3D Force Button Sensor Development Kit (Beta v1.0)

Installation and Operation Manual

Document #: 3DFDK_B1.0_MAN_SEP22

September, 2022

Foreword

Information contained in this document is the property of Contactile Pty Ltd. and shall not be reproduced in whole or in part without prior written approval of Contactile Pty Ltd. The information herein is subject to change without notice and should not be construed as a commitment on Contactile Pty Ltd. This manual is periodically revised to reflect and incorporate changes made to the 3D Force Button Sensor Development Kit.

Contactile Pty Ltd assumes no responsibility for any errors or omissions in this document. Users' critical evaluation is welcome to assist in the preparation of future documentation.

Conditions of Sale

Contactile's conditions of sale apply to all products sold by Contactile to the Distributor under this Agreement. The conditions of sale that apply are provided on the USB flash drive shipped with the product in the folder 'LEGAL' in the root directory.

End User Licence Agreement

Contactile's end user license agreement applies to all software and algorithms included with the products sold by Contactile. The end user license agreement that applies is provided on the USB flash drive shipped with the product in the folder 'LEGAL' in the root directory.

Compliance

The devices are sold as is.

The devices are specifically designed solely for the purposes of research and development only made available on a business-to-business basis.

The devices are not for resale.

Table of Contents

1 Introduction

The 3D Force Button Sensor Development Kit (Beta v1.0) is a system of (up to) five 3D Force Button Sensors per adapter, (up to) two Adaptors, and a Controller. Each 3D Force Button Sensor can measure 3D force. The Controller supplies power for (up to) two Adaptors and coordinates the simultaneous data acquisition from up to ten 3D Force Button Sensors. The Development Kit is shipped with visualisation software and (optional) C++ libraries for Windows and Linux environments and a ROS node for developing software control algorithms using the sensor signals.

The main components of the 3D Force Button Sensor Development Kit (Beta v1.0) are shown in Figure 1.1, connected to a laptop running the visualisation software.

Figure 1.1 – The 3D Force Button Sensor Development Kit (Beta v1.0). Laptop not included.

This document contains the installation and operation manual for the 3D Force Button Sensor Development Kit (Beta v1.0).

2 Safety

2.1 General

The customer should verify that the maximum loads and moments expected during operation fall within the sensing range of the sensor as outside this range, sensor reading accuracy is not guaranteed (refer to section *5.2 Force sensing*). Particular attention should be paid to dynamic loads caused by robot acceleration and deceleration if the sensors are mounted on robotic equipment. These forces can be many multiples of the value of static forces in high acceleration or deceleration situations.

2.2 Explanation of warnings

The warnings included here are specific to the product(s) covered by this manual. It is expected that the user heed all warnings from the manufacturers of other components used in the installation.

Danger indicates that a situation could result in potentially serious injury or damage to equipment.

Caution indicates that a situation could result in damage to the product and/or the other system components.

2.3 Precautions

DANGER: Do not attempt to disassemble the sensor. This could damage the sensor and will invalidate the calibration.

DANGER: Do not attempt to drill, tap, machine, or otherwise modify the sensor casing. This could damage the sensor and will void any warranty.

DANGER: Do not use the sensor on abrasive surfaces or surfaces with sharp points/edges. This could damage the silicone surface of the sensor.

CAUTION: Sensors may exhibit a small offset in readings when exposed to intense light sources.

CAUTION: Exceptionally strong and changing electromagnetic fields, such as those produced by magnetic resonance imaging (MRI) machines, constitute a possible source of interference with the operation of the sensor and Controller.

CAUTION: Temperature variations can cause drift in sensor readings. Some temperature compensation is included in the Development Kit. However, bias removal in software prior to operation is necessary, and it is recommended that biasing is performed each time the sensor is known to be unloaded.

3 Getting started

3.1 Introduction

This section describes the contents of the 3D Force Button Sensor Development Kit (Beta v1.0). Installation is covered in section 4.

3.2 Unpacking

Check the shipping box and components for damage during shipping. Any damage should be reported to Contactile Pty Ltd.

Standard components of the Development Kit are:

- Up to 10x 3D Force Button Sensor (Beta v1.0)
- Up to 2x Adaptor (Beta v1.0)
- 1x Controller (v2.0)
- Up to 2x Sensor Cable – 600 mm length
- 1x USB cable – 1 m length
- Contactile USB flash drive

3.3 Development Kit Components

3.3.1 3D Force Button Sensor (Beta v1.0)

The 3D Force Button Sensor (Beta v1.0) can measure 3D force. Figure 3.1 shows the 3D Force Button Sensor (Beta v1.0).

Figure 3.1 – The 3D Force Button Sensor (Beta v1.0)

For detailed specifications of the sensor, refer to section *5 3D Force Button Sensor Specification*.

3.3.2 Adaptor (Beta v1.0)

The Adaptor (Beta v1.0) can connect to up to five 3D Force Button Sensors (Beta v1.0). Figure 3.2 shows the Adaptor (Beta v1.0).

Figure 3.2 – The Adaptor (Beta v1.0)

For detailed specifications of the Adaptor, refer to section *6 Adaptor Specification*.

3.3.3 Controller (v2.0)

The Controller (v2.0) coordinates the simultaneous data acquisition from up to ten 3D Force Button Sensors (Beta v1.0). The Controller also supplies power to up to ten 3D Force Button Sensors (Beta v1.0) over the same single USB cable used for communications. Figure 3.3 shows the Controller (v2.0).

Figure 3.3 – The Controller (v2.0)

For detailed specifications of the Controller, refer to section *7 Controller Specifications*.

3.3.4 Sensor Cable (v2.0)

The sensor cable connects an Adaptor (Beta v1.0) to the Controller (v2.0). The sensor cable is a Molex PicoBlade 10 pin female-to-female cable assembly. The sensor cable is shown in Figure 3.4.

Figure 3.4 – The Sensor Cable (v2.0)

NOTE: The sensor cable comprises part of the calibrated sensor. Changing the length or type of the cable can affect the calibration. Check with Contactile when making cabling changes to ensure your system's calibration will not be affected.

3.3.5 USB Cable

The Development Kit comes with a standard 1 m long USB 2.0 cable for connecting the Controller to a PC (for power and communications). The USB cable is shown in Figure 3.5.

Figure 3.5 – The USB cable

NOTE: The US cable comprises part of the calibrated sensor. Changing the length or type of the cable can affect the calibration. Check with Contactile when making cabling changes to ensure your system's calibration will not be affected.

