EQUIPMENT SERVICE ON SITE

EquiServ®

Providing Factory Service For Automotive Service Equipment

WHEEL ALIGNER

EEWA533A, EEWA532A
EEWA531A

Service Manual

SEPTEMBER 2003

Table of Contents

INTRODUCTION

GENERAL I
ALIGNMENT FUNCTIONS I
PREFERENCE FUNCTIONS II
MAINTENANCE FUNCTIONS 3.1 SOFTWARE III
MAINTENANCE MENU 3.2 SOFTWARE IV
SOFTWARE FEATURES V
IMPORTANT SAFETY INSTRUCTIONS VI
LOCKOUT AND/OR TAGOUT SYSTEM PROCEDURE VII
ELECTRICAL SAFETY PRECAUTIONS VII
HANDLING STATIC SENSITIVE PCB'S VIII
SERVICE GUIDELINES VIII

CHAPTER 1 AC/DC POWER DISTRIBUTION

AC THEORY OF OPERATION 1-1
- AC DISTRIBUTION 1-1

D.C.THEORY OF OPERATION 1-1
- POWER SUPPLY BOX 1-1
- IVS PROCESSOR BOARD 1-1
- CAMERA CONTROLLER BOARD 1-1
- LED BOARD 1-2
- CCD CAMERA 1-2
- CAMERA POD ASSEMBLY 1-2
- CAMERA INTERFACE TEST POINTS 1-2
- IVS TEST POINTS 1-3
- IVS POWER SUPPLY 1-3
- IVS BLOCK DIAGRAM 1-5
- HIB BLOCK DIAGRAM 1-7

CHAPTER 2 THEORY OF OPERATION

GENERAL 2-1
- CAMERAS 2-1
- TARGETS 2-3
- TARGET ACQUISTION 2-4
- IVS PROCESSOR (INTEGRATED VISION SYSTEM) 2-4

3D VISION THEORY 2-5
- PERSPECTIVE 2-5
- FORESHORTENING 2-7
- THE CIRCLE 2-8
- POSITIONING SEQUENCE 2-10
- SIDE-TO-SIDE DETERMINATION 2-11
- RELATIVE CAMERA POSITIONING (RCP) 2-12
- THE FIXTURE 2-12
- MODELING THE VEHICLE IN 3-DIMENSIONAL SPACE 2-15
- MEASURING STEERING ANGLES 2-15

CHAPTER 3 CHECKOUT, CALIBRATION AND MAINTENANCE

TROUBLESHOOTING THE IVS SYSTEM 3-1
GUIDELINES 3-1
PC ACCESS 3-2
BACK PANEL 3-3
PC HOOKUP 3-3
ALIGNMENT SOFTWARE INSTALLATION 3-4
SPECIFICATION INSTALLATION 3-8
PLATINUM SOFTWARE INSTALLATION 3-12
VOICEALIGN™ SOFTWARE INSTALLATION 3-14
ADDING HYPER TERMINAL TO THE DESKTOP 3-16
MAINTENANCE MENU 3.1 SOFTWARE 3-17
CAMERA VIEW 3-18
TARGET ID 3-19
WINDOWS UTILITIES 3-23
COVERING THE BASICS 3-24
IVS PROCESSOR BOARD 3-25
POST (POWER ON SELF TEST) 3-26
SUCCESSFUL POST VERIFICATION 3-27
RUNNING HYPERTERMINAL 3-28
GOOD “POST” TEST USING HYPERTERMINAL 3-30
FAILED “POST” TEST USING HYPERTERMINAL 3-31
CHANNEL DIAGNOSIS 3-32
POST TEST LED’S 3-34
CSR PREFERENCES 3-35
TID PREFERENCES 3-35
STEPS FOR CHANGING PREFERENCES 3-36
IVS UTILITIES - THRU REVISION 3.1 SOFTWARE 3-38
CAMERA TEST 3-39
CAMERA AIMING 3-42
TOOLS REQUIRED 3-42
CAMERA AIMING PROCESS 3-43
RELATIVE CAMERA POSITIONING (RCP) 3-47
RCP NOTES 3-51
RCP CHECK 3-52
HUB CAMERA TEST 3-54
COPROCESSOR HIGH TEST 3-57
TARGET CHECK 3-59
HMAIN.TXT 3.1 SOFTWARE 3-61
MODIFYING THE HMAIN.CMD / HMAINARAGO.CMD FILE 3-63
MAINTENANCE MENU SOFTWARE 3-73
CALIBRATION 3-74
TID 3-75
CAMERA POD ROTATION 3-76
ACTIVATE AND CALIBRATE THE RIDE HEIGHT MEASURING DEVICE 3-77
CALIBRATION AND PREFERENCE BACKUP 3-79
DIAGNOSTICS 3.2 SOFTWARE 3-80
CAMERA TEST 3-81

3.3 OR GREATER DIAGNOSTIC SOFTWARE 3-84
CAMERA VIEW (3.3 OR GREATER) 3-85
DATA EXAMINATION MODE (3.3 OR GREATER) 3-86
CODES LIKELY TO APPEAR ON AN DATA EXAMINATION SCREEN 3-87
VIEW POST RESULTS (3.3 OR GREATER) 3-88
COMBINED DIAGNOSTICS (3.3 OR GREATER) 3-89
IVS PROCESSING TEST (3.3 OR GREATER) 3-89
CAMERA TEST (3.3 OR GREATER) 3-89
IVS A/D CONVERTER TEST (3.3 OR GREATER) 3-92
TARGET CHECK (3.3 OR GREATER) 3-92
RACK CHECK (3.3 OR GREATER) 3-93
STORED DATA VIEWING TOOLS 3-94
STORED IMAGE ANALYSIS (3.3) 3-94
STORED DIAGNOSTIC FILE ANALYSIS (3.3 OR GREATER) 3-95
EXPORT DIAGNOSTIC FILES (3.3 OR GREATER) 3-97
OTHER DIAGNOSTIC IMPROVEMENTS 3-98
RCP CHECK (3.3 OR GREATER) 3-98
ACQUISITION SCREEN LOST TARGET HELP ICONS 3-98

CHAPTER 4 SECURITY

GENERAL 4-1
SECURITY KEY DISK 4-1
BRAND SPECIFIC 4-1
SPECIFICATIONS 4-1
SOFTWARE FEATURES 4-1
HIB 4-2
IVS 4-2
HIB REPLACEMENT 4-3
IVS REPLACEMENT 4-4

CHAPTER 5 ARAGO 3™

GENERAL 5-1
COMPONENT IDENTIFICATION 5-2
IVS PROCESSOR REPLACEMENT 5-3
POWER SUPPLY REPLACEMENT 5-5
CAMERA REPLACEMENT 5-6
LEFT CAMERA REPLACEMENT 5-6
RIGHT CAMERA REPLACEMENT 5-7
CALIBRATE POD MOTORS 5-8
CAMERA AIM PROCEDURES - VERTICAL / HORIZONTAL ADJUSTMENT 5-9
CAMERA POD ROTATION 5-10
COMMON POD 5-12

APPENDIX A INSTALLATION INSTRUCTIONS

GENERAL A-1

INTRODUCTION

GENERAL

The 3D Image Aligner is a revolutionary concept in performing wheel alignments. The system uses a camera based machine vision technology that provides many benefits to the shop owner and alignment technicians. It is the fastest, most accurate, and easiest to use aligner ever made. One of the benefits of new technologies is the use of state-of-the-art components and computer programming that makes the task of servicing this product easier than previous generations of alignment equipment. One of the most obvious differences is the lack of an electronic measuring head, the source of many of the failures and inaccuracies on conventional products.

The “eyes” of the vision-based 3D Aligner are the two cameras mounted on either end of a camera beam. The cameras are high-resolution CCD video type operating in gray-scale, similar to those used in security and surveillance applications. The proprietary design lens is for this usage, and is permanently mounted to the camera and triple-sealed for protection. The camera also has a band-pass filter, limiting the spectrum of light that can enter the lens. With any camera there is an optical “field of view” that is a characteristic of the lens design. Anyone who has used a camera or single lens telescope knows that what you see is what you get no more, no less. The cameras on the 3D Aligner are no different.

This unit incorporates many security features that totally eliminates unauthorized use of the software. The loading of each piece of software requires that a key disk be installed to load the software. Once the software has been successfully loaded the unit disables the “Key Disk” leaving them useless on other units. The unit transfers the information from the “Key Disk” to the HIB or IVS PCB that in turn transfers it to the hard drive. This information is stored in both locations. If for any reason the unit requires that the software be reloaded, it uses the information from the HIB or IVS that was taken from the “Key Disk” on the initial loading process.

ALIGNMENT FUNCTIONS

The main menu of the aligner is the control center for the unit. (Figure I-1) It offers the operator easy control of the basic alignment features. Moving the mouse pointer over the icon gives the operator a short description of the icon function. See the operators manual for a more detailed list and description of the many features and functions of the aligner.

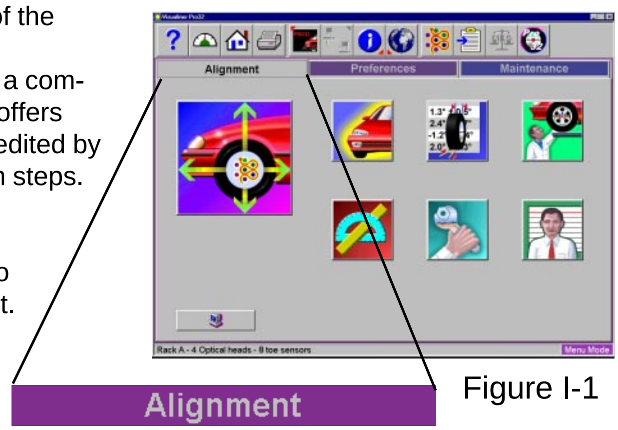
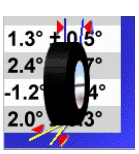


Figure I-1

Run Wizard - Steps the operator through a complete alignment. The alignment machine offers many factory default wizards that can be edited by the operator to either add or delete certain steps.

Vehicle Selection - Allows the operator to select a particular vehicle for an alignment. This selection can be made at any point in the alignment by clicking on the “Home” icon and selecting the “Vehicle Selection” icon.



Vehicle Specification - Allows the operator to view the specifications for the vehicle chosen from the vehicle selection icon. The operator has the ability to edit the specifications and save the edit specification to a custom specification database.

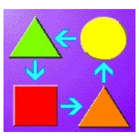
Inspection - Offers a variety of inspection menu allowing the operator to perform predetermined inspections. Six Inspection screen are available under Inspections as well as a Diagnostics icon. These are Pre-Alignment Inspection, Tire Inspection, Brake Inspection, Under Car Inspection, Under Hood Inspection, and Courtesy Inspection.

Measurement - Offers quick access to several angular measurement screens such as Caster, SAI, Steering Angles, and Vehicle Dimensions.

Adjustment - Offers access to a variety of features that assist the technician with adjustment of alignment angles. Some of these features include Live Caster, A-Arm Adjust, Rear Shim Programs, and Cradle Adjust.

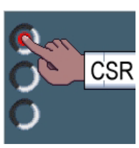
Customer Data - Offers the operator easy control for finding, adding or editing any customer data that has been previously saved from past alignments. Information can then be retrieved and sorted through a myriad of different options.

PREFERENCE FUNCTIONS



User Interaction - Gives the operator control of “Features”, “Displays”, “User Login” and “Security.

Units of Measure - Allows the operator to control the way the unit displays alignment measurements.



CSR Preferences - This is a secure location for tenical personnel only. Allows a field technician to overide any security that may have been entered by the operator.

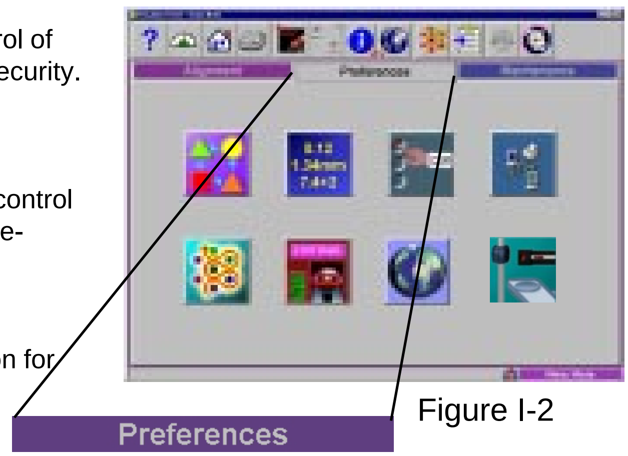
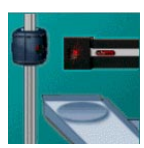
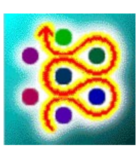


Figure I-2

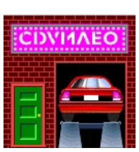
Connectivy - Protocall options for various alignment options.



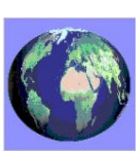
System Configuration - Select either two or three camera system.



Select Wizard - Allows the operator to select any default alignment wizard or access to customize wizards to meet their specific alignment option needs.



Store Name - Allows the operator to input specific store information to be used on printouts.



Regional Settings - Allows the operator to choose screen language and an alternate language (if installed). Also allows access to different spec databases.

MAINTENANCE FUNCTIONS 3.1 SOFTWARE

The aligner offers many diagnostic tools to assist in troubleshooting. The maintenance menu is accessed from the “Main Menu” screen by clicking on the “Maintenance” tab. (Figure I-3)

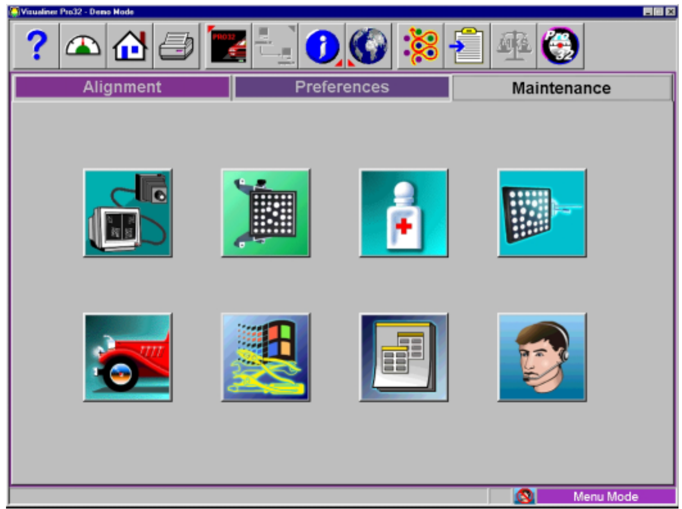


Figure I-3

Camera View - Quick access to viewing the cameras field of view.

TID - Utility used to ID targets using conventional wheel clamps.

Preventive Maintenance - Access to “Weekly, “Monthly” and the History of Maintenance performed on the aligner.

TID Hub Pin Clamp - Utility used to ID targets using the “Hub Pin Clam” wheel clamp. (Must have Hub Pin Clamp available checked under the “Preferences” “User Interaction” menu).

Demo Mode - Utility used by Sales Personnel to demonstrate the operation and features of the aligner.

Windows Utilities - Access to various Windows Utilities including “Software and Specification installation and web access.

Database Utilities - Allows the operator to backup and restore customer installation to floppy disketts.

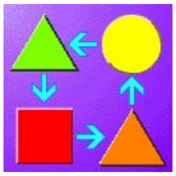
Speaker Training - Allows the operator to verbally train the alignment unit to excecute alignment commands based on voice control. (Available on Platinum software only)

More of these features and tools are explained later in this Manual.

MAINTENANCE MENU 3.2 SOFTWARE

General Maintenance for the Pro32 IVS system is performed using this Maintenance Menu. (Figure I-4) Many of the features used in 3.2 software are explained in the 3.1 software section found in Chapter 3. The features and icons in 3.1 software have moved into different sections of this software.

Figure I-4



Calibration - Software used to perform several calibration procedures including TID, Camera Aim, Hub Pin ID, RCP, and RCP Check.

Diagnostic - Several diagnostic procedures used to troubleshoot different parts of the system including Camera View, Camera Check, IVS Processing Test and Target Check.

Preventative Maintenance – Software feature that guides the equipment operator through recommended periodic aligner maintenance. (See Operators Manual for details)

Demo Mode - A program used primarily by sales representatives and training personnel. This is program that demonstrates the capabilities of the aligner software without actually having a vehicle available. It is a useful tool for training new or experienced users about machine features. (See Operators Manual for details)

Windows Utilities – Allows access to the Windows Desktop and also allows the operator to perform routine installation of printers, software, etc. See 3.1 software "Windows Utilities" for details.

Database Utilities – The feature is used for backing up and restoring alignment based data files, customer data, etc. (See Operators Manual for details)

Speaker Training – Optional Hardware / Software package that allows and end-user to control the aligner through voice commands. (See Operators Manual for details)

SOFTWARE FEATURES

- Multiple beam capability added for 3D imaging system.
- Support for new CCD conventional sensors. (Old Conventional Sensors are not supported).
- Support for USB HIB.
- Advanced vehicle dimensions. (3D - Platinum)
- Tire diameter calculation display. (3D - Platinum)
- Ride Height Charting. (Platinum)
- Voice driven alignment. (Platinum)
- Feature security added via key disks and option codes. The Platinum features are:
    - Voice Driven Alignment.
    - V3D Advanced Vehicle Dimension.
    - V3D Tire Diameter Calculation and Display.
    - Customer Data.
    - Shop Management Integration.
    - Ride Height Charting.
    - OEM Options.
- Vehicle specification security added via key disks.
- On-line specification security.
- Branding via key disks.
- Added customer database backup and restore.
- Added capability for non-desktop mode window's alignment.
- Conventional demo mode no longer requires an HIB.
- Customer records are not saved if customer information is not entered.
- Shop management controls are upgraded.
- Individual wheel rollback optimisations.
- Improved printouts.
- Diagnostic printout via <Ctrl><Alt>D.
- Integrated Cold Weather Adjustment. (3D only)

IMPORTANT SAFETY INSTRUCTIONS

When using this equipment, basic safety precautions should always be followed, including the following:

1. **Read all instructions.**
2. **Do not operate equipment with a damaged power cord or if the equipment has been damaged until it has been examined by a qualified authorized service technician.**
3. **If an extension cord is used, a cord with a current rating equal to or more than that of the machine should be used. Cords rated for less current than the equipment may overheat. Care should be taken to arrange the cord so that it will not be tripped over or pulled.**
4. **Always unplug equipment from electrical outlet when not in use. Never use the cord to pull the plug from the outlet. Grasp plug and pull to disconnect.**
5. **To reduce the risk of fire, do not operate equipment in the vicinity of open containers of flammable liquids (gasoline).**
6. **Keep hair, loose fitting clothing, fingers and all parts of the body away from moving parts.**
7. **Adequate ventilation should be provided when working on operating internal combustion engines.**
8. **To reduce the risk of electric shock, do not use on wet surfaces or expose to rain.**
9. **Do not hammer on or hit any part of the control panel with weight pliers.**
10. **Do not allow unauthorized personnel to operate the equipment.**
11. **Use only as described in this manual. Use only manufacturer's recommended attachments.**
12. **Always securely tighten the wing nut before spinning the shaft.**
13. **ALWAYS WEAR SAFETY GLASSES. Everyday eyeglasses only have impact resistant lenses, they are NOT safety glasses.**
14. **Balancer is for indoor use only.**

SAVE THESE INSTRUCTIONS

LOCKOUT AND/OR TAGOUT SYSTEM PROCEDURE

1. Notify all affected employees that a lockout or tagout system is going to be utilized and the reason thereof. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilized and shall understand the hazards thereof.

2. If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open toggle switch, etc.)

3. Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc.

4. Lockout and/or tagout the energy isolating devices with individual lock(s) or tag(s).

5. After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate. ***CAUTION: RETURN OPERATING CONTROL(S) TO "NEUTRAL" OR "OFF" POSITION AFTER THE TEST [DE-ENERGIZED STATE].***

6. The equipment is now locked out or tagged out.

ELECTRICAL SAFETY PRECAUTIONS

Make sure the aligner is unplugged before disconnecting any wires in preparation for replacing any boards, cables or other items within the unit. Use the *"Lockout and/or Tagout"* procedure.

When working on this aligner, keep three points in mind:

CAUTION!

THIS UNIT MUST BE PLUGGED IN TO A PROPER AC OUTLET FOR THE UNIT TO OPERATE CORRECTLY. REFER TO THE UNIT ID PLATE LOCATED ON THE BACK OF THE UNIT. EXTENSION CORDS ARE NOT RECOMMENDED, BUT IF AN EXTENSION CORD MUST BE USED, USE A CORD THAT IS LESS THAN 50 FEET WITH A 16 AWG, OR ABOVE 50 FEET AND LESS THAN 100 WITH A 14 AWG.

1 Aligner voltages refer to the "return" (white) side of the AC line. Yet sometimes outlet wiring is reversed. In that case, electrical neutral connects to the "hot" side of the line. The aligner operates normally, but the PC board floats 110 VAC above safety ground. **Assume that points inside the aligner console are at 110VAC**; observe all safety precautions. If you make measurements with grounded test equipment, use an isolation transformer. An oscilloscope is an example of such test equipment.

2 The aligner is susceptible to power line spikes and noise. **You must connect the equipment to safety ground**. Does your machine do "strange things" or exhibit intermittent problems? Check for a proper ground at the machine and the power outlet. If you're using an extension cord, check that, too. It must be constructed of at least 16 gauge wire and under 50 feet long.

3 Schematic voltages refer to the "return" side of the line, not safety ground. When measuring voltage, use the white wire on the line power terminal block as ground. Don't use the third, center safety ground terminal. Another place to access ground is at the shield. The black wire in the shielded transducer cables also connects to the ground return.

HANDLING STATIC SENSITIVE PCB'S

Electrostatic discharge can destroy high impedance ICs if uncontrolled. Use the following techniques to avoid damaging ICs:

- Leave new circuit boards in their antistatic bags until ready for use.
- When replacing boards, proms, etc. be sure to turn off power to the machine first
- Use an anti-static wrist strap. Connect it to chassis ground on the equipment or to an available raw ground.
- Touch the chassis of the equipment to put yourself at the same static potential as the equipment.
- Grasp the PCB from opposite sides using your fingertips. Do not grasp the components on the board.

⚠ WARNING!

USE STANDARD ANT-STATIC PROCEDURES WHILE PERFORMING THESE INSTRUCTIONS

When inserting PCB's:

- Place boards on a grounded static mat after removal.
- Remove the new PCB from the original package onto a grounded static mat. Save packaging to use when returning defective boards.
- Remove power from the machine (un-plug from wall) before installing the PCB.
- Avoid handling components needlessly.
- Do not set PCBs on insulating surfaces such as paper, glass, rubber, or plastic.
- Static is generated by friction. The following actions promote static generation:
- Wearing silk or nylon clothing.
- Walking on carpets.
- Walking with rubber soled shoes.

Static generation is increased when certain environmental conditions exist. Conditions of low humidity combined with wearing silks or nylons, walking on carpets, or walking with rubber soled shoes may create large electrostatic charges on your person, capable of blowing a hole in the substrate of an IC.

SERVICE GUIDELINES

- **BEFORE REPLACING** circuit boards, verify that the main power supply operates within specifications.
- **VERIFY** that board connectors are fully seated.
- **NEVER** remove boards or disconnect a connector with the power on!
- **MAKE SURE** that you completely understand what the aligner does. *(If it works, you can't fix it!)* Refer to the *Aligner Operator's Manual*, application notes, and flow diagrams.
- **BE CAREFUL** when handling circuit boards! Wear an anti-static wrist strap.
- **WHEN TRANSPORTING** circuit boards, use anti-static bags.

NOTE: RELATIVE HUMIDITY HAS A DIRECT EFFECT ON STATIC CHARGE BUILDUP. AS HUMIDITY DECREASES, STATIC BUILDUP USUALLY INCREASES.

CHAPTER 1
AC/DC POWER DISTRIBUTION

AC THEORY OF OPERATION

⚠ WARNING!

DANGEROUS HIGH VOLTAGES
ARE PRESENT IN THIS EQUIPMENT

Always use "one hand rule" when working with AC voltages by keeping one hand in your pocket or behind your back. Before removing any wires on the equipment, always verify that the equipment is turn **"OFF"**. Turn off the Main Power switch in the back of the unit and unplug the AC power cord from the AC outlet.

AC DISTRIBUTION

Alignment Console and Camera Power Supply primary voltage is 110VAC, 60Hz via the hot side (black wire) of the AC power cord. On the Alignment console the power comes to a power strip then is distributed to the Monitor, Printer, USB HIB Box and if so equip the battery charger for voice control module.
For the camera power supply box, the power comes via the hot side (black wire) of the AC power cord to a EMI filter to a on/off switch then to the power supplies.

D.C.THEORY OF OPERATION

POWER SUPPLY BOX

The power supply receives 110VAC, from the wall outlet . The power supply is located in the right side of the two piece boom or within the pod guards on the ARAGO3. Power comes in the box Via a EMI filter before the power switch then is split between two power supplies, both supplies are fused. The first power supply is dedicate to +24Vdc for the strobes on the camera pods. The other power supply has three output voltages; +12Vdc, +5Vdc, +3.3 ±.100Vdc. The 12Vdc and 3.3Vdc outputs must be loaded for the supply to operate. All output lines are then tied together on a molex cable to feed voltage to the IVS board.

IVS PROCESSOR BOARD

The IVS processor board receives its power from the power supply box via a 10 pin molex cable that plugs into JP18. It receives +24Vdc ±2.0Vdc, +12Vdc ±.8Vdc, +5Vdc ±.25Vdc and +3.3Vdc ±.100Vdc that can be tested at marked points behind the JP18 connector. The IVS board uses +3.3Vdc, +5Vdc, +12Vdc, it also generates +2.5Vdc. The +12Vdc, +5Vdc and +24Vdc (strobe) are passed to the camera interface boards.

CAMERA CONTROLLER BOARD

The camera controller board is mounted behind the camera pod assembly. It receives power from the power supply box through the IVS board via the 15 pin connector on JP1 Cal. cam., JP2 left cam., and JP3 right cam. +24Vdc, +12Vdc, +5Vdc respectively. The strobes circuit uses the +24Vdc for the LEDs that can be tested on the TP12 of the camera interface board. The camera uses +12Vdc that can be verified on TP11 and 5Vdc that can be tested at TP10 on the interface board. The above test points use the ground TP7 located on the same board.

LED BOARD

The LED board has sixty four individual LEDs that are tied four in series and sixteen different series lines. It uses 24Vdc that has passed through the camera interface board. On the red line there is a strobe circuit that switches the black lead from open to on to drive the LEDs. Both the 5Vdc and 12Vdc voltage have to be present for the stobes to work. The test points for the 24Vdc is TP12 of the camera interface board.

CCD CAMERA

(Charge Couple Device) Uses 12Vdc to power the camera this voltage can be tested at pins 1 for 12Vdc and 4 for ground at connector J2 of the camera interface board. Pin 3 is the video signal and 2 is gain cmd control.

CAMERA POD ASSEMBLY

The camera pod assembly consist of CCD camera, LED board and camera interface board to make up a pod assembly. These components can not be replaced individually, they calibrate these at the factory as a unit.

CAMERA INTERFACE TEST POINTS

The ground for all in coming voltage test points is located at TP6 and TP7. TP10 +5VDC, TP11 +12VDC camera voltage TP12 24VDC is used for strobes. (Figure 1-1)

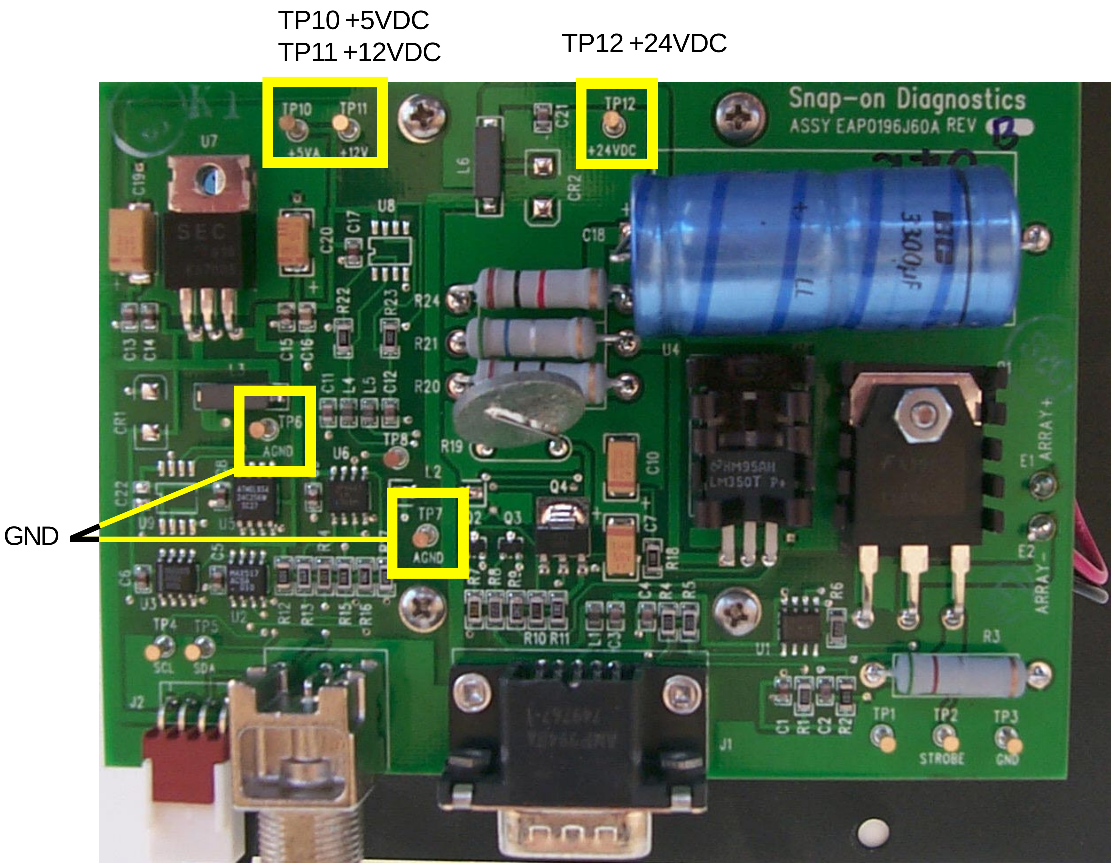


Figure 1-1

IVS TEST POINTS

The test points are close to the incoming power cable except for the +2.5Vdc ± .1Vdc is set back a little further behind Cr13 and Cr14. The +3.3 Vdc ± .100Vdc is located between L11 and L13, +5Vdc ± .25Vdc is between L11and L12, +12Vdc ± .8Vdc is between L12 and L10, +24Vdc ± 2.0Vdc is located between L10 and L9. Ground for all test points on ground line at the connector. (Figure 1-2)

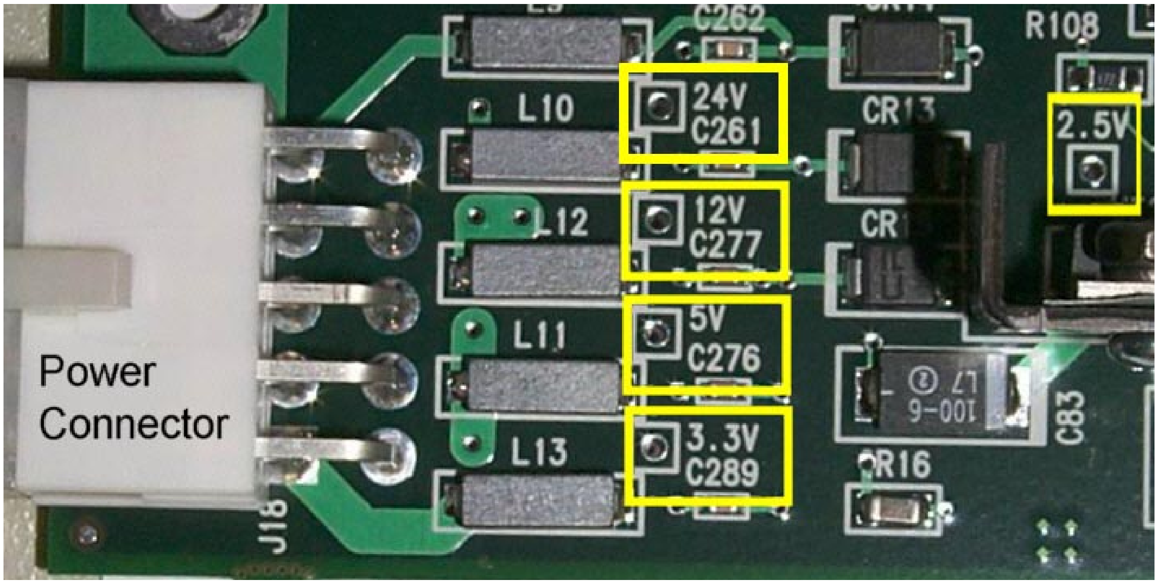


Figure 1-2

IVS POWER SUPPLY

The IVS system contains one Power Supply Box. The box contains two separate Power Supplies, within the box. The 24 volt power supply supplies the strobes on the camera interface. The 3.3, 5, 12 volt power supply, supplies the IVS PCB and passes both the 5 volt and 12 volt power to the camera interface. (Figure 1-3)

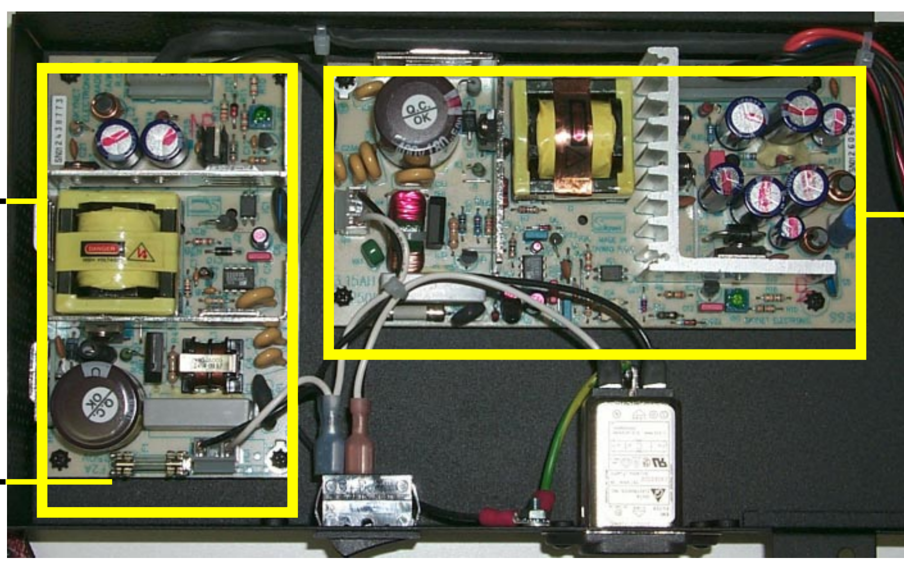
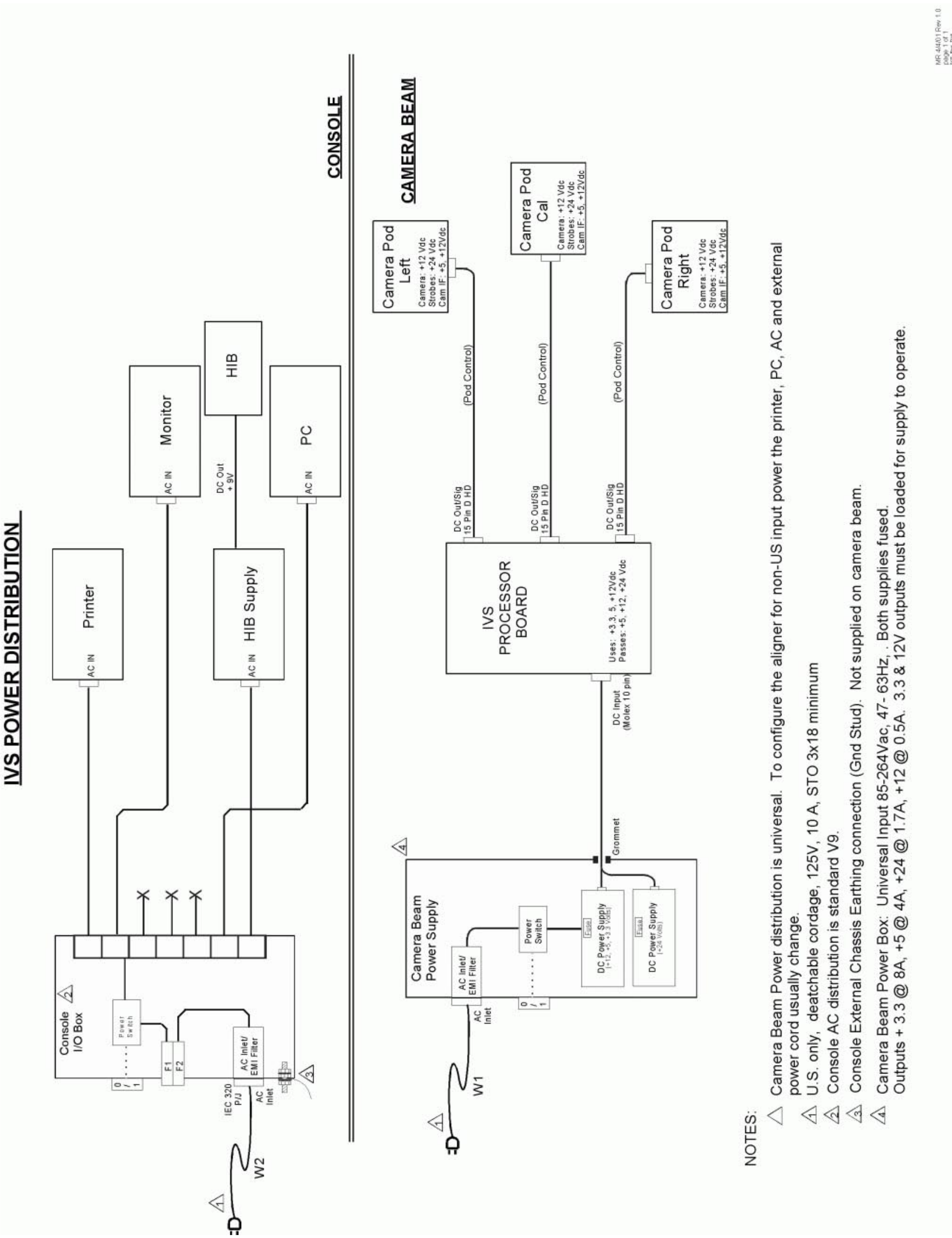
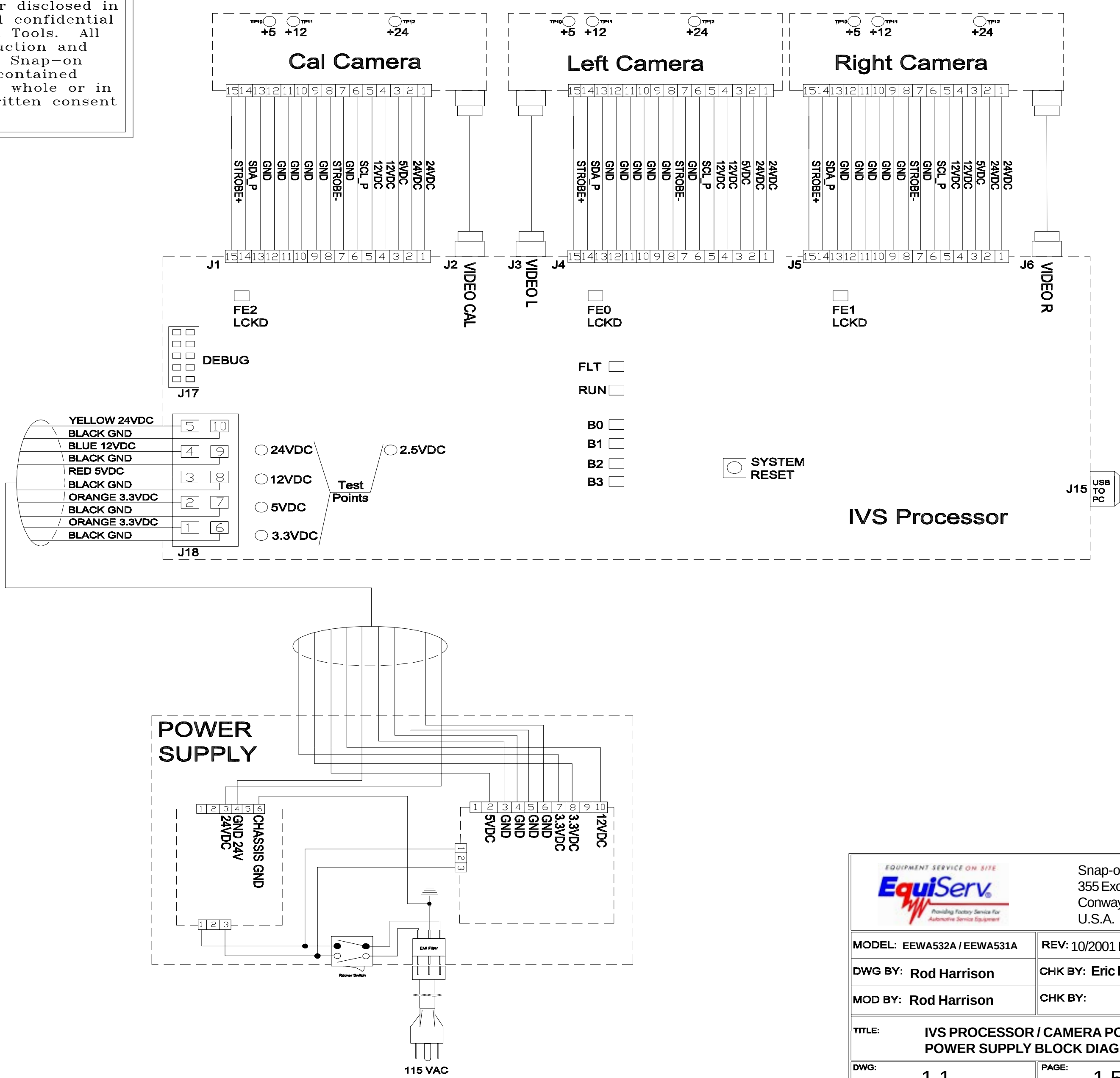


Figure 1-3


IVS POWER DISTRIBUTION
CONSOLE
CAMERA BEAM
Printer
AC IN
HIB Supply
Monitor
HIB
PC
DC Out
+ 9V
Console
I/O Box
Power Switch
F1
F2
AC Inlet/
EMI Filter
IEC 320
P/J
AC
Inlet
W2
IVS
PROCESSOR
BOARD
Uses: +3.3, 5, +12Vdc
Passes: +5, +12, +24 Vdc
DC Out/Sig
15 Pin D HD
(Pod Control)
Camera Pod
Left
Camera: +12 Vdc
Strobes: +24 Vdc
Cam IF: +5, +12Vdc
Camera Pod
Cal
Camera Pod
Right
DC Input
(Molex 10 pin)
Grommet
Camera Beam
Power Supply
Power
Switch
Fuse
DC Power Supply
(+12, +5, +3.3 Volts)
DC Power Supply
(+24 Volts)
W1
NOTES:
Camera Beam Power distribution is universal. To configure the aligner for non-US input power the printer, PC, AC and external power cord usually change.
1 U.S. only, deatchable cordage, 125V, 10 A, STO 3x18 minimum
2 Console AC distribution is standard V9.
3 Console External Chassis Earthing connection (Gnd Stud). Not supplied on camera beam.
4 Camera Beam Power Box: Universal Input 85-264Vac, 47- 63Hz, . Both supplies fused.
Outputs + 3.3 @ 8A, +5 @ 4A, +24 @ 1.7A, +12 @ 0.5A. 3.3 & 12V outputs must be loaded for supply to operate.

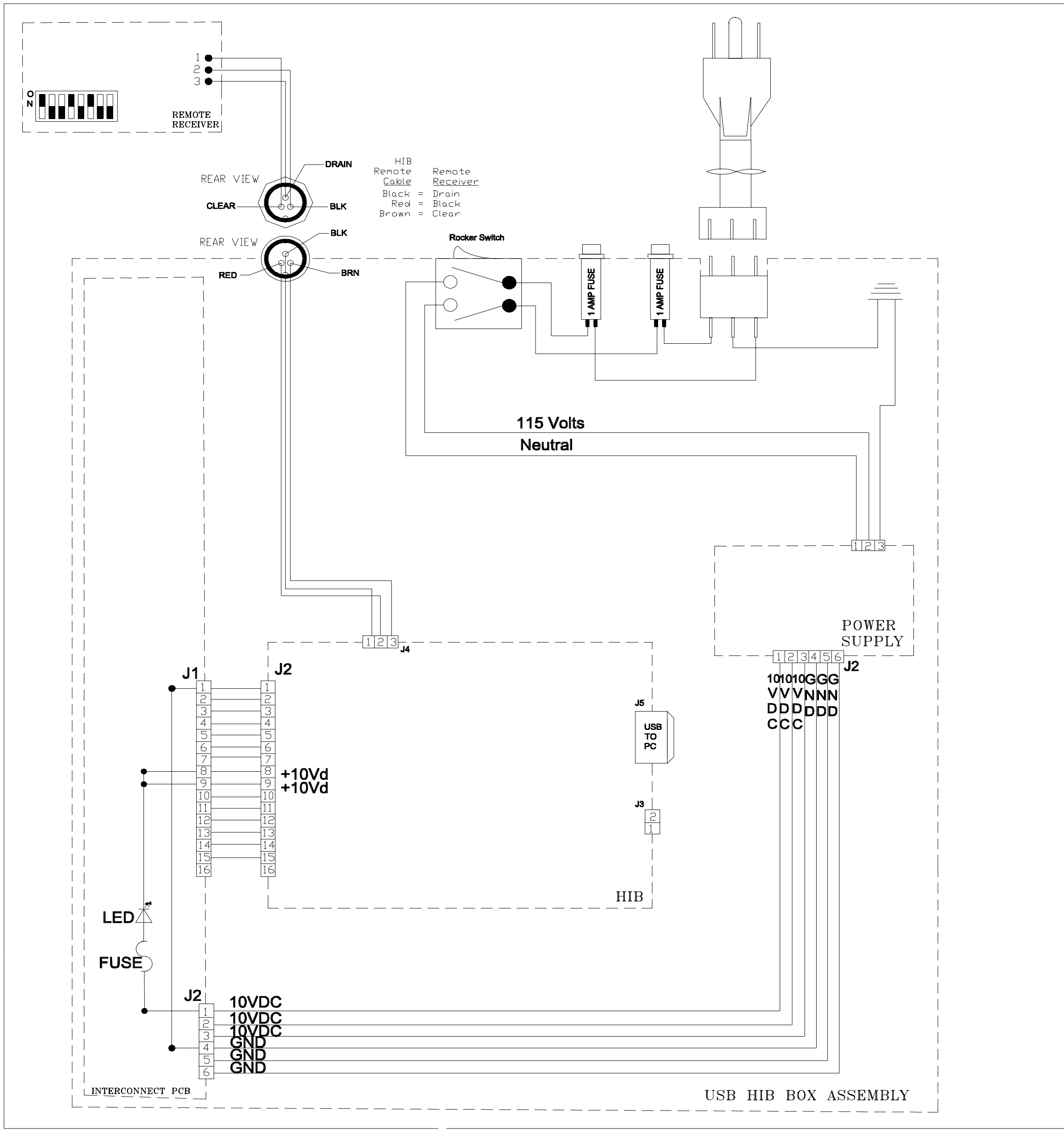
IVS BLOCK DIAGRAM



Snap-on Diagnostic
355 Exchange Ave
Conway, AR 72032
U.S.A.

MODEL: EEWA532A / EEWA531A	REV: 10/2001 Rev. a
DWG BY: Rod Harrison	CHK BY: Eric Bryan
MOD BY: Rod Harrison	CHK BY:
TITLE: IVS PROCESSOR / CAMERA POD / POWER SUPPLY BLOCK DIAGRAM	
DWG: 1-1	PAGE: 1-5

HIB BLOCK DIAGRAM



EQUIPMENT SERVICE ON SITE
EquiServ®
Providing Factory Service For Automotive Service Equipment

Snap-on Diagnostic
355 Exchange Ave
Conway, AR 72032
U.S.A.

MODEL: EEWA532A / EEWA531A	REV: 09/2003Rev. C
DWG BY: Rod Harrison	CHK BY: Eric Bryan
MOD BY: Rod Harrison	CHK BY: Mike Gill
TITLE: POWER SUPPLY / HIB BLOCK DIAGRAM	
DWG: 1-2	PAGE: 1-7

CHAPTER 2
THEORY OF OPERATION

GENERAL

The 3D Image Aligner is a revolutionary concept in performing wheel alignments. The system uses a camera based machine vision technology that provides many benefits to the shop owner and alignment technicians. It is the fastest, most accurate, and easiest to use aligner ever made. One of the benefits to new technologies is the use of state-of-the-art components and computer programming that makes the task of servicing this product easier than previous generations of alignment equipment. One of the most obvious differences is the lack of an electronic measuring head, the source of many of the failures and inaccuracies on conventional products. There is not much about this aligner that is conventional.

Shop owners and alignment technicians easily recognize the many strengths of this system compared to conventional measuring-head systems. As the 3D Aligner was prepared for introduction into other International markets such as Asia and Latin America, it became evident that the tasks of developing language translations and market-specific vehicle specification databases was overwhelming with DOS. The decision was made in 1998 to develop a Windows-based user interface for the 3D aligner in parallel with efforts to do the same for the company's conventional wheel alignment system. Introduced in the fall of 1998, the Windows environment was introduced. The Windows compliant Pro32 software has a robust set of features, adds the familiarity and power of Windows, and has 27 different languages and 13 different specification databases. In addition, Windows offers powerful networking capabilities that will gain in importance as the automotive service industry discovers the benefits of information sharing between the front point-of-sale counter and the back shop. In 2001 Snap-on introduced IVS (Integrated Vision System) further improving 3D vision technology, by improving components within the measuring system. Making it faster, easier firmware and component upgrades, and on board diagnosis of the camera system. The V3D version3 incorporates the IVS system for measuring alignment angles. The heart of IVS is combining the functions of the coprocessor and hub boards into one board. The cameras and power supply were upgraded, cameras no longer have the genlock board to sync timing signals. The power supply now has two individual supplies in one box.

CAMERAS

The "eyes" of the vision-based 3D Aligner are the two cameras mounted on either end of a camera beam. The cameras are high-resolution CCD video type operating in gray-scale, similar to those used in security and surveillance applications. The proprietary design lens is for this usage, and is permanently mounted to the camera and triple-sealed for protection. The camera also has a band-pass filter, limiting the spectrum of light that can enter the lens. With any camera there is an optical "field of view" that is a characteristic of the lens design. Anyone who has used a camera or single lens telescope knows that what you see is what you get no more, no less. The cameras on the 3D Aligner are no different.

The field of view (Figure 2-1 / 2-2) is located along each side of the alignment rack and is a cone-shaped "tunnel" that expands in size as it moves further away from the cameras. The tunnel is approximately two feet in diameter near the front turntables. The centerlines of the tunnels are close to vehicle spindle height and about 15 inches outside of the outer wheel surface of an average car. In fact, the cameras are initially aimed upon aligner installation so that the targets, when mounted onto an average vehicle, would be located in the center of that tunnel. This insures that any vehicle placed on the rack in front of the 3D Aligner, from the widest to the narrowest, will have the targets mounted within the cameras' field of view. If any target is outside of the field of view the aligner will not work. The CCD Camera is mounted to the pod frame on three spring-loaded bolts. This allows adjustment of the camera during installation (camera aiming).

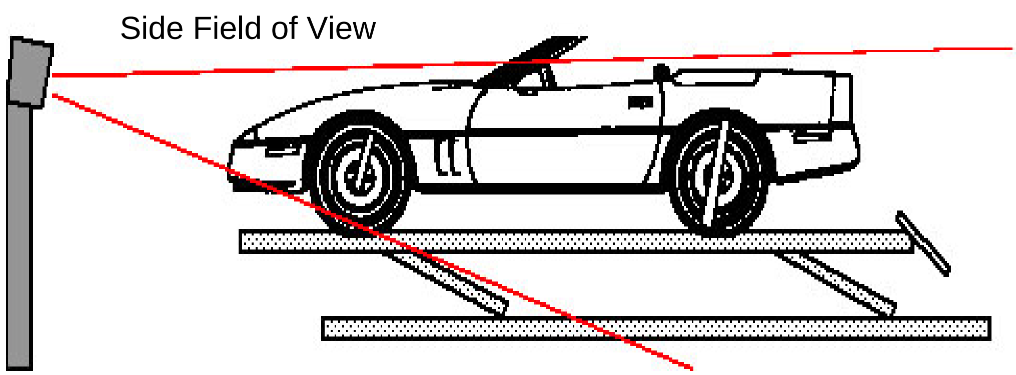


Figure 2-1

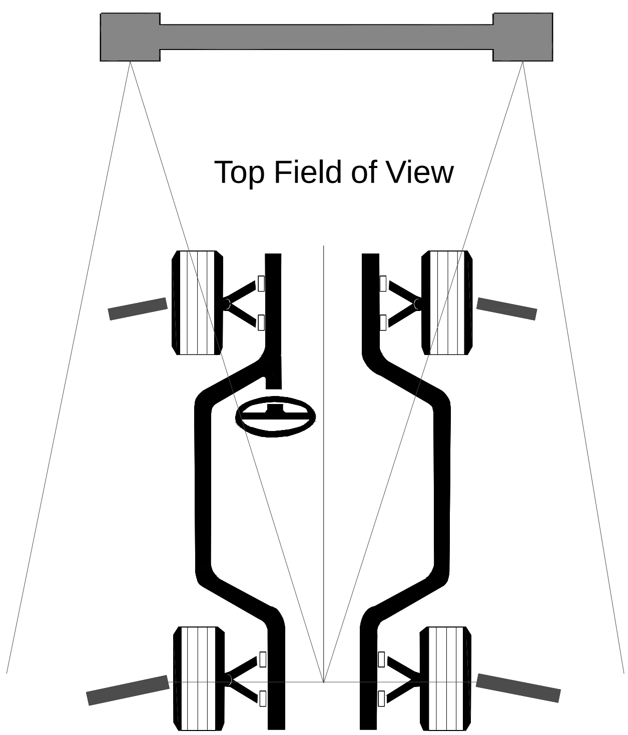


Figure 2-2

The Strobe Board contains 60 red LED's in an array to provide a source of bright light to reflect off the targets when camera images are taken. These LED's are rated for 100,000 hours continuous operation, and up to 50% of the LED's can fail without affecting the cameras ability to see the targets. Much like the flash that is needed to take photographs with a consumer camera. Most people immediately notice the flashing red lights – these are the LED's which are synchronized with the cameras so an image is "captured" every time the lights flash (roughly 2 times per second). The Camera Interface PCB is between the IVS Board and the CCD Camera and Strobe Board. It acts as an interface and controller. It contains the GRID PROM, which has calibration data about the camera such as focal length, pin cushion, warp sheet distortion, etc. This calibration is done at the factory and is unique to each Camera Pod. It is downloaded by the software and stored on the hard drive for reference during image calculations. During operation the camera interface board is given command signals from the IVS board to control the strobe (how bright and how long the LED's work) and gain (how long the camera will remain open to gather images).

TARGETS

The target's visual surface is a series of circles or "dots" made of a retroreflective material. This material returns any light that hits its surface at a 90-degree angle directly back towards the source (Figure 2-3). If we are looking at the reflected light, it is brightest at the center of the light source. As we move away from the source the brightness of the light diminishes rapidly. Street signs have retroreflection material on certain parts of their surface. This material reflects light from a vehicle's headlights back to the motorist's eyes. The portion of the sign that traffic control wants the driver to pay attention to is reflective, while the rest of the sign fades into darkness. Drivers in other cars cannot see the reflected light from the headlights of other cars because the angle of view is too large. In the case of the 3D Aligner, light is generated by the LED's, hits the target, and returns along the same path to the camera which placed in the center of the LED array.

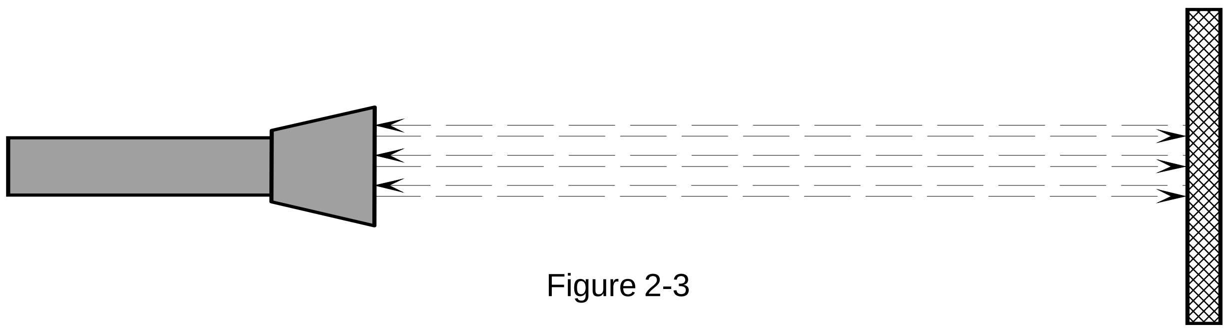


Figure 2-3

The retroreflection material is placed on an aluminum backing plate to insure the reflective pattern remains flat. This assembly is then mounted into a hard ABS plastic housing for shock and damage protection. Finally, a special piece of tempered glass is placed on top of the retroreflection material for final protection from damage. The top glass is special for two reasons. First, it is an "optical grade" glass that is fee of imperfections and impurities. This is necessary so the reflected image the cameras see is not altered by glass imperfections. Second, the backside of the glass contains a pattern of "dots" etched from a jet-black emulsion material. This dot pattern created by the glass allows the cameras to see a very unique item that the 3D Aligner recognizes. The various dimensions of this pattern of dots is a known quantity that is stored within the program and is used as a constant, forming the basis of our vision-based measuring system.

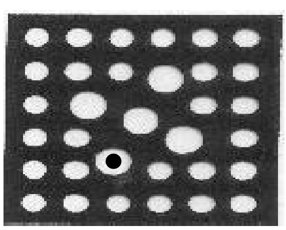


Figure 2-4

There are 33 dots on each target (Figure 2-4) laid out in a very distinct manner. A great deal of time and effort was placed on designing this pattern of dots. In some ways the dots appear to be randomly placed, but in other ways appear to have some symmetry. Some of the dots are larger than other dots, and there is even one dot that is a "donut". It must be noted that these circles we see are geometrically the "roundest" circles we will ever encounter this is necessary for the interpretation of angles, as we will learn later. Note also that the dots on the rear targets are larger than the front targets to allow vision at a further distance.

