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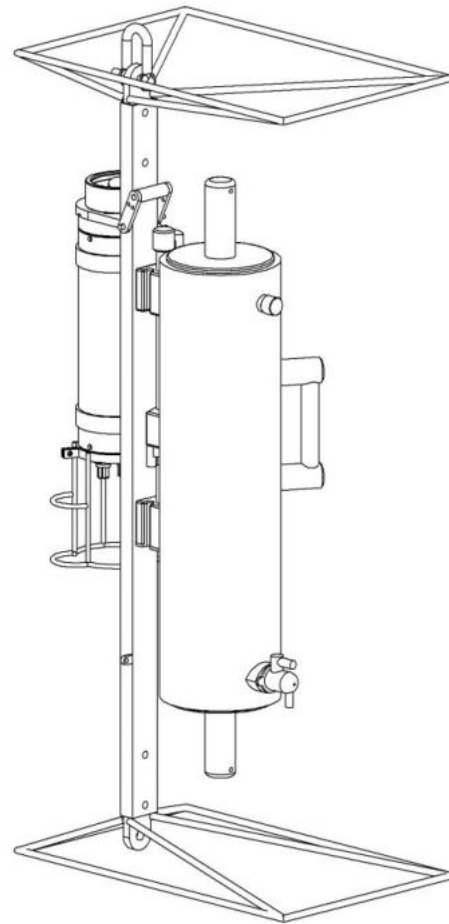
Apparatebau GmbH

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## SINGLE FIRE MODULE WITH EXTERNAL BATTERY PACK FOR COMBINED ONLINE / OFFLINE USE

CATALOGUE NO. 436 994 - 995

### OPERATION MANUAL



Edition 04/21

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## GENERAL DESCRIPTION

The **SINGLE FIRE MODULE** is a light and handy instrument for obtaining a water sample at a specific depth. The model with **EXTERNAL BATTERY PACK** is a stand-alone instrument for ONLINE / OFFLINE use and can be upgraded with a CONDUCTIVITY sensor and a TEMPERATURE sensor by adding the CT-Set.

The **SINGLE FIRE MODULE** consists of a standard water sampler, mounted to a stainless steel rack which is equipped with a motor-driven release device. Impact protection for sampler and release device is made by two dismountable cages on top and bottom side of the instrument. Simply remove the cages when the instrument shall be mounted to an ROV, lander or any other protective structure.

The standard rack can accommodate **PLASTIC WATER SAMPLERS** (also known as NISKIN SAMPLER) of 1.7, 2.5 and 5 liters capacity and **FREE FLOW WATER SAMPLERS** of 5 liters capacity. An extended rack for PLASTIC and FREE FLOW WATER SAMPLERS of 10 liters capacity is available upon request.

In online mode, operated in conjunction with standard electro-mechanical cables, the water sampler is actuated via push-button control by the mains powered Deck Command Unit. This also handles measuring data of the integrated high-precision pressure sensor and optional temperature and conductivity sensors.

In offline mode, operated in conjunction with steel or fiber ropes, the water sampler is automatically actuated according to a pre-programmed pressure (depth). Measuring data of the pressure sensor are recorded inside the internal data memory during the operation. The capacity of internal memory is good for 180 to 500 hours of recording, depending on the actual sensor configuration of the **SINGLE FIRE MODULE**. The stored data can be transferred to a PC by using the data acquisition software **OceanLab**.

Power supply is made by 3 long-time lithium batteries with sufficient capacity for approx. 30 deployments. The batteries are located in an easily removable battery housing.

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## STANDARD EQUIPMENT

1. 1 Single Fire Module with motor-driven release device,  
with two dismountable impact protection cages
2. 1 Plastic Water Sampler PWS of 1.7 liters capacity
3. 1 Deck Command Unit with mains cable
4. 4 Screws to mount the Deck Command Unit to a 19"-rack
5. 1 Connecting cable (to slip ring box of winch), approx. 3 metres long Fig. 1 C
6. 1 Test run cable, approx. 30 metres long Fig. 1 D
7. 1 Counter plug SUBCONN IL 2 F Fig. 1 A
8. 1 Spare O-ring 10 x 4 for axle duct Fig. 3 C
9. 1 Spare O-ring no. 020 for axle box case Fig. 3 E
10. 1 Spare O-ring no. 151 for pressure housing Fig. 3 H
11. 1 Spare O-ring no. 009 for switch shaft Fig. 3 J
12. 1 Spare O-ring no. 120 for Battery Housing
13. 1 Can O-ring lubricant
14. 1 Can pin lubricant
15. 3 Lithium batteries DURACELL DL 123A / 3 V or equivalent
16. 1 Dummy DC 2 F Fig. 1 E
17. 1 Dummy DC 2 M Fig. 1 B
18. 1 Programming cable MC IL 5 F – Sub-D 9 pin, approx. 30 meters long
19. 1 Adaptor cable MC IL 5 F – IL 2M
20. 1 Dummy connector MC DC 5 F
21. 1 Hexagon socket screw key 5 mm
22. 2 Shackles 10mm
23. 1 Spanner 17 mm
24. 1 Spare fuse (250V~, 500mA, fast) for conductor (Deck Command Unit)
25. 1 Spare fuse (125V~, 500mA, fast) for conductor (Motor Unit)
26. 1 Operating manual
27. 1 serial PC cable
28. 1 USB-Stick **OceanLab**

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## TECHNICAL DATA

### Single Fire Module:

Length:	950 mm
Width:	280 mm
Depth:	440 mm
Empty weight:	15 kg
Material of water sampler:	PVC, NBR
Material of rack:	stainless steel
Material of Motor Unit:	titanium
Material of release device:	POM
Operational depth:	3000 m
Operating temperature:	-2 ... + 60°C
Connector at Motor Unit:	Subconn MC BH 5 M
Data memory:	16 MByte

### Deck Command Unit:

Type:	Metal housing for 19"-rack / desktop case.
Protection class:	IP20 (not for use on deck)
Display:	Supertwist LCD with LED backlight

### Power supply:

Underwater Unit:	
Type:	3 Lithium batteries Duracell DL 123 A or equivalent
Nominal voltage:	3 x 3V = 9 V
Capacity:	sufficient for approx. 30 operations in basic configuration
Deck Command Unit:	
Mains supply:	85 ... 260 V AC / 50 ... 60 Hz

### Operating temperature:

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

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## BATTERY CHANGE

1. Make sure that the lever switch at the outside of the Motor Unit is switched into position **O**.
2. Unplug the cable connection between Battery Housing and Motor Unit.
3. Loosen the Battery Housing from the Motor Unit by screwing the star grip screw counter-clock wise and bring Battery Housing into a dry room.
4. Unscrew the union nut from the Battery Housing and remove pressure tube.
5. Place 3 lithium batteries DURACELL DL123A /3 V or equivalent into the battery holders. Take care of **correct polarity**. Secure all batteries with retainer covers.
6. Make sure that the sealing surface in the pressure tube is clean and uninjured. If necessary use a lint-free cloth for cleaning.

