

THE VOLTAGE BEING MEASURED IS APPLIED ACROSS A VOLTAGE DIVIDER COMPRISED OF THE 1M OHM RESISTOR 'R1' IN THE PROBE AND RESISTORS IN THE PRIMARY VOLTAGE ATTENUATOR (R4~R14). THE VOLTAGE RANGE SWITCH 'VRS-W3F' TAPS OFF FROM THE APPROPRIATE POINT IN THE VOLTAGE DIVIDER (DEPENDING ON WHICH VOLTAGE RANGE IS SELECTED), AND THIS IS APPLIED TO THE HIGH IMPEDANCE AMPLIFIER (SEE BELOW).

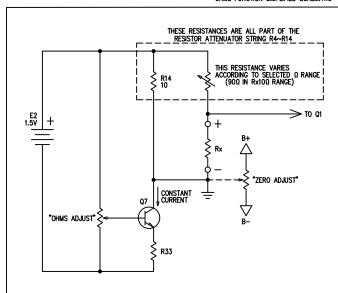
THE VOLTAGE BEING MEASURED IS APPLIED ACROSS THE VOLTAGE RANGE SWITCH 'VRS-WIF' AND ITS ASSOCIATED RESISTORS 'R2' & 'R3'. IN ALL BUT THE HIGHEST VOLTAGE RANGE, NO ATTENUATION TAKES PLACE, BUT IN THE 1500V RANGE, THOSE TWO RESISTORS ATTENUATE THE SIGNAL TO A LEVEL THAT DOES NOT EXCEED THE ISOUV RANCE, INJUSE HWY RESIDENCE ATTINES HERE AT THE MEAN TO A CLEEP THE RECTIFIER DIODES' VOLTAGE RATING. THEN, MA 'WAS-WZF', THE SIGNAL IS PASSED THROUGH SOME COMBINATION OF RECTIFIER DIODES DI∼D3. AS THE SIGNAL VOLTAGE CETS INTO THE HIGHER RANGES, MORE DIODES ARE USED IN SERIES SO THAT THEIR INDIVIDUAL VOLTAGE LIMITS ARE NOT EXCEEDED. CAPACITOR 'C2' FUNCTIONS AS A FILTER TO PRODUCE A SMOOTH DC SIGNAL WHICH IS THE AVERAGE OF THE RECTIFIED INPUT VOLTAGE. THE RESULTING SIGNAL IS THEN APPLIED TO THE PRIMARY VOLTAGE ATTENUATOR (WHICH FOR AC MEASUREMENTS DOES NOT INCLUDE THE 1M RESISTOR INSIDE THE PROBE ("RI"). WHEN IN THE 1500V AC RANGE, BECAUSE OF THE PRE-ATTENUATION PROVIDED BY "R2" & "R3", THE SWITCH "VRS-W3R" IS ARRANGED TO USE LESS ATTENUATION THAN WOULD BE THE CASE WHEN MEASURING DC VOLTAGES.

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THE IM-16, UNLIKE ITS MORE CAPABLE SIBLING THE IM-25, DOES NOT HAVE THE CAPABILITY OF DIRECTLY
MEASURING CURRENT (AMPS/MILLIAMPS). HOWEVER, BY USE OF AN EXTERNAL SHUNT RESISTOR(S), THE IM-16
CAN STILL BE USED IN ITS VOLTAGE MEASURING CAPACITY TO BE PART OF A CURRENT MEASURING SCHEME.

