MULTITORQ™

TORQUE AND DATA ANALIZING SYSTEM

TECHNICAL MANUAL

OPERATION AND CALIBRATION INSTRUCTIONS

CDI *TORQUE PRODUCTS*

CONSOLIDATED DEVICES, INC.

CONTENTS

SAFETY WARNINGS AND CAUTIONS

1. Read this manual completely before using the MULTITORQ™ system.

2. Always wear safety goggles when applying torque to fasteners.

3. To ensure personal safety and prevent equipment damage, make sure that all components, including all sensors, adaptors, extensions, drivers and sockets are rated to match or exceed the torque you will be applying.

4. Observe all equipment, system and manufacturer's warning, cautions and procedures when using this meter.

5. Do not use this meter with power off. Always turn on the meter so the torque values are indicated on the display.

6. Use the pre-set alarm circuity to protect fasteners and sensors from an overload.

7. Do not press Zero-Tare while torque is applied.

8. To avoid damaging sensors:
   - Do not use a torque sensor to break fasteners loose.
   - Verify the calibration of any sensor whose capacity you know or suspect has been exceeded. (Display shows OVER when sensor capacity is exceeded.)
   - Check that the sensor's capacity matches or exceeds each application before proceeding.

9. For personal safety and to avoid sensor damage, follow good, professional tool practices when using drivers with sensors:
   - Use the correct size socket for the fastener.
   - Do not use sockets showing wear or cracks.
   - Replace fasteners with rounded corners.
   - Always pull (don't push) on a wrench handle, and adjust your stance to prevent a possible fall should something give. Do not use extensions, such as a pipe, on the handle of a wrench.
   - When using ratchets, make sure the direction lever is fully engaged in the correct position.

Introduction

The MULTITORQ™ portable electronic torque analizer displays torque readings from sensors that attach between sockets and driver. MULTITORQ™ is a highly versatile torque analizer/data acquisition system that can be used with sockets, extensions, universal joints, ratcheting drivers and any combination of these. Sensors, purchased separately, are available in 8 ranges from 2-20 in-oz, to 150-1500 ft-lb, and provide readings with an accuracy of better than 1 percent.

The torque analizer features a wide angle veiwing LCD display with selectable readouts in ft-lb, in-lb, in-oz, Nm, dNm, mkg and cmkg units, depending upon the sensor in use.

Torque analizer settings are entered on a push-button membrane keyboard. High and low torque limits are adjustable to give an audible and visual alarm. The user selects Track mode to display torque values as they are applied, or Peak mode to display the highest torque value applied.

The torque analizer stores and recalls up to 3500 readings and provides SPC statistical analysis output. Both RS-232 and Mitutoyo serial communication is available for printer and computer interfacing.

The torque analizer operates from an internal rechargeable NiCad battery or directly from a battery charger powered by the AC line. A sensor idle and display sleep mode conserve battery power.

Torque limits are indicated on dual LED and audible indicators. An audio output jack permits the use of head phones in a noisy environment. A belt clip on the back of the meter leaves both hands free when working portable.

The torque analizer and the optional sensors can be calibrated by the user with a known torque input. A special memory chip, built into the sensor, identifies the sensor's range and calibration parameters to any MULTITORQ™ torque analizer.

The meter is shipped with a low battery charge. The battery should be brought up to full charge (overnight) before the meter is used.
The information in this manual is general. CDI makes no claims as to the suitability of this information for diverse user applications.

Specifications

Torque Analizer

Display . . . . 4 Digit w/Alpha & Numerical Function Flags
Display Capacity* . . . . 4 Digits, 8,000 Counts
Accuracy . . +/- 1% of Reading (10 to 100% of Sensor Range)
. . +/- 2% with 201-O-MT and 101-I-MT Sensors
Push Button Key Pad . . . . Hi/Lo Alarm, Zero Tare,
Set-up, Units, Store/Recall/Clear,
Send, Statistics, Enter
Units of Measurement . . . . ft-lb, in-lb, in-oz,
Nm, dNm, mKg and cmKg

Operating Temperature . . . . 23 to 42ºC (40 to 110ºF)
Storage . . . . -20 to 50ºC (-2 to 122ºF)
Humidity . . . . Up to 90%, Non-condensing
Dimensions . . . . 3" Wide, 2.5" High, 6" Deep
(3" High with Belt Clip)
Weight . . . . 1 Pound
Charge Life (Full Charge to Shut-off) . . . 20 Hours Continuous
Battery Chargers. . . . . . . .120 VAC or 220 VAC (50-60Hz)
Output . . . . 9VDC, 200 mA.

