Enriching the quality of life for people everywhere.

iQ™ 200

Service Manual

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A Division of International
Remote Imaging Systems, Inc.

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1
Introduction

1. Introduction

Intended Use

The iQ™200 Automated Urinalysis System (iQ200 System) is an ***in-vitro* diagnostic use device** composed of the iQ200 Automated Urine Microscopy Analyzer (iQ200), connected physically and electronically to the AUTION MAX™ AX-4280 Automated Urine Chemistry Analyzer (AX-4280), and a workstation. The iQ200 System is used to automate the complete routine urinalysis profile, including urine test strip chemistry panel, specific gravity, color, clarity, and microscopic analysis, providing quantitative or qualitative counts of formed elements, such as cells, casts, crystals, and organisms.

Optionally, the iQ200 Automated Urine Microscopy Analyzer can be used as a stand-alone device for microscopic analysis, and the results from the iQ200 can be combined with other urine chemistry results.

This document is the Service Manual for the iQ200 Automated Urine Microscopy Analyzer. It is intended to be used by Iris Diagnostics trained personnel.

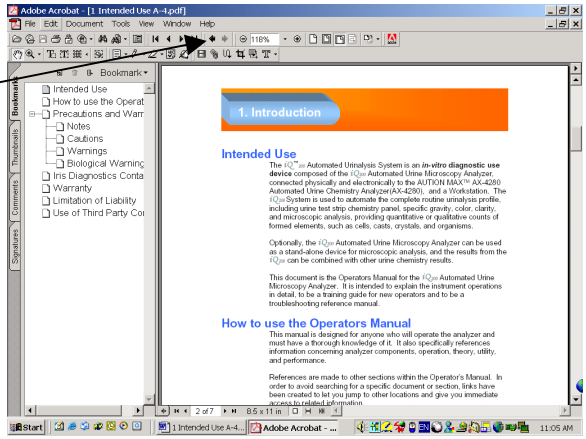
How to use this Manual

References are made to other sections within the Manual. In order to avoid searching for a specific document or section, links have been created to let you jump to other locations and to give you immediate access to related information.

1. Introduction

To follow a link:

1. Select the hand tool
2. Links are indicated in the following manner:
   - The text is colored blue and underlined. Example: Iris Diagnostics Contact Information.
3. Position the pointer over the linked area on the page until the pointer changes to the hand with a pointing finger. Then click the link.
4. To return to the previous section, click on the Go to Previous View button.
5. The Bookmark pane, located on the left side of the screen, can be used as a "linked" table of contents. Click on the **+** or **–** sign located next to the title to expand or collapse the selection for a bookmark. Clicking on a bookmark will take you automatically to the starting page of the selected section.



1. Introduction

Precautions and Warnings

The Manual includes information and warnings that must be observed by the operator to ensure safe operation of the system. Important messages are highlighted with borders and special icons identifying the type of message enclosed.

There are four types of messages.

Notes

NOTE: Highlights important facts, gives helpful information and tips, and clarifies procedures.

Cautions

CAUTION: Electrical caution! Unplug before handling.

CAUTION: Laser light caution. A laser is used to read the barcodes. Protect eyes from the laser light.

CAUTION: If any liquid is spilled onto the Sampler, wipe the area clean before testing. Leaving the spill may cause crystals to form and block the movement of the sample racks.

Warnings

WARNING: Identifies potentially hazardous situations that could result in serious injury to laboratory personnel.

Biological Warning

WARNING: Wear protective gloves to prevent exposure to pathogens. Discard contaminated materials according to applicable regulations.

Warranty

Iris Diagnostics, a Division of International Remote Imaging Systems, Inc. (Iris) warrants that the products manufactured by it, its Divisions or Subsidiaries and sold hereunder shall be free from defects in material and/or workmanship, under normal use and service, for the period expiring twelve (12) months from the completion of installation under standard procedure by Iris Diagnostics or an authorized Iris Diagnostics distributor, or upon Purchaser's signature on Iris Warranty/Acceptance form, or eighteen (18) months from shipment, whichever occurs first. Iris Diagnostics makes no warranty whatsoever regarding products manufactured by persons other than Iris Diagnostics, its Divisions or Subsidiaries and Purchaser's sole source of warranty therefore, if any, is the original manufacturer's warranty.

No warranty extended by Iris Diagnostics shall apply to any products which have been modified, altered, or repaired by persons others than those authorized or approved by Iris or to products sold as "used."

Iris Diagnostics' obligation under this warranty is limited SOLELY to the repair or replacement, at Iris Diagnostics' option, of defective parts, F.O.B. warehouse or local Iris office, or as otherwise specified by Iris. Repairs or replacement deliveries shall not interrupt or prolong the term of this warranty. Iris Diagnostics warranty does not apply to consumable materials, except as specially stated in writing, not to products or parts thereof manufactured by Purchaser.

This limited warranty is made on condition that immediate written notice of any defect be given to Iris Diagnostics and that Iris inspection reveals that the Purchaser's claim is valid under the terms of this warranty.

Iris Diagnostics makes no warranty other than the one set forth herein or that which may be provided in a separate warranty covering the applicable product category. Such limited warranty is in lieu of all other warranties, expressed or implied, including but not limited to any expressed or implied warranty of merchantability or fitness for particular purposes and such constitutes the only warranty made with respect to the products.

Limitation of Liability

Iris Diagnostics shall not be liable for any loss of use, revenue or anticipated profits, or for any consequential or incidental damages resulting from the sale or use of the products.

Use of Third Party Computer Products

Iris Diagnostics does not recommend that the microcomputers provided as a functional part of the iQ200 Automated Urine Microscopy Analyzer or the iQ200 System be employed for performing any software or hardware-based applications other than those specifically furnished to operate and support the Iris instrument system, or those recommended and offered by Iris Diagnostics specifically as accessories or enhancements for the Iris instrument system. No other third party application software should be installed in these microcomputers in addition to those provided or recommended by Iris Diagnostics, without the expressed approval of Iris Diagnostics Technical Services, in order to avoid potential performance and reliability problems which can result from incompatibility factors, errors in use of such software, or software-based "viruses."

Installation of such third party software, or non-approved electronic cards or other devices, without advance Iris Diagnostics approval may affect the terms of or void any Iris Diagnostics warranty otherwise in effect, covering Iris Diagnostics supplied software and hardware on the microcomputers and the overall performance and reliability of the entire Iris Diagnostics instrument system.

Iris Diagnostics Contact Information

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2

Installation Procedures

2. Installation Procedures

Installation Requirements

Space Requirements

The iQ_{200} is a tabletop unit requiring free space on a standard (36 inch: 0.9m) height countertop of approximately 36 inches wide by 24 inches deep (91cm by 61cm), with vertical clearance of at least 24 inches (61cm).

Workstation

The Workstation is a desktop computer, video monitor, keyboard and mouse requiring a suitable counter or desktop, which provides comfortable access and a good viewing angle. It is suggested that, if possible, the WorkStation be placed in a work area, which can be semi-darkened to increase screen display visibility and reduce glare.

The data connections are made between the iQ_{200} and the Workstation (and the AX-4280 and the WorkStation, if applicable) via the special cables provided.

Location

For most laboratories, the iQ_{200} is placed near an open benchtop work area which can be used for preparation of urine tubes and sample racks. All data transmissions from the iQ_{200} (and the Ax-4280, if used) are routed to the Workstation, which manages and controls all communications to the Laboratory Information System (LIS) via serial connections.

Requirements

The iQ_{200} uses standard 90V to 240V stable power supply. The voltage parameters are not customer configurable. Uninterruptible power supplies are recommended and available from Iris Diagnostics for the iQ_{200} and the Workstation (and the AX-4280 if applicable) to maintain system operation during short power outages and brownouts. This allows for an orderly shutdown of instruments without the loss of data.

Installation

The iQ_{200} will be installed by a factory-trained representative from Iris Diagnostics.

2. Installation Procedures

Shipping Cartons

The iQ200 is shipped in three cartons. Open each carton and check the packaged items. If any of the items are damaged or missing, immediately notify your distributor.

Instrument Carton

Item number	Description	Qty
800-3200	iQ200	1
700-3103	Printer	1
250-3082	Printer Cable	1
700-3100	Analysis Processor	1
700-3210	Results Processor	1
700-3104	Analysis Processor Software CD	1
700-3102	Monitor	1
700-3101	Keyboard and Mouse	1
800-3204	Accessory Kit • Sample Racks (661-3500) • Calibrator Rack (700-3008) • Control/Focus Rack (700-3007) • iQ Lamina Cap, Filter & Tubing (700-3781) • Operators Manual CD (700-9999)	 10 1 1 1 1
250-3083 250-3501	Cable, crossover RS 232, Analysis Processor to Results Processor	1 1

Starter Kit A Carton

Item number	Description	Qty
800-3102	iQ Lamina (four containers plus one filter)	1
475-0021	Iris Diluent (four bottles)	1
475-0003	Iris System Cleanser (four bottles)	1

Starter Kit B Carton (needs refrigeration)

Item number	Description	Qty
800-3104	iQ Control/Focus Set (four bottles)	1
800-3103	iQ Calibrator (four bottles)	1

2. Installation Procedures

Installation

To ensure safety, we advise you to read these operating instructions very carefully and take all proper precautions.

Precautions

The entire unit weighs approximately 120 lbs. Choose a place to set up the unit before completing its assembly.

If the unit must be moved, separate the Sampler from the analyzer before moving. If these two units come apart while being carried, it may result in injury or severe damage.

Always keep a distance of at least 2 inches (5 cm) between the rear of the unit and the wall. If this distance is not maintained, the connecting tubes and cables may overheat.

Do NOT use power frequencies or voltage other than those specified in this document. Connection to an inappropriate power source may cause injury or fire.

Make certain that the power supply for the iQ200 is from a dedicated line that provides power to no other instruments or appliances. If power is not clean and steady, a UPS and/or power conditioner is recommended.

Do NOT disassemble or modify the unit. Doing so may cause injury and/or instrument malfunction.

Place the unit on a stable and level surface free of vibration. Failure to do so may cause injury or malfunction of the unit.

Do NOT place the unit where it may be affected by chemicals, corrosive gases or electronic noise. Doing so may cause injury or malfunction of the unit.

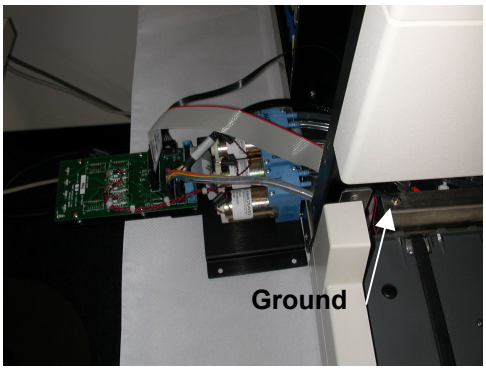
Do NOT place the unit where it may be affected by water, direct sunlight or draft. This may yield incorrect results, and the unit may be damaged.

Select a room to set up the unit where the temperature can be controlled between 50°F (10°C) and 86°F (30°C), and humidity in a range of 20% to 80%.

2. Installation Procedures

Connecting the Sampler

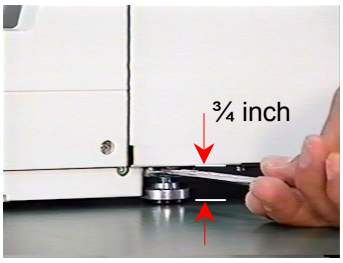
In order to protect the Analyzer and Sampler from damage during transport, each section is secured with tape. Follow the procedure below before installing the unit.



1. Remove the left side panel of the analyzer and the EMI shielding panel.
2. Remove the four screws securing the STM SIC and diaphragm pumps.
3. Connect the grey ribbon cable from the sampler to J01 on PCBA 101-5014 STM SIC.
4. Connect the multi-colored wiring cable to J02 on PCBA 101-5014 STM SIC.
5. Connect the black specimen tube detector cable to J9 on PCBA 101-5014 STM SIC.
6. Connect the ground cable to the chassis of the microscopy module.
7. Insert the hooks of the sampler into the slots of the analyzer. Be careful not to catch the cables.
8. Reattach the STM SIC and diaphragm pumps to the chassis.

CAUTION: For external devices, connect only a device with a cross cable that conforms to the RS-232C interface. Other cables may cause electric shock or fire.

Adjust the Height of the Analyzer

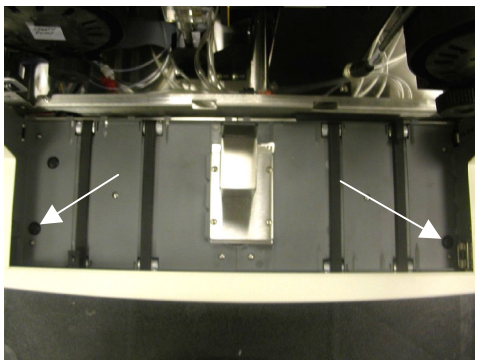


- Using a 7/16” wrench, loosen the locking nuts located under the analyzer.
- Adjust the height of the Sampler by rotating the feet. The space between the bench top and the analyzer must be ¾ inch.
- After adjusting the height, tighten the locking nuts.

Adjust the Sampler

Two adjustment feet are located under the Sampler. They are accessed from the top of the Sampler. Each foot must be in contact with the benchtop.

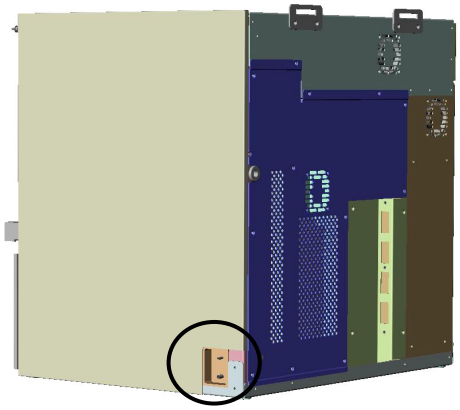
- Using a flat head screwdriver, remove the two rubber caps located on the front corners of the Sampler. The top of the feet (screws) can be seen.
- Using a Phillips screwdriver (+), turn each of the two screws clockwise until the adjustment feet touch the bench top.
- Reinsert the rubber caps.



CAUTION: Make sure the height of the Sampler is adjusted correctly. Otherwise, the Sampler and the Probe may be damaged.

Installing the Lamina Container

- Install the Lamina cap with filter on a fresh Lamina container.
- Connect one end of the Lamina tubing to the top fitting on the right side of the analyzer. Connect the other end to the fitting of the Lamina cap.



Connecting the Drain Tubing

- Connect the drain tubing to the bottom fitting on the right side of the analyzer.
- The Drain Tubing can be directed to the designated waste area according to local regulations.
- If direct drainage is not an option, slide the Drain Tubing inside a waste container (approximately 2 in.) **Make sure the waste container is lower than the microscopy module**.

2. Installation Procedures

Computers Connections

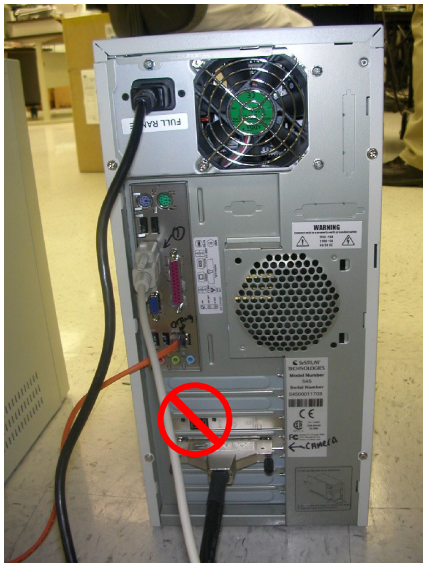
Analysis Processor (AP)

1. Connect the video monitor cable to the video monitor and the video port.
2. Connect the keyboard cable to the keyboard port.
3. Connect the mouse cable to the mouse port.
4. Connect the power cord into the power inlet, and then plug into an electrical outlet.
5. Connect the printer cable to the printer and the printer port.
6. Connect one end of the orange crossover cable to the network card port of the motherboard (upper port).

CAUTION: DO NOT connect the crossover cable (orange cable) to the bottom ports of the computer towers. Once the computers have been started, the configuration will automatically update and **CANNOT** be returned to the network card port.

Results Processor (RP)

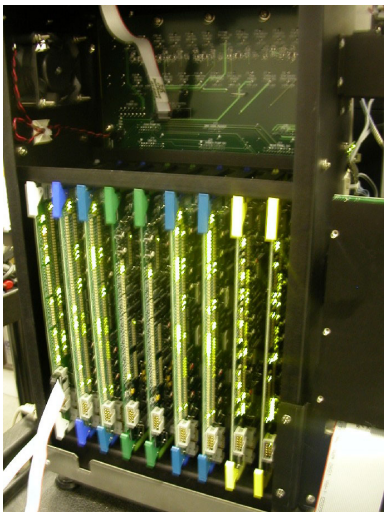
1. Connect the power cord into the power inlet, and then plug into an electrical outlet.
2. Connect the other end of the orange crossover cable to the network card port of the motherboard (upper port).
3. Connect the 100-pin camera data cable to the frame grabber port.
4. Connect one end of the RS232 cable to the serial port on the SM computer; connect the other end to the serial port 1 (top port) on the back of the iQ200.



2. Installation Procedures

Startup

Note: Before power up, check inside the instrument and ensure the cables and tubing are secured and remove any packaging material.



Turn on power in the following order:

1. Results Processor
2. Analysis Processor
3. Video monitor
4. Main power switch on the back of the Microscopy Module

Note: Wait until the Instrument screen is displayed. Check the status on the top left corner of the screen is "**OFF**".

5. Press the green ON/OFF button on the front of the Microscopy Module
6. Remove the panel and the EMI shielding from the left side of the Microscopy Module to access the cardcage

Note: Verify **NO** red LEDs are present on the circuit boards inside the cardcage. If red LEDs are observed, clear the fault before continuing the installation.

7. Logon to the workstation. Identifier ***[IRIS]*** password *iris2k1* (lowercases).

Note: Verify the Microscopy Module is in Standby mode as indicated by a status light (green) on the instrument and displayed on the top left side of the screen.

8. After startup, the Lamina tank located inside the Microscopy Module will fill automatically.
9. Place three tubes in the first three positions of the Control rack. Fill each tube with Iris Diluent.
10. Run the Control rack **twice** to prime the lines located after the Lamina tank.

Run Focus

1. Place provided Focus barcode label onto a glass sample tube.
2. Place a sample tube with 6 mL of **iQ Focus** material (REF 475-0060) in position 5 of the Control rack.
3. Load the Control rack onto right side of the iQ200 sampler.
4. Press the **Start** on the top left side of the Microscopy Module.

Run Calibration Rack

1. Transfer 3 mL of **iQ Calibrator** into 10 round-bottom 16 x 100 mm glass test tubes.

NOTE: Do not use plastic tubes or pipetting devices.

2. Place provided barcodes on each test tube and place the test tubes into the Calibration rack (gray inserts).
3. Load the Calibration rack onto right side of the iQ200 sampler.
4. Press the **Start** on the top left side of the Microscopy Module.
5. Verify the Run Equivalency Factor (REF) is between 1.5 and 2.5.

Run Control Rack

1. Place provided Positive and Negative barcode labels onto glass samples tubes (one each).
2. Load the tubes into a control rack, positions 6 and 7.
3. Fill the tubes with 3 mL of control.
5. Load the Control rack onto right side of the iQ200 sampler.
6. Press the **Start** on the top left side of the Microscopy Module.
7. Verify the QC values are within the specifications.
8. Repeat Control rack 10 times and verify CV's of < 5%

Preparation for Starting Operation

Perform Setup

See Operator's Manual - Setup.

Installation Checklist

Complete and mail or fax to **Iris Diagnostics**
Attention Technical Services
9172 Eton Avenue
Chatsworth, CA 91311
Fax number: 1-818-700-9661

Account Name	
Address	
Telephone Number	
Installation Performed by	
Installation Date	
Analyzer Serial Number	

		Check
Inventory	☐ Analyzer carton ☐ Accessories carton ☐ Starter Pack A & B	☐ ☐ ☐
Installation	☐ Connect the Sampler ☐ Install the Lamina Container ☐ Connect the Drain Tubing ☐ Computers Connections ☐ Power up the Results Processor ☐ Power up the Analysis Processor ☐ Power up the Microscopy Module ☐ Prime the internal Lamina tank and fluidic paths	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Validation	☐ Setup Parameters (see Operators Manual Ch. 3) ☐ Run Focus ☐ Verify Flow Cell tilt ☐ Run Calibration ☐ Run Controls ☐ Submit all validation data to IRIS Diagnostics	☐ ☐ ☐ ☐ ☐ ☐

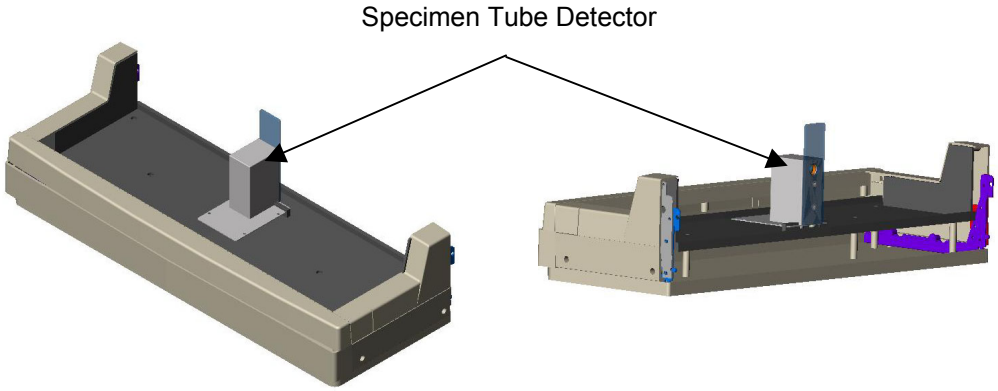
3

Components

3. Components

Sample Transport Mechanism

The Sample Transport Mechanism refers to the mechanisms associated with delivering test tubes of specimen to Specimen Presentation Assembly. The STM is composed of the Sampler and the Specimen Tube Detector.



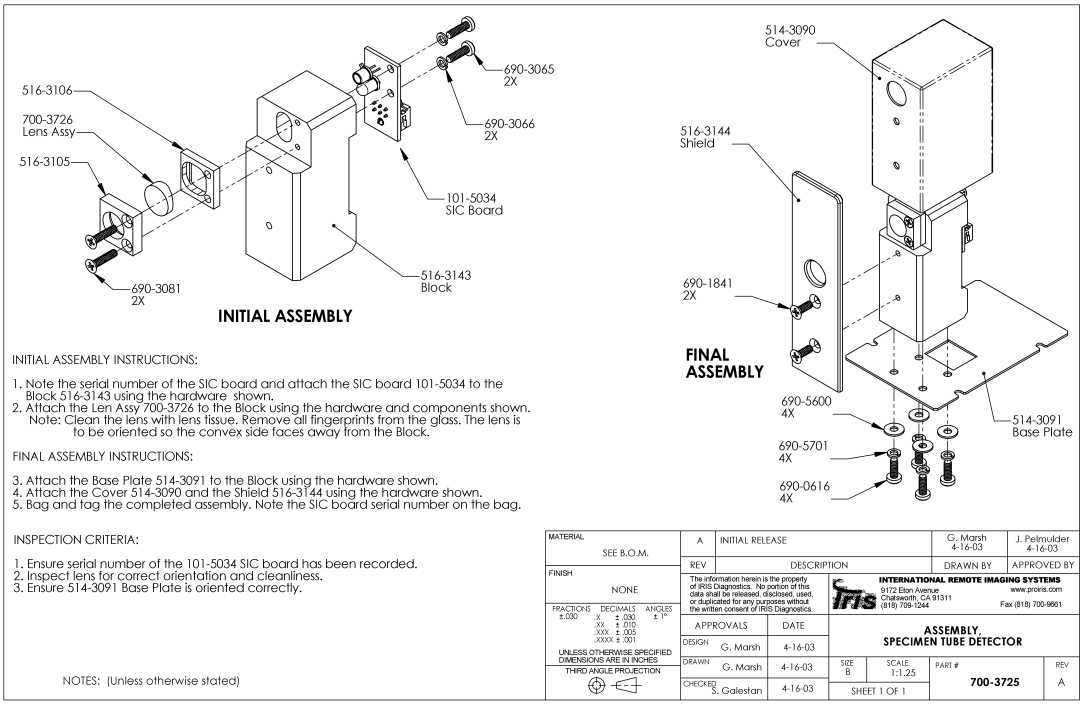
Sampler # 700-3006

The Sampler is located on the front of the iQ_{200} and is similar to the sampler used on the AX-4280. A bridge connection can be installed between the two systems allowing automatic transfer of sample racks after they have been processed on the AX-4280.

Sample racks, each capable of holding 10 tubes, are loaded on the right side of the sampler. To start the transport of the racks to the pipetting station, the operator presses the "**Start**" button. The Sampler presents sample tubes loaded onto racks at the pipetting station. The Sampler also has electro-optical sensing of various internal (relating to motor and actuator positions) and external (relating to rack position) status. The SM was specifically designed to use the Arkray Sampler.

Specimen Tube Detector # 700-3725

This small assembly uses specially focused visible light to determine if a sample tube is present at the position where the pipette can extract specimen. Because racks are not necessarily filled with samples tubes, the specimen tube detector allows the Microscopy Module to skip positions where there is no sample tube, avoiding using consumables for non-existent specimens, and achieving higher specimen throughput.



Component drawings may change without notice. Please contact IRIS Diagnostics to determine the current revision level.

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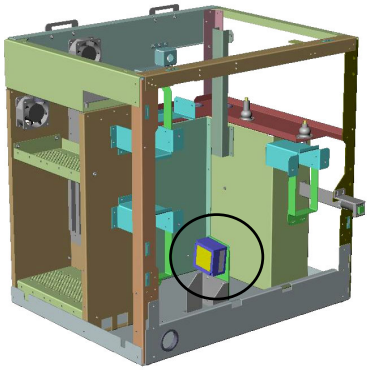
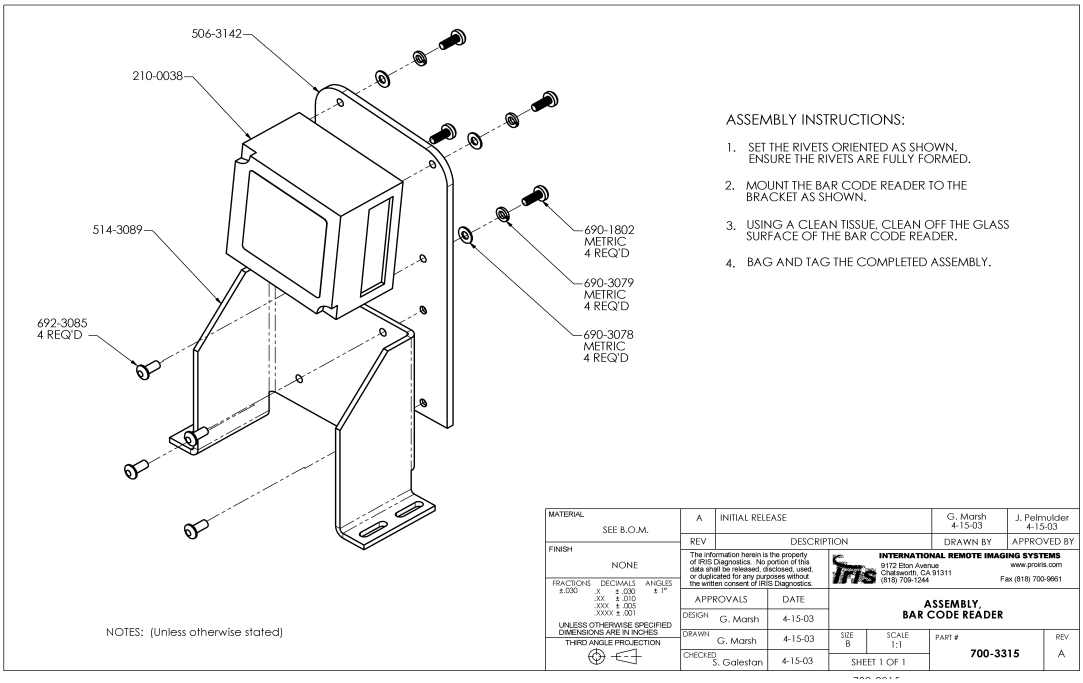
Barcode Reader # 700-3315

The Barcode Reader uses a class-II laser and an optical scanning process to “read” barcodes.