3.3.6 Contactile USB Flash Drive

The Development Kit comes with a Contactile USB flash drive containing manuals, software, and legal documents. The USB flash drive is shown in Figure 3.6.

Figure 3.6 – The Contactile USB Flash Drive

A summary of the contents of the USB flash drive are described in Table 3.1.

Table 3.1 – Contents of Contactile USB flash drive

Folder Name	Description of Contents	More Information
MANUALS	3DFDK_B1.0_MAN_JAN22	Development kit manual (this document)
LEGAL	CONDITIONSOFSALE _20211028	The conditions of sale
	ENDUSERLICENCEAGREEMENT _20211028	The end user licence agreement
SOFTWARE/ VIS	Java GUI for real-time visualisation and data logging	See section 9 of this manual

4 Installation

4.1 Precautions

Before attempting to mount or connect the 3D Force Button Sensor(s), Adaptor(s) or Controller, the user must ensure they have read the specifications and safety information pertaining to the sensors (see section *5 3D Force Button Sensor Specification*), Adaptors (see section *6 Adaptor Specification*) and the Controller (see section *7 Controller Specifications*).

4.2 Mounting

DANGER: Do not attempt to drill, tap, machine, or otherwise modify or disassemble the Sensor, Adaptor or Controller. This could damage the sensor and will void any warranty.

Mount the sensor(s) to a structure with sufficient mechanical strength. Not doing so can lead to suboptimal performance. The sensor can be mounted using the bolt pattern provided – See Figure 5.1.

The Adaptor and Controller can be mounted if desired. Mount the Adaptor and/or Controller to a structure with sufficient mechanical strength that is moving together with the sensors to avoid mechanically loading/cycling the FPC cables and sensor cables. Not doing so can lead to suboptimal performance. The Adaptor can be mounted using the bolt pattern provided – See Figure 6.3. The Controller can be mounted using the bolt pattern provided – See Figure 7.4.

4.3 Connecting the sensor(s), Adaptor(s) and Controller

CAUTION: Do not stress or over bend the sensor cable, especially where it is attached to the sensor. Sharp bends must be avoided as they can damage the cable and sensor and will void the warranty.

CAUTION: Be careful not to crush the sensor cable by over-tightening tie wraps or walking on the cable, since this may damage the cable.

CAUTION: Do not attempt to disconnect sensor cables by pulling on the cable itself; this can damage your system.

Each sensor is connected to an Adaptor via an FPC cable. Each Adaptor is connected to the Controller via a sensor cable. The sensor cable is connected to the Controller into one of the sensor ports (labelled SEN0 and SEN1). The FPC and sensor cables must be routed so that they are not stressed, pulled, kinked, cut, or otherwise damaged throughout the full range of motion.

4.4 Powering up the Controller and sensors

After connecting the sensor(s), Adaptor(s) and the Controller, connect the USB cable between the Controller and a PC. The LED labelled HUB on the Controller should flash white, and subsequently, should turn solid white when a serial connection is made with the Controller via the PC. For more information about the LED indicator panel on the Controller, refer to section *7.3 Status indicators*.

4.5 Interfacing the Controller to a PC

After powering up the Controller through, the PC that is connected can be used to read the data being transmitted by the Controller, via the same USB connection.

The Controller device coordinates the simultaneous data acquisition from up to two Adaptors (v2.0), connected to up to five 3D Force Button Sensors each; i.e., coordinates sampling of up to ten 3D Force Button Sensors.

Data transmission between the Controller device and the host computer is via a serial connection emulated on the USB connection, visible as a COM port on the host computer.

Calibrated 3D force values can be read on the host computer using the software provided (see section *9 Visualisation Software*), or the customer can develop their own software to read and unpack the data (see section *8 Serial communication protocol*).

4.5.1 Normal operation start-up sequence

Under normal operation when a Sensors are connected to Adaptors on each of the sensor ports, SEN0 and SEN1, as soon as the Controller is connected to a laptop/PC via a micro-USB to USB cable, the HUB LED will then start flashing white as the Controller waits for a serial connection to be established with the laptop/PC.

When a serial connection is established, the HUB LED will turn solid white, and if an Adaptor and sensors were connected to the SEN0 sensor port, then the SEN0 LED will turn solid white, and if an Adaptor and sensors were connected to the SEN1 sensor, then the SEN1 LED will turn solid white.

5 3D Force Button Sensor Specification

5.1 Physical specifications

5.1.1 Sensing element

The physical characteristics of the 3D Force Button Sensor are summarised in Table 5.1.

Table 5.1 – Physical characteristics of sensing element.

Height	5 mm
Diameter	14 mm
Material	Silicone
Shore hardness	A20 / A40

Note: Pillar size, shape, spacing, and hardness can be customised - height and hardness most easily.

5.1.2 Casing

The physical characteristics of the casing of the 3D Force Button Sensor are summarised in Table 5.2.

Table 5.2 – Physical characteristics of casing.

Dimensions (W x L x H mm)	15.0 × 19.0 × 4.3
Material	ABS plastic
Mounting	2x M2 threaded holes on bottom side

5.1.3 Environmental conditions

The 3D Force Button Sensor (Beta v1.0) is designed to be used in standard laboratory or light-manufacturing conditions and does not yet have ingress protection to withstand dusty environments, or fresh- or salt-water immersion to any depth. The 3D Force Button Sensor (Beta v1.0) may be used in environments with up to 95% relative humidity, non-condensing.

5.1.4 Mechanical drawings

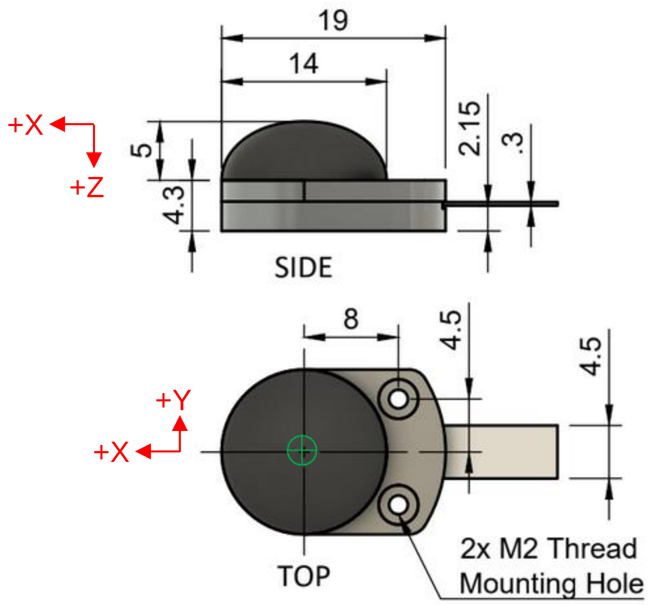

Figure 5.1 – Mechanical drawing of 3D Force Button Sensor (v2.0). All dimensions are in mm. X-, Y- and Z-axis orientations are labelled with red arrows (→). Origin of measurement frame of reference is labelled with a green target (⊕).

