Instruction Manual



Maxum III

Digital Indicator

Document Part No. 2239028 Rev. D

Mahr

Models

Part No. Short Range	Part No. Long Range	Description	Stem Diameter	Stem Length mm / inch
2033101	2033102**	No output	0.375”	17mm / 0.670”
2033103	2033104		0.375”	38mm / 01.50”
2033105	2033106		8mm	17mm / 0.670”
2033107	2033108		8mm	38mm / 1.50”
2033111	2033112**	6 Pin output	0.375”	17mm / 0.670”
2033113	2033114		0.375”	38mm / 01.50”
2033115	2033116**		8mm	17mm / 0.670”
2033117	2033118		8mm	38mm / 1.50”
2033121	2033122	10 pin output	0.375”	17mm / 0.670”
2033123	2033124		0.375”	38mm / 01.50”
2033125	2033126**		8mm	17mm / 0.670”
2033127	2033128		8mm	38mm / 1.50”
2033001		Display Unit	No Stem	Use with Digital Transducer 2033091 - 2033099
2033011				
2033021				

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These instructions apply to the Maxum III Indicators and Indicating units:

1.0 PRECAUTIONS AND GENERAL INFORMATION

All Maxum III Models: Your new Maxum III Digital Electronic Indicator will provide both Standard and Enhanced measurements. When placed in the Enhanced Mode, the Maxum III provides the capability of measuring relative maximum, minimum and T.I.R. values

Maxum III units come with battery installed and operate in the traditional Standard Maxum Mode. When not in use the Indicator or Indicating unit is left in its **Sleep** mode which conserves battery power. ('2.1 Maxum III Features' on page 9).

The unit also includes removable overlays for duplication of the previous Maxum and Maxum Plus model design where needed.

Maxum III units are ruggedly built to withstand hard use, and their gasketed case, crystal and stem assemblies resist encroachment by most fluids. However, Maxum III Indicators, Indicating Units and Digital Transducers should never be immersed. Regularly inspect all seals and spindle boots to guard against fluid penetration.

Digital Output Models:

To prevent contaminants from entering the 6 or 10-pin digital output connectors, the dust cap should always be firmly in place whenever an output cable is not connected.

Digital Transducers:

Any Maxum III Indicating Unit can be used with any Maxum III Digital Transducer. Make sure the transducer connector is properly aligned with the indicator connector before connecting them. Maxum III Indicating Units **may not** be used with Maxum and Maxum Plus style remote transducers. Maxum III Digital Transducers must be used with an adapter cable to connect to Maxum and Maxum Plus Indicating Units (*'7.0 Specifications' on page 42 for adapter cable part numbers).*

NOTE: *To disconnect the Digital Transducer, pull the connector straight out; do not twist or unscrew the connector. Also, do not severely bend, twist or strain the transducer cable.*

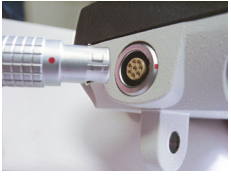


Figure 1

2.0 PRODUCT FEATURES

2.1 Maxum III Features

Switchable Inch / Metric Units

Allows the indicator to display in 'in' units or 'mm' units. Selectable in the Setup Mode.

Tolerance Limits

Allows the selection of left and right tolerance limits within the analog scale displayed.

Range Signal

There are two conditions that occur when the readings are over-range. The Off-Scale condition occurs when the fan display exceeds the analog scale and is indicated by a flashing segment at the most left or right segment location. The Over-Range condition occurs whenever the digital reading is exceeded and is indicated by a blank display that shows both the polarity sign and the in/mm units icon. Unit is still active and not to be confused with the Sleep Mode condition.

Selectable Digital Resolution

There are two selections for digital resolution with each Digital Range selection (see below):

Digital Range	Available Resolutions
±0.100 inch / ±1.99 mm	0.0005" or 0.0001" / 0.005 mm or 0.001mm
±0.040 inch / ±1.0 mm	0.0005" or 0.0001" / 0.005 mm or 0.001 mm
±0.0199 inch / ±0.199 mm	0.00005" or 0.00002" / 0.001 mm or 0.0005 mm

Selectable Digital Range

The **Short Range** Maxum III unit is capable of selecting two digital ranges. The Short Range model can select between ±0.040 and ±0.199 in (±1.00 and ±0.199 mm) ranges. The **Long Range** model has one range of ±0.100 in (±1.99 mm) only.

Selectable Analog Magnification

Each Maxum III unit is capable of selecting between two minimum analog graduation values. An inch/metric overlay can be used for traditional analog display preference. The **Long Range** model can select between 0.001 and 0.0005 in (0.01 and 0.005 mm) resolutions. The **Short Range** model can select between 0.001 and 0.0005 in (0.01 and 0.005 mm) resolutions for the ±0.040 in / ±1.0 mm range and between 0.0005 and 0.0001 in (0.005 and 0.001 mm) resolutions for the ±0.0199 in / ±0.199 mm range

Sleep Mode

The Maxum III unit is designed with an auto power down feature to conserve battery life. If it senses approximately 10 minutes of inactivity (i.e. no spindle movement, no buttons pushed, no Digimatic data output request), the unit will go into a **Sleep** state. Display shows only a '**+**' or '**-**' sign depending on measuring direction selected in setup. Unit is inactive.

*OPTION: The **Sleep Mode** may be disabled as a factory option when requested at time of order. However, when using battery power the life of the battery will be reduced. This option is typically used with the **Remote External Power** option, which bypasses battery operation.*

Transducer Range

Maxum III Remote Indicating Units auto-sense the type of Digital Transducer plugged into it. There are two types of Digital Transducers that are auto-sensed; **Short Range** versions, which have a ±0.040 in / ±1.0 mm measuring range and **Long Range** versions, which have a ±0.100 in / ±1.99 mm measuring range.

Digital Output

Each Maxum III unit is capable of selecting between three choices of data output format; the Standard Maxum output format, the Maxum Serial output format, and a Digimatic output format.

Digital Calibration

The Maxum III indicator can be calibrated via pushbutton sequencing for accurate performance.

Low Battery Signal

The text **Bat** is displayed on the digital display signifying that a battery change is necessary which helps avoid collection of bad data. It initially flashes as a warning then under continuous use eventually remains on so that no readings will be displayed.

Calibration Lockout (Option)

Allows the entry into the calibration mode via an access key (Order No. 2240545 - 6 pin, Order No. 2240547 -10 pin) when plugged into the data output port. Calibration is inaccessible without this Access Key. Specific models only.

Setup Lockout (Option)

Allows the entry into the setup mode via an Access Key (Order No. 2240545 - 6 pin, Order No. 2240547 -10 pin) when plugged into the data output port. Setup mode is inaccessible without this Access Key. Specific models only.

Remote External Power (option)

allows use of remote power from an external regulated power supply or data collector via the data output port. When remotely powered, battery is bypassed and it is not used unless remote source is inactive. Available on models that have a data output port only. Never use an external power supply on models that do not have this special option feature.

External Power Supply:

6 pin model 2239090

10 pin model 2239091

CAUTION: DO NOT *continuously toggle external power source on and off as this can cause damage to the digital indicator and the remote power source.*

DO NOT *remove or install the external power source cable while the external source in on.*

Ratio Model (Option)

There are two ratios available for the Maxum III indicator. All standard models come with a 1:1 ratio meaning 0.010 inch movement of the spindle results in 0.010inch reading on the indicators digital display. Some applications require a 4:5 ratio. Maxum III models ordered with this 4:5 ratio will read 0.008 inch on the indicators digital display when the spindle is moved 0.010inch in linear travel. There are no other ratios available on this indicator. This is a factory set option.

2.1.1 Controls - Standard Mode

Makes use of 6 push button modes, (Left Limit, Left Display Index, Right Display Index, Right Limit, Autozero) for selections in two operating modes (Standard and Enhanced) and separately for entering the Setup Mode and Calibration Mode. Buttons are only active when a reading is on the display.

