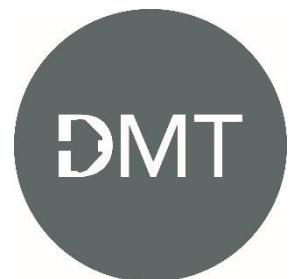


WIRE MYOGRAPH SYSTEM – 420A

USER MANUAL VOL. 3.0



TRADEMARKS

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DMT reserves the right to alter specifications as required.

This document was, as far as possible, accurate at the time of printing. Changes may have been made to the software and hardware it describes since then. New information may be supplied separately.

This documentation is provided with Wire Myograph system - 420A

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CONTENTS

TRADEMARKS	2
SAFETY	5
EMC / EMI	
CHAPTER 1 - SYSTEM OVERVIEW	10
1.1 Interface front panel	10
1.2 Interface rear panel	11
1.3 Dual Wire Myograph - 420A	12
CHAPTER 2 - SETTING UP	13
2.1 Setting up the Wire Myograph System	13
2.2 The first force calibration	15
CHAPTER 3 - THE WIRE INTERFACE MENUS	16
3.1 General description on how to navigate the touch screen	16
3.1.1 Power-up screen	17
3.1.2 Main Menu	17
3.1.3 Zero Menu	19
3.1.4 Heat Menu	19
3.1.5 Timer and Buzzer Menu	20
3.1.6 Settings Menu	21
3.1.6.1 Force Calibration Menu	21
3.1.6.2 pH Calibration Procedure	25
3.1.6.3 Select Analog Output	27
3.1.6.4 Interface Settings	28
APPENDIX 1 - SPEC SHEET	30

SAFETY

The Wire Myograph System has been designed for use only in teaching and research applications. It is not intended for clinical or critical life-care use and should never be used for these purposes. Nor for the prevention, diagnosis, curing, treatment, or alleviation of disease, injury, or handicap.

- Do not open the apparatus: the internal electronics pose a risk of electric shock.
- Do not use this apparatus near water.
- To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Objects filled with liquids should not be placed on the apparatus.
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
- Only use attachments and accessories specified by the manufacturer.
- Unplug this apparatus during lightning storms or when unused for long periods of time.

The Wire Interface is delivered with an external 100-240VAC to 24VDC adapter. Protect the power adapter and cord from being walked on or pinched. Particularly at power plugs and the point where they connect to the apparatus. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way; such as, the power-supply cord or plug is damaged, liquid has spilled onto or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

EMC/EMI

This equipment has been tested and found to comply with the limits for a Class B Digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception (which can be determined by monitoring the interference while turning the equipment off and on), the user is encouraged to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different to that which the receiver is connected to.
- Consult the dealer or an experienced radio/TV technician for help.

EC DECLARATION OF CONFORMITY

Danish Myo Technology A/S
Certify and declare that the following apparatus:

Wire Myograph System - 420A

Restrictive use: Only for laboratory use.

Manufactured by
Danish Myo Technology A/S
Rho 14
8382 Hinnerup
Denmark

Conforms with the essential requirements of the EMC Directive 2004/108/EC.

Based on the following specifications applied by:

EN 61326-1:2006

EN 61326-2-6:2006

EN 61326-2-6/Corr.:2007

And with the LVD Directive 2006/95/EC.

Based on the following specifications applied by:

