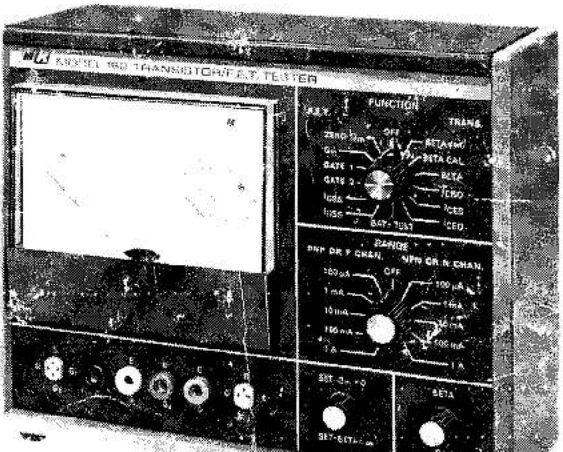
# INSTRUCTION MANUAL

## B&K MODEL 162

# TRANSISTOR/ F.E.T. TESTER



B&K

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# INSTRUCTION MANUAL

FOR

# Model 162

# TRANSISTOR/ F.E.T. TESTER

*B & K DIVISION OF DYNASCAN CORPORATION*
1801 West Belle Plaine Avenue
Chicago, Illinois 60613

# INTRODUCTION

The B&K Model 162 TRANSISTOR/FET TESTER has been designed to quickly test conventional (bipolar) transistors and the newer field effect transistors (FETs) IN-CIRCUIT and OUT-OF-CIRCUIT using the same simple testing procedure. The DYNASCAN Dynaflex FP3 probe can be used with the Model 162 to provide the fastest in-circuit test available. The 162 also tests diodes, SCRs, UJTs and Triacs. It is the fastest and simplest means available today for detecting faulty solid state elements in electronic products of all types.

The Model 162 TRANSISTOR/FET TESTER is battery operated. The unit has no internal high voltage. All in-circuit tests are made with the equipment under test turned off. For added safety, it is recommended that on AC-powered equipment, the AC line plug be removed from the power outlet prior to connecting Tester.

# MODEL 162 SPECIFICATIONS

Tests conventional (bipolar) and field effect transistors.

Tests in-circuit and out-of-circuit with same technique.

Tests diodes, unijunctions, SCRs and Triacs.

Collector current: 100 microamperes to 1 ampere in steps of 10.

Collector voltage: 1.5 volts DC.

Beta: 1 to 50, 10 to 500, 100 to 5000.

Leakage: 5 ranges: 0-100 $\mu$A, 0-1 mA, 0-10 mA, 0-100 mA, 0-1 Amp.

Measures: $I_{CBO}$, $I_{CES}$, $I_{CEO}$, $I_{GSS}$, $I_{DSS}$, Beta, $G_m$ ($G_m$: 0 to 50,000 $\mu$ mhos).

Color-coded jacks and test leads.

Integral bipolar and FET transistor sockets.

Weight: 6 lbs. 4 oz. with batteries.

Rugged steel case: 9″ wide, 7¼″ high, 4″ deep.

High sensitivity, 4¾ inch meter.

Batteries included (Type D; 1.5 Volts—Alkaline recommended).

# SOLID STATE DEVICE TESTING SIMPLIFIED

A significant need exists for a low cost, simple-to-use transistor tester suitable for rapidly diagnosing problems in solid state electronic products.

It is impossible to build a simplified tester that completely tests any device. Even if it were possible, the tester would not be useful to the typical user. It would require too much time to set up and test each device for all its paramcters. Fortunately, certain key tests will rapidly tell whether a device is good or bad. The tests cannot be absolutely foolproof and in rare cases the tester might reject a good device.

Another requirement for a "quick results" tester for servicing solid state circuits is the tester should be independent of Transistor Manuals. This is important since in addition to over 15,000 registered transistors there are at least that many unregistered for which there is no data. These are in-house device numbers for which the manufacturer and the supplier know the specifications, but no one else does. The B&K transistor tester has been designed to solve all the above-mentioned practical problems. When a semiconductor fails, the failure is detectable without knowing the original specifications of the device. We rely upon the set's designer to have selected the right transistor type; one with proper Beta, high frequency gain, power dissipation, voltage breakdowns, collector capacitance and other critical parameters. To test the device, we need only to test the device for gain and to make sure all its important leakage measurements are within acceptable limits for a given application. The only information needed is where to find the device connections on the board, what type of circuit function it performs, and what kind of device it is. A schematic and parts location diagram carry all the information required to test every kind of semiconductor device in the circuit.

# DETERMINING COMMON FAILURES

To find the most likely devices which may have failed in a faulty circuit, there are two basic rules to follow:

Rule (1) Check the large power devices first.

This rule is derived from the physical properties of heat dissipation. When a tiny solid state device is used to control a lot of power, it generates internal heat. To get rid of the heat the device has to be placed in a large package which, for economy reasons, the designer does not over design. Thus, a big device is normally operated at its full capability and runs hot. Any failure, if it is going to occur, is accelerated by this excess heat. The devices handling the most power and thus getting hot should be checked first.

Rule (2) Check the input and output devices next.

If a device is used as an input or output device connected to antenna, 115V A.C., speaker, etc., it is subject to the abuse of lightning, shorted speakers, line transients, misguided "screwdriver mechanics" etc. The more the device is isolated from the inputs and outputs by intervening circuit stages, such as a device in the middle of the schematic, the less likely it is to fail.

