

**STRENGTH DYNAMOMETER
MODEL CSD 300
OPERATIONS MANUAL**

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A. General Information

The Chatillon Model CSD300 Strength Dynamometer is a rugged electronic instrument which provides an economical means for measuring human muscle performance up to 500 lb. force. It is suitable for use in Physical, Occupational, Rehabilitation and Sports Medicine or any other patient assessment application where average or peak muscle strength quantification is required. It is also designed for use in Job Task Analyses in a variety of applications that require measured data. Its portability offers versatility in both clinic and field environments.

The CSD300 is supplied with a variety of attachments for both push and pull testing. The rubber padded push attachments are normally used for manual muscle strength testing while the other metal push attachments are designed for job task analysis. Care should be exercised so as not to produce excessive side loading during installation of the attachments which could damage the instrument.

An 8 inch extension rod is included to improve access to hard to reach push or pull points. Two (2) detachable handles and two snap hooks are also provided to facilitate pulling and lifting assessments. The handles may be used in push tests as long as precautions are taken to ensure stabilization of the dynamometer body and/or attachment at the point where the force is applied. Any slippage due to a patient's push effort may cause the dynamometer to rotate about the centerline of the handles. A resulting impact may damage the instrument itself, requiring factory service.

Custom fixtures may be mounted on the dynamometer by utilizing the threaded end of the dynamometer shaft which is a $\frac{5}{16}$ -18 male thread, $\frac{3}{8}$ " long. The CSD300 can accommodate attachment weights up to a maximum of 50 lb. when the instrument is used in a vertical position. Any fixture weight that exceeds this "tare" capacity will reduce the net capacity of the dynamometer. (Example: a fixture weighing 60 lb. attached to the CSD300 will reduce the dynamometer net capacity to 490 lb.)

When used in a horizontal position the fixture weight should not exceed approximately 5 lb. The resulting side load may effect the accuracy of the readings.

Four (4) threaded holes ($\frac{1}{4}$ -20 thread x $\frac{7}{8}$ " deep) are provided at the rear corners of the dynamometer for applications where rigid mounting may be required.

Battery Power/AC Adapter

The dynamometer is powered by a rechargeable Nicad battery. Since Nicad batteries will discharge while not in use, it may be necessary to recharge the unit when it has not been used for a while. A "BATT" indicator on the display indicates a limited amount of time is remaining (approximately 1/2 hour) before the battery requires recharging. Two battery chargers are available, one for 115 Vac and one for 220 Vac. To charge the dynamometer battery, plug the accompanying charger into a proper voltage source and insert the charger jack into the receptacle on the end of the gauge. Charge the battery for 12-14 hours, which will yield approximately 8 hours of continuous operation. (The battery can be recharged more than 500 times.)

NOTE: Do not use a charger other than the one supplied with the gauge. The charger is specially designed to prevent overcharge, which could damage the battery. The gauge can also be operated continuously with the charger connected.

B. Operating Features

Either pushing or pulling forces may be applied to the dynamometer shaft. The instrument is preprogrammed to perform a 5 second test. The microprocessor internally monitors the instantaneous forces and stores the maximum value that occurs during the 5 seconds in memory. During the last 3 seconds of the test, the microprocessor averages the instantaneous readings and stores this value in memory also. The results of 5 repetitions may be stored in memory before the data must be transcribed or sent to a peripheral computer, printer or other compatible device.

After the second test, the microprocessor computes the coefficient of variation and the percent difference trial to trial. These values are also stored in memory.

After completion of a series of tests, the results may be recalled and shown on the LCD display for review. In addition, push readings are indicated by a "C" or "C PEAK" (Compression) and pull readings are indicated by a "T" or "T PEAK" (Tension) on the display.

C. Key Functions

The instrument is controlled by a two position ON/ OFF switch on the side of the case and a seven key keypad:

TEST – places the instrument in the test mode. The display indicates the number of test results currently in memory, such as 0, 1, etc.

MEAN – press "MEAN" once to recall the mean value from the last test. Press "MEAN" again to display the number of test results in memory. Each subsequent press of "MEAN" steps through the mean values in the order stored.

PEAK – press "PEAK" once to recall the peak value from the last test. Press "PEAK" again to display the number of test results in memory. Each subsequent press of "PEAK" steps through the peak values in the order stored.

CV – press "CV" once to recall the coefficient of variation computed for the completed tests. Press once more to display the number of test results stored in memory.

% – press "%" once to recall the percent difference between "PEAK" for the last two trials. Press once more to display the number of test results stored in memory.

RESET – press "RESET" to clear the memory and prepare for another series of tests. A single press of "RESET" clears all of the memory registers, MEAN, PEAK, CV and %.

SEND – Send or transmit data to a peripheral computer or printer through the bidirectional RS-232 port.

