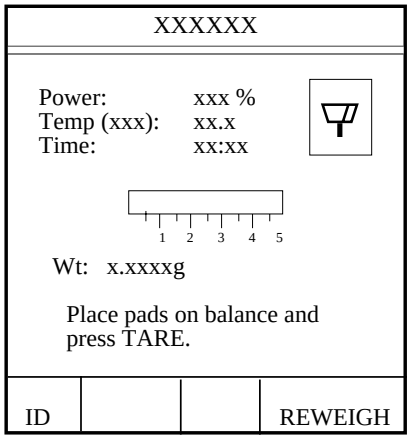
12. Press the operation key below NEXT PAGE to access additional method parameters.



13. Press the numbers (1 - 6) and enter the appropriate method parameters.

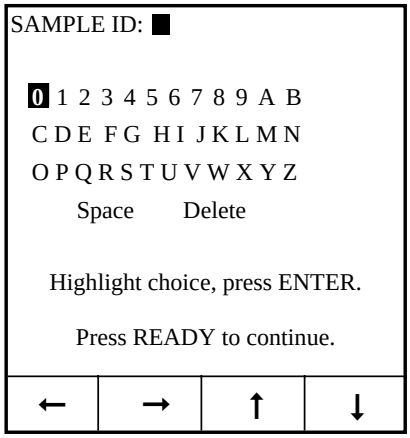
14. Press READY to begin the method analysis.

Note: The method test screen appears indicating the power, temperature, and time.



15. If Autotrack is turned off and a method identification name or number is required, press the operation key below ID.

16. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

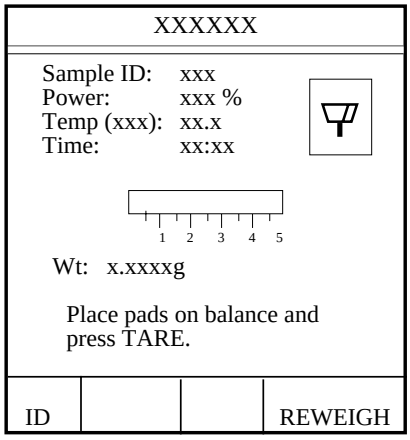


Note: If using an identification number only, use the numeric keys to enter the number.

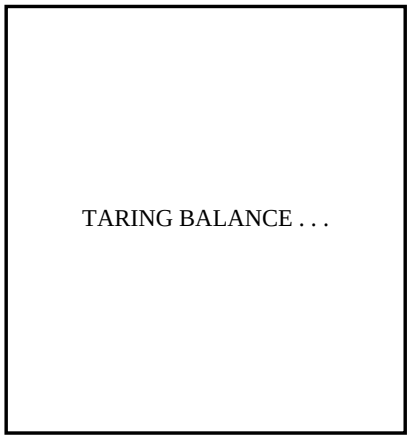
17. Press READY to return to the test screen.

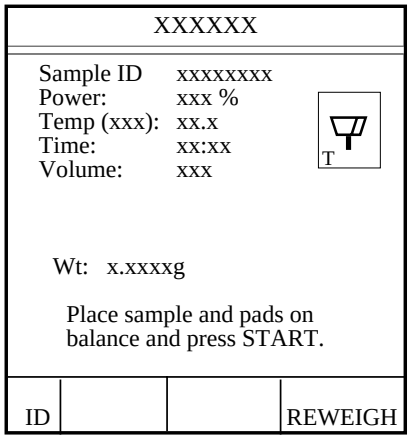
18. Lift the cover of the SMART System^5. Place two glass fiber sample pads on the balance pan. Close the instrument cover.

19. Press TARE.



20. Wait for the instrument to tare the weight of the sample pads.

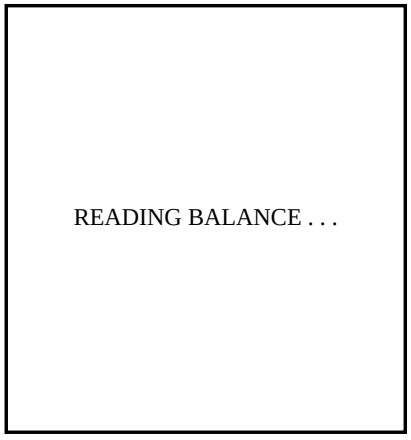




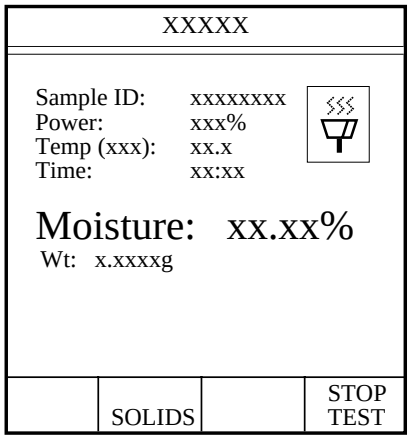
Note: The "T" in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

21. Lift the instrument cover. Apply the sample in a thin, even layer to one of the sample pads. Quickly and gently place the sample pads back on the balance pan. Close the instrument cover.

22. Press START.



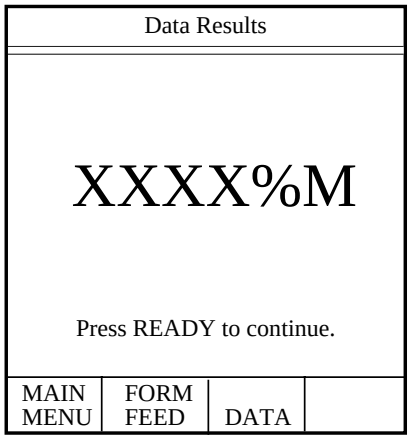
The instrument reads and records the initial weight of the sample prior to beginning the analysis.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time).

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

Note: Press the operation key below STOP TEST to abort the analysis.

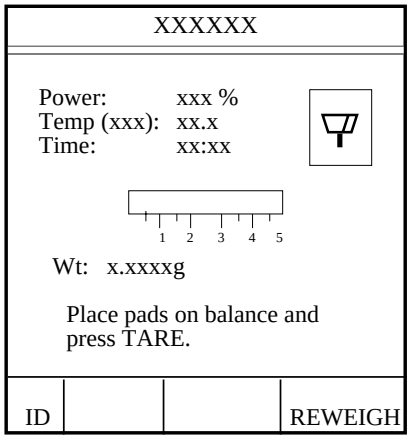


When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

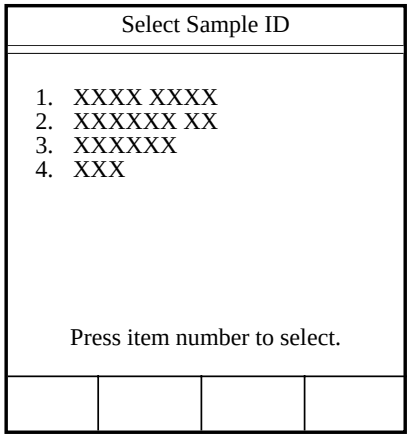
24. To ash the dried sample, fold the pads; place them in an ashing crucible; and place the crucible in the ashing furnace. Ash the sample by the defined method.

25. Press READY.

26. Press the operation key below REWEIGH.

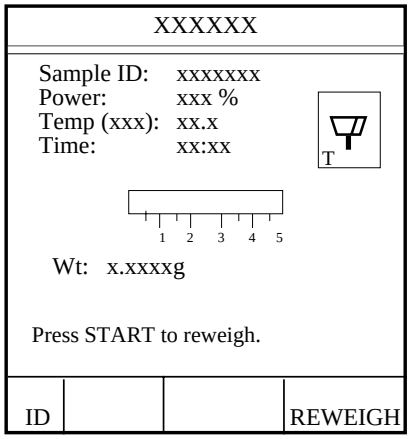


27. Press the numerical key to select the proper sample to be reweighed.



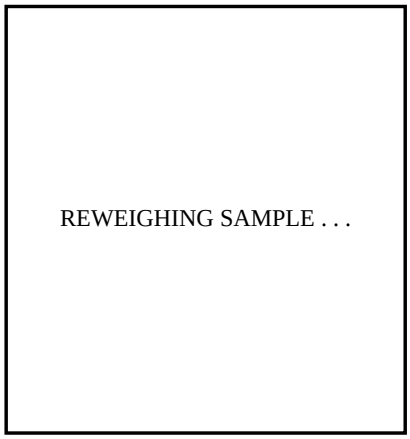
28. Lift the instrument cover. Place the ashed sample on the balance pan. Close the instrument cover.

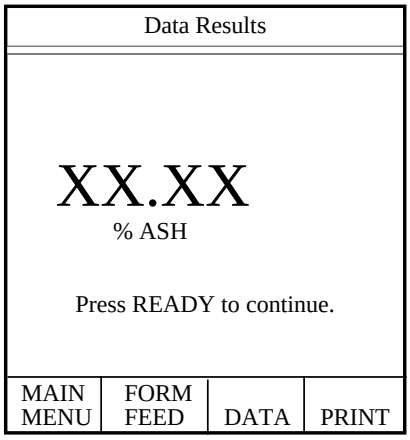
29. Press START.



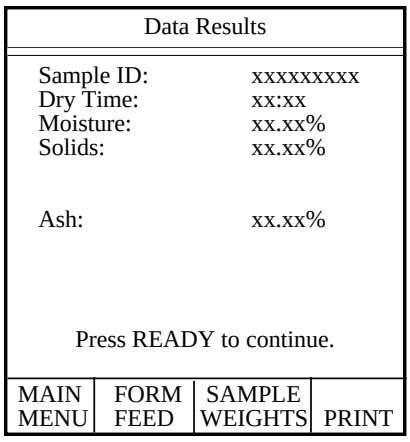
Note: To reweigh additional samples, press READY and follow the steps outlined above.

The instrument reweighs the ashed sample and calculates the data results.

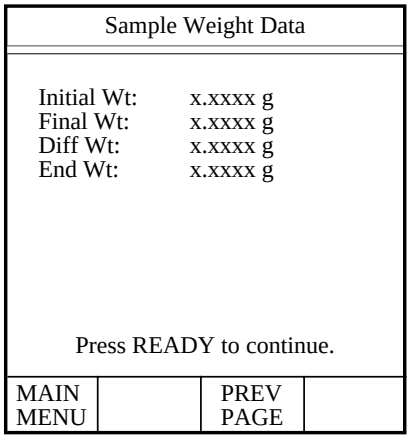




30. Press the operation key below DATA to display the analysis data.

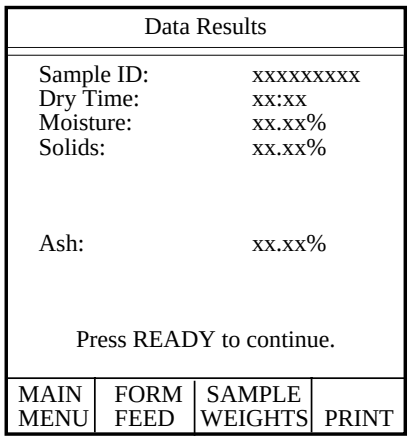


31. Press the operation key below SAMPLE WEIGHTS to view sample weight information.



The Sample Weight Data screen displays the initial weight, the final weight, the differential weight and the end weight.

32. Press the operation key below PREV PAGE to return to the Data Results screen.



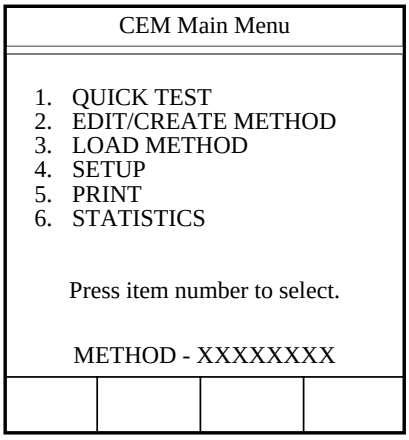
33. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to continue analysis using the same method.

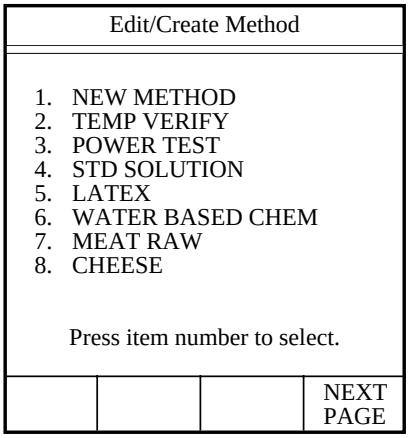
34. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

Moisture/Fat or Moisture/Fat/Protein -Standard

1. With the CEM Main Menu displayed, press “2” to activate the Edit/Create Method screen.



2. Press “1” to create a new method.

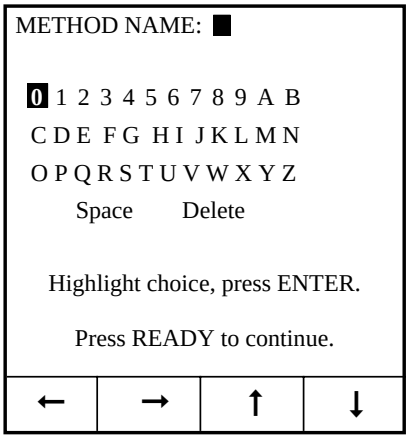


3. Using the operation keys below the arrows select the first letter or number of the method name.

4. Press ENTER.

5. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).

Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

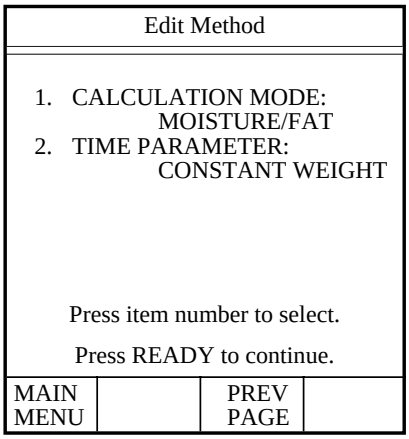


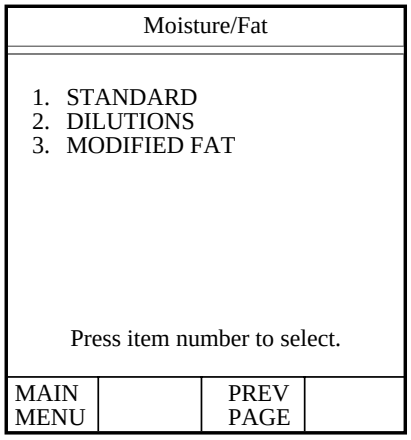
6. Press READY.

7. Press “1” to toggle and select “Moisture/ Fat” or “Moisture/Fat/Protein.”

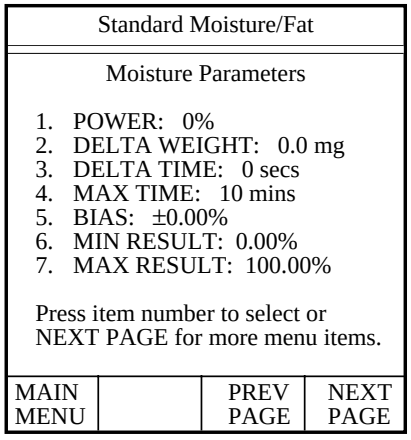
8. Press “2” to toggle and select “Constant Weight” or “Set Time.”

9. Press READY.



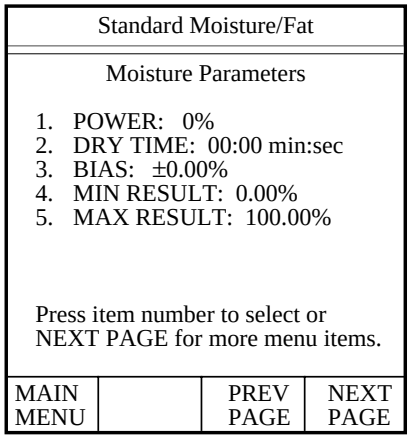


10. Press “1” to select “Standard.”

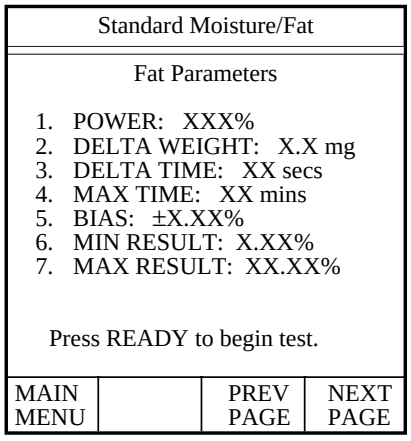


11. Press the numbers (1 - 7 Constant Weight or 1 - 5 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



12. Press the operation key below NEXT PAGE to access the fat parameters screen.



13. Press the numbers (1 - 7) and enter the appropriate method parameters.

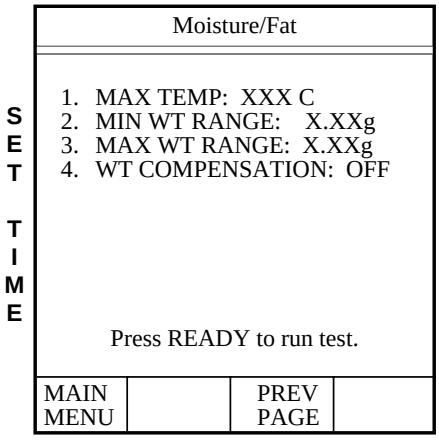
Note: Press the operation key below PREV PAGE to return to the moisture parameters screen.

14. Press the operation key below NEXT PAGE to access additional method parameters.

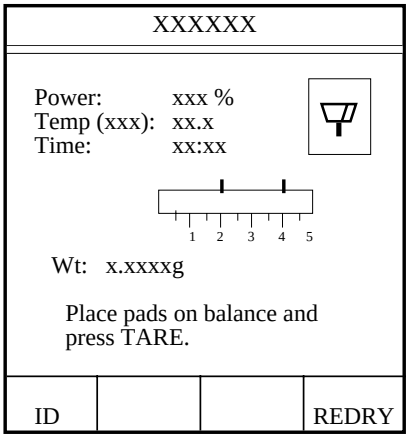
Note: Press the operation key below "Prev Page" to return to the fat parameters screen.

15. Press the numbers (1 - 3) and enter the appropriate method parameters.

16. Press READY to begin the analysis.

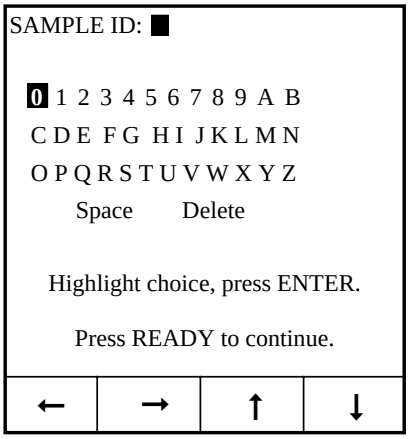


17. If Autotrack is turned off and a sample identification name or number is required, press the operation key below ID.



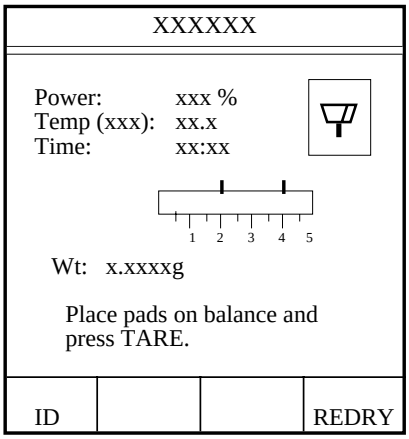
18. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

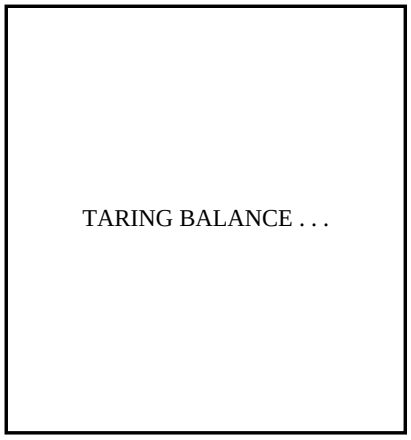
Note: If using an identification number only, use the numeric keys to enter the number and press ENTER.



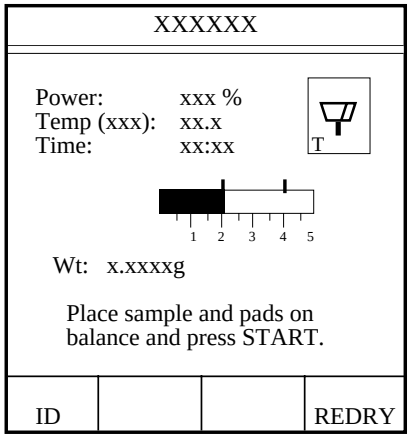
19. Lift the cover of the SMART System^5. Place one round and two square glass fiber sample pads on the balance pan (round pad on bottom). Close the instrument cover.