Since the engineers designed the target dot pattern with great precision, they know the exact dimensions of each dot and the distance from any one dot to another. It is possible then to create a computer model of this pattern that the 3D Aligner software could use as it looked at camera images. This would be usable in the program only if we were certain that the target attached to the vehicle matched the computer model. Since it is impractical to have an engineer hand-make each target to the required precision, a detailed manufacturing process was created to make sure each target was an exact duplicate of the original design. The glass dot patterns are made using a process similar to that used in the manufacture of computer integrated circuits, a process called *photolithography*. First, two (one front, one rear) very exact and expensive master templates were created with the assistance of IBM's semiconductor division. A master target template is placed on a sheet of optical grade glass that is coated with photographic emulsion. The assembly is then exposed to light. The result is a photographic negative – a perfect reproduction of the master target template in negative form. The resultant pattern is computer scanned for accuracy compared to the computer model. Those that pass are assembled into targets, and those that fail are scrapped.

TARGET ACQUISTION

When we begin a new alignment the program has no idea where the targets are located. The software turns on the cameras and goes into a "search mode", looking throughout the cameras' field of view for any targets. We see this on the screen in the form of 4 red targets away from the wheels. Since the software knows what a target looks like, when it sees an object that may be a target it applies what is called a "fit algorithm" – how closely does that object match what it knows to be a target. In this way, objects that are not targets (such as reflective lamps on the vehicle) are ignored. As each target is found and fitted (or acquired) it turns blue on the screen and appears attached to the wheel. When a target is acquired the software "hones in" on that region of the camera view ignoring activity in the background. This allows the system to be more responsive to changes in target position.

IVS PROCESSOR (INTEGRATED VISION SYSTEM)

The IVS PCB is the primary control and interface component for the systems contained within the Camera Beam. It is located in the hub enclosure behind the logo panel on Camera Beam or within the pod guard (Arago III). The IVS board communicates with the PC via USB, or serial port for POST testing. It has a data connection with each Camera Pod, sending low level commands such as gain, strobe, as required. The cameras are totally independent of each other, there is no master camera for timing and synchronization. As the cameras acquire images, using the LED's as a light source, they send analog video back to the IVS board. The IVS board converts the analog video image to a digital signal. This board is the primary system control component, linking together the user interface software with the image gathering system. It also performs the camera image processing and the calculations necessary to determine wheel alignment angles. The IVS Board, based on inputs from the alignment software, sends out high level camera control commands. Examples of these commands are when to start and stop taking images, and how long to allow light to enter the camera (shutter). The IVS board communicates commands with the camera interface via a high-speed serial data line. The IVS Board distributes the appropriate lower level commands to the camera components. The camera images are digitized on the IVS Board and sent to the PC via USB. To process these digital images, the IVS Board utilizes POWER P.C. microprocessor operating @ 255Mhz and a bus frequency of 75Mhz.
Image processing is memory intensive – for this reason, the IVS Board has 64MB of high-speed SDRAM in a dimm module on-board. Through a series of complex algorithms, images are processed up to 5 times per second, and the information sent to the alignment software running on the host PC for display as wheel alignment values. The board also has 3 on board genlock circuits capable of handling up to four concurrent cameras on 3 independent channels. The IVS board contains on board diagnostics know as POST (POWER ON SELF TEST). Power dissipation is controlled on the IVS board. During power up the IVS board does a self test. First a hard reset of the EPP, USB, Galileo, Front end, serial status, all LED's are reset to on. The camera hardware is reset. The power PC executes from bootflash. The setup of the power PC operational registers and loads the galileo chip and then performs romboot POST. It copies loader from flash to the SDRAM, then begins the loader execution. The ROMBOOT ends and the loader begins the execution of POST. The run LED is on or blinks, the status LED's cycle for one second, then sends a message to the host through the serial port (if serial cable is connected) it then checks for diagnostics request. If no failures are reported it then attempts to handshake with host and wait for the download via the USB port. It then downloads the application to the SDRAM and begins the application execution. The application then turns on the run LED. The fault LED is off. The LED's (B0-B3) begin cycling, genlock LED's are on if cameras are connected and functional. The application is loaded and the IVS board then controls the timing signals based on a real time clock set 9.3Mhz. Packets of information are sent to the camera interface board, these packets contain strobe, gain, Vsync, Hsync. On the return side of the camera interface board, information enters through the genlock circuit. The information that is not used is removed, then the timing and video is extracted. The signal is sent to a 8 bit A/D converter to be digitized. The signal then travels to a rate buffer before going to DMA control for Byte packaging before being dropped off in SDRAM memory, waiting for host to request the information for image processing. During the boot up the IVS board will "read/write" a memory test on the camera interface board to be sure it can communicate with the camera. It looks at the video from the cameras, if it determines that a good video signal is present it will continue to load. It then checks the header for the grid file on the EPROM located on the camera interface board against the CMD file on the hard drive. If the headers do not match the grid file from the camera will then download to the hard drive.

3D VISION THEORY

From the previous discussions of the components of the 3D Aligner we have a basic understanding of how the hardware system functions. But how does the software take these camera images of target dots and interpret them as wheel alignment angles?

PERSPECTIVE

One of the things the 3D Aligner must determine is how far away each target is from the cameras at any given moment. As everyone knows, objects appear to get smaller as the move farther away, even though their actual size remains the same. If you look at a screwdriver 2 feet away from you it looks much larger than it does at 20 feet away (Figure 2-5). This effect is called *perspective*. Artists create the illusion of depth and distance in two-dimensional drawings using this technique.

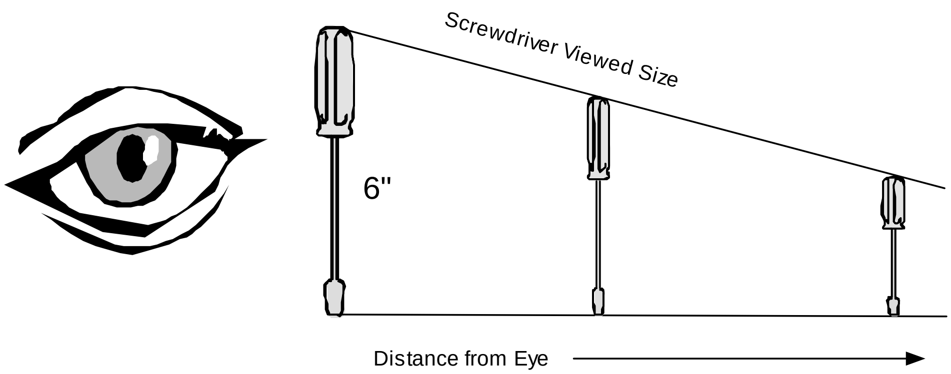


Figure 2-5

In the example above, assume that the screwdriver is 6 inches long. If you had a way to “measure” the exact size of the screwdriver your eye sees at some distance away, through the application of high school level mathematics you can determine how far the screwdriver is from your eye. On the following page there is a more detailed explanation.

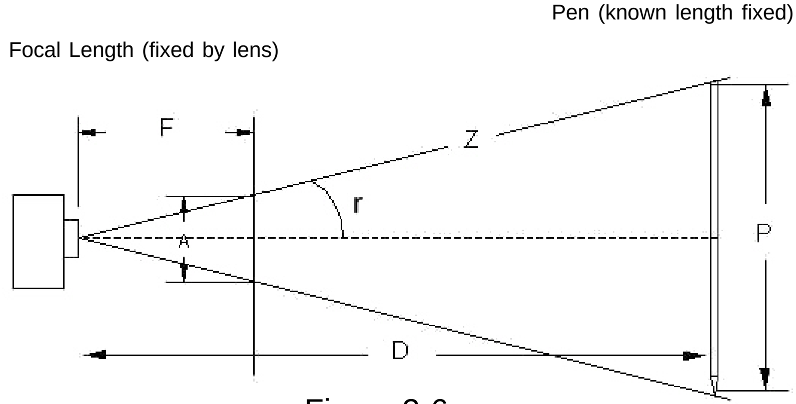


Figure 2-6

Of the mathematical principles.
In this example (Figure 2-6), the camera is at a fixed point in space. All fixed camera lenses have a fixed focal point. The distance from the camera to the focal point is a known value F, created by the designers of the lens. The size of the pen is a known value P, created by the designers of the pen. The perceived size of the pen is measured by our “software” at the focal point and becomes a known value A. The goal of this exercise is to determine the distance D from the camera to the pen.

First, we must find the angle r by applying formulas from basic trigonometry:

$$\tan r = \frac{(A/2)}{F} \quad \text{and} \quad Z^2 = (P/2)^2 + D^2$$

Since we know A,F,P and Z can be calculated and the angle can be found using trigonometric tables. Once the angle is known, we can use it in another trigonometry formula to find D:

$$D = \frac{(P/2)}{\tan r}$$

Since we know P and r we can calculate D – we now know the distance the pen is from the camera.

Applying this to the 3D Aligner, the image analysis software takes each image and precisely measures the size of each dot on the photograph – this is the perceived size (A). We already discussed the known values of focal length (F) and size of the dots (P). Thus, using the above math the 3D Aligner can measure the distance from the cameras to any dot on the targets and can do so with a high degree of accuracy – it can measure a target 20 feet away to less than 1 mm accuracy.

FORESHORTENING

The discussion earlier about perspective and the screwdriver example assumed that the screwdriver (or target) was “normal” to your eye (Figure 2-7). Normal means the object is being viewed straight on (perpendicular or at 90 degrees), so its full length is observed.

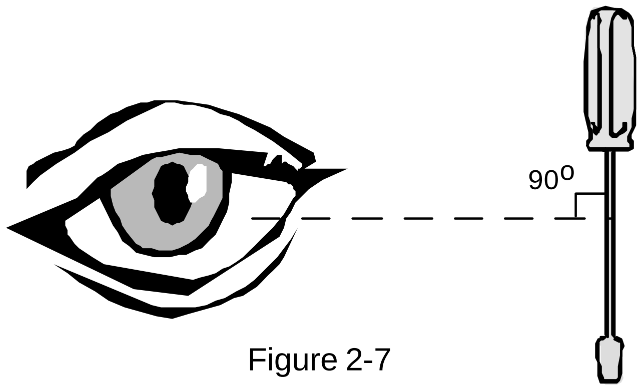


Figure 2-7

Look what happens to the observed size of the screwdriver when it is rotated away from 90 degrees to your eye–it appears smaller (Figure 2-8).

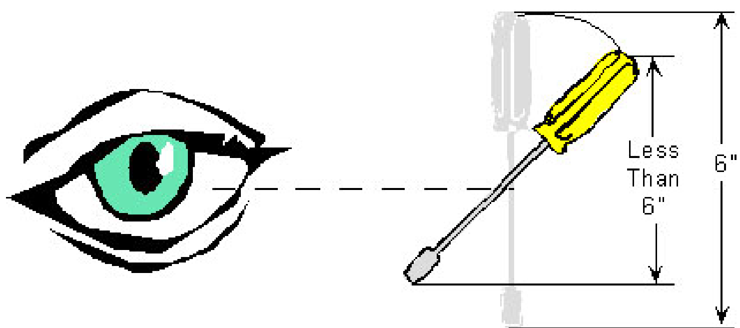


Figure 2-8

The observed size of the screwdriver becomes shorter. The more it is rotated, the smaller it appears to be. This effect is called *foreshortening*. As before, if you know the actual size of the screwdriver is 6 inches, by measuring the observed size and applying mathematics it is possible to determine the screwdriver’s angle of orientation with respect to the normal view.

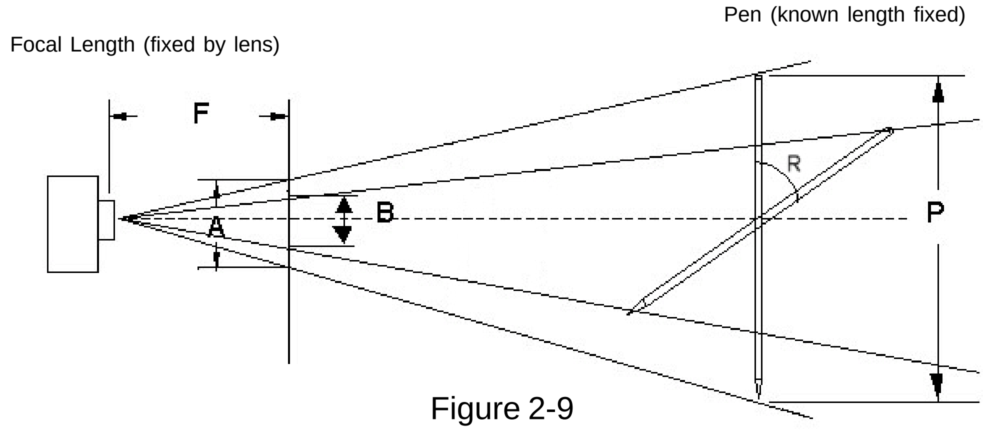
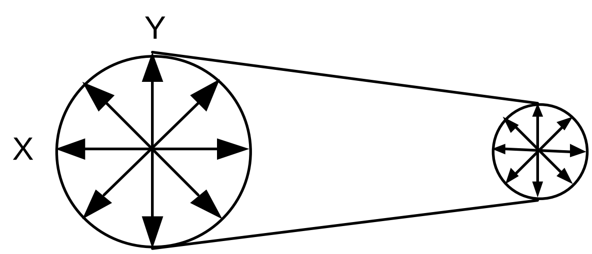


Figure 2-9

In this example (Figure 2-9), the camera is at a fixed point in space. All fixed camera lenses have a fixed focal point. The distance from the camera to the focal point is a known value F, created by the designers of the lens. The size of the pen is a known value P, created by the designers of the pen. The observed size of the pen is measured by our "software" at the focal point and becomes a known value B. The goal of this exercise is to determine the angle of orientation R away from the normal position.

THE CIRCLE

Hopefully by now we have some understanding of how the 3D Aligner can determine how far away the targets are and their angle of orientation. Of course, when placed on a vehicle the dots are likely to be at varying distances from the cameras and at varying angles or orientation at any given moment. An observer to the above may ask, "how can the aligner tell the difference between the effects of perspective and foreshortening? All it knows are the targets images are it sees are smaller than their actual size. What about orientation changes in 3 dimensions?". The answer is a powerful geometric shape, the circle. As you will find out, the circle was chosen as the geometric shape for the targets because of its mathematical relationships. For this discussion, assume the



Normal View of Circle - Moving Away

Figure 2-10

aligner targets consist of a single large dot.

The circle has some unique characteristics that make it useful for the 3D Aligner. When you look at a circle from the normal position (straight on, or a 90-degree angle), the diameter across is equal no matter where it is measured (Figure 2-10). As the circle moves away from you, the diameters appear to get smaller due to the effects of perspective as discussed earlier.

Now look what happens as the circle is rotated about the X-axis – in two dimensions it appears to be an elliptical shape (Figure 2-11).

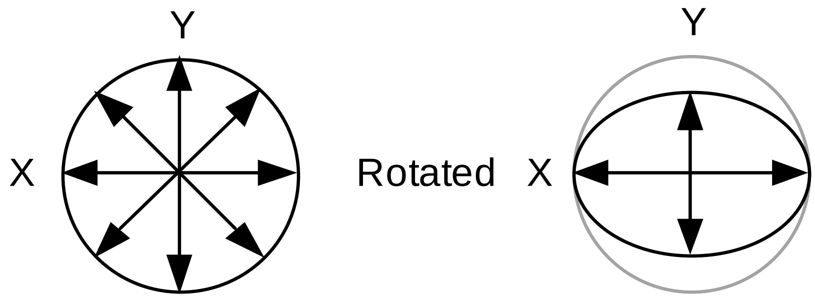


Figure 2-11

The more we rotate the circle about the x-axis, the smaller the y-axis diameter appears. In fact, a mathematical relationship exists that says if you can measure the length of the y-axis line and the length of the x-axis (the circle's true diameter), you can determine the angle of rotation. To put this all together, no matter how you rotate the circle in any dimension (X, Y, Z), the true diameter axis is always visible. This is called the ellipse's *long axis*. The 3D Aligner measures every diameter on the target dot and uses the long axis it finds as the true diameter to determine how far away the target is through perspective. Then, it looks at the diameters in the other dimensions that are 90 degrees to the true diameter to find the *short axis* and determines the angle of orientation away from normal with foreshortening. Using these methods it determines where the target dot is in three-dimensional space with respect to the camera, both distance and orientation. It is the circle's unique characteristics that allow the aligner to distinguish between the effects of perspective and orientation. Examine below to see and example of a target rotated in different directions. (Figure 2-12)

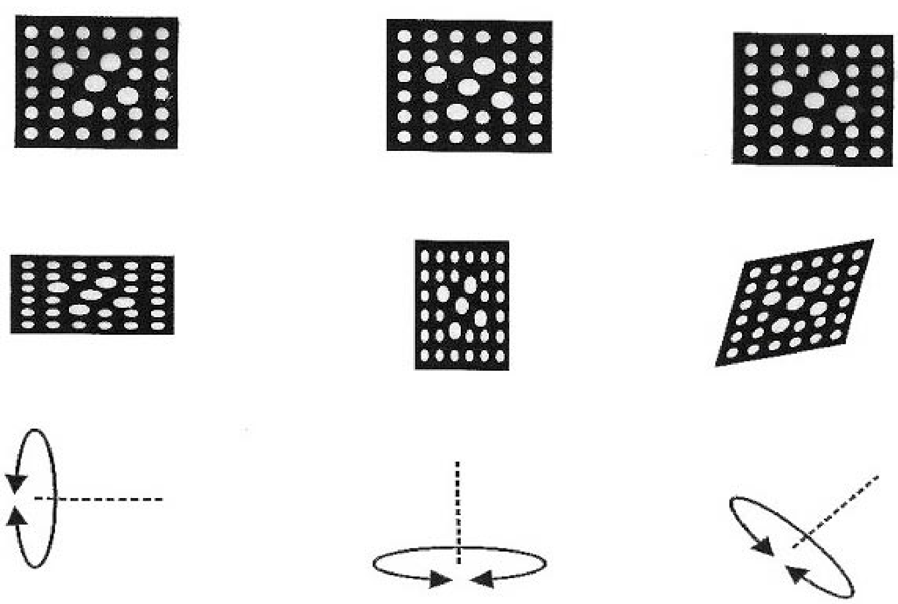


Figure 2-12

For this discussion we assumed the target has only one dot. In reality, each target has 33 dots (and there are 4 targets), and the 3D Aligner's powerful computer system analyzes each circle simultaneously for incredible accuracy and resolution. We have now seen how the aligner uses the camera images to determine the targets location and orientation in 3-dimensional space. It now has the capability to measure, but how does it use these principles to measure wheel alignment angles?

POSITIONING SEQUENCE

The 3D Aligner knows where the targets are, but it does not yet know where the vehicle is. Of course, the targets are attached to the vehicle's wheels, and this provides the link to the vehicle's alignment angles. The term "wheel alignment" is a bit misleading. We don't adjust the wheels, we adjust the suspension and steering components, resulting in changes at the wheel. It is the vehicle "spindle" that receives the alignment, and the wheels are just along for the ride. All wheel alignment equipment uses the spindle as a starting point, usually by either placing the measuring device directly opposite the spindle or by performing a runout compensation referencing gravity or the rack. The 3D Aligner finds the spindles in a unique way that improves accuracy and speed.

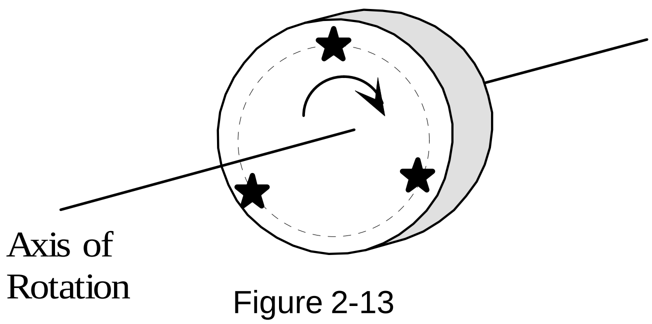
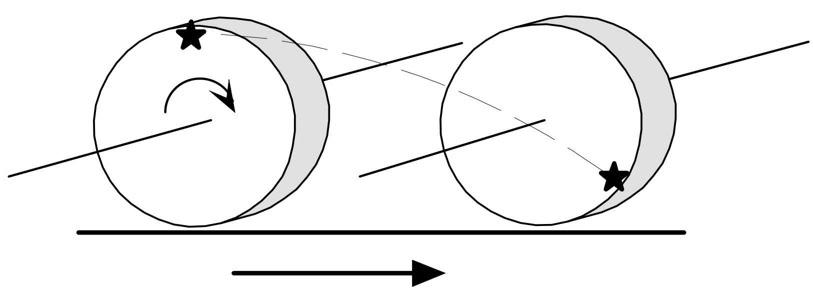


Figure 2-13

A single point on the wheel/tire is represented by the star. If we rotate the wheel/tire (Figure 2-13) and track the position of the star at various points we would find the star movement forms a circle. If we determine the center of the circle we have defined the axis of rotation of the wheel/tire. In automotive terms, the axis of rotation of the wheel is called the spindle.

The 3D Aligner locates the vehicle spindles directly using a procedure called *positioning*. In positioning, we rotate the wheel/tire/target by pushing the vehicle back. As the vehicle moves, the cameras track the location and orientation of the target dots. If the wheel went through a complete 360-degree rotation each dot would scribe a circle as described in (Figure 2-13). If we took our scribed circle and determined where the center of that circle was located, we would find the spindle. The dot moves back as well as rotating about the axis, this allows the software to locate the spindle position in 3 dimensions with respect to the camera (Figure 2-14).
Of course there is more than one point on our targets that the cameras can track, there are 33 reflective dots.



Movement of a Point During Positioning

Figure 2-14

As we move the car back, each dot is tracked for distance and orientation, with the software using this data to create 33 circles of different sizes. Each circle is then analyzed for the center point, with the results averaged to determine the vehicle's spindle. Since there is a target on each wheel the software finds each of the 4 spindles simultaneously.
In the last paragraphs the positioning sequence described the targets dots scribing a circle through a 360-degree rotation of the wheel. In reality, this is not practical a full wheel rotation would require a roll back of 5 to 7 feet, depending on the circumference of the tire. Most alignment racks cannot handle this. The engineers were able to shorten the wheel rotation angle to 35-degrees ± 5. This works out to 6 to 10 inches of roll back, which is easy to accomplish with most vehicles.

When the vehicle is rolled back, the 3D software directly locates the spindles and now knows 4 distinct points in space with respect to the cameras that are part of the vehicle. Since the vehicle is now back off the rack turntables, it is necessary to roll it forward to perform any corrections. The aligner uses the software when rolling the vehicle forward as a check of the results of the roll back. As the operator moves the vehicle forward we repeat the positioning sequence. When the vehicle returns to the turntables we have a new measurement of spindle locations. The software then compares the results of the roll back with those of the roll forward; if they agree, the program is satisfied and moves on; if they do not agree an error message appears called “Wheel Wobble” and we are forced to repeat positioning until they agree. This is one of many examples of where the 3D Aligner performs “quality checks” to insure the highest degree of accuracy possible.

SIDE-TO-SIDE DETERMINATION

The 3D Aligner gathers target images utilizing two cameras mounted on the ends of a beam. This beam is positioned higher than the vehicle’s wheels to allow the cameras to see the rear targets (the front targets are smaller, allowing easier viewing of the rear). Each camera can see a front and rear target on its side of the vehicle, and thus determine their locations and orientations, and find the two spindles on that side. However, each camera cannot see the targets on the other side of the vehicle. When determining alignment angles such as thrust angle and setback, it is necessary to “connect” the vehicle sides, to know the relationship of the left side to the right side. To do this, the 3D Aligner must know the positions of each camera with respect to one another.

To get an idea of the type of analysis the 3D Aligner program must do. In the picture (Figure 2-15) there is a vehicle with all targets attached. The program can determine the distance from each camera to the front and rear targets on its side of the vehicle as indicated by the check marks using perspective. What it cannot do directly is determine the distance from the camera to the front and rear targets on the other side (question marks). The way to find the cross-distance is to know the distance between the 2 cameras called “RCP” on the figure. If RCP is known it is straightforward mathematics to determine the cross-distance in question since two sides of a right triangle are known – Pythagorean Theorum: $a^2 + b^2 = c^2$. But how does the program know the dimension RCP? We must tell it!

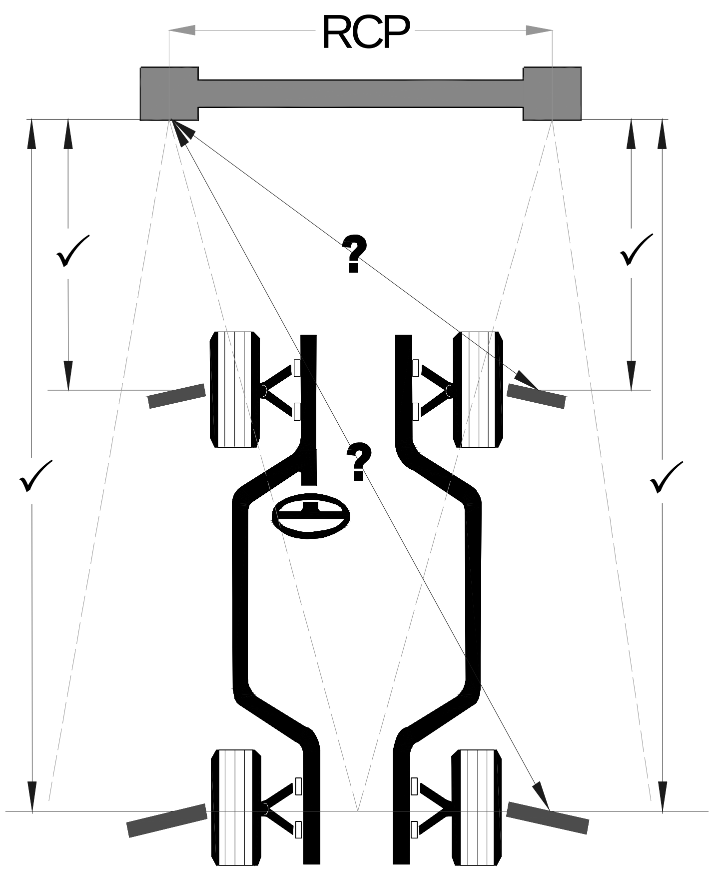


Figure 2-15

RELATIVE CAMERA POSITIONING (RCP)

It would be easy to say that we know the distance between the cameras because we designed and manufacture the Camera Beam and cameras. However, the knowledge the aligner must have about the relationship of one camera to another is critical and must be known to high level of precision – manufacturing tolerances in the beam and camera assemblies are too variable to be counted on. When the aligner is installed the technician mounts the cameras onto the beam. Later, the technician performs a camera aim in which he/she alters the position of the cameras. Once all camera movements are completed it is time for us to help the program find out where the cameras are with respect to each other. We must perform Relative Camera Positioning.

THE FIXTURE

The fixture used to perform RCP is also used for camera aiming. It consists essentially of a bar about 5.5 feet in length with a target attached on each end (a front and rear). Stands are used to place it on the alignment rack, which should be at alignment height so the targets are visible to the cameras.
Due to manufacturing tolerances and transportation of the fixture, we cannot be sure its dimensions are the same as the design. We must measure it each time we perform RCP. Of course, we always have a highly accurate measurement tool at our disposal – the 3D Aligner. To measure the length of the fixture we place the assembly on the right runway of the rack in the view of the right camera (Figure 2-16).

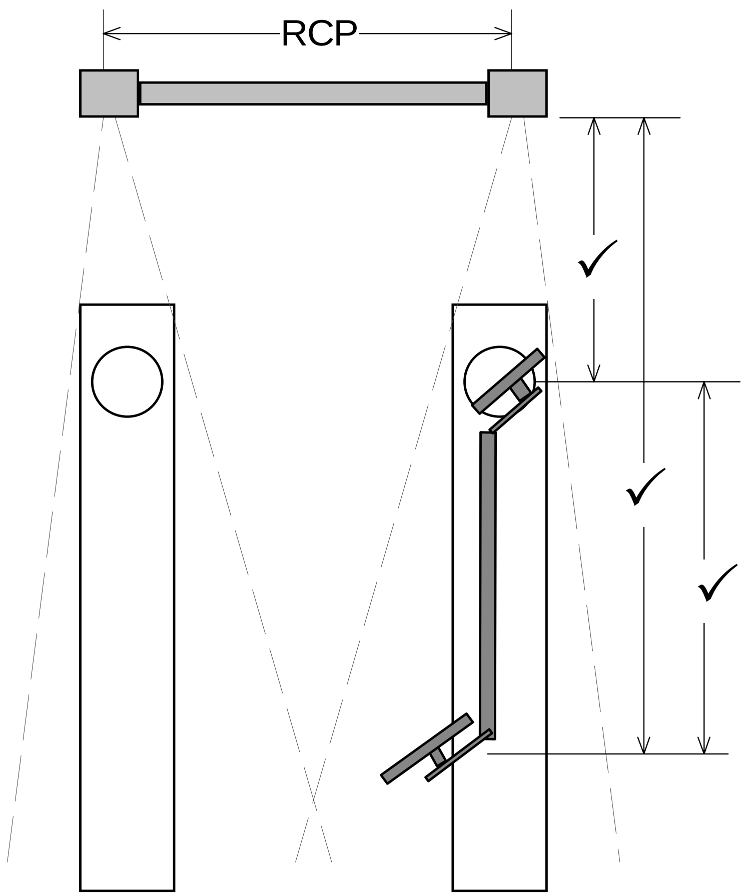


Figure 2-16

The right camera measures the distance to the front target and the rear target, and subtracts the two with the difference being the fixture length. This is stored in memory for usage later in the RCP procedure.

To determine Relative Camera Position we need to take the fixture of a length we now and place it across the runways, placing one target in the left camera's vision and one target in the right camera's vision (Figure 2-17).

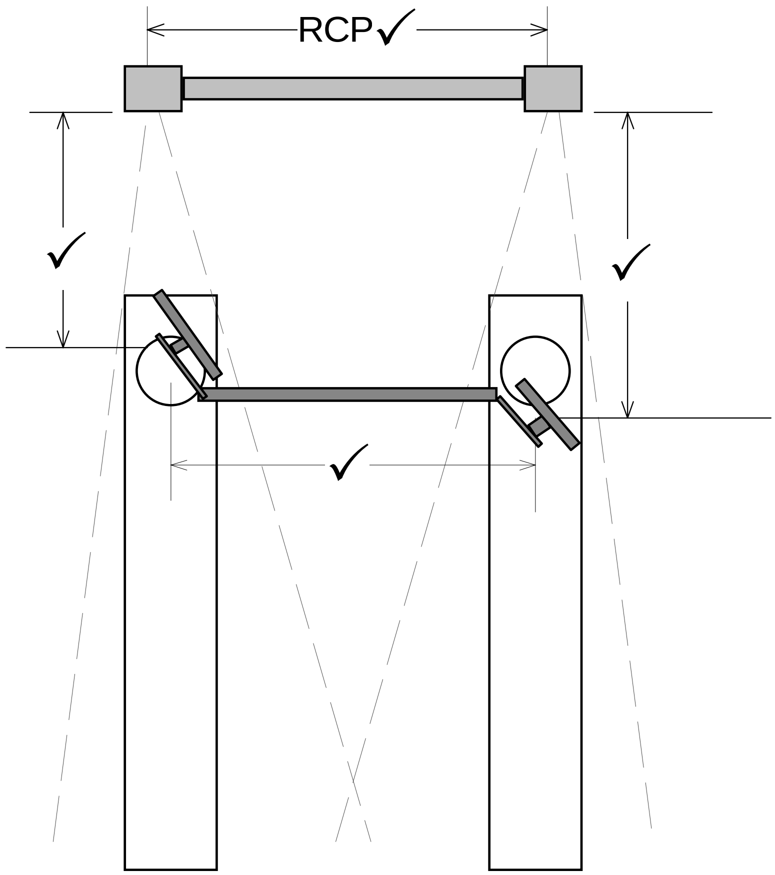


Figure 2-17

The right camera measures the distance to the right target, the left camera measures the distance to the left target, and the memory has the fixture length. We have 3 of the 4 sides of a trapezoid, and through application of mathematics we can determine the fourth – RCP. We also recheck our calculations several times by placing the fixture back on the runways at different points before proceeding.

The RCP procedure establishes the missing dimension that allows side-to-side determination – each camera's position with respect to each other. The accuracy of this calculation is highly dependent on the fixture being dimensionally stable as we move it from point to point on the rack. The final step is to recheck the fixture to make sure it is the same length. We call this rechecking the fixture length.

We do this by placing the fixture on the left runway so that both targets are in the visual field of the left camera (Figure 2-18). If we measure with one camera, then measure with a different camera and get the same values we can be sure the fixture has remained stable and our RCP is valid.

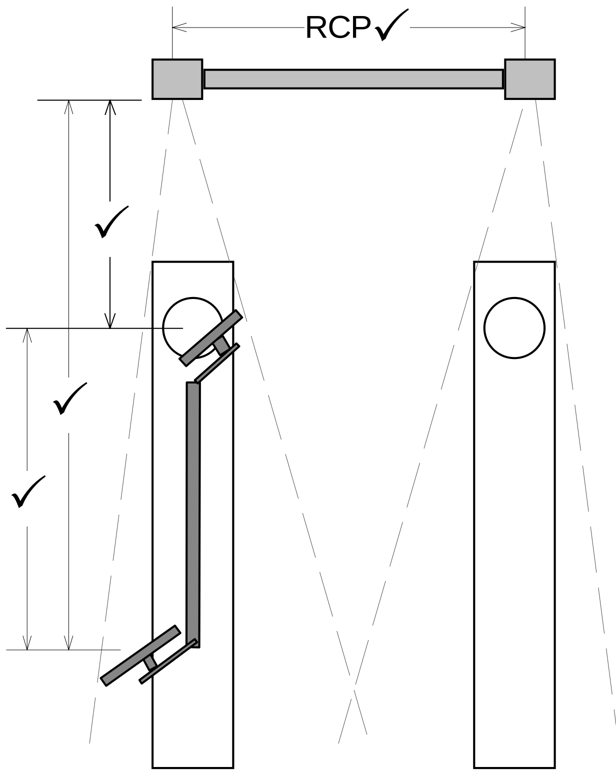


Figure 2-18

If the final check reveals the fixture has changed dimensions during the process we are given notice and must repeat the RCP procedure from the beginning. Because the Camera Beam is rigid, the cameras are hard-mounted to the beam. And the structure is away from the action, the system does not require periodic maintenance calibration. The only way the affected is cam with respect to the other – not likely to happen in every day usage.

MODELING THE VEHICLE IN 3-DIMENSIONAL SPACE

After Positioning is completed, and the program is able to relate one side of the vehicle to the other, the software knows 4 distinct points that create a plane in space that are part of the vehicle. It takes these points and creates a 3-dimensional model of the vehicle plane. From this model, all alignment angles, caster, SAI, camber, and toe are referenced to the vehicle plane. This is contrast to conventional measuring-head aligners that use gravity or the rack surface as a reference. For this reason, the 3D Aligner does not rely on a level lift. In reality, the aligner does not require gravity to measure, but our vehicle's physical state will change radically in a weight-less environment.

MEASURING STEERING ANGLES

The steering angles caster and SAI are defined by physical components of the vehicle suspension, those that define the steering axis (such as upper and lower ball joints on a short-arm long-arm suspension). Conventional aligners measure these angles using gravity gauges and the toe system by monitoring the affect these angles have on those angles as the wheels turn. Once again the 3D Aligner is unique and superior.

The 3D program locates the steering axis directly in 3-dimensional space in the same way it found the vehicle's spindles. We locate the axis by putting our targets in motion about the axis by turning the wheels. First, we turn one direction 10 to 13 degrees. The software monitors the movement of the target dots, which scribe an arc. The program finds the center of each of the 33 arcs, averages, and knows where the steering axis is located. As with the spindle determination, we check our findings by turning the wheels the other direction. If the two steering axis calculations agree, we pass this along to other parts of the software that convert axis locations to caster and SAI angles referenced to the vehicle plane.

CHAPTER 3
CHECKOUT, CALIBRATION AND MAINTENANCE

TROUBLESHOOTING THE IVS SYSTEM

This Chapter was written for the purpose of troubleshooting the V3D IVS system. Earlier systems had different components that are not in the IVS system. Using this manual to troubleshoot earlier systems will result in return errors from some of the DIAGNOSTIC TEST(S). Before using this troubleshooting guide there are some steps that the user must follow. Failure to follow these guidelines will result in longer repair times and repeated callbacks. In using this guide always start with basics regardless of the complaint.

GUIDELINES

- Before beginning any diagnosis verify the customer's complaint and aligner's condition in great detail. In many cases the problem is not the equipment, it's an operator error.
- Never make more than one change at a time on a defective machine. This could result in extended repair times and unnecessary parts replacements.
- If the replacement part did not fix a problem reinstall the original component. (Before trying something else)
- If the replacement part appears to fix the machine take a few minutes to reinstall the defective part and verify the repair and diagnosis. Verification always ensures that the problem has been resolved and usually prevents a return service call.
- When sending a defective part back for repair a detailed description of the failure should be included with it. Failure to follow this procedure may result in a failed part getting returned to the field un-fixed.
- Every Technician should keep a notebook with descriptions of errors, and fixes he has encountered on the V3D. It's easier repair future problems based on known good experiences instead of guessing what was done the last time this problem was seen.
- Always have current software on-hand. Current software revision levels can be found at http://www.equiserv.com/techsupport/ServiceSoftware/SoftwareMatrix/AlignerMatrix.htm
- Before disconnecting the 15 pin high-density cables that connect to the cameras make sure the camera beam power has been turned off. Although there is circuitry in place to discharge the capacitors on the camera interface board. ***THESE ASSEMBLIES ARE NOT HOT SWAPABLE!*** Disconnecting the 15pin high-density cable from the camera pods with the power on will result in the camera pods and the IVS board being rendered unserviceable.

PC ACCESS

There are two different cabinets (Figure 1 and 2) available with the V3D IVS system. The back Panel (Figure 3-3) and PC hookups (Figure 4 and 5) for both are identical. The illustrations below show's PC access for each of the cabinets. Remove the philip screws where indicated and remove the back panel.

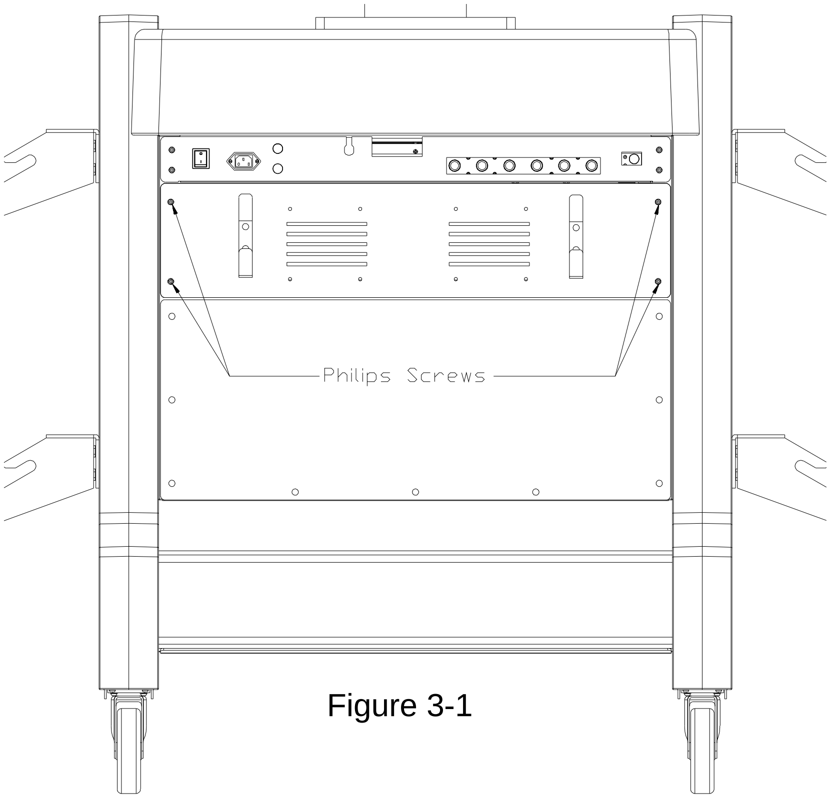


Figure 3-1

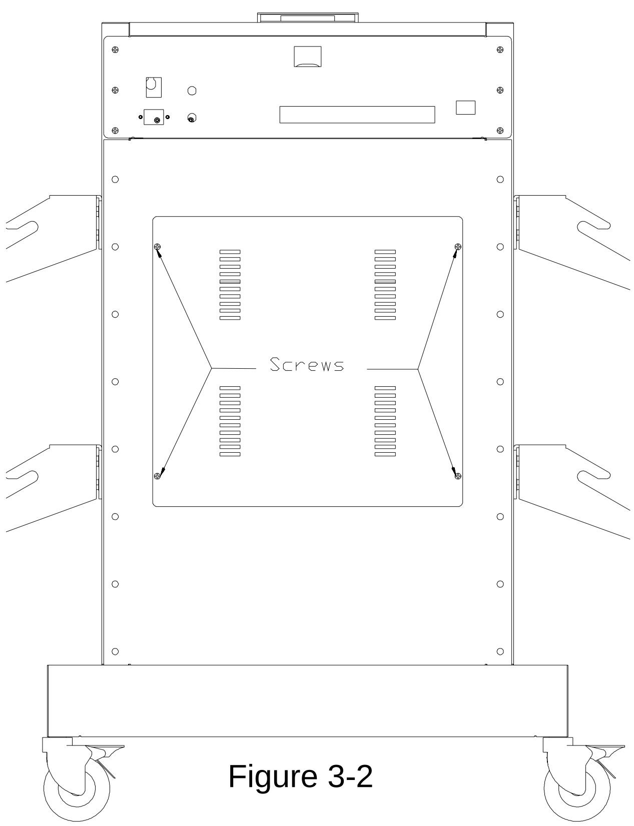


Figure 3-2

BACK PANEL

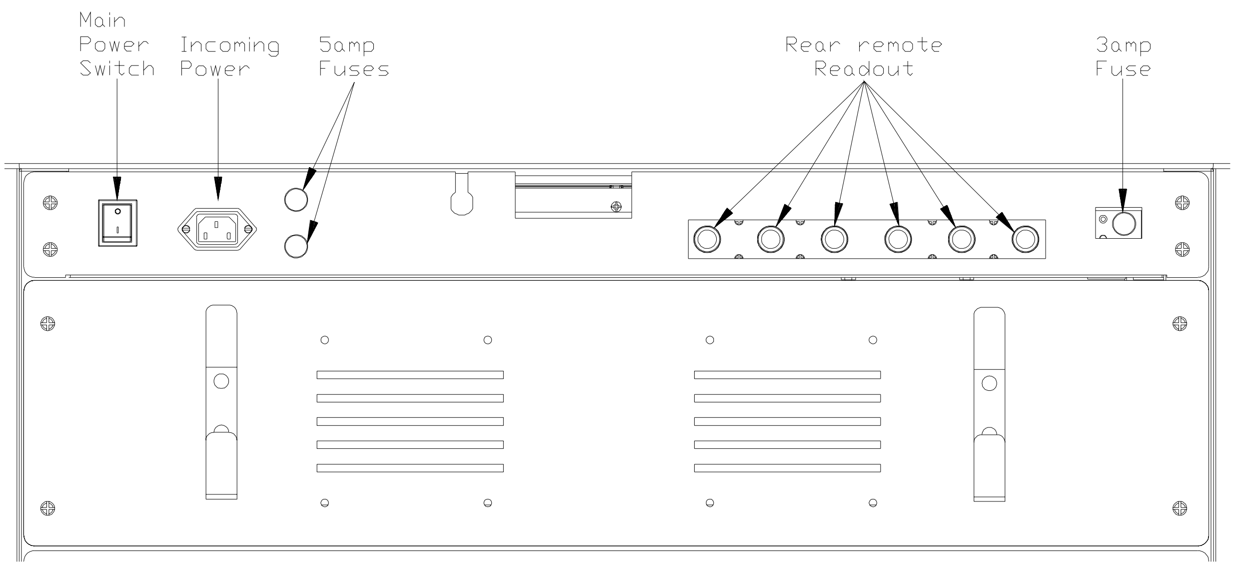
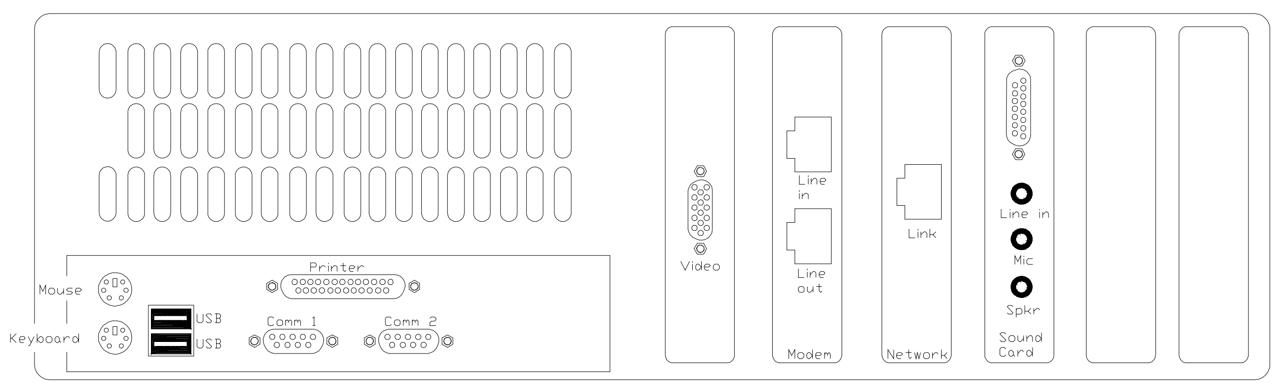


Figure 3-3

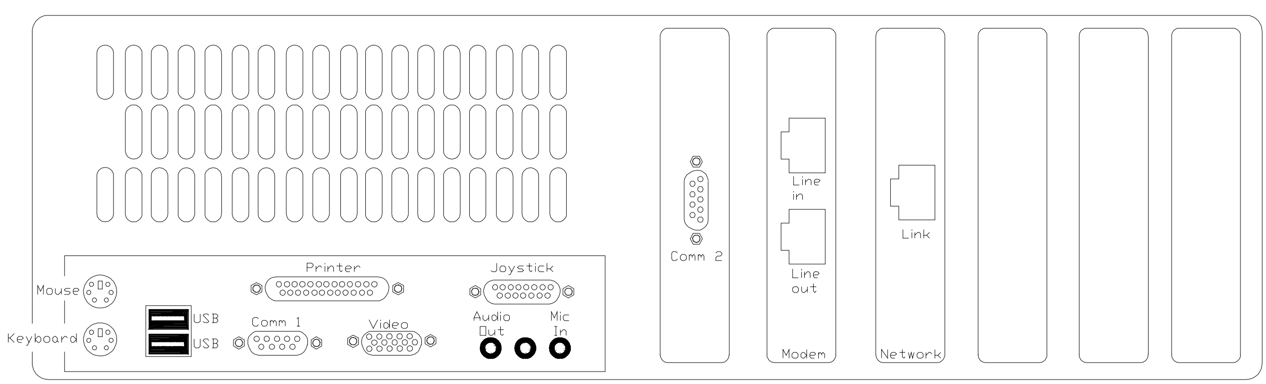
PC HOOKUP

The illustrations below show the PC hookup currently available with the V3D IVS system, specifications are subject to change without notice.



700MHZ

Figure 3-4



800MHZ

Figure 3-5

ALIGNMENT SOFTWARE INSTALLATION

1. Software Components required:
   - Alignment Software CD
   - Brand "Key Disk" floppy
   - Platinum Options "Key Disk" floppy
   - VoiceAlign™ "Key Disk" floppy
   - Specification CD
   - Specification "Key Disk" floppy

2. Boot the aligner to the Windows desktop. (Figure 3-6)

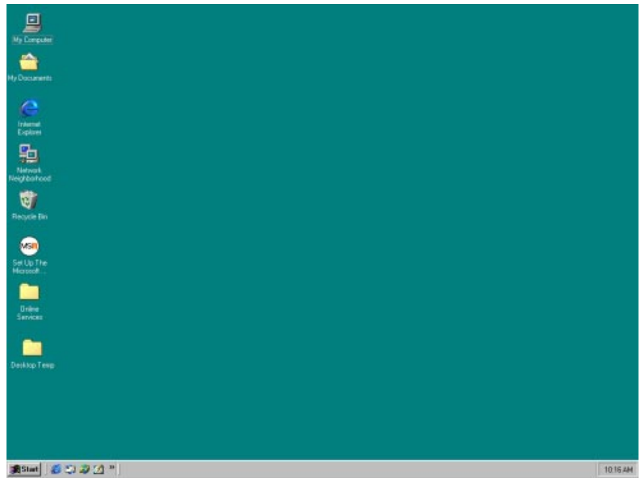


Figure 3-6

3. Insert the CD labeled Alignment software. If "Auto insert" is turned on the alignment software will automatically begin the installation process.

4. The install program will first install the EZ Shim software. After EZ Shim has been installed the unit will automatically re-boot.

5. After re-booting the unit will install Acrobat® Reader. After Acrobat® has been loaded the unit will once again re-boot. (Figure 3-7)

NOTE: IF THE UNIT DOES NOT RE-BOOT AFTER THE INSTALLATION OF ACROBAT®, THE UNIT WILL NEED TO BE RESTARTED BY REINSERTING THE ALIGNMENT PROGRAM BACK INTO THE CD DRIVE.

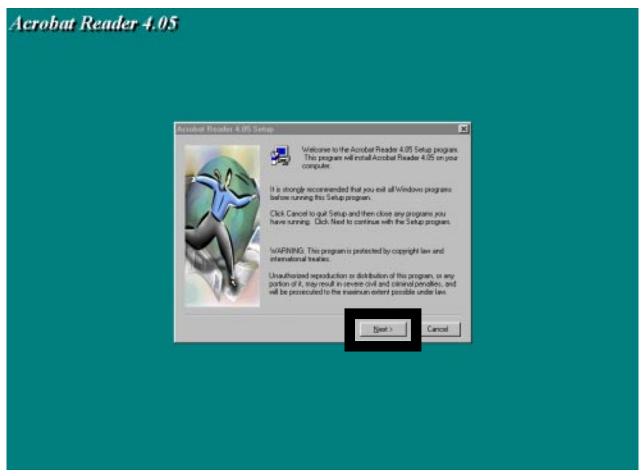


Figure 3-7

6. After rebooting, the alignment program will run and begin to load the alignment software. The install Wizard is the first screen to appear. Press **<NEXT>** to begin the installation. (Figure 3-8)

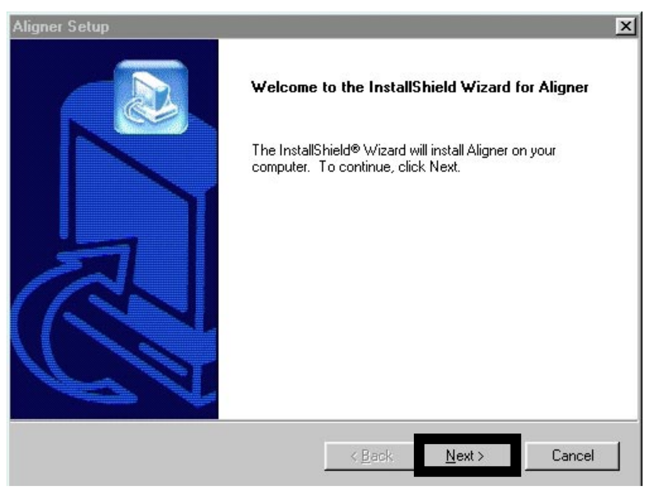


Figure 3-8

7. Read the License Agreement, if you agree click on **<YES>**. Clicking on **<NO>** will abort the installation process. (Figure 3-9)

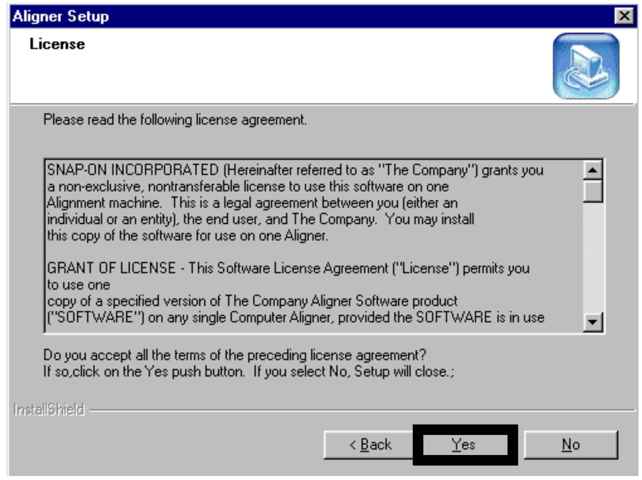


Figure 3-9

8. The alignment CD is not sensor or brand specific, the operator must choose which type of alignment software is to be loaded. Click on the icon button to choose the alignment software that you would like to install and click **<NEXT>** to proceed. (Figure 3-10)

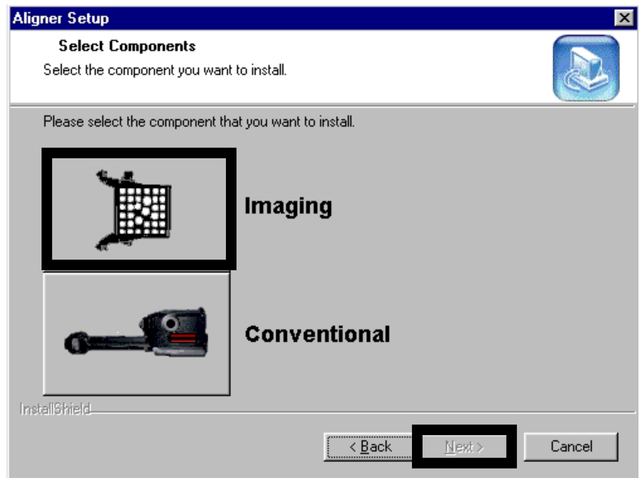


Figure 3-10

9. The default designation for the alignment software is "**C:\Program Files\Snap-on Technologies\Aligner"** click on **<NEXT>** to proceed with software installation. (Figure 3-11)

NOTE: THE INSTALLER SHOULD ALWAYS USE THE SOFTWARE DEFAULT DESIGNATED PATH.

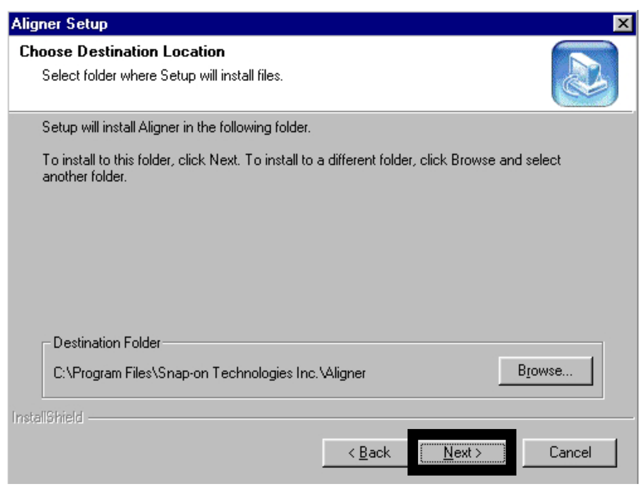


Figure 3-11

10. The next screen to appear is the language selection screen. The aligner has many different languages for easy user interface. Select the languages for this installation and then click **<NEXT>**. (Figure 3-12)

Figure 3-12

11. The aligner confirms the languages that have been chosen. Click on **<NEXT>** to proceed with the installation. If a language is not chosen, the operator can click on **<BACK>** to step back a screen the select additional languages. (Figure 3-13)

NOTE: AFTER INSTALLATION A USER CAN ADD ADDITIONAL LANGUAGES AT ANY TIME BY REINSTALLING THE SOFTWARE. THIS PROCESS WILL NOT OVERWRITE ANY PREFERENCES ALREADY SETUP BY OTHER USERS IF THE DEFAULT DESIGNATION WAS CHOSEN IN STEP 9.

