



**Model TR-5-600-QC  
Mechanical Fixture System  
INSTRUCTION MANUAL**

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P/N 4400-021  
Revision 11/2001  
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Specifications and operational characteristics of the System are subject to change. CheckSum, Inc. cannot take responsibility for any direct or consequential damages arising from use of this manual or the related product.

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# Limited Warranty

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CheckSum, Inc. 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, Inc. 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, INC. 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, Inc.
3. Mark the package clearly with the RMA number.
4. CheckSum will repair the product and return it postage-paid. Repairs are typically completed within one working day of receipt.

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



# Introduction

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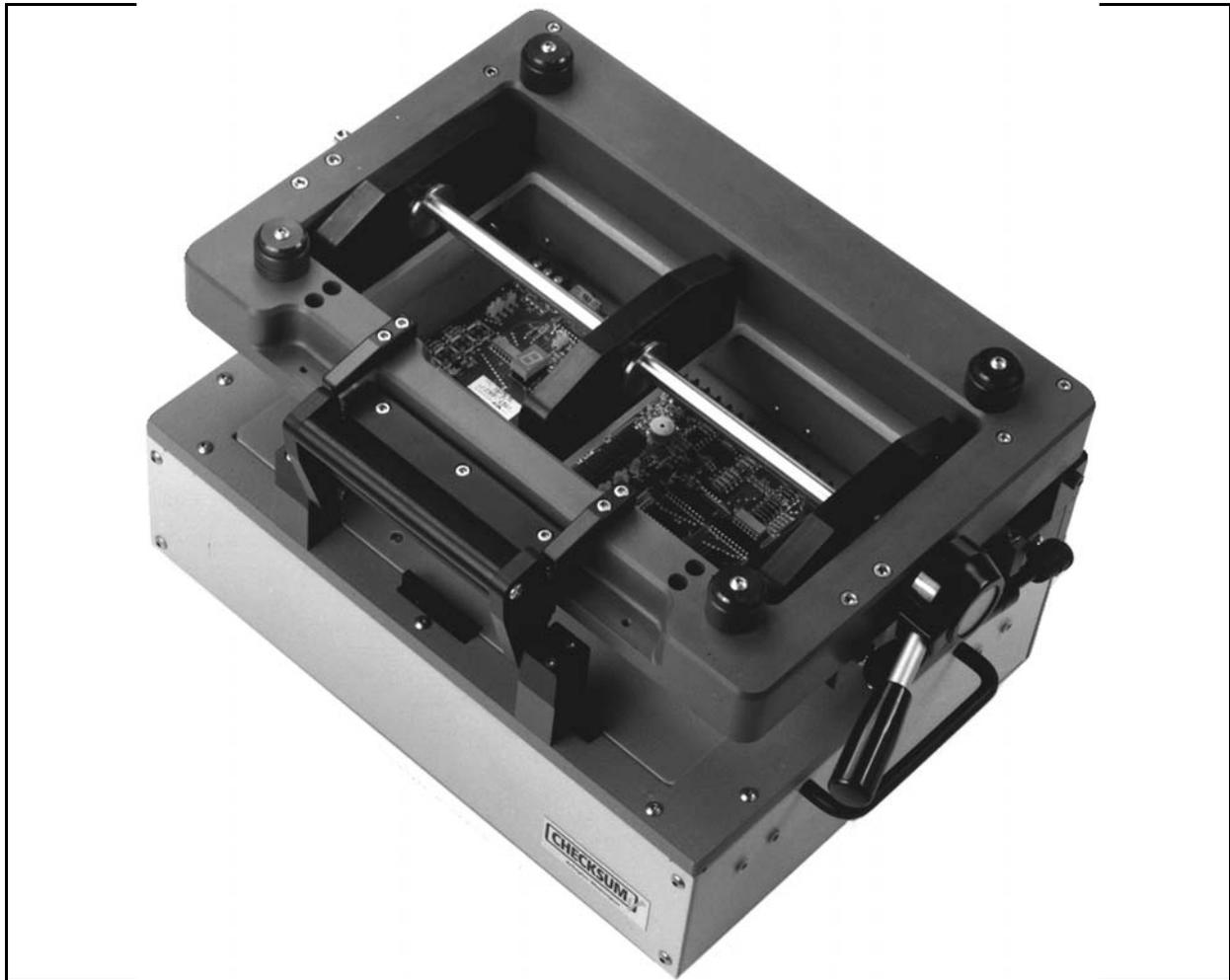
## System Overview

The CheckSum Model TR-5-600-QC Mechanical Fixture System 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.



