



Editor's Corner



www.TheAmericanSurveyor.com

Volume 2, No. 2 March/April 2005
© Cheves Media LLC

PUBLISHER Allen E. Cheves
allen.cheves@chevesmedia.com

EDITOR Marc S. Cheves, LS
marc.cheves@chevesmedia.com

ASSOCIATE EDITOR Joel Leininger, LS
ASSISTANT EDITOR Jacalyn Cheves

CONTRIBUTING WRITERS

| | |
|------------------------------|--------------------------|
| Dan Beardslee, LS | Jeff Lock |
| Silvio A. Bedini | Dan Martin |
| Joseph Bell, LS | John Matonich, LS |
| Joe Betit, LS | Jerry Penry, LS |
| J. Anthony Cavell, LS | Al Pepling, LS |
| Paul Cuomo, LS | Mark X. Plog, LS |
| James J. Demma, Esq., LS | Walt Robillard, Esq., LS |
| Dr. Richard L. Elgin, LS, PE | Fred Roeder, LS |
| Fred Henstridge, LS | Gavin Schrock, LS |
| Chuck Karayan, LS | Laurence Succi |
| Gary Kent, LS | Angus W. Stocking, LS |
| Wendy Lathrop, LS | Patrick Toscano, LS |
| Thomas Liuzzo, LS | Rj Zimmer, LS |

The staff and contributing writers may be reached via the online Message Center at www.TheAmericanSurveyor.com.

GRAPHIC DESIGN LTD Creative, LLC
WEBMASTER Joel Cheves
ACCOUNT EXECUTIVE Richard Bremer
rich.bremer@chevesmedia.com

The American Surveyor (ISSN 1548-2669) is published January/February, March/April, May, June, July/August, September/October, November and December by Cheves Media LLC. Editorial mailing address: 905 W. 7th St., #331, Frederick, MD 21701. Tel: (301) 620-0784.

The American Surveyor is a publication of Cheves Media LLC, 905 W. 7th St., #331, Frederick, MD. No part of this publication may be reproduced in any form without the express written permission of the publisher. Opinions and statements made by the writers and contributors do not necessarily express the views of Cheves Media LLC.

Subscriptions prices in the U.S.: \$29.95 for 1 year. Canada: 1 year \$34.95 US; international subscriptions \$64.95 per year (Airmail), U.S. funds prepaid. Back issues (subject to sufficient stock) are available for \$4.95 + S/H.

New subscription inquiries and all other address changes should be sent to *The American Surveyor*, P.O. Box 4162, Frederick, MD 21705-4162. Fax: 301-695-1538. Subscribe online @ www.TheAmericanSurveyor.com

Made in the United States of America



Proud Member of:



Something New Under the Sun!

My introduction to total stations was the Hewlett Packard 3820 in the 1970s. We quickly learned that even though we used its electronic leveling capabilities to level the instrument, as soon as the instrument was leveled, it started drifting out of level. We also learned that because most of our topography shots were Face 1 only, the more the instrument drifted out of level—especially for steeply inclined sights—the more error we incurred in each shot. To combat this, we stacked a back sight, and the instrument operator would periodically reacquire the back sight and re-level the instrument. We were able to achieve fantastic vertical accuracies by following this procedure.

As surveyors, we've watched technology advance so far so quickly that it sometimes seems that, at least as far as instruments are concerned, nothing new is possible. Not so, as evidenced by the recent introduction of the new S6 total station from Trimble. This exciting new instrument incorporates two significant technologies—magnetic drive and improved vertical-sensing—and has thereby eliminated one of the oldest difficulties known to surveyors: the ability to automatically keep an instrument pointed where you want it, and the use of an instrument to easily establish true vertical or horizontal lines.

For quite some time, total stations have used dual-axis compensators to correct angles for mislevelment in the plumb axis. But because dual-axis compensators do not correct aiming errors, Trimble has invented SurePoint technology that uses superior level-sensing information, coupled with extremely fine control of the servos, to keep the instrument correctly pointed. In a resurrection of technology that was used in the 1970s on the HP3820 total station, the level-sensing mechanism of the S6 uses a light beam that reflects off a liquid surface in the instrument. The theory here is that the surface of the liquid will always be level. The position of a light reflected off this surface can be detected electronically. The 3820 used liquid mercury, but because mercury is a hazardous substance, the S6 uses liquid silicon.

Anybody who has run an instrument has noticed that horizontal angles change as you incline the telescope. The greater the inclination, the





more the deviation. The S6 solves this problem with SurePoint by automatically re-aiming the telescope and eliminating the error in Face 1-only measurements. This will allow the user to easily “strike” a truly vertical or

horizontal line. Previously, if you wanted to extend a straight line through the instrument, you had to turn 180° in Face 1, plunge the telescope and repeat for Face 2, and then physically split the difference on the ground to set the true

180° point. Likewise, to extend a vertical line, all you need to do is sight the point from which you want the line extended and move the telescope up or down. Throughout the motion of the telescope, the crosshairs will be truly vertical above or below the reference point.

Here’s how it works: Essentially, the new servo drive consists of a circular magnet holder (**see illustration**) that is separated from another concentric structure by an air gap. Through the use of motor windings, current is applied and interacts with the magnets to cause the magnet holder to move. Depending on how much current is applied and what the polarity is, the magnet holder can be caused to speed up, slow down, hold or change direction. The instrument user can finely control the direction and speed of servo movement through a knob on the side of the instrument. Another benefit of MagDrive is dramatically reduced time to transit the instrument: 3 seconds as opposed to 9 seconds.