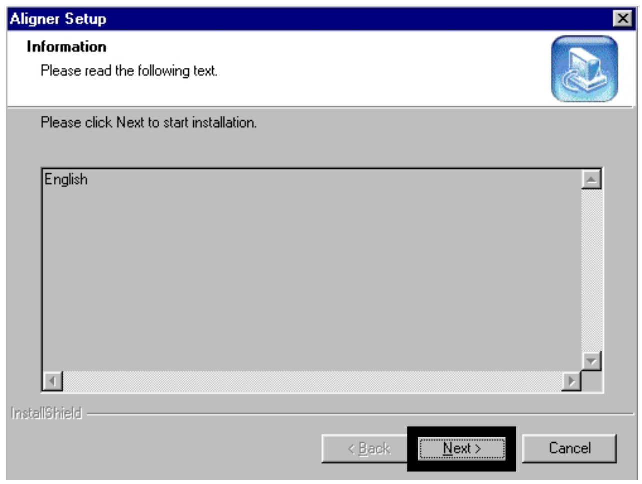


Figure 3-13

12. After a successful installation the Install Shield Wizard will display a installation complete. The unit will need to be re-booted before you can use the program, click on **<FINISH>** to re-boot the aligner. (Figure 3-14)

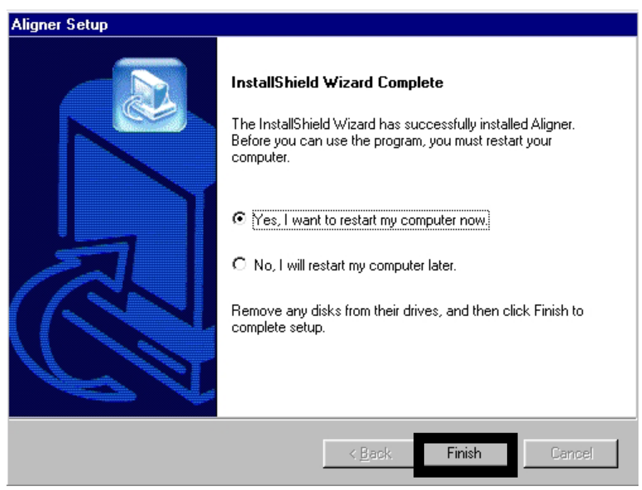


Figure 3-14

13. During the re-booting process a screen will appear asking the user to insert the **"Key Disk"** for branding. Insert the brand specific "Key Disk" into the floppy drive and click on **<OK>**. Once the **"Key Disk"** has been loaded the disk is branded rendering it useless for installations on other units. Store the disk in the cabinet for future installations for this unit only. (Figure 3-15)

Figure 3-15

14. By default the logo screen is the first screen to appear after the alignment software loads. To access the alignment software click on the **<OK>** button in the lower right hand corner of the screen. (Figure 3-16)

SOFTWARE INSTALLATION COMPLETED

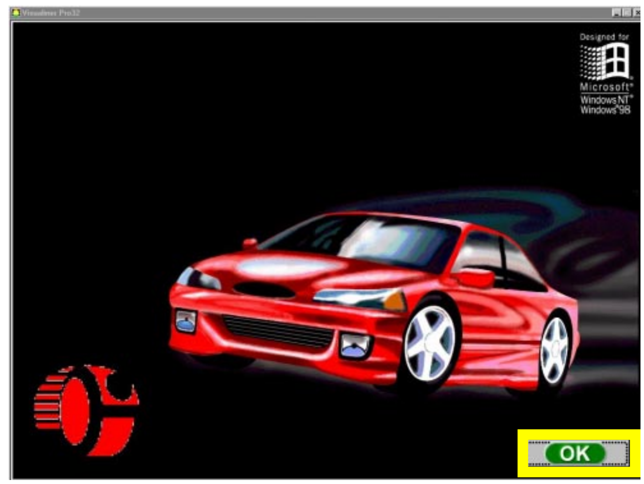


Figure 3-16

SPECIFICATION INSTALLATION

1. Choose the **<PREFERENCES>** tab from the main menu of the alignment software. (Figure 3-17)

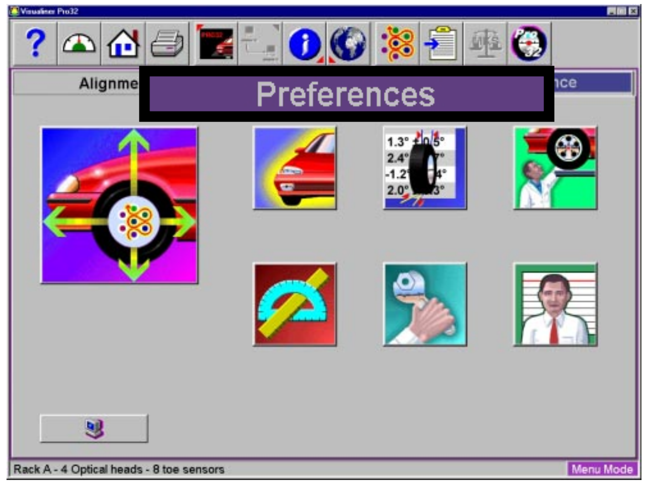


Figure 3-17

2. From the Preference menu select the **"USER INTERACTION"** icon. (Figure 3-18)

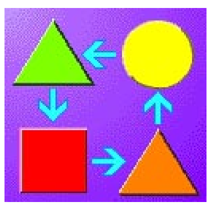


Figure 3-18

3. From the User Interaction menu select the **<SECURITY>** tab. (Figure 3-19)

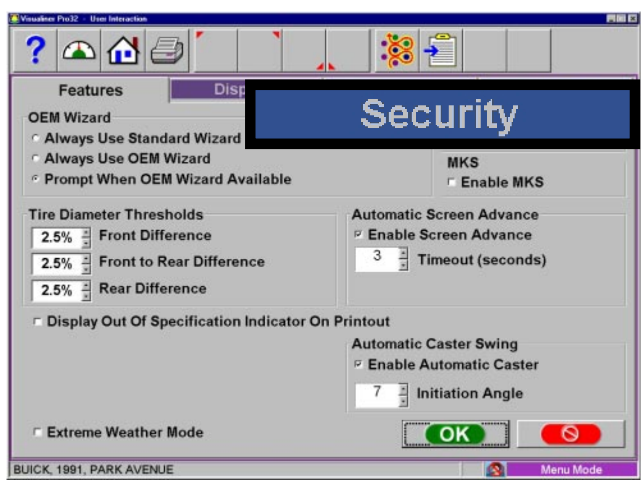


Figure 3-19

4. From the Security Menu select the **"KEY DISK"** radio button. Insert the **"SPECIFICATION KEY DISK"** into the floppy drive and select **<APPLY>**. Once the **"Key Disk"** has been loaded the disk is branded rendering it useless for installations on other units. Store the disk in the cabinet for future installations for this unit only. (Figure 3-20)

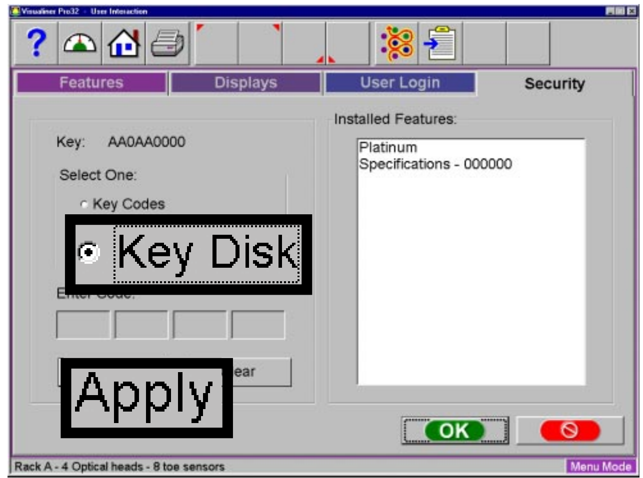


Figure 3-20

5. Jump back to the Main Alignment menu by clicking on the **"HOME"** key in the upper left hand corner. (Figure 3-21)

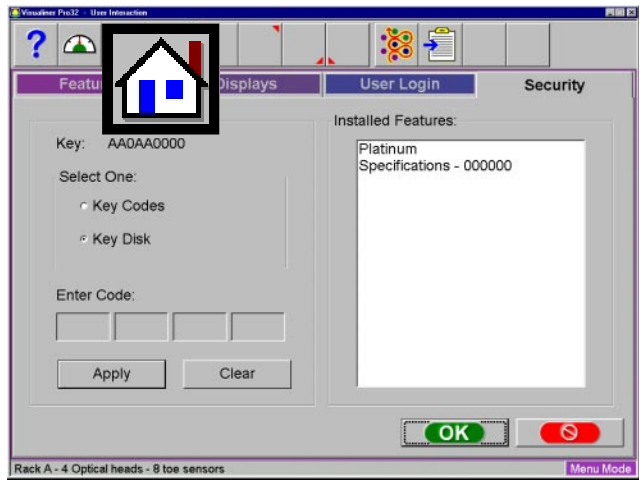


Figure 3-21

6. Choose the **<Maintenance>** tab from the Main Menu. (Figure 3-22)

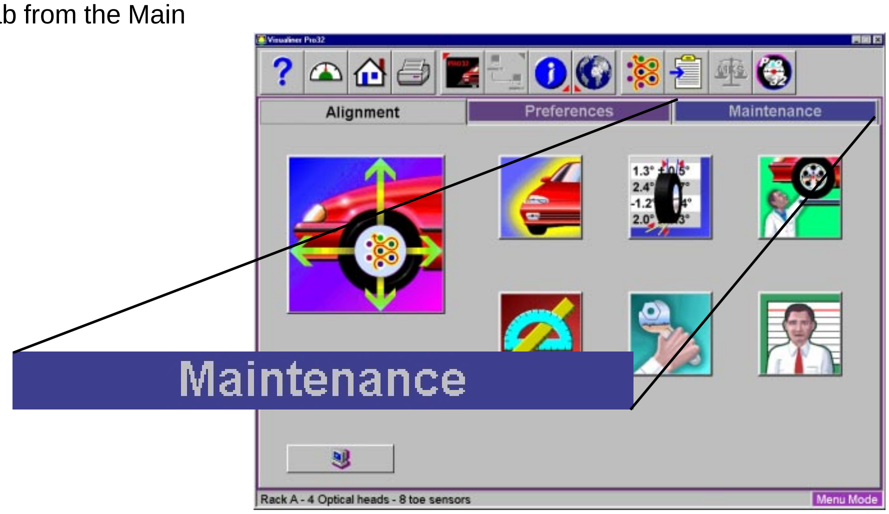


Figure 3-22

7. Choose the **"Windows Utilities"** icon from the Maintenance Menu. (Figure 3-23)

Figure 3-23

8. Double click on the **<Install>** icon from the Windows Utilities. (Figure 3-24)

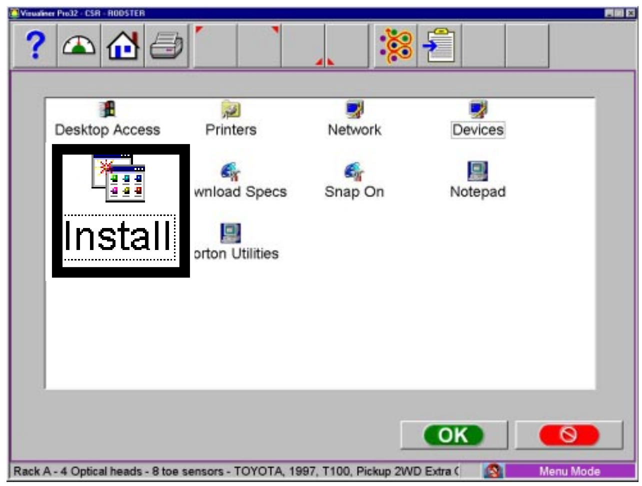


Figure 3-24

9. Insert the specification CD in the DVD drive and choose the **"Install from CD"** radio button and click on **<OK>**. (Figure 3-25)

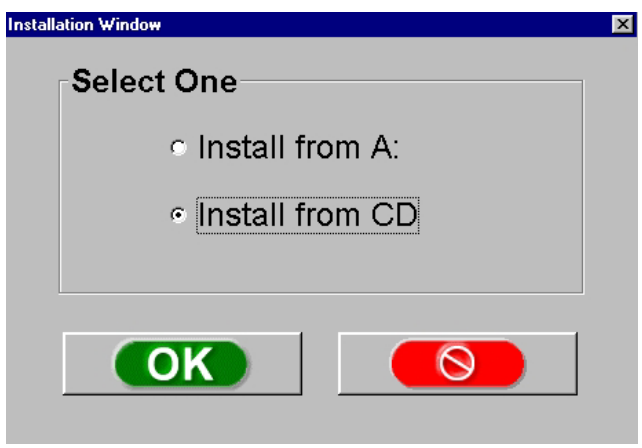


Figure 3-25

10. Choose the language for installation. This does not choose a particular specification database. This language selection only changes the dialogue for the installation of the software. (Figure 3-26)

Figure 3-26

11. Follow all on screen instructions using the default directory for installation. When prompted re-boot the aligner. (Figure 3-27)

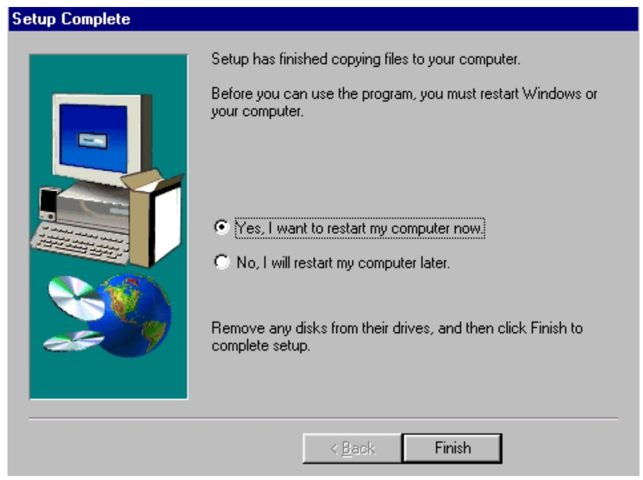


Figure 3-27

SPECIFICATION INSTALLATION COMPLETED

PLATINUM SOFTWARE INSTALLATION

1. Choose the **<PREFERENCES>** tab from the main menu of the alignment software. (Figure 3-28)

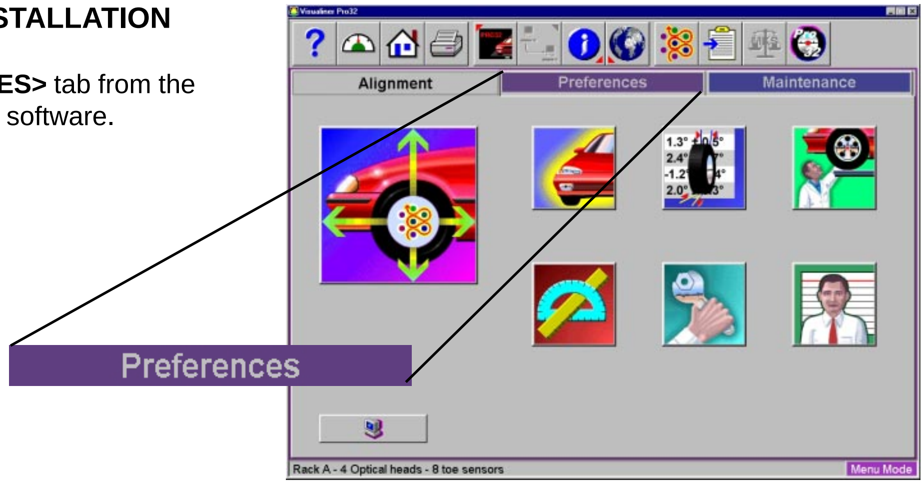


Figure 3-28

2. From the Preference menu select the **"USER INTERACTION"** icon. (Figure 3-29)

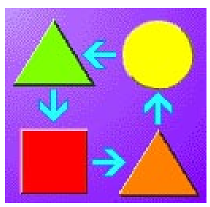


Figure 3-29

3. From the User Interaction menu select the **<SECURITY>** tab. (Figure 3-30)

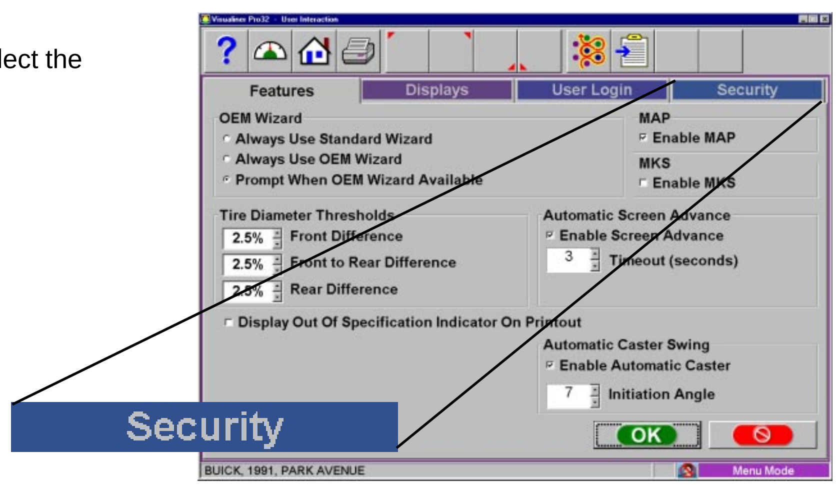


Figure 3-30

4. From the Security Menu select the **"KEY DISK"** radio button. Insert the "PLATINUM KEY DISK" into the floppy drive and select **<APPLY>**. Once the "Key Disk" has been loaded the disk is branded rendering it useless for installations on other units. Store the disk in the cabinet for future installations for this unit only. (Figure 3-31)

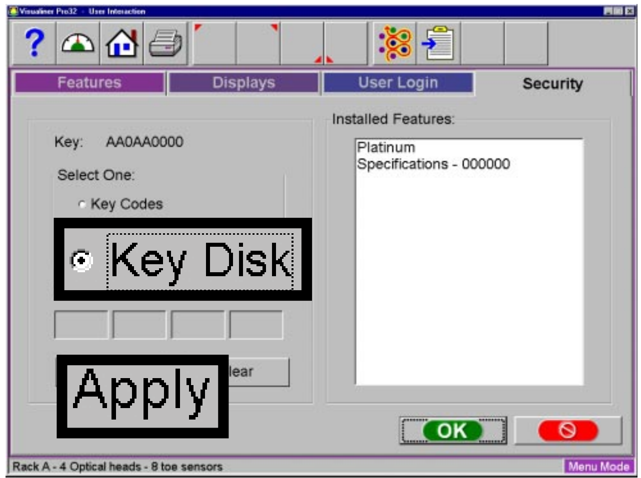


Figure 3-31

PLATINUM INSTALLATION COMPLETED

VOICEALIGN™ SOFTWARE INSTALLATION

1. Choose the **<PREFERENCES>** tab from the main menu of the alignment software. (Figure 3-32)

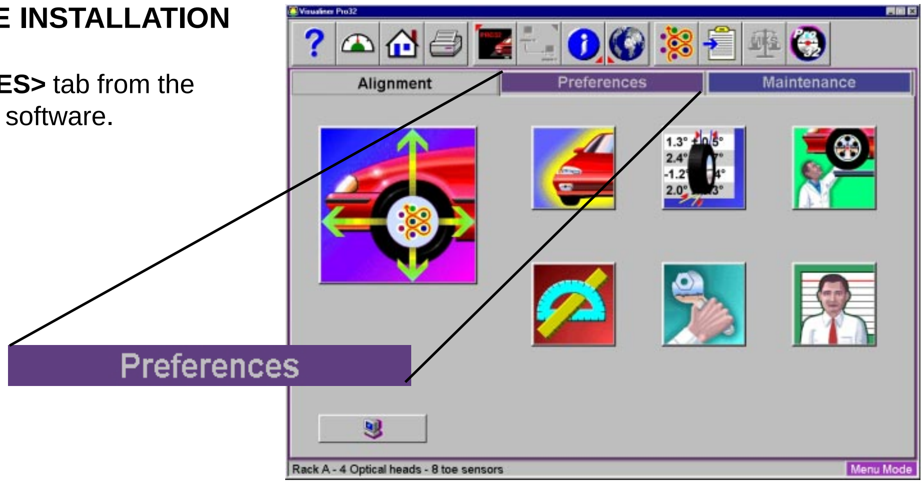


Figure 3-32

2. From the Preference menu select the **<USER INTERACTION>** icon. (Figure 3-33)

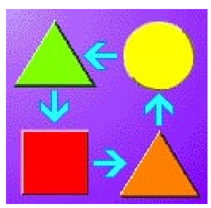


Figure 3-33

3. From the User Interaction menu select the **<SECURITY>** tab. (Figure 3-34)

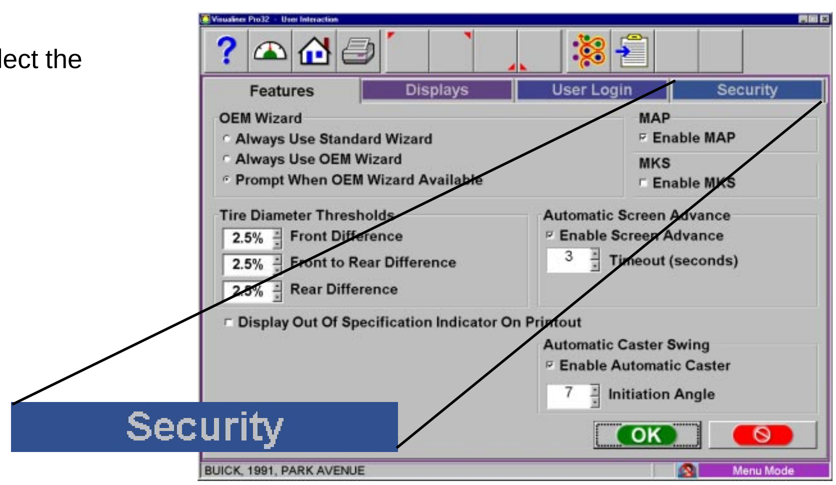


Figure 3-34

4. From the Security Menu select the **"KEY DISK"** radio button. Insert the **"VOICEALIGN™ KEY DISK"** into the floppy drive and select **<APPLY>**. Once the **"Key Disk"** has been loaded the disk is branded rendering it useless for installations on other units. Store the disk in the cabinet for future installations for this unit only. (Figure 3-35)

5. For VoiceAlign™ to be activated, the aligner must be restarted. If in the **"Non Desktop"** mode click the **<X>** box in the upper right corner of any screen or the "Shut Down Windows" icon on the Main Menu screen. If the aligner is setup to run in the "Desktop" or Windows access mode, simply restart the aligner program.

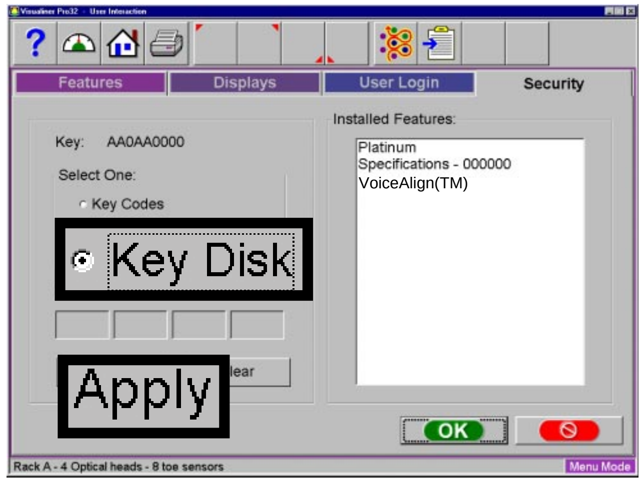


Figure 3-35

VOICEALIGN™ INSTALLATION COMPLETED

ADDING HYPER TERMINAL TO THE DESKTOP

Hyper terminal is loaded on default from the manufacture. If in the event that a complete format and reload becomes necessary follow these instructions for installing and properly setting up hyper terminal to work with the IVS system. These instructions are assuming that Windows 98 has been loaded on a clean hard drive and the “Recovery Media” CD is available.

1. Close down all software applications. Insert the “Recovery Media” CD into the drive. If “Auto Insert” is turned on close down the Windows installation process.

2. Click on **<Start> <Settings>** and choose “Control Panel”.

3. Double Click the “Add/Remove Programs” icon.

4. Click on the “Windows Setup” tab.

5. Double click on the “Communications” component.

6. Place a check mark next to “HyperTerminal” and click on **<OK>**. If hyper terminal already has a check mark beside it click on **<CANCEL>** and then **<OK>** and proceed to step 8.

7. Click on the **<Apply>** button to install the hyper terminal component.

8. Click on **<Start> <Run>** and type <HYPERTRM> and click on **<OK>**.

9. At the prompt enter the name of the hyper terminal connection and choose an icon. The factory default name of the connection is “Camera Beam to Com 1”. Click on **<OK>** after naming the connection.

10. A details box will ask for a connection type. Connect using “Direct to Com1” and click on **<OK>**.

11. The factory Port Settings are
    - **Bits per second:** 9600
    - **Data bits:** 8
    - **Parity:** None
    - **Stop bits:** 1
    - **Flow control:** Hardware

    After setting up the Port Settings click on **<OK>**

12. Complete the operation by clicking on **<File> <Save>** and then **<File> <Exit>** and choose to close down the connection.

13. Close the “Control Panel” by clicking on the **<X>** in the upper right corner.

14. To add the connection to the desktop click on **<File> <Programs> <Accessories> <Communications>** and choose the Hyper Terminal folder.

15. Hold down the **<CTRL>** key and drag the newly created icon to the desktop.

16. Follow the instructions “RUNNING HYPERTEMINAL” in this manual to test the connection.

MAINTENANCE MENU 3.1 SOFTWARE

General Maintenance for the Pro32 IVS system is done using this Maintenance Menu. (Figure 3-36)

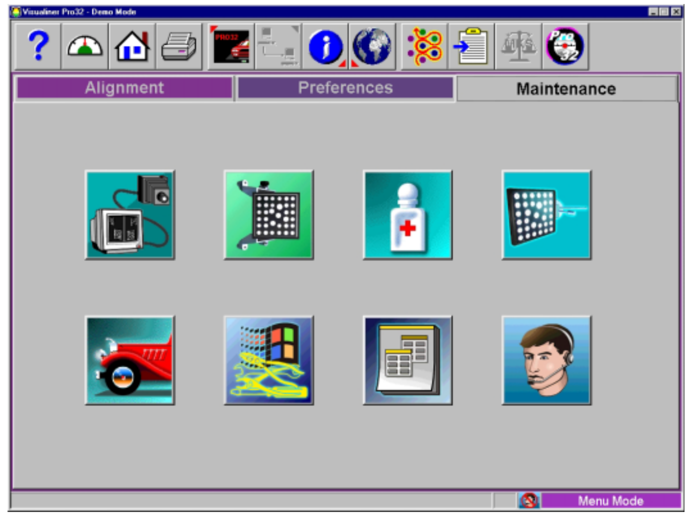


Figure 3-36

Camera View - Used to acquire raw camera images.

TID - Used to perform Target Identification on wheel targets.

Preventative Maintenance – Software feature that guides the equipment operator through recommended periodic aligner maintenance. (See Operators Manual for details)

Hub Pin Clamp Identification - The customer must have Hub Pin Clamps. This utility is similar to Target Identification but must be done if Hub Pin Clamps are available. The aligner will not perform accurate alignments using the Hub Pin Clamps if this is not done. (See Operators Manual for details)

Demo Mode - A program used primarily by sales representatives and training personnel. This is program that demonstrates the capabilities of the aligner software without actually having a vehicle available. It is a useful tool for training new or experienced users about machine features. (See Operators Manual for details)

Windows Utilities – Allows access to the Windows Desktop and also allows the operator to perform routine installation of printers, software, etc.

Database Utilities – The feature is used for backing up and restoring alignment based data files, customer data, etc. (See Operators Manual for details)

Speaker Training – Optional Hardware / Software package that allows and end-user to control the aligner through voice commands. (See Operators Manual for details)

CAMERA VIEW

This screen shows the view of the targets as seen by the Visualiner 3-D™ cameras on each side of the vehicle. Camera View can be used to assure proper positioning of the camera beam when a movable beam is used to mount the cameras. The Movable Camera Beam can be lifted to varying heights for vehicle adjustment. This is also valuable as a troubleshooting aid whenever the software has difficulty during target acquisition, or loses a target for a long time period. In order for the Visualiner 3-D™ to work properly, the cameras must see the front and rear targets within the "field of vision" described by this screen. This does not however ensure that the cameras are working properly other problems may exist with the cameras however they can still acquire targets.

1. From the Home screen, select the Maintenance tab. (Figure 3-37)

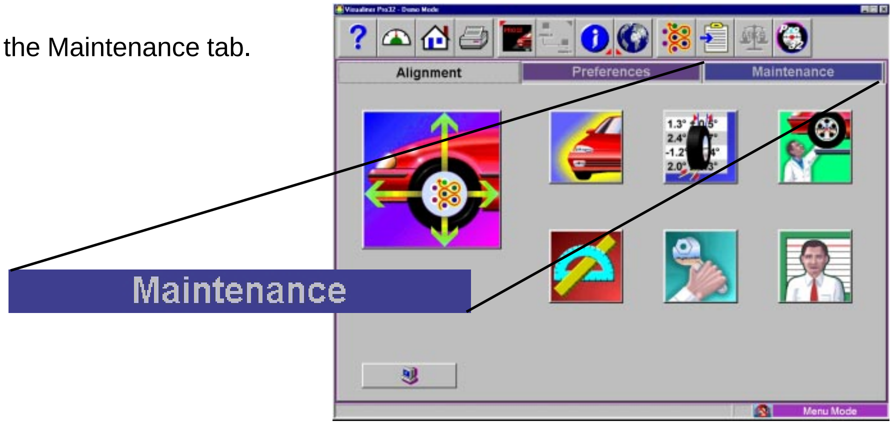


Figure 3-37

2. Click on the Camera View icon to initiate the procedures. (Figure 3-38)

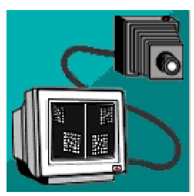


Figure 3-38

3. A camera view field will display what the cameras are seeing. (Figure 3-39)

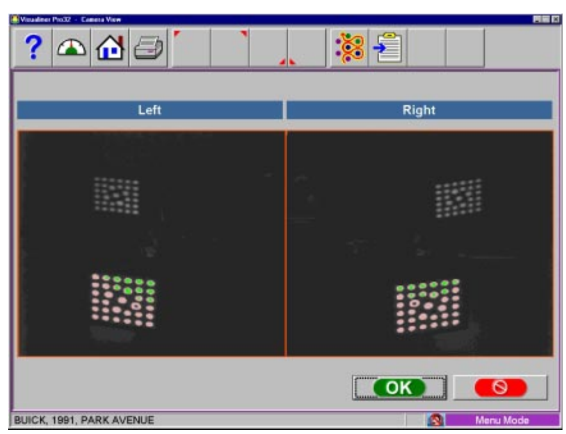


Figure 3-39

TARGET ID

The Target ID process is integrated into the graphical user interface. Anytime target ID is done the aligner must be re-booted before the new values will be used. The “Standard Clamps” come standard with the aligner. The customer has the option of purchasing other styles of wheel clamps. If other wheel clamps other than the standard are available they must be ID’d before using them in the alignment procedure.

1. From the Home screen, select the Maintenance tab. (Figure 3-40)

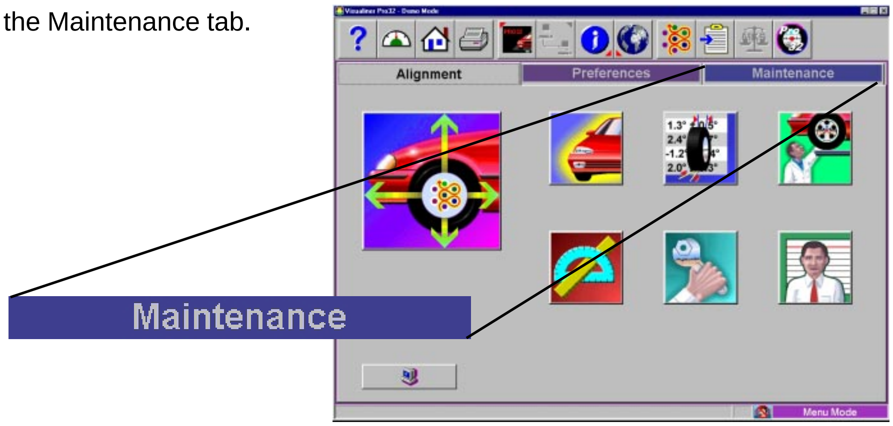


Figure 3-40

2. Click on the Target ID icon to initiate the procedures. (Figure 3-41)

Figure 3-41

3. Select the type of target ID to be performed. Choices are “Standard Clamps” or “Hub Pin Clamp”. These instructions are written for the “Standard Clamps”. (Figure 3-42)

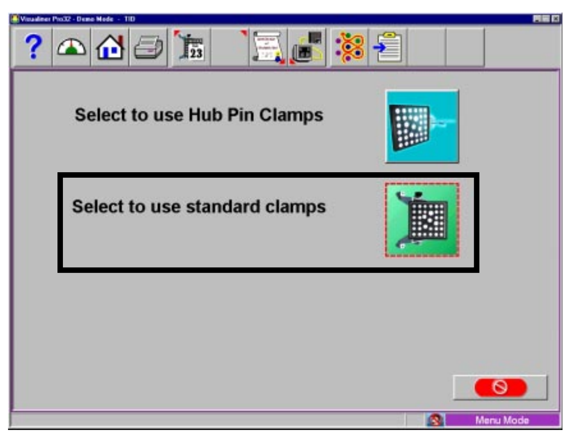


Figure 3-42

4. Move the box around the screen using the arrow keys and click OK, or you can double-click on the desired wheel. (Figure 3-43)

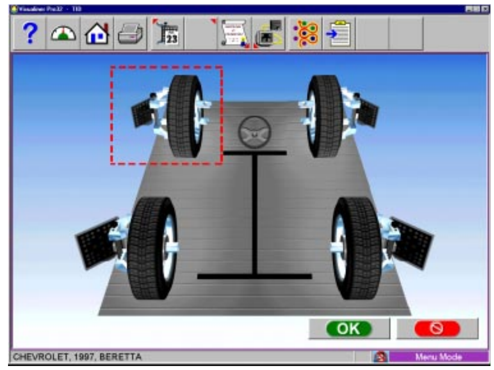


Figure 3-43

5. Once the wheel is selected the screen will instruct the operator to place the target/clamp assembly on the front wheel and lock the steering wheel using the clamp. (Figure 3-44) This step insures the wheels will not move laterally during the Target ID procedure. The next step on this screen is to elevate the front wheels to allow them to rotate as needed. Click OK when ready to proceed.

NOTE: USE RIGID SUPPORTS, ANY DOWN MOVEMENT OF THE WHEELS CAN AND WILL CAUSE INCORRECT MEASUREMENTS WHICH WILL IN TURN CAUSE INACCURATE ALIGNMENT READINGS.

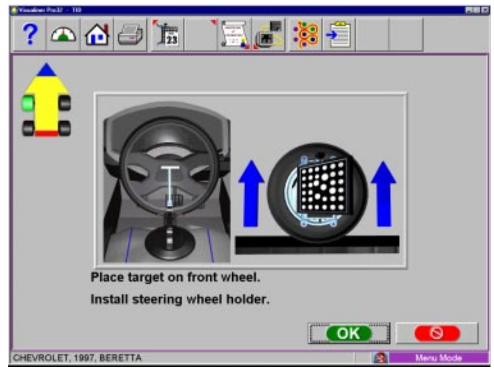


Figure 3-44

6. Once the system acquires the target an arrow indicates the direction to rotate the target/wheel. The initial rotation is 25º forward. (Figure 3-45)

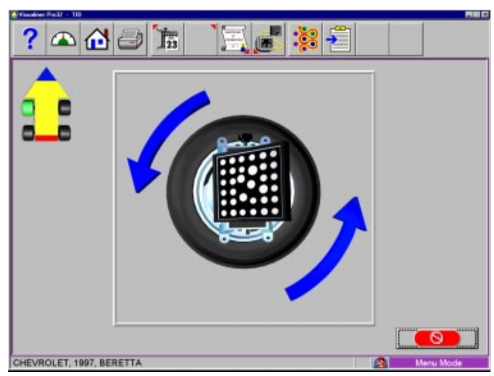


Figure 3-45

7. If the tire and wheel is rotated past the 25º point the arrows will change from blue to red letting the operator know to rotate back. (Figure 3-46)

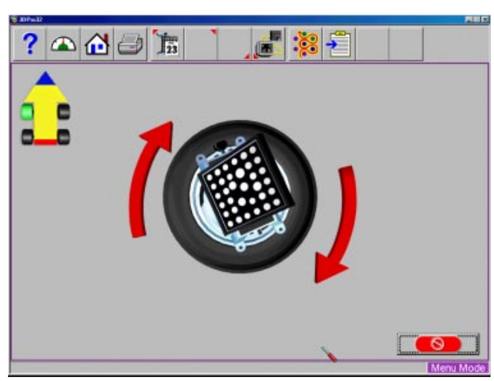


Figure 3-46

8. Once the wheel has reached the desired location a stop sign will appear in the center of the wheel. Hold the wheel steady as the aligner will take a reading. (Figure 3-47)

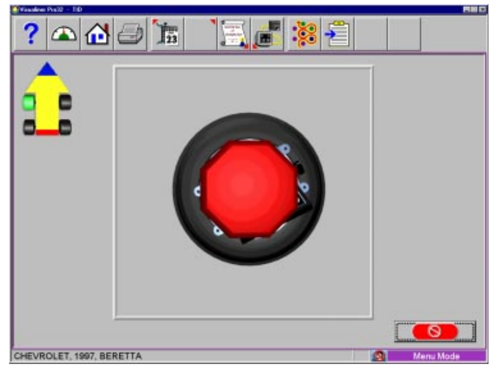


Figure 3-47

9. After the readings have been taken the screen instructs with arrows indicating to rotate the wheel and target back 90º. (Figure 4-48) This 90 degrees is from the first 25º forward, rotate the tire back until a stop sign appears as in step 8 and hold the wheel steady as another reading will be taken.

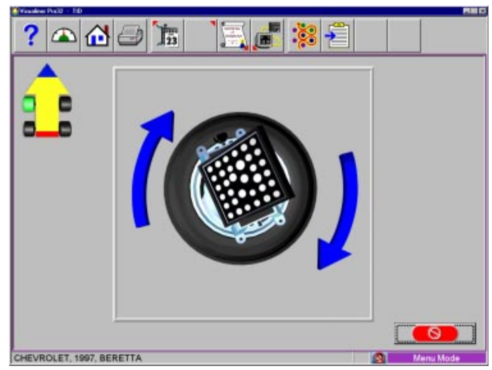


Figure 3-48

10. After the readings are taken the arrows indicate to rotate the tire and wheel assembly forward 90º. (Figure 3-49) Rotate the wheel until a stop sign appears and hold the wheel steady as a reading will be taken.

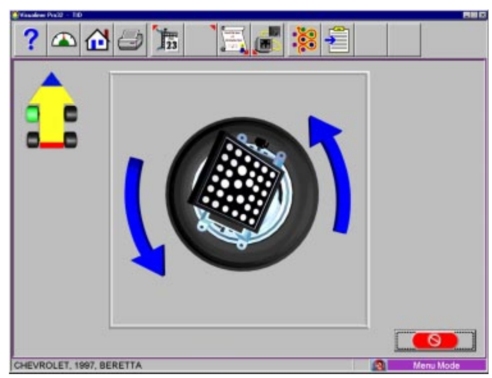


Figure 3-49

11. After the completion of a successful target ID the screen indicates to lower the wheel. (Figure 3-50) This is not necessary if the opposite side target is needing to be ID, click on the **<OK>** button and select the next target. Lower the wheels after all four targets have been ID'd.

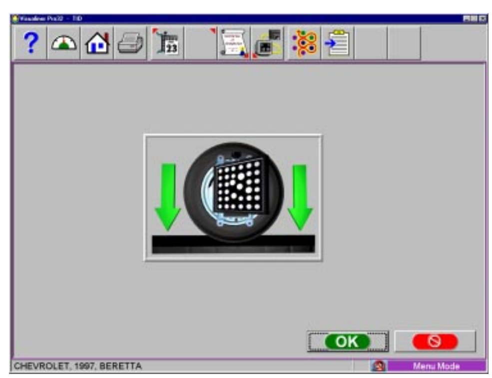


Figure 3-50

13. The program returns to the Target Selection screen to allow additional targets to be ID'd. (Figure 3-51) Repeat this process for all targets. A green check mark appears next to the targets that have been ID'd.

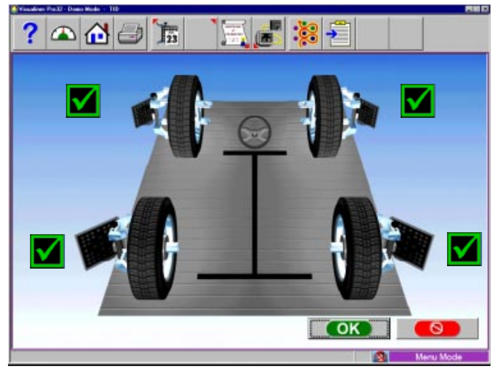


Figure 3-51

14. Checking current TID dates can quickly be determined by clicking on the date icon in the tool bar. (Figure 3-52) The software brings a date screen forward displaying a matrix for each target and the last date that TID was done on each target.

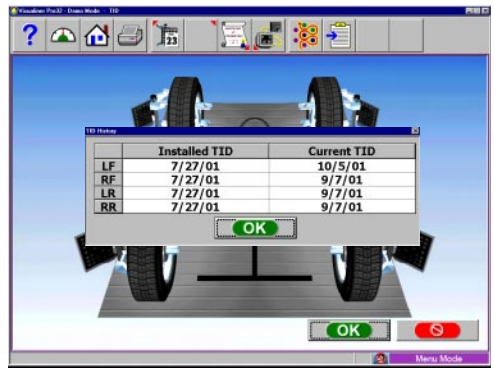


Figure 3-52

NOTE: TARGET ID IS ALWAYS PERFORMED WITH THE FRONT OR REAR TARGET MOUNTED TO THE FRONT WHEELS. THE ALIGNMENT PROGRAM MUST BE RE-BOOTED BEFORE THE NEW VALUES ARE USED.

WINDOWS UTILITIES

The Windows® operating system is transparent to the operator. Without having access to Windows®, the user would not be able to perform some of the needed functions to maintain the aligner. The Windows utility menu offers all of the needed access to Windows® while maintaining the Windows® environment integrity. (Figure 3-53)

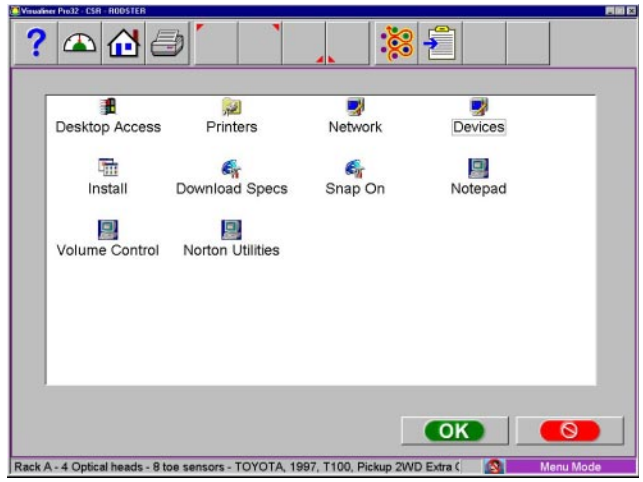


Figure 3-53

Desktop Access - Allows access to the Windows® desktop in emergency situations. Disables access to the Windows® Desktop. Should the unit arrive without access to the desktop a password is available to the service technician to allow access. To obtain security access the technician must call the Support Help Desk to obtain access rights. For security purposes this access code is not given in any documentation, this is to prevent unauthorized entry to the Windows environment.

Printer - Allows installation of printers and printer maintenance functions.

Network - Allows the operator access to Windows® networking utilities.

Devices - Allows the operator access to Windows® system properties.

Install - Used to Install Alignment Software upgrades and Specification updates.

Download Specs - Future expansion that will allow the customer to download specification updates from the internet.

Snap-on - Hyperlink to Snap-on and subsidiary companies of Snap-on. Use F5 to back page.

Notepad - Allows access to Windows Notepad.

Volume - Allows access to control the volume output of the speakers.

Norton Utilities - A stand alone software program to allow the operator to troubleshoot problem PC's. (See manual that is supplied with the software)

COVERING THE BASICS

These procedures must be followed before placing a call to tech support. Failure to have these answers when asked result in longer customer down time and additional calls to TECHNICAL SUPPORT.

1. Verify complaint. (Remember, operator error requires proper training, no service tools or service parts are needed.)

2. Note the conditions in great detail (I.E.)
    - Weather,
    - Temperature,
    - Time of day,
    - Sun position,
    - Heater locations,
    - CRT under the camera,
    - CPU speed and type,
    - Motherboard type,
    - Installed memory,
    - Printer type,
    - Software revision #,
    - Machine serial #,
    - Modification Status,
    - Hardware configuration,
    - Is the machine using the latest files? (I.E. software version level)

3. Is the condition repeatable? If yes, ... what sequence makes the condition occur?

4. Where is the machine located in the shop?

5. Distance from cameras to Turn plate centerline and distance between the camera pods (Is the unit within the proscribed installation parameter?)

6. What type of equipment is used near it? (Possible interference)

7. Check camera view.
    - Ensure Cal Target is visible, and un-obscured.
    - Clean the targets.
    - Clean the camera lens. (To clean camera use canned air don't touch lens with fingers)

8. Verify TID, and RCP File dates are valid. *.VCD / *.PLD. The RCP and TID dates should be no older then the installation date of the unit.

NOTE: RCCP.PLD AND RCTP.PLD TYPICALLY WILL HAVE DATES OLDER THEN THE INSTALL DATE. THIS IS NORMAL.

9. Verify Power and ground to unit is acceptable. (115 volts ± 10%)

    - Is this a dedicated circuit?
    - Verify polarity.(correct orientation of hot neutral, and ground)
    - Verify ground. Aligner must be properly grounded. (Resistance from Aligner to earth ground should be less 0.5 Ohms.)

10. Check for mechanical issues. (Clamps, cables, damage to unit)

11. Check and review for any service bulletins that may be available. www.Equiserv.com.

IVS PROCESSOR BOARD

1. Verify the voltage at the IVS board. Measure voltage at the pads located at the lower left corner of the IVS board. (Figure 3-54)

   - Pad labeled 2.5Vdc should read 2.5Vdc ±.1Vdc
   - Pad labeled 3.3Vdc should read 3.3Vdc ± .1Vdc
   - Pad labeled 5Vdc should read 5Vdc ± .25Vdc
   - Pad labeled 12Vdc should read 12Vdc ± .8Vdc
   - Pad labeled 24Vdc should read 24Vdc ± 2.0Vdc
   - If the voltage is out of spec replace the power supply. Do not attempt to adjust the output voltage!

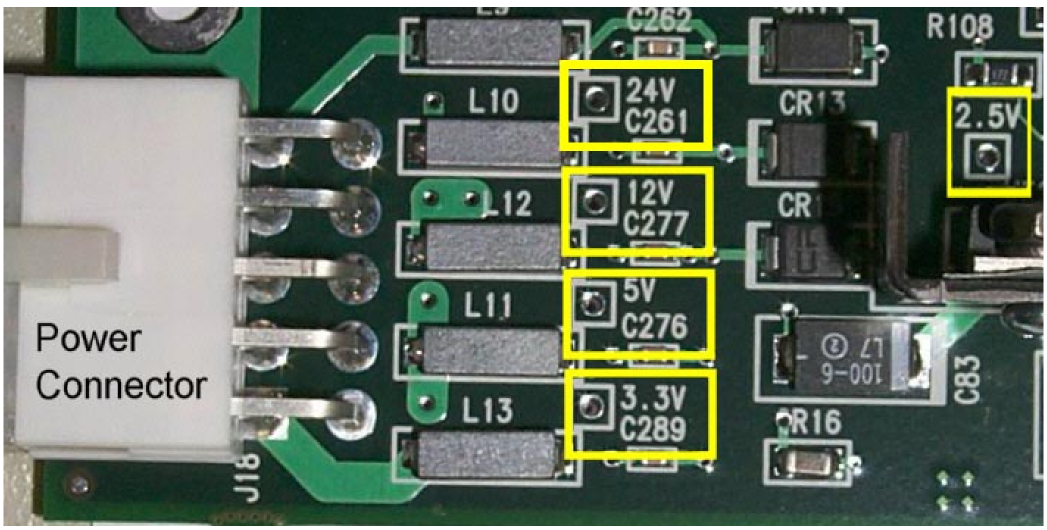


Figure 3-54

2. Check the integrity of the camera data cables.

3. Check for successful completion of POST.

POST (POWER ON SELF TEST)

- Runs anytime the IVS board is powered up.
- Does not need to be connected to the PC to run.
- Should be run by cycling power to the IVS board off then on (Hitting the reset button on the board is not recommended).
- Uses a special serial cable to communicate with the PC COMM PORT (cable must be procured through Engineering)

What does POST do?

POST tests the IVS for the device presence and internal register of the following Items:

SDRAM Memory: POST tests all memory Address and Data lines and will plug in data at random locations to see if memory is there.

Genlock: Checks that the IVS board can synch or lock to the cameras.

Image Capture DMA: Checks that the camera can output an image, and checks the timing of that image. ***Note: This tells us nothing about the image quality.***

Leading and Trailing Tag Data: Tells us when an image starts, when an image ends, and when it was taken. This is also used to determine if the image is “good”.

Serial Port Loopback: Tests communication out to the serial port.

I2C R/W to All Camera Grid Proms: Checks our ability to communicate out to the Grid Proms. ***Note**: **We will pass this test even if the Grid Prom is blank.***

BootFlash R/W: Tests our ability to read and write to the BootFlash, where the board start up code is stored.

Optional Flash R/W: Tests our ability to read and write to the Optional Flash that is used for security (similar to HIB board).

Selected Error Detection Capability: This is where we inject errors into the system (IVS board) and check that the CPLD can detect those errors.

POST does **not** test the following items:

- USB External Communication
- Image Quality, A/D response
- Gain
- Strobe

Post reports the following items:

- CPLD Revision Status
- FPGA Revision Status
- RomBoot Revision and Date
- GridFlash Number of Writes of all Cameras
- Number of Cameras connected

SUCCESSFUL POST VERIFICATION

1. Using a 5/64 Hex key remove the two 6/32-button head Hex screws from the IVS main housing cover (located on the lower RH beam V3D2 & located at the left tower base Arago III). Remove the IVS main housing cover.
2. Switch on the power for the IVS and cameras and observe the LED's on the IVS board.
3. Verify that all LED's are on for ~1 second during reset. (Figure 3-55)

Figure 3-55

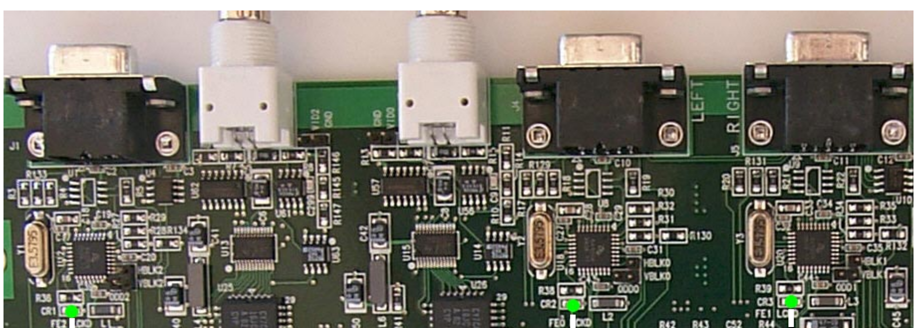
4. Run Led on for ~1 second at start of POST. (Figure 3-56)

Figure 3-56

5. All LEDs briefly illuminate and then cycle for ~2 seconds.
6. Verify run Led on or blinking for the remainder of POST.

7. Verify locked indication as genlock chips initialize in sequence and lights the genlock lights. (Figure 3-57)

Figure 3-57



- Verify locked condition at all times
- Verify Fault Lamp Does not illuminate after LEDs Cycle.

8. If Fault Led illuminates read test number from B0-B3, attach serial cable and rerun POST (see Post fails diagnosis)

9. At end of POST verify all status lights go out. The system is now waiting for software down load from Pro32. (Figure 3-58)

Note: The genlock lights, And the RTC light will remain on. POST is finished at this time.

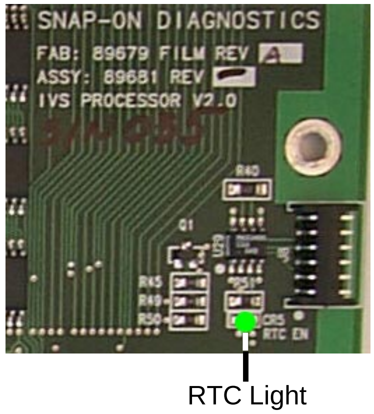


Figure 3-58

If the unit (PC and Cameras) were rebooted at the same time
The sequence will continue as follows:

6. At the beginning of the download once IVS connection with the PC is established LED's Run, B0, B1, and B2 will illuminate.

7. Watch to see that Pro32 successfully boots and the IVS down load screen shows success.

8. Ensure the Fault Light does not Illuminate.

9. From Pro32 start new alignment and make sure the run lamp on the IVS board is flickering.

10. With a vehicle on the rack and targets attached, or targets set on the rack (in the proper orientation). Go to camera view and verify that all five targets are visible.

11. Return to the rollback screen and verify that the wheels turn blue and positioning completes successfully.

12. After the successful completion of positioning perform Caster swing, and verify that it can be completed successfully.

RUNNING HYPERTERMINAL

The previous discussion covered a proper IVS processor boot up sequence. All of this can be viewed using a feature of Windows called "Hyperterminal". Factory default software loads hyperterminal and adds an icon on the Windows desktop. By double clicking the icon hyperterminal is turned on and ready to view an IVS processor boot up (POST). This procedure is also a very valuable tool for proper troubleshooting and repair of any suspected IVS V3D camera beam issue.

1. Make sure both the camera beam and the aligner console is powered down.

2. Remove the access cover to the IVS Processor and unplug the USB connection (J15).

3. Remove the back access panel on the aligner console.

4. Attach the Data Communication cable (EAW0235J08A) to COM Port 1 of the PC. If the COM Port does not work try plugging the cable into the other COM Port.

5. Attach the Serial Connection end of the Data Communication cable to (J17) the Serial Connection of the IVS Processor (Directly above IVS Power Connector).

6. Power up the PC and exit the alignment software.

7. Double click the "Hyper terminal" icon on the Windows desktop and allow it to load.

8. Power up the IVS Processor.

7. The IVS processor completes a POST and displays the boot up sequence on the Hyperterminal screen. (Figure 3-59)

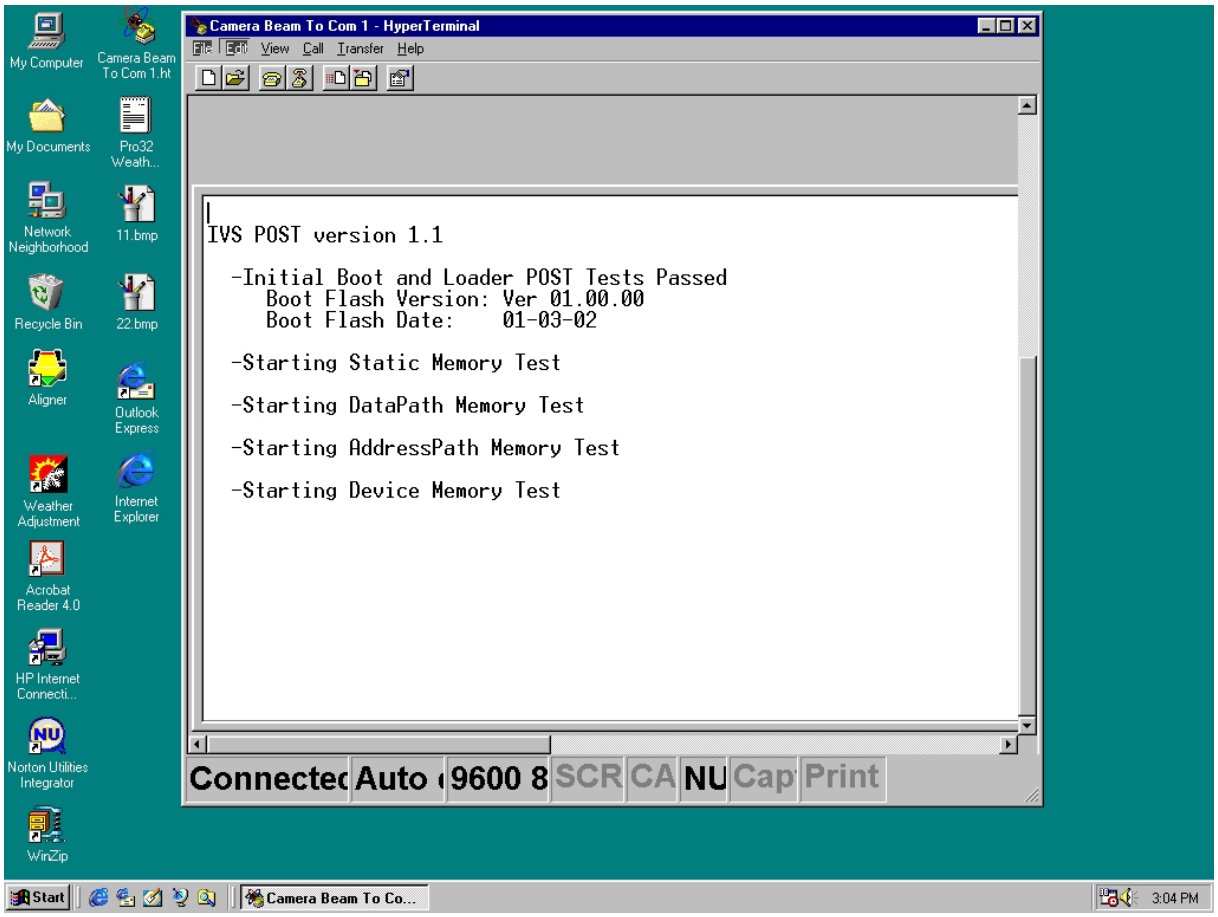


Figure 3-59

HYPER TERMINAL SETTINGS:

Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: Hardware

GOOD "POST" TEST USING HYPERTERMINAL

IVS POST version 1.1

- Initial Boot and Loader POST Tests Passed
  Boot Flash Version: Ver 01.00.00
  Boot Flash Date: 03-02-01
- Starting Static Memory Test
- Starting DataPath Memory Test
- Starting AddressPath Memory Test
- Starting Device Memory Test
- Starting Proc Pld Test, PLD Revision = 0xa0
- Starting Flash Memory Test
  EraseCount for Flash 0 = 88
  EraseCount for Flash 1 = 88
- Starting USB Port Test

ERRORS IN THIS AREA REQUIRE IVS BOARD REPLACEMENT

- Starting Initialize Front End
  Camera 0: Line Count = 305 Pixel Count = 488
  Camera 1: Line Count = 305 Pixel Count = 488
  Camera 2: Line Count = 305 Pixel Count = 488 (Arago III only)
- Starting I2C Verify GRID eeprom Tests
  Grid Flash program count for Camera 0 = 35
  Grid Flash program count for Camera 1 = 43
  Grid Flash program count for Camera 2 = 87 (Arago III only)
- Starting Image Capture No Interrupt
  Cam0 1st field
  Cam0 2nd field
  Cam1 1st field
  Cam1 2nd field
  Cam2 1st field (Arago III only)
  Cam2 2nd field (Arago III only)
- POST done

ERRORS IN THIS AREA RE-QUIRE CHANNEL DIAGNOSIS!

No Failures Detected

FAILED "POST" TEST USING HYPERTERMINAL

IVS POST version 1.1

- Initial Boot and Loader POST Tests Passed
  Boot Flash Version: Ver 01.00.00
  Boot Flash Date: 03-02-01
- Starting Static Memory Test
- Starting DataPath Memory Test
- Starting AddressPath Memory Test
- Starting Device Memory Test
- Starting Proc Pld Test, PLD Revision = 0xa0
- Starting Flash Memory Test
  EraseCount for Flash 0 = 125
  EraseCount for Flash 1 = 125
- Starting USB Port Test
- Starting Initialize Front End
  Camera 0: Line Count = 305 Pixel Count = 488
  *** Error Camera 1 is connected but no Video present ***
  Failed initial lock for Camera 1, attempting lock recovery
  Failed lock recovery 0 for Camera 1,
  Failed lock recovery 1 for Camera 1,
  Failed lock recovery 2 for Camera 1,
  Failed lock recovery 3 for Camera 1,
  Failed lock recovery 4 for Camera 1,
  *** Error Camera 1, will not lock ***
  *** Error Incorrect Pixel Count Camera 1 ***
  *** Error Incorrect Line Count Camera 1 ***
  Camera 1: Line Count = 305 Pixel Count = 463
  Camera 2: Line Count = 305 Pixel Count = 488 (Arago III only)

NOTE: ERROR IN CAMERA 1 PIXEL COUNT

- Starting I2C Verify GRID eeprom Tests
  Grid Flash program count for Camera 0 = 45
  Grid Flash program count for Camera 1 = 49
  Grid Flash program count for Camera 2 = 87
- Starting Image Capture No Interrupt
  Cam0 1st field
  Cam0 2nd field
  Cam1 1st field
  Cam1 2nd field
- Test_ID = 11,Error: pix or line count
  Cam2 1st field
  Cam2 2nd field

POST done
***** Failures Detected !!! *****

CHANNEL DIAGNOSIS

Source 0=Camera 0= Left Camera

Source 1=Camera 1=Right Camera

Source 2=Camera 2=CAL Camera

Channel Diagnosis is used to differentiate the error between the following items:

Front End of the IVS board = IVS board replacement
Cameras/ Camera pod = Pod assembly replacement
Cables (video/ Data)= Cable replacement

Using the given example of a Failed POST test the correct course of action would be to:

1. Power down the IVS board
2. Disconnect the left camera (camera 0) and the right camera (camera 1) from the IVS board, and plug the right camera into the connectors marked left and the left camera into the connectors marked right.
3. Power up the IVS board and check POST Status
4. If error remained at camera 1 replace the IVS board
5. If error moved to Camera 0 suspect bad camera pod assembly, or defective cables.
6. Power down the IVS Board
7. At the Camera pods swap the cables between Camera 0 and Camera 1
8. Power up the IVS board and check POST Status
9. If error is reported at Camera 0 replace cable (in this case you would replace the video cable)
10. If the error is reported at Camera 1 replace the Camera pod assembly
11. Power down the unit and replace the defective part and verify no failures in POST
12. Power down the unit, disconnect the Serial cable, and connect the USB cable
13. Power up the unit and verify aligner functionality (Target acquisition, Positioning, Caster swing, ETC..)

