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TROUBLESHOOTING

LEVEL SENSE INDICATORS AND ERROR MESSAGES

7.2 PREFINAL SERVICE SOFTWARE - A TROUBLESHOOTING TOOL

Purpose

Prefinal Service software can provide a valuable information for locating a problem. this software must be installed and operated using the guidelines provided under [Heading 4.2, PREFINAL SERVICE SOFTWARE INSTALLATION AND OPERATION](#). In this section, the various tests available within this software are listed in alphabetical order, with a short description of the test, the areas of the instrument being checked, and suggestions on what to check if a test should fail. [Table A.4-1](#) provides a quick reference of available tests.

This software is not intended to be a Pass/Fail for system performance: the SVP must be run after using the Prefinal Service software.

Tools/Supplies Needed

- ❑ COULTER® EPICS® XL/XL-MCL Prefinal Software diskette, PN 7231244

Preparation

Consult, as needed, the instructions for installing and operating the Prefinal Service Software under [Heading 4.2, PREFINAL SERVICE SOFTWARE INSTALLATION AND OPERATION](#).

Note: This software is not intended to be a Pass/Fail for system performance. The SVP must be run after using the Prefinal Service software.

ADC Zero Adjust

ATTENTION: To perform this adjustment, you must prepare the Trans Data Acquisition card by removing the jumper from E1 to E2 and reinstalling it in position E2 to E3 and by placing the circuit card on a card extender which allows access to the adjustment potentiometer. Although the adjustment must be made using the card extender, the desired 0.3 to 0.9 mVdc reading must be obtained while the circuit card is not on the extender. The ADC Zero Adjust must be run anytime the Trans Data Acquisition card or an Amp/Signal Conditioner card is replaced. After running the ADC Zero Adjust, the Grand Canyon Adjust must also be run. Make sure the jumper is installed at E1 to E2 before performing the Grand Canyon Adjust.

Purpose

This test is used to adjust the ADC Zero on the Trans Data Acquisition card. The circuit card is first put on a card extender and E2 is jumpered to E3 to ground the input to the Sample/Hold and ADC circuitry. Potentiometer, R8, is then adjusted to obtain a 0.3 to 0.9 mVdc reading on the screen. The circuit card is then reinstalled without the extender. The test is run again to verify a 0.3 to 0.9 mVdc reading on the screen. If this is not the case, then the circuit card is extended again and adjusted again to get a 0.3 to 0.9 mVdc reading when the card is not on the extender. After the reading is obtained, the jumper must be moved back to the E1 to E2 position. After running the ADC Zero Adjust, the Grand Canyon Adjust must also be run.

Circuit Card Checked in this Test





- Trans Data Acquisition card

Response if Test Fails

- Jumper E2 to E3 may not be properly installed.
- Trans Data Acquisition card may be defective.

Amp Gain Control**Purpose**

This selection controls the Amp/Signal Conditioner gain for all the signals.

At the Workstation keyboard, select the desired parameter (PMT1, PMT2, PMT3, PMT4, AUX, FS, or SS) using the  or  key. This selection does not provide a PASS or FAIL message. Press  to increase the gain or  to decrease the gain as needed. While adjusting the amplifier gain, observe the response of the bar graph for the parameter being adjusted.

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails

- Amp/Signal Conditioner card may be defective.

Amp Saturation Test**Purpose**

This test verifies the R164 adjustment is not set too low. If set too low, the pulse before the integrator will saturate before the INTEGRAL output saturates. This is hard to detect because as the pulse before the integrator saturates more, the output of the integrator will increase because the pulse width will increase. A gain of 2 should produce a 5 V pulse while a gain of 5 should produce a 10 V pulse.

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS



Response if Test Fails







- One of the Amp/Signal Conditioner cards may be defective. **Do not adjust R164. This is a factory adjustment.** Replace the circuit card as instructed under [Heading 4.15, AMP/SIGNAL CONDITIONER CARD REPLACEMENT AND/OR CALIBRATION](#).

Attenuator Control

Purpose

This selection controls the Amp/Signal Conditioner card attenuator for all signals.

At the Workstation keyboard, select the desired parameter (PMT1, PMT2, PMT3, PMT4, AUX, FS, or SS). This selection does not provide a PASS or FAIL message. Use the  or  key to select the parameter. Using the following information as a reference, determine the desired change then press the key designated to produce that change.

Desired Change	Key to Activate Change
To increase attenuation by 10.0%	Press 
To decrease attenuation by 10.0%	Press 
To increase attenuation by 1.0%	Press 
To decrease attenuation by 1.0%	Press 
To increase attenuation by 0.1%	Press 
To decrease attenuation by 0.1%	Press 

While adjusting the attenuation, observe the response of the bar graph for the parameter being adjusted.

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails

- Amp/Signal Conditioner card may be defective.

Beeper Test

Purpose

This test ensures that the beeper on the Cytometer is working properly.

Circuit Card Checked in this Test

- Cyto Transputer card

Response if Test Fails

- Cyto Transputer card may be defective.
- Beeper may be defective.
Note: This beeper is located on the Cytometer frame, not on the Cyto Transputer card.
- Interconnecting cable from the Analyzer backplane to the beeper is defective.
- Sound port, P67, may be defective.

Canyon Jumper Test

Purpose

This test ensures that the RAMP jumper (E4 to E5) is installed on each Amp/Signal Conditioner card. If the jumper is properly installed on each card, PASS is displayed. If a jumper is not properly installed on a Amp/Signal Conditioner card, the screen freezes with the name of the parameter displayed in red.

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails

- Install E4 to E5 jumper.

Count Rate Test

Purpose

This test checks the count rate register on the Trans Data Acquisition card. It should read approximately 4.0 kHz. This test provides a PASS or FAIL response.

Circuit Card Checked in this Test

- Trans Data Acquisition card

Response if Test Fails

- Replace the Trans Data Acquisition card.




DMA Acquisition - Not Used

Front Panel Test

Purpose

This test ensures the indicators on the front panel display and the sample station switches (RUN, AUTO, PRIME, and CLEANSE) are working properly. The bar graph signals for the indicators on the front panel display come from the Trans Data Acquisition card. The signals for the other indicators and the sample station switches come from the Cyto Transputer card.

Note: The AUTO switch is present only if the MCL option is installed.

To start, press  and look at the front panel display to ensure the test is functioning. Use the  or  key to move to the next indicator to be checked. A dash (—) indicates the switch is inactive; an asterisk (*) indicates the switch is activated.

Circuit Cards Checked in this Test

- Top Panel Display 2 card
- Front Panel LED and Switch Input 2 card (in the sample station of an XL-MCL Cytometer)
- Front Panel LED and Switch Input card (in the sample station of an XL without the MCL option)
- Interconnecting cable from the Analyzer backplane to the Front Panel LED and Switch Input 2 card or Front Panel LED and Switch Input card, as applicable
- Cyto Transputer card (front panel display indicators and sample station switches)
- Trans Data Acquisition card (bar graphs)

Response if Test Fails

Note: If the malfunction involves the bar graphs, you may want to perform the Pulse RAMP Test.

- Top Panel Display 2 card may be defective.
- Front Panel LED and Switch Input 2 card (in the sample station of an XL-MCL Cytometer) or Front Panel LED and Switch Input card (in the sample station of an XL without the MCL option) may be defective.
- Interconnecting cable from the Analyzer backplane to the Front Panel LED and Switch Input 2 card or Front Panel LED and Switch Input card may be defective.
- If only the front panel display indicators and/or sample station switches are malfunctioning, the Cyto Transputer card may be defective.
- If only the bar graphs are malfunctioning, the Trans Data Acquisition card may be defective.

General Information



This screen lists the operation assigned to the various function keys.

Function Key	Operation
F1	Begin All Tests
F2	Loop All Tests
F3	Loop Single Test
F4	Help
F5	Quick Test
F6	Loop on Error Enable/Disable
F7	System Configuration
F8	Manual I/O
F9	No assigned operation
F10	Exit to DOS

Grand Canyon Adjust

ATTENTION: The Grand Canyon Adjust must be performed anytime the Trans Data Acquisition card or an Amp/Signal Conditioner card is replaced. Always run the ADC Zero Adjust **before** doing this adjustment. Before starting is adjustment, remove jumper E4 to E5 from any Amp/Signal Conditioner card being tested.

Purpose

This test is used to adjust the Gap/Spike on the Amp/Signal Conditioner card for each parameter (PMT1, PMT2, PMT3, PMT4, AUX, FS, and/or SS). This is done by adjusting potentiometer R34 on each Amp/Signal Conditioner card to obtain a reading as close to 00.000 mV as possible. The acceptable range is 00.000 to -05.000 mV. A slightly negative reading within the green display range is better than positive due to a possible positive thermal drift. Jumper E4 to E5 must be removed from any Amp/Signal Conditioner card before making an adjustment. Select the parameter to be adjusted using  or .

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails

- Amp/Signal Conditioner card may be defective.
- Trans Data Acquisition card may be defective.
- Make sure the ADC Zero Adjust was done on the Trans Data Acquisition card prior to performing the Grand Canyon Adjust.

Grand Canyon Test

Purpose

This test quick checks the Gap/Spike adjustment on the Amp/Signal Conditioner cards.

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS







Response if Test Fails

- Grand Canyon Adjust may need to be done.
- Trans Data Acquisition card may have been adjusted after the Grand Canyon Adjust rather than before the Grand Canyon Adjust.
- One or more of the amplifiers on the Amp/Signal Conditioner cards have drifted.

Histogram Test

Purpose

This test checks the histograms generated by the ADC on the Trans Data Acquisition card. It checks for gaps between channels of a normal distribution.

- To select the parameter to test, press  or , as applicable.
- To select the number of bits used to generate the histogram, press  or , as applicable.
- To start the histogram building process which culminates with displaying the histogram on the Workstation screen, press .
 - ▶ The histogram is normalized to the center of the screen.
 - ▶ Each channel on the screen corresponds to an ADC channel at the resolution selected.
- To return to the selection screen, press .

Initialize System

Purpose

This selection is used to power up the system before any amplifier operation. This command waits for the dc restorers on the amplifier cards to stabilize and then serves the pulse on each card to 5.0 V. All cards are initialized to a known state.

Circuit Cards Checked in this Test

- Cyto Transputer card
- Trans Data Acquisition card
- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails



- Amp/Signal Conditioner card may not be triggering conversion.
- Trans Data Acquisition card may not be converting.














Laser Control

Purpose

This selection controls the laser. The laser can be turned ON and OFF through this screen. The power and current from the laser are monitored and displayed on the screen.

Options

At the Workstation keyboard, select the desired option using the  or  key then press the designated key to produce the desired change.

Laser Current Option	Key to Activate Change
To increase laser current by 10.0 Amps	Press 
To decrease laser current by 10.0 Amps	Press 
To increase laser current by 1.0 Amp	Press 
To decrease laser current by 1.0 Amp	Press 
To increase laser current by 0.1 Amp	Press 
To decrease laser current by 0.1 Amp	Press 
Laser Power Option	
To increase laser power by 10.0 mW	Press 
To decrease laser power by 10.0 mW	Press 
To increase laser power by 1.0 mW	Press 
To decrease laser power by 1.0 mW	Press 
To increase laser power by 0.1 mW	Press 
To decrease laser power by 0.1 mW	Press 
Laser Control Option	
Toggle the laser ON/OFF	Press 

Components Checked in this Test

- System Interface card
- Argon laser head
- Argon laser power supply

Response if Test Fails

- System Interface card may be defective.
- Argon laser head may be defective.
- Argon laser power supply may be defective.

Laser Warm Up

Purpose

This selection shows the warm-up characteristics of the laser. It plots the laser current versus time on the Workstation screen.

Lock Up Test - Not Used

MCL Bar Code Head Test

WARNING The laser beam can cause eye damage if viewed either directly or indirectly from reflective surfaces (such as a mirror or shiny metal surface). Avoid direct exposure to beam. Do not view the beam directly. Make sure the laser exit port is pointed away from your eyes.

Purpose

This test checks the bar-code head to ensure it is working. It is used to check a replacement head before complete installation. The replacement head must be plugged in but does not need to be mounted to perform this test. It simply enables the head to scan and reports the scanner results on the Workstation screen.

MCL Bar Code Test

Purpose

This test allows the adjustment of the bar-code head to allow the reading of the carousel number label and the carousel position labels. The scan is centered in both labels. The spacebar on the Workstation keyboard is used to move the carousel to the two positions.

MCL Burn In

Purpose

This selection cycles the MCL through a carousel continuously. A carousel full of sample tubes with bar-code labels is used to perform this test. All errors are reported on the Workstation screen.

Error Index Numbers

Each error represents a specific error array element.

Error Message	Error Index Numbers
ERROR_MCL_DISABLED	0X00000001
ERROR_DOOR_OPEN	0X00000002
ERROR_LASER_DISABLED	0X00000004
ERROR_OUT_OF_BOUNDARIES	0X00000008
ERROR_PROBE_MOVE	0X00000010
ERROR_RLV_MOVE	0X00000020
ERROR_CAROUSEL_HOME	0X00000100
ERROR_CAROUSEL_MOVE	0X00000200
ERROR_CAROUSEL_LABEL	0X00000400
ERROR_CAROUSEL_TURN	0X00000800
ERROR_TUBE_POSITION	0X00001000
ERROR_TUBE_FLUNG	0X00002000
ERROR_TUBE_JAMMED	0X00004000
ERROR_UPLOAD	0X00010000
ERROR_RAM	0X00020000
ERROR_ROM	0X00040000
ERROR_CPU	0X00080000
ERROR_SERIAL_1_SEND	0X00100000
ERROR_SERIAL_1_RCV	0X00200000
ERROR_SERIAL_2_SEND	0X00400000
ERROR_SERIAL_2_RCV	0X00800000
ERROR_PARALLEL_SEND	0X01000000
ERROR_PARALLEL_RCV	0X02000000
ERROR_REQUEST	0X80000000

MCL Carousel Label

Purpose

This test checks that the carousel labels are readable and in the proper positions.

MCL Carousel Status

Purpose

This selection ensures that the MCL Carousel Tube Position and Home sensors are working properly.

Test Sequence

1. The carousel is stepped until the Home sensor goes inactive then active. If this does not take place within a full revolution, an error is reported.
2. The carousel is stepped until the Tube Position sensor goes inactive then active. If this does not take place within eight steps, an error is reported.

Response if Test Fails

- Home sensor may be defective.
- Tube Position sensor may be defective.

MCL Door Switch Test

Purpose

This test ensures that the MCL Door Status is working. It reports the current condition of the MCL door.

Response if Test Fails

- MCL door switch may be defective.
- A cable associated with the MCL door may be defective.

MCL Finger Test

Purpose

This test allows the adjustment of the sample tube rotation finger. The spacebar on the Workstation keyboard is used to cycle the carousel in and out to allow access to the finger for adjustment.

MCL Home Align

Purpose

This test is used to adjust the MCL carousel Home position. The Home sensor is adjusted to align the Home rotational position to its proper place. The carousel in/out adjustment screw is used to adjust the home in/out position.

Summary of Test Sequence

The keyboard spacebar is used to step the MCL through a two step adjustment procedure. The sequence is to place the carousel on the hub and to home the carousel. The position is checked and the Spacebar pressed to move the carousel out of the way to access the carousel in/out position screw. The cycle is repeated until no further adjustments are necessary.

MCL Manual Control




Purpose

This selection allow manual control over the MCL movements. The MCL sensor status is also reported.

Sensor Status

- A dash (—) indicates the sensor is inactive.
- An asterisk (*) indicates the sensor is activated.

Controls

- To select what moves, press the  or  key as needed.
- To toggle movement, press  as needed.

MCL Mix Test

Purpose

This test ensures the mix motor is functioning properly. A carousel with a tube of water is placed in position 1 for this test. The MCL will continuously mix this sample until stopped by the user.

MCL Pneumatic Status

Purpose

This selection ensures that the pneumatic cylinder movement sensors are working properly. Each cylinder is moved and the sensor status for that cylinder is monitored. Each of the sensors are blocked as the cylinder is moving and becomes unblocked when the cylinder is fully extended or fully contracted. The probe up/down cylinder is an exception. It is unblocked in the fully extended position.

Sensor Status

- A dash (—) indicates the sensor is inactive (blocked).
- An asterisk (*) indicates the sensor is activated (unblocked).

Response if Test Fails

- Sensor may be defective.
- Air cylinder may be stuck.
- Valve may be defective.

MCL POWER UP Status

Purpose

This selection causes the MCL to do a system reset which causes it to go through its normal power up reset diagnostics. This is the same command the Cytometer software uses to power up the MCL. The result message is then displayed on the Workstation screen. If any errors are encountered, they are reported.

Response if Test Fails

- MCL position sensors may be defective.
- Air cylinder may be stuck.
- One or more valves may be defective.

MCL Probe Align

Purpose

This selection allows the adjustment of the probe height inside the sample tube. The keyboard spacebar is used to cycle the probe up and down.

MCL ROM Test

Purpose

This selection ensures that the ROM in the MCL CPU card is working properly and is the correct version. The ROM is compared to a file on the test disk to ensure that it is the same. The ROM version is also reported.

Response if Test Fails

- MCL ROM may be defective.
- MCL ROM may be an incorrect version.

MCL Scan Reliability

Purpose

This test ensures the reliability of the bar-code reader. A fully loaded carousel with bar-code labels is used for this test. Bad reads are reported on the Workstation screen. The carousel is run continuously until stopped by the user.

MCL Stepper Noise Test

Purpose

This test continuously homes the carousel until stopped by the user. The stepper noise is monitored to ensure it is not excessive.

Response if Test Fails

- Stepper motor may be defective.
- Motor belt may be too tight.

MCL Terminal

Purpose

This selection allow <ESC> codes to be sent to the MCL through the Cytometer parallel port. The MCL can then be controlled manually using its most primitive commands.

Commands

Perform a system reset before running any of these commands.

- MCL_RESET_CMD is activated by pressing **[Esc][M][R]**.
- MCL_VER_LEVEL_CMD is activated by pressing **[Esc][M][V]**

Any attempt to run a System Level, Carousel Movement, Door, TLV, Sampling Probe, Bar-code Scanner, or High Level command without first resetting the system will be ignored; however, Status and Diagnostic commands do not have this same safeguard and may be run without first resetting the system. As a result, use the Status and Diagnostic commands with caution!

Commands		Keystrokes to Initiate
System Level Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD ([Esc][M][R]) MCL_VER_LEVEL_CMD ([Esc][M][V]) Any attempt to run a command without first resetting the system will be ignored.	MCL_DISABLE_CMD	[Esc][M][D]
	MCL_ENABLE_CMD	[Esc][M][E]
	MCL_FLUSH_CMD	[Esc][M][F]
Carousel Movement Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD ([Esc][M][R]) MCL_VER_LEVEL_CMD ([Esc][M][V]) Any attempt to run a command without first resetting the system will be ignored.	CARO_MOVE_TUBE_CMD	[Esc][C][A]nn
	CARO_DIR_CW_CMD	[Esc][C][C]
	CARO_DIRECTION_QUERY_CMD	[Esc][C][D]
	CARO_HOME_POS_CMD	[Esc][C][H]
	CARO_MOVE_IN_CMD	[Esc][C][I]
	CARO_LOAD_POS_CMD	[Esc][C][L]
	CARO_MOVE_OUT_CMD	[Esc][C][O]
	CARO_PWR_QUERY_CMD	[Esc][C][P]
	CARO_VIBRATE_QUERY_CMD	[Esc][C][Q]
	CARO_STEP_TUBE_CMD	[Esc][C][R]
	CARO_VIBRATE_COUNT_CMD	[Esc][C][U]nn
	CARO_VIBRATE_CMD	[Esc][C][V]
	CARO_DIR_CCW_CMD	[Esc][C][W]
	CARO_LOPWR_CMD	[Esc][C][X]
	CARO_HIPWR_CMD	[Esc][C][Y]
	CARO_RESET_CNTLR_CMD	[Esc][C][Z]

Commands		Keystrokes to Initiate
Door Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD (Esc)M(R) MCL_VER_LEVEL_CMD (Esc)M(V) Any attempt to run a command without first resetting the system will be ignored.	DOOR_LOCK_CMD	(Esc)D(L)
	DOOR_WAS_OPENED_CMD	(Esc)D(O)
	DOOR_UNLOCK_CMD	(Esc)D(U)
TVL Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD (Esc)M(R) MCL_VER_LEVEL_CMD (Esc)M(V) Any attempt to run a command without first resetting the system will be ignored.	RLV_DOWN_CMD	(Esc)L(D)
	RLV_MIX_CMD	(Esc)L(M)
	RLV_MIX_TIME_QUERY_CMD	(Esc)L(Q)
	RLV_TURN_CMD	(Esc)L(R)
	RLV_MIX_TIME_CMD	(Esc)L(T)nn
	RLV_UP_CMD	(Esc)L(U)
Sampling Probe Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD (Esc)M(R) MCL_VER_LEVEL_CMD (Esc)M(V) Any attempt to run a command without first resetting the system will be ignored.	PROBE_DOWN_CMD	(Esc)P(D)
	PROBE_UP_CMD	(Esc)P(U)
Bar-code Scanner Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD (Esc)M(R) MCL_VER_LEVEL_CMD (Esc)M(V) Any attempt to run a command without first resetting the system will be ignored.	READ_CARO_NO_CMD	(Esc)S(C)
	READ_BAR_CODE_CMD	(Esc)S(G)
	READ_TUBE_ID_CMD	(Esc)S(I)
	SCAN_RESET_CMD	(Esc)S(R)
	READ_TUBE_POS_CMD	(Esc)S(T)
High Level Commands Note: Perform a system reset before running any of these commands. MCL_RESET_CMD (Esc)M(R) MCL_VER_LEVEL_CMD (Esc)M(V) Any attempt to run a command without first resetting the system will be ignored.	LOCATE_TUBE_CMD	(Esc)T(L)nn
	UNLOAD_TUBE_CMD	(Esc)T(U)
	RAISE_TUBE_CMD	(Esc)T(R)

Commands		Keystrokes to Initiate
Status Commands Note: Any status command may be performed without first performing a system reset. Use these commands with caution!	MCL_STATUS_CMD	Esc M S
	CARO_STATUS_CMD	Esc C S
	DOOR_STATUS_CMD	Esc D S
	HEAD_STATUS_CMD	Esc H S
	RLV_STATUS_CMD	Esc L S
	PROBE_STATUS_CMD	Esc P S
Diagnostic Commands Note: Any status command may be performed without first performing a system reset. Use these commands with caution!	DIAG_CARO_STEP_CMD	Esc X A
	DIAG_PROBE_RAISE_CMD	Esc X B
	DIAG_PROBE_LOWER_CMD	Esc X C
	DIAG_RLV_RAISE_CMD	Esc X D
	DIAG_RLV_LOWER_CMD	Esc X E
	DIAG_CARO_RESET_CMD	Esc X F
	DIAG_CARO_LOPWR_CMD	Esc X G
	DIAG_CARO_HIPWR_CMD	Esc X H
	DIAG_CARO_DIR_CW_CMD	Esc X I
	DIAG_CARO_DIR_CCW_CMD	Esc X J
	DIAG_CARO_IN_CMD	Esc X K
	DIAG_CARO_OUT_CMD	Esc X L
	DIAG_CARO_HOME_POS_CMD	Esc X M
	DIAG_FINGER_OUT_CMD	Esc X N
	DIAG_FINGER_IN_CMD	Esc X O
	DIAG_READ_BAR_CODE_CMD	Esc X P
	DIAG_SCAN_RESET_CMD	Esc X Q
	DIAG_READ_SENSORS_CMD	Esc Y A
	DIAG_MIX_ON_CMD	Esc Y B
	DIAG_MIX_OFF_CMD	Esc Y C
	DIAG_CARO_STEP_TUBE_CMD	Esc Y D
	DIAG_ROM_DUMP1_CMD	Esc Z A
	DIAG_ROM_DUMP2_CMD	Esc Z B

Memory Test

Purpose

This test ensures that the external memory in all the transputers is working properly. An XL or XL-MCL instrument may have either three or four transputers. These transputers are located on the Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II in the Workstation computer and on the Cyto Transputer card in the Cytometer.

- The Opto Transprocessor EXMEM card or Opto Transprocessor EXMEM II card (whichever is applicable) has either one or two transputers.
 - ▶ Each transputer has 4 MB of memory per processor.
 - ▶ Circuit card is located in the Workstation computer. In the FlowCentre tower computer, this circuit card is located in the bottom slot. In the original FlowCentre computer, this circuit card is located in far left slot.
 - ▶ The Opto Transprocessor EXMEM card (non-EMC version) is used in an XL or XL-MCL instrument with a serial number Z09062 or below.
 - ▶ The Opto Transprocessor EXMEM II card (EMC version) is used in an XL or XL-MCL instrument with a serial number Z09063 or above.
- The Cyto Transputer card always has two transputers.
 - ▶ Each transputer has 1 MB of memory per processor.
 - ▶ Circuit card occupies the slot labeled CYTO TRANS PROC in the Data Acquisition card cage in the Cytometer.

Circuit Cards Checked in this Test

- Opto Transprocessor EXMEM card or Opto Transprocessor EXMEM II card (whichever is applicable) contains transputers T1 and/or T2.
 - ▶ If the circuit card has only one transputer, it is designated T1.
 - ▶ If the circuit card has two transputers, the second transputer is designated T2.
- Cyto Transputer card contains two transputers, designated T3 and T4.
 - ▶ Transputer T3 is located in socket U52.
 - ▶ Transputer T4 is located in socket U54.

Response if Test Fails

Replace the transputer that failed the test and its associated memory.

- Opto Transprocessor EXMEM card or Opto Transprocessor EXMEM II card (whichever is applicable) contains transputers T1 and/or T2.
 - ▶ If the circuit card has only one transputer, it is designated T1 and is located in socket U16. Its memory is made up of four 1 MB SIMMs (U12, U13, U14, and U15).
 - ▶ If the circuit card has two transputers, the second transputer is designated T2 and is located in socket U27. Its memory is also made up of four 1 MB SIMMs (U17, U18, U19, and U22).

- Cyto Transputer card contains two transputers, designated T3 and T4.
 - ▶ Transputer T3 is located in socket U52. Its memory is made up of eight 1 MB x 1 Bit DRAMs (U31, U37, U43, U47, U50, U55, U58, and U59).
 - ▶ Transputer T4 is located in socket U54. Its memory is made up of eight 1 MB x 1 Bit DRAMs (U18, U26, U30, U34, U40, U46, U48, and U53).

Mike's Test -Not Used

New Board

Purpose

For future hardware development.

Noise Test and Offset

ATTENTION: This test is to be used only as a reference. Do not make adjustments.

Purpose

This test is designed to check the noise and offset of the system. This is accomplished by causing a conversion and generating a histogram of the desired parameters. The input to this parameter is grounded through the test switch. The resulting histogram shows both the offset of the amplifier and the ADC on the Trans Data Acquisition card. It also shows the noise distribution of that parameter.

Circuit Cards Checked in this Test

- Trans Data Acquisition card
- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails

- If all the parameters demonstrate noise, replace the Trans Data Acquisition card.
- If an individual parameter demonstrates noise, replace the corresponding Amp/Signal Conditioner card (PMT1, PMT2, PMT3, PMT4, AUX, FS, or SS).

OPTO DMA Test

Purpose

This test ensures that the Opto Transprocessor EXMEM card or Opto Transprocessor EXMEM II card can perform a Direct Memory Access (DMA) operation to the Workstation computer. The test transfers 256 bytes in each direction and verifies the data. It also ensures that DMA channel 0 (jumpers X7 and X8) is selected.

Circuit Cards Checked in this Test

- Opto Transprocessor EXMEM card is the non-EMC version used in XL and XL-MCL instruments with the serial number Z09062 and below.
- Opto Transprocessor EXMEM II card is the EMC version used in all XL and XL-MCL instruments with the serial number Z09063 and above.

The circuit card is located in the Workstation computer. In the FlowCentre tower computer, this circuit card is located in the bottom slot. In the original FlowCentre computer, this circuit card is located in far left slot.

Response if Test Fails

- Verify that jumpers X7 and X8 are properly installed on the circuit card.
- Possible DMA conflict on DMA 0 on the Workstation computer bus.

OPTO Interrupt Test

Purpose

This test ensures that the interrupt on the Opto Transprocessor EXMEM card or Opto Transprocessor EXMEM II card is working properly. It also ensures that the interrupt is on IRQ11 (jumper X12).

Circuit Cards Checked in this Test

- Opto Transprocessor EXMEM card is the non-EMC version used in XL and XL-MCL instruments with the serial number Z09062 and below.
- Opto Transprocessor EXMEM II card is the EMC version used in all XL and XL-MCL instruments with the serial number Z09063 and above.

The circuit card is located in the Workstation computer. In the FlowCentre tower computer, this circuit card is located in the bottom slot. In the original FlowCentre computer, this circuit card is located in far left slot.

Response if Test Fails

- Verify that jumper X12 is properly installed on the circuit card.
- Possible IRQ conflict on IRQ11 on the Workstation computer bus.

OPTO Link Test

Purpose

This test ensures that the Transputer Link path from the Opto Transprocessor EXMEM card or Opto Transprocessor EXMEM II card in the Workstation computer through the optical cable and into the last (third or fourth) transputer located on the Cyto Transputer card in the Data Acquisition card cage in the Cytometer is working properly. It echoes 10 256-byte loops from one end to the other.

Circuit Cards Checked in this Test

- Opto Transprocessor EXMEM card is the non-EMC version used in XL and XL-MCL instruments with the serial number Z09062 and below.
or
Opto Transprocessor EXMEM II card is the EMC version used in all XL and XL-MCL instruments with the serial number Z09063 and above.
- Cyto Transputer card that occupies the slot labeled CYTO TRANS PROC in the Data Acquisition card cage in the Cytometer.
- Optical cable connecting the two circuit cards.

Response if Test Fails

- Verify the optical cable connection is correct:

Workstation Computer		Cytometer
TX	→	RX
RX	←	TX

- Check the jumpers on the Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card, as applicable.

Note: This circuit card is located in the Workstation computer. In the FlowCentre tower computer, this circuit card is located in the bottom slot. In the original FlowCentre computer, this circuit card is located in far left slot.



- If the card is an Opto Transprocessor EXMEM card (the non-EMC version used in XL and XL-MCL instruments with the serial number Z09062 and below), see [Figure A.2-12](#) and the jumper settings that follow.
 - If the card is an Opto Transprocessor EXMEM II card (EMC version used in all XL and XL-MCL instruments with the serial number Z09063 and above), see [Figure A.2-13](#) and the jumper settings that follow.
- Check the jumpers on the Cyto Transputer card. See [Figure A.2-6](#) and the jumper settings that follow the illustration.







PMT Voltage Control

Purpose

This selection controls the high voltage supplies for PMT1, PMT2, PMT3, and PMT4. A separate Bertan power supply drives each Amp/Signal Conditioner card.

Note: PMT4 and the Bertan power supply for PMT4 are on 4-color systems only.

At the Workstation keyboard, select the desired PMT using the  or  key then press the designated key to produce the desired change.

Option	Key to Activate Change
To increase PMT voltage by 100.0 Vdc	Press 
To decrease PMT voltage by 100.0 Vdc	Press 
To increase PMT voltage by 10.0 Vdc	Press 
To decrease PMT voltage by 10.0 Vdc	Press 
To increase PMT voltage by 1.0 Vdc	Press 
To decrease PMT voltage by 1.0 Vdc	Press 

Circuit Cards Checked in this Test

- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, and PMT4 (optional)

Response if Test Fails

- High voltage Bertan power supply may be defective.
- DAC on an Amp/Signal Conditioner card may be defective.

Pneumatic Sensor Test

Purpose

This test checks the condition of the bellow sensors. The system pressure and vacuum sensors are expected to go on several seconds after the compressor is turned ON. The sample pressure and vacuum sensors are activated by applying pressure and vacuum to the sample station while a sample tube is in place. The sample station up/down sensor is activated by moving the sample station up and down.

Circuit Cards Checked in this Test

- System Interface card
- System pressure sensor
- System vacuum sensor
- Sample pressure sensor
- Sample vacuum sensor
- Manual sample station up/down sensor

Response if Test Fails

- System Interface card may be defective.
- Sensor may be defective.

Pulse RAMP Test

Purpose

This test ensures the bar graphs on the front panel display are working properly. These signals originate from the Trans Data Acquisition card. Each signal is ramped from zero to full scale. The bar graph should ramp up and down with the signal. The screen indicates how the bar graph should look in real time.

Components Checked in this Test

- Top Panel Display 2 card
- Interconnecting cable from the Analyzer backplane to the Top Panel Display 2 card
- Trans Data Acquisition card (bar graphs)

Response if Test Fails

- Top Panel Display 2 card may be defective.
- Trans Data Acquisition card may be defective.
- Interconnecting cable from the Analyzer backplane to the Top Panel Display 2 card may be defective.

ROM Test

Purpose

This test ensures the two ROM chips (U25 and U51) on the Cyto Transputer card are the correct version and that they are working properly. To accomplish this check, the ROM on the circuit card is compared to files on the test disk to ensure they are the same. The ROM version is also reported.

Circuit Card Checked in this Test

- Cyto Transputer card

Response if Test Fails

- Verify the correct version is installed.
- Verify the ROM chips are installed correctly. To locate U25 and U51, refer to [Figure A.2-6](#) as needed.
- One or both ROM chips may be defective. To locate U25 and U51, refer to [Figure A.2-6](#) as needed.

Run Beads

Purpose

This test allows a sample to be run on the Cytometer. It allows the usage of a digital oscilloscope to align the optical system of the Cytometer.

Sample Leak Test

Purpose

This test ensures that the sample station seals on the manual sample station and the MCL sample station are not leaking. To perform this test, a sample tube must be inserted in the manual sample station and a fully loaded carousel must be loaded in the MCL. The manual sample station is tested first by pressurizing a sample tube for a few seconds and then the pressure is removed from the sample tube. The sample pressure switch is then monitored for 30 seconds. If the switch indicates pressure then the sample station is not leaking. The MCL is tested in a similar manner.

Components Checked in this Test

- Manual sample station
- MCL sample station

Response if Test Fails

- If a leak is detected in the manual sample station only, check for leaks in associated tubings.
- If a leak is detected in the MCL sample station only, check for leaks in associated tubings.
- If a leak is detected in both the manual and MCL sample stations, check for a leak in tubing that is common to both sample stations.

Scope Test - Not Used

Segment Valve Test

Purpose

This test checks the segmenting valve to ensure proper rotation.

Response if Test Fails

- One or more of the segmenting valve cylinders may be defective.
- One or more tubings may be attached incorrectly to one or more segmenting valve cylinders.
- Segmenting pads may be binding.

Set N Transputers

Purpose

Checks and sets the number of transputers in the system (Cytometer and Workstation computer).

System Parameter Test

Purpose

This test shows the level variation (noise) on the system parameters of the system.

T805 Test

Purpose

This test ensures that the T805 chip is in the proper socket on the Opto Transprocessor EXMEM card (non-EMC version used in XL and XL-MCL instruments with the serial number Z09062 and below) or Opto Transprocessor EXMEM II card (EMC version used in all XL and XL-MCL instruments with the serial number Z09063 and above), as applicable.

This circuit card is located in the Workstation computer. In the FlowCentre tower computer, this circuit card is located in the bottom slot. In the original FlowCentre computer, this circuit card is located in far left slot.

The T805 has a floating point processor and must be the first transputer in the transputer path in order for the system software to function properly. A floating point operation is performed and tested to verify this.

Circuit Cards Checked in this Test

- If an XL or XL-MCL instrument with the serial number Z09062 or below, the Opto Transprocessor EXMEM card (non-EMC version) is checked.
- If an XL or XL-MCL instrument with the serial number Z09063 or above, the Opto Transprocessor EXMEM II card (EMC version) is checked.

Response if Test Fails

Failure of this test may indicate the circuit card has an INS425/INS405 transputer (instead of the INS805 transputer). If the test fails, inspect U16. If the T805 (INS805) is missing or has been replaced by a 400 series device, then disregard the failure.

Temperature Test

Purpose

This test shows the warm-up characteristics of the Cytometer. It plots the temperature versus time on the Workstation screen. It uses the temperature sensor on the System Interface card to read the temperature.

Valve Burn In

Purpose

This selection continuously exercises the manual sample station up/down cylinder and the segmenting valve.

Valve Control

Purpose

This selection controls the pneumatic system. It allows manual control over each individual valve in the system. The sheath and sample pressures are also monitored and displayed here. The Sheath Sample Differential can also be adjusted here. If an emergency shutdown is required, pressing the **Spacebar** immediately turns off all the valves.

Options

At the Workstation keyboard, select valve to control using the **↑**, **↓**, **←**, or **→** key, as needed, then press the key designated in the following table to produce the desired response.

Valve Control Option	Key to Select or Activate Option
To select valve to control	Press ↑ , ↓ , ← , or → as needed.
To toggle selected valve condition	Press Enter .
To set continuous toggle of selected valve	Press Tab . Note: Pressing the Tab key a second time stops the continuous toggle.
To turn off all valves including the compressor	Press Spacebar .
Differential Pressure Control*	Key to Activate Change*
To increase differential pressure by 0.001 psi	Press Insert .
To decrease differential pressure by 0.001 psi	Press Delete .
To increase differential pressure by 0.010 psi	Press Home .
To decrease differential pressure by 0.010 psi	Press End .
To increase differential pressure by 0.100 psi	Press Page Up .
To decrease differential pressure by 0.100 psi	Press Page Down .

* Differential pressure is adjusted by six keys (**Insert**, **Delete**, **Home**, **End**, **Page Up**, and/or **Page Down**) on the Workstation keyboard. On the keyboard, the upper keys (**Insert**, **Home**, and **Page Up**) increase pressure and the lower keys (**Delete**, **End**, and **Page Down**) decrease pressure. The left keys (**Insert** and **Delete**) produce small increment changes and the right keys (**Page Up** and **Page Down**) produce larger increment changes.

Circuit Card Checked in this Test

- System Interface card

Response if Test Fails

- System Interface card may be defective.
- Associated pinch valve may be defective.
- Compressor may be defective.
- Associated pressure sensor and/or pressure switch may be defective.

Valve Sequence

Purpose

This selection allow the system to be drained and cleaned out for shipment.

DRAIN VACUUM CHAMBER

Drains the waste chamber if full.

SHUTDOWN AND CLEANUP

Performs the shutdown and cleanup procedure on the Cytometer to ready it for shipment.

VME Addr Bus Test

Purpose

This test ensures that the Cyto Transputer card can communicate with each card in the Data Acquisition card cage through the VME bus on the P1 connector. Each card has a readback register that can be written to and read from. Each circuit card has an individual address that is written to that card's readback register. After all the circuit cards have been written to, the readback registers are then read. The values read from each card should match its address. If these values do not match, the card was not addressed properly. The address may be overlapping or missing.

Circuit Cards Checked in this Test

- Cyto Transputer card
- System Interface card
- Trans Data Acquisition card
- Amp/Signal Conditioner card for SS, FS, AUX, PMT4, PMT3, PMT2, and PMT1

Response if Test Fails

- VME Address Bus may be open or shorted.
- Cyto Transputer VME Bus Drivers may be defective.
- Address Decoder on one or more of the circuit cards being tested may be defective.

VME Data Bus Test

Purpose

This test ensures that the Cyto Transputer card can communicate with each card in the Data Acquisition card cage through the VME bus on the P1 connector. Each card has a readback register that can be written to and read from. A rotating bit is written to each of these registers and then read back. The value that is read is checked to ensure it is the same value that was written.

Circuit Cards Checked in this Test

- Cyto Transputer card
- System Interface card
- Trans Data Acquisition card
- Amp/Signal Conditioner card for PMT1, PMT2, PMT3, PMT4, AUX, FS, and SS

Response if Test Fails

- VME Data Bus may be open or shorted.
- Cyto Transputer VME Bus Drivers may be defective.
- Readback register on one or more of the circuit cards being tested may be defective.

Waste Chamber Full Test

Note: Appears as Waste Cham. Full Test on the Workstation display.

Purpose

This test ensures the waste chamber sensor, often referred to as the eyeball sensor, is working properly.

This check involves the following sequence of events:

1. The waste chamber is emptied and then filled. As it is filling, the eyeball sensor is monitored. When the liquid level reaches the sensor, the fill operation should cease. If this does not occur within a specified amount of time, the fill operation is stopped and an error is reported.
2. The waste chamber is emptied for 5 seconds.
3. The waste chamber is then filled until the sensor detects the liquid again. The time for this is reported and the Fill/Empty ratio is displayed. This is an indicator of the liquid flow from the sheath container, through the flow cell to the waste chamber and out to the waste container.

Note: Pinched tubing will affect these time. Currently, there is no specification for these times. This specification is currently being developed.

Components Checked in this Test

- System Interface card
- Waste chamber liquid level sensor

Response if Test Fails

- System Interface card may be defective.
- Waste chamber liquid-level sensor may be defective.

XY Display - Not Used

8 PARTS LISTS, 8.1-1

8.1 MASTER PARTS LISTS, 8.1-1

8.2 ILLUSTRATED PARTS, 8.2-1

Overview, 8.2-1

Locating a Part Number, 8.2-1

ILLUSTRATIONS

- 8.2-1 XL Cytometer with MCL Option, Illustrated Components, 8.2-2
- 8.2-2 XL-MCL Cytometer Covers, Doors, and Latches (See Table 8.2-2), 8.2-4
- 8.2-3 MCL Covers and Associated Hardware (See Table 8.2-3), 8.2-6
- 8.2-4 XL Cytometer Covers, Doors, and Latches (See Table 8.2-4), 8.2-8
- 8.2-5 Power Supply Cover, Door, Latches, and Casters (See Table 8.2-5), 8.2-10
- 8.2-6 FlowCentre II Workstation (See Table 8.2-6), 8.2-12
- 8.2-7 FlowCentre Workstation (See Table 8.2-7), 8.2-14
- 8.2-8 MCL Option Assembly (See Table 8.2-8), 8.2-16
- 8.2-9 MCL Vertical Plate Components (See Table 8.2-9), 8.2-18
- 8.2-10 Lifter Air Cylinder and Attachments (See Table 8.2-10), 8.2-20
- 8.2-11 Probe Up/Down Air Cylinder and Attachments (See Table 8.2-11), 8.2-21
- 8.2-12 Front Display Panel (See Table 8.2-12), 8.2-22
- 8.2-13 Data Acquisition Card Cage (See Table 8.2-13), 8.2-24
- 8.2-14 Upper Pneumatics Drawer (See Table 8.2-14), 8.2-26
- 8.2-15 VL22 - Exploded View of Upper Valve (See Table 8.2-15), 8.2-28
- 8.2-16 Bracket and Fittings - Upper Pneumatics Drawer (See Table 8.2-16), 8.2-29
- 8.2-17 VL21 - Exploded View of Lower Valve (See Table 8.2-17), 8.2-30
- 8.2-18 Quick Disconnects Below Upper Pneumatics Drawer (See Table 8.2-18), 8.2-31
- 8.2-19 Optical Collection Area, Rear View (See Table 8.2-19), 8.2-32
- 8.2-20 Optical Collection Area, Front View (See Table 8.2-20), 8.2-34
- 8.2-21 Optical Collection Area with Filter Shield Removed (See Table 8.2-21), 8.2-36
- 8.2-22 Beam-Shaping Stage Components (See Table 8.2-22), 8.2-37
- 8.2-23 Flow Cell and Fluorescence Pickup Lens with Associated Hardware
(See Table 8.2-23), 8.2-38
- 8.2-24 Argon Laser, Power Supply, and Mounting Hardware (See Table 8.2-24), 8.2-40
- 8.2-25 Reagent Drawer (See Table 8.2-25), 8.2-42
- 8.2-26 Sheath Liquid Filter (See Table 8.2-26), 8.2-44
- 8.2-27 Sheath Liquid Filter Purge (Vent) Connections (See Table 8.2-27), 8.2-46
- 8.2-28 Sheath Container (See Table 8.2-28), 8.2-48
- 8.2-29 Cleaning Agent Container (See Table 8.2-29), 8.2-49
- 8.2-30 Sample Station (Manual) for XL-MCL Cytometer, Front View
(See Table 8.2-30), 8.2-50
- 8.2-31 Sample Station (Manual) for XL-MCL Cytometer, Rear View
(See Table 8.2-31), 8.2-52
- 8.2-32 Sample Station for XL Cytometer (See Table 8.2-32), 8.2-54
- 8.2-33 Sample Station for XL-MCL and XL Cytometers - Mechanical Assembly
(See Table 8.2-33), 8.2-56
- 8.2-34 Segmenting Valve Assembly (See Table 8.2-34), 8.2-58
- 8.2-35 Air Cylinder and Related Hardware for Segmenting Valve Middle Pad
(See Table 8.2-35), 8.2-60
- 8.2-36 Air Cylinder and Related Hardware for Front and Rear Segmenting Valve Pads
(See Table 8.2-36), 8.2-61

8.2-37	Lower Pneumatics Drawer (See Table 8.2-37), 8.2-62
8.2-38	Pinch Valve and Associated Components, Lower Pneumatics Drawer (See Table 8.2-38), 8.2-64
8.2-39	Solenoid Manifold, Lower Pneumatics Drawer (See Table 8.2-39), 8.2-66
8.2-40	QD10 and QD11 (Coupling and Fittings), Lower Pneumatics Drawer (See Table 8.2-40), 8.2-67
8.2-41	Quick-Disconnect Fittings and Brackets, Lower Pneumatics Drawer (See Table 8.2-41), 8.2-68
8.2-42	Cytometer Rear Panel, Lower (See Table 8.2-42), 8.2-70
8.2-43	Fan Assembly, Cytometer Rear Panel (See Table 8.2-43), 8.2-72
8.2-44	Cytometer Right Side Compartment (See Table 8.2-44), 8.2-74
8.2-45	Power Supply Module - Left Side with Cover Removed (See Table 8.2-45), 8.2-76
8.2-46	VL32, VL30, and VL31 - Exploded View (See Table 8.2-46), 8.2-78
8.2-47	Power Supply Module - Front Panel Components (See Table 8.2-47), 8.2-80
8.2-48	Vacuum Trap and Related Components (See Table 8.2-48), 8.2-82
8.2-49	Water Trap (Air/Water Filter Separator) and Related Components (See Table 8.2-49), 8.2-83
8.2-50	Front Panel including Voltage Supply Monitor Card and Hardware (See Table 8.2-50), 8.2-84
8.2-51	System Pressure Gauge and Related Components (See Table 8.2-51), 8.2-85
8.2-52	System Pressure Adjustment Knob and Related Components (See Table 8.2-52), 8.2-86
8.2-53	Vacuum and Air Filters with Related Components (See Table 8.2-53), 8.2-87
8.2-54	System Vacuum Gauge and Related Components (See Table 8.2-54), 8.2-88
8.2-55	Power Supply Module - Right Side with Cover Removed (See Table 8.2-55), 8.2-89
8.2-56	Waste Container (See Table 8.2-56), 8.2-90
8.2-57	Power Supply Module - Rear Panel Components (See Table 8.2-57), 8.2-92
8.2-58	Box Fan with Related Hardware (See Table 8.2-58), 8.2-94
8.2-59	Check Valves and Chokes with Related Components (See Table 8.2-59), 8.2-95
8.2-60	Fittings (See Table 8.2-60), 8.2-96
8.2-61	Tie Wraps and Mounting Hardware (See Table 8.2-61), 8.2-97
8.2-62	Flexible Duct Components and Assembly Instructions (See Table 8.2-62), 8.2-98

TABLES

8.1-1	Common Names and Categories used in Master Parts List, 8.1-1
8.1-2	Master Parts List - A and B, 8.1-3
8.1-3	Master Parts List - C, 8.1-3
8.1-4	Master Parts List - D, 8.1-9
8.1-5	Master Parts List - E, 8.1-10
8.1-6	Master Parts List - G, 8.1-17
8.1-7	Master Parts List - H and I, 8.1-18
8.1-8	Master Parts List - J and K, 8.1-19
8.1-9	Master Parts List - L, 8.1-20
8.1-10	Master Parts List - M, 8.1-21
8.1-11	Master Parts List - N and O, 8.1-22
8.1-12	Master Parts List - P, 8.1-23
8.1-13	Master Parts List - R, 8.1-26
8.1-14	Master Parts List - S, 8.1-26
8.1-15	Master Parts List - T, 8.1-31

- 8.1-16 Master Parts List - V, 8.1-32
- 8.1-17 Master Parts List - W, 8.1-33
- 8.2-1 Illustrations Not Referenced from Figure 8.2-1, 8.2-3
- 8.2-2 XL-MCL Cytometer Covers, Doors, and Latches (See Figure 8.2-2), 8.2-5
- 8.2-3 MCL Covers and Associated Hardware (See Figure 8.2-3), 8.2-7
- 8.2-4 XL Cytometer Covers, Doors, and Latches (See Figure 8.2-4), 8.2-9
- 8.2-5 Power Supply Cover, Door, Latches, and Casters (See Figure 8.2-5), 8.2-11
- 8.2-6 FlowCentre II Workstation (See Figure 8.2-6), 8.2-13
- 8.2-7 FlowCentre Workstation (See Figure 8.2-7), 8.2-15
- 8.2-8 MCL Option Assembly (See Figure 8.2-8), 8.2-17
- 8.2-9 MCL Vertical Plate Components (See Figure 8.2-9), 8.2-19
- 8.2-10 Lifter Air Cylinder and Attachments (See Figure 8.2-10), 8.2-20
- 8.2-11 Probe Up/Down Air Cylinder and Attachments (See Figure 8.2-11), 8.2-21
- 8.2-12 Front Display Panel (See Figure 8.2-12), 8.2-23
- 8.2-13 Data Acquisition Card Cage (See Figure 8.2-13), 8.2-25
- 8.2-14 Upper Pneumatics Drawer (See Figure 8.2-14), 8.2-27
- 8.2-15 VL22 - Exploded View of Upper Valve (See Figure 8.2-15), 8.2-28
- 8.2-16 Bracket and Fittings - Upper Pneumatics Drawer (See Figure 8.2-16), 8.2-29
- 8.2-17 VL21 - Exploded View of Lower Valve (See Figure 8.2-17), 8.2-30
- 8.2-18 Quick Disconnects Below Upper Pneumatics Drawer (See Figure 8.2-18), 8.2-31
- 8.2-19 Optical Collection Area, Rear View (See Figure 8.2-19), 8.2-33
- 8.2-20 Optical Collection Area, Front View (See Figure 8.2-20), 8.2-35
- 8.2-21 Optical Collection Area with Filter Shield Removed (See Figure 8.2-21), 8.2-36
- 8.2-22 Beam-Shaping Stage Components (See Figure 8.2-22), 8.2-37
- 8.2-23 Flow Cell and Fluorescence Pickup Lens with Associated Hardware
(See Figure 8.2-23), 8.2-39
- 8.2-24 Argon Laser, Power Supply, and Mounting Hardware (See Figure 8.2-24), 8.2-41
- 8.2-25 Reagent Drawer (See Figure 8.2-25), 8.2-43
- 8.2-26 Sheath Liquid Filter (See Figure 8.2-26), 8.2-45
- 8.2-27 Sheath Liquid Filter Purge (Vent) Connections (See Figure 8.2-27), 8.2-47
- 8.2-28 Sheath Container (See Figure 8.2-28), 8.2-48
- 8.2-29 Cleaning Agent Container (See Figure 8.2-29), 8.2-49
- 8.2-30 Sample Station (Manual) for XL-MCL Cytometer, Front View
(See Figure 8.2-30), 8.2-51
- 8.2-31 Sample Station (Manual) for XL-MCL Cytometer, Rear View
(See Figure 8.2-31), 8.2-53
- 8.2-32 Sample Station for XL Cytometer (See Figure 8.2-32), 8.2-55
- 8.2-33 Sample Station for XL-MCL and XL Cytometers - Mechanical Assembly
(See Figure 8.2-33), 8.2-57
- 8.2-34 Segmenting Valve Assembly (See Figure 8.2-34), 8.2-59
- 8.2-35 Air Cylinder and Related Hardware for Segmenting Valve Middle Pad
(See Figure 8.2-35), 8.2-60
- 8.2-36 Air Cylinder and Related Hardware for Front and Rear Segmenting Valve Pads
(See Figure 8.2-36), 8.2-61
- 8.2-37 Lower Pneumatics Drawer (See Figure 8.2-37), 8.2-63
- 8.2-38 Pinch Valve and Associated Components, Lower Pneumatics Drawer
(See Figure 8.2-38), 8.2-65
- 8.2-39 Solenoid Manifold, Lower Pneumatics Drawer (See Figure 8.2-39), 8.2-66
- 8.2-40 QD10 and QD11 (Coupling and Fittings), Lower Pneumatics Drawer
(See Figure 8.2-40), 8.2-67

- 8.2-41 Quick-Disconnect Fittings and Brackets, Lower Pneumatics Drawer
(See Figure 8.2-41), 8.2-69
- 8.2-42 Cytometer Rear Panel, Lower (See Figure 8.2-42), 8.2-71
- 8.2-43 Fan Assembly, Cytometer Rear Panel (See Figure 8.2-43), 8.2-73
- 8.2-44 Cytometer Right Side Compartment (See Figure 8.2-44), 8.2-75
- 8.2-45 Power Supply Module - Left Side with Cover Removed (See
Figure 8.2-45), 8.2-77
- 8.2-46 VL32, VL30, and VL31 - Exploded View (See Figure 8.2-46), 8.2-79
- 8.2-47 Power Supply Module - Front Panel Components (See Figure 8.2-47), 8.2-81
- 8.2-48 Vacuum Trap and Related Components (See Figure 8.2-48), 8.2-82
- 8.2-49 Water Trap (Air/Water Filter Separator) and Related Components
(See Figure 8.2-49), 8.2-83
- 8.2-50 Front Panel including Voltage Supply Monitor Card and Hardware
(See Figure 8.2-50), 8.2-84
- 8.2-51 System Pressure Gauge and Related Components (See Figure 8.2-51), 8.2-85
- 8.2-52 System Pressure Adjustment Knob and Related Components
(See Figure 8.2-52), 8.2-86
- 8.2-53 Vacuum and Air Filters with Related Components (See Figure 8.2-53), 8.2-87
- 8.2-54 System Vacuum Gauge and Related Components (See Figure 8.2-54), 8.2-88
- 8.2-55 Power Supply Module - Right Side with Cover Removed
(See Figure 8.2-55), 8.2-89
- 8.2-56 Waste Container (See Figure 8.2-56), 8.2-91
- 8.2-57 Power Supply Module - Rear Panel Components (See Figure 8.2-57), 8.2-93
- 8.2-58 Box Fan with Related Hardware (See Figure 8.2-58), 8.2-94
- 8.2-59 Check Valves and Chokes with Related Components (See Figure 8.2-59), 8.2-95
- 8.2-60 Fittings (See Figure 8.2-60), 8.2-96
- 8.2-61 Tie Wraps and Mounting Hardware (See Figure 8.2-61), 8.2-97
- 8.2-62 Flexible Duct Components and Assembly Instructions
(See Figure 8.2-62), 8.2-98

8.1 MASTER PARTS LISTS

ATTENTION: Part numbers issued by the Oracle system are six-digit numbers.