These two rules cover most of the failures encountered. They are ranked in order of most likely failures. First, suspect the power devices as failures as these will be most common. The next most common failures are input devices or those devices which drive the output power devices. The least likely to fail are the "innermost" devices that are removed by at least one stage at the input and are two stages away from an output.

To classify any semiconductor you need to know only two parameters—the voltage at which it operates and the amount of current that it passes. The voltage is easily obtained from the schematic. The current, however, must be judged by the physical size of the device and the application. If the device is used as an output stage, then it either falls into the intermediate power class or the power class.

The intermediate power class includes such things as output stages of portable radios and the video output stage of a TV set. The power class is always enclosed in a large device package and, typically, is used as an audio output, TV vertical output or TV horizontal output. Devices in the intermediate power class are generally used to drive the devices in the

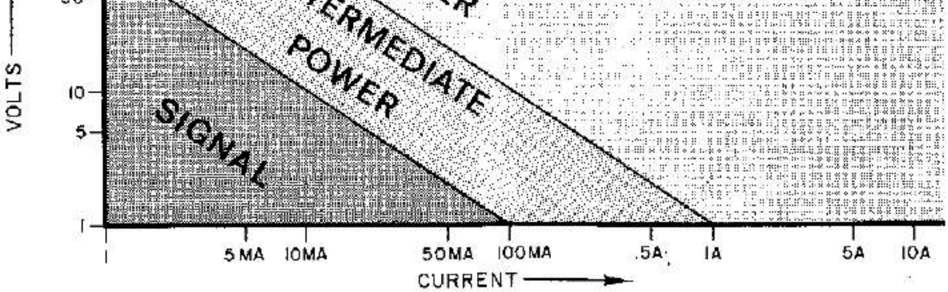


Figure 1. Power Category of Device

power class. Figure 1 is a breakdown of the three classifications of semiconductors. This figure is applicable for all types of semiconductor devices, whether they are transistors or not.

The main problem lies in deciding how to test the intermediate power devices. They should always be tested as signal devices. If operated at low voltages, they may be tested as power devices. If they operate at high voltages (video output stages), test them as signal devices.

The next step in classification is determining what kind of device it is. If it is a transistor, either conventional (bipolar) or field effect, then it is tested by following the basic step-by-step instructions in the programmed section of this manual. If it is a diode, UJT, SCR, Triac or other device, refer to pages 13 to 15 to test it.

Note: a 1 Amp rectifier for 110 V A.C. falls into the power class, whereas, a 1 mA 25V diode detector falls into the signal class. An SCR falls into the power class and the UJT driving it falls into the intermediate power class. A UJT is capable of supplying 50 mA at a few volts.

Once the device has been identified as to type, physical location in the set, and power or signal category, we are able to test it. The last step involves, "How do we interpret the tests in terms of good device or bad device?"

This is generally phrased in terms of what Beta is "good" and what leakage is "good." The key to the B&K Model 162 tester is that NEITHER QUESTION IS VALID! The first question as to what Beta is "good" can only be answered IF WE KNEW ITS EXACT BETA AT THE TIME IT WAS MANUFACTURED. The same holds true for the question, what leakage is "good". A failure of a device is characterized by a CHANGE IN ITS PARAMETERS FROM THE DATE IT WAS MANUFACTURED! The device could have failed and still be within the device specifications for Beta. No device manual can tell you what the Beta was of a particular device at the time of its construction. Even the manufacturer can't!

The question that arises is what do Beta and leakage tests tell us?

Beta tells us that there are no open connections inside the device. If the device has Beta greater than one, then there are no open leads. The most significant test of course is Beta, but this only tells us that it is a "transistor", not whether it is good or bad. In order to tell whether the transistor is good or bad, three leakage tests should be performed. Three leakage tests are a unique feature of the B&K 162 Transistor/FET Tester, and are not found on any other manufacturers' testers. All three tests are necessary since there is a common class of failures (avalanche breakdown between collector and emitter) which can be missed on other testers. This type of failure is found in high voltage circuits and is equivalent to a short, or partial short between collector and emitter which still results in "good Beta" and leaves the collector-to-base junction and base-to-emitter junction "intact."

The key to the leakage tests is that all three leakages are different in a good device. If any of the two leakages are approximately equal, the device is defective. Any significant leakage for a silicon device indicates a defective device. Figure 2 is a table of typical leakages for good germanium and good silicon devices.

| TYPE OF LEAKAGE | GERMANIUM Signal | Power | SILICON Signal | Power |
|---|---|---|---|---|
| ICBO | 1μA | 10μA | .001μA | .01μA |
| ICES | 5μA | 50μA | .005μA | .05μA |
| ICEO | 50μA | 300μA | .01μA | .5μA |

Figure 2.

The table shows the reason for the popularity of silicon devices.

Suppose you have a device which passes the leakage tests and shows high ICBO, and you don't know whether it is germanium or silicon. (If it is silicon it is defective but if it is germanium, it is good.)

