

Spectra Precision Laser DG613/DG813 Basic Setup Information Guide

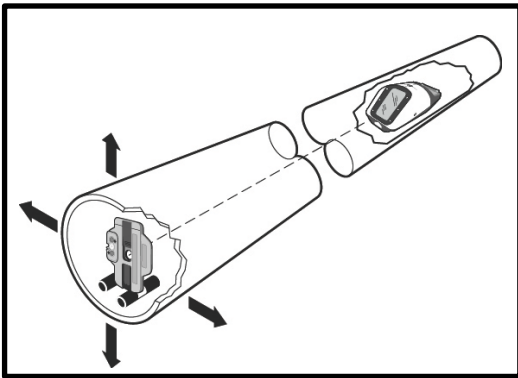
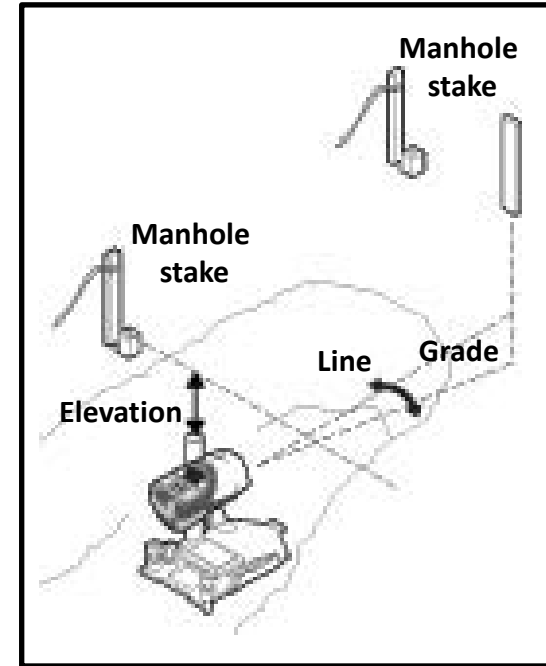


English

Applications and Setups

This section describes three fundamentals for using the Model DG813/613 to install gravity flow pipe; they are Grade, Elevation, and Line otherwise known as G-E-L.

To install gravity flow pipe, the pipe is set to a percentage of Grade that has been determined by some engineered plans. The gravity flow pipe is designed to be set to some engineered Elevation. Finally, the gravity flow pipe will be installed between two designed points, therefore defining Line.



The process for setting up the Model DG813/613 remains the same. The laser beam shall be sloped to match the plans. The Elevation of the pipe or cut to invert is given from the plans at which the laser shall be used to control that elevation, and finally set the laser on Line to match the orientation of the pipe run.

After all have been set, installing pipe is accomplished by inserting a laser target into new pipe sections and then aligning the pipe until the laser target's bulls-eye is centered on the beam.

GRADE:

Grade establishes the slope of the pipe and is generally displayed in percent (%). A rise of 1ft (1 m) over a run of 100-ft (100 m) equals 1.00%.

After setting Grade into the unit, the laser automatically slopes the beam to match the slope of the pipe and maintain its slope if disturbed.

Note: Some engineering plans list the pipe's grade on a per foot or per meter basis. Before using your Model DG813/613, transfer the engineered slope information into the Laser according to the Grade Display Mode feature. Consult your salesman or service personnel for Grade Display Mode configuration.

ELEVATION:

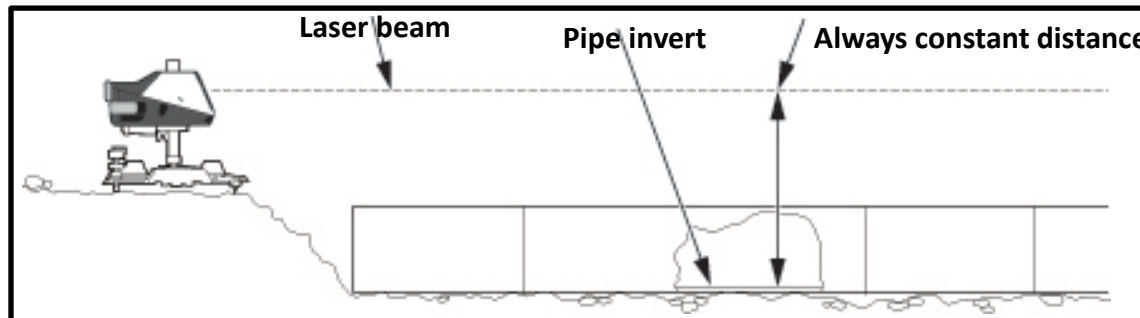
Depending on the application and jobsite conditions, the laser may be set to an elevation that matches either the centerline of the pipe, at some distance above the invert of the pipe, or set over the top of the pipe.

When setting the laser a surveyed manhole grade hub must be available to set the laser at the proper elevation and the pipe will be installed at the correct elevation.

LINE:

Line insures proper direction of the pipe run between manholes according to the engineered plans.

Once Grade, Elevation, and Line are set, the laser will be projected at the proper grade, elevation, and line for the pipe run. After a little practice, it normally takes about 5 minutes to set up the laser and start laying pipe.








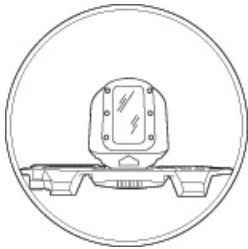
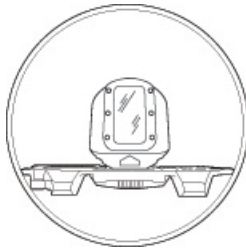
Setup, Step by Step:

Set Elevation for Small In-the-Pipe or Pre-cast Inverts:

1. The Laser automatically centers in the 6-inch (150-mm) diameter pipe and pre-cast inverts without using any additional accessories.
2. The Laser automatically centers in 8-inch (200-mm) diameter pipe with the 1248 mounting plate.
3. Use the following chart to determine how to setup the laser so the laser beam is centered in the following pipe sizes.

Pipe Diameter	Required Mounting Accessories				
		A	B	C	Set Up
		1230	1237	1248	
6 inch or 150 mm	None				1
8 inch or 200 mm	Legs Down			X	2
10 inch or 250 mm	Legs Up	X	X		3
12 inch or 300 mm	Legs Down	X	X		4
15 inch or 400 mm	Legs Down	X	X		5

Illustration

Set Up	A 1230	B 1237	C 1248
1			
2			
3			
4			
5			

Elevation of Flat Bottom Manholes

1. When a Laser is to be set on a flat surface where the laser beam is not centered in the pipe, use model 1230 Heavy Duty Trivet Plate and Universal Fixed Pole.
2. Using this system, the elevation of the laser beam can be set by either measuring down from a grade offset hub outside the trench or up from the floor of the manhole to the beam.
3. The 1239 has both tenths/hundredths and cm/mm scales for setting the elevation of the beam.

1230/1237 Heavy Duty Invert Plate

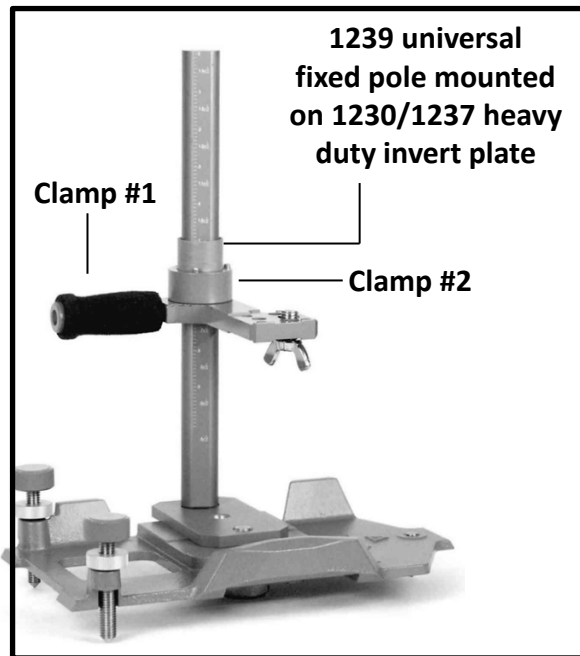
The invert plates model 1230 (English) and 1237 (Metric) are one piece cast aluminum support plates that provides automatic self-centering of the Laser in 10 in. (250 mm), 12 in. (300 mm) or 15 in. (400mm) pipe diameters. The invert plates are used along with the 1239 Universal Fixed Pole for setups on the manhole bottom, outside of the manhole or in pipes larger than 15 in. (400 mm) diameter.

1239 Universal Fixed Pole

The 1239 Universal Fixed Pole supports a Laser at a predetermined elevation above the invert. The 1239 may be used with the 1228 Universal Adjustable Invert Plate, the 1230/1237 Heavy Duty Invert Plates, or the 1244 T-Bar Assembly.

