

Acumar Single and Dual Digital Inclinerometers User's Manual



3700 Sagamore Parkway North
Lafayette, IN 47904 USA
Tel: (765) 423-1505 • (800) 428-7545
Fax: (765) 423-4111
info@lafayetteinstrument.com
www.lafayetteinstrument.com

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Introduction

Inclinometers are instruments used to measure the angle of a subject with respect to a level or gravity. In medical or clinical applications, the inclinometer determines a person's range of motion. Typically, range of motion is referenced from the body's natural position. The flexion angle or extension angle of the body segment or joint under evaluation is then measured in degrees.

Several different types of manual inclinometers exist on the market. The water-filled "Bubble" Inclinometer and the water-filled "Pendulum" Inclinometer are widely used. These inclinometers usually offer a two-degree marking for readings. Digital inclinometers typically display angle in one-degree increments for ease of reading.

The Acumar Digital Inclinometer provides easy-to-use, wireless data that can be logged into any PC. A built-in microprocessor automatically calculates and displays the actual range of motion of the joints. These special features of the Acumar Inclinometer assist evaluators to offer more objective range of motion measurements.

The sole purpose of this User's Manual is to describe the use of the Acumar Digital Inclinometer and/or its accessories and is not intended to describe medical procedures or standards. The user is advised to refer and follow specific procedures such as the AMA Guides to the Evaluation of Permanent Impairment (5th & 6th editions) or any applicable state or local guidelines of procedures.

Background

The Acumar Digital Inclinometer was developed in response to many physicians and clinicians who expressed a need to have a modernized easy-to-use instrument to help document data in an objective manner.

Lafayette Instrument Company recognizes and is grateful for the numerous physicians, clinicians and others who willingly participated in guiding the development, and we are committed to continuing to serve the needs of the evaluation community and welcomes any input from the user in the field of evaluation and outcome assessment.

Basic Functions

1. Start

Starts reading, Power ON/OFF

2. Hold

Hold and store reading. The six most recent values are stored for review and comparison.

3. View

Stored data may be recalled and viewed - up to the last six held data entries. Also displayed are the high, low, and average values; to assist in consistent and valid testing.

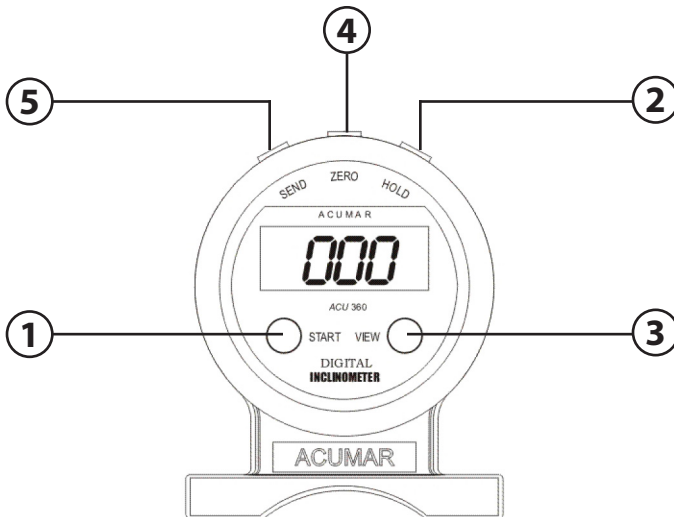
4. Zero

This will establish a relative "zero" in any position. Angles will be read from the new reference position.

5. Send

Transmits IR data to optional data receiver for documentation and graphing.

