

### WARRANTY

Daetron warrants to the original purchaser that the MC300 is free from defects in workmanship and materials for a period of 90 days plus delivery time, from the date of purchase. DAETRON will repair or replace at its option, without charge a defective unit upon delivery by mail (prepaid and insured) to the following address.

DAETRON  
P.O. BOX 641, STATION U  
935 THE QUEENSWAY  
TORONTO ONTARIO CANADA  
M6Z 5Y9

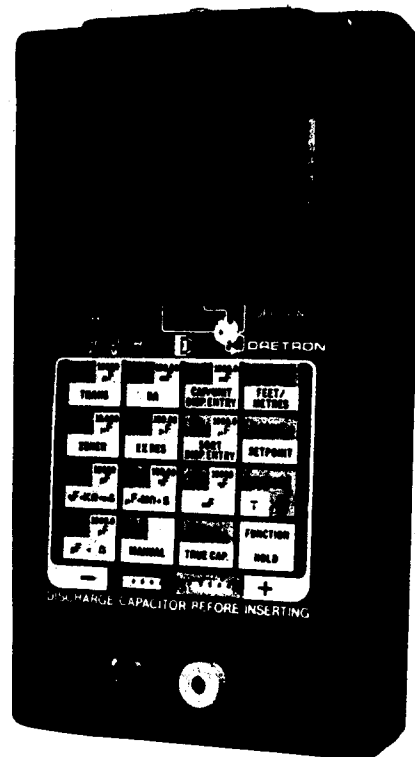
NOTE: IF RETURNING THIS UNIT FROM A COUNTRY OTHER THAN CANADA, PLEASE ATTACH PROPER DOCUMENTATION TO INDICATE THE UNIT IS BEING RETURNED FOR REPAIR AS ANY CHARGES INCURRED BY DAETRON BECAUSE OF IMPROPER DOCUMENTATION WILL BE CHARGED TO THE CUSTOMER.

Please pack carefully to avoid breakage in transit. This warranty does not apply if the unit has been misused, altered, abused, damaged (accidental or otherwise), miscalibrated or if the serial number is altered, defaced or removed. The above also applies to any damage in transit. DAETRON will not be liable for any consequential, incidental, or special damages resulting from the use, misuse or loss of use of this instrument.



# DAETRON MC300

DIGITAL  
CAPACITANCE  
METER



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## SPECIFICATIONS

RANGE | FULLY AUTORANGING FROM 000.1 pF TO 999.9 mF ( 1 FARAD)  
 | MANUAL RANGE CAPABILITY IN 10 RANGES  
 | 0.0 pF TO 1,000.0 pF | 10.000 uF TO 100.00 uF  
 | 1,000.0 pF TO 10,000 pF | 100.00 uF TO 1,000.0 uF  
 | 10,000 pF TO 100.00 nF | 1,000.0 uF TO 10,000 uF  
 | 100.00 nF TO 10,000 nF | 10,000 uF TO 100.00 mF  
 | 10,000 nF TO 10,000 uF | 100.00 mF TO 1,000.0 mF

ACCURACY | 0.5 % OF FULL SCALE FROM 0.1 pF TO 100.00 uF  
 | 2.0 % OF FULL SCALE FROM 100.00 TO 10,000 uF  
 | 5.0 % OF FULL SCALE FROM 10,000 uF TO 1 FARAD  
 | ACCURACY IS VALID FOR BOTH AUTO AND MANUAL RANGEING

EXTENDED RESOLUTION | SHOWS INTERNAL 5th DIGIT RESOLUTION BY  
 | SHIFTING DISPLAY TO THE LEFT (MSD  
 | DISAPPEARS) AND DISPLAYING 5th DIGIT  
 | ON LSD LOCATION (AVAILABLE ON 7 RANGES  
 | ONLY)

TRUE CAPACITANCE | CALCULATES THE VALUE OF TRUE CAPACITNAGE IF CAPACITOR  
 | IS LEAKY. ACCURACY IS + 5.0 % WHEN THIS FEATURE IS  
 | ACTIVATED UNLESS CAPACITOR IS A NON-LEAKY TYPE, THEN  
 | NORMAL ACCURACY APPLIES

LEAKAGE | CALCULATES INSULATION RESISTANCE OR CURRENT OF  
 | CAPACITOR IF CAPACITOR IS LEAKY. ACCURACY OF LEAKAGE  
 | READING IS +20 % WHEN THIS FEATURE IS ACTIVATED

TIME CONSTANT | CALCULATES TIME CONSTANTS WITH A USER DEFINED 4 DIGIT  
 | RESISTOR VALUE ENTERED IN FROM THE KEYBOARD

DIELECTRIC ABSORPTION | CYCLES CAPACITOR THROUGH 3 PREDETERMINED TIMED  
 | PERIODS OF SOAKAGE, DISCHARGE AND RECOVER AFTER  
 | WHICH THE DISPLAY READS A RATIO OF FULLY CHARGED  
 | VOLTAGE TO RECOVER VOLTAGE.

