

NDT

JAMES INSTRUMENTS INC.

NON DESTRUCTIVE TESTING SYSTEMS



Cementometer T-C-10 R

Operating Instructions

T-C-10 Overview

The James Instruments T-C-10 Cementometer is a revolutionary, industry first water to cement ratio meter. Using the most sophisticated microwave technology, it allows the user to instantaneously record the water to cement ratio of fresh concrete. Using the frequency dependant probe the T-C-10 Cementometer measures only the true moisture present in the plastic form mix.

Two robust 4.5 inch stainless steel prongs with a diameter of .290 allow proper penetration into the fresh mix, it should be noted that the prongs should be fully inserted into the mix for accurate results. Proper cleaning and maintenance of the prongs is very important. Prongs should be wiped down with a dry cloth before, during and after testing. Impurities on the prongs may result in erroneous detection from the sensor probe.

The reading from the sensor probe is received then translated by the advanced microprocessor technology embedded in the data logging unit. The T-C-10 data logger is a multifunctioning unit which can store data, calculate proper correlation of your own material using the calibration feature, take the average of recorded data, show water to cement ratio of type I & III cement and also download saved data to a P.C via a RS232 port.

As stated in the previous paragraph the T-C-10 comes pre-programmed to analyze Type I & III cement. These modes have been programmed into the T-C-10 to facilitate the use of the unit for the end user but for more accuracy a calibration for your mix should be done.

The download feature in T-C-10 Cementometer enables the user to view his data and store it to a personal computer. Data transferred shows time, date, and water to cement ratio taken at that time. There is no calibration analysis in the P.C software, as it is intended for viewing and record keeping purposes only.

To summarize the T-C-10 Cementometer is an easy and accurate way of testing moisture in a controlled and uncontrolled environment. Every effort has been made in providing a user friendly robust and accurate system for the measurement of water to cement ratio in fresh concrete. A robust sensor which responds to water contents has been created. This feeds data into the main microprocessor data logging unit allowing the user to instantaneous water to cement ratio of their mix under test.

Display button description

The following key switches are used to perform the functions of the James Instruments Cementometer.

1. Power Switch

Turns the instrument on and off

2. Up Arrow

Used to scroll through the menus and increase a displayed value

3. Down Arrow

Used to scroll through the menus and decrease a displayed value

4. Enter Key

Used to select a menu item and save displayed values in the direct, cement I, cement III and user programs modes.

5. H Key

This multifunctional key performs different functions depending on the mode that the instrument is in.

Direct, Cement I, Cement III and User Program Mode

Averages the last 10 reading and displays the results along with an "A".

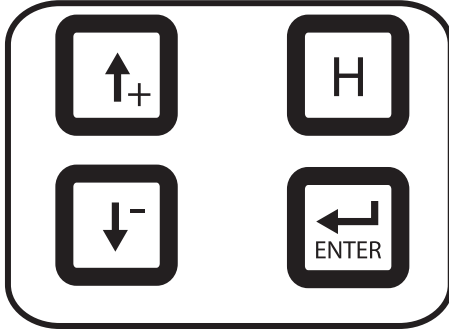
New Program Mode

When creating a program for a new material, normally 9 Water-to-Cement Ratio data points are entered. However if less than 9 data points are desired then the "H" Key is used to terminate the operation.

User Program Mode

If the operator selects this mode of operation the instrument will request that a valid program 0 – 9 be selected. If no user programs have been created then the 'H' key will allow the operator to exit this mode.

T-C 10 Cementometer
Microwave Moisture Meter



Operating Modes

The James Instruments Cementometer allows the user to determine the water /cement ratio in four different modes.

1. Direct-Display the direct frequency from the material that was collected by the probe.
2. Cement I- Display the direct Water to Cement ratio for type I cement
3. Cement III- display the Water to Cement ratio for type III cement
4. User Program-Display the Water to Cement ratio for a user material

Direct

The James instruments Cementometer unit allows the user to view the probe's direct reading on the LCD display. This reading can be translated to a corresponding water cement ratio when used in the New program function of the cementometer.