Features:

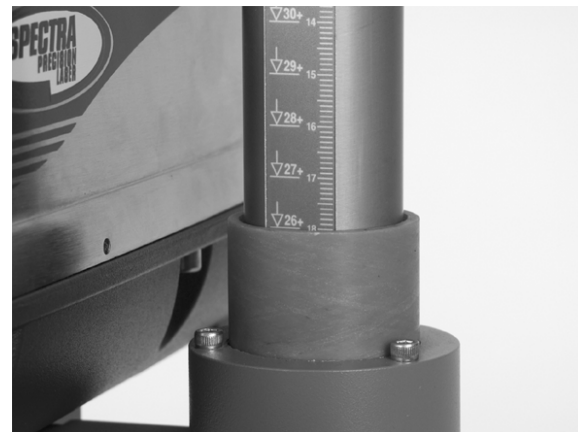
1. Pole Clamp – slides onto the vertical pole and is secured with the pole clamp's handle.
2. Top Pole Scale (TPS) – determines the distance between the top of the pole to the center of the laser beam.
3. Mounting Plate Scale (MPS) – determines the distance between the center of the laser beam and the bottom of the Model Mounting Plate. This scale is represented with down arrows next to the scale numbers.



2.



3.

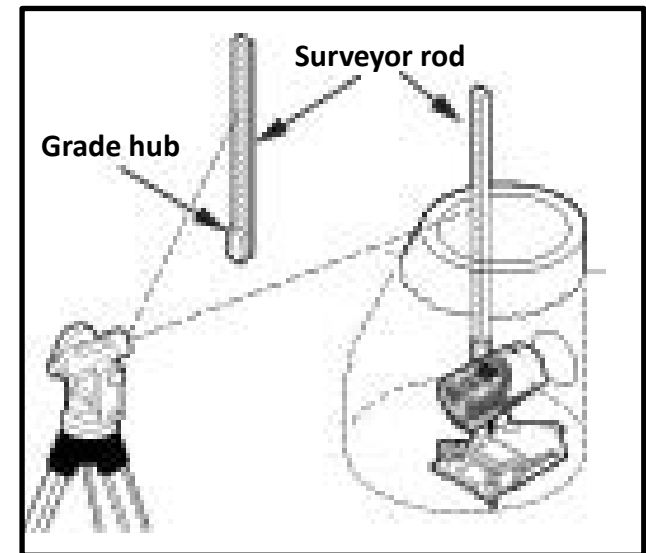
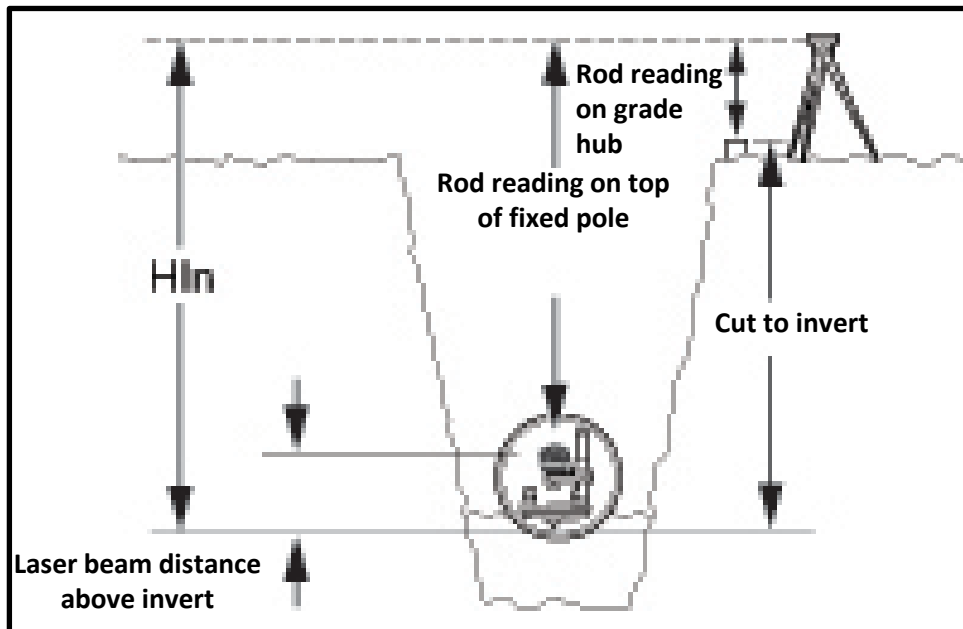


Method 1: Using the Top Pole Scale (TPS)

Grade rod set on top of the Universal Fixed Pole.

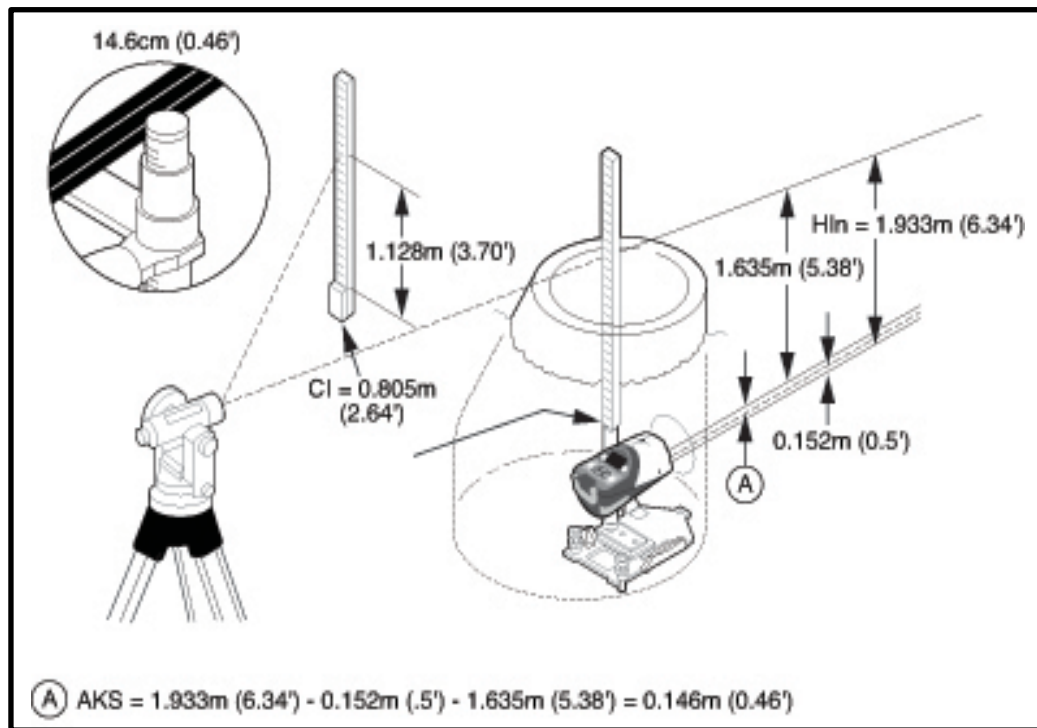
Note: You must first decide what elevation the laser beam shall be used above the invert!

1. Record the “cut-to-invert” information from the grade hub.
2. Set up an automatic level and measure the elevation (HI) of the automatic level above the grade hub.
3. Set a grade rod on top of the 1239 Universal Fixed Pole and record the measurement with the automatic level.
4. Subtract the desired elevation of the laser beam above the pipe’s invert.
5. Calculate the TPS (Top Pole Scale) setting.
6. Adjust the pole clamp until the reading edge equals TPS.
7. The laser is now at the proper working elevation.



Example 1: Setting the Grade Rod on top of the Top Pole Scale

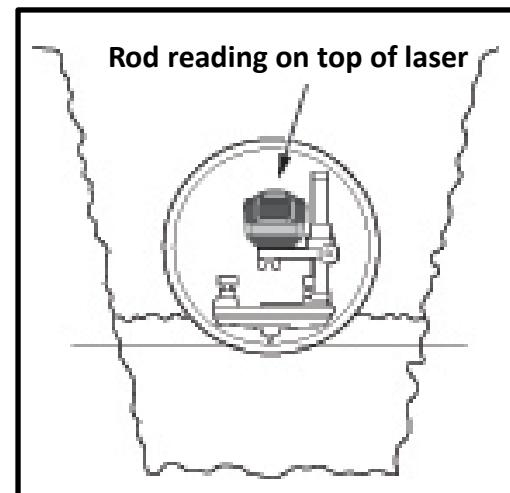
Step	Description	Feet / Inch	Metric
Step 1	Decide what elevation the laser beam shall be used above the invert.	0.5 ft	0.152 m
Step 2	Record the “Cut to Invert” information from the grade hub.	2.64 ft	0.805 m
Step 3	Measure the elevation (HI) of the optical instrument above the grade hub.	3.70 ft	1.128 m
Step 4	Subtract the measured distance from the optical instrument to the top of 1239 Universal Fixed Pole	-5.38 ft	-1.635 m
Step 5	Subtract the desired elevation of the laser beam above the pipe’s invert.	-0.50 ft	-0.152 m
Step 6	Calculated TPS =	2.64 ft 3.70 ft -5.38 ft <u>-0.50 ft</u> 0.46 ft	0.805 m 1.128 m -1.635 m <u>-0.152 m</u> 0.146 m
Step 7	Adjust the pole clamp until the reading edge is aligned with the TPS reading (0.46 ft or 0.146 m)		
Step 8	The laser beam is now set at your desired working elevation (6 inches / 0.5 ft / 152.4 mm) above the invert of the proposed pipe.		