Component drawings may change without notice. Please contact IRIS Diagnostics to determine the current revision level.

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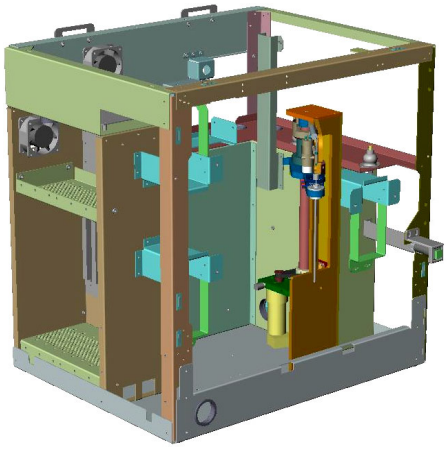
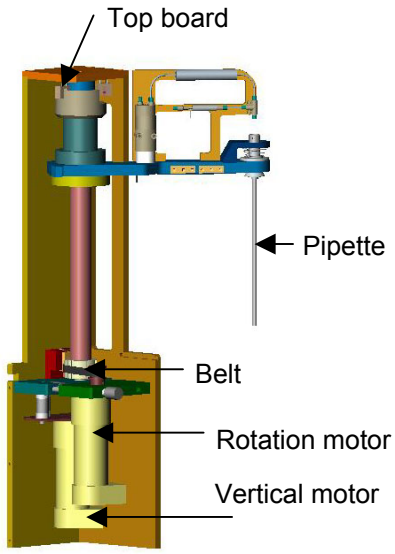
Specimen Presentation Assembly # 700-3700

The SPA or “Specimen Presentation Assembly,” is associated with the “front end” handling of the urine. Mechanically, the SPA mixes the specimen within the sample tube for uniform particle distribution, aspirates sample from the test tube, and delivers it to the next process in the Microscopy Module. The pipette (a vertical two-lumen tube) is mounted onto a two-axis arm, and provides the means for positioning the pipette down into the sample tube. The SPA includes two DC motors with integral encoders—one for vertical translation of the pipette arm, and one for rotation of the pipette arm.

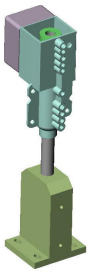




Crash Detect Function

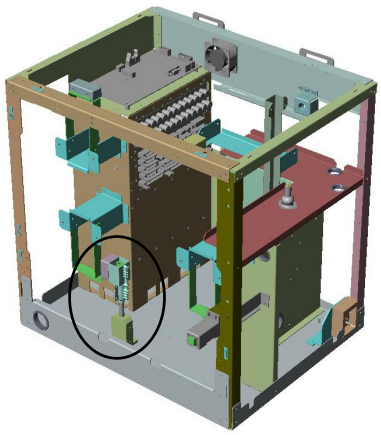
The Crash Detect function senses one switch (of a pair of snap-action switches mounted on the SPA arm itself). A latched relay on the SPA SIC is held pulled-in until the Hard Crash switch on the SPA arm opens (due to a crash), the relay drops out, and drive to the vertical motor is interrupted. When the relay is pulled in, the green “Vert OK” LED is on. When the relay is dropped out the red “Vert Crash” LED is on. At Microscopy Module power-up, the Hard Crash condition is automatically reset by an alternate signal on the SPA SIC. There is a push-button switch on the SPA SIC to manually resets the Hard Crash condition if the incoming Hard Crash signal (from the Hard Crash switch on the SPA arm) is no longer asserted. Under normal conditions, the manual switch is not used. Even when the vertical motor is disabled by the crash relay dropping out, the SPA SIC will still allow upward vertical motion of the SPA arm, but not downward motion.

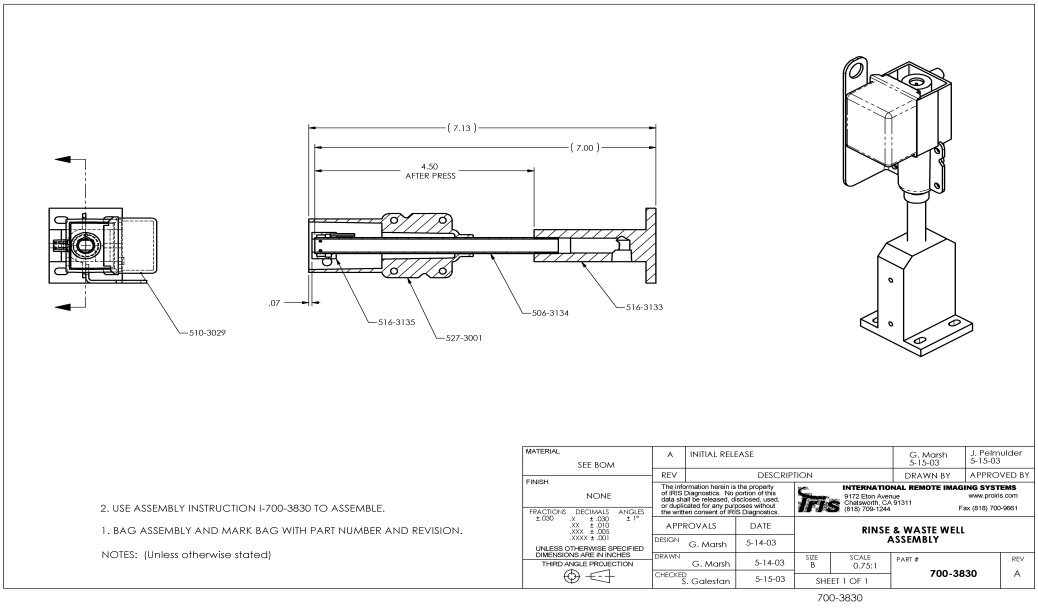
Waste/Rinse Well # 700-3830



The Rinse function is used to fill the well with Lamina in order to clean the pipette between sampling.

The Waste function collects all waste liquids (samples and Lamina) used during sample processing, then draining the fluids through the Waste Pump into the waste tubing.





700-3830

Component drawings may change without notice. Please contact IRIS Diagnostics to determine the current revision level.

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Diaphragm Pumps

The diaphragm pumps are DC motor driven pumps located on the left side of the instrument next to the sampler. They are from left to right:

1. Air Pump
2. Waste Pump
3. Rinse Pump
4. Fill Pump

The liquid pumps are identical and can be switched for troubleshooting purposes.

Air Pump # 700-3877

This pump fills the air tank and is used for mixing the specimen through the charge and air mix valves.

Waste Pump # 700-3874

This pump drains the waste well.

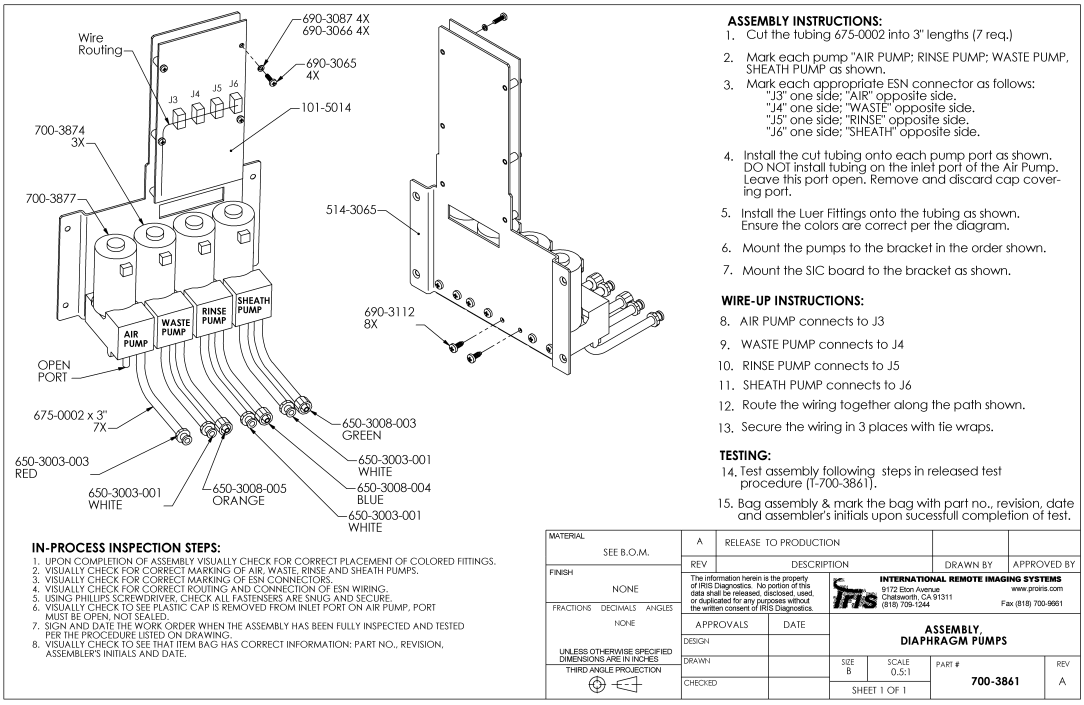
Rinse Pump # 700-3874

This pump fills the rinse well for cleaning the pipette.

Fill Pump # 700-3874

This pump maintains the level inside the Lamina tank.

3. Components



ASSEMBLY INSTRUCTIONS:

1. Cut the tubing 675-0002 into 3" lengths (7 req.)
2. Mark each pump "AIR PUMP; RINSE PUMP; WASTE PUMP, SHEATH PUMP as shown.
3. Mark each appropriate ESN connector as follows:
   "J3" one side; "AIR" opposite side.
   "J4" one side; "WASTE" opposite side.
   "J5" one side; "RINSE" opposite side.
   "J6" one side; "SHEATH" opposite side.
4. Install the cut tubing onto each pump port as shown. DO NOT install tubing on the inlet port of the Air Pump. Leave this port open. Remove and discard cap covering port.
5. Install the Luer Fittings onto the tubing as shown. Ensure the colors are correct per the diagram.
6. Mount the pumps to the bracket in the order shown.
7. Mount the SIC board to the bracket as shown.

WIRE-UP INSTRUCTIONS:

8. AIR PUMP connects to J3
9. WASTE PUMP connects to J4
10. RINSE PUMP connects to J5
11. SHEATH PUMP connects to J6
12. Route the wiring together along the path shown.
13. Secure the wiring in 3 places with tie wraps.

TESTING:

14. Test assembly following steps in released test procedure (T-700-3861).
15. Bag assembly & mark the bag with part no., revision, date and assembler's initials upon sucessfull completion of test.

IN-PROCESS INSPECTION STEPS:

1. UPON COMPLETION OF ASSEMBLY VISUALLY CHECK FOR CORRECT PLACEMENT OF COLORED FITTINGS.
2. VISUALLY CHECK FOR CORRECT MARKING OF AIR, WASTE, RINSE AND SHEATH PUMPS.
3. VISUALLY CHECK FOR CORRECT MARKING OF ESN CONNECTORS.
4. VISUALLY CHECK FOR CORRECT ROUTING AND CONNECTION OF ESN WIRING.
5. USING PHILLIPS SCREWDRIVER, CHECK ALL FASTENSERS ARE SNUG AND SECURE.
6. VISUALLY CHECK TO SEE PLASTIC CAP IS REMOVED FROM INLET PORT ON AIR PUMP, PORT MUST BE OPEN, NOT SEALED.
7. SIGN AND DATE THE WORK ORDER WHEN THE ASSEMBLY HAS BEEN FULLY INSPECTED AND TESTED PER THE PROCEDURE LISTED ON DRAWING.
8. VISUALLY CHECK TO SEE THAT ITEM BAG HAS CORRECT INFORMATION: PART NO., REVISION, ASSEMBLER'S INITIALS AND DATE.

MATERIAL	REV	DESCRIPTION	DRAWN BY	APPROVED BY
SEE B.O.M.	A	RELEASE TO PRODUCTION		
FINISH: NONE				
FRACTIONS DECIMALS ANGLES: NONE				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES				
THIRD ANGLE PROJECTION				

INTERNATIONAL REMOTE IMAGING SYSTEMS
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APPROVALS	DATE
DESIGN	
DRAWN	
CHECKED	

ASSEMBLY, DIAPHRAGM PUMPS

SIZE	SCALE	PART #	REV
B	0.5:1	700-3861	A

SHEET 1 OF 1

Component drawings may change without notice. Please contact IRIS Diagnostics to determine the current revision level.

IRIS Diagnostics
9172 Eton Ave
Chatsworth, Ca 91311
Ph# 818-709-1244

Peristaltic Pumps # 700-3820

Cannula Pump

This pump is used to push the sample into the Flow Cell.

Lamina Pump

This pump is used to backwash the fluidic system. During sample processing, the pump is in Home position allowing Lamina to be directed into the Flow Cell.

Evacuation Pump

This pump is used to:

- aspirate the sample into the pipette
- evacuate liquids from the Flow Cell to the Waste Well
- draw Lamina into the Flow Cell when the Lamina Pump is in Home position.

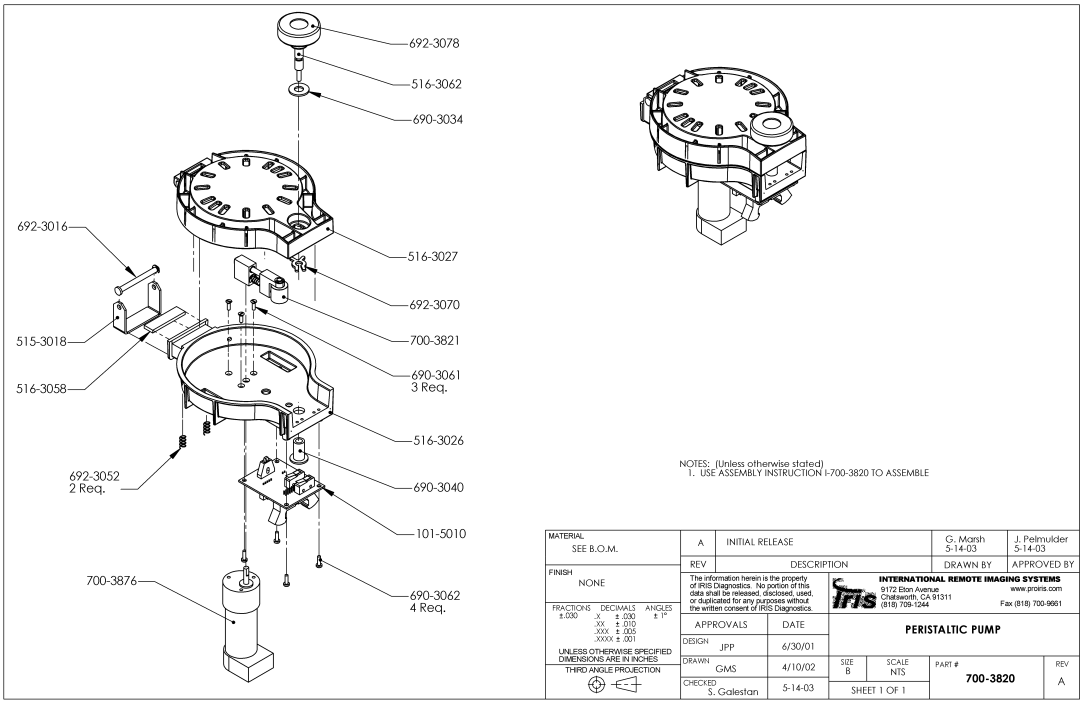
Pump Cover Closed and Cassette-In-Place Detection

Three switches are located on the Pump SIC for cover-closed detection, and for cassette-in-place detection.

The cover-closed detection senses the end of the shaft of the threaded knob that closes the pump cover. If the knob is not fully screwed, the pump will not run.

The Cassette-In-Place detection senses the presence of a small tab on the cassette indicating that the cassette has been inserted into the pump. If the tab is not detected, the pump will not run.

3. Components



Component drawings may change without notice. Please contact IRIS Diagnostics to determine the current revision level.

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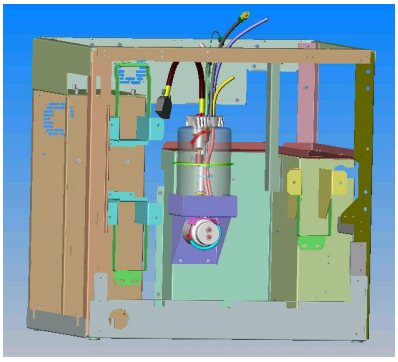
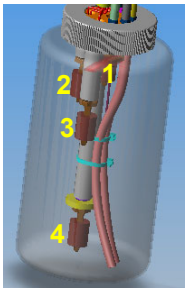
Lamina Tank # 700-3784



The Lamina Tank, located on a bracket above the air tank, is used as a reserve to avoid running out of Lamina. The Fill pump fills the Lamina Tank directly from the external Lamina container.

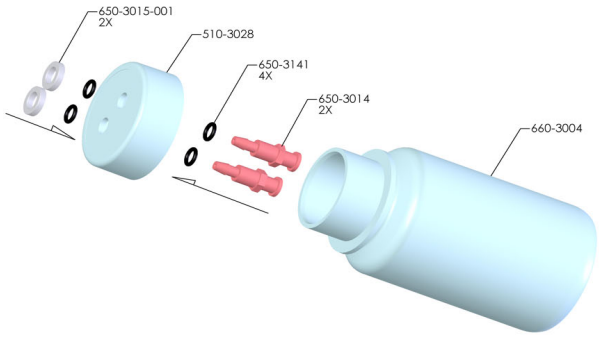
Four liquid level sensors are inside the Lamina tank. From top to bottom:



1. Overflow detector – when this level is reached, the Fill Pump stops filling the tank.
2. Refill detector – when this level is reached, the Fill Pump is activated to refill the tank.
3. Low-level detector – the external Lamina container is empty. An error message with medium priority is generated, sample processing continues.
4. Empty level detector – the external Lamina container is empty. An error message with high priority is generated; sample processing is stopped until a new container is installed.

Air Tank # 700-3802

The Air Tank maintains air pressure used for the air mixing of the specimen inside the sample tube before pipetting.



1. Assemble parts as shown and firmly screw Cap (510-3028) onto Bottle (660-3004). Gently tighten Lock Nuts (650-3015-001) using plier.

2. Perform Leak Test according to P-09-0039.

Notes:
1. Refer to P-09-0039 for Leak Test

MATERIAL: SEE B.O.M	A	Initial Release	
FINISH: NONE	REV	DESCRIPTION	DRAWN BY / APPROVED BY
FRACTIONS ±.030 · DECIMALS X ±.030, XX ±.010, XXX ±.005, XXXX ±.001 · ANGLES ±1°	APPROVALS	DATE	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DESIGN		
THIRD ANGLE PROJECTION	DRAWN		
	CHECKED		

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ASSEMBLY, 125ml AIR TANK

SIZE	SCALE	PART #	REV
B	1:2	700-3802	A

SHEET 1 OF 1

Component drawings may change without notice. Please contact IRIS Diagnostics to determine the current revision level.

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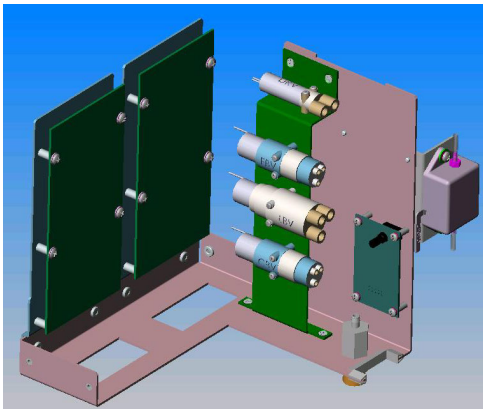
Valves



Solenoid Valves

Located inside the microscopy module, on the right of the Lamina Tank, from top to bottom:

Drain Valve # 700-3844

The Drain Valve is used to remove any air bubble present inside the Flow Cell.

Evacuation Bypass Valve # 700-3843

When this valve is opened, the Evacuation Peristaltic pump aspirates fluids from the drain outlet of the Flow Cell into the Waste Well.

When closed, the valve diverts the flow from the Evacuation Pump to the Waste Well.

Lamina Bypass Valve # 700-3842

When this valve is opened, Lamina goes to the Waste Well.

When closed, Lamina goes to the Flow Cell.

Cannula Bypass Valve # 700-3881

When this valve is opened, Lamina goes to the Flow Cell via the PBV.

When closed, Lamina goes to the Waste Well.

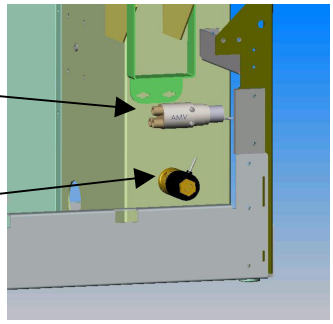
Pipettor Bypass Valve # 700-3880

Located on the Specimen Presentation Assembly. When this valve is opened, sample and/or Lamina go to the Flow Cell.

When closed, sample is aspirated in the flow line.

Air Valves

The Air Valves are located on the right front side of the instrument, underneath the Optical Bench Assembly.

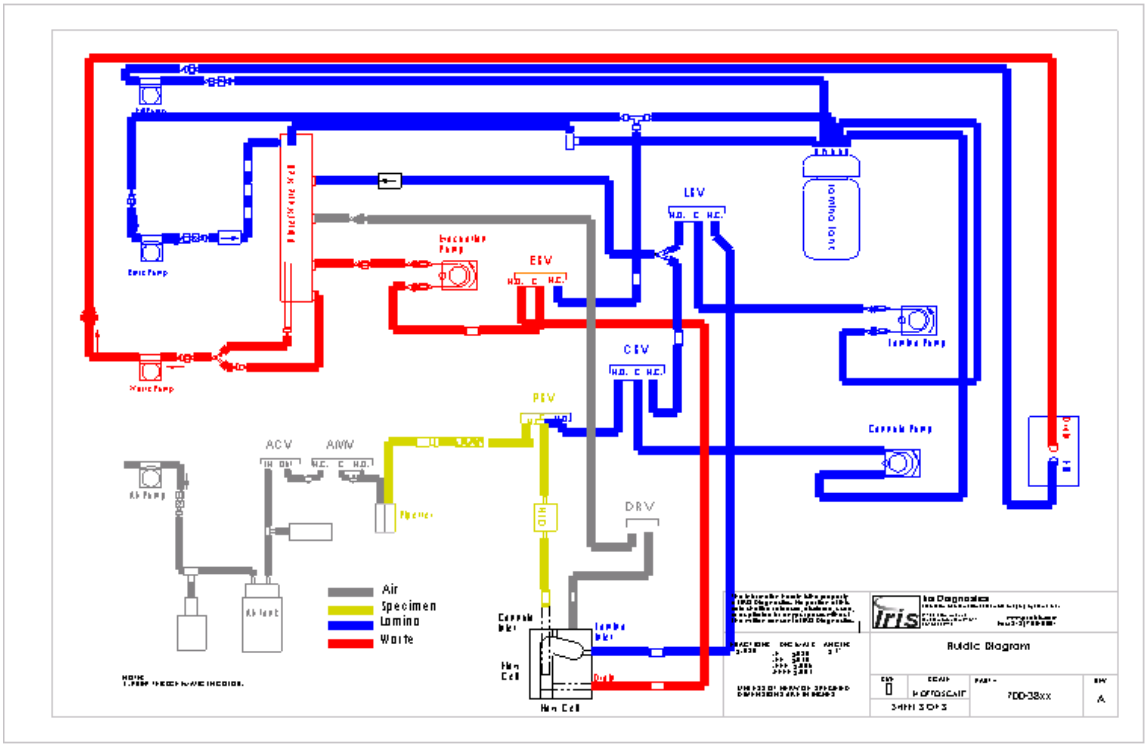


Air Mix Valve # 700-3887

The Air Mix Valve is used to mix the specimen inside the sample tube.

Air Charge Valve # 700-3888

The Air Charge Valve is used to refill the pressure in the Air Line for the mixing circuit.



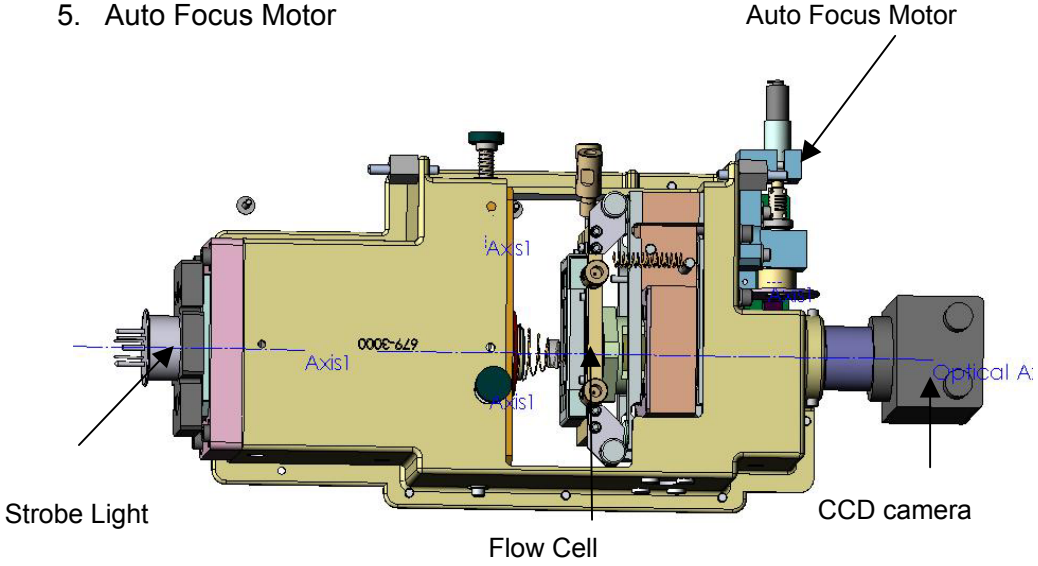
Optical Bench Assembly #700-3500

Sample is presented as a lamina sandwiched between enveloping layers of suspending fluid. The fluids pass into the Flow Cell in front of a microscope. The lamination positions the specimen exactly within the depth of focus and field of view of the objective lens of the microscope. A CCD (charged coupling device) video camera, connected to the microscope, captures five hundred frames per sample, as each microscopic field of view is illuminated by the flash of a strobe lamp. The resulting pictures are digitized and delivered to the Analysis Processor computer.

The Optical Bench Assembly (OBA) is a mechanical/electro-optical assembly that provides for the microscopic images of a transmissively-illuminated ultra-thin sheet of the specimen to be captured as a video image by the CCD camera. Three thermistors are mounted on different component parts of the OBA to check that the temperature is stable. When temperatures are changing, the sub-micron accuracy required for proper images requires re-focusing.

The mechanical part of the OBA includes:

1. Flow Cell
2. Strobe Light
3. CCD camera
4. 20 x Objective
5. Auto Focus Motor



Flow Cell # 525-3077

This precision assembly is where the thin sheet of liquid specimen is presented in a continuous flow microscope-slide manner for observation by the image capturing system. The sample is pulled into the Flow Cell by the Evacuation pump. Lamina encases the sample, keeping the specimen in thin sheet, and keeps the specimen away from the Flow Cell surfaces to minimize surface contamination.