Continued on next page

The cementometer displays the highest possible direct reading of approximately 1302 when the probe is not in use. The displayed reading will gradually begin the decrease when a higher moisture presence is detected in the material being used for calibration of the cementometer. The direct reading display can be used as troubleshooting tool.

Cement I

The **Cement I** mode in the James Instruments Cementometer is a pre determined calibration of water/cement ratios specifically for Type I cement. In house research and development has determined and analyzed using every standard and reference available to accurately correlate a relationship between the reading of the probe and that of the Type I cement.

Due to the fact that different types of cements and aggregates may be used it is advised to calibrate and find the true correlation of your concrete mix.

Data can be saved in to memory by pressing the "Enter" key, also an average of the readings in memory can be displayed by pressing the "H" key. If the water/cement ratio is outside the normal range of .35 to .65 "Out of Range" will be displayed and cannot be saved into memory.

Cement III

The **Cement III** mode in the James Instruments Cementometer is a pre determined calibration of water/cement ratio specifically for Type III cement. In house research and development has determined and analyzed using every standard and reference available to accurately correlate a relationship between the reading of the probe and that of the Type III cement.

Due to the fact that different types of cements and aggregates may be used it is advised to calibrate and find the true correlation of your concrete mix.

Data can be saved in to memory by pressing the "Enter" key, also an average of the readings in memory can be displayed by pressing the "H" key. If the water/cement ratio is

outside the normal range of .35 to .65 "Out of Range " will be displayed and cannot be saved into memory.

User Program

The user mode in the Cementometer unit displays the water/cement ratio for a material calibrated by the operator. Ten user programs are available for custom calibration by the user.

When this mode is selected the currently selected User Program number will be displayed along with the message "Change? NO".

If this program number is desired just press the Enter Key and water-to-cement ratio for this program will be displayed.

If another program number is desired, press the Up Key and "YES" will be displayed. Pressing the Down Key will display a "NO". With the "YES" displayed pressing the Enter Key will allow the operator to select another User Program. Use the Up and Down Keys to display the desired program number then, press the Enter Key to select it. The water-to-cement ratio for this program will be displayed.

Displayed data can be averaged and displayed by pressing the "H" Key. The averaged data will be displayed along with the letter "A".

Data can be saved in external memory by pressing the Enter Key. A letter "S" will be displayed indicating a saved operation.

If cement moisture is outside the range of water-to-cement ratios entered during the calibrating of a new material "Out Of Range" will be displayed instead of the normal data. This data cannot be saved.

NEW PROGRAM/ Calibration

This mode is used to create the program for a new material. Since this process may take some time the automatic 15-minute timer is turned off. Make sure the instrument's batteries are fresh or the instrument is operating from an auxiliary power supply. The operator can select any one of

Continued on next page

10 programs for this new material. If the operator selects a program that has already been programmed he will be given the option to either erase the program or select a different one.

Follow the steps below to do a calibration procedure

Step 1

Using the Up or down arrow keys navigate to the new program menu screen.

Step 2

After selecting the New Program Mode, "Prog No = X" will be displayed. Use the Up and Down Keys to display the program number for the new material. Then press the Enter Key to select it.

Step 3

Displayed will be "Select W/C" and W/C = .10. Water-to-cement ratios of 0.10 to 0.99 can be entered. Use the Up and Down Key to display the moisture of the new material and then select it by pressing the Enter Key.

Step 4

Displayed will be "W/C = the selected W/C" and "Spl 1 = XXXX". Spl stands for Sample, so Spl 1 means Sample 1. XXXX is the direct reading from the probe. The operator must enter 5 samples for each water-to-cement ratio. A sample reading is entered into the program by pressing the Enter Key.

Step 5

When 5 samples have been entered the instrument will again display "Select W/C" and W/C = last entered value. Again, use the Up and Down Key to display the moisture of the new material and then select it by pressing the Enter Key.

