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UHURA & DIRC II

Manual v1.1

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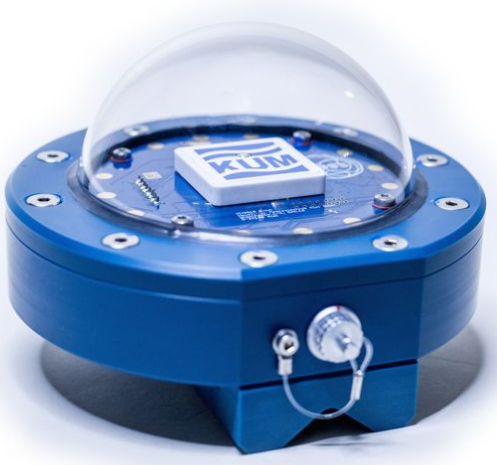

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Contents

1 Overview GPS-system “DIRC II / UHURA”

Figure 1: GPS-Antenna “UHURA”

Exact timing is a vital part of most fields of research. The most commonly used method of synchronization today is GPS. But many cheaper GPS receivers lack a one-pulse-per-second (1PPS) signal and their time usually has high latency and jitter. The GNSS antenna “UHURA” is designed to receive GPS, GLONASS and GALILEO. It is BEIDOU-ready.

“UHURA” provides NMEA-data using RS485 with both 4800 baud and 9600 baud. Inside “DIRC II” the signal is converted to RS232. An extra line provides a latency-free, DCF77 encoded PPS signal. On top of the second pulse the DCF77-Signal is encoded. This way you can synchronize systems that would otherwise need an extra radio receiver.

“UHURA” is delivered in a watertight housing and can be equipped with cables up to 100m length.

The central control unit in the lab is called “DIRC II”. “DIRC II” provides power to “UHURA” and collects the GPS data. To communicate with the data logger, connect a PC and the seismic data logger “6D6” or “6D7” to “DIRC II”. You can also download the data with “DIRC II”. Finally, the “DIRC II” can establish a WiFi access-point to communicate with the data logger using any WiFi device .

Figure 2: DIRC II

Size

	Size	Cable length	Weight	IP code
DIRC II	220 × 180 × 95 mm	1 m	1700 g	IP54
UHURA	D 140 × 90 mm	30 m, 50 m, 100 m	800 g	IP67

2 Connectors

2.1 Description of the connectors

Figure 3: Connectors of DIRC II

Number	Connection	No. of Pins	Description
1	Power	5	External Power Supply
2	ON/OFF	–	Switches power on
3	WiFi	–	Switches WiFi on
4	PC	4	Connects internal USB hub to PC
5	GPS	8	Socket for GPS antenna “UHURA”
6	6D6 / 6D7	16	Communication with the datalogger and LED to indicate data logger model
7	StiK	12	Socket for StiK™ data download

Note: The power supply unit differs from the power supply unit of the predecessor “DIRC in the Box”. Interchanging the power supplies does not cause damage, the “DIRC II” just does not work.

2.2 8-pin Socket “GPS”, communication with“UHURA”

Pin	Purpose	Source	Description
1	Vcc	DIRC II	12 Volt
2	1PPS -	UHURA	Second pulse minus[1]
3	1PPS +	UHURA	Second pulse plus
4	NMEA - 9600	UHURA	NMEA 9600 baud minus
5	NMEA + 9600	UHURA	NMEA 9600 baud plus
6	NMEA - 4800	UHURA	NMEA 4800 baud minus
7	NMEA + 4800	UHURA	NMEA 4800 baud plus
8	GND	DIRC II	Signal Ground

[1] RS485 is used for communication with the antenna, therefore a pair of wires is used for each signal line.

2.3 16-pin Socket, communication with “6D7” and “6D6”

Both data logger “6D7” and “6D6” use the same connector **with different connection cables**.

2.3.1 Data Logger 6D7

The cable to use with “6D7” is marked with a red sleeve on the “DIRC II” end, and with a laser engraving on the pressure tubes end. A LED at Position 6 in the picture above indicates whether a “6D6” or a “6D7” data logger is connected.

