Integrator Manual

Surface Analyst™ XA-Kit

Archer 8.15

This English language document is the original Integrator Manual.

Document Version #1

Contents

1 Introduction

1.1 Purpose and Scope of this Manual

The purpose of this Integrator Manual is to give instructions for how to integrate the Surface Analyst XA-Kit into existing pieces of equipment. Instructions for specific program commands and administrative functions of the Surface Analyst are given in the Control API Guide and the Administrator Manual, respectively.

This manual is not intended to be an end-user manual. It is the responsibility of the integrator to supply appropriate documentation to the end user.

The images presented in this manual may differ from the actual appearance of your Surface Analyst.

1.2 Important Notes

Important information that is not safety-related is shown in a note message like one of the following:

This note gives information on how to avoid equipment malfunctions or property damage. If you do not follow this note, your warranty may be voided or you may receive incorrect measurements or both.

This note gives other useful, important information.

1.3 Intended Use

The intended use of the Surface Analyst is to measure the surface energy properties of a material surface. Do not use the Surface Analyst for any other use.

The Surface Analyst XA-Kit is not intended for use in hazardous locations. If you require a Surface Analyst for use in hazardous locations, contact Brighton Science.

1.4 Contact Us

Contact us for general inquiries, technical support, and sales:

Brighton Science
4914 Gray Road
Cincinnati, OH 45232
513.469.1800
service@brighton-science.com

Visit us at brighton-science.com

2 Technical Specifications

Item	Specification
Weight	18 lb (8.2 kg) with full cartridge
Control Cabinet Dimensions	Height:12 in (300 mm) Width: 15 in (380 mm) Depth: 6.1 in (155 mm)
Length of inspection head tether	59 - 82 in (1.5 - 2.1 m)
Control Cabinet Protection Class	IP 54, NEMA 12
Power	12 VDC, 2.5A Power supply (input): 100-240 VAC, 0.3A, 50/60 Hz Power supply (output): 12 VDC, 2000 mA Power supply cable length: 53 in (1346 mm)
Operating conditions	Indoor use only Maximum altitude: 6562 ft (2000 m) Temperature: 41° - 104°F (5° - 40°C) Minimum relative humidity:15% Maximum relative humidity: 80% for temperatures up to 31 °C (88 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F)
Noise emission	Less than 72 dB(A)
Cartridge fluid	HPLC-grade water (standard)
Cartridge capacity	10,000 measurements
Cartridge weight (full)	1.0 lb (450 g)
Inspection time	2 seconds *
Image storage capacity	40,000

* Inspection time may be longer with certain options enabled.

3 Quick Start Guide

This chapter includes the most important information to get you started in your integration of the Surface Analyst as quickly as possible.

It is important to understand that the Surface Analyst XA-Kit is a powerful inspection system that needs careful set-up in order to function properly within your specific application. After familiarizing yourself with this chapter, be sure to read this manual in its entirety in order to learn how to best integrate the Surface Analyst XA-Kit into your application.

3.1 Important Documentation

The following documentation is on the USB flash drive that is included with your Surface Analyst XA-Kit. Make sure to read and understand each document before beginning your integration.

- Integrator Manual (this document: XA Kit_8.xx_IM....pdf)
  - The Integrator Manual gives you instructions on how to install, set up, control, and maintain the Surface Analyst.
- Administrator Manual (XA Kit_8.xx_AM....pdf)
  - The Administrator Manual gives information about the Archer software including administrative functions, process parameter settings, and purchasable options.
- Control API Guide
  - The included Control API Guide describes the command and response communication channel to use for automating the operation of the Surface Analyst.

If you are using LabVIEW, then the following documents (also on the USB flash drive) are good resources:

- LabVIEW Library (LabVIEW_Library_Archer8.xx.rar)
  - This document contains a LabVIEW program for each API command.
- API/LabVIEW Naming Guide (XA_Archer8.xx_API-LabVIEW_Naming.xlsx)
  - This document contains a cross-reference between the commands in the API guide and names used in the LabVIEW library.

3.2 Remote API Control vs Remote DIO Control

Remote API Control

The standard method to control the Surface Analyst XA-Kit is through the Ethernet API. Through the API, you have full control of the Surface Analyst. The host system can receive contact angles and images from the Surface Analyst, and functions like performance checks are performed fully automatically.

Remote DIO Control

Optionally, you may choose to use the Remote DIO Control method of contol. This is a simplified control mode using digital I/O signals (ready/pass/fail). There is no contact angle information or images accessible by the controlling unit. This option is not recommended for automation applications.

For more information, see "Control of the Surface Analyst" on page 39.

3.3 Connection Ports and Connectors

The connection ports are located either on the left side or back side of the control cabinet, depending upon how you ordered the Surface Analyst XA-Kit. See "Surface Analyst XA-Kit Diagrams" on page 16.

A US 110VAC AC adapter with remote switch activation cable is provided standard. If you need an international version of the AC adapter, you may order it from Brighton Science. See "Spare Parts" on page 53.

3.4 Mechanical Integration Notes

- Read the chapter "Installation and Setup" on page 27 to learn how to properly install and set-up the Surface Analyst.
- Never disconnect the inspection head tether from the control cabinet. Be sure to have a way of getting the inspection head inside your cell without detaching it.
- For service purposes, the inspection head must be detachable from the robot or XYZ axes to which it is mounted.
- Mount the control cabinet so that the display is about eye height.
- Be sure to orient the control cabinet so that you can change the fluid cartridges. Refer to the drawing "Control Cabinet" on page 21 for clearance recommendations.
- Position and mount the control cabinet above where the inspection head is to be mounted.
- A purge station needs to be fabricated and installed. See "Set Up a Purge Station" on page 38 for instructions.
- An accessible holder for the PCS cards needs to be fabricated and installed. See "Set up a PCS Fixture" on page 36
- For best results, position the inspection head so that it points and dispenses downwards. Other orientations are possible with restrictions. However, head orientation must always be downwards for purging and performance checks. Contact Brighton Science for more information.
- For best measurement results, avoid internal lighting within the cell, and protect the inspection head from exposure to external light sources during measurements. Light sources other than the light emitted by the inspection head can negatively affect the drop detection.

3.5 Electrical Integration Notes

- Read the chapter "Installation and Setup" on page 27 to learn how to properly install and set-up the Surface Analyst.
- Communication is through a standard RJ45 Ethernet cable (not included with the XA-Kit).
- The AC adapter operates from 100-240 VAC (with the standard US 110VAC AC adapter)
- The optional DIO connection is through a special 18 pin connector (provided to you if you purchased the DIO option). See "Connect the DIO (Option)" on page 30.
- If you want to control the green multipurpose button remotely (for remote start-up, for example), wire a dry contact into the remote switch activation cable (pre-wired with the AC adapter). Close the contact for 0.5 seconds for remote start-up. See "Connect the Power" on page 28.
- To start the Surface Analyst manually, press the green multipurpose button. To shut down manually, touch the "Shutdown" icon on page 1 of the Menu screen.

3.6 Software Integration Notes

- The included Control API Guide describes the command and response communication channel to use for automating the operation of the Surface Analyst.
- Your controlling device must have an Ethernet port.
- If you are using the LabVIEW drivers provided by BTG, the IP address must be set to 192.168.0.30
- Read "Control of the Surface Analyst" on page 39 for complete instructions for how to control the Surface Analyst.
- The XA-Kit includes a router. Refer to "Set Up Communications" on page 31 for setup instructions.

3.7 Quick Start: Operation

This section gives you quick instructions for operation of the Surface Analyst using Remote API Control. For more detail and instructions for Remote DIO Control, see "Control of the Surface Analyst" on page 39.

The RD (Remote Device) commands listed in this section are described in the Control API Guide.

3.7.1 Starting the Surface Analyst

1. Press the main switch to connect the XA-Kit controller to power.
2. Power on the Surface Analyst using one of the following methods:
   - Press the green multipurpose button to power on manually.

     or
   - Power on remotely if you wired in a dry contact into the remote switch activation cable. (See "Connect the Power" on page 28.)
3. The startup sequence takes about 3 minutes. During startup, the Ethernet connection starts working. To check if the Surface Analyst is up and running, you can send a ping (RD Command **Ping>**) periodically (every 10 sec is recommended).
4. After the startup sequence is complete, the Surface Analyst goes automatically to the Measurement screen.
5. Send RD Command **GetStatus>** to verify the following:

   Free space > 20%

   Cartridge status = CART_OK

   Performance Check status - PCHECK_OK

   Pump status - PUMP_OK
6. Send RD Command **DropCount>** to check if there are enough drops for your run. It is recommended to display the drop count on the user interface.

   The Surface Analyst will stop measuring when the drop count runs out. Make sure you have an adequate number of drops to complete your batch prior to starting a run.
7. Send RD **Command GoToMeasurement>** to make sure the system is still in measurement mode.
8. Move the inspection head to the purge station.
9. Perform a TenShot purge

The TenShot purge is performed every time the Surface Analyst is turned on and anytime it has not been used for more than 2 hours.

RD Command: **TenShotPurge>**

The TenShot purge takes about 7 seconds to complete.

10. The Surface Analyst is now ready to use.

3.7.2 Running Measurements

1. Because the valve that dispenses water dries out over time, you will need to prime the valve before taking measurements. Priming fills the nozzle with water and prepares the valve for dispensing. Do either of the following:
    a. Move the inspection head to the purge station, and send RD Command **PrimeShot>** before each run
    b. Track the time from the last dispense. If it is longer than 1 minute, then move the inspection head to over the purge station and send the RD Command **PrimeShot>**. No action is needed if the time is equal or less than 1 minute.
2. Move the inspection head to the desired position over the surface to be measured. Make sure the inspection head is 12.7 mm over the surface (see "Mount and Position the Inspection Head" on page 34).
3. Send RD **Command Measure>** or **Measure NP>**.
4. Check for errors. For example, if you move the inspection head fast and stop hard, you most likely will get the error **TM_ERROR-PRESSURE-XXX>**. This is because of movements of the waterline require the pressure to stabilize. If you receive the pressure error, send the **Measure>** or **MeasureNP>** again for up to 10 times.
5. Move the inspection head to the next location and repeat steps 3-4.

3.7.3 Performance Check Notes

A performance check is recommended at the beginning of each day and as needed to verify that the Surface Analyst is operating at maximum performance.See "Doing Performance Checks" on page 64 and "Performance Checks" on page 41 for more information.

For a flowchart of the performance check sequence, see "Performance Check Sequence" on page 42

Also, refer to the Control API Guide for further detail about the various commands used for a performance check.

- Before sending RD Commands **PCHK(a)>** or **PCHKNP(a)>**, the inspection head must be over the QR code on the PCS card. Make sure the inspection head is 12.7 mm over the surface (see "Mount and Position the Inspection Head" on page 34).
- Before sending RD Commands **Measure>** or **MeasureNP>**, the inspection head must be over one of the yellow targets on the PCS card.
- A minimum of 5 measurements is needed for one round of the performance check. If the Surface Analyst needs to make adjustments, then another 5 measurements will be needed, and so on. Dispensing up to 9 measurements on one yellow target reduces the frequency of PCS card changes.

- In order to make the best use of the PCS, you can deposit several drops on each of the targets,as shown in Fig. 1. Refer to "PCS Card" on page 24 for specifications of the PCS.

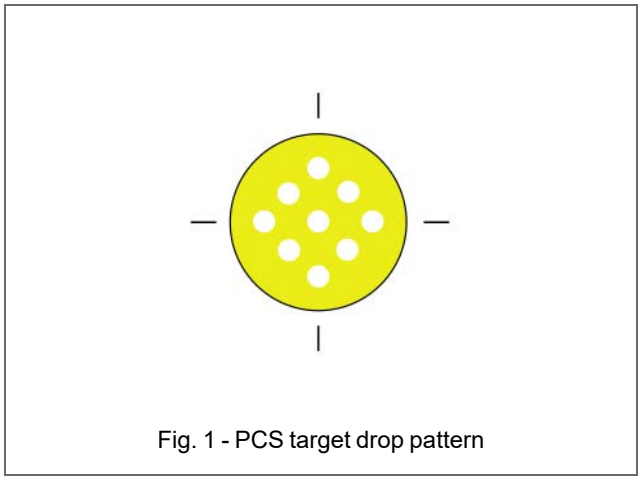


Fig. 1 - PCS target drop pattern

- Be aware that the position of the yellow circles can vary due to tolerances of the card and holder.It is best not to measure too close to the edge of the yellow circle

3.7.4 Shutting Down

To shut down the Surface Analyst, send the RD command **ShutDown>**.

3.8 Testing

The XA-Kit as shipped is in “automation” mode. If you want to take measurements manually by pressing the green multipurpose button for purposes of installation or testing, contact BTG Labs Service to unlock the “manual” mode.

It is important to set the Surface Analyst back to "automation" mode before a production run. Otherwise, popup messages and the like can disrupt the automated control.

4 Overview of the Surface Analyst

The Surface Analyst XA-Kit is an inspection device that is designed to be integrated into your existing equipment. It determines surface energy by measuring the contact angle of a water drop deposited on your surface. The measuring, image processing, and results calculations are controlled by Archer, Brighton Science's proprietary software.

The main system components consist of the following:

- The Surface Analyst control cabinet which houses the Archer software, the fluid dispensing system, and associated controls
- The inspection head containing the camera, lights, and fluid dispensing nozzle
- Digital Input and Output (DIO) for integration with your equipment (where applicable)

There are two different ways your equipment may be configured to control the Surface Analyst:

- Remote API Control (full control)--the standard method of control using an ethernet connection (see "Remote API Control (Full Control)" on page 39)
- Remote DIO Control (limited control)--a limited method of control using the digital inputs and outputs (see "Remote DIO Control (Limited Control)" on page 48)

For more information regarding the general functioning of the Surface Analyst, see Appendix A: "General Operation of the Surface Analyst".

4.1 Surface Energy and Contact Angles

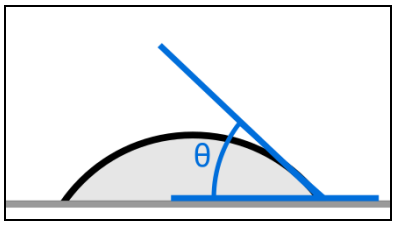
The Surface Analyst gives you important information about the surface energy of your product in a fast, easy, non-destructive way.

Knowing the surface energy of your product is important for assuring the success of many processes, including the following:

- Adhesion
- Sealing
- Painting and coating
- Printing
- Hydrophobic applications

What contact angles tell you

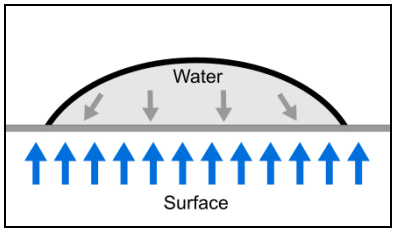
The Surface Analyst deposits a drop of fluid onto a surface and measures the contact angle between the drop and the surface.



The contact angle (θ) tells you how much the surface is able to attract other substances.

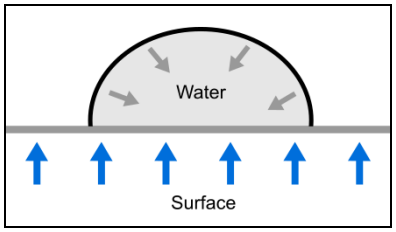
If the fluid spreads out thinly, that means that the fluid is attracted more strongly to the surface than to itself.

- The surface has a high surface energy.
- The contact angle is low.
- This surface is generally good for bonding applications.



If the fluid "beads", then the fluid is attracted more strongly to itself than to the surface.

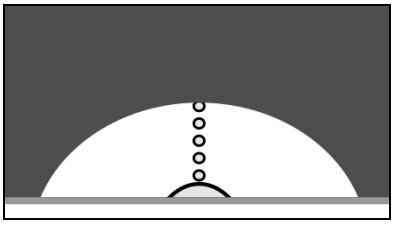
- The surface has a low surface energy.
- The contact angle is high.
- This surface is generally not good for bonding applications, but it is good for anti-stick and hydrophobic applications.



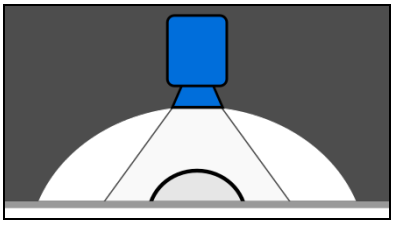
4.2 How the Surface Analyst Works

The Surface Analyst measures the contact angle of a fluid drop on your surface to determine the surface energy.

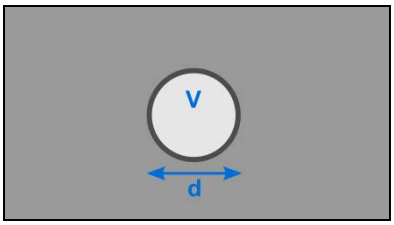
1. The Surface Analyst pulses a stream of several droplets onto the surface. These droplets combine to form one small drop (less than 2 microliters).This process is called Ballistic Deposition.



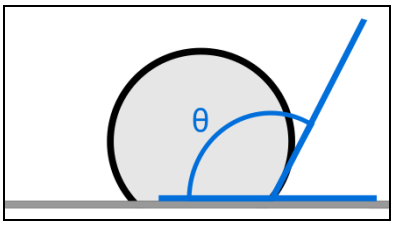
2. A camera views the drop from above and takes a picture.



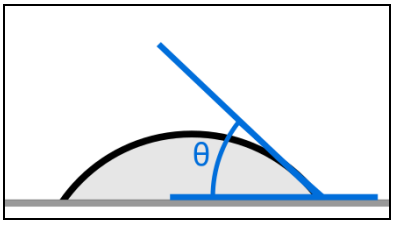
3. The Archer software determines the diameter of the drop. Using the known volume of the drop, Archer calculates the contact angle.



