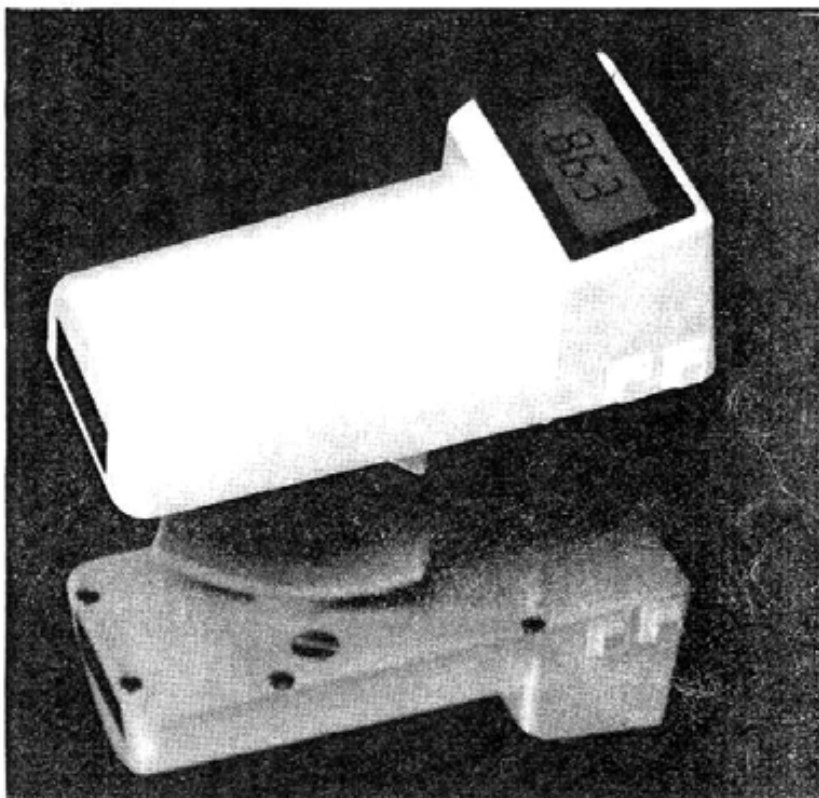




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## INSTRUCTION MANUAL

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NICHOLAS MANUAL MUSCLE TESTER  
Model 01160



NICHOLAS MANUAL MUSCLE TESTER  
Model 01160

**CONTENTS**

The Model 01160 includes:

- One - Nicholas Manual Muscle Tester
- One - Protective Carrying Case
- One - Examiner's Force Test Support
- One - Carrying case shoulder strap
- One - Flat Blade Screwdriver

# **NICHOLAS MANUAL MUSCLE TESTER**

by Lafayette Instrument Company

Model 01160

## **INSTRUCTIONS**

The Nicholas Manual Muscle Tester (MMT) was originally conceived by Dr. James A. Nicholas of Lenox Hill Hospital in New York City. The MMT is a hand-held device for objectively quantifying eccentric muscle strength. Using the Nicholas MMT, the peak force required to break an isometric contraction is measured as the examiner applies force against the subject. The MMT readily lends itself to large, pre-participation screenings or field examinations where bulky, more expensive systems do not. The Nicholas MMT is the only easily administered strength measuring device available to the clinician, trainer and coach.

Dr. Nicholas and the professional staff of Lenox Hill Hospital have dedicated over ten years of research to develop and validate the patented features now found in the new Nicholas MMT. Lightweight, the MMT is small enough to be held in one hand and easily read. A specially designed load cell eliminates errors due to non-perpendicular loading within the normal angles of force application. The MMT features digital accuracy and ranges from 0.0 to 199.9 kilograms, equivalent to approximately 440 pounds. This range will allow testing of most major muscle groups. The size and weight of the MMT permit the examiner to use the same procedures and break test techniques (described in the literature) without any modification of technique or positioning. The unit is simply placed between the examiner's hand and the limb being tested. The examiner's downward force is transmitted to the limb through the MMT unit. Research indicates that manual muscle tests obtained from the same patient by different examiners using the MMT are not significantly different. (9)

### **DESCRIPTION**

The Nicholas MMT has the following features:

Easy to Read:	LCD display shows peak force output in kilograms
Maximum Force:	0 - 199.9 Kilos
Easy to Use:	Tapered case is designed to fit any hand
Digital Accuracy:	Up to +/- 0.5 percent of full scale
Built-in Peak Freeze:	Displays the maximal recording achieved during each test

