INTRODUCTION

Today’s automobiles and trucks are engineered and built to precise specifications. In repairing a damaged vehicle, restoration to manufacturer’s specifications is critical in the proper function of all aspects of the automobile. With the limited tolerances now allowed, it is imperative that correct measuring of damaged vehicles be done using the most reliable and accurate measuring systems available. Simple visual inspection with out the use of precision measuring instruments will no longer provide the accuracy needed to bring a vehicle back into specifications.

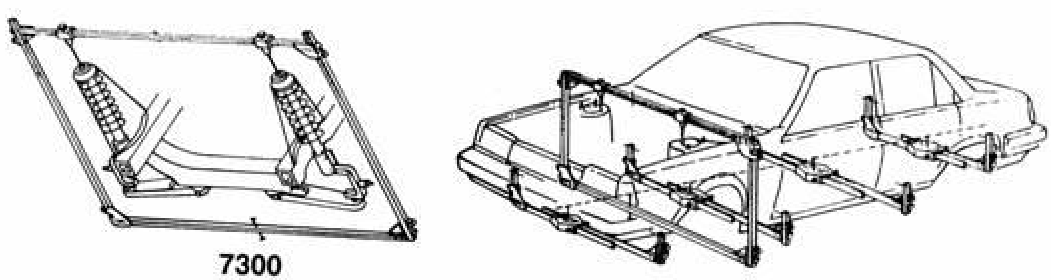
This manual outlines the use of the Mo-Clamp Measuring Equipment products. The methods and techniques described in this manual are generally accepted and used throughout the vehicle repair industry. Use of this equipment by trained and experienced technicians will speed the diagnosis of damaged vehicles and assist the technician in the repair process.

MO-CLAMP MEASURING EQUIPMENT

The goal of a repair of any vehicle is twofold: (1) to bring the vehicle into manufacturer's specifications, and (2) to be profitable for the repair facility. In order to accomplish both goals, the repair technician must be effective in determining the extent and nature of damage. To accomplish this task, the technician must be familiar with the purpose and use of measuring equipment.

The precision instruments described in this manual are designed to assist the technician with fast and accurate measuring. They are easy to understand, easy to install and easy to read. They are manufactured to be durable and provide years of effective use.

Mo-Clamp measuring equipment consists of four basic tools: a self-centering gauge set (part number 7200), a strut tower gauge (part number 7300), a tram gauge (part number 7001) and a measuring tape.



Along with the manufacturer's specifications, these instruments will allow the technician to obtain all the necessary measurements needed in vehicle repair.

Tramming Instructions

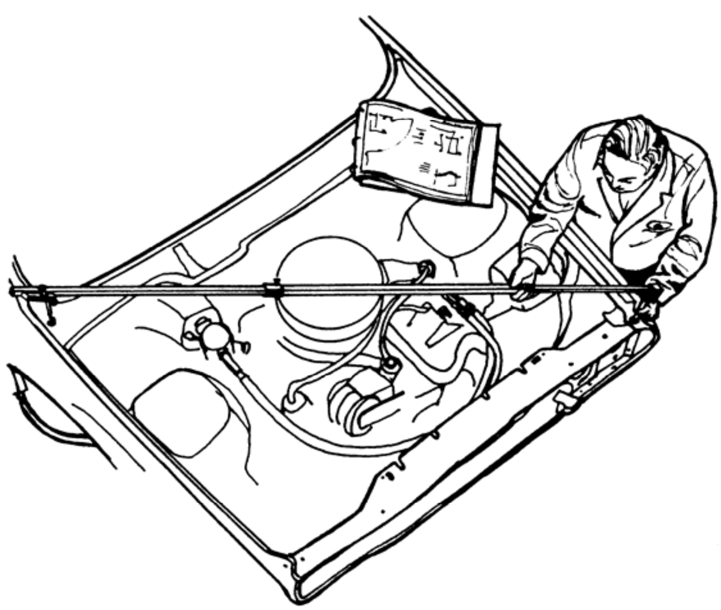
Introduction

The tram was designed to give the technician an opportunity to assess the amount of damage to a specific area on a vehicle by measuring from one point to another with or without the use of data. The first trams were just lengths of string used to compare distances for square. Strings were also used to go completely around a vehicle's 4 wheels to check to be sure the wheels are correctly following each other. This part of an alignment is called tracking.

