



By Al Pepling, LS

Al Pepling practices surveying with CWM Environmental in Kittanning, Pennsylvania. He is licensed as a Professional Land Surveyor in PA, past president of the New Jersey Society of Professional Land Surveyors, and held a Professional Planners license when residing in New Jersey.

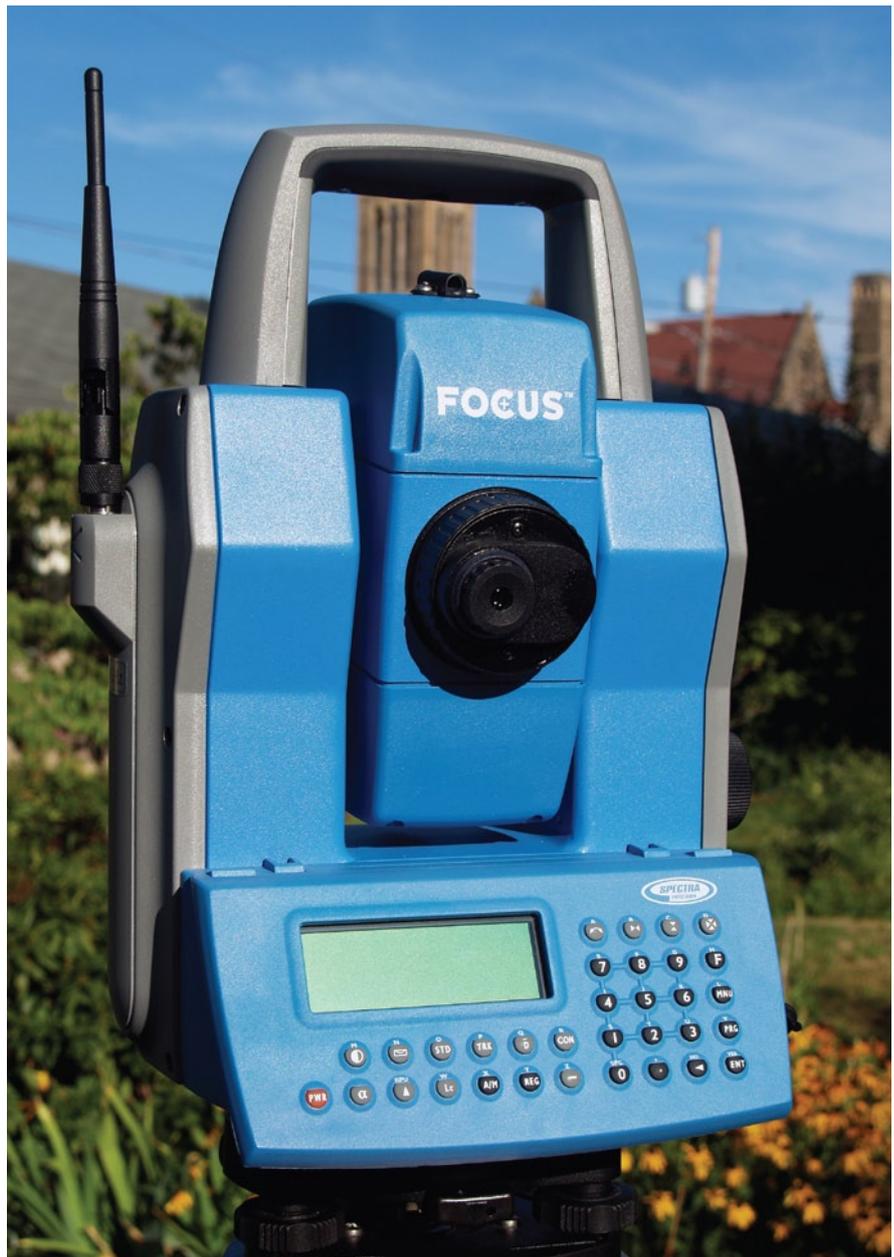
Spectra Precision FOCUS 10

The Spectra Precision's FOCUS 10 brings back a lot of memories from an instrument I reviewed several years ago. Without a doubt, the FOCUS 10 has benefited from the former, but is updated and less expensive even in terms of 2002 dollars. And that's a good thing, since many more surveyors will be able to benefit from robotic ownership.

The FOCUS 10 family of instruments is available in 3" and 5", (DIN 18723), accuracies. The least count reading is 1" and 2" when tracking. It has a dual axis level compensator with a working range of $\pm 6'$. It can be purchased as a "Servomotor" unit, what we all have used as a standard optically pointed total station. The top of the line is the full "robotic" version that can be controlled completely from the person with the controller at the rod.

The measuring device is a Laser Class 1 pulsed laser diode. This not the type of laser that "burns" holes through material, and it falls in the category of lasers termed "eye-safe". However, the User Guide cautions against looking into the scope while the laser is "on".