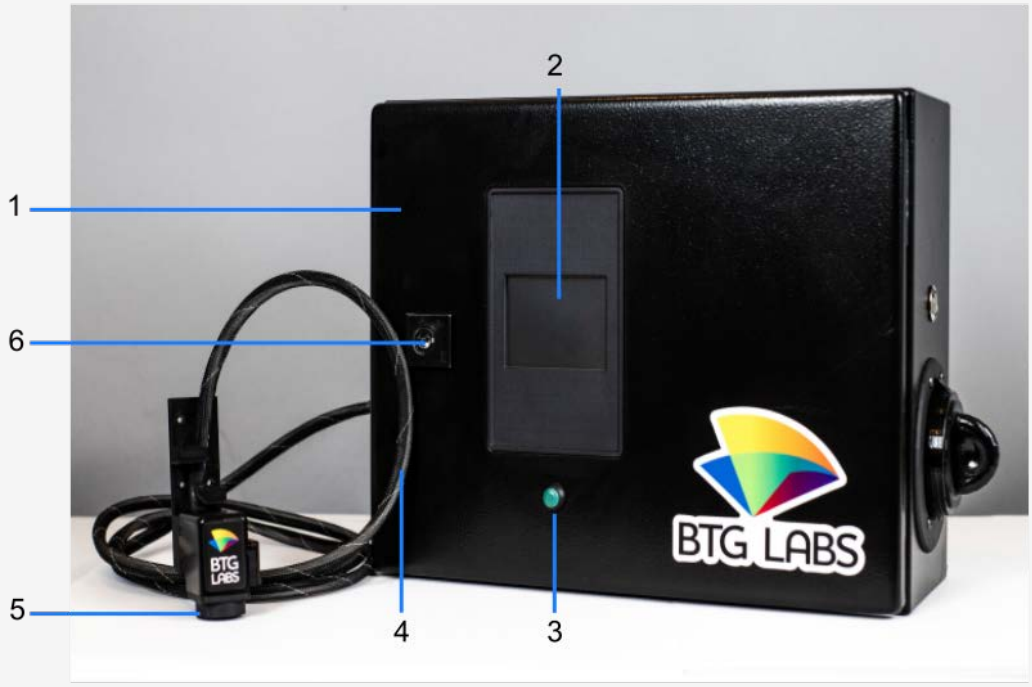
4. A large contact angle shows that the surface has low surface energy.



A small contact angle shows that the surface has high surface energy.



4.3 Surface Analyst XA-Kit Diagrams



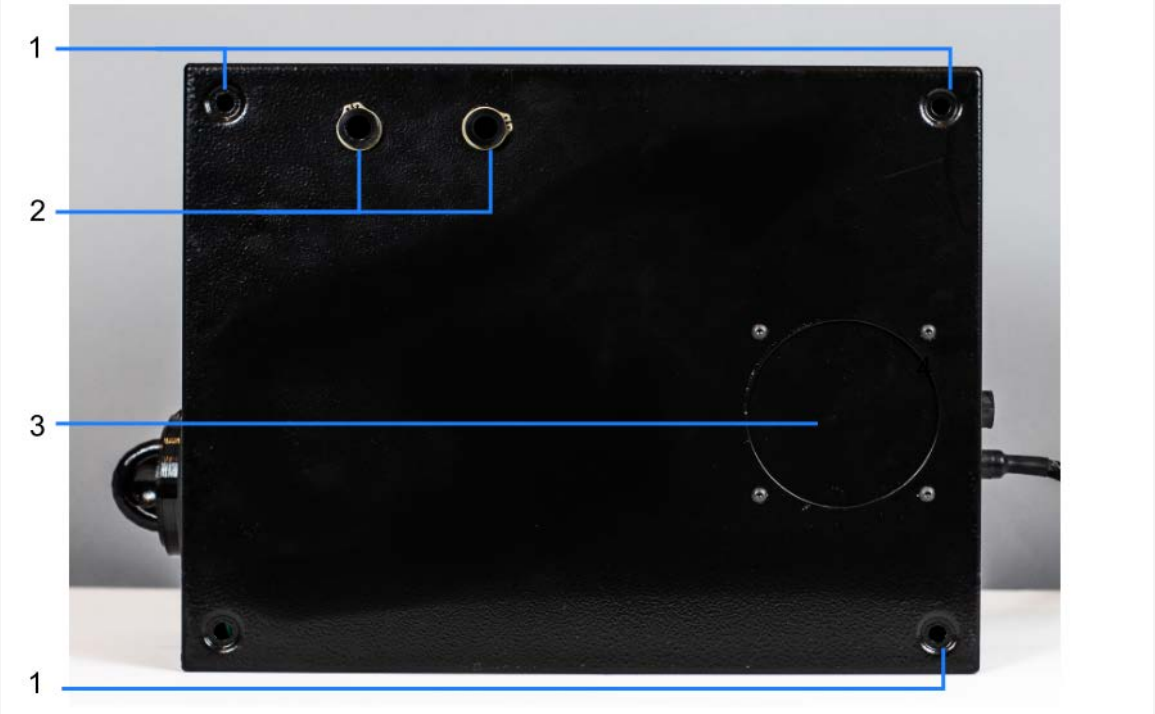
1	Control cabinet with Archer software	2	Display
3	Green Multipurpose Button	4	Inspection head tether
5	Inspection head	6	Cabinet lock

Fig. 2 - Front of the XA-Kit

1	Power supply port	2	Ethernet port (Ethernet cable not included)
3	USB port	4	Main switch
5	Inspection head tether	6	Cartridge release button
7	Cartridge bay with cartridge		

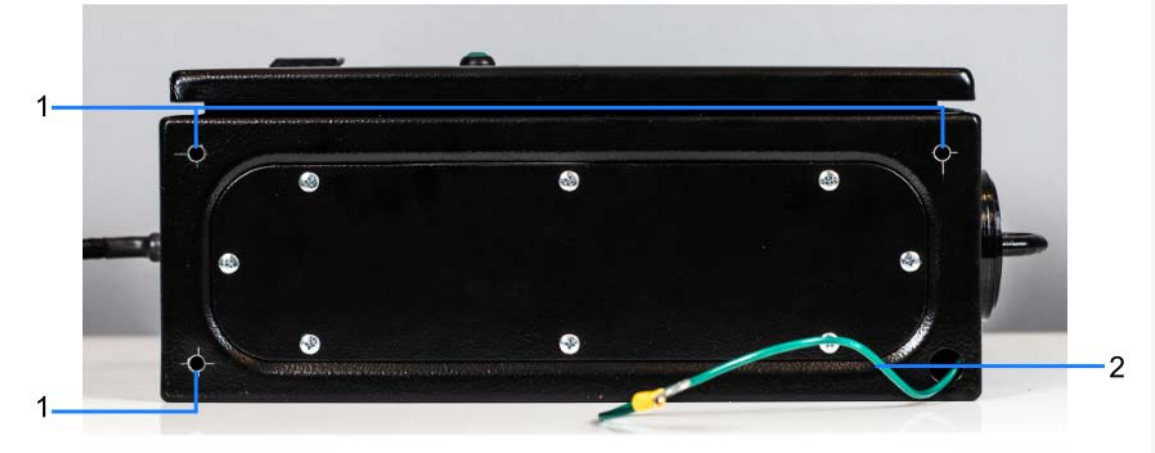
Fig. 3 - Right and left sides of the XA-Kit

Fig. 4 - Optional digital input/output (DIO) connection



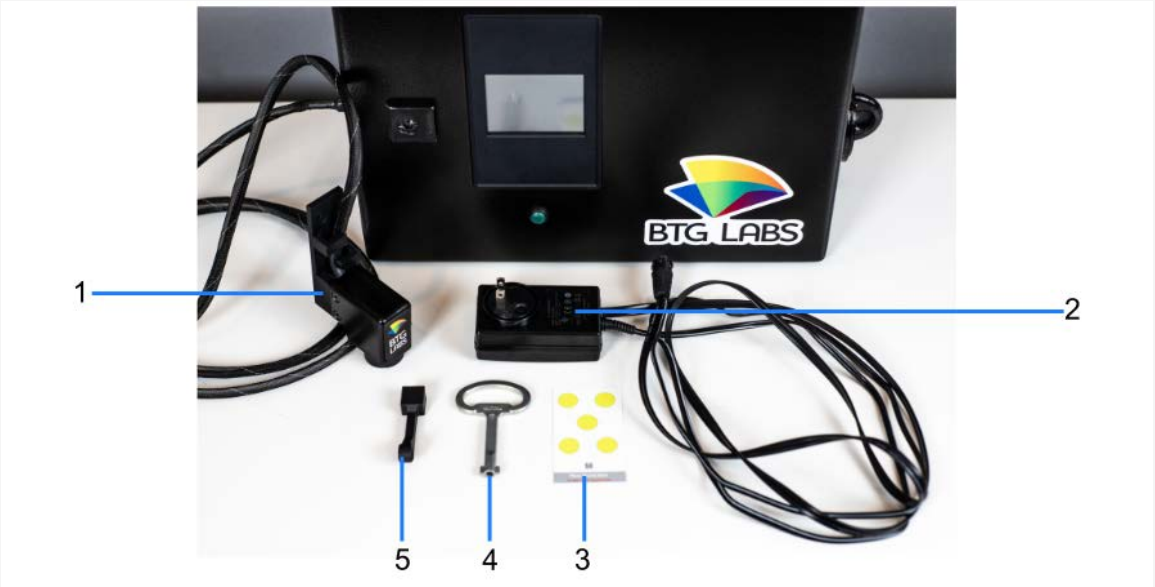
1	Mounting holes (3 accessible)	2	Burp valve exhaust
3	Alternate location for connection ports		

Fig. 5 - Back of the XA-Kit



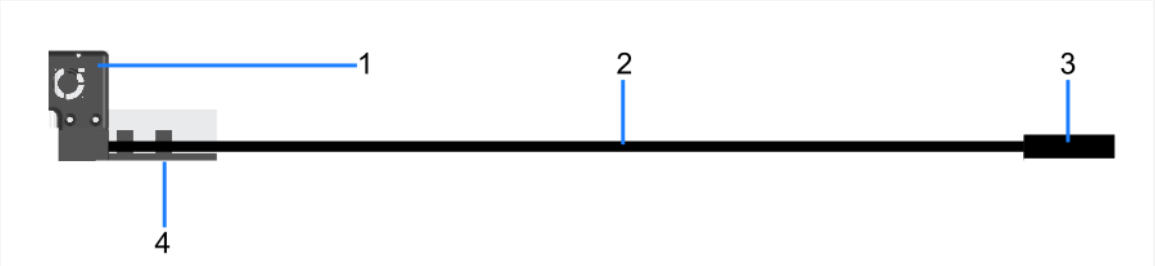
1	Mounting holes	2	Grounding wire

Fig. 6 - Bottom of the XA-Kit



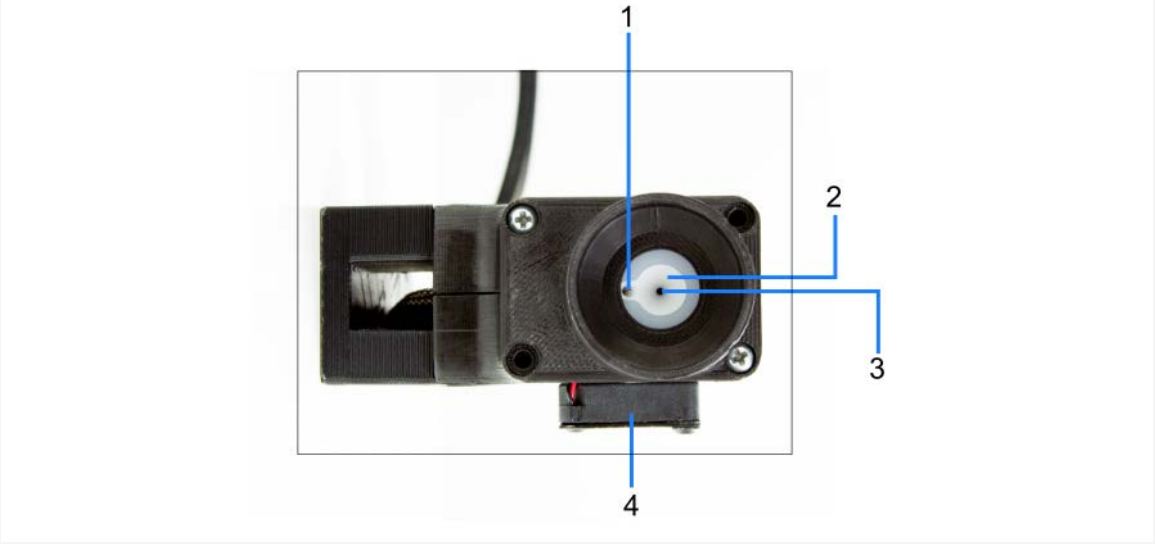
1	Inspection head	2	AC adapter with remote switch activation cable
3	PCS cards	4	Control cabinet key
5	12.7 mm measuring gauge		

