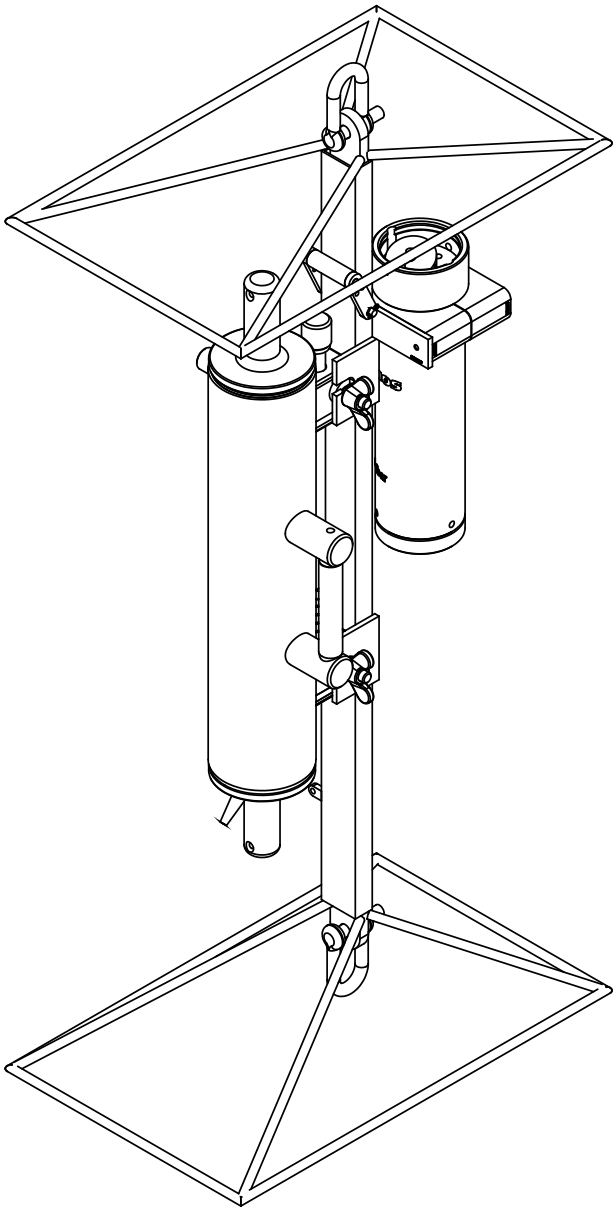


SINGLE FIRE MODULE SFM

OPERATION MANUAL

Product ID 436 890

Edition 09/26

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NOTICE



Please read this manual carefully before operating or performing maintenance on the instrument. Pay special attention to all danger, warning and caution statements. Failure to do so could result in serious injury and/or damage to the instrument. Keep manual available at all times.

LAYOUT AND MEANING OF WARNINGS

All safety instructions found in this operation manual follow this pattern (signal words):

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to personal injury.
NOTICE may also indicate a situation which, if not avoided, may cause damage to equipment.

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TERMINOLOGY

motor unit: pressure housing with electronics and motor

underwater unit: underwater device with mounted motor unit

GENERAL DESCRIPTION

The Single Fire Module **SFM** is a light and handy stand-alone instrument for obtaining a water sample at a specific depth.

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 provided by two dismountable cages on the 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 PWS of 1.7 and 5 liters capacity. Extended racks for 2.5 liters PWS and 5 liters Free Flow resp. 10 liters PWS and 10 liters Free Flow are available on request.

In online mode – operated in conjunction with standard electro-mechanical cables – the water sampler is closed via push button ACTION by the Command Unit. The Command Unit also displays measuring data of the integrated high-precision pressure sensor.

In offline mode – operated in conjunction with a steel or fiber rope – the water sampler is automatically closed at a pre-programmed pressure (depth). Measuring data of the pressure sensor is recorded to the internal data memory during operation.

The power supply consists of internal rechargeable LiFePO4 batteries using state-of-the-art lithium iron phosphate chemistry (LiFePO4) with capacity sufficient for approx. 100 to 200 hours of operation at 1 Hz measurement interval. The rechargeable batteries can be charged with the supplied charger. The charger is usable worldwide.

STANDARD EQUIPMENT

1.	1 Single Fire Module with motor-driven release device	
2.	2 Dismountable impact protection cases	
3.	2 Shackles 10 mm	
4.	1 Plastic water sampler	
5.	1 Dummy connector SUBCONN MC DC 5 M	
6.	1 LiFePO4 charger with connecting cable	
7.	1 Command Unit	
8.	1 Slip ring box cable, aproxx. 3 meters long	Fig. 1 F
9.	1 Pig tail SUBCONN IL 2 F with locking sleeve	Fig. 1 C
10.	1 Adaptor cable: SUBCONN MC IL 5 F – IL 2 M, 80 cm long	Fig. 1 B
11.	1 Full speed serial cable: SUBCONN MCIL 5 F – 2 m – Lemo	Fig. 1 J
12.	PC to serial cable: SUBCONN MC IL 5 F – 2 m – USB	Fig. 1 K
13.	1 Can pin lubricant	
14.	1 Dummy connector DC 2 F	
15.	1 Dummy connector DC 2 M	
16.	1 Box spanner 17 mm	
17.	1 Hexagon socket screw key 2.5 mm	
18.	1 Hexagon socket screw key 5 mm	
19.	1 Spare fuse (125V~, 125mA, Littelfuse 154.125) for long distance telemetry protection	
20.	1 Operation manual	
21.	1 USB flash drive with software OceanLab	

TECHNICAL DATA

Single Fire Module:

Length:	440 mm
Width:	280 mm
Height:	950 mm
Empty weight:	12 kg
Materials of water sampler:	uPVC, NBR
Material of rack:	stainless steel
Material of underwater unit:	titanium
Material of release device:	POM
Operational depth:	3000 m (optional: 6000 m)
Electronics operate from:	-40° C … +85° C

Operational depth:

Standard:	3000 m
Option:	6000 m

NOTICE



To avoid damage do not exceed the maximum operational depth of the instrument!

Pressure sensor:

Standard:	0 – 3000 dbar
Option:	0 – 6000 dbar
Resolution:	0.1 dbar (0.15 dbar for 6000 dbar version)
Initial accuracy (0 … 50° C):	<0.02 % f.s.
Time constant:	10 ms

Power Supply:

Type:	2 rechargeable LiFePO4 batteries
Nominal voltage:	6.6 V
Capacity:	2500 mAh *capacity sufficient for approx. 100 to 200 hours of operation at 1 Hz measurement interval.*
Charge conditions:	approx. 2.5 hours at 1500 mA to 80% capacity approx. 5 hours to 100% capacity
Charge temperature:	+5° C … +55° C
Life-expectancy:	more than 2000 charge-discharge-cycles
Self-discharge:	typ. 1% per month

Charger:

System:	charger for 2 cell LiFePO4 packs
Type:	FRIWO FW7290 LiFePO4 Charger for 2 cell
Input voltage:	100 … 240 V AC

Charge current:	1500 mA

Data transmission:

Connector:	SUBCONN MC BH 5 F
Pig tail (included):	SUBCONN IL 2 F
Full speed serial:	USB 2.0, 2 meter cable Short circuit and ESD protected. *For programming and bulk data retrieval.*
Telemetry:	4.8 kbaud, 3.3 V for cable lengths >10 km, protected against overvoltage, short circuit, ESD protected. *for online operation*

Data memory for offline mode:
Effective 120 MB, sufficient for up to 3400 hours of recording @ 1Hz sampling rate and base configuration.