Data Storage/Recall . . . . 3,500 Measurements
Serial Output Port . . . . RS-232 (True), 300 - 19.2K Baud,
and Mitutoyo (Statistical Protocol)
Statistical Analysis . . . . Max, Min, Range, Mean,
Sigma N, Sigma, Cp, Cpk,
%Error, -NoGo, +NoGo
Histogram: Lower Set Limit, Upper Set Limit, Divisions

* MULTITORQ display ignores torque inputs less than 0.5% of
full scale in Track mode and 2.0% of full scale in Peak mode.

Sensors

MULTITORQ™ Sensors provide industry standard square drives.
They feature a full bridge strain-gage @ 350 Ohms nominal.

Sensors use a built-in EEPROM memory chip that stores sensor
identification and calibration factors. Once a sensor is calibrated, it
retains its accuracy between all MULTITORQ™ Meters.

User calibration of sensors is possible given a known input torque
and the MULTITORQ™ torque analyzer Set-up function. Refer to
page 12 for Calibration Procedures.

Sensors can withstand an overload of 150% of full range. The
MULTITORQ™ torque analyzer will alarm, (audible beep and
display "OVER" flag) at 110 % of rated capacity.

Range	Part No.	Drive	Diam.	Length	Cable
2-20 in-oz*	201-O-MT	1/4 in	0.5 in	2.9 in	48 in
1-10 in-lb*	101-I-MT	1/4 in	0.7 in	2.9 in	48 in
5-50 in-lb	501-I-MT	1/4 in	0.9 in	2.1 in	48 in
20-200 in-lb	2001-I-MT	1/4 in	0.9 in	2.1 in	48 in
10 -100 ft-lb	1002-F-MT	3/8 in	1.2 in	2.4 in	48 in
25-250 ft-lb	2503-F-MT	1/2 in	1.4 in	2.6 in	48 in
60-600 ft-lb	6004-F-MT	3/4 in	2.0 in	3.9 in	96 in
150-1500 in-lb	15005-F-MT	1 in	2.4 in**	4.4 in	92 in***

  * Knurled Handle for Fingertip Control
  ** Diameter Does Not Include Side Mounted Connector
 *** Heavy Duty Coiled Cord with 4 pin MS style Sensor Connector

Sensor Ranges and (Resolutions) in Different Units of Torque Measurement

Part Number	Range	ft-lb	in-lb	in-oz	Nm	dNm	mKg	cmKg
201-O-MT	2-20 oz-in	.010-.104 (.001)	0.125-1.250 (.001)	2.00-20.00 (.02)	.014-.140 (.001)	.140-1.410 (.001)	.001-.014 (.001)	0.140-1.440 (.001)
101-I-MT	1-10 in-lb	.083-.830 (.001)	1.00-10.00 (.01)	16.0-160.0 (.1)	.110-1.130 (.001)	1.13-11.30 (.01)	.015-.115 (.001)	1.15-11.50 (.01)
501-I-MT	5-50 in-lb	.416-4.167 (.002)	5.00-50.00 (.02)	80.0-800.0 (.4)	.565-5.560 (.002)	5.65-56.50 (.02)	.057-.575 (.002)	5.76-57.60 (.02)
2001-I-MT	20-200 in-lb	1.67-16.67 (.01)	20-200 (.1)	320-3200 (1)	2.26-22.60 (.01)	22.6-226.0 (.1)	0.230-2.300 (.001)	23.0-230.0 (.1)
1002-F-MT	10-100 ft-lb	10.0-100.0 (.1)	120-1200 (1)		13.5-135.5 (.1)	135-1355 (1)	1.38-1.83 (.01)	138-1383 (1)
2503-F-MT	25-250 ft-lb	25.0-250.0 (.1)	300-3000 (2)		34.0-340.0 (.2)	340-3400 (2)	3.45-34.66 (.02)	345-3450 (2)
6004-F-MT	60-600 ft-lb	60.0-600.0 (.2)	720-7200 (3)		81.3-813.5 (.4)	813-8135 (4)	8.30-83.00 (.04)	830-8300 (4)
15005-F-MT	150-1500 ft-lb	150-1500 (1)			203-2035 (1)		20.7-207.5 (.1)	