Example 2 Failed POST Test

IVS POST version 1.1

- Initial Boot and Loader POST Tests Passed
  Boot Flash Version: Ver 01.00.00
  Boot Flash Date: 03-02-01
- Starting Static Memory Test
- Starting DataPath Memory Test
- Starting AddressPath Memory Test
- Starting Device Memory Test
- Starting Proc Pld Test, PLD Revision = 0xa0

  ** Failed Proc_Pld Init at Addr = 0x80000006 **
  Data = 0xdc00, S/B = 0xc000
  Test_ID = 5,Error: Proc PLD
- Starting Flash Memory Test
  EraseCount for Flash 0 = 10
  EraseCount for Flash 1 = 10
- Starting USB Port Test
- Starting Initialize Front End
  Camera 0: Line Count = 305 Pixel Count = 488
  Camera 1: Line Count = 305 Pixel Count = 488
  Camera 2: Line Count = 305 Pixel Count = 488 (Arago III only)
- Starting I2C Verify GRID eeprom Tests
  Grid Flash program count for Camera 0 = 52
  Grid Flash program count for Camera 1 = 88
  Grid Flash program count for Camera 2 = 49 (Arago III only)
- Starting Image Capture No Interrupt
  Cam0 1st field
  Cam0 2nd field
  Cam1 1st field
  Cam1 2nd field
  Cam2 1st field (Arago III only)
  Cam2 2nd field (Arago III only)

POST done

*** Failures Detected !!! ***

WHAT IS THE PROBABLE CAUSE OF THE ABOVE FAILED POST TEST? IVS BOARD

POST TEST LED'S

In the event a Serial Cable is not available a technician can use the table below to aid in the proper diagnostic and troubleshooting of the IVS system. This is done by powering on the IVS processor and waiting for a fault to appear. Make note of the LED or LED's that are lit and use the table to determine the problem. Test ID 1 through 7 diagnosis the IVS processor. Test ID 8 through 11 diagnosis the camera system.

LEDs (B3 . . B0)	TestID	Test Name	Test Description
0 0 0 1	1	Verify Serial Port	Verifies the ability to Read and write to the Serial port controller chip.
0 0 1 0	2	Init Serial Port	Initializes the Serial Port and performs a local loopback test on the port.
0 0 1 1	3	Verify CPU Instruction	Verifies the CPU instruction set. (Not currently implemented)
0 1 0 0	4	Verify App Ram Area	Performs memory test on the SDRAM memory.
0 1 0 1	5	Verify Proc PLD	Verifies the Altera CPLD functions. Verifies the ability to force, detect and report various errors to the CPU.
0 1 1 0	6	Verify Flash Memory	Verifies the ability to read & write to the 2 Flash memory blocks.
0 1 1 1	7	Verify USB Port	Verifies the ability to Read and write to the USB port controller chip.
1 0 0 0	8	Init Front End	Initializes the front end camera interfaces. Checks for cameras connected, initializes the genlock chips, verifies video lock on all connected cameras, verifies line and pixel counts
1 0 0 1	9	Verify Front End Registers	Verifies the ability to read & write to the Front End FPGA registers and shutter block memory areas. (Not currently implemented)
1 0 1 0	10	Verify I2C	Verifies ability to read and write to the Flash memory area (GPROMS) on all cameras that are connected.
1 0 1 1	11	ImageCapture No Int	Verifies the ability to capture 1 frame of image data (both odd and even fields) from all connected cameras. Verifies line and pixel count, leading and trailing tag data, image length, and DMA operation. Does not check image quality.

CSR PREFERENCES

There should be no reason for the preferences of the aligner to be changed. Changes made in the preferences can ultimately affect the aligners accuracy. Listed are the preferences and a brief explanation of it's use. This feature should be used with extreme caution.

1. Positioning Stability Count (Default 5) - How many planes the unit must acquire in sequence before measurements are displayed.
2. Caster Stability Count (Default 5) - How many planes the unit must acquire in sequence during caster sweeps to display the measurement. Note: The more it is, the more repeatable the measurements.
3. Linear Stability Tolerance (Default .10) - Distance Measurement. Measures the height of the target and must be constant to acquire a target.
4. Angular Stability Tolerance (Default .05) - Angle of the target. Measures the width of the target and must be constant to acquire a target.
5. Positioning Angle (Default 40) - How many degrees the target must rollback before acquiring a reading.
6. Positioning Angle Tolerance (Default 10) - Minimum / Maximum for “Positioning Angle”.
7. Centering Tolerance (Default .25) - The maximum a target can be turned before the unit will ask the operator to steer the wheels straight ahead. Steering angle during centering.
8. Positioning Wobble Tolerance (Default .10) - Maximum angle that a target can move during positioning before wheel wobble occurs.
9. Caster Roll Tolerance (Default .30) - Maximum angle that a target can roll during caster sweep before wheel roll occurs.
10. Smoothing Factor (Default .7) - Smooths out display meters. Note: Keeps meters from jumping.
11. Dropout (10ms units) (Default 350) - Amount of time it takes to drop a target when a target is blocked.
12. Allow Individual Toe Editing (Default unchecked) - This allows for individual toe specification edit during specification editing procedures.
13. Allow Positioning Wobble (Default checked) - Allows the operator to by pass “Wheel Wobble” if box is unchecked the operator must redo and pass wheel positioning on all 4 wheels.
14. Allow Caster Roll (Default checked) - Allows the operator to by pass “Wheel Roll” during caster sweep. If the box is unchecked the operator must redo and pass a successful caster sweep without wheel roll.
15. Reset Tolerances - Resets all tolerances back to manufactures specification.

NOTE: RUNNING THE EXTREME WEATHER PATCH SOFTWARE CHANGES DEFAULTS.

TID PREFERENCES

These values are used when performing a Target ID (TID). These preferences are found in the CSR Preferences by clicking on the TID Preferences tab.

1. Measurement Angle (Default 90) - Total rotation of the target from the forward position back.
2. Forward Bias Angle (Default 25) - Maximum amount of forward rotation for TID
3. Wobble tolerance (Default 10) - The maximum amount of wobble during TID.

4. Maximum Claw Change (Default 2.0) - Maximum amount of claw change before software flags errors during TID.

5. TID Stability Count (Default 5) - Minimum amount of consecutive snapshots of the target before the unit identifies it as a valid target.

6. Reset Tolerances - Resets the unit back to manufacture defaults.

STEPS FOR CHANGING PREFERENCES

1. From the Main Menu click on the Preference tab and then click on the “Log In / Out button. (Figure 3-60)

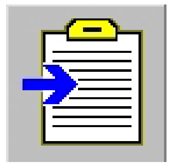


Figure 3-60

2. Log in as CSR using the 20 digit code given from technical support. (Figure 3-61)

Figure 3-61

3. Click on the CSR Preferences icon in the Preference menu. (Figure 3-62)

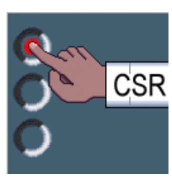


Figure 3-62

4. Use the Up/Down pointers to change the values. (Figure 3-63)

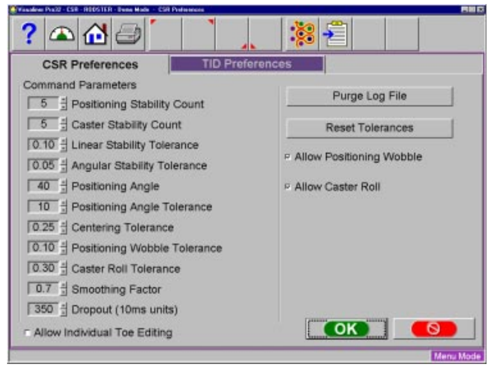


Figure 3-63

5. Click on the TID Preferences tab to access and view TID Preferences. Click on **<OK>** to save changes and exit. (Figure 3-64)

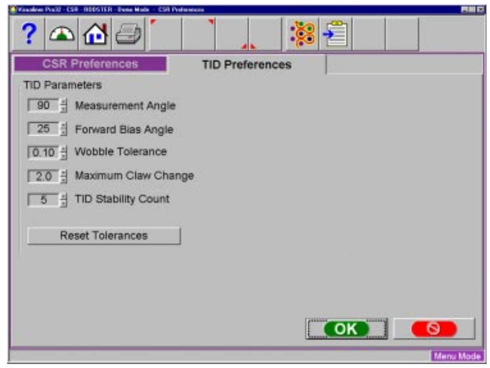


Figure 3-64

IVS UTILITIES - THRU REVISION 3.1 SOFTWARE

The IVS Utility software is a stand alone program function outside of the alignment software. No special software is required to load it, it comes as standard software with the aligner software package. The alignment software must be closed down in order to run and perform the features of the Utilities. There are no operator functions in this software, this is strictly used by technicians to diagnose and repair suspected aligner failures. These functions can be accessed by clicking on <START> and selecting “IVS UTILITIES”. (Figure 3-65)

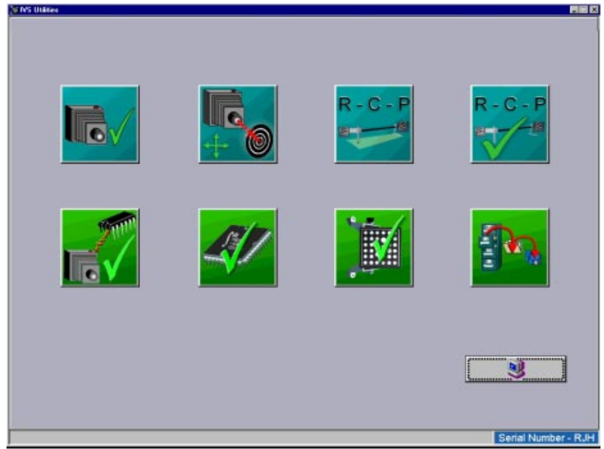
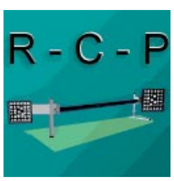


Figure 3-65

Camera Test - Utility used for checking to see if the camera will respond to both “Gain” and “Strobe” commands.

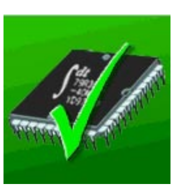
Camera Aim - Utility to aim the camera after installation. Maximizes the range for the camera to see targets for most alignments. See Camera Aiming Process.



Relative Camera Position (RCP) - Process used to identify the camera’s distance from one another. See Relative Camera Positioning.

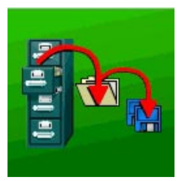
RCP Check - Utility to check the accuracy of the current RCP used by the aligner.

Hub-Camera Test - Utility used to test camera image count.



Coprocessor High Test - Utility used to check IVS capability of acquiring targets and processing images.

Target Check - Checks the validity of each target.



File Copy - Utility used for copying files to a floppy diskette.

CAMERA TEST

This test eliminates the IVS processor and gives the operator control of both cameras. The purpose of this test checks the response of both cameras. Assumptions can be made that both camera are functioning correctly to commands normally sent by the IVS Processor.

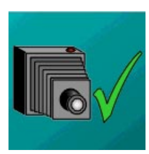
1. Shutdown the alignment program by clicking on the **<X>** in the upper right corner.
2. Make sure that the camera beam is powered up.
3. Raise the alignment rack to alignment height.
4. Place the rear targets just behind the front turnplates. (Figure 3-66)

Figure 3-66

5. Enter the IVS Utilities by clicking on **<START> <IVS UTILITIES>**. (Figure 3-67)

Figure 3-67

6. Single click on the Camera Test icon. (Figure 3-68)



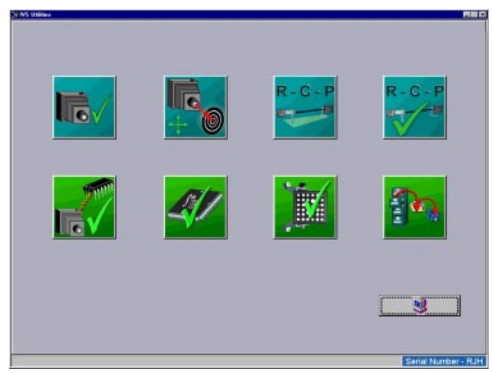


Figure 3-68

6. Once the IVS processor loads an image of the targets should appear on the monitor. (Figure 3-69)

Figure 3-69

7. Beginning with the left camera slide both the “GAIN” and the “STROBE” slider bars all the way to the right. The image of the target for the left side should respond to the change by “BLOOMING”. (Figure 3-70)

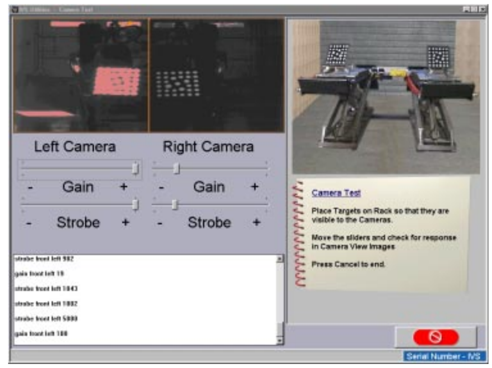


Figure 3-70

9. Slide the “GAIN” and the “STROBE” slider bars for the RH camera all the way to the right. The image of the target should again respond by “BLOOMING”. (Figure 3-71)

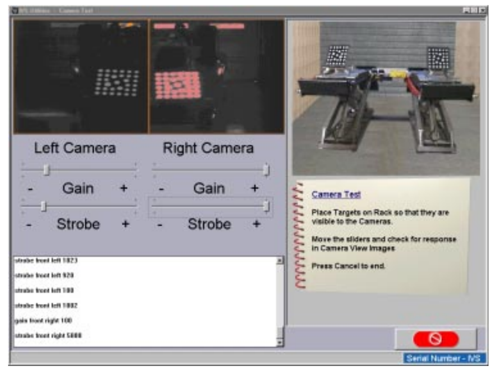


Figure 3-71

10. Exit the test by clicking on the **<CANCEL>** button.

If any part of this test fails, voltage checks can be made on the camera interface board. Simply remove the shield guard from the end of the camera beams. Remove the adjusting lock nuts and washers and gently pull the camera from the camera beam. (Figure 3-72)

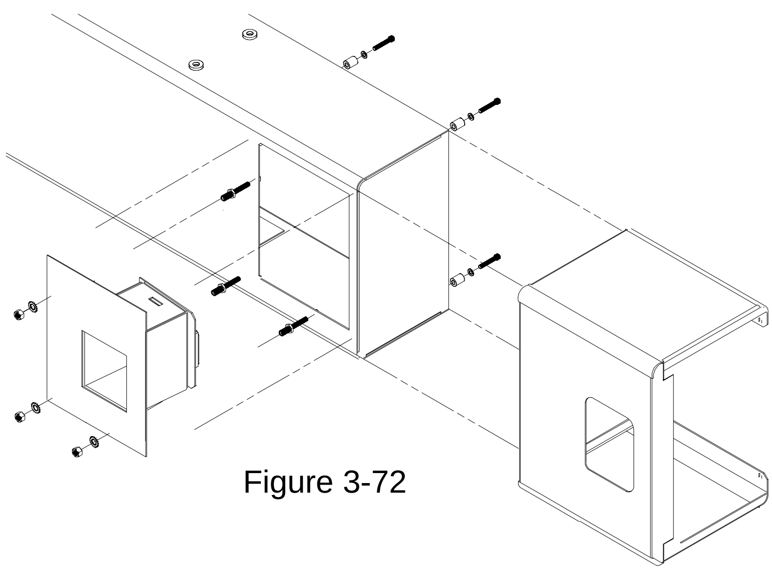


Figure 3-72

With a digital VOM check the test points for the proper voltage. (Figure 3-73)

- TP10 +5VDC
- TP11 +12VDC
- TP12 +24VDC
- TP7 GND
- TP6 GND

Figure 3-73

CAMERA AIMING

The purpose of the camera aiming procedure is to set the cameras' view for the best possible operating envelope. This allows the aligner to see small and large vehicles and all sizes in between. Camera aiming is normally done at installation time only. However if the aligner is not able to acquire targets on some vehicles the technician may need to re-aim the cameras.

RCP Fixture Assembly

1. Raise the lift to the alignment working height with no vehicle. Set the lift down on the locks.

2. The RCP fixture must be assembled prior to use. The components consist of:
    - Aluminum bar
    - Large and Small Target
    - 3/8" nut driver
    - flatblade screwdriver.

3. Attach the small target to the single leg bracket.

4. Attach the large target to the double leg bracket.

5. Clean the targets using glass cleaner and a soft lint free towel. **DO NOT USE A SHOP TOWEL.**

TOOLS REQUIRED

- Basic set of Hand Tools (screwdrivers, pliers, 3/8 drive socket set, wrench set, these should be standard and metric.)
- Set of Ball Head Hex Wrenches (standard and metric.)
- Sturdy Cable Cutters
- 25 ft Tape Measure.
- Camera Aiming Tools. (00088623000, 01122380000)
- Digital Volt/Ohm Meter.
- Camera Aim/RCP Fixture. (00089612000)
- Service Manual and Service Bulletins.
- Known good replacement parts.
- Serial cable (10 feet long).
- Large C-clamps.
- Chalkline
- Hilti Drill (assorted bits)
- Alignment Software

CAMERA AIMING PROCESS

NOTE: BEFORE PERFORMING CAMERA AIM, CHECKS SHOULD BE MADE FOR THE PROPER INSTALLATION. CAMERA OFFSET HEIGHT, INSTALLATION BASELINE, LIFT CENTERLINE SHOULD BE DOUBLE CHECKED PER THE INSTALLATION INSTRUCTIONS. ANY DEVIATIONS FROM THE INSTALLATION CAN GREATLY AFFECT THE AMOUNT OF AIM ADJUSTMENTS. FOR INITIAL INSTALLATION THE COLUMN AND BEAMS SHOULD NOT BE ANCHORED FOR THIS PURPOSE.

1. Power on the camera beam assembly.

2. Power on the console assembly.

3. The camera aiming software is performed using the 3D utility software. The 3D Utility program will only load once the alignment program is shut down.

4. The alignment program is embedded into the start up directory and will boot the alignment software on power up. The technician must exit the alignment software before camera aiming is done. This can done by clicking on the small **<X>** in the upper right hand corner of the alignment menu.

5. The operator will be prompted to Quit Application. Click on **<YES>** to end the alignment process and bring you back to the Windows desktop.

6. From the Window desktop single click **<Start> <IVS Utilities>**.

7. The Operator will be prompted for the unit Serial number. This number is located on the back of the camera beam assembly.

8. The camera aiming process is started by clicking on the camera aiming icon. (Figure 3-74)

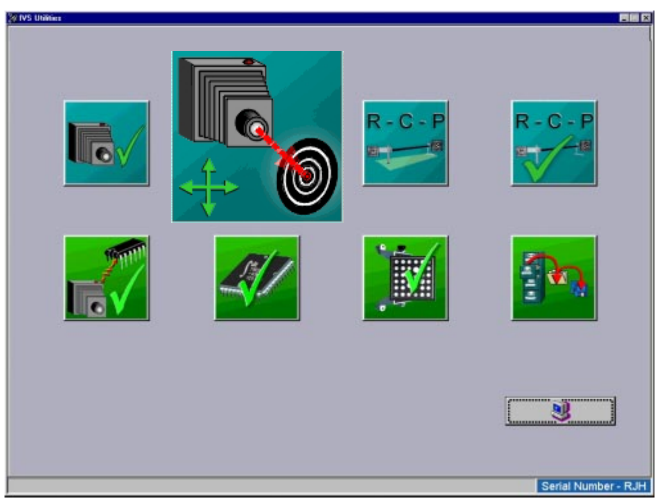


Figure 3-74

9. In order to maximize the range and the operation of the V3D aligner the operator must chose the “Vehicle Width” and the “Post Type”.

Select Vehicle Width	**Select Post Type**
Narrow	Single Post
Normal	Twin Post
Wide	Moveable Boom

Post Type

The **single post** is made solely for the rectangular beam. It mounts directly over the centerline of the alignment bay.

The **twin post** holds the camera beam with two post. Mounted out on the ends for the camera beam to sit on. There is a twin post assembly for both the triangular and rectangular camera beam, these are not interchangeable.

The **moveable boom** is a lift type beam mounted in the center of the bay. The camera beam is mounted to the beam via a bracket. This type was designed to work at all alignment rack heights.

Select Vehicle Width

The choice is made by determining the type of vehicles the user will be primarily working with. As an example, for a shop in Europe that is aligning primarily small cars we would select the “narrow” setup. For a shop in the United States whose primary business is larger pickup trucks we would select “wide”. For a tire shop that sees a variety of vehicles we would select the “normal or wide” setup. The chart gives some examples of what vehicles are suitable to each setting.

	Narrow			**Normal**			**Wide**		
DISTANCE (TT to Back of Cameras)	**90"**	**102"**	**114"**	**90"**	**102"**	**114"**	**90"**	**102"**	**114"**
Large Vehicles									
Hummer	N	N	N	N	N	N	N	Y	Y
Dodge 3500 (dualie)	N	N	N	N	N	N	Y	Y	Y
F350 Superduty Aftermarket Rims	N	N	N	N	Y	Y	Y	Y	Y
Chevy C3500	N	N	N	Y	Y	Y	Y	Y	Y
Volkswagen LT50	N	Y	Y	Y	Y	Y	Y	Y	Y
F350 Superduty	N	Y	Y	Y	Y	Y	Y	Y	Y
Chevy Van 30 (bus)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ford Bronco	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ford Club/Econoline Van	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ford Expedition	Y	Y	Y	Y	Y	Y	Y	Y	Y
MB SEL600	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dodge Van	Y	Y	Y	Y	Y	Y	Y	Y	Y
Chevrolet Suburban	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ford Explorer	Y	Y	Y	Y	Y	Y	Y	Y	Y
GMC Safari Van	Y	Y	Y	Y	Y	Y	Y	Y	Y
Small Vehicles									
Austin Mini	Y’	Y	Y	N	Y’	Y	N	N	Y’
Fiat 126	Y’	Y	Y	N	Y	Y	N	Y’	Y
Suzuki SJ410	Y’	Y	Y	Y’	Y	Y	N	Y’	Y
Suzuki Samurai	Y	Y	Y	Y’	Y	Y	N	Y’	Y
Yugo GV	Y	Y	Y	Y’	Y	Y	N	Y’	Y
VW Beetle	Y	Y	Y	Y’	Y	Y	N	Y’	Y
Alfa Romeo Spider	Y	Y	Y	Y’	Y	Y	N	Y	Y
Chevrolet Sprint	Y	Y	Y	Y’	Y	Y	N	Y	Y
Isuzu Impulse	Y	Y	Y	Y’	Y	Y	Y’	Y	Y
Porshe 911	Y	Y	Y	Y	Y	Y	Y’	Y	Y
Hyundai Excel	Y	Y	Y	Y	Y	Y	Y’	Y	Y

Y Fully Measurable

Y’ Fully Measurable, except for Full Lock to Lock steering

The cameras have three adjustments, horizontal, vertical and a fine adjustment. (Figure 3-75) These screws are used during the aiming process to maximize the cameras view. The camera aiming software is designed to aid the installer on which adjustment screw to adjust based on the installation. The camera comes from the manufacture centered within it's total range of adjustment.

Figure 3-75

10. Place the small target on the right rail, the large target on the left rail with the feet centered front to rear on the turntables and side to side with respect to the runways. Slide the turntables inboard or outboard if necessary. Click on OK when ready. (Figure 3-76)

Figure 3-76

11. A screen with two images of the targets should appear along with two white horizontal lines. (Figure 3-77) The cameras have been preaimed at the factory to minimize the amount of adjustment that should be made.

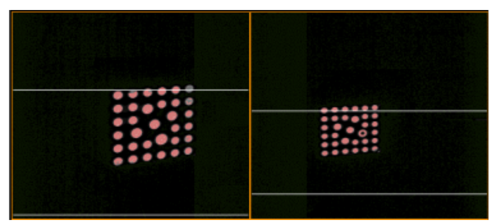


Figure 3-77

12. If the images do not appear within the horizontal lines checks should be made to the rack height versus the column height. It may be easier to raise or lower the rack height or the column height to bring the images within the lines. On a fixed camera beam any changes made in the height of the rack ultimately affects the alignment height for the operator. In some cases it may be necessary to add shims between the camera beams and the cameras to get the targets relatively close this should be used as a last resort. (Figures 78)

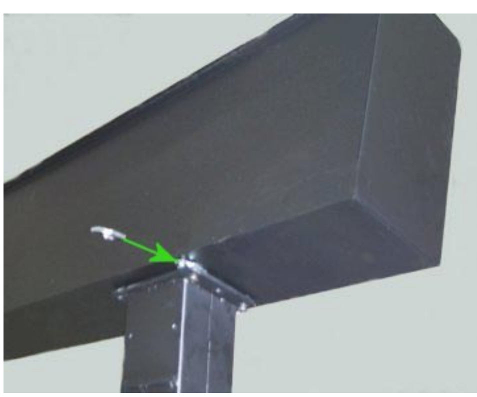


Figure 3-78

13. **Fine adjustments.** Using the adjustment screws indicated by the software, loosen the jam nuts and adjust the screws until the target image appears inside the horizontal lines on both sides. (Figure 3-79) It may be necessary to use two screws to make this adjustment. After adjustments have been made tighten the jam nuts and click on **<OK>**.

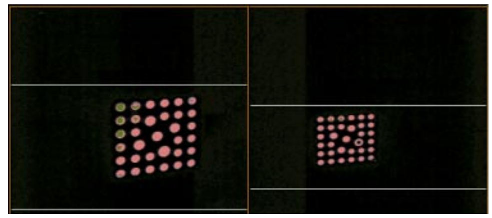


Figure 3-79

14. Move the calibration bar back 7 feet on the rack. (Figure 3-80) Center the fixture from side to side. Ensure the distance between the foot edge and the rack are the same on both sides. **IMPORTANT: Use a tape Measure.** Click on **<Ok>** when ready.

Figure 3-80

15. A screen with two (4) vertical bars appear with two targets that appear much smaller than the last screen. (Figure 3-81) This is because the targets were moved further away from the cameras.

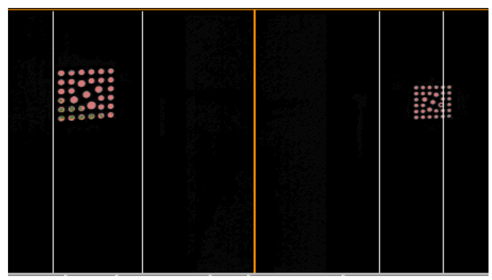


Figure 3-81

16. If the camera beam is not installed square with the alignment rack the camera beam may need to be squared. This can be done by rotating the camera center beam or move either the LH or RH column forward or rearward on a twin post to minimize the amount of screw adjustment. (Figure 3-82)

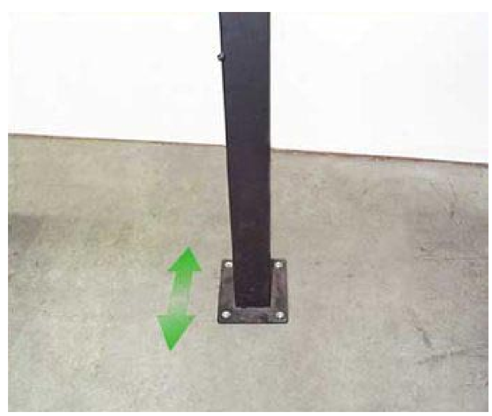


Figure 3-82

17. **Fine Adjustment** Using the adjustment screws indicated by the software, loosen the jam nuts and adjust the screws until the target image appears inside the vertical lines on both sides. (Figure 3-83) It may be necessary to use two screws to make this adjustment. After adjustments have been made tighten the jam nuts and click on **<OK>**.

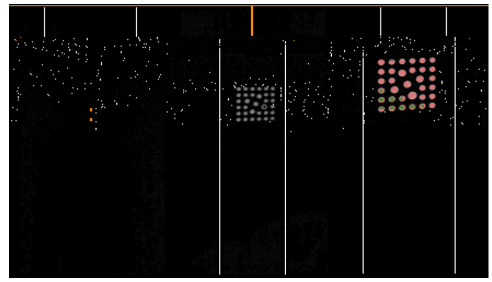


Figure 3-83

18. Drill the holes and bolt the uprights to the floor and repeat the process beginning with step 8 making sure to choose the correct setup in step 9.

NOTE: RCP MUST BE PERFORMED ANYTIME AFTER A CAMERA AIM IS COMPLETED. THIS ENSURES THE ACCURACY OF THE ALIGNER.

RELATIVE CAMERA POSITIONING (RCP)

The purpose of the camera calibration procedure is to measure the cameras' positions relative to each other. This allows the aligner to make accurate measurements between the left and right sides of the vehicle. For this reason the alignment program will not run until a valid RCP has been performed.

Note: Relative Camera Positioning is normally done at installation time only.

Tools needed: Fixed-Length Steel Fixture with two targets.

1. Raise the empty lift to working height (no vehicle). Close the garage door to block any stray daylight.

2. Prepare the Calibration Fixture

3. Clean the two targets on the fixture, according to the user manual. Use a glass cleaning fluid and a soft cloth. Make sure that the glass is free from grease and dirt.

4. Power on the camera beam assembly.

5. Power on the console assembly.

6. The RCP software is performed using the IVS Utility software. The IVS Utility program will only load once the alignment program is shut down.

7. The alignment program is embedded into the start up directory and will boot the alignment software on power up. The technician must exit the alignment software before RCP is done. This can done by clicking on the small **<X>** in the upper right hand corner of the alignment menu.

8. The operator will be prompted to Quit Application. Click on **<YES>** to end the alignment process and bring you back to the Windows desktop.

9. From the Window desktop single click **<Start> <IVS Utilities>**.

10. Choose the RCP icon from the selection.

11. The alignment machine will begin to load and start the IVS processors.

12. Slide the turntables to the outboard position. Place the calibration bar on the right rack rail, with the small target on the outside of the front turntable, and the large target towards the rear center of the rail. Click on **<OK>** when done. (Figure 3-84)

Figure 3-84

13. Two images should appear in the upper left hand portion of the screen. The images will alternately change colors from "clear, pink, green" the aligner is sampling the images and will automatically prompt the technician for advancement. (Figure 3-85)

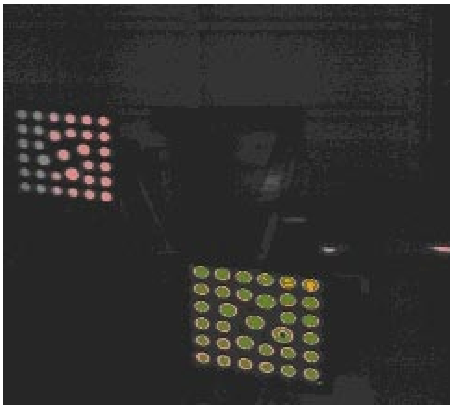


Figure 3-85

14. After a period of time a message is displayed to raise the plunger on the double leg bracket. (Figure 3-86) This will cause the images to rotate on the screen. Click on **<OK>** when one.

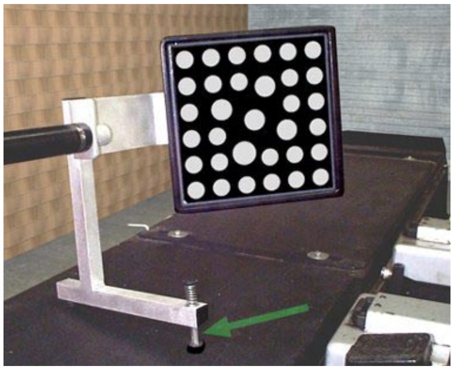


Figure 3-86

15. Retract the 1.5" plunger. Place the cal bar with the small target on the right rail, the large target on the left rail with the feet centered front to rear on the turntables. (Figure 3-87) Slide the turntables inboard if necessary. Click on **<OK>** when done.

Figure 3-87

16. Move the cal bar back on the rack approximately 2 feet on the rack. (Figure 3-88) Click on **<OK>** when done.

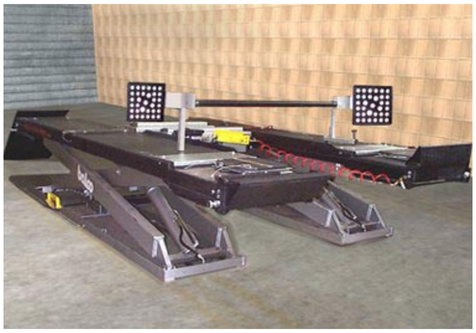


Figure 3-88

17. Move the cal bar back again approximately 2 feet on the rack. (Figure 3-89) Click on **<OK>** when done.

Figure 3-89

18. Move the cal bar back again to the front turntables. Place the small target on the right rail and the large target on the left rail. Center the feet front to rear. (Figure 3-90) Click on **<OK>** when done.

Figure 3-90

19. Place the cal bar on the left rail with the small target in the center of the front table and the large towards the rear outside of the rail. (Figure 3-91) Click on **<OK>** when done.

Figure 3-91

20. Extend the plunger under the rear foot. (Figure 3-92) Click on **<OK>** when done.

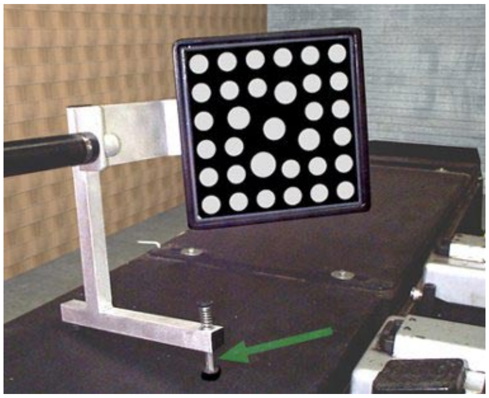


Figure 3-92

21. ***Congratulations!*** You have successfully completed calibration.

RCP NOTES

Some time elapses between each step of the RCP process. If the program does not seem to be progressing, examine the targets for dirt or grease, and then move the calibration fixture a small amount and observe the on-screen view's response. If there is no response it will be necessary to reboot the computer and restart RCP.

During the RCP steps you may see a message appear stating "**Plane 1 of 3 is Outlier ...**". This usually occurs if the target position changes during the time when the software is examining the targets (i.e. you are still moving the fixture). These error messages have no bearing on the outcome of RCP and can be ignored.

The final steps of RCP check the dimensional integrity of the fixture during the procedure. If the fixture has physically changed is dimensions the software returns a message concerning an "RTP Error" exceeding a tolerance of 0.080. RTP stands for Relative Target Position, meaning that the position of the targets on the fixture has changed. Recheck the tightness of all fasteners and repeat the RCP procedure using extreme care when moving the fixture around. **RCP MUST BE SUCCESSFULLY COMPLETED BEFORE ANY ALIGNMENTS ARE PERFORMED.**

You may see the error message:

> **"Cannot find the large (or small) target is blocked or dirty, look at the display above"**

This means that the camera can not see the entire target for some reason. The camera must be able to clearly see the whole target. Find out what is blocking the camera's view, using the image display, and remove the obstruction. If there is no apparent reason for this message simply wait – the software usually locates the target within 30 seconds.

You may see one of these messages:

> **"Raise the small (or large) target"**
> **"Lower the small (or large) target"**
> **"Move the small (or large) target to the right"**
> **"Move the small (or large) target to the left"**

This indicates that the target cannot be located, look at the screen and adjust the assembly accordingly.

The cameras must be calibrated whenever a camera's position changes relative to the other camera. The beam normally secures both cameras in a fixed position, but it is possible for one or both to be knocked out of position.

Camera relative positions will change, requiring a new RCP, under the following circumstances:

- A camera has been removed for any reason, or if the camera has been replaced
- The cameras have been re-aimed
- A camera pod or the beam has been hit by a heavy object
- The aligner has been moved to a different location
- After a major earthquake or other natural event

NOTE: CAMERA CALIBRATION IS NOT NECESSARY WHEN THE ENTIRE CAMERA BEAM OR CONSOLE IS MOVED SLIGHTLY WITHOUT DISTURBING THE CAMERAS' POSITION RELATIVE TO THE BEAM.

RCP CHECK

If the Relative Camera Positioning is questioned the “RCP CHECK” can quickly determine if the current RCP file is valid.

1. Shutdown the alignment program by clicking on the **<X>** in the upper right corner.

2. Make sure that the camera beam is powered up.

3. Raise the alignment rack to alignment height.

4. Enter the IVS Utilities by clicking on **<START> <IVS UTILITIES>**. (Figure 3-93)

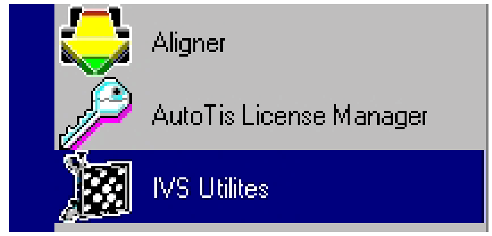


Figure 3-93

6. Single click on the RCP Check icon. (Figure 3-94)

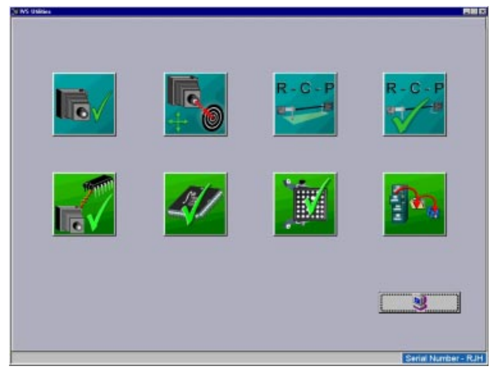


Figure 3-94

7. Place the RCP Check fixture (EAA0256J00A) and stands on the alignment rack just behind the turnplates. (Figure 3-95)

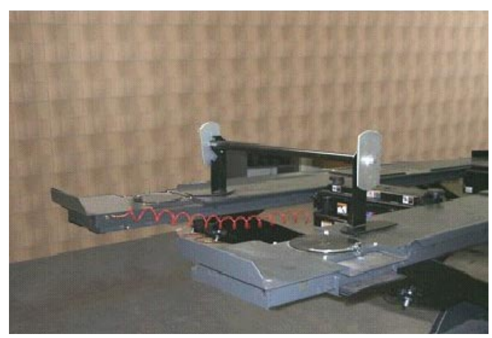


Figure 3-95

8. Mount both Rear targets on the check fixture as indicated and rotate the knobs to the 12:00 position and click on **<OK>**. (Figure 3-96)

Figure 3-96

9. Rotate that calibration bar forward 25º and allow the aligner to acquire a reading (Figure 3-97) Click on **<OK>**.

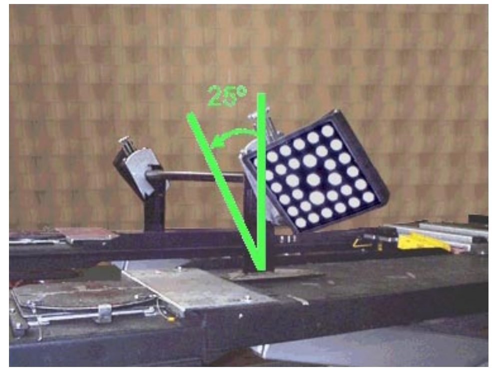


Figure 3-97

10. Rotate that calibration bar back 90º and allow the aligner to acquire a reading (Figure 3-98) Click on **<OK>**.

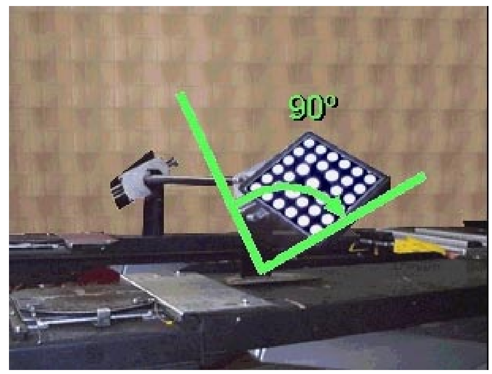


Figure 3-98

11. RCP Check is Complete. (Figure 3-99) Any failures indicates that the RCP is in question and should be redone. See Relative Camera Positioning earlier in this chapter.

Figure 3-99

HUB CAMERA TEST

For the aligner to accurately collect data and display images it has to continuously acquire images and send this information back to the IVS Processor. These images are in turned processed by the IVS Processor and sent to the computer via the USB connection and displayed as alignment angles. The Hub Camera test is two fold, first the cameras must acquire images and second the IVS Processor must be able to collect this data in send it to the computer and display these images in a RAW format.

1. Shutdown the alignment program by clicking on the **<X>** in the upper right corner.

2. Make sure that the camera beam is powered up.

3. Raise the alignment rack to alignment height and place the rear targets just behind the front turnplates. (Figure 3-100)

Figure 3-100

4. Enter the IVS Utilities by clicking on **<START> <IVS UTILI-TIES>**. (Figure 3-101)

Figure 3-101

5. Single click on the Hub-Camera test icon. (Figure 3-102)

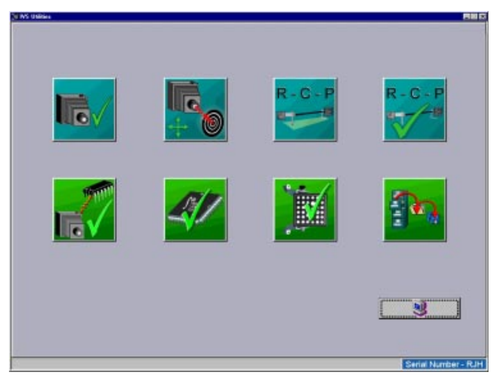


Figure 3-102

6. An image of the targets should appear on the screen. (Figure 3-103) The text box does a refresh every 10 seconds and should update the image count for each wheel. Run the test for approximately 5 minutes and click on the cancel key to exit this test.

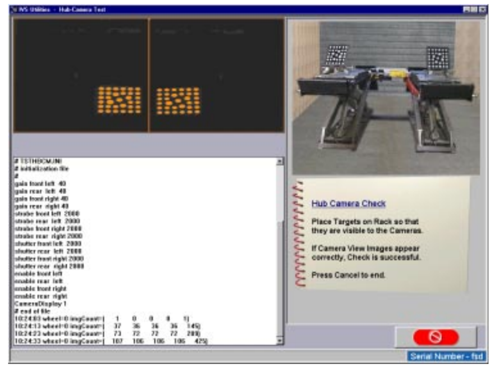


Figure 3-103

7. To open and view the file click on **<START> <RUN>** and type <C:\IAS\PROG\TSTHBCM.TXT> in the command line and click on **<OK>**. Notepad will open the text file. Using the gutter bar in notepad scroll to the bottom of the page. Looking at the sample on the next page, look to see that the image count for each column increases.

```
Date: 2001/10/12, Time: 08:39:37. Program: C:\IAS\PROG\TSTHBCM.EXE

VersionName IVS Utilities, VersionNumber 2.11, VersionDate July 27, 2001
Loading Program C:\ias\prog\ivs.mot
Waiting for Receive Thread to start.
Receive Thread Started.
Initializing Ivs Communications
IVS:   OK
08:39:50 Reading keyword file C:\IAS\PROG\TSTHBCM.CMD
08:39:50 kwpOn = 0
# TSTHBCM.INI
# initialization file
#
gain front left  40
gain rear  left  40
gain front right 40
gain rear  right 40
strobe front left  2000
strobe rear  left  2000
strobe front right 2000
strobe rear  right 2000
shutter front left  2000
shutter rear  left  2000
shutter front right 2000
shutter rear  right 2000
enable front left
enable rear  left
enable front right
enable rear  right
CameraDisplay 1
# end of file
```

	Wheel 0	Wheel 1	Wheel 2	Wheel 3	Total Count
08:39:53 wheel=3 imgCount=(	0	0	0	1	1)
08:40:03 wheel=3 imgCount=(	36	36	36	37	145)
08:40:13 wheel=3 imgCount=(	72	72	72	73	289)
08:40:23 wheel=3 imgCount=(	108	108	108	109	433)
08:40:34 wheel=3 imgCount=(	144	144	144	145	577)
08:40:44 wheel=3 imgCount=(	180	180	180	181	721)
08:40:54 wheel=3 imgCount=(	216	216	216	217	865)
08:41:04 wheel=3 imgCount=(	252	252	252	253	1009)
08:41:14 wheel=3 imgCount=(	288	288	288	289	1153)
08:41:24 wheel=3 imgCount=(	324	324	324	325	1297)
08:41:34 wheel=3 imgCount=(	360	360	360	361	1441)
08:41:44 wheel=3 imgCount=(	396	396	396	397	1585)
08:41:54 wheel=3 imgCount=(	432	432	432	433	1729)
08:42:04 wheel=3 imgCount=(	468	468	468	469	1873)
08:42:14 wheel=3 imgCount=(	504	504	504	505	2017)
08:42:24 wheel=3 imgCount=(	540	540	540	541	2161)
08:42:35 wheel=3 imgCount=(	576	576	576	577	2305)
08:42:45 wheel=3 imgCount=(	612	612	612	613	2449)
08:42:55 wheel=3 imgCount=(	648	648	648	649	2593)
08:43:05 wheel=3 imgCount=(	684	684	684	685	2737)
08:43:15 wheel=3 imgCount=(	720	720	720	721	2881)
08:43:25 wheel=3 imgCount=(	756	756	756	757	3025)
08:43:35 wheel=3 imgCount=(	792	792	792	793	3169)
08:43:45 wheel=3 imgCount=(	828	828	828	829	3313)
08:43:55 wheel=3 imgCount=(	864	864	864	865	3457)
08:44:05 wheel=3 imgCount=(	900	900	900	901	3601)
08:44:15 wheel=3 imgCount=(	936	936	936	937	3745)
08:44:25 wheel=3 imgCount=(	972	972	972	973	3889)
08:44:35 wheel=3 imgCount=(	1008	1008	1008	1009	4033)
08:44:46 wheel=3 imgCount=(	1044	1044	1044	1045	4177)
08:44:56 wheel=3 imgCount=(	1080	1080	1080	1081	4321)
08:45:06 wheel=3 imgCount=(	1116	1116	1116	1117	4465)
08:45:16 wheel=3 imgCount=(	1152	1152	1152	1153	4609)
08:45:26 wheel=3 imgCount=(	1188	1188	1188	1189	4753)
08:45:36 wheel=3 imgCount=(	1224	1224	1224	1225	4897)
08:45:46 wheel=3 imgCount=(	1260	1260	1260	1261	5041)
08:45:56 wheel=3 imgCount=(	1296	1296	1296	1297	5185)
08:46:06 wheel=3 imgCount=(	1332	1332	1332	1333	5329)
08:46:16 wheel=3 imgCount=(	1368	1368	1368	1369	5473)
08:46:26 wheel=3 imgCount=(	1404	1404	1404	1405	5617)
08:46:36 wheel=3 imgCount=(	1440	1440	1440	1441	5761)
08:46:47 wheel=3 imgCount=(	1476	1476	1476	1477	5905)
08:46:57 wheel=3 imgCount=(	1512	1512	1512	1513	6049)
08:47:07 wheel=3 imgCount=(	1548	1548	1548	1549	6193)
08:47:17 wheel=3 imgCount=(	1584	1584	1584	1585	6337)
08:47:27 wheel=3 imgCount=(	1620	1620	1620	1621	6481)
08:47:37 wheel=3 imgCount=(	1656	1656	1656	1657	6625)
08:47:47 wheel=3 imgCount=(	1692	1692	1692	1693	6769)
08:47:57 wheel=3 imgCount=(	1728	1728	1728	1729	6913)

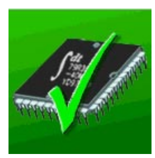
COPROCESSOR HIGH TEST

A “canned” image of all 4 targets are stored on the hard drive. This image is a known good perfect image of all 4 targets. When running the Coprocessor High Test the system shuts down the cameras on the camera beam and the sends the IVS Processor this “canned” image to process. If the IVS Processor was unable to process this known good image assumptions could be made that the IVS Processor was bad.

1. Shutdown the alignment program by clicking on the **<X>** in the upper right corner.
2. Make sure that the camera beam is powered up.
3. Enter the IVS Utilities by clicking on **<START> <IVS UTILI-TIES>**. (Figure 3-104)

Figure 3-104

4. Single click on the Coprocessor High test icon. (Figure 3-105)



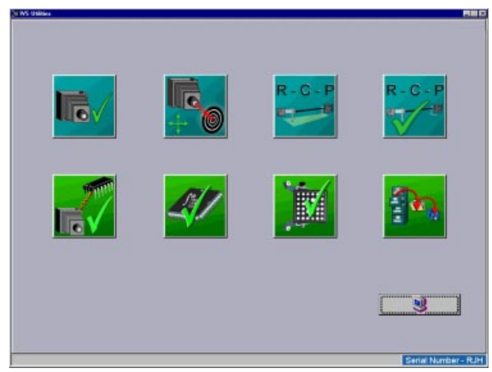


Figure 3-105

5. An image of all 4 targets should appear on the screen. (Figure 3-106) The text box does a refreshes approximately every 1 second and should update . Run the test for approximately 5 minutes and click on the cancel key to exit this test.

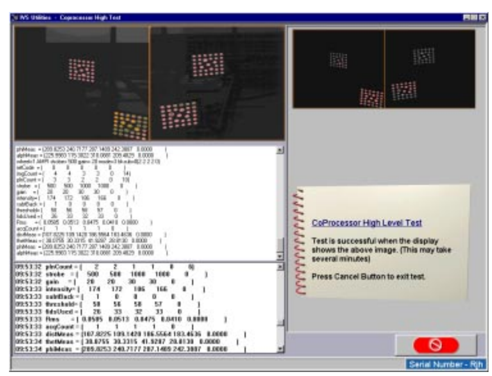


Figure 3-106

6. To open and view the file click on **<START> <RUN>** and type C:\IAS\PROG\TSTCOHI.TXT in the command line and click on **<OK>**. Notepad will open the text file. Using the gutter bar in notepad scroll to the bottom of the page. Looking at the sample, look to see that the image count (imgCount) and plane count (plnCount) for each column increases.

```
Date: 2001/10/12, Time: 09:38:18. Program: C:\IAS\PROG\TSTCOHI.EXE

VersionName IVS Utilities, VersionNumber 2.11, VersionDate July 27, 2001
Reading keyword file C:\IAS\PROG\TSTCOHI.CMD
kwpOn = 0
Loading Program C:\ias\prog\ivs.mot
Waiting for Receive Thread to start.
Receive Thread Started.
Initializing Ivs Communications
IVS:   OK
09:38:30 Reading keyword file C:\IAS\PROG\TSTCOHI.CMD
09:38:30 kwpOn = 0
# TSTCOHI.INI
# initialization file
CameraDisplay 1
# end of file
09:38:37 wheel=2 AMPI strobe=1000 gain= 30 mode=3 bksub=1(0 0 4 0 0)
09:38:37  retCode  = (        0        0      115        0        0         )
09:38:37  imgCount = (        0        0        1        0        0        1)
09:38:37  plnCount = (        0        0        0        0        0        0)
09:38:37  strobe   = (        0        0     1000        0        0         )
09:38:37  gain     = (        0        0       30        0        0         )
09:38:37  intensity= (        0        0      157        0        0         )
09:38:37  subtBack = (        0        0        1        0        0         )
09:38:37  threshold= (        0        0       70        0        0         )
09:38:37  fidsUsed = (        0        0       32        0        0         )
09:38:37  Rms      = (  0.0000   0.0000   0.0472   0.0000   0.0000         )
09:38:37  acqCount = (        0        0        0        0        0         )
09:38:37  distMeas = (100.0000 100.0000 186.5652 200.0000   0.0000         )
09:38:37  thetMeas = ( 35.0000  35.0000  41.9278  35.0000   0.0000         )
09:38:37  phiMeas  = ( 35.0000  35.0000 287.1503  35.0000   0.0000         )
09:38:37  alphMeas = ( 35.0000  35.0000 310.0923  35.0000   0.0000         )

09:45:39 wheel=1 AMPI strobe= 500 gain= 20 mode=3 bksub=0(2 2 2 2 0)
09:45:40  retCode  = (        0        0        0        0        0         )
09:45:40  imgCount = (       17       17       17       17        0       68)
09:45:40  plnCount = (       16       16       16       16        0       64)
09:45:40  strobe   = (      500      500     1000     1000        0         )
09:45:41  gain     = (       20       20       30       30        0         )
09:45:41  intensity= (      174      172      186      166        0         )
09:45:41  subtBack = (        1        0        0        0        0         )
09:45:41  threshold= (       50       56       58       57        0         )
09:45:42  fidsUsed = (       26       33       32       33        0         )
09:45:42  Rms      = (  0.0585   0.0513   0.0475   0.0410   0.0000         )
09:45:42  acqCount = (        1        1        1        1        0         )
09:45:42  distMeas = (107.8225 109.1420 186.5564 183.4636   0.0000         )
09:45:43  thetMeas = ( 38.0755  30.3315  41.9287  28.8130   0.0000         )
09:45:43  phiMeas  = (289.8253 240.7177 287.1489 242.3887   0.0000         )
09:45:43  alphMeas = (225.9983 115.3022 310.0881 209.4829   0.0000         )
```

```
09:54:13 wheel=1 AMPI strobe= 500 gain= 20 mode=3 bksub=0(2 2 2 2 0)
09:54:14  retCode   = (        0        0        0        0        0         )
09:54:14  imgCount  = (       37       37       37       37        0      148)
09:54:14  plnCount  = (       36       36       36       36        0      144)
09:54:14  strobe    = (      500      500     1000     1000        0         )
09:54:14  gain      = (       20       20       30       30        0         )
09:54:14  intensity= (      174      172      186      166        0         )
09:54:15  subtBack  = (        1        0        0        0        0         )
09:54:15  threshold= (       50       56       58       57        0         )
09:54:15  fidsUsed  = (       26       33       32       33        0         )
09:54:15  Rms       = (   0.0585   0.0513   0.0475   0.0410   0.0000         )
09:54:16  acqCount  = (        1        1        1        1        0         )
09:54:16  distMeas  = (107.8225 109.1420 186.5564 183.4636   0.0000         )
09:54:16  thetMeas  = ( 38.0755  30.3315  41.9287  28.8130   0.0000         )
09:54:17  phiMeas   = (289.8253 240.7177 287.1489 242.3887   0.0000         )
09:54:17  alphMeas  = (225.9983 115.3022 310.0881 209.4829   0.0000         )
```

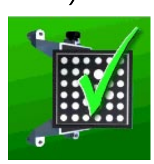
TARGET CHECK

This simple test checks the validity of the targets. Should a user continually receive error messages during alignments to clean the targets or should a camera not acquire a target this test will check for valid targets.

1. Shutdown the alignment program by clicking on the **<X>** in the upper right corner.
2. Make sure that the camera beam is powered up.
3. Enter the IVS Utilities by clicking on **<START> <IVS UTILITIES>**. (Figure 3-107)

Figure 3-107

4. Single click on the Target Check icon. (Figure 3-108)



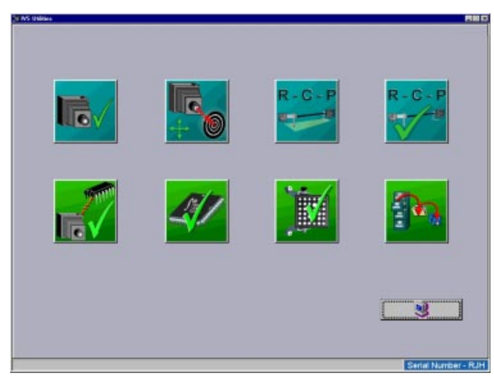


Figure 3-108

5. Raise the rack to alignment height and set the target and wheel clamp assembly to be checked on the alignment rack just behind the turnplates. (Figure 3-109_

Figure 3-109

6. Single click on the target icon being tested. (Figure 3-110)

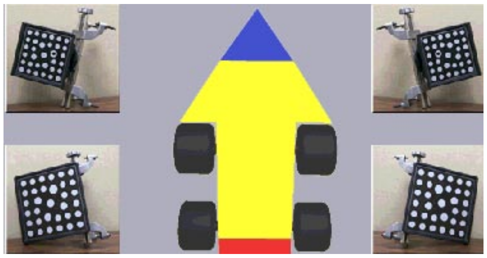


Figure 3-110

7. After the test completes a check mark should appear beside the target being checked. (Figure 3-111)

8. The target check should take no more than 10 seconds to complete. If after 10 seconds the test does not pass run the test using a different target from the same side. If that target passes the test the target that failed the test is not seen by the aligner as a valid target and should be replaced.

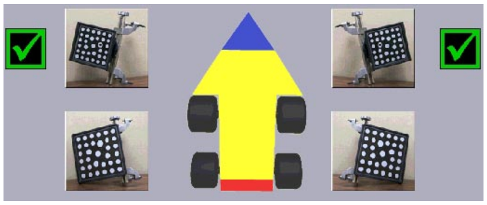


Figure 3-111

HMAIN.TXT 3.1 SOFTWARE

The V3D IVS system is continually writing data to the hard drive. This information is stored on the hard drive in a text file. This text file can be used to troubleshoot and provide the service technician with valuable information to make system repairs. The basic text file records boot up and alignment information only, however additional information can be obtained by modifying the "HMAIN.CMD" file. To view the basic "HMAIN.TXT" file follow the steps listed.

1. Close the alignment program by clicking on the **"X"** in the upper RH corner of the main menu. Click on "YES" to shut down the alignment software.

2. Click on **<START> <RUN>** and type C:\IAS\PROG\HMAIN.TXT notepad will then open up the basic "HMAIN.TXT" file. The text file shown below list two alignment completions.