EN 61010-1:2010

EN 61010-2-030:2010

CHAPTER 1 - SYSTEM OVERVIEW

1.1 INTERFACE FRONT PANEL

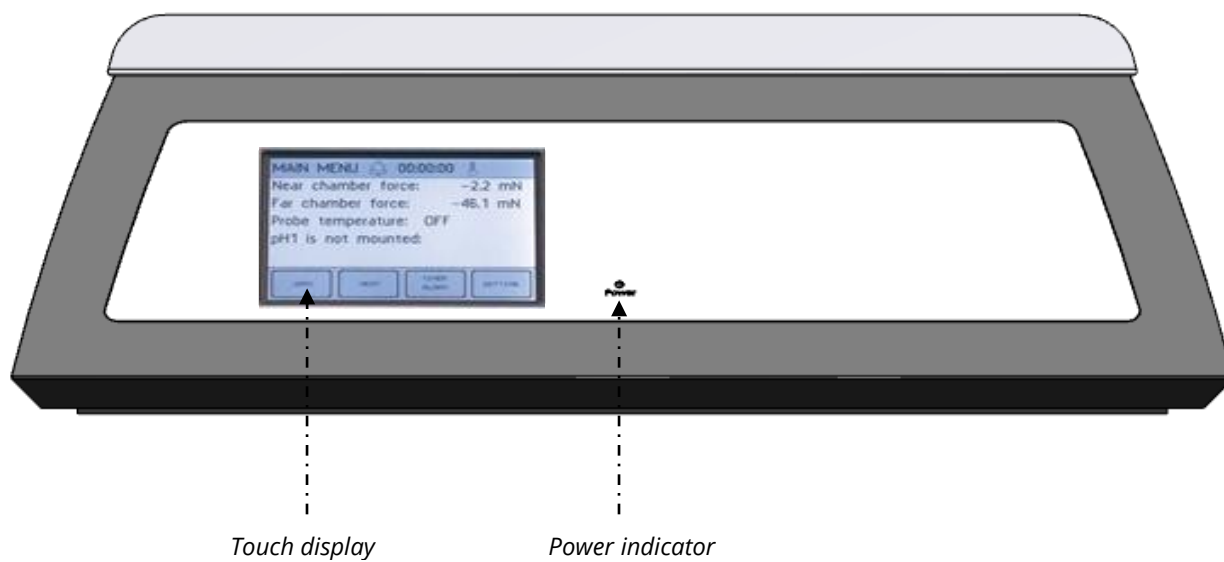


Figure 1.1 Interface front panel

1.2 INTERFACE REAR PANEL

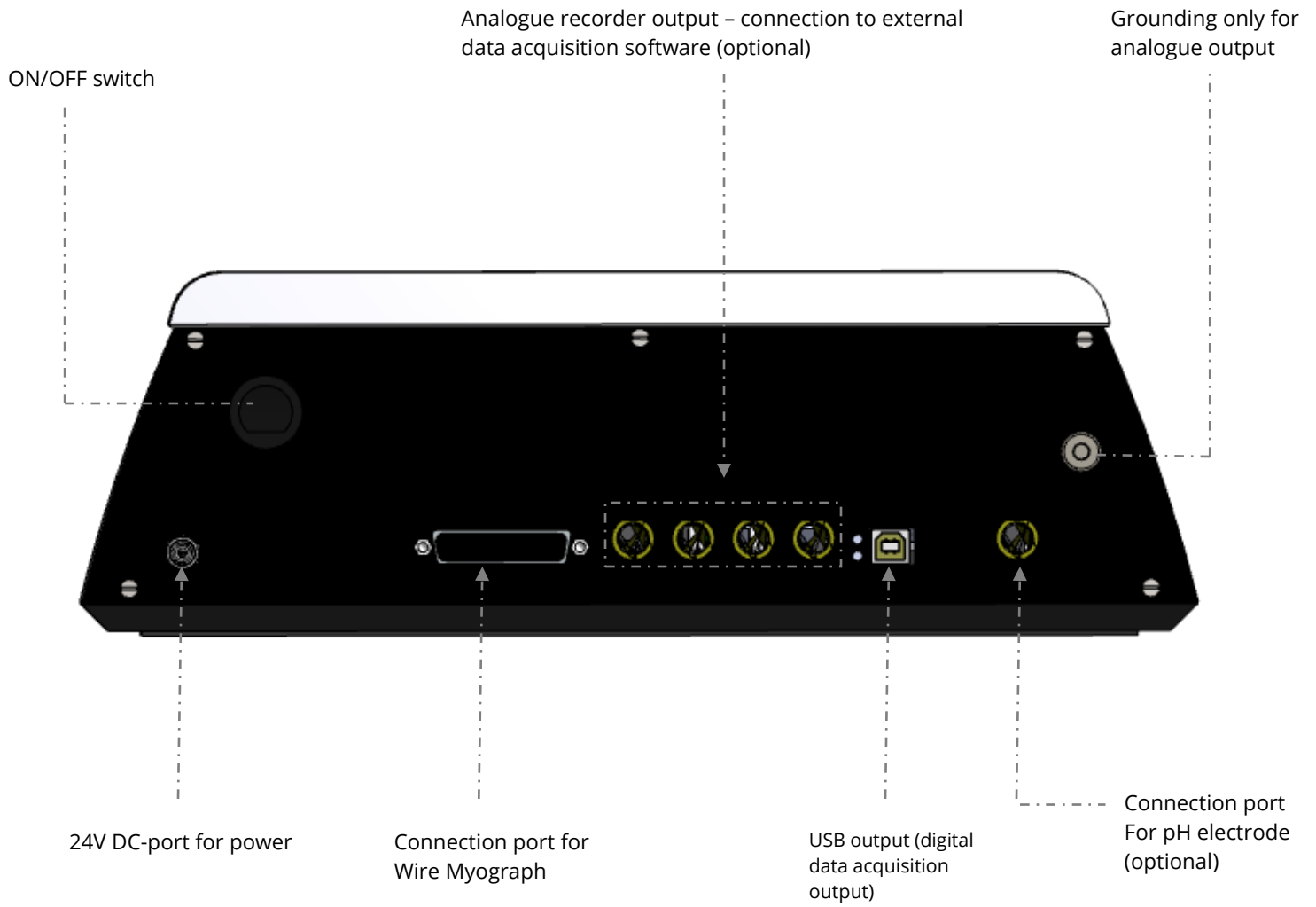


Figure 1.2 Interface rear panel

1.3 DUAL WIRE MYOGRAPH - 420A

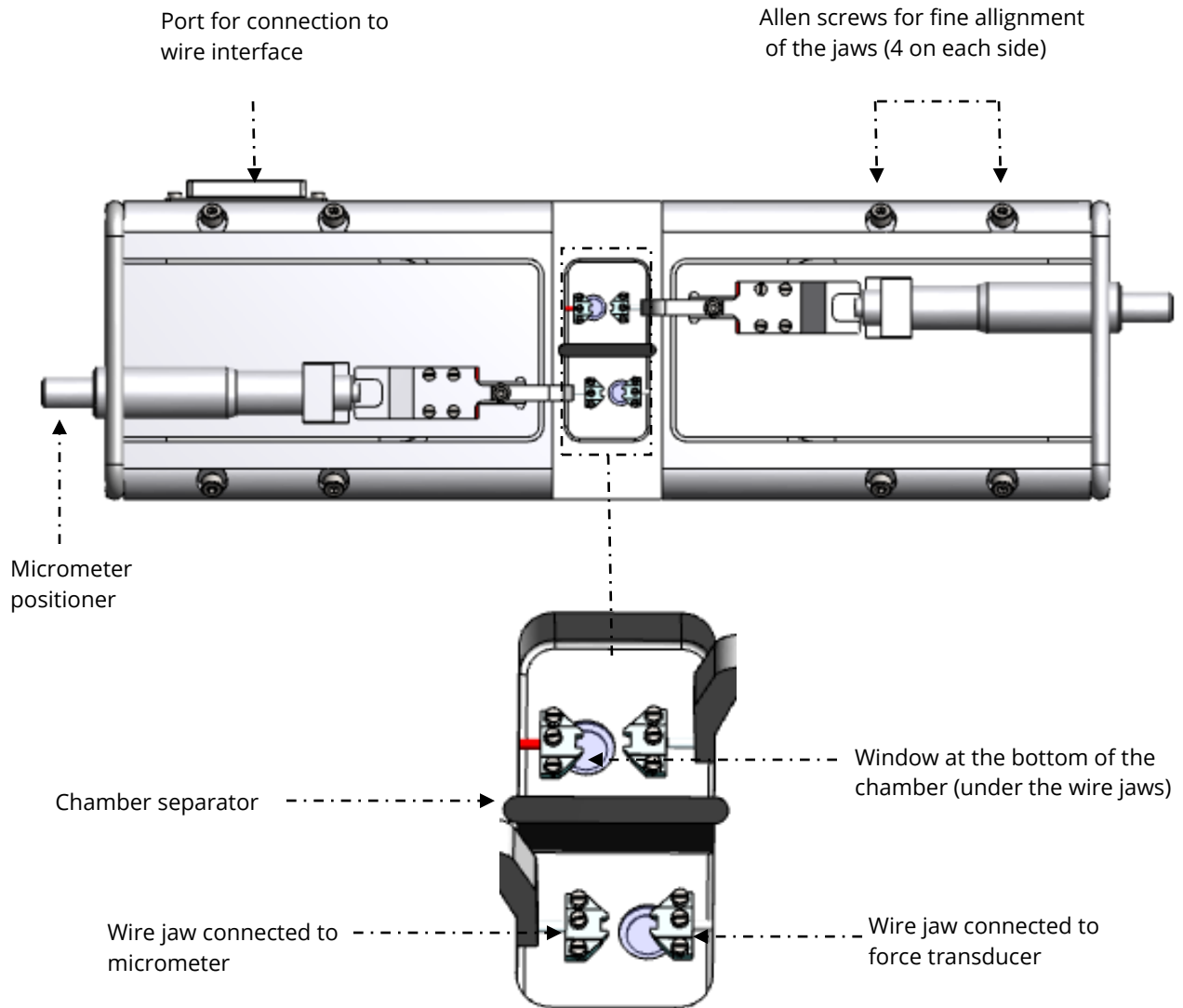


Figure 1.3 Dual Wire Myograph - 420A with close-up of the chamber

CHAPTER 2 - SETTING UP

2.1 SETTING UP THE WIRE MYOGRAPH SYSTEM

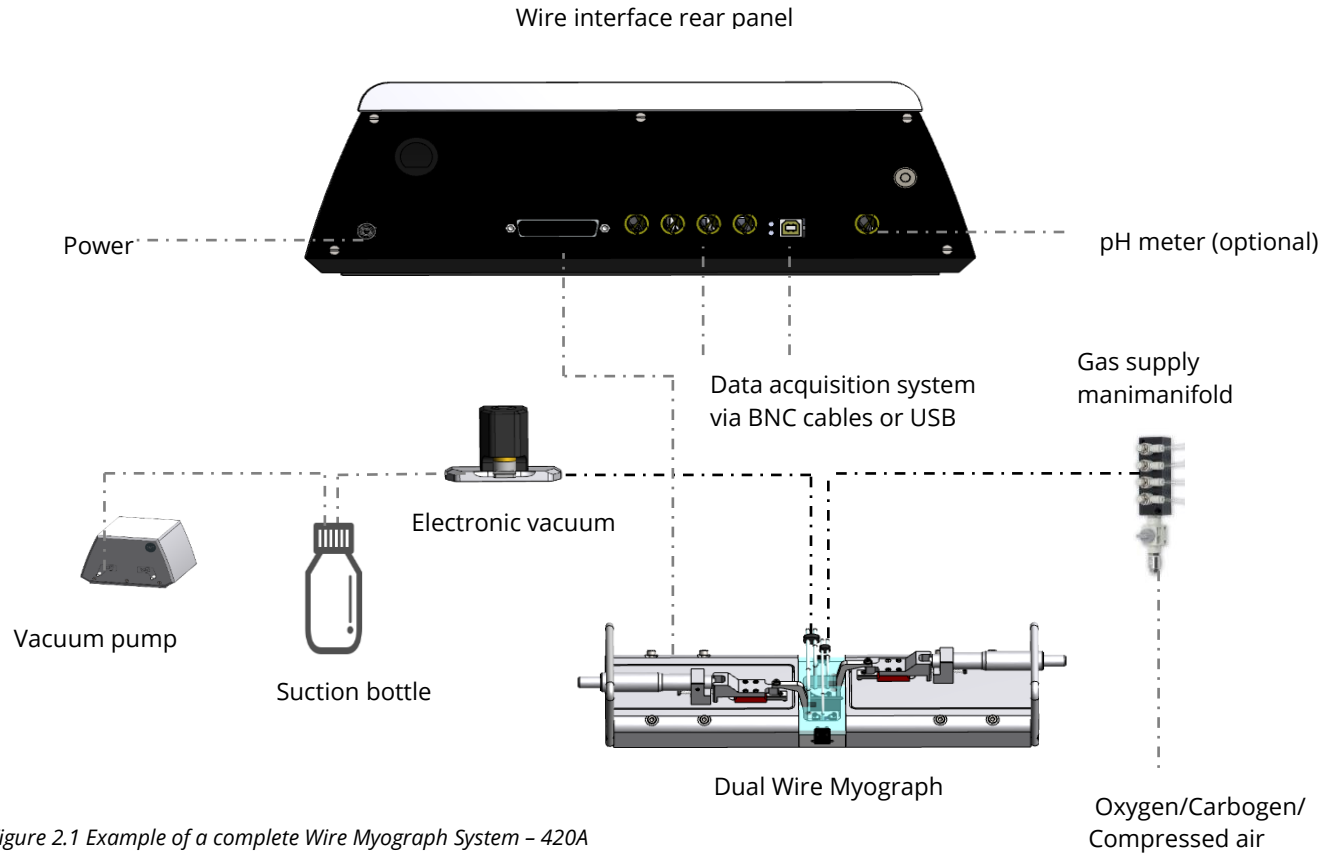


Figure 2.1 Example of a complete Wire Myograph System – 420A

Figure 2.1 is a complete set-up for the Wire Myograph System. The set-up includes optional equipment such as pH electrode for measuring pH in the buffer, an electronic vacuum valve, suction bottle, vacuum pump, and a computer and Data Acquisition System.

IMPORTANT: TO RECORD A NOISE-FREE ANALOGUE SIGNAL IT IS IMPORTANT TO CONNECT THE WIRE INTERFACE GROUND CONNECTION TO THE DATA ACQUISITION SYSTEM'S GROUND CONNECTION.

1. Wire Myograph to Wire Interface connection: Connect the Wire Myograph to the Wire Interface using the grey 44/25-pin connector cable. The end of the cable with the temperature probe is attached to the Wire Myograph.
2. Wire Interface to computer connection: Data acquisition is possible either by connecting the Wire Interface directly to a computer, or through a data acquisition system able to collect voltage output (0-2.5volts) such as a PowerLab data acquisition system or similar system.
 - Direct computer USB connection for Labchart (AD Instruments) users (Labchart 8 Pro or newer): Connect the Wire Interface to the computer with the USB cable from the back panel to the USB port. Install the DMT device enabler software on the computer