**Do not use absorbent cotton!**

7. Slightly grease the sealing surface in the pressure tube with O-ring lubricant.
8. Make sure that the O-ring in the flange is clean and uninjured. If necessary use a lint-free cloth for cleaning.

**Do not use absorbent cotton!**

9. 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!**

10. Make sure that the groove in the flange is clean and uninjured. If necessary use a lint-free cloth for cleaning.

**Do not use absorbent cotton!**

11. Slightly grease a spare O-ring no. 120 with O-ring lubricant.
12. Put the greased O-ring into the groove of the flange.
13. Carefully press the flange into the pressure tube.
14. Fasten the flange at the pressure tube with the plastic union nut.
15. Slightly grease the pins of the underwater connectors with pin lubricant and re-establish the electric connection between Battery Housing and Motor Unit.
16. Place the Battery Housing in its seat at the Motor Unit.
17. Fix the Battery Housing at the Motor Unit with the star grip screw.

**Do not use any tool!**

---

## OPERATING MODES (online or offline mode)

Selection of the operating mode is made **before switching on the Motor Unit** by connecting the Deck Command Unit via adaptor cable MC IL 5 F -> IL 2 M to the MC BH 5 M connector of the Motor Unit to operate the instrument in ONLINE MODE for ONLINE OPERATION

- or -

by connecting the PC via programming cable MC IL 5 F -> Sub-D 9 pin directly to the MC BH 5 M connector of the Motor Unit to prepare an OFFLINE OPERATION resp. to transfer stored data from the Motor Unit to the PC after an offline operation

- or -

by placing the dummy connector MC DC 5 F directly at the Motor Unit to carry out an OFFLINE OPERATION according to the pre-programmed activation pressure.

The **SINGLE FIRE MODULE automatically** starts an OFFLINE OPERATION when switched on if neither adaptor cable MC IL 5 F -> IL 2 M nor programming cable is connected and thus creates a new data file in internal memory.

Recorded data of previous offline operations will not be deleted. The **SINGLE FIRE MODULE** will stop recording automatically when the internal data memory is completely used.

Important note: Automatic data recording will only take place in offline mode! To log / record data while operating online a PC running **OceanLab** can be connected to the Deck Command Unit via RS232.

Online operation can be performed via RS232 if suitable signal converting equipment is installed at both ends of the electrical cable. In this case the PC running **OceanLab** can be connected directly to the signal converting equipment using the programming cable. A special cable from the underwater part of the signal converting equipment to the Motor Unit is required.

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## WIRING FOR ONLINE OPERATION

1. The connection between Deck Command Unit and Underwater Unit is made by a single or multi conductor cable in conjunction with the supplied adaptor cable MC IL 5 F – IL 2 M. The single- or multi conductor cable is not included in our scope of delivery.
2. Using a single conductor cable (one isolated core and one outer steel armour) the isolated core of the cable has to be connected to the white core of pin 2 (data) of the supplied counter plug SUBCONN IL 2 F (Fig. 1 A). The outer steel armour of the cable has to be connected to the black core of pin 1 (ground).
3. Using a multi conductor cable (two or more isolated cores) any two cores of this cable have to be connected to the white (data) and the black (ground) core of the supplied counter plug SUBCONN IL 2 F (Fig. 1 A).
4. When an existing single or multi conductor cable is already equipped with an underwater connector, the supplied connector SUBCONN IL 2 F (Fig.1 A) has to be combined with a counter plug (corresponding to the existing connector) to a cable adaptor.
5. The connection from the ship side end of the single or multi conductor cable at the winch drum (via slip rings of the winch) to the Deck Command Unit has to be made by using the supplied connecting cable (Fig. 1 C): The core of the single or multi conductor cable coupled to pin 1 (ground) of the plug SUBCONN IL 2 F (Fig. 1 A) has to be connected to the brown core of the connecting cable (Fig. 1 C). The core coupled to pin 2 (data) of the plug SUBCONN IL 2 F has to be connected to the blue core of the connecting cable.
6. To avoid corrosion at the contacts of the connector SUBCONN IL 2 F (Fig. 1 A) the contacts should be slightly greased with pin lubricant and always be protected by the dummy DC 2 M (Fig. 1 B) when the single or multi conductor cable is not used.
7. Install Deck Command Unit in a dry room. The use on deck is not allowed.
8. Bring main switch into position "0".
9. Connect mains cable to the socket located at the rear side of the Deck Command Unit (Fig. 2 A).
10. Connect mains cable to mains supply (85 ... 260V AC / 50 ... 60 Hz).

**THE CONNECTION OF THE UNDERWATER CONNECTOR TO THE SINGLE OR MULTI CONDUCTOR CABLE HAS TO BE MADE WITH GREATEST CARE!**

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



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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, located at the rear side (Fig. 2 A).
2. Mains fuse (2 A slow), integrated in the socket for the mains cable (Fig. 2 A)
3. Main switch **POWER**, illuminated (Fig. 2 B).
4. Socket **UNDERWATER UNIT** to connect the Underwater Unit via test run cable resp. single or multi conductor cable (Fig. 2 C).
5. Socket **PERSONAL COMPUTER SERIAL PORT** to connect a personal computer (Fig. 2 D).
6. Button **ACTION** to activate the water sampler (Fig. 2 E).
7. Keyboard **MENU + - ENTER** for menu control (Fig. 2 F).
8. Alphanumeric display (four lines, 40 characters each) with backlight (Fig. 2 G).
9. Set screw **CONTRAST** to adjust the contrast of the display at the rear side of the housing.
10. Fuse (250V AC / 0.5 A / fast) for **CONDUCTOR** at the rear side of the housing.

### MAIN SCREEN:

The main screen is displayed after switching on Deck Command Unit and Underwater Unit when a valid electrical connection has been established.

```
MULTI WATER SAMPLER 1 bottle / 3000m
UNDERWATER UNIT: END OF OPERATION
PRESS 1400.3 dbar    BOTTLE 01 closed
BATTERY 8.9 V
```

First line:

**MULTI WATER SAMPLER 1 bottle / 3000m** type of instrument connected,  
incl. the depth range of the instrument.

**To avoid damages do not exceed the maximum operational depth range of the instrument!**

Second line:

**UNDERWATER UNIT: MOTOR RUNS** during activating the sampler.  
**UNDERWATER UNIT: END OF OPERATION** the sampler has been closed.

