The Technical Side - Prisms Part II

By Chris Cothrun, Service Technician, Ingenuity, Inc. - Sparks Facility

As promised in the last issue, we are still discussing prisms. Following are some tips to get better range and accuracy out of your prisms.

Keeping glass prisms clean and free of scratches is important for a good return signal to the EDM. This may seem obvious to most of you but it is amazing how many prisms I see that are in bad shape. The front surface collects the most dirt and can be gently cleaned with a tissue whenever the dirt becomes obvious. The front surface also collects the most scratches. Almost all of the dirt and scratches can be avoided by using the prism caps and keeping the prism in a padded bag or case when not in use. The back side of the prism also collects dust but at a slower rate. This can be seen by looking into the prism with a light source at just the right angle. The dirt can be removed by disassembling the prism and wiping the back surfaces. Avoid leaving fingerprints on the glass. The small amount of acid in a fingerprint can permanently etch reflective coatings and even the glass itself. Prisms are available that have been hermetically sealed to keep water and dust out. These work great until age and abuse break the seal and dirt and moisture enter the prism. The prisms then cannot be cleaned and gradually become worthless. For this reason we prefer prisms that can be disassembled and cleaned. Some prisms are coated on the back side with gold or silver. This keeps the back side clean and reflective as long as the coating is not scratched. The disadvantage to this is the percentage of reflected light is slightly lower than that of a clean, uncoated prism.

Prism quality is also important for a good return signal. The main consideration of prism quality is the angular accuracy between the three sides of the corner cube. The sides of the cube on a good survey prism are ground and polished to an accuracy of within 2 arc seconds of being perpendicular to each other. If the prism is not ground to this accuracy the returned beam will diverge or spread a great deal more, resulting in a weakened return signal. For this reason we recommend avoiding the lower quality prisms that are inexpensive but result in lower EDM range.

Ideally, the face of the prism should be perpendicular to the line of sight from the EDM. Unfortunately this rarely happens. The angle of incidence from the EDM to the front face of the prism affects the strength of the return signal along with the distance measured. The returned signal is decreased as the frontal area of the prism presented to the EDM becomes smaller. At 20 degrees out of alignment the return signal is reduced by about 50%. More importantly, the measured distance becomes longer as the prism is rotated. There are two reasons for this. The optical path inside the prism gets longer and the prism face moves farther away from the EDM as the prism rotates. Depending on the prism offset, the error can be as much as .02 feet for just 20 degrees misalignment. This demonstrates the importance of using tilting targets for accurate work.

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Some of the information for these two articles on prisms came from previously written sources. An article by Doug Johnson in the Feb-Mar 1981 issue of P.O.B. had some good information. Some guidelines I obtained from City of Reno Survey Dept. along with manufacturers' literature were also very helpful. We welcome any reader's comments or additions to this or any previous column. Send any correspondence to The Technical Side, 1562 Linda Way, Sparks, NV 89431 or fax it to (702) 359-6671.

Technical Questions:

Feel free to send them in writing to:

Institute of Survey Technology
of Ontario
Attn: Brian Munday
1043 McNicoll Avenue
SCARBOROUGH, Ontario
M1W 3W6
or
FAX them to: 416-491-2576