Specifications for distance measurement accuracies are $\pm (0.01 \text{ ft} + 3 \text{ ppm})$ and $\pm (0.032 \text{ ft} + 3 \text{ ppm})$ while in the tracking mode. It has the same accuracy to reflective foil. At distances of 6.56 ft, (the minimum it can shoot), up to 656 ft the accuracy remains as per above, but greater than 656 ft the accuracy is $\pm (0.016 \text{ ft} + 3 \text{ ppm})$. Prism distances ranges are 8,200 ft to a single and 11,480 ft to a triple in the standard range, and a maximum distance of 18,040 ft long range. The range to reflective foil varies



Focus 10 configured with keypad for reflectorless operation at the instrument.



360° prism/diodes for use at the prism pole, (left) and RMT 602 for traversing, (right).

from 590 ft to 5,248 ft depending on the thickness of the foil. Something that sets the FOCUS 10 apart is the fact that it sets the ppm for the ambient conditions of a site continuously over a -60 through 195 ppm range, ensuring the most correct distance measurement at the instant it is measured. This is something one should seriously consider on any instrument and certainly on a new instrument.

In the reflectorless mode to an 18% Kodak Gray Card the range is up to 656 ft, while using a 90% reflective Kodak Gray Card will get you out to 1,968 ft. The range to a concrete surface is 656-984 ft. A shot on wood construction will be in the range of 492-984 ft. A shoot to metal construction is similar except the longer range is limited to 656 ft. Lightly colored rocks have a range of 492-820 ft as a shot on a local church steeple confirmed. More darkly colored rocks have a range of 328-492 ft according to the specifications. My experience, although not scientifically

tested and confirmed, is that surface texture contributes to the range of a shot. Smoother textures combined with lighter colors permit longer shots than rougher textured, darker colored surfaces. This is especially true when locating trees for an AIA specification. It would be interesting to see the results of a rigorous test over varying lighting conditions on a variety of objects with a reflectorless instrument versus conventional prism and offset measurements comparing the accuracy of each. Let's throw in perpendicularity versus obliqueness to the same object just to make it more interesting. Perhaps the results would be of more interest to academia than to the practicing surveyor, but who knows?

When testing equipment, my practice is to turn at least two or more direct and reverse readings on any traverse that I do and usually three to four sets. With my blended trifocal glasses, positioning my eye at the telescope has become the largest source of pointing error for me.

My average spread per angle is now in the 4-5 second range with two sets and 3-4 second range with three or more sets. Sporadically I turn some 2.0 to 2.5 second spreads like I used to do. The fully robotic FOCUS 10, when operating in the robotic mode and turning sets, returned spreads between one and two seconds consistently!

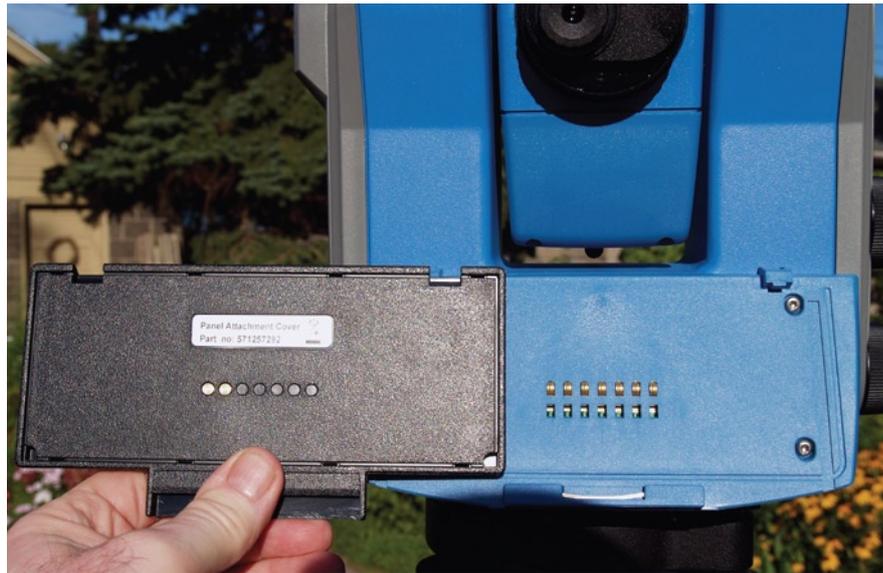
Consistency of the results of your procedures gives one an added measure of confidence when signing and sealing a survey, be it ALTA or not. Ask yourself this question, "If I use the same procedures on every traverse, should I not get the same results each traverse?" The principle of measurement used in the FOCUS 10 'is based on reading an integrated signal over the whole surface of the angle sensor and producing a mean angular value. In this way, inaccuracies due to eccentricity and graduation are eliminated.'