Fig. 7 - Accessories



1	Inspection head	2	Tether
3	Tether connector	4	Inspection head mounting plate

Fig. 8 - Inspection head and tether



1	Nozzle	2	LED light diffuser
3	Camera	4	Fan

Fig. 9 - Inspection head detail

5 Engineering Drawings

5.1 Control Cabinet

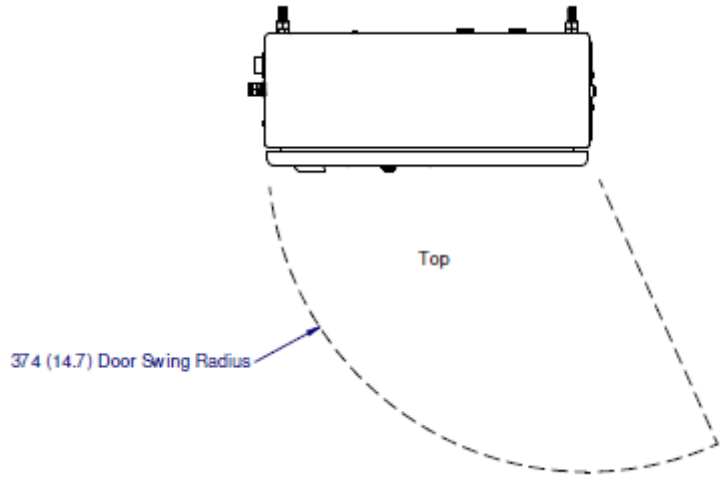


Fig. 10 - Cabinet door swing radius

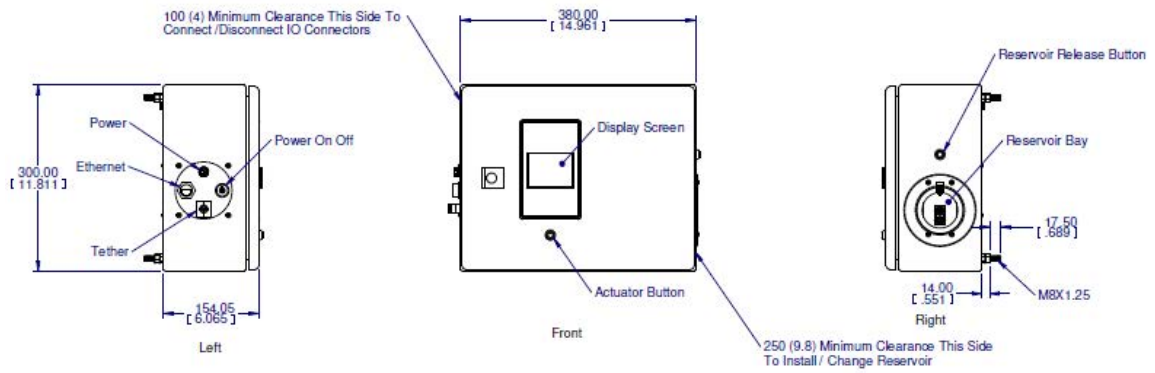


Fig. 11 - Front and side, including side clearances

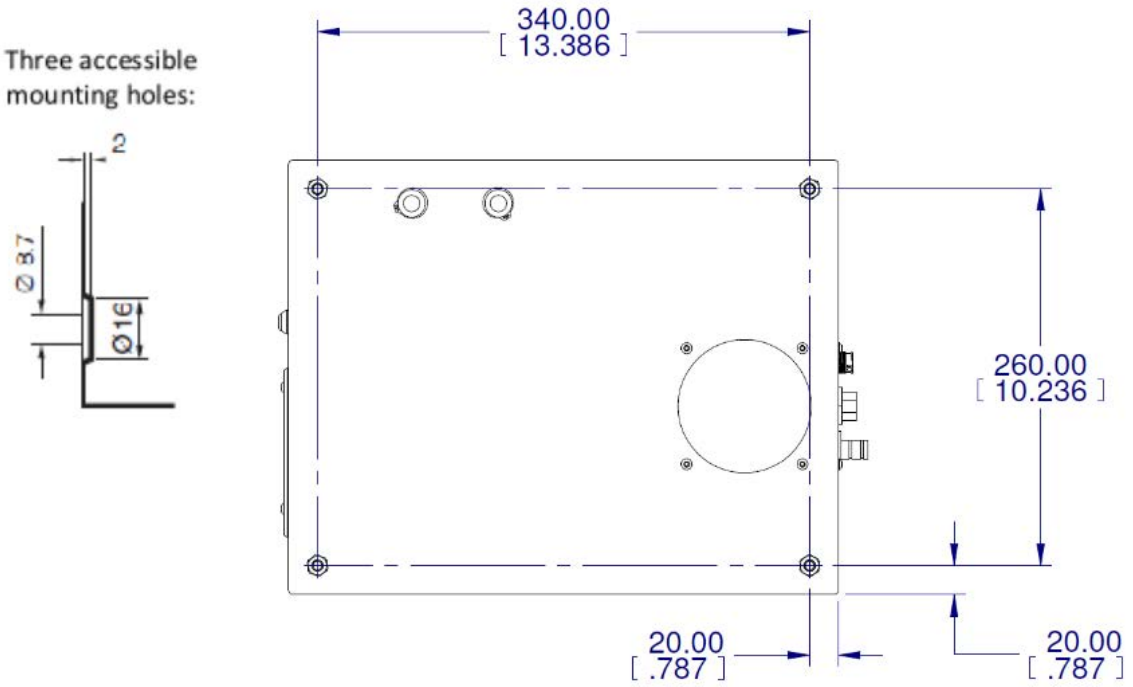


Fig. 12 - Back

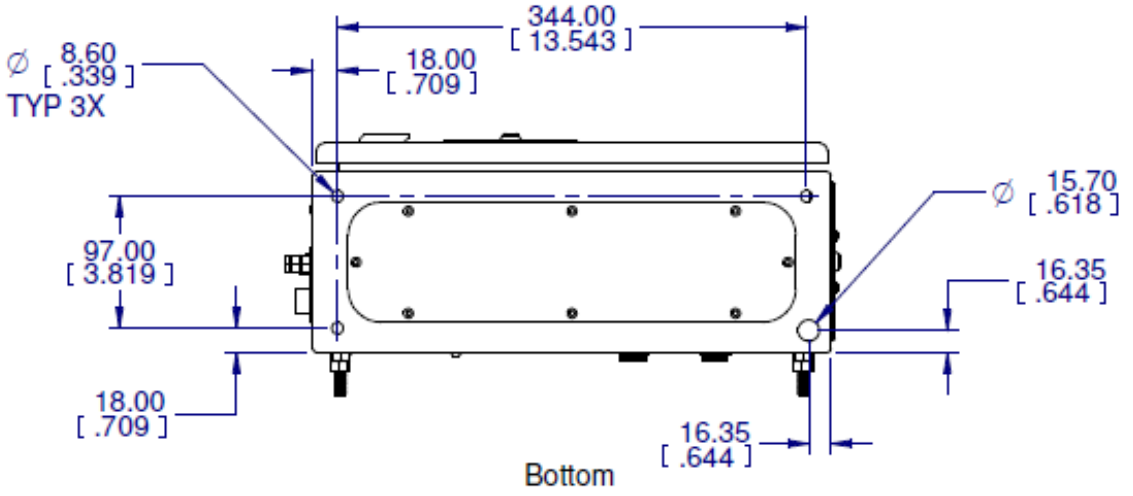


Fig. 13 - Bottom

5.2 Inspection Head and Tether

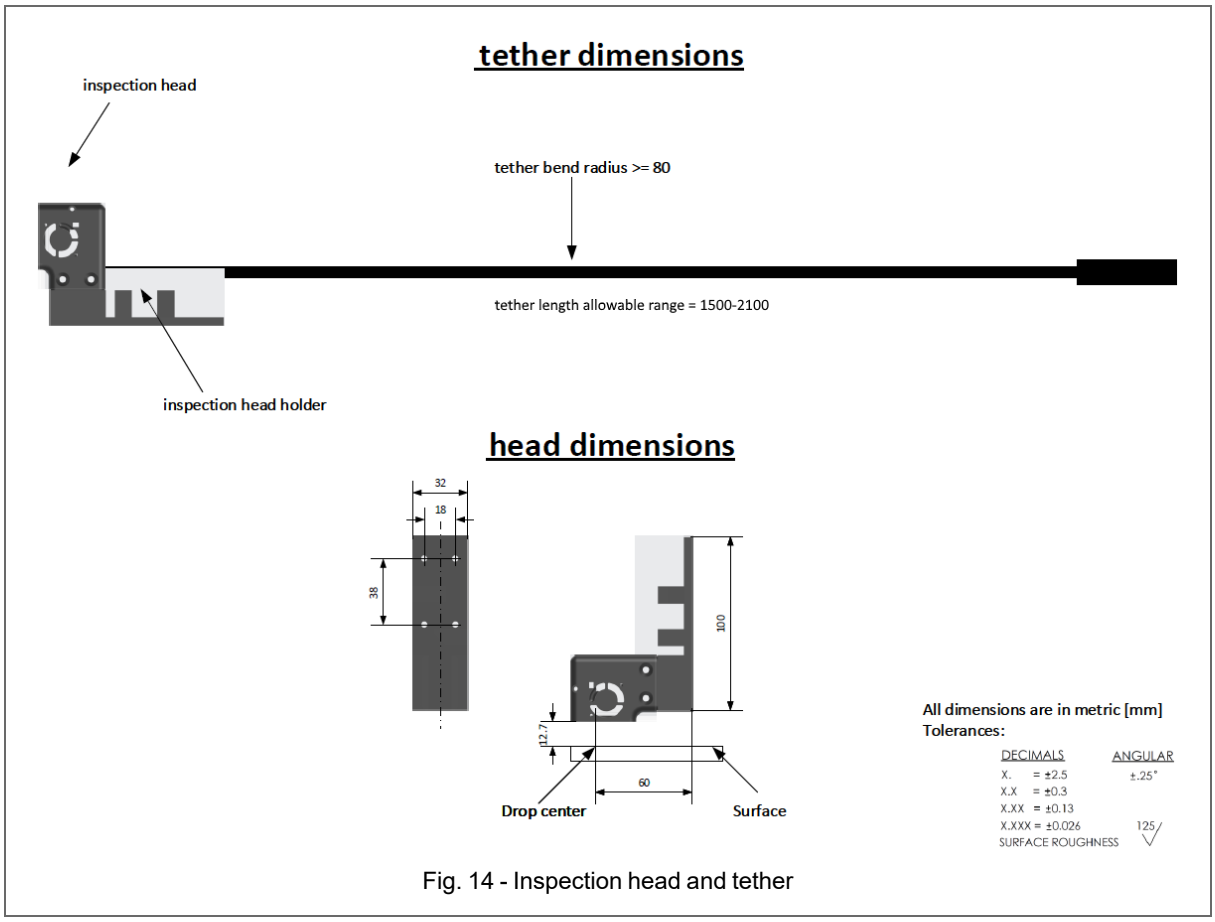


Fig. 14 - Inspection head and tether

5.3 PCS Card

Use this drawing of the PCS card for accurate programming of the performance check positions and the QR code.

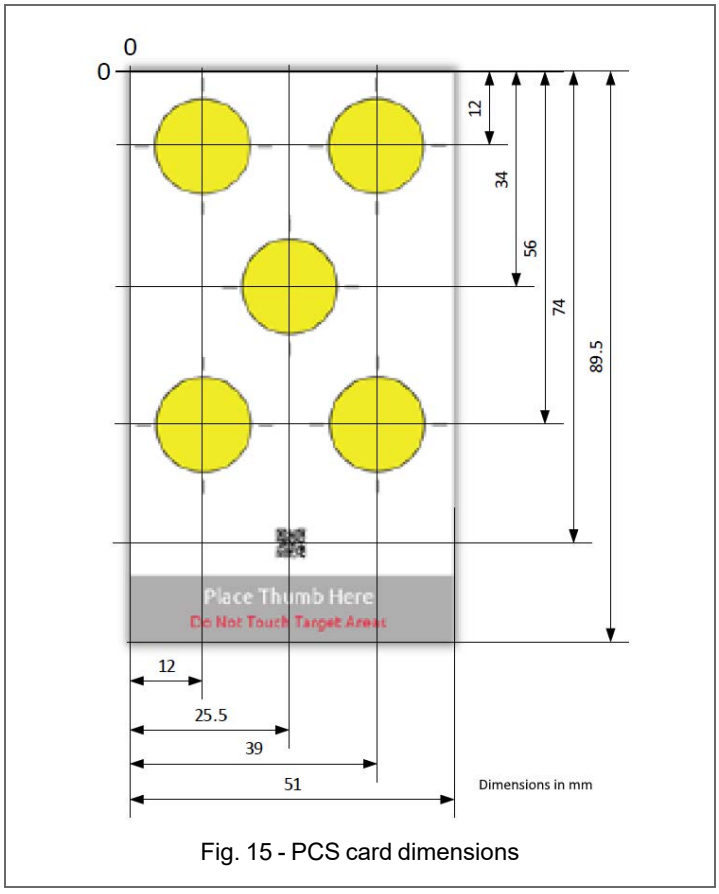
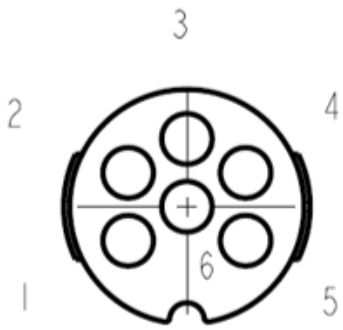


Fig. 15 - PCS card dimensions

5.4 Wiring Diagrams

Power



XA Power	Customer side	Pin#	XA side
	Power adapter 110/240VAC to 12VDC	1	+12VDC
		2	GND
	Cable with 2 lines	3	Remote start up (Green button)
		4	
	NC	5	NC
	NC	6	NC

Fig. 16 - XA-Kit wiring diagram

Note: An AC/DC adapter with connector is included.

Digital Input/Output (DIO) (if included)

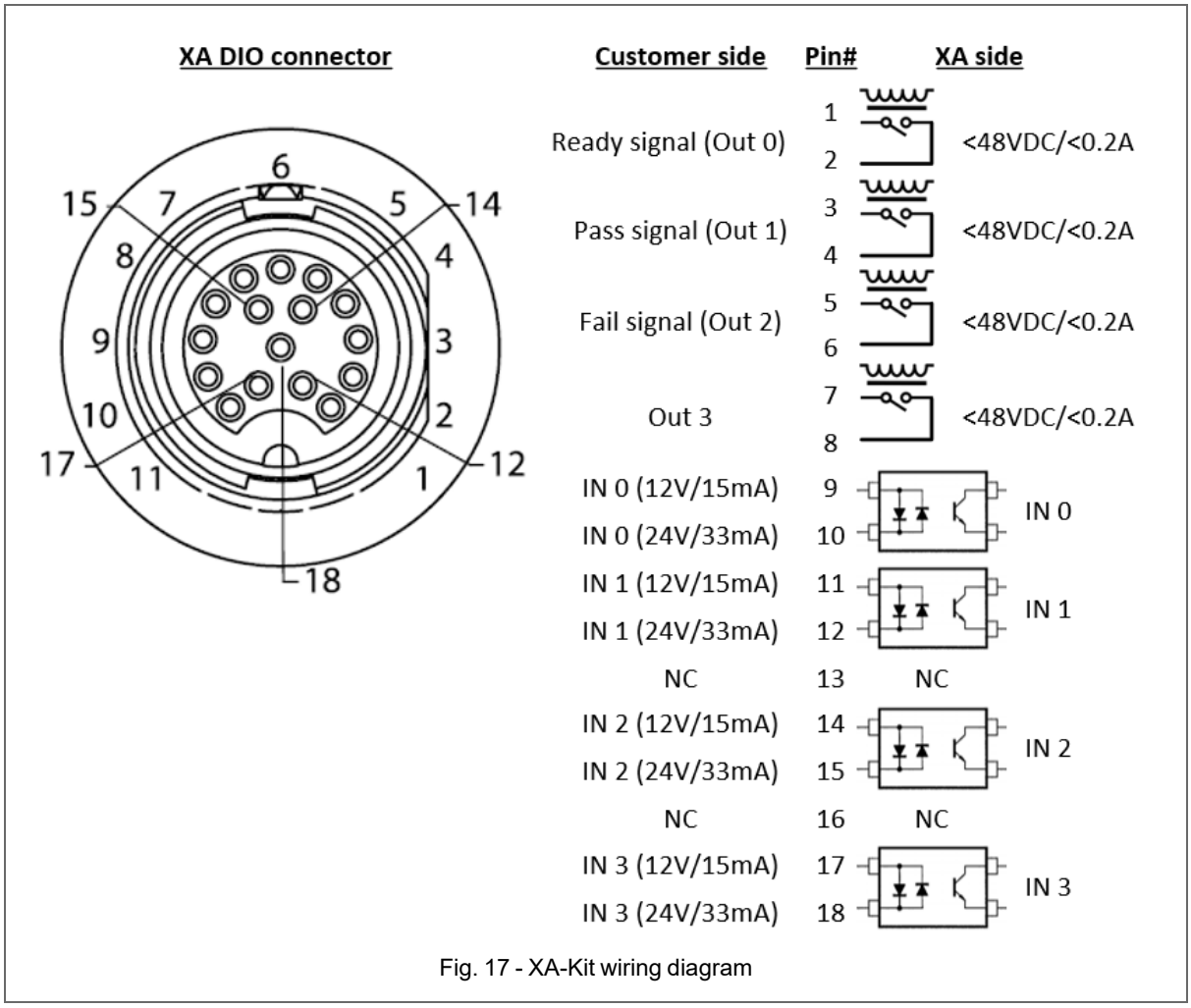


Fig. 17 - XA-Kit wiring diagram

Note: Ready / Pass / Fail signals may only be used in manual mode.

6 Installation and Setup

6.1 Mount the Control Cabinet

Mounting holes are provided for attachment to either the back or the bottom of the control cabinet (3 holes each). Attach the control cabinet to your cell using the mounting holes shown in Fig. 18 or Fig. 19.

It is important to follow these guidelines when mounting the control cabinet:

- Be sure to orient the control cabinet so that you can change the fluid cartridges. Refer to the drawing "Control Cabinet" on page 21 for clearance recommendations.
- Mount the control cabinet so that the display is about eye height.
- Position and mount the control cabinet above where the inspection head is to be mounted.

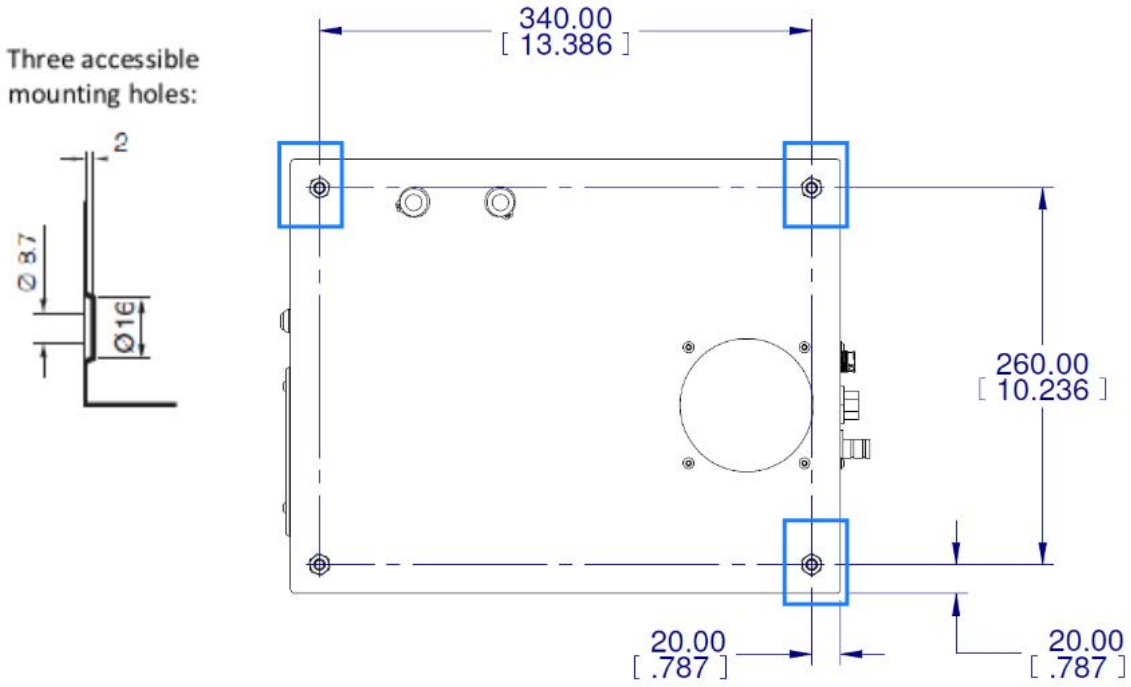


Fig. 18 - Surface Analyst control cabinet mounting holes (back)

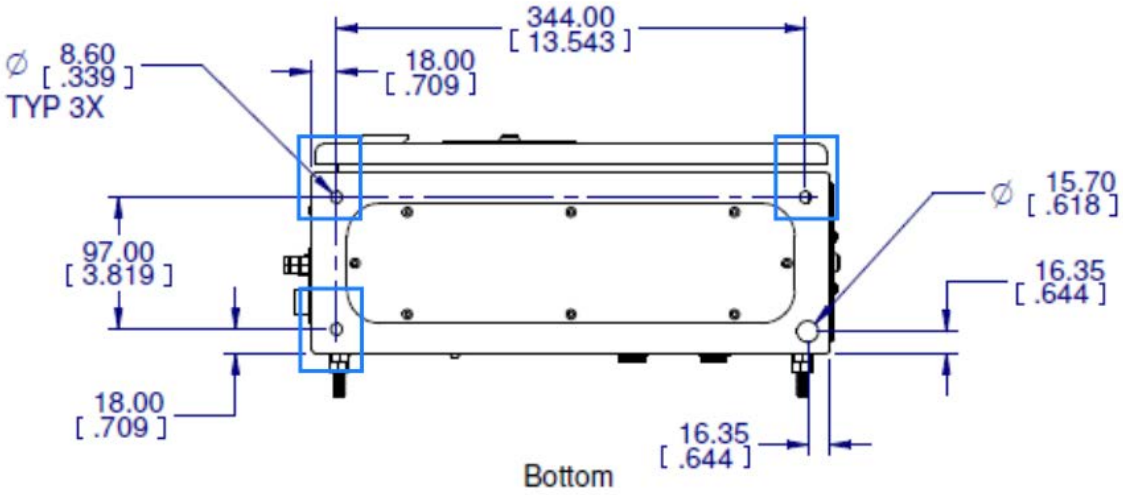


Fig. 19 - Surface Analyst control cabinet mounting holes (bottom)

6.2 Connect the Ethernet Cable

An Ethernet connection is only required for Remote API Control. Connect an RJ45 Ethernet cable (not included) to the port shown in Fig. 20.

