



PRODUCTS, INC.

## **USER MANUAL**



The UltraTester is intended for research purposes only.

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## DESCRIPTION

The Ultradent Products, Inc. UltraTester is a machine that can be used to test and compare different adhesives used in the dental and orthodontic industries. This machine is simple to use yet still very versatile and flexible. This machine is composed of two main parts. On the top of the machine there is a load cell with a display that measures and displays the amount of pressure applied during a test. The platform of the machine is connected to a motor that can raise and lower the platform to apply pressure to the test specimen so that it is compressed between the load cell and the platform. As with any test, it is extremely important to isolate and maintain the direction of force applied to the specimen. With this in mind, the UltraTester has been engineered with aircraft aluminum to be lightweight yet highly rigid to facilitate maintaining a high level of reliability and accuracy.

## **BASIC OPERATION**

Two rocker switches located on the front of the machine are used to position the platform and run a test. Many different types and sizes of test specimens can be used on this machine. The "Jog" switch on the front right-hand side of the machine is used to quickly position the platform to allow the test specimen to fit between the load cell and the platform. Press the switch up to move the platform closer to the load cell, or press the switch down to move the platform farther away from the load cell.

#### Note: Because the test is run at a very slow speed, the platform should be positioned to allow the smallest gap possible between the specimen and the crosshead. Otherwise a long waiting period may occur before the actual load may engage.

The "Test" switch on the left side of the machine is used to start a test cycle. A test can be run in compression or tensile mode. Press the "Test" switch up to start a test in compression mode. Press the "Test" switch down to start a test in tensile mode.

## **MACHINE START-UP**

Make sure that the crosshead is securely attached to the load cell and that the notched contact is securely attached to the crosshead. Make certain that the load cell is not loose. Power up the UltraTester by plugging in the 24-volt DC (120/240-volt AC–DC switching) power supply supplied with the machine into the back of the base.

Make sure the On/Off switch on the back of the upper display is in the "On" position. When first powered on, the meter will perform a "digital check" or internal diagnostics which are indicated by the meter scrolling through

a countdown sequence from 5 to 0 after which a value between 70 and 80 lbs will be displayed. Press "Zero" to clear the start-up value. The meter is now in "Live" mode and will now display force values. To display "Peak" or maximum values, press the "Peak" key. The "Peak" mode is indicated by the green LED illuminated next to the word "Peak" on the right side of the display. The meter will display the same value seen after the "digital check" since it was the last captured "maximum" value. Press "Zero" to clear this value. Most of the time a very small value (< 0.2 lbs) will remain due to the very high-capacity load cell in use. If the small remaining value is more than 0.2 lbs, you should return the meter to "Live" mode by pressing the "Peak" key again, pressing "Zero" again, and then returning to "Peak" mode for testing.

# Note: Upon start-up it is common that you may need to repeat the "Zero" process several times as the meter warms up. It is also necessary to re-zero the machine at times if the temperature changes much during operation.

If the load cell is not plugged into the meter, an error message will be displayed. To fix this problem, turn the meter off, plug the 14-pin connector wire from the back of the load cell into the bottom of the meter, and turn the meter back on.

The meter is set to read in pounds by default (indicated by a green LED in upper right corner of display) but can be switched to kilograms by pressing and holding "Peak" key for 3 seconds.

## QUICK START

- 1. Plug unit in.
- 2. Wait for countdown (Digital Check) to end.
- 3. Press "Zero."
- 4. Press "Peak."
- 5. Press "Zero." Repeat Steps 4 & 5 if meter doesn't completely zero.
- 6. Position specimen slightly too high to fit into notch.
- 7. Lower platform until specimen is just able to slide into notch.
- 8. Press up on the "Test" switch. Remember the machine should be in "Peak" mode during testing to capture maximum value.