5.2 Force sensing

The force sensing range and measurement resolutions of the 3D Force Button Sensor are listed in Table 5.3.

Table 5.3 – Force sensing ranges for valid reading, and associated measurement resolution (standard deviation of sensing error).

Single sensing element						
	4 N Option		12 N Option		20 N Option	
	Fx, Fy	Fz	Fx, Fy	Fz	Fx, Fy	Fz
Sensing range (N)	±4	4	±8	12	±12	20
Resolution (N)	< ±0.01	< ±0.01	< ±0.02	< ±0.02	< ±0.05	< ±0.05

5.3 Temperature effects on accuracy

Temperature variations can cause drift in sensor readings; this is due to variation in LED output and due to thermal expansion/contraction of the pillar silicone. Some temperature compensation is included in this version of the 3D Force Button Sensor. However, bias removal in software prior to operation is necessary and it is recommended that biasing is performed each time the sensor is known to be unloaded. Bias removal is a standard procedure for many commercial force/torque sensors.

5.4 Electrical specifications

5.4.1 Anti-alias filtering

A hardware anti-alias low-pass filter with a cut-off frequency of 338.8 Hz for 1000 Hz sampling frequency is applied to each of the four photodiode signals coming from each sensor. The frequency response of the anti-alias filter is shown in Figure 5.2.

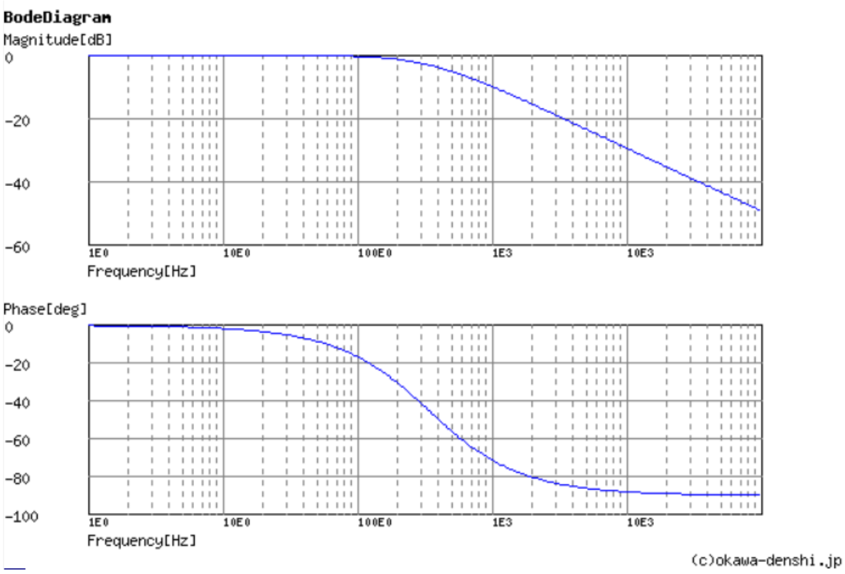

Figure 5.2 – Input filter frequency response (-3dB @ 235Hz)

5.4.2 Sampling rate

Each sensor can be sampled at 1000 Hz at full 16-bit resolution. This is coordinated by the Controller.

6 Adaptor Specification

6.1 Physical specifications

6.1.1 FPC ports

The Adaptor (Beta v1.0) has five FPC ports labelled A – E for connecting up to five 3D Force Button Sensors. The FPC ports are shown in Figure 6.1.

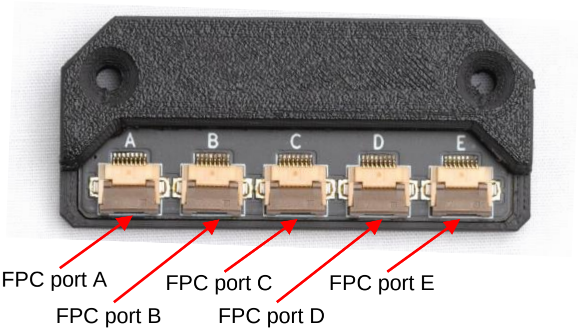

Figure 6.1 – FPC ports of Adaptor (Beta v1.0).

6.1.2 Controller port

The Adaptor has one controller port. The controller port is for connecting the Adaptor to the SEN0 or SEN1 port of the Controller via the sensor cable. The controller port is shown in Figure 6.2.

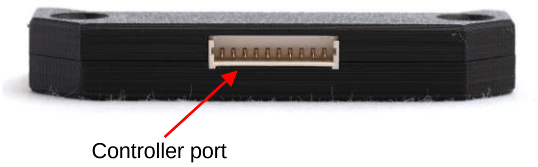

Figure 6.2 – Controller port of Adaptor (Beta v1.0).

6.1.3 Casing

The physical characteristics of the casing of the Adaptor are summarised in Table 7.1.

Table 6.1 – Physical characteristics of Adaptor casing.

Dimensions (W x L x H mm)	54 × 24 × 8.6
Material	ABS plastic
Mounting	2x M4 countersunk holes on top -side – see Figure 7.4

6.1.4 Environmental conditions

The Adaptor is designed to be used in standard laboratory or light-manufacturing conditions and does not yet have ingress protection to withstand dusty environments, or fresh- or salt-water immersion to any depth. The Adaptor may be used in environments with up to 95% relative humidity, non-condensing.

