3M™ EM Eye Meter

Handheld ESD/EMI Event Detector, EM Field, RF Signal Meter

User's Guide

3M

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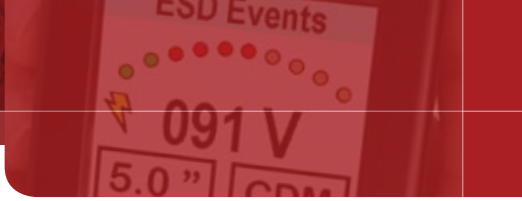

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3M™ EM Eye Meter, Model CTM048

CTM048-21, CTM048-28, CTM048-29 and CTM048-2128

Safety Statements

Read, understand, and follow all safety information contained in this user's guide prior to use of the 3M EM Eye Meters. Retain these instructions for future reference.

FCC

EXPLANATION OF SIGNAL WORD CONSEQUENCES	
⚠ WARNING:	Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury and/or property damage.
⚠ CAUTION:	Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury and/or property damage.

⚠ WARNING:

To reduce the risks associated with hazardous voltage, which if not avoided, could result in death or serious injury:

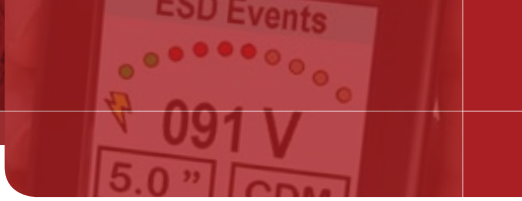
- Never allow children or other non-qualified persons to come in contact with battery charger;
- Never use battery charger outdoors or in other wet locations;
- Always use extreme caution to avoid coming into contact with any exposed electrical conductors of the equipment being measured with the EM Eye Meter.

To reduce the risks associated with hazardous voltage or possible fire or explosion related to internal Li-ion battery, which if not avoided, could result in death or serious injury:

- Use only the battery charger provided with the product;
- If the battery charger is missing or damaged, only replace with one supplied by 3M.

To reduce the risks associated with electrostatic discharge (ESD) voltage, which if not avoided, could result in damage to the meter:

- To install or change antennas, turn off the meter, install or change antennas, turn meter back on;
- Avoid touching antenna when meter is turned on.



⚠ CAUTION:

To reduce the risks associated with ground water contamination or from fire or burns from improper disposal:

- Never incinerate or dispose of product in a manner inconsistent with local, state or federal regulations.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada

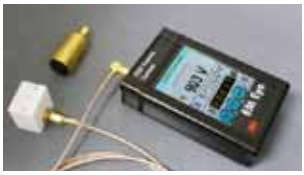
This Class A digital apparatus complies with Canadian ICES-003.

Overall Features

The 3M™ EM Eye Meter is a universal instrument that is capable of providing measurements for many various parameters, which are determined by the type of sensor connected to the EM Eye Meter. Below are the three sensors that are available now:

- **ESD Events Detection** – The EM Eye Meter is capable of detecting ESD events of most testing models, specifically focusing on the CDM model. It is easy to operate and can be used by almost anyone who is involved with ESD. The EM Eye Meter provides information on estimated discharge voltages at a specific location, what time the event occurred and how many discharges have occurred. The meter's size is so small it can be used in tight locations inside a tool or in a wider area of interest. For extended temperature environments, the EM Eye Meter can use an optional special remote antenna which will work in most conditions. All information is recorded on miniSD™ card for easy review and retrieval of data.
- **Electromagnetic Field Measurement** – By simply placing the Electromagnetic Field (EMF) sensor head into the EM Eye Meter base, the EM Eye Meter transforms into a dedicated EMF meter, a power density meter and an EIRP meter. The EM Eye Meter detects and measures high frequency electric fields that may be present in equipment, tools, circuit boards or on any process in a manufacturing area. The EM Eye Meter also measures high frequency electric fields from mobile phones, over-the-air TV signals, wireless LANs and any other source generating fields within its specification. The EM Eye Meter comes with a miniature directional antenna that measures various field parameters. The directional antenna reduces the influence of ambient electromagnetic fields when measuring emission coming from the specific source. So whether you're in the fields of product design, mobile phones, TV signals or wireless LANs, the portable EM Eye Meter is an important part of your toolbox.
- **RF Signal Sensor** – The EM Eye Meter with the replacement RF Sensor head is capable of measuring RF signals. Usually used by radio communications designers and engineers, the EM Eye Meter will be able to provide a readout of RF signal voltages. The EM Eye Meter offers exceptional sensitivity and linearity.

User Features

Modular Construction The 3M™ EM Eye Meter with the modular construction concept can expand to different applications. With the current design, it measures ESD events, electromagnetic fields (EMF), power density, effective isotropically radiated power and radio frequency (RF).	
Touch Screen to Power ON The EM Eye Meter is designed with a modern user interface. All buttons and controls are within the display itself. With its display and touch screen, it is easier for users to quickly navigate through the features that were built into the meter.	
Speaker and Headphone Alarm Outputs The EM Eye Meter, with a speaker and headphones, allows flexible means for audible indications, beeping or "warbling" like a radio. If one is in a noisy place, a headphone jack for optional headphones can be used for clearer audio.	
Remote or Local Antenna Selection 3M recognizes that an engineer may be working in tight physical locations. The EM Eye Meter is small and portable with expansion accessories that can be fitted in hard-to-reach places, and in hot or cold temperatures.	
Easy Data Logging to Memory Card The EM Eye Meter supports data logging by using a miniSD™ card and exports to an Excel spreadsheet. Having data at hand enables quick analysis. Solutions can be decided quickly and can be measured on the spot.	

Box Contents

Please confirm that the following accessories are included in your 3M™ EM Eye Meter package when you open it:

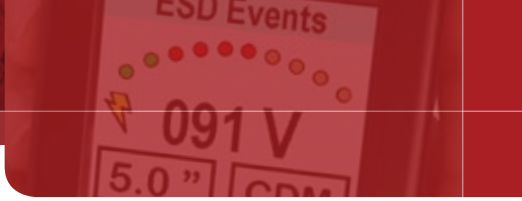
- Base EM Eye Meter module
- One or more of the following sensors heads:
  - ESD event sensor with antenna
  - Electromagnetic field sensor with antenna
  - RF signal sensor (includes RF cable and 20 dB attenuator)
- Power supply adapter
- Optional accessories may be ordered separately:
  - Remote antenna CTC113; CTC115 (extended temperature)

Serial Number

The serial number of your meter is a 5-digit number located at the top left section of the Menu F screen.

Precautions

- **Do not drop the meter. This may damage the instrument and will void the warranty.**
- **Do not discharge directly into the antenna metals as it may damage the input sensors and will void the warranty.**
- **Be cautious in the placement of antenna and the module heads; align the parts while assembling.**
- **Do not use sharp objects to touch the screen.**
- **Do not use a wrench or pliers to screw or unscrew the antenna. Use your bare hands.**
- **Do not remove the miniSD™ card while the power is on. Turn off the meter before removing the miniSD card.**
- **Do not remove the sensor heads while the power is on. Turn off the meter before removing and replacing the heads.**



Attaching the Sensor Heads

Please keep in mind the following when using the modular sensor heads.

BEFORE CONNECTING TO AN INPUT SOURCE, TOUCH THE OUTSIDE SURFACE OF THE 3M™ EM EYE METER INPUT CONNECTOR. THIS WILL HELP PREVENT ESD SHOCK TO THE METER.

1. The **power must be turned off** when changing the sensor heads.
2. Make sure to gently plug or unplug the sensor heads.
3. Plug or unplug the sensor heads by gripping them firmly balanced on each side. Do not use the antenna for plugging and unplugging the sensor heads.
4. If the antenna is separated from the sensor head, reattach it when the sensor head is securely in place.

