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CONGRATULATIONS: You have purchased one of the finest Four-wheel Alignment Systems available at any price.

Fill out and return the Warranty Card within 90 days to activate the warranty and free lifetime technical support.

Factory Technical Support

(8 AM to 6:30 PM Eastern)

800-468-2321

(Consult the shop manual concerning methods for making alignment adjustments.)

EASY START GUIDE FOR THE TECHNICIAN

This is a guide for the practical and easy use of the Laser 4. Refer to the detailed sections of the Operations Manual for more specific information.

I. Calibration

One of the main features of the Laser 4 is the precision calibration bar that can be used to easily ensure that the instrumentation is always calibrated and accurate. In essence the calibration bar is made up of two perfectly parallel end surfaces for checking the cross beam calibration and two parallel side surfaces for checking the rear facing beam calibration. The beams are adjustable up and down and side to side. The procedure is as simple as aiming the beam at the appropriate mirrored surface and then aiming the mirror so the beam is reflected back in the exact same direction. It takes seconds.

II. Wheel Clamps

Another “quality” feature of the Laser 4 is the special wheel clamp. One highlight of the design is the rotating feet that automatically align to the wheel. Another is the way in which run-out is compensated. The rotating plates in the center of the wheel clamp have three adjustable legs to allow for adjustment so that the plates are completely perpendicular to the axis of the wheel rotation (Like leveling the legs of an appliance). Once set, the plate is always in the correct plane, no matter what position the wheel is rotated. If adjusted and set on an aluminum wheel, additional compensation is seldom required. Just rotate the wheel one revolution and be sure that the camber does not change appreciably.

III. Camber

Camber is the amount the wheels lean in or out. It is checked with the electronic caster/camber gauge. Most vehicles have negative camber and adjustment is seldom required unless the ride height of the vehicle has changed. The important point to remember is that the camber on one side is supposed to “cancel out” the “steering effect” of camber on the other side. If one side has more camber than the other, the vehicle will pull to one side. The vehicle will pull to the side on which the wheel leans the most outward or the least inward at the top.

IV. Caster

Caster is the amount of camber change when the wheel is steered out and then in a total of 30 to 40 degrees. (15 to 20 degrees out, 15 to 20 degrees in) It is checked with the electronic caster/camber gauge, by zeroing the scale when turned out and then taking the reading when turned in. (Keep the gauge level in both positions.) Like camber, the important point to remember is that the caster on one side is supposed to “cancel out” the “steering effect” of caster on the other side. The vehicle will pull to the side that has the least positive or most negative caster.

Caster and Camber can be adjusted within specifications to compensate for each other to eliminate the tendency of the vehicle to pull to one side. Just because the caster and camber are within specification does not mean the vehicle will go straight!

EASY START GUIDE FOR THE TECHNICIAN (continued)

V. Front Toe

The major feature of the Laser 4 is that the desired toe angle of each wheel is “set” with the calibrated tapered magnets on each wheel. Then, the tie rods of the vehicle (steering wheel straight) are set so the side-to-side laser beam reflects back to zero. This makes the two gauges parallel to each other and the wheels are pointing away from parallel (usually inward) by the angle that the magnets were set to initially. The toe in inches or millimeters is the automatic result of the angle and the wheel diameter. IT’S THAT EASY!

VI. Thrust Angle

Once the front toe is set, it’s important to ensure that the front wheels are pointing in the same direction as the rear wheels. Otherwise the vehicle will “self-steer” or pull in one direction, and/or the steering wheel will not be centered. Like the front, the rear toe is set the same for each wheel with the special tapered magnets. When the rear laser beams are reflected back to the front scales, with both sides of the front scales reading the same, and the front toe still zero on the side to side scale (by adjusting the front tie rods as necessary) a “thrust-angle” alignment is complete. If caster and camber are also compensated, as mentioned earlier, the vehicle will go perfectly straight, with NO PULL! On cars where front camber and caster are not adjustable, with practice and experimentation, the technician can even compensate and offset the pull created by caster or camber with thrust angle settings. If Caster, Camber, and Toe are all within specs, there will be no unnecessary tire wear. IT’S THAT EASY USING THE LASER 4!

THE LASER 4 CAN BE USED TO DO PROPER ALIGNMENTS FASTER AND EASIER, WITH MORE CUSTOMER SATISFACTION THAN ANY OTHER SYSTEM AVAILABLE!

REMEMBER THE GOAL IS NOT JUST TO SET TO SPECIFICATIONS, BUT TO ELIMINATE UNNECESSARY TIRE WEAR AND TO MAKE THE VEHICLE GO STRAIGHT!

VII. Four Wheel Alignment

The only difference is that the rear toe is adjusted, as necessary, so that the reflected laser beams not only read the same on both scales, but also read “5” on each side or exactly in the middle. This means that the rear toe is exactly the figure “dialed in” to the rear toe mirrored gauges. Again, IT’S THAT EASY USING THE LASER 4!

VII. Print-out

The Smart Laser Module gives tremendous capability. Before and After readings can be recorded and stored. (Caster and Camber directly from the Caster/Camber gauge. Specifications are entered manually. Toe readings for Before, Specifications, and After are entered manually. Remember that the “After” toe figures should be the same as the “Spec” since these are “dialed in” with the special magnets.) The fast and easy way is to record the “After” readings and tear off the bottom of the printout with the customer data to show the customer that the job was done right. Rear Toe is either “Compensated” if doing a Thrust Angle Alignment or “Adjusted” if doing a Four Wheel Alignment.