If you are new to robotic instrumentation and you sight through the scope to verify what the robotic is aiming at, you are in for a surprise. It will not be aimed "dead on" the target to your eye. This is normal! Read the horizontal and zenith angles in the autolock and/or robotic modes. Then aim the instrument yourself with the servos. The angle reading should match depending on your ability to aim. If they do not match within your personal pointing tolerance, you need to carry out horizontal and zenith angle collimation and a tracker collimation. Make sure the instrument person is aware of this difference and comfortable with it.

The servo control knobs are sensitive in four steps, transparent to the user. I could use the standards to turn toward the target or spin the servo knob rapidly to get close to the target. When optically aiming, I came to appreciate the very fine motion that the motors in this gun are capable of. Manual sighting with the servos is faster than even dual-motion tangent screws with clamps. The FOCUS 10 servos rate with the best I have used to date. However, for doing stakeout, you cannot set the angle any quicker than you can use the data collector and robotics to set the angle for you. A concern of mine over the years has been the servo's durability. So I called on a fellow surveyor, John Evers, LS, who has been using a similar instrument with servos since 2001. They have held up very well from John's experience. Having your instruments maintained annually or biannually is a good investment to gain trouble-free operation, the longevity of



Focus 10 with cover in place of key pad for controlling operations from the prism pole.



Cover removed to show key pad contacts.

any mechanical/electro-mechanical device, and more important, maintenance of your good reputation.

There is an internal battery unit housed in the bottom of the FOCUS 10, and there are external batteries and adapters for their use. A single battery adapter connects to the instrument via a standard Hirose connector. The shipment I received included two "Multi Adapters" which hold three external batteries each. I did not run out of battery. Three different chargers were also included, and I used them all. One of them was the "Super Charger" which lived up to its name. It brought back memories to this old 50's-60's motor head. 440 Hemis, three miles to the gallon and all that! The prism pole that the 360° tracker prism was mounted to was itself a battery. This design is a very wise way of packaging, adding weight to the carbon fiber pole and eliminating a cable as well. Heads up design in my opinion! If you can swing it, the setup I had would be the way to go, hands down.

The remote targets contain the "tracker diodes," which is how the instrument is aimed at the prism. I did not ask for a technical explanation, I just know that it works and works better than my eyes. This method eliminates the risk of the instrument locking onto other reflecting objects than the RMT, (Remote Measuring Target). My use of the gun was not in a heavily trafficked area. The occasional car passing by had no impact on the gun's ability to follow me along

my data collection path. It is analogous to driving a car, you sure do not have to know how to design and repair one to enjoy the benefits of driving one.

An RMT 602 is the standard remote target for use with the FOCUS 10. A non-tiltable one was shipped to me. Two "AA" batteries are used to power it. My primary use for it was on the tripod and tribrach setups. My thanks to Rob Barth and the folks at Precision Laser and Instrument for loaning me a tilt able unit for traversing. All of my side shots were done at the prism pole using the RMT 606 consisting of a 360° array prism ring as well as a 360° tracking diode circle. It is powered directly from the pole or can be powered via a Hirose connection to a battery source other than the prism pole.

In my practice of surveying I have worked on crews, with crews, and solo with conventional equipment. Yes, that even includes construction stakeout! Permit me to draw some comparisons between solo with conventional and solo with fully robotic equipment.

Traversing is faster with fully robotic equipment. The speed comes from turning the sets of angles with the bonus of better precision as a plus. Once you need side shots for boundary markers, possessory evidence, topography, etc., the fully robotic is in a class by itself. There really is no comparison at all. The fully robotic is just more productive, period. With construction stakeout, again the fully robotic is more productive. With a two-

man crew the fully robotic becomes even more productive than a solo operator. Other confirming opinions may be found online on various survey-related forums.

Now a word about the "controller" that I used for this article. It was a TDS Ranger with TDS Survey Pro version 4.5.1 aboard (firmware version was 5.0.3). Some years ago I reviewed the original Ranger and this newer unit's shape and keyboard are a well-appreciated improvement. The 520 mHz processor kept me from getting bored waiting for things to happen. It is fast and the screen is easy to read in direct sunlight. Couple this with the reliability of operation and the graphics on board and you have got a winning combination. These are some of the reasons TDS software is well-accepted by surveyors.

An interesting option for the Ranger is the compact flash card GPS unit to aid the robot in finding the FOCUS 10. My testing of this option was very limited and with the diode tracking system working so well it saw little use. Surveyors in more open sky areas will probably make much more use of it than I did. I am sure that GPS technology will improve making this device a "must have".

The FOCUS 10 is a well-built, solid performer. Considering its heritage that is not unexpected. What impressed me was how easily everything worked together, both software and hardware. It will be a money maker for those who choose to buy it, be it you or your competition. Think about that for a minute, but not much longer! 