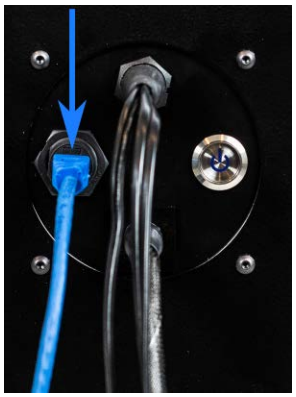


Fig. 20 - Ethernet connection

6.3 Connect the Power

Connect the AC adapter to the power supply port as shown in Fig. 21.

Plug the AC adapter into a standard 120 V outlet.

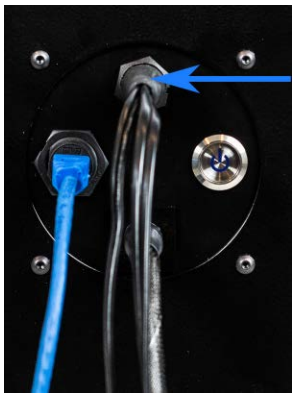


Fig. 21 - Power connection

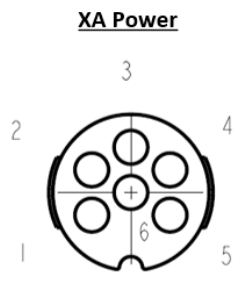


Fig. 22 - Wiring diagram - Power

If you want to control the green multipurpose button remotely (for remote start-up, for example), wire a dry contact into the remote switch activation cable (pre-wired with the AC adapter). Close the contact for 0.5 seconds for remote start-up.

To start the Surface Analyst manually, press the green multipurpose button. To shut down manually, touch the "Shutdown" icon on page 1 of the Menu screen.

6.4 Grounding

A grounding wire with an M6 ring terminal has been installed and is accessible through the bottom of the control cabinet.

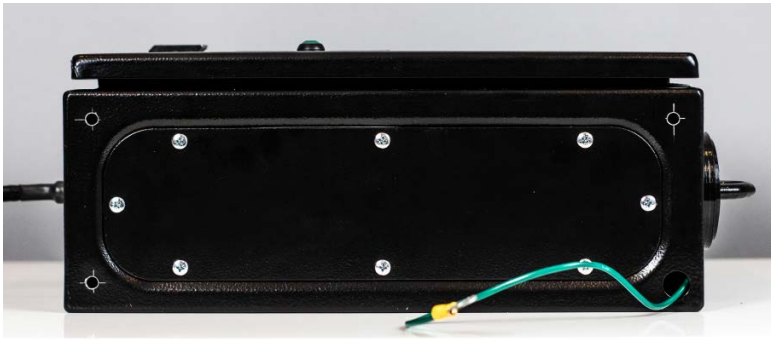


Fig. 23 - Grounding wire

6.5 Connect the DIO (Option)

Fig. 24 - Optional DIO connection port

If a DIO connection with cable are included with your Surface Analyst, observe the following when integrating digital input and output (DIO):

- 4 input pins and 4 output pins are available for separate devices if your Surface Analyst is configured for Remote API Control. For Remote DIO Control, there are no available DIO pins for separate devices.
- Current and voltage limits are as shown in Fig. 25.
- The DIO is not controlled through a real-time operating system and will have variable latencies and responses. High-precision timed events are not suitable.

Refer to the wiring diagram in Fig. 25 for integration of input and output devices.

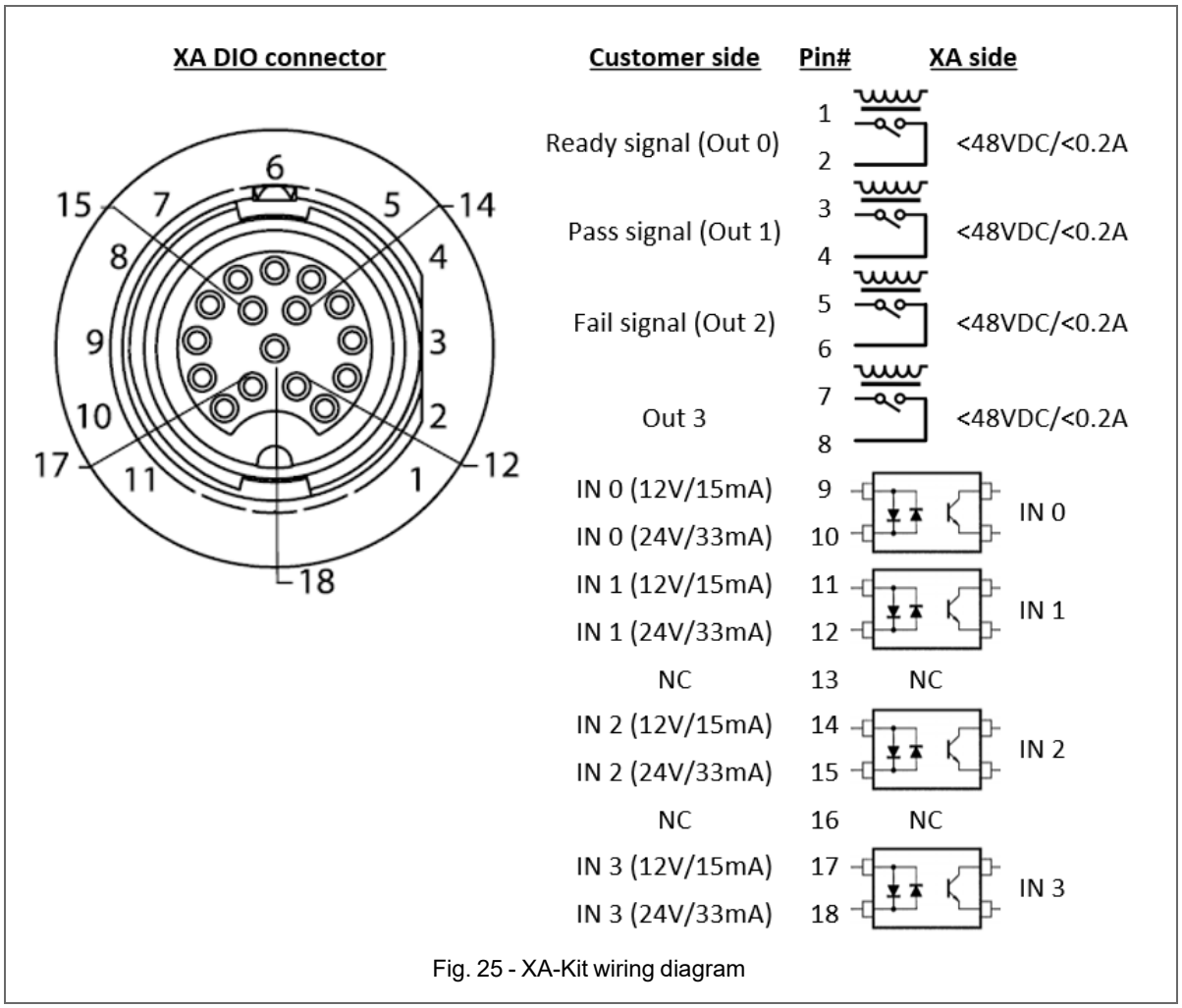


Fig. 25 - XA-Kit wiring diagram

6.6 Set Up Communications

Setting up communications is only required for Remote API Control. Refer to the Control API Guide for the following information:

- How to open a socket
- Base recommended settings
- Testing communications

A router is included with the XA-Kit. Follow these setup instructions:

1. Connect the XA-Kit Ethernet port with the PC Ethernet port using a standard Ethernet cable.
2. Open any browser and enter the default router IP address: **192.168.0.1**

   Username is auto-populated with: "root".
3. Enter the default password **admin**.

The router home screen appears as in Fig. 26.

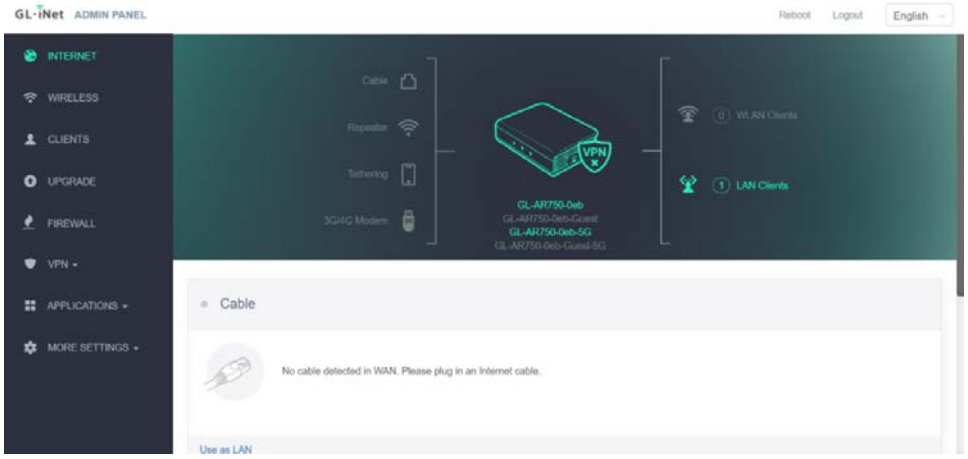


Fig. 26 - Router home screen

4. In the left-hand menu, go to **MORE SETTINGS** to change settings as necessary.

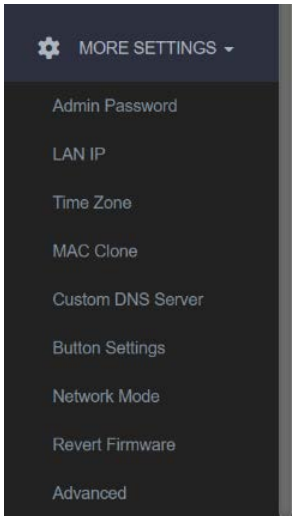


Fig. 27 - MORE SETTINGS menu

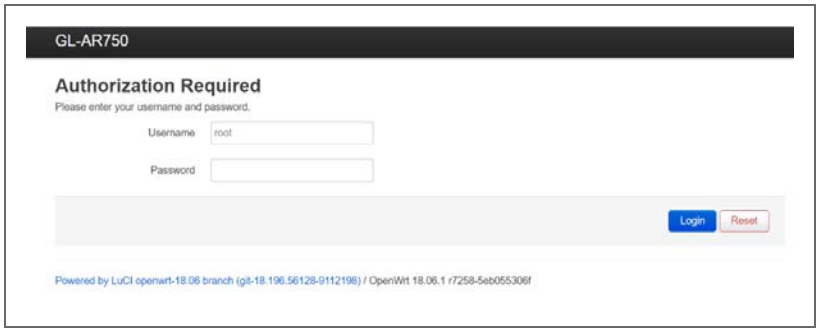
a. Select **Admin Password** to change the administrator password.

b. Select **LAN IP** to change the default router LAN IP.

> Changing the default router LAN IP address will delete the XA-Kit fixed IP address!

c. Select **Advanced** to change any router setting.

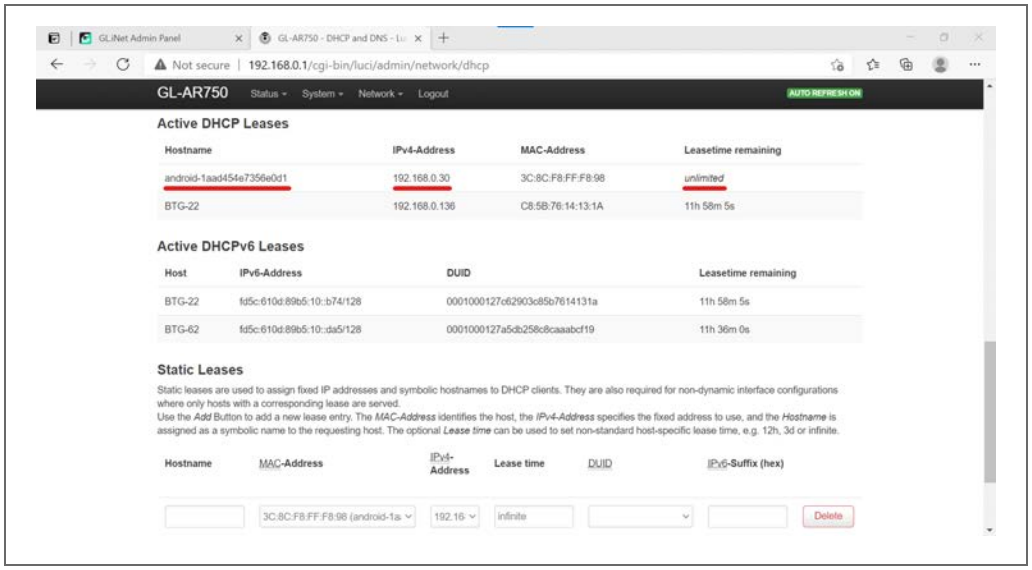
5. To change the XA-Kit fixed IP address, do the following:
   a. Select **MORE SETTINGS ⇨ Advanced**
   b. You are prompted to enter your password. Use the default password (admin) or the new password, if you changed it.



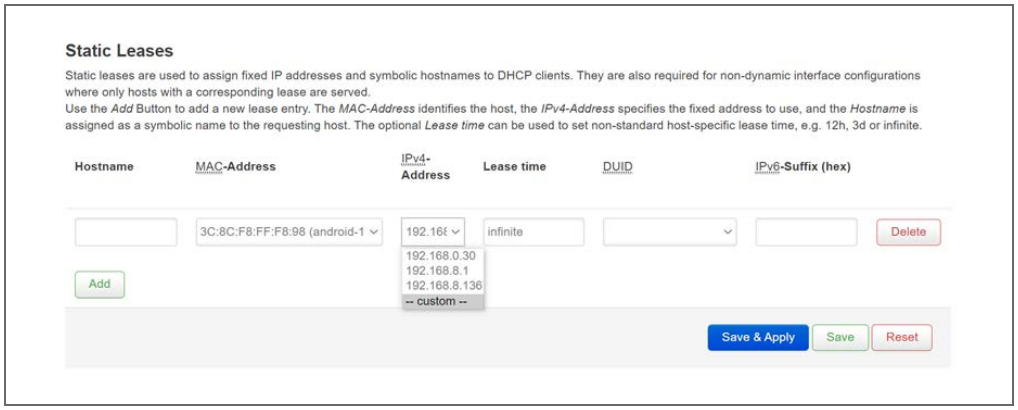
   c. Select **Network ⇨ DHCP and DNS**

   d. Scroll to the bottom of the page to the Static Leases section. The default IP address for the XA-Kit is set to 192.168.0.30.

The XA-Kit must be bound to a static IP address.



e. Click the IPv4 Address pull-down menu. Select **custom** to set the new IP address within router's LAN IP range.



f. Type in **Infinite** in the Lease time field.

g. Click **Save & Apply**.

6.7 Mount and Position the Inspection Head

1. For service purposes, the inspection head must be detachable from the robot or XYZ axes to which it is mounted.
2. When positioning the inspection head, be sure to observe the following:
   - For best results, position the inspection head so that it points and dispenses downwards. Other orientations are possible with restrictions. However, head orientation must always be downwards for purging and performance checks. Contact Brighton Science for more information.

     Do not excessively bend the tether. The bend radius of the tether should not be less than 3.3 in (84 mm).
   - Do not allow the tether to be compressed or crimped.
   - Never disconnect the inspection head tether from the control cabinet. Be sure to have a way of getting the inspection head inside your cell without detaching it.
   - For service purposes, the XA head must be detachable from the robot arm or axes to which it is mounted.
3. For best measurement results, avoid internal lighting within the cell, and protect the inspection head from exposure to external light sources during measurements. Light sources other than the light emitted by the inspection head can negatively affect the drop detection.

4. Adjust the distance of the inspection head to the surface to be measured by spacing it according to the 12.7 mm measuring gauge, as shown in Fig. 28.

Fig. 28 - Inspection head distance to surface

The orientation of the camera on the inspection head mounting plate is as shown in Fig. 29.

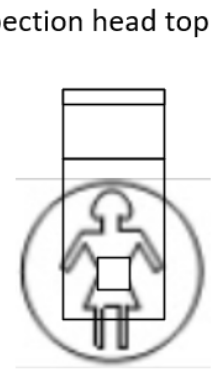


Fig. 29 - Camera orientation

6.8 Set up a Fixed Alignment Point

A fixed alignment point is only necessary for systems with robots or similar automated positioning systems. Fig. 30 shows the configuration for a recommended alignment hole to use for aligning the robot. (See "Startup" on page 39.)