Data sampling rate:
1 Hz, 2 Hz, 4 Hz, 10 Hz *(user adjustable).*

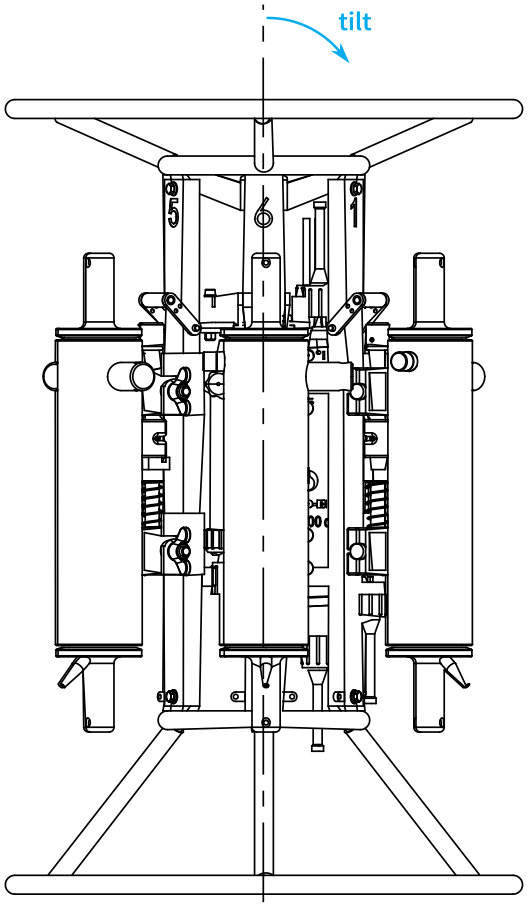
Telemetry cable connection requirements:
Single or multi conductor cable, negative pole may be in contact with sea water.
Resistance (go- and return line): max. 1 kOhm
The single or multi conductor cable is not included in our scope of delivery!

INCLINOMETER

Both the Command Unit and OceanLab will display the instrument's orientation as a tilt angle.

TILT

Will be displayed if the instrument is within ± 60° in straight orientation.



USER CALIBRATION (RESET FUNCTION)

The inclinometer is factory calibrated and there is usually no need to perform a field calibration. However, if the instrument is slightly outside the straight orientation (i.e. displaying a small offset <5° when the instrument is in its neutral position), this offset can be compensated:

- Put the instrument in a static neutral position
  i.e. do not perform this on deck of a ship, doing so will lead to angle measurement errors

  Make sure tilt shows max 5°.

Command Unit:

- Press the soft button next to the angle display in the main component window.
- Press **Reset**.

OceanLab:

- Click on Controlling mode > Tilt.
- Click **Reset**.

INTERNAL BATTERY

The lithium ion battery built into the instrument use lithium iron phosphate (LiFePO4) chemistry. This chemistry inherently is the **safest** currently available on the market with highest thermal and chemical stability and highest tolerance to abuse. In contrast to other lithium ion batteries, the LiFePO4 battery does **NOT** tend to thermal runaway, gassing or explosion.

LiFePO4 batteries have **no memory effect**, thus a partial charge is possible with no adverse effects. They can be partially charged or discharged with no adverse effect on cycle life.

NOTICE

Do not store the device with fully depleted battery for extended periods – this will reduce the life span of the battery. Instead, charge to approx. 80% state of charge (according to item 5. at page **Fehler! Textmarke nicht definiert.**) and keep cool for storage.

The battery is fully integrated into the motor unit of the Single Fire Module. A replacement by the end user is not possible.

The motor unit of the SFM has to be returned to our factory for battery replacement when it has reached its end of life.

The expected life time of the battery is typically 2000 charging cycles / 10 years.

CHARGING

⚠WARNING

Keep the charger in a dry place (indoor use only)!

The charger should be disconnected from mains supply when not in use.

Do not plug in the charger in case of damaged case, power plug or cable.

Do not use the supplied charger for other batteries than rechargeable double cell LiFePO4 packs!

1. Bring the SFM in a dry room.
2. Remove dummy connector MC DC 5 M.
3. Connect the charger to the SFM.
4. Connect charger to mains supply (100 ... 240 V AC). Select appropriate primary plug for your mains supply. The charging process will start automatically.

A **fast flashing green** LED indicates the rapid charge process. Depending on state of discharge, the rapid charge process will last up to 2.5 hours.

A **fast flashing yellow** LED indicates that the batteries are defective or connected in wrong polarity.

After the rapid charge process (leading to approx. 80% state of charge) the charger switches over to maintenance charge (indicated by **slow flashing green** LED). The maintenance charge process will last up to an additional 2.5 hours.

A **permanent green** LED indicates that the batteries have been completely charged.

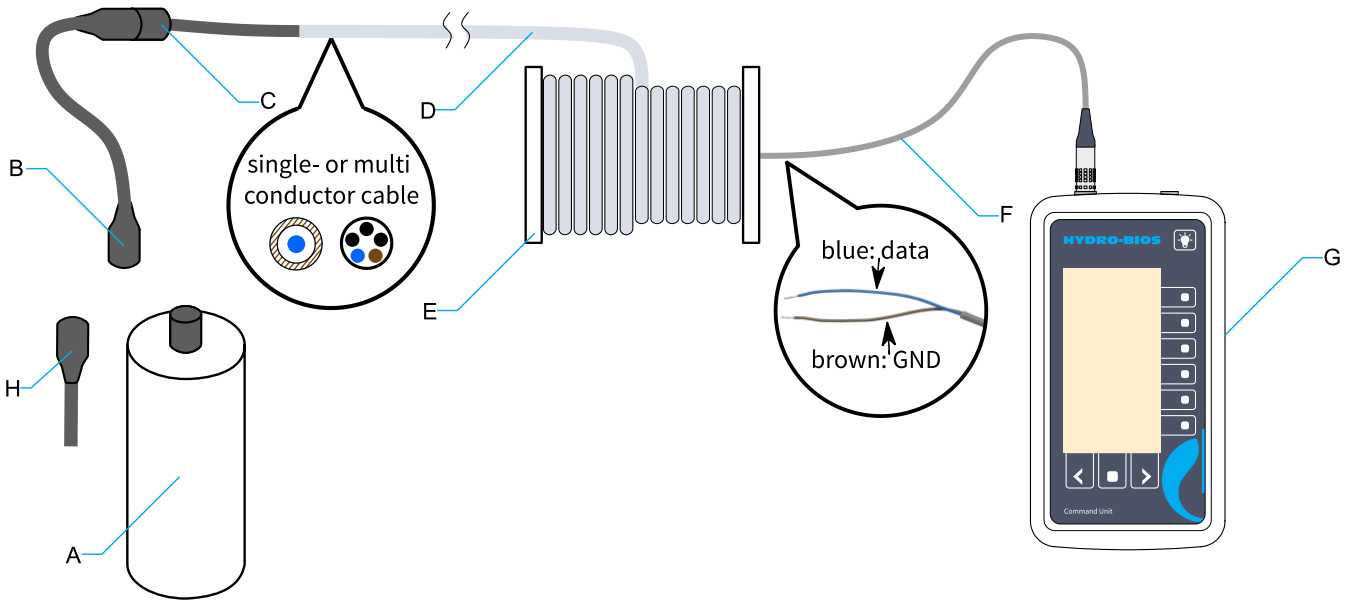
5. Disconnect charger from mains supply.
6. Disconnect SFM from charger.
7. Slightly grease the contacts of the dummy MC DC 5 M with pin lubricant, plug the dummy connector to the SFM and secure it with the locking sleeve.