 - Analog Data Output through a PowerLab or similar data acquisition system (optional): Connect the Wire Interface to the analog data acquisition system using BNC cables. Connect Rec 1 (Chamber 1) on the Wire Interface to Input 1 on the analog data acquisition system. Rec 2 (Chamber 2) to Input 2 on the analog data acquisition system 2. Connect the analog data acquisition system to one of the USB-ports on the computer.
3. Turn on the Power: Turn on the power to the Wire Interface at the power switch and then turn on the computer. Start the data acquisition program on the computer and the Wire Myograph System is now ready for use.
4. Gas supply: Connect the pipes for gas supply, manifold or similar on the Wire Myograph chamber cover (see figure 2.2) to an adjustable gas supply using thin silicone tubing.
5. Suction connection: Connect the suction pipes on the Wire Myograph chamber cover (see figure 2.2) to a vacuum pump via a suction bottle and the electronic vacuum valve as illustrated in figure 2.1.
6. pH electrode (optional): Connect the pH meter to the pH port on the rear of the Wire Interface.

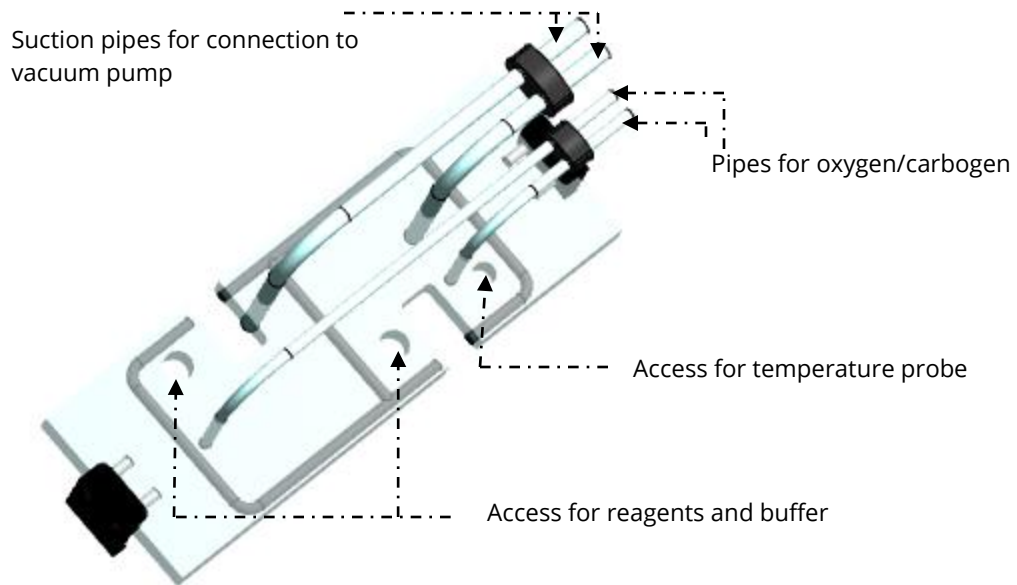


Figure 2.2 Chamber cover for Wire Myograph 420A

2.2 THE FIRST FORCE CALIBRATION

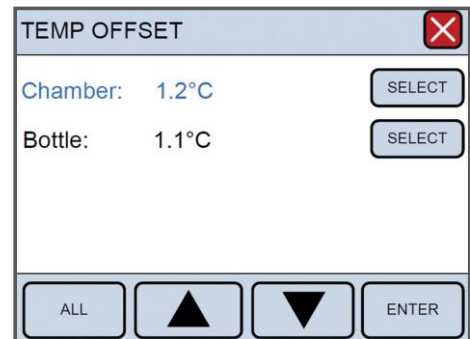
Prior to shipping, the Wire Myograph System has gone through two days of continuous testing including final force calibrations. However, DMT recommends that a new force calibration is performed before using the Wire Myograph System. The force calibration procedure is described in detail in chapter 3.1.6.1.