In addition the second line is used to display ERROR MESSAGES, if any (see page 10).

Third line:

**PRESS 1400.3 dbar** actual pressure value of the integrated Pressure Sensor.  
**BOTTLE 01 closed** number of last closed sampler.

Fourth line:

**BATT 8.9 V** battery voltage of the Underwater Unit.

**Notice:** Batteries should be changed when battery voltage falls below 7 V whilst the motor is not running. When the battery voltage falls below 1.5 V the Motor Unit is 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 are 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:

The menu screen is displayed upon pressing button **MENU** (Fig. 2 F):

<b>MENU</b>	<b>&gt; QUIT MENU</b>
	<b>MANUAL MOTOR CONTROL</b>
<b>SELECT: +/-</b>	<b>RESET BOTTLE NUMBER</b>
<b>START: ENTER</b>	<b>RESET PRESSURE SENSOR</b>

Left column:

**MENU** Indication for main menu.

**SELECT: +/-** Selection of menu items is made by using the buttons + and -.  
Pressing button + moves the marker > one line down,  
Pressing button - moves the marker > one line up.

**START: ENTER** Press button **ENTER** to enter the selected menu item.

Right column:

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

**MANUAL MOTOR CONTROL** (accessible with Motor Unit connected only) to start 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 AND MANUAL MOTOR CONTROL

### MENU ITEM: QUIT MENU:

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

### MENU ITEM: MANUAL MOTOR CONTROL:

<p>MANUAL MOTOR CONTROL START MOTOR: PRESS ENTER MOTOR TURNS QUIT: MENU</p>
---

### MANUAL MOTOR CONTROL

Indication of menu item.

### START MOTOR: PRESS ENTER

To start a short motor run (1/2 revolution of the motor axle) press button **ENTER**.

### MOTOR TURNS

will be displayed for approx. 1.5 second after pressing button **ENTER** as indication that the motor is active.

### QUIT: MENU

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

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

### MENU ITEM: RESET BOTTLE NUMBER:

```
RESET BOTTLE NUMBER
  SET NUMBER TO ZERO: PRESS ENTER
  BOTTLE = 0
QUIT: MENU
```

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

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

**BOTTLE = 0** will be displayed after pressing button **ENTER** as indication that the reset has been carried out successfully.

**QUIT: MENU** To quit menu item (without or after resetting the bottle number) and to return to menu screen press **MENU**.

### 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 **ENTER**. 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**.

**QUIT: MENU** To quit menu item (without or after resetting the Pressure Sensor) and to return to menu screen press **MENU**.

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## PREPARATION FOR OPERATION

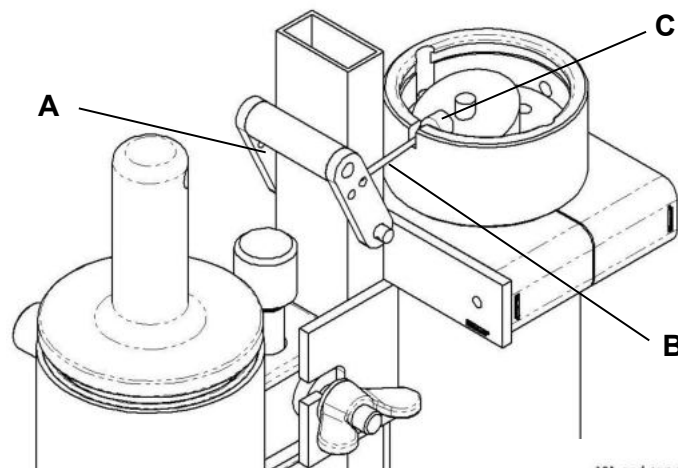
1. Connect the SINGLE FIRE MODULE to the Deck Command Unit by using the adaptor cable MC IL 5 F – IL 2 M and the test run cable (Fig. 1 D).
2. When the SINGLE FIRE MODULE has not been operated for a longer period, a TEST RUN should be carried out as follows to control proper functioning of the system.

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

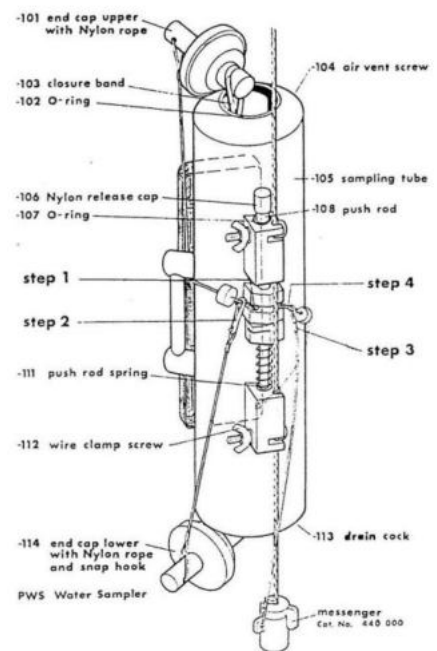
Switch on the Deck Command Unit and the Underwater Unit. When a correct communication between Deck Command Unit and Underwater Unit has been established, the **MAIN SCREEN** will be displayed

Press the **ACTION** button at the Deck Command unit once to activate the release device. The inclined releaser disc will carry out a full revolution.

3. Check battery voltage of the Underwater Unit (fourth line inside the **MAIN SCREEN**). **Replacement of batteries is needed at the latest when the battery voltage falls below 7.0V.**
4. Check **PRESSURE** value of the Underwater Unit (second line inside the **MAIN SCREEN**). Use **MENU** function **RESET PRESSURE** to eliminate air pressure variations in case the value considerably differs from zero.
5. Switch off Deck Command Unit and Underwater Unit and disconnect test run cable from Deck Command Unit and Underwater Unit.
6. Lift the striking bar **A** of the rack and put rope **B** with the plastic ball **C** into the slit of the release device.



7. The Water Sampler is opened as described on its label. Carry out **step 1** and **step 2**. **Steps 3 and 4** are not applicable.
8. The **SINGLE FIRE MODULE** is now ready for operation.
9. When no connection of the Underwater Unit is needed, the connector MC BH 5 M at the Underwater Unit should always be protected by the corresponding dummy connector MC DC 5 F to avoid corrosion of the contacts. Regularly grease the pins of the dummy connector with supplied PIN-lubricant.



