



**Model TR-5 Fixture Kit  
INSTRUCTION MANUAL**

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Specifications and operational characteristics of the System are subject to change.  
Checksum, LLC cannot take responsibility for any direct or consequential damages arising  
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# Limited Warranty

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CheckSum, LLC warrants its fixturing products to be free from defects in material and workmanship under normal use and service for the period of 90 days from date of original product shipment from CheckSum. This warranty extends only to the original purchaser and excludes products or parts that have been subject to misuse, neglect, accident, or abnormal conditions of operations.

CheckSum, LLC reserves the right to replace the product in lieu of repair. If the failure has been caused, as determined by CheckSum, by misuse, neglect, accident, or abnormal conditions of operation, repairs will be invoiced at a nominal cost. In such case, an estimate will be submitted before the work is started, if requested.

**THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. CHECKSUM, LLC SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.**

In the event of a failure of a product during the warranty period:

1. Contact CheckSum for a returned material authorization number (RMA).
2. Pack the product in its original packing material or suitable equivalent and return it postage-paid to CheckSum, LLC. Mark the package clearly with the RMA number.
3. CheckSum will repair the product and return it postage-paid. Repairs are typically completed within two working days of receipt.

In the event that expedited repair is necessary, call CheckSum for information. In many cases a replacement module can be provided immediately.



# Introduction

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## System Overview

The CheckSum Model TR-5 Fixture Kit provides a means to connect your unit-under-test (UUT), such as a printed circuit assembly, via a bed-of-nails to a CheckSum Test System. The Model TR-5 can test UUTs of up to about 150 test points (back panel connectors cutouts are provided for at least 200 test points) and 14" by 14" UUT size can be accommodated. The TR-5-1612-C can accommodate up to 500 probes, and UUT size up to 13.5" x 8.5". For larger UUTs, or those requiring more probes, it is necessary to use vacuum or pneumatic-type bed-of-nails fixture systems such as the CheckSum Model TR-3 or TR-7.

The CheckSum Model TR-5 Fixture Kit can be used with various CheckSum Test System electronics including the Model TR-2, TR-4 or TR-8 Manufacturing Defects Analyzer Systems, the Model CL-77 Scanning Ohmmeter Test System, the Model R-90 Continuity Test System, and the Model G-50 Cable Test System.

As shown in Figure 1, 50-pin ribbon cables carry the stimulus and measurement signals from the test electronics in the System controller (PC) to 50-pin cable connectors on the back of the Model TR-5 Fixture. Internal to the Fixture, custom wire-wrapped wiring carries the test signals from the back panel connectors to the bottom of the spring probe receptacles.

The UUT is pressed down onto the spring probes with pressure rods installed on a hinged top cover. As the top cover is latched into position, the UUT stays in alignment with the spring probes via guide pins that fit into tooling holes on the UUT. The Model TR-5-1612-C actuates the probes when the lever on the lid is actuated by the operator. The Model TR-5 Fixture does not require any external inputs such as electricity or vacuum. It is completely mechanical in operation.

When purchased with a CheckSum Test System, a grounding cable and probe are included with the Model TR-5 Fixture. These are used for probing test points on either the UUT or Fixture. This assists you in naming pins or locating particular points.

The Model TR-5 Fixture Kit needs to be customized for the particular UUT, or family of UUTs, that it will be used with. This process involves drilling the Fixture kit, installing guide pins to align the UUT, installing spring probes/receptacles, doing internal wiring, and installing pressure rods. This customization process is described in this instruction manual.