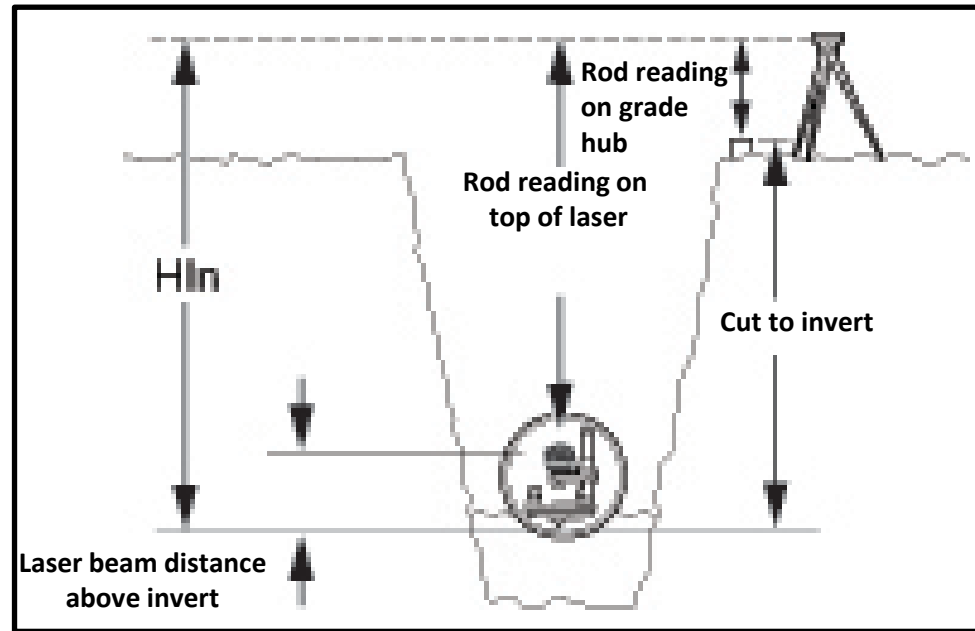
Method 2: Setting Grade Rod on Top of Laser

Note: Using this method, the offset distance of 0.23 ft (70 mm) between the top of the Laser housing and the center of the laser beam will be used.

1. Decide what elevation of the laser beam shall be used above the invert.
2. Record the “cut-to-invert” information from the grade hub.



3. Set up an automatic level and measure the elevation of the automatic level above the grade hub.
4. Add elevation measurement of instrument to “cut-to-invert” from grade hub.
5. Subtract the desired working of elevation of laser beam above invert
6. Subtract the beam offset (0.23 ft / 70 mm).
7. Calculate new rod reading.
8. Set the rod on top of the Laser and adjust the elevation of the laser until the correct rod reading is observed.
9. The laser beam is now at the proper working elevation.



Example 2: Setting Grade Rod on Top of Laser

Step	Description	Feet / Inch	Metric
Step 1	Decide what elevation the laser beam shall be used above the invert.	0.5 ft	0.152 m
Step 2	Record the “cut-to-invert” information from the grade hub.	2.64 ft	0.805 m
Step 3	Measure the elevation (HI) of the optical instrument above the grade hub.	3.70 ft	1.128 m

Step 4	Add elevation measurement of instrument to “cut-to-invert” from grade hub.	5.38 ft	1.635 m
Step 5	Subtract the desired elevation of laser beam above the pipe’s invert.	-0.50 ft	-0.152 m
Step 6	Subtract beam offset (0.23 ft / 70 mm).	-0.23 ft	-.070 m
Step 7	Calculated Rod Reading =	2.64 ft 3.70 ft -0.50 ft <u>-0.23 ft</u> 5.61 ft	0.805 m 1.128 m -0.152 m <u>-0.070</u> <u>m</u> 1.711 m
Step 8	Set the rod on top of the Laser and adjust elevation until the correct rod reading is observed.	5.61 ft	1.711 m
Step 9	The laser beam is now set at your desired working elevation (6 inches / 0.5 ft / 152.4 mm) above the invert of the proposed pipe.		

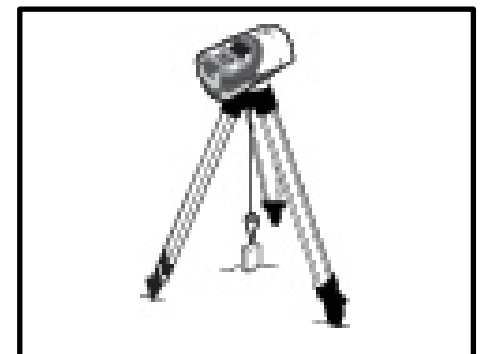
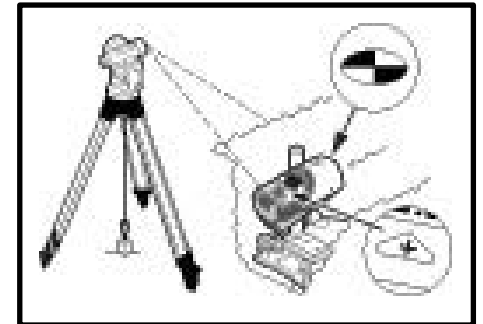
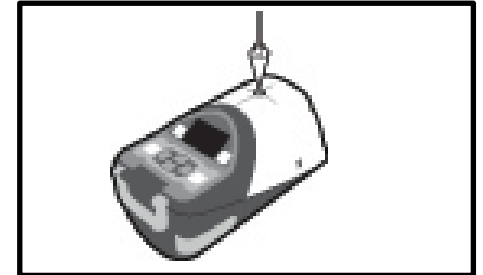
Setting Line

The principle for setting line is always the same. The Laser is positioned over the starting point of the pipe run then aimed to the second control point on line. The further your second point is from the laser, the more accurate your line will be.

First Point Setup (Using Plumb-bob):

Whether using the Laser in the invert or attached to the various mounting plates the goal is to always set the Laser's line axis bulls-eye target over the vertical centerline of the pipe. This is accomplished by one of the following methods:

1. Place the bulls-eye target under a plumb bob that has been transferred from an offset grade hub.
2. If using a transit or theodolite, align the bulls-eye target to the vertical cross hair of the transit's telescope.
3. If the bulls-eye target cannot be seen, use the plus sign on the positive grade button to align the target to the vertical cross hair of the transit.
4. In an over-the-top setup, set the laser on a tripod and plumb bob them over the first grade stake.



Second Far-Point Alignment:

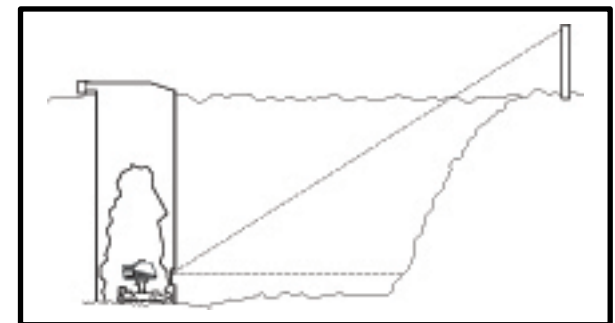
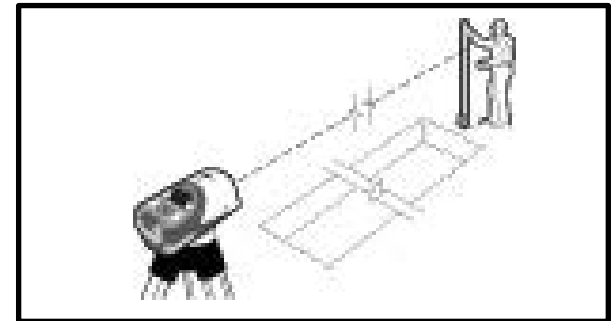
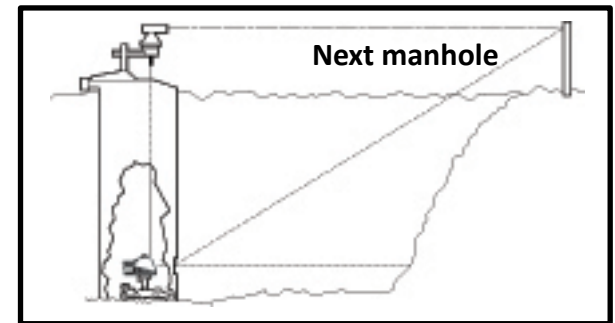
1. Simultaneously press both Left and Right Line buttons to center the laser's $\pm 10^\circ$ of line travel.
2. Press either Line button to align the laser beam to the second control point. If using a wireless remote control, point the remote towards the laser and press the appropriate line button.

