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## **Introduction**

The CTI\_Mx is an intelligent coating thickness measurement gauge. It allows the user to configure certain parameters that optimizes the gauge operation for specific measuring tasks. User configurable functions provided in the CTI\_Mx include data storage, organization and identification, units of measurement, counted average measurement, high-low limits for pass-no pass operation, probe calibration and data down loading and transfer options.

The CTI\_Mx has been designed to provide this wide array of functions while maintaining simplicity, ease, and speed in its operation. This is accomplished by using a menu driven system with LCD prompts and a simple three key user input. Any function can be accessed quickly by simply scrolling through some menus and selecting the desired option in each.

# Applications

<b>Models</b>	<b>Application</b>
CTI_MF	Non-ferrous coatings on ferrous substrates
CTI_MN	Non-metal coatings on non-ferrous substrates
CTI_MT	Both applications

# 1- Using the CTI\_Mx

## 1.1 The Three-key User Input

The CTI\_Mx provides three user-input keys that allow the user to scroll through layers (levels) of menus, select options. And set numerical parameters.



- 1- Turns the power on
- 2- Selects displayed menu option
- 3- Enters numerical parameters



- 1- Scrolls up through menu options
- 2- Increases displayed value



- 1- Scrolls down through menu options
- 2- Decreases displayed value

## **1.2 Menus**

The CTI\_Mx utilizes several layers (see MENU MAP) of menus to facilitate quick and simple gauge operation. All of the menus in the CTI\_Mx system are continuous (i.e., if the user scrolls through an entire menu list and continues to scroll in the same direction, the menu list will be repeated after it has reached the end of the list). Thus, the user can scroll up or down from any item on the menu. All of the menus in the CTI\_Mx system contain an EXIT option. By selecting the EXIT option from any menu, that menu will be escaped and the previous menu will be entered. (Selecting EXIT from the main menu puts the gauge into the current measurement mode).

## **1.3 Turning on the CTI\_Mx**

The user must take care that the probe not be in close proximity to a metal surface at the time of power up, since a probe initialization procedure is executed at this time. Upon pressing the ON-SEL key to turn on the gauge, the LCD will momentarily display TEKNOCOM, and then enter a measurement mode, with the LCD displaying "--". If the close proximity of a metal surface to the probe is sensed, LIFT PROBE will scroll across the LCD until the probe is moved away from the metal surface. Then the gauge will enter a measurement mode.

**CTI\_Mx will shut off automatically after about 90 seconds of sensing no activity.**


## 1.4 MENU MAP

- \* Use ⊕ or ⊖ key to scroll up or down within the Main Menu or within a Level.
- \* Use ⊞ key to progress to the next Level (moving to the right across the diagram).

Main Menus ▼	Submenus →						
	Level1	Level2	Level3	Level4	Level5	Level6	Level7
MEMORY	EXIT	return to the Main Menu					
	TAG	EXIT	returns to Level1 Submenus				
		Z - A batches	character list	character list	character list	character list	character list
	PRINT	ALL	prints all batches ( not recommended )				
		EXIT	returns to Level1 Submenus				
		Z - A batches	prints the selected batch				
	STATUS	ALL	displays the overall status of the gauge's memory				
		EXIT	returns to Level1 Submenus				
		Z - A batches	MIN	returns to measuring mode			
			CNT	returns to measuring mode			
			DEV	returns to measuring mode			
			AVG	returns to measuring mode			
			MAX	returns to measuring mode			
	CLEAR	ALL	clears all batches and returns to measuring mode				
		EXIT	returns to Level1 Submenus				
		Z - A batches	clears the selected batch				
	ON/OFF	OFF	turns the active memory batch off				