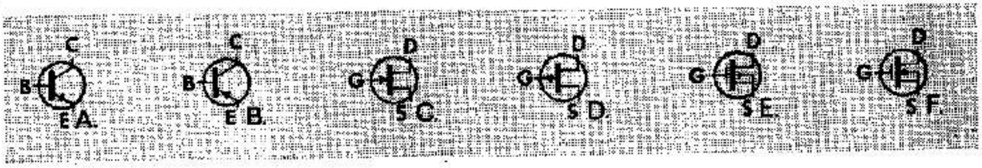
To determine whether the device is germanium or silicon, set the tester into the Beta Cal position and adjust to Cal Beta point. Measure the voltage between base and emitter with a VOM or VTVM. If it is less than .4 volts, the device is germanium; if it is greater than .5 volts, it is silicon.

## CLASSIFYING GENERAL SEMICONDUCTOR DEVICE TYPE

Inspect schematic diagram and locate specific device to determine the device type, go to page indicated below, and perform prescribed steps:

Page 9 TRANSISTOR TESTING
Pages 11 & 12 FET TESTING
Page 13 DIODE TESTING
Page 14 UJT TESTING
Page 14 SCR TESTING
Page 15 TRIAC TESTING

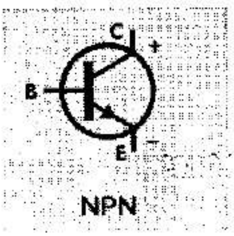
If in doubt, inspect the device symbol on the schematic. Transistors are shown in Figures A & B. FETs are shown in Figures C, D, E and F.



## DETERMINING BASIC TRANSISTOR TYPE

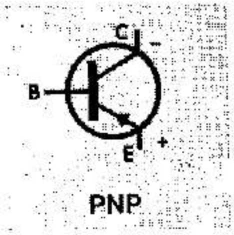
Determine whether TRANSISTOR is NPN or PNP.

If in doubt, look up device symbol on schematic. NPN transistors are shown in Figure 4 and will have a positive collector-to-emitter voltage. PNP transistors are shown in Figure 5 and will have a negative collector-to-emitter voltage.



**NPN**

**Figure .4.**

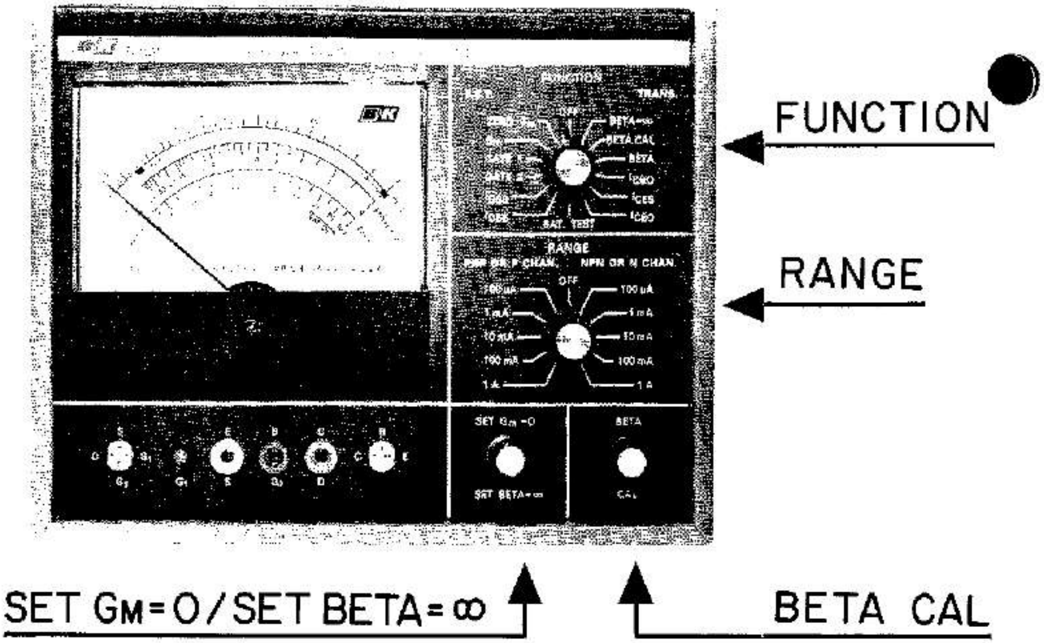


**PNP**

**Figure 5.**

Inspect the schematic and note what the device is used for to determine whether the transistor is a power or signal device.

Power devices are larger and may have heat sinks. If in doubt, test as a signal device to avoid possible damage. Power devices are normally used in speaker, vertical and horizontal sweep outputs, controlling power to set, etc. At times, for high power requirements, a smaller power device is used to drive a high power one.



## CONTROLS ON TESTER

FUNCTION—this multiposition switch selects the type of semiconductor and the tests to be performed. Transistors are tested to the right and FETs are tested to the left.

RANGE this switch selects the current range for leakage tests. It is also used in transistor Beta test to set collector current for power or signal transistors.

BETA CAL—this is a dual potentiometer. It is used in transistor testing to calibrate the Beta scale. It is not used in FET testing.

SET Gm = O/SET BETA = ∞ – this is a two function, dual potentiometer. For transistors, it calibrates the BETA = ∞, much like an ohmmeter. For FETs it calibrates the Gm = 0 point.

## TESTING CONVENTIONAL (BIPOLAR) TRANSISTORS

### Setting Test Current Into Device

Set FUNCTION Switch to "OFF" position.

