JOHNSON LEVEL & TOOL®

22X Builder's Transit Level

Model No. 40-6910

Instruction Manual

Congratulations on your choice of this 22X Builder's Transit Level. We suggest you read this instruction manual thoroughly before using the instrument. Save this instruction manual for future use.

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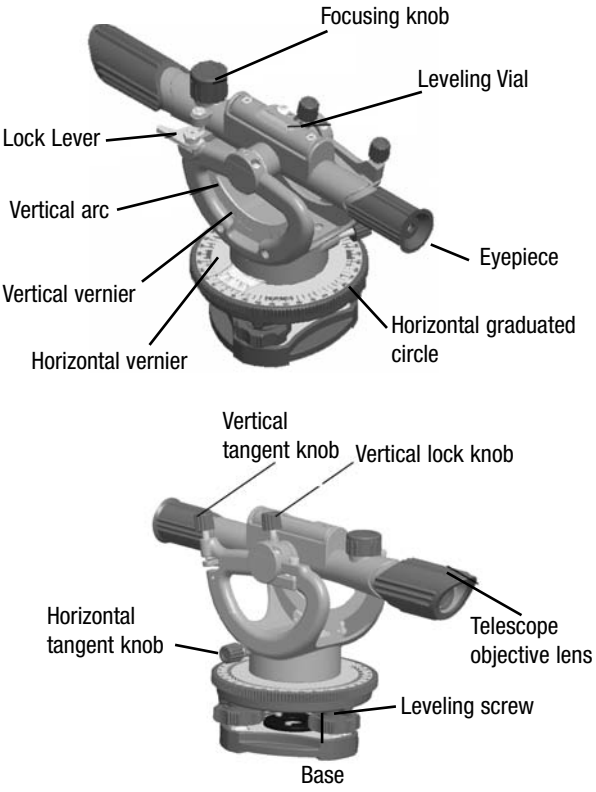
2. Features and Functions

- Horizontal Circle - Graduated to single degrees and reads by vernier direct to 15 minutes
- Vertical Arc - Reads to degrees 45-0-45º
- Horizontal Tangent Screw & Vertical Lock & Tangent Screw - For precise movement control.
- Built-in Sunshade - For clear sighting
- Top Mounted Leveling Vial - For effortless viewing
- Large Leveling Screws - Easy to turn
- Versatile - Ideal for leveling foundations, driveways, patios, floors, for grading street, curbs ditches for aligning fences; or any other light construction job.

3. Location of Part/Components

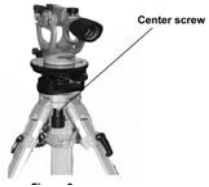


4. Operating Instructions

IMPORTANT: It is the responsibility of the user to verify the calibration of the instrument before each use.

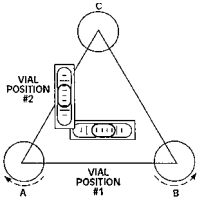
Set-Up the instrument on the tripod

When setting up the tripod, make sure the three tripod points are firmly into the ground and the top of the tripod head is as level as possible. Adjust the height of the tripod to a comfortable viewing height, and secure the retractable legs. Attach the instrument to the tripod head with the center screw and tighten securely as shown in figure below.



Leveling

Mount the instrument on the tripod, lock the telescope in place with the lock lever and line up the telescope vial in position #1 as shown. Then grasp screws A & B so that both thumbs are moving in opposite directions, either toward each other or away from each other. Note that the bubble moves in the same direction as your left thumb.



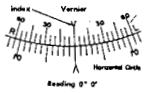
Keep about half the length engaged. When the bubble is centered in position #1, turn the instrument and observe the vial in position #2. Now center the bubble in position #2 using only screw C. The instrument should now be leveled, but to be certain, double-check. Rotate the instrument 180º so the vial is reversed. If the bubble will not center when reversed, follow adjustment procedure outlined under "Bubble Adjustments."

Aiming and Focusing

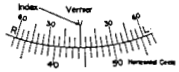
Rotate the instrument by hand to aim the telescope to the far object. Rotate the focusing knob until the object can be observed clearly. Rotate the horizontal tangent knob, to place the vertical cross hairs on the object.