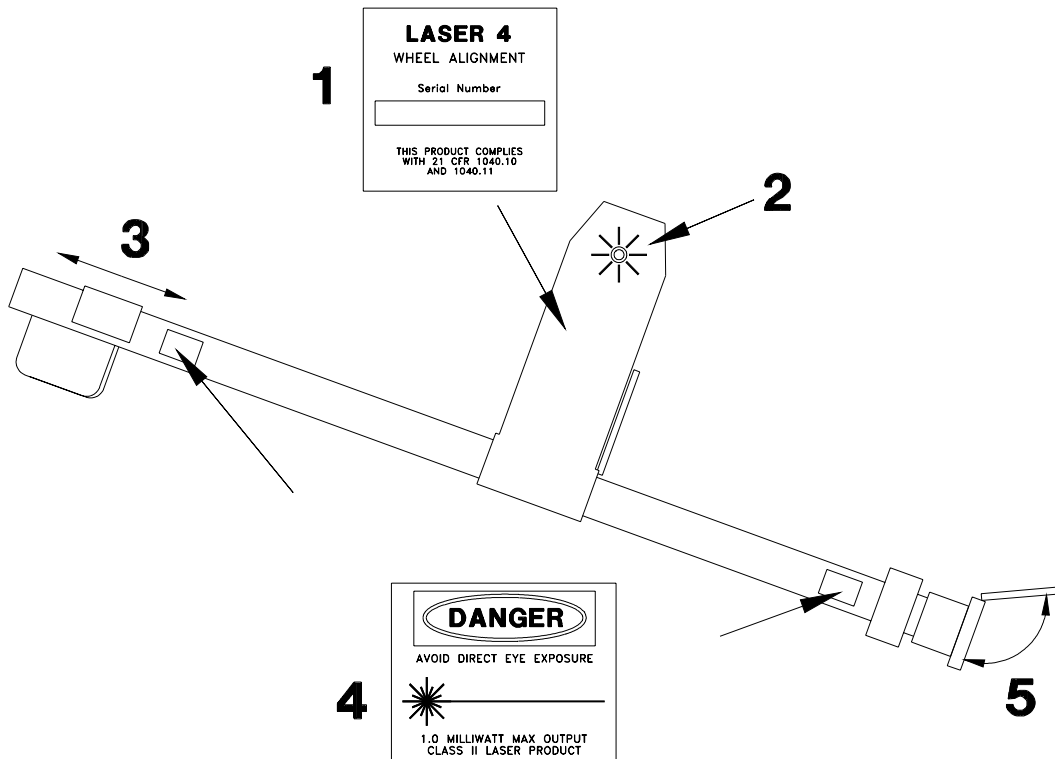


Figure 1

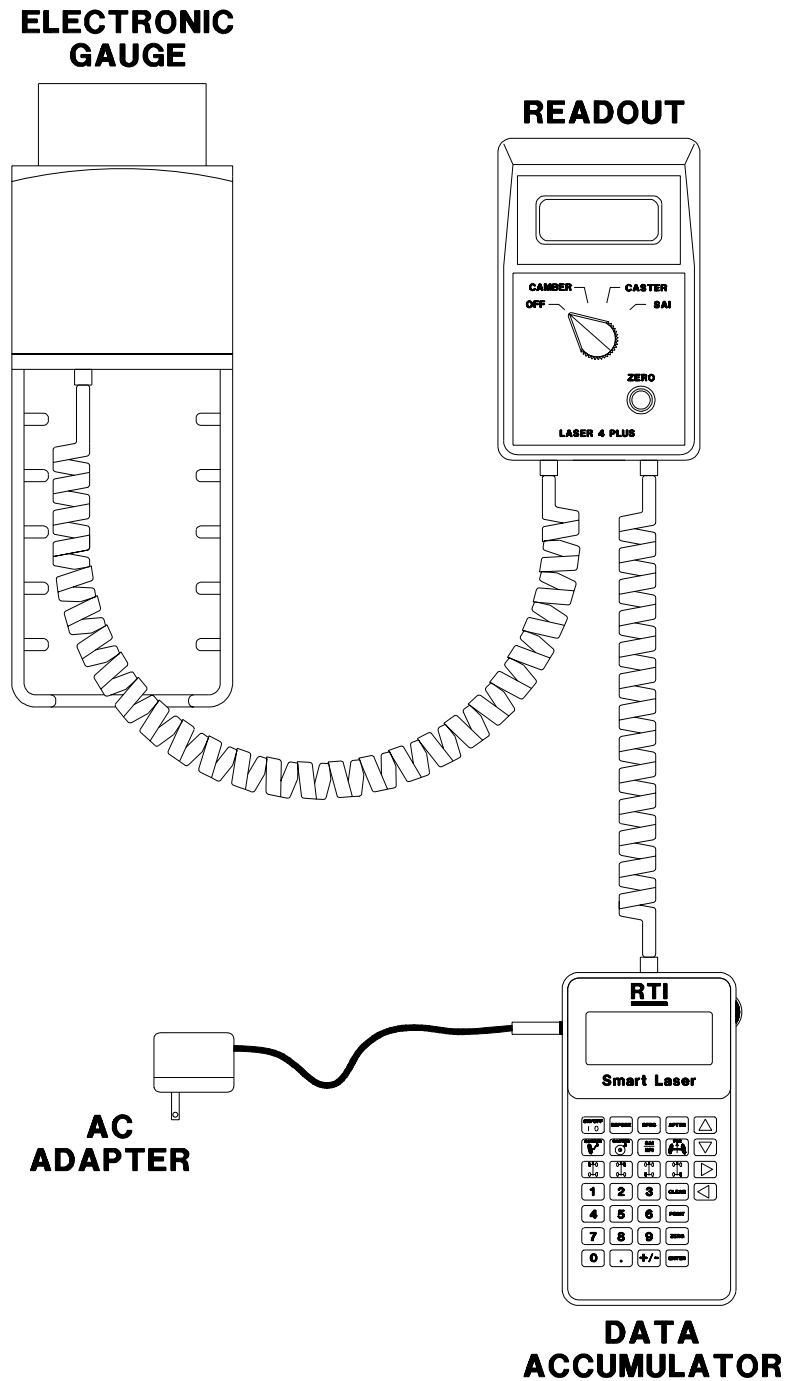
The Smart Laser 4 is a four-wheel alignment system that uses three Class II laser products. These lasers have a maximum output power of 1.0 milliwatts. The laser tubes meet all government safety standards, although common sense dictates that one should not stare directly into the beam. Laser precision is unaffected by light, temperature, and the concentrated light beam is clearly visible anywhere. The following precautions have been taken to ensure the safety of the system (See Fig. 1):

- 1) Serial Number label is located on underside of casting on power supply cover. Each serial number is recorded for future identification.
- 2) LED light comes on as soon as power is activated to laser beam.
- 3) Slide cover must be slid toward casting to uncover laser beam (LH Toe Gauge only).
- 4) Caution decals are located on the unit.
- 5) Flip-open protective cap protects laser unit when not in use.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

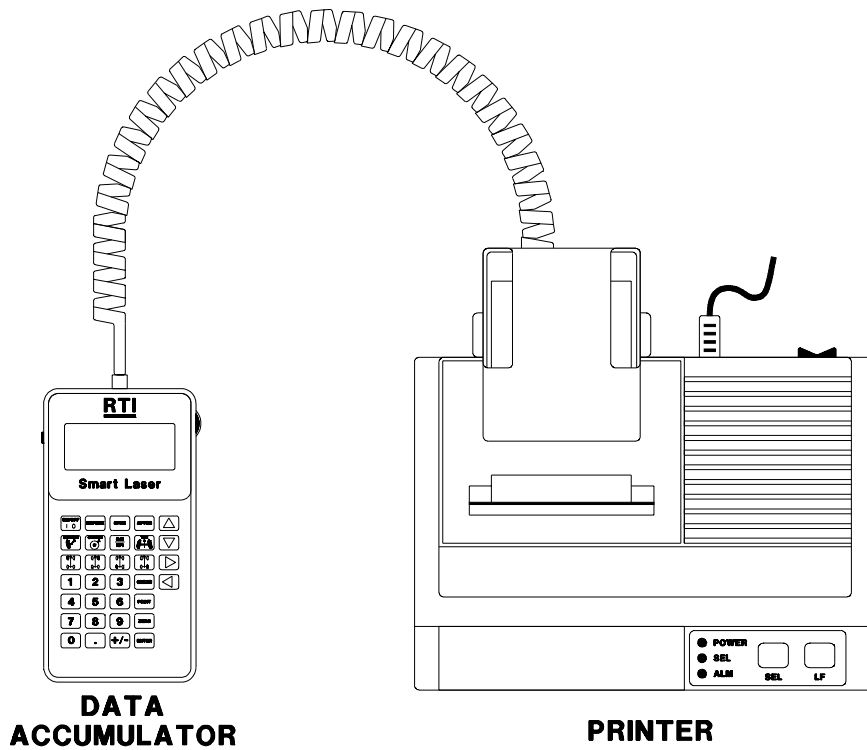
HARDWARE CONNECTIONS

Connection of the Electronic Gauge, Readout, and Data Accumulator is shown below. This configuration is used for collecting data during the alignment procedure.



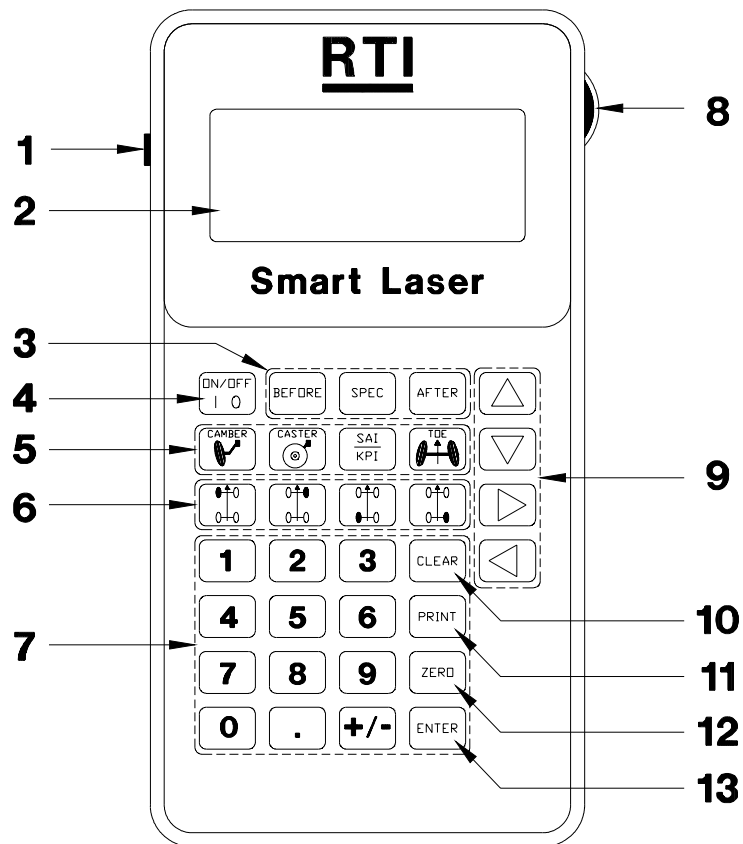
PRINTER CONNECTION

Connection of the Data Accumulator to the Printer is shown below. This configuration is used to transfer data from the Data Accumulator to the Printer. A printout can then be made for the shop's record and the customer if desired. Refer to the Printer Instruction Manual packed separately for printer operation and maintenance.



DATA ACCUMULATOR FEATURES

Features of the Data Accumulator are shown below.



- 1 AC Adapter Receptacle
- 2 LCD Graphic Display
- 3 Category - Before, Spec, or After
- 4 Power Switch - press to toggle unit on and off
- 5 Parameter - Camber, Caster, SAI, and Toe
- 6 Wheel Designation - Left Front, Right Front, Left Rear, Right Rear
- 7 Numeric Keypad
- 8 Contrast Control for LCD Graphic Display
- 9 Arrow Keys - Up, Down, Right, Left
- 10 Clear Key - Clears LCD Display
- 11 Print Key - Prints accumulated data on Printer
- 12 Zero Key - Zeros the LCD Display during Caster and SAI measurements
- 13 Enter Key - Records data displayed on LCD Display for later printing

BATTERIES

Readout One 9 volt Battery

Data Accumulator Attach AC Adapter to AC Adapter Receptacle to charge the main battery. An audible beep every three seconds indicates that the battery needs recharging. The unit will automatically shut off if battery power becomes excessively low. Also, the unit automatically shuts off after five minutes of non-use to conserve battery power.

A long-life lithium battery powers the application program. A message “BATTERY LOW” or “LITHIUM LOW” on the LCD Display indicates this battery is running low. Contact Technical Support if this message appears

ENTERING PERSONAL INFORMATION

This information only needs to be entered once during the first use of the system.

The Data Accumulator will permanently store up to five lines (16 characters each) of personal information such as the business name, address, phone number, etc. This information will automatically print at the top of each printout from the printer. Follow these steps to enter this information:

- 1 Press the ON/OFF key to turn the unit on.
- 2 Press the 1 key. Ignore the next message displayed.
- 3 Momentarily press and release the following keys in order 9 - 8 - 2 . The display will indicate “ENTER LINE 1 OF PERSONAL INFO”. A blinking cursor indicates the position of the first character entry.
- 4 Use the Arrow Keys (See Figure on Page 7, Item 9) to move the cursor and enter characters in each position. The Up and Down arrow keys change the alpha-numeric characters at the cursor position. The numbers and alphabet can be scrolled by holding the Up or Down arrow keys. After each character is selected, press the Right arrow key to move the cursor to the next position. Pressing the Left arrow key will move the cursor to the preceding position.
- 5 Press the Enter Key after each line of information is complete. The LCD Display will indicate which of the five lines of data is being entered.

DATA ACCUMULATOR - TYPES OF DATA

CATEGORY...

Three categories of data can be entered into the Data Accumulator during a typical alignment procedure. Some data is entered manually, determined by measurements observed or from a specification book. Other data is entered through the Readout from the Electronic Gauge during the actual alignment process. The three types of data are spec, before, and after. The type of data to be entered is selected by pressing the appropriate BEFORE, SPEC, or AFTER key (Item 3, Page 7).