### RESISTANCE/OHMS SFF DFTAIL BFLOW

 BALANCED BRIDGE METER CIRCUIT
 THE SIGNAL COMING FROM THE PRIMARY VOLTAGE ATTENUATOR, OR FROM THE OHMS MEASURING CIRCUIT. IS APPLIED TO THE HIGH IMPEDANCE AMPLIFIER, WHICH CONSISTS OF FET '01' AND ASSOCIATED TRANSISTOR '04', WHICH IS CONFIGURED AS A CONSTANT CURRENT SINK. THIS AMPLIFIER HAS A VERY HIGH INPUT IMPEDANCE AND A LOW OUTPUT IMPEDANCE, ALLOWING HIGH RESISTANCE INPUT 'FRONT-END' CIRCUIT RESISTANCES. THE OUTPUT OF 'Q1' IS APPLIED TO A BALANCED BRIDGE CIRCUIT COMPRISED OF 'Q5' & 'Q6' WITH RESISTORS 'R24' & 'R27'. THE BRIDGE IS SET UP TO BE BALANCED WHEN THE VOLTAGE FROM 'QI' IS ABOUT 4.7V. WITH THE BRIDGE BALANCED, THERE IS NO VOLTAGE DIFFERENCE BETWEEN THE LEFT AND RIGHT SIDES OF THE BRIDGE, AND SO NO CURRENT FLOWS THOUGH THE METER MOVEMENT, AND IT POINTS TO THE LEFT SIDE OF THE SCALE. WHEN THE OUTPUT OF 'Q1' INCREASES, THE BRIDGE BECOMES IMBALANCED, WITH DIFFERENT VOLTAGES ON THE LEFT AND RIGHT SIDES, AND THIS RESULTS IN A CURRENT FLOWING THROUGH THE METER MOVEMENT. SERIES CALIBRATION TRIM POTENTIOMETERS 'R25' & 'R26' ALLOW THE TWEAKING OF HOW MUCH METER CURRENT FLOWS FOR A GIVEN AMOUNT OF BRIDGE IMBALANCE. THE 'FUNCTION SWITCH' ALLOWS DIFFERENT METER CONNECTIONS DEPENDING ON WHICH FUNCTION IS CURRENTLY SELECTED.

## OHMS FUNCTION SIMPLIFIED SCHEMATIC



THIS SIMPLIFIED DIAGRAM OMITS ALL OF THE SWITCHING AND REARRANGES THE COMPONENTS TO MAKE THE CIRCUIT FUNCTION CLEARER. SEE SHEET 1 FOR FULL CIRCUIT.

THE 1.5V "C" CELL 'E2' PROVIDES THE EXCITATION VOLTAGE THAT CAUSES CURRENT TO FLOW IN THE MAIN OHMS FUNCTION CIRCUIT LOOP. THE SAME 1.5V CELL, VIA THE "OHMS ADJUST" POTENTIOMETER, PROVIDES A REFERENCE VOLTAGE TO THE BASE OF Q7. WHICH ALONG WITH THE RESISTOR R33 FORMS A CONSTANT-CURRENT SINK, THEREBY REGULATING THE CURRENT IN THE MAIN OHMS FUNCTION CIRCUIT LOOP TO A CONSTANT

The other component in the main circuit loop is a fixed precision  $10\Omega$  resistance 'R14'. The constant current in the loop causes a constant voltage to be developed

A VOLTAGE DIVIDER CONSISTING OF A RANGE-DEPENDENT PRECISION RESISTANCE (COMPRISED OF SOME OF THE RESISTORS IN THE PRIMARY VOLTAGE ATTENUATOR RESISTOR STRING) AND THE SERIES—CONNECTED RESISTANCE UNDER TEST (Rx) WHICH IS CONNECTED TO THE IM-16 VIA THE TEST LEADS/PROBE, PROVIDES A VOLTAGE TO HIGH IMPEDANCE AMPLIFIER Q1 THAT IS NON-LINEARLY RELATED TO THE RESISTANCE OF Rx. THE VOLTAGE PRESENTED TO Q1 CAN BE BIASED UP OR DOWN (FROM THE PERSPECTIVE OF THE BALANCED BRIDGE METER CIRCUIT) BY THE ACTION OF THE "ZERO ADJUST" POTENTIOMETER AND ASSOCIATED "BIAS ADJUST" POTENTIOMETERS (NOT SHOWN HERE). THIS ALLOWS 'ZEROING OUT' ANY ERRORS IN THE FRONT-END OHMS MEASUREMENT CIRCUIT AND TEST LEADS.