CHAPTER 3 - THE WIRE INTERFACE MENUS

This chapter contains a detailed description of how to navigate the touch screen menus and how to use the special features of the Wire Interface.

3.1 GENERAL DESCRIPTION ON HOW TO NAVIGATE THE TOUCH SCREEN

Menus on the Wire Interface are all accessible by a touch screen. To access a menu, simply touch the screen. When a setting needs to be changed, press SELECT beside the line to be changed.



The line to be modified will turn blue, indicating that the Wire Interface is waiting for input. When ALL is chosen, all lines corresponding to all four channels will turn blue.



Changing the numeric value for the chosen parameter can be done by touching UP or DOWN arrows.



Once the desired setting has been chosen, pressing ENTER will lock the selection and be stored in memory.



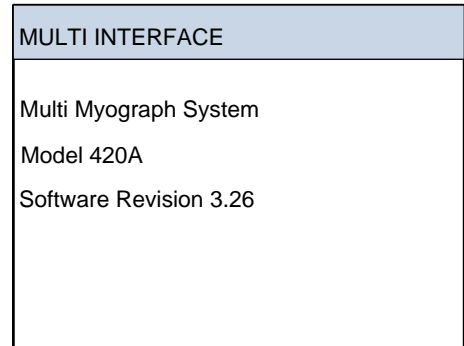
Pressing the white X in the red box will exit the menu and take you automatically to the Main Menu.



3.1.1 POWER-UP SCREEN

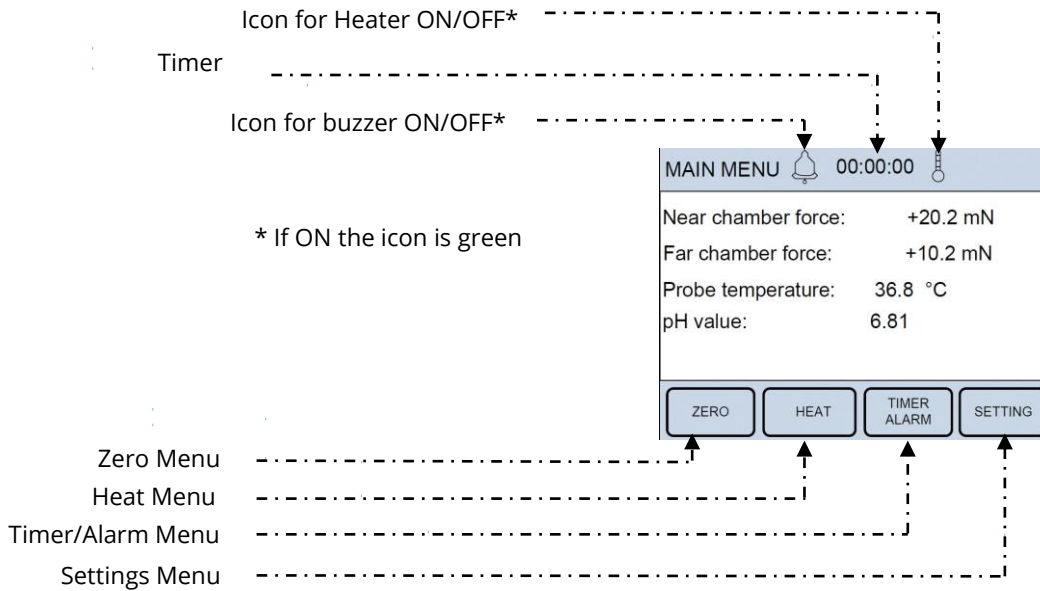
After turning on the Wire Interface, an introduction screen appears. It displays the product system, model no., firmware version number, date and the system ID number.

The system is auto-initializing while this screen is displayed.



3.1.2 MAIN MENU

The Main Menu gives a good overall status on how the Wire Interface is working. It displays the force, pH, probe temperature, timer and the active status (buzzer, timer, heat).



Buzzer icon:

This icon indicates the status on the Buzzer.

If the icon is grey the Buzzer is OFF.

If the icon is green the Buzzer is ON (active) and will make a sound when the timer reaches zero.



OFF



ON

00:00:00

Timer:

The Timer is a countdown timer that can be set to maximum 24 hours. If the Buzzer is activated, it will buzz when the timer reaches zero.



OFF



ON

Heat icon:

This icon indicates the status of the chamber heat.

If the icon is grey the Heat is OFF.

If the icon is green the Heat is ON (active).

Four sub-menus are accessible from the Main Menu screen:

Zero Menu

Heat Menu

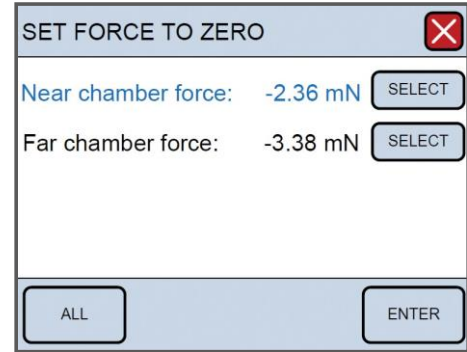
Timer/Alarm Menu

Setting Menu



3.1.3 ZERO MENU

This menu is used to zero the output of the transducers. When using a data acquisition program like LabChart by AD Instruments®, this feature will reset the baseline of the chart traces without affecting the calibrations or physically changing any pre-load tensions placed on the mounted vessels. The channels can be changed individually by pressing SELECT or all at once by pressing ALL. Pressing ENTER will execute the zero function and return the user to the Actual Force display.



3.1.4 HEAT MENU

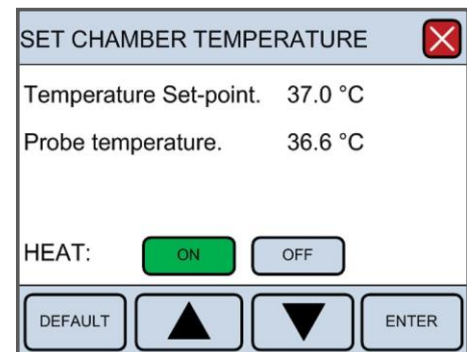
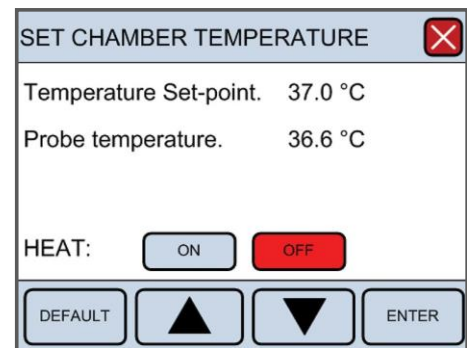
The heating temperatures are controlled from this menu. To turn the heat on, or to change the temperature for the system, press HEAT in the Main Menu. The Heat Menu will be displayed allowing the user to change the system temperature, as well as turn the heat on or off. Pressing DEFAULT will automatically reset the temperature setpoint to 37°C. Manually change the temperature by pressing UP or DOWN arrows. Pressing ENTER will save the new temperature setpoint.