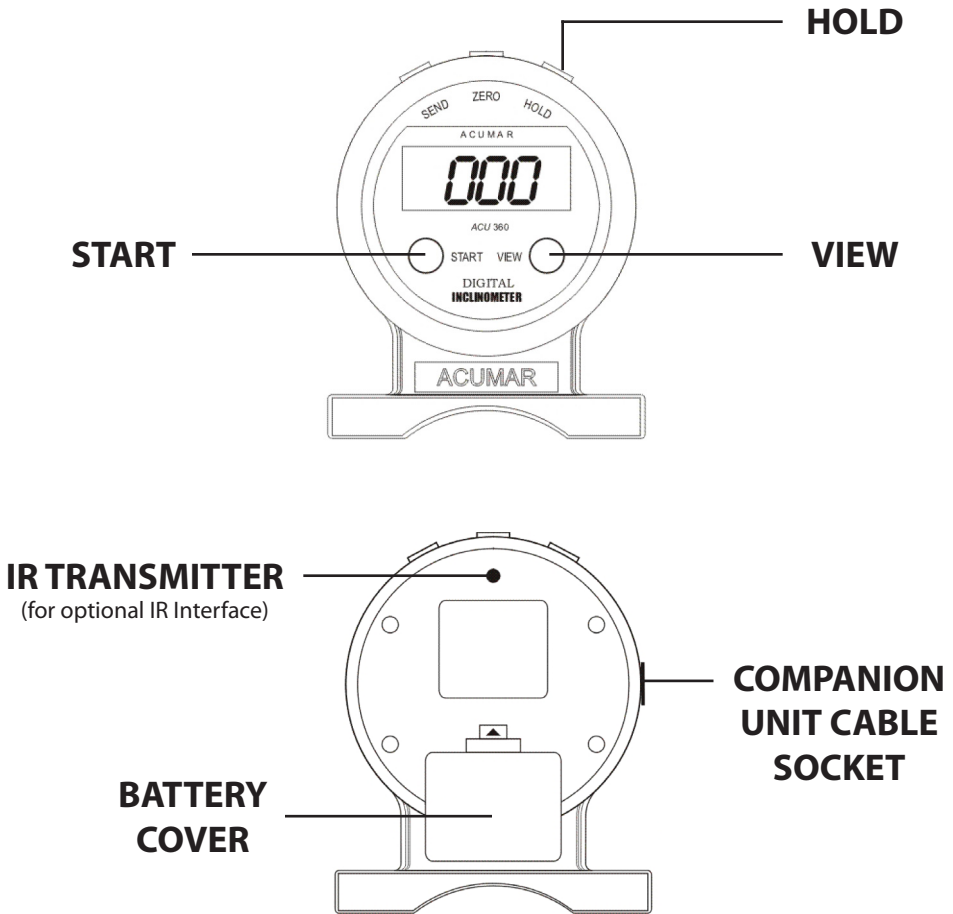
Figure 1: Main Unit



Single Inclinometer: Basic Operation

1. Turn power on by pressing the START button located in the lower left of the unit.
2. To test range of motion, do the following:
 - a. First, establish a point of reference by placing the inclinometer on the arm or hand and read the angle while the body rests in a natural position.
 - b. Then move the body segment under evaluation to see the angle reading change.
 - c. The range of motion is displayed on the LCD in degrees.
3. Turn the unit off by pressing the START button again. (The unit will turn off automatically after three minutes if there is no further activity.)

Figure 2: Main Unit



Storing Multiple Data Readings Sample Exercise

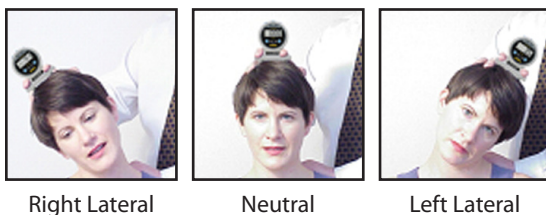
1. Place the inclinometer on your hand in the natural, neutral position.
2. Flex your hand. When maximum flex has been reached, press the HOLD button on the top right side of the inclinometer. Repeat 1 and 2 to store up to six measurement readings.

After several readings have been stored, they may be displayed one-at-a-time with repeated pressing of the VIEW button. Readings will be viewed in sequential order of the last six readings. You will also see the highest reading, indicated by "H" followed by its value, the lowest reading, indicated by "L"; and the average value, indicated by "A".

Cervical Lateral Bending using Single Inclinometry Example

Prepare the Inclinometer

1. Press the START button on the Main Unit.
2. Ask individual to place head in neutral position.
3. Place the Main Unit over the calvarium.