	EXIT	returns to Level1 Submenus
	Z - A batches	turns the selected batch of memory on
EXIT		returns to measuring mode
CONFIG	EXIT	
	VERSION	displays the version
	SERIAL NUM	displays the gauge's serial number
	FACTORY	resets the gauge to factory setup ( <b>clears contents of all memory batches</b> )
	TIME	allows the user to change the time
	DATE	allows the user to change the date
UNITS	EXIT	returns to Main Menus
	MICRONS	returns to measuring mode with metric unit of measurement
	MILS	returns to measuring mode with English unit of measurement
LIMITS	EXIT	returns to Main Menus
	HIGH	allows the user to change or set a high limit
	LOW	allows the user to change or set a low limit
	ON	turns the limit mode on with the existing Hi and Low setup
	OFF	turns the limit mode off
CAM	CAM OFF	turns the <u>C</u> ounted <u>A</u> verage <u>M</u> easurement mode off
	CAM EXIT	returns to Main Menus
	CAM 99 - 2	tuns the CAM mode on with the selected number of readings to be averaged
CAL	EXIT	returns to Main Menus
	1 PT	00 PLATE(probe) returns to measurement mode
	2 PTS	00 PLATE(probe) W/SHIM (probe) COMPLETE returns to measurement mode


## 1.5 Accessing the Main Menu from a Measurement Mode

To exit a measurement mode and access any of the optional functions from the menu driven system, press the  key.

Returning to a measurement mode from a menu function is automatic upon completion of most of the optional operations provided on the menus. (See Menu Map)

Gauge operation can be returned to a measurement mode from the Main Menu by selecting EXIT.

## 2- The Battery

The CTI\_Mx is powered by a standard nine-volt **alkaline** battery. There is a battery voltage sensing capability built into the gauge. When the battery voltage drops below a certain threshold, the LCD will prompt the user with low battery ICON(). When this prompt appears, the battery should be replaced soon.

## 3- Taking Measurements

There are four different measurement modes to suit the needs of the user. The simplest and quickest measurement mode is the Single

Measurement mode. The other measurement modes are used when the user desires to store measurement readings in the gauge memory, determine the averages of sets of a particular number of measurement readings, or store the calculated averages of several sets of measurement readings in the gauge memory.

Each of these measurement modes are explained later in this section.

Measurement readings are taken in the same manner in all of the measurement modes.

Upon initially entering a measurement mode, the gauge will display “ - - - “. (The CTI\_Mx always enters a measurement mode immediately when it is turned on. The measurement mode entered will be the one that the gauge was configured for when it turned off after its last use).

To Take a measurement reading, the probe must be placed and held steadily on the coated surface of a metal substrate. While the probe is placed on the surface, the measured thickness readings will be continuously updated and displayed. When the gauge senses that the probe is positioned in a stable manner, it will beep, indicating that a valid measurement has been made. Once a valid measurement has been made and the probe is lifted, the value of the measurement will be displayed until the probe is placed down for the next measurement.

**NOTE:** If the probe is not lifted after the beep, it will continue to update readings. To take a new


reading, the probe must be lifted first and then placed down on the surface.

**If no new measurement is taken for several seconds, the LCD will start to periodically display the date and the time.** After each time, the date or time is displayed, the LCD display will revert to the last measurement reading. **If no new measurement or key action is taken for approximately two minutes, the gauge will automatically shut off. When the gauge is turned back on, it will automatically enter the same measurement mode it was in when it turned off.** Thus, measurements can be resumed as if the unit never shut off, even in the middle of storing a batch of memory, or in the middle of a set of readings to be averaged.

### **3.1 Single Measurement Mode**

This mode can be used when storage of measurement readings and/or averaging of sets of readings are not required. This measurement mode is the simplest and fastest measurement mode and requires no user configuration. The thickness measurement reading is the only thing displayed on the LCD in this mode (except for the periodic date and time displays when readings are not being taken).

### 3.2 Measure-Store Mode

To select this mode first press the  key to enter into Menu mode from measuring mode.

