

# DIWAR

## Digital WAverider Receiver

### *general*

This unit receives and digitizes the signal from the Waverider.  
Up to six Waveriders can be received sequentially (not simultaneously).

Combined with an MS-DOS (personal) computer (not included) it provides on-line data handling.

Communication is through an RS232 serial port.  
For monitoring purposes an analog output is also available.

We have BASIC software available that performs spectral or statistical analysis.  
The program runs on BASICA, GWBASIC and QUICK BASIC.

The following information is presented almost real time:

#### A) Spectral data:

Print out options:

- Spectral density from .03 Hz to .6 Hz with .01 Hz resolution
- Hs, Tz,  $M_{-1}/M_0$  and  $M_0/M_1$

Storage:

- 20 minutes records of the raw data time series
- Spectral density from .03 Hz to .6 Hz with .01 Hz resolution
- Spectral parameters Hs,  $\sqrt{(M_{-2}/M_0)}$ ,  $M_{-1}/M_0$ ,  $M_0/M_1$ ,  $\sqrt{(M_0/M_2)}$  and  $\sqrt{(M_2/M_4)}$ .
- Spectral moments  $M_{-2}$ ,  $M_{-1}$ ,  $M_0$ ,  $M_1$ ,  $M_2$ ,  $M_3$ ,  $M_4$
- Sea surface temperature if temperature option is installed in Waverider and Diwar.

Display options:

- Bar plot of spectrum with indication of Hs and Tz.
- List of 16 equal energy bands that allows to estimate the "waveheight" in a period time of interest.
- Hs, Tz,  $M_{-1}/M_0$  and  $M_0/M_1$  as one line per Waverider.

or

#### B) Wave statistics:

Display and printout:

- $H_{max}$ ,  $T_{max}$ , H1/10, T1/10, H1/3, T1/3, Havg, Tz, EPS4, data quality (percentage of well received data points, low frequency noise).

Storage:

- as above
- plus ordered list of waves (crest, trough, zero-up crossing period).

Attached: pages 2 - 6, 8 and 9 from manual.



## 1 Introduction

The DIWAR is designed for the reception of the wave-height data as transmitted by the Waverider.

It contains a radio receiver, phase lock FM demodulator, anti-aliasing filter, AD-Converter and a serial communication port.

A maximum number of seven DIWAR units can be controlled simultaneously by aid of one computer if the daisy-chain feature is used.

### Radio range

Reliable radio reception of a Waverider over a distance of 50 km is possible if the wave height does not exceed 10 metre. The range is reduced to 30 km for 25 metre wave height.

### Channel selection

A selection of one of the six crystal controlled channels can be made either by manual selection or by command control in the remote mode.

The selected channel is indicated in the output message.

### Analog output

A continuous analog signal representing the wave-height is available. It has a sensitivity of 0.2 V/m and a range of +/- 20.48 metres.

### Digital output

The digital output is the result of the analog to digital conversion at the analog wave-height signal. The resolution is 1 cm/bit with a range of 12 bits (+/- 20.48 metres).

A message containing this data and address, channel and status bits is transferred via the serial (RS232) port either under command control or in the Autonomous mode with 2 or 2.56 Hz rate.

### Autonomous mode

The DIWAR can be put in the Autonomous mode either under command control or manually by removing the 'EXT' jumper.

The Autonomous mode is default after power up with or without 'EXT' jumper. The data message is sent periodically with a jumper selectable rate of 2 or 2.56 Hz.

### Signal quality monitoring

The phase lock demodulator gets unlocked if there are poor reception conditions. This condition is indicated by the 'UNLOCK' led.

A lock/unlock output signal is also available.

The monitored lock/unlock condition before a new ADC sample is indicated in the status bits of the output message.

### Internal calibration

If 'EXT' jumper is not present or with 'EXT' jumper present while running at 9600 baud only, the DIWAR performs a selftest at power up.

During this selftest the phase lock demodulator is disconnected from the radio receiver and connected to two fixed crystal controlled frequencies respectively. The scale-factor is calculated to correct for inaccuracy of the wave data. If the scale inaccuracy is more than 5% a status bit is set.

In case the 'EXT' jumper is present while running 300, 600, 1200 or 2400 baud the scale-factor is set to default 1. The user can perform this test using the commands for selection of test frequency 1 and 2.

Status bits in the channel field of the output message indicate the selection of these test frequencies.

The duration of the selftest is about 18 sec.

The first message after power up contains the status and resulting scale-factor.

### Signal level monitoring

The input of the AD converter can be connected to the A.G.C. signal of the radio receiver using the 'AGC/Temp' command.

The voltage of this A.G.C. signal is a measure of the HF signal level.

### Power requirements

The DIWAR accepts any mains voltage from 100 to 300 V AC, 40 to 500 Hz without any adjustment. The AC Power is less than 10 VA.

The unit can also operate from a DC source of 10 to 30 V.

As DC power consumption is low (< 0.5 W) battery operation is practical.