11/23/01 1:44:07 AM Starting Application **(V9.exe started)**
11/23/01 1:44:07 AM Visualiner Pro32 Version: 3.1.0.0 [JBC] Brand **(Loading brand specific software)**
Loading RCP File C:\ias\prog\rcp.pld last modified October 17, 2001 **(Valid RCP file loaded: Be sure the date listed is later than the date the aligner was installed.)**
OpenIvsUSB (0) passed, count=0
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001 **(TID files)**
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001 **(TID files)**
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001 **(TID files)**
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001 **(TID files)**
OpenIvsUSB () IVS_handle is valid. count=1 **(IVS handshake)**
Loading C:\IAS\PROG\ivs.mot last modified September 28, 2001 **(Loading IVS: This is seen on the screen as VODI being pumped with fuel)**
Receive Thread Started Successfully.
IVS: OK **(IVS loaded)**
13:54:48 Reading keyword file C:\IAS\PROG\hmain.cmd **(Reading command file)**
13:54:48 kwpOn = 0
13:54:48 Prom GRIDHEADER and title same as c:\ias\prog\gpromL.grd **(Checking Camera GridHeader files)**
13:54:48 Prom GRIDHEADER and title same as c:\ias\prog\gpromR.grd
Checking GRD File c:\ias\prog\gpromL.grd last modified October 03, 2001 **(Comparing Camera Grid files with Grid files on the Hard drive.)**
Checking GRD File c:\ias\prog\gpromR.grd last modified October 03, 2001
11/23/01 1:44:22 AM Loading Alignment Database AlignmentData.mdb **(Loading alignment Specifications)**
11/23/01 1:44:22 AM Showing Main Screen Window **(Clicked on "OK" from splash screen)**
11/23/01 1:44:27 AM Beginning A New Alignment **(Clicked on New Alignment)**
11/23/01 1:44:37 AM Loading Specs for TOYOTA, 1997, T100, Pickup 2WD Extra Cab **(Vehicle selected for alignment)**
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001 **(Aligner loads TID files for the type of Wheel clamp selected)**
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001

```
             LeftCenter RightCenter   LeftRight   sumDeltas
casterLeft    2.403       2.357       2.572       0.143
casterRight   2.334       2.294       2.332       0.026
saiLeft      15.245      11.210      13.250       2.690
saiRight     11.139      11.526      11.341       0.258
passed
passed
passed
passed
passed
11/23/01 1:53:47 AM     Beginning A New Alignment
11/23/01 1:53:56 AM     Loading Specs for CHEVROLET, 2002, CORVETTE
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
             LeftCenter RightCenter   LeftRight   sumDeltas
casterLeft    2.188       2.255       2.230       0.045
casterRight   2.091       2.246       2.087       0.106
saiLeft      11.451      11.263      11.363       0.125
saiRight     13.233      11.497      12.351       1.157
passed
passed
passed
passed
passed
```

MODIFYING THE HMAIN.CMD / HMAINARAGO.CMD FILE

Care should be taken before any modifications are done to the command file, backing up this file is highly recommended. The file controls all aspects and performance of the aligner. Changes made to this file will ultimately control the performance of the aligner, such changes could cause the aligner the ability to acquire targets and/or properly perform accurate alignments.

1. Close the alignment program by clicking on the **<X>** in the upper RH corner of the main menu. Click on **<YES>** to shut down the alignment software.

2. Click on **<START> <FIND>** and click on **"Files or Folders"**.

3. Type the name of the file you are searching, [H][M][A][I][N][.][C][M][D] or [H][M][A][I][N][A][R][A][G][O][.][C][M][D] Make sure that the location is the **"C drive"** and that the radio button **"Include subfolders"** is selected and click on the **"Find Now"** button. (Figure 3-112)

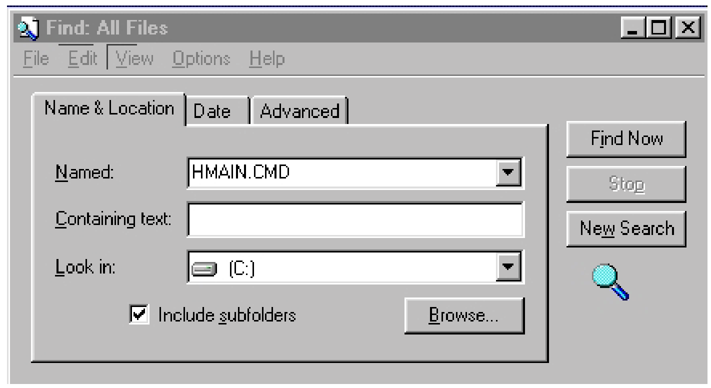


Figure 3-112

4. Once the file is located highlight the file by single clicking on it. (Figure 3-113) Insert a formatted 1.44mb floppy into drive **"A"**. Right click on the **"*.CMD"** file and use the **"Send to 3½ Floppy"** to copy the file to the floppy diskette. Once the file has been copied to the floppy return to the **"Find File"** command and double click on the HMAIN.CMD file to open the file up in notepad.

Note: ***The Hmain.cmd for 3.1 software is located in C:\IAS\PROG, for 3.2 or greater it is located in C:\Program Files\Snapon Technologies Inc\Aligner\IAS.***

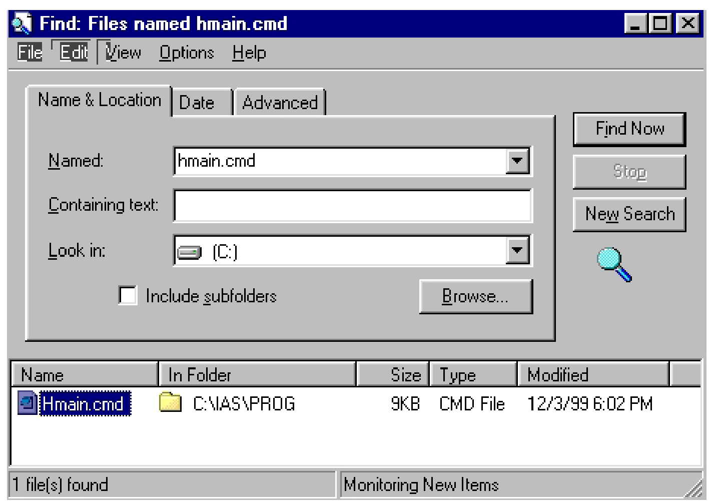


Figure 3-113

5. Locate the line item in the HMAIN.CMD / HMAINARAGO.CMD (Arago) file labeled "#Mpacifier = 6000. Remove the # sign, this allows more information to be written to the HMAIN.TXT file. Changed the 6000 to 2000, this allows the information that is written to the HMAIN.TXT file to update every 20 seconds.

6. Close the file and restart Pro32 and allow it to run with targets mounted on a vehicle on the rack for at least 5 minutes.

7. Close the alignment program by clicking on the **<X>** in the upper RH corner of the main menu. Click on **<YES>** to shut down the alignment software.

NOTE: ***DO NOT FORGET TO CHANGE THE "HMAIN.CMD" FILE BACK TO FACTORY DEFAULT BY ADDING THE # SIGN IN FRONT OF THE LINE ITEM LABELED "MAPACIFIER"***

8. Open the Hmain.txt file by clicking on **<START> <RUN>** and type C:\IAS\PROG\HMAIN.TXT (3.1 software) or C:\PROGRAM FILES\SNAP-ON TECHNOLOGIES INC\ALIGNER\IAS\HMAIN.TXT (3.2 Software) C:\PROGRAM FILES\SNAP-ON\TECHNOLOGIES INC\ALIGNER\IAS\HMAINARAGO.TXT (Arago III) notepad will then open up the "HMAIN.TXT" file.

Below is a snap shot of the extra data collected by turning on the "Mpacifier". The items have been numbered with explanations of each item below.

```
1.  wheel=0 AMPI strobe=5000 gain= 95 mode=3 bksub=1 2. (1 1 1 1 0)
3.  retCode   = (     102      102      102      102        0        )
4.  imgCount  = (      32       31       31       31        0     125)
5.  plnCount  = (       0        0        0        0        0       0)
6.  strobe    = (    5000     2320     2320     2320        0        )
7.  gain      = (      95       44       44       44        0        )
8.  intensity= (        0        0        0        0        0        )
9.  subtBack  = (       1        1        1        1        0        )
10. threshold= (       50       50       50       50        0        )
11. fidsUsed  = (       0        0        0        0        0        )
12. Rms       = (  0.0000   0.0000   0.0000   0.0000   0.0000        )
13. acqCount  = (       0        0        0        0        0        )
14. distMeas  = (100.0000 100.0000 200.0000 200.0000   0.0000        )
15. thetMeas  = ( 35.0000  35.0000  35.0000  35.0000   0.0000        )
16. phiMeas   = ( 35.0000  35.0000  35.0000  35.0000   0.0000        )
17. alphMeas  = ( 35.0000  35.0000  35.0000  35.0000   0.0000        )
```

1. Identifies certain parameters for a particular wheel.
   0 = LF
   1 = RF
   2 = LR
   3 = RR

2. Search mode for all cameras (LF,RF,LR,RR,Calibration Target)
   1 = Look for target
   2 = Acquired the target
   3 = Acquired but lost for 3 images. Minimum search mode.
   4 = Had acquired target but lost it and looking for it. Maximum search mode.

3. Return Code
   0 = Good
   102 = Can't locate any blobs.
   103 = Not enough blobs found.
   112 = Intensity is not in range of command parameters. Note: 137 is the same thing.
   125 = Region of interest for rear wheels changed suddenly.
   126 = Region of interest for rear wheels changed suddenly.
   149 = Can't find asterisk blobs (4 dots) Note: 142 & 156 same thing.

4. Accumulated count of images acquired.

5. Accumulated count of planes acquired.

6. Strobe - Brightness of the LED's

7. Gain - The amount of voltage sent to the CCD. The higher the voltage the brighter the image.

8. Intensity - The amount of light sent back from the target.
   Minimum = 100
   Maximum = 220
   Goal = 160

9. Subtback - Subtract Background noise. Unit is set to autocontrol.
   0 = Off
   1 = On

10. Threshold -

11. FidsUsed - Amount of circles on the target that the camera sees. The camera must see at least 25 to identify the target as a valid target.

12. RMS - Background noise, should be .06 or less .15max. How round are the dots on the target.

13. Acqcount - How long to acquire targets

14. Distmeas - Distance from the camera to the relative target.

15. Thetmeas - Angle of the target

16. Phimeas - N/A

17. Alphmeas - N/A

Below is an Hmain.txt file with MPACIFIER turned on and set to update every 20 seconds. The Hmain.txt file has two completed alignments.

```
11/23/01 2:12:22 AM     Starting Application
11/23/01 2:12:22 AM     Visualiner Pro32  Version: 3.2.0.0 [JBC] Brand

Loading RCP File C:\ias\prog\rcp.pld last modified October 17, 2001
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
OpenIvsUSB (4) passed, count=0
OpenIvsUSB (4) passed, count=1
Loading C:\IAS\PROG\ivs.mot last modified September 28, 2001
Receive Thread Started Successfully.
02:12:37 Reading keyword file C:\IAS\PROG\hmain.cmd
02:12:38 kwpOn = 0
02:12:38 Prom GRIDHEADER and title same as c:\ias\prog\gpromL.grd
02:12:38 Prom GRIDHEADER and title same as c:\ias\prog\gpromR.grd
Checking GRD File c:\ias\prog\gpromL.grd last modified October 03, 2001
Checking GRD File c:\ias\prog\gpromR.grd last modified October 03, 2001
11/23/01 2:12:44 AM     Loading Alignment Database AlignmentData.mdb
11/23/01 2:12:48 AM     Showing Main Screen Window
02:12:49 wheel=0 AMPI strobe=5000 gain= 95 mode=3 bksub=1(1 1 1 1 0)
02:12:49  retCode  = (     102      102      102      102        0         )
02:12:49  imgCount = (      32       31       31       31        0      125)
02:12:49  plnCount = (       0        0        0        0        0        0)
02:12:49  strobe   = (    5000     2320     2320     2320        0         )
02:12:49  gain     = (      95       44       44       44        0         )
02:12:49  intensity= (       0        0        0        0        0         )
02:12:49  subtBack = (       1        1        1        1        0         )
02:12:49  threshold= (      50       50       50       50        0         )
02:12:49  fidsUsed = (       0        0        0        0        0         )
02:12:49  Rms      = (  0.0000   0.0000   0.0000   0.0000   0.0000         )
02:12:49  acqCount = (       0        0        0        0        0         )
02:12:49  distMeas = (100.0000 100.0000 200.0000 200.0000   0.0000         )
02:12:49  thetMeas = ( 35.0000  35.0000  35.0000  35.0000   0.0000         )
02:12:49  phiMeas  = ( 35.0000  35.0000  35.0000  35.0000   0.0000         )
02:12:49  alphMeas = ( 35.0000  35.0000  35.0000  35.0000   0.0000         )
11/23/01 2:12:50 AM     Beginning A New Alignment
11/23/01 2:13:01 AM     Loading Specs for TOYOTA, 1997, T100, Pickup 2WD Extra
   Cab
02:13:09 wheel=2 AMPI strobe=5000 gain= 95 mode=3 bksub=0(1 1 1 1 0)
02:13:09  retCode  = (     102      102      103      102        0         )
02:13:09  imgCount = (     100      101      103      100        0      404)
02:13:09  plnCount = (       1        1        0        0        0        2)
02:13:09  strobe   = (     500     1077     5000      500        0         )
02:13:09  gain     = (      10       21       95       10        0         )
02:13:09  intensity= (       0        0        0        0        0         )
02:13:09  subtBack = (       0        0        0        0        0         )
02:13:09  threshold= (      70       70       70       70        0         )
02:13:09  fidsUsed = (       0        0        0        0        0         )
02:13:09  Rms      = (  0.0000   0.0000   0.0000   0.0000   0.0000         )
02:13:09  acqCount = (       0        0        0        0        0         )
02:13:09  distMeas = (106.9758 104.5921 200.0000 200.0000   0.0000         )
02:13:09  thetMeas = ( 34.3831  35.7059  35.0000  35.0000   0.0000         )
02:13:09  phiMeas  = (287.4882 240.9491  35.0000  35.0000   0.0000         )
```

```
02:13:09  alphMeas = (218.5716 115.5393  35.0000  35.0000   0.0000         )
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
02:13:29 wheel=0 AMPI strobe=5000 gain= 95 mode=3 bksub=0(1 1 1 1 0)
02:13:29  retCode  = (     102      103      102      102        0         )
02:13:29  imgCount = (     167      171      169      172        0      679)
02:13:29  plnCount = (       1        1        0        0        0        2)
02:13:29  strobe   = (    5000     5000     1077      500        0         )
02:13:29  gain     = (      95       95       21       10        0         )
02:13:29  intensity= (       0        0        0        0        0         )
02:13:29  subtBack = (       0        0        0        0        0         )
02:13:29  threshold= (      70       70       70       70        0         )
02:13:29  fidsUsed = (       0        0        0        0        0         )
02:13:29  Rms      = (  0.0000   0.0000   0.0000   0.0000   0.0000         )
02:13:29  acqCount = (       0        0        0        0        0         )
02:13:29  distMeas = (106.9758 104.5921 200.0000 200.0000   0.0000         )
02:13:29  thetMeas = ( 34.3831  35.7059  35.0000  35.0000   0.0000         )
02:13:29  phiMeas  = (287.4882 240.9491  35.0000  35.0000   0.0000         )
02:13:29  alphMeas = (218.5716 115.5393  35.0000  35.0000   0.0000         )
02:13:49 wheel=3 AMPI strobe=1808 gain= 10 mode=3 bksub=0(2 2 1 2 0)
02:13:49  retCode  = (       0        0      103        0        0         )
02:13:49  imgCount = (     263      270      267      270        0     1070)
02:13:49  plnCount = (      87       92       66       85        0      330)
02:13:49  strobe   = (     691      512      500     1808        0         )
02:13:49  gain     = (      10       10       10       10        0         )
02:13:49  intensity= (     144      177        0      148        0         )
02:13:49  subtBack = (       0        0        1        0        0         )
02:13:49  threshold= (      70       70       50       70        0         )
02:13:49  fidsUsed = (      33       33        0       33        0         )
02:13:49  Rms      = (  0.0492   0.0384   0.0000   0.0470   0.0000         )
02:13:49  acqCount = (       4        1        0        2        0         )
02:13:49  distMeas = (115.6414 112.8777 236.5085 233.3453   0.0000         )
02:13:49  thetMeas = ( 37.8858  31.6536  39.0507  32.8684   0.0000         )
02:13:49  phiMeas  = (242.9933 283.9061 241.6644 287.8440   0.0000         )
02:13:49  alphMeas = (118.8678 211.9262 205.5783 310.5777   0.0000         )
02:14:09 wheel=1 AMPI strobe= 514 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:14:09  retCode  = (       0        0        0        0        0         )
02:14:09  imgCount = (     373      381      377      379        0     1510)
02:14:09  plnCount = (     193      195      171      179        0      738)
02:14:09  strobe   = (     826      514     3082     1811        0         )
02:14:09  gain     = (      10       10       10       10        0         )
02:14:09  intensity= (     189      172      173      155        0         )
02:14:09  subtBack = (       0        0        0        0        0         )
02:14:09  threshold= (      70       70       70       70        0         )
02:14:09  fidsUsed = (      33       33       31       33        0         )
02:14:09  Rms      = (  0.0409   0.0425   0.0537   0.0532   0.0000         )
02:14:09  acqCount = (       4        3        3        9        0         )
02:14:09  distMeas = (107.0214 104.5674 227.8863 224.8012   0.0000         )
02:14:09  thetMeas = ( 34.3491  35.5051  35.7502  37.8339   0.0000         )
02:14:09  phiMeas  = (287.0144 241.2989 289.8308 237.7938   0.0000         )
02:14:09  alphMeas = (217.5137 116.3679 313.9728 197.6337   0.0000         )
```

```
02:14:29 wheel=2 AMPI strobe=3082 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:14:29  retCode  = (       0        0     8192        0        0         )
02:14:29  imgCount = (     495      503      500      501        0     1999)
02:14:29  plnCount = (     309      317      196      298        0     1120)
02:14:29  strobe   = (     594      514     3082     2216        0         )
02:14:29  gain     = (      10       10       10       10        0         )
02:14:29  intensity= (     171      157        0      178        0         )
02:14:29  subtBack = (       0        0        0        0        0         )
02:14:29  threshold= (      70       70       70       70        0         )
02:14:29  fidsUsed = (      33       33        0       33        0         )
02:14:29  Rms      = (  0.0416   0.0503   0.0000   0.0474   0.0000         )
02:14:29  acqCount = (       3        3        1        3        0         )
02:14:29  distMeas = (104.3708 107.3195 227.7903 224.8366   0.0000         )
02:14:29  thetMeas = ( 27.3316  42.5947  35.7470  37.7936   0.0000         )
02:14:29  phiMeas  = (295.9972 248.5710 289.8089 237.9201   0.0000         )
02:14:29  alphMeas = (235.6486 131.4028 313.9245 197.9124   0.0000         )
             LeftCenter RightCenter   LeftRight   sumDeltas
casterLeft    2.320       2.352       2.263       0.059
casterRight   2.619       2.247       2.309       0.248
saiLeft      10.341      11.848      11.040       1.005
saiRight     14.370      11.673      13.087       1.798
passed
passed
passed
passed
passed
02:14:49 wheel=3 AMPI strobe=2216 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:14:49  retCode  = (       0        0        0        0        0         )
02:14:49  imgCount = (     604      613      607      612        0     2436)
02:14:49  plnCount = (     410      427      233      409        0     1479)
02:14:49  strobe   = (     716      514     3115     2216        0         )
02:14:49  gain     = (      10       10       10       10        0         )
02:14:49  intensity= (     170      171      173      177        0         )
02:14:49  subtBack = (       0        0        0        0        0         )
02:14:49  threshold= (      70       70       71       70        0         )
02:14:49  fidsUsed = (      33       33       32       33        0         )
02:14:49  Rms      = (  0.0500   0.0503   0.0477   0.0461   0.0000         )
02:14:49  acqCount = (       3        3        3        3        0         )
02:14:49  distMeas = (106.9629 104.6474 227.7816 224.8436   0.0000         )
02:14:49  thetMeas = ( 34.1747  35.8390  35.7443  37.8203   0.0000         )
02:14:49  phiMeas  = (287.1527 241.1257 289.8562 237.8602   0.0000         )
02:14:49  alphMeas = (217.7932 115.8999 314.0264 197.7687   0.0000         )
02:15:09 wheel=1 AMPI strobe=2320 gain= 44 mode=3 bksub=0(1 1 1 1 0)
02:15:09  retCode  = (     112      112      115      115        0         )
02:15:09  imgCount = (     722      731      724      729        0     2906)
02:15:09  plnCount = (     516      533      338      515        0     1902)
02:15:09  strobe   = (    2320     2320     2320     1077        0         )
02:15:09  gain     = (      44       44       44       21        0         )
02:15:09  intensity= (     249      249      209      116        0         )
02:15:09  subtBack = (       0        0        0        0        0         )
02:15:09  threshold= (      70       70       71       70        0         )
02:15:09  fidsUsed = (      31       33       33       33        0         )
02:15:09  Rms      = (  0.0442   0.0461   0.0528   0.0489   0.0000         )
02:15:09  acqCount = (       0        0        0        0        0         )
02:15:09  distMeas = (106.9682 104.6434 227.8807 224.8222   0.0000         )
02:15:10  thetMeas = ( 34.1613  35.8404  35.7315  37.8378   0.0000         )
02:15:10  phiMeas  = (287.1527 241.1248 289.7638 237.8608   0.0000         )
```

```
02:15:10  alphMeas = (217.7874 115.8937 313.8450 197.7670   0.0000         )
11/23/01 2:15:10 AM     Beginning A New Alignment
11/23/01 2:15:16 AM     Loading Specs for CHEVROLET, 2002, CORVETTE
02:15:29 wheel=3 AMPI strobe=1077 gain= 21 mode=3 bksub=0(1 1 1 1 0)
02:15:29  retCode  = (     102      102      102      102        0         )
02:15:29  imgCount = (     794      803      797      802        0     3196)
02:15:29  plnCount = (     517      534      340      517        0     1908)
02:15:29  strobe   = (    1077     1077     1077     1077        0         )
02:15:29  gain     = (      21       21       21       21        0         )
02:15:29  intensity= (       0        0        0        0        0         )
02:15:29  subtBack = (       0        0        0        0        0         )
02:15:29  threshold= (      70       70       70       70        0         )
02:15:29  fidsUsed = (       0        0        0        0        0         )
02:15:29  Rms      = (  0.0000   0.0000   0.0000   0.0000   0.0000         )
02:15:29  acqCount = (       0        0        0        0        0         )
02:15:29  distMeas = (106.9608 104.6771 227.7722 224.6724   0.0000         )
02:15:29  thetMeas = ( 34.1688  35.7945  35.7538  37.8937   0.0000         )
02:15:29  phiMeas  = (287.0998 241.1339 289.8572 237.8466   0.0000         )
02:15:29  alphMeas = (217.6682 115.9160 314.0322 197.7183   0.0000         )
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrf.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawlr.vcd last modified August 14, 2001
Loading TID File c:\ias\data\clawrr.vcd last modified August 14, 2001
02:15:49 wheel=2 AMPI strobe=3407 gain= 10 mode=3 bksub=0(3 2 2 2 0)
02:15:49  retCode  = (     102        0      119        0        0         )
02:15:49  imgCount = (     873      882      875      879        0     3509)
02:15:49  plnCount = (     546      573      374      554        0     2047)
02:15:49  strobe   = (     500      512     3407     1756        0         )
02:15:49  gain     = (      10       10       10       10        0         )
02:15:49  intensity= (       0      171        0      151        0         )
02:15:49  subtBack = (       0        0        0        0        0         )
02:15:49  threshold= (      70       70       70       70        0         )
02:15:49  fidsUsed = (       0       33        0       33        0         )
02:15:49  Rms      = (  0.0000   0.0420   0.0000   0.0527   0.0000         )
02:15:49  acqCount = (       3        1        4        2        0         )
02:15:49  distMeas = (106.9703 104.6446 227.8449 224.8135   0.0000         )
02:15:49  thetMeas = ( 34.1520  35.8438  35.7530  37.8469   0.0000         )
02:15:49  phiMeas  = (287.1568 241.1302 289.8198 237.8402   0.0000         )
02:15:49  alphMeas = (217.7912 115.9062 313.9531 197.7358   0.0000         )
02:16:09 wheel=3 AMPI strobe=2046 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:16:09  retCode  = (       0        0        0        0        0         )
02:16:09  imgCount = (     970      984      977      981        0     3912)
02:16:09  plnCount = (     623      667      471      645        0     2406)
02:16:09  strobe   = (     669      512     4007     2046        0         )
02:16:09  gain     = (      10       10       10       10        0         )
02:16:09  intensity= (     152      177      126      158        0         )
02:16:09  subtBack = (       0        0        0        0        0         )
02:16:09  threshold= (      70       70       71       71        0         )
02:16:09  fidsUsed = (      33       33       31       31        0         )
02:16:09  Rms      = (  0.0493   0.0370   0.0621   0.0454   0.0000         )
02:16:09  acqCount = (       9        2        3        5        0         )
02:16:09  distMeas = (115.1289 112.5323 236.2988 233.2922   0.0000         )
02:16:10  thetMeas = ( 36.3169  31.0090  38.5794  32.8775   0.0000         )
```

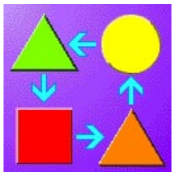
```
02:16:10  phiMeas  = (247.2157 279.4693 242.2380 287.0694   0.0000         )
02:16:10  alphMeas = (128.5897 202.0620 206.9634 308.8268   0.0000         )
02:16:29 wheel=0 AMPI strobe= 602 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:16:29  retCode  = (       0        0        0        0        0         )
02:16:29  imgCount = (    1076     1094     1087     1091        0     4348)
02:16:29  plnCount = (     715      777      574      755        0     2821)
02:16:29  strobe   = (     602      512     3051     2046        0         )
02:16:29  gain     = (      10       10       10       10        0         )
02:16:29  intensity= (     162      179      173      165        0         )
02:16:29  subtBack = (       0        0        0        0        0         )
02:16:29  threshold= (      70       70       70       71        0         )
02:16:29  fidsUsed = (      32       33       33       33        0         )
02:16:29  Rms      = (  0.0447   0.0378   0.0487   0.0472   0.0000         )
02:16:29  acqCount = (      11        2        4        5        0         )
02:16:30  distMeas = (106.8988 105.3340 227.6440 225.8298   0.0000         )
02:16:30  thetMeas = ( 34.5576  35.3522  35.0545  36.6637   0.0000         )
02:16:30  phiMeas  = (290.3276 243.2984 290.1258 242.3358   0.0000         )
02:16:30  alphMeas = (224.8394 120.8016 314.4534 208.0471   0.0000         )
02:16:49 wheel=1 AMPI strobe= 512 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:16:49  retCode  = (       0        0     8192        0        0         )
02:16:49  imgCount = (    1198     1217     1209     1213        0     4837)
02:16:49  plnCount = (     832      900      619      877        0     3228)
02:16:49  strobe   = (     690      512     3051     2046        0         )
02:16:50  gain     = (      10       10       10       10        0         )
02:16:50  intensity= (     188      172        0      165        0         )
02:16:50  subtBack = (       0        0        0        0        0         )
02:16:50  threshold= (      70       70       70       71        0         )
02:16:50  fidsUsed = (      32       33        0       32        0         )
02:16:50  Rms      = (  0.0444   0.0465   0.0000   0.0447   0.0000         )
02:16:50  acqCount = (       2        2        2        5        0         )
02:16:50  distMeas = (105.7001 106.4042 227.6091 225.5535   0.0000         )
02:16:50  thetMeas = ( 31.1443  38.5335  35.0686  36.9224   0.0000         )
02:16:50  phiMeas  = (293.3725 246.8420 290.1157 241.0535   0.0000         )
02:16:50  alphMeas = (230.8696 128.0741 314.4469 205.1056   0.0000         )
             LeftCenter RightCenter   LeftRight   sumDeltas
casterLeft    2.807       2.391       2.239       0.379
casterRight   2.286       2.219       2.302       0.055
saiLeft       4.730      12.418       8.458       5.125
saiRight     10.565      11.597      11.089       0.688
wheel=0 "roll"=  0.55, tolerance=  0.30. failed
passed
passed
wheel=3 "roll"=  0.49, tolerance=  0.30. failed
wheel=4 "roll"=  0.49, tolerance=  0.30. failed
02:17:10 wheel=2 AMPI strobe=3024 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:17:10  retCode  = (       0        0        0        0        0         )
02:17:10  imgCount = (    1306     1326     1316     1322        0     5270)
02:17:10  plnCount = (     935     1009      649      986        0     3579)
02:17:10  strobe   = (     676      512     3024     2046        0         )
02:17:10  gain     = (      10       10       10       10        0         )
02:17:10  intensity= (     170      176      170      166        0         )
02:17:10  subtBack = (       0        0        0        0        0         )
02:17:10  threshold= (      70       70       70       71        0         )
02:17:10  fidsUsed = (      33       33       31       33        0         )
02:17:10  Rms      = (  0.0448   0.0519   0.0520   0.0537   0.0000         )
02:17:10  acqCount = (       2        2        4        5        0         )
02:17:10  distMeas = (106.9286 105.0526 227.7186 225.4758   0.0000         )
```

```
02:17:10  thetMeas = ( 34.2630  35.3363  35.3409  37.0859   0.0000         )
02:17:10  phiMeas  = (288.5629 243.0578 289.8664 240.4394   0.0000         )
02:17:10  alphMeas = (220.8874 120.2837 313.9426 203.6996   0.0000         )
02:17:30 wheel=3 AMPI strobe=2046 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:17:30  retCode  = (       0        0        0        0        0         )
02:17:30  imgCount = (    1430     1450     1440     1447        0     5767)
02:17:30  plnCount = (    1059     1133      773     1111        0     4076)
02:17:30  strobe   = (     676      512     3024     2046        0         )
02:17:30  gain     = (      10       10       10       10        0         )
02:17:30  intensity= (     169      175      169      166        0         )
02:17:30  subtBack = (       0        0        0        0        0         )
02:17:30  threshold= (      70       70       70       71        0         )
02:17:30  fidsUsed = (      33       33       32       33        0         )
02:17:30  Rms      = (  0.0434   0.0499   0.0514   0.0525   0.0000         )
02:17:30  acqCount = (       2        2        4        5        0         )
02:17:30  distMeas = (106.9442 105.0509 227.7675 225.4884   0.0000         )
02:17:30  thetMeas = ( 34.2624  35.3208  35.3172  37.0670   0.0000         )
02:17:30  phiMeas  = (288.5211 243.0711 289.8803 240.4299   0.0000         )
02:17:30  alphMeas = (220.7943 120.3023 313.9690 203.6698   0.0000         )
02:17:50 wheel=0 AMPI strobe= 676 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:17:50  retCode  = (       0        0        0        0        0         )
02:17:50  imgCount = (    1555     1574     1564     1571        0     6264)
02:17:50  plnCount = (    1184     1257      897     1235        0     4573)
02:17:50  strobe   = (     676      512     3024     2046        0         )
02:17:50  gain     = (      10       10       10       10        0         )
02:17:50  intensity= (     169      175      169      166        0         )
02:17:50  subtBack = (       0        0        0        0        0         )
02:17:50  threshold= (      70       70       70       71        0         )
02:17:50  fidsUsed = (      33       33       32       32        0         )
02:17:50  Rms      = (  0.0469   0.0471   0.0541   0.0509   0.0000         )
02:17:50  acqCount = (       2        2        4        5        0         )
02:17:50  distMeas = (106.9395 105.0529 227.7276 225.4844   0.0000         )
02:17:50  thetMeas = ( 34.2513  35.3226  35.3170  37.0985   0.0000         )
02:17:50  phiMeas  = (288.5173 243.0734 289.8356 240.4324   0.0000         )
02:17:50  alphMeas = (220.7912 120.3090 313.8733 203.6721   0.0000         )
02:18:10 wheel=1 AMPI strobe= 512 gain= 10 mode=3 bksub=0(2 2 2 2 0)
02:18:10  retCode  = (       0        0        0        0        0         )
02:18:10  imgCount = (    1679     1699     1688     1695        0     6761)
02:18:10  plnCount = (    1306     1382     1021     1359        0     5068)
02:18:10  strobe   = (     583      512     3024     2046        0         )
02:18:10  gain     = (      10       10       10       10        0         )
02:18:10  intensity= (     151      175      169      166        0         )
02:18:10  subtBack = (       0        0        0        0        0         )
02:18:10  threshold= (      70       70       70       71        0         )
02:18:10  fidsUsed = (      32       33       31       32        0         )
02:18:10  Rms      = (  0.0484   0.0492   0.0502   0.0541   0.0000         )
02:18:10  acqCount = (       2        2        4        5        0         )
02:18:10  distMeas = (106.9565 105.0429 227.6911 225.4630   0.0000         )
02:18:10  thetMeas = ( 34.2340  35.3267  35.3295  37.1150   0.0000         )
02:18:10  phiMeas  = (288.5359 243.0571 289.8729 240.3939   0.0000         )
02:18:10  alphMeas = (220.8295 120.2774 313.9621 203.5862   0.0000         )
02:18:30 wheel=3 AMPI strobe=5000 gain= 95 mode=3 bksub=0(1 1 1 1 0)
02:18:30  retCode  = (     102      102      102      102        0         )
02:18:30  imgCount = (    1785     1805     1795     1802        0     7187)
02:18:30  plnCount = (    1384     1460     1099     1437        0     5380)
02:18:30  strobe   = (    2320     2320     5000     5000        0         )
02:18:30  gain     = (      44       44       95       95        0         )
```

```
02:18:30  intensity= (       0        0        0        0        0          )
02:18:30  subtBack = (       0        0        0        0        0          )
02:18:30  threshold= (      70       70       70       71        0          )
02:18:30  fidsUsed = (       0        0        0        0        0          )
02:18:30  Rms      = (  0.0000   0.0000   0.0000   0.0000   0.0000          )
02:18:30  acqCount = (       0        0        0        0        0          )
02:18:30  distMeas = (106.9432 105.0460 227.7489 225.4883   0.0000          )
02:18:30  thetMeas = ( 34.2525  35.3165  35.3297  37.0793   0.0000          )
02:18:30  phiMeas  = (288.5482 243.0621 289.9119 240.4359   0.0000          )
02:18:30  alphMeas = (220.8541 120.2876 314.0287 203.6849   0.0000          )
```

MAINTENANCE MENU SOFTWARE

General Maintenance for the Pro32 IVS system is performed using this Maintenance Menu. (Figure 3-114) Many of the features used in 3.2 software are explained in the 3.1 software section. The features and icons have moved into different sections of this software. If you do not find explanations described in this section see the 3.1 software section.



Calibration - Software used to perform several calibration procedures including TID, Camera Aim, Hub Pin ID, RCP, and RCP Check.

Diagnostic - Several diagnostic procedures used to troubleshoot different parts of the system including Camera View, Camera Check, IVS Processing Test and Target Check.

Figure 3-114

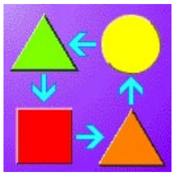
Preventative Maintenance – Software feature that guides the equipment operator through recommended periodic aligner maintenance. (See Operators Manual for details)

Demo Mode - A program used primarily by sales representatives and training personnel. This is program that demonstrates the capabilities of the aligner software without actually having a vehicle available. It is a useful tool for training new or experienced users about machine features. (See Operators Manual for details)

Windows Utilities – Allows access to the Windows Desktop and also allows the operator to perform routine installation of printers, software, etc. See 3.1 software "Windows Utilities" for details.

Database Utilities – The feature is used for backing up and restoring alignment based data files, customer data, etc. (See Operators Manual for details)

Speaker Training – Optional Hardware / Software package that allows and end-user to control the aligner through voice commands. (See Operators Manual for details)



CALIBRATION

The IVS Calibration software is used to perform periodic maintenance to the aligner. This software is mainly used by the repair technician. The Target Identification and Hub Pin Clamp Identification features are used by the customer to perform general maintenance should a target need replacing or an accidental drop.

TID - Utilities used for performing Target Identification for 3 different types of clamps available to the end-user including Standard Clamps, Universal Clamps and Hub Pin Clamps.

Camera Aim - Utility to aim the camera after installation. Maximizes the range for the camera to see targets for most alignments. See 3.1 “Camera Aiming” for step by step instructions.

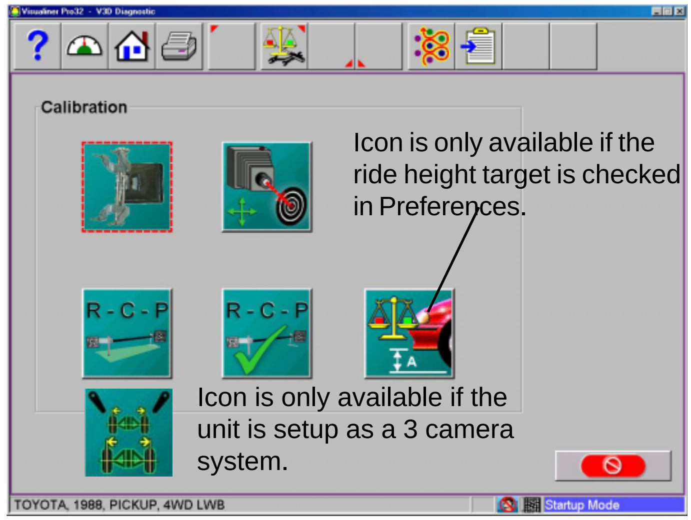
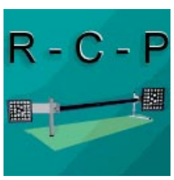
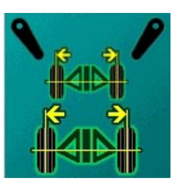


Figure 3-115



Relative Camera Position (RCP) - Process used to identify the camera’s distance from one another. See Relative Camera Positioning. See 3.1 software “Relative Camera Position” (RCP) for step by step instructions.

RCP Check - Utility to check the accuracy of the current RCP used by the aligner. See 3.1 software “RCP Check” Process for step by step instructions.



Pod Position Rotation - Utility used to calibrate the camera pod position on an Arago system. This utility is only available if the system is setup as a 3 camera system on the “Setup Menu”. This feature replaces the RCP icon.

Ride Height Target Calibration - Utility used to calibrate the “Ride Height Target” if available. See the section to activate and calibrate ride height target for more information.

TID

The V3D IVS system has 3 different types of wheel clamps available to the end-user. (Figure 3-116) Each clamp has a specific use. The “Conventional Clamp” comes standard with the aligner. Each target / clamp must be ID’d before using them in the alignment process. Once these targets have been ID’d the customer will then have to choose which clamp assembly he/she will be using for each alignment.

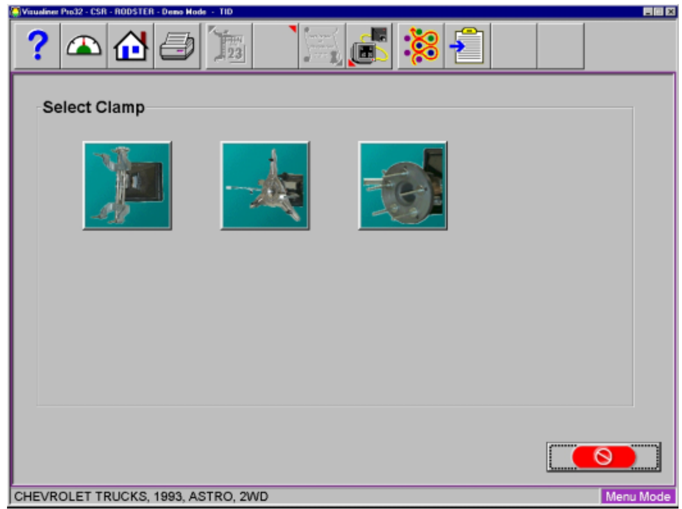
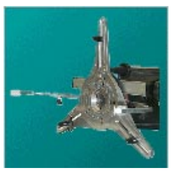


Figure 3-116

Conventional Clamp - Used to perform Target Identification on Conventional Wheel clamps. These clamps and target come standard with the aligner. See “Target ID” earlier in this chapter for procedures.



Universal Clamp - Used to perform TID using the universal clamp. Procedure is the same as Conventional Clamps.

Hub Pin Clamp - Used to perform TID using the Hub Pin Clamp. Procedure is the same as Conventional Clamps.

CAMERA POD ROTATION

In order to maximize the Arago 3 alignment system. The camera have been mounted on a swivel pod assembly. This swivel pod allows the right and left cameras to rotate in order to see the targets in all field of views (Narrow, Normal and Wide). The Arago does not require RCP because the third camera maintains constant calibration.

1. From the calibration icon single click on the "Camera Pod Rotation" icon. (Figure 3-117)

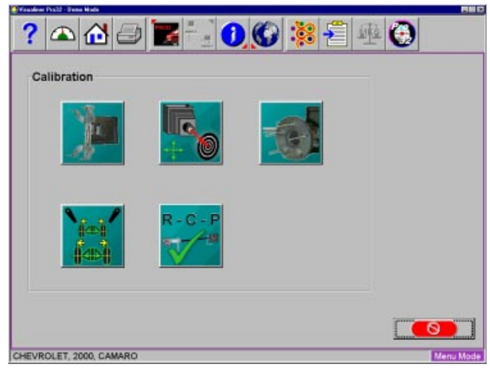


Figure 3-117

2. Adjust the camera lever's to the illustrated position shown on the screen and click on **<OK>**. (Figure 3-118)

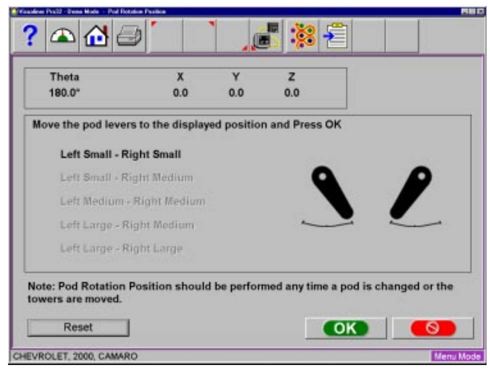


Figure 3-118

3. After clicking on "Ok" as indicated in step 2, the camera rotation levers change positions. Move the camera levers to the position shown and click on **<OK>**. (Figure 3-119)

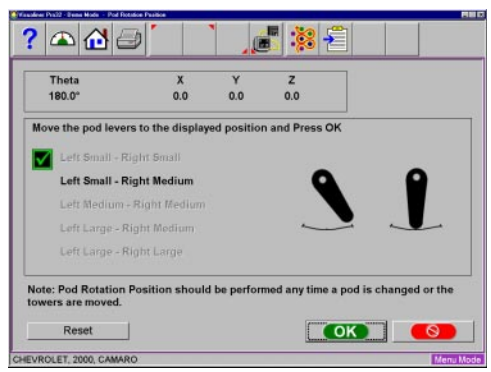


Figure 3-119

4. Continue the process until all camera positons have been checked. After the final rotation lever has been checked click on the **<Cancel>** button to exit. (Figure 3-120)

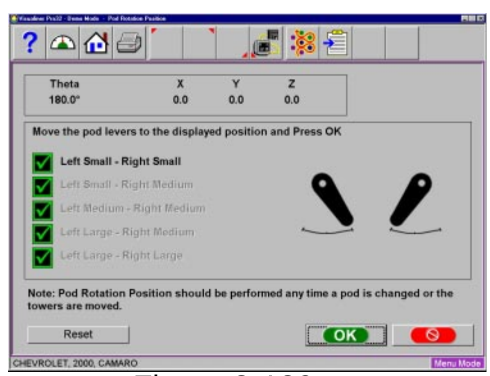
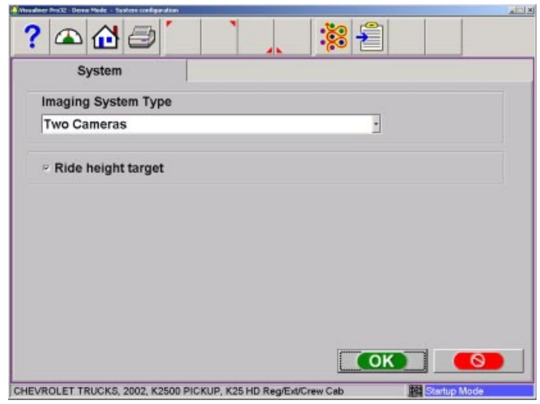


Figure 3-120

NOTE: ***IF A MISTAKE IS MADE DURING THE TEACHING PROCESS, THE OPERATOR CAN SIMPLY CLICK ON THE RESET BUTTON TO CLEAR THE LEARNING PROCESS AND START AT THE BEGINNING.***

ACTIVATE AND CALIBRATE THE RIDE HEIGHT MEASURING DEVICE

From the ***Main Menu*** select the ***Preference*** tab, click on the ***System Configuration*** icon and click on ***Ride Height Target*** to activate the Ride Height Target feature.



CALIBRATE

1. From the ***Main Menu*** select the ***Maintenance*** tab, click on the ***Calibration*** icon and click on ***Ride Height Target Calibration*** icon to begin the calibration process.

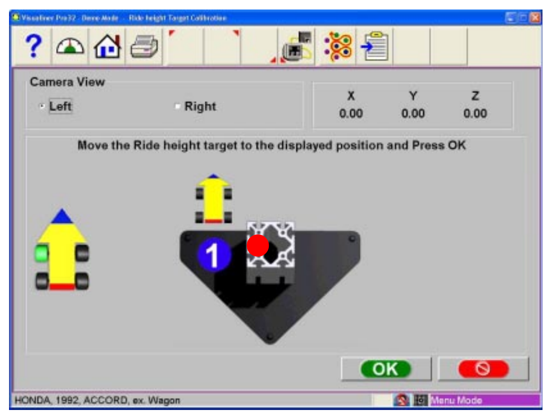
2. Locate the Ride Height Calibration fixture and place the fixture on one of the lift runways so the straight edge is toward the camera.

3. Select the side of the rack you are to calibrate from.

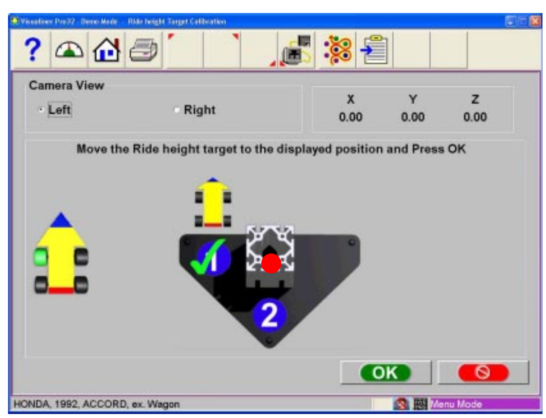
4. Place the tip of the target pointer into the hole in the base of the calibration fixture.

NOTE: THE POINTER TIP MUST REMAIN IN THE HOLE DURING ALL STEPS OF CALIBRATION.

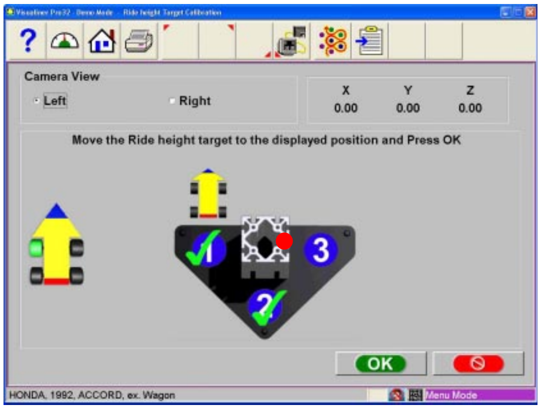
5. Tilt the target to the first position. The reflective surface of the target should be facing the camera. The target should be steady during each step.



6. When the circled "1" is Checked, tilt the target to position "2".



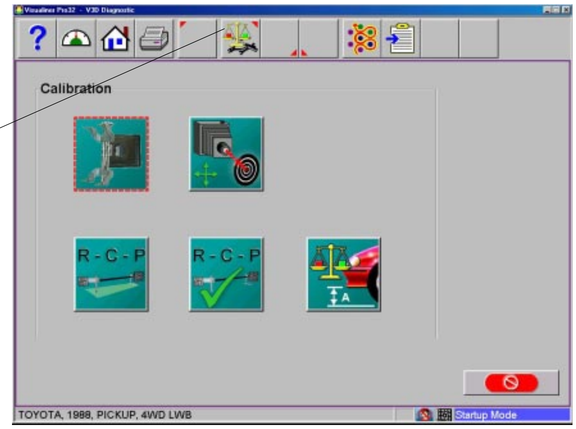
7. Proceed with calibration, until all three steps have been completed.

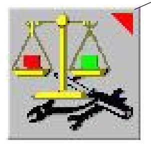


8. Should calibration of the ride height target fail, a warning dialogue box will pop up and the user must begin the process from the beginning.

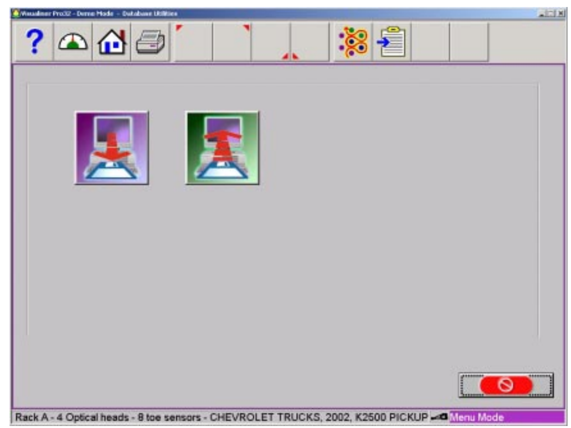
NOTE: IF THE TIP BECOMES DAMAGED AS SHOWN BELOW, DRESS THE TIP WITH A FILE AND RE-CALIBRATE.

CALIBRATION AND PREFERENCE BACKUP





This feature is only available on software revision 3.4 or greater. All alignment machines are unique in their own way. Each aligner has different calibration factors and preferences. CCP alignment software also offers users many different options in the way of looks and feel. Each user spends many hours customizing the alignment software for his/her look and feel. Each alignment shop may have a different logo that may show up on a printout of each printed alignment result. Calibration and Preference backup offers the user or technician a way of backing up all customized options and alignment calibration to a 1.44mb floppy diskette. Should an alignment machine require a hard drive replacement the user or technician can simply restore all data from a saved floppy diskette back on to the newly installed hard drive. From the ***Main Menu*** click on the ***Maintenance Tab*** click on the ***Calibration*** icon and then click on the ***Calibration Utilities*** icon on the toolbar as illustrated above.



Backup - It is recommended after every calibration that the user backup the new data in case of a PC or Hard Drive failure. This enables the user to quickly restore the alignment system's calibration and preference data after the operating system has been restored. It is recommended that each time the system is backed up that the same disk be used and dated on the floppy disk label. A 1.44mb formatted floppy diskette is required to perform this operation. If the floppy diskette being used contains any information the system will automatically prompt the user to format the diskette using the operating systems format command.

Restore - Should a hard drive failure occur, simply install the last known alignment calibration and preference data disk and restore the aligner back to the user's prefered preference.

NOTE: IF THE OPERATOR IS NOT SURE IF THE SAVED DATA ON THE FLOPPY DISKETTE IS NOT CURRENT IT IS RECOMMENDED THAT A CALIBRATION BE PERFORMED. FAILURE TO HAVE ACCURATE CALIBRATION DATA CAN AND WILL CAUSE EXCESSIVE TIRE WEAR.

DIAGNOSTICS 3.2 SOFTWARE

All diagnostic software explanations are explained earlier in this Chapter. Earlier software used to write each test to a separate file (explained earlier). With 3.2 software all diagnostics test are written to the HMAIN.TXT file. The choices available in 3.2 software are listed below. (Figure 3-121)

Camera View - Used to acquire raw camera images. See "Camera View" explained earlier in this chapter.

Camera Test - Utility used to test camera image count. Also used for checking to see if the camera will respond to both "Gain" and "Strobe" commands. Additional test added over 3.1 software, details explained on the next page.

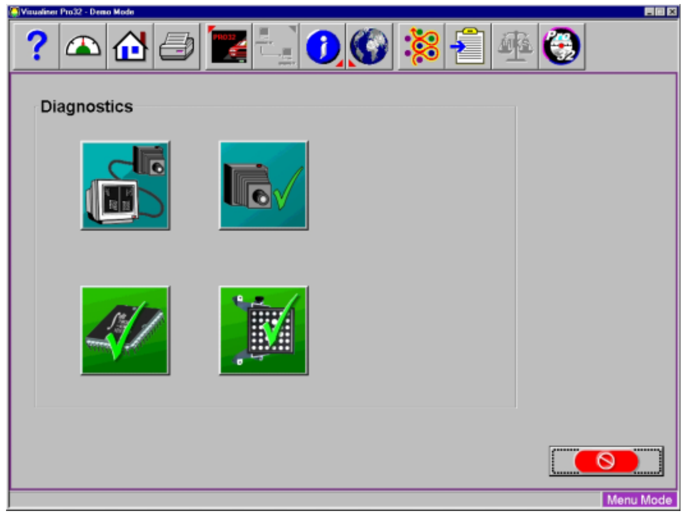
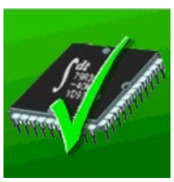


Figure 3-121



IVS Processing Test - Utility used to check IVS capability of acquiring targets and processing images. 3.2 software writes this information data to the HMAIN.TXT. See Co-Processor High Test in 3.1 for details.

Target Check - Checks the validity of each target. See "Target Check" explained earlier in this chapter. 3.2 Software writes this information to the HMAIN.TXT file. See Target Check in 3.1 for details.

CAMERA TEST

For the aligner to accurately collect data and display images it has to continuously acquire images and send this information back to the IVS Processor. These images are in turned processed by the IVS Processor and sent to the computer via the USB connection and displayed as alignment angles. The Hub Camera test is two fold, first the cameras must acquire images and second the IVS Processor must be able to collect this data in send it to the computer and display these images in a RAW format.

1. Make sure that the camera beam is powered up.

2. Raise the alignment rack to alignment height and place the rear targets just behind the front turnplates. (Figure 3-122)

Figure 3-122

3. From the Main Menu click on the Maintenance tab. (Figure 3-123)

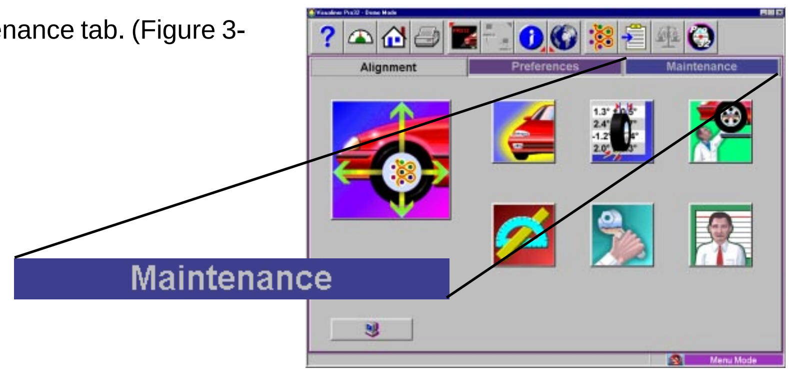


Figure 3-123

4. Single click on the Diagnostic icon. (Figure 3-124)

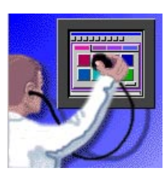


Figure 3-124

5. Single click on the Camera test icon. (Figure 3-125)

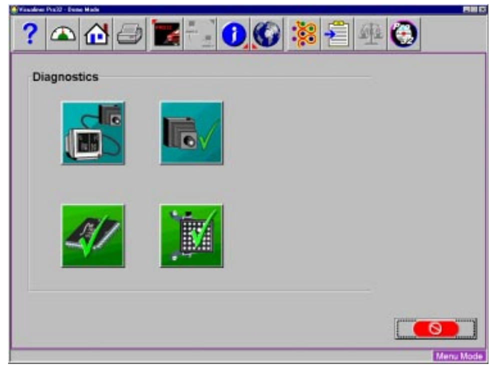


Figure 3-125

6. Once the IVS processor loads an image of the targets should appear on the monitor. (Figure 3-126)

Figure 3-126

7. Beginning with the left camera slide both the “GAIN” and the “STROBE” slider bars all the way to the right. The image of the target for the left side should respond to the change by “BLOOMING”. (Figure 3-127) Repeat the process on the RH side.

   If any part of this test fails, voltage checks can be made on the camera interface board. (Figure 3-128) Simply remove the shield guard from the end of the camera beams. Remove the adjusting lock nuts and washers and gently pull the camera from the camera beam.

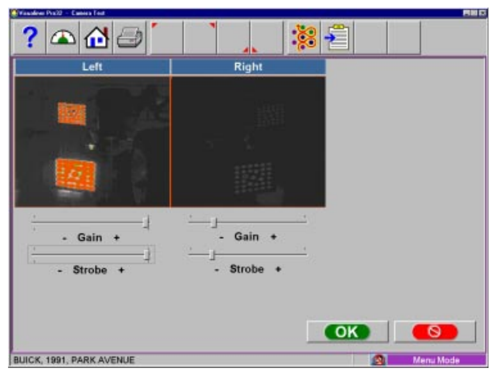


Figure 3-127

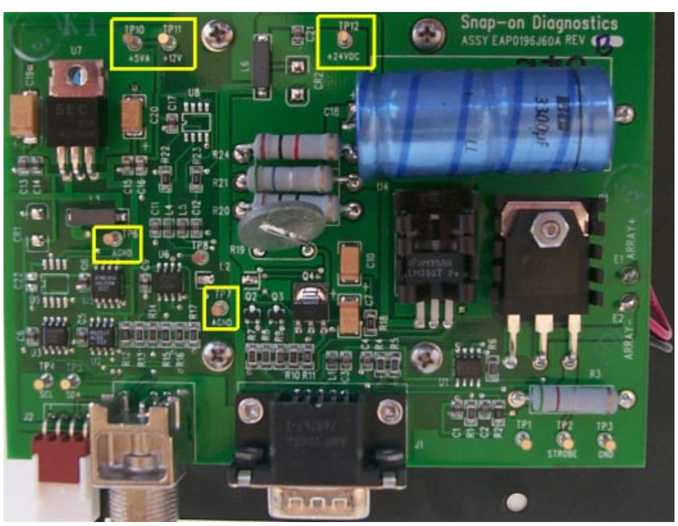


Figure 3-128

- TP10 +5VDC
- TP11 +12VDC
- TP12 +24VDC
- TP7 GND
- TP6 GND

9. Using a white piece of paper, cover the complete camera lens. The entire image for that side should turn “ORANGE”. (Figure 3-129) The image should not have any black spots which would indicate dirt on the lens. If black spots show up try lightly blowing off the camera lens with a can of compressed air. If the spots remain, replace the camera assembly and retest.

CAUTION!

NEVER USE SHOP AIR, DAMAGE TO THE CAMERA COULD OCCUR.