## **PERFORMING A SHEAR TEST**

Check the bonded specimen to make sure that there is not any excess composite or adhesive adjacent to the bonded composite which might interfere with placing the composite specimen precisely into the notched crosshead. If any debris is present, it should be removed using a razor blade in a scraping motion directed away from the bonded composite. Press the "Zero" key on upper display. Verify meter is in "Peak" mode.

Place a bonded specimen into the test base clamp with the roots pointing up leaving about 3mm of the mounted specimen forward from the upper portion of the clamp. Secure the specimen by tightening the thumbnuts firmly. Place the clamped specimen 10 mm behind the crosshead on the loading platform. Using the "Jog" switch (front right rocker switch) position the specimen so that it is slightly too high to fit into the notch. Bring the specimen forward to contact the back of the notched crosshead. Use gentle pressure and slide the bonded specimen back and forth against the back of the notched crossed while simultaneously pressing the "Jog" switch downward with short intervals until the specimen begins to catch/stick in the notch.

At this time only a few short downward strokes on the "Jog" switch should be necessary to allow the bonded specimen to slide fully forward into the notch. Using a thumb on the crosshead and a forefinger on the back of the specimen, press the specimen and crosshead together to make sure there is no space between them. Press up on the "Test" switch (front left rocker switch) and wait for the load to engage and maximum value to be captured. At any time during a test, pressing either the "Jog" switch or the "Test" switch will stop the test.

## MACHINE DISPLAYS

### **Upper Display**

The upper display is connected directly to the load cell and will display the test results in pounds (lb) or kilograms (kg). The lights on the left and right side of the display indicate the current mode of the display.

The "Peak" key can be pressed to display the peak value measured during a test.

#### Peak

This key toggles the meter between units selection (lb/kg) and peak capture operation if enabled in the User Mode "A" Menu.

#### Zero

This key sets the indicator to display zero, provided the following conditions are met:

- 1. The indicator is displaying a "Gross" value.
- 2. The displayed value is within the zero reset range that is programmed in function F4 of the Setup Mode "F" Menu.

#### "Peak Hold" Feature

The digital indicator's optional "Peak Hold" feature enables the user to capture maximum values automatically, hold the values in memory, and display them for viewing. The meter has two modes of operation: "Live" mode and "Peak" mode. These modes can be alternatively selected by depressing the "Peak" key on the keypad. Depressing the "Peak" key for *less* than three seconds will toggle the meter between "Live" mode and "Peak" mode. Depressing the "Peak" key for *more* than three seconds will toggle units between Ib and kg.

- 1. In "Peak" mode, the display updates as the force increases but not as the force decreases. Subsequent forces of greater magnitude than previous forces will be captured and held on the display until cleared, or until a larger force is sensed.
- 2. Depressing the "Zero" key clears the "Peak" register, whether in "Live" mode or in "Peak" mode.

LED INDICATORS	MEANING
ZERO	Better known as the "Center of Zero" indicator, this light is active whenever the displayed weight is within $\pm$ 0.25 divisions of true zero.
NET	Indicates display is a net value.
GROSS	Indicates display is a gross value.
TARE	Indicates a tare value has been established in the system.
LB, KG	Indicates the measurement unit displayed (weight).
STABLE	This light is on whenever the input signal is stable.

Table 1: LED Indicators

#### Meter Configuration/User Settings

The upper display contains two primary setup menus:

- 1. The Setup Mode "F" menu configures the indicator as part of the measurement system.
- 2. The User Mode "A" menu configures the serial communication port and enables user options.

The Setup and User menus consist of several menu selections, each with its own submenu of choices.

Power off the indicator by unplugging the power source.

On the back cover, move the "Setup/Calibration" switch to the opposite position (see Figure 1).

Power on the indicator by plugging in the power source. The indicator displays "F1" to indicate that you are in Setup Menu mode.



To set up the indicator, enter the appropriate menu mode. Once there, four of the front panel keys become directional navigators to move around in the menus, and one key is used to store or "Set" your selections. Refer to Figure 2.



