

NATIONAL RADIO ASTRONOMY OBSERVATORY
Tucson, Arizona

March 10, 1983

TO: J. M. Payne
FROM: R. W. Freund
SUBJECT: 22 Bit Shaft Angle to Digital Converter System

A multi-pronged, parallel effort will be required to produce the new INDUCTOSYN based shaft angle to digital conversion system by July 1983. Part of this effort is already underway at the Green Bank shop where the mechanical housing for the INDUCTOSYN plates is being fabricated. Work, however, has barely started on the electronics and its mechanical packaging system.

The design time for the electronic interface (between the converter and the existing 12 meter computer/display system) and the mechanical packaging of the electronics necessitates at least one month. Fabrication of the two mechanical packages by the Green Bank shop requires between one and two months. Integration of all the electronics into the package and testing means yet another month or two.

None of the work mentioned in the above paragraph can commence without knowledge of both electronic and mechanical characteristics of the shaft angle to digital converter. This information is not presently available. By purchasing a commercially available complete converter system, it should be possible to obtain the required information within one month from the order placement.

Eleven commercial companies have been investigated as to their capabilities to supply a complete single axis 22 bit converter system. Such a system must consist of the following components:

- 1) 13 BIT resolution or greater INDUCTOSYN to digital converter.
- 2) Pre-amplifier system for INDUCTOSYN output signals.
- 3) Excitation generator for INDUCTOSYN input signals.
- 4) 10 BIT resolution with less than 0.5 LSB accuracy resolver to digital converter.
- 5) Excitation generator for resolver input signals.

Only one company can supply all the above components - Northern Precision Laboratories. Table 1 shows the companies investigated and their responses. Due to time limitations, the price figures

quoted are not firm, but only budgetary estimates.

Five NPL customers have been contacted concerning their experiences with NPL supplied shaft angle to digital converter systems. All five, with one minor exception, have not had any difficulties with the converter systems. The one exception is the NRAO VLA project which has experienced some minor problems with gain drift due to aging and/or temperature variation of the INDUCTOSYN output pre-amplifier. This particular system is the oldest investigated, being designed about 1974. Table 2 enumerates the NPL customers, their systems' resolution, design year, and comments.

Some of the contacted INDUCTOSYN users expressed an interest in higher resolution converter systems. Dr. Bobby Ulich of the MMT in Tucson, is presently developing a 26 bit system (0.019 arc second) requiring a mini or micro-computer. If more than 22 bit resolution is necessary, a simplified converter scheme has been developed by the author that warrants further investigation.

For the new 22 bit resolution shaft angle to digital converter system to be operational on the NRAO 12 meter telescope by summer, the complete converter system components should be obtained from a single commercial supplier (NPL) as soon as possible.

TABLE 1 - VENDORS

COMPANY	COMPLETE 22 BIT SINGLE AXIS SYSTEM	COMPLETE 13 BIT INDUSTOSYN TO DIGITAL CONVERTER
Analog Devices, Inc. P. O. Box 280 Norwood, MA 02062 (617) 329-4700	N/A	N/A
Atec, Inc. P. O. Box 19426 Houston, TX 77224 (713) 468-7971	N/A	N/A
Computer Conversion Corp. 6 Dunton Court East Northport, NY 11731 (516) 261-3300	N/A	N/A
Control Sciences 9601-1 Owensmouth Avenue Chatsworth, CA 91311 (213) 344-7383	N/A	N/A
Farrand Controls 99 Wall Street Valhalla, NY 10597 (914) 761-2600	N/A	\$1,000.00
Interface Engineering, Inc. 386 Lindelof Avenue Stoughton, MA 02072 (617) 344-7383	N/A	N/A
Heidenhain Corp. 80 North Scott Street Elk Grove Village, IL 60007 (312) 593-6161	N/A	N/A
Natel Engineering Co. 8954 Mason Avenue Canoga Park, CA 581-3950	N/A	N/A
Northern Precision Lab., Inc. 11 Madison Road Fairfield, NJ 07006 (210) 227-4800	\$6,250.00	\$4,000.00
Ocean Technology, Inc. 2835 North Naomi Burbank, CA 91504 (213) 849-7111	N/A	N/A

TABLE 1 (Continued)

COMPANY	COMPLETE 13 BIT SINGLE AXIS SYSTEM	COMPLETE 13 BIT INDUSTOSYN TO DIGITAL CONVERTER
Singer - Kearfott Division 1150 McBride Avenue Little Falls, NJ 07424 (201) 785-6000	N/A	N/A

Notes: N/A - Not Available.
Pricing is not fixed but a budgetary estimate only.
Any necessary spare components are not included in this summary.

TABLE 2 - USERS

<u>USER</u>	<u>SYSTEM RESOLUTION</u>	<u>DESIGN YEAR</u>	<u>COMMENTS</u>
Naval Observatory Flagstaff, AZ Dr. A. V. Hewitt (602) 774-6623	17 bit 20/21 bit	1977 1981	No problems with converter system
Naval Observatory Washington, D. C. Dr. B. L. Klock (202) 653-1557	25 bit - 3 speed	1979	Good reliability, would like higher resolution
JPL Pasadena, CA P. Lipsuis (213) 577-9849	20 bit	1977	Operates in harsh environment with no problems
NRAO - VLA Project Socorro, NM L. Temple (505) 835-2927 ext. 260	20 bit	1974	Minor problems with drift in preamp
MMT Tucson, AZ Dr. B. L. Ulich (602) 626-1558	24 bit	1980	Actively investigating higher resolution