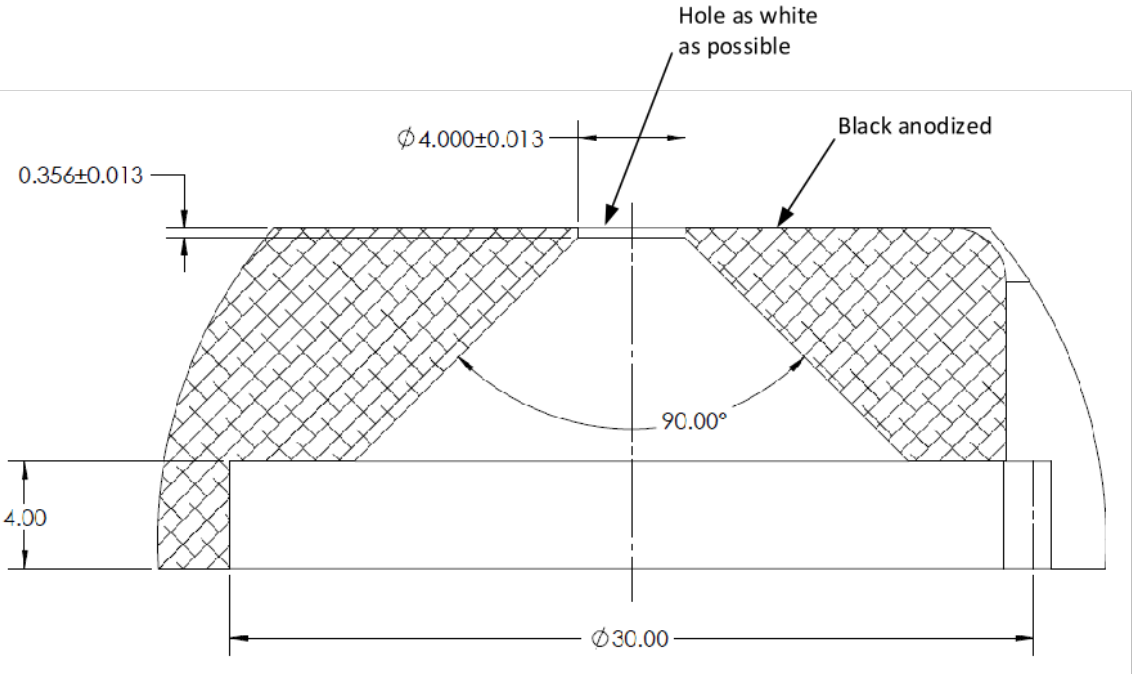


Fig. 30 - Alignment hole

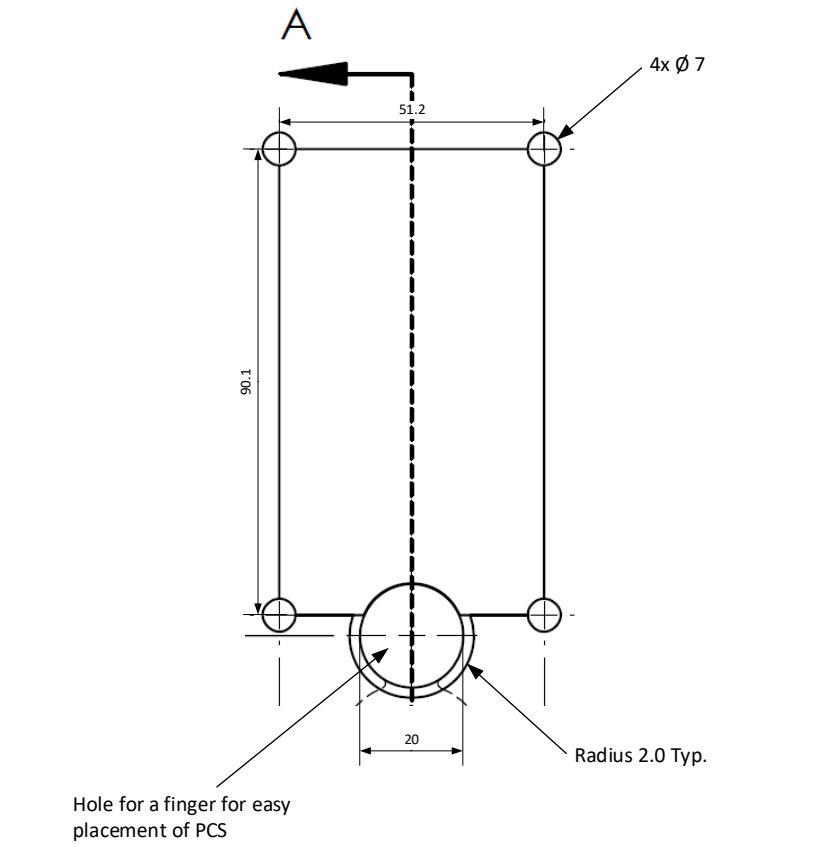
6.9 Set up a PCS Fixture

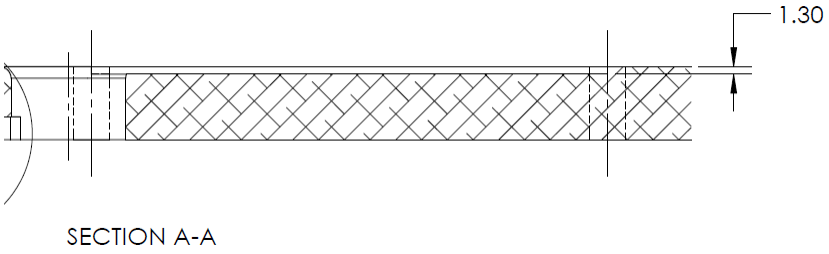
A PCS (Performance Check Surface) is a special card used for performance checks (see "Doing Performance Checks" on page 64).

It is recommended that you make a fixture to hold the PCS card like the design shown in Fig. 31. For a drawing of the PCS card, see "PCS card dimensions" on page 24

Be sure to position the PCS fixture so that it is accessible to the user.

Recommended Performance Check Surface holder





SECTION A-A

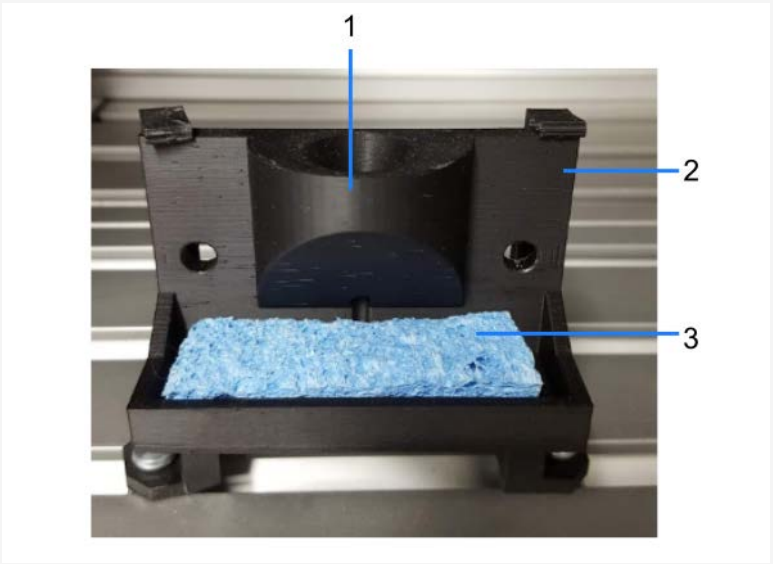
All dimensions are in metric [mm]
Tolerances:

DECIMALS	ANGULAR
X. = ±2.5	±.25°
X.X = ±0.3	
X.XX = ±0.13	
X.XXX = ±0.026	125
SURFACE ROUGHNESS	

Fig. 31 - Recommended PCS fixture

6.10 Set Up a Purge Station

An appropriate receptacle (purge station) should be provided to absorb the fluid that is released from the inspection head nozzle during a prime or purge (see "Purging" on page 45). An example of a suggested purge station design is shown in Fig. 32.



1	Splash guard with drainage hole at the bottom
2	Main body of purge station
3	Sponge to hold up to 15 grams of fluid

Fig. 32 - Purge station suggested design

7 Control of the Surface Analyst

This chapter gives information on how to control the various functions of the Surface Analyst. For information regarding how the Surface Analyst works, refer to Appendix A: "General Operation of the Surface Analyst".

There are two different ways your equipment may be configured to control the Surface Analyst:

- Remote API Control (full control)--the standard method of control using an ethernet connection (see "Remote API Control (Full Control)" below)
- Remote DIO Control (limited control)--a limited method of control using the digital inputs and outputs (see "Remote DIO Control (Limited Control)" on page 48)

7.1 Remote API Control (Full Control)

Remote API Control is the standard method of controlling the Surface Analyst whereby remote device commands (RD commands) are issued over an Ethernet connection. Further information, as well as a detailed description of all RD commands, can be found in the Control API Guide.

The operations described in this section are as follows:

- Startup --Performed every time the Surface Analyst is turned on
- Measurement runs--The normal production measuring process
- Performance check--Performed periodically to maintain optimal performance of the Surface Analyst
- Cartridge change--Performed whenever the fluid cartridge is empty and needs changing
- Purging--Performed when air needs to be expelled from the tubing
- Data Management--Clearing the database storage before it is full
- DIO Integration--Communicating with input and output devices
- Shutdown--Performed when the Surface Analyst is turned off
- Other functions--Drop notes and live video

Because no unsolicited messages appear during operation, periodically check the status to verify connectivity and to look for issues. Use the RD command **GetStatus>** to verify connectivity and to retrieve the following information:

- Free storage space available
- Cartridge status
- Performance check status
- Pump status

7.1.1 Startup

The startup sequence needs to be performed every time the Surface Analyst is turned on.

1. Press the main switch to connect the XA-Kit controller to power.
2. Power on the Surface Analyst using one of the following methods:
   - Press the green multipurpose button to power on manually.

     or
   - Power on remotely if you wired in a dry contact into the remote switch activation cable. (See "Connect the Power" on page 28.)

3. The startup sequence takes about 3 minutes. During startup, the Ethernet connection starts working. To check if the Surface Analyst is up and running, you can send a ping (RD Command **Ping>**) periodically (every 10 sec is recommended).
4. After the startup sequence is complete, the Surface Analyst goes automatically to the Measurement screen.
5. Send RD Command **GetStatus>** to verify the following:

   Free space > 20%

   Cartridge status = CART_OK

   Performance Check status - PCHECK_OK

   Pump status - PUMP_OK
6. Send RD Command **DropCount>** to check if there are enough drops for your run. It is recommended to display the drop count on the user interface.

   The Surface Analyst will stop measuring when the drop count runs out. Make sure you have an adequate number of drops to complete your batch prior to starting a run.
7. Send RD **Command GoToMeasurement>** to make sure the system is still in measurement mode.
8. Move the inspection head to the purge station.
9. Perform a TenShot purge

   The TenShot purge is performed every time the Surface Analyst is turned on and anytime it has not been used for more than 2 hours.

   RD Command: **TenShotPurge>**

   The TenShot purge takes about 7 seconds to complete.
10. If appropriate, align the robot or positioning system to a fixed alignment point.

    This step ensures that all of the programmed measurement positions will be accurate.

    Notes:

    - This step is only necessary for systems with robots or similar automated positioning systems.
    - A fixed alignment point in the form of a circle is recommended. (See "Set up a Fixed Alignment Point" on page 35.)
    - Follow this sequence of commands:

      a. Move the robot to the alignment point.
      b. Put the Surface Analyst into measurement mode (**GoToMeasurement>**).
      c. Take a picture of the alignment point (**Align>** or **AlignNP>**. Note: **Align** includes the picture image; **AlignNP** does not.)
      d. Adjust the robot position if required.

7.1.2 Measurement Runs

When taking a measurement, the Surface Analyst deposits a drop on the surface to be measured, takes a picture of the drop deposition, processes the image, and then returns the results. Do the following steps for each measurement run.

1. Activate measurement mode to start the pump and prepare the Surface Analyst for measuring.

   RD Command: **GoToMeasurement>**
2. Move the inspection head to the purge station, if priming is to be performed.

3. Prime the Surface Analyst. Priming fills the nozzle with water and prepares the valve for dispensing. This is necessary because the water in the valve can evaporate over time. A prime shot only needs to be performed if the Surface Analyst has not taken a measurement in the past 10 minutes.

   RD Command: **PrimeShot>**

4. Load a surface profile. A surface profile is a group of settings for the particular surface you are measuring. Refer to the Administrator Manual for more information regarding surface profiles. You do not need to load a new surface profile if you are continuing to measure the same surface as the previous measurement.

   RD Commands:

   - Display available surface profiles: **GetProfiles>**
   - Load surface profile "a": **LoadProfile(a)>**

5. Move the Surface Analyst inspection head to the location where the measurement will take place. Make sure the inspection head is 12.7 mm over the surface (see "Mount and Position the Inspection Head" on page 34).

6. Take a measurement.

   RD Commands:

   - To take a measurement which includes the picture image, use **Measure>**.
   - To take a measurement with no picture image, use **MeasureNP>**.

   For information about the results packets returned by the Surface Analyst, refer to the Control API Guide.

7. Check for errors. For example, if you move the inspection head fast and stop hard, you most likely will get the error **TM_ERROR-PRESSURE-XXX>**. This is because of movements of the waterline require the pressure to stabilize. If you receive the pressure error, send the **Measure>** or **MeasureNP>** again for up to 10 times.

8. Repeat Step 2-7 for each measurement of the run.

7.1.3 Performance Checks

A performance check is recommended at the beginning of each day and as needed to verify that the Surface Analyst is operating at maximum performance. See "Doing Performance Checks" on page 64 for more information.

Use the following RD commands to retrieve information from previous performance checks:

- For the date and time of the last performance check, use **GetLastPCHK>**.
- For the data from the last performance check, use **LogLastPCHK>**.

7.1.3.1 PCS Card Recommendations

Follow these recommendations for best results:

1. In order to make the best use of the PCS, you can deposit several drops on each of the targets,as shown in Fig. 33. Refer to "PCS Card" on page 24 for specifications of the PCS.

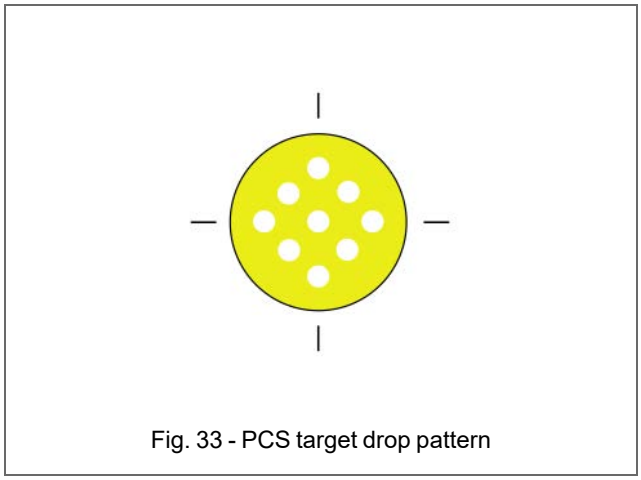


Fig. 33 - PCS target drop pattern

2. Make sure that the PCS cards are held flat at all times during a performance check.
3. Change out the PCS after the completion of a performance check.
4. Be aware that the position of the yellow circles can vary due to tolerances of the card and holder.It is best not to measure too close to the edge of the yellow circle

7.1.3.2 Performance Check Sequence

The **PCHK(a)>** command is used to initiate a performance check, where "a" is the timeout in seconds. Each measurement within the sequence uses **Measure>** or **MeasureNP>** commands. Refer to the Control API Guide for more detailed descriptions of these commands.

Fig. 34 depicts the programming sequence for a performance check.

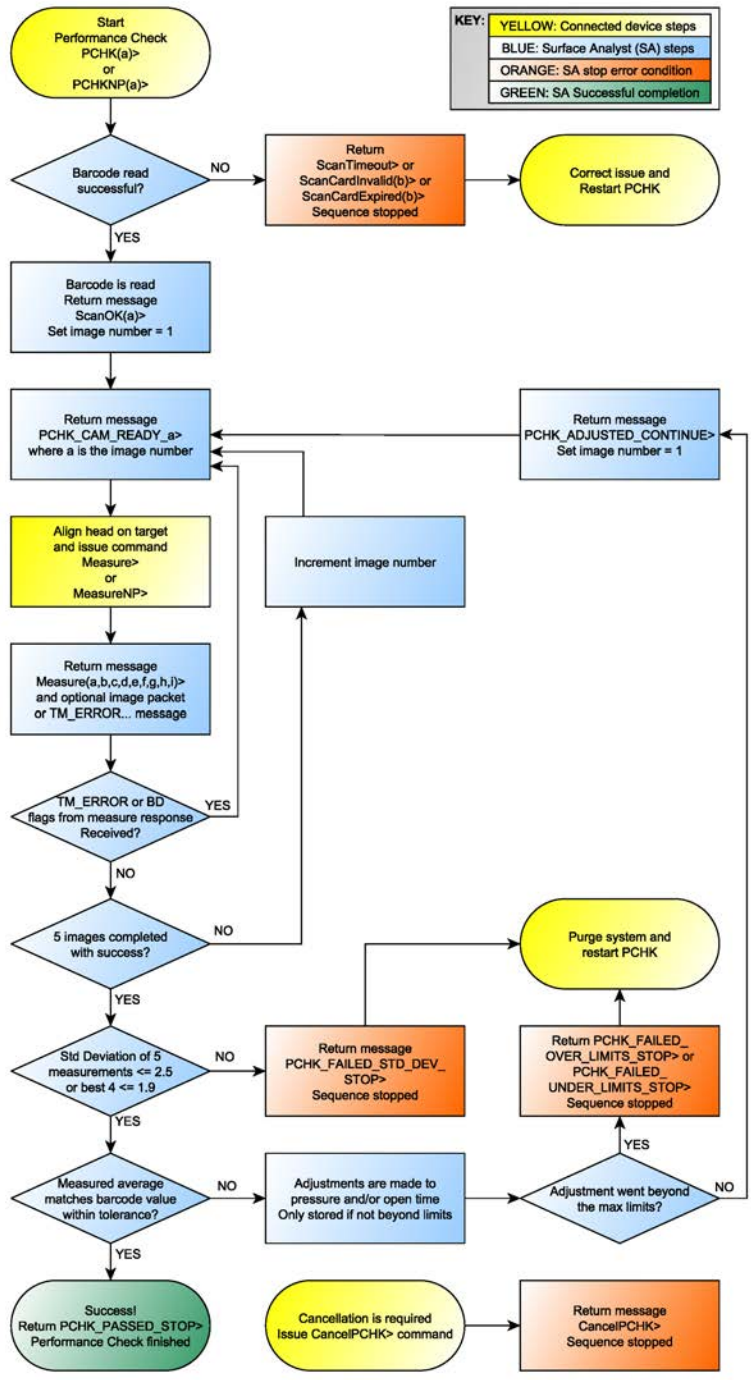


Fig. 34 - Performance check flowchart

7.1.4 Cartridge Change

When the fluid cartridge is empty, it needs to be changed. Check the fluid remaining in the cartridge with the following commands:

- To check the number of fluid drops that have been used for purging and performance checks, use **PurgeDropCount>**.

- To check the number of fluid drops used for taking measurements, use **DropCount>**.

The Surface Analyst returns the information in the form (a,b) where

a = number of drops used
b = number of drops available

Follow these steps to change a fluid cartridge:

1. Move the Surface Analyst inspection head to the purge station.
2. Use the RD command **ChangeCartridge(a)>** to begin the cartridge change, where "a" is the 16-character serial number located on the new cartridge. You can enter the dashes or omit them.