*Figure 1 - Model TR-5-600-QC Fixture System (Lid Open)*

The Model TR-5-600-QC Fixture System uses a mechanical-advantage fixture press that provides alignment and pressure for testing. For each UUT, a customized fixture is built using a low-cost replaceable fixture kit (KIT600-QC). The customized fixture is then installed in the fixture press when testing for the particular UUT is necessary. Changing to a new fixture only takes a few minutes. See the manual section on Customizing the Fixture Kit for complete details.



*Figure 2 - Model TR-5-600-QC Fixture System (Ready to Test)*

The standard Model TR-5-600-QC is configured with 200 test points. Two additional FIX-200P-RB 200-Point Receiver Block/Wiring modules can be installed which allow it to accommodate UUTs of up to 600 test points. The fixture system can test UUTs up to 11.75" by 8.50". Space for components above the UUT circuit board is approximately 1.150". See figure 4 for Fixture Profile dimensions.

The CheckSum Model TR-5-600-QC Fixture System can be used with various CheckSum Test System electronics such as manufacturing defects analyzer (MDA) systems or functional test systems.

The test system uses 50-pin ribbon cables to 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-5-600-QC Fixture Press. Internal to the Fixture, custom wire-wrapped wiring carries the test signals from the fixture kit interface to the bottom of the spring probe receptacles.

Installing a customized fixture kit into the press involves placing the probe-plate/pan assembly into the press cavity and installing the clear polycarbonate top pressure plate onto the fixture lid.

## **Testing**

To use the system for testing, the UUT is first placed onto the fixture. The UUT is typically positioned by means of guide pins that fit into tooling holes on the UUT. These provide accurate alignment with the spring probes.

After the top cover lid is closed and latched, turning the lever arm causes the top pressure plate to move down and press the UUT onto the spring probes located in the bottom plate. The UUT is pressed down onto the spring probes with pressure rods installed on the hinged top cover.

## **Capabilities**

The Model TR-5-600-QC provides 0.5" of linear working travel. This travel accommodates both single-sided and dual-sided probing, but not dual-level probing.

The KIT600-QC 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's probe plate for probes and guide pins, 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



# Specifications

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## TR-5-600-QC Configuration

The Model TR-5-600-QC Fixture Press includes the press, one FIX-200P-RB 200-point Receiver Block/Wiring module, and this instruction manual.

When building a customized test head, order:

1. A Model KIT600-QC Fixture Kit which includes a probe plate and pan assembly, 2 shipping/storage handles, 1 clear polycarbonate top pressure plate, and ten fixed-length pressure rods (MA-ROD).
2. For each 200-points wired for the UUT, order one FIX-200P-WB 200-point wiring block (includes block and targets) for connection to CheckSum Test System electronics.
3. For each 15-25 probes, order a Model MA-ROD pressure rod. Ten are included with each kit to accommodate UUTs of up to about 200 points. If tapered (pointed) pressure rods are necessary, order the MA-ROD-T.

## Specifications

### Fixture Press (TR-5-600-QC):

Weight	Approximately 30 lbs. (approximately 35 lbs. shipping wt.)
Overall Dimensions	20" W x 14" D x 11" H (19" high with the top open)

## Fixture Kit (KIT600-QC):

Maximum UUT Probe Area	11.75" W x 8.50" D
Working Area Above UUT	1.150" (UUT PCB to top pressure plate)
Working Area Below Probe Plate	2.44" (inside the bottom pan)
Probe Plate	0.375" G-10 (FR-4) material
Top Plate	0.5" clear polycarbonate material
Weight	Approximately 10 lbs.