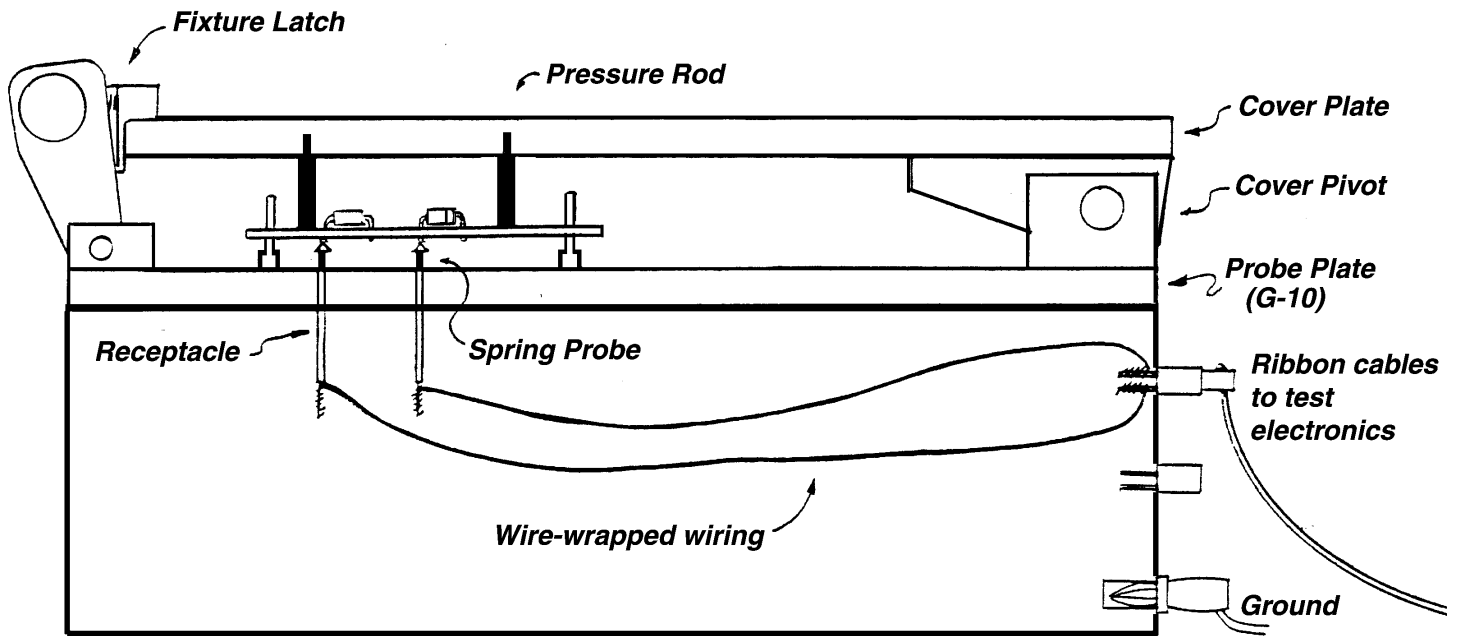


Figure 1 - Fixture Block Diagram

# Specifications

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## Checksum Model TR-5 Fixture Kit

### Includes:

- Fixture Kit
- 10 Pressure Rods
- 2 50-pin Wire-Wrap Connectors
- Test Probe (when purchased with System)
- Grounding Cable (when purchased with System)
- Instruction Manual

### Features:

- Standard banana plug for ground and/or probe
- Can accommodate up to about 150 test points (500 for TR-5-1612-C). Has back panel wiring provisions for 200 or more test points.

### Dimensions:

	<b>TR-5-812</b>	<b>TR-5-1216</b>	<b>TR-5-1620</b>
Weight:	~12 lbs	~19 lbs	~32 lbs
Cabinet/Cover Size:	8" x 12" x 7"	12" x 16" x 7"	16" x 20" x 7"
Usable UUT Size:	6"x6"	10" x 10"	14" x 14"
Inside Depth:	4" (inside cabinet)		
UUT height:	1.65" (1.55" TR-5-1612-C) probe plate to cover plate when engaged		
Probe Plate:	3/8" FR-4 (G-10)		
Top Cover:	1/2" Acrylic		
Limited Warranty:	90 days parts/labor		

## Available Accessories

- Model FIX-PROBE-24  
Crown-style spring probes that can be used for most probe applications.
- Model FIX-PROBE-03  
Pyramid-style spring probe that can be used for most through-hole or via probing applications.
- Model FIX-PROBE-29  
Waffle-style spring probes that can be used for many probing applications.
- Model FIX-RECEP-WW  
Receptacle for the spring probes. The bottom of the receptacle accommodates wire-wrapping via a .025" square post. A spring probe (such as the Model FIX-PROBE-24) is inserted into the top of the receptacle.
- Model FIX-TOOL-150  
A tool to use for installing the receptacles. This tool allows you to tap receptacles into the fixture probe plate without damage to the receptacles, setting them to the proper height.
- Model FIX-GPIN-x  
Guide pins used to position the UUT on the Fixture. These are positioned to utilize tooling holes in the UUT for ensuring accurate alignment with respect to the spring probes. The Model FIX-GPIN-x is available in several diameters and is made of stainless steel. If necessary, the guide pins can be reduced in diameter by a lathe to the proper size for your UUT. CheckSum also has other common diameters available from stock. Please contact CheckSum for availability.

<b>Part Number</b>	<b>Diameter</b>
FIX-GPIN-122	.122"
FIX-GPIN-137	.137"
FIX-GPIN-156	.156"
FIX-GPIN-183	.183"

- Model M-ROD  
Press-down rods for applying pressure to the the top of the UUT in TR-5 fixture kits. Approximately one pressure rod is typically used for each 15 probes. Standard CheckSum pressure rods install into .124" holes in the

clear top plate. The rod length is 1.25". These are also available in tapered form by specifying a -T at the end of the part number (M-ROD-T).

