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## MULTI WATER SAMPLER MWS 12

CATALOGUE NO. 436 913

## OPERATION MANUAL

Edition 01/21

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## GENERAL DESCRIPTION

The **MULTI WATER SAMPLER MWS 12** is a 12-bottle version of the HYDRO-BIOS MULTI WATER SAMPLER. It consists of Deck Command Unit and a stainless steel Underwater Array to which 12 Plastic Water Samplers of 1,7 to 10 litres capacity can be mounted.

The dimensions of 110 cm diameter and 140 cm height with a weight of approx. 85 kg allow an easy handling even on small research vessels.

The **MULTI WATER SAMPLER MWS 12** is equipped with a motor-driven release device with integrated Pressure Sensor - the Water Samplers are closed in the succession of their mounting to the array (i.e. no. 1, 2, 3, ..., 12).

The connection between Deck Command Unit and Underwater Unit is made by a single- or multiconductor cable.

The Underwater Array with the opened water samplers is lowered to the greatest scheduled depth where the first water sampler is closed by push button control from the Deck Command Unit.

A signal from the Underwater Unit to the Deck Command Unit indicates the number of the just closed water sampler.

The next water samplers are actuated in the desired water depths during heaving.

Power supply of the Underwater Unit is made by 3 long-time lithium batteries placed in a removable battery housing with capacity sufficient for approx. 100 hours of operation. The Deck Command Unit is mains operated (85 - 260 V AC).

In case that the research vessel is not equipped with a single- or multiconductor cable, a special offline-version is available which can be programmed to actuate the water samplers in pre-selected depths steps.

An upgrade for the Motor Unit with different sensors of various parameters is available upon request.

Technical specifications of single- or multiconductor cable see page 5.

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## STANDARD EQUIPMENT

1. 1 Stainless steel Underwater Array,  
Motor Unit and Battery housing made of titanium,  
standard operational depth: 6000 metres  
1 integrated Depth Meter, standard measuring range: 6000 dbar
2. 1 Deck Command Unit with 4 plastic feet (can be pressed out from the  
inside of the Deck Command Unit), incl. mains cable
3. 1 Connecting cable (to slip ring box of winch), 3 metres long Fig. 1 C
4. 1 Test Run Cable, 30 metres long Fig. 1 D
5. 1 Counter Plug SUBCONN IL 2 F Fig. 1 A
6. 1 Spare O - ring 10 x 4 for axle duct Fig. 6 C
7. 1 Spare O - ring no. 020 for axle box case Fig. 6 E
8. 1 Spare O - ring no. 151 for pressure housing Fig. 6 H
9. 1 Spare O - ring no. 009 for switch shaft Fig. 6 J
10. 1 Spare O - ring no. 120 for Battery Housing
11. 1 Can O-ring lubricant
12. 1 Can pin lubricant
13. 3 Lithium batteries DURACELL DL 123 A / 3 V (or equivalent)
14. 1 Dummy SUBCONN DC 2 M Fig. 1 B
15. 1 Dummy SUBCONN DC 2 F Fig. 1 E
16. 1 Box spanner 10 mm
17. 1 Hexagon socket screw key 5 mm
18. 1 Hexagon socket screw key 3 mm
19. 1 Spare fuse (250 V AC / 0.5 A / fast) for conductor (Deck Command Unit)
20. 1 Spare fuse (125 V AC / 0.5 A / fast) for conductor (Underwater Unit)
21. 4 Screws to mount the Deck Command Unit into a 19"-rack
22. 1 Operating manual
23. 1 USB-Stick OceanLab

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## TECHNICAL DATA

### Underwater Array:

Frame dimensions: 110 cm dia. x 140 cm  
Weight: 85 kg

### Pressure Sensor (Depth Meter):

Standard: 0 - 3000 dbar  
Resolution: 0.1 dbar  
Accuracy (0...50°C): typ. < 0.1%

### Materials:

Underwater Array: Stainless steel  
Motor Unit: Titanium  
Battery housing: Titanium  
Water Samplers: PVC

### Operational Depth:

Standard: 3000 m

### Connector at Motor Unit:

Standard: SUBCONN MC BH 5 M

### Cable Counter Plug:

Standard: SUBCONN IL 2 F

### Deck Command Unit:

Metal housing for use in 19"-rack or as table-housing, not for use on deck (IP 20).  
Push button control for activating the water samplers.  
Supertwist LCD-module with LED backlight.  
Indication of sampler number, depth, battery, status.

### Power supply:

Underwater Unit: 3 Lithium Batteries type DL 123 A / 3 V or equivalent, capacity sufficient for approx. 100 hours of operation.  
Deck Command Unit: 85 - 260 V AC / 50 - 60 Hz

### Data Transmission:

Frequency shift keying (FSK), 1200 baud, 5 V / 10 mA  
Short circuit protection, ESD protection.

### Operating temperature:

Motor Unit: - 40...+ 85°C  
Deck Command Unit: 0 ... + 70°C

### Cable connection:

Single- or multiconductor cable, one pole can be in contact with sea water.  
Minimum breaking load 3500 kg.  
Cable resistance (go and return line) max. 1000 Ohms.

**The single- or multiconductor cable is not included in our scope of delivery!**

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## ELECTRICAL CONNECTION DECK COMMAND UNIT / UNDERWATER UNIT

1. The connection between Deck Command Unit and Underwater Unit is made by a single- or multiconductor cable. **This cable is not included in our scope of delivery.**
2. The minimum breaking load of the cable shall be 3500 kg.
3. The cable resistance (go and return line) should not exceed 1000 Ohms.
4. Single conductor cable (one core isolated and one outer steel armor):  
The isolated core of the cable has to be connected to the white core of PIN 2 of the connector SUBCONN IL 2 F (Fig. 1 A), the outer steel armor of this cable has to be connected to the black core of PIN 1.
5. Multi conductor cable:  
Any two cores of this cable are connected to the cores of the supplied connector SUBCONN IL 2 F (Fig. 1 A).
6. When the existing single- or multiconductor cable is already equipped with an underwater connector, the supplied plug SUBCONN IL 2 F (Fig. 1 A) has to be combined with a corresponding counter plug of the existing plug-in connection to a cable adaptor.
7. The cable connection of the other end of the single- or multiconductor cable to the Deck Command Unit (via slip rings at the cable winch) is made by using the connecting cable (Fig. 1 C). The core connected to PIN 1 of the connector IL 2 F (Fig. 1 A) has to be connected to the brown core of the connecting cable (Fig. 1 C). The core connected to PIN 2 of the connector SUBCONN IL 2 F (Fig. 1 A) has to be connected to the blue core of the connecting cable (Fig. 1 C).
8. When the single- or multiconductor cable is not used, the connector SUBCONN IL 2 F (Fig. 1 A) should always be protected by the DUMMY SUBCONN DC 2 M (Fig. 1 B) to avoid corrosion of the contacts. Beforehand the contacts should be slightly greased with the special PIN-lubricant.