Figure 4: Connection Cable for 6D7

“DIRC II” is equipped with an internal web server and access point. When connecting to a data logger “6D7”, connect to the WiFi with the SSID “Dirc-9nnnnnn” (nnnnnn representing the serial number of “DiRC II”). The default password is `seismics`. Open a browser on your device and enter to `10.0.0.1` as address to access the webserver on “DIRC II”.

2.3.2 Data Logger 6D6

The cable to use with “6D6” is completely black and has no laser engraving on the pressure tube end:

Figure 5: Connection Cabel for 6D6

“6D6”, the predecessor of “6D7”, is equipped with its own web server. When connecting to a data logger “6D6”, wait 45 seconds until a new access point with the SSID “6D6-nnnnnn” appears (nnnnnn representing the serial number of “6D6”). The default password is `seismics`. Open a browser on your device and enter to `10.0.0.1` to access the webserver on the “6D6” data logger.

Note: Do not connect to the WiFi with the name “Dirc-nnnnnn”, this only works for use with the “6D7” data logger.

2.3.3 Pin configuration

Pin	Purpose	Source	Description
	UHURA		
1	NMEA 9600	DIRC II	NMEA with 9600 baud[1]
2	1 PPS	DIRC II	Pulse-per-second from GPS[2]
3	AGND	DIRC II	Signal Ground GPS
	6D6		
4	VCC USB	6D6	5V USB
5	USB-DN	6D6	USB Data line
6	USB-DP	6D6	USB Data line
7	USB-GND	6D6	Signal Ground USB
8	VBAT2	6D6	Vdd from the battery pack inside the pressure tube[2]
9	VCNC	DIRC II	Vdd back to web server[3]
10	NMEA 4800	DIRC II	NMEA with 4800 baud
11	–	DIRC II	shield
	6D7		
12	VCC USB	6D7	5V USB
13	USB-DN	6D7	USB Data line
14	USB-DP	6D7	USB Data line
15	TxD	6D7	Serial Data Line
16	RxD	6D7	Serial Data Line

[1] 3.3V UART

[2] There is a DCF77-signal coded on top of the – latency free – second pulse to synchronize systems that require a radio signal instead.

[3] The webserver of “6D6” is only powered when connected to the communication socket. There is a bridge between VBAT2 and VCNC inside the socket. This way the web server is definitely shut off when the cable is unplugged. “6D7” has no webserver incorporated, it is installed inside “DIRC II” instead.

You can use “DIRC II” to synchronize dataloggers manufactured by the company SEND (and other instruments that require 4800 baud) as well.

3 Description of the DIRC II LEDs

LED	Status	Description
Power	green	System is switched on
	off	System is switched off
WiFi	green	WiFi is switched on
	off	WiFi is switched off
PC	green	USB Hub is powered by PC or power supply
	off	USB hub not powered
GPS	green	GPS connected, but no GPS Fix yet
	flashing	GPS signal is valid[1]
	off	GPS not connected
StiK™	green	StiK™ is attached
	flashing	Data download from StiK™
	off	No StiK™ is attached
6D6	green	a 6D6 data logger is attached
	off	no 6D6 data logger found
6D7	green	a 6D7 data logger is attached
	off	no 6D7 data logger found

[1] The GPS-antenna is configured to only hand over validated signals. If there are less than 4 satellites or weak signal, the signals are set to zero. When the LED is flashing you can be sure that a GPS signal exists *and that it is reliable*. However, we recommend to wait at least 15 minutes after the first GPS fix. The reason for that is the information policy of the GPS system: information about leap seconds is transmitted every 15 minutes only.

4 Description of the UHURA LED

Status	Description
red	System is booting
orange	System has no fix yet
green flash	System working. Second pulse represents a binary "0"[2]
blue flash	System working. Second pulse represents a binary "1"[2]

[2] On top of the GPS-NMEA the second pulse is DCF77 encoded. This is to supply outdated data logger that require this feature.