### **SPECIFICATIONS**

Size: 6 1/4" x 2 1/8" x 3"

Weight: 21 ounces

Range: 0.0 - 199.9 kilograms

Accuracy: Up to +/- 0.5 percent of full scale

Sensitivity: 0.1 kilogram

Length of Operation: 55 hours, battery powered

Recommended Battery: 9-volt alkaline battery

### **PRECAUTIONS**

- 1) When performing repeated trials, inconsistent placement of the MMT will affect scores
- 2) Extreme temperature, especially heat, may affect the values obtained
- 3) The MMT cannot tolerate the stress of being used as a floor scale
- 4) Care should be taken not to drop the MMT, or it may affect the calibration

Figure 1

FRONT VIEW

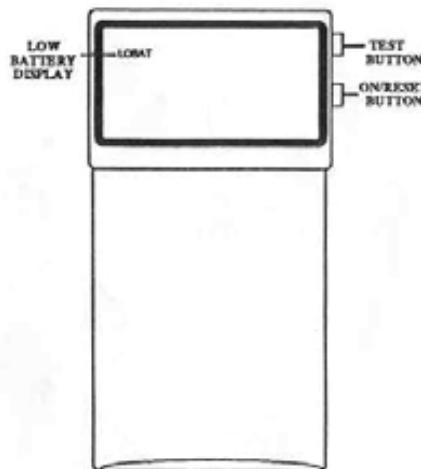
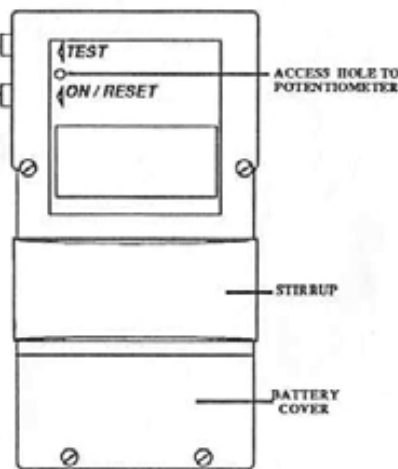


Figure 2

BACK VIEW



### USING THE NICHOLAS MMT

**On/Reset Button:** Turns MMT power on and resets display to zero. After each test, hold this button down until display resets to zero. Note: If display does not reset to zero: 1) hold reset button in for 30 seconds to ensure that the electronics have warmed up; 2) see Adjusting the "Reset" Value.

**Test Button:** Depress button until display reading stabilizes. This provides a built-in self-check mechanism of the electronics. A reading greater than  $\pm 5.0$  kg from 50 kg should be checked with a call to our factory.

**"LOBAT" Display:** Tells operator that battery needs replacement. (See Figure 1)

**Automatic Shut-off:** The MMT shuts itself off after 60 seconds of non-use, eliminating excessive battery drain.

**Battery Replacement:** Simply remove bottom two screws on back of unit. (See Figure 2)

**Calibration Procedures:** Can only be done at the factory. We use certified, electronic instrumentation to apply full-scale pressure.

**Adjusting the "Reset" Value:** This may be necessary due to fluctuations in temperature which affect the electronic strain gauges. An access hole for the potentiometer which adjusts the "reset" value is located on the back of the MMT in the label area. (See Figure 2)

Turning the potentiometer with a small-sized, flat-blade screwdriver will change the "reset" value. For your convenience, a screwdriver has been placed under the foam in the bottom of the carrying case. It is important to turn the potentiometer slowly as it is sensitive and only a slight adjustment may be necessary. Hold the reset button in for 30 seconds before making any adjustments to make sure the electronics are warm. If after 30 seconds the "reset" value is greater than zero, turn the potentiometer very slightly in a clockwise direction to decrease the "reset" value. (A counterclockwise direction increases the "reset" value.) Then, check the "reset" value again by depressing the reset button. Repeat this procedure until display reaches zero.