Reading the Vernier

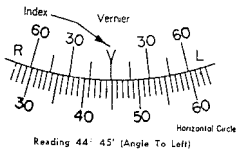
The vernier is actually a double vernier, that is, two verniers in one. This makes it possible to read any angle turned by the telescope, whether to the right or to the left. For example, consider that you have turned an angle to the left (counter-clockwise) after first having set the circle to read 0º. Refer to the bottom figure, this is what your vernier looks like after having turned the angle.



Initial Setting of Horizontal Circle and Vernier



Reading 44° 20' (Angle to Left)



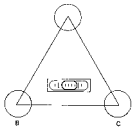
In the illustration to the right, the index has passed the 44 degree line but has not gone as far as the 45 degree line. In this case, the third vernier line from the index is lined up with one of the lines on the circle. Since each vernier line represents 15 minutes add 45 minutes to the 44 degree reading (3 times 15 minutes equals 45 minutes). Therefore our exact reading is 44 degrees, 45 minutes (44º45').

The Vertical Vernier.

In reading the vertical vernier, the principle is exactly the same as the horizontal vernier. Note however, that the vernier is below the circle portion rather than inside as in the case of the horizontal. One other minor difference is that you will read angles up or down rather than left or right. Here again is a double vernier. The right hand side reads angles of elevation (up) and the left hand side reads angles of declination (down). These are the only differences between the horizontal and vertical verniers.

5. Calibration

5.1 Bubble adjustment



If the telescope bubble does not remain centered after having leveled the instrument, and reversed the telescope end for end (180º) (as described under the Leveling section) the need for adjustment is indicated. Use a 3mm hex key.


Bubble level screws

With an adjusting screw “A” facing to the right of the bubble and with telescope directly in line with two of the three leveling screws, note to which side the bubble is off. If to the left, loosen screw “B” and tighten screw “A” very slightly to remove **ONE-HALF** the error. Remove the other half of the error with the two level screws in line with the telescope. If the bubble is still not exactly centered, repeat the procedure. If bubble is off to the right, loosen screw “A” and tighten screw “B”. Otherwise the procedure is identical.

5.2 Instrument accuracy check

Set up the instrument in an area that is as level as possible and which is about 220 ft. long. Place two matching level rods about 200 ft. apart with the faces toward each other. Position and level the instrument so that the distance from the instrument to each rod is the same. (Fig. 1)

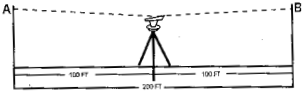


Fig. 1

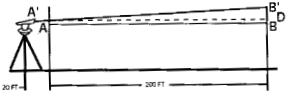
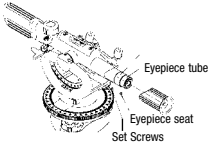


Fig. 2

Take a reading on each rod with the instrument. Note the difference and record them. Next, move the instrument to another point in line with the two level rods as shown in Fig. 2. Level the instrument and take readings on the two level rods. The difference should be the same (A-A should equal B-B). The difference between A-A and B-B is the instrument error at 200 feet.

5.3 Instrument accuracy adjustment



If the error is more than 3/16" at 100', it is necessary to adjust the instrument.
When adjusting the instrument:

1. Remove rubber cover to expose the two calibration set screws.
2. Using a 1.5mm Allen wrench, loosen the two calibration set screws.
3. Rotate the eyepiece seat to make the crosshair center in the reticle of instrument on the same level with a known reference point. Then rotate the eyepiece tube to make the horizontal hair on the reticle of instrument level by using a known level reference point.
4. Tighten the two set screws and restore rubber cover to its original position.

5.4 Setting Points in Line with use of transit-level

Points A and B are two points which are on a line. Center and level your instrument over point A; sight on point B. Bring vertical hair exactly on point B by means of the tangent screw. A pencil held vertically at B is useful to show this point. Depress the telescope to set points between A and B on line.