The components in the master parts list are listed alphabetically by their common names or categories. [Table 8.1-1](#) lists the common names and categories used, further defines the categories, and references the table in this section where those components appear. Within each table the part numbers are listed in numeric order. When applicable, a component is cross referenced to its illustration in [Heading 8.2](#).

Table 8.1-1 Common Names and Categories used in Master Parts List

Common Name/ Category	Category Includes	Table
Adaptor	Cleaning tube	8.1-2
Assembly	Front door (Power Supply module), XL overlay panel, and solenoid valve and manifold used in the lower pneumatics drawer	8.1-2
Bracket		8.1-2
Cable	Assemblies, harnesses, power, and coaxial	8.1-3
Choke		8.1-3
Circuit breaker		8.1-3
Computer		8.1-3
Consumable	Gloves, beads, reagents, storage media	8.1-3
Cover	All non-hinged panels and component covers	8.1-3
Cylinder		8.1-3
Disk drive	CD-ROM and floppy	8.1-4
Documentation	Operator manuals	8.1-4
Door	All hinged panels	8.1-4
Duct		8.1-4
Fan		8.1-5
Filter	Optical, gas, light and water; filter holders	8.1-5
Fingerguard		8.1-5
Fitting	Barbed, brass, feed-through, insert, panel, quick-disconnect, T- and Y- connectors	8.1-5
FRU		8.1-5
Fuse		8.1-5
Gasket		8.1-6
Hinge		8.1-7
Holder	Cylinder, pinch valve, prism and tube	8.1-7
Insert		8.1-7
Jumper		8.1-8
Keyboard		8.1-8
Kit	4-color installation, PMI, and sheath filter	8.1-8
Label	For light filters, shields, reagent containers, carousel, and test tubes	8.1-9

Table 8.1-1 Common Names and Categories used in Master Parts List (Continued)

Common Name/ Category	Category Includes	Table
Manifold		8.1-10
Module	Power Supply	8.1-10
Monitor		8.1-10
Motor		8.1-10
Mount		8.1-10
Muffler		8.1-10
Nut		8.1-11
O-ring		8.1-11
Panel	For front of reagent drawer and front of Power Supply module	8.1-12
PCB	All printed circuit boards	8.1-12
Plate		8.1-12
Power supply		8.1-12
Printer		8.1-12
Regulator	All pressure and vacuum regulators	8.1-13
Screw		8.1-14
Sensor		8.1-14
Software		8.1-14
Spring		8.1-14
Stage		8.1-14
Switch		8.1-14
Tank	Sheath, cleanse, waste (also referred to as container or bottle)	8.1-15
Target		8.1-15
Tie wrap		8.1-15
Tool	Individual hand tools, Beckman Coulter service tool kit, Service Resource Kit	8.1-15
Transducer		8.1-15
Tray		8.1-15
Tubing	PEEK, polyurethane, silicone	8.1-15
Valve	Check, pinch, solenoid (pneumatic and hydraulic)	8.1-16
Washer		8.1-17

Table 8.1-2 Master Parts List - A and B

Description	Part Number	Figure	Item
Adaptor, cleaning tube	6859297		
Arm. probe, for manual sample station	1020873	8.2-33	2
Assembly, front door, Power Supply module, black	6856160	8.2-5	11
Assembly, front door, Power Supply module, grey	6807047	8.2-5	11
Assembly, solenoid valve, pressure relief valves and manifold, used in the lower pneumatics drawer	6232587	8.2-39	
Assembly, XL overlay panel	6855862	8.2-12	10
Backplane, Analyzer	6705220		
Block, stop, used with MCL carousel base assembly	1022128	8.2-8	9
Bracket, 45° angled, used to secure fitting inserts	6805879	8.2-41	12
Bracket, cleanse tank (also referred to as detergent bottle bracket)	1020978	8.2-29	10
Bracket, door angle	6856945	8.2-30	12
Note: Verify proper orientation before attaching.		8.2-32	13
Bracket, front panel	1021769	8.2-12	1
Bracket, gas cylinder upper	1021764	8.2-3	17
Bracket, hinged machine, attaches MCL upper and lower bases	6858657	8.2-3	5
Bracket, MCL lower base	6858635	8.2-3	19
Bracket, MCL sample station	6805649	8.2-31	12
Bracket, sheath tank (also referred to as sheath bottle bracket)	1020981	8.2-28	9
Bracket, shut-off valve	6856718	8.2-27	5
Bracket, two pinch valve	6855212	8.2-16	1
Bushings, shock mount, rubber axial, 4 lb., 73 lb./in., 84 Hz, for laser cooling fan module	2523659		
Buzzer, cable assembly	6028318		

Table 8.1-3 Master Parts List - C

Description	Part Number	Figure	Item
Cable assembly, MCL door open detector	6028424	8.2-3	14
Cable assembly, MCL, CPU main	6028428		
Cable assembly, MCL, PCB to opto	6028423		
Cable assembly, mini-universal MATE-N-LOK 3-position plug to Hall Effect sensor, for manual sample station	6028330	8.2-33	11
Cable assembly, Printer, bar-code, 25-pin, D-plug	6028303		
Cable assembly, sheath pressure	6028328		
Cable, +24 Vdc	6028311		

Table 8.1-3 Master Parts List - C (Continued)

Description	Part Number	Figure	Item
Cable, +24 Vdc, EMC	6028689		
Cable, +5 Vdc	6028305		
Cable, +5 Vdc, EMC	6028687		
Cable, ± 15 Vdc	6028306		
Cable, ± 15 Vdc, EMC	6028688		
Cable, analog/logic power (non EMI)	6028307		
Cable, bar-code communications (also referred to as the bar-code programming cable)	6028275		
Cable, bar-code scanner	6003011		
Cable, cont B interface	6028308		
Cable, CYT12, fiber optic	6028716		
Cable, Cyto dc power	6028319		
Cable, CYTO dc power EMI harness	6028700	8.2-42	11
Cable, Cytometer CYT12	6028314		
Cable, external, analog power	6027106		
Cable, external, analog power, EMC	6028696		
Cable, external, CYT12	6028304		
Cable, external, logic power, 9 V	6027105		
Cable, external, logic power, 9 V, EMC	6028694		
Cable, external, MCL power	6027108		
Cable, external, MCL power, EMC	6028695		
Cable, external, Power Supply module control, 25-pin, laser control	6028302		
Cable, fiber optic interface (FL rib)	6028294		
Cable, fiber optic interface, shielded, EMC	6028650		
Cable, front panel power	6028430		
Cable, ground braid, 6 inches long with two #8 rings	6028152	8.2-13	12
		8.2-24	6
Cable, ground strap, on Power Supply module	6027875	8.2-5	9
Cable, harness that includes Logic, MCL, and Analog power supply dc internal cables Note: Attach using three female screw lock assembly kits for D-type connectors, PN 2104261.	6028693	8.2-57	2
Cable, laser control (FL rib)	6028292		
Cable, laser control interface	6028299		
Cable, laser control, shielded, Cytometer, EMC	6028651		
Cable, laser supply control, EMC	6028652		
Cable, MCL, CPU interface	6004071		

Table 8.1-3 Master Parts List - C (Continued)

Description	Part Number	Figure	Item
Cable, MCL, dc, CYTO	6028431		
Cable, MCL, dc, CYTO, EMC	6028699		
Cable, scanner interface	6028432		
Cable, sensor	6028290		
Cable, sensor/reg control (FL rib)	6028289		
Cable, sensor/reg control, shielded, EMC	6028702		
Cable, solenoid power, 2 position connector for solenoid with two 60 in. 22 AWG conductor wires for circuit card connection, lower pneumatics drawer	6028130	8.2-39	7
Cable, solenoid power, Clippard 3 position connector for solenoid with two 26 AWG (19/38) tinned copper conductor wires for circuit card connection, lower pneumatics drawer	6028287	8.2-38	9
Cable, solenoid, 25 conductor flat ribbon cable with 3 subminiature D insulation displacement connectors, 81 in. length, lower pneumatics drawer	6028293		
Cable, level sensor, with undercut O-ring groove	6028526	8.2-28	8
Note: O-ring seal, PN 2512031, is not needed with the sheath tank assembly but is needed with the cleanse tank assembly.		8.2-29	8
Calibration test box, pneumatic	2907103		
Cap, cleanse	1021818	8.2-29	4
Cap, sheath tank (or bottle)	1018613	8.2-28	4
Cap, waste tank	1022581		
Carousel, MCL	6859682		
Cartridge, hard drive, Bernoulli, 90 MB	2016551		
Cartridge, removable drive, Bernoulli, 150 MB	2016646		
Cartridge, toner, Hewlett Packard, for HP LaserJet 6P/SPSe	2016708		
Caster, swivel with brake, 2 in. diameter wheel	2523658	8.2-5	13
Choke, metal, black, 0.010 orifice	6213011	8.2-59	7
Choke, metal, blue, 0.012 orifice	6213010	8.2-59	7
Choke, metal, brown, 0.006 orifice	6213009	8.2-59	7
Choke, metal, gold, 0.004 orifice	6213008	8.2-59	7
Choke, metal, green, 0.016 orifice	6213007	8.2-59	7
Choke, metal, red, 0.008 orifice	6213006	8.2-59	7
Note: Designated as CK 2 and 3 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886.			
Choke, plastic, grey, 0.016 in. orifice	6213012	8.2-14	13
Note: Designated as CK 12 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886.		8.2-59	8

Table 8.1-3 Master Parts List - C (Continued)

Description	Part Number	Figure	Item
Choke, plastic, brown, 0.025 in. orifice Note: Designated as CK 4, 5, 6, 7, 8, 9, 10, and 11 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886.	6213015	8.2-59	8
Choke, pneumatic, 0.0102 diameter, 0.062 barb and 10-32 threaded connections, brass Note: Choke must be oriented as shown in the associated figure when installation is complete.	6232637	8.2-8 8.2-10 8.2-11	15 3 1
Circuit breaker, 0.5 A, 250 Vac Note: Circuit breaker locations may differ according to system power requirements. Use Figure 8.2-57 to verify the circuit breaker amperage required for the system being serviced.	5101028	8.2-57	7
Circuit breaker, 1 A, 250 Vac, for 220 Vac and 240 Vac systems	5101025	8.2-57	4
Circuit breaker, 1.5 A, 250 Vac Note: Circuit breaker locations may differ according to system power requirements. Use Figure 8.2-57 to verify the circuit breaker amperage required for the system being serviced.	5101026	8.2-57 8.2-57	5 6
Circuit breaker, 2 A, 250 Vac Note: Circuit breaker locations may differ according to system power requirements. Use Figure 8.2-57 to verify the circuit breaker amperage required for the system being serviced.	5120227	8.2-57 8.2-57	3 4
Circuit breaker, 3 A, 250 Vac Note: Circuit breaker locations may differ according to system power requirements. Use Figure 8.2-57 to verify the circuit breaker amperage required for the system being serviced.	5120228	8.2-57 8.2-57	4 5
Circuit breaker, 0.8 A, 250 Vac Note: Circuit breaker locations may differ according to system power requirements. Use Figure 8.2-57 to verify the circuit breaker amperage required for the system being serviced.	5101027	8.2-57 8.2-57	6 7
Circuit breaker, 4 A, 250 Vac, for 100 Vac and 120 Vac systems Note: Circuit breaker locations may differ according to system power requirements. Use Figure 8.2-57 to verify the circuit breaker amperage required for the system being serviced.	5120229	8.2-57	3
Cleaning tube, adaptor	6859297		
Clip, MCL sample probe retainer	2837022	8.2-9	7
Clip, red shipping, for pinch valves	1008315		
Coil, cooling, for Power Supply module	6856536	8.2-55	3
Coil, cooling, used in right side compartment	6856551	8.2-44	14
Computer, Atlas PCI III Pentium 200 processor, referred to as FlowCentre computer, also includes PN 2016665 (mouse) and PN 2016758 (keyboard)	2016753	8.2-7	1
Computer, Pentium 133 MHz, 16 MB RAM, minimum 540 MB hard drive, 2 MB video, Atlas, also includes a Microsoft serial mouse	2016669(R)		

Table 8.1-3 Master Parts List - C (Continued)

Description	Part Number	Figure	Item
Computer, Pentium III processor, 550 MHz minimum, referred to as FlowCentre II tower computer, also includes PN 2016876 (mouse) and PN 2016881 (keyboard)	2016874	8.2-6	3
Computer, Pentium processor, 166 MHz minimum, 16 MB RAM, minimum 1.2 GB HDD, minimum 2 MB video, Atlas PCI III, replacement for PN 2016669, also includes a serial compatible mouse, PN 2016161	2016802(R)		
Connector, BNC coaxial, panel mount, jack-to-jack adapter	2121644	8.2-42	10
Connector, universal mate-n-lock 2-pin plug, panel/cable mount	2104356	8.2-44	7
Consumable, COULTER CLENZ cleaning agent, 10-L box	8546931		
Consumable, COULTER CLENZ cleaning agent, 500 mL-bottle	8546929		
Consumable, COULTER CLENZ cleaning agent, 5-L box	8546930		
Consumable, CYTO-TROL™ control cells	6604248		
Consumable, Flow-Check™ fluorospheres	6605359		
Consumable, Flow-Set™ fluorospheres	6607007		
Consumable, IsoFlow sheath fluid	8547008		
Consumable, latex gloves, large/extra large	5415175		
Consumable, latex gloves, medium/large	5415174		
Consumable, latex gloves, small/medium	5415179		
Consumable, storage media, 3.5 in. floppy diskette, DSHD, 10 per box, unformatted	2016394		
Consumable, test tubes, 12 x 75 mm	2523749		
Coupling joint, cylinder rod end, 8-32 fastening, black oxide Note: Coupling has an internal hex for tightening.	2523700	8.2-8	16
Coupling, quick-connect, panel-mount adapter and nut assembly for attaching 10 tube quick-disconnect couplings to a panel, black	6232530	8.2-18	1
		8.2-40	7
Coupling, quick-disconnect QD10, male body, 10 tube capacity body (includes the 8 fittings shown in Figure 8.2-40)	6232532	8.2-40	1
Coupling, quick-disconnect QD11, female body, 10 tube capacity body (includes the 8 fittings shown in Figure 8.2-40)	6232531	8.2-40	2
Coupling, quick-disconnect QD13, female body, 10 tube capacity body (includes the 7 fittings shown in Figure 8.2-18)	6232533	8.2-18	3
Coupling, quick-disconnect QD14, male body, 10 tube capacity body (includes the 7 fittings shown in Figure 8.2-18)	6232534	8.2-18	2
Cover, filter, black	6856735	8.2-2	3
		8.2-4	3
Cover, filter, grey	6807084	8.2-2	3
		8.2-4	3
Cover, flow cell shield	1020965	8.2-23	14
Cover, left-side, for XL Cytometer without MCL option, black	6856727	8.2-4	10
Cover, left-side, for XL Cytometer without MCL option, grey	6807074	8.2-4	10

Table 8.1-3 Master Parts List - C (Continued)

Description	Part Number	Figure	Item
Cover, left-side, for XL-MCL Cytometer, black	6858522	8.2-2	15
Cover, left-side, for XL-MCL Cytometer, grey	6807076	8.2-2	15
Cover, Power Supply module three-surface (left-side, top, right-side), black	6856369	8.2-5	14
Cover, Power Supply module three-surface (left-side, top, right-side), grey	6807082	8.2-5	14
Cover, rear duct, Laser vent	1022440		
Cover, right-side, black	6856494	8.2-2 8.2-4	2 2
Cover, right-side, grey	6807079	8.2-2 8.2-4	2 2
Cover, sample station	6858247	8.2-33	23
Cover, top, black Note: Attach using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.	6858129	8.2-2 8.2-4	1 1
Cover, upper rear, black	1018854	8.2-2 8.2-4	16 12
Cover, upper rear, grey	1025310	8.2-2 8.2-4	16 12
Cover, top, grey Note: Attach using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.	6807080	8.2-2 8.2-4	1 1
Cylinder, air, double-acting with single-end spring-return, universal mount, 0.63 bore, 3.25 stroke, 150 psi maximum pressure, for manual sample station	6232575	8.2-33	12
Cylinder, air, double-acting, single-ended, front block mount, 0.63 bore, 1.50 stroke, 250 psi maximum pressure, used to move front and rear segmenting valve pads	6232574	8.2-36	4
Cylinder, air, in/out	6232570	8.2-8	13
Cylinder, air, MCL	6232572		
Cylinder, air, probe up/down, double acting, 150 psi, 0.375 bore, front stud and rear clevis mount Note: Remove the large nut from the cylinder. Make sure you replace the small cylinder rod nut before installing.	6232595	8.2-9 8.2-11	15 3
Cylinder, air, STD	6232602		
Cylinder, double-acting air, 0.75 bore, rotating rod with 1.50 stroke, used to move segmenting valve's middle pad	6232723	8.2-35	4
Cylinder, gas, MCL door (may also be referred to as MCL bay cylinder)	6858666	8.2-3	18
Cylinder, lifter air, double acting, 250 psi, 0.56 bore, stud mount each end Note: If present, remove and discard the large nut on each end before installing.	6232591	8.2-9 8.2-10	14 1
Cylinder, piston rod clevis for 0.56 bore, 250 psi cylinder, 10-32 threaded with hex nut for mounting	6232590	8.2-10	4

Table 8.1-4 Master Parts List - D

Description	Part Number	Figure	Item
Data entry, keyboard, long	2016392		
Data entry, keyboard, short	2016592		
Data entry, membrane, overlay and switch, for XL-MCL sample station	1021734	8.2-30	6
Data entry, overlay and membrane switch sample cup XL Note: Before installation, remove paper backing.	1016815	8.2-32	6
Disk drive, 3.5 in. floppy	2016454		
Disk drive, 3.5 in. floppy, 1.44 MB, black, for FlowCentre computer PN 2016753	2016962	8.2-7	2
Disk drive, 3.5 in. floppy, 1.44 MB, white, for FlowCentre II tower computer PN 2016874	2016972	8.2-6	1
Disk drive, 5.25 in. floppy	2016298		
Disk drive, CD-ROM, 8X minimum, internal IDE, for FlowCentre computer PN 2016753	2016959	8.2-7	3
Disk drive, CD-ROM, 8X minimum, internal IDE, for FlowCentre II tower computer PN 2016874	175742	8.2-6	2
Display, monitor, 21 in., SVGA, color	2016754		
Display, monitor, Sony® Trinitron®, 17 in., multiscan color	2016721		
Display, sample cup membrane, for XL-MCL Cytometer	1021696	8.2-30	11
Display, window Note: Remove the protective plastic sheet. Ensure the LED grooves are lined up with the LEDs on the panel overlay (PN 6855862). Install the lower center screw (PN 2806084) in the display window before placing the display window on the panel overlay. Hand tighten this screw. Do not use a power driven screwdriver.	1016814	8.2-12	11
Documentation, COULTER® FlowCentre™ Multimedia Workstation	4237415		
Documentation, Data Management, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237237		
Documentation, Getting Started, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237238		
Documentation, Master Index, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237295		
Documentation, Operating Summary, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237299		
Documentation, Operator's Guide, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237297		
Documentation, Reference, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237298		
Documentation, Special Procedures and Troubleshooting, COULTER® EPICS® XL and COULTER® EPICS® XL-MCL SYSTEM II™	4237296		
Door, MCL sample station, with handle and magnet attached	6858842	8.2-30	7
Door, XL sample station, with attached handle	6858840	8.2-32	8

Table 8.1-4 Master Parts List - D (Continued)

Description	Part Number	Figure	Item
Door, front panel display, black	6856490	8.2-2	14
Note: Attach door using two 3-in. #5 swag hinges, PN 1021176. Attach each hinge using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.		8.2-4	11
		8.2-12	7
Door, front panel display, grey	6807085	8.2-2	14
Note: Attach door using two 3-in. #5 swag hinges, PN 1021176. Attach each hinge using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.		8.2-4	11
		8.2-12	7
Drive, hard, 20 GB minimum, 7200 RPM IDE HDD	2016963		
Note: Drive may be used in FlowCentre II tower computer PN 2016874 or FlowCentre computer PN 2016753.			
Drive, removable, Bernoulli, SCSI	2016552		
Duct, flexible, 3 1/8 i.d. x 10-in. length, rectangular flange at one end, needed to assemble flexible duct for Argon laser assembly	2603060	8.2-24	24
Note: Assembly instructions are illustrated in Figure 8.2-62 .		8.2-62	2

Table 8.1-5 Master Parts List - F

Description	Part Number	Figure	Item
Fan, 64 CFM, 24 Vdc, 6.37 in. square, 1.6 in. deep, for laser cooling	2603054	8.2-24	11
Fan, box, 106 CFM, 24 Vdc (4.68 square x 1.5 thickness)	2603025	8.2-42	1
Note: To ensure proper cable length, verify fan orientation before attaching the fan to the Cytometer frame.		8.2-43	4
<ul style="list-style-type: none"> • Cable for B1 (fan near the MCL side of the unit) must be oriented center to top as seen in the “fan to shock mount” illustration in Figure 8.2-43. • Cable for B2 (fan near the HeNe laser head extension) must be oriented left of center as seen in the “filter assembly to fan” illustration in Figure 8.2-43. 			
Fan, box, 90 CFM, 24 Vdc, 4.69 square x 1.0 in. thickness, used in Power Supply module	2603058	8.2-47	1
Note: Fans on the rear panel should be positioned so that its output wires are inside the panel near the other fan (upper fan’s wires are oriented towards the bottom; lower fan’s wires, towards the top).		8.2-57	13
		8.2-58	4
Fan, chassis, for FlowCentre computer PN 2016753	2016961		
Fan, chassis, for FlowCentre II tower computer PN 2016874	175741	8.2-6	9
Fan, shock mount, for 4-inch fan, black	2603053	8.2-43	3
Fastener, ball stud	2840037	8.2-24	2
Filter, air, 4-inch pad, 45 PPI	2603010	8.2-5	5
		8.2-43	10
		8.2-58	1

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
Filter, gas, hydrophobic, 0.2 micron, disposable plastic	6232561	8.2-47	7
		8.2-53	3
Filter, light, used in filter slot 1, 525 band pass (525 BP)	3814134	8.2-20	9
Filter, light, used in filter slot 2, 575 band pass (575 BP)	3814135	8.2-20	9
Filter, light, used in filter slot 3, 620 band pass (620 BP)	3814289	8.2-20	9
Filter, light, used in filter slot 4, 488 dichroic long pass (488 DL)	3814136	8.2-20	9
Filter, light, used in filter slot 5, 488 laser blocker (488 BK)	3802072	8.2-20	9
Filter, light, used in filter slot 6, 550 dichroic long pass (550 DL)	3814067	8.2-20	9
Filter, light, used in filter slot 7, 600 dichroic long pass (600 DL)	3814138	8.2-20	9
Filter, light, used in filter slot 8, 645 dichroic long pass (645 DL)	3814274	8.2-20	9
Filter, light, used in filter slot 9, 675 band pass (675 BP)	3814139	8.2-20	9
Filter, water trap (air/water filter separator), 5 micron	6232725	8.2-44	12
Note: May need to apply a thin line of pipe sealant, PN 1601056, across threads before insertion. A note in the item description of the associated figure explains the application, if applicable.		8.2-47	3
		8.2-49	2
Finger guard, grille for fan air filter on 4-inch box fan	2603009	8.2-5	4
Note: Raised ribs should face out.		8.2-43	9
		8.2-58	3
Fitting, elbow, adjustable, 10-32 ports, O-ring sealed brass miniature, for bulkhead mounting	6232360	8.2-8	14
Fitting, elbow, adjustable, 3/32 i.d. hose barb to 10-32 threaded, brass miniature	6232813	8.2-38	2
Note: Fitting must be oriented as shown after tightening.			
Fitting, elbow, hose barb, 0.187 i.d. to 1/8 MPT, brass	6216128	8.2-44	13
Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown in the associated figure after tightening.		8.2-46	1
		8.2-48	1
		8.2-49	1
Fitting, feed-thru isolator, white, with 10-32 threads	1016486	8.2-60	2
Fitting, feed-thru, hose-barb union, 0.062 i.d. to 0.093 i.d. with 10-22 threaded	6216353	8.2-60	3
Fitting, feed-thru, hose-barb union, metal, 0.093 i.d. to 0.093 i.d. with 10-32 threads	1005699	8.2-60	1
Fitting, ferrule nut, black, for 0.062 o.d. tubing	6232526	8.2-34	6
Fitting, ferrule, natural, for 0.062 o.d. tubing	6232525	8.2-34	7
Fitting, hex-head adapter, 10-32 tap to 1/8 MPT, brass	6216004	8.2-44	9
Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion.			

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
Fitting, hose barb union, 0.062 i.d. to 10-32 threaded	6232086	8.2-15	1
		8.2-17	4
		8.2-33	10
		8.2-35	3
		8.2-36	3
		8.2-39	9
		8.2-44	1
Fitting, hose barb union, 0.125 i.d. to 10-32 threaded	6232085	8.2-17	1
		8.2-44	3
Fitting, hose barb, elbow, 0.093 i.d. to 10-32 threaded, white, nylon Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Tighten until the O-ring is squeezed then continue to tighten until the fitting is oriented as shown in Figure 8.2-27 .	6232208	8.2-27	10
Fitting, hose barb, elbow, 0.187 i.d. to 1/8 FPT, nickel-plated brass Note: After tightening, fitting must be oriented as shown in the associated figure. Application of a thin line of pipe sealant, PN 1601056, across attachment threads may be required.	6232214	8.2-49	3
		8.2-51	1
		8.2-54	1
Fitting, hose-barb union, 0.062 i.d. to 0.062 i.d.	1005697	8.2-16	2
		8.2-33	22
Fitting, hose-barb union, 0.062 i.d. to 0.062 i.d., clear	6232109	8.2-60	6
Fitting, hose-barb union, 0.062 i.d. to 0.093 i.d.	6232352	8.2-60	4
Fitting, hose-barb union, 0.062 i.d. to 10-32 threaded	1005693	8.2-59	5
Fitting, hose-barb union, 0.093 i.d. to 0.093 i.d.	9908083	8.2-60	7
Fitting, hose-barb union, 0.093 i.d. to 0.125 i.d. tubing, clear	6232246	8.2-60	5
Fitting, hose-barb union, 0.115 i.d. to 0.180 i.d.	6232104	8.2-16	3
Fitting, insert, black female quick-connect, internal connector to 0.125 i.d. hose barb	6232469	8.2-18	5
		8.2-40	4
		8.2-41	11
Fitting, insert, black male quick-connect, internal connector to 0.125 i.d. hose barb	6232468	8.2-18	7
		8.2-40	5
		8.2-41	10
Fitting, insert, white female quick-connect, internal connector to 0.082 i.d. hose barb	6232588	8.2-18	4
		8.2-40	3
		8.2-41	4
Fitting, insert, white female quick-connect, internal connector to 0.094 i.d. hose barb (inserted three places in the 45° angled bracket, PN 6805879)	6232799	8.2-41	3

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
Fitting, insert, white male quick-connect, internal connector to 0.082 i.d. hose barb	6232581	8.2-18	6
		8.2-40	6
		8.2-41	5
Fitting, Luer, 0.125 i.d.	6232527		
Fitting, miniature adapter, 10-32 tap in 0.125 MPT plug, nickel-plated brass	6232683	8.2-35	5
Fitting, miniature tee branch with 10-32 ports	6232359	8.2-15	3
		8.2-17	3
Fitting, miniature, 10-32 threaded, 10-32 tap, adjustable, brass	6216002	8.2-10	2
		8.2-11	2
		8.2-35	1
		8.2-36	1
Fitting, poly-flow, poly-flow, elbow, 0.250 o.d. to 1/8 MNPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads that will be screwed in the pressure relief valve. Fitting must be oriented as shown in the associated figure after tightening.	6216027	8.2-52	3
Fitting, quick-connect, blue male, couples with female blue body, PN 6232309	6232306		
Fitting, quick-connect, female, 0.125 flow, 0.375 MNPT, white acetal delrin, single connect	6232703	8.2-53	2
Fitting, quick-connect, female, 0.250 flow, 0.375 MNPT, white acetal delrin, single connect	6232700	8.2-53	4
Fitting, quick-connect, female, internal panel mount, 0.125 flow, coupling pair latch, barb, white acetal delrin	6232478	8.2-28	7
		8.2-29	7
Fitting, quick-connect, female, internal panel mount, 0.125 i.d., coupling pair latch, barb, white acetal delrin	6232470	8.2-28	2
		8.2-29	2
Fitting, quick-connect, green male, couples with female green body, PN 6232606	6232607		
Fitting, quick-connect, internal, panel mount, 10-32, white female body, 0.125 flow (couples with white insert, PN 6232266)	6232466	8.2-27	7
Fitting, quick-connect, male, elbow, 0.250 o.d., white acetal delrin	6232702	8.2-53	1
Fitting, quick-connect, male, external elbow, 0.250 o.d., white acetal delrin	6232472	8.2-26	2
		8.2-27	6
		8.2-28	1
		8.2-29	1
Fitting, quick-connect, male, external elbow, 0.375 o.d., white acetal delrin	6232522	8.2-26	3
		8.2-53	5
Fitting, quick-connect, orange male, couples with female orange body, PN 6232304	6232305		

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
Fitting, quick-connect, panel mount, blue female body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with blue insert, PN 6232306, also with automatic shut-off) Note: If installing the quick-connect on the Cytometer rear panel, insert a #50 I-tooth washer, PN 2826042, between the panel and the hex nut.	6232309	8.2-42 8.2-57	9 12
Fitting, quick-connect, panel mount, green female body with nut, 0.250 o.d. (couples with green insert, PN 6232607)	6232606	8.2-57	9
Fitting, quick-connect, panel mount, orange female body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with orange insert, PN 6232305, also with automatic shut-off) Note: If installing the quick-connect on the Cytometer rear panel, insert a #50 I-tooth washer, PN 2826042, between the panel and the hex nut.	6232304	8.2-42 8.2-57	6 10
Fitting, quick-connect, panel mount, yellow female body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with yellow insert, PN 6232307, also with automatic shut-off) Note: If installing the quick-connect on the Cytometer rear panel, insert a #50 I-tooth washer, PN 2826042, between the panel and the hex nut.	6232303	8.2-42 8.2-57	7 11
Fitting, quick-connect, white male, couples with female white body, PN 6232466	6232266		
Fitting, quick-connect, yellow male, couples with female yellow body, PN 6232303	6232307		
Fitting, T-connector, adjustable, 3/32 i.d. hose barb to 3/32 i.d. hose barb to 10-32 threaded, brass miniature	6232814	8.2-38	1
Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to 1/8 MPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown in the associated figure after tightening.	6216127	8.2-44 8.2-46 8.2-52	11 4 2
Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to threaded, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.	6216129	8.2-39	1
Fitting, T-connector, hose-barb union, 0.093 i.d. to 0.125 i.d. to 0.125 i.d., nylon, white	6232322	8.2-14 8.2-60	10 15
Fitting, Y-connector, adjustable, hose barb, 0.190 o.d. to 0.120 o.d. to 10-32 threaded, brass miniature with stainless steel stud Note: Fitting must be oriented as shown after tightening.	6232819	8.2-38	3
Fitting, Y-connector, hose-barb union, 0.050 i.d. x 0.130 o.d., blue	6232263	8.2-60	11
Fitting, Y-connector, hose-barb union, 0.062 i.d. to 0.062 i.d. to 0.062 i.d.	9909059	8.2-60	14
Fitting, Y-connector, hose-barb union, 0.082 i.d. to 0.082 i.d. to 0.062 i.d., clear	6216181	8.2-60	13
Fitting, Y-connector, hose-barb union, 0.085 i.d. x 0.172 o.d., white	1018245	8.2-60	10
Fitting, Y-connector, hose-barb union, 0.093 i.d. to 0.093 i.d. to 0.093 i.d., clear	6232259	8.2-60	12
Fitting, Y-connector, hose-barb union, 0.125 i.d. to 0.125 i.d. to 0.125 i.d., clear	6216081	8.2-60	8
Fitting, Y-connector, hose-barb union, 0.125 i.d. to 0.125 i.d. to 0.125 i.d., nylon, white	6232257	8.2-60	9

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
Flow cell	6858386	8.2-23	9
Flow cell, complete	6859156		
Foot, rubber	6858988	8.2-2	5
Note: Use setscrew, PN 2810028, to attach foot to the Cytometer frame.		8.2-4	5
Frame, Power Supply module	6856206		
FRU, Argon air-cooled laser head	7000358	8.2-24	23
FRU, Argon air-cooled laser power supply, switching, for 100 Vac system	7000431	8.2-24	14
		8.2-45	1
FRU, Argon air-cooled laser power supply, switching, for 115 Vac system	7000721	8.2-24	14
		8.2-45	1
FRU, Argon air-cooled laser power supply, switching, for 220 or 240 Vac system	7000432	8.2-24	14
		8.2-45	1
FRU, beamshaper 2	7000450	8.2-22	1
FRU, Bertan high voltage power supply	7000193	8.2-13	7
FRU, cleanse tank with sensor assembly	7000379	8.2-29	
FRU, coil assembly, waste	7000353		
FRU, compressor assembly, dual-head, for 100/120 Vac system	7000371	8.2-45	2
FRU, compressor assembly, dual-head, for 220/224 Vac system	7000372	8.2-45	2
FRU, fluorescence PMT	7000197	8.2-19	6
		8.2-21	2
FRU, focus knob III	7000451	8.2-22	4
FRU, focus knob2	7000449	8.2-22	4
FRU, forward scatter (FS) detector	7000359	8.2-21	5
FRU, laser blower assembly	7000719	8.2-24	10
FRU, lower pneumatics drawer assembly	7000374	8.2-37	
FRU, manual sample head	7000351	8.2-33	18
FRU, manual sample station, for XL-MCL Cytometer with grey covers	7000678	8.2-2	9
		8.2-30	Front view
		8.2-31	Rear view
FRU, MCL cable shorting plug	7000455		
FRU, MCL cable shorting plug, EMC	7000466		
FRU, MCL carousel base assembly	7000189	8.2-8	8
FRU, MCL carousel in/out sensor cable assembly	7000434		
FRU, MCL carousel tube-position sensor cable assembly	7000436		

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
FRU, MCL carousel-home sensor cable assembly	7000435		
FRU, MCL head sensor cable assembly	7000438	8.2-9	16
FRU, MCL lift motor (up/down) sensor cable assembly	7000437		
FRU, MCL lifter assembly	7000443	8.2-8	4
FRU, MCL lower base cover, black	7000199	8.2-2	11
FRU, MCL lower base cover, grey	7000676	8.2-2	11
FRU, MCL option assembly	7000433	8.2-8	
FRU, MCL probe sensor cable assembly	7000439	8.2-9	2
FRU, MCL probe slide assembly (low friction precision ball slide assembly with two carriages)	7000446	8.2-9	10
FRU, MCL sample head	7000456	8.2-9	9
FRU, MCL sample station door assembly	7000444	8.2-30	10
FRU, MCL solenoids	7000555	8.2-8	19
FRU, MCL tube rotator assembly Note: Attach the tube rotator assembly to the MCL vertical plate using two hex screws (#6-32 x 0.25 in. length, HSC-head), PN 2851395.	7000430	8.2-8	20
FRU, MCL door (upper cover), black	7000376	8.2-2	12
FRU, MCL door (upper cover), grey	7000675	8.2-2	12
FRU, MCL vortexer foot assembly	7000579	8.2-8	5
FRU, Power Supply, +24 Vdc	7000357	8.2-55	2
FRU, Power Supply, +5 Vdc	7000356	8.2-55	4
FRU, Power Supply, ±15 Vdc	7000355	8.2-55	5
FRU, Power Supply, MCL, assembly consisting of a +5 Vdc and ±12 Vdc supply and a +24 Vdc supply	7000362	8.2-55	6
FRU, reagent drawer with slides assembly Note: Order front panel separately - for grey XL flow cytometer order PN 6807089; for grey XL-MCL flow cytometer order PN 6807088; for black XL or XL-MCL flow cytometer order PN 6855934.	7000677	8.2-2 8.2-4 8.2-25	4 4 2
FRU, regulator, electronic pressure (electronic transducer), for regulating sample pressure Note: Attach to posts using one #25 flat washer (0.265 i.d. x 0.484 o.d. x 0.027 in. thickness), PN 2827064, one #25 split-lock washer (0.26 i.d. x 0.49 o.d. x 0.062 in. thickness), PN 2826051, and one hex nut (#25-20 UNC x 0.437 AF x 0.164 in. thickness), PN 2822072. Requires two sets.	7000192	8.2-14	1
FRU, regulator, pressure, 0-10 psi, for regulating sheath pressure (4 psi flow)	7000720	8.2-14	5

Table 8.1-5 Master Parts List - F (Continued)

Description	Part Number	Figure	Item
FRU, sample station, manual, for XL-MCL Cytometer with black covers	7000354	8.2-2 8.2-30 8.2-31	9 Front view Rear view
FRU, segmenting valve assembly	7000370	8.2-34	
FRU, segmenting valve front pad	7000196	8.2-34	3
FRU, segmenting valve knob	7000198	8.2-34	8
FRU, segmenting valve middle pad	7000191	8.2-34	2
FRU, segmenting valve rear pad	7000195	8.2-34	1
FRU, sheath tank with sensor assembly	7000378	8.2-28	
FRU, side scatter diode	7000352	8.2-19	2
FRU, side scatter diode	7000352	8.2-21	1
FRU, sample station assembly, for XL Cytometer (without MCL option) with black covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.	7000360	8.2-4 8.2-32	9
FRU, sample station, for XL Cytometer without MCL option with grey covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.	7000679	8.2-4 8.2-32	9
FRU, upper pneumatics drawer assembly	7000375	8.2-14	
FRU, vacuum chamber Note: Attach using two self-lock screws (#6-32 x 0.37 in. length, pan-head), PN 2839039.	7000373	8.2-37	3
FRU, visible laser diode scanner (MCL bar-code reader) Note: Attach the scanner head to the MCL vertical plate using four machine screws (#6-32 x 0.25 in. length, pan-head), PN 2806009.	7000042	8.2-8	2

Table 8.1-6 Master Parts List - G

Description	Part Number	Figure	Item
Gasket, #10 black, ethylene propylene	6216345	8.2-3 8.2-20 8.2-59	24 6 6
Gasket, cleanse cap	1021812	8.2-29	5
Gasket, ferrule	1021797	8.2-9	6

Table 8.1-6 Master Parts List - G (Continued)

Description	Part Number	Figure	Item
Gauge, 0 to 30 in. Hg, for monitoring system vacuum, 1.5-inch diameter, panel mount (includes panel mounting hardware) Note: Apply a thin line of pipe sealant, PN 1601056, across gauge threads before attaching the fitting. Gauge must be oriented as shown in Figure 8.2-54 after tightening.	6232183	8.2-47 8.2-54	8 2
Gauge, 0 to 60 psi, for monitoring system pressure, 1.5-inch diameter, panel mount (includes panel mounting hardware) Note: Apply a thin line of pipe sealant, PN 1601056, across gauge threads before attaching the fitting. Gauge must be oriented as shown in Figure 8.2-51 after tightening.	6232189	8.2-47 8.2-51	5 2
Grommet, 0.375 i.d. x 0.560 o.d., nylon	2851080	8.2-50	5

Table 8.1-7 Master Parts List - H and I

Description	Part Number	Figure	Item
Hinge (lid stay), left-hand, 4.875 CTRS, 0.56 in. wide, 0.095 in. thick, brass-plated steel	2523666	8.2-13	14
Hinge (lid stay), right-hand, 4.875 CTRS, 0.56 in. wide, 0.095 in. thick, brass-plated steel	2523667	8.2-13	9
Hinge, #5 swag, 3-inch Note: Attach each hinge using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head, PN 2839039) and #6 flat washers (PN 2827147).	1021176	8.2-12	6
Hinge, door, for Power Supply module	1020939	8.2-5	2
Holder, finger, for manual sample station	1020897	8.2-33	15
Holder, intro rod Note: Attach the intro rod holder to the probe actuator bracket using two machine screws (pan-head, #6-32 x 0.25 in. length), PN 2806009.	1021652	8.2-9	4
Holder, MCL spring	1021765	8.2-31	6
Holder, optical filter	1018542	8.2-20	12
Holder, sample tube, for manual sample station	1021679	8.2-33	17
Housing, MCL probe	6858616	8.2-2	13
Hub, carousel (as referred to as indexing hub)	7701140	8.2-8	7
Insulation, needed to assemble flexible duct for Argon laser assembly Note: Assembly instructions are illustrated in Figure 8.2-62 .	1018547	8.2-24 8.2-62	24 1
Interlock, high voltage (HV), snap action cheat switch	5110031	8.2-55	1

Table 8.1-8 Master Parts List - J and K

Description	Part Number	Figure	Item
Jumper, use with Cyto Transputer card	2121023		
Keeper, upper base, MCL	1021763		
Keyboard, 104-key minimum, AT®/PS Windows 95, black, for FlowCentre computer PN 2016753	2016758	8.2-7	7
Keyboard, 104-key minimum, AT®/PS Windows 95/98, for FlowCentre II tower computer PN 2016874	2016881	8.2-6	7
Kit, 4 color upgrade	6912932		
Kit, bar-code labels, 35 labels, blank sheet	6913149		
Kit, bar-code labels, for 12 x 75 test tubes	6913343		
Kit, bar-code scanner	6913337		
Kit, bar-code, MCL EPROM	6914990		
Kit, cartridge, color Printer, Hewlett Packard, for HP-1600C	6914967		
Kit, computer, FlowCentre Multimedia Workstation	6915113		
Kit, insertion rod replacement	6913097		
Kit, MCL upgrade in black	6912669		
Kit, MCL upgrade in grey	6915506		
Kit, networking option, server upgrade with LANtastic® network software and Sybase® SQL Anywhere™ PC database server software	6914958		
Kit, optical alignment	6914939		
Kit, PMI	6913241		
Kit, printer, color (includes parallel port card, HP-1600C color Printer and color Printer cartridges)	6913335		
Kit, re-image, for the FlowCentre desktop computer, PN 2016753 Note: Kit includes 3.5 in. bootable disk, PN 6417654, CD-ROM for Caching Controller, PN 7270409, and CD-ROM for Ultra 33 ATA Controller, PN 7270413.	6915175		
Kit, re-image, for the FlowCentre II tower computer, PN 2016874	7270464		
Kit, Sample/MCL Intro Line	6912941	8.2-34	4
Kit, sheath filter replacement	6912942	8.2-26	1
Kit, software replacement, COULTER EPICS XL/XL-MCL SYSTEM II Version 3.0	6915303		
Knob, pinch valve	1018728	8.2-27	2
Knob, snout	1021682	8.2-23	3

Table 8.1-9 Master Parts List - L

Description	Part Number	Figure	Item
Label (J69)	2427902	8.2-44	6
Label, 488 BK / Slot 5	2429706	8.2-20	11
Label, 488 DL / Slot 4	2429704	8.2-20	11
Label, 525 BP / Slot 1	2429708	8.2-20	11
Label, 550 DL / Slot 6	2429703	8.2-20	11
Label, 575 BP / Slot 2	2429709	8.2-20	11
Label, 600 DL / Slot 7	2430206	8.2-20	11
Label, 620 BP / Slot 3	2429858	8.2-20	11
Label, 645 DL / Slot 8	2429857	8.2-20	11
Label, 675 BP / Slot 9	2430195	8.2-20	11
Label, caution, interlock defeat, attach to MCL drip pan flange (PN 6858636)	2430416	8.2-3	21
Label, caution, laser radiation, attach to MCL drip pan flange (PN 6858636)	2430417	8.2-3	22
Label, Class 3B Laser Product	2430348	8.2-20	1
Label, laser danger	2427785	8.2-20	2
		8.2-23	15
Label, waste container	2428039	8.2-56	3
Labels, bar-code, 1, for carousel	2430185		
Labels, keyboard short	2430458		
Labels, keyboard, long	2429044		
Labels, tube position, 1-32	2430186		
Labels, XL with MCL	1021770		
Latch, concealed pull-up catch and keeper, 1.9 x 1.1 x 0.3 in., black nylon Note: Use associated figures to verify proper orientation of latch catch and keeper.	2851859	8.2-2	6
		8.2-3	12
		8.2-4	6
		8.2-31	1
		8.2-31	11
Latch, magnetic, 0.24 width x 0.82 length x 0.52 thickness, for Power Supply module front door	2840053	8.2-5	6
Lens holder, 10 mm	6859219	8.2-22	2
Lens holder, 80 mm	6859220	8.2-22	3
Letter tray, upgrade, Hewlett Packard, for LaserJet IIP Plus Printer	2016557		
Line cord, 125 Vac / 15 A, shielded, 14 AWG stranded, NEMA 5-15 plug to a stripped end, 9-ft. 10-in. length including connector Note: Strain relief set for one line cord, PN 6027766.	6028530	8.2-45	7
		8.2-57	8

Table 8.1-10 Master Parts List - M

Description	Part Number	Figure	Item
Magnet, disk, rare earth, 0.187 o.d. x 0.063 thickness Note: Before installation, remove the sample station door and lay the door near the edge of a table with the handle positioned over the edge. With the door flat, apply one drop of instant adhesive, PN 1601082 inside the hole behind the handle then immediately install the magnet in the hole. Be very careful not to smear the adhesive.	2523394	8.2-32	7
Manifold, rear panel	1018616	8.2-44	4
MCL compression spring, for XL-MCL sample station door, rated 8.1 lb. per inch, (0.148 in. diameter x 0.75 in. length x 0.021 in. width)	2523737	8.2-30	9
MCL drip pan flange	6858636	8.2-3	20
MCL option assembly	6706138		
MCL push cylinder, for XL-MCL sample station door	6858841	8.2-30	8
MCL upper base, black	6858519	8.2-3	2
MCL upper base, grey	6807078	8.2-3	2
MCL upper window Note: Before installing the window in the upper cover, remove the paper covering from the bottom side only (leave the paper on the top side), apply a thin line of epoxy, PN 1615132, to the rim of the upper cover, install the window, allow the epoxy to set, then remove the paper covering from the top of the window.	1021737	8.2-3	3
Memory, 128 MB, PC 100 SDRAM, ECC correctable, DIMM module, for FlowCentre II tower computer PN 2016874	2016969		
Memory, 16 MB, 70 NS tin-plated SIMM, for FlowCentre computer PN 2016753	2016973		
Monitor, 17-inch display, flat screen	2016938	8.2-6 8.2-7	4 4
Monitor, 22-inch CRT display	2016951		
Mount, pull-apart pinch valve	1017501	8.2-15 8.2-17 8.2-27 8.2-38	7 8 13 5
Mount, shock, rubber, axial mount, 16 lb, 256 lb/in., 78 Hz	2523660	8.2-24	13
Mount, shock, rubber, axial mount, 4 lb, 73 lb/in., 84 Hz, for laser cooling fan module (may also be referred to as bushings)	2523659		
Mount, wire tie, 0.51 in. length x 0.33 in. width, for use with #6 screw	6011019	8.2-3 8.2-41 8.2-61	10 2 3
Mount, wire tie, 0.75 x 0.75, with #6 hole, adhesive back	6027284	8.2-61	1
Mount, wire tie, 1 x 1, with #6 hole, adhesive back	6011015	8.2-61	2
Mouse pad	2016725	8.2-6 8.2-7	5 5

Table 8.1-10 Master Parts List - M (Continued)

Description	Part Number	Figure	Item
Mouse pointing device, for use with 166 MHz Pentium computer PN 2016802 and 133 MHz Pentium computer PN 2016669	2016161		
Mouse pointing device, PS/2 compatible, for FlowCentre computer PN 2016753	2016665	8.2-7	6
Mouse pointing device, PS/2 scroll point, for FlowCentre II tower computer PN 2016874	2016876	8.2-6	6
Muffler, exhaust	6216286		
Muffler, noise reducing pneumatic, 0.125 MNPT, 0.812 diameter, 2.125 length Note: Hand tighten only.	6232501	8.2-46 8.2-52	5 1

Table 8.1-11 Master Parts List - N and O

Description	Part Number	Figure	Item
Nut, hex (#10-32 UNF x 0.375 AF x 0.130 in. thickness)	2822016	8.2-33	13
		8.2-36	5
Nut, hex (#25-28 UNF x 0.437 AF x 0.140 in. thickness)	2822040	8.2-35	6
Nut, hex (#2-56 UNC x 0.187 AF x 0.066 in. thickness)	2822050	8.2-30	2
		8.2-32	10
Nut, hex (0.25-36 UNS x 0.375 AF x 0.094 in. thickness)	2851995	8.2-42	5
Nut, hex (47-32 UNS x 0.562 AF x 0.078 in. thickness)	2822033	8.2-27	3
Nut, self-lock (#4-40 x 0.250 AF x 0.109 in. thickness)	2821009	8.2-45	6
Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)	2821010	8.2-5	3
		8.2-12	9
		8.2-13	13
		8.2-24	4
		8.2-31	10
		8.2-43	1
		8.2-50	1
		8.2-58	5
Nut, self-lock (10-32 x 0.375 AF x 0.156 in. thickness)	2821018	8.2-33	8
Nut, thumb, diamond knurl (#6-32 UNC x 0.500 o.d. x 0.625 in. length), black dichromate	2851998	8.2-3	16
Optical media, rewritable, 1 G	2016567		
Optical media, rewritable, 650 MB	2016568		
Optical media, write once, 1 G	2016570		
Optical media, write once, 650 MB	2016569		
O-ring, 1.864 i.d. x 0.070 w, BUNA 60, for vacuum chamber	2512098		

Table 8.1-11 Master Parts List - N and O (Continued)

Description	Part Number	Figure	Item
O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall	2523062	8.2-15	2
		8.2-17	2
		8.2-27	9
		8.2-33	9
		8.2-35	2
		8.2-36	2
		8.2-39	8
		8.2-44	2
O-ring, silicone seal, 0.364 i.d. x 0.070 width	2512031	8.2-29	9
		8.2-37	2
O-ring, silicone seal, 1.850 i.d. x 0.210 width, for sheath container	2523724	8.2-28	5
O-ring, silicone, used as rubber band, 2.300 i.d. x 0.103 width	2523451	8.2-25	1
		8.2-53	6

Table 8.1-12 Master Parts List - P

Description	Part Number	Figure	Item
Panel, front window, plexiglass, for Power Supply module	1020931		
Panel, front window, smoked dark Lexan, Power Supply module front door	1025141	8.2-5	8
Panel, reagent drawer front, for XL flow cytometer, grey	6807089	8.2-25	3
Panel, reagent drawer front, for XL or XL-MCL flow cytometer, black	6855934	8.2-25	5
Panel, reagent drawer front, for XL-MCL flow cytometer, grey	6807088	8.2-25	4
PCB, 3 Com Ethernet, replacement card not available	N/A	8.2-6	12
PCB, Adaptor SCSI Host	2016457		
PCB, Amp/Signal Conditioner	6705321	8.2-13	5
PCB, Bar-Code Decoder	2016561	8.2-8	1
PCB, CYT12 Receiver, EMC Note: Attach using hex nut, PN 2851995 (0.25-36 UNS x 0.375 AF x 0.094 in. thickness).	6706391	8.2-57	1
PCB, Cyto Transputer (also referred to as Cytometer Transputer card)	6705318	8.2-13	1
PCB, FALS Hybrid Detector	6705706		
PCB, Fiber Optic Interface Note: Uses fiber interface cable, PN 6028650 (9-position, D-receptacle to plug, 55-in. long).	6705324	8.2-42	4
PCB, Front Panel LED and Switch Input 2, for XL-MCL instrument only	6705742	8.2-31	9
PCB, Front Panel LED and Switch Input, for XL Cytometer without MCL option	6705193	8.2-32	3