Take Measurements

1. Ask individual to bend their head to the left.
2. When individual reaches maximum range of motion, press the HOLD button to store the maximum left cervical lateral bending angle.
3. Ask individual to return to the neutral position.
4. Repeat measurement steps one through three 3 to 6 times to achieve validity criteria* of ± 5 degrees or 10%.
5. Follow steps one through four for right cervical lateral bending.

View Data

1. To recall stored data, press the VIEW button to activate View Mode.
2. Pressing the VIEW button repeatedly will display the stored readings, as well as the "H" (high), "L" (low) and "A" (average) values.

* Refer to AMA Guides to the Evaluation of Permanent Impairment

Advanced Application Techniques: Advanced Functions

1. VIEW (momentary press)

- Subsequent presses display previously stored data, up to last six stored values. Also the high and low absolute stored angles are displayed, followed by the average angular value.

2. ZERO (momentary press)

- Will mark the new reference point as “zero.”
- All subsequent readings are referenced to the marked zero point until the START button is pressed to clear the memory setting.
- When ZERO is pressed and held for three seconds:
 - The “zero” reference is set to the nearest 90 degree axis - for plumb measurements.

3. HOLD (momentary press)

- Stores the current reading.
- Up to six data readings. If you press more than six times, only the last six readings will be stored.
- AMA Guides suggest a minimum of three data and maximum of 6 data readings.

4. SEND (momentary press)

- Sends stored data.
- If no data has been stored, it will tab to the next data field.

Questions and Answers

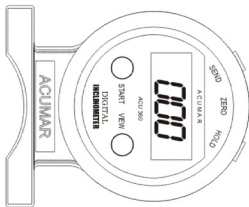
Q. Can you set zero at any angle as a new zero reference?

- A.** Yes. By pressing the ZERO button at any angle, the inclinometer will establish a new reference angle for subsequent readings.

Q. Can you rotate the axis of reading?

- A.** Yes. Normally the inclinometer reads zero degrees when the base is placed on a horizontal level. If you want the base of the inclinometer as a vertical line to read zero, rotate the inclinometer base approximately 90° (plus or minus 30°), then press the ZERO button down and hold for three seconds. The inclinometer automatically seeks for a new gravity axis. From there on, any reading will be taken with reference to the new rotated axis.

Figure 4: Rotating Axis of Reading



ZERO

Press and hold for five seconds to seek and rotate to a new gravity axis

Specifications

| | |
|---------------|--|
| Range | 360° (reads 0 to $\pm 185^\circ$) |
| Resolution | 1° |
| Memory | Holds up to 6 readings |
| LCD Display | Reads in degrees |
| Auto Shut Off | After 3 minutes, unit enters a "sleep" state to save battery life. |
| Battery | <p>6V Alkaline ($\frac{1}{2}$ AA)</p> <ul style="list-style-type: none">• Radio Shack 23-469• Kodak K28A• Energizer A544• Duracell PX28A• Panasonic 4LR44 <p>For additional battery life:</p> <p>6V Lithium ($\frac{1}{2}$ AA)</p> <ul style="list-style-type: none">• Kodak K28L• Energizer L544• Duracell PX28L <p><i>NOTE: Companion unit does not require an additional battery.</i></p> |
| Size | 4" H x 3.3" W x 0.8" D |