Strobe Light # 065-0059

The strobe light provides short high-intensity, parallel-light strobe-light impulses on a controlled basis as illumination through the thin sheet of specimen. This subsystem includes a 400V to 1000V strobe power supply and a high intensity strobe flash tube.

CCD Camera # 700-3565

The CCD camera, coupled to the Microscope, takes magnified high-resolution digital pictures of the sample going through the Flow Cell.

20 x Objective # 220-3009

The objective magnified the sample going through the Flow Cell.

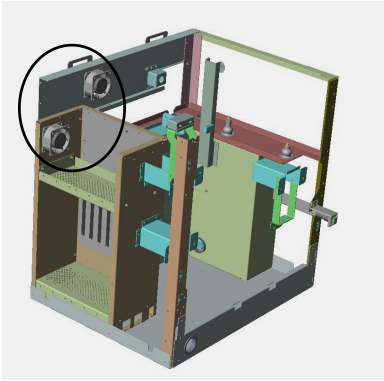
Auto Focus System # 700-3505

This mechanism allows moving the Flow Cell into the appropriate position where the thin specimen is focused for image capture. Focus position is achieved with an ultra-fine-pitch stepper motor providing a movement of about 0.2 microns per full step.

Power System Assembly # 230-3000

This assembly includes the international-voltage-range AC-line-to-DC converters to generate +24V and +5V regulated DC for the entire Microscopy Module, and the strobe power supply. The regulated voltages out of the Power system assembly are brought to the Power SIC through a 10-wire cable and a locking Molex connector.

Cooling Fans # 700-3892 & 700-3412



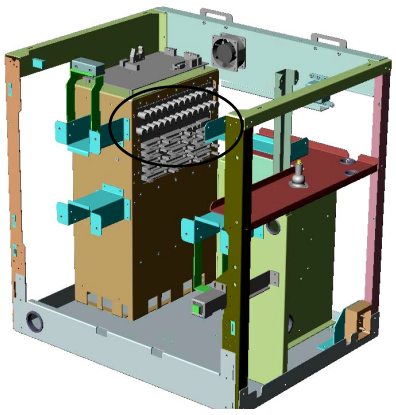
While the Microscopy Module is designed to operate with only natural convection, at higher ambient temperatures, it may be necessary to use some forced-air cooling.

Two fans are present: one in the cardcage area, and one in the main instrument area. These fans are turned on by +24V power switched on when the temperature sensed by a local thermistor goes above 34 ^{o}C ± 1^{o}C and switched off when the temperature goes below 29 ^{o}C ± 1^{o}C. These fans plug into individual 2-pin connectors on the Backplane.

Fuses and Visible LEDs

The fuses are quick-acting, miniature and pluggable. The fuse socket is soldered to the PCB and has a threaded plastic cap that mechanically retains the fuse. Three different fuse ratings are used:

- 0.50 A Iris 056-3000
- 1.0 A Iris 056-3004
- 2.5 A Iris 056-3001



The Backplane has 22 fuses and 22 visible red LEDs. Each LED is each associated with a power protection fuse, and the LED lights only when DC power is on (via the Power SIC) and the fuse is blown.

The fuses are mounted in two rows, with even number fuses on the top and odd numbered fuses on the bottom; fuse numbers increasing from left to right. The LEDs are mounted in a single row between the fuses, and each vertically aligned with its associated fuse.

Assignment of these Fuses and LEDs is given in the table below where the “Protects power through” column refers to the Backplane connector through which the protected power leaves the Backplane PCBA.

Note that three of the fuses have their power provided through SSMB circuits, and the LEDs will not light, even when the fuse is blown, if the corresponding SSMB is not plugged into the Backplane.

Backplane Fuses and LEDs

Fuse & LED	Fuse Rating	Protects power through	Voltage and Function Protected
F3 D3	0.50A	J19	+5V SPA SIC
F4 D4	2.5A	J20	+24V Sampler measurement stepper (through SSMB1)
F5 D5	2.5A	J20	+24V Sampler front stepper (through SSMB1)
F6 D6	0.50A	J23	+5V Pump SIC: Lamina Pump, STM SIC
F7 D7	0.50A	J22	+5V Pump SIC: Cannula Pump
F8 D8	0.50A	J21	+5V STM Sampler
F9 D9	0.50A	J14	+5V OBA power
F10 D10	1.0A	J11	+24V Rear Panel SIC power
F11 D11	2.5A	J18	+24V Do-All SIC power
F12 D12	0.50A	J18	+5V Do-All SIC power
F13 D13	0.50A	J11	+5V Rear Panel SIC power
F14 D14	0.50A	J21	+24V Sample Transport Module SIC power

Fuse & LED	Fuse Rating	Protects power through	Voltage and Function Protected
F15 D15	0.50A	J14	+24V OBA focus stepper power (through SSMB2)
F16 D16	0.50A	J10	+5V Status Board power
F17 D17	0.50A	J12	+5V FSV SIC power
F18 D18	0.50A	J13	+5V Barcode Reader power
F19 D19	1.0A	J12	+24V FSV SIC power
F20 D20	0.50A	J17	+5V Pump SIC: Evacuation Pump
F21 D21	0.50A	J24, J25	+24V Fan power
F22 D22	0.50A	J16	+5V Power SIC Camera Circuits power
F23 D23	2.5A	J16	+24V Strobe Power Supply power
F24 D24	1.0A	J16	+24V Camera 24VDC to 12VDC Inverter power

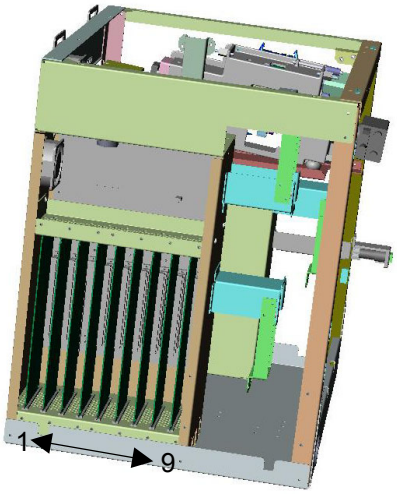
PCBA Summary

Many of the boards have LEDs indicating dynamic operating status of the board and its controlling firmware.

Item No	Board name or Sub assembly	Number	# in system	Location
1	HLCB	101-5000	1	Card cage
2	MSCB	101-5001	4	Card cage
3	DCVB	101-5043	2	Card cage
4	SSMB	101-5007	2	Card cage
5	Backplane	101-5003	1	Card Cage
6	SPA SIC	101-5004	1	Behind SPA
7	Pump SIC	101-5010	3	Behind Peri-pump
8	OBA SIC	101-5053	1	Side of Optical bench
9	STM SIC	101-5014	1	Above pumps left panel
10	Pressure Transducer Board	101-5016	2	Valves mounting next to optical bench
11	Power SIC	101-5020	1	Above cardcage
12	Rear Panel SIC	101-5030	1	Behind backplane
13	SM Status Board	101-5032	1	Top left front panel
14	STD Board	101-5034	1	Inside tube detector
15	FITD	101-5041	4	Waste well – pressure transducer
16	FSV SIC	101-5045	1	Right board behind lamina container
17	Do-All SIC	101-5046	1	Left board behind lamina container
18	Waste Well Electrode Board	101-5047	1	Waste well
19	ESN Board	101-5049	42	
20	SPA Opto Board	101-5052	1	SPA
21	Lamina ESN Bd	101-5048	1	Inside lamina container
22	Waste Well FITD	101-5054	1	Waste well
23	OBA Focus Home	101-5055	1	Above CCD camera

Cardcage

The Microscopy Module control center is the cardcage, and is composed of the Microscopy Module backplane, assembly number 101-5003, and nine circuit boards (called the **Cardcage boards)**. The backplane has nine 120-pin DIN connectors into which the Cardcage boards plug. The color of the card guides for each slot position identifies the type of board required in the slot—the color of the board's plastic card ejector should match the color of the card guide. There are also 16 other connectors on the backplane for interface to the rest of the SMCS system.



High Level Control Board (HLCB), # 101-5000

The HLCB, located in slot #1, is the highest level controlling entity in the Microscopy Module. It includes the Master Controller, six high-level controllers, and the FQM low-level controller that itself controls a multi-point scanner. There is **one** HLCB with **white** card ejectors.

Motor/Scanner Control Board (MSCB), # 101-5001

The MSCB provides low-level closed-loop control over two independent DC motor/encoders and a multi-point scanner. There are **four** MSCB boards with **blue** card ejectors. They are interchangeable.

- Slot 2 Sample Presentation Assembly
- Slot 3 Sample Presentation Assembly
- Slot 6 Fluidic block
- Slot 7 Sample Transport Module (sampler)

DC Valve Board (DCVB), # 101-5043

The DCVB provides control for solenoid-operated valves, and includes the ability to electrically measure activation and release operation of the valves being controlled. There are **two** DCVB boards with **green** card ejectors. They are interchangeable.

- Slot 4 Sample Presentation Assembly
- Slot 5 Fluidic block

Stepper/Scanner/Motor Board (SSMB), # 101-5007

The SSMB, located in slots 8 and 9, provides control for two stepper motors, low-level closed-loop control DC for one DC motor/encoders, and a multi-point scanner. There are **two** SSMB boards with **yellow** card ejectors. They are interchangeable.

- Slot 8 Sample Transport Module (sampler)
- Slot 9 Optical Bench Assembly

Backplane # 101-5003

Except for power and signal distribution, analog input signal EMI filtering, protection of power, and fuse status resistor divider networks, the backplane has no other function. It has no active elements.

Backplane SMCS Interconnect Connectors

Connector	Type	Connects to	Function
J10	20-pin ribbon header	SM Status Board J1	SM Status Board signals
J11	26-pin ribbon header	Rear Panel SIC J5	Rear Panel SIC
J12	40-pin ribbon header	FSV SIC J1	FSV Valve interface
J13	10-pin ribbon header	Barcode Reader	Bar Code Reader
J14	20-pin ribbon header	OBA SIC J1	OBA signals
J15	10-pin ribbon header	Power SIC J3	Strobe PIC control
J16	14-pin Molex receptacle.	Power SIC J2	Power to/from Power SIC
J17	20-pin ribbon header	Evacuation Pump SIC J1	Evacuation Pump
J18	40-pin ribbon header	Do-All SIC J1	Do-All SIC signals
J19	34-pin ribbon header	SPA SIC J1	SPA SIC signals
J20	16-pin ribbon header	STM SIC J12	STM Motor signals, STM J02
J21	34-pin ribbon header	STM SIC J11	STM Optical signals, STM J01, STM STD, diaphragm pumps, STM tether ESN, Barcode reader ESN tether.
J22	20-pin ribbon header	Cannula Pump SIC J1	Cannula Pump
J23	20-pin ribbon header	Sheath Pump SIC J1	Sheath Pump
J24	2-pin receptacle.	Cardcage Fan	Cardcage fan
J25	2-pin receptacle.	Main SM Fan	Main SM fan

Signal Interface Concentrators (SICs)

While the SMCS cardcage is the central brains of the SMCS, the control and monitor signals of the SMCS must reach the electrical hardware that it is measuring and controlling. To achieve this signal distribution, the SMCS includes many "Signal Interface Concentrators' PCBAs (**SIC**s) located throughout the SM.

The SICs provide a local place where the individual elements of the particular subsystem of the SM have their electrical signals "concentrated." In some cases, there is ESN capability on the SICs.

Power SIC # 101-5020

The Power SIC provides a controlled interface between the DC power supply, and the rest of the SMCS. It also provides controlled power to the Strobe. The Power SIC is mounted atop the SMCS Cardcage, and interfaces to backplane connector J15 through a 10-wire ribbon connector, and to backplane connector J16, a 14-wire discrete wire connector with large gauge wires carrying the actual power signals. The Power SIC receives power directly from the DC Power supply via another 10-pin discrete wire connector. It also provides 12-volt regulated power to the CCD camera. The power delivered to the Cardcage (and the rest of the SMCS) is switched off and on by a logical signal from the SM front panel "Standby" switch.

The Power SIC connectors are summarized in table below.

Connect.	Type	Connects to	Function
J1	10-pin discrete female header Molex MiniFit Jr	Power Supply DC terminals Cable, P1	Unswitched regulated power from power supply
J2	12-pin discrete female header Molex MiniFit Jr	Cable to Backplane, J16	Switched/Fused power to/from backplane
J3	10-pin ribbon header w/locks	Cable to Backplane, J15	OBA SIC PIC16 control
J4	5-pin discrete header	Cable to Video Camera	Power to camera, sync from camera
J5	6-pin discrete header	Cable to Strobe power supply	Strobe power, strobe trigger
J6	3-pin discrete header	Cable to SM front panel standby-switch	SMCS power off/on logic control, +24V to indicator LED in switch
J202	20-pin shrouded ribbon header	(test programming cable)	PIC programming during test
J203	10-pin shrouded ribbon header	(test diagnostic cable)	Quad RS-232 driver bd (test & diagnostics)

Pump SIC #101-5020

The Pump SIC concentrates the signals from the elements of a peristaltic pump assembly, including: the DC pump motor, its rotation encoder, the home detect optical sensor, a cassette-in-place switch and a pair of cover-closed switches. The signals from a Pump SIC connect to the SMCS backplane through a 20-wire ribbon cable. The three Pump SICs in the SMCS:

1. Evacuation Pump assembly, connected into backplane connector J17,
2. Cannula Pump assembly, connected into backplane connector J22,
3. Sheath Pump assembly, connected into backplane connector J23.

The Pump SIC connectors are summarized in table below.

Connect.	Type	Connects to	Function
J1	20-pin ribbon header	Backplane: J17 (Evacuation pump) J22 (Cannula pump) J23 (Lamina pump)	Main signals to SMCS for: Evacuation pump, Cannula pump, or Lamina pump
J2	12-pin female ESN	DC motor and encoder assy, P1	Motor and Encoder signals

FSV SIC # 101-5045

The Fluid System Valve (**FSV**) SIC concentrates the leads from up to 12 solenoid valves that operate the fluid system. The signals are brought to SMCS backplane J25 through a 40-wire ribbon cable. The FSV SIC is mounted alongside the Do-All SIC on the Fluid System Valve Assembly.

The FSV SIC connectors are summarized in table below.

Connect.	Type	Connects to	Function
J1	40-pin ribbon header	Backplane J12	Main signals to SMCS
J2	12-pin female ESN	Monitored Valve #1 P1	DCVB1 Valve #1 (Stain option)
J3	12-pin female ESN	Monitored Valve #2 P1	DCVB1 Valve #2
J4	12-pin female ESN	Monitored Valve #3 P1	DCVB1 Valve #3
J5	12-pin female ESN	Monitored Valve #4 P1	DCVB1 Valve #4
J6	12-pin female ESN	Monitored Valve #5 P1	DCVB1 Valve #5
J7	12-pin female ESN	Monitored Valve #6 P1	DCVB1 Valve #6
J8	12-pin female ESN	Monitored Valve #7 P1	DCVB2 Valve #1
J9	12-pin female ESN	Monitored Valve #8 P1	DCVB2 Valve #2
J10	12-pin female ESN	Monitored Valve #9 P1	DCVB2 Valve #3
J11	12-pin female ESN	Monitored Valve #10 P1	DCVB2 Valve #4
J12	12-pin female ESN	Monitored Valve #11 P1	DCVB2 Valve #5
J13	12-pin female ESN	Monitored Valve #12 P1	DCVB2 Valve #6
J14	12-pin female ESN	+24V discrete #1 P1	MSCB2 +24V drive #3 and MSCB3 +24V drive #3
J15	12-pin female ESN	+24V discrete #2 P1	MSCB2 +24V drive #4 and MSCB3 +24V drive #4
J16	12-pin female ESN	+24V discrete #3 P1	MSCB2 +24V drive #5 and MSCB3 +24V drive #5

SPA SIC # 101-5004

The SPA SIC incorporates signals from the SPA. It is mounted directly to the SPA assembly. It has two 12-pin ESN connectors for the interface to the two DC motors/encoders (rotational and vertical) of the SPA, an ESN connector for the bottom vertical limit sensor, a 10-pin ribbon header for connection to the SPA Optical Board (for detection of rotational limits and vertical top limit), an ESN connector for the crash detection assembly, and a final ESN connector for a tethered ESN to the entire SPA assembly. The interface from the SPA SIC to SMCS backplane J19 is through a 34-wire ribbon cable.

SPA SIC Visible LEDs

The SPA SIC has 7 visible LEDs though which an observer can deduct operational status of the SPA. The LEDs are identified in table below.

Item	LED legends	LED color	# LEDs
Vertical Motor Encoder Signals	Rot A, Rot B	Green	2
Horizontal Motor Encoder Signals	Rot A, Rot B	Green	2
Crash Status	Vert OK	Green	1
Crash Status	Vert Crash	Red	1
Motors Disabled	Motors Disabled	Red	1

SPA SIC Push-Button Switches

There is a single push-button on the SPA SIC that manually resets the Hard Crash condition if the incoming Hard Crash signal (from the Hard Crash switch on the SPA arm) is no longer asserted.

Connect.	Type	Connects to	Function
J1	34-pin ribbon header	Backplane J19	Main signals to SMCS
J2	12-pin female ESN	SPA Assy Tether ESN	SPA Assy ESN
J3	12-pin female ESN	SPA Vertical Motor ESN	SPA Vertical Motor ESN, DC motor and encoder
J5	12-pin female ESN	SPA Rotation Motor ESN	SPA Rotation Motor ESN, DC motor and encoder
J6	12-pin female ESN	SPA Bottom Sensor switch ESN	SPA Bottom Sensor ESN and switch
J7-J9	(designators not used)		
J10	10-pin ribbon header	SPA Opto Bd	SPA vertical & rotational homes and other limit.

OBA SIC #101-5053

The OBA (Optical Bench Assembly) SIC incorporates all of the signals from the optical bench. The interface to SMCS backplane J14 is through a 20-wire ribbon cable (J1). The OBA SIC translates the unipolar stepper drive signals from the SSMB to bipolar drives suited for the micro-stepper used in the OBA. The OBA SIC reads the sense signals from the stepper motor assembly to limit movement in the event of reaching a motion limit in one direction or the other. The OBA SIC is physically mounted on the OBA.

The OBA SIC connectors are summarized in table below.

Connector	Type	Connects to	Function
J1	20-pin ribbon header	Backplane J14	Main signals to SMCS
J2	12-pin female ESN	Focus Stepper Motor P1	Stepper Motor Phase Coils
J6	12-pin female ESN	OBA thermistors P1	OBA ESN
J7	12-pin female ESN	Camera tethered P1	Camera tethered ESN
J8	12-pin female ESN	Strobe Trigger Unit tethered P1	Strobe Trigger Unit tethered ESN
J9	12-pin female ESN	Strobe Bulb tethered P1	Strobe Bulb tethered ESN
J10	12-pin female ESN	Strobe Power Supply tethered P1	Strobe Bulb tethered ESN
J11	12-pin female ESN	Flow Cell tethered P1	Flow Cell tethered ESN
J12	12-pin female ESN	Focus Position Optical Sensors P1	**Iris config.**: Dual opto-focus home. **Newport config.**: end limits for linear actuator.

Do-All SIC # 101-5046

The Do-All SIC is used for interfacing to SMCS backplane J18 through a 40-wire ribbon cable, and providing a concentrating place for the cables to all of the SMCS pressure transducers, the FITDs. The Do-All SIC is mounted alongside the FSV SIC on the Fluid System Valve Assembly.

The Do-All SIC connectors are summarized on the table below.

Connect.	Type	Connects to	Function
J1	40-pin ribbon header	Backplane J18	Main signals to SMCS
J2	10-pin ribbon header	Pressure Transducer #1	Pressure Transducer #1
J3	10-pin ribbon header	Pressure Transducer #2	Pressure Transducer #2
J4	10-pin ribbon header	Pressure Transducer #3	Pressure Transducer #3
J5	10-pin ribbon header	Pressure Transducer #4	Pressure Transducer #4
J6	12-pin female ESN	FITD #1 P1	spare FITD or +5V input device
J7	12-pin female ESN	FITD #2 P1	spare FITD or +5V input device
J8	12-pin female ESN	FITD #3 P1	Specimen FITD
J9	12-pin female ESN	FITD #4 P1	Waste Well FITD
J10	12-pin female ESN	Spare #1 device P1	Spare #1 FITD or +5V input device
J11	12-pin female ESN	Spare #2 device P1	Spare #2 FITD or +5V input device
J12	12-pin female ESN	Spare #3 device P1	Spare #3 FITD or +5V input device
J13	12-pin female ESN	Spare +24V drive #1 P1	Spare +24V drive #1
J14	12-pin female ESN	Spare +24V drive #2 P1	Spare +24V drive #2
J15	12-pin female ESN	Spare +24V drive #3 P1	Spare +24V drive #3
J16	12-pin female ESN	Spare +24V drive #4 P1	Spare +24V drive #4

Rear Panel SIC # 101-5030

The Rear Panel SIC provides the signal interface from the SM to the external world through three DB9F connectors. It has in internal interface to the internal Lamina Container level sensor. It provides an ESN connector for the cooling fan, and a tethered ESN for identifying the SMCS power supply. It connects to backplane connector J11 through a 26-wire ribbon cable (J1).

STM SIC # 101-5014

The STM SIC provides an interconnect capability between the two built-in cables from the Arkray STM to the Microscopy Module. It interfaces to the cardcage backplane connectors J20 and J21. It is also the interface point for the diaphragm pumps of the Microscopy Module, the Specimen Tube Detector (mounted on the STM), and the tethered ESNs for the STM and for the Barcode Reader.

Other PCBAs

ESN Board # 101-5049

The ESN board is a very small PCB that includes a male 12-pin connector on one side, and a 256-byte EEPROM on the other. On the EEPROM side of the PCB, there are also 8 PCB solder pads for interconnecting the signals from external devices (generally, the devices being identified by the ESN), through the 12-pin connector to the mating board onto which the ESN board is plugged. The ESN PCBAs are always part of some other sub-assembly, either by being wired to the sub-assembly (through wires on 2 or more of the ESN PCB solder pads), or by being tethered.

Lamina ESN # 101-5048

The Lamina ESN is used as part of the Lamina Container Assembly for interfacing (and identifying) the float sensor switches of that assembly. It provides for three of the four switches on the Lamina Container Assembly to be summed through a weighted resistor network for a pseudo-analog level detection scheme.

FITD PCBA # 101-5041

The PCB of this assembly is incorporated into two different subassemblies for detecting the presence of water-based fluids in its proximity.

SM Status Board PCBA # 101-5032

The SM Status board is both a display panel providing a user visual interface and covers interlock switches for the top cover and the front access door. It interfaces to SMCS backplane J10 through a 20-wire ribbon cable.

STD PCBA # 101-5034

The Specimen Tube Detector board is a small electro-optics assembly that is part of the Specimen Tube Detector. It senses the presence of a specimen test tube at the STM test station. It has a 6-pin connector for interface to the STM SIC.

Pressure Transducer Board #101-5016

The Pressure Transducer board is mounted to a pressure transducer and a signal-conditioning amplifier to provide a pressure signal from a liquid or air medium. The board electrical interface is via an integral 10-pin ribbon cable. The Air Storage pressure transducer connects to J2 of the Do-All SIC.

SPA Optical Board # 101-5052

This board supports three optical interrupters, and is mounted on the top of the SPA assembly. Two of the interrupters are for the SPA arm rotation movement home and forward limit detections, and the third is for the Vertical movement (top) home detection.

LED Visual Indicators

LED visual indicators are used throughout the SMCS to provide local indication of status. LEDs will be red, green, and yellow (or amber). Generally, the red LED will indicate a fault condition, and the yellow LED will indicate a “caution” condition.

1. On the Cardcage boards, the LEDs are positioned in two rows at the front edge of the board where they are viewed normal to the board’s surface, but they can be seen in a front view of the card cage by viewing slightly towards the component side of the PCBs.
2. On the SMCS backplane, they are located in the area above the connectors, generally non-obscured by the cables connected to the backplane. All of the LEDs on the backplane are red, and indicate which (if any) of the 22 fuses are blown.
3. On the various remote circuit boards, they are appropriately placed for the application.

4

Adjustments

Accessing the Service Screen

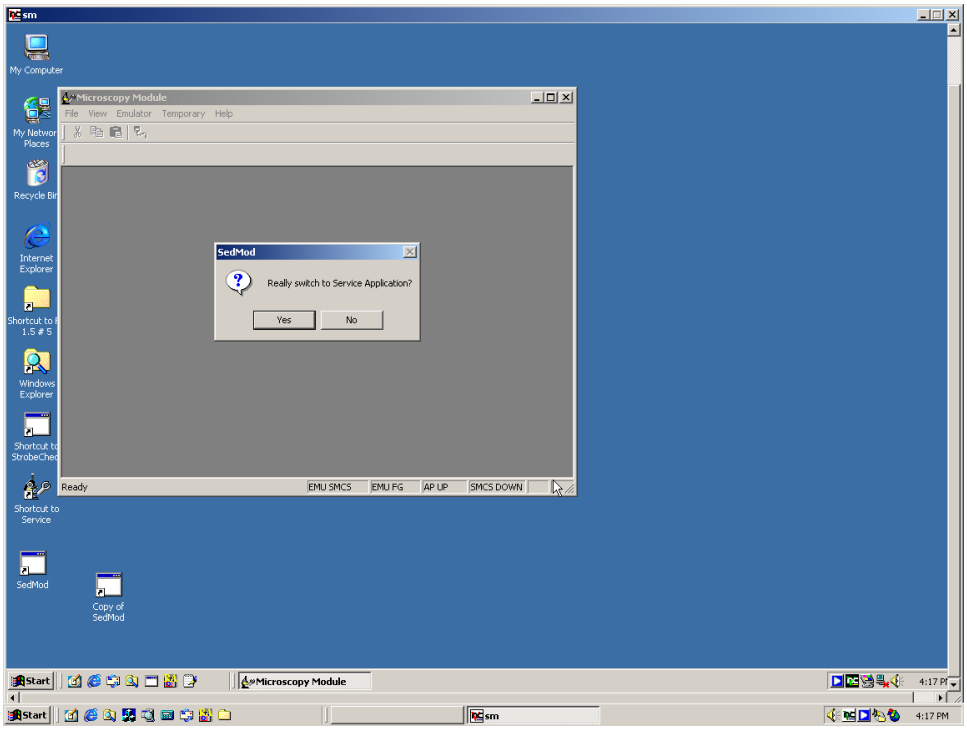
Press the Windows key on the keyboard (located between Ctrl and Alt keys). The Windows toolbar will be displayed at the bottom of the screen.

Using the mouse, select **Programs** – **VNC** – **Run VNC Viewer**.

Left click the mouse to start VNC Viewer. Select **SM** as VNC server, and then click **OK**. Enter the password: **iris2k1** (lowercase), then click **OK**.