Table 8.1-12 Master Parts List - P (Continued)

Description	Part Number	Figure	Item
PCB, MCL CPU	6705712	8.2-8	21
PCB, MCL Interface	6705700	8.2-13	2
PCB, Motor Filter, EMC	6706409	8.2-8	3
PCB, Network Interface	2016621		
PCB, Sensor Note: Place a hole spacer (0.140 i.d. x 0.250 o.d. x 0.250 in. length), PN 2843032, on each post before installing the circuit card. Secure using self-lock nuts (#6-32 x 0.312 AF x 0.140 in. thickness), PN 2821021.	6705217	8.2-14	4
PCB, Opto Transprocessor EXMEM, non-EMC, 2 fiber connectors Note: Card may be used in FlowCentre II tower computer PN 2016874 or FlowCentre computer PN 2016753.	6705355		
PCB, Opto Transprocessor EXMEM II, EMC, 3 fiber connectors Note: Card may be use in FlowCentre II tower computer PN 2016874 or FlowCentre computer PN 2016753.	6706394	8.2-6 8.2-7	10 8
PCB, Parallel Port Adapter (computer card requires PCI bus)	2016883		
PCB, PCI Sound, for FlowCentre II tower computer PN 2016874 Note: No replacement card is available for FlowCentre computer PN 2016753.	2016971	8.2-6	11
PCB, PCI Video, for FlowCentre computer PN 2016753	2016974	8.2-7	12
PCB, PCI Video, for FlowCentre II tower computer PN 2016874	2016970	8.2-6	13
PCB, Power Module Control II, EMC version, for instruments with a serial number Z09063 or higher	6706390	8.2-45	8
PCB, Power Module Control, for instruments with a serial number Z09062 or lower	6705231	8.2-45	8
PCB, Serial/Parallel Adapter Interface (computer card requires ISA bus)	2016678		
PCB, Solenoid Power Distribution	6705761	8.2-37	7
PCB, System Interface	6705340	8.2-13	3
PCB, Top Panel Display 2	6705206	8.2-12	5
PCB, Trans Data Acquisition	6705314	8.2-13	4
PCB, Transient Absorber EMC (also referred to as Transient Voltage Suppressor 2 card)	6706401	8.2-45	4
PCB, Transient Voltage Suppressor 2 (also referred to as Transient Absorber EMC card)	6706401	8.2-45	4
PCB, Voltage Selector, for 100 Vac system	6705442	8.2-45	9
PCB, Voltage Selector, for 120 Vac system	6705237	8.2-45	9
PCB, Voltage Selector, for 220 Vac system	6705470	8.2-45	9
PCB, Voltage Selector, for 230/240 Vac system	6705472	8.2-45	9
PCB, Voltage Supply Monitor	6705720	8.2-47 8.2-50	4 3

Table 8.1-12 Master Parts List - P (Continued)

Description	Part Number	Figure	Item
PCB, PMT Distribution and Laser Fan Control	6705199	8.2-19	5
Note: Refers to the two cooling fans mounted on the Cytometer frame. These fans cool the Argon laser.		8.2-24	20
Pin, universal mate-n-lock connector, 20-14 AWG, brass and gold	2104365	8.2-44	5
Plate, 12 insert fitting, with captive knurl knob, lower pneumatics drawer	6858589	8.2-41	6
Plate, 5 insert fitting, with captive knurl knob, used only on XL with MCL option installed, for QD68, QD71, and QD89 connections, lower pneumatics drawer	6858590	8.2-41	9
Plate, 6 insert fitting, with captive knurl knob, for QD64, QD65 and QD72 connections, lower pneumatics drawer	6858591	8.2-41	7
Plate, 6 insert fitting, with captive knurl knob, for QD66, QD67, QD74, and QD75 connections, lower pneumatics drawer	6858592	8.2-41	8
Plate, Argon laser power supply mounting	6856067	8.2-24	15
Plate, compressor shock mount	6855960		
Plate, flow cell	1022362	8.2-23	10
Plate, lens holder	1018737	8.2-20	7
Plate, magnet catcher	1019621	8.2-30	5
Note: Attach using instant adhesive, PN 1601082. Apply only one drop.		8.2-32	9
Plate, top, for manual sample station	1020910	8.2-33	19
Plenum, laser duct out	6856941	8.2-24	1
Plunger, ball (#6-40 x 0.312 long)	2516002	8.2-20	13
Power Supply, ATX power supply with PFC (power factor correction) for self adjustment and regulation, manufactured by 3Y Power Technology, voltage range 90 to 264 Vac, for FlowCentre II tower computer PN 2016874	2016919	8.2-6	8
Power Supply, with EMI shielding assembly, for FlowCentre computer, PN 2016753	2016977	8.2-7	13
Printer, Hewlett Packard, HP InkJet 2280, color printer, 14 PPM minimum in draft mode, 1200 x 600 DPI minimum, 100/240 Vac, includes bi-directional parallel port interface cable	2016953		
Printer, Hewlett Packard, HP LaserJet 2200D, black print only, 8 PPM minimum, 600 DPI minimum, 110/120 Vac, includes parallel interface cable	2016752		
Printer, Hewlett Packard, HP LaserJet 4	2016707		
Printer, Hewlett Packard, HP LaserJet 4P	2016616		
Printer, Hewlett Packard, HP LaserJet 5P	2016575		
Printer, Hewlett Packard, HP LaserJet IIP Plus	2016554		
Printer, Hewlett Packard, HP-1600C, color Printer	2016675		
Printer, Inkjet, 120 Vac	2016553		
Printer, Zebra STRIPE S-500, bar	2016676		
Probe, MCL sample	6858663	8.2-9	5
Probe, sample pickup holder	1020977		

Table 8.1-12 Master Parts List - P (Continued)

Description	Part Number	Figure	Item
Probe, sample, used in manual sample station	6858174	8.2-33	6
Promise, Ultra 66 IDE PCI Controller with cable, for FlowCentre tower computer PN 2016753	2016960		
Push-button, for opening MCL upper base door, black	6858700	8.2-2	10
Push-button, for opening MCL upper base door, grey	6807075	8.2-2	10
Note: MCL push-button must be properly positioned before inserting the shoulder screw, PN 2852256		8.2-31	4

Table 8.1-13 Master Parts List - R

Description	Part Number	Figure	Item
Regulator, vacuum	6232254	8.2-14	11
Regulator, voltage to pressure	2306059		
Re-imaging CD-ROM for Caching Controller, for the FlowCentre desktop computer PN 2016753	7270409		
Re-imaging CD-ROM for Ultra 33 ATA Controller, for the FlowCentre desktop computer PN 2016753	7270413		
Re-imaging CD-ROM, bootable, FlowCentre Workstation Restoration Disk for FlowCentre II tower computer PN 2016874	7270464		
Re-imaging disk, Imaging Utility Boot, 3.5 in. floppy diskette, for the FlowCentre desktop computer PN 2016753	6417654		
Note: For larger hard drives that use the Ultra 66 controller, use the re-imaging bootable CD-ROM, PN 7270626. The 3.5 in. diskette is not needed.			
ROMLOCK, special connector for use with EXPO32 Cytometer Acquisition software	2016892		

Table 8.1-14 Master Parts List - S

Description	Part Number	Figure	Item
Sample station, for an XL with black covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.	6856869	8.2-32	4
Sample station, for an XL with grey covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.	6807083	8.2-32	4
Sample station, for an XL-MCL with black covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.	6858518	8.2-30	1
Sample station, for an XL-MCL with grey covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.	6807081	8.2-30	1

Table 8.1-14 Master Parts List - S (Continued)

Description	Part Number	Figure	Item
Sample station, long screw, top	2806117		
Screw, machine (#2-56 x 0.19 in. length, pan-head)	2802006	8.2-3	15
Screw, machine (#4-40 x 0.25 in. length, HSC-head)	2804083	8.2-8	11
Screw, machine (#4-40 x 0.38 in. length, FL82 flat-head), used to mount MCL head	2804044	8.2-9	8
Screw, machine (#4-40 x 0.75 in. length, pan-head)	2804039	8.2-33	24
Screw, machine (#6-32 x 0.19 in. length, UF82-head), used to secure lens holder in filter slot 9 only	2806077	8.2-20	8
Screw, machine (#6-32 x 0.25 in. length, UF82 flat-head)	2806104	8.2-3	11
Note: When securing lens holders in filter slots, use this screw to secure lens holders 1 through 8 only. Use PN 2806077 to secure the lens holder in slot 9.		8.2-14	2
		8.2-20	8
Screw, machine (#6-32 x 0.31 in. length, pan-head)	2806182	8.2-3	13
Screw, machine (#6-32 x 0.38 in. length, FL82 flat-head)	2806137	8.2-3	23
		8.2-8	6
Screw, machine (#6-32 x 0.38 in. length, hex-head)	2806102	8.2-23	7
Screw, machine (#6-32 x 0.38 in. length, HSC button-head)	2806201	8.2-3	8
Screw, machine (#6-32 x 0.38 in. length, UF82-head)	2806140	8.2-25	7
Screw, machine (#6-32 x 0.44 in. length, FL82 flat-head)	2806162	8.2-32	5
Screw, machine (#6-32 x 0.62 in. length, FL82 flat-head)	2806073	8.2-43	11
		8.2-58	2
Screw, machine (#6-32 x 0.62 in. length, pan-head)	2806075	8.2-43	5
Screw, machine (#6-32 x 0.75 in. length, pan-head)	2806128	8.2-33	5
		8.2-43	8
Screw, machine (#6-32 x 0.75 in. long, FL82 flat-head)	2806084	8.2-12	8
Note: At the bottom of the display window, install the center screw in the display window before placing the display window on the panel overlay (PN 6855862). This screw must be hand tightened. Do not use a power driven screwdriver.			
Screw, machine (#6-32 x 1.00 in length, HSC head)	2806200	8.2-33	16
Screw, machine (#6-32 x 1.25, pan-head)	2806096	8.2-23	13
		8.2-39	5
Screw, machine (#6-32 x 2.00 in. length, FL82 flat-head)	2806148	8.2-24	9
Screw, machine (#6-32 x 2.00 in. length, pan-head)	2806159	8.2-24	8
Screw, machine (#6-40 x 1.125 in. length, hex-head)	2851982	8.2-23	5
Screw, machine (#8-32 x 0.25 in. length, UF82-head)	2808080	8.2-46	3
Screw, machine (#8-32 x 0.75 in. length, black FL82 flat-head)	2808099	8.2-3	4
Screw, machine (#6-32 x 0.38 in. length, pan-head)	2806017	8.2-5	1
Note: Apply one drop of adhesive sealant, PN 1601065, to screw threads before insertion.			

Table 8.1-14 Master Parts List - S (Continued)

Description	Part Number	Figure	Item
Screw, machine, knurled (#4-40 x 0.75 in. length, hex socket head)	2851975	8.2-8	12
		8.2-23	1
Screw, self-lock (#10-32 x 0.75 in. length, pan-head)	2839051	8.2-24	16
Screw, self-lock (#4-40 x 0.25 in. length, pan-head)	2839024	8.2-31	8
Screw, self-lock (#4-40 x 0.37 in. length, pan-head)	2839025	8.2-33	21
Screw, self-lock (#6-32 x 0.25 in. length, pan-head)	2839009	8.2-24	22
Screw, self-lock (#6-32 x 0.37 in. length, pan-head)	2839039	8.2-2	7
		8.2-4	7
		8.2-5	12
		8.2-12	2
		8.2-13	11
		8.2-19	3
		8.2-20	4
		8.2-23	16
		8.2-27	8
		8.2-31	3
		8.2-32	1
		8.2-37	8
		8.2-41	1
		8.2-42	3
Screw, self-lock (#6-32 x 0.38 in. length, hex-head), self-lock by nylon strip lock installed on the screw thread	2851989	8.2-8	10
Screw, self-lock (#6-32 x 0.62 in. length, pan-head)	2839043	8.2-21	4
Screw, self-lock (#6-32 x 1.12 in. length, pan-head)	2839074	8.2-39	4
Screw, self-lock (#8-32 x 0.37 in. length, pan-head)	2839057	8.2-8	17
Screw, setscrew (#4-40 x 0.125 in length, hex-head)	2807026	8.2-23	4
		8.2-27	1
Screw, setscrew (#4-40 x 0.156 in length, hex-head)	2807052	8.2-20	10
Screw, shoulder (#6-32 x 0.188 length, 0.500 long shoulder, hex-head)	2851978	8.2-9	11
Screw, shoulder (#6-32 x 0.30 in. length, 0.117 in. shoulder)	1017593	8.2-13	8
Screw, shoulder (#8-32 x 0.188 length, 0.750 long shoulder)	2851952	8.2-9	12
Screw, shoulder (#4-40 x 0.156 length, 0.560 long shoulder, hex socket head)	2852256	8.2-31	5
Note: MCL push-button, PN 6807075, must be properly positioned before inserting this shoulder screw.			
Screw, special laser mounting	1022396	8.2-24	3
Screw, stainless steel setscrew with locking element, (#6-32 x 0.25 in. length, half dog point, hex head), for MCL finger	2852321	8.2-8	18

Table 8.1-14 Master Parts List - S (Continued)

Description	Part Number	Figure	Item
Screw, thumb, knurled nickel-plated brass (6-32 x 0.375 in. length)	2815003	8.2-19	1
Screwlock, female assembly kit for attaching a D-type connector	2104261	8.2-42	8
Sensor assembly, waste level	6858159	8.2-56	2
Sensor flag, MCL guide cup	1021706	8.2-9	17
Sensor flag, MCL probe	1021708	8.2-9	3
Sensor, optical, reagent level	6028327		
Sensor, waste chamber, with undercut O-ring groove Note: Replace the original rubber gasket with O-ring seal, PN 2512031. Discard the original rubber gasket.	6028599	8.2-37	2
Setscrew, for rubber foot, PN 6858988	2810028		
Shaft, 0.375 square, for manual sample station	1020914	8.2-33	1
Shield, EMC, removable side	6858802	8.2-14	3
Shield, EMI/EMC, contact strip with adhesive mount, beryllium copper alloy, on Power Supply module front door	5704051	8.2-5	7
Shield, filter, for 3-color system	6859189		
Shield, filter, for 4-color system	6859190	8.2-20	5
Slide rail, deep channel (6.0 in.), lower pneumatics drawer	1405017		
Snout, pinhole	6858921	8.2-23	8
Socket joint, quick-disconnect with spring loaded sleeve, for 0.253-inch diameter ball stud, stainless steel	2523743	8.2-33 8.2-36	14 6
Socket joint, quick-disconnect with spring loaded sleeve, for 0.253-inch diameter ball stud, stainless steel	2523798	8.2-35	7
Software, COULTER EPICS XL/XL-MCL Prefinal, on 3.5 in. floppy diskette	7231244		
Software, COULTER EPICS XL/XL-MCL SYSTEM II, Version 3.0	6706441		
Software, EXPO32™ ADC Cytometer, on CD-ROM, also includes appropriate ROMLOCK connector (PN 2016892)	6418337		
Software, LANtastic network V8.0, 2 to 10 user license, on CD-ROM	6417325		
Software, LANtastic network V8.0, single-user license, on CD-ROM	6417324		
Software, Sybase® SQL Anywhere™ PC database server software, 4 user license, on CD-ROM	6417323		
Solenoid, 2-way, normally-open (N.O.)	6214067	8.2-44	8
Solenoids with manifold, MCL 4	6232582		
Spacer, cylinder, 0.500 i.d. x 0.562 o.d. x 0.062 thickness	6216012	8.2-15 8.2-17 8.2-38	6 7 6
Spacer, hole, #10 (0.194 i.d. x 0.250 o.d. x 0.360 in. long), aluminum	2851953	8.2-9	13
Spacer, hole, 0.140 i.d. x 0.250 o.d. x 0.250 in. length	2843032	8.2-50	4

Table 8.1-14 Master Parts List - S (Continued)

Description	Part Number	Figure	Item
Spacer, internally and externally threaded (#6-32 x 0.250 DP to #6-32 x 0.375, aluminum alloy)	2851866	8.2-24	19
Spacer, tapped, 6-32 x 1.625 in. length x 0.250 in. hex, aluminum	2851363	8.2-37	6
Spring, extension, 0.180 o.d. x 0.50 in. coiled length, 0.026 in. wire diameter, rated at 20.2 lbs/in. Note: Hook spring first to the spring holder, PN 1021765, and then to the post on the MCL push-button, PN 6807075. Make sure the push-button does not bind on the plastic.	2523733	8.2-31	7
Spring, extension, 0.250 o.d. x 1.38 in. coiled length, 0.026 in. wire diameter, rated at 1.42 lbs/in.	2515109	8.2-9	1
Stage, snout	6859217	8.2-23	6
Stage, snout support	1021703	8.2-23	2
Stud, ball (10-32 x 0.50 length) Note: Apply one drop of adhesive sealant, PN 1601065, to screw threads before insertion.	1022369	8.2-33	7
Switch bar, MCL	1021762		
Switch, hall effect, manual, station	5120177		
Switch, normally-open vacuum/pressure (single pole, double throw), used to monitor 2-inches Hg Note: Attach using two self-lock nuts (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009.	5120232	8.2-14	6
Switch, normally-open vacuum/pressure (single pole, single throw), used to monitor 3 psi Note: Attach using two self-lock nuts (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009.	5120221	8.2-14	7
Switch, straight lever	5111211		
Switch, vacuum/pressure (single pole, double throw), used to monitor 10-inches Hg Note: Attach to post using a self-lock nut (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009. Secure lower opening to the panel using a #4 flat washer (0.125 i.d. x 0.250 o.d. x 0.036 in. thickness), PN 2827146, and machine screw (#4-40 x 0.75 in. length, pan-head), PN 2804039.	5120224	8.2-14	8
Switch, vacuum/pressure (single pole, double throw), used to monitor 25 psi Note: Attach using two self-lock nuts (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009.	5120178	8.2-14	9
Switch, vacuum/pressure, 17 in.	5120222		
Switch, vacuum/pressure; waste pressure, normally open, single pole single throw, 3-in. water, located in the Power Supply module Note: Must be installed with contacts up so that wires can be connected as shown in Figure 8.2-45. The blue wire from E14 on the Power Module Control card is attached to SN13's left contact and the white wire (from E15) is attached to SN13's right contact.	5120230	8.2-45	5

Table 8.1-15 Master Parts List - T

Description	Part Number	Figure	Item
Tank, cleanse, without sensor (also referred to as cleanse bottle)	2523650	8.2-29	6
Tank, sheath without sensor (also referred to as sheath bottle)	2523649	8.2-28	6
Tank, waste, 1-gallon rectangular (also referred to as bottle)	2523697	8.2-56	1
Test tubes, 12 x 75 mm	2523749		
Tie wrap with flag marker, 4.4 in. long, 0.1 in. wide, marker size 0.31 in. x 0.75 in.	6011017	8.2-61	6
Tie wrap, nylon, 15 in. long, 0.19 in. wide, nylon	6011003	8.2-24	24
		8.2-61	8
		8.2-62	3
Tie wrap, nylon, 4 in. long, 0.1 in. wide, nylon	6011001	8.2-3	9
		8.2-61	5
Tie wrap, nylon, 6.7 in. long, 0.14 in. wide, nylon	6011002	8.2-61	7
Tie wrap, screw mount, #6 sizer, 7.4 in. long, 0.19 in wide	6011006	8.2-24	12
		8.2-43	6
		8.2-58	6
		8.2-61	4
Tool kit, Beckman Coulter service	5415102		
Tool, card extender	6705582		
Tool, circuit analyzer, 3-wire	2906883		
Tool, ESD kit, static-dissipative field kit	5415097		
Tool, Service Resource Kit CD-ROM	6417471		
Tool, trimmer pot adjustment	5402071		
Trap, vacuum	6232176		
Trap, vacuum, with miniature polycarbonate bowl	6232724	8.2-47	2
		8.2-48	2
Trap, water	6232177		
Tray, MCL drip	1021735	8.2-3	1
Tube, pickup	1020976	8.2-28	3
		8.2-29	3
Tubing, clear with black stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202203		
Tubing, clear with blue stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202209		
Tubing, clear with green stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202208		
Tubing, clear with grey stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202211		
Tubing, clear with orange stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202206		
Tubing, clear with red stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202205		
Tubing, clear with violet stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202210		
Tubing, clear with white stripe, polyurethane, 0.082 i.d. x 0.144 o.d.	3202212		

Table 8.1-15 Master Parts List - T (Continued)

Description	Part Number	Figure	Item
Tubing, clear, polyurethane, 0.076 i.d. x 0.144 o.d., referred to as sheath tubing	3213215		
Tubing, clear, polyurethane, 0.082 i.d. x 0.144 o.d.	3202036		
Tubing, PEEK, flow cell intro line, 3.75 in. 0.013 i.d. x 0.025 wall, tan	1022073	8.2-34	5
Tubing, PEEK, manual sample intro line, 14 in. 0.010 i.d. x 0.026 wall, blue	1021636	8.2-34	5
Tubing, PEEK, MCL sample intro line, 15 in. 0.010 i.d. x 0.026 wall, blue	1021654	8.2-34	5
Tubing, pull-apart I-beam with black stripe, silicone, 0.062 i.d.	3213136	8.2-27	12

Table 8.1-16 Master Parts List - V

Description	Part Number	Figure	Item
Valve, electro-pneumatic, solenoid and pilot actuator combination valve, 24 Vdc / 30 psi, 4.5 lbs. pinch force Note: In the lower pneumatics drawer, attach using two self-lock screws (#6-32 x 0.37 in. length, pan-head), PN 2839039.	6232492	8.2-15	4
		8.2-17	5
		8.2-37	1
		8.2-38	8
Valve, black-striped check, 0.125 i.d. to 0.125 i.d. tubing	6232080	8.2-59	3
Valve, check, 0.125 i.d. to 0.082 i.d. tubing	6232605	8.2-59	2
Valve, check, 0.125 i.d. to 0.125 i.d. tubing	6214107	8.2-59	3
Valve, check, 0.156 i.d. to 0.156 i.d. tubing Note: Designated as CV 1, 3, 6, 9, and 10 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886.	6214106	8.2-14	12
		8.2-37	4
		8.2-59	1
Valve, check, for 0.062 i.d. to 0.062 i.d. tubing Note: Designated as CV 2, 4, 5, 7, and 8 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886.	6214108	8.2-27	14
		8.2-44	10
		8.2-59	4
Valve, double solenoid, pilot-actuated latching two-position five-port spool valve, 24 Vdc, operating pressure 14 to 100 psi	6232393	8.2-39	2
Valve, dump, system pressure, for 100/120 Vac system	6232368	8.2-45	3
		8.2-46	2
Valve, dump, system pressure, for 220/240 Vac system	6232367	8.2-45	3
		8.2-46	2
Valve, pressure relief (with plugs), 30 psi	6208005	8.2-47	6
		8.2-52	4
Valve, pressure relief, 30 psi, solenoid valve and manifold assembly, used in the lower pneumatics drawer	6232587	8.2-39	

Table 8.1-16 Master Parts List - V (Continued)

Description	Part Number	Figure	Item
Valve, pull-apart pinch, double-action, white, standard	6855763	8.2-15	8
		8.2-17	9
		8.2-27	11
		8.2-37	5
		8.2-38	4
Valve, single solenoid, pilot-actuated two-position five-port spool valve, 24 Vdc, operating pressure 20 to 100 psi	6232376	8.2-39	6
Valve, vacuum relief	6214017		
Valve, water trap drain, 24 V (Cytometer)	6214067		

Table 8.1-17 Master Parts List - W

Description	Part Number	Figure	Item
Washer, E-tooth, #6, 0.140 i.d. x 0.312 o.d. x 0.022 thickness	2826012	8.2-25	6
Washer, flat, #10 (0.21 i.d. x 0.51 o.d. x 0.051 thickness)	2827021	8.2-24	18
Washer, flat, #2 (0.094 i.d. x 0.25 o.d. x 0.02 in. thickness)	2827095	8.2-30	4
		8.2-32	12
Washer, flat, #4 (0.125 i.d. x 0.250 o.d. x 0.036 thickness)	2827146	8.2-33	20
		8.2-42	12
Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)	2827147	8.2-2	8
		8.2-4	8
		8.2-5	10
		8.2-12	3
		8.2-13	10
		8.2-20	3
		8.2-21	3
		8.2-23	11
		8.2-24	5
		8.2-31	2
		8.2-32	2
		8.2-33	3
		8.2-37	9
		8.2-39	3
		8.2-42	2
		8.2-43	2
		8.2-50	2
Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)	2827159	8.2-3	6

Table 8.1-17 Master Parts List - W (Continued)

Description	Part Number	Figure	Item
Washer, flat, #6 (0.156 i.d. x 0.375 o.d. x 0.031 in. thickness)	2827056	8.2-3	25
Washer, flat, #6 (0.156 i.d. x 0.375 o.d. x 0.046 thickness)	2827134	8.2-19 8.2-24	4 21
Washer, flat, #8 (0.172 i.d. x 0.359 o.d. x 0.030 thickness)	2827081	8.2-12	4
Washer, I-tooth, #47, 0.47 i.d. x 0.60 o.d. x 0.020 thickness	2826030	8.2-15 8.2-17 8.2-27 8.2-38	5 6 4 7
Washer, split-lock, #10 (0.19 i.d. x 0.33 o.d. x 0.047 in. thickness)	2826045	8.2-24	17
Washer, split-lock, #2 (0.09 i.d. x 0.17 o.d. x 0.02 in. thickness)	2826001	8.2-30 8.2-32	3 11
Washer, split-lock, #4 (0.12 i.d. x 0.20 o.d. x 0.25 in. thickness)	2826002	8.2-33	25
Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.03 in. thickness)	2826035	8.2-23 8.2-24 8.2-33 8.2-43	12 7 4 7
Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.031 in. thickness)	2826059	8.2-3	7
Waste tank holder	6859001		

8.2 ILLUSTRATED PARTS

ATTENTION: Part numbers issued by the Oracle system are six-digit numbers.

Overview

To expedite finding a part number, the illustrations in this section are organized in functional groups. [Figure 8.2-1](#) is the anchor illustration from which you can quickly access a specific illustration. Illustrations that cannot be accessed from [Figure 8.2-1](#) are listed in [Table 8.2-1](#).

[Figure 8.2-1](#) is referred to as the anchor illustration because it serves as the reference point for accessing other illustrations. There are no part numbers associated with this illustration, only referrals to other more specific illustrations. Each referral either accesses a specific illustration or an anchor illustration for the selected area.

Illustrations in this section use an arabic numeral and alphabetic letter configuration.

- An arabic numeral is used to identify a part listed in the associated table.
- A capital letter indicates a component or assembly that has additional detailed illustrations available.

Locating a Part Number

1. To quickly locate a part number, always begin at the anchor illustration, [Figure 8.2-1](#).
 - a. Locate the problem area on the anchor illustration and note the associated letter.
 - b. Locate the associated letter in the **Figure Reference** column and note the figure number that best fits the configuration of the instrument being repaired.
 - c. Go to the referenced figure number.

Note: In the electronic version, each figure reference is in hypertext so that when you select the reference, the illustration quickly appears. A single selection may provide the needed illustration; however, it can require up to three selections to see an exploded view of an assembly.

Using the hypertext links is the fastest way to access an illustration. If you choose to scroll through the IPL, you will encounter stop points. Because illustrations require a large amount of memory, an IPL file must be split into smaller files to enhance its loading and accessibility features. Unless you are scrolling, these divisions are invisible. When you scroll to the end of a section and encounter a stop point, use the navigation bar. Select the left pointer to jump back to the previous section or select the right pointer to continue to the next section.

2. If the needed part is not illustrated, review the **Figure Reference** column to determine if another illustration is available.
 - a. If another illustration is available, go to the referenced figure number.
 - b. If no additional illustrations are available, see the master parts list. Some parts are not illustrated.

Figure 8.2-1 XL Cytometer with MCL Option, Illustrated Components

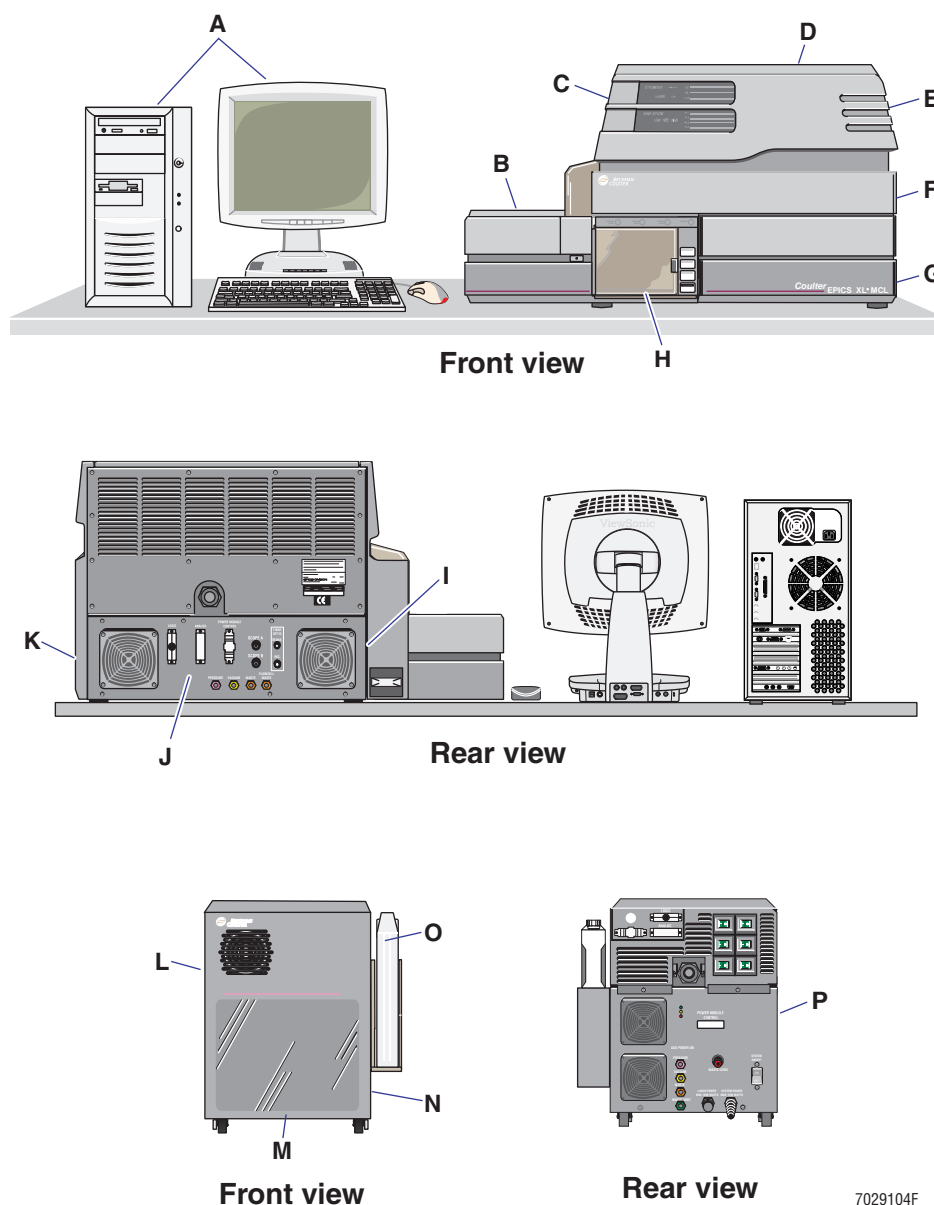


Figure Reference

- A** Workstation
- FlowCentre II, [Figure 8.2-6](#)
 - FlowCentre, [Figure 8.2-7](#)

At the Cytometer . . .

- B** MCL option, [Figure 8.2-8](#)
Vertical plate components, [Figure 8.2-9](#)
- C** Front display panel, [Figure 8.2-12](#)
- D** Data Acquisition card cage, [Figure 8.2-13](#)
- E** Upper pneumatics drawer, [Figure 8.2-14](#)
- F** Optical collection area (includes laser, optics, filters, and PMTs), [Figure 8.2-19](#)
- G** Reagent drawer, [Figure 8.2-25](#)
- H** Manual sample station
- Unit **with** MCL option, [Figure 8.2-30](#)
 - Unit **without** MCL option, [Figure 8.2-32](#)
 - Mechanical assembly, [Figure 8.2-33](#)

Segmenting valve, [Figure 8.2-34](#)

- I** Lower pneumatics drawer, [Figure 8.2-37](#)
- J** Rear panel components, [Figure 8.2-42](#)
- K** Right side compartment, [Figure 8.2-44](#)

At the Power Supply . . .

- L** Left side compartment, [Figure 8.2-45](#)
- M** Front panel components, [Figure 8.2-47](#)
Front door and related hardware, [Figure 8.2-5](#)
- N** Right side compartment, [Figure 8.2-55](#)
- O** Waste container, [Figure 8.2-56](#)
- P** Rear panel components, [Figure 8.2-57](#)

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Table 8.2-1 Illustrations Not Referenced from [Figure 8.2-1](#)

Title	Figure Number
XL-MCL Cytometer Covers, Doors, and Latches	Figure 8.2-2
MCL Covers and Associated Hardware	Figure 8.2-3
XL Cytometer Covers, Doors, and Latches	Figure 8.2-4
Power Supply Cover, Door, Latches, and Casters	Figure 8.2-5
Check Valves and Chokes with Related Components	Figure 8.2-59
Fittings	Figure 8.2-60
Tie Wraps and Mounting Hardware	Figure 8.2-61

Figure 8.2-2 XL-MCL Cytometer Covers, Doors, and Latches (See [Table 8.2-2](#))

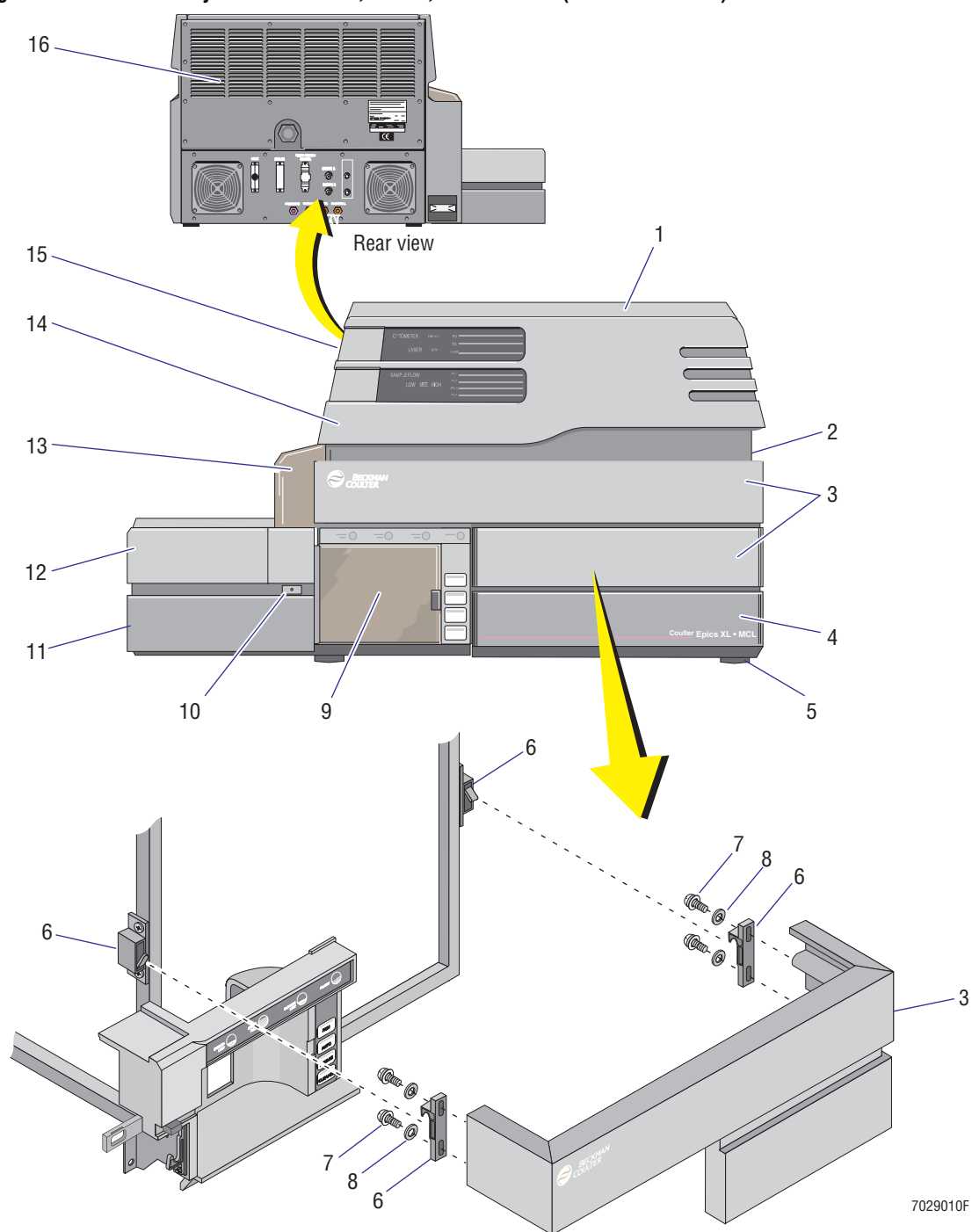
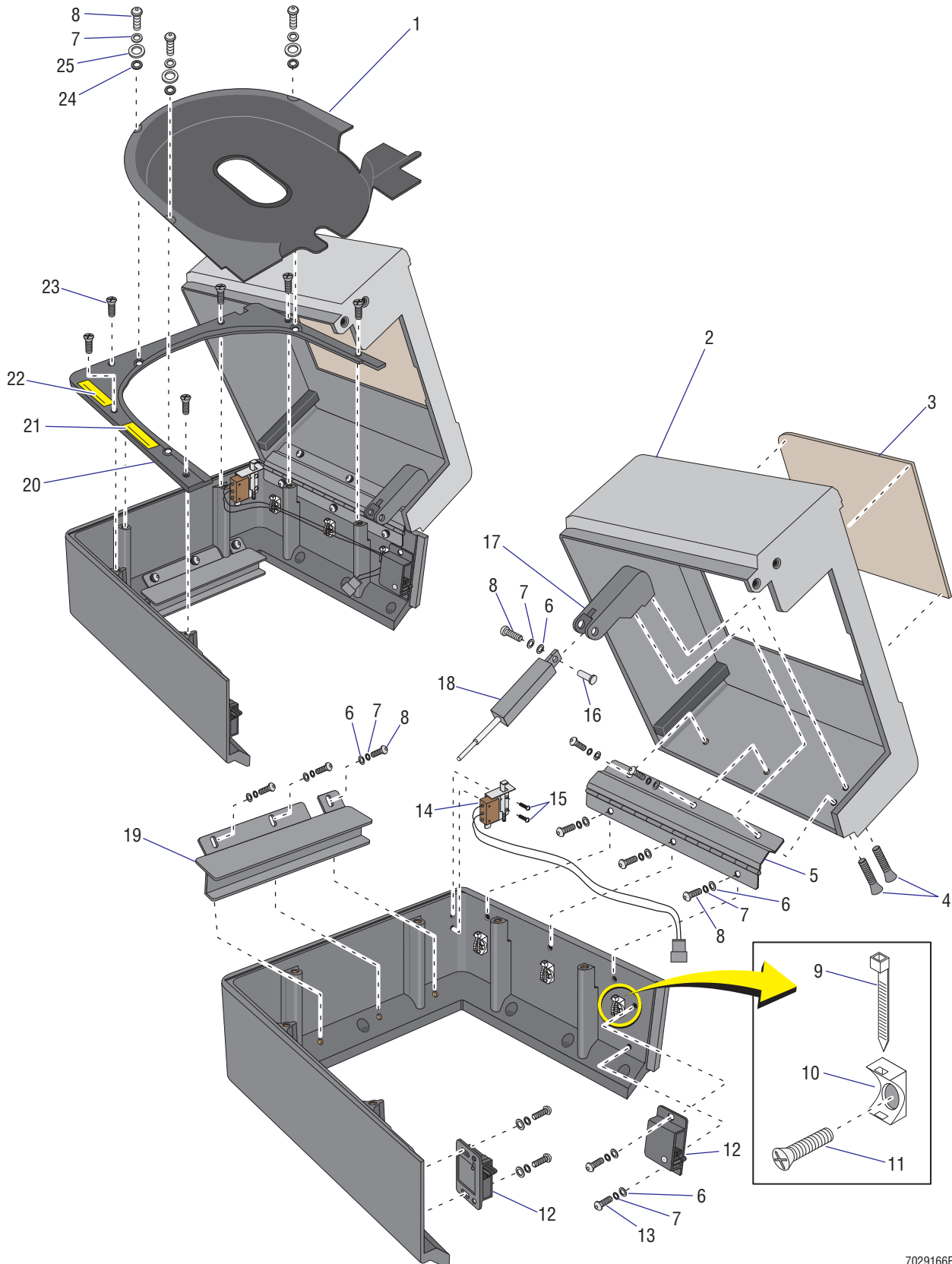


Table 8.2-2 XL-MCL Cytometer Covers, Doors, and Latches (See [Figure 8.2-2](#))

Item	Part Number	Description
1	6807080	Cover, top, grey
	6858129	Cover, top, black Note: Attach using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.
2	6807079	Cover, right-side, grey
	6856494	Cover, right-side, black
3	6807084	Cover, filter, grey
	6856735	Cover, filter, black
4	7000677	FRU, reagent drawer with slides assembly Note: Order front panel separately - for grey flow cytometer order PN 6807088; for black flow cytometer order PN 6855934.
5	6858988	Foot, rubber Note: Use setscrew, PN 2810028, to attach foot to the Cytometer frame.
6	2851859	Latch, concealed pull-up catch and keeper, 1.9 x 1.1 x 0.3 in., black nylon Note: The latch catches are attached to the Cytometer frame and latch keepers, to the center front cover (filter cover). Use Figure 8.2-2 to verify proper orientation of each latch catch and keeper.
7	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
8	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
9	7000678	FRU, sample station, manual, for XL-MCL Cytometer with grey covers
	7000354	FRU, sample station, manual, for XL-MCL Cytometer with black covers Note: See Figure 8.2-30 for an exploded view of components.
10	6807075	Push-button, for opening MCL upper base door, grey
	6858700	Push-button, for opening MCL upper base door, black
11	7000676	FRU, MCL lower base cover, grey
	7000199	FRU, MCL lower base cover, black
12	7000675	FRU, MCL door (upper cover), grey
	7000376	FRU, MCL door (upper cover), black
13	6858616	Housing, MCL probe
14	6807085	Door, front panel display, grey
	6856490	Door, front panel display, black Note: Attach door using two 3-in. #5 swag hinges, PN 1021176. Attach each hinge using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.
15	6807076	Cover, left-side, for XL-MCL Cytometer, grey
	6858522	Cover, left-side, for XL-MCL Cytometer, black
16	1025310	Cover, upper rear, grey
	1018854	Cover, upper rear, black

Figure 8.2-3 MCL Covers and Associated Hardware (See [Table 8.2-3](#))

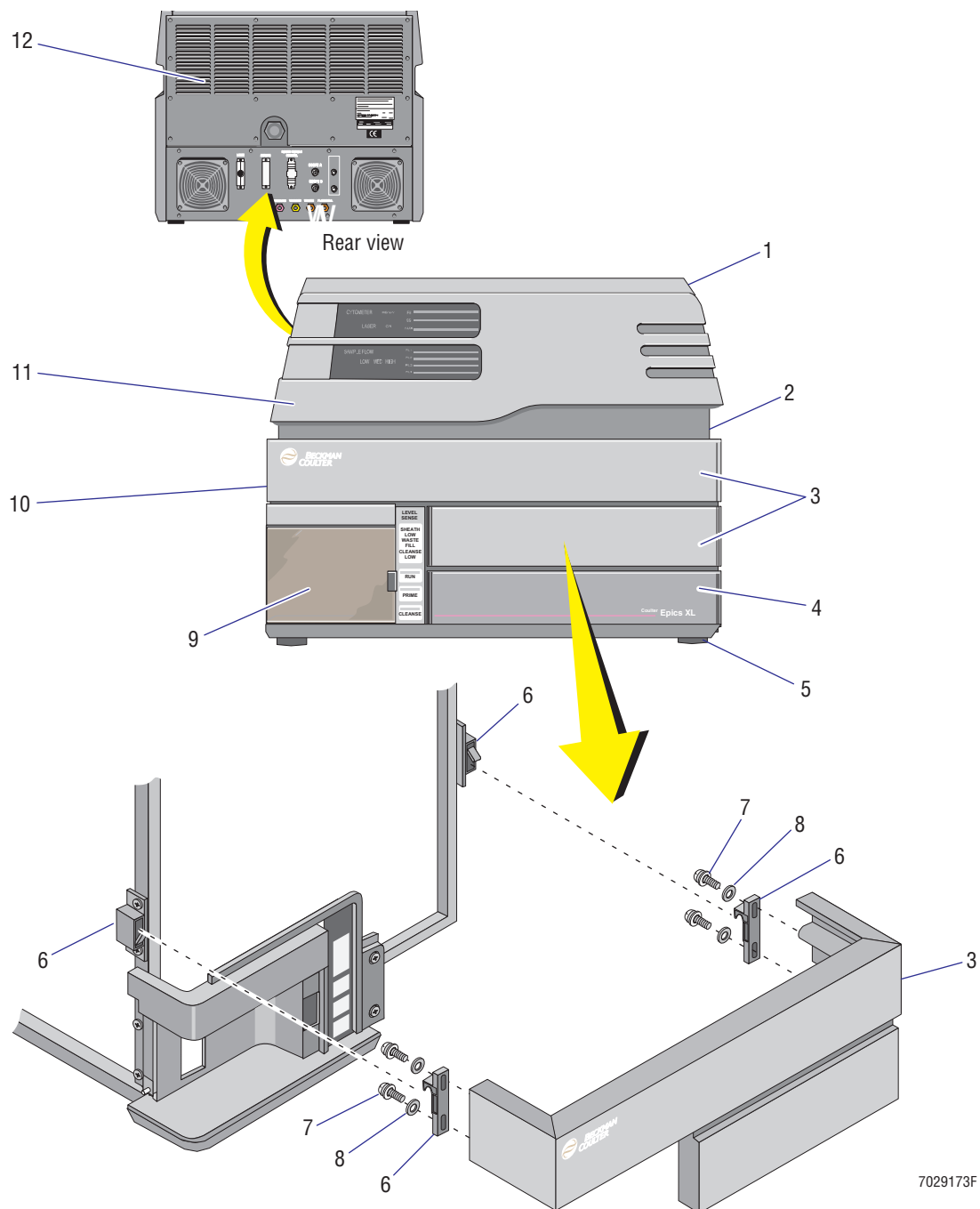


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Table 8.2-3 MCL Covers and Associated Hardware (See Figure 8.2-3)

Item	Part Number	Description
1	1021735	Tray, MCL drip
2	6807078	MCL upper base, grey
	6858519	MCL upper base, black
3	1021737	MCL upper window Note: Before installing the window in the upper cover, remove the paper covering from the bottom side only (leave the paper on the top side), apply a thin line of epoxy, PN 1615132, to the rim of the upper cover, install the window, allow the epoxy to set, then remove the paper covering from the top of the window.
4	2808099	Screw, machine (#8-32 x 0.75 in. length, black FL82 flat-head)
5	6858657	Bracket, hinged machine, attaches MCL upper and lower bases
6	2827159	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
7	2826059	Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.031 in. thickness)
8	2806201	Screw, machine (#6-32 x 0.38 in. length, HSC button-head)
9	6011001	Tie wrap, nylon, 4 in. long, 0.1 in. wide, nylon
10	6011019	Mount, wire tie, 0.51 in. length x 0.33 in. width, for use with #6 screw
11	2806104	Screw, machine (#6-32 x 0.25 in. length, UF82 flat-head)
12	2851859	Latch, concealed pull-up catch and keeper, 1.9 x 1.1 x 0.3 in., black nylon Note: Only latch catches are shown in Figure 8.2-3. Use Figure 8.2-3 to verify proper orientation of each latch catch. The latch keeper that connects with the front latch catch is located on the left side of the manual sample station. The latch keeper that connects to the back latch catch is located on the MCL frame.
13	2806182	Screw, machine (#6-32 x 0.31 in. length, pan-head)
14	6028424	Cable assembly, MCL door open detector
15	2802006	Screw, machine (#2-56 x 0.19 in. length, pan-head)
16	2851998	Nut, thumb, diamond knurl (#6-32 UNC x 0.500 o.d. x 0.625 in. length), black dichromate
17	1021764	Bracket, gas cylinder upper
18	6858666	Cylinder, MCL gas (may also be referred to as MCL bay cylinder)
19	6858635	Bracket, MCL lower base
20	6858636	MCL drip pan flange
21	2430416	Label, caution, interlock defeat
22	2430417	Label, caution, laser radiation
23	2806137	Screw, machine (#6-32 x 0.38 in. length, FL82 flat-head)
24	6216345	Gasket, #10 black, ethylene propylene
25	2827056	Washer, flat, #6 (0.156 i.d. x 0.375 o.d. x 0.031 in. thickness)

Figure 8.2-4 XL Cytometer Covers, Doors, and Latches (See [Table 8.2-4](#))

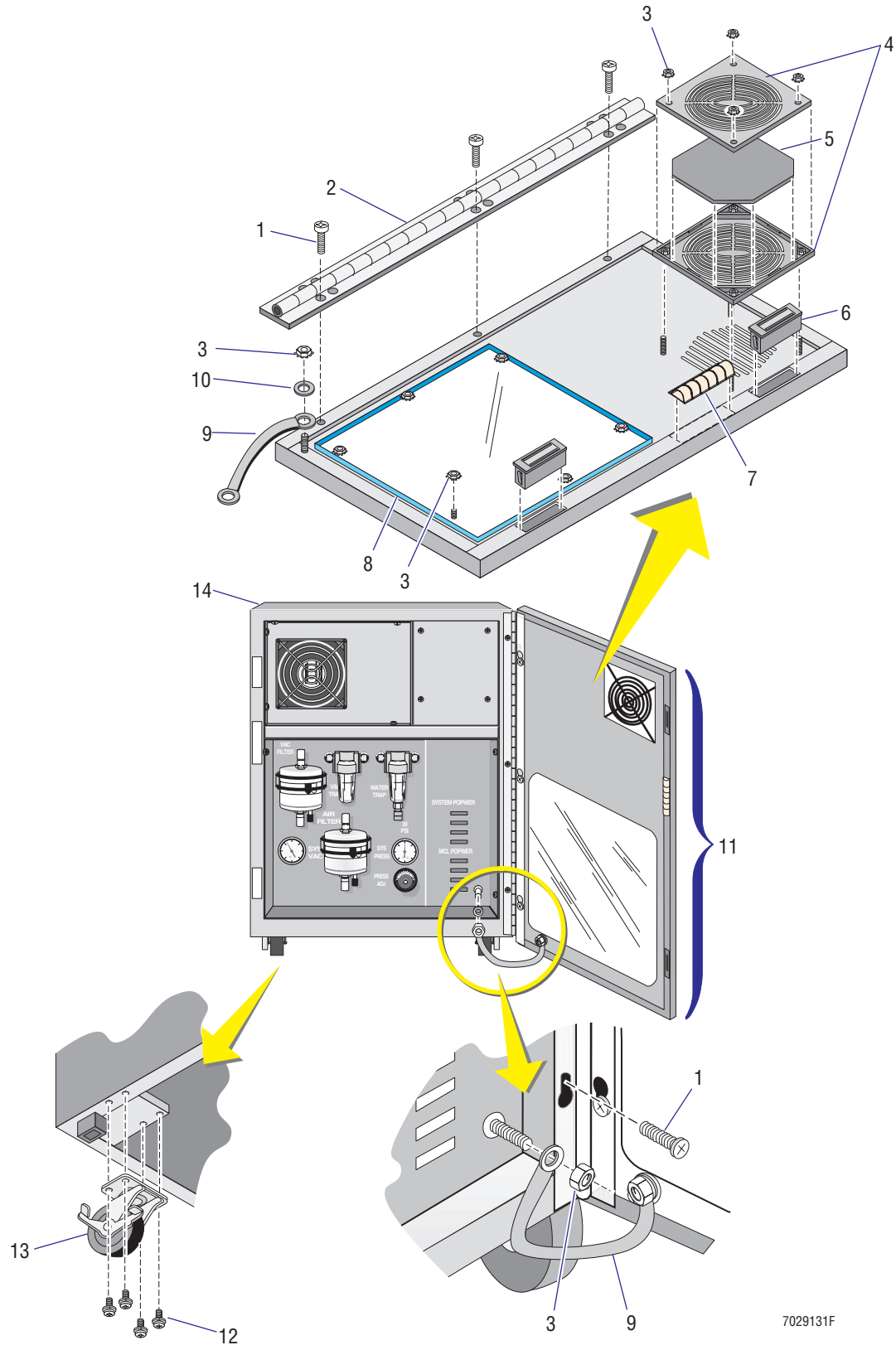


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Table 8.2-4 XL Cytometer Covers, Doors, and Latches (See [Figure 8.2-4](#))