- BEFORE This data is entered during the initial check of the vehicle.
- SPEC This data is entered from an Alignment Specification Manual.
- AFTER This data is entered after alignment adjustments are complete.

PARAMETER...

Four parameters are evaluated during a typical alignment; Camber, Caster, SAI, and Toe. Data for each of these parameters is entered by pressing the appropriate CAMBER, CASTER, SAI, or TOE key (Item 5, Page 7). This data is recorded for each of the three categories mentioned above; Before, Spec, and After.

- CAMBER This data is read by the Data Accumulator directly for Before and After. The Spec data is entered manually.
- CASTER This data is read by the Data Accumulator directly for Before and After. The Spec data is entered manually.
- SAI This data is read by the Data Accumulator directly for Before and After. The Spec data is entered manually.
- TOE This data must be entered manually for Before and After as observed on the laser beam instrumentation as described in the Toe Reading section. The Spec data is entered manually.

WHEEL DESIGNATION...

Data is entered for each of the four wheels on the vehicle. The parameters mentioned above are entered for the wheel selected by pressing the appropriate key (Item 6, Page 7)

DATA ACCUMULATOR - COLLECTING DATA

The Data Accumulator is used to collect and store data during the alignment procedure. Connect the Data Accumulator to the Readout as shown on Page 5 when data is to be collected. It is only necessary to connect the Data Accumulator to the Readout during Caster, Camber and SAI steps of an alignment to collect the Before and After readings for the various wheels. It can be disconnected and kept safely nearby during the other steps of the alignment. Power can be turned off to prolong the battery life without loss of previously stored data.

To collect a reading, connect the Data Accumulator to the Readout and turn on the power. The Readout will be displaying the reading to be collected and stored by the Data Accumulator. Select Before or After, select the parameter being recorded (Caster, Camber or SAI), and select which wheel is being serviced. The LCD Display on the Data Accumulator will show the actual reading of the selected parameter. Press the Enter key to record and store the reading.

DATA ACCUMULATOR - MANUAL ENTRY OF DATA

Other data must be manually entered into the Data Accumulator. Toe and all Spec data is manually entered as follows:

- 1 Select the proper Category, Parameter, and Wheel Designation (Page 7, Items 3, 5, and 6).
- 2 Press the CLEAR key (Page 7, Item 10)
- 3 Position the cursor using the Right and Left arrow keys (Page 7, Item 9).
- 4 Enter the desired number using the Numeric Keypad (Page 7, Item 7).
- 5 Press ENTER key to store the reading (Page 7, Item 13).
- 6 If a mistake is made, press the ENTER key and start again with Step 2.

NOTE: After entering the value for Toe on the rear right wheel, the LCD display will show the following:

THRUST ANGLE?

1. COMPENSATED
2. ADJUSTED
3. NEITHER

Press 1, 2, or 3 to select the method used during the rear toe adjustments. Choose COMPENSATED if a thrust angle alignment only was performed. Choose ADJUSTED if a four-wheel alignment was performed. Refer to the proper sections of this manual for the two procedures. The printout will indicate thrust angle compensated or adjusted.

DO NOT TURN UNIT OFF UNTIL PRINTOUT HAS BEEN MADE

PRINTER OPERATION

Alignment data is recorded in the Data Accumulator during the alignment procedure as described in the following pages. This data is then transferred to the printer and a printout is generated. Following are the steps to generate a printout:

- 1 Connect the Data Accumulator to the Printer as shown on Page 6.
- 2 Connect the printer to an appropriate power source. Turn the Printer on (power switch is on rear). The green POWER indicator will be illuminated.
- 3 Press the SEL key on the Printer to place it online. The green SEL indicator will be illuminated.
- 4 Press the PRINT key. The display will indicate "USE DEFAULT SPECIFICATIONS?" with the option of 1. YES or 2. NO. Select NO by pressing the 2 key.

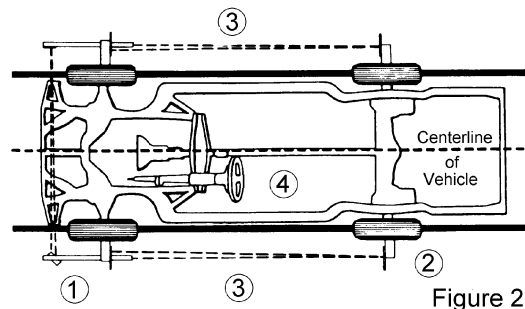
NOTE: If YES is selected, the printout will show that default specs were selected and print Left Camber of -00.50, Right Camber of -00.40, and Total Toe of -00.15.
- 5 The display will indicate "ENTER REPAIR ORDER #". The arrow keys can be used to enter a customer specific number such as the work order number. The up and down arrows scroll through the alpha-numeric characters and the right and left arrows move the cursor. Press the ENTER key after the information has been entered.
- 6 The display will indicate "ENTER MAKE OF VEHICLE". Use arrow keys as above and press ENTER key after information has been entered.
- 7 The display will indicate "ENTER MODEL OF VEHICLE". Use arrow keys as above and press ENTER key after information has been entered.
- 8 The display will indicate "ENTER YEAR OF VEHICLE". **Use the number keys to enter the year (the up and down arrow keys do not function in this step).** A year must be entered. Use the right and left arrow keys to move the cursor. Press the ENTER key after information has been entered.
- 9 The display will indicate "ENTER TYPE OF VEHICLE". Use arrow keys as above and press ENTER key after information has been entered.
- 10 The display will indicate "PRINTING" as the printer generates the printout.
- 11 The display will indicate "CLEAR?" with the options of 1. YES or 2. NO. Press the 2 key if another printout is desired, otherwise, press the 1 key.
- 12 Turn the Printer off and disconnect the Data Accumulator.

SAMPLE PRINTOUT

SMART LASER ALIGNMENT SYSTEM		
SHOP NAME		
ADDRESS		
CITY		
STATE		
PHONE		
BEFORE		
<hr/>		
FRONT	LEFT	RIGHT
CAMBER	+...-	+...-
CASTER	+...-	+...-
SAI/KPI	+...-	+...-
TOTAL TOE	+...-	
REAR		
CAMBER	+...-	+...-
TOE	+...-	+...-
TOTAL TOE	+...-	
SPEC		
<hr/>		
FRONT	LEFT	RIGHT
CAMBER	+...-	+...-
CASTER	+...-	+...-
SAI/KPI	+...-	+...-
TOTAL TOE	+...-	
CASTER SHOULD BE EQUAL WITHIN 0.5 DEG.		
REAR		
CAMBER	+...-	+...-
TOE	+...-	+...-
TOTAL TOE	+...-	
ALIGNMENT RESULTS		
REPAIR ORDER #		
MAKE		
MODEL		
YEAR		
TYPE		
AFTER		
<hr/>		
FRONT	LEFT	RIGHT
CAMBER	+...-	+...-
CASTER	+...-	+...-
SAI/KPI	+...-	+...-
TOTAL TOE	+...-	
REAR		
CAMBER	+...-	+...-
TOE	+...-	+...-
TOTAL TOE	+...-	
THRUST ANGLE		
REAR ADJUSTED		

FOUR WHEEL ALIGNMENT

Rear wheels must track and follow the front wheels in a parallel direction with all four wheel adjusted to the common centerline of the vehicle.
(See Fig. 2)



1) Front wheel alignment and front wheel toe on car manufacturer's specifications.

2) Rear wheel alignment and rear wheel toe on car manufacturer's specifications.

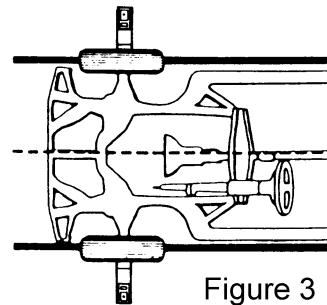
3) Front wheels track to rear wheel thrust lines and to centerline of vehicle.

4) Steering wheel centered in straight ahead position.

BASIC STEPS TO DO FOUR WHEEL ALIGNMENTS

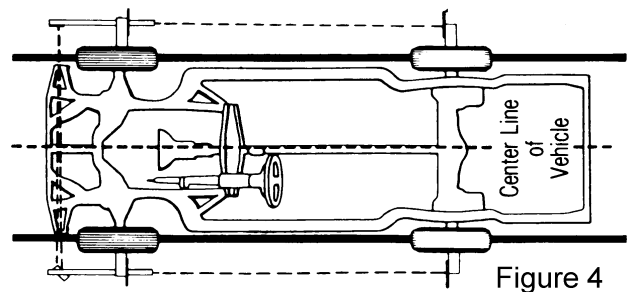
Step 1

Adjust front wheel camber and caster to car manufacturer's settings. (See Fig. 3)



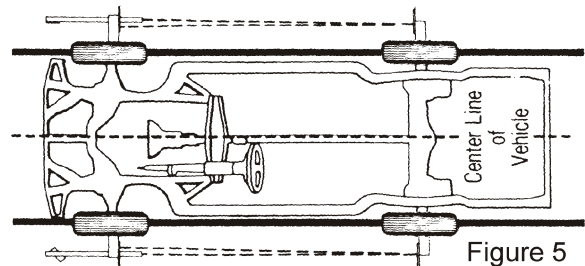
Step 2

Center steering wheel. Adjust front wheel toe to manufacturer's setting. (See Fig. 4)



Step 3

Adjust front wheels to rear wheel in relation to rear axle position. (See Fig. 5)



Step 4

Adjust rear wheel camber and toe to car manufacturer's setting.

PRE-ALIGNMENT CHECKS

To maintain a true alignment job; ensure maximum tire mileage and steering safety, it is important to perform certain pre-alignment checks before doing wheel alignment adjustments. They are:

1. Inflate tires to proper inflation pressures.
2. Check car spring height.
3. Check shock absorbers and struts.
4. Inspect steering/suspension parts for wear or looseness. Replace parts which are worn beyond manufacturer's accepted tolerances.
5. Check calibrations of the Laser 4 wheel alignment equipment. See Calibration Procedure section of this manual.