The new servo and level-sensing approach is only part of the story, however. While many total stations use either an absolute or an incremental method of reading the glass circles, the S6 uses both. An absolute angle encoder is analogous to a direction instrument, for example an optomechanical instrument like a T-2. It simply electronically subtracts the beginning from the ending circle readings to determine the angle. An incremental encoder electronically sets zero on the circle and then counts up or down from there as the instrument is turned. To the user, however, both types display angles in the same manner. The S6 glass circles have two sets of bar codes etched onto them, through which a laser shines and is read by digital circuitry. (**see circle mechanism illustration**).

Another innovation for the S6 is its MultiTrack prism technology. The instrument will work with conventional passive prisms as well as active Target ID prisms. Target ID can handle up to eight different prisms. What this means is that you can have up to eight different total stations on a job site, and all can operate without confusion because each “knows” the identity of the various prisms.

continued on page 73

Center cutaway views show parts that make up servo drives for horizontal and vertical angles. Bottom cutaway shows circle mechanism with dual encoders.

According to Trimble, *MagDrive servo technology is based on a direct drive and frictionless electromagnetic drive technique. The direct drive system allows the servo motors to be mounted directly on the horizontal and vertical axis, removing the need for additional mechanical gearing.*

The integration with the angle sensor enhances the speed of the servo motors by providing fast angle values to be used by the servo processor. MagDrive servo technology provides high accuracy, high speed turning servo capabilities with low power consumption. The frictionless motion also removes servo noise and reduces instrument wear.

continued from page 8

As with many of the new electronic instruments, a user can get onboard by purchasing an entry-level setup, and then adding all the increased capabilities as needed. The entry

price for the servo-only S6 is under \$14,000. By the time all the bells and whistles are added, such as AutoLock and full robotic operation, the price climbs to around \$38,000. This price includes the full kit: poles, prisms,

robotic holder with integrated 2.4 Ghz radio and a Trimble CU controller.

With the introduction of the S6, Trimble has demonstrated that there truly is something new under the sun. Through a marvelous combination of electronics and the laws of physics, they've succeeded in building a better mousetrap. The S6 dramatically increases accuracy for something that surveyors do a lot of: Face 1-only measurements. The servos are quieter, faster, and by constantly applying superior level information are able to automatically keep the instrument pointed at the same point. This technology also allows the establishment of truly vertical or horizontal lines in only one face, something we surveyors have needed for centuries. *AS*

Marc Cheves is Editor of the magazine.



AdvertisersDirectory

| | | | | | |
|--|------------------|--|----|--|---------------|
| Allen Precision Equipment | 16-17; 59, 64-65 | Lewis and Lewis Enterprises | 72 | Sokkia | IBC |
| www.allenprecision.com | | www.lewis-lewis.net | | www.sokkia.com | |
| Berntsen International | 79 | MAPuser.com | 58 | Spar Point | 29 |
| www.berntsen.com | | www.mapuser.com | | www.sparllc.com | |
| Carlson Software | BC | MARK-IT | 72 | Spatial Resources | 69 |
| www.carlsonsw.com | | www.survey-markers.com | | www.spatialresources.com | |
| Crain | 69 | Metropolitan State College of Denver | 69 | Starplus Software | 68 |
| www.crainsurvey.com | | www.mscd.edu/~surdd/ | | starplus@earthlink.net | |
| CST/berger (Stanley) | 5 | Ohmex | 70 | SubSurface Instruments | 33 |
| www.cstsurvey.com | | www.ohmex.com | | www.sslocators.com | |
| Dale R. Beeks | 68 | Pacific Crest Corporation | 71 | Survey Review | 53 |
| dbeeksci@aol.com | | www.pacificcrest.com | | www.surveyreview.org | |
| Dunham & Morrow | 71 | Penn State World Campus | 71 | Surveyor's Historical Society | 53 |
| www.magneticlocator.com | | www.worldcampus.psu.edu/pub/gism/now | | 812-537-2000 | |
| Flood Insights | 70 | Pentax | 5 | Thales Navigation | 43 |
| www.floodinsights.com | | www.westernlatitudes.com | | www.thalesnavigation.com | |
| GPS2CAD | 70 | Project Tracker Pro | 68 | Topcon | IFC-1, 11, 43 |
| www.GPS2CAD.com | | www.projecttrackerpro.com | | www.topconpositioning.com | |
| International Products Inc. (IPI) | 68 | Quik Stake (Parker Davis) | 21 | Traverse PC | 19, 76 |
| www.intproducts.com | | www.quikstake.com | | www.traverse-pc.com | |
| I-Site | 78 | SECO Manufacturing | 62 | Trimble | 34-35, 55 |
| www.isite3d.com | | www.surveying.com | | www.trimble.com | |
| Leica Geosystems | 23, 31 | Schonstedt Instrument Company | 77 | Tripod Data Systems (TDS) | 2-3, 7 |
| www.leica-geosystems.com | | www.schonstedt.com | | www.tdsway.com | |
| Leica Geosystems HDS | 39 | Skinner Auctioneers & Appraisers | 69 | Western Latitudes | 45 |
| www.hds.leica-geosystems.com | | www.skinnerinc.com | | www.westernlatitudes.com | |