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## OPERATION IN ONLINE MODE

1. Connect the Deck Command Unit to the slip ring box of the winch by using the supplied 3 meters long connecting cable (Fig. 1 C).
2. Connect the SINGLE FIRE MODULE mechanically and electrically (by using the supplied adaptor cable) to the winch cable. Regularly grease the pins of the underwater connectors with supplied PIN-lubricant.
3. Switch on Deck Command Unit and Underwater Unit. The following text will be temporarily displayed at the LC-display:

**UNDERWATER UNIT: NO DATA**

4. The **MAIN SCREEN** will be displayed when communication has been established:

**MULTI WATER SAMPLER 1 bottle / 3000m**

**PRESS 0000.0 dbar    BOTTLE 00 closed**

**BATTERY 8.9 V**

5. Lower the **SINGLE FIRE MODULE** to the scheduled depth.
6. Press the **ACTION** button at the Deck Command Unit once to activate the release device. The activating process of the water sampler is indicated by **MOTOR RUNS** in the second line of the **MAIN SCREEN**.

**MULTI WATER SAMPLER 1 bottle / 3000m**

**UNDERWATER UNIT: MOTOR RUNS**

**PRESS 1400.3 dbar    BOTTLE 00 closed**

**BATTERY 8.9 V**

7. Wait until closing of the water sampler has been finished, indicated by **BOTTLE 01 closed** in the third line of the **MAIN SCREEN**.

**MULTI WATER SAMPLER 1 bottle / 3000m**

**UNDERWATER UNIT: END OF OPERATION**

**PRESS 1400.3 dbar    BOTTLE 01 closed**

**BATTERY 8.9 V**

8. Retrieve the SINGLE FIRE MODULE and bottle the sample for storage.
9. Switch off Deck Command Unit and Underwater Unit.
10. Disconnect Underwater Unit from the winch cable.
11. Protect the connector MC BH 5 M at the Underwater Unit by the corresponding dummy connector MC DC 5 F to avoid corrosion of the contacts. Regularly grease the pins of the dummy connector with supplied PIN-lubricant.

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## OPERATION IN OFFLINE MODE

1. To prepare for **OFFLINE OPERATION** connect the programming cable MC IL 5 F --> Sub-D 9 pin to the connector MC BH 5 M of the Motor Unit before switching it on.
2. Connect the programming cable to the serial COM-port of the PC.
3. Switch on the Motor Unit.
4. Start **OceanLab**.
5. Start communication with the **SINGLE FIRE MODULE** by clicking the CONNECT button inside **OceanLab**.
6. Make sure that the **BOTTLE** number indicates 00.
7. Enter the CONTROLLING MODE and select **MEMORY** from the list of components. Make sure that the remaining capacity of data memory is sufficient for the next operation.
8. When the remaining capacity seems barely sufficient click on button **CLEAR MEMORY** to clear the data memory of the Motor Unit.

### **THIS FUNCTION IS IRREVERSIBLE!**

**Please note that the SINGLE FIRE MODULE automatically starts an OFFLINE-OPERATION when switched on with neither adaptor cable MC IL 5 F --> IL 2 M nor programming cable connected and thus creates a new data file inside the data memory! The measuring data of a previous OFFLINE-OPERATION will not be deleted. The SINGLE FIRE MODULE will stop recording measuring data automatically when the data memory is completely used.**

9. Select **PRESSURE PROGRAMMING** from the list of implements to get access to the list of programmable activating pressures.
10. Enter the **UNLOCK PRESSURE** in the format:  
**nnnn.n** (nnnn.n: pressure in dbar)  
  
The Motor Unit will be disabled during lowering the **SINGLE FIRE MODULE** into the water until reaching the **UNLOCK PRESSURE** (but will continuously record measuring data). Thus the **UNLOCK PRESSURE** should be at least. 5 dbar greater than the activating pressure of the water sampler.
11. Enter the **BOTTLE CLOSING PRESSURE** in the format:  
**mmmm.m** (mmmm.m: pressure in dbar)  
  
This pressure **must** be smaller than the **UNLOCK PRESSURE**.
12. Click on button **SEND TO INSTRUMENT** to transfer the activating event to the Motor Unit.
13. Switch off the Motor Unit.
14. Remove the programming cable (MC IL 5 F --> Sub-D 9 pin) from the Motor Unit.
15. Slightly grease the pins of the connector SUBCONN MC BH 5 M at the Motor Unit with pin lubricant.
16. Place the dummy SUBCONN MC DC 5 F on the connector SUBCONN MC BH 5 M at the Motor Unit and secure it with its locking sleeve.
17. Just before deployment switch on the Motor Unit of the **SINGLE FIRE MODULE**.
18. Lower the **SINGLE FIRE MODULE** to depth and carry out the scheduled depth profile.
19. When the Underwater Unit is back on board switch off the Motor Unit.

- 
20. To prepare the data transfer from the Motor Unit to the PC connect the programming cable to the Motor Unit and the PC.
  21. Switch on the Motor Unit.
  22. Start **OceanLab**.
  23. Inside **OceanLab** enter the **CONTROLLING MODE**.
  24. Select **MEMORY** inside the components window.
  25. All data files stored inside the instruments data memory are available inside the **FILE TABLE**. Each file is marked with date and time of session start, file size and a green or red dot. A green dot indicates that the file has already been stored at the PC. A red dot indicates that the file has not yet been stored at the PC.
  26. Use tick boxes to select data files for data transfer to the PC.
  27. Click on button **READ SELECTED FILES** to transfer the stored data from the Underwater Unit to a disk file.
  28. Inside the toolbar of **OceanLab** click on button **STOP SESSION** to disconnect from the instrument.
  29. Switch off the Motor Unit.
  30. Use the **MONITORING MODE** of **OceanLab** to evaluate the data files(s).
  31. To avoid corrosion at the contacts slightly grease the pins of the connector MC BH 5 M at the Motor Unit with pin lubricant and protect it with the dummy MC DC 5 F.



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## IMPACT PROTECTION CAGES

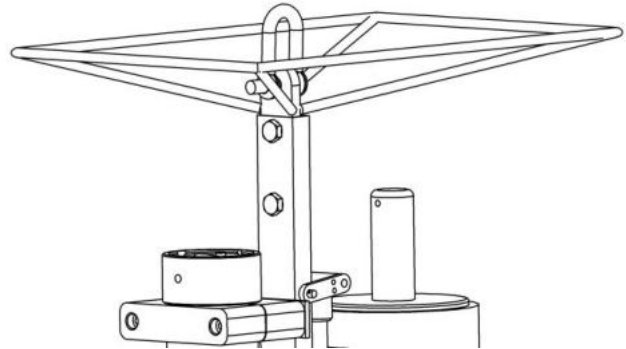
Impact protection for sampler and release device is made by two dismantlable cages on top and bottom side of the instrument. Simply remove the cages when the instrument shall be mounted to an ROV, lander or any other protective structure.

