OPERATION INSTRUCTIONS

Form 5829-T, 02-10
Supersedes Form 5829-T, 07-09

ForceMatch® HD / GSP9600HD Series

GSP9620HD

Heavy-Duty Wheel Balancers

With SmartWeight® Balancing Technology

Software Version 3.1

HUNTER Engineering Company

OWNER INFORMATION

Model Number____
Software Version Number ____
Serial Number ____
Date Installed ____
Service and Parts Representative____
Phone Number ____
Sales Representative ____
Phone Number ____

Concept and Procedure Training Checklist

	Trained	Declined
Safety Precautions	☐	☐
Autostart		
Servo-Stop		
Maintenance & Calibration	☐	☐
Cleaning, Lubrication, and Maintenance of Adaptors, Hub, and Shaft		
Calibrating the Balancer		
Calibrating the Load Roller and Dataset Arms		
Calibrating the Inflation Station		
Mounting the Wheel/Tire Assembly	☐	☐
Verifying Mounting Repeatability with Centering Check Feature		
Cone Mounting		
Pressure Ring and Spacers		
Flange Plate and Cone Mounting		
Wheel Balancing	☐	☐
SmartWeight®		
Standard		
Mixed Weights		
Adhesive Weights with Auto Dataset® Arms		
Split-Spoke®		
RimScan		
Patch Balancing with Auto Dataset® Arms (optional)		
TPMS		
Do's and Don'ts of Wheel Balancing	☐	☐
Loaded Runout Measurement and ForceMatching®	☐	☐
Adjusting P/SUV/LT Limits	☐	☐
Assembly Measurements		
Applying Previous Wheel Measurements		
Applying Previous Tire Measurements		
Wheel Measurement with Dataset Arms		
Tire Installed		
Bare Rim		
Matching Without Rim Runout		
Loaded Runout Measurement First Harmonic Diagnosis Screen	☐	☐
"Current ForceMatch® Measurements"		

HUNTER Engineering Company

Do's and Don'ts of Loaded Runout Measurement ☐ ☐

Individuals and Date Trained

______________________________ ______________________________
______________________________ ______________________________
______________________________ ______________________________
______________________________ ______________________________
______________________________ ______________________________
______________________________ ______________________________

CONTENTS

1. Getting Started

1.1 Introduction

The ForceMatch® HD / GSP9600HD wheel balancers are LCD based. The ForceMatch® HD / GSP9600HD ForceMatch® is a wheel balancer with the added capabilities of measuring tire/wheel runout.

The ForceMatch® HD / GSP9600HD ForceMatch® balancer includes a unique "load roller" which applies up to 300 pounds of force against the rotating assembly. The roller measures the loaded runout of the assembly. The ForceMatch® HD / GSP9600HD technology eliminates many of the time consuming, subjective, and often non-productive manual measurements previously used to diagnose and repair ride disturbance concerns. The operation of this diagnostic tool is discussed later in this manual.

This manual provides operation instructions and information required to operate the ForceMatch® HD / GSP9600HD. Read and become familiar with the contents of this manual prior to operating the ForceMatch® HD / GSP9600HD.

The owner of the ForceMatch® HD / GSP9600HD is solely responsible for arranging technical training. The ForceMatch® HD / GSP9600HD is to be operated only by a qualified trained technician. Maintaining records of personnel trained is solely the responsibility of the owner and management.

"References"

This manual assumes that you are already familiar with the basics of tire balancing. The first section provides the basic information needed to operate the ForceMatch® HD / GSP9600HD. The following sections contain detailed information about equipment operation and procedures. *"Italics"* are used to refer to specific parts of this manual that provide additional information or explanation. For example, *refer to "Equipment Components," page 13.* These references should be read for additional information to the instructions being presented.

1.2 For Your Safety

Hazard Definitions

Watch for these symbols:

⚠ **CAUTION:**	Hazards or unsafe practices, which could result in minor personal injury or product or property damage.

⚠ **WARNING:**	**Hazards or unsafe practices, which could result in severe personal injury or death.**

⚠ **DANGER:**	**Immediate hazards, which will result in severe personal injury or death.**

These symbols identify situations that could be detrimental to your safety and/or cause equipment damage.

IMPORTANT SAFETY INSTRUCTIONS

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

Read all instructions before operating the ForceMatch® HD / GSP9600HD.

Read and follow the instructions and warnings provided in the service, operation and specification documents of the products with which this ForceMatch® HD / GSP9600HD is used (i.e., automobile manufacturers, tire manufacturers etc.).

Do not operate equipment with a damaged cord or equipment that has been dropped or damaged until a Hunter Service Representative has examined it.

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.

If an extension cord is necessary, a cord with a current rating equal to or more than that of the equipment 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.

Verify that the electrical supply circuit and the receptacle are properly grounded.

To reduce the risk of electrical shock, do not use on wet surfaces or expose to rain.

Verify the appropriate electrical supply circuit is the same voltage and amperage ratings as marked on the balancer before operating.

⚠ **WARNING:**	**DO NOT ALTER THE ELECTRICAL PLUG. Plugging the electrical plug into an unsuitable supply circuit will damage the equipment and may result in personal injury.**

To reduce the risk of fire, do not operate equipment near open containers of flammable liquids (gasoline).

Read and follow all caution and warning labels affixed to your equipment and tools. Misuse of this equipment can cause personal injury and shorten the life of the balancer.

Keep all instructions permanently with the unit.

Keep all decals, labels, and notices clean and visible.

To prevent accidents and/or damage to the balancer, use only Hunter ForceMatch® HD / GSP9600 Series Vibration Control System recommended accessories.

Use equipment only as described in this manual.

Never stand on the balancer.

Wear non-slip safety footwear when operating the balancer.

Keep hair, loose clothing, neckties, jewelry, fingers, and all parts of body away from all moving parts.

Do not place any tools, weights, or other objects on the safety hood while operating the balancer.

ALWAYS WEAR OSHA APPROVED SAFETY GLASSES. Eyeglasses that have only impact resistant lenses are NOT safety glasses.

Keep the safety hood and its safety interlock system in good working order.

Verify that the wheel is mounted properly and that the wing nut is firmly tightened before spinning the wheel.

The safety hood must be closed before pressing the green “START” key, located on the right front corner of the console, to spin the wheel.

Hood Autostart will cause the balancer shaft to spin automatically upon hood closure. For the next Autostart, the safety hood has to be lifted to the full up position and then closed.

Raise safety hood only after wheel has come to a complete stop. If safety hood is raised before the spin is completed, the weight values will not be displayed.

Do not let cord hang over any edge or contact fan blades or hot manifolds.

The red “STOP” key, located on the right front corner of the LCD support, can be used for emergency stops.

⚠ DANGER: **Never reach under the hood while the balancer is performing a runout measurement or balance spin.**

SAVE THESE INSTRUCTIONS.

Wheel and Tire Weight Specifications

The following wheel and tire combination must not be exceeded:

500 lbs. (227 kg) - 52 inch diameter (1321 mm)

Electrical

The ForceMatch® HD / GSP9600HD is manufactured to operate at a specific voltage and amperage rating.

Make sure that the appropriate electrical supply circuit is of the same voltage and amperage ratings as marked on the balancer.

⚠ WARNING: **DO NOT ALTER THE ELECTRICAL PLUG. Plugging the electrical plug into an unsuitable supply circuit will damage the equipment.**

Make sure that the electrical supply circuit and the appropriate receptacle is installed with proper grounding.

To prevent the possibility of electrical shock injury or damage to the equipment when servicing the balancer, power must be disconnected by removing the power cord from the electrical power outlet.

After servicing, be sure the balancer ON/OFF switch is in the “O” (off) position before plugging the power cord into the electrical power outlet.

This device is rated as Class A for radiated emissions.

In the event of radio interference, the display read out may flicker - this is normal.

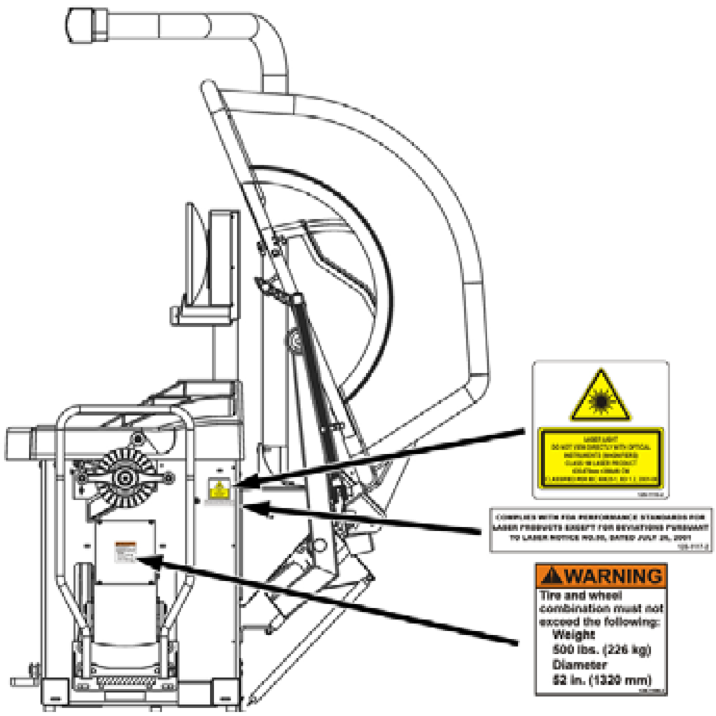
Decal Information and Placement

Right Side View

Decal 128-1196-2 gives the maximum wheel diameter and maximum wheel weight for the ForceMatch® HD / GSP9600HD.

Decal 128-1116-2 warns the user not to view the laser light with optical instruments.

Decal 128-1117-2 shows the FDA performance standards compliance.

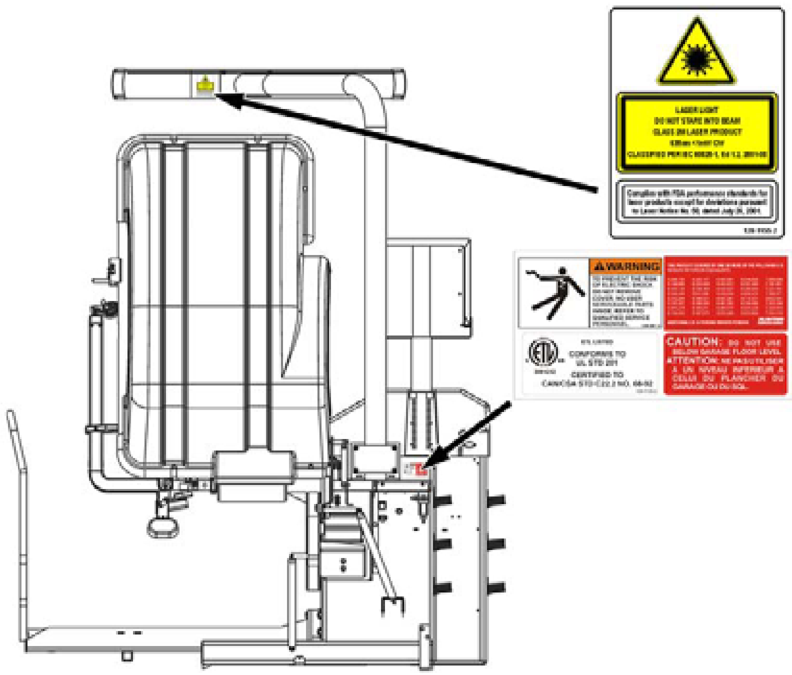


Back View

Decal 128-381-2 warns the user not to remove the cover of the ForceMatch® HD / GSP9600HD because of the risk of electrical shock and not to use below garage floor level.

Decal 128-1120-2 informs the user that the equipment is ETL listed.

Decal 128-1155-2 warns the user not to view the laser light with optical instruments.



Specific Precautions/Power Source

The ForceMatch® HD / GSP9600HD is intended to operate from a power source that will apply 230 volts (208 - 240), 1 phase, 50/60 Hz between the supply conductors of the power cord. The power cord supplied utilizes a twist lock connector, NEMA L6-20P. This machine must be connected to a 20 amp branch circuit. Please refer all power source issues to a certified electrician. *Refer to "Installation Instructions for ForceMatch® HD / GSP9600HD LCD and GSP9600HD ForceMatch Wheel Balancers," Form 5711T.*

> ⚠ **CAUTION:** A protective ground connection, through the grounding conductor in the power cord, is essential for safe operation. Use only a power cord that is in good condition.

For information on converting from single phase NEMA L6-20P plug to thee phase NEMA L15-20P plug *refer to Form 5350T, "NEMA L6-20P to NEMA L15-20P Power Plug Conversion Instructions."*

Specific Precautions/BDC Laser Indicator

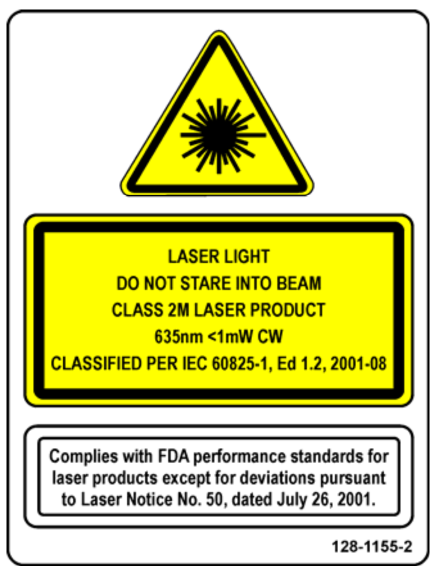
The BDC (Bottom Dead Center) Laser Indicator is a class 1M laser designed to aid in applying adhesive weights. The laser is not a field serviceable or adjustable part.

Use caution in regard to reflective materials around the laser and never look into the laser beam

Specific Precautions/TDC Laser Indicator

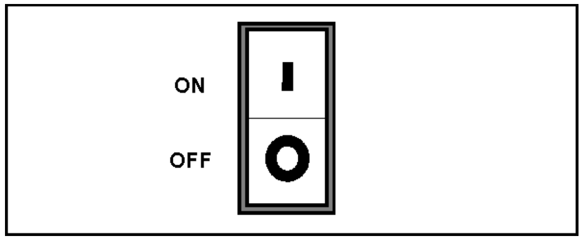
The TDC (Top Dead Center) Laser Indicator is a class 2M laser designed to aid in applying adhesive weights. The laser is not a field serviceable or adjustable part.

Use caution in regard to reflective materials around the laser and never look into the laser beam.



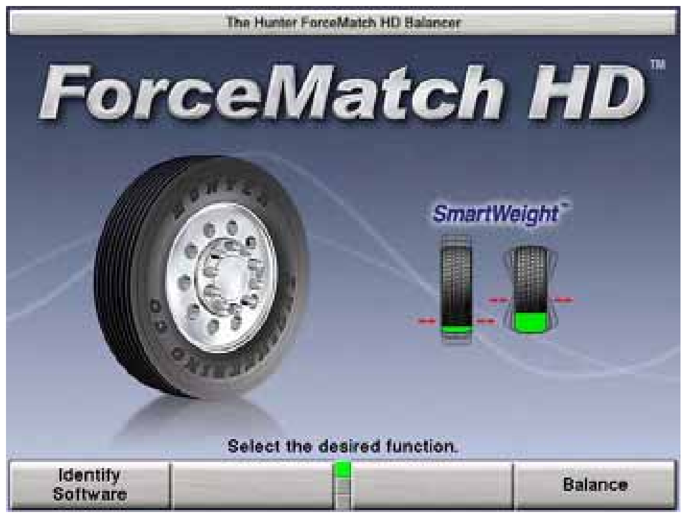
Turning Power ON/OFF

The ON/OFF switch is located on the back of the balancer cabinet. To turn the balancer "ON," press the "I" side of the ON/OFF switch. To turn the balancer "OFF," press the "O" side of the ON/OFF switch.



The system requires only a few seconds to "boot up." During "boot up," the system will generate a high-pitched tone until the software is loaded and running.

After the ForceMatch® HD / GSP9600HD performs a self-check, the "Logo" screen will appear indicating the unit is ready for use.



Equipment Installation and Service

A factory-authorized representative should perform installation.

This equipment contains no user serviceable parts. All repairs must be referred to a qualified Hunter Service Representative.

NOTE:	To replace program cartridge, refer to "Program Cartridge Removal and Installation," page 103.

Equipment Specifications

Electrical

Voltage:	230VAC +10% / -15%, 1 phase, 50/60 Hz, *power cable includes* NEMA 20 amp plug, L6-20P
Amperage:	3 amperes
Wattage:	3450 watts (peak)

Air

Air Pressure Requirements:	100-175 PSI (6.9-12.0 bar)
Approximate Air Consumption:	4 CFM (110 Liters/Minute)

Atmospherics

Temperature:	+32°F to +122°F (0°C to +50°C)
Relative Humidity:	Up to 95% Non-condensing
Altitude:	Up to 6000 ft. (1829 m)

Sound Pressure Level

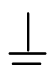
Equivalent continuous A-weighted sound pressure at operator's position does not exceed 70 dB (A).

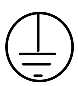
Safety Summary

Explanation of Symbols

These symbols may appear on the equipment.

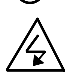
 Alternating current.

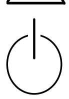
 Earth ground terminal.

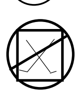
 Protective conductor terminal.

I ON (supply) condition.

 OFF (supply) condition.

 Risk of electrical shock.

 Stand-by switch.

 Not intended for connection to public telecommunications network.

1.3 Equipment Components

ForceMatch® HD / GSP9600HD
ForceMatch® Balancer

Accessories

Kit 20-2260-1

A.	76-433-1	Steel Wing Nut
B.	223-68-1	Pressure Ring – Polymer
C.	65-72-2	Balancer Calibration Weight
D.	46-320-2	Spacer – Polymer
E.	175-353-1	4.5” O.D. Polymer Cup
F.	106-82-2	Sleeve, Scratch Guard
G.	221-589-2	Weight Hammer – Passenger and LT
H.	221-695-2	Weight Hammer – Heavy-Duty
I.	221-659-2	Adhesive Weight Scraper
J.	25-166-2	Alcoa 000700 Rim Wear Gauge
K.	106-162-2	A-1339 22mm Sleeves
L.	106-163-2	A-1573 22mm Sleeves
M.	106-164-2	A-1778-TN 22mm Sleeves
N.	221-694-2	X-1775-WB Wire Brush

NOTE:	Hunter wheel balancers do not include a standardized set of mounting adaptors.

For optional accessories, *refer to Wheel Balancer Brochure, Form 3203T.*

1.4 Operating the Console

Using Softkeys

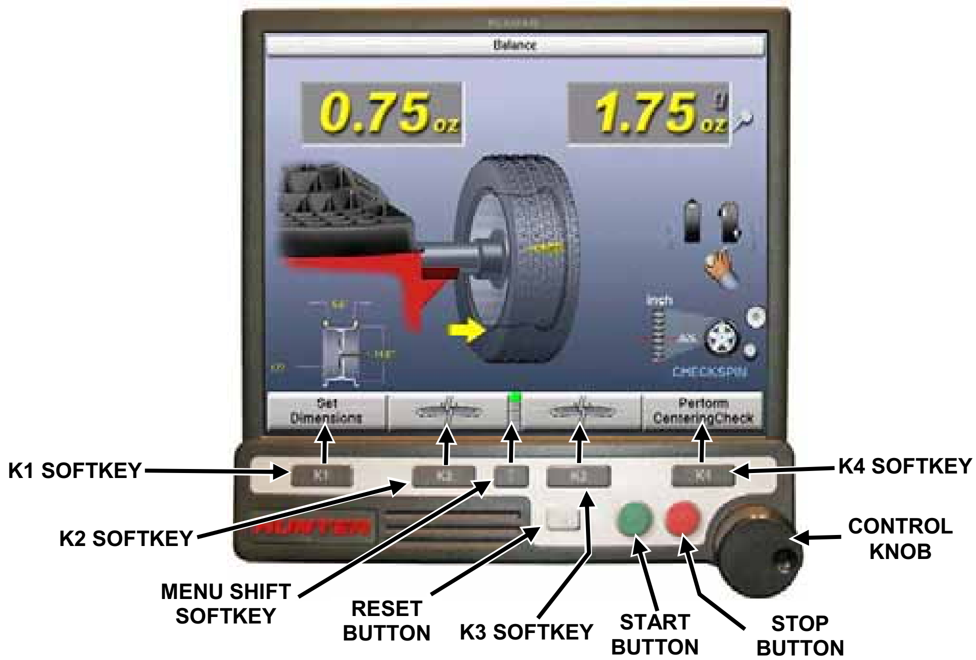
The “softkeys,” located on the LCD support console directly beneath the LCD, provide operator control of the balancer.

The four menu labels that appear at the bottom of each video screen are referred to as the “softkey labels.” Each label indicates the action that the program takes when the corresponding K1, K2, K3, or K4 key is pressed.

The display between the “K2” and “K3” labels indicates how many rows of labels are available. Most screens have only one or two rows, however more rows are possible. The green box indicates the row that is currently displayed.

The menu row is changed by pressing the menu shift key, . When this key is pressed, the menu labels change to the next row down. If the last row is currently displayed, the menu labels change to the first row.

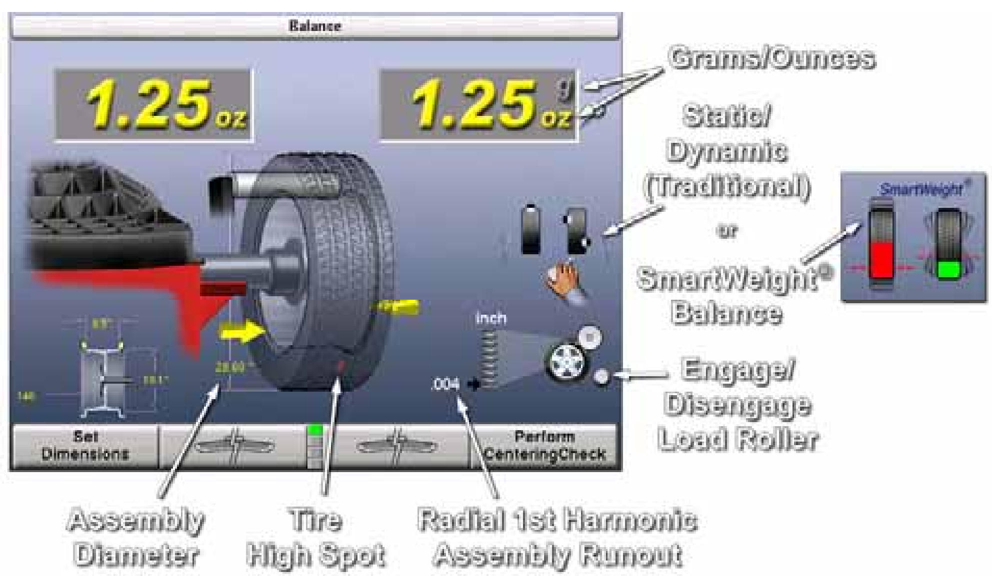
Throughout this manual, the statement press “nnnnnnn” means press the softkey with the label “nnnnnnn.” If the required label is not on the current menu, press  to change rows until the desired label is displayed.



Using Control Knob

The control knob is located to the right of the softkeys. The control knob accesses the on-screen switches and manually inputs data. The available on-screen switches are dependent upon the setup configuration of the balancer.

Pushing in on the control knob cycles through the available on-screen switches on the current primary screen. The “selected” switch is the one showing the hand or in the case of SmartWeight, the text is highlighted. Rotating the control knob clockwise or counter-clockwise changes the setting for the selected on-screen switch.



The control knob can also be used to switch between SmartWeight and traditional balancing, as long as both traditional and SmartWeight modes are enabled in setup. Press the knob until the SmartWeight is highlighted or the hand appears on the static/dynamic switch. Next, press and hold the control knob until the opposite balance mode icon appears.

NOTE:	If SmartWeight mode is enabled, the balancer will always return to SmartWeight balancing upon dimension entry or a reset.

Resetting the Program

The wheel balancing program may be reset at anytime by using the **R** key, located on the LCD support console directly beneath the LCD. To reset the balancer, press the reset key twice within a four-second period without pressing any other keys in-between. This prevents a single accidental keystroke from resetting the system.

When the balancer is reset, the information collected for the wheel balance in progress is erased and the display returns to the “Logo” screen.

2. Balancing Overview

2.1 Balancing Modes

SmartWeight™ Balancing Technology

SmartWeight™ balancing technology is a method of analyzing forces on a wheel during balancing. This results in less weight used, and less time balancing tires.

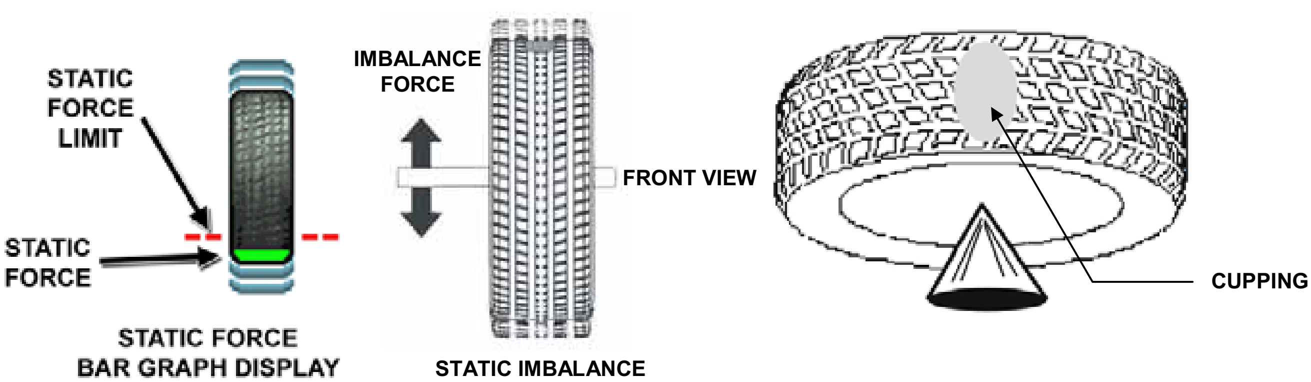
SmartWeight is not a procedure. Instead, it measures the forces of side-to-side shimmy and up-and-down shake and computes weight to reduce these forces. This reduces the amount of weight, reduces time, reduces check spins and chasing weights, and saves the shop time and money.

SmartWeight can reduce the number of steps in the balancing process.

Balancing Theory

Static Imbalance

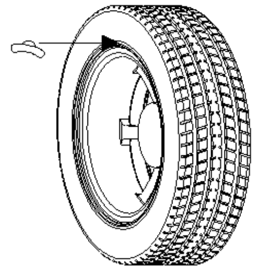
As the word static implies, the tire will be balanced when at rest. For example, if an unmoving assembly was centered on a cone and was balanced, it would be statically balanced. A “bubble balancer” is designed to statically balance a tire/wheel assembly.



Static imbalance is where there is one amount of weight located in the center of the tire/wheel assembly causing an imbalance. As the weight rotates, centrifugal forces are created causing the wheel to lift as the weight reaches top dead center. This lifting motion causes the tire/wheel assembly to move “up and down” creating a bounce to be felt. This static imbalance condition is evident by a “jiggle” or up-down movement of the steering wheel. These vibrations may also be apparent in the body, with or without steering wheel shake.

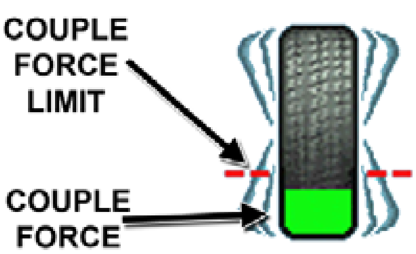
A statically imbalanced tire driven for an extended period may cause “cupping” in the tire’s tread, create vibration, and adversely effect handling.

Static balancing alone is a seldom-recommended procedure. For example, a single weight is commonly placed on the inner clip weight position for cosmetic purposes. This is not a recommended practice and usually insures the assembly is not properly dynamically balanced. The assembly may then experience side-to-side imbalance while in motion, causing a shimmy condition and objectionable vibration.

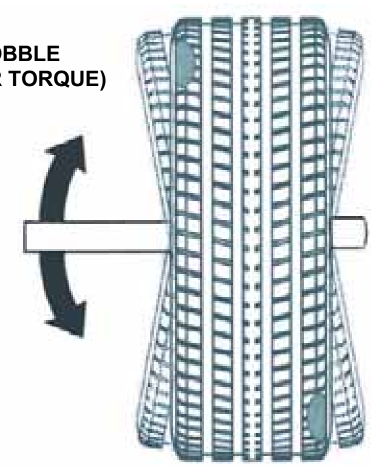


Couple Imbalance

In general terms, dynamic imbalance is defined as where one or more locations of the tire/wheel assembly are heavier causing an imbalance force and/or an imbalance wobble. Shown below is a tire/wheel assembly with two heavy spots of equal weight which are located 180 degrees from each other on opposite sides. As this assembly rotates, centrifugal forces cause a large imbalance wobble to be created, but the imbalance force (as well as the static imbalance) will be zero. A wheel with this condition will cause a wobble or shimmy to be felt in the steering wheel. Excessive dynamic imbalance of this type creates a shimmy that transfers through the suspension components to the occupants of the vehicle, especially at higher speeds.



COUPLE FORCE BAR GRAPH DISPLAY

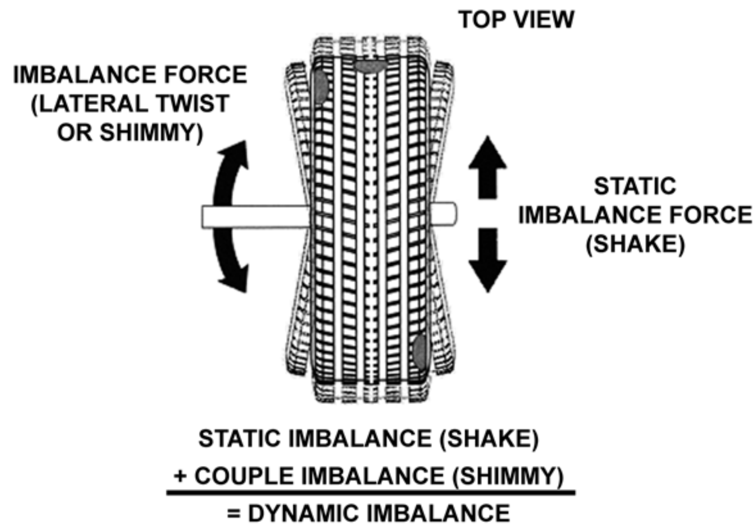


ZERO STATIC IMBALANCE WITH LARGE COUPLE IMBALANCE

Modern “dynamic” balancers spin the wheel in order to measure both the up and down imbalance force and the wobble or shimmy related imbalance (side-to-side).

Dynamic balancers direct the operator to place correction weights on the inside and outside correction locations of the rim so that both imbalance shake (static) and imbalance wobble (couple) will be eliminated.

NOTE:	SmartWeight balancing may utilize a single weight placement to balance out shake and shimmy forces.



Static and Dynamic Imbalance Sensitivity

As a general rule of thumb, to achieve the best balance on an automotive sized tire and wheel assembly (15”):

Residual static imbalance should be less than 1/4 ounce.

Residual couple imbalance should be less than 3/4 ounce.

Residual couple imbalance is preferred over remaining static imbalance.

It takes much more residual couple imbalance to cause a vibration than the same amount of static imbalance.

The larger the diameter used for weight placement, the smaller the amount of correction weight is required.

The wider the distance between the two weight placement locations, the smaller the amount of correction weight is required.

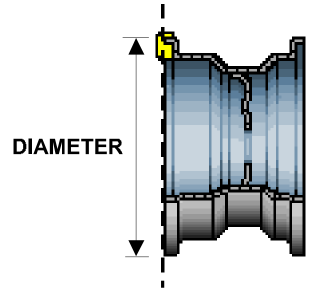
If static balance is the only option, always verify that the remaining couple residual imbalance is within acceptable tolerance.

NOTE:	SmartWeight balancing performs this check automatically.

For detailed information on adjustment and setup of modes of wheel balancing sensitivity see section 5.1 and section 6.3.

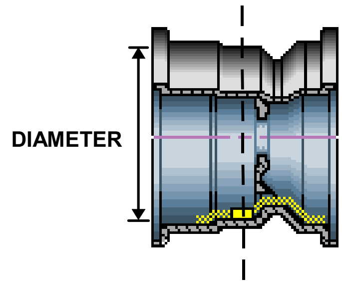
2.2 Identifying the Static Balance Weight Plane

In "STANDARD BALANCE" mode, using only a clip-on weight, the plane is input as follows:



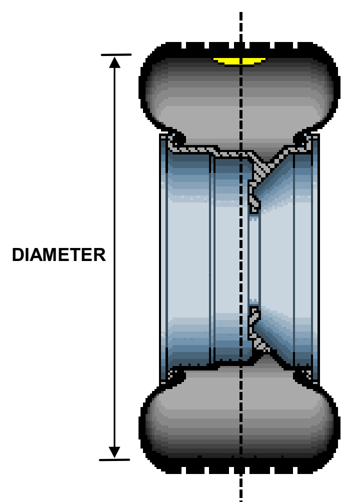
For static balancing, it is recommended that you place half of the correctional weight value on each side of the tire to reduce residual dynamic imbalance.

In "MIXED WEIGHTS BALANCE" mode and "ADHESIVE WEIGHTS BALANCE" mode, using an adhesive weight, the plane is input as follows:



For static balancing, it is recommended that the adhesive weight be placed as close to the center of the wheel as possible to reduce residual dynamic imbalance.

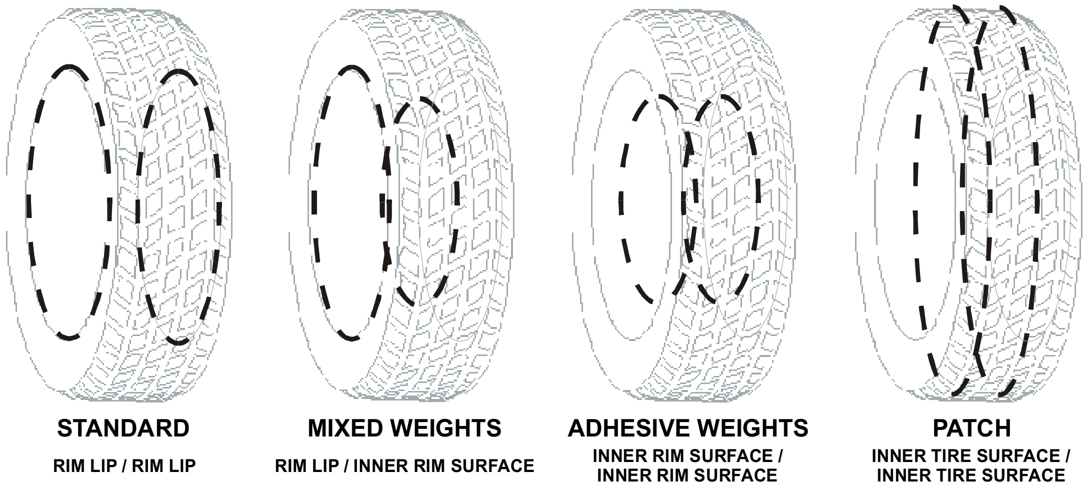
In "PATCH BALANCE" mode, using a patch weight, the plane is input as follows:



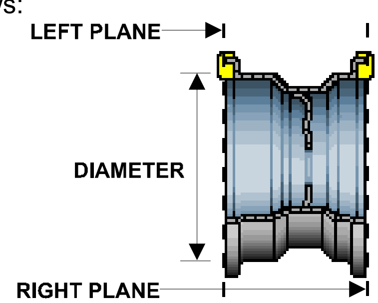
For static balancing, it is recommended that the patch weight be placed as close to the center of the tread as possible to reduce residual dynamic imbalance.

2.3 Identifying the Dynamic Balance Weight Planes

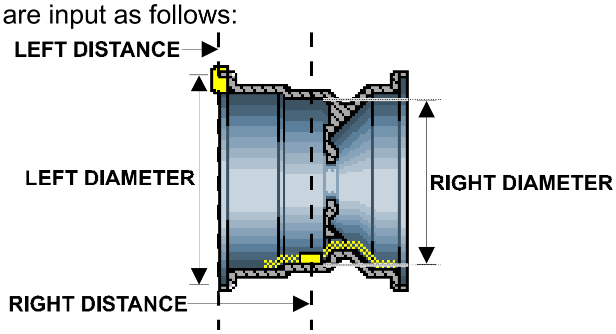
The balancer must know the location of the two weight circle planes for placement of correction weights on the wheel assembly. Each plane is described by a distance from the balancer and a diameter.