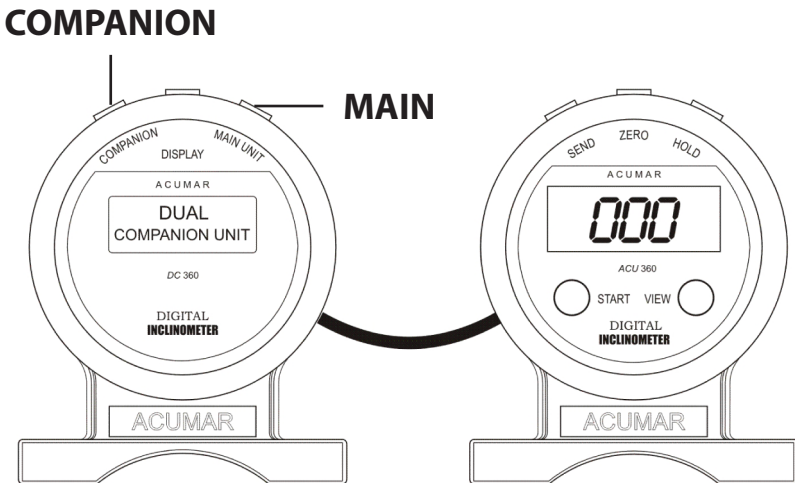
Dual Inclinometer: Basic Operation

The Dual Inclinometer consists of Main and Companion units. When connected together, it reads both the Main (A) and Companion (C) angle and automatically computes and displays the Joint angle (A-C). When the COMPANION button is pressed the display only shows the angle of the Companion unit. When the MAIN UNIT button is pressed the display only shows the angle of the Main unit. The VIEW button steps through Main (A), Companion (C), and Joint (J = A-C). The MAIN UNIT and COMPANION buttons will move directly to the appropriate value within the reading when pressed while in VIEW mode.

Storing data

1. Press the START button to begin new measurements.
2. Press the HOLD button to capture all three angles simultaneously: A, C, and J (A-C).
3. Up to six readings can be stored.

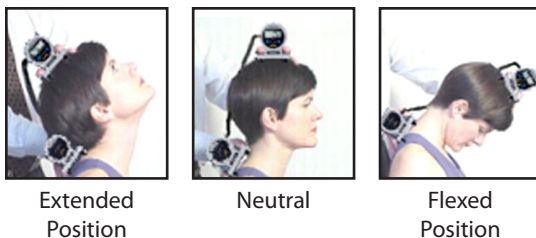
Figure 5: Companion Unit and Main Unit with Connecting Cable



Sample Exercise

1. Place both units on a flat surface and observe that the reading is zero. Incline the units in opposite directions and notice that the display shows A-C = the angle between them. *Note: use the ZERO button to a relative zero at any starting angle, as desired.*
2. Now press and hold the COMPANION button. Notice that the display only responds to the movement of the companion unit.
3. Press and hold MAIN UNIT button to display the angle of the main unit. Notice that the display only responds to the movement of the main unit.

Cervical Flexion and Extension using Dual Incliniometry Example



Take Measurements

1. Place the Main Unit over the calvarium and the Companion Unit over the skin covering the T1 spinous process. Then press the START button on the Main Unit.
2. When individual is in the neutral position, press ZERO.
3. To measure cervical flexion ask individual to flex head forward completely and press the HOLD button to store the maximum flexion angle (Main angle minus Companion Angle).
4. Ask individual to return to the neutral position and repeat measurements two to five times to achieve validity criteria* of $\pm 5^\circ$ or 10%.
5. For cervical extension measurements, the above instructions may be repeated starting with the neutral position and asking the individual to extend the head backward instead.

View Data

1. To view stored data, press the VIEW button to activate View Mode.
2. Pressing the VIEW button repeatedly will display stored readings (main, companion, and joint), maximum, minimum, and average values.

* Refer to AMA Guides to the Evaluation of Permanent Impairment, 5th & 6th editions

Disclaimer

This manual is designed solely to illustrate the use of the Acumar Digital Inclinometer and/or its accessories, and is not intended nor implied to describe medical examination procedures. Selecting methods of examination and interpreting measured results are the responsibility of practitioners.

Lafayette Instrument Company will not warrant that any procedures described herein meet any current or past medical examination guides or procedures required by state or any local governments or other organizations. Lafayette expressly disclaims all liability arising from use of this manual. Acumar Digital Inclinometer or related product(s) as stated in the warranty in the latter part of this user's manual.

The use of Acumar Digital Inclinometers to take objective measurements combined with Acumar™ excel templates or any other forms can produce patient files. Like any other patient data, if protection of the privacy of patient files is required, it is the sole responsibility of the provider and of the practitioner. Acumar disclaims all liability for any and all claims.

Lafayette does not express or imply that the any reference values that may appear on any forms are accurate, relevant, or clinically significant and hereby disclaims all liability for their clinical use herein. Medical judgment should be the ultimate faculty of the practitioner.

One Year Limited Warranty

Digital Inclinometer, Accessories “product(s)”

If, within one year from the date of original purchase, the Acumar Technology's Digital Inclinometer fails to function because of defects in materials or workmanship, the manufacturer will, at its option, either repair or replace such product(s).