Step 6

When 9 different moisture samples have entered the programming will be complete and the mode will be automatically changed to Direct. If the operator wants to enter less than 9 different moistures this is OK but the programs accuracy will be reduced. When the operator has entered the number of different samples desired (less than 9) the instrument displays "Select W/C" and W/C = last entered value. Pressing the 'H' Key at this time will complete the programming and the mode will be change to Direct.

Calibration Procedure

Sand and Aggregate Preparation

Fine Aggregate (sand)

We advise using ASTM C-128 & ASTM C-127 when preparing a cement mix for calibration of a user mode for the Cementometer unit. Surface- saturated-dry (SSD) is very important.

ASTM -C-128: Standard test method for density, relative density (Specific gravity) and absorption of fine aggregate.

Step 1

Drying of the specimen is a very important step in this procedure as values for absorption (SSD) may be higher for aggregates not dried before soaking. This higher number could lead to erroneous water/cement ratio reading when calibration is in progress.

Dry 1kg of fine aggregate in a suitable pan at a temperature of 110 deg Celsius. Dry for 24 hours or until sample stops losing water weight.

Step2

Remove sample from oven a let stand to cool a handling temperature.

Continued on next page

Step 3

Weight and record the sample. C 128-01, 8.1 states the following" cover with water, either by immersion or by the addition of at least 6% moisture to the fine aggregate, and permit to stand for 24 hours. "

Step 4

Remove excess water from sample but be careful not to lose fine aggregate, now spread the sample on a flat non- absorbent. Allow a warm breeze from a small table top fan to flow through the sample. Stir the sample frequently to allow homogeneous drying. This procedure should be done until sample shows signs that it has reached SSD (step 6).

Step 5

For proper SSD determination a commercially bought cone should be used, ASTM C 128-01, 6.4 specs the mold as follows.

"6.4 Mold and Tamper for surface Moisture Test - The metal mold shall be in the form of a frustum of a cone with dimensions as follows: 40 ± 3 mm inside diameter at the top, 90 ± 3 mm inside diameter at the bottom, and 75 ± 3 mm in the height, with the metal a minimum thickness of .8 mm. The metal tamper shall have a mass of 340 ± 15 g and a flat circular tamping face 25 ± 3 mm in diameter."

Step 6

ASTM C-128-01, 8.3

8.3 Test for Surface Moisture- Hold the mold firmly on a smooth nonabsorbent surface with large diameter down. Place a portion of the partially dried fine aggregate loosely in the mold by filling it to overflowing and heaping additional material above the top of the mold by holding it with the cupped fingers of the hand holding the mold. Lightly tamp the fine aggregate into the mold with 25 lights drops of the tamper. Start each drop approximately 5 mm above the top surface of the

fine aggregate. Permit the tamper to fall freely under gravitational attraction on each drop. Adjust the starting height to the new surface elevation after each drop and distribute the drops over the surface. Remove loose sand from the base and lift the mold vertically. If surface moisture is still present, the fine aggregate will retain the molded shape. Slightly slumping the molded fine aggregates indicates that it has reached surface-dry conditions."

Coarse Aggregate

The following procedure is used to determine the *SSD* of coarse aggregate using ASTM C-127 standard. It is advised to use this standard when preparing a cement mix for the calibration of a user mode of the cementometer.

Step 1

Place the coarse aggregate sample in an oven safe tray and dry sample for 24 hr \pm 4 hrs at $110 \pm 5^\circ\text{C}$.

Step 2

Remove coarse aggregate and let to cool at room temperature for 1 to 3 hrs for samples of 3.7 mm. larger size aggregates may require longer cooling times. Record aggregate weight at this point.

Step 3

After cooling immersion of coarse aggregates is necessary, a sample container is required. ASTM C-127-01, 6.2-6.3 which specifies the sample container and water tank as follows.

" 6.2 *Sample Container*- A wire basket of 3.35 mm (No.6) or finer mesh, or a bucket of approximately equal breath and height, with a capacity of 4 to 7 L for 37.5 mm (1 1/2 in) nominal maximum size aggregate or smaller, and larger container as needed for testing larger maximum size aggregates. The container shall be

Continued on next page

constructed so as to prevent trapping air when the container is submerged."