D. Units of Operation

The instrument is designed to operate in any one of three systems of units, LB (pounds force), KG (kilograms force) or N (Newtons). The instrument is factory set to operate in pounds force. If operation in one of the other available systems of units is required, proceed as follows:

1. Turn the instrument OFF.
2. Press and hold "TEST" then turn the instrument ON and continue to hold "TEST" for 2 seconds. Release "TEST". The display will show "0". If "0" is flashing, the instrument will display the test results in pounds force. To continue to operate in pounds force, press "SEND".
3. To select kilograms force, press "CV" once. The display will show "1". Then press "SEND".
4. To select Newtons, press "CV" once more, then press "SEND".

E. Operating Procedure

1. Mount the appropriate attachment on the dynamometer shaft. Be sure to thread the attachment all the way on until it is finger tight against the shoulder on the shaft. Install the handles in the side holes of the casing as required.
2. When the patient and dynamometer are in position for the first test, press "TEST" to enter the test mode. The display will show "0".
3. Instruct the patient to apply force in accordance with the assessment procedure. When a threshold force of 16 lb. is reached, the internal clock will start the 5 second test period. During the first test, the display will show "1 1". At the end of the 5 second test period the display will show "1 1 1 1" indicating the completion of the 5 second test. The first "MEAN" and "PEAK" test results may be recalled by pressing the appropriate keys.
4. Prepare for the next assessment. When the patient and dynamometer are in position for the second test, press "TEST" to enter the test mode. The display will show "1" indicating that one set of data is already in memory.

NOTE: Prior to each subsequent test, check that the attachment is still secure against the shoulder on the shaft.

5. Instruct the patient to apply force in accordance with the assessment procedure. When a threshold force of 16 lb. is reached, the internal clock will start the 5 second test period. During the second test, the display will show "2 2". At the end of the 5 second test period the display will show "2 2 2 2" indicating completion of the 5 second test. The MEAN and PEAK test results may be recalled by pressing the appropriate keys. The CV and % Difference may also be recalled from memory.
6. Repeat the above sequence until the desired number of trials are completed. (A maximum of five trials may be completed before the data must be transcribed or sent to a peripheral device.)
7. When the data has been recorded, press "RESET" to clear the memory and prepare for another series of tests.

F. Setting Data Transmission Parameters

The Chatillon Hand-Held Dynamometers can be connected to a peripheral device with an RS-232 port to automatically store or print the collected data. The data transmission parameters of our instrument must be set to match the peripheral device. The display will show the transmission parameters in the following sequence:

Baud rate	19.20	= 19,200
	9600	^{note 1}
	4800	
	2400	
	1200	
	600	
	300	
Units	0 1	^{note 1} = Transmit data with units (i.e. 219.6 lb)
	0 2	= Transmit data only (i.e. 219.6)
Data & stop bits	7-2	^{note 1} = Seven data bits & two stop bits
	8-1	= Eight data bits & one stop bit
Parity	EP	= Even parity (1)
	-P	^{note 1} = No parity

(note 1: Factory settings)

To set the transmission parameters proceed as follows:

1. Start with the dynamometer "OFF".
2. Depress and hold "SEND" then turn the unit "ON" but continue to hold "SEND" for 3 seconds. The display will show 19.20 indicating that you are in the proper mode. If the display is flashing, this indicates the currently programmed parameter.
3. To select the parameter shown, depress "SEND".
4. To step through the available selections, depress "MEAN".
5. Depress "SEND" when the desired parameter is displayed.
6. Depressing "SEND" causes the display to move to the next parameter. After the last parameter is selected, depressing "SEND" will cause the display show "ON".
7. If you miss the desired transmission parameter turn the dynamometer "OFF" and repeat steps 2 thru 6.

Sample readout

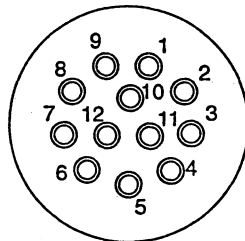
5	Data
0088.5	lb
0078.5	lb
0086.8	lb
0087.0	lb
0071.5	lb
Peak Data	
0087.0	lb
0088.5	lb
0093.0	lb
0090.0	lb
0077.0	lb
% Diff.	
002.5	
009.8	
000.9	
017.6	
C =	007.7

G. Interconnecting Cable Setup

The CSD300 is supplied with a 12-pin female connector on the unit to provide both digital and analog output. Assemble a cable as required to connect the CSD to the peripheral device. The pin-outs for the output on the dynamometer are:

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
4-10	-	-	NOT CONNECTED	
11	-	-	ANALOG	GND ANALOG GROUND
12	-	O	ANALOG SIG	ANALOG OUTPUT

CSD I/O Pin-out Mating Connector



(viewed from solder side)

Chatillon Part No. NC000285

H. Troubleshooting

SYMPTOM	PROBLEM	REMEDY
Display blank; will not respond to keypad.	Battery discharged or at end of life (over 500 charges).	Charge battery or replace if necessary. (See page 2)
Dynamometer displays digits or dashes (- - - -), but otherwise will not respond to keypad or applied force.	Indicates damage to load cell or other internal electronic problem.	Consult Chatillon
"BATT" displayed in upper right corner of display.	Indicates battery power is low.	Recharge battery. (See Page 2)
"EEEE" momentarily displayed when "TEST" is depressed.	Test data memory is full.	Transcribe data then depress "RESET" to clear memory for the next series of tests.
Test data will not transmit to peripheral device via RS-232 interface.	Transmission parameters not matched to peripheral device.	Program transmission parameters to match peripheral device. (See section F.)
	OR Faulty cable.	Check cable for broken or loose wires and proper pin connections. (See section G.)

