



# ***FITMASTER***

**Professional Bicyclist Sizing Instrument**

## **Owner's Manual**

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Dear Fitmaster Customer:

Thank you for choosing Fitmaster to help you offer the ultimate in rider service. The Fitmaster is designed to provide precise measurements and years of daily use.

This manual is designed to make it easy to assemble and use this instrument. While we provide guidance on the set-up, merchandising and use of the Fitmaster, there is no substitute for proper training, experience and commitment to serving the rider. With these tools and skills, you can significantly enhance the ability of your business to deliver quality fits to the riding community.

Thanks again and may you create many satisfied customers through this tool.

Sincerely,

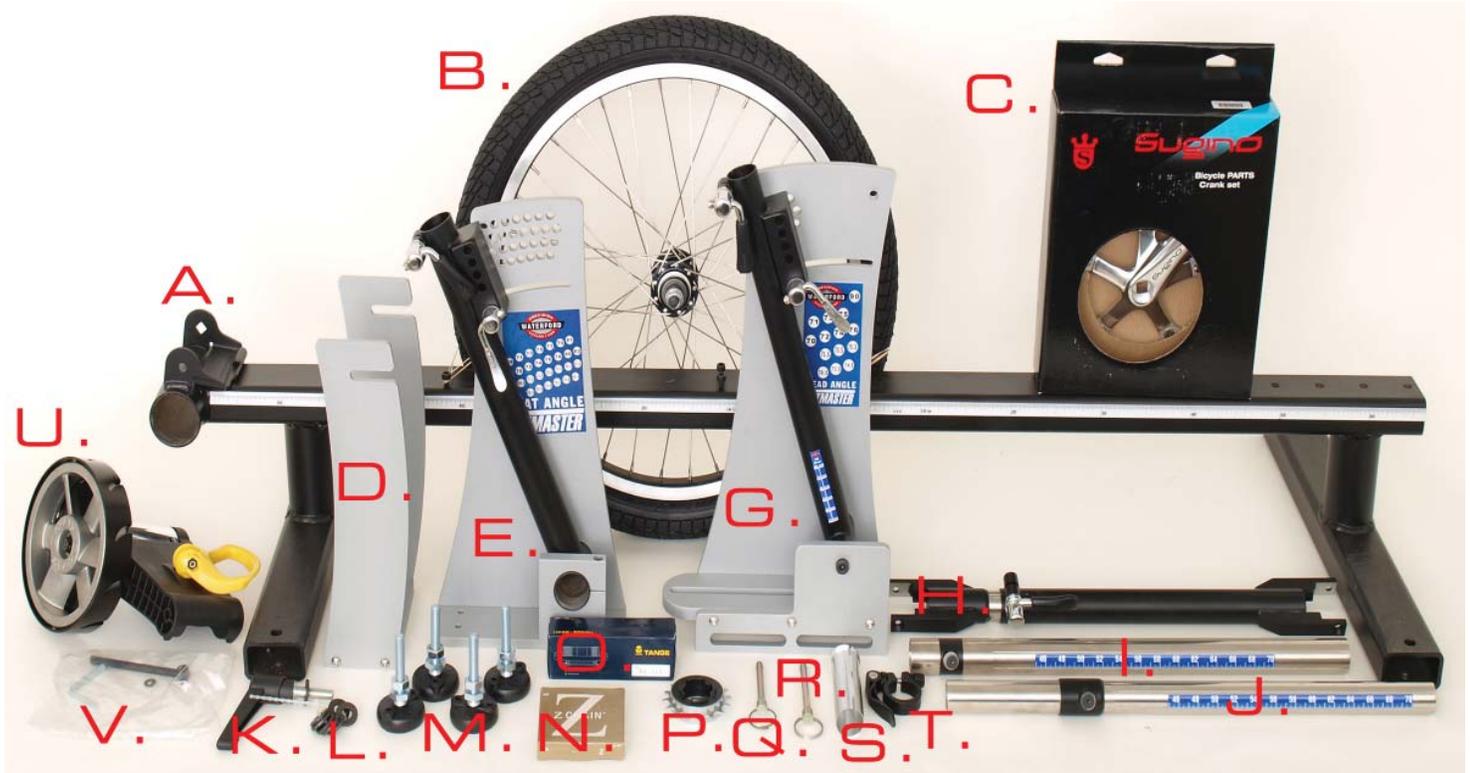
The Waterford Team.

# Safety Warning



Injury can result if fingers or other body parts get caught between the chain and the gears, or in other moving parts such as the wheel while in motion. Keep small children away from the Fitmaster.

## Parts List



Item	Qty	Description
A.	1	Fitmaster base
B.	1	Wheel and tire
C.	1	Crank assembly
D.	1	Rear wheel mount assembly
E.	1	Rear angle plate assembly
G.	1	Front angle plate assembly
H.	1	Top tube assembly
I.	1	Head tube slider
J.	1	Seat tube slider
K.	1	Front base plate tightening handle.
L.	1	Spacers for rear axle
M.	1	Levelers
N.	1	Chain
O.	1	Bottom bracket assembly
P.	1	Cog
Q.	1	Front angle pin (longer)
R.	1	Rear angle pin (shorter)
S.	1	Seat clamp insert
T.	1	Seat clamp
U.	1	Magnetic resistance unit

# Assembly Instructions

- A. Establish a roomy assembly area, close to the area to be used for fitting.
- B. Prior to assembly, you will want to acquire the appropriate tools and non-supplied parts:
- C. Proper and safe assembly requires average bicycle mechanic skills, including the ability to:
- Install a bottom bracket
  - Install a bicycle chain
  - Install a rear cog
  - Install a nutted rear wheel

## Tools for Assembly / Operation

Item	Qty	Description
Assembly/maintenance tools		
1	1	Allen wrench - 4mm
2	1	Allen wrench - 5mm
3	1	Allen wrench - 6mm
4	1	Allen wrench - 8mm
5	1	15mm axle wrench
6	1	Container grease (red lithium)
7	1	Set BB mounting tools
8	1	Adjustable wrench
9	1	Chain tool
10	1	Tire pump and mounting tools.
Tools for use in fittings		
11	1	Level / angle finder (optional)
12	1	Metric tape measure
13	1	Plumb bob
14	1	Straightedge (optional)

**Be sure to lubricate all threads before securing parts.**

## Step 2. Unpack the Fitmaster.

Check off the parts against the parts list.