16.3 *Water Tank*- A water tight tank into which the sample container is placed while suspended below the balance."

The coarse aggregate sample should be immersed in the water tank for 24 hr \pm 4 hrs. The purpose for the 24 hr immersion is to allow the aggregate's pores to essentially fill.

Step 4

Remove the coarse aggregate from the sample container and roll in a towel to dry until all visible films of water are gone. Record weight of the aggregate sample at this point.

Having your aggregates at SSD when mixing is very important and the following equation should be used to determine the percentage of moisture required to SSD your aggregate.

$$\text{Absortion, \%} = [(B - A) / A] \times 100$$

A= mass of oven dry test sample in air, g.

B= mass of surface-saturated-dry test sample in air, g.

Allow your coarse aggregate to SSD (Saturated- surface-dry) for 24 hours prior to adding to your mixture.

Mixing Your Sample

Proper mixing of your sample concrete is a very important process for the calibration of a user mode in the Cementometer unit. Your sample mixture should be that of 1 cubic yard and it is suggested to start at the .35 W/C ratio.

* Material needed for a 1 cubic yard concrete mix:

2 cubic yard commercially available tilting mixer
59 lbs surface-saturated-dry fine aggregate
46 lbs surface-saturated-dry coarse aggregate
29 lbs cement paste
4.95 lbs of water

As stated in an earlier paragraph the material above equals a 1 cubic yard of .35 W/C concrete mix. The following order should be followed to properly mix the concrete.

Step 1

Spray down inner dome of tilting mixer to moisten drum.

Step 2

Remove any excess water from the drum and start revolving the mixer.

Step 3

Add 10 % of the water and coarse aggregate in to the drum.

Step 4

Add 50 % of the fine aggregate and cement into the drum.

Step 5

Add 60 % of the coarse aggregate and the remaining water until approximately 1/4 to 1/3 of the water is remaining in the reservoir being used to contain water.

Step 6

Add the remaining fine aggregate and cement to the drum followed by the remaining coarse aggregate and water.

Continued on next page

Step 7

Let sample mix properly until a proper paste has been achieved.

Again, this is a .35 W/C ratio mix. Remove concrete (plastic) mix from mixer and place in a non conductive bucket for testing with the cementometer. The mix should be put back into the drum so more water can be added to the mix to make a higher W/C ratio.

Step 8

Once the sample has been put back into the drum, start rotating drum.

Step 9

Add 1.45 Lbs of water to the mix and let rotate. This is now .40 W/C ratio concrete mix and it is ready for testing with the cementometer.

Repeat steps 7-9 until .75 W/C or direct number of cementometer has reached lowest possible value.

* Materials used for research and development may vary depending on aggregate types.

Upload Data

The James Instruments Cementometer unit allows the user to upload their data to a P.C. with a Win 98- WinXP operating system. The accompanied P.C. software is solely for the purpose of viewing your data and analysis for calibration purposes should be done through the new program menu on the Cementometer.

The following procedure should be done to successfully download data to a P.C.

Step 1

Connect personal computer and cementometer using the 9 pin RS-232 cable supplied with the instrument.

Step 2

Turn Cementometer unit on.

Step 3

Open Cementometer P.C software

Step 4

Using the up or down arrow keys on the Cementometer unit scroll to the UPLOAD DATA menu screen. Press the Enter key "H" to enter the UPLOAD DATA mode. The cementometer will display "Erase? NO", using the up or down arrow keys select "yes or no". Choosing "yes" will erase all data after transmission has been completed.

Step 5

On the P.C software proceed to click on the download button icon{bmc upload.bmp } to open port.

Step 6

Press the enter key "H" on the cementometer unit to begin data transfer to the P.C. Please note that the Cementometer software waits 45 seconds for data before it automatically ends transmission and closes its port.

If data was successfully transferred it can be saved as a text file (TXT.) for later retrieval. Pressing the enter key "H" on the cementometer after transmission changes the instruments mode to direct ending the upload process.

