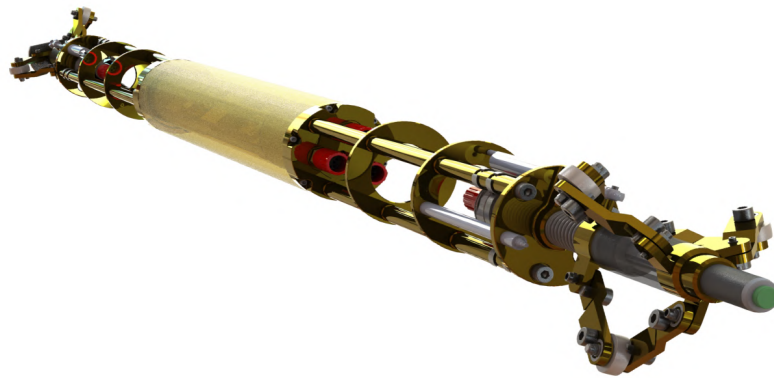# DL20 – Manual
v. 2021-1

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Introduction

The data logger (DL20) is the newest iteration of ice core drill logger. The newest version is an improvement of the previous system (DL81), optimized for measurement precision, modulability, and the possibility to execute special measurements. The DL20 measures pressure, inclination, azimuth angles, temperature, and hole diameter. The system contains the following sensors: 2x ISD4000, 1x ISM3D, 2x linear transducers, 1x end stop button, and 1x end thermistor. The intended supply voltage and power line communication is 375VDC using a MM74HC942N modem. This is not implemented in the current setup, instead a 15VDC supply is used. Data is logged on local SD storage and broadcasted either via modem or on-board USB. Data stream can be monitored live via modem once the 375VDC power line is implemented. Stored data can be downloaded using DL20 DG.

Contents

1 Overview

The DL20 is shown in Figure 1. It has four main components: electrical Housing, pressure chamber, bottom caliper, and top caliper. The system has and two external connections; main power (15VDC) and data connection for the DL20 DG.
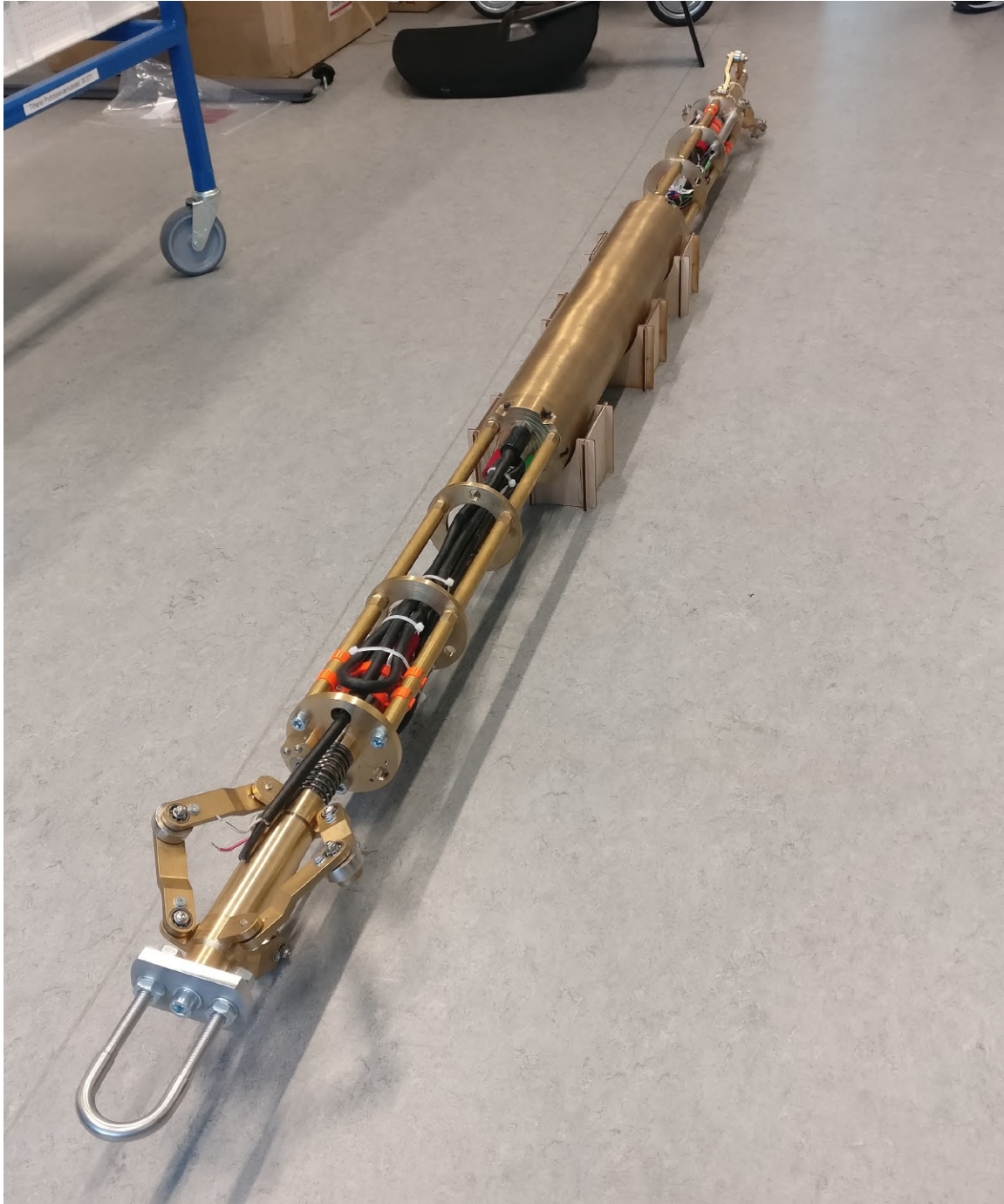

Figure 1: DL20.

2 Before Use

To ensure correct data logging and safe use of the DL20, the following criteria must be met.

2.1 Calibration

Make sure the following components are correctly calibrated in accordance to instructions:

1. ISM3D

2. ISD4000 (Top)

3. ISD4000 (Bottom)

4. Transducer (Top)

5. Transducer (Bottom)

6. Thermistor

2.1.1 ISM3D

Calibrating the ISM3D must be done with the DL20 fully assembled, to correctly map the system's soft- and hard-iron effects. Use the DL20 DG to access the ISM3D for calibration (See section 7 - ISM3D Calibration).

2.1.2 ISD4000

Calibration of the two ISD4000 must be in accordance to specifications from Impact Subsea [5]. The sensors are supplied fully calibrated and must be re-calibrated with one year intervals.

2.1.3 Transducer

Calibrating the transducers positioned at the top and bottom calipers must be done using the DL20 power supply and circuit to ensure correct correlation between logged data and calibration.

2.1.4 Thermistor

Calibrating the thermistor positioned near the bottom caliper must be done using the DL20 power supply and circuit to ensure correct correlation between logged data and calibration.

2.2 Pressure Seal

Before using the system in high-pressure environments (submerged drill core sampling). All seals must be tested at the required pressure with sufficient overhead, with all bolts tightened to specified tightening torque.

3 Assembly

3.1 Electrical Housing

The electrical housing (Component A) is mounted inside the pressure chamber (Component B), by sliding it inside the pressure chamber, apply light pressure.

> Take extra care not to damage the end flange of pressure chamber during installation
> Do not bend electrical housing or cables during installation.

Figure 2: DL20 Assembly, electrical housing (A), pressure chamber (B).

3.2 Bottom Caliper

1. The bottom caliber (Component C) is connected to to the Bottom side of the electrical housing and pressure chamber (Component B).

Figure 3: DL20 Assembly, bottom caliper.

2. The correct side of the electrical housing is marked **BOTTOM**, connect cables between the electrical housing and bottom caliper.
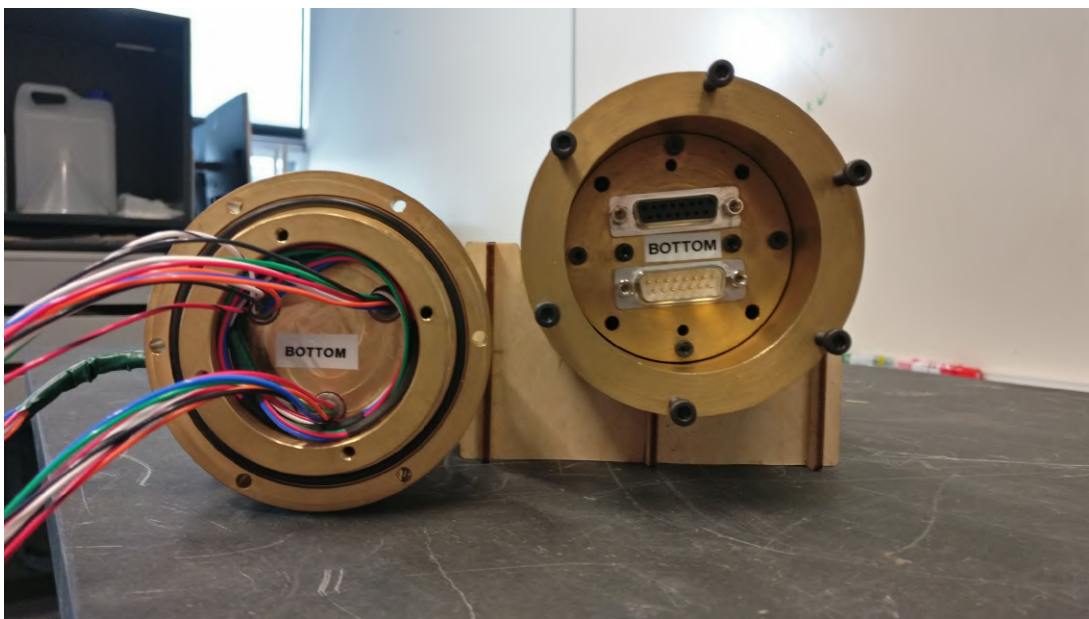

Figure 4: DL20 Assembly, bottom markings on electrical housing and Bottom caliper.