Functional Description - DISPLAY

The 4 digit, .5 inch, wide angle LCD display shows applied torque in TRACK mode or the highest torque value captured in PEAK-hold mode. This display is also used for SETUP programming and to indicate functions and fault conditions

Display flags include: dNm, Nm, cmkg, mkg, in-oz, in-lb, and ft-lb units of measure, OVER torque alarm, LO BATT battery monitor, real time torque TRACK and captured PEAK modes.
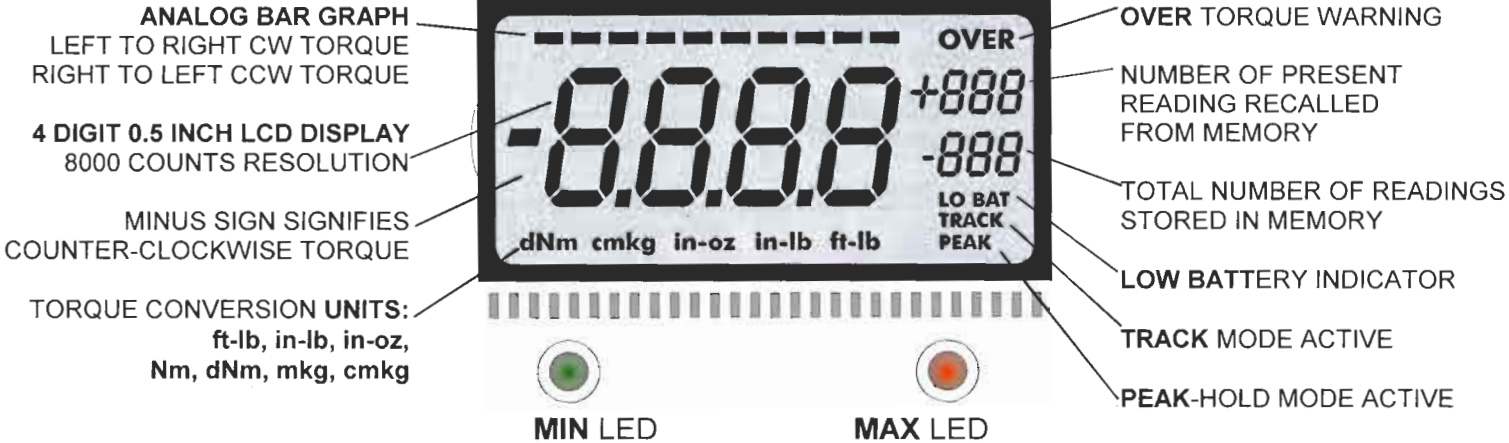
A small 3 digit display indicates the number of the present reading recalled from memory. Below it, another 3 digit display shows the total number of readings stored in memory. In the SET-UP mode, these displays indicate the UPPER (+) and LOWER (-) percentage values for ALARM preset, respectively.

A ten segment analog bar graph, scaled to the ALARM preset value, provides a live indication of applied torque. The graph moves left to right for CW and right to left for CCW torque inputs.

A green LED indicates at lease MINimum preset torque is presently applied and a red LED indicates MAXimum preset torque

WIDE ANGLE LIQUID CRYSTAL DISPLAY

ANALOG BAR GRAPH
LEFT TO RIGHT CW TORQUE
RIGHT TO LEFT CCW TORQUE

4 DIGIT 0.5 INCH LCD DISPLAY
8000 COUNTS RESOLUTION

MINUS SIGN SIGNIFIES
COUNTER-CLOCKWISE TORQUE

TORQUE CONVERSION **UNITS:**
ft-lb, in-lb, in-oz,
Nm, dNm, mkg, cmkg

OVER TORQUE WARNING

NUMBER OF PRESENT
READING RECALLED
FROM MEMORY

TOTAL NUMBER OF READINGS
STORED IN MEMORY

LOW BATTERY INDICATOR

TRACK MODE ACTIVE

PEAK-HOLD MODE ACTIVE

MIN LED   **MAX** LED

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Functional Description - KEY PAD

MEMBRANE KEY PAD

Power ON/OFF to and from sleep mode. (Battery Saver Switch on side of unit).