Set RANGE Switch according to the following table:

| TRANSISTOR TYPE | IN CIRCUIT | OUT OF CIRCUIT |
|---|---|---|
| Signal NPN – | 100 mA NPN | 10 mA NPN |
| Signal PNP – | 100 mA PNP | 10 mA PNP |
| Power NPN – | 1 A NPN | 100 mA NPN |
| Power PNP – | 1 A PNP | 100 mA PNP |

NOTE: The FUNCTION Switch positions of the 162 are arranged in the same order as the 162 is used. Each successive step is outlined below.

## BATTERY TEST

Rotate FUNCTION switch to BAT. TEST position.

Rotate RANGE switch to "NPN 100 mA" position and short collector test lead to emitter test lead. Meter needle should deflect to BAT. OK area on meter scale.

Repeat test in "PNP 100mA" position of RANGE switch.

(This checks the two main battery cells within the 162. The FET bias battery lasts for its shelf life. However, for convenience, replace it whenever replacing main batteries). If batteries must be replaced, refer to instructions at end of manual.

### Calibrating Tester for BETA = ∞

Connect test leads to transistor or insert it in proper socket. Set FUNCTION Switch to BETA = ∞ against panel and adjust knob so that meter needle aligns at the left hand end of scale on "∞" mark. This BETA = ∞ control balances out in-circuit impedance. If needle can be set to "∞" mark, go to Page 10.

If you can't set meter needle to "∞" mark, pull out same knob and readjust needle to "∞" mark. Failure to adjust indicates either a bad transistor or, in some cases, too low an in-circuit impedance. Remove transistor from circuit board, insert transistor properly into socket on 162 front panel (or connect to color-coded leads as marked) and repeat above step with device out-of-circuit.

### Setting BETA CAL

This step sets the multiplier factor for the Beta reading on the black scale marked BETA.

Set FUNCTION Switch to BETA CAL position. Push knob marked "BETA CAL" in against tester panel and adjust until meter needle aligns with center of red "CAL. X1" rectangle on BETA scale for in-circuit tests or with center of red "CAL. X10" rectangle for out-of-circuit tests.

If you can't align needle, pull out BETA CAL knob and adjust until needle aligns with center of proper red rectangle. Inability to set meter needle to center of proper red rectangle indicates either a bad transistor or too low an in-circuit impedance. Remove transistor from circuit. Insert it in proper socket (or connect colored test leads properly) and repeat above step (setting BETA CAL) with the device out-of-circuit.

### Determining Beta

Rotate FUNCTION knob to BETA position. Read Beta directly on top scale marked BETA if you calibrated to the CAL X1 mark in the previous step. (If you calibrated meter to the CAL X10 mark, multiply the Beta indication by the factor 10 to get actual Beta of device.)

To improve Beta reading when Beta is very high, set RANGE Switch pointer to the next lower current range without readjusting BETA CAL control. Multiply Beta reading by an additional factor of 10. For example, if original BETA scale multiplier obtained in BETA CAL adjustment was X10, it will now be X100. If original BETA scale multiplier was XI, it will now be X10.

If Beta reads low with device in-circuit (less than 10), device may be defective. Remove from circuit and retest. If Beta reads greater than 10 in-circuit, device is probably O.K.

## OUT-OF-CIRCUIT LEAKAGE TESTING

Since all leakage tests are high impedance in nature, the tests must be made out-of-circuit to prevent associated circuit elements from excessively shunting measurements. Set FUNCTION Switch to ICBO. Adjust RANGE Switch, as required, and read leakage current (ICBO) on red scale.

For small signal devices, ICBO will be less than 1 μA. For high power devices, particularly germanium, ICBO leakages of 5 μA are not uncommon.

Device is bad if ICBO leakage of greater than 20 μA occurs in a power device or greater than 2 μA occurs in a signal device.

Set FUNCTION Switch to ICES. Check ICES leakage current reading. If meter is off-scale, adjust RANGE Switch until needle is not pinned. ICES should be greater than the ICBO reading obtained by previous step above. If readings are equal, device is bad. NOTE: An extremely small or zero reading for both ICBO and ICES does not indicate a bad device, particularly in low power or signal silicon devices.

## MEASURING DEVICE LEAKAGE CURRENT RELATIONSHIPS

Set FUNCTION Switch to ICEO. If needle is pinned, adjust RANGE Switch and check ICEO leakage reading on red scale. ICEO should be greater than ICES. If readings of ICEO and ICES are equal and greater than zero, the device is bad. If both readings are very small or zero, the device is O.K.

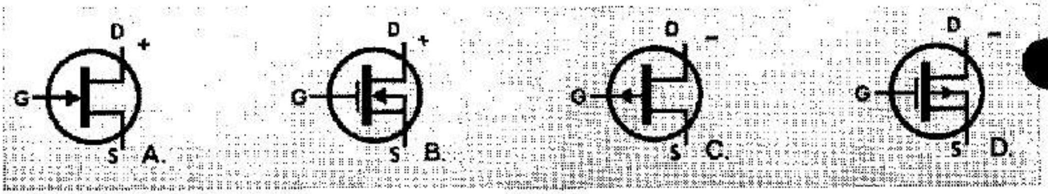
NOTE: ICEO is normally about Beta times ICBO. For germanium power devices an ICEO of 1 or 2 mA may be O.K.

