MkIII, DWR-G and WR-SG Datalogger

Introduction

All current Datawell Waverider buoys (DWR-7, DWR-9, DWR-G4, DWR-G7, DWR-G9, WR-SG7 and WR-SG9) are equipped with an internal datalogger. This datalogger has been developed as an integral part of the buoy. As a result, the construction and operation of the datalogger differs greatly from the previous MKII internal and external dataloggers. This document describes the features and operation of the new datalogger.

Construction

The new datalogger (hereafter referenced as “logger”) uses type-1 compact flash modules for non-volatile storage of the recorded wave data. The logger is integrated in the electronics unit of the MKIII, DWR-G and WR-SG buoys. The flashcard is mounted in a special slot that can be accessed from the outside of the electronics unit. The flashcard is therefore easily removed by opening the hatch and ejecting the flashcard.

Data storage

The logger reserves two areas on the flashcard. The following data is stored on these two areas.

Spectra and events

All spectrum and system files generated and transmitted by the buoy are logged. Relevant system events and error message are recorded in a human-readable log file. The buoy automatically reserves sufficient space on the flashcard for 3 years of continuous event, spectrum and system file logging. The remaining space on the flash card is used for displacement data.

Displacements

Displacement data is selectively logged according to a sorting algorithm. This sorting algorithm works as follows:

Displacements (heave, north and west data) are logged per day. The half-hourly Hs (significant wave height) is logged and the file is characterized by the maximum Hs that occurred during the day. All displacements are logged until the reserved space is filled. When the reserved space has been filled, the files with the smallest Hs file, those considered less interesting, are replaced by files with greater Hs.

As a result, the reserved space on the flashcard is completely filled with displacement data of the most interesting time periods, namely those with a rough sea and consequently high maximum Hs. The algorithm allows for a configuration-less logger that always uses the available storage capacity to the maximum.

Timestamps

The MKIII, DWR-G and WR-SG buoys are all standard equipped with a GPS receiver. The GPS receiver is used to automatically set and adjust the internal clock of the logger. Manual setting of the clock is therefore not necessary. All data recorded by the logger is tagged with a timestamp generated by the internal clock. Note that the timestamp is therefore referenced to the GPS time. To convert to local time, a correction is necessary.

Storage capacity and logging period

The following table shows the relationship between the size of the flashcard and the available storage time.

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Flashcard size	Months of spectra	Days of displacements
64 Mbyte	36	Approx. 40
128 Mbyte	36	Approx. 140
256 Mbyte	36	Approx. 300
512 Mbyte	36	Approx. 700
1024 Mbyte	36	Approx. 1400
2048 Mbyte	36	Approx. 2800

The logger's firmware can handle flashcard sizes up to 2 Gbyte (2048Mbyte). Flashcard sizes smaller than 64Mbyte are not supported. It is recommended that only industrial grade compact flash cards be used. For availability of these cards, please contact Datawell sales.

Data retrieval and analysis

Data is retrieved by removing the flashcard from the logger and inserting it in a compact flash card reader. The logger uses the FAT16 file system. The flashcards can therefore be read by any (windows) computer equipped with a compact flash card reader. The reader is not supplied by Datawell but can be bought from any computer supplier. Downloading of the data through the serial port is not possible. The W@ves21 package supports reading and analysis of the data generated by the logger. It is important that proper procedures are followed when deploying or retrieving a logger. Before removing the flash card or even removing the power it is important that the logger is stopped. To stop the logger, use the console command stoplog. Refer to the buoy manual for more information. Once stopped, the power may be disconnected and the flash card ejected. Sometimes a few files or even the whole flash card can not be read. Several causes may result an invalid flash card or corrupted files, e.g. exhausted batteries at the end of the operational life or disconnecting the power before stopping the logger. Windows provides a utility (check disk) to repair the flash card and sometimes to restore the corrupted files. To repair a card, follow the procedure below:

- First save a copy of all readable files to your hard disk.
- Either invoke the DOS prompt or go to "Start", select "Run" and type "cmd<enter>" or "command<enter>".
- Type "chkdsk <DRIVE> /F. For example: chkdsk E: /F
- The check disk-utility will perform a disk scan, repair the FAT and print a report.
- Copy all newly repaired files to your hard disk.