Figure 2

- 1. To move to a new "F" heading, use the "Left" ! or "Right" " key to move right or left in the Setup Menu Chart.
- To move to the selection level, press the "Zero" ↓ key once. The current saved selection is shown.
- 3. To view the available selections for the current "F" heading, use the "Left" or "Right" key to move through the selection field.
- To store a new selection, press the "Set" key. To exit without saving, press the "PEAK" ↑ key to return to the current "F" heading.

Repeat Steps 1 through 4 until the Setup Menu is programmed.



#### Setup Mode "F" Menu

Figure 3: Setup Menu Chart

#### Notes on the Setup Menu

- 1. There is an "F21" submenu present that IS FOR FACTORY USE ONLY!
- 2. Detailed descriptions of the setup menu parameters can be found in the "Setup Menu Table" below
- 3. The User Mode "A" submenus appear when scrolling left or right from the "F" menu.

#### **Exiting the Setup Menu**

- 1. Power off the indicator by unplugging the power source.
- 2. On the back cover, move the "Setup/Calibration" switch back to its original position.
- 3. Power on the indicator by plugging in the power source. The display will go through a digital check then settle into "Live" operating mode.

All front panel keys will now return to their normal mode of operation.

(/> indicates factory default)

NAME/CODE	DESCRIPTION	CODE/VALUE	
F1 – Graduations	Specifies number of full scale consistent with legal requirements and environmental limits on the useful system resolution.	1,500 2,500 4,000 6,000 10,00 20,000 40,000	2,000 3,000 <b>5,000 ~</b> 8,000 12,000 30,000 50,000
F2 – Span Gain	Span Gain is related to AID integration time. The larger the span gain, the higher the internal resolution but the slower the update speed. Note: The KB must be recalibrated whenever this parameter is altered.	25 <b>75                                   </b>	50 100 200
F3 – Zero Track Band	Selects the range within which the KB Series will automatically zero. Selections are in Display Divisions.	Od <b>0.5d ∽</b> 3d 5d	5d
F4 – Zero Range	Selects the range within which the scale may be zeroed.	<b>100%                                   </b>	
F5– Motion Band	Sets the level at which motion is detected by comparing the present display update with the previous one. If motion is not detected for two seconds or more, the system is considered stable, and it can process a Print or Zero command.	<b>1d</b> ✓ 3d 5d 10d	
F6 – Digital Filter	Averages readings to produce higher stability. The higher the filter setting, the greater the stability but the slower the indicator's response time. Choose 8 unless a very fast response is needed.	1 4 2 8	
F7 – Overload Limits	Selects the desired formula which determines the point at which the indicator shows overload. All selections are based on the primary unit selected in F8.	FS <b>FS+2% ✓</b> FS+1d FS+9d	
F8 – Calibration Unit	Selects the primary base unit to be used in the calibration process. Also the default unit for normal operation. "1" = primary unit is in lbs. "2" = primary unit is in kgs.	1 ✓ 2	

(< indicates factory default)

NAME/CODE	DESCRIPTION CODE/VALUE		
F9 – Display Divisions	Determines the desired display increments.	<b>1</b> ✓ 2 5	
F10 – Decimal Pt.	Determines location of the decimal point.	<b>0</b> ✓ 0.0 0.00 0.000 0.000 00	
F16 – Zero calibration	Places indicator into the zero calibration routine. Scrolling down with the ZERO key one level begins the procedure.	Press ZERO key to begin sequence	
F17 – Span Calibration	Places indicator into the span calibration routine. Scrolling down with the ZERO key one level begins the procedure.		
F18 – View Calibration	Actuates the function that allows you to view both the zero and span calibration value. The values displayed in this function are valid only after calibration (F16 & F17) has been successfully completed. Scrolling down with the ZERO key one level begins the procedure.		
F19 – Key-in Zero	Allows you to key in a known zero calibration value in case of memory loss in the field.Press ZERO key begin sequence		
F20 — Key-in Span	Allows you to key in a known span calibration value in case of memory loss in the field. Scrolling down with the ZERO key one level begins the procedure.Press ZERO key begin sequence		
F21 – Factory Reset	CAUTION!!! This submenu will reset all parameters in the "F" and "A" menu to the and "A" menus to the original factory default settings.Press ZERO key twice to execute		