20. Press TARE.





22. Wait for the instrument to tare the weight of the sample pads. The method test screen will reappear when the tare function is complete.



Note: The “T” in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

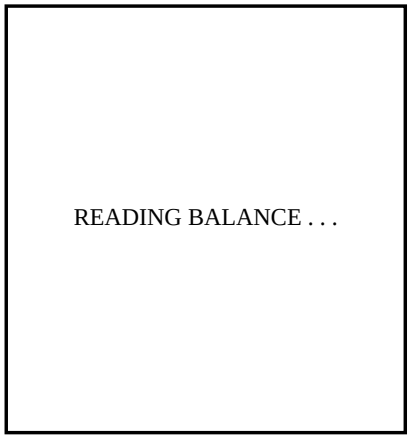
23. Lift the instrument cover. Remove the square pads from the sample pan.

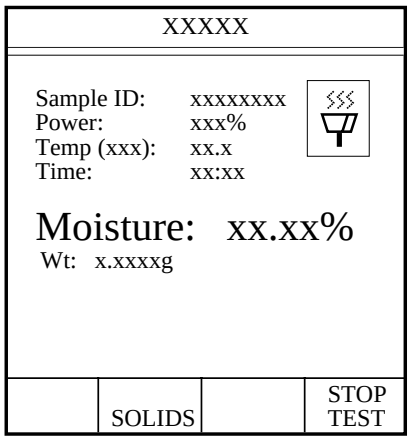
24. Apply sample in a thin, even layer to one of the square sample pads and cover the sample with the second pad.

25. With the round pad still on the balance pan, quickly place the square sample pads back on the balance pan. Close the instrument cover.

26. Press START.

The instrument reads and records the initial weight of the sample prior to beginning the analysis.



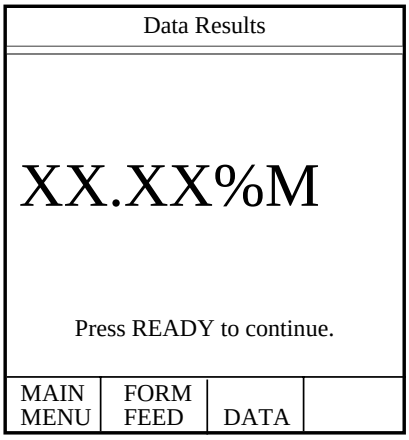


As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time. The sample weight decreases as the moisture is removed.

Note: Press the operation key below STOP TEST to end the analysis.

During the drying time, the operation key below SOLIDS may be pressed to display % solids or % moisture.

When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.



27. Press READY to redry sample or to analyze additional samples.

28. Lift the cover and remove the pads from the balance pan.

29. Fold the square pads in half and place them in the extraction chamber of the Fat Extraction System. Place the round pad (smooth side up) in the recess at top of the extraction chamber. Close and latch the lid.

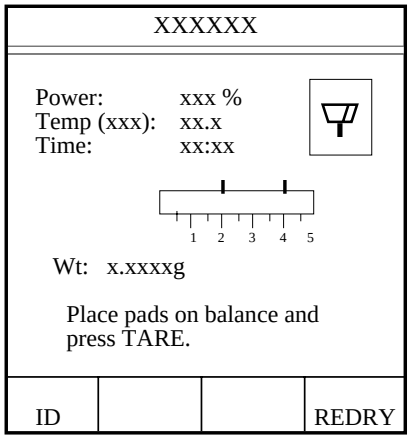
WARNING

Failure to insert or properly position the round filter pad in the recess at the top of the extraction chamber could result in operator exposure to solvent due to leakage or possible spraying and/or damage to the Fat Extraction System, resulting from solid matter entering the distillation system.

AVERTISSEMENT

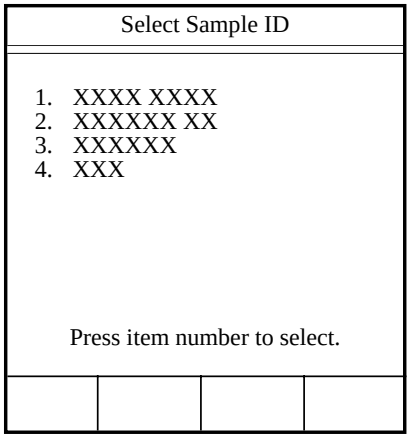
L'installation incorrecte du filtre rond (coussinet) situé sur la partie supérieure de la chambre d'extraction peut exposer l'opérateur à une possible fuite ou vapo-risataion du solvent. De plus, le systeme d'extraction des matières grasses peut être endommagé résultant du passage des matières solides dans le système de distillation.

30. Press the Run/Stop button on the extractor to start the extraction cycle. When the extraction is complete, a beep tone will sound, and the light in the Run/Stop button will flash. While the extractor cup is still in the inverted position, unlatch the lid and remove the round sample pad on which the chopped square pads and extracted and dried sample have been deposited. Latch the cup lid. The extractor cup will automatically rotate 180 degrees to the upright position.

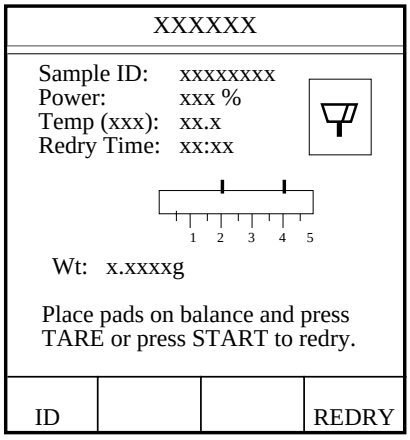


Note: Additional samples can be dried prior to redry of samples. Samples must be kept in proper order for redrying.

31. Press the operation key below REDRY.

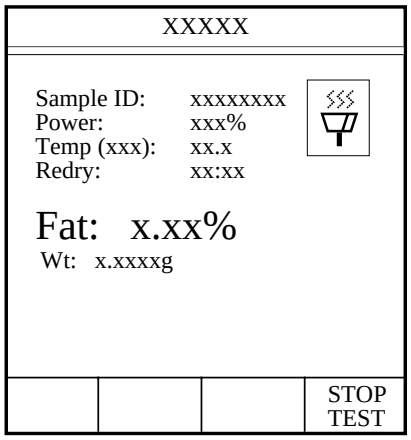


32. Using the numeric key(s), press the number of the sample to be redried.



33. Lift the cover of the SMART System^5. Place the round pad with the extracted sample on the balance pan. Close the instrument cover.

34. Press START.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting down. The sample weight decreases as the moisture is removed.

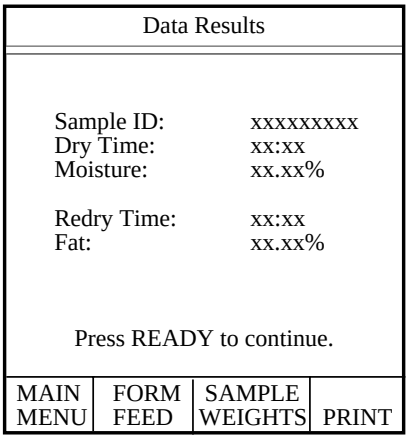
Note: Press the operation key below STOP TEST to end the analysis.

When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying the % fat.

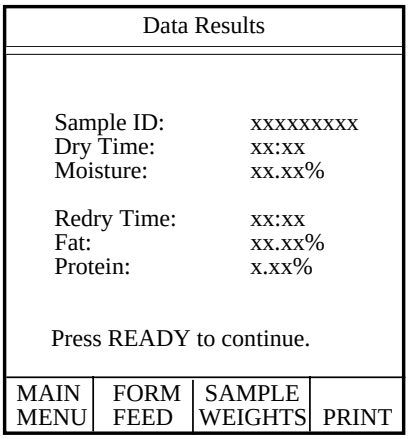
Note: Press the operation key below FORM FEED to advance paper from the internal printer.

35. Press the operation key below DATA to display the analysis data.

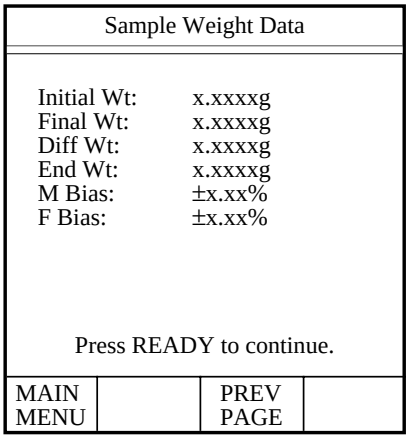
36. Press the operation key below SAMPLE WEIGHTS to display the weight data.

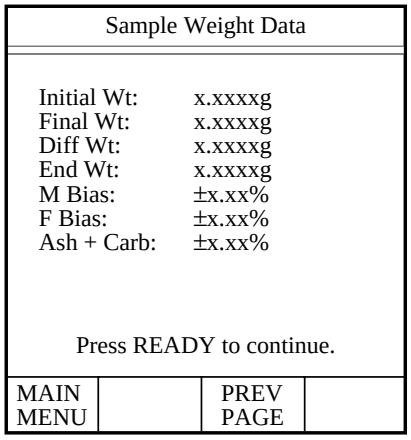


Note: If performing a moisture/fat/protein analysis, the data results screen will also provide the % protein of the sample.



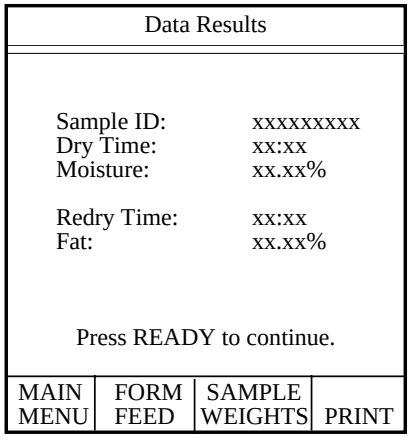
The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.





Note: If performing a moisture/fat/protein analysis, the sample weight data screen will also display an ash and carbohydrate percentage.

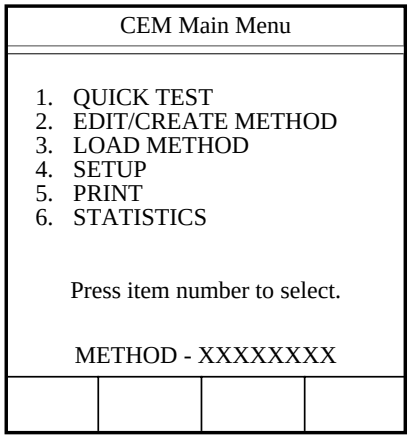
37. Press the operation key below PREV PAGE to return to the Data Results screen.



38. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to analyze additional samples using the same method.

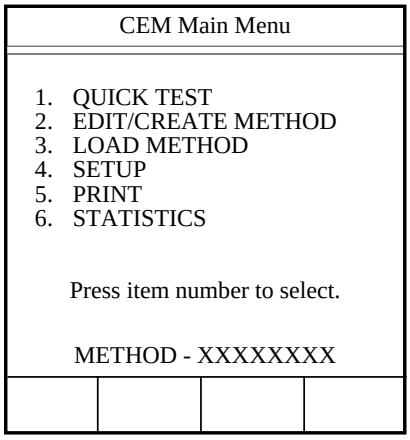
39. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.



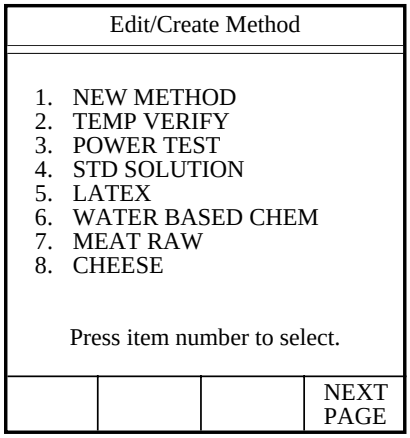
Moisture/Fat or Moisture/Fat/Protein - Dilutions

Note: Refer to the Setup section of this manual to ensure that the applicable external balance is selected.

1. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



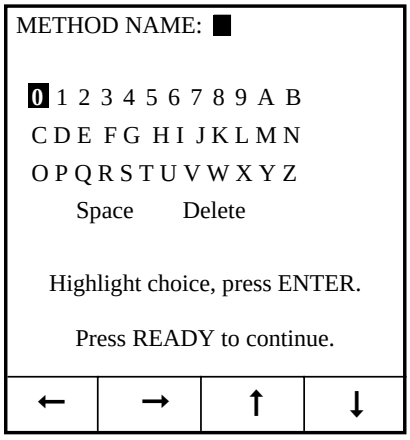
2. Press "1" to create a new method.



3. Using the operation keys below the arrows select the first letter or number of the method name.

4. Press ENTER.

5. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).



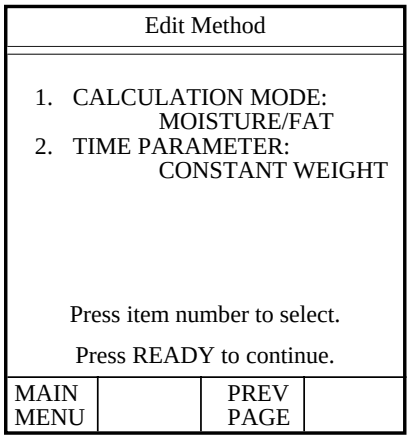
Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

6. Press READY.

7. Press "1" to toggle and select "Moisture/ Fat" or "Moisture/Fat/Protein."

8. Press "2" to toggle and select "Constant Weight" or "Set Time."

9. Press READY.



Moisture/Fat			
1. STANDARD 2. DILUTIONS 3. MODIFIED FAT Press item number to select.			
MAIN MENU		PREV PAGE	

10. Press “2” to select “Dilutions.”

Dilution Moisture/Fat			
Moisture Parameters 1. POWER: 0% 2. DELTA WEIGHT: 0.0 mg 3. DELTA TIME: 0 secs 4. MAX TIME: 10 mins 5. BIAS: ±0.00% 6. MIN RESULT: 0.00% 7. MAX RESULT: 100.00% Press item number to select or NEXT PAGE for more menu items.			
MAIN MENU		PREV PAGE	NEXT PAGE

CONSTANT WEIGHT

11. Press the numbers (1 - 7 Constant Weight or 1 - 4 Set Time) and enter the appropriate method moisture parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.

Dilution Moisture/Fat			
Moisture Parameters 1. POWER: 0% 2. DRY TIME: 00:00 min:sec 3. BIAS: ±0.00% 4. MIN RESULT: 0.00% 5. MAX RESULT: 100.00% Press item number to select or NEXT PAGE for more menu items.			
MAIN MENU		PREV PAGE	NEXT PAGE

SET TIME

12. Press the operation key below NEXT PAGE to access the fat method parameters screen.

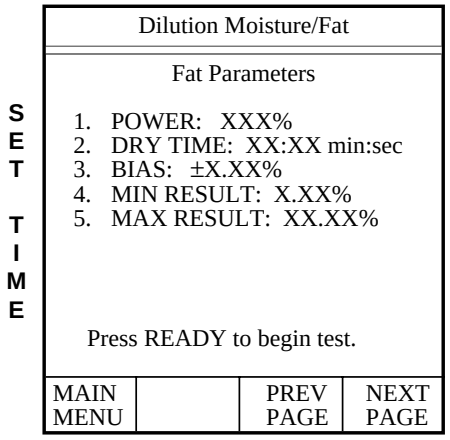
Dilution Moisture/Fat			
Fat Parameters 1. POWER: XXX% 2. DELTA WEIGHT: X.X mg 3. DELTA TIME: XX secs 4. MAX TIME: XX mins 5. BIAS: ±X.XX% 6. MIN RESULT: X.XX% 7. MAX RESULT: XX.XX% Press READY to begin test.			
MAIN MENU		PREV PAGE	NEXT PAGE

CONSTANT WEIGHT

13. Press the numbers (1 - 7 Constant Weight or 1 -5 Set Time) and enter the appropriate method fat parameters.

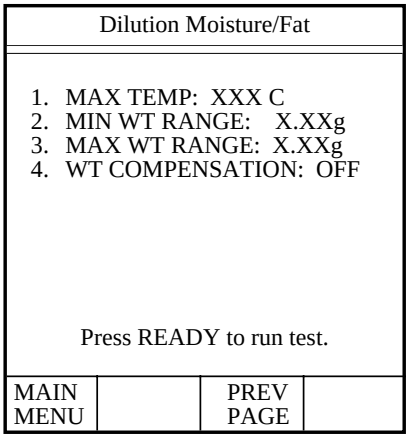
Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.

14. Press the operation key below NEXT PAGE to access additional method parameters.



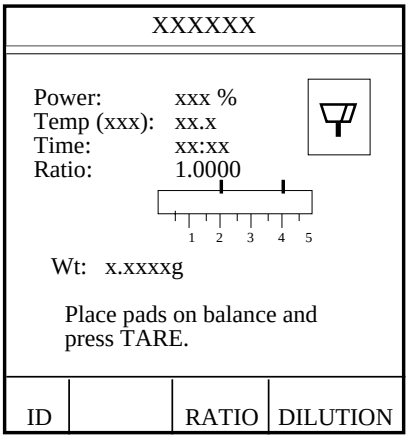
15. Press the numbers (1 - 3) and enter the appropriate method parameters.

16. Press READY to begin the analysis.



Note: The method test screen appears indicating the power, temperature, time, and ratio.

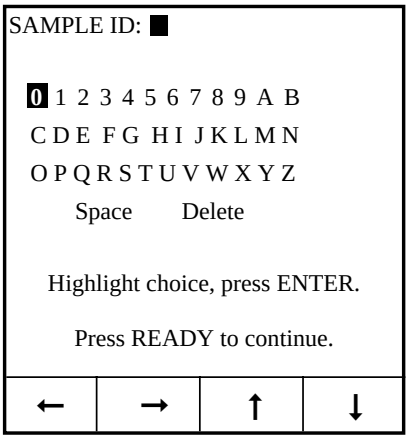
17. If Autotrack is off and a sample identification name or number is required, press the operation key below ID.

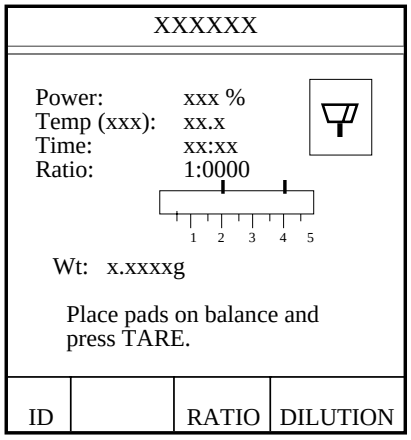


18. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

Note: If using an identification number only, use the numeric keys to enter the number

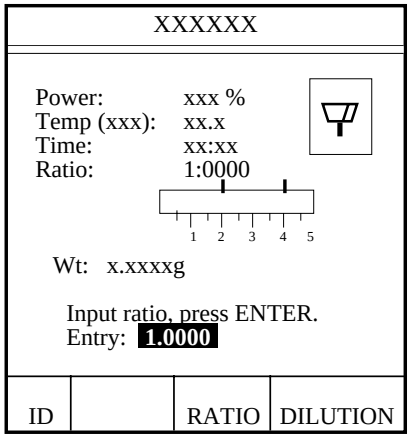
19. Press READY to return to the method screen.





Note: If the sample and diluent are to be weighed on a balance not connected to the SMART System^5, press the operation key below RATIO to enter the dilution ratio.

Note: The applicable external balance must be selected in Setup procedures to perform a moisture/fat or moisture/fat/protein dilution analysis.

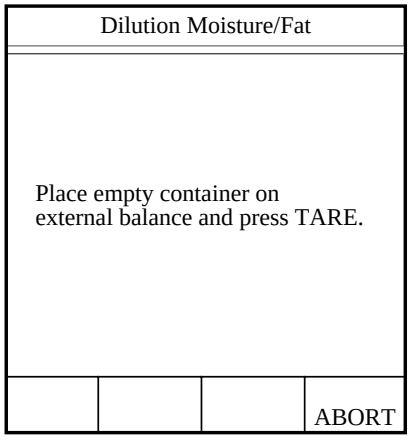


20. Using the numeric keys, enter the dilution ratio.

Note: The dilution ratio is the ratio between the amount of sample and the amount of diluent. The internal dilution ratio is calculated as the sample weight after the diluent is added divided by the initial sample weight.

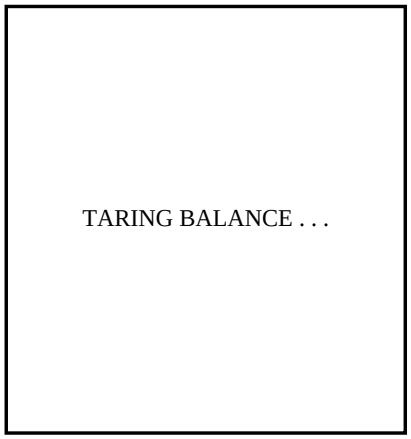
21. Press ENTER.