#### Shows on display

MEMORY  
EXIT  
ON/OFF  
A

	MEM	um
A1		--

#### Press this key




Ready to take readings and store them in the selected batch A

In this mode, measurement readings are stored in the gauge memory (see MEMORY in the Optional Functions Mode section for more details). In addition to displaying the measurement readings in this mode, the LCD will display two characters on the left. These characters (batch location characters) indicate the location in the current batch of data, where the next measurement reading will be stored. The data batches in the CTI\_Mx are organized as a continuous column. The first batch location character will be a letter denoting the batch that the data is being stored. The second character is a number. That number indicates the position of the memory location in the column. This position always starts at 1 and is increased with each successive reading. For example, if the user chooses to turn on data batch U, upon entering the Measurement Store mode, U1

will appear on the left side of the LCD, and the first measurement reading taken will be stored in the batch location denoted by U1. After the first reading is taken and stored, U2 will appear on the left side of the LCD. This denotes the batch location where the second measurement reading will be stored, and so on.

### 3.3 Counted Average Measurement Mode (CAM Mode)

To select this mode first press the  key to enter into Menu mode from measuring mode.

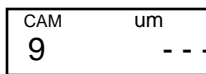
**Shows on display**

**Press this key**

MEMORY  
CAL  
CAM  
CAM OFF  
CAM 2  
CAM 3



.....  
CAM 9



Ready to take readings and show the average, min and Max of each set of 9 readings.

In the CAM mode, the CTI\_Mx has the capability of taking a set of consecutive

measurement readings (between 2 and 99) and determining the average, maximum and minimum values of the readings in a set. The number of readings to be included in each set, is selected by the user (see CAM in the Optional Functions mode section). Upon user selection of this number, the gauge enters CAM mode. After the first measurement is completed, a number (set indicator) indicates the number of readings that must be taken to complete the current set for averaging. Thus, each time a measurement is completed, the number on the left will decrease. Soon after the final measurement of a set is completed and the measured thickness displayed, the gauge beeps again and the average of the set of readings is displayed. By pressing the  $\oplus$  or  $\ominus$  key, the minimum and the maximum values will be displayed. To take another set of readings to be averaged, no user key inputs are required. When the probe is placed for another reading, the process is automatically repeated until the CAM mode is exited and the CAM function turned off.

### **3.4 Counted Average Measurement-Store Mode (CAM-Store Mode)**

This mode is a combination of the measure-Store mode and the CAM mode. Only the calculated averages of each set of readings are written to the gauge memory. These calculated average readings are stored in the same manner that single measurement readings are stored, in the Measurement Store mode.

Upon entering this mode, the two batch location characters will appear on the left (see Measure-Store mode) while “ - - - “ is displayed on the right, just as in the Measure-Store mode. When the first measurement is completed and the measured thickness displayed, the two batch location characters will disappear and the set indicator number (see CAM mode) will appear, as it does in the CAM mode. When the probe is lifted, the set indicator will disappear and the batch location characters will reappear. The left side of the LCD display will continue to alternate between the batch location characters and the set indicator number in the same manner. As in CAM mode, the average of a set of readings will be displayed after the final measurement of each set (this is the value that will be stored).

#### **4- Main Menu Mode**

In this mode the user can scroll through the main menu and choose any of the functions on the menu. The Main Menu mode can be accessed at any time while the gauge is in a measurement mode by pressing the ON key. Thus, at any time parameters can be checked and/or reconfigured, functions turned on or off, memory scanned or calibration updated.

Main Menu:



MEMORY  
EXIT  
CONFIG

UNITS  
LIMITS  
CAM  
CAL



Information about each of the Main Menu options is given in the following section.

## 5-Optional Functions Mode

### 5.1 MEMORY

The CTI\_Mx allows the user to store up to 26,000 measurement readings. These readings can be stored in up to 26 separate batches (each denoted by a “batch letter”. Upon selecting MEMORY, the following menu is entered:

	EXIT	
	EXPORT **	
	TAG	
	PRINT	
	STATUS	
	CLEAR	
	ON/OFF	

Those options that are indicated by (\*\*) are not the standard options.

All of the functions on this menu allow the user to operate on any of the memory batches individually. Thus, upon selecting any of these functions, a menu will be entered which contains

26 batch titles (the first characters of which will be A, B, C, ....Z, the batch letters). (Some of the menus contain a few more items also. These will be mentioned in the appropriate Memory subsections, but menus will not be listed). **Some of these batch letters may be succeeded by a star symbol. The star indicates that there is some data stored in that batch.**

### **5.1.1 ON/OFF**

This function is used to select a memory batch or to turn off the memory function so that measurements can be taken in one of the non-storage measurement modes (the OFF option only appears in the ON/OFF menu when the memory function is enabled or “ON”).

