

**Manual of Operation and Instruction**

**Model 3190  
True Mold Angle  
Device**

**for the  
Model 4140 Gyrotory Compactor**



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## SAFETY ALERT SYMBOL



The Safety Alert Symbol shall appear within this manual. Wherever it appears in this manual or on safety signs affixed to the machine, this is to make all aware of the potential for personal injury and to be cautious when these images are present.

Always observe all WARNING, CAUTION, and NOTE recommendations listed within this manual before operating the machine.



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# NOTES

# INTRODUCTION

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Troxler's Model 4140 Gyrotory Compactor provides safe, reliable gyrotory compaction of asphalt specimens at a given compaction pressure and angle of gyration. The Model 3190 True Mold Angle Device (TMA) provides a real-time display of the compaction angle, enabling the compactor operator to accurately and independently verify the true angle of the mold while the compactor is in operation.

To complement the TMA's real-time data display, a True Mold Angle software package is provided with the unit. This software can be used to upload and store angle measurement data on a computer.

The TMA attaches to the frame of the Model 4140, and measures the mold angle externally.

The TMA is a *passive measuring device* that does not interfere with the normal operation of the gyrotory compactor. The TMA does not affect the mold angle being measured, or the relationship between the surface of the sample and the active ram head or ram foot.

Because the TMA is external to the mold, it does not limit the amount of sample that can be placed in the mold during the test. This enables the TMA to perform dynamic measurements during the preparation of actual specimens. There is no need to extrapolate or project possible angles for full-sized samples from one-quarter or half-sized samples with the TMA.

During compaction, residue from the asphalt sample may bind to the mold wall creating an uneven surface. These irregularities will adversely affect the angle measurement of an internal measuring device if its measurement probes contact the inner walls of the mold. The TMA, however, measures the angle using the external surface of the mold.

## **TWO-POINT MEASUREMENT METHOD**

The TMA measures mold angle using a simple and traditional two-point measuring method. Troxler has used this concept to measure mold angle since the company started manufacturing the Model 4140 Gyrotory Compactor.

The two-point measurement uses a simple trigonometric function to calculate gyrotory compactor mold angle. Because the TMA is secured to the frame of the compactor, the angle measured is net of frame deflection and therefore is the true mold angle. The result is that the TMA gives precise and accurate true mold angle measurements in a passive and independent manner.

The TMA method reasonably assumes that the mold wall is rigid and non-deformable under normal compaction loads. The mold wall is parallel to the centerline of the mold so that the measured angle is concurrent with the cylindrical axis of the mold and specimen during compaction.

Most importantly, the TMA is capable of isolating gyrotory mold angle from other compaction variables. End plate or platen deflections and translations do not affect the measured angle. Mixture surface deflections and temperature variations do not skew the results. Therefore, compliance with AASHTO T312 §4.1 and §9.5 is easily ascertained and, if necessary, corrections to gyrotory mold angles can be made reliably.

# UNPACKING AND INSPECTION

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Upon receipt of the TMA from the factory, perform a complete inspection and inventory. If the shipping carton and/or any other part or accessory appears damaged, notify the carrier and your Troxler Representative **immediately**.

## NOTE

**To ensure the safe return of the TMA to Troxler for repair or maintenance, please keep the original shipping box and all packing materials.**

Check the shipping carton for the following:

- ◆ Model 3190 TMA assembly (PN 109932)
- ◆ Molded transport case (PN 900977)
- ◆ Packaging foam set (PN 109938)
- ◆ AC adapter, 12 V dc, CE international (PN 108354)
- ◆ Serial cable, 8 ft (PN 106514)
- ◆ Safety cover assembly (PN 109937)
- ◆ Manual of Operation and Instruction (PN 109596)
- ◆ CD-ROM, True Mold Angle software (PN 110080)

Inspect the outside surfaces of the TMA for damage.



# COMPONENTS

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Figure 1 shows the TMA and its components. Use the figure to locate and identify the parts described in the following paragraphs.

During compaction, the TMA's *LCD (liquid crystal display)* shows the maximum, minimum, and average compaction angles, as well as the standard deviation of the measurements.

The *Reset* button clears the TMA memory and restarts the angle measurements and standard deviation calculations.

The *ac adapter* (not shown) provided with the TMA connects to the *12 V dc power input* connector.