## Warranty:

90 days parts and labor limited warranty.

## Ordering Information:

<b>Model</b>	<b>Description</b>
TR-5-600-QC	Fixture Press, (with 200-Points)
FIX-200P-RB	200-Point Receiver Block/Wiring for the TR-5-600-QC (with block, probes, and wiring)
KIT600-QC	Fixture Kit, 600 Points Maximum
FIX-200P-WB	200-Point Wiring Block for the KIT600-QC (includes block and targets)
MA-ROD	Pressure Rod (1.150")
MA-ROD-T	Tapered Pressure Rod (1.150")
FIX-PROBE-24	Crown-Style Spring Probe
FIX-PROBE-03	Pyramid-Style Spring Probe
FIX-PROBE-29	Waffle-Style Spring Probe
FIX-RECEP-WW	Wire-wrap Receptacle (socket)
FIX-TOOL-150	Receptacle Installation Tool for TR-5-600-QC
FIX-PIN- <i>nnn</i>	Guide Pin ( <i>nnn</i> is diameter in mil - standard is 122, 137, 156, or 183)

# Installing the Fixture Press

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## Fixture Press

The fixture press is heavy, so you will not want to move it around on a regular basis. When it does need to be use the handles provided for this purpose on the sides of the unit.

## Interface Cable Connection

Connect the 50-pin ribbon cables from the back of the CheckSum test system to the cables at the back of the TR-5-600-QC. These are labeled to eliminate confusion.

If you have questions about how to make the connections, refer to (1) any customized system installation instructions that may have come with your system, (2) the *Internal Wiring* section of this manual for conventions used, or (3) call CheckSum for assistance.

## Adding additional FIX-200P-RB 200-Point Receiver Block/Wiring Modules

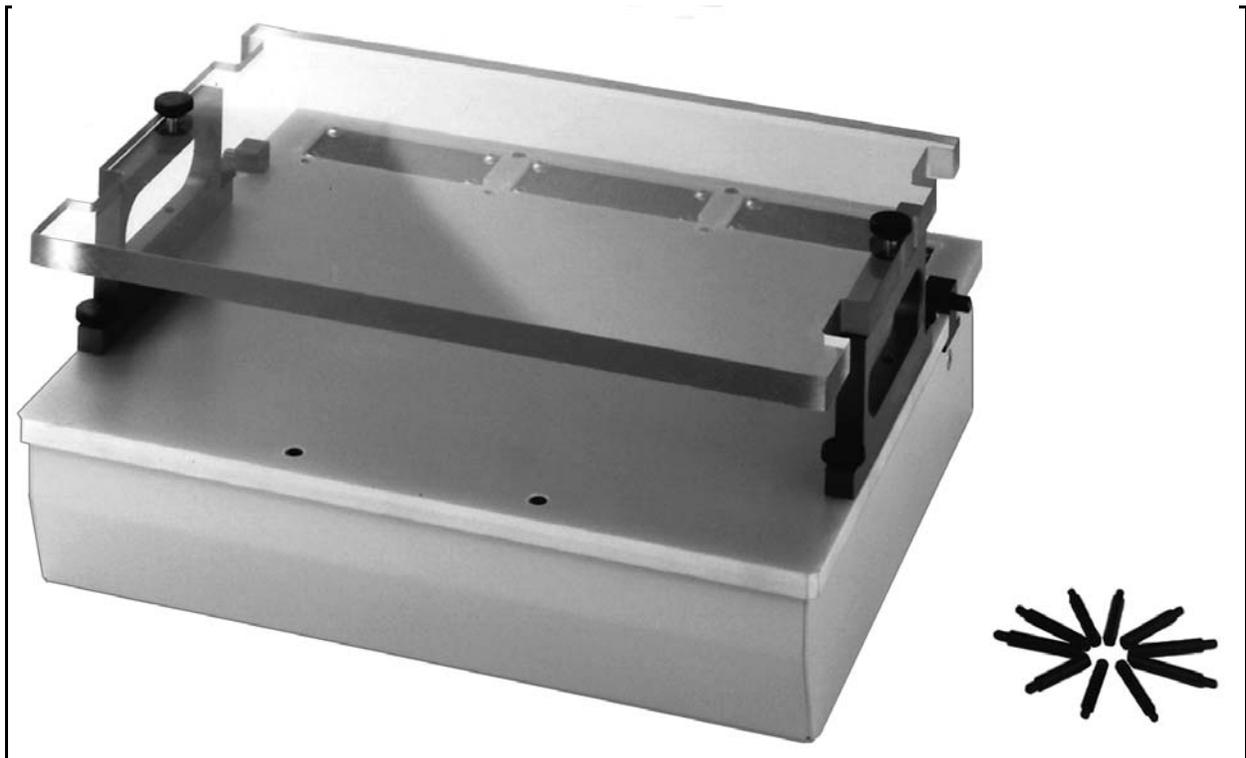
Remove any fixture from the press. Pass the four cables up from the fixture cavity into the rear opening. Holding the interface block level, push it up and align it with the other interface block. Attach it with four # 8-32 socket button head screws, two from the front side and two from the back of the press. Use two screws to install the cable strain relief bracket. The four cables should be held firmly under the bracket.