Item	Part Number	Description
1	6807080	Cover, top, grey
	6858129	Cover, top, black Note: Attach using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.
2	6807079	Cover, right-side, grey
	6856494	Cover, right-side, black
3	6807084	Cover, filter, grey
	6856735	Cover, filter, black
4	7000677	FRU, reagent drawer with slides assembly Note: Order front panel separately - for grey flow cytometer order PN 6807089; for black flow cytometer order PN 6855934.
5	6858988	Foot, rubber Note: Use setscrew, PN 2810028, to attach foot to the Cytometer frame.
6	2851859	Latch, concealed pull-up catch and keeper, 1.9 x 1.1 x 0.3 in., black nylon Note: The latch catches are attached to the Cytometer frame and latch keepers, to the center front cover (filter cover). Use Figure 8.2-4 to verify proper orientation of each latch catch and keeper.
7	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
8	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
9	7000679	FRU, sample station, for XL Cytometer, grey
	7000360	FRU, sample station, for XL Cytometer, black Note: See Figure 8.2-32 for an exploded view of components.
10	6807074	Cover, left-side, for XL Cytometer, grey
	6856727	Cover, left-side, for XL Cytometer, black
11	6807085	Door, front panel display, grey
	6856490	Door, front panel display, black Note: Attach door using two 3-in. #5 swag hinges, PN 1021176. Attach each hinge using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head), PN 2839039, and #6 flat washers, PN 2827147.
12	1025310	Cover, upper rear, grey
	1018854	Cover, upper rear, black

Figure 8.2-5 Power Supply Cover, Door, Latches, and Casters (See [Table 8.2-5](#))

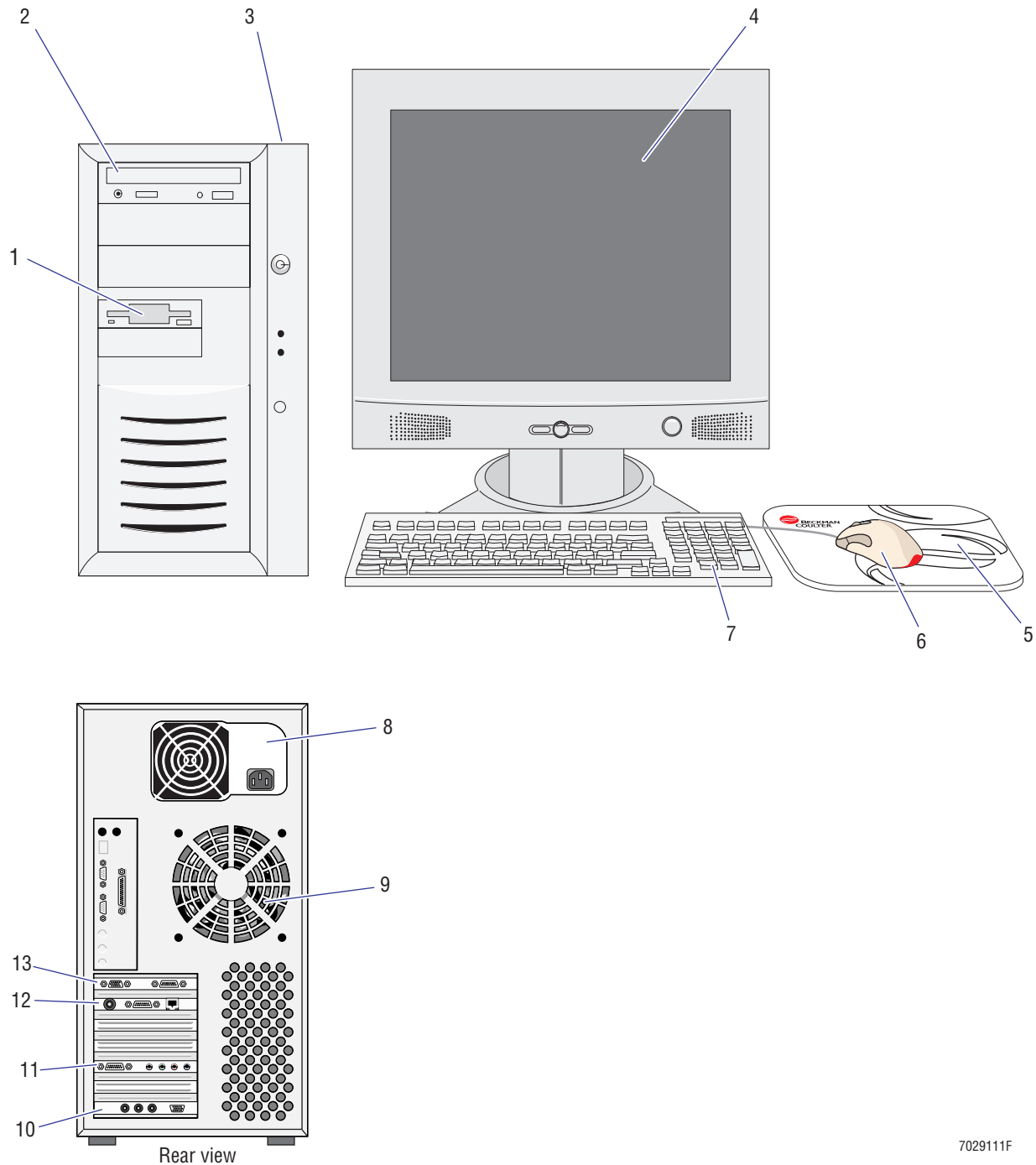


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Table 8.2-5 Power Supply Cover, Door, Latches, and Casters (See Figure 8.2-5)

Item	Part Number	Description
1	2806017	Screw, machine (#6-32 x 0.38 in. length, pan-head) Note: Apply one drop of adhesive sealant, PN 1601065, to screw threads before insertion.
2	1020939	Hinge, door
3	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
4	2603009	Finger guard, grille for fan air filter on 4-inch box fan Note: Raised ribs should face out.
5	2603010	Filter, air, 4-inch pad, 45 PPI
6	2840053	Latch, magnetic, 0.24 width x 0.82 length x 0.52 thickness
7	5704051	Shield, EMI/EMC, contact strip with adhesive mount, beryllium copper alloy
8	1025141	Panel, front window, smoked dark Lexan
9	6027875	Cable, ground strap
10	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
11	6807047 6856160	Assembly, front door, grey Assembly, front door, black
12	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
13	2523658	Caster, swivel with brake, 2 in. diameter wheel
14	6807082 6856369	Cover, three-surface (left-side, top, right-side), grey Cover, three-surface (left-side, top, right-side), black

Figure 8.2-6 FlowCentre II Workstation (See [Table 8.2-6](#))

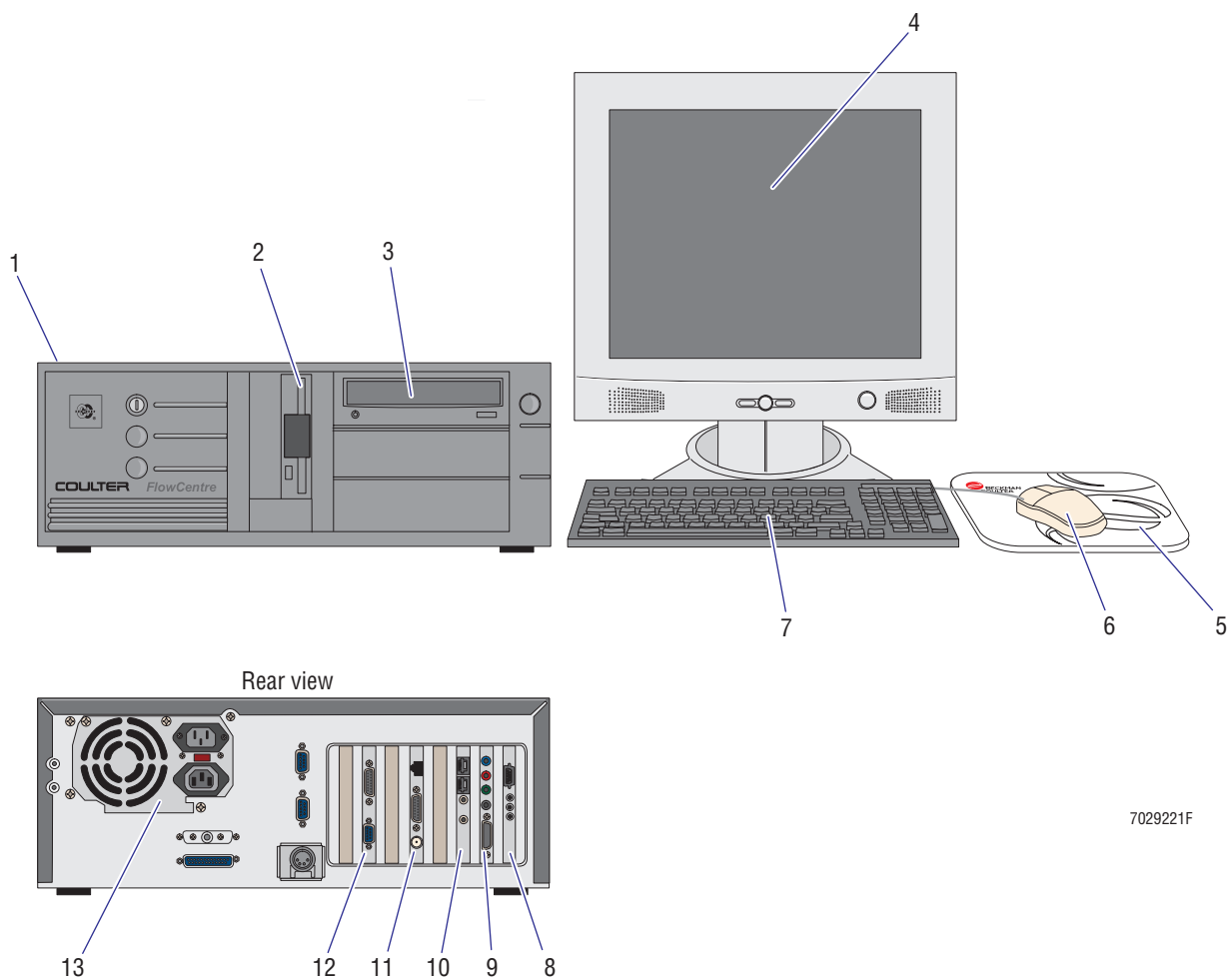


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Table 8.2-6 FlowCentre II Workstation (See Figure 8.2-6)

Item	Part Number	Description
1	2016972	Drive, diskette, 3.5 in., 1.44 MB, white
2	175742	Drive, CD-ROM, 8X minimum, internal IDE
3	2016874	Computer, Pentium III processor, 550 MHz minimum, referred to as FlowCentre II Tower Computer, also includes PN 2016876 (mouse) and PN 2016881 (keyboard)
4	2016938	Monitor, 17-inch display, flat screen
	2016951	Monitor, 22-inch CRT display (not shown)
5	2016725	Mouse pad
6	2016876	Mouse pointing device, PS/2 scroll point
7	2016881	Keyboard, 104-key minimum, AT®/PS Windows 95/98
8	2016919	Power Supply, ATX power supply with PFC (power factor correction) for self adjustment and regulation, voltage range 90 to 264 Vac, manufactured by 3Y Power Technology Model YM-6042A
9	175741	Fan, chassis
10	6706394	Card, Opto Transprocessor EXMEM II, EMC, 3 fiber connectors
	6705355	Card, Opto Transprocessor EXMEM, non-EMC, 2 fiber connectors (not shown)
		Note: Cards may be used in the FlowCentre II tower computer, PN 2016874, or FlowCentre desktop computer, PN 2016753.
11	2016971	Card, PCI Sound
12	N/A	Card, 3 Com Ethernet, replacement card not available
13	2016970	Card, PCI Video
Not shown	2016963	Drive, hard, 20 GB minimum, 7200 RPM IDE HDD
		Note: Drive may be used in the FlowCentre II tower computer, PN 2016874, or FlowCentre desktop computer, PN 2016753.
Not shown	2016969	Memory, 128 MB, PC 100 SDRAM, ECC correctable, DIMM module
Not shown	2016892	ROMLOCK, special connector for use with EXP032 Cytometer Acquisition software

Figure 8.2-7 FlowCentre Workstation (See [Table 8.2-7](#))



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Table 8.2-7 FlowCentre Workstation (See Figure 8.2-7)

Item	Part Number	Description
1	2016753	Computer, Atlas PCI III Pentium 200 processor, referred to as FlowCentre Computer, also includes PN 2016665 (mouse) and PN 2016758 (keyboard)
2	2016962	Drive, diskette, 3.5 in., 1.44 MB, black
3	2016959	Drive, CD-ROM, 8X minimum, internal IDE
4	2016938	Monitor, 17-inch display, flat screen
	2016951	Monitor, 22-inch CRT display (not shown)
5	2016725	Mouse pad
6	2016665	Mouse pointing device, PS/2 compatible
7	2016758	Keyboard, 104-key minimum, AT®/PS Windows 95, black
8	6706394	Card, Opto Transprocessor EXMEM II, EMC, 3 fiber connectors
	6705355	Card, Opto Transprocessor EXMEM, non-EMC, 2 fiber connectors (not shown)
		Note: Cards may be used in the FlowCentre II tower computer, PN 2016874, or FlowCentre desktop computer, PN 2016753.
9	N/A	Card, PCI Sound, replacement card not available
10	N/A	Card, Modem (may not be found in all FlowCentre computers)
11	N/A	Card, 3 Com Ethernet, replacement card not available
12	2016974	Card, PCI Video
13	2016977	Power Supply, with EMI shielding assembly
Not shown	2016963	Drive, hard, 20 GB minimum, 7200 RPM IDE HDD
		Note: Drive may be used in the FlowCentre II tower computer, PN 2016874, or FlowCentre desktop computer, PN 2016753.
Not shown	2016973	Memory, 16 MB, 70 NS tin-plated SIMM
Not shown	2016960	Promise, Ultra 66 IDE PCI Controller with cable
Not shown	2016892	ROMLOCK, special connector for use with EXPO32 Cytometer Acquisition software

Figure 8.2-8 MCL Option Assembly (See Table 8.2-8)

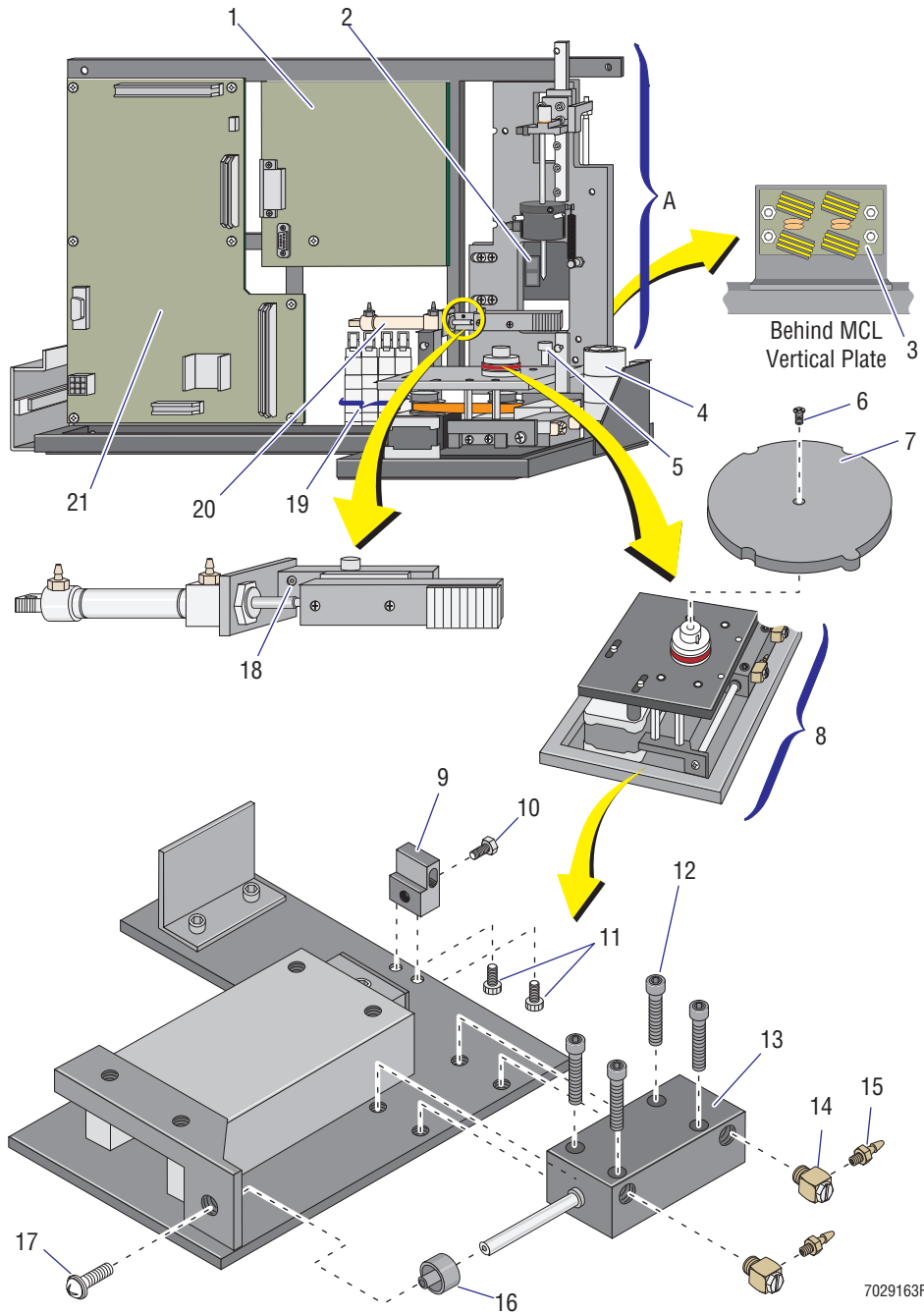


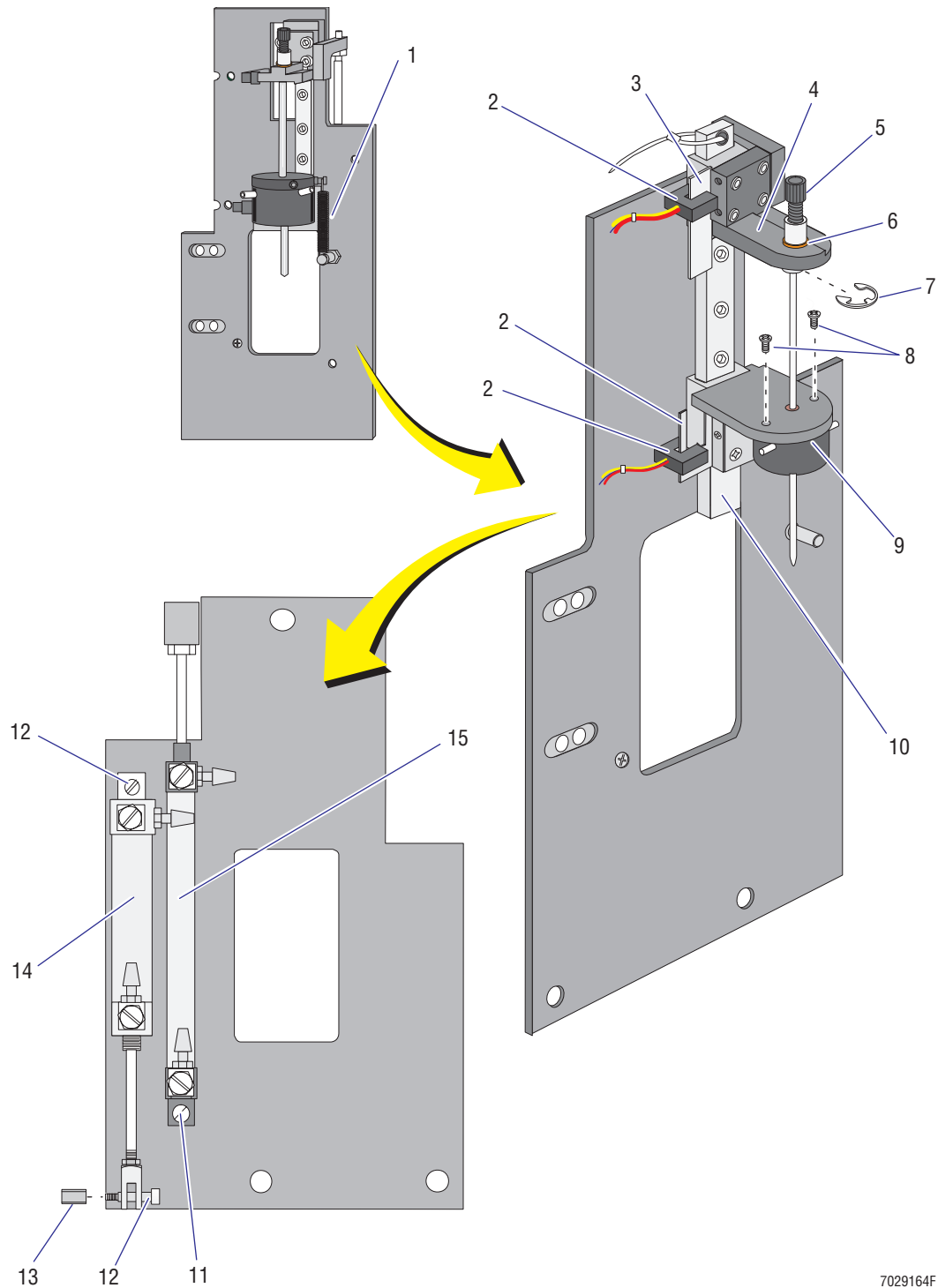
Figure Reference

A Vertical plate components,
Figure 8.2-9

Table 8.2-8 MCL Option Assembly (See Figure 8.2-8)

Item	Part Number	Description
	7000433	FRU, MCL option assembly
1	2016561	Card, Bar-Code Decoder
2	7000042	FRU, visible laser diode scanner (bar-code reader) Note: Attach the scanner head to the MCL vertical plate using four machine screws (#6-32 x 0.25 in. length, pan-head), PN 2806009.
3	6706409	Card, Motor Filter, EMC
4	7000443	FRU, MCL lifter assembly
5	7000579	FRU, MCL vortexer foot assembly
6	2806137	Screw, machine (#6-32 x 0.38 in. length, FL82 flat-head)
7	7701140	Hub, carousel (also referred to as indexing hub)
8	7000189	FRU, MCL carousel base assembly
9	1022128	Block, stop
10	2851989	Screw, self-lock (#6-32 x 0.38 in. length, hex-head), self-lock by nylon strip lock installed on the screw thread
11	2804083	Screw, machine (#4-40 x 0.25 in. length, HSC-head)
12	2851975	Screw, machine, knurled (#4-40 x 0.75 in. length, hex socket head)
13	6232570	Cylinder, air, in/out
14	6232360	Fitting, elbow, adjustable, 10-32 ports, O-ring sealed brass miniature, for bulkhead mounting
15	6232637	Choke, pneumatic, 0.0102 diameter, 0.062 barb and 10-32 threaded connections, brass Note: Choke must be oriented as shown when installation is complete.
16	2523700	Coupling joint, cylinder rod end, 8-32 fastening, black oxide Note: Coupling has an internal hex for tightening.
17	2839057	Screw, self-lock (#8-32 x 0.37 in. length, pan-head)
18	2852321	Screw, stainless steel setscrew with locking element, (#6-32 x 0.25 in. length, half dog point, hex head)
19	7000555	FRU, MCL solenoids
20	7000430	FRU, MCL tube rotator assembly Note: Attach the tube rotator assembly to the MCL vertical plate using two hex screws (#6-32 x 0.25 in. length, HSC-head), PN 2851395.
21	6705712	Card, MCL CPU

Figure 8.2-9 MCL Vertical Plate Components (See [Table 8.2-9](#))



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Table 8.2-9 MCL Vertical Plate Components (See [Figure 8.2-9](#))

Item	Part Number	Description
1	2515109	Spring, extension, 0.250 o.d. x 1.38 in. coiled length, 0.026 in. wire diameter, rated at 1.42 lbs/in.
2	7000439	FRU, probe sensor cable assembly
3	1021708	Sensor flag, MCL probe
4	1021652	Holder, intro rod Note: Attach the intro rod holder to the probe actuator bracket using two machine screws (pan-head, #6-32 x 0.25 in. length), PN 2806009.
5	6858663	Probe, MCL sample
6	1021797	Gasket, ferrule
7	2837022	Clip, MCL sample probe retainer
8	2804044	Screw, machine (#4-40 x 0.38 in. length, FL82 flat-head)
9	7000456	FRU, MCL sample head
10	7000446	FRU, MCL probe slide assembly (low friction precision ball slide assembly with two carriages)
11	2851978	Screw, shoulder (#6-32 x 0.188 length, 0.500 long shoulder, hex-head)
12	2851952	Screw, shoulder (#8-32 x 0.188 length, 0.750 long shoulder)
13	2851953	Spacer, hole, #10 (0.194 i.d. x 0.250 o.d. x 0.360 in. long), aluminum
14	6232591	Cylinder, lifter air, see Figure 8.2-10 for an exploded view that includes attachments
15	6232595	Cylinder, probe up/down air, see Figure 8.2-11 for an exploded view that includes attachments
16	7000438	FRU, head sensor cable assembly
17	1021706	Sensor flag, MCL guide cup

Figure 8.2-10 Lifter Air Cylinder and Attachments (See Table 8.2-10)

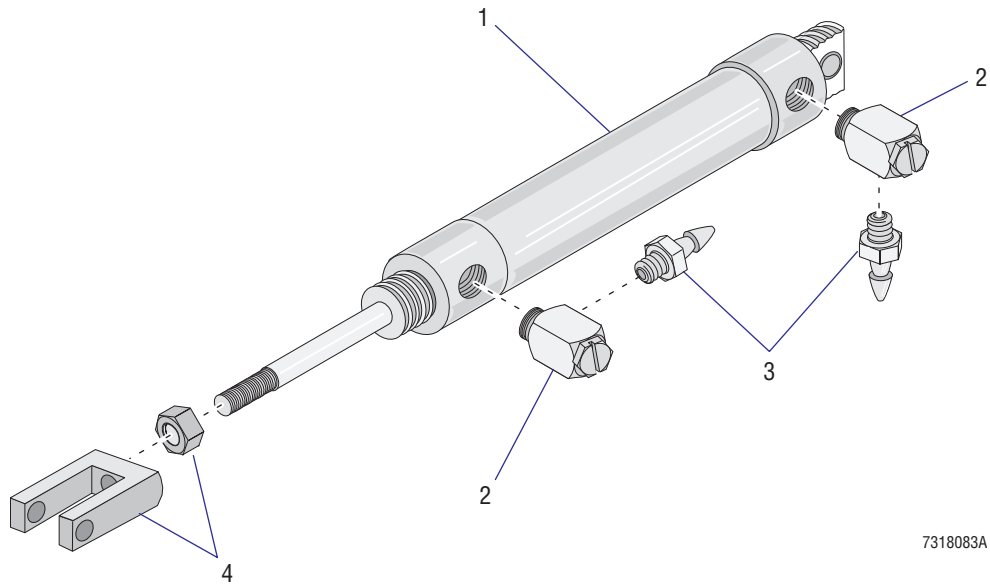


Table 8.2-10 Lifter Air Cylinder and Attachments (See Figure 8.2-10)

Item	Part Number	Description
1	6232591	Cylinder, lifter air, double acting, 250 psi, 0.56 bore, stud mount each end Note: If present, remove and discard the large nut on each end before installing.
2	6216002	Fitting, miniature, 10-32 threaded, 10-32 tap, adjustable, brass
3	6232637	Choke, pneumatic, 0.0102 diameter, 0.062 barb and 10-32 threaded connections, brass Note: Choke must be oriented as shown when installation is complete.
4	6232590	Cylinder, piston rod clevis for 0.56 bore, 250 psi cylinder, 10-32 threaded with hex nut for mounting

Figure 8.2-11 Probe Up/Down Air Cylinder and Attachments (See Table 8.2-11)

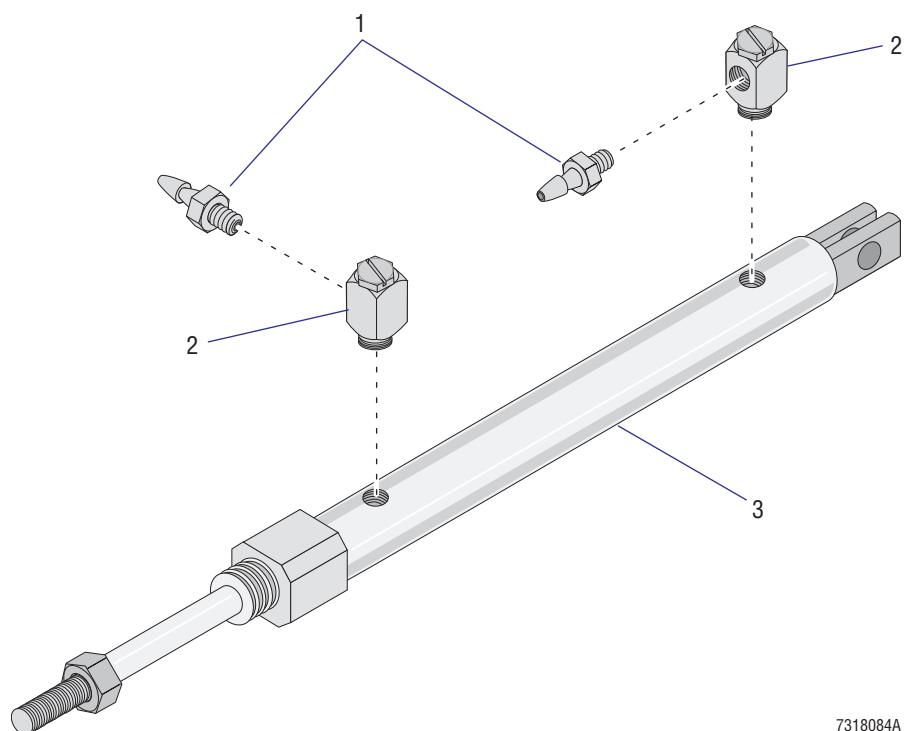
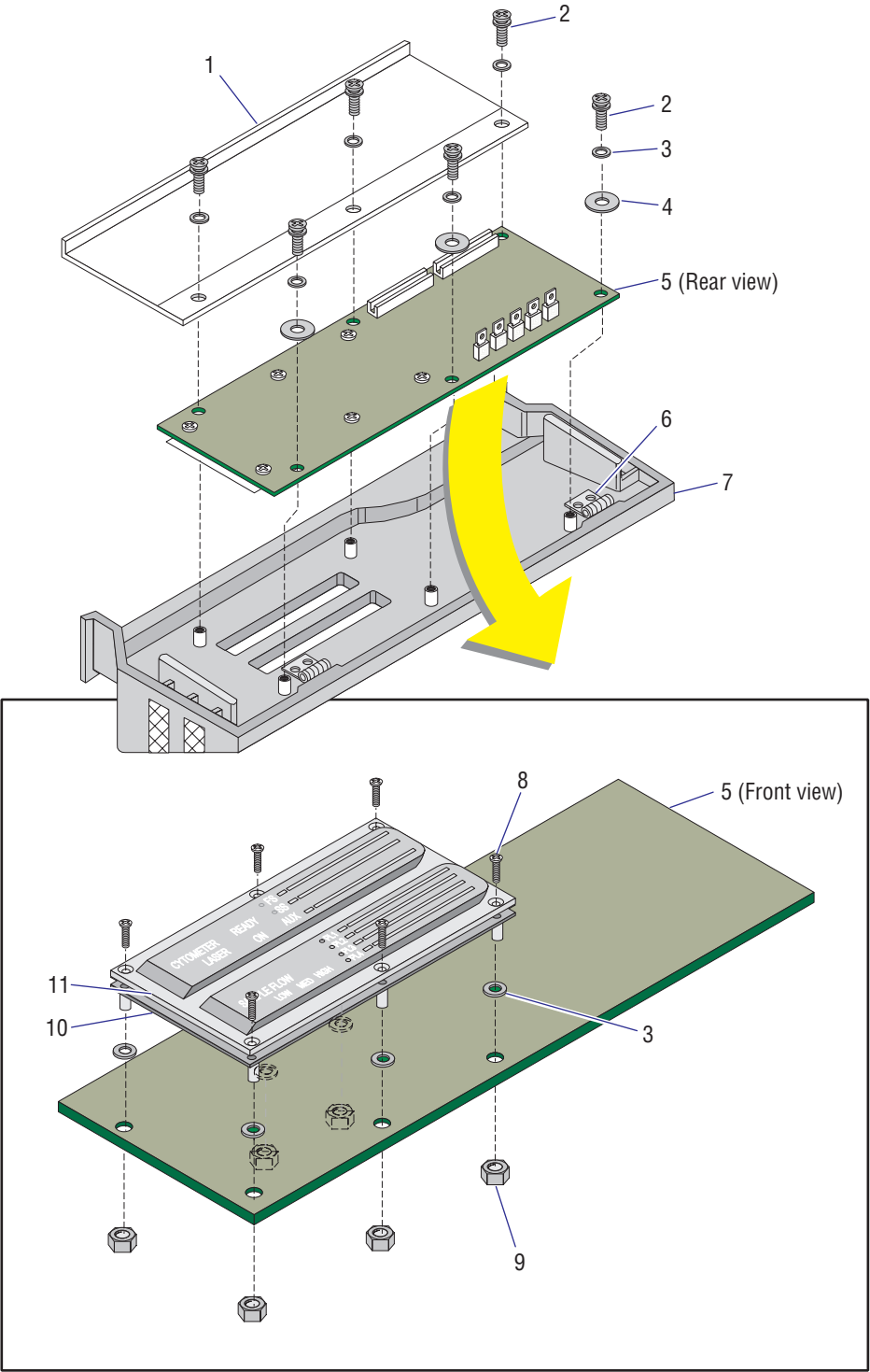


Table 8.2-11 Probe Up/Down Air Cylinder and Attachments (See Figure 8.2-11)

Item	Part Number	Description
1	6232637	Choke, pneumatic, 0.0102 diameter, 0.062 barb and 10-32 threaded connections, brass Note: Choke must be oriented as shown when installation is complete.
2	6216002	Fitting, miniature, 10-32 threaded, 10-32 tap, adjustable, brass
3	6232595	Cylinder, air, probe up/down, double acting, 150 psi, 0.375 bore, front stud and rear clevis mount Note: Remove the large nut from the cylinder. Make sure you replace the small cylinder rod nut before installing.

Figure 8.2-12 Front Display Panel (See [Table 8.2-12](#))

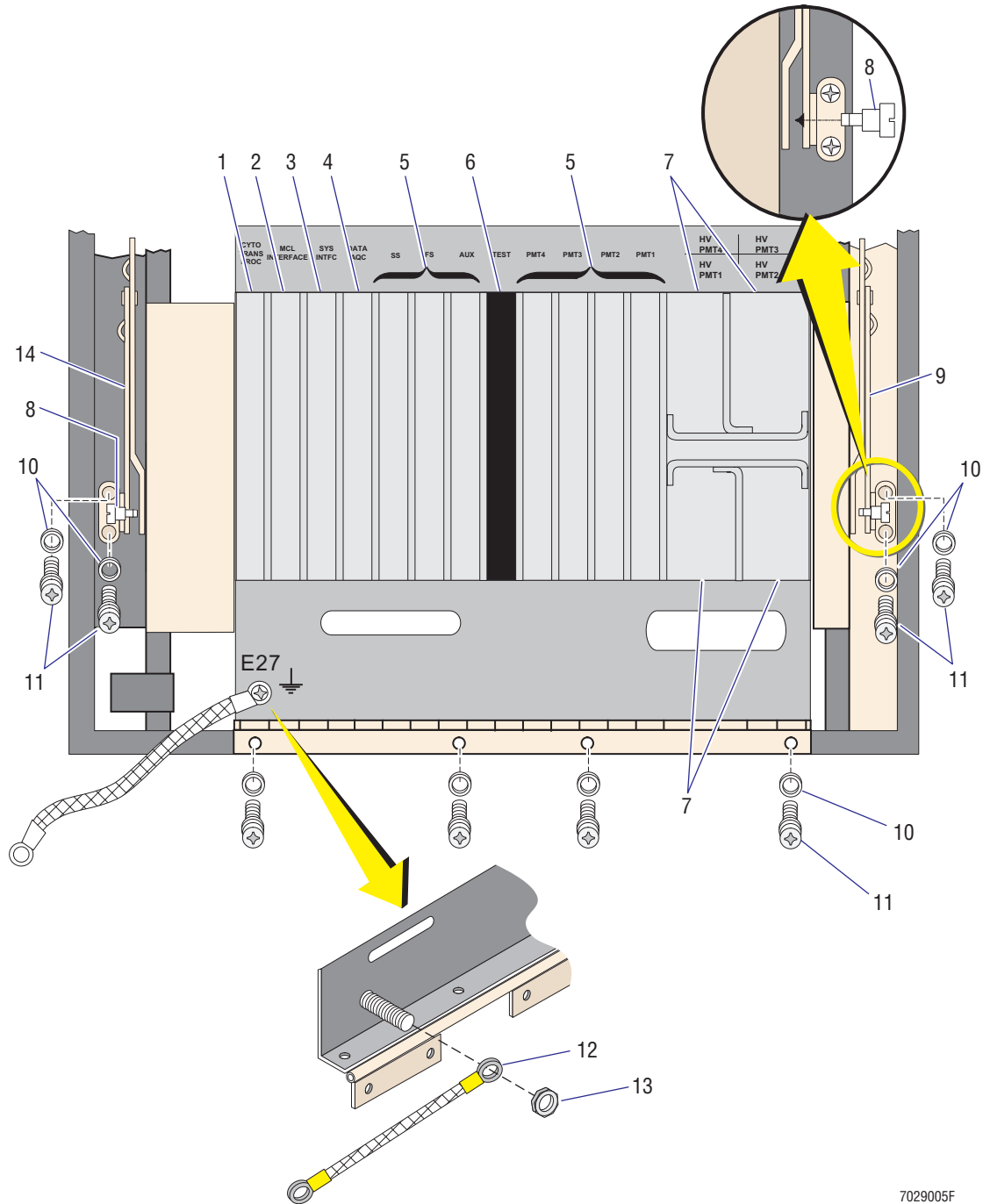


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Table 8.2-12 Front Display Panel (See Figure 8.2-12)

Item	Part Number	Description
1	1021769	Bracket, front panel
2	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
3	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
4	2827081	Washer, flat, #8 (0.172 i.d. x 0.359 o.d. x 0.030 thickness)
5	6705206	Card, Top Panel Display 2
6	1021176	Hinge, #5 swag, 3-inch Note: Attach each hinge using four sets of self-lock screws (#6-32 x 0.37-in. length, pan-head, PN 2839039) and #6 flat washers (PN 2827147).
7	6807085 6856490	Door, front panel display, grey Door, front panel display, black
8	2806084	Screw, machine (#6-32 x 0.75 in. long, FL82 flat-head) Note: At the bottom of the display window, install the center screw in the display window before placing the display window on the panel overlay (PN 6855862). This screw must be hand tightened. Do not use a power driven screwdriver.
9	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
10	6855862	Assembly, XL overlay panel
11	1016814	Display, window Note: Remove the protective plastic sheet. Ensure the LED grooves are lined up with the LEDs on the panel overlay (PN 6855862). Install the lower center screw (PN 2806084) in the display window before placing the display window on the panel overlay. Hand tighten this screw. Do not use a power driven screwdriver.

Figure 8.2-13 Data Acquisition Card Cage (See [Table 8.2-13](#))



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Table 8.2-13 Data Acquisition Card Cage (See [Figure 8.2-13](#))

Item	Part Number	Description
1	6705318	Card, Cyto Transputer (also referred to as Cytometer Transputer card)
2	6705700	Card, MCL Interface
3	6705340	Card, System Interface
4	6705314	Card, Trans Data Acquisition
5	6705321	Card, Amp/Signal Conditioner
6	N/A	Spare slot (used as a test slot in manufacturing)
7	7000193	FRU, Bertan high voltage power supply
8	1017593	Screw, shoulder (#6-32 x 0.30 in. length, 0.117 in. shoulder)
9	2523667	Hinge (lid stay), right-hand, 4.875 CTRS, 0.56 in. wide, 0.095 in. thick, brass-plated steel
10	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
11	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
12	6028152	Cable, ground braid, 6 inches long with two #8 rings
13	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
14	2523666	Hinge (lid stay), left-hand, 4.875 CTRS, 0.56 in. wide, 0.095 in. thick, brass-plated steel
Not shown	6705220	Backplane, Analyzer

Figure 8.2-14 Upper Pneumatics Drawer (See [Table 8.2-14](#))

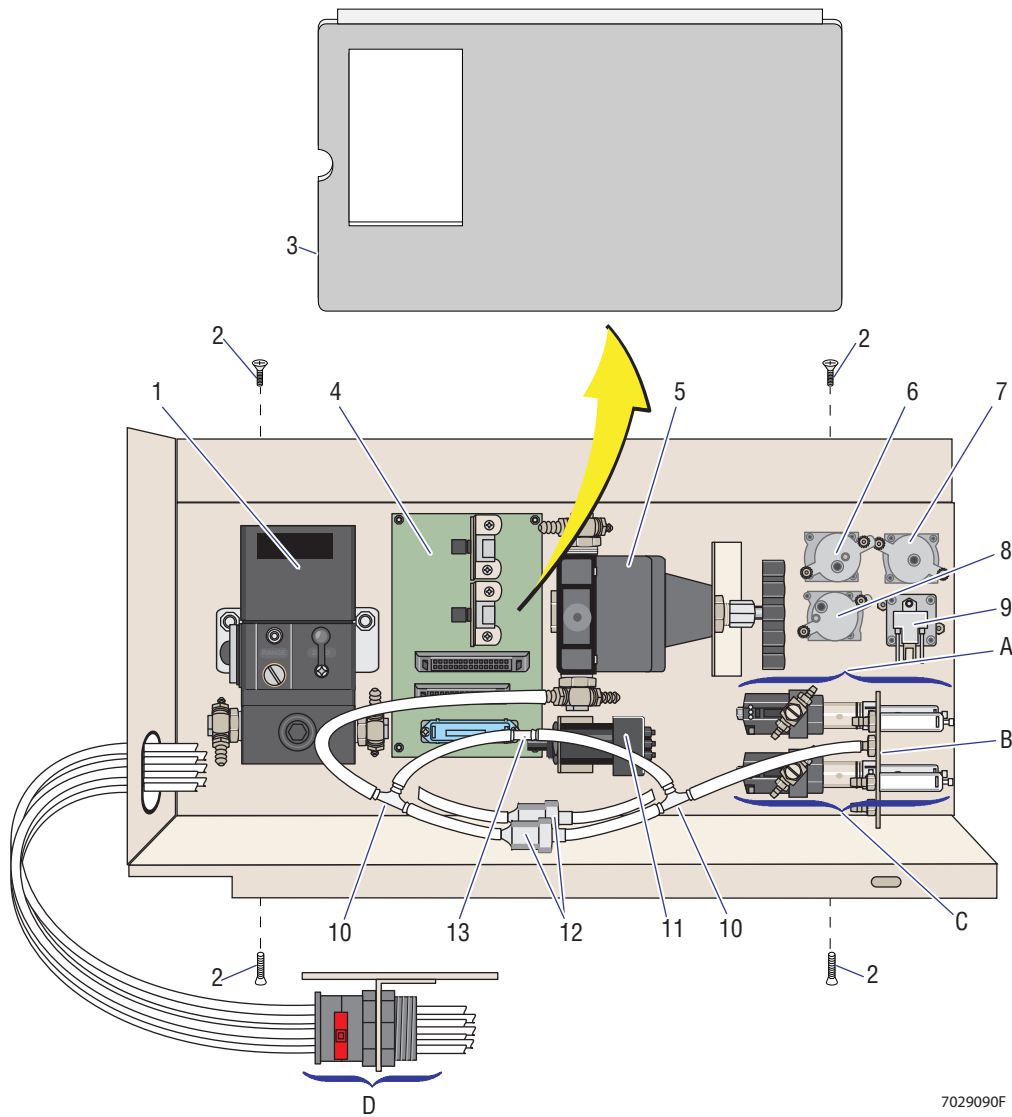


Figure Reference

- A** VL22 (upper valve), [Figure 8.2-15](#)
- B** Bracket and fittings, [Figure 8.2-16](#)
- C** VL21 (lower valve), [Figure 8.2-17](#)
- D** Quick Disconnects (QD13 and QD14), [Figure 8.2-18](#)

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Table 8.2-14 Upper Pneumatics Drawer (See Figure 8.2-14)

Item	Part Number	Description
	7000375	FRU, upper pneumatics drawer assembly
1	7000192	FRU, regulator, electronic pressure (electronic transducer), for regulating sample pressure Note: Attach to posts using one #25 flat washer (0.265 i.d. x 0.484 o.d. x 0.027 in. thickness), PN 2827064, one #25 split-lock washer (0.26 i.d. x 0.49 o.d. x 0.062 in. thickness), PN 2826051, and one hex nut (#25-20 UNC x 0.437 AF x 0.164 in. thickness), PN 2822072. Requires two sets.
2	2806104	Screw, machine (#6-32 x 0.25 in. length, UF82 flat-head)
3	6858802	Shield, EMC, removable side
4	6705217	Card, Sensor Note: Place a hole spacer (0.140 i.d. x 0.250 o.d. x 0.250 in. length), PN 2843032, on each post before installing the circuit card. Secure using self-lock nuts (#6-32 x 0.312 AF x 0.140 in. thickness), PN 2821021.
5	7000720	FRU, regulator, pressure, 0-10 psi, for regulating sheath pressure (4 psi flow)
6	5120232	Switch, normally-open vacuum/pressure (single pole, double throw), used to monitor 2-inches Hg Note: Attach using two self-lock nuts (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009.
7	5120221	Switch, normally-open vacuum/pressure (single pole, single throw), used to monitor 3 psi Note: Attach using two self-lock nuts (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009.
8	5120224	Switch, vacuum/pressure (single pole, double throw), used to monitor 10-inches Hg Note: Attach to post using a self-lock nut (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009. Secure lower opening to the panel using a #4 flat washer (0.125 i.d. x 0.250 o.d. x 0.036 in. thickness), PN 2827146, and machine screw (#4-40 x 0.75 in. length, pan-head), PN 2804039.
9	5120178	Switch, vacuum/pressure (single pole, double throw), used to monitor 25 psi Note: Attach using two self-lock nuts (#4-40 x 0.250 AF x 0.109 in. thickness), PN 2821009.
10	6232322	Fitting, T-connector, hose-barb union, 0.093 i.d. to 0.125 i.d. to 0.125 i.d., nylon, white
11	6232254	Regulator, vacuum
12	6214106	Valve, check, 0.156 i.d. to 0.156 i.d. tubing
13	6213012	Choke, gray, 0.016 orifice

Figure 8.2-15 VL22 - Exploded View of Upper Valve (See [Table 8.2-15](#))

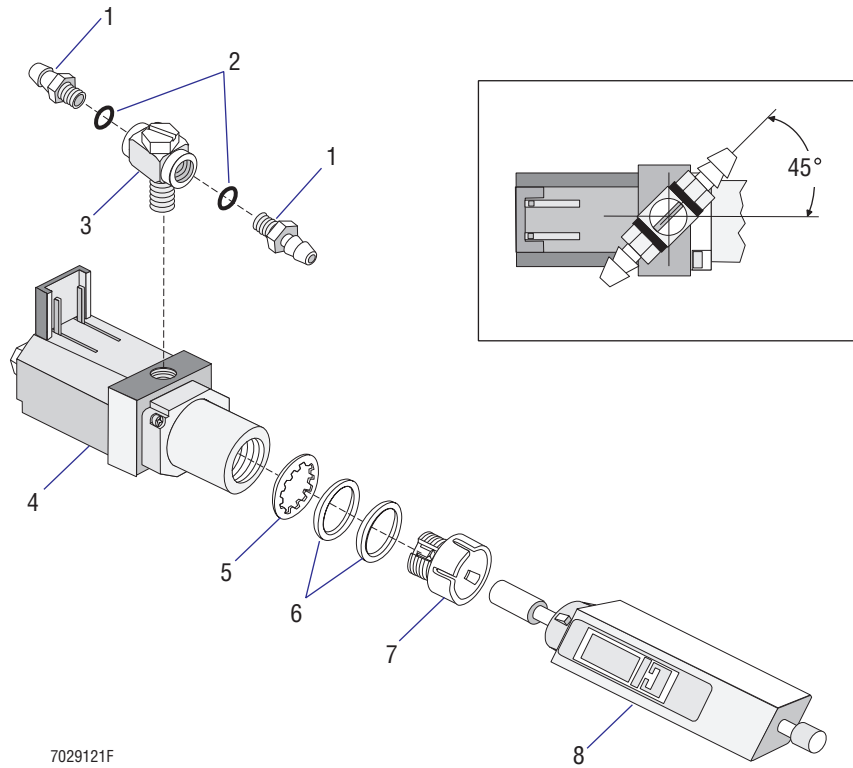
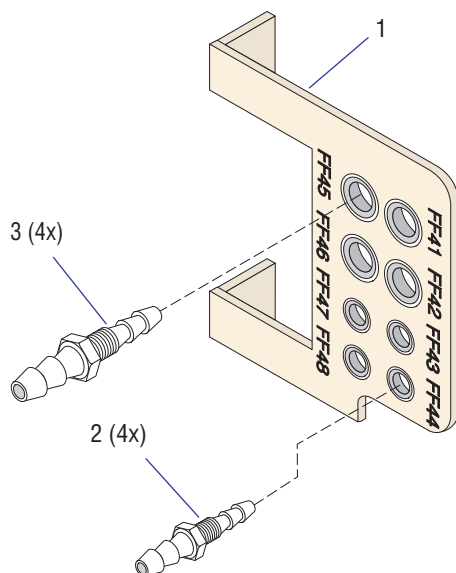


Table 8.2-15 VL22 - Exploded View of Upper Valve (See [Figure 8.2-15](#))

Item	Part Number	Description
1	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded
2	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
3	6232359	Fitting, miniature tee branch with 10-32 ports
4	6232492	Valve, electro-pneumatic, solenoid and pilot actuator combination valve, 24 Vdc / 30 psi, 4.5 lb pinch force
5	2826030	Washer, I-tooth, #47, 0.47 i.d. x 0.60 o.d. x 0.020 thickness
6	6216012	Spacer, cylinder, 0.500 i.d. x 0.562 o.d. x 0.062 thickness
7	1017501	Mount, pull-apart pinch valve
8	6855763	Valve, pull-apart pinch, double-action, white, standard

Figure 8.2-16 Bracket and Fittings - Upper Pneumatics Drawer (See Table 8.2-16)



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Table 8.2-16 Bracket and Fittings - Upper Pneumatics Drawer (See Figure 8.2-16)

Item	Part Number	Description
1	6855212	Bracket, two pinch valve
2	1005697	Fitting, hose-barb union, 0.062 i.d. to 0.062 i.d.
3	6232104	Fitting, hose-barb union, 0.115 i.d. to 0.180 i.d.