Attaching the Antenna

In order to avoid damaging the EM Eye Meter, installation and replacement of the antenna must be done with great care. An excessive amount of force or improper installation may permanently damage the meter.

Attach the antenna to the input connector by simply screwing it in by hand.

DO NOT OVERTIGHTEN THE CONNECTION. Screw in the antenna firmly but gently. Do not use any tools other than your hand to attach and detach the antenna.

Power Supply and Charger

Use only the power supply that comes with the 3M™ EM Eye Meter. Do not use any other power supply as it may damage the meter.

Battery Care

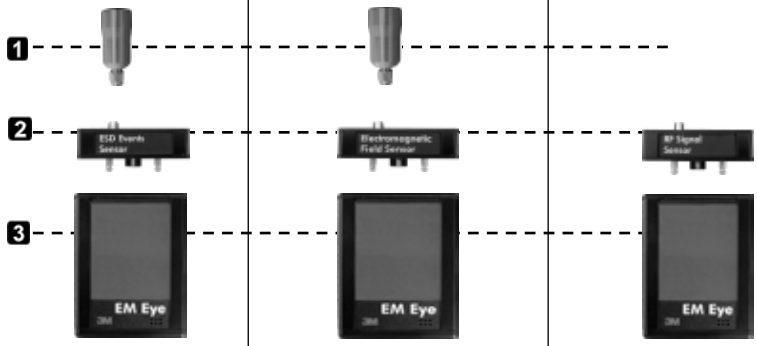
Charging for the first time

To improve the battery life we recommend that you make three fully charge-discharge cycles. For example: fully charge the meter for two hours or overnight, then use the meter until it is fully discharged (do not recharge it at half-charge-life). Repeat this step two times. It would normally take two hours to fully charge the battery, but since the meter power is on while charging; it would extend the charge time to four hours. Succeeding charging would be at any duration. Use only the supplied charger.

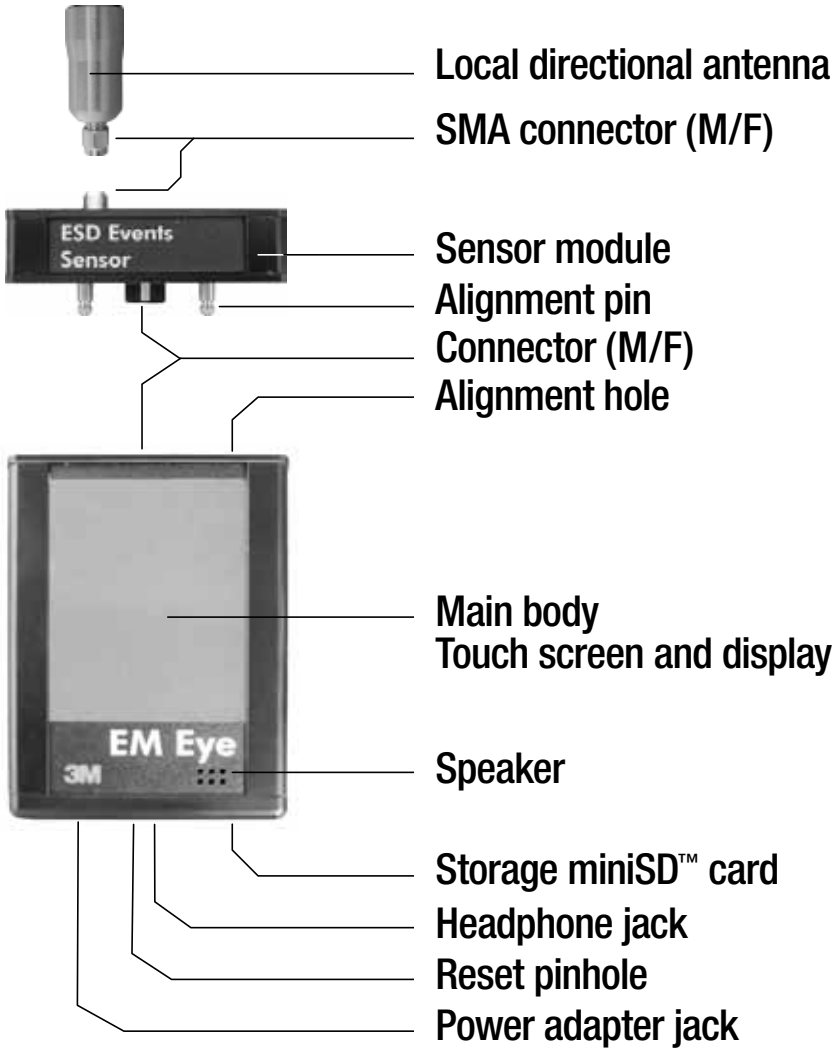
Power On

Using your finger, press and hold any spot on the screen for approximately three seconds – do not use any tools to perform this action. If a new sensor was installed, a sequence of initialization will take place for the first time for approximately ten seconds. After that, the switch-on action will take approximately three seconds. The main display screen appears after the initialization and a beep will sound. The EM Eye Meter will then perform a battery check. If the battery is too low to provide reliable operation, it will not turn on. The screen will go white momentarily and then the meter will power up. After the initial power up, the meter will go directly to the main screen.

Connecting Up

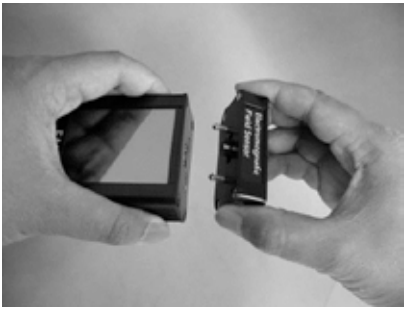
ESD Events Meter	EM Field Meter	RF Meter
		
1 Antenna CTS001	Antenna CTS001	(External cable sources)
2 ESD Event Module	Electromagnetic Field Module	RF Signal Module
3 Base EM Eye Meter Module	Base EM Eye Meter Module	Base EM Eye Meter Module
4 Memory Card (miniSD™ card) Format: FAT32 512 Mb, 1 Gb, 2 GB *Supplied with miniSD and regular SD card adapter	Memory Card (miniSD™ card) Format: FAT32 512 Mb, 1 Gb, 2 GB *Supplied with miniSD and regular SD card adapter	Memory Card (miniSD™ card) Format: FAT32 512 Mb, 1 Gb, 2 GB *Supplied with miniSD and regular SD card adapter
5 Power Supply/Charger  *Not included: Australian power plug	Power Supply/Charger  *Not included: Australian power plug	Power Supply/Charger  *Not included: Australian power plug
6 3M™ Remote Antenna CTC113 CTC115 (high temperature)  *Not included: order separately	3M™ Remote Antenna CTC113 CTC115 (high temperature)  *Not included: order separately	RF Cable BNC connector 20db Attenuator  * Included with the purchase of the CTC029 model. Otherwise needs to be ordered separately.

Parts Description



Modular Assembly and Disassembly

Carefully insert the sensor head and antenna to avoid damaging the 3M™ EM Eye Meter.



1. Position the sensor head so that the dowel pins align with the holes.

2. With the initial head midway through, reposition it so that it is parallel to the body.

3. Press the sensor head firmly against the body until both surfaces are flat with each other.

4. Insert and screw in the antenna making sure that it's not too tight or too loose. Do not use any tools other than your hand.

(*Note: Antenna is not applicable for the RF Signal Sensor.)

If the assembly isn't done correctly, you may receive one of the following error and warning messages. To correct, follow the instructions as indicated within the message.