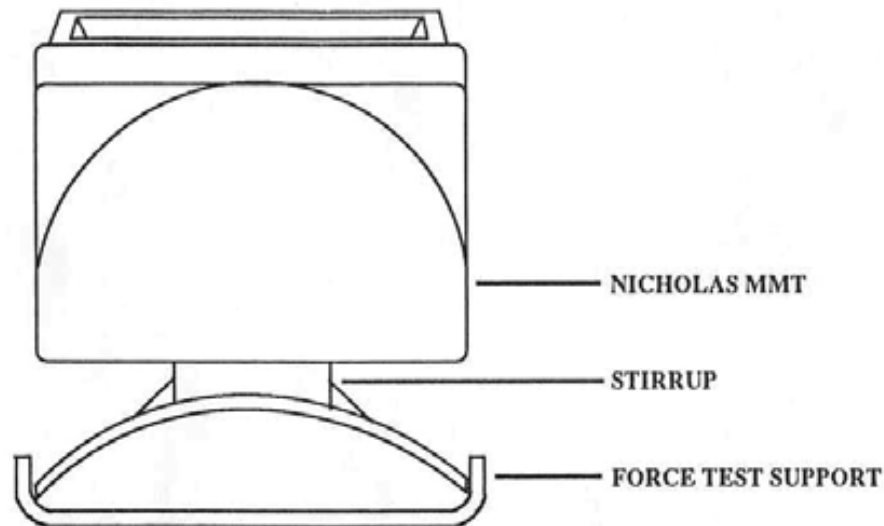
**CAUTION:** The display cannot show a negative number. Therefore, if the potentiometer is turned past zero, forces in the 0.5 kg. range will read zero. It is important, therefore, to turn the potentiometer in very small increments and recheck the "reset" value after each adjustment. After adjusting the "reset" value to zero, put a light force on the stirrup of the MMT. If the display still reads zero, the potentiometer has been turned past zero into the negative range. Adjust the "reset" value in the positive direction by turning the potentiometer in a counterclockwise direction.

**Serial Number:** Located inside, on the back of the battery cover.

**Warranty:** Lafayette Instrument Company guarantees all new equipment against defects in materials and workmanship to the original purchaser for a period of one (1) year from the date of shipment, unless otherwise stated. During this period, Lafayette Instrument Company will repair or replace, at its option, any items found to be defective. This warranty does not extend to damage resulting from alteration, misuse, neglect, normal wear and tear, or accident. Warranty also does not cover battery replacement. Please check your battery before returning this instrument for repair.

**Service:** Please call Lafayette Instrument Company toll-free at 1-800-428-7545 if you have any questions regarding the use of this equipment or for a Return Authorization Number if you need repairs.

*Figure 3*  
END VIEW



#### **EXAMINER'S FORCE TEST**

When the subject is stronger than the examiner in the position tested, unreliable impressions of strength will occur. It is difficult to detect weakness because the subject's deficit may be well above the examiner's maximum strength. Therefore, prior to any testing or evaluation using the Nicholas MMT, the examiner should identify the extent of his or her strength measurement capabilities. The examiner determines the maximum force he or she can generate with one hand, then with two hands, by pushing the MMT against the Examiner's Force Test Support. The Force Test Support protects the stirrup of the MMT from excessive flexion. When testing the examiner's strength, care should be taken to apply force the same way it will be applied to the subject. (See Figure 3)

## **MANUAL MUSCLE TEST PROCEDURE - KENDALL METHOD**

Each test is performed in a similar manner. The subject raises the limb to the specified height and maximally resists the examiner's efforts to depress it. The examiner places the MMT between his hand and the subject's limb, taking care not to grasp the stirrup of the MMT. A downward force is gradually applied over one second to allow the subject to adjust and recruit the maximum amount of muscle fibers. The examiner applies additional force until the muscle contraction begins to break and the limb begins to lower. Further force is applied to completely lower the limb, ending the test before the limb touches the surface of the table or chair. The subject should be instructed that the test is over when the limb has been lowered. This prevents a "rebounding" of the limb when the examiner releases the pressure. Impacting, which results from the examiner continuing to apply force after the limb has been lowered, is a major source of error. In tests lasting no longer than 3 seconds, the peak force achieved is most likely the maximum strength effort for that motion. (1)

The following tests have been found to be excellent gauges of proximal limb strength by Dr. Nicholas (references attached) and are quite often revealing in terms of undetected weaknesses resulting from previous injury or inadequate rehabilitation.