Select **UNITS** conversion: ft-lb, in-lb, in-oz Nm, dNm, cmkg, mkg

Manual **ZERO TARE**. Also momentarily displays present sensor range and preset limits. (Automatic Zero Tare at power on, from sleep mode, and at sensor change).

STORE present torque reading in memory and clear peak-hold display.

RECALL last torque reading from memory. Push ENTER to exit recall mode.

SEND data to serial port, RS-232 printer or Mitutoyo statistical printer. (Must be in Recall mode to SEND).

CLEAR last reading from display. To clear entire memory, push RECALL then push CLEAR twice.

Scroll **UP** increases numeric values and selects Track of Peak modes during Set-up programming.

SHIFT to next blinking digit or flag during Set-up programming.

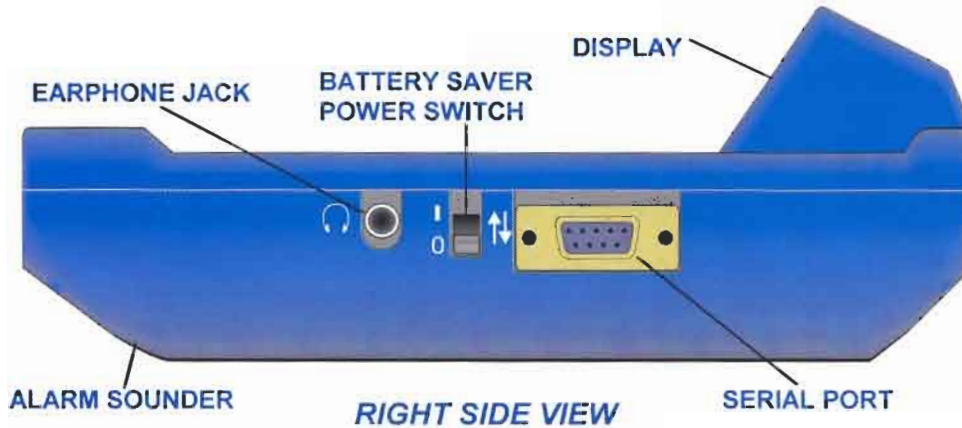**SET-UP** preset limits, printer port, and sensor calibration.

Sends all memory data, **STAT**istical analysis and histogram to RS-232 port.

ENTER program parameters during Set-up programming. Also used to exit Recall mode.

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Functional Description - Input/Output

END VIEW

RIGHT SIDE VIEW

Labels: EARPHONE JACK, BATTERY SAVER POWER SWITCH, DISPLAY, ALARM SOUNDER, SERIAL PORT, 9V DC, SENSOR, MADE IN U.S.A., CHARGER JACK, SENSOR CONN

BATTERY SAVER POWER SWITCH — Disconnects the rechargeable battery from the MULTITORQ™ circuit. At power-on, unit comes to life, self-checks and returns to last SET-UP parameters unless sensor has been changed.

INTERNAL MEMORY BACKUP BATTERY — (not shown) retains set-up and last memory data for up to 10 years.

EARPHONE JACK — 1/8 inch diameter stereo tip jack, provides two distinctive tones; a low tone at MIN preset torque input and a high tone at or above MAX torque input. (Does not disable the Alarm sounder when in use).

ALARM SOUNDER — Produces a distinctive 2KHz continuous tone at MIN preset torque input and a pulsating tone at or above MAX torque input. Also sounds momentarily at each key pad entry.
CHARGER JACK — Accepts 9VDC, 200 mA charger. May also be used on the bench as power supply from the AC line. (Center contact positive)

SERIAL PORT — Accepts DE9S subminiature 9-pin female connector. True RS-232 communication port. Configurable to computer and serial printer down loading of data list or statistical analysis with histogram. Also configurable to MITUTOYO statistical printer protocol.