ZEROING | ALLOWS ZEROING OF ANY CAPACITANCE VALUE UP TO 100.0 uF  
 | BY 3 DIFFERENT METHODS  
 | 1. POWER ON METHOD - AUTO ZEROS ANY VALUE AT TERMINALS  
 | UP TO 100.0 pF  
 | 2. DEPRESSING ZERD KEY - ANY VALUE AT TERMINALS UP TO  
 | 100.0 uF IS ZEROED  
 | 3. ENTER THE ZERO VALUE THROUGH THE KEYBOARD

SORTING CAPACITORS | 2 BASIC CONFIGURATIONS  
 | 1. SORTING IN HIGH/GOOD/UNDER METHOD BY DEFINING A  
 | DEADBAND  
 | 2. SORTING IN % DEVIATION AROUND A USER DEFINED  
 | SETPOINT

CABLE | AUTOMATICALLY CALCULATES LENGTHS OF CABLES IN FEET,

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## INTRODUCTION

The Daetron model MC300 is a compact hand held 4 digit LCD Digital Capacitance Meter capable of measuring over the full range of 0.1 pF to 1 FARAD (999.9 mF), in completely autoranging or manual modes. This instrument incorporates so many features that the user is well advised to read and understand this manual thoroughly so as to avoid any misunderstandings about how the unit works. Complex procedures involving certain features could lead an unwary user to think the unit is not working properly.

The MC300 is probably the most powerful hand held Digital Capacitance Meter on the market today, incorporating new ideas never before implemented in a unit of such quality and reasonable cost.

The basic method of measuring capacitance involves the use of charging and discharging the capacitor while counting the time of this cycle. The cycle time is converted to display a value which is equivalent to the value of the capacitor under test. The microprocessor controlling the circuitry senses when the value of any capacitor is over ranged for that value and switches to the next higher range resistor.

## INSTALLING THE BATTERY

To install a battery make sure the power switch is in the off position. Slide off the back cover and clip the 9 volt battery to the battery clip and insert it beside the spare fuse holder. Slide the cover back on. Always use an alkaline battery as this will last a lot longer than regular zinc carbon or heavy duty batteries. If using a NI-CAD battery, the ability to read zener diodes will be impaired as it has a slightly lower voltage. IT IS IMPORTANT THAT A GOOD QUALITY BATTERY BE INSTALLED AS THE WARRANTY IS VOID IF THE UNIT IS DAMAGED BY A LEAKY BATTERY.

## USING THE OPTIONAL AC BATTERY ADAPTOR (DAETRON MODEL PS100)

Read the following procedure very carefully. Insert the plug of the adaptor into the MC300 jack on the top of the unit. Next insert the adaptor into the AC outlet. Failure to use this procedure may result in damage to the AC adaptor. Also using an AC adaptor will allow a higher voltage Zener diodes to be read. (Max. of 24 VDC). The MC300's one year warranty is voided on any units operating on any other than the DAETRON PS100 or a unit that has been approved by DAETRON.

## GETTING STARTED

Despite it's complicated looking appearance the MC300 is very easy to use when initially checking capacitors. The unit is ready to test capacitors when the power switch is turned on. Before placing the capacitor in the terminal slots make sure to discharge the capacitor. The terminal slots have a large wattage resistor connected to them when the power switch is in the "off" position. So if your not sure whether your capacitor is discharged, make sure to short the leads or insert the unit into

## STEP 4.

Remove the 0.1 uF to 0.2 uF capacitor. Insert the 10 uF to 20 uF capacitor. Take a reading of this capacitor. If the value varies from the known value of this capacitor then adjust P3 until it is the same.

## STEP 5.

Remove the 10 uF to 20 uF capacitor. Insert the 1000 uF to 2000 uF capacitor. Take a reading of this capacitor. If the value varies from the known value of this capacitor then adjust P4 until it is the same.

## MAINTENANCE

### INPUT PROTECTION

The MC300 incorporates diode clamping and a 1/4 ampere fuse to protect against charged capacitors. This protection however is no guarantee that the instrument will not be damaged if the user forgets to discharge the capacitor before inserting into the binding posts. So remember to ALWAYS DISCHARGE YOUR CAPACITORS.

### IF YOUR INSTRUMENT STOPS WORKING WORK

### FUSE REPLACEMENT

The 1/4 ampere fuse is located under the lid of the battery compartment. If the fuse is suspected to be open circuited remove it carefully from its holder. To check the fuse don't trust your eyes, check it out with an ohmmeter. If it's defective remove a good fuse from the spare fuse holder and insert it in the fuse holder. Replace the fuse only with a 1/4 ampere, 250 V, AGC regular blow fuse. Using a fuse with a higher current rating may result in damage to the instrument.

otherwise the unit won't work. The leads of the calibration capacitors must be very clean to prevent false readings.

