Borehole casing deviation tools provide accurate measurements of a drillhole's orientation in three dimensions. The instrument uses a series of measurement stations, or 'shots' and records orientation by the measured dip and azimuth readings. Historically, two methods existed; photographic tools determined dip and azimuth using photographs of the graticule on a floating compass ball, and the mechanical tools used angular scales on a locking gimbaled compass. Both were time-consuming and subject to reading errors and a variety of mechanical problems.

The modern electronic tool uses digitised signals from state-of-the-art solid state sensors to determine dip and azimuth. The electronic tool is capable of taking thousands of shots in any orientation, which boosts efficiency and permits entirely new ways of using the tool. Data are provided in spreadsheet format ready for import into mapping and other software packages. The main advantages over the previous instruments are improved efficiency, speed and digital accuracy.

The electronic survey tool employs a three-component accelerometer, a three-component flux gate magnetometer and a computer. Data from the accelerometer are used to determine the dip or inclination of the tool with respect to the vertical. Data from the magnetometer are used to determine the azimuth of the tool with respect to local magnetic north. Additional parameters such as tool face, magnetic field strength, and magnetic dip are also computed. The computer provides power management, timekeeping, data digitising, data storage and communication.

Multishot mode is the preferred method of data gathering. The tool is first connected to a control computer which synchronises the clocks and starts the survey. Since the tool can store thousands of shots, the shot interval is usually set to 10 or 15 seconds. After disconnecting from the computer, the tool is lowered or pumped into the hole.

An efficient way to run the tool is to pump the tool in once a hole is finished. The tool is extended in front of the bit on nonmagnetic rods, and is set to take shots every 10 seconds. Thus, a detailed survey with shots at every joint can be taken with almost no time cost.

With a wireline interface, the same tool can also be used in real-time steering or orientation applications by connecting it to a single-conductor wireline. Tool face, dip, and azimuth can then be observed on the control computer at 5 second intervals. The tool will operate over a 10 km wireline.

One of the great advantages of the casing deviation tool over the old photomechanical tools is that magnetic diagnostics are provided. The tool provides readings of magnetic field strength and magnetic field dip. Deviation in one or both of these parameters can be used to detect azimuth interference from ore bodies and drilling equipment. These diagnostic parameters can also aid the geologist in defining the geological setting and locating contacts.