SENSOR INPUT — Accepts DE9P subminiature 9-pin male connector. Sensors feature full bridge, 350 ohm, strain gages and built-in EEPROM memory chip for range identification and calibration. Sensor excitation is 6.0 volts DC. Gages are sampled 3 times/second in idle mode and 256 times/second when input exceed 1% of sensor range.

SET-UP Measurement Modes

When delivered, the MULTITORQ™ torque analizer is programmed to read torque in the TRACK mode. The preset limit is set to the installed sensor's full scale range and the MIN and MAX percentages are zero. If the torque analizer has been used before, it will return to the last SET-UP program including the torque data stored in memory, unless a different sensor is installed.

At power ON, the torque analyzer does a display check and self-test. It automatically identifies the installed sensor and sets its rated UNITS for display. The sensor full scale range is displayed for 2 seconds, then preset torque, upper limit percent and lower limit percent are displayed for 2 seconds. (With no sensor present the torque analyzer sounds a pulsating alarm and the display scrolls "no SEnSor.")

At power ON, or when changing sensors, the meter automatically sets ZERO TARE. It is important that no torque be applied to the sensor during start-up.

Using SET-UP to:

- Set Preset Torque.
- Set MAX torque as a percentage over preset torque.
- Set MIN torque as a percentage under preset torque.
- Select TRACK or PEAK modes.

Procedure:

1 Push SET UP key. The most significant digit (MSD) on the large numeric display will blink on and off.
2 Push the △ key to increment the MSD of the desired preset torque value. Be sure to consider decimal point location. (Push UNITS to change torque units.)
3 Push the ▷ key to shift right, to the next significant digit.
4 Repeat steps 2 and 3 for the last two digits. The 10's digit on the small upper numeric display will blink on and off.
5 Push the △ key to increment the 10's digit setting the desired MAX torque alarm as a percentage over the preset torque
6 Push the ▷ key to shift to the 1's digit.
7 Repeat steps 5 and 6. The 10's digit on the small lower numeric display will blink on and off.
8 Push the △ key to increment the 10's digit setting the MIN torque alarm as a percentage under the preset torque.
9 Push the ▷ key to shift to the 1's digit.
10 Repeat steps 8 and 9. The TRACK flag or PEAK flag will blink on and off.
11 Push the △ key to toggle between TRACK and PEAK flags.
12 Push ENTER to accept the Set-up program and return to torque measurement mode. (ENTER may be pushed any time

DISPLAY IN PRESET SET-UP MODE

TORQUE **PRESET** DIGITS

MAX TORQUE **PERCENT** OVER PRESET

MIN TORQUE **PERCENT** UNDER PRESET

TRACK / PEAK FLAGS

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SET-UP Printer Modes

When delivered, the MULTITORQ™ torque analizer is programmed to communicate with an RS232 serial printer or computer COM port. All data in memory, statistical analysis and a histogram including MAX and MIN preset limits are printed. The serial port can also be programmed to simply dump the stored torque values from memory. This is particularly handy for users wishing to crunch the data in a spreadsheet or database using a computer.

Alternatively, the torque analyzer can be programmed to communicate with a MITUTOYO statistical printer. This printer provides the same data list, statistical analysis and histogram.

At power ON, the torque analyzer recalls the last Set-up program.

Using SET-UP to:

- Select Printer Mode.
- Set Baud Rates for Printers.
- Set Carriage Return and Character Delays.

Procedure:

1 Push SET UP key and hold for 3 seconds. The display momentarily reads "COdE," then the most significant digit (MSD) on the large numeric display will blink on and off.
2 Using the △ key to increment digits and the ▷ key to shift to the next digit, program the number "2711" into display.
3 Push the ENTER key. (The small upper numeric display will read "P9" indicating printer select address code).
4 Using the △ key to increment digits and the ▷ key to shift