Figure 8.2-17 VL21 - Exploded View of Lower Valve (See [Table 8.2-17](#))

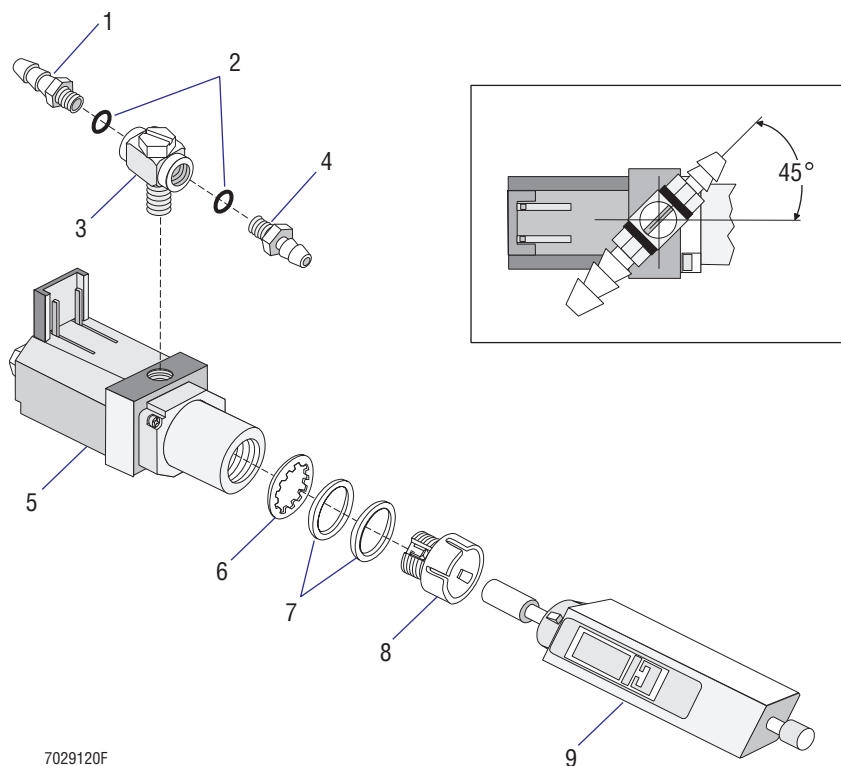
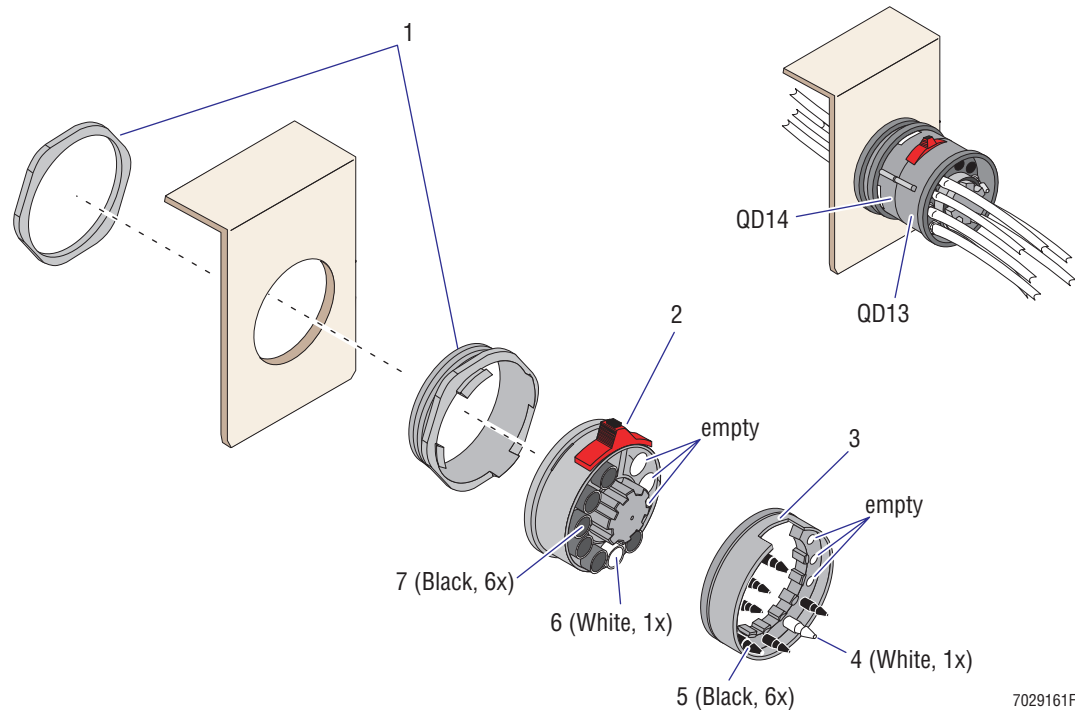


Table 8.2-17 VL21 - Exploded View of Lower Valve (See [Figure 8.2-17](#))

Item	Part Number	Description
1	6232085	Fitting, hose barb union, 0125 i.d. to 10-32 threaded
2	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
3	6232359	Fitting, miniature tee branch with 10-32 ports
4	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded
5	6232492	Valve, electro-pneumatic, solenoid and pilot actuator combination valve, 24 Vdc / 30 psi, 4.5 lb pinch force
6	2826030	Washer, I-tooth, #47, 0.47 i.d. x 0.60 o.d. x 0.020 thickness
7	6216012	Spacer, cylinder, 0.500 i.d. x 0.562 o.d. x 0.062 thickness
8	1017501	Mount, pull-apart pinch valve
9	6855763	Valve, pull-apart pinch, double-action, white, standard

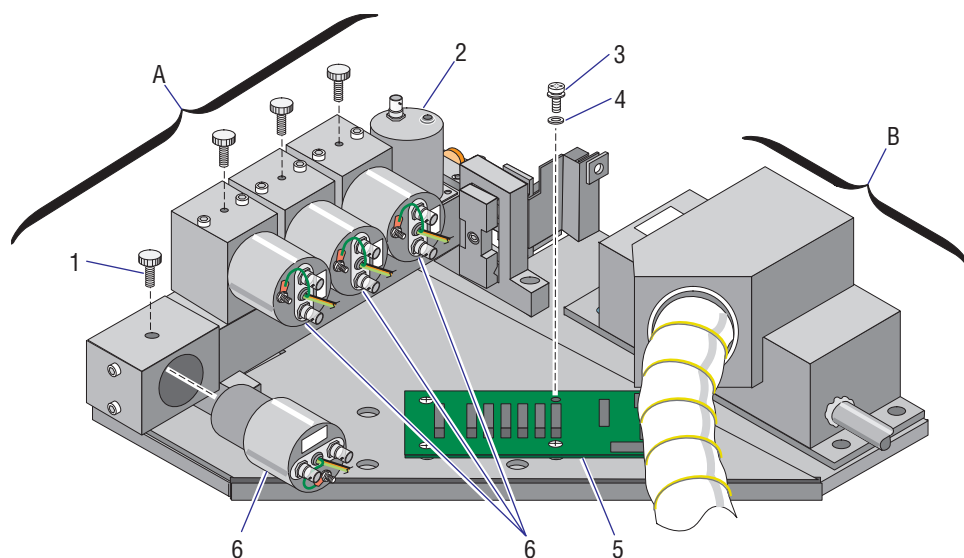
Figure 8.2-18 Quick Disconnects Below Upper Pneumatics Drawer (See Table 8.2-18)

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Table 8.2-18 Quick Disconnects Below Upper Pneumatics Drawer (See Figure 8.2-18)

Item	Part Number	Description
1	6232530	Coupling, quick-connect, panel-mount adapter and nut assembly for attaching 10 tube quick-disconnect couplings to a panel, black
2	6232534	Coupling, quick-disconnect QD14, male body, 10 tube capacity body (includes the 7 fittings shown in Figure 8.2-18)
3	6232533	Coupling, quick-disconnect QD13, female body, 10 tube capacity body (includes the 7 fittings shown in Figure 8.2-18)
4	6232588	Fitting, insert, white female quick-connect, internal connector to 0.082 i.d. hose barb
5	6232469	Fitting, insert, black female quick-connect, internal connector to 0.125 i.d. hose barb
6	6232581	Fitting, insert, white male quick-connect, internal connector to 0.082 i.d. hose barb
7	6232468	Fitting, insert, black male quick-connect, internal connector to 0.125 i.d. hose barb

Figure 8.2-19 Optical Collection Area, Rear View (See [Table 8.2-19](#))



Rear view

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Figure Reference

- A** Front view (includes filter shield and filters), [Figure 8.2-20](#)
Front view with filter shield removed (includes flow cell and FALS detector), [Figure 8.2-21](#)
- B** Argon Laser (includes Power Supply and mounting hardware), [Figure 8.2-24](#)

Table 8.2-19 Optical Collection Area, Rear View (See [Figure 8.2-19](#))

Item	Part Number	Description
1	2815003	Screw, thumb, knurled nickel-plated brass (6-32 x 0.375 in. length)
2	7000352	FRU, side scatter diode
3	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
4	2827134	Washer, flat, #6 (0.156 i.d. x 0.375 o.d. x 0.046 thickness)
5	6705199	Card, PMT Distribution and Laser Fan Control
6	7000197	FRU, fluorescence PMT

Figure 8.2-20 Optical Collection Area, Front View (See [Table 8.2-20](#))

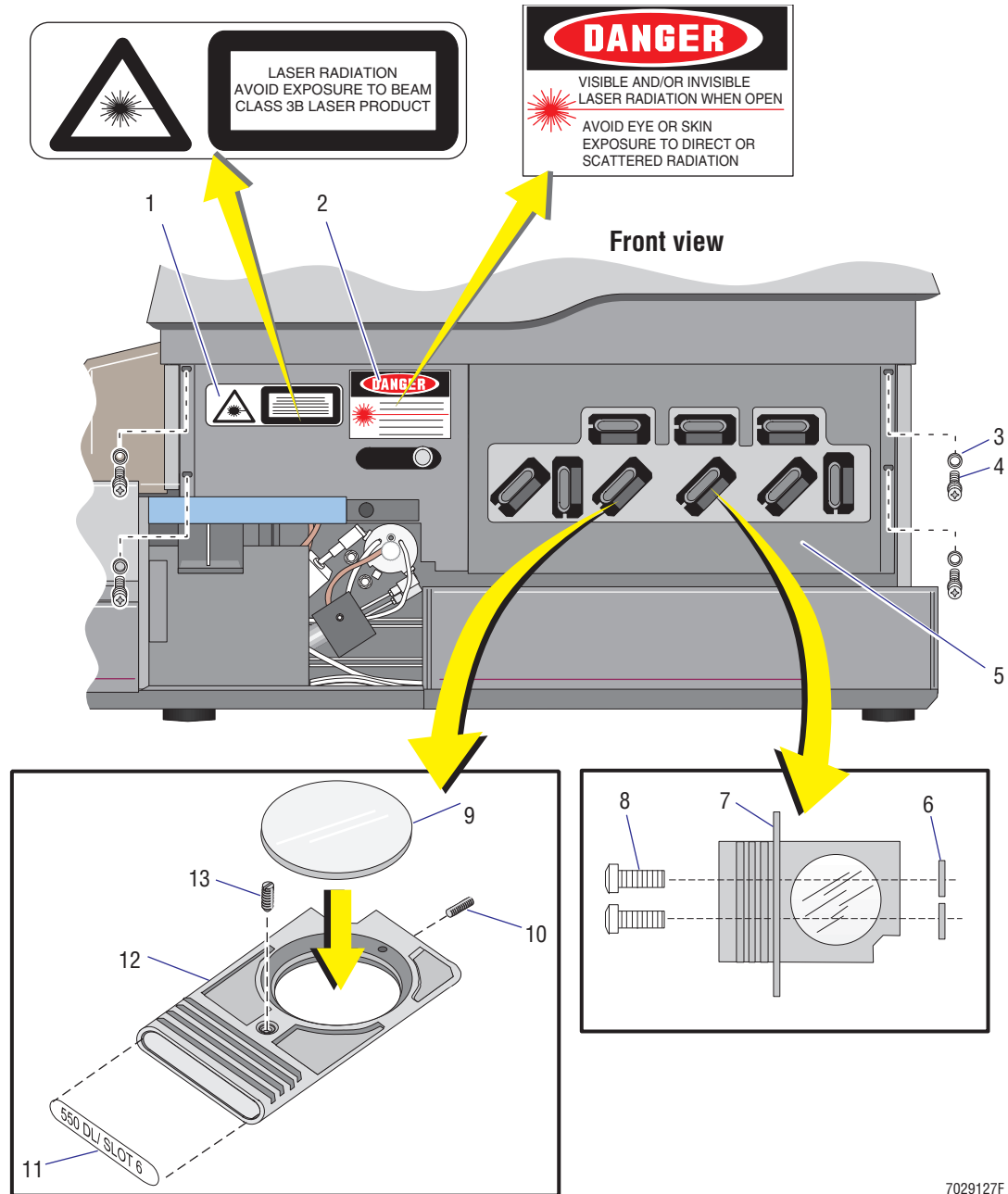
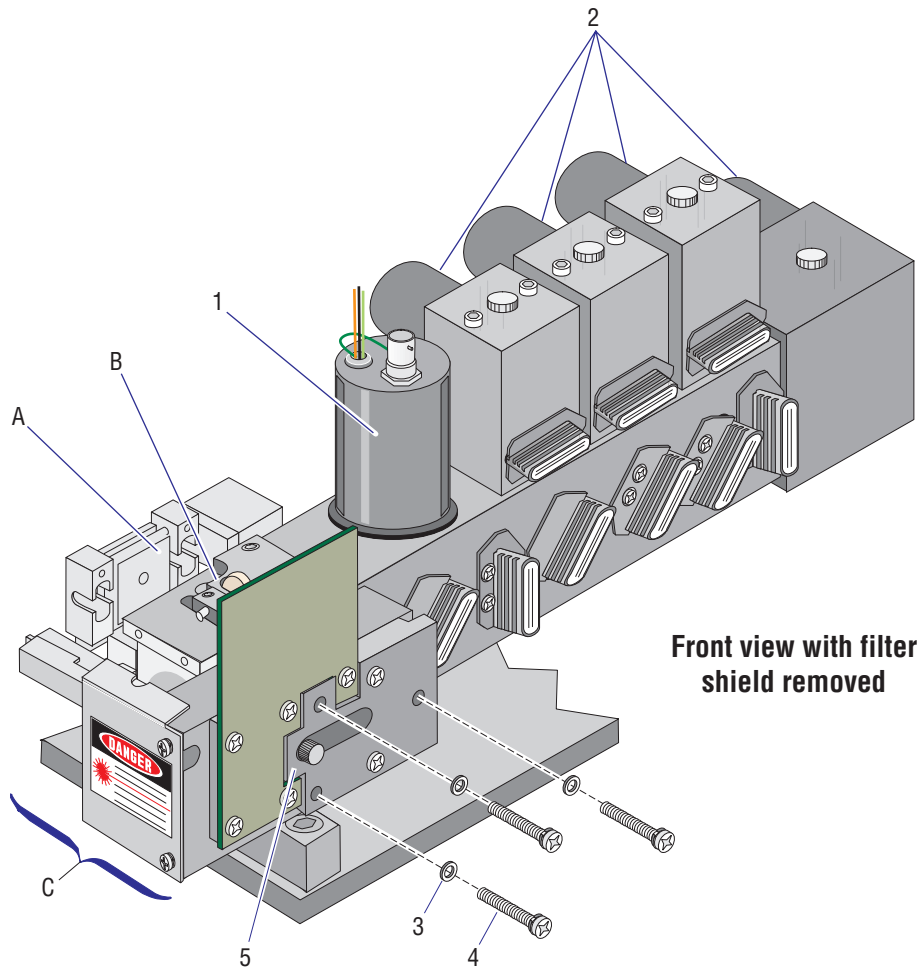


Table 8.2-20 Optical Collection Area, Front View (See Figure 8.2-20)

Item	Part Number	Description
1	2430348	Label, Class 3B Laser Product
2	2427785	Label, laser danger
3	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
4	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
5	6859190	Shield, filter for 4-color system
	6859189	Shield, filter for 3-color system (not shown)
6	6216345	Gasket, #10 black, ethylene propylene, used only in slot 9 between lens holder and PMT housing
7	1018737	Plate, lens holder
8	2806104	Screw, machine (#6-32 x 0.25 in. length, UF82-head), used to secure lens holders in slots 1 through 8 only
	2806077	Screw, machine (#6-32 x 0.19 in. length, UF82-head), used to secure lens holder in slot 9 only
9	3814134	Filter, light, used in slot 1, 525 band pass (525 BP)
	3814135	Filter, light, used in slot 2, 575 band pass (575 BP)
	3814289	Filter, light, used in slot 3, 620 band pass (620 BP)
	3814136	Filter, light, used in slot 4, 488 dichroic long pass (488 DL)
	3802072	Filter, light, used in slot 5, 488 laser blocker (488 BK)
	3814067	Filter, light, used in slot 6, 550 dichroic long pass (550 DL)
	3814138	Filter, light, used in slot 7, 600 dichroic long pass (600 DL)
	3814274	Filter, light, used in slot 8, 645 dichroic long pass (645 DL)
	3814139	Filter, light, used in slot 9, 675 band pass (675 BP)
10	2807052	Screw, setscrew (#4-40 x 0.156 in length, hex-head)
11	2429708	Label, 525 BP / Slot 1
	2429709	Label, 575 BP / Slot 2
	2429858	Label, 620 BP / Slot 3
	2429704	Label, 488 DL / Slot 4
	2429706	Label, 488 BK / Slot 5
	2429703	Label, 550 DL / Slot 6
	2430206	Label, 600 DL / Slot 7
	2429857	Label, 645 DL / Slot 8
	2430195	Label, 675 BP / Slot 9
12	1018542	Holder, filter
13	2516002	Plunger, ball (#6-40 x 0.312 long)

Figure 8.2-21 Optical Collection Area with Filter Shield Removed (See [Table 8.2-21](#))



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Figure Reference

- A** Beamshaper assembly, [Figure 8.2-22](#)
- B** Fluorescence pickup lens and adjustment hardware, [Figure 8.2-23](#)
- C** Flow cell and associated hardware, [Figure 8.2-23](#)

Table 8.2-21 Optical Collection Area with Filter Shield Removed (See [Figure 8.2-21](#))

Item	Part Number	Description
1	7000352	FRU, side scatter diode
2	7000197	FRU, fluorescence PMT
3	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
4	2839043	Screw, self-lock (#6-32 x 0.62 in. length, pan-head)
5	7000359	FRU, forward scatter (FS) detector

Figure 8.2-22 Beam-Shaping Stage Components (See Table 8.2-22)

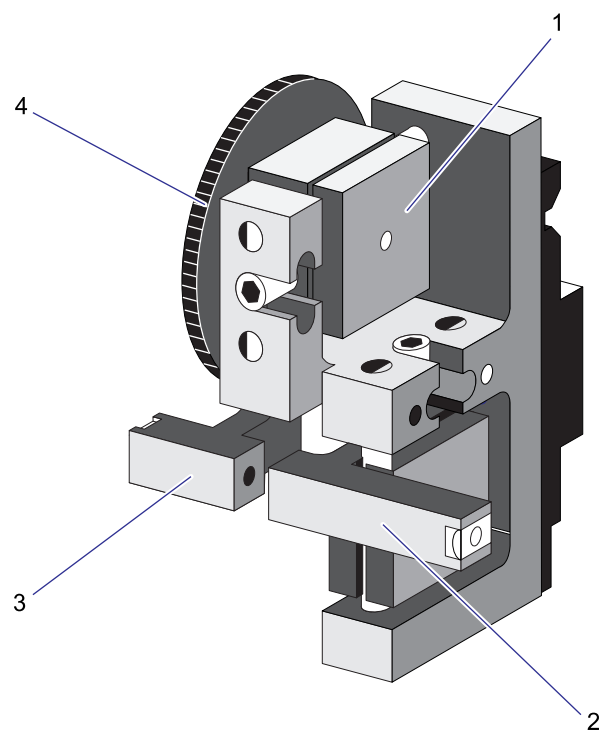
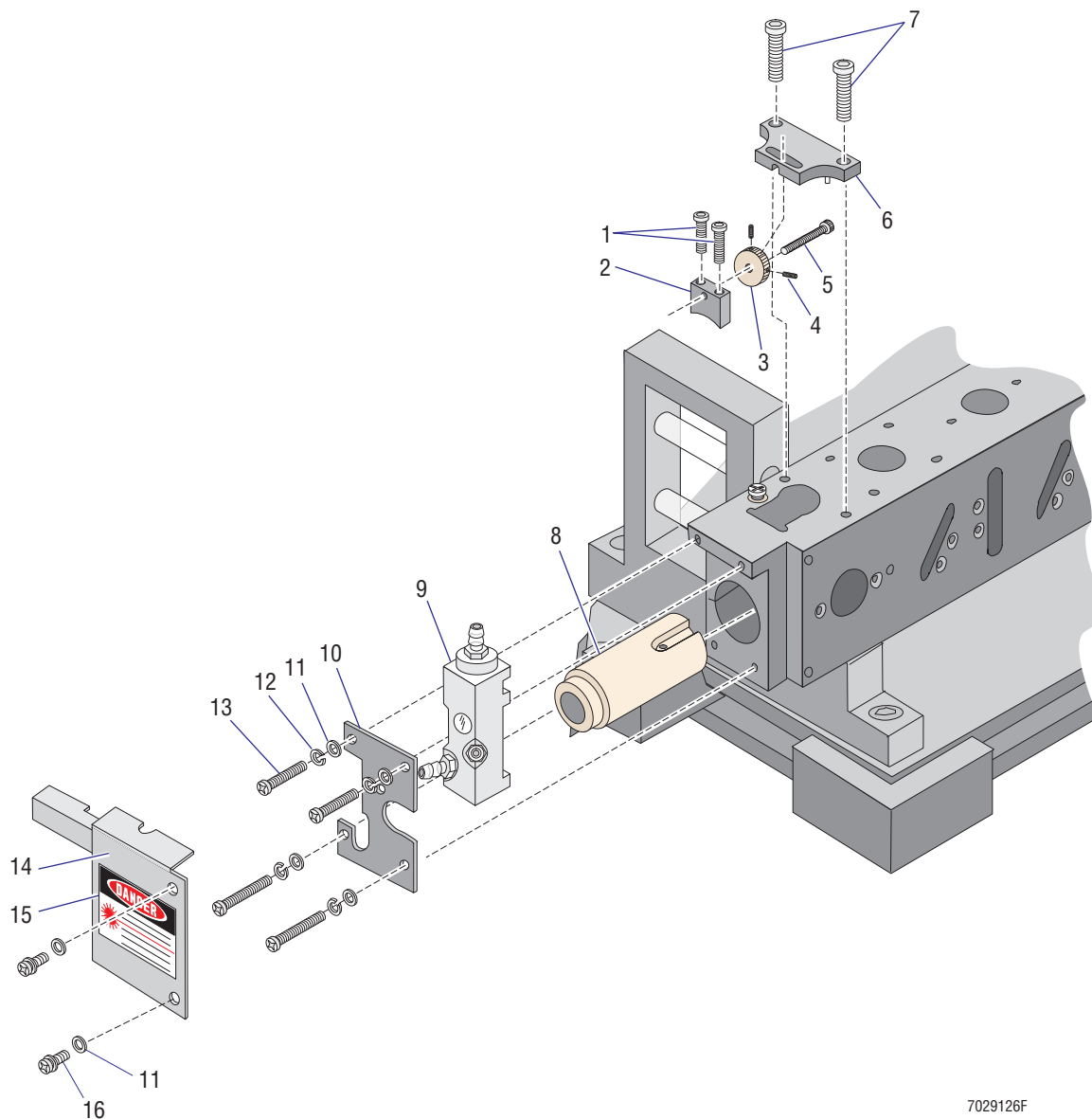


Table 8.2-22 Beam-Shaping Stage Components (See Figure 8.2-22)

Item	Part Number	Description
1	7000450	FRU, beamshaper 2
2	6859219	Lens holder, 10 mm
3	6859220	Lens holder, 80 mm
4	7000451	FRU, focus knob III
	7000449	FRU, focus knob2

Figure 8.2-23 Flow Cell and Fluorescence Pickup Lens with Associated Hardware (See [Table 8.2-23](#))



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Table 8.2-23 Flow Cell and Fluorescence Pickup Lens with Associated Hardware (See [Figure 8.2-23](#))

Item	Part Number	Description
1	2851975	Screw, machine, knurled (#4-40 x 0.75 in. length, hex socket head)
2	1021703	Stage, snout support
3	1021682	Knob, snout
4	2807026	Screw, setscrew (#4-40 x 0.125 in length, hex-head)
5	2851982	Screw, machine (#6-40 x 1.125 in. length, hex-head)
6	6859217	Stage, snout
7	2806102	Screw, machine (#6-32 x 0.38 in. length, hex-head)
8	6858921	Snout, pinhole
9	6858386	Flow cell
10	1022362	Plate, flow cell
11	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
12	2826035	Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.03 in. thickness)
13	2806096	Screw, machine (#6-32 x 1.25 in. length, pan-head)
14	1020965	Cover, flow cell shield
15	2427785	Label, laser danger
16	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)

Figure 8.2-24 Argon Laser, Power Supply, and Mounting Hardware (See [Table 8.2-24](#))

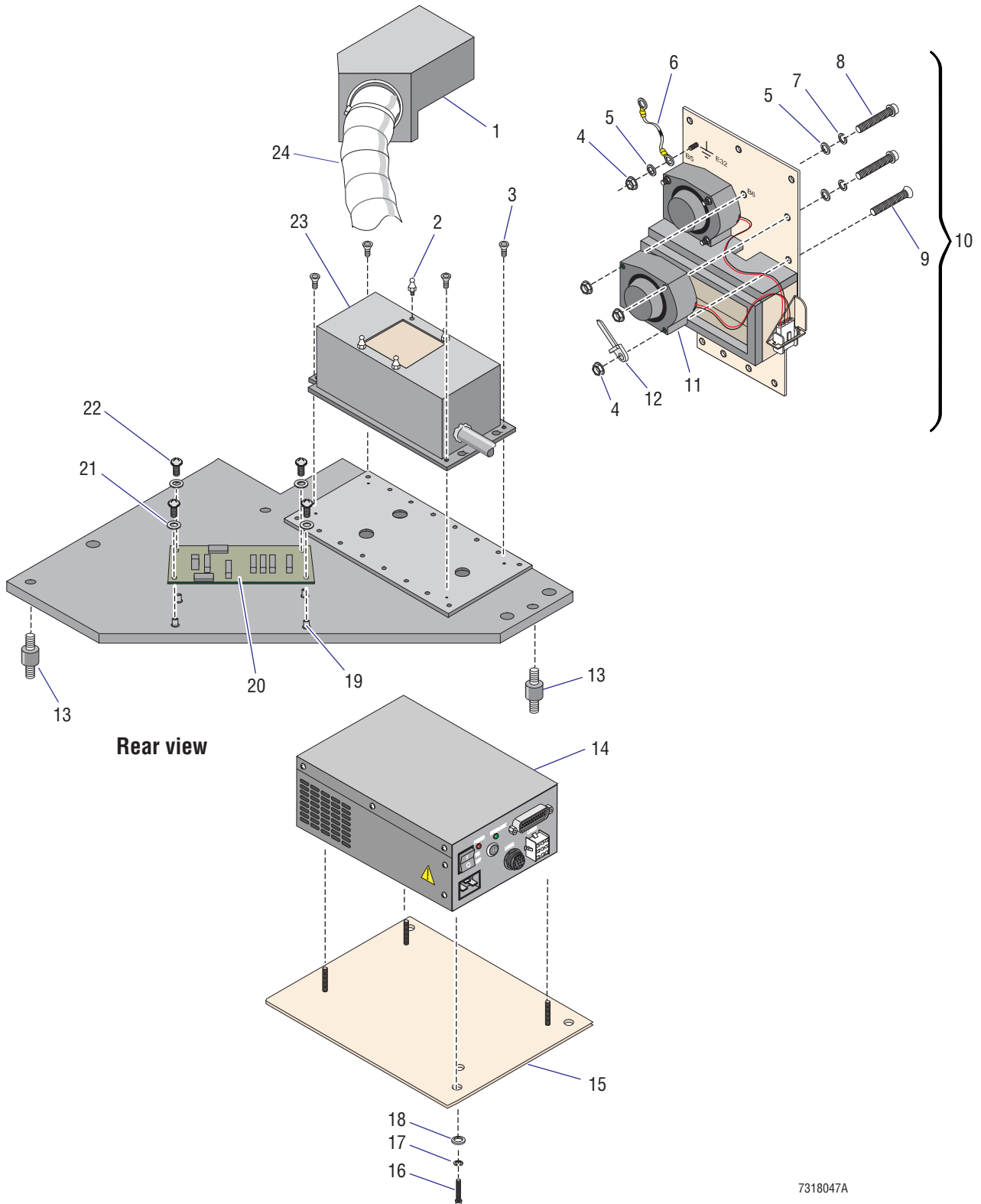


Table 8.2-24 Argon Laser, Power Supply, and Mounting Hardware (See Figure 8.2-24)

Item	Part Number	Description
1	6856941	Plenum, laser duct out
2	2840037	Fastener, ball stud
3	1022396	Screw, special laser mounting
4	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
5	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
6	6028152	Cable, ground braid, 6 in. length with two #8 rings
7	2826035	Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.03 in. thickness)
8	2806159	Screw, machine (#6-32 x 2.00 in. length, pan-head)
9	2806148	Screw, machine (#6-32 x 2.00 in. length, FL82 flat-head)
10	7000719	FRU, laser blower assembly
11	2603054	Fan, 64 CFM, 24 Vdc, 6.37 in. square, 1.6 in. deep
12	6011006	Tie wrap, screw mount, #6 sizer, 7.4 in. long, 0.19 in wide
13	2523660	Mount, shock, rubber, axial mount, 16 lb, 256 lb/in., 78 Hz
14	7000431	Power supply, Argon air-cooled laser, switching, for 100 Vac system
	7000721	Power supply, Argon air-cooled laser, switching, for 115 Vac system
	7000432	Power supply, Argon air-cooled laser, switching, for 220 or 240 Vac system
15	6856067	Plate, Argon laser power supply mounting
16	2839051	Screw, self-lock (#10-32 x 0.75 in. length, pan-head)
17	2826045	Washer, split-lock, #10 (0.19 i.d. x 0.33 o.d. x 0.047 in. thickness)
18	2827021	Washer, flat, #10 (0.21 i.d. x 0.51 o.d. x 0.051 thickness)
19	2851866	Spacer, internally and externally threaded (#6-32 x 0.250 DP to #6-32 x 0.375, aluminum alloy)
20	6705199	Card, PMT Distribution and Laser Fan Control Note: Refers to the two cooling fans mounted on the Cytometer frame. These fans cool the Argon laser.
21	2827134	Washer, flat, #6 (0.156 i.d. x 0.375 o.d. x 0.046 thickness)
22	2839009	Screw, self-lock (#6-32 x 0.25 in. length, pan-head)
23	7000358	FRU, Argon air-cooled laser head
24		Flexible duct must be assembled using the following parts:
	1018547	Insulation
	2603060	Duct, flexible, 3 1/8 i.d. x 10-in. length, rectangular flange at one end
	6011003	Tie wrap, nylon, 15 in. long, 0.19 in. wide, nylon (need three of these) Note: Assembly instructions are illustrated in Figure 8.2-62.
Not shown	2523659	Mount, shock, rubber, axial mount, 4 lb, 73 lb/in., 84 Hz, for laser cooling fan module (may also be referred to as bushings)

Figure 8.2-25 Reagent Drawer (See [Table 8.2-25](#))

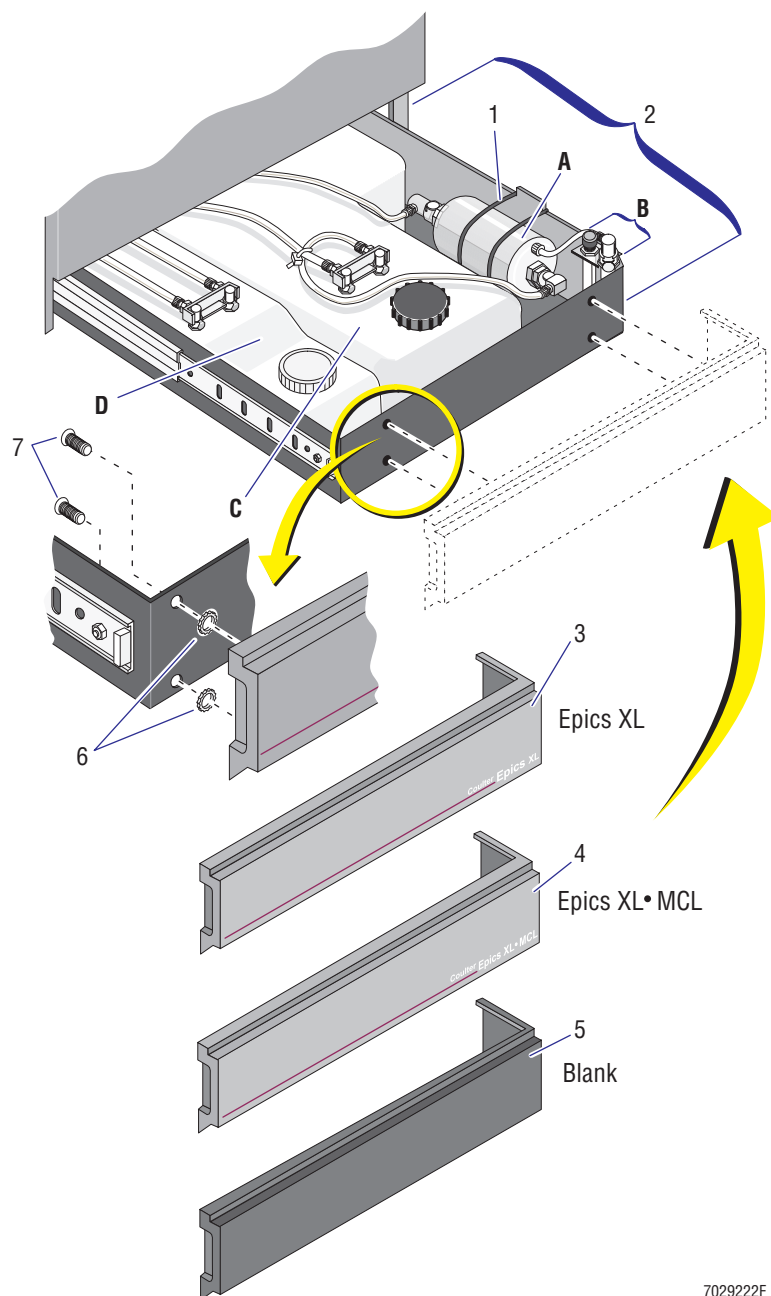


Figure Reference

- A** Sheath liquid filter,
[Figure 8.2-26](#)
- B** Sheath liquid filter
purge (vent) connections,
[Figure 8.2-27](#)
- C** Sheath container,
[Figure 8.2-28](#)
- D** Cleaning agent container,
[Figure 8.2-29](#)

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Table 8.2-25 Reagent Drawer (See [Figure 8.2-25](#))

Item	Part Number	Description
1	2523451	O-ring, silicone, used as rubber band, 2.300 i.d. x 0.103 width
2	7000677	FRU, reagent drawer with slides assembly
3	6807089	Panel, reagent drawer front, for XL flow cytometer, grey
4	6807088	Panel, reagent drawer front, for XL-MCL flow cytometer, grey
5	6855934	Panel, reagent drawer front, for XL or XL-MCL flow cytometer, black
6	2826012	Washer, E-tooth, #6, 0.140 i.d. x 0.312 o.d. x 0.022 thickness
7	2806140	Screw, machine (#6-32 x 0.38 in. length, UF82-head)

Figure 8.2-26 Sheath Liquid Filter (See [Table 8.2-26](#))

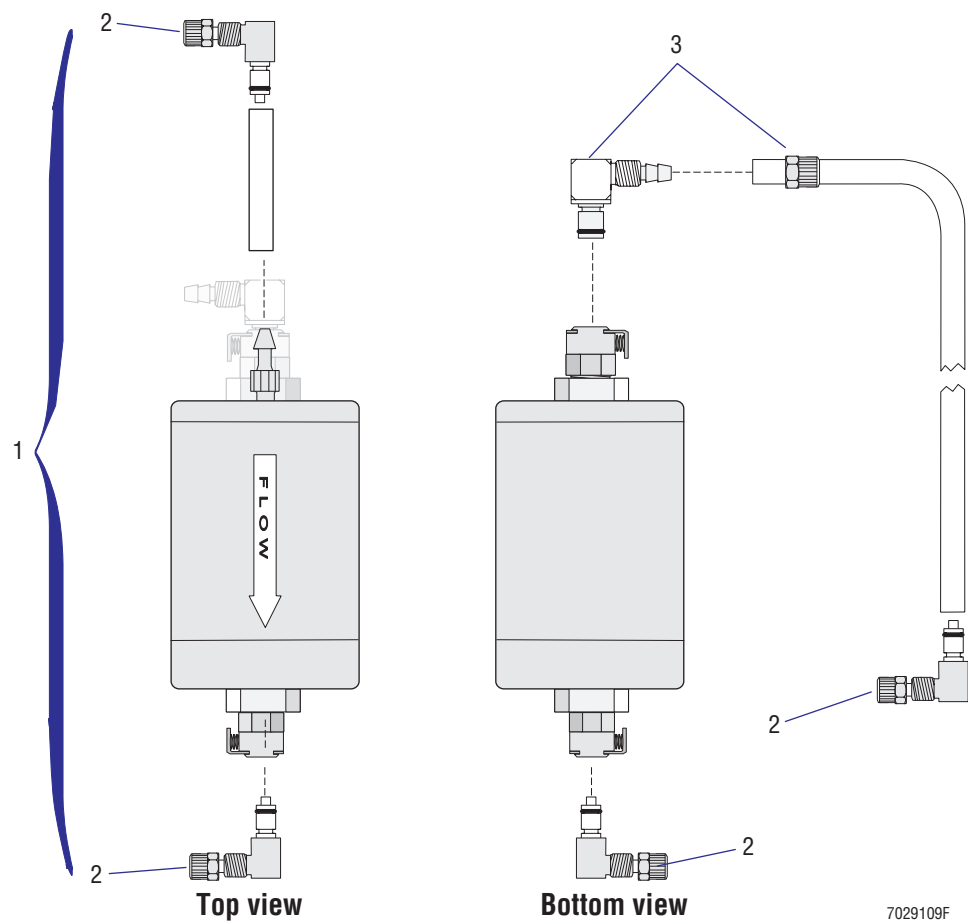


Table 8.2-26 Sheath Liquid Filter (See [Figure 8.2-26](#))

Item	Part Number	Description
1	6912942	Assembly, sheath filter
2	6232472	Quick-connect, male, external elbow, 0.250 o.d., white acetal delrin
3	6232522	Quick-connect, male, external elbow, 0.375 o.d., white acetal delrin

Figure 8.2-27 Sheath Liquid Filter Purge (Vent) Connections (See [Table 8.2-27](#))

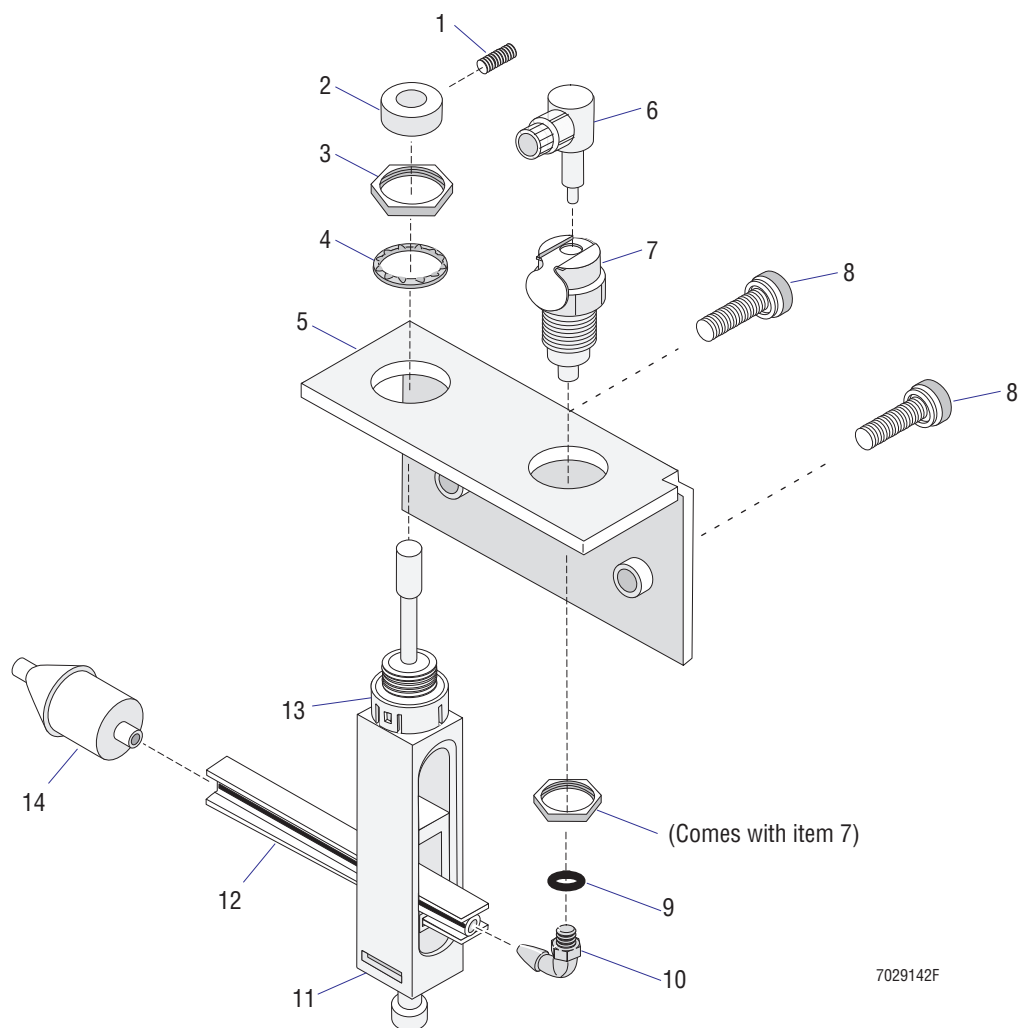


Table 8.2-27 Sheath Liquid Filter Purge (Vent) Connections (See [Figure 8.2-27](#))

Item	Part Number	Description
1	2807026	Screw, setscrew (#4-40 x 0.125 in length, hex-head)
2	1018728	Knob, pinch valve
3	2822033	Nut, hex (47-32 UNS x 0.562 AF x 0.078 in. thickness)
4	2826030	Washer, I-tooth, #47, 0.47 i.d. x 0.60 o.d. x 0.020 thickness
5	6856718	Bracket, shut-off valve
6	6232472	Quick-connect, male, external elbow, 0.250 o.d., white acetal delrin
7	6232466	Quick-connect, internal, panel mount, 10-32, white, 0.125 flow (couples with white insert, PN 6232266)
8	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
9	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
10	6232208	Fitting, hose barb, elbow, 0.093 i.d. to 10-32 threaded, white, nylon Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Tighten until the O-ring is squeezed then continue to tighten until the fitting is oriented as shown in Figure 8.2-27 .
11	6855763	Valve, pull-apart pinch, double-action, white, standard
12	3213136	Tubing, pull-apart I-beam with black stripe, silicone, 0.062 i.d., approximate 8-inch length
13	1017501	Mount, pull-apart pinch valve
14	6214108	Valve, check, for 0.062 i.d. to 0.062 i.d. tubing

Figure 8.2-28 Sheath Container (See Table 8.2-28)

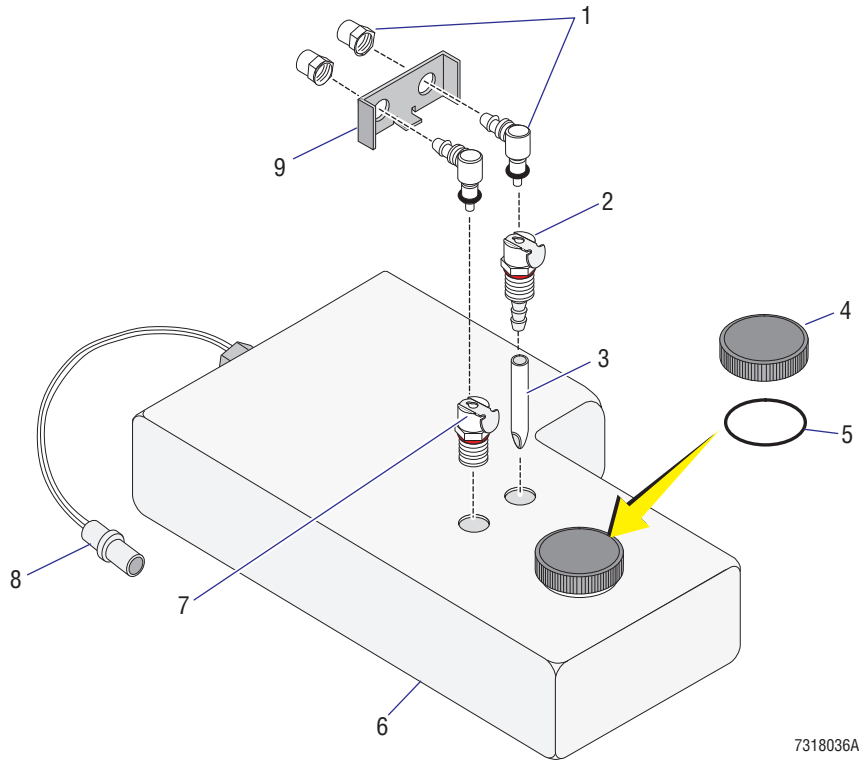


Table 8.2-28 Sheath Container (See Figure 8.2-28)

Item	Part Number	Description
	7000378	FRU, sheath tank with sensor assembly
1	6232472	Quick-connect, male, external elbow, 0.250 o.d., white acetal delrin
2	6232470	Quick-connect, female, internal panel mount, 0.125 i.d., coupling pair latch, barb, white acetal delrin
3	1020976	Tube, pickup
4	1018613	Cap, sheath tank (or bottle)
5	2523724	O-ring, silicone seal, 1.850 i.d. x 0.210 width
6	2523649	Tank, sheath without sensor (also referred to as sheath bottle)
7	6232478	Quick-connect, female, internal panel mount, 0.125 flow, coupling pair latch, barb, white acetal delrin
8	6028526	Cable, level sensor, with undercut O-ring groove (O-ring is not needed)
9	1020981	Bracket, sheath tank (also referred to as sheath bottle bracket)

Figure 8.2-29 Cleaning Agent Container (See Table 8.2-29)

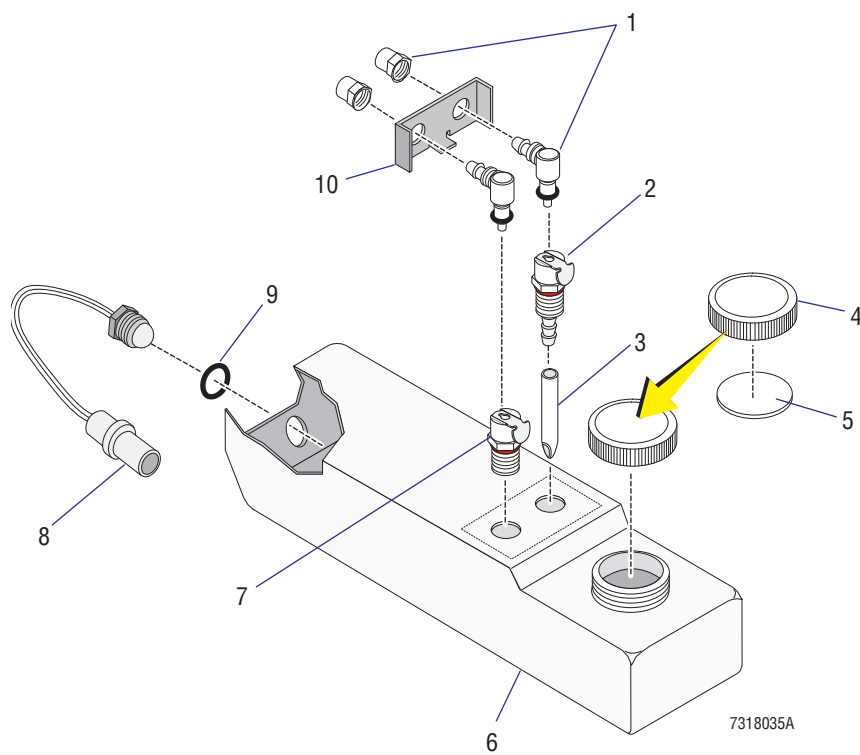
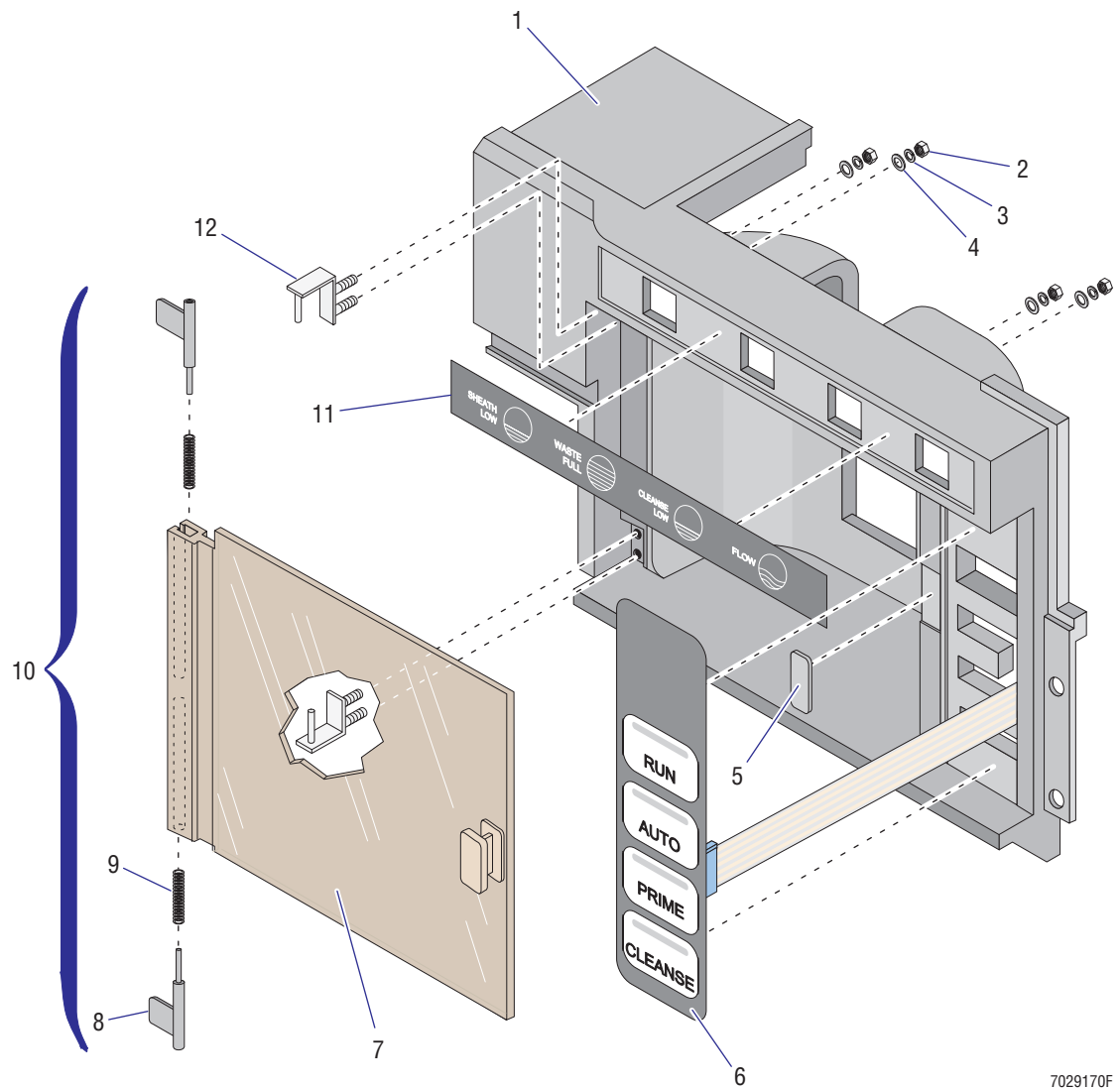


Table 8.2-29 Cleaning Agent Container (See Figure 8.2-29)

Item	Part Number	Description
	7000379	FRU, cleanse tank with sensor assembly
1	6232472	Quick-connect, male, external elbow, 0.250 o.d., white acetal delrin
2	6232470	Quick-connect, female, internal panel mount, 0.125 i.d., coupling pair latch, barb, white acetal delrin
3	1020976	Tube, pickup
4	1021818	Cap, cleanse
5	1021812	Gasket, cleanse cap
6	2523650	Tank, cleanse, without sensor (also referred to as cleanse bottle)
7	6232478	Quick-connect, female, internal panel mount, 0.125 flow, coupling pair latch, barb, white acetal delrin
8	6028526	Cable, level sensor, with undercut O-ring groove Note: Must use with O-ring seal, PN 2512031.
9	2512031	O-ring, silicone seal, 0.364 i.d. x 0.070 width
10	1020978	Bracket, cleanse tank (also referred to as detergent bottle bracket)

Figure 8.2-30 Sample Station (Manual) for XL-MCL Cytometer, Front View (See [Table 8.2-30](#))



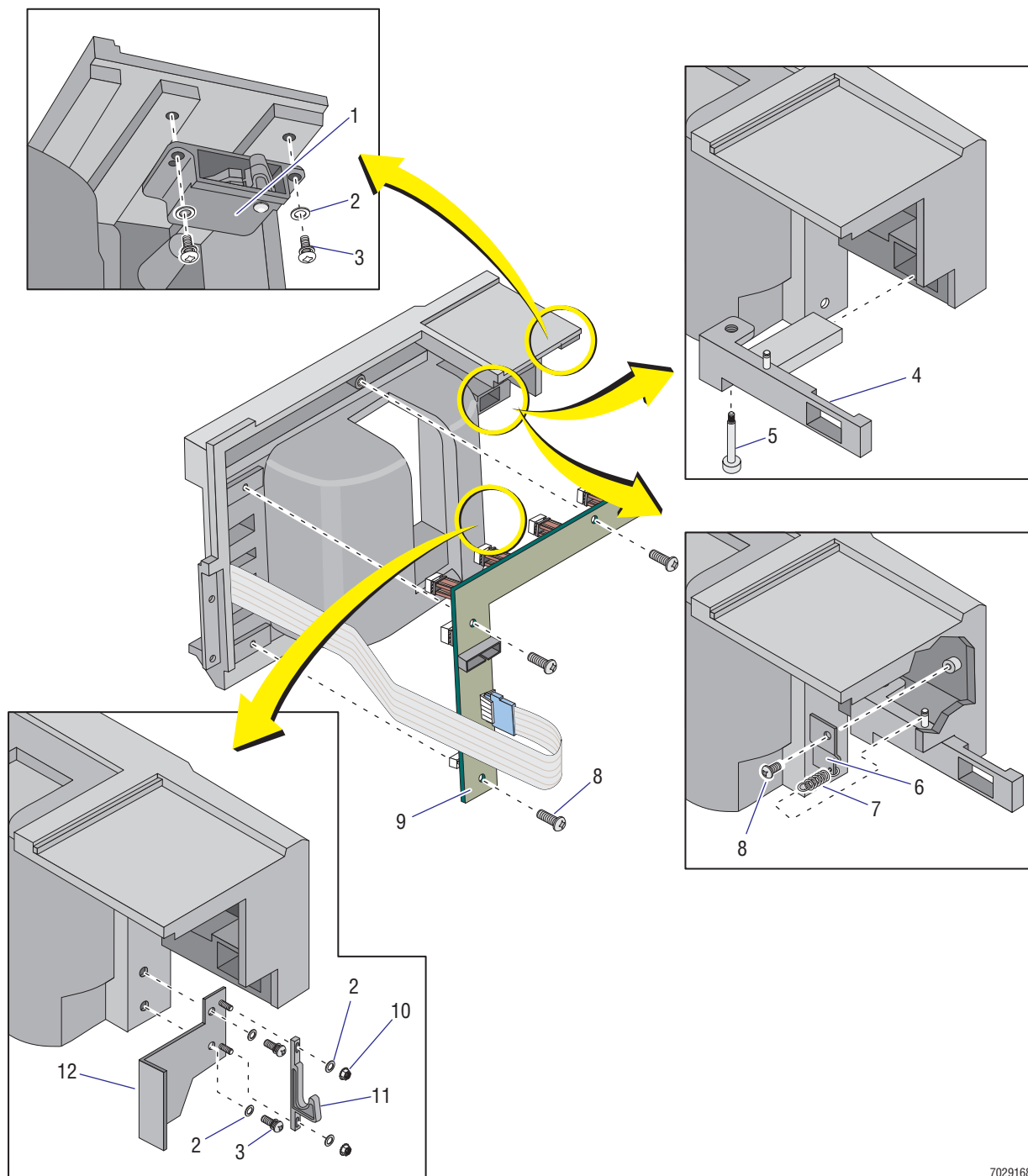
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Note: See [Figure 8.2-31](#) for the rear view of the manual sample station on an XL-MCL flow cytometer.