- Model MA-ROD

Press-down rods for applying pressure to the the top of the UUT in TR-5-1612-C fixture kit. Approximately one pressure rod is typically used for each 15 probes. Standard CheckSum pressure rods install into .124" holes in the clear top plate. The rod length is 1.15". These are also available in tapered form by specifying a -T at the end of the part number (MA-ROD-T).



# Customizing the Fixture Kit

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Before using the Model TR-5 Fixture, it is necessary to customize it for the particular UUT, or family of UUTs, that you will be testing.

This process can be performed by fixturing contractors that specialize in this type of work.

Alternatively, if you have equipment to do accurate drilling and wire-wrapping, customization can be done in-house. As an option, CheckSum can provide the necessary probes and special tools for building mechanical fixtures.

The steps involved in this process are covered in this chapter.

## Positioning the UUT in the Fixture

There are several considerations when determining how to position the UUT in the test fixture:

If you have potentiometers, jumpers, switches or adjustments that are made from the edge of the UUT, you should attempt to orient the UUT so that these are available from the sides rather than the front or back. For most right-handed people, it is easier from the right edge of the Fixture.

As the Fixture cover is closed, there is a slight forward pressure (towards the latch) on the UUT. This is absorbed by the guide pins so that the spring probes should not be effected. However, to minimize this effect, you should position the UUT as far toward the latch as practical. Also, use of a larger fixture than necessary will help minimize this pressure.

## Installing Guide Pins

Guide pins are used to accurately position the UUT with respect to the spring probes. The guide pins go through tooling holes in the UUT. You should attempt to have at least two guide pins, positioned as far apart as possible, for every UUT.

The position of the guide pins is used as a reference for all of the spring probes, so they must be accurately placed. The guide pins should be approximately .003" smaller than the tooling hole in the UUT to allow easy placement of the UUT without binding, but still

accurately positioning the UUT. The position and size of the tooling holes is normally called out in the drill & trim drawing used for PCB fabrication.

There are four standard diameters of guide pins available from CheckSum. These can be reduced in size by a lathe if necessary. Since they are made of hardened stainless steel, use of a carbide cutting tool is recommended when turning them down. Additional sizes are also available directly from CheckSum.

After the entire probe plate is layed out, the holes for the guide pins and probes are drilled. When using CheckSum Model FIX-GPIN-x guide pins, you can use a # 18 drill in the probe plate, then press the guide pin into place. Alternatively, you can use an 11/64" drill, slip the guide pin into place, then fasten it from the bottom with a #2-56 screw (included with guide pin).

## Installing Spring Probes

In typical manufacturing defects analyzers (MDAs), such as the CheckSum Models TR-2/4/8, standard practice is to use one spring probe for each electrical network, even though that network might go to multiple components and pins.

When four-terminal measurement capability is available, such as with the CheckSum Model TR-4 or TR-8, it is a good practice to install an extra pin on ground, each power supply, and any other low impedance components that need to be very accurately measured. This allows for external sense of these points. The MDA Instruction Manual has more details about how to choose test points, or you can call CheckSum to discuss this issue with respect to your specific testing needs.

In general, though, there are no special requirements when wiring the test head for CheckSum test electronics. Since the test points of CheckSum Test Systems are all electrically equivalent, any point can be wired to any other point. The maximum current that can be provided by the test systems is in the low mA region, so large wires (greater than # 22-# 28) are not required. Also, no high frequency signals are present so the use of twisted pairs or coax wiring is not necessary.

### Note

*If you are wiring power to the UUT for power-on tests or other special requirements, you may need to increase the wire sizes beyond typical wire-wrap sizes to accommodate current draws in excess of 100 mA.*

Since the test point electronics are universal in nature, you may randomly wire the test head, then probe the wired fixture to assign pin names prior to programming the UUT.

In most cases, it is easiest to first mark a schematic with sequential numbers showing the test points. This can be used to wire the fixture, then serves as a valuable aid to the

programmers and technicians troubleshooting and repairing UUTs. Using this technique also allows the test program to be entered in parallel with fixture construction.

Once you have electrically chosen the probe points, you can determine where to physically drill them. In most facilities, all of the PCB pin positions are drilled and then probes installed just where necessary. This allows the flexibility to easily add or move probes as necessary to accommodate design changes or to correct for errors when first choosing probe placement.

If you have a drill tape or disk for your boards, but not an NC drill, it may be practical to have a facility with an NC drill (such as a PCB fabrication shop or CheckSum) do the drilling. If not, you can do the drilling yourself, either by drilling through an unloaded PCB or by using 1:1 filmwork of the PCB as a guide.

For standard spring probe receptacles, such as those available from CheckSum, a #50 drill is used. This yields a .068"/.070" hole. The FR-4 (G-10) material, as used in the probe plate, is abrasive and hard on bits. Use of carbide drill bits and high drilling speed helps make the bits last longer.