To turn the heat on press ON and it will turn green. The

system will heat to the desired temperature setpoint. In the Main Menu the heat icon turns green when the heat is on.

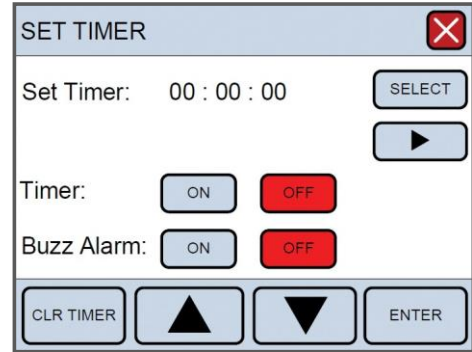


ON



3.1.5 TIMER AND BUZZER MENU

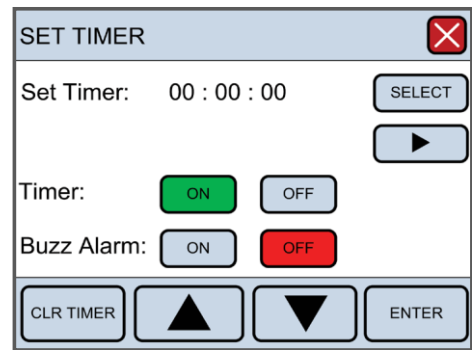
The timer and buzzer are controlled from this menu. Use SELECT to program the timer. The timer can be programmed in the interval from 0 to 23:59:59 (Hours: minutes: seconds). When Set Timer is selected use the up and down arrows to program the timer. Use the RIGHT arrow to move from hours, minutes and seconds. Press ENTER to save the programmed time.



To start the timer, press ON and it will turn green.

When the timer reaches zero it automatically switches to OFF.

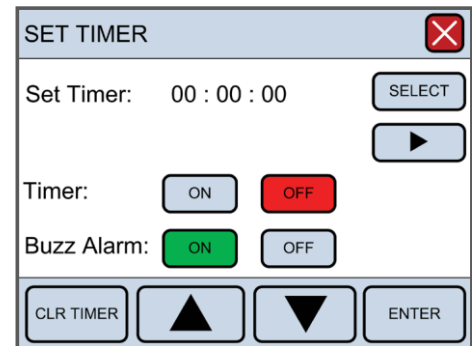
If the buzzer is turned on it will make a tone when the timer reaches zero.



To activate the buzzer, press ON and it will turn green. In Main Menu the bell icon also turns green.



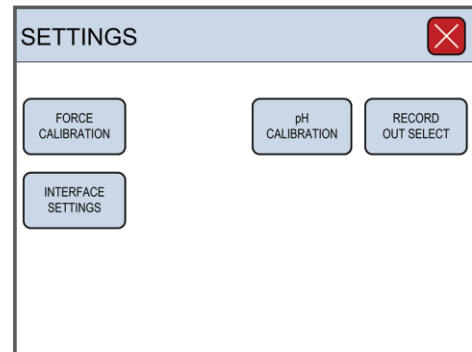
ON



3.1.6 SETTINGS MENU

The Setting Menu contains several submenus. These submenus include:

- Force calibration
- pH calibration
- Record out select
- Interface settings

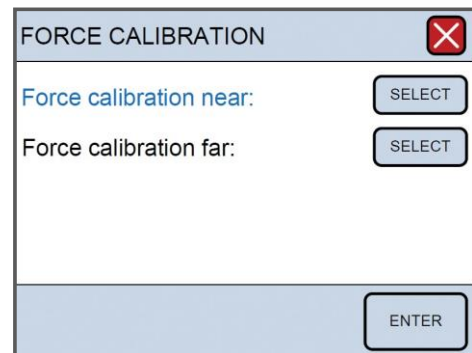


3.1.6.1 Force Calibration Menu

Prior to shipping the Wire Myograph System has gone through two days of continuous testing, including final force calibrations. However, DMT recommends that new force calibrations are performed before starting to use the Wire Myograph System for the first time.

Begin the calibration procedure by pressing Force Calibration in the Settings Menu. The sub-menu will list 2 chambers for calibration. The calibration procedure is listed in 6 individual steps and needs to be performed to calibrate the system. Before starting the force calibration, the following is performed.

- Place the calibration bridge and T-balance on the Wire Myograph (see figure 3.1) allowing it to be warmed up together with the Wire Myograph. Turn on the heating in the Heat sub-menu to the appropriate temperature used during your experiments
- Mount a 40µm stainless steel wire on the jaws connected to the force transducers.



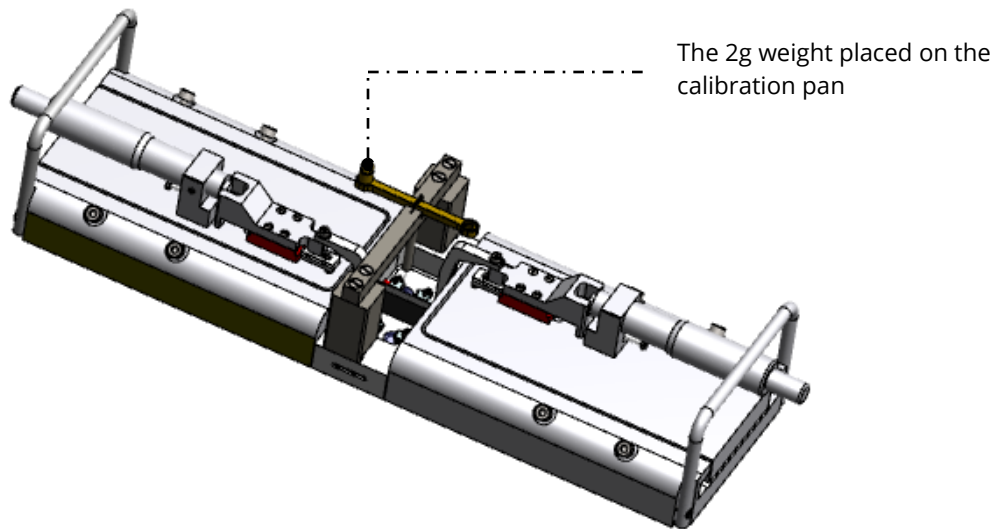
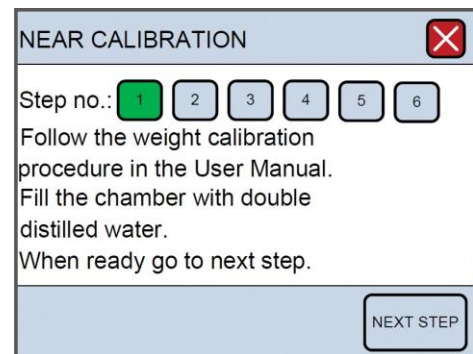


Figure 3.1 Force calibration set-up - showing placement of the calibration bridge and T-balance for Dual Wire Myograph - 420A

Step 1 - Involves setting up the chamber for calibration. Fill the chamber to a normal level with double distilled water. Move the jaws apart.

Press NEXT STEP.