6.1.5 Mechanical drawings

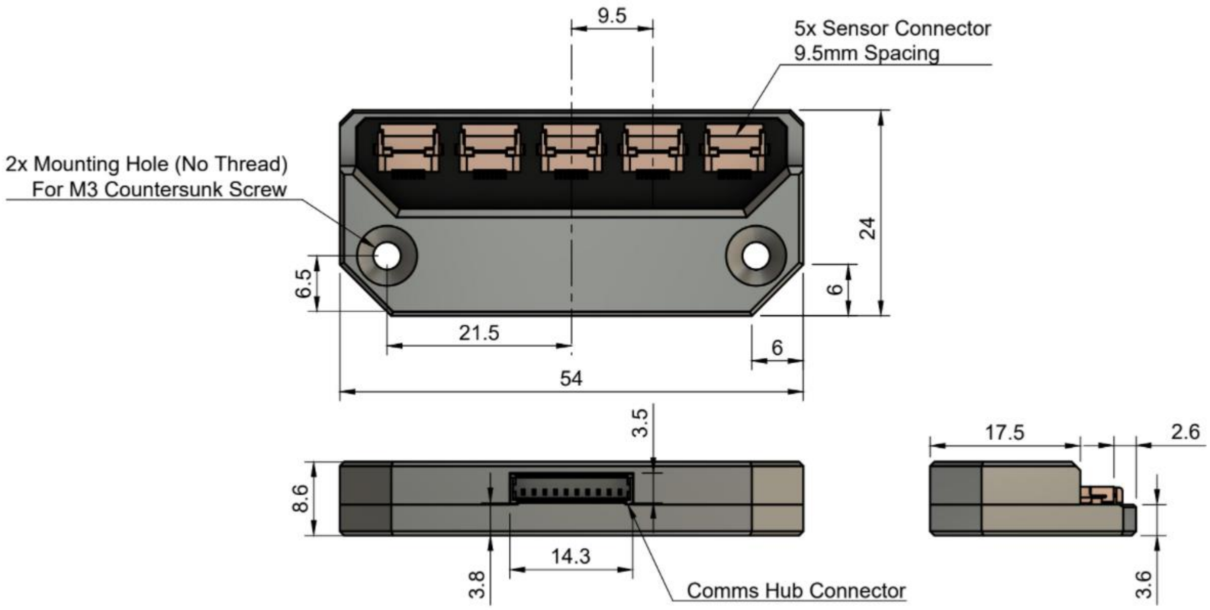

Figure 6.3 – Mechanical drawing of Adaptor (Beta v1.0). All dimensions are in mm.

7 Controller Specifications

7.1 Physical specifications

7.1.1 Sensor ports

The Controller has two sensor ports, labelled SEN0 and SEN1. The sensor ports are shown in Figure 7.1.

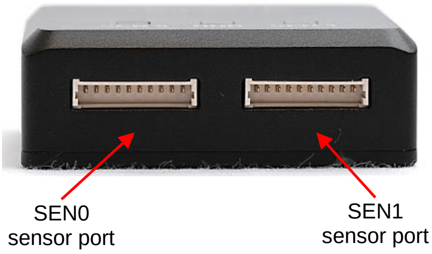

Figure 7.1 – Sensor ports of the Controller (v2.0)

7.1.2 Micro-USB port

The Controller has one micro-USB port as shown in Figure 7.2.

Figure 7.2 – Micro-USB port of the Controller (v2.0)

The micro-USB port supplies power to the Controller from the PC and transmits data to the PC from up to two sensors at a rate of 1000 Hz. The Visualisation Software, the C++ Library and/or the ROS Node can be used to read the data – see the respective manual for further instructions.

7.1.3 Indicator panel

On the top face of the Controller, there are three indicator LEDs labelled HUB, SEN0 and SEN1. The indicator panel is shown in Figure 7.3. The LEDs indicate the status of the system:

- HUB – indicates the Controller status
- SEN0 – indicates the status of sensors connected to an Adaptor on to the SEN0 port
- SEN1 – indicates the status of sensors connected to an Adaptor on to the SEN1 port

In general, a solid white LED indicates that the status is functional, a flashing white LED indicates waiting for some event, and a solid red LED indicates an error. For more information on the different states of the LEDs, see section *7.3 Status indicator*.

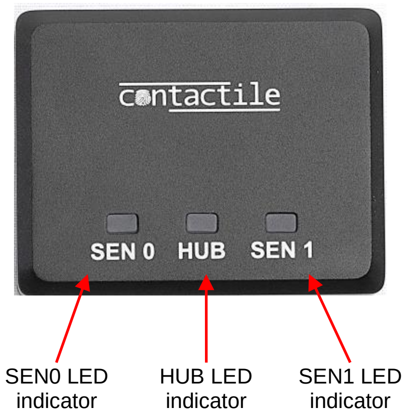

Figure 7.3 – Indicator LEDs of the Controller (v2.0)

7.1.4 Casing

The physical characteristics of the casing of the Controller are summarised in Table 7.1.

Table 7.1 – Physical characteristics of Controller casing.

Dimensions (W x L x H mm)	46 × 36 × 16
Material	Anodised Aluminium
Mounting	4x M3 threaded holes on bottom-side – see Figure 7.4

7.1.5 Environmental conditions

The Controller is designed to be used in standard laboratory or light-manufacturing conditions and does not yet have ingress protection to withstand dusty environments, or fresh- or salt-water immersion to any depth. The Controller may be used in environments with up to 95% relative humidity, non-condensing.