FRONT WHEEL SETBACK

Front wheel setback is a condition in which one front wheel has been driven or pushed back, out of alignment, from the opposite wheel. It is caused by one wheel of the vehicle striking a curb or pothole in the road forcing that wheel back from the other (See Fig. A).

To measure front wheel setback with the Laser 4 wheel alignment system, adjust front wheel toe; center steering wheel, and note the location of the Laser beam on the wheel setback scale (See Fig. B) of the passenger side laser toe gauge. Make sure that the Laser toe gauges are centered on the wheel clamps. The scale reads either right or left wheel setback. The front wheel suspension should be adjusted if the setback is greater than 1/4 inch. Excessive front wheel setback will cause a change in caster.

The Laser 4 alignment system automatically compensates for front wheel setback because of the use of the tapered, precisely ground magnets. When toe is adjusted to zero, the tube of the optical toe gauges become parallel to each other. Front wheel toe reading is unaffected by front wheel setback.

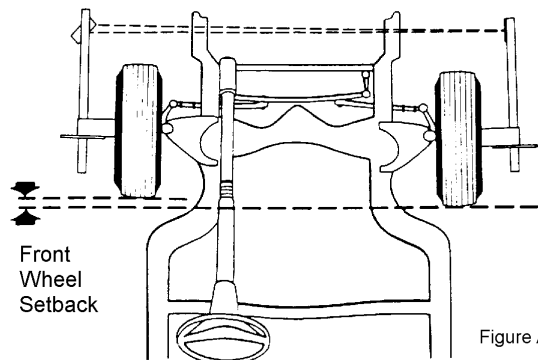


Figure A

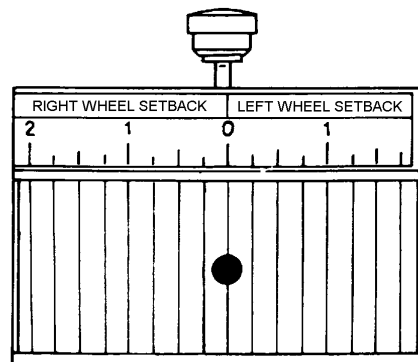


Figure B

INSTALL WHEEL CLAMPS

Install Wheel Clamps on each wheel. (See Fig. 6) Adjust the four bars in each clamp for the best fit to the wheel rim. Two sets of notches on one end or a threaded pin on the other end provide for inside or outside mounting to the wheel rim. Use double-sided foam tape at contact points on decorative or soft metal rims. Make sure that the Wheel Clamps are securely attached.

Select the configuration which gives the most secure fit with the least amount of pressure on the wheel rim.

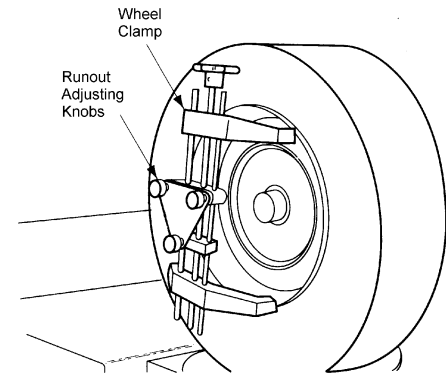


Figure 6

COMPENSATING WHEEL RUNOUT (Laser 4)

Wheel Clamps must be adjusted to compensate for wheel runout. This adjustment is made using the three Runout Adjusting Knobs.

- 1) Raise wheel and tire from turning gauge or rear wheel slip plate. Turn wheel so the large wheel clamping knob is at the top (12 o'clock position).
- 2) Mount the Electronic Gauge on the Wheel Clamp as shown (See Fig.7). Center the magnet on the Wheel Runout Compensating Adapter. Turn the Electronic Gauge so it is level.
- 3) Set the selector to CASTER (See Fig. 8).
- 4) Rotate the wheel so the wheel clamp adjusting knob is at the 2 o'clock position. Turn the Electronic gauge so it is once again level. Note the value on the Digital Readout Screen. Ignore the + or - which appears before the numbers.

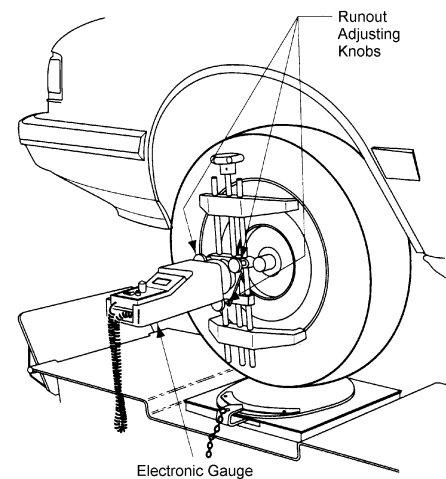


Figure 7

- Repeat at the 4, 6, 8, and 10 o'clock positions. Re-level the Electronic gauge at each position.
- 5) Turn the wheel to the position where the largest numeric reading was observed. Turn the Runout Adjusting Knobs to decrease this reading by one-half. Press the Zero Button and repeat step 4, checking for the largest numeric reading at each of the six positions.
 - 6) The wheel clamp is properly adjusted when the Electronic Gauge reads within 0.1 at all six positions.

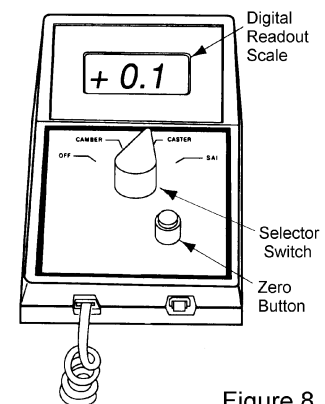


Figure 8

COMPENSATING WHEEL RUNOUT

Wheel Clamps must be adjusted to compensate for wheel runout. This adjustment is made using the three Wheel Runout Adjusting Knobs.

- 1) Raise wheel and tire from turning gauge or rear wheel slip plate. Turn wheel so the large wheel clamping knob is at the top (12 o'clock position).
- 2) Mount the Spirit Level Gauge on the Wheel Clamp. (See Figure 9) Center the magnet on the Wheel Runout Compensating Adapter. Turn the Spirit Level Gauge so it is level.
- 3) Zero the Caster Spirit Level using the adjusting knob on the bottom of the unit.
- 4) Rotate the wheel so the wheel clamp adjusting knob is at the 2 o'clock position. Turn the Spirit Level Gauge so it is once again level. Note the amount of movement of the bubble away from zero.

Repeat at the 4, 6, 8, and 10 o'clock positions. Re-level the Spirit Level Gauge at each position.

- 5) Turn the wheel to the position where the largest movement of the bubble was observed. Turn the Runout Adjusting Knobs to decrease this reading by one-half. Zero the Caster Spirit Level and repeat step 4, checking for the largest movement of the bubble away from zero at each of the six positions.
- 6) The wheel clamp is properly adjusted when the bubble does not move away from zero at all six positions.

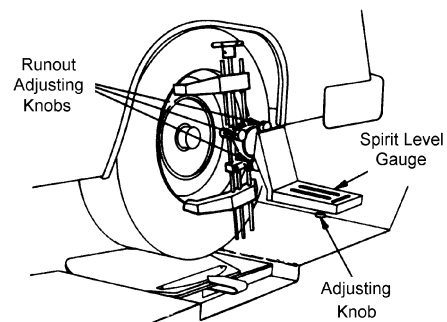


Figure 9

CAMBER READING

Camber: The inward or outward tilt of the wheel at the top

Camber is measured in degrees.

Wheel exactly vertical: Zero camber

Top of wheel tilts in: Negative camber

Top of wheel tilts out: Positive camber

A vehicle with Negative Camber is shown in Fig. 10.

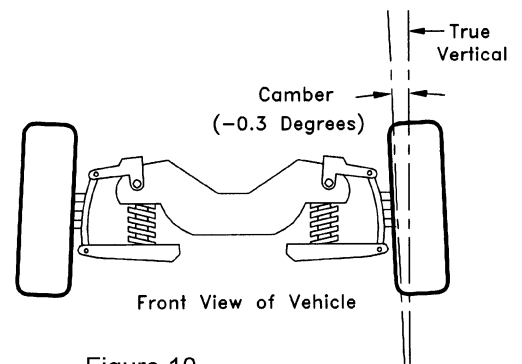


Figure 10

Proceed with the following steps to read Camber:

- 1) Place front wheels in straight ahead position with steering wheel level. The engine must be started if the vehicle has power steering. Remove locking pins from the turning radius gauges and rear wheel slip plates. Rotate each wheel until the large wheel clamp adjusting knob is at the top.
- 2) Lower all four wheels until the front wheels rest on the turning radius gauges and the rear wheels rest on the rear wheel slip plates. Be sure turning radius gauges are centered under the front tires.
- 3) Install brake pedal depressor. The engine must be running if the vehicle has power brakes.
- 4) Bounce the vehicle at both front and rear to normalize the suspension weight.
- 5) Mount the Electronic Gauge on the left front Wheel Clamp. Be sure the magnet is centered on the mounting disk (See Fig. 11).
- 6) Set the selector to CAMBER (See Fig. 12).
- 7) Read Camber on the Digital Readout Scale (A negative 0.3 is indicated in Fig. 12). The numeric read out will be preceded by a + or - to indicate positive or negative Camber.
- 8) Repeat the above procedure on the right front wheel. If camber adjustments and specifications are available for the rear wheels, repeat the above on each wheel.