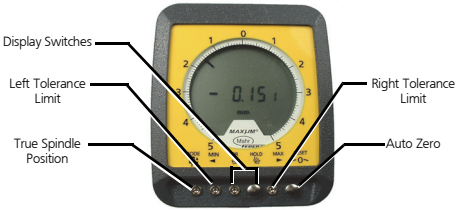


Figure 2 *- Indicator shown in TSP Mode*

True Spindle Position

Enters unit into its **TSP** Mode to show the actual position of the spindle in the indicator's measuring range.

Left Tolerance Limit

Sets the left arrow at desired limit.

Display Switches

Indexes the digital readout and analog display clockwise (right-handed switch) or counterclockwise (left-hand switch). The display switches will function only when the Indicator or Indicating Unit is in the **Auto-Zero** (gaging) mode.

Right Tolerance

Sets the right arrow at desired limit.

RESET

To electronically set both the analog display and digital readout to zero.

2.1.2 Controls - Enhanced Mode

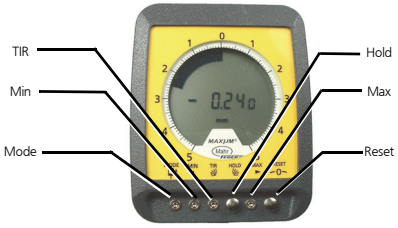


Figure 3

MODE

Shows the real time static measurement of the spindle in the indicator's measuring range while in **Enhanced Mode** (see Section, '4.2 Enhanced Mode' on page 28). When the mode button is used to activate the Enhanced function the indicator's analog display changes to the alternate mode, i.e. a normal **Fan** display changes to a **Single Element** display, and dynamic button functions become active.

MIN

Activates the dynamic minimum value retention function. Displays the lowest or most negative measurement seen by the indicated movement.

TIR

Activates the dynamic **Total Indicated Reading Value** retention function. Displays the lowest and highest points on the analog scale (if not exceeded) and the total reading of **max minus min** (max - min) on the digital readout.

HOLD

Activates the **Hold** function, which freezes the displayed reading at that moment in time. A second press of the button releases the frozen reading and updates the display to the current spindle position. This function can also be remotely triggered via the output port on specific models - see Section ’8.0 Output Information’ on page 43.

MAX

Activates the **Dynamic Maximum Value** retention function. Displays the highest or most positive measurement seen by the indicated movement.

RESET

Electronically sets both the analog display and digital readout to zero when in the **Enhanced Actual** or **TIR** modes. Electronically sets both the analog and digital readout to the current spindle position location in the minimum or maximum modes. This function can also be remotely triggered via the output port on specific models (Section, ’8.0 Output Information’ on page 43).

3.0 Setup Mode

The Maxum III has six operator changeable features, which are selectable in the indicators Setup Mode. These features are: changing linear units between inch and millimeter, changing of measuring direction polarity, selecting of two digital ranges (full or reduced - short range models only), selecting the digital resolution, how to select the analog scale magnification including proper overlay usage, and selecting of data output format to be used with an external device. The Maxum III uses the two **mushroom** push-buttons to enter Setup Mode, make feature selections, and exit Setup Mode. A quick reference sheet of but-

ton operation for the Maxum III setup menu is provided at the end of the manual '9.0 Quick Step Flow Chart' on page 55.

NOTE: *For models with the Setup Mode Lockout Option this mode is accessible with the Access Key:*

Order No. 2240545 - 6-pin,

Order No. 2240547 -10-pin

when plugged into the data output port. Setup Mode is inaccessible without this Access Key.

3.1 Entering Setup Mode

Entering the Setup mode is accomplished by pressing and holding the **HOLD** button for three or more seconds until the display shows **SEt**, indicating ***Setup Mode. At the **SEt** screen, press and release the **RESET** button to enter the selection menu of setup features.

***NOTE:** The Setup Mode can only be entered while the unit is in both **Standard Mode** and then **tsp** (true spindle position) mode. Refer to '4.1 Operating the Maxum III' on page 25.*

Once in the Setup Mode simply press the corresponding button to toggle through the features and choices. The **RESET** button toggles through the setup menu items and the **HOLD** button toggles through the indicated feature selections. The selection displayed is the one that is saved when exiting the Setup Mode.



Figure 4 *- Maxum III indicator in Setup Mode*

3.1.1 Exiting Setup Mode

To exit Setup Mode press and hold the **RESET** button a minimum of 3 seconds then release the button. The setup menu item should disappear and the unit is back into its operating **TSP** Mode. If the unit has not exited from the Setup mode, then repeat this step again.

3.2 Changing inch / metric units

1. Enter setup mode.
2. Press the **RESET** button until the letter **u** indicates the unit's setup feature.



Figure 5 - Shown in Millimeter Units

3. Press the **HOLD** button to toggle between inch (**in**) and metric (mm) units. Notice the in/mm icon indicates the selected units on the LCD display.



Figure 6 - Shown in Inch Units

3.3 Changing Measuring Direction

1. Enter **Setup Mode**
2. Press the **RESET** button until the letter **d** shows in the last digital position of the LCD display. The **d** indicates the **Direction Setup** feature.



Figure 7 - Shown in Reverse Polarity Direction

3. Press the **HOLD** button to toggle between Normal (**n**) and Reverse (**r**) direction. Notice the tolerance arrows also indicate the direction change.

3.4 Changing Digital Range

1. Enter setup mode.
2. Press the **RESET** button until the letter **r** shows in the last digital position of the LCD display. The **r** indicates the digital Range Setup feature.
3. Press the **HOLD** button to toggle between standard range and reduced range selections. Notice on the LCD display that the digital readout will change from one measuring range to another. Only **Short Range Models** have this selection available.



Figure 8

For **Long Range Models** the choice is fixed at 100 in (1.99 mm).

For short range models the choices will be 0.040in and 0.020 in - for the 0.0199" range (1.00 mm and 0.199 mm).



Figure 9

3.5 Changing Digital Resolution

1. Enter Setup Mode.
2. Press the **RESET** button until the letter **r** shows in the last digital position of the LCD display. The **r** indicates the digital Range setup feature.
3. Press the **RESET** button once to enter the Digital Resolution setup feature. Note that there is no half-digit icon used for this setup feature.



Figure 10

4. Press the **HOLD** button to toggle between standard digital resolution and high digital resolution selections. Resolution selections are dependent on indicator model and digital range selection (see, 'Overlay Selection Table' on page 20).



Figure 11

3.6 Selecting Analog Fan Scale/ Overlay

3.6.1 Setting-up the Indicator Analog Fan Scale

1. Enter Setup Mode
2. Press the **RESET** button until the letter **F** shows in the last digital position of the LCD display. The **F** indicates the analog Fan display setup feature.
3. Press the **HOLD** button to toggle through the analog graduation value selections.



Figure 12

Notice the fan display toggles between half full scale (only half the LCD fan segments are on) and full scale (all the LCD fan segments are on). This **?** fan scale and full fan scale help the operator in deciding which overlay to use.

The **?** fan scale indicates that the 25-0-25 overlay should be used. The full fan scale indicates that either the 5-0-5 or 50-0-50 overlay should be used. See the following Section, '3.6 Selecting Analog Fan Scale/ Overlay' on page 19 and corresponding to the 'Overlay Selection Table' on page 20 for correct installation and choice when using the overlay option.



Figure 13

3.7 Installing and Removing the Overlay Scale

Once the pushbutton settings have been set, if desired, install the corresponding overlay onto the front of the Maxum III per table, Overlay Selection Table' on page 20. The following is a recommended procedure for installing and removing the overlay from the front of the Maxum III indicator.