3. Cables are twisted and fitted inside the pressure chamber housing. All 6 Bolts are tight-ened, fastening the caliper to the pressure chamber.

> Make sure cables are not clamped during installation.
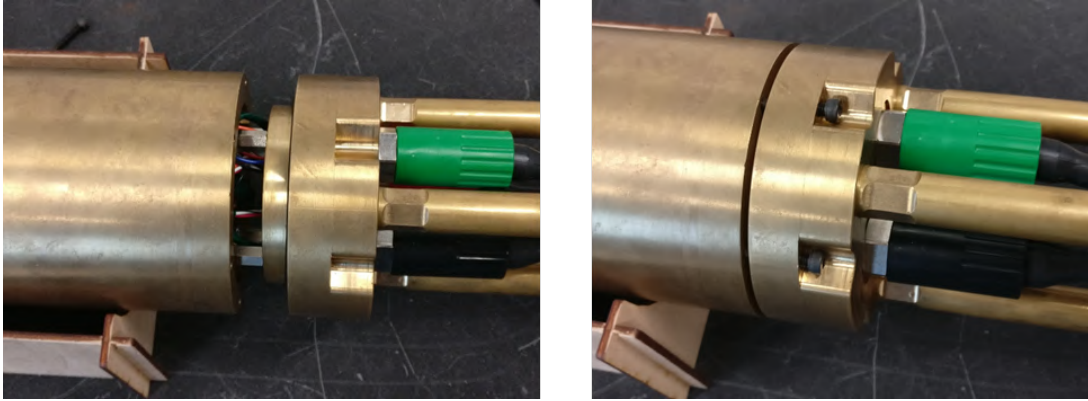>
> Bolts are tightened to 3.2 Nm

Figure 5: DL20 Assembly, fastening.

3.3 Top Caliper

1. The top caliber (Component D) is connected to to the Top side of the electrical housing and pressure chamber (Component B).

Figure 6: DL20 Assembly, top caliper.

2. The correct side of the electrical housing is marked **TOP**, connect cables between the electrical housing and top caliper.

Figure 7: DL20 Assembly, top markings on electrical housing and Top caliper.

3. Cables are twisted and fitted inside the pressure chamber housing. All 6 Bolts are tightened, fastening the caliper to the pressure chamber.

Make sure cables are not clamped during installation.
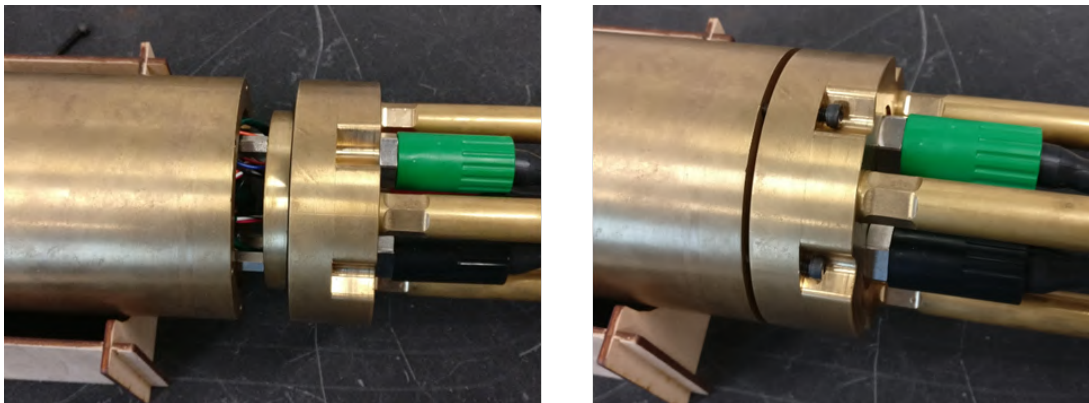
Bolts are tightened to 3.2 Nm

Figure 8: DL20 Assembly, fastening.

3.4 Tightening Torque

During extended service or disassembly of the top and bottom calipers two sets of bolts must be tightened to a specific torque to ensure proper assembly.

3.4.1 Longitudinal Rods
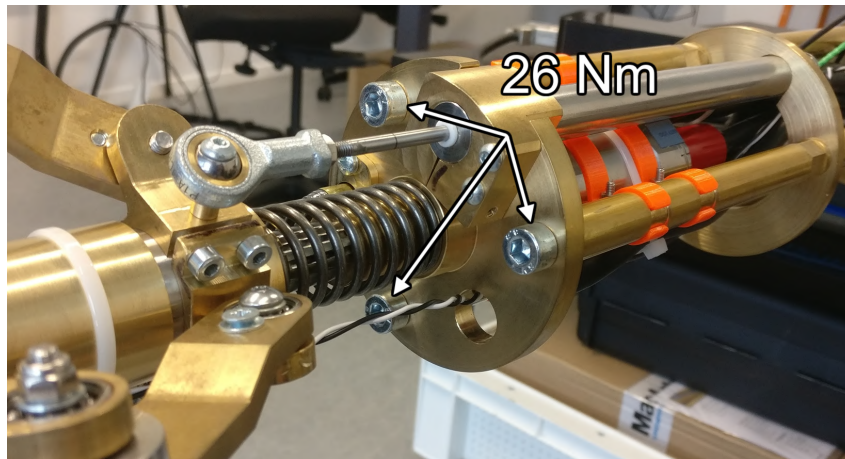
Bolts shown in Figure 9 must be tightened to 26 Nm.

Figure 9: DL20 Assembly – Longitudinal Rods (26 Nm).

3.4.2 Caliper Center Rod
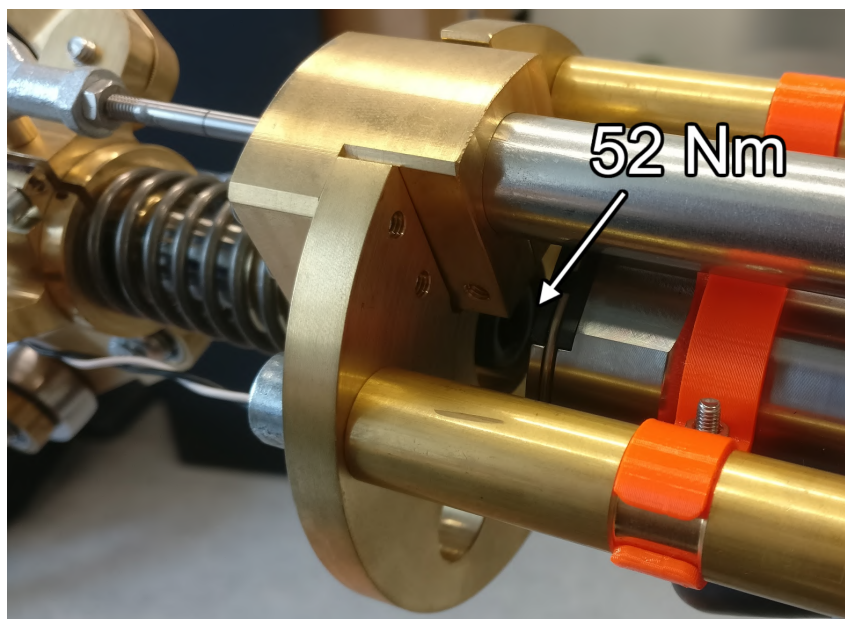
Bolt shown in Figure 10 must be tightened to 52 Nm.

Figure 10: DL20 Assembly – Caliper Center Rod (52 Nm).