### BIAS ADJUSTMENT:

NOTE THAT THREE CALIBRATION TRIM POTENTIOMETERS (TRIM POTS) ARE LOCATED ON THE TOP FLANGE OF A SUB-PANEL WHICH CAN BE ACCESSED BY REMOVING THE TOP SHELL OF THE IM-16'S CASE. TURN ALL FRONT PANEL SWITCHES, THE FRONT PANEL 'OHMS ADJUST'
CONTROL, AND THE THREE TRIM POTS ('AC CAL', 'DC CAL, AND 'BIAS' ADJUST), TO THEIR FULLY COUNTER-CLOCKWISE POSITIONS. THEN TURN THE "ZERO ADJUST" CONTROL TO ITS CENTER OF ROTATION. THE "OHMS ADJUST" AND "ZERO ADJUST" CONTROLS USE 10-TURN
POTENTIOMETERS WITH BALL BEARING "PLANETARY" DRIVES, AND THUS THEIR ROTATIONAL POSITION CANNOT BE DETERMINED SIMPLY BY VIEWING
THEIR KNOBS. INSTEAD, TURN THEM COUNTER-CLOCKWISE UNTIL THE RESISTANCE REQUIRED TO MOVE THE KNOB INCREASES. FOR CENTERING THE 'ZERO ADJUST' CONTROL, AFTER TURNING IT FULLY COUNTER-CLOCKWISE, USE A SMALL PIECE OF TAPE (OR SIMILAR MARKER) ON THE 12 O'CLOCK POSITION OF THE KNOB. THEN TURN THE KNOB FIVE FULL ROTATIONS CLOCKWISE.

CALIBRATION

- OCCUCK POSITION OF THE KNOW, THEN KNOW THE FOLD ROTATIONS CLOCKINGS.

  MOVE THE "FUNCTION" SWITCH FROM THE "AC" POSITION TO THE "OC" POSITION.

  VERRY THAT THE METER MOVEMENT IS POINTING EXACILY AT ZERO; IF NECESSARY, ADJUST THE SET SCREW ON THE LOWER METER FACE AS REQUIRED TO ZERO THE POINTER, TAPPING LIGHTLY ON THE METER FACE WHILE MAKING THE ADJUSTMENT.

  PLUG THE PROBE'S PHONE PLUG INTO THE JACK ON THE LOWER RIGHT OF THE FRONT PANEL, AND SET THE PROBE'S SWITCH TO THE 'DC'
- POSITION. NOTE THAT, INSTEAD OF THE COMBINATION PROBE, MOST COMMON "YMM" STALE PROBE SETS MAY BE USED WITH THE IM-16,
  MAKING SURE TO USE THE PROBE MARKED FOR "DC" OR "DC VOLTS" FOR THE NEXT STEPS.
  PLUG THE IM-16'S POWER CORD INTO A SUITABLE AC POWER OUTLET AND MOVE THE 'FUNCTION' SWITCH FROM THE 'OFF' TO THE 'LINE'
  POSITION. THE METER MOVEMENT WILL PROBABLY DEFLECT OFF-SCALE TO THE LEFT.
- VERY SLOWLY TURN THE 'BIAS' ADJUSTMENT TRIM POT CLOCKWISE UNTIL THE METER MOVES TO THE RIGHT AND INDICATES ZERO AGAIN; NOTE THAT THIS ADJUSTMENT CAN BE 'TOUCHY', SO MAKE A TINY ADJUSTMENT THEN WAT A MOMENT FOR METER MOVEMENT TO STABILIZE. THEN

- THEN THE 'ZERO ADJUST' CONTROL FULLY CLOCKWISE (UNTIL IT REQUIRES MORE EFFORT TO TURN); THE METER SHOULD INDICATE APPROXIMATELY 15 ON THE BLACK SCALE WHICH ENDS WITH 50 ON ITS RIGHT END.