# Customizing the Fixture Kit

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Before using the Model TR-5 Fixture System, it is necessary to customize fixture kits for each particular UUT, or family of UUTs, that you will be testing. Figure 3 shows a Model KIT600-QC with the 10 pressure rods.



*Figure 3 - Model KIT600-QC*

Customizing the fixture can be performed by CheckSum, or local 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 accessories for building these fixtures.

The steps to build custom fixtures are covered in this chapter.

## **Removing the Probe Plate from the Bottom Pan**

Remove the four # 8/32 socket head screws from the probe plate. Two of the screws are in the center front of the probe plate. The two in the back of the probe plate are located closest to the edge, between the wiring blocks. Remove the two # 8/32 flat head screws (one on each side) from the bottom pan.

## **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.

Under normal circumstances, the UUT is centered on the fixture kit. However, you may wish to position it near an edge in some cases. For example:

1. You need easy access to the side of the assembly, or
2. You will be putting several UUTs on the same fixture.

## **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.

In most cases it is easiest for the operator to install and remove UUTs with only two guide pins. If the UUT is somewhat symmetrical and could be installed incorrectly, it is a good practice to install an additional, smaller guide pin in an unused non-symmetrical hole in the UUT. This can prevent the UUT from being installed incorrectly.

### Note

*If your UUT does not have tooling holes, you can use edge-guide brackets or guide pins. However, this is not ideal since alignment can be unreliable.*

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 holes 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 or in the drill file for the UUT.

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 to a different size.

The guide pins should not be installed until after the holes for the spring probes have been located and drilled. Otherwise they get in the way of the drilling process.

When using CheckSum Model FIX-GPIN-nnn guide pins, you can use a #18 drill in the probe plate for each guide pin, 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.

A ridge on the CheckSum guide pins prevents the UUT from getting closer than 0.055 inches from the probe plate.

## **Installing Spring Probes**

In typical manufacturing defects analyzers (MDAs), such as the CheckSum Model TR-2, TR-4 and TR-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 and 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 MDA test electronics. Since the test points of CheckSum MDA 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.*

If you will be installing functional test modules in the fixture (e.g., the Model TR-6-2 Fixture Interface or the Model FIX-50P-SWO), these can be installed on the bottom of the probe plate or on the bottom of the pan. The fixture is easier to work with if any accessory electronics such as this are attached to the bottom of the probe plate.

The first step is to assign test point numbers. If you are using CAD conversion to generate your test program, you can use the points assigned in this process. For manual test point assignment, 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. It is a good idea to drill all the PCB pad positions, but only install probes 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 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 or 1.75mm drill is used. This yields a .068"-.070" hole.

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.