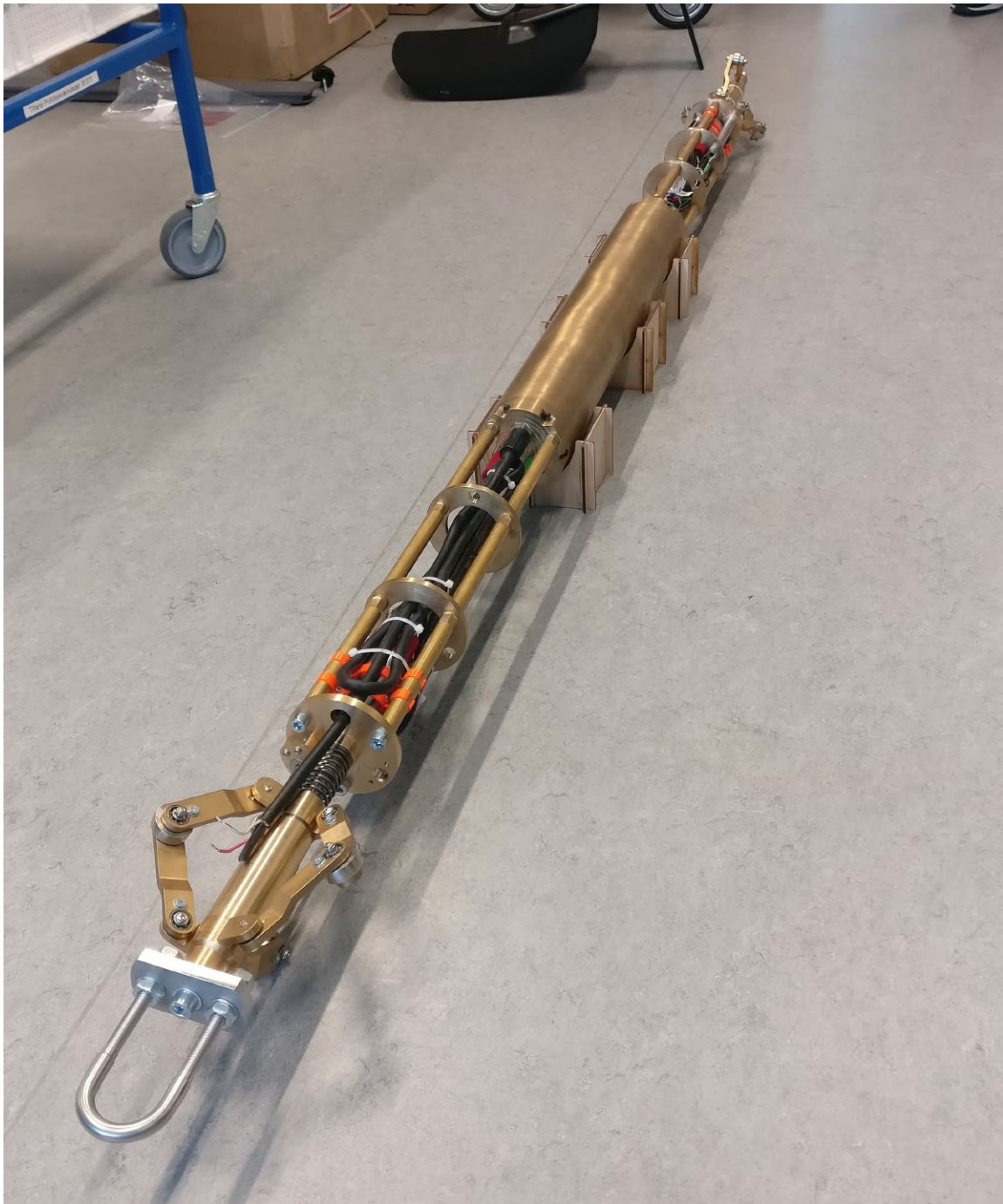## 3.5   Fully Assembled

DL20 fully assembled.

Figure 11: DL20 Assembled.

4 Data Logging

4.1 Starting Data Logging

To start data logging:

▍ Warning: Data logging can not be started with DL20 DG data cable connected!

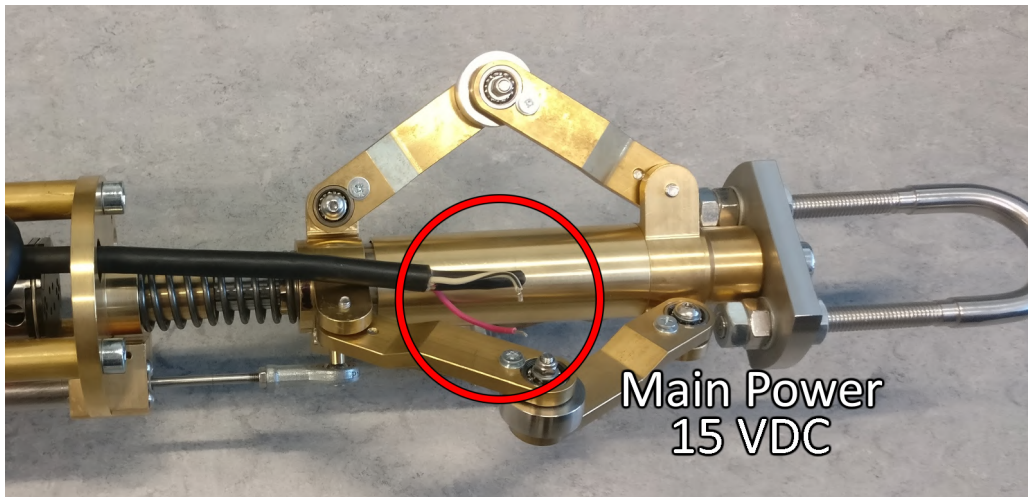1. Power on the system using the Main Power input (Red 15VDC, White/Black GND).[1]

Figure 12: DL20 Main Power (15VDC).

2. Start data logging by pressing and holding the End Stop button for >3 seconds.[2]

▍ See appendix if data logging does not start.

Figure 13: DL20 End stop button, press and hold 3 sec to start data logging.

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[1]Two beeps should be heard (1 high and 1 low note) followed by a low note every 2 sec.
[2]Two high pitch beeps notes should be heard followed by silence.

4.2   Data File Generation

A new data file is generated with an incrementing sample number when a data log is started.

- DATA_0.TXT

- DATA_1.TXT

- DATA_2.TXT

- ...

4.3   Data File Format

The data files generated by the DL20 is in the following format:

QQQQQ FFFFF GGGGG VVVVV B $ISHPR, hhh.hh, ll.ll, rrr.rr YY $ISHPR, ddd.ddd, M, ppp.pppp, B, tt.tt, C xx $ISHPR, DDD.DDD, M, PPP.PPPP, B, TT.TT, C XX	
QQQQQ	= Incrementing Sample number
FFFFF	= Transducer 1 (Top) digital value for position
GGGGG	= Transducer 2 (Bottom) digital value for position
VVVVV	= Temperature digital voltage measurement
B	= End Stop button value
$ISHPR	= ISM3D measurements
hhh.hh	= Heading in degrees
ll.ll	= Pitch in degrees
rrr.rr	= Roll in degrees
YY	= NMEA standard checksum
$ISHPR	= ISD4000 1 (Top) measurements
ddd.ddd,M,	= Depth in Meters
ppp.pppp,B,	= Pressure in Bar
tt.tt,C	= Temperature in degrees Celsius
xx	= NMEA standard checksum
$ISHPR	= ISD4000 2 (Bottom) measurements
DDD.DDD,M,	= Depth in Meters
PPP.PPPP,B,	= Pressure in Bar
TT.TT,C	= Temperature in degrees Celsius
XX	= NMEA standard checksum

5   Using DL20 DG

Use the DL20 DG to calibrate the on–board ISM3D or to download data from the on–board local storage.

| The DL20 DG can not be used when data logging is active!
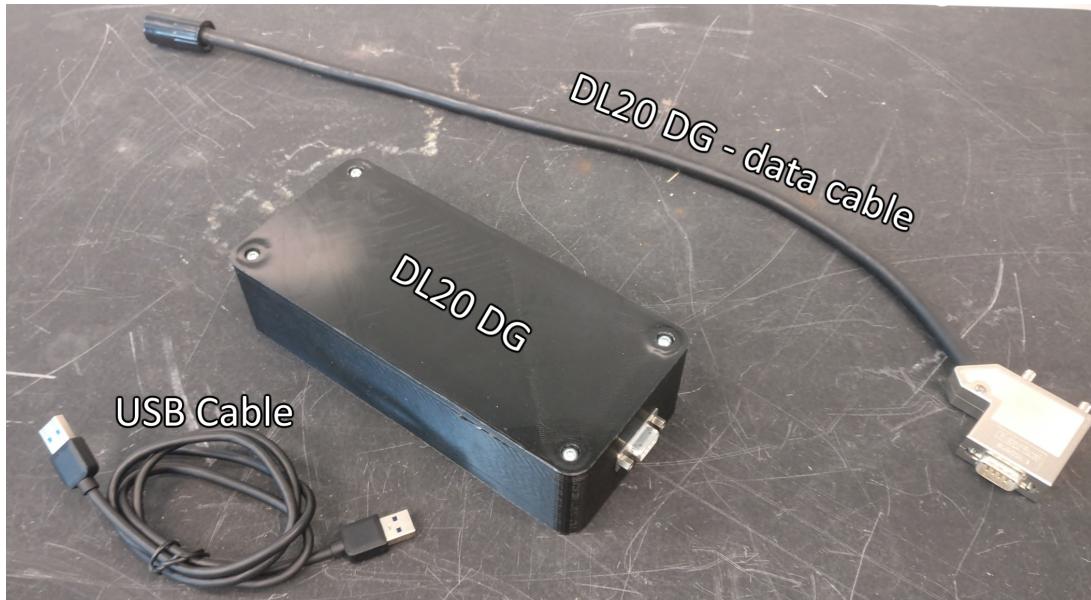