22. Press the operation key below DILUTION to engage the external balance and activate the dilution menu.



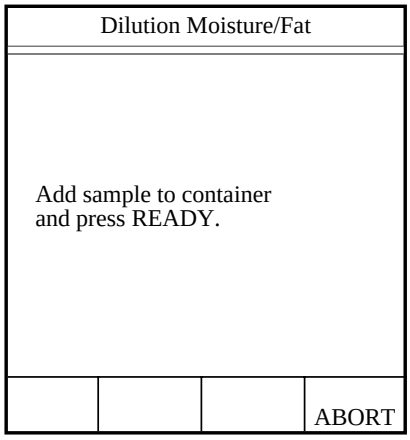
23. Place an empty container suitable for the sample and diluent on the external balance. Wait for the weight to stabilize.

24. Press TARE.

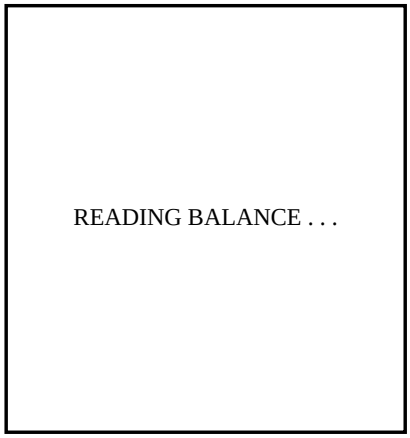


25. Wait for the instrument to tare the weight of the container.

26. Place the sample in the container on the external balance pan.



The instrument reads and records the weight of the sample.

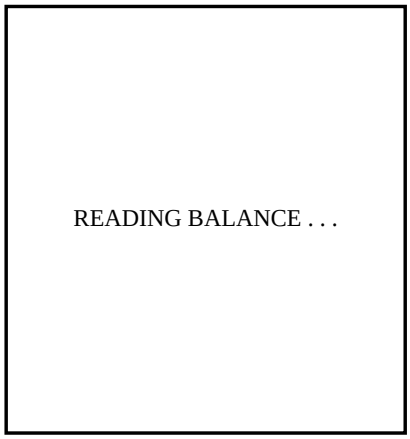


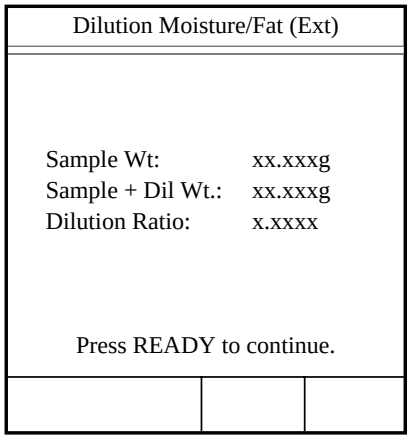
27. Add the diluent to the sample in the container on the external balance pan.

28. Wait for the weight to stabilize.

29. Press READY.

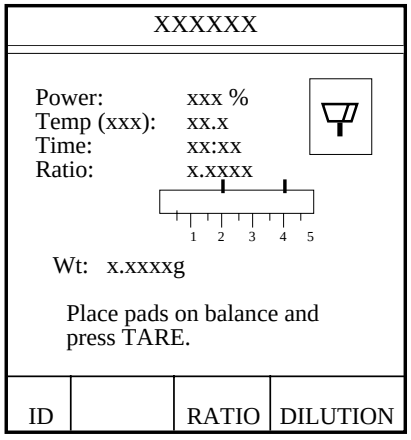
The instrument reads and records the weight of the sample and diluent.





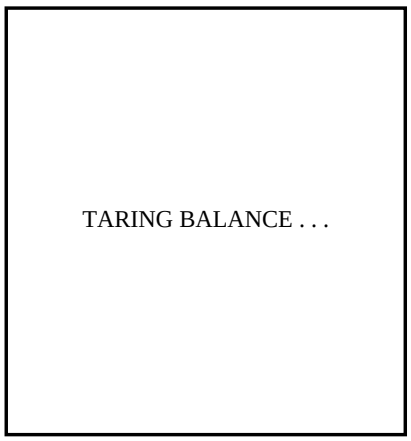
The instrument displays the weight of the sample, the weight of the sample and diluent, and the dilution ratio.

30. Press READY to continue the analysis.



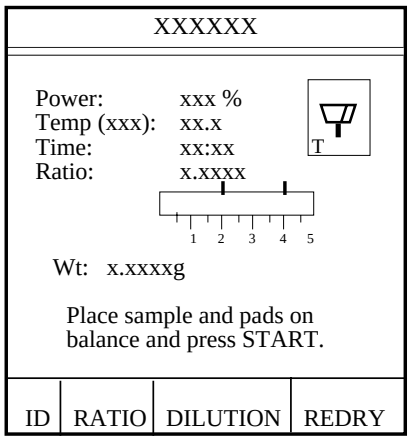
31. Lift the cover of the SMART System^5. Place one round and two square glass fiber sample pads on the balance pan (round pad on bottom). Close the instrument cover.

32. Press TARE.



33. Wait for the instrument to tare the weight of the sample pads.

Note: The “T” in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

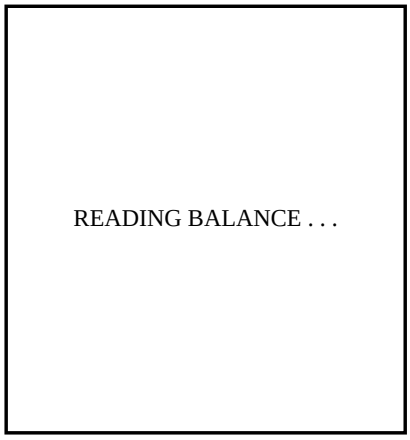


34. Lift the instrument cover. Remove the square sample pads from the balance pan.

35. Apply the diluted sample in a thin, even layer to one of the square sample pads and cover the sample with the other square sample pad.

36. With the round pad still on the balance pan, quickly and gently place the sample pads back on the balance pan. Close the instrument cover.

The instrument reads and records the initial weight of the sample prior to beginning the analysis.

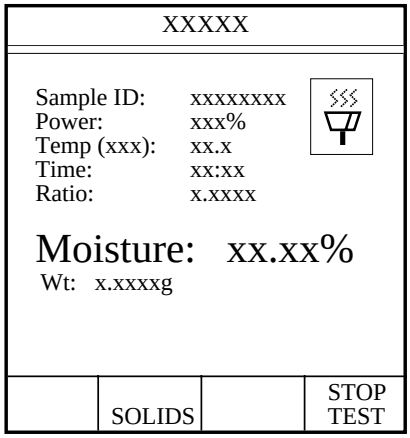


As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time). The sample weight decreases as the moisture is removed.

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

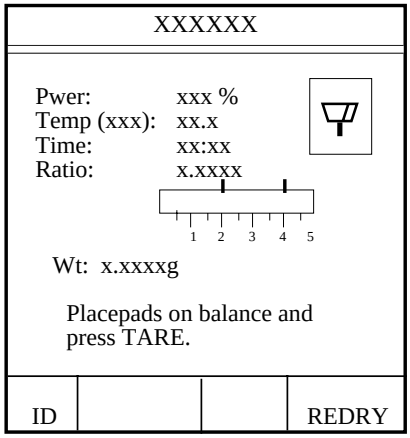
Note: Press the operation key below FORM FEED to advance paper from the internal printer.



37. Press READY to redry the sample or to analyze additional samples using the same method.

38. Lift the cover of the SMART System^5. Remove the pads from the balance pan.

39. Fold the square pads in half and place them in the extraction chamber of the Fat Extraction System. Place the round pad (smooth side up) in the recess at the top of the extraction chamber. Close and latch the lid of the extraction chamber.

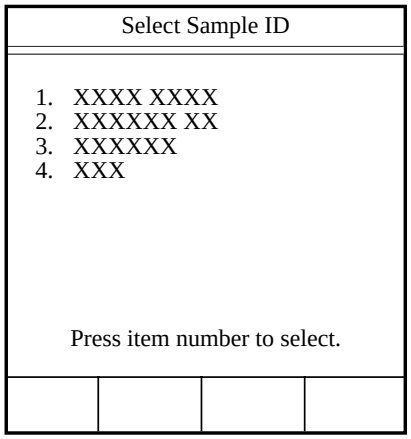


WARNING

Failure to insert or properly position the round filter pad in the recess at the top of the extraction chamber could result in operator exposure to solvent due to leakage or possible spraying and/or damage to the Fat Extraction System, resulting from solid matter entering the distillation system.

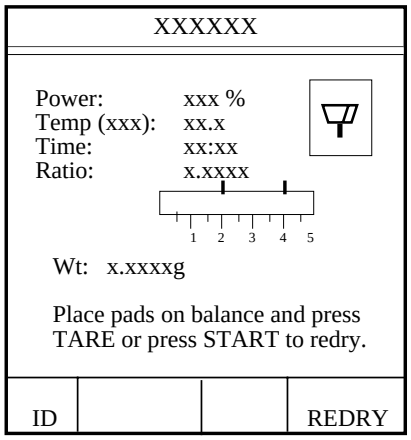
AVERTISSEMENT

L'installation incorrecte du filtre rond (coussinet) situé sur la partie supérieure de la chambre d'extraction peut exposer l'opérateur à une possible fuite ou vaporisataion du solvent. De plus, le systeme d'extraction des matières grasses peut être endommagé résultant du passage des matières solides dans le système de distillation.



40. Press the Run/Stop button on the extractor to start the extraction cycle. When the extraction is complete, a beep tone will sound, and the light in the Run/Stop button will flash. While the extractor cup is still in the inverted position, unlatch the lid and remove the round sample pad on which the chopped square pads and extracted and dried sample have been deposited. Latch the cup lid. The extractor cup will automatically rotate 180 degrees to the upright position.

Note: To dry additional samples, place the square and round sample pads on the balance and press TARE.

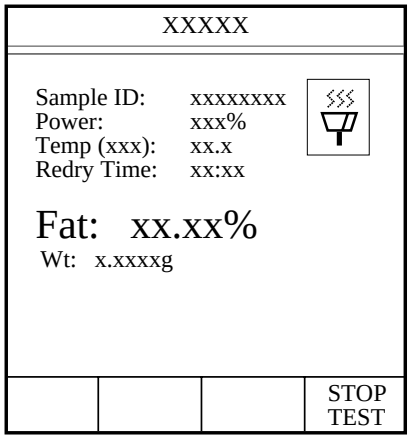


41. Press the operation key below REDRY.

42. Using the numeric key(s), press the number of the sample to be redried.

43. Lift the cover of the SMART System^5. Place the round pad with the extracted sample on the balance pan. Close the instrument cover.

44. Press START.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting down. The sample weight decreases as the moisture is removed.

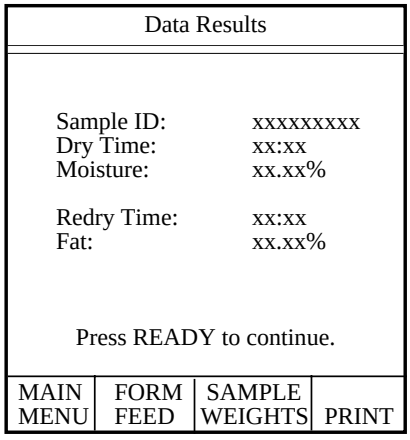
Note: Press the operation key below STOP TEST to end the analysis.

When the drying time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying the % fat.

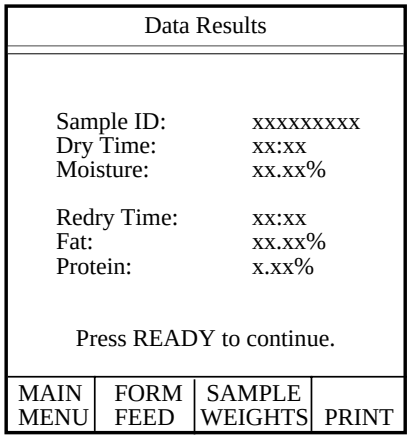
Note: Press the operation key below FORM FEED to advance paper from the internal printer.

45. Press the operation key below DATA to display the analysis data.

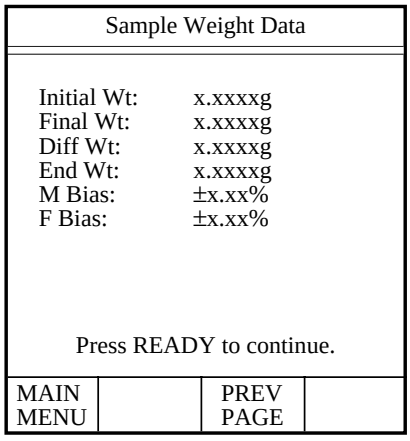
46. Press the operation key below SAMPLE WEIGHTS to display the weight data.

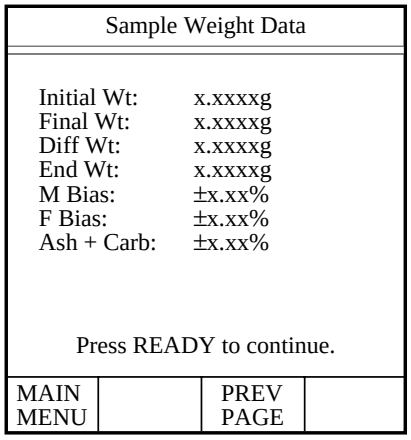


Note: If performing a moisture/fat/protein analysis, the data results screen will also provide the % protein of the sample.



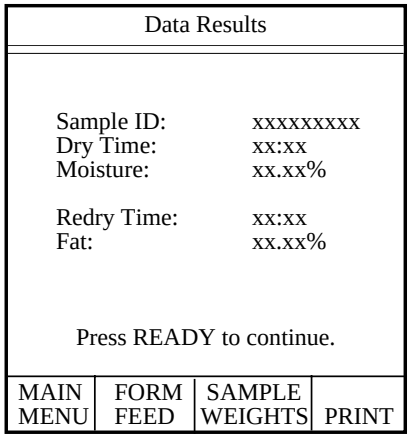
The Sample Weight Data screen displays the initial weight, the final weight and the differential weight.





Note: If performing a moisture/fat/protein analysis, the sample weight data screen will also display an ash and carbohydrate percentage.

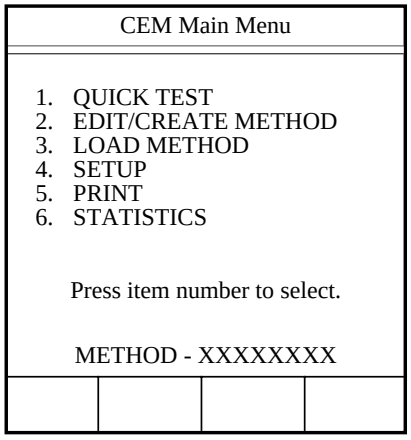
47. Press the operation key below PREV PAGE to return to the Data Results screen.



48. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

Note: Press READY to analyze additional samples using the same method.

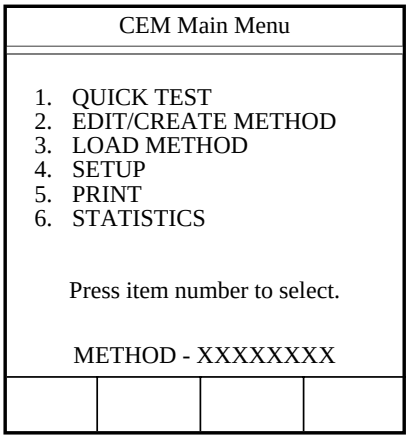
49. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.



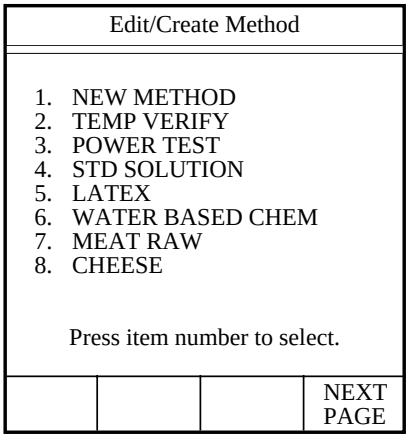
Moisture/Fat or Moisture/Fat/Protein - Constant Weight - Modified

Note: Refer to the Setup section of this manual to ensure that the applicable external balance is selected.

1. With the CEM Main Menu displayed, press "2" to activate the Edit/Create Method screen.



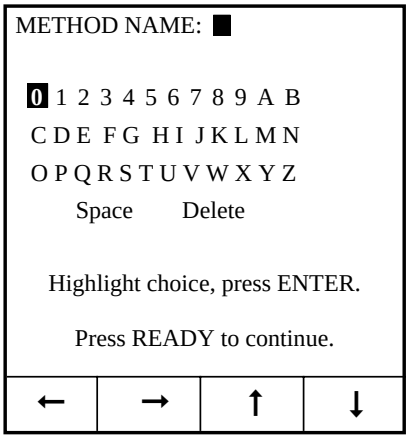
2. Press "1" to create a new method.



3. Using the operation keys below the arrows select the first letter or number of the method name.

4. Press ENTER.

5. Continue using the operation keys to select each letter or number of the method name. Press ENTER after each selection until the entire method name is selected (16 characters maximum).



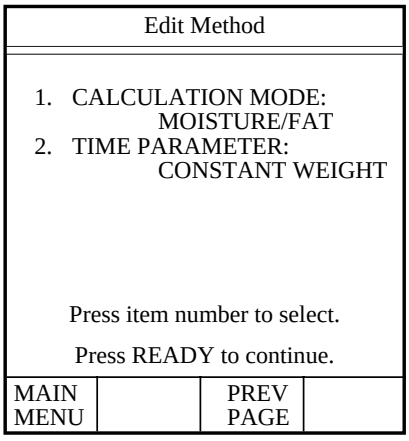
Note: If the method name utilizes numbers only, use the numeric keypad to enter the numbers for the name.

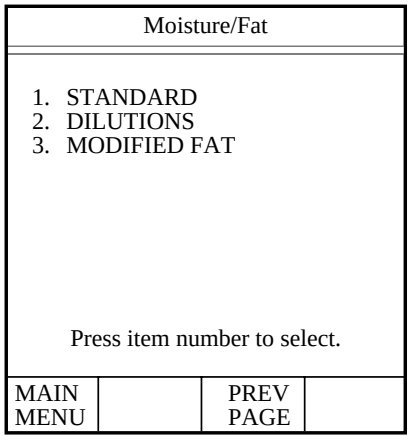
6. Press READY.

7. Press "1" to toggle and select "Moisture/ Fat" or "Moisture/Fat/Protein."

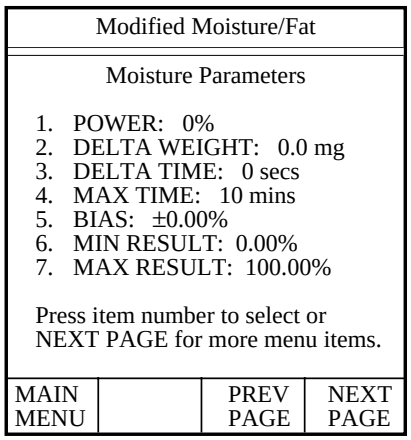
8. Press "2" to toggle and select "Constant Weight" or "Set Time."

9. Press READY.





10. Press “3” to select “Modified Fat.”

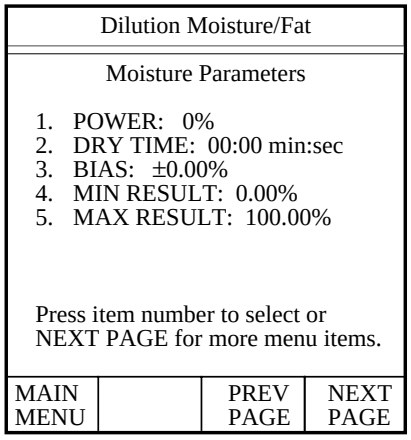


CONSTANT WEIGHT

Note: Press the operation key below PREV PAGE to return to the moisture/fat mode screen.

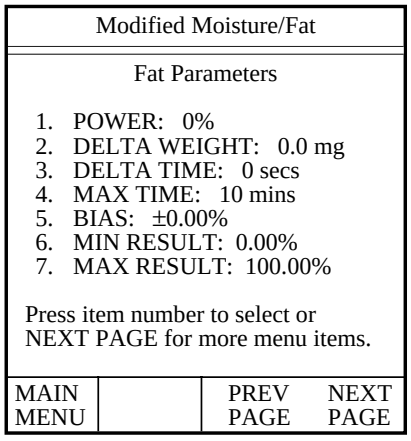
11. Press the numbers (1 - 7 Constant Weight or 1 - 5 Set Time) and enter the appropriate method parameters.

Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.



SET TIME

12. Press the operation key below NEXT PAGE to access the fat method parameters screen.

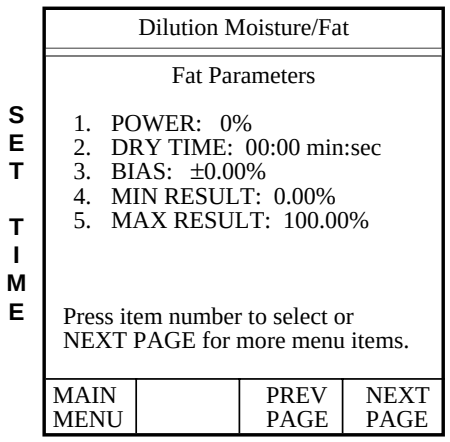


CONSTANT WEIGHT

13. Press the numbers (1 - 7 Constant Weight or 1 -5 Set Time) and enter the appropriate method fat parameters.

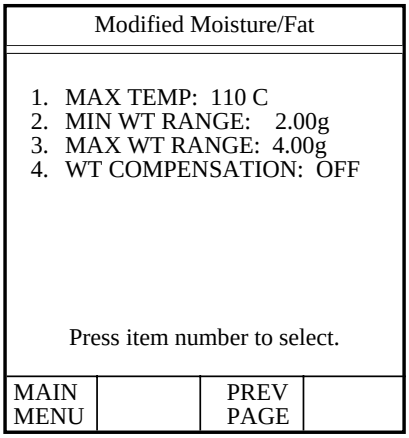
Note: Refer to the QUICK TEST section of this manual for instructions for entering method parameters for Constant Weight and Set Time.

14. Press the operation key below NEXT PAGE to access additional method parameters.

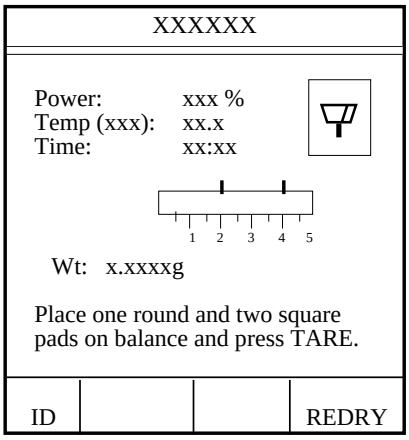


15. Press the numbers (1 - 3) and enter the appropriate method parameters.

16. Press READY to begin the analysis.



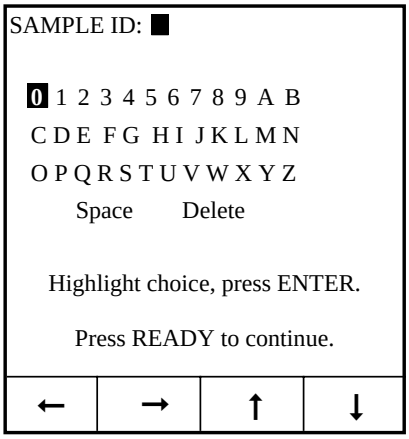
17. If Autotrack is turned off and a sample identification name or number is required, press the operation key below ID.

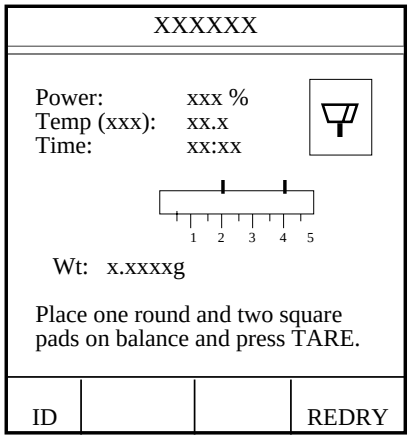


18. Using the operation keys below the arrows, position the cursor on (select) the first number or letter of the sample identification. Press ENTER. Continue to position the cursor on each letter or number and press ENTER until the identification is complete.

Note: If using an identification number only, use the numeric keys to enter the number.

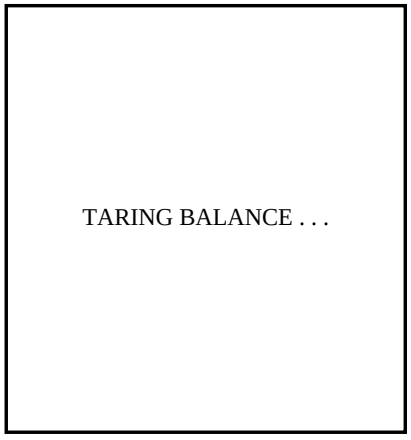
19. Press READY to return to the method test screen.



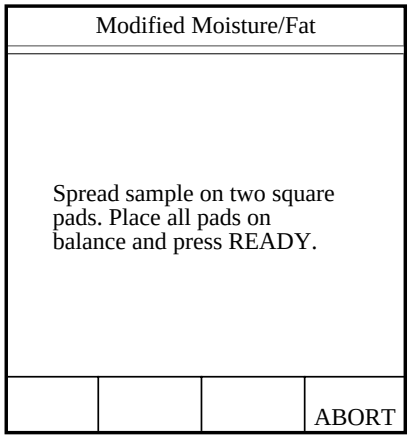


20. Lift the cover of the SMART System^5. Place one round and two square glass fiber sample pads on the balance pan (round pad on bottom). Close the instrument cover.

21. Press TARE.



22. Wait for the instrument to tare the weight of the pads.

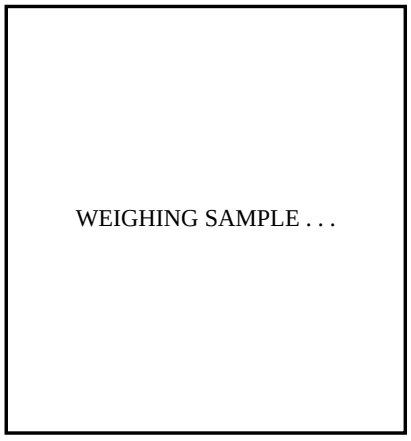


23. Lift the cover of the SMART System^5. Remove the square sample pads from the balance pan.

24. Apply the sample in a thin, even layer to one of the square sample pads and cover the sample with the other square pad.

25. With the round pad still on the balance pan, quickly and gently place the square sample pads back on the balance pan. Close the instrument cover.

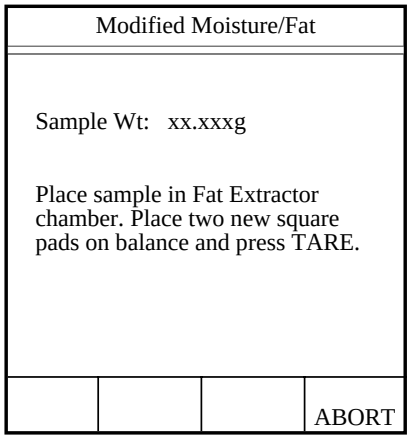
26. Press READY.



The SMART System^5 weighs and records the initial weight of the sample.

27. Lift the cover of the SMART System5. Remove the pads from the balance pan.

28. Fold the square pads in half and place them in the extraction chamber of the Fat Extraction System. Place the round pad (smooth side up) in the recess at the top of the extraction chamber. Close and latch the lid of the extraction chamber.



WARNING

Failure to insert or properly position the round filter pad in the recess at the top of the extraction chamber could result in operator exposure to solvent due to leakage or possible spraying and/or damage to the Fat Extraction System, resulting from solid matter entering the distillation system.

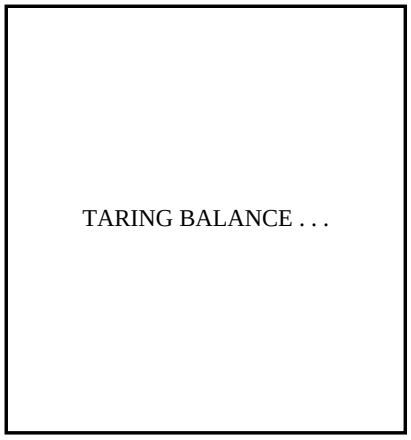
AVERTISSEMENT

L'installation incorrecte du filtre rond (coussinet) situé sur la partie supérieure de la chambre d'extraction peut exposer l'opérateur à une possible fuite ou vaporisataion du solvent. De plus, le systeme d'extraction des matières grasses peut être endommagé résultant du passage des matières solides dans le système de distillation.

29. Press the Run/Stop button on the extractor to start the extraction cycle. When the extraction is complete, a beep tone will sound, and the light in the Run/Stop button will flash. While the extractor cup is still in the inverted position, unlatch the lid and remove the round sample pad on which the chopped square pads and extracted and dried sample have been deposited. Latch the cup lid. The extractor cup will automatically rotate 180 degrees to the upright position.

30. Place one round and two square glass fiber sample pads on the balance pan (round pad on bottom) of the SMART System5. Close the instrument cover.

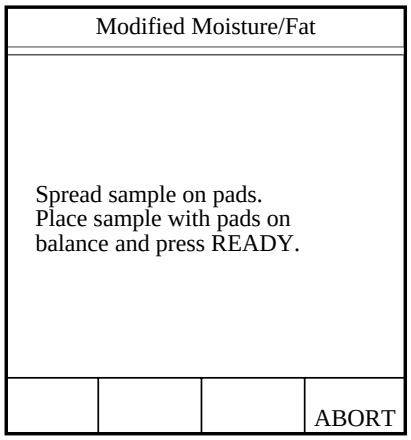
31. Press TARE.



32. Wait for the SMART System^5 to tare the weight of the sample pads.

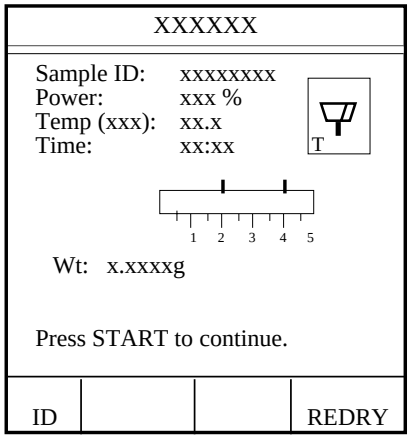
33. Lift the cover of the SMART System^5. Remove the square sample pads from the balance pan.

34. Apply the sample in a thin, even layer to one of the square sample pads and cover the sample with the other square pad.



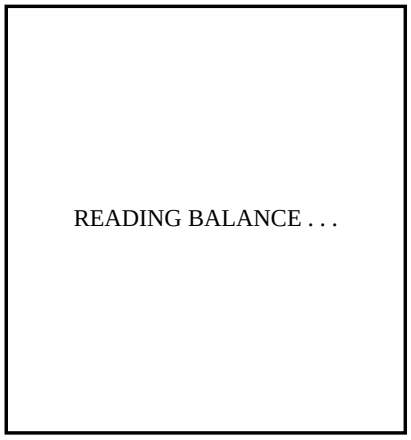
35. With the round pad still on the balance pan, quickly and gently place the square sample pads back on the balance pan. Close the instrument cover.

36. Press READY.



Note: The “T” in the lower left corner of the balance icon indicates that the weight of the sample pads has been tared.

37. Press START.



The instrument reads and records the initial weight of the sample prior to beginning the analysis.

As the analysis begins, the flashing microwave indicators in the balance icon appear and the time begins counting (up for Constant Weight or down for Set Time). The sample weight decreases as the moisture is removed.

During the drying time, the operation key below SOLIDS or MOISTURE may be pressed to display % solids or % moisture.

When the weight loss is equal to or less than the selected parameter, five short beeps will be heard, and the Data Results screen will appear, displaying either the % moisture or % solids as selected.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

38. Press READY to dry sample no. 1.

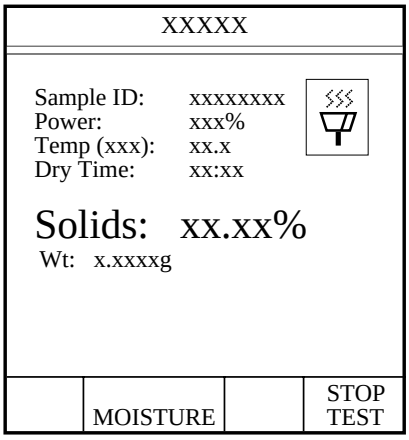
39. Lift the cover of the SMART System5. Remove the pads from the balance pan. This sample (sample no. 2) can be discarded.

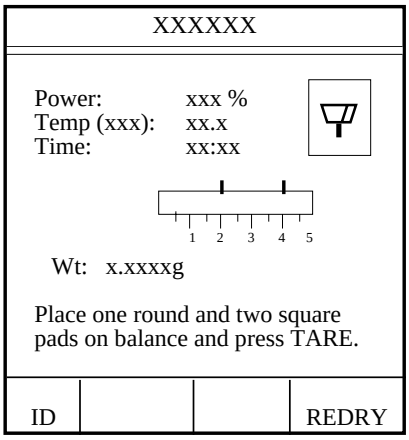
40. When the extraction of sample no. 1 is complete, the extractor cup will be inverted, a beep tone will sound, and the light in the Run/Stop button will flash. While the extractor cup is still in the inverted position, unlatch the lid and remove the round sample pad on which the chopped square pads and extracted sample have been deposited. Latch the cup lid. The extractor cup will automatically rotate 180 degrees to the upright position.

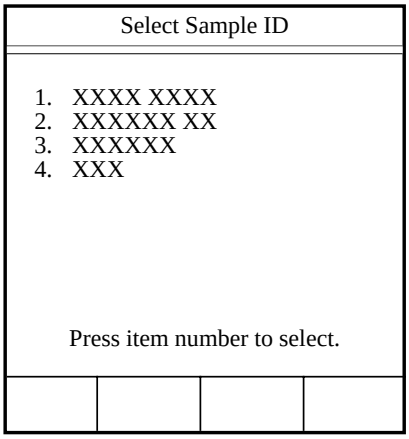
41. Place the round pad with the extracted sample no. 1 on the balance pan of the SMART System5. Close and latch the instrument cover.

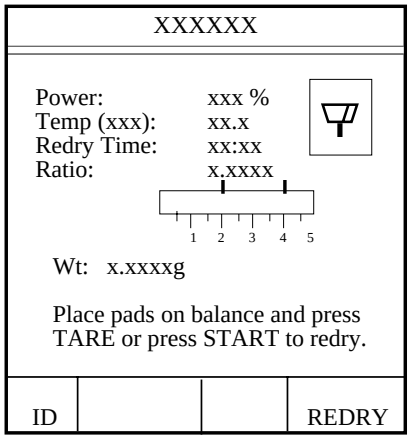
42. Press the operation key below REDRY.

43. Using the numeric key(s), press the applicable number of the sample to be redried.

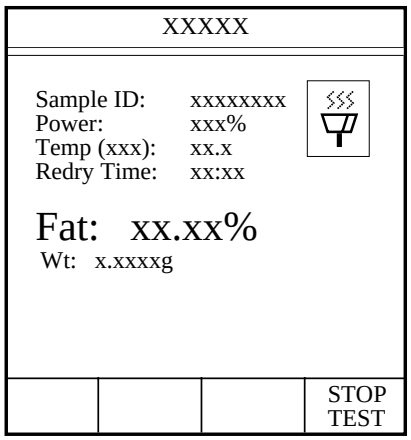








44. Press START.



As the analysis begins, the flashing microwave indicators in the balance icon appear and the redry time begins counting down. The sample weight decreases as the moisture is removed.

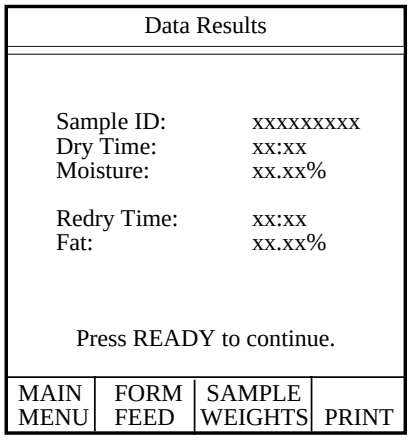
Note: Press the operation key below STOP TEST to end the analysis.

When the redry time is complete, five short beeps will be heard, and the Data Results screen will appear, displaying the % fat.

Note: Press the operation key below FORM FEED to advance paper from the internal printer.

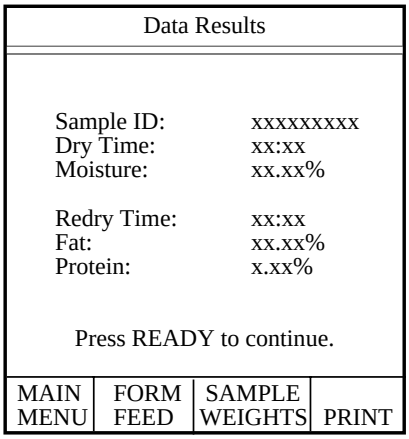
45. Press the operation key below DATA to display the analysis data.

Note: The SMART System5 will store the final weight of the fat extracted sample. Based on the weight of sample no. 1 prior to extraction, the weight prior to redry, and the final weight after redry plus the weights of sample no. 2 prior to and following the drying process, the instrument will compute and display fat, and if applicable, protein analysis results.



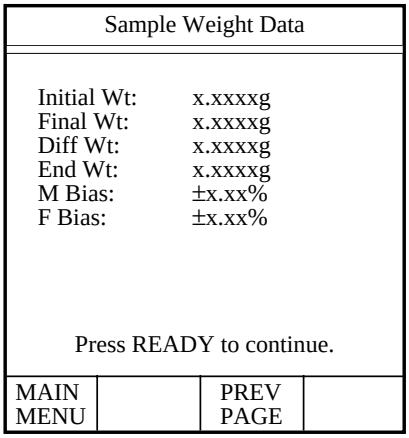
46. Press the operation key below SAMPLE WEIGHTS to display the weight data.

Note: If performing a moisture/fat/protein analysis, the data results screen will also provide the % protein of the sample.

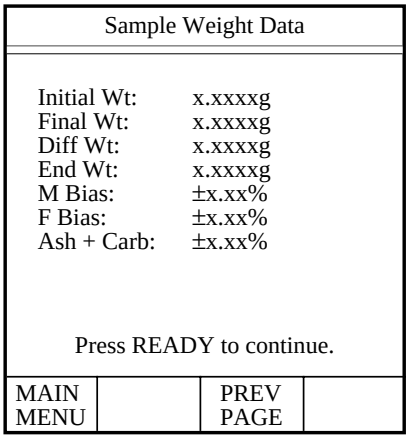


The Sample Weight Data screen displays the initial weight, the final weight and the differential weight

Note: If performing a moisture/fat/protein analysis, the sample weight data screen will also display an ash and carbohydrate percentage.



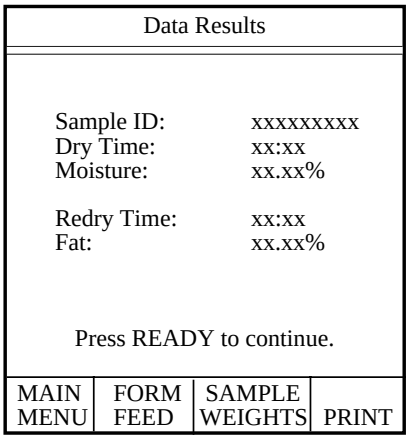
47. Press the operation key below PREV PAGE to return to the Data Results screen.



48. Press the operation key below PRINT to print the analysis results either on the internal printer or an external printer, if installed.

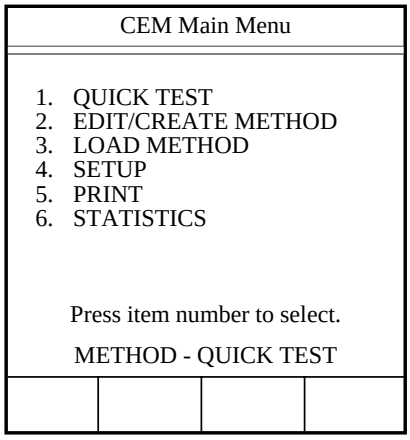
Note: Press READY to analyze additional samples using the same method.