The FR-4 (G-10) material, as used in the probe plate, is quite abrasive. Use of carbide drill bits and milling tools helps make the bits last longer.

Once the probe board is drilled, you can install the spring probe receptacles (such as the CheckSum Model FIX-RECEP-WW) 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 (such as those provided by CheckSum), it should be compressed by about .167" when the UUT is pressed down. See figure 4 for additional fixture profile dimensions.

The CheckSum FIX-TOOL-150 installs the receptacles to be .150" from the top of the probe plate. When used with the standard length pressure rods, this provides the proper amount of travel for standard probing with .062"-thick PCBs.

This spacing allows the probes, in most instances, to make adequate contact to standard lead ends or when directly touching the PCB where there are no leads. For optimum height when probing a bare PCB pad, you can install these receptacles at .200" height from the probe plate.

Conversely, you can decrease the height of the receptacles if you have longer leads on the PCB.

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 by hand or with a non-metallic tool (no special tool is necessary). Most probing can be accommodated by crown head style probes such as the CheckSum FIX-PROBE-24.

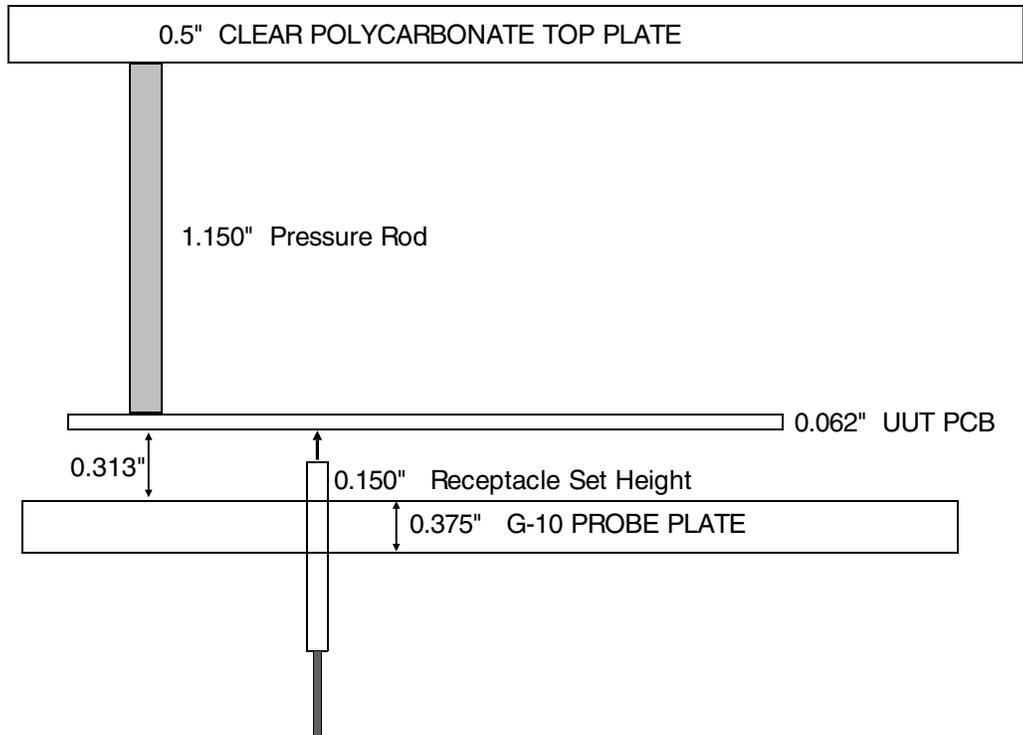
Note

*The tip of the spring probe can be damaged if a metallic tool is used to press the spring probe into the receptacle.*

Standard probes use about 5.5 oz. of spring force each, although higher force probes can be used if the probe count is relatively low and lower force probes (e.g., 3.5 oz) can be used in very high probe-count applications.

The probe head styles used by CheckSum will handle most probing applications. To determine the head styles and spring forces necessary for special needs, you can obtain literature from the probe manufacturers listed in the Appendix of this manual.