NOTICE

In no case must the underwater unit be submerged without the appropriate cable connections resp. dummy connectors attached!

ONLINE OPERATION

WIRING FOR ONLINE OPERATION



A. motor unit attached to Single Fire Module
B. adaptor cable: 5-pin connector to 2-pin connector
C. 2-pin socket (pig tail) attached to winch cable
D. electromechanical winch cable (e.g. single- or multi conductor cable)
E. winch and winch cable
F. slip ring box cable: 2 open wires to 4-pin lemo plug
G. Command Unit
H. dummy connector

1. Connection between Command Unit and underwater unit is made by a single- or multi conductor cable in conjunction with the supplied adaptor cable MC IL 5 M – IL 2 M. The single- or multi conductor cable is not included in our scope of delivery.
    a. When using a *single conductor cable* (one isolated core and outer steel armour) the isolated core of the cable has to be connected to the white core of pin 2 (data) of the supplied pig tail SUBCONN IL 2 F. The outer steel armour of the cable has to be connected to the black core of pin 1 (ground).
    b. When 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) wires of the supplied pig tail SUBCONN IL 2 F.
    c. When an existing single- or multi conductor cable is *already equipped with an underwater connector*, the supplied pig tail SUBCONN IL 2 F has to be combined with a counter plug (corresponding to the existing connector) to a cable adaptor.
2. 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 Command Unit has to be made by using the supplied slip ring box cable: The steel armour (or core in case of a multi conductor cable) coupled to pin 1 (ground)

of the plug SUBCONN IL 2 F has to be connected to the brown wire of the slip ring box cable. The core coupled to pin 2 (data) of the plug SUBCONN IL 2 F has to be connected to the blue wire of the slip ring box cable.

NOTICE

To avoid corrosion at the contacts of the underwater connectors the contacts should be slightly greased with pin lubricant and always be protected by the corresponding dummy when the single- or multi conductor cable is not used.

NOTICE

When the connector IL 2 F has been attached to the single- or multi conductor cable recently or when a new cable adapter has been attached, a continuous supervision of the display of the Command Unit is recommended during the first operation. For localization and repair of faults see chapter *Localization of Faults* of the Command Unit operation manual.

NOTICE

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!

In particular make sure not to accidentally connect HYDRO-BIOS-equipment to devices from other manufacturers because this could damage the Command Unit, the MWS or other connected equipment.

Data may be viewed and logged by a PC (running OceanLab 4 or later) connected to the Command Unit (Fig. 1).

SAMPLER AND WIRING TEST BEFORE ONLINE OPERATION

This test should be carried out:

- prior to first deployment of the SFM on any vessel
- after any changes / work / maintenance on related shipside wiring, winch, slip ring, wet end terminator of electromechanical cable
- when SFM and / or winch have not been used for an extended period of time

In order to check the function of Command Unit and underwater unit in conjunction with shipside wiring (i.e. single- or multi conductor winch cable, slip ring, wiring to lab) the following steps have to be carried out:

> ***CAUTION***
>
> **PINCH POINT!**
> TO AVOID INJURY TO THE OPERATORS OR DAMAGE TO THE INSTRUMENT CAUSED BY CLOSING OF THE SAMPLER ON AIR THE SAMPLER MUST **NEVER** BE ARMED DURING TESTS!

> ***NOTICE***
>
> Make sure no other electrical / electronical equipment is actively using the abovementioned electrical connections during test or operation of the SFM. Failure to do so may result in loss of data and / or damage to equipment.

1. Connect the slip ring box cable to the Command Unit.
2. Remove dummy connector SUBCONN MC DC 5 F from the underwater unit.
3. Slightly grease the pins of all underwater connectors of the underwater unit and the adaptor cable with PIN-lubricant.
4. Connect adaptor cable MC IL 5 M – IL 2 M to the connector MC BH 5 F on the underwater unit.
5. Connect the single- or multi conductor cable to the adaptor cable (Fig. 1).
6. Lift the striking bar A of the rack and put rope B with the plastic ball C into the slot of the release device (Fig. 2) **but do not arm the sampler**.

> ***CAUTION***
>
> **PINCH POINT!**
> **Keep hands and fingers clear.**

7. Switch on the Command Unit. The main screen displays pressure readings and bottle number and other instrument data.
8. Check battery voltage displayed on the Command Unit.
9. Press **ACTION** on the Command Unit.
10. The closing mechanism will start moving and the display shows the message **Motor running**.

11. After a few seconds the indication of the bottle number is updated and the message **Operation done** will be displayed.
12. Observe the battery voltage on the Command Unit. The batteries of the underwater unit should be charged when the battery voltage falls below 6.2 V (indicated by a blinking battery symbol next to the voltage value) while the motor of the underwater unit is running.
13. Switch off the Command Unit.
14. To avoid corrosion at the contacts of the connectors the contacts should be slightly greased with pin lubricant and always be protected with their respective dummy connectors when no single or multi conductor cable is connected.

If this test passes the data connection is ready.

Should the test fail see the chapter *Localization of faults* of the Command Unit operation manual.

PREPARATION FOR OPERATION

⚠CAUTION



PINCH POINT!
Keep hands and fingers clear.

1. Lift the striking bar **A** of the rack and put rope **B** with the plastic ball **C** into the slot of the release device (Fig. 2).
2. The water sampler is opened as described on its label.

The Single Fire Module is now ready for operation.

ONLINE OPERATION: DEPLOYMENT

When the SFM has not been operated for a longer period, a SAMPLER AND WIRING TEST BEFORE ONLINE OPERATION acc. to page 12 should be carried out to check proper functioning of the system.

1. 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.

NOTICE

In no case must the underwater unit be submerged without the appropriate cable connections resp. dummy connectors attached!

2. Switch on the Command Unit.
3. Lower the SFM to the desired depth and stop the winch.
4. To close the water sampler press **ACTION** on the Command Unit. The display indicates **Motor running**. After a few seconds the indication of the bottle number is incremented and **Operation done** will be displayed.
5. Heave the SFM back on deck and switch off the Command Unit.
6. Thoroughly rinse the Single Fire Module with fresh water.

If more than one operation is planned during an expedition the single- or multi conductor cable may remain connected to the underwater unit.

If a further operation of the SFM is not intended it is good practice to disconnect the winch cable. To avoid corrosion of the contacts slightly grease the pins with pin-lubricant and plug the dummy MC DC 5 M onto the connector MC BH 5 F and plug the dummy DC 2 M into the connector IL 2 F of the single- or multi conductor cable.

OFFLINE OPERATION

SAMPLER TEST BEFORE OFFLINE OPERATION

A SAMPLER MECHANICAL AND BATTERY TEST is recommended before each deployment (see page 22).