Overlay Selection Table

INCH

Legacy Model	Digital Range	Digital Resolution	Analog Graduation	Analog Scale	Overlay Used
LONG RANGE MODEL					
New	±0.100in	0.0005	0.0005	25	25-0-25
New	±0.100in	0.0005	0.0010	50	50-0-50
New	±0.100in	0.0001	0.0005	25	25-0-25
DEI-X7XXX	±0.100in	0.0001	0.0010	50	50-0-50
New	±0.040in	0.0005	0.0005	25	25-0-25
New	±0.040in	0.0005	0.0010	50	50-0-50
DEI-X2XXX	±0.040in	0.0001	0.0005	25	25-0-25
DEI-X3XXX	±0.040in	0.0001	0.0010	50	50-0-50
SHORT RANGE MODEL					
New	±0.040in	0.0005	0.0005	25	25-0-25
New	±0.040in	0.0005	0.0010	50	50-0-50
DEI-X2XXX	±0.040in	0.0001	0.0005	25	25-0-25
DEI-X3XXX	±0.040in	0.0001	0.0010	50	50-0-50
DEI-X1XXX	±0.0199in	0.00005	0.0001	5	5-0-5
New	±0.0199in	0.00005	0.0005	25	25-0-25
DEI-X0XXX	±0.0199in	0.00002	0.0001	5	5-0-5
New	±0.0199in	0.00002	0.0005	25	25-0-25

METRIC

Legacy Model	Digital Range	Digital Resolution	Analog Graduation	Analog Scale	Overlay Used
LONG RANGE MODEL					
New	±1.99mm	0.005	0.005	25	25-0-25
New	±1.99mm	0.005	0.01	50	50-0-50
New	±1.99mm	0.001	0.005	25	25-0-25
DEI-X6XXX	±1.99mm	0.001	0.01	50	50-0-50
New	±1.0mm	0.005	0.005	25	25-0-25
New	±1.0mm	0.005	0.01	50	5 or 50
New	±1.0mm	0.001	0.005	25	25-0-25
DEI-X5XXX	±1.0mm	0.001	0.01	50	5 or 50
SHORT RANGE MODEL					
New	±1.0mm	0.005	0.005	25	25-0-25
New	±1.0mm	0.005	0.01	50	5 or 50
New	±1.0mm	0.001	0.005	25	25-0-25
DEI-X5XXX	±1.0mm	0.001	0.01	50	5 or 50
DEI-X4XXX	±0.199mm	0.001	0.001	5	5 or 50
New	±0.199mm	0.001	0.005	25	25-0-25
New	±0.199mm	0.0005	0.001	5	5 or 50
New	±0.199mm	0.0005	0.005	25	25-0-25

3.7.1 Installation

1. Chose the correct color and overlay scale from the table above (Overlay Selection Table'). Inch readout uses the green side of the overlay and metric (mm) uses the yellow side of the overlay.

2. Remove protective sheets from the overlay. Take the overlay and place one side of the long edge under the lip of the housing.



Figure 14 *- Unit shown without overlay*

3. Slightly bend the overlay and insert it under the front housing lip on the opposite side.

4. Once the overlay is installed over the crystal operate the indicator to make sure the readings correlate to the settings selected in the indicator.



Figure 15 *- Unit shown with yellow metric overlay*

3.7.2 Removal

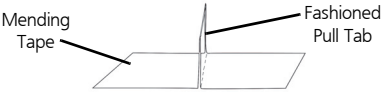
NOTE: *This is a recommended removal process and not necessarily the only method of removing the overlay. This method will be least likely to cause any damage or scratching of the overlay or the protective crystal.*

1. Use about a 4 inch length of general type Scotch® type mending tape. Form it into an upside-down **T** shape

with the sticking portion facing down. Refer to Figure 16.

2. Place the bottom sticking portion of the tape onto the surface of the overlay only, see Figure 16. Make sure it is secure or flat.
3. Simply pull-up on the tape to remove the overlay.
4. Carefully remove the tape from the overlay and discard the tape. Do not leave the tape on the overlay for long periods of time.

Fold a piece of mending tape as shown to fashion a tab that can be used to pull the dial face after it has been taped to its surface.





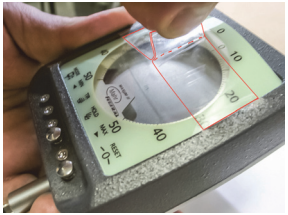




Figure 16

3.8 Selecting Data Output Format

1. Enter setup mode
2. Press the **RESET** button until the letter **o** shows in the last digital position of the LCD display. The **o** indicates the data output format setup feature.
3. Press the **HOLD** button to toggle through the following selections:

St	Standard classic Maxum output format
dI	Digimatic/BCD output format
AS	Serial ASCII output format
Off	Data Output is disabled and no output is provided



Unit shown with Standard output



Unit shown with Digimatic output



Unit shown with serial output

Figure 17

For more information on the data output formats see Section, '8.0 Output Information' on page 43.

4.0 OPERATION

The Maxum III indicator is shipped with its battery installed. There is no power switch; the Indicator is always **ON** However, when the Spindle is fully extended (at rest) or fully depressed, the Indicator is in its **Sleep Mode**, and only the '**+**' or '**-**' sign is displayed.

4.1 Operating the Maxum III

Fully depress the Spindle once, and hold. The opposite sign appears. This assures that the Maxum III Indicator is operational. The in/mm icon also appears when the unit is active.

A Maxum III Indicator can be mounted in a gage or fixture using an optionally available back., or the Indicator can be stem-mounted. The 'Canister Style' Digital Transducer must be mounted by its stem only. Do not mount this transducer by its 1.00 in / 25.4 mm diameter barrel. Mounting brackets and racks are available to hold Digital Transducers and Indicating Units for use with fixture gages.

4.1.1 Off-Scale

Whenever the digital reading exceeds the analog display range, the last single analog display graduation will blink. This signals that the remaining digital range is still operational, however the analog range has been exceeded.



Figure 18 - Indicator shown in **Off-Scale** condition

4.1.2 Over-Range

Over-Range occurs when digital range has been exceeded. When the digital range is exceeded, the Indicator is in an 'over-range' condition and is indicated by a blank display that shows both the polarity sign and the in/mm units icon. Unit is still active and not to be confused with the 'Sleep mode' condition, which only shows the polarity sign.

Whenever this occurs in the **Enhanced Mode**, the spindle must be returned to an on scale value, which is indicated by a single

segment. Enhanced functions using the **FAN** display (MIN, MAX and TIR) require the user to depress the **RESET** button after obtaining an on-scale reading. In **Enhanced mode**, the indicator reacts like a traditional Maxum Plus, digital readings are restored with any on-scale reading.



Figure 19 *- Indicator shown in Over-Range condition*

4.1.3 Standard Mode

This mode operates according to the traditional Maxum unit. This is the normal static measuring mode and is indicated by a normal static **Fan** display and no tolerance arrows when within tolerance. If out of tolerance one of the arrows will be flashing.

4.1.4 Initial Setup - Standard/TSP Mode

This mode shows the actual position of the spindle in the Indicator's measuring range. When True Spindle Position is activated, the Indicator's analog display changes to the alternate mode, i.e. a normal **Fan** display changes to a **Single Element** display and vice-versa.

Use a ballpoint pen or similar pointed instrument to activate switches. Do not use a pencil; graphite dust may affect button switches.

1. Mount the Indicator or Digital Transducer in the gage.
2. Place the Nominal or Zero Master in the gage.
3. Press and release the **True Spindle Position** (TSP) button. Unit must be on-scale.
4. Mechanically adjust the Indicator or Digital Transducer until reading is at or near zero.

Securely lock the Indicator or Digital Transducer in position making sure reading is still at or near zero.

Press and release the **Auto-Zero** button for final zero setting.

The unit is now in standard measuring mode and ready to gage parts.

NOTE: *Some Mahr gages are furnished with separate instructions covering their use with Maxum III Indicators. Refer to those instructions for specific steps for setup and operations.*

NOTE: *To Save battery life, the gage setup should permit the Indicator to return to its* ***Sleep Mode*** *when not in use.*

4.1.5 Setting Upper and Lower Tolerance Limits

Limits may be set to the resolution of the least digit anywhere within each model's analog range. Both limits can be set on the same side (unilateral) of zero or on opposite sides (bilateral) of zero. Unit must be in **Standard Operating Mode** for this setting procedure. Selection cannot be made while in **TSP** mode.