### REMOVAL

To remove the impact protection cages the following steps have to be carried out:

1. Unscrew the hexagon head screws at top and bottom protection cage. Mind the washers below the screw heads. Tool: Spanner 17mm
2. Extract the flats of the protection cages from the stainless steel rack.

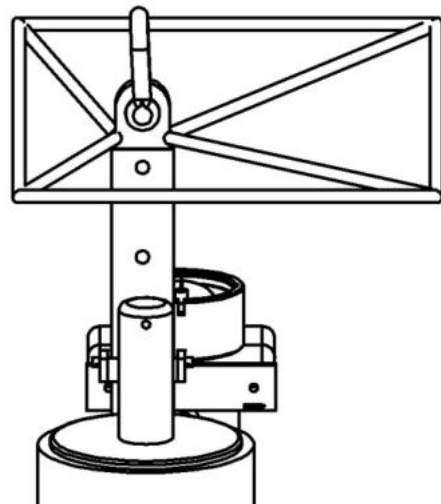
In this condition the SINGLE FIRE MODULE can be mounted to lander arrays, ROVs or any other underwater structure.



### MOUNTING

To mount the impact protection cages the following steps have to be carried out:

1. Slide the flats of top and bottom protection cage into the stainless steel rack. Mind the dissymmetric design of the protection cages!
2. Fix top and bottom protection cage by using the hexagon head screws (M10 x 16) and the corresponding washers. Tool: Spanner 17mm
3. Mount a 10mm shackle to the suspension eye of the bottom protection cage in case you want to add an additional bottom weight to the SINGLE FIRE MODULE.

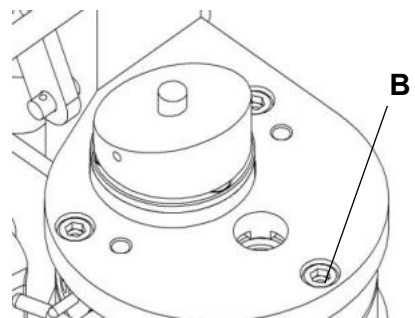
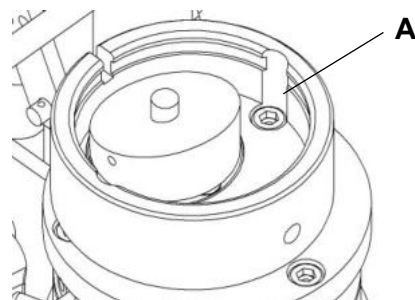


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## REMOVAL AND MOUNTING INSTRUCTIONS FOR THE MOTOR UNIT

### REMOVAL

1. Remove any cable from connector MC BH 5 M at the Motor Unit.
2. Place dummy MC DC 5 F on connector MC BH 5 M.
3. Loosen both hexagon socket screws M 6 (A) of the black release device.  
Tool: Hexagon Socket Screw Key 5 mm
4. Remove the black release device.
5. Loosen all three hexagon socket screws M 6 (B) of the Motor Unit.  
Tool: Hexagon Socket Screw Key 5 mm
6. Remove the Motor Unit.



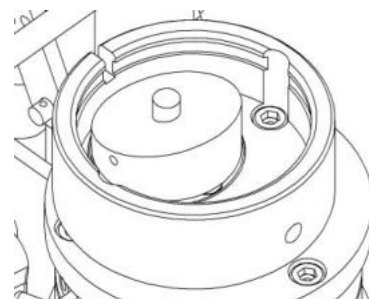
### MOUNTING

1. Re-mount Motor Unit and release device.  
Tool: Hexagon Socket Screw Key 5 mm

The Underwater Unit does only work properly when the synchronization between Motor Unit and gearing has been established. **The lower side of the inclined releaser disc has to point towards the slit inside the black release device.**

In case the inclined releaser disc points to the opposite direction, the following steps have to be carried out:

1. Connect the test run cable to the Motor Unit (with Battery Housing connected).
2. Connect the test run cable to the Deck Command Unit.
3. Switch on the Deck Command Unit, the main switch is illuminated, the display indicates: **UNDERWATER UNIT: NO DATA**
4. Switch lever switch at the Motor Unit into position **I**, the display indicates the MAIN SCREEN.
5. Press button **MENU** at the Deck Command Unit to open the MENU SCREEN.
6. Select **MANUAL MOTOR CONTROL** by pressing button **+** and enter this menu item by pressing button **ENTER**.
7. Press button **ENTER** again to start a short motor run (half revolution of the motor axle) and to set the bottle number to zero.
8. Return to MAIN SCREEN: Press button **MENU**, then select **QUIT MENU** and press button **ENTER** to leave the MENU SCREEN.
9. The Motor Unit is synchronized and ready for operation.
10. Switch lever switch at the Motor Unit into position **O**.
11. Switch off the Deck Command Unit.
12. Remove the test run cable.



---

## LOCALIZATION OF FAULTS

1. Upon switching on the Deck Command Unit, the main switch is not illuminated (Fig. 2 B), the display remains empty:
  - No connection to mains supply. Check connection from mains cable to Deck Command Unit and to mains socket.
  - The integrated fuse (2 A slow) of the Deck Command Unit burnt out. Change mains fuse located in the posterior partition of the drawer (spare fuse in the anterior partition) below the mains connector on rear side of the Deck Command Unit.
  - The mains socket has no voltage. Check mains socket and the cables leading to mains socket.
  - The mains cable is defective. Replace mains cable.
2. After switching on Deck Command Unit and Motor Unit the following error message appears:  
**UNDERWATER UNIT: NO DATA:**
  - The Batteries of the Underwater Unit are exhausted. Install new batteries.
  - The electrical connection between Deck Command Unit and Motor Unit is interrupted. Localization of cable faults see below.
  - The fuses (0.5 A / fast) for the connecting cable (CONDUCTOR) in the Deck Command Unit (at rear side of housing) and in the Motor Unit (at the electronics board) burnt out. They have to be replaced.
3. After switching on Deck Command Unit and Motor Unit the following error message appears:  
**SINGLE CONDUCTOR CABLE: SHORT CIRCUIT:**
  - The connecting cable from Deck Command Unit to winch has wrong polarity. An interchange of both pins is necessary (see WIRING FOR ONLINE OPERATION, page 8).
  - The electrical connection between Deck Command Unit and Motor Unit has a short circuit. Localization of cable faults see below.
4. After switching on Deck Command Unit and Motor Unit the following error message appears:  
**UNDERWATER UNIT: INVALID DATA:**
  - The connected Motor Unit is not compatible with the Deck Command Unit. Connect a compatible Motor Unit.