Table 8.2-30 Sample Station (Manual) for XL-MCL Cytometer, Front View (See Figure 8.2-30)

Item	Part Number	Description
1	7000678	FRU, manual sample station, for XL-MCL Cytometer with grey covers
	7000354	FRU, manual sample station, for XL-MCL Cytometer with black covers
	6807081	Sample station, for an XL-MCL with grey covers
	6858518	Sample station, for an XL-MCL with black covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.
2	2822050	Nut, hex (#2-56 UNC x 0.187 AF x 0.066 in. thickness)
3	2826001	Washer, split-lock, #2 (0.09 i.d. x 0.17 o.d. x 0.02 in. thickness)
4	2827095	Washer, flat, #2 (0.094 i.d. x 0.25 o.d. x 0.02 in. thickness)
5	1019621	Plate, magnet catcher Note: Attach using instant adhesive, PN 1601082. Apply only one drop.
6	1021734	Data entry, membrane, overlay and switch, for XL-MCL
7	6858842	Door, XL-MCL sample station, with handle and magnet attached
8	6858841	MCL push cylinder, for sample station door
9	2523737	MCL compression spring, for XL-MCL sample station door, rated 8.1 lbs per inch, (0.148 in. diameter x 0.75 in. length x 0.021 in. width)
10	7000444	FRU, MCL sample station door assembly
11	1021696	Display, sample cup membrane
12	6856945	Bracket, door angle Note: Verify proper orientation before attaching.

Figure 8.2-31 Sample Station (Manual) for XL-MCL Cytometer, Rear View (See [Table 8.2-31](#))



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Note: See [Figure 8.2-30](#) for the front view of the manual sample station on an XL-MCL flow cytometer.

Table 8.2-31 Sample Station (Manual) for XL-MCL Cytometer, Rear View (See Figure 8.2-31)

Item	Part Number	Description
	7000678	FRU, manual sample station, for XL-MCL Cytometer with grey covers
	7000354	FRU, manual sample station, for XL-MCL Cytometer with black covers
1	2851859	Latch, concealed pull-up catch and keeper, 1.9 x 1.1 x 0.3 in., black nylon Note: Only the latch catch is shown in Figure 8.2-31, item 1. Use Figure 8.2-31 to verify proper orientation of this latch catch.
2	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
3	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
4	6807075	MCL push-button Note: MCL push-button must be properly positioned before inserting the shoulder screw, PN 2852256
5	2852256	Screw, shoulder (#4-40 x 0.156 length, 0.560 long shoulder, hex socket head) Note: MCL push-button, PN 6807075, must be properly positioned before inserting this shoulder screw.
6	1021765	Holder, MCL spring
7	2523733	Spring, extension, 0.180 o.d. x 0.50 in. coiled length, 0.026 in. wire diameter, rated at 20.2 lbs/in. Note: Hook spring first to the spring holder, PN 1021765, and then to the post on the MCL push-button, PN 6807075. Make sure the push-button does not bind on the plastic.
8	2839024	Screw, self-lock (#4-40 x 0.25 in. length, pan-head)
9	6705742	Card, Front Panel LED and Switch Input 2
10	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
11	2851859	Latch, concealed pull-up catch and keeper, 1.9 x 1.1 x 0.3 in., black nylon Note: Only the latch keeper is shown in Figure 8.2-31, item 11. Use Figure 8.2-31 to verify proper orientation of the latch keeper. This latch keeper connects with the front latch catch on the MCL lower base cover. See Figure 8.2-3.
12	6805649	Bracket, MCL sample station

Figure 8.2-32 Sample Station for XL Cytometer (See [Table 8.2-32](#))

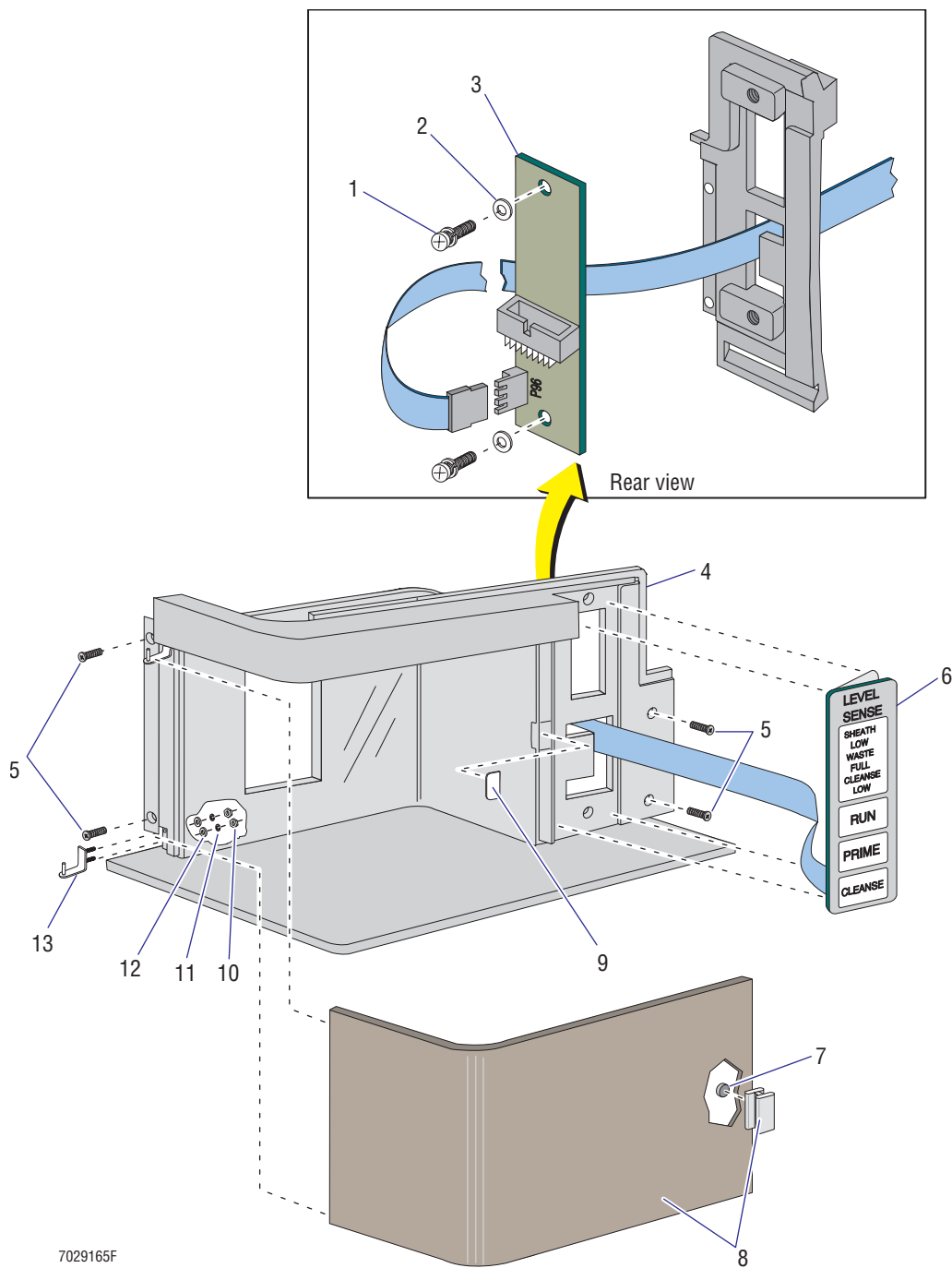
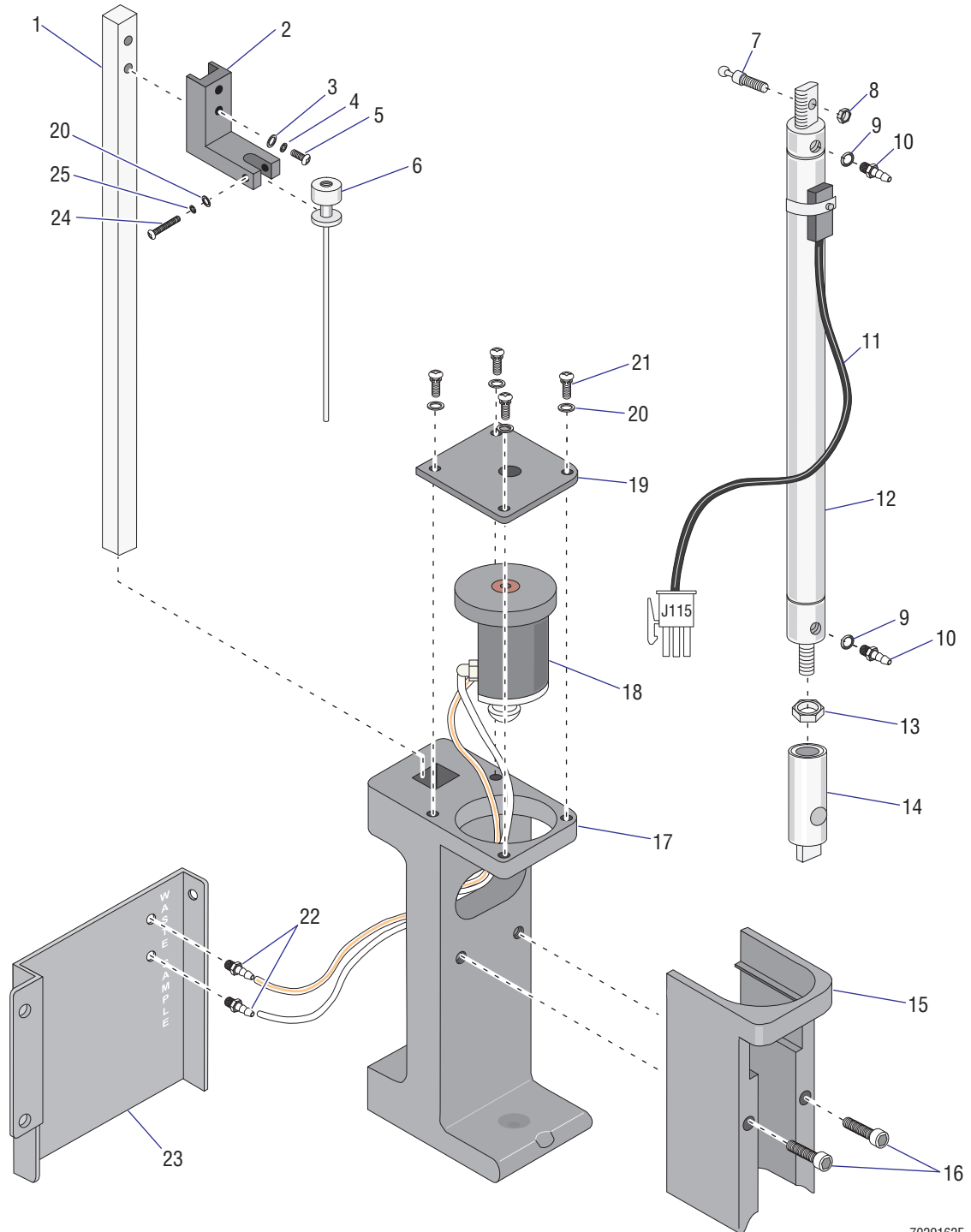


Table 8.2-32 Sample Station for XL Cytometer (See Figure 8.2-32)

Item	Part Number	Description
	7000679	FRU, sample station assembly, for XL Cytometer with grey covers
	7000360	FRU, sample station assembly, for XL Cytometer with black covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.
1	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
2	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
3	6705193	Card, Front Panel LED and Switch Input
4	6807083	Sample station, for an XL with grey covers
	6856869	Sample station, for an XL with black covers Note: Before attaching sample station to the Cytometer, make sure the flow cell cover and filter shield are attached to the Cytometer.
5	2806162	Screw, machine (#6-32 x 0.44 in. length, FL82 flat-head)
6	1016815	Data entry, overlay and membrane switch sample cup XL Note: Before installation, remove paper backing.
7	2523394	Magnet, disk, rare earth, 0.187 o.d. x 0.063 thickness Note: Before installation, remove the sample station door and lay the door near the edge of a table with the handle positioned over the edge. With the door flat, apply one drop of instant adhesive, PN 1601082 inside the hole behind the handle then immediately install the magnet in the hole. Be very careful not to smear the adhesive.
8	6858840	Door, XL sample station, with attached handle
9	1019621	Plate, magnet catcher Note: Attach using instant adhesive, PN 1601082. Apply only one drop.
10	2822050	Nut, hex (#2-56 UNC x 0.187 AF x 0.066 in. thickness)
11	2826001	Washer, split-lock, #2 (0.09 i.d. x 0.17 o.d. x 0.02 in. thickness)
12	2827095	Washer, flat, #2 (0.094 i.d. x 0.25 o.d. x 0.02 in. thickness)
13	6856945	Bracket, door angle

Figure 8.2-33 Sample Station for XL-MCL and XL Cytometers - Mechanical Assembly (See [Table 8.2-33](#))



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Table 8.2-33 Sample Station for XL-MCL and XL Cytometers - Mechanical Assembly (See Figure 8.2-33)

Item	Part Number	Description
1	1020914	Shaft, 0.375 square
2	1020873	Arm. probe
3	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
4	2826035	Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.03 in. thickness)
5	2806128	Screw, machine (#6-32 x 0.75 in. length, pan-head)
6	6858174	Probe, sample
7	1022369	Stud, ball (10-32 x 0.50 length) Note: Apply one drop of adhesive sealant, PN 1601065, to screw threads before insertion.
8	2821018	Nut, self-lock (10-32 x 0.375 AF x 0.156 in. thickness)
9	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
10	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded
11	6028330	Cable assembly, mini-universal MATE-N-LOK 3-position plug to Hall Effect sensor
12	6232575	Cylinder, air, double-acting with single-end spring-return, universal mount, 0.63 bore, 3.25 stroke, 150 psi maximum pressure
13	2822016	Nut, hex (#10-32 UNF x 0.375 AF x 0.130 in. thickness)
14	2523743	Socket joint, quick-disconnect with spring loaded sleeve, for 0.253-inch diameter ball stud, stainless steel
15	1020897	Holder, finger
16	2806200	Screw, machine (#6-32 x 1.00 in length, HSC head)
17	1021679	Holder, sample tube
18	7000351	FRU, manual sample head
19	1020910	Plate, top
20	2827146	Washer, flat, #4 (0.125 i.d. x 0.250 o.d. x 0.036 thickness)
21	2839025	Screw, self-lock (#4-40 x 0.37 in. length, pan-head)
22	1005697	Fitting, hose-barb union, 0.062 i.d. to 0.062 i.d.
23	6858247	Cover, sample station
24	2804039	Screw, machine (#4-40 x 0.75 in. length, pan-head)
25	2826002	Washer, split-lock, #4 (0.12 i.d. x 0.20 o.d. x 0.25 in. thickness)

Figure 8.2-34 Segmenting Valve Assembly (See Table 8.2-34)

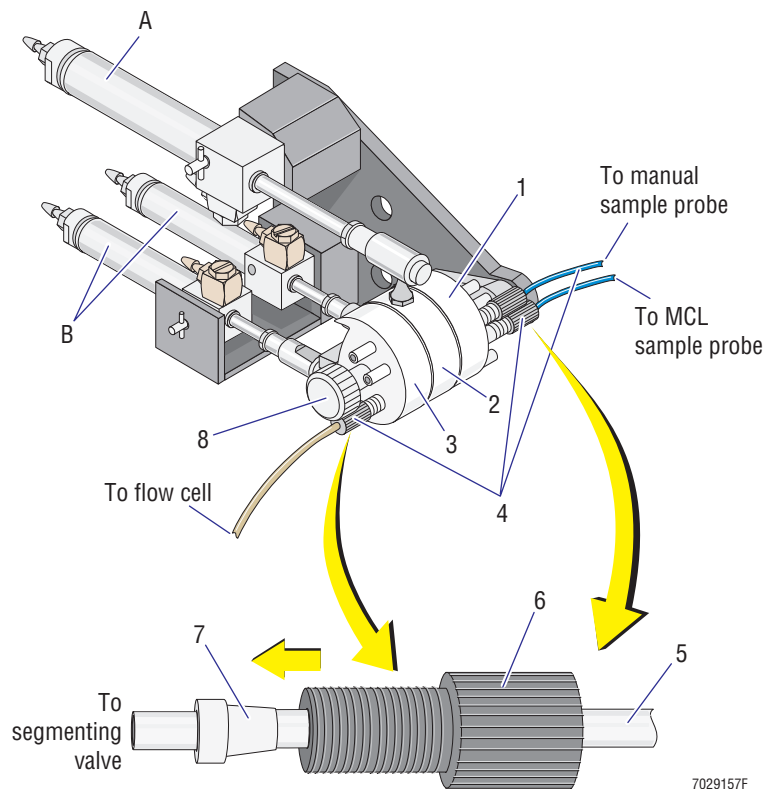


Figure Reference

- A** Air cylinder and related hardware for segmenting valve middle pad, [Figure 8.2-26](#)
- B** Air cylinder and related hardware for segmenting valve front and rear pads, [Figure 8.2-27](#)

Table 8.2-34 Segmenting Valve Assembly (See [Figure 8.2-34](#))

Item	Part Number	Description
	7000370	FRU, segmenting valve assembly
1	7000195	FRU, segmenting valve rear pad
2	7000191	FRU, segmenting valve middle pad
3	7000196	FRU, segmenting valve front pad
4	6912941	Kit, Sample/MCL Intro Line
5	1021636	Tubing, PEEK, manual sample intro line, 14 in. 0.010 i.d. x 0.026 wall, blue
	1021654	Tubing, PEEK, MCL sample intro line, 15 in. 0.010 i.d. x 0.026 wall, blue
	1022073	Tubing, PEEK, flow cell intro line, 3.75 in. 0.013 i.d. x 0.025 wall, tan
6	6232526	Fitting, ferrule nut, black, for 0.062 o.d. tubing
7	6232525	Fitting, ferrule, natural, for 0.062 o.d. tubing
8	7000198	FRU, segmenting valve knob

Figure 8.2-35 Air Cylinder and Related Hardware for Segmenting Valve Middle Pad (See [Table 8.2-35](#))

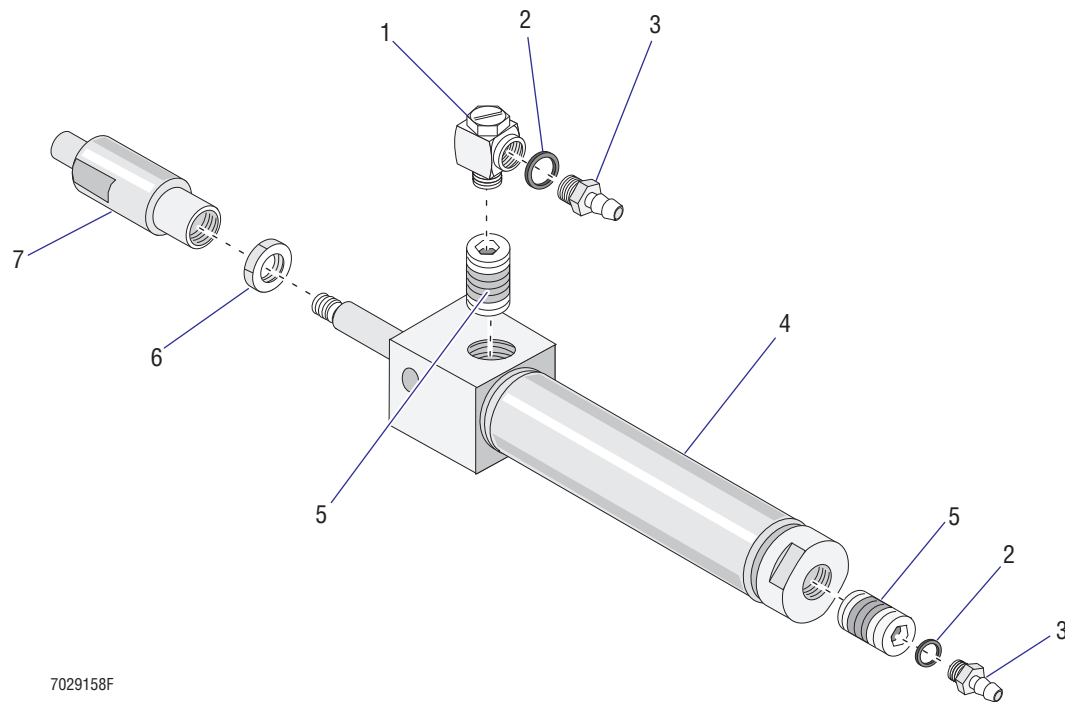
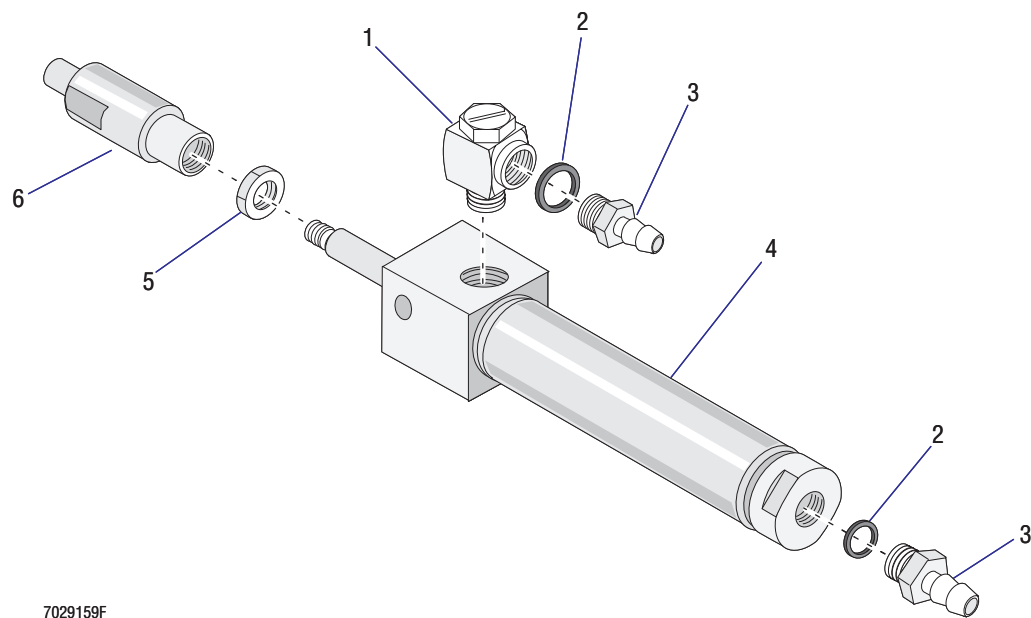


Table 8.2-35 Air Cylinder and Related Hardware for Segmenting Valve Middle Pad (See [Figure 8.2-35](#))

Item	Part Number	Description
1	6216002	Fitting, miniature, 10-32 threaded, 10-32 tap, adjustable, brass
2	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
3	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded
4	6232723	Cylinder, double-acting air, 0.75 bore, rotating rod with 1.50 stroke
5	6232683	Fitting, miniature adapter, 10-32 tap in 0.125 MPT plug, nickel-plated brass
6	2822040	Nut, hex (#25-28 UNF x 0.437 AF x 0.140 in. thickness)
7	2523798	Socket joint, quick-disconnect with spring loaded sleeve, for 0.253-inch diameter ball stud, stainless steel

Figure 8.2-36 Air Cylinder and Related Hardware for Front and Rear Segmenting Valve Pads
(See [Table 8.2-36](#))



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Table 8.2-36 Air Cylinder and Related Hardware for Front and Rear Segmenting Valve Pads
(See [Figure 8.2-36](#))

Item	Part Number	Description
1	6216002	Fitting, miniature, 10-32 threaded, 10-32 tap, adjustable, brass
2	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
3	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded
4	6232574	Cylinder, air, double-acting, single-ended, front block mount, 0.63 bore, 1.50 stroke, 250 psi maximum pressure
5	2822016	Nut, hex (#10-32 UNF x 0.375 AF x 0.130 in. thickness)
6	2523743	Socket joint, quick-disconnect with spring loaded sleeve, for 0.253 in. diameter ball stud, stainless steel

Figure 8.2-37 Lower Pneumatics Drawer (See [Table 8.2-37](#))

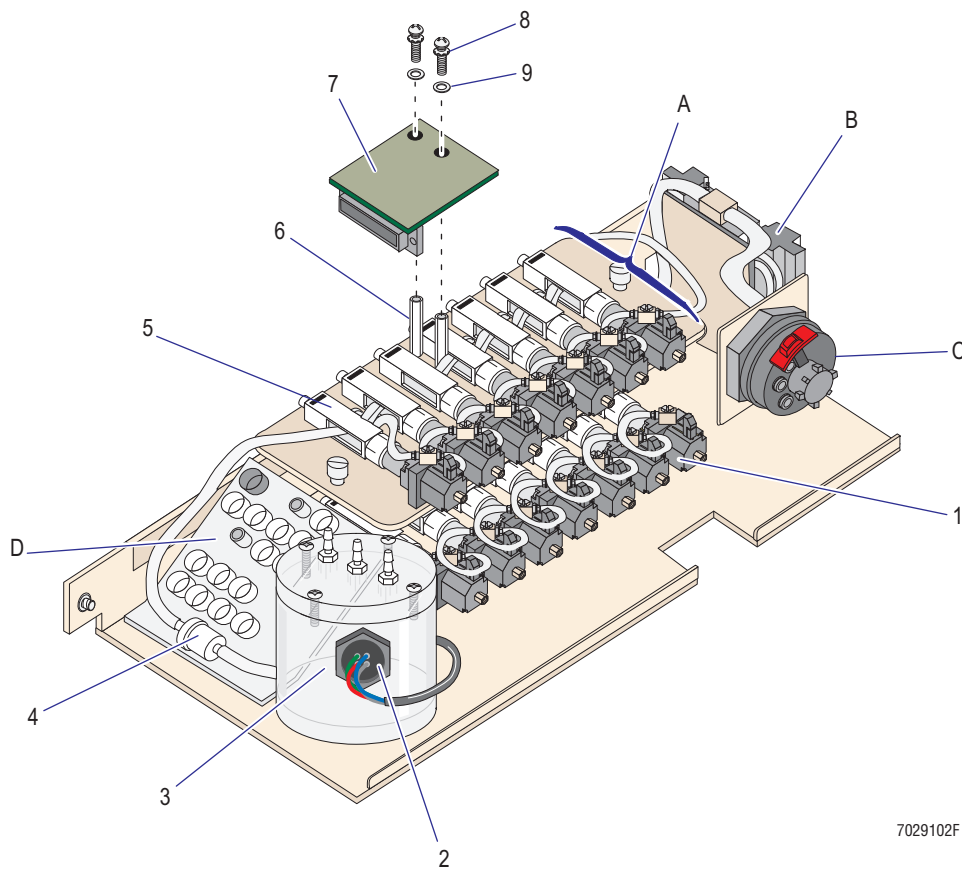


Figure Reference

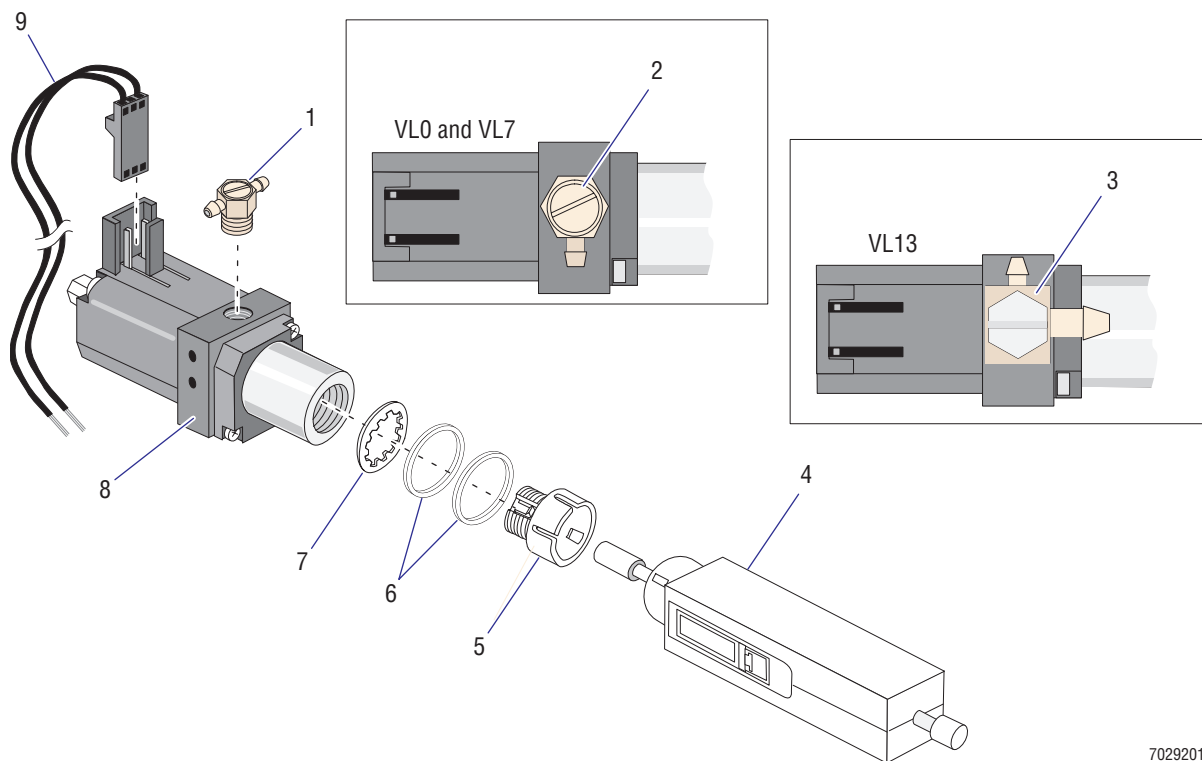
- A** Pinch valve and associated components, [Figure 8.2-38](#)
- B** Solenoid manifold, [Figure 8.2-39](#)
- C** QD10 and QD11 (coupling and fittings), [Figure 8.2-40](#)
- D** Quick-disconnect fittings and brackets, [Figure 8.2-41](#)

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Table 8.2-37 Lower Pneumatics Drawer (See Figure 8.2-37)

Item	Part Number	Description
	7000374	FRU, lower pneumatics drawer assembly
1	6232492	Valve, electro-pneumatic, solenoid and pilot actuator combination valve, 24 Vdc / 30 psi, 4.5 lb pinch force, see Figure 8.2-38 for an exploded view that includes related components Note: Attach using two self-lock screws (#6-32 x 0.37 in. length, pan-head), PN 2839039.
2	6028599	Sensor, waste chamber, with undercut O-ring groove
	2512031	O-ring, silicone seal, 0.364 i.d. x 0.070 width (not shown) Note: Replace the original rubber gasket with O-ring seal, PN 2512031. Discard the original rubber gasket.
3	7000373	FRU, vacuum chamber Note: Attach using two self-lock screws (#6-32 x 0.37 in. length, pan-head), PN 2839039.
4	6214106	Valve, check, 0.156 i.d. to 0.156 i.d. tubing
5	6855763	Valve, pull-apart pinch, double-action, white, standard, see Figure 8.2-38 for an exploded view that includes related components
6	2851363	Spacer, tapped, 6-32 x 1.625 in. length x 0.250 in. hex, aluminum
7	6705761	Card, Solenoid Power Distribution Note: 25 conductor flat ribbon cable assembly with subminiature D connector, PN 6028293, is connected to this circuit card.
8	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
9	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
Not shown	1005697	Fitting, hose-barb union, 0.062 i.d. to 0.062 i.d., metal feed-through fittings for attaching tubings (FF3 through FF16 on the inside bracket and FF18 through FF38 on the upper panel)

Figure 8.2-38 Pinch Valve and Associated Components, Lower Pneumatics Drawer (See [Table 8.2-38](#))

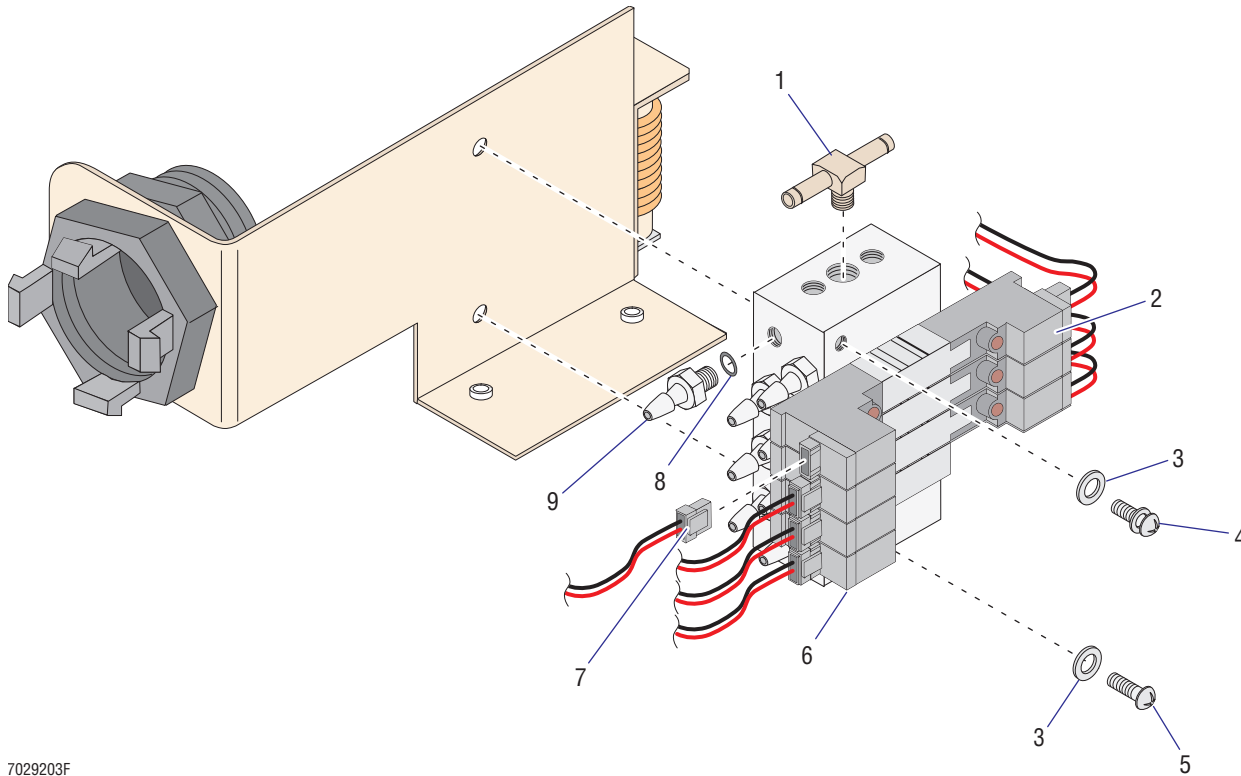


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Table 8.2-38 Pinch Valve and Associated Components, Lower Pneumatics Drawer (See [Figure 8.2-38](#))

Item	Part Number	Description
1	6232814	Fitting, T-connector, adjustable, 3/32 i.d. hose barb to 3/32 i.d. hose barb to 10-32 threaded, brass miniature
2	6232813	Fitting, elbow, adjustable, 3/32 i.d. hose barb to 10-32 threaded, brass miniature Note: Fitting must be oriented as shown after tightening.
3	6232819	Fitting, Y-connector, adjustable, hose barb, 0.190 o.d. to 0.120 o.d. to 10-32 threaded, brass miniature with stainless steel stud Note: Fitting must be oriented as shown after tightening.
4	6855763	Valve, pull-apart pinch, double-action, white, standard
5	1017501	Mount, pull-apart pinch valve
6	6216012	Spacer, cylinder, 0.500 i.d. x 0.562 o.d. x 0.062 thickness
7	2826030	Washer, I-tooth, #47, 0.47 i.d. x 0.60 o.d. x 0.020 thickness
8	6232492	Valve, electro-pneumatic, solenoid and pilot actuator combination valve, 24 Vdc / 30 psi, 4.5 lb pinch force Note: Attach using two self-lock screws (#6-32 x 0.37 in. length, pan-head), PN 2839039. Check alignment to ensure it is straight and is parallel to other assemblies before tightening the screws.
9	6028287	Cable, solenoid power, Clippard 3 position connector for solenoid with two 26 AWG (19/38) tinned copper conductor wires for circuit card connection

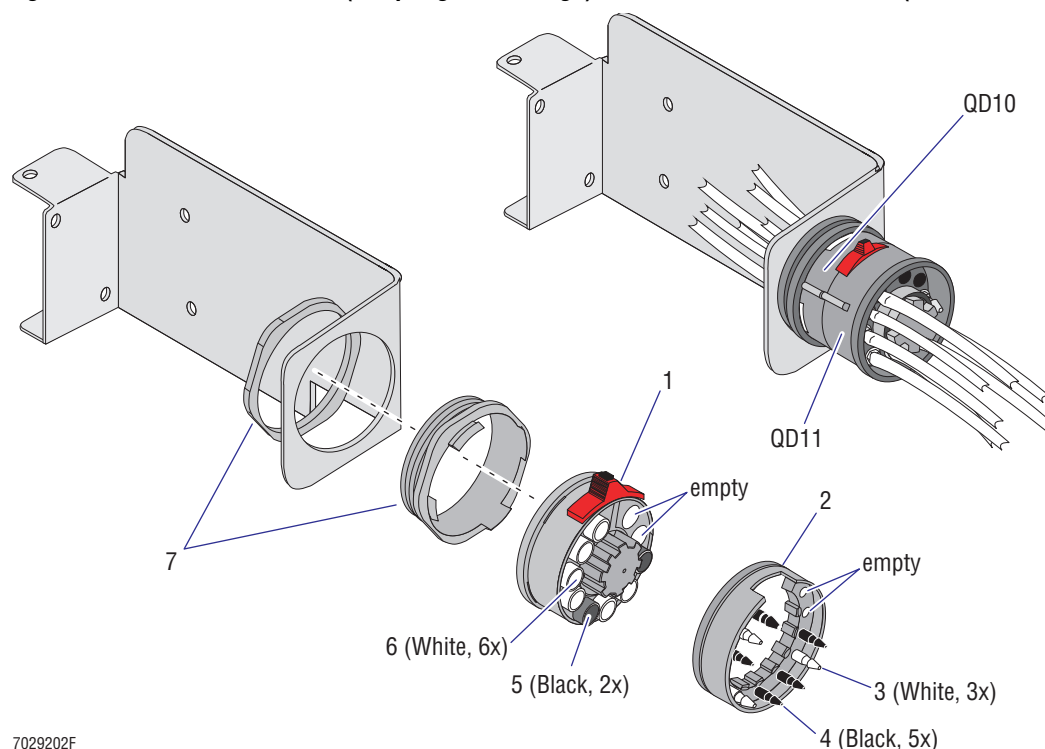
Figure 8.2-39 Solenoid Manifold, Lower Pneumatics Drawer (See Table 8.2-39)



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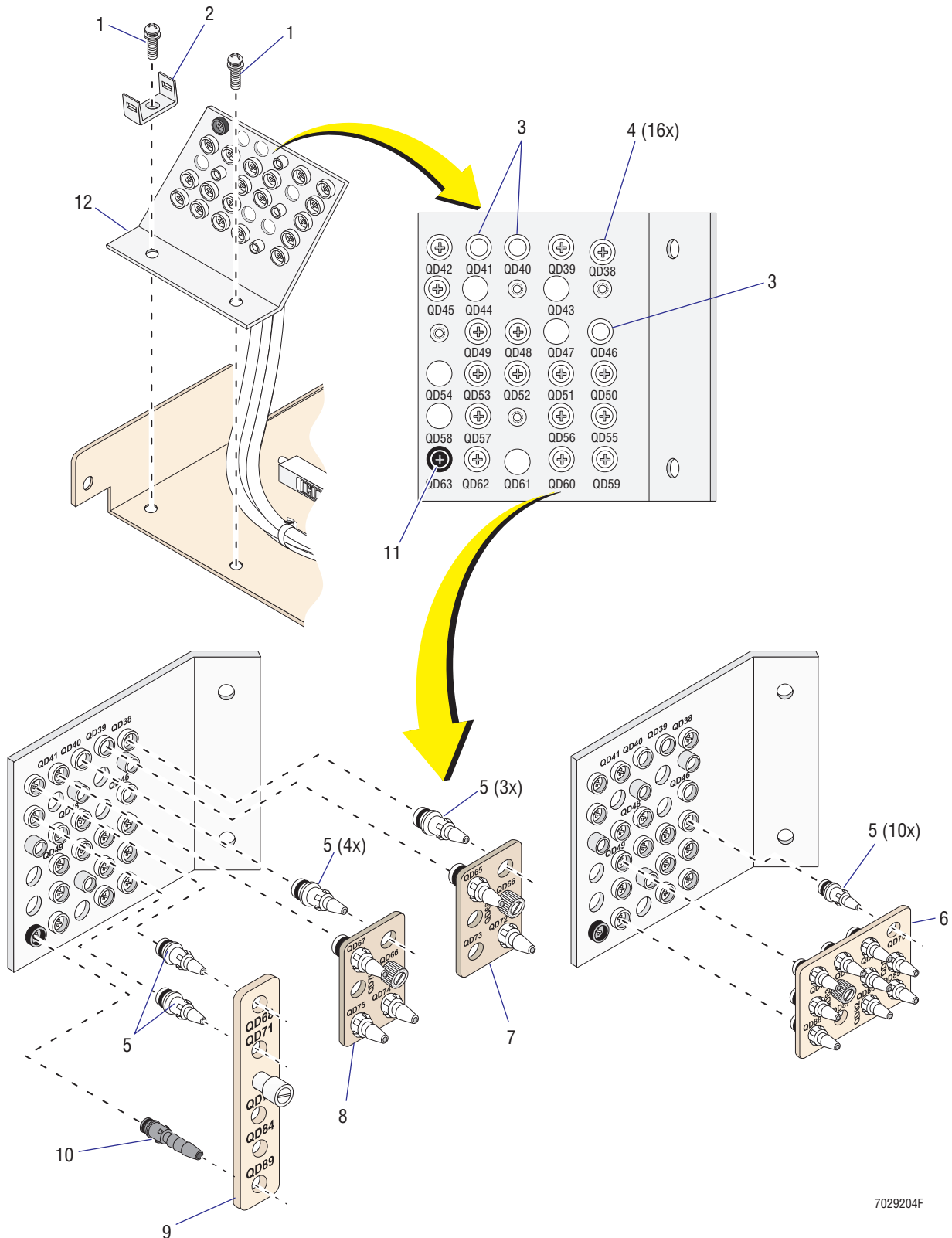
Table 8.2-39 Solenoid Manifold, Lower Pneumatics Drawer (See Figure 8.2-39)

Item	Part Number	Description
	6232587	Assembly, solenoid valve, pressure relief valves and manifold
1	6216129	Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to threaded, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
2	6232393	Valve, double solenoid, pilot-actuated latching two-position five-port spool valve, 24 Vdc, operating pressure 14 to 100 psi
3	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
4	2839074	Screw, self-lock (#6-32 x 1.12 in. length, pan-head)
5	2806096	Screw, machine (#6-32 x 1.25 in. length, pan-head)
6	6232376	Valve, single solenoid, pilot-actuated two-position five-port spool valve, 24 Vdc, operating pressure 20 to 100 psi
7	6028130	Cable, solenoid power, 2 position connector for solenoid with two 60 in. 22 AWG conductor wires for circuit card connection
8	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
9	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded

Figure 8.2-40 QD10 and QD11 (Coupling and Fittings), Lower Pneumatics Drawer (See Table 8.2-40)**Table 8.2-40 QD10 and QD11 (Coupling and Fittings), Lower Pneumatics Drawer (See Figure 8.2-40)**

Item	Part Number	Description
1	6232532	Coupling, quick-disconnect QD10, male body, 10 tube capacity body (includes the 8 fittings shown in Figure 8.2-40)
2	6232531	Coupling, quick-disconnect QD11, female body, 10 tube capacity body (includes the 8 fittings shown in Figure 8.2-40)
3	6232588	Fitting, insert, white female quick-connect, internal connector to 0.082 i.d. hose barb (inserted 3 places in QD11, PN 6232531)
4	6232469	Fitting, insert, black female quick-connect, internal connector to 0.125 i.d. hose barb (inserted 5 places in QD11, PN 6232531)
5	6232468	Fitting, insert, black male quick-connect, internal connector to 0.125 i.d. hose barb (inserted 2 places in QD10, PN 6232532)
6	6232581	Fitting, insert, white male quick-connect, internal connector to 0.082 i.d. hose barb (inserted in 6 places in QD10, PN 6232532)
7	6232530	Coupling, quick-connect, panel-mount adapter and nut assembly for attaching 10 tube quick-disconnect couplings to a panel, black

Figure 8.2-41 Quick-Disconnect Fittings and Brackets, Lower Pneumatics Drawer (See [Table 8.2-41](#))

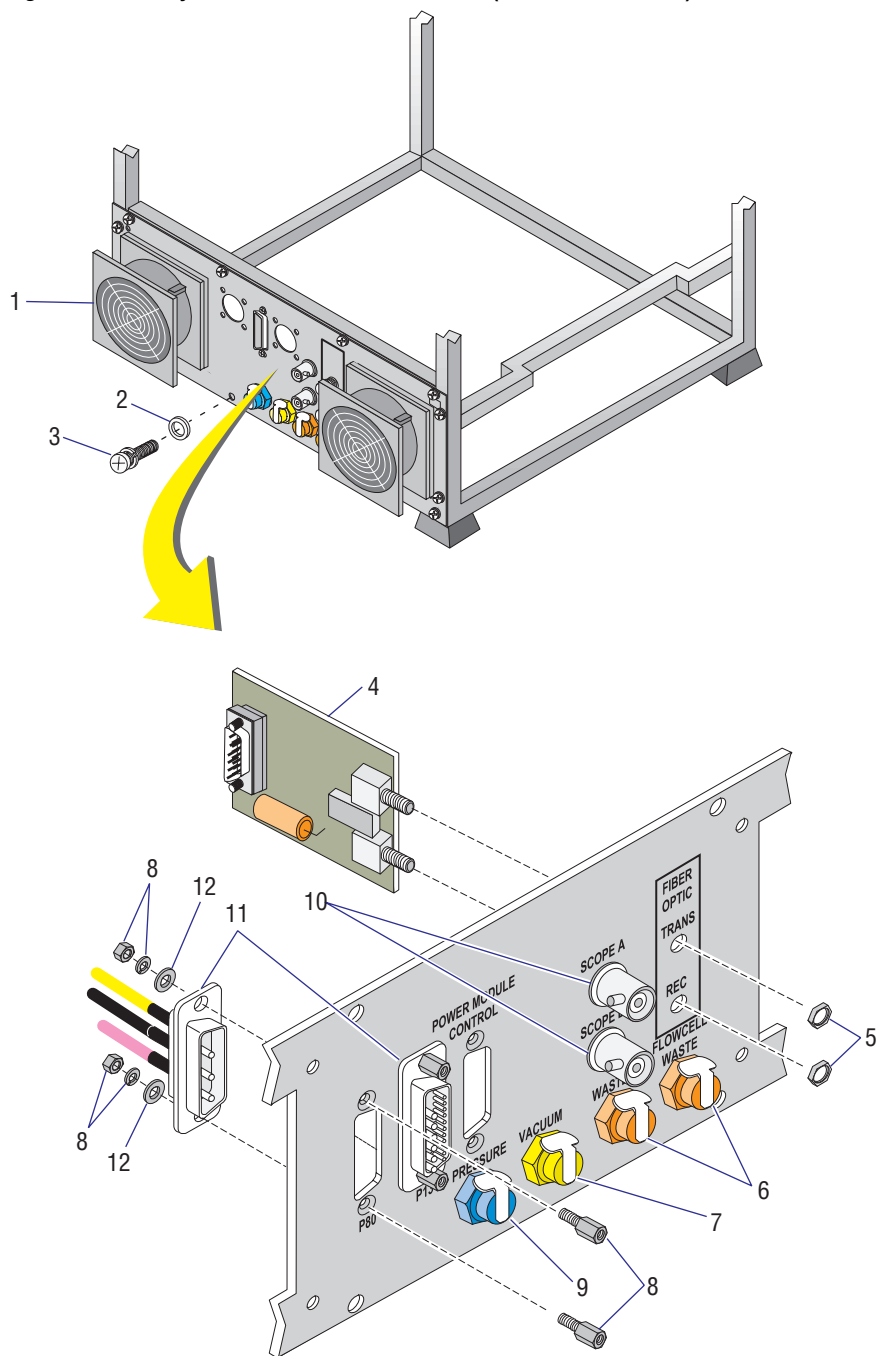


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Table 8.2-41 Quick-Disconnect Fittings and Brackets, Lower Pneumatics Drawer (See [Figure 8.2-41](#))

Item	Part Number	Description
1	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
2	6011019	Mount, wire tie, 0.51 in. length x 0.33 in. width, for use with #6 screw
3	6232799	Fitting, insert, white female quick-connect, internal connector to 0.094 i.d. hose barb (inserted three places in the 45° angled bracket, PN 6805879)
4	6232588	Fitting, insert, white female quick-connect, internal connector to 0.093 i.d. hose barb with shutoff valve (inserted 16 places in the 45° angled bracket, PN 6805879)
5	6232581	Fitting, insert, white male quick-connect, internal connector to 0.082 i.d. hose barb (couples with PN 6232588 or PN 6232799)
6	6858589	Plate, 12 insert fitting, with captive knurl knob
7	6858591	Plate, 6 insert fitting, with captive knurl knob, for QD64, QD65 and QD72 connections
8	6858592	Plate, 6 insert fitting, with captive knurl knob, for QD66, QD67, QD74, and QD75 connections
9	6858590	Plate, 5 insert fitting, with captive knurl knob, used only on XL with MCL option installed, for QD68, QD71, and QD89 connections
10	6232468	Fitting, insert, black male quick-connect, externally sealed tube fitting insert (couples with PN 6232469)
11	6232469	Fitting, insert, black female quick-connect, internal connector to 0.125 i.d. hose barb (inserted one place in the 45° angled bracket, PN 6805879)
12	6805879	Bracket, 45° angled, used to secure fitting inserts

Figure 8.2-42 Cytometer Rear Panel, Lower (See [Table 8.2-42](#))



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Table 8.2-42 Cytometer Rear Panel, Lower (See Figure 8.2-42)

Item	Part Number	Description
1	2603025	Fan, box, 106 CFM, 24 Vdc (4.68 square x 1.5 thickness) Note: To ensure proper cable length, verify fan orientation before attaching the fan to the Cytometer frame. <ul style="list-style-type: none">• Cable for B1 (fan near the MCL side of the unit) must be oriented center to top as seen in the “fan to shock mount” illustration in Figure 8.2-43.• Cable for B2 (fan near the HeNe laser head extension) must be oriented left of center as seen in the “filter assembly to fan” illustration in Figure 8.2-43.
2	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
3	2839039	Screw, self-lock (#6-32 x 0.37 in. length, pan-head)
4	6705324	Card, Fiber Optic Interface Note: Uses fiber interface cable, PN 6028650 (9-position, D-receptacle to plug, 55-in. long).
5	2851995	Nut, hex (0.25-36 UNS x 0.375 AF x 0.094 in. thickness)
6	6232304	Quick-connect, panel mount, orange body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with orange insert, PN 6232305, also with automatic shut-off) Note: Insert a #50 I-tooth washer, PN 2826042, between the panel and the hex nut.
7	6232303	Quick-connect, panel mount, yellow body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with yellow insert, PN 6232307, also with automatic shut-off) Note: Insert a #50 I-tooth washer, PN 2826042, between the panel and the hex nut.
8	2104261	Screwlock, female assembly kit for attaching a D-type connector
9	6232309	Quick-connect, panel mount, blue body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with blue insert, PN 6232306, also with automatic shut-off) Note: Insert a #50 I-tooth washer, PN 2826042, between the panel and the hex nut.
10	2121644	Connector, BNC coaxial, panel mount, jack-to-jack adapter
11	6028700	Cable, CYTO dc power EMI harness
12	2827146	Washer, flat, #4 (0.125 i.d. x 0.250 o.d. x 0.036 thickness)