Any convenient method, such as a height stand or a bench comparator, may be used to set limits. Once set, limits are retained in memory, even when the Indicator is in its **Sleep mode**, and remain set until changed. If no limits are needed, move them outside the normally used portion of the measuring range.

1. Depress the spindle and press the **Left Tolerance Limit** ◀ button or press the appropriate display ◀◀ button to index the digital readout to the desired lower limit (-) set point.

2. Press and release the **Left Tolerance Limit** ◀ button. A blinking left arrow appears.

3. Depress the spindle and press the **Right Tolerance Limit** ▶ button or press the appropriate display ▶▶ button to index the digital readout to the desired upper limit (+) set point.

4. Press and release the **Right Tolerance Limit** ▶ button. A blinking right arrow appears.

NOTE: *To set limits, the measuring spindle must be positioned within the analog range of the display. To use display buttons, the Indicator must be in the measuring mode.*

NOTE: *To check limit settings, use display buttons to index the fan and digital display through limit set points. Reset limits if necessary. This can be used to set tolerance value more precisely. A single press and release of the display button moves*

one least significant digit. A press and hold of the display button will gradually increase the speed of LSD change. Note, however, this will re-position the auto-zero setting.

4.1.6 Reapportioning Measuring Range

For most comparative measurements, the measuring range is apportioned equally on both sides of zero. However, for certain applications, the range may be offset partially or completely to either side of zero.

1. Press and release **True Spindle Position**  button.
2. Depress the indicator or transducer spindle until display shows the desired mid-range point.
3. Press and release the Auto-Zero ⌐0¬ button.

NOTE: *Reapportioning the measuring range away from its true electrical zero position may influence the accuracy of the unit. Measuring range cannot be reapportioned on Maxum III Indicator models where the reduced Digital Range of 0.199 mm has been selected.*

4.2 Enhanced Mode

This mode operates according to the traditional Maxum Plus unit. This is the dynamic measuring mode and is indicated by a dynamic **Fan** display and one solid tolerance arrow when out of tolerance in the **Enhanced Mode**. When in **Enhanced/Actual Mode** both tolerance arrows are simultaneously flashing and the readings are static.

4.2.1 Enhanced/Actual Mode

Displays a static real-time representation of the gaging contact movement.

The Maxum III allows the resetting of the dynamic reading to enable the start of a measurement cycle and to **HOLD** the current reading for **Display Value** capture. In order to minimize power requirements, the Maxum III enters a **Sleep Mode** after an extended period of inactivity (Approx. 10 minutes). Spindle travel or depressing **Zero/Reset** awakens up the indicator.

4.2.1.1 How to change between the Standard Mode and the Enhanced Mode:

*NOTE: The following steps require the unit to be **on-scale**. **On-scale** means that a digital reading is viewed on the digital display.*

1. When the **True Spindle Position** (TSP) button is pressed and released, the indicator displays the True Spindle Position in the **Standard Mode**. (Section, '4.1.4 Initial Setup - Standard/TSP Mode' on page 26)
2. To enter the **Enhanced/Actual Mode**, press and hold the True Spindle Position (**TSP**) button (>2 seconds) until the two tolerance arrows begin to flash on the display. Readings are static in this mode.
3. To toggle back to the **Standard/TSP Mode** press and hold the True Spindle Position (**TSP**) button (>2 seconds) until the two tolerance arrows disappear from the display.

4.2.2 Enhanced/Dynamic Mode

The unit has to be in the **Enhanced/Actual Mode** in order to enter into the full **Enhanced Mode**. While in **Enhanced/Actual** a press and release of the **min**, **TIR**, **Hold**, or **Max** button enters into its corresponding selection. The dynamic functions are described below.

4.2.2.1 Minimum Reading

Displays the smallest measurement only.

Pressing the **Min** button selects the **Min Mode**. The left tolerance limit arrow of the display is on and the fan be reads from full scale MAX to the MIN value. Use the **Reset** button to clear the displayed Minimum value and start a new min measurement.

NOTE: (When using this and the following functions, spindle location is indicated by a single moving segment within the Fan display.)

4.2.2.2 Maximum Reading

Displays the largest measurement only.

Pressing the **MAX** button selects the **MAX** mode, the right tolerance limit arrow of the display will be on and the fan will be

reading from full scale **MIN** to the **MAX** value. Use the **RESET** button to clear the displayed Maximum value and start a new Max measurement.

4.2.2.3 Total Indicated Reading

Displays the **Total Indicated Reading** (**MAX-MIN**)

Pressing the **TIR** button selects **Total Indicated Reading**. Both tolerance limit arrows will be on and the fan reads the MAX to MIN travel. Use the reset button to clear the displayed TIR value and start a new TIR measurement. When TIR is reset it starts from the center zero reading on the indicator. The analog fan displays the min and max points and the digital value will be the total indicated reading of maximum minus minimum.

4.2.2.4 Hold / Update

Freezes and unfreezes the live display reading.

In the Enhanced Mode, this pushbutton toggles between **HOLD** and **UPDATE**. When in **HOLD**, the flashing segment in the **FAN Display** stops blinking, but retains the last measurement; the indicator does not update the reading. When pressed again, thereby deactivating **Hold**, the indicator resumes operation. When the **Hold** function is active, all other control buttons are disabled.

4.2.2.5 Reset

Resets the Dynamic Function for its next measurement.

In the Dynamic Function, this button is used to reset the **Dynamic Measurement** and sets the indicator to start the next measurement. The displayed value becomes the **Minimum** and **Maximum** values and the **TIR** becomes zero. In the **Enhanced Actual Mode** and the **Standard Mode**, this button functions as a zero button.

5.0 MAINTENANCE

5.1 Battery Signal

When the **Low Battery Signal** appears on the display (**BAt**), it indicates that battery power is too low for dependable readings. The indicator or indicating unit display continues to operate for a limited time (approximately a few hours). If used continually during this warning period the unit eventually ceases to display a reading and will only have the **BAt** indicated on it. This feature assures that inaccurate readings do not occur due to insufficient power.

Refer to section, ‘6.0 Parts and Service’ on page 37 of this instruction booklet for replacement battery part numbers and ordering information.

5.1.1 Changing the Battery

5.1.1.1 Disassembly

1. Place Indicator or Indicating Unit face down on a clean soft cloth. If applicable, disconnect the Digital Transducer and/or output accessory cable.
   - Alternately unscrew the two captive screws that hold the battery compartment door in place (Figure 20-A).

   The screws are design to push the door away from the case allowing an easy grip for removing the door.
2. Once the screws are completely unthreaded, carefully lift the battery door off the rear case (Figure 20-B).
3. Remove battery as specified below in the **CAUTIION** note below (Figure 20-C).



A Alternately unscrew the Battery Compartment Door



B Carefully remove the door



C Replace battery P/N 2239138

Figure 20

CAUTION: DO NOT REMOVE THE SCREWS FROM THE DOOR!
Do not tamper with the screw design (captive screws) as this can potentially cause difficulty in removing the door next time.

5.1.1.2 Reassembly

1. Carefully replace the old battery with a new battery, observing polarity symbols.

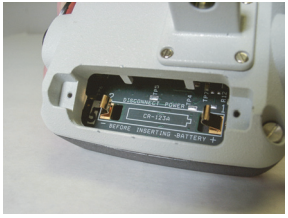


Figure 21 *- Battery polarity shown inside*

NOTE: *All Maxum III Indicators and Indicating Units use a 3.0 volt commercially available lithium battery. See Section, '6.0 Parts and Service' on page 37 of these instructions for battery part numbers and ordering information.*

2. Replace the battery door cover to the rear case. Make sure that the o-ring is aligned and in place during reassembly to insure proper seal of the battery compartment. For Indicating Units, reconnect the Digital Transducer. Pick up Indicator or Indicating Unit and observe display; some or all of the display elements will be **On**. Immediately depress and slowly release the measuring spindle to return the Indicator or Indicating Unit to its **Power Down** mode.