The Trams we offer today have evolved considerably and are all capable of delivering a 3 dimensional look at the area you are questioning. Three dimensional tramming involves the ability to establish a datum plane with the tool and the built-in level provides that ability.

Most technicians make the mistake of setting the pointers the same height and comparing points which is a basic, tape measure approach to defining a length on a vehicle. This is sometimes satisfactory for a quick check measurement point to point with no data and is NOT the way the measurements were developed. With our tram and instructions you will be able to not only look at the length compared to the actual data the car was built to but you will be able to effect repairs back to factory specs and the sheet metal will fit. Every time.

Centering on bolts and holes has been, up till now, a real problem. With the addition of our cones and sockets we are able to address holes, rivets, bolts of various sizes and stay centered on them so one technician can operate the tram and get the best possible readings.



Setup Procedures

There are four parts to the tram. An outer body of the tram, the extension designed for longer measurements, the inner slide which has the smaller dimensions for close tolerances and the pointers.

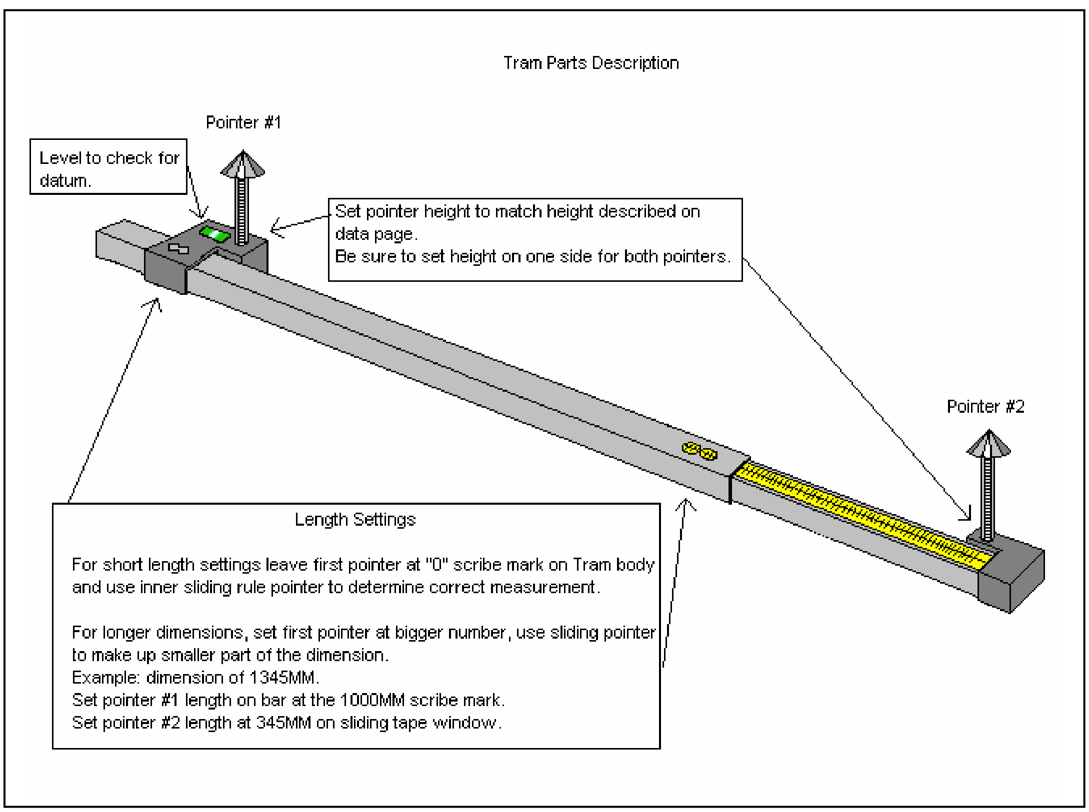
The pointers slide into the holes at the ends of the tram. Notice the dimension marks on the pointers are usually read at the bottom edge of the ends they are fastened into. To be accurate just be sure to either read the top or the bottom but not on both sides. These are to set the differences in height between the various points on your data sheets.