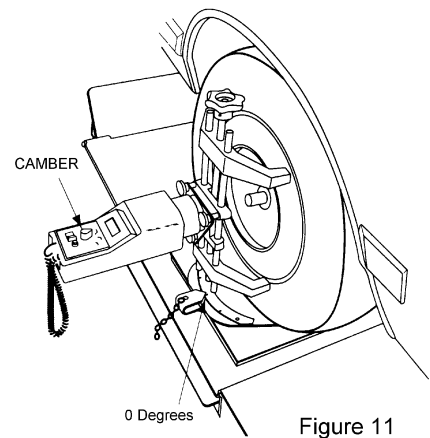


Figure 11

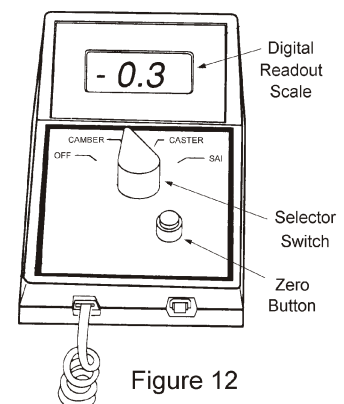


Figure 12

CASTER READING

Caster: The backward or forward tilt of the ball joint or strut at the top

Caster is measured in degrees:

- | | |
|--|-----------------|
| Spindle support arm straight up and down on the true vertical: | Zero Caster |
| Spindle support arm is tilted forward at the top from true vertical: | Negative Caster |
| Spindle support arm is tilted back at the top from true vertical: | Positive Caster |

A vehicle with Positive Caster is shown in Fig. 15.

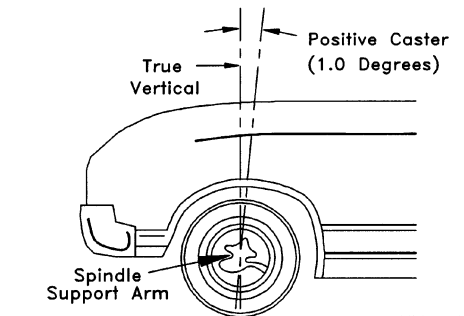


Figure 15

Proceed with the following steps to read Caster:

- 1) With the Electronic Gauge mounted on the left front wheel clamp, turn the left front wheel outward at the front for a 20 degree reading on the radius gauge. (See Fig. 16)
- 2) Turn the Electronic Gauge so it is level.
- 3) Set the selector to CASTER. Press the Zero Button. (See Fig. 17)
- 4) Turn the wheel inward at the front for a 20 degree reading on the radius gauge. This is a total swing of 40 degrees.
- 5) Turn the Electronic Gauge so it is level.
- 6) Read Caster on the Digital Readout Scale (A positive 1.0 is indicated in Fig.18). The numeric reading will be preceded by a + or - to indicate positive or negative Caster.
- 7) Repeat the above procedure on the right front wheel.

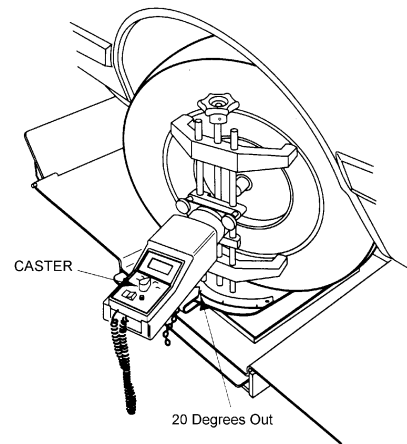


Figure 16

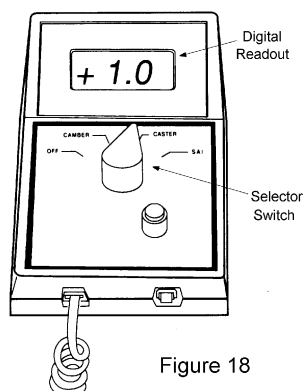


Figure 18

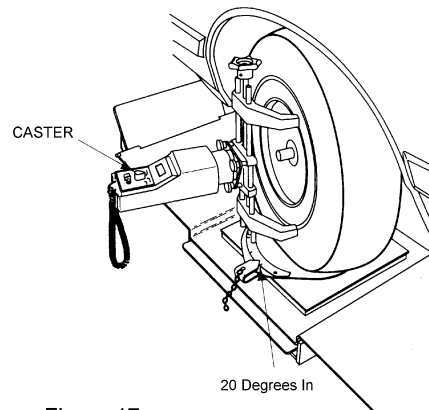


Figure 17

STEERING AXIS INCLINATION (SAI) READING

SAI: The inward tilt of the ball joint or strut at the top

Proceed with the following steps to read SAI:

- 1) With the Electronic Gauge mounted on the left front wheel clamp, turn the left front wheel outward at the front for a 20 degree reading on the radius gauge. (Refer to Fig.19)
- 2) Turn the Electronic Gauge so it is level.
- 3) Set the selector to SAI. Press the Zero Button. (See Fig. 23)
- 4) Turn the wheel inward at the front for a 20 degree reading on the radius gauge. This is a total swing of 40 degrees. (See Fig. 20)
- 5) DO NOT RE-LEVEL THE ELECTRONIC GAUGE.
- 6) Read SAI on the Digital Readout Scale (A positive 14.5 is indicated Fig. 23)
- 7) Repeat the above procedure on the right front wheel.

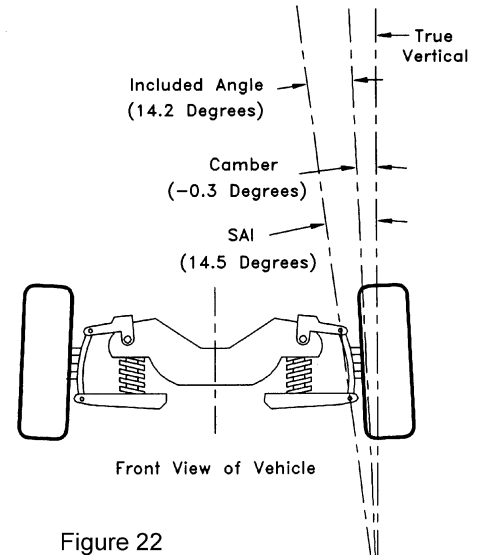


Figure 22

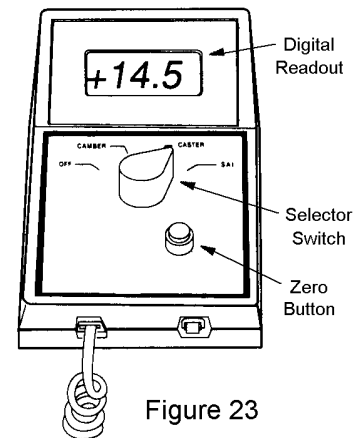


Figure 23

INCLUDED ANGLE

Included Angle: Total of the Camber and SAI Readings

Subtract negative Camber from SAI (as for the above example):

SAI	14.5
Camber	<u>-0.3</u>
Included Angle	14.2

Add positive Camber readings to SAI:

SAI	14.5
Camber	<u>+0.5</u>
Included Angle	15.0

INSTRUMENTATION SET-UP

Center the Steering Wheel:

Center the steering wheel in the straight ahead position and clamp in place with the Steering Wheel Holder. The engine must be running to set the steering wheel position on cars with power steering.

Mount the Left & Right Laser Toe Gauges:

- 1) Determine the manufacturer's preferred total toe specification for the front wheels. Rotate the tapered magnet on each Laser Toe Gauge to **one-half** this specified value. (See Fig. 27)

EXAMPLE: The manufacturer's preferred total toe specification is 0.08 inches Toe In. Rotate both of the tapered magnets to one-half this value which is 0.04 inches.

- 2) Mount the Laser Toe Gauges to the Wheel Clamps. Center the magnet on the Wheel Runout Compensating Adapter. Connect the safety strap to the Wheel Clamp for extra protection against damage. (See Fig. 28)
- 3) Level the Laser Toe Gauges using the spirit level located on the top. This is not critical (Refer to Calibration, Page 28).
- 4) Flip the power switch to ON and open the protective covers on the laser beams.

Mount the Rear Retro-screens:

- 1) Determine the manufacturer's preferred total toe specification for the rear wheels. Rotate the tapered magnet on each of the Rear Retro-screens to **one-half** this specified value. (See Fig. 27)
- 2) Mount the left and right Rear Retro-screens to the Wheel Clamps. Center the magnet on the Wheel Runout Compensating Adapter. Connect the safety strap to the Wheel Clamp for extra protection against damage.

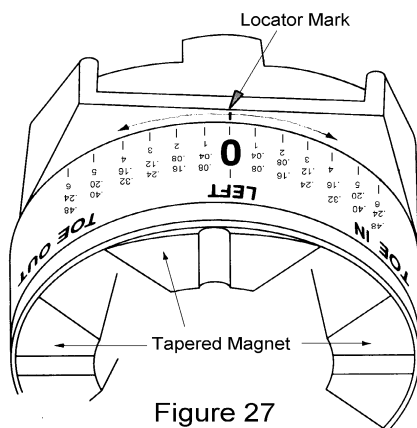


Figure 27

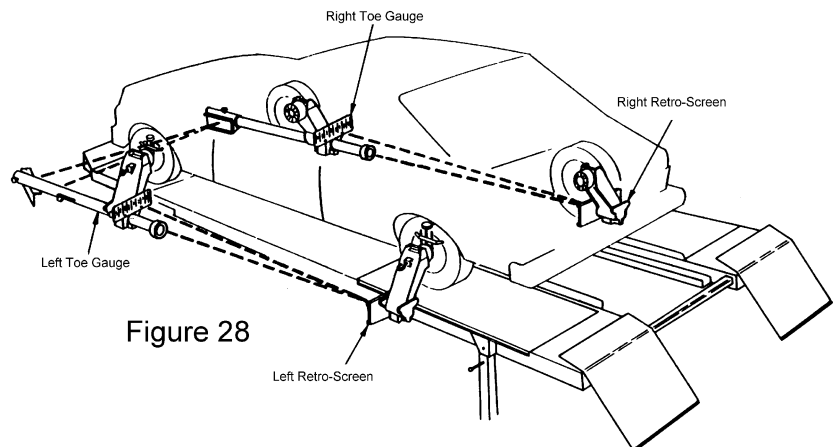


Figure 28

FRONT WHEEL TOE READING

Toe: *The difference in distance between the front and rear of the front wheels*

Toe-in: Distance between front of wheels is less than distance between rear of wheels

Toe-out: Distance between front of wheels is greater than distance between rear of wheels

Adjust Laser Beam Mirror & Target:

The Left Laser Toe Gauge projects a laser beam onto the right mirror (A). This beam is reflected back to the graduated toe scale on the Left Laser Toe Gauge. (See Fig. 29)

Adjust the laser beam vertically to the center of the mirror (A) by using the knob (E) on the Left Laser Toe Gauge. Rotate the laser beam assembly inside the tube of the Left Laser Toe Gauge. Re-tighten knob.