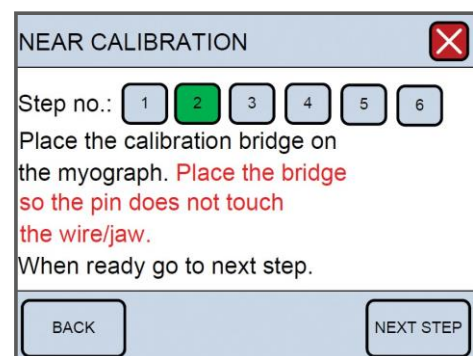
IMPORTANT: TURN ON THE HEAT AND SET THE TEMPERATURE AT THE LEVEL AT WHICH THE EXPERIMENTS WILL BE PERFORMED.



Step 2 - Involves setting up the Calibration Kit for the actual force calibration. Make sure that the T-balance pin is placed between the wire and the jaw as illustrated in figure 3.2. Carefully move the calibration bridge until the T-balance pin is placed freely between the wire and the jaw, which means it does not touch the wire or the jaw, see figure 3.2.

Press NEXT STEP when the calibration kit has been properly placed.

NOTE: THE WEIGHT SHOULD NOT BE ON THE T-BALANCE YET.



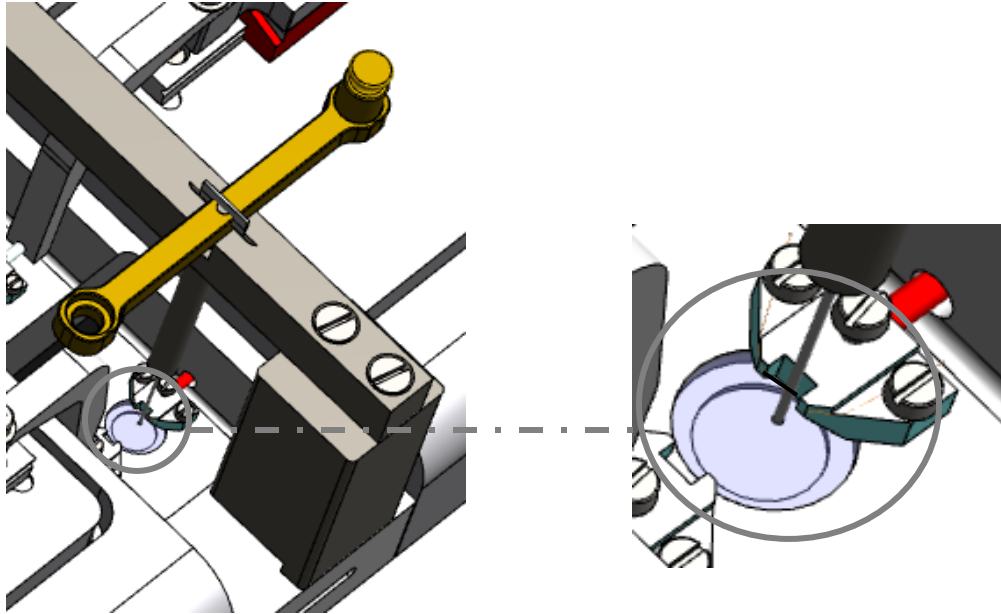
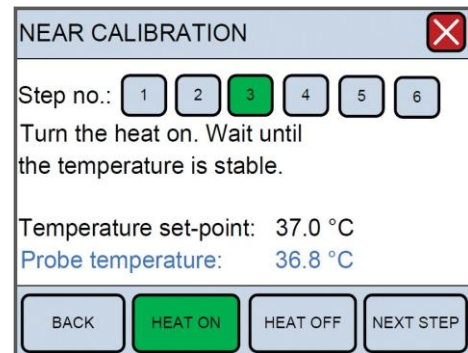


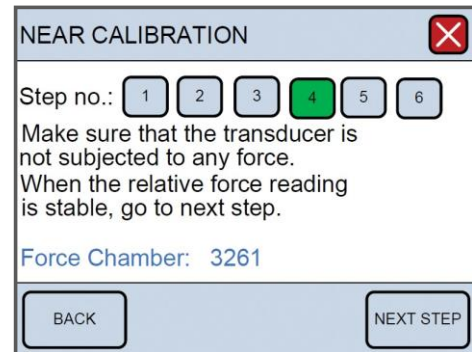
Figure 3.2 Illustration of how to fit the T-balance between the wire and the gap in the jaw support

Step 3 - Initiates the heating process for the chamber. In order for the calibration to be accurate, the transducers must be heated to the experimental temperature to be used. This accommodates heat-induced expansion of the electronic parts in the transducer. Otherwise, inaccurate readings and transducer drift may occur, producing errors into the experiment. Therefore, now turn the heat on by pressing HEAT ON.



Place the temperature probe into the chamber for the first calibration to determine when the chamber has reached the target temperature. Heating will take about 20 to 30 minutes for the chamber and transducers to reach 37°C with the chamber covers in place. Once the chamber is heated and have reached the target temperature, press NEXT STEP.

Step 4 - is the first step in the actual force calibration process. A four-digit number will be displayed in blue at the bottom of the screen. If nothing has been disturbed during the heating process, the zero, 0 gram, or 0.0mN calibration should be stable as indicated by the four-digit number. Wait at least 30 to 45 seconds until the four-digit number is stable before pressing NEXT STEP.



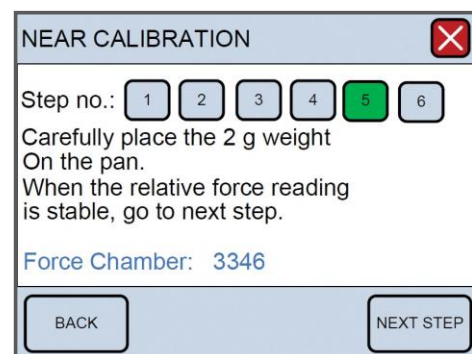
NOTE: NORMAL OPERATING VALUES FOR THE FORCE TRANSDUCER DURING CALIBRATION SHOULD BE BETWEEN 3000 AND 3500. IF THE VALUE IS 0, A SINGLE DIGIT, OR A THREE DIGIT NUMBER, THE FORCE TRANSDUCER IS BROKEN AND NEEDS TO BE REPLACED.

IF THE VALUE IS LESS THAN 2000 OR GREATER THAN 4500 BUT STILL A FOUR DIGIT NUMBER, THE FORCE TRANSDUCER IS BROKEN BUT SHOULD BE ABLE TO BE REPAIRED BY A TEMPERATURE COMPENSATION DONE BY DMT.

IF THE MESSAGE OFF IS DISPLAYED ON THE MAIN PAGE OF THE WIRE INTERFACE, EVEN THOUGH THE CHAMBER IS PLUGGED IN AT THE REAR OF THE WIRE INTERFACE, THE FORCE TRANSDUCER IS BROKEN AND NEEDS TO BE REPLACED. IN ADDITION, IF THE FORCE READING(S) APPEAR YELLOW, CANNOT BE RESET TO ZERO, AND THE TRANSDUCER CANNOT BE RECALIBRATED, THE FORCE TRANSDUCER IS BROKEN AND NEEDS TO BE REPLACED.

Step 5 - At this step, place the 2gram weight at the pan on the calibration T-balance closest to the transducer (over the transducer) see figure 3.1, to simulate the stretch created by the contraction of a mounted ring preparation.