The limiting factor on the total probe load (number of probes times the probe spring force) is the amount of pressure that the system needs to exert to press the UUT on the spring probes. If probe loading is excessive, it can also cause the fixture cover and probe plate to flex, causing improper operation.



*Figure 4 Fixture System Profile (spring pin compressed)*

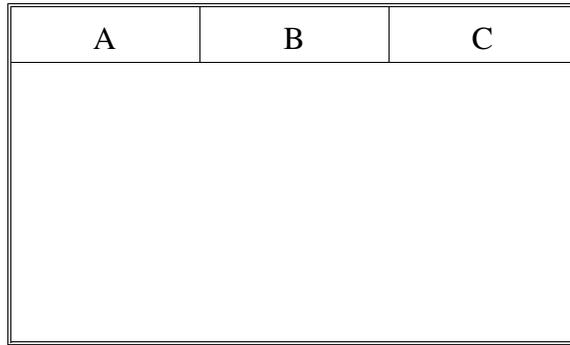
## Internal Wiring

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 wiring blocks. Typically, a wire size of #22-#26 gauge is used for this purpose.

You will need enough 200-pin wiring blocks to accommodate all of the test points wired for the assembly. These are available from CheckSum as part number FIX-200P-WB. They are installed into the probe plate on the fixture kit, so that the wire-wrap leads are inside the fixture pan. Install them so that points 1-200 are in the A position, 201-400 in the B position, and 401-600 in C position.

Fixture kits are shipped from CheckSum with blank covers over the unused wiring block cutouts.

Figure 5 shows the block installation convention used by CheckSum.



*Figure 5 - KIT600-QC Wiring Block Installation Convention  
(shown from the top and front of the Fixture Kit)*

Test-points can be wired starting at block A (1-200) and ending at block C (points 401-600). In some installations other options may be installed in the test system.

If other options are used, it is recommended to start with pins in block C for TR-6 (C151-C200), TR-6-1 (C101-C150), TR-8 PWR (C51-C100), and SMT, SMT-CAP, or BST modules (C1-C50).

The connector pin numbers are shown on the interface panel of the fixture. The pin-out for a typical wiring block is shown in Figure 6 as follows:

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49
52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100
51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97	99
102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150
101	103	105	107	109	111	113	115	117	119	121	123	125	127	129	131	133	135	137	139	141	143	145	147	149
152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182	184	186	188	190	192	194	196	198	200
151	153	155	157	159	161	163	165	167	169	171	173	175	177	179	181	183	185	187	189	191	193	195	197	199

*Figure 6 - KIT600-QC Wiring Block Numbering Convention  
(shown from top and front of the Fixture Kit)*

## Pressure Rods

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

The fixed-length pressure rods are installed by drilling a .125" hole in the polycarbonate top plate, then pressing the pressure rod into the hole.

You should install a minimum of four to six pressure rods. The more probes that you have and the larger the UUT, the more pressure rods you will need. For each 100 probes that are installed, the upward force on the UUT will be about 33 lbs. Typically, one rod is installed for about each 15-25 probes, depending on the board layout.

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

### Note

*In order to ensure proper alignment when drilling or milling the cover plate, there are accurate matching alignment holes in the Fixture bottom probe plate and top plate. In the probe plate there are two 0.196 inch drilled holes roughly centered from front to rear and 12.25 inches center-to-center. On the pressure plate, there are also two corresponding 0.196 inch drilled holes.*

# Testing Operations

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After the Model TR-5-600-QC fixture has been customized, but before it is used, it must be installed in the fixture press, 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-5-600-QC to the Test Electronics

Prior to installing the Model TR-5-600-QC, 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 ribbon cables at the rear of the Model TR-5-600-QC. Each connector is labeled to show which test point cable should be connected.

## Installing the Fixture into the Fixture Press

To install the customized fixture in the press, the lid must to be open. To open or close the fixture press lid, the lever-arm handle must be in the back position (fully-clockwise position). To open the press lid, push the lid latch handle back and lift the top lid; the two support struts will hold the lid in the upright position.