NOTE: *Whenever the battery is removed and replaced, the Indicator or Indicating Unit will lose its previous zero setting.*

NOTE: *Maxum III indicators do not need to have the rear case removed and doing so will void the warranty.*

5.2 Checking Accuracy

Accuracy is checked at zero, both ends of the digital range, and approx. halfway between zero and both ends of the digital range. Use a heavy-duty comparator stand with fine adjustment and five gage blocks as listed in Table A.

1. Mount the Indicator (or Digital Transducer) securely on the comparator stand and place the **Zero** gage block under the measuring spindle.

2. Using the Indicator's **Standard Mode**, Press and release the True Spindle Position button to enter the TSP mode.

3. Adjust the stand until the digital readout reads exactly zero. Do not use Auto-Zero.

4. Remove the **Zero** block and place each of the other gage blocks under the measuring spindle. Observe the digital reading for each. Each reading should be within the allowable variation listed in the table on page 33 If not, refer to Section, '5.4 Calibration' on page 35.

Maxμm®III Model	Digital Range	Gage Blocks to Use	Reading should be*	Allowable Variation in Digital Reading
Short Range	± 0.0199in	0.101in 0.110in 0.120in 0.130in 0.139in	-0.01900 -0.01000 0.00000 +0.01000 +0.01900	± .00005
Short Range	± 0.0400in	0.100in 0.120in 0.140in 0.160in 0.180in	-0.0400 -0.0200 .00000 +0.0200 +0.0400	± .0004
Short Range	± 0.199mm	1.12mm or 2.12mm 1.21mm or 2.21mm 1.31mm or 2.31mm 1.41mm or 2.41mm 1.50mm or 2.50mm	-0.190 -0.100 0.000 +0.100 +0.190	± 0.001
Short Range	± 1.000mm	4.0mm 4.5mm 5.0mm 5.5mm 6.0mm	-1.000 -0.500 0.000 +0.500 +1.000	± 0.010
Long Range	± 0.100in	.100in .150in .200in .250in .300in	-0.1000 -0.0500 0.0000 +0.0500 +0.1000	± 0.0007
Long Range	± 1.99mm	1.01mm 2.00mm 3.00mm 4.00mm 4.99mm	-1.990 -1.000 0.000 +1.000 +1.990	± 0.014
*See Note				**Re-zero with .100" block.

*NOTE: For indicators or Indicating Units having counterclockwise display direction, readings will have opposite signs.

5.3 Cleaning the Spindle

The measuring spindle may require cleaning if it does not move freely.

1. Unscrew the Contact Point. Use soft jaw pliers, or protect the Contact Point with a soft cloth.
2. Carefully remove the Boot.
3. Using a 9/32" or adjustable wrench, unscrew the threaded Bushing from the end of the stem.

CAUTION: *The Black Ferrite Core is fragile. Handle with care. Do not remove the Core from the end of the spindle unless it is damaged and requires replacement.*

4. Carefully remove Retaining Ring from the Spindle.
5. Clean all metal parts and flush out spindle cavity with a suitable solvent.
6. Clean the Boot and O-Ring separately, using a suitable cleaning agent. If either is worn or damaged, replace it.
7. When components are clean and dry, reassemble the spindle to the indicator or digital transducer. Use new Retaining Ring - ***do not re-use the old one.***.

Do not lubricate Spindle assembly

5.3.1 Contact Points

Maxum III Indicator and Digital Transducer models having an 0.375 in / 9,5 mm diameter stem can use any regular 4-48 threaded indicator contact point. Metric Maxum III indicator and Digital Transducer models having an 0.315 in / 8 mm diameter stem use an M2.5 threaded contact point.

Many alternate contact points are available; refer to the appropriate Mahr Product Catalog.

It is recommended that wear on contacts be monitored and changed when appropriately needed. Worn contacts can be a cause for incorrect measured readings.

5.4 Calibration

NOTE: *When calibrating, the indicator must be in its Standard Mode, not Enhanced Mode.*

NOTE: Auto Zero must not be used when calibrating. Any offset due to the use of Auto Zero, will be reflected in calibration accuracy. The indicator must be in TSP mode.

5.4.1 Resetting Digital Gain

Use a heavy-duty comparator stand with fine adjustment and two gage blocks as listed in the table on page 36. This procedure uses gage blocks that are 75% of the indicator's full scale. The **Calibration Mode** is selected outside the **Setup Mode**. Make sure that the indicator has an on-scale reading throughout this entire procedure.

1. Put the indicator into its **Standard Mode** (if previously in its Enhanced Mode).
2. Once in **Standard Mode**, press and release the **True Spindle Position**  button to put the unit in **TSP** (True Spindle Position) mode.
3. Press and hold the **TIR**  button until the text **CAL** shows on the digital display. The **CAL** text will show for a few seconds before returning to a live display.

The reverse fan display indicates the digital **POT** position. If needed, the **POT** may be reset to its center position by a press and release of the zero reset button

4. Once there is a live display, place the **Zero** size gage block under the measuring spindle and adjust comparator stand until the digital readout reads **exactly** zero. ***Do not use Auto-Zero***.
   - if gain adjustment doesn't change, press the **RESET** button to set the digital potentiometer to center.
5. Remove the **Zero** gage block and replace it with the second gage block. observe the digital readout. If necessary, use the **Decrement** and **Increment Cal Position** buttons  until the digital readout agrees exactly with the reading listed in the table on page 36.
6. Remove the second gage block and replace it with the **Zero** block. The digital readout should read exactly zero. If not, repeat steps 3 through 5.
7. After setting gain, exit the calibration mode with a quick press and release of the **TSP/Mode** button . The indicator returns to its **Standard** Operating Mode in the **TSP** Mode.

8. With the **Zero** block in place, press and release the **Auto-Zero** button for final zero setting against the zero master. The indicator should now be in its operating mode and ready for measurements.

NOTE: For Indicators or Indicating Units having counterclockwise display direction, readings will have opposite signs.

	Digital Range	Range Type	'Zero' Gage Block	Reading with 'Zero' Block should be:	Second Gage Block	Reading with Second Block Should be:*
**	±0.0199 in	Short	0.115 in	0.00000	0.100 in	-0.01500
**	±0.0400 in	Short	0.130 in	0.0000	0.100 in	-0.0300
	±0.100 in	Long	0.175 in	0.0000	0.100 in	-0.0750
	±0.199 mm	Short	1.15 mm	0.0000	1.00 mm	-0.1500
	±1.000 mm	Short	1.75 mm	0.000	1.00 mm	-0.750
	±1.99 mm	Long	2.50 mm	0.000	1.00 mm	-1.50
						*See Note Above.

** *NOTE: Indicates factory calibrated range (75% of Full Scale).*

6.0 Parts and Service

Maxum III Indicator parts and service are available from Mahr Inc., Providence, RI, U.S.A. Contact your Mahr Federal representative in Providence. Carefully pack items to prevent damage in shipment. Include a brief description of the problem and the name, address and telephone number of a person to contact if we have any questions

For expedited warranty service, contact our Customer Service Department at 1-401-784-3100 and obtain a Return Authorization Number.

Send shipments to:

Mahr Inc.Repair Department
1139 Eddy Street
Providence, Rhode Island 02905
U.S.A.

6.1 Replacement Parts

Contact Points	
Most Maxum III Indicators and Digital Transducers are furnished with one of the following Contact Points:	
PT-223	For .375" dia. Stem -1/4" long, radiused tip, 4-48 thread
PT-563	For .375" dia. Stem -1/4" long, radiused tip, 4-48 thread-for use with Lifting Lever
EPT-1037-W1	For 8mm dia. Stem 6 mm long, radiused tip, M2.5 thread
EPT-1037-W2	For 8mm dia. Stem 6 mm long, radiused tip, M2.5 thread-for use with Lifting Lever
Many alternate Contact Points are available. Refer to the Mahr Precision Gages catalog.	