The *serial cable* (not shown) can be connected to the *serial port* to upload angle measurements to a PC using the TMA software provided with the unit.

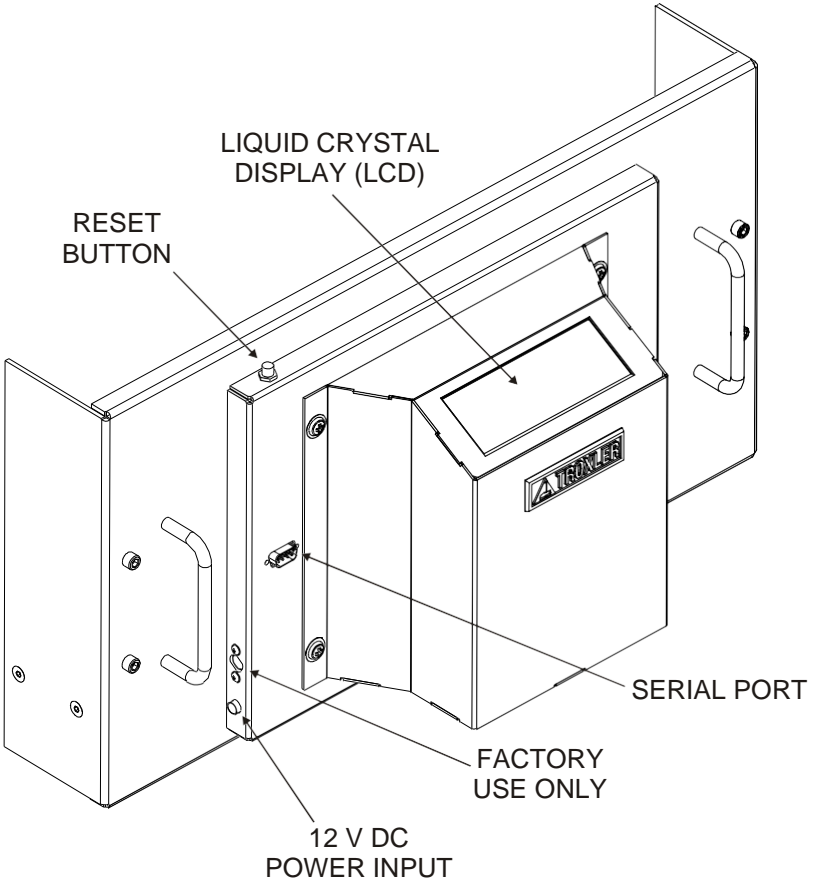
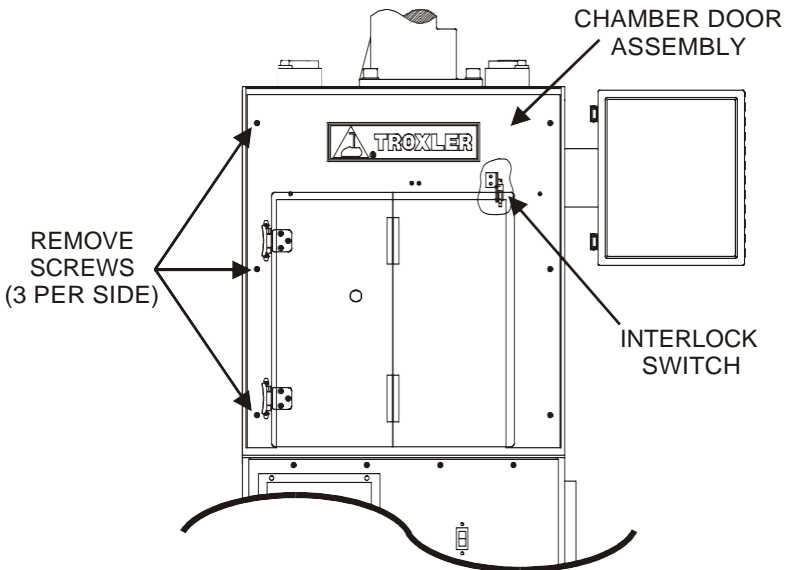


Figure 1. Model 3190 True Mold Angle Device

# **CHAMBER DOOR ASSEMBLY REMOVAL**

To use the TMA, the chamber door assembly must be removed from the Model 4140 Gyratory Compactor and the safety cover provided with the TMA must be installed as follows:

1. Using a Phillips screwdriver, remove the six screws that secure the chamber door assembly to the right and left frame members of the compactor (see Figure 2).
2. Pull the door assembly forward about 2 inches (5 cm).
3. An interlock switch is mounted on the back of the chamber door assembly. The switch has three wiring terminals; a red and a black wire are connected to two of these three terminals. Record the switch terminal to which each wire is connected. (This information will be required if the chamber door assembly is later re-installed.)