7.1.6 Mechanical drawings

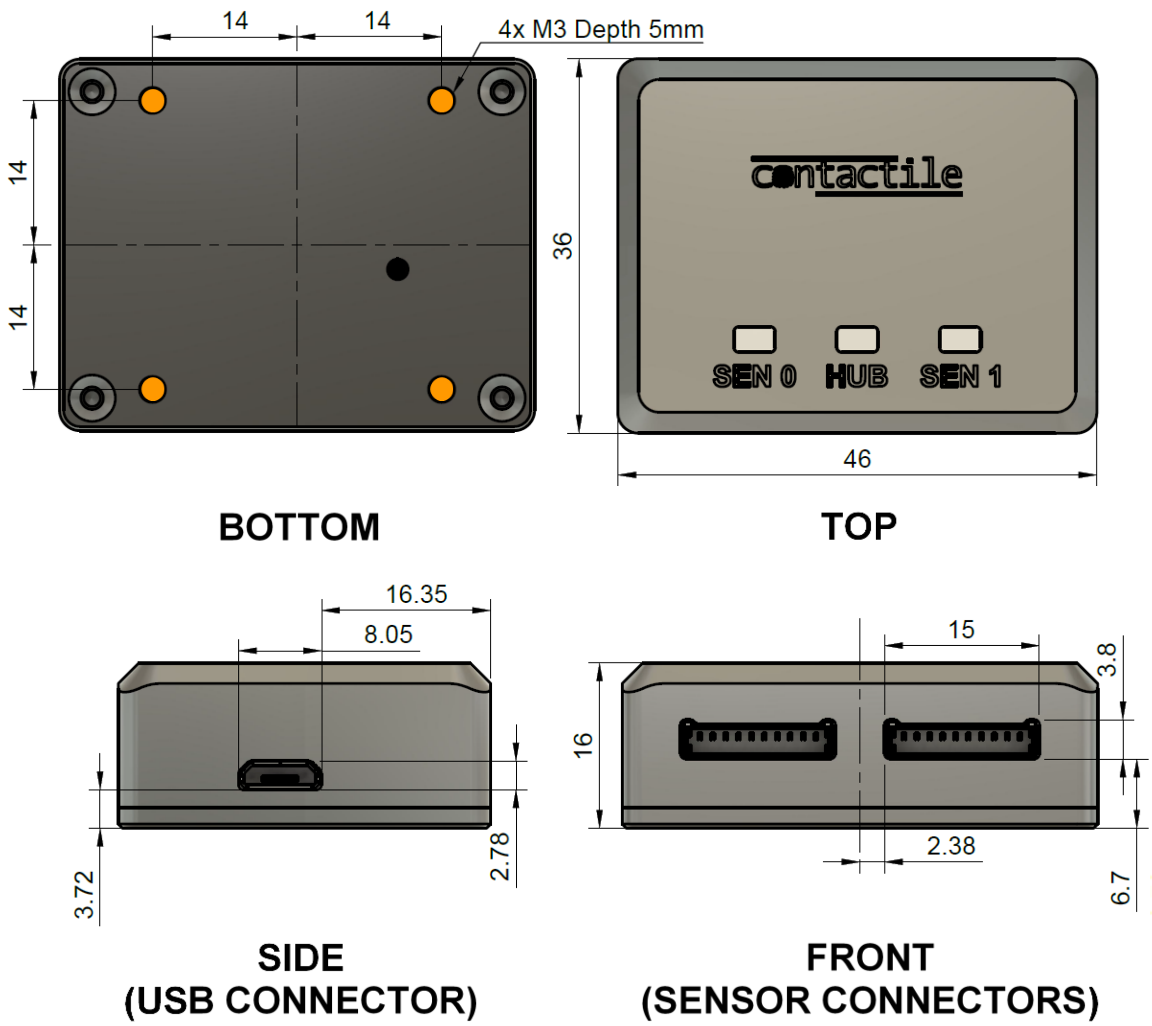

Figure 7.4 – Mechanical drawing of the Controller (v2.0). All dimensions are in mm. Customer mounting interface is shown as orange circles (●).

7.2 Power

Power for the Controller, up to two Adaptors and up to ten 3D Force Button Sensors is supplied over the same single micro-USB to USB cable used to communicate with the Controller. A standard USB 2.0 5 V / 500 mA port is sufficient. USB 3.0, 3.1, or 3.2 are also compatible.

The power draw of the Controller with ten sensors connected is 5 V / up to 200 mA current.

7.3 Status indicators

7.3.1 HUB LED

Once the Controller is powered, the HUB LED indicates the status of the Controller. The HUB LED can be in one of four states which are described in Table 7.2.

Table 7.2 – States of the HUB LED

State	Description
Off	There is no power to the Controller
Flashing white	The Controller is waiting for a serial connection to be established
Solid white	The Controller is functioning normally and sampling data
Solid red	The Controller has experienced an error

7.3.2 SEN0 LED and SEN1 LED

Once the Controller is powered, the SEN0 LED and SEN1 LED indicate the status of the Adaptor and Sensors connected to the SEN0 and SEN1 sensor port, respectively. The SEN0 and SEN1 LED can each be in one of four states which are described in Table 7.3.

Table 7.3 – States of the SEN0 LED and SEN1 LED

State	Description
Off	If the PWR LED is also off, there is no power to the Controller; If the PWR LED is solid white, then there is no Adaptor connected to the SEN0/SEN1 port
Solid white	The Controller is sampling data from the sensors connected to the Adaptor on the SEN0/SEN1 port
Solid orange	The Controller has experienced an initialisation error related to the sensors connected to the Adaptor on the SEN0/SEN1 port
Solid red	The Controller has experienced an initialisation error related to the sensors connected to the Adaptor on the SEN0/SEN1 port

8 Serial communication protocol

8.1 Data packet

The data streamed through the USB is fully resolved and thus users can read and parse the data using any software programming language they desire.

8.1.1 Reading the data packet

The Controller is connected to a computer via a serial connection emulated on the computer's USB port. Data is streamed through the serial port in binary format with 8-bit byte size.

Each sample of data is organised as a data packet beginning with 4 prescribed start bytes (0x55, 0x66, 0x77 and 0x88) and ending with 4 prescribed end bytes (0xAA, 0xBB, 0xCC and 0xDD). Immediately preceding the end bytes are 2 checksum bytes which contain the truncated sum of each byte in the data packet (excluding the start bytes, end bytes and checksum bytes) so that the data integrity can be confirmed.

To read a sample from the COM port:
1. Read one byte at a time until four consecutive bytes matching the start bytes are found.
2. Read one byte at a time and store these data to a buffer until four consecutive bytes matching the end bytes are found

To validate the data integrity:
1. Calculate the sum of individual bytes of data in the buffer excluding the final two checksum bytes, and truncate the result to a two-byte unsigned integer
2. Compare the calculated sum to the transmitted checksum bytes

8.1.2 Parsing the data packet

After reading the data packet into a buffer, the user program should parse the data to extract the data required for the user program.

Indexes in the data packet assume indexing beginning at zero – i.e., the first byte after the start packet is has byte index 0.

Multi-byte data is LSB (least significant byte first) – i.e., Little-Endian.

The data packet is described in Figure 8.1.