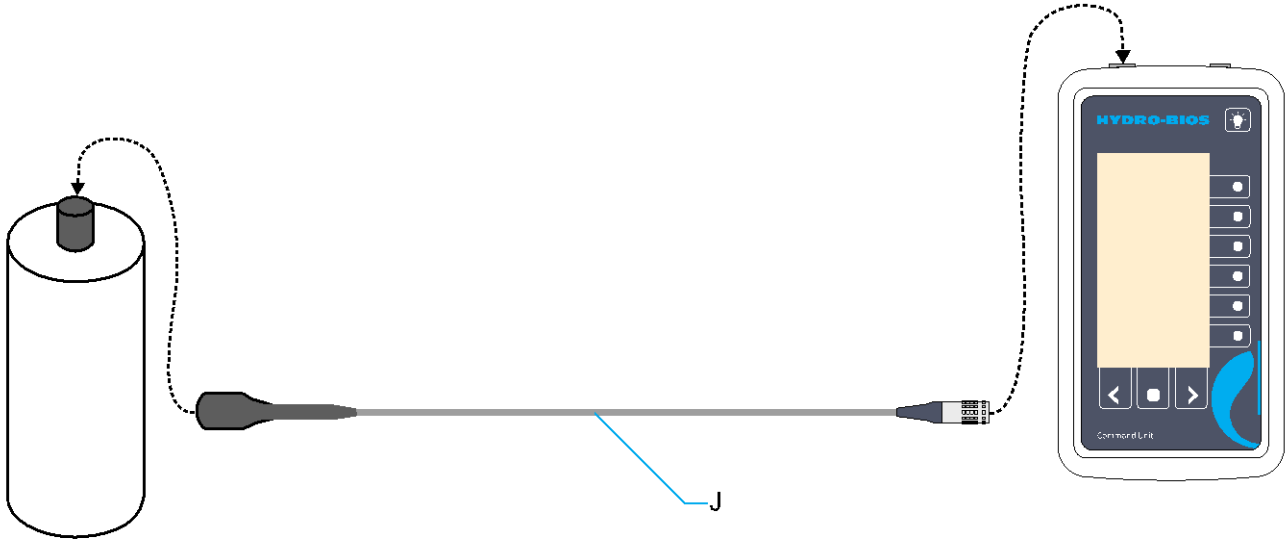
PROGRAMMING FOR OFFLINE OPERATION

The pressure value at which the sample will be taken in offline operation has to be programmed using one of the three methods below. Which one is most convenient will depend on the setup and operation details.

In any case, the following must be observed when programming:

- The **Bottle** number has to read **0** and the release block of the SFM has to be in start position (Fig. 3).
  Otherwise programming is disabled.
- The underwater unit is locked during lowering the SFM into the water until reaching the UNLOCK PRESSURE (but will continuously record measuring data). Thus the UNLOCK PRESSURE should be at least 0.5 dbar greater than the closing pressure of the water sampler.
- The UNLOCK PRESSURE has to be greater than 0.5 dbar.

METHOD A: USING COMMAND UNIT



J. full speed serial cable

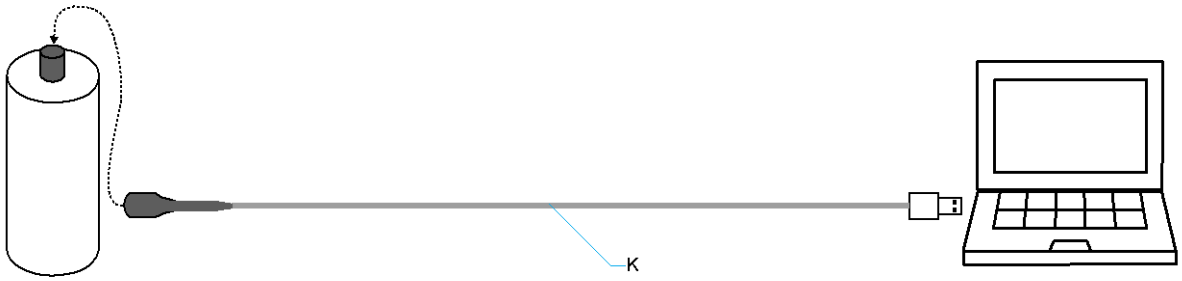
1. Establish a direct connection between Command Unit and SFM using the full speed serial cable.
2. Switch on the Command Unit.
3. Press the soft button next to **Pressure programming** (you may have to scroll left or right by using the **<** and **>** soft buttons below the screen.) *The current programming is displayed.*
4. Press the soft button next to the pressure values to edit the entry.
5. Press **Accept** (indicated with a check mark ✓) to save edit.
6. Check if the remaining memory capacity is sufficient for the planned mission.

It is displayed on the main screen (e. g. **Free memory: 200 hours***).*

It may be necessary to change the page using **>** *and* **<** *in order to see this.*

7. Proceed with instructions in section OFFLINE OPERATION: DEPLOYMENT.

METHOD B: USING PC RUNNING OCEANLAB

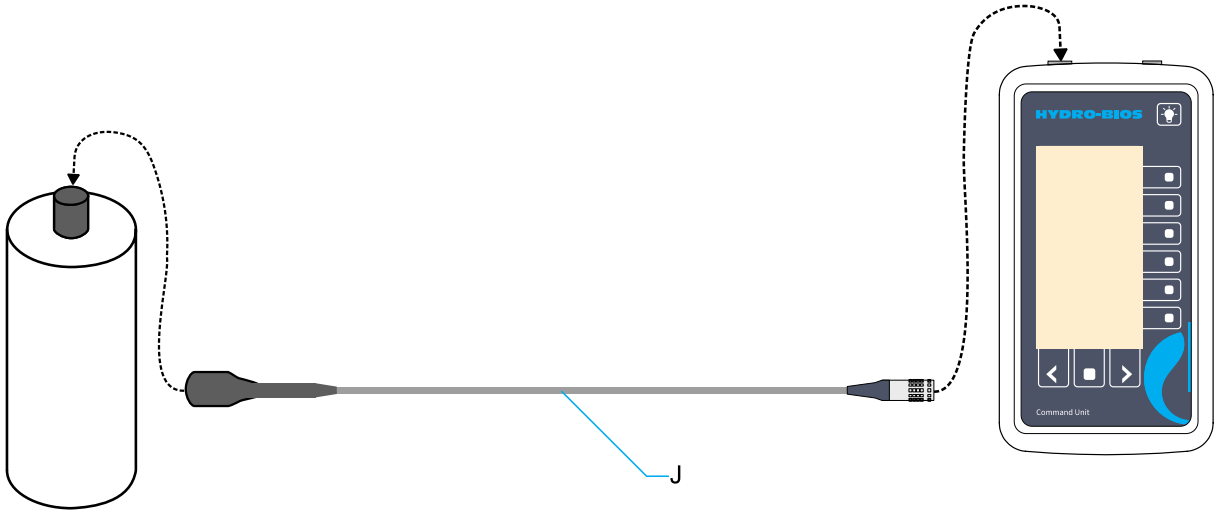


K. PC to serial cable

1. Establish a connection between SFM and PC using the PC to serial cable.
2. Start OceanLab 4 (or later) on the PC.
3. Click on **Connect** in OceanLab.

   OceanLab now displays sensor and state readings for the SFM.
4. Click on **Controlling mode**.
5. Click on **Pressure programming**.
6. Enter the desired pressure value.
7. Click **Send to instrument**.
8. Select **Memory** from the list of components and make sure that the remaining data memory is sufficient for the next operation.
9. Disconnect OceanLab.
10. Proceed with instructions in section OFFLINE OPERATION: DEPLOYMENT.