Table 2: Setup Menu (F Values)

(/> indicates factory default)

NAME/CODE	DESCRIPTION CODE/VALUE		
A1 – Baud Rate	Selects the baud rate for data120024transmission through the serial port.480096		
A2 – Data Bits	Selects the number of data and parity of serial transmission.8n 7E 70707n		
A3 – Mode of Serial Transmission	Selects when data will be out of the serial port printer or computer: "C" = Continuous mode; send data continuously. "d" = Demand mode; send data when a PRINT command is issued from the printer, computer, or indicator.	C d ~	
A4 – Display Check	Actuates the function that illuminates all digit segments, decimal points, and LCD sequence indicators in a test sequence. Pressing the ZERO key to scroll down one level begins the test sequence.	Press ZERO key to begin sequence	
A5 – Disable the lb/ kg Key	Allows the Ib/kg key to be disabled so that an operator cannot accidentally press the key and change the displayed units. "0" = Disable the Ib/kg key "1" = Enable the Ib/kg key	0 1 ~	
A6 – Serial Port	Selects the mode of the RS-232 serial port.	<b>0</b> ✓ 1	
A7 – ID No. Enable	Allows the ID number to be disabled in the Print Ticket mode. Valid only when $0 \checkmark$ A6 is set to "1." "0" = Disable the ID No. "1" = Enable the ID No.1		
A8 – ID No. Entry	Actuates the function that allows entry of a new ID No. Valid only when A6 is set to "1." Pressing the ZERO key to scroll down one level begins the sequence.	0 – 19999 (500) 0 – 99999 (500E) <b>123456 0 ✓</b>	
A9 – No. of Line	Actuates the function that allows entry of the desired number of line feeds to be printed in Print Ticket Mode. Valid only when A6 is set to "1."	on that allows entry0 – 99lber of line feeds to5 ✓Ticket Mode. Validt to "1."	

Table 3: Setup Menu (A Values)

#### Lower Display

The lower display shows the test duration set point (bottom) and the test cycle elapsed time (top) or the test speed. To toggle between the "Test Duration Time" and "Test Speed" display, press the "1/2/SET" key. In the top left corner of the lower display there is a "1" or a "2" displayed with an "N" just below it. When screen "1" is selected, the data displayed is the "Test Duration Time" data. When screen "2" is selected the "Test Speed" is displayed.

#### **Adjustable Parameters**

To allow for various kinds of testing, there are parameters that can be modified. These parameters can be modified on the lower display that is mounted on the top of the machine base. The two main parameters are the "Test Duration Time" and the "Test Speed." These parameters can be modified easily by following the steps below. Other more advanced parameters can also be modified by following the advanced parameter adjustment instructions below.

#### Modify Test Duration Time & Test Speed

- 1. Select the screen that corresponds to the parameter that you need to modify by pressing the "1/2/SET" key.
- Use the "0," "1," "2," "3," and "4" keys to increment the corresponding digit (0 for 1s, 1 for 10s, 2 for 100s etc). The lower value in the display will begin to blink. (NOTE: The value is not active while blinking.)
- 3. To accept the blinking value, hold down the "1/2/SET" key for at least two seconds. The display will stop blinking when the value becomes active.

#### Advanced Parameter Adjustment for Lower Display

- 1. Press the "MODE" key until you see an "R" just above the word "RUN" on the middle of the left side of the display.
- 2. There will be a "PV" blinking near the upper value. Press the "4" key to select the parameter type (see Table 1 below) for the parameter you would like to modify.
- 3. Use the "0," "1," "2," and "3" keys to select the parameter number.
- Hold down the "5" key for at least two seconds. This will turn on/off the blinking "PV," and an "SV" will start blinking near the lower value.
- 5. Use the "0," "1," "2," "3," and "4" keys to enter the desired value for the parameter type and number showing in the upper value of the display. The lower value will begin to blink.