*Figure 2. Removing Compactor Chamber Door Assembly*

4. Remove the wires from the interlock switch by pulling the quick disconnect terminals from the switch terminals.
5. Completely remove the chamber door assembly from the compactor and set it aside.
6. Connect the two wires removed in step 4 by plugging the two quick disconnect terminals into one another as shown in Figure 3.

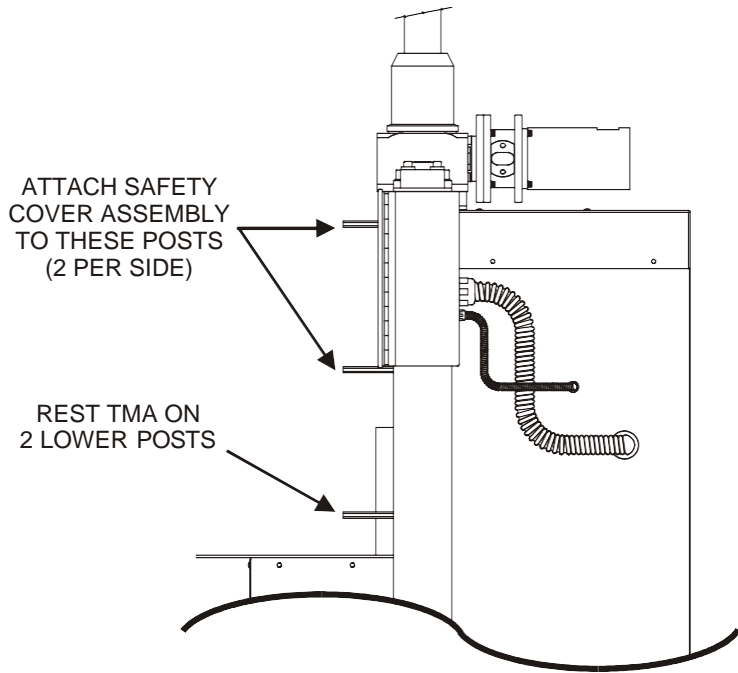
**NOTE**

**If the two wires are not connected to each other, the compactor will not operate.**



*Figure 3. Connecting the Two Interlock Switch Wires*

7. A safety cover assembly is provided with the TMA. Attach this assembly to the four upper mounting posts using four of the screws removed in step 1 (see Figure 4).



*Figure 4. Compactor Mounting Posts (Side View)*

# OPERATING THE TMA

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To use the TMA during a compaction cycle:

1. Prepare the asphalt specimen as described on page 4–4 of the Model 4140 *Manual of Operation and Maintenance*.
2. Place the loaded mold into the Model 4140 compaction chamber.
3. Lift the TMA into place. The two L-shaped brackets at the bottom of the TMA should rest on the two lower mounting posts on the left and right frame rails (see Figure 4).
4. Slide the TMA onto the mounting posts until the two magnets on the rear of the TMA contact the left and right frame rails. These magnets secure the TMA in place.

## NOTE

**Ensure that the TMA does not rest on the compactor table.**

5. Connect the ac adapter to the 12 V dc input connector and plug the ac adapter into a 120 V ac outlet.
6. If using the True Mold Angle software to upload angle data to a computer, connect the serial cable from the TMA to a serial port on the computer. Refer to page 11 for instructions on installing, starting, and using the software.
7. Compact the specimen as described on page 4–5 of the Model 4140 *Manual of Operation and Maintenance*. During the compaction process, the TMA displays the maximum, minimum, and average measured mold angle, as well as the standard deviation of the measurements. This information is updated each gyration.