Figure 8.2-43 Fan Assembly, Cytometer Rear Panel (See [Table 8.2-43](#))

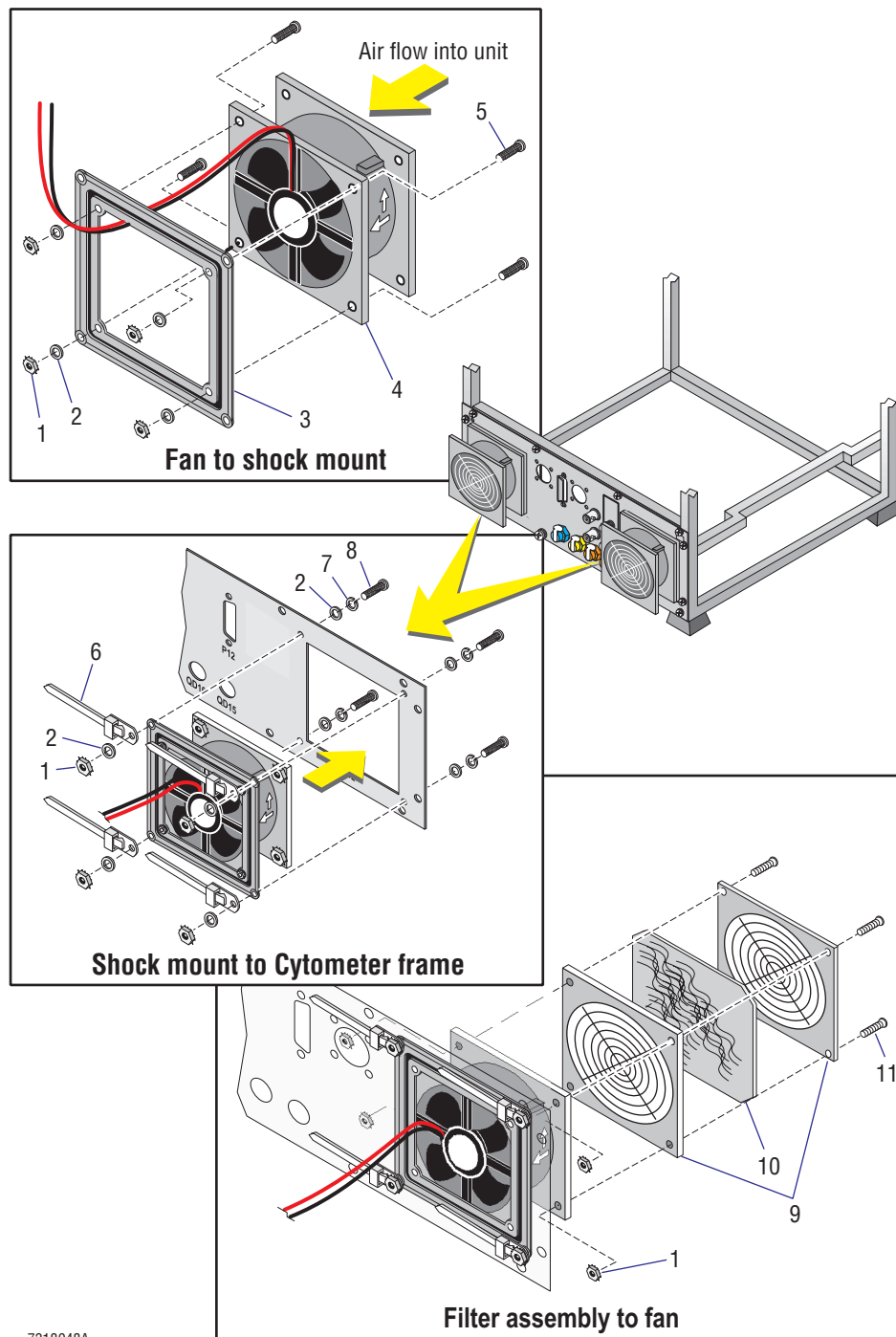
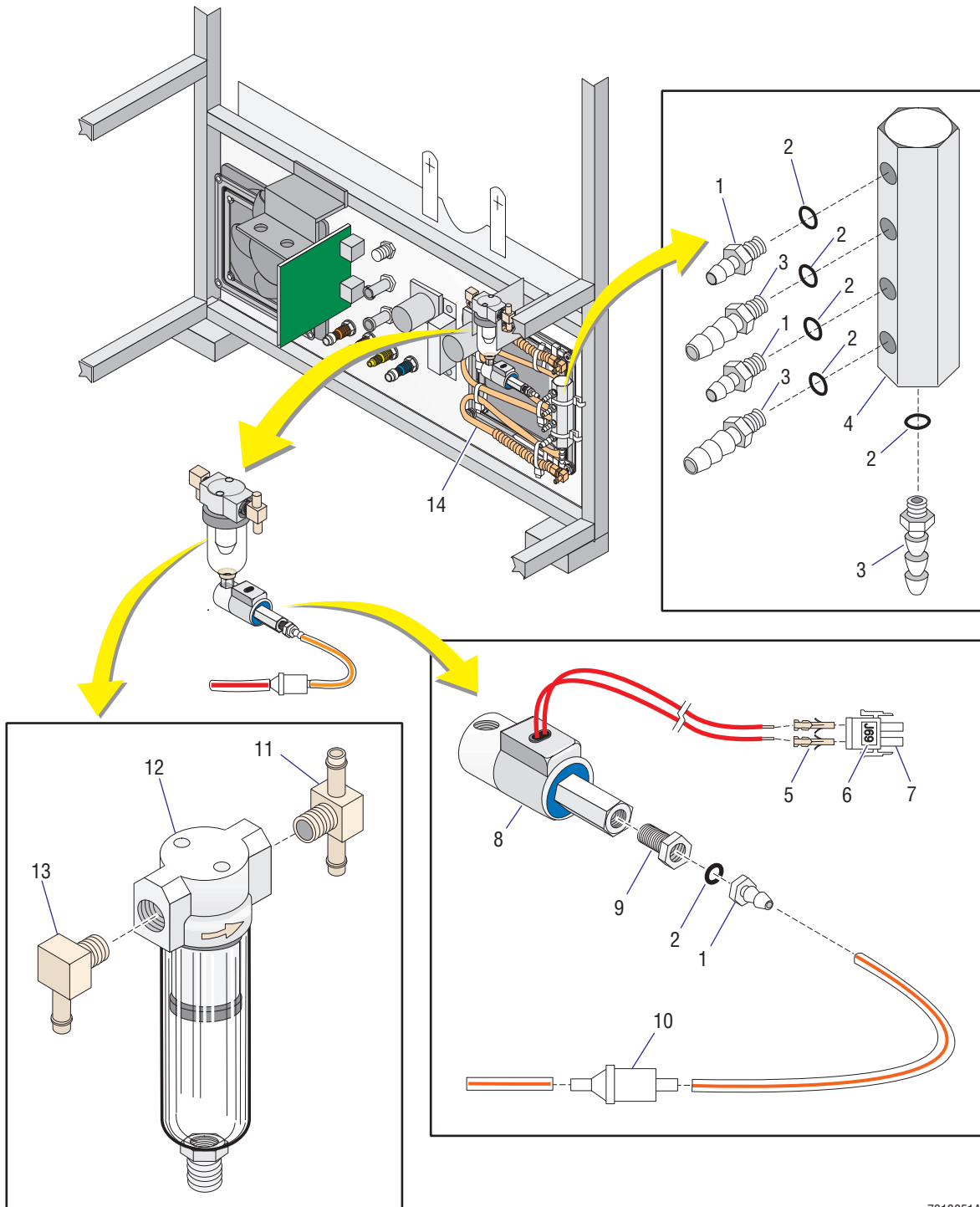


Table 8.2-43 Fan Assembly, Cytometer Rear Panel (See Figure 8.2-43)

Item	Part Number	Description
1	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
2	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
3	2603053	Fan, shock mount, for 4-inch fan, black
4	2603025	<p>Fan, box, 106 CFM, 24 Vdc (4.68 square x 1.5 thickness)</p> <p>Note: To ensure proper cable length, verify fan orientation before attaching the fan to the Cytometer frame.</p> <ul style="list-style-type: none"> • Cable for B1 (fan near the MCL side of the unit) must be oriented center to top as seen in the “fan to shock mount” illustration in Figure 8.2-43. • Cable for B2 (fan near the HeNe laser head extension) must be oriented left of center as seen in the “filter assembly to fan” illustration in Figure 8.2-43.
5	2806075	Screw, machine (#6-32 x 0.62 in. length, pan-head)
6	6011006	Tie wrap, screw mount, #6 sizer, 7.4 in. long, 0.19 in wide
7	2826035	Washer, split-lock, #6 (0.14 i.d. x 0.25 o.d. x 0.03 in. thickness)
8	2806128	Screw, machine (#6-32 x 0.75 in. length, pan-head)
9	2603009	<p>Finger guard, grille for fan air filter on 4-inch box fan</p> <p>Note: Raised ribs should face out.</p>
10	2603010	Filter, air, 4-inch pad, 45 PPI
11	2806073	Screw, machine (#6-32 x 0.62 in. length, FL82 flat-head)

Figure 8.2-44 Cytometer Right Side Compartment (See [Table 8.2-44](#))

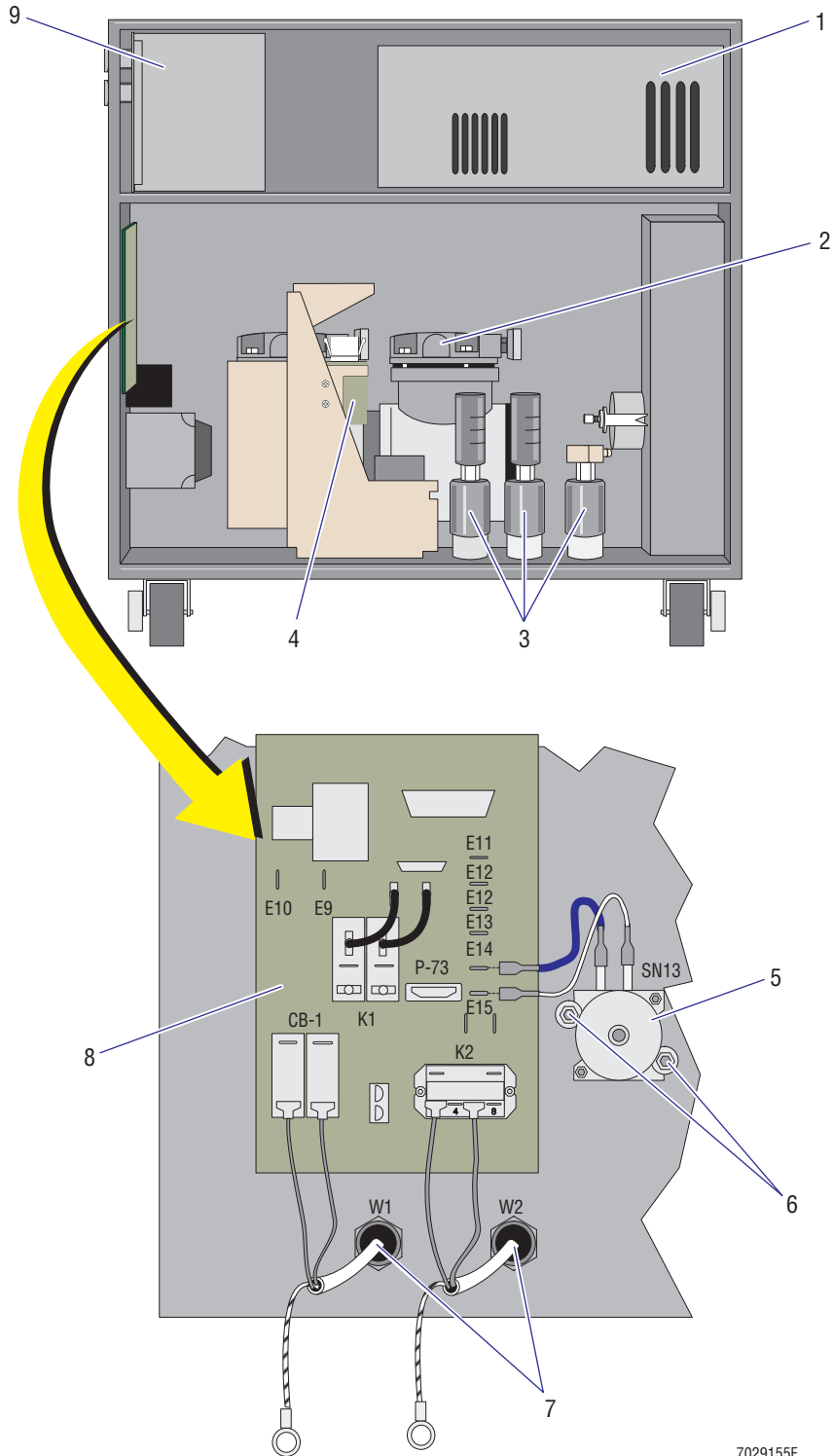


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Table 8.2-44 Cytometer Right Side Compartment (See Figure 8.2-44)

Item	Part Number	Description
1	6232086	Fitting, hose barb union, 0.062 i.d. to 10-32 threaded
2	2523062	O-ring, ethylene propylene seal, 0.187 i.d. x 0.050 wall
3	6232085	Fitting, hose barb union, 0.125 i.d. to 10-32 threaded
4	1018616	Manifold rear panel
5	2104365	Pin, universal mate-n-lock connector, 20-14 AWG, brass and gold
6	2427902	Label (J69)
7	2104356	Connector, universal mate-n-lock 2-pin plug, panel/cable mount
8	6214067	Solenoid, 2-way, normally-open (N.O.)
9	6216004	Fitting, hex-head adapter, 10-32 tap to 1/8 MPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion.
10	6214108	Valve, check, for 0.062 i.d. to 0.062 i.d. tubing
11	6216127	Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to 1/8 MPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
12	6232725	Filter, water trap (air/water filter separator), 5 micron Note: Apply a thin line of pipe sealant, PN 1601056, across threads before inserting the threads in the solenoid.
13	6216128	Fitting, elbow, hose barb, 0.187 i.d. to 1/8 MPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
14	6856551	Coil, cooling

Figure 8.2-45 Power Supply Module - Left Side with Cover Removed (See [Table 8.2-45](#))

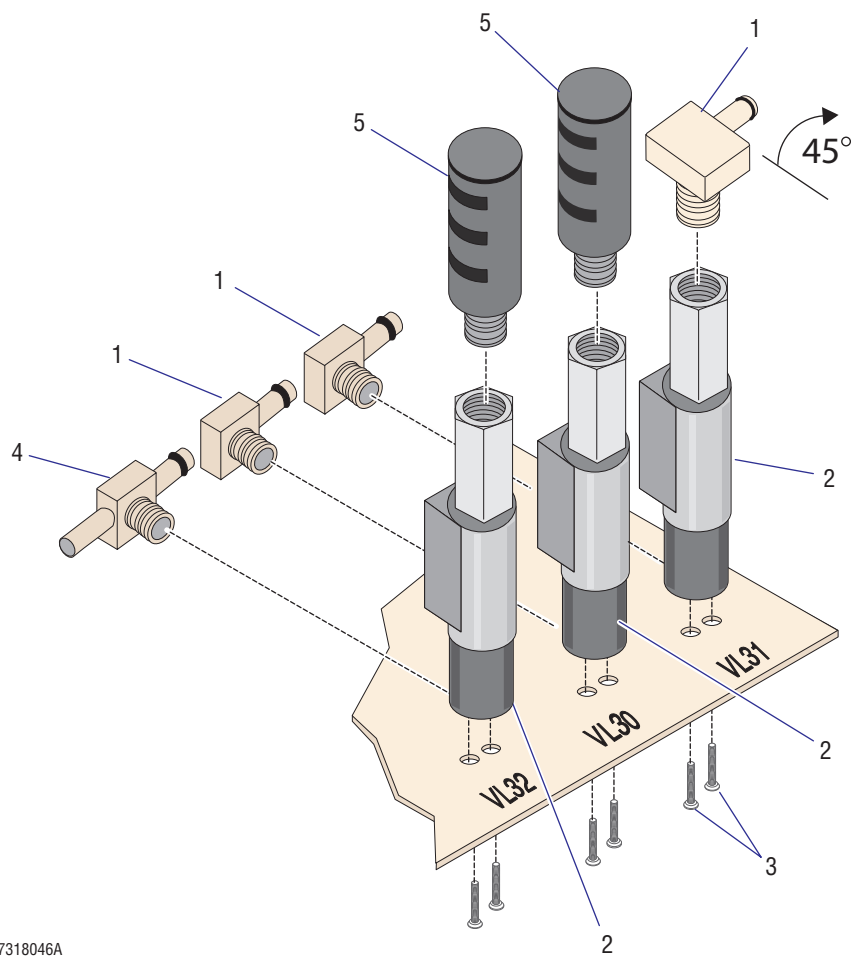


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Table 8.2-45 Power Supply Module - Left Side with Cover Removed (See Figure 8.2-45)

Item	Part Number	Description
1	7000431	Power supply, Argon air-cooled laser, switching, for 100 Vac system
	7000721	Power supply, Argon air-cooled laser, switching, for 115Vac system
	7000432	Power supply, Argon air-cooled laser, switching, for 220 or 240 Vac system
2	7000371	FRU, compressor assembly, dual-head, for 100/120 Vac system
	7000372	FRU, compressor assembly, dual-head, for 220/224 Vac system
3	6232368	Valve, dump, system pressure, for 100/120 Vac system, see Figure 8.2-46 for an exploded view that includes attachments
	6232367	Valve, dump, system pressure, for 220/240 Vac system, see Figure 8.2-46 for an exploded view that includes attachments
4	6706401	Card, Transient Absorber EMC (also referred to as Transient Voltage Suppressor 2 card)
5	5120230	Switch, vacuum/pressure; waste pressure, normally open, single pole single throw, 3-in. water Note: Must be installed with contacts up so that wires can be connected as shown in Figure 8.2-45. The blue wire from E14 on the Power Module Control card is attached to SN13's left contact and the white wire (from E15) is attached to SN13's right contact.
6	2821009	Nut, self-lock (#4-40 x 0.250 AF x 0.109 in. thickness)
7	6028530	Line cord, 125 Vac / 15 A, shielded, 14 AWG stranded, NEMA 5-15 plug to a stripped end, 9-ft. 10-in. length including connector Note: Strain relief set for one line cord, PN 6027766.
8	6705231	Card, Power Module Control, for instruments with a serial number Z09062 or lower
	6706390	Card, Power Module Control II, EMC version, for instruments with a serial number Z09063 or higher
9	6705442	Card, Voltage Selector, for 100 Vac system
	6705237	Card, Voltage Selector, for 120 Vac system
	6705470	Card, Voltage Selector, for 220 Vac system
	6705472	Card, Voltage Selector, for 230/240 Vac system

Figure 8.2-46 VL32, VL30, and VL31 - Exploded View (See Table 8.2-46)



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Table 8.2-46 VL32, VL30, and VL31 - Exploded View (See Figure 8.2-46)

Item	Part Number	Description
1	6216128	Fitting, elbow, hose barb, 0.187 i.d. to 1/8 MPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
2	6232368 6232367	Valve, dump, system pressure, for 100/120 Vac system Valve, dump, system pressure, for 220/240 Vac system
3	2808080	Screw, machine (#8-32 x 0.25 in. length, UF82-head)
4	6216127	Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to 1/8 MPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
5	6232501	Muffler, noise reducing pneumatic, 0.125 MNPT, 0.812 diameter, 2.125 length Note: Hand tighten only.

Figure 8.2-47 Power Supply Module - Front Panel Components (See [Table 8.2-47](#))

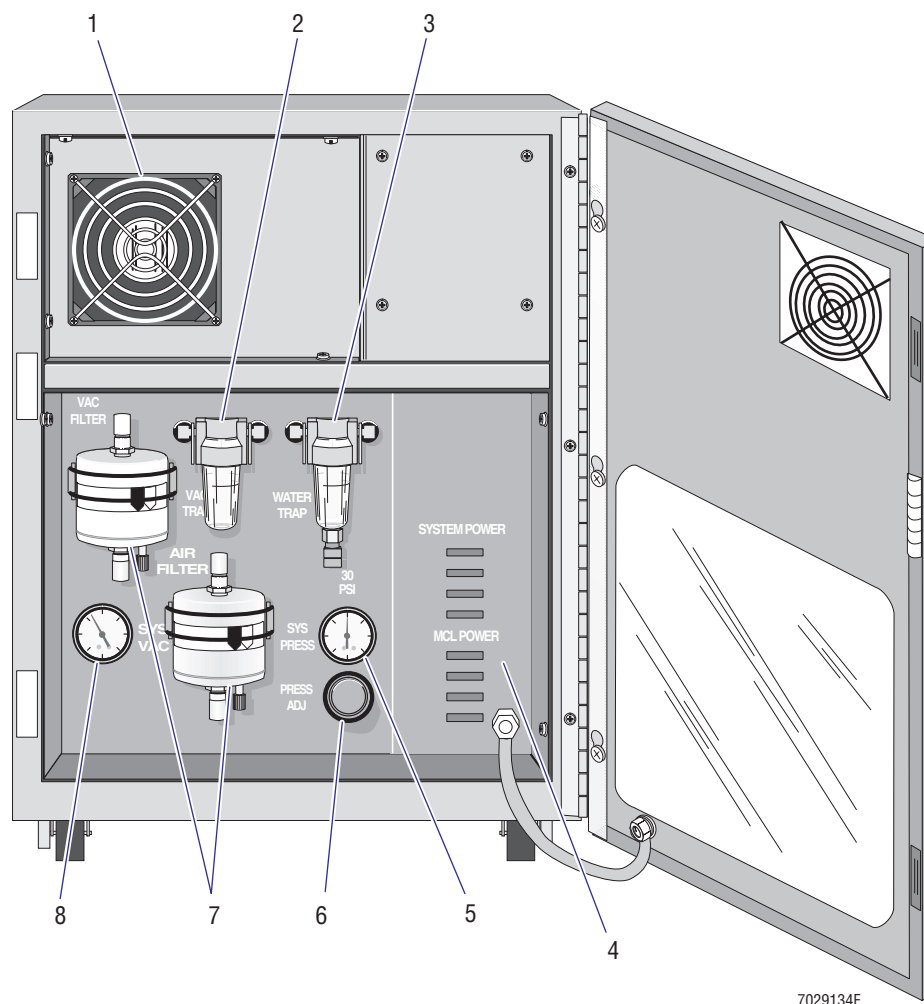


Table 8.2-47 Power Supply Module - Front Panel Components (See [Figure 8.2-47](#))

Item	Part Number	Description
1	2603058	Fan, box, 90 CFM, 24 Vdc, 4.69 square x 1.0 in. thickness
2	6232724	Trap, vacuum, with miniature polycarbonate bowl, see Figure 8.2-48 for an exploded view that includes attachments
3	6232725	Filter, water trap (air/water filter separator), 5 micron, see Figure 8.2-49 for an exploded view that includes attachments
4	6705720	Card, Voltage Supply Monitor, see Figure 8.2-50 for an exploded view that includes attachments
5	6232189	Gauge, 0 to 60 psi, for monitoring system pressure, panel mount, see Figure 8.2-51 for an exploded view that includes attachments
6	6208005	Valve, pressure relief, see Figure 8.2-52 for an exploded view that includes attachments
7	6232561	Filter, gas, hydrophobic, 0.2 micron, disposable plastic, see Figure 8.2-53 for an exploded view that includes attachments
8	6232183	Gauge, 0 to 30 in. Hg, for monitoring system vacuum, panel mount, see Figure 8.2-54 for an exploded view that includes attachments

Figure 8.2-48 Vacuum Trap and Related Components (See Table 8.2-48)

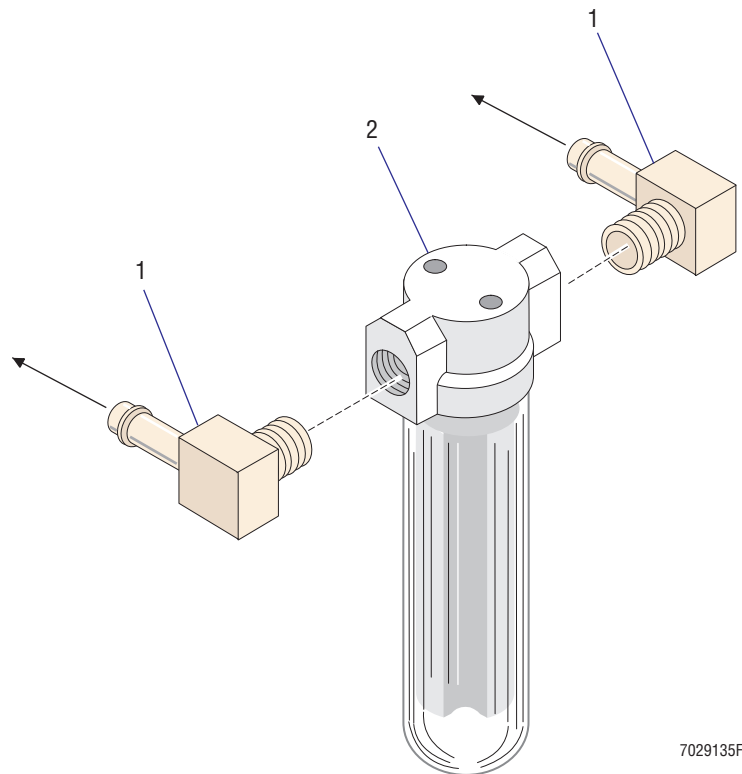


Table 8.2-48 Vacuum Trap and Related Components (See Figure 8.2-48)

Item	Part Number	Description
1	6216128	Fitting, hose barb, elbow, 0.187 i.d. to 1/8 MNPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
2	6232724	Trap, vacuum, with miniature polycarbonate bowl

Figure 8.2-49 Water Trap (Air/Water Filter Separator) and Related Components (See Table 8.2-49)

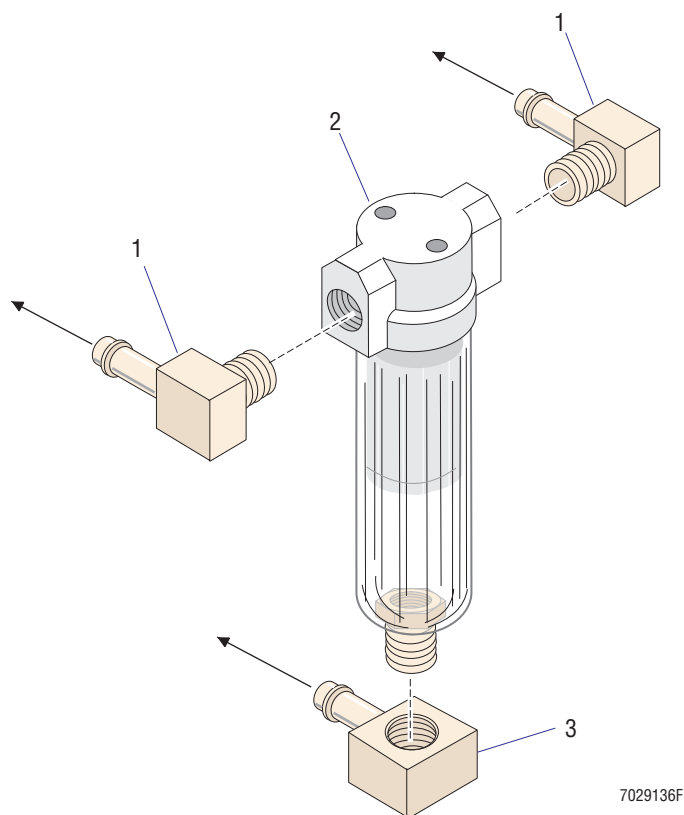


Table 8.2-49 Water Trap (Air/Water Filter Separator) and Related Components (See Figure 8.2-49)

Item	Part Number	Description
1	6216128	Fitting, hose barb, elbow, 0.187 i.d. to 1/8 MNPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
2	6232725	Filter, water trap (air/water filter separator), 5 micron Note: Apply a thin line of pipe sealant, PN 1601056, across lower threads before attaching the bottom fitting, PN 6232214.
3	6232214	Fitting, hose barb, elbow, 0.187 i.d. to 1/8 FPT, nickel-plated brass Note: Apply a thin line of pipe sealant, PN 1601056, across lower threads of the water trap filter, PN 6232725, before attaching the fitting. Fitting must be oriented as shown after tightening.

Figure 8.2-50 Front Panel including Voltage Supply Monitor Card and Hardware (See [Table 8.2-50](#))

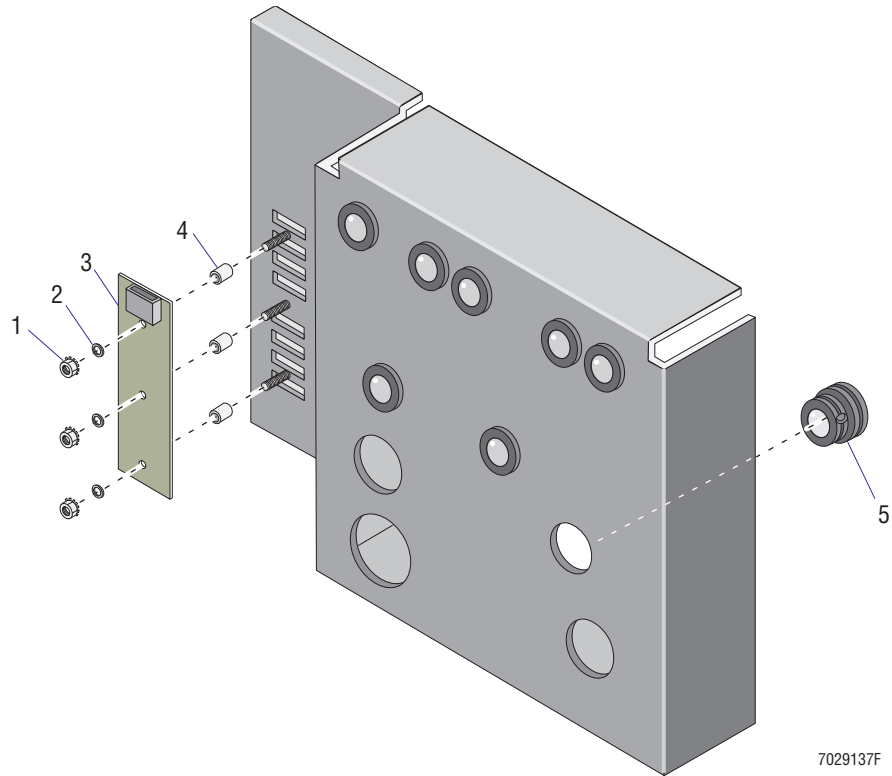
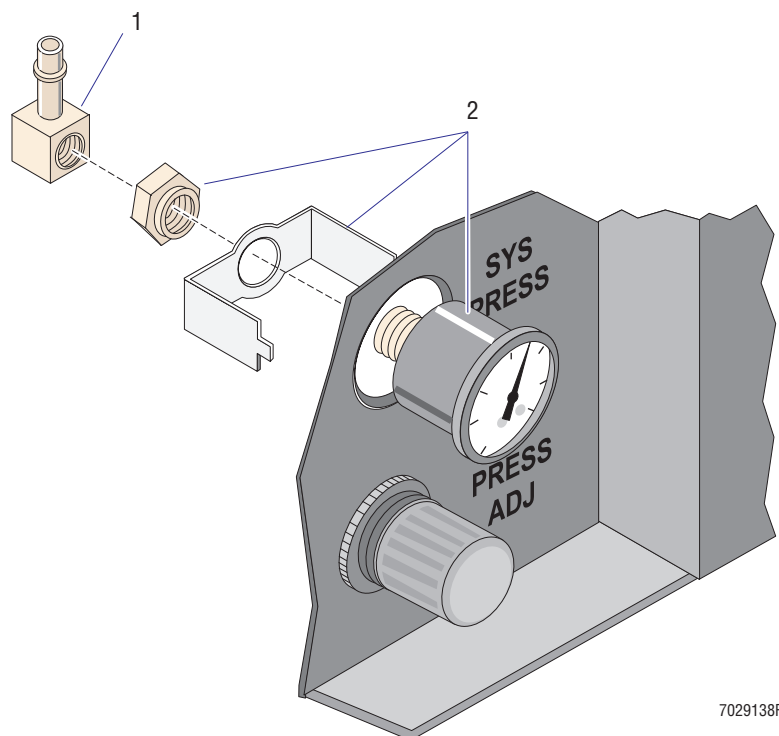


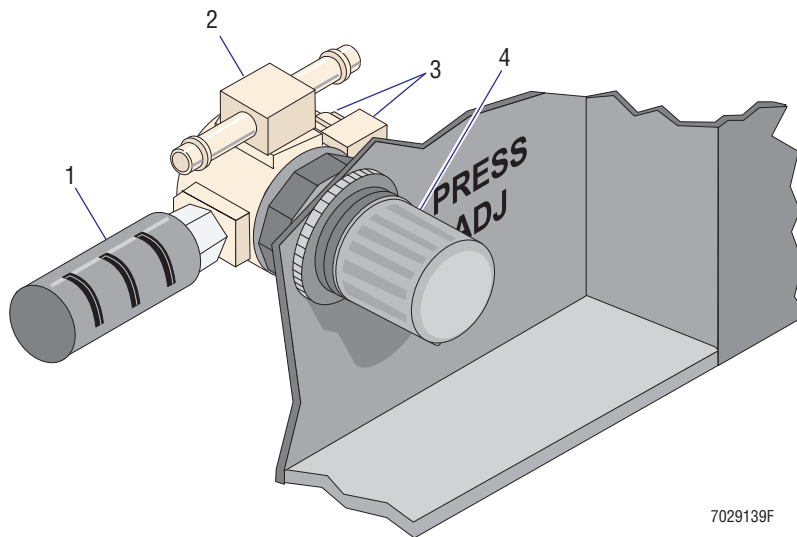
Table 8.2-50 Front Panel including Voltage Supply Monitor Card and Hardware (See [Figure 8.2-50](#))

Item	Part Number	Description
1	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
2	2827147	Washer, flat, #6 (0.156 i.d. x 0.312 o.d. x 0.036 in. thickness)
3	6705720	Card, Voltage Supply Monitor
4	2843032	Spacer, hole, 0.140 i.d. x 0.250 o.d. x 0.250 in. length
5	2851080	Grommet, 0.375 i.d. x 0.560 o.d., nylon

Figure 8.2-51 System Pressure Gauge and Related Components (See Table 8.2-51)**Table 8.2-51 System Pressure Gauge and Related Components (See Figure 8.2-51)**

Item	Part Number	Description
1	6232214	Fitting, hose barb, elbow, 0.187 i.d. to 1/8 FPT, nickel-plated brass Note: Fitting must be oriented as shown after tightening.
2	6232189	Gauge, 0 to 60 psi, for monitoring system pressure, 1.5-inch diameter, panel mount (includes panel mounting hardware) Note: Apply a thin line of pipe sealant, PN 1601056, across gauge threads before attaching the fitting. Gauge must be oriented as shown after tightening.

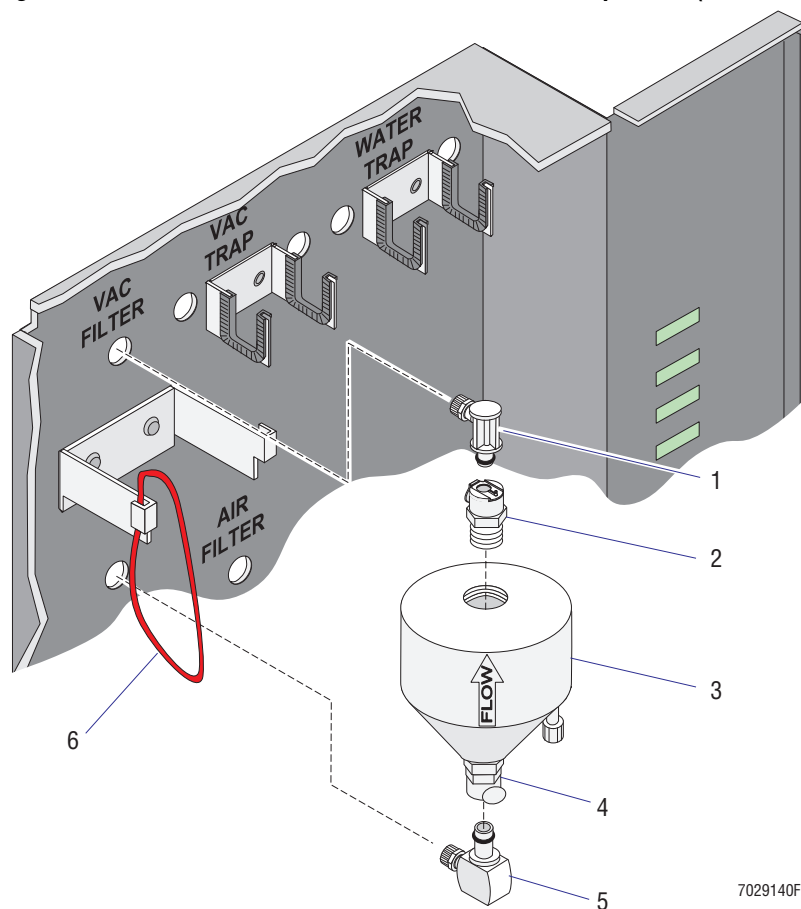
Figure 8.2-52 System Pressure Adjustment Knob and Related Components (See [Table 8.2-52](#))



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Table 8.2-52 System Pressure Adjustment Knob and Related Components (See [Figure 8.2-52](#))

Item	Part Number	Description
1	6232501	Muffler, noise reducing pneumatic, 0.125 MNPT, 0.812 diameter, 2.125 length
2	6216127	Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to 1/8 MNPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. Fitting must be oriented as shown after tightening.
3	6216027	Fitting, poly-flow, poly-flow, elbow, 0.250 o.d. to 1/8 MNPT, brass Note: Apply a thin line of pipe sealant, PN 1601056, across threads that will be screwed in the pressure relief valve. Fitting must be oriented as shown after tightening.
4	6208005	Valve, pressure relief (with plugs), 30 psi

Figure 8.2-53 Vacuum and Air Filters with Related Components (See Table 8.2-53)**Table 8.2-53 Vacuum and Air Filters with Related Components (See Figure 8.2-53)**

Item	Part Number	Description
1	6232702	Quick-connect, male, elbow, 0.250 o.d., white acetal delrin
2	6232703	Quick-connect, female, 0.125 flow, 0.375 MNPT, white acetal delrin, single connect
3	6232561	Filter, gas, hydrophobic, 0.2 micron, disposable plastic
4	6232700	Quick-connect, female, 0.250 flow, 0.375 MNPT, white acetal delrin, single connect
5	6232522	Quick-connect, male, external elbow, 0.375 o.d., white acetal delrin
6	2523451	O-ring, silicone, used as rubber band, 2.300 i.d. x 0.103 width

Figure 8.2-54 System Vacuum Gauge and Related Components (See Table 8.2-54)

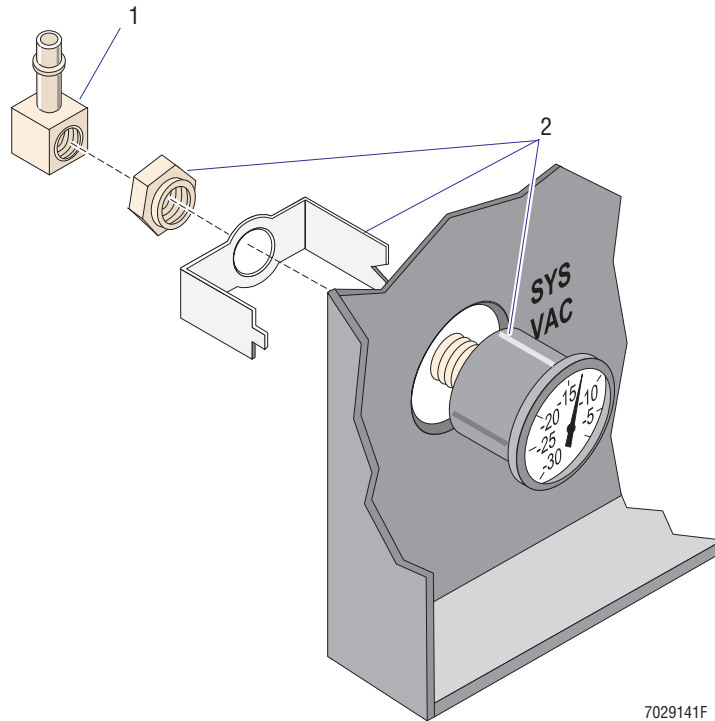


Table 8.2-54 System Vacuum Gauge and Related Components (See Figure 8.2-54)

Item	Part Number	Description
1	6232214	Fitting, hose barb, elbow, 0.187 i.d. to 1/8 FPT, nickel-plated brass Note: Fitting must be oriented as shown after tightening.
2	6232183	Gauge, 0 to 30 in. Hg, for monitoring system vacuum, 1.5-inch diameter, panel mount (includes panel mounting hardware) Note: Apply a thin line of pipe sealant, PN 1601056, across gauge threads before attaching the fitting. Gauge must be oriented as shown after tightening.

Figure 8.2-55 Power Supply Module - Right Side with Cover Removed (See Table 8.2-55)

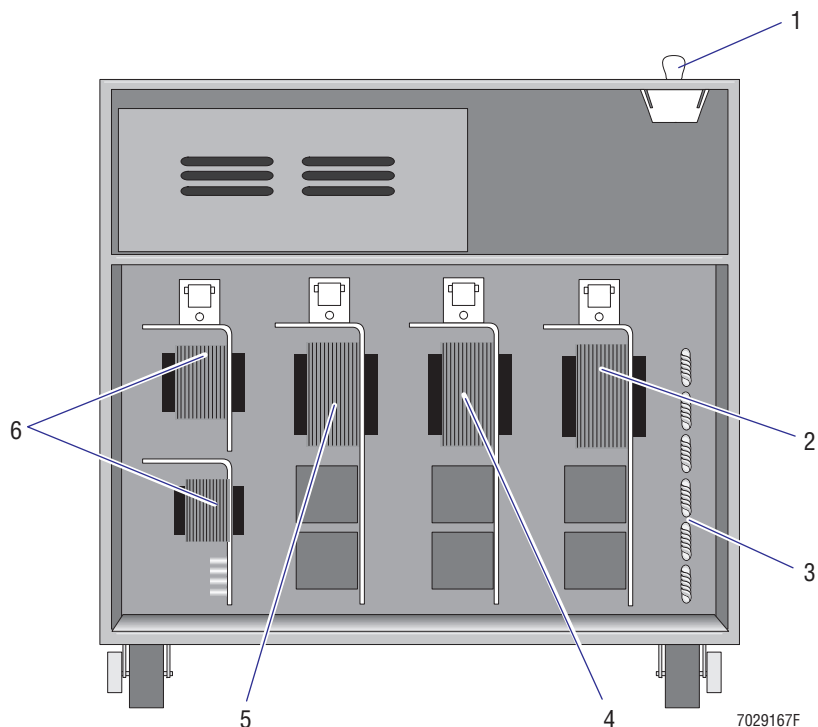
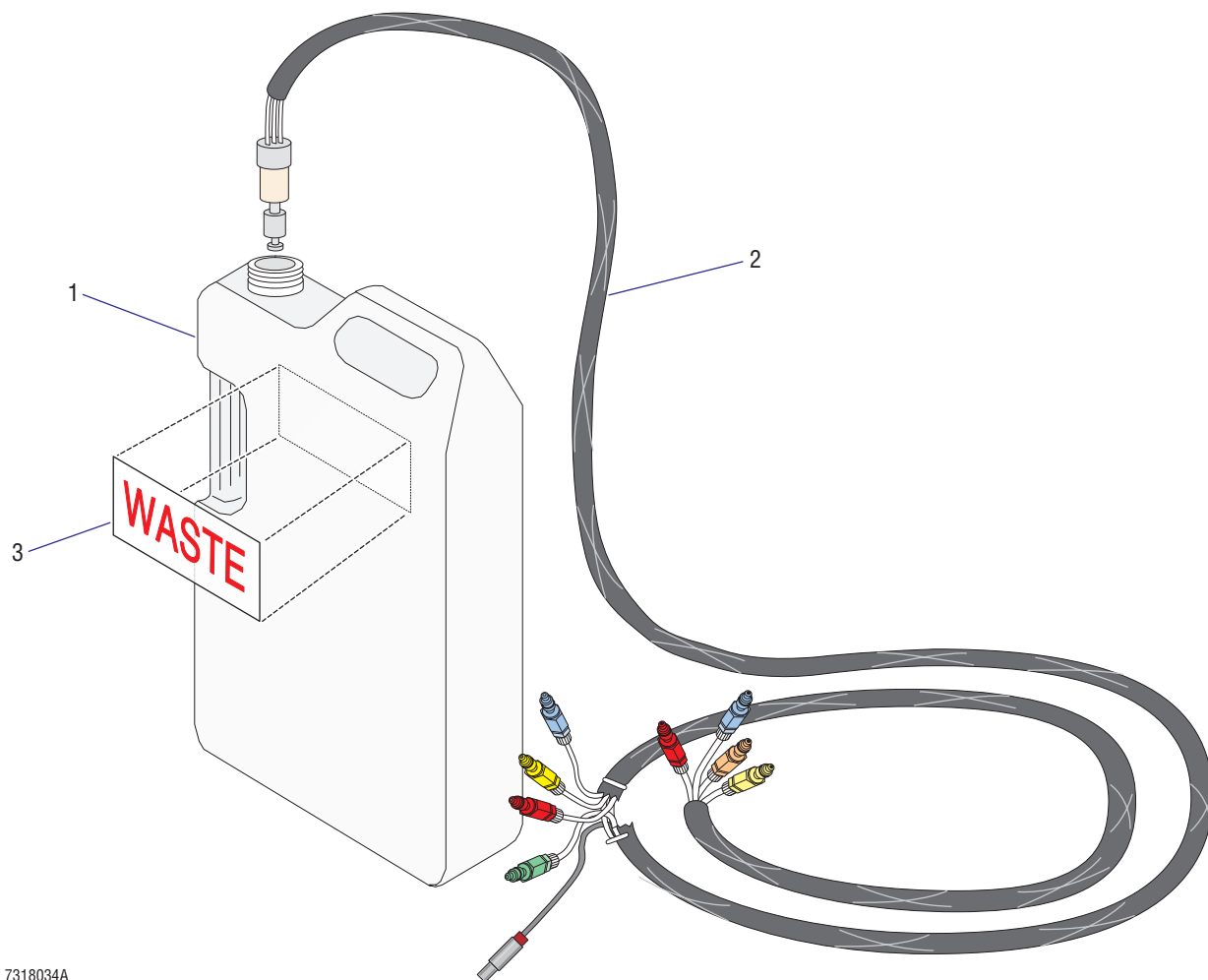


Table 8.2-55 Power Supply Module - Right Side with Cover Removed (See Figure 8.2-55)

Item	Part Number	Description
1	5110031	Interlock, high voltage (HV), snap action cheat switch
2	7000357	FRU, Power Supply, +24 Vdc
3	6856536	Coil, cooling
4	7000356	FRU, Power Supply, +5 Vdc
5	7000355	FRU, Power Supply, ± 15 Vdc
6	7000362	FRU, Power Supply, MCL, assembly consisting of a +5 Vdc and ± 12 Vdc supply and a +24 Vdc supply

Figure 8.2-56 Waste Container (See [Table 8.2-56](#))



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Table 8.2-56 Waste Container (See [Figure 8.2-56](#))

Item	Part Number	Description
1	2523697	Tank, waste, 1-gallon rectangular (also referred to as bottle)
2	6858159	Sensor assembly, waste level
3	2428039	Label, waste container

Figure 8.2-57 Power Supply Module - Rear Panel Components (See [Table 8.2-57](#))

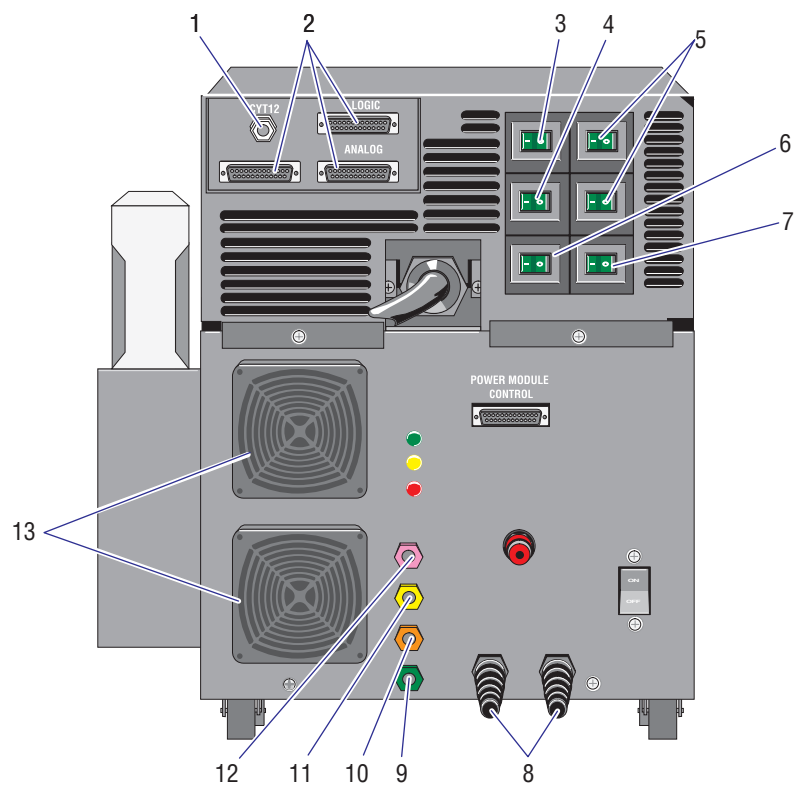


Table 8.2-57 Power Supply Module - Rear Panel Components (See [Figure 8.2-57](#))

Item	Part Number	Description
1	6706391	Card, CYT12 Receiver, EMC Note: Attach using hex nut, PN 2851995 (0.25-36 UNS x 0.375 AF x 0.094 in. thickness).
2	6028693	Cable, harness that includes Logic, MCL, and Analog power supply dc internal cables Note: Attach using three female screw lock assembly kits for D-type connectors, PN 2104261.
3	5120229	Circuit breaker, 4 A, 250 Vac, for 100 Vac and 120 Vac systems
	5120227	Circuit breaker, 2 A, 250 Vac, for 220 Vac and 240 Vac systems
4	5120228	Circuit breaker, 3 A, 250 Vac, for 100 Vac systems
	5120227	Circuit breaker, 2 A, 250 Vac, for 120 Vac systems
	5101025	Circuit breaker, 1 A, 250 Vac, for 220 Vac and 240 Vac systems
5	5120228	Circuit breaker, 3 A, 250 Vac, for 100 Vac and 120 Vac systems
	5101026	Circuit breaker, 1.5 A, 250 Vac, for 220 Vac and 240 Vac systems
6	5101026	Circuit breaker, 1.5 A, 250 Vac, for 100 Vac and 120 Vac systems
	5101027	Circuit breaker, 0.8 A, 250 Vac, for 220 Vac and 240 Vac systems
7	5101027	Circuit breaker, 0.8 A, 250 Vac, for 100 Vac and 120 Vac systems
	5101028	Circuit breaker, 0.5 A, 250 Vac, for 220 Vac and 240 Vac systems
8	6028530	Line cord, 125 Vac / 15 A, shielded, 14 AWG stranded, NEMA 5-15 plug to a stripped end, 9-ft. 10-in. length including connector Note: Strain relief set for one line cord, PN 6027766.
9	6232606	Quick-connect, panel mount, green body with nut, 0.250 o.d. (couples with green insert, PN 6232607)
10	6232304	Quick-connect, panel mount, orange body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with orange insert, PN 6232305, also with automatic shut-off)
11	6232303	Quick-connect, panel mount, yellow body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with yellow insert, PN 6232307, also with automatic shut-off)
12	6232309	Quick-connect, panel mount, blue body with nut, automatic shut-off, 0.125 flow x 0.250 o.d. (couples with blue insert, PN 6232306, also with automatic shut-off)
13	2603058	Fan, box, 90 CFM, 24 Vdc, 4.69 square x 1.0 in. thickness, see Figure 8.2-58 for an exploded view that includes related hardware Note: Fan should be positioned so that its output wires are inside the panel and near the other fan (upper fan's wires are oriented towards the bottom; lower fan's wires, towards the top).
Not shown	6705231	Card, Power Module Control (behind cover), see Figure 8.2-45 for circuit card location

Figure 8.2-58 Box Fan with Related Hardware (See Table 8.2-58)