Fig. 35 - Fluid cartridge serial number

3. The Surface Analyst responds with **CC_SERIAL_OK>** if a valid code was entered.
4. The following message appears on the touchscreen: "Please remove the old cartridge by pressing the release button and pressing forward to unlock it". Remove the cartridge by pushing down on it while pressing the release button as shown in Fig. 36.

Fig. 36 - Releasing the cartridge

5. After removing the cartridge, the message is displayed: "Please insert the cartridge with serial number x", where "x" = the serial number you entered for the new cartridge.

6. Insert the new cartridge, pushing it in until it clicks into place.

Fig. 37 - Inserting the cartridge

7. The Surface Analyst begins a continuous purge. See "Purging" below for more information. The message "Purging..." appears on the touchscreen.
8. When the cartridge change sequence is complete, the Surface Analyst returns the message **CC_ COMPLETE>**.
9. Send the used cartridge back to Brighton Science.

Avoid removing a fluid cartridge unnecessarily. Every time a cartridge is re-installed, the Surface Analyst performs a continuous purge.

7.1.5 Purging

Purging pushes fluid through the tubing to ensure consistent dispensing. Purging is also used to force air out of the tubing after activities such as cartridge changes, inspection head changes, and troubleshooting.

Purging should be performed with the inspection head positioned over the purge station to contain the fluid that is released.

The types of purging operations include the following:

- Ten shot purge
  - RD Command: **TenShotPurge>**
  - Uses 10 drops
  - Performed whenever the Surface Analyst is turned on
  - Performed whenever the Surface Analyst has not been used for more than 2 hours
  - Takes 7 seconds to complete
- Deep Purge
  - RD Command **DeepPurge>**
  - Uses approximately 1200 drops
  - Performs a combination of open flow and frequency sweeps
  - Takes about 1 minute to complete
- Continuous purge
  - RD Command: **ContinuousPurge**>
  - Uses 100 drops
  - Long duration
  - Performed after a cartridge change
  - Performed automatically in certain cases during a performance check
  - Takes about 8 seconds to complete
- Factory purge (generally for BTG labs only)
  - RD Command: **FactoryPurge>**
  - Uses 13,000 drops

- Primarily used during initial installation and for troubleshooting purposes only
- Takes about 8 minutes to complete
- RD Command to cancel a factory purge: **CancelFactoryPurge>**

Water used for purging and performance checks does not count against the total available drops for measurements listed in the Technical Specifications.

7.1.6 Data Management

Follow these guidelines to manage your data appropriately.

- Use one of the following communication methods for transferring data:
  - Use an ADB command to copy the database to your local hard drive.
  - Use API to receive the data as packets that can be used to reconstruct the database locally.
- If the data storage becomes full, then the Surface Analyst will stop working. Use the RD command **GetStatus>** to check the percentage of free space available. It is recommended to not use more than about 80% of the available space.

  It is recommended to delete all data after 30,000 measurements or following a cartridge change (whichever comes first). Failure to do this will result in slower run times.

- Use the RD command **DeleteResults>** to delete the Surface Analyst database before it becomes full. Be sure to back up **results.db** prior to deletion if you are not already storing the results data on your remote device.

7.1.7 Digital Inputs and Outputs (DIO) Integration

See "Connect the DIO (Option)" on page 30 for connections, voltages, pin numbers, and proper wiring for DIO.

The following RD commands are available to control DIO:

- Use RD command **GetInputPin(a)>** to get the status of a DIO input bit pin number "a".
- Use RD command **SetOutputPin(a,b)>** to set the DIO output pin number "a" to the output status "b".

7.1.8 Shutdown

1. Use the RD command **ShutDown>** to power down the Surface Analyst.
2. Press the main switch to turn off the power supply.

If you are finished with a measurement run, but you decide not to shut down the Surface Analyst, you should turn the pump off using the command **PumpOff>**. You can turn the pump back on with the command **PumpOn>** or **GoToMeasurement>**.

7.1.9 Other Functions

The following table describes other common functions you can perform with RD commands. For more detailed descriptions as well as a complete listing of all RD commands, refer to the Control API Guide.

Function description	RD Command
Create a drop note "a" Display the current drop note Reference "Adding a Drop Note" on page 71	**SetDropNote(a)>** **GetDropNote>**
Display the current image of the Surface Analyst screen. You can create a live video stream for setup and user alignment by the repeated use of this command.	**GetScreen>**

7.2 Remote DIO Control (Limited Control)

Remote DIO Control is a means of allowing limited control via digital inputs and outputs without the use of an Ethernet connection. This is a specially pre-configured mode of control whereby most functions are accessed through the Surface Analyst touchscreen menus. Refer to Appendix A: "General Operation of the Surface Analyst" to understand the functioning of the Surface Analyst and to learn about the functions that are accessible from the touchscreen.

No DIO pins are available for other uses if you have Remote DIO Control configured.

The only remote functioning available in the Remote DIO Control configuration is through DIO pins for the following operations:

- Triggering a measurement and getting results
- Ready signal

The operations described in this section are as follows:

- Startup --Performed every time the Surface Analyst is turned on
- Measurement runs--The normal production measuring process
- Performance check--Performed periodically to maintain optimal performance of the Surface Analyst
- Cartridge change--Performed whenever the fluid cartridge is empty and needs changing
- Shutdown--Performed when the Surface Analyst is turned off

7.2.1 Startup (Remote DIO Control)

The startup sequence needs to be performed every time the Surface Analyst is turned on.

1. Press the main switch to turn on the power supply.
2. Power on the Surface Analyst using one of the following methods:
   - Press the green multipurpose button to power on manually.

     or
   - Power on remotely if you wired in a dry contact into the remote switch activation cable. (See "Connect the Power" on page 28.)
3. Perform an extended purge upon startup of the Surface Analyst and any time the Surface Analyst has not been used for over 2 hours. You need to be logged in as an administrator in order to perform a purge. The password is provided in the Welcome Letter which is shipped with the Surface Analyst. To perform an extended purge, go to Menu screen page 4 ⇨ **Purge** ⇨ **Continuous/Extended** ⇨ **Extended**.

7.2.2 Measurement Runs (Remote DIO Control)

When taking a measurement, the Surface Analyst deposits a drop on the surface to be measured, takes a picture of the drop deposition, processes the image, and then returns the results. Do the following steps for each measurement run.

1. Press the green multipurpose button to activate measurement mode.

   The ready signal is on when the system is ready to take a measurement.

   If you have wired a dry contact into the green multipurpose button connection, you can activate the green multipurpose button remotely. See "Connect the Power" on page 28.

2. If prompted, prime the Surface Analyst by pressing the green multipurpose button. Priming fills the nozzle with water and prepares the valve for dispensing. A prime shot only needs to be performed if the Surface Analyst has not taken a measurement in the past 10 minutes.
3. Load a surface profile. A surface profile is a group of settings for the particular surface you are measuring. You do not need to load a new surface profile if you are continuing to measure the same surface as the previous measurement. See "Before you begin measuring, load a surface profile that is suitable for the surface that you are testing. Depending upon which options are included with your Surface Analyst and how they are configured, you may instead be automatically prompted to choose a surface profile or scan a surface profile QR code. For more information about surface profiles, read the Administrator Manual." on page 59
4. Move the Surface Analyst inspection head to the location where the measurement will take place.
5. Take a measurement by pressing the green multipurpose button.

   The pass signal is on when a measurement passes.

   The fail signal is on when the measurement fails.
6. Repeat Step 1-5 for each measurement of the run.

The Surface Analyst will stop measuring when the drop count runs out. Make sure you have an adequate number of drops to complete your batch prior to starting a run. The drop icon 

tells you how many drops you have remaining in the cartridge for taking measurements. This count does not include drops used for purging and performance checks.

7.2.3 Performance Checks (Remote DIO Control)

A performance check is recommended at the beginning of each day and as needed to verify that the Surface Analyst is operating at maximum performance. See "Doing Performance Checks" on page 64 for instructions on how to do a performance check.

7.2.4 Cartridge Change (Remote DIO Control)

The Surface Analyst will prompt you when the cartridge is empty and needs changing. At any time, you can find out how many drops you have used by viewing the number on the drop icon 

in the Measurement screen or by going to page 2 of the About screen (Menu screen page 2). The capacity of the cartridge is listed in "Technical Specifications" on page 7.

If you need to remove the cartridge before it is empty (not recommended), then log in as an administrator, and go to Menu screen page 4 ⇨ **Cartridge change / install**.

Follow the prompts from the Surface Analyst to change the cartridge.

Notes:

- Move the inspection head to the purge station before changing the cartridge, as the Surface Analyst automatically performs a continuous purge upon completion.
- The serial number is located as shown in Fig. 38.

Fig. 38 - Fluid cartridge serial number

- Remove the cartridge by pushing down on it while pressing the release button as shown in Fig. 39.

Fig. 39 - Releasing the cartridge

- When inserting the new fluid cartridge, push it in until it clicks into place.

Fig. 40 - Inserting the cartridge

- The Surface Analyst performs a continuous purge after the new cartridge is installed.
- Send the used cartridge back to Brighton Science.

Avoid removing a fluid cartridge unnecessarily. Every time a cartridge is re-installed, the Surface Analyst performs a continuous purge.

7.2.5 Shutdown (Remote DIO Control)

1. Touch the "Shutdown" icon on page 1 of the Menu screen.

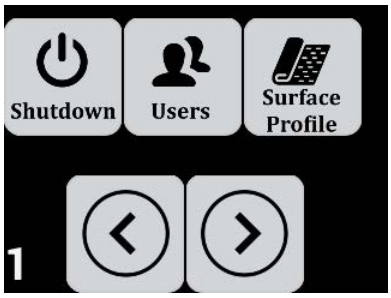


Fig. 41 - Menu screen page 1

2. Press the main switch to turn off the power supply.

8 Cleaning and Maintenance

Proper cleaning and maintenance is important to keeping the Surface Analyst functioning at peak performance.

8.1 Keeping the Surface Analyst Clean

Do the following to keep the Surface Analyst clean:

- Use LCD display wipes to clean the touchscreen.
- Wipe the control cabinet with a slightly damp cloth.
- Isopropyl alcohol (IPA) may be used to clean the bottom of the inspection attachment.
- Never use cleaners that contain ammonia. Never use any abrasive chemicals, solvents or soaps.

8.2 Maintaining the Surface Analyst

Do the following maintenance to keep the Surface Analyst functioning properly:

- It is recommended to delete all data after 30,000 measurements or following a cartridge change (whichever comes first). Failure to do this will result in slower run times.
- It is recommended to have the Surface Analyst calibrated every year. A message appears on the screen when you log in if the unit is due for calibration. Contact Brighton Science to have your equipment calibrated.

  Failure to have your Surface Analyst calibrated may result in unreliable contact angle measurements.

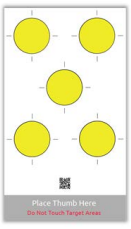
- Handle the inspection head with care.

  Do not try to remove the camera, lights, fan filter, or any other part.

  Never insert anything into the nozzle or valve orifice, as you may damage it. If the valve becomes clogged, contact Brighton Science.

9 Spare Parts

The following items are available for purchase. Contact Brighton Science Sales Department at (513) 469-1800, or orders@brighton-science.com. You can order online at brighton-science.com.

Item		Part Number
XA Fluid Cartridge (Water)		30104
AC Adapter with remote switch activation cable (US version)		30124-000
AC Adapter with remote switch activation cable (International version)		30124-001
Control cabinet key		11656
12.7 mm measuring gauge		11657
USB Drive		11234
Performance Check Surface (PCS cards) Pack of 25 Visit brighton-science.com for other quantity options.	 	11693

10 Warranty

The following warranty and disclaimers apply to US purchasers:

This Limited Warranty provides the following assurance to the Purchaser of the Surface Analyst™ (Equipment).

(1) Should the Equipment fail to function within normal tolerances due to a defect in materials or workmanship within a period of one (1) year, from the date of delivery of the Equipment to the purchase, BTG Labs will at its sole option: (a) repair or replace any part or parts of the Equipment; (b) provide a functionally comparable replacement Equipment at no charge to Purchaser.

B. BTG's Limited Warranty set forth in Section A (1), is expressly contingent upon the following conditions:

(1) Purchaser must give BTG written notice of the defect within twenty-four (24) hours of discovery.

(2) The Equipment must be returned to BTG, within thirty (30) days after discovery of the defect. BTG may, at its sole option, choose to repair the Equipment on site.

(3) Any attempt by the Purchaser to repair or replace the Equipment, or any part thereof, will render this Limited Warranty null and void, and of no effect whatsoever. Further, and abuse or misuse of the Equipment, whether accidental, reckless or intentional will render this Limited Warranty null and void, and of no effect whatsoever.

C. This Limited Warranty is limited to its express terms. In particular:

(1) Except as expressly provided by this Limited Warranty, BTG IS NOT RESPONSIBLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES BASED ON ANY DEFECT, FAILURE OR MALFUNCTION OF THE EQUIPMENT, WHETHER THE CLAIM IS BASED ON WARRANTY, CONTRACT, TORT OR OTHERWISE.

Specifications and Warranty

(1) THE WARRANTIES CONTAINED HEREIN ARE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WHETHER ARISING FROM STATUTE, COMMON LAW, CUSTOM OR OTHERWISE. NO EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO PATENTS OR ANY OTHER INTELLECTUAL PROPERTY SHALL EXTEND BEYOND THE PERIOD SPECIFIED IN A (1) ABOVE. THIS LIMITED WARRANTY SHALL BE THE EXCLUSIVE REMEDY AVAILABLE TO ANY PERSON.

(2) This Limited Warranty is made only to the Purchaser of the Equipment, and in no way can be assigned, transferred or in any other way conveyed to any other party. Any conveyance or attempted conveyance of this Limited Warranty will render this Limited Warranty null and void, and of no effect whatsoever.

(3) The exclusions and limitations set out above are not intended to, and should not be construed so as to contravene mandatory provisions of applicable law. If any part or term of this Limited Warranty is held to be illegal, unenforceable or in conflict with applicable law by a court of competent jurisdiction, the validity of the remaining portions of the Limited Warranty shall not be affected, and all rights and obligations shall be construed and enforced as if this Limited Warranty did not contain the particular part or term held to be invalid. This Limited Warranty gives the purchaser specific legal rights. The purchaser may also have other rights which vary from state to state.

(4) No person has any authority to bind BTG, as to any representation, condition or warranty except this Limited Warranty.

(5) INDEMNIFICATION: Except for damages, claims or losses solely due to BTG's acts or omissions, Purchaser, to the extent permitted by law, will indemnify and hold BTG, free and harmless from and any costs, claims or liabilities (including Attorneys' Fees), arising from or relating to losses, claims, injury to or

death of any person, including buyer, or for damage to property arising from Purchaser's use and possession of the Equipment or from the acts or omissions of any person or persons, including Purchaser, using or possessing the Equipment.

(6) This Limited Warranty and all terms thereof will be governed by the laws of the State of Ohio, with jurisdiction in the State and Federal Courts located in Hamilton County, Ohio.

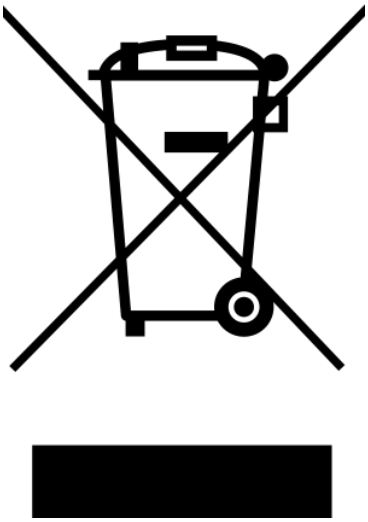
(3) The exclusions and limitations set out above are not intended to, and should not be construed so as to contravene mandatory provisions of applicable law. If any part or term of this Limited Warranty is held to be illegal, unenforceable or in conflict with applicable law by a court of competent jurisdiction, the validity of the remaining portions of the Limited Warranty shall not be affected, and all rights and obligations shall be construed and enforced as if this Limited Warranty did not contain the particular part or term held to be invalid. This Limited Warranty gives the purchaser specific legal rights. The purchaser may also have other rights which vary from state to state.

(4) No person has any authority to bind BTG, as to any representation, condition or warranty except this Limited Warranty.

(5) INDEMNIFICATION: Except for damages, claims or losses solely due to BTG's acts or omissions, Purchaser, to the extent permitted by law, will indemnify and hold BTG, free and harmless from and any costs, claims or liabilities (including Attorneys' Fees), arising from or relating to losses, claims, injury to or death of any person, including buyer, or for damage to property arising from Purchaser's use and possession of the Equipment or from the acts or omissions of any person or persons, including Purchaser, using or possessing the Equipment.

(6) This Limited Warranty and all terms thereof will be governed by the laws of the State of Ohio, with jurisdiction in the State and Federal Courts located in Hamilton County, Ohio.

11 Disposing and Recycling



This symbol on the product(s) and / or accompanying documents means that used electrical and electronic products should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to designated collection points where it will be accepted free of charge.

Alternatively, in some countries you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point.

Penalties may be applicable for incorrect disposal of this waste, in accordance with you national legislation.

For business users in the European Union:

If you wish to discard electrical and electronic equipment, please contact your dealer or supplier for further information.

Information on Disposal in other Countries outside the European Union:

This symbol is only valid in the European Union. If you wish to discard this product, please contact your local authorities or dealer and ask for the correct method of disposal.

Do not dispose of batteries in the trash or in a single stream recycling program. Take all unneeded, spent, or damaged batteries to a facility that specifically handles lithium-ion battery disposal.

Appendix A: General Operation of the Surface Analyst

This appendix describes the general operation of a Surface Analyst. The descriptions represent the functionality of a typical hand-held Surface Analyst instrument. Some of the functions and images may not apply exactly to the XA-Kit model.

The functionality of the green check mark button of the hand held instrument is the same as the green multipurpose button on the control cabinet of the XA-Kit.