### Note

*If the lever-arm is engaged, the lid latch mechanism can not be actuated to latch or release the lid. This is an interlock to protect the UUT from allowing the pressure rods and any top probes from sliding over the UUT.*

To lower the press lid, squeeze the lid latch handle open, lower the lid, then release the lid latch handle to engage the latch mechanism.

Installing the fixture kit is comprised of two operations: installing the probe-plate/pan assembly, then installing the top plate. Following is a description of these operations.

## Probe Plate/Pan Installation

Carefully follow these instructions to push the fixture down until it latches in the press.

### Note

*Once the fixture is installed (front probe plate latch is engaged), the spring probes in the press interface blocks will cause the fixture to pop-up quickly if the front latch is released. To prevent this and protect your fingers, follow the method of releasing the latch to remove the fixture (see page 24).*

1. If the clear top pressure plate is attached to the probe/pan assembly, remove it from the handles, set the handles aside, and pick up the fixture probe/pan without the handles.
2. The fixture probe/pan is inserted with the black pivot pins and spring probe pin targets towards the rear of the press. Tilt the fixture to allow the rear of the unit to slip under the bar in the fixture press.
3. With the unit pushed back in the press and the two pivot pins resting in the slots on the press, lower the fixture probe/pan until it stops.
4. Press down on the front of the fixture which will cause the fixture probe/pan to latch into the press base.
5. The handles should be stored so they can be used to attach the top pressure plate to the probe/pan for storage when this fixture is not in use.

### 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.*

## Top Pressure Plate Installation

The top pressure plate must be installed in the correct orientation. The detent notches on the edges of the plate are oriented towards the back of the fixture press. Lift the top pressure plate up under the fixture press lid and align the slots in the pressure plate with the four support brackets on the underside of the lid. The lid brackets fit in the slots in the top pressure plate. With the top plate held up against the underside of lid, slide it down, towards the back of the lid. It will snap into place when engaged by the detents on each side of the lid. The support brackets will position and hold the top plate.

## Installing the UUT in the Fixture

To install the UUT into the completed test fixture, first open the top cover. To do so, grasp the top latch handle in the front and press it back. Once it is unlatched, the top opens with assist from the struts. The UUT is then installed over the guide pins.

## Performing the Test

Once the UUT is in place, the top cover is pressed down until the latch engages.

### Note

*Before lowering the pressure plate to the UUT, check to ensure that the pressure rods are not going to make contact with the UUT in the wrong places. If this is the case, the press has adequate force to seriously damage the fixture and/or the UUT.*

The lever arm is moved counter-clockwise to apply pressure to the spring probes. The test is then started via the system keypad or computer keyboard, depending on the particular CheckSum Test System that you are using.

After the test, move the lever arm fully clockwise, then open the latch and allow the lid to open. Finally, remove the UUT.

## Removing the Fixture from the Fixture Press

Once you are done testing a type of assembly and ready to change to a new type, it is necessary to remove the fixture kit from the press. You can carefully use your hand to hold the fixture down while you pull the center probe plate latch forward to release the fixture.

### Note

*The installed fixture will pop-up quickly when the front probe plate latch is released. To prevent this and protect your fingers, hold down the probe plate firmly as you release the latch and slowly allow the fixture to raise up.*

1. Remove the top pressure plate.
2. Firmly hold down on the probe plate.
3. Pull and hold the center probe plate latch forward.
4. Allow the fixture to slowly raise up.
5. Remove the fixture from the TR-5-600-QC base.
6. Install the handles into the probe plate.
7. Place the pressure plate on top of the handles and use the thumb screws to attach it.

The fixture is now ready for storage, and installation of a new customized fixture.

## Fixturing Source List



**Spring Probes & Receptacles:**

QA Technology  
Hampton, New Hampshire  
Phone (603) 926-0348

Interconnect Devices Inc. (IDI)  
Kansas City, Kansas  
Phone (913) 342-5544

**Custom Fixturing:**

Checksum, Inc.  
P.O. Box 3279  
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FAX (360) 435-5535  
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