Instruction Manual NC002367
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CHATILLON® DFT Series
ACCUFORCE® CD2 Series

Digital Force Gauges

Operating Instructions

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ILLUSTRATIONS

PRECAUTIONS

- Read the instruction manual completely before attempting to use the DFT/CD2 Series. By following the instructions contained in this manual, the optimum accuracy and performance can be attained.

- Turn off the DFT/CD2 Series before connecting or disconnecting any cables to the instrument.

- Do not overload the DFT/CD2 Series! The instrument can handle an overload of up to 150% of rated full scale. The display will indicate "OVERLOAD" when the gauge exceeds 116% of full scale. When the force applied is removed and "OVERLOAD" is no longer displayed, the gauge will not read above 121% of full scale in the Tension Peak or Compression Peak modes. Therefore, you must contact your local distributor to ensure the load cell was not damaged, unless you are confident the force applied did not exceed 150% of full scale.

- The DFT/CD2 Series is designed for axial loading only! Applying load on an angle or eccentric loading may cause erroneous readings.

- Do not use tools to attach the shaft adapter and accessories to the gauge. Use "Finger-Tight" torque only when attaching adapters to the gauge to prevent damage to the load cell.

- IMPORTANT NOTE: Before using the DFT/CD2 Series, fully charge the rechargeable Nicad battery by plugging in the supplied battery charger into the battery charger jack on the instrument and the proper AC outlet. Use only the battery charger supplied with the gauge. Using other chargers can overcharge and damage the battery.

1. INTRODUCTION AND PRODUCT OVERVIEW

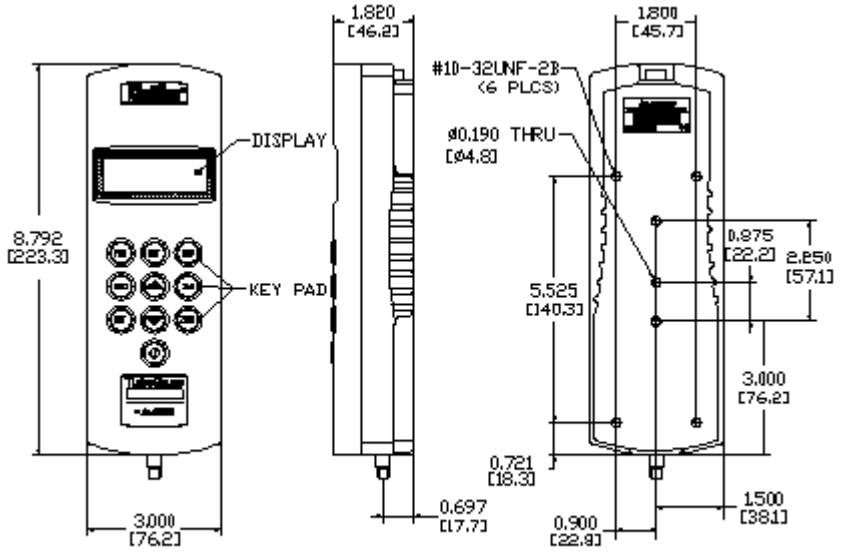
The DFT/CD2 Series family of digital force gauges manufactured by AMETEK Test and Calibration Instruments Division have been designed to provide accurate compression and tension force measurements using an internal load cell. These instruments have been precisely crafted to provide years of reliable service. Each gauge comes equipped with a rechargeable battery pack, AC battery charger, accessory attachments, and a handy carrying case.

1.1. **PRODUCT FEATURES**

The key features of the DFT/CD2 Series are:

- Load capacity up to 500 LBF
- 1,000 Samples per second update rate permits precise capturing of peak compression and tension loads.
- Intuitive menu structure for setup, operation and maintenance are displayed by the instrument in a graphical format.
- Data storage for up to 100 data values.
- Rugged aluminum housing offers long life. Top housing is reversible.
- Variable printing formats available.
- Mounting arrangements for attaching gauge to manual and motorized test stands.
- Ergonomically designed.
- Readings are selectable using several engineering units: LB, KG, N.
- Field calibration.
- RS-232 and Mitutoyo standard output port.
- Can be controlled remotely via RS-232 port.

1.2. **DFT/CD2 PHYSICAL DIMENSIONS**



E96-190

Figure 1.1 DFT/CD2 Dimensions

1.2.1. About the Keypad

The DFT/CD2 keypad consists of ten dedicated keys (PEAK, EXIT, MENU, UNITS, SAVE, XMIT, ZERO, ON/OFF, UP ARROW, DOWN ARROW). When an active key is pressed, the gauge transmits an audible “BEEP”. Correspondingly, when an inactive keypad is pressed, the gauge makes no sound.

MENU key moves you through the configuration process and is used to select operating options. Selecting the MENU key will invoke the current option that is displayed by the gauge. When a new option is accepted, the option flashes three times. The display will then move to the next configurable option.

EXIT key moves you back to the main display screen.

PEAK key cycles through three different operating modes: capture of the Normal reading; Peak Compression reading; or Peak Tension reading. The selected mode is indicated in the upper left of the display screen.

SAVE key stores current test data reading in memory. Up to 100 different data points may be retained in memory and downloaded via the gauge RS-232 port or Mitutoyo ouputs.

UP/DOWN ARROW keys are used to select options within each setup display. They are also used to display stored data within the gauge memory while in Data Review Mode.

UNITS key allows you to select the display reading in Pounds force (LB), Kilograms (KG) and Newtons (N). This setting is indicated in the lower right of the main display screen.