METHOD C: USING DATA TRANSPORT MODE



J. full speed serial cable

L. Command Unit serial cable to PC

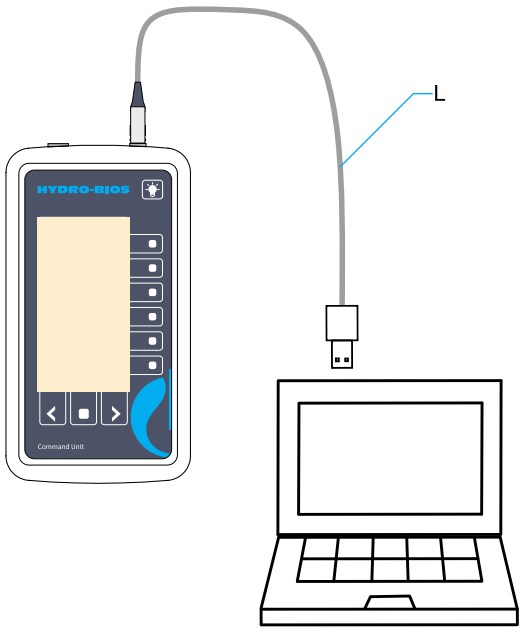
This method is useful if the SFM is out of cable reach from the PC.

See the Command Unit operation manual for more details on the data transport mode.

In this mode, the Command Unit will remember the last underwater unit it has been connected to and list its options towards Oceanlab.

1. Establish a connection between OceanLab and Command Unit using the Command Unit serial cable to PC.
2. Switch on the Command Unit.
3. Press the soft button **Data transport** next to the Command Unit display.
4. Click on **Connect** on the PC inside OceanLab.
5. Use OceanLab to edit programming as described under method B.
6. Click **Send to instrument** to transfer programming to the Command Unit.

   The Command Unit will indicate that it received valid programming with a check mark. ✓
7. Optionally check the device clock and set it if necessary.
8. Click **Disconnect** in OceanLab.
9. Unplug the USB cable from the Command Unit.



10. Bring the Command Unit to the SFM.
11. Establish a direct connection between Command Unit and SFM using the full speed serial cable.
12. Switch on the Command Unit (if it has been switched off in the interim).
13. The Command Unit will automatically transfer the programming to the SFM.
    The display will indicate success by displaying a second check mark. ✓✓
14. Press **Stop transport**.
15. Check if the remaining memory capacity is sufficient for the planned mission.
    It is displayed on the main screen (e. g. **Free memory: 2 days***).*

16. Optionally verify the programmed value pressing the soft button next to **Pressure programming**[1].
17. Proceed with instructions in section OFFLINE OPERATION: DEPLOYMENT.

OFFLINE OPERATION: DEPLOYMENT

The SFM automatically starts an OFFLINE OPERATION when it has been programmed and activated.

1. Establish a direct connection between Command Unit and SFM using the full speed serial cable.
2. Just before deployment, the SFM has to be activated by pressing the soft button **Activate** (below **Pressure programming**).
   - *It may be necessary to change the viewed page using > and < in order to see this. The SFM is now active and will wait for the programmed unlock pressure to be reached.*
   - *A **1-hour timer** starts on activation. If the sampler is not deployed (reaches 5 m or the unlock depth) within this time, it will auto-deactivate to save memory space and battery capacity.*
3. Remove the cable from the underwater unit.
4. To avoid malfunctions, make sure that the dummy SUBCONN MC DC 5 M has been slightly greased and is placed on the connector SUBCONN MC BH 5 F at the underwater unit and is secured with its locking sleeve.

NOTICE

In no case must the underwater unit be submerged without the appropriate cable connections resp. dummy connectors attached!

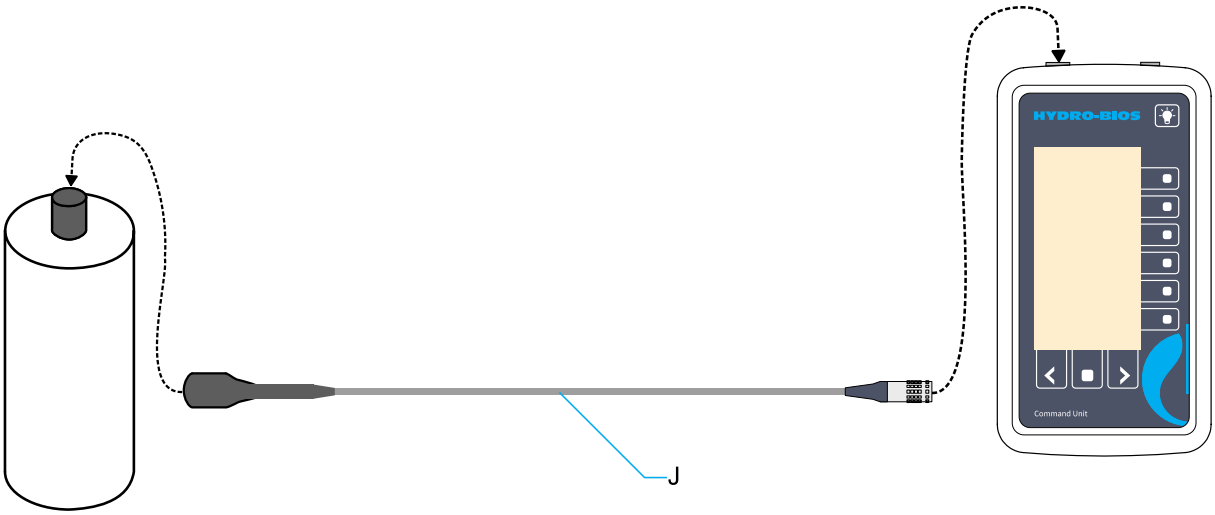
5. Lower the SFM into the water.
6. Make sure to pass the programmed UNLOCK PRESSURE during lowering the SFM to unlock the underwater unit. The water sampler will be automatically closed at the programmed pressure step during upcast.
7. When the SFM is back on deck connect the Command Unit and press the **Deactivate** soft button.
8. Thoroughly rinse the SFM with fresh water.

VIEWING RECORDED OFFLINE DATA

To view recorded offline data the files have to be transferred to a PC. This can be done using one of the two following methods:

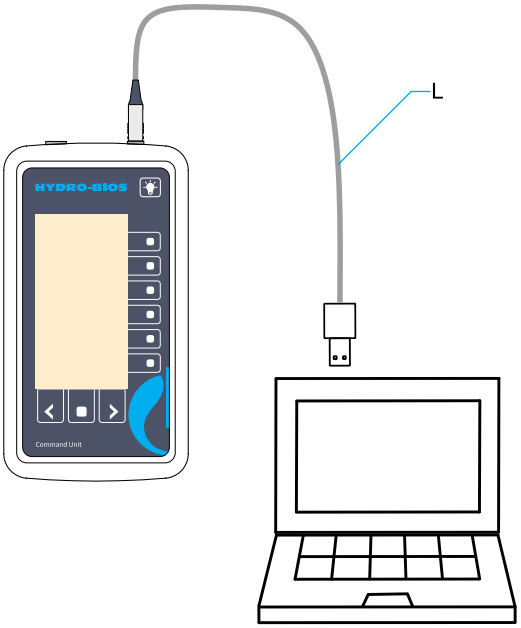
[1] On instruments with additional programming functions (e.g. real time programming) pressing the soft button next to the programming method will first select it (put a check mark next to it). The second press will display the programmed value.