- 6. Hold down the "1/2/SET" key for at least two seconds to accept the new value. The lower value will stop blinking.
- 7. Press the "MODE" key until you see an "N" in the upper left corner of the display.

#### Parameters List

The following table is a list of parameters that can be modified to adjust how the machine behaves.

PARAMETER TYPE	PARAMETER NUMBER	DESCRIPTION
Sv	0	Test cycle time (sec). Default 60 seconds. This is how long the test cycle will run.
d	10	Test speed (mm/min) Default 1 mm/min This is how fast the platform moves during a test cycle
d	11	Jog speed (mm/min). Default 36 mm/min. This is how fast the platform moves while pressing the "Jog" switch on the right side of the machine.
d	12	Jog Acceleration (ms). Default 1000 ms. This is the time it takes for the motor to accelerate to the jog speed.
d	13	Max pressure (lbs or kg). Default 500. This is used for more delicate test appliances that could be damaged during the test. You can limit the amount of pressure applied during the test. When this value is reached on the load cell, the machine will interrupt the test.

Table 4: Lower Display Parameters

## LOAD CELL CALIBRATION

The load cell supplied with the UltraTester has a 1,000 lb capacity and has been calibrated at Ultradent Products prior to shipment. This load cell is

highly rugged and stable and should not need frequent calibration but should be checked periodically to verify that it is in fact still reading within 0.5 lbs at 100 lbs. To verify that the meter and load cell are functioning properly, install the calibration plate into the top of the load cell and place a known weight on it (preferably greater than 50 lbs). If the reading is off by more than 0.1% follow the instructions below.

(Caution: Parameters in calibration mode should not be modified without proper understanding and knowledge of function.)

The load cell is calibrated by following the procedures described for functions in F16 (Zero) and F17 (Span) of the Setup Mode Menu. Each procedure places a value into the indicator's nonvolatile memory—F16, the zero value (offset/dead load) and F17, the span value (gain/live load). The minimum calibration reference that can be used is 1% of full-scale capacity. After the two calibration procedures are executed successfully, record both calibration values in Table 2 below using the F18 View procedure.

INDICATOR	ZERO CALIBRATION VALUE	SPAN CALIBRATION VALUE
SIN:		

Table 5: Calibration

In the unlikely event that either value is lost while in the field, the Setup Mode Menu makes provisions for reentering these values via functions F19 and F20, thus eliminating the need for recalibration with a calibration reference.

### Zero Calibration (F16)

- While in the Setup mode, scroll to "F16," then scroll down once using the "Down" key to enter the Zero Calibration Menu. The display will momentarily show "C 0" followed by a value. This value is the internal A/D count and can prove useful when trying to troubleshoot setup problems.
- 2. After making sure there are no span calibration reference signals present, press the "Down" key again to zero out any displayed value.
- 3. Press the "Set" key to store the zero offset value. The display will show "EndCO" momentarily, then revert back to "F16." At this time, proceed to the "F17" span calibration to complete calibration of the indicator.





#### Span Calibration (F17)

- 1. While in the Setup mode, scroll to "F17", then scroll down once using the "Zero" key to enter the "Span Calibration Menu."
- 2. The display will momentarily show "C1" for the span calibration, followed by a value with one flashing digit. This value will be zero, with the decimal point position selected in function F10.
- 3. Now place a calibrated test weight on the load cell directly loaded through the load cell hole.
- 4. Use the four directional keys to adjust the displayed value to the actual calibration reference value. Increase the flashing digit by pressing the "Up" key. Decrease the flashing digit by pressing the "Down" key. Pressing the "Right" key or the "Left" key will change the position of the flashing digit.
- 5. After setting the exact value, press the "Set" key to store the value.