XMIT key transmits the displayed value from an individual test or all test data stored in memory via the gauge RS-232 port or Mitutoyo output.

ZERO key returns current display to zero reading.

ON/OFF Turns power to the gauge ON or OFF.

1.2.2. About the Display

The DFT/CD2 series display is an LCD dot matrix display. As different keys are pressed, the display adjusts accordingly. The display illustrates different symbols such as: battery symbol indicating the battery is running low; round circle represents that Auto-Shutdown has been activated; force being applied to the load cell is represented by a “C” for compression or a “T” for tension. The upper left corner of the display indicates the operational mode (NORM, T-PK or C-PK). The bottom right hand corner represents the measurement unit LB, KG, N. The display updates 4 times per second.

NORMAL DISPLAY starts up after the gauge is turned on. Unit of measure setting (lower right) toggles through LB, KG, N by use of the UNITS key. Graphic indicator shows portion of battery charge remaining (if the battery is low) and the time remaining until auto shutdown. Pressing the **MENU** key cycles the display through nine different menu options, allowing the user to adjust gauge settings as shown in Figure 1.2. Settings are adjusted by using the UP and DOWN ARROW keys. Use the EXIT key to take the user back to normal start up screen.

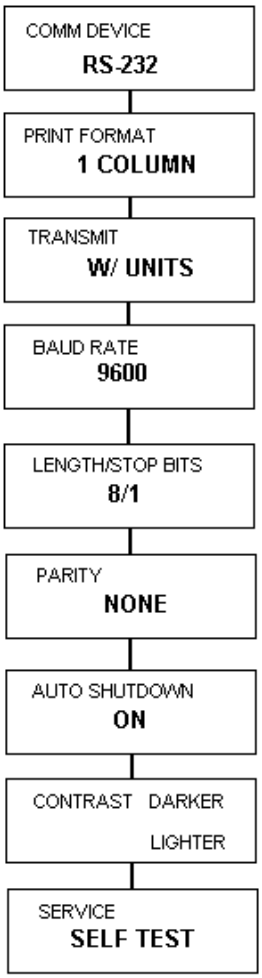


Figure 1.2 DFT/CD2 Menu

1.3. RECHARGING BATTERIES

A rechargeable NiCad battery powers the DFT/CD2 Series. Since the NiCad batteries continue to discharge when not in use, it may be necessary to recharge the unit before use. When the battery power begins to lose its charge, the Battery Indicator will appear on the display. As the battery loses its charge, the dark filling in the indicator slowly disappears. When the indicator is no longer filled, the gauge will automatically shutdown. To recharge the battery, plug the battery charger included with the gauge into the correct voltage source and insert the charger jack into the receptacle on the end of the gauge. Charge the battery for 10-12 hours to yield approximately 8-10 hours of continuous operation. The gauge can be operated continuously with the battery charger connected to the gauge.

Note: Before using the gauge, please fully charge the NiCad battery pack. Use only the battery charger supplied with the gauge. Using other chargers can overcharge and damage the battery.

1.4. CONNECTING TO EXTERNAL DEVICES

The DFT/CD2 Series can be configured to accept input from an external source, and/or to send output to an external data-recording device, such as a strip chart recorder, an RS-232 or Mitutoyo printer, or a personal computer. It can be used in combination with CHATILLON test stands and application software such as NEXYGEN to meet a wide variety of application requirements. To connect the gauge to a device, attach the appropriate interface cable to the port located on the end of the gauge and the other end to the external device.

1.5. REVERSING THE HOUSING

The DFT/CD2 Series is shipped shaft down for test stand mounted applications, and the display on the front of the gauge is configured accordingly. For performing operations in which the gauge will be hand held it may be desirable to rotate the front housing so that the display and logo will be viewed right side up. To perform this procedure, remove the two screws from the back of the gauge, carefully rotate the front housing 180 degrees being careful not to pull, pinch or twist the wires inside, and then reinstall the screws.

NOTE: When removing the screws to the back housing, please utilize proper ESD (Electro Static Discharge) precautions. Touching the printed circuit board without taking the proper ESD precautions may cause damage to the printed circuit board.

1.6. **SETTING UP FOR SAFE USE**

The DFT/CD2 Series should be properly setup before accurate and most of all, safe measurement can be made.

Only when you verified that you will be conducting a safe test, proceed as follows:

- Determine how the sample will be tested and verify that the DFT/CD2 Series can handle the test.
- If desired, mount the gauge to the test fixture.
- If you will be powering the instrument from the AC line, plug the charger into its jack on the instrument. Plug the charger into the correct AC voltage outlet (the required AC voltage, current and frequency are listed on the charger).
- If powering the gauge from batteries, fully charge the batteries before using.
- Attach all necessary attachments and plug in cables if applicable. Route the cables so that they do not interfere with the test.
- Attach the specimen, zero the gauge by pressing the ZERO key, and begin to take measurements.

2. FRONT PANEL OPERATION

The DFT/CD2 Series can operate in one of three test modes: Normal, Data save and Configuration.

2.1. NORMAL MODE

The principle function of the Normal Mode is to provide indications of load applied to the load cell. Instantaneous force, peak-tension and peak-compression readings can be displayed and scaled in a variety of units of measure.

2.1.1. Selecting type of Measurement – Capturing Peaks

The gauge continuously measures instantaneous tension or compression forces (often called normal readings). It also captures peak-tension and peak-compression forces. Pressing the PEAK key will cycle between Normal, Tension-Peak, and Compression-Peak measurements. The upper left corner of the display will indicate NORM, T-PK, C-PK, respectively.