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

The localization of cable faults is made according to the following instructions:

1. Carry out a TEST RUN (page 13, paragraph 2.) by using the test run cable (Fig. 1 D). In case of success the fault has to be located in the cable connection from Deck Command Unit to Underwater Unit.
2. Check electrical splice between the connector SUBCONN IL 2 F and the single or multi conductor cable: **90% of all cable faults are located here!**
3. Check the connection from single or multi conductor cable to the slip rings of the winch.
4. Check slip rings of the winch.
5. Check electrical connection from the winch to the Deck Command Unit.
6. After repair a TEST RUN via winch is applicable to check the success of the repair.

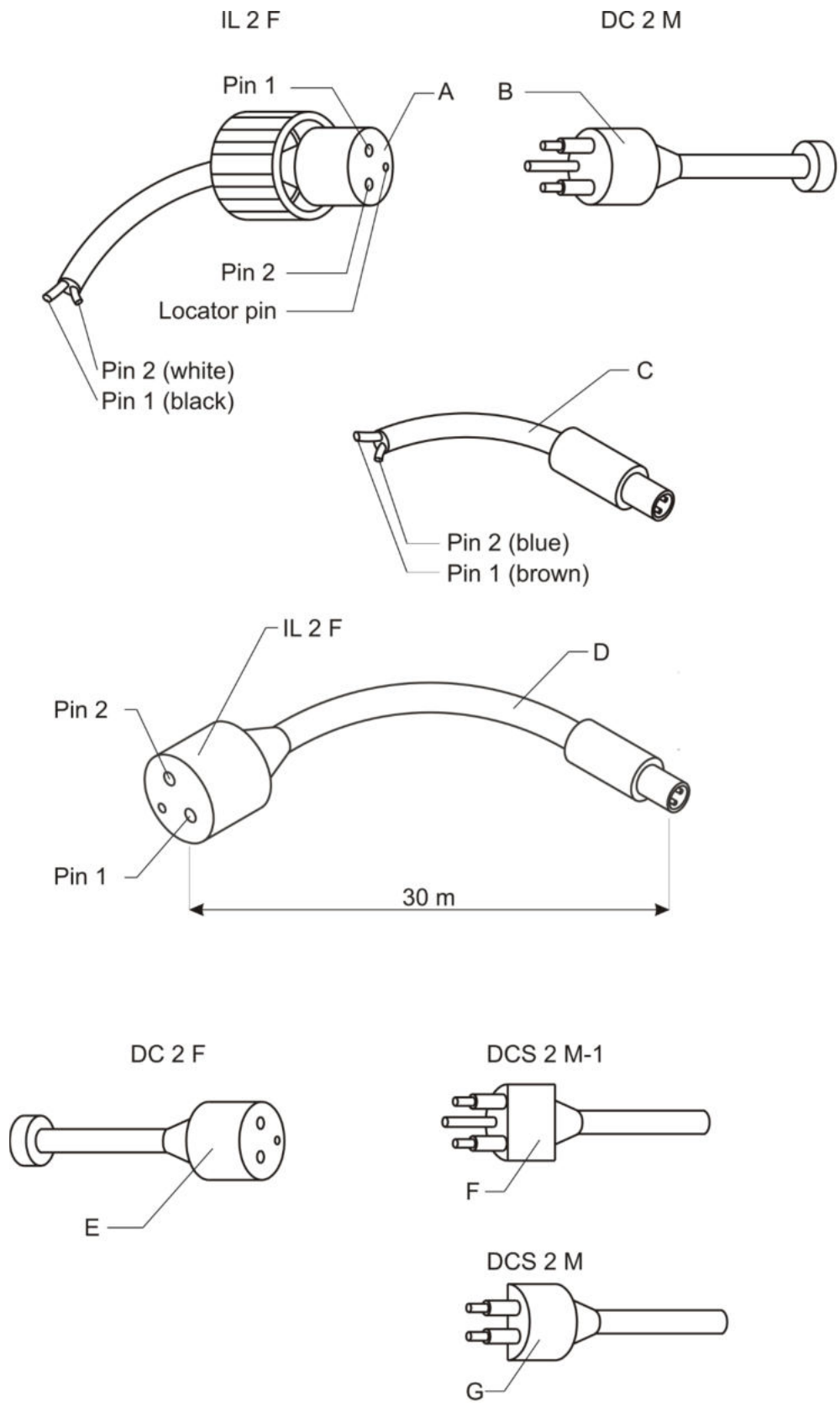


Fig 1

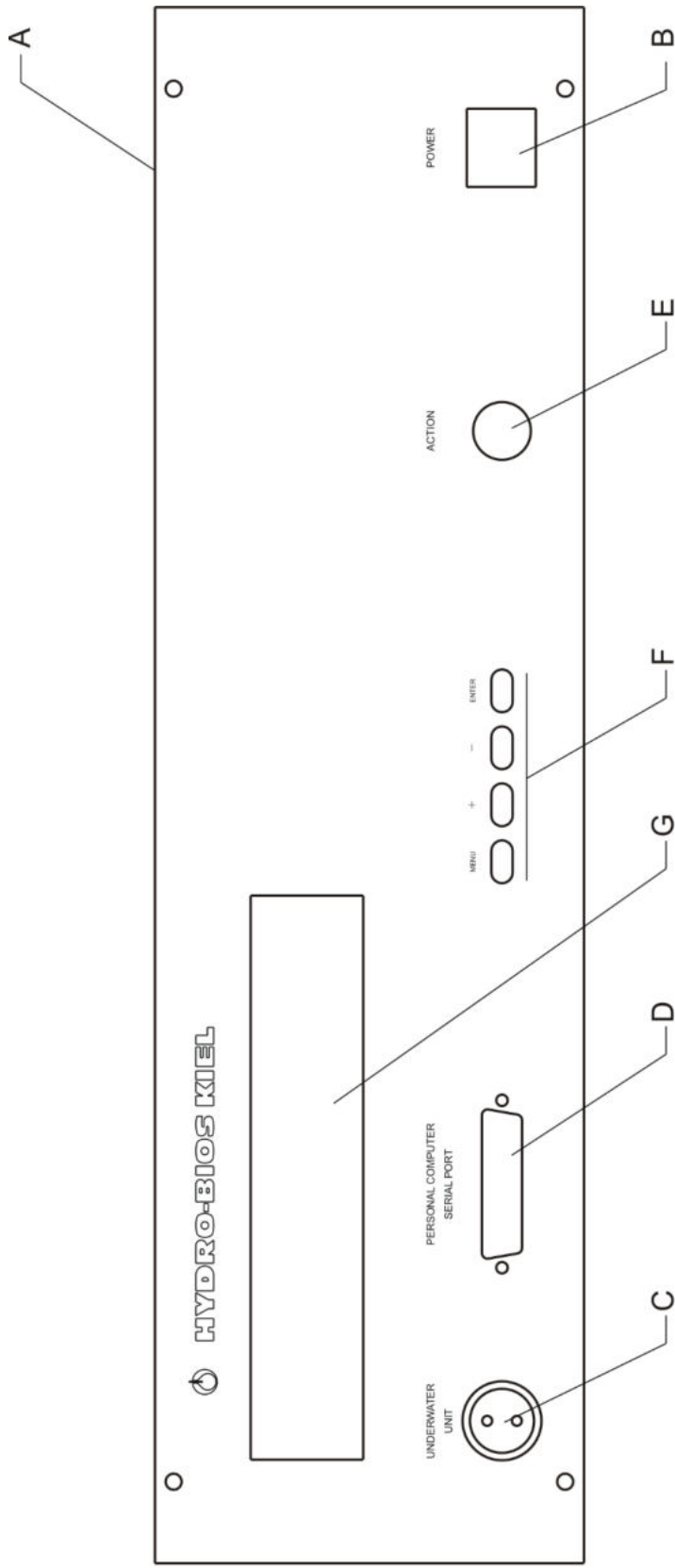


Fig. 2

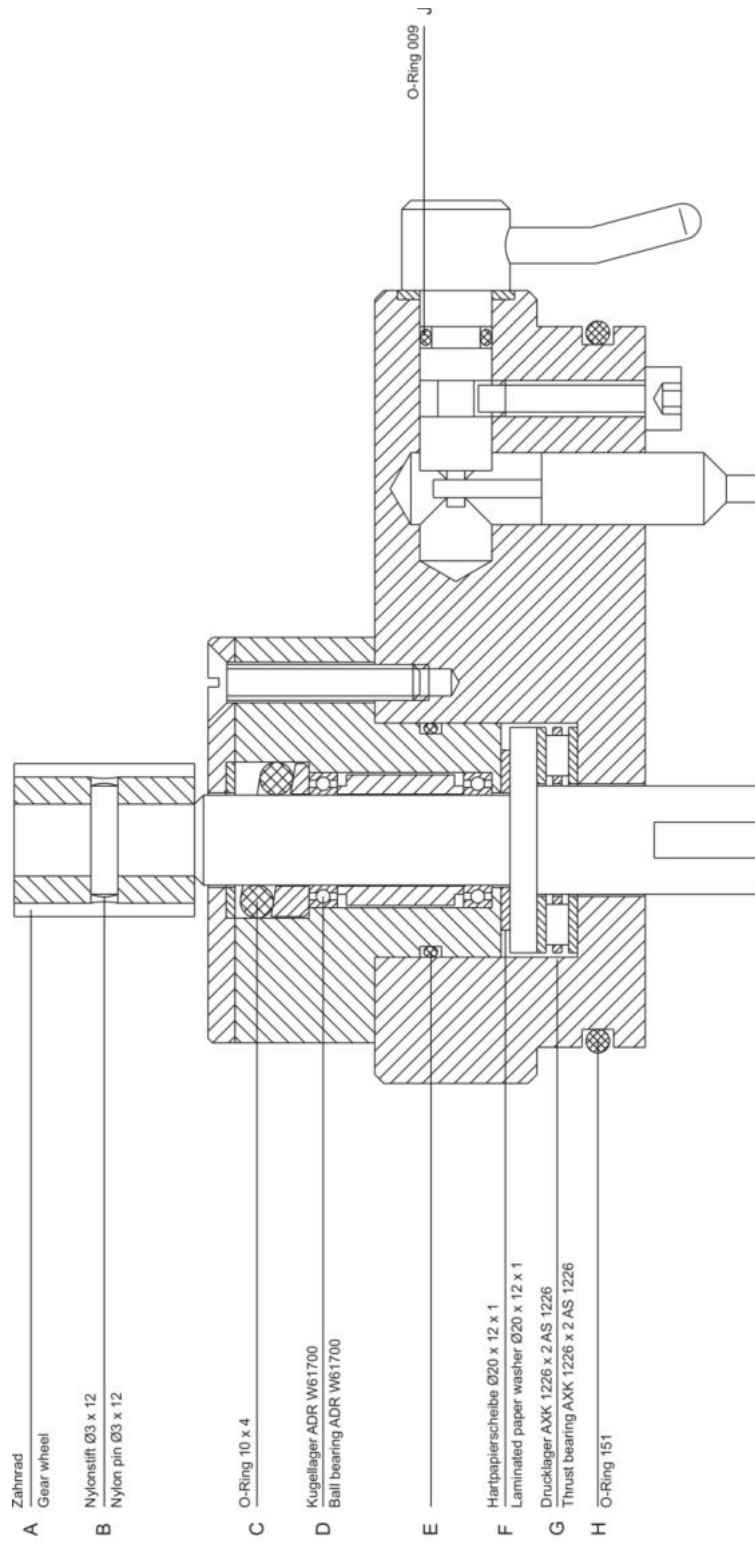
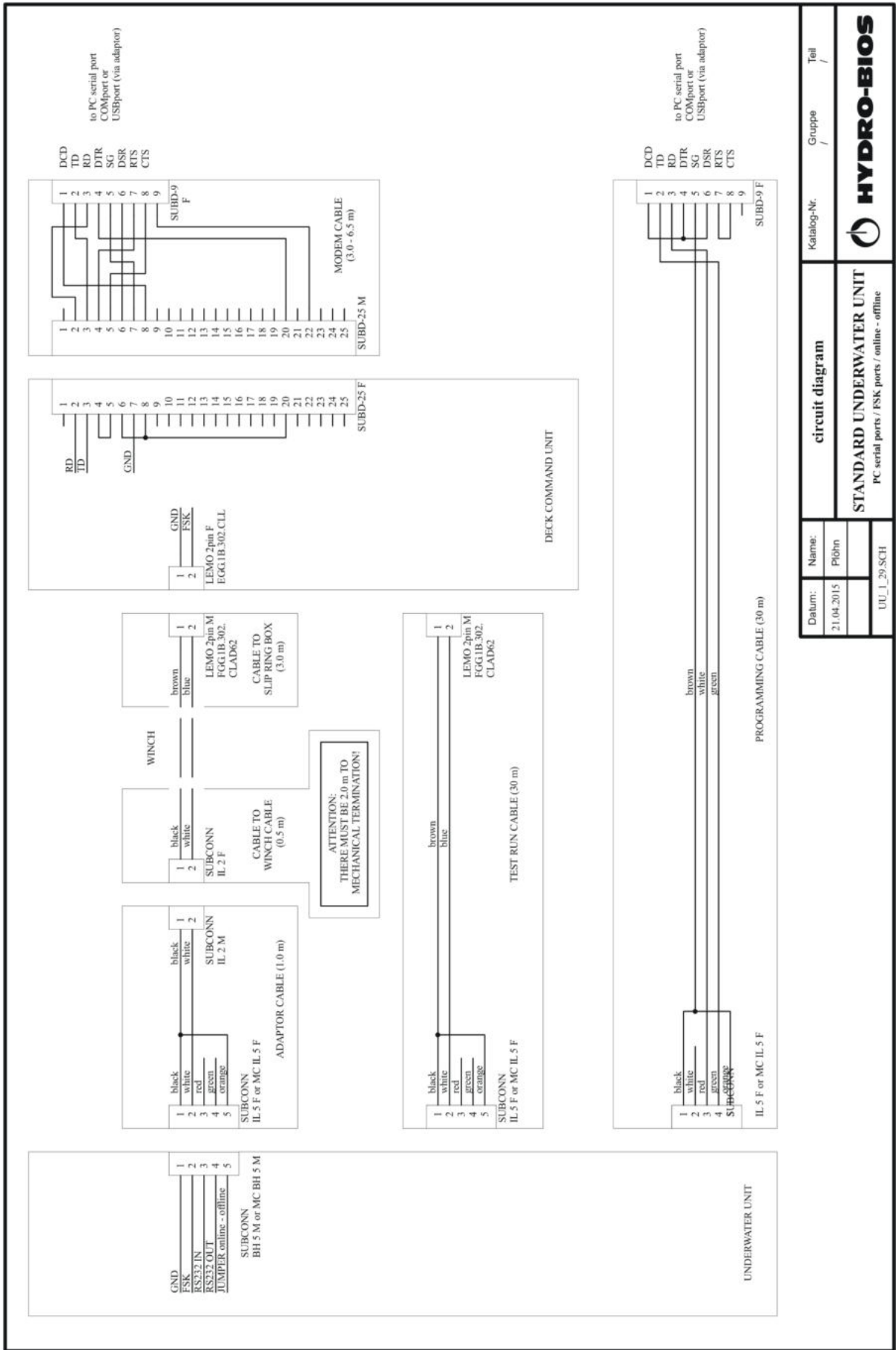
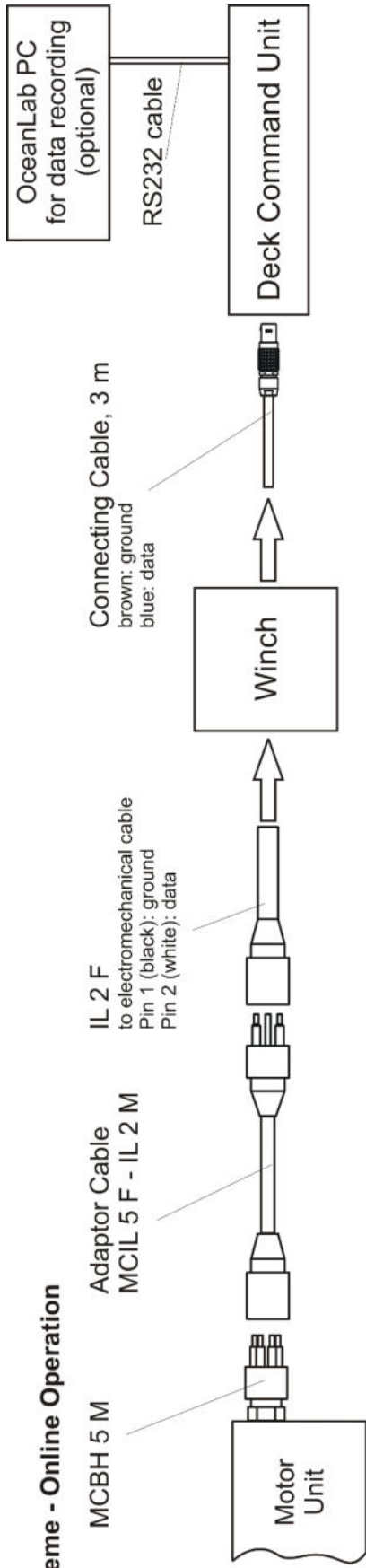


