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It is Currently Modern in the Field of Geodesy Application of Levels

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A B S T R A C T

This article analyzes information about the new modern optical, electronic and digital levels, the principles of operation and current advantages, as well as the necessary information about the efficiency and effectiveness of leveling.

A R T I C L E I N F O

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I. INTRODUCTION

Levels are one of the most widely used geodetic instruments. Because of their functions and technical capabilities, levels are widely used in the construction of industrial and engineering buildings, construction of roads, high-precision geodetic surveying and installation, excavation of trenches, pipelines and communications, landscape design, etc.

The development of modern technology has led to the creation of new types of levels. According to the basic classification, depending on the principle of operation of these devices, levels are divided into three types - optical, electronic digital and laser levels.

Optical levels are geodetic instruments for geometric leveling, which means determining the relative heights between points using a level bar. The level is mounted on a tripod and rough alignment of the tool is performed using circular alignment and treger lifting screws. Modern optical levels have automatic compensators. It serves to keep the level optical axis in a working horizontal position. The compensator absorbs insignificant effects and suppresses movements, shifts, vibrations, and temperature deformations. It is also accepted that this device is closely called a damper and that it is air and magnetic. Spectra Precision levels in the AL2XX series are equipped with these reliable devices. The compensator provides stable and accurate measurements. The principle of operation of the compensator in conjunction with the air damper is as follows: the prism and the mirror are hung on four ribbons and try to assume a horizontal position at each instrument deflection, correcting the optical beams. Vibration damping is performed using a load located at the bottom of the pendulum. Air damping devices are treated with respect when performing high-precision work. In magnetic damper compensators, vibration suppression is performed using a magnetic field. The lower part of the pendulum is made of steel alloy and is located at a certain distance from the fixed permanent magnet. Thus, image stabilization in the level field of view and

vibration suppression occurs at speed. Magnetic damper levels have proven themselves in performing tasks that require technical precision. The accuracy of the optical levels is determined from the mean square error of measuring the relative heights of 1 km of secondary road. You will also need to consider the magnification of the viewing tube to make the optics and image clear and sharp when choosing levels.

Digital technology allows to significantly expand the scope of application of levels. Electronic levels are a multi-functional geodetic instrument equipped with an electronic memory device and software for processing the obtained measurements. In electronic levels, the count is taken automatically from a special barcode bar, the bars are differentiated along its entire length, while the count is taken many times, which significantly increases the reliability of the results. It is enough to focus on the rail, focus the image and perform counting by pressing the keyboard. The instrument performs the measurement and displays the value obtained on the screen and the distance to the rail. The use of electronic levels eliminates the personal errors of the performer and speeds up the measurement process.

A completely different approach has been taken to rotating laser levels. Unlike optical and electronic levels, they do not require great skill from the user, facilitating the work of professionals in various fields, especially builders. The built-in laser moves a beam of a certain length, which rotates and is projected in the air or in any plane. The instrument is leveled independently of the horizon with maximum accuracy.

Spectra Precision Laser has 50 years of manufacturing experience. The company has launched the production of the most reliable and technically advanced laser leveling and leveling equipment. The GL700 is a fundamentally new solution for the modern construction industry. This high-precision instrument not only constructs visible horizontal and vertical planes, but also performs its recording (fixation) to bring it to the desired position. One of its main innovative features is the ability to provide a slope on both axes. This increases the geodetic work several times and saves the project markings from numerous recalculations. The operator can perform the work alone using the remote control. Attached to the rail, the laser receiver captures light at a distance of 900 m and reports the position of a given plane. The receivers are also mounted on the arrows or buckets of construction machinery, significantly simplifying the work of the machinist and reducing the number of passes.

Spectra Precision Laser laser levels have proven themselves well in planning and installation work on construction sites around the world. General descriptions of modern levels are given in Table 1.1.

General characteristics of modern levels

	
SP series of AL series Medium squared errors in the secondary path ± AL24A = 1.0 / AL24M = 1.5 / AL28A = 2.0 / Al32A = 2.5 mm / km Magnification 32 * / 28 * / 24 * / 20 *, straight image, autocompensator, weight 1.8 kg.	AT-20/24/28/32 levels Medium squared errors in the secondary path ± AT20 = 2.5 / AT24 = 2.0 / AT28 = 1.5 / AT32 = 1.0 mm / km Magnification 20 * / 24 * / 28 * / 32 *, autocompensator, weight 1.34 kg.

 DS-32x DS-3210 levels Medium quadratic errors in the secondary path ± 1.0 mm / km Magnification 32 *, autocompensator, weight 1.55 kg.	 NI-3 levels Mean square error in the secondary path ± 1.6 mm / km Magnification 32 *, autocompensator, weight 2.0 kg.
 UOMZ 4N-2KL levels The mean square error on the secondary track is ± 2.0 mm / km Magnification 30 *, weight 2.0 kg	 UOMZ 4N-3KL levels The mean square error in the secondary path is ± 2.5 mm / km Magnification 23 *, weight 1.5 kg.
 UOMZ N-05 levels The mean square error in the secondary path is ± 0.4 mm / km Magnification 42 *.	 B20-35 / B30-35 / B40-35 Sokkia levels The new series Sokkia automatic levels are well protected from dust and water, environmental influences according to the IRx6 standard.

 B1 and B1S Sokkia levels Medium quadratic errors in the secondary path ± 0.5 mm / km Magnification 32 *, autocompensator, weight 3.2 kg, OM1.	
 I20 and V21 Sokkia levels Taken from production! Magnification 30 * 32 *, accurate image, auto-compensator, magnetic damper, protected from dust and moisture according to Irx4 standard, OM5 micrometer nozzle.	 PL1 Sokkia levels Taken from production! Mean square error in the secondary path ± 0.2 mm / km Magnification 42 *, straight image, weight 4.8 kg.
 Trimble DiNi 03 DiNi 07 levels According to the survey	 NV101 NV101-4 NV101-GC laser levels horizontal and vertical plane, 30mm to 3mm average square error, working radius - up to 150 m, self-leveling, resistant to falling from 1 m to the concrete floor.

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