NOTE: Line speed increases the longer you press the line button. To slow the line speed, release the line button then press again.


Setting Line with the Line Set/Check Feature:

Line Set/Check can be used to align the beam to a forward grade hub by moving the laser to its maximum leveling limit then returning it to the original grade setting. Line Set/Check is beneficial for setting line if a manhole mount or transit is not available.

NOTE: Before using Line Set/Check, the Laser must be accurately positioned for cross-axis roll to insure the laser beam will track plumb.



Press and release the **M** button at the standard display and select **Line Set/Check** using the **(+)/(-)** and left/right buttons.

Pressing and releasing **E** button activates the Line Set/Check mode while the flashing Line Set/Check symbol  appears together with a bubble vial.

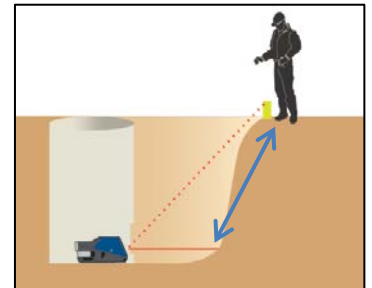
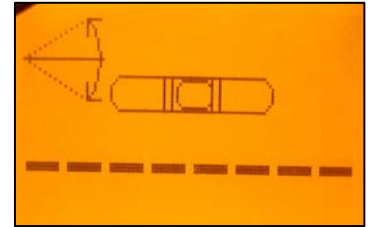
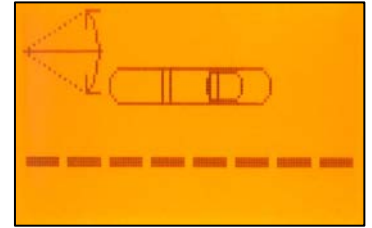
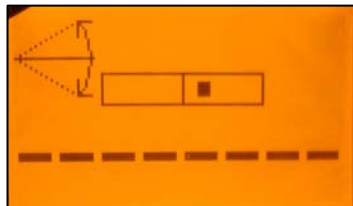
Adjust the bubble vial until it is centered and the Line Set/Check symbol stops flashing.

Pressing and releasing the **E** button starts the beam moving automatically up to 45°.

Using the **+** or **-** button at the RC803 remote control or at the laser stops the automatic upwards beam movement.

Adjust the beam using **Left/Right** buttons until the beam is centered at the line stake.

After aligning the beam to the required direction position, pressing and releasing the **EL** button starts the beam plumb down movement to the previous dialed in grade value.



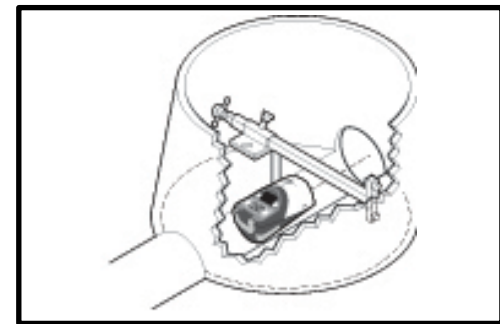
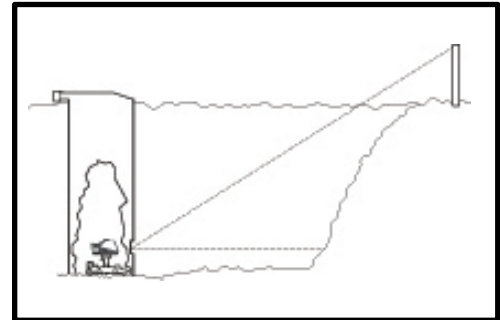
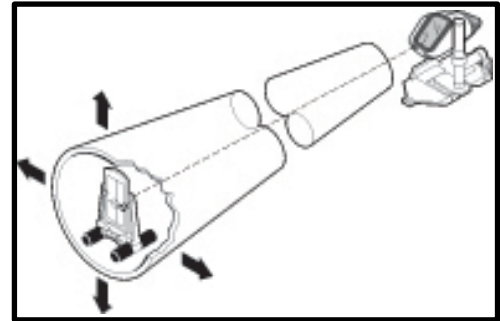
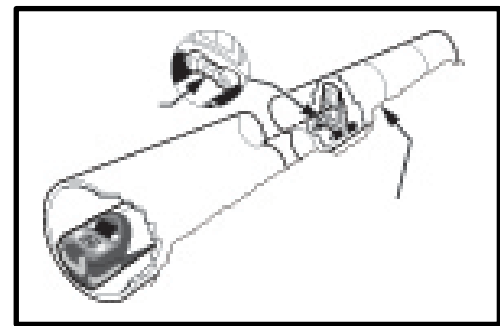
Laying Pipe/Setup

1. First Day Setups -Use the line buttons to align the laser to the next manhole.
2. Second day setups - Select a target that can establish the centerline or distance above the invert in your pipe too the correct grade, elevation, and line set the laser in the last pipe checked to be set.
3. Align the laser to the target using the line buttons on the Laser or using the wireless remote.
4. Lay Pipe – set the target in each new section of pipe and adjust the pipe until the laser intersects the target's bulls eye.

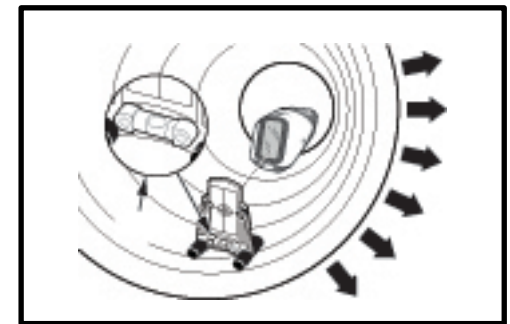
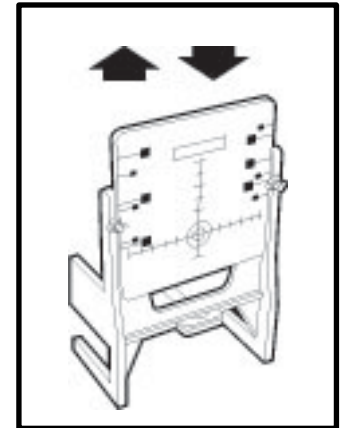
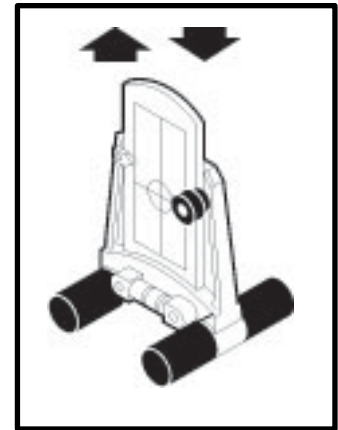
Large Pipe

The Laser can be set directly on the flow line using the various mounting plates or a 1244 T-bar for increased stability and an unobstructed flow line.

1. Set Grade Elevation, and Line into the Laser for large pipe applications.



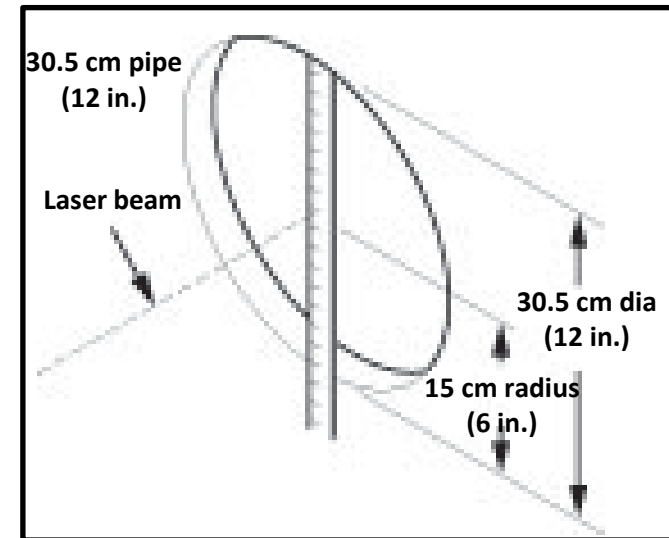
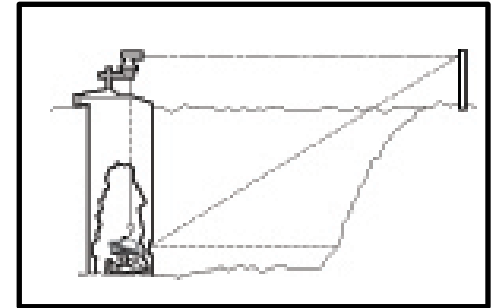
2. Set an adjustment pipe target so that the target's bull eye is at the same distance above the invert as your laser.
3. Place the pipe target in the last section of the pipe that has been checked to be at the correct grade, elevation and line.
4. Adjust the pipe target until it's level vial reads level.
5. Align the laser to the target's bulls eye using the line buttons on the Laser or the Wireless Remote.
6. Lay Pipe – Set the target in each new section of the pipe and adjust the pipe until the laser intersects the target's bulls eye while the target is level.