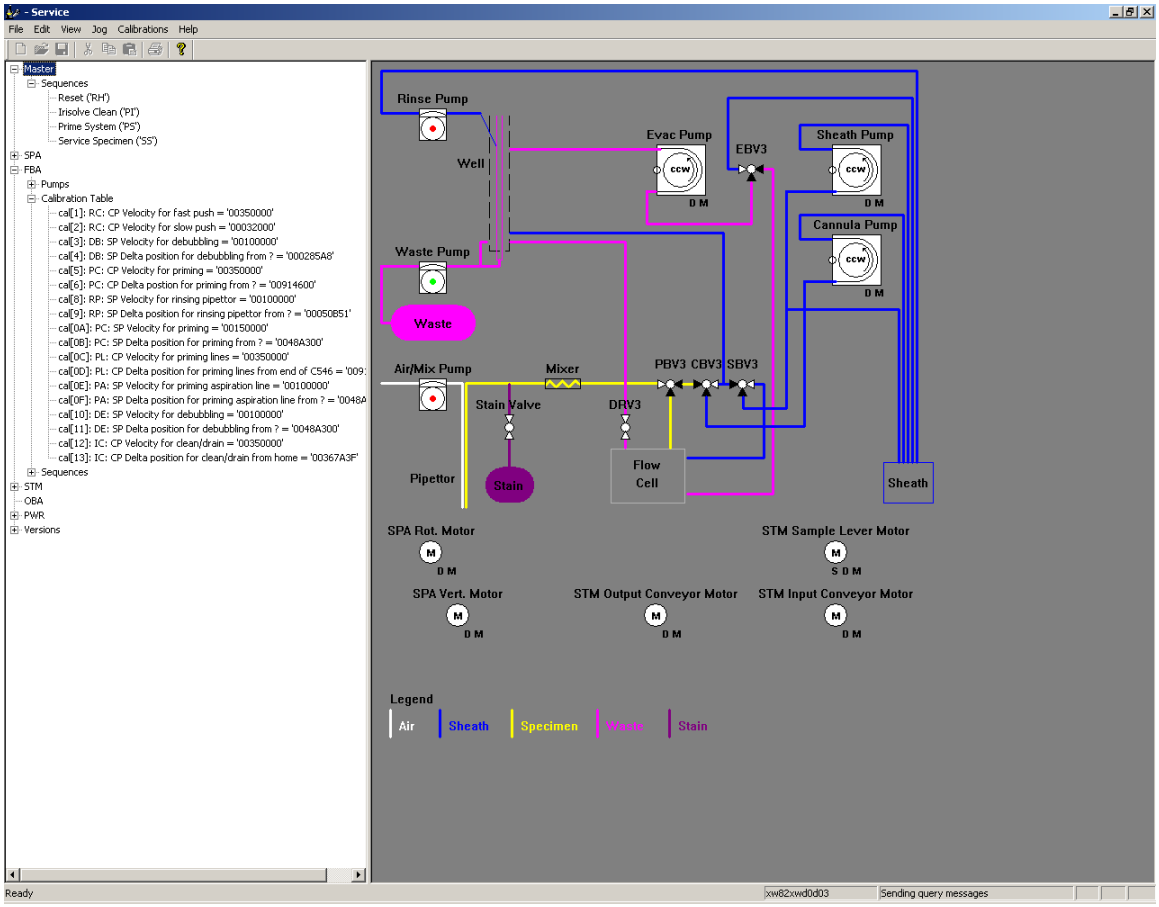
The screen will display the SM computer desktop. The Microscopy Module window will be open.

From the **Microscopy Module** toolbar, select **File** – **Switch to Service Application**.



Select **Yes** to switch to Service Application. After about 1 minute, the **Service Screen** will be displayed.

4. Adjustments



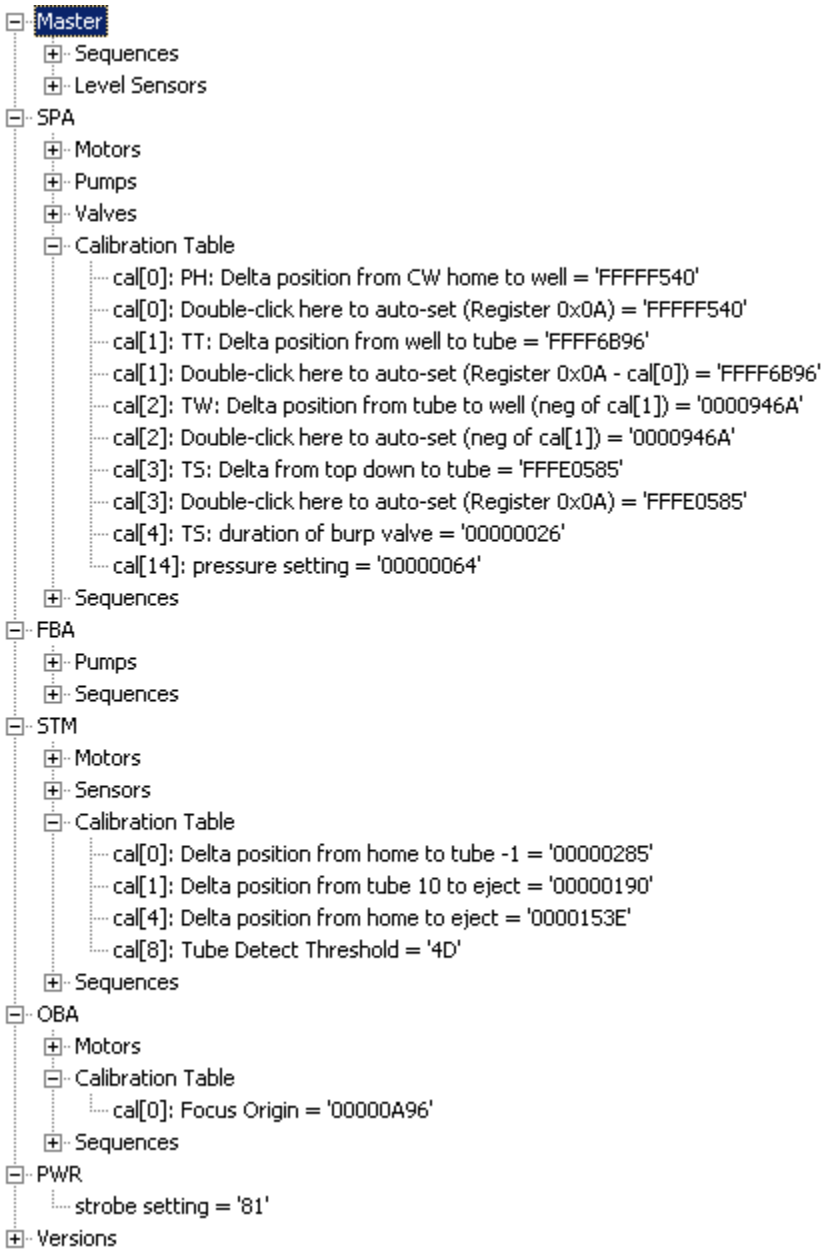
Calibration Table

The tree displays relevant calibration table entries. Each entry indicates its calibration table position as well as its purpose and often the sequence from which it's activated (e.g., "cal[1]: RC: CP Velocity for fast push" indicates calibration table index 1, activated from sequence "RC", purpose "Velocity for fast push"). In general, if you double-click on a calibration table entry you will be prompted for a new value to set.

Calibration Auto-Sets

In some cases there is more than one item in the tree for a given calibration table entry. In such cases, the second entry provides a more convenient way to set the value. The label indicates what the shortcut will do; double-click on the shortcut to perform the action. For example, "cal[1]: Double-click here to auto-set (Register 0x0A - cal[0])" will set calibration table entry 1 to the difference of register 0x0A and calibration table entry 0. See Register 0x0A.

4. Adjustments



Sampler Calibration

The purpose of this calibration is to properly set the location of the #1 test tube rack position. The locations of tubes #2 through #10 are automatically computed and do not need calibration.

Material required

Normal control rack with rubber tube rest removed from tube position 1.

Procedure

1. Start Service Application, then power up the iQ200.
2. Place the control rack on the left side of the Sample Transport Assembly.
3. Open the "**STM**" from the Service Application menu tree then "**Sequences**" then double click "**Initialize Rack ('M1')**" then "**OK**". (The Sampler presents the test tube rack to a position BEFORE the actual #1 position)
4. From the Service Application menu tree under (**STM, Sequences**) select double click "**Move Next**" **('MN')**" then "**OK**". After the MN command is executed the test tube rack should be in front of the Specimen Tube Detect tube position 1)
5. The hole in the bottom of tube position 1 should be centered over the floor plates of the Sampler.
   a. If the hole is aligned directly in the center of the floor plates, no further calibration is required.
   b. If the hole has stopped short of or passed over the floor plate edges, a new calibration value must be entered.
6. To change the calibration value, go to the **STM**'s Calibration branch and double click on "**Delta position from home to tube –1=XXXXX**". The position is controlled by Table Index "XP 00" which is set to a value of "00000280". Re-set this value higher or lower depending on the position desired.

Note: Value "00000275" will position the rack short of the original value, "00000285" will move the rack further than the original value.

Specimen Tube Detector Alignment

Material required

Routine rack with retaining clip on #1 position.
One glass 16 x 100mm test tube with blank label with vertical centerline drawn on it.

Procedure

1. Start Service Application, then power up the iQ200.
2. Insert the tube with white label and vertical centerline drawn on it, making sure it is correctly positioned in the rack. Place the Routine Rack on the right side of the Sampler.
3. From the Service Application menu, click on "**STM**" then "**Sequences**" then double click "**Initialize Rack ('M1')**" then "**OK**" to activate the Sampler and present the test tube rack to a position BEFORE the actual #1 position.
4. Double-click on "**MN**" ("move next" command presents the rack to the #1 tube position).
5. Verify that the tube detector's red spot is centered on the tube's centerline. Physically adjust the tube detector if necessary:
   a. Loosen the four retaining screws.
   b. Adjust the STD position until the red spot is centered on the line.
   c. Tighten the four retaining screws to secure the STD.

Specimen Tube Detector Calibration

The purpose of this calibration is to set the tube detect sensitivity of the Specimen Tube Detector. The Specimen Tube Detector is an electro – optical device used to detect the presence of a specimen tube in the tube rack. The STD emits a beam of light directed at the #1 tube position, which reflects off the surface of the tube back to a collector in the STD. The intensity of the reflected beam is converted to a hexadecimal value. This value is compared to the pre-set threshold value. If the value is above the threshold, the software assumes a tube is present.

Note: Make sure the Sampler calibration has been performed **BEFORE** calibrating the Specimen Tube Detector.

Material required

Routine rack with retaining clip on #1 position.
One glass 16 x 100mm test tube with blank label with vertical centerline drawn on it.

Procedure

1. Start Service Application, then power up the iQ200.
2. Insert the tube with white label and vertical centerline drawn on it, making sure it is correctly positioned in the rack. Place the Routine Rack on the right side of the Sampler.
3. From the Service Application menu, click on "**STM**" then "**Sequences**" then double click "**Initialize Rack ('M1')**" then "**OK**" to activate the Sampler and present the test tube rack to a position BEFORE the actual #1 position.
4. Double-click on "**MN**" ("move next" command presents the rack to the #1 tube position).
5. Verify that the tube detector's red spot is centered on the tube's centerline. Physically adjust the tube detector if necessary:
   a. Loosen the four retaining screws.
   b. Adjust the STD position until the red spot is centered on the line.
   c. Tighten the four retaining screws to secure the STD.
6. Double-click on "**MN**", then **OK** to move to the next empty position.
7. From the Service Application menu, click on "**STM**" then "**Sensors**" then double-click "**tube detect (raw)**"
8. Record the value for no tube position.
9. Use the **hexadecimal** calculator to compute the new threshold value: (no tube data) + 10.
10. From the Service Application menu, click on STM's "**Calibration Table**", then click on "**Tube Detect Threshold**", enter the calculated value and click "**OK**".

Specimen Presentation Assembly (SPA) and Waste/Rinse Well Calibration

This procedure describes the steps necessary to calibrate the SPA module and the Waste Well with respect to each other and the #1 tube position of the Sampler.

Note: Make sure the Sampler calibration have been performed **BEFORE** calibrating the Specimen Tube Detector.

Material required

Normal Specimen Rack with test tube in position #1.

Procedure

Waste Well Positioning

1. Start Service Application, then power up the iQ200.
2. Insert a Normal Specimen rack with a standard glass tube in position #1 and place the rack on the right side of the sampler.
3. From the Service Application menu tree, open **SPA** and then open the **SPA's Calibration table.**
4. From the top windows tool bar click **Jog**.
5. Select **SPA Vertical Jog** (The Velocity window will appear)
6. From the Velocity window, select **Home** then **OK**.
7. From the top windows tool bar click **Jog**.
8. Select **SPA Rotational Jog** (The Jog Velocity window will appear)
9. From the Jog Velocity window, select **Home** then **OK**.
10. From the top windows tool bar click **Jog**.
11. Select **SPA Rotational Jog** (The Jog Velocity window will appear)
12. Using the up down arrows on the keyboard, center the pipettor over the Waste Well and click **Home** then "**OK**".
13. From the Service Applications menu tree **SPA Calibration table** Double click on "**cal[0] Double-click here to auto-set** the new waste well calibration value.
14. Click **YES** to confirm. Your new calibration value has now been set.

    To verify proper setting. From the **SPA** menu tree open **Sequences** and select "**Pipettor Home** ('PH') and then **OK** to execute. Verify the pipette tip is centered over the Waste Well.

15. Open the **STM** branch from the Service Application menu tree,
16. Open **Sequences** and double click "**M1"** and click **OK** to execute the command. This positions the rack in its initialized position.

17. Double click on the "**MN"** command under the STM Sequence and then **OK** to execute.

NOTE: This should position the test tube located in position 1 into the correct sampling position. If not recalibrate the **STM**.

Test Tube Centering Position

1. From the top windows tool bar click **Jog**.
2. Select **SPA Rotational Jog** (The Velocity window will appear)
3. From the Velocity window, select **Home** then **OK**.
4. From the top windows tool bar click **Jog**.
5. Select **SPA Rotational Jog** (The Velocity window will appear)
6. Using the up down arrows on the keyboard, center the pipette over the center of test tube located in position #1 and then click **Home** then "**OK**".
7. From the SPA calibration table Double click on **cal[1]:Double-click here to auto set** to store test tube #1's new calibration value.
8. Click **YES** to confirm. Your new calibration value has now been set.

From the Service Application menu tree, under **SPA Sequences** double click on "**Pipettor Home** ('PH'). Click **OK** to Execute and verify the pipette tip is centered over the Waste Well. Double click on "**To Tube ('TT')**" and click **OK** to execute and verify the pipette tip is centered directly over the center of test tube #1.

Test Tube Depth Positioning

1. From the top windows tool bar click **Jog**.
2. Select **SPA Vertical Jog** (The Velocity window will appear)
3. Using the up down arrows on the keyboard, lower the pipette into the test tube until it's 3mm from the bottom of the tube (the test tube can be lifted to determine the distance the pipette is from the bottom of the tube) then click **Home** then "**OK**". .
4. From the Service Applications menu tree SPA Calibration table Double click on **cal[3]:Double click here to auto set** (Register 0x0A='XXXXXXXX".
5. Click **YES** to confirm. Your new calibration value has now been set.

Air Pressure Calibration

Material required

Calibrated air pressure gauge
16 x 100 mm round bottom glass tubes
Iris Diluent

Procedure

1. Remove the shield to access the front of the instrument.
2. Insert a T fitting between the air pressure pump line and the air pressure bottle (black connector).
3. Run a line from the T fitting to a calibrated air pressure gauge.
4. Place a tube with 6mL of Diluent in a rack.
5. Place the rack on the right side of the sampler and press GO. The air system pressurizes during the fluid wash procedure.
6. Read the air pressure on the air pressure gauge following the sample cycle. The air pressure should be between 12 and 13psi.
7. If the air pressure needs to be adjusted, proceed with the following steps:

   If the Service Application is at Rev 1.1 or higher:

   a. Start the Service Application.
   b. Under the **SPA Calibration**, adjust the **Pressure Setting** value (Cal 14).
   c. Repeat steps 4 through 6 until the air pressure reading on the gauge is within the acceptable range.

   If the Service Application is before Rev 1.1:

   a. Call Technical Services for assistance.
8. Process several samples after the adjustments have been made:
   a. When the pipette descends into a sample tube, the pipette releases a single large bolus of air. The sample will shoot up inside the tube to about 1 cm from the top of the tube.
   b. If the sample overflows the top of the tube, decrease the air pressure.
9. Acceptance criteria:
   a. Air pressure: 12 to 13psi.
   b. Height of sample in tube during mixing: < 1cm from the top of the tube.

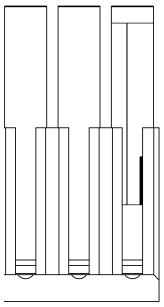
Barcode Reader Alignment

NOTE: The light beam from the Barcode Reader is of low intensity and usually difficult to see. Reducing the ambient light will increase the visibility of the beam.

Material Required

Routine Rack
16 x 100 mm glass test tube
Gauge label

Procedure



1. Make sure that the Sample Transport Calibration has been performed.
2. Start the Service Application.
3. Attach the gauge label on a glass test tube. Insert the tube in position #1 of a routine Rack so that the guideline is flush with the side of the rack. The gauge line will be located 2mm of center.
4. Place the Rack on the right side of the Sampler.
5. From the Service Application, click on **STM**, then **Sequences**.
6. Double-click on **Initialize Rack M1**, and then click **OK**.
7. Double-click on **Move Next MN**, and then click **OK** to position the test tube in front the Barcode Reader.
8. Double-click on **Read Barcode BC**, and then click **OK**.
9. Observe the gauge label while the barcode reader is scanning, the beam should be on the vertical line printed on the label.
10. Loosen the screws of the mounting bracket and move the bracket to align the beam on the alignment line of the gauge label.
11. Tighten the screws to secure the barcode reader position.

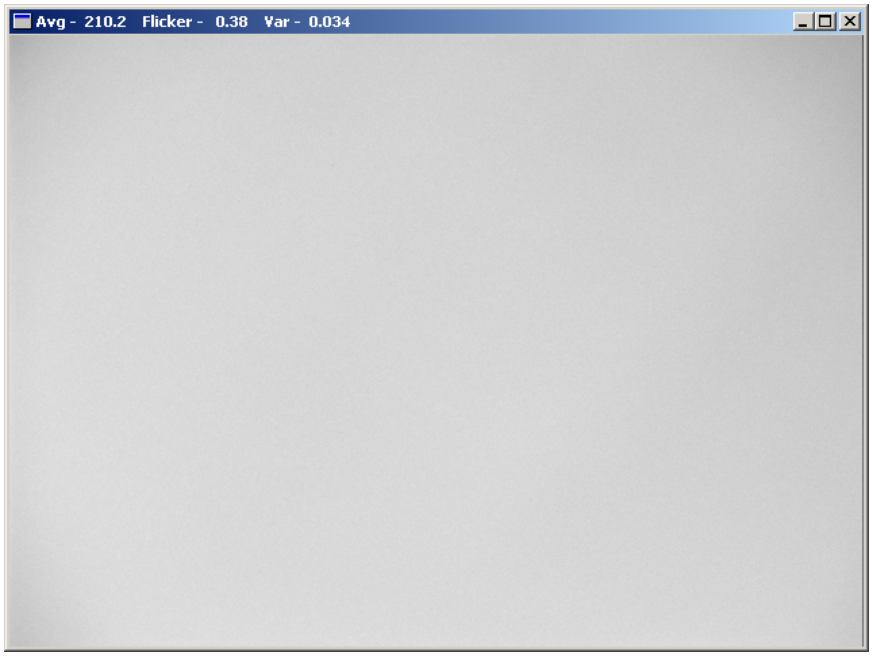
Collimation

What is a Collimation?

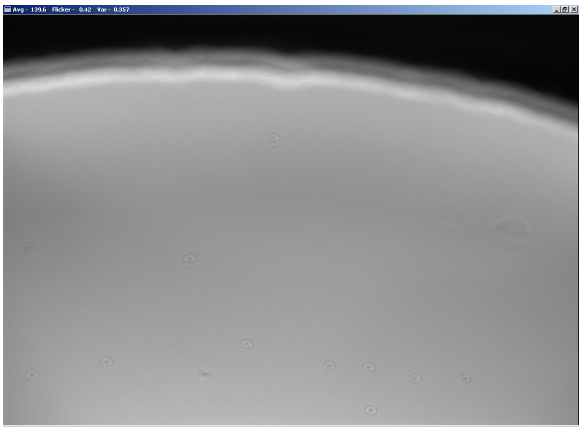
Collimation is the adjustment of the alignment of each optical element with regard to the others. The collimation is a drastic way of improving considerably the optical performance. No high-resolution result can be obtained without an irreproachable collimation, since image processing is incapable of compensating for the damages caused by a misalignment.

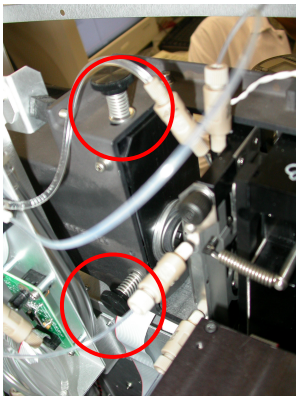
Condenser Alignment

1. Open the **Service** application and turn on iQ 200 when prompted.
2. From the **Service** application, click on **View** then **Video** to display the live video.
3. In Video View, the Avg light should be about 210 and the Var. should be lower than .035.

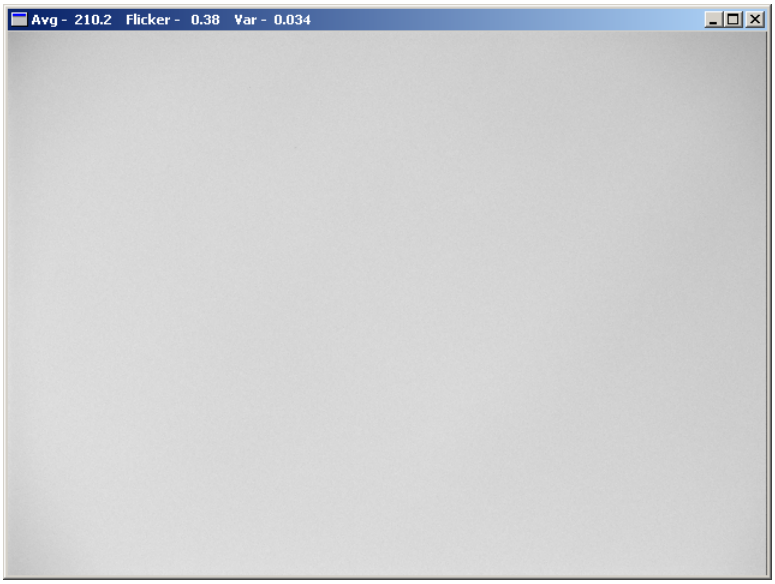


4. Turn the lateral knob clockwise to reach one edge of iris.





5. Turn the lateral adjustment knob counter clockwise to the other edge of the iris.
6. Use the knobs to adjust the condenser alignment until the live video is centered.



7. Close the Live Video window.
8. Exit the Service Application.

Run Auto Focus

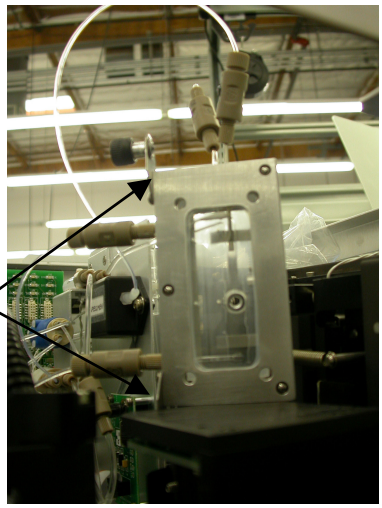
Run one glass tube with barcode label filled with 6mL of Focus in position 5 of a QC rack.

Flow Cell Replacement

Flow Cell Removal

1. Disconnect the four tubing connected to the flow cell by unscrewing the fittings.

CAUTION: Use caution when removing tubing from the flow cell, the stainless steel cannulas are very fragile.



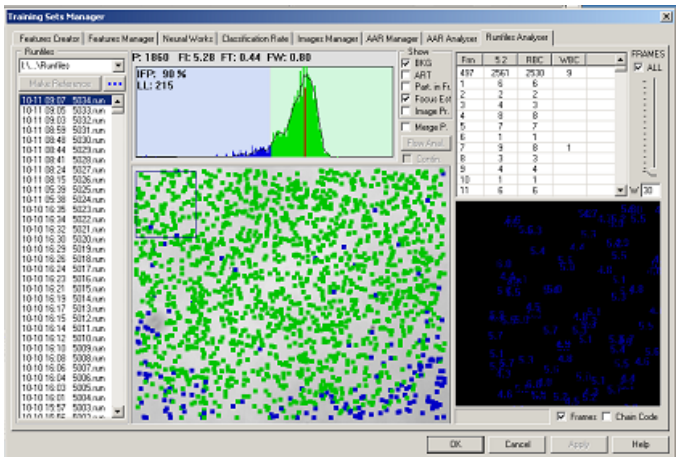
2. Loosen the two locking screws located on the side of the flow cell.
3. Remove the flow cell from the Optical Bench Assembly.
4. Using a syringe, flush the flow cell with deionized water and recap.

Flow Cell Installation

1. Connect the four tubing to the flow cell.
2. Slide the flow cell into the mount, and then tighten the two locking screws.

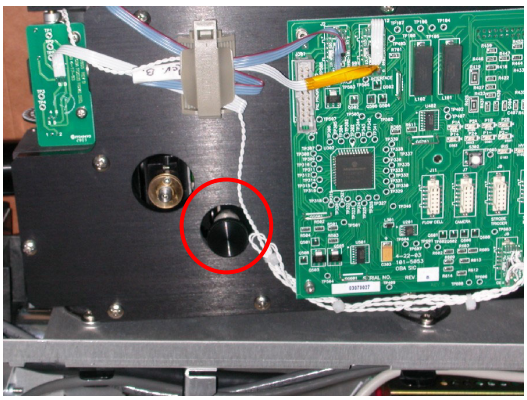
Flow Cell Lateral Adjustment

1. Place one glass tube in position 1 of a routine rack. Fill the tube with 3 mL of positive control. Do not apply barcode labels on the tube.
2. Place the rack on the right side of the sampler and press GO.
3. Press the Windows key on the keyboard.
4. Select **Program** – **Accessories** - **Window Explorer**.
5. Select **C: - Iris2k1 – Bin**. Double-click on **Runfile Analyzer** file.
6. Select the following options:
   - Show Part in Fr (particles in frame)
   - Focus Est (focus estimator)
   - Frame - ALL
7. Preview the runfile to evaluate the cell distribution on the screen.
8. Below is an example of the image you should see of a correct lateral adjustment.



NOTE: If the flow cell is not properly aligned, you will see an area within the field that will NOT display any cells.

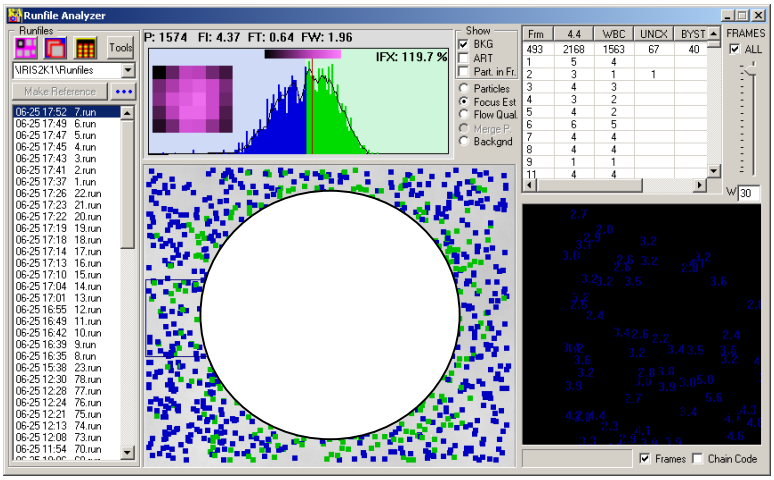
9. If a lateral alignment is needed, use the knob highlighted on the right.