## Step 3. Install the base levelers.

Remove the levelers from their packaging. Screw in the height adjustment nut to the maximum depth (but do not tighten). Then screw the levelers into the holes in each of the four feet.



## Assembly (cont'd)

### Step 4. Install the resistance unit.

Bolt the resistance unit to the base. Be sure to insert the bolt through the square hole. Then tighten. Insert the positioning bolt in its hole and line up with the leveling bolt integrated into the resistance unit. Once the threaded section is inserted into the head, tighten the knob to bring the unit as far down as possible. Then, after mounting the wheel, turn the knob counter-clockwise raise the roller until it fully engages the tire.



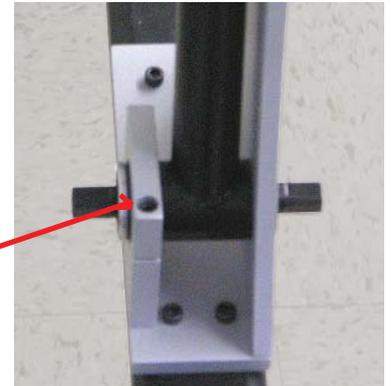
### Step 5. Install the rear wheel support.

Remove and then replace the bolts in the base using a 4mm hex head wrench.



### Step 6. Install the rear angle plate assembly.

- Use the 4mm hex head bolts installed on the base to attach the plate to the base.
- Install the bottom bracket - following manufacturer instructions.
- Tighten the pillow block to remove any play while allowing the BB shell to turn as you change the seat angle.



### Step 7. Install the crank.

- Install chainring to drive side crank using chainring bolts.
- Install the crank on the BB spindle according to the manufacturer's specification.



## Assembly (cont'd)

### Step 8. Install the Cog on the rear wheel.

Hand tightening is sufficient since pedalling will naturally tighten the cog.



### Step 9. Install the wheel and chain.

The rear wheel plate is designed to fit up to a 130mm spacing wheel (This lets you build a Cyclops Powertap wheel to fit your Fitmaster). Spacers are included with the wheel to allow the 120mm hub to mount properly. BE SURE TO PUT THE SPACERS NEXT TO THE HUB BEFORE INSTALLING THE WHEEL. Using the chain tool, install the chain according to the manufacturer's specifications. Tension the chain as you would with a fixed gear or single speed bike.

### Step 10. Install the front angle plate.

- Slide the front angle plate on the base from the front so as not to damage the rulers on the base.
- Secure the plate with the ratcheting front plate bolt. Tip: start with the third hole from the rear to fit bike of the most popular sizes and geometries.
- To screw in, lift up the handle, then hand thread in the bolt. NOTE: When tightened, the bolt merely needs to be snug, Over-tightening makes it harder to loosen it up for adjustment.



## Step 11. Assemble and install the head and seat tube sliders.

Insert the head tube and set tube sliders into their respective tubes. Then remove the pivot bolts and bolt on the front and rear top tube slider yokes. Tighten pivot bolts enough to be snug while maintaining easy pivoting.



## Step 12. Install the seat tube insert and clamp.

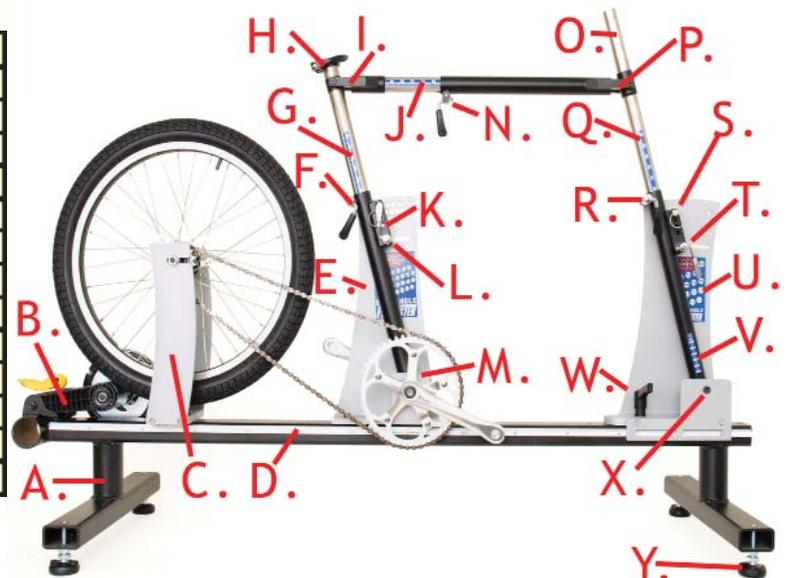


Insert the seat tube insert (which insures a proper fit-up with 27.2mm seat posts). Then slip the quick-release clamp over the assembly. You are now ready to install a seatpost.