2.1.2. Selecting Units of Measure

Force indications can be displayed in LB, KG, or N. The gauge displays the active units of measure in the lower right corner of the LCD display. Pressing the UNITS key will cycle between the three available measuring units.

2.1.3. Zeroing

Zeroing allows you to exclude the weight of accessories and attachments from the indicated force readings. It also clears captured peak tension and compression readings. To zero the gauge, momentarily press the ZERO key. Only the current measurement type (i.e., NORM, T-PK, C-PK) will be zeroed. To zero and clear all measurement types press and hold the PEAK key and then press the ZERO key.

2.1.4. Transmitting Readings

Pressing the XMIT key will cause the gauge to transmit a single reading (current measurement type and current units) through the output port (Mitutoyo or RS-232). If the gauge is in NORM mode, the data value (NORM, T-PK or C-PK) displayed on the screen will be transmitted. If the gauge is in the Data Review Mode, then all of the stored values will be transmitted.

2.2. DATA SAVE MODE

The Data Save Mode permits the operator to store up to 100 data sets acquired during tests. Each data set consists of 2 items: (1) sample number and (2) tension peak value, compression peak value or indicated instantaneous force with unit of measure. The total number of data sets is limited to 100. Data is stored in a nonvolatile memory and is retained even if the gauge is turned off or the battery pack is removed. Stored data sets can be reviewed (displayed), printed, or uploaded to a personal computer.

2.2.1. **Storing Readings**

While in Normal Mode, press the SAVE key to enter the Data Save Mode. The gauge operates just like in the Normal Mode except that additional information is shown on the display. The PEAK key selects the type of measurement being displayed, e.g. instantaneous force, peak-tension, or peak-compression force, and the UNITS key is used to select the unit of measure. The ZERO and ZERO-PEAK keys zero the current reading or all readings, respectively. The XMIT key causes the gauge to send the current reading through the output port.

The top line of the display shows "#YYY" which indicates the data set number where the next data set will be stored, e.g. #003 means the next stored value will represent the third sample. The bottom line shows the percentage of data memory used. When 100% is indicated, the memory is full and no more data can be stored until the memory is cleared. In the Data Save Mode (not Data Review Mode), the gauge will display the word "FULL" where the "YYY" is displayed when memory is 100% full. To save the current reading, momentarily press the SAVE key. A complete data set is stored and the data set index is incremented. To save another data set, simply press the SAVE key again.

All saved data sets can be reviewed by pressing the UP ARROW key to invoke the Data Review screen. Note that the Data Review screen cannot be invoked if there is no data stored. To clear memory (and erase ALL saved data) press and hold the ZERO key and then press the SAVE key.

2.2.2. **Reviewing and Printing Stored Readings**

To enter the Data Review screen, press the UP ARROW key from the Data Save Mode. The gauge displays the most recent displayed measurements. The top line of the display shows "#YYY" which represents the last data set stored. The second line shows the data value stored, which may be either the NORM, T-PK, C-PK value indicated in the upper left corner of the display. The third line shows the percentage of memory used and the units of measure of the stored value.

Press XMIT key to send all data sets to the output port using the currently selected print format. See Section 2.3.2 for data/print details. Use the UP ARROW or DOWN ARROW keys to select data sets. Press the EXIT or SAVE key to return to the Data Save Mode. Note that the Data Review display cannot be invoked if there is no data stored.

2.3. **CONFIGURATION MODE**

The Configuration Mode facilitates setup, configuration and the customizing of the DFT/CD2 Series to satisfy varying needs of users. See Section 4.2 Menu Structures.

2.3.1. **Configuring Output Port**

The output port of the DFT/CD2 Series supports RS-232 Serial Port and Mitutoyo Port standards for easy interfacing to printers, personal computers, and Mitutoyo devices. Before a connection between the gauge and an external device can be established, the output port must be properly configured. First a proper communication standard must be selected. From the Normal mode screen, press the MENU key. The COMM DEVICE: selection screen will display either RS-232 or MITUTOYO, indicating the current output port configuration.

2.3.1.1. **Enabling the MITUTOYO Output**

To enable the MITUTOYO standard, press the MENU key from the Normal Mode display. If MITUTOYO is displayed, the MITUTOYO output is already enabled. Press the MENU key to advance the gauge to the next display, which is AUTO SHUTDOWN.

If RS-232 is displayed after depressing the MENU key from the Normal Mode display, then you will need to change to the MITUTOYO output. Press the UP or DOWN ARROW key until MITUTOYO is displayed and then press the MENU key. The word MITUTOYO will flash three times, signifying that the enabling process is complete. The screen will next display AUTO SHUTDOWN. Press EXIT key at any time to return to Normal Mode. Proceed to Section 2.3.2 for information in the MITUTOYO print format.

NOTE: When a Mitutoyo printer is attached to the gauge and the gauge is powered ON or OFF, the following will print "*NO DATA*".

2.3.1.2. **Enabling and Configuring the RS-232 Port**

To enable the RS-232 Serial Port standard or to further configure the port, press the MENU key from the Normal Mode display. If RS-232 is displayed, then this option is already enabled. Press the MENU key to advance to the next display – PRINT FORMAT.

If MITUTOYO is displayed, the Mitutoyo output option is enabled and must be changed. To enable the RS-232 standard, press the UP or DOWN ARROW key until RS-232 is displayed and then press the MENU key. The word RS-232 will flash three times, signifying that the enabling process is complete. The screen will next display PRINT FORMAT. Press EXIT at any time to return to the Normal Mode.