METHOD A: USING COMMAND UNIT TRANSPORT MODE



J. full speed serial cable

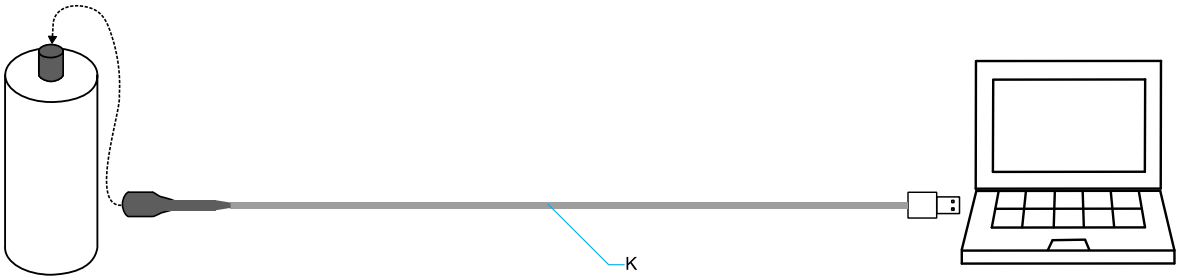
L. Command Unit serial cable to PC



The Command Unit is used as a mass storage device. This is useful when SFM and PC are outside of cable reach and Method B can therefore not be used.

1. Switch on the Command unit.
2. Press the soft button labelled **Data transport** if transport mode is not already active.
3. Establish a direct connection between Command Unit and SFM using the full speed serial cable.
   - *If the SFM is still active at this point, the Command Unit will automatically leave the transport mode and show the main screen instead. In this case press the* **Deactivate** *soft button, then press the soft button next to* **Memory** *and then* **Synchronize** *to go back to the transport mode.*
   - *If there are new files available for syncing to the Command Unit, it will automatically start syncing data. A progress bar will now indicate that files are being transferred to the Command Unit. Depending on the sampling rate and mission duration this can take from several seconds to several minutes.*
4. When file transfer is complete (**Files synched**): Disconnect the cable connecting Command Unit and SFM.
5. Establish a connection between OceanLab and Command Unit using the Command Unit serial cable to PC (no SFM attached).
6. Start OceanLab and press **Connect**.
7. Continue with “Steps common to method A and B” below.

METHOD B: USING DIRECT CONNECTION TO PC



K. PC to serial cable

1. To prepare the data transfer of the stored data to the PC connect the PC to serial cable (MC IL 5 M --> USB) to the connector MC BH 5 F of the underwater unit.
2. Connect the PC to serial cable to the PC's USB port.
3. Start OceanLab and press **Connect**.
4. Click **Deactivate** inside the components window to deactivate the SFM programming.
5. Continue with "Steps common to method A and B" below.

STEPS COMMON TO METHOD A AND B

1. Inside OceanLab enter the **Controlling mode**.
2. Select **Memory** from the list of components.
3. All data files stored inside the instrument's data memory are available inside the file table.
4. Follow the on screen instructions inside OceanLab to transfer files to the PC.
5. Disconnect the cable.

MAINTENANCE

SAMPLER MECHANICAL AND BATTERY TEST

This test ensures the mechanism runs smoothly and that the rechargeable batteries have sufficient capacity. It should be performed when the batteries are in an unknown state of charge or the SFM has not been used for an extended period of time. The procedure is described assuming the Command Unit will be used to control the SFM but it can also be carried out using a PC and Oceanlab.

1. Establish a direct connection between Command Unit and SFM using the full speed serial cable.
2. Switch on the Command Unit.
3. Confirm **Motor position** and **Bottle** number reads **0** (zero) and the release block is in start position (Fig. 3).

> ***CAUTION***
>
> 
>
> PINCH POINT!
> TO AVOID INJURY TO THE OPERATORS OR DAMAGE TO THE INSTRUMENT CAUSED BY CLOSING OF THE SAMPLERS ON AIR THE SAMPLERS MUST **NEVER** BE ARMED DURING TESTS!

During the test observe the battery voltage displayed on the Command Unit. The batteries of the underwater unit should be charged when the battery voltage falls below 6.2 V (indicated by a blinking battery symbol next to the voltage value) while the motor of the underwater unit is running.

4. Press the soft button labelled **ACTION**.

   The motor will run, advancing the release block. After approx. 3 seconds the motor will stop, the **Bottle** number will now read **1 – Operation done**.
5. To reset the SFM after the test press the soft button next to **Bottle** and then **Reset**.
6. Once these steps have been carried out successfully the instrument has passed the test.

UNDERWATER CONNECTORS

The underwater connectors need just a little care to ensure a long life-span. It is advisable to grease the sealing surfaces of the pins with pin lubricant. This avoids corrosion of the contacts and reduces wear while plugging and unplugging.

To conserve the cable connectors never unplug by pulling on the cable and avoid bending radiuses above all narrow, sharp edges.

> ***NOTICE***
>
> 
>
> **In no case must the underwater unit be submerged without the appropriate cable connections resp. dummy connectors attached!**

Clean underwater connectors with warm soapy water. Avoid chemicals to get in contact with the connectors.

IMPACT PROTECTION CAGES

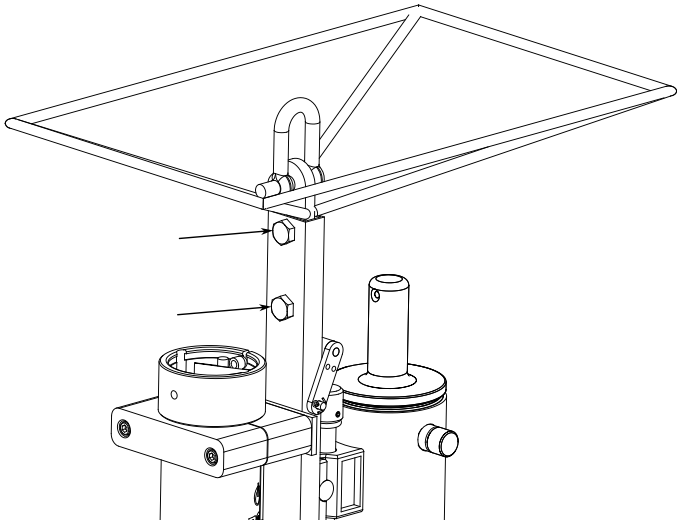
The impact protection for sampler and release device is provided by two dismountable cages on top and bottom of the instrument. Simply remove the cages when the instrument shall be mounted to a ROV, lander or any other structure.

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 protection cages from the stainless steel rack.

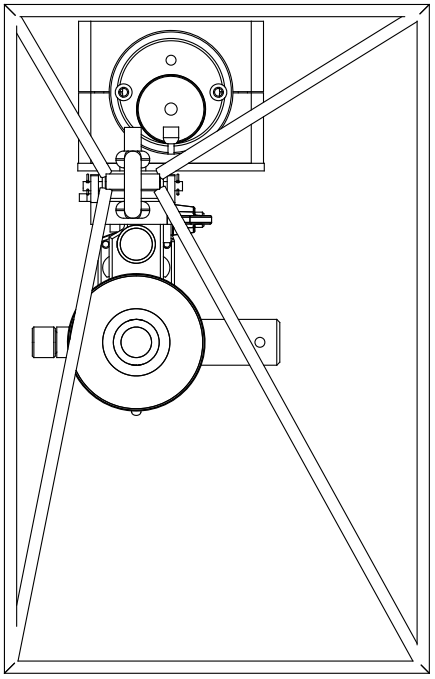
In this condition the Single Fire Module can be mounted to lander arrays, ROVs or any other underwater structure.



Mounting

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

1. Slide top and bottom protection cages into the stainless steel rack. Mind the asymmetric design of the protection cages!
2. Fix top and bottom protection cages with the hexagon head screws (M10 x 16) and the corresponding washers. Tool: Spanner 17 mm
3. Mount a 10 mm 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.