Set Clock

This mode is used to set the internal Real-Time-Clock. This device keeps track of the current time and date. A battery is attached to this device so that even with power turned

Continued on next page

off it still operates.

Follow the steps below to adjust the date and time

Step 1

Use the up or down arrow keys to navigate to the SET CLOCK menu screen. Press enter to select.

Step 2

The cursor starts blinking over the Hours display. To set the current hour, use the Up and Down Keys and then press the Enter Key to select the setting. The cursor will then shift over to the Minutes display. It is set the same as the hour. The cursor will move to the Month, Day of the Month and finally the year, as the current items are set.

Step 3

When the clock's settings are complete the mode will be automatically changed to Direct.

PC Software

The PC software that has been developed for the cementometer is for data upload only and not for calibration purposes. Calibration is to be done on the cementometer using the new program function.

Tools

Upload (Ctrl+U) {bmc upload.bmp }

This command is used to upload data from data logger unit to the CPU.

For Proper upload of data to a P.C. please follow these steps

Open the Cementometer software ("T-C-10 Cementometer" will appear on the upper left corner) on the P.C.

Connect P.C and Cementometer unit by the RS - 232 serial ports.

Use the up or down arrow keys on the Cementometer front panel to navigate to the Upload menu option.

Press enter.

Go to the Cementometer software (needs to be installed on P.C.) click on the upload icon {bmc upload.bmp } or press CTRL + U.

Cementometer software will ask you to "Please start upload".

At this moment press the enter key on the Cementometer (Cementometer software waits 50 seconds for the upload information.)

If no data is received after 50 seconds a "No data received" sub screen will appear.

Data will appear on the screen after all data has been transferred.

Save data in desired folder.

Ports

This command allows setting the correct (RS-232) com port. It can be Com1 through Com 4. The default setting is com 1.

Repair Policy

United States | Canada | International

STEP 1: Ship the instrument in a box that meets UPS, Fed Ex, and standard shipping regulations. Enclose a note describing the problem you are having and name and phone number of the person to contact in your organization.

STEP 2: The instrument will be evaluated within one week of receipt. The contact person will be contacted with an estimate with the cost of the repair.

STEP 3: Upon receipt of your authorization of repair and payment terms, delivery time will be 2 weeks from that day.

If you need the repair back sooner than this, you have the

Continued on next page

option of paying an express service fee of 10 percent of the purchase price of said instrument plus the repair cost. With this service, you can receive the instrument back within 3 working days.

Obsolete equipment will have an express charge of \$375.00 plus the cost of the repair.

International repair shipments must contain a commercial invoice listing the instrument being returned and must contain the words:

Country of manufacture: USA

Instrument being returned to manufacturer for repair – no value for customs, value for carriage only

Ship the complete system to:

James Instruments, Inc.

3727 North Kedzie Avenue

Chicago, IL 60618

Attn: Repairs

Home page: www.ndtjames.com

E-mail: info@ndtjames.com

James Instruments, Inc.

3727 N.Kedzie

Chicago, IL 60618

USA

Tel: (773) 463-6565

Toll Free: (800) 426-6500

Fax: (773) 463-0009

Home Page: www.ndtjames.com

E-mail: info@ndtjames.com

Instructional Manual Cementometer T-C-10 R

James Instruments Inc. warrants to the original user, that each product of its manufacture is free from defects in material and factory workmanship.

James Instruments Inc. obligation under this warranty is limited to correction without charge, any part found to have material or workmanship defects when returned to its factory, transportation prepaid, within six months of manufacture.

James Instruments Inc. shall not be liable for loss, damage or expenses directly or indirectly from the use of its product or from any other cause.

James Instruments Inc. shall declare the warranty void if it is found the equipment has been opened, misused or tampered with.

NDT **JAMES INSTRUMENTS INC.**
NON DESTRUCTIVE TESTING SYSTEMS

727 North Kedzie Avenue,
Chicago, Illinois 60618
1-800-426-6500 (773) 463-6565
FAX (773) 463-0009
e-mail: info@ndtjames.com
<http://www.ndtjames.com>