The most important test is that ICEO is greater than ICES and that ICES is greater than ICBO for a good transistor.

## DETERMINING BASIC FET TYPE

Determine whether the FET device is N-channel or P-channel. Set RANGE Switch to 100μA NPN for an N-channel or to 100μA PNP for P-channel. Go to Page 12.

If in doubt, inspect the device symbol on the Schematic. N-channel FETs are shown in figures A & B and will have a positive Drain-to-Source supply. P-channel devices are shown in figures C & D and will have negative Drain-to-Source supply.



Determine if device is dual gate, or not. Connect 2nd gate lead if it is a dual gate device.

If in doubt, check Schematic or device number. Dual gate devices are shown in Figures E & F.

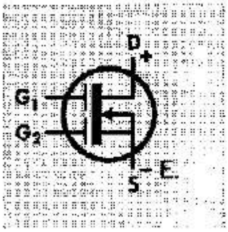


Figure E

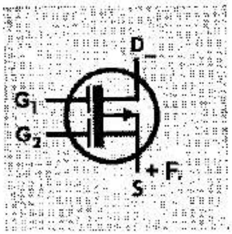


Figure F

## CALIBRATING Gm

Rotate FUNCTION Switch to ZERO Gm. Push and adjust "SET Gm = 0" Knob so meter reads Zero Gm. Go to TESTING Gm step below.

If you can't set:

Failure to adjust Zero indicates defective battery. Replace Battery.

## TESTING Gm

Set FUNCTION Switch to "Gm".

Note Gm reading.

If Gm = 0, device is open and defective.* If Gm = ∞, the device is shorted or incircuit impedance is too low. Remove device from circuit and re-check.

*Special FETs are enhancement devices. These are found in switching circuits, are rarely used in consumer products and cannot be tested on this instrument.

## TESTING GATE CONTROL

Move FUNCTION Switch to "Gate 1" position. Note reading. A decrease in the Gm reading should occur. If a decrease does not occur, then remove device and recheck out-of-circuit. Failure of the Gm reading to decrease for the out-of-circuit test indicates a faulty device since the gate cannot control the device.

If the device is a dual gate, switch the FUNCTION Switch to "Gate 2". A decrease in Gm should occur as just described above. If the device is not dual gate, the meter will read the same as for Gm test.

## FET OUT-OF-CIRCUIT LEAKAGE TEST

Remove FET from circuit (if appropriate). Set FUNCTION Switch to IGSS. Set RANGE Switch to 100μA position. The IGSS leakage current indicated on red scale should be less than 1 μA. Any greater reading indicates a bad device.

Set FUNCTION Switch to IDSS. The reading should be between 100μA and 10mA. No reading indicates defective device . . . unless it is an enhancement mode FET which is normally not found in consumer products.

## TESTING OTHER SEMICONDUCTOR DEVICES

Your B&K Model 162 Transistor/FET Tester is unique in that it can also test other semiconductor devices with a minimum of test actions on the part of the user.

Step-by-step procedures follow for testing:

- Diodes—see page 13
- Unijunction transistors—see page 14
- SCRs—see page 14
- Triacs—see page 15

## TESTING DIODES

1. Set FUNCTION Switch to ICEO.
2. Set RANGE Switch to OFF.
3. Connect the diode's cathode to the collector lead (blue) and the diode's anode to the emitter lead (yellow).

4. Switch the RANGE Switch to 100µA NPN and read the reverse current. This should read a few microamperes or less. If it reads above full scale, check the polarity of your connections.

5. Switch the RANGE Switch to 1 mA PNP for signal diodes and 1A PNP for rectifiers. A good diode will read above 80 on the leakage scale.

6. Zener Diodes and Varactor Diodes should be tested as signal diodes. The test will not check the Zener voltage nor diode capacitance. However, it will check the device as a good diode and in almost all cases this will suffice.

## TESTING UJTs

1. Set FUNCTION Switch to Igss.

2. Set RANGE Switch to OFF.

3. Connect UJT as follows: Emitter to $G_1$ (black),
   Base 1 to S (yellow),
   Base 2 to D (blue).

4. Switch the RANGE Switch to 100µA N-channel for N type devices or to 100µA P-channel for P type devices (Rare). This measures the leakage current Ieb2s which should be less than 1 µA for a good device.

5. Switch the FUNCTION Switch to Idss and the RANGE Switch to 1 mA N-channel for N type devices. (1 mA P-channel for the rare P type devices.) This test will be typically between 150µA to 400µA for Rbb between 10K to 3K.

6. Switch the RANGE Switch to 100mA P-channel for emitter current (100mA N-channel for the rare P type devices). This reading will be typically 15 to 60mA. No reading indicates an open emitter.

## SPECIAL NOTE

Certain SCR's and Triacs require more than 1.5 volts to gate on. It is necessary to modify the test setup slightly by inserting a 1.5 volt flashlight cell in series with the emitter lead. For testing SCR's and Triacs with the range switch in the 1A P-channel position, the negative end of the battery connects to the device; when testing Triacs in the 1A N-channel position, reverse the battery.

## TESTING SCRs THYRISTOR

1. Set the FUNCTION Switch to Iceo.

2. Set RANGE Switch to 1A P-channel.
3. Connect the SCR as follows:

   Gate to Base lead (green),
   Anode to Emitter lead (yellow),
   Cathode to Collector lead (blue).