For systems configured with Remote API Control: While most functions will work with robot mode on, turn robot mode off for full functionality of the touchscreen and pop up messages. To turn robot mode off, use the RD command **RobotModeOff>** followed by a system reboot. Turn robot mode back on with the command **RobotModeOn>** followed by a system reboot.

A.1 Understanding the Basic Archer Screens

Archer is the software that controls the Surface Analyst and performs all the calculations. This section gives an introduction to the basic Archer screens most commonly used.

A.1.1 The Menu Screen

The screen page number appears in the lower left corner. You can access a different page of the Menu screen by touching the arrow icons.

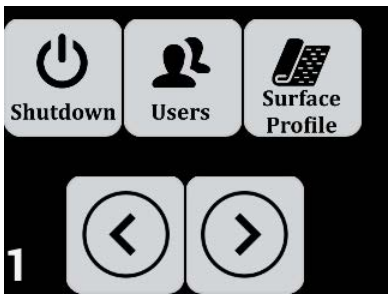


Fig. 42 - Page 1 of the Menu screen

A.1.2 The Measurement Screen

The Measurement screen is the screen you see while in measurement mode. You can get to the Measurement screen by pressing the check mark button or by touching the back arrow icon on page 1 of the Menu screen.

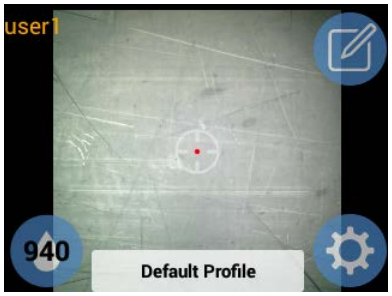


Fig. 43 - Measurement screen

- The current user name is displayed in the top left corner.
- The drop note icon displays the Drop Note menu. See "Adding a Drop Note" on page 71
- The drop icon tells you how many drops you have remaining in the cartridge for taking measurements. This count does not include drops used for purging and performance checks.
- The box in the lower middle of the screen displays the loaded surface profile.
- Touching the gear icon brings you to the first page of the Menu screen.

A.2 Operating the Surface Analyst

The basic steps for operating the Surface Analyst are as follows:

1. Turn on the Surface Analyst.
2. Purge or prime the Surface Analyst (if required).
3. Do a performance check (if required). A performance check is recommended at the beginning of each day and as needed to verify that the Surface Analyst is operating at maximum performance.
4. Load a surface profile.
5. Take a measurement.

Detailed instructions for these steps are included in the following sections.

A.2.1 Turn on the Surface Analyst

Press the green multipurpose button to power on the Surface Analyst.

A.2.2 Prime or Purge the Surface Analyst

Priming and purging ensure consistent dispensing.

Any time after ten minutes of inactivity, a prime (also known as a prime shot) needs to be performed.

A purge is performed upon startup whenever the Surface Analyst has been inactive for over 7 days.

1. A "Prime Needed" or "Purge Needed" message appears on the screen whenever priming or purging is needed.

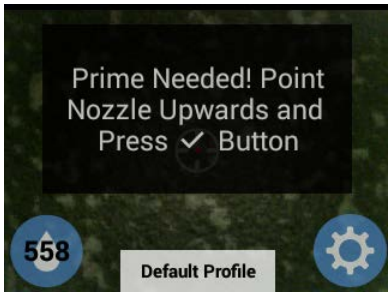


Fig. 44 - Prime Needed message

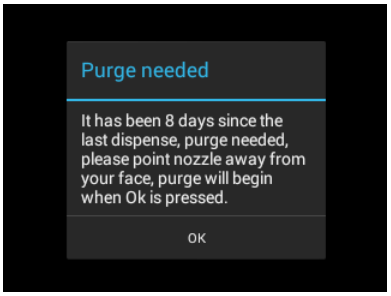
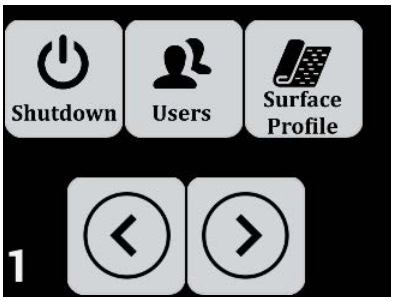


Fig. 45 - Purge Needed message

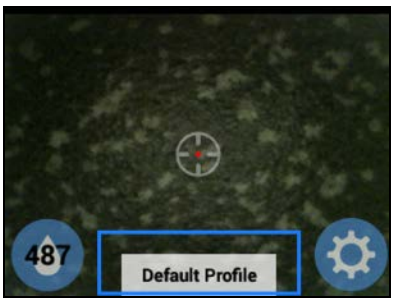
2. After the prime shot (or purge), the Measurement screen is displayed. A short time after that, the screen changes to the Menu screen. The amount of time that the Measurement screen is displayed is called the preview timeout. The default preview timeout is 45 seconds. An administrator can change this time.

Before you begin measuring, load a surface profile that is suitable for the surface that you are testing. Depending upon which options are included with your Surface Analyst and how they are configured, you may instead be automatically prompted to choose a surface profile or scan a surface profile QR code. For more information about surface profiles, read the Administrator Manual.

1. On page 1 of the Menu screen, touch **Surface Profile**.



If you are in the Measurement screen, you can also access the surface profiles by touching the box at the bottom of the screen.

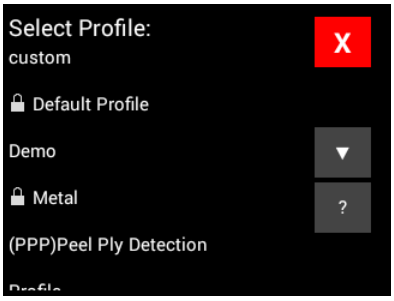


2. Choose one of the available surface profiles. Touch **Yes** when prompted to load the selected profile.

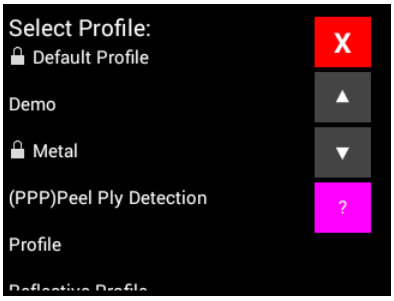
   You may touch the square X icon to exit the Surface Profile screen.

   If there are more available profiles than fit on the screen, arrows appear to help you navigate to them.

   Surface profiles having a lock icon are created by Brighton Science and cannot be modified

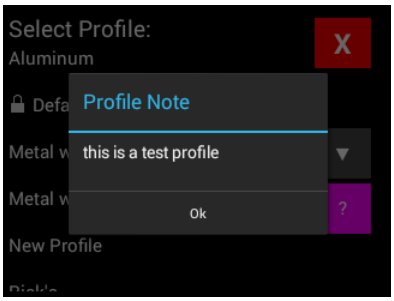


   If you want to find out information about a surface profile, touch the question mark box and then touch a surface profile.



   If information was created for the surface profile, a description appears. See the administrator manual for instructions for adding profile notes.

   Touch Ok to close the profile note.



A.2.3 Take a Measurement

A performance check is recommended at the beginning of each day and as needed to verify that the Surface Analyst is operating at maximum performance. See "Doing Performance Checks" on page 64.

1. To take a measurement, press the check mark button or the back arrow in Menu screen page 1 to put the Surface Analyst in measurement mode.
2. Place the inspection head squarely onto the area to be tested. Make sure the inspection attachment or base of the head makes stable contact with the surface.
3. While holding the head steady against the surface, press the check mark button .

A red banner reading "Hold in place" appears.

Do not move the head during the drop deposition. Otherwise, you may get a faulty measurement.

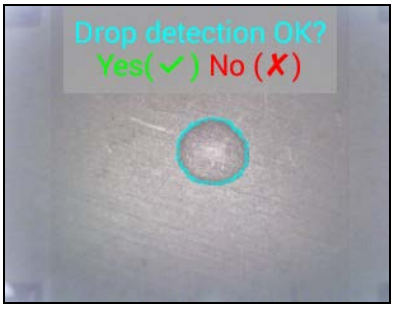
4. You may move the head when the green banner reading "Analyzing" appears.

If the camera is not able to take a good picture, a message appears for you to take another measurement.

To exit this screen, either tap the red banner, press the check mark button, or press the X button.

5. Press the check mark button to accept the drop detection. Press the X button to reject the drop detection and take a new measurement. To know when to accept or reject a drop detection, see "Accepting or Rejecting the Drop Detection" on page 63 .

If you reject the drop detection, go back to Step 1.



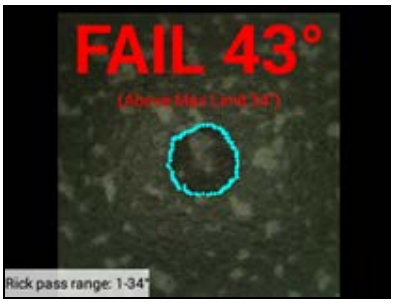
A.2.4 View the Measurement Results

The measurement results are displayed on the screen after you take a measurement.

When set up to do so, a "Pass" or "Fail" message appears with a calculated contact angle.

The pass or fail result is determined by the allowable contact angle range of the loaded surface profile.

If the measurement fails, the allowable limit is displayed.



When set up to do so, a passing measurement displays in yellow text to warn you if it is close to the allowable limit.

If the "Default" profile is loaded, or if pass/fail limits are disabled, you only see the contact angle result.

A.2.5 Shutdown (Remote DIO Control)

1. Touch the "Shutdown" icon on page 1 of the Menu screen.

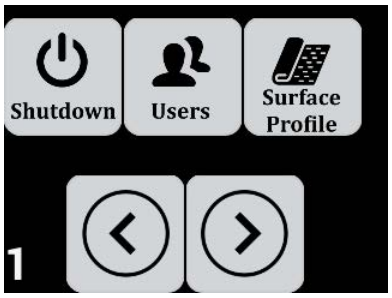


Fig. 46 - Menu screen page 1

2. Press the main switch to turn off the power supply.

A.3 Accepting or Rejecting the Drop Detection

A drop detection is the software's determination of the edge of the deposited drop, represented by a pattern of colored dots. The quality of the drop detection is dependent upon things such as surface irregularities and how steady you hold the head during measuring.

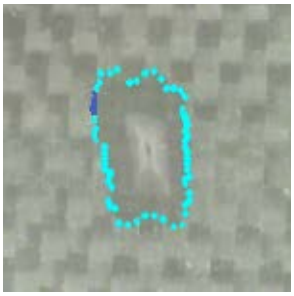
Fig. 47 - Drop detection

If SmartDrop is not enabled in the loaded surface profile, then the message "Drop detection OK?" displays immediately after you take a measurement. The colored dots flash until you accept or reject the drop detection.

Press the check mark button to accept a good drop detection. A drop detection is good if the colored dots closely follow the edge of a satisfactorily-deposited drop.

The following images are examples of good drop detections:





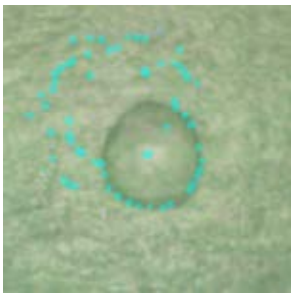
The shape of the blue dots does not need to be a perfect circle as long as the dots follow the edge of the drop, and the drop is not distorted by abnormal features.

Press the X button to reject the drop detection in the following cases:

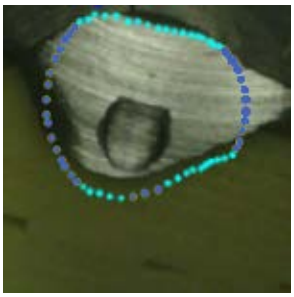
- The colored dots do not follow the edge of the drop.
- No clear image of a drop appears on the screen.
- The drop is distorted due to abnormal features in the surface or due to the drop falling off the surface.

The following images are examples of bad drop detections:

Dots inside of drop



Inspection head moved during measuring



Dots outside of drop

If you have a high number of poorly formed drop detections, contact Brighton Science.

A.4 Doing Performance Checks

A performance check is recommended at the beginning of each day and as needed to verify that the Surface Analyst is operating at maximum performance.

A performance check consists of the following:

1. Measurements are performed on each of the five targets on the PCS card.
2. The Surface Analyst automatically analyzes the results from the measurements. If necessary, internal settings are adjusted to ensure proper contact angle readings on the PCS card.

A.4.1 Performance Check Surface (PCS)

The Performance Check Surface (PCS) is a special card that you must use when doing a performance check.

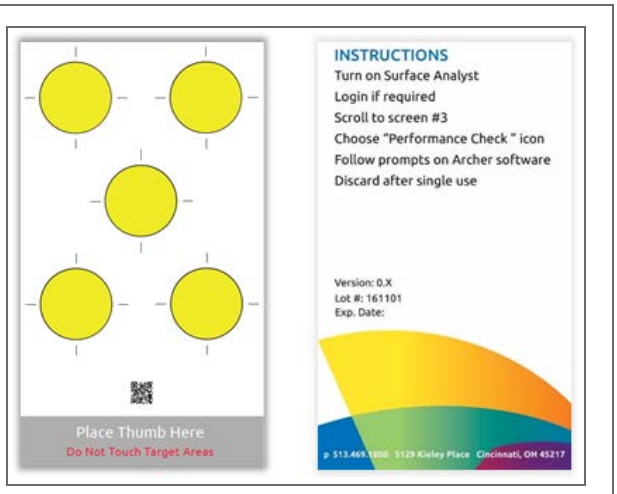


Fig. 48 - PCS (front and back)

The PCS has five circular targets. These targets are printed with a special ink having a controlled and consistent surface energy. There are instructions printed on the back side of the card.To order new cards, see "Spare Parts" on page 53. You can order online at brighton-science.com.

Special information about the PCS:

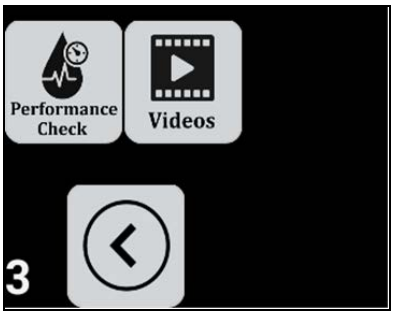
- Use a PCS for only one performance check. Discard the card after you complete the performance check.
- Keep unused PCS cards in the bag with the desiccant packet.
- PCS cards expire at the end of the month printed on the card.
- Touch the PCS only in the "Place Thumb Here" area.

Do not touch the targets. If you do, the performance check will not work properly.

A.4.2 Performance Check Procedure

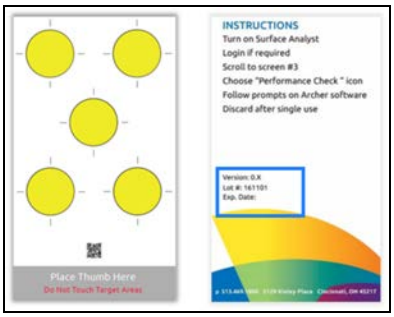
1. To watch a video of the performance check procedure, touch **Videos** on page 3 of the Menu screen.

   To start a performance check, touch the **Performance Check** icon.



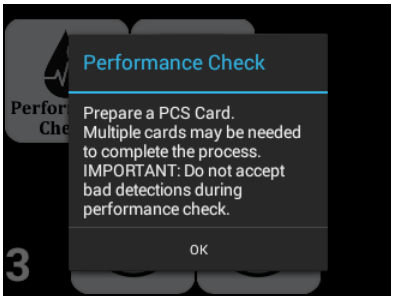
2. Prepare a PCS (Performance Check Surface). Check the expiration date to make sure it has not expired. The card is good through the end of the month printed.

   Be sure not to touch the yellow targets on the card.

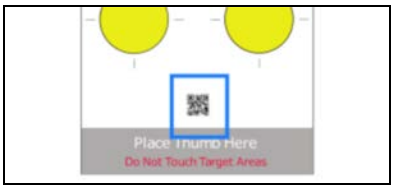


3. Have more than one PCS card on hand, as multiple cards may be necessary to complete the performance check.

   Touch **OK** when you are ready to start the performance check.

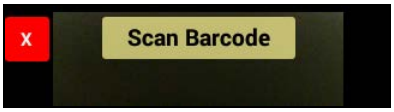


4. Place the Surface Analyst head on the PCS and over the QR code. Make sure that the crosshairs are completely on the code.



   The Surface Analyst scans the code.

   If you need to cancel the scan, touch the red box with the "x".



   If your PCS is close to its expiration date, a message reminds you to order replacements soon.

5. Position the crosshairs over a yellow target on the PCS.

   Press the check mark button to dispense a drop.

   To abort the performance check, touch the gear icon .

6. Press the check mark button if the drop detection is good. (See "Accepting or Rejecting the Drop Detection" on page 63.)

   If the drop detection is not good, press the X button and try again at a different location on the same target.

   Do not accept bad drop detections!

7. After completing testing on all targets, a message tells you the results of the test:

   - Check Passed

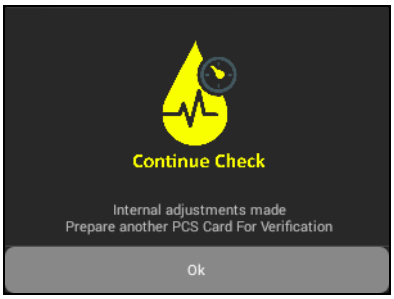
     You are finished with the performance check. Touch **OK** to return to the Measurement screen.

     OR...

   - Continue Check

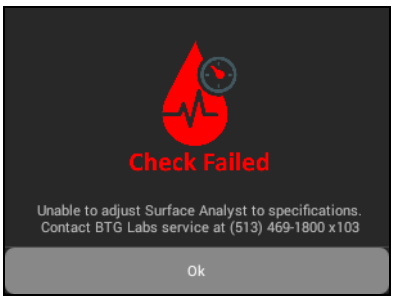
     Internal adjustments were made. You need to continue the performance check to confirm the adjustments. The Surface Analyst may guide you through a purge during this process. Touch **OK** to continue, using a new PCS card of the same lot number.

     OR...