If you have any components on the bottom of the board, you can use a milling machine to create openings in the probe plate to provide clearance.

Once the probe board is drilled, you can install the spring probe receptacles from the top of the probe plate. To install them, use a small hammer in conjunction with a special tool (e.g., CheckSum Model FIX-TOOL-150) to tap the receptacles into place.

The receptacles should be installed to the depth for proper compression when the UUT is pressed down. Typically, the proper compression length is two-thirds of the total travel for the probes. For example, if you are using a probe with .250" total travel, it should be compressed to about .167" when the UUT is installed. A standard set-height of .150" works in almost all applications with .062"-thick UUTs. This can be accomplished by tapping in the receptacles with the FIX-TOOL and stopping at the correct height, or using the FIX-TOOL-150 that has a fixed set-depth of .150".

Depending on the probes that you are using and the lead-lengths on the UUT, you may need to install some receptacles at different depths than others.

After the receptacles are in place, the spring probes are installed. These can be hand-pressed into the top of the receptacle with light pressure so that no special tool is necessary. Most probing can be accommodated by serrated head style probes.

Standard probes used in mechanical fixtures use about 5.5 oz. of spring force each, although higher force probes can be used if the probe count is relatively low. The limiting factor on the total probe load (number of probes times the probe spring force) is the amount of pressure that the operator needs to exert to close the fixture lid. Also, if probe loading is excessive, it can also cause the fixture cover to flex.

## Internal Wiring

Once the receptacles are installed, the Fixture can be internally wired. This is performed by wire-wrapping from the bottom of the spring probe receptacles to the back panel connectors. Typically, a wire size of # 22-# 26 gauge is used for this purpose.

The connector pin numbers are shown on the back panel of the Fixture. The pin out for a typical connector is shown in Figure 2 below.

In order to facilitate wiring, you can remove the bottom panel, any of the sides, or hinge up the top cover and probe plate. Be sure to leave enough slack in the wires to accommodate raising the probe plate later.

49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

*Figure 2 - Back Panel Connector Numbering Convention (shown from outside of Fixture)*

## Pressure Rods

Once the UUT has been drilled and wired, the pressure rods that press the UUT down onto the spring probes can be installed.

The pressure rods are installed by drilling .124" holes in the top cover, then pressing the pressure rods into the bottom of the top cover. In most applications, they set the proper UUT height if the UUT PCB is .062" thick, and the receptacles are set to .150".

You should install a minimum of four to six pressure rods. The more probes that you have and the larger the board, the more pressure rods you will need. For each 50 probes that are installed, the upward force on the UUT will be about 12.5 lbs. Typically, one rod is installed for about each 15 probes.

If the UUT has any switches or adjustments which require access from above, the access holes should be drilled at this time. In order to maintain the strength of the top cover, the access holes should be no larger than minimally necessary for access.

Note

*In order to ensure proper alignment when drilling or milling the cover plate, there are accurate matching alignment holes on the Fixture probe plate and top cover.*



# **Testing Operations with the Model TR-5**

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After the Model TR-5 has been customized, but before it is used, it must be connected to the Test System and the UUT must be installed in it. This section describes how to perform these operations.

## **Connecting the Model TR-5 to the Test Electronics**

Prior to installing the Model TR-5, you must first install the test electronics into your computer. Refer to the Instruction Manual included with your Test System for details of this process.

The ribbon cables from the test electronics connect directly to the back panel of the Model TR-5. Each connector is labeled to show which test point cable should be connected. Depending on how many test points are wired into the Fixture, it probably is not necessary to install all four cables.

## **Connecting System Ground and Probe**

In order for the probe to work, it must be connected to the ground on your computer. To make this ground connection, a ground cable and probe are included with your first Fixture as part of a System purchase.

Connect one end of the ground cable to a screw on your computer back panel. Connect the other end to the banana jack on the back of your Model TR-5 Fixture. Finally, if you will be programming and want to use the probe, connect the probe assembly to the ground cable at the Model TR-5.

### Note

*In order to protect the UUT and Test System from ESD (electrostatic discharge), it is advisable to have the operator wear a wrist strap. Typical ESD wrist-straps with banana plug connectors can be easily connected to the back panel banana jack.*

## **Installing the UUT in the Fixture**

To install the UUT into the completed test fixture, first open the top cover. To do so, using one hand, grasp the latch in the front and the latch bar and squeeze them together. Once it is unlatched, you can open the top cover to any position.

The UUT is then installed over the guide pins.

Once the UUT is in place, the top cover is pressed down until the latch engages, which holds the top cover (and UUT) in place with tension on the spring probes. This can take several pounds of pressure, depending upon how many probes are installed. The Model TR-5-1612-C requires that you actuate the top-mounted lever to engage the probes.