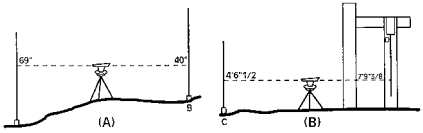
To Continue line beyond C, set Transit-Level over B, sight C, and continue process

If the top of a stake cannot be seen, when you come to set point C, sight with the aid of a plumb bob: first, to find where to drive the stake, and secondly, to note the point on the top of the stake. If it is necessary to continue this line beyond point C, center and level your instrument over point B, sight point C and continue this procedure.

5.5 Determining difference in elevation

Measuring a difference in elevation from one set-up

To find the difference of elevation between two points which can be observed from one position, set up and level your instrument about midway between these points. Be sure that a leveling rod held on both opposite points can be read when your telescope is level. Each point should not be greater than 150 to 200 feet away from the instrument or you may have difficulty reading the rods. The height of the line of sight (horizontal crosshair) above or below each of the points is found by reading the rod.

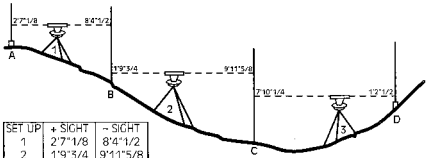


A line of sight 69 inches above A and 40 inches above B is shown above. Therefore, B is higher than A by 29 inches.

Suppose one of your points is below the line of sight and the other above (Fig. B), C is 4 feet 6-1/2 inches below the line of sight, and point D, the underside of a floor beam is 7 feet 9-3/8 inches above the line of sight (the latter reading having been obtained by holding the rod upside down with the foot of the rod against the beam). D is then higher than C by an amount equal to 4 feet 6-1/2 inches plus 7 feet 9-3/8 inches, or a total of 12 feet 3-7/8 inches.

5.6 Measure the difference in elevation requiring more than one set-up

If two points are either too far apart or at too great a difference of elevation to be observed from one set-up, the procedure shown below is recommended. This example assumes that you want to find the difference in elevation between points A and D. To make the finding of this difference simple, use the convenient terms **plus (+) sight** and **minus (-) sight** and carry the readings at each set-up as shown.



SET UP	+ SIGHT	- SIGHT
1	2'7"1/8	8'4"1/2
2	1'9"3/4	9'11"5/8
3	7'10"1/4	1'2"1/2
SUM	12'3"1/8	19'6"5/8

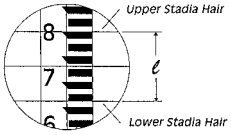
Difference of elevation of D with respect to A = 12'3"1/8 -19'6"5/8 = -7'3"1/2. Minus sign indicates D is below A.

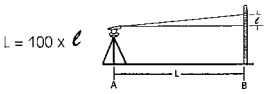
NOTE: + Sight is rod reading from point to line of sight. - Sight is rod reading from line of sight to point.

The difference of elevation between D and A is found by taking the difference between the sum of the plus sights and the sum of the minus sights. If the sum of the plus sights is larger, the final point is higher than the starting point. If the sum of the minus sights is larger, the final point is lower than than the starting point.

5.7 Stadia Distance Measuring

Distance measuring can be done using the stadia hairs of the reticle.





The distance between the upper stadia hair and the lower stadia hair is set at a 1:100 ration. So if the difference is 1 foot, the person holding the grade rod is 100 feet away from the instrument.

5.8 Measuring Horizontal Angles

To measure or lay out an angle, set the instrument over a point and level it up. Use a plumb bob with about six feet of string. Attach the plumb bob string to the hook under the instrument by means of a large loop fastened by a slipknot and adjust the plumb bob until it is clear of the ground point. By shifting the entire instrument, set the tripod (keeping tripod head as level as possible by estimation) so that the plumb bob appears to be over the ground point. Next, press the legs of the tripod into the ground and lower the plumb bob until its point is about one-quarter inch above the point on the ground. The final centering of the instrument can be made by loosening the tripod center bolt and slowly shift the instrument until the plumb bob is directly over the point on the ground. Then retighten the tripod center bolt and re-level the instrument.

To measure horizontal angles, such as FIG (Fig. 8), center and level your

instrument over point F in accordance with previous instructions.