Indicator Parts		
ECS-1214	Dust Cap for Output Connector (1)	
2239003	**Battery Door Assembly** – (complete assembly recommended for purchase)	
	2239034	Seal for battery door cover (1)
	2239010	Battery door (1)
	2239001	Screw, Battery Door (2) {requires special tool for assembly}
	2239002	Speed-Nut, Battery Door (2) {requires special tool for assembly}
ERG-1046	O-Ring, Case (1)	
ESW-1270	Screw, case, captive (4)	
ERG-1044	O-Ring, used with ESW-1270 captive screw (4)	
ENT-1118	Nut, Plug (no output models)	
Batteries		
2239138	3.0Volt lithium battery, Type CR123A (1400mA-h)	

Spindle Assembly Parts

Digital Transducer	A Contact Pt	B Boot	C Bushing	D O-Ring	E Retaining Ring	F Spindle	G Spacer **	H Core Assy	J Spring	K Spindle Assy^^
203309 1 or 3	PT-223	EGU-1022	EBU-1245**	ERG-1042	ERG-1049	EAS-1840-W	EBU-1246-W	EAS-1843	ESP-1112	EAS-3043-W
203309 5 or 7	EPT-1037-W1	EGU-1022	EBU-1245**	ERG-1042	ERG-1049	EAS-1908-W_	EBU-1246-W_	EAS-1843	ESP-1112	EAS-3044-W_
2033099	PT-225	EGU-1022	EBU-1456	ERG-1042	ERG-1049	EAS-2885	NONE	EAS-2884	ESP-1112	EAS-3042
2033090	EPT-1037-W1	EGU-1022	2239057	NONE	NONE	2239056	NONE	EAS-2884	ESP-1112	
203309 2 or 4	PT-223	EGU-1046	EBU-1448**	ERG-1042	ERG-1049	EAS-2817-W	EBU-1447-W	EAS-2857	ESP-1154	EAS-3016-W
203309 6 or 8	EPT-1037-W1	EGU-1046	EBU-1448**	ERG-1042	ERG-1049	EAS-2824-W_	EBU-1447-W_	EAS-2857	ESP-1154	EAS-3041-W_
Maxum®III										
Short Range -Z X	PT-223	EGU-1022	EBU-1245**	ERG-1042	ERG-1049	EAS-1840-W	EBU-1246-W	EAS-1843	ESP-1112	EAS-3043-W
Long Range -Z X	PT-223	EGU-1046	EBU-1448**	ERG-1042	ERG-1049	EAS-2817-W_	EBU-1447-W_	EAS-2857*	ESP-1154	EAS-3016-W_
Short Range -Y X	EPT-1037-W1	EGU-1022	EBU-1245**	ERG-1042	ERG-1049	EAS-1908-W	EBU-1246-W	EAS-1843	ESP-1112	EAS-3044-W_
Long Range -Y X	EPT-1037-W1	EGU-1046	EBU-1448**	ERG-1042	ERG-1049	EAS-2824-W_	EBU-1447-W_	EAS-2857*	ESP-1154	EAS-3041-W_
Short Range -V X	PT-223	NONE	EBU-1245**	ERG-1042	ERG-1049	EAS-1906-W	EBU-1246-W	EAS-1843	ESP-1112	

LEGEND

Contact Thrd 4 48/2.5mm

** use EBU-1349(reamed EBU-1245) & 2237337(reamed EBU-1448) for replacement parts.

Core Thd 2-56

Z=(0.375" Ø stem)
Y=(8mm Ø stem)
V=(0.375" Ø, no boot)

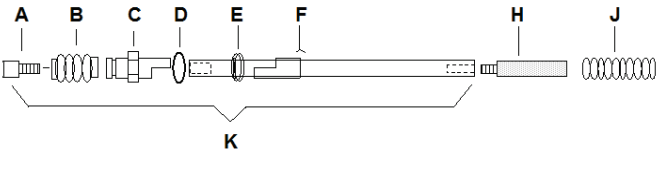
** -Spacer Not Shown

Maxum®III Models:
Short Range ≤ 0.040in/1.00mm range
Long Range 0.100in/1.99mm range

^^ -Same as spindle W-Number(See F)

X=Stem Length

Stem Length	20331(0.1.2)x	Transducer	F Spindle	G Spacer
.670" / .870"	x = 1, 2, 5, 6	W1	W1	None
1.50"	x = 3, 4, 7, 8	W2	W2	W1
2.00"	special	W3	W3	W2
3.00"	special	W4	W4	W3



Description	Mahr Part #
Remote Foot Switch (Hold/Reset)	EAS-2868 (10pin output models)
Remote Hand Switch (Hold/Reset)	EAS-2867 (10pin output models)
Overlay Kit	2239040 (includes all 3 overlays below)
5-0-5 Overlay	2239052
25-0-25 Overlay	2239053
50-0-50	2239054
Access Key (6pin output)	2240545
Access Key (10pin output)	2240547
Splash Cover	ECV-1307-W1
Lug Back	EBK-1006
Adjustable Slide Back	EBK-1007
Rack Back	EBK-1005
Screws for Mounting Backs	ESW-1252
Serial Output Cable (6pinM to db9pinF), 8 ft / 2.5 m	2239036
Serial Output Cable (10pinM to db9pinF), 8 ft / 2.5 m	2239038
Digimatic Output Cable (6pinM), 8 ft / 2.5 m	2239035
Digimatic Output Cable (10pinM), 8 ft / 2.5 m	2239037
For other accessories see the Precision Gages Product Catalog or visit our website at: www.mahr.com	

7.0 Specifications

MODELS:	LONG RANGE	SHORT RANGE
Digital Range:		
Standard Range	±0.100 in / ±1.99 mm	±0.040 in / ±1.00 mm
Reduced Range	None	±0.0199 in / ±0.199 mm
Digital Resolution		
	0.0001 in / 0.001 mm	0.00002 in / 0.0005 mm
(switchable^)	0.0005 in / 0.005 mm	0.00005 in / 0.001 mm
		0.0001 in / 0.001 mm
		0.0005 in / 0.005 mm
Analog Range:	25 or 50	5 or 25 or 50
Analog Resolution:		
	0.001 in / 0.01mm	0.001 in / 0.01 mm
(switchable^)	0.0005 in / 0.005mm	0.0005 in / 0.005 mm
		0.0001 in / 0.001 mm
Total Spindle Travel:	0.250 in / 6.35mm	0.120 in / 0.3 mm
Pre-Travel^:	0.020 in / 0.5mm	0.010 in / 0.3 mm
Over-Travel^:	0.030 in / 0.8mm	0.030 in / 0,.8 mm
Accuracy:		
Standard Range	0.35% of Total Range	0.5% of Total Range
Reduced Range	N/A	0.25% of Total Range
Repeatability:	± One Least Digit	± One Least Digit
Gaging Force:	3-4 oz. / 85-112 gm, preloaded	
Operation Temperature:	50° to 130° F / 10° to 55°C	
Storage Temperature:	-4° to 149°F / -20° to 65°C	
IP Rating:	54	
Weight:	Approximately 13.6 oz / 385 gm	
Battery Life:	Approximately 4000 hours	
Operating Voltage	2.8 to 3.1VDC	
^ - Dependent on standard or reduced range selected. Standard Range shown.		

8.0 Output Information

The Maxum III comes complete with digital output for communication with data collection devices. Three outputs are available on the Maxum III Indicator. The output to be used by the operator is selectable in one of three formats:

- Standard Maxum
- Serial ASCII
- Digimatic or BCD

The output from the indicator is based on the selection that is set in the **Setup Mode**. The output port may also be turned **Off** as part of the setup selection. The default setting is for **Standard** (**St**) Maxum format. To change to the other optional formats (see Section, '3.0 Setup Mode' on page 14).

CAUTION: Make sure proper cable and device connections are used with the data output selected on the indicator. improper use and lack of compatibility could be cause for system component malfunction.

A plastic cap covers the output receptacle when not in use. The pin-outs and description for each output format is described as follows:

8.1 STD Maxum Output

This format, consisting of a clock signal, 35 bit data stream and a plus/minus signal, has allowed for communication to virtually all data collection devices. Because of the remote **HOLD** and **RESET** features we offer two connector configurations. These are specified as 6-pin or 10-pin as part of the Maxum III ordering number.