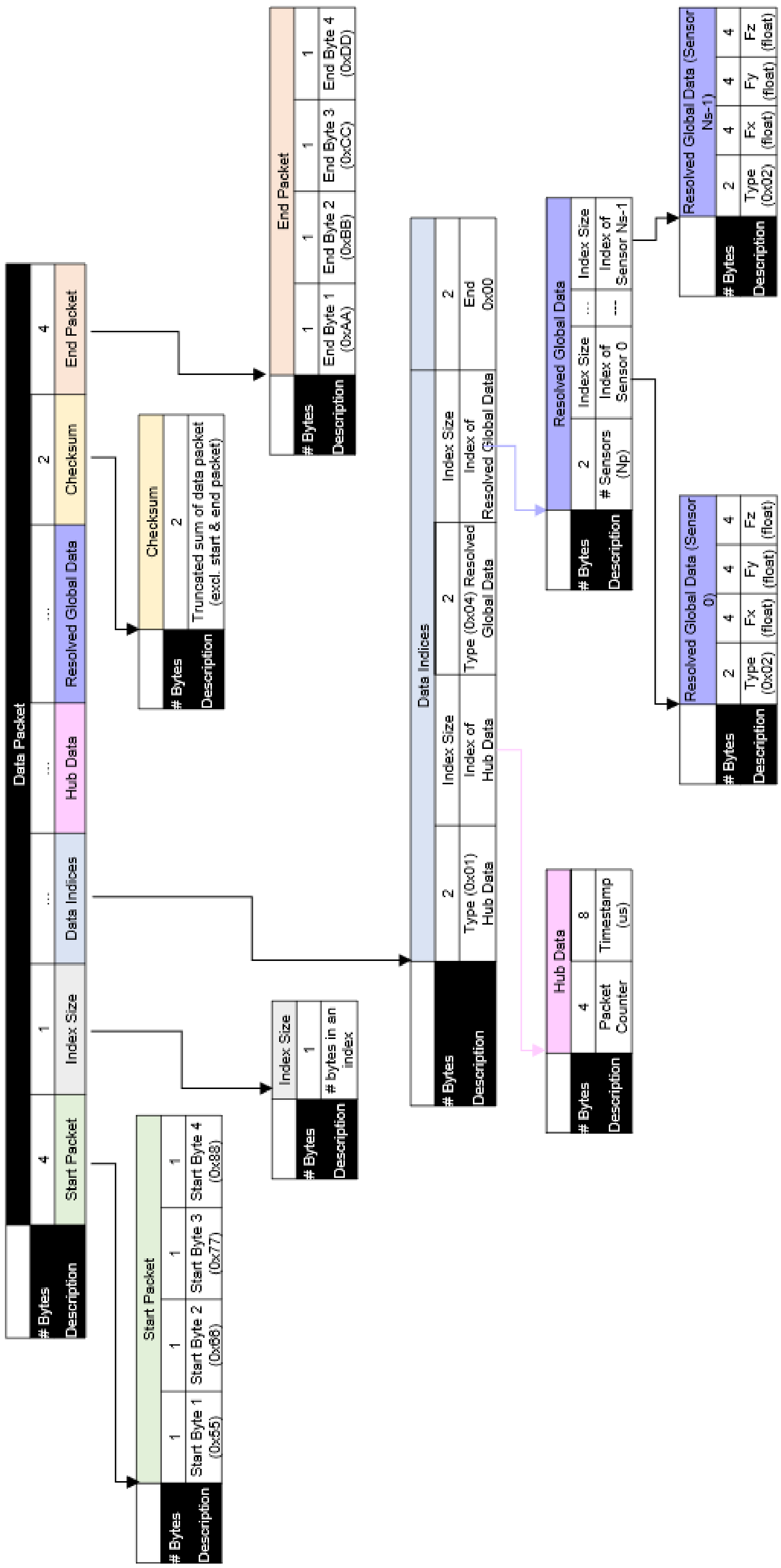

Figure 8.1 – Data packet structure

8.2 Commands

The Controller accepts commands via the COM port. The commands are sent as ASCII characters. These are listed in Table 8.1.

Table 8.1 – Commands accepted by the Controller

ASCII Characters		Command Description
z\n	Bias sensors	Sends a bias request to the Controller. A bias should be performed after connecting to the serial port and starting to stream data with the sensor unloaded. A bias should be performed each time the sensor is known to be unloaded. A bias operation can take up to 2 s. Ensure that the sensor remains unloaded throughout this time.

9 Visualisation Software

A Java-based graphical user interface (GUI) is provided for basic post-installation testing and general demonstration of sensor operation. This GUI can be found on the Contactile USB flash drive which was shipped with the Development Kit. The executable file is located in the folder 'SOFTWARE/VIS' in the root directory.

9.1 Getting started

9.1.1 End user licence agreement licence

Contactile's end user license agreement applies to all software and algorithms included with the products sold by Contactile. The end user license agreement that applies is provided on the USB flash drive shipped with the product in the folder 'LEGAL' in the root directory.

9.1.2 Hardware installation

Controller should first be connected to the Adaptor(s) and sensor(s) and then to a PC via the micro-USB port on the Controller before you can use the visualisation software.

The data transmission protocol between the Controller device and the PC is a serial connection emulated on the USB connection, visible as a COM port on the PC. After connecting the Controller to the PC, use the PCs device manager to determine the COM port number of the connection.

9.1.3 Software installation

The visualisation software is provided on the Contactile USB flash drive that was shipped with the development kit. Copy the entire contents of the Contactile USB flash drive to a location on the PC running Microsoft Windows.

9.1.4 Microsoft Windows display settings

Before starting the software, for the GUI to display in full screen, it is recommended to change the Windows display settings. In Windows 10:

1. Type "Display Settings" in the Windows search bar
2. Open the "Display Settings"
3. In the section "Scale and layout", change the "size of text, apps and other items" to "100%"

9.2 Operation

9.2.1 Starting the software

Run the executable file "PTSVIS_Fingertip_2.0.exe".

9.2.2 Start-up sequence

Once the software is launched, the GUI will appear. A serial connection will need to be made before the software begins sampling and displaying the data. To select a COM port and make a serial connections, see *9.4.1 Changing the COM port*).

9.3 GUI components

The top left area of the GUI window is a visual representation of the sensor connected to the SEN0 port of the Controller, and the top right is a visual representation of the sensor connected to the SEN1 port. Directly below each sensor visual representation is an area displaying 3D force plots for each sensor. There are also numerous controls for changing the display options, connecting to the Controller, logging data, and biasing the sensors - these are highlighted in Figure 9.1.