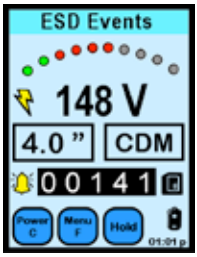
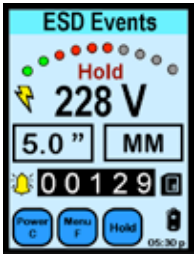
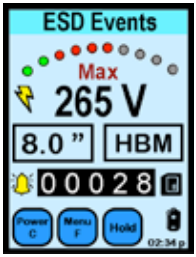
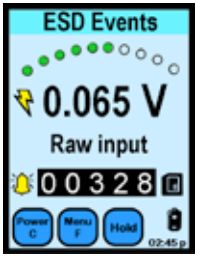
ERROR: Sensor is disconnected. Click here to turn device off.	**ERROR: Card was removed. Data may be lost and card could be damaged. Click here to close the window.**	**ERROR: Card was removed. Data may be lost and card could be damaged. Click here to close the window.**
The meter is turned on without the sensor module.	The storage card (miniSD™) is removed while the meter is powered on.	The meter is turned on with no storage card in place.
ERROR: Card was removed. Data may be lost and card could be damaged. Click here to close the window.	**ERROR: Card was removed. Data may be lost and card could be damaged. Click here to close the window.**	**ERROR: Invalid memory card. Format or replace it. Click here to close the window.**
A new card is inserted or when a card is empty.	Inserting a card that has contents other than the 3M™ EM Eye Meter files.	The card is not formatted to FAT32. Formatting is done using the PC.
	ERROR!!! STACK OVERFLOWED Click here to turn device off.	
	This is a fatal error. If it appears even after resetting, please contact 3M.	

Reset Button

If the EM Eye Meter locks up or the display freezes, press the reset button to restart the meter. The reset button is in a small hole found near the power supply jack. Use an unbent paper clip to push the button inside the small hole.

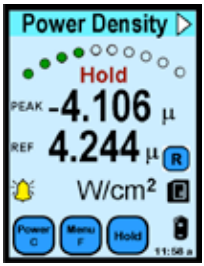
ESD Event Detection Instrument

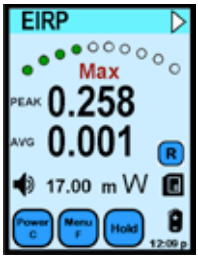
The 3M™ EM Eye Meter will help you detect ESD events. This will help you make sound decisions in tackling what may have been a daunting task. The EM Eye Meter has four modes of ESD event detection. Switching between any of the modes will give you immediate data analysis. Solving ESD problems requires data; a before-and-after analysis of data may now be measured and used to tailor ESD control programs.

			
CDM Mode	**MM Mode**	**HBM Mode**	**Raw Input Mode**
In IC testing, ICs that are sliding through tubes may be charged up. Once the lead touches the metal tracks, a CDM can occur. This mode will prove that the CDM event occurred.	A moving, ungrounded cart may accumulate charges in its path. As it approaches a metallic worktable and bumps into it, a discharge may occur and may adversely affect nearby products or instruments. Use the EM Eye Meter in MM mode to detect such events.	In IC testing, operators that are handling an IC (i.e. fixing bent leads) may be discharging through the IC. Use the HBM mode to detect this action.	For engineers who want to simply analyze raw ESD signals for further analysis, the Raw Input mode provides actual voltages received by an antenna.
In feeder bowls where the ICs are arranged for sorting or orientation, voltages may be induced by the vibrating bowl. Find any ESD events during this process.	In using a bad soldering iron, induced voltages may cause discharges to the components mounted into the PCB. Use grounded tools and confirm that no ESD events will be detected by using the MM mode.	During picking up of an IC by a person not properly wearing a wrist strap, use the EM Eye Meter to alarm the operator of such events.	Use the Raw Input mode for advanced characterization of ESD events.
When a person wearing a wrist strap improperly picks up an IC with tweezers, they should use the EM Eye Meter to alarm the operator of such events.			
In testing ICs, as the lead contacts with the socket or a board, an ESD event may occur. Beware of such occurrences.	In tracks where DIP or SOIC's flow, beware of pins touching the metal tracks, as a discharge may happen at any time.		

EM Field/Power Density/EIRP Instrument

The 3M™ EM Eye Meter is a handy tool for the detection and analysis of electromagnetic fields.





EM Field Sensor

This sensor provides several important functions:

For the EMC engineer, it helps with diagnostics of electromagnetic emission from the product and for troubleshooting a problem.

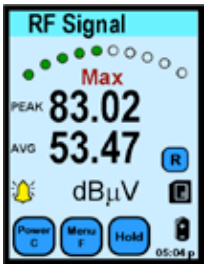
For the manufacturing engineer, it assists in identifying sources of harmful electromagnetic interference in production that causes equipment lock-up, sensitive component damage and other problems.

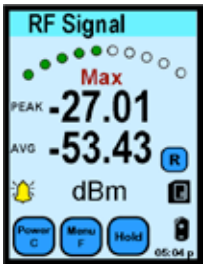
For those who install and maintain antennae of radio transmitters and mobile phones, the EM Eye Meter will provide readings of the field strength, including peak and average values. Further, patented algorithm allows the EM Eye Meter to measure EIRP of emission sources.

For those who are concerned with EMI and RF safety, the EM Eye Meter provides measurements of power density for both continuous and pulsed signals and data averaging.

RF Signal Detection Tool

The 3M™ EM Eye Meter is a handy tool for the RF communications design engineer. Used in the laboratory, this tool measures signals from RF cables, TV cables, wireless LANs, or RF card readers/writers.





USES

For RF design engineers, the EM Eye Meter can be used in the lab for measurements of RF test generators.

For RF communication engineers, the EM Eye Meter can be used to measure signal strengths anywhere in the circuits or on cables.

ESD Events Display and Controls

For the detection of ESD events in CDM, MM or HBM models.

Settings and displays

(denotes a touch screen feature)

POWER C	Press the “Power C” button to: 1) Clear or reset the screen data (momentarily press) 2) Turn the meter OFF (long press for 4 seconds)
MENU F	Press the “Menu F” button to: 1) Adjust brightness 2) Adjust auto-OFF-time 3) Select antenna options
NAVIGATOR	Press the arrow buttons to: 1) Increase or decrease value settings 2) Move fields or cursor around the setup screen 3) Return to the main screen by pressing the center arrow
HOLD	Press the “Hold” button to: 1) Freeze the display (the “Hold” symbol appears) 2) Freeze maximum values (press twice for the “Max” symbol to appear)
DATA STORAGE	Press to read the data from the memory card
TRUE-ESD	TRUE-ESD mode, toggle to enable CDM FILTER mode
ALL-SIGNAL	ALL-SIGNAL mode, toggle to enable ALL SIGNAL mode
BATTERY	Battery level display
TIME 01:01 p	Displays time, press to setup
ESD MODE 4.0 " CDM	Press to set calculations for CDM, MM or HBM models. Also sets the distance to the ESD target
COUNTER 00000	Counter display for ESD events detected
THRESHOLD BAR	Displays relative amplitude level of detected ESD events. Green means the ESD event is below set threshold, Red means the ESD event is above threshold. Press this button to adjust the ESD event threshold voltage
AUDIO	Selectable audio mode Tone (bell), speaker/volume and mute
VOLTAGE DISPLAY 000 V	Displays the estimated voltage readout of the ESD event or other signals as detected through the antenna

EM Field Display and Controls

Settings and displays

(denotes a touch screen feature)