to the next digit, program the selected printer mode code:
 "0001" = RS232 - Data, Statisitcs, Hystogram Down Load
  "0002" = MITUTOYO Protocol
  "0004" = RS232 - Memory List Dump to Printer/Computer
5 Push the ENTER key. (The small upper numeric display will read "P10" indicating baud rate select address code).
6 Using the △ key to increment digits and the ▷ key to shift to the next digit, program the selected baud rate code:
  "0012" = 1200 Baud   "0096" = 9600 Baud
  "0024" = 2400 Baud   "0192" = 19.2K Baud
  "0048" = 4800 Baud
7 Push the ENTER key. (The small upper numeric display will read "P11" indicating carriage return delay address code).
8 Using the △ key to increment digits and the ▷ key to shift to the next digit, program carriage return delay in milliseconds. (default = "0600")
9 Push the ENTER key. (The small upper numeric display will read "P12" indicating character delay address code).
10 Using the △ key to increment digits and the ▷ key to shift to the next digit. Program character delay in milliseconds. (default = "0014")
11 Push the ENTER key to accept and end printer set-up.

DISPLAY IN PRINTER SET-UP MODE

PROGRAM CODES, BAUD RATE CODES, DELAY mSEC

PROGRAM ADDRESS INDICATOR
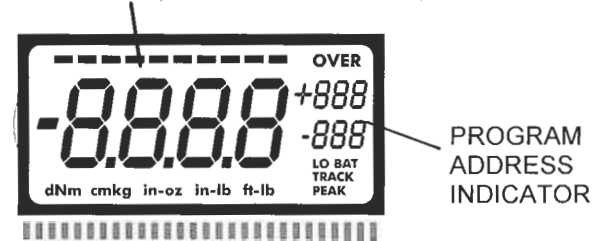
How to Measure Torque

Caution: If the display ever indicates OVER, discontinue torquing and verify the calibration of the sensor. (See Page 11)

Caution: Never push the ZERO TARE key with torque applied.

Caution: For best accuracy sockets should be attached directly to the sensor's male drive. If an extension is used, the extension should be installed between the sensor and the wrench — not between the sensor and the socket. See Fig.1

TRACK Mode

1. Select the desired torque sensor and connect it to the MULTITORQ™ torque analizer.
2. Turn ON the torque analizer using the power switch located on the right side. If the power switch is already ON, push the ON/OFF key to wake up the torque analizer from sleep mode.
3. If the display indicates PEAK mode, refer to SET-UP programming on page 7 to change to TRACK mode.
4. Using the UNITS key, select the desired units of measure.
5. Applied torque is read in real time on the large 4 digit numeric display.
6. The torque analizer will sound a continuous tone and the MIN (Green) LED will light when torque input reaches the lower preset value, (preset minus percent tollerance.)
7. The meter will sound a pulsating tone and the MAX (Red) LED will light when torque input reaches the upper preset value, (preset plus percent tollerance.)

To change the preset value and MIN-MAX, (upper and lower percentage tollerances), refer to SET-UP on page 7.

PEAK-HOLD Mode

1. Select the desired torque sensor and connect it to the MULTITORQ™ torque analizer.
2. Turn ON the torque analizer using the power switch located on the right side. If the power switch is already ON, push the ON/OFF key to wake up the meter from sleep mode.
3. If the display indicates TRACK mode, refer to SET-UP programming on page 7 to change to PEAK mode.
4. Using the UNITS key, select the desired units of measure.
5. Applied torque is captured and held on the large 4 digit numeric display. The reading will increase if additional torque is applied.
6. The torque analizer will sound a continuous tone and the MIN (Green) LED will light when torque input reaches the lower preset value, (preset minus percent tollerance.)
7. The torque analizer will sound a pulsating tone and the MAX (Red) LED will light when torque input reaches the upper preset value, (preset plus percent tollerance.)
8. To clear the display push the CLEAR key.

To change the preset value and MIN-MAX, (upper and lower percentage tollerances), refer to SET-UP on page 7.
The torque analizer will go into sleep mode if idle for 5 minutes.
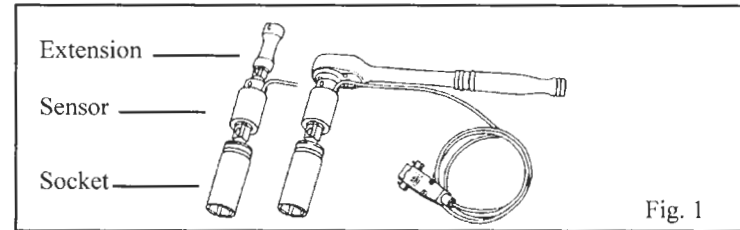

Extension ———

Sensor ———

Socket ———

Fig. 1

A CORRECT DRIVER - SENSOR - SOCKET RELATIONSHIP :
Sensors should always be next to the socket. If an extension were used , the extension would go between the sensor and the ratchet (driver) - Not between the sensor and the socket.