Fig. 3

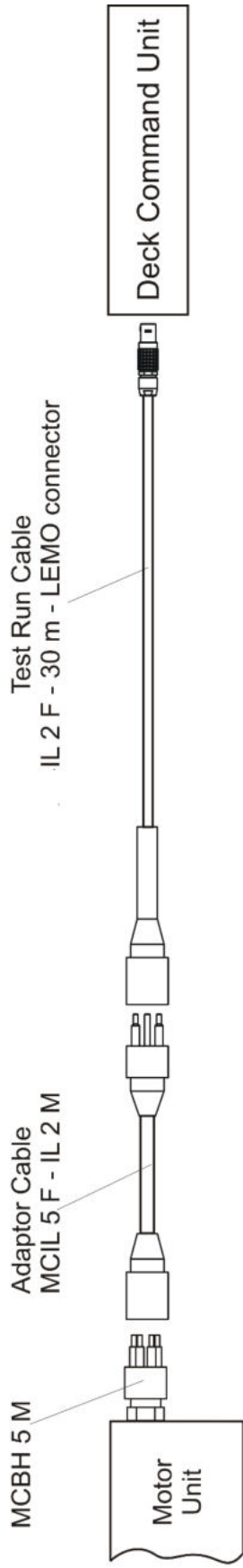


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<b>STANDARD UNDERWATER UNIT</b>			
PC serial ports / FSK ports / online - offline			
<b>HYDRO-BIOS</b>			

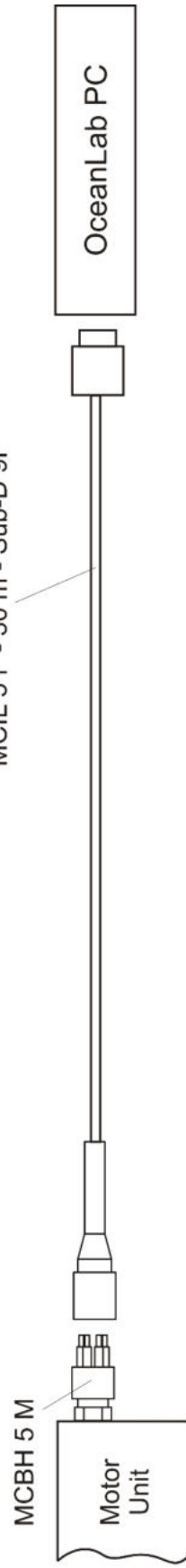
**Wiring Scheme - Online Operation**



**Wiring Scheme - Test Run**



**Wiring Scheme - Programming for Offline Deployment**





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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.