49. Press the operation key below MAIN MENU to end the analysis and return to the CEM Main Menu screen.

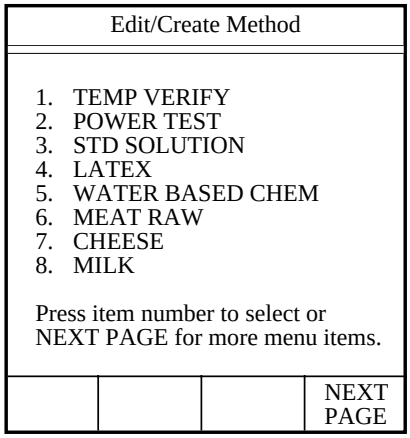


Load Method

1. Press “3” to select and load a method for use in an analysis.

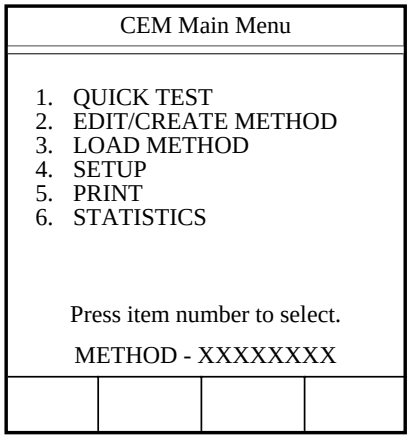


2. Press the item number of the method to be loaded.



When the CEM Main Menu returns to the screen, the selected method will be displayed.

3. Press READY to display the initial screen of the selected method.



Setup

Setup procedures include system parameters such as date/time, printer functions, utilities, calibration, system password, etc.

1. With the CEM Main Menu displayed, press “4” to activate Setup.

2. Press “1” to activate the System Options screen.

Autotrack ID automatically assigns each sample a sequential identification number (001 - 300). Once 300 is reached, the system will overwrite number 001 with new information.

3. Press “1” to toggle Autotrack ID “On” or “Off.”

The system can be programmed to print the results or data at the end of each test.

4. Press “2” to toggle **Autoprint** between “Off,” “Results” and “Data.”

Autostart permits the instrument to be programmed to automatically begin a test once the weight of the sample pads is tared, the sample is placed on the pads and the instrument cover is closed.

5. Press “3” to toggle Autostart “On” or “Off.”

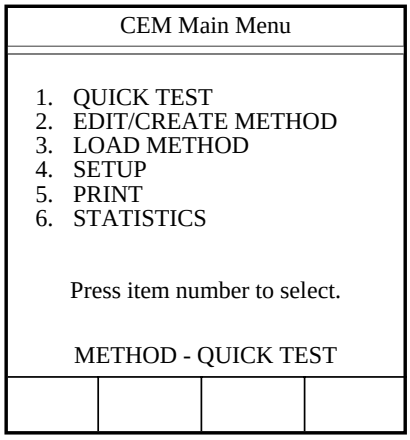
6. Press “4” to toggle and select the proper information pertaining to an **external balance** – “None,” “Sartorius,” “Mettler,” “Scientech” or “Other.”

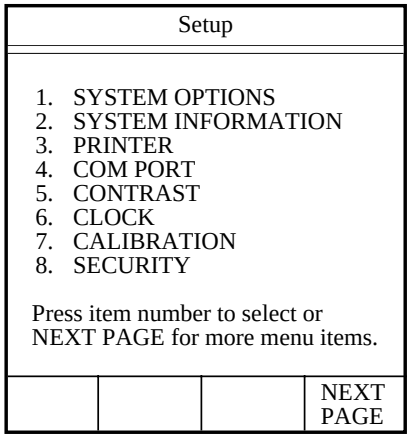
7. Press “5” to toggle and select the proper software **language** – “English,” “German,” “French,” or “Spanish.”

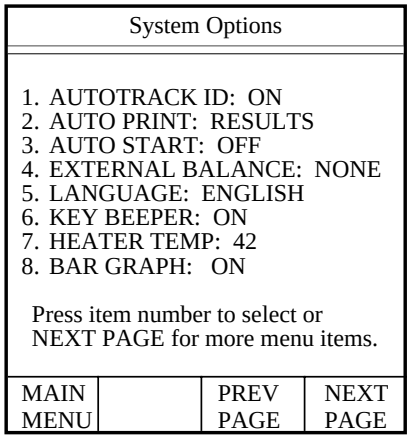
The **Key Beeper** is an audible “beep” after each key stroke and can be turned on or off.

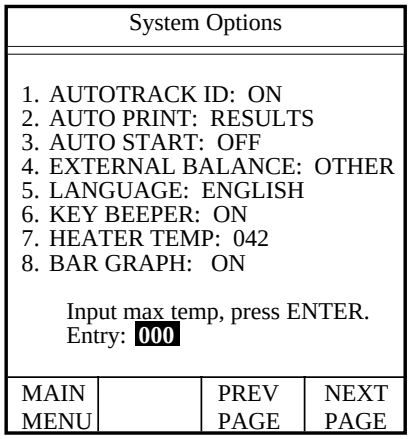
8. Press “6” to toggle the key beeper “On” or “Off.”

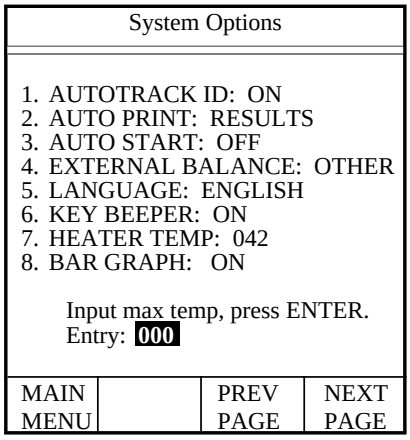
9. Press “7” to select and enter the **heater temperature**. CEM recommends a heater temperature of 42°C.











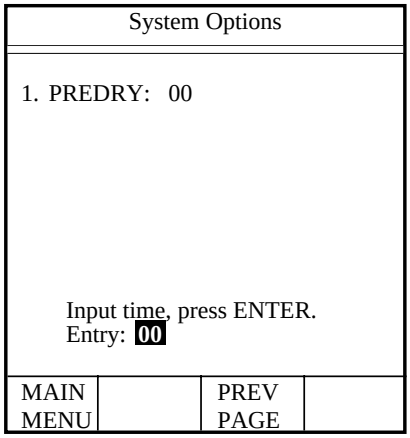
10. Using the numeric keys, enter the heater temperature. Press ENTER.

The **bar graph**, which displays during a sample analysis, is designed to provide a visual representation of the initial sample weight.

11. Press “8” to toggle the bar graph “On” or “Off.”

12. Press the operation key below NEXT PAGE to access additional system options.

Predry time is a set time for the instrument to activate microwave energy, once the TARE key is pressed, to dry the sample pads prior to taring the weight of the pads.

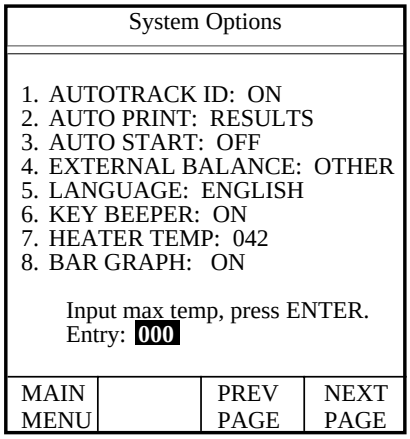


13. Press “1” to select and enter a **predry** time.

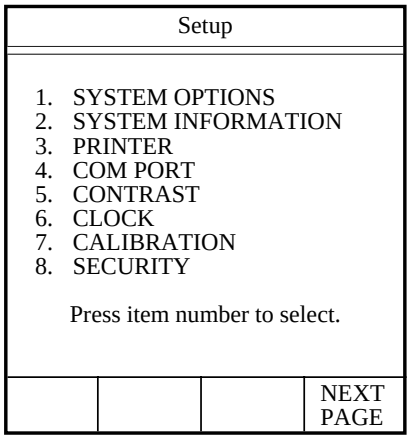
14. Using the numeric keys, enter the preheat time (0 - 60 seconds).

15. Press ENTER.

16. Press the operation key below prev page to return to the System Options screen.



17. Press the operation key below PREV PAGE to return to the Setup screen.

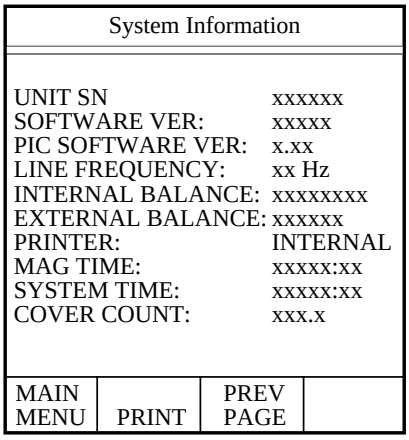


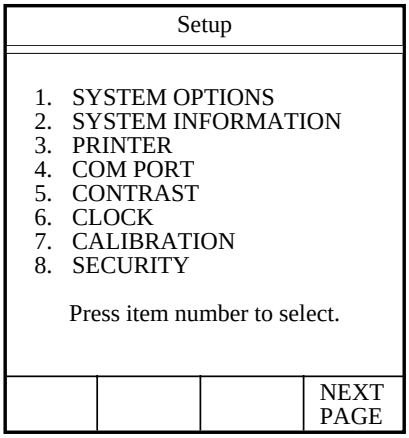
18. Press “2” to activate the System Information screen.

The **System Information** screen is for information purposes only. This screen provides the system software version, the PIC software version, the electrical line frequency, the type of internal and external balance, etc.

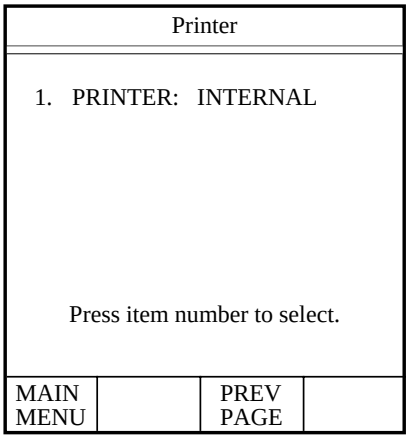
19. Press the operation key below PREV PAGE to return to the Setup screen.

20. Press “3” to activate the Printer screen.





21. Press “1” to toggle and select the “Internal” printer or an external **printer**.



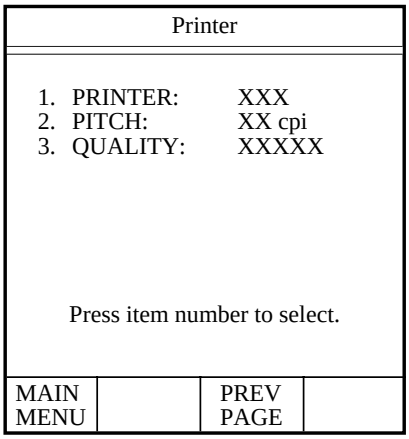
Note: If an external printer is selected, the following screen will appear.

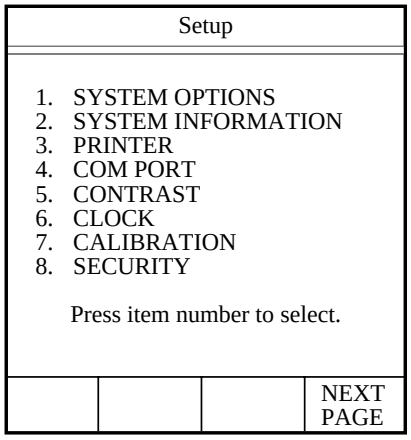
22. Press “1” to toggle and select the applicable external printer – IBM, Epson, Citizens, HP LaserJet or Canon Bubble.

23. Press “2” to toggle and select the applicable printer pitch – 10, 12 or 17 cpi.

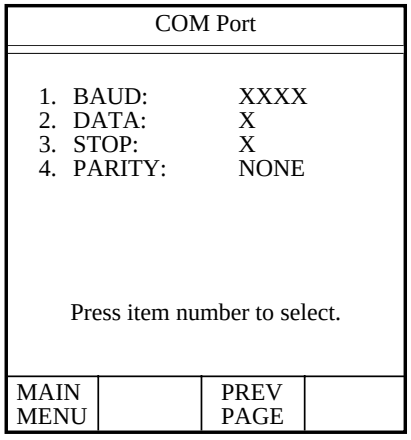
24. If applicable, press “3” to toggle and select the quality of print – Draft or NLQ (Near Letter Quality).

25. Press the operation key below PREV PAGE to return to the Setup screen.





26. Press “4” to activate the **Communication Port** screen.



27. Press “1” to toggle and select the applicable baud rate for the communication port – “1200,” “2400,” “4800,” or “9600.”

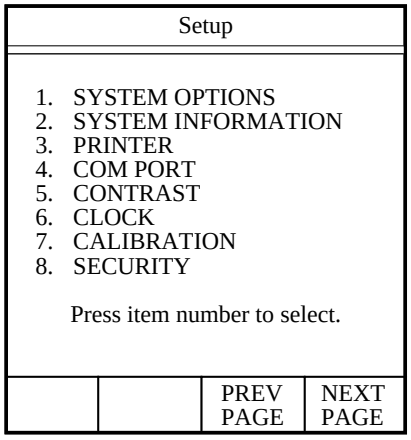
28. Press “2” to toggle and select the applicable data bits – “7” or “8.”

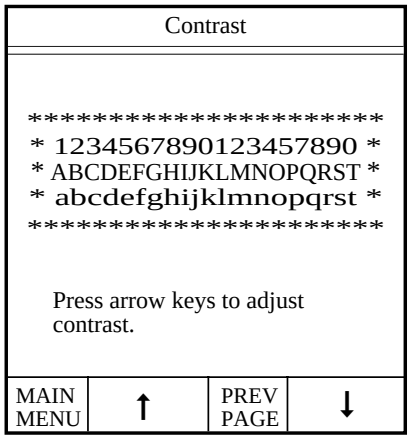
29. Press “3” to toggle and select the applicable stop bit(s) – “1” or “2.”

30. Press “4” to toggle and select the applicable parity – “None,” “Even,” or “Odd.”

31. Press the operation key below PREV PAGE to return to the Setup screen.

32. Press “5” to activate the **Contrast** screen.

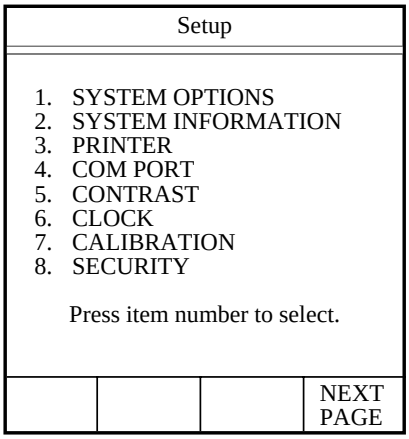




33. Press the operation key(s) below the “up” and “down” arrows to adjust the instrument screen to the desired level.

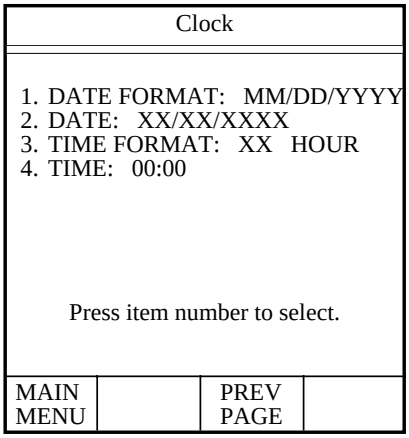
34. Press the operation key below PREV PAGE to return to the Setup screen.

35. Press “6” to activate the **Clock** screen.



36. Press “1” to toggle and select the desired date format – “MM/DD/YYYY” or “DD/MM/YYYY.”

37. Press “2” to enter the appropriate date.

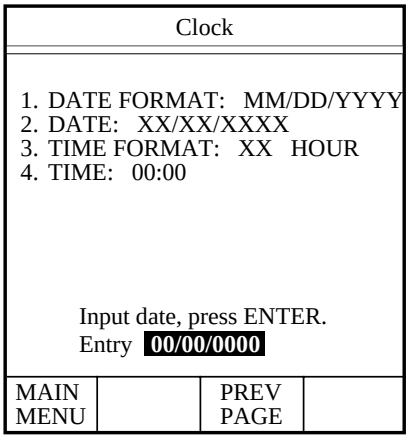


38. Using the numeric keypad, enter the date based on the selected date format.

39. Press ENTER.

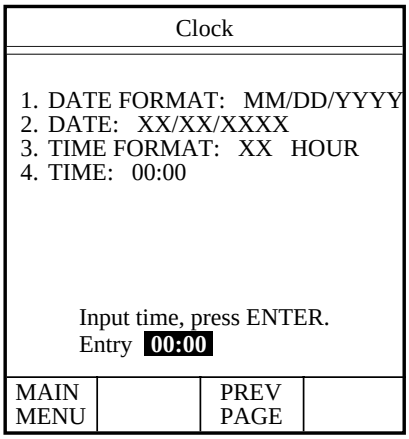
40. Press “3” to toggle and select the desired time format – “24” or “12” hour.

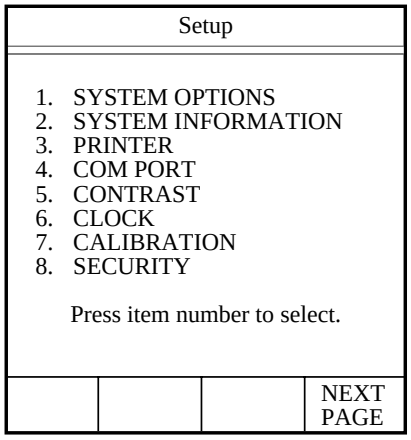
41. Press “4” to enter the time of day.



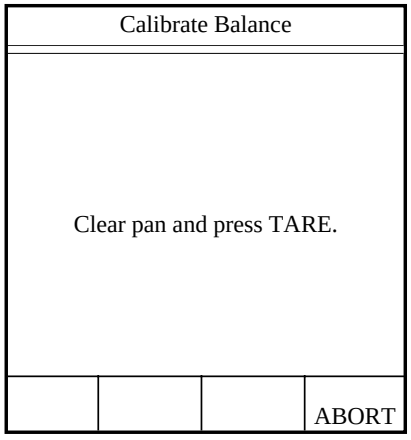
42. Using the numeric keypad, enter the time of day.

43. Press the operation key below PREV PAGE to return to the Setup screen.



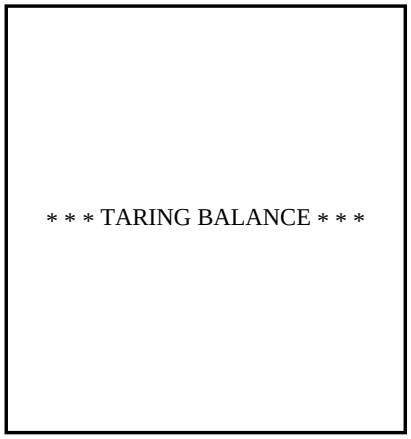


44. Press “7” to activate the **Calibration** screen.

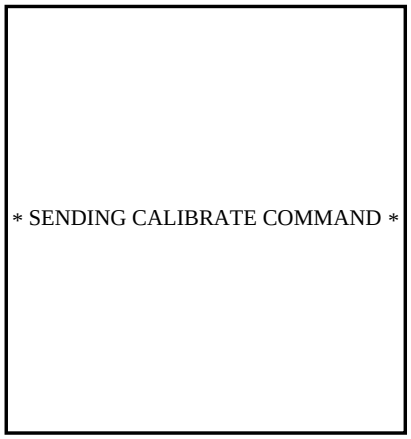


45. Ensure that the balance pan is free of any weight.

46. Press TARE.

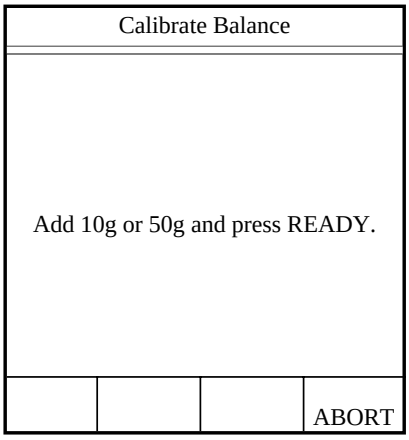


47. Wait for the instrument to tare the weight of the balance pan.

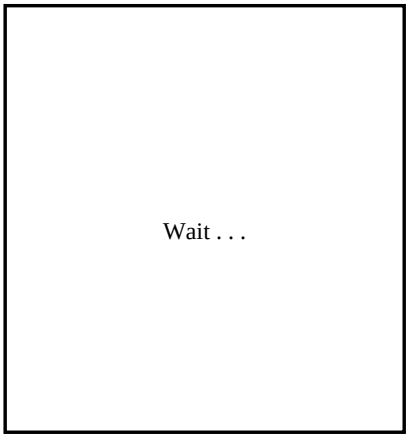


48. Lift the instrument cover. Place either a 10 gram or 50 gram weight. Close the instrument cover.

Note: Press any key to abort the balance calibration.