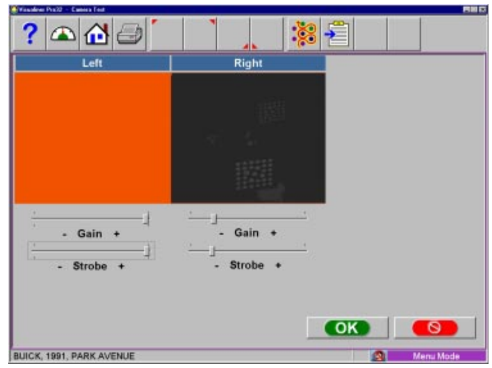


Figure 3-129

10. Open the HMAIN.TXT file, check to make sure that the image count for each wheel is moving upward. This ensures that the IVS processor has the ability to process images.

```
ResetUSB () DeviceIoControl() failed
OpenIvsUSB (7) passed, count=3
Loading TID File C:\Program Files\Snap-on Technologies Inc\Aligner\Ias\clawlf.vcd
   last modified October 31, 2001
Loading TID File C:\Program Files\Snap-on Technologies Inc\Aligner\Ias\clawrf.vcd
   last modified November 01, 2001
Loading TID File C:\Program Files\Snap-on Technologies Inc\Aligner\Ias\clawlr.vcd
   last modified October 16, 2001
Loading TID File C:\Program Files\Snap-on Technologies Inc\Aligner\Ias\clawrr.vcd
   last modified October 16, 2001
OpenIvsUSB () IVS_handle is valid. count=4
Loading C:\Program Files\Snap-on Technologies Inc\Aligner\Ias\ivs.mot last modi-
   fied October 12, 2001
OpenIvsUSB (7) passed, count=4
Receive Thread Active.
Receive Thread Started Successfully.
02:30:42 Reading keyword file C:\Program Files\Snap-on Technologies
   Inc\Aligner\Ias\tstcam.cmd
02:30:43 kwpOn = 0
02:30:43 Prom GRIDHEADER and title same as ias\gpromL.grd
02:30:43 Prom GRIDHEADER and title same as ias\gpromR.grd
Starting IVS system. Number of Cameras = 2  Expected 2
02:30:46 wheel=2 imgCount=(      0       0       1       0       1)
02:30:56 wheel=2 imgCount=(     36      36      37      36     145)
02:31:06 wheel=2 imgCount=(     72      72      73      72     289)
02:31:16 wheel=3 imgCount=(    108     108     108     109     433)
02:31:26 wheel=3 imgCount=(    144     144     144     145     577)
02:31:36 wheel=3 imgCount=(    180     180     180     181     721)
02:31:46 wheel=3 imgCount=(    216     216     216     217     865)
02:31:56 wheel=3 imgCount=(    252     252     252     253    1009)
Strobe Front Left 2244
02:31:16 wheel=2 imgCount=(    108     108     109     108     433)
Gain Front Left 42
02:31:27 wheel=2 imgCount=(    144     144     145     144     577)
ResetUSB () DeviceIoControl() failed
```

3.3 OR GREATER DIAGNOSTIC SOFTWARE

New and Improved Diagnostic tools/features have been added in version 3.3 software. These new tools will aid the service technician in diagnosing and troubleshooting the V3D without having to modify any command files. These new tools do not however eliminate the need for checking and determining proper voltage, proper environment and proper operation. ***NOTE: THAT THIS SOFTWARE IS DESIGNED TO TROUBLESHOOT V3D IMAGING ISSUES.***

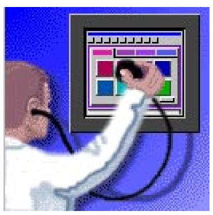


Figure 3-130

Each of these tests have a definite pass/fail criteria added to them. These are automatically checked by the software each time you run them. The following sections display the icon associated with each tool and gives an explanation of what each test is trying to achieve. Please note that the unit you are working on could display different figures and numbers. There have been no changes to the Main Maintenance Menu, entering the diagnostic tools is achieved by clicking on the diagnostic icon from the maintenance menu.

NOTE: EXIT EACH TEST BY CLICKING ON THE "OK" or "CANCEL" BUTTON. FAILURE TO DO SO COULD CAUSE ERRONEOUS ALIGNMENT READINGS.

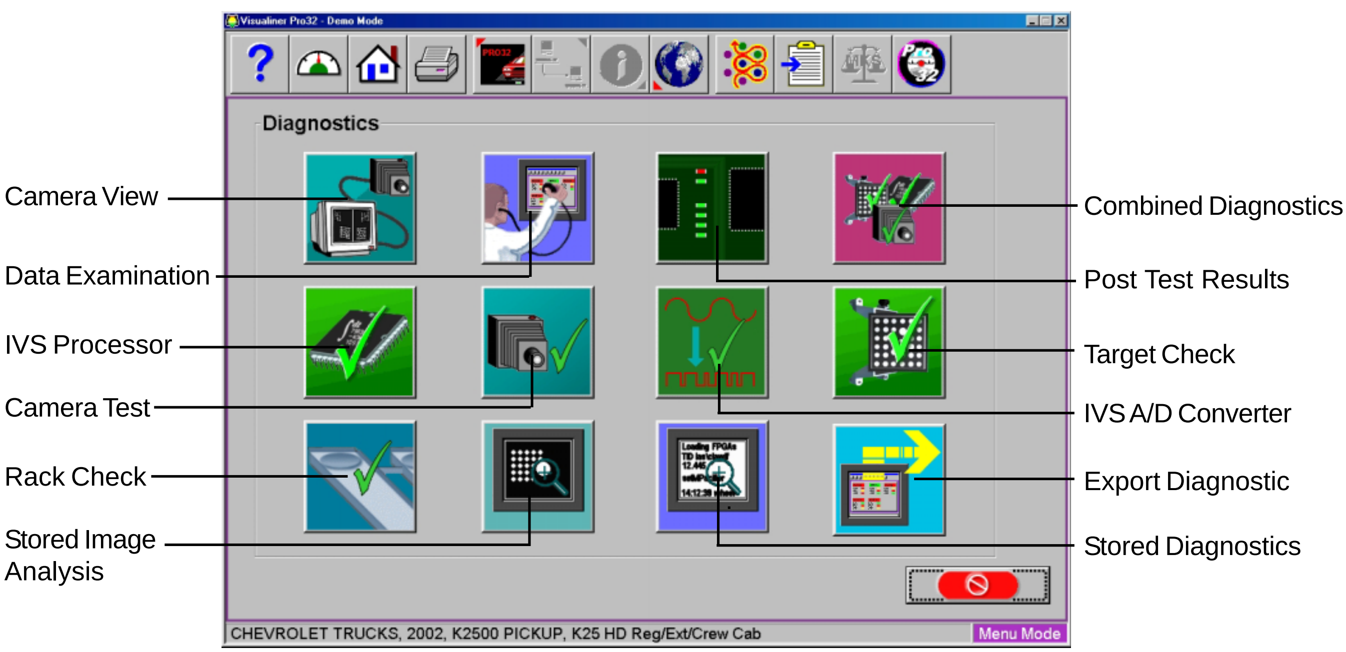


Figure 3-131

CAMERA VIEW (3.3 OR GREATER)

- Targets must be mounted on vehicle.
- This screen displays a count of the received images over each sides display. If one camera is sending a lot less images then another ±15%, this may be an indication of a camera problem. ***NOTE: THAT THE THIRD CAMERA ON AN ARAGO SYSTEM WILL SEND ONLY 50% OF THE IMAGES.***
- Displays a camera error icon if no images have been received from a camera.

The operator can click on either the “Manual or Automatic target search mode to acquire targets. The camera motor will activate and move the cameras either up or down until valid images are acquired.

Arago Only

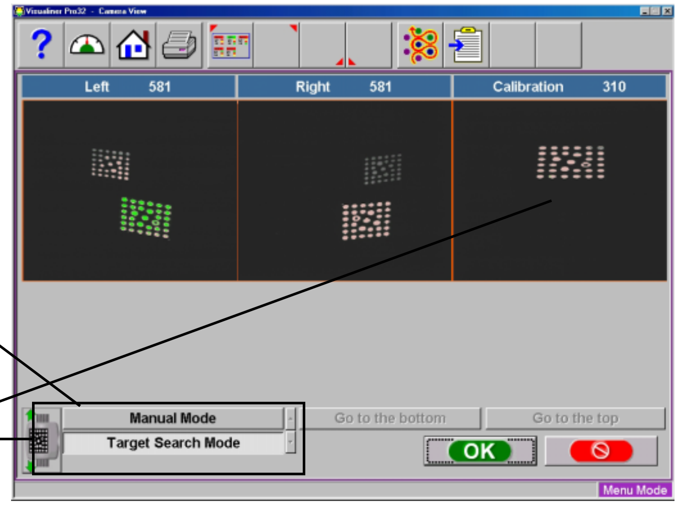


Figure 3-132

Camera error icons will appear if no valid images are acquired.

Click on “OK’ or “Cancel” to exit.

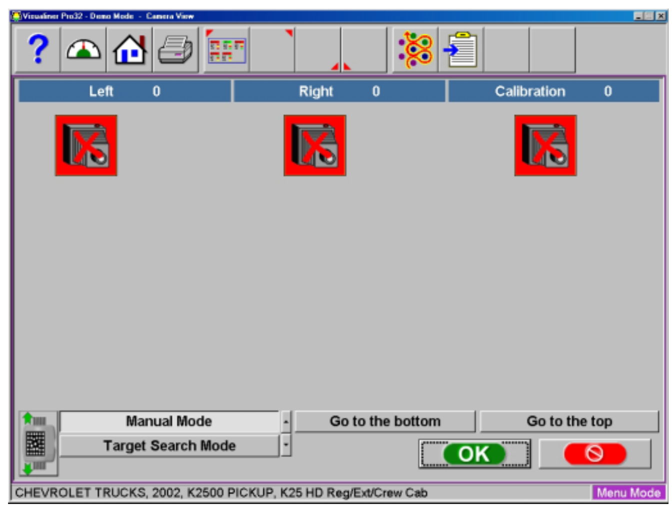
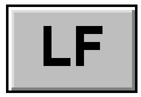


Figure 3-133

DATA EXAMINATION MODE (3.3 OR GREATER)

- This mode allows the operator to look at raw plane generation data as it arrives.
- Allows easy display of pacifier data without having to look at text files.
- Displays the number of proto-blobs (potential target blobs) as well as measured blobs.
- Translates error codes into text explanations that may aid in diagnostics.

The data examination mode displays a myriad of information without having to open and change the ".cmd" file and turn on the mpacifier command. The information is updated on-going and can be used by the operator if a failure in the alignment mode occurs. This test has two pages of information. By clicking on the small respective target identification in the upper left hand corner the operator receives the second page of information. This is only available when you access this screen form the Menu mode and not from the camera view toolbar button.



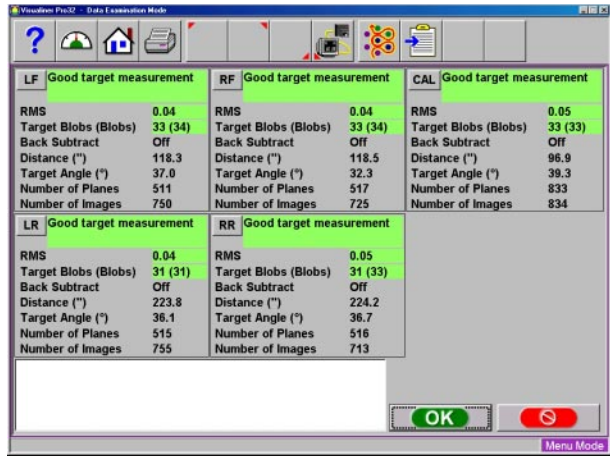


Figure 3-134

RMS - Background noise, should be .06 or less, .15 is maximum.

Target Blobs (Blobs) - Number of Blobs (dots) identified. The number in parenthesis is the number of potential dots.

Back Subtract - Subtract background noise. Unit is set to autocontrol. Normal working mode should be off. However shops that may have a lot of light autocontrol would turn this on.

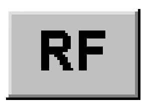
Distance (") - Distance from the camera to the respective target in inches.

Target Angle (°) - Angle of target in respect to wheel clamp.

Number of Planes - Number of target planes that the camera has acquired.

Number of Images - Number of raw images that the camera has acquired.

Retrieve additional data by clicking on the target identification icon.



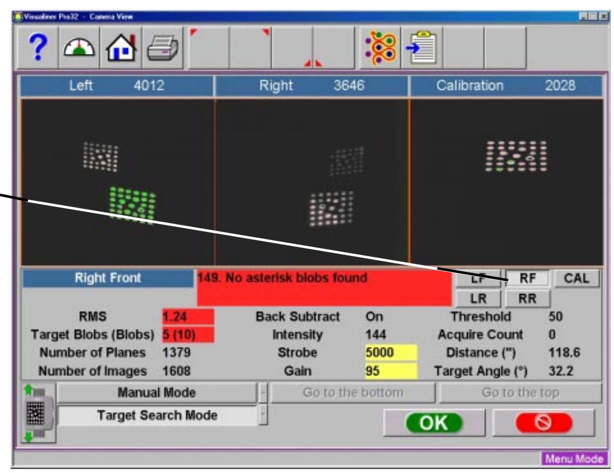


Figure 3-135

Intensity - The amount of light sent back from the target. Minimum = 100 Goal = 160 Maximum = 220

Strobe - Brightness of the LED's

Gain - The amount of voltage sent to the CCD, the higher the number the brighter the image.

Threshold -

Acquire Count - How long it takes to acquire the target.

The user can quickly jump to each targets information by clicking on the target identification icon.

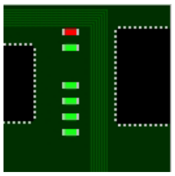
This screen will display warning indications if any of the following criteria have been exceeded or if a target is not visible.

- Target angle greater then 48 degrees.
- Distance to front target greater then 160 inches (4.064 meters).
- Distance to rear target greater then 240 inches (6.096 meters).
- Target RMS greater then 0.10.
- Number of target blobs less then 29
- Number of images is 0 for a particular camera.
- Number of planes is 0 for a particular wheel.
- If the strobe is >4000 or the gain is >75.

CODES LIKELY TO APPEAR ON AN DATA EXAMINATION SCREEN

Error Code	Error Text	Explanation
0	Good Target Measurement	Successfully found Target
101, 118	Too many protoblobs	Too many possible blobs in the camera view to allow us to sort and get a target
102, 119	No blobs found	No targets blobs are visible to the camera
103, 120, 122, 138, 110	Num. blobs less then number of asterisk fids	Found some blobs but insufficient number are visible to recognize a target
112	Intensity not in range	The intensity is not at a correct level to enable us to calculate values
115	AMSTATE_ROI_TBD Ok	We have established the ROI (Region of Intrest) and will soon be getting target data
123, 223	The RMS is too large	To much error in seeing the target, vibration or dirty targets are a possible cause.
149	No asterisk blobs	Can see a target but cannot recognize what it is as we cannot see the asterisk blobs.
151, 158	Too many asterisk blobs	Too many asterisk blobs are visible to identify this target
152, 159	Too few asterisk blobs	Too few asterisk blobs are visible to identify this target
176	Validate target failed	If validate target is turned on, we see a target but it is not in the correct orientation, reflections or other aligners in the camera view possible cause
177	Too few blobs are visible	Target not fully visible.
255	No data received	No data received from the IVS for this target

NOTE: CLICK ON “OK OR “CANCEL” TO EXIT ALL TEST!



VIEW POST RESULTS (3.3 OR GREATER)

- This utility opens the last POST data file from the IVS board memory.
- Pressing F5 on the view screen re-initiates POST.

Click on “OK’ or “Cancel” to exit this test.

IVS POST

-Initial Boot and Loader POST Tests Passed
RomBoot Flash Version: Ver 01.00.00
RomBoot Flash Date: 01-03-02
Loader Flash Version: Ver 01.02.00
Loader Flash Date: 02-06-28
-Starting Static Memory Test
-Starting DataPath Memory Test
-Starting AddressPath Memory Test
-Starting Device Memory Test
-Starting Proc Pld Test, PLD Revision = 0xb0
-Starting Flash Memory Test
- BootFlash is protected - no VPP
-Starting FE FPGA Test, FE FPGA Revision = 0xb1

ERRORS IN THIS AREA REQUIRE IVS BOARD REPLACEMENT

-Starting Initialize Front End
Camera 0: Line Count = 305 Pixel Count = 488
Camera 1: Line Count = 305 Pixel Count = 488
Camera 2: Line Count = 305 Pixel Count = 488 ARAGO ONLY
-Starting I2C Verify GRID eeprom Tests
Grid Flash program count for Camera 0 = 46
Grid Flash program count for Camera 1 = 44
Grid Flash program count for Camera 2 = 48 ARAGO ONLY
-Starting Image Capture No Interrupt
Cam0 1st field
Cam0 2nd field
Cam1 1st field
Cam1 2nd field
Cam2 1st field ARAGO ONLY
Cam2 2nd field ARAGO ONLY

ERRORS IN THIS AREA REQUIRE CHANNEL DIAGNOSIS!

-PPC Temp = 66 degrees C
-Starting Motor Control Test ARAGO ONLY
-Starting USB Port Test
-POST done

ERRORS IN THIS AREA REQUIRE IVS BOARD / MOTOR DIAGNOSTICS

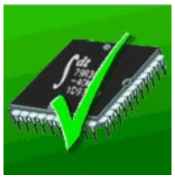
No Failures Detected

NOTE: EACH TIME THE IVS IS POWERED UP OR “F5” IS PRESSED WHILE IN THE “VIEW POST RESULTS” A POST TEST FILE IS WRITTEN TO THE HARD DRIVE. THE NAME OF THIS FILE IS “POST_Results.htm”..

COMBINED DIAGNOSTICS (3.3 OR GREATER)

- Performs all common tests in sequence
  - IVS Processing Test
  - Camera Test
  - A/D Converter test
  - Target Check
- Allows a one button diagnostic test routine for simplicity.
- Stores all results into its own text file (CombinedDiags.txt).
- Allows the technician option of printing this file at the end of the tests.

Click on “OK’ or “Cancel” to exit this test.



IVS PROCESSING TEST (3.3 OR GREATER)

- This verifies basic communication with the IVS board.
- It checks the ability of the system to process canned images. This ensures that the board is able to process data without the complication of ensuring functioning cameras.
- We feed a known set of images into the IVS. This should result in a known set of planes being sent to the PC. If this does not occur it may be the result of a faulty IVS board.

Click on “OK’ or “Cancel” to exit this test.

CAMERA TEST (3.3 OR GREATER)

NOTE: THIS TEST REQUIRES TARGETS TO BE MOUNTED ON A VEHICLE OR THAT THE TARGETS BE SETTING ON THE RACK.

- This first tests the basic operation of the cameras without using grid data (raw images) i.e. can we actually receive images from each.
- Next it forces a reread of the camera grid data and compares with the local files on the PC. This verifies the camera memory read mechanism as well.
- Then it tests the operation of the gain/strobe change mechanism by requesting user feedback (personal judgment) on the changes in received images as the gain changes and in the change in the rate of LED flashing as the strobe changes.
- Then it allows the operator to make manual gain / strobe adjustments.
- Last it tests AGC (Automatic Gain Control) by bringing the gain down low. If the automatic gain control restriction is damaged the camera will automatically increase the gain which will show on screen as a bright target.

Click on “OK’ or “Cancel” to exit this test.

The first test of the "Camera Test" test the cameras' capabilities of reading raw images. After running the test for approximately a minute click on the "OK" button. The operator is asked whether the images appeared correctly. Comparison is made from the image in the lower right hand corner.

The second test of the "Camera Test" forces a reread of the grid files on the camera and compares them to the files on the PC, verification is also made of the camera memory read mechanism. This test all three cameras grid files. Note: This test takes a couple of minutes.

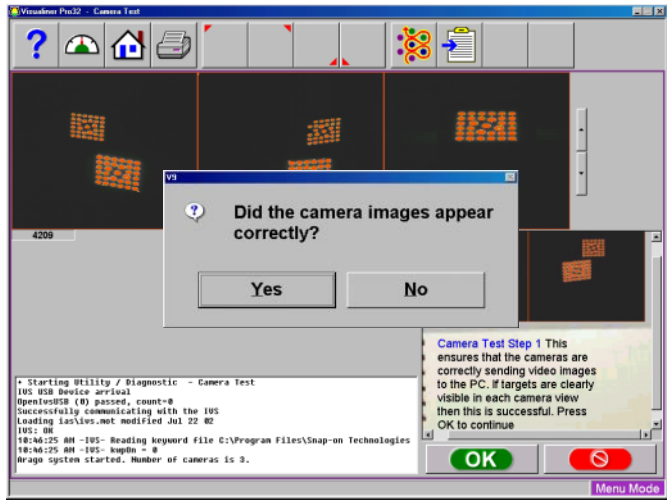


Figure 3-136

The third test, test both the gain and strobe of the camera's independently. As the gain is changed check that the image intensity changes in the camera view.

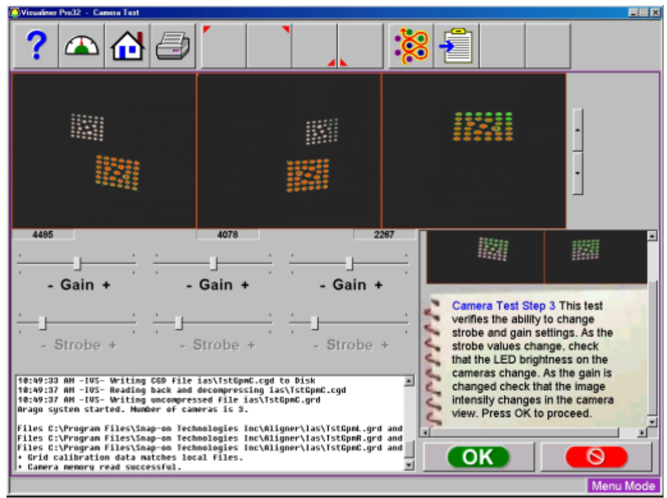


Figure 3-137

As the strobe value change, check that the brightness on the cameras change and that the rate at which they flash changes.

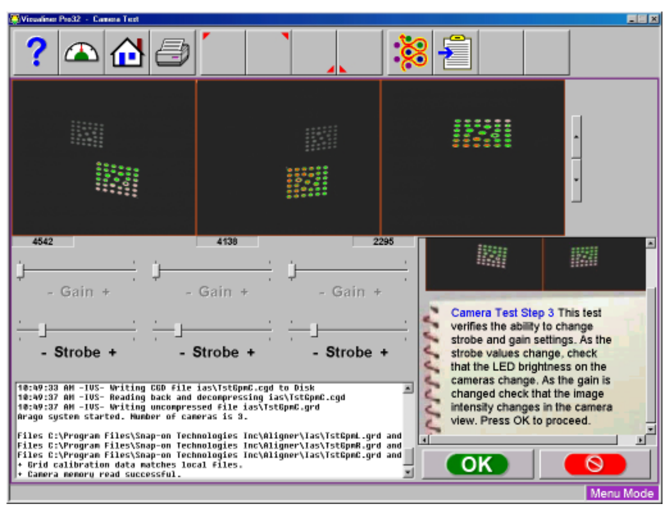


Figure 3-137

The fourth test hands the control over to the operator. Manually adjusting both the Gain and Strobe should cause the images in the view to change.

Slide both the Gain and the Strobe to the maximum setting. The image for that side should turn the targets to bright orange.

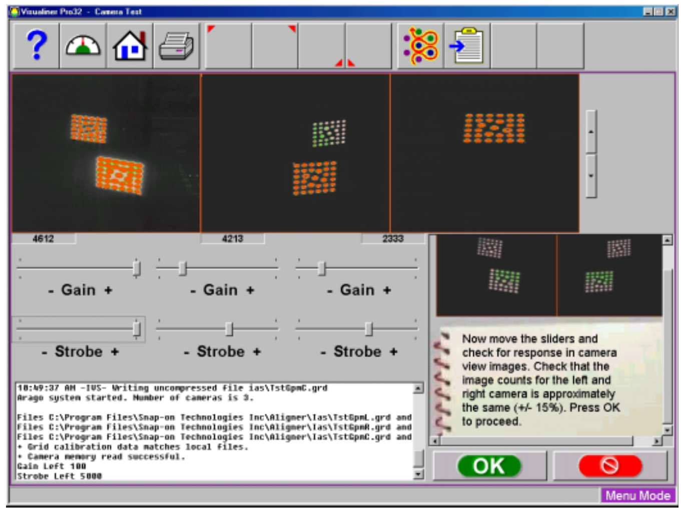


Figure 3-138

Using a white sheet of paper, cover the camera lens. The image should turn completely orange. Check the image for black dots which could indicate a dirty lens. If black dots or specs are detected try blowing the lens clean using canned air. If blowing the lens does not clean up the image replacement of that camera is recommended.

CAUTION!

NEVER USE SHOP AIR, DAMAGE TO THE CAMERA COULD OCCUR.

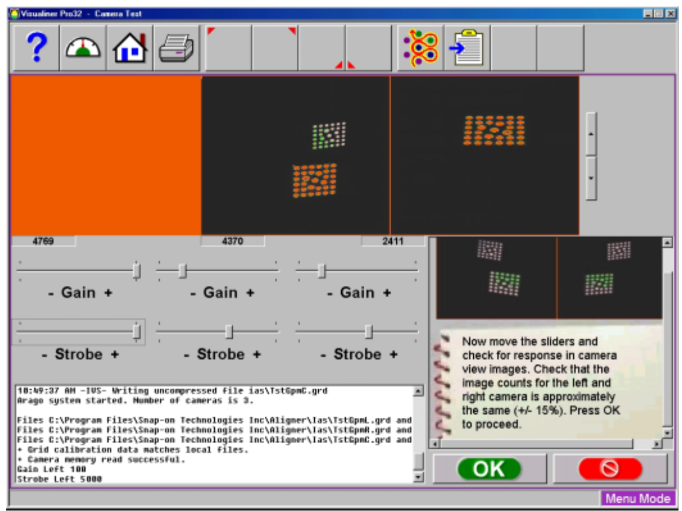


Figure 3-139

The final test for the camera's is the "AGC" (Automatic Gain Control) for the cameras. With the targets still mounted to the vehicle the images should appear dim. If the targets show a red coloring on the fids it is a good indication of an automatic gain control on that camera assembly.

Click on "OK' or "Cancel" to exit this test.

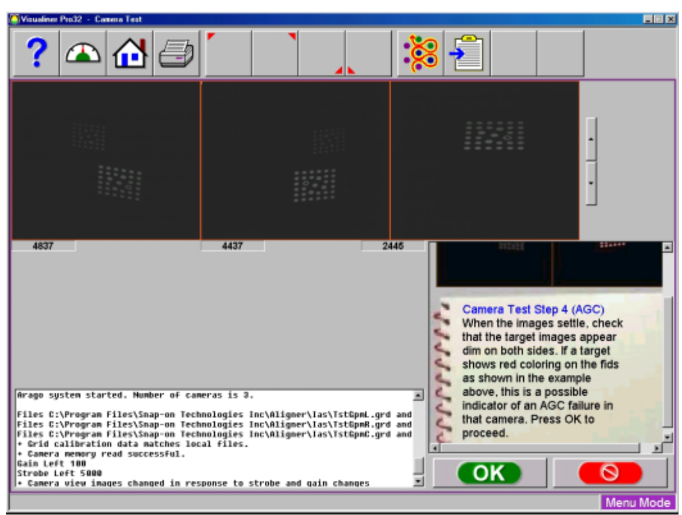


Figure 3-140

IVS A/D CONVERTER TEST (3.3 OR GREATER)

- This tests the functionality of the A/D converters on the IVS board. This allows you to differentiate this type of error from a camera problem.
- This test functions by getting images from each camera and ensuring that each possible A/D converted bit has been exercised on and off. This tells us that the A/D is working correctly.

NOTE: TARGETS MUST BE USED, FAILURE TO RUN THIS TEST WITHOUT VALID TARGETS WILL RESULT IN ERRORS.

Click on “OK’ or “Cancel” to exit this test.

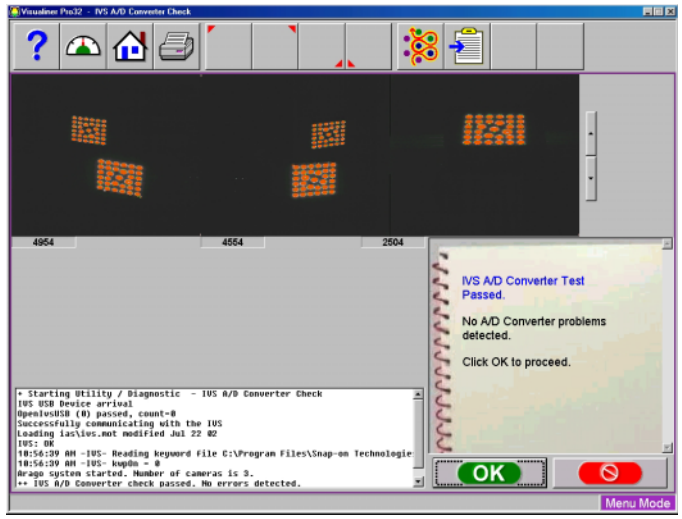


Figure 3-141

TARGET CHECK (3.3 OR GREATER)

- This test checks the RMS (RMS is an indicator of the error obtained in acquiring a target) and the number of fids for each wheels target. In Arago systems it also checks the calibration camera.
- The 3.3 version is dynamic, allowing you to easily try the target in different positions and conditions.
- The utility warns if the number of visible target blobs is less than 29 or if the RMS is greater than 0.10.

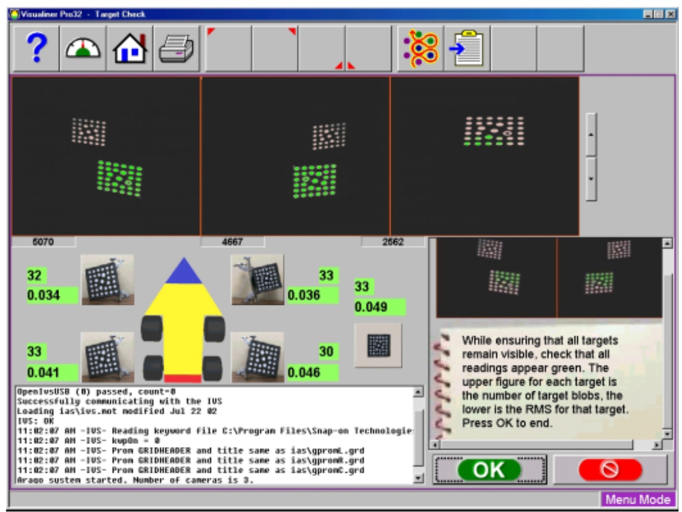


Figure 3-142

At the end of the test check marks indicate that each target is valid and the information section should produce something similar to the following table.

LF - Number of Fids 33 RMS 0.0337 Status - Good
RF - Number of Fids 32 RMS 0.0360 Status - Good
LR - Number of Fids 32 RMS 0.0408 Status - Good
RR - Number of Fids 33 RMS 0.0409 Status - Good
Cal - Number of Fids 30 RMS 0.0490 Status - Good
++ Target Check Passed
++ All targets are within allowable tolerances.

NOTE: THE MAXIMUM AMOUNT OF FIDS IS 33 WHILE THE MINIMUM AMOUNT IS 27 BEFORE IT LOSES THE TARGET.

Click on “OK’ or “Cancel” to exit this test.

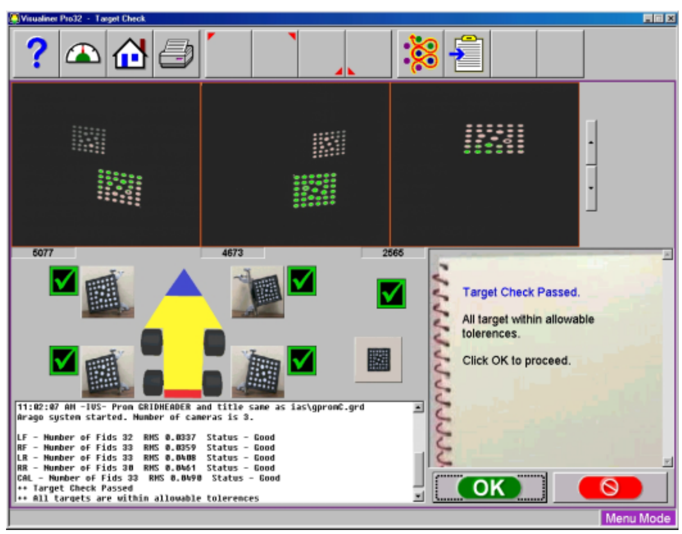


Figure 3-143

RACK CHECK (3.3 OR GREATER)

The V3D is designed to perform a perfect alignment every time. The levelness of the rack "side-to-side" or "front-to-rear" is irrelevant to performing this perfect alignment, however a rack that is non coplanar (parallel) will induce erroneous readings because the suspension of the vehicle is under stress.

- This test checks how coplanar (parallel) the rack is. Even though we are very resistant to rack problems, non coplanar racks can introduce some error to our system.
- If the lag between rails is less then 0.02 inches (0.5 mm), the rack is considered to be coplanar.
- If the lag is greater then 0.02 inches and less then 0.3 inches we display the value but leave it up to the individual shop to decide what to do. Although this will not cause a great deal of problems is will affect the alignment readings a small amount.
- If the lag is over 0.3 (7.5mm) inches we tell the user to adjust the rack to the manufacturers specifications as this will affect alignment accuracy.

This test requires the use of the RCP fixture although RCP is not needed using an Arago alignment system the technician must have this fixture to check the rack rails for a coplanar (parallel) condition.

1. Place the RCP fixture across the rack with the small target on the RF turntable and the large target on the LF turntable and press "OK".

2. Move the RCP fixture towards the rear of the rack just FORWARD of the rear slip plates.

(Figure 144) displays the results of a rack that is coplanar.

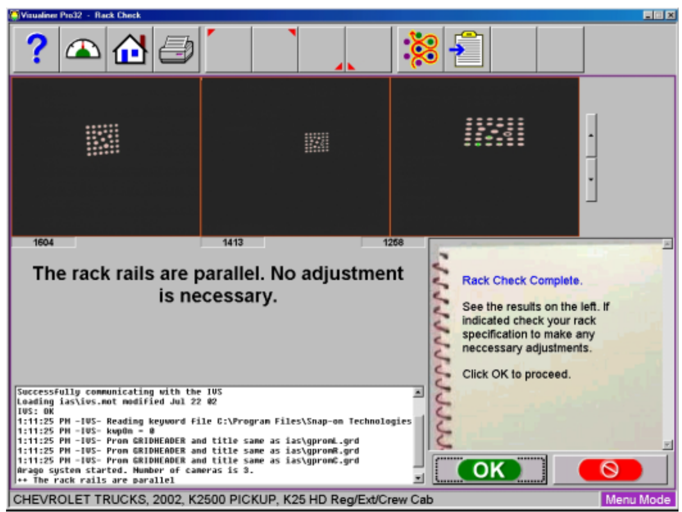


Figure 3-144

(Figure 145) displays the results of a rack that is non coplanar and requires rack rail adjustments.

Click on "OK' or "Cancel" to exit this test.

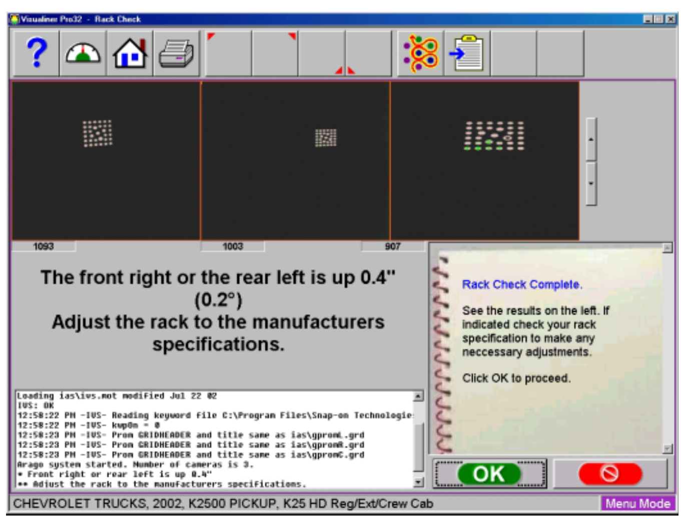


Figure 3-145

STORED DATA VIEWING TOOLS

These tools are used to view or analyze previously store diagnostics data. The main way of storing this data is using the pacifier enable keystroke combination (Ctrl Alt P). When a user is having some problems with the Aligner, he/she can enable this mode which saves images from all wheels and starts saving pacifier data in a *Hmain.diag* file which also contains the contents of the *Hmain.txt* file from just before the pacifier was enabled. The aligner stays in this record mode until a new alignment is begun or the hmain.diag file is viewed using the utility below.

The following dialog shows you that the mode has been enabled. After pressing "OK" please wait a few seconds while the images are being saved before continuing.

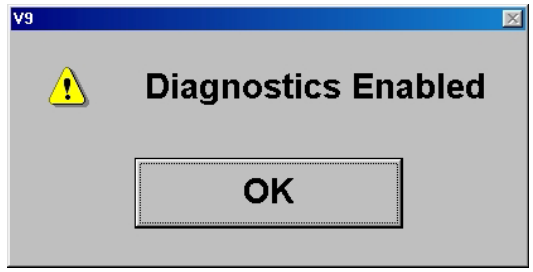


Figure 3-146

STORED IMAGE ANALYSIS (3.3)

- This allows you to view and zoom into stored images (stored using Ctrl Alt P).

NOTE: EACH TIME "CTRL ALT P" IS PRESSED IT WILL OVERWRITE THE PREVIOUS STORED IMAGES. IF TARGETS ARE NOT AVAILABLE IN THE CAMERA VIEW THERE WILL BE NO IMAGES TO LOOK AT USING THIS FUNCTION.

- Allows you to view individual pixel intensity levels.
- Display interlaced images to allow for verification of correct interlacing. An interlacing error will be evident by blobs that are non contiguous over each line.

Moving the cursor over the image displays both the X and Y location of the cursor it also displays the pixel value (intensity) of the cursor location. The brighter the cursor location the higher the intensity value. Left clicking on the image using the mouse zooms in on that location.

Click on "OK' or "Cancel" to exit this test.

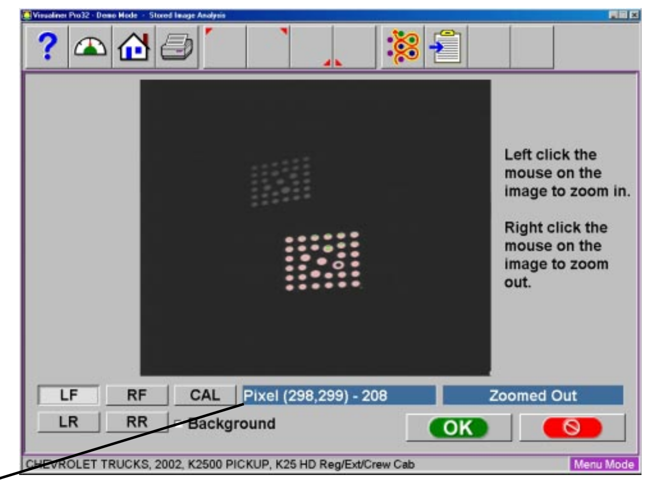
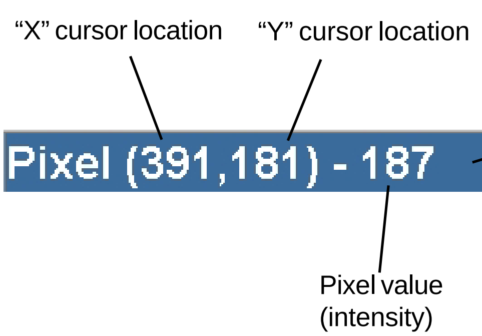


Figure 3-147



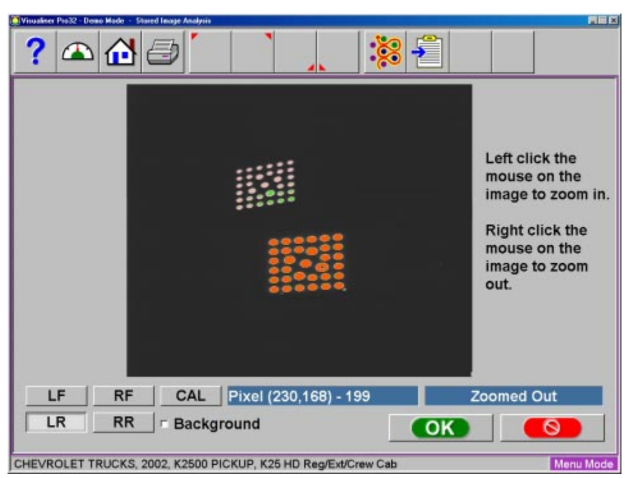


Figure 3-148

STORED DIAGNOSTIC FILE ANALYSIS (3.3 OR GREATER)

- This allows the operator to examine a stored hmain.diag file (stored using Ctrl Alt P) without having to search the hard drive.
- It can also allow the operator to examine the *Hmain.txt* file.
- Playback of the file in a data examination mode allows simulated real time analysis of problems.

Clicking on the “Stored Diagnostic File Analysis” icon accesses the “*Hmain.diag*” and “*Hmain.txt”* file. These stored diagnostic files gives the operator the same information as turning on the Mpacifier in the command file in previous versions of software.

Should a unit have intermittent failures the technician should instruct the customer to activate the diagnostic software by clicking on “Ctrl Alt P” at the time of the failure. This enables the diagnostic software to capture all of the data for future playback. The diagnostic file will automatically terminate at the beginning of the next alignment. If “Ctrl Alt P” is pressed again, a new diagnostic file will over write previous information.

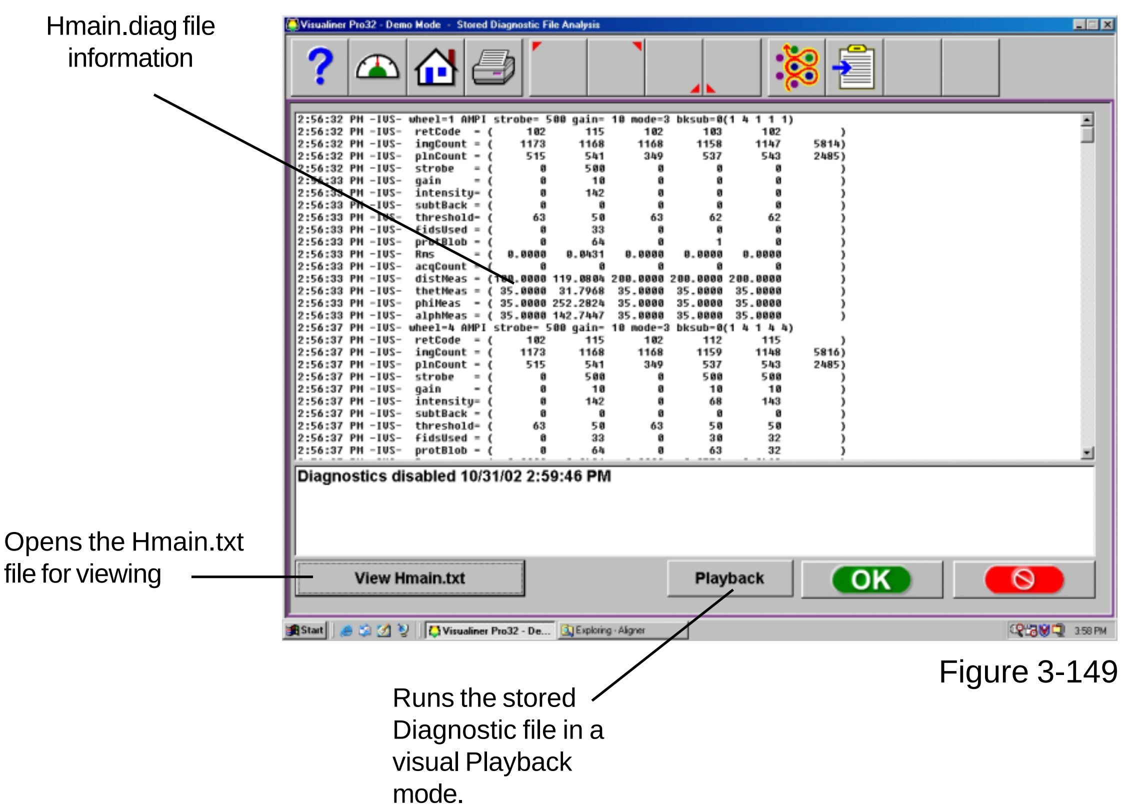


Figure 3-149

Stored Diagnostic Analysis Continued

By clicking on the “Playback” button the aligner accesses the *Hmain.diag* file and starts to playback all of the data that was captured. The screen will open up in the Data Examination mode with easy visuals for the technician to see and help diagnosis problems. The technician can easily pause the data playback by clicking on the “Pause / Play” button. To exit the Data Examination mode the technician needs to simply click on the “Cancel” button after which the aligner will revert back to the “Stored Diagnostic File Analysis” screen.

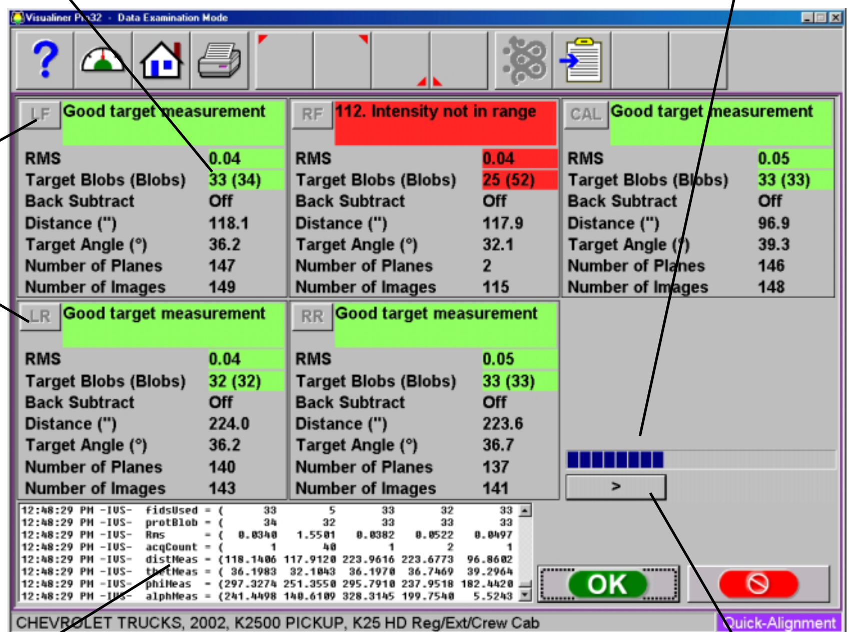
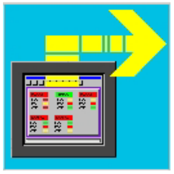


Figure 3-150

NOTE: IF THE DIAGNOSTIC SOFTWARE HAS BEEN ENABLED, BE SURE TO RESET THE ALIGNER BY CLICKING ON THE HOME ICON AND THEN THE BEGIN ALIGNMENT ICON. FAILURE TO DO SO WILL CONTINUOUSLY WRITE DATA TO THE DIAGNOSTIC FILE.



EXPORT DIAGNOSTIC FILES (3.3 OR GREATER)

The diagnostic file export icon allows the technician to easily find and export all potential diagnostic information to a floppy disk or to any other location. The following files can be exported.

- *Hmain.txt* is the normal logging file
- *Hmain.diag* is a diagnostic file generated when you use the Ctrl Alt P diagnostic logging mode.
- *Combined Diagnostics* is a combined log file containing all the results of a one button diagnostic routine.
- *IVS POST Results* is the HTML file generated by the running of the IVS POST routine.
- *Stored Images* saves all images saved using the “Ctrl Alt P” diagnostic logging mode into a zip file named *Images.zip*.

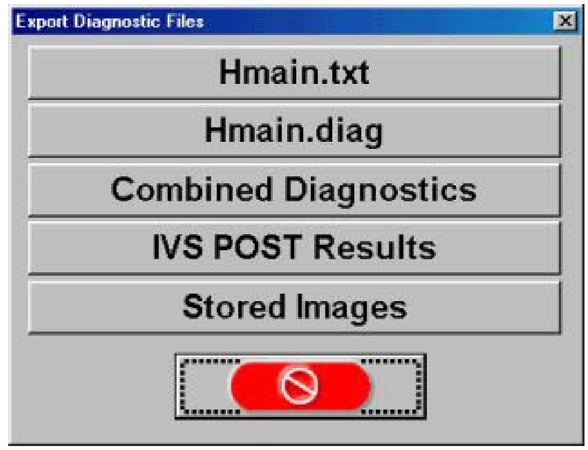


Figure 3-151

When an item has been selected to export, the default directory is the location where the file is currently located. To save it on a floppy, for example, simply select Floppy A from the “Save” in the pull down menu and click “Save”. By default the files are named accordingly.

- *Hmain.txt*
- *Hmain.diag*
- *CombinedDiags.txt*
- *Post_Result.htm*
- *Images.zip* (Multiple images of raw camera views)

NOTE: IF A MULTIPLE DIAGNOSTIC FILES ARE TO BE SAVED EACH FILE MUST BE EXPORTED AND SAVED AS A DIFFERENT NAME.

EXAMPLE:

1st set of saved files.	Hmain.diag	Hmain.txt	Images.zip
2nd set of saved files.	1Hmain.diag	1Hmain.txt	1Images.zip
3rd set of saved files.	2Hmain.diag	2Hmain.txt	2Images.zip

Click on “OK’ or “Cancel” to exit this test.

OTHER DIAGNOSTIC IMPROVEMENTS

RCP CHECK (3.3 OR GREATER)

- The RCP check is actually located under the calibration button.
- This checks the RCP using a calibration bar. This remains the same as in older versions of the Pro32.
- The criteria for passing this test is as follows for the average test bar:
  - o Mean Total Toe = -0.05 +/- 0.08 degrees.
  - o Mean Camber = 0.1 +/- 0.20 degrees.
- In an Arago unit this routine differs as it can check and can rewrite POD calibration data. It does this by doing an IVS RCP and comparing the values with a Arago dynamically calculated RCP. It warns the user if the angular difference in RCP is greater then 0.04 degrees or if the linear difference if greater then 0.07 inches (1.8 mm).

ACQUISITION SCREEN LOST TARGET HELP ICONS

This addition to the acquisition screen displays a help icon next to each dropped target which will give a tool tip explaining the problem.

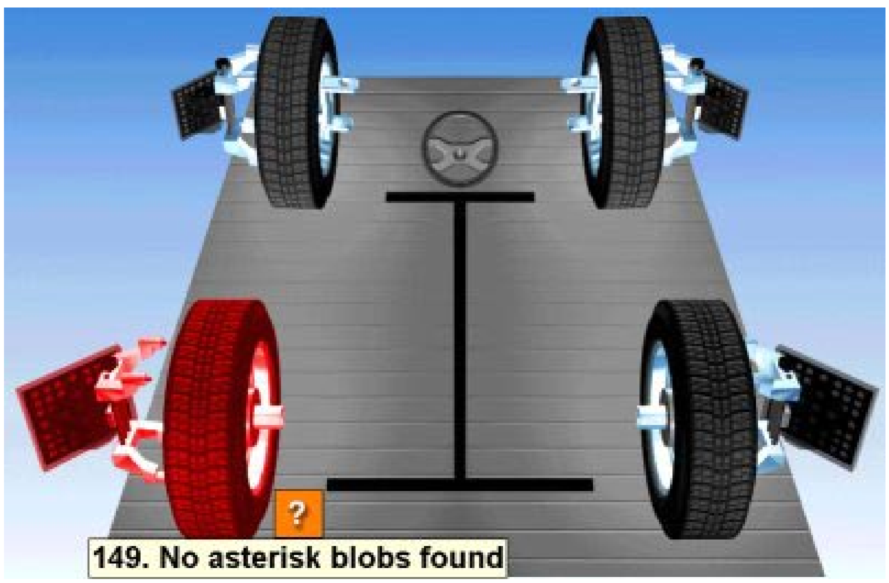


Figure 3-152

CHAPTER 4
SECURITY

GENERAL

The aligner incorporates many security features that totally eliminates **unlawful** duplication of the software. The loading of each piece of software requires that a key disk be installed to load the software. Once the software has been successfully loaded the unit disables the "Key Disk" leaving them useless for use with other units, this ensures the disk are used only on the aligner it was originally installed on. The unit transfers the information from the "Key Disk" to the HIB on 3.1 software or lower and uses the IVS processor on 3.2 software and future versions. The HIB or IVS in turn transfers it to the hard drive. This information is stored in both locations. If for any reason the unit requires that the software be reloaded, it uses the information from the HIB or IVS that was taken from the "Key Disk" on the initial loading process.

SECURITY KEY DISK

1. Brand Specific
2. Specification
3. Software Features
4. VoiceAlign™ (Optional)
5. HIB Key Disk (Comes with HIB replacement PCB)
6. IVS Key Disk (Comes with IVS processor)

BRAND SPECIFIC

As stated in the software installation the unit requires that it be branded before it is usable. The new CCP software loads many different brands of software, however the branding disk initiates the foreground software. All commands between the different software brands are identical but the "look" is the only difference. Once the unit has been branded the unit will display that particular software foreground. This information is stored on both the computers hard drive and the USB HIB or IVS. On each boot up the software will perform a roll-call with the HIB or IVS, if the branding that is written on the hard drive and the HIB/IVS match, the unit will continue with the loading process. If during roll call both the hard drive and the HIB/IVS are different the unit will prompt the operator for a brand disk. The unit is shipped with this brand disk and must be inserted into the floppy drive to re-brand both the hard drive and the HIB/IVS. If the brand floppy cannot be located the technician must call the technical support department so a verification can be done and a "key code" generated for the branding of the unit. A technician should at that time reorder a brand key disk to replace the lost disk that came with the unit initially.

SPECIFICATIONS

The unit is also shipped with a specification key disk that activates vehicle specification for alignment use. Once the specification key disk has been installed and specification initiated the key disk is no longer needed. On boot up the HIB or IVS will do a roll-call with the computers hard drive, if the information agrees the vehicle specification will be available for alignments. Future specification updates will be sent with each specification CD and will need to be installed before specifications from the new CD are available. The operator can then discard the older specification key disk as it will not work with the newer specification software. If for any reason a technician cannot locate the specification key disk or finds the one sent with the specification update is not usable the technician can call the technical support department. Once the specification update has been verified the technical support department can generate a "Key Code" for specifications. A technician should at that time reorder a specification key disk to replace the lost disk that came with the software.

SOFTWARE FEATURES

Each unit is sold with a software package. Each package activates particular software features of the alignment system. On the initial load of the aligner the operator/technician is instructed to install the "software features key disk". After installing the key disk the aligner writes this information to both the HIB PCB or IVS Processor and the computers hard drive. On all other boot ups the HIB or IVS will do a roll-call with the computers hard drive, if the information agrees the software features will be available for alignments. If for any reason a technician cannot locate the software features key disk or finds the one sent with the aligner is not usable the technician can call the technical support department. Once the software features have been verified the technical support department can generate a “key code” for software features. A technician should at that time reorder a software features key disk to replace the lost disk that came with the aligner.

HIB

The HIB is the control center for all security key features for the aligner with 3.1 software or lower. Information is written to the HIB and this information is used each time the aligner boots. The HIB performs a roll-call of Branding, Specification and Software Features. Once this information is known the alignment software will utilize this information to perform each alignment and maintenance function. If an aligner hard drive were to be formatted and reloaded with Windows® and Alignment software, the information that is stored on the HIB will load all previous features.

IVS

The IVS is the control center for all security key features for the aligner with 3.2 software or higher. Information is written to the IVS and this information is used each time the aligner boots. The IVS performs a roll-call of Branding, Specification and Software Features. Once this information is known the alignment software will utilize this information to perform each alignment and maintenance function. If an aligner hard drive were to be formatted and reloaded with Windows® and Alignment software, the information that is stored on the IVS will load all previous features.

NOTE: IF A UNIT IS UPGRADED FROM 3.1 TO A NEWER VERSION OF SOFTWARE, THE ALIGNER WILL TRANSFER ALL SECURITY TO THE IVS PROCESSOR. THE IVS PROCESSOR WILL THEN CONTROL ALL SECURITY FEATURES OF THE ALIGNMENT SYSTEM.

HIB REPLACEMENT

NOTE: ***ONCE A HIB IS REPLACED THE ALIGNER WRITES INFORMATION TO THE HIB RENDERING IT USELESS TO OTHER UNITS. CARE SHOULD BE USED BEFORE REPLACING THE HIB AS THE ALIGNER TIES ITSELF TO THE HIB.***

1. Shutdown the aligner software by clicking on the “X” in the upper right hand corner of the software program.
2. Unplug the unit from the power source.
3. Unplug the camera beam power source.
4. From the rear of the aligner, remove the 4 phillip screws that secure the rear drawer into the cabinet.
5. Gently slide the drawer from the cabinet using care.
6. Unplug the USB connection leading into the HIB box and the remote sensor cable.
7. Remove the 4 phillip screws that secure the cover from the USB HIB box and set it to the side.
8. Locate the HIB PCB and unplug the 3 cables that attach to the HIB PCB.
9. Remove the four 1/4” nuts securing the HIB PCB.
10. Install the new HIB PCB and reverse procedures for assembly.
11. Plug in all connections.
12. Power up the unit and allow the software to load.
13. During the software load the unit will ask for the replacement key disk to be inserted. After inserting the floppy key disk click on **<OK>**.
14. The aligner will transfer all necessary files to the new HIB tying the aligner and the HIB together.
15. Package the old HIB and HIB key disk and return to the factory.