Top View

REMOVAL INSTRUCTIONS FOR THE MOTOR UNIT

If the motor of the Single Fire Module has to be removed for repair resp. maintenance, the following steps have to be carried out:

1. Remove any cable from connector MC BH 5 F at the underwater unit.
2. Plug dummy MC DC 5 M into connector MC BH 5 F.
3. Loosen both hexagon socket screws M 6 of the black motor clamp. Tool: Hexagon Socket Screw Key 5 mm
4. Pull complete motor unit out of the motor clamp.

MOUNTING INSTRUCTIONS FOR THE MOTOR UNIT

The Single Fire Module only works properly when the synchronization between motor and release device has been established. In order to re-establish the synchronization before mounting the following steps have to be carried out:

1. Connect the dismounted motor unit to the Command Unit.

2. Press the soft button next to the **Bottle** number display.
3. Press **Half step** to carry out a short motor run (half revolution of the motor axle). The **Bottle** number will be reset to **0**. Repeat this until the release block is in start position (Fig. 3).

   The motor is now synchronized and ready for remounting.
4. Remove connecting cable from connector MC BH 5 F at the motor unit.
5. Slightly grease the pins with PIN-lubricant and plug the dummy connector MC DC 5 M into connector MC BH 5 F.
6. Guide motor unit into motor clamp until release device rests against motor clamp.
7. Align slot of the release device in the direction of the rope at the striking bar.
8. Tighten both hexagon socket screws M 6 of the black motor clamp. Tool: Hexagon Socket Screw Key 5 mm