## NOTE

**When processing an asphalt specimen, the average mold angle should be between 1.23° and 1.27°.**

## **NOTE**

**If angle data is to be downloaded from the TMA to a computer, do not disconnect the 12 V dc power from the TMA.**

8. To remove the TMA from the compactor, unplug the ac adapter from the 120 V ac outlet and disconnect it from the TMA. Disconnect the serial cable from the TMA. Pull the TMA forward and lift it from the compactor.

# TRUE MOLD ANGLE SOFTWARE

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During a compaction cycle, the TMA measures the excursions of its upper and lower probes and uses these values to determine the gyration angle. Starting with the third gyration of the cycle, the TMA stores the excursion values and resulting angle for each gyration.

The True Mold Angle software supplied with the TMA is used to upload and store the excursion and angle data on a computer. The data is stored in a comma-delimited format, as shown in Figure 5.

The following sections provide instructions on the installation, setup, and use of the True Mold Angle software.

```
3,1.249,.000,6.092,.000
4,1.288,3.480,9.760,.000
5,1.286,3.476,9.748,.000
6,1.286,3.476,9.748,.000
7,1.284,3.480,9.744,.000
8,1.283,3.480,9.736,.000
9,1.284,3.480,9.740,.000
10,1.280,3.480,9.724,.000
11,1.279,3.488,9.728,.000
12,1.279,3.484,9.724,.000
13,1.279,3.484,9.724,.000
14,1.279,3.484,9.724,.000
15,1.278,3.484,9.716,.000
16,1.279,3.484,9.720,.000
17,1.279,3.484,9.724,.000
18,1.279,3.488,9.724,.000
19,1.277,3.488,9.716,.000
20,1.277,3.488,9.716,.000
21,1.278,3.488,9.720,.000
22,1.276,3.492,9.716,.000
23,1.276,3.492,9.716,.000
24,1.275,3.492,9.712,.000
25,1.277,3.492,9.720,.000
•
•
•
```

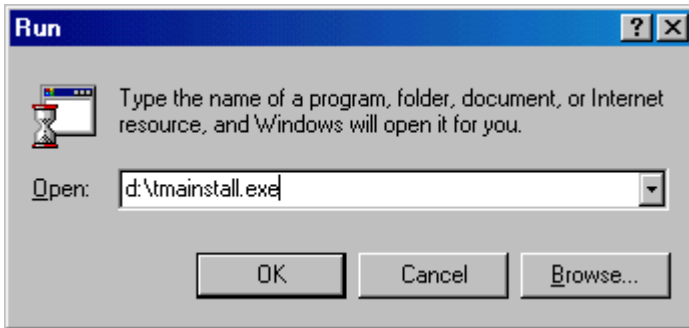
*Figure 5. Sample Data from TMA*



## **SOFTWARE INSTALLATION**

To install the True Mold Angle software:

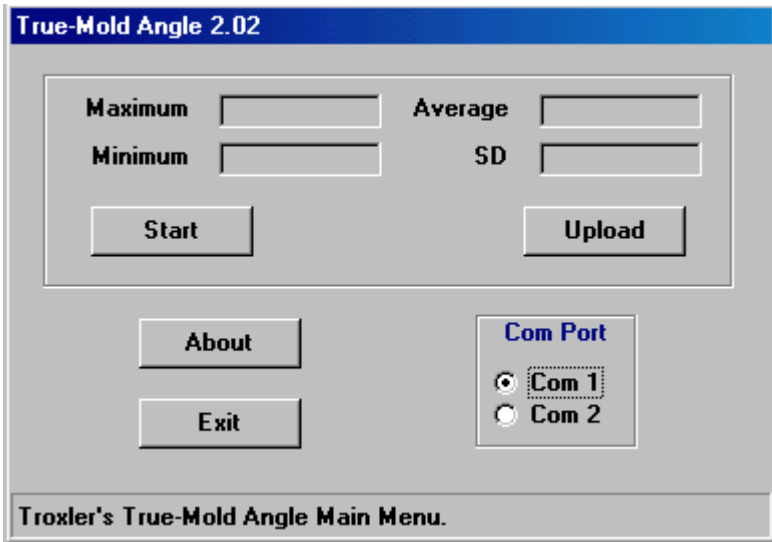
1. Insert the True Mold Angle CD-ROM into the computer's CD-ROM drive.
2. From the Windows 95/98 desktop, click on the **Start** button in the taskbar.
3. Select **Run**. The dialog box shown in Figure 6 is displayed.
4. Type **d:\tmainstall.exe** (where *d:* is the letter designation of the CD-ROM drive) and then press the **<Enter>** key or click on the **OK** button. Follow the instructions on the screen.
5. The installation program adds a **Troxler** group to the Programs menu, with the program items: **TMA** and **Uninstall TMA**. The installation program also places a shortcut icon for the **TMA** application on the Windows desktop.