**The connection of the SUBCONN connector to the single- or multiconductor cable  
has to be made with greatest care.**

**Most malfunctions are caused by cable connecting faults!**

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## PREPARATION FOR OPERATION

1. The Deck Command Unit has to be brought into a dry room.  
**An operation on deck is not allowed!**
2. The main switch **POWER** of the Deck Command Unit has to be switched into position **0** (Fig. 4 B).
3. Switch lever switch at the outside of the Motor Unit into position **0** (Fig. 2 F).
4. Remove changeable rack no. 12 (Fig 3 K) from the array. Tool: Spanner 10 mm
5. Unplug the cable connection between Battery Housing and Motor Unit.
6. Loosen the Battery Housing from the Motor Unit by screwing the star grip screw counter-clockwise.
7. Bring the Battery Housing into a dry room.
8. Unscrew the union nut from the Battery Housing and remove pressure tube.
9. Place 3 lithium batteries DURACELL DL 123 A / 3 V or equivalent into the battery holders. Take care of **correct polarity**. Secure all batteries with retainer covers.
10. Make sure that the sealing surface in the pressure tube is clean. If necessary use a lintfree cloth for cleaning.  
**Do not use absorbent cotton!**
11. Slightly grease the sealing surface in the pressure tube with O-ring lubricant.
12. Make sure that the O-ring in the flange is clean and uninjured. If necessary use a lintfree cloth for cleaning.
13. If the O-ring is defective, use a blunt tool (e.g. ball point pen cartridge or a piece of wood) to take the O-ring out of the groove.  
**Take care that the groove in the flange will not be damaged!**
14. Make sure that the groove in the flange is clean and uninjured. If necessary use a lintfree cloth for cleaning.  
**Do not use absorbent cotton!**
15. Slightly grease a spare O-ring no. 120 with O-ring lubricant.
16. Put the greased O-ring into the groove of the flange.
17. Carefully press the flange into the pressure tube.
18. Fasten the flange at the pressure tube with the plastic union nut.
19. Slightly grease the pins of the underwater connectors with pin lubricant.
20. Re-establish the electrical connection between Battery Housing and Motor Unit.
21. Place the Battery Housing in its seat at the Motor Unit.
22. Fix the Battery Housing at the Motor Unit with the star grip screw.  
**Do not use any tool!**
23. Batteries have to be changed when battery voltage falls below 7 V (See DECK COMMAND UNIT, page 8).
24. Remount changeable rack no. 12 to the array (Fig. 3 K). Tool: Spanner 10 mm

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## DECK COMMAND UNIT: COMPONENTS AND MAIN SCREEN

The Deck Command Unit is equipped with the following components:

1. Socket for mains cable with integrated mains fuse (250 V AC / 2 A / slow) located at rear side of the housing (Fig. 4 A).
2. Main switch **POWER**, illuminated (Fig 4 B).
3. Socket **UNDERWATER UNIT** to connect the Underwater Unit via Test Run Cable resp. single or multi conductor cable (Fig. 4 C).
4. Socket **PERSONAL COMPUTER SERIAL PORT** (Fig. 4 D) to connect a PC.
5. Push button **ACTION** (Fig. 4 E) to actuate the water samplers in the succession of their mounting to the array.
6. Keyboard **MENU + - ENTER** for menu control (Fig. 4 F).
7. Alphanumeric display (four lines, 40 characters each) with backlight (Fig. 4 G).
8. Regulating screw **CONTRAST** to adjust the contrast of the alphanumeric display, located at rear side of the housing (Fig. 4 A).
9. Fuse (250 V AC / 0.5 A / fast) for CONDUCTOR, located at rear side of the housing.

The following screens are displayed at the alphanumeric display:

### MAIN SCREEN:

The main screen appears when Deck Command Unit and Underwater Unit are switched on and a correct cable connection has been established.

MULTI WATER SAMPLER 12 bottles / 6000m
UNDERWATER UNIT: MOTOR RUNS
PRESS 0180.5 dbar                      BOTTLE 01 closed
BATTERY 9.6 V

The first line of the main screen indicates the connected underwater equipment incl. the range of the integrated depth meter.

**To avoid damages do not exceed the maximum operational depth of the depth meter.**

The second line indicates:

**UNDERWATER UNIT: MOTOR RUNS** Current activating process of a sampler.

**UNDERWATER UNIT: END OF OPERATION** The last sampler has been activated.

During the rest of operation the second line is used as display for messages (see below).

The third line of the main screen includes:

**PRESS 0180.5 dbar** actual pressure value of the integrated Pressure Sensor.

**BOTTLE 01 closed** the number of the last closed water sampler.

The fourth line of the main screen indicates:

**BATTERY 9.6 V** the actual battery voltage of the Underwater Unit.

The batteries should be changed when the battery voltage falls below 7 V during a period with inactive motor. Upon reaching a battery voltage of less than 1.5 V the Underwater Unit will be switched off automatically. A restart requires a new set of batteries.

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## DECK COMMAND UNIT: ERROR MESSAGES AND MENU SCREEN

### ERROR MESSAGES:

The following error messages will be displayed in the **second line** of the display only:

**UNDERWATER UNIT: NO DATA** No data received from the Underwater Unit:

The Motor Unit is switched off or not connected, or the batteries of the Motor Unit are exhausted, or the cable connection between Deck Command Unit and Motor Unit is interrupted.

**UNDERWATER UNIT: INVALID DATA** data received from the Underwater Unit are invalid:

The connected Motor Unit is not compatible with the Deck Command Unit.

**SINGLE CONDUCTOR CABLE: SHORT CIRCUIT** short-circuit detected in the cable connection between Deck Command Unit and Motor Unit.

### MENU SCREEN:

To call the main menu screen press **MENU** key of the keyboard:

MENU	>	QUIT MENU
		MANUAL MOTOR CONTROL
SELECT: +/-		RESET BOTTLE NUMBER
START: ENTER		RESET PRESSURE SENSOR

The left column of the main menu screen includes:

**MENU** Indication for main menu.

**SELECT: +/-** To select a menu item press **+** or **-** key.

By pressing the **+** key the marker **>** will be moved to the line below, by pressing the **-** key the marker **>** will be moved to the previous line.

**START: ENTER** To enter the selected menu press **ENTER** key.

The right column of the main menu screen includes the following menu items:

**QUIT MENU** To quit menu screen and return to main screen.

**MANUAL MOTOR CONTROL** (accessible with Motor Unit connected only) to start out a short motor run (1/2 revolution of the motor axle) and to set the bottle number to **0**, used to synchronize Motor Unit with Deck Command Unit.

**RESET BOTTLE NUMBER** (accessible with Motor Unit connected only) to set the bottle number to **0**, used to synchronize Motor Unit with Deck Command Unit.

**RESET PRESSURE SENSOR** (accessible with Motor Unit connected only) to recalibrate the Pressure Sensor. Use menu item whilst Underwater Unit stands on deck at temperatures from +5°C to +35°C only.

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## DECK COMMAND UNIT: QUIT MENU MANUAL MOTOR CONTROL

### MENU ITEM: QUIT MENU:

Call this menu item to quit the menu screen and to return to the main screen.

### MENU ITEM: MANUAL MOTOR CONTROL:

MANUAL MOTOR CONTROL START MOTOR: PRESS ENTER MOTOR TURNS QUIT: MENU
---

**MANUAL MOTOR CONTROL** Indication of menu item.

**START MOTOR: PRESS ENTER** To start out a short motor run (1/2 revolution of the motor axle) press the **ENTER** key. Additionally the bottle number is set to **0**. will be displayed for approx. 1.5 sec. after pressing the **ENTER** key.

**MOTOR TURNS**

**QUIT: MENU**

To quit menu item (without or after carrying out a short motor run) and return to menu screen press **MENU** key.