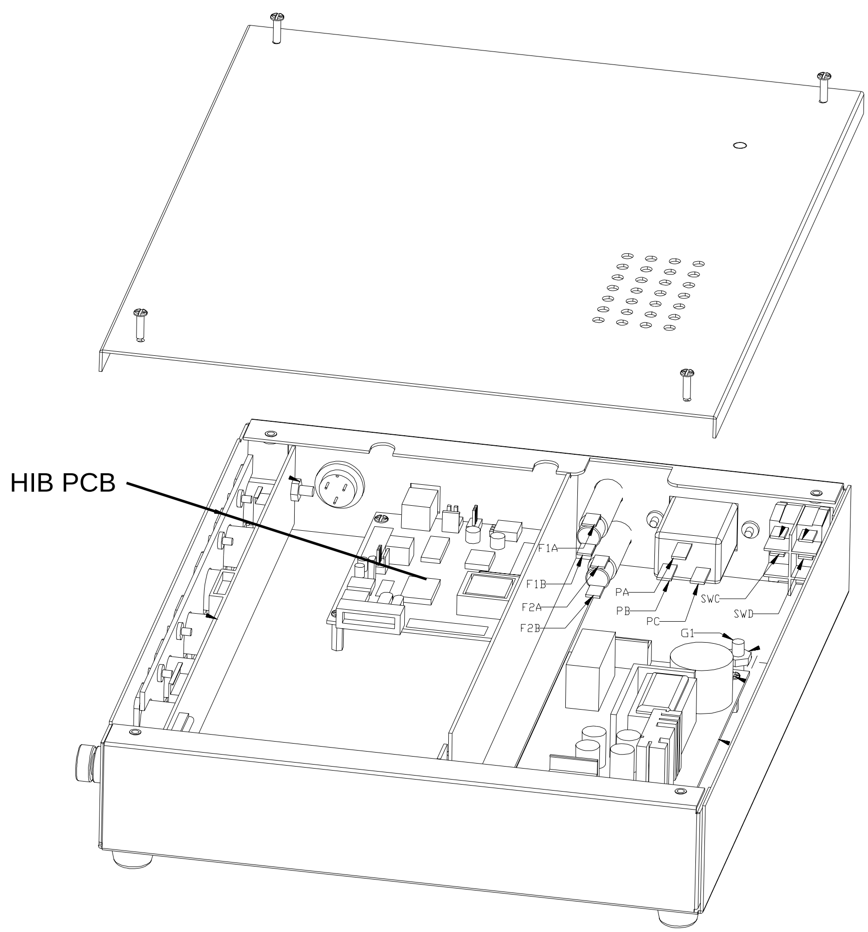


Figure 4-1

IVS REPLACEMENT

NOTE: ***ONCE A IVS IS REPLACED THE ALIGNER WRITES INFORMATION TO THE IVS RENDERING IT USELESS TO OTHER UNITS. CARE SHOULD BE USED BEFORE REPLACING THE IVS PROCESSOR AS THE ALIGNER TIES ITSELF TO THE IVS.***

1. Shutdown the aligner software by clicking on the “X” in the upper right hand corner of the software program.
2. Unplug the unit from the power source.
3. Unplug the camera beam power source.
4. Remove the front cover from the IVS Processor
5. Hold the cover plate from inside the cross beam and remove the two ¼ screws from the top of the left hand cross beam and remove the acess plate.
6. Unplug all wiring harnesses from the IVS Processor.
7. Remove the 4 phillip screws that secure the IVS Processor.
8. Install the new IVS PCB and reverse procedures for assembly.
9. Plug in all connections.
10. Power up both the aligner console and the IVS Processor the unit and allow the software to load.
11. During the software load the unit will ask for the replacement key disk to be inserted. After inserting the floppy key disk click on **<OK>**.
12. The aligner will transfer all necessary files to the new IVS PCB tying the aligner and the IVS together.
13. Package the old IVS and IVS key disk and return to the factory.

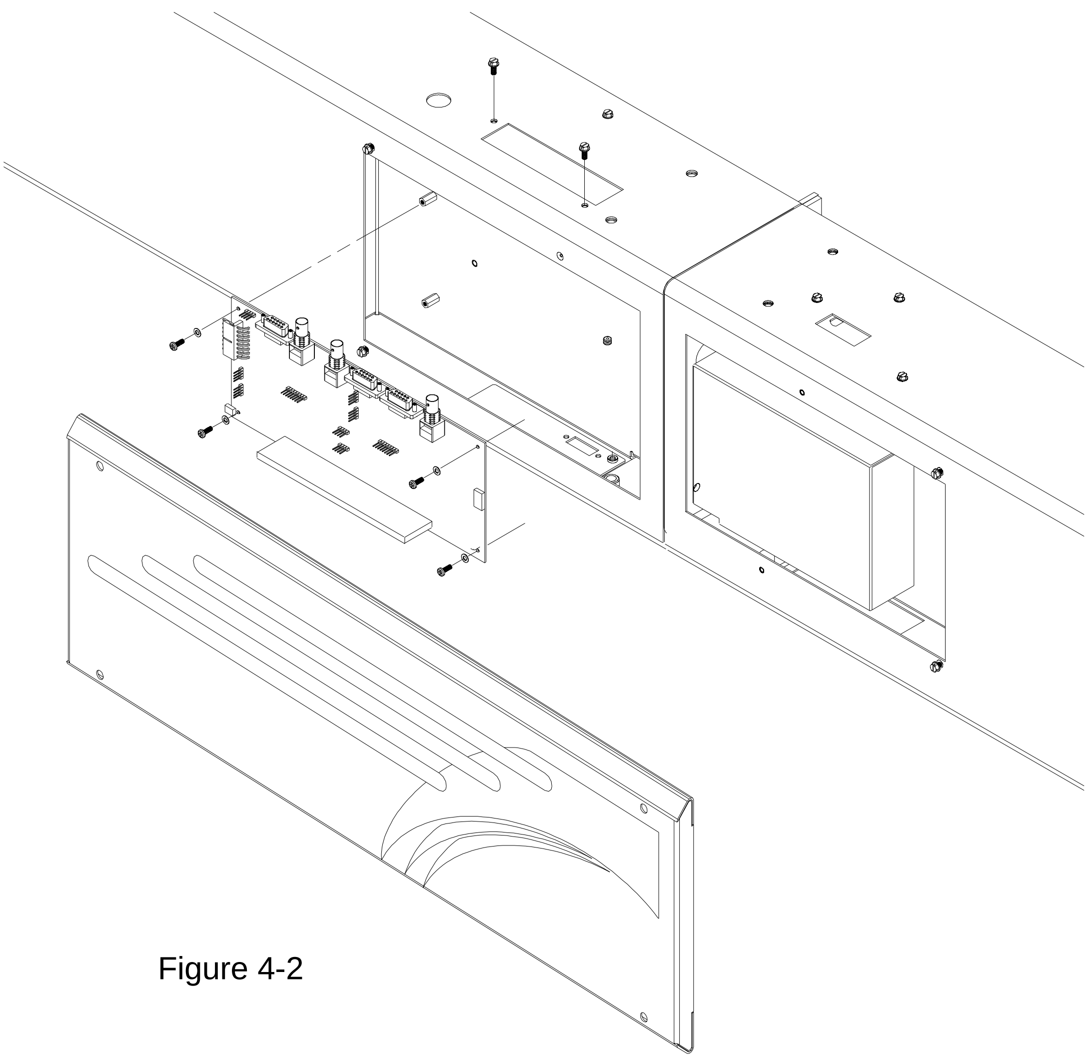


Figure 4-2

CHAPTER 5
ARAGO 3™

GENERAL

This chapter was written for the purpose of removing and replacing components used on the Arago 3™ alignment system. The service technician should use the previous chapters of this manual to troubleshoot the Arago 3™. The unique design of an Arago 3™ system does not require calibration at installation or at anytime thereafter. The unit comes equipped with a third camera that constantly monitors calibration and makes any adjustments necessary through the use of the software. The camera assemblies are factory calibrated and can be placed into service after installation and setup. Camera assemblies do not have to be replaced as a pair, however if ISO certification is to be maintained, they must be replaced as a pair or, a field RCP procedure must be performed with a current ISO certified calibration fixture. The Arago 3™ is made up of two aluminum extrusions mounted in front of the alignment rack on the outboard edge so that the CCD camera systems can see down the length of the vehicle on both sides. Each aluminum extrusion have camera pods mounted on them that move in a vertical direction as the lift is raised or lowerd providing the customer has purchased the lift kit. The lift kit for the Arago 3™ consist of DC motor and cable to raise / lower the pods. A counterweight is installed in the LH aluminum extrusion, this weight raises the RH camera pod as the DC motor raises the LH camera pod.

The Arago 3™ will operate at optimum performance providing the installation was done correctly. Do not at anytime assume that the installation of any unit is correct. Failure to follow the correct installation procedure can and will produce errors in the system. Become familiar with the correct installation procedures and deminsions. Knowing this information can save many hours of customer down time and diagnostic time. The installation instructions can be found in the back of this manual.

Electrical components of the Arago 3™ have been described in detail in chapter 1. The Arago 3™ have identical camera components used on the conventional IVS V3D, however these components have been assembled at the factory as calibrated assemblies. References to the cameras are made in this chapter and the installation instructions that need to be identified. The left pod assembly consist of a “Left Camera” and “Calibration Camera”, this assembly is referred to as “CAM-CAM”. The right pod assembly consist of a “Right Camera” and a “Target”, this assembly is referred to as “CAM-TARGET”. Each are unique in design and replaced as assemblies. ***NOTE: AT NO TIME SHOULD A COMPONENT BE REPLACED, THE CAMERAS MUST BE REPLACED AS AN ASSEMBLY.*** Each camera is mounted on a “Pod Car” assembly, the “Pod Cars” are identical in design however the mounting orientation of the camera assemblies are different.

The Power Supply used in the Arago 3™ is indentical to the conventionl IVS V3D. The IVS PCB used in an Arago has additional connection for the DC motor. This IVS PCB will work in the conventional IVS V3D however the conventional IVS PCB will not work in an Arago aligner because of the DC motor connection. Both the Power Supply and the IVS Processor are mounted inside the Tower Base Shield on the left side. Power requirements for each component is described in chapter 1 of this manual. For easy identification and hookup each video and control cable have been color coded labled the camera assemblies have also been color coded with labels. This color coding should always be followed if at any time a cable or a camera assembly is changed the technician must apply the correct color coding labels to each component, this will ensure that all connections are made correctly and ease the troubleshooting procedures or replacement in the future should it arise (described later).

COMPONENT IDENTIFICATION

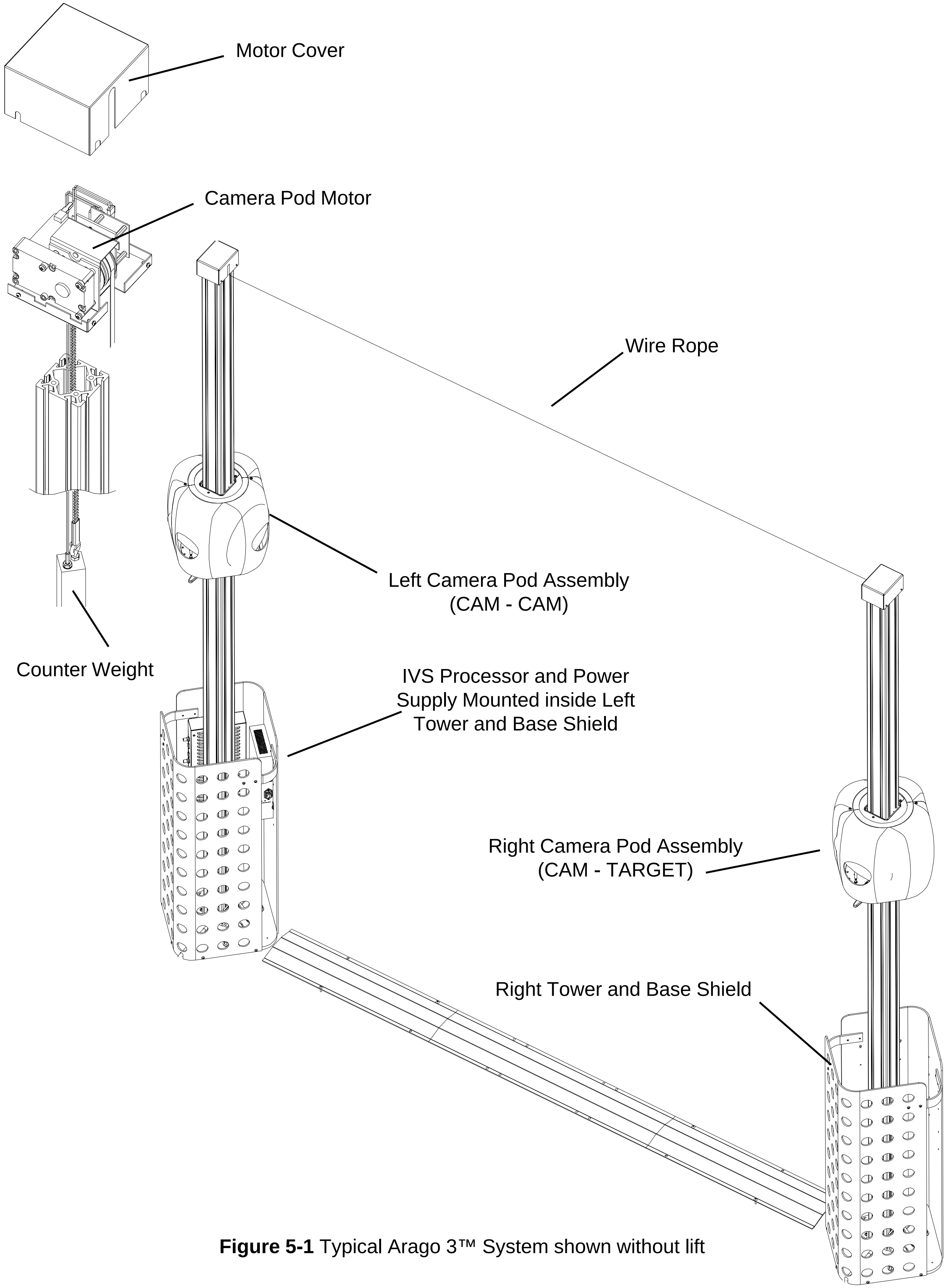


Figure 5-1 Typical Arago 3™ System shown without lift

IVS PROCESSOR REPLACEMENT

NOTE: THE ALUMINUM EXTRUSION AND GUARDS HAVE BEEN REMOVED FOR CLARITY ONLY.

⚠ WARNING!

DANGEROUS HIGH VOLTAGES ARE PRESENT IN THIS EQUIPMENT

1. Power down the unit by toggling the switch to the Power Supply to the <OFF> position. (Figure 5-2)
2. Un-plug the power cable from the power source and the power supply box. (Figure 5-2)
3. Carefully un-plug all video and control cables from the IVS Processor. (Figure 5-2)

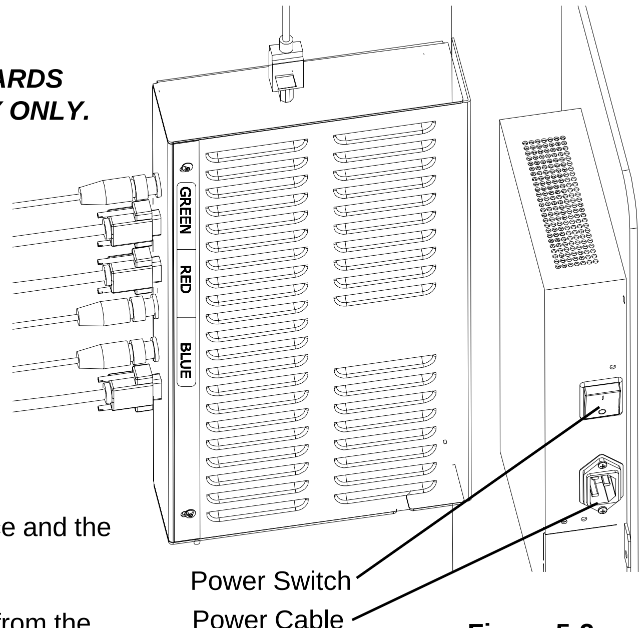


Figure 5-2

4. Remove the two screws covering the IVS Processor and place cover to the side.
5. On the IVS Processor un-plug the power cable J18 leading from the Power Supply.
6. Using a philips screwdriver remove the screws holding the IVS Processor to the base guard. (Figure 5-3)

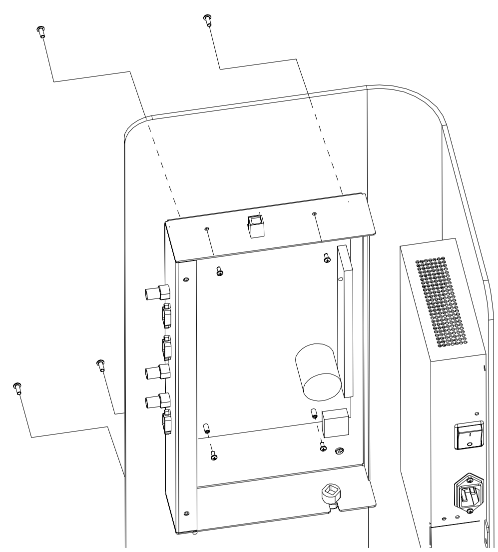


Figure 5-3

7. Place the IVS Processor box on a clean work area.
8. Remove the screws holding the IVS Processor in the box and carefully remove the IVS Processor. (Figure 5-4)
9. Install new Processor and place old processor in packageing to return for repair.

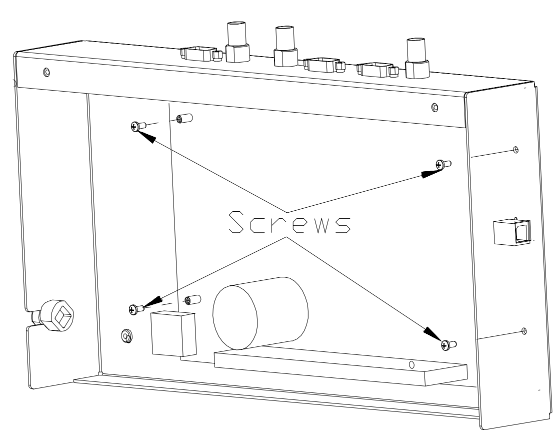


Figure 5-4

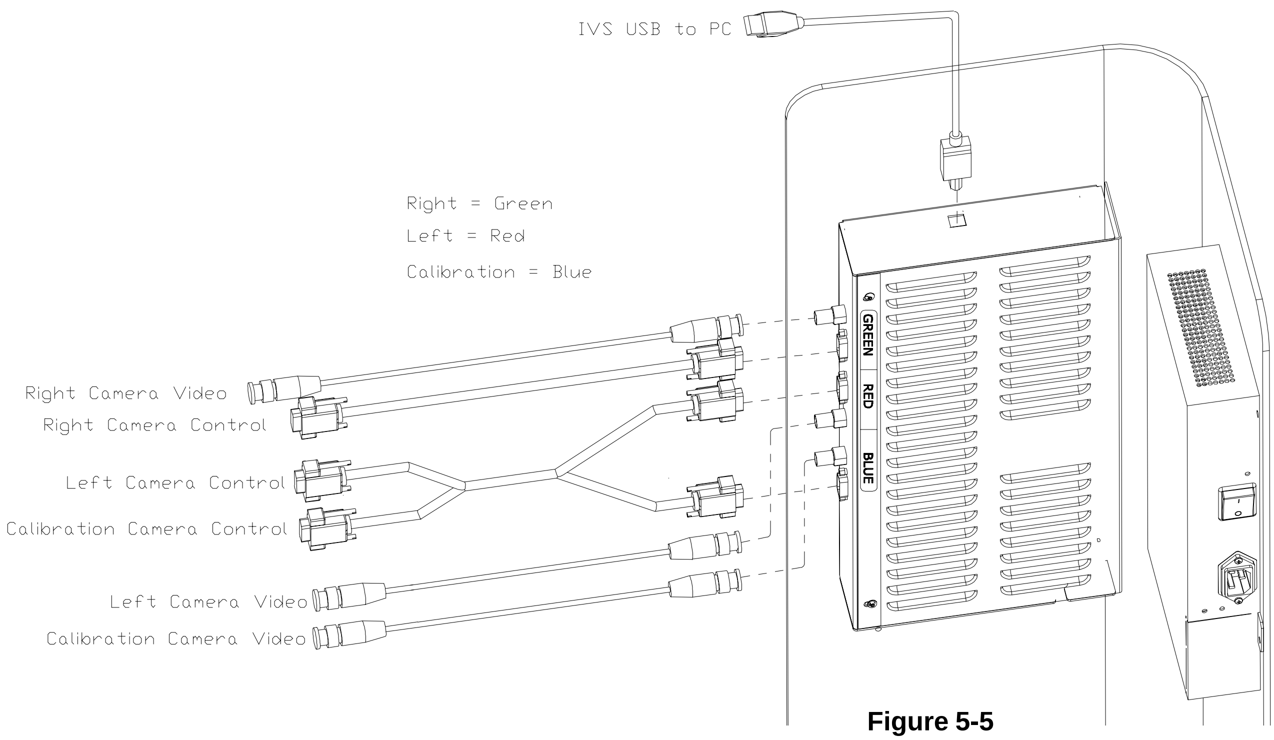


Figure 5-5

10. Reverse procedure for installation of the IVS Box.

11. Reconnect the video and control cables to the newly installed processor. The cables and box has been color coded to prevent errors. (Figure 5-5)

12. Reconnect all power connections.

13. Power up both the aligner console and the IVS Processor the unit and allow the software to load.

14. During the software load the unit will ask for the replacement key disk to be inserted. After inserting the floppy key disk click on **<OK>**.

15. The aligner will transfer all necessary files to the new IVS PCB tying the aligner and the IVS together.

16. Verify repair with customer.

POWER SUPPLY REPLACEMENT

No components inside the Power Supply are serviceable. Should a Power Supply fail it must be replaced as a unit.

NOTE: THE ALUMINUM EXTRUSION AND GUARDS HAVE BEEN REMOVED FOR CLARITY ONLY.

⚠ WARNING!

DANGEROUS HIGH VOLTAGES ARE PRESENT IN THIS EQUIPMENT

1. Power down the unit by toggling the switch to the Power Supply to the <OFF> position.
2. Un-plug the power cable from the power source and the power supply box.
4. Remove the two screws covering the IVS Processor and place cover to the side.
5. On the IVS Processor un-plug the power cable J18 leading from the Power Supply.
5. Remove the screws and nuts holding the Power Supply to the tower guard. (Figure 5-6)
6. Reverse the procedures for installation and verify all voltages. (Figure 5-7)

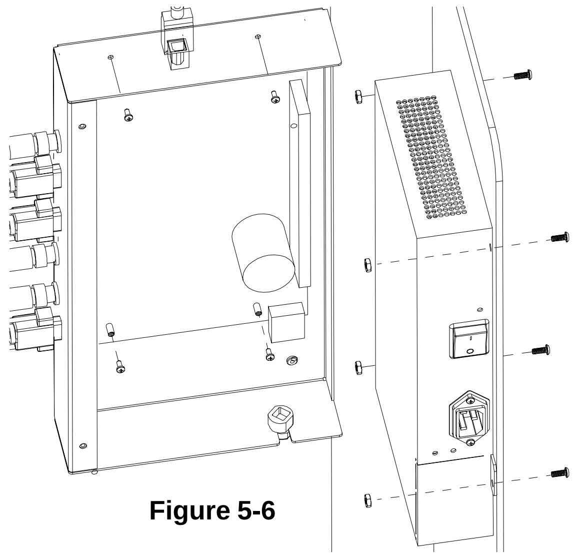


Figure 5-6

- Pad labeled 2.5Vdc should read 2.5Vdc ±.1Vdc
- Pad labeled 3.3Vdc should read 3.3Vdc ± .1Vdc
- Pad labeled 5Vdc should read 5Vdc ± .25Vdc
- Pad labeled 12Vdc should read 12Vdc ± .8Vdc
- Pad labeled 24Vdc should read 24Vdc ± 2.0Vdc

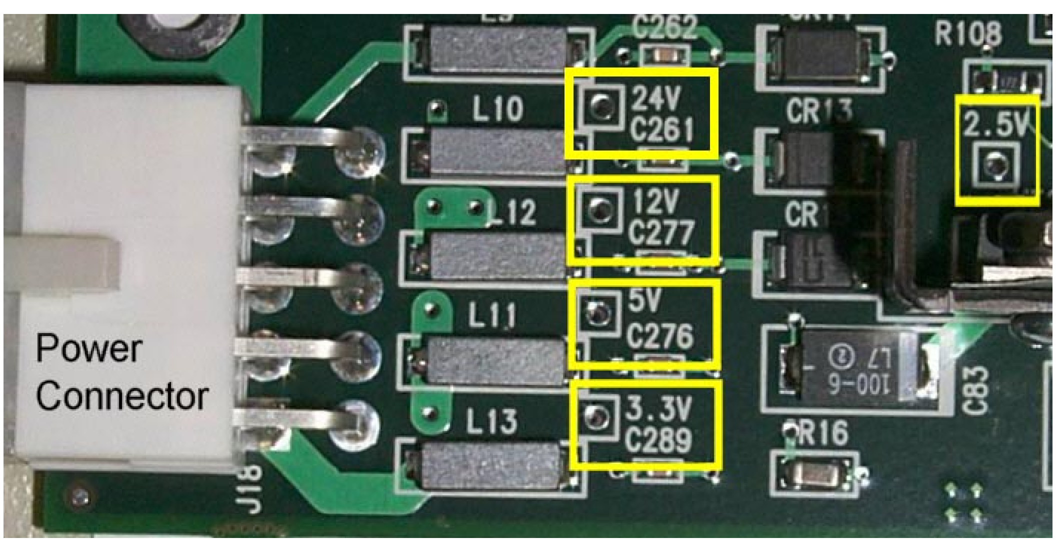


Figure 5-7

CAMERA REPLACEMENT

NOTE: THE "CAM-CAM" AND "CAM-TARGET" MUST BE REPLACED AS AN ASSEMBLY. THE ASSEMBLIES COME CALIBRATED FROM THE FACTORY.

Assemblies shown without pod covers (Figure 5-8)

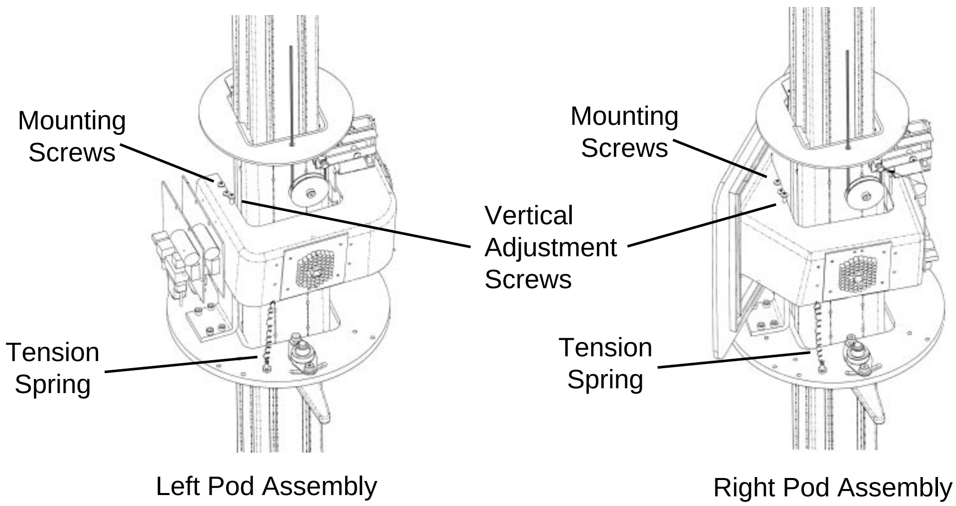


Figure 5-8

LEFT CAMERA REPLACEMENT

1. Power down the unit by toggling the switch on the Power Supply to the <OFF> position.

2. Un-plug the power cable from the power source and the power supply box.

3. Remove the screws from the upper and lower pod covers. Gently separate the pod covers from the camera assemblies.

4. Disconnect the video and control cables from the Camera PCB's.

5. Using needle nose pliers remove the tenison spring from the "CAM-CAM" assembly. (Figure 5-9)

5. Loosen the two mounting screws holding the "CAM-CAM" to the Pod Assembly and gently work the "CAM-CAM" away from the Pod Assembly. (Figure 5-9)

6. Install the new "CAM-CAM" assembly.

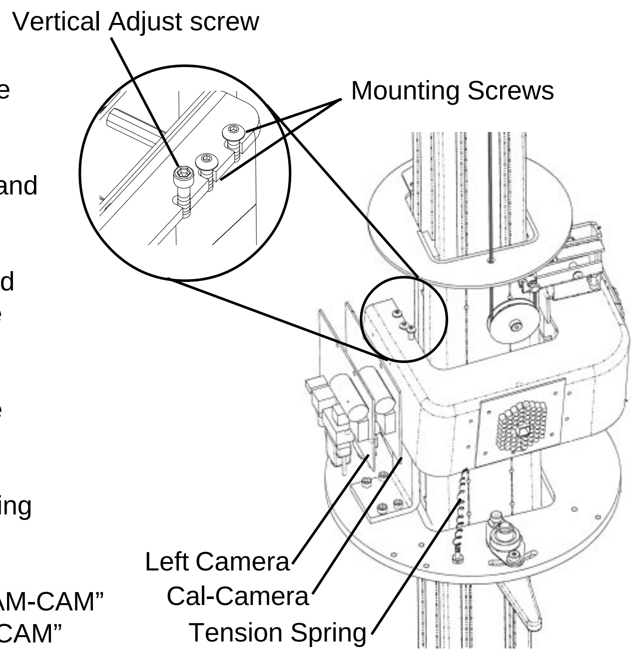


Figure 5-9

NOTE: THE "CAM-CAM" HAS TWO CAMERA BOARDS, EACH OF WHICH ARE COLOR CODED. APPLY COLOR CODE DECALS TO THE NEW "CAM-CAM" ASSEMBLY.

7. Attach all video and control cables. Perform both the Vertical and Horizontal Camera Aim procedures and test the unit and return to service.

RIGHT CAMERA REPLACEMENT

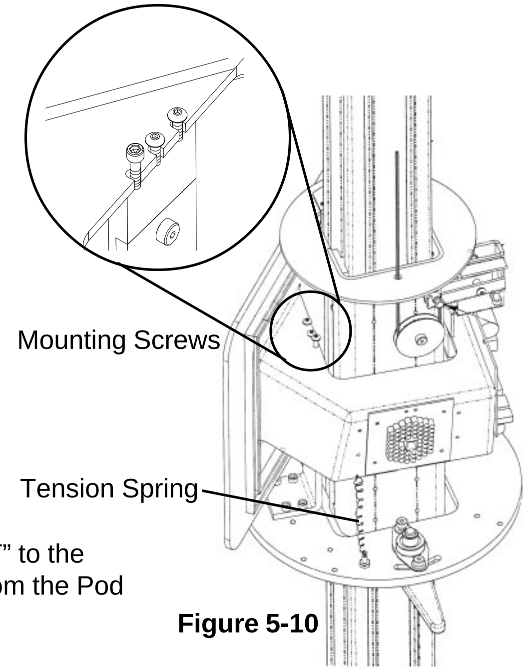


Figure 5-10

1. Power down the unit by toggling the switch on the Power Supply to the <OFF> position.

2. Un-plug the power cable from the power source and the power supply box.

3. Remove the screws from the upper and lower pod covers. Gently separate the pod covers from the camera assemblies.

4. Disconnect the video and control cables from the Camera PCB's.

5. Using needle nose pliers remove the tension spring from the "CAM-TARGET" assembly. (Figure 5-10)

6. Loosen the two mounting screws holding the "CAM-TARGET" to the Pod Assembly and gently work the "CAM-TARGET" away from the Pod Assembly.

7. Install the new "CAM-TARGET" assembly. The right camera assembly requires the camera chassis to be "maneuvered" from the left toward the Pod car and then moved to the right, into position. Do not attempt to force the pieces together. Any deformation of the chassis will void the calibration.

8. Apply color code decals to the new "CAM-TARGET" assembly.

9. Attach all video and control cables. Perform both the Vertical and Horizontal Camera Aim procedures and test the unit and return to service.

CALIBRATE POD MOTORS

The motor needs to know how far it has moved each time it looks for the targets. We can only judge distance by the speed of the motor times the length of time it was moving. Calibration gives us this speed, usually a few inches a second. We need an accurate distance to get an accurate speed. The result of an inaccurate motor may be a jerky target search where either the motor moves too far each search increment or too little.

Before beginning the calibration process the camera pods must be adjusted to the very botton or the very top of their travel.

1. From the Main Menu , select the Maintenance tab.
2. From the Maintenance tab, select Aligner Diagnostics.
3. From the Aligner Diagnostic, select Camera View.

NOTE: IT IS NOT NECESSARY THAT THE CAMERAS SEE TARGETS AT THIS TIME.

4. Using the mouse pointer click on the “Go to the bottom” button (Figure 5-11). The motor should power up and move both cameras to the bottom of their travel (bottom shutoff switch).
5. Exit by clicking on the “Home” key in the toolbar.

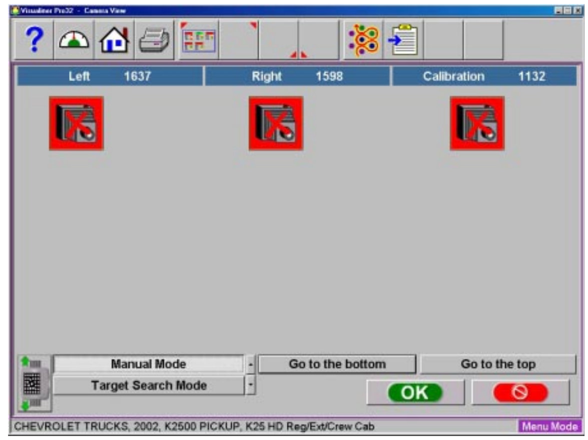


Figure 5-11

6. From the Main Menu, select the Preference tab.
7. From the Preference tab, select the System Configuration Icon.

8. Make sure that the Imaging System Type is set to Three Cameras.
9. Check both the “Pod Motors Available” and “Enable Motor Target Search” boxes”.
10. Measure the distance between both the upper and lower stop switches and input this into the distance section.
11. Using the mouse pointer click on “Calibrate Pod Motors”.
12. The pod motor should travel to the upper limit switch and then travel the the lower shutoff switch. Pay attention that the cables hanging from the Left Hand camera does not accidentally trip the lower shutoff switch. If this should happen the technician must repeat the “Calibrate Pod Motor” procedure. After the cameras travel the distance the unit should automatically enter both the “Up” and “Down” distance, usually the distance would be a couple of inches a second.

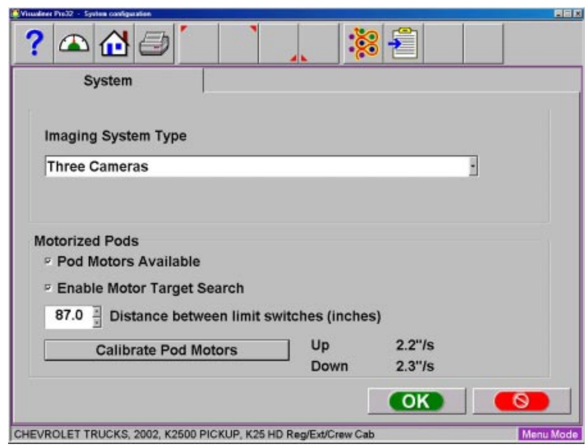


Figure 5-12

CAMERA AIM PROCEDURES - VERTICAL / HORIZONTAL ADJUSTMENT

1. Set the lift/rack to the normal alignment height and measure the distance from the floor to the turntables and record this value (Turntable Height "A").

2. Measure the installation baseline, this is the distance from the turntable centerline to the back of the Arago tower base, record this value (Baseline Distance).

3. Using the chart determine the overall camera height and record this value.

Baseline Distance*	Camera Offset Height (B)
If at 90" (min)	22"
If at 100"	24"
If at 110"	26"
If at 120" (max)	28"

*Use the setting closest to actual

(A)	Turntable Height		_______ inches
(B)	Camera Offset Height	+	_______ inches
(C)	Overall Camera Height	=	_______ inches

4. From the Main Menu, select the Maintenance tab.

5. From the Maintenance tab, select Calibrate.

6. From Calibrate, select Camera Aim.

7. Place the RCP fixture across the front of the rack with the small target on the Right Hand turntable and the large target on the Left Hand turntable, center the fixture on the turntables.

8. Using the Up/Down arrows move the camera pods to the camera height recorded in step 3 (C). This is the distance between the floor and the bottom of the camera pod. Press "OK" to continue.

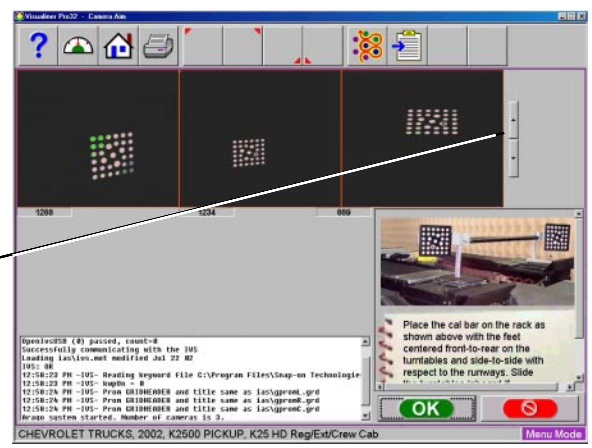


Figure 5-13

9. Make sure that both camera pod rotation levers on the bottom of the cameras are set in the middle of their travel and that the each camera pod starts in a level position. If the cameras are not aligned within the Horizontal lines (Figure 5-14) adjustments to the camera can be made by adjusting the hex head cap screw on the camera pods. Press "OK" to continue.

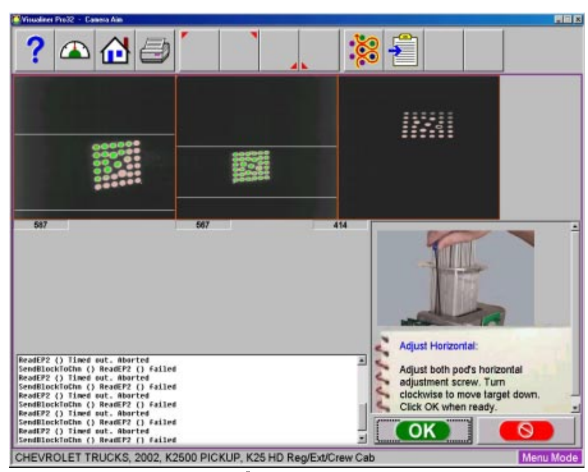


Figure 5-14

10. Move the RCP fixture back 7 feet, the fixture should be located in front of the rear slip plates. If the targets are not aligned within the vertical lines loosen the vertical aiming bolt, while holding the adjustment lever at the medium position, turn the pods to aim (Figure 5-15). Tighten the bolt and press "Ok" to continue. If the camera aiming procedure was done correctly a message should indicate a successful camera aim and to run the pod rotation position routine.

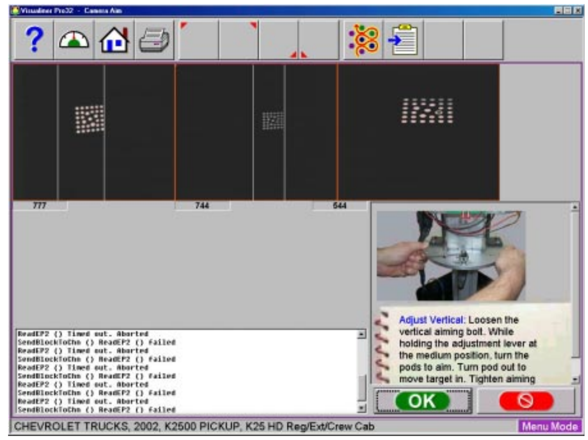


Figure 5-15

CAMERA POD ROTATION

NOTE: THIS PROCEDURE MUST BE FOLLOWED ANYTIME A "CAM-CAM", "CAM-TARGET" OR POD ADJUSTMENT LEVER IS REPLACED.

In order to maximize the Arago 3™ alignment system, the cameras have been mounted on a swivel pod assembly. This swivel pod allows the right and left cameras to rotate in order to see the targets in all field of views (Narrow, Normal and Wide). The Arago does not require RCP because the third camera maintains constant calibration.

1. From the calibration menu single click on the "Camera Pod Rotation" icon. (Figure 5-16)

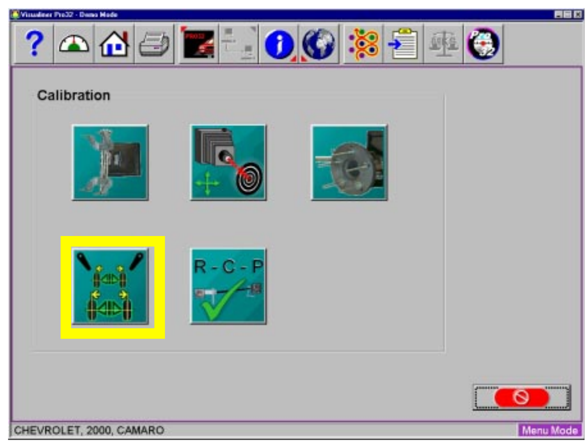


Figure 5-16

2. Adjust the camera lever's to the illustrated position shown on the screen and click on **<OK>**. (Figure 5-17)

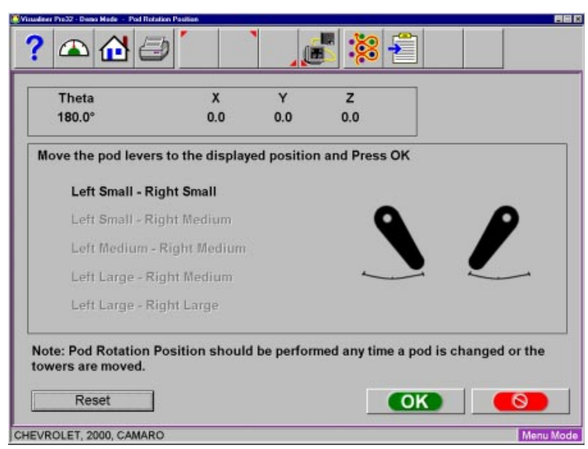


Figure 5-17

3. After clicking on "Ok" as indicated in step 2, the camera rotation levers change positions. Move the camera levers to the position shown and click on **<OK>**. (Figure 5-18)

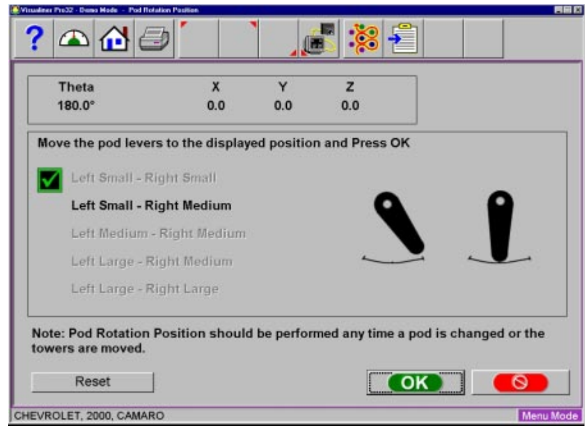


Figure 5-18

4. Continue the process until all camera positons have been checked. After the final rotation lever has been checked click on the **<Cancel>** button to exit. (Figure 5-19)

NOTE: ***IF A MISTAKE IS MADE DURING THE TEACHING PROCESS, THE OPERATOR CAN SIMPLY CLICK ON THE RESET BUTTON TO CLEAR THE LEARNING PROCESS AND START AT THE BEGINNING.***

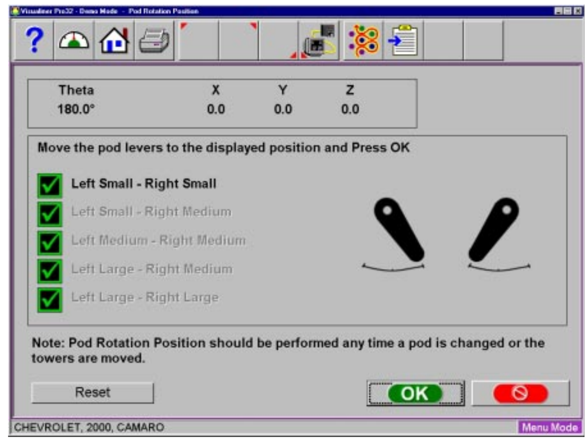


Figure 5-19

COMMON POD

The Left and Right Pod assemblies are identical. Very little service is required to maintain the pod assemblies. A Pod has (4) pads attached that travel inside channels on the aluminum extrusion in a vertical direction. Should a pad wear out follow the instructions below to replace these pads.

1. Power down the unit by toggling the switch on the Power Supply to the <OFF> position.

2. Un-plug the power cable from the power source and the power supply box.

3. Remove the screws from the upper and lower pod covers. Gently separate the pod covers from the camera assembly.

4. Disconnect the video and control cables from the Camera PCB's.

5. Remove the phillip screws holding the cable strain relief bracket to the pod and feed the cables through to opening of the pod assembly.

6. Using needle nose pliers remove the tenison spring from the Camera Assembly.

7. Loosen the two mounting screws holding the Camera Assembly to the Pod Assembly and gently work the Camera Assembly away from the Pod.

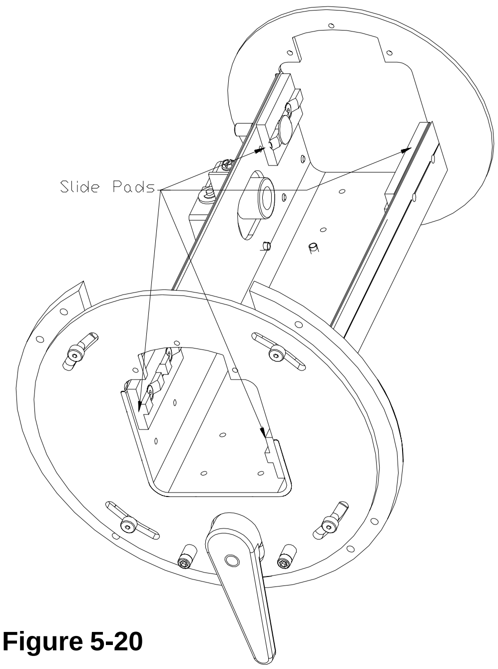


Figure 5-20

8. Temporarily tighten the locking nut to hold the camera pod in place and remove the barrel nut on the end of the cable (if equipped).

9. Using a ladder to reach the top of the extrusion, remove the upper pulley cover from the top of the aluminum extrusion and remove the pulley assembly, marking the two holes used for the pulley for re-assembling.

10. Loosen the locking nut from step 8 and slide the Pod assembly up and off of the aluminum extrusion.

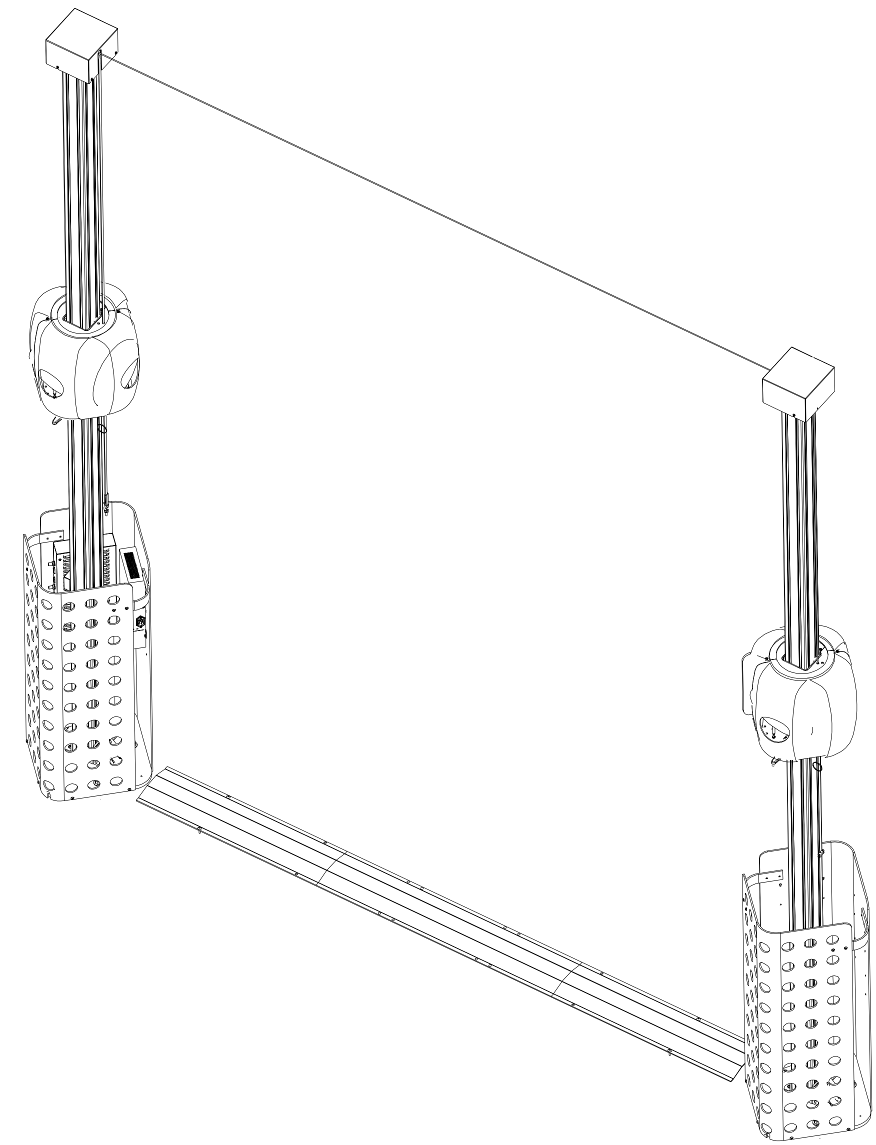
11. Inspect and replace the pad assembly using Locktite 222 on all slide pad mounting screws during assembly. (Figure 5-20)

APPENDIX A
INSTALLATION INSTRUCTIONS

GENERAL

The installation instruction is for reference only. This version (Form 5838-4) is supplied for your information or can be copied for the installer. Part numbers for the Installation Instructions are as follows:

JBC   Form 5838-4   This form can be ordered by calling 1.800.362.8326 and ask for the print shop.



Arago 3™

Installation Instructions

Form TEEWA533A

Blank Page

John Bean • 309 Exchange Avenue • Conway Arkansas 72032
Phone: (501) 450-1500 • Fax: (501) 450-1585

Arago 3™
Installation Instructions
Form 5838

INTRODUCTION

An Arago 3™ aligner is installed much the same as conventional imaging machines, however there are unique considerations which must be addressed. Several supporting documents are referred to during this procedure, if unsure of document availability make arraignments prior to attempting the installation. Follow these instructions carefully for a successful installation.

An Arago 3™ system normally does not require RCP calibration at installation. The camera assemblies are factory calibrated and can be placed into service shortly after installation and setup. Camera assemblies do not have to be replaced as a pair, however if traceable factory calibration is to be maintained, they must be replaced as a pair. No field calibration is required in this case. It is also possible to replace the camera assemblies singly, but a field RCP procedure must be performed

These instructions cover the main aspects of Arago 3™ installation:

- ⇨ Preparing for installation
- ⇨ Qualifying the site for installation
- ⇨ Console assembly and setup
- ⇨ Placement/assembly base and support columns
- ⇨ Placement/assembly and setup of the Pod motorized transport system
- ⇨ Camera aiming procedures
- ⇨ Initial operation of Arago 3™ software

Before attempting installation, read these instructions thoroughly and understand the tasks involved. Review all requirements of installation to avoid oversights resulting in lost revenue, and lost customer confidence. Be aware of the environment conducive to the optimum performance of imaging alignment. Procure the necessary tools to do a quality job and last most important, perform the installation safely by observing all precautions associated with the task at hand.

INSTALLATION PROCEDURES

1. Qualify the site for installation

Verify site requirements per JBC Pre-Installation Form 5705. The Pre-Installation check-list was created primarily with sales personnel in mind, however it can be used as tool to verify bay conformance to requirements. Below are some key issues to consider for a successful installation. See Figure 5 on page 11 for a typical bay layout.

Power Source
115 volts AC, 15 amp noise free dedicated service, assure a good ground

Rack integrity:
Is the rack/lift safe, are the lock mechanisms secure
Check for runway coplanar at all heights
Is rack relatively level - for ease of rollback
Turntable condition - free from binding, do they exhibit good rotational stability
Rollback requirements - is a kit required - acquire if necessary
Is the field of view conducive with imaging alignment (no obstructions)

Floor integrity:
Will the floor adequately support the rack, has a core test been performed?
Is the concrete properly cured, new flooring should be cured at least 28 days.
Are there any pipes, or wiring under the floor that could be drilled into?
Will the floor flex, crumble, are there expansion joints?

Environmental concerns
Inspect the area for heaters, reflections, adjacent machinery, fans, RFI etc.

Space requirements
Can the camera be positioned from the TT a distance from 90” to 120”
(108” - 114” recommended)
The distance between the tower baseplates of 81” to 93” (87” recommended)

Adjacent Power Noise
Look for motor noise/hash, shared processors, RFI

Ergonomics
Can the operator move about freely to work safely and view the CRT
Will the movable camera feature be utilized in the installation?

2. Tools and equipment required for installation

Study the list below and make procurement arrangements prior to installation. Time is poorly spent searching for proper tools once the project has begun. The check list below is comprehensive and based on actual installations in a variety of locations.

- ☐ T-handle Ball-end Hex Wrenches; 3/8, 3/16, 1/8, 3/32, 5/32
- ☐ #1 Phillips Screwdriver - Pod Covers
- ☐ Heavy Duty Wire/Cable Cutter - Used To Cut Or Trim Transport Cable
- ☐ Pliers - Installation Of Lanyard Cables
- ☐ Box End or Combination Wrenches: 3/4 - 7/8; 9/16 - 1/2; 7/16 - 3/8
- ☐ Tape Measure - Used To Square The Optics With The Lift Center Line, And For Camera offset
- ☐ Chalk Line - Used For Lift Center Line
- ☐ 2 Or 4 Foot Level - Leveling Support Columns
- ☐ Tin Snips - Used To Open Carton Banding
- ☐ Box Cutters - Opening Cartons
- ☐ Electrical Tape - Secure Wires
- ☐ Plastic Wire Ties - Dressing Cables
- ☐ VOM - Verifying Supply Voltage
- ☐ 16 Oz. Hammer - Set Anchor Bolts
- ☐ Hammer Drill And 1/2" Bit
- ☐ Carpenters Pencil - Mark Support Location On Floor
- ☐ Calibration Bar - Camera aim
- ☐ Glass Cleaner And Rags - Cleaning Of Targets After Install if Necessary
- ☐ Small Flashlight
- ☐ Adjustable Wrench
- ☐ Instructions

3. Assembly and setup of the console

Consoles are shipped mostly complete, however some minor assembly is required upon installation. Refer to the illustration below for a completed console. The installation personnel will be required to assemble the clamp hanger brackets to the cabinet, In addition, the computer and its peripherals must be placed into the console and wired together.

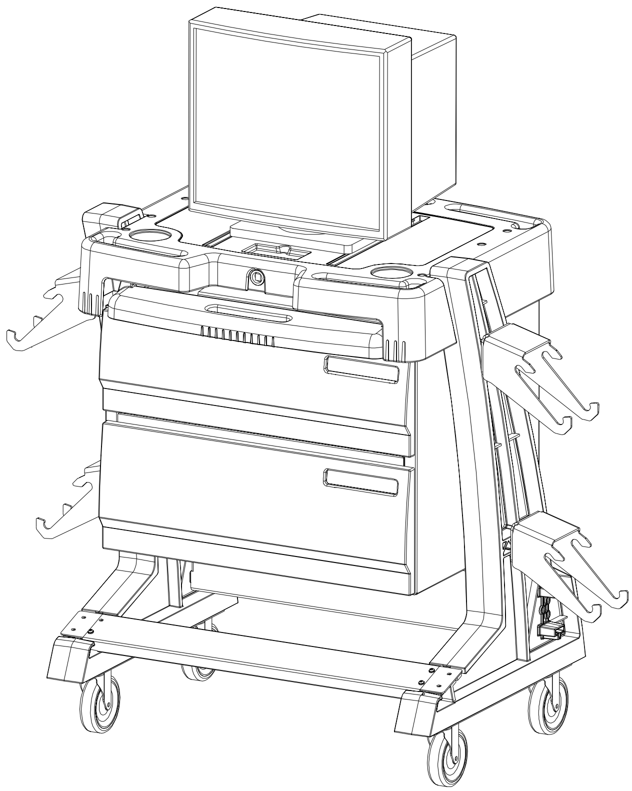


Figure 1 - Fully Assembled Console

1. Remove the console from the skid.
2. Install the wheel clamp hanger brackets onto the side of the console.
3. Locate all cartons associated with the console and computer assembly.
4. Inspect each component for damage, notify shipping company immediately if dam aged, report any shortages to customer service.
5. Place the Monitor on the console top, secure with the sliding fasteners.
6. Remove the back panel from the rear of the console as shown in Figure 2.
7. Place the desktop PC into the top console shelf from the front.
8. Place the keyboard and the mouse on the sliding drawer. Feed the cables through the hole in the middle of the drawer. Secure cables to underside of drawer with plastic cable ties.
9. Place the printer in the bottom console drawer. Install toner cartridges and paper.
10. Route cables from each of the above peripherals to the rear of the PC. Refer to the drawing detail in Figures 2 and 3 for proper cable connections.