The remaining accessories are cones for bigger holes and sockets to go over bolt heads and rivets.

First set up the height differences on your pointers. If one data point shows a height of 325MM and the other a height of 250MM you would set the pointers so the tram will fit over or around obvious obstructions and the pointers will reflect the difference of 75MM.

The second step is to determine the distance setting between the points in question. For these instructions we will assume the length between the points is 1345MM. On the outer main body of the tram set the first pointer at 100. That is 100Centimeters which is actually 1000MM. You will see the marks on the body to set this measurement.

Next slide the second pointer, which is attached to the inner slide with the tape measure, out to reflect the additional 345MM you need to complete the dimension.



Reading the Damage

The tram is set and ready to put up to the points in question now. As you move the tram to the damaged area, be certain to put the pointers to the correct points according to the height you set the pointers at. It is *very* easy to reverse the pointers at this time and obtain erroneous readings.

If the vehicle is set into pinch weld clamps for pulling it should be fairly level. If it is sitting on tires, be sure to have all four tires at the same pressure and the vehicle on a fairly level place on the shop floor. If the vehicle is on a lift, be sure the lift feet are set the same so the vehicle will be as level as possible.

When you place the tram up to the points in question you need to be sure to check the bubble inside the pointer holder to see if the tram is level. Now do the cross-check to the opposite points and see if the tram level shows the same problems or perhaps a different picture will emerge from the use of the bubble?

The bubble is a unique part of the tram, only found on Mo-Clamp tools. It allows a “third dimension” to become visible and you may be able to determine damages more thoroughly than with just a point to point one dimension tram.

Comparison Measuring

The second method of measuring a vehicle is by a comparison of “good side” to “bad side”.

Set the pointer to a spot on a bolt head or in a hole that you want to check and set the second pointer at a point a distance from the first one. Be sure to choose points that have identical points across from them.

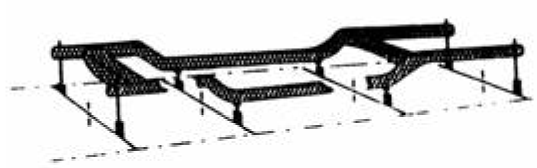
The final comparison is to switch the tram from the good points to the same points on the bad side and see how far off they are. By comparing side-to-side you will get a fairly accurate look at initial damage and be able to get very close in the reconstruction process. Remember to recheck often as you do the reconstruction as there is movement on both sides of centerline.

Self-Centering Alignment Gauges

Self-centering alignment gauges indicate misalignment by allowing the technician to "read" down a series of gauges.

Self-centering gauges:

- have two sliding horizontal bars that remain parallel as they move inward or outward
- Can be adjusted to any width, within the limits of the bar, for installation on various areas of the vehicle.
- Have centering pins that remain centered regardless of how wide the bars are spread.
- Will hang parallel to the area of the body from which they are hung using the two vertical scales attached to the instrument.
- Are used to view centerline and datum dimensions of the reference points from which they are hung.



Installing Gauges

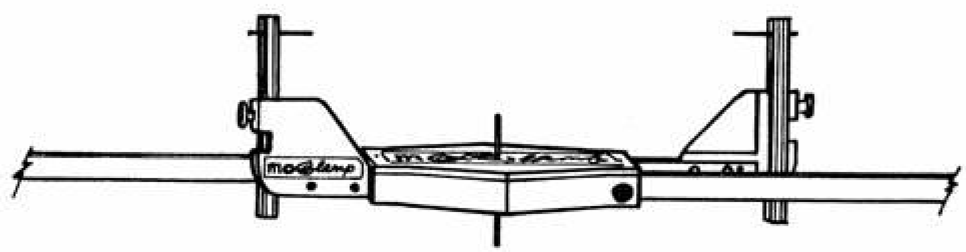
Gauges must be hung where structural alignment can be measured, generally at control points. Depending on the extent of damage, three or four gauges may be necessary for proper measuring.