Capacitors needed:

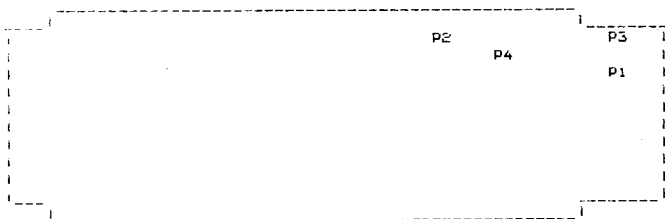
one capacitor of value between	1,000 uF to 2,000 uF
" " " "	10 uF to 20 uF
" " " "	100 nF to 200 nF
" " " "	1000 pF to 2000 pF

The user must know the accuracy to about 0.5%. If there is access to an accurate capacitance bridge or meter then there is no need to obtain premium tolerance capacitors. Also the electrolytic capacitor used should have as little leakage as possible to calibrate that range.

To get at the calibration potentiometers inside the case use the following procedure to get the back cover off. Unscrew the jack nut from the battery adaptor jack. Peel off the four rubber feet covering the case screws. Remove the four screws using a phillips screwdriver. Separate the front and back cover very slightly while pulling down on the front cover. When the cover is off the unit is now ready to calibrate.

STEP 1.

The screwdriver used used be plastic or non conductive, if not, be absolutely sure to avoid accidentally shorting out other components when adjusting the potentiometers. The following diagram shows the locations of the various potentiometers.



STEP 2.

Turn the unit on and depress the 'red' ZERO key to eliminate any stray capacitance. Insert the 1,000 pF to 2,000 pF in the terminal slots. Take a reading of this capacitor. If the value varies from the known value of the test capacitor then adjust P1 until it is the same.

STEP 3.

Remove the 1,000 to 2,000 pF capacitor. Insert the 100 nF to 200 nF capacitor in the terminal slots. Take a reading of this capacitor. If the value varies from the known value of this capacitor then adjust P2 until it is the same.

the slots when the power switch is in the "off" position. Also observe polarity when connecting polarized capacitors. As you can see there is no "zero" potentiometer. The MC300 will automatically zero any capacitance up to about 150 pF at the input terminals when initially turned on. So if you want to measure small value capacitors make sure to remove them before powering up. If you leave large valued capacitors in place and then turn the unit on, the MC300 will measure it accurately, however when that capacitor is remove the stray capacitance at the terminals will be displayed because they weren't auto-zeroed on power up. Because the unit is fully autoranging there is no need to select any particular range as this is done automatically. There is a manual capability that will select a particular range. See MANUAL RANGING.

Never apply a voltage to the test jacks or slots, as damage may occur even though it is fuse protected.

When there is no capacitance to be read the display will show either 000.0 or -000. There will never be any reading lower than -000. If the user tries to read a capacitor and gets a zero display or a reading which is suspiciously low then remove the capacitor and depress the 'white' ZERO key (see zeroing the MC300).

When taking general readings always make sure to wait a few seconds for the readings to stabilize as the capacitor may have been inserted into the middle of a conversion. This is especially true when operating any of the various features of the MC300. On some features a slight drifting might cause exaggerated drifting when that particular feature is activated due to the rounding and truncating of data during calculations.

The user should be aware that any type of capacitor (ceramic, electrolytic, paper, etc.) can cause marginal, drifting or inconsistent readings if the capacitor is not performing to its rated capability. Even many good capacitors will display different readings within a few minutes time. Capacitance will also vary with applied voltage as well as length of time under that voltage, and temperature (unless it is an extremely stable type like a NPO or CGG type).

When measuring capacitors between 100 and 10,000 uF sometimes the display will flash "QUER" for awhile until enough conversions have been accumulated to display a count. This does not necessarily mean that the capacitor is overranged. Be patience when measuring these large capacitors as the MC300 is taking measurements and a valid count will be displayed eventually.

Since the MC300 is completely autoranging it must be able to distinguish a shorted capacitor from an extremely large capacitor like 1 FARAD. To measure any capacitor over 10,000 uF turn the MC300 off, insert the capacitor and make sure its completely discharged and turn the MC300 on. The waiting period before a display is available is long. A 100,000 uF capacitor for example will take approximately 40 seconds before a display is available. Larger capacitors take correspondingly larger times.

TO SUMMERIZE:

1. Discharge capacitor before testing by shorting the leads together or inserting it into the terminal slots with the

power switch in the "off" position.