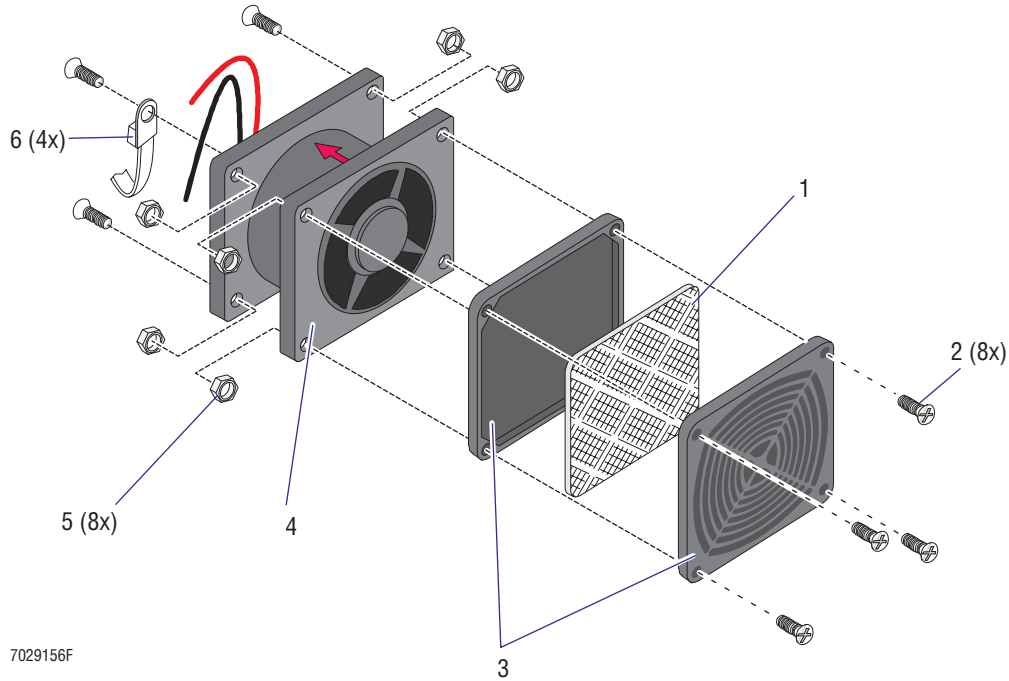
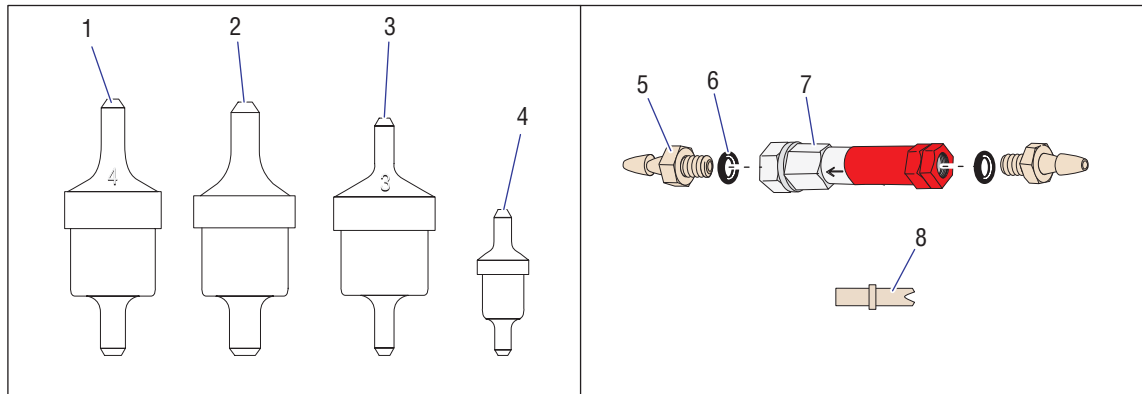


Table 8.2-58 Box Fan with Related Hardware (See Figure 8.2-58)

Item	Part Number	Description
1	2603010	Filter, air, 4-inch pad, 45 PPI
2	2806073	Screw, machine (#6-32 x 0.62 in. length, FL82 flat-head)
3	2603009	Finger guard, grille for fan air filter on 4-inch box fan Note: Raised ribs should face out.
4	2603058	Fan, box, 90 CFM, 24 Vdc, 4.69 square x 1.0 in. thickness Note: Fan should be positioned so that its output wires are inside the panel and near the other fan (upper fan's wires are oriented towards the bottom; lower fan's wires, towards the top).
5	2821010	Nut, self-lock (#6-32 x 0.250 AF x 0.109 in. thickness)
6	6011006	Tie wrap, screw mount, #6 sizer, 7.4 in. long, 0.19 in wide

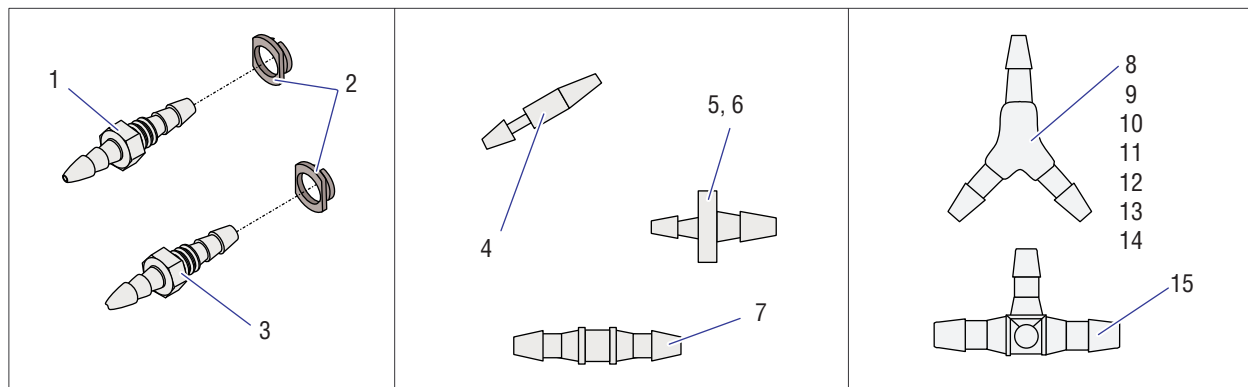
Figure 8.2-59 Check Valves and Chokes with Related Components (See Table 8.2-59)

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Table 8.2-59 Check Valves and Chokes with Related Components (See Figure 8.2-59)

Item	Part Number	Description
1	6214106	Valve, check, 0.156 i.d. to 0.156 i.d. tubing, designated as CV 1, 3, 6, 9, and 10 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886
2	6232605	Valve, check, 0.125 i.d. to 0.082 i.d. tubing
3	6214107	Valve, check, 0.125 i.d. to 0.125 i.d. tubing
	6232080	Valve, black-striped check, 0.125 i.d. to 0.125 i.d. tubing
4	6214108	Valve, check, for 0.062 i.d. to 0.062 i.d. tubing, designated as CV 2, 4, 5, 7, and 8 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886
5	1005693	Fitting, hose-barb union, 0.062 i.d. to 10-32 threaded
6	6216345	Gasket, #10 black, ethylene propylene
7	6213008	Choke, metal, gold, 0.004 orifice
	6213009	Choke, metal, brown, 0.006 orifice
	6213006	Choke, metal, red, 0.008 orifice, designated as CK 2 and 3 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886
	6213011	Choke, metal, black, 0.010 orifice
	6213010	Choke, metal, blue, 0.012 orifice
	6213007	Choke, metal, green, 0.016 orifice
8	6213015	Choke, plastic, brown, 0.025 orifice, designated as CK 4, 5, 6, 7, 8, 9, 10, and 11 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886
	6213012	Choke, plastic, grey, 0.016 orifice, designated as CK 12 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886

Figure 8.2-60 Fittings (See Table 8.2-60)

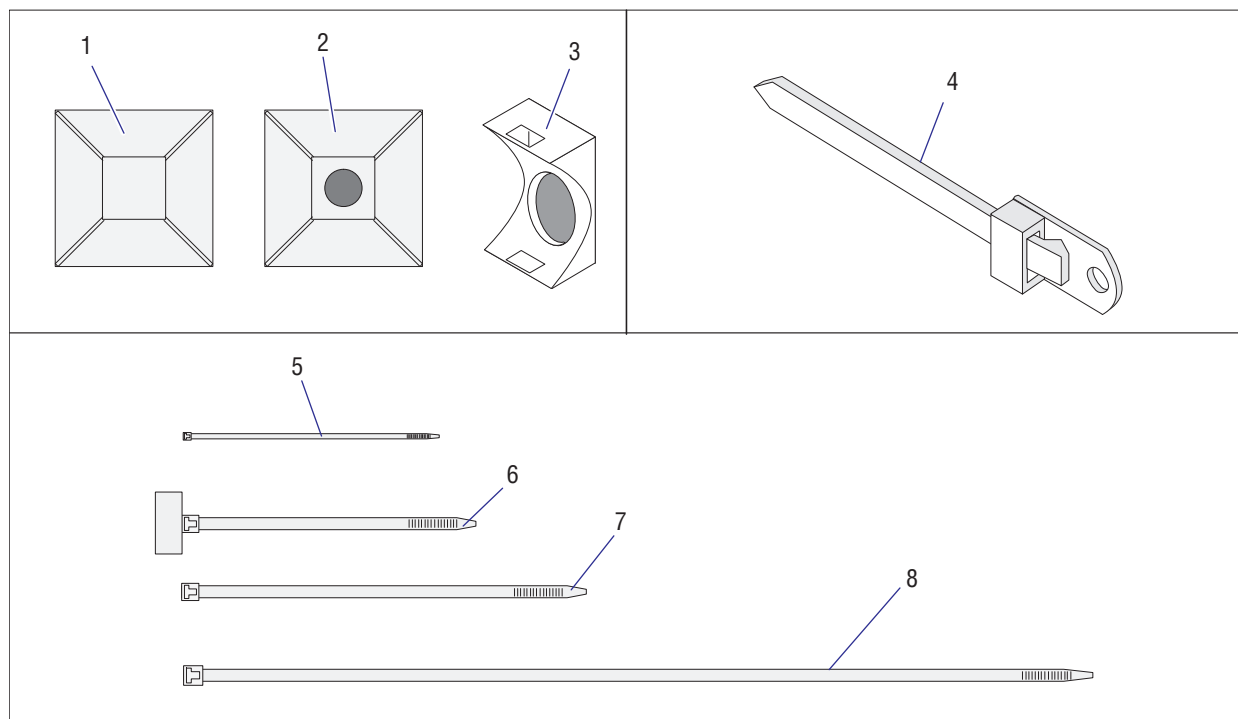


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Table 8.2-60 Fittings (See Figure 8.2-60)

Item	Part Number	Description
1	1005699	Fitting, feed-thru, hose-barb union, metal, 0.093 i.d. to 0.093 i.d. with 10-32 threads
2	1016486	Fitting, feed-thru isolator, white, with 10-32 threads
3	6216353	Fitting, feed-thru, hose-barb union, 0.062 i.d. to 0.093 i.d. with 10-22 threaded
4	6232352	Fitting, hose-barb union, 0.062 i.d. to 0.093 i.d.
5	6232246	Fitting, hose-barb union, 0.093 i.d. to 0.125 i.d. tubing, clear
6	6232109	Fitting, hose-barb union, 0.062 i.d. to 0.062 i.d., clear
7	9908083	Fitting, hose-barb union, 0.093 i.d. to 0.093 i.d.
8	6216081	Fitting, Y-connector, hose-barb union, 0.125 i.d. to 0.125 i.d. to 0.125 i.d., clear
9	6232257	Fitting, Y-connector, hose-barb union, 0.125 i.d. to 0.125 i.d. to 0.125 i.d., nylon, white
10	1018245	Fitting, Y-connector, hose-barb union, 0.085 i.d. x 0.172 o.d., white
11	6232263	Fitting, Y-connector, hose-barb union, 0.050 i.d. x 0.130 o.d., blue
12	6232259	Fitting, Y-connector, hose-barb union, 0.093 i.d. to 0.093 i.d. to 0.093 i.d., clear
13	6216181	Fitting, Y-connector, hose-barb union, 0.082 i.d. to 0.082 i.d. to 0.062 i.d., clear
14	9909059	Fitting, Y-connector, hose-barb union, 0.062 i.d. to 0.062 i.d. to 0.062 i.d.
15	6232322	Fitting, T-connector, hose-barb union, 0.093 i.d. to 0.125 i.d. to 0.125 i.d., nylon, white

Figure 8.2-61 Tie Wraps and Mounting Hardware (See Table 8.2-61)



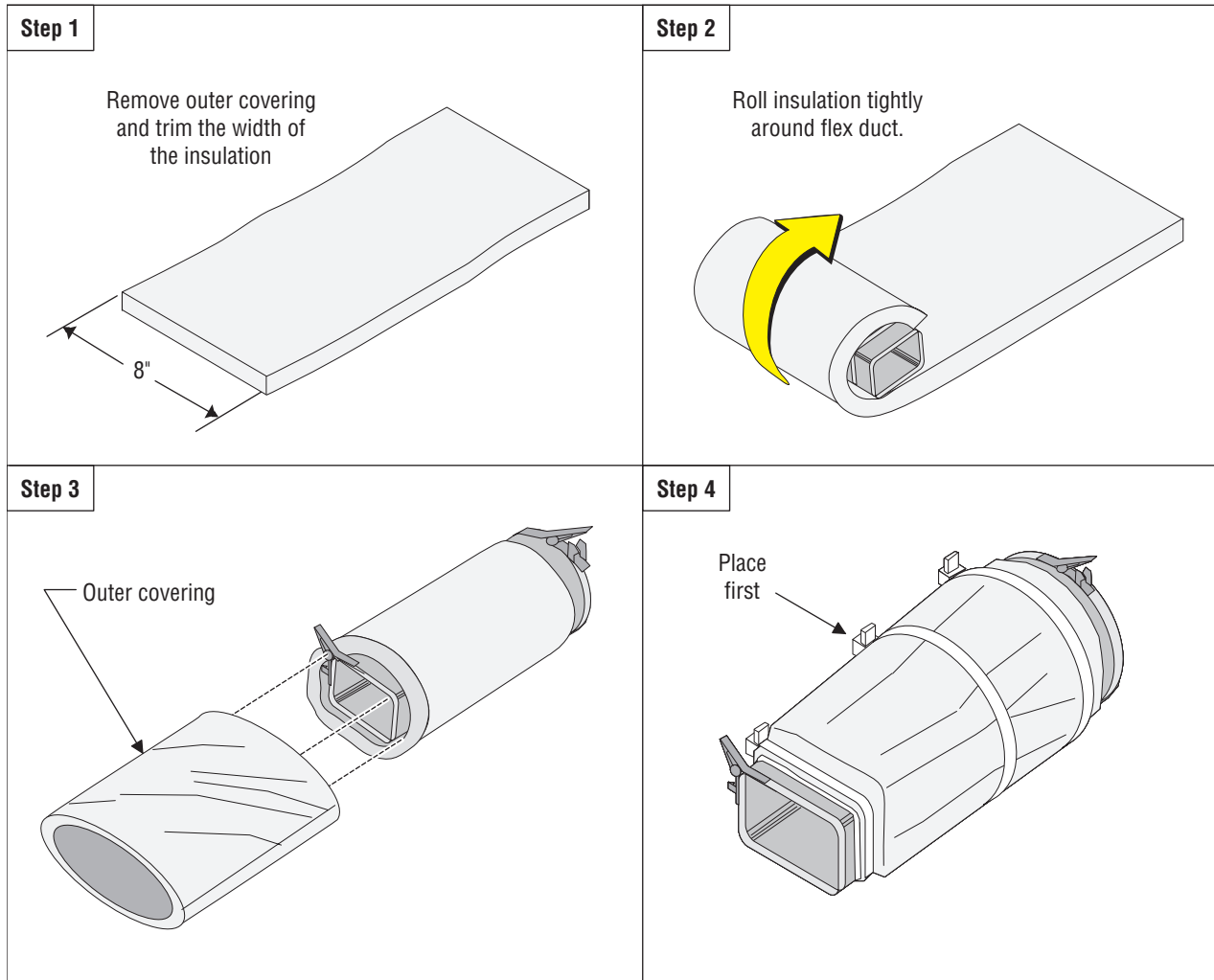
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Note: For laser mounting hardware, go to the illustration for the laser.

Table 8.2-61 Tie Wraps and Mounting Hardware (See Figure 8.2-61)

Item	Part Number	Description
1	6027284	Mount, wire tie, 0.75 x 0.75, with #6 hole, adhesive back
2	6011015	Mount, wire tie, 1 x 1, with #6 hole, adhesive back
3	6011019	Mount, wire tie, 0.51 in. length x 0.33 in. width, for use with #6 screw
4	6011006	Tie wrap, screw mount, #6 sizer, 7.4 in. long, 0.19 in wide
5	6011001	Tie wrap, nylon, 4 in. long, 0.1 in. wide, nylon
6	6011017	Tie wrap with flag marker, 4.4 in. long, 0.1 in. wide, marker size 0.31 in. x 0.75 in.
7	6011002	Tie wrap, nylon, 6.7 in. long, 0.14 in. wide, nylon
8	6011003	Tie wrap, nylon, 15 in. long, 0.19 in. wide, nylon

Figure 8.2-62 Flexible Duct Components and Assembly Instructions (See Table 8.2-62)



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Table 8.2-62 Flexible Duct Components and Assembly Instructions (See Figure 8.2-62)

Item	Part Number	Description
1	1018547	Insulation
2	2603060	Duct, flexible, 3 1/8 i.d. x 10-in. length, rectangular flange at one end
3	6011003	Tie wrap, nylon, 15-in. long, 0.19 in. wide, nylon

A QUICK REFERENCE INFORMATION, A.1-1**A.1 TOLERANCES AND LIMITS, A.1-1**

MCL CPU Card, A.1-1

A.2 CIRCUIT CARD LAYOUTS WITH KEY COMPONENTS, A.2-1

Amp / Signal Conditioner Card, A.2-2

Circuit Card Locations in the Cytometer, A.2-2

Component Locations, A.2-2

Jumpers, A.2-2

Switches, A.2-2

Analyzer Backplane - Front View, A.2-3

Backplane Location in the Cytometer, A.2-3

Component Locations, A.2-3

Jumpers, A.2-3

Switches, A.2-3

Analyzer Backplane - Rear View, A.2-4

Backplane Location in the Cytometer, A.2-4

Component Locations, A.2-4

Jumpers, A.2-4

Switches, A.2-4

Bar-Code Decoder Card, A.2-5

Circuit Card Location in the Cytometer, A.2-5

Component Locations, A.2-5

Jumpers, A.2-5

Switches, A.2-5

CYT12 Receiver EMC Card, A.2-6

Circuit Card Location in the Power Supply Module, A.2-6

Component Locations, A.2-6

Jumpers, A.2-6

Switches, A.2-6

Cyto Transputer Card, A.2-7

Circuit Card Location in the Cytometer, A.2-7

Component Locations, A.2-7

Jumpers, A.2-7

Switches, A.2-7

Fiber Optic Interface Card, A.2-8

Circuit Card Location in the Cytometer, A.2-8

Component Locations, A.2-8

Jumpers, A.2-8

Switches, A.2-8

Front Panel LED and Switch Input Card, A.2-9

Circuit Card Location in the Cytometer, A.2-9

Component Locations, A.2-9

Jumpers, A.2-9

Switches, A.2-9

Front Panel LED and Switch Input 2 Card, A.2-10

Circuit Card Location in the Cytometer, A.2-10

Component Locations, A.2-10

Jumpers, A.2-10

Switches, A.2-10

MCL CPU Card, A.2-11	
Circuit Card Location in the Cytometer, A.2-11	
Component Locations, A.2-11	
Jumpers, A.2-11	
Switches, A.2-11	
MCL Interface Card, A.2-12	
Circuit Card Location in the Cytometer, A.2-12	
Component Locations, A.2-12	
Jumpers, A.2-12	
Switches, A.2-12	
Opto Transprocessor EXMEM Card (Non-EMC Version), A.2-13	
Circuit Card Location in the Workstation, A.2-13	
Component Locations, A.2-13	
Jumpers, A.2-13	
Switches, A.2-13	
Opto Transprocessor EXMEM II Card (EMC Version), A.2-14	
Circuit Card Location in the Workstation, A.2-14	
Component Locations, A.2-14	
Jumpers, A.2-14	
Switches, A.2-14	
PMT Distribution and Laser Fan Control Card, A.2-15	
Circuit Card Location in the Cytometer, A.2-15	
Component Locations, A.2-15	
Jumpers, A.2-15	
Switches, A.2-15	
Power Module Control Card (Non-EMC Version), A.2-16	
Circuit Card Location in the Power Supply Module, A.2-16	
Component Locations, A.2-16	
Jumpers, A.2-16	
Switches, A.2-16	
Power Module Control II Card (EMC Version), A.2-17	
Circuit Card Location in the Power Supply Module, A.2-17	
Component Locations, A.2-17	
Jumpers, A.2-17	
Switches, A.2-17	
Sensor Card, A.2-18	
Circuit Card Location in the Cytometer, A.2-18	
Component Locations, A.2-18	
Jumpers, A.2-18	
Switches, A.2-18	
Solenoid Power Distribution Card, A.2-19	
Circuit Card Location in the Cytometer, A.2-19	
Component Locations, A.2-19	
Jumpers, A.2-19	
Switches, A.2-19	
System Interface Card, A.2-20	
Circuit Card Location in the Cytometer, A.2-20	
Component Locations, A.2-20	
Jumpers, A.2-20	

- Switches, A.2-20
- Top Panel Display 2 Card, A.2-21
 - Circuit Card Location in the Cytometer, A.2-21
 - Component Locations, A.2-21
 - Jumpers, A.2-21
 - Switches, A.2-21
- Trans Data Acquisition Card, A.2-22
 - Circuit Card Location in the Cytometer, A.2-22
 - Component Locations, A.2-22
 - Jumpers, A.2-22
 - Switches, A.2-22
- Voltage Selector Card, A.2-23
 - Circuit Card Location in the Power Supply Module, A.2-23
 - Component Locations, A.2-24
 - Jumpers, A.2-24
 - Switches, A.2-24
- Voltage Supply Monitor Card, A.2-25
 - Circuit Card Location in the Power Supply Module, A.2-25
 - Component Locations, A.2-25
 - Jumpers, A.2-25
 - Switches, A.2-25
- A.3 PROTOCOL PARAMETERS, A.3-1
 - CHANNEL 500 Protocol, A.3-1
 - Switch Point 1 Test, A.3-1
 - Acquiring Fluorospheres, A.3-2
- A.4 PREFINAL SERVICE SOFTWARE, A.4-1
 - Available Tests, A.4-1
 - MCL Option Commands, A.4-4
- A.5 CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS, A.5-1
 - Overview, A.5-1
 - Main Cytometer Components, A.5-1
 - Locating a Component, A.5-1
 - Cytometer Anchor Illustration, A.5-2
 - Components Accessed with the Cytometer Top Cover Removed, A.5-5
 - Data Acquisition Card Cage, A.5-7
 - Data Acquisition Card Cage, Component Locations, A.5-7
 - Optical Collection Area, A.5-13
 - Optical Collection Area, Component Locations (Rear View), A.5-13
 - Components Accessed with the Right Side Cover Removed, A.5-16
 - Components Accessed with the Center Front Cover Removed, A.5-21
 - Components Accessed with the Filter Shield Removed, A.5-24
 - Components Inside the Reagent Drawer, A.5-27
 - Rear Panel Components, A.5-29
 - Manual Sample Station Components, Cytometer with MCL Option, A.5-32
 - Manual Sample Station Components, Cytometer without MCL Option, A.5-36
 - Segmenting Valve Components, A.5-39
 - Components on the MCL Option, A.5-42

	Carousel Components, A.5-42
	MCL Components Accessible with Covers Removed, A.5-44
	Components in the Left Side of the Cytometer, A.5-47
	Front Panel Display Components, A.5-55
A.6	POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS, A.6-1
	Overview, A.6-1
	Main Power Supply Module Components, A.6-1
	Locating a Component, A.6-1
	Power Supply Module Anchor Illustration, A.6-2
	Components Located Behind the Front Door of the Power Supply Module, A.6-4
	Components in the Left Side of the Power Supply Module, A.6-9
	Components in the Right Side of the Power Supply Module, A.6-12
	Components on the Rear Panel of the Power Supply Module, A.6-14
A.7	HOT KEYS AVAILABLE WITH SYSTEM II™ SOFTWARE, A.7-1
	Acquisition Screen, A.7-1
	Listmode Screen, A.7-1
B	HARDWARE/SOFTWARE CONFIGURATIONS AND REQUIREMENTS, B.1-1
B.1	FlowCentre™ II MULTIMEDIA WORKSTATION COMPUTER CONFIGURATION, B.1-1
	Installed Peripherals, B.1-1
	Installed Drives, B.1-1
	Preloaded Software, B.1-1
	BIOS SETUP Defaults, B.1-1
	DEFAULT Settings for the System BIOS, B.1-2
	Standard CMOS Setup, B.1-2
	Advanced CMOS Setup, B.1-2
	Advanced Chipset Setup, B.1-3
	Power Management Setup, B.1-3
	PCI / Plug and Play Setup, B.1-4
	Peripheral Setup, B.1-5
	WINDOWS 98 Configuration from Device Manager, B.1-6
	Control Panel Setup, Device Manager, Computer, B.1-6
	CONFIG.SYS Configuration, B.1-7
	AUTOEXEC.BAT Configuration, B.1-8
B.2	FlowCentre™ MULTIMEDIA WORKSTATION COMPUTER CONFIGURATION, B.2-1
	Installed Peripherals, B.2-1
	Installed Drives, B.2-2
	Preloaded Software, B.2-2
	Circuit Card Locations, B.2-2
	BIOS Password, B.2-2
	AMI WIN BIOS Configuration, B.2-3
	Standard Setup, B.2-3
	Advanced Setup, B.2-3
	Chipset Setup, B.2-4

- Power Mgmt (Power Management) Setup, B.2-4
 - PCI / PnP Setup, B.2-5
 - Peripheral Setup, B.2-6
 - Supervisor, B.2-6
 - WINDOWS 95 Configuration from Device Manager, B.2-7
 - Control Panel Setup, Device Manager, Computer, B.2-7
 - CONFIG.SYS Configuration, B.2-8
 - AUTOEXEC.BAT Configuration, B.2-9
- B.3 INTEL® PENTIUM® 166 PROCESSOR CONFIGURATION, B.3-1
 - Installed Peripherals, B.3-1
 - Installed Drives, B.3-1
 - Preloaded Software, B.3-1
 - BIOS Password, B.3-1
 - AMI WIN BIOS Configuration, B.3-2
 - Standard Setup, B.3-2
 - Advanced Setup, B.3-2
 - Chipset Setup, B.3-3
 - Power Mgmt (Power Management) Setup, B.3-3
 - PCI / PnP Setup, B.3-4
 - Peripheral Setup, B.3-5
 - Supervisor, B.3-5
- B.4 LANtastic® NETWORK OPERATING SYSTEM MINIMUM REQUIREMENTS, B.4-1
 - DOS Requirements, B.4-1
 - Windows Requirements, B.4-1
- B.5 Sybase® SQL ANYWHERE™ MINIMUM REQUIREMENTS, B.5-1
 - Client Requirements, B.5-1
 - Database Server Requirements, B.5-1
 - Network Requirements, B.5-1
- C FIELD WORKSHEETS, C.1-1
 - C.1 WORKSHEETS, C.1-1
 - Field Engineer Worksheet, C.1-1
 - Network Configuration Worksheet, C.1-2
- D EXAMPLES OF SETUP FILES, D.1-1
 - D.1 CLIENT FLOW CYTOMETER, D.1-1
 - Config.sys, D.1-1
 - Autoexec.bat, D.1-1
 - Startnet.bat, D.1-1
 - Xl_graph.cng, D.1-2
 - D.2 FILE SERVER, D.2-1
 - Config.sys, D.2-1
 - Autoexec.bat, D.2-1
 - Startnet.bat, D.2-1

E NETWORK PROTOCOL SPECIFICATIONS, E.1-1

E.1 802.3, E.1-1

F BAR-CODE SPECIFICATIONS, F.1-1

F.1 BAR-CODE LABELS, F.1-1

Acceptable Bar Codes, F.1-1

Optical Characteristics of Bar-Code Labels, F.1-1

NE (Narrow Elements) Width, F.1-2

WE/NE (Wide Elements/Narrow Elements) Ratio, F.1-2

Printing Methods, F.1-2

Check Sum Algorithm, F.1-2

F.2 MCL BAR-CODE SCANNER, F.2-1

Types of Scanners, F.2-1

Decoding, F.2-1

Communication Protocol, F.2-1

For an Instrument with the ALL CODES EEPROM Installed, F.2-1

For an Instrument with an Original EEPROM Installed, F.2-2

MCL Bar-Code Scanner Setup, F.2-2

Default Configurations for the EEPROM, F.2-2

Symbologies, F.2-3

Special Considerations, F.2-3

F.3 HAND-HELD BAR-CODE SCANNER OPTION, F.3-1

Types of Scanners, F.3-1

Hand-Held Bar-Code Scanner Setup Parameters, F.3-1

Default Configurations, F.3-1

General Parameters, F.3-2

Serial Communication Parameters, F.3-2

Symbologies, F.3-2

Wand Emulation Parameters, F.3-3

Keyboard Wedge Parameters, F.3-3

Memory Module Set Up, F.3-3

Supplemental Programming Symbols, F.3-3

F.4 BAR-CODE PRINTER, F.4-1

ILLUSTRATIONS

A.2-1 Amp / Signal Conditioner Card - Component Locations, A.2-2

A.2-2 Analyzer Backplane, Front View - Component Locations, A.2-3

A.2-3 Analyzer Backplane, Rear View - Component Locations, A.2-4

A.2-4 Bar-Code Decoder Card - Component Locations, A.2-5

A.2-5 CYT12 Receiver EMC Card - Component Locations, A.2-6

A.2-6 Cyto Transputer Card - Component Locations, A.2-7

A.2-7 Fiber Optic Interface Card - Component Locations, A.2-8

A.2-8 Front Panel LED and Switch Input Card - Component Locations, A.2-9

A.2-9 Front Panel LED and Switch Input 2 Card - Component Locations, A.2-10

A.2-10 MCL CPU Card - Component Locations, A.2-11

A.2-11 MCL Interface Card - Component Locations, A.2-12

- A.2-12 Opto Transprocessor EXMEM Card (Non-EMC Version) - Component Locations, A.2-13
- A.2-13 Opto Transprocessor EXMEM II Card (EMC Version) - Component Locations, A.2-14
- A.2-14 PMT Distribution and Laser Fan Control Card - Component Locations, A.2-15
- A.2-15 Power Module Control Card (Non-EMC Version) - Component Locations, A.2-16
- A.2-16 Power Module Control II Card (EMC Version) - Component Locations, A.2-17
- A.2-17 Sensor Card - Component Locations, A.2-18
- A.2-18 Solenoid Power Distribution Card - Component Locations, A.2-19
- A.2-19 System Interface Card - Component Locations, A.2-20
- A.2-20 Top Panel Display 2 Card - Component Locations, A.2-21
- A.2-21 Trans Data Acquisition Card - Component Locations, A.2-22
- A.2-22 Voltage Selector Card for 120 Vac System - Component Locations, A.2-24
- A.2-23 Voltage Supply Monitor Card - Component Locations, A.2-25
- A.5-1 XL Cytometer with MCL Option, Anchor Illustration for Locating Components, A.5-2
- A.5-2 Components Accessed with the Cytometer Top Cover Removed (See Table A.5-2), A.5-5
- A.5-3 Data Acquisition Card Cage (See Table A.5-3), A.5-7
- A.5-4 Optical Collection Area, Rear View (See Table A.5-4), A.5-13
- A.5-5 Right Side View of the Cytometer with the Cover Removed (See Table A.5-5), A.5-16
- A.5-6 Inside View of the Cytometer with the Center Front Cover Removed (See Table A.5-6), A.5-21
- A.5-7 Inside View of the Cytometer with the Filter Shield Removed (See Table A.5-7), A.5-24
- A.5-8 View of an Open Reagent Drawer (See Table A.5-8), A.5-27
- A.5-9 Rear Panel Components, Exterior View (See Table A.5-9), A.5-29
- A.5-10 XL-MCL Manual Sample Station Components (See Table A.5-10), A.5-32
- A.5-11 XL Manual Sample Station Components (See Table A.5-11), A.5-36
- A.5-12 Segmenting Valve Components (See Table A.5-12), A.5-39
- A.5-13 Carousel Components (See Table A.5-13), A.5-42
- A.5-14 MCL Components Accessible with Covers Removed (See Table A.5-14), A.5-44
- A.5-15 Lower Pneumatics Drawer Components (See Table A.5-15), A.5-48
- A.5-16 Front Panel Display Components (See Table A.5-16), A.5-55
- A.6-1 Power Supply Module, Anchor Illustration for Locating Components, A.6-2
- A.6-2 View of the Power Supply Module with the Front Door Open (See Table A.6-2), A.6-4
- A.6-3 Left Side View of the Power Supply Module with Cover Removed (See Table A.6-3), A.6-9
- A.6-4 Right Side View of the Power Supply Module with Cover Removed (See Table A.6-4), A.6-12
- A.6-5 Rear View of the Power Supply Module (See Table A.6-5), A.6-14

TABLES

- A.1-1 MCL CPU Card, A.1-1
- A.1-2 MCL Power Supply Voltage Adjustments, A.1-1
- A.1-3 XL-MCL Flow Cytometer - Acceptable Voltage Ranges, A.1-1
- A.3-1 CHANNEL 500 Protocol, A.3-1
- A.3-2 LIN/LOG SWITCH POINT 1 TEST Protocol, A.3-1

A.3-3	Protocol to Acquire Fluorospheres, A.3-2
A.4-1	Tests on Prefinal Software Diskette, A.4-1
A.4-2	MCL Option Commands, A.4-4
A.5-1	XL Cytometer with MCL Option, Component and Assembly Accessibility, A.5-3
A.5-2	Components Accessed with the Cytometer Top Cover Removed and Their Functions, A.5-6
A.5-3	Data Acquisition Card Cage, Components and Functions, A.5-8
A.5-4	Optical Collection Area, Components and Functions, A.5-14
A.5-5	Components in the Right Side of the Cytometer and their Functions, A.5-17
A.5-6	Components Behind the Center Front Cover and their Functions, A.5-22
A.5-7	Components Behind the Filter Shield and their Functions, A.5-25
A.5-8	Components Inside the Reagent Drawer and their Functions, A.5-28
A.5-9	Components Attached to the Rear Panel and their Functions, Exterior View, A.5-30
A.5-10	XL-MCL Manual Sample Station Components and their Functions, A.5-33
A.5-11	XL Manual Sample Station Components and their Functions, A.5-37
A.5-12	Segmenting Valve Components and Their Functions, A.5-40
A.5-13	Carousel Components and Their Functions, A.5-43
A.5-14	MCL Components Accessible with Covers Removed and Their Functions, A.5-45
A.5-15	Components in the Lower Pneumatics Drawer and Their Functions, A.5-49
A.5-16	Front Panel Display Components and Their Functions, A.5-56
A.6-1	Power Supply Module, Component and Assembly Accessibility, A.6-3
A.6-2	Components behind the Front Door of the Power Supply Module, A.6-5
A.6-3	Components in the Left Side of the Power Supply Module, A.6-10
A.6-4	Components in the Right Side of the Power Supply Module, A.6-13
A.6-5	Components on the Rear Panel of the Power Supply Module, A.6-15
A.7-1	Hot Keys Available When the Acquisition Screen is Displayed, A.7-1
A.7-2	Hot Keys Available When the Listmode Screen is Displayed, A.7-1
E.1-1	802.3 Specifications, E.1-1
F1-1	Acceptable Bar Codes, F1-1
F1-2	Code-Related Specifications, F1-2
F2-1	MCL Bar-Code Scanner - Default Configuration, F2-2
F3-1	Hand-Held Bar-Code Scanner - Default Configuration, F3-1
F3-2	Hand-Held Bar-Code Scanner - General Parameters, F3-2
F3-3	Hand-Held Bar-Code Scanner - Symbologies, F3-2
F3-4	Hand-Held Bar-Code Scanner - Keyboard Wedge Parameters, F3-3
F4-1	Bar-Code Printer - DIP Switch Settings, F4-1

A.1 TOLERANCES AND LIMITS

MCL CPU Card

ATTENTION: The MCL voltages are measured at the MCL CPU card, but adjustments are made on the corresponding MCL power supply in the right-side compartment of the Power Supply module. For the MCL power supply locations, refer to [Figure A.6-4](#).

Table A.1-1 MCL CPU Card

Voltage and Acceptable Range	Test Point	Ground
+5 Vdc ± 0.005	TP1	TP2 (GND)
-12 Vdc ± 0.005	TP3	TP2 (GND)
+12 Vdc ± 0.005	TP4	TP2 (GND)
+24 Vdc ± 0.005	TP5	TP2 (GND)

Table A.1-2 MCL Power Supply Voltage Adjustments

Voltage and Acceptable Range	Adjustment Potentiometer on an MCL Power Supply
+5 Vdc ± 0.005	Use +5V ADJ on the +5 and ± 12 Vdc MCL power supply
-12 Vdc ± 0.005	Use -12V ADJ on the +5 and ± 12 Vdc MCL power supply
+12 Vdc ± 0.005	Use +12V ADJ on the +5 and ± 12 Vdc MCL power supply
+24 Vdc ± 0.005	Use V ADJ on the +24 Vdc MCL power supply

Table A.1-3 XL-MCL Flow Cytometer - Acceptable Voltage Ranges

Voltage	Connector	Pins
+5 Vdc	P66	1
+15 Vdc	P65	11, 12, 13
-15 Vdc	P65	2, 3, 4
+24 Vdc	P66	9, 10

A.2 CIRCUIT CARD LAYOUTS WITH KEY COMPONENTS

This appendix contains key component and test point locations as well as applicable jumper and switch settings for the following circuit cards:

Card Name	Figure Reference
Amp / Signal Conditioner Card	Figure A.2-1
Analyzer Backplane - Front View	Figure A.2-2
Analyzer Backplane - Rear View	Figure A.2-3
Bar-Code Decoder Card	Figure A.2-4
CYT12 Receiver EMC Card	Figure A.2-5
Cyto Transputer Card	Figure A.2-6
Fiber Optic Interface Card	Figure A.2-7
Front Panel LED and Switch Input Card (XL only)	Figure A.2-8
Front Panel LED and Switch Input 2 Card (XL-MCL only)	Figure A.2-9
MCL CPU Card	Figure A.2-10
MCL Interface Card	Figure A.2-11
Opto Transprocessor EXMEM Card (Non-EMC Version)	Figure A.2-12
Opto Transprocessor EXMEM II Card (EMC Version)	Figure A.2-13
Power Module Control Card (Non-EMC Version)	Figure A.2-15
Power Module Control II Card (EMC Version)	Figure A.2-16
PMT Distribution and Laser Fan Control Card	Figure A.2-14
Sensor Card	Figure A.2-17
Solenoid Power Distribution Card	Figure A.2-18
System Interface Card	Figure A.2-19
Top Panel Display 2 Card	Figure A.2-20
Trans Data Acquisition Card	Figure A.2-21
Voltage Selector Card	Figure A.2-22
Voltage Supply Monitor Card	Figure A.2-23

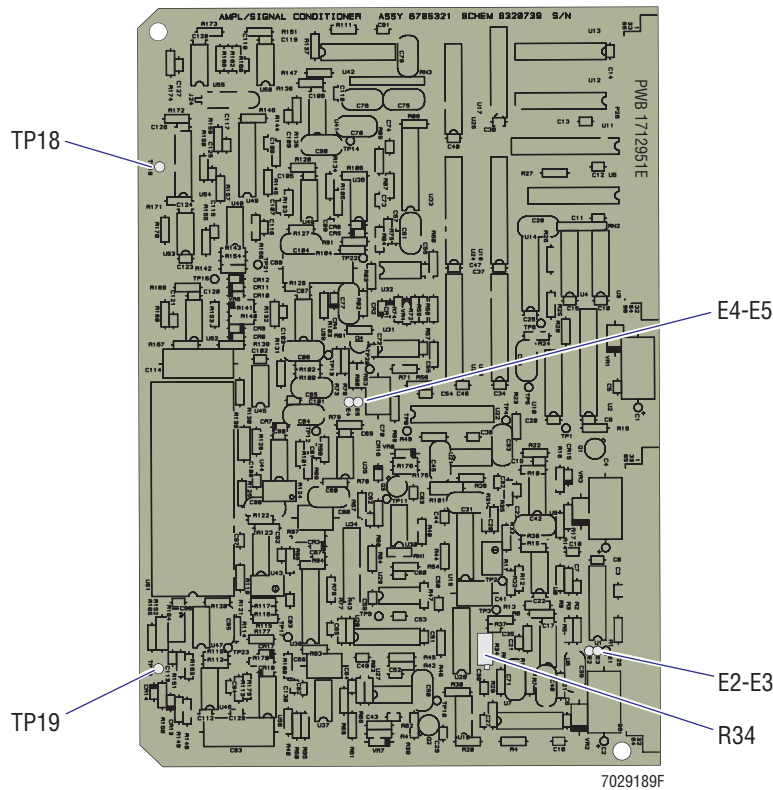
Amp / Signal Conditioner Card

Circuit Card Locations in the Cytometer

On a four-color system, Amp / Signal Conditioner cards occupy seven slots in the Data Acquisition card cage. Only six slots are used if it is a three-color system. This circuit card is used in the slots labeled (left to right) SS, FS, AUX, PMT4 (missing in a three-color system), PMT3, PMT2, and PMT1. To locate these Amp/Signal Conditioner cards, see [Figure A.5-3](#).

Component Locations

Figure A.2-1 Amp / Signal Conditioner Card - Component Locations



Jumpers

E2 to E3 and E4 to E5

Switches

N/A

Analyzer Backplane - Front View

Backplane Location in the Cytometer

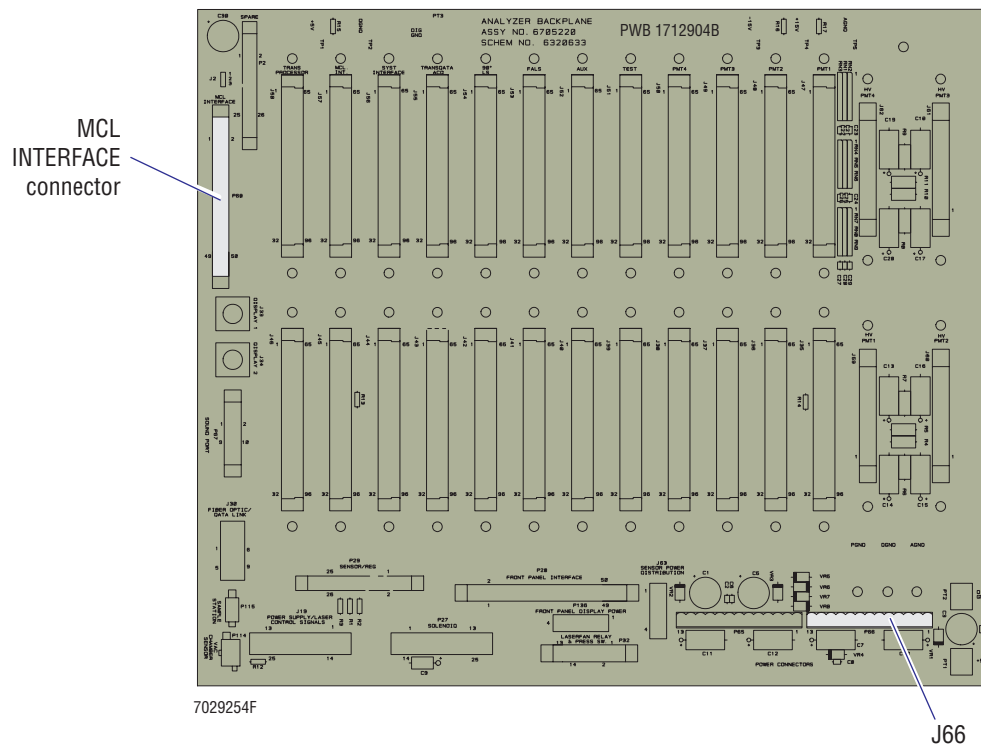
The Analyzer backplane is attached to the rear of the Data Acquisition card cage. Most of this backplane is behind the Data Acquisition card cage so that only those components on the lower portion of this backplane are easily accessible.

To easily access the lower portion of the Analyzer backplane, remove the Cytometer front door and lock the Data Acquisition card cage in its upright position outside the Cytometer.

Components near the lower edge of the backplane (such as J66) may be accessed while the Data Acquisition card cage is inside the Cytometer by simply lifting the front door and unlatching the display panel.

Component Locations

Figure A.2-2 Analyzer Backplane, Front View - Component Locations



Jumpers

N/A

Switches

N/A

Bar-Code Decoder Card

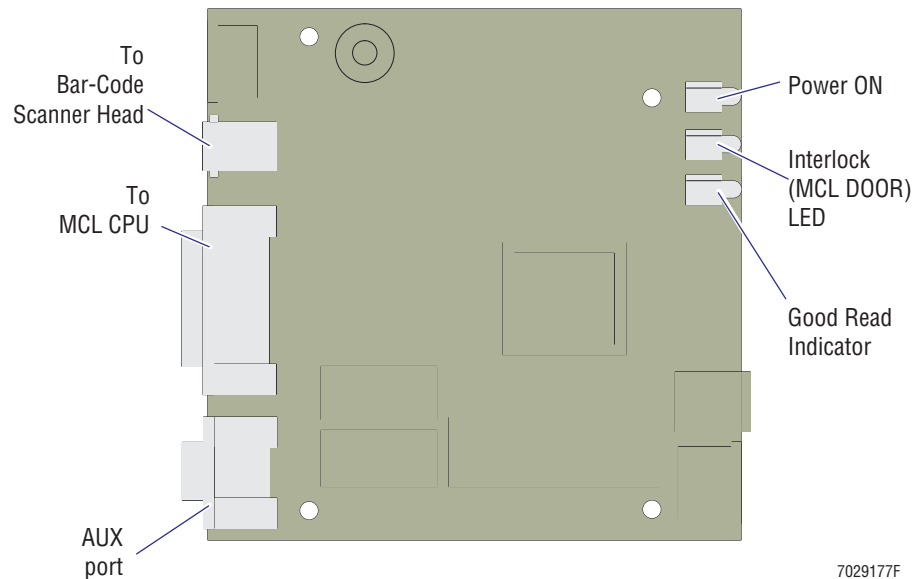
ATTENTION: This card is present only when the MCL option is installed.

Circuit Card Location in the Cytometer

The Bar-Code Decoder card is the smaller of the two circuit cards attached to the MCL main frame on the left-side of the Cytometer. This circuit card is present only when the MCL option is installed. To locate the Bar-Code Decoder card, see [Figure A.5-14](#).

Component Locations

Figure A.2-4 Bar-Code Decoder Card - Component Locations



Jumpers

N/A

Switches

N/A

CYT12 Receiver EMC Card

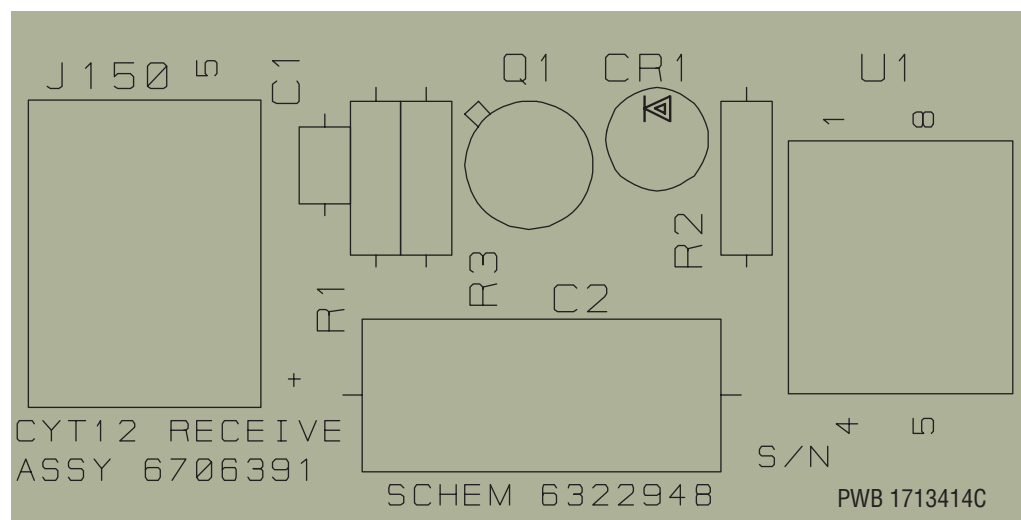
ATTENTION: This circuit card is only used in XL and XL-MCL instruments with the serial number Z09063 or higher. XL and XL-MCL instruments with the serial number Z09062 or lower do not use this circuit card.

Circuit Card Location in the Power Supply Module

The CYT12 Receiver EMC card is attached to the CYT12 connector on the rear of the Power Supply module. The circuit card is inside the Power Supply module. To locate the CYT12 connector, see [Figure A.6-5](#).

Component Locations

Figure A.2-5 CYT12 Receiver EMC Card - Component Locations



7029194F

Jumpers

N/A

Switches

N/A

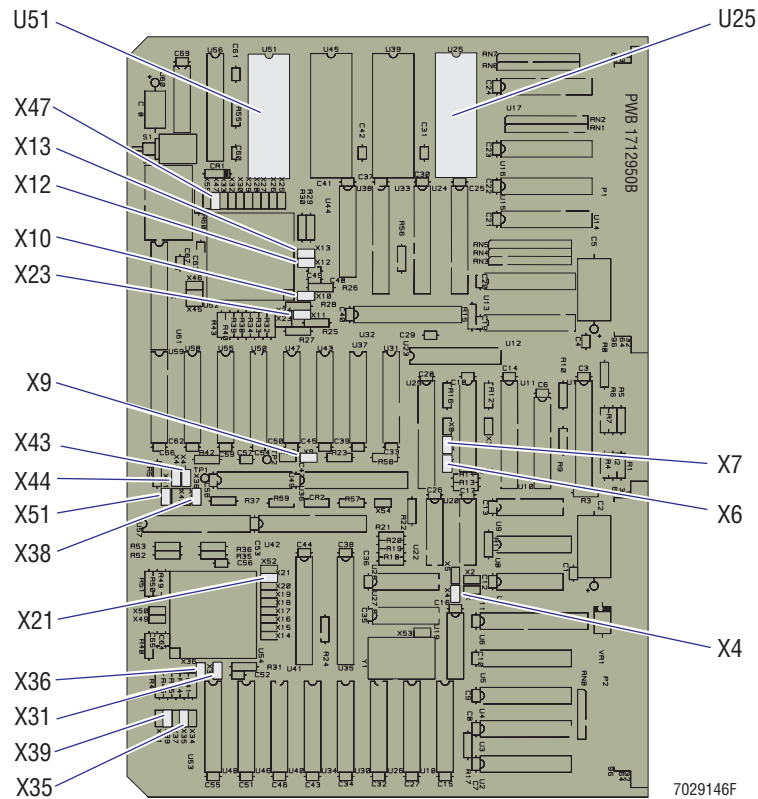
Cyto Transputer Card

Circuit Card Location in the Cytometer

The Cyto (Cytometer) Transputer card occupies the slot labeled CYTO TRANS PROC in the Data Acquisition card cage. To locate the Cyto Transputer card, see [Figure A.5-3](#).

Component Locations

Figure A.2-6 Cyto Transputer Card - Component Locations



Jumpers

X4, X6, X7, X9,
X10, X12, X13,
X21, X23,
X31, X35, X36, X38, X39,
X43, X44, X47,
X51

Switches

N/A

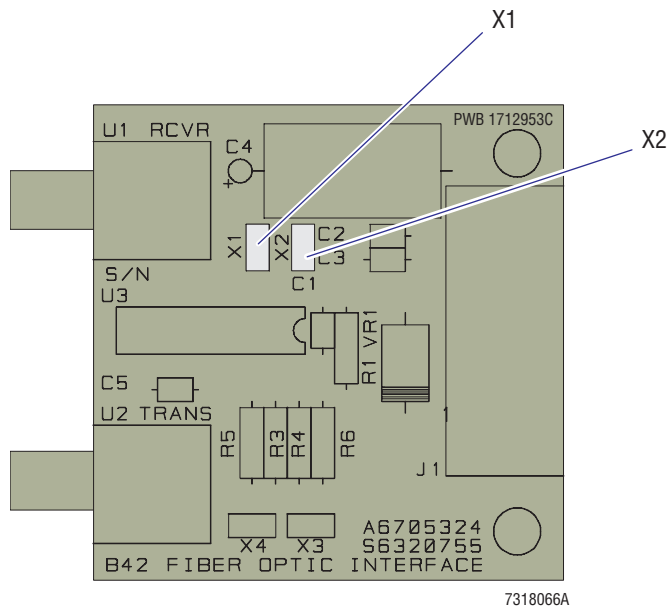
Fiber Optic Interface Card

Circuit Card Location in the Cytometer

The Fiber Optic Interface card is attached to the lower rear panel inside the Cytometer. To locate the Fiber Optic Interface card, see [Figure A.5-9](#).

Component Locations

Figure A.2-7 Fiber Optic Interface Card - Component Locations



Jumpers

X1 and X2

Switches

N/A

Front Panel LED and Switch Input Card