STORE AND RECALL Readings in Memory

To store a reading in TRACK mode, push the STORE key while torque is being applied. The number of each stored reading is displayed in the small upper numeric display.

To store a reading in PEAK-HOLD mode, push the STORE key after the torque reading has been captured. The display will automatically clear for the next reading.

To display previously stored readings, push the RECALL key. Continue to push RECALL to decrement from last reading to first. (The number of the displayed torque reading is indicated in the small upper numeric display). Push ENTER to exit recall mode.

To clear the entire memory in recall mode push the CLEAR key twice within one second. Push ENTER to exit recall mode.

DOWN LOADING - Printer or Computer

Refer to SET-UP Printer Modes on Page 8.

Connect the RS232 printer cable between the MULTITORQ™ torque analizer serial port and the serial printer or computer com port.

Note: To generate a compete statistical report, both high and low (MIN and MAX) preset levels must be programmed into the meter. Refer to SET-UP Measurements Mode on page 7.

STATISTICAL Down Load to Printer

1   Push STAT key. Display will momentarily indicate "CALC" and then "SEnd" during down load to the printer.

DATA LIST Down Load to Printer

1   Push RECALL key.
2   Push SEND key. Display will indicate "SEnd" during down load to the printer.

DATA LIST Down Load to Computer

Set up the computer to receive serial communication. Example: using an IBM compatible and Windows '95, open up Terminal program, click on "START," click on "RUN," and type "TERMINAL," then <ENTER>.

1   Push RECALL key.
2   Push SEND key. Display will indicate "SEnd" during down load to the computer.

On the example computer, click on "EDIT," "SELECT ALL," "COPY." Open the spreadsheet, click on "EDIT," "PASTE."

MITUTOYO Printer Interface

1   On Mitutoyo, press CLEAR then TOL LIMIT keys.
2   On Multitorq, push SET-UP key then SEND key.
3   On Mitutoyo, pressTOL LIMIT key again.
4   On Multitorq, push ENTER key, (to exit Set-up).
5   On Multitorq, push RECALL then SEND keys. Display will indicate "SEnd" during down load to the Mitutoyo printer.
6   ON Mitutoyo, press STAT key. Printer will generate statistical data list, analysis and histogram.

Calibration

Equipment Required:

- Torque Tester, accurate to 1/4% of reading, or a precision test bar and certified calibration weights.

QUICK CHECK

1 With the MULTITORQ™ torque analizer in the TRACK mode, (refer to page 7), apply a known torque that is 10% of sensor rating in the CW direction.
2 Verify the display reading is within +/-1% of the applied torque.
3 Apply about 70% of sensor rating and verify the reading is withing +/-1%.
4 Repeat both checks in the CCW direction. If any reading is out of specification proceed to Sensor Calibration below:

SENSOR CALIBRATION

1 Install the sensor to be calibrated and turn ON the MULTITORQ™ torque analizer.
2 Push SETUP key and hold for three seconds.
3 Program calibration code "**5251**" into the display using the △ increment key and the ▷ shift keys.
4 Push ENTER key. The small upper display reads "CAL" and the lower display reads "FS."
5 Push UNITS key to match units on sensor label.
6 Program full scale value of sensor into the display using△ increment key and ▷ shift keys.
7 Push ENTER key. Display now reads "LoAd." The small