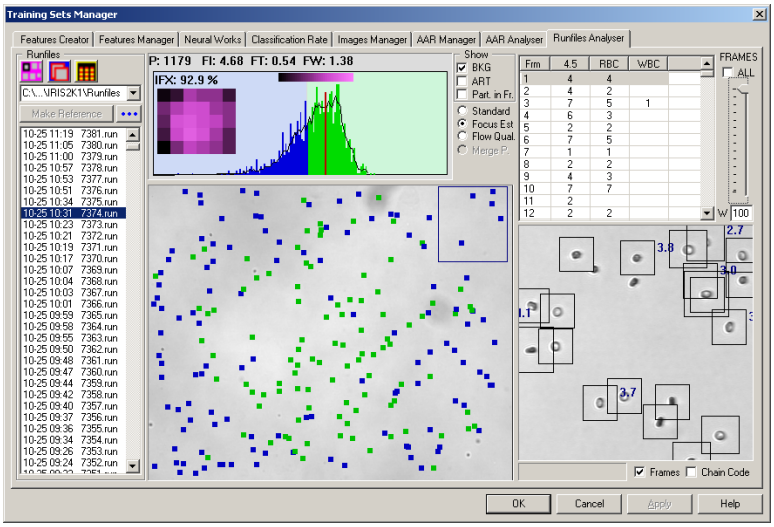
Flow Cell Tilt Adjustment

Make sure the Service Application software is closed before starting this procedure

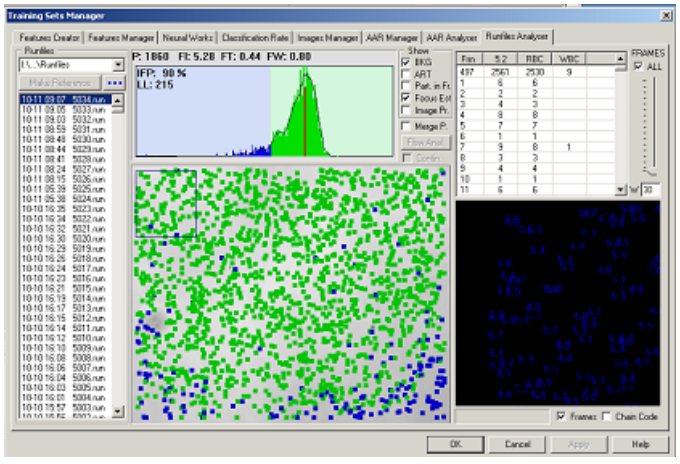
1. Press the Windows key on the keyboard.
2. Select **Program** – **Accessories** - **Window Explorer**.
3. Select **C: - Iris2k1 – Bin**. Double-click on **Runfile Analyzer** file.
4. Select the following options:
   - Show Part in Fr (particles in frame)
   - Focus Est (focus estimator)
   - Frame - ALL
5. Load a sample rack with **10 glass tubes**. Fill each tube with 3 mL of positive control. Do not apply barcode labels on the tubes.
6. Place the rack on the sampler and press the Start button.
7. When a tube run is completed, click on the Refresh button. 
8. Select the new run results.
9. In order to determine if the tilt of the flow cell needs to be adjusted you will need get the focus at the highest FI possible and then move the flow cell farther away from the camera / objective by moving the focus motor in the positive direction.
10. Below is an example of the image you should see of a correctly adjusted flow stream tilt to the optical bench. A properly tilted flow cell will show the green dots form a circle that is centered in the camera view.

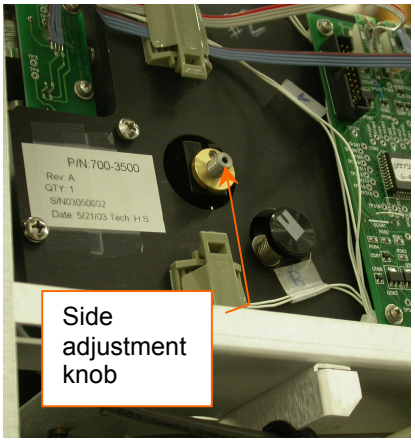


11. Upper right corner:
    You will need to qualitatively evaluate the “halos” of each corner of the same run file to determine if the field curvature is the same from each corner of the camera field of view.

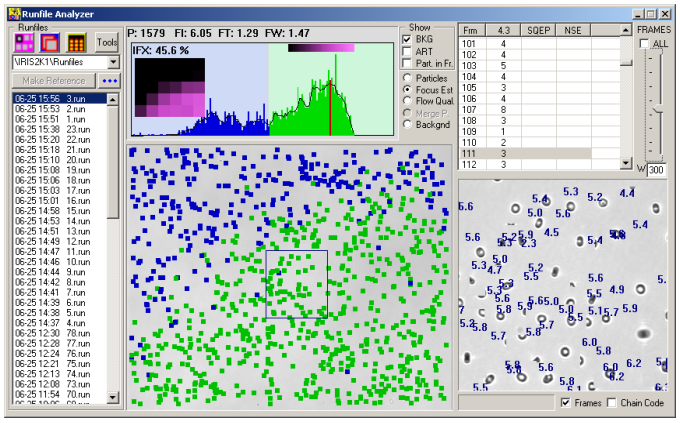


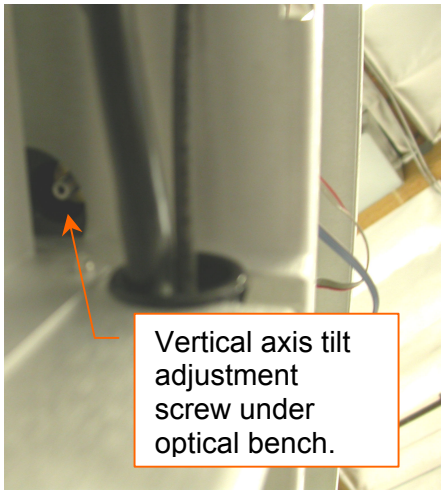
12. The example below shows a flow cell that needs more extreme tilt adjustment. Note the blue dots on the lower edge of the flow stream. This represents the left side of the flow cell.
13. When the blue dots appear at the **bottom**, adjust the side adjustment screw counter clockwise. When the FI is on the light side of focus, the field curvature will begin to show if your tilt is correct.





14. When blue dots appear at **top** and on the **left** corner you will need to adjust the Vertical tilt adjustment screw counter clockwise to correct this type of tilt and the Side adjustment screw clockwise.





15. When the tilt adjustment is complete, run a Focus tube.
16. After the Focus passes, run a Calibration rack.
17. After the Calibration rack passes, run a Control Rack.

5

Service Application Software

5. Service Application Software

Accessing the Service Screen

Startup

If the analyzer is already on, its power must be cycled within about 30 seconds of starting the Service program. If the analyzer is off, it must be powered on within about 30 seconds of starting the Service program. Failure to satisfy these conditions may cause the Establishing Link phase to fail.

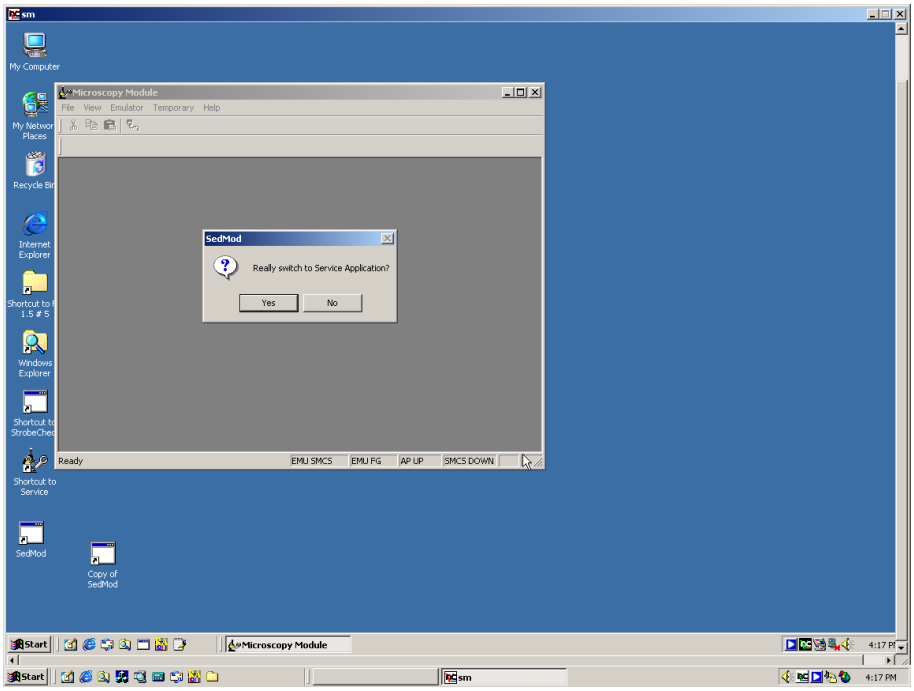
Press the Windows key on the keyboard (located between Ctrl and Alt keys). The Windows toolbar will be displayed at the bottom of the screen.

Using the mouse, select **Programs** – **VNC** – **Run VNC Viewer**.

Left click the mouse to start VNC Viewer. Select **SM** as VNC server, and then click **OK**. Enter the password: **iris2k1** (lowercases), then click **OK**.

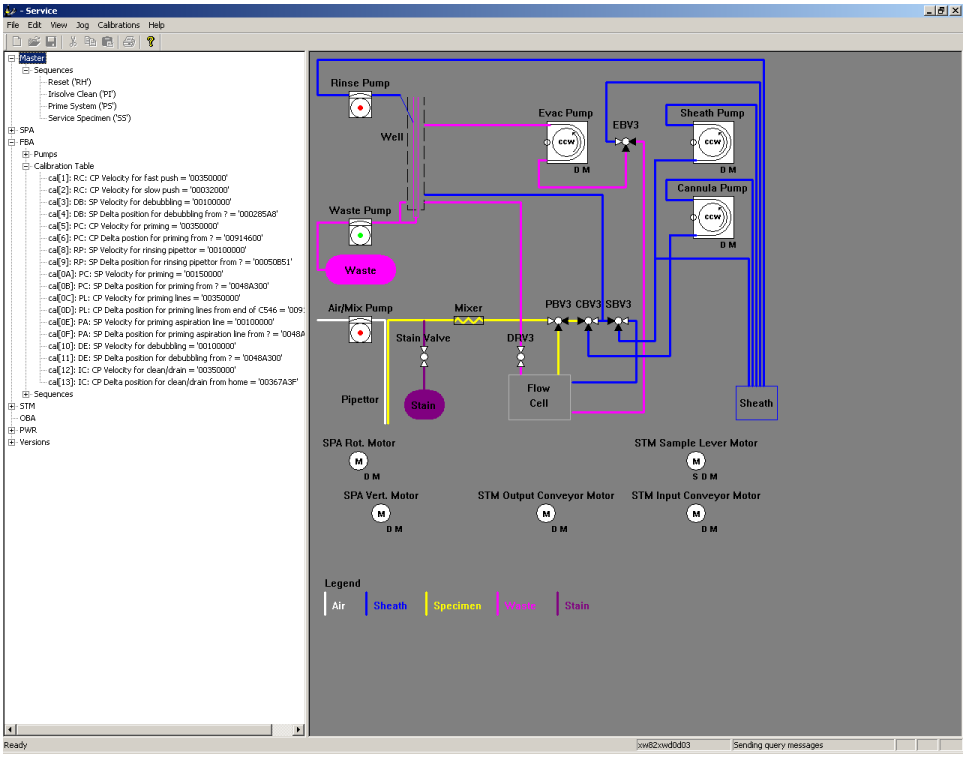
The screen will display the SM computer desktop. The Microscopy Module window will be open.

From the **Microscopy Module** toolbar, select **File** – **Switch to Service Application**.



Select **Yes** to switch to Service Application. The system will prompt to switch off the Microscopy Module. When connections are established with the Results Processor, the system will prompt to turn the Microscopy Module back on.

The **Service Screen** will be displayed.



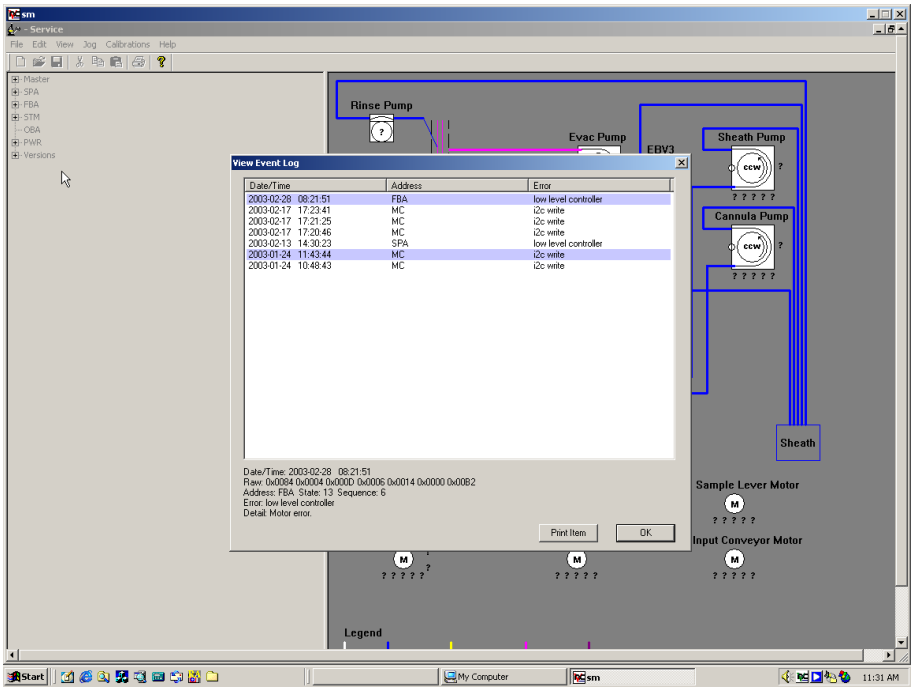
The main screen is divided into two panes, the Tree View Pane and the Fluid Schematic Pane, with a Menu Bar across the top and a Status Bar across the bottom.

Establishing Link

When the Service program first starts up, it must establish a link with the analyzer control system. During this period, both the Tree View Pane and the Fluid Schematic Pane are disabled, as well as many menu items. The status of the link is shown in the status bar at the bottom of the screen.

Tip: While waiting for the connection to be established, you may want to review the Event log. Using the mouse, select **File**, **View Event Log**.

5. Service Application Software



Live Operation

Once the link has been established, the Service program commences live operation, during which the Tree View Pane and the Fluid Schematic Pane are enabled, as well as the majority of the menu items.

At this point, you may examine sensor values, send motor commands, run sequences, etc. See Tree View Pane, Fluid Schematic Pane and Menu Bar for further information.

Tree View Pane

The Tree View Pane provides a hierarchical view of the system. Individual nodes of the tree control may be expanded or collapsed similar to other tree controls found in many Windows™ programs.

Tip: To reduce screen clutter, expand only the parts of the tree pertaining to what you are working on.

Some of the items contained in the tree are also contained in the Fluid Schematic Pane, but the tree contains many more. Types of items found in the tree:

- Commands
- Preset Moves
- Sensors
- Calibration Table
- Sequences

5. Service Application Software

Commands

If you double-click on a command, you will be asked to confirm the command. Some commands (typically labeled with the word "set") request additional data (e.g., "set move velocity" requests the velocity to be set). Commands are one of the low-level building blocks of the control system. You can execute multiple commands simultaneously, but there is typically no reason to do so. **Use *Commands* to test very low-level aspects of the instrument, such as whether a sensor is responding.**

Tip: To use a *move* command, **always** set the velocity and delta position before executing the move, **unless** the last thing you did was execute the same move. Otherwise, the move will be executed using the last velocity and delta, which might not be what you think.

Preset Moves

If you double-click on a preset move, you will be asked to confirm whether you would like to execute the preset move. Preset moves are specific commands used by the instrument's sequences (e.g., the SPA has a preset move to move the rotational motor from the waste well to the specimen tube position). In all other respects, preset moves are just like commands.

Tip: Preset moves often are meant to be executed from some particular position. The starting position is usually indicated in the label (e.g., "move from well to tube"). Make sure you satisfy the starting condition before executing the preset move.

Sensors

If you double-click on a sensor its value will be updated more quickly. Once updated, it will return to the normal update rate. See Polling. Sensors are updated via commands, so they can be executed simultaneously with other commands. Digital sensors are displayed with either a '1' or a '0', indicating True/False, Blocked/Not Blocked, Enabled/Not Enabled, etc. Analog sensors display the hexadecimal value (e.g., '64', which is 6x16 + 4 = 100 decimal). In some cases (e.g., STM's tube detector) both the digital value and the analog value are displayed.

Tip: If the sensor displays a question mark ('?') its value has not been ascertained. When the Service program first starts, all sensors display question marks. If the question marks persist for a particular sensor it is probably an indication of a problem with the associated micro controller.

Register 0x0A

The sensor labeled “Register 0x0A” is a special sensor only found on motors. When the motor is sent home the control system updates register 0x0A to reflect the distance it had to move to get to home, effectively measuring the last position. This is useful when setting some calibration table entries.

Calibration Table

Calibration Auto-Sets

In some cases there is more than one item in the tree for a given calibration table entry. In such cases, the second entry provides a more convenient way to set the value. The label indicates what the shortcut will do; double-click on the shortcut to perform the action. For example, “cal[1]: Double-click here to auto-set (Register 0x0A - cal[0])” will set calibration table entry 1 to the difference of register 0x0A and calibration table entry 0. See Register 0x0A.

Sequences

If you double-click on a sequence you will be asked to confirm whether you would like to run the sequence. Sequences correspond to the sequences of commands used in the control system to perform major operations on the instrument, such as the STM’s M1 sequence, which advances a rack to the initial position. The program does not let anything else run while a sequence is running, although it does allow other commands, sequences, etc., to be queued (e.g., if you start the STM’s M1 sequence, the program will let you queue up the MN sequence or the home command, but neither one will actually be run until the M1 sequence completes).

Fluid Schematic Pane

The Fluid Schematic pane provides a schematic view of the fluid system as well as the other motors not directly related to the fluidics in the analyzer.

Tip: The schematic shows a logical layout; this layout in many cases does not correspond to the actual physical layout. The logical layout is meant to facilitate understanding the system: it is not meant as a picture atlas to familiarize technicians with machine layout.

The Fluid Schematic shows:

- Diaphragm Pumps
- Peristaltic Pumps
- 3-Way Valves
- 2-Way Valves
- Motors
- Tube Connectors
- Other Regions of Interest

Diaphragm Pumps

Diaphragm pumps are shown in one of three states:

- *Question mark ('?')* – status of the pump is not known.
- *Red dot* – pump is not activated.
- *Green dot* – pump is activated.

Double-clicking on a diaphragm pump image offers to toggle its activation (i.e., turn it on or off).

Peristaltic Pumps

Peristaltic pumps are shown with a graphic indicating which direction is counter-clockwise. Moving any pump forward or positive moves clockwise; backward or negative is counter clockwise.

By design, double-clicking on a peristaltic pump image has no effect to make it more difficult to accidentally run the pump. Accidentally running a peristaltic pump could damage the analyzer.

The peristaltic pump is shown surrounded by sensor values. If a sensor is inactive, no value is shown. If a sensor is active, it shows a corresponding letter:

- *B* – Busy. The motor is in motion.
- *E* – Error. A motor error has been detected.
- *S* – Stall. Position error exceeded specified limits.
- *D* – Done. Motor has reached target position.
- *M* – Motor Off. Drive output is off.
- *H* – Home. The home sensor is blocked. ***Tip:*** After successfully executing a motor home command, the motor position is moved slightly off the sensor, so the home sensor is almost never active after going home! If you suspect problems homing a motor, try blocking and unblocking its home sensor to make sure the sensor is working.

Tip: Be careful moving peristaltic pumps! Double check direction and valve settings to prevent over-pressuring the system!

3-Way Valves

3-Way valves are shown in one of three states:

- *Question mark ('?')* – status of the valve is not known.
- Otherwise, blackened ports indicate the path fluid may take.

Double-clicking on a valve image offers to toggle the valve.

2-Way Valves

2-Way valves are shown in one of three states (yes, three):

- *Question mark ('?')* – status of the valve is not known.
- *Ports blackened* – fluid may flow through the valve.
- *Ports whitened* – fluid *may not* flow through the valve.

Double-clicking on a valve image offers to toggle the valve.

Motors

Motors are shown surrounded by sensor values. . If a sensor is inactive, no value is shown. If a sensor is active, it shows a corresponding letter:

- *B* – Busy. The motor is in motion.
- *E* – Error. A motor error has been detected.
- *S* – Stall. Position error exceeded specified limits.
- *D* – Done. Motor has reached target position.

- *M* – Motor Energized. Drive output is enabled.
- *H* – Home. A home sensor is blocked. ***Tip:*** After successfully executing a motor home command, the motor position is moved slightly off the sensor, so the home sensor is almost never active after going home! If you suspect problems homing a motor, try blocking and unblocking its home sensor to make sure the sensor is working. Motors may have from zero to two home sensors.

Double-clicking on a motor image will offer to move or home the motor, depending on the motor.

Tube Connectors

Colored lines representing tube connections connect various parts of the fluid schematic. The fluid schematic color-codes the connections to represent their general usage (e.g., the line going through the Air/Mix Pump is white to denote air).

Tip: there is a legend at the bottom of the screen describing the colors.

Other Regions of Interest

The fluid schematic displays other regions of interest to provide orientation as to the purpose and logical location of various elements. For instance, the Well is shown even though it has no controls of its own.

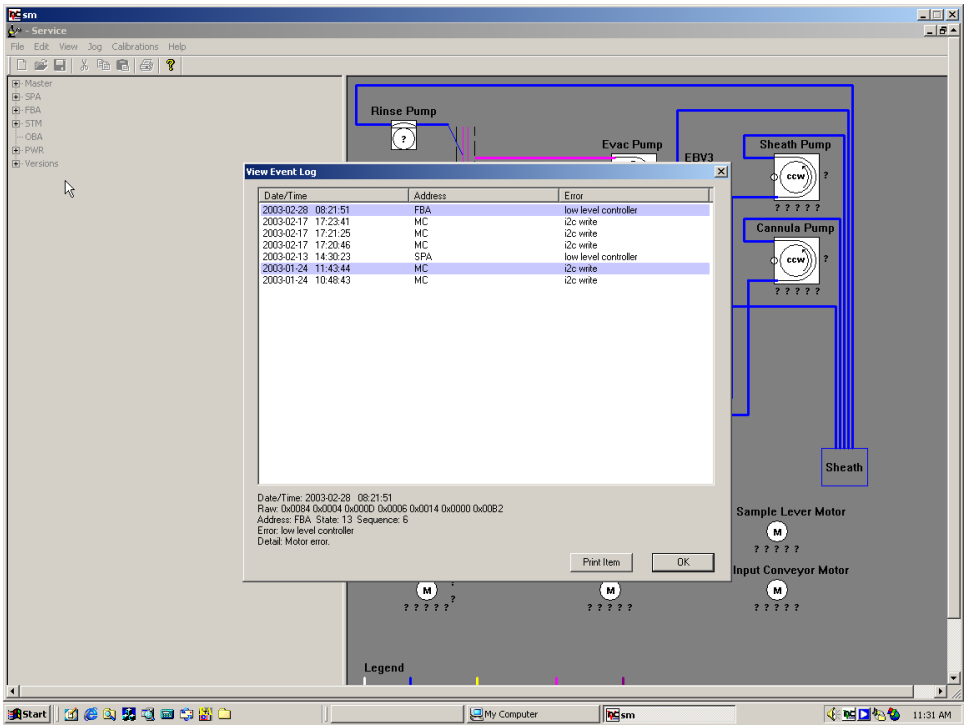
Menu Bar

File Menu

View Event Log

Selecting this item displays the View Event Log dialog box. This shows a list of the events (usually errors of some kind) recorded on behalf of the analyzer control system, from most recent to least recent. Events are stored in a first-in, first-out storage scheme, so oldest events may be purged from the system, but the storage should be sufficient to troubleshoot existing problems.

The bottom of the View Event Log dialog box shows details on the selected event. When the box is first displayed, it shows details of the most recent event. Select other events to show their details. The selected event may be printed.



Show Versions Report

This command displays a list of the firmware versions in Internet Explorer. The list may be printed using the IE print command.

Exit

Selecting this item exits the Service program, closing any windows it might have opened, and restarts the main SM program (which is the program that should be running under normal circumstances).

Tip: The power to the analyzer must be cycled to restore it to normal operational mode!

Edit Menu

The Edit menu has normal cut, copy and paste menu items (as well as undo), but they are only available when doing text entry in dialog boxes.

View Menu

Toolbar

Check this item to show the toolbar. Uncheck it to hide the toolbar.

Status Bar

Check this item to show the status bar. Uncheck it to hide the status bar.

Polling

One of the following values can be chosen:

- *Off* – Turn polling off. When the current group of query messages completes, the link status will show “Idle” and remain there. Polling will not continue until something besides Polling: Off is chosen. Some menu items cannot be selected unless polling is turned off.
- *Slow* – Polling is turned on. There does not seem to be any difference between Slow, Medium and Fast.
- *Medium* – Polling is turned on. There does not seem to be any difference between Slow, Medium and Fast.
- *Fast* – Polling is turned on. There does not seem to be any difference between Slow, Medium and Fast.

Video

Selecting this item displays the live video window (ViewPXD), or brings it to the top if it is already being displayed.

Record Video Statistics

This command gets the video statistics from the live video window and appends them to a data file. If the live video window has not been started, this command starts it and pauses a few seconds, providing time for the live video window to initialize. The statistics – “Avg”, “Flicker” and “Var” – are appended to C:\iris2k1\reports\VideoStatistics.csv. Comma separated value files (.csv) are commonly used to exchange data with data manipulation applications such as Excel.

Terminal

Displays the Terminal window. This item is only enabled when the Polling is off and the link status is “Idle”.

The Terminal window consists of a scrolling list of message traffic between the Service program and the analyzer control system, an area in which to type new messages, a Send button to send the new message, and OK/Cancel buttons to close the Terminal window.

The Terminal Window, **an advanced feature**, allows messages to be typed in directly and their replies to be displayed.

Tip: The Terminal Window should only be used by very advanced users or under the direct supervision of very advanced users.

Jog Menu

There are several items on the Jog menu. Selecting one of these items displays a Jog dialog box for the motor indicated. These items can only be selected after the communications link has been established.

A Jog dialog box consists of the following items:

- A title indicating which motor it controls.
- Velocity radio buttons to choose between Coarse and Fine velocity.
- Instructions indicating to hold down an arrow key to move and release the arrow key to stop.
- A graphic indicating whether the up/down or left/right arrow keys are used.
- A Home button to home the motor.
- An OK button to close the Jog dialog box.

Jog is usually used to position a motor for calibration. Position the motor as desired, then press the Home button so the position will be stored in Register 0x0A for the appropriate motor (each motor has its own in its Sensors section). Then use Calibration Auto-Sets to store the calibration value.

Tip: Jog response improves greatly if you turn Polling off!

Status Bar

The Status Bar has five status areas in the lower right of the display. From left to right:

- Current Message Status
- Link Status
- Caps Lock Status
- Num Lock Status
- Scroll Lock Status

Current Message Status

The current message status area of the status bar shows the message currently being processed. The Service application communicates with the instrument by sending it messages. Processing a message entails sending the message, waiting for the instrument to echo the message back, then waiting for the message reply (not all messages expect a reply, but many do). The message currently being processed is displayed in the current message status area. If no message is currently being

processed, this area is blank. The Service application updates this area about once per second, so if messages are being processed quickly, some messages might not show up in the current message status. That is normal.

Tip: Under almost all circumstances the current message status can be ignored! *The only time it is important is if the Service application appears to hang*. In such cases, the exact text of the current message can help engineering investigate the problem. You can try restarting the system to see if the problem goes away.

Tip: Messages entered through the Terminal window don't get displayed in the current message status area.