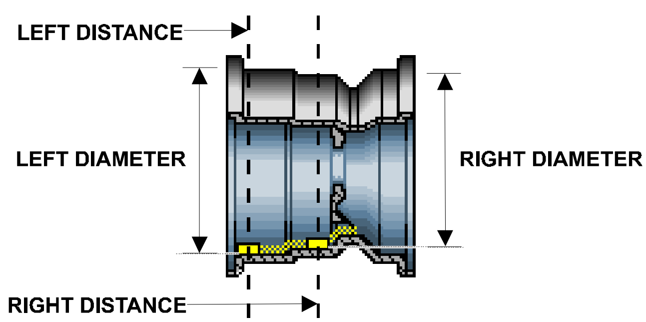
In “STANDARD BALANCE” mode, using only clip-on weights, left and right planes are input as follows:



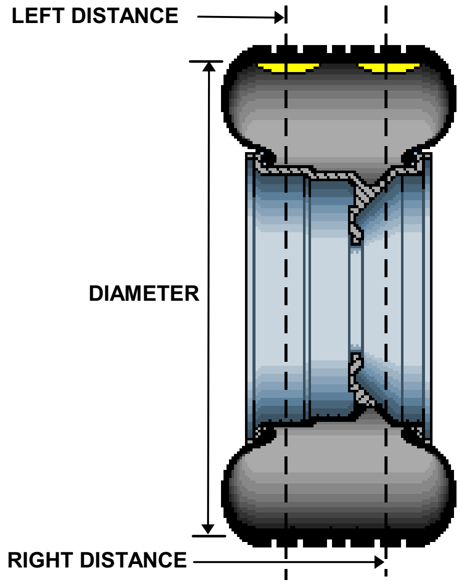
In “MIXED WEIGHTS BALANCE” mode, using clip-on and adhesive weights, the left and right planes are input as follows:



In “ADHESIVE WEIGHTS BALANCE” mode, left and right planes are input as follows:



In “PATCH BALANCE” mode, using patch weights, left and right planes are input as follows:



2.4 SmartWeight® Dynamic Weight Planes

SmartWeight requires the operator to enter two weight planes. This balancing method will automatically determine if one or both weight planes require a weight to be added. This eliminates “blinded” static single plane balancing, which alone may not be sufficient to solve vibration issues.

2.5 Loaded Runout Measurement

Loaded runout measurement is new to the automotive and heavy-duty truck industry. Loaded runout measurement can be used to solve eccentricity related tire and wheel vibration.

With recent changes in vehicle sensitivity and increasing ride quality expectations, wheel balancing alone may not be sufficient to eliminate the tire/wheel assembly as a vibration source. The ForceMatch® HD / GSP9600HD is a measuring tool that automatically detects possible vibration sources in a tire/wheel assembly that cannot be identified by traditional balancing methods. As a runout measurement tool, the ForceMatch® HD / GSP9600HD significantly reduces troubleshooting time, and offers improved ride quality.

The load roller on the ForceMatch® HD / GSP9600HD ForceMatch® balancer measures the tire/wheel assembly to determine how “round” the assembly is when rolling under a load. If a tire were not exposed to the road surface, then balance would be more than sufficient. However, not all tires roll round under a load. For example, an egg-shaped tire/wheel assembly can be balanced about its axis, but an egg-shaped tire/wheel loaded against a surface would not give a smooth ride.

The ForceMatch® HD / GSP9600HD ForceMatch® balancer reduces diagnostic time by identifying eccentrics that would not be detected by the normal balancing procedure. Loaded runout measurement also detects loaded and free measured runout, and balancer mounting error, allowing superior quality balance of the entire wheel assembly.

Loaded runout measurement is a measurement of the wheel assembly as would be found from an actual road test of a vehicle. The ForceMatch® HD / GSP9600HD is equipped with a load roller to take the Loaded Runout Measurement. The load roller places up to 300 pounds of force on the spinning tire, and then automatically withdraws from wheel.

3. Mounting Wheels on the Balancer

3.1 Mount the Wheel on the Spindle Shaft

⚠ **CAUTION:**	Use only cones and accessories that are specifically designed for the ForceMatch® HD / GSP9600HD.

Proper balance requires that the tire/wheel assembly be centered on the balancer. Tire/wheel assemblies can be balanced to zero, even with the tire/wheel assembly mounted off-center. The main objective of the balancer operator is to center the wheel on the hub and shaft, using the best available method. Mounting the wheel off-center creates incorrect measurements of imbalance and runout conditions.

Remove any existing wheel weights, rocks, and debris from the tire tread, and clean the center hole of the wheel. Inspect inside of wheel for excessive accumulation of dirt and debris. Remove if necessary before balancing.

Accurate balancing depends on accurately centering the wheel. *Refer to "CenteringCheck®," page 32*.

NOTE:	If the basic cone and adaptors do not fit the wheel, additional centering adaptors will be necessary. A wheel that cannot be properly centered, cannot be properly balanced. All balancers require additional centering adaptors to properly center certain types of wheels. For additonal information, *refer to Form 3203T for optional accessories.*

When using cones or commercial duty direct fit collets, install the removable spring on the shaft to pre-load the cone or collet. This is not required for Heavy-Duty adaptors.

NOTE:	While the spring is not required for Heavy Duty adaptors, it does not have to be removed when using Heavy Duty adaptors.

With the safety hood open, place the wheel mounting cone on the spindle shaft against the spring plate. Position the wheel with the inside surface facing the balancer, centered on the cone.

Install the plastic clamping cup and wing nut on the spindle shaft against the wheel and secure the entire assembly by firmly tightening the wing nut.

If equipped with optional Spindle-Lok® foot pedal, depress and hold down while tightening the wing nut. Holding the shaft locked while tightening the wing nut improves centering accuracy.

Slowly roll the wheel towards you while tightening the wing nut. This improves accurate wheel centering, since the wheel is allowed to roll up the taper of the cone as opposed to forcing it to slide up the cone.

Mounting Error Detection Features

To verify that the tire/wheel assembly is centering, remount the tire/wheel assembly and observe the results. Do any of the following conditions occur?

- Weight amount varies excessively
- Weight location changes
- Runout and loaded runout measurements vary

If any of these conditions occur, the centering accuracy of the tire/wheel assembly needs to be verified.

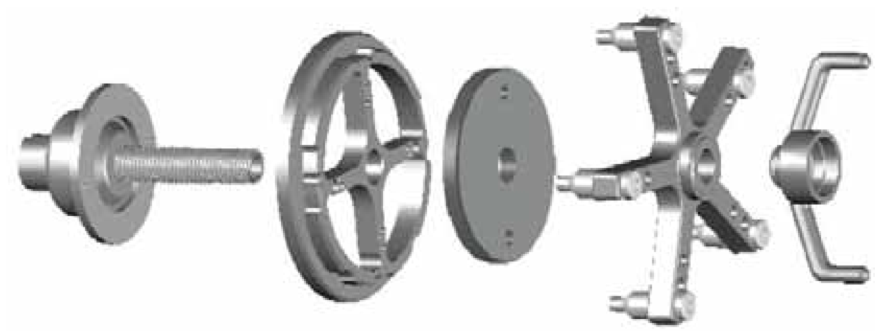
There are two methods using wheel runout that the ForceMatch® HD / GSP9600HD will utilize to detect mounting error:

- Anytime the wheel runout is measured, the displayed diagnostic message may caution the operator to check wheel mounting if runout on inner and outer bead seats move up and down or side to side together.
- From the balance screen, the operator can choose to perform a CenteringCheck®. The CenteringCheck® feature will automatically

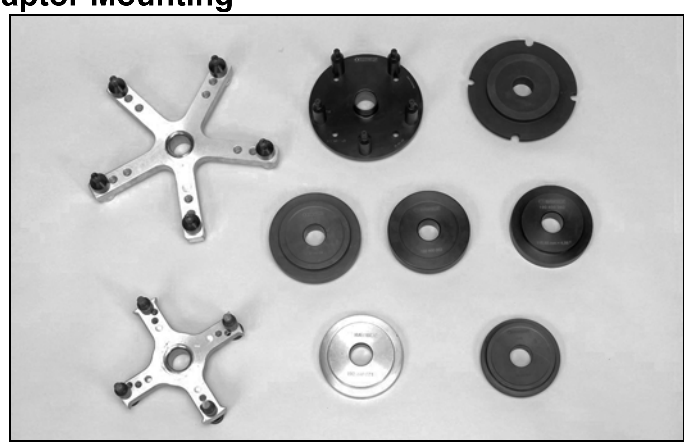
confirm if the wheel is centered for the operator on the balancer (preventing improper measurement from occurring).

Heavy-Duty Adaptor Mounting

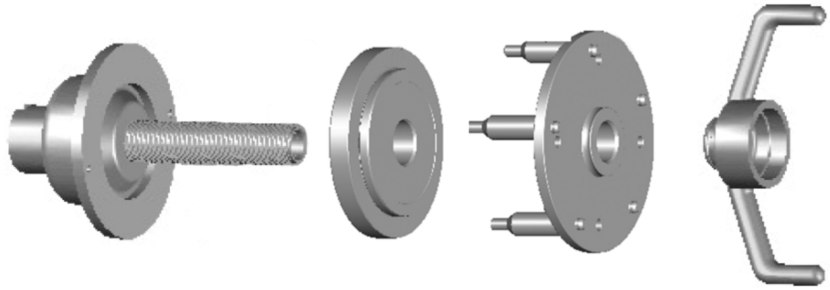
When using the heavy-duty adaptors, the spacer (gold) and collet (black) may be bolted to the hub face of the balancer with the HHCS provided.



Medium-Duty Adaptor Mounting



When using the medium-duty adaptors, the collet is placed on the spindle with the stepped side facing away towards the wheel.

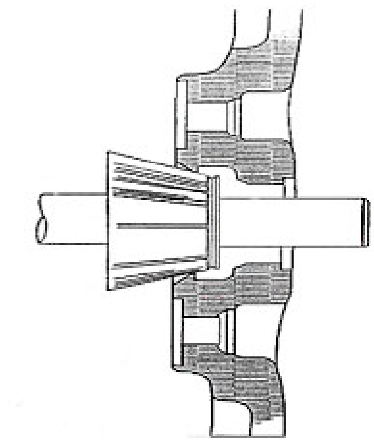


Light-Duty Adaptor Mounting

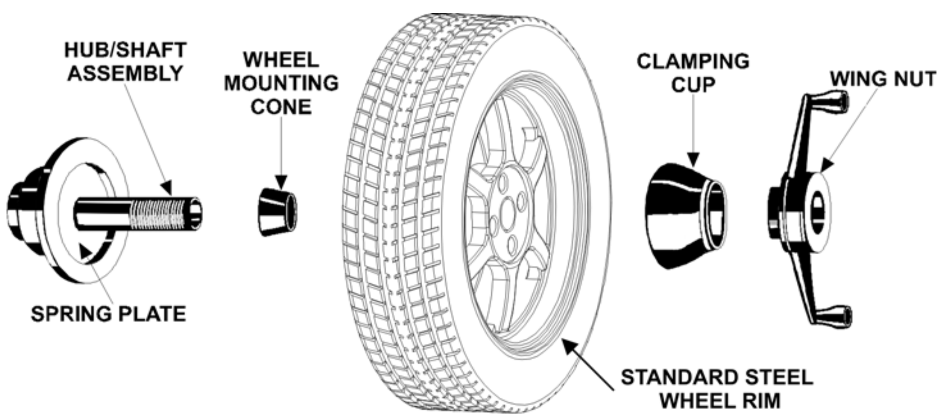
Front/Back Cone Mounting

Cone mounting is one of the most common and reliable ways to mount wheels on balancers.

Select the proper wheel mounting cone by placing it in the center bore of the wheel to be balanced. Select the cone that contacts the wheel nearest the center of the cone.



Install the spring plate and place the wheel mounting cone on the spindle against the spring plate. Mount the wheel with the inner rim facing the balancer and centered on the cone.



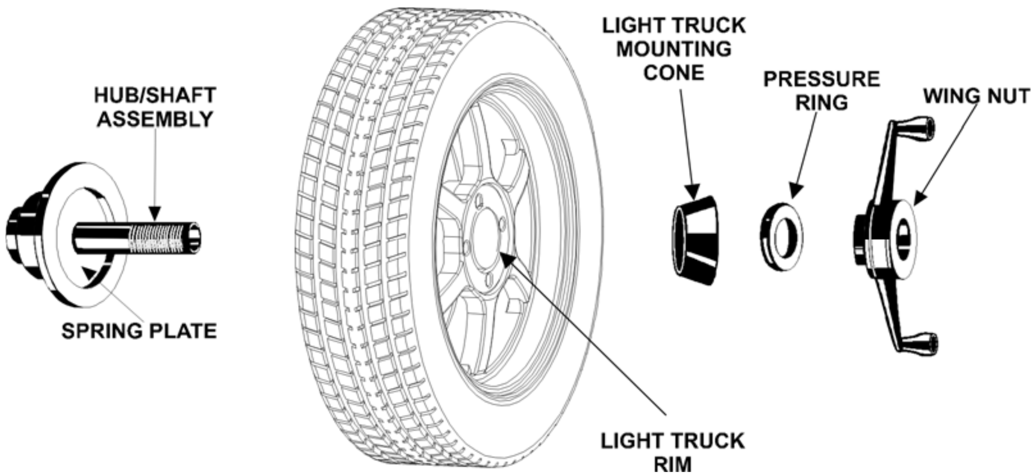
NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

Install the clamping cup and wing nut on the spindle shaft against the wheel and secure the entire assembly by firmly tightening the wing nut, while depressing the foot pedal to hold the spindle in place.

OR

Use the Spindle-Lok® foot pedal: depress and hold down while tightening the wing nut. Holding the shaft locked while tightening the wing nut improves centering accuracy. Slowly roll the wheel toward you during the initial tightening of the wing nut. This aids in accurate wheel centering and increased repeatability, since the wheel is allowed to roll up the taper of the cone as opposed to forcing it to slide up the cone.

Wheels with center holes over 3 9/16 inch diameter require the light truck cone. The light truck cone can be installed from the outside of the wheel. (When using the light truck cone, the plastic clamping cup is not used.)



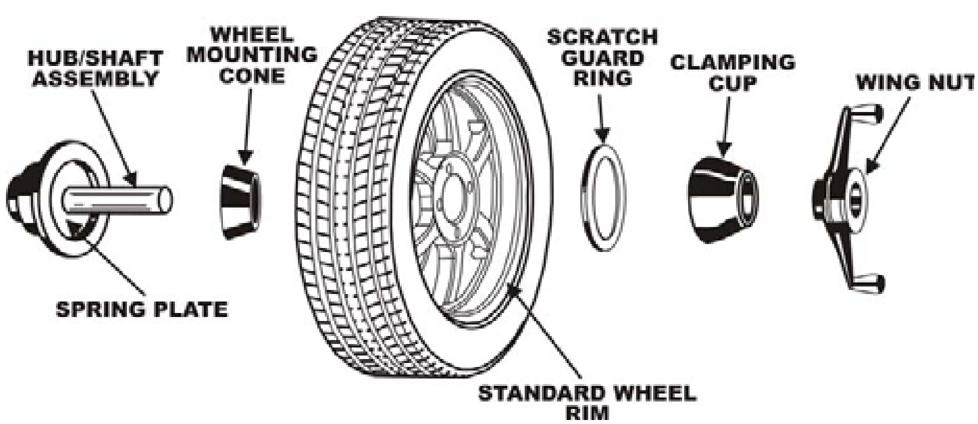
Using Plastic Wheel Mounting Washer

The plastic wheel mounting washer, 46-320-2, may be used to prevent scratches on wheels where the standard plastic cup and scratch guard cannot be used.

The plastic wheel mounting washer may also be used when mounting a wheel with a large offset that is between cone sizes. Use of the washer between the spring and inside cone can improve centering ability by increasing cone pressure against the wheel.

For example: One cone size is too small because the captivated spring is not pressing the cone against the inner wheel opening, but the next larger cone size is too big and will not fit the opening. Use the smaller cone size with the plastic wheel mounting washer to “extend” the spring plate to hold the mounting cone against the wheel opening with greater pressure.

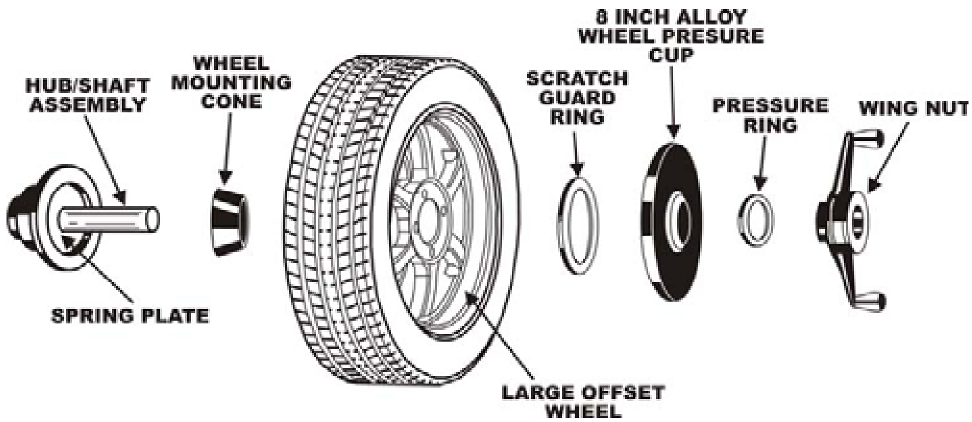
The scratch guard may be installed on the clamping cup to protect aluminum rims from being marred, but should not be used on steel wheels.



NOTE:	Use only the wing nut supplied with the ForceMatch® HD / GSP9600HD.

NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

In some cases, the mounting pad of the wheel may be extremely wide, and the standard clamp cup will not properly contact the wheel hub area. In these cases, the optional nine inch alloy wheel pressure cup may be used in place of the clamping cup.



NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

Wheels with center bores over 3 9/16 inch diameter require one of the light truck cones. The light truck cones must be mounted from the outside of the wheel.

NOTE:	When using the light truck cones, the pressure ring is used in place of the clamping cup.

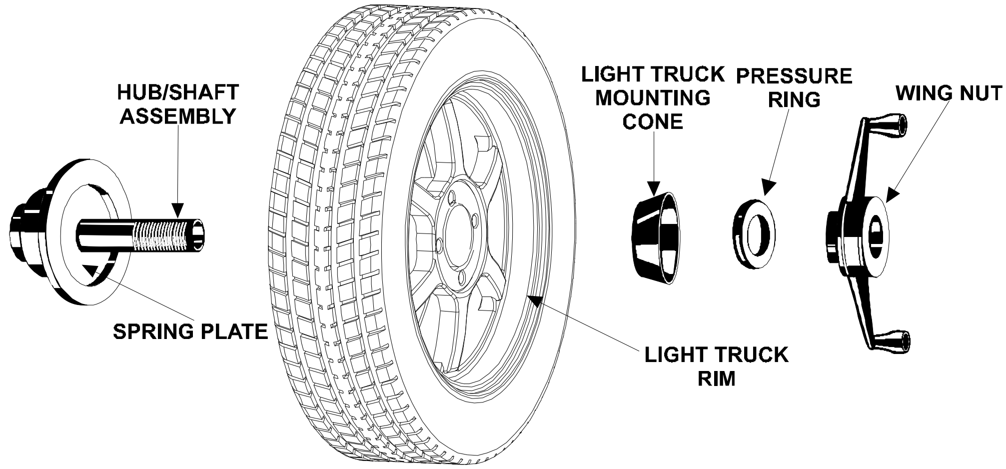
This procedure utilizes a tapered cone inserted from the front side of the wheel instead of the backside as previously described.

Select the proper wheel mounting cone by placing it in the center bore of the wheel to be balanced. Choose the cone that contacts the wheel nearest the center of the cone.

Mount the wheel with the inner rim facing the balancer. Place the wheel mounting cone on the spindle with the small end of the cone facing the front of the wheel.

Install the wing nut and pressure ring assembly onto the spindle shaft against the wheel and secure the entire assembly by firmly tightening the wing nut.

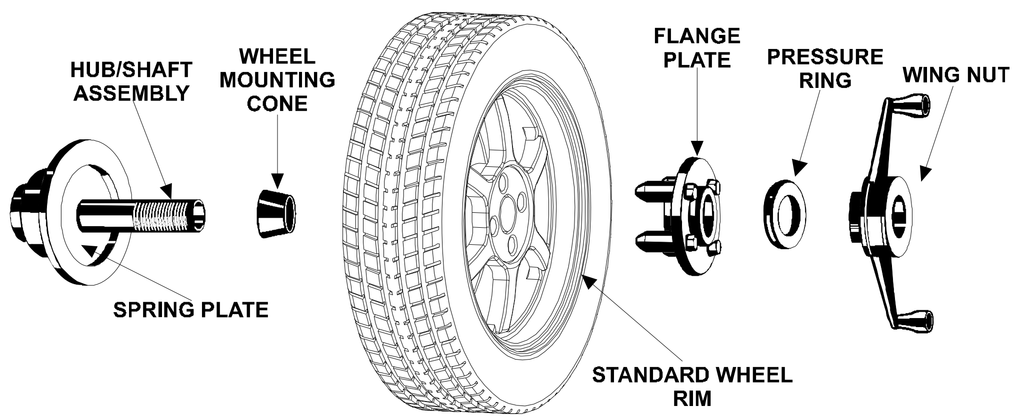
Heavy wheel centering may benefit by (1) pulling the tire away from the hub face at top dead center while tightening the wing nut or (2) use of optional wheel lift to position heavy wheel onto shaft and cone. This helps the wheel to overcome gravity against the hub or spacer.



NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

Cone/Flange Plate Mounting

Wheels may be centered using the lugholes and center bore with a flange plate and centering cone. It is important that a back mounted cone be used to support and center the wheel when using flange plates.



NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

The correct flange adaptor setup is determined by:

Measure and set the bolt circle diameter and number of studs to use against the lug holes.

Set the number of lugholes as follows:

A three-lug wheel uses three studs.

A four-lug wheel uses four studs.

A five-lug wheel uses five studs.

A six-lug wheel uses three studs.

A seven-lug wheel uses seven studs.

An eight-lug wheel uses four studs.

Choose the correct taper design of flange studs to fit the wheel lug seats. The mounting area of the flange stud must match the design of the wheel's lughole seat or depression.

The flange plate must be able to apply pressure to the center of the wheel while maintaining perpendicularity to the shaft.

NOTE:	If the lug seats are unevenly machined or worn, an optional universal flange adaptor with compressible studs or bolt on lugs may be used to more accurately mount the wheel with the cone.

Flange plates are useful when the wheel cannot be properly centered off the hub bore with a tapered cone alone because of improper fit, interference, or lack of a center hole.

A flange plate in many cases adds value because it aids in more effective centering than a tapered cone alone. This statement is true for many wheels including hub centric wheels. That is why a flange plate and back cone may be more accurate and repeatable, regardless of whether the wheel is lug centric or hub centric.

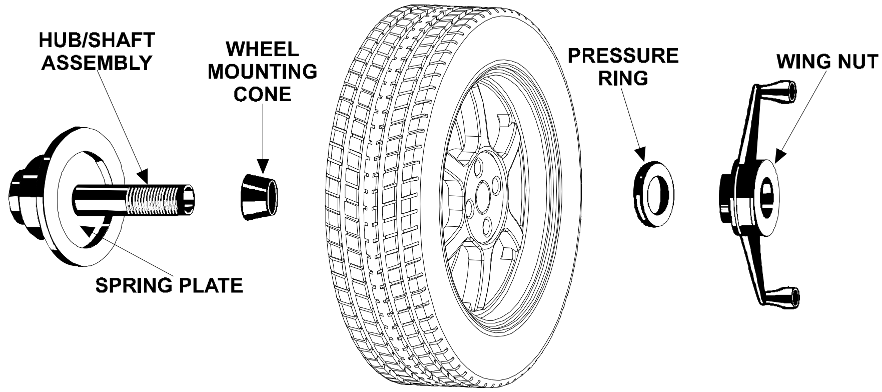
Using the Pressure Ring and Spacers

Pressure Ring

The pressure ring clips on to the wing nut. It is used in lieu of the clamping cup.

It may also be used in place of a clamping cup if space is limited between the wheel and the end of the spindle.

The pressure ring should be used to prevent the wing nut from directly contacting an adaptor or a cone. It will act as a bearing to enable higher clamping forces.



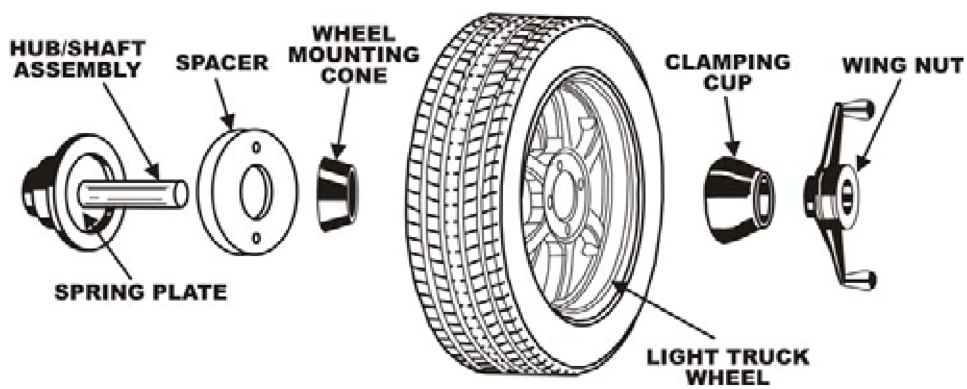
NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

Spacers

There are two types of spacers Hub Ring Spacers and Shaft Spacers.

Hub Ring Spacers

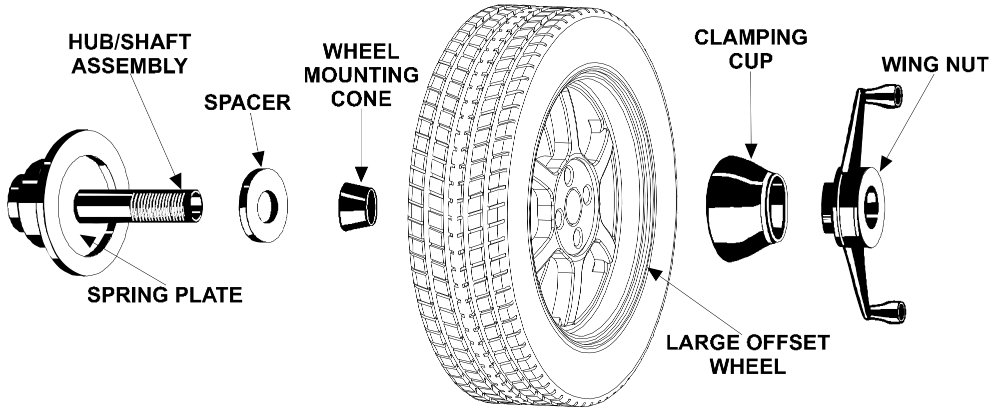
These light truck spacers are designed to build a larger pocket when using extra large truck cones. It also provides a location for the centering pins found on some dual wheel configurations.



NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

Shaft Spacers

The shaft spacer can be used to make the cone contact the hub bore more firmly.



NOTE:	This balancer model is equipped with a removable pre-load cone spring. The removable pre-load cone spring is not needed for heavy duty adaptors. It is used only in automotive or light truck applications.

For example, one cone size is too small because the spring plate is not pressing the cone against the inner wheel opening, but the next larger cone size is too large and will not fit the opening. Use the smaller cone size, with the spacer, to extend the spring plate and hold the smaller mounting cone against the wheel opening with greater pressure.

3.2 CenteringCheck®

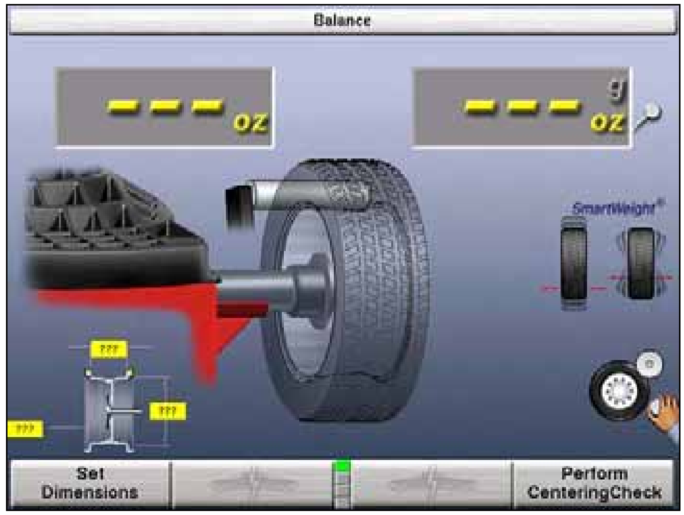
Balance Method

NOTE:	Balance CenteringCheck® is the preferred method for large truck wheels.

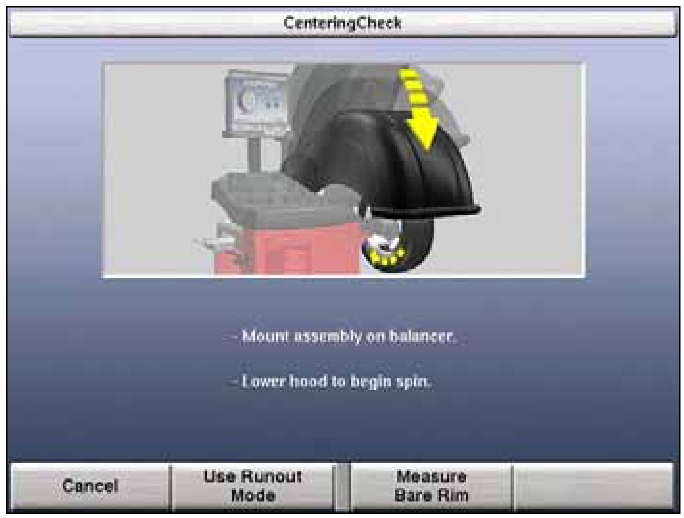
The Balance CenteringCheck® feature can be used to inspect each mounting to identify possible centering errors, thus preventing improper measurements from occurring. This procedure does not require use of the Dataset® Arms.

On-screen prompts lead you through the procedure as follows:

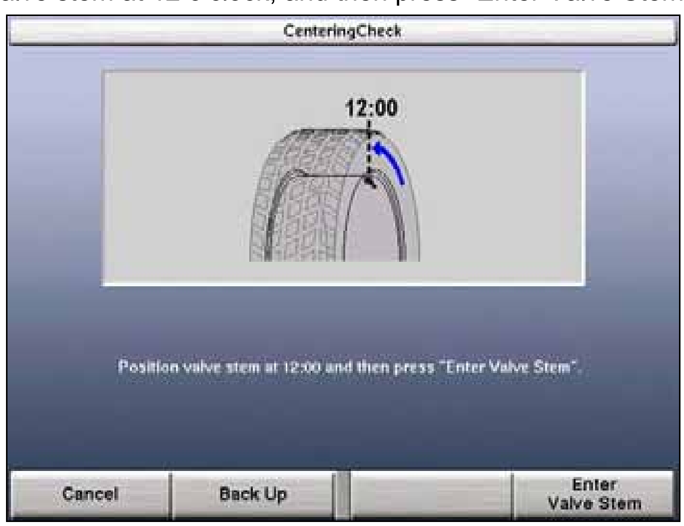
Select "Perform Centering Check" from the menu.



With the tire/wheel assembly mounted on the balancer, lower the safety hood.



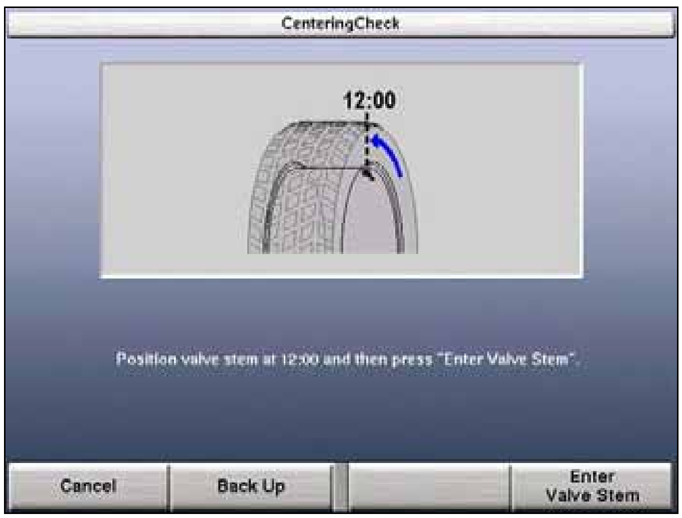
Position the valve stem at 12 o'clock, and then press "Enter Valve Stem."



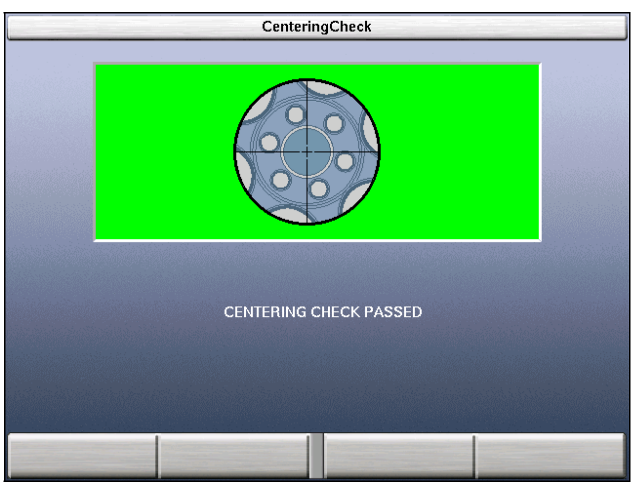
After measuring rim runout, you will be prompted to loosen the wheel and re-clamp at another position. One half turn (approximately 180 degrees) from the current position is recommended.

Lower the safety hood to spin again.

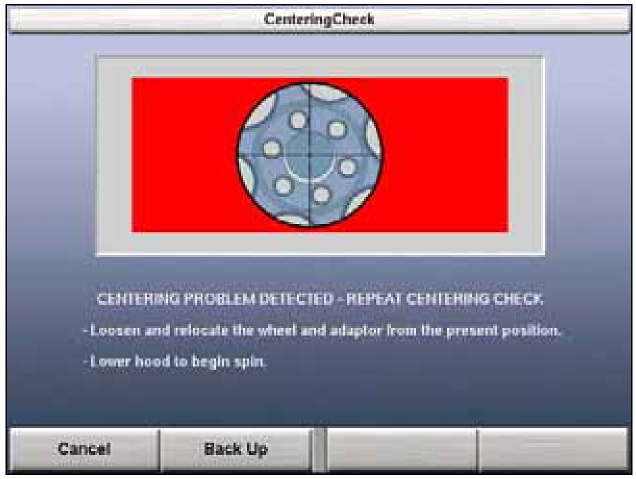
Once more, position the valve stem at 12 o'clock, and then press "Enter Valve Stem."



If the rim is centered properly, the following screen will appear briefly.



The ForceMatch® HD / GSP9600HD will then proceed to the “Balance” screen. If a centering problem is detected, the following screen will appear.



The procedure will repeat the re-centering check up to four times and always compare the previous measurement to the next check. If centering is not achieved after four attempts, the following screen will appear.

Check for:

correct mounting cone/adaptor for this wheel design.

wheel defect such as a metal burr interfering with the cone/adaptor.

dirt or debris interfering with the cone/adaptor.

Follow the on-screen prompts, and then press “Restart Procedure.”

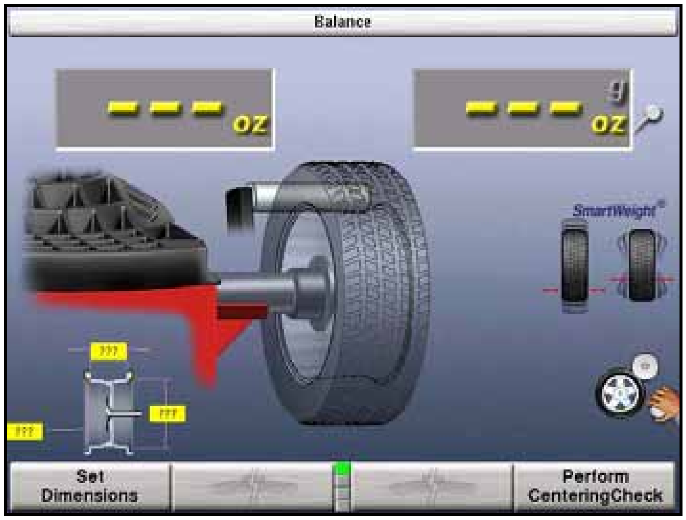
Standard Method

NOTE:	CenteringCheck® is used for automotive or light truck rims when the rim can be measured using the DataSet arms.

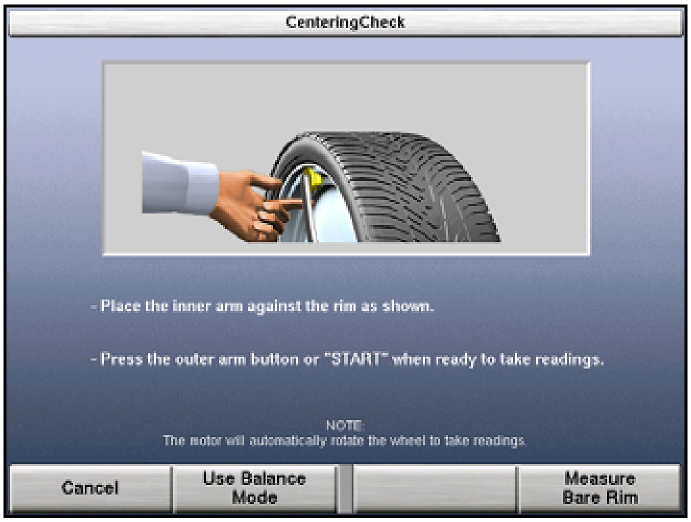
The CenteringCheck® feature can be used to inspect each mounting to identify possible centering errors, thus preventing improper measurements from occurring. The inner Dataset® arm is used to measure wheel runout which is an indication of mounting repeatability.