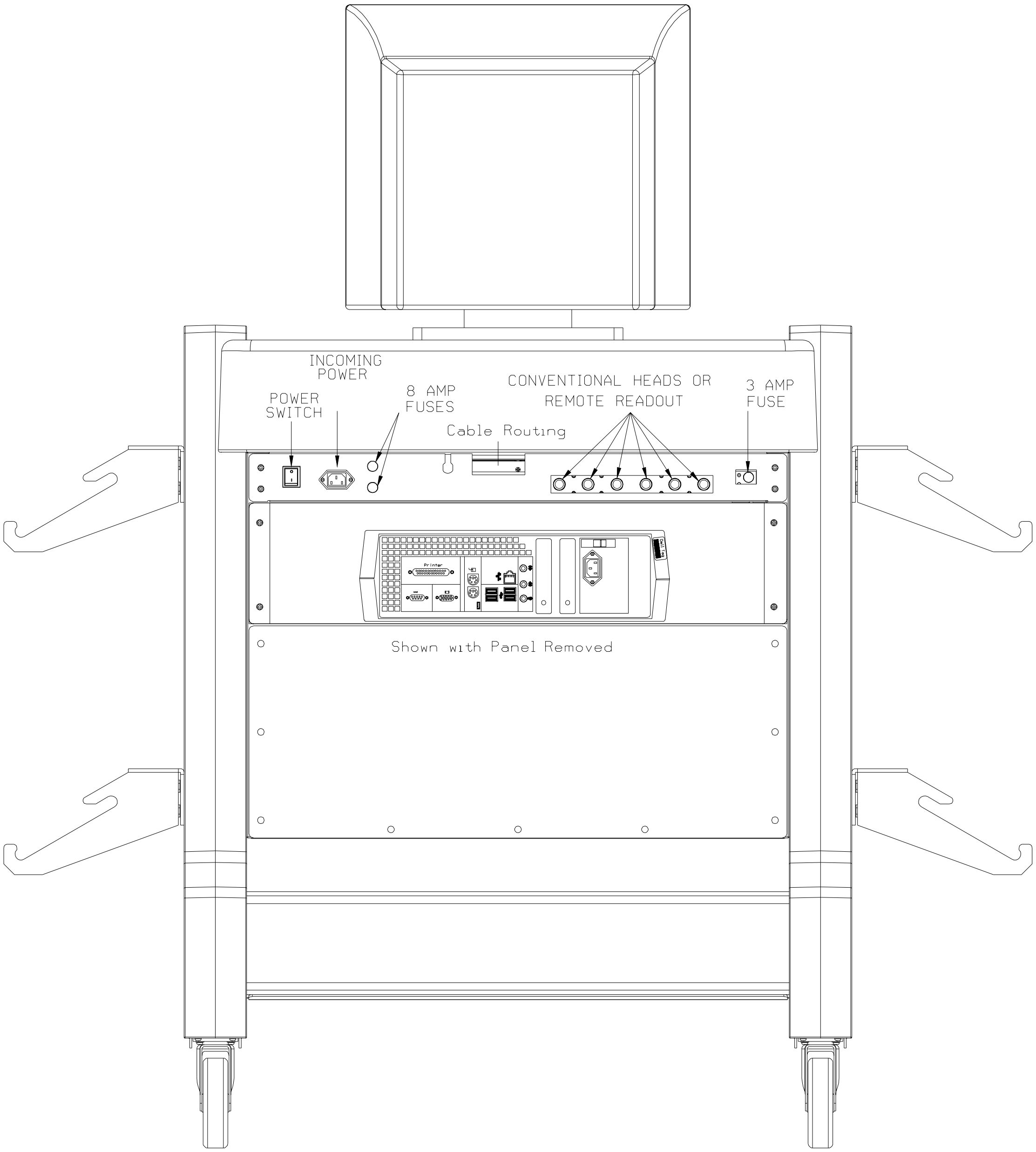


Figure 2 - Console rear view with PC access panel removed

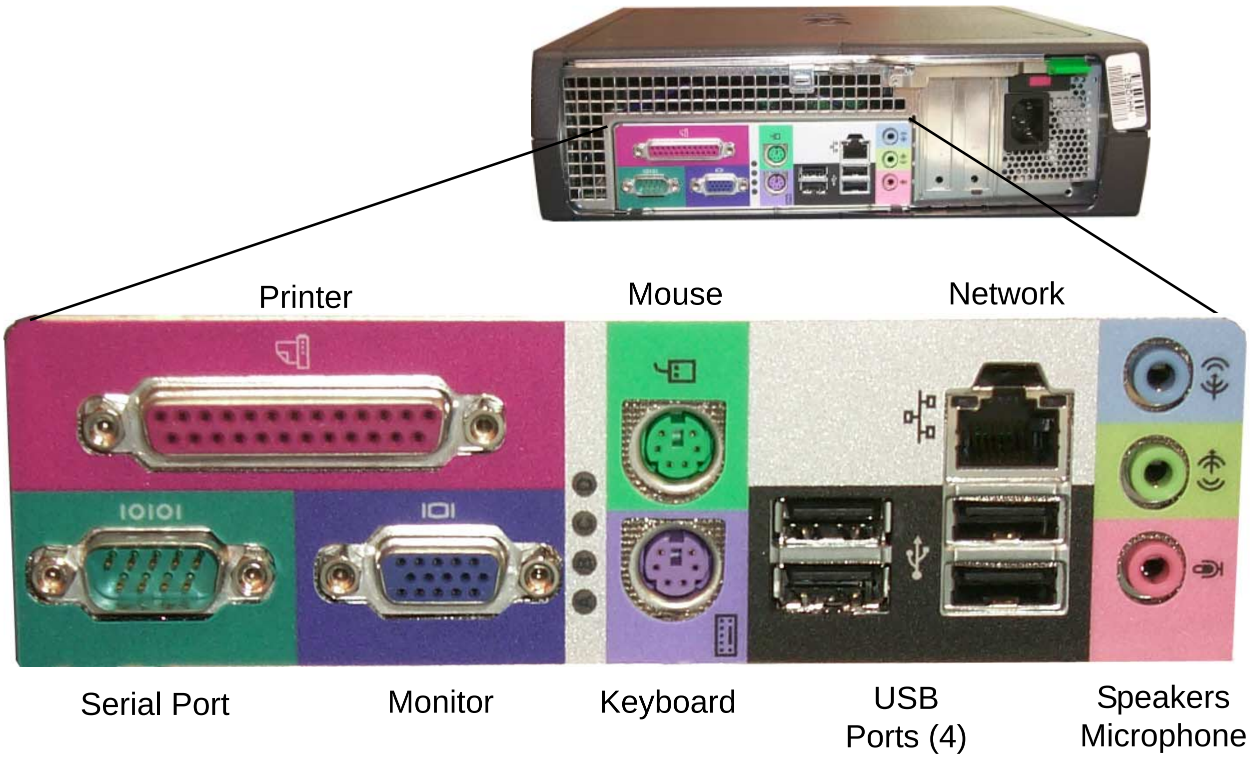


Figure 3 - Rear view of PC

NOTE: Check interconnect harnesses and cables before applying powering to PC.
Using the Console to View Camera Assembly Instructions

Once the Console is assembled, the PC can be booted and software configuration finalized. Verify proper PC operation before reattaching rear panel.

4. Installation Baseline layout

These instructions assume a lift or rack is being used as the alignment surface. If the floor is to be used, identify the spot where the turntables will rest, and base measurements from that spot. Reference *Installation Dimensions Worksheet 1* for the following steps.

1. Determine the ***Lift Centerline***. Measure between runways front and rear and mark midpoints on both. A mark can be made forward of the lift by placing one end of a string at a spot on one side of the lift, placing a marker on the other end of a string, and scribing an arc forward of the lift across the centerline. Repeat scribing an arc from the same spot on the other side of the lift. The intersection of the two arcs is the lift centerline. Use a chalk line to snap a centerline between the marks, and project out at least 114 inches in front of the rack, or to the shop wall if closer. See *Figure 5*.

2. Determine the ***Turntable Centerline*** by raising the lift to the predetermined alignment height (step 1). Use a plumb-bob from the center of the turntable and mark a spot on the floor next to each turntable. Snap a chalk line through the marks to establish the centerline. Use the plumb bob on the outside of the turntables to mark a center spot on the floor on the outside of each runway (See *Figure 5*.

3. Determine the ***Turntable Height*** (the normal operating height of the rack). On a multilevel lift (i.e. parallelogram) put an average size car on the lift and raise it until the alignment technician feels comfortable performing wheel turns, rolling the vehicle back and forth, and making toe/camber adjustments from underneath. On other lifts/racks (such as a hoist rack) it is necessary to use the leveling leg height. Typical turntable height is from 30" to 36".

   Measure the distance from the floor to the top of the lift turntables, record this value in the worksheet as TURNTABLE HEIGHT, measurement "A"

   If the user will be operating the Arago 3™ without the moveable feature you may want to mark this height position so it is easy to raise the lift to this chosen height later – this is the height the operator must use when performing alignments. One way is to hang a chain from the lift so it hangs just off of the ground when the rack is at alignment height – this should be visible from the lift operation controls.

4. Determine the ***Installation Baseline***. The Arago 3™ camera supports must be installed a minimum of 90 inches (2286 mm), and no greater than 120 inches (3048 mm) from the center of the turntables to the rear of the camera base. The ideal distance for optimum performance is 108" - 114" (2743 - 2896 mm). Measure 108" – 114" (or whatever the space will allow within the above parameters) from the turntable centerline forward at two locations and mark these points. Snap a chalk line on the floor through these two points. This is the *installation baseline* (See *Figure 5*). Record this distance in the *INSTALLATION DIMENSIONS WORKSHEET 1* shown on page 12.

   Measure the distance from the Turntable Centerline to the Installation Baseline. Use this figure to determine value "B" in Worksheet 1

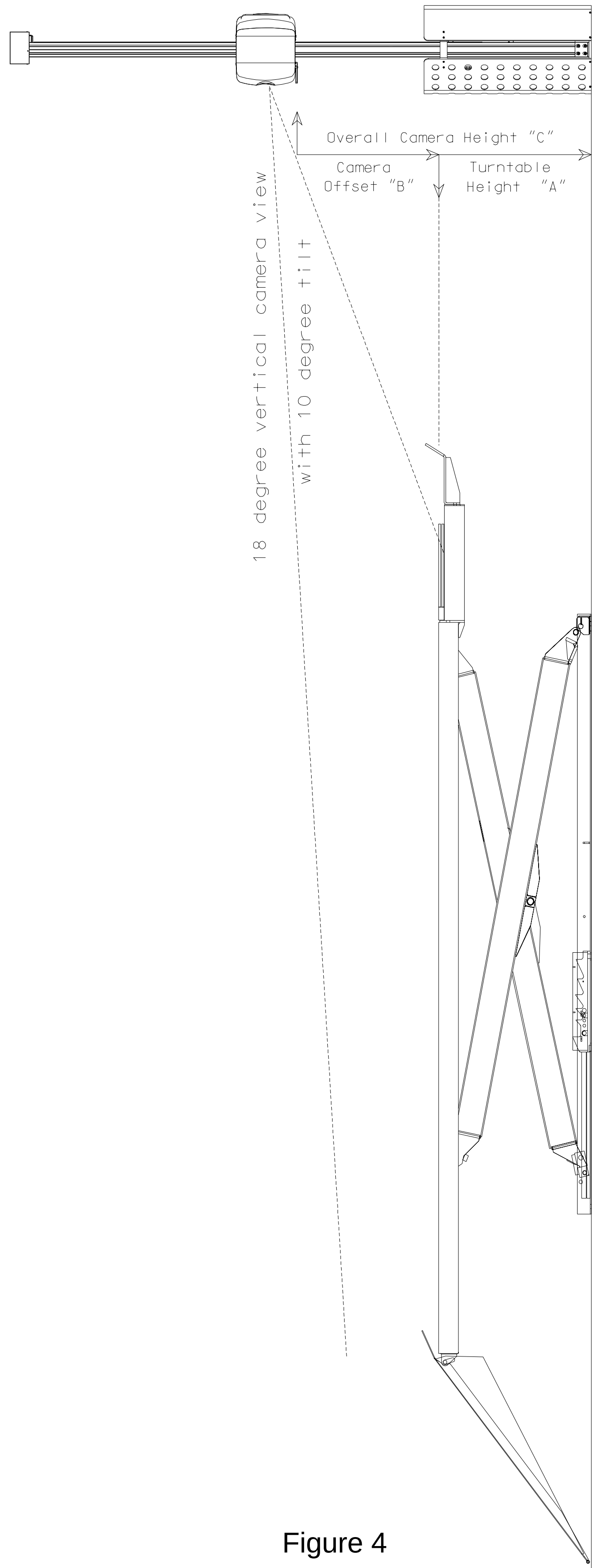

Overall Camera Height "C"
Camera
Offset "B"
Turntable
Height "A"
18 degree vertical camera view
with 10 degree tilt

Figure 4

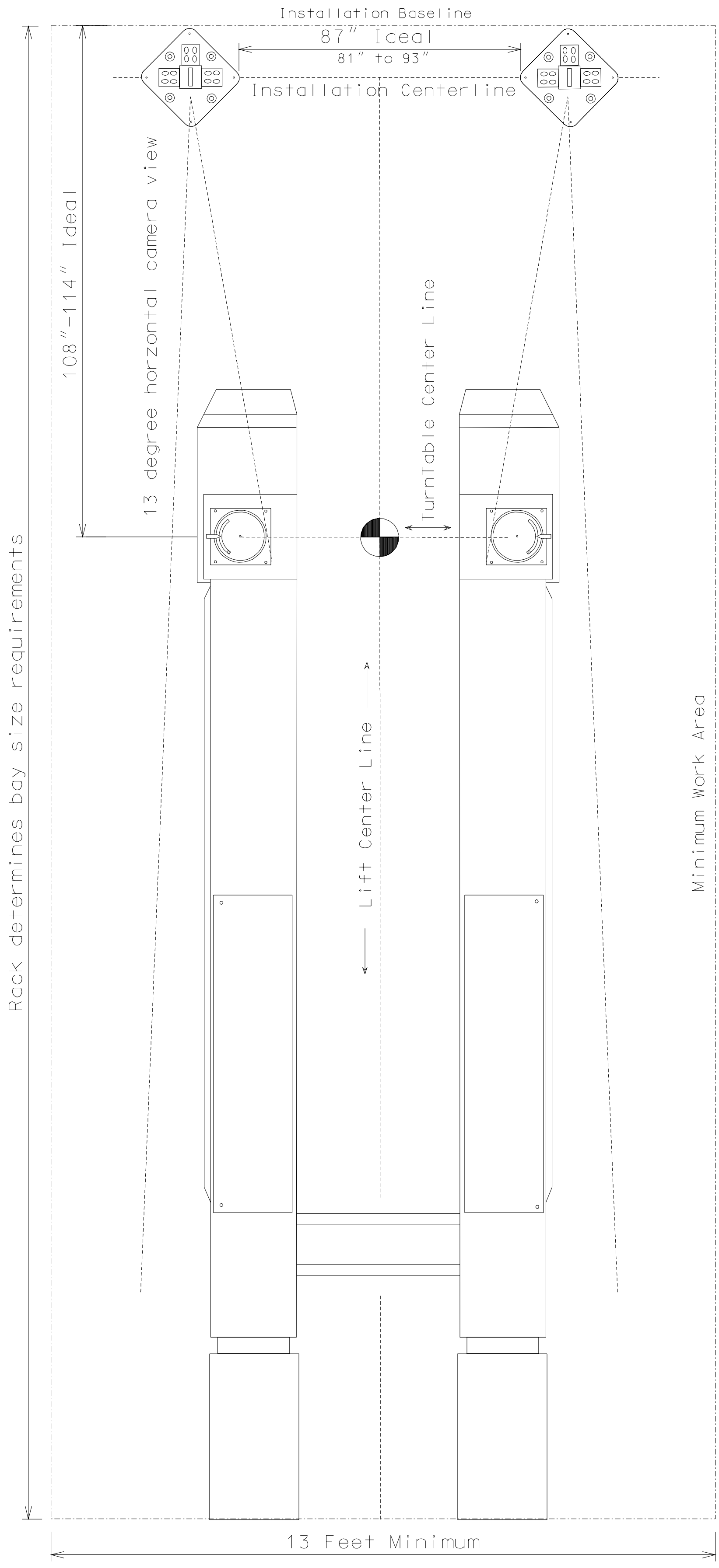

Installation Baseline
87" Ideal
81" to 93"
Installation Centerline
108"-114" Ideal
13 degree horzontal camera view
TurnTable Center Line
Rack determines bay size requirements
Lift Center Line
Minimum Work Area
13 Feet Minimum

Figure 5

INSTALLATION DIMENSIONS WORKSHEET 1
Use the following table to enter measurements to determine height to setup camera pods.

1) Distance between the ground and the turntable top with the lift at preferred working height:

TURNTABLE HEIGHT = (A) ___________

2) Distance from turntable centerline to the Installation Baseline: (Maximum = 120”, Minimum = 90”)

TABLE 1

BASELINE DISTANCE*	CAMERA OFFSET HEIGHT (B)
If at 90” (min)	22”
If at 100”	24”
If at 110”	26”
If at 120” (max)	28”

* Use the setting closest to actual

DESIRED CAMERA OFFSET = (B) __________

NOTE: RAISE LIFTS/RACK TO THE PREFERRED WORKING HEIGHT BEFORE MEASURING

4) Determine Camera Height (Add)			
	(A) Turntable Height	_________	**inches**
	(B) Camera Offset	+ _________	**inches**
	(C) Overall Camera Height	= _________	**inches**

5 - Support Base Assembly

***NOTE**: Support base assemblies are normally shipped completely assembled, however if assembly is required for service or some other reason refer to steps below.*

***NOTE:** Also included in the base assembly box are the front and rear tower base shields. These will be assembled to the base plate later.*

1. Assembling two (2) T-nuts onto each gusset bracket using a 5/32 T-handle hex wrench. Note the location of nut extrusions, they should face away from the gusset. Refer to Figure 6 for orientation. Do not tighten screws at this time.

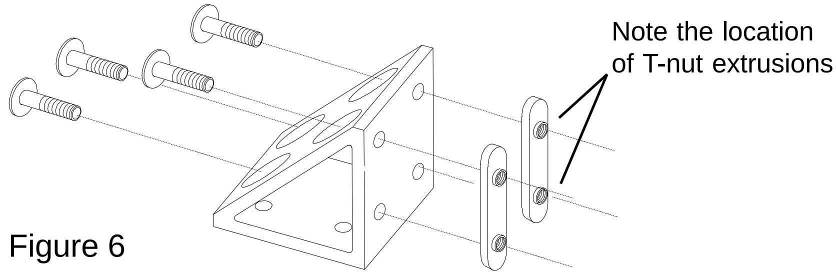


Figure 6

2. Place three (3) Gusset/T-nut assemblies onto the base plate as shown in Figure 7 and secure using four (4) 5/16-18 cap screws per gusset. Do not tighten, hardware will be tightened when support columns are placed onto the base. Start all base shield screws into base for use later. Leave about 1/4 inch protruding.

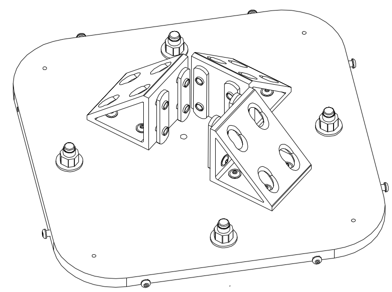


Figure 7

3. Position base assemblies onto floor based upon measurements made earlier. Center the base on the installation baseline marked earlier. Base Plates will generally be 87 inches apart. Refer to Figure 5 on page 11 for layout detail. Using a marker, mark the hole locations for the 4 mounting bolts with each plate.

4. Using a rotary hammer drill equipped with a 1/2 x 12 inch bit, bore each hole carefully. It is generally a good idea to drill all the way through the slab so that if the anchor must be removed later, it can be driven through the concrete and into the ground below. Clear debris before proceeding.

HINT: Bore one hole, tap in an anchor bolt and lightly secure the base with this one bolt. Proceed boring another hole using the hole in the base as a guide. Continue one hole at a time until all four are inserted.

HINT: Pour a small amount of water into the hole as it is being bored to significantly reduce concrete dust. Use a shop vacuum to clean area before proceeding.

! ! DO NOT BOLT DOWN PLATE PERMANENTLY AT THIS TIME ! !

5. Set each base assembly onto floor in the approximate location where they are to be installed. Locate the drilled and tapped end of each column, this will be the top. Place the bottom of a column into each of the base assemblies in the upright position. Tighten the side T-nut assemblies first, then tighten the screws securing the gusset to the base. This procedure should stabilize the column and base. See Figure 8 for detail.

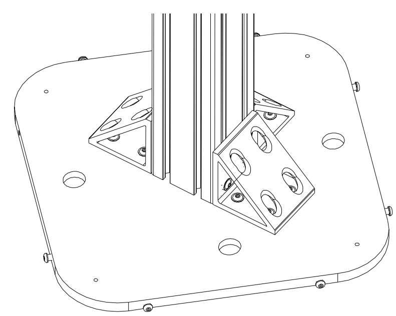


Figure 8

6. Assembling Support Columns

1. Place the left column-base assembly horizontally across 2 cardboard boxes or sawhorses for component assembly. The base assembly boxes are ideal for this procedure.

2. Remove the pod covers from both pod cars, set aside until later.

3. Place pod cars on the support columns. Make sure the levers are pointing in the forward position. Note the base mounting gussets, the three gussets are to the sides

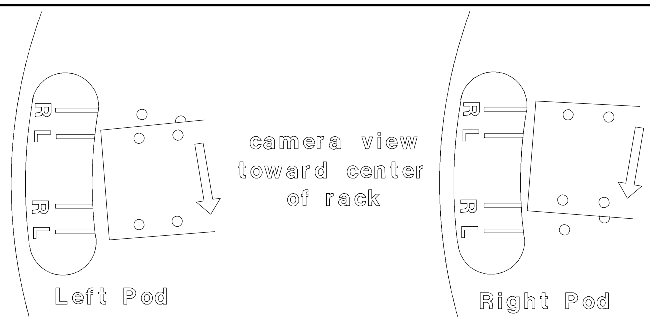


Figure 9a

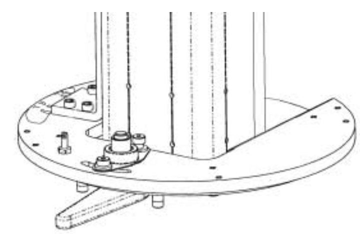


Figure 9b - Lever toward rack

and one on the rear leaving the front of the base clear. Its very important to note the orientation of the columns.

Left and right pod cars are identified by the position of the camera mounting bracket. The mounting bracket is associated with a label as shown in Figure 9a. The label designates the location of the camera frame mounting bracket making it a left or right pod. Position the Pod Car as shown in Figure 9b. The adjustment lever should be pointing toward the rack on both pods

NOTE: Camera assemblies will be attached to the Pod car later.

4. Make sure that the pod cars slide easily, if not, slide adjustment may be required. Slide the pod car to about the mid way point on the tower and snug the locknut on the right side of each pod car to prevent the car from sliding. Do not overtighten.

Left Column Assembly

5. Assemble counter weight, cable to the front, belt to the rear. Make sure the ribbed part of the belt is oriented as in Figure 10. Make sure the cable connections are tight, and jamnuts are installed. Slide the weight-cable assembly into the center of the left tower with the cable to the front and belt to the rear. Do not allow cable and belt to twist. See Figure 10 for assembly detail.

6. Assemble motor drive to top of left tower with cover base using 3 hex cap screws. See Figure 10 for assembly detail.

   A. Remove cable guide/cover (Fig 12)
   B. Route cable over pulley
   C. Route belt over pulley
   D. Mount drive unit/base to tower

7. Mount belt to left pod car in the outer hole with nut and jam nut. See Figure 11.

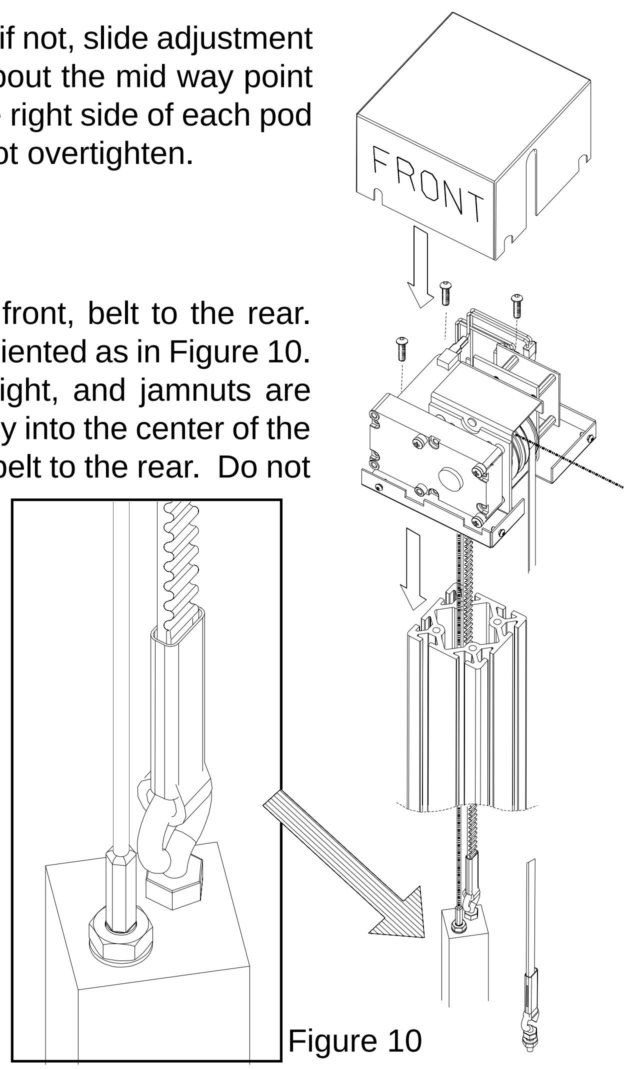


Figure 10

8. Lift column slowly at an angle, allow weight to slide downward to remove slack in belt.

9. Reinstall cable guide so the plastic roller makes light contact with the belt. See Figure 12 for detail.

10. Loosen lock nut, slide left pod car down to put tension on belt if necessary. Snug pod lock nut. DO NOT OVERTIGHTEN!

11. Install control cables onto motor drive unit.

12. Route the motor drive cable through the rear of the pod car and into the tower ribs and secure with the plastic cover. Removal of upper and lower cable strain reliefs are necessary to feed cable through rear of pod. Secure the cable to the tower by snapping the plastic channel cover into one of the grooves over the cable. Replace the upper strain relief. Leave the lower strain relief off for camera cable attachment later.

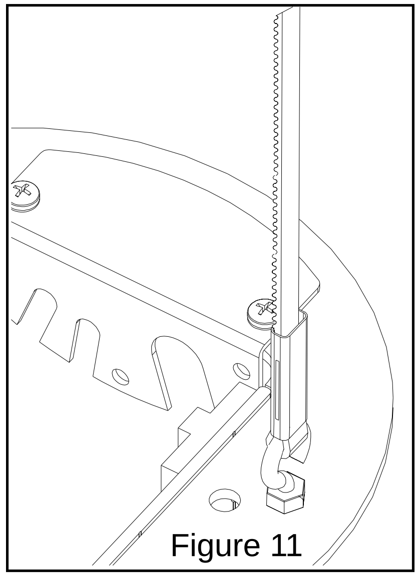


Figure 11

13. Mount motor drive cover as shown in Figure 10. Tighten the pulley shoulder bolts just enough to secure cover. Pulleys should move freely.

14. Place the Left Tower assembly over the anchors set earlier and into the standing position.

15. Using a 2 or 4 foot Level, shim or adjust the column base assembly until column is level. Tighten anchors to 50 ft lbs torque.

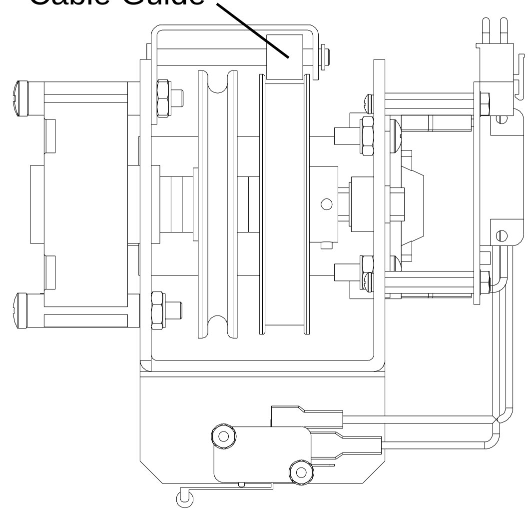


Figure 12 - Cable Guide must be positioned as shown .

Right Column Assembly

16. Screw the eye bolt with jam nut into end of the short counterweight and tighten jam nut.

17. Mount cable to eye bolt, using “U” type cable clamp. Keep end short enough that it will not interfere with inside of tower. See Detail “A” in Figure 14.

18. Drill one 0.25 ~ 0.31 (1/4 ~ 5/16) diameter hole in top of RH pod. See Detail “B” in Figure 14. This to be on inside of tower, opposite from existing cable hole. Remove all machining chips from pod. NOTE: This hole may be predrilled in later models

19. Route counterweight cable through square hole in lower bracket. The flanges of the lower plate should be oriented so they will point up after attaching to the tower.

20. Slide short counterweight into RH tower, and attach lower bracket to top of right column with 5/16-18 cap screws. See Figure 14.

21. Attach pulleys, bolts, and spacers to bracket. Assemble nuts finger tight for now. See Figure 13 for bracket, pulley, and spacer assembly detail.

23. Place main cable over outer pulley. This is the cable from the left tower.

24. Route right short counter weight cable over inner pulley.

25. Route free end of right side counter weight cable through hole in top-left side of pod. With cable through hole in top of pod, install "U" bolt cable clamp about 2 inches from end of cable. The cable is pre-cut to the proper length. See Figure 14.

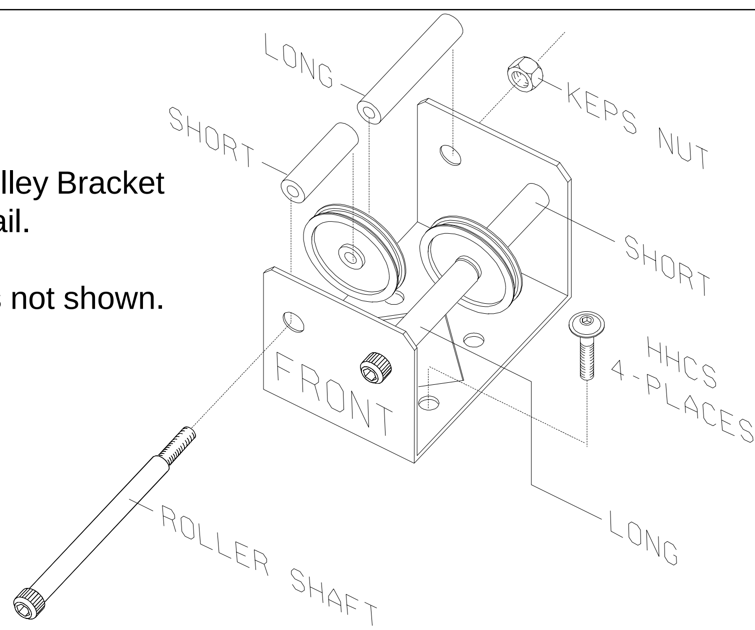
26. Raise right tower into position and anchor into place. Level as required, tighten anchor bolts as directed in step 14.

27. Loosen the pod lock nut, move the right pod car to the same height as the left pod car, lock into place. Trim main cable to this position. Make sure the cable has no slack. Attach main cable through outer hole on right side of pod, secure with cable clamp. See Figure 14.

NOTE: Generally with the cable pulled hand tight, raise the pod 1/2 inch higher than the left side, tie off cable. Release tension on the lock bolts just enough to allow free movement. Let the weight of the car remove any residual slack of the cable, the car should now be even with the left pod car.

Figure 13 - Pulley Bracket assembly detail.

Note: Cable is not shown.



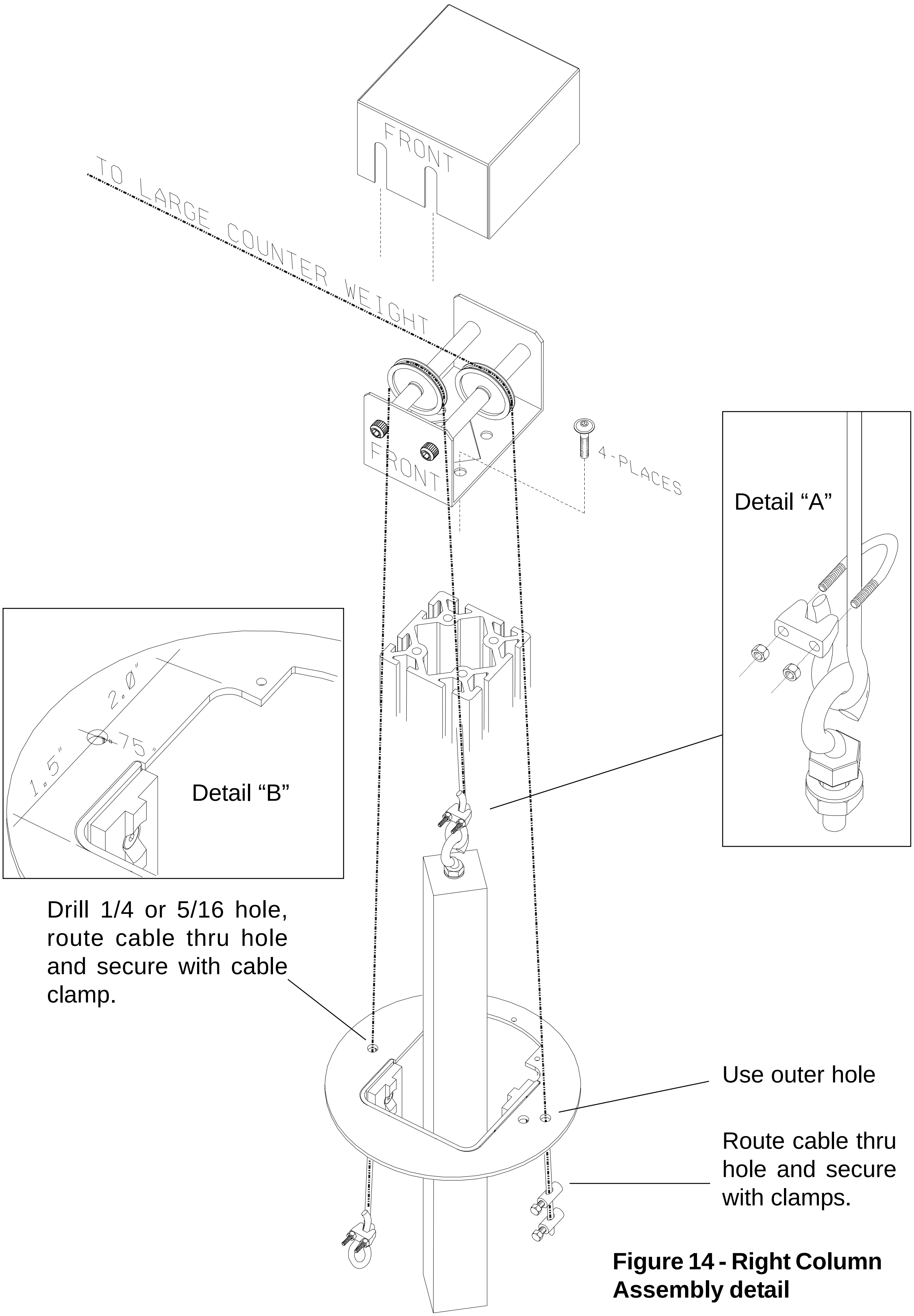


Figure 14 - Right Column Assembly detail

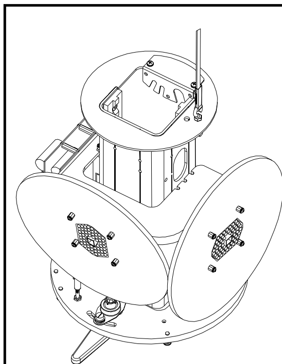
28. Mount the lower limit switch to the front of the left column at 38 inches above the baseplate. This distance is necessary to prevent pinching of the hand or obstacles between the camera and lower shields. The distance between the lower and upper limit switches should be approximately 81-82 inches. Measure this with a tape measure for use later. Mount the travel bumper on the front of the right column at this same height. The distance between travel limiters is:_____________ inches.

7 - Attachment of Cameras

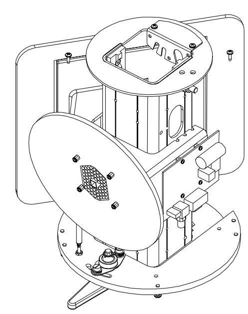
1. The left camera assembly is referred to as the “Cam-cam” while the right side is referred to as the “Cam-Targ”. Camera assemblies are shipped with camera and Pod Car together and un-assembled for shipping protection. The camera assemblies are installed onto the Pod Car after all support tower assembly and transport work is completed. This assures that the camera will be out of harms way until required for setup. See Figure 15.

2. Carefully Attach the “Cam Cam” to the left Pod Car. The cam-cam is secured with two socket head screws located on the left side of the Pod Car. The third screw on the bracket is used to adjust camera vertical aim. Attach the tension spring to the eye screw located on the front edge of the pod car. Secure the top end of the spring to the hole in the lower edge of the camera assembly.

3. Repeat the above steps for the “Cam-Targ” assembly to be mounted to the right Pod Car. The right camera assembly requires the camera chassis to be “maneuvered” from the left toward the Pod car and then moved to the right into position. Do not attempt to force the pieces together. Any deformation of the chassis will void the calibration. Check all mechanical connections before proceeding.



Cam-Cam



Cam-Targ

Figure 15

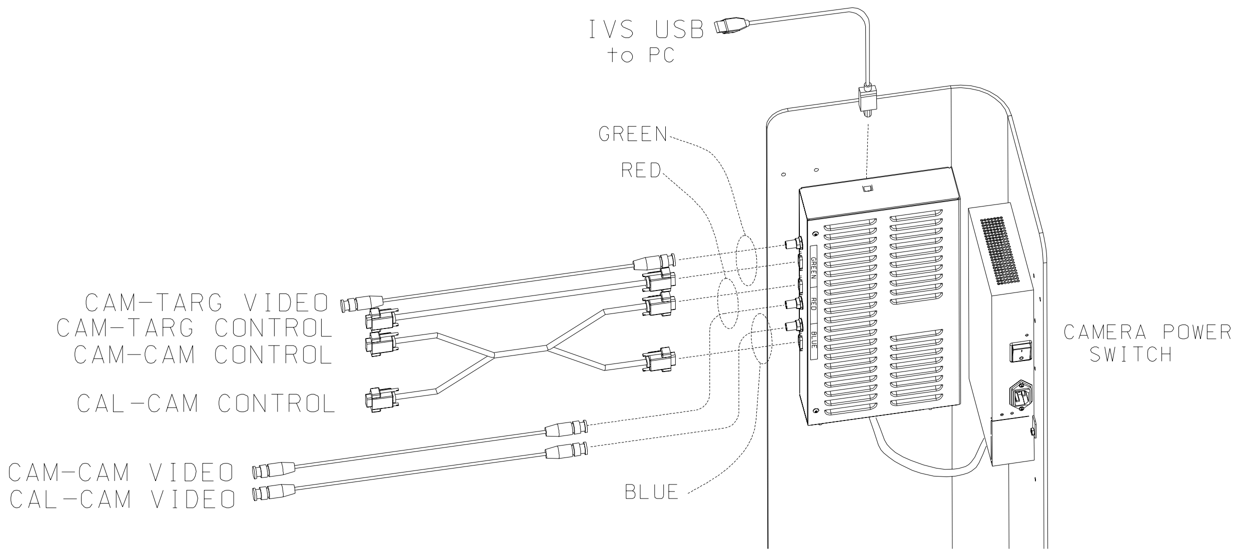


Figure 16

8- Electrical Assembly

1. Locate the power supply and interface box assemblies. Attach the power supply to left rear Base shield using three 6-32 x 3/8 screws and nuts. Refer to Figure 16 for detail.

2. Attach the IVS interface box to the rear left rear base shield using four 6-32 x 3/8 socket head cap screws. Figure 16.

9 - Attach Base Shields

1. Attach column base shields using four 10-32 x 3/8 socket head screws each.

2. Connect support brackets to the shields. There are two support brackets for each set of base shields. Refer to Figure 17, next page, for detail.

10 - Cable Connection

Cam-Cam Pod (left side)

1. Locate the short thick double ended communications cable, and two short Video cables. Install these on the left camera pod by feeding the 3 cables from underneath the Pod and securing with the strain relief bracket. Note, the cable ends intended to connect to the camera have molded strain-reliefs to be used in conjunction with the pod strain relief bracket.

2. After the cables have been secured, attach to the camera PCBs. The PCBs and cables are identified with color bands. Match the bands of the cables to the bands on the PCBs. Likewise the IVS interface box is labeled with color bands. The Left camera PCB is located on the outboard side of the Pod and is identified with a RED band. The Calibration Camera, marked with a BLUE band, uses the PCB on the inside location. Refer to the Illustration in Figure 12 for Left Pod connection orientation.

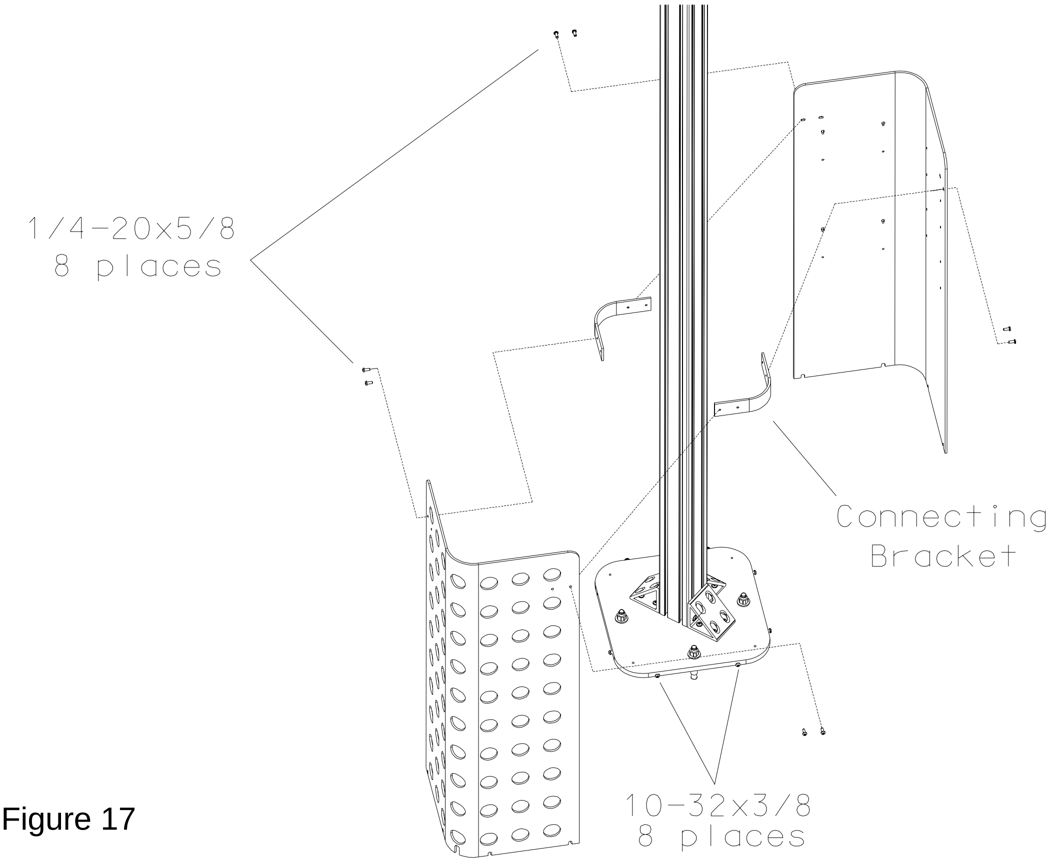


Figure 17

3. Carefully connect cables from Left Camera Pod to the IVS BOX. Note the position of the color bands, match accordingly. Refer to Figure 16 for IVS detail.

Cam-Targ Pod (right side)

1. Locate the long single ended communications cable with the Green band, and one long video cable. Install these on the right camera pod by feeding the 2 cables from underneath the Pod and secure with the strain relief bracket.

2. After the cables have been secured, attach to the camera PCB. The PCB and cables are identified with color bands. Match the bands of the cables to the bands on the PCBs.

3. Carefully connect cables from Camera Pods to the IVS BOX. The IVS interface box is labeled with color bands as is the camera pod PCBs. The Right camera PCB is identified with a green band, the left camera with red and the calibration camera; blue. Refer to Figure 16 for IVS detail.

4. Connect the IVS USB cable to the console PC USB receptacle. See Figure 3 on page 8 for PC connector detail and Figure 16 on page 19 for connecting to IVS box.

5. Connect AC power cable to camera/IVS power supply.
NOTE: Recheck all connections for mechanical and electrical integrity

6. Loosen the Pod Car lock nuts so both cars are suspended on the cables.
IMPORTANT: Loosen the Pod Car lock nuts only enough to allow for free movement, excessive play on the lock screw may cause the free end of the screw to bind in the column guide.

11 - CALIBRATE POD MOTORS

The software needs to know distance traveled each time it searches for the targets. The computer calculates speed by knowing the distance times the length of time while moving. Calibration determines this speed, usually a few inches a second. An accurate distance is required to get an accurate speed. The result of an inaccurate motor calibration may be jerky target search where the motor moves too far each search increment or too little.

Before beginning the calibration process the camera pods must be adjusted to the very bottom or the very top of their travel.

1. From the Main Menu, select the Maintenance tab.
2. From the Maintenance tab, select Aligner Diagnostics.
3. From the Aligner Diagnostic, select Camera View.

NOTE: IT IS NOT NECESSARY THAT THE CAMERAS SEE TARGETS AT THIS TIME.

4. Using the mouse, select Manual Mode, then "Go to the bottom" (Figure 18). The motor should power up and move both cameras to the bottom of their travel (bottom shut-off switch).

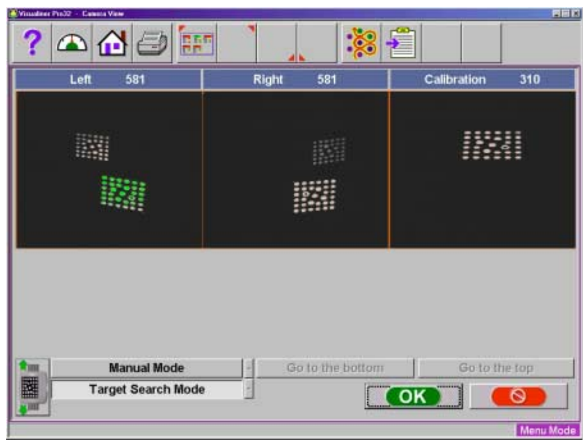


Figure 18

5. Exit by clicking on the "Home" key in the toolbar.
6. From the Main Menu, select the Preference tab.
7. From the Preference tab, select the System Configuration Icon.

8. Make sure that the Imaging System Type is set to Three Cameras. (Figure 19)
9. Check both the "Pod Motors Available" and "Enable Motor Target Search" boxes".
10. Measure the distance between both the upper and lower stop switches and input this into the distance section. See Step 28 page 18 for this recorded value.
11. Using the mouse pointer click on "Calibrate Pod Motors".
12. The pod motor should travel to the upper limit switch and then travel the lower shut-off switch. Pay attention that the cables hanging from the Left Hand camera does not accidentally trip the lower shut-off switch. If this should happen the technician must repeat the "Calibrate Pod Motor" procedure. After the cameras travel the distance the unit should automatically enter both the "Up" and "Down" distance, usually the distance would be a couple of inches a second.

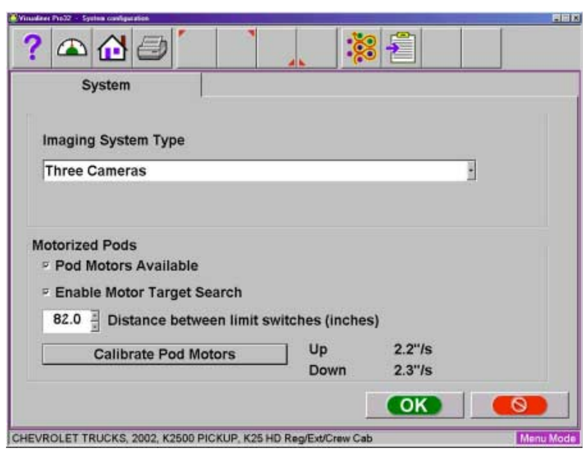
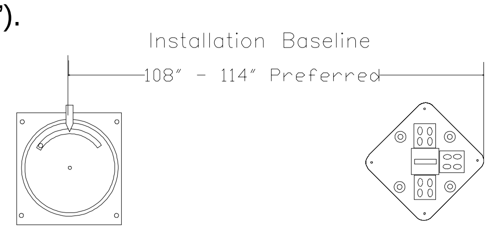


Figure 19

12 - CAMERA AIM PROCEDURES - VERTICAL / HORIZONTAL ADJUSTMENT

1. Set the lift/rack to the normal alignment height and measure the distance from the floor to the turntables and record this value (Turntable Height “A”).



2. Measure the installation baseline, this is the distance from the turntable centerline to the back of the Arago tower base, record this value (Baseline Distance).

3. Using the chart determine the overall camera height and record this value.

Baseline Distance*	Camera Offset Height (B)
If at 90” (min)	22”
If at 100”	24”
If at 110”	26”
If at 120” (max)	28”

*Use the setting closest to actual

(A)	Turntable Height	______	inches
(B)	Camera Offset Height	+ ______	inches
(C)	Overall Camera Height	= ______	inches

4. From the Main Menu, select the Maintenance tab.

5. From the Maintenance tab, select Calibrate.

6. From Calibrate, select Camera Aim.

7. Place the RCP fixture across the front of the rack with the small target on the Right Hand turntable and the large target on the Left Hand turntable, center the fixture on the turntables.

8. Using the Up/Down arrows move the camera pods to the camera height recorded in step 3 (C). This is the distance between the floor and the bottom of the camera pod. Press “OK” to continue. See Figure 20.

9. Make sure that both camera pod rotation levers on the bottom of the cameras are set in the middle of their travel and that the each camera pod starts in a level position. If the cameras are not aligned within the Horizontal lines (Figure 21) adjustments to the camera can be made by adjusting the hex head cap screw on the camera pods. Press “OK” to continue.

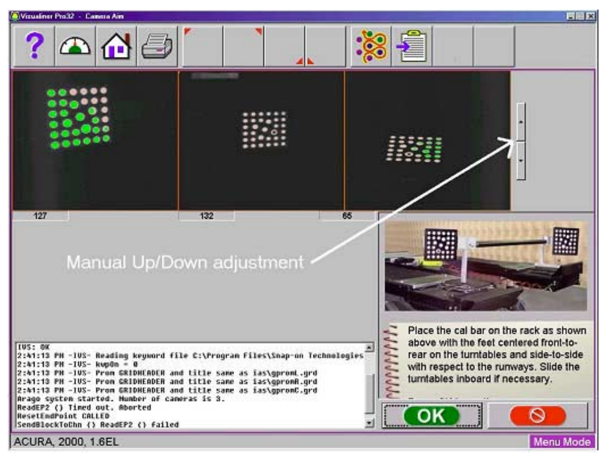


Figure 20

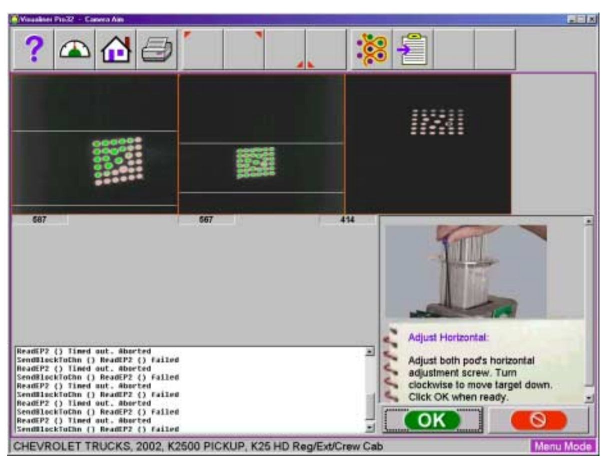


Figure 21

10. Move the RCP fixture back 7 feet, the fixture should be located in front of the rear slip plates. If the targets are not aligned within the vertical lines loosen the vertical aiming bolt, while holding the adjustment lever at the medium position, turn the pods to aim (Figure 22). Tighten the bolt and press "OK" to continue. If the camera aiming procedure was done correctly a message should indicate a successful camera aim and to run the pod rotation position routine.

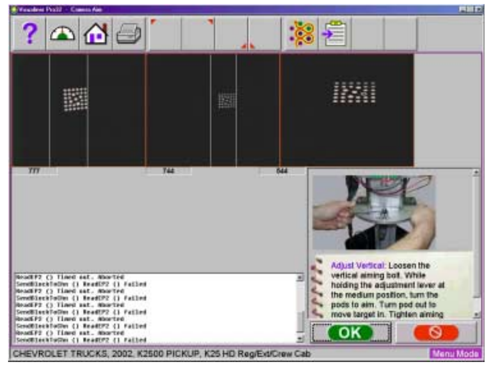


Figure 22

13 - Camera Pod Rotation

In order to optimize the Arago 3 alignment system, the cameras have been mounted on a swivel pod assembly. This swivel pod allows the right and left cameras to rotate horizontally to see the targets in all fields of views (Narrow, Normal and Wide). The Arago 3 does not require initial RCP because the third camera maintains constant calibration.

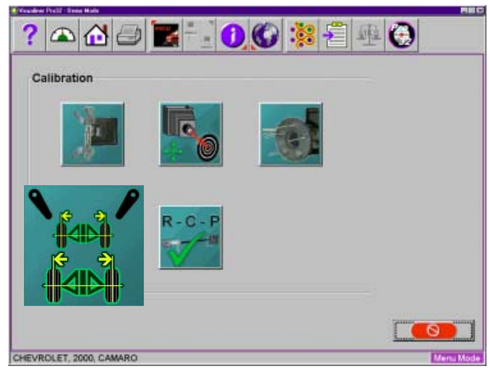


Figure 23

The System does however need to know what is narrow, normal and wide. The following steps should be followed to complete system setup in preparation for use. In this step the system is looking at the calibration target only.

1. From the calibration icon single click on the "Camera Pod Rotation" icon. (Figure 23)

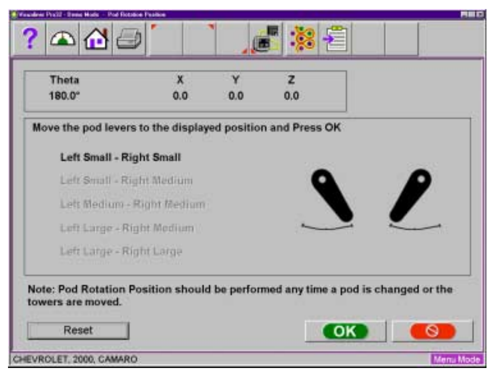


Figure 24

2. Adjust the camera lever's to the illustrated position shown on the screen and click on **<OK>**. (Figure 24)

3. After clicking on "OK" as indicated in step 2, the camera rotation levers change positions. Move the camera levers to the position shown and click on **<OK>**. (Figure 25)

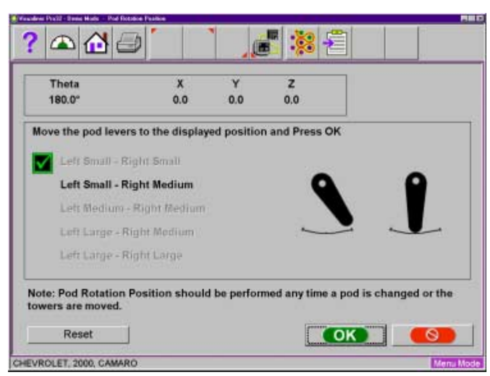


Figure 25

4. Continue the process until all camera positions have been checked. After the final rotation lever has been checked click on the **<Cancel>** button to exit. (Figure 26)

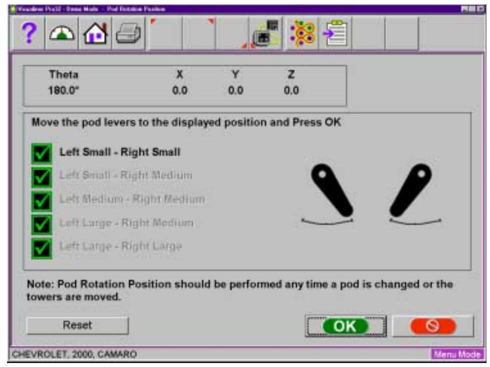


Figure 26

NOTE: ***IF A MISTAKE IS MADE DURING THE TEACHING PROCESS, THE OPERATOR CAN SIMPLY CLICK ON THE RESET BUTTON TO CLEAR THE LEARNING PROCESS AND START AT THE BEGINNING.***

14 - Finalizing the Installation

1. Place protective floor covers over harnesses to prevent damage from traffic. Covers can be secured with 1/4" anchors or with adhesive sealer.
2. Attach the foam shields to the camera Strobe boards using the screws and washers pre-attached to the boards. See Figure 15 on page 18 for illustration.
3. Attach the protective covers to both pod assemblies. Covers are secured with 4 screws on the bottom and 2 on the top. See Figure 27 for detail. Covers should not bind the pod at any point.
4. Inspect all connections for proper contact both mechanical and electrical.
5. Make sure cable covers are in place and are properly installed
6. Refer to Figure 18 on page 21, select "Target Search Mode". Raise and lower the lift several times and make sure the system operates as intended.
7. Perform an alignment, preferably with a vehicle of known integrity, verify results. Refer to service instructions to address any discrepancies incurred at this point.

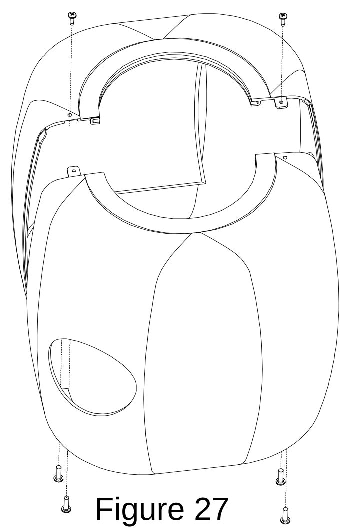


Figure 27

NOTE: Target ID is not required upon installation. ID is performed at the factory during the final assembly and performance evaluation prior to shipping. However, if a target is replaced or serviced for some reason, ID should be performed on that assembly.

Final Checkout - check that pods travel up and down reliably. Test to see how much force is required to raise pod and again to pull pod lower. Force should be about the same in either direction, and should be about 5 pounds or more.

Insure that pod cars are not dragging on the towers: Inspect for burrs on towers. Burnish the towers, by installing pod on tower before it is erected, and sliding repeatably with side force in various directions, until pods slide freely on towers. If binding persists, file the plastic guides. Pods should slide down towers when one end is on floor and other end is resting on lower guard. Only a slight push should start the pod down the slope.

Lubricate the pulleys only if necessary with dry graphite or teflon. Do not lubricant, grease or oil the pod slides.

15 - System training

Spend time with our new customer going over the software flow and operation of his new system. A few minutes here will save hours later for both you and the technician. Things to cover are outlined but not limited to the items below:

- ⇨ System features and specifications
- ⇨ Proper system start-up and shut down
- ⇨ Windows operation (if he has a desktop mode activated)
- ⇨ Software navigation
- ⇨ Setup, system interaction, preferences, features
- ⇨ Using Wizards
- ⇨ Perform an alignment
- ⇨ Navigation of the Arago 3™ Pro32 software features

USA
John Bean
309 Exchange Avenue
Conway, Arkansas 72032
Tel.: (800) 362-8326 or (501) 450-1500
Fax: (501) 450-1585

FRANCE
John Bean
Snap-On Equipment France
Z.A. Du Vert Galant
15, rue de la Guivernone
BP 7175
95310 Saint Ouen L'Aumone
Tel: (33) 1-3448-5878
Fax: (33) 1-3448-5879

UNITED KINGDOM
Snap-On Equipment Ltd.
John Bean Equipment Group
Old Medow Road
Kings Lynn
Norfork
PE30 4WJ

CANADA
John Bean
6500 Millcreek Drive
Mississauga, Ontario
Canada L5N 2W6
Tel: (905) 814-0114
Fax: (905) 814-0110

JBC GERMANY
Geschaeftsbereich der Snap-on Equipment GmbH
Werner-von-Siemens-Str. 2
D-63419 Pfungstadt
Deutschland
Tel: +49 (0) 6157 12 600
Fax: +49 (0) 6157 12 601

LATIN AMERICA
Snap-on Tools International, Ltd.
2801 80th Street
Kenosha, WI 53143
Tel: (262) 656-5003
Fax: (414) 656-1403

TEEWA533A

5838-4....03/07/2003..wdc... © copyright Snap-on Technologies 2002-2003 Printed in the USA

EQUIPMENT SERVICE ON SITE

EquiServ®

Providing Factory Service For
Automotive Service Equipment

355 Exchange Avenue
Conway, AR 72032

  Printed in U.S.A.