  BY TURN THE 'ZERO ADJUST' CONTROL COUNTER—CLOCKWISE UNTIL THE METER ACAIN READS ZERO.

  CHANGE THE 'FUNCTION' SWITCH FROM 'DC+' TO 'DC-' AND CONTINUE TO TURN THE 'ZERO ADJUST' CONTROL UNTIL FULLY COUNTER—CLOCKWISE. THE METER SHOULD AGAIN READ APPROXIMATELY 15 ON THE BLACK 50 SCALE.

  RETURN THE 'ZERO ADJUST' CONTROL TO ITS CENTER OF ROTATION (WHERE THE METER READS '0'). THEN TWEAK IT CAREFULLY SO THAT THE METER REMAINS AT ZERO WHILE MOVING THE 'FUNCTION' SWITCH BACK AND FORTH BETWEEN 'DC-' AND 'DC+'

### DC CALIBRATION:

- IDENTIFY A SUITABLE REGULATED DC POWER SOURCE, SUCH AS A BENCH POWER SUPPLY. SET IT TO 10V AND VERIFY WITH THE SUPPLY'S OWN METER OR A SEPARATE DC VOLTMETER; THE ACTUAL VOLTAGE IS NOT IMPORTANT, AS LONG AS IT IS LESS THAN 15V AND ITS EXACT VALUE IS VERIFIED.
- TURN THE 'VOLTS RANGE' SWITCH TO ITS '15V' POSITION.
- TURN THE 'FUNCTION' SWITCH TO 'DC+'.
- USE THE 'ZERO ADJUST' CONTROL TO ZERO THE METER.
- SET THE COMBINATION TEST PROBE'S SWITCH TO THE 'DC' POSITION, OR USE A COMMON "VTVM" PROBE SET'S 'DC' OR 'DC VOLTS' PROBE, AND CONNECT THE PROBE TIP TO THE (+) SIDE OF THE POWER SOURCE AND THE PROBE'S BLACK (-) LEAD TO THE POWER SOURCE'S (-).

  6) ADJUST THE 'DC CAL' TRIM POT UNTIL THE METER POINTER RESTS OVER THE '10' POSITION ON THE BLACK SCALE
- HAVING '15' AT ITS FAR RICHT END; IF THE POWER SOURCE WAS SET TO SOME VOLTAGE OTHER THAN 10V, ADJUST FOR THAT READING INSTEAD.

### AC CALIBRATION:

- CHOOSE A FAIRLY STABLE AC VOLTAGE TO USE AS A REFERENCE; IT IS PROBABLY EASIEST TO USE THE 120V LINE VOLTAGE. SINCE THE IM-16 MEASUREMENT CIRCUITRY IS ISOLATED FROM THE INCOMING AC POWER, IT IS SAFE TO USE THE SAME AC POWER SOURCE FOR THE FOLLOWING STEPS.
- 2) USING A SEPARATE AC VOLTMETER (THIS WILL PROBABLY BE THE SAME MULTIMETER USED FOR VERIFYING THE VOLTAGE OF THE POWER SOURCE IN STEP 1 OF THE 'DC CALIBRATION' ABOVE), NOTE THE ACTUAL VOLTAGE OF THE
- AC REFERENCE VOLTAGE, e.g. ABOUT 120V.

  3) SET THE 'VOLTS RANGE' SWITCH TO ITS 150V POSITION, AND CONNECT THE IM-16'S TEST LEADS TO THE AC REFERENCE VOLTAGE, MAKING SURE TO SET THE PROBE'S SWITCH TO THE 'AC/OHMS' POSITION, OR USE THE
- SER THE 'FUNCTION' SWITCH TO 'AC'. ADJUST THE 'AC CAL' TRIM POT UNTIL THE METER MOVEMENT INDICATES THE AC REFERENCE VOLTAGE, e.g. 120V, AS READ ON THE METER'S RED AC SCALE WHICH ENDS WITH '15' AT ITS RIGHT SIDE; 15 ON THIS SCALE MEANS
- 6) DISCONNECT THE IM-16'S TEST LEADS FROM THE AC REFERENCE VOLTAGE.