After repair it is also possible to erase all files, should you redeploy this flash card. Never deploy a logger with a corrupted flash card.

Displacement data file format

Displacement data is logged in files with the .RDT suffix.

Initially, one file contains 48 displacement data messages of half an hour each, covering one single day. However, if the number of displacement files exceeds 256 (> 256 days or approximately > 8 months), one file can contain more consecutive days of displacement data. The filename is made up of the maximum significant wave height Hs during that day coded in 3 characters and the exact date. The max

{Hs} label is coded as 3 characters A-Z corresponding to 0-25. The first character has a power of 676 cm, the second has a power of 26 cm and the third has a power of 1 cm. The date is coded as DDMMY and applies to the last sample in the file. To give an example: 05123AAC.RDT, means 5 December 2003, max{Hs} label = 2 cm. A displacement message has a variable length and it's message ID is 0x30 (that is hexadecimal format). The timestamp in the message indicates the start of the raw data. See the table at the end of this document for a detailed description of the displacement message

Spectrum and system file format

Spectral data and system files are logged in files with the .SDT suffix. The filename itself carries the month and year. To give an example: S11-2002.SDT, for November 2002. Each file contains a month of half-hourly spectrum/system-file messages, hence 31*24*2 = 1488 messages at the maximum.

A spectrum/system message has a fixed length (550 bytes) and it's message ID is 0x10 (that is hexadecimal format). The timestamp in the message indicates the end of the half hour period in which the data for the spectrum was gathered. See the table at the end of this document for a detailed description of the spectrum / system file message.

Spectrum / system file message format

	Byte	Value	Description
header	0	0x2A	Start of message
	1	0x10	Message id
	2	0x02 (MSB)	Message length in bytes (550 bytes) excl. checksum and header [unsigned short]
	3	0x26 (LSB)	
checksum	4	0x1E	XOR checksum of bytes 0..3 [char]
data	5	(MSB)	Year [unsigned short]
	6	(LSB)	
	7		Month [char]
	8		Day [char]
	9		Hour [char]
	10		Minute [char]
	11	(MSB)	Word #0 of spectrum file [short]
	12	(LSB)	
	13	(MSB)	Word #1 of spectrum file [short]
	14	(LSB)	
	...	...	...
	521	(MSB)	Word #255 of spectrum file [short]
	522	(LSB)	
	523	(MSB)	Word #0 of system file [short]
	524	(LSB)	
	525	(MSB)	Word #1 of system file [short]
	526	(LSB)	
	...	...	...
	553	(MSB)	Word #15 of system file [short]
	554	(LSB)	
checksum	555		XOR checksum of bytes 5..554 [char]

Displacements message format

	Byte	Value	Description
header	0	0x2A	Start of message
	1	0x30	Message id
	2	(MSB)	Message length in bytes (10+n*6 bytes, n = number of samples) excl. checksum and header [unsigned short]
	3	(LSB)	
checksum	4		XOR checksum of bytes 0..3 [char]
data	5	(MSB)	Year [unsigned short]
	6	(LSB)	
	7		Month [char]
	8		Day [char]
	9		Hour [char]
	10		Minute [char]
	11	(MSB)	Sample rate in Hz [float]
	12		
	13		
	14	(LSB)	
	15	(MSB)	Heave [short]
	16	(LSB)	
	17	(MSB)	North [short]
	18	(LSB)	
	19	(MSB)	West [short]
	20	(LSB)	
	21	(MSB)	Heave [short]
	22	(LSB)	
	23	(MSB)	North [short]
	24	(LSB)	
	25	(MSB)	West [short]
	26	(LSB)	
	...	...	...
checksum	15+n*6		XOR checksum of bytes 5..15+n*6 [char]