CenteringCheck® may be used with either a “bare rim” or a “rim with tire assembly.” On-screen prompts lead you through the procedure as follows:

Select “Perform Centering Check” from the menu.

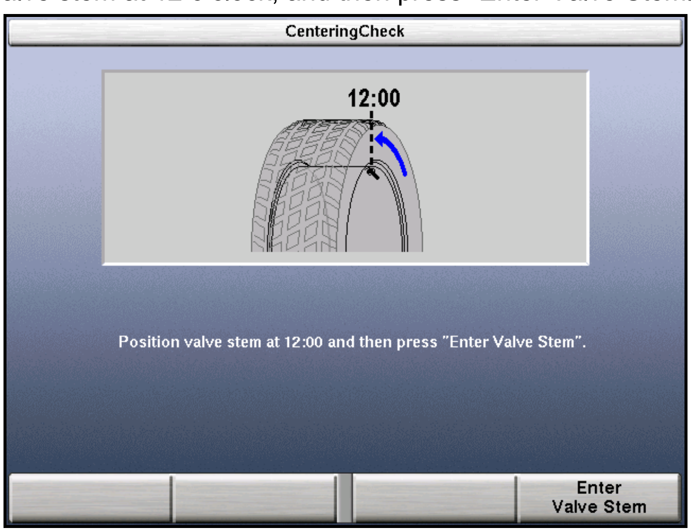


Place the inner Dataset® arm against the rim at a location that will maintain unobstructed contact for a complete revolution. *Refer to “Using the Auto Dataset® Arms,” page 56.*



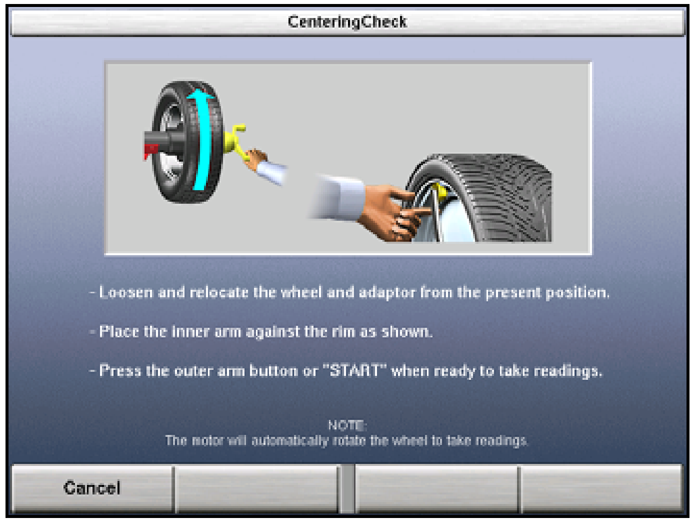
Press the outer Dataset® arm button or “Start” when ready to take readings.

Position the valve stem at 12 o’clock, and then press “Enter Valve Stem.”



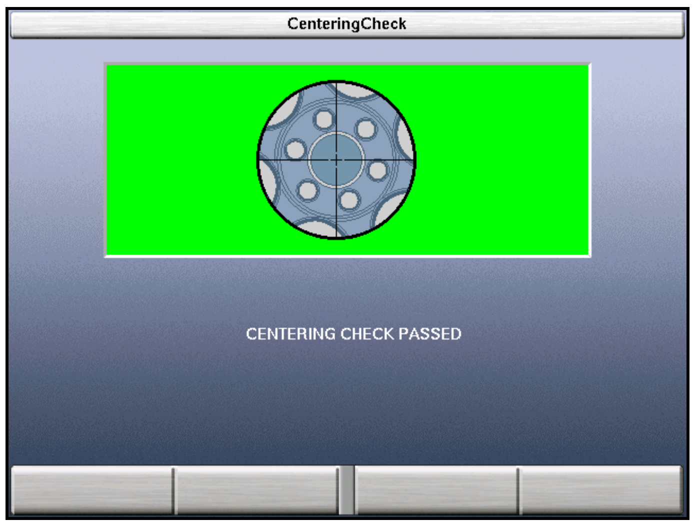
After measuring rim runout, you will be prompted to loosen the wheel and re-clamp at another position. One half turn (approximately 180 degrees) from the current position is recommended.

Place the inner arm against the rim as shown.

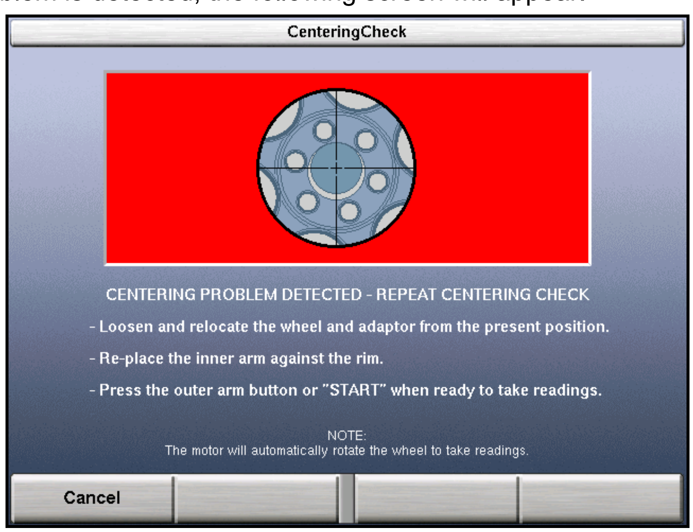


Press the outer arm button or “Start” when ready to take readings.

Once more, position the valve stem at 12 o’clock, and then press “Enter Valve Stem.” If the rim is centered properly, the following screen will appear briefly.



The ForceMatch® HD / GSP9600HD will then proceed to the “Balance” screen. If a centering problem is detected, the following screen will appear.



The procedure will repeat the re-centering check up to four times and always compare the previous measurement to the next check. If centering is not achieved after four attempts, the following screen will appear.

Check for:

correct mounting cone/adaptor for this wheel design.

wheel defect such as a metal burr interfering with the cone/adaptor.

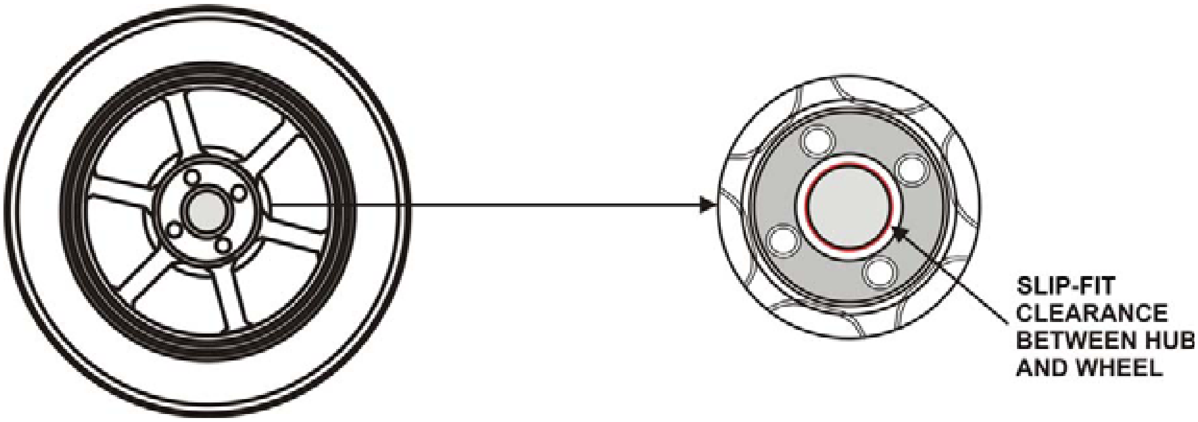
dirt or debris interfering with the cone/adaptor.

Follow the on-screen prompts, and then press "Restart Procedure."

3.3 On-Vehicle Wheel Mounting Methods

Hub Centric

A hub centric wheel is aligned to the hub by the center bore of the wheel. The vehicle weight rests on the hub bore. The clearance between the hub bore and the hub on a hub centric wheel is between 0.003 and 0.004 of an inch. A hub centric wheel is identified by removing the lug nuts (or bolts) and moving the wheel up, down, and side-to-side. If there is little or no movement, the wheel is centered by the hub.



To verify if the wheel is hub centric:

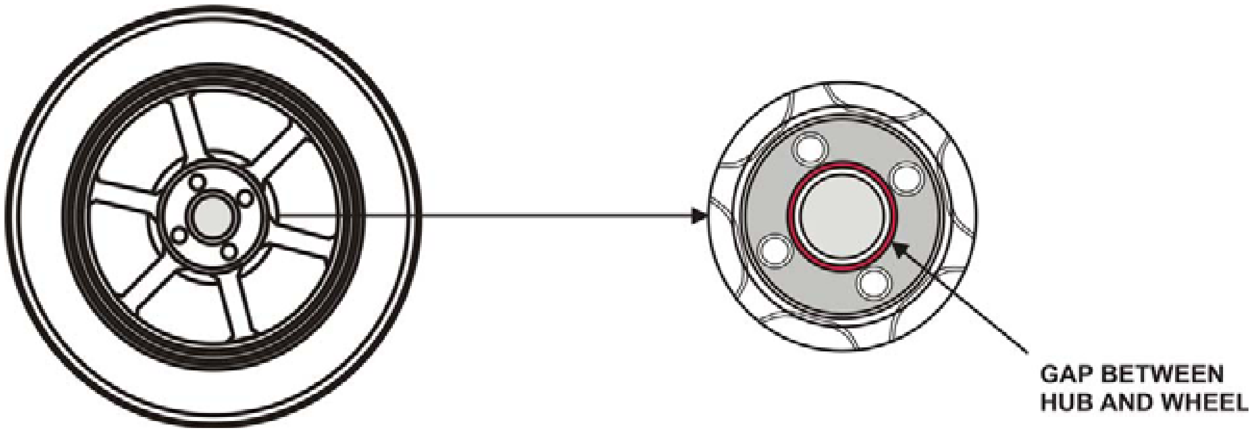
Remove the lug nuts (or bolts) and try to move the wheel up/down and side/side on the hub.

If the wheel has no appreciable movement around or about the centerline of the hub, it should be considered hub centric.

A hub centric wheel will have very little (0.003 – 0.004") clearance or a slip fit to the hub.

Lug Centric

A lug centric wheel is identified by removing the lug nuts (or bolts) and moving the wheel up, down, and side-to-side. If movement around the hub is apparent, the wheel is centered on the vehicle by the lugs or studs of the axle flange.

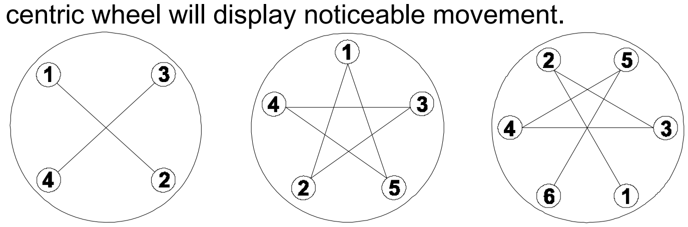


TIP:	When mounting a lug centric wheel to a vehicle, extreme centering care must be taken by ensuring the lug nuts (bolts) are tightened equally, while rotating the wheel. “Step-torque” star pattern to proper torque specification.

To verify if the wheel is lug centric:

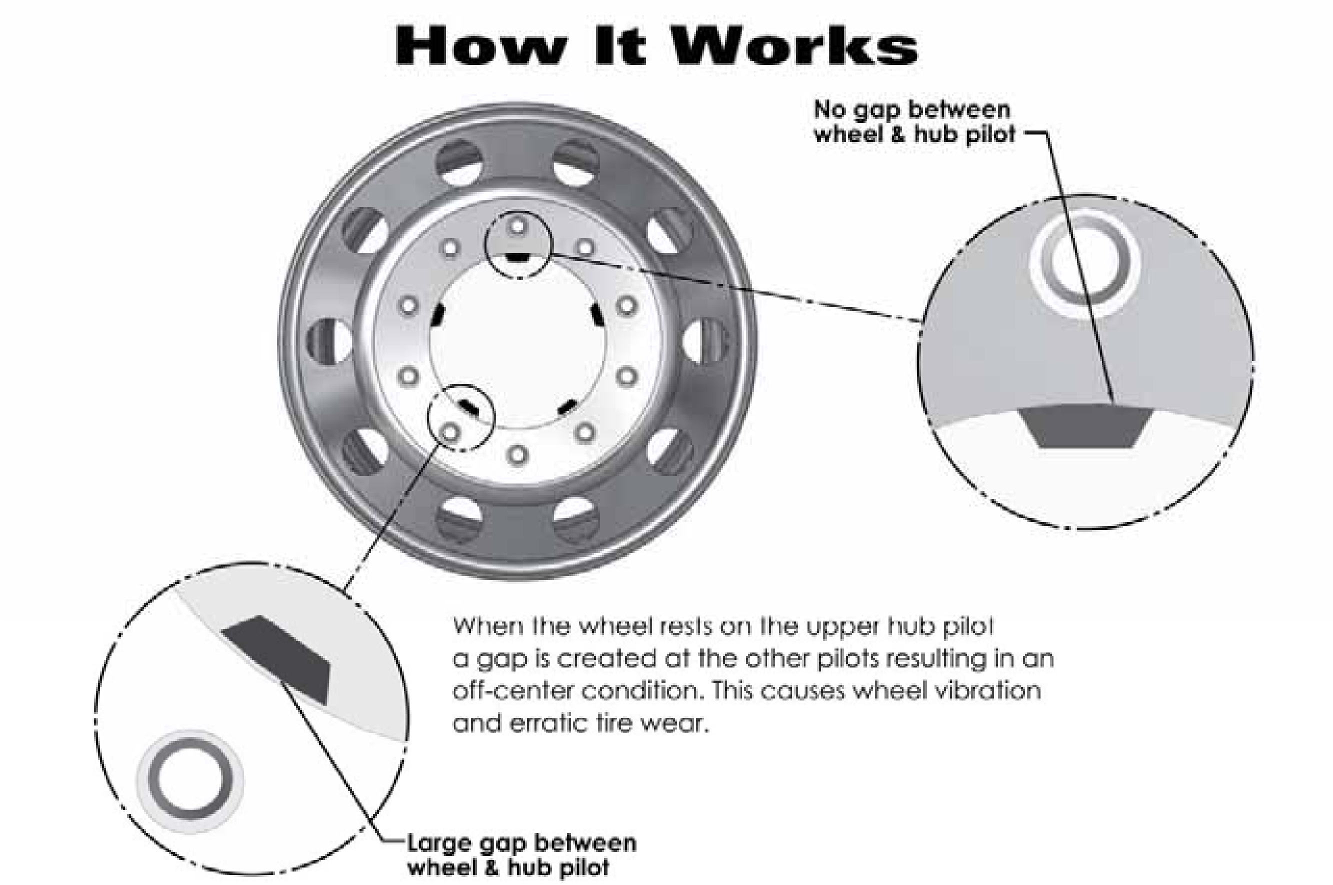
Remove the lug nuts (or bolts) and try to move the wheel up/down and side/side on the hub.

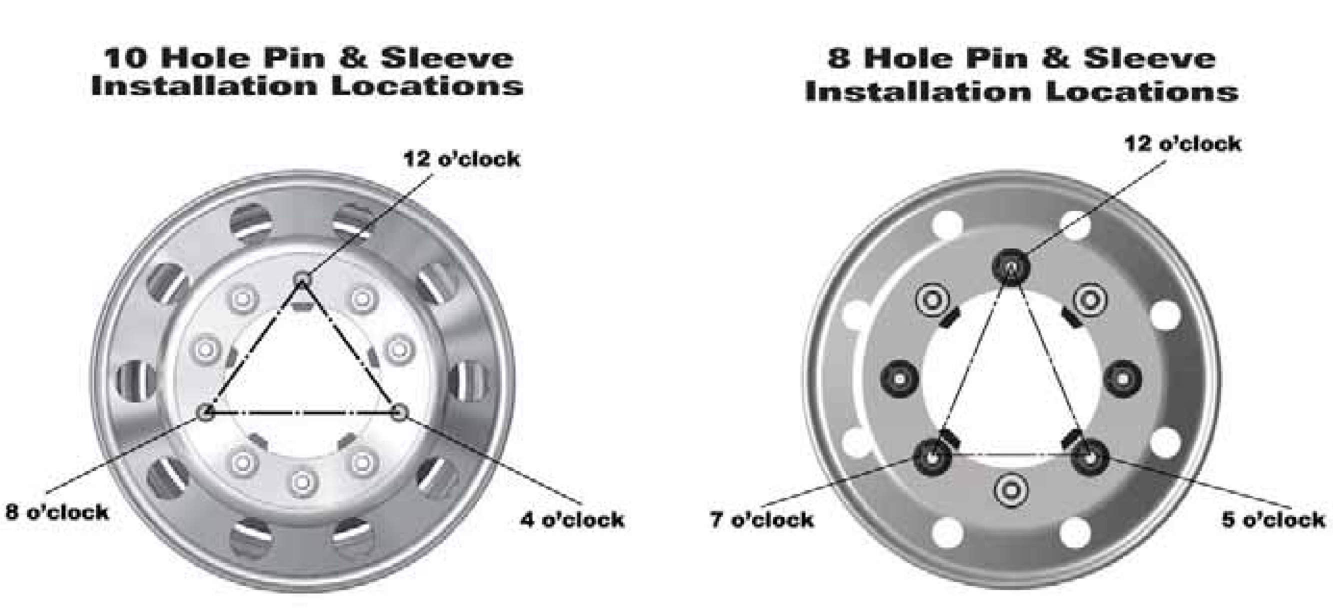
A lug centric wheel will display noticeable movement.



Heavy-Duty Hub Centric

When mounting lug centric heavy-duty and medium-duty wheels, use the included lug sleeves to ensure proper wheel mounting.





4. Balancing a Wheel

4.1 Balancing Procedures

The ForceMatch® HD / GSP9600HD balancers offer two primary ways to balance tires:

1. SmartWeight™ balancing technology
2. Traditional balancing technology

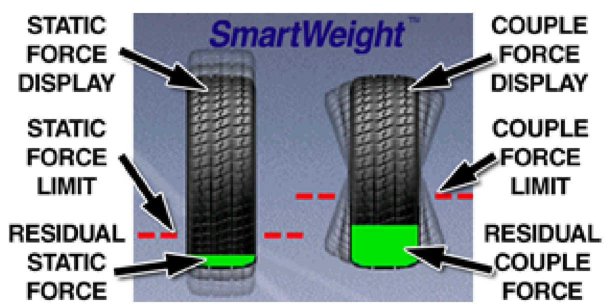
Both of these methods can balance tires dynamically. The main difference is SmartWeight will reduce the amount of corrective weight and possibly limit the number of steps in a basic wheel balancing situation.

SmartWeight™ Balancing Technology

SmartWeight™ balancing technology is a method of analyzing forces on a wheel during balancing. SmartWeight is not a procedure. Instead, it measures the forces of side-to-side movement and up-and-down shake and computes weight to reduce these forces. This reduces the amount of weight, reduces time, reduces check spins and chasing weights. SmartWeight saves the shop time and money.

Using SmartWeight™

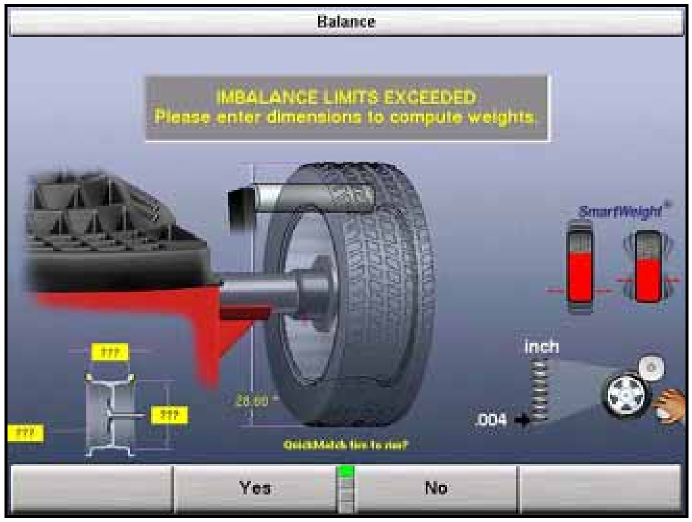
The SmartWeight enabled balancing display varies slightly from the standard balancing display. The primary difference between the displays is the SmartWeight tire graphs that display the static and couple forces within a tire/wheel assembly.



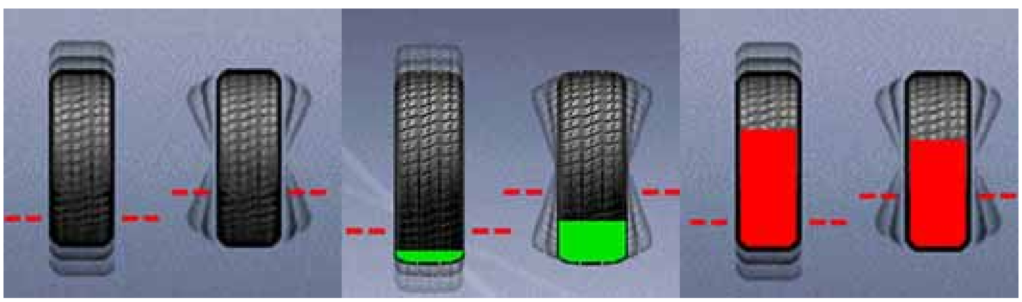
The red-dotted line represents the acceptable amount of force the tire can have that will not result in a ride problem. Any forces below that line will be shown in green. Any forces that are above that level will be shown in red and indicate an excessive amount of force.

The traditional "static" and "dynamic" modes are eliminated. The traditional non-round off mode is eliminated. These modes are no longer necessary with SmartWeight balancing.

Install the tire/wheel assembly as normal. Rim measurements are not required. Lower the hood and spin.



If SmartWeight requires correction weights wheel dimensions will be required. Enter the dimensions using the dataset arms. The SmartWeight tire graphs will display red for excessive forces and green for acceptable amounts of force. Prior to measurement the tire graphs will display no color.



The screen will display the amount and location of corrective weight necessary. Install the weights in the appropriate manner using the correct type of weight and lower the hood to re-spin and check the balance. Instead of displaying zeros in the weight display, SmartWeight displays “OK,” indicating that the force levels are reduced to within the acceptable tolerances.

Switching from SmartWeight™ to Traditional Dynamic Balancing Modes

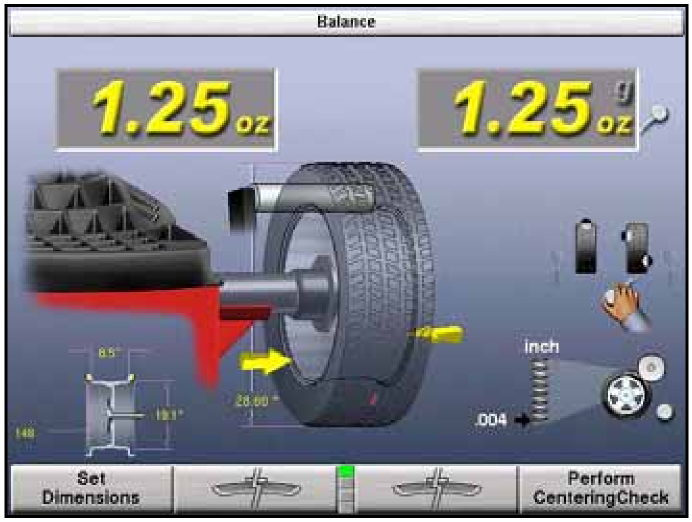
At any time, SmartWeight can be switched to traditional balancing as long as both standard and SmartWeight modes are enabled in setup.

Press the knob until SmartWeight is highlighted. Once highlighted, press and hold the knob till the standard balance icons appear. Cycle back the same way.

Dynamic Balancing Selection

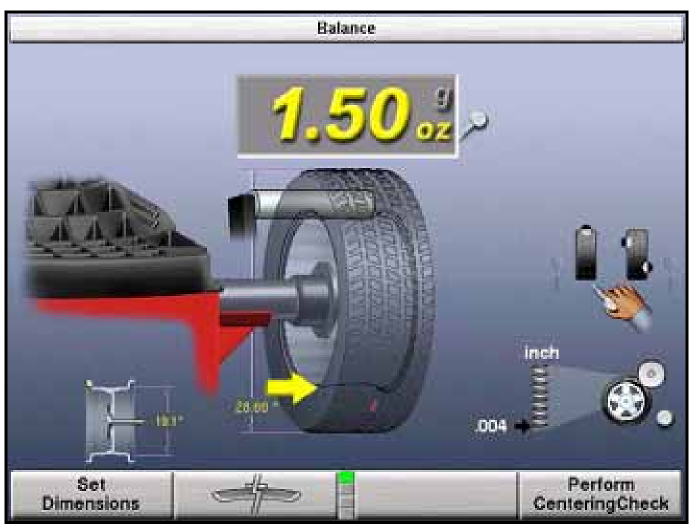
Dynamic balancing is selected by pointing the indicator to while rotating the control knob. Dynamic will always display two weight planes.

Dynamic balancing provides a more complete balance than static balancing. Dynamic balancing should be selected whenever possible to minimize vehicle vibration. *Refer to "Couple Imbalance," page 18.*



Static Balancing Selection

Static balancing is selected by pointing the indicator to while using the control knob. Static balancing provides a less desirable balance than dynamic balancing. Dynamic balancing should be selected whenever possible to minimize vehicle vibration. *Refer to "Static Imbalance," page 17.*

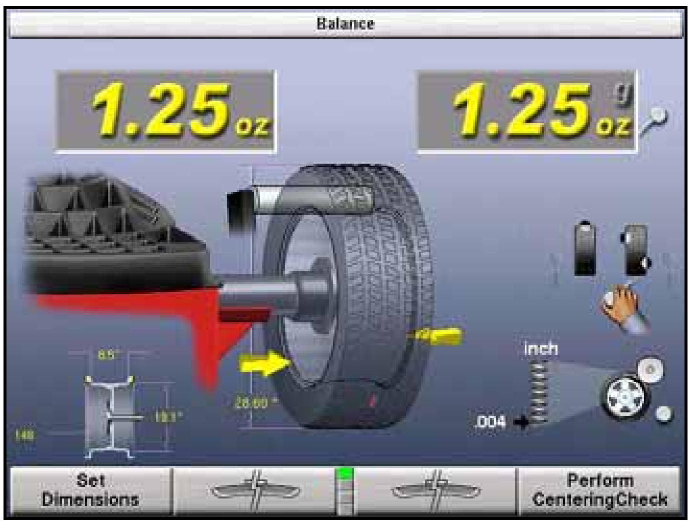


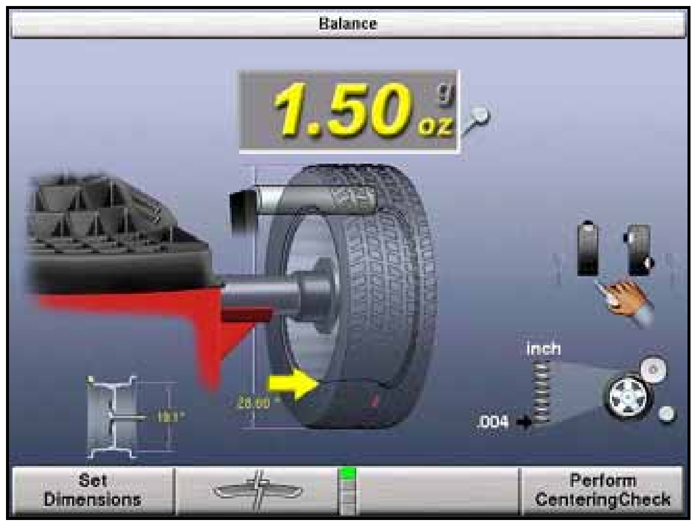
Static Balance Mode Reminder (Except Patch Balance)

Two reminder pop-up text messages appear on the balance screen dialog box when selecting static mode. The first screen gives the warning: “Avoid STATIC single-plane balancing.”

The second screen suggests: “DYNAMIC dual-plane balancing recommended (even for hidden weights).”

If STATIC is selected, the reminders show up again at the end of the spin, and if in clip-on weight mode, the dynamic weights are shown momentarily, and then the static weight is displayed.

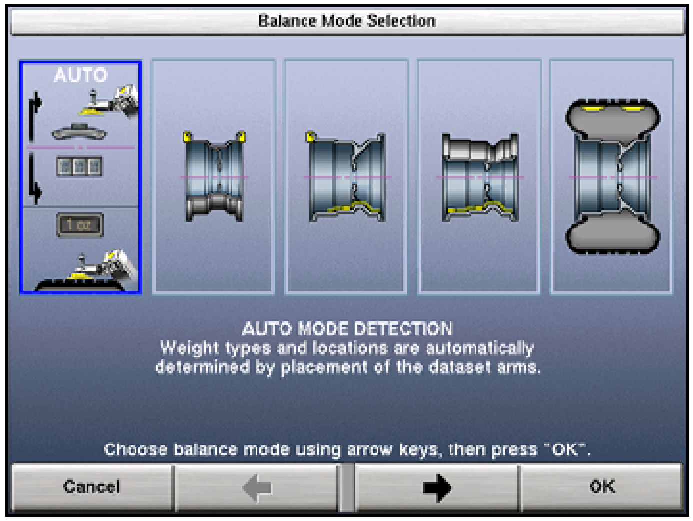




Selecting Weight Types and Placement Modes

Press  to change the weight types and placement. The ForceMatch® HD / GSP9620HD offers Standard Balance, Mixed Weights Balance, Adhesive Weights Balance, and Patch Balance® for dynamic and static modes.

With these four selections, a correction weight can be placed at an infinite number of locations, based upon the choice of the operator.



AUTO MODE DETECTION is the default setting automatically choosing the correct type of weights and locations determined by the placement of the Dataset® arms.

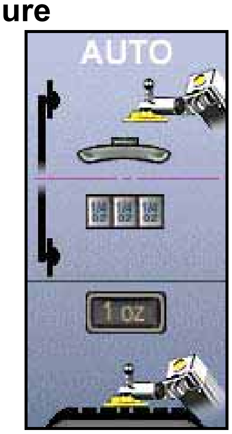
STANDARD BALANCE should be selected when clip-on weights can be used for both rim flanges.

MIXED WEIGHTS BALANCE should be selected when a clip-on weight can be used on the inner rim flange, but not on the outer rim flange. Mixed Weights Balance uses an adhesive weight for the right weight plane instead of a clip-on weight to avoid marring aluminum rims or to hide weights from view.

ADHESIVE WEIGHTS BALANCE should be selected when clip-on weights cannot be used on either rim flange.

PATCH BALANCE should be selected when the tire has a very large imbalance in the tire assembly. The large imbalance can be corrected with Patch Balancing and then the assembly can be fine-tuned with one of the other balancing procedures.

AUTO MODE Balancing Procedure

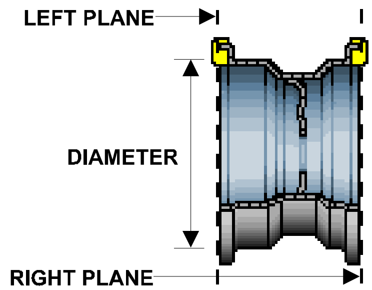


Selecting AUTO MODE will choose the correct type of weights and locations determined by the placement of the Dataset® Arms.

In Auto Mode, the inner Dataset arm automatically activates the clip weight mode when in the upwards position and shifts to the adhesive weight mode when placed in the downward position. The exact location to place the weight is chosen by the operator while prompted from the screen. When the location position is chosen, depressing the Spindle-Lok brake pedal enters the exact location.

AUTO MODE incorporates procedures of specific wheel balance methods as outlined below.

STANDARD Balancing Procedure (Using Clip-On Weights)



Verify that the wheel is clean and free of debris.

Remove all previous weights.

Mount tire/wheel assembly. *Refer to "Mount the Wheel on the Spindle Shaft," page 23.*

Press "."

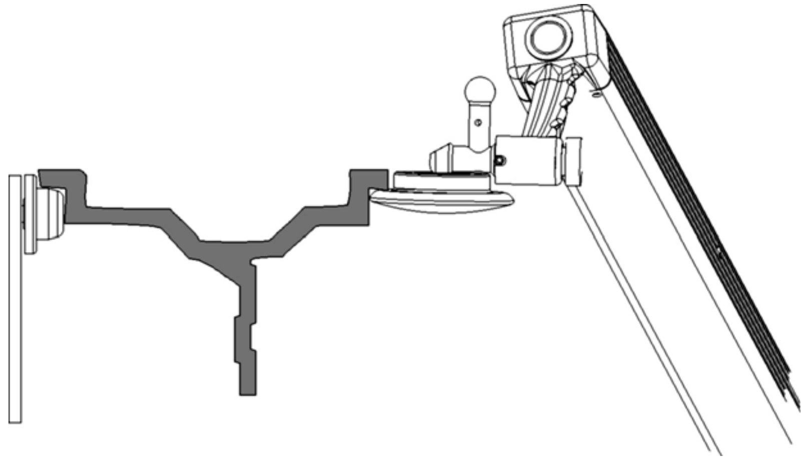
Use the softkey arrows to select "STANDARD BALANCE" and press "OK."

Select either grams or ounces by rotating the control knob and highlighting either "g" or "oz."

Select "DYNAMIC" by rotating the control knob to highlight "." *Refer to "Dynamic Balancing Selection," page 43.*

Use both Dataset® arms in the **UPWARD** position at the clip-on weight location to measure the distance, diameter, and rim width dimensions. *Refer to "Using the Auto Dataset® Arms," page 56.*

NOTE:	The Dataset® Arms should be positioned in the location for weight placement. Refer to “Measuring Dimensions for Standard Clip-on Weight Balancing,” page 57.



Enter the data by depressing the foot pedal. Release the Dataset® arms.

Close safety hood.

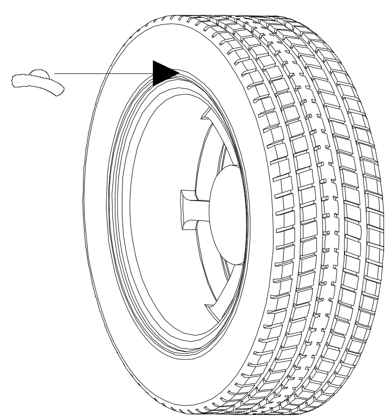
Press the green “START” button if “Hood Autostart” is disabled.

After wheel comes to a complete stop, raise the safety hood.

The ForceMatch® HD / GSP9600HD will find the TDC for the left weight plane if “Servo-Stop” is enabled. “Servo-Stop” will hold the wheel in the TDC position while the weight is applied. The weight amount will be displayed in green.

Attach the weight amount shown on the display for the left weight plane to the inner rim of the wheel.

NOTE:	If optional HammerHead™ TCD weight locator is installed, the weight should be applied at the location marked by the laser.

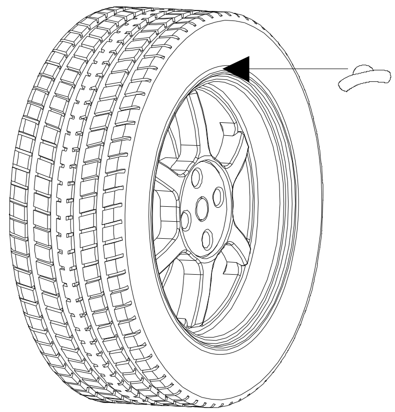


If necessary, use the left “  ” to split the weight. *Refer to “Split Weight® Feature,” page 83.*

Press the green “START” button with the safety hood in the raised position and the ForceMatch® HD / GSP9600HD will find the TDC for the right weight plane.

Attach the weight amount shown on the display for the right weight plane to the outer rim of the wheel.

NOTE:	If optional HammerHead™ TCD weight locator is installed, the weight should be applied at the location marked by the laser.



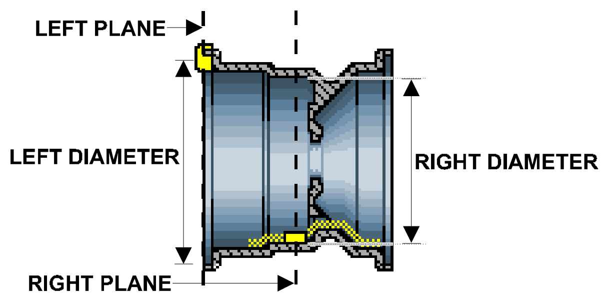
If necessary, use the right " " to split the weight. *Refer to "Split Weight® Feature," page 83.*

Verify balance condition by spinning again with the load roller disabled. *Refer to "Load Roller Operation," page 65.*

Left and right weight plane displays should show "zero."