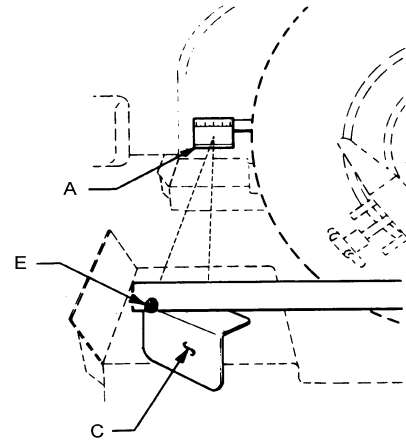


Figure 29

If the laser beam, reflected back from the mirror (A), doesn't strike the graduated toe scale, loosen both knobs (R) on the Right Laser Toe Gauge (See Fig. 30). Rotate the mirror housing (A) until the laser beam image strikes the graduated toe scale. Re-tighten both knobs.

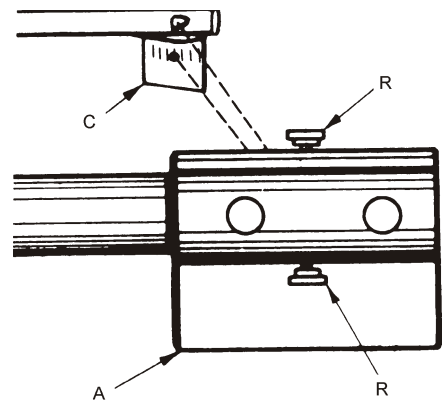


Figure 30

Reading Front Wheel Toe:

Read Front Wheel Toe on the graduated toe scale on the Left Laser Toe Gauge. (See Fig. 31)

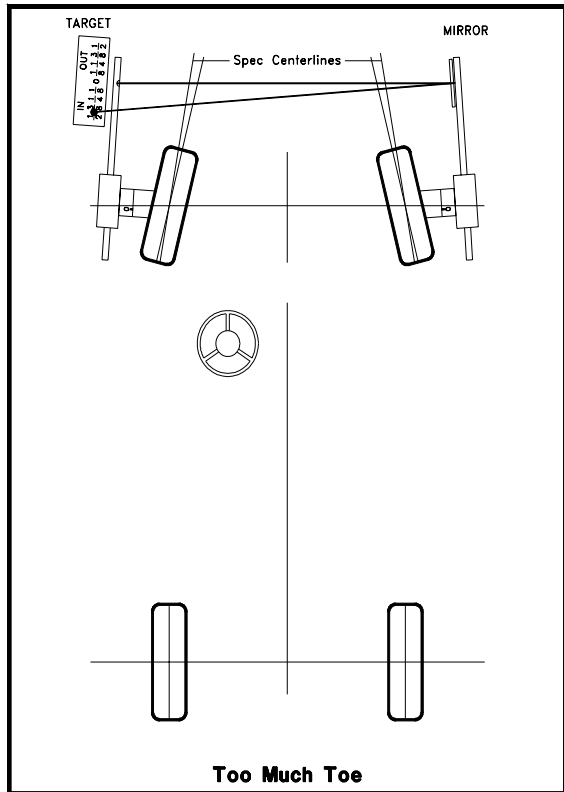
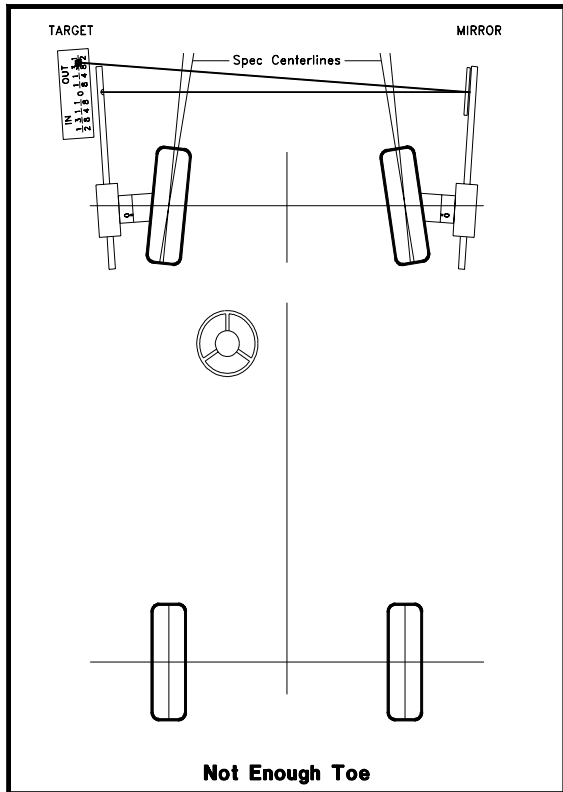
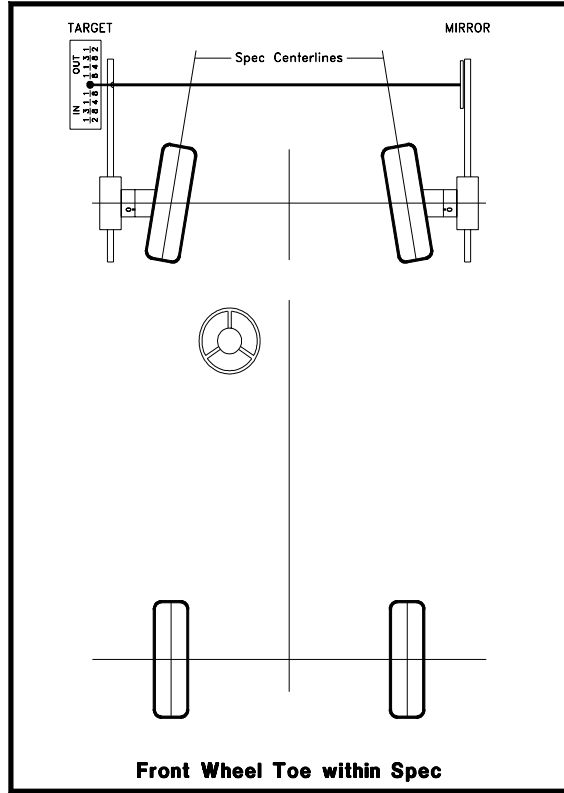
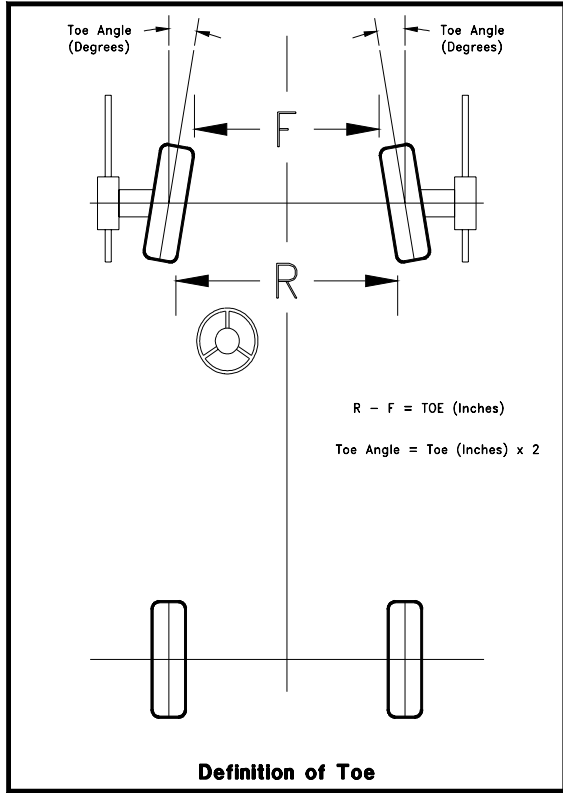
Toe is within spec if the laser beam image is in the center of the scale at zero.

IN			TOTAL TOE					OUT				
.48	.40	.32	.24	.16	.08	0	.08	.16	.24	.32	.40	.48
DEGREES												
INCHES												
MM												
6	5	4	3	2	1	0	1	2	3	4	5	6

Figure 31

One-half of the manufacturer's total toe specification is already dialed in with each of the magnets, so a reading of zero on these scales means the toe is correctly adjusted to the manufacturer's specification.

TOE READING ILLUSTRATIONS



FRONT WHEEL ALIGNMENT VEHICLE CENTERLINE

- 1) Project the laser beams from the Left and Right Toe Gauges onto the Rear Retro-screens. If the beam does not strike the rear mirror, check the level of the Laser Toe Gauge. (See Fig. 32)
- 2) Note the readings on the scales of the rear screens. Add both readings and divide by two.
- 3) Adjust both tie rods or tie rod adjusting sleeves equally so that the rear screens register the desired reading determined in Step 2.

EXAMPLE:

One rear wheel screen registers 5 (See Fig. 33) and the other one registers 7 (See Fig. 34), the total is 12.

Divide by 2 and adjust both tie rods equally until the laser beam falls on 6 on each retro screen.

- 4) Re-check front wheel toe to be sure it remains on zero. If not, re-adjust front wheel toe to zero. Re-check the rear retro-screens for equal readings.