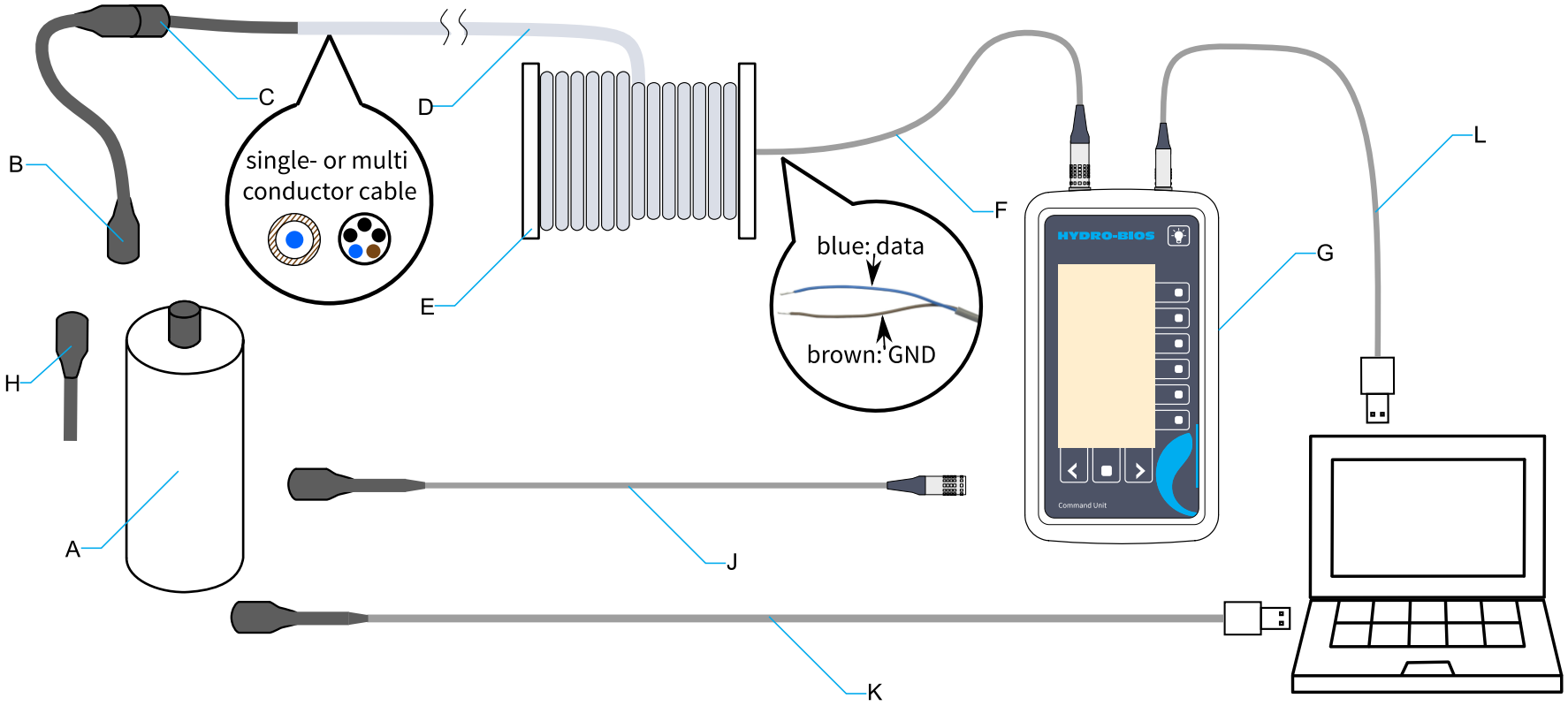


Fig. 1: connections overview

A. probe / sampler

B. adaptor cable

C. pig tail

D. electromechanical winch cable

E. winch

F. slip ring box cable

G. Command Unit

H. dummy connector

J. full speed serial cable

K. PC to serial cable

L. Command Unit serial cable to PC

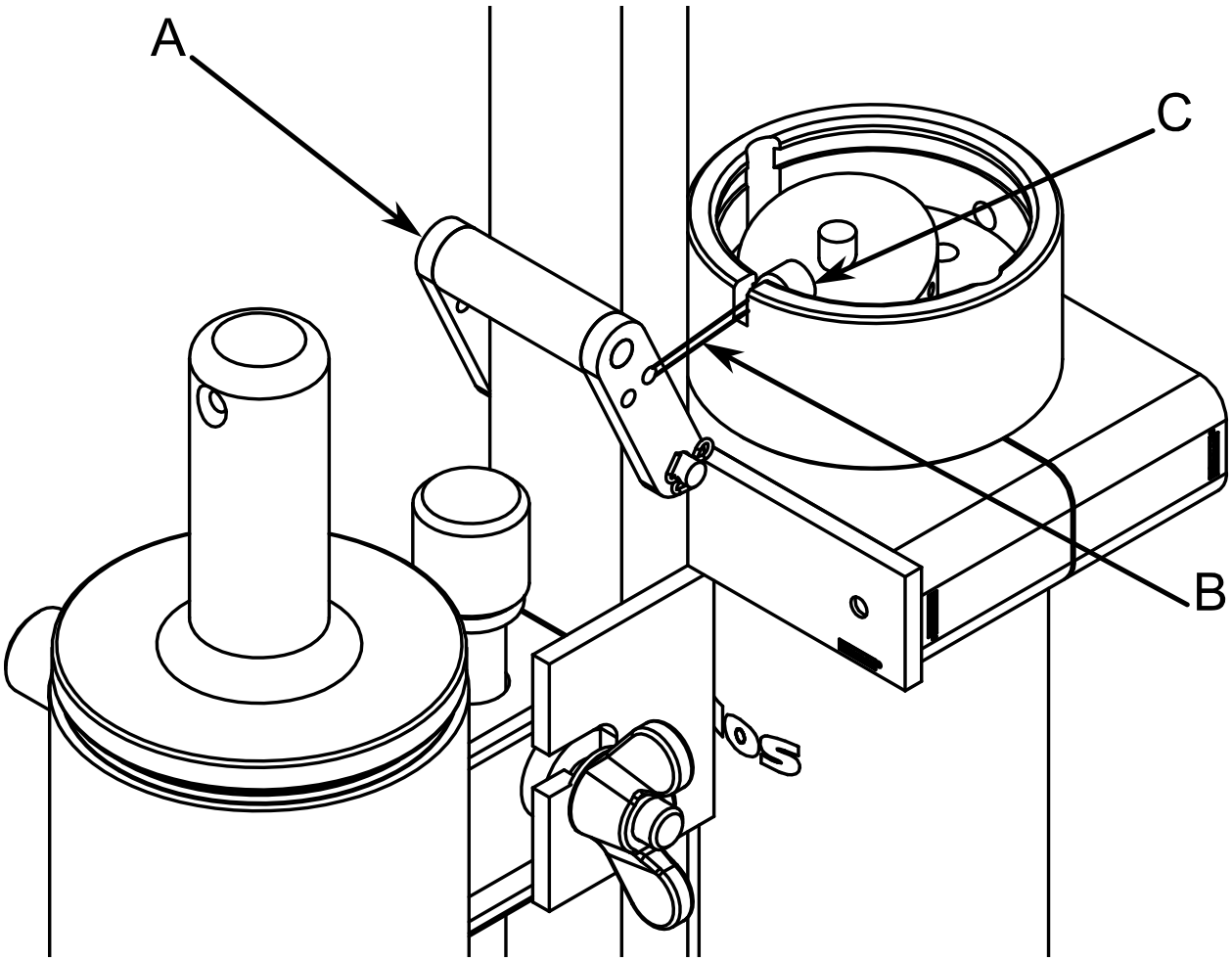


Fig. 2: striking bar and release device

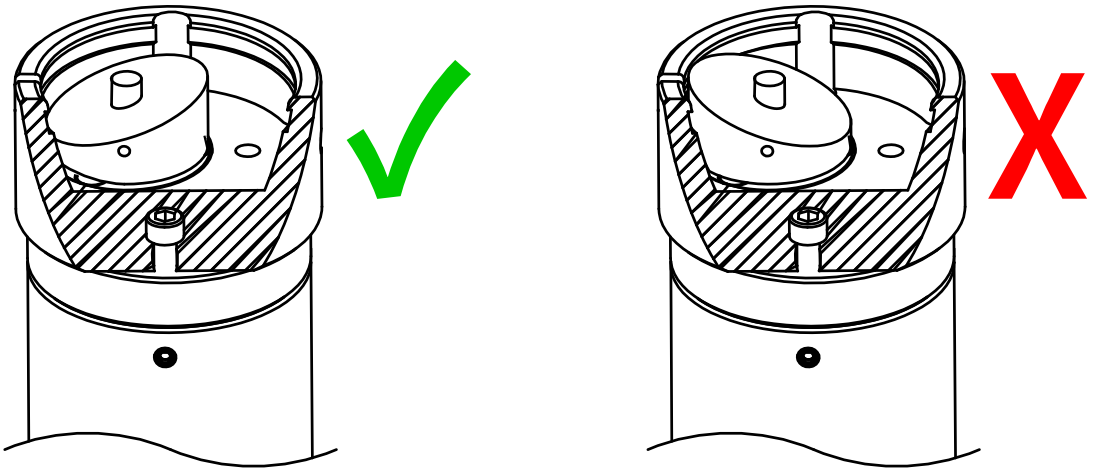


Fig. 3: start position

DO NOT RELEASE SAMPLER ON AIR!

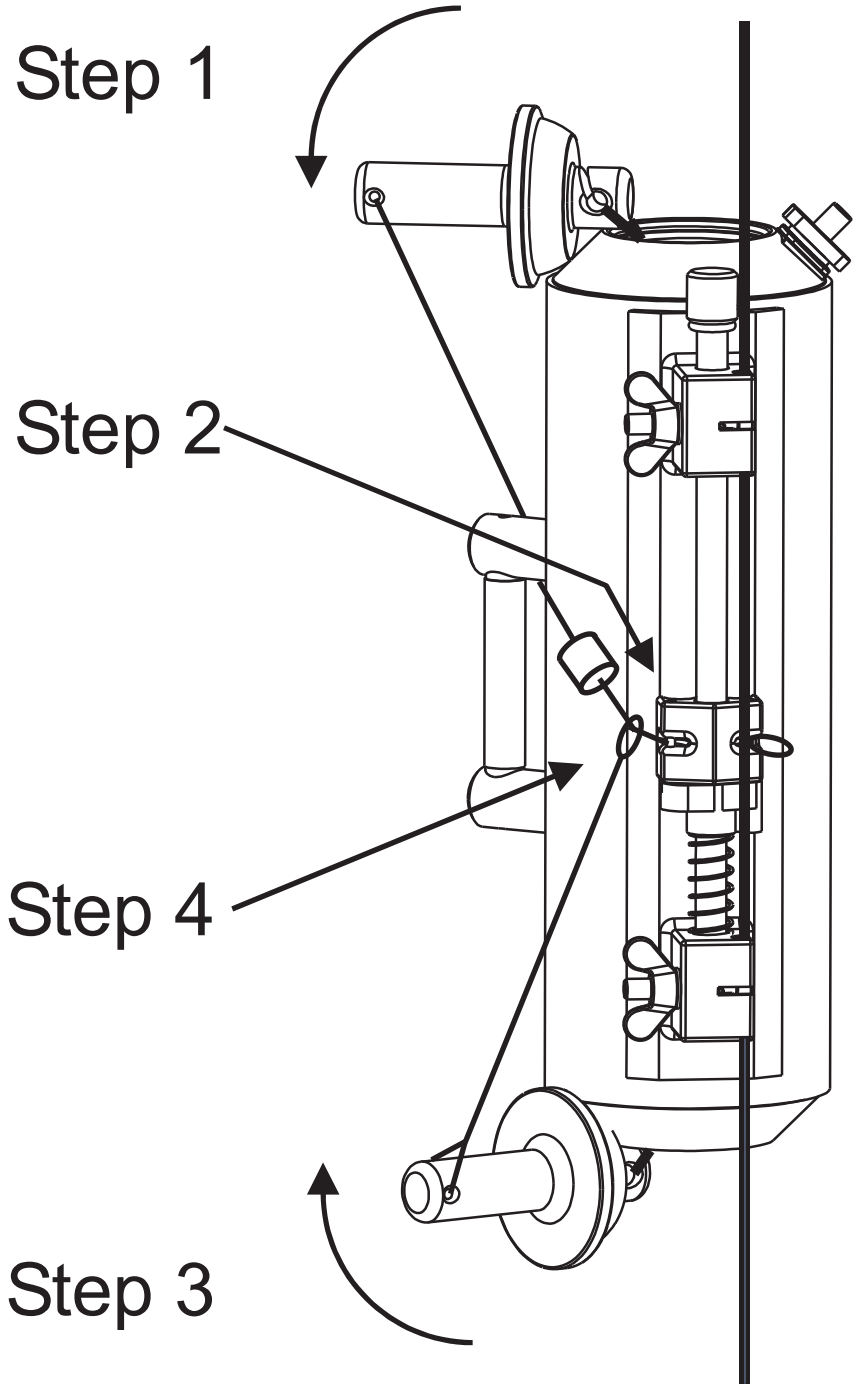


Fig. 4: arming of water sampler