upper display also reads "CAL."
8 Apply clockwise (CW) torque to the sensor until the MULTITORQ alarm indicates sufficient input exercise.
9 Remove torque completely by placing the sensor flat on bench. Display now shows alternating "-00-" and "0—0."
10 Push ZERO TARE key. The torque analizer automatically adjusts for any residual zero offset. Display now reads 10% of the sensor's rated capacity with MSD blinking. Small lower display reads "1."
11 Apply 10% of the sensor's rated capacity in CW torque.
12 Push ENTER key. The display will read approximately "0400" during a count down sequence of 9 to 1 as indicated on the small lower numeric display. Used during factory calibration, this allows a visual check on the Multitorq's internal analog-to-digital (A/D) converter. The display momemtarily reads "O|-" (OK) or an error code indicative of a bad sensor EEPROM, connector, etc. The display then reads 70% percent of the sensor's rated capacity with MSD blinking..
13 Apply 70% of the sensor's rated capacity in CW torque.
14 Push ENTER key. Display will read approximately "3000" A/D counts during count down as explained in step 12 above.
15 Push SETUP key and hold for three seconds.
16 Program calibration code "**5252**" into the display using the△ increment key and the ▷ shift keys.
17 Push ENTER key. The small upper display reads "CAL" and the lower display reads "FS."
18 Program full scale value of sensor into the display using△ increment key and ▷ shift keys.
19 Push ENTER key. Display now reads "LoAd." The small upper display also reads "CAL."

20 Apply counter-clockwise (CCW) torque to the sensor until the alarm sounds, indicating sufficient input exercise.
21 Remove torque completely by placing the sensor flat on bench. Display now shows alternating "-00-" and "0—0."
22 Push ZERO TARE key. The torque analizer automatically adjusts for any residual zero offset. Display now reads -10% of the sensor's rated capacity with MSD is blinking. Small lower display reads "-1."
23 Apply 10% of the sensor's rated capacity in CCW torque.
24 Push ENTER key. The display will read approximately "-0400" during a count down sequence of 9 to 1 as explained in step 12 above. The display reads "O|-" (OK) or an error code indicative of a bad sensor EEPROM, connector, etc. The display then reads -70% percent of the sensor's rated capacity with MSD is blinking.
25 Apply 70% of the sensor's rated capacity in CCW torque.
26 Push ENTER key. Display will read approximately "-3000" A/D counts during count down as explained in step 12 above.

Accesories

	Part Number
MULTITORQ™ TORQUE AND DATA ANALIZER	1600-MT

NOTE : *MULTITORQ 1600-MT INCLUDES THE POWER PACK P115-30 AND THE CARRY CASE 1600-50*

Sensors:

Range	Drive	Diam.	Length	Cable	
2-20 in-oz*	1/4 in	0.5 in	2.9 in	48 in	201-O-MT
1-10 in-lb*	1/4 in	0.7 in	2.9 in	48 in	101-I-MT
5-50 in-lb	1/4 in	0.9 in	2.1 in	48 in	501-I-MT
20-200 in-lb	1/4 in	0.9 in	2.1 in	48 in	2001-I-MT
10 -100 ft-lb	3/8 in	1.2 in	2.4 in	48 in	1002-F-MT
25-250 ft-lb	1/2 in	1.4 in	2.6 in	48 in	2503-F-MT
60-600 ft-lb	3/4 in	2.0 in	3.9 in	96 in	6004-F-MT
150-1500 in-lb	1 in	2.4 in**	4.4 in	92 in***	15005-F-MT

  * Knurled Handle for Fingertip Control
 ** Diameter Does Not Include Side Mounted Connector
*** Heavy Duty Coiled Cord with 4 pin MS style Sensor
    Connector

Power Packs (Charger)

	Part Number
120 VAC to 9VDC @ 200 mA	P115 - 30
220 VAC to 9VDC @ 200 mA (GERMANY)	82 - 68
220 VAC to 9VDC @ 200 mA (AUSTRALIA & ENGLAND)	82 - 66

Head Phones

	Part Number
Dual Headset with 1/8 inch Stereo Plug.	1600 - 30

Interface Cable

	Part Number
RS-232 Serial Printer Cable	1600 - 10
RS-232 P.C.	1600 - 20

Carry Case

	Part Number
High Impact Plastic w/Foam Inserts	1600 - 50

CDI Serivce and Calibration Centers

Consolidated Devices Inc. (CDI)
19220 San Jose Ave.
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CDI TORQUE PRODUCTS

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