STANDARD balancing procedure is complete.

MIXED WEIGHTS Balancing Procedure (Combination of Clip-On & Adhesive Weights)



Verify that the wheel is clean and free of debris.

Remove all previous weights.

Mount tire/wheel assembly. *Refer to "Mount the Wheel on the Spindle Shaft," page 23.*

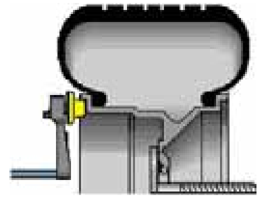
Press " ."

Use the arrows to select "MIXED WEIGHTS BALANCE" and press "OK."

Select either grams or ounces by rotating the control knob and highlighting either "g" or "oz."

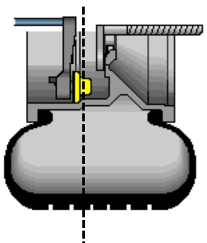
Select "DYNAMIC" by rotating the control knob to highlight " ." *Refer to "Dynamic Balancing Selection," page 43.*

Use both Dataset® arms in the **UPWARD** position at the clip-on weight location to measure the distance, diameter, and rim width dimensions. *Refer to “Using the Auto Dataset® Arms,” page 56.*



Do **NOT** return the arm to the “home” position.

Using the **DOWNWARD** position, move the inner Dataset® arm disk edge to the location for placement of the right edge of the adhesive weight on the right weight plane and enter data by depressing the foot pedal. *Refer to “Using the Auto Dataset® Arms,” page 56.*



Close safety hood.

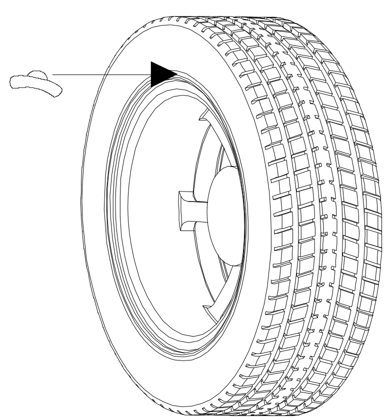
Press the green “START” button if “Hood Autostart” is disabled.

After wheel comes to a complete stop, raise safety hood.

The ForceMatch® HD / GSP9600HD will find the TDC for the left weight plane if “Servo-Stop” is enabled. “Servo-Stop” will hold the wheel in the TDC position while the weight is applied.

NOTE:	If optional HammerHead™ TCD weight locator is installed, the weight should be applied at the location marked by the laser.

Attach the clip-on weight amount shown on the DISPLAY for the left weight plane to the inner rim of the wheel.



If necessary, use the left “  ” to split the weight. *Refer to “Split Weight® Feature,” page 73.*

Servo-Activated Laser automatically locates BDC to aid in fast adhesive weight positioning.

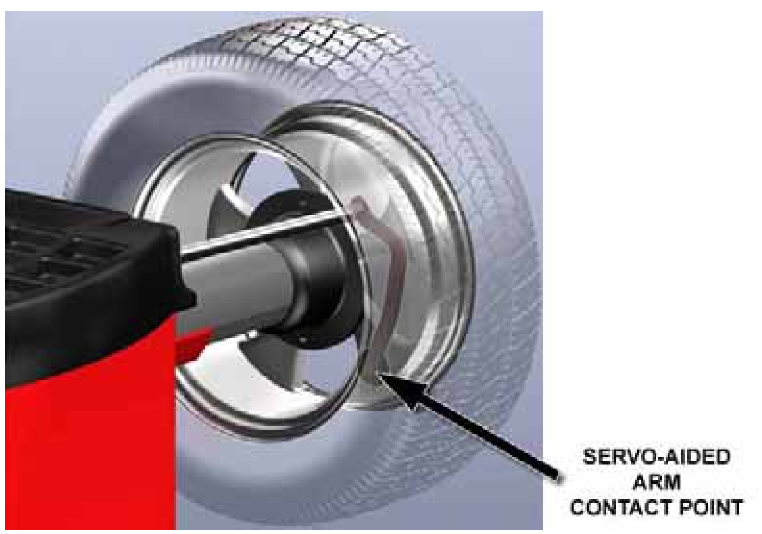
The BDC laser locator automatically displays a vivid line at bottom dead center after a wheel has been spun. The laser turns off when the wheel is spun again.

Place the correction weight centered on the laser line at a close distance to where the initial measurement took place inside the wheel.

Laser line encourages correct wheel weight placement for accurate angle positioning to eliminate static force. Providing that there are not large diameter changes inside the wheel, the small distance errors of placing the weight at a slightly different distance from the previous measurement will not significantly affect the couple force and the wheel will acceptable perform a check spin."

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

Alternative method to position the adhesive weight uses the inner dataset arm and the servo. *Refer to "Servo-Aided Adhesive Weight Placement," page 59.* When servo is enabled, move dataset arm as shown to trigger the servo and then follow screen instructions.

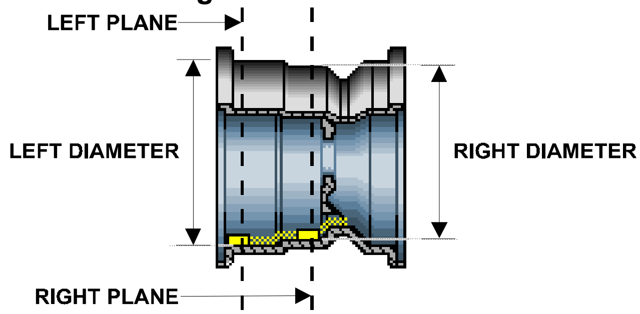


If necessary, use the right " " to split the weight. *Refer to "Split Weight® Feature," page 73.*

Left and right weight plane displays should show "zero."

MIXED WEIGHTS balancing procedure is complete.

ADHESIVE WEIGHTS Balancing Procedure



Verify that the wheel is clean and free of debris.

Remove all previous weights.

Mount tire/wheel assembly. *Refer to "Mount the Wheel on the Spindle Shaft," page 23.*

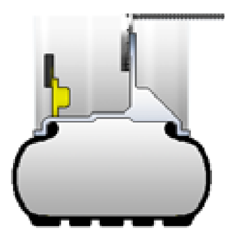
Press " ."

Use the arrows to select "ADHESIVE WEIGHTS BALANCE" and press "OK."

Select either grams or ounces by rotating the control knob and highlighting either "g" or "oz."

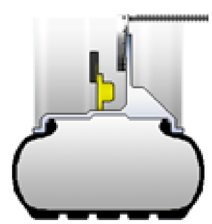
Select "DYNAMIC" by rotating the control knob to highlight " ." *Refer to "Dynamic Balancing Selection," page 43.*

Using the **DOWNWARD** position, place the inner Dataset® arm disk edge to the outermost location for placement of the right edge of the left adhesive weight and enter the data by depressing the foot pedal. *Refer to "Using the Auto Dataset® Arms," page 56.*



Do **NOT** return the inner Dataset® arm to the "home" position.

Using the **DOWNWARD** position, move the inner Dataset® arm disk edge to the innermost location for placement of the right edge of the right adhesive weight and enter the data by depressing the foot pedal. *Refer to "Using the Auto Dataset® Arms," page 56.*



Close safety hood.

Press the green "START" button if "Hood Autostart" is disabled.

After wheel comes to a complete stop, raise the safety hood.

Servo-Activated Laser automatically locates BDC to aid in fast adhesive weight positioning.

The BDC laser locator automatically displays a vivid line at bottom dead center after a wheel has been spun. The laser turns off when the wheel is spun again.

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

Alternative method to position the adhesive weight uses the inner dataset arm and the servo. *Refer to “Servo-Aided Adhesive Weight Placement,” page 59.* When servo is enabled, move dataset arm as shown to trigger the servo and then follow screen instructions.

If necessary, use the left “ ” to split the weight. *Refer to “Split Weight® Feature,” page 83.*

Return the inner Dataset® arm to the home position.

With the servo enabled, attach the adhesive weight for the right weight plane using the weight amount shown on the DISPLAY. *Refer to “Servo-Aided Adhesive Weight Placement,” page 59.* If servo is not enabled, BDC placement should be used. *Refer to “Manual Weight Position Measurement,” page 57.*

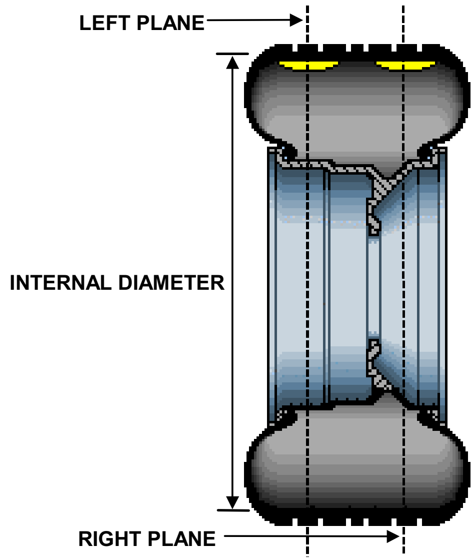
If necessary, use the right “ ” to split the weight. *Refer to “Split Weight® Feature,” page 83.*

Left and right weight plane displays should show “zero.”

ADHESIVE WEIGHTS balancing procedure is complete.

PATCH BALANCE® Procedure

Weighted balance patches will be placed on the inside of the tire at the edge of the tread area beside the sidewall as shown below:



NOTE:	Weighted balance patches should be installed only in tread area. Do not install weighted balance patches near sidewall or shoulder of tire.

Verify that the wheel is clean and free of debris.

Remove all previous weights.

Mount tire/wheel assembly. *Refer to “Mount the Wheel on the Spindle Shaft,” page 23.*

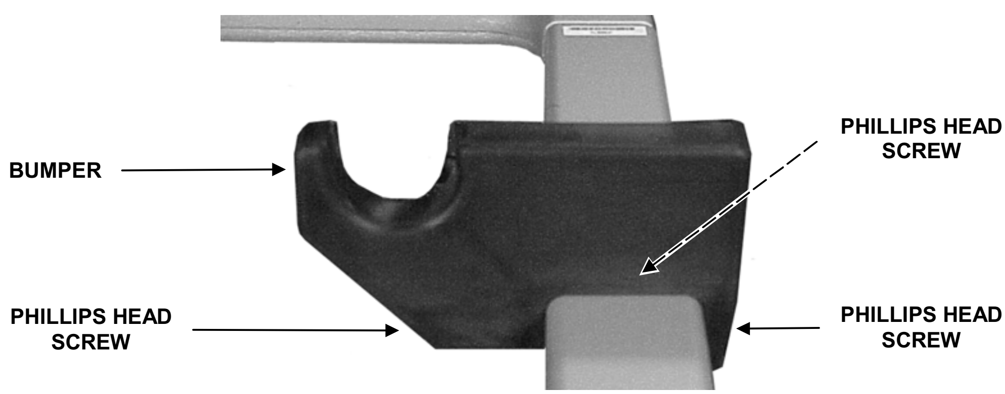
Press “.”

Use the arrows to select “PATCH BALANCE” and press “OK.”

Select either grams or ounces by rotating the control knob and highlighting either “g” or “oz.”

Select “DYNAMIC” by rotating the control knob to highlight “.” *Refer to “Dynamic Balancing Selection,” page 43.*

NOTE:	When measuring large tires that will use balance patches, it may require removal of the outer arm “home position” bumper for ample clearance of the outer Dataset® arm. The bumper can be removed by loosening three Phillips head screws and gently pulling the bumper away from the arm.



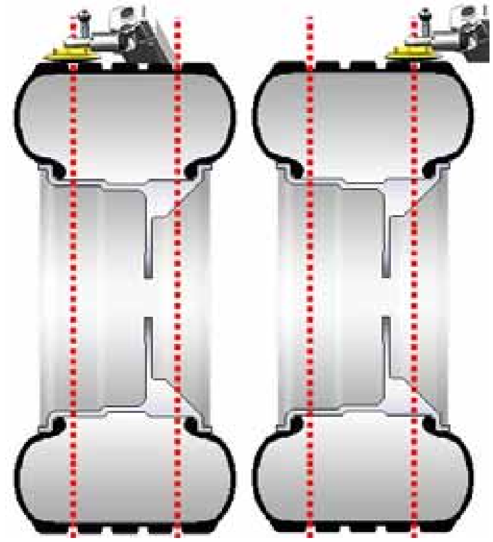
Measure and enter the weight plane distances as follows:

Set two of the widest weighted balance patches available side-by-side on the tread directly above where the left and right weighted patches will be installed inside of the tire. The patches should be positioned as far apart from each other as possible, but should not be placed in the sidewall or shoulder area of the tire.

Mark the tire tread at the center of the patches for future placement reference and remove the patches from the wheel.

Place outer Dataset® arm roller directly over the left mark and enter data by depressing the foot pedal.

Place outer Dataset® arm roller directly over the right mark and enter data by depressing the foot pedal.



Close safety hood.

Press the green “START” button if “Hood Autostart” is disabled.

After wheel stops spinning, raise the safety hood.

Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will find TDC for the left weight plane. Mark the tire’s inner sidewall for patch placement.

Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will find TDC for the right weight plane. Mark the tire’s outer sidewall for patch placement.

Place an aligning mark on the tire and rim to align them back together after applying the patch weights.

Remove wheel from balancer and dismount tire from rim.

Install left weight plane weighted balance patch(s) at mark(s) as instructed by manufacturer's instructions.

Install right weight plane weighted balance patch(s) at mark(s) as instructed by manufacturer's instructions.

Mount tire onto rim, aligning rim and tire marks.

Verify balance condition by spinning again with the load roller disabled. *Refer to “Load Roller Operation,” page 65.*

Finish the patch balancing procedure by returning to the appropriate balance procedure for the type of wheel being balanced. Verify balance condition by spinning again, and attach weights as necessary to correct for residual imbalance.

PATCH balancing procedure is complete.

Wheel Assembly Selection for Saving Spin Data

Saving Spin Data

The ForceMatch HD/ GSP9600HD tracks the wheel assembly currently being balanced.

The balancer assumes that the technician is working "around the vehicle" by beginning at the **LEFT FRONT** and working around the vehicle in a clockwise fashion. Successive spins are stored as either "before" or "after" data based on the following rules:

- If the weight displays read "OK/OK" or "---/---", assume the next complete spin is "before" data
- If the weight displays read anything other than "OK/OK" or "---/---", assume the next complete spin is "after" data

"Prompt for Wheel Assembly ID" can be disabled in setup when "Balance" is selected from the Logo screen.

Storing Measurements

Verify that the wheel is clean and free of debris.

Remove all previous weights.

Mount tire/wheel assembly. *Refer to "Mount the Wheel on the Spindle Shaft," page 23.*

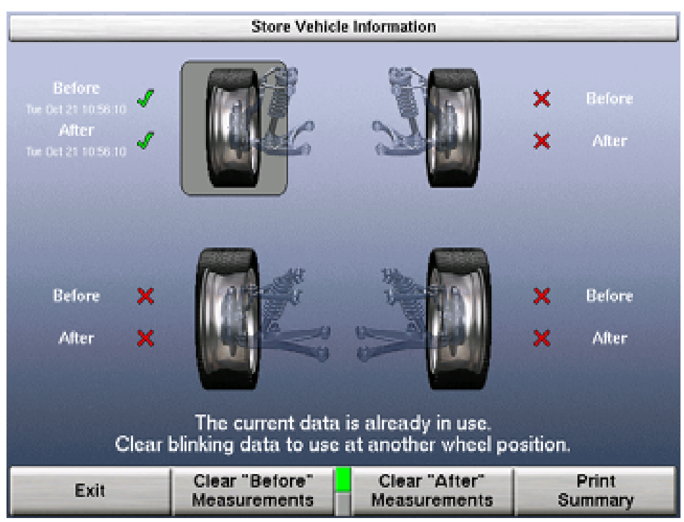
Enter the rim dimensions using the Dataset® arms and select "Balance".

Close safety hood.

Press the green "START" button if "Hood Autostart" is disabled.

Press the "Menu Shift"  until the "Store Measurements" selection is available.

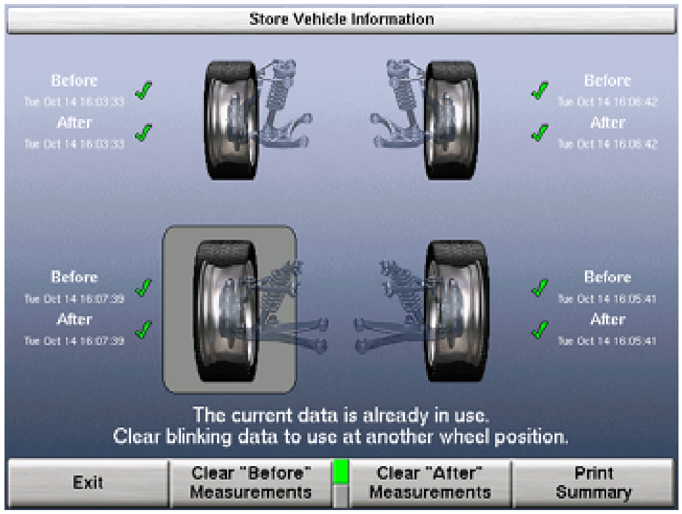
Select "Store Measurements". The measurements are stored for the front left assembly.



Select "Exit" to continue.

Balance assembly and continue to the next assembly. The "Store Measurements" screen will automatically progress to the next assembly in a clockwise direction.

Repeat “Store Measurements” until all assemblies are complete.



Select either “Clear Before Measurements” or “Clear After Measurements” to use that data at another wheel position.

To reset all stored measurements, Press the “Menu Shift” until the “Clear Data” selection is available. Select “Clear Data” and “OK” to reset.

Print Summary

A printout is available that incorporates a detailed image of each wheel assembly with the stored measurements. If a measured value is out of tolerance compared to the recalled specification, the value will be printed in red.

Select “Print Summary” to view the before and after results.

Select “Print” to send before and after balance summary results to the printer.

4.2 Using the Auto Dataset® Arms

Auto Dataset® arms perform two functions:

- Input weight position measurements for balancing.
- Input wheel runout measurements for ForceMatch™ Measurements. Refer to “ForceMatch™ Measurement,” page 65.

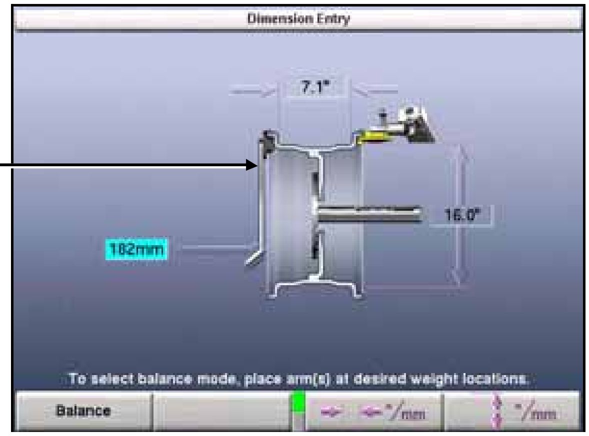
Auto Dataset® is a faster and more accurate method to take rim measurements than traditional methods. Auto Dataset® is used to input rim distance, rim width, and weight plane location automatically. The Dataset® Arms of the ForceMatch® HD /

GSP9600HD are positioned on the weight plane and data is entered by depressing the foot pedal.

Automatic Weight Position Measurement

The Dataset® arms can be used to enter weight position dimensions instantly and accurately. The arms are "triggered" when they are moved away from their home position. When the arms are triggered, a blinking graphic depicting the Dataset® arm on the "Dimension Entry" screen identifies the plane currently being inputted.

INNER DATASET
ARM TRIGGERED
(BLINKING)



In most cases, the Dataset® Arms are used to input the exact weight position.

The exact weight position is entered by holding the arm(s) stable in the desired location and depressing the foot pedal to enter the dimensional data.

Manual Weight Position Measurement

NOTE:	If optional HammerHead™ TCD weight locator is installed, the weight should be applied at the location marked by the laser.

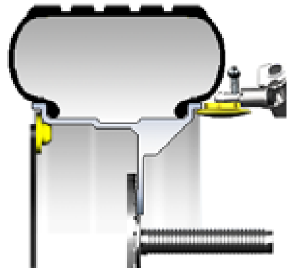
While on the "Set Dimensions" view of the "Balance" primary screen, the control knob can be used to enter rim dimensions manually.

Hunter Engineering Company recommends using the inner and outer Dataset® arms to enter dimensions. *Refer to "Using the Auto Dataset® Arms," page 56.*

Measuring Dimensions for Standard Clip-on Weight Balancing

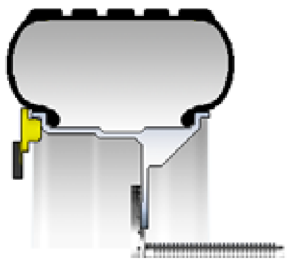
To measure rim dimensions for clip-on weights, activate the Standard balancing mode. Pull the inner Dataset® arm away from the weight tray and **UPWARD** until it is touching the top of the wheel inner rim lip. Simultaneously pull the outer Dataset® arm out and upward until it is touching the top of the wheel outer rim lip. While the Dataset® arms are in place, depress the foot pedal to enter the dimensional data. The ForceMatch® HD / GSP9600HD will beep to confirm data entry.

NOTE:	Dataset® arms can input dimensions separately if desired.



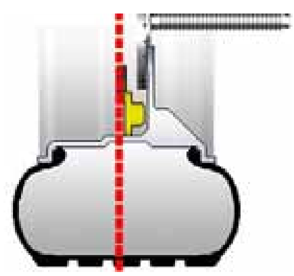
Measuring Dimensions for Mixed Weights (Clip-on/Tape-on) Balance

To measure rim dimensions for the clip-on weight, pull the inner Dataset® arm away from the weight tray and **UPWARD** until it is touching the wheel inner rim lip. Depress the foot pedal to enter the dimensional data. The ForceMatch® HD / GSP9600HD will beep to confirm data entry.



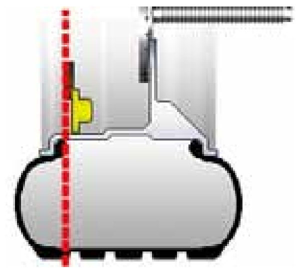
Do **NOT** return the Dataset® arm to the home position.

Move the Dataset® arm **DOWNWARD** until the roller disk edge is touching the wheel at the right edge of the desired adhesive weight location. Depress the foot pedal to enter the dimensional data. The ForceMatch® HD / GSP9600HD will beep to confirm data entry.



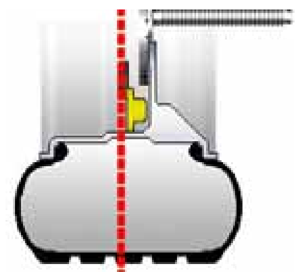
Measuring Dimensions for Adhesive Weights Balancing (Tape-on/Tape-on)

To enter adhesive weight dimensions for the inner plane, pull the inner Dataset® arm away from the weight tray and **DOWNWARD**, until the roller disk edge is touching the wheel at the right edge of the desired left weight plane location. Depress the foot pedal to enter the dimensional data. The ForceMatch® HD / GSP9600HD will beep to confirm data entry.



Do **NOT** return Dataset® arm to the home position.

Move the Dataset® arm at the right weight plane location in the **DOWNWARD** position and depress foot pedal to enter dimensional data. The ForceMatch® HD / GSP9600HD will beep to confirm data entry.



Servo-Aided Adhesive Weight Placement

When Servo-Stop is enabled in setup, the inner Dataset® arm can be used to assist in proper placement of adhesive weights. Servo-aided weight placement is a more precise method of weight placement than manual weight placement. The motor will automatically rotate the wheel to the contact point of the arm. This eliminates the need for the user to “eyeball” BDC, which often results in weight placement error.

Spin the wheel using Mixed Weights or Adhesive Weights selection.

Shape the weight to a contour similar to the curve of the rim.

Using dimensional information previously obtained the on-screen graphic displays and identifies the exact location of the weight plane and the current position of the inner Dataset® arm. Pull the inner Dataset® arm out from the base until the arm and the weight location are overlapping.

Maintaining that distance, rotate the Dataset® arm toward the inner rim surface, and then apply the adhesive weights to the rim.

NOTE:	If the servo is off (but is enabled in setup), pressing the “START” button with the hood in the RAISED position will restart the servo for adhesive weight application.

Manual Adhesive Weight Placement

NOTE:	Manual weight placement is not as accurate as servo-aided weight placement. Servo-aided weight placement should be used whenever possible.

NOTE:	If the servo-aided weight placement is enabled, press the "STOP" button with the hood in the **RAISED** position to disable.

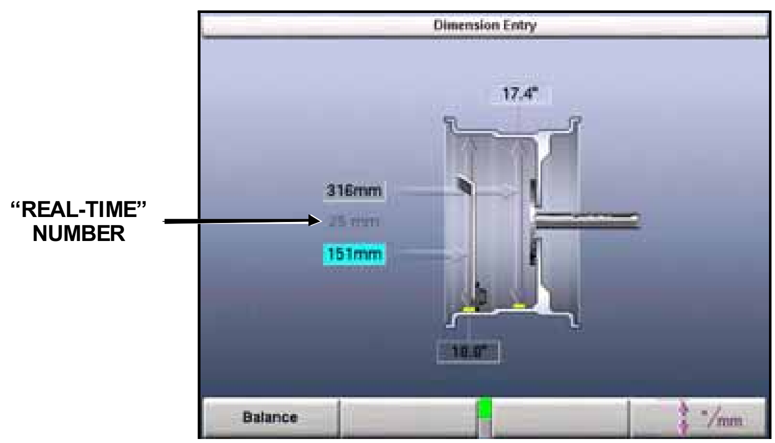
To manually place adhesive weights on the rim after spinning, the inner Dataset® arm should be used to verify the previously inputted distance.

Rotate the wheel until the location arrow of the desired weight plane is green.

Lift the inner Dataset® arm from home position. The "real-time" number displayed between the two numbers that represent previously inputted data displays the current reading of the inner Dataset® arm. The arm should be placed in the downward position on the rim until the real-time number matches the previously inputted data.

NOTE:	Lifting the inner Dataset® arm will trigger the balancer for dimension input. Do NOT step on the foot pedal or new dimensions will be entered.

The weight should be placed at **BDC** at that distance.



Rim Runout Measurements

Rim runout can be measured with the tire mounted to the rim, or the bare rim can be measured separately for more precise measurements. If the assembly does not have a flat faced rim, take the runout measurement. *Refer to "Rim Runout Measurement (Wheel Assembly)," page 62. If the assembly is flat faced, and you are prompted by the ForceMatch® HD / GSP9600HD to take runout data, or to verify the runout data already taken with the tire in place, take the runout measurement as described in "Rim Runout Measurement (Bare Rim)," page 64.*

Bare rim measurement is a more accurate method of measuring rim runout. Bare rim measurements can also be used to audit bare rims prior to the installation of a tire.

Runout can be viewed by selecting "Show Runout and QuickMatching" from the "Balance" primary screen.

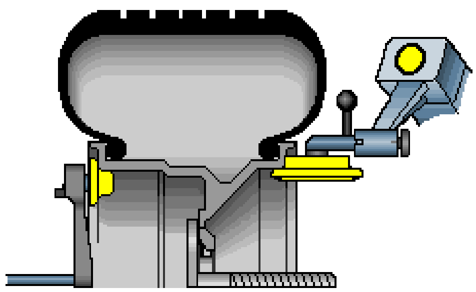
Single Arm Inner Dataset Runout Measurement

The inner Dataset Arm can be used alone externally to measure rim runout of the inboard bead seat. This method is not as accurate as two position measurement, but it is faster for ForceMatch® predictions.

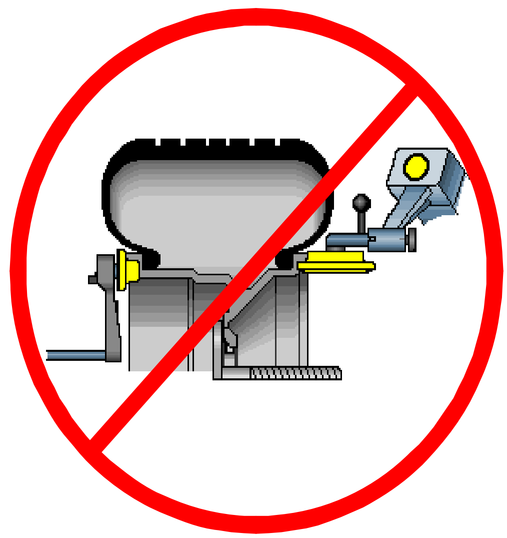
Rim Runout Measurement (Wheel Assembly)

If beaded runout is excessive with the wheel assembly, the ForceMatch® HD / GSP9600HD ForceMatch® balancer will prompt you to measure rim runout. The “Measure Rim Runout” popup screen can be selected from the “Balance” primary screen, or by pressing the outer arm button once. To measure rim runout with the tire on the rim, remove all clip-on weights from the rim and place the inner and outer Dataset® arm on the rim as shown below:

NOTE:	Note the location of the Dataset® arms on the rim. The location for rim runout measurement is **NOT** the same as the location for inputting rim dimensions for weight location.



CORRECT POSITION FOR MEASURING RIM RUNOUT

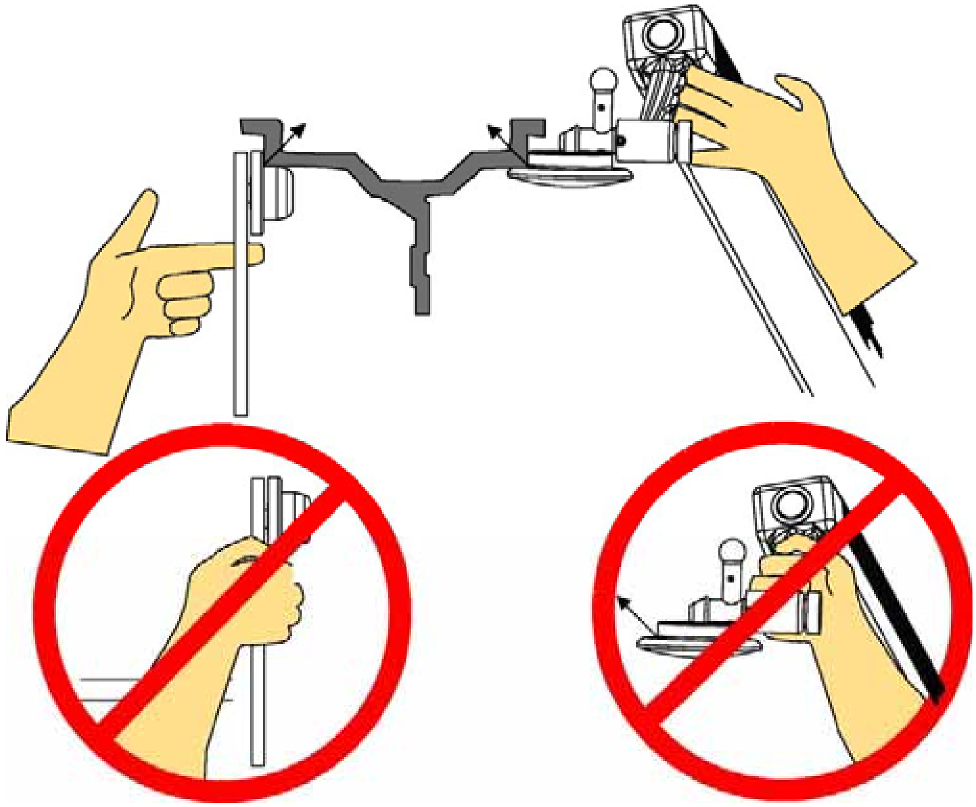


INCORRECT POSITION FOR MEASURING RIM RUNOUT

When Dataset® arms are in place, press the outer arm button. The motor will slowly rotate the wheel to measure runout. While the wheel is in motion, **gently apply a constant upward and inward fingertip pressure on both Dataset® arms as shown below:**

⚠ **CAUTION:**	Take care when placing hands to measure rim runout that no part of your hands or body interferes with parts in motion.

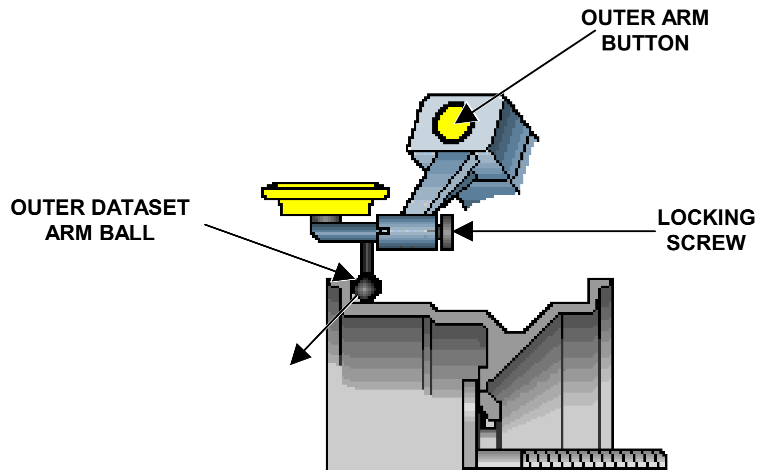
NOTE:	Do not grasp the Dataset® arms. Use fingertip pressure only.



The runout data will automatically be displayed when the operation is complete. The inner and outer rim runout first harmonics will be shown as amounts in the upper left-hand corner of the screen. Radial high spots of runout will be shown as blue indicators on the rim. Lateral high spots will be shown as orange indicators on the rim when "Show Lateral High Spots" is selected. The average of the inner and outer radial first harmonic high spots is taken to locate the average radial first harmonic rim low spot (matching mark). *Refer to "Harmonics & T.I.R. Data/Plots," page 98.*

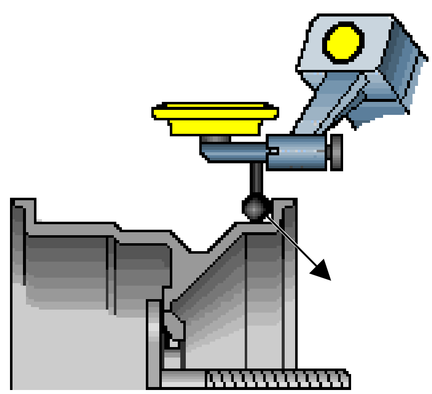
Rim Runout Measurement - Bare Rim

To measure bare rim runout, remove the tire from the rim. Mount the bare rim on the ForceMatch® HD / GSP9600HD. Select "Measure Rim Runout" from the "Balance" primary screen. Select "Measure Bare Rim." Loosen the outer Dataset® arm locking screw by turning it counter-clockwise. Pull out and rotate the rim runout ball on the outer Dataset® arm to the downward position. Secure the locking screw. Place the outer Dataset® arm ball against the left bead seat lip as shown below:



When outer Dataset® arm ball is in place, press the outer arm button. The motor will slowly rotate the rim to measure runout. While the wheel is in motion, gently apply a downward and outward pressure on the outer Dataset® arm ball.

When the screen prompts, place the outer Dataset® arm ball against the right bead seat lip as shown below:



When the Dataset® arm ball is in place, press the outer arm button. The motor will slowly rotate the rim to measure runout. While the wheel is in motion, gently apply a downward and outward pressure on the Dataset® arm ball.

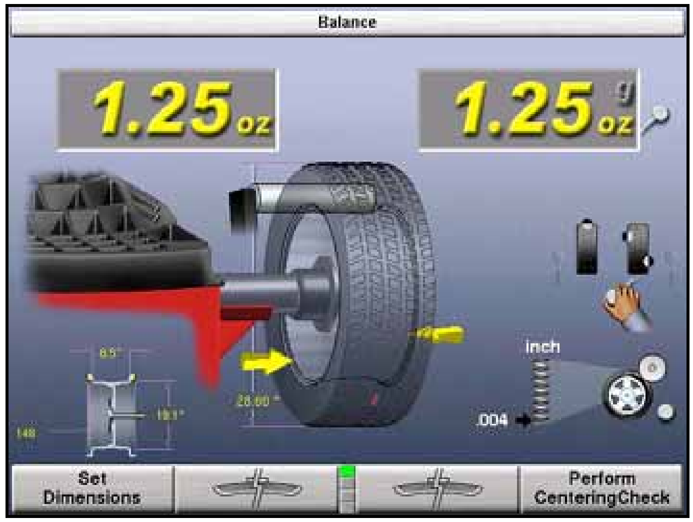
If the data will be used in ForceMatching®, scribe a mark with chalk or a marker to realign the rim to the hub/shaft assembly after the tire is mounted. After mounting the tire and re-spinning, the runout data of the bare rim may be recalled by pressing "Recall Last Rim Data" from the "Runout and QuickMatching" popup screen. *Refer to "ForceMatching® Using Previous Bare Rim Measurement," page 67.*

4.3 Load Roller

ForeceMatch™ Roller Operation

The load roller runs parallel to the tire and applies a perpendicular load on the assembly to take ForceMatch® loaded runout measurements. It is capable of producing up to 300 pounds of force.

The load roller can be enabled and disabled by turning the control knob. When the load roller is enabled, the display will show the load roller on the screen as shown below.