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## DECK COMMAND UNIT: RESET BOTTLE NUMBER RESET PRESSURE SENSOR

### MENU ITEM: RESET BOTTLE NUMBER:

RESET BOTTLE NUMBER SET NUMBER TO ZERO: PRESS ENTER BOTTLE = 00 QUIT: MENU
---

**RESET BOTTLE NUMBER** Indication of menu item.

**SET NUMBER TO ZERO: PRESS ENTER** To reset the bottle number press **ENTER**.

**BOTTLE = 00** Return signal from the Underwater Unit after pressing **ENTER** key.

**QUIT: MENU** To quit menu item and return to menu screen press **MENU** key.

### MENU ITEM: RESET PRESSURE SENSOR:

RESET PRESSURE SENSOR SET PRESSURE TO ZERO: PRESS ENTER PRESSURE = 0000.0 dbar QUIT: MENU
--

**RESET PRESSURE SENSOR** Indication of menu item.

**SET PRESSURE TO ZERO: PRESS ENTER** To recalibrate the Pressure Sensor press the **ENTER** key.

Use menu item whilst Underwater Unit stands on deck at temperatures from +5°C to +35°C and has reached surrounding temperature only.

**The recalibration is irreversible!**

**PRESSURE = 0000.0 dbar** Return signal from the Underwater Unit after pressing **ENTER** key.

**QUIT: MENU** To quit menu item and return to menu screen press **MENU** key.

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## FIRST TEST RUN

In order to control the function of the Deck Command Unit and the Underwater Unit the following steps are to be carried out:

### THE WATER SAMPLERS MUST NOT BE OPENED FOR THE TEST RUN !

1. The Deck Command Unit has to be switched off, the main switch **POWER** (Fig. 4 B) is not illuminated.
2. The lever key of the Underwater Unit has to be switched to position **O** (Fig. 2 F).
3. Connect the Test Run Cable (Fig. 1 D) to the Deck Command Unit (Fig. 4 C).
4. Remove the dummy DC 2 F from the Underwater Unit (Fig. 1 E).
5. Slightly grease the pins of the connector BH 2 M (Fig. 2 A) of the Underwater Unit with the PIN-lubricant.
6. Connect the Test Run Cable (Fig. 1 D) to the Underwater Unit (Fig. 2 A).
7. Lift the striking bar **J** of the rack no. **1** and put rope **D** with the plastic ball **C** into the corresponding slit no. **1** (Fig. 2, Fig. 3).
8. Repeat this procedure for racks no. **2** to no. **12**.
9. Switch on the Deck Command Unit, the main switch **POWER** is illuminated (Fig. 4 B), the display indicates: **UNDERWATER UNIT: NO DATA**
10. The lever key of the Underwater Unit has to be switched to position **I** (Fig. 2 F), the main screen appears at the display of the Deck Command Unit.

MULTI WATER SAMPLER 12 bottles / 6000 m	
PRESS 0000.0 dbar	BOTTLE 00 closed
BATTERY 9.6 V	

11. Now press push button **ACTION** at the Deck Command Unit (Fig. 4 E). The second line of the display indicates with **UNDERWATER UNIT: MOTOR RUNS** the current activating process of the first water sampler. After 2 seconds the indication of the bottle number is updated: **BOTTLE 01 closed**. One second later the activating process of the first water sampler is completed, the text in the second line of the display disappears.
12. The procedure (as described in point 11.) has to be repeated another 11 times. Finally the second line of the display indicates with **UNDERWATER UNIT: END OF OPERATION** that a complete operation has been simulated. The release block (Fig. 2 B) is now again between slit no. **1** and no. **12** (Fig. 2).
13. Switch off Underwater Unit (Fig. 2 F) and Deck Command Unit (Fig. 4 B).
14. Remove the Test Run Cable (Fig. 1 D).

When a **SECOND TEST RUN** of the **MULTI WATER SAMPLER MWS 12** is not intended, plug the dummy DC 2 F (Fig. 1 E) onto the connector BH 2 M (Fig. 2 A) and plug the dummy DC 2 M (Fig. 1 B) into the connector IL 2 F (Fig. 1 A) of the single or multi conductor cable. Beforehand the contacts should be slightly greased with the special Pin-lubricant.

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## SECOND TEST RUN

In order to control the function of the Deck Command Unit and the Underwater Unit together with the single or multi conductor cable the following steps are to be carried out:

### THE WATER SAMPLERS MUST NOT BE OPENED FOR THE TEST RUN !

1. The Deck Command Unit has to be switched off, the main switch **POWER** (Fig. 4 B) is not illuminated.
2. The lever key of the Underwater Unit has to be switched to position **O** (Fig. 2 F).
3. Connect the connection cable from the slip ring box of the winch (Fig. 1 C) to the Deck Command Unit (Fig. 4 C).
4. Slightly grease the pins of the connector BH 2 M (Fig. 2 A) of the Underwater Unit with the PIN-lubricant.
5. Connect the single or multi conductor cable (Fig. 1 A) to the Underwater Unit (Fig. 2 A).
6. Lift the striking bar **J** of the rack no. **1** and put rope **D** with the plastic ball **C** into the corresponding slit no. **1** (Fig. 2, Fig. 3).
7. Repeat this procedure for racks no. **2** to no. **12**.
8. Switch on the Deck Command Unit, the main switch **POWER** is illuminated (Fig. 4 B), the display indicates: **UNDERWATER UNIT: NO DATA**
9. The lever key of the Underwater Unit has to be switched to position **I** (Fig. 2 F), the main screen appears at the display of the Deck Command Unit.

MULTI WATER SAMPLER 12 bottles / 6000 m	
PRESS 0000.0 dbar	BOTTLE 00 closed
BATTERY 9.6 V	

10. Now press push button **ACTION** at the Deck Command Unit (Fig. 4 E). The second line of the display indicates with **UNDERWATER UNIT: MOTOR RUNS** the current activating process of the first water sampler. After 2 seconds the indication of the bottle number is updated: **BOTTLE 01 closed**. One second later the activating process of the first water sampler is completed, the text in the second line of the display disappears.
11. The procedure (as described in point 10.) has to be repeated another 11 times. Finally the second line of the display indicates with **UNDERWATER UNIT: END OF OPERATION** that a complete operation has been simulated. The release block (Fig. 2 B) is now again between slit no. **1** and no. **12** (Fig. 2).
12. Switch off Underwater Unit (Fig. 2 F) and Deck Command Unit (Fig. 4 B).

When an operation of the **MULTI WATER SAMPLER MWS 12** is not intended, the single or multi conductor cable has to be removed. To avoid corrosion of the contacts, plug the dummy DC 2 F (Fig. 1 E) onto the connector BH 2 M (Fig. 2 A) and plug the dummy DC 2 M (Fig. 1 B) into the connector IL 2 F (Fig. 1 A) of the single or multi conductor cable. Beforehand the contacts should be slightly greased with the special Pin-lubricant.

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## OPERATION

When the connector IL 2 F has been attached to the single or multi conductor cable newly resp. when a new cable adapter has been produced, a continuous supervision of the display of the Deck Command Unit is recommended during the first operation. Upon receiving an error message (see page 9) switch off the Deck Command Unit and recover the instrument immediately. The localization and repair of faults will be made according to chapter LOCALIZATION OF FAULTS, page 16.