Once RS-232 has been selected, the gauge will advance and guide you through the PRINT FORMAT setup (Section 2.3.2), and the

configuration settings of Baud Rate, Transmit Units, Length/Stop Bits and Parity. Press EXIT to return to the Normal Mode.

2.3.1.3. **Configuring RS-232 – Transmit Units**

The readings transmitted via the RS-232 port of the DFT/CD2 Series can be appended with the unit of measure information. After the PRINT FORMAT is selected, the TRANSMIT selection display appears showing the current stored selection that is either W/ UNITS or W/O UNITS. Press the UP or DOWN ARROW key to toggle between the two selections. Press the MENU key to accept the TRANSMIT selection and advance to the next configuration step. If the selection was changed, the new selection will flash three times to indicate that the new selection has been applied. If the selection did not change from the original setting, the gauge will advance to the next configuration step without flashing. Press EXIT key to return to the Normal Mode display.

2.3.1.4. **Configuring RS-232 – Baud Rate**

The RS-232 transmitter/receiver of the DFT/CD2 Series can be configured to operate at 300, 600, 1200, 2400, 4800, 9600, 19,200, 28,800, 38,400, 57,600, 115,200 Baud. After the TRANSMIT UNITS selection is chosen, the BAUD RATE selection is displayed indicating the current selected baud rate. Press the UP or DOWN ARROW key to toggle through the different baud rate selections. Press the MENU key to accept the desired baud rate. If the baud rate is different from the originally stored baud rate, the new baud rate will flash three times indicating the new baud rate has been applied. If the baud rate is not changed, the gauge will advance to the next configuration step without flashing. Press EXIT to return to the Normal Mode display.

2.3.1.5. **Configuring RS-232 – Word Length**

The RS-232 transmitter/receiver of the DFT/CD2 Series can be configured for 8/1 (8 data bits, 1 stop bit) or 7/2 (7 data bits, 2 stop bits) operation. After the BAUD RATE configuration step, the LENGTH/STOP BITS display appears with the currently configured length/stop bits. Press the UP or DOWN ARROW key to toggle between the two selections. Press MENU key to accept desired word length. If the word length format has changed, the new format will flash three times, indicating the new word length has been applied. If the word length format did not change, the gauge will advance to the next configuration step without flashing. Press EXIT key to return to the Normal Mode display.

2.3.1.6. **Configuring RS-232 – Parity**

The RS-232 transmitter/receiver of the DFT/CD2 Series can be configured for EVEN or NONE parity. After the WORD LENGTH configuration, the gauge will display the currently configured parity of the gauge. Press the UP or DOWN ARROW key to toggle between the two selections. Press the MENU key to select the desired parity. If the parity format has changed, the new format will

flash three times, indicating the new parity has been applied. If the parity format did not change, the gauge will advance to the next configuration step without flashing. Press EXIT key to return to the Normal Mode display.

Note: When word length 7/2 and parity EVEN are both selected, the RS-232 transmitter/receiver is configured for 7 data bits, 1 stop bit and even parity.

2.3.2. Formatting Stored Data Printouts

The DFT/CD2 Series supports 1 COLUMN or 2 COLUMN format for data printing with RS-232. MITUTOYO printing always uses the 1 COLUMN format.

- **1 COLUMN FORMAT:** This option prints one force value per line.

  MITUTOYO Output

  -0008.5
  0006.5

  RS-232 Output

  -0008.5 LB T-PK
  0006.5 LB Norm

- **2 COLUMN FORMAT:** This option prints the sample number and force value on each line.

Sample	Data
001	-0008.5 LB T-PK
002	0006.5 LB Norm

  To invoke the print format screen (PRINT FORMAT:) press the MENU key followed by the selection of RS-232 in the COMMUNICATION DEVICE selection display. The PRINT FORMAT selection screen will display the current stored PRINT FORMAT. Press the UP or DOWN ARROW key to toggle between the two selections. Press MENU key to accept desired print format. If the print format has changed, the new format will flash three times, indicating the new print format has been applied. If the print format did not change, the gauge will advance to the next configuration step without flashing. Press EXIT key to return to the Normal Mode display.

2.3.3. Configuring AUTO SHUTDOWN

If enabled, the AUTO SHUTDOWN feature will turn off the DFT/CD2 Series after 10 minutes of inactivity. Inactivity is defined by no keypad presses, no commands received from the output port, and no significant change in applied force. This feature may be disabled.

To invoke the AUTO SHUTDOWN feature, continue to press the MENU key until the gauge displays AUTO SHUTDOWN. You can activate the AUTO SHUTDOWN feature by using the UP OR DOWN ARROW key to select either ON or OFF. Once On is displayed press MENU key and the AUTO SHUTDOWN feature is now activated. To disable this feature, select the OFF and press MENU key and the feature will be disabled. If the auto shutdown format has changed, the new format will flash three times, indicating the new auto shutdown format has been applied. If the auto shutdown did not change, the gauge will advance to the next configuration step without flashing. Press EXIT key to return to the Normal Mode display.

2.3.4. **Adjusting the Display Contrast**

The graphical LCD display of the DFT/CD2 Series may have to be adjusted to provide the best contrast for the viewing angle and ambient temperature. To invoke the display contrast adjustment screen (CONTRAST:) continue to press the MENU key until CONTRAST display appears. The CONTRAST screen will display both LIGHTER and DARKER. Press the UP or DOWN ARROW key to change the display contrast. Press the MENU key to accept the desired contrast. The gauge will then advance to the SERVICE selection menu. Press EXIT key to return to the Normal Mode display.