Link Status

The link status area of the status bar shows the status of the communications link to the analyzer control system. Here are the possible statuses in chronological order:

- "Starting ASTM"
- "Establishing link (may take a minute)"
- "Could not establish link"
- "Connection established"
- "Sending initialization messages"
- "Sending initial query messages"
- "Sending query messages"
- "Idle"

"Starting ASTM"

During normal operation the analyzer control system communicates to the PC using the ASTM E1381 protocol, which provides high robustness at the cost of some sacrifice of bandwidth. The Service program must initially link using this protocol, so it starts an ASTM session.

"Establishing link (may take a minute)"

After starting the ASTM protocol, the Service program verifies the ASTM link. It then issues commands to the analyzer control system to switch the communications protocol from ASTM to a more or less raw serial protocol (gaining bandwidth at some sacrifice of robustness). Finally, it issues commands to the analyzer control system to put it into service mode.

Tip: Certain types of errors detected by the analyzer control system during startup may cause the View Event Log dialog to pop up. In such cases the Service program will probably "be stuck" in the establishing link phase. The error reported by the View Event Log must be remedied to proceed. Remedy the error, restart the Service program and cycle the power on the analyzer.

"Could not establish link"

If any of the steps in "Establishing link (may take a minute)" fail, this message is displayed, along with one or more dialog boxes stating the link could not be established.

Troubleshooting Failure to Establish Link

In order of most likely to least likely:

Startup – Restart the Service program and cycle the analyzer power within a few seconds of each other. Starting up one or the other too late is the most common cause of failure to establish link. Sometimes a "glitch" in the startup of one or the other causes it to take longer to get going. In either case, restarting the Service program and cycling the analyzer power close together often results in a successful link.

Cable – Check the cable connecting the Sediment Module PC to the analyzer. There is only one serial port on the PC, but the analyzer has several: the cable should go to the top-most connector. Swap cables if necessary.

Analyzer Failure – If the analyzer startup process encounters an error it may not be able to start up its serial port properly. This might result in a red light on the analyzer front panel. Remove the left side panel to see if there are any lights on any of the boards in the cage.

PC Serial Port – Connect a null-modem cable between the Results PC serial port and one of the serial ports on the Analysis Processor PC (or another PC with a known-good serial port).

Fuses – Double-check analyzer fuses, particularly F13.

20-Pin Ribbon Cable from Rear Panel SIC to J14 on Backplane – Check the cable connecting the rear panel SIC to the backplane.

HLCB – Swap the HLCB.

Rear Panel SIC – Swap the Rear Panel SIC.

"Connection established"

This status is briefly displayed after successfully establishing the connection.

"Sending initialization messages"

This status indicates the initialization messages are being sent to the analyzer control system. This happens once, directly after establishing the connection.

"Sending initial query messages"

After sending the initialization messages, the Service program sends a group of initial query messages to read the value of things that don't change during machine operation (e.g., calibration table entries, firmware versions). This happens once, directly after sending the initialization messages.

"Sending query messages"

Directly after sending the initial query messages and periodically thereafter, the Service program sends query messages to read the value of things that might change during machine operation (e.g., sensors). The periodic polling can be turned off via the Polling menu.

"Idle"

This status is displayed during the brief interval between sending each periodic set of query messages. The periodic polling can be turned off via the Polling menu.

Caps Lock Status

Displays the status of the keyboard Caps Lock key. Not particularly useful, but many programs have this.

Num Lock Status

Displays the status of the keyboard Num Lock key. Not particularly useful, but many programs have this.

Scroll Lock Status

Displays the status of the keyboard Scroll Lock key. Not particularly useful, but many programs have this.

Program Operation

Frequently Asked Questions (FAQ)

Why Does a Sensor Display the Wrong Value?

The Service program gets sensor values by polling the sensors periodically. It takes several seconds to poll all the sensors in the analyzer (actually, more like 10 seconds). After a very brief pause, we poll again, over and over (unless you turn Polling off). The sensor value is correct when it is read, but the true value might change between the last reading and present time.

There are two ways you can make sure the reading is current:

- Wait until the Link Status indicates “Idle” *twice*.
- Double-click on whichever one of the Sensors you want to update in the Tree View Pane (this usually causes the sensor to update within about one second).

Which Controller Does Component X (Pump, Valve, etc.) Belong To?

Pump	Type	Controller
Evacuation Pump (EP)	Peristaltic	SPA
Lamina Pump (SP)	Peristaltic	FBA
Cannula Pump (CP)	Peristaltic	FBA
Fill Pump	Diaphragm	FBA
Waste Pump	Diaphragm	FBA
Air/Mix Pump	Diaphragm	FBA
All Valves	3-Way, 2-Way	SPA

What Are the Communication Addresses of the Major System Components?

Component	Communication Address
Master Controller (MC, MST)	N/A
SPA	82
FBA	84
STM	86
OBA	88

What Should I Do If the Service Application Appears to Hang?

The most likely cause would be diagnosed with the Current Message Status indicator. See that section for details.

6
Troubleshooting

6. Troubleshooting

Bypassing Error Condition

If the instrument displays a red flag error condition, login using IRIS as login name and iris2k1 as password.

Error Messages

I2C Slave module (Inter Integrated Circuit)

No module error occurred.
Bad data value in I2C command.
CR terminator not at expected pstn.
Address I2C phase not expected.
Data I2C phase not expected.
Previous I2C command not processed.
Previous I2C character not processed.
Undefined state found in I2C code.
Hardware status incorrect for read.
Hardware status incorrect for write.
Unexpected request for read data.
Unknown error occurred.

CMD module

No module error occurred.
Ready timeout prior to read op.
Ready timeout prior to command.
Ready timeout prior to data out.
No match found for rcvd command.
/0' not found in expected location.
Unknown error occurred.
FQM module errors start at 0x20.

Static LPCTSTR sg_aszerror_FQM

No module error occurred.
Out-of-range electrode specified.
A/D conversion failed to complete.
Electrode measurement exceeded ttl time.
Electrode sample timer overflowed.
Unknown error occurred.

6. Troubleshooting

Motor module errors start at 0x20.

static LPCTSTR sg_aszerror_Motor[]
No module error occurred.
Ready timeout prior to read op.
Ready timeout prior to command.
Ready timeout prior to data out.
Improper status after hwr reset.
Improper status after int reset.
Read data vs write data error. This error also results from out-of-range command velocities.
Low-level stepper drive overtime.
Low-level stepper drive overcurrent.
Low-level stepper PIC fault signal.
Low-level stepper PIC undefined flt.
Stepper motor move command without init.
Stepper motor home position error exceeded.
Stepper motor failed to clear home sense.
Stepper motor failed to detect home sense.
Stepper backlash exceeded max value.
Base velocity higher than peak velocity.
Unknown error occurred.

Power module errors start at 0x20

static LPCTSTR sg_aszerror_Power[]
No module error occurred.
Unknown error occurred.

Scanner module errors start at 0x20

static LPCTSTR sg_aszerror_Scanner[]
No module error occurred.
A/D conversion failed to complete.
Non-existant Led specified.
Blown fuse detected during scan.
Crash detector 0.
Crash detector 1.
Waste well overflow.
Door interlock.
Spare.
Unknown error occurred.

Valve module errors start at 0x20

static LPCTSTR sg_aszerror_Valve[]
No module error occurred.
A/D timeout 1.
A/D timeout 2.
A/D timeout 3.
A/D timeout 4.
Unknown error occurred.
Vrify failed.

Iris Diagnostics Contact Information

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Electronics

Electronics

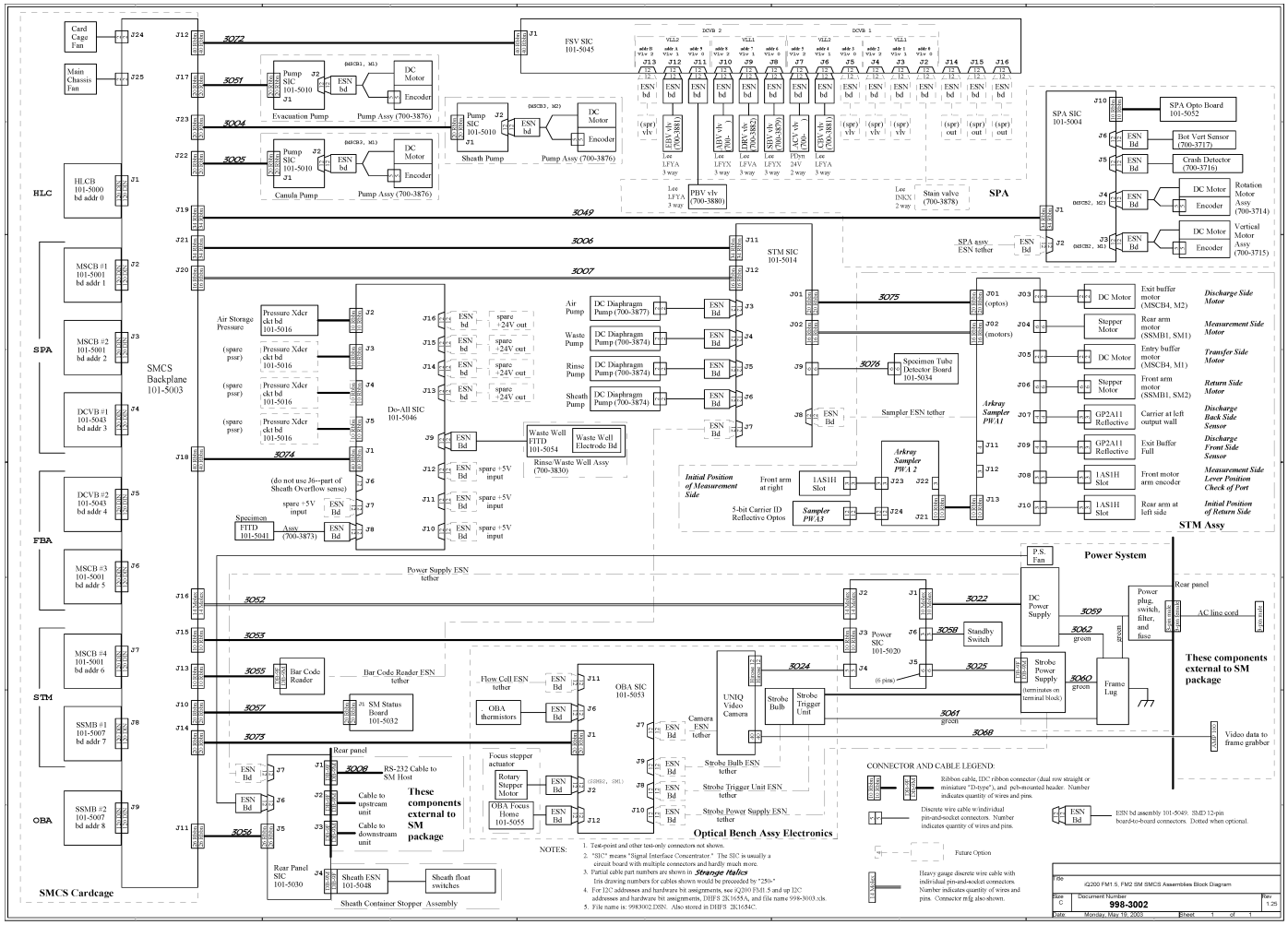
General Functions

The electronic and electronically based functions of the Microscopy Module are identified as follows:

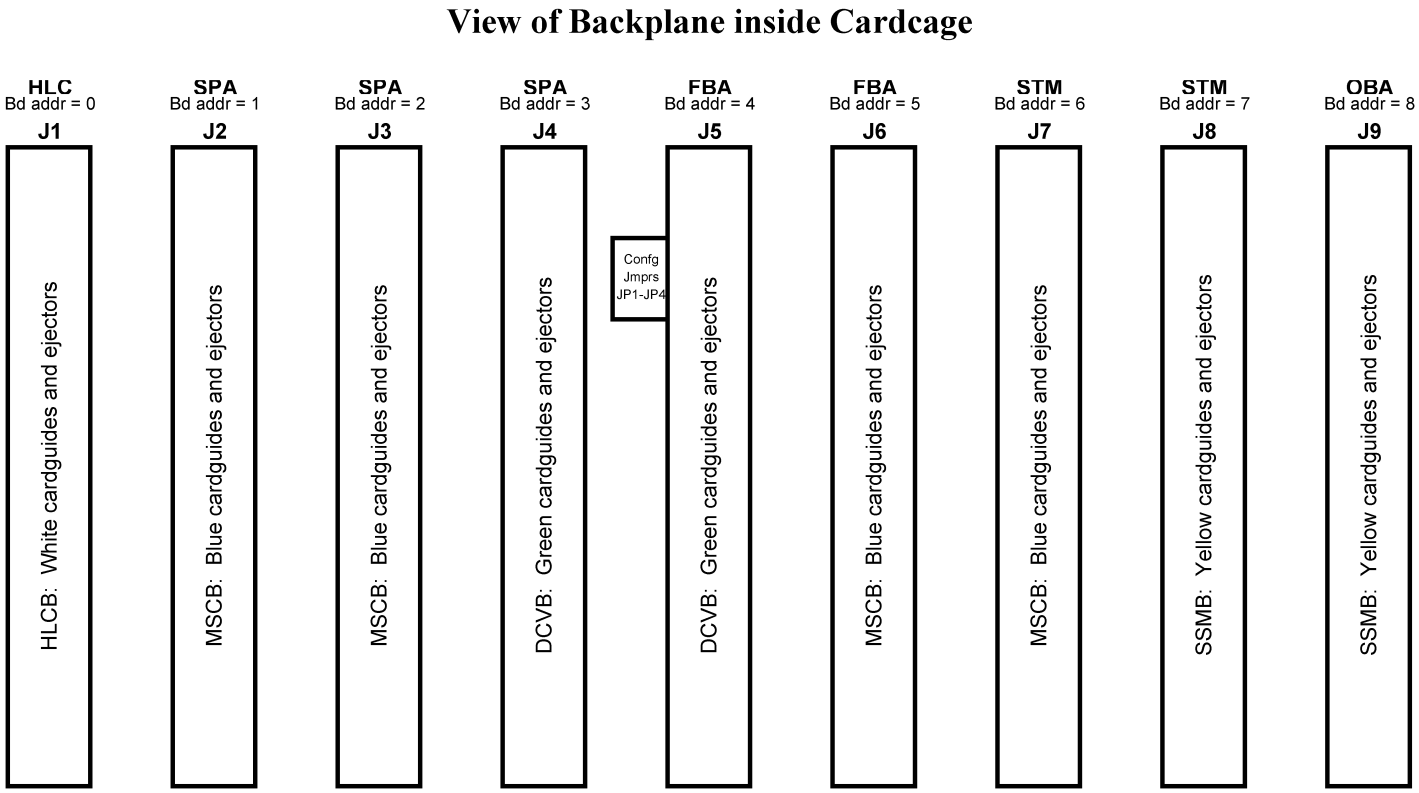
- High level hierarchical software control of lower-level functions,
- Communications between microcontrollers at adjacent hierarchical levels via inter integrated circuit communications links,
- Communications with the Microscopy Module Computer via an RS-232 link,
- Indications via visual displays of Microscopy Module status,
- Closed-loop control of some DC motors,
- Position sensing of various mechanical movements of the subsystems,
- Open loop control (power off-on) of DC motors,
- Control of discrete DC solenoid valves,
- Control of a system of DC solenoid-actuated valves and sensing proper operation of the valves,
- Sensing of the presence or absence of water based fluids in a small-diameter tube, and the level of water based fluids in a waste well,
- Electrical sensing of various digital and analog status signals,
- Control of high- and low- speed stepper motors
- Controlling and receiving data from a bar-code scanner
- Local ambient temperature sensing and DC fan-motor control
- Control (but not data) interfacing with the data-processing parts of the iQ200
- The electronic serial number system, an electronic system for identifying the individual assemblies, subassemblies and other elements that represent the totality of the iQ200 Microscopy Module.

7. Electronics

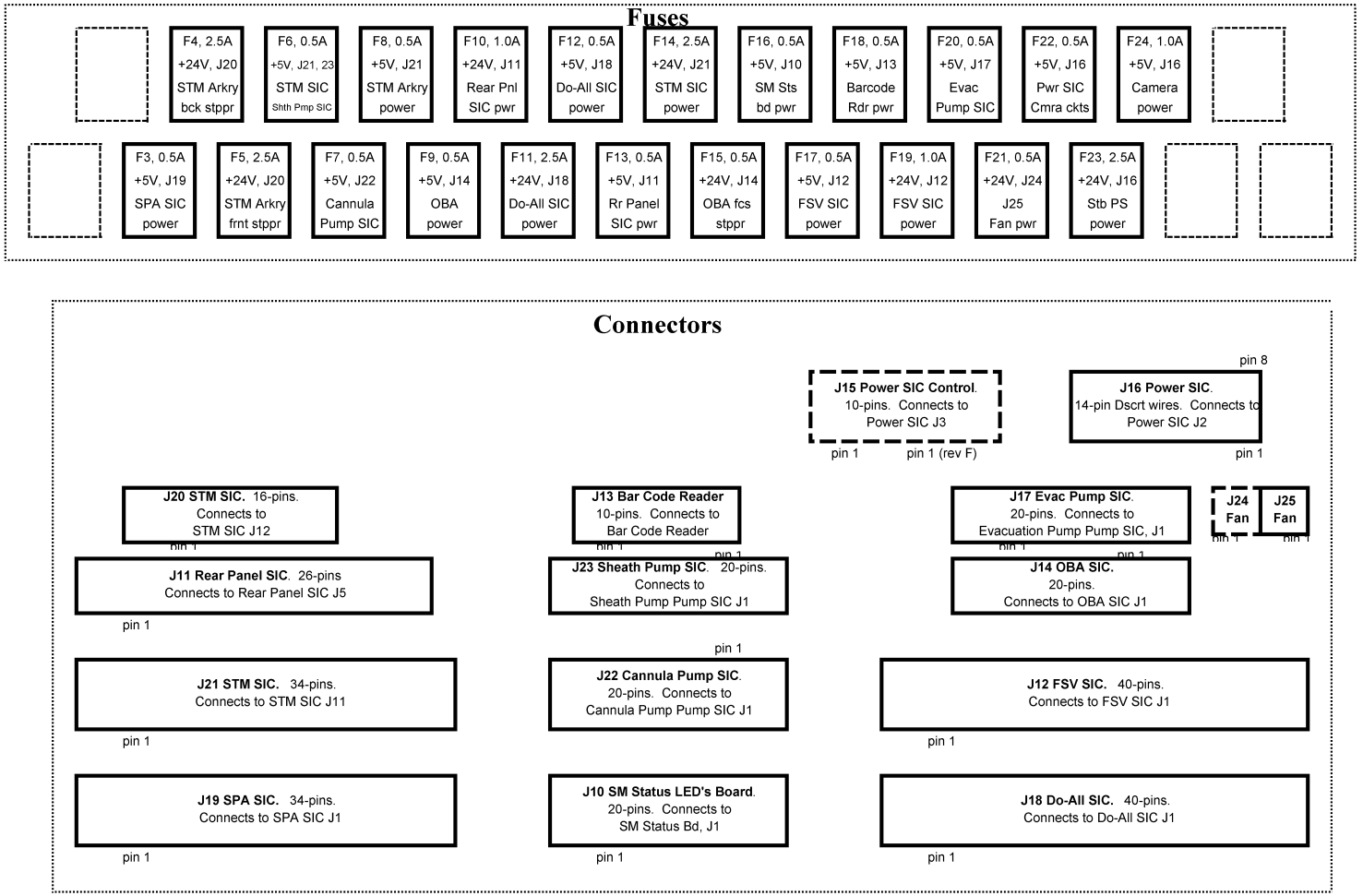
Overview



View of Backplane inside Cardcage



Rear view of Backplane -- Fuses and Connections to Internal parts of Microscopy Module



Addresses and Summary

Item #		Bd Addr	Board Type	Board Name	Sub-Sys.	PIC-18	PIC-16	RS232 Diag	ICD prog	Controls	I2C Addresses							
											fixed addr	HLB	SPA	FBA	STM	DSP	OBA	VM
1		**0**	**HLCB**	**HLCB**	**HLB**	**MST**		J501-1		**Master Controller (runs the HLB)**								
	a									MST serial EEPROM 8Kx8	yes	A4						
	b						FQM	J502-3	J301-1	Field Query Manipulator, Front panel Xfce		80						
	c					**SPA**		J501-2		High Level SPA control		82						
	d									SPA serial EEPROM 32x8	yes		A4					
	e					**FBA**		J501-3		High Level FBA control		84						
	f									FBA serial EEPROM 32Kx8	yes			A4				
	g					**STM**		J501-4		High Level STM control		86						
	h									STM serial EEPROM 32Kx8	yes				A4			
	i									Bar Code Reader (RS-232 interface directly to STM PIC-18)					--			
	j					**DSP**		J502-1		Device Status Processor (DSP)		8A						
	k									DSP serial EEPROM 32Kx8	yes					A4		
	l					**OBA**		J502-2		Optical Bench control		88						
	m									OBA serial EEPROM 32Kx8	yes						A4	
2		**1**	**MSCB**	**SPA MSCB 1**	**SPA**													
	a						M1	J302-1	J301-1	Evacuation Pump			B0					
	b						M2	J302-2	J301-2				B2					
	c						SCN	J302-3	J301-3	SPA scnng, Crash Det via XSCAN, Air Pump, Waste Pump, Rinse Pump, spare pump.			D0					
3		**2**	**MSCB**	**SPA MSCB 2**	**SPA**													
	a						M1	J302-1	J301-1	Pipetter Vertical Motion			B4					
	b						M2	J302-2	J301-2	Pipetter Rotational Motion			B6					
	c						SCN	J302-3	J301-3	Pipetter motion end limits; Crash reset pulse; SVV, SPV, 5 spare valves; fuse monitors F9, F10, F13, F17, F18, F22, F25.			D2					
4		**3**	**DCVB**	**SPA DCVB 1**	**SPA**													
	a						VM	J302-1	J301-1	SPA Valve Mid PIC			92					
	b						VLL1	J302-2	J301-2	SPA Valves, Low Level Cntrlr #1 (valves 1-3)								98
	c						VLL2	J302-3	J301-3	SPA Valves, Low Level Cntrlr #2 (valves 4-6)								9A
5		**4**	**DCVB**	**FBA DCVB 2**	**FBA**													
	a						VM	J302-1	J301-1	FBA Valve Mid PIC (* I2C bus depends on jumpers on the backplane)				92*				92*
	b						VLL1	J302-2	J301-2	FBA Valves, Low Level Cntrlr #1 (valves 7-9)								9C
	c						VLL2	J302-3	J301-3	FBA Valves, Low Lvl Cntrlr #2 (valves 10-12)								9E

Item #		Bd Addr	Board Type	Board Name	Sub-Sys.	PIC-18	PIC-16	RS232 Diag	ICD prog	Controls	I2C Addresses							
											fixed addr	HLB	SPA	FBA	STM	DSP	OBA	VM
6		**5**	**MSCB**	**FBA MSCB 3**	**FBA**													
	a						M1	J302-1	J301-1	Cannula Pump				B0				
	b						M2	J302-2	J301-2	Sheath Pump				B2				
	c						SCN	J302-3	J301-3	Cannula & Sheath pmp limits, Cannula & Sheath prssr xdcrs; SVV, SPV, 5 spare valves, fuse monitors: F11, F12, F20, F23, F24				D0				
7		**6**	**MSCB**	**STM MSCB 4**	**STM**													
	a						M1	J302-1	J301-1	Arkray Carrier Input Tray DC motor					B0			
	b						M2	J302-2	J301-2	Arkray Carrier Output Tray DC motor					B2			
	c						SCN	J302-3	J301-3	STD; fuse monitors: F1-F8, F19, F21; Arkray carrier ID input signal; down stream rdy; up stream strt; Carrier ID addresses; down stream strt; upstream rdy					D0			
8		**7**	**SSMB**	**STM SSMB 1**	**STM**													
	a						DCM	J303-1	J301-1						B4			
	b						SM1	J303-2	J301-2	Measurement (Inboard) Linear Stepper					B6			
	c						SM2	J303-3	J301-3	Front (Outboard) Linear Stepper					B8			
	d						SCN	J303-4	J301-4	Arkray position detectors; cardcage thermistor; main thermistor; card cage fan; main fan; upstream & dwnstrm pwr control, Arkray US & DS reset.					D2			
9		**8**	**SSMB**	**OBA SSMB 2**	**OBA**													
	a						DCM	J303-1	J301-1								B4	
	b						SM1	J303-2	J301-2	Optical Bench Focus Stepper							B6	
	c						SM2	J303-3	J301-3								B8	
	d						SCN	J303-4	J301-4	Optical Bench sensors							D2	
10		**--**	**Power SIC**	**Power SIC**	**HLB**		STB	J203-1	J203-1	Strobe Power Supply (not in card cage)		8C						

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes								special Notes
BA: 0 BT: HLCB BN: HLCB SS: HLCB	MST	**Master Controller**			MST runs the HLB						
		MST serial EEPROM 32K x 8	I2C: HLB A4								
	SPA	High Level SPA control	I2C: HLB 82								
		SPA serial EEPROM 32K x 8	I2C: SPA A4								
	FBA	High Level FBA control	I2C: HLB 84								
		FBA serial EEPROM 32K x 8	I2C: FBA A4								
	STM	High Level STM control	I2C: HLB 86								
		STM serial EEPROM 32K x 8	I2C: STM A4								
		Bar Code Reader			RS-232 interface directly to STM PIC-18						
	OBA	High Level OBA control	I2C: HLB 88								
		OBA serial EEPROM 32K x 8	I2C: OBA A4								
	DSP	Device Status Processor (DSP)	I2C: HLB 8A								
		DSP serial EEPROM 32K x 8	I2C: DSP A4								
		ESN Group Control	**ESN RLY**	**STS bit**							
		ESN Group Ctrl Bit 0	0 (B15)		look on Do-All SIC for Relay Status LED -- LED on when relay on						
		ESN Group Ctrl Bit 1	1 (C15)		look on Do-All SIC for Relay Status LED -- LED on when relay on						
		ESN Group Ctrl Bit 2	2 (A16)		look on Do-All SIC for Relay Status LED -- LED on when relay on						
	FQM	Field Query Manipulator	I2C: HLB 80								
		Analog inputs	**Ana In**	**STS bit**		**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		Sheath signal	0 (A19)	6		long	(none)	low	0	13	8-lvl ana sig, 1st thrshld
		Sheath signal	0 (A19)	7		long	(none)	low	0	56	8-lvl ana sig, 2nd thrshld
		Sheath signal	0 (A19)	8		long	(none)	low	0	109	8-lvl ana sig, 3rd thrshld
		SHEATH-OVRFLW	1 (B19)								do not scan on FQM
		2.5V Ref	2			short	(none)	low			Analog measurement
		Switch Inputs	**XSW-IN**	**STS bit**		**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		Pauses Switch input	0 (A26)	0		short	1.0K to +5V	low	0	128	
		Indicator LED Drive Outputs	**XLED**	**XLD STS**							
		Pause Switch Green LED	0 (A28)	4							low-true
		Pause Switch Red LED	1 (C28)	3							low-true
		SM Status "Error" LED	2 (A29)	2							low-true
		SM Status "Standby" LED	3 (B29)	0							low-true
		SM Status "Measure" LED	4 (C29)	1							low-true
			5 (A30)								
			6 (B30)								
			7 (C30)								