2. Try to make sure the leads are as clean as possible.
3. Remove capacitor from the terminal slots and make sure there is nothing in the transistor socket.
4. Turn on the power and the unit will automatically zero any stray capacitance.
5. Place the capacitor in the terminal slots while observing the proper polarity and watch the display to obtain a reading. (Remember that the unit is fully autoranging).
6. Do not hold the capacitor as this will affect the reading especially with small value capacitors.
7. Let the display stabilize for a few seconds.
8. When using test leads make sure to zero the additional capacitance (see ZEROING THE MC300). Another characteristic of using test leads is, as the capacitor value to be measured gets lower the stability or repeatability of the display deteriorates. In particular, small pF values are almost immeasurable when using long test leads.
9. To measure capacitors over 10,000 uF turn the MC300 off, insert the capacitor, make sure its completely discharged, turn the unit on again and wait for a display (be patient it takes awhile).

#### ENTERING IN INFORMATION ON THE KEYPAD

When depressing any key on the keyboard all of the LED lamps will flash to indicate a valid key entry. The microprocessor polls the keyboard in between conversions. Therefore the user must be patient when trying to activate any feature especially when a large value capacitor is being read, as during that charge or discharge period the keyboard is inaccessible. So make sure to keep your finger on the key for a little while until the LED's flash.

There are some symbols on the keyboard that are not utilized as they are reserved for compatibility with future models.

#### ZEROING THE MC300

The MC300 can be zeroed by 1 of 3 methods. The first method is as explained before, simply turn the unit on with nothing in the terminal slots. The second method is to depress the 'red' ZERO button. This is useful for zeroing the capacitance of long leads when using the banana jacks. The ZERO key will zero values up to 100 uF, thereby being able to measure even very small values with very long leads.

A third method is to enter in a zero value through the keypad. This is done by immediately beginning to enter the value by depressing the 'red' numbers and then pressing the ZERO key and then depressing 1 of 3 'grey' keys showing the electrical units (pF, nF, uF). This method is useful if it is difficult to measure a 'zero' value at the terminal slots. Do not enter in a value greater than 100 uF.

numbers of the chosen value on the 'red' numbers on the keypad. Depress the 'white' time constant symbol (the greek letter tau) and then depress the proper electrical unit on the 'grey' keys marked ohms, K ohms or M ohms. The display will now go back to reading capacitance values. To activate the time constant mode depress the FUNCTION/HOLD key and then the 'white' time constant key. The display will now show the time constant value in time. The time unit can be read from the LEDs. To get back to reading capacitance values depress the FUNCTION/HOLD key and then the time constant key.

The user should note that the displayed value may not agree with a value calculated with a calculator because only the first 3 significant digits are used and the rest of the display is truncated. For example a value of 8979 pF is truncated to 8970 pF.

#### POWER

The MC300 is powered by a 9 volt battery (see INSTALLING THE BATTERY). When the battery is low the display will indicate the word BATT and the unit will become inoperable. The MC300 can also be used with an optional AC battery adaptor (DAETRON MODEL PS100) which can be used as an ordinary battery eliminator. The MC300 THE MC300 WARRANTY IS VOID IF THE UNIT IS DAMAGED BY A LEAKY BATTERY.

NOTE: As some adaptors may destroy the power circuitry the AC adaptor used must be DAETRON'S PS100 or one approved by DAETRON or the warranty is void.

#### TIPS ON SAVING POWER

Obviously these tips apply only when using a battery. The largest power consumption is used when reading very large capacitors. So it is wise not to leave these units running for very long as they may quickly drain the battery. Another time when there is large power consumption is when checking forward biased diodes. Monitoring the voltage using the ZENER diode mode (see Zener diode and rectifier) will allow the user to predict battery failure. When in that mode without using any Zener diode, will show the open circuit voltage of the voltage multiplier circuit. As this voltage is unregulated it will be observed to decrease as the battery voltage goes down.

#### CALIBRATION

Be careful when calibrating as any damaged done to the instrument will void the warranty. The MC300 Digital Capacitance Meter is accurately calibrated at the factory with the temperature not deviating more than 70 degrees to 77 degrees F. Recalibration is not considered necessary unless repair has been made to those parts which affect calibration or if there is any reason to suspect that the meter accuracy is off. All that is required is a small screwdriver to adjust the four potentiometers and several capacitors that cover the various ranges and are of a known value to within 0.5%. Also the battery must be in good condition

## RECTIFIERS

Follow the same procedure as the above zener diode procedure but take two readings, one for forward voltage and another for reverse voltage. If there is no diode in the transistor socket then the full open circuit voltage will be displayed. This is 24 to 25.5 volts. If a diode is reverse biased then it will read 24 to 25.5. If the diode forward biased then it will read 000.0.

NOTE: It is assumed that the unit is being operated with the AC adaptor. Operation with a 9 volt battery may show a much lower reversed bias voltage.

To deactivate this feature press the 'white' FUNCTION key twice when the display is showing ZENR.