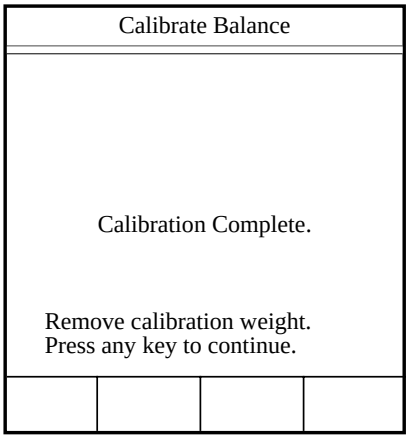


Note: Wait for the instrument to calibrate the balance with the applicable weight.

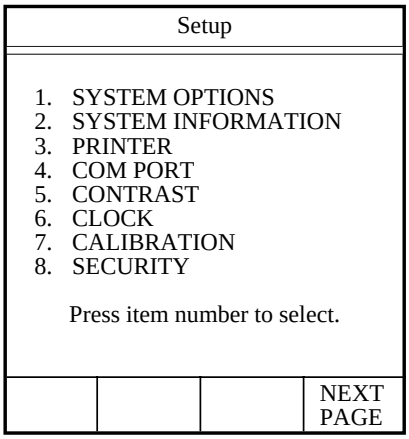


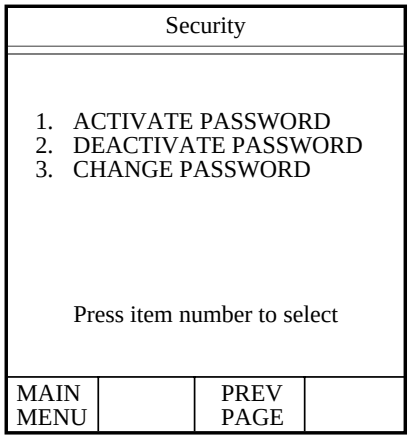
49. Remove the calibration weight from the balance pan.

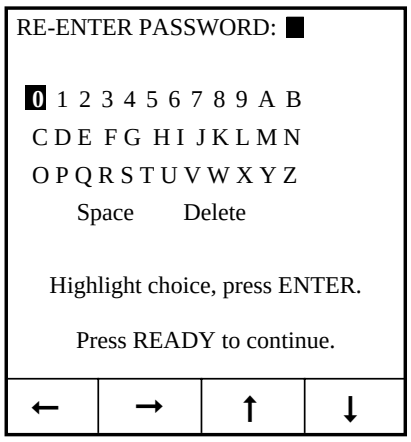
50. Press any key to return to the Setup screen.

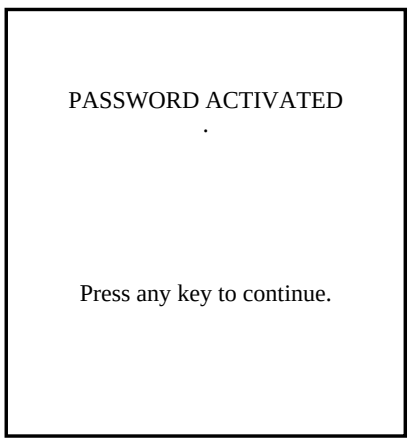


51. Press “8” to activate the **Security** screen.









Security permits the entry of a password to prevent unauthorized entry of programs into the instrument or unauthorized alteration of program parameters. Once a password is entered and activated, new programs cannot be entered and program parameters cannot be altered without entry of the proper password.

CAUTION

To avoid being unable to enter new programs or alter program parameters, ensure that any activated password is recorded or documented for retrieval.

Mise en garde

Afin d'éviter d'être incapable d'entrer un nouveau programme ou modifier un paramètre, s'assurer de documenter ou d'inscrire tout mot-de-passe actif pour le retrouver.

52. Press "1" to enter and activate a system password.

53. Using the operation keys below the arrows, select the first letter or number of the password.

54. Press ENTER.

Note: If the password utilizes numbers only, use the numeric keys to enter the numbers for the password.

55. Continue using the operation keys to select each letter or number of the password. Press ENTER after each selection until the entire password is selected.

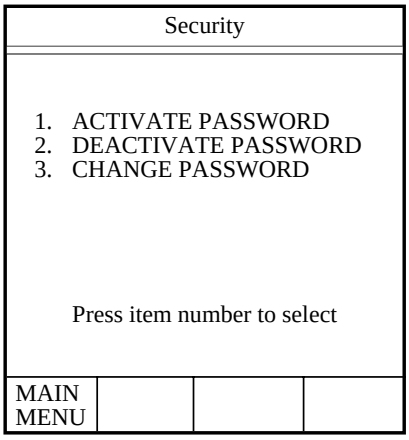
56. Press READY.

57. Using the operation keys below the arrows, select each letter or number of the password and press ENTER after each selection to re-enter the password.

58. Press READY to activate the selected password.

59. Press any key to return to the security screen.

60. Press “2” to deactivate an entered password.



61. Using the operation keys below the arrows, select the first letter or number of the password to be deactivated.

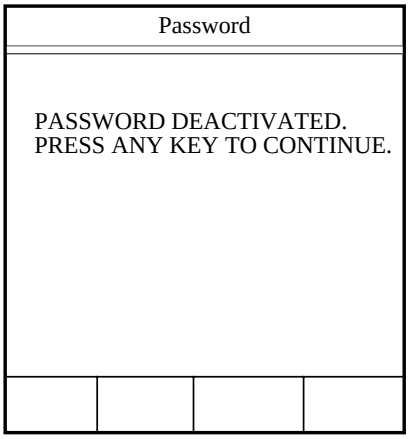
62. Press ENTER.

Note: If the password utilizes numbers only, use the numeric keypad to enter the numbers for the password.

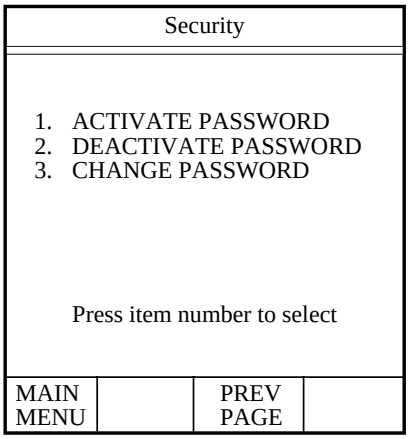
63. Continue using the operation keys to select each letter or number of the password. Press ENTER after each selection until the entire password is selected.

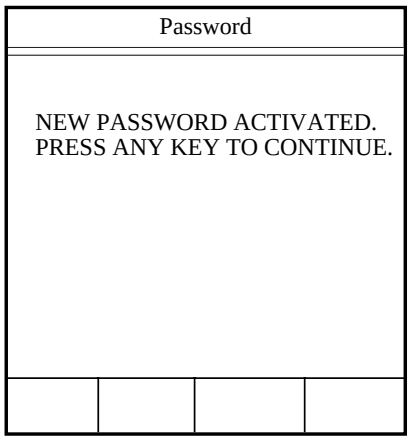
64. Press READY.

65. Press any key to return to the Security screen.



66. Press “3” to change a password.





67. Using the operation keys below the arrows, select the first letter or number of the old password.

68. Press ENTER.

Note: If the password utilizes numbers only, use the numeric keypad to enter the numbers for the password.

69. Continue using the operation keys below the arrows to select each letter or number of the old password. Press ENTER after each selection until the entire password is selected.

70. Press READY.

71. Using the operation keys below the arrows, select the first letter or number of the new password.

72. Press ENTER.

Note: If the password utilizes numbers only, use the numeric keypad to enter the numbers for the password.

73. Continue using the operation keys to select each letter or number of the new password. Press ENTER after each selection until the entire password is selected.

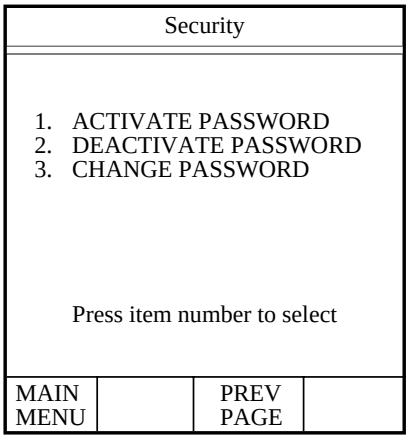
74. Press READY.

75. Using the operation keys below the arrows, select each letter or number to re-enter the password and press ENTER after each selection.

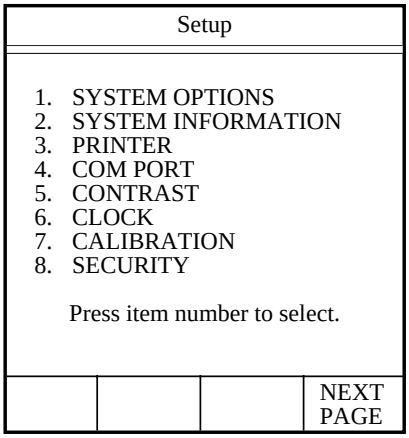
76. Press READY to activate the selected password.

77. Press any key to return to the Security screen.

78. Press the operation key below PREV PAGE to return to the Setup screen.

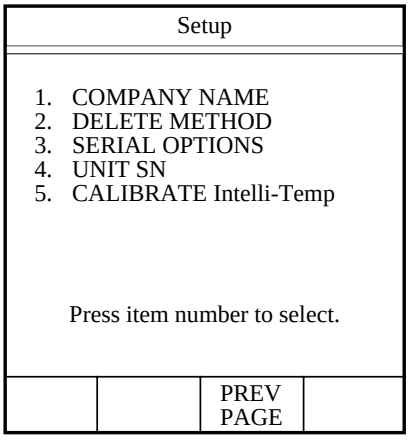


79. Press the operation key below NEXT PAGE.



80. Press "1" to enter a company name.

A company name can be entered for identification purposes.



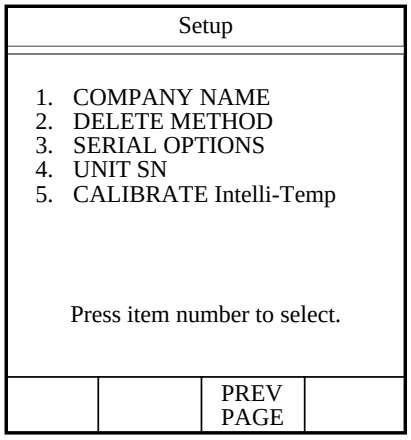
81. Using the operation keys below the arrow, select the first letter or number of the company name.

82. Press ENTER.

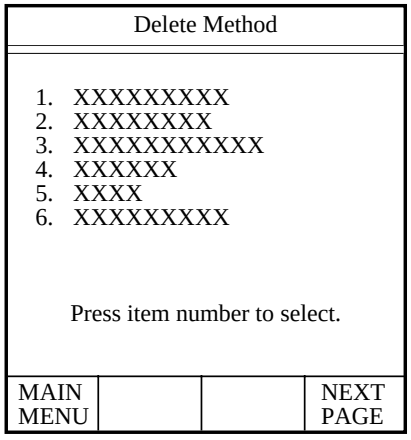
Note: If the company name utilizes numbers only, use the numeric keypad to enter the numbers for the company name.

83. Continue using the operation keys to select each letter or number of the company name. Press ENTER after each selection until the entire name is selected.

84. Press READY to return to the Setup screen.

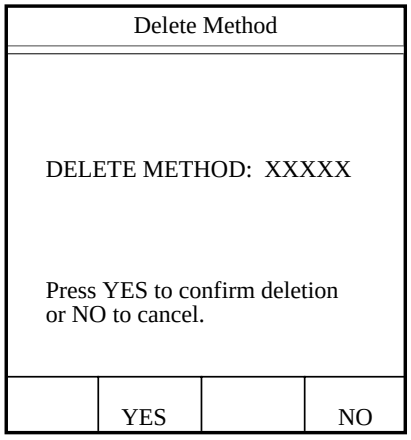


85. Press “2” to activate the Delete Method screen.

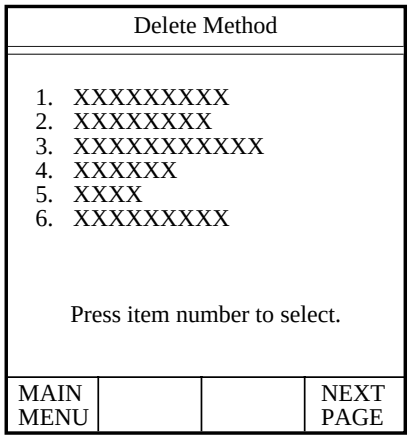


86. Press the number of the method to be deleted.

Note: If necessary, press the operation key below NEXT PAGE to locate the method to be deleted.



87. Press the operation key below YES to delete the method or “No” to cancel the deletion process.



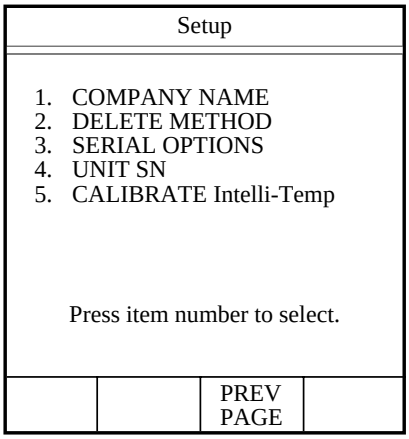
88. Press EXIT to return to the Setup screen.

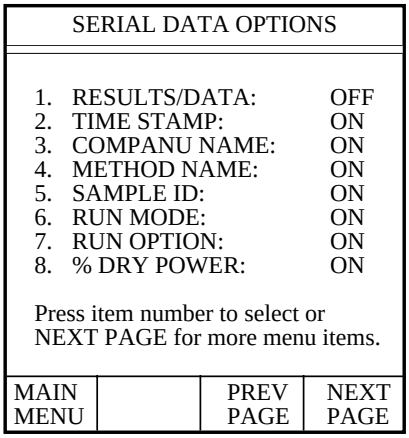
89. Press “3” to access the Serial Options screen.

Note: The Serial Options screens (4) are for use when connecting the SMART System5 to a PC. If the instrument is connected to a PC, the “Results Data” in the first options screen should be turned “on.” The additional information presented in the Serial Options screens should be turned “on” or “off” based on methods being performed and the data desired to be sent to the PC.

90. Press the applicable number(s) to turn the data results “on” or “off.”

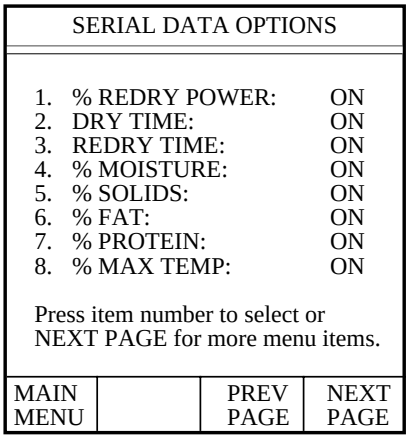
91. Press the operation key below NEXT PAGE to access additional serial data options.





92. Press the applicable number(s) to turn the data results “on” or “off.”

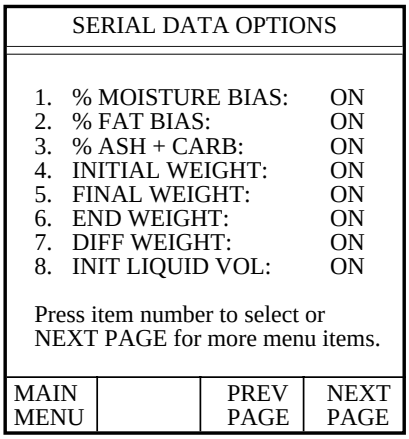
93. Press the operation key below NEXT PAGE to access additional serial data options.

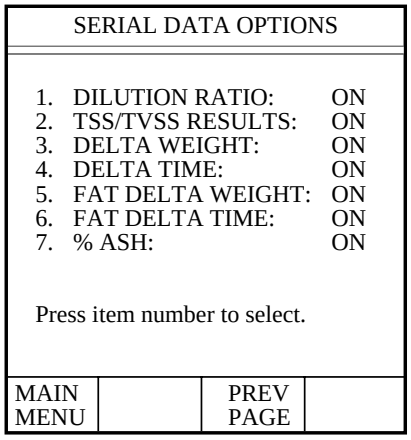


94. Press the applicable number(s) to turn the data results “on” or “off.”

95. Press the operation key below NEXT PAGE to access additional serial data options.

96. Press the operation key below MAIN MENU to return to the CEM Main Menu.

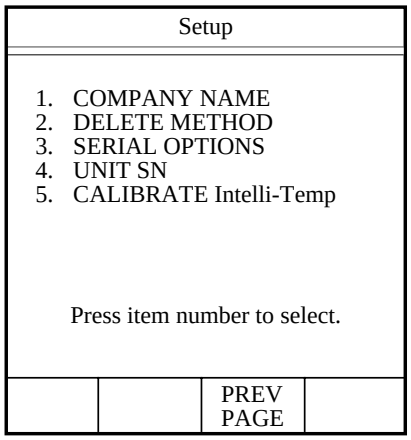




97. Press the applicable number(s) to turn the data results “on” or “off.”

98. Press the operation key below NEXT PAGE to access additional serial data options.

99. Press the operation key below PREV PAGE to return to the Setup screen.



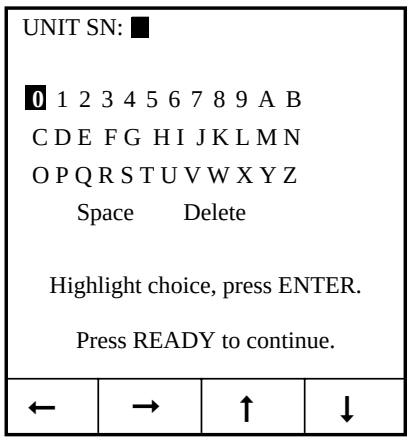
100. Press “4” to access the Unit Serial Number screen.

Note: If the instrument, due to component failure, etc., cold starts, the instrument serial number will be erased from the instrument software. The serial number can be found on the instrument nameplate on the back of the instrument and reentered into the software.

101. Using the operation keys below the arrows, select the first letter of the serial number.

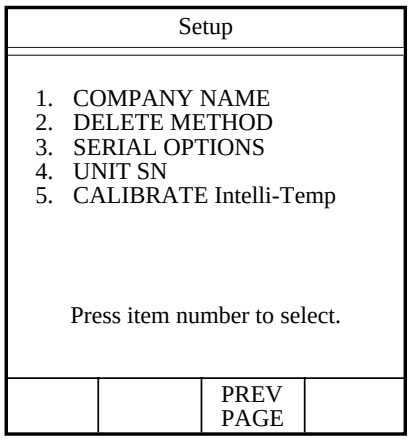
102. Press ENTER.

103. Continue using the operation keys to select each letter and number of the serial number. Press ENTER after each seletion until the entire serial number is selected.



104. Press READY to return to the Setup screen.

105. Press “5” to access the Calibrate Intelli-Temp screen.

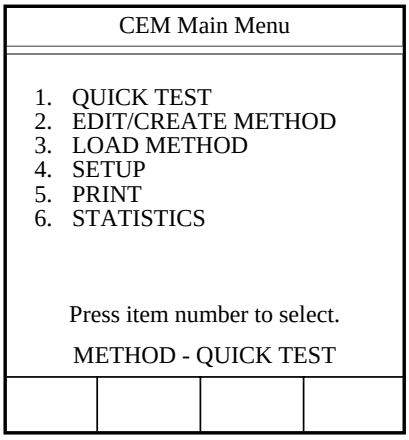


Note: The SMART System^5 is completely factory calibrated. Calibration of the Intelli-Temp is not necessary prior to system use. Calibration is recommended only for verification of system operation or if a problem with calibration is suspected. Refer to the Maintenance, Trouble-shooting and Service section of this manual for calibration procedures.

106. Press EXIT to return to the CEM Main Menu.

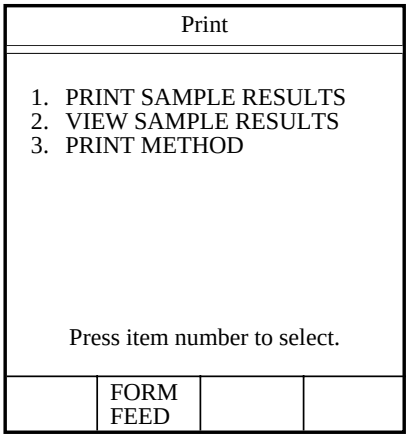
Print

1. Press “5” to print sample results or method parameters or to view sample results.



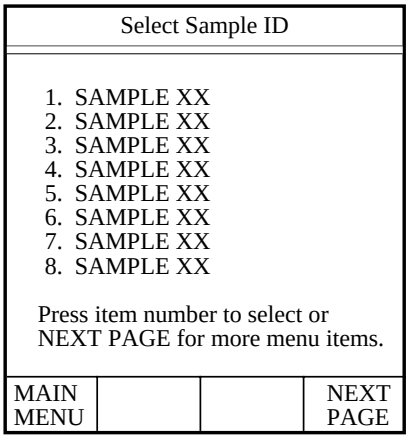
2. Press “1” to print sample results.