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes										special Notes
BA: 1 BT: MSCB BN: SPA MSCB 1 SS: SPA					Special Conditions								
	M1	Evacuation Pump	I2C: SPA B0		Home function associated with Analog input & Opto LED as below								
			(M+: A33, M-: A34) (A: A18, B: A17)		Motor stop on Crash Detect or Stop-All-Motors								
					PID param: kp = 0x0090, ki =0x0020, kd = 0x0020, il = 0x0100								
	M2	(spare)	I2C: SPA B2										
			(M+: B33, M-: B34) (A: C18, B: C17)		PID param: kp = 0x0090, ki =0x0020, kd = 0x0020, il = 0x0100								
	SCN	SPA scanning	I2C: SPA D0		Functions assigned and controlled as detailed below								
		Analog inputs & Opto LEDs	**Ana In**	**Sts LED**	**Opto Type**	**Opto LED**	**LED cur**	**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		M1 (Evac Pump) Home	0 (A19)	0	HOA0708	0 (A26)	40ma	long	2.8K to GND	hi	72	255	Automatic "Home Function"
		Sheath Pump Home	1 (B19)	1	HOA0708	1 (B26)	40ma	long	2.8K to GND	hi	72	255	Automatic "Home Function"
			2 (C19)	2									
			3 (A20)	3									
		Air storage prssr (Do-All SIC J2)	4 (B20)	4	n/a	none	n/a	long*	2.8K to GND*	low	72	255	*Also available on MSCB3, but only of of the two (MSCB1 or MSCB3) should be scanned.
		(spare prssr #3) (Do-All SIC J3)	5 (C20)	5	n/a	none	n/a	long*	2.8K to GND*	low	72	255	
		(spare prssr #1) (Do-All SIC J4)	6 (A21)	6	n/a	none	n/a	long*	2.8K to GND*	low	72	255	
		(spare prssr #2) (Do-All SIC J5)	7 (B21)	7	n/a	none	n/a	long*	2.8K to GND*	low	72	255	

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes			special Notes
BA: 1 (cont) BT: MSCB BN: SPA MSCB 1 SS: SPA	SCN (cont)	**+24V Outputs**	**+24V Out**	**Dty Cyc**	**Other Conditions**	
		Rinse dphrgm pmp (STM SIC J5)	0 (A35)	1/1		
		Waste dphrgm pmp (STM SIC J4)	1 (C35)	1/1		
		Air dphrgm pmp (STM SIC J3)	2 (A36)	1/1		
		Sheath dphrgm pmp (STM SIC J6)	3 (B36)	1/1	Control Shared with MSCB 3	
		+24V Inputs	**+24V In**	**Sts Bit**		
		Code ID	0 (A32)	0	Tells the PIC whether FM1 or FM2 and up	"1" = FM1.5 and up
		Digital Outputs	**Dig Out**	**Dty Cyc**		
		Digital Inputs	**Dig In**	**Sts Bit**		
		Evac pump cassette in place	0 (A15)	0		
		Evac pump cover in place	1 (B15)	1		
		SHEATH-OVRFLW (Do-All SIC J6)	2 (C15)	2	Is also wired to FQM analog 1, but should not be used thereon.	J6, R8, D11 rmvd frm Do-All SIC
		Stain Out FITD (Do-All SIC J7)	3 (A16)	3		
		Specimen FITD (Do-All SIC J8)	4 (B16)	4	Also available on MSCB3	"1" indicates liquid present
		Waste Well FITD (Do-All SIC J9)	5 (C16)	5	Also available on MSCB3	"1" indicates waste well ovrflw
		Stop All Motors	6 (B17)	6	Door Interlocks--activates if a door is open	low-true
		XSCAN	**XSCAN**			
		Crash Detect (soft)	0 (A08)			low-true

Hardware Bit Assignments and Details

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes									special Notes
BA: 2 BT: MSCB BN: SPA MSCB 2 SS: SPA				Special Conditions								
	M1	Pipetter Vertical Motion	I2C: SPA B4	Home function assoicated with Analog input & Opto LED as below								
			(M+: A33, M-: A34)	Motor down stop on Crash Detect or stop on Stop-All-Motors								
			(A: A18, B: A17)	PID param: kp = 0x0090, ki =0x0028, kd = 0x0020, il = 0x0180								
	M2	Pipetter Rotational Motion	I2C: SPA B6	Home function assoicated with Analog input & Opto LED as below								
			(M+: B33, M-: B34)	Motor stop on Crash Detect or or Stop-All-Motors								
			(A: C18, B: C17)	PID param: kp = 0x0100, ki =0x0100, kd = 0x1000, il = 0x1000								
	SCN	SPA scanning, Motion end limits, heater, crash dtct, IriSolve Pmp	I2C: SPA D2	Functions assigned and controlled as detailed below								
		Analog inputs & Opto LEDs	**Ana In**	**Sts LED**	**Opto Type**	**Opto LED**	**LED cur**	**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		M1 (Vertical Motion--top sensor) Home CW	0 (A19)	**0**	QVA11134	0 (A26)	35 ma	long	2.8K to GND	low	0	61	Vertical Board--Auto "Dual Home Function"
		M2 (Rotational Motion--back sensor) Home CW	1 (B19)	1	QVA11134	1 (B26)	35 ma	long	2.8K to GND	low	0	61	Auto "Dual Home Function"
			2 (C19)	**5**									
		M2 (Rotational Motion--front sensor) Home CCW	3 (A20)	3	QVA11134	3 (A27)	35 ma	long	2.8K to GND	low	0	61	Auto "Dual Home Function"
		Soft Crash	4 (B20)	4	n/a	none	--	short	698 to GND	low	0	128	This is a pair of snap-action switches
		M2 (Vert Motion--bottom sensor) Home CW	5 (C20)	**2**	n/a	none	--	short	698 to GND	low	0	128	Vertical Board--Auto "Dual Home Function" This detector is a snap-action switch
			6 (A21)	6									
			7 (B21)	7									
			8 (C21)										
		F25 monitor: J10+5VM	9 (A22)	9	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F22 monitor: J16+5VM	10 (B22)	10	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F13 monitor: J11+5VM	11 (C22)	11	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F10 monitor: J11+24VM	12 (A23)	12	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.
		F17 monitor: J12+5VM	13 (C23)	13	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F18 monitor: J13+5VM	14 (A24)	14	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F9 monitor: J14+5VM	15 (B24)	15	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes			special Notes
BA: 2 (cont) BT: MSCB BN: SPA MSCB 2 SS: SPA	SCN (cont)	**+24V Outputs**	**+24V Out**	**Dty Cyc**		
		ASV (Do-All SIC J13)	0 (A35)	1/1	Control Shared with MSCB 3	Sig name on bkpln: SPV-VLV
		(spare valve #6 -- Do-All SIC J14)	1 (C35)	1/1	Control Shared with MSCB 3	Sig name on bkpln: SVV-VLV
		(spare valve #1 -- Do-All SIC J15)	2 (A36)	1/1	Control Shared with MSCB 3	
		(spare valve #2 -- Do-All SIC J16)	3 (B36)	1/1	Control Shared with MSCB 3	
		(spare valve #3 -- FSV SIC J14)	4 (C36)	1/1	Control Shared with MSCB 3	
		(spare valve #4 -- FSV SIC J15)	5 (A37)	1/1	Control Shared with MSCB 3	
		(spare valve #5 -- FSV SIC J16)	6 (B37)	1/1	Control Shared with MSCB 3	
			7 (C37)			
		+24V Inputs	**+24V In**	**Sts Bit**		
		Code ID	0 (A32)	0	Tells the PIC whether FM1 or FM2 and up	"1" = FM1.5 and up
		Digital Outputs	**Dig Out**	**Dty Cyc**		
		SPA Vertical Motor Enable Pulse (Crash reset pulse)	0 (C10)	1/1		
		Digital Inputs	**Dig In**	**Sts Bit**		
		(spare +5V in #1 -- Do-All SIC J10)	0 (A15)	0		
		(spare +5V in #2 -- Do-All SIC J11)	1 (B15)	1		
		(spare +5V in #3 -- Do-All SIC J12)	2 (C15)	2		
		Hard Crash	3 (A16)	3	Occurs when SPA relay drops out due to excessive crash	low-true
			4 (B16)	4		
			5 (C16)	5		
		Stop All Motors	6 (B17)	6	Door Interlocks--activates if a door is open	low-true
		XSCAN	**XSCAN**			
		Crash Detect (soft)	0 (A08)			low-true
		Crash Detect (hard)	1 (A09)			low-true

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes		special Notes
BA: 3				Special Conditions	
BT: DCVB	VM	SPA Valves	I2C: SPA 92		
BN: SPA DCVB 1		Valve Name	Valve Addr (hex)		
SS: SPA		Stain	0	Control Shared with DCVB 2	
		ASV (Air Supply Valve)	1	Control Shared with DCVB 2	
		(spare)	2	Control Shared with DCVB 2	
		AMV (Air Mix Valve)	3	Control Shared with DCVB 2	
		CBV	4	Control Shared with DCVB 2	
		(spare)	5	Control Shared with DCVB 2	
		SBV (stain Bypass Valve)	6	Control Shared with DCVB 2	
		DRV	7	Control Shared with DCVB 2	
		(spare)	8	Control Shared with DCVB 2	
		PBV	9	Control Shared with DCVB 2	
		EBV	A	Control Shared with DCVB 2	
		(spare)	B	Control Shared with DCVB 2	
	VLL1	Low Level Valve Drive 1	I2C: VM 98	Can be controlled by either DCVB 1 or DCVB 2	
		Stain Valve	1 (Hi: A32, Lo:A33)		(FSV SIC, J2)
		ASV	2 (Hi: B32, Lo:B33)		(FSV SIC, J3)
		(spare)	3 (Hi: C32, Lo:C33)		(FSV SIC, J4)
	VLL2	Low Level Valve Drive 2	I2C: VM 9A	Can be controlled by either DCVB 1 or DCVB 2	
		AMV	4 (Hi: A34, Lo:A35)		(FSV SIC, J5)
		CBV	5 (Hi: C32, Lo:C33)		(FSV SIC, J6)
		(spare)	6 (Hi: A36, Lo:A37)		(FSV SIC, J7)

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes										special Notes
BA: 5 BT: MSCB BN: FBA MSCB 3 SS: FBA				Special Conditions									
	M1	Cannula Pump	I2C: FBA B0	Home function assoicated with Analog input & Opto LED as below									
			(M+: A33, M-: A34) (A: A18, B: A17)	Motor stop on Crash Detect, Stop-All-Motors or CP door open									
				PID param: kp = 0x0090, ki =0x0020, kd = 0x0020, il = 0x0100									
	M2	Sheath Pump	I2C: FBA B2	Home function assoicated with Analog input & Opto LED as below									
			(M+: B33, M-: B34) (A: C18, B: C17)	Motor stop on Crash Detect, Stop-All-Motors or SP door open									
				PID param: kp = 0x0090, ki =0x0020, kd = 0x0020, il = 0x0100									
	SCN	FBA scanning	I2C: FBA D0	Functions assigned and controlled as detailed below									
		Analog inputs & Opto LEDs	**Ana In**	**Sts LED**	**Opto Type**	**Opto LED**	**LED cur**	**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		M1 (Cannula Pump) Home	0 (A19)	0	HOA0708	0 (A26)	40ma	long	2.8K to GND	high	72	255	Automatic "Home Function"
		M2 (Sheath Pump) Home	1 (B19)	1	HOA0708	1 (B26)	40ma	long	2.8K to GND	high	72	255	Automatic "Home Function"
			2 (C19)	2									
			3 (A20)	3									
		Air storage prssr (Do-All SIC J2)	4 (B20)	4	n/a	none	n/a	long*	2.8K to GND*				*Also available on MSCB1, but only one of of the two (MSCB1 or MSCB3) should be scanned.
		Stain Bottle prssr (Do-All SIC J3)	5 (C20)	5	n/a	none	n/a	long*	2.8K to GND*				
		(spare prssr #1) (Do-All SIC J4)	6 (A21)	6	n/a	none	n/a	long*	2.8K to GND*				
		(spare prssr #2) (Do-All SIC J5)	7 (B21)	7	n/a	none	n/a	long*	2.8K to GND*				
			8 (C21)	8									
		F24 monitor: J16-CAM+24VM	9 (A22)	9	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.
		F23 monitor: J16-STB+24VM	10 (B22)	10	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.
		F20 monitor: J17+5VM	11 (C22)	11	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F12 monitor: J18+5VM	12 (A23)	12	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F11 monitor: J18+24VM	13 (C23)	13	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.
		F3 monitor: J19+5VM	14 (A24)	14	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F14 monitor: J21+24VM	15 (B24)	14	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes			special Notes
BA: 5 (cont) BT: MSCB BN: FBA MSCB 3 SS: FBA	SCN (cont)	**+24V Outputs**	**+24V Out**	**Dty Cyc**		
		(spare valve #6 -- Do-All SIC J13)	0 (A35)	1/1	Control Shared with MSCB 2	Sig name on bkpln: SPV-VLV
		(spare valve #6 -- Do-All SIC J14)	1 (C35)	1/1	Control Shared with MSCB 2	Sig name on bkpln: SVV-VLV
		(spare valve #1 -- Do-All SIC J15)	2 (A36)	1/1	Control Shared with MSCB 2	
		(spare valve #2 -- Do-All SIC J16)	3 (B36)	1/1	Control Shared with MSCB 2	
		(spare valve #3 -- FSV SIC J14)	4 (C36)	1/1	Control Shared with MSCB 2	
		(spare valve #4 -- FSV SIC J15)	5 (A37)	1/1	Control Shared with MSCB 2	
		(spare valve #5 -- FSV SIC J16)	6 (B37)	1/1	Control Shared with MSCB 2	
		Sheath dphrgm pmp (STM SIC J6)	7 (C37)	1/1	Control Shared with MSCB 1	Sig nm on bkpln: SPR+24V-DRV
		+24V Inputs	**+24V In**	**Sts Bit**		
		Code ID	0 (A32)	0	Tells the PIC whether FM1 or FM2 and up	"1" = FM1.5 and up
		Digital Outputs	**Dig Out**	**Dty Cyc**		
		Digital Inputs	**Dig In**	**Sts Bit**		
		Cannula Pump Cassette In Place	0 (A15)	0		
		Cannula Pump Cover In Place	1 (B15)	1		
		Sheath Pump Cassette In Place	2 (C15)	2		
		Sheath Pump Cover In Place	3 (A16)	3		
		Specimen FITD (Do-All SIC J8)	4 (B16)	4	Also available on MSCB1	"1" indicates liquid present
		Waste Well FITD (Do-All SIC J9)	5 (C16)	5	Also available on MSCB1	"1" indicates waste well ovrflw
		Stop All Motors	6 (B17)	6	Door Interlocks--activates if a door is open	low-true
		XSCAN	**XSCAN**			
		Crash Detect	0 (A08)			

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes									special Notes
BA: 6 BT: MSCB BN: STM MSCB 4 SS: STM				Special Conditions								
	M1	Arkray Carrier Input Buffer DC motor	I2C: STM B0									
			(M+: A33, M-: A34) (A: A18, B: A17)									
	M2	Arkray Carrier Output Buffer DC motor	I2C: STM B2									
			(M+: B33, M-: B34) (A: C18, B: C17)									
	SCN	Arkray Sampler scanning: Position Detectors	I2C: STM D0	Functions assigned and controlled as detailed below								
		Analog inputs & Opto LEDs	**Ana In**	**Sts LED**	**Opto Type**	**Opto LED**	**LED cur**	**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		Specimen Tube Present (STD)	0 (A19)	0	MV8141 L14N1	0 (A26)	50ma	long	2.8K to GND	low	80	255	
		(Unused, but scanned)	1 (B19)	n/a				long					To insert delay so duty cycle of STD isn't so high
		(Unused, but scanned)	2 (C19)	n/a				long					To insert delay so duty cycle of STD isn't so high
		(Unused, but scanned)	3 (A20)	n/a				long					To insert delay so duty cycle of STD isn't so high
		F4 monitor: J20-SM1+24VM	4 (B20)	4	n/a	none	--	short	none	low	143	255	slow scan fuse monitor funct.
		F5 monitor: J20-SM2+24VM	5 (C20)	5	n/a	none	--	short	none	low	143	255	slow scan fuse monitor funct.
		F8 monitor: J21+5VM	6 (A21)	6	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F7 monitor: J22+5VM	7 (B21)	7	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
		F6 monitor: J23+5VM	8 (C21)	8	n/a	none	--	short	none	low	164	255	slow scan fuse monitor funct.
			9 (A22)	9									
		F15 monitor: J14-SM1+24VM	10 (B22)	10	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.
		F19 monitor: J12+24VM	11 (C22)	11	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.
			12 (A23)	12									
		F21 monitor: J24+24VM	13 (C23)	13	n/a	none	--	short	none	low	176	255	slow scan fuse monitor funct.

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes			special Notes
BA: 6 (cont) BT: MSCB BN: STM MSCB 4 SS: STM	SCN (cont)	**+24V Outputs**	**+24V Out**	**Dty Cyc**		
		+24V Inputs	**+24V In**	**Sts Bit**		
		Code ID	0 (A32)	0	Tells the PIC whether FM1 or FM2 and up	"1" = FM1.5 and up
		Digital Outputs	**Dig Out**	**Dty Cyc**		
		Carrier ID address 0	0 (C10)	1/1	Arkray J01-13	
		Carrier ID address 1	1 (C11)	1/1	Arkray J01-14	
		Carrier ID address 2	2 (A12)	1/1	Arkray J01-15	
		SM-DS-OUT	3 (B12)	1/1		
		SM-US-OUT	4 (C12)	1/1		
		Digital Inputs	**Dig In**	**Sts Bit**		
		Carrier ID Selected Signal	0 (A15)	0	Arkray J01-12	
		SM-DS-IN!	1 (B15)	1	lo-true	
		SM-US-IN!	2 (C15)	2	lo-true	
		Stop All Motors	6 (B17)	6	Door Interlocks--activates if a door is open	low-true
		XSCAN	**XSCAN**			
		Crash Detect	0 (A08)			

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes									special Notes
BA: 7 BT: SSMB BN: STM SSMB 1 SS: STM				Special Conditions								
	DCM		I2C: STM B4 (M+: A33, M-: A34) (A: A18, B: A17)									
	SM1	Measurement (Inboard) Linear Stepper	I2C: STM B6	Home function assoicated with Analog input as below								
				Motor stop on Crash Detect or Stop-All-Motors								
	SM2	Front (Outboard) Linear Stepper	I2C: STM B8	Home function assoicated with Analog input as below								
				Motor stop on Crash Detect or Stop-All-Motors								
	SCN	STM scanning: Position Detectors	I2C: STM D2	Functions assigned and controlled as detailed below								
		Analog inputs & Opto LEDs	**Ana In**	**Sts LED**	**Opto Type**	**Opto LED**	**LED cur**	**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
			0 (A19)	0									
			1 (B19)	1									
		Msrmnt Stepper Home sensor	2 (C19)	2	Arkray	n/a	--	short	2.5K to +5V	low	0	128	Arkray J01-06
		Front Stepper Home sensor	3 (A20)	3	Arkray	n/a	--	short	2.5K to +5V	low	0	128	Arkray J01-07
		Code ID	5 (C20)	5	n/a	none	--	short	1.4K to GND	low	0	100	"1" = FM1.5 and above
		Card cage thermistor	6 (A21)	6	n/a	none	--	short	5K to +5V	low	146	157	card cage fan cntrl: 34°C/29°C
		Main chassis thermistor	7 (B21)	7	n/a	none	--	short	5K to +5V	low	146	157	main chassis fan cntrl. " "
		+24V Outputs	**+24V Out**	**Dty Cyc**	**Notes**								
		Card cage fan	0 (A35)	1/1	Activates based on ANA-IN 6. @ 34°C fan turns on, 29°C fan turns off.								
		Main fan	1 (C35)	1/1	Activates based on ANA-IN 7. @ 34°C fan turns on, 29°C fan turns off.								
		+24V Inputs	**+24V In**	**Sts Bit**	**Notes**								
		Digital Outputs	**Dig Out**	**Dty Cyc**	**Notes**								
		Supply Upstream Power	0 (C10)	1/1									
		Supply Dnstream Power	1 (C11)	1/1									
		Upstrm & DwnStrm Reset	2 (A12)	1/1									Hi-true reset

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes			special Notes
BA: 7 BT: SSMB BN: OBA SSMB 1 SS: OBA	SCN (cont)	**Digital Inputs**	**Dig In**	**Sts Bit**	**Notes**	
		Discharge Back-side sensor	0 (A15)	0	Arkray J01-04	
		Discharge Front-side sensor	1 (B15)	1	Arkray J01-03	
		Transfer Front-side sensor	2 (C15)	2	Arkray J01-02	
		Meas side lvr pos chck of port	3 (A16)	3	Arkray J01-08	
		Stat Set sensor	4 (B16)	4	Arkray J01-09	
		Stat Case sensor	5 (C16)	5	Arkray J01-11	
		Stop All Motors	6 (B17)	6	Door Interlocks--activates if a door is open	low-true
		XSCAN	**XSCAN**		**Notes**	
		Crash Detect	0 (B13)			

BA: Board Addess BT: Board Type BN: Board Name SS: Sub system	PIC-18 PIC-16	Controls or Monitors	parameters & Notes										special Notes
BA: 8 BT: SSMB BN: OBA SSMB 2 SS: OBA					Special Conditiions								
	DCM		I2C: OBA B4										
	SM1	Optical Bench Focus Stepper	I2C: OBA B6		Back home sensor: Ana In 0								
	SM2												
	SCN	Optical Bench sensors	I2C: OBA D2		Functions assigned and controlled as detailed below								
		Analog inputs & Opto LEDs	**Ana In**	**Sts LED**	**Opto Type**	**Opto LED**	**LED cur**	**Period**	**Load**	**Gain**	**Lw Thr**	**Hi Thr**	
		OBA Focus Home sensor	0 (A19)	0	slot	0 (A26)	20 ma	short		low	0	128	
			1 (B19)	1									
			2 (C19)	2									
		OBA thermistor #1	3 (A20)	3	n/a	none	--	short	10K to +5V	low	n/a	n/a	Analog measurement
		OBA thermistor #2	4 (B20)	4	n/a	none	--	short	10K to +5V	low	n/a	n/a	Analog measurement
		Code ID	5 (C20)	5	n/a	none	--	short	1.4K to GND	low	0	100	"1" = FM1.5 and above
		OBA thermistor #3	6 (A21)	6	n/a	none	--	short	10K to +5V	low	n/a	n/a	Analog measurement
			7 (B21)	7									
		+24V Outputs	**+24V Out**	**Dty Cyc**									
		+24V Inputs	**+24V In**	**Sts Bit**									
		Digital Outputs	**Dig Out**	**Dty Cyc**									
		Digital Inputs	**Dig In**	**Sts Bit**									
		Stop All Motors	6 (B17)	6	Door Interlocks--activates if a door is open								low-true
		XSCAN	**XSCAN**										
		Crash Detect	0 (B13)										
Discrete Elements													
Power SIC		Power SIC	I2C: HLB A6		(the Power SIC is not in the Cardcage.)								

Hardware Assignment Cross Reference

Item Name	Signal Name(s)	Item Category	Item Description	Cardcage control element	Directly Connected SIC or Interface Bd
DC Motors (with and without encoder)					
Evacuation Pump	EVAC-PMP-M+, ...M-	DC gearmotor w/encoder	Evacuation Peri Pump.	MSCB1, M1	Backplane, J17
spare motor drive		spare DC motor/encoder	Spare pwm dc motor control	MSCB1, M2	
Cannula Pump	CANNULA-PMP-M+, ...M-	DC gearmotor w/encoder	Cannula Peri Pump.	MSCB3, M1	Backplane, J22
Sheath Pump	SHEATH-PMP-M+, ...M-	DC gearmotor w/encoder	Sheath Peri Pump.	MSCB3, M2	Backplane, J23
SPA Vertical	VERT-MOT+, VERT-MOT-	DC gearmotor w/encoder	SPA Vertical Motor.	MSCB2, M1	SPA SIC, J3
SPA Rotation	ROT-MOT+, ROT-MOT-	DC gearmotor w/encoder	SPA Rotational Motor.	MSCB2, M2	SPA SIC, J4
STM Input Bufer	INPUT-BUF-MOT+, ...MOT-	DC motor, no encoder	Arkray input (right side) belt DC motor.	MSCB4, M1	STM SIC, J02
STM Output Buffer	OUTPUT-BUF-MOT+, ...MOT-	DC motor, no encoder	Arkray output (left side) belt DC motor.	MSCB4, M2	STM SIC, J02
spare motor drive		spare DC motor/encoder	Spare pwm dc motor control	SSMB1, DCM	
spare motor drive		spare DC motor/encoder	Spare pwm dc motor control	SSMB2, DCM	
Motor Encoders					
Evacuation Pump	EVAC-PMP-ENC-A, ...B	DC gearmotor encoder	Evacuation Peri Pump Motor encoder.	MSCB1, M1	Backplane, J17
spare encoder		DC gearmotor encoder	Spare pwm dc motor control	MSCB1, M2	
Cannula Pump	CANNULA-PMP-ENC-A, ...B	DC gearmotor encoder	Cannula Peri Pump.	MSCB3, M1	Backplane, J22
Sheath Pump	SHEATH-PMP-ENC-A, ...B	DC gearmotor encoder	Sheath Peri Pump.	MSCB3, M2	Backplane, J23
SPA Vertical	VERT-ENC-A, ...B	DC gearmotor encoder	SPA Vertical Motor.	MSCB2, M1	SPA SIC, J3
SPA Rotation	ROT-ENC-A, ...B	DC gearmotor encoder	SPA Rotational Motor.	MSCB2, M2	SPA SIC, J4
spare encoder		DC gearmotor encoder	Spare pwm dc motor control	SSMB1, M	
spare encoder		DC gearmotor encoder	Spare pwm dc motor control	SSMB2, M	
Stepper Motors					
STM Measurement	INBRD-STPR-MOT-P1+, ...P1- J20-SM1+24V INBRD-STPR-MOT-P2+, ...P2-	Uni-polar stepper motor	Arkray "inner" linear motion	SSMB1, SM1	STM SIC, J02
STM Move out	OUTBRD-STPR-MOT-P1+, ...P1- J20-SM2+24V OUTBRD-STPR-MOT-P2+, ...P2-	Uni-polar stepper motor	Arkray "outer" linear motio	SSMB1, SM2	STM SIC, J02
OBA focus	FSM-P1+, ...P1- J14-SM1+24V FSM-P2+, ...P2-	Bi-polar stepper motor	OBA focus stepper motor	SSMB2, SM1	OBA SIC, J2
spare		spare Uni-polar stppr motor	Spare stepper motor drive	SSMB2, SM2	
Diaphragm Pumps					
Air Pump	AIR-PUMP	DC brush diaphragm pump	Air pump	MSCB1, SCN, +24Vout 2	STM SIC, J3
Rinse Pump	RINSE-PUMP	DC brush diaphragm pump	Waste well sheath rinse supply pump	MSCB1, SCN, +24Vout 0	STM SIC, J5
Sheath Pump	SPR+24V-DRV	DC brush diaphragm pump	Sheath internal container refill pump	MSCB1, SCN, +24Vout 3	STM SIC, J6
Waste Pump	WASTE-PUMP	DC brush diaphragm pump	Waste well emptying pump	MSCB1, SCN, +24Vout 1	STM SIC, J4