Remember, a 2gram weight in a 90° vector is divided, and the transducer will only detect 1 gram or 9.81mN of force. The weight placement should cause a positive increase in the four-digit number. Wait at least 30 to 45 seconds for the applied force to stabilize before pressing NEXT STEP.



Step 6 - is to verify that the calibration was performed correctly. The Force Chamber reading should be $9.81 \pm 0.1\text{mN}$. If the Force Chamber reading is off by more than 0.1mN , then remove the weight, press BACK to return to Step 4, and repeat the calibration process. If the Force Chamber reading is satisfactory, then press NEXT STEP to end the calibration.

After calibrating the force transducer, carefully remove weight, T-balance and calibration bridge. The Wire Myograph System is now ready for force measurements.

3.1.6.2 pH Calibration Menu (optional)

The pH Module in the 420A is locked by a code. If the screen shown here below turn up a code is needed from DMT to unlock the pH module.

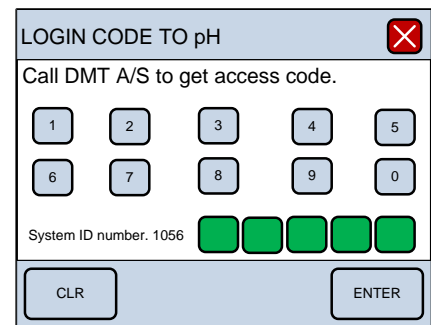
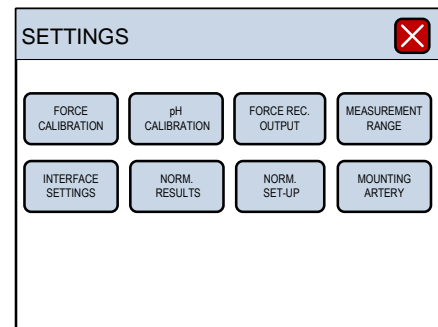
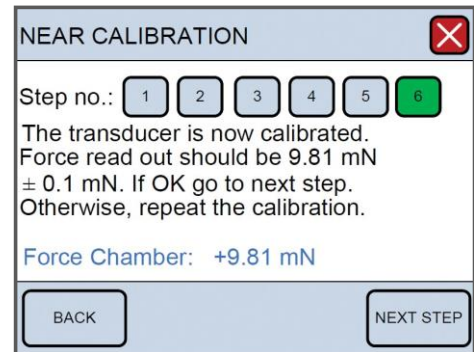
By ordering the pH sensor from DMT the pH sensor is delivered with the unlocking code and a quick guide how to do it. Entering the code will open the pH Calibration menu.

The 420A system has a build-in pH meter and a pH-meter electrode plug-in port marked PH on the back side of the 420A interface.

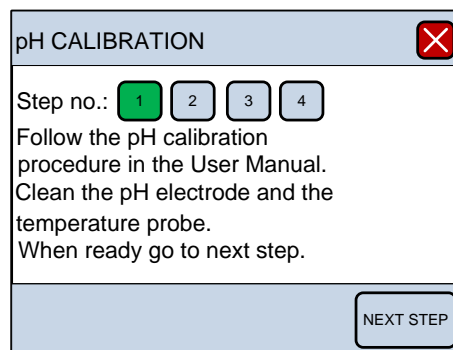
The pH electrode can be ordered at DMT by contacting your sales representative or emailing sales@dmtdk.

The pH calibration procedure is listed in 4 individual steps and needs to be performed one at a time.

NOTE: BEFORE THE PH CALIBRATION IS PERFORMED BE SURE TO SELECT THE WAY THE PH ELECTRODE IS TO BE USED. SEE THE SUB-MENU UNDER PH SET-UP UNDER INTERFACE SETTINGS



Step 1 - Step 1 involves cleaning the pH electrode and the temperature probe with double distilled water. When ready Press NEXT STEP.



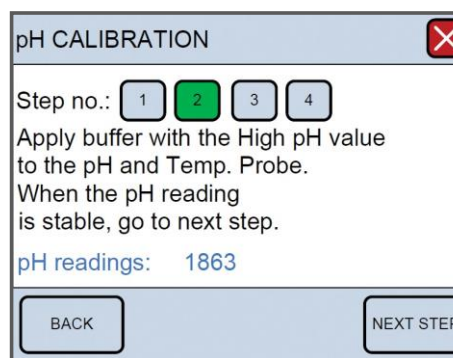
pH CALIBRATION

Step no.: 1 2 3 4

Follow the pH calibration procedure in the User Manual. Clean the pH electrode and the temperature probe. When ready go to next step.

NEXT STEP

Step 2 - Place the pH electrode and temperature probe in the high buffer solution (here pH 7) and turn on stirring. When the relative pH output in the blue line is stable, press NEXT STEP.



pH CALIBRATION

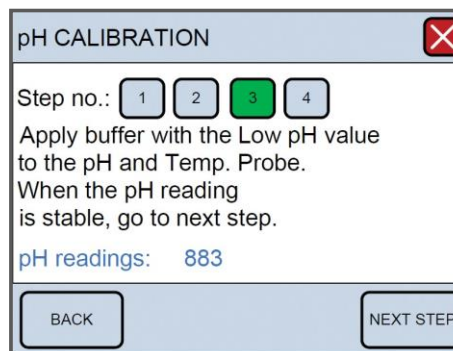
Step no.: 1 2 3 4

Apply buffer with the High pH value to the pH and Temp. Probe. When the pH reading is stable, go to next step.

pH readings: 1863

BACK NEXT STEP

Step 3 - Place the pH electrode and temperature probe in the low buffer solution (here pH 4) and turn on stirring. When the relative pH output in the blue line is stable, press NEXT STEP.



pH CALIBRATION

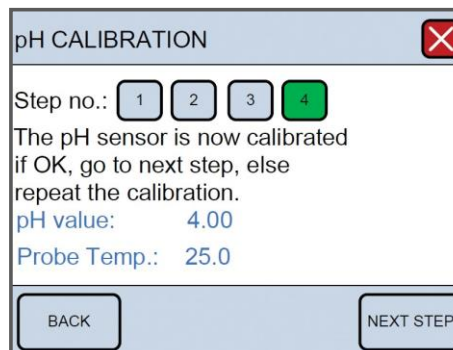
Step no.: 1 2 3 4

Apply buffer with the Low pH value to the pH and Temp. Probe. When the pH reading is stable, go to next step.

pH readings: 883

BACK NEXT STEP

Step 4 - The calibration is now finished. The readings in the two bottom lines are the actual pH and temperature readings.



pH CALIBRATION

Step no.: 1 2 3 4

The pH sensor is now calibrated if OK, go to next step, else repeat the calibration.

pH value: 4.00

Probe Temp.: 25.0

BACK NEXT STEP

3.1.6.3 Select Analog Output (optional)

The Select Analog Output Menu determines what will be sent to the BNC analogue output (REC 1, REC 2 REC 3, REC 4 at the back of the Wire Interface). There are 4 analog outputs, and each output is individually programmable. Any change made to the analog output will affect the data sent from the Wire Interface to a data acquisition system such as AD Instruments PowerLab. Therefore, remember to check the data acquisition system's set-up when a change is made. The analog output is working in range of -2,5V to +2,5V.