1. When the **MULTI WATER SAMPLER** has not been operated for a longer period, a **SECOND TEST RUN** acc. to page 13 should be carried out to control proper functioning of the system.
2. The Deck Command Unit has to be switched off, the main switch **POWER** (Fig. 4 B) is not illuminated.
3. The lever key of the Underwater Unit has to be switched to position **O** (Fig. 2 F).
4. Lift the striking bar **J** of the rack no. **1** and put rope **D** with the plastic ball **C** into the corresponding slit no. **1** (Fig. 2, Fig. 3).
5. Repeat this procedure for racks no. **2** to no. **12**.
6. The Water Samplers are opened as described on the label (Fig. 5). Carry out **step 1** and **step 2**, **step 3** is not applicable.
7. Switch on the Deck Command Unit, the main switch **POWER** is illuminated (Fig. 4 B), the display indicates: **UNDERWATER UNIT: NO DATA**
8. The lever key of the Underwater Unit has to be switched to position **I** (Fig. 2 F), the main screen appears at the display of the Deck Command Unit.

MULTI WATER SAMPLER 12 bottles / 6000 m	
PRESS 0000.0 dbar	BOTTLE 00 closed
BATTERY 9.6 V	

9. The Underwater Unit is lowered to the greatest scheduled depth, the winch has to be stopped.
10. To close the first water sampler press push button **ACTION** at the Deck Command Unit (Fig. 4 E). The second line of the display indicates with **UNDERWATER UNIT: MOTOR RUNS** the current activating process of the first water sampler. 2 seconds later the indication of the bottle number is updated: **BOTTLE 01 closed**. After one more second the activating process of the first water sampler is completed, the text in the second line of the display disappears.
11. The Underwater Unit has to be heaved by the winch to the next sampling depth.
12. The winch has to be stopped again and the next water sampler is closed as described in point 10.
13. This procedure has to be repeated for water samplers no. **3** up to no. **12**
14. Switch off Underwater Unit (Fig. 2 F) and Deck Command Unit (Fig. 4 B) when the Underwater Unit is back on board.

The single or multi conductor cable must not be removed from the Underwater Unit when more than one operation is planned during an expedition.

When a further operation of the **MULTI WATER SAMPLER MWS 12** is not intended, the single or multi conductor cable has to be removed. To avoid corrosion of the contacts, plug the dummy DC 2 F (Fig. 1 E) onto the connector BH 2 M (Fig. 2 A) and plug the dummy DC 2 M (Fig. 1 B) into the connector IL 2 F (Fig. 1 A) of the single or multi conductor cable. Beforehand the contacts should be slightly greased with the special Pin-lubricant.

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## REMOVAL AND MOUNTING INSTRUCTIONS FOR THE MOTOR

When the motor of the Underwater Unit has to be removed for repair resp. maintenance, the following steps have to be carried out:

### Removal

1. Remove the Test Run Cable resp. single or multi conductor cable from the Underwater Unit.
2. Unscrew 3 hexagon socket screws M 6 (Fig. 2 G). and remove the motor housing.  
Tool: Hexagon Socket Screw Key 5 mm

### Mounting

The Underwater Unit does only work properly, when the synchronization between motor and gearing has been established. The synchronization is not in order, when

- a) the driving toothed wheel of the motor has been turned electrically or mechanically in dismounted condition
- b) the the red releaser is not positioned between slit no. **1** and no. **12** of the basic ring (Fig. 2 B)

In order to re-establish the synchronization before mounting, the following steps have to be carried out:

1. Connect the Test Run Cable (Fig. 1 D) to the Deck Command Unit (Fig. 4 C).
2. Connect the Test Run Cable (Fig. 1 D) to the removed motor housing (Fig. 2 A).
3. Switch on the Deck Command Unit, the main switch **POWER** is illuminated (Fig. 4 B), the display indicates :

#### **UNDERWATER UNIT: NO DATA**

4. The lever key of the motor housing has to be switched to **I** (Fig. 2 F), the main screen appears at the display of the Deck Command Unit (see DECK COMMAND UNIT, page 8).
5. Press the **MENU** key to call the main menu screen.
6. Select menu item **MANUAL MOTOR CONTROL** by pressing the **+** key and enter the menu item by striking the **ENTER** key.
7. Press **ENTER** key again to carry out a short motor run (half revolution of the motor axle) and to set the bottle number to zero.
8. Return to the main menu screen by pressing **MENU** key.
9. Select menu item **QUIT MENU** and return to the main screen by pressing the **ENTER** key.
10. The motor is synchronized and ready for remounting.
11. The red releaser block is to be turned by hand until it is positioned between slit no. **1** and no. **12** of the basic ring (Fig. 2 B).
12. Now the motor is mounted with the 3 hexagon socket screws M 6 onto the gear box without distorting the position of the red releaser block.  
Tool: Hexagon Socket Screw Key 5 mm
13. Carry out a **FIRST TEST RUN** (see page 12).

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## LOCALIZATION OF FAULTS

In order to localize the reason for a fault, comply with the following instructions.

After switching on the Deck Command Unit the main switch **POWER** (Fig. 4 B) is not illuminated, the display is empty:

1. Mains cable is not (or not correct) connected to the socket at the rear side of the Deck Command Unit or the mains supply. Check these connections.
2. Integrated main fuse burnt out. Disconnect the mains cable from the Deck Command Unit. Change main fuse (250 V AC / 2 A / slow) located in the posterior partition of the drawer (reserve fuse in the anterior partition) below the mains cable connector at the rear side of the Deck Command Unit.
3. Mains cable is defective, it has to be replaced.
4. No voltage at the mains socket. Check mains socket, line and mains supply.

Error message **UNDERWATER UNIT: NO DATA** occurs:

1. Underwater Unit is not connected. Check the connection at Deck Command Unit and Underwater Unit.
2. Underwater Unit is switched off. Switch on the Underwater Unit.
3. Batteries of the Underwater Unit are exhausted. Insert a new set of batteries (see PREPARATION FOR OPERATION, page 7).
4. The cable between Deck Command Unit and Underwater unit is broken. To localize cable faults comply with the instructions below.
5. The integrated fuses of Deck Command Unit (250 V AC / 0,5 A / fast, located at the rear side of the housing) and Underwater Unit (125 V AC / 0,5 A / fast, located at the electronics board) for the CONDUCTOR are burnt out. They have to be replaced.

Error message **SINGLE CONDUCTOR CABLE: SHORT CIRCUIT** occurs:

1. The cable connection between Deck Command Unit and Underwater Unit has wrong polarity. Both cores have to be interchanged (compare to ELECTRICAL CONNECTION DECK COMMAND UNIT / UNDERWATER UNIT, page 6).
2. The cable connection between Deck Command Unit and Underwater Unit has a short circuit. To localize cable faults comply with the instructions below.

Error message **UNDERWATER UNIT: INVALID DATA** occurs:

1. The received data are not valid, the Deck Command Unit does not support the connected Underwater Unit. Use correlated Underwater Unit.

### **MOST MALFUNCTIONS ARE CAUSED BY CABLE FAULTS !**

In order to localize a cable fault comply with the following instructions:

1. Check the connection between the plug SUBCONN IL 2 F (Fig. 1 A) and the single or multi conductor cable (and check the cable adapter if used).  
**90% of all faults are found here !**
2. Check the connection from single or multi conductor cable to the slip rings of the cable winch.
3. Check the slip rings of the cable winch.
4. Check the cable connection between cable winch and Deck Command Unit.