Figure 14: DL20 DG

5.1   Connecting the DL20 DG

To connect the DL20 DG:
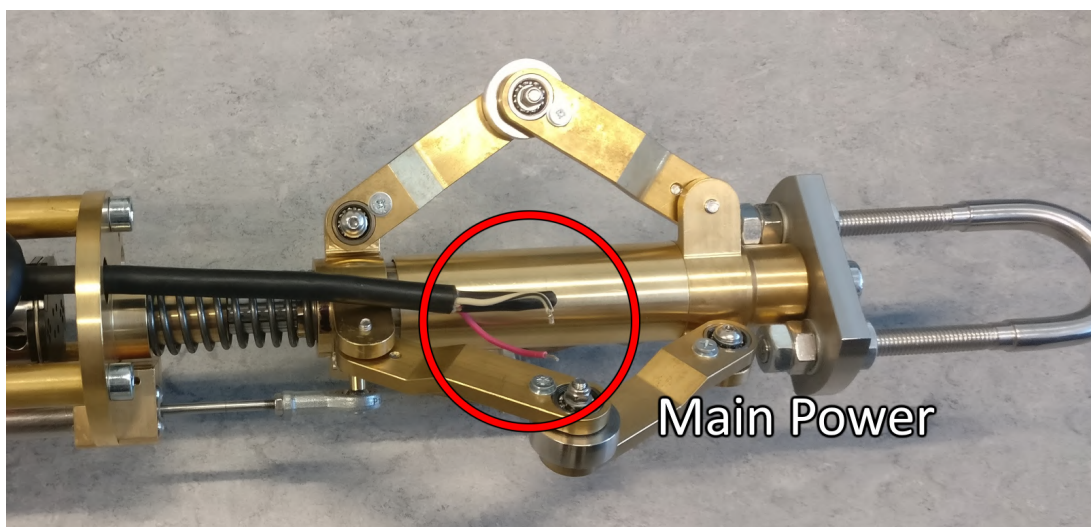
1. Disconnect the main power from the DL20

Figure 15: DL20 Main Power.
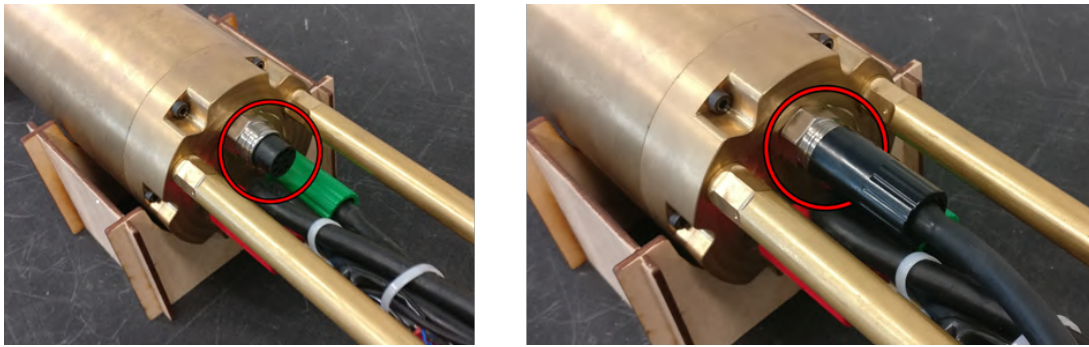
2. Connect DL20 DG data cable to the DL20 bottom side

Figure 16: Connecting DL20 DG data cable to DL20.
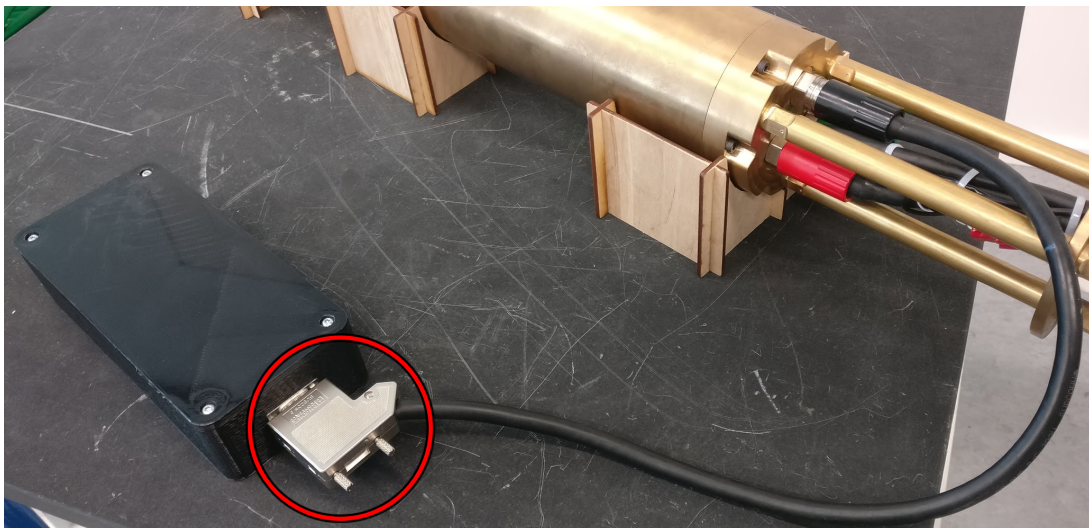
3. Connect DL20 DG data cable to the DL20 DG

Figure 17: DL20 connection to DL20 DG.

4. Connect DL20 DG to a PC using USB cable

Figure 18: DL20 DG connection to PC.

- To access onboard ISM3D use the USB port marked **ISM**.

- To access DL20 local storage use USB port marked **SD**.

Figure 19: DL20 DG USB ports.

6 Downloading Data Files from DL20

6.1 Installing DL20 DG app

Download and install the DL20 DG app:

1. Download DL20 DG installer from [1].

2. Run installer as admin and follow instructions .

6.2 Installing CH340 Driver

Download and install CH340 drivers to be able to connect to the DL20 DG.

1. Download CH34x drivers from [3].

2. Extract files and install using `.exe` file.

▌ See appendix for instruction if PC does not automatically update device drivers after install.

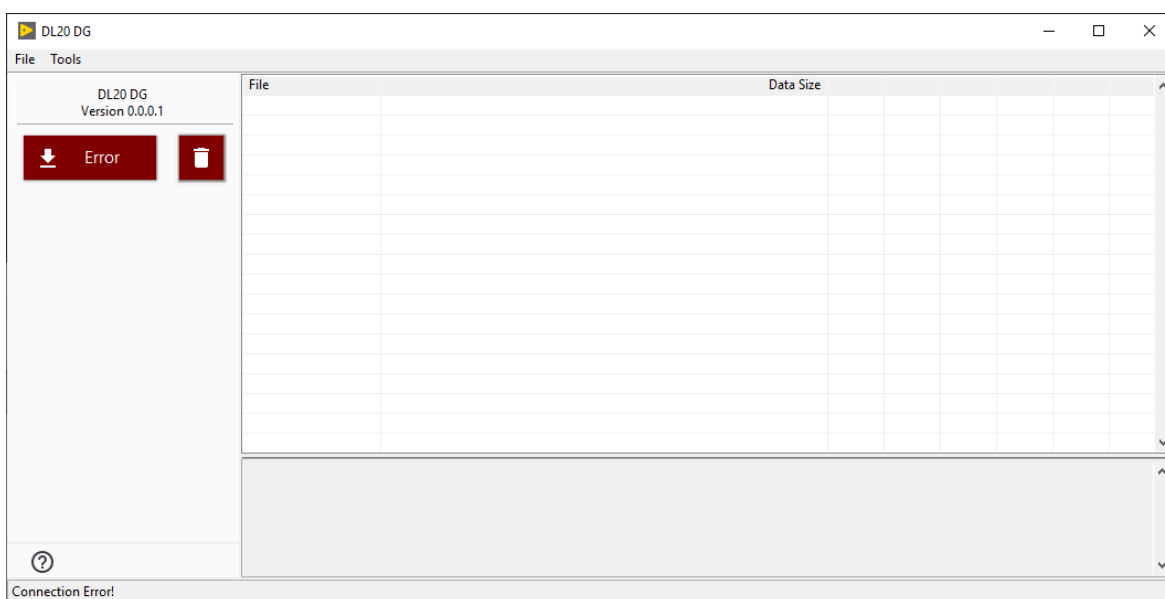## 6.3 Starting DL20 DG app

To use the DL20 DG app:

1. Connect DL20 DG and use USB port marked **SD** (See subsection 5.1).

2. Start DL20 DG app.

3. System will automatically detect and connect to the DL20 DG.
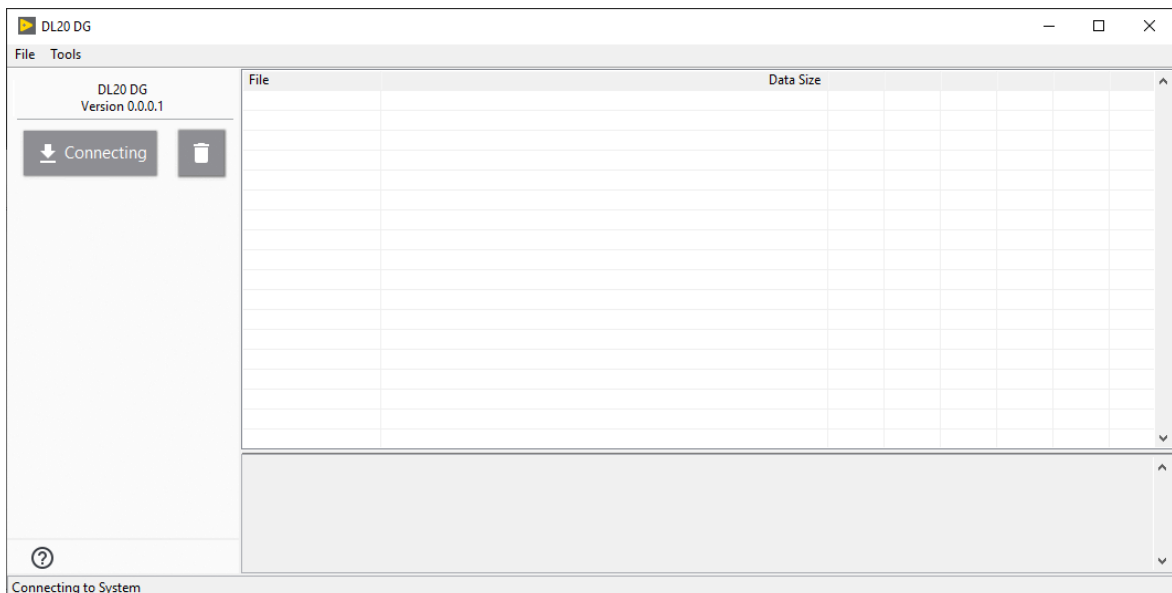
4. Wait for system to initialize, if connection is established a list of data files will display
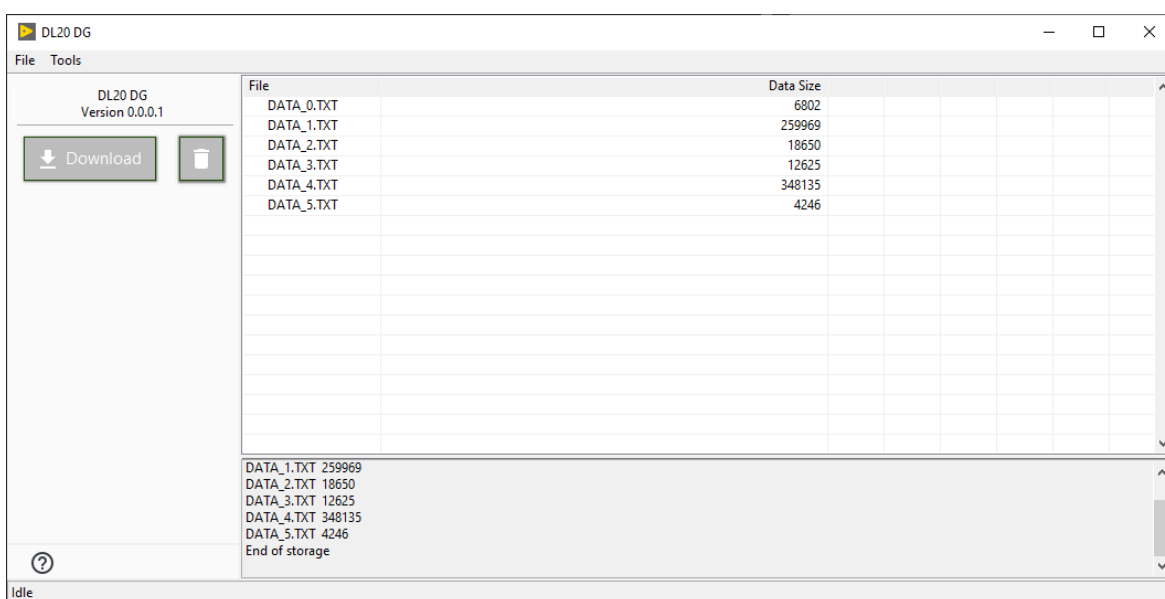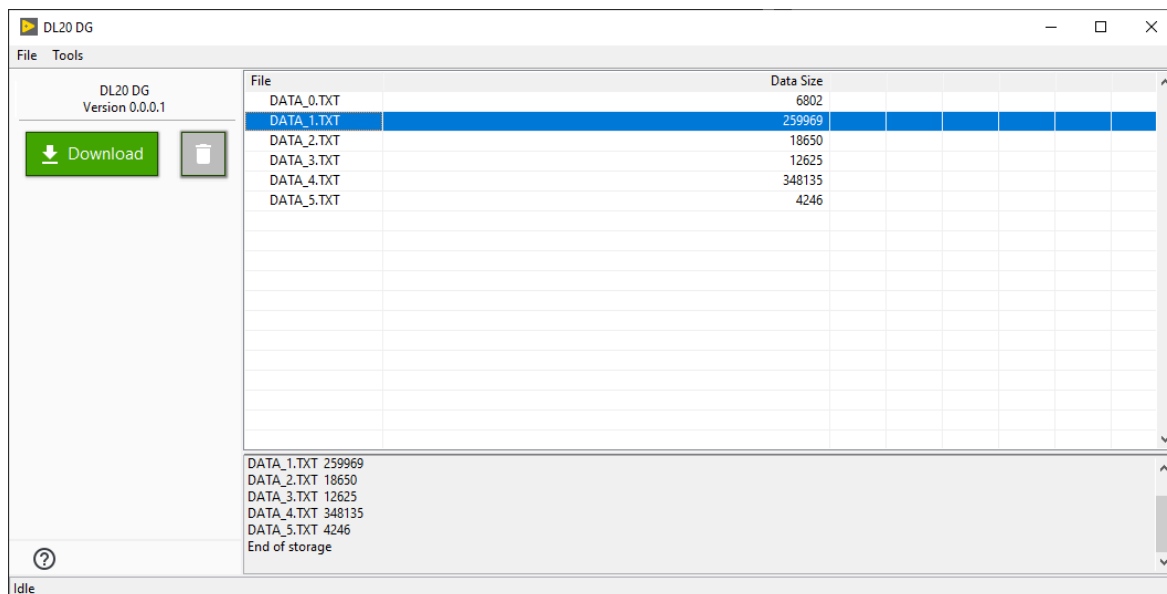

5. Errors will be displayed if initialization fails
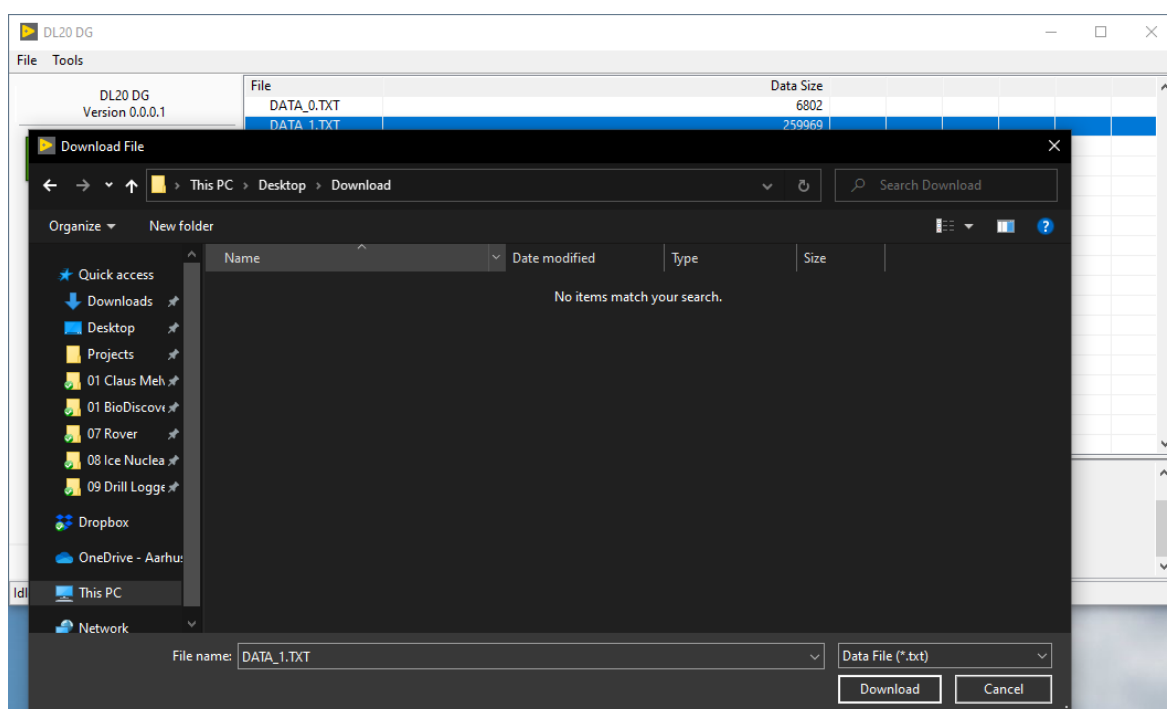

See appendix for list of common errors.