To obtain warranty service, contact your dealer for return address. Deliver the product (postpaid) to the location specified by your dealer. Purchaser must include the dated sales receipt (as proof of purchase), and a brief explanation describing why the product is inoperable or how it was damaged.

This warranty does not cover damage resulting from accident, misuse or abuse, water, extreme temperatures, tampering, attachment of unauthorized accessories, servicing performed or attempted by unauthorized agencies, product(s) that have been modified in any fashion, product(s) that have not been maintained in accordance with the instructions in the manual, or any other conditions whatsoever that are beyond the control of the manufacturer.

This product(s) are intended to be used by professional practitioners who are knowledgeable in examination procedures and applicability of test method and proper use. The manufacturer is not responsible for the interpretation of results and use of the information gathered by this product(s). Interpretation of the results are the sole responsibility of the user. In no event will the manufacturer be liable for damages, incidental or consequential, domestic or international, rising from the purchase and use or inability to use the product(s) even if the manufacturer has been advised of the possibility of such damages.

Except as provided herein, the manufacturer makes no warranties, express or implied, including without limitation the implied warranties without limitation of merchantability and fitness for a particular purpose, loss of business, business interruption, loss of business information or other indirect or consequential loss arising out of the use or inability to use or supply or non-supply of the product(s). All warranties for the product(s), expressed or implied, are limited to the warranty period set forth above.

If the product(s) do not perform as warranted herein, the original purchaser's sole remedy will be the repair or replacement of the product(s) as provided above. This warranty gives you specific legal rights. You may also have other rights, which vary from state to state. Because of individual state regulations, some of the above limitations and exclusions may not apply to you.

Terms and Conditions

LIC Worldwide Headquarters

Toll-Free: (800) 428-7545 (USA only)

Phone: (765) 423-1505

Fax: (765) 423-4111

Email: sales@lafayetteinstrument.com

export@lafayetteinstrument.com (Outside the USA)

Mailing Address:

Lafayette Instrument Company

PO Box 5729

Lafayette, IN 47903, USA

Lafayette Instrument Europe:

Phone: +44 1509 817700

Fax: +44 1509 817701

Email: eusales@lafayetteinstrument.com

Phone, Fax, Email or Mail-in Orders

All orders need to be accompanied by a hard copy of your purchase order. All orders must include the following information:

- Quantity
- Part Number
- Description
- Your purchase order number or method of pre-payment
- Your tax status (include tax-exempt numbers)
- Shipping address for this order
- Billing address for the invoice we'll mail when this order is shipped
- Signature and typed name of person authorized to order these products
- Your telephone number
- Your email address
- Your FAX number

Domestic Terms

There is a \$50 minimum order. Open accounts can be extended to most recognized businesses. Net amount due 30 days from the date of shipment unless otherwise specified by us. Enclose payment with the order; charge with VISA, MasterCard, American Express, or pay COD. We must have a hard copy of your purchase order by mail, E-mail or fax. Students, individuals and private companies may call for a credit application.

International Payment Information

There is a \$50 minimum order. Payment must be made in advance by: draft drawn on a major US bank; wire transfers to our account; charge with VISA, MasterCard, American Express, or confirmed irrevocable letter of credit. Proforma invoices will be provided upon request.

Exports

If ordering instrumentation for use outside the USA, please specify the country of ultimate destination, as well as the power requirements (110V/60Hz or 220V/50Hz). Some model numbers for 220V/50Hz will have a "C" suffix.

Quotations

Quotations are supplied upon request. Written quotations will include the price of goods, cost of shipping and handling, if requested, and estimated delivery time frame. Quotations are good for 30 days, unless otherwise noted. Following that time, prices are subject to change and will be re-quoted at your request.

Cancellations

Orders for custom products, custom assemblies or instruments built to customer specifications will be subject to a cancellation penalty of 100%. Payment for up to 100% of the invoice value of custom products may be required in advance. Cancellation for a standard Lafayette Instrument manufactured product once the product has been shipped will normally be assessed a charge of 25% of the invoice value, plus shipping charges. Resell items, like custom products, will be subject to a cancellation penalty of 100%.