I. Calibration Check Procedure

Chatillon recommends a calibration check no less than once every six months. Certain patient assessment applications and heavy usage may dictate more frequent checking. Unless the dynamometer is abused it should hold factory calibration within the rated tolerance over a long period of time.

Noted below is the recommended calibration check procedure. If the check shows an out of tolerance condition, return the instrument to Chatillon for factory service.

Equipment required: Rigid vertical mount for the dynamometer

Calibrated weights to 500 lb. total.

Weights in increments of 100 lb. should be used to check mid-range readings. Calibrated weights traceable to National Institute of Standards & Technology (NIST) are recommended.

Dynamometer hook and handles.

The calibration check mount should be similar in design to that shown in Figure 1 (See page 9).

This type of support permits self alignment of the dynamometer when the check weights are applied. Horizontal alignment of the radiused slots that support the dynamometer handles is critical in order to eliminate reading error induced by side loading. The vertical legs of the fixture should support the handles near the dynamometer body, allowing minimal clearance for self alignment when weight is applied. The entire calibration mount fixture should be free from any vibration.

1. Attach the large snap hook to the dynamometer shaft. Install the side handles and position the dynamometer in the mount with the hook down.
2. The dynamometer should be "exercised" three (3) times from zero to full capacity of 500 lb. and return to ensure stable and repeatable readings.
3. With no load on the dynamometer, clear the memory by pressing "RESET".
4. Suspend the first 100 lb. weight from the dynamometer hook. Allow the instrument to stabilize then press "TEST". Wait at least 5 seconds then add each additional 100 lb. weight, up to 500 lb, one at a time and in the same manner. Be sure to press "TEST" after each weight is added.
5. Remove the weights and then recall the reading at each increment by pressing "MEAN" to step through the readings.
6. Invert the dynamometer so that the load shaft faces up. Remove the hook and replace it with a compression test fixture.
7. Then repeat steps 2 thru 5. All readings should be within the rated tolerance of ± 1 lb.

If any of the initial readings are out of tolerance, the check should be repeated to determine whether or not the error was induced by vibration or some other cause.

NOTE: CONSULT CHATILLON IF THE FORCE READINGS ARE OUTSIDE THE RATED TOLERANCE. THE DYNAMOMETER REQUIRES RECALIBRATION.

J. Specifications

CAPACITY: 500 lb. force

ACCURACY: ± 1 lb.

TARE CAPACITY (Maximum Fixture Weight): 50 lb

WEIGHTS: Dynamometer with Handles: 3 lb. Complete with Carrying Case: 11 lb

THREAD SIZES: Shaft: $\frac{5}{16}$ -18 X $\frac{3}{8}$ " Long Male

Rear Mounting: $\frac{1}{4}$ -20 X $\frac{1}{2}$ " Deep Female, (4 places)

NOTE: The dynamometers are capable of measuring up to 110% of their rated capacities. This "extra" capacity is provided in order to accommodate fixture weight. Any fixture weight which exceeds the tare capacity will reduce the net capacity of the dynamometer. (Example: A fixture weighing 60 lb. attached to the CSD 300 would reduce the dynamometer's capacity to 490 lb.)

STANDARD ACCESSORIES:

QTY	ITEM	P/N
1pr	Handles (1" dia.)	CSDK1
1ea	Disc ($\frac{3}{4}$ " dia. hard rubber)	NC000751-2
1ea	Disc ($\frac{3}{4}$ " dia. soft rubber)	NC000751-1
1ea	Small rectangular push ($\frac{5}{8}$ " X $\frac{3}{4}$ ")	NC000738-1
1ea	Large rectangular push (3 $\frac{1}{2}$ " X $\frac{3}{4}$ ")	NC000730-1
1ea	Curved push attachment	NC000737-1
1ea	Large snap hook	NC000756
1ea	Medium V-notch ($\frac{5}{8}$ " dia.)	NC000721
1ea	Large V-notch (1" dia.)	NC000725
1ea	Extension ($\frac{1}{2}$ " dia.)	13047
1ea	Pistol grip	20012-1
1ea	Knurled nut ($\frac{5}{16}$ -18 thread)	NC000857
1ea	Allen wrench ($\frac{5}{32}$ ")	NC000846

K. Maintenance

Under normal operating conditions, the CSD300 should not require maintenance except for periodic calibration checks. If any foreign material should get inside the dynamometer casing, it may be removed by access through the split case. The case should not be opened for any other reason.

Please contact Chatillon for calibration and service.