2.3.5. **Performing the Self Test**

In the Self Test Mode, the DFT/CD2 Series performs a series of self-diagnostic tests. The Self Test menu displays facts about the gauge settings and allows the operator to verify that the keys are working properly. The SELF TEST is accessed by pressing the MENU key until the SERVICE menu is displayed and CONTINUE is displayed. Scroll through the menu by pressing the UP or DOWN ARROW key until SELF-TEST is displayed. Press the MENU key to accept and place the gauge into the self-test operation.

Press the EXIT key during any step (except for the Keypad Test) to return the gauge to the previous SELF-TEST menu selection. The KEYPAD Test (the last part of the Self-Test) may only be exited by pressing the ON/OFF key. The following are the seven Self-Test steps and their functions:

- SOFTWARE VERSION
- SOFTWARE REVISION
- CAPACITY: The capacity of the gauge is displayed in the unit of measurement that has been selected (i.e., LB, KG, N).
- % FULL SCALE : Indicates the force being applied to the gauge as a percentage of full scale. This percentage is measured relative to the COMPRESSION NO LOAD force that was present when the gauge was last calibrated (Section 2.3.6.1 Step 9).
- PLACE GAUGE HORIZONTALLY: Indicates to the operator to place the gauge horizontally.

- ZERO LOAD: PASS or FAIL will show on the display. If PASS is indicated, then proceed to next step. If fail is the result, the load cell may be damaged and you will need to contact your local distributor, as the gauge may need to be serviced.
- KEYPAD TEST: When a key is pressed, except for the ON/OFF key, the display indicates the key's function. The only way to exit this screen is to press the ON/OFF key, which will turn OFF the gauge.

2.3.6. Calibrating the DFT/CD2 Series

The DFT/CD2 Series has a built-in calibration procedure that permits verification and adjustments to the gauge without returning it to the factory. The following additional requirements are needed:

- You must have a way to mount the gauge vertically in both tension and compression directions.
- The DFT/CD2 Series will permit calibration using deadweights representing 100% of the rated full scale with 20% increments. For example, calibrating a 10 LB gauge, the deadweights must be in 20% increments for a total of 10 LB at the correct local gravity.

The calibration process is invoked from the Normal Mode by pressing the MENU key until the SERVICE menu appears and CONTINUE is displayed. Scroll through the menu by pressing the UP or DOWN ARROW key until CALIBRATE is displayed. Press the MENU key to accept Calibration Mode. The gauge will display PRESS MENU TO BEGIN. Press MENU and proceed to Section 2.3.6.1.

2.3.6.1. DFT/CD2 Series Calibration Steps 1 – 16

This section leads you step by step through the calibration process.

Note: The DFT/CD2 Series will not advance if an error has occurred during the calibration process. The gauge will display one of two possible error messages. The first message (NOT STABLE) may be displayed due to excessive vibration. The second message (OUT OF RANGE) is displayed when the gauge detects a nominal error of 20%. Pressing the ON/OFF key during any phase of the calibration process will cause the gauge to discard any new calibration information.

Step 1 The display prompts you to "SELECT UNITS TO CALIBRATE". Press the UP or DOWN ARROW key to cycle through the available units of measure. Press the MENU key to accept the selected units of measure, or press the EXIT key to return to the Normal Mode.

Step 2 The display prompts you to "SELECT CAPACITY". Press the UP or DOWN ARROW key to cycle through available capacities. Press the MENU key to accept the displayed capacity and to proceed on to the next step. Press the EXIT key to return to the previous calibration step.

Predefined capacities depend on the units of measure selected:
LB: 2, 10, 50, 100, 200, 500
KG: 1, 5, 20, 50, 100, 200
N: 10, 50, 200, 500, 1000, 2000

Step 3 The display prompts you to “PLACE GAUGE IN HORIZONTAL POSITION”. After doing so, press the MENU key to proceed to the next step (the gauge displays “ZEROING”) or press EXIT to return to the previous calibration step.

Step 4 The display prompts you to “ADD FULL SCALE COMPRESSION LOAD”. Add full scale compression load to the gauge and exercise the load cell three times. Stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to the previous calibration step.

Step 5 The display prompts you to “ADD 80% FULL SCALE COMPRESSION LOAD”. Apply 80% of full scale compression load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE COMPRESSION LOAD”.

Step 6 The display prompts you to “ADD 60% FULL SCALE COMPRESSION LOAD”. Apply 60% of full scale compression load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE COMPRESSION LOAD”.

Step 7 The display prompts you to “ADD 40% FULL SCALE COMPRESSION LOAD”. Apply 40% of full scale compression load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE COMPRESSION LOAD”.

Step 8 The display prompts you to “ADD 20% FULL SCALE COMPRESSION LOAD”. Apply 20% of full scale compression load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE COMPRESSION LOAD”.

Step 9 The display prompts you to “SETUP GAUGE COMPRESSION NO LOAD”. Remove all weight from gauge, leaving fixtures attached to gauge and press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step.

Otherwise, press the EXIT key to return to “ADD FULL SCALE COMPRESSION LOAD”.

Step 10 The display prompts you to “ADD FULL SCALE TENSION LOAD”. Add full scale tension load to the gauge and exercise the load cell three times. Stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to ”ADD FULL SCALE COMPRESSION LOAD”.