## IDENTIFICATION OF BIPOLAR TRANSISTOR TYPES (NPN, PNP)

To identify transistor types make sure there is no capacitor in the terminal sockets as the transistor socket is interconnected. Depress the FUNCTION/HOLD key and then depress the 'white' TRANS key. The display will now display the word TRAN. Place the transistor in the top three receptacles of the transistor socket in any lead configuration as these three sockets have equal potential at this point. Depress the 'white' TRANS key again and the display will identify whether this is a NPN or PNP transistor. If the unit is unable to identify the correct type then the display will indicate the word BAD. There is no guaranty that all bipolar types will be identified but the majority should. Therefore when there is a bad indication this does not necessarily mean that this transistor is bad, unless you already know what to expect from testing previous transistors of this type. When it does read bad remove the transistor and try another configuration as sometimes the unit might be able to take a reading in this new configuration with that particular transistor type. Depress the 'white' TRANS key again and the display will now identify the leads of the transistor by following the white arrows leading from the transistor socket and pointing to three digits on the LCD display. For example if the display shows EBC then that means that the left hand lead is the emitter, the middle lead is the base and the right hand lead is the collector. Depressing the 'white' TRANS key will revert back to the TRAN display. The unit is now ready to accept another transistor. To go to reading capacitance values remove the transistor from the socket and pressing the FUNCTION/HOLD key twice will go back to reading capacitance values.

Sometimes a transistor type is extremely noisy when operating in the MC300 environment. This sometimes causes noise spikes which might throw the program into a loop. If this happens turn the unit off and start over again with a different pin configuration for the transistor.

## TIME CONSTANT

The MC300 can calculate time constants by accepting a 4 digit resistance value from the keypad (for example 23.87 K ohms). To enter in the resistance value enter the four most significant

## TO SUMMARIZE:

METHOD 1. Turn the unit on and the MC300 will auto-zero any value at the terminal slots or the banana jacks.

METHOD 2. Depress the 'red' ZERO button and the unit will zero any value up to 100 uF.

METHOD 3. Enter a value by depressing the red numbers on the keypad, then press the 'red' ZERO key, then press 1 of 3 electrical units located on the grey keys (pF, nF, uF). Do not enter in a value greater than 100 uF.

## MANUAL RANGE

The MC300 also has a 10 range manual capability. To activate this feature depress the 'white' FUNCTION/HOLD key and then press the 'blue' MANUAL key. The unit will now be in 'manual' mode and will generally be the lowest range (1000.0 pF). To change the range simply depress any of the blue range keys all the way up to 1,000.0 mF (1 FARAD). While in the manual range any key that has a 'blue' range indicator on it will not allow any other function on that key to be entered, for example entering numbers or selecting any of the 'white' keys. To terminate 'manual' mode, depress the 'white' FUNCTION/HOLD key and depress the 'blue' MANUAL key.

In no way does the manual range features improve the performance or accuracy or time response of the unit. Its best usefulness is learning to compare and distinguish, from different relative electrical units and their relationships.

## TO SUMMARIZE:

1. Depress the 'white' FUNCTION/HOLD key.
2. Depress the 'blue' MANUAL key.
3. Depress any of the 'blue' range keys.
4. To terminate 'manual' mode, depress the white FUNCTION/HOLD key and depress the 'blue' MANUAL key.

## FREEZING THE DISPLAY WITH THE 'HOLD/FUNCTION' KEY

The display can be frozen when reading capacitors on any of the features that are activated. To do this depress the 'white' FUNCTION/HOLD key and the display will freeze. This means that the capacitor can be removed and the display will still show the reading at the time of holding.

The hold can be used when reading normal values, true capacitance, any form of leakage, any of the setpoint modes, time constant readings, cable readings as well as when the extended resolution mode is activated.

## TRUE CAPACITANCE

If a capacitor is leaky it will display a reading higher than expected. To read a value which would display the true capacitor, that is a value which would be displayed if there was no leakage, Press the 'white' HOLD/FUNCTION key and then the 'white' TRUE CAP. key. The display will now show the true capacitance as if the capacitor had no leakage. The MC300

calculates the true capacitance by monitoring the ratio of charge to discharge times.

This feature is very useful for doing 'incircuit' readings. To do this make sure the power to the circuit under test is off, and the capacitor is discharged and leads are connected to the banana jacks from the capacitor under test. For a valid display to show up the circuitry of the capacitor must allow the capacitor to charge to at least 2 VDC. If the circuit resistance is too low then the capacitor will appear shorted and the unit will be incapable of making any further conversions. Also note that the incircuit test circuit must be resistive in nature and not paralleled with any semiconductors (like decoupling capacitors) as this will greatly deteriorate the accuracy.

It is not recommended that the TRUE CAP feature be used for general readings as the accuracy is much less than normal readings. The TRUE CAP function only approximates true capacitance.

To deactivate this mode depress the 'white' FUNCTION/HOLD key and then press the 'white' TRUE CAP. key.

TO SUMMARIZE:

1. Depress the 'white' FUNCTION/HOLD key.
2. Depress the 'white' TRUE CAP. key.
3. To deactivate this feature depress the 'white' FUNCTION/HOLD key and depress the 'white' TRUE CAP. key.

