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A MODULAR FAMILY OF MINIATURE INSTRUMENTS FOR
SIMPLE ACQUISITION AND IN FIELD PROCESSING
OF OCEANOGRAPHIC DATA

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Summary

The paper describes a general system for design of oceanographic instruments. The system uses a standard mechanical housing and a variety of compatible electronic units which can be plugged into the housing in a few seconds. Data are recorded on solid state memories and transferred to different readout devices via optocoupling through the sealed instrument top. By reading data directly into a microprocessor, processed data may be presented in the field within minutes. Details of the system are presented in the Poster Session.

Basic components in an oceanographic instrument.

A modern instrument for acquisition of data from the sea will in general consist of:

1. One or several sensors.
2. Electronic circuits for organizing the measurements, processing the signals, storing the information or for transmitting the information to the user.
3. A power supply.
4. A mechanical device which surrounds 1 - 4.

Basic design targets.

A designer who wants to make a new instrument faces both mechanical and electronic design problems.

The basic target for the mechanical part of an instrument design is to make a housing which is easy to handle, is strong enough to meet shocks, water pressure and other mechanical stress factors, is protected against corrosion and does not make changes in the parameter to be measured. The target for the electronic design is to make low power circuits that process the variables as precisely as possible, store the information as reliable as possible and present it to the user in a format that matches his standard as far as practical possible.

Dealing with fast and slow changes.

The nature of the oceanographic environment is stable over a time scale of millions of years. This means that a mechanical design which fulfills basic mechanical demands as listed above in principle never needs to become obsolete.

The nature of the electronic components available to the designer are changing extremely fast. This means that designs which may seem impressive when finished may become obsolete within few months later.

Modular designs.

Making new mechanical designs each time new electronic components become available is both impractical and expensive. A more economic way to meet progress in electronics in instrumentation is to make instruments based on standard mechanical modular units in combination with electronic modules. The electronic modules may have different functions and contain different components, but they must be easily exchangeable into the same mechanical housing. This means that all electronic components must be mounted on circuit boards of standard size and shape and be adapted to the available volume of the mechanical unit. The Institute of Marine Research in Bergen is presently developing a miniature instrument system based on such modules.

The basic mechanical module is a transparent plastic tube of length 340 mm and outer diameter 50 mm which has been sealed in one end. The tube can be fixed to a mooring line like a Nansen bottle or it can be screwed into a rotor cage to be used in a current meter.

Several electronic modules that fit into the pressure tube have been designed. The first generation of electronic modules, like the models described in ref. 1 and ref. 2. contain sensors for current speed, current direction and temperature - a solid state memory for 1 - 16 observations and a digital display which present the re-

corded information directly through the transparent pressure tube on command from a magnet held outside it.

The present generation of modules have a RAM type data memory with a storing capacity of 32000 bits. They are typically able to record 1024 observation sets of current speed, direction, temperature and time.

The instruments have programmable measuring intervals, operate on lithium cell batteries and present their information to the user via two light emitters which are encapsulated in the transparent instrument top.

Data readout is obtained by snapping a readout head over the instrument top. The readout head makes the recorded information to be flashed from light emitters in the instrument to photodetectors in the readout head in 32 seconds. The readout head can be plugged into a small computer which processes and presents the information in a few minutes or to a simpler device that either shows the information on displays or records it on tape, during the readout time.

Advantages with the modular system.

The modular system as presented hence makes possible:

- Standardized mechanical instrument parts weighting in the order of 1 kg which are inexpensive to produce, are easy to handle and are basically non corrosive.
- Standardized electronic units which can be mounted into the mechanical unit in a few seconds and then be commanded, interrogated and read through transparent parts of the sealed mechanical unit.

- In field processing of data to any wanted level of sophistication - carried out by the instrument user himself within minutes after the instrument has been returned from the sea.

Further development.

The next generation of the electronic units will contain a microprocessor, an extended data memory and a calibration memory. This will make possible features like automatic calibration in software, remote programming and remote data readout using the anchor line as a bus for transfer of information between instrument and user.

The accompanying posters will explain the system in more details.

References.

1. Trygve Gytre and Svein Sundby:

"A new instrument for simple observations of current speed and direction in the field."

ICES C.M. 1977/C:23, Hydrography Committee.

2. Trygve Gytre:

"A simple field instrument for measuring and recording up to 16 observations of current speed and direction."

ICES C.M. 1979/C:53, Hydrography Committee.