6.4 Downloading a Data File

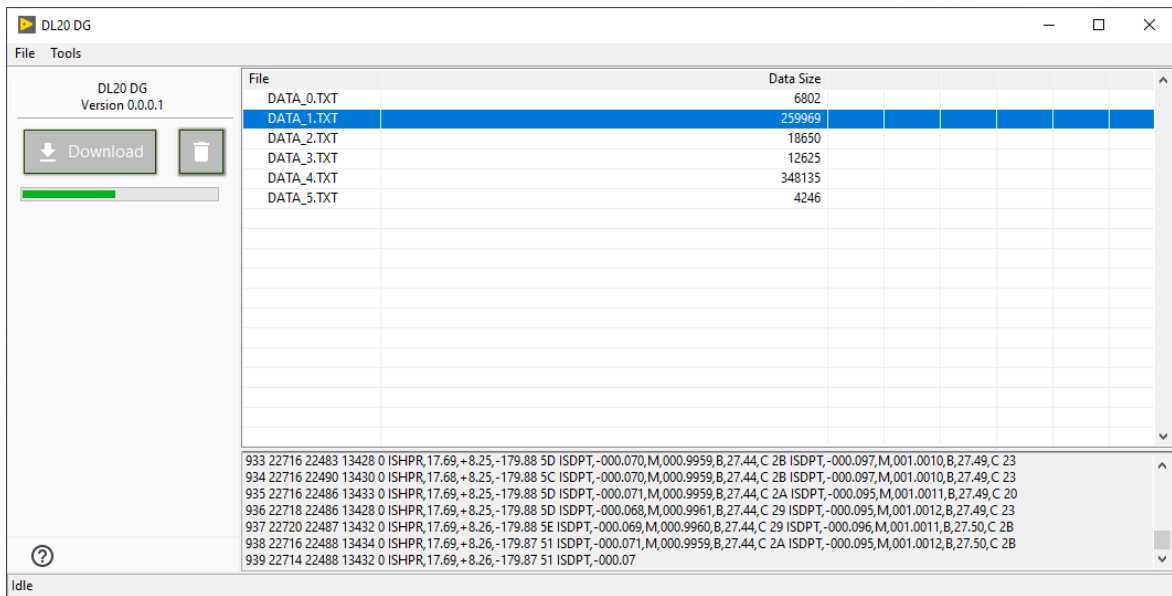To download a datafile from the DL20 local storage:

1. Select file from list and press Download .
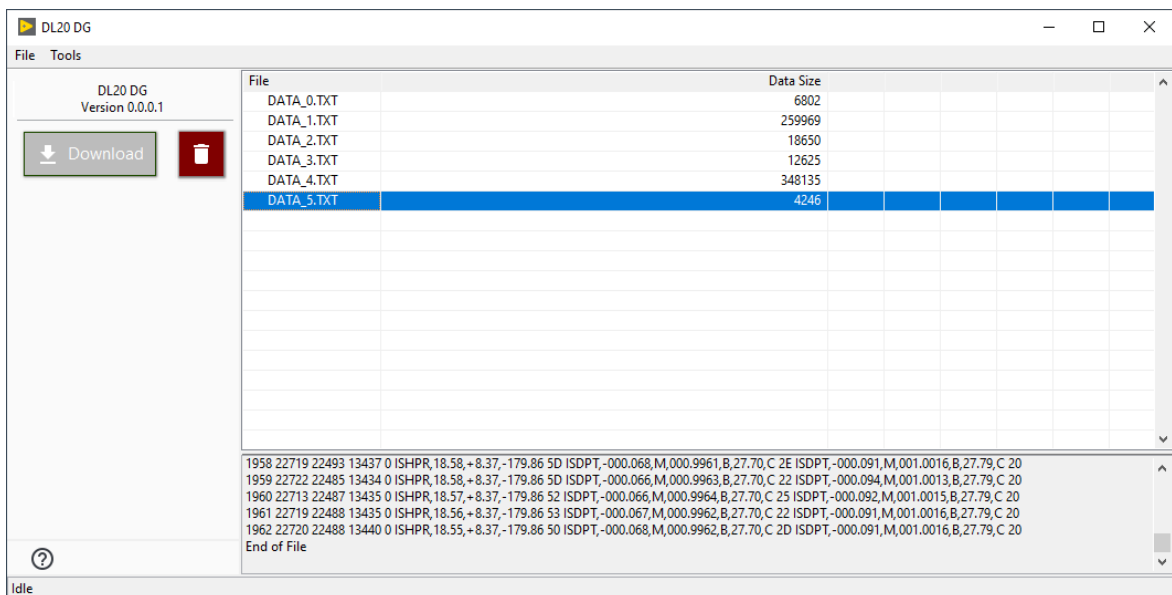

2. Choose a file location and name and confirm.

3. Wait for progress bar to fill during download.

6.5 Deleting a Data File

To delete a datafile on the DL20 local storage:

1. Select file from list and press Delete icon

7 ISM3D Calibration

7.1 Installing seaView

Calibration software made by impactsubsea:

1. Download **seaView v1.9.0** from [4].

2. Extract the files from the downloaded zip file.

7.2 Using seaView

To calibrate the onboard ISM3D:

1. Connect DL20 DG and use the USB port marked **ISM** (See subsection 5.1).

2. Start seaView.

For instructions on how to use seaView see [4]

8 Firmware

8.1 Broadcast Mode

The DL20 firmware[2] has two possible modes, `PC_COMM` and `MODEM_COMM`. The mode is selected in the preamble of the software by uncommenting either `PC_COMM` or `MODEM_COMM`.

```
1  //#define MODEM_COMM  1 // <-- Uncomment for Low speed modem communication
2  #define PC_COMM 1        // <-- Uncomment for High speed PC communication
```

`PC_COMM` broadcasts high speed data via the internal processors USB port using this mode disables the on-board modem broadcast. In this mode the logging (and broadcast speed) is 2 Hz. The frequency can be set by altering the sample rate of the ISM3D and the two ISD4000. The broadcast is set to a baud rate of 115200 resulting in a maximum of 576 kBps. One data package contains 133 Bytes, resulting in a maximum speed of 540 Hz. The ISM3D is rated to 250 Hz and the ISD4000 is rated to 100 Hz.

The highest sample rate in this mode is 100 Hz.

`MODEM_COMM` broadcasts low speed data via the on-board modem, using this mode disables the high speed USB broadcast. In this mode the logging (and broadcast speed) is 0.5 Hz. The modem has a maximum baud rate of 600, resulting in a maximum of 75 Bps. As one data package 133 Bytes is will take 1.8 sec to transmit.

The highest sample rate in this mode is 0.5 Hz.

The sample rate can be adjusted by altering the `sampleDt` variable, which is the time between each logged data. The frequency at which data is broadcasted (either via PC or Modem communication) can be altered using the `surfaceFrequency` variable.

9 Appendix

9.1 Prerequisites to run DL20 DG app

To run DL20 DG app, you must have,

1. CH340 drivers properly installed on your PC.

2. DL20 DG connected to PC via USB cable using port labeled **SD**.

3. DL20 DG connected to the DL20 via the data cable.

4. DL20 main power disconnected.

9.2 Common Errors

9.2.1 DL20 – Data logging not starting

- Make sure Power is supplied to system (15 VDC).

- Make sure End Stop Button is pressed for >3 seconds after system is powered up.

- Make sure DL20 DG data cable is disconnected.
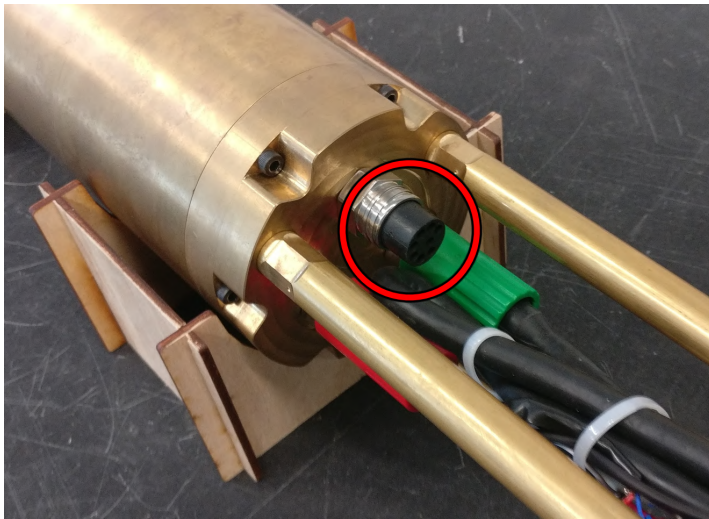
- Restart data logging following procedure explained in subsection 4.1.

9.2.2 DL20 – No audible sound from system

- Make sure Power is supplied to system (15 VDC).

- Sound might be too low to hear, listen near end flanges of pressure chamber.

9.2.3 DL20 – Continue beeping after Start Button Pressed

- If beeps are long, system can't connect to local storage (See subsubsection 9.2.4).

- If beeps are short with long delay data logging hasn't started (See subsubsection 9.2.1)

9.2.4 DL20 – "SD connection error" or no files generated

• Make sure SD card is inserted fully into SD card reader (See subsubsection 9.2.8).

• Restart system and follow procedure explained in subsection 4.1.

• If data logging does still not start, extract and reformat SD card to FAT16 format.

9.2.5 DL20 DG app – Connection Error

• Make sure DL20 DG is connected to PC via USB port marked **SD.**

• Make sure DL20 main power is disconnected.