## OHMS CALIBRATION:

- 1) MAKE SURE THAT A COMBINATION PROBE HAS ITS SWITCH SET TO 'AC/OHMS' OR USE THE 'AC/OHMS' PROBE OF A "VTVM" PROBE SET; ACCIDENTALLY USING THE 'DC' TEST PROBE WILL SKEW ALL RESISTANCE READINGS BY 1M OHM! SET THE 'FUNCTION' SWITCH TO ITS 'OHMS' POSITION.
- 2) SET THE FUNCTION SWITCH TO THE 'RX1' POSITION.

  3) SET THE 'CHMS RANGE' SWITCH TO THE 'RX1' POSITION.

  4) SHORT THE TEST PROBE TO THE BLACK (-) TEST LEAD AND VERIFY THAT THE METER GIVES A READING OF ZERC; IF NOT, ADJUST THE 'ZERO ADJUST' CONTROL TO RE-ZERO THE METER.

  5) UN-SHORT THE TEST PROBE FROM THE BLACK TEST LEAD, AND ADJUST THE 'CHMS ADJUST' CONTROL UNTIL THE METER POINTER RESTS DIRECTLY OVER THE LAST SCALE MARK AT THE FAR RIGHT END OF THE GREEN CHMS SCALE.

  6) RE-SHORT THE TEST PROBE TO THE BLACK TEST LEAD AND VERIFY THAT THE METER POINTER FALLS BACK TO
- ZERO OR NEARLY SO (DUE TO THE INHERENT RESISTANCE OF THE TEST LEADS, THE METER WILL LIKELY READ SOME SMALL DEVIATION NEAR THE FAR LEFT END OF THE SCALE).
- 7) IN THE FOLLOWING STEPS, THE 1M RESISTOR THAT IS BUILT INTO THE 'DC' TEST PROBE WILL BE USED TO CHECK THE HIGHEST OHMS RANGE.
- TURN THE 'OHMS RANGE' SWITCH TO THE 'Rx100k' POSITION.
- SET THE COMBINATION TEST PROBE'S SWITCH TO THE 'DC' POSITION, OR USE THE 'DC' TEST PROBE, AND MAKE SURE THAT THE PROBE IS SHORTED TO THE BLACK TEST LEAD. THE METER POINTER SHOULD INDICATE APPROXIMATELY '10' ON THE GREEN OHMS SCALE (10 x 100k = 1M).

- 1) ALL RESISTANCES ARE SHOWN IN OHMS UNLESS MARKED 'K' (KILO) OR 'M' (MEGA). ALL NON-POTENTIOMETER RESISTORS ARE WIREWOUND 'WW' TYPE UNLESS
  DENOTED 'CC' FOR CARBON COMPOSITION TYPE. ALL NON-POTENTIOMETER RESISTORS ARE 1/2W UNLESS INDICATED. ALL 'CC' RESISTORS ARE 10% TOLERANCE
  UNLESS INDICATED. ALL 'WW' RESISTORS ARE 1% TOLERANCE AND, ALTHOUGH NOT WARKED, ARE PROBABLY IW. POTENTIOMETERS ARE DENOTED ON HEATHKIT
  ASSEMBLY DIAGRAMS WITH 'TERMINAL TO N THE CCW END OF THE ELEMENT, 'TERMINAL 3' ON THE CW END OF THE ELEMENT, AND 'TERMINAL 2' ON THE
  WIPER, AND THESE TERMINAL NUMBERS ARE ALSO SHOWN ON THESE DRAWINGS; THE ACTUAL POTS ARE NOT SO MARKED.