Rotate the instrument until point E is nearly in line with the vertical crosshair. Turn tangent screw until vertical crosshair is on point E. By hand set the horizontal circle to read zero. Swing the telescope toward point G until the vertical crosshair is exactly on point G. Your instrument is furnished with a vernier and you will be able to read the angle closer than a single degree. The use of a vernier is explained earlier in this manual.

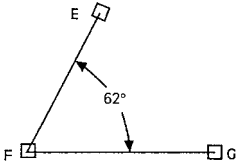


Fig. 8

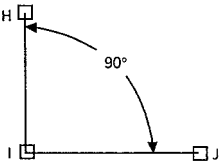


Fig. 9

In layout work, it is frequently necessary to set off an angle, usually 90º. Assume that the 90º angle HIJ is to be laid off and points H and I are shown (Fig. 9). Therefore, J is the point you are to set.

6. Technical Specifications

Telescope	Erect
Magnification	22X
Leveling accuracy	± 3/16"/100 ft. (±5mm/30m)
Working range	Up to 200' (60m)
Minimum focus	4' (1.2m)
Clear objective aperture	22mm
Field of view	± 2'/100 ft. (±0.6m/30m)
Number of lenses	5
Level vial	4' per 2mm
Graduation diameter	110mm
Horizontal circle:	
Graduations	1º
Number	Each 10º, 0-90-0º
Vernier	Double direct to 15 min.
Vertical arc:	
Graduations	1º
Number	Each 10º, 45-0-45º
Weight	2.204 lbs (1kg)
Center screw thread	5/8" - 11

7. Care and Handling

Care must be taken to maintain the accuracy of the instrument.

- After each use, the instrument should be wiped clean and kept in its carrying case.
- Remove dust from the lenses with a soft brush or a nonabrasive wipe. Never tough the lenses with your fingers.
- Store the instrument in a dust-free area with low humidity.

8. Product Warranty

Johnson Level & Tool offers a three year limited warranty on each of its products. You can obtain a copy of the limited warranty for a Johnson Level & Tool product by contacting Johnson Level & Tool's Customer Service Department, as provided below, or by visiting our web site at www.johnsonlevel.com. The limited warranty for each product contains various limitations and exclusions.

Do not return this product to the store/retailer or place of purchase. Non-warranty repairs and course calibration must be done by an authorized Johnson® service center or Johnson Level & Tool's limited warranty, if applicable, will be void and there will be NO WARRANTY. Contact one of our service centers for all non-warranty repairs. A list of service centers can be found on our web site at www.johnsonlevel.com or by calling our Customer Service Department. Contact our Customer Service Department for Return Material Authorization (RMA) for warranty repairs (manufacturing defects only). Proof of purchase is required.

NOTE: The user is responsible for the proper use and care of the product. It is the responsibility of the user to verify the calibration of the instrument before each use.

For further assistance, or if you experience problems with this product that are not addressed in this instruction manual, please contact our Customer Service Dept.

In the U.S., contact Johnson Level & Tool's Customer Service Department at 888-9-LEVELS.

In Canada, contact Johnson Level & Tool's Customer Service Department at 800-346-6682.

9. Product Registration

Enclosed with this instruction manual you will find a warranty registration card to be completed for your product. You will need to locate the serial number for your product that is located on the bottom of the unit. **PLEASE NOTE THAT IN ADDITION TO ANY OTHER LIMITATIONS OR CONDITIONS OF JOHNSON LEVEL & TOOL'S LIMITED WARRANTY, JOHNSON LEVEL & TOOL MUST HAVE RECEIVED YOUR PROPERLY COMPLETED WARRANTY CARD AND PROOF OF PURCHASE WITHIN 30 DAYS OF YOUR PURCHASE OF THE PRODUCT OR ANY LIMITED WARRANTY THAT MAY APPLY SHALL NOT APPLY AND THERE SHALL BE NO WARRANTY.**

10. Accessories

Johnson® accessories are available for purchase through authorized Johnson® dealers. Use of non-Johnson® accessories will void any applicable limited warranty and there will be NO WARRANTY. If you need any assistance in locating any accessories, please contact our Customer Service Department.

In the U.S., contact Johnson Level & Tool's Customer Service Department at 888-9-LEVELS.

In Canada, contact Johnson Level & Tool's Customer Service Department at 800-346-6682.