Batteries can also be used as a standby power source if the mains AC supply is not reliable. Take-over is automatic and without interruption of operation.

### Connectors

All necessary mating connectors and cables are supplied with the unit.

The 25p female connector (A) is used for communication with a computer.

The 25p male connector (B) is used for 'daisy-chaining' several DIWAR's in order to operate them all using one computer.

### Antenna amplifier

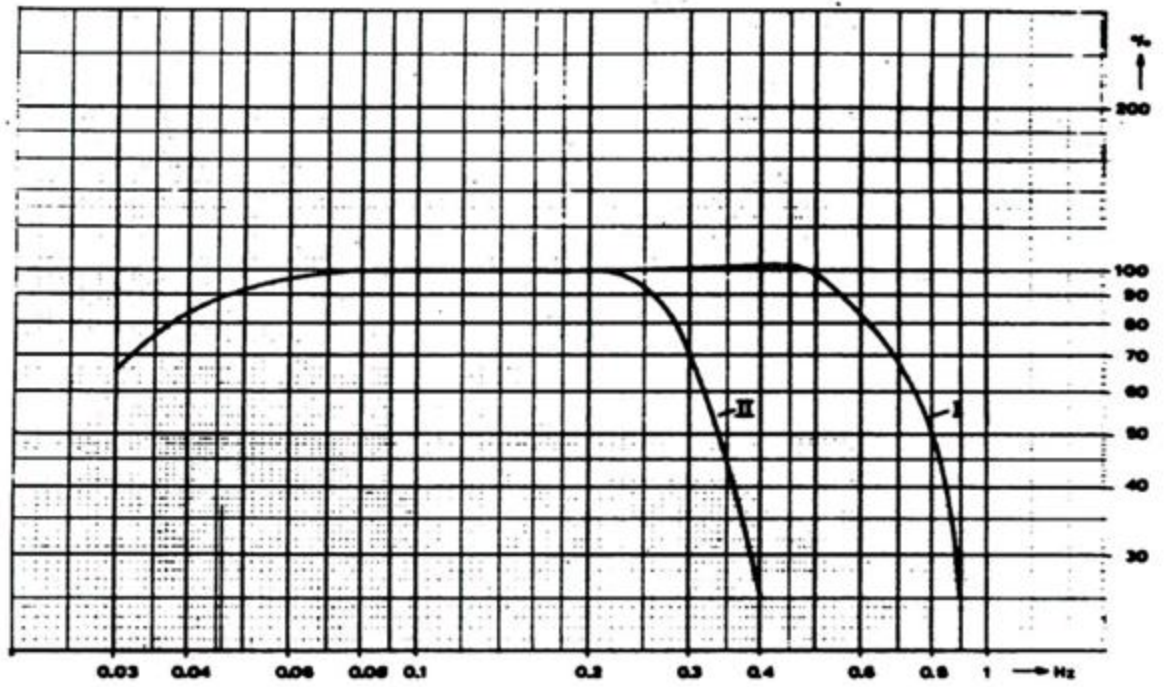
The antenna amplifier has an output which can be connected to an input of another DIWAR in the 'daisy-chain' etc.



## 2 Specifications

General	Construction	One chassis mounted in a 19 inch cabinet, suitable for rack mounting.
	Height	3 units
	Ambient temperature	- 10 - + 50 deg C.
	Humidity	non-condensing
	Power requirement	AC: 100-300 V, 40-500 Hz, 10 VA max. DC: 10-30 V, 0.5 W max.
Antenna	Three types of antennas are available	
	Standard:	
	1) Quarter-wave ground-plane, rated at 80 knots wind speed.	
	Optional:	
	2) Directional, quarter-wave ground-plane. Gain forward 3 dB higher than type 1. Front to back ratio 9 dB. Same wind rating as type 1.	
	3) Rugged quarter-wave whip antenna for shipboard use (range < 20 km) rated at > 100 knots wind speed.	
Outputs	Analog output:	
	Available at point E of connector A. Point D is ground.	
	The analog vertical displacement signal is filtered by a fifth order low pass anti-aliasing filter (0.6 Hz).	
	Sensitivity	0.2 V/m
	Range	+/- 4.096 V for +/- 20.48 m
	Overall linearity	better than 0.4% (including Waverider).
	Overall accuracy	better than 3.5% within the temperature range (including Waverider).
	Load impedance	10 kOhm minimum
	Digital output:	
	Available at serial port A.	
	A message of three contiguous transferred bytes contains the corresponding vertical displacement data.	
	AD-Conversion	12 bits (value 0-4095)
	Range	-2048 to +2047 cm.
	Unlock:	
	An unlock signal is available at point A of connector A. D is common ground.	
Lock	Open collector non-conducting output state.	
Unlock	+ 5 V via 20 kOhm.	
Serial port	RS232 compatible in- and output lines	
	Voltage level	+/- 3 - 30 V
	Word length	8 bits
	Parity	None
	Stopbits	2
Baud rate	300, 600, 1200, 2400 baud as selected by the proper baud rate jumper.	
	Without any baud rate jumper the baud rate is 9600 ! In this special case, which is different from earlier instruments, the DIWAR will perform a selftest after power up to determine the scale-factor for correction of the subsequent digital wave data output.	