POWER C	Press the “Power C” button to: 1) Clear or reset the screen data (momentarily press) 2) Turn the meter OFF (long press for 4 seconds)	
MENU F	Momentary press adjusts time interval for data recording 1) INTERVAL recording 2) AVERAGE value	Long press 1) Adjust brightness 2) Adjust OFF-time 3) Select AF
NAVIGATOR	Press the arrow buttons to: 1) Increase or decrease value settings 2) Move fields or cursor around the setup screen 3) Return to the main screen by pressing the center arrow	
HOLD	Press the “Hold” button to: 1) Freeze the display (the “Hold” symbol appears) 2) Freeze maximum values (press twice for the “Max” symbol to appear)	
DATA STORAGE	Press to read the data from the memory card	
RECORD DATA	Press record area to start data writing onto the miniSD™ storage card	
UNIT	Press “UNIT” button to change units between dBµV/m or V/m	
BATTERY	Battery level display	
TIME	Displays time, press to setup	
MODE OPTION	The triangle at the upper right side of display switches modes sequentially as follows: EM Field → Power Density → EIRP → EM Field When pressed at the “Hardware” setup menu, any of the mode options maybe disabled or enabled	
THRESHOLD BAR	Displays relative amplitude level of EMF detected. Green means EMF is below set reference, Red means EMF is above reference. Press it to adjust the EMF references	
AUDIO	Selectable audio mode: Tone (bell), speaker/ volume, mute	
PEAK	Displays the peak readout of EMF, Power Density and EIRP	
AVG	Displays the average readout of EMF, Power Density and EIRP	
REF	Displays the reference level setting, either memory or current references. (EMF and Power Density only)	

RF Signal Sensor Display and Controls

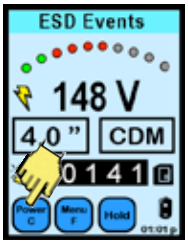
Settings and displays

(denotes a touch screen feature)

POWER C		Press the “Power C” button to: 1) Turn the meter ON (press the screen for three seconds) 2) Turn the meter OFF (press for three seconds)
MENU F		Momentary press adjusts time interval for data recording 1) INTERVAL recording 2) AVERAGE value Long press 1) Adjust brightness 2) Adjust OFF-time 3) Select AF
NAVIGATOR		Press the arrow buttons to: 1) Increase or decrease value settings 2) Move fields or cursor around the setup screen 3) Return to the main screen by pressing the center arrow
HOLD		Press the “Hold” button to: 1) Freeze the display (the “Hold” symbol appears) 2) Freeze maximum values (press twice for the “Max” symbol to appear)
DATA STORAGE		Press to read the data from the memory card
RECORD DATA		Press “Record” button to start data writing onto the miniSD™ storage card
UNIT	dBµV/m → dBm → mV	Press “UNIT” button to change units between dBµV/m, dBm and mV
BATTERY		Battery level display
TIME	01:01 p	Displays time, press to setup
THRESHOLD BAR		Displays amplitude level of RF signal detected. Green means RF signal is below reference, Red means RF signal is above reference. Press it to adjust the RF signal references.
AUDIO		Selectable audio mode Tone (bell), speaker/volume and mute
PEAK	PEAK 67.35	Displays the peak readout of RF signal.
AVG	AVG 60.93	Displays the average readout of RF signal.
REF	REF 78.39	Displays the reference level setting, either memory or current references.

Common Display and Controls

POWER and CLEAR

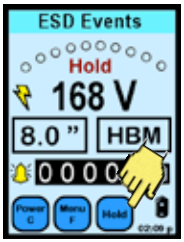


The POWER C button turns off the 3M™ EM Eye Meter or clears the values that are on display.

To turn off the meter, press and hold the POWER C button for approximately four seconds or longer until the meter goes off.

To reset all of the values on the display, press the POWER C button for approximately one second.

HOLD and MAX



The HOLD button toggles the HOLD data and MAX data sequentially.

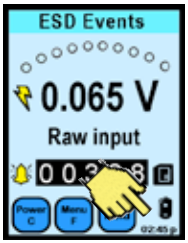
HOLD freezes the current data on the display. The instrument will not be active at this point.

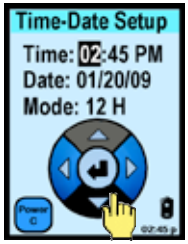
MAX displays the maximum voltages detected by the EM Eye Meter above the set threshold.

Pressing the HOLD button for the third time will disable the HOLD and MAX function and returns to normal run mode.

HOLD and MAX does not affect recording into memory storage. Data is still being recorded even if HOLD and MAX is active.

TIME





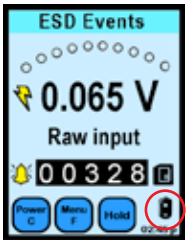
To set the time, press the time display.
The NAVIGATOR screen appears.
Press the left or right arrows to move the shaded area that need to be changed.

Press the up or down button to scroll and set the numbers.

Press the center button to return to the main screen.

Time: AM/PM format or 24-hour format
Date: Format as MM/DD/YY
Mode: 12-hour, 24-hour format

BATTERY



The BATTERY symbol is not a touch feature. It displays the approximate level of battery life remaining for use.


Full charge life: approximately 8 hours at 10% brightness; approximately 4 hours at 100% brightness.
This data applies for fully charged, new batteries. The battery has a full charging time of about two hours.

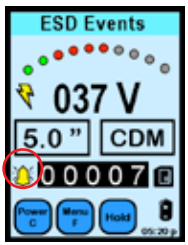

Half charge


<1 hour charge, charging is required


Battery is discharged, charging is required


Charging in progress

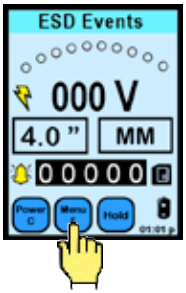
AUDIO INDICATORS



The AUDIO INDICATOR button scrolls through the following audio modes:
1) Tone (bell)
2) Speaker at low volume
3) Speaker at middle volume
4) Speaker at loud volume
5) Mute
The BELL audio mode sends an audible beep for every ESD event count detected. The SPEAKER, on the other hand, produces the “crackling” or "humming" amplitude-demodulated sounds of ESD event or EMF. This may provide a better feel of what discharges or EMF sounds like. The MUTE disables the audio and the unit operates in silent mode.

ESD Events Display and Controls

MENU FUNCTION



Press the MENU F icon and the NAVIGATOR icon appears.
Press the up/down arrows to scroll through functions.
Press the left or right arrows to set values and options.
Press the center button to return to the main screen.

Serial Number
The serial number is a five-digit number indicated at the top left section of the screen.

Brightness
10% to 100%, with 10% increments.

Auto Off Time
Disabled or adjustable between 1 to 9 minutes.

Antenna
1) Local antenna; 2) Remote antenna.

Antenna Types

Local Antenna
CTS001 is a directional antenna that comes as a default with the set. Use this antenna for general purposes.

3M™ Remote Antenna
CTC113-6FT – general use omnidirectional antenna, ambient temp, black plastic with screw mounting.

CTC115-6FT – general use omnidirectional antenna, high temp (-55 to 165°C), white plastic with screw mounting.

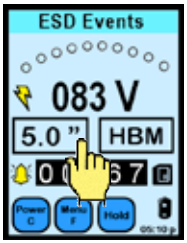
ESD EVENT MAGNITUDE and COUNTER

The VOLTAGE display is not a touch feature. This displays the estimated voltage detected at the antenna which corresponds to a model selected at the ESD MODE button.

The COUNTER is not a touch feature, but it displays the number of ESD events that had occurred above the threshold level setting.

The maximum event count it can register is up to 32,767. The counter restarts to zero after the maximum count.

ESD MODELS



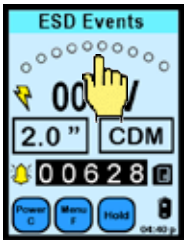
The ESD MODE button enables the user to choose between RAW INPUT and calculations of HBM, MM and CDM.