In a Manhole

The Laser can be setup in a manhole using a transit to accurately set line. The transit is plumbed over the laser on a mount that clamps to the manhole. The laser is projected down the center of the pipe.

1. Set the Laser support in the manhole and attach it to the support.
2. Adjust the laser to the chosen height above the invert and on the vertical centerline of the exit hole for the proposed pipe.
3. Point the Laser towards the next manhole.
4. Hold an engineering rule on the vertical centerline and adjust the laser's height to the desired height above the invert.

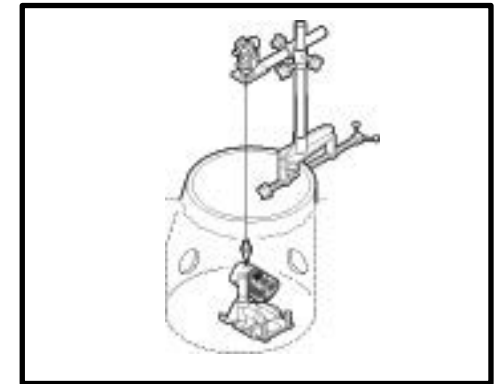
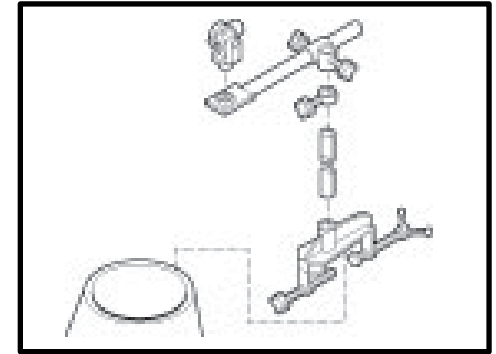


Line (transit method)

1. Set a manhole mount and transit on the manhole.
2. Clamp the manhole mount base to the side of the manhole to establish a stable transit support.
3. Secure the vertical arm into the manhole mount base.
4. Assemble the horizontal arm, horizontal clamp, and vertical support clamp to the vertical arm and position over the top of the Laser.
5. Attach your transit to the 5/8 x 11 (M16) threaded adapter in the horizontal arm.
6. Transit Alignment:

You may position your transit over the Laser's bulls eye target in one of the following methods:

- a. Optical Plummet: Use the Laser Plummet and if your transit is equipped with an optical plummet, adjust the horizontal arm to position the transit's optical plummet over the Laser's bulls eye target.
- b. Plumb Bob: If your transit does not have an optical plummet, suspend a plumb bob from the transit, and align it over the Laser's bulls eye target.



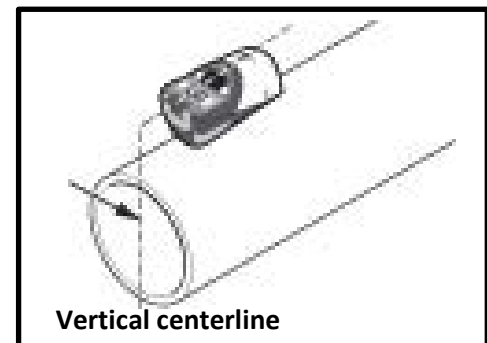
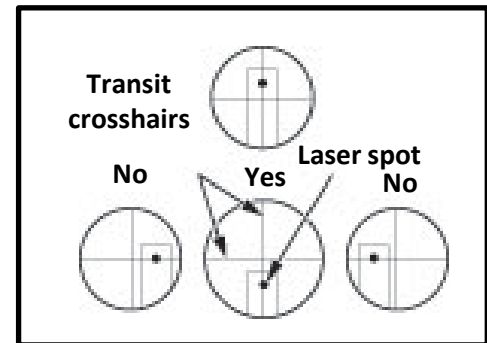
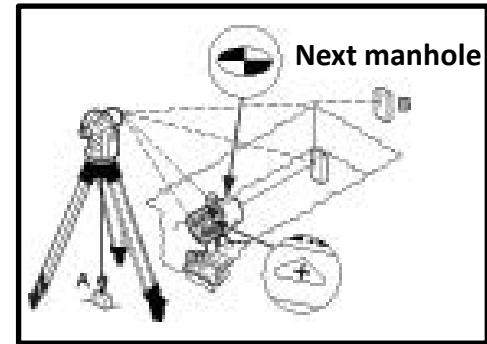
7. After rough positioning the transit over the bulls eye target, use the transit's leveling base to accurately adjust the transit to the bullseye target.
8. Once the transit is set over the Laser's bulls eye target, sight the transit on the centerline of the next manhole and lock the scope on line.
9. Plunge the scope into the trench and set a stake on line 20 – 25 feet (6 – 8 m) from the first manhole.
10. Use the line buttons to intersect the stake with the laser beam.
11. Look through the transit at the stake and readjust the beam until it is aligned with the vertical crosshair of the transit.
12. Lay pipe - Set the pipe target in each new section of pipe and adjust the pipe until it intersects the target's bulls eye.

NOTE: This method assumes that the manhole was set at the correct elevation. If there is any question as to the manhole accuracy, check the manhole and pipe invert elevation and transfer an offset to check the line of pipe entering or exiting the manhole.

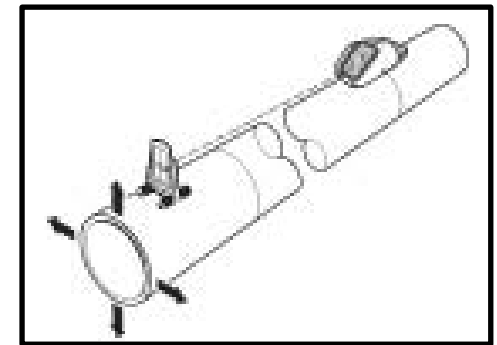
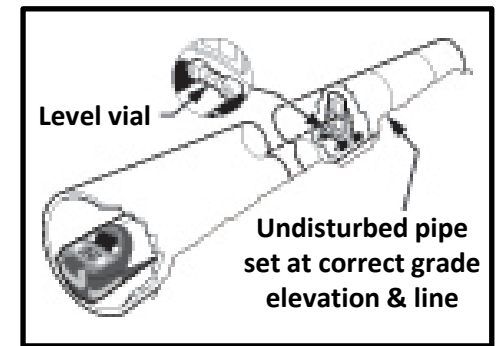
On Top of the Pipe

1. Line – Set the Laser until it is over the vertical centerline of the pipe and pointing toward the next manhole.

NOTE: It may be necessary to support the Laser with extra gravel, dirt, or sub-base material.

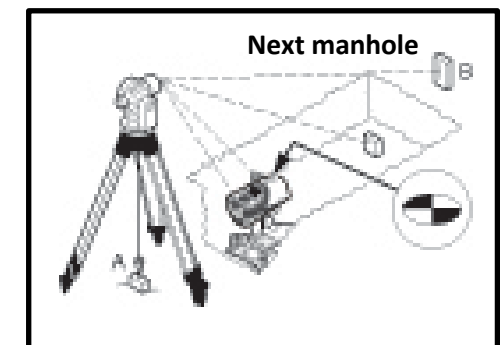


2. Set an adjustable pipe target (Model 936 or 956) so that the target's bulls eye is at the same distance above the pipe as your laser beam.
3. Place the pipe target on top of the last section of pipe that has been checked to be at the correct grade, elevation, and line.
4. Adjust the pipe target until it's level vial reads the target is level.
5. Align the laser to the target's bulls eye using the line buttons on the Laser or the Wireless Remote.
6. Lay Pipe – Set the target on top of each new section of pipe and adjust the pipe until the laser intersects the target's bulls eye while the target is level.

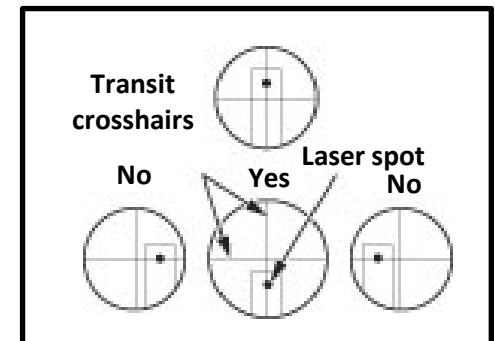


Open Excavations

1. Set a transit over the first point on the proposed pipeline behind the manhole where the pipe run starts.
2. Align the transit to the next manhole and lock the transit on line.
3. Plunge the transit into the open excavation where the manhole will be placed.
4. Set the Mounting Plate and the 1239 Universal Fixed Pole on stable sub-base material in the open excavation and on line.
5. Grade - Enter grade into the Laser.