*Figure 6. Installing the True Mold Angle Software*

## **STARTING THE TRUE MOLD ANGLE SOFTWARE**

To start the True Mold Angle software, double-click on the **TMA** icon on the Windows 95/98 desktop or click on the **Start** button, select the **Programs** menu and the **Troxler** folder, and select the **TMA** menu item. The software briefly displays a copyright screen while loading. Upon completion, the software displays the *Main Menu* shown in Figure 7.



*Figure 7. True Mold Angle Software Main Menu*

## UPLOADING DATA

The True Mold Angle software can upload angle data from the TMA into the computer either in real-time (during a compaction cycle) or after a compaction cycle is complete.

### **NOTE**

**The TMA stores only the angle data from the most recent compaction cycle. This data is available for uploading at any time until a new compaction cycle is begun or power has been removed from the TMA.**

## Uploading Data During Compaction

To acquire data from the TMA during a compaction cycle:

1. Click the **Start** button on the *Main Menu*. The software requests a file name as shown in Figure 8.
2. Enter a filename, followed by the extension *.txt*, but do not press the **<Enter>** key or click on the **OK** button.
3. Follow the directions on page 9 for operating the TMA while compacting the specimen. After the compactor has begun gyrating, press the **<Enter>** key or click on the **OK** button.
4. The command line at the bottom of the *Main Menu* displays **Initializing...**, then **Waiting for data...** During the compaction cycle, the software uploads angle data from the TMA and writes this data into the filename entered in step 2.

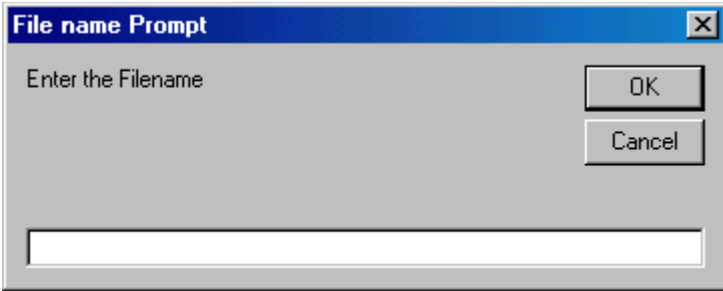


Figure 8. File Name Prompt

## Uploading Stored Data

### NOTE

The TMA stores only the angle data from the most recent compaction cycle. This data is available for uploading at any time until a new compaction cycle is begun or power has been removed from the TMA.

To upload the angle data stored in the TMA from the most recent compaction cycle:

1. Click the **Upload** button. The software requests a file name as shown in Figure 8.
2. Enter a filename, followed by the extension *.txt*, and then press the **<Enter>** key or click on the **OK** button.
3. The command line at the bottom of the *Main Menu* displays **Initializing...**, then **Collecting data... Please wait.** The software uploads the angle data from the TMA and writes this data into the filename entered in step 2 above.

# REPLACEMENT PARTS

Match the item number shown in the table below with the correct part in Figure 9 on the following page.