NOTE:	The load roller cannot be enabled in “Bare Rim Spin” mode.

When the load roller is disabled, only a balance spin will be performed. This can be useful for a balance check spin after weights have been applied.

Load roller data can be viewed by selecting “Show Runout” from the “Balance” primary screen.

4.4 ForceMatch® Tire and Wheel Mounting

ForceMatch® tire and wheel mounting procedure is a method of aligning the high spot of the radial loaded runout first harmonic (once-per-revolution component) with the average low spot of the radial rim runout first harmonic to decrease vibration in the wheel assembly. *Refer to “Loaded Runout Measurement,” page 22.*

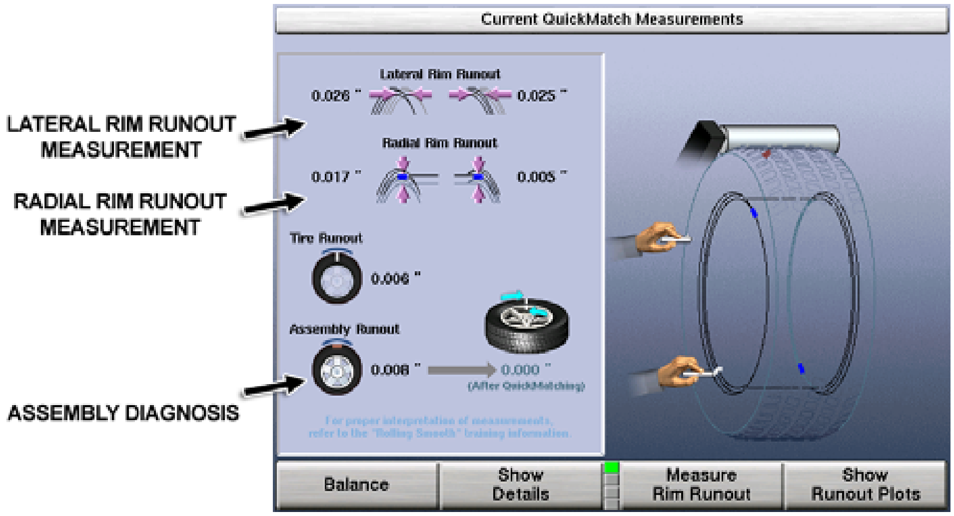
ForceMatch® is available as a softkey selection if enabled from the setup menu.

After measuring the assemblies loaded runout, it prompts the operator “ForceMatch? Yes or No.” *Refer to “Rim Runout Measurements,” page 61.* If the operator chooses “Yes,” the ForceMatch® HD / GSP9600HD will then prompt the operator to measure rim runout.

After measuring rim runout, the results will be shown on the “Current Runout” popup screen.

NOTE:	ForceMatch® tire and wheel mounting procedure results and benefits are not computed until rim runout is measured.

The "Current Runout" screen will display a message informing you if ForceMatching® will be beneficial.

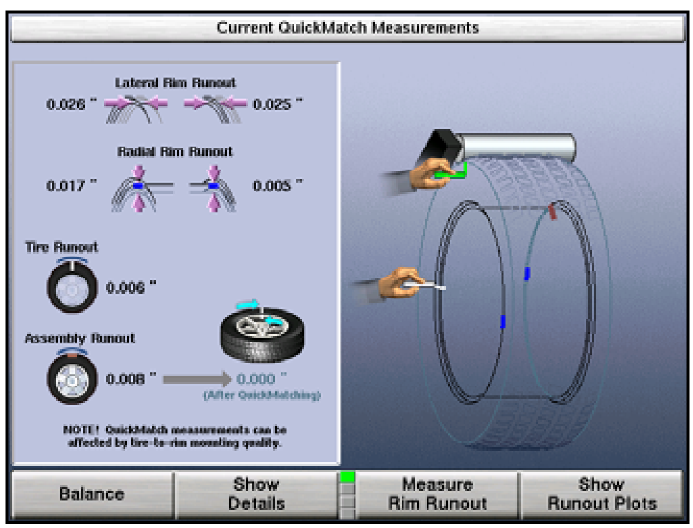


NOTE:	Lateral rim runout measurement reading will not be available if Truck ForceMatch® procedure is used.

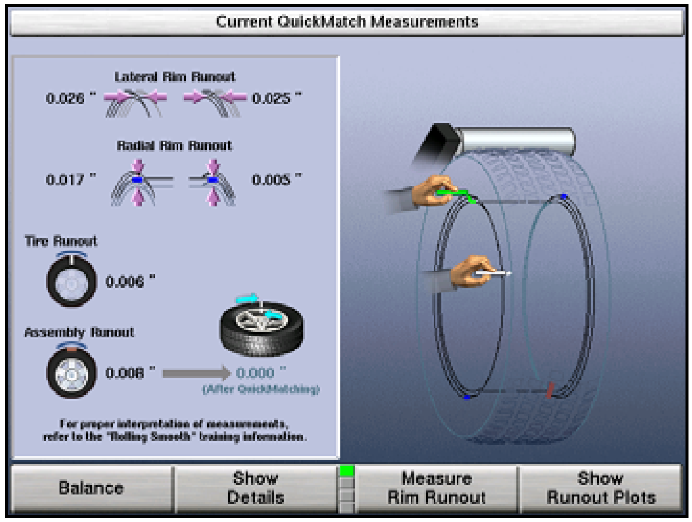
ForceMatch® Procedures

To correct loaded runout by ForceMatch®:

Rotate the tire loaded runout high spot on the wheel to TDC, or with the hood in the raised position and the servo enabled, press "START." Mark the tire with a piece of chalk or a marker at TDC.



Rotate the rim low spot on the wheel to TDC, or with the hood in the raised position and the servo enabled, press "START." Mark the rim with a piece of chalk or a marker at TDC.



Use a tire changer and align the tire and rim marks to one another. *Refer to the operation instructions for the tire changer in your shop.*

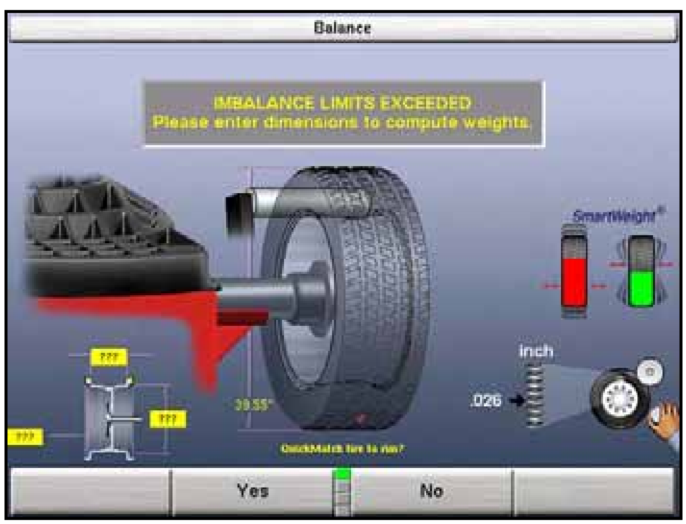
NOTE:	If the wheel assembly can be corrected by ForceMatch®, the results can be viewed prior to removing the assembly from the balancer by viewing the "Current ForceMatch Measurements" primary screen.

ForceMatch® is complete.

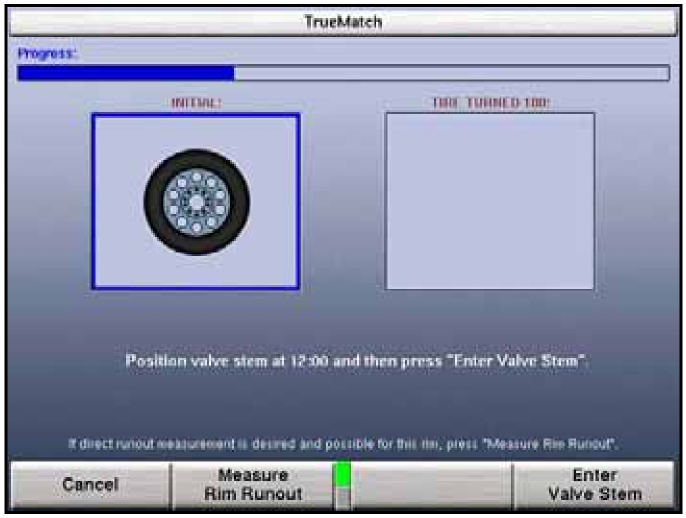
ForceMatch® Using 180° Process

This process is recommended on all HD assemblies or where external rim measurement is not feasible.

After measuring the assemblies' loaded runout, choose "Yes."

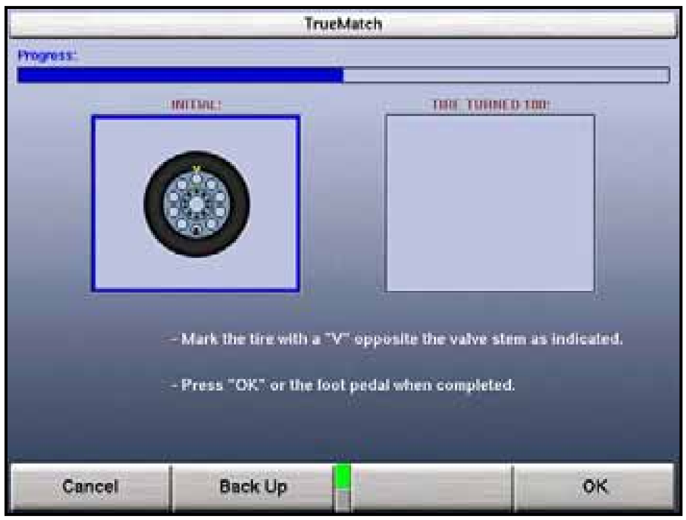


Place the valve stem at 12:00 and select “Enter Valve Stem.”



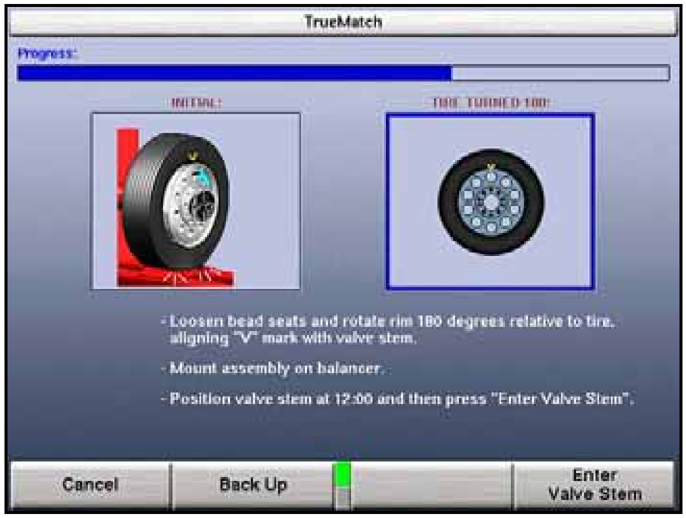
The balancer will now rotate the tire/wheel assembly 180°.

Mark the tire at TDC after assembly has stopped rotating. Press “OK.”

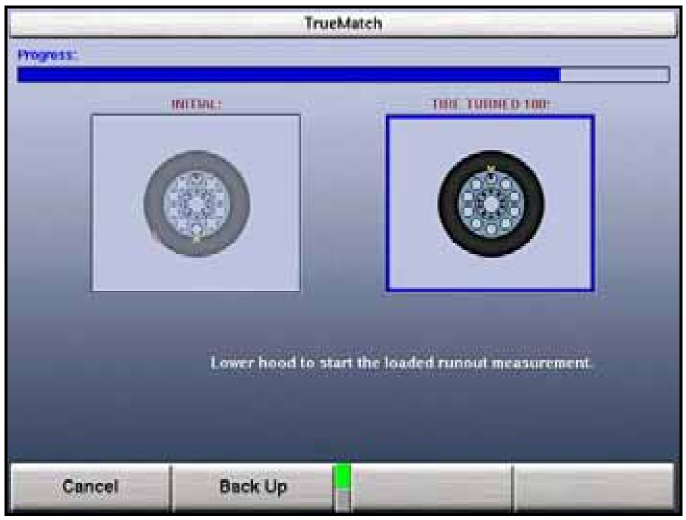


Remove the assembly from the balancer and align the mark on the tire with the valve stem.

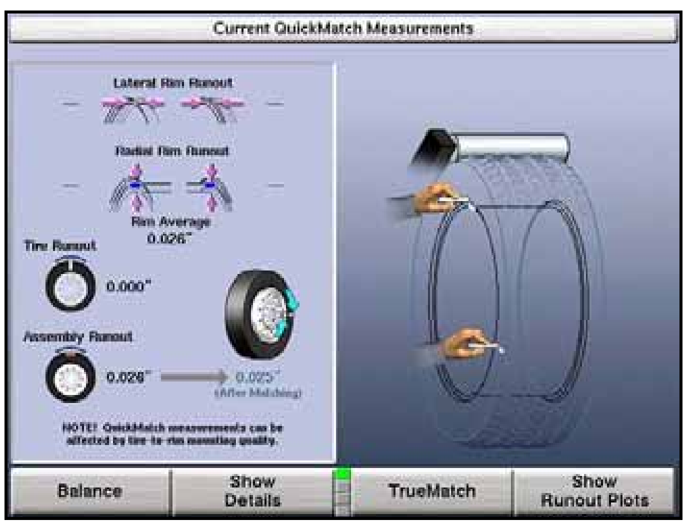
Mount the assembly on the balancer again and position the valve stem at 12:00. Press “Enter Valve Stem.”



Lower the hood to take a loaded runout measurement.



The ForceMatch® HD / GSP9600HD will display the results.



ForceMatch® Using Previous Bare Rim Measurement

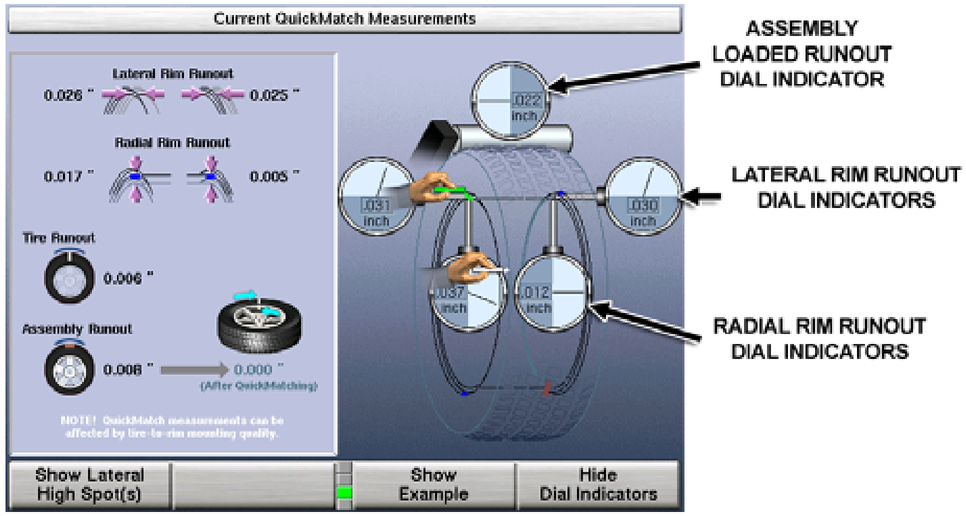
If bare rim measurements *(refer to "Rim Runout Measurement -Bare Rim," page 64)* have been taken and will be used for ForceMatch® procedures, it will be necessary to scribe two aligning marks with a marker or chalk on the hub/shaft assembly and the rim. This will allow you to align the rim and hub/shaft assembly back together after mounting the tire on the rim. After spinning with the tire mounted and the load roller enabled, press "Apply Last Rim Data" from "Current ForceMatch Measurements" primary screen. This will recall the bare rim runout data from the previous rim measurement.

ForceMatch® Using Previous Loaded Runout Measurement

- This procedure should be used if a bare rim measurement will be taken for rim runout data after the Loaded Runout Measurement has been obtained, such as when the rim runout data cannot be measured from the outside surface of the rim.
- With chalk or a marker, draw two aligning marks on the hub/shaft assembly and the rim.
- Mark the tire at the location of the valve stem and label the line "VS."
- Remove the assembly from the balancer.
- Remove the tire from the rim and remount the bare rim onto the balancer, being careful to realign the rim and hub/shaft assembly marks.
- Take the bare rim measurement. *Refer to "Rim Runout Measurement - Bare Rim," page 64.*
- Press "Apply Last Tire Data" to recall the previous loaded runout Measurement.
- Mark the rim at the high spot of tire loaded runout and label the mark "TR."
- Mark the rim at the low spot of rim runout and label the mark "RR."
- Lay the tire down on the floor.
- Remove the rim from the balancer and set it on top of the tire with the valve stem ("VS") mark on the tire aligned to the valve stem.
- With the valve stem and valve stem ("VS") mark aligned, transfer the loaded runout ("TR") mark from the rim to the tire and label it "TR."
- Mount the tire on the rim with the loaded runout ("TR") mark on the tire and rim runout ("RR") mark on the rim aligned.

Dial Indicator Gauges Feature

The “Show Dial Indicators” key may be selected from the “Current ForceMatch Measurements” screen to display on-screen dial indicator gauges. Each gauge displays the runout (actual arm movement) encountered at that location. This data is also displayed as the total indicated reading (T.I.R.) data on the runout plot screens. *Refer to “Harmonics & T.I.R. Data/Plots,” page 98.* If there is green only showing in the span of the gauge, T.I.R. runout is acceptable. If green and yellow appear on the span of the gauge, T.I.R. runout is marginal. If red appears on the span of the gauge, T.I.R. runout has been exceeded. The dial indicator located directly above the tire tread is the loaded runout of the assembly as taken by the load roller. As the wheel assembly is rotated on the spindle, the dial indicator gauges will change to display current information for each dial indicator gauge position.



“Hide Dial Indicators” can be selected to remove the dial indicator gauges from the screen. Rim runout and loaded runout will still be graphically depicted on the screen.

Lateral/Radial Rim High Spot Indicators Feature

The “Show Lateral High Spot(s)” and “Show Radial High Spot(s)” softkeys are available to select a graphic depiction of the exact radial (blue indicators) or lateral (orange indicators) first harmonic runout high spot locations. The high spots indicated are the high spots of the first harmonic, NOT the T.I.R. runout high spots. The lateral/radial high spots correspond to the lateral and radial first harmonic rim runout amounts on the left side of “Current ForceMatch Measurements” screen. Located 180 degrees from the rim matching mark is a green indicator that will appear between the rim lips to identify the rim average 1st harmonic high spot.

Encountering ForceMatch® Prediction Errors

Below are some reasons why the ForceMatch® HD / GSP9600HD may not match or quantify the value of the tire or the assembly.

- **Incorrect Mechanical Wheel Mounting on the Shaft:**
  This can be caused from worn or damaged adaptors, rust, or debris on the wheel, shaft, hub, adaptors, or a cone contacting a wheel on an irregular surface. Verify proper mounting by performing a centering check.
- **External Rim Measurement vs. Actual Bead Seat Measurement:**
  There is a high correlation between external and internal measurement, however the operator must consider each wheel design individually. Some cast or closed-faced wheels cannot be accurately measured externally. The tire must be removed for accurate bead seat runout measurements.
- **Incorrect Tire Bead Seating Procedures:**
  Tire technology is always changing. Today's vehicles require the tire to be designed to tightly adhere to the wheel, preventing slippage between the two components. As a result, incorrect tire bead seating procedures are becoming more of an issue in solving vibration complaints. In many cases, a wheel will display high non-uniformity values because of increased tire bead interference, wheel design, or improper bead seating procedures. If the tire is re-loosened from the wheel and properly lubricated and remounted, the level of non-uniformity may decrease dramatically. On sensitive vehicles, sometimes there is benefit to slightly over-inflating the tire, deflating the air, and then re-inflating to optimize bead seating.
- **Insufficient Use of Tire Mounting Lube During Mounting:**
  "Lube is Good!" Proper lubrication on the tire bead **and** rim areas including bead seat, hump, balcony, and drop center are vital in achieving proper seating of the tire bead to the wheel assembly. Aggressive acceleration or braking should be avoided for the first 500 miles to prevent tire to wheel slippage.
- **Rim Safety Hump Design 'Hangs Up' Tire Bead During Bead Seating:**
  Some types of wheels use a square safety hump that may further inhibit uniform tire bead seating. This further underscores the importance of proper lubrication and bead seating procedures.
- **Temporary Flat Spotting:**
  Flat spotting may occur when the tire is in one position for an extended period of time, such as a parked vehicle, improper storage of the tire, and temperature extremes. Measurements for force and balance will stabilize as soon as the tire is driven for a few miles. This important issue can also affect traditional wheel balancing procedures.
- **Excessive Lateral Runout of Tire and/or Rim:**
  A tire or wheel with high lateral readings may affect the predicted results.

Do's and Don'ts of Loaded Runout Measurement

- Some tires may need to be warmed up to remove temporary flat spots prior to testing.
- Verify the wheel is centered before measurements are taken.
- Use wing nut provided and it must be tight.
- Tire inflation pressure must meet vehicle manufacturer's specifications.
- The tire/wheel assembly must be free of debris.
- Bare rim runout measurements or ForceMatch® 180° procedure are required if the wheel design does not permit external measurement of the outer bead seat area.
- Use realistic Runout measurement values for the vehicle being tested.
- If chosen values have been exceeded, never use Runout measurement alone to warranty a tire unless specified by the manufacturer.

5. Balancing Features and Options

5.1 SmartWeight® Balancing Technology

SmartWeight® balancing technology is a method of analyzing forces on a wheel during balancing. This results in less weight used, and less time balancing tires.

SmartWeight is not a procedure. Instead, it measures the forces of couple side-to-side shimmy and static up-and-down shake and computes weight to reduce these forces. This reduces the amount of weight, reduces time, reduces check spins, chasing weights, and saves the shop time and money.

SmartWeight can reduce the number of steps in the balancing process. Not only does SmartWeight give the customer a better riding vehicle, it also helps the environment by using less corrective weight, and speeds up the wheel balance process which saves the shop time and money.

Static and non-rounding modes are eliminated to simplify operation. Always enter at least two weight positions during wheel measurement in SmartWeight mode. All other functions are identical to the traditional balancing method.

SmartWeight will also compute the amount of weight saved over time. A histogram of weight savings statistics can be viewed from the “Logo” screen.

Static and Dynamic Imbalance Sensitivity

As a general rule of thumb, to achieve the best balance on an automotive sized tire and wheel assembly (15 inch rim):

Residual static imbalance should be less than 1/4 ounce (7 grams).

Residual couple imbalance should be less than 3/4 ounce (21 grams).

Residual couple imbalance is preferred over remaining static imbalance.

It takes much more residual couple imbalance weight to cause a vibration than the same amount of static imbalance correction weight.

The larger the diameter used for weight placement, the smaller the amount of correction weight is required for static correction.

The wider the distance between the two weight placement locations, the smaller the amount of correction weight is required for couple correction.

If static balance is the only option, always verify that the remaining couple residual imbalance is within acceptable tolerance. SmartWeight is the only way to verify.

NOTE:	SmartWeight balancing performs this check automatically.

5.2 SmartWeight Forces and Limits Feature

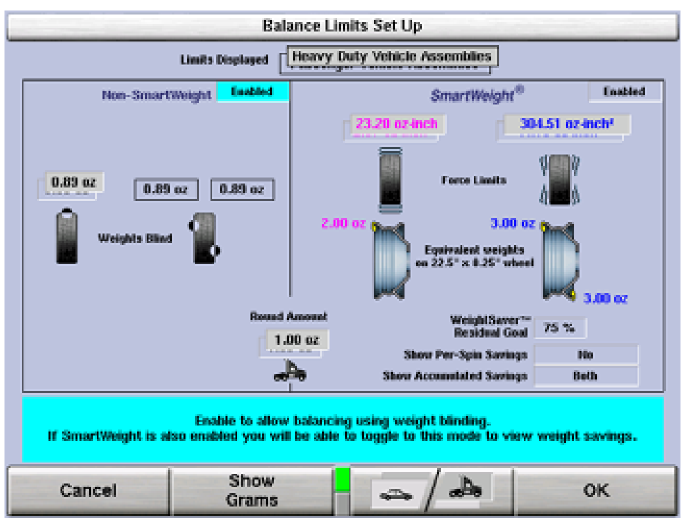
The static and couple forces are adjustable and show equivalent weight amounts on an example 15"x7" wheel. Static force is measured in oz. per inch. Couple force is measured in oz. per inch^2. The defaults are preset for virtually all vehicle sensitivity limits.

5.3 Weightsaver® Wheel Balancing Feature

NOTE:	Balance Limits setup may only be viewed when in service mode.

Essentially, SmartWeight® sets limits on the forces. Weightsaver® adjusts the percentage of these forces to either save weight, or have a more fine-tuned balance. With SmartWeight, when the bar graph is in the green it is within acceptable limits. Weightsaver allows that bar graph window to be changed.

The Weightsaver wheel balancing feature is a percentage of the force limit intentionally left in the assembly to save weights.



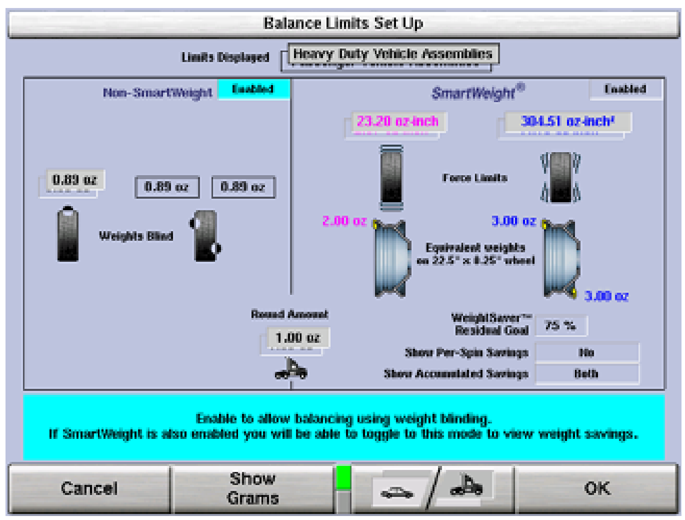
Adjusted lower value favors a lower residual force and a higher percentage value favors weight savings. The following example is set at the default of 75%. A 75% residual goal means that Weightsaver allows 75% of the maximum allowed couple force to remain. This saves more weight, saves time, and saves money.

A summary of the amount of weight savings using SmartWeight® balancing technology is available.

5.4 SmartWeight Odometer

SmartWeight Odometer displays the accumulated savings on the balance screen.

The odometer can be enabled/disabled in setup, (service mode) showing weight savings, money savings or both. Within “Balancing Limits” setup, choose the display of SmartWeight Odometer or/and per-spin savings. Factory default is the display of odometers and no per-spin display.



Show Savings Summary

When the SmartWeight Odometer is present on screen, press the “Show Savings Summary” softkey for detailed explanation of savings.

NOTE:	“Show Savings Summary” will be “projected savings” when selected time frame exceeds actual time of use.

A summary of the savings due to SmartWeight is displayed.

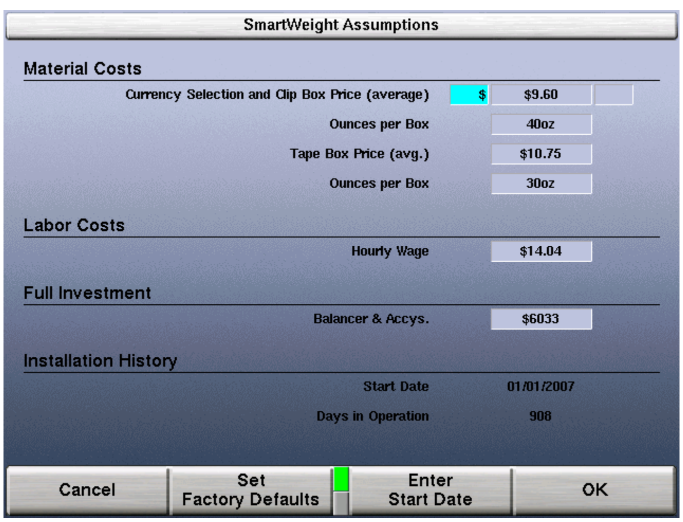
NOTE:	“Set Assumptions” key available in “Service Mode” only.

Rolling the selector knob will change from Daily to Weekly to Monthly Yearly and Five Year savings.

Select “Print Screen” to print the weight savings displayed.

To enter actual weight costs and labor costs for cost savings calculation, select “Set Assumptions” (service mode) softkey for the “Smart Weight” screen.

NOTE:	“Installation Date” must be entered for Investment Return calculations to function.



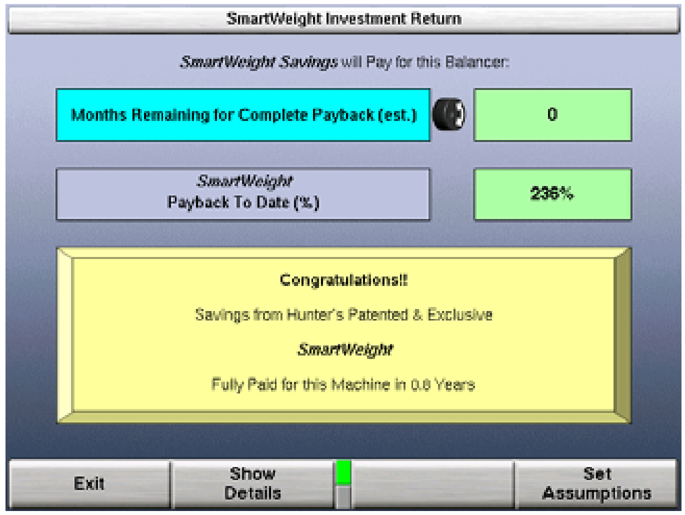
Enter requested information with control knob: rotate to change value and press to advance to next field.

NOTE:	"Set Assumptions" key available in "Service Mode" only.

Select "Enter Install Date" softkey to enter a date for the savings screen to properly show time to savings values.

Select "Exit" softkey when done.

To view the payback of balancer from savings due to SmartWeight, select "Investment Return" softkey from the "Smart Weight" screen.

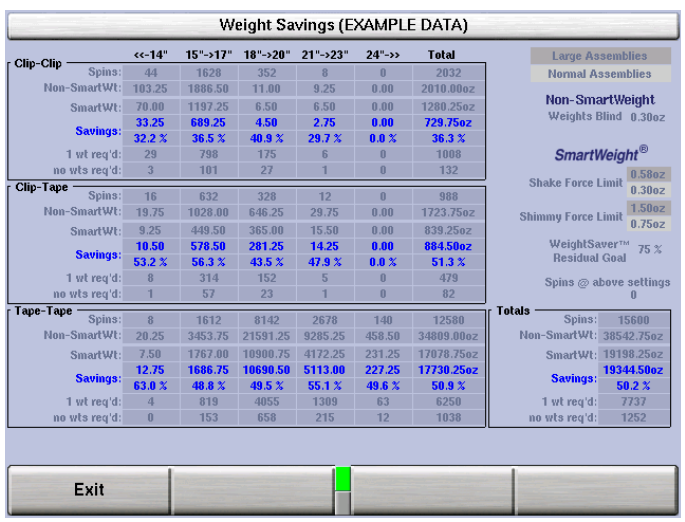


Rolling the selector knob will change from months to years of payback. Pressing the selector knob and then rolling it will change from percentage payback to total monetary value.

Select "Print Screen" to print the weight savings displayed.

Select "Exit" softkey when done.

To view additional details of savings due to SmartWeight, select "Show Details" softkey from the "Smart Weight" screen.



The page shows the amount of weight savings, highlighted in blue, using SmartWeight® balancing technology. The savings are shown in both actual weight and percentage.

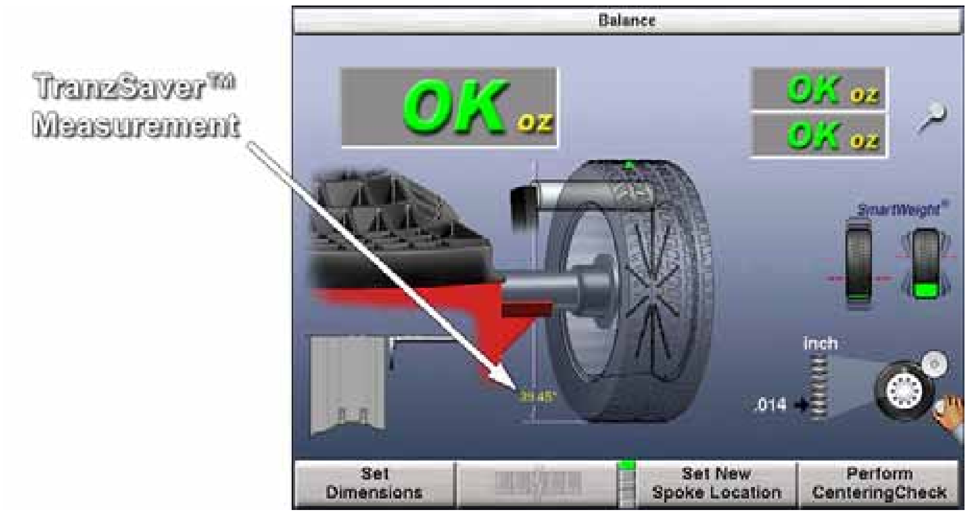
Select "Print Screen" to print the weight savings displayed.

Select "Exit" softkey when done.

NOTE:	The statistics can be cleared by selecting the “Clear Data” softkey. This could be used if tracking weight during a specific period. The “Clear Data” key may only be selected when in Service Mode. *For more information refer to “Service Mode Setup and Features,” page 104.*

5.5 TranzSaver™

NOTE:	TranzSaver™ measurement will only display when ForceMatch® is enabled.



TranzSaver™ displays the diameter of the tire and wheel assembly on the balance screen. Measuring overall tire diameter and comparing the diameter to other tires on the same vehicle may be important for all-wheel drive and four-wheel drive vehicles to ensure proper drive line performance and minimize the potential for premature transmission transfer case failure.

Mismatched tires in varying diameters or using unequal inflation pressures for AWD and 4WD vehicles may result in immediate drivability problems or premature transmission transfer case failure. This necessitates that 4WD and AWD vehicles use tires that are very closely matched in diameter and inflation pressures. Tire diameter variations can be caused by using different sized tires, tires with different tread designs, tires made by different manufacturers, different inflation pressures or even tires worn to different tread depths.

Depending on the vehicle and manufacturer, AWD and 4WD drivetrains can vary greatly in their sensitivity to unequal tire diameters. Consult the vehicle owner's manual for vehicle manufacturer's recommendations when replacing less than four tires. If 4x4 or AWD vehicles manufacturer's recommendations are not available, a good ‘rule of thumb’ is that all tires should be within 0.30” diameter of each other.

TranzSaver™ data may be displayed in assembly diameter, assembly revolutions or assembly circumference.

TRANZSAVER REVOLUTIONS MODE **TRANZSAVER CIRCUMFERENCE MODE**

Dual Wheel Mounting

Total wheel assembly diameter is essential information when mounting duals. Equal diameters should always be mounted in pairs to prevent uneven wear and loading due to tire diameter differences. Using the TranzSaver™ number on the balancer display will help with the pairing process. Marking the diameter on the sidewall of the tire may help in future pairing.

When mounting duals, it is also recommended to place the high spot of each tire 180 degrees from each other to help reduce vibrations, the high spot of the tire is shown as a brown mark in the tire tread area. When the tire is rotated, the brown spot moves with the tire. When the high spot reaches TDC the mark on the display will turn green. Use this feature to mark the high spot on the tire or reference when mounting on the vehicle. This can be a time saver if all pre-mounted assemblies are marked.

NOTE:	Pressing the “Start” button three times will servo to the assembly high spot.

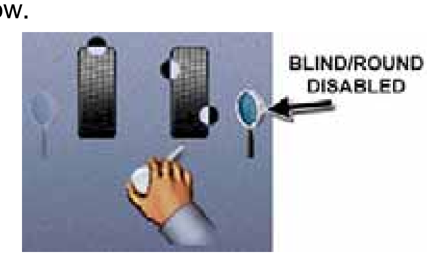
5.6 Blinding and Rounding (Traditional Balancing Method)

In non-SmartWeight mode the balancer can display either an “actual” or “blinded and rounded” amount of imbalance.

The balancer can display either an “actual” or “blinded and rounded” amount of imbalance.

“Blind” is a tolerance or amount of imbalance required before an imbalance amount is displayed. “Round” allows the balancer to display weight imbalance to a desired increment. The blind and round values can be changed in the “Setup” procedure. *Refer to “Service Mode Setup and Features,” page 104.*

While in the “Balance” primary screen, blind and rounding may be disabled by rotating the control knob to highlight the magnifying glass. The actual amounts of imbalance for the selected mode will be displayed when “Blind and Rounding” are disabled as shown below.



5.7 TPMSpecs ™ Feature

NOTE:	TPMS information is currently available for light duty and passenger cars only.

NOTE:	TPMS specifications can also be found on Hunter Aligners (with WinAlign 11.0) and online at UnderCarInfo.NET (subscription service).