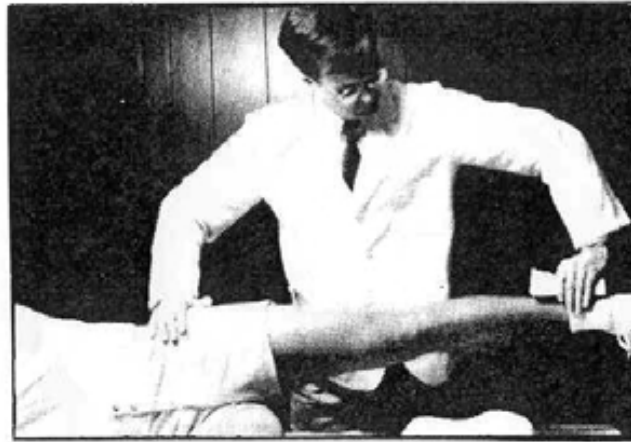
### MODIFIED HIP FLEXION (WITH HAND SUPPORT)



**POSITION:** The subject is instructed to sit erect on the edge of a table with the lower legs hanging freely, not touching the floor. The subject grasps the front edge of the table, keeping the back erect. One trial consists of testing the left leg, then the right leg. After a demonstration, the patient is asked to raise the thigh eight inches off the surface of the table and maintain the position.

**TEST:** The examiner stands directly in front of the patient with both feet firmly planted on the ground. The examiner's arms should be fully extended when placing the MMT on the patient's thigh. If this is not possible or uncomfortable, the examiner should use a sturdy stool to stand on. The MMT is held with the examiner's dominant hand. The non-dominant hand is either placed on the patient's shoulder or is used to help break the muscle contraction - i.e., both hands grip the MMT. The Nicholas MMT is placed just proximal to the patella (above the kneecap). The subject is told to maintain the raised position and not allow the examiner to lower the leg. The test is stopped before the limb impacts on the table. The exact procedure is repeated on the right leg.

## HIP ABDUCTION



**POSITION:** Hip abduction is tested in the sidelying position. The subject is instructed to lie on his right side, with the bottom (right) leg flexed at the hip and the left (testing) leg held in complete extension at the hip and knee. The patient is permitted to grasp the edge of the table with the left hand.

**TEST:** The subject is asked to abduct the leg 12 inches from the surface of the table and maintain this posture while the examiner applies a downward force just proximal to the lateral malleolus (above the outside of the ankle) through the Nicholas MMT. As usual, the test is stopped prior to impact. The subject then assumes the same position on his opposite side, with the right (testing) leg held straight and the right hand grasping the edge of the table.

## SHOULDER ABDUCTION



**POSITION:** The patient is seated on a sturdy chair with a back and without arms. He is instructed to grasp the side of the seat with the right arm while abducting (raising arm to side) the left arm to 90 degrees. For consistency, the hand may be clenched into a fist.

**TEST:** The examiner stands directly behind the patient, placing his right hand on the patient's left shoulder and his left hand, which is holding the MMT, just proximal (above) to the subject's left wrist. While stabilizing the proximal shoulder joint, a downward force is applied through the MMT to lower the arm. It is important to complete the range of motion of the exam, lowering the arm to not more than 20 degrees of abduction.

The test is repeated on the right arm, with the examiner shifting hands and stabilizing the right shoulder.

## SHOULDER EXTENSION



**POSITION:** The subject lies prone (on stomach) on a table with his arms at his sides with the head in neutral rotation. The examiner stands beside the subject on his left side.

**TEST:** As the subject extends the left arm upward, the examiner stabilizes the scapula (shoulder blade) with his left hand and places the MMT proximal to (above) the subject's wrist with his right hand. A downward force is applied to break the contraction and lower the arm to the table, stopping just before impact.

*This article is abstracted in proceedings at the 33rd Annual Meeting, Orthopaedic Research Society, January 19-22, 1987, San Francisco, California*

Population Norms: 1002 normal subjects, age 10 to 82, were used. Age groupings and 95% confidence limits for each motion are listed below in kgs of force.

	<u>HAb</u>	<u>HF</u>	<u>HAd</u>	<u>MPLS</u>
<u>Females</u>				
≤ 17	11-12	21-23	11-13	42-50
18-34	15-17	24-26	13-14	51-55
35-54	13-15	19-21	10-12	43-47
≥ 55	8-12	12-16	8-11	28-39
<u>Males</u>				
≤ 17	14-16	30-33	16-21	69-80
18-34	21-23	41-44	21-23	83-88
35-54	20-22	37-40	18-21	74-81
≥ 55	16-18	29-33	15-18	59-67

Neither height nor weight correlated with any measure for either sex. Female MMT proximal leg strength (MPLS), the sum of breaking forces of HF, HAb and HAd, was significantly lower than male MPLS in all age groups. Strength increased with age in both sexes up to age 34. Females lost more strength than males with age from the second age group to the oldest.