At the NAVIGATOR button:
Press the up/down arrows to set the distance.
Press the left or right arrows to set ESD event models.
Press the center button to return to main screen.

Effective distance range
0.5” (1.3 cm) to 15.0” (38.1 cm)

Model
1. Human Body Model (HBM)
2. Machine Model (MM)
3. Charge Device Model (CDM)
4. Raw input

ESD THRESHOLD

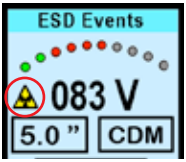


The THRESHOLD, in a form of an ARC LED bar, displays the detection level of the ESD events detected. When pressed, the threshold level may be adjusted.

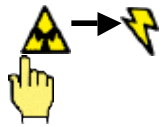
With the NAVIGATOR bar:
Press the left or right arrows to set the ESD event threshold voltage.
Press the center button to return to the main screen.

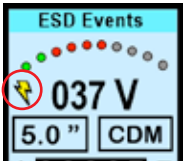
Threshold Levels
0 - 10 Volts at 1V increments
10 - 990 Volts at 10V increments
1 - 999mV for RAW input

“TRUE-ESD FILTER” and “ALL-SIGNAL”



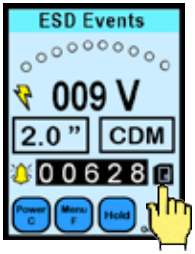
After pressing the lightning bolt symbol or the TRUE-CDM-FILTER button, the triangle button appears on the display. In this mode, the EM Eye Meter will detect most signals, including ESD and some EMI signals.





After pressing the triangle or the ALL-SIGNAL button, the lightning bolt symbols appears on the display. In this mode, the EM Eye Meter will detect ESD events that are mostly CDM in nature.

DATA STORAGE and READ



The DATA STORAGE button displays the data stored in the miniSD™ card found at the bottom of the 3M™ EM Eye Meter.

Scroll through the recorded data using the NAVIGATOR button.

The displayed information is as follows:
(ESD mode) (Threshold) (Distance) (CDM on/off) (Date) (Voltage sensed) (Time) (Data bar indicator)

Data from the miniSD card can be exported using the utility software described in the following section.

MEMORY STORAGE CARD

Memory storage card
The EM Eye Meter works with the following memory cards:
SanDisk 512 Mb, 1 Gb, 2 Gb, miniSD or microSD (ships with a standard SD adapter and a miniSD adapter).

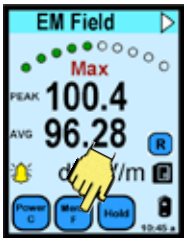
Format: FAT32

In reading data to a PC, use an SD™ card adapter or a suitable USB card reader.

Some cards may not be compatible. Non-compatibility is indicated by an “X” mark overlaid on the card button display. For other memory card types, please contact 3M for verification.

Electromagnetic Field Meter, Power Density Meter and Effective Isotropically Radiated Power (EIRP) Meter Display and Controls

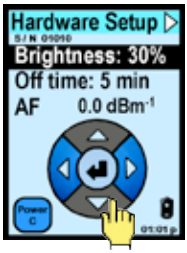
MENU FUNCTION



When the MENU F button is pressed momentarily, the INTERVAL and AVERAGE data recording timing can be configured.

INTERVAL, in seconds, is the sampling time for PEAK data to be recorded onto the miniSD™ storage card.

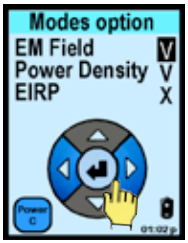
AVERAGE, in seconds, is the sampling time for AVERAGE data to be recorded onto the miniSD storage card.



When the MENU F button is pressed for a longer period, the hardware setup is shown. At this point, brightness, off-time and antenna factor can be adjusted.

Relative Antenna Factor (AF)
-40 dBm^{-1} to 40 dBm^{-1}

Default relative antenna factor for the supplied local antenna is 0.



At the HARDWARE SETUP menu, press the triangle (MODE OPTION) button located at the upper right side of the display.

The MODES OPTION screen is used to enable or disable any of the functions modes: 1) EM field; 2) Power Density; and 3) EIRP.

You can always enable previously disabled modes.

Use the navigation bar as follows:
UP/DOWN scrolls the cursor field through the three modes.
LEFT/RIGHT enables or disables the selected mode.

"V" – enabled; "X" – disabled

EMF UNITS CONVERSION

		Pressing the UNITS button toggles between dBµV/m and V/m unit.

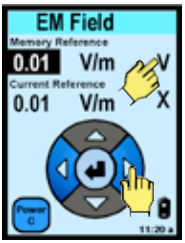
POWER DENSITY UNITS

	The UNIT button is not a touch feature. The unit of power density is W/cm².

EIRP UNITS

		By pressing the distance area, the distance for EIRP measurements can be configured from 0.25 to 20 meters.

BAR GRAPH/REFERENCE Display and Button



When the bar graph area is pressed, the THRESHOLD mode is entered and the reference level for EMF measurement can be set.

With the NAVIGATOR bar:
Press the left or right arrows to adjust EMF references.
Press the up or down arrows to move the field cursor.
Press the center button to return to the main screen.

Reference options:
1. Memory Reference
2. Current Reference

To choose between Memory or Current reference, press "V" (enable) or "X" (disable) at the right side of display.

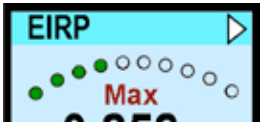
Reference mode is helpful if you wish to hear an audio alarm whenever EMF exceeds a certain level. If any of the reference modes are enabled, you should see the REF label shown on the main screen. The bottom line of the display will now show the reference value of the peak signal. PLEASE NOTE: The top line shows the "difference" (not the PEAK as labeled) between the ACTUAL PEAK measured and the REFERENCE setting. Therefore, whenever the "actual peak" value of the EMF signal is higher than the reference, the difference is a positive number and an alarm is issued. In the example display shown, the difference is 0.105 V/m, the reference is 0.010 V/m, therefore the actual peak is 0.115 V/m.

Adjust the reference settings by pressing the THRESHOLD and NAVIGATOR button.

When data is being recorded, the actual peak value above the reference setting will still be recorded.

Memory and Current Reference

These references are used for convenience. The “memory” reference is the value which is stored in the memory all of the time and saved when the device is powered off or when the main battery is removed. The “current” reference is the average value of the measured signal (background noise shown in PEAK value) which was detected by the unit, when you entered into the reference menu. If you enable this reference, it works the same way as the memory reference. When you disable it and switch back to the main menu, this value is lost. Current reference is useful to detect signals with the level higher than background noise.

	For the bar graph under the EIRP mode, the BAR GRAPH display is not a touch feature. It shows the relative magnitude of signal received through the antenna.

DATA STORAGE and READ (EM Field Sensor)

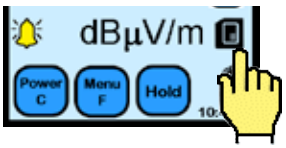
The RECORD button (“R”) writes the displayed readings and settings onto the miniSD™ storage card; press the “R” button to activate RECORD. At this point, the button turns red and data is being written onto the storage card. To stop recording, press the red button again. The recording works in conjunction with the settings made on page 26 (Intervals), and/or page 28 (Reference) of this manual.

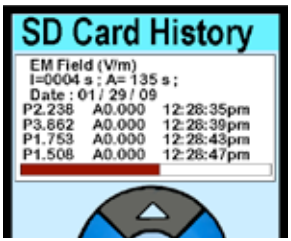
A data line is recorded based on the timing interval which was preset at the "Intervals" menu. If the interval is 1 second, there will be 10 data lines within 10 seconds of recording.