6. Attach the Laser to the 1239 Universal Fixed Pole.
7. Sight through the transit at the Laser.
8. Adjust the Laser and the mounting plate until the bullseye target or “+” symbol on the positive grade button is aligned with the transit’s vertical crosshair.
9. Elevation - Determine the correct elevation for the invert of the proposed pipe.
10. Determine if you wish to set the laser beam on the centerline of the pipe or at a constant distance above the flow line.
11. Adjust the Laser until you are at the chosen height above the invert.
12. Set an adjustable pipe target (Model 936 or 956) so that the target’s bullseye is at the same distance above the invert as your laser beam.
13. Place the pipe target in the last section of pipe that has been checked to be at the correct grade, elevation, and line.
14. Plunge the transit into the open excavation and set a stake on line 20 – 25 feet (6 – 8 m) from the next manhole.
15. Line - Look through the transit at the next stake; align the laser to the vertical crosshair of the transit using the Line buttons on the Laser or the Wireless Remote.
16. Lay Pipe – Set the target in each new section of pipe and adjust the pipe until the laser intersects the target’s bulls eye while the target is level.



Over the Top

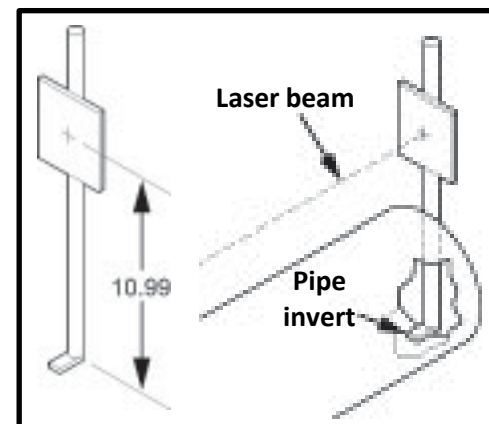
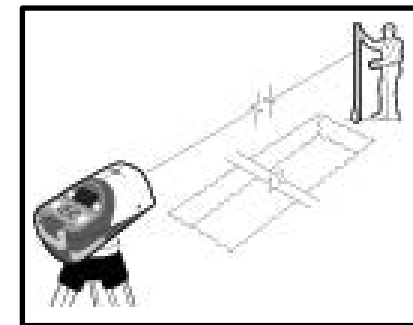
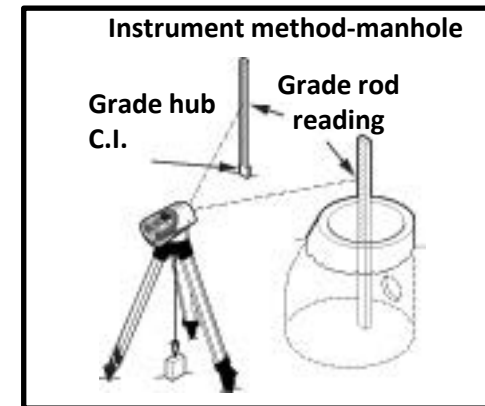
The Laser can be set on a tripod or mounting plate above the excavation on the pipe itself. A laser target is mounted on a pole and is adjusted to give the correct distance from the beam to the pipe invert. For accurate line control, a level vial can be attached to the pole to ensure that the target is held vertically. This is an excellent setup for shallow cuts for trenches where water is present.

1. Attach the Laser to a tripod having a 5/8-inch x 11 thread.
2. Set the tripod and Laser on line behind the first manhole and insure the system is level.
3. Suspend a plumb bob from the tripod or use a Laser Plummet over the first point.
4. Transfer the elevation into the manhole using a level, transit, or with your laser set to 0.00% grade.
5. Set a stake on the centerline of the pipe so the top of the stake is at invert elevation.
6. Use the wireless remote to position the beam on the rod as you take your readings.
7. Add your grade rod reading to your cut-to-invert reading.
8. Set a target on rod at this distance. For Example:

Rod reading = 6.48

Cut-to-invert = 4.51

Set to = 10.99



DG813/613 Additional Accessories

1248 Mounting Plate

Allows the laser to automatically center in an 200 mm (8 inch) diameter pipe using 1248 mounting plate.



1244 and 1244-1 T-Bars

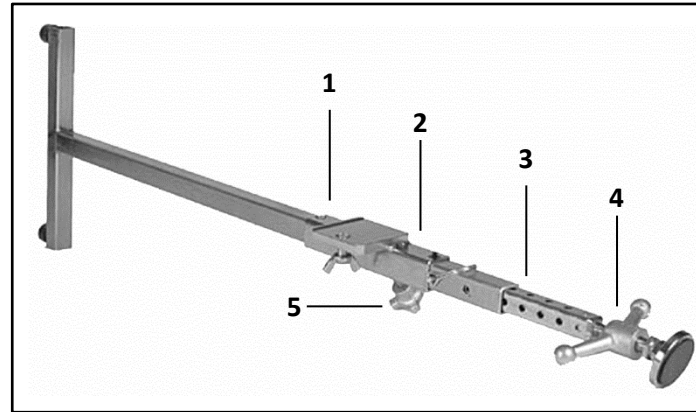
The 1244 T-Bar is a mounting support system for using a Laser in large diameter pipe, manholes, or open excavated trenches where high stability and a variable elevation adjustment is required.

The 1244 can be used with a 1239 Universal Fixed Pole for precast invert setups for unobstructed flowlines.

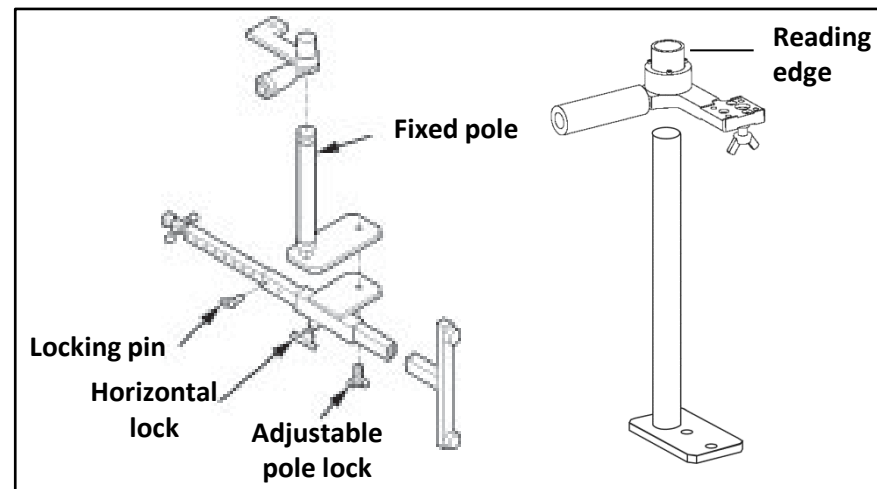
The 1244 can also be used in large diameter pipe to place the laser beam parallel to the centerline of the pipe.

Pipe Diameter Application	Recommended T-Bar
42 – 80 inch (1.07 to 2.03 m)	1244
33 – 66 inch (0.83 to 1.58 m)	1244-1

NOTE: Both models can be shortened for use in smaller diameter pipes and manholes. The speed release handle provides 5 inches (13 cm) of fine adjustment range.



1. Extension Bar – allows for one-inch (25 mm) coarse adjustments in the T-Bar’s overall length.
2. Locking Pin – holds the extension bar in place.
3. Mounting Plate – supports the Laser or the 1239 Universal Fixed Pole.
4. Speed Release Handle – tightens the T-Bar into place and allows for quick release.
5. Horizontal Lock Knob – allows the mounting plate to slide freely along the extension bar and positions the laser on line.

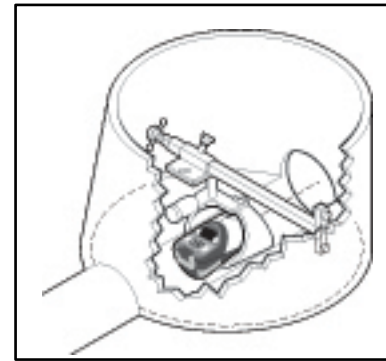
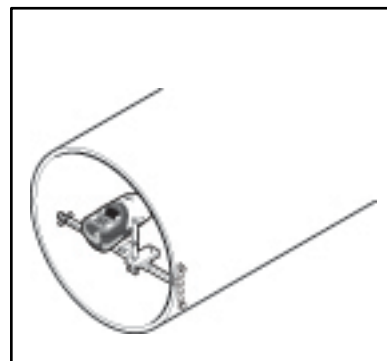
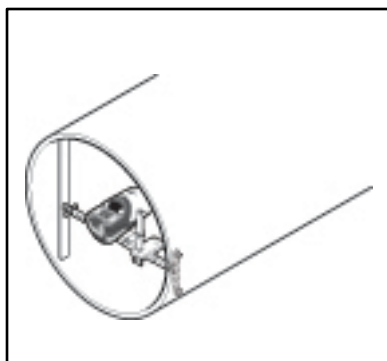
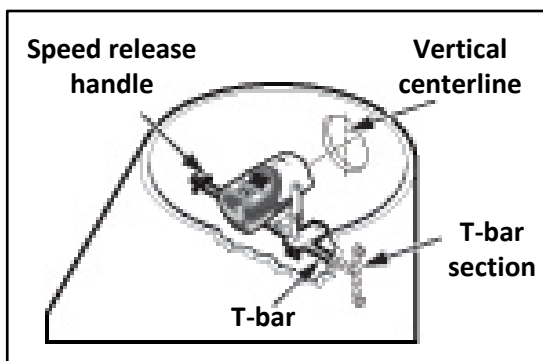


Setup Instructions:

1. Attach the vertical pole to the T-Bar.
2. Adjust the length of the T-Bar using the locking pin to fit your setup.

NOTE: The “T” section of the bar must be vertical.