After localization and removal of faults carry out a **SECOND TEST RUN** (page 13) for control purposes. When the **SECOND TEST RUN** has been completed successfully, the **MULTI WATER SAMPLER MWS 12** is ready for operation again.

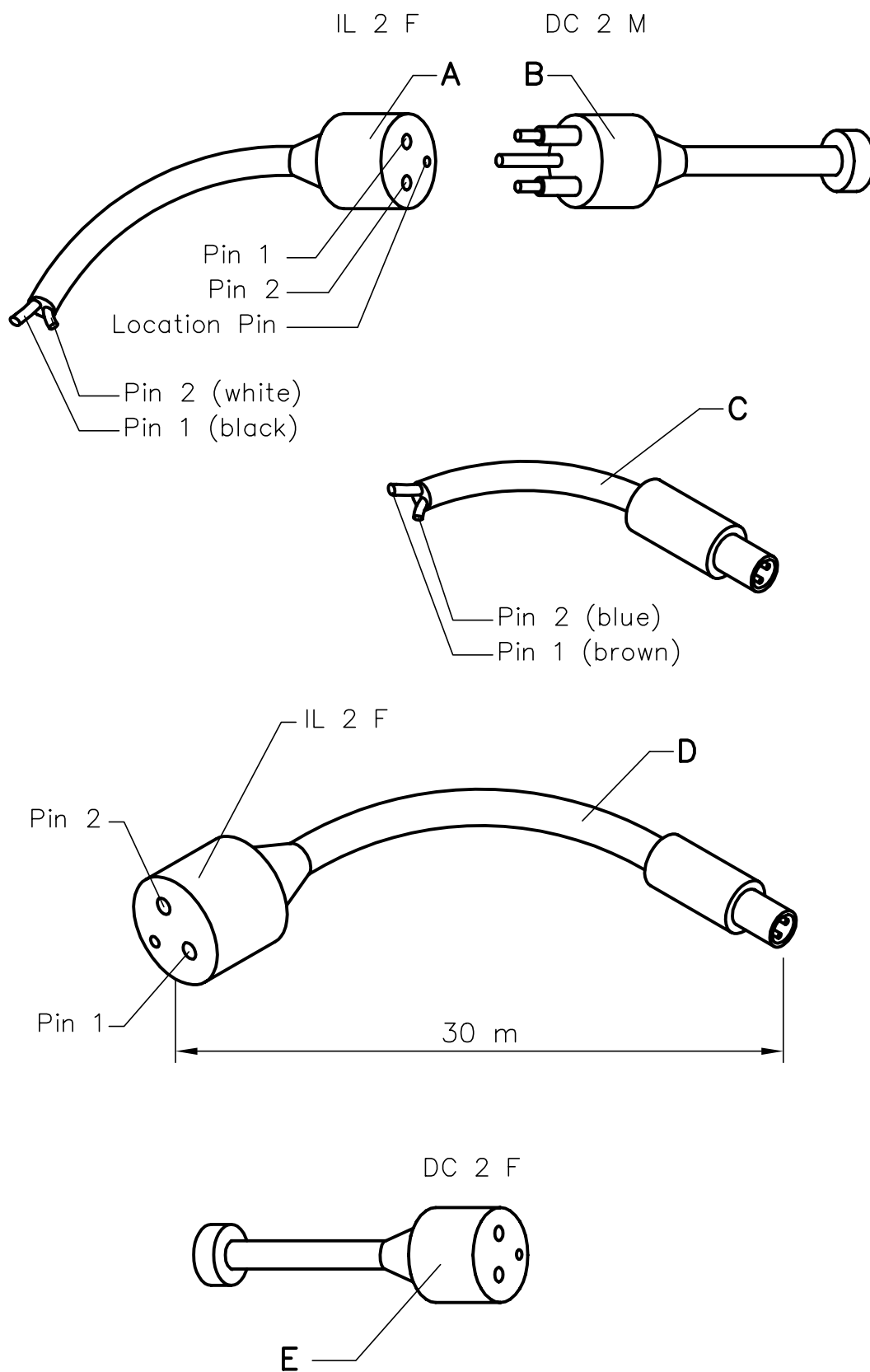


Fig. 1

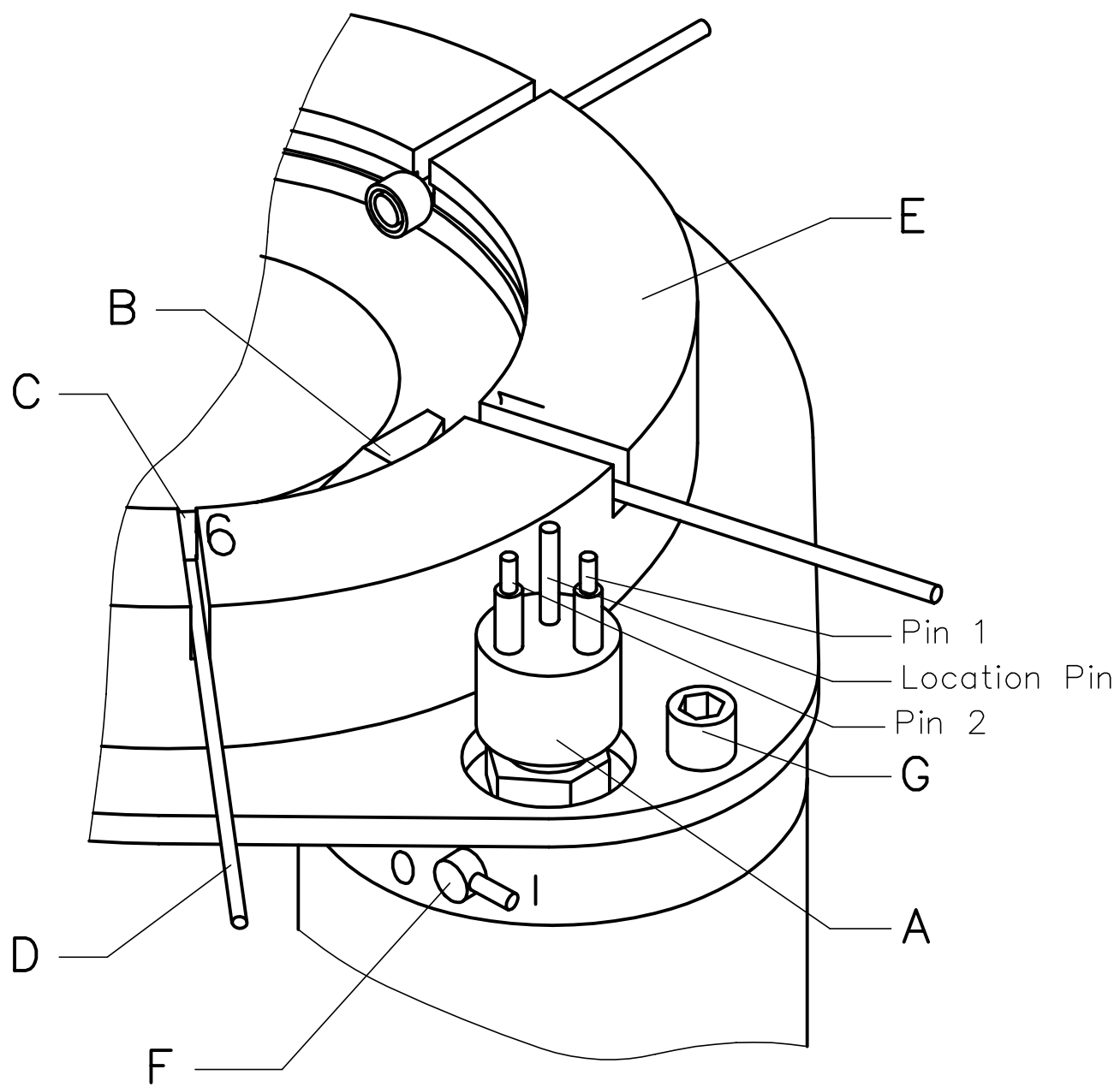


Fig. 2

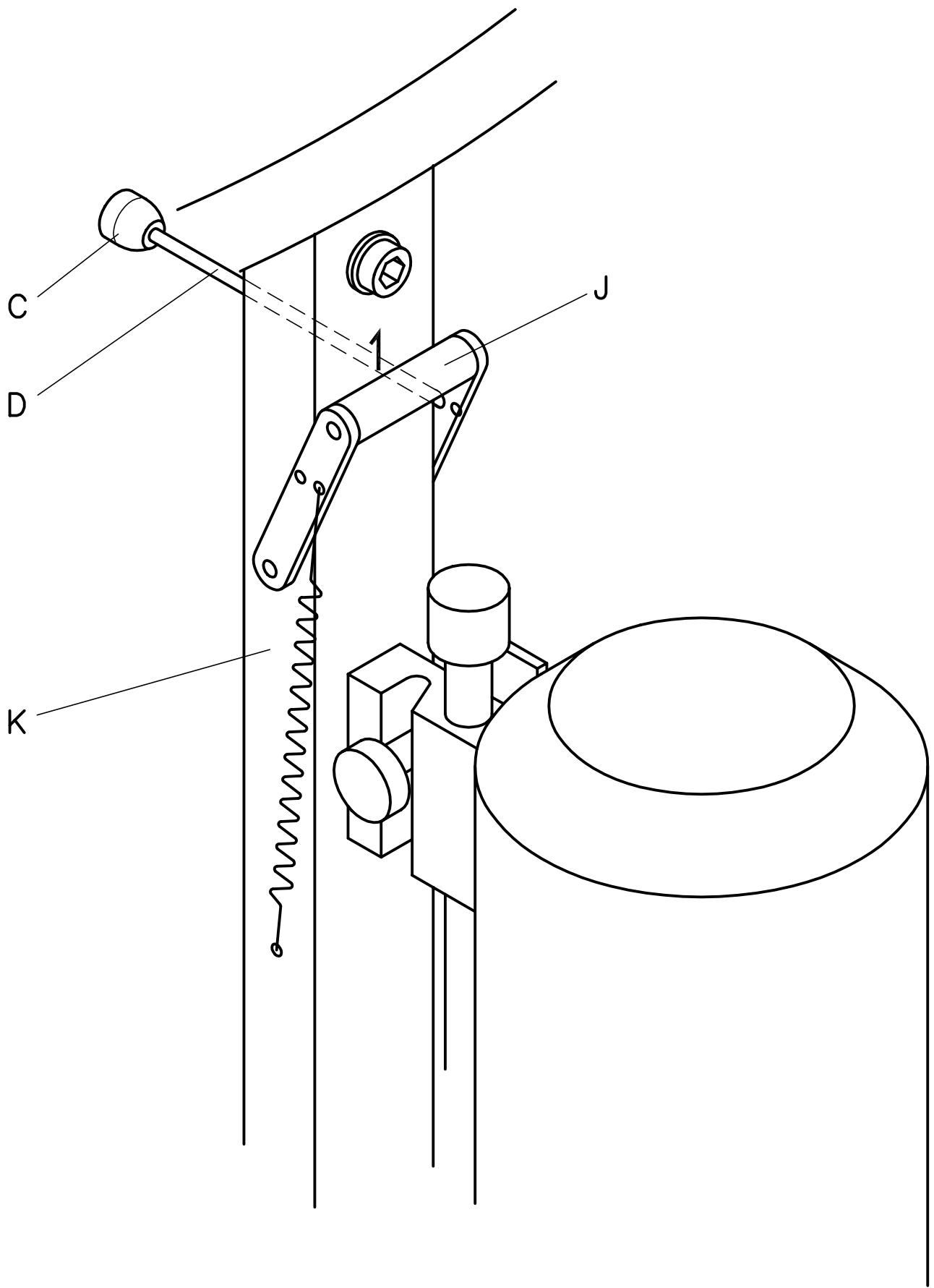


Fig. 3

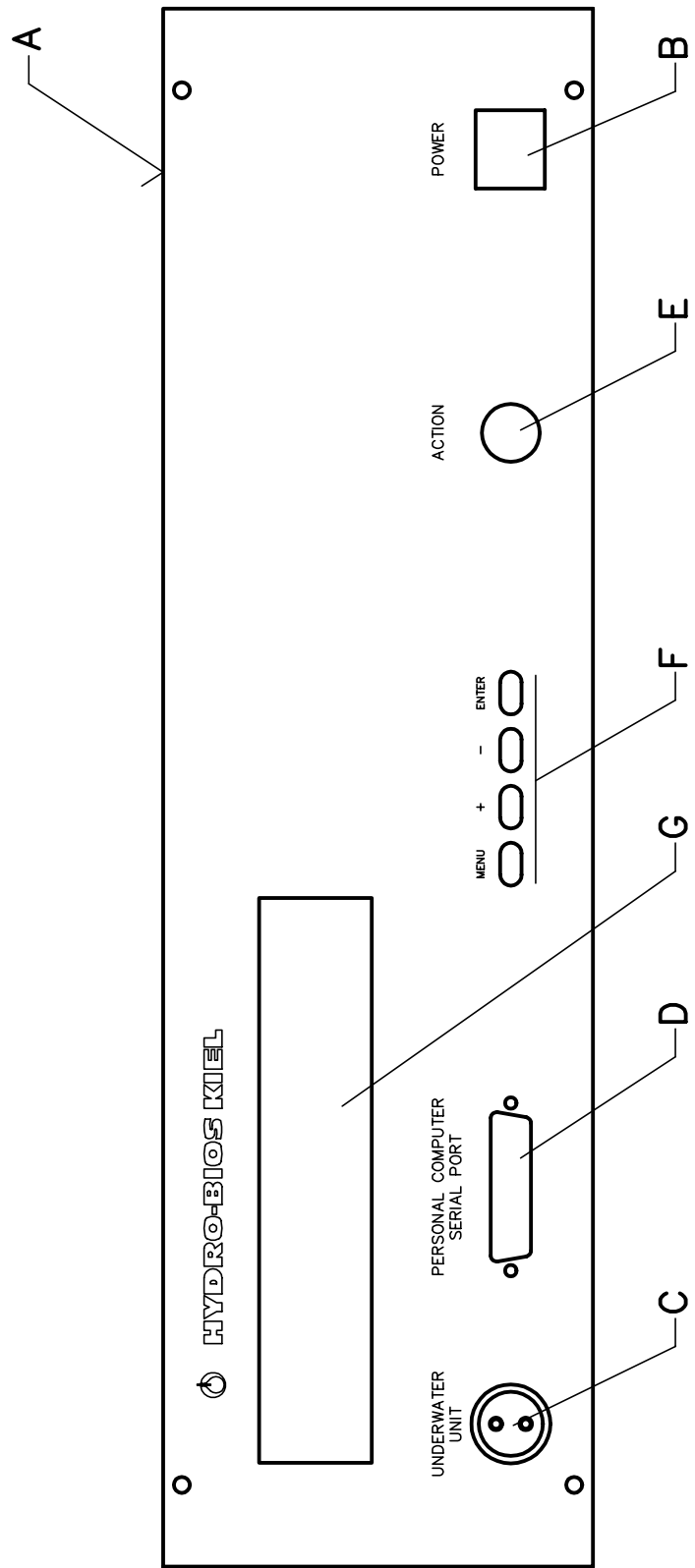
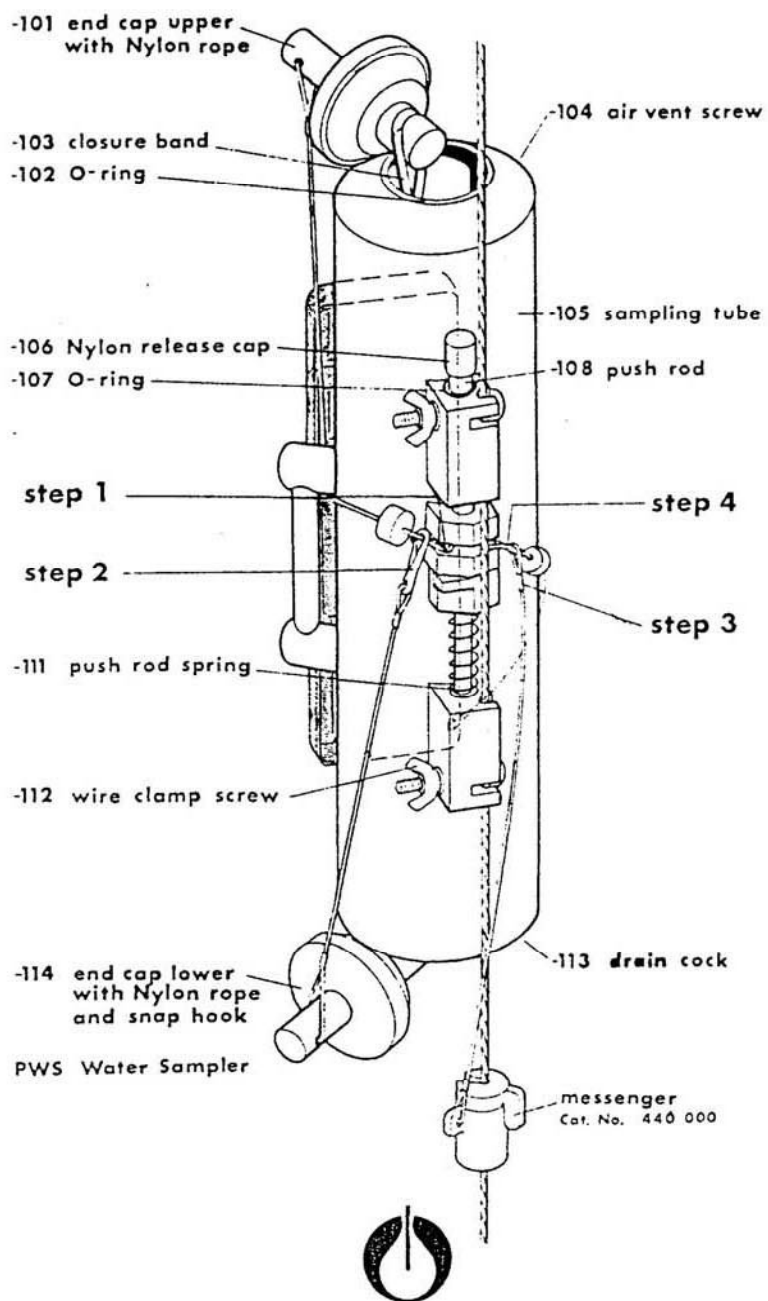