It is also based on the settings for References on page 28. If any of the references are enabled, a data line is added within the preset interval whenever a peak signal was detected above the reference setting. If the Reference is not enabled, data lines are added at intervals showing the current peak and average signals.

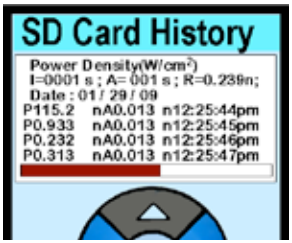
The DATA STORAGE button displays the data stored on the miniSD™ card found at the bottom of the meter. Press this button to show the SD™ card history screen. Scroll through the data recorded using the NAVIGATOR button.

Note: If an “X” mark is overlaid onto the DATA STORAGE button, a non-compatible SD storage card is inserted. (See Data Storage section.)

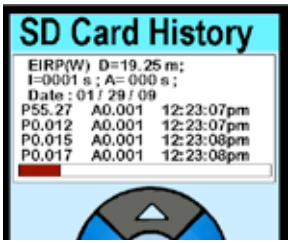




EM FIELD Data:
(EM field meter) (Units) (Interval) (Average) (Date) (Peak) (Average record) (Time)



POWER DENSITY Data:
(Power density meter) (Interval) (Average) (Reference) (Date) (Peak) (Average) (Time)

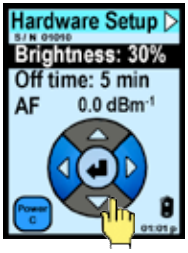


EIRP Data:
(EIRP meter) (Distance) (Interval) (Average) (Date) (Peak) (Average record) (Time)

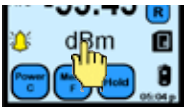
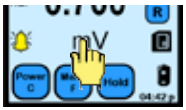
Data from the miniSD card can be exported using utility software described in the data software section.

RF Signal Sensor Display and Controls

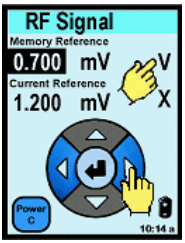
MENU FUNCTION

		When the MENU F button is pressed momentarily, the INTERVAL and AVERAGE data recording timing can be configured. INTERVAL, in seconds, is the sampling time for PEAK data to be recorded onto the miniSD™ storage card. AVERAGE, in seconds, is the sampling time for AVERAGE data to be recorded onto the miniSD storage card.
		When the MENU F button is pressed for a longer period, the hardware setup is shown. At this point, brightness, off-time and attenuation can be adjusted. **Attenuation (ATT):** If the input to the antenna is big enough, set the attenuation from 0 to 20dB. When the attenuation is set to 20dB, an additional label of “20dB” is placed along with the “RF Signal” top heading.

RF UNITS CONVERSION

			When pressed, the units area toggles between dBµV, dBm and mV units. dBµV → dBm → mV

BAR GRAPH/REFERENCE Display and Button



When the bar graph area is pressed, you can set the reference level for RF measurement.

With the NAVIGATOR bar:
Press the left or right arrows to adjust RF references.
Press the up or down arrows to move the field cursor.
Press the center button to return to the main screen.

Reference options:
1. Memory Reference
2. Current Reference

To choose between Memory or Current reference, press "V" (enable) or "X" (disable) at the right side of display.

Reference mode is helpful if you wish to hear an audio alarm whenever the RF exceeds a certain level. If any of the reference modes are enabled, you should see the REF label shown back in the main screen. The bottom line of the display will show the reference value of the peak signal. PLEASE NOTE: The top line shows the "difference" (not the PEAK as labeled) between the ACTUAL PEAK measured and the REFERENCE setting. Therefore, whenever the "actual peak" value of the RF signal is higher than the reference, the difference is a positive number and an alarm is activated. In the example display shown, the difference is 1.453mV, the reference is 0.700 mV, therefore the actual RF signal peak is 2.153 mV.

Adjust the reference settings by pressing the THRESHOLD and NAVIGATOR buttons.

When data is being recorded, the actual peak value above the reference setting is recorded, not the "difference" value.

DATA STORAGE and READ (RF Signal Sensor)

The RECORD button (“R”) writes the displayed readings and settings onto the miniSD™ storage card; press the “R” button to activate RECORD. At this point, the button turns red and data is being written onto the storage card. To stop recording, press the red button again.

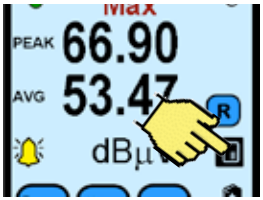
The recording works in conjunction with the settings made on page 31 (Intervals), and/or page 32 (Reference) of this manual.

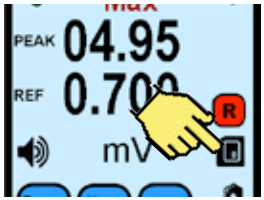
A data line is recorded based on the timing interval which was preset at the "Intervals" menu. If the interval is 1 second, there will be 10 data lines within 10 seconds of recording.

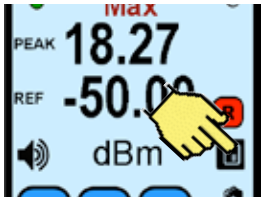
It is also based on the settings for References on page 32. If any of the references are enabled, a data line is added within the preset interval whenever a peak signal was detected above the reference setting. If the Reference is not enabled, data lines are added at intervals showing the current peak and average signals.

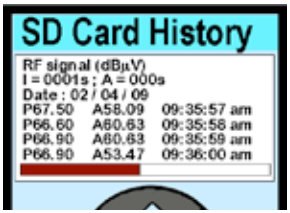
The DATA STORAGE button displays the data stored on the miniSD card found at the bottom of the meter. Press this button to show the SD™ card history screen. Scroll through the data recorded using the NAVIGATOR button.

Note: If an “X” mark is overlaid onto the DATA STORAGE button, a non-compatible SD storage card is inserted. (See Data Storage section.)

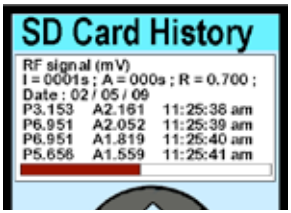




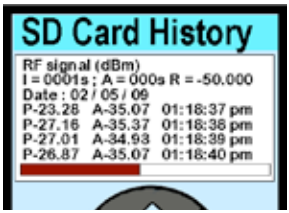




RF Signal Data:
(Interval) (Average) (Date) (Peak) (Average record) (Time)



RF Signal Data:
(Interval) (Average) (Reference) (Date) (Peak) (Average) (Time)

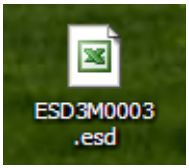


RF Signal Data:
(Interval) (Average) (Reference) (Date) (Peak) (Average record) (Time)

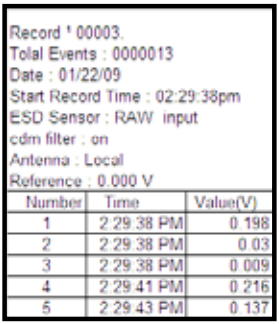
Data from the miniSD card can be exported using utility software described in the data software section.

To Access the Data Using a PC

1. Go to www.3Mstatic.com/software to download the software that will allow you to access the data from the 3M™ EM Eye Meter from your PC.
2. Download the .EXE or the .ZIP files for the EM Eye Meter.
3. Install the program “em eye fi le converter.exe“.