- 6. If the calibration was successful, the display will show "EndC1" momentarily then revert back to F17. At this time it is suggested that the calibration values be recorded for future use.
- 7. If the calibration was *not* successful, one of the error messages below will appear. Take the indicated action to correct the problem, then perform a new calibration.

"Err0" - The calibration reference or the adjusted keyed-in value is larger than the measurement range. Change the calibration reference or check the input data, or change the measurement range (F1).

"Err1" - The calibration reference or the adjusted keyed-in value is smaller than 1% of the measurement range. Change the calibration reference or check the input data, or change the measurement range (F1).

"Err2" - The internal resolution is not high enough to accept the calibration value. Select a larger parameter for the Span Gain (F2). SEE APPENDIX.

## View Calibration Values (F18)

## Note: The values displayed in this procedure are valid only after a successful calibration has been performed using F16 and F17.

- 1. While in the Setup mode, scroll to "F18," then scroll down once using the "Zero" key to enter the View Calibration menu.
- 2. The display will momentarily show "CAL 0," followed by a value. This value is the zero calibration value and should be recorded in the calibration table (Table 2). Press any key to continue.
- 3. The display will momentarily show "CAL 1," followed by another value. This value is the span calibration value and should also be recorded in the Calibration Table. Press any key to return to upper level (F18).

### Key In Zero Calibration Value (F19)

# Note: This procedure is intended for emergency use only in the case of nonvolatile memory loss. A valid zero calibration value obtained from a successful F16 calibration procedure must be used.

- 1. While in the Setup mode, scroll to "F19", then scroll down once using the "Down" key.
- 2. The display will momentarily show "CAL 0," followed by a flashing zero. Use the four directional keys to adjust the displayed value to the zero calibration value.
- 3. After setting the exact value, press the "Set" key to save the value.
- 4. The display will show "E CAL 0" momentarily then revert back to F19.

Key In Span Calibration Value (F20)

Note: This procedure is intended for emergency use only in the case of nonvolatile memory loss. A valid zero calibration value obtained from a successful F17 calibration procedure must be used.

- 1. While in the Setup mode, scroll to "F20," then scroll down once using the "Down" key.
- 2. The display will momentarily show "CAL 1," followed by a flashing zero. Use the four directional keys to adjust the displayed value to the span calibration value.
- 3. After setting the exact value, press the "Set" key to save the value.
- 4. If the entered value is greater than zero, the display will show "E CAL 1" momentarily then revert back to F20. If a value of zero is entered, the indicator will briefly show "Err 5" then revert back to the screen described above in Step 2.

CODE	MODE	MEANING/POSSIBLE SOLUTION
00000 0	Normal Operating Mode	Gross overload. A measurement value greater than the measurement range has been applied. Remove the calibration reference signal or try recalibrating the indicator. Otherwise, check for a defective transducer connection or possible transducer damage due to overloading.
Err 0	Span Calibration Mode (F17)	Keyed-in value is less than 1% of full-scale capacity. Use a greater calibration reference signal or check keyed-in value.
Err 1	Span Calibration Mode (F17)	Keyed-in value is larger than full-scale capacity. Use a smaller calibration reference signal or check keyed-in value.
Err 2	Span Calibration Mode (F17)	Keyed-in value is larger than full-scale capacity. Use a smaller calibration reference signal or check keyed-in value.
Err 3	All Modes	Nonvolatile memory read error. One or more setup parameters have been lost.
Err 4	All Modes	Nonvolatile memory write error. Indicator needs service.
Err 5	Key In Span Calibration Mode (F20)	You have attempted to enter a zero value for C1. Enter a known calibration value greater than zero

## **APPENDIX: DISPLAYED ERROR CODES**

CODE	MODE	MEANING/POSSIBLE SOLUTION
Err 7	Initialization	No reading from the ADC. Make sure there is a transducer connected to the indicator at start-up.
Err 9	Normal Operating Mode	Span calibration value has been lost. Recalibrate the scale.

Table 6: Displayed Error Codes









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