3. Use the speed release handle to secure the T-Bar in the manhole or large pipe at a position that enables the vertical pole to support the laser at the predetermined elevation.
4. Loosen the horizontal lock knob to allow the laser and mounting plate to be adjusted to the line of the pipe.



Pipe Targets

The correct target you use depends on the elevation of the laser beam above the pipe invert and your personal preference.

Pipe Diameter Application	Recommended Pipe Target
6 – 12 inches (150 – 300 mm)	956 Target w/small Pipe Target
15 – 21 inches (350 – 500 mm)	956 Target w/large Pipe Target
15 – 30 inches (400 – 800 mm)	936 Target
greater than 30 inches (800 mm)	936 Target

Through the Pipe Applications:

For pipes with a diameter of 21 inches (500 mm) or less, the laser beam is normally projected on the centerline of the pipe. When the target is calibrated to the pipe's diameter, the target may be used in any orientation in the pipe to maintain the target's bullseye on center with the pipe.

When the laser is set above the flow-line other than the pipe's centerline, the target must be leveled in the pipe. If the target is not level, the pipe may be placed off line or grade.

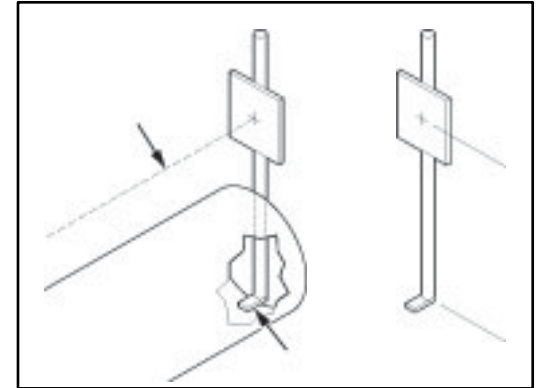
Over the Top Applications:

For over the top setups you will need to assemble a target from a 10 x 10 inch (25 x 25 cm) red or white Plexiglas. A couple of u-bolts, and a $\frac{3}{4}$ inch (20 mm) rigid or thick walled plastic pipe of a length to match your setup will be needed.

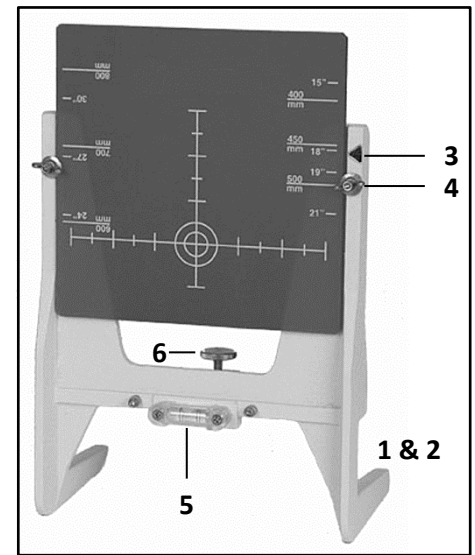
Model 936 Adjustable Pipe Target

The 936 Adjustable Pipe Target centers the laser beam in 15 to 30 inch (400 to 800 mm) diameter pipes when the target is aligned to the scale on the target's frame.

1. 2 x 4 Mount – used where a 2 x 4 supports the target in large pipe when the laser beam is 15 inches (400 mm) above the pipe inverts. Cut a 2 x 4 to a length and placed in the pipe so that the 936 intersects the laser beam on the target's bullseye.
2. Pipe Bore Mount – used when the laser beam is near the top of the pipe. The target is hung upside down in the pipe and the target is adjusted until the beam intersects the target bullseye. This frees the pipe of obstructions in the flow line.
3. Reference Arrow – calibrates the target scales for the diameter of pipe in which the laser is centered.



4. Target Clamps – secure the target into position.
5. 2 x Level Vials – provides a level reference for the 936 whether it is used upright or inverted. A level target is required where the elevation of the beam is at some distance above the invert other than the pipe's centerline.
6. Lock – secures the target frame to a 2 x 4 when the 936 is being used in large diameter pipe.



Model 956 Optically Enhanced Universal Target

The 956 adjustable Pipe Target center's the laser beam in 6 to 21 inches (150 to 500 mm) diameter pipes when the proper target element is aligned to the scale on the target's frame.



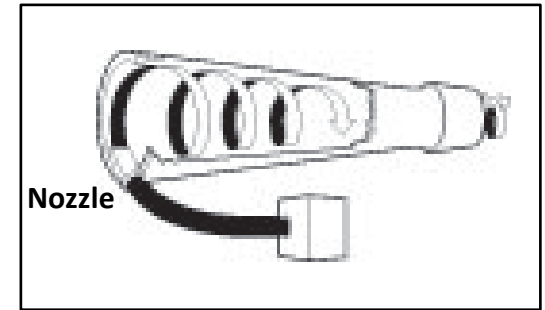
Refraction

1. Refraction is the bending of light at the interface of two substances caused by a difference in the speed of light. Shooting a laser beam through a pipe having gas and varying temperatures can be compared to shining a flashlight beam into a pool of water and seeing the light bend.
2. Refraction of the laser is preceded by what appears to be a flaming of the laser spot at the edges. When this occurs, it is time to mix the air within the pipe by some external means such as a blower. This occurs on sunny days when a hot pipe is placed in a cool ditch. The pipe bottom cools first and the warmer air in the upper half of the pipe causes the laser beam to refract down towards the cooler air.
3. Solvent fumes can also cause refraction from the glue used at joints, or on very cold days when a cold pipe is placed in a warm trench.
4. Refraction is a small diameter pipe problem. When small diameter pipe is set, it is recommended to place the hot-sun-baked side of the pipe down in the trench so that it will cool faster against the earth. This helps create temperature stability in the pipe.
5. Generally, refraction of the laser beam occurs at the last four or five joints of the pipe. This is because the last few sun-baked joints of the pipe have not had a chance to cool in the shade of, and against the earth of the trench.
6. If possible, always back-fill the pipe as you go. The earth is a great temperature stabilizer as it surrounds the pipe. The earth tends to stabilize the temperature of the pipe and the air inside. Use of a blower in conjunction with back-filling accelerates temperature stabilization. Always back-fill immediately unless the jobsite condition makes it impossible.

7. To fully minimize the effects of refraction, it is advisable to use a blower after the pipe run exceeds 50 feet (15 m). Operate the blower at a speed that minimizes the effects of refraction.

As the pipe length increases, increase the speed of the blower.

8. When using a blower, make sure it is taking in fresh air through the intake. On the discharge end, the nozzle should be angled to bounce the air off the side of the pipe thereby creating a spiral or corkscrew effect.



9. If possible, mount the nozzle on the side of the pipe or in the invert. Avoid attaching the nozzle at the top of the pipe unless there is no other choice, as this will push the warmer gas through the pipe. If a strong wind is blowing down the pipe and fighting the blower, it may not be needed.

10. In large diameter pipe, 18 inches (45 cm) and larger, it is better to position the blower nozzle off the invert below the laminar surface of the gas. If this is insufficient, three alternatives are possible. Use two electric blowers, a Homelite Model III-B (or equivalent) gas driven blower or a short blast of air from an air compressor, to clean out the line.

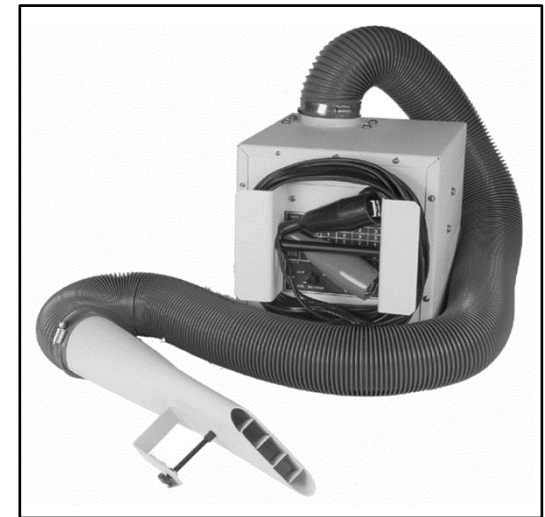
11. If the beam still can not be controlled, have your backhoe excavate five buckets full and then one or two empty buckets as if it were bailing water. The blower is pushing heavy fumes in the pipe that can not get out of the trench without someone's help. Cast the empty bucket on the low side of the surface or on the downwind side of the cut.