Gauges must be attached at identical points on opposite sides of the vehicle. Any point which is convenient will suffice. As the gauges should remain in place during the entire repair process, the gauges must be secure when initially attached.

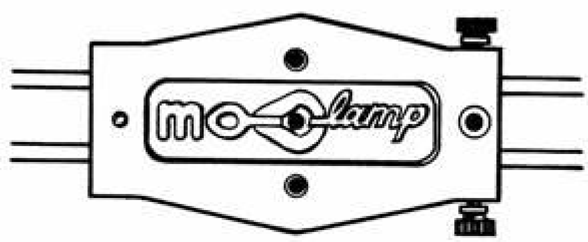
Three major factors will determine the positioning of the gauges:

- The position must be near a control point
- It must be in an area where the gauge can be conveniently hung and will remain secure throughout the repair.
- It must be in an area which will not interfere with holds or pulls.

The first two gauges must be installed in the front and rear of the center section. These will be the basis from all other gauges refer. The next gauges should be hung from the vehicle ends. Side sway, datum and out of level will be indicated by these. More gauges may be hung as needed to properly assess the damage.



Locking thumb screws are provided in the center of the unit. Locking these screws will prevent the gauge from changing width and falling from the vehicle during the repair procedure. If it is necessary for the gauge to flex in width during the repair of the vehicle, the locking screw should be loosened.



The self-centering alignment gauge set consists of the following:

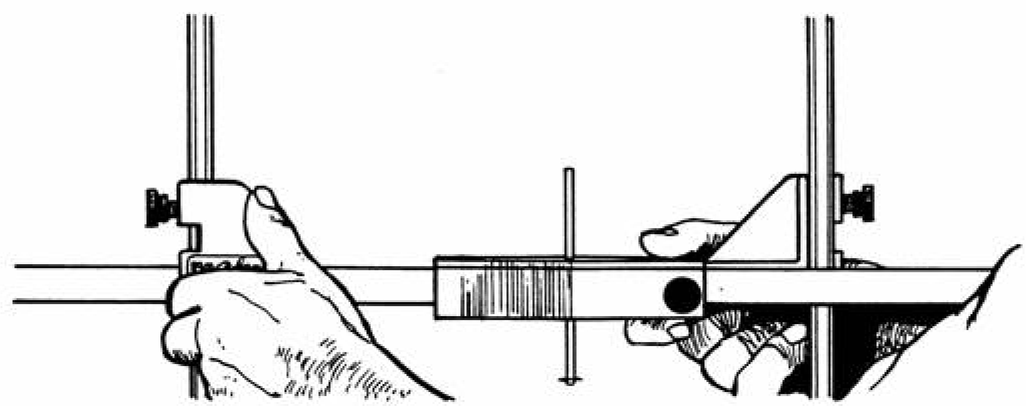
- four gauges (one 32” gauge, two 36” gauges and one 40” gauge)
- four sets of vertical scales (two 8” scales, one 16” scale and one 24” scale)

Before using a gauge, the gauge should be centered. This is accomplished by tightly pushing the crossbars together against the center unit.