• Possible fix:

  1. Disconnect USB from DL20 DG.
  2. Reconnect DL20 DG to PC via USB port marked **SD.**
  3. Press Tools ⟩⟩ Reconnect Systems
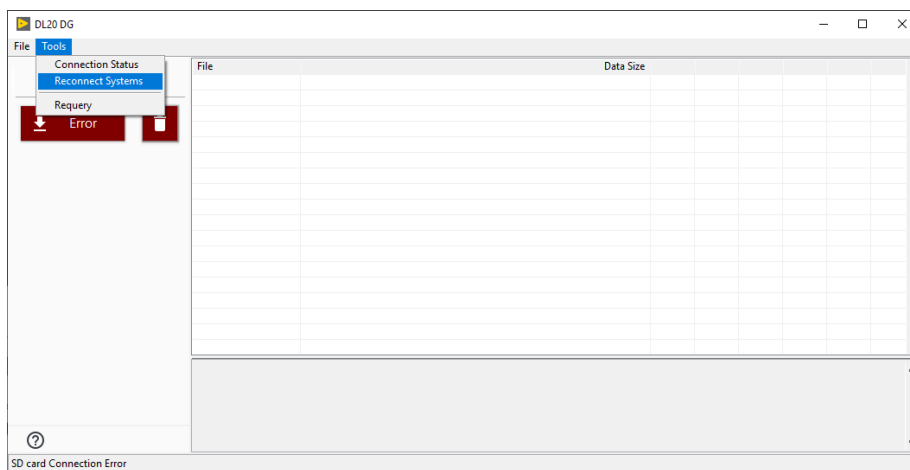
9.2.6 DL20 DG app – SD card Connection Error

• Make sure DL20 DG is connected to the DL20

• Make sure DL20 main power is disconnected

• Possible fix:

  1. Disconnect USB from DL20 DG
  2. Reconnect DL20 DG to PC via USB port marked **SD.**
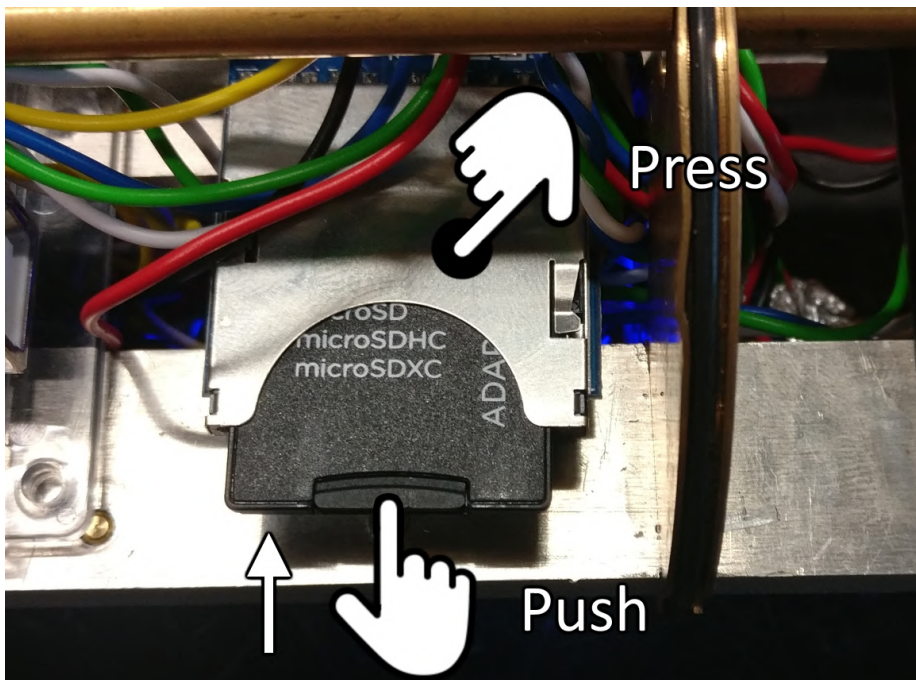
3. Press Tools ≫ Reconnect Systems
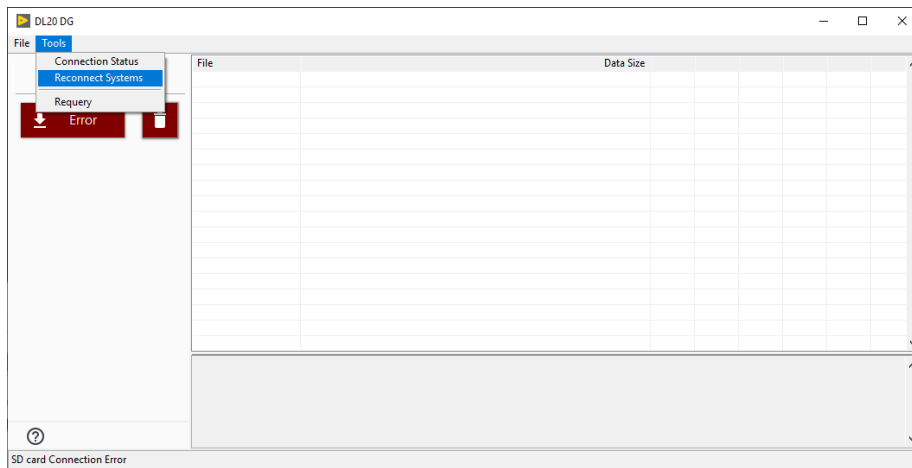
9.2.7   DL20 DG app – System Connected, no files found

- DL20 local storage might be empty.

- If system is connected and nothing happens, press Tools ≫ Requery
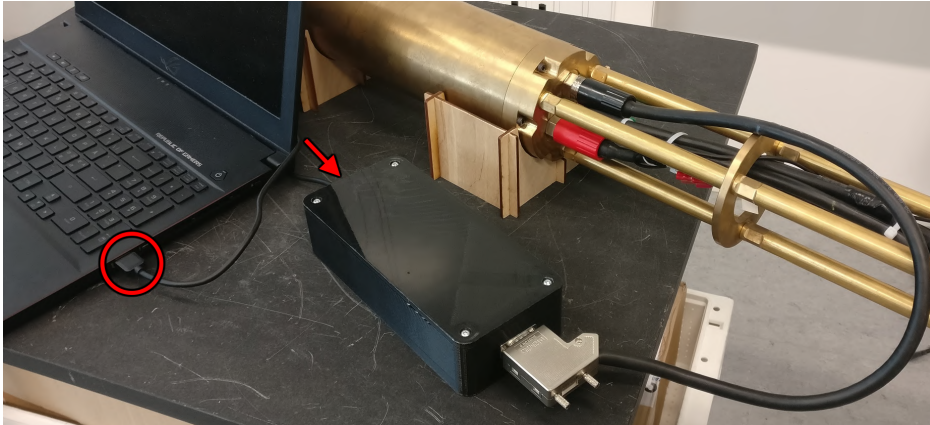
9.2.8   SD Card won't stay inserted in SD reader

- Push until an audible *click* to release/lock SD card.

- Possible fix:
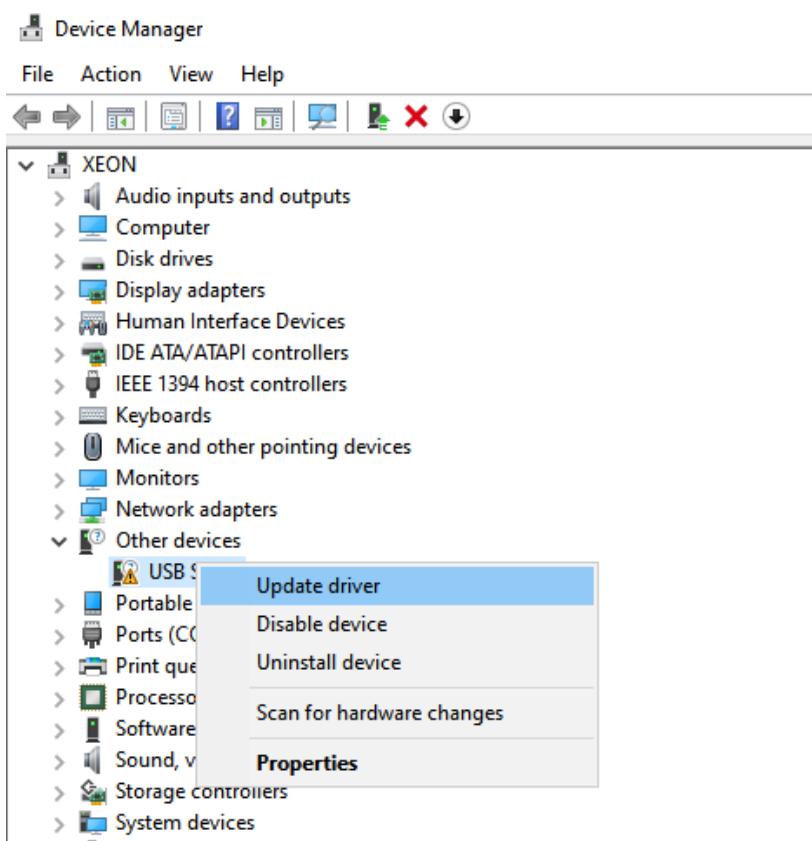
  - Apply gentle pressure to SD card reader.