12. Another solution is to have a Homelite III-B blower (or equivalent) at the cut end of the trench pulling these fumes from the cut as the electric blower blows them out of the pipe. This method does not tie up production and gets the job done more efficiently.
13. In summary, if all of the above fail to solve this problem, use the laser in an over-the-top setup.

Model 929 Blower

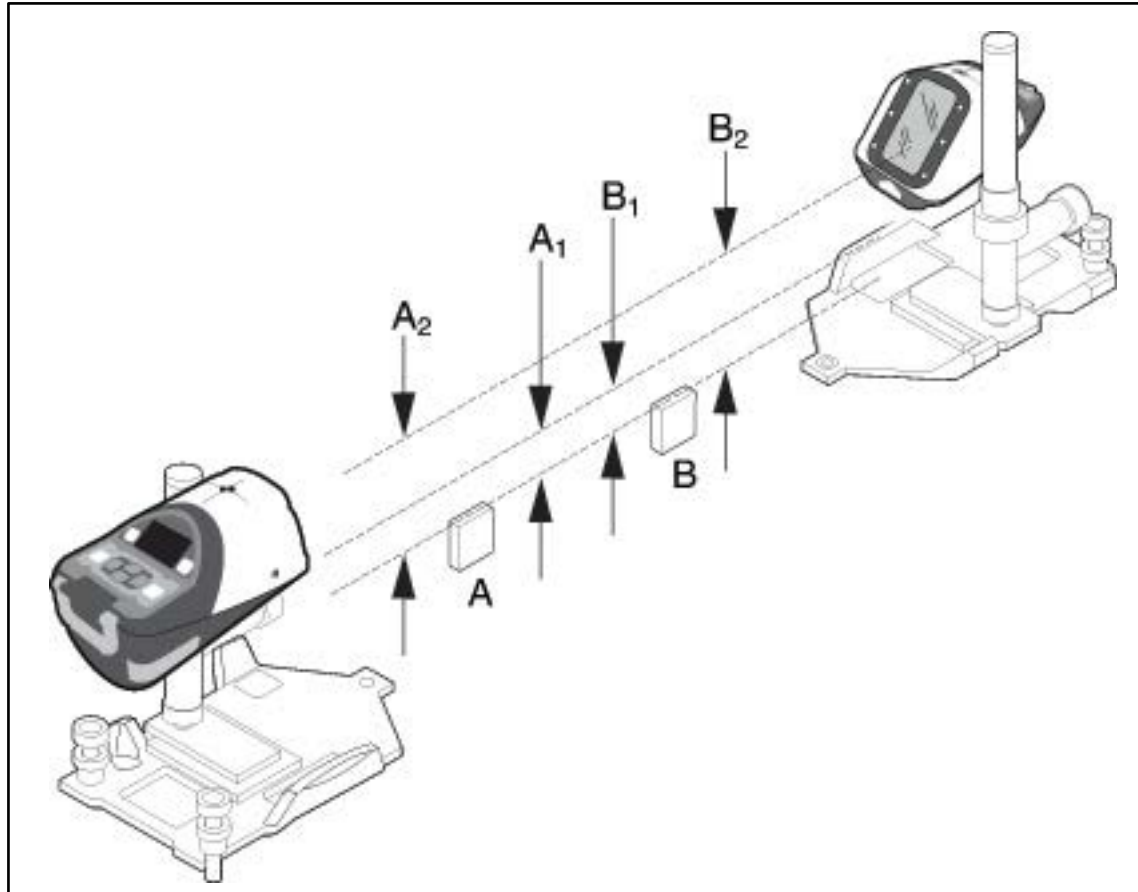
Operating Instructions:

1. Use a separate 12-volt automotive battery to power the blower.
2. Point the nozzle into the pipe to create a corkscrew effect.
This is the most effective way to create temperature stabilization.
3. Insure the air intake is not blocked and the 929 is not set in water. The support handle/cord wrap bracket is on the opposite side of the air intake. This handle can hook over a manhole step to keep the unit out of water in the pipe.
4. Start the blower with the first section of pipe. Use the table on the blower to determine the blower speed from the length and size of pipe being installed. Although very unlikely, be aware too much air can also cause refraction.



Calibration

Checking Calibration



Checking the calibration of your pipe laser is easy. All you need is an engineer's rule and your pipe laser.

1. Select a level road, parking lot or field whose rise is not more than 4 inches in 100 feet (10 cm/30 m).
2. Choose two points (A and B) about 100 feet (30 m) apart. The distance doesn't have to be measured, but the points must be found, so mark them well.
3. Set up the pipe laser just behind the lowest point and rough level.
4. Turn on the pipe laser and let it warm up for about 10 minutes.
5. Set the grade counter to 0.000%.
6. Aim the laser beam so that it passes over points A and B. Allow the pipe laser to self-level.
7. Accurately measure the elevation to the center of the beam at point A and record the elevation as A1 in a table like the one shown below.

	Point A	Point B
Second Reading	A2	B2
First Reading	A1	B1
Difference	A2 - A1	B2 - B1
Error in 100 feet (30 m)	$\frac{(A2 - A1) - (B2 - B1)}{2}$	

8. Accurately measure the elevation to the center of the beam at point B and record the elevation as B1.
9. Move the pipe laser behind point B and aim the laser beam so that it passes over points A and B. Allow the pipe laser to self-level.
10. Accurately measure the elevation to the center of the beam at point B and record the elevation as B2.
11. Accurately measure the elevation to the center of the beam at point A and record the elevation as A2.
12. Subtract the A1 and B1 elevation readings from A2 and B2 elevation readings.

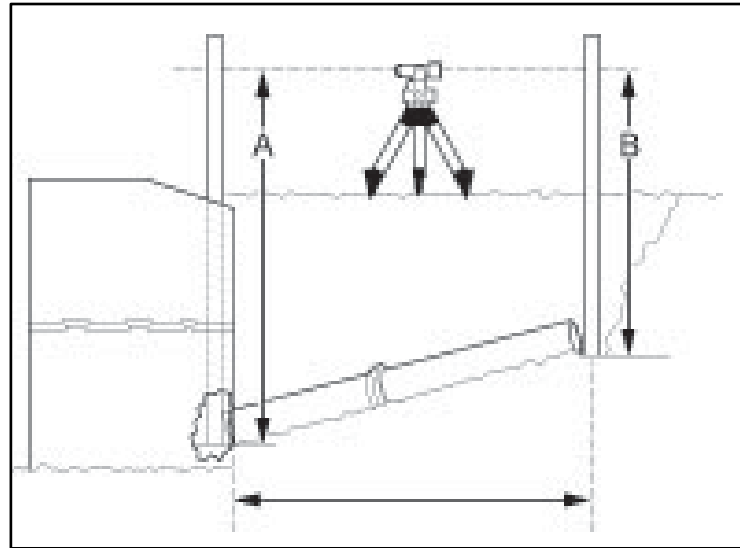
Note: *Your laser is in calibration if the difference between $A2 - A1$ equals $B2 - B1$.*

Note: *If $A2 - A1$ is greater than $B2 - B1$, the laser beam is shooting high and you should readjust the laser's calibration bringing the beam to level.*

Note: *If $A2 - A1$ is less than $B2 - B1$, the laser beam is shooting low and you should readjust the laser's calibration bringing the beam to level.*

Note: *If the error is greater than 0.02 feet in 100 feet (6.4 mm/30 m), return the pipe laser to an authorized Trimble service center.*

Grade Check



After the first 25 – 50 feet (8 – 15 m) of pipe has been laid, it is recommended that you make a grade check to insure that the setup is correct, and that the system is properly operating.

The illustration shows a method for checking grade.

1. Using a transit level, or an automatic level and a grade rod, take a reading at the beginning of the pipe “A”.
2. Using the same instruments, obtain a level reading at the end of the pipe “B”.
3. The difference between the readings equals the rise over the run.
4. In terms of % of grade, rise divided by the run times 100 equals the percent of grade.

Note: *The user of this equipment is expected to follow all operating instructions and make periodic checks on the proper grade, elevation, and line of the pipe as it is being laid. Trimble or its representatives assumes no responsibility for improperly laid pipe.*

Example:

	Feet / Tenths	Metric
Rod Reading at "A"	15.74 feet	4.801 m
Rod Reading at "B"	12.289 feet	3.749 m
Rise or Difference (A – B)	3.451 feet	1.052 m
Distance from A to B	145 feet	44.196 m
Rise divided by Run	0.0238	0.0238
Rise divided by Run times 100 = Laser Setting	2.38%	2.38%
Rise according to engineering plans	(2.38% * 145 feet) = 3.451 feet	(2.38% * 44.196 m) = 1.052 m

The pipe is laid correctly when the rod reading "A" minus rod reading "B" equals the rise according to the engineering plans.

Spectra Precision Laser DG613/DG813 Basic Setup Information Guide

English

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