5 DIRC and DIRC II

There are currently two data loggers in the market – *6D6* and *6D7* – and its corresponding communcation boxes *DIRC in the box* and *DIRC II*:

Figure 6: 6D6, 6D7 and DIRC in the Box and DIRC II

5.1 6D6 and DIRC in the box

6D6 has been launched in 2015 and has an integrated web server. The corresponding communication box *DIRC in the box* is supplying an access point, getting all data from the web server of *6D6*. Power consumption of *DIRC in the box* is quite low, it can even be operated with the integrated rechargeable battery. Part of delivery is a small power supply and a cable to communicate with *6D6*. To communicate with *6D6*, you could either use the USB-cable that comes with *DIRC in the box*, or use WiFi. When using WiFi, you have to connect to the SSID that is named **6D6** followed by the serial number **of the data logger**.

DIRC in the box communicates with *6D6* only, communication with *6D7* is not possible.

5.2 6D7 and DIRC II

Data logger *6D7* has been launched in 2023. The web server is no longer integrated in the data logger but in the communication box *DIRC II* instead. Therefor, the power consumption of *DIRC II* is significantly higher and it need a stronger power supply. To indicate this, both power cable and power plug are marked red.

Figure 7: Powersupply for DIRC II

NOTE: Do not interchange the power cables of the two units. *It will not cause any damage,* but it won't work.

DIRC II can communicate both with *6D6* and *6D7*, but needs different communication cables for the different units. The cable for *6D6* is completely black and has no laser engraving, while the cable for *6D7* has a red marking and a laser engraving.

Figure 8: 6D6 and 6D7 use different connection cables!

NOTE: Do not interchange the power cables of the two units. *It will not cause any damage,* but it won't work.

To communicate with the data logger *6D7*, you could either use the USB-cable that comes with *DIRC II*, or use WiFi. When using WiFi, you have to connect to the SSID that is named "DIRC" followed by the serial number of DIRC II.

6 Available Cables

Figure 9: Cables for 6D6 and 6D7

Both data logger “6D6” and “6D7” use the same connector **but with different connection cables**. The cable to use with “6D6” is completely black and has no laser engraving on the pressure tube end.

The cable to use with “6D7” is marked with a red sleeve on the “DIRC II” end, and with a laser engraving on the pressure tube end.

7 Performance

Receiver type: 72-channel UHURA engine; GPS L1C/A, SBAS L1C/A, QZSS L1C/A, QZSS L1 SAIF, GLONASS L1OF, BeiDou B1I, Galileo E1B/C

Parameter	**Specification**					
Accuracy of time pulse sig	RMS 99%	30 ns 60 ns				
Frequency of time pulse sig		0.25 Hz to 10 MHz				
Operat. limits[1]	Dynamics Altitude Velocity	$\leq$ 4 g 50 000 m 500 m/s				
Velo. acc.[2] Head. acc.[2]		0.05 m/s 0.3 degrees				
GNSS		GPS	GLONASS & GPS	GLONASS	BeiDou	Galileo
Horizontal pos. acc.[3]		2.5m	2.5m	4m	3m	TBC[4]
Max navigation update rate		5 Hz	10 Hz	10 Hz	10 Hz	10 Hz
Time-To-First-Fix[5]	Cold start	26 s	29 s	30 s	34 s	45 s
	Hot start	1 s	1 s	1 s	1 s	1 s
	Aided starts[5]	2 s	2 s	2 s	3 s	7 s
Sensitivity[7]	Track & Nav	-164 dBm	-164 dBm	-163 dBm	-160 dBm	-154 dBm
	Reacquis.	-160 dBm	-159 dBm	-156 dBm	-155 dBm	-152 dBm
	Cold start	-148 dBm	-147 dBm	-145 dBm	-143 dBm	-133 dBm
	Hot start	-157 dBm	-156 dBm	-155 dBm	-155 dBm	-151 dBm

[1] Assuming Airborne < 4 g platform

[2] 50% at 30 m/s

[3] CEP, 50%, 24 hours static, -130 dBm, > 6 SVs

[4] To be confirmed when Galileo reaches full operational capability

[5] All satellites at -130 dBm, except Galileo at -127 dBm

[6] Dependent on aiding data connection speed and latency

[7] Demonstrated with a good external LNA

8 WARNING – READ THIS FIRST!

All personnel involved with the installation, operation, or maintenance of the equipment described in this manual should read and understand the warnings and recommendations provided below.