Asymmetrical Vehicle Gauge Application

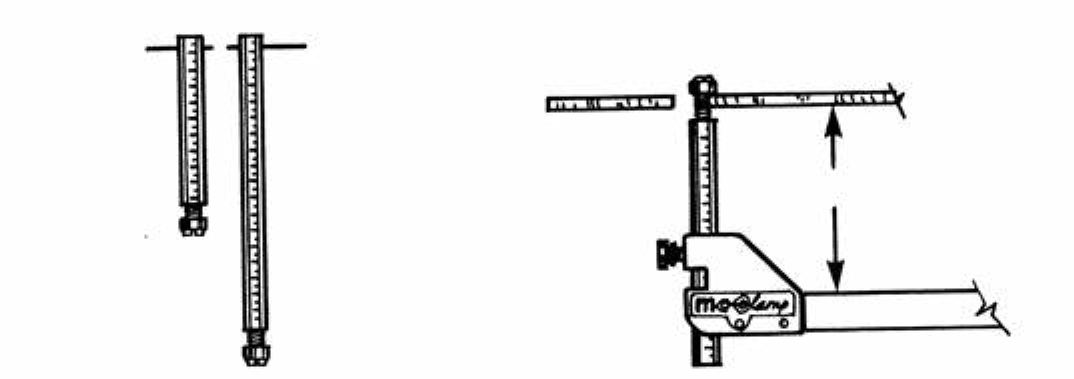
In the event that an asymmetrical measurement occurs on any vehicle, it will be indicated on the data sheet by either a left side/right side specification note indicating a difference or you may notice that diagonal, length, or distance to center measurements from side to side are not equal. Many front wheel drive cars have a variance due to transverse engines and off-center mounts and cradles. Some vehicles use asymmetrical dimensions for suspension mounts to improve steering. If an asymmetrical dimension is located in an area where it is beneficial to monitor a control point, the gauge is easily adjusted to fit the need.

First note the amount of difference from side to center line. You will be sliding one of the parallel bars of the gauge while holding the other the bar stationary until the amount of the difference from true center is achieved as measured from the center pin. Simply hold the main body of the gauge, wrap your thumb around the center pin while holding the vertical bar with your fingers of the same hand. Now pull the other vertical bar away from center until the correct distance is measurable between the housing and the vertical bar mount. Make sure you hang the gauge with the offset to the correct side of the vehicle. Verify that by checking the dimension char for driver’s side/passenger side identification.

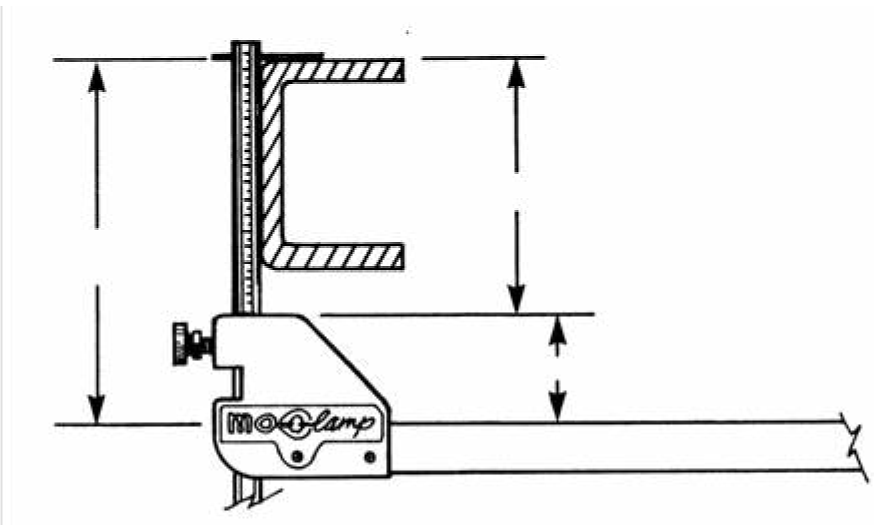


Installing Gauges with Adjustable Scales

Mo-Clamp centering gauges come with adjustable scales. Scales are calibrated from the lower side of the attaching pins allowing the technician to set accurate heights without use of a tape measure. Scales may also be inverted and hung in jig holes, using the screw head to attach the gauge to the vehicle. Height can then be measured using a tape measure from the screw head to the datum bar.

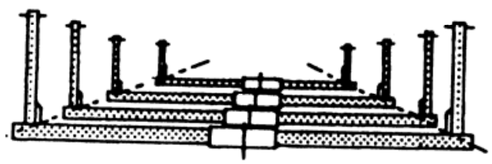


The adjustable scale may be read in either of two ways. The reading may be from the top of the scale holder or it may be from the top of the crossbar. This difference must be accounted for in all cases. A reading of 5” on the scale holder will give an overall reading of 7”.