Fig. 4

**DON'T CLOSE WATERSAMPLER ON AIR!**



**HYDRO-BIOS KIEL**

**Fig. 5**

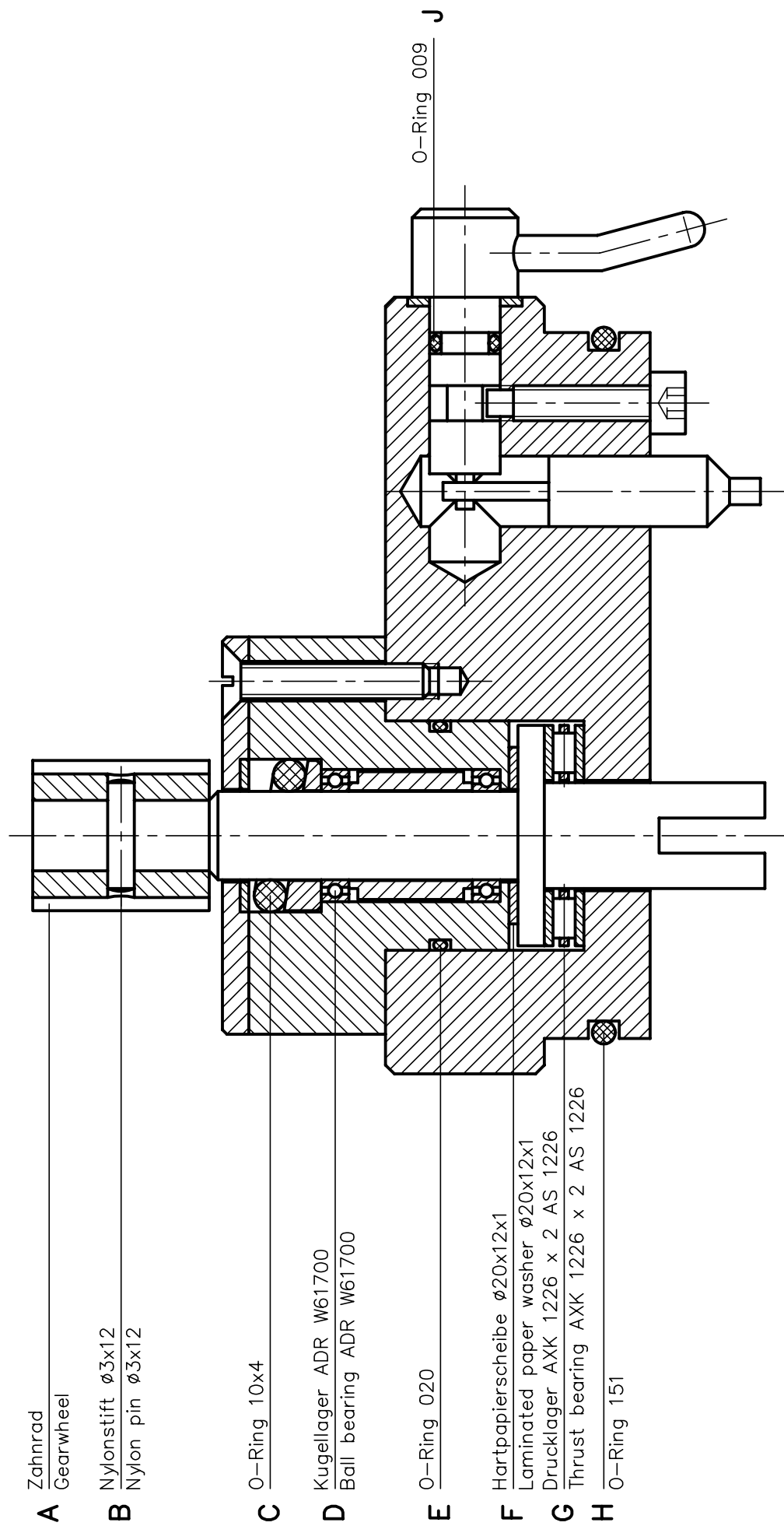


Fig. 6

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## CT-SET FOR MULTI WATER SAMPLER MWS