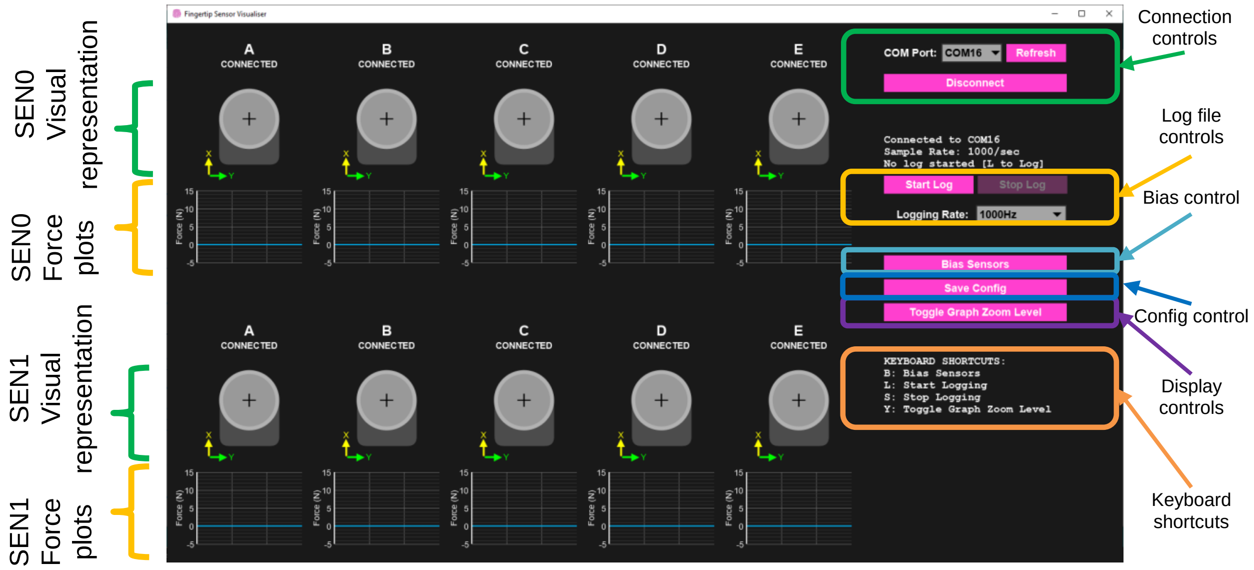

Figure 9.1 – GUI components of the visualisation software.

9.3.1 Visual representation of sensor force

The visual representation takes a top view of the sensor. Each sensor is represented as a 2-D grey (when unloaded) or white (when loaded) circle shape with a cross hair representing the tip of the pillar. The representation of an unloaded sensor is shown alongside the physical sensor is shown in Figure 9.2.

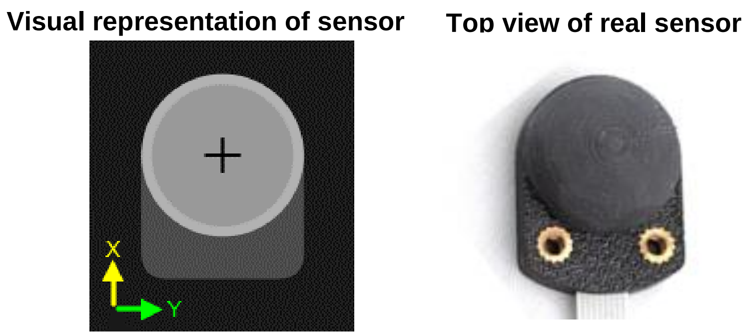

Figure 9.2 – Visual representation of sensor in GUI, including the X and Y axis orientation; and corresponding physical sensor.

The cross hair moves up and down, and right and left to indicate positive and negative forces acting on the sensor, in the X- and Y-axis, respectively. The shape of the pillar representation deforms as a result of forces being applied in the X- and Y- axis. Additionally, Z compression of the sensor is represented by a grey circle centred at the cross-hair – larger positive Z force results in a larger grey circle. Contact is represented by a change in the colour of the pillar – when the pillar is not in contact, it is grey, and when contact is made, the pillar becomes white. For visual purposes, the default threshold for a pillar to be considered in contact is 0.2 N in any one axis. Figure 9.3 shows an unloaded pillar, a pillar that is compressed to 1.5 N in the Z-axis, a pillar compressed to 5 N in the Z-axis, and a pillar compressed to 6 N in the Z-axis and a force is applied in the positive Y-axis.

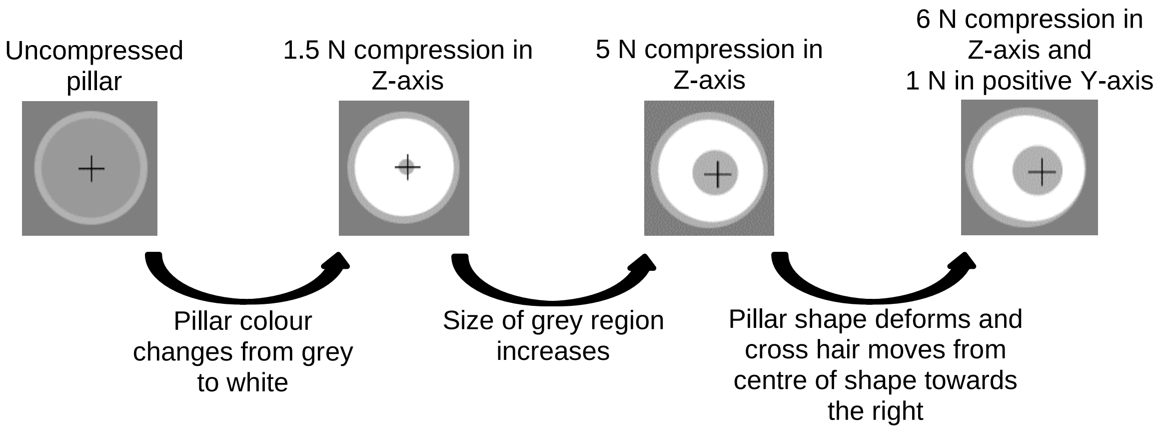

Figure 9.3 – Visual representation of a sensor when uncompressed, compressed to different z-forces, and under Y-axis force.

9.3.2 Force plots

For each pillar, the calibrated X-, Y- and Z-axis forces vs. time are displayed in a single plot. The relative locations of the force vs. time plots correspond to the pillar location in the sensor visualisation. The X-axis force is displayed as a yellow trace, the Y-axis force is displayed as a green trace, and the Z-axis force is displayed as a blue trace. Figure 9.4 shows a force vs. time plot for a sensor.

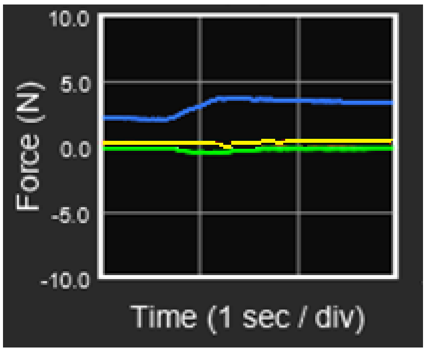

Figure 9.4 – Force vs. time plot. The X-axis force is displayed in yellow, the Y-axis force is displayed in green, and the Z-axis force is displayed in blue.

9.4 GUI controls

9.4.1 Changing the COM port

The GUI controls related to the serial connection are shown in Figure 9.5. To change the COM port number of the serial connection to the Controller:

1. If the GUI is already connected to a COM port, click the Disconnect button.
2. Click on the Refresh button to refresh the list of available COM ports.
3. Select the appropriate COM port number from the COM Port drop down list.
4. Click on the Connect button.