Step 11 The display prompts you to “ADD 80% FULL SCALE TENSION LOAD”. Apply 80% of full scale tension load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE TENSION LOAD”.

Step 12 The display prompts you to “ADD 60% FULL SCALE TENSION LOAD”. Apply 60% of full scale tension load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE TENSION LOAD”.

Step 13 The display prompts you to “ADD 40% FULL SCALE TENSION LOAD”. Apply 40% of full scale tension load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE TENSION LOAD”.

Step 14 The display prompts you to “ADD 20% FULL SCALE TENSION LOAD”. Apply 20% of full scale tension load to the gauge and stabilize the weight. Press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE TENSION LOAD”.

Step 15 The display prompts you to “SETUP TENSION NO LOAD”. Remove all weight from gauge, leaving fixtures attached to gauge and press MENU key to proceed. The gauge will display “CALIBRATING” and the gauge will proceed to the next step. Otherwise, press the EXIT key to return to “ADD FULL SCALE TENSION LOAD”.

Step 16 If the calibration was successful, the display indicates ”TO SAVE NEW CALIBRATION PRESS MENU”. Press MENU to save the new calibration and return to the Normal Mode, or press the EXIT key to return to “ADD FULL SCALE TENSION LOAD”.

3. REMOTE OPERATION AND SETUP

The DFT/CD2 Series can accept and execute commands through the RS-232 serial port. The command set is tailored to make it easy to configure and operate the instrument under computer control. The string commands are sent as strings of ASCII characters. The following string commands are recognized:

Command	Response	Description
	Legend: ^ is space (20 hex); 9 is a number 0 through 9; ± is a space or a minus <CR> is Carriage Return (0D hex); <LF> is Line Feed (0A hex).	
	^^^^^^^^^<CR><LF>	On power-up, this line is sent
A	Unit^=lb^<CR><LF> or Unit^=kg^<CR><LF> or Unit^=N^^<CR><LF>	Sends currently selected units
F		Toggles between Data Collect and the Normal and Peak Modes
P		Steps through Normal and Peak Modes: Normal, Tension Peak, Compression Peak
R		Resets the gauge: zeroes all modes
S	^N-MODE^^^<CR><LF> or TP-MODE^^^<CR><LF> or CP-MODE^^^<CR><LF> or DC-MODE^^^<CR><LF>	Sends currently selected mode: Normal, Tension Peak, Compression Peak and Data Collect
U		Steps through Units in the following order: lb, kg, N

Table 3.1
Remote Operation and Setup Commands

Command	Response	Description
X or ?	±99.999^lb<CR><LF> or ±9999.9^kg<CR><LF> or ±99.999^N^<CR><LF>	Sends data on display with the position of the decimal place the same as on display. If in Data collect Mode, sends data from the Data Collect filter instead. If "Transmit Units" is set to transmit without units, lb, kg, and N are replaced by ^^.
	ERROR^^^^^<CR><LF>	Response during force overload
Y	Y204 to Y211	Begins sending instantaneous, Tension Peak, Compression Peak or Data Collect data from 100 times per second to once every 2 seconds.
Z		Zeroes the currently selected mode: Normal, Tension Peak or Compression Peak.

Table 3.1
Remote Operation and Setup Commands

4. TECHNICAL REFERENCE

4.1. SPECIFICATIONS

Accuracy: ±0.15% of Full Scale ±1 LSC

Tare capacity: 10% of Full Scale. A tare value of greater than 10% can be used, however the full range of the gauge capacity may not be reached.

Deflection: 0.01 inch maximum at full load.

Safe Overload: Gauge will display "OVERLOAD" when the force applied exceeds 116% of the gauge capacity.

Overload: Maximum overload is 150% of full scale capacity. Load Cell deformation may occur when overload exceeds 150% of full scale capacity. Contact your local AMETEK distributor if you experienced and overload exceeding 150% of full scale capacity.

Temperature Range: 40 to 110°F (5 to 45°C)

Temperature Stability: 0.06% per °F

Analog Output: -2.0 to +2.0VDC ±0.018VDC

Digital Output: RS-232 and MITUTOYO

Firmware Revision Control: Capability to download future revisions of firmware using software upgrade kit.

Display Update: Four samples per second (250ms refresh) in Normal or Peak Mode.