### OPERATION MANUAL

Edition 10/16

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## GENERAL DESCRIPTION

The **CT-SET FOR MULTI WATER SAMPLER MWS** is the basic set of sensors offering the full capability of an oceanographic Multi Parameter Probe for a **MULTI WATER SAMPLER MWS**.

It consists of one conductivity sensor, one temperature sensor and an additional electronics board which are integrated into the Motor Unit. Together with the pressure sensor of the **MULTI WATER SAMPLER MWS** the **CT-Set** delivers precise standard parameters for oceanographic measurements of physical values.

Long-term stability in combination with high accuracy and a wide range of options makes the **CT-Set** the ideal basis for an integrated sampling and measuring system.

The built-in 16 bit high performance A/D converter in standard version allows the simultaneous measurement with up to 8 sensors of various physical, chemical and optical parameters.

For operations of the **MULTI WATER SAMPLER MWS** with a steel wire (no single or multi conductor cable available) an **OFFLINE-Set** with PC programmable depth depending sampling intervals is available as option.

The measuring data of the **CT-Set** are completely integrated into the Deck Command Unit of and the data acquisition software **OceanLab**. From the CTD data **OceanLab** computes salinity, density and sound velocity according to UNESCO formulas.

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## STANDARD EQUIPMENT

1. 1 Conductivity sensor, mounted to the back lid of the Motor Unit
2. 1 Temperature sensor, mounted to the back lid of the Motor Unit
3. 1 Electronics board, integrated into the Motor Unit
4. 2 Spare O-rings 16 x 1.5 for sensor flange
5. 1 Protecting cage, mounted to the back lid of the Motor Unit
6. 1 Additional LC-display, integrated into the Deck Command Unit

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## TECHNICAL DATA

### CONDUCTIVITY SENSOR:

Measuring principle: 7-pole electrode cell  
Range: 0 ... 65 mS/cm  
Accuracy:  $\pm 0.01$  mS/cm  
Response time: 100 msec. at a flow rate of 0.5 m/sec.  
Maximum pressure: 3000 dbar

The conductivity sensor consists of a quartz glass cylinder with 7 platinum coated electrodes. The cell is constructed symmetrically. The central electrode is used as power input (alternating current of 1 kHz) and both outer electrodes are used as return leads. The electrical field in a homogenous medium is symmetrically divided at both half cells. The respective inner pair of electrodes of each half cell measures the voltage drop.

### TEMPERATURE SENSOR:

Measuring principle: Pt 100  
Range:  $-2^{\circ}\text{C}$  ...  $+32^{\circ}\text{C}$   
Accuracy:  $\pm 0.005^{\circ}\text{C}$   
Response time: approx. 150 msec.  
Maximum pressure: 3000 dbar

The temperature sensor is a platinum resistor Pt 100 in a tiny ceramic carrier of 15 mm length and 0.9 mm diameter. It is fitted in a slender titanium tube of 1.2 mm diameter and a length of approx. 30 mm. This delicate tip is resistant to a pressure of 3000 dbar but is extremely sensitive to knocks and inflection. Therefore the tip is surrounded by a perforated titanium shield tube which is mounted to the back flange of the Motor Unit.

The platinum resistor is connected in 4-wire technique.

### POWER SUPPLY:

No extra power supply requested. The CT-Set is powered by the 3 Lithium batteries type DURACELL DL 123 A / 3V (or equivalent) of the Motor Unit.

The capacity of one set of batteries is sufficient for approx. 40 hours of continuous operation.

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## SERVICE AND MAINTENANCE

The best maintenance for the CT-Set is to handle it with care. Despite the fact that the complete instrument is a substantial construction, extreme shocks should be avoided. Apart from that, there are only few instructions and maintenance rules to be observed ensuring a long life-span and precise measuring data.

To avoid corrosion and salt incrustation the complete **MULTI WATER SAMPLER MWS**, with special care for the Motor Unit and the sensors, should be rinsed with fresh water after use.

### CONDUCTIVITY SENSOR

The conductivity sensor in principal is not maintenance free. A regular inspection for plant cover and electrolytic calcification is required because both effects influence the accuracy of the sensor.

Calcareous deposits which originate from electrical current flow inside the sensor are easily removed when the cell is immersed in a diluted acid for a few minutes. The quantity of rising CO<sub>2</sub>-bubbles gives information on the rate of calcification. The sensor is completely decalcified when the bubble formation has ceased. Heavier incrustation may require a longer immersion in diluted acid with following cleaning with a non-metallic bottle brush. Afterwards the sensor has to be rinsed with fresh water. Particular care has to be taken that the metal components on the electrode surfaces are not scratched nor must they come in contact with metals. After cleaning the sensor with acid an increased conductivity reading may occur which will normalize within one hour. Depending on the operating duration this procedure has to be carried out every few months.

### TEMPERATURE SENSOR

The temperature sensor is maintenance free. Dirt and plant cover only prolong the time constant but have no effect on the precision. When cleaning the sensor take special care of the sensitive tip inside the shield tube which should not be bent.

### REPLACEMENT OF SENSORS

The replacement of a sensor generally does not require to open the Motor Unit (exception: pressure sensor which can only be replaced in the factory). Proceed as follows:

1. Unscrew the central hexagon socket screw M 6 from the back lid of the Motor Unit and remove the fixing disc (tool: hexagon socket screw key 5 mm).
2. Carefully remove the respective sensor whilst gently turning it out of its fitting in the lid of the Motor Unit.
3. Disconnect the plug contacts.
4. Make sure that the boring for the sensor inside the back lid of the Motor Unit is clean and uninjured. If necessary use a lintfree cloth for cleaning.
5. Make sure that the O-rings of the new sensor are clean and uninjured.
6. Slightly grease the O-rings of the sensor with O-ring lubricant.
7. Connect the new sensor to the plug contacts.
8. Carefully press the new sensor into its boring inside the back lid of the Motor Unit.
9. Remount fixing disc and hexagon socket screw M 6 (tool: hexagon socket screw key 5 mm).

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## CALIBRATION

To read calibration data and raw data of the **CT-SET FOR MULTI WATER SAMPLER MWS** from the Underwater Unit and to transfer calibration data of the CT-Set to the Underwater Unit please use the **CONTROLLING MODE** inside the data acquisition software **OceanLab**.

For association of raw data values and calibration coefficients to the sensors and regression formulas please refer to the **CONFIGURATION PROTOCOL** which is delivered with the instrument.