Note: Proceed to step 4 for instructions to view sample results or step 6 for instructions to print a method.

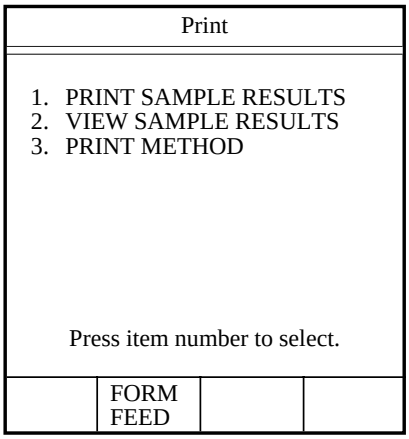


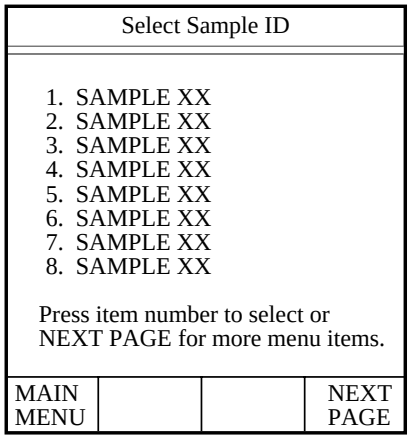
3. Using the numeric key(s), enter the number of the sample for which results are to be printed.

Note: Press the operation key below NEXT PAGE for additional samples.



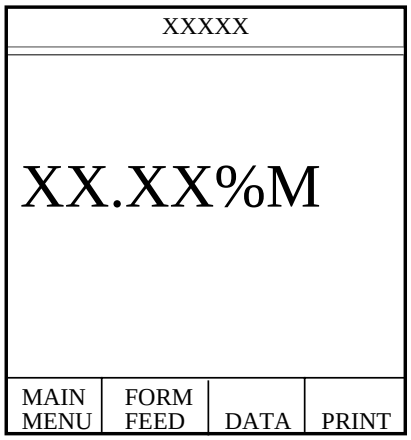
4. Press “2” to view sample results.





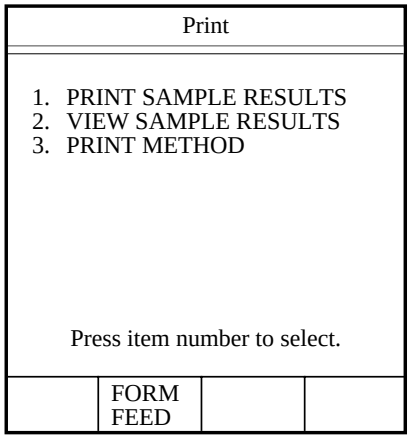
5. Using the numeric key(s), enter the number of the sample for which results are to be viewed.

Note: Press the operation key below NEXT PAGE for additional samples.

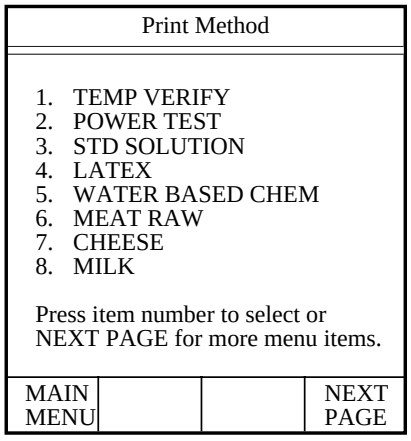


The analysis results for the selected sample appear on the screen.

Note: Press the operation key below FORM FEED to advance paper from the internal printer. Press the operation key below DATA to view the "Data Results" screen. Press the operation key below "Print" to print the results information.



6. Press "3" to print a method.



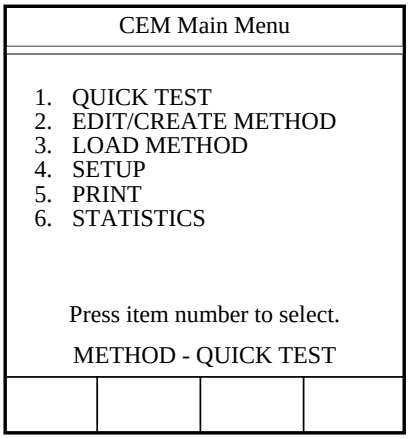
7. Press the number of the method to be printed.

Note: Press the operation key below NEXT PAGE to access additional methods, if applicable.

Once the method is selected, the printer prints the method information.

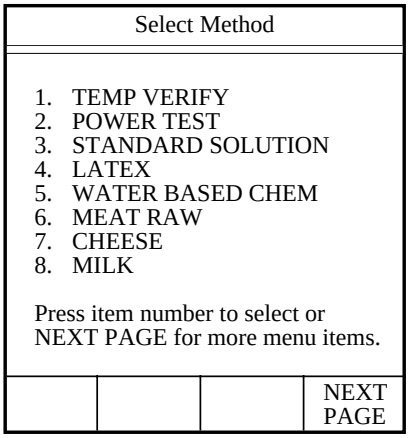
Statistics

1. Press “6” to access the statistics screens and menu.

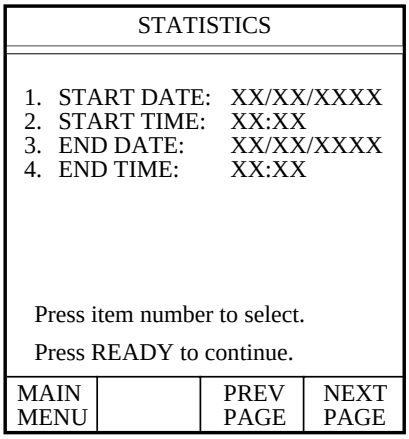


2. Press the applicable number for the method for which statistics are to be viewed and/or printed.

Note: Press the operation key below NEXT PAGE for additional methods, if applicable.



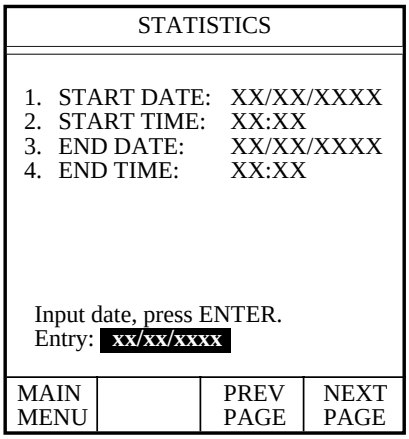
3. Press “1” to enter a start date.

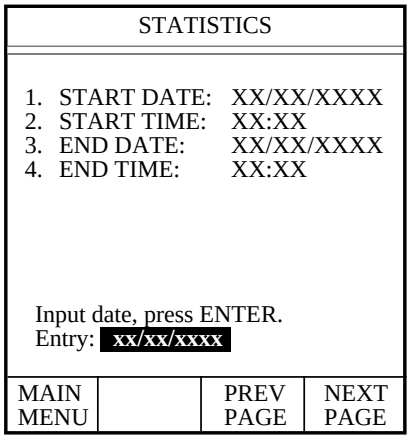


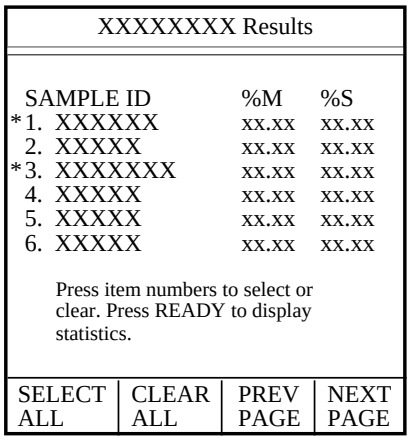
4. Using the numeric keys, enter the beginning date for displaying method statistical data.

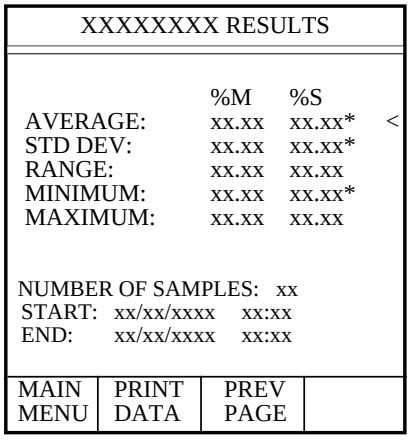
5. Press ENTER.

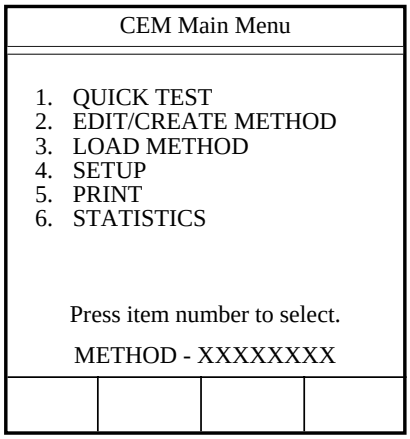
6. Press “2” to enter a start time.











7. Using the numeric keys, enter the last date for displaying method statistical data.

8. Press ENTER.

9. Press “3” and “4” and repeat steps 3 through 8 to enter the end date and end time.

10. Press the operation key below NEXT PAGE to access the next statistical screen.

Note: The cursor on the right side of the screen moves to select specific results.

Note: Tagged data items are denoted with an asterisk.

11. Press the operation key below SELECT ALL to tag (select) all data (insert asterisks).

12. Press the operation key below CLEAR ALL to clear all tags (remove asterisks).

13. Press READY to display the average and standard deviation calculation results.

Note: The samples tagged on the previous screen are displayed with the average and deviation data.

14. Press the operation key below PRINT DATA to print the information displayed on the instrument screen.

15. Press the operation key below PREV PAGE to return to the previous page. Once the previous screen is accessed, items can be retagged for additional data, etc.

16. Press the operation key below MAIN MENU to return to the CEM Main Menu screen.

External Printer

The SMART System^5 supports a variety of different external printer standards –

- IBM
- Epson
- Citizens
- HP Laserjet
- Canon Bubble
- Epson Color 740 - Available from CEM Corporation and requires no setup.

To install the Epson Color 740, follow the procedures outlined below. Refer to the manual shipped with the printer for illustrations and explanation of the terminology used.

1. Press the power switch of the SMART System^5 to the “off” position.

2. Remove the printer and its accessories from the shipping carton. Place the printer on a vibration-free printer stand or a solid, sturdy laboratory workbench or table. Save all packing materials.

3. Plug one connector of the cord shipped with the printer into the socket on the printer. Plug the other connector into the parallel port of the SMART System^5. Plug the printer power cord into a grounded AC electrical outlet.

4. Press the power switch of the printer to the “on” position.

5. Press the power switch of the SMART System^5 to the “on” position.

6. Refer to the SETUP section of this manual for instructions for selection of an external printer within the system software.

External Balance

1. Press the power switch of the SMART System^5 to the “off” position.

2. Place the external balance on a vibration-free sturdy laboratory workbench or table.

3. Plug one connector of the cord shipped with the external balance into the socket on the balance and the other connector into the external balance port of the SMART System^5. Plug the balance power cord into a grounded AC electrical outlet.

4. Based on the type of external balance used, refer to the manufacturer’s manual and/or CEM Corporation instructions for specific procedures for setup and configuration of the balance and instrument.

Outlined below are default values for compatible external balances.

Denver Instrument:	300 Baud No Parity 8 Data Bits 2 Stop Bits
Mettler:	2400 Baud Even Parity 7 Data Bits 1 Stop Pit
Sartorius:	1200 Baud Odd Parity 7 Data Bits 1 Stop Bit
Scientech:	2400 Baud Even Parity 7 Data Bits 1 Stop Bit

Serial Printer Setup

Outlined below are default values for a personal computer or serial printer to be connected to the SMART System5.

9600 Baud
No Parity
8 Data Bits
1 Stop Bit

Bar Code Reader Setup

Outlined below are default values for a bar code reader to be connected to the SMART System5.

1200 Baud
No Parity
8 Data Bits
1 Stop Bit

Personal Computer

Items Required: Desktop or Notebook Computer
Windows 98 or Higher Operating System
Microsoft Word or Excel Software
Null Modem Cable (9-pin Connection Cable)

Connections

1. Turn the SMART System5 and computer off.

2. Connect the 9-pin connection cable to the right port on the back of the instrument labeled “PC Port.”

3. Connect the other end of the cable to an open serial port on the back of the computer (Com 1 or Com 2).

SMART System5 Setup

1. Turn the SMART System5 on.

2. With the Main Menu displayed, press “4” to activate the Setup Menu.

3. With the Setup Menu displayed, press “4” to activate Com Port.

4. Press “1” to toggle and select a baud rate of “9600.” Press “2” to toggle and select a data bits rate of “8.” Press “3” to toggle and select a stop bits rate of “1.” Press “4” to toggle and select a parity of “0.”

5. Press the operation key below PREV PAGE to return to the Setup screen.

6. Press “3” to activate the Serial Options screen. Select the options to be transferred to the computer.

7. Press EXIT to return to the Main Menu.

Computer Setup

1. Turn the computer on.

2. From the “Programs” menu, open “HyperTerminal.” Proceed to step 8.

Note: If HyperTerminal is not accessible from the Programs menu, perform steps 3 through 7.

3. From the “Settings” menu, open “Control Panel.”

4. From the “Control Panel” menu, double click the mouse to open “Add/ Remove Programs.”

5. Select the “Windows” setup. From the Windows menu, double click the mouse to open “Communications.”

6. Using the mouse, click the box beside “HyperTerminal.” Using the mouse, click “OK.” The Windows setup reappears. Using the mouse, click “OK.”

7. From the “Programs” menu, open “Accessories.” From the “Accessories” menu, open “HyperTerminal.”

8. Using the mouse, double click the “Hypertrm” icon.

9. At the name prompt, using the keyboard, type “Lwterminal.” Using the mouse, click “OK.”

10. The computer screen will read “Direct to Com 1.” Using the mouse, click “OK.”

11. Enter port settings as follows: Bits per second – 9600, Data bits – 8, Parity – None, Stop bits – 1, Flow control – Hardware.

Method Operation and Collection of Test Data

1. Using the mouse, select “Window” on the toolbar at the top of the computer screen. Select “Transfers” from the Window menu. Select “Capture Text” from the Transfcr menu.

2. Select a directory (default directory is Windows). Type a “file name” (maximum 8 characters), followed by “.”, followed by a three-character extension. CEM recommends using a unique extension for the file name to assist in file identification. Using the mouse, click “OK.”

3. With the Main Menu of the SMART System^5 displayed, press “3” to select and load a method for analysis.

4. Press the number of the method to be loaded.

Note: If required, press the operation key below NEXT PAGE to locate the desired method.

5. The Main Menu returns to the screen with the selected method displayed. Press READY to display the initial screen of the selected method.

6. Follow instructions in this manual to perform the method. The method data will be electronically forwarded to the file opened above on the computer.

7. Upon completion of sample data to be forwarded to the computer file, use the mouse to select “Window” on the toolbar. Select “Transfer” from the Window menu. Select “Capture Text” from the Transfer menu. Select “Stop” from the Capture Text menu.

8. Using the Program menu, open Microsoft Word or Excel. Select “File” on the toolbar. From the File menu, select “Open.” Select the directory where the data file is stored. Select “All Files” to ensure the file will be displayed. Select the applicable file. Using the mouse, click “OK.”

Maintenance, Troubleshooting and Service

The following information covers routine maintenance and basic troubleshooting. For detailed instructions concerning service and repair, contact the CEM Service Department or the nearest subsidiary or distributor.

Cleaning Recommendations

Clean the interior of the SMART System^5 cavity with warm, soapy water applied with a soft cloth. Do not use abrasive cleaners or solvents because they could scratch the cavity coating. Rinse and thoroughly dry all cleaned areas.

Routine Maintenance

A monthly preventive maintenance program is recommended to ensure optimum performance of the SMART System^5.

1. Cover, Latch and Interlocks – Carefully inspect the instrument cover, latch and interlocks to verify that they are clean and working properly. Ensure that there is no loosening of or damage to the cover hinges or latch. Ensure that the cover closes securely.

2. Balance – Verify balance calibration using the procedure outlined in the Setup section of this manual.

3. Air Shield – Inspect the air shield for damage or degradation.

4. Microwave Leakage Measurement – Follow procedures outlined on the following pages.

Special Tools and Kits

The following kit is available to assist with the SMART System^5.

Power Test Kit (907845) – used to verify that microwaves are being produced.
Note: Beaker from Power Test Kit can also be used for IR Accuracy Test.

Troubleshooting

The most important principle in troubleshooting the SMART System5 is to check each component of the system separately and trace any malfunction to its source.

Verify each of these factors:

- Balance Calibration
- Microwave Power Measurement
- Standard Solution Test
- Analytical Method (verify analysis method) – If necessary, contact the CEM Applications Department or the nearest subsidiary or distributor.

A qualified service technician, using standard troubleshooting techniques, should be able to identify and resolve operational problems. If a problem persists, call the CEM Service Department or the nearest subsidiary or distributor.

Troubleshooting Guide

Symptom	Possible Cause/Remedy
Instrument Inoperative	Ensure that instrument is properly connected to power outlet and that the power switch is in the "on" position. Check fuses and replace if necessary.
Balance Will Not Tare	Balance overloaded. Use less sample.
Balance Not Operating	Ensure that balance stem is installed and centered.
No Microwave Drying	Instrument cover not closed and latched properly. Check dual voltage supply and fuses (10A fuses for 60 Hz and 5A for 50 Hz) and correct dual voltage supply and/or replace fuses, if required.
Sample Burning	Sample too large and/or unevenly applied to pad. Sample not homogeneous. Sample not positioned under temperature sensor. Power level too high.
Results Not Reproducible	Sample applied unevenly to pad. Sample not homogeneous and absorbs microwaves unevenly. Keep sample container closed when not extracting sample. Work quickly when applying sample to pads and placing pads on balance pan.
Incorrect Results	Verify proper sample handling, spread techniques and method parameters.
"Data Results Invalid" Displayed at End of Test	Final weight greater than initial weight. Repeat test. Check balance calibration.
"Cover Open" Message	Ensure that the instrument cover is properly closed.
Low Power	Check for faulty relay and replace if required.
Improper Heating	Ensure that the air shield is installed and not clogged.
Discoloration or Oil Buildup on Air Shield	Replace the air shield.

Troubleshooting Guide

Symptom	Possible Cause/Remedy
Balance Over Load Error	Weight on balance is too large to be recognized by balance.
Balance Under Load Error	Weight on balance is too small to be recognized by balance.
Thermal Overload Error	Ensure that instrument cover is closed properly. Ensure that switches on all three interlocks are adjusted properly.
Fuses Blow	Check dual voltage supply and fuses (10A fuses for 60 Hz and 5A for 50 Hz) and correct dual voltage supply and/or replace fuses, if required.
Balance Error	Balance stem not installed. Turn instrument off, install balance stem and turn instrument on. Ensure that instrument is located on a stable work surface. Balance cable not installed. Properly install cable. Balance not calibrated. Perform calibration using 10g or 50g weight.
Instrument Will Not Calibrate	Instrument turned on before balance stem and pan were installed. Turn instrument off, install stem and pan, and turn instrument on.
Unstable Balance Readings	Faulty balance. Contact CEM Service.
Balance Displays Incorrect Weight	Faulty balance. Contact CEM Service.
IR Reads Negative Number(s)	Faulty IR sensor. Contact CEM Service.
Instrument Top Cover Difficult to Close or Noisy when Opened	Gas spring installed improperly or faulty gas spring. Contact CEM Service.
Garbled Display	Cold start instrument. Contact CEM Service.
Intermittent “clicking” when Microwaves On	Arcing at microwave waveguide slot. Contact CEM Service.

Error Messages

Due to system operation and component failure, the following error messages can appear on the display screen.

COMMUNICATIONS ERROR

Check all connections for the external balance and/or computer.

BALANCE ERROR

BALANCE NOT RESPONDING

The above error messages relate to the internal balance. Ensure that the balance stem and pan are installed prior to turning the instrument on. Ensure that the balance is properly installed and calibrated. If error message continues after troubleshooting, replace balance.

BALANCE UNDER LOAD

The Balance Under Load message indicates that the weight on the balance is too small to be recognized by the balance.

BALANCE OVER LOAD

The Balance Over Load message indicates that the weight on the balance is too large to be recognized by the balance.

STACK OVERFLOW

OP CODE ERROR

ILLEGAL INT ERROR

FLOATING POINT ERROR

The above messages indicate component failure. If any of these error messages appear on the screen, turn the SMART System^5 off. Do not attempt further operation. Call the CEM Service Department or the nearest subsidiary or distributor.