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The Nicholas Manual Muscle Tester is manufactured by:  
 Lafayette Instrument Company  
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 Lafayette, Indiana U.S.A. 47903

Our toll free number is 1-800-428-7545  
 In Indiana, call collect 1-317-423-1505  
 FAX 1-317-423-4111

## REFERENCES

- 1) Kroemer, K.H. and Howard, J.M.: "Towards Standardization of Muscle Strength Testing," *Medicine and Science in Sports* 2: 224 - 230, 1970.
- 2) Kendall, H.O., Kendall, F.P. and Wadsworth, G.E.: "Muscle Testing and Function," Baltimore, Williams and Wilkins, 1971.
- 3) Nicholas, J.A. et al: "A Study of thigh muscle weakness in different pathological states of the lower extremity," *The American Journal of Sports Medicine* 4: 241-248, 1976.
- 4) Nicholas, J.A., Sapega, A. et al: "Factors influencing manual muscle tests in physical therapy," *Journal of Bone and Joint Surgery* 60A: 186-190, 1978.
- 5) Saraniti, AJ, Gleim, G.W. et al: "The relationship between subjective and objective measurements of strength," *Journal of Orthopaedic and Sports Physical Therapy* 2: 15 - 19, 1980.
- 6) Nicholas, J.A., et al: "Neurophysiologic inhibition of strength following tactile stimulation of the skin," *The American Journal of Sports Medicine* 8: 181-186, 1980.
- 7) Marino, M., Gleim, G.W. et al: "The efficacy of manual assessment of muscle strength using a new device," *The American Journal of Sports Medicine* 10: 360-365, 1982.
- 8) Marino, M., Gleim, G.W.: "Muscle strength and fiber typing," *Clinics in Sports Medicine* 3: 85-100, 1984.
- 9) Nicholas, J.A. et al: "Characterization of a strength measurement device," *Proceedings of the Orthopaedic Research Society, 33rd Annual Meeting, January 19-22, 1987.*
- 10) Magnusson, S.P., Gleim, G.W., and Nicholas, J.A.: "Subject variability of shoulder abduction strength testing," *The American Journal of Sports Medicine* 18:349-353, 1990

Date: \_\_\_\_\_

### STRENGTH EVALUATION FORM

Patient Name: \_\_\_\_\_

Examiner's Name: \_\_\_\_\_

Diagnosis: \_\_\_\_\_ Injured Side: \_\_\_\_\_

Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

Sport: \_\_\_\_\_ Test #: \_\_\_\_\_

Resting BP: \_\_\_\_\_ Post-test BP: \_\_\_\_\_

#### MMT

	Right	Left	% Deficit
Shoulder Extension	_____	_____	
	_____	_____	
mean=	_____	_____	_____
Shoulder Abduction	_____	_____	
	_____	_____	
mean=	_____	_____	_____
Hip Flexion	_____	_____	
	_____	_____	
mean=	_____	_____	_____
Hip Abduction	_____	_____	
	_____	_____	
mean=	_____	_____	_____
Hip Adduction	_____	_____	
	_____	_____	
mean=	_____	_____	_____

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### RETURNS

Equipment may not be returned without first receiving a Return Goods Authorization Number (RGA).

When returning equipment for service, please call Lafayette Instrument to receive a RGA number. Your RGA number will be good for 30 days. Address the shipment to: Lafayette Instrument Company, 3700 Sagamore Parkway North, Lafayette, IN 47904, U.S.A. Shipments cannot be received at the PO Box. The items

should be packed well, insured for full value, and returned along with a cover letter explaining the malfunction. Please also state the name of the Lafayette Instrument representative authorizing the return. An estimate of repair will be given prior to completion ONLY if requested in your enclosed cover letter. We must have a hard copy of your purchase order by mail or fax, or repair work cannot commence.

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Lafayette Instrument guarantees its equipment against all defects in materials and workmanship to the ORIGINAL PURCHASER for a period of one (1) year from the date of shipment, unless otherwise stated. During this period, Lafayette Instrument will repair or replace, at its option, any equipment found to be defective in materials or workmanship. If a problem arises, please contact our office for prior authorization before returning the item. This warranty does not extend to damaged equipment resulting from alteration, misuse, negligence or abuse, normal wear or accident. In no event shall Lafayette Instrument be liable for incidental or consequential damages. There are no implied warranties or merchantability of fitness for a particular use, or of any other nature. Warranty period for repairs or used equipment purchased from Lafayette Instrument is 90 days.

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Damaged equipment should not be returned to Lafayette Instrument prior to thorough inspection.

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