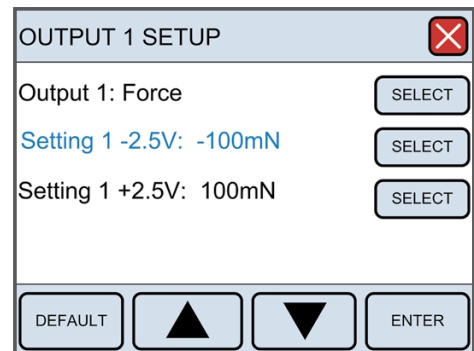
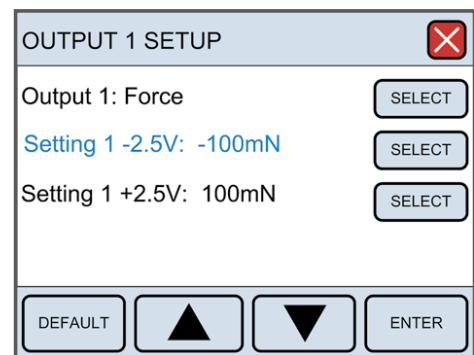
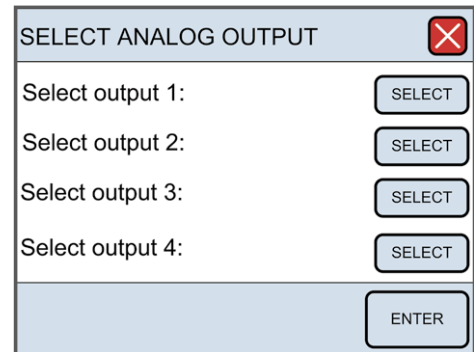
Use SELECT to select the out-channel number to be changed. Press ENTER to go to the output set-up.

Use the UP and DOWN arrow or DEFAULT to change/select a new set-up.

The following parameters in the Wire Interface can be selected as output to the analog channels. Force Near, Force Far, Temperature Probe, Chamber Temperature, pH1, (Optional: Digital Output 1, Digital Output 2, Digital Input 1, Digital Input 2).

When the chosen parameter is selected press ENTER to save the value in the memory.

The output range is -2,5V to +2,5V. The user can select the parameter value that gives -2,5V and the value that gives +2,5V. In this example -100mN is -2,5V and +100mN is +2,5V. Selecting asymmetrical values is also valid. They can be -2,5V = 0mN and +2,5V = 100mN.

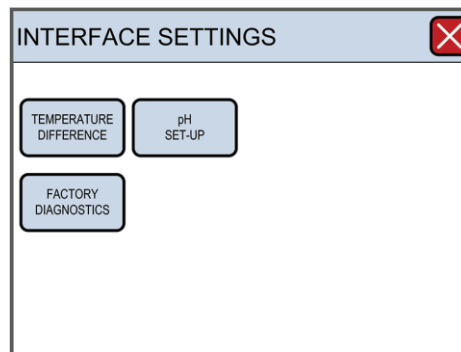


NOTE: REMEMBER TO PRESS ENTER TO SAVE THE LINE CHANGES IN MEMORY.

3.1.6.4 Interface Settings

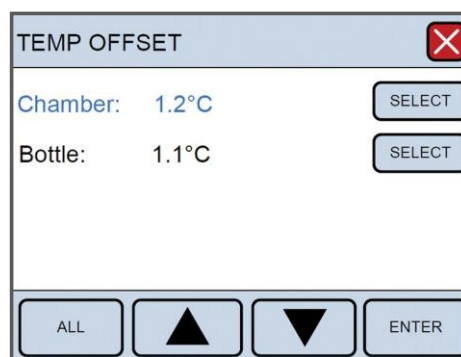
The Interface Settings sub-menu has an additional three sub-menus:

1. Temperature Difference
2. pH Set-up
3. Factory Diagnostics



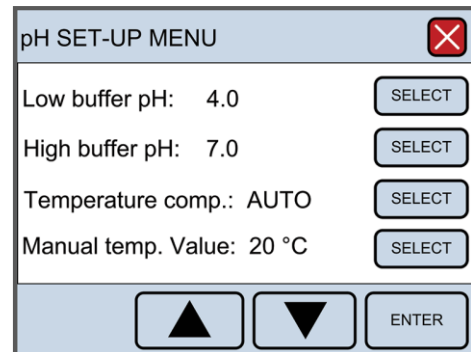
1. Temperature Difference (offset): The temperature difference function allows the user to fine tune the temperature set point of the system. Although the temperature set point for the system can be set in the Heat Menu there may be a small discrepancy between the actual temperature of the system and the defined set point.

The user can adjust the temperature of the chamber and bottle individually to fine-tune the temperature setting, so the exact temperatures are achieved in the chamber and bottle. This is referred to as a temperature offset (TEMP OFFSET ON CHAMBER). The SELECT and ALL functions are the same in this menu as for previously described menus. Pressing ENTER will store the numbers in memory for future experiments.

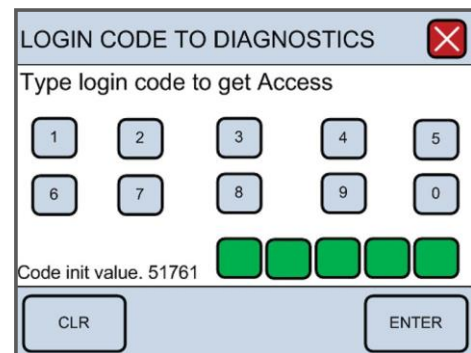


2. pH Set-up Menu: The pH calibration is a 2-point calibration. In the pH set-up menu, the two pH values used for the 2-point pH calibration should be selected. The default in the pH Calibration setup is the pH values 4 and 7. If using pH buffer with different pH values than 4 and 7 for the pH calibration enter the appropriate pH.

The temperature is an important parameter in the calibration formula and is obtained automatically if the temperature compensation it is set to AUTO as shown. If MANUAL is chosen, a manually set temperature is used in the pH calibration formula, and the temperature probe is not used. In the MANUAL mode, the temperature of the calibration buffer is measured with a thermometer and entered manually in the Manual temp. Value line.



3. Factory Diagnostics: Entering Factory Diagnostics will display the Login code to diagnostics window. This window is only for trained technicians and used for diagnostics and troubleshooting purposes. The general user will not have access to this window. Entering the proper five-digit login code however will allow the trained technician access to diagnostics panels that will provide information during a malfunction, or mechanisms to change other settings controlled by the on-board computer.



APPENDIX 1 - SPECSHEET

CHAMBER:

Chamber volume (min) with divider in place	2.7ml
Chamber(s)	2
Chamber material	Acid resistant stainless steel
Vessel size	>30µm
Vessel normalization	Manually
Micrometer resolution	0.01mm
Mounting type	Jaws

TEMPERATURE:

Range	15.0 to 50.0°C
Resolution	0.1°C
Stability	±0.2°C
Heating	Yes

TRANSDUCER:

Output reading	mN
Range	±200mN
Resolution	0.01mN
Force calibration	Yes

OUTPUT:

Data communication	USB 2.0
Analogue output channels	4
Analogue output range	±2.5V

Danish Myo Technology A/S

E-mail: sales@dmtdk

Tel.: +45 87 41 11 00

Fax: +45 87 41 11 01



DMT-USA, Inc.

E-mail: sales@dmtdusa.com

Tel.: +1 734 707 0250

Fax: +1 678 302 7013



DMT-China

Tel.: 86-21-6486 9685

Fax: 86-21-5877 0063



DMT-Asia Pacific

Tel.: +61 2 8814 1597