## Complete Fitmaster with Terminology

Description	Description
A. Fitmaster Base	M. PillowBlock (BB Clamp)
B. Resistance Unit	N. Top Tube Quick Release
C. Rear Wheel Strut	O. Steerer Tube
D. Base Plate Ruler	P. Head Tube Pivot Yoke
E. Rear Angle Plate	Q. Head Tube Slider/Ruler
F. Seat Tube Quick Release	R. Head Tube Length Quick Release
G. Seat Tube Slider/Ruler	S. Head Angle Pin
H. Seat Clamp	T. Head Angle Quick Release
I. Seat Tube Pivot Yoke	U. Head Angle Plate
J. Top Tube Slider/Ruler	V. Bottom Bracket Drop Scale
K. Seat Angle Pin	W. Head Tube Slider Ratcheting Bolt
L. Seat Angle Quick Release	X. Lower Head Tube Pivot
	Y. Base Adjustable Foot



# Setting up your Fitmaster for Use

## Planning and Fit Area Preparation

The Fitmaster is part of a collection of tools to assist you in providing the best in professional bicycle fitting services. Merchandising can significantly improve your shop's overall success in several ways:

1. You are better able to efficiently conduct a proper fitting.
2. The rider is more willing to place his or her confidence in you.
3. You improve quality control by using more systematic and accurate information.
4. You can earn higher revenue with an organized and complete presentation.

Plan carefully to insure that you get the most precise fitting results, efficient service delivery and the highest possible customer satisfaction.

- **Studio Space:** Careful planning of your studio space is one key to providing great service while maximizing the productivity of your fit area. Shops short on space will should incorporate tool storage and use the surrounding walls to store components and measurement tools.
- **The fitting area** should be far enough out of the way to facilitate a comfortable and focused environment, but visible enough to reinforce to your customers that you are capable of professional fits.
- **Dressing area** for riders getting fitting services. You'll get better results when the rider is wearing their riding clothes.
- **Level Surface:** The Fitmaster should be mounted on a level surface - with preferably less than 5mm of slope between the front and the rear of the machine. This facilitates accurate measurements - especially those that require a level.
- **Platform:** It's easier to adjust the machine and observe the rider when the Fitmaster is mounted on a platform, 12-18 inches above the surrounding floor. The platform is a handy place to store fit-related tools and components. If over 1 foot off the floor, the platform should include a step.
- **Other Fitting Equipment:** The fit area should include space for related fitting tools such as the Fit Kit and a wind trainer for observing and measuring the rider's existing bike.
- **Tool storage:** Storage for fitting and Fitmaster-related tools such as tape measures, plumb bobs, wrenches and stems.
- **Fit-related components:** Custom bike-related products, such as stems, saddles, shoes and so on, should be located within easy reach. Many shops merchandise saddles, bars and stems in the fit studio so the fit area can do double duty.
- **Computer:** A desk or kiosk with computer, printer and internet access is helpful for getting manufacturer and other information.
- **Furniture:** If space permits, provide chairs for observing riders and for guests to be comfortable during the fitting session.
- **Forms or Systems:** Good forms facilitate a disciplined approach to fitting. They allow you another way to analyse the rider's issues and to replicate a past fit. If your store has or will have two or more fitting professionals, consider setting up a



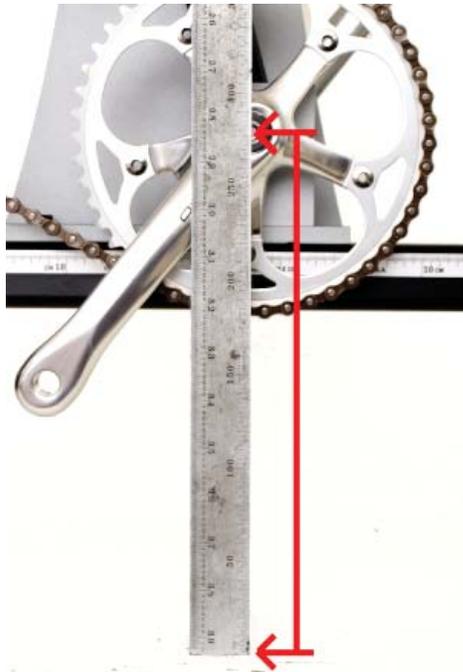
## Component Selection for Professional Fitting

A properly equipped fit studio should include the following components:

- **Saddles:** The Fitmaster fits a 27.2mm seatpost. You may want to purchase additional seatposts and install a range of saddles to allow comparison and quickly prepare for different riders. This can also help you close stock bike sales.
- **Handlebars:** Consider setting up a selection of popular bar widths (40cm, 42cm and 44cm outside to outside, for example) reaches and styles, with brake levers and bar tape, ready to match to the rider's recommended fit. Don't forget to include a flat bar set up for hybrid or off-road fitting.
- **Stem:** A Fit Kit FitStem lets you adjust your stem dimensions without having to swap stems. This is especially useful when fitting a rider to a stock geometry. When fitting for custom geometry, having a selection of standard stems on hand lets you adjust the frame dimensions based on a normal stem, giving the rider more options to adjust the stem length at a later time without affecting the bike's handling.
- **Cranks:** The Fitmaster is supplied with a single crank. Consider buying an adjustable crank or a selection of crank lengths.
- **Headset spacers:** A selection of 1 1/8" spacers helps you fine tune a fit.

# Level the Fitmaster

The Fitmaster is designed to support coordinate measuring systems for documenting both frame design and final bike fits. To make this work the lower head tube pivot point must be level with the center of the bottom bracket. To insure this, adjust the levelers until both points are the same distance off the floor. You can check your fit with a laser level.



# Setting up the Upper Head Tube

The Fitmaster's Zero-Stack head tube design offers considerable flexibility in setting up the design. The basic head tube simulates a classic lug design, with 27mm upper head tube (UHT - measured as the center of the top tube/head tube intersection to the top of the head tube). From this basic position, add headset spacers to model the effect of different configurations. Review with your custom bike supplier the options available for the upper head height and head tube extension options. Likewise, you'll want to know the effective upper head tube lengths for the stock bike manufacturers you



(Illustration at left) Shows a red 15mm spacer to simulate a threadless upper headset. Integrated headsets use a smaller stack (typically 6mm).



(Illustration at center) Simulates a 10mm head tube extension with a 15mm simulated threadless upper headset.