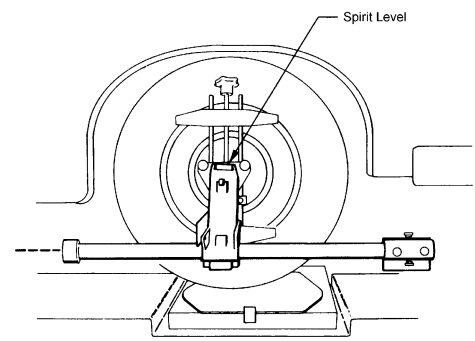


Figure 32

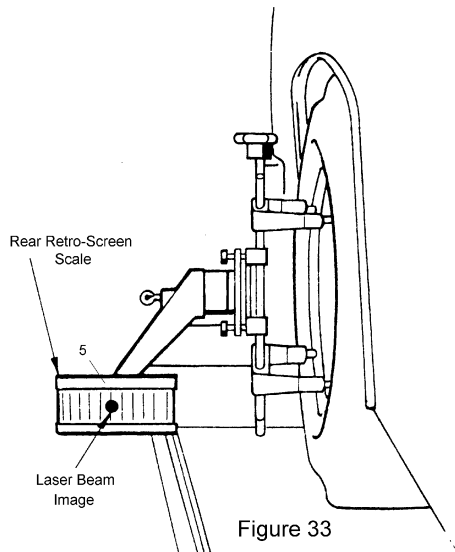


Figure 33

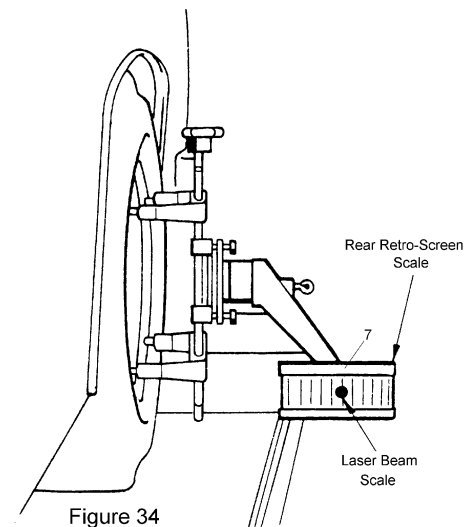
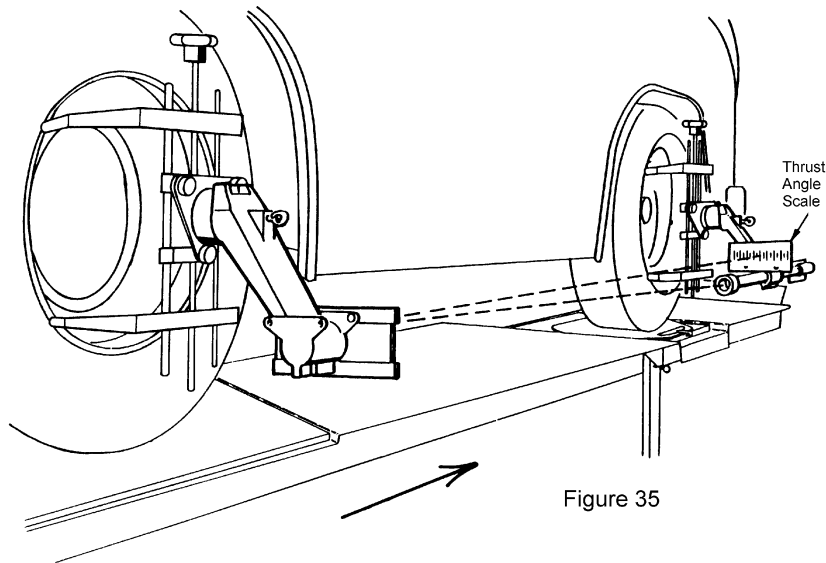


Figure 34

This is a "Two Wheel Alignment"

THRUST ANGLE ALIGNMENT



- 1) Check that both Laser Toe Gauges are level. The laser beams should be visible on the rear Retro-screen mirrors (See Fig. 35).
- 2) Rotate the rear Retro-screen assemblies out of level, if necessary, so that the laser beams will be reflected back to the front Toe Gauges and be visible on the Thrust Angle Scales.
- 3) Note the readings on the Thrust Angle Scales. Add both readings and divide by two.
- 4) Adjust both tie rods or tie rod adjusting sleeves equally so that the Thrust Angle Scales register the desired reading determined in Step 3.

EXAMPLE:

One Thrust Angle Scale registers 4 (See Fig. 36) and the other one registers 6 (See Fig. 37), the total is 10.

Divide by 2 and adjust both tie rods equally until the laser beam falls on 5 on each Thrust Angle Scale.

Right Rear Thrust Angle Scale

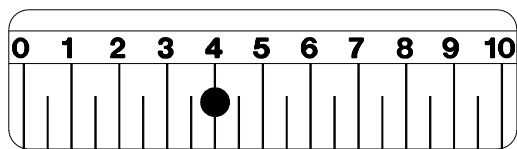


Figure 36

Left Rear Thrust Angle Scale

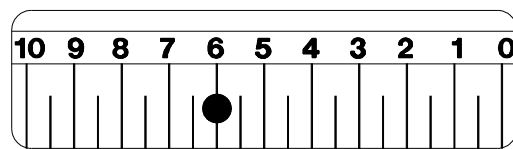


Figure 37

This is a Thrust Angle Alignment where the front wheel position is corrected for rear wheel misalignment.

TOTAL VEHICLE FOUR-WHEEL ALIGNMENT _____

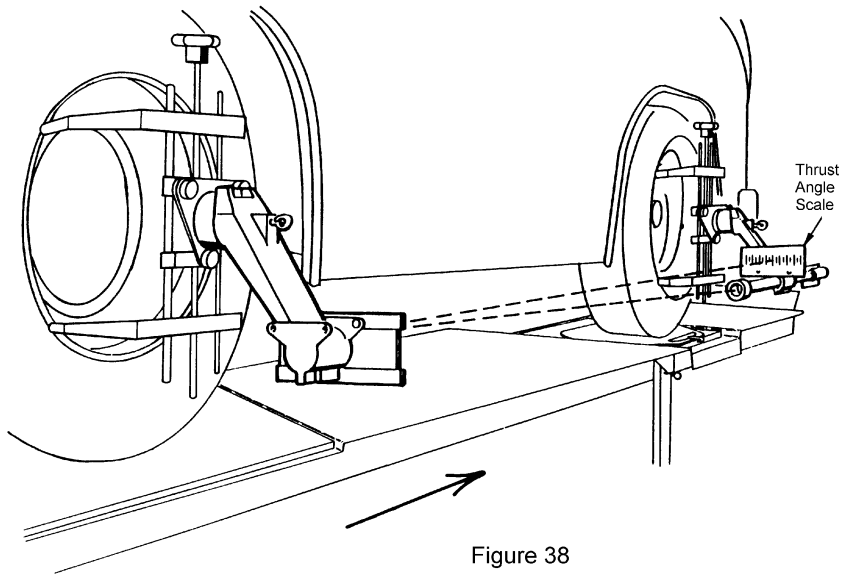


Figure 38

- 1) Check that both Laser Toe Gauges are level. The laser beams should be visible on the rear Retro-screen mirrors.
- 2) Rotate the rear Retro-screen assemblies out of level if necessary, so that the laser beams will be reflected back to the front Toe Gauges and be visible on the Thrust Angle Scales.
- 3) Note the reading on each of the Thrust Angle Scales. Adjust the toe of each rear wheel until the laser beam image on the corresponding Thrust Angle Scale is in the middle at the number 5.

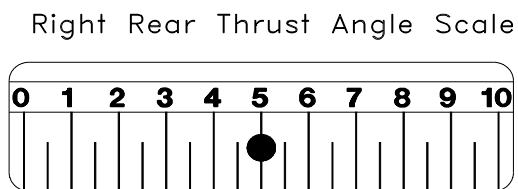


Figure 39

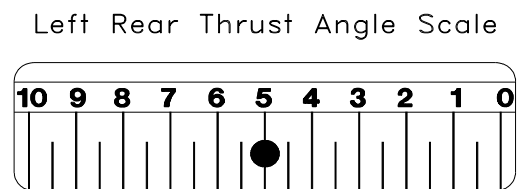


Figure 40

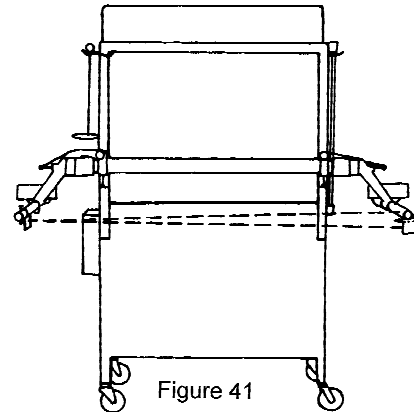
This completes a four-wheel alignment.

CALIBRATION PROCEDURE

Mount and level the Calibration Bar on Calibration Stands or the rear of the Storage Cart

Calibration of Front Wheel Toe Laser Beam (See Figure 42)

- 1) Rotate the tapered magnets on the Left and Right Toe Gauges to zero.
- 2) Mount the Left and Right Toe Gauges on the ends of the Calibration Bar. Be sure the centers of the magnets fit over the raised machined surfaces at the ends of the Calibration bar.