  2) ALL SWITCHES ARE SHOWN IN THEIR FULL COUNTER-CLOCKWISE POSITION AS VIEWED FROM THE FRONT.
- WHERE SPARE SWITCH TERMINALS ARE USED AS TIE POINTS, THEIR HEATHKIT TERMINAL NUMBERS ARE SHOWN AND THEY ARE MARKED "TP" AND THE APPLICABLE SWITCH IDENTIFIER DESIGNATION IS GIVEN, THE TERMINAL IS PART OF THE
- 4) THE FOUR SELECTOR SWITCHES ARE IDENTIFIED ON THESE DRAWINGS BY THE USE OF ABBREVIATED IDENTIFIERS, GIVEN AS A PREFIX, AND A HYPHEN FOLLOWED BY A SUFFIX IS ADDED AFTER THE PREFIX. A PREFIX OF 'PS' REFERS TO "POWER SWITCH" (OFF/LINE/BATT), FS' IS FOR "FUNCTION SWITCH" (AC/DC-/DC+, OHMS) WHERE THESE DRAWINGS OFTEN USE '11' INSTEAD OF 'OHMS', 'VRS' IS FOR "VOLTS RANGE" SWITCH, 'ORS' FOR "OHMS RANGE" SWITCH. THE SUFFIX OHMS, WHERE HESE DRAWINGS OF HEN USE II INSIGED OF OHMS, WE IS FUR VOLTS KANGE SWINDT, INS FOR "MARER, e.g., "-WI" FOR "MARER I" AND "-W" FOR "MARER I", WHERE I IS ALWAYS THE ONE CLOSEST TO THE FRONT OF THE METER. MOST WAFER'S HAVE ROTORS AND CONTACT ON BOTH THEIR FRONT AND REAR SURFACES, AND "F' & "R' ARE ADDED TO THE END OF EACH SUFFIX ACCORDINGLY. NOTE THAT ON SOME SWITCHES, IT CAN BE DIFFICULT TO DETERMINE WHETHER A SPECIFIC SOLDER TAB IS ACTUALLY FOR THE FRONT OR REAR WAFER ROTH REAR WAFER RARRANGEMENT MIGHT HAVE ITS SOLDER TAB ON THE FRONT OF THE WAFER, AND VICE VERSA. THE HIGHEST NUMBERED WAFER ON EACH SWITCH IS THE ONE THAT TERMINATES DIRECTLY TO THE CIRCUIT BOARD TRACES/FOILS.
- 5) A SMALL SQUARE SYMBOL DESIGNATES HOLES IN THE CIRCUIT BOARD WHERE WIRES FROM THE WIRING HARNESS ARE TERMINATED, WITH THE WIRE COLOR SHOWN ADJACENT TO THE SYMBOL (THE WIRE COLOR IS ALSO SHOWN IN THE CIRCUIT BOARD); A DIAMOND SHAPED SYMBOL SYMBOL IS FOR SHORT WIRES SHOWN ADJUSTANT IO THE SYMBOL (THE WIRE COLOR IS ALSO SHOWN IN THE CHOOL BOARD); A DIAMOND STREED STIMBUL VIS FOR SHORT WIRES CONNECTING BETWEEN CIRCUIT BOARD.

  CONNECTING BETWEEN CIRCUIT BOARD.

  FOUR WIRES HAVE WHITE INSULATION, BUT THE COLOR IS NOT MARKED ON THE CIRCUIT BOARD.