#### LEAKAGE, INSULATION RESISTANCE, CURRENT

This feature works only in the nF, uF and mF ranges. Reading leakage values is accomplished by monitoring the ratio of the charge to discharge times and displaying the corresponding calculated value of either insulation resistance or current. If the capacitor is not leaky then the display will show 'none' as if there is no leakage.

To read leakage depress the 'red' LEAKAGE key. The display will show insulation resistance in ohms or Kohms with the corresponding lighted LED to indicate the proper multiplier for that value. Depressing the same key again will indicate the leakage in current. The value of current is calculated by dividing the indicated resistance into 2 VDC.

By continually depressing the LEAKAGE key the display will toggle back and forth between insulation resistance and current and normal capacitance readings.

If there is no leakage detected or is too small to be read by the MC300 then the display will indicate no leakage by displaying the word NONE.

The range of values depends on the value of capacitance and the range currently being used. In most cases leakage is only displayed when it is sufficiently high enough to greatly affect the charge discharge cycle. In all cases the maximum leakage detected is 100k ohms or less (In some cases it can be 10K ohms or less).

However for most ranges, 5 digits are normally active. To view the internal fifth digit depress the FUNCTION/HOLD key and then depress the 'white' EX RELS key. The display will shift to the left (MSD disappears) and the least significant internal digit will be shown at the LSD position. If only 4 digits happen to be used for any particular capacitor, then of course no shifting will occur and the display will not change. To view normally just repeat the same procedure and the display will shift to the right and go back to normal. Don't ever leave the unit in this mode as forgetting to deactivate it may cause a lot of confusion later on.

#### ZENER DIODES AND RECTIFIERS

The MC300 has the ability to measure the zener breakdown voltage of a zener diode from approximately 5 volts up to about 24 volts. This of course depends on the condition of the battery as the test voltage for this feature is not regulated. If a AC battery adaptor is used then the complete operating voltage is always maintained (see AC ADAPTOR). The bottom receptacle in the transistor socket (zener anode) is ground and the open circuit output voltage of the extreme right hand socket is 24 to 25.5 volts (zener cathode).

#### ZENER DIODES

To operate this feature depress the FUNCTION/HOLD key and then depress the 'white' ZENER key. Make sure there is no capacitor connected to the terminal inputs as they have a common connection to the transistor socket where the zener diode is tested. The display will show the word ZENR indicating the diode is ready to be installed. Place the zener according to the zener diode symbol at the transistor socket. Depress the 'white' ZENER key and the display will show the zenering voltage. Depress the ZENER key again and the display goes back to the word ZENR and ready to accept another diode. If the diode is defective and open circuited then the full 24 to 25.5 volts of the zener supply voltage will be shown.

light up indicating kilometres.

4. To go back to reading value just depress the 'red' CABLE key.

NOTE: The unit cannot toggle back and forth between mile and kilometres or feet and metres.

#### DIELECTRIC ABSORPTION (DA)

Due to the internal leakage of the MC300 circuitry the effective range of this feature is usually from 1  $\mu$ F and up. Smaller values can be measured but a correspondingly high value of DA will be displayed which is useful for comparative purposes.

Some capacitors don't completely discharge unless they are shorted for a very long time. This ability to remember a voltage is known as dielectric absorption. The effect is the same has having a secondary capacitor in series with a large resistor, parallel to the main capacitor. The value is expressed as a ratio of the voltage across a fully charged capacitor to the voltage across that same capacitor when it has been discharged and left to recover or a certain period of time. This is the technique used in the MC300 to measure DA. The cycle is broken down into three time periods. The first is a period of soakage, followed by a discharge period and then a recover period. To enter into the DA mode depress the FUNCTION/HOLD key and the 'white' DA key. The display will read DA. To continue with the test depress the same key again. The MC300 will cycle the capacitor through three predetermined time periods of approximately 60 seconds charge (soakage), 2 seconds discharge, 30 seconds recover times. The display will then show the ratio of the charge voltage to that of the recovered voltage. During these cycles the keyboard is inaccessible and the display will indicate to wait by displaying WAIT for wait.

A capacitor with a reading close to 0 has a low DA and one close to 1 has a high reading. It is obvious to say the lower the reading the better. Readings using this MC300 method are typically lower than 0.05 for large capacitors with a low DA and 0.3 for smaller value capacitors with a low DA. The smaller the value the higher the reading because of the internal leakage of the MC300 circuitry.

#### EXTENDED RESOLUTION

In most cases reading capacitance with even 4 digit resolution is sometimes more than adequate, as the more digits there are the likelier the least significant digits will drift around randomly from noise in the environment as well as different performance characteristic depending on the charging resistor. In some cases some capacitors are extremely stable in certain ranges. When this is likely to occur the user may select to view the internal 5th digit of resolution.

The MC300 incorporates a total of 4 or 5 digits of resolution of which the most significant 4 are displayed. When small value capacitors in relation to the currently used charging resistor are measured the MC300 uses only four digits.