| ITEM | BIN NO.     | DESCRIPTION                      | QTY. |
|------|-------------|----------------------------------|------|
| 1    | 104663      | SMALL TROXLER LOGO PLATE         | 1    |
| 2    | 106949      | CABLE ASSY, ANGLE SERIAL         | 1    |
| 3    | 108555      | LOGIC PROBE TMA 319X             | 2    |
| 4    | 108835      | LABEL, TRUE MOLD ANGLE           | 1    |
| 5    | 109798      | LOGIC PROBE BRACKET, TMA: 319X   | 1    |
| 6    | 109804      | COVER ASSEMBLY, TMA: 3190,1      | 1    |
| 7    | 109824      | ALUMINUM HANDLE, TMA: 3190,1,2   | 2    |
| 8    | 109852      | DISPLAY BRACKET, TMA: 3190,1     | 1    |
| 9    | 109853      | ELECTRONICS BRACKET, TMA: 3190,1 | 1    |
| 10   | 109906      | PCB, CPU ASSY 3191               | 1    |
| 11   | 109911      | CABLE ASSY POWER, RESET          | 1    |
| 12   | 109926      | SURFACE COVER BOX                | 1    |
| 13   | 109927      | MOUNTING PLATE 4140 TMA          | 1    |
| 14   | 109928      | MAGNETIC HOLDER                  | 2    |
| 15   | 109929      | POST, SPACING                    | 4    |
| 16   | 109930      | GUIDE RAIL                       | 2    |
| 17   | 109933      | DISPLAY BRACKET SPACER PLATE     | 2    |
| 18   | 109934      | CABLE ASSY, CDI PANEL            | 1    |
| 19   | 109935      | DIAL IND. EXT. 3/16 X 1/750L     | 2    |
| 20   | 000001-0200 | LOCKWASHER #2 INT TOOTH SS       | 4    |
| 21   | 000001-0401 | WASHER, #4 INT. LOCK SS          | 2    |
| 22   | 000061-1000 | #2 HEX NUT SS                    | 4    |
| 23   | 000064-1010 | NUT, HEX 4-40 X 3/16 SS          | 2    |
| 24   | 000100-0003 | SCREWLOCK KIT                    | 1    |
| 25   | 000106-1401 |                                  | 4    |
| 26   | 000206-1601 | SCREW, 4-40 X .375 THMS PHIL SS  | 2    |
| 27   | 000406-4801 | SCREW, 8-32 X .375 SHCS, SS      | 9    |
| 28   | 000408-4807 | SCREW, 8-32 X 1/2 SHC            | 4    |
| 29   | 000606-4107 | SCREW, 10 - 32 X .375 FLATHD SOC | 4    |
| 30   | 000812-4800 | SCREW, 1/4-20 X .750 SOC HD CAP  | 2    |
| 31   | 000844-4807 | SCREW, 1/4-20 X 2.75 SOC HD CAP  | 4    |
| 32   | 000910-0434 | #2 ROUND SPACER, .125"L. PLASTIC | 4    |
| 33   | 107692-     | CABLE, LCD                       | 1    |
| 34   | 108192-3191 | LCD DISPLAY ASSY, TMA:3190,1,2   | 1    |
| 35   | 27-5050     | PUSH NUT FLAT-ROUND 3/8 OD       | 2    |
| 36   | 38-0821     | WASHER #8 FLANGED C'SUNK SS      | 4    |
| 37   | 408-1501    | SCREW 8-32 x 1/2 OHMS PHIL SS    | 4    |
| 39   | 18127.0001  | LOCTITE 242                      | AR   |