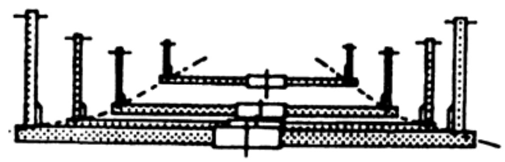


Unusual Situations
Datum

The datum line is an imaginary flat surface parallel to the underbody of the vehicle. It is the line from which height measurements are made. Centerline gauges assist the technician in identifying correct datum of a vehicle.



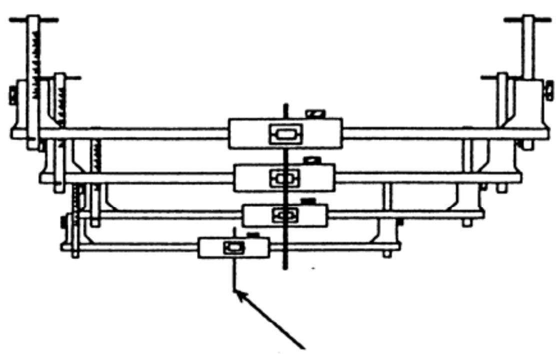
Correct Datum



Incorrect Datum

Sway

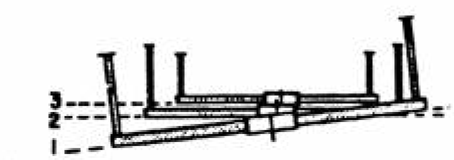
Sway is a misalignment in either the rear or front section of the vehicle as it relates to the center section of the vehicle. Position yourself so that the center pins from the two center section gauges are in line with each other. Stay in that position and compare the position of the additional gauges to the center section. Any variance will indicate sway. All gauges ***must*** be compared to the center section gauges.



Center Pin Misalignment

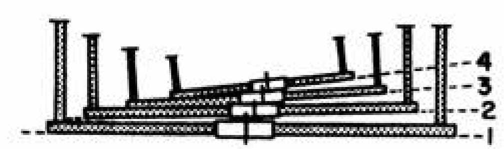
Out-of-Level

Position yourself so that each gauge can be sighted across toward the center section. You may find it easier to look over one and under another. If the gauges aren't exactly parallel, there is and out-of-level situation.



Twist

Twist is normally an out-of-level condition that is detected within the center section of the vehicle. Using on the two center section gauges, compare to see if they are parallel. If they are not exactly parallel, the center section has a twist. This will affect any gauges mounted beyond the center also and must be corrected first.

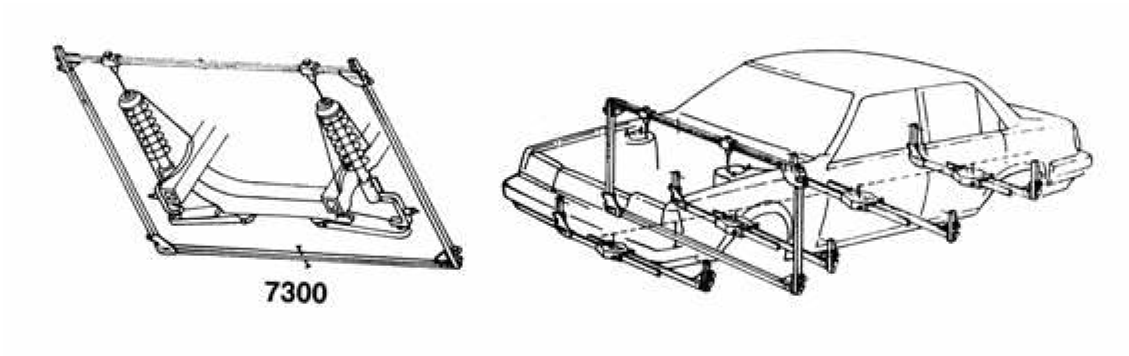


Installation of Strut Tower Gauge

The strut tower gauge is a precision instrument which allows the technician to visually determine if upper body parts or strut towers are out of alignment when compared to the centerline and datum line.

The strut tower gauge comes with two different sets of hanger pins to attach to the vehicle. The upper horizontal bar is calibrated from the centerline out to the ends. The vertical bars are adjustable to allow setting to the datum height. The lower horizontal bar has a fixed center sighting pin, and is adjusted for level and datum heights using the hanger scales.