4. Run and open the file from the miniSD™ card. The extension is “ESD3M0003.esd”.



Record ' 00003
Tolal Events : 0000013
Date : 01/22/09
Start Record Time : 02:29:38pm
ESD Sensor : RAW input
cdm filter : on
Antenna : Local
Reference : 0.000 V

Number	Time	Value(V)
1	2:29:38 PM	0.198
2	2:29:38 PM	0.03
3	2:29:38 PM	0.009
4	2:29:41 PM	0.216
5	2:29:43 PM	0.137

5. From the data shown, select the row of data.
6. Save it into a folder.
7. Launch Excel application.
8. Open the file that you just saved from the folder.
9. Sort and analyze data by using the tools in Excel.

Application Notes

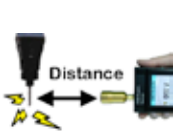
Detection of ESD events generated from a torque driver or soldering iron tool: A torque driver that is isolated from ground produces large amounts of charge at the tip of the tool. It is possible that this charge may pass through nearby components, thereby damaging the components. To prevent such damage, test and qualify the torque driver or any similar tools using the 3M™ EM Eye Meter. **How?** A typical procedure would be to 1) identify a target source of ESD, such as the tip of the tool where it contacts with the PCB. 2) Classify whether it resembles any of the three models HBM, MM or CDM. In this case it is close to MM. After that, 3) set the EM Eye Meter to that particular model, then select a distance where the EM Eye Meter can be fixed.

EM Eye Meter setting:

ESD mode:	MM
Threshold:	50V
Distance:	6 inches
Filter:	TRUE-ESD

As a good practice, set the EM Eye Meter threshold to half of the ESD-sensitive device threshold. Example, if a device is 100V-sensitive, set the EM Eye Meter to 50V threshold.

Note: It is important to know the sensitivity threshold levels of ESD-sensitive devices. These can be obtained from the IC product designer or manufacturer.

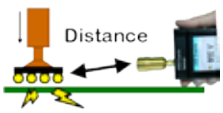


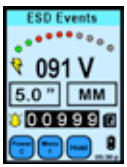
Detection of ESD events in component auto-insertion: At times, auto insert machines lose their ground connection due to mechanical vibration or wear and tear. Dirt can also be a cause for poor grounding of moving parts. Ungrounded moving parts become a potential source of charge; when the charge becomes big enough, it may pass through the PCB and damage the IC chips. To solve this problem, always make sure that moving parts are grounded and regularly checked.

To use the EM Eye Meter to check for ESD events, do the following: 1) identify a target location of ESD events such as the landing pad of IC chips onto the PCB; 2) Classify whether it resembles any of the three models HBM, MM or CDM. In this case it is close to MM or CDM; after that, 3) set the EM Eye Meter to that particular model, then select a distance where the EM Eye Meter can be affixed.

EM Eye Meter setting:

ESD mode:	1) MM, 2)CDM
Threshold:	10V
Distance:	5 inches
Filter:	TRUE-ESD



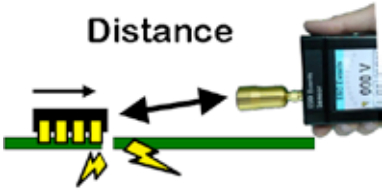


Detection of ESD Events Using the 3M™ EM Eye Meter

Detection of ESD events in feeder bowls

EM Eye Meter setting:

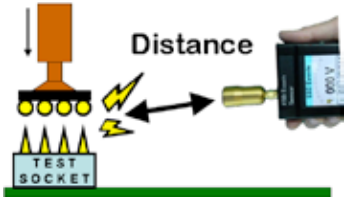
ESD mode:	CDM
Threshold:	10V
Distance:	2 inches
Filter:	TRUE-ESD



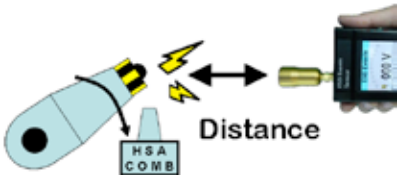
Detection of ESD events in IC handlers

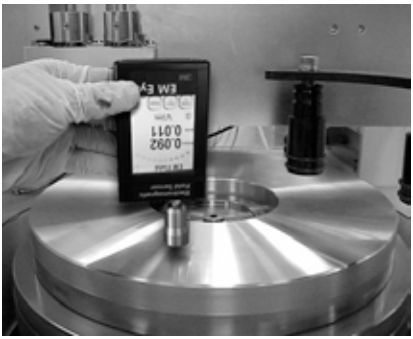
EM Eye Meter setting:

ESD mode:	CDM
Threshold:	10 V
Distance:	3 inches
Filter:	TRUE-ESD

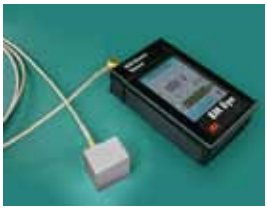


Detection of ESD events in HSA and HDD assembly processes



Analysis of electromagnetic fields in slider manufacturing processes	
Detection of EMI sources	
Detection of noisy cables	

ESD Measurements in Tight Spaces
In cases where a tight space or extreme temperature is involved, a remote antenna connects to the 3M™ EM Eye Meter through an axial cable. The remote antenna is small at 2.0x2.5x2.5 cm cube and can withstand temperatures from -55°C to +165°C.



Semiconductor test handlers In testing an IC, a mechanical pick-place socketing assembly is housed in a tight chamber which is set at high or low temperatures. The remote antenna (CTC113 or CTC115) can be fitted onto the EM Eye Meter making it possible for advanced analysis. EM Eye Meter setting: ESD mode: CDM Threshold: 3V Distance: 3 inches Filter: TRUE-ESD Antenna: CTC113 or CTC115	
Die attach process For detecting discharges from wafers onto pick-and-place mechanisms. EM Eye Meter setting: ESD mode: CDM Threshold: 10V Distance: 4 inches Filter: TRUE-ESD	
Head stack assembly For detecting discharges in HSA machines. EM Eye Meter setting: ESD mode : CDM Threshold : 3V Distance : 3 inches Filter : TRUE-ESD	

ESD Events Verification

Verification can be carried out using several different procedures.

Screw-shaker method
This is one the simplest methods of verifying that your meter is able to detect ESD signals. Tribocharging is created by simply shaking a plastic container with metal screws in it. The metal bumping against each other creates multiple discharges – which will then be detected and counted by the 3M™ EM Eye Meter. If the EM Eye Meter does not respond to this step, try the 718 method shown below.

718 method
This method is more effective for verification using a 3M™ Static Sensor 718 and 718A combination. By creating charging at alternate polarities and touching the metal plate with the charger pin, huge ESD signals are created, which the EM Eye Meter should easily detect.

If the EM Eye Meter does not detect any signals at all, it may be damaged. Please contact 3M for repair and calibrations.

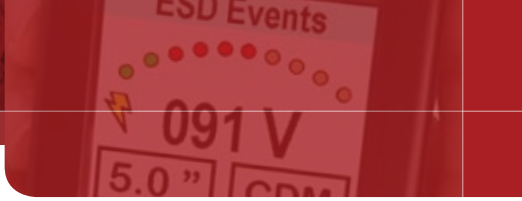
Note: As the EM Eye Meter sensor input by itself is a sensitive device, do not expose the antenna to direct discharges through its antenna

Calibration

The EM Eye Meter comes from the factory calibrated. It is recommended that you calibrate the EM Eye Meter once a year at the factory.