The standard Maxum output is provided through a six pin connector. (Since this is the old format, most existing data collection devices will be compatible with this connector.)

The 10-pin is the same output format which includes control lines for **HOLD** and **RESET**.

Maxum III models using the 6-pin or 10-pin connector and output format selected for Standard Maxum have a pin-out designation as follows:

Pin #	Signal Name Maxum III with 6-pin conn.	Signal Name Maxum III with 10-pin conn.
1	+5V	+5V
2	Clock Out	Clock Out
3	Digital Out	Digital Out
4	Sign '1' (-)	Sign '1' (-)
5	Signal Com	Signal Com (Gnd)
6	Shield	Shield
7	N/A	Not for customer use***
8	N/A	Not for customer use***
9	N/A	RESET
10	N/A	HOLD

*** - These pins are never to be connected to. User assumes any and all liability when connecting to pins 7 & 8.

Data is available at up to 16 readings per second. The complete output signal consists of three signals:

- A Clock Signal
- A Digital Data stream
- A Sign Signal

During the **Power Down** state an output signal is sent approximately every 0.844 seconds.

8.1.1 Power Inputs

The Maxum III normally runs on battery. When the output connection is attached, a 5 volt and ground connection powers the Maxum III output circuitry.

8.1.2 Signal Output

The three basic signals output from the Maxum III are:

- **Clock** (clk out)
- **Digital stream** (dig. out)
- **Sign** (sign '1' (-))

The **Sign** signal is logic high when the minus (**-**) sign is visible. The **Clock** is 16.384 kilohertz square wave signal which is active for 12.7 ms during valid data time, otherwise this signal is in the

low state. The Digital Line is normally in a low state when no data is available.

When digital data is available, the digital line goes high and the rising edge of the clock signal goes high. This is the start pulse for the beginning of the **Digital Stream**. The next 35 bits of the Digital Stream read on the rising edge of the clock pulse contain all the information in seven segment code.

The entire digital stream is 2.20 milliseconds in length. The sign data is low (**+**) or high (**-**) for 0.4 ms before and 4.0 ms after the digital start pulse. The digital line (start pulse) and clock are used as the main indicators for data input. The Maxum III has the buffered signals available at the output connector.

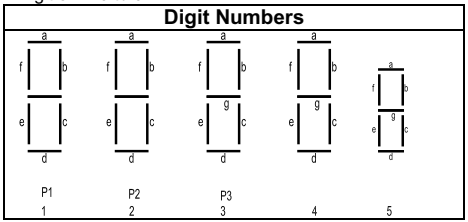
8.1.3 Hardwired

Digit #1-All segment connected together including the period. There is no 'g' segment.

Digit #2-Segment b and c connected together. Segment a, d, e, f connected together. There is no 'g' segment.

8.1.4 Possible Combinations

Digit 1	0 or OFF
Digit 2	0, 1 or OFF
Digit 3	0 to 9
Digit 4	0 to 9
Digit 5	0 to 9



Maxum III Enhanced Mode

BIT	ACT	MIN	MAX	TIR	UPDATE	HOLD
23	0	0	1	1	X	X
24	0	1	0	1	X	X
25	X	X	X	X	0	1

Bit Position	Data
0	Start pulse
1	g3
2	e3
3	d3
4	c3
5	b3
6	a3
7	f3
8	g4
9	e4
10	d4
11	c4

(Cont.)	
12	b4
13	a4
14	f4
15	g5
16	e5
17	d5
18	c5
19	b5
20	a5
21	f5
22	A1 P1 (all segments connected)
23	X - see Table 1
24	X - see Table 1
25	X - see Table 1
26	B2 (b2 c2 connected)
27	A2 (a2, d2, e2, f2 connected)
28	X or mm
29	P3
30	low battery warning
31	Upper limit (X for Maxum Plus Enhanced Mode)
32	Analog seg. 0
33	P2
34	lower limit (X for Maxum Plus Enhanced Mode)
35	X or – (minus sign)

The Maxum III serial output bits 23, 24, and 25 marked with an '**X**' is not used. However, for **Maxum III Enhanced Mode** use the table on page 46.

NOTES:

- **P1, P2, P3** - Refers to period digit number. i.e., P2 period on digit 2
- **BIT 1 through BIT 21** - Refers to segment location digit numbers. i.e., - c3; segment c of digit 3
- **A2** - Segments a, d, e and f of digit 2 are on or off.
- **B2** - segments b and c of digit 2 are on or off.
- **BIT 28** - Logic Low (0) units are in inch. Logic high (1) 'mm' units in millimeters.
- **BIT 30** - Low battery warning bit set during low battery warning condition.
- **BIT 35** - Logic Low (0) polarity of reading is a positive value. Logic high (1), '**-**' polarity of reading is a negative value.

8.1.5 Signal Input

8.1.5.1 HOLD/UPDATE

In the **Enhanced Mode**, this control performs a toggle function to either **HOLD** or **UPDATE** the Maxum III dynamic measurements. In this manner, the unit can be made to freeze the last set of readings:

- **Actual**
- **MAX**
- **MIN**
- **TIR**

After **UPDATE** has been activated, the display will resume operations, and the Actual, MAX, MIN, and TIR values are updated as if there had been no interruption. The assertion signal is a momentary logic 110, (GND) of at least 100 µSec. duration.

In the **Standard Mode**, connecting this input to **GND** causes the unit to enter the **True Spindle Mode** of control. This only occurs when the unit has an on-scale reading.

8.1.5.2 RESET/ZERO (Wake-Up)

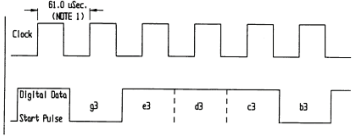
This input performs the **WAKE-UP** function from a '**Sleep**' mode condition.

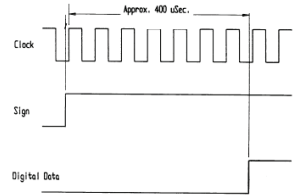
In the **Enhanced Mode**, this input resets the dynamic measurement reading. The currently displayed value becomes the maximum and minimum values, and the **TIR** value becomes zero. If the unit is in the **Actual** mode of operations, this input performs the **ZERO** function as described in the reference note below.

The assertion signal is a momentary logic '**O**' (**GND**) of at least 100 ms duration.

INOTE: *In the Standard Mode, grounding the input causes the unit to display the quantity '**O**' in both the analog and digital displays. This input is an external zeroing control. As with normal operation unit must be on-scale for it to zero the gage.*

Clock Starts ~8.3 ms before sign
or
~8.7 ms before Start pulse





Clock Stops ~1.8 ms after last bit

Sign is valid ~1.8 ms after last data bit

Maxum Digital Data Output Sequence

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Sp	g3	e3	d3	c3	b3	a3	f3	g4	e4	d4	c4	b4	a4	f4	g5	e5	d5	c5	b5	a5	f5	A1 P1	x	x	x	B2

27	28	29	30	31	32	33	34	35
A2	x	P3	LB	UL	A S D	P2	LL	x

8.2 ASCII Output

This digital output is provided to allow ASCII serial byte communications with other electronic devices. This is often referred to as a serial communication format. Data is transferred at 2400 baud and is updated 16 times a second. Maxum III models use a 6-pin or 10-pin connector and feature a SERIAL OUTPUT capability. The 10-pin model also offers a RESET and HOLD capability.