THERMAL OVERLOAD

The Thermal Overload error message indicates that a door interlock switch is improperly adjusted or that the cooling fan is not operating properly. The current method is aborted. Verify proper operation of the door interlocks and fan. Turn the instrument off and back on. Call the CEM Service Department.

Standard Solution (Saline) Test

Note: The standard solution test is for routinely checking proper performance of the SMART System5. It is not to be used as a calibration solution.

1. Press “3” to load a method for method operation.

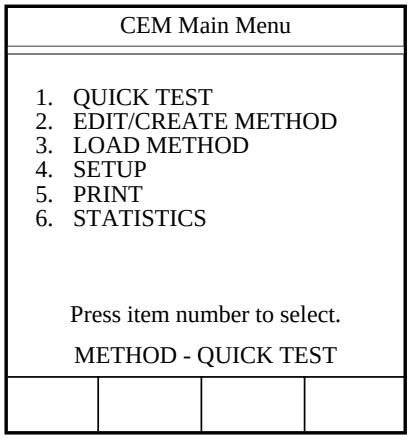
2. Press “3” to select “Standard Solution.”

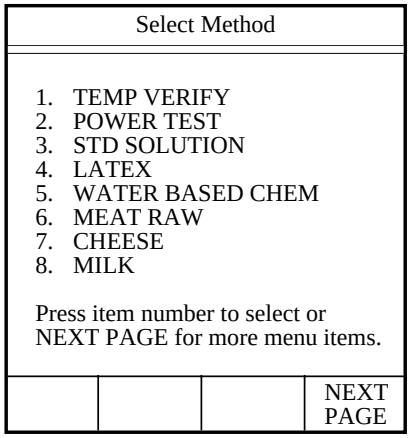
3. Press READY.

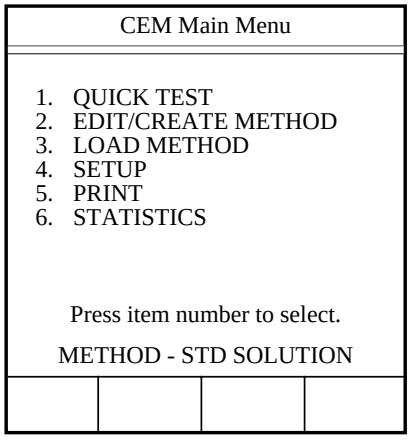
4. Follow instructions on screens to perform Standard Solution test.

5. Check microwave leakage during test.

Note: CEM Standard Solution is formulated to yield results of 7 - 11% solids. Upon installation, the test should be performed five (5) times. Results of the five tests should be calculated to determine the average percent solids value. Future tests should be within ±0.1% absolute of the initial percent solids.







Microwave Leakage Measurement

The cover and cavity of the SMART System^5 are designed for durability and reliable operation in laboratory conditions. External radiation checks are performed on the instrument at several points in the manufacturing process to ensure that microwave leakage is only a fraction of that permitted by U.S. law (5 mW/cm^2).

The instrument is equipped with a safety interlock system which stops the generation of microwave energy when the instrument cover is not securely closed. If the interlock system fails, a monitoring mechanism will blow the fuse through which power is supplied to the magnetron, rendering the microwave power system inoperable.

To verify that the cover is sealing and the interlock system is working properly the SMART System^5 should be tested for microwave leakage. To test for leakage, operate the instrument at 100% power for 5 minutes. While it is operating, use a federally approved microwave leakage detector such as the Holaday Model HI-1500 and measure the microwave leakage around the cavity and at the fan grill. Leakage should not exceed 5 mW/cm^2. If the instrument shows excessive microwave leakage, do not attempt further operation. Contact the CEM Service Department or the nearest CEM subsidiary or distributor.

Microwave test meters are available from CEM Corporation. CEM does not recommend use of inexpensive meters available in electronics stores because they lack the necessary sensitivity to properly test an instrument for microwave leakage.

Intelli-Temp™ Calibration

Note: The SMART System^5 is completely factory calibrated. Calibration is recommended only for verification of system operation or if a problem with calibration is suspected.

Note: Calibration of the Intelli-Temp requires a CEM SMART System^5 Intelli-Temp Calibrator (p.n. 159695). Prior to calibration, the calibrator must be preheated.

1. With the CEM Main Menu displayed, press "4" to activate Setup.

2. Press the operation key below NEXT PAGE.

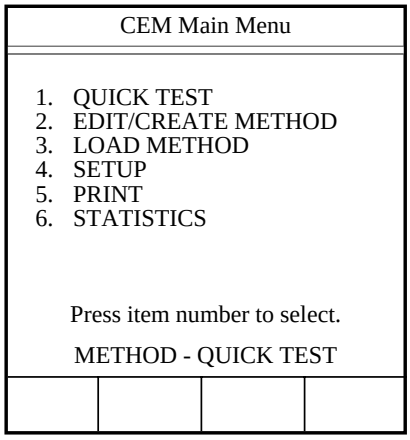
3 Plug the Intelli-Temp Calibrator into an electrical outlet. Wait until the "Ready" light is illuminated.

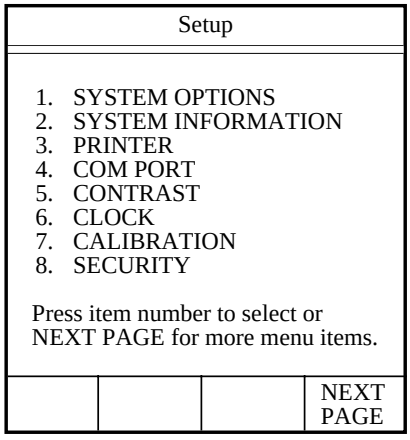
4. Place the Intelli-Temp Calibrator into the instrument cavity, ensuring that the recess in the bottom of the calibrator is snugly fitted on the balance stem retainer so that the calibrator is flat against the cavity floor.

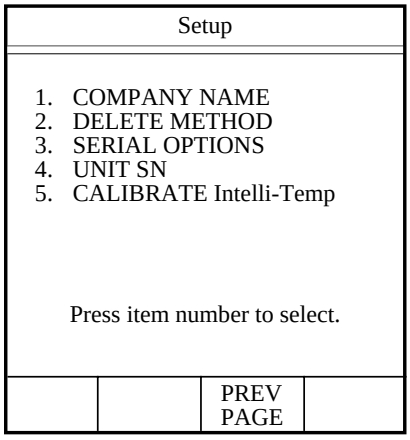
5. Press "5" to access the Calibrate Intelli-Temp screen.

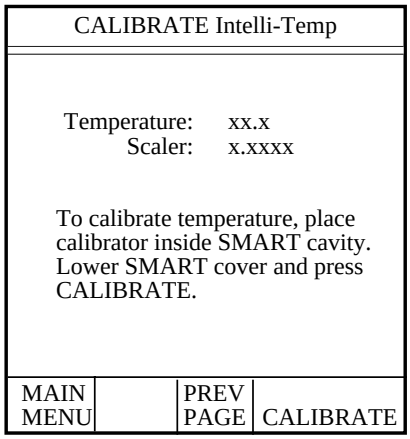
6. Lower the instrument cover.

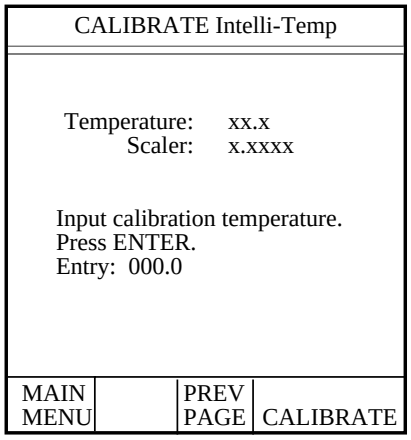
7. Press the operation key below CALIBRATE.





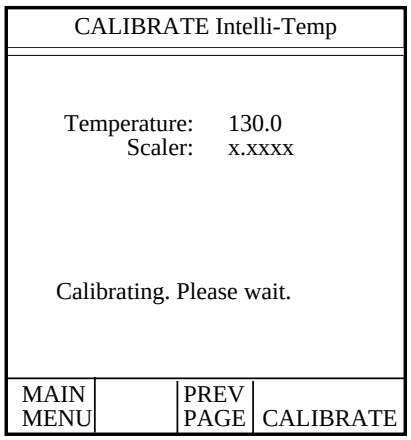




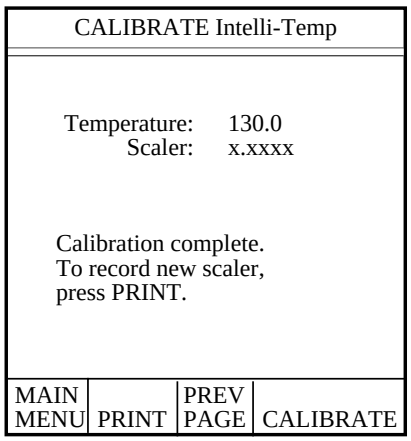


8. Using the numeric keys, enter the calibration temperature on the calibrator (130°C).

9. Press ENTER.



10. Wait for the calibrator to calibrate the Intelli-Temp.



11. Press PRINT. Retain the printout of the system information with the new scaler value for future use during maintenance or servicing.

12 Press EXIT to return to the CEM Main Menu.

Intelli-Temp™ Verification

The SMART System^5 Intelli-Temp temperature feedback system permits rapid temperature measurement of the sample during the drying processin order to adjust microwave power delivery. The Intelli-Temp Verification program is designed to verify that the system is performing properly.

CAUTION

If the SMART System^5 has not been operated for a period of one hour, preheat the instrument by operating it empty for 5 minutes at 100% power in the Quick Test program.

Mise en garde

Lorsque le SMART System^5 n'est pas en opération pour une période de plus d'une (1) heure, réchauffer l'instrument vide durant 5 minutes à 100% de puissance au programme "Quick Test."

1. Turn the instrument off. Lift the instrument cover. Remove the balance pan. Lift the balance stemstraight up from the opening in the cavity. To prevent damage to the balance assembly, do not move the balance stem from side to side during removal. Turn the instrument on.

2. Press "3" to access the "Load Method" screen.

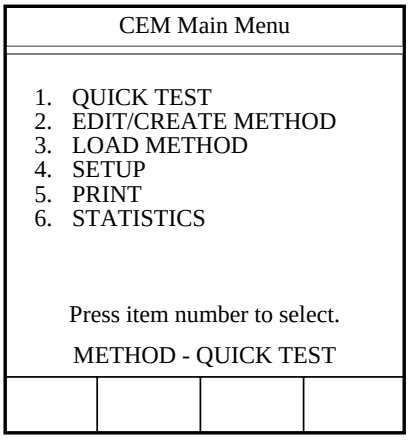
3. Press "1 - Temp Verify."

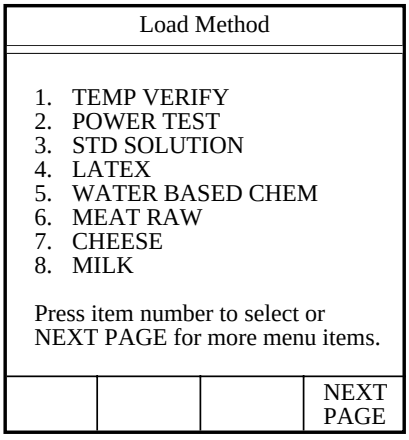
4. Press READY.

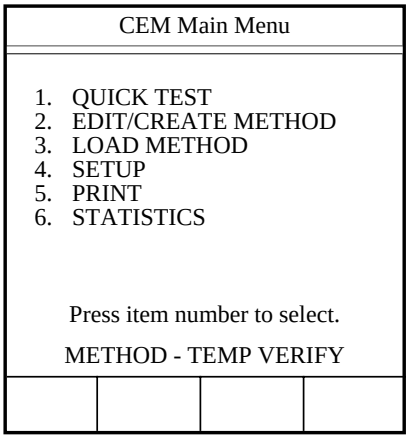
5. Pour 100 mL of water into a glass or polypropylene beaker.

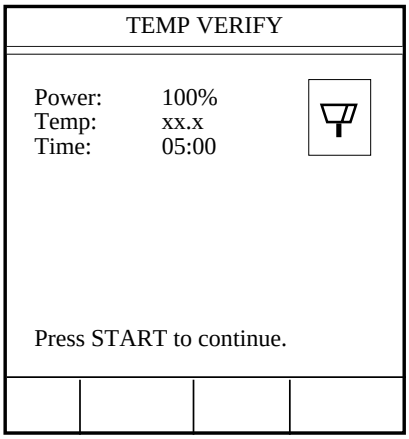
6. Lift the instrument cover. Carefully place the beaker in the center of the cavity. Close and latch the cover.

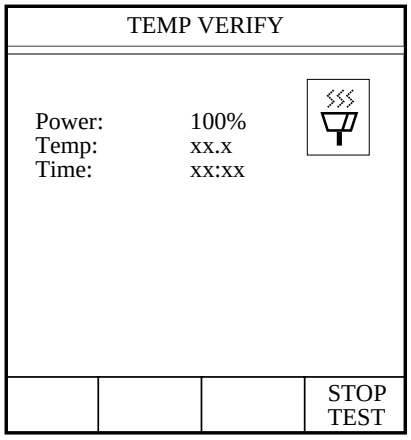
7. Press START.

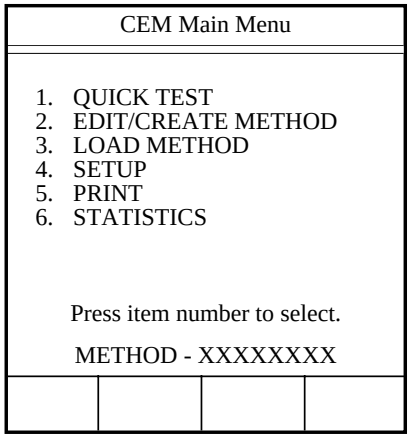












8. At the end of the 5-minute period, lift the instrument cover. Using a digital thermometer, stir the water. Note the temperature of the water. Remove the thermometer.

9. Close the instrument cover. Note the temperature reading on the instrument display.

10. The reading on the display should be within ±5 degrees C of the temperature reading on the thermometer in step 8.

11. If the two temperatures (thermometer reading from step 8 and display reading from step 9) are not within ±5°C, contact the CEM Service Department or the nearest subsidiary or distributor.

12. Press the operation key below MAIN MENU to return to the CEM Main Menu.

Service and Repair

WARNING

The SMART System^5 utilizes high voltage and microwave radiation. Instrument service and repair must be undertaken only by technicians trained in the repair and maintenance of high voltage and microwave power systems.

Mise en garde

Le SMART System^5 requiert une haute tension et produit une radiation de micro-ondes. L'entretien et les réparations doivent être seulement fait par un personnel formé en réparation et entretien de systèmes opérant avec de haute tension et produisant de micro-ondes.

If damage to the SMART System^5 is detected, do not attempt further instrument operation. Contact the CEM Service Department or the nearest subsidiary or distributor.

CEM Limited, LLC
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P.O. Box 200
3100 Smith Farm Road
Matthews, NC 28104 -5044 USA

Within the continental United States

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Fax: (704) 821-4368

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CEM S.r.l.
Via Dell'Artigianato, 6/8
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Italy
Tel: (39) 35-896224
Fax: (39) 35-891661

WARNING

To avoid possible electrical shock or exposure to microwave energy, disconnect the instrument from the electrical outlet prior to any disassembly procedures.

Mise en garde

Pour éviter toute possibilité d'une décharge électrique ou une exposition aux micro-ondes, débrancher l'instrument de la prise de courant avant toutes procédures de désassasemblage.

It is recommended that service and repair by the user be limited to replacing components such as fuses, printed circuit boards, interlocks, etc. The user may find it convenient to stock an assortment of replacement parts to facilitate service procedures.

WARNING

Prior to troubleshooting or replacement of any component in the high voltage section of the SMART System5, the instrument must be switched off and unplugged from the electrical outlet. Permit the instrument to sit idle for at least two (2) minutes. Using a well insulated screwdriver, tough the end of the screwdriver between terminals of the high voltage capacitor (illustrated in figure 5) to discharge all residual voltage from the instrument.

Mise en garde

Avant de reparer ou remplacer une pièce dans la section de haute tension, l'instrument doit être débranchéde la prise de courant. L'instrument doit être laissé au repos pour un minimum de deux (2) minutes. En utilisant un tourne-vis bien isolé, placer l'extrêmité du tourne-vis entre les terminaux de l'accumulateur de haute tension (tel qu'illustré à la figure 5) afin de décharger l'instrument de tout courant résiduel.

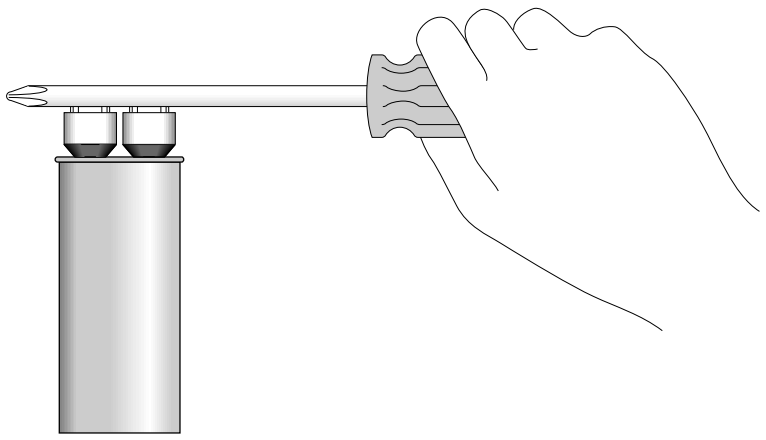

Figure 5. Discharge of Residual Voltage from High Voltage Capacitor

Specifications

Moisture/Solids Range:	0.01% to 99.99% in liquids, solids and slurries. 0.01% resolution.
Balance:	50 gram capacity, 0.1mg readability
Microwave Power:	150 - 300 with active control
Program/Data Storage:	100 methods and 300 results
Standard Software:	Constant Weight and Time, Fat, Moisture, TS, TSS, TVSS, Dilution, and Syringe Weigh
Data Entry:	Keypad with menu-driven software
Display:	Black and White VGA (320 x 240)
Accessory Ports:	2 serial, RS 232, 9 pin ports for external balance, computer or bar code reader 1 parallel port, 25 pin for external printer
Standard Printer:	Internal impact printer
Electrical Requirements:	120 VAC (± 10%), 60 Hz, 10 Amps 240 VAC (± 10%), 50/60 Hz, 5 Amps
Instrument Dimensions	22.0 in. (W) x 23.25 in. (D) x 14.50 in. (H) 55.9 cm (W) x 59l.1 cm (D) x 36.8 cm (H)
Weight:	55 lbs., 25 kg

Warranty

What Is Covered:

CEM Corporation warrants that the instrument will be free of any defect in parts or workmanship and will, at its option, replace or repair any defective part (excluding consumables) or instrument.

For How Long:

This warranty remains in effect for 365 days from date of delivery to the original purchaser

What Is Not Covered:

This warranty does not cover parts or workmanship which have been damaged due to:

- Neglect, abuse or misuse,
- Damage caused by or to test samples,
- Damage incurred during instrument relocation,
- Damage caused by or to any attached equipment,
- Use of incorrect line voltages or fuses,
- Fire, flood, "acts of God" or other contingencies beyond the control of CEM Corporation,
- Improper or unauthorized repair, or
- Any other damage caused by purchaser or its agents.

Responsibilities of Purchaser:

To ensure warranty coverage, the purchaser must:

- Use the instrument according to directions,
- Connect the instrument properly to a power supply of proper voltage,
- Replace blown fuses,
- Replace consumables and
- Clean the instrument as required.

How to Get Service:

Purchaser should contact the Service Department of CEM Corporation or the nearest CEM subsidiary or distributor for return authorization and for proper crating and shipping instructions to return instrument, freight prepaid, for service. On-site repairs by an authorized service technician are available through the CEM Service Department. Travel costs will be charged to the purchaser for on-site repairs.

Within the U.S.
CEM Corporation
3100 Smith Farm Rd.
Matthews, NC 28105-5044
(800) 726-5551
Fax: (704) 821-4368

Outside the U.S.
CEM Corporation
3100 Smith Farm Rd.
Matthews, NC 28105-5044
(704) 821-7015
Fax: (704) 821-4368

Warranty Disclaimer:

CEM Corporation hereby excludes and disclaims any warranty of merchantibility or fitness for any particular purpose. No warranty, express or implied, extends beyond the face hereof. CEM Corporation shall not be liable for loss of use of instrument or other incidental or consequential costs, expenses or damages incurred by the purchaser or any other user. This warranty is not transferable.

Purchaser's Rights under State Law:

This warranty gives the purchaser specific legal rights, and the purchaser may also have other rights which vary from state to state.