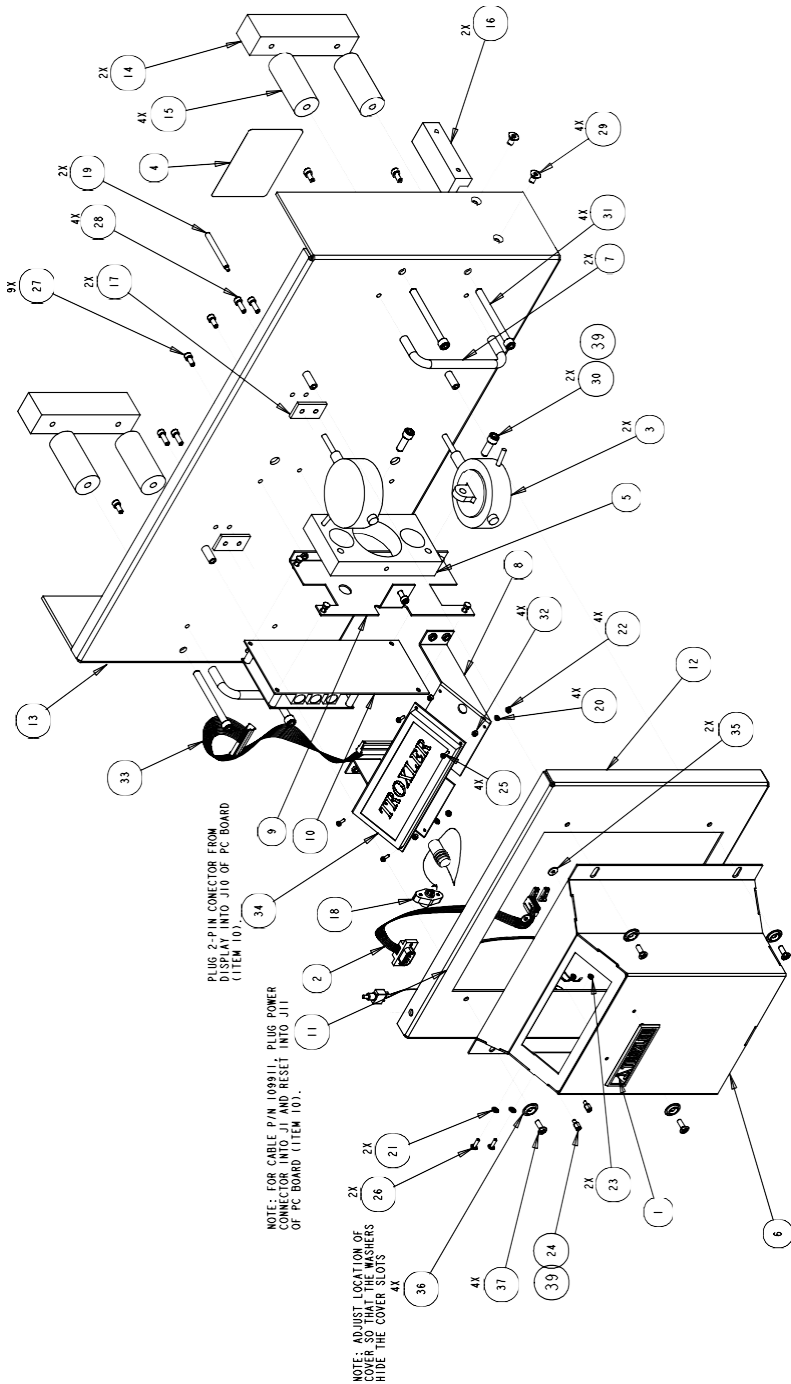


Figure 9. TMA Assembly Drawing  
 Model 3190 True Mold Angle Device

## RETURNING PARTS FOR SERVICE

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Items returned for service must be accompanied by an RGA (Returned Goods Authorization) number, and a description of the instrument and its problem. This information is used by Troxler shipping and service personnel to expedite the repair work.

To obtain an RGA number, please call or fax Troxler headquarters at Research Triangle Park, or one of the branch offices with your request (see list on page iii).

Please have the following information available when requesting an RGA number:

- Unit (or part) model and serial number.
- Part number/serial number (if applicable).
- Is the unit (part) still under warranty?
- Problem or difficulty you are having with the unit.
- Shipment method to Troxler and for return shipment.
- Shipping and billing address (not P.O. Box) – street address and zip.
- Phone number/contact (for questions from Troxler).
- Will estimate be required prior to performing any work on the part?
- Payment method: credit card, account number, or purchase order number. **All government agencies (city, county, state, and federal) must send purchase order numbers.**

### NOTE

**To prevent order duplication, if an order has been placed by telephone, please write “Confirming Order” on any follow-up written requests.**

# **SPECIFICATIONS**

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## **ENVIRONMENTAL CONDITIONS**

|                                      |                                 |
|--------------------------------------|---------------------------------|
| <b>Ambient Storage Temperature</b>   | -55 to 85 °C<br>(-67 to 185 °F) |
| <b>Ambient Operating Temperature</b> | 10 to 50 °C<br>(50 to 122 °F)   |
| <b>Altitude Rating</b>               | 2000 meters maximum             |
| <b>Humidity</b>                      | 92% maximum                     |

## **ELECTRICAL SPECIFICATIONS**

### **Power Requirements:**

**Power supply (AC adapter)** 100–240 V ac, 47–63 Hz,  
Single phase, 0.4 A

**TMA** 12 V dc, 500 mA

**Serial Port:** 9-pin male D-subminiature  
connector

## **MECHANICAL SPECIFICATIONS**

**Size, Unit with Transport Case** 61L × 25W × 43H cm  
24L × 10W × 17H in

**Weight** 3.6 kg (8lb)

**Shipping Weight, Unit with Packaging** 6.4 kg (14 lb)



# NOTES