#### TG SUMMARIZE:

1. Depress the LEAKAGE key once to read insulation resistance.
2. Depress the LEAKAGE key again to read current.
3. Continuing to depress this key will cause the display to toggle back and forth between insulation resistance and current and normal capacitance values.

#### SORTING CAPACITORS

The MC300 is capable of sorting capacitors in 2 different modes. The different sorting modes are as follows.

- SORTING IN HIGH/GOOD/UNDER METHOD BY DEFINING A DEADBAND
- SORTING IN % DEVIATION AROUND A USER DEFINED SETPOINT

Before sorting can commence 2 setpoints must be chosen. Always enter the setpoints while in the normal reading modes or false readings may occur. There are two methods of entering in setpoints. If sorting is to commence after cable or time constant measurements have been done and/or the 2 setpoints have not been entered in, then the sorting mode will use whatever values are present for the cable or time constant modes as the same memory is used for both and no error indication will be displayed. So make sure to enter in the setpoints. The range of this feature is limited to 100  $\mu$ F. If an 80  $\mu$ F capacitor is off tolerance and is actually 110  $\mu$ F then the MC300 will not detect that particular value under this feature.

To enter in the low setpoint enter the value on the 'red' numbers on the keypad. Depress the 'grey' SETPOINT key once. Depressing the key a second time will allow the high setpoint to be entered. After depressing the 'grey' SETPOINT key once or twice then the electrical unit is chosen by depressing 1 of 3 grey keys marked pF, nF or  $\mu$ F.

The display will now continue to read normal value. To activate the HIGH/GOOD/LOW setpoint depress the 'red' SORT key. If the value is above the high setpoint then the display will indicate 'HIGH'. If the value is between the high and low setpoints then the display will indicate 'GOOD'. If the value is below the low setpoint then the display will indicate 'LOW'.

To activate the % deviation mode depress the 'red' SORT key again. If the value is above the high setpoint the display will indicate the % deviation above the high setpoint. If the value is between the high and low setpoints then the display will indicate 'GOOD'. If the value is below the low setpoint then the display will indicate the % deviation below that setpoint. If the % deviation is to be sorted about a single setpoint then simply make the low setpoint equal in value to the high setpoint. During the % deviation mode some values may be so far off tolerance that the display will revert to showing OVER or LOW or HIGH.

The second method of entering in setpoints is to use the SORT DISP. ENTRY key. Depress the white FUNCTION and depress the SORT DISP. ENTRY key and the value currently being displayed will be entered in as a setpoint. To choose the setpoint now



depress the 'red' number 1 for the first setpoint and number 2 for the second setpoint.

#### TO SUMMARIZE:

1. Enter the first setpoint by entering the capacitance value on the 'red' keys.
2. Depress the 'grey' SETPOINT key once for the first setpoint.
3. Depress any of the 'grey' keys marked pF, nF, uF, mF to select the appropriate electrical unit.
4. The unit will now continue to read whatever value is at the terminals.
5. To enter in the second setpoint follow the same above procedure but depress the 'grey' SETPOINT key twice instead of once as in line number two.
6. To activate the SDRT mode depress the 'red' SORT key and the display will indicate HIGH, GOOD, or LOW. The HIGH indication means the value at the terminals is higher than the first setpoint. The GOOD indication means the value at the terminals is between the first setpoint and the second setpoint. The LOW indication means the value at the terminals is lower than the second setpoint.
7. To activate the % deviation mode depress the 'red' SORT key a second time. If the value is above the first setpoint the display will indicate the % value above the value of that first setpoint. If the value is below the second setpoint, the display will indicate the % value below that second setpoint. If the value is between the two setpoints then the display will indicate word GOOD.
8. To show the % deviation around just a single setpoint rather than around a deadband, simply choose the same value for both the first and second setpoints.
9. To enter in the value currently being displayed as a setpoint depress the 'white' FUNCTION key and then the SDRT DISP. ENTRY followed by the 'red' number 1 or number 2 to indicate the lower setpoint or higher setpoint respectively.

#### CABLE MEASUREMENTS

The MC300 can measure the lengths of cables up to a theoretical 9,999 miles or kilometres. The cable must have at least two or more wires, and be completely uniform in composition. That is to say the cable can't start off with two wires and then somewhere along the way several other strains are added. The cable must also be open circuited at the end of the cable. If a multiconductor cable is measured, only two of the strands needbe utilized to measure its length. Make sure the two strands in this multiconducted cable are as short as possible and protrude from one of the ends and not a few inches from it.