   - Performance Check Failed

     The Surface Analyst could not be adjusted to specifications. Contact Brighton Science.

A.4.3 Performance Check Results

Archer uses information about the exact properties of your specific PCS card when the QR code is scanned. The pass or fail results of the performance check are based upon these properties.

The explanations for the performance check results are as follows:

Performance Check Complete

Fig. 49 - Performance check complete

If the measurements taken during the performance check are in an acceptable range appropriate to your PCS, then the performance check passes and is complete. Touch **OK**.

Adjustments Made

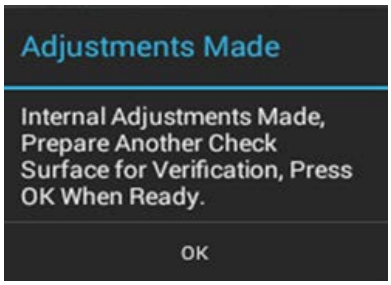


Fig. 50 - Adjustments made

If the average of the five measurements is slightly shifted from the expected value of your PCS card, the Surface Analyst automatically makes adjustments to the fluid dispensing to optimize performance.

Prepare another PCS card, and touch **OK**. The Surface Analyst guides you through the process of verifying the internal adjustments.

Performance Check Failed

A performance check failure happens in the following instances:

- The measurements were inconsistent (the standard deviation was too high)
- The required adjustments to the fluid dispensing were either over or under the acceptable internal limits

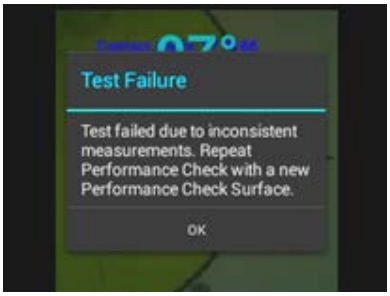


Fig. 51 - Performance check failure: standard deviation too high

Prepare another PCS card and touch **OK**. The Surface Analyst guides you through another performance check.

If too many performance checks end in failure, then a message appears for you to contact Brighton Science.

Water used for purging and performance checks does not count against the total available drops for measurements listed in the Technical Specifications.

A.5 Viewing Drop History

The Surface Analyst can store several thousand images in its log file.

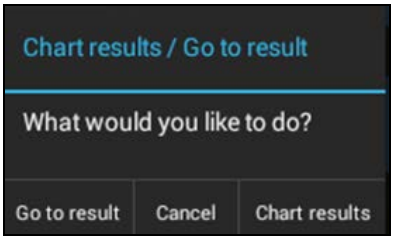
A.5.1 Chart Results

You can review contact angle test results in a graph form for fast and easy trend analysis.

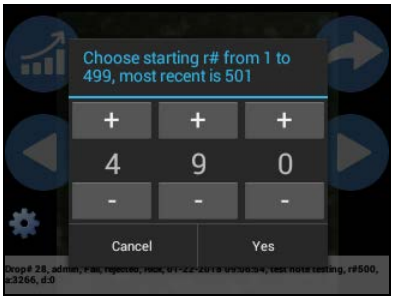
1. Touch the chart icon in the Drop History screen

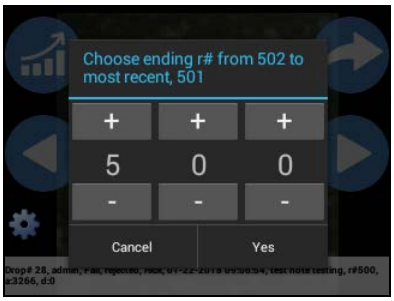
2. Select "Chart results".

   Selecting "Go to Result" takes you to a single result only.



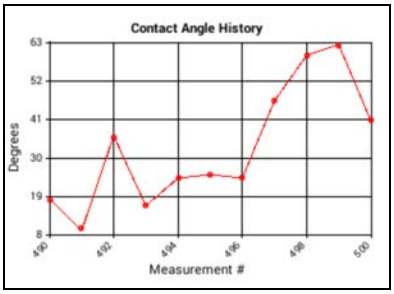
3. Select the starting and ending measurement result numbers (r#) by using the + and -.



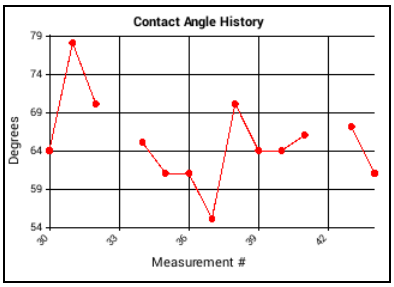


The r# is a counter that keeps track of measurements. It resets when data is deleted, but it does not reset when a cartridge is changed.

4. The results graph appears showing the contact angle history.



The graph omits points where the drop detection was rejected or where the drop size was too small.



A.5.2 The Drop History Screen

If you want to view a previous drop image, touch the drop icon 

in the Measurement screen to access the Drop History screen.

Fig. 52 - Drop History screen

The Drop History screen has the following functions:

- It displays the following information at the bottom of the screen:
  - Drop number (how many drop depositions have occurred with the current cartridge)
  - Active user (only named users appear)
  - Measurement results
  - Drop detection acceptance status
  - Loaded surface profile
  - Date and time of measurement
  - Drop note, if used (See "Adding a Drop Note" below.)
- The chart icon allows you to set a range to chart your results in a graph. See "Chart Results" on page 69.
- The back arrow icon icon sends you back to the Measurement screen.
- The arrows allow you to view different drop images.

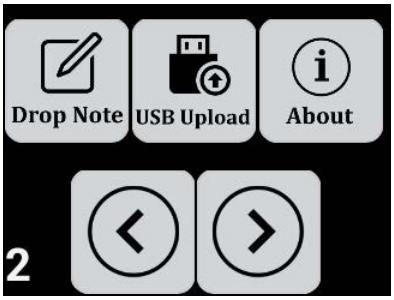
A.6 Adding a Drop Note

A drop note is a note you add to one measurement or a series of measurements. A drop note is stored with all subsequent measurements until you change or delete the note.

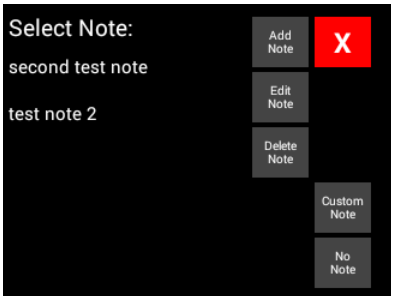
If you have Remote API Control configured, you may add a drop note with an RD command, see "Other Functions" on page 46

1. Go to page 2 of the Menu screen.

   Touch **Drop Note**.



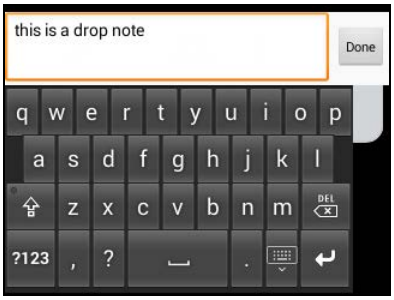
2. You have the choice of selecting an existing note, modifying an existing note, deleting an existing note, or creating a new note.



   - Touch one of the listed notes to make it the active note.
   - Touch **Edit Note** or **Delete Note** to edit or delete an existing note.
   - Touch **Add Note** to create a new note that will be added to the list.
   - Touch **Custom Note** to create a new note that is not saved to the list.

3. Type in your note.

   Touch **Done** to complete your note.

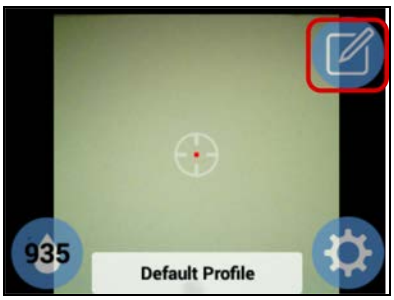


4. Touch **Yes** to accept the note.

   The note will be stored with every measurement, beginning with the next measurement.

   You can view the current drop note in Menu screen page 2 ⇨ **About** ⇨ page 2.

5. If you have an active drop note, you can access the drop note menu directly from the Measurement screen by touching the drop note icon.



6. To cancel or change the note:

   a. Touch **Drop Note** on Menu Screen page 2.
   b. Touch **No Note** and then **OK**.

A.7 Uploading Data Via USB

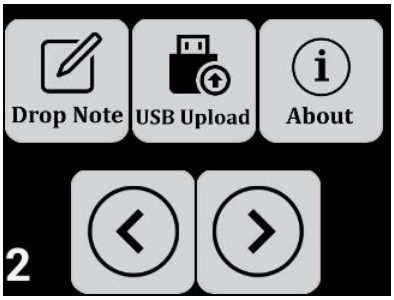
The Surface Analyst stores all history data. You can upload this data onto a USB flash drive.

1. Turn on the Surface Analyst.

   Plug a USB flash drive into the USB port.

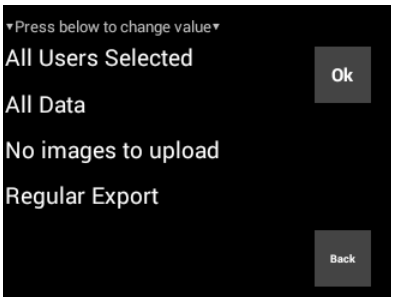
2. Go to page 2 of the Menu screen.

   Touch the **USB Upload** icon.



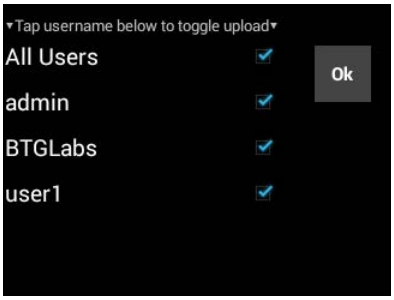
3. If you are satisfied with the settings, then touch **Ok** to begin the export. Otherwise, you may touch each of the settings to change its value.

   If you wish to leave the export menu without exporting, then touch **Back**.



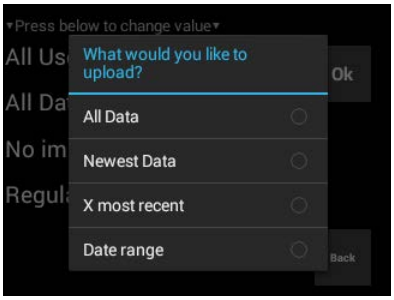
   Touch the first setting to change which user data to export.

   Check the boxes of the users to include in the upload. Touch **Ok** to continue.

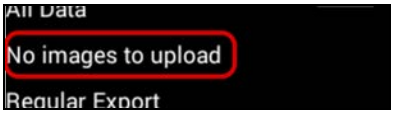


   Touch the second setting to change what time period of data to include.

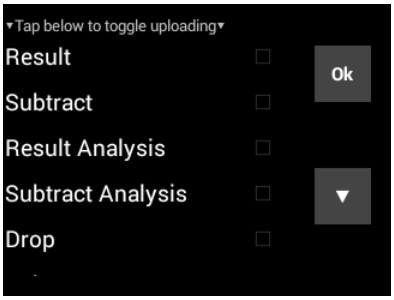
All Data	All data is exported.
Newest Data	Only data since the last export is exported.
X most recent	Choosing this allows you to set how many of the most recent results to include in the export.
Date range	Set a date range of what data to include.



Touch the third setting to change what kinds of images to include.



If you leave all the boxes unchecked, then no images will be exported. This results in a faster export.



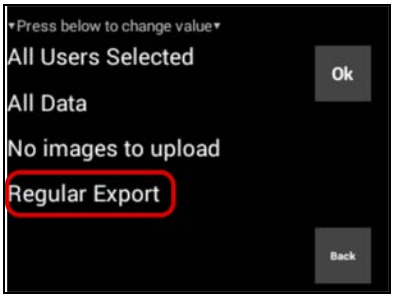
Drop and Substrate images are the original raw images taken for each measurement. These images are only available if your Surface Analyst has been set to save raw images (not common and not recommended). See the Administrator Manual for more information.

Touch **Ok** to continue.

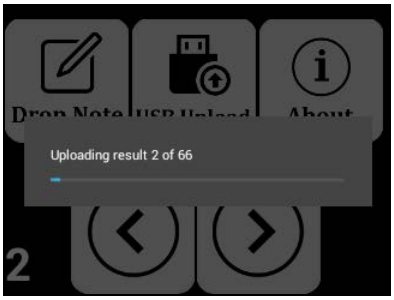
Touch the last setting to set the type of export.

Toggle this setting to set either **Regular Export** or **Full Export**. See "Regular Export vs Full Export" on the next page to learn the difference between the two types of exporting.

Touch **Ok** to begin the export. If you wish to leave the export menu without exporting, then touch **Back**.

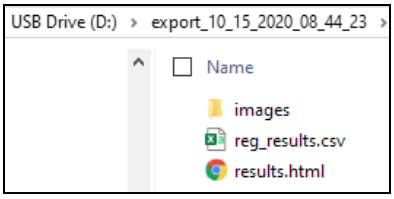


4. The data uploads onto the USB flash drive.



Archer saves your settings so that you do not need to re-set them the next time you export data.

5. The results and images are stored on the USB drive in the export folder labeled with the date and time. An HTML file is provided with the data export for previewing the data.



Regular Export vs Full Export

A regular export includes the most commonly used information in an easy-to-handle CSV file. The following table describes the information that is included in a regular export:

Regular Export Column Descriptions

Column	Header	Description
A	username	This is the name of the logged-in user.
B	Drop Note	This is the text of the Drop Note.
C	ContactAngle	This is the measured contact angle which was displayed on the screen at the end of the measuring process. NOTE: A value of 999 indicates that there was an error in the measurement process and a contact angle could not be measured.
D	profile	This is the name of the surface profile which was active when this measurement was taken.
E	minangle	This is the minimum pass value for the contact angle when dyne mode is not enabled. NOTE: When dyne mode is enabled, this value is present in the export but is not used for pass/fail determination.
F	maxangle	This is the maximum pass value for the contact angle when dyne mode is not enabled (this is the standard mode). NOTE: When dyne mode is enabled this value is present in the export but is not used for pass/fail determination.
G	passorfail	A value of "Pass" or "Fail" represents whether or not the measurement was within the pass/fail limits.
H	acceptedorrejected	This represents the user or automated drop acceptance. The values to be expected in this column are “accepted” or “rejected”.
I	timestamp	This is the date and time value at the time the measurement was taken. This cell is formatted yyyy-mm-ddThh:mm:ss.nnn.
J	dropnumber	This is the measurement user drop number. NOTE: This number decrements on each measurement taken, and resets when the cartridge is replaced (to the maximum number of drops in the new cartridge). For re-analyzed images the drop number from the original inspection is used.
K	cartridgeserial	This is the serial number of the installed cartridge. NOTE: This field contains both the serial number entered by the user and the date when the cartridge was installed.

Column	Header	Description
L	WettingImageNumber	(Wetting Analytics only) This gives the image number in a set.
M	WettingDelta	(Wetting Analytics only) This is the difference in contact angle between the current inspection and the first image of the set.
N	WettingPassOrFail	(Wetting Analytics only) This is the result of the wetting analysis (Pass/Fail).
O	Type	This contains information about the type of inspection performed.
P	resultimage	This is the relative path to the result image PNG file. NOTE: This field is empty if images are not configured to be saved or if export does not include this image type.
Q	subtractimage	This is the relative path to the subtraction image PNG file. NOTE: This field is empty if images are not configured to be saved or if export does not include this image type.
R	subtractanalysis	This is the relative path to the result image with overlaid analysis PNG file. NOTE: This field is empty if images are not configured to be saved or if export does not include this image type.
S	rsultanalysis	This is the relative path to the result image with overlaid analysis PNG file. NOTE: This field is empty if images are not configured to be saved or if export does not include this image type.
T	dropimage	This is the relative path to the drop image PNG file. NOTE: This field is empty if images are not configured to be saved or if export does not include this image type.
U	substrateimage	This is the relative path to the substrate image PNG file. NOTE: This field is empty if images are not configured to be saved or if export does not include this image type.

A full export contains all of the same data as a regular export, plus additional data. The information exported in a full export is more comprehensive and the resulting CSV file lists most of the data collected by the Surface Analyst. This data includes image capture and image processing settings as well as other internal settings. It also includes dyne information, if your Surface Analyst is configured for dynes.

Administrators can also upload the entire results database (DB file). See the Administrator Manual for more information.

A.8 Viewing the Software License, Settings, and Other Information

To view the software license, settings, and other information, go to page 2 of the Menu screen, and touch **About**.

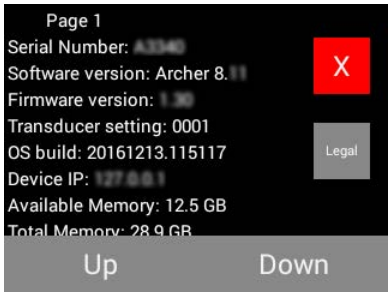


Fig. 53 - About screen page 1

For license information and the End User License Agreement (EULA), touch the square **Legal** icon.

Touch **Up** or **Down** to scroll through the different pages on the About screen. The following information is contained on each of the pages:

Page 1

- Serial number of the Surface Analyst
- Archer software version
- Firmware version
- Head firmware version
- Transducer setting
- Fan settings
- Valve use counter
- OS build
- Device IP
- Memory information
- Battery type

Page 2

- Active user
- Loaded surface profile
- Drops remaining/used (Drops used for measurements and purging are counted separately.)
- Auto login status
- Current drop note
- Minimum and maximum pass angles
- Near Fail limit
- Drop detection accept setting
- SmartDrop limit
- Settings for outlier detection
- Current time and time zone
- Cartridge serial number
- Calibration due date
- Number of days since last performance check

Page 3

- Drop dispense settings
- Internal purge settings

Page 4

- General and image process settings (Read the Administrator Manual for more information.)
- Settings for installed purchasable options

Page 5

- Image capture settings (Read the Administrator Manual for more information.)

Page 6

- Purchasable options which are installed on the Surface Analyst

  See "Viewing Installed Purchasable Options" on page 1 for explanations of the codes.

Touch the square **X** icon to exit the About screen.

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