4. Switch FUNCTION Switch momentarily to ICES and back to ICEO. This triggers the device on. The reading should remain above 50 on the leakage scale.
5. Momentarily disconnect the cathode lead and reconnect it. This returns the device to the blocking state. It should now read below 5 on the leakage scale.

### TESTING TRIACS

1. Set FUNCTION Switch to ICEO; set RANGE Switch to 1A N-channel.
2. Connect the TRIAC:

   Gate to Base lead (green),
   Anode to Emitter lead (yellow),
   Cathode to Collector lead (blue).

3. Switch the FUNCTION Switch to ICES momentarily and back to ICEO. This triggers the device ON. The reading now should remain above 50 on the red leakage scale.
4. Momentarily disconnect the cathode lead and reconnect it. This returns the TRIAC to its blocking state. It should now read below 5 on the red leakage scale.
5. Switch the RANGE Switch to 1A P-channel and note that the device still blocks current as in Step 4.
6. Repeat Steps 3 and 4 for the 1A P-channel setting to check the device's ability to both block and conduct in the opposite direction.

## THEORY OF OPERATION OF MODEL 162 TESTER

The Model 162 TRANSISTOR/FET TESTER is a DC transistor tester. It is capable of testing transistors at collector currents from 1 milliampere to 1 ampere. This provides tests for both small signal and power devices. The circuitry is arranged so that a fixed amount of collector current is always flowing through the device. This is accomplished by adjusting the "base" current injected into the transistor stage so that a known amount of collector current is flowing. The 162 then computes Beta from the base current necessary to attain this known collector current. The meter needle indicates the effective circuit DC Beta with the transistor IN-CIRCUIT and the actual device DC Beta with the transistor OUT-OF-CIRCUIT. The SET Gm/SET BETA control balances out DC resistances IN-CIRCUIT between the collector and emitter and any leakage current that may be flowing. In order to keep the same procedure for OUT-OF-CIRCUIT testing, the 162 incorporates a simulated collector-to-emitter load. Thus, the user always sets this control for each device tested.

The BETA CAL control is a control which adjusts the current fed into the base. The calibration procedure adjusts the base current to provide a fixed collector set point which is the collector current flowing.

The collector current flowing is either 1 milliampere, 10 milliamperes, 100 milliamperes or 1 ampere. Occasionally, limitations in the in-circuit test occur when the DC in-circuit impedances are so low that no base current can be put into the device or sufficient collector voltage cannot be impressed across it. In these cases the device is removed from the circuit for testing Beta. The three leakage tests are performed out-of-circuit. They test for collector-to-base leakage with emitter open ($I_{CBO}$), collector-to-emitter leakage with the base shorted to the emitter ($I_{CES}$), and collector-to-emitter leakage with the base open ($I_{CEO}$).

The three currents in the device are related in a good device so that $I_{CES}$, the collector-to-emitter current with the base shorted, lies in between the $I_{CEO}$, collector-to-emitter current with the base open, and $I_{CBO}$ collector-to-base leakage current. If any of these three currents are equal in pairs the device is defective; for example if $I_{CBO} = I_{CES}$. Such a case happens in avalanche breakdown. Here the collector-to-emitter current with the base open is almost equal to the collector-to-emitter current with the base shorted.

FETs are tested by measuring the Gm of the device. Theoretically, the Gm of a FET can be measured by measuring the channel resistance. The voltage impressed across the channel during this test is always less than 1/10 of a volt. The Gm scale is basically one over $R_{DS}$ (resistance between drain and source).

The ohmmeter measures the Gm of the device; however, it does not check the gate. The gates of a FET are checked by reverse biasing the gates, one at a time, and noting that the Gm decreases. The Gm reading should go down as the gate is reverse biased. Two leakage tests are provided for FET testing. The first of these is the gate leakage.

Any non-zero reading of gate leakage indicates a bad device since $I_{GSS}$ is typically in the nanoampere region. The second test actually measures the channel current $I_{DSS}$ at 1½ volts. This is not a leakage as most FETs display some current in the 2 to 4 ma. region. This $I_{DSS}$ test verifies that the channel is conducting and is useful in matching devices.

E B

## BATTERY REPLACEMENT

To replace batteries:

- Remove four Phillips-head screws from case back
- Carefully lift off top and back
- Unsolder old batteries
- Carefully resolder new batteries according to indicated polarities (use Type D, 1.5 volts, alkaline recommended)
- Replace cover and secure screws gently to avoid stripping threads in case body

NOTE: Switch both RANGE and FUNCTION controls to OFF position when not actively using the Model 162 Tester in order to conserve battery life.

## WARRANTY SERVICE INSTRUCTIONS

1. Make sure batteries are not run down or improperly connected.
2. Check common electronic parts using schematic parts list.
3. Defective parts, removed from units under the warranty period should be returned to the factory, prepaid. The package should include the model, serial number and date of product purchase. These parts will be exchanged at no charge.
4. If the above procedure does not correct the unit, pack the product securely, forward it prepaid (express preferred) to your nearest B & K authorized service agency. A detailed list of troubles encountered should be enclosed.

Contact your local B & K Distributor for the name and location of your nearest service agency, or write to

*Service Department*
B & K DIVISION OF DYNASCAN CORPORATION
1801 West Belle Plaine Avenue
Chicago, Illinois 60613

# B & K MODEL 162 PARTS LIST

## MISCELLANEOUS

| SCHEMATIC SYMBOL | DESCRIPTION | B & K PART No. |
|---|---|---|
| | Bracket, cover-panel | 251-058-9-001 |
| | Retainer, front panel | 261-031-9-001 |
| | Case, sides-bottom | 272-064-9-001 |
| | Meter | 320-020-9-001 |
| | Rubber foot | 381-004-9-001 |
| | Flip card manual | 480-098-9-001 |
| | Schematic | 488-082-9-001 |
| | Carton | 500-158-9-001 |
| | Filler (2 req.) | 503-035-9-001 |
| | Cover assembly | 521-076-9-001 |
| | Battery holder assembly | 521-077-9-001 |
| | Mounting ring for transistor socket | 741-035-9-001 |
| | Transistor socket | 762-002-9-001 |
| | FET socket | 762-003-9-001 |
| | Battery spring clip | 767-026-9-001 |
| | BANANA jack, black | 773-015-9-802 |
| | BANANA jack, yellow | 773-016-9-802 |
| | BANANA jack, green | 773-017-9-802 |
| | BANANA jack, blue | 773-018-9-802 |

NOTE—Standard value resistors and capacitors are not listed.
Values may be obtained from schematic diagram.

Minimum charge $2.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express.

Specify serial number when ordering replacement parts.

# B & K MODEL 162 PARTS LIST

488-062-9-002B

## RESISTORS

| SCHEMATIC SYMBOL | DESCRIPTION | B & K PART No. |
|---|---|---|
| R-11 | 10 ohm ½W 1% Deposited carbon resistor | 002-102-3-100 |
| R-12 | 110 ohm ½W 1% Deposited carbon resistor | 002-102-3-111 |
| R-3 | 9K ohm ½W 1% Deposited carbon resistor | 002-102-3-902 |
| R-8 | 1K ohm ½W 2% Deposited carbon resistor | 002-102-4-102 |
| R-14 | 120 ohm ½W 5% Deposited carbon resistor | 002-102-5-121 |
| R-9 | MANGANIN RESISTANCE WIRE | 004-067-9-001 |
| R-10 | 1 ohm 1W 1% wire wound resistor | 004-090-9-001 |
| R-5 | 366 ohm ½W 1% Carbon film resistor | 004-091-9-001 |
| R-2 | 15K/250 ohm 1/6W Tandem carbon pot with switch-zero set | 008-103-9-001 |
| R-7 | 250K/250 ohm 1/6W Tandem carbon pot with switch-Beta Cal | 008-104-9-001 |
| R-4 | 400 ohm wirewound trim pot | 009-007-9-001 |
| R-13 | 10 ohm wirewound rheostat | 009-024-9-001 |

## SWITCHES

| | | |
|---|---|---|
| SW-2 | Rotary switch 4 deck range | 083-081-9-001 |
| SW-1 | Rotary switch 5 deck function | 083-082-9-001 |

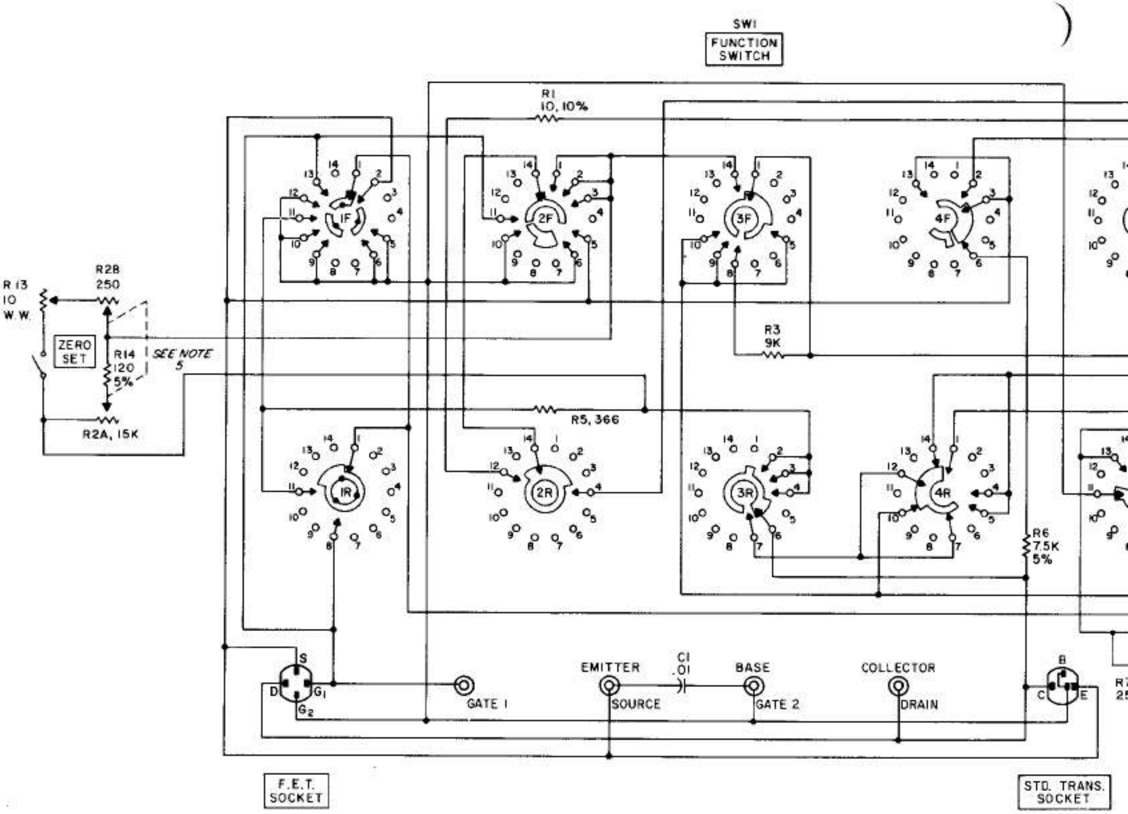
## KNOBS

| | | |
|---|---|---|
| | Knob with pointer | 751-040-9-001 |
| | Knob | 751-059-9-001 |

## TEST LEADS

| | | |
|---|---|---|
| | Assembly, small clip test lead, black | 522-047-9-001 |
| | Assembly, small clip test lead, yellow | 522-047-9-002 |
| | Assembly, small clip test lead, green | 522-047-9-003 |
| | Assembly, small clip test lead, blue | 522-047-9-004 |

**COMPOSITE**
**499-007-9-001B**



SWI FUNCTION SWITCH

POS. 1 — OFF
2 — BETA = ∞
3 — BETA CAL.
4 — BETA
5 — $I_{CBO}$
6 — $I_{CES}$
7 — $I_{CEO}$
(2–7) TRANSISTOR

8 — BATTERY TEST
9 — $I_{DSS}$
10 — $I_{GSS}$
11 — GATE 2
12 — GATE 1
13 — Gm
14 — ZERO Gm
(9–14) F.E.T.

TRANSISTO
MO
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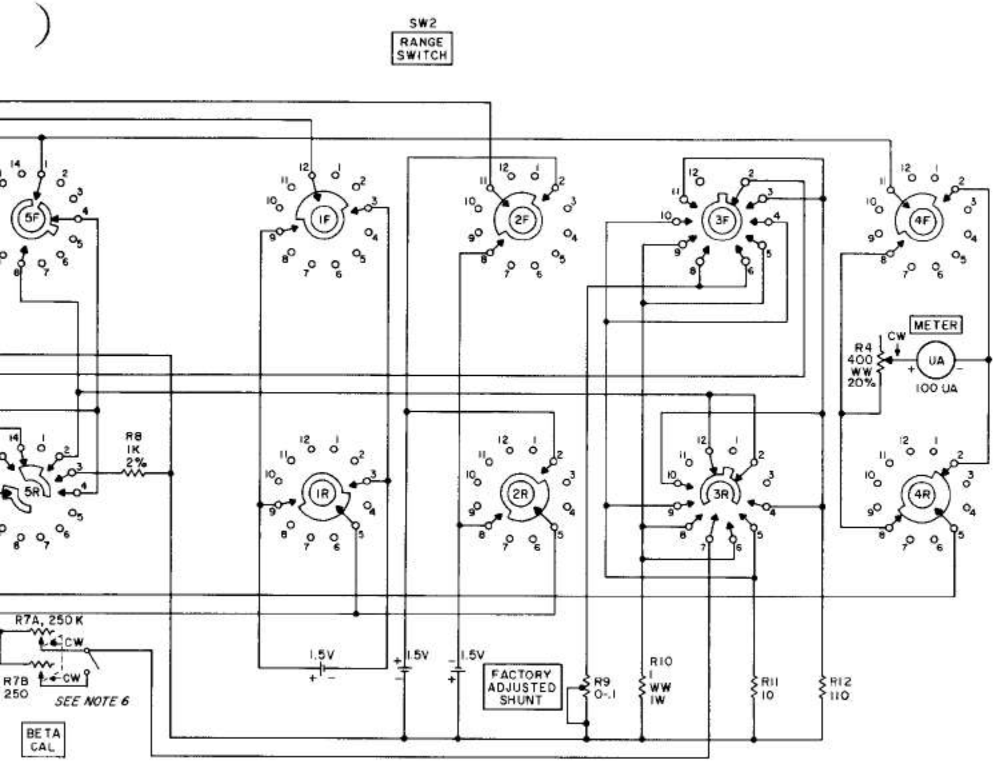

SW2 RANGE SWITCH

POS. 1— OFF
2— 100 UA
3— 1 MA
4— 10 MA
5— 100 MA
6— 1A
} NPN OR N CHANNEL

7— NOT USED
8— 1A
9— 100 MA
10— 10 MA
11— 1 MA
12— 100 UA
} PNP OR P CHANNEL

**TOR/F.E.T. TESTER**
**ODEL 162**
**-082-9-001 B**

NOTES:
1. RESISTORS ARE IN OHMS, 1/2 WATT, 1% UNLESS OTHERWISE SPECIFIED. WW= WIRE WOUND.
2. CAPACITORS ARE IN MICROFARADS, 20% UNLESS OTHERWISE SPECIFIED.
3. SWITCHES ARE SHOWN IN "OFF" POSITION.
4. SWITCHES, SOCKETS AND JACKS ARE VIEWED FROM FRONT.
5. PUSH-PULL SWITCH ON R2 CONTROLS R2B.
6. PUSH-PULL SWITCH ON R7 CONTROLS R7B.