(Illustration at right) Shows a 10mm simulated head tube extension, a red 15mm spacer to simulate a threadless upper headset plus 20mm of headset spacers, over which you mount the stem and bars.

# Using your Fitmaster

## Using the Head Tube Ruler

One major feature of the Fitmaster is the ability to simulate stock bike designs. Most bike brands provide the head tube lengths for each frame size. Using the head tube length and other available information, you can calculate the proper Fitmaster Head Tube Length, making set up easy.



000000	000000 (mm):
71	9
71.5	9
72	8
72.5	7
73	7
73.5	6
74	5
74.5	4

The Fitmaster Head Tube Length (known as "FM HT Length", is the distance between the upper head tube pivot and the lower head tube pivot. This is the distance shown on the head tube ruler. To calculate the proper head tube length, you'll need the following information:

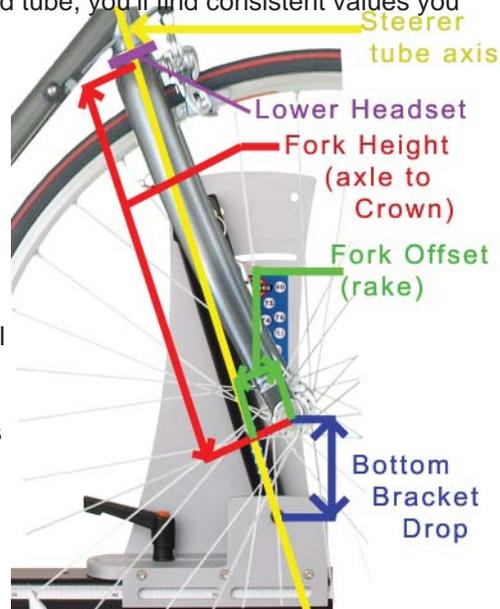
**Upper Head Tube Distance:** Stock bike suppliers are consistent in their upper head tube designs, limiting themselves to one or two configurations. By measuring the distance from the top tube / head tube intersection to the top of the head tube, you'll find consistent values you can use when calculating the right FMHT Length.

**Lower Headset Height:** On most traditional threaded and threadless headsets, this value is 13-14mm. Integrated headset designs have a much smaller height - only 1-3mm.

**Fork Height:** This is the distance from the axle to crown, along the axis of the steerer tube. It's generally 368-362mm for most composite and uncrown 49mm brake forks and 364-366mm for steel crowned forks.

**Bottom Bracket Drop:** Most 700C road race frames have a 65-70mm drop, while recreational frames have a 75-80mm drop.

**Bottom Bracket Drop Correction Factor:** A correction factor is required to account for the fact that the bottom of the theoretical fork height is below the front axle and that the bottom bracket drop is measured vertically though the steerer tube is at the head angle. The correction factor, measured in millimeters, depends principally on the head angle. The slacker the head tube, the greater the correction.



Below is the formula calculating the head tube:

FMHT Length =  
 Head tube length  
 Minus the UHT (upper head tube)  
 Plus the Lower Headset  
 Plus the Fork Height  
 Plus the Bottom Bracket Drop  
 Minus the Bottom Bracket Drop Correction Factor

Example: the Gunnar 62cm Roadie has a 210mm head tube, upper head tube of 31mm, fork height of 368mm, bottom bracket drop of 70mm and head angle of 73.5 degrees. The FMHT Length = 210mm - 31mm + 14mm + 368mm + 70mm - 6mm = 625mm.

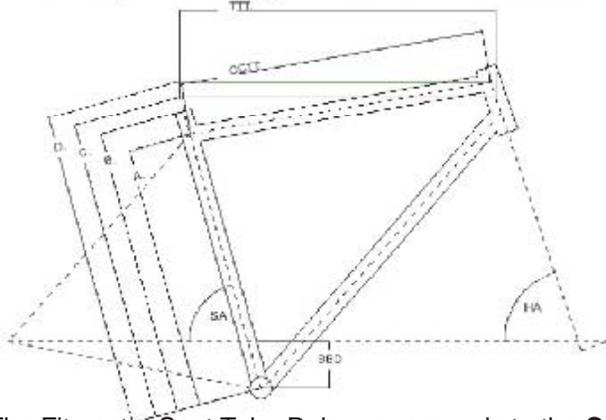
Once you calculate the first model in the size run, it's simple to extend the values for other bikes in the line. The 60cm Roadie has head tube 20mm shorter, but otherwise having the same values. It has a FMHT Length of 605mm. The table at right calculates the

Gunnar Roadie (2009)								
Size	Head Tube	Upper HT	Lower Headset	Fork Height	BB Drop	Head Angle:	Correc-tion	FM HT
48cm	106	25	14	343	45	72.5	7	476
50cm	96	25	14	368	70	71.5	9	514
52cm	117	31	14	368	70	73	7	531
54cm	135	31	14	368	70	73.5	6	550
56cm	152	31	14	368	70	73.5	6	567
58cm	169	31	14	368	70	73.5	6	584
60cm	190	31	14	368	70	73.5	6	605
62cm	210	31	14	368	70	73.5	6	625

# Using the Seat Tube Ruler

A careful understanding of the bicycle vendor's published information lets you set up the seat tube. There are several types of seat tube lengths, all of which are measured from the center of the bottom bracket:

## Sloped Top Tube Frame



- A. Center-to-Center: This is the measurement from the bottom bracket to the intersection of the top tube and the seat tube. This is the value measured on the Fitmaster seat tube label.
- B. Center-to-Top: This is the physical seat tube, measured from the bottom bracket to the top of the seat tube.
- C. Theoretical Seat Tube: This is the center to center distance to a point determined by the frame designer. This lets the designer control the head tube height independently of the reach.
- D. Effective Seat Tube: This is the center to center seat tube length to a point horizontal to the top tube / head tube intersection. Some bike designers use this as the measuring point of the top tube, as well.