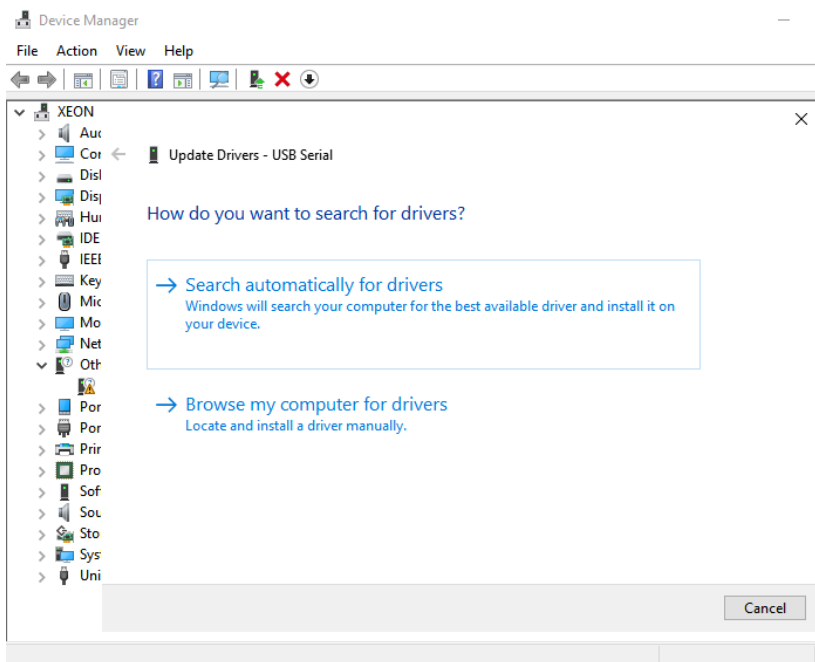## 9.3 How to install and update CH340 drivers

1. Download and install CH34x driver [3].
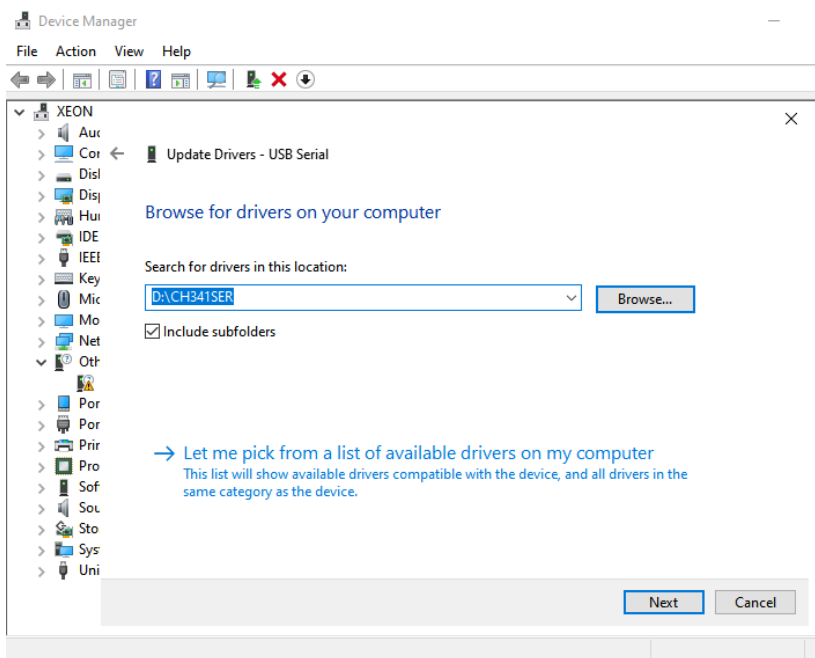
2. Plug in DL20 data grabber (SD) to PC.

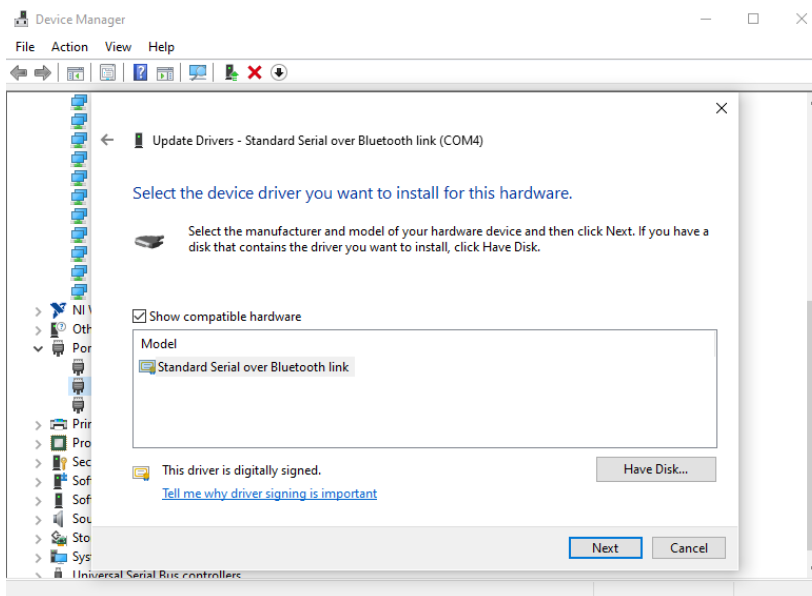3. Open Device manager, right click USB serial.
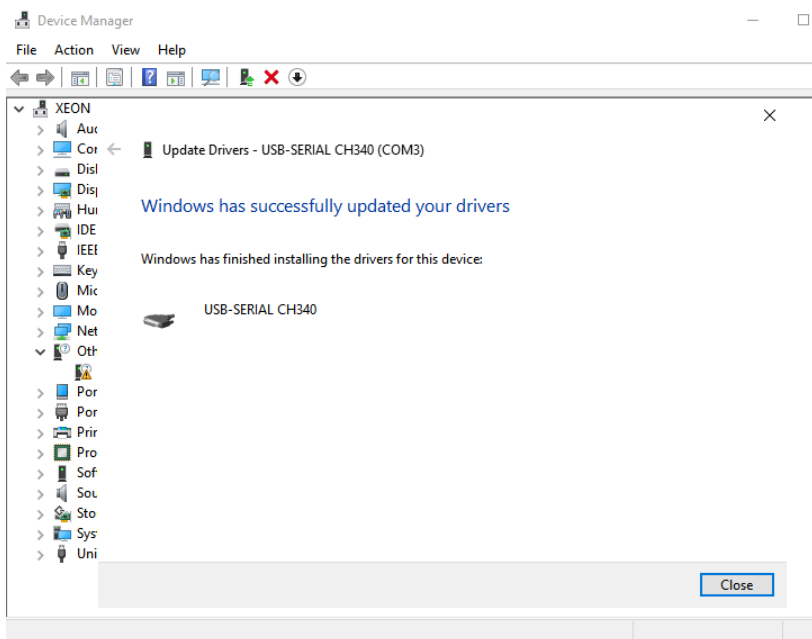
4. Browse my computer for drivers.

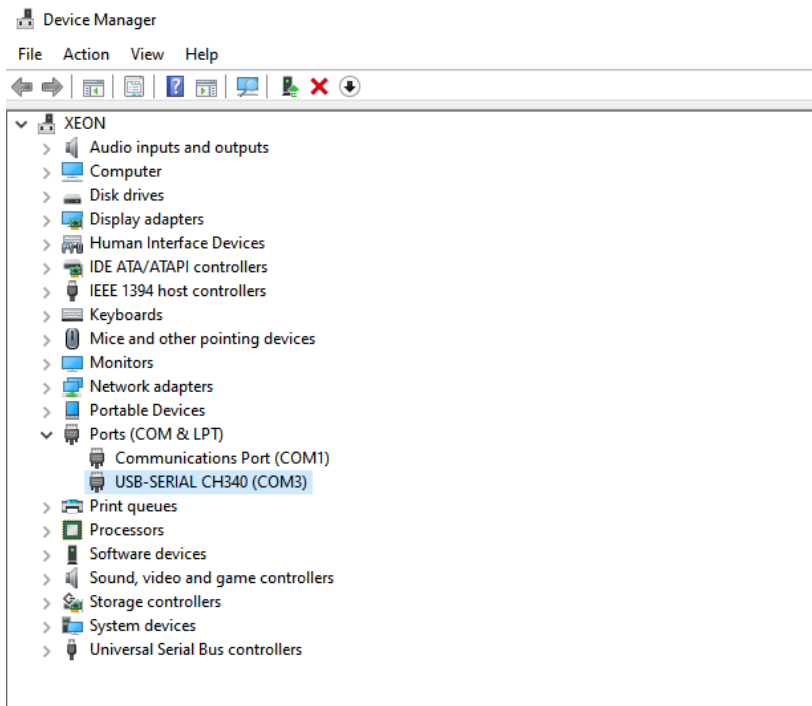5. Let me pick from a list of available drivers on my computer.

6. Select USB-SERIAL CH340, Next.

7. Finished, Close.

8. CH340 driver installed and working.

References

[1] https://github.com/MadsR/DL20/releases/

[2] https://github.com/MadsR/DL20

[3] https://sparks.gogo.co.nz/assets/_site_/downloads/CH34x_Install_Windows_v3_4.zip

[4] https://www.impactsubsea.co.uk/seaview/

[5] https://www.impactsubsea.co.uk/isd4000/