To select a batch from the menu, select the ON/OFF option then scroll up to the desired batch letter and select it. The gauge will enter Measure-Store mode (or CAM-Store mode if the CAM function is on), and readings will be stored in the selected memory batch.

NOTE: When selecting a batch, if there is an \* after the batch letter, that batch contains previously stored information.

### **5.1.2 EXPORT \*\***

This function can be used to write a batch of readings to a mem-pack, batches of readings may

be sent anywhere to be viewed or printed without the need to take the gauge out of the field.

### **5.1.3 TAG**

This function is used to add an identification tag to the batch letters denoting the memory batches. It can also be used to change or delete an already existing tag.

Upon selecting the batch letter to which the tag is to be added, deleted or changed, the bottom segment of the left-most LCD character place will blink. The scroll keys can be used to scroll through a large menu of figures and characters. When the first character is chosen, the bottom segment of the next character place of the LCD will blink. Continue to select figures and characters until they have been selected for all 7 positions (a space is a valid selection). When the figure for the final position has been selected, the gauge will return to the Main Menu.



### **5.1.4 PRINT**

This function is used to download or print to a printer a batch of readings through the RS232 port.

The format for printing can be set in one batch at a time is recommended.



CONFIG. Submenu (see 5.2.5)

To activate this function, select the PRINT option from the MEMORY menu.


The first choice is ALL (batches). By pressing the  key the next batch will be displayed, A,B,C.....Z. Select the desired batch to be printed by pressing the  key.

### 5.1.5 STATUS

This function can be used to check the status of the overall gauge memory or individual batches of memory. The STATUS menu contains the 26 batch titles and ALL. The overall status of the gauge memory can be checked by selecting ALL. Upon selecting ALL, the following message will scroll across the LCD: USED [number of memory locations used] OUT OF [number of total memory locations]. To check the status of an individual batch, select the desired batch letter.

Upon selecting the batch, the following statistical information can be scrolled by pressing the  and  keys:

**MIN**.....minimum thickness  
**MAX**.....maximum thickness  
**AVG**.....average thickness  
**DEV**.....stand deviation of the readings  
**CNT**.....number of readings in the batch

To exit this function while one of these above statistical information is displayed, press the  key, the gauge will return to the last measurement mode.

### 5.1.6 CLEAR


This function can be used to erase memory and clear batch organization parameters in a particular batches or all of the gauges memory at once. To clear all of the memories select ALL. To clear a particular batch, simply select the batch letter representing that batch.

### 5.2 CONFIG

The CTI\_Mx processor has an on-board clock that keeps track of the date and time. (Used in identifying data batches).

The CONFIG option allows the user to check and reset the date and time if necessary. Also, it allows the user to verify the code version and serial number of the gauge, and to reset the gauge functions to their factory-reset states.

Upon selecting CONFIG, the following menu is entered:

 EXIT  
VERSION




SERIAL NUMBER  
FACTORY  
TIME  
DATE





### 5.2.1 DATE

Upon selecting DATE, the current date according to the gauge clock, will be displayed as follows:

MT/DY/YR

The bottom segment of the first month's digit will blink. If the first month's digit needs to be changed, it can be increased at this time using the  key or decreased by using the  key. When the value is correct, press the .

After the value is selected, the bottom segment of the next digit will blink indicating that the digit may be reset using the  or  key. This process will continue until the last digit (second digit of the year) has been selected.

### 5.2.2 TIME

Upon selecting TIME, the current time according to the gauge clock will be displayed as follows:

## HR-MN-SD

The hour display is 00-23 as in the military time system. The time can be reset in the same manner as the date. (see DATE).




### 5.2.3 FACTORY

Upon selecting FACTORY, THE LIMITS, CAM, UNITS, CAL , and **MEMORY** configurations will all be cleared and reset to the initial factory settings.