WARNING

This manual is a reference book only. It does not claim completeness and refers to other literature in certain chapters. This manual cannot and shall not substitute an instrument introduction through an expert. Programming and deployment of an autonomous deep-sea instrument is an utmost complex affair and require the detailed know-how of all components and their composition in order to guarantee successful operation. That's why we expressly recommend that solely trained personnel shall operate and maintain the instruments.

Static Sensitive Devices

This equipment contains devices that are extremely sensitive to static electrical charges. Therefore extreme care should be taken when handling them, as static electricity may be present on the body and clothing. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

High Voltages

High Voltage may be present in all parts of the UHURA & DIRC II. Use caution when the electronics are removed from their containers for servicing.

Improper Line Voltage

Operation with improper line voltage may cause serious damage to the equipment. Always ensure that the proper line voltage is used.

Hardware Variations and Compability

The UHURA & DIRC II contains both standard and proprietary hardware. At times K.U.M. may change the standard components due to their availability or performance improvements. Although the component manufacturers, along with their models and styles may change from unit to unit, replacement components will generally be interchangeable. K.U.M. will make every effort to see that replacement components are interchangeable. K.U.M. may also change certain hardware per customer requirements. Therefore, portions of this manual, such as parts lists and test features, are subject to change. These sections should be used for reference only. When changes are made that affect UHURA & DIRC II operation, they will be explicitly noted.

Purpose of this Manual

The purpose of this manual is to provide the user with information on the setup, operation, care, and features of the UHURA & DIRC II. Although this manual encompasses the latest operational features of the UHURA & DIRC II, some features of the UHURA & DIRC II may be periodically upgraded. Therefore the information in this manual is subject to change and should be used for reference only.

Warnings, Cautions, and Notes

Where applicable, warnings, cautions, and notes are provided in this manual as follows:

WARNING!
Identifies a potential hazard that could cause personal injury or death to yourself or to others.

CAUTION!
Identifies a potential hazard that could be damaging to equipment or could result in the loss of data.

NOTE:
Recommendations or general information that is particular to the material being presented. It may also refer to another part of this manual or to another manual.

Liability

K.U.M. has made every effort to document the UHURA & DIRC II in this manual accurately and completely. However, K.U.M. assumes no liability for errors or for any damages that result from the use of this manual or the equipment it documents. K.U.M. reserves the right to upgrade features of this software and to make changes to this manual without notice at any time.

Warranty statement

All equipment manufactured by K.U.M. is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by K.U.M. free of charge. Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty, and K.U.M. disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose, and there is no warranty of merchantability. This warranty applies only if:

- The items are used solely under the operating conditions and in the manner recommended in Seller's instruction manual, specifications, or other literature.
- The items have not been misused or abused in any manner, nor have repairs been attempted thereon without the approval of K.U.M. Customer Service.
- Written notice of the failure within the warranty period is forwarded to Seller and the directions received for properly identifying items returned under warranty are followed.
- The return notice authorizes Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall be warranted for the remaining portion of the original warranty period only.

Equipment not manufactured by K.U.M. is supported only to the extent of the original manufacturer's warranties.

Returned Material Authorization

Prior to returning any equipment to K.U.M., a Returned Material Authorization (RMA) number must be obtained. The RMA will help us identify your equipment when it arrives at our receiving dock and track the equipment while it is at our facility. The material should be shipped to the address provided in the K.U.M. Customer Service section. Please refer to the RMA number on all documents and correspondences as well. All returned material must be shipped prepaid. Freight collect shipments will not be accepted.

CAUTION! Never attempt to ship portable topside units in their outdoor case alone. Although rugged, these cases are not intended to be used as shipping containers, and the delicate internal components could be damaged if used in this manner.

All shipments must be accompanied by a copy of your proforma invoice, showing the value of the material and the reason for its return. When shippend from outside the European Union: If the reason is for repair, it must be clearly stated in order to move through customs quickly and without duties being charged. Whenever possible, please send copies of original export shipping documents with the consignment.

Final Disposal

The UHURA & DIRC II contains materials (especially batteries) that need proper disposal. Please contact customer service if your local disposal contractor is in doubt.

Customer Service

Customer service personnel at K.U.M. are always eager to hear from users of our products. Your feedback is welcome, and is a valuable source of information which we use to continually improve these products. Therefore we encourage you to contact K.U.M. Customer Service to offer any suggestions or to request technical support:

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