3M™ EM Eye Meter Specifications

GENERAL	
Functions	ESD event detector Electromagnetic Field (EMF) meter Power Density meter Effective Isotropically Radiated Power (EIRP) meter Radio Frequency (RF) meter
Audio Indicators	Speaker: Beep or analog audio with selectable volume
External Data Storage	MiniSD™ Card, FAT32 format, SanDisk 512Mb, 1GB, 2GB (For other card types, please contact 3M for verification.)
Recording Interval	Peaks: 1-360 seconds Average signals: 0.1-360 seconds
Battery Type	1) Lithium-Ion, internal 2) Lithium coin, internal Batteries are not user serviceable. Please contact 3M for service.
Battery Charge Life	New batteries: ~8 hours at 10% brightness; ~4 hours at 100% brightness Charging time: 2 hours
Operating Temperature	10-40ºC
Relative Humidity	30% - 70% RH
Display	TFT RGB LCD 240 × 320 pixels
Size	65 W × 32 D × 105 L mm
Headphone Jack	3.5 mm (1/8 in.)
Antenna/Cable Connector	Reverse SMA
Power Supply/Charger	Input: 100-240V ~ 50-60 Hz 0.2A Output: 5.0V 1000mA Center: Positive, ID 1.3 mm; OD 3.5 mm Plug converter: EU, US, China, Korea, Taiwan, Philippines Power supply/charger regulatory marks:



ESD Event Sensor	
ESD Event Characterization Modes	Human body model (HBM), machine model (MM), charged device model (CDM), Raw input (ESD), All signals (ESD and other noise signals)
Raw Input Resolution	1mV (1mV-15mV); 15mV (1mV-1500mV) (detection resolution: 1mV)
Threshold Resolution	1-10 Volts, 10-990 Volts. Raw input: 1mV (1-15mV) and 15mV (15-1500mV)
Distance Detection Range	1.3 cm (0.5 in) – 38.1 cm (15.0 in)
ESD Counter Range	0 – 32,767 counts (screen count)
Hardware Setup	Brightness, Auto-off-time
Antenna Options	Local, or remote (CTC113 for regular use, or CTC115 for high temp use)

Electromagnetic Field Sensor			
Function Modes	**Electromagnetic Field**	**Power Density Meter**	**EIRP Meter**
Peak Range	Min: 0.001 V/m Max: 20.00 V/m	Min: 0.027 nW/cm^2 Max: 106.1 uW/cm^2	Min: 0.001W Max: 5333 W @ 20 m.
Average Range	Min: 0.001 V/m Max: 20.00 V/m	Min: 2.65 nW/m^2 Max: 1.06 Watts/m^2	
Memory Reference Range	Min: 0.01 V/m Max: 20.00 V/m	Min: 0.027 nW/cm^2 Max: 106.1 uW/cm^2	
Current Reference Range	Min: 0.01 V/m Max: 20.00 V/m	Min: 0.027 nW/cm^2 Max: 106.1 uW/cm^2	
Units	V/m, dBuV/m	W/cm^2	Watts
EIRP Distance	Na	Na	0.25 – 20.0 m 0.82 – 65.60 ft
Frequency Bandwidth	**1 MHz to 2.5 GHz**		
Antenna Factor Range	-40.0 to 40.0 dBm^{-1}		
Hardware Setup	Brightness, Off-time, Antenna factor (AF)		
Frequency Response	10 MHz – 2.5 GHz		
Antenna Options	**Local, or remote (CTC113 for regular use, or CTC115 for high temp use)**		
Record Interval Range	**1 – 360 seconds**		
Record Average Range	**0.1 – 360 seconds**		

RF Signal Sensor	
Unit Modes	dBuV, dBm, mV
Dynamic Range	Min: -55 dBm Max: 0 dBm
Recording Interval for Peak	0.100 – 224.0 mV
Recording Interval for Average	0.100 – 224.0 mV
ATT (Attenuation)	00 dB / 20 dB
Frequency Bandwidth	1 MHz to 2.5 GHz

Model and Part Numbers

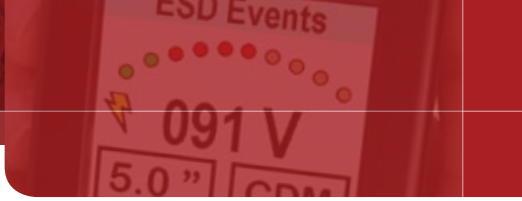
CTM048-2128 3M™ Eye Meter with ESD and EMI sensors, 80-0012-2091-4
CTM048-21 3M Eye Meter with ESD sensor, 80-0012-2092-2
CTM048-28 3M Eye Meter with EMI sensor, 80-0012-2093-0
CTM048-29 3M Eye Meter with RF sensor, 80-0012-2094-8

When sensors are added to a customer's existing EM Eye Meter:

CTC021 ESD sensor for use with the CTM048 EM Eye Meter, 80-0012-2095-5

CTC028 EMI sensor for use with the CTM048 EM Eye Meter, 80-0012-2096-3

CTC029 RF sensor for use with the CTM048 EM Eye Meter, 80-0012-2097-1



3M™ EM Eye Meter

Regulatory Information

China RoHS

Electronic Industry Standard of the People's Republic of China, SJ/T11363-2006, Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products.

This symbol, per Marking for the Control of Pollution Caused by Electronic Information Products, SJ/T11364-2006, means that the product or part **does** contain a substance, as detailed in the chart below, in excess of the following maximum concentration values in any homogeneous material: (a) 0.1% (by weight) for lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers; or (b) 0.01% (by weight) for cadmium. Unless otherwise stated by 3M in writing, this information represents 3M's best knowledge and belief based upon information provided by third party suppliers to 3M.

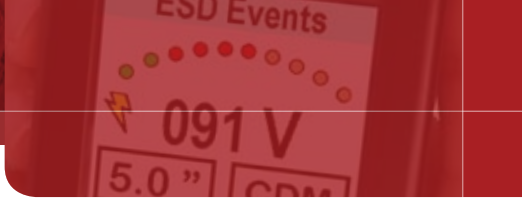
This numerical reference should not be construed as a representation regarding the product's life or an extension of a product warranty. In the event any product is proven not to conform with 3M's Regulatory Information Sheet, then 3M's entire liability and buyer's exclusive remedy, will be at 3M's option either: (i) replacement of product with a conforming product, or (ii) refund of the purchase price paid by buyer for each non-conforming product, within a reasonable time after written notification of said non-conformance and return of said product to 3M. 3M shall not under any circumstances be liable for direct, incidental, special, or consequential damages (including but not limited to loss of profits, revenue, or business) related to or arising out of this certification, including, the use, misuse or inability to use the product. Unless stated otherwise in writing, the foregoing language cannot be waived, modified, or supplemented in any manner whatsoever.

产品中有毒有害物质或元素的名称及含量
Name and Content of Hazardous Substances or Elements

部件名称 (Part or Component Name)	有毒有害物质或元素 (Hazardous Substances or Elements)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 Cr(VI)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板焊盘/安装孔 (Terminations in PCBs)	×	○	○	○	○	○
电阻器脚的表面薄膜复盖层 (Finish plating of resistor terminations)	×	○	○	○	○	○
电阻器玻璃部分的含铅量 (Lead in glass in resistors)	×	○	○	○	○	○
装置的焊接部 (Solder in instrument)	×	○	○	○	○	○
IC焊接部 (Solder in IC)	×	○	○	○	○	○

○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。(Indicates that this hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.)

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。(Indicates that this hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.)"


ESD Events
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5.0 ”

U.S. Patents: 7,525,316, 6,563,319, 6,144,341

Important Notice

All statements, technical information, and recommendations related to 3M's products are based on information believed to be reliable, but the accuracy or completeness is not guaranteed. Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use. Any statements related to the products which are not contained in 3M's current publications, or any contrary statements contained on your purchase order shall have no force or effect unless expressly agreed upon, in writing, by an authorized officer of 3M.

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This product will be free from defects in material and manufacture for a period of one (1) year from the time of purchase. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

If this product is defective within the warranty period stated above, your exclusive remedy shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. **Except where prohibited by law, 3M will not be liable for any indirect, special, incidental or consequential loss or damage arising from this 3M product, regardless of the legal theory asserted.**

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