Maxum III models using the 6-pin or 10-pin connector and output format selected for ASCII have a pin-out designation is as follows in the table on the right:

Pin #	Signal Name Maxum III with 6-pin conn.	Signal Name Maxum III with 10-pin conn.
1	+5V	+5V
2	Clock Out	Clock Out
3	Digital Out	Digital Out
4	Sign '1' (-)	Sign '1' (-)
5	Signal Com	Signal Com (Gnd)
6	Shield	Shield
7	N/A	Not for customer use***
8	N/A	Not for customer use***
9	N/A	RESET
10	N/A	HOLD

*** These pins are never to be connected to. User assumes any and all liability when connecting to pins 7 & 8. This digital output protocol is as shown in the next section "8.2.1 Protocol"

8.2.1 Protocol

1start bit 2 stop bits
7 bits ASCII character 2400 baud
No parity bits

NOTE: *When using serial output cable 2239036 or 2239038 Protocol for com setting is 8-N-1 9600 Baud.*

The character strings will be in one of the following formats:

±1.99mm	**d**	**s**	**<SP>**	**DD**	**?**	**DC**	**DB**	**DA**	**M**	**t**	**<SP>**	**<LF>**
±0.100in	**d**	**s**	**<SP>**	**?**	**DD**	**DC**	**DB**	**DA**	**I**	**t**	**<SP>**	**<LF>**
±1.00mm	**d**	**s**	**<SP>**	**DD**	**?**	**DC**	**DB**	**DA**	**M**	**t**	**<SP>**	**<LF>**
±0.040in	**d**	**s**	**<SP>**	**?**	**0**	**DC**	**DB**	**DA**	**I**	**t**	**<SP>**	**<LF>**
±0.199mm	**d**	**s**	**<SP>**	**?**	**DD**	**DC**	**DB**	**<SP>**	**M**	**t**	**<SP>**	**<LF>**
±0.0199in	**d**	**s**	**<SP>**	**?**	**0**	**DC**	**DB**	**DA**	**I**	**t**	**<SP>**	**<LF>**

DA, DB, DC, DD Numeric Values
<SP> = ASCII space character
<LF> = ASCII Line Feed character
I = indication of inch measurements
M = indication of mm measurements
s = indication of measurement polarity
d = indication of dynamic display mode. Can assume one of the following:

When **HOLD** function is ***ACTIVE***
A = indication of actual mode
M = indication of maximum mode
L = indication of minimum mode
T = indication of TIR mode

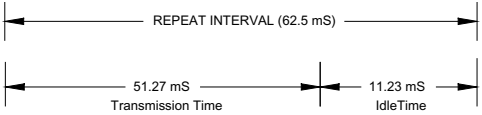
When **HOLD** function is ***INACTIVE***
a = indication of actual mode
m = indication of maximum mode
I = indication of minimum mode
t = indication of TIR mode
<SP> = if the standard product mode is active

t = indication of possible over or under limit condition
(active in standard mode only). Can assume one of the following:

0 = exceeds upper tolerance limit **U** = exceeds lower tolerance limit
<SP> = if the enhanced product mode is active.

8.2.2 Operation

The measurement update rate is 16 Hz. Therefore; a new data value is available every 62.5 ms. The transmission window characteristics are illustrated in the following timing diagram:



8.2.3 Sleep Mode/Over range

The serial output signal is suspended for these conditions.

8.2.4 Electrical Characteristics (ASCII)

The ASCII format serial output is compatible with TTL voltage levels, and it is capable of driving two standard TTL loads.

8.2.5 Power Input

The Maxum III requires a regulated +5V D.C. and GROUND input to power the output circuitry.

8.3 Digimatic / BCD Output

This method is a clocked serial BCD data stream consisting of 13 digits totaling 52 bits, emulating Mitutoyo's format. The digital output permits the LCD displayed displacement to be transferred to an external device such as a printer, personal computer or data collection system. The output is accessed via a 6-pin or 10pin connector. The remote HOLD or UPDATE capability is not available on this output format.

Pin-out as follows:

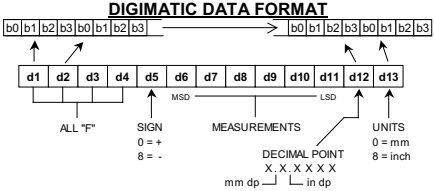
Pin #	Signal Name Maxum III with 6-pin conn.	Signal Name Maxum III with 10-pin conn.
1	N/A	Not for Customer Use***
2	SCLK	SCLK
3	SDAT	SDAT
4	SREQ	SREQ
5	Digital GND	Digital GND
6	Chassis GND	Chassis GND
7	N/A	Not for Customer Use***
8	N/A	Not for Customer Use***
9	N/A	RESET
10	N/A	HOLD

8.4 Theory of Operation

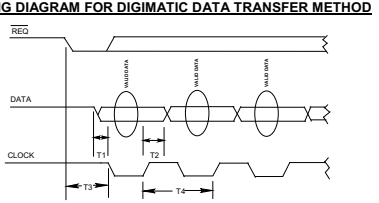
Enabling the data request line (SREQ\, pin # 4) will activate data transmission. The SREQ\ input is falling edge triggered and active low, it must go from high to low and held low until data transmission starts, then it can be brought high. A single output data reading comprises 13 digits (d1 - d13) with each digit being 4 bits

long for a total of 52 bits for each message. The bit order for each BCD digit is LSB to MSB. Data is valid during the low clock pulse and during either clock transition (from low/high or high/low). One display value is transmitted for each SREQ\ received. There is a one clock delay between each BCD digit.

8.4.1 Digimatic Data Format



8.4.1.1 Timing Diagram for Digimatic Data Transfer Method



T1 = 90 µs (min), T2 = 124 µs, T3 = < 62.5 ms, T4 = 428 µs

Clock Period	428 µsec
BCD Transfer Time	For 4 bits / digit is: 2.14 µsec
Reading Transfer Time	For 13 digits / reading is: 27.8 µsec
Reading Transfer Rate	16 Readings / second

8.4.1.2 BCD Encoded Data Format

EXAMPLES OF BCD ENCODED DATA FORMAT

EXAMPLE: + 1 . 2 3 4 5 mm

d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
F	F	F	F	0	0	1	2	3	4	5	4	0

EXAMPLE: - 0 . 3 4 9 mm

d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
F	F	F	F	8	0	0	0	3	4	9	4	0

EXAMPLE: - 0 . 1 9 7 5 in

d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
F	F	F	F	8	0	0	1	9	7	5	5	1

EXAMPLE: OFF - SCALE CONDITION

d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13
F	F	F	F	8/0	F	F	F	F	F	F	5/4	1/0

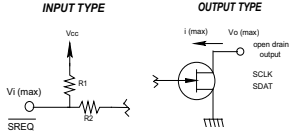
BCD: Off-Scale Note:
All BCD digit fields will be set to 'F'. The sign, decimal point, and unit fields are encoded normally.

8.4.2 Electrical Characteristics

There are two types of hardware data communications signals associated with the Maxum III Digimatic output, one is the input type and the other is the output type. To establish a logic level with the input type, be it logic high or logic low the external circuitry must be an open drain or an open collector type of driver. Internally the input type is at logic high via a pull up resistor to Vcc. To establish an output logic level with the output type, the external circuitry must provide a pull up resistor to external equipment Vcc.

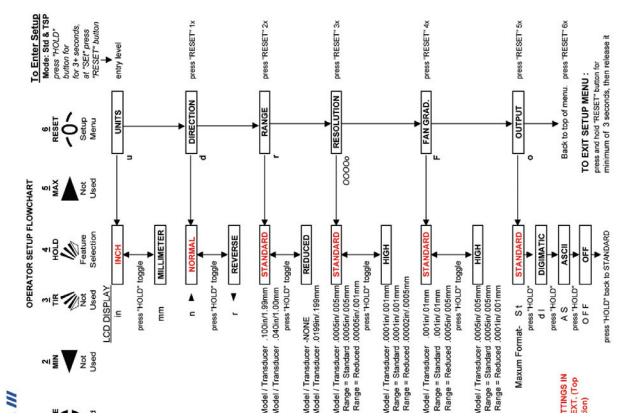
8.5 Mating Connectors

PARAMETER	PIN #	TEST CONDITION	MAX RATINGS	UNITS
input	4	Vi (max)	7.0	V
output	2, 3	Vo (max)	7.0	V
		I (max)	1.0	mA



Mating Connectors	
Connector	**Mahr Federal Part No.**
6 pin	ECN-1521
10 pin	ECN-1689

9.0 Quick Step Flow Chart



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