The Fitmaster Seat Tube Ruler corresponds to the **Center to Center** value. Some manufacturers provide the Center to Center values. Most others only provide the center-to-top. If it's the latter, take a sample of one or more stock sizes and measure the distance from the top tube / seat tube intersection to the top of the seat tube, also known as the **Upper Seat Tube** (or, in Waterford parlance **seat tube P-value**). This value is generally consistent from one size to another.

**Very Small Frames:** The Fitmaster's ability to fit really tall frames limits how short a seat tube it can simulate. This limit may be higher than physical seat tube of shorter frames. As a result, you may have to establish settings that properly simulate the handlebar position of the frame, but which may not show all the slope on the frame.

# Using the Top Tube Ruler

The illustration above shows the two ways to measure the top tube:

TTT means Theoretical Top Tube - this assumes the top tube is horizontal.  
 CCTT means Center-to-Center top tube length, or the physical top tube length measured from the center of the seat tube to the center of the head tube.

Most bicycle vendors provide the Theoretical Top Tube but not the Center to Center. To set up a bike that mimics this fit:

1. Determine the upper seat tube length for this model of frame and therefore the center to center seat tube value.
2. Set up the head tube - both the height and the angle.
3. Set the seat angle.
4. Set the seat tube length so as to level the top tube.
5. Set the top tube length equal to the theoretical top tube by moving the front plate forward or back.
6. Lock the front plate and then adjust the seat tube length until you match the calculated center to center seat tube value.

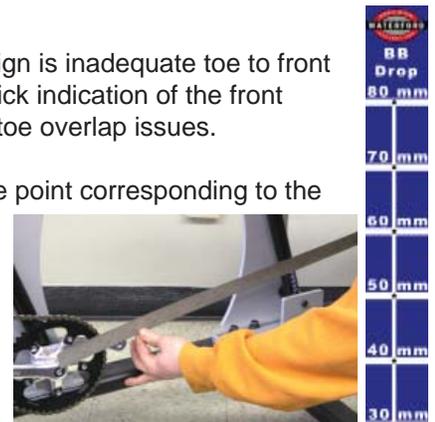
# Using Bottom Bracket Drop Scale



One of the biggest sources of conflict between rider fit and bike design is inadequate toe to front wheel clearance. The Fitmaster steerer tube label lets you get a quick indication of the front center of the prospective design and thereby to determine possible toe overlap issues.

- A. Determine the bottom bracket drop of the design.
- B. Measure the distance from the center of the bottom bracket to the point corresponding to the bottom bracket drop.
- C. Add the expected fork rake.

For example, on a 75mm bottom bracket drop design, you might measure 565mm. Add a 45mm rake for a total of 610mm. The table below shows approximate front center based on shoe size and popular tire sizes. Then adjust the threshold for crank length (based on a default 172.5mm length), pedal choice (assumes clipless pedals) and fender use. A rider using short toe clips, 700x32C tires, fenders and 175mm crank with size 9 shoes has an approximate threshold of 612mm. In this example, the rider may have some minor toe overlap with the fender.



Shoe Sizes				Tire Sizes						Adjustments		
Europe	US Men	US Women	CM	650C 21mm	650C 23mm	700C 21mm	700C 23mm	700C 25mm	700C 27mm	700C 29mm	The front wheel steer center should be adjusted as below:	
J8	6	7.5	24.5	545	547	545	547	545	547	545	Clipless pedals	None
J9	7	8.5	25.1	545	546	545	546	545	546	545	Clipless pedals	10mm
M1	8	9.5	25.7	547	548	547	548	547	548	547	Toe clips/fenders	10mm
M2	9	10.5	26.3	546	547	546	547	546	547	546	Clipless pedals	20mm
M3	10.5	12	27.1	547	548	547	548	547	548	547	Fenders	10mm
M4	11.5	13	27.9	547	548	547	548	547	548	547	Toe clips/fenders	20mm
M5	12.5	14	28.6	546	547	546	547	546	547	546	Clipless pedals	20mm
M6	14	15.5	29.3	547	548	547	548	547	548	547	Toe clips/fenders	20mm

# Fit Documentation System

Delivering high quality, professional fitting services involves not just the physical tools and space. Having a sound documentation system insures:

- Improved fit service quality by providing cross checks among the different sources information about the rider.
- Consistent service over time and among different staff members.
- Systematic and replicatable fitting services.
- More productive fittings because of easier to find resources and the elimination of wasted effort.
- The ability to systematically upgrade your fitting services as tools and techniques become available.

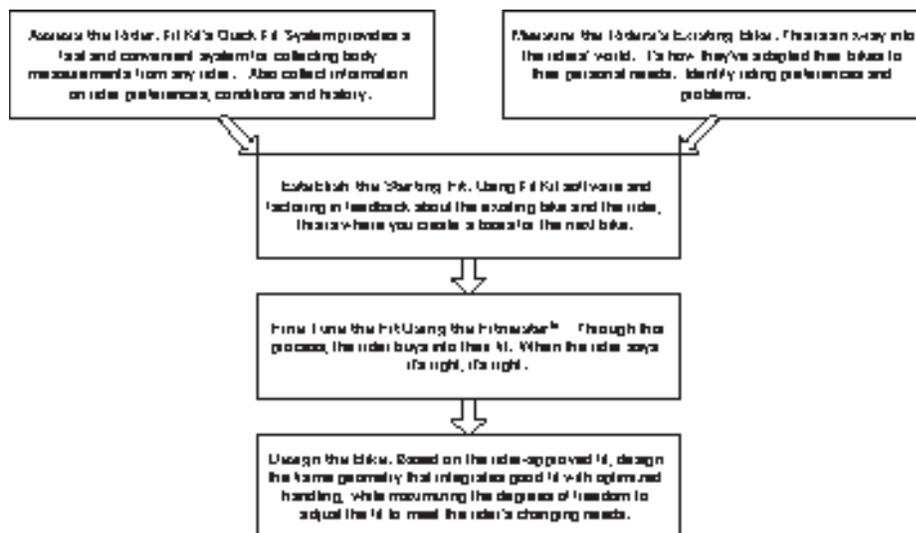
Waterford recommends developing a documentation binder to help manage your information. The binder should include:

- Procedures for executing the different kinds of fit services you offer.
- Information on stock bikes you offer to simplify Fitmaster Setup.
- Blank fit forms.
- Completed fit forms.
- This documentation.