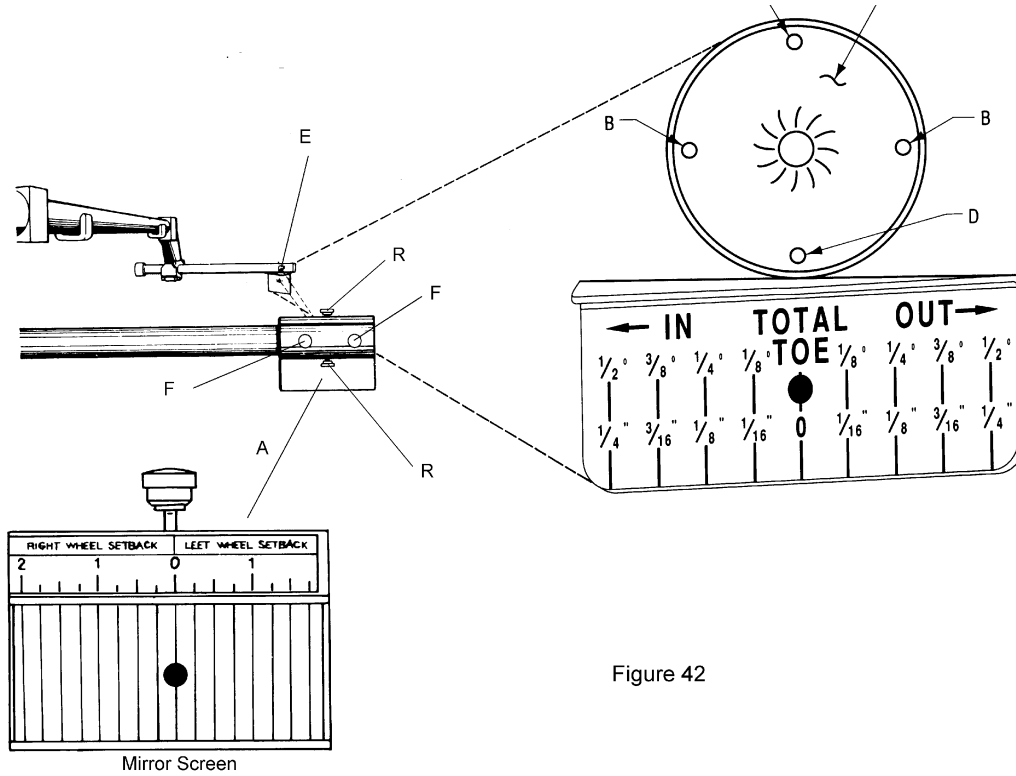


- 3) Level both Toe Gauges and check the laser beam on the mirror screen (A). If the laser beam image is not located midway up on the mirror screen (A), loosen the knob (E) on the Left Toe Gauge and slide it up or down. This moves the laser beam image vertically until it is on the mirror.
- 4) The center of the laser beam image should be on zero on the screen (A). If not, alternately adjust Allen set screws of the laser diode bulb retainer on the Left Toe Gauge until the center of the beam image reads zero on the Right Toe Gauge screen (A).

There are four Allen set screws on the laser diode retainer. The top and bottom set screws (D) control the vertical movement of the beam image. The left and right screws (B) control side-to-side movement of the beam image.

- 5) Adjust the mirror (A) up or down as required so the reflected laser beam image is on the front toe scale. Loosen knobs (R) to make any required adjustments.
- 6) Adjust Allen set screws (F) until the center of the laser beam image reads zero on the front toe scale (C).

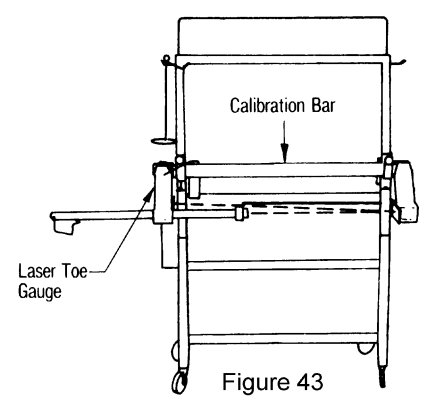
CALIBRATION PROCEDURE



The Gauges are now parallel - "Toe reads zero"

Calibration of Right & Left Toe Gauge Laser Beams

- 1) Rotate all tapered magnets on the Toe Gauges and Rear Retro-screens to zero
- 2) Mount the Left Toe Gauge and Left Retro-screen to the machined surfaces on the side of the Calibration Bar.



CALIBRATION PROCEDURE

Calibration of Right & Left Toe Gauge Laser Beams (continued)

- 3) Level the Toe Gauge and project the laser beam image on the rear Retro-screen. (See Figure 44) The center of the beam image must be on 6 and **midway up** the mirror. If not, alternately loosen and tighten Allen set screws on the laser diode retainer.

There are four Allen set screws on the laser diode retainer. (See Figure 45) The top and bottom set screws (D) control the vertical movement of the beam image. The left and right screws (B) control side-to-side movement of the beam image.

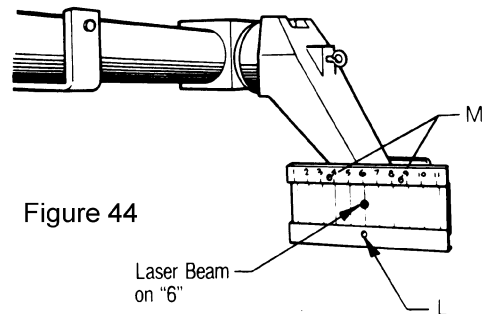


Figure 44

If a problem is encountered while doing an alignment where the laser beam will not hit the front target, recheck this step to be sure the beam is midway up on the mirror with the Toe gauge level (bubble centered in Spirit Level).

- 4) Check the location of the reflected laser beam image on the Thrust Angle Scale on the Laser Toe gauge.

With the Rear-retro Screen level, the center of the image should be mid-way up and on 5 on the Thrust Angle Scale.

If not, adjust the two screws (M) (See Fig. 44) until the image is on 5 and adjust screw (L) until the image is mid-way up on the Thrust Angle Scale.

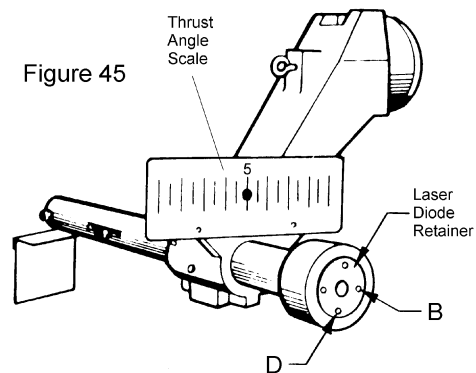


Figure 45

- 5) Remove the Left Toe Gauge and Left Retro-screen. Mount the Right Toe Gauge and Right Retro-screen and repeat steps 1 through 4.

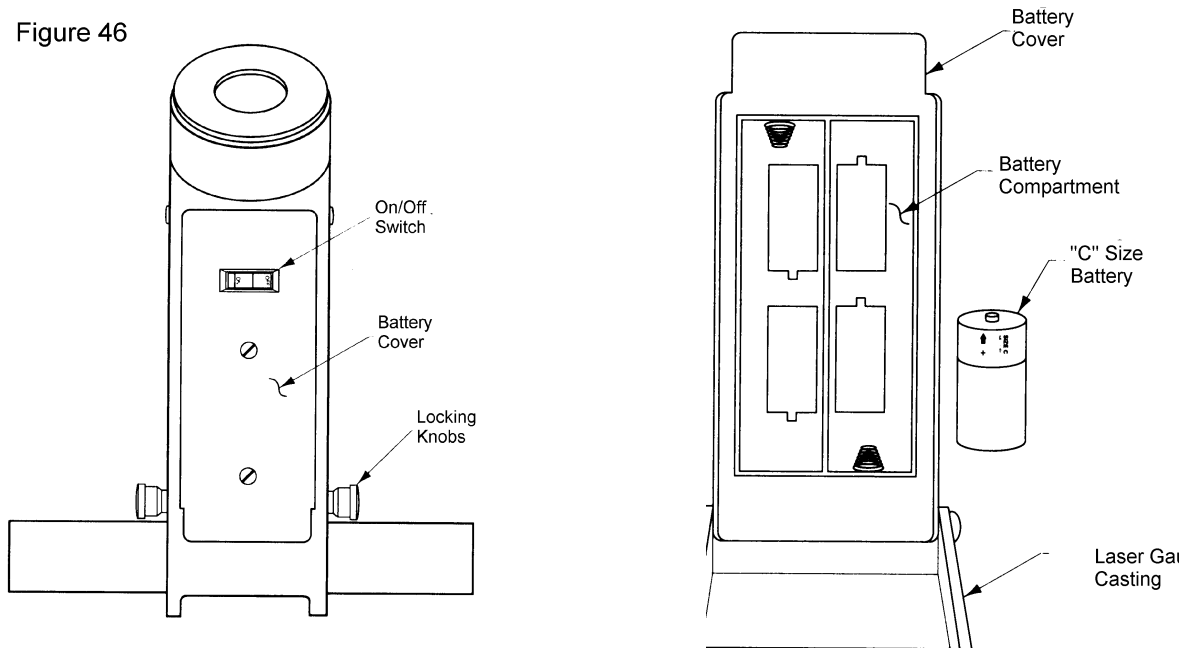
The Retro-screen is now at a perfect 90 degree angle to the front Toe Gauge and the laser beam image indicates zero toe on the Thrust Angle Screen.

BATTERY REPLACEMENT

The Laser 4 is powered by eight “C” batteries; four batteries located in each Toe Gauge. Alkaline batteries are recommended for extended life.

The batteries should be replaced when the laser beam image becomes dim or can no longer be seen.

Figure 46



Laser Toe Gauge Battery Replacement (See Figure 46):

- 1) Flip the Laser Toe Gauge switch to OFF.
- 2) Place the Laser Toe Gauge on a workbench with the underside of the casting facing up.
- 3) Loosen the battery cover locking knobs and open the cover.
- 4) Replace the batteries following the diagram in the battery holder. Flip the switch to ON to be sure the laser diode operates. Flip the switch to OFF.
- 5) Close the cover and secure with the battery cover locking knobs.

Readout Battery Replacement:

Replace the Readout battery (9 volt) by removing the plastic battery compartment cover on the rear.