  SWITCH TERMINALS ARE DESIGNATED WITH A SMALL ROUND SYMBOL O; THE INTERNAL NUMBERS SHOWN ON THIS DRAWING MATCH THE ORIGINAL HEATHKIT SCHEMATICS. SIMILAR ROUND SYMBOLS WITH INTERNAL NUMBERS ARE USED FOR THE POTENTIOMETER TERMINALS.
- 7) THE ORIGINAL HEATHAIT COMBINATION TEST PROBE & SWITCH IS SHOWN ON THIS DRAWING, AS THESE ARE "UNOBTAINIUM" NOW, THEY MAY BE REPLACED USING COMMON "YTYM" STYLE SEPARATE "AC/OHMS" AND "DC" PROBES ("DC" HAVING AN INTEGRAL IM SERIES RESISTOR) AND TEST LEADS. THE "DC" PROBE IS USED ONLY FOR DC VOLTS.
- THIS TWO SHEET SCHEMATIC INCLUDES MUCH ADDITIONAL INFORMATION NOT INCLUDED ON HEATHKIT'S DOCUMENTS. THIS ADDED INFORMATION WAS OBTAINED BY CAREFUL STUDY OF SOME IM-16'S DURING THEIR RESTORATION. THIS ADDED INFORMATION IS INCLUDED WHENEVER ITS ABSENCE IN THE ORIGINAL DOCUMENTS PROVED TO BE PROBLEMATIC DURING THOSE RESTORATIONS.
- 9) THE RESISTANCE SHOWN FOR THE METER MOVEMENT IS BASED ON PHYSICAL MEASUREMENT, AND IS AN APPROXIMATE VALUE WHICH MIGHT NOT EXACTLY MATCH ANY FACTORY SPECIFICATIONS.

# **SPECIFICATIONS**

- EIGHT RANGES 0.5V, 1.5V, 5V, 15V, 50V, 150V, 500V, 1500V FULL SCALE
- INPUT IMPEDANCE = 11M ON ALL RANGES
   ACCURACY = +/- 3% OF FULL SCALE

- AC VOLTS: EIGHT RANGES 0.5V, 1.5V, 5V, 15V, 50V, 150V, 500V, 1500V FULL SCALE INPUT IMPEDANCE = 1M ON ALL RANGES
- ACCURACY = +/- 5% OF FULL SCALE FREQUENCY RESPONSE = +/- 2dB, 20Hz~1MHz
- SEVEN RANGES: Rx1 (10Ω AT CENTER OF OHMS SCALE), Rx10, Rx100, Rx1k, Rx10k, Rx10k, Rx1M

- AMPUFIER/METER MOVEMENT CIRCUIT: 6.8V, FROM EITHER BATTERY 'E1' (CONVENTIONAL 9V BATTERY) OR FROM THE AC POWER LINE (105~125VAC OR 210~250VAC, 50~60Hz) VIA THE BUILT-IN POWER SUPPLY
- OHMS EXCITATION: 1.5V, FROM BATTERY 'E2' (CONVENTIONAL "C" CELL)

## SEMICONDUCTORS:

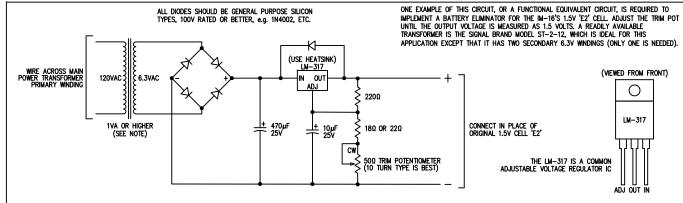
- 1x 204304 FET TRANSISTOR
  6x 2N3393 GENERAL PURPOSE NPN SILICON BJT TRANSISTORS
  4x GENERAL PURPOSE SILICON DIODE 1A, 100PIV OR HIGHER (1N2071 OR 2N4000 SERIES, e.g. 2N4005)
- 1x 6.8V ZENER DIODE (PS18775 OR 1N4736)

- CIRCUIT GROUND ISOLATED FROM METER CHASSIS AND EARTH GROUND (VIA THE AC POWER CORD)
   TEST PROBE IS EITHER A TYPICAL 'VTWM' TEST LEAD SET, OR THE ORIGINAL COMBINATION TEST PROBE WITH DC/AC-OHMS SWITCH, OR MODERN REPLACEMENTS USING SEPARATE TEST PROBES FOR 'DC VOLTAGE ONLY' AND 'ACCOHMS' (FOR AC VOLTS, ALL CURRENT, AND OHMS); THE 'DC ONLY PROBE MUST HAVE AN INTEGRAL PRECISION 1M RESISTOR CONNECTED BETWEEN THE END OF THE (+) TEST LEAD AND THE PROBE TIP