The accuracy of the measurement depends on the quality of the data supplied to the MC300. The unit calculates the length of the cable under test by dividing the value of the capacitance at the terminals by the value per unit length supplied by the operator. The more accurate the value per unit length is the more accurate the reading is. Also the cable itself must have a

relatively uniform capacitance over the whole length of the cable. In other words the quality of the cable itself as far as the capacitance per unit length is concerned, has an important contribution to the accuracy of the final measurement. For example, in measuring a cable that is 4,000 feet long, the first 1,000 feet is 15 pF per foot and the last 3,000 feet is 16 pF per foot, the accuracy will obviously be affected no matter what value has been entered as the capacitance per unit length. Another factor affecting accuracy is the value of the additional capacitance if the cable is measured rolled up on a spool, as opposed to it being strung out. If this capacitance is known then it can be nulled out by entering this value and depressing the 'red' ZERO key (see ZEROING THE MC300). The user must also be aware that this value changes if the spool is only half filled with the cable that is to be measured.

There are two ways of entering the value per unit length. The first is to place a 1 foot or 1 metre sample at the terminal slots. If using test leads with the banana jacks, make sure to null out the value of these test leads (see ZEROING THE MC300). Depress the FUNCTION/HOLD key and then depress the 'white' CAP/UNIT DISP. ENTRY key. The sample has now been entered in.

The second way to enter in a sample is to simply enter in the capacitance value on the keypad, depress the 'grey' FEET/METRES key and then the 'grey' key indicating pF. Enter in no more than one decimal point figures.

At this point it is not necessary to indicate whether you are entering feet or metres as this is decided later on. Now cable measurements can be read. Depress the 'red' CABLE key to read in feet. The MC300 will automatically read in feet or miles if the cable is over 5,280 feet. If the reading is in feet the red LED lamps will NOT light up. If in miles the LED will all light up. To read in metric depress the 'white' FUNCTION/HOLD key from normal reading mode and then depress the 'red' CABLE key. The display will now show readings in metres or kilometres and will be indicated by the LED lamps being on or off respectively.

To get out of this mode depress the CABLE key.

#### TO SUMMARIZE:

1. Capacitance per unit length must be entered in first -two methods
  - a) Place 1 foot or 1 metre of cable in the terminal slots and depress the FUNCTION/HOLD key and then the 'white' CAP/UNIT DISP. ENTRY key. The value shown on the display will be the capacitance per unit sample.
  - b) Enter in a sample value in capacitance on the 'red' numbers, depress the 'grey' FEET/METRES key and then the 'grey' key indicating pF. Enter in no more than one decimal point figures.
2. To read lengths in feet depress the 'red' CABLE key. The display will show measurements in feet and miles when lengths are over 5,280 feet. The LED lamps will all light up indicating miles.
3. To read lengths in metres depress the FUNCTION/HOLD key and then the 'red' CABLE key. When readings go over 999 metres the display will show kilometres. The LED lamps will all

MEASUREMENTS | METRES, MILES, KILOMETRES  
| (THEORETICAL RANGE OF 10,000 MILES).  
| SAMPLE CAPACITANCE IS ENTERED IN IN 2 DIFFERENT WAYS  
| 1. VALUE IS ENTERED IN THROUGH THE KEYPAD  
| 2. PLACING A 1 FOOT OR 1 METRE SAMPLE AT THE INPUT  
| TERMINALS AND DEPRESSING THE "CAP/UNIT" KEY

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HOLD FUNCTION | FREEZES THE DISPLY WHEN MEASURING:  
| VALUE, TRUE CAPACITNCE, TIME CONSTANT, LEAKAGE,  
| EXTENDED RESOLUTION, ANY SORTING MODE AND CABLE  
| MEASUREMENT

-----  
INPUT | DIODE CLAMPING AND FUSE PROTECTED INPUTS AT BOTH  
| INPUT SOCKETS AND BANANA JACKS. DISCHARGE RESISTOR IN  
| OFF POSITION OF POWER SWITCH AT TERMINAL SOCKETS AND  
| BANANA JACKS

-----  
TRANSISTOR | CAPABILITY OF IDENTIFYING TRANSISTOR TYPE (NPN, PNP)  
TESTS | AND THEIR LEADS ( COLLECTOR, BASE, EMITTER )  
| INSERT TRANSISTOR IN ANY LEAD CONFIGURATION IN THE 3  
| INPUTS OF THE TRANSISTOR SOCKET

-----  
ZENER DIODE AND | READS ANY ZENER DIODE VALUE UP TO 24V AND DISPLAYS  
RECTIFIER TESTS | VOLTAGE ON THE DISPLAY.

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POWER | NEEDS ONLY A SINGLE 9V BATTERY  
| DISPLAY INDICATES LOW BATTERY CONDITIONS BY DISPLAYING  
| BATT

-----  
CASE | HI-IMPACT ABS PLASTIC CASE WITH METAL TILT STAND  
| DIMENSIONS 180 MM X 98 MM X 44 MM

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ACCESSORIES | INCLUDES INSTRUCTION MANUAL WITH CALIBRATION  
| PROCEDURE AND SPARE FUSE

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OPTIONS | CC100 CARRYING CASE, PS100 AC BATTERY ADAPTOR  
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