### 5.2.4 SERIAL NUMBER

Upon selecting SERIAL NUMBER, the serial number of the gauge will be displayed.

### 5.2.5 Select the print

Select the prints format option by pressing the  key or scroll through the choices by  or  keys.

**PRT STAT:** By selecting this function, the statistical figures of the readings are printed (min, Max, average and standard deviation).

**NO STAT:** If this function is selected, the statistics are not printed.

**PRT DENS:** By selecting this option, a density graph of the readings is printed. This graph will represent the distribution of the readings.

There are three sets of GRAPHICS format to be selected.

**1- TEXT or GRAPHICS:**

TEXT format is compatible with all serial port printers.

GRAPHICS format is only compatible with U-Tronics, some IBM and EPSON serial port printers.

**2- SMOOTH or COURSE**

**3- NORMAL or WIDE:**

By selecting WIDE, the appearance of the graph would be twice as wide as normal size.

**PRT DATA:** If PRT DATA is selected, all the readings are also printed.

**NO DATA:** By selecting this function, the readings are not printed for that batch.

### 5.3 UNITS

The CTI\_Mx will display and store measurement readings in mils or microns. The UNITS function is used to choose the desired units of measurement.

Upon selecting UNITS, the following menu is entered:





	EXIT	
	MICRONS	
	MILS	

Select MILS to display and store measurement readings in mils. Select MICRONS to display and store measurement readings in microns. Upon selecting the desired units, the gauge operation returns to the current measurement mode.

### 5.4 LIMITS

The CTI\_Mx allows the user to choose an upper limit and/or lower limit for pass/no-pass operation.


Upon selecting LIMITS, the following menu is entered:

	EXIT	
	HIGH	
	LOW	
	ON	
	OFF	

### **5.4.1 OFF**

Select OFF to turn off the limit function.

### **5.4.2 HIGH**

Select HIGH to set the upper limit. Upon selecting HIGH, HI L 0.00 will appear. The number shown represents a thickness reading. The scroll keys can be used to change this number to equal the desired upper limit. Select by pressing the  key.

### **5.4.3 LOW**

Select LOW to set the lower limit. Upon selecting LOW, LOWL 0.00 will appear. The procedure for selecting the lower limit is the same as the procedure for selecting the upper limit (see HIGH).

### **5.4.4 ON**

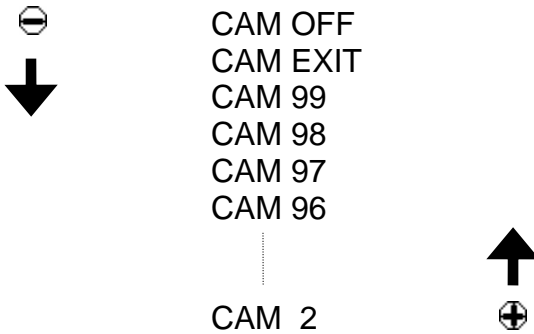
Select ON to turn on the limit function.

## **5.5 CAM**

The CTI\_Mx provides the option of counted average measurements. Calculated averages of sets containing a specified number of consecutive measurements can be displayed and stored (see

CAM MODE and CAM-Store mode in the Taking Measurements section).

Upon selecting CAM, the following menu is entered:



### 5.5.1 CAM OFF

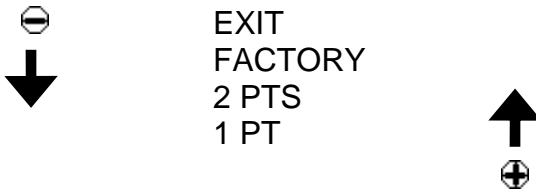
Select CAM OFF to turn off the CAM function so that only single readings will be displayed or stored.

### 5.5.2 CAM 2 - CAM 99

The number at the right determines the number of measurements in each set of measurements to be averaged. Upon selecting one of these options, the gauge will enter CAM mode or CAM-Store mode.