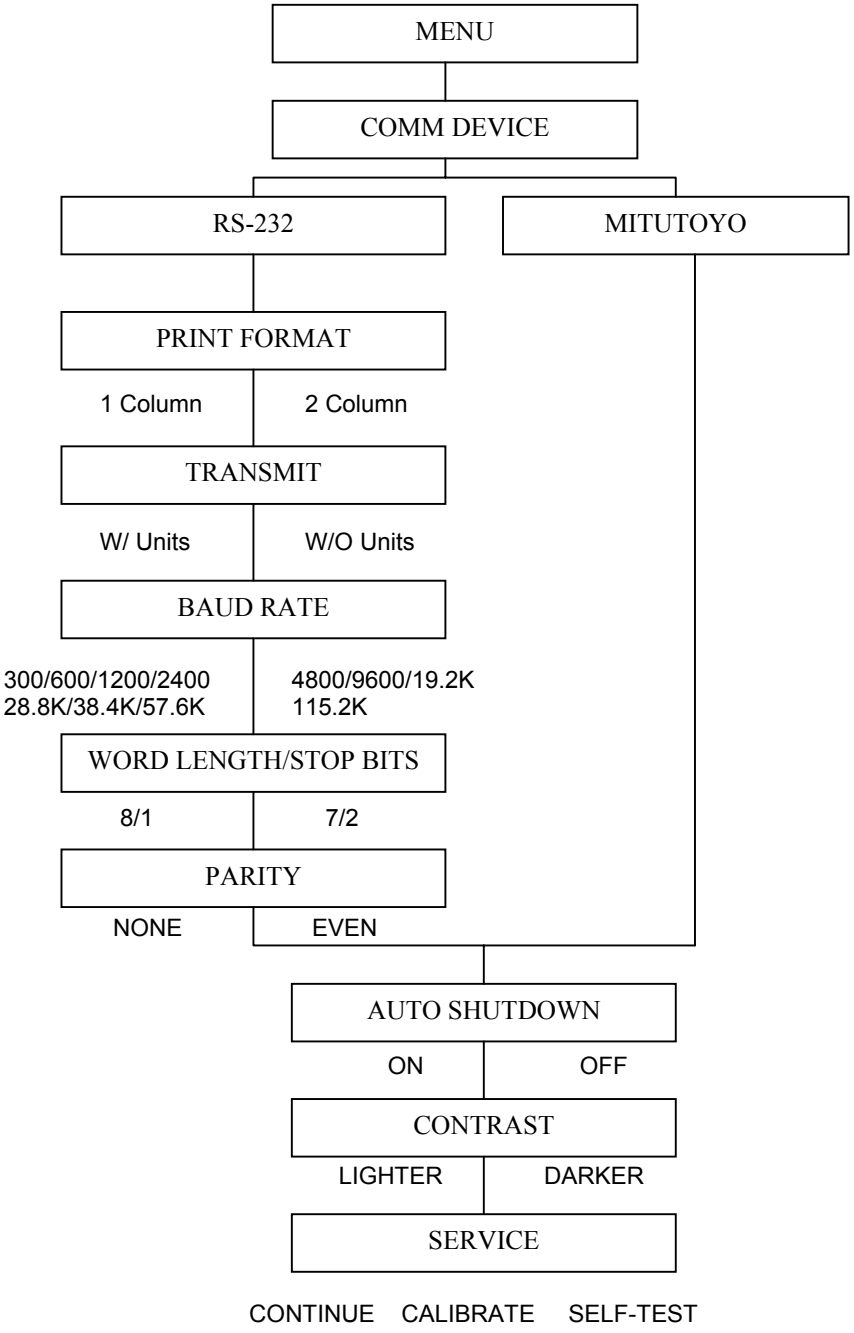
Data Collect Mode: 200 samples per second

Data Storage: Stores up to 100 data samples per second

Sampling Rate: 1,000 samples per second

Battery Charge Life: 8-10 hours of continuous operation when fully charged.

4.2. **MENU STRUCTURE**



4.3. **OUTPUT PORT SPECIFICATIONS**

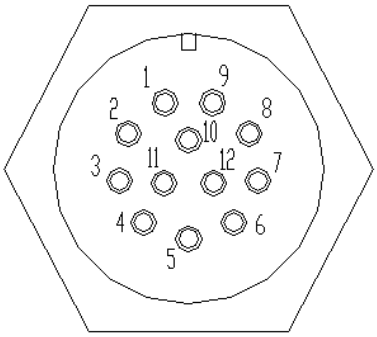


Figure 4.3 I/O Connector (On Gauge)
(View from Solder End)

The DFT/CD2 Series is supplied with a 12-pin female connector on the gauge to provide both digital and analog outputs. AMETEK offers a variety of cables to handle most applications (Refer to Section 4.5.4). Select the cable type required to connect the DFT/CD2 Series gauge to the peripheral device. The pin out of the connector is shown in Figure 4.3. Pin assignments are defined in Table 4.3.

Pin	Symbol	I/O	Purpose	Description
1	TXD	O	RS-232	Transmitted Data
2	RXD	I	RS-232	Received Data
3	GND	-	Ground	Digital Ground
4		O	Clock	Mitutoyo Clock
5		O	Ready	Mitutoyo Ready
6		I	Request	Mitutoyo Request
7		O	Data	Mitutoyo Data
8		I		(Reserved)
9		O		(Reserved)
10	GND	-	Ground	Digital Ground
11		-	Analog GND	Analog Ground
12		O	Analog SIG	Analog Output

Table 4.3 I/O Connector Pinout

4.4. DEFAULT SETTINGS

The DFT/CD2 Series gauges come configured with the following default settings from the factory.

- **Mode:** Normal
- **Units of Measure:** LB
- **Communication:**
  - **Device:** RS-232
  - **Print Format:** 1 Column
  - **Transmit Units:** W/ Units
  - **Baud Rate** 9600
  - **Length/Stop Bits:** 8/1
  - **Parity:** None
- **Auto Shutdown:** On