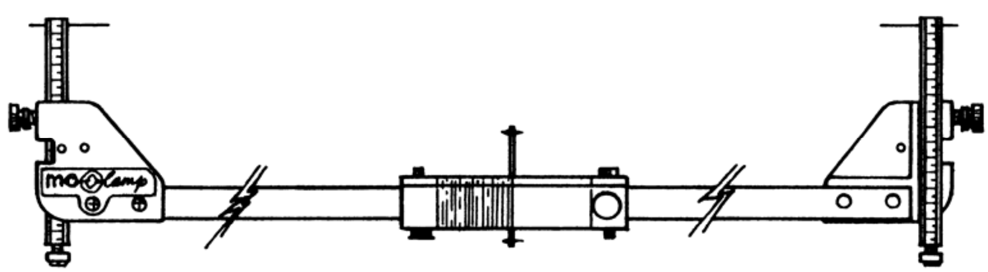
A hole may be drilled in either the frame rail or the rocker, if there is no alternative way of mounting a gauge. Variations in height may be measured on the scale from the crossbar to the rocker or frame.



After attaching the strut tower gauge to the vehicle, and adjusting the vertical scales to the proper height, the center sighting pin on the lower horizontal bar should visually line up with the centerline gauge sighting pins if the upper body dimensions of the vehicle are correct. Additional measurements may be taken with either a tape measure or a tram gauge to assure that other dimensions from the datum line and/or centerline are correct.

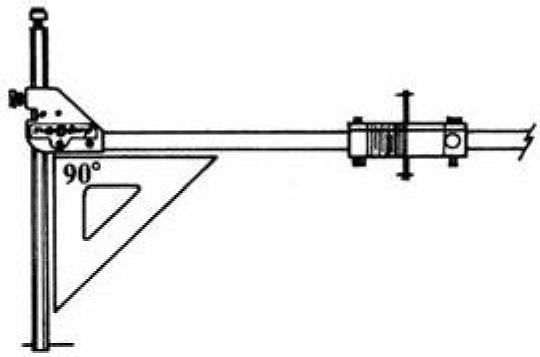
Maintenance and Operating Tips

The self-centering alignment gauge operates by means of two crossbars moving in opposite directions through a center assembly. Ball bearings hold the crossbars tightly against rollers so that there is never “play” in the gauge. The sighting pin stays in the exact center of the gauge assembly.



The design of this gauge gives it great durability. However, it must be kept clean and occasionally calibrated. For accurate measurements, the scale holder must remain square with the crossbars.

To calibrate gauges, use a steel square after placing the 16” scale in the holder. If not square, loosen the attaching bolts and shift the scale holder to a square position, then retighten the bolts securely.



To clean gauges, wipe them off with a rag and cleaning solvent. Should there be an excessive build-up of dirt and grease on the crossbars, fine grit sandpaper and solvent may be used to clean the instrument.

Replacement Parts

Replacement parts for all Mo-Clamp measuring instruments are available.
Please use the following part numbers when ordering.

Part # 7001 Mo-Clamp Tram Gauge

850011	3 1/8” finished slide
850019	Thumb screw
850021	Fixed head
850034	2” connector sleeve
850060	8” pointers
850061	24” pointers
7055	cone and pointer
7056	5 piece socket set and pointer

Part # 7200 Mo-Clamp Centerline Gauge

710030	Sight pin
710035	Retainer clips
710040	Spring for sight pin
710055	Cap screw
710161	8” vertical scales
710162	12” vertical scales
710163	16” vertical scales
710164	24” vertical scales
710165	30” vertical scales (optional)
710114	¾” Brass thumb screw
850019	½” thumb screw
900500	Tape measure

Part # 7300 Mo-Clamp Strut Tower Gauge

710030	Sight pin
710035	Retainer clips
710090	Top scale
710091	Bottom scale
710101	Pointer holder bracket
710106	4” reverse cone pointer
710107	8” reverse cone pointer
710108	8” tower pointers
710109	4” tower pointers
710166	40” vertical scales