## 5.6 CAL

Upon selecting CAL, the following menu is entered into:



### 5.6.1 2 PTS



Upon selecting 2 PTS, 00 PLATE will flashing on the LCD. This prompts the user to place the probe steadily on a bare metal plate. (NOTE: the metal plate used for calibration should be as similar as possible to the metal substrate upon which the coating thickness will be measured.) When the first zero plate calibration measurement is complete, the gauge will beep and the LCD will display CAL and a measurement. Then MORE/SEL will flash on the LCD. At this point, the user has the option of taking another zero plate measurement, or moving on to the next step in the calibration process. (If more than one zero plate

measurement is made, the results will be averaged. It is recommended that several zero plate measurements be taken if the surface of the metal plate is rough or uneven. One zero plate measurement is sufficient for smooth surfaces.) To make successive zero plate measurements, the procedure for the first zero plate measurement is repeated. When a sufficient number of zero plate measurements have been completed, press the  key when the MORE/SEL prompt appears. At this time, W/SHIM will appear on the LCD. This prompts the user to place a shim of known value on the bare metal plate and place the probe steadily on top of the shim. (NOTE: If the range of coating thickness to be measured is known, select a shim with a thickness in that range). When the non-zero measurement is complete, ADJC and a thickness measurement value will appear on the LCD. The user then can use the scroll keys ( key and  Key) to increase or decrease the thickness value shown until it is equal to the known value of the shim. When this is done the  key is pressed and calibration is completed, COMPLETE will appear on the LCD. The  key is then pressed again to enter the current measurement mode.

### 5.6.2 1 PT

This calibration option is used when quickness and simplicity are essential, or a shim of a known thickness is not available.

(For applications where the highest possible accuracy is essential. The 2 PT calibration is recommended.)

Upon selecting 1 PT, 00 PLATE will appear on the LCD. This prompts the user to make a zero plate measurement. This process is identical to the zero plate measurement process in the two-point calibration. (See 2 PTS for details) When a sufficient number of zero plate measurements have been completed, press  key when the MORE/SEL prompt appears. At this time, COMPLETE will appear on the LCD. Press the  key again to enter the current measurement mode.

### **5.6.3 FACTORY**

Selecting FACTORY loads factory present calibration data. Gauge Operation will return to the current measurement mode immediately upon selecting FACTORY.

## WARRANTY INFORMATION

### • Warranty Statement •

Sabern Instruments warrants the CTI M series against defects in materials and workmanship for a period of one year from receipt by the end user. Additionally, Sabern Instruments warrants probe and accessories against such defects for a period of 90 days from receipt by the end user. If Sabern Instruments receives notice of such defects during the warranty period, Sabern Instruments will either, at its option, repair or replace products that prove to be defective.

Should Sabern Instruments be unable to repair or replace the product within a reasonable amount of time, the customer's alternative exclusive remedy shall be refund of the purchase price upon return of the product.

### • Exclusions •

The above warranty shall not apply to defects resulting from: improper or inadequate maintenance by the customer; unauthorized modification or misuse; or operation outside the environmental specifications for the product.

Sabern Instruments makes no other warranty, either express or implied, with respect to this product. Sabern Instruments specifically disclaims any implied warranties of merchantability or fitness for a particular purpose. Some states or provinces do not allow limitations on the duration of an implied warranty, so the above limitation or exclusion may not apply to you. However, any implied warranty of merchantability or fitness is limited to the one-year duration of this written warranty.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state or province to province.

• **Obtaining Service During Warranty Period** •

If your hardware should fail during the warranty period, contact Sabern Instruments and arrange for servicing of the product. Retain proof of purchase in order to obtain warranty service.

For products that require servicing, Sabern Instruments may use one of the following methods:

- Repair the product
- Replace the product with a re-manufactured unit
- Replace the product with a product of equal or greater performance
- Refund the purchase price.

- **After the Warranty Period** •

If your hardware should fail after the warranty period, contact Sabern Instruments for details of the services available, and to arrange for non-warranty service.

**CAUTION: Do not leave the Instrument in direct sunlight for an extended period of time, i.e., on dashboard or in a metal tool box in the back of an open truck.'**

**FOR TECHNICAL ASSISTANCE**

Contact:

Branch Office at:

