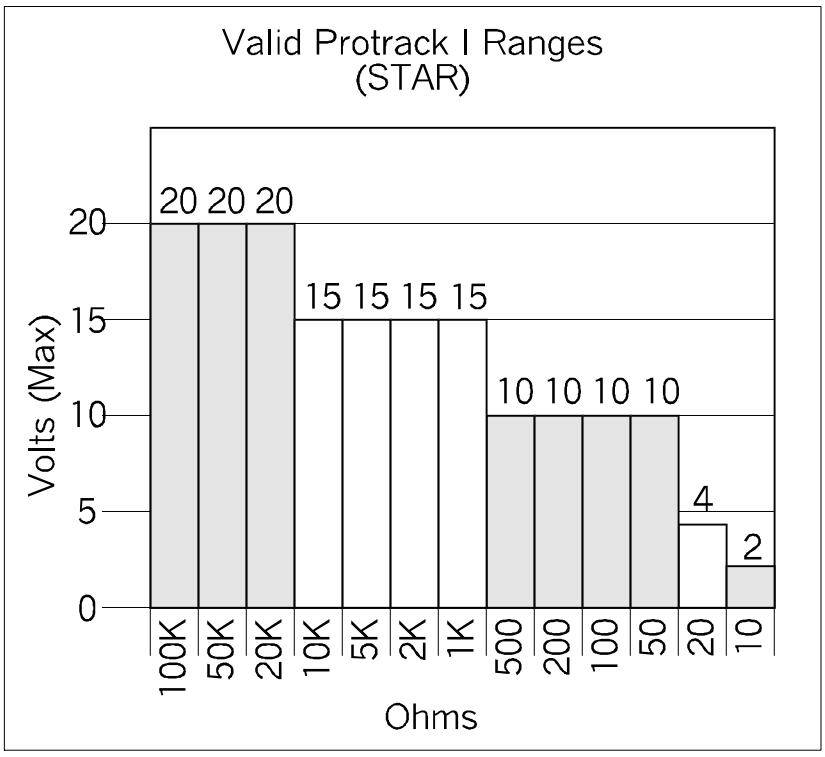
The Affects of Analog Signature Analysis on Electronic Component Characteristics

Using a Huntron Tracker including the Huntron ProTrack will not damage a component under test when proper techniques are applied. Two advanced and exclusive features of the ProTrack's (analog signature analysis (ASA) are the Smart Tracker Active Range (STAR) and the MaxV (Maximum Voltage) feature. Both these features prevent components from being inadvertently exposed to possibly excessive test current levels (for example, 20 Volts and 10 ohms). The STAR settings were derived from previous Tracker range limitations that have proved to be dependable over the last two decades. The ProTrack's MaxV feature is an additional built-in test safeguard where the user can define the ProTrack's maximum output voltage. The ProTrack's STAR feature is always enabled and cannot be disabled. The STAR feature is designed to limit the maximum power of any test range available at the ProTrack's output terminals. This feature ensures that the test range parameters cannot be set to any combination that might overpower the component under test.



Safe Tracker Active Range (STAR) Selection Chart

There are guidelines that should be observed when testing certain types of transistors.
It is possible for a Tracker to alter the current gain (hFE or ß) of a bipolar transistor whenever the emitter is tested. Either the base-emitter or collector-emitter test circuits satisfy this criterion. While heating of the device due to the current produced by the instrument may cause a temporary change in hFE (most noticeable in a 10V or higher range), a permanent shift in hFE may occur whenever the base-emitter junction is forced into reverse breakdown

(~6-20 Volts). If the voltage is above 6 Volts, then the magnitude of the shift depends on the duration of the test and the resistance selected. Reducing the voltage to 5 Volts or less will avoid this problem. Most bipolar transistor circuit designers take into account a wide variation in hFE as a normal occurrence and design the related circuitry to function properly over the expected range of hFE. The effects mentioned above are for the most part much smaller than the normal device variation so that the use of this instrument will have no effect on the functionality of good devices and can fulfill its intended purpose of a means to locate faulty components. However, some circuits may depend on the hFE of the particular part in use e.g. instrumentation that is calibrated to certain hFE value, or precision differential amplifiers with matched transistors. In such instances, we suggest following these guidelines:
1. Use 5 Volts or less for testing the base-emitter or collector-emitter.
2. If using 6 Volts or greater, then keep the duration of the test as short as possible.
3. Identify the base, emitter and collector pins of the device and then test the collector-base junction to determine whether it is an NPN or PNP. Since the emitter is not tested there will be no effect on hFE regardless of the selected voltage.

Also note that the gate in some power MOSFET transistors is not internally protected and can be damaged by excessive gate-to-source voltage. When in a properly designed circuit, the circuit provides the needed protection. This is mainly an issue if testing parts out of circuit. To minimize the possibility of damage, use only use range settings below 10V when probing power MOSFET transistors.
Huntron Trackers have been in use for over thirty years and been adopted by major corporations and organizations such as the U.S. Navy, Philips Medical, Lockheed Martin, Motorola, U.S. Air Force, U.S. Marines, Tektronix and many more.

Independent Test Results

The following section is from an independent test lab of electronic components. Their report was obtained as unbiased evidence of the Huntron Tracker ability to test CMOS and TTL integrated circuits without altering them in any way.

Huntron Tracker TTL and CMOS Tests

Component Concepts
Everett, WA 98201

OBJECT
To determine the effect of testing signals from a Huntron Tracker in-circuit component tester on performance of CMOS and TTL integrated circuits.

COMPONENTS TESTED
- Motorola MC4011B
- Texas Instruments 74LS11

TEST REPORT
Component Concepts, Inc., an independent test lab for active electronic components, performed testing on the effect of part exposure to the Huntron Tracker. The Huntron Tracker is an in-circuit stand-alone component tester. Two types of components were tested and pertinent data recorded prior to test with the Tracker. The components were then tested and data logged after the Tracker test. Two sets of data, pre- and post-, were then compared for any possible effect that the Tracker might have had on the components. Seventy-five 74LS11s and seventy-five MC4011Bs were tested. All components passed after testing with the Tracker. The data logged parameters were input and operating current, and output voltage. No discernable effects were observed upon analysis of the pre- and post- data logs.

The exact test is as follows:
1. All components before testing were subjected to 48 hours burn-in at 125 degrees Celsius.
2. 74LS11 and MC4011B tested for pass/fail operation at 125 degrees Celsius.
3. 75 of each component tested for propagation delay, pass/fail.
4. Components data logged for specific parameters.
5. Components subjected to test by the Tracker.
6. Propagation delay tested.
7. Post-test data log performed, same parameters recorded.
8. Data logs analyzed to determine any effects of the Huntron Tracker upon components.

TEST DISCUSSION

The testing procedures used can only validate the externally measurable parameters of the component and its function. The internal functioning of the component can be assumed to follow with the externally measurable parameters.

The lots of components received from Huntron were uniform in date code and manufacture. All components were 100% functional after a static burn-in of 48 hours.

The TTL and CMOS components were tested on an HP 5045 IC Tester (Ser. #1712A00222). The data was recorded on a companion HP 9825 Calculator. Huntron provided a Tracker (Ser. #21F01001), which was connected to a sequence unit that, according to Huntron, automatically connected the leads of the component to the tester one lead at a time. The actual functioning of the sequencer and the two test units are the not the responsibility of Component Concepts other than the following of instructions provided by Huntron for proper operation.

After burn-in, the components were tested pass/fail for propagation delay in a bench set-up using a pulse generator and 100MHz HP oscilloscope. The components were also data logged. They were then tested on the sequencer wit the two testers attached. After being tested with the sequencer, the components were again tested for propagation delay and data logged. At all times, attention was paid to ESD precautions.

TEST RESULTS

At pre-test, after burn-in, all components were functional for DC and AC parameters and seventy-five components were data logged from each type, 74LS11 and MC4011B. A comparison of data after testing showed no significant change in either input current or output voltage under load. The data printed out by the HP 9825 Calculator was reduced to a more readable format which clearly shows the value recorded before and after testing and the differences between the two values.

The majority of the differences between values are within the accuracy limits of the HP 5045 Tester. Points where there are differences greater than that value are not significant in number to produce any possible negative conclusions on tester interaction with the tested components. Based on the collected data, the Huntron Tracker had no discernable impact on the components it tested.

SPECIFIC TESTING SEQUENCE

(1) Burn-in (100%) 180 pieces at 125 degrees Celsius = 48 hours
(2) Electrical (100%) to obtain 150 units to be labeled as follows:
- Label 25 units as HH1, HH2, HH3…..HH25
- Label 25 units as HM1, HM2, HM3…..HM25
- Label 25 units as HL1, HL2, HL3…..HL25
- Label 25 units as VH1, VH2, VH3…..VH25
- Label 25 units as VM1, VM2, VM3…..VM25
- Label 25 units as VL1, VL2, VL3…..VL25

(3) Electrical (100%) in the following sequence:
   (a) HH1,HH2…..HH25
   (b) HM1, HM2…..HM25
   (c) HL1, HL2…..HL25
   (d) VH1, VH2…..VH25
   (e) VM1, VM2…..VM25
   (f) VL1, VL2…..VL25

For DC parametrics and function per the manufacturers specifications, T_A=25 degrees Celsius. They are to be tested on a HP5054 digital IC tester. All parameters are logged. Propagation delay tested per specification for pass/fail only.

(4) Connect Huntron Tracker to sequencer (sequencer is a piece of equipment supplied by Huntron, Inc. which applies testing signals from the Tracker and tester to the device under test) to each piece of equipment and turn power ON.

(5)
   (a) Set Tracker range to HIGH.
   (b) Set Tester range to HIGH.
   (c) Insert HH1 in zero insertion force socket marked Huntron Tracker located on top of the sequencer.
   (d) Activate start button on sequencer. The red LED will come on when sequencing is completed (it takes 90 seconds).
   (e) Remove devices under test.
   (f) Repeat steps (c), (d), (e), (f) for HH2, HH3…..HH25 and VH2, VH3…..VH25

(6) Set Tracker and tester range to MEDIUM and repeat steps (c), (d), (e) and (f) described in (5) for HM1, HM2…..HM25 and VM1, VM2…..VM25.

(7) Set Tracker and tester range to LOW and repeat steps (c), (d), (e) and (f) described in (5) for HL1, HL2…..HL25 and VL1, VL2…..VL25.

(8) Electric test (100%) in the following sequence:

- HH1, HH2…..HH25
- HM1, HM2…..HM25
- HL1, HL2…..HL25
- VH1, VH2…..VH25
- VM1, VM2…..VM25
- VL1, VL2…..VL25

For DC parametrics and function, T_A = 25 degrees Celsius. Propagation delay tested per specification for pass/fail only. All parameters logged on HP5054 digital tester.