Exchanges and Refunds

Please see the cancellation penalty as described above. No item may be returned without prior authorization of Lafayette Instrument Company and a Return Goods Authorization (RGA#) number which must be affixed to the shipping label of the returned goods. The merchandise should be packed well, insured for the full value and returned along with a cover letter explaining the reason for return. Unopened merchandise may be returned prepaid within thirty (30) days after receipt of the item and in the original shipping carton. Collect shipments will not be accepted. Product must be returned in saleable condition, and credit is subject to inspection of the merchandise.

Repairs

Instrumentation may not be returned without first receiving a Return Goods Authorization Number (RGA). When returning instrumentation 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, USA.

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. 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 for non-warranty repairs.

Damaged Goods

Damaged instrumentation should not be returned to Lafayette Instrument prior to a thorough inspection. If a shipment arrives damaged, note damage on delivery bill and have the driver sign it to acknowledge the damage. Contact the delivery service, and they will file an insurance claim. If damage is not detected at the time of delivery, contact the carrier/shipper and request an inspection within 10 days of the original delivery. Please call the Lafayette Instrument Customer Service Department for repair or replacement of the damaged merchandise.

Limited Warranty

Lafayette Instrument Company warrants equipment manufactured by the company to be free of defects in material and workmanship for a period of one year from the date of shipment, except as provided hereinafter. The original manufacturer's warranty will be honored by Lafayette Instrument for items not manufactured by Lafayette Instrument Company, i.e. resell items. This assumes normal usage under commonly accepted operating parameters and excludes consumable products.

Warranty period for repairs or used instrumentation purchased from Lafayette Instrument is 90 days. Lafayette Instrument Company agrees either to repair or replace, at its sole option and free of part charges to the customer, instrumentation which, under proper and normal conditions of use, proves to be defective within the warranty period. Warranty for any parts of such repaired or replaced instrumentation shall be covered under the same limited warranty and shall have a warranty period of 90 days from the date of shipment or the remainder of the original warranty period whichever is greater. This warranty and remedy are given expressly and in lieu of all other warranties, expressed or implied, of merchantability or fitness for a particular purpose and constitutes the only warranty made by Lafayette Instrument Company.

Lafayette Instrument Company neither assumes nor authorizes any person to assume for it any other liability in connection with the sale, installation, service or use of its instrumentation. Lafayette Instrument Company shall have no liability whatsoever for special, consequential, or punitive damages of any kind from any cause arising out of the sale, installation, service or use of its instrumentation. All products manufactured by Lafayette Instrument Company are tested and inspected prior to shipment. Upon prompt notification by the Customer, Lafayette Instrument Company will correct any defect in warranted equipment of its manufacture either, at its option, by return of the item to the factory, or shipment of a repaired or replacement part. Lafayette Instrument Company will not be obliged, however, to replace or repair any piece of equipment, which has been abused, improperly installed, altered, damaged, or repaired by others. Defects in equipment do not include decomposition, wear, or damage by chemical action or corrosion, or damage incurred during shipment.

Limited Obligations Covered by this Warranty

1. In the case of instruments not of Lafayette Instrument Company manufacture, the original manufacturer's warranty applies.
2. Shipping charges under warranty are covered only in one direction. The customer is responsible for shipping charges to the factory if return of the part is required.
3. This warranty does not cover damage to components due to improper installation by the customer.
4. Consumable and/or expendable items, including but not limited to electrodes, lights, batteries, fuses, O-rings, gaskets, and tubing, are excluded from warranty.
5. Failure by the customer to perform normal and reasonable maintenance on instruments will void warranty claims.
6. If the original invoice for the instrument is issued to a company that is not the company of the end user, and not an authorized Lafayette Instrument Company distributor, then all requests for warranty must be processed through the company that sold the product to the end user, and not directly to Lafayette Instrument Company.

Export License

The U.S. Department of Commerce requires an export license for any polygraph system shipment with an ULTIMATE destination other than: Australia, Japan, New Zealand or any NATO Member Countries. It is against U.S. law to ship a Polygraph system to any other country without an export license. If the ultimate destination is not one of the above listed countries, contact us for the required license application forms.