Figure 9.5 – Changing the COM port in the GUI and connecting

9.4.2 Biasing the sensor data

To bias the data (i.e., remove any offset in the calibrated force data when the sensor is unloaded), ensure that the sensor is unloaded and the signals are in a steady state, click on the Bias Sensors button (Figure 9.6). The bias operation takes approximately 2 s. Ensure that the sensor remains unloaded throughout this time. The sensor calibrated force signals should become zero after this point.

Figure 9.6 – Biasing the sensors

9.4.3 Save COM port configuration

To save the default COM port, first select the COM port from the drop down menu (see section *9.4.1 Changing the COM port*), then select the Save Config button (see Figure 9.7).

Figure 9.7 – Save Config button

9.4.4 Change graph Y-axis limits

To increase the force-axis resolution (i.e., reduce the limits of the force-axis) of the force vs. time plots, click on the Toggle Force Y-Range button (see Figure 9.8). Each time the Toggle Force Y-Range button is pressed, the force-axis limits will reduce, until the minimum limit of ±0.5 N. If the force-axis limits are ±0.5 N and the Toggle Force Y-Range button is pressed, then the force-axis limits will reset to the maximum limit of ±10 N.

Figure 9.8 – Toggle Force Y-Range button

9.4.5 Log file controls

The log file controls are shown in Figure 9.9.

Figure 9.9 – Log file controls

9.4.5.1 Changing the log file rate

To change the log file sampling rate, select the appropriate rate from the-drop down list next to Logging Rate. The log file sampling rate can only be changed when the GUI is not logging data.

9.4.5.2 Start/stop logging

To start logging data, click on the Start Logging button. If data logging had previously been started, click on the Stop Logging button to stop logging and save the log file – see section *10 Log file* for more information about the log file.

9.4.6 Keyboard shortcuts

A list of keyboard shortcuts is displayed in the GUI. These are shown in Figure 9.10.

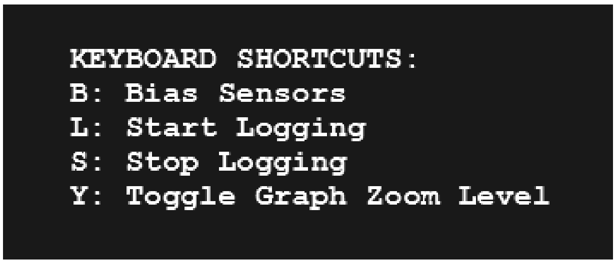

Figure 9.10 – List of keyboard shortcuts displayed in the GUI

10 Log file

10.1 Overview

The visualisation software can generate a log file of the sensor data.

10.2 Log file location

The log file is stored in the Logs subfolder in the same location as the Visualisation Software executable file (PTSVIS_Fingertip_2.0.exe) which was run to launch the GUI.

10.3 Log file name

The name of the log file that is generated is LOG_YYMMDD_hhmmss.csv where YY is the two digit year, MM is the two digit month, DD is the two digit day, hh is the two digit hour, mm is the two digit minute and ss is the two digit second from the system clock at the time that the log file was created.

10.4 Log file format

The log file is saved as comma-separated values (CSV) in ASCII text format. The order of the values and a description is shown in Table 10.1.

Table 10.1 – Data in log file

Data Order	Data Name	Data Description	
1	T_us	Timestamp in µs	Timestamps
2	S0_G_FX	Sensor 0, X-axis force in Newtons	Sensor 0, forces
3	S0_G_FY	Sensor 0, Y-axis force in Newtons	
4	S0_G_FZ	Sensor 0, Z-axis force in Newtons	
5	S1_G_FX	Sensor 1, X-axis force in Newtons	Sensor 1, forces
6	S1_G_FY	Sensor 1, Y-axis force in Newtons	
7	S1_G_FZ	Sensor 1, Z-axis force in Newtons	
⁞			
29	S9_G_FX	Sensor 9, X-axis force in Newtons	Sensor 9, forces
30	S9_G_FY	Sensor 9, Y-axis force in Newtons	
31	S9_G_FZ	Sensor 9, Z-axis force in Newtons	

S0, refers to the sensor connected in position A, S1 refers to the sensor connected in position B, and so on, and S4 refers to the sensor connected in position E, of the Adaptor connected to the SEN0 port. Similarly, S5, refers to the sensor connected in position A, S6 refers to the sensor connected in position B, and so on, and S9 refers to the sensor connected in position E, of the Adaptor connected to the SEN1 port of the Controller.

If a sensor is not connected, the log file will contain values of 0.0 for FX, FZ and FZ in the corresponding data columns.

11 Maintenance

11.1 General

For most applications, there are no parts that need to be replaced during normal operation.

11.2 Cleaning

CAUTION: The Sensor and Adaptor casing material is ABS plastic. Do not clean with solvents such as acetone as this may damage the casing. Isopropanol is a suitable cleaning agent; however, care must be taken to avoid liquid ingress.

CAUTION: The Sensor pillar material is silicone. Do not clean with strong alkaline or acidic substances. Isopropanol is a suitable cleaning agent; however, care must be taken to avoid liquid ingress.

CAUTION: The Controller casing material is anodised aluminium. Do not clean with strong alkaline or acidic substances which can cause corrosion. Isopropanol is a suitable cleaning agent; however, care must be taken to avoid liquid ingress.

Sensors, Adaptors and the Controller must be kept free of excessive dust, debris, and moisture. Debris and dust should be kept from accumulating on or in the sensor(s) and Controller.

11.3 Silicone integrity

Periodic inspection of the condition of the silicone of the sensor(s) is recommended. During normal use, the silicone surface finish may become dull - this is normal.

If the silicone appears worn or there are signs of damage, the silicone may need to be replaced and the sensor recalibrated. Contact Contactile for options on replacing the silicone and recalibration.

11.4 Cabling and connectors

In industrial-like applications that continuously or frequently move the system’s cabling, you should periodically check the cable jacket for signs of wear.

Damage to the outer jacketing of the sensor cable could enable moisture or water to enter an otherwise sealed sensor. Ensure the cable jacketing is in good condition to prevent sensor damage.

The sensor cables are not designed to be frequently connected and disconnected. To avoid damage to the sensor cables and sensor ports, avoid frequently connecting and disconnecting the sensor(s) from the Controller.

The sensor cables and connectors are not designed to be user serviceable. Contact Contactile for options on repairing or replacing cables and connectors.

11.5 Periodic calibration

Periodic calibration of the sensor and its electronics is required to maintain accuracy and resolution. We recommend annual recalibrations, especially for applications that frequently cycle the loads applied to the sensor. Contact Contactile for options on recalibration.