4.5. ACCESSORIES, SPARE PARTS, MOUNTING KITS & CABLES

4.5.1. Accessories

Accessory	Part Number	DFT/CD2					
		2	10	50	100	200	500
Carrying Case, DFT	SPK-DFT-073	1	1	1	1	1	1
Carrying Case, CD2	SPK-CD2-101	1	1	1	1	1	1
Battery Charger 110V[1]	SPK-FMG-069A	1	1	1	1	1	1
Battery Charger 220V[1]	SPK-FMG-069B	1	1	1	1	1	1
Shaft Adapter	SPK-DFT-068A	1	1	1	1	0	0
Shaft Adapter	SPK-DFT-068B	0	0	0	0	1	1
Hook	SPK-FMG-012A	1	1	0	0	0	0
Hook & Coupling Assy	SPK-FMG-012B	0	0	1	1	0	0
Hook & Coupling Assy	SPK-FMG-012C	0	0	0	0	1	1
Flat Adapter	SPK-FMG-011A	1	1	1	1	0	0
Flat Adapter	SPK-FMG-011B	0	0	0	0	1	1
Chisel Adapter	SPK-FMG-008A	1	1	1	1	0	0
Chisel Adapter	SPK-FMG-008B	0	0	0	0	1	1
Point Adapter	SPK-FMG-009A	1	1	1	1	0	0
Point Adapter	SPK-FMG-009B	0	0	0	0	1	1
Notch Adapter	SPK-FMG-010A	1	1	1	1	0	0
Notch Adapter	SPK-FMG-010B	0	0	0	0	1	1
Extension Rod	SPK-FMG-013A	1	1	1	1	0	0
Extension Rod	SPK-FMG-013B	0	0	0	0	1	1
Hex Key	SPK-FMG-015	1	1	1	1	1	1
Operator Manual	SPK-DFT-072	1	1	1	1	1	1
Quick Reference Guide	NC002490	1	1	1	1	1	1

Note: [1] A Battery Charger is provided standard with your DFT/CD2 Series gauge. The voltage type depends on the type of gauge specified.

4.5.2. **Spare Parts**

Accessory	Part Number	DFT/CD2					
		2	10	50	100	200	500
Load Cell Assy, 2 LB	SPK-DFT-065A	1	0	0	0	0	0
Load Cell Assy, 10 LB	SPK-DFT-065B	0	1	0	0	0	0
Load Cell Assy, 50 LB	SPK-DFT-065C	0	0	1	0	0	0
Load Cell Assy, 100 LB	SPK-DFT-065D	0	0	0	1	0	0
Load Cell Assy, 200 LB	SPK-DFT-065E	0	0	0	0	1	0
Load Cell Assy, 500 LB	SPK-DFT-065F	0	0	0	0	0	1
Battery Pack Assy	SPK-DFT-067	1	1	1	1	1	1
Keypad, DFT	SPK-DFT-063	1	1	1	1	1	1
Keypad, CD2	SPK-CD2-100	1	1	1	1	1	1
PC Board Assy	SPK-DFT-064	1	1	1	1	1	1
Lens	NC002355	1	1	1	1	1	1
Bottom Case Assy, DFT	SPK-DFT-070	1	1	1	1	1	1
Bottom Case Assy, CD2	SPK-CD2-103	1	1	1	1	1	1
Power Jack Cable Assy	SPK-FMG-066	1	1	1	1	1	1
12-Pin Cable Assy	SPK-FMG-071	1	1	1	1	1	1

4.5.3. **Mounting Kits**

Test Stand Model	2-Hole 100 LB or Less	4- Hole 200 LB
LTS	See Note 1	N/A
LTC	See Note 1	N/A
HTC	HTCK-2[2]	N/A
TCM 201	SPK-FM200-019[3]	SPK-FM200-018[3]
TCD 200	SPK-FM200-019[3]	SPK-FM200-018[3]
LF Plus	SPK/LFM/0003[4]	SPK/LFM/0003[4]

Notes:

1. Must remove Dowel Pin P/N 3256 from gauge adapter.
2. Must remove Dowel Pin P/N 3256 from HTCK-2 plate.
3. Included with test stand.
4. Adapter will come with test stand if specified when ordering LF Plus.

4.5.4. **Cables**

Cable	Description
NC000850-1	Connects DFT/CD2 Series Gauge to a personal computer with a 9-pin RS-232 connection
NC000652	Connects DFT/CD2 Series Gauge to a personal computer with a 25-pin RS-232 connection
NC000654	Connects DFT/CD2 Series Gauge to a Mitutoyo device with a 10-pin connection
NC000647	Connects DFT/CD2 Series Gauge to Chatillon model TCD Test Stand
ENC0125	Connects DFT/CD2 Series Gauge to Chatillon Model TCM201 Test Stand
NC000653	Connects DFT/CD2 Series Gauge to X-Y Recorder using a dual banana jack plug

4.6. **FIRMWARE UPGRADES**

The DFT/CD2 Series gauges feature a flash memory to facilitate field upgrades of the instrument firmware. Upgrade kits will be offered by AMETEK as new features are added to the instrument. The downloading of firmware from the upgrade kits will require the DFT/CD2 Series gauge to be connected to a personal computer. The DFT/CD2 series firmware upgrade kit part number is E80-716.

5. **PRODUCT WARRANTY**

This instrument is warranted against defects in workmanship, material and design for one (1) year from date of delivery to the extent that AMETEK will, at its sole option, repair or replace the instrument or any part thereof which is defective, provided, however, that this warranty shall not apply to instruments subjected to tampering or abuse, or exposed to highly corrosive conditions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED AND AMETEK HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. AMETEK SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, ANY ANTICIPATED OR LOSS PROFITS.

This warranty is voidable if the purchaser fails to follow any and all instructions, warnings, and cautions in the instrument's Instruction Manual.

If a manufacturing defect is found, AMETEK will replace or repair the instrument or replace any defective part thereof without charge; however, AMETEK's obligation hereunder does not include the cost of transportation which must be borne by the customer. AMETEK assumes no responsibility for damage in transit, and any claims for such damage should be presented to the carrier by the purchaser.

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