The TPMSpecs feature identifies vehicles with tire pressure monitoring systems. It also provides in-depth information regarding the service of TPMS.

- **TPMS Type**
- **Sensor Type**
- **Reset Required on Tire Rotation or Replacement**
- **Reset Tool Requirement**
- **Required Tools**
- **Reset Procedure**
- **TPMS Hints**
- **Information / Disclaimers**

TPMSpecs may be accessed in two ways.

Option 1:

From the Main Balance screen, scan a VIN barcode. TPMS information for the vehicle scanned will automatically be retrieve and display.

Option 2:

From the Main Balance screen, press the menu key to shift down the softkey rows until “Recall TPMS Info” softkey appears. Press “Recall TPMS Info” softkey and then select appropriate vehicle from the drop down menu, using the control knob or softkeys.

TPMSpecs screens to displays detailed TPMS service information for the vehicle.

The “AT A GLANCE” overview starts each vehicle TPMS specification. The first image shows the type of TPMS sensor on the vehicle. The following three images show the requirements for servicing the wheel: process, scan tool and OEM scanner. The red border, yellow border or grayed appearance of the image denotes the requirement as required, optional or not required. Red and white striped border (as in above TPMSpecs screen) indicates the requirement is possibly required; refer to the explanation below the images.

Scroll down by turning the control knob for detail TPMS information for the vehicle.

5.8 Hunter Help Feature

The Hunter Help feature (version 3.1 software or higher required for Hunter Help Files) provides tips and procedures for Hunter balancers and tire changers. It also provides a Rolling Smooth Sample Quiz.

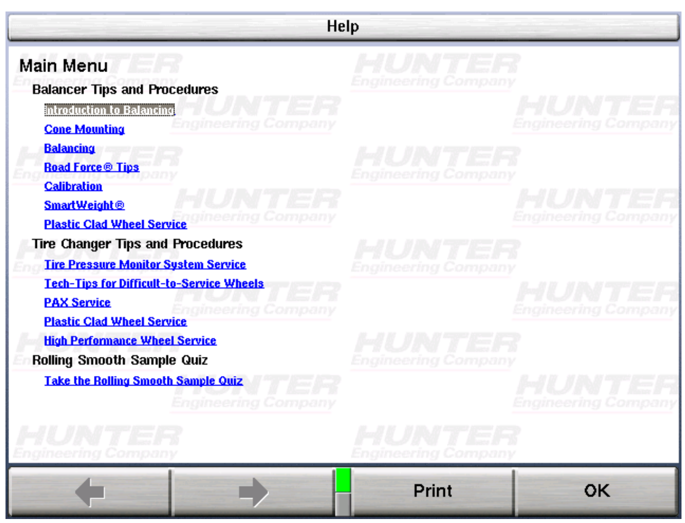
Additional content will be added to the Hunter Help files and can be updated as new content becomes available.

To access Hunter Help:

From a balance screen, arrow down to the bottom row of soft keys and select "Help" .

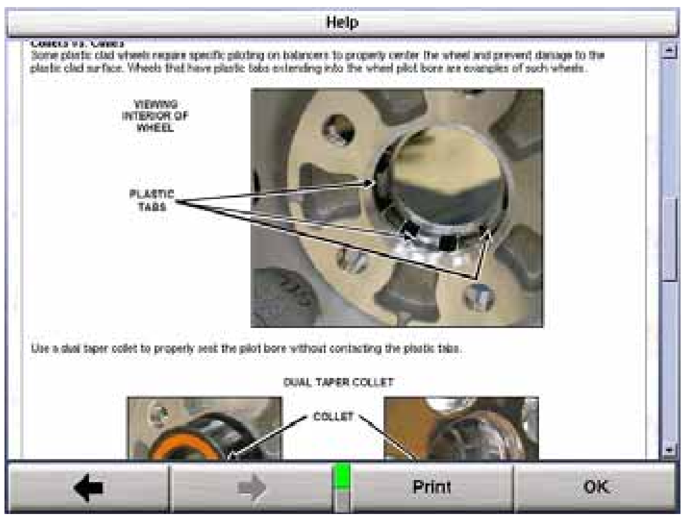
From the Main Menu, select the item to view by highlighting the selection. Scroll down by turning the control knob. Press the control knob to view the selection.

NOTE:	The help screens may change as new content is added.

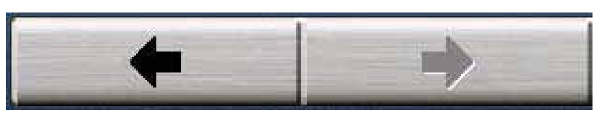


Some items have sub-menus that will display help on a specific topic. Press the control knob to view the selected topic.

Detailed help on specific topics can also be printed. Select “Print” to print the page currently being viewed.



Use the forward and back buttons for additional navigation.



Scroll up or down to locate the “Main Menu” selection. Press the control knob to return to the main help menu.

Select “OK” at any time to return to the balance screen.

5.9 Motor Drive/Servo-Stop

The intelligent DC motor drive on the ForceMatch® HD / GSP9600HD is able to position and hold the tire assembly in position for weight application, apply different amounts of torque, and control the speed and direction of the spindle.

If Servo-Stop is enabled, when the “Start” button is pushed with the hood in the **raised** position, while weights are showing, the motor will automatically rotate the wheel to the next weight plane and hold the assembly in position for weight or ForceMatching® Mark application.

Servo-Stop can be enabled or disabled from the “Set Up” primary screen. *Refer to “Setting Up the Servo-Stop/Servo-Push,” page 105.*

5.10 Spindle-Lok® Feature

Depressing the foot pedal will lock the spindle. Locking the spindle will stabilize the wheel for attaching weights at precise locations if automatic weight positioning is disabled, and will allow for tightening and loosening of the wing nut. Do not use the Spindle-Lok® as a brake to stop a spinning wheel.

NOTE:	Depressing the foot pedal will cancel Servo-Stop.

⚠ **CAUTION:**	Using the Spindle-Lok® to stop a spinning wheel may result in personal injury or damage to the balancer.

5.11 Hood Autostart Feature

The balancer can be set to automatically spin the wheel upon hood closure. After a spin, the hood must be lifted completely before the balancer will Autostart again.

For safety, the balancer will not Autostart in “Calibration,” “Setup,” “Diagnostics,” if no balancing procedure is selected, or if the Inflation Station hose is out of its “home position.”

The hood close Autostart feature can be enabled or disabled in the “Setup” procedure. *Refer to “Setting Up the Hood Autostart Feature,” page 105.*

5.12 Loose Hub Detect Feature

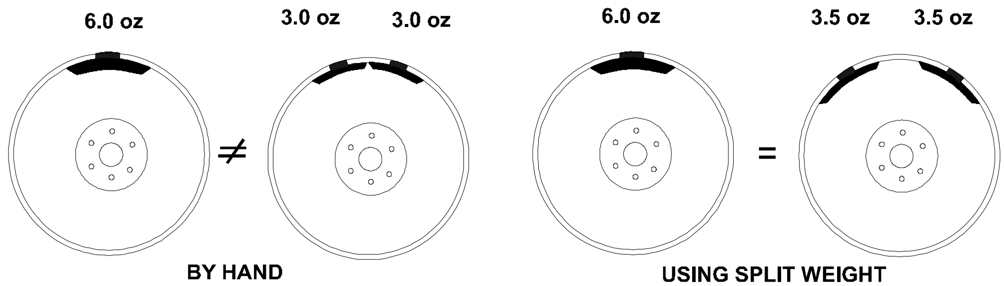
When the ForceMatch® HD / GSP9600HD senses that the wheel is loose, it will automatically stop the spin. You should tighten the wing nut before proceeding.

NOTE:	If the wing nut appears to be tight, remove the wing nut and then clean and lubricate the spindle threads. *Refer to “Spindle Hub Face and Shaft Maintenance,” page 127.*

5.13 Split Weight® Feature

Press “” to change the required imbalance correction weight amount into two smaller size weights. The angle is adjusted by the balancer to produce the non-rounded correction called for by the single weight before split. This provides exact imbalance correction without weight trimming. The non-rounded imbalance is split regardless of whether blind and rounding is enabled. For this reason, Split Weight® is more accurate than applying a single weight with the blind and rounding enabled.

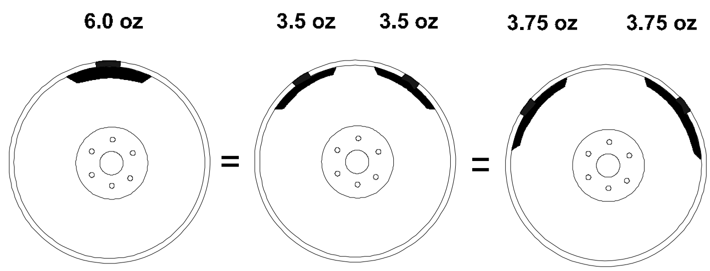
Split Weight® is especially useful when the imbalance amount is large or unavailable, such as 6.0 ounces. Split Weight® eliminates the error caused by placing two 3.0 ounce weights side-by-side, which would leave a substantial residual imbalance:



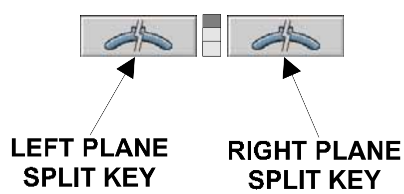
Use “” when the weight location interferes with a hubcap or trim ring, when one weight is too large, to avoid weight trimming, or to substitute for a weight size that is out of stock.

Split Weight® Operation

Each time “” is pressed, the two weights are increased to the next largest weight size and are placed (fanned out) further down the rim, as shown below.



NOTE:	To return to the original single weight, you can either toggle the control knob between static and dynamic, or continue to split the weight until all choices are exhausted.



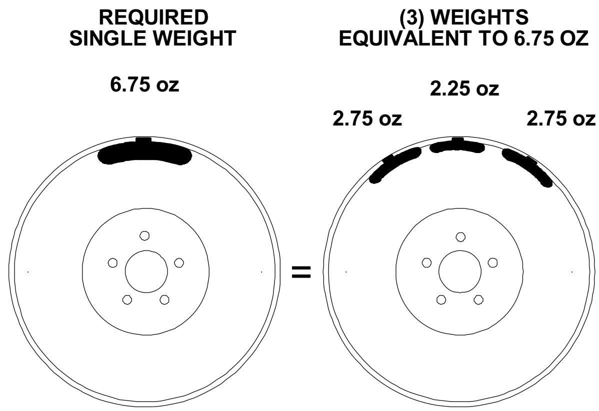
Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will find the first split weight plane.

Attach the appropriate weight as displayed on the console.

Continue pressing “START” with the safety hood in the RAISED position and attaching the weights until all weights shown on the console have been applied.

Correcting Large Imbalances

Split Weight® can also be used to apply three weights when needed. For example, a large wheel may require 6.75 ounces. Not only is this size unlikely to be in the weight tray, but splitting 6.75 ounces would likewise result in large weights. In this case, apply one-third of the called for weight (in this case 2.25 ounces) at the 6.75 ounce weight location and spin the assembly again. The display will now call for a 4.5 ounce weight to be placed on top of the 2.25 ounce weight.



Press “” to fan out the two weights until they clear the previously applied 2.25 ounce weight. Then place the two indicated ounce weights on either side of the 2.25 ounce weight using the TDC indicators.

NOTE:	If optional HammerHead™ TCD weight locator is installed, the weight should be applied at the location marked by the laser.

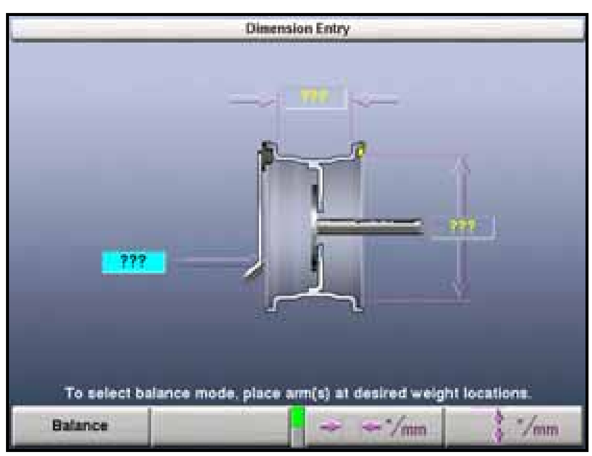
Another method to correct large imbalances may be achieved with Patch Balancing. *Refer to “Patch Balance Procedure,” page 52.*

5.14 Split Spoke® Feature

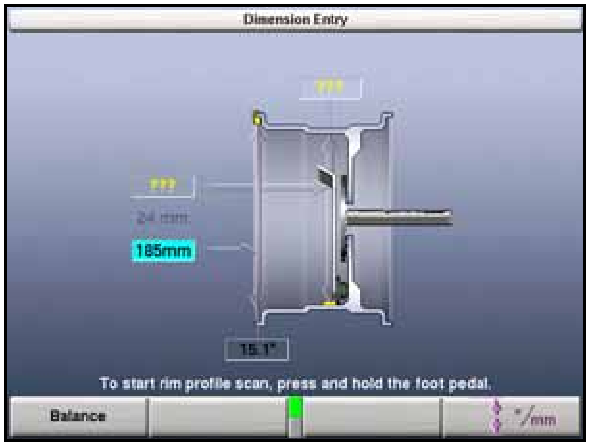
When in either mixed weight or adhesive weight modes, (dynamic or static), correction weights can be hidden behind the spokes of a wheel. The example below is in the mixed weight mode.

Hiding Adhesive Weight behind Spoke

Move the inner Dataset® arm to left weight plane position. Enter the data by pressing the foot pedal.



Move the inner Dataset® arm to the far right weight position, using the **DOWNWARD** arm position. Enter the data by pressing the foot pedal.



After inputting weight plane(s), the Split Spoke® feature may be initiated by the following steps before returning the arm to the “home” position:

Move the inner Dataset® arm to a position centered behind a spoke, using the **DOWNWARD** arm position. Enter the data by pressing the foot pedal.

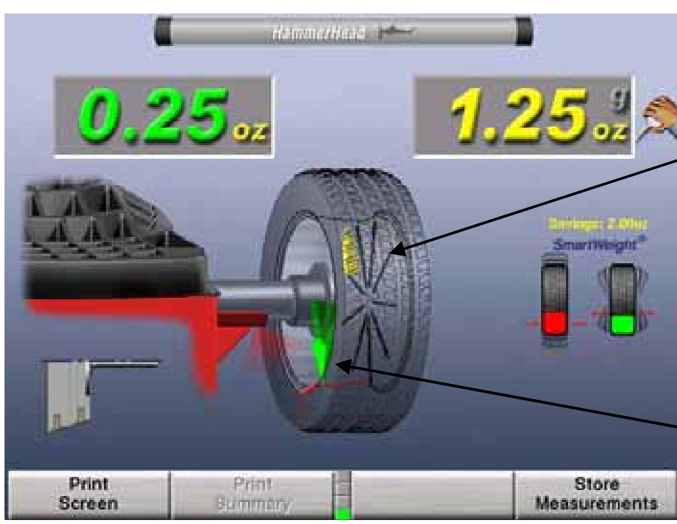
Rotate the wheel to position the Dataset® arm behind an adjacent spoke (nearest spoke in either direction). Enter the data by pressing the foot pedal.

Return the inner Dataset® arm to the home position.

Close safety hood.

Press the green “START” button if “Hood Autostart” is disabled.

After wheel comes to a complete stop, raise safety hood.



Place the left plane weight (if in DYNAMIC mode) per the balance procedure being performed. Refer to “Balancing Procedures,” page 41.

Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will servo to the location for the right adhesive weight plane (dynamic) or the static adhesive weight plane (static), aligned with first spoke.

Located at the BDC, attach the adhesive weight behind the first spoke using the weight amount shown on the DISPLAY.

Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will servo to the location for the second spoke.

Attach the appropriate weight as displayed on the console.

Verify balance condition by spinning again with the load roller disabled. Refer to “Load Roller Operation,” page 65.

All weight plane displays should show “zero.”

SPLIT SPOKE® balancing procedure is complete.

NOTE:	When SmartWeight® is enabled in conjunction with wheel spoke entry, a separate feature called “SmartSpoke” can in many instances allow the use of weight at only one spoke when it would have required two using conventional spoke mode balancing. When this occurs, “SmartSpoke” flashes for a few seconds just under the right weight digit.

Re-entering Similar Wheel after Split Spoke® is Enabled

Once Split Spoke® mode is enabled; use the “Set New Spoke Location” key to input the spoke orientation of the other three rims from a set to avoid re-measuring the weight plane dimensions each time. This can be performed with or without the laser.

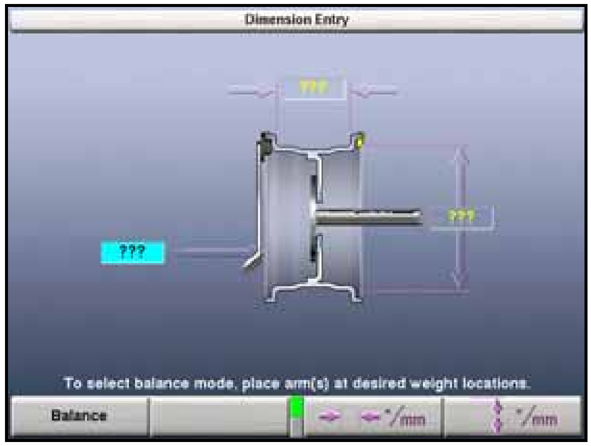
Use the laser or move the inner Dataset® arm to a position centered behind a spoke, using the **DOWNWARD** arm position to align the spoke location.

Enter the data by pressing the foot pedal.

Placing Hidden Weight Inside of Hollow Spokes

On some wheels, it may be possible to hide all of the right weight plane adhesive weights inside of the hollow spoke. However, wheel construction may make it impossible to enter the right weight plane with the inner Dataset arm.

The following example is in the mixed weight mode. Move the inner Dataset® arm to left plane position. Enter the data by pressing the foot pedal.



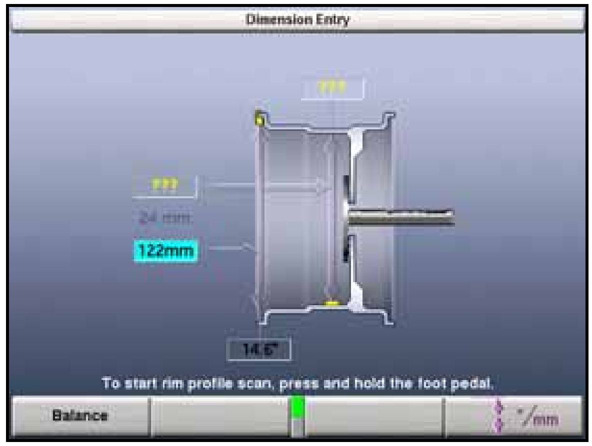
Measure the distance from the left weight plane to the desired right weight plane, using a tape measure. This distance must be in millimeters (convert inches to millimeters by multiplying by 25.4).

Measure the weight plane diameter manually, using caliper or tape measure.

NOTE:	This may need to be done before the wheel is mounted on the ForceMatch® HD / GSP9600HD.

Add the measurement from the left weight plane to the desired right weight plane to the distance to the inner rim lip and enter this new dimension manually.

Enter the weight plane distance (mm) and diameter (in) manually.



Close safety hood.

Press the green “START” button if “Hood Autostart” is disabled.

After wheel comes to a complete stop, raise safety hood.

Place the left plane weight (if in DYNAMIC mode) per the balance procedure being performed. Refer to “Balancing Procedures,” page 41.

Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will servo to the location for the right adhesive weight plane (dynamic) or the static adhesive weight plane (static), aligned with the first spoke.

With the servo enabled, attach the adhesive weight behind the first spoke using the weight amount shown on the LCD.

Press the green “START” button with the safety hood in the RAISED position and the ForceMatch® HD / GSP9600HD will servo to the location for the second spoke.

Attach the appropriate weight as displayed on the console.

All weight plane displays should show “OK” after check spin.

Split Spoke® balancing procedure is complete.

5.15 RimScan™ Wheel Profile Scanner

RimScan™ wheel profile scanner analyzes and reproduces a cut-away view of the rim profile. This is highly advantageous for difficult applications and for accurately placing each individual wheel weight. RimScan combined with SmartWeight™ makes single corrective weight placement simpler and more frequent, further reducing or eliminating the static residual.

RimScan is available only if SmartWeight is enabled. RimScan is designed for adhesive weights or mixed weight balancing methods.

Setting Dimensions with RimScan

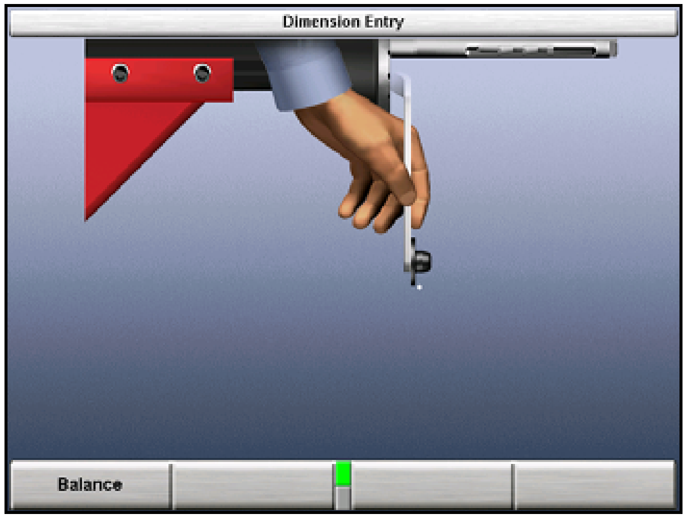
Select “Balance” from the main screen and install the wheel on the spindle.

NOTE:	For mixed weights, first move the inner Dataset® arm in the **UPWARD** position to the clip-on weight location and tap foot pedal to measure the distance and diameter dimensions prior to performing RimScan.

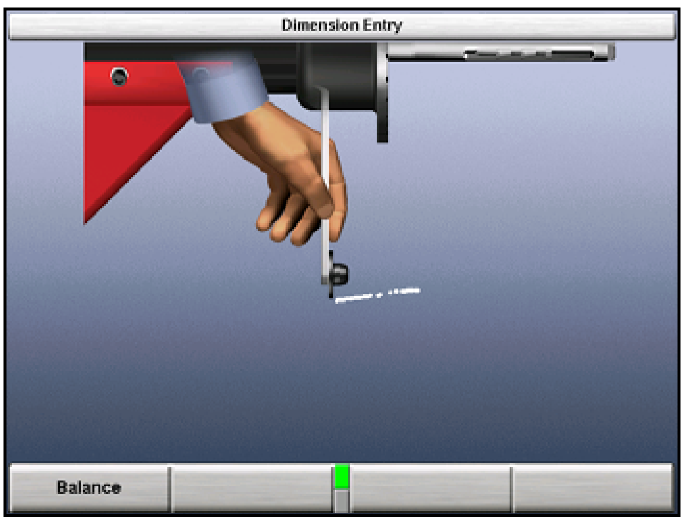
To initiate RimScan, pull the inner Dataset® arm away from the weight tray and turn to the down position.

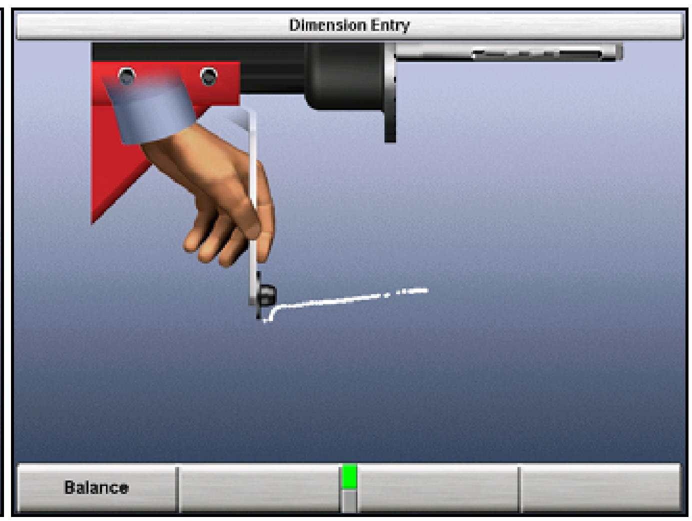
The rim profile can be scanned starting with the rim lip, or from the inside of the wheel. Place the Dataset® arm against the rim at the desired location, ***depress and hold*** the foot pedal.

The RimScan draw screen will automatically appear.

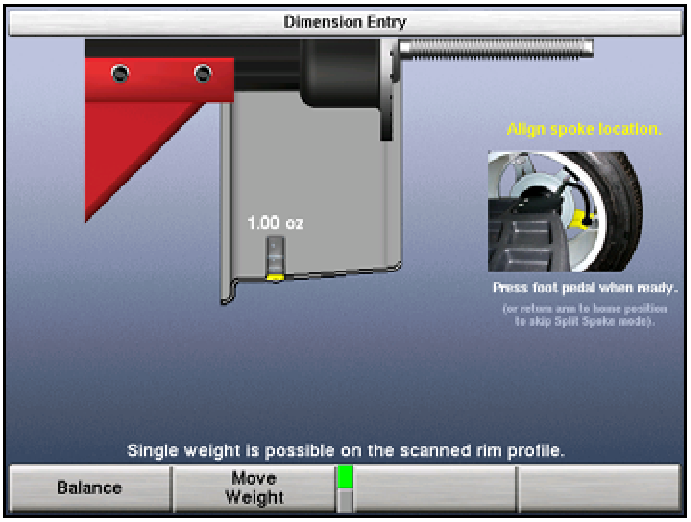


As shown below, draw the Dataset® arm across the rim to produce an on-screen, live progress of the wheel representation. While it is not necessary to "draw" slowly with the Dataset® arm, it will produce a more accurate representation of the rim profile especially with rims having multiple steps or taper.





When the scan is complete, release the foot pedal and a rim illustration will appear with weight planes automatically placed at correct positions for tapers or steps.

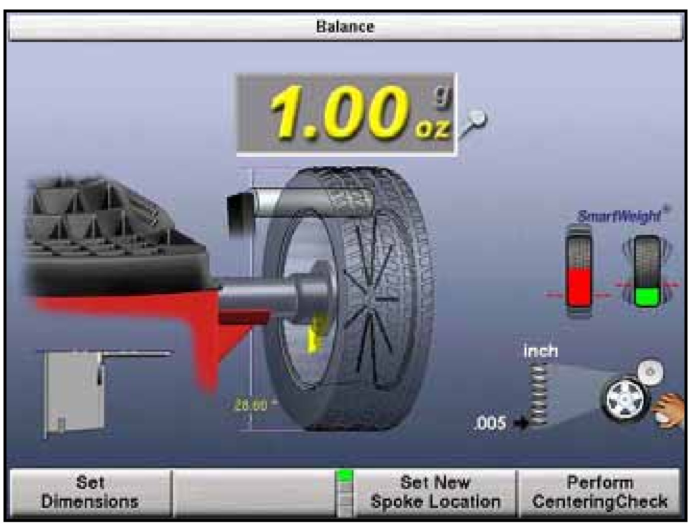


If desired, locate spokes as instructed.

The user has the ability to change corrective weight location(s). Select “Move Weight” and change weight position with the Control knob. Push the control knob to switch between left and right weight planes.

Select “Find Best Location” to let the balancer decide what is the optimum corrective weight location. If by chance the user-selected weight positions are unacceptable, “Find Best Location” will return the weights to the optimum positions.

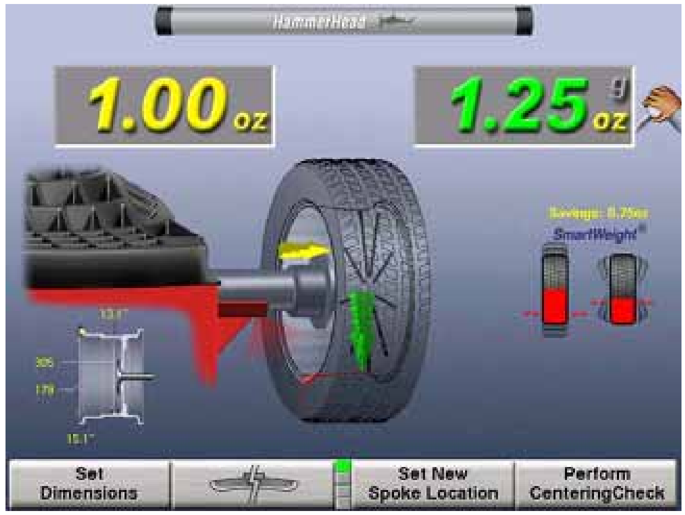
RimScan is compete. Select “Balance to continue to the balance screen or return dataset arm to home position. After a scan is performed the profile will appear on the balance screen.



Real-Time Predictions with RimScan and SmartWeight®

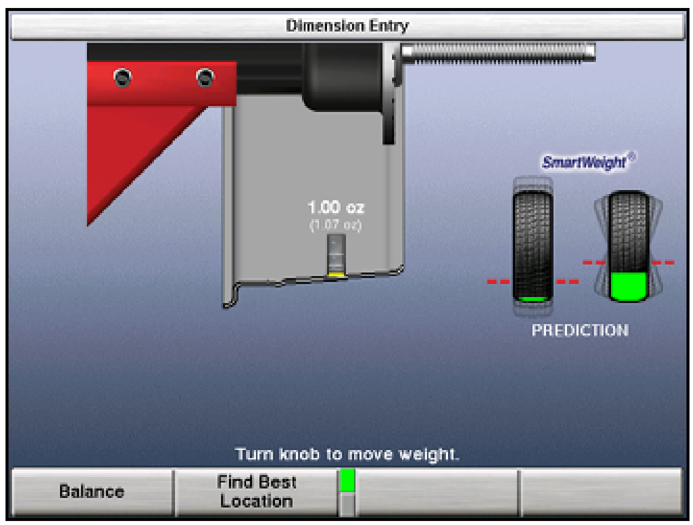
NOTE:	Real-Time prediction is only available for single weight solutions.

Once dimensions are measured, the balance screen will display the corrective weight required and the SmartWeight static and couple forces, along with the RimScan display identifying the weight location.



If a single corrective weight is required RimScan and SmartWeight work together to further reduce the amount of weight used.

Select “Set Dimensions” to illustrate RimScan profile. If the weight location cannot be achieved or is undesirable, turn the control knob to change the weight position. As the position changes, the SmartWeight force graphs will display a prediction of the force results corresponding to the weight.



5.16 BDC Laser Adhesive Weight Locator

Servo-Activated Laser automatically locates BDC to aid in fast adhesive weight positioning.

During the mixed weights and adhesive weights balancing procedures, the BDC laser locator automatically displays a vivid line at bottom dead center after a wheel has been spun. The laser turns off when the wheel is spun again.

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

This Laser Product is designated as Class 1M during all procedures of operation.

Never look directly into the laser. Doing so may cause serious injury.

Operation accessible radiation fields:

Wavelength	635-660nm
Laser Power for Classification	<390uW via 7mm aperture
Beam Diameter	<5mm at aperture
Divergence	<1.5mrad x <2rad
Transverse Beam Mode	TEM00

5.17 HammerHead® TDC Laser Clip-On Weight Locator (Optional)

The Balancer will find the TDC for the left or right weight plane if “Servo-Stop” is enabled. “Servo-Stop” will hold the wheel in the TDC position while the servo-activated laser automatically locates TDC to aid in fast clip-on weight positioning.

The TDC laser locator automatically displays a vivid line at top dead center after a wheel has been spun. The laser turns “off” when the wheel is spun again.

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

This Laser Product is designated as Class 2M during all procedures of operation.

Do not stare into the beam or view directly with optical instruments. Doing so may cause serious injury.

Operation accessible radiation fields:

Wavelength	635-660nm
Laser Power for Classification	<1mW via 7mm aperture
Beam Diameter	<5mm at aperture
Divergence	<1.5mrad x <2rad
Transverse Beam Mode	TEM00

5.18 Wheel Lift

Raising the Wheel Assembly

Slide the appropriate mounting cone onto the spindle.

Position wheel lift carriage at the end of the wheel lift rail.

Press the lift control handle “down” until the trolley carriage is at its lowest level.

Roll the wheel assembly onto the wheel lift carriage.

Raise the lift control handle “up” to move the lifting assembly into a position where the wheel assembly can be installed onto the spindle.

Slide the tire/wheel assembly onto the spindle and center on the mounting cone. Verify that the wheel assembly is centered vertically on the spindle.

NOTE:	Lower wheel lift as needed to clamp wheel, but keep the wheel lift carriage in place under the wheel assembly.

Clamp wheel onto the spindle.

Keep the wheel lift carriage in place under the wheel assembly and close the hood. The lifting assembly will automatically lower and park the carriage below.

NOTE:	Allowing the balancer to park the wheel lift carriage in place under the wheel assembly will make the removal and lowering of wheel assembly easier and quicker.

Lowering the Wheel Assembly

Remove wheel clamp.

Starting with the wheel lift carriage parked under the wheel assembly; raise the lift control handle “up” to move the lifting assembly to the wheel assembly.

Slide the carriage with wheel assembly to the end of the wheel lift rail.

Press the lift control handle “down” until the carriage is at its lowest level.

Roll wheel assembly from carriage.

5.19 Print Summary

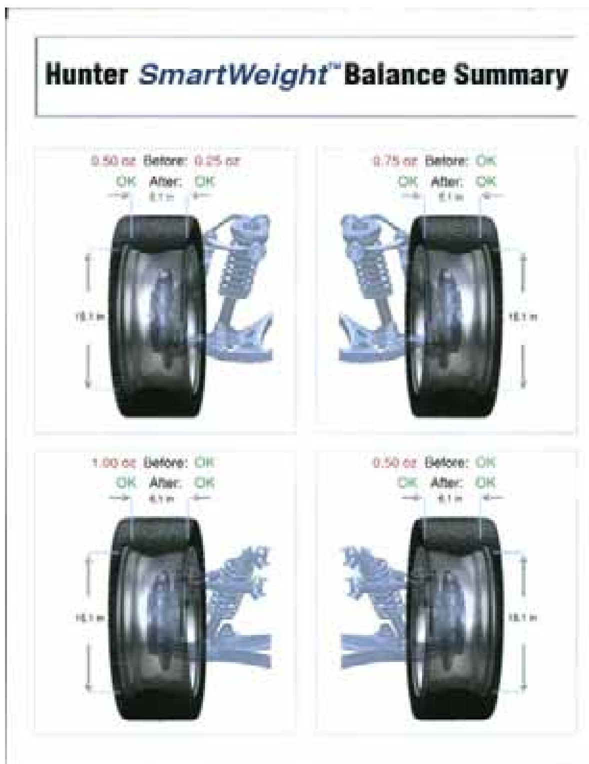
Balance and loaded runout screens have “Print Summary” and “Store Measurements” keys on the last key row. The printout combines data from the balance, loaded runout, and diagnosis explanation (if it exists) screens, replacing up to four screen prints with one much faster formatted output.

Press the “Store Measurements” key to save the balance, loaded runout, and runout measurements for later printing along with measurements after balancing.

NOTE:	Measurements are retained only as long as power is left on.

Imbalance condition, static vs. dynamic, and balance weight types are printed. Split and Spoke weight values are printed as the single weight equivalent (better indication of imbalance since weight angles are not printed).

Tire runout and rim runout are not printed on the main printout page. If this information is desired, printing while in service mode will produce an additional page duplicating the charted information on the “Show Details” screen through fourth harmonics.



NOTE:	Printed summaries of the savings due to SmartWeight are available. *Refer to section “5.4 SmartWeight Odometer” on page 75.*

5.20 Harmonics & T.I.R. Data/Plots

A graphic depiction of the data displayed on the “Current Runout & Road Force” popup screen can be viewed by selecting “Show Runout Plots” from the “Details” popup screen.

The dotted line represents total indicated reading (T.I.R.), actual movement of the load roller or Dataset® arms. The total indicated reading numeric data displayed is the difference between the highest and lowest value measured. Harmonics are calculated from the T.I.R. data and then shown graphed as a solid curve. The harmonic numeric data displayed represents the difference between the highest and lowest value of the curve. During ForceMatch®, the first harmonic vibration of the tire is matched opposite of the first harmonic vibration of the rim (average of the inner and outer measured flanges or bead seats) to reduce the vibration of the wheel assembly. *Refer to "ForceMatch®," page 65.*

Viewing Multiple Harmonics

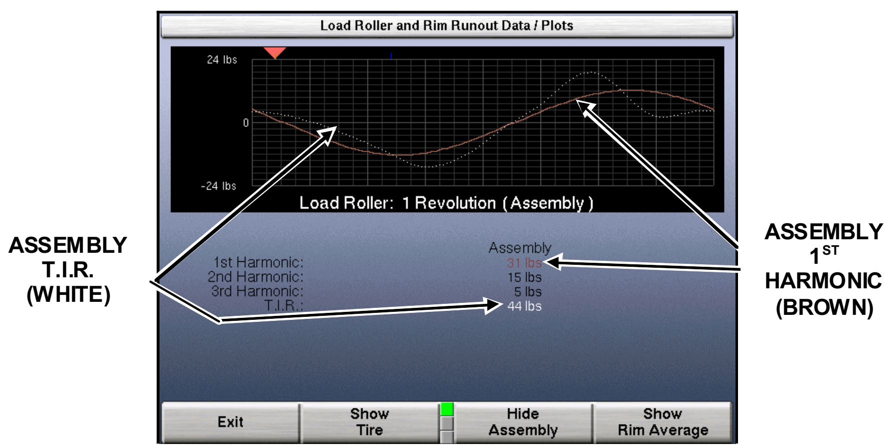
You may also select to see plots of multiple harmonic vibrations for the assembly, tire or rim. Each time "Show Next Harmonic" is selected, the next harmonic amount will be highlighted in color and the corresponding harmonic curve (such as a twice-per revolution wave representing the second harmonic) will be plotted on the graph and sized according to the highlighted amount.

Viewing Multiple Revolutions

The runout plots automatically show one complete revolution of the assembly by default. The "Show All Revolutions" key may be selected to show all four measured revolutions of data on the load roller plot or the two revolutions of data on the rim plots. This makes it possible to view the data for consistency in measurement for each revolution.

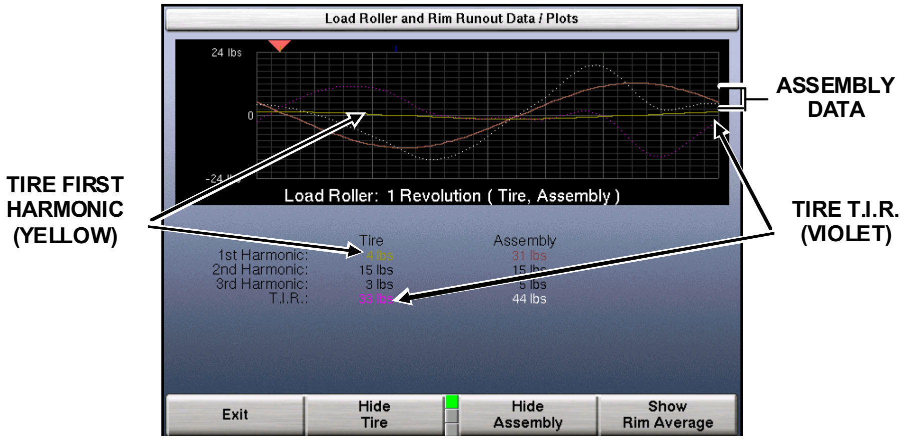
Assembly Data Plots Screen

When "Show Runout Plots" is selected, the "Rim and Load Roller Runout Plots" screen will appear. The initial screen defaults to the first harmonic plot of the load roller data for the assembly. The assembly lines are color coded to represent a specific value as follows:



Tire Data Plots Screen

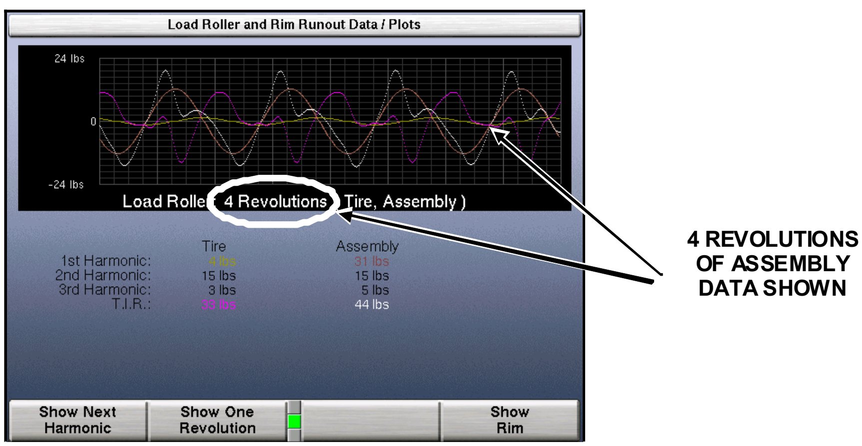
Selecting “Show Tire” will show the tire harmonic and total indicated reading of runout data with the rim contribution removed. The “Tire” lines are color coded to represent a specific value as follows:



Selecting “Hide Tire” or “Hide Assembly” from the Load Roller Runout Plot Screen will conceal the corresponding plot from view. This makes it easier to examine individual data or print a specific plot.

From the second menu row, selections for multiple harmonics and multiple revolutions of data are available. You may select to see any combination of data, harmonics, and revolutions desired.

For instance, the plot below shows the four revolutions for the first harmonic for assembly loaded road force data.



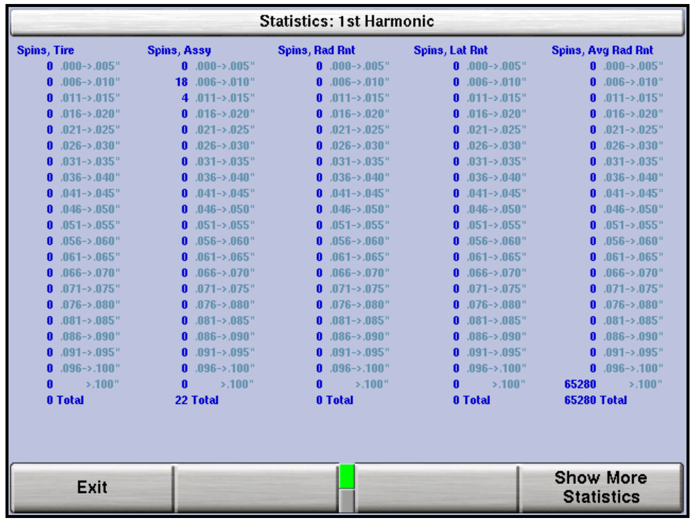
Selecting “Show One Revolution” will return the data to the single revolution plot.

5.21 Statistics

Show Statistics

From the logo screen, “View Statistics” may be selected from the second menu tier. This allows a tally of the spins to be categorized by their road force, radial runout, and lateral runout measurements and viewed or printed for statistical purposes.

NOTE:	The statistics screen does not tally balance results.


Statistics: 1st Harmonic

Range	Spins, Tire	Spins, Assy	Spins, Rad Rnt	Spins, Lat Rnt	Spins, Avg Rad Rnt
.000->.005"	0	0	0	0	0
.006->.010"	0	18	0	0	0
.011->.015"	0	4	0	0	0
.016->.020"	0	0	0	0	0
.021->.025"	0	0	0	0	0
.026->.030"	0	0	0	0	0
.031->.035"	0	0	0	0	0
.036->.040"	0	0	0	0	0
.041->.045"	0	0	0	0	0
.046->.050"	0	0	0	0	0
.051->.055"	0	0	0	0	0
.056->.060"	0	0	0	0	0
.061->.065"	0	0	0	0	0
.066->.070"	0	0	0	0	0
.071->.075"	0	0	0	0	0
.076->.080"	0	0	0	0	0
.081->.085"	0	0	0	0	0
.086->.090"	0	0	0	0	0
.091->.095"	0	0	0	0	0
.096->.100"	0	0	0	0	0
>.100"	0	0	0	0	65280
Total	0	22	0	0	65280

The first statistics screen, shown above, represents spin counts for first harmonic results. Columns 3 and 4 show the larger runout amount of the two measured rim lips for each spin (the smaller values for each spin are not stored). Column 5 shows the radial average of the two rim lips. The rim average is used for ForceMatch®.

The “Show More Statistics” key can be selected to show second harmonic, third harmonic, and T.I.R. results for all spins. Column 5, rim average data, will not be shown in these cases.

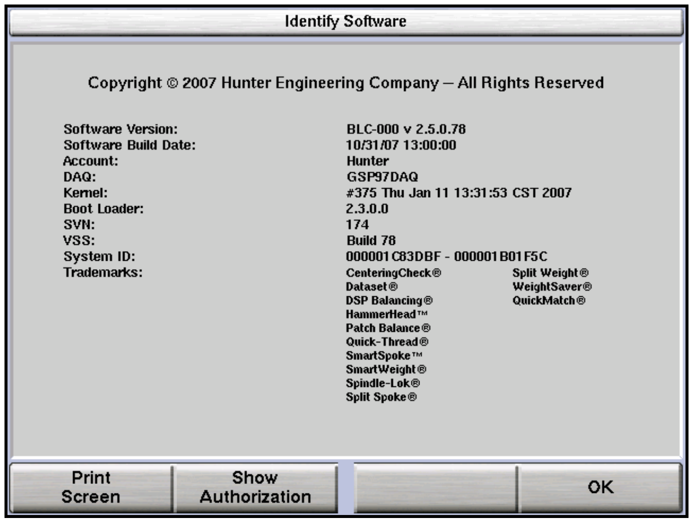
“Clear Data” can also be selected (key is only available in Service Mode) to erase the tabulated statistics data.

If statistics are displayed in metric units, then the displayed ranges will be converted from inches to millimeters and from pounds to kilograms.

6. Equipment Information

6.1 Software Identification

Selecting “Identify Software” from the logo screen will display the software version. Trademarks may also be viewed from this screen.



6.2 Program Cartridge Removal and Installation

Remove the rear cover from the support assembly for the LCD display by removing the six #8 screws. Set the rear cover and attaching hardware aside.

Insert to program cartridge into the cartridge jack located on the side of the board within the support assembly. Verify that program cartridge is fully seated.

Install the supplied electronic security x-key in the button socket on the board within the support assembly.

Taking care not to pinch any cables, re-install the rear cover to the support assembly with the previously removed six #8 screws.

AFTER INSTALLING PROGRAM CARTRIDGE:

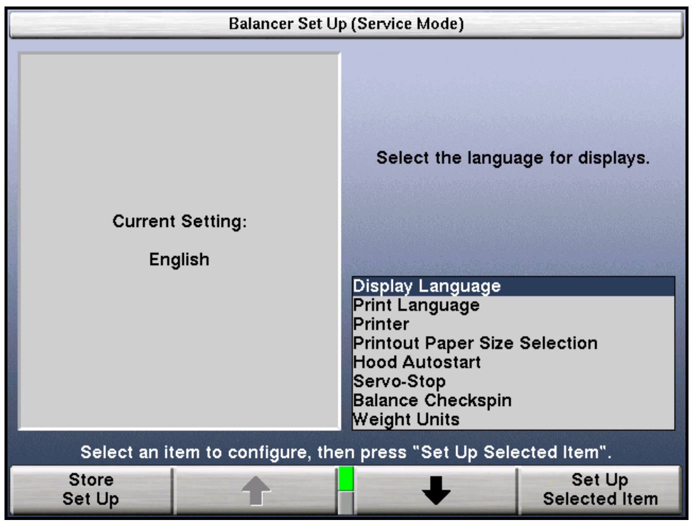
Select "Show Authorization" to view information on the program cartridge and x-key.

View setup options by selecting "Setup" from the "Balance" primary screen. Change setup options to the desired settings. Press "Store Setup" to complete "Setup" procedures.

NOTE:	**The ForceMatch® HD / GSP9600HD must be completely re-calibrated after program cartridge installation.** *Refer to "Calibration Procedures," page 115.* Calibration tool, 221-672-1, is required.

6.3 Balancer Set Up

The "Set Up" screen contains a list box of set up items and may be selected from the second row of softkeys on the "Logo" screen.



Change set up features by selecting "Set Up Selected Item." The gray box at the top of the item set up menu displays the current setting for each feature. The blue box in the middle of the set up screen describes the highlighted choice from the list box below. Use the soft keys to select the desired setting for each feature. Select "OK" when the desired choice is highlighted. To exit set up procedures and save changes that were made, select "Store Set Up" from the menu. The screen will automatically return to the "Logo" screen.

NOTE:	The set up information is not stored until "Store Set Up" is pressed on the wheel balancer "Set Up" screen.

To abandon the set up procedures without saving changes, select the "Cancel" key or simply reset the system.

Display Language

Use "Display Language" to select the language used for displays.

Print Language

Use "Print Language" to select the language used for printouts.

Printer

Use "Printer" to set up the printer. The current default printer is the Hewlett-Packard DeskJet.

Printout Paper Size Selection

Use "Printout Paper Size Selection" to select the correct size paper for printouts.

Hood Autostart Feature

Use "Hood Autostart Feature" to enable or disable the automatic spin of spindle upon closing of the hood.

Servo-Stop

Use "Servo-Stop" to enable or disable the balancer feature of the intelligent DC motor drive automatically rotating the wheel to the weight or ForceMatch Mark positions. Servo-Push may also be enabled, which allows pushing the wheel (approximately 1/8 of a revolution) to cause the intelligent DC motor drive to automatically rotate the wheel to the next weight or ForceMatch Mark positions. Pressing the "START" key may still be used for this function.

Balance Checkspin

Use "Balance Checkspin" to enable or disable the load roller during balance verification spins. When enabled the load roller will automatically disabled as necessary. This must be enabled for SmartWeight to record a weight saving spin.

Weight Units

Use "Weight Units" to select English or Metric units for displaying wheel weights.

NOTE:	Balancer must be in service mode to view/change the remaining set-up items: Set Date and Time, Prompt To Set Date and Time, Balance Limits, Prompt for Wheel Assembly ID and Spindle Type. *Refer to "6.4 Service Mode Setup and Features" and page 108.*

Runout Units

Use "Runout Units" to select English or Metric units for displaying runout measurements.

Assembly Diameter Measurement

Use "Assembly Diameter Measurement" to enable or disable the display of the assembly diameter measured by the load roller.

Set Date and Time

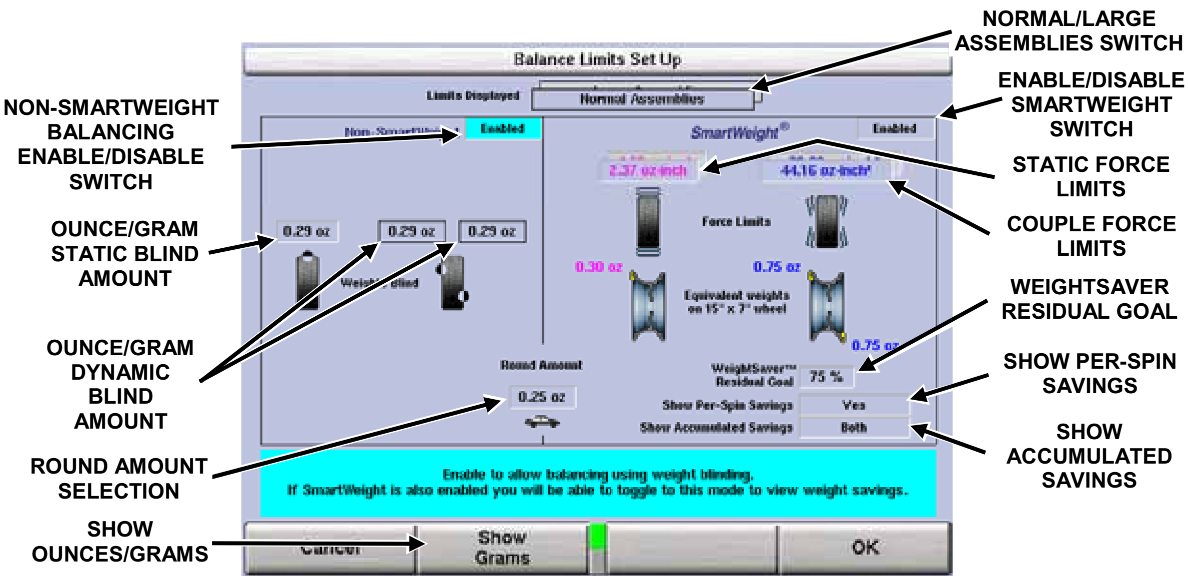
Use "Set Date and Time" to select the correct date and time for both display and printouts.

Prompted Centering Checks

Use "Prompted Centering Checks" to enable or disable the program to automatically prompt the user to perform a centering check on each wheel.

Balance Limits

Use “Balance Limits” to enable and set limits for both standard wheel balancing and SmartWeight balancing.



Click on the control knob to change the fields. The current selected field will be highlighted with a description at the bottom of the screen.

Setting Up the Weight Units

Select the corrective weight units as ounces or grams.

Setting Up the Round Amount

Used to select the amount to which ounce weights is rounded. Ounce Round Amount options include 0.05 ounces, 0.25 ounces, 0.50 ounces, and 1.00 ounces. Gram Round Amount options include 1 gram, and 5 grams.

Setting Up the Blind Amount (Non-SmartWeight Options)

Used to select the amount below which ounce weights are shown as zero. Ounce Blind Amount options include 0.22 ounces, 0.29 ounces, 0.58 ounces, and 0.89 ounces. Gram Blind Amount options include 4 grams, 8 grams, 16 grams, and 25 grams.

SmartWeight® Options - Setting Up the Force Limits

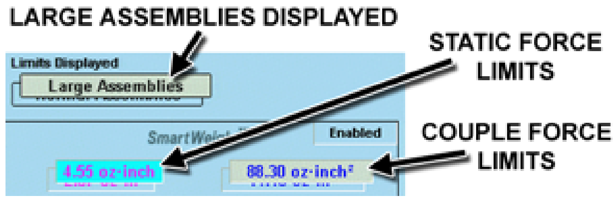
NOTE:	The force limits values are set to exact default measurements and should not be changed except by qualified personnel for very specific reasons.

Any changes to the limits can be reset by selecting the “Set Factory Defaults” softkey.

Static Force Limit and Couple Force Limit (SmartWeight® Option)

Force Limits can be adjusted for the up and down static force and the side-to-side couple force. The shown balance weight on the average wheel assembly is equivalent to the force limit value. Settings for large assemblies

Static and Couple force limits are set for normal wheel assemblies and large wheel assemblies. The "Limits Displayed" field indicates which are currently displayed.



NOTE:	Large Assembly force limits follow "Show Savings," as clicking on the control knob to change the fields.

Weightsaver® Residual Goal (SmartWeight Option)

Weightsaver® residual goal is the percent of the shimmy force limit intentionally left in the assembly to save weight. A lower value favors lower residual shimmy and a higher value favors weight savings.

The Residual Goal has a default of 75% of the maximum allowed shimmy force to maximize weight savings.

Show Savings (SmartWeight Option)

Use to set the option to display the weight savings after each balance.

Prompt for Wheel Assembly ID

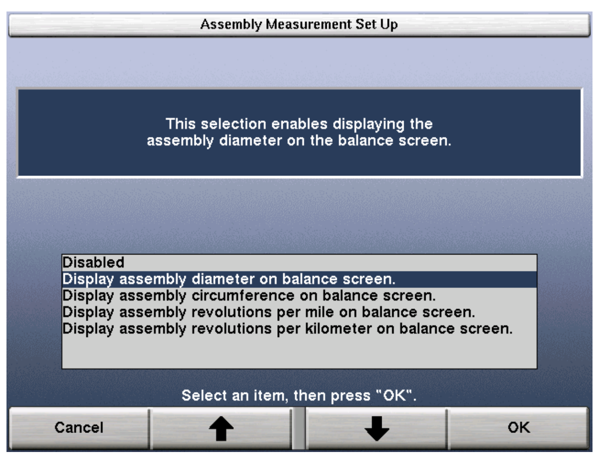
Enables or disables prompting of the user to enter the current assembly before saving.

Spindle Type

Use "Spindle Type" to set the spindle type to correctly match to the installed spindle. Select either the standard threaded spindle or the optional Auto-Clamp pneumatic spindle.

TranzSaver™

Enables TranzSaver data to be displayed as assembly diameter, assembly circumference or assembly revolutions.



HammerHead™

Use "HammerHead" to set up the optional dual overhead laser device

6.4 Service Mode Setup and Features

NOTE:	Service Mode should only be used by authorized users or Hunter Engineering Company authorized service personnel. Some options in Service Mode may not be available. Options in Service Mode are dependent on the specific authorization key installed.

Enter “Service Mode” by pressing and holding K2 and K3 and pressing the Reset softkey twice quickly from any screen. This will immediately return the user to the main screen and “Service Mode” will then be displayed at the top of the screen.

“Service Mode” enables the selection of advanced customized settings and hardware specific setup.

6.5 Updating TPMS Specifications and Hunter Help Files

NOTE:	The following instructions pertain to the updating TPMS specifications and Hunter Help Files for the first time. Additional yearly updates are performed in a similar manner, using an update code. Additional instructions will be supplied at that time.

TPMS specifications and Hunter Help Files may be updated by downloading a new file from the Web to the TPMS USB flash drive supplied with the balancer.

To download TPMS specifications and Hunter Help Files, the following items are required:

A Hunter Balancer
(version 3.0 software or higher required for TPMS specifications)
(version 3.1 software or higher required for Hunter Help Files)

A PC with an internet connection

User Name and Password

TPMS USB flash drive

If Software Version is Less than 3.0 - Locate Balancer Serial Number

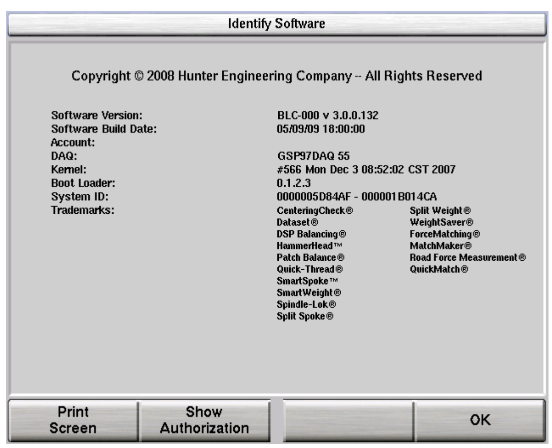
From the logo screen, select “Identify Software” (**K1**). The Identify Software screen will be displayed.

Locate the System ID section. Write down the first number that is shown. This is the password needed to retrieve updates.

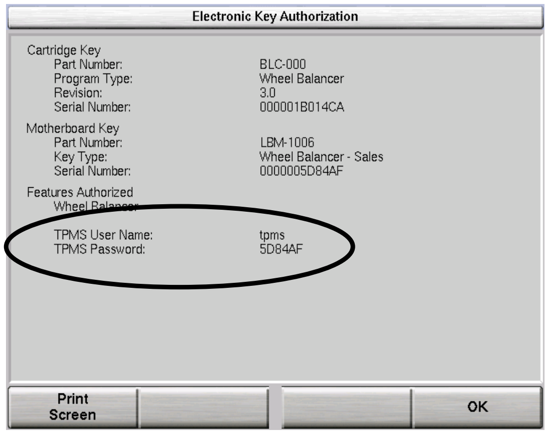
NOTE:	When writing down the Serial Number, trim the leading zero’s from the number. Example: Displayed Serial Number: **000000070B19** Write down: **70B19**

If Software Version is 3.0 or Greater - Retrieve User Name and Password from Balancer

Select “Identify Software” from the logo screen.



Then select “Show Authorization”. The User Name and password appear at the bottom of the list.



Write User Name and Password down for use when downloading updated TPMS specifications and Hunter Help Files.

Remove the TPMS Flash Drive

Turn Balancer “off” using power switch located on back, near base of LCD support.

To access and remove the TPMS flash drive, first remove the plug from the back panel of the LCD support.

NOTE:	If the balancer is not equipped with a plug, then the entire back panel should be removed to access the drive.

Pull the TPMS flash drive from the USB port within the LCD support.

Download Specifications

Using a PC connected to the internet, insert the TPMS flash drive into one of the USB ports.

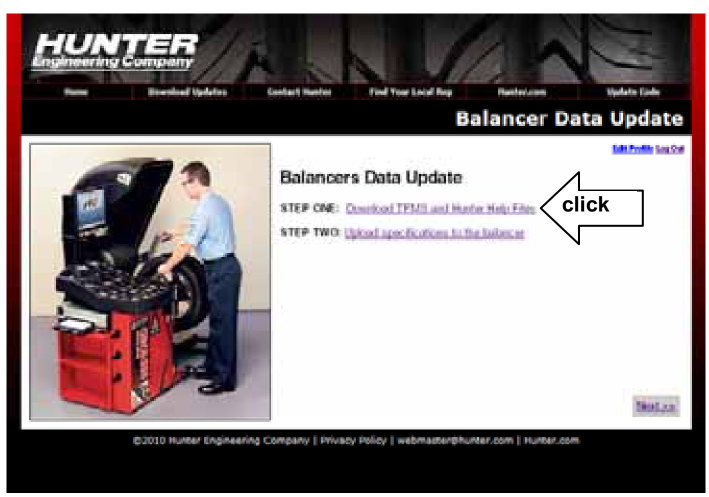
Log on to **Error! Hyperlink reference not valid.**.

Enter **tpms** as the User Name. Enter the password for the balancer and click "Logon".

NOTE:	User Name and password are case sensitive.

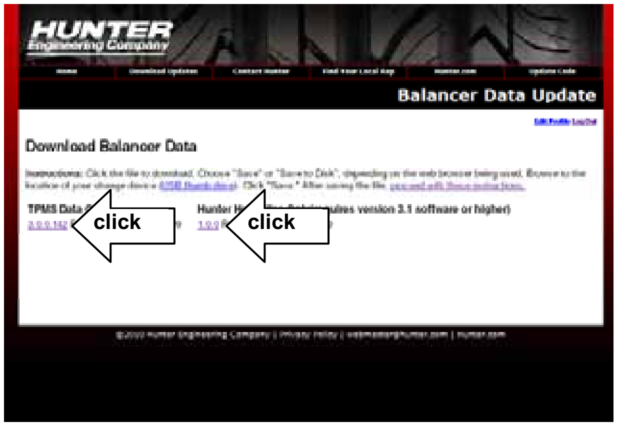
Enter your customer information. Make sure your email address is correct. Click on **"Submit"**.

Click the "Download TPMS and Hunter Help Files" link.

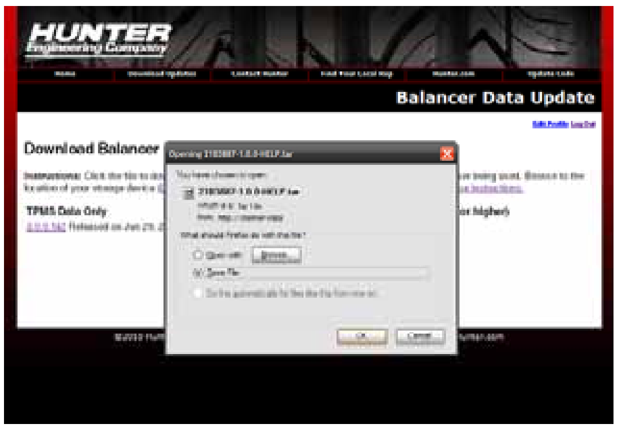


Select the file(s) you wish to download.

NOTE:	Both the TPMS Data (version 3.0 software or higher required for TPMS specifications) and Hunter Help Files (version 3.1 software or higher required for Hunter Help Files) should be downloaded for initial setup.



Choose "Save" or "Save to Disk", depending on the web browser being used. Browse to the location of your storage device (TPMS thumb drive). Click "Save." The files should be saved to the root level of the thumb drive.



When the file(s) has been successfully saved to your TPMS flash drive, you may log out and proceed to upload the TPMS specifications and Hunter Help Files to the balancer.

Upload TPMS Specifications and Hunter Help Files to the Balancer

Insert the TPMS flash drive into the balancer's USB port located in LCD support.

Re-install the plug over the access hole in the back panel of the LCD support.

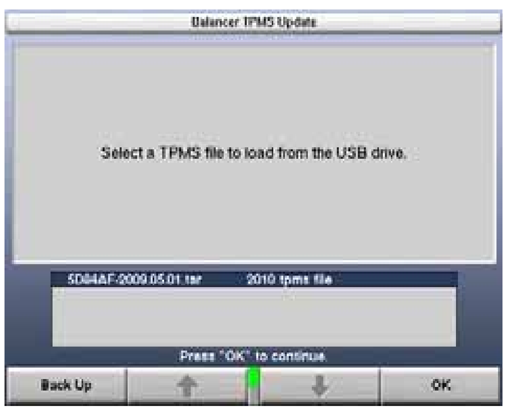
Turn Balancer "on" using power switch located on back.

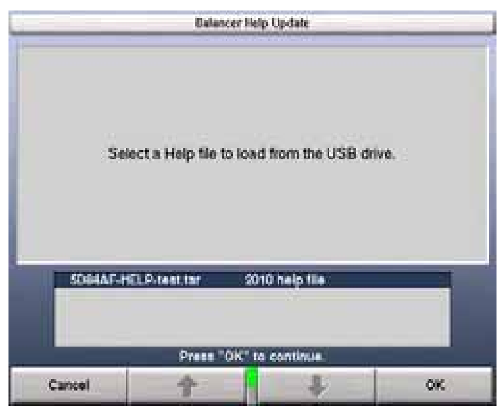
Beginning at the Logo Screen, press either “Update TPMS” (version 3.0 software or higher required for TPMS specifications) or “Update Help Files” (version 3.1 software or higher required for Hunter Help Files) on the bottom row of the softkeys.

NOTE:	The “Update TPMS” and “Update Help Files” softkeys will only be available if a valid TPMS file or valid Hunter Help File exists at the root level of the USB drive. Only files that have been downloaded using this balancer’s user name and password will enable the update procedure.

NOTE:	**Version 3.1 software or higher** - After either the TPMS file or the Help File has been updated, the balancer will then prompt to also update the other file, if it exists at the root level of the USB drive.

Depending of the selected update, the balancer will display either the Balancer TPMS Update screen or the Balancer Help Update screen will be displayed. Select the appropriate TPMS file or Help file (matching the name of the file you downloaded from the Web) and press “OK”.

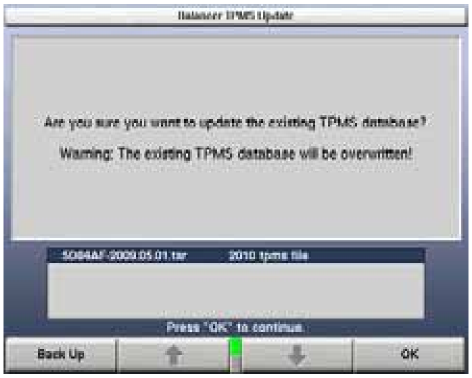


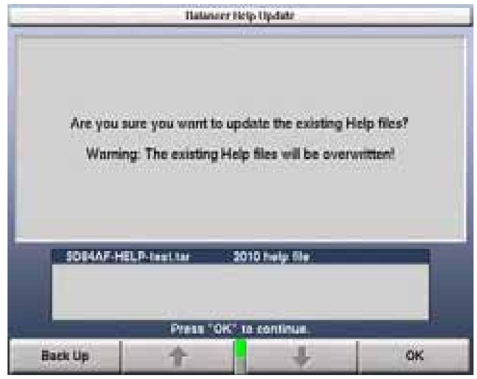


NOTE:	If you wish to exit the uploading process at any time, a “Cancel” or “Back Up” key is available.

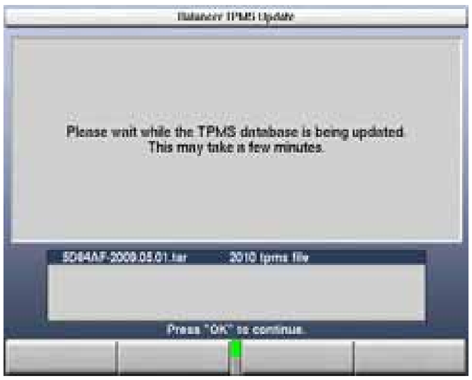
NOTE:	If a TPMS file or Help file is incompatible with your currently installed software cartridge, a note will appear beside the file name. This indicates that you need to contact your Hunter Service Representative to order a new software cartridge.

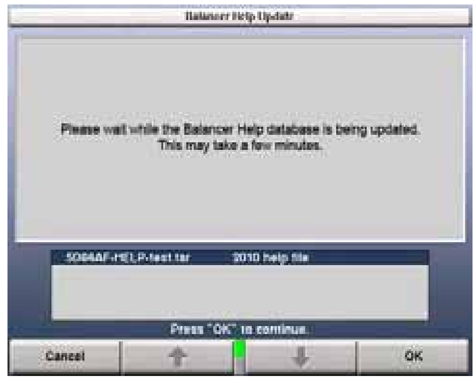
The balancer will prompt the user to confirm the upload. Press “OK” to continue.



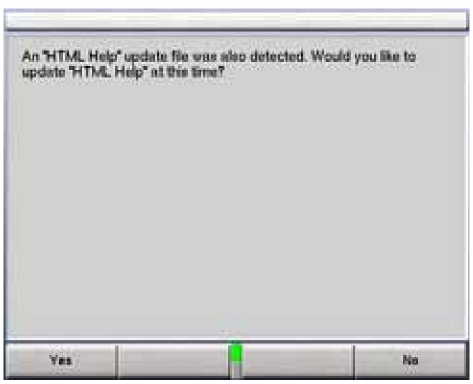


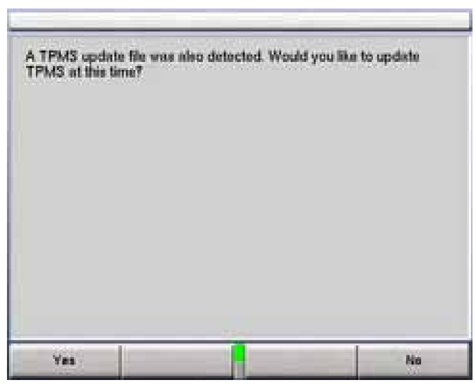
The balancer may take a few minutes to complete the uploading process.



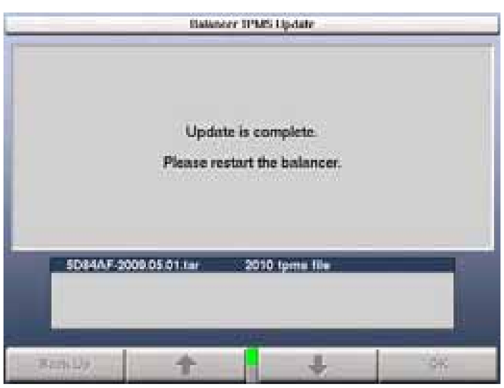


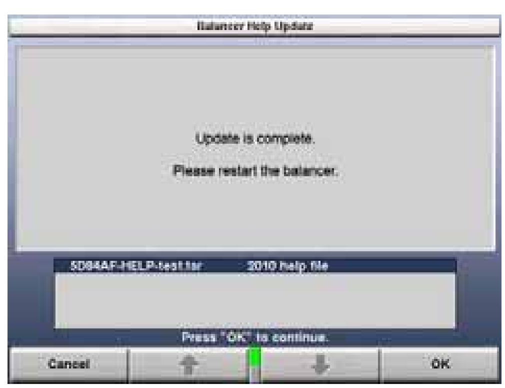
After either the TPMS file or the Help File has been updated, the balancer will then prompt to also update the other file, if it exists at the root level of the USB drive.





Once the upload is complete, restart the balancer turning it “off” and then back “on” using power switch.





The updated TPMS specifications and Help files are now ready for use.

7. Calibration and Maintenance

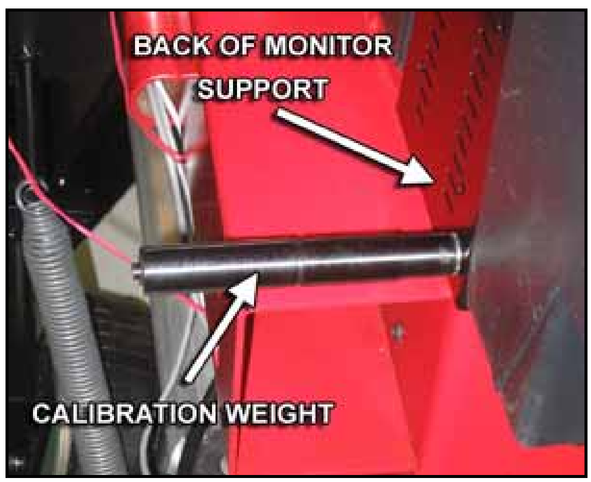
7.1 Calibration Procedures

Quick Calibration Check Procedure

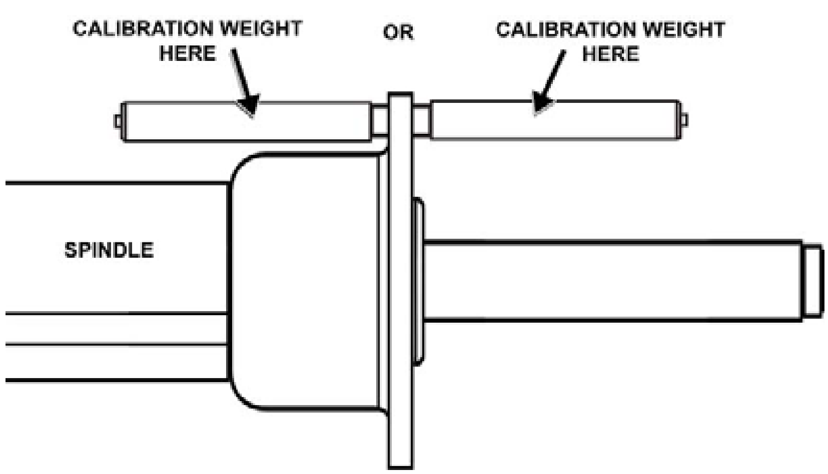
Quick Cal™ Check can be performed from the “Logo” screen immediately after initial boot-up or after a reset is performed. It provides a quick way to check the calibration of the force sensors used for balancing.

NOTE:	Quick Cal™ Check does not check the calibration of the Dataset® arms, or load roller.

The weight used for calibrating the balancer and the inner Dataset® arm is stored on the back of the monitor support.



Install the calibration weight on either side of the hub faceplate using either hole.



From the “Logo” primary screen, close the hood and press “Start.”

The screen will ask the user to verify that a Quick Cal-Check Spin should be performed.

Press “Start” again for the calibration-check spin.

The display screen will read “Calibration Ready,” indicating the balancer is calibrated and ready to use.

NOTE:	If “Calibration Out” occurs, the balancer needs to be recalibrated. Refer to “Balancer (3 Spin Procedure),” page 117.

Check angle accuracy by verifying that when the weight location indicator is rotated to TDC (12 o’clock position), the calibration weight is at TDC (12 o’clock position). If cal weight is in a position other than TDC, perform calibration procedure.

The Quick Cal™ Check is complete.

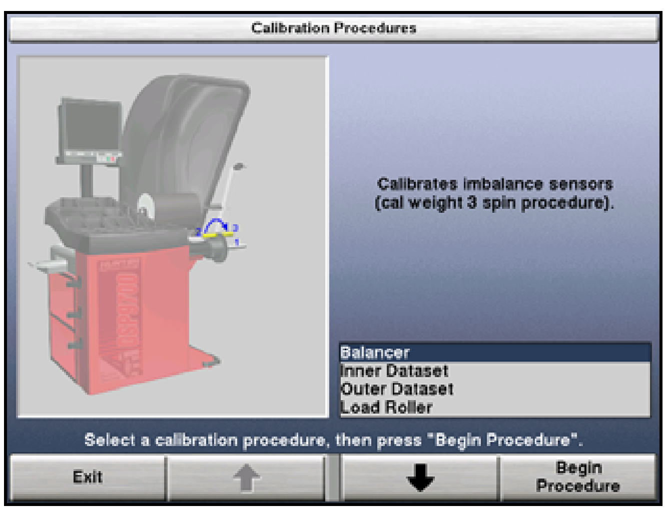
Calibration Menu

Select “Calibrate” from the “Logo” screen. The “Calibration Procedures” primary screen contains a list box of calibration procedures. As the procedures are individually highlighted by selecting “↑” or “↓”, the equipment components to be calibrated for each procedure are illustrated on the ForceMatch® HD / GSP9600HD image.

Select “Show Calibration Data” to view the specific details of each calibration procedure.

Calibration can be performed on the Balancer, the Inner Dataset® Arm, the Outer Dataset® Arm, and the load roller.

Highlight the desired procedure, and select “Begin Procedure.” When finished calibrating, select “Exit.” Throughout the calibration procedures, “Back Up” can be selected to return to the previous step.



Dataset® arm and load roller calibrations require the optional calibration tool, 221-672-1. Balancers with StraightTrak® require Kit 20-1693-1 *(refer to Form 4886T, Calibration Instructions for StraightTrak® Kit 20-1693-1).*

Balancer (3 Spin Procedure)

> **⚠ CAUTION:** Remove all cones from shaft prior to beginning calibration procedures.

Select “Calibrate” from the “Logo” screen.

Select “Balancer” from the “Calibration Procedures” primary screen.

Select “Begin Procedure.”

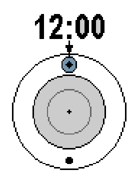
Spin 1:

Lower hood and press the green “START” button.

Spin 2:

Lift hood and install calibration weight on the left side of the faceplate in either hole by threading the calibration weight clockwise into the hole.

Rotate calibration weight to the 12:00 position.



Select “Enter 12:00 Position.”

Lower hood and press the green “START” button.

Spin 3:

Lift hood, remove calibration weight, and install calibration weight in the same hole on the opposite side of the faceplate by threading calibration weight clockwise into hole.

Lower hood and press the green “START” button.

If calibration succeeds, the LCD will display a “Calibration Complete” message.

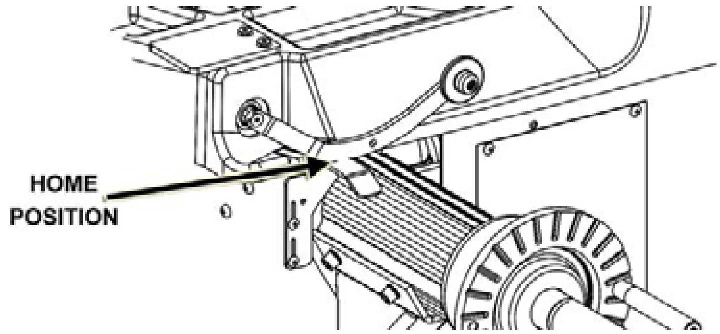
If calibration fails, such as if the weight was placed incorrectly during the procedure, the ForceMatch® HD / GSP9600HD will keep previous balancer calibration data.

Inner Dataset® Arm (Calibration Tool, 221-672-1, Required)

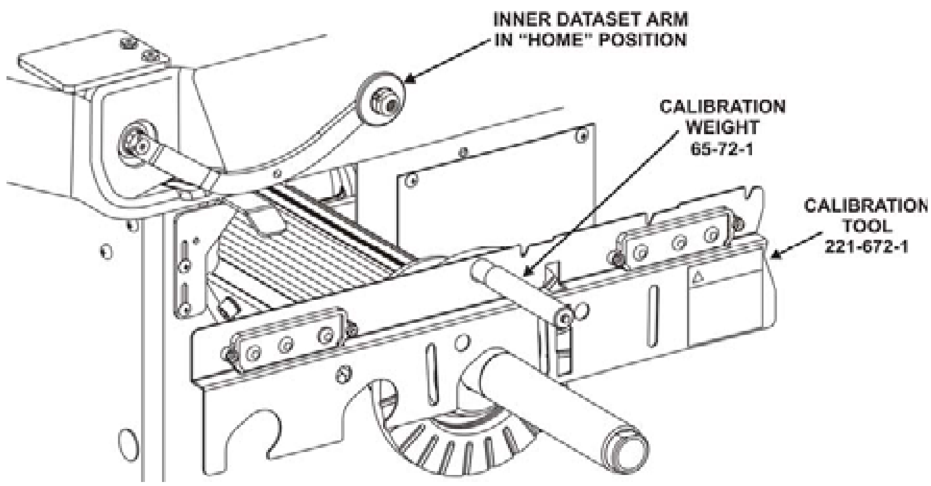
Select “Inner Dataset” from the “Calibration Procedures” primary screen.

Select “Begin Procedure.”

Verify that the inner arm is in the “home” position at the top of the weight tray and is not moving. Tap the foot pedal once or press “Enter Cal Step.”



Place the calibration tool on the shaft using the middle spindle shaft slot. Align the center hole of the calibration tool with a calibration weight thread hole, and tighten the calibration weight securing the calibration tool to the hub face as shown below.

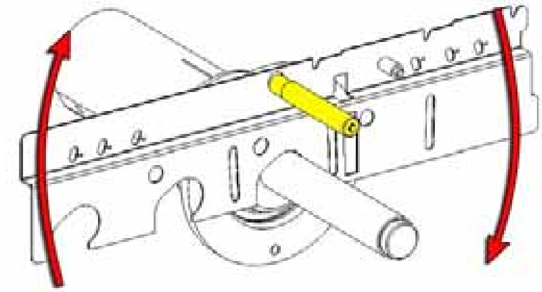


⚠ **CAUTION:**	Do NOT operate balancer with calibration tool attached. Remove calibration tool immediately after performing this procedure.

Press “OK” when calibration tool is installed.

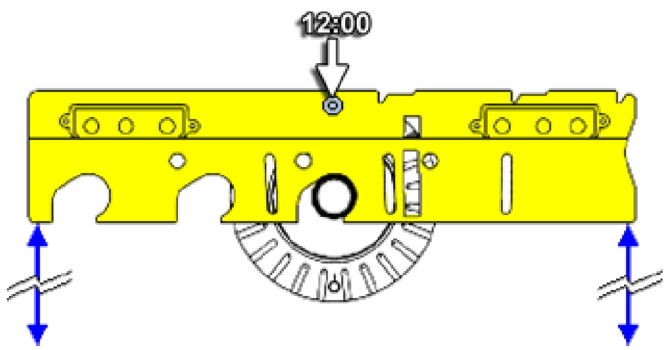
NOTE:	You may have to rotate the tool up to 1 1/2 turns.

Rotate the calibration tool slowly by hand, clockwise until the ForceMatch® HD / GSP9600HD beeps.

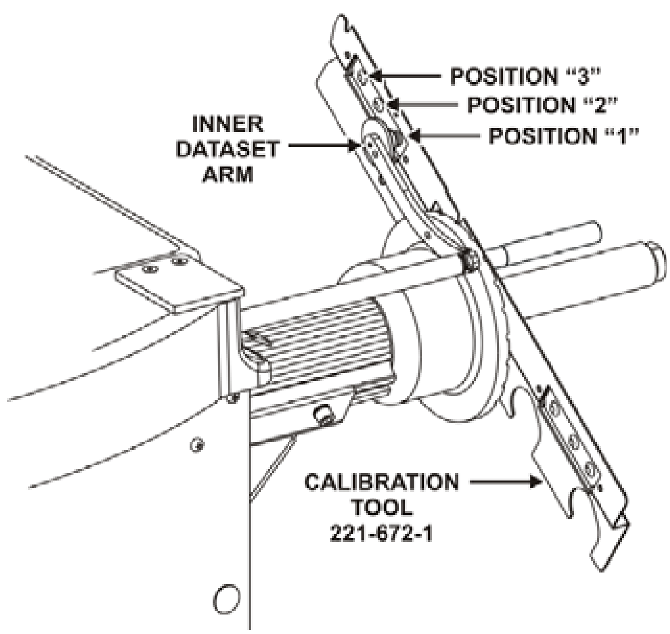


NOTE:	To verify that the tool is parallel to the floor, measure from both ends of the calibration tool to the floor. The measurement will be the same at both ends when the tool is parallel to the floor.

Position the calibration tool parallel to the floor. Tap the foot pedal once or press "OK."



Place the inner Dataset® arm at upward position "1." Tap the foot pedal once or press "Enter Cal Step."

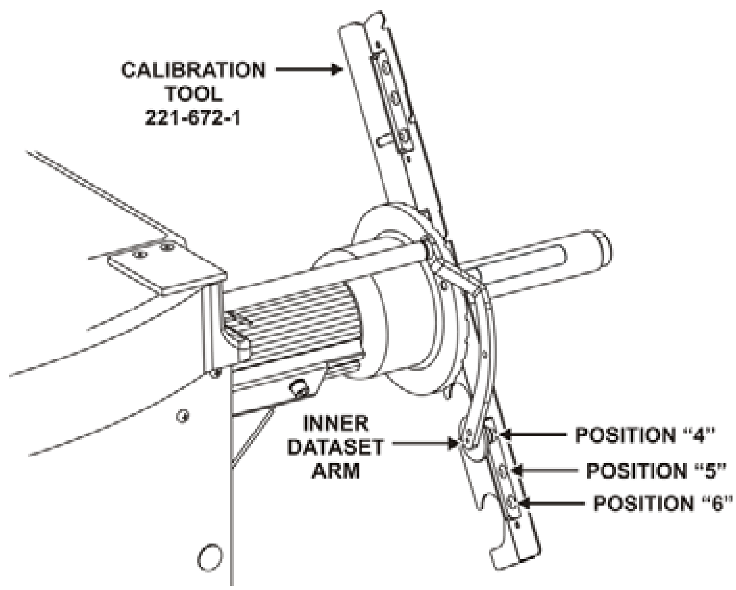


NOTE:	If the inner Dataset® arm is unstable while entering any step, a long, high-pitched tone will sound to advise that the step has **NOT** been entered. Stabilize the arm and re-enter the step.

Place the inner Dataset® arm at upward position "2." Tap the foot pedal once or press "Enter Cal Step."

Place the inner Dataset® arm at upward position "3." Tap the foot pedal once or press "Enter Cal Step."

Place the inner Dataset® arm at downward position "4." Tap the foot pedal once or press "Enter Cal Step."



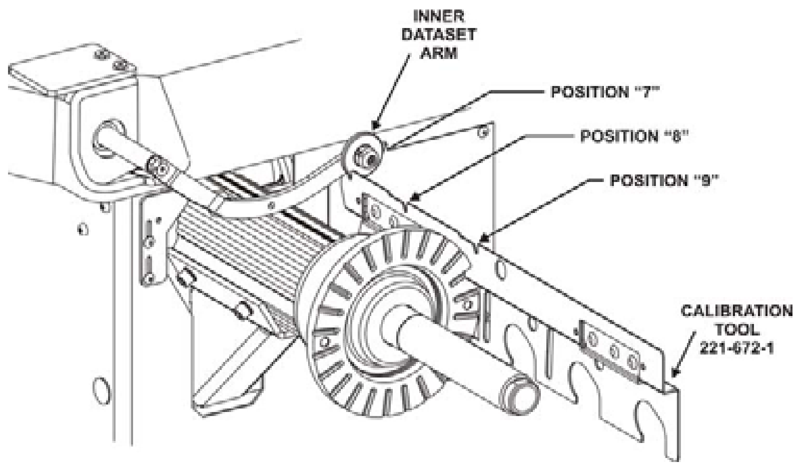
Place the inner Dataset® arm at downward position "5." Tap the foot pedal once or press "Enter Cal Step."

Place the inner Dataset® arm at downward position "6." Tap the foot pedal once or press "Enter Cal Step."

Remove the calibration weight from the calibration tool and return it to its storage position.

Position the calibration tool parallel to the spindle shaft on the hub using the hub mounting slot as shown.

Place the inner Dataset® arm at the position “7.” Tap the foot pedal once or press “Enter Cal Step.”



Place the inner Dataset® arm at the position “8.” Tap the foot pedal once or press “Enter Cal Step.”

Place the inner Dataset® arm at the position “9.” Tap the foot pedal once or press “Enter Cal Step.”

Inner Dataset® arm calibration is complete.

Outer Dataset® Arm (Calibration Tool, 221-672-1, Required)

Select “Outer Dataset” from the “Calibration Procedures” primary screen.

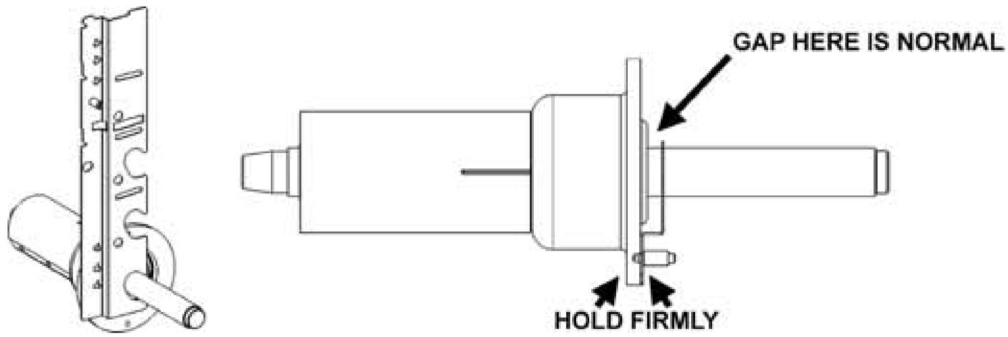
Select “Begin Procedure.”

With the hood in the raised position, verify that the outer arm is in the “home” position and that the arm and hood are not moving. Tap the foot pedal once or press “Enter Cal Step.”

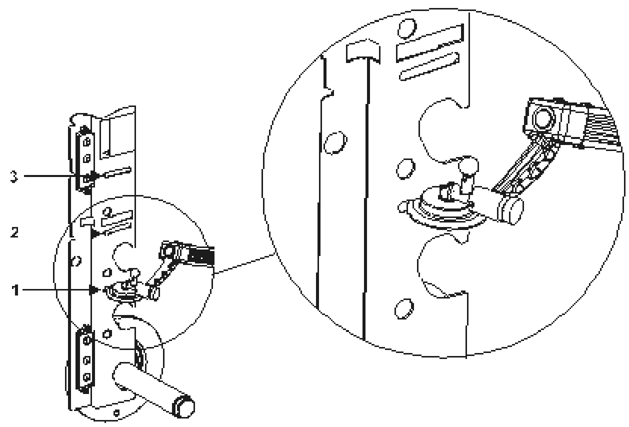
Outer Dataset in “Home” Position

NOTE:	The calibration tool should be in full contact with the hub face, but allow a gap to exist between the tool and the hub face.

Place the calibration tool on the spindle shaft using the spindle shaft slot closest to the end of the calibration tool and hold in an upright position, flat against the hub.



Place the outer Dataset® arm at position “1.” Tap the foot pedal once or press “Enter Cal Step.”

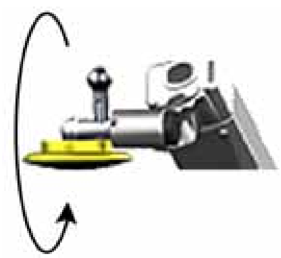


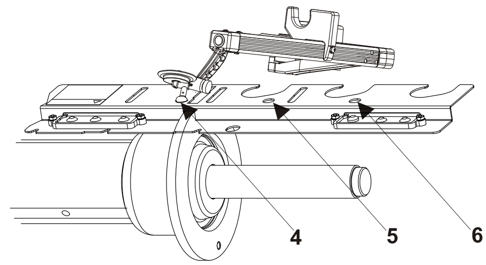
NOTE:	If the outer Dataset® arm is unstable while entering any step, a long, high-pitched tone will sound to advise that the step has NOT been entered. Stabilize the arm and re-enter the step.

Place the outer Dataset® arm at position “2.” Tap the foot pedal once or press “Enter Cal Step.”

Place the outer Dataset® arm at position “3.” Tap the foot pedal once or press “Enter Cal Step.”

Loosen the outer Dataset® arm locking screw by turning it counterclockwise and rotate the outer arm ball into the downward position by pulling the locator pin out of the locator slot and rotating the ball 180 degrees. Secure the locking screw. Place the calibration tool on the hub using the hub mounting slot as shown.





Place the outer Dataset® arm ball in the hole for position "4." Tap the foot pedal once or press "Enter Cal Step."

Place the outer Dataset® arm at position "5." Tap the foot pedal once or press "Enter Cal Step."

Place the outer Dataset® arm at position "6." Tap the foot pedal once or press "Enter Cal Step."

Rotate the outer arm ball back to the upward position.

Outer Dataset® arm calibration is complete.

Load Roller (Calibration Tool, 221-672-1, Required)

Select "Calibrate" from the "Logo" screen.

Select "Load Roller" from the "Calibration Procedures" primary screen.

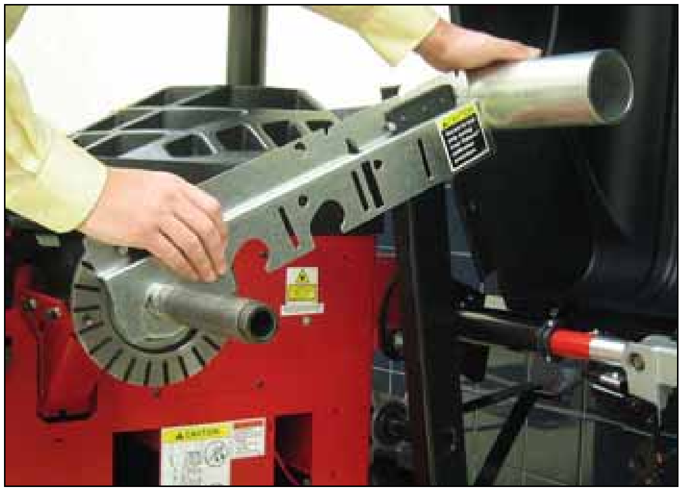
Select "Begin Procedure."

Verify that the load roller is in the "home" position and is not moving. Tap the foot pedal once or press "Enter Cal Step."

Disconnect the air supply and load roller return spring.

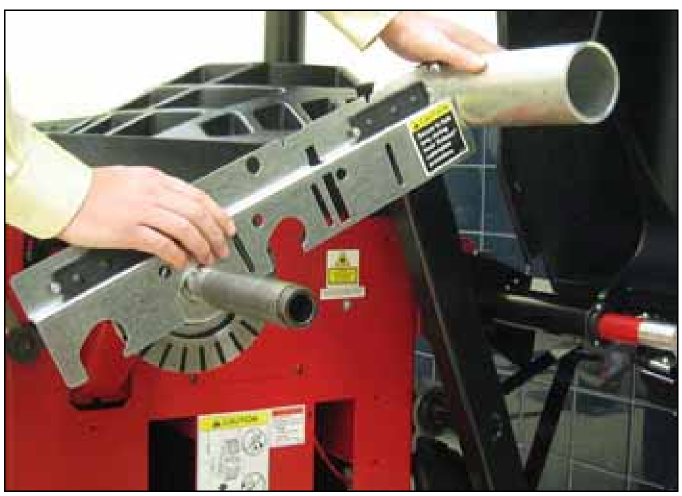
⚠ **CAUTION:**	Failure to disconnect the air supply may result in personal injury.

Position the calibration tool on the spindle shaft using the spindle shaft slot closest to the end of the tool. Place load roller at position “1.” Tap the foot pedal once or press “Enter Cal Step.”



NOTE:	If the load roller is unstable while entering any step, a long, high-pitched tone will sound to advise you that the step has NOT been entered. You must stabilize the load roller and re-enter the step.

Position the calibration tool on the spindle shaft using the middle spindle shaft slot. Place load roller at position “2.” Tap the foot pedal once or press “Enter Cal Step.”



Position the calibration tool on the spindle shaft using the spindle shaft slot closest to the center of the tool. Place load roller at position “3.” Tap the foot pedal once or press “Enter Cal Step.”

Reconnect the load roller return spring.

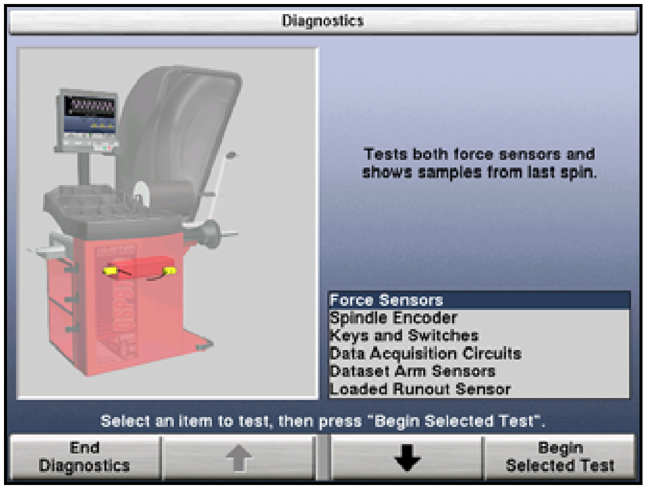
Reconnect the air supply.

⚠ **CAUTION:**	To prevent injury, verify that the load roller return spring is reconnected **PRIOR** to reconnecting the air supply.

Load roller calibration is complete.

7.2 Diagnostic Procedures

The “Diagnostics” primary screen can be selected by pressing “Diagnostics” from the “Logo” screen. The “Diagnostics” primary screen contains a list box of diagnostic procedures. As the procedures are individually highlighted by selecting “↑” or “↓,” the equipment components for each diagnostic procedure are shown in yellow on the illustrated ForceMatch® HD / GSP9600HD.



Most of the diagnostic data is for the sole purpose of conveying information to the Hunter Service Representative. The service representative may request information from these screens to diagnose service concerns. The ability to convey diagnostic data to the representative prior to service expedite repair to the equipment.

Begin each highlighted diagnostic procedure by selecting “Begin Selected Test.” To exit a diagnostic procedure, select “End This Test.” On many test screens there will also be an option for printing the test screen.

Force Sensors

Tests both force sensors and displays samples from the last spin. Close hood to initiate test sequence. Either left or right sensor can be displayed. Other visual controls that are available are “zoom,” “pan left,” and “pan right.”

Spindle Encoder

Tests the encoder wheel attached to the spindle. Visual controls that are available are “zoom,” “pan left,” and “pan right.” Close hood and select “Take Readings” to initialize test.

Keys and Switches

Tests the keypad and switches. Each working keypad and switch will beep upon closure to verify that it is in working order. This will include all switches, such as the inflation station, hood open/close, etc.

Data Acquisition Circuits

Tests the data acquisition circuits. Screen displays real-time samples as acquired by main PC Board electronics of all circuits.

Dataset Arm Sensors

Tests the inner and outer dataset arms. Install wheel, apply dataset arms, and press the outer dataset arm switch to initialize the test. The tests measure both the lateral and radial data from the inner and outer dataset arms.

Loaded Runout Sensor

Tests the sensor mounted on the load roller. Visual controls that are available are “zoom,” “pan left,” and “pan right.”

7.3 Diagnostic Procedures (Service Mode Enabled)

Loaded Runout Air Components (Service Mode Only)

Measures forces exhibited by the air bag and inflation station. Install a wheel assembly, close the hood, and select the desired option from the menu.

Motor Drive (Service Mode Only)

Tests rpm's and torque of the motor drive compared to the exact rpm or load setting. The rpm setting can be manually adjusted from this screen using the control knob. Tests on the motor drive can be focused on speed control or torque control. Close hood and push the "Start" button to begin the test.

7.4 Cleaning the Console

When cleaning the console, use window cleaning solution to wipe off the display console and cabinet. Do not spray window cleaning solution directly onto control panel or LCD. Power should be "OFF" prior to cleaning the LCD.

> ⚠ **WARNING:** **Exposing the balancer to water either by hose, bucket, or weather may cause risk of electrical shock to operator or bystanders and will damage the electrical system. Place, store, and operate the balancer only in a dry, sheltered location.**

7.5 Maintenance

Spindle Hub Face and Shaft

Keep the shaft and wing nut threads clean and lubricated. Lubricate the shaft without contaminating the hub face. Select "Clean Spindle Threads" from the "Balance" primary screen. Run the edge of a rag between the threads while the spindle is slowly turned by the motor drive. If any signs of dirt or debris appear on the spindle threads, the spindle should be cleaned immediately prior to mounting a wheel.

> ⚠ **CAUTION:** Failure to clean spindle properly will result in a loss of clamping force. Due to the force applied to the wheel by the load roller, it is critical to maintain optimum clamping force.

Lubricate the shaft with a coating of light lubricant with Teflon® such as Super Lube® by Loctite after cleaning. Do not lubricate the spindle hub face mounting surface. This could cause slipping between the wheel and the hub face. Keep the hub face mounting surface clean and dry.

BDC Laser Adhesive Weight Locator Maintenance or Service

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

This Laser Product is designated as Class 1M during all procedures of operation.

Never look directly into the laser. Doing so may cause serious injury.

Do not intentionally use a reflective device to enhance or re-direct the laser.

Do not operate the laser if the cover or seal is damaged.

There is no required maintenance or service to keep the BDC Laser in compliance.

Any necessary repair or maintenance should be done by the factory only. The BDC Laser Locator has no field serviceable parts.

The unit should never be opened or modified.

Optional HammerHead™ TDC Laser Clip-On Weight Locator Maintenance or Service

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

This Laser Product is designated as Class 2M during all procedures of operation.

Never look directly into the laser. Doing so may cause serious injury.

Do not intentional use a reflective device to enhance or re-direct the laser.

Do not operate the laser if the cover or seal is damaged.

There is no required maintenance or service to keep the TDC Laser in compliance.

Any necessary repair or maintenance should be done by the factory only. The TDC Laser Locator has no field serviceable parts.

The unit should never be opened or modified.

7.6 Mounting Cone Maintenance

Keep the mounting cones clean and lubricated. Lubricate with a coating of light lubricant with Teflon® such as Super Lube® by Loctite.

Do not use cones in any way that is not described in this operation manual. This could cause damage to the mounting cone and not allow for proper mounting of the wheel.

8. Glossary

Amplitude (Magnitude)

Amplitude is the amount of force or the intensity of the vibration.

Back Coning

Back coning is the use of a cone to center the wheel on the balancer's shaft from the backside, primarily due to the chamfer of the wheel. Term is also referred to as Back-Cone Mounting.

Backspacing

The distance measured from the mounting face to the back edge of the wheel.

BDC

The abbreviation for bottom dead center also referred to as 6 o'clock.

Bead seating

Bead seating is the process of seating the tire to the rim bead seats. Bead seating preferably occurs just after the tire and rim have been assembled, but may gradually change and optimize over a longer period. If loaded with the ForceMatch® HD / GSP9600HD load roller or driven, the position of the bead may optimize or always remain seated improperly, unless the tire is demounted, lubricated, and remounted. However, the load force and its' relatively short duration will not necessarily solve defective mounting of the tire bead seat to the rim seat.

Bolt Pattern Circle

The diameter of an imaginary circle drawn through the center of each lughole, and virtually always on the same centerline as the hub bore of the wheel.

Computerized Vibration Analyzer

A device used to determine the frequency of the vibration by isolating the vibrations with the greatest magnitude.

Cycle

A cycle is one complete disturbance.

Dampen

Dampen is to decrease the magnitude of a vibration or sound.

Dampers

Dampers are used to reduce the magnitude of a given vibration. Rubber is commonly used to isolate and dampen vibrations.

Dataset®

Datasets are the inner and outer electronic arms on the ForceMatch® HD / GSP9600HD. By positioning the Dataset arms and entering data using the foot pedal, rim dimensions can be recorded for balancing.

Dynamic Balance

A procedure that balances the wheel assembly by applying correction weights in two planes so that up and down imbalance and side to side imbalance are eliminated.

Force Matching®

A method of aligning the high spot of the tire's radial force variation with the low spot of rim runout to decrease rolling vibration in the wheel assembly.

Forced Vibration

Vibrates when energy is applied.

Free Vibration

Continues to vibrate after the outside energy stops.

Frequency

The number of disturbances that occur per unit of time.

Front Coning

When the wheel requires the cone to center the wheel on the balancer's shaft from the front. Also referred to as Front-Cone Mounting.

Harmonic

A vibration that is identified by the number of occurrences per revolution. For example, a 1st harmonic vibration has a once per revolution vibration component.

Hertz

A unit of frequency: one disturbance per second.

Hub Centric

The wheel is centered using the center hole of the wheel.

Inflation Station

A feature on newer models of the ForceMatch® HD / GSP9600HD that automatically inflates or deflates tires to a predetermined air pressure.

Lateral Runout

The amount of side-to-side movement as the tire/wheel assembly rotates.

Lug Centric

The wheel is centered using the lugholes rather than the wheel center hole.

Magnitude (Amplitude)

The amount of force or the intensity of the vibration.

MatchMaker®

Allows the operator to match up four identical tires on identical rims, to achieve the optimal combination of match mounting.

Natural Frequency

The point at which an object will vibrate the easiest.

Order

The number of disturbances per cycle (rotation). For example, a 1st order vibration occurs once per cycle, and a 2nd order vibration occurs twice per cycle.

P, P/SUV, LT

“P Tires” refers to passenger tires, “LT Tires” refers to light truck tires, and “P/SUV Tires” refers to P-Rated sport utility vehicle tires.

Phase

The position of a vibration cycle relative to another vibration cycle in the same time reference.

Phasing

The cycle pattern of two or more vibrations that overlap and combine to increase the overall magnitude.

Pressure Ring

The accessory used to prevent the wing nut from contacting the wheel when on the balancer shaft.

ForceMatch®

ForceMatch® tire and wheel mounting procedure is a method of aligning the high spot of the radial loaded runout first harmonic (once-per-revolution component) with the average low spot of the radial rim runout first harmonic to decrease vibration in wheel assembly.

Radial Force Variation (RFV)

A term describing a measurement of the tire uniformity, under load, measuring the variation of the load acting toward the tire center.

Radial Runout

A condition where the tire and wheel assembly is slightly out of round forcing the spindle to move up and down as the vehicle rolls along a smooth surface.

Reed Tachometer

A mechanical device that uses reeds to indicate the frequency and magnitude of the vibration.

Resonance

The point where a vibrating component’s frequency matches the natural frequency of another component.

Responding Component

The noticeable component that is vibrating.

Road Force®

A change in the force between the wheel and the axle while rotating under a load.

Servo-Stop

The ability to locate varying positions of the tire/wheel assemblies and hold the position in place while correctional weights or OE-Matching marks are applied.

SmartWeight® Balancing Technology

SmartWeight measures the forces placed on a wheel and balances in an effort to reduce those forces, thus saving weight, time, and money.

Source Component

A component causing another object to vibrate, such as a tire/wheel assembly.

Spindle-Lok®

A feature that locks the spindle in place by depressing the foot pedal.

Static Balance

A procedure that balances the wheel assembly using only a single weight plane.

TDC

An abbreviation for top dead center. Also referred to as 12 o'clock.

Torque Sensitive Vibration

The vibration occurs when accelerating, decelerating, or applying the throttle.

Total Indicated Reading (T.I.R.)

Data measurements taken by the load roller (measured in lbs. or kg) or Dataset® Arms (measured in inches or millimeters) representing the actual runout measured. The T.I.R. data represents the difference in value between the highest and lowest value measured.

Transference Path

The object(s) that transfer the frequency.

TranzSaver™

TranzSaver™ displays the diameter of the tire and wheel assembly on balance screen

Vibration

A shaking or trembling, which may be heard or felt.

Weightsaver® Feature

Weightsaver® is the percentage of maximum shimmy allowed. The larger the percentage, the greater the weight savings.

Wheel Diameter

Dimension measured on the inside of the rim at the bead seats.

Wheel Offset

The measured distance between the mounting face of the wheel and the centerline of rim.

Wheel Width

Dimension measured on the inside of the rim between the bead seats.

HUNTER RESEARCH AND TRAINING CENTER

HUNTER . . . dedicated to service excellence through professional training

HUNTER TRAINING - Hunter operates the most advanced, up-to-date Training Center in the industry today.

The courses have been designed to meet the needs of new and experienced technicians who want to increase their mechanical and diagnostic capabilities. The low student-teacher ratio (average 7 to 1) and the emphasis on “hands-on” training (80% time in shop) create an excellent learning environment.

Highlights of the Hunter Training Center include:

- An instruction staff with over 100 years of shop, field, and teaching experience.
- Fully-equipped service bays.
- Classrooms equipped with modern teaching aids.
- The most up-to-date wheel alignment, balancing service and brake equipment on the market today.

Align 1 (Basic Alignment Theory and Practice) 3 day / 24 hrs

Students will learn basic wheel alignment service through classroom and hands-on practice. Pre-alignment services, wheel alignment angle theory and wheel alignment equipment operation are the focus of this course. Basic wheel alignment adjustments will be demonstrated and students will practice on vehicles in a shop environment.

Align 3 (Advanced Diagnostics and OE Procedures) 2-day / 16 hrs

This class focuses on using advanced diagnostic angles and measurements to determine damaged suspension and steering components. Techniques used in finding damaged parts are reinforced with classroom scenarios and hands-on labs designed to both challenge and further embed these much needed skills.

GSP9700 Certification 2-days / 16 hrs

This course combines the Rolling Smooth course with a certification program for Hunter Engineering’s GSP9700 Road Force Measurement system. Students use hands-on practice with the GSP9700 to gain a proficiency level acceptable to be deemed certified.

HDT Alignment 1 (Fundamental Alignment) 3-day / 24 hrs

Classroom and shop practice is used to teach the basic elements of Class 8 truck wheel alignment. Students will learn the proper method to measure and correct the required basic alignment angles using state of the art equipment. Trailer alignment is included.

Align 2 (Advanced theory / Aftermarket Adjustment) 2-day / 16 hrs

Modified vehicle wheel alignment is the focus of this course. Students learn how to use alignment angles to achieve vehicle handling performance in conjunction with ride height kits and modified tire/wheel packages. Aftermarket alignment adjustment kits are discussed and demonstrated.

Performance Tire (Basic and Advanced Tire Changing) 1-day 8 hrs

Students will learn basic terminology and theory related to servicing tires and wheels. Students learn the proper techniques for changing tires on tulip clamp and table top tire changer designs. This course covers the proper tire changing techniques for low profile tires, run flat designs, and tire/wheel assemblies using TPMS.

Rolling Smooth (Basic & Advanced vibration theory) 1-day / 8 hrs

This course offers a study of vehicle vibration specific to wheel speed. The student will learn basic vibration terminology and vibration theory, Shop activities include the measurement of Road Force Variation, wheel runout and balance. Additional diagnostic tools are discussed.

HDT Alignment 2 (Advanced Alignment) 2-day / 16hrs

The student will understand the cause and affect of basic alignment angles relative to ride quality, performance and tire life. Classroom and shop practice are used to learn the proper use of diagnostic alignment angles. Additional adjustment techniques and alignment system operation are explored in both the classroom and lab environment. Busses and RVs are discussed.

HUNTER UNIVERSITY

Hunter University’s eLearning courses are designed for all student levels and can be used as an integral supplement to instructor-led training courses. In-depth information, detailed graphics, video and modular segments assist the participant in expanding their knowledge base at a self-determined level. Go to www.hunter.com and click on **TRAINING.**

For further information about other classes offered or to schedule into a class, simply call the Hunter Research and Training Center at 1-800-448-6848.