Item Name	Signal Name(s)	Item Category	Item Description	Cardcage control element	Directly Connected SIC or Interface Bd
Valves (monitored)					
BPV	DCVB2-V3H, ...V3L	Monitored valve		DCVB2, VLL1, VLV2	FSV SIC, J10
CBV	DCVB1-V5H, ...V5L	Monitored valve		DCVB1, VLL2, VLV1	FSV SIC, J6
CGV	DCVB1-V6H, ...V6L	Monitored valve		DCVB1, VLL2, VLV2	FSV SIC, J7
DRV	DCVB2-V2H, ...V2L	Monitored valve		DCVB2, VLL1, VLV1	FSV SIC, J9
EBV	DCVB2-V5H, ...V5L	Monitored valve	Evacuation Bypass Valve	DCVB2, VLL2, VLV1	FSV SIC, J12
PBV	DCVB2-V4H, ...V4L	Monitored valve	Pipette Bypass Valve	DCVB2, VLL2, VLV0	FSV SIC, J11
SBV	DCVB2-V1H, ...V1L	Monitored valve		DCVB2, VLL1, VLV0	FSV SIC, J8
spare	DCVB1-V2H, ...V2L	Monitored valve		DCVB1, VLL1, VLV1	FSV SIC, J3
spare	DCVB1-V3H, ...V3L	Monitored valve		DCVB1, VLL1, VLV2	FSV SIC, J4
spare	DCVB1-V4H, ...V4L	Monitored valve		DCVB1, VLL2, VLV0	FSV SIC, J5
spare	DCVB2-V6H, ...V6L	Monitored valve	spare valve	DCVB2, VLL2, VLV2	FSV SIC, J13
spare--rsrvd	DCVB1-V1H, ...V1L	Monitored valve	hi-current drive reservd for stain valve	DCVB1, VLL1, VLV0	FSV SIC, J2
Analog Inputs					
Air storage pressure	AIR-BUF-PSSR	Pressure Xdcr Output	Air storage bottle pressure	MSCB1, SCN, Ana In 4	Do-All SIC, J2
Air storage pressure	AIR-BUF-PSSR	Pressure Xdcr Output	Air storage bottle pressure	MSCB3, SCN, Ana In 4	Do-All SIC, J2
Cannula Pump Home PQ	CANNULA-PMP-HOME-PQ	Phototransistor output	Cannula Pump home phototransistor	MSCB3, SCN, Ana In 0	Cannula Pmp Pmp SIC
Cardcage thermistor	(10K thermistor on bckpln)	thermistor on backplane	Thermistor for cardcage temperature	SSMB1, SCN, Ana In 6	backplane
Code ID	(+5V drctly to bkpln input pin)	hardwired +5V on bkpln	Logic signal to indicate FM1.5 and up	SSMB1, SCN, Ana In 5	backplane
Code ID	(+5V drctly to bkpln input pin)	hardwired +5V on bkpln	Logic signal to indicate FM1.5 and up	SSMB2, SCN, Ana In 5	backplane
Evac Pmp Home PQ	EVAC-PMP-HOME-PQ	Phototransistor output	Evac pump home phototransistor	MSCB1, SCN, Ana In 0	Evac Pmp Pmp SIC
Front stepper home sensor	STM-RTN-HOME	5V digital input	STM digitized measurement snsr home	SSMB1, SCN, Ana In 3	STM SIC, J01
Fuse 10 monitor J11 +24V	J11+24VM	Fuse monitor via divider	Fuse 10 monitor J11 +24V	MSCB2, SCN, Ana In 12	backplane
Fuse 12 monitor J18 +24V	J18+24VM	Fuse monitor via divider	Fuse 11 monitor J18 +24V	MSCB3, SCN, Ana In 13	backplane
Fuse 12 monitor J18 +5V	J18+5VM	Fuse monitor via divider	Fuse 12 monitor J18 +5V	MSCB3, SCN, Ana In 12	backplane
Fuse 13 monitor J11 +5V	J11+5VM	Fuse monitor via divider	Fuse 13 monitor J11 +5V	MSCB2, SCN, Ana In 11	backplane
Fuse 14 monitor J21 +24V	J21+24VM	Fuse monitor via divider	Fuse 14 monitor J21 +24V	MSCB3, SCN, Ana In 15	backplane
Fuse 15 mon J14 Stpr 1 +24V	J14-SM1+24VM	Fuse monitor via divider	Fuse 15 monitor J14 stppr motor 1 +24V	MSCB4, SCN, Ana In 10	backplane
Fuse 17 monitor J12 +5V	J12+5VM	Fuse monitor via divider	Fuse 17 monitor J12 +5V	MSCB2, SCN, Ana In 13	backplane
Fuse 18 monitor J13 +5V	J13+5VM	Fuse monitor via divider	Fuse 18 monitor J13 +5V	MSCB2, SCN, Ana In 14	backplane
Fuse 19 monitor J12 +24V	J12+24VM	Fuse monitor via divider	Fuse 19 monitor J12 +24V	MSCB3, SCN, Ana In 11	backplane
Fuse 20 monitor J17 +5V	J12+5VM	Fuse monitor via divider	Fuse 20 monitor J17 +5V	MSCB3, SCN, Ana In 11	backplane
Fuse 21 monitor J24 +24V	J24+24VM	Fuse monitor via divider	Fuse 21 monitor J24 +24V	MSCB3, SCN, Ana In 13	backplane

Item Name	Signal Name(s)	Item Category	Item Description	Cardcage control element	Directly Connected SIC or Interface Bd
Analog Inputs (cont)					
Fuse 22 monitor J16 +5V	J16+5VM	Fuse monitor via divider	Fuse 22 monitor J16 +5V	MSCB2, SCN, Ana In 10	backplane
Fuse 23 mon J16 STB +24V	J16-STB+24VM	Fuse monitor via divider	Fuse 24 monitor J16 strobe +24V	MSCB3, SCN, Ana In 10	backplane
Fuse 24 mon J16 CAM +24V	J16-CAM+24VM	Fuse monitor via divider	Fuse 24 monitor J16 camera +24V	MSCB3, SCN, Ana In 9	backplane
Fuse 25 monitor J10 +5V	J10+5VM	Fuse monitor via divider	Fuse 25 monitor J10 +5V	MSCB2, SCN, Ana In 9	backplane
Fuse 3 monitor J19 +5V	J19+5VM	Fuse monitor via divider	Fuse 3 monitor J19 +5V	MSCB3, SCN, Ana In 14	backplane
Fuse 4 mon J20 Stppr 1 +24V	J20-SM1+24VM	Fuse monitor via divider	Fuse 4 monitor J20 stppr motor 1 +24V	MSCB4, SCN, Ana In 4	backplane
Fuse 5 mon J20 Stppr 2 +24V	J20-SM2+24VM	Fuse monitor via divider	Fuse 5 monitor J20 stppr motor 2 +24V	MSCB4, SCN, Ana In 5	backplane
Fuse 6 monitor J23 +5V	J23+5VM	Fuse monitor via divider	Fuse 6 monitor J23 +5V	MSCB3, SCN, Ana In 8	backplane
Fuse 7 monitor J22 +5V	J22+5VM	Fuse monitor via divider	Fuse 7 monitor J22 +5V	MSCB3, SCN, Ana In 7	backplane
Fuse 8 monitor J21 +5V	J21+5VM	Fuse monitor via divider	Fuse 8 monitor J21 +5V	MSCB3, SCN, Ana In 6	backplane
Fuse 9 monitor J14 +5V	J14+5VM	Fuse monitor via divider	Fuse 9 monitor J14 +5V	MSCB2, SCN, Ana In 15	backplane
Main chassis thermistor	(10K thermistor on bckpln)	thermistor on backplane	Thrmstr for main chassis temperature	SSMB1, SCN, Ana In 7	backplane
Msmrnt stepper home sensor	STM-MSR-HOME	5V digital input	STM digitized measurement snsr home	SSMB1, SCN, Ana In 2	STM SIC, J01
OBA Focus Home photo Q	FH-PQ	Opto-transistor output	OBA Focus Home phototransistor	SSMB2, SCN, Ana In 0	OBA SIC, J12
OBA thermistor #1	OBA-THERM1	Thermistor to GND	OBA mechanism thermistor	SSMB2, SCN, Ana In 3	OBA SIC, J6
OBA thermistor #2	OBA-THERM2	Thermistor to GND	OBA mechanism thermistor	SSMB2, SCN, Ana In 4	OBA SIC, J6
OBA thermistor #3	OBA-THERM3	Thermistor to GND	OBA mechanism thermistor	SSMB2, SCN, Ana In 6	OBA SIC, J6
Pippette arm Rotation Home	ROT-HOME-PQ	Opto-transistor output	SPA rotatn position home (back sensor)	MSCB2, SCN, Ana In 1	SPA SIC, J10
Pippette arm Rotation limit	ROT-FRT-LIM-PQ	Opto-transistor output	SPA rotatn position limit (front sensor)	MSCB2, SCN, Ana In 3	SPA SIC, J10
Pippette arm Vertical bottom	VERT-LWR-LIM-PQ	5V lever switch output	SPA vert position home (top of travel)	MSCB2, SCN, Ana In 5	SPA SIC, J16
Pippette arm Vertical Home	VERT-HOME-PQ	Opto-transistor output	SPA vert position home (top of travel)	MSCB2, SCN, Ana In 0	SPA SIC, J10
Sheath Container Ovrflow	SHEATH-OVRFLW	5V Digital input	Sheath Ovrflw sw. (Not used here)	HLCB, FQM, Ana In 1	Rear Panel SIC, J4
Sheath Container Sensor	SHEATH-SIGNAL	5V Analog input	8-level sig frm intrnl Sheath Cntnr Assy	HLCB, FQM, Ana In 0	Rear Panel SIC, J4
Sheath Pump Home PQ	SHEATH-PMP-HOME-PQ	Phototransistor output	Sheath Pump home phototransistor	MSCB3, SCN, Ana In 1	Sheath Pmp Pmp SIC
Soft Crash	SOFT-CRSH!	5V lever switch output	SPA soft crash switch	MSCB2, SCN, Ana In 4	SPA SIC, J5
spare pssr signal	SPR-PSSR-1	Pressure Xdcr Output	spare presure xdcr signal	MSCB1, SCN, Ana In 6	Do-All SIC, J2
spare pssr signal	SPR-PSSR-1	Pressure Xdcr Output	spare presure xdcr signal	MSCB3, SCN, Ana In 6	Do-All SIC, J2
spare pssr signal	SPR-PSSR-2	Pressure Xdcr Output	spare presure xdcr signal	MSCB1, SCN, Ana In 7	Do-All SIC, J2
spare pssr signal	SPR-PSSR-2	Pressure Xdcr Output	spare presure xdcr signal	MSCB3, SCN, Ana In 7	Do-All SIC, J2
spare pssr signal	STAIN-PSSR	Pressure Xdcr Output	spare presure xdcr signal	MSCB1, SCN, Ana In 5	Do-All SIC, J2
spare pssr signal	STAIN-PSSR	Pressure Xdcr Output	spare presure xdcr signal	MSCB3, SCN, Ana In 5	Do-All SIC, J2
STD signal	STD-PQ	Phototransistor output	STD phototransistor	MSCB4, SCN, Ana In 0	STM SIC, J9

Item Name	Signal Name(s)	Item Category	Item Description	Cardcage control element	Directly Connected SIC or Interface Bd
OLED Drives					
Cannula Pmp Home Opto-LED	CANNULA-PMP-HOME-OLED	Opto-LED drive input	Cannula Pump home opto-LED	MSCB3, SCN, OLED 0	Cannula Pmp Pmp SIC
Evac Pmp Home Opto-LED	EVAC-PMP-HOME-OLED	Opto-LED drive input	Evac pump home opto-LED	MSCB1, SCN, OLED 0	Evac Pmp Pmp SIC
OBA Focus Home Opto-LED	FH-OLED	Opto-LED drive input	OBA Focus Home opto-LED	SSMB2, SCN, OLED 0	OBA SIC, J12
Sheath Pmp Home Opto-LED	SHEATH-PMP-HOME-OLED	Opto-LED drive input	Sheath Pump home opto-LED	MSCB3, SCN, OLED 1	Sheath Pmp Pmp SIC
SPA arm Rot Home Opto-LED	ROT-HOME-OLED	Opto-LED drive input	SPA rot pos hm (bck sensor) opto-LED	MSCB2, SCN, OLED 1	SPA SIC, J10
SPA arm Rot limit Opto-LED	ROT-FRT-LIM-OLED	Opto-LED drive input	SPA rot pos lim (frnt sensor) opto-LED	MSCB2, SCN, OLED 3	SPA SIC, J10
SPA arm Vert Home Opto-Led	VERT-HOME-OLED	Opto-LED drive input	SPA vert pos hm (top of trav) opto-LED	MSCB2, SCN, OLED 0	SPA SIC, J10
STD signal Opto-LED	STD-OLED	Opto-LED drive input	STD opto-LED	MSCB4, SCN, OLED 0	STM SIC, J9
Digital Outputs					
Carrier ID address 0	CID-ADR0	5V digital output	Arkray STM tray ID reader addr 0	MSCB4, SCN, Dig Out 0	STM SIC, J01
Carrier ID address 1	CID-ADR1	5V digital output	Arkray STM tray ID reader addr 1	MSCB4, SCN, Dig Out 1	STM SIC, J01
Carrier ID address 2	CID-ADR2	5V digital output	Arkray STM tray ID reader addr 2	MSCB4, SCN, Dig Out 2	STM SIC, J01
Crash relay reset pulse	SPA-VERT-EN	5V digital output	SPA vertical crash relay reset pulse	MSCB2, SCN, Dig Out 0	SPA SIC
Downstream output signal	SM-DS-OUT	5V digital output	Handshake signal to downstream unit	MSCB4, SCN, Dig Out 3	Rear Panel SIC, J3
ESN Rly Ctrl Bit 0	GRP-CTL0!	5V digital output	ESN group relay control, bit 0	HLCB, MST, CTL0	Do-All SIC
ESN Rly Ctrl Bit 1	GRP-CTL1!	5V digital output	ESN group relay control, bit 1	HLCB, MST, CTL1	Do-All SIC
ESN Rly Ctrl Bit 2	GRP-CTL2!	5V digital output	ESN group relay control, bit 2	HLCB, MST, CTL2	Do-All SIC
Pause Sw grn LED	XLED0	5V digital output	Pause Switch, green LED, 0V = on	HLCB, FQM, XLED 0	SM Status Bd.
Pause Sw red LED	XLED1	5V digital output	Pause Switch, red LED, 0V = on	HLCB, FQM, XLED 1	SM Status Bd.
SM Status blue LEDs	XLED4	5V digital output	blue "measure" status LEDs, 0V = on	HLCB, FQM, XLED 4	SM Status Bd.
SM Status green LEDs	XLED3	5V digital output	green "standby" status LEDs, 0V = on	HLCB, FQM, XLED 3	SM Status Bd.
SM Status red LEDs	XLED2	5V digital output	red "error" status LEDs, 0V = on	HLCB, FQM, XLED 2	SM Status Bd.
Supply downstream power	SUPPLY-DS-PWR	5V digital output	Control sig to enable downstream +24V	SSMB1, SCN, Dig Out 2	Rear Panel SIC, J3
Supply upstream power	SUPPLY-US-PWR	5V digital output	Control signal to enable upstream +24V	SSMB1, SCN, Dig Out 0	Rear Panel SIC, J2
Upstream output signal	SM-US-OUT	5V digital output	Handshake signal to upstream unit	MSCB4, SCN, Dig Out 4	Rear Panel SIC, J2
Upstrm/Dwnstrm reset	ARKRAY-RST	5V digital output	Control reset signal to Arkray units	SSMB1, SCN, Dig Out 3	Rear Panel SIC, J2 &J3

Item Name	Signal Name(s)	Item Category	Item Description	Cardcage control element	Directly Connected SIC or Interface Bd
Digital Inputs					
Cannula pmp cover in place	CANNULA-PMP-CVR-IN-PLC	5V lever switch input	Evac pump door sense switch	MSCB3, SCN, Dig In 1	Cannula Pmp Pmp SIC
Cannula pmp cssette in place	CANNULA-PMP-CSST-IN-PLC	5V lever switch input	Evac pump cassette sense switch	MSCB3, SCN, Dig In 0	Cannula Pmp Pmp SIC
Carrier ID Selected Signal		5V digital input	Sgnal addressed by CID-ADDR0..2	MSCB4, SCN, Dig In 0	STM SIC, J01
Crash Notice	CRASH!	XSCAN digital input	Crash signal from any Scanner	MSCB1, SCN, XSCAN 0	on backplane
Crash Notice	CRASH!	XSCAN digital input	Crash signal from any Scanner	MSCB2, SCN, XSCAN 0	on backplane
Crash Notice	CRASH!	XSCAN digital input	Crash signal from any Scanner	MSCB3, SCN, XSCAN 0	on backplane
Crash Notice	CRASH!	XSCAN digital input	Crash signal from any Scanner	MSCB4, SCN, XSCAN 0	on backplane
Crash Notice	CRASH!	XSCAN digital input	Crash signal from any Scanner	SSMB1, SCN, XSCAN 0	on backplane
Crash Notice	CRASH!	XSCAN digital input	Crash signal from any Scanner	SSMB2, SCN, XSCAN 0	on backplane
Downstream input signal	SM-DS-IN!	5V digital input	Hndshk signal from downstream unit	MSCB4, SCN, Dig In 1	Rear Panel SIC, J3
Evac pump cassette in place	EVAC-PMP-CSST-IN-PLC	5V lever switch input	Evac pump cassette sense switch	MSCB1, SCN, Dig In 0	Evac Pmp Pmp SIC
Evac pump cover in place	EVAC-PMP-CVR-IN-PLC	5V lever switch input	Evac pump door sense switch	MSCB1, SCN, Dig In 1	Evac Pmp Pmp SIC
Pause Switch	FP-SW!	5V manual switch input	SM "Pause" switch, 0V = switch prssd	MSCB1, SCN, Xsw-In 0	SM Status Bd.
Sheath Cntnr Ovrflow	SHEATH-OVRFLW	5V float-switch input	Sheath Ovrflw sw. +5V = Overflow	MSCB1, SCN, Dig In 2	Rear Panel SIC, J4
Sheath pmp cover in place	SHEATH-PMP-CVR-IN-PLC	5V lever switch input	Sheath pump door sense switch	MSCB3, SCN, Dig In 1	Sheath Pmp Pmp SIC
Sheath pmp cssette in place	SHEATH-PMP-CSST-IN-PLC	5V lever switch input	Sheath pump cassette sense switch	MSCB3, SCN, Dig In 0	Sheath Pmp Pmp SIC
spare +5V in #1	SPR-DIGIN-1	5V digital input	soare input for FITD-type 5V signal	MSCB2, SCN, Dig In 0	Do-All SIC, J10
spare +5V in #2	SPR-DIGIN-2	5V digital input	soare input for FITD-type 5V signal	MSCB2, SCN, Dig In 1	Do-All SIC, J11
spare +5V in #3	SPR-DIGIN-3	5V digital input	soare input for FITD-type 5V signal	MSCB2, SCN, Dig In 2	Do-All SIC, J12
spare FITD	STAIN-OUT-FITD	spare FITD driven 5V input	spare FITD input -- was STAIN-OUT	MSCB1, SCN, Dig In 3	Do-All SIC, J7
Specimen FITD	SPECIMEN-FITD	FITD driven 5V input	Specimen sensing FITD	MSCB1, SCN, Dig In 4	Do-All SIC, J8
Specimen FITD	SPECIMEN-FITD	5V digital input	Specimen FITD liquid sense	MSCB3, SCN, Dig In 4	Do-All SIC, J8
Stop All Motors	ALL-MOTORS-STOP!	5V switch input	Stop All Motors signal	MSCB1, SCN, Dig In 6	SM Status Bd.
Stop All Motors	ALL-MOTORS-STOP!	5V switch input	Stop All Motors signal	MSCB2, SCN, Dig In 6	SM Status Bd.
Stop All Motors	ALL-MOTORS-STOP!	5V switch input	Stop All Motors signal	MSCB3, SCN, Dig In 6	SM Status Bd.
Stop All Motors	ALL-MOTORS-STOP!	5V switch input	Stop All Motors signal	MSCB4, SCN, Dig In 6	SM Status Bd.
Stop All Motors	ALL-MOTORS-STOP!	5V switch input	Stop All Motors signal	SSMB1, SCN, Dig In 6	SM Status Bd.
Stop All Motors	ALL-MOTORS-STOP!	5V switch input	Stop All Motors signal	SSMB2, SCN, Dig In 6	SM Status Bd.
Upstream input signal	SM-US-IN!	5V digital input	Hndshk signal from upstream unit	MSCB4, SCN, Dig In 2	Rear Panel SIC, J2
Waste Well FITD	WST-WELL-FITD	FITD driven 5V input	Waste Well Overflow sense FITD	MSCB1, SCN, Dig In 5	Do-All SIC, J9
Waste well FITD	WST-WELL-FITD	5V digital input	Waste well level FITD liquid sense	MSCB3, SCN, Dig In 5	Do-All SIC, J9

Item Name	Signal Name(s)	Item Category	Item Description	Cardcage control element	Directly Connected SIC or Interface Bd
+24V Outputs					
Cardcage cooling fan	CARD-CAGE-FAN-DRV	+24V output	Supplies +24V to cardcage cooling fan	SSMB1, SCN, +24Vout 0	Backplane, J24
Diaphragm pump +24V output drives, see "**Diaphragm Pumps**" subheading					
Main chassis cooling fan	MAIN-CHASSIS-FAN-DRV	+24V output	Supplies +24V to main chassis clng fan	SSMB1, SCN, +24Vout 1	Backplane, J25
spare +24V drive	24V-DRV1	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 4	FSV SIC, J14
spare +24V drive	24V-DRV1	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 4	FSV SIC, J14
spare +24V drive	24V-DRV2	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 5	FSV SIC, J15
spare +24V drive	24V-DRV2	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 5	FSV SIC, J15
spare +24V drive	24V-DRV3	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 6	FSV SIC, J16
spare +24V drive	24V-DRV3	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 6	FSV SIC, J16
spare +24V drive	SPR_24V-DRV1	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 2	Do-All SIC, J15
spare +24V drive	SPR_24V-DRV1	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 2	Do-All SIC, J15
spare +24V drive	SPR_24V-DRV2	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 3	Do-All SIC, J16
spare +24V drive	SPR_24V-DRV2	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 3	Do-All SIC, J16
spare +24V drive	SPR+24V-DRV	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 7	STM SIC, J6
spare +24V drive	SPR+24V-DRV	+24V output	spare open-drain 24V drive.	MSCB1, SCN, +24Vout 3	STM SIC, J6
spare +24V drive	SPV-VLV	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 0	Do-All SIC, J13
spare +24V drive	SPV-VLV	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 0	Do-All SIC, J13
spare +24V drive	SVV-VLV	+24V output	spare open-drain 24V drive.	MSCB3, SCN, +24Vout 1	Do-All SIC, J14
spare +24V drive	SVV-VLV	+24V output	spare open-drain 24V drive.	MSCB2, SCN, +24Vout 1	Do-All SIC, J14
+24V Inputs					
Code ID, MSCB1	(10K resistor to +24V)	+24V logic input	"1" Tells PIC if FM1.5 and up.	MSCB1, SCN, +24V In 0	Backplane
Code ID, MSCB2	(10K resistor to +24V)	+24V logic input	"1" Tells PIC if FM1.5 and up.	MSCB2, SCN, +24V In 0	Backplane
Code ID, MSCB3	(10K resistor to +24V)	+24V logic input	"1" Tells PIC if FM1.5 and up.	MSCB3, SCN, +24V In 0	Backplane
Code ID, MSCB4	(10K resistor to +24V)	+24V logic input	"1" Tells PIC if FM1.5 and up.	MSCB4, SCN, +24V In 0	Backplane

ESN I2C Addresses

Item #	ESN Item	tethere	Fixed	I2C addr	Group 0								Group 1								Group 2								Group 3								Group 4								Group 5								Group 6								Group 7								total
					0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	
1	SPA SIC ESN			G0-A0	1																																																													1
2	SPA opto bd			G0-A2		1																																																											1
3				G0-A4																																																													0
4	SPA Vert bot sensor			G0-A6				1																																																									1
5				G0-A8																																																													0
6	SPA Crash Detector			G0-AA						1																																																						1
7	SPA Rot Encoder			G0-AC							1																																																				1
8	SPA Vert Encoder			G0-AE								1																																																			1
9				G1-A0																																																													0
10	SPA Assy ESN	1		G1-A2										1																																																	1
11				G1-A4																																																													0
12	SM Users Status Bd		X	G1-A6												1																																															1
13	Fluid System Valve SIC			G1-A8													1																																														1
14	FSV SIC +24V drv 1			G1-AA														1																																													1
15	FSV SIC +24V drv 2			G1-AC															1																																											1
16	FSV SIC +24V drv 3			G1-AE																1																																										1
17	STD		X	G2-A0																	1																																										1
18	STM SIC			G2-A2																		1																																									1
19	Bar code reader Assy	1		G2-A4																			1																																								1
20	Arkray Sampler Assy	1		G2-A6																				1																																							1
21	Air Pump			G2-A8																					1																																						1
22	Waste Pump			G2-AA																						1																																					1
23	Rinse Pump			G2-AC																							1																																				1
24	Spare Pump			G2-AE																								1																																			1
25	OBA SIC			G3-A0																									1																																		1
26	OBA mechanical assy			G3-A2																										1																																	1
27	Camera	1		G3-A4																											1																																1
28	Strobe trigger unit	1		G3-A6																												1																															1
29	Strobe bulb	1		G3-A8																													1																														1
30	Strobe PS	1		G3-AA																														1																													1
31	Flow Cell	1		G3-AC																															1																													1
32				G3-AE																																																														0
33	Cannula Pump Pmp SIC			G4-A0																																	1																											1
34	Canula Pump Motor			G4-A2																																		1																										1
35	Sheath Pump Pump SIC			G4-A4																																			1																									1
36	Sheath Pump Motor			G4-A6																																				1																								1
37	Evac Pump Pump SIC			G4-A8																																					1																							1
38	Evac Pump Motor			G4-AA																																						1																						1
39				G4-AC																																																															0
40				G4-AE																																																															0

Item #	ESN Item	tethere	Fixed	I2C addr	Group 0								Group 1								Group 2								Group 3								Group 4								Group 5								Group 6								Group 7								total
					0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	0	2	4	6	8	A	C	E	
41	Air Storage Prssr Xdcr			G5-A0																																									1																								1
42	Spare Prssr Xdcr #3			G5-A2																																										1																							1
43	Spare Prssr Xdcr #1			G5-A4																																											1																						1
44	Spare Prssr Xdcr #2			G5-A6																																												1																					1
45	ASV Air Valve			G5-A8																																													1																				1
46	Spare +24V Drv #1			G5-AA																																														1																			1
47	Spare +24V Drv #2			G5-AC																																															1																		1
48	Spare +24V Drv #3			G5-AE																																																1																	1
49	(do not use)			G6-A0																																																	■																0
50	Spare FITD			G6-A2																																																		1															1
51	Specimin FITD			G6-A4																																																			1														1
52	Waste Well FITD			G6-A6																																																				1													1
53	Spare +5V in #1			G6-A8																																																					1												1
54	Spare +5V in #2			G6-AA																																																						1											1
55	Spare +5V in #3			G6-AC																																																							1										1
56	Do-All SIC ESN			G6-AE																																																								1									1
57	Seath Cntainer Sensor			G7-A0																																																									1								1
58	Power Supply Fan			G7-A2																																																										1							1
59	Rear Panel SIC			G7-A4																																																											1						1
60	Power Supply	1		G7-A6																																																												1					1
61				G7-A8																																																																	0
62				G7-AA																																																																	0
63				G7-AC																																																																	0
64				G7-AE																																																																	0
	"1" = I2C address used ====>				1	1	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	
	Total loads on I2C ====>				6								6								8								7								6								8								7								4								

Total Existing Electrical Hardware ESNs:	30
Total Tethered ESNs	9
Total Option (Spare) ESNs	13
Unusable ESNs	1
Total unassigend ESNs	11
Total ESNs, all categories	64

Legend:

unused	
used	1
unusable	■

8

Schematics

8. Schematics

998-3002 SM SMCS Assemblies Block Diagram