REVISION A 3-30-2023

- MAIN ATTENUATOR AND AC ATTENUATOR VOLTAGE DIVIDERS ARE COMPRISED OF 1% TOLERANCE PRECISION
- MREWOUND RESISTORS
  METER MOVEMENT IS 6", 100µ FULL SCALE, 1275Ω RESISTANCE, 100 DEGREE MOVEMENT
- DIMENSIONS: 16-3/8" WIDE, 7-3/4" HIGH, 5-7/8" DEEP NET WEIGHT: 7-1/2 POUNDS WITH BATTERIES INSTALLED

## SUGGESTED 'OHMS FUNCTION' BATTERY ELIMINATOR SCHEMATIC



# PROBES & TEST LEADS

THE IM-16 IS DESIGNED TO USE THE SAME KIND OF COMBINATION PROBE/TEST LEAD SET ALSO USED BY OTHER HEATHKIT ANALOG METERS. INCLUDING THE IM-25 SOLID-STATE VOM AND MOST OF THE VACUUM TUBE VOLTMETER-MILLIAMMETERS (VTVM) PRODUCTS, INCLUDING THE V-7, IM-11, IM-13, IM-18, IM-28, IM-5218, IM-5218. THIS TYPE OF PROBE/TEST LEAD SET HAS A SINGLE 1/4" PHONE PLUG WITH A SHIELDED CABLE COMING FROM IT AND GOING TO A SINGLE PROBE; THE PROBE HAS AN INTEGRAL SWITCH TO SELECT BETWEEN 'DC VOLTS' AND 'AC VOLTS/OHMS'. MOST OF THE ABOVE MODELS CAN ONLY MEASURE DC & AC VOLTS AND OHMS: THE EXCEPTION IS THE IM-25. WHICH CAN ALSO MEASURE DC & AC CURRENT, IN WHICH CASE THE PROBE'S SWITCH MUST BE SET TO THE "AC/OHMS" POSITION FOR BOTH TYPES OF CURRENT. IN OTHER WORDS, "DC VOLTS" IS THE ONLY TYPE OF MEASUREMENT WHERE THE "DC" SWITCH POSITION CAN BE USED.

since the original heathkit combination probe is rare these days, and examples in working order are very rare, these meters (including the im-16) can use most modern "vtvm" probe & test lead sets. These typically have a single 1/4" phone plug, use three regular test leads instead of a single shielded cable, and have two probes, one for 'dc' and the other FOR 'AC/OHMS' (ALSO OK FOR DC & AC CURRENT).

THE KEY TO WHICH PROBE TO USE INVOLVES KNOWLEDGE OF THE FACT THAT THE 'DC' PROBE MUST INCORPORATE A PRECISION (5% TOLERANCE OR BETTER, 1% PREFERABLE) 1M OHM RESISTOR, 1/4W OR LARGER, WHICH MUST BE CONNECTED BETWEEN THE PROBE END OF THE TEST LEAD AND THE THE POOF THE MEASUREMENTS. IN THE MEANS THAT THE RESISTOR WILL BE CONNECTED BETWEEN THE PROBE END OF THE ORIGINAL HEATHKIT COMBINATION PROBE, THE RESISTOR IS ALWAYS IN SERIES WITH THE SHIELDED CABLE'S CENTER CONDUCTOR AND THE PROBE TIP, AND THE INTEGRAL SWITCH SIMPLY SHORTS OUT THE RESISTOR WHEN IN THE 'AC/OHMS' POSITION. THE METER CIRCUITRY IS DESIGNED TO REQUIRE THIS RESISTOR BE IN-CIRCUIT FOR AC VOLTS MEASUREMENTS, AND OUT-OF-CIRCUIT FOR ALL OTHER TYPES OF MEASUREMENTS.

HEATHKIT IM-16 SOLID STATE VOM SCHEMATIC DIAGRAM SHFFT 2 OF 2

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