## Overall transfer function (Waverider + Diwar)



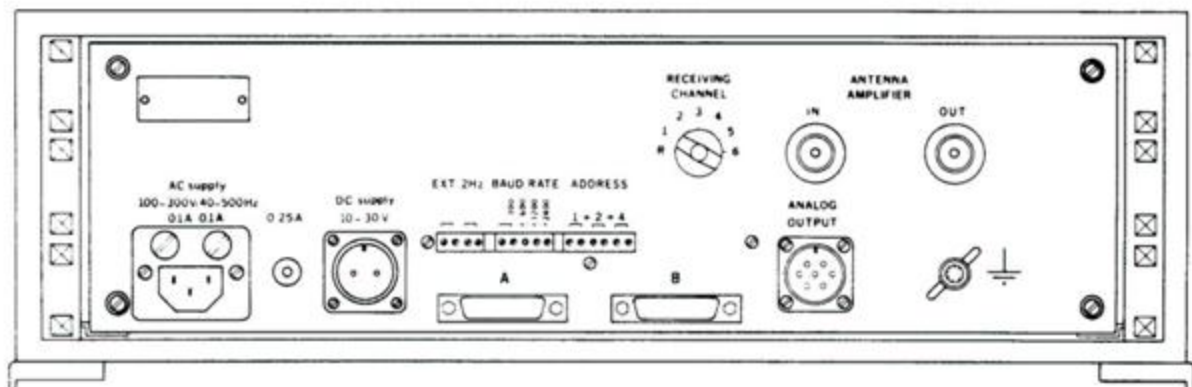
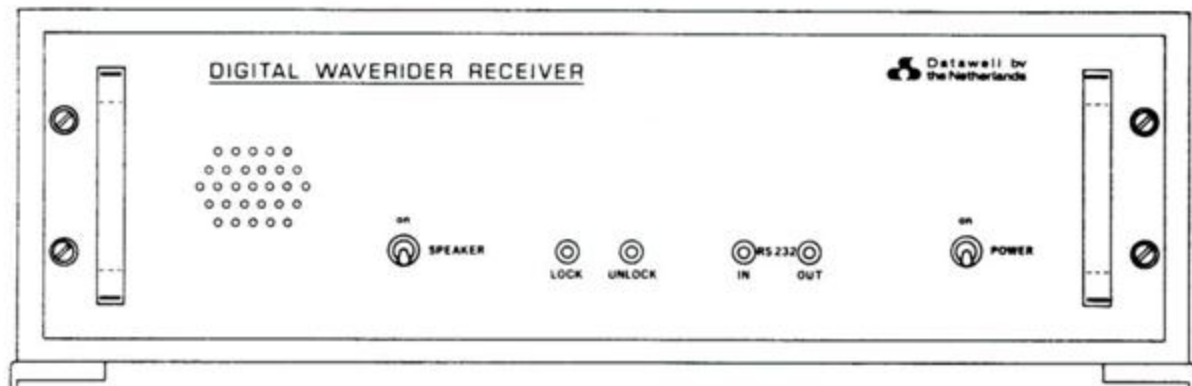
- I Frequency response of analog and digital output.  
0.6 Hz filter, standard.
- II Frequency response of analog and digital output.  
0.3 Hz filter, optional.

### 3 Options

The DIWAR can be equipped with an optional printed circuit board for demodulation of the temperature signal from a Waverider buoy which has also been modified for temperature measurement.

The bytes containing the temperature with status data are attached to the standard message. This message is extended to 5 bytes and is only sent once in the second message after the request by the 'AGC/Temp' command (see appendix II - 1).

Digital Waverider Receiver, DIWAR  
(front and back panel)



## 4 Front and back panel description

### Front panel left to right:

- Speaker switch.  
If on, the fm wave signal should be audible.  
Lock and unlock indication.  
Indicates if phase lock filter is locked to the wave fm signal.
- "RS232 IN" indicates that a command is received via the serial input.
- "RS232 OUT" indicates that data is transmitted via the serial output.
- Power switch.

### Back panel from left to right:

- Socket for mains supply with fuses.
- Fuse 0.25 Amp. (battery supply).
- Connector for battery supply: point A positive  
point B negative
- RS232 connector A: to be connected to a serial computer port.  
For connections see chapter 5.
- RS232 connector B: If connected to connector A of a second unit, communication between one personal computer and more units is possible.
- Jumper blocks  
For interconnection see 6 (Installation).
- Analog outputs: Point D common  
point E analog output  
point A unlock signal  
+ 5 V via 20 k if unlocked  
Open circuit if locked.
- Channel switch: in position "R" channel choice is via command control.
- Antenna amplifier input.
- Antenna amplifier output can be connected to antenna input of a second unit.
- Earth connection.