On the next page you'll find a model professional fitting form. It is compatible with several fitting systems, particularly the Fit Kit System. Fit Kit has developed an excellent set of tools for collecting basic fit information about the rider and calculating a starting (so-called "Developmental") fit recommendation. It represents an excellent foundation for performing professional fits at all levels. Among the fit results recorded on the form are Slowtwitch.com's Stack and Reach, Serotta's x/y Coordinate system and Waterford's Quick Fit results.

We also include sample custom frame fit and stock bike fit procedures.

The overall Fitmaster professional fit methodology is illustrated at right. It starts with a thorough inventory of the rider - the skeleton, soft tissues, riding habits and riding objectives. You then develop a starting fit based on the information supplied. The Fitmaster allows you to refine and verify the fit. Then, you complete the bike selection or design based on the refined fit. Occasionally, some design considerations will affect fit, such as wheel choice, tire size, fork choice, or the need to fit fenders and/or racks.



## Documenting your Bicycle Product Lines

Your documentation binder should also include information on all the brands and models for which you expect to perform fittings. It makes fittings for special order bikes productive, since you can easily set up the Fitmaster to mimic a stock bike. This is can be as simple as copying geometry sheets off the internet if their information is adequate. You may want to supplement this information where needed. For example, Trek includes Stack and Reach values with their geometries, but they do not include the center to center seat tube lengths. You can easily provide the supplemental info on the margins. Below is an example table for a Gunnar Roadie showing all the key fit information:

Gunnar Roadie (2009)												
Size	Head Tube	Lower Headset	Fork Height	BB Drop	Head Angle	Correction	Upper HT	FMHT	FM Seat Tube	FM Top Tube	The Top Tube	Stand-over
48cm	105	14	343	45	72.5	7	25	47.6	367	484	500	685
50cm	96	14	368	70	71.5	9	25	51.4	367	492	510	709
52cm	117	14	368	70	73	7	31	53.1	447	515	530	749
54cm	135	14	368	70	73.5	6	31	55.0	467	534	550	768
56cm	152	14	368	70	73.5	6	31	56.7	487	543	560	785
58cm	169	14	368	70	73.5	6	31	58.4	507	552	570	802
60cm	190	14	368	70	73.5	6	31	60.5	527	562	580	820
62cm	210	14	368	70	73.5	6	31	62.5	547	572	590	840

River Name:		File No:		Filing Date:	
River Phone:		Gauge:			
<b>Flat Plate Measurements</b>					
Type of Filing Style:					
Filing Date - Objective:					
H-Line Year:		Years Filing:		Height:	
Elev:		Inches:		Feet:	
Sew:		Inch:		Structure:	
Sew:		Inches/Dia:		Elev/Dia:	
Comments:		Part 111 or Recreable ID:			
<b>Flat Plate Measurements</b>					
Sewer-Equal:		Sewer Scale:		Elev Top Tube/Green Combo:	
Sewer Tube C-to-C:		Curb Level:		Inch TT Green:	
* Ability to open to the center of top plate indicated by green - all other measurements are *					
Comments:					
<b>Horizontal Hole Measurements</b>					
Hole Size/Dia:					
R/Pine Top of Sewer:		Sewer Top to Burn:		Sewer Angle:	
Sewer Top to Burn:		Hole Above Sewer:		Reach:	
Sewer Cover:		Sewer:		Spacers:	
Notes/Comments:					
<b>Hole Flat Plate Measurements</b>					
Use cover or:					
Sewer Hole Elev:					
Hole:					
Sewer Invert Elev:					
Structure Elev:					
Hole Above:					
Sewer/Dia:					
Other Observations:					
<b>Horizontal Measurements</b>					
Sewer Tube C-to-C:		Top Tube C-to-C:		Elev T Level:	
Sewer Angle:		Sewer Scale:		Elev T Spacers:	
Flange to Back:		Reach:		Hurry - cover:	
<b>Flat Plate Measurements</b>					
R/Pine Top of Sewer:		Sewer Top to Burn:		Hole to Burn:	
Sewer Scale:		Through Sewer Lid:		Sewer Structure:	
Through Sewer Hood:				Level:	
Sewer Setback:				Level:	
Burner Hood:				Elev or 60" hole ID:	
				Burner Hood:	
<b>Vertical Hole Measurements</b>					
Burner Hood:					
Hole Size:		Hole Size:		Elev:	
Pipe Type:				Burn Back:	
Club Cover:		Elev. Dead End Below:		Sewer Box:	
Elev. Elev. Burner:					
Other Comments:					
Sewer:					



# Using the Base Plate Ruler for Coordinate Measurements

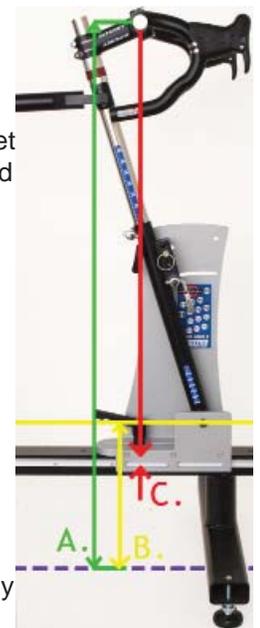
The geometry of the fitmaster is ideal for coordinate measurement, whether using Slowtwitch.com's stack and reach measurements, Serotta's x/y coordinates or any other system.

All coordinate systems are defined by the "Zero" point (0,0). The center of the bottom bracket serves as the "Zero" point for bicycle frame measurement. Accordingly, zero on the base plate ruler is directly under the bottom bracket. To establish zero for the y-axis, first measure the bottom bracket height.



**Slowtwitch.com Stack and Reach Measurements (left):** The bottom of the red headset spacer indicates the top of the head tube. This is the target measurement position for Stack and Reach Measurements:

1. Stack measurement: Use a tape measure to measure the distance from the target point to the ground (A.). Subtract the distance from the bottom bracket to the ground (B.)
2. Reach measurement: Use a plumb bob to find the position on the base plate ruler directly below the target point (C.)



**Serotta x/y coordinates (right):** Serotta x/y coordinates use the center of the handlebars at the stem as the target position:

1. Y-coordinate: Use a tape measure to measure the distance from the target point to the ground (A.). Subtract the distance from the bottom bracket to the ground (B.)
2. X-coordinate: Use a plumb bob to find the position on the base plate ruler directly below the target point (C.)

## Waterford "Quick Fit" Measurement System

Waterford uses a simple system for documenting bike fit - that is, the position of the saddle and the handlebars in relation to the bottom bracket. This accomplishes the same objective as the x/y-coordinates:

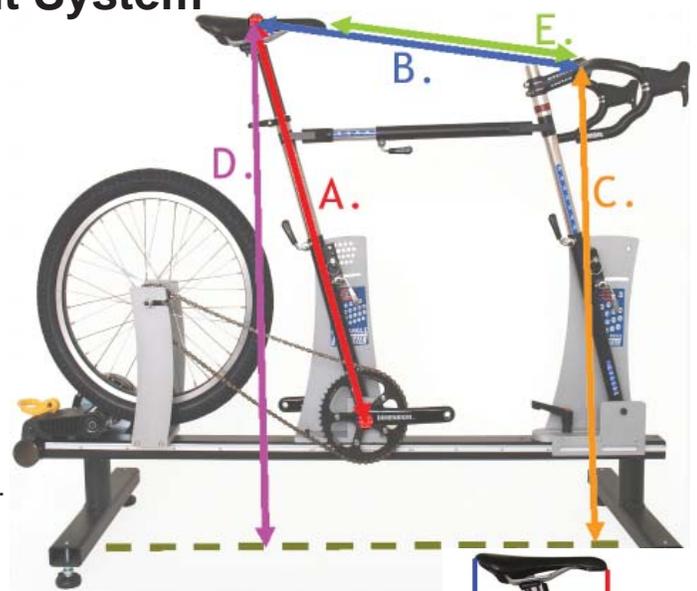
**Bottom Bracket to Top of Saddle:** (A. - known as the saddle height) - measured from the center of the bottom bracket up the seat tube to the top of the saddle.

**Top of Saddle to Top of Bars:** (B.) It's measured from the point at the top of the saddle at the seat tube axis to the top of the handlebars at the stem - measured in a straight line - not the horizontal equivalent.

**Saddle to Bar Drop:** (D. minus C.) Subtract the top of bars to the floor from the top of saddle to the floor.

**Seat Angle:** Measured in degrees, this affects drives the bikes fore-aft geometry.

**Saddle Tip to Top of Bars:** (E. - known as Tip to Bars). This positions the saddle in the rails to allow precise replication of the fit.



## Using the Base Plate Ruler for Saddle Setback Measurements

Because saddles vary in total length, rail length and rail location, it is important to document the actual position of the saddle in a way that can be replicated. The Fitmaster provides rulers on the base plate positioned with zero directly under the center of the bottom bracket.

You can measure the horizontal saddle position either at the front or the back of the saddle. Simply drop a plumb bob from the rear of the saddle (point A. at right) or the tip of the saddle (point B. at right).



# Fitting For a Custom Frame

## Step 1: Complete the basic rider assessment.

## Step 2: Prepare the Fitmaster based on the starting fit:

- A. Mount the appropriate crank length and re-tighten the rear wheel. Be sure to have the proper chain tension (advanced).
- B. Mount the starting stem and handlebars based on the fit.
- C. Mount the rider's choice of saddle or (if no saddle specified), a suitable saddle.
- D. Install either the rider's pedals or pedals compatible with the rider's cycling shoes.
- E. Loosen the front angle plate bolt on the Fitmaster.
- F. Set the head angle based on the comparable frame designs and sizes.
- G. Set the seat angle based on the starting design.
- H. Set the seat tube length to the starting value.
- I. Level the top tube; then set the head tube height.
- J. Set the starting top tube length.
- K. Adjust the saddle height to the starting value estimated by your initial calculations.
- L. Secure all sliders.

The rider is ready to get on the Fitmaster.

## Step 3: Perform initial static leg extension evaluation.



- A. Determine the most appropriate saddle height. As shown in the illustrations at right, the rider's knee should be slightly bent when at the bottom of the pedal stroke (approximately 27 degrees on a goniometer).
- B. Determine the most appropriate saddle setback: A good starting point is to put the rider's foot in the 3:00 position (as shown at left). Then drop a plumb bob from the front of the knee. The plumb bob should point to the center of the pedal spindle. If you should discover the need to make a significant change to the setback, you may want to adjust the seat angle. In an ideal world, the leg extension and knee-to-pedal spindle relationship should work with the saddle in the middle of the rails. If you need to make significant (more than 2cm) setback adjustments, you may need to recheck the seatpost height.



## Step 4: Get rider feedback and adjust the rider fit .

The rider should pedal under light to moderate resistance to warm up. Waterford recommends that the rider warm up fully - 5-10 minutes - before providing feedback on the fit.

- A. Look for rocking of the hips from side to side or riding with the feet pointed downward. These symptoms indicates excessive leg extension.
- B. Look for excessive back movement ("hopping up and down"), this may indicate too low a saddle position.
- C. Look for comments about knee pain - another indicator of improper saddle height..
- D. Listen for comments about being cramped or over-stretched. This indicates the need for a top tube adjustment.
- E. Listen for complaints about lower back and shoulder pain. These symptoms typically indicate a problem with handlebar height and reach as well as saddle angle.

The above comments just scratch the surface of possible conditions to address through the fitting process. Training and experience will provide you the skills to address a wide range of fit issues. We recommend making only one adjustment at a time. For example, if appropriate, raise the handlebar, then review the results with the rider. Continue to adjust the rider's position until he or she feels comfortable with their riding position and otherwise show reasonable form.

## Step 5: Check the Front Center.

## Step 6: Record measurements.

# Fitting to a Stock Design

## Step 1: Complete the basic rider assessment.

- A. Select the model and size used for the fitting. Determine the Fitmaster settings for the model and size being evaluated.
- B. Starting crank length (advanced).
- C. Establishing the proper starting stem dimensions.
- D. Select and mount appropriate saddle.

## Step 2: Prepare the Fitmaster based on the starting fit:

- A. Mount the appropriate crank and re-tighten the rear wheel. Be sure to have the proper chain tension (advanced).
- B. Mount the starting stem and handlebars based on the fit. An adjustable stem is particularly helpful.
- C. Mount the rider's choice of saddle or (if no saddle specified), a suitable saddle.
- D. Install the rider's pedals or pedals compatible with the rider's cycling shoes.
- E. Loosen the top tube slider.
- F. Set the seat and head angles.
- G. Set the head tube height. Level the top tube.
- H. Set the top tube length and rise to match the target frame dimensions.
- I. Set the center to center set tube height.
- J. Set the seat height according to your starting fit calculations. .

## Step 3: Perform initial static leg extension evaluation.



- A. Determine the most appropriate saddle height. As shown in the illustrations at right, the rider's knee should be slightly bent when at the bottom of the pedal stroke (approximately 27 degrees on a goniometer).
- B. Determine the most appropriate saddle setback: A good starting point is to put the rider's foot in the 3:00 position (as shown at left). Then drop a plumb bob from the front of the knee. The plumb bob should point to the center of the pedal spindle. If you should discover the need to make a significant change to the setback, you may want to adjust the seat angle. In an ideal world, the leg extension and knee-to-pedal spindle relationship should work with the saddle in the middle of the rails. If you need to make significant (more than 2cm) setback adjustments, you may need to recheck the seatpost height.



## Step 4: Get rider feedback and adjust the rider fit .

The rider should pedal under light to moderate resistance to warm up. Waterford recommends that the rider warm up fully - 5-10 minutes - before providing feedback on the fit.

- A. Look for rocking of the hips from side to side or riding with the feet pointed downward. These symptoms indicate excessive leg extension.
- B. Look for excessive back movement ("hopping up and down"), this may indicate too low a saddle position.
- C. Look for comments about knee pain - another indicator of improper saddle height..
- D. Listen for comments about being cramped or over-stretched. This indicates the need for a top tube adjustment.
- E. Listen for complaints about lower back and shoulder pain. These symptoms typically indicate a problem with handlebar height and reach as well as saddle angle.

An adjustable fit stem comes in handy since the frame remains fixed during the fit verification process. If the stem required becomes too extreme, consider an alternate size or even a custom design.

The above comments just scratch the surface of possible conditions to address through the fitting process. Training and experience will provide you the skills to address a wide range of fit issues. Continue to adjust the rider's position until he or she feels comfortable with their riding position and otherwise show reasonable form.

## Step 5: Record measurements.



# **FITMASTER**

## **Care and Maintenance**

The Fitmaster is designed to give years of commercial use with a minimum of care. Below are measures that insure the proper functioning of your Fitmaster:

1. Lubricate all threads during assembly and re-assembly.
2. Keep all mechanical parts - chain, hubs, bottom bracket properly adjusted and lubricated.
3. Keep the seatpost lubricated with a light coating of non-interacting material such as Syntace Friction Paste. This lets you install carbon fiber seatposts as well as alloy or steel seatposts. Periodically remove and re-treat the seatpost.
4. Lubricate the pivot points and stainless steel sliders with a lithium grease or equivalent.
5. Keep the pillow block properly tightened. It should be as tight as will still allow you to change the seat angle. If it's too loose, the bottom bracket will shift under pedal.
6. Periodically check the pivot points for proper tightness. They should be tight enough not to allow any play but loose enough to allow smooth pivoting..
7. Wipe down your Fitmaster with a damp cloth after every fit session.
8. Periodically remove the front plate and apply a light coating of grease to the underside to keep it sliding smoothly over the base. Be sure to remove it by sliding it off the front of the machine.

## **Warranty**

Waterford Precision Cycles, Inc. ("Waterford") warrants against all defects in material or workmanship for Waterford-produced parts for a period of one year from the date of purchase.

- This warranty does not cover normal wear and tear, normal maintenance items or any damage, failure or loss caused by:
  1. Accident, misuse, neglect, abuse or improper maintenance.
  2. Structural modifications made by anyone other than Waterford Precision Cycles.
  3. Failure to follow instructions or warnings in the owner's manual.
- This Warranty is applicable to the original purchaser only.
- This Warranty does not cover separately sold products including wheel, tires, chain, seatpost, crank and bottom bracket. Please address any warranty claims to the respective manufacturer.
- Waterford will, at its option, repair or replace a defective product. Dealer labor charges are not covered by this warranty.
- Waterford is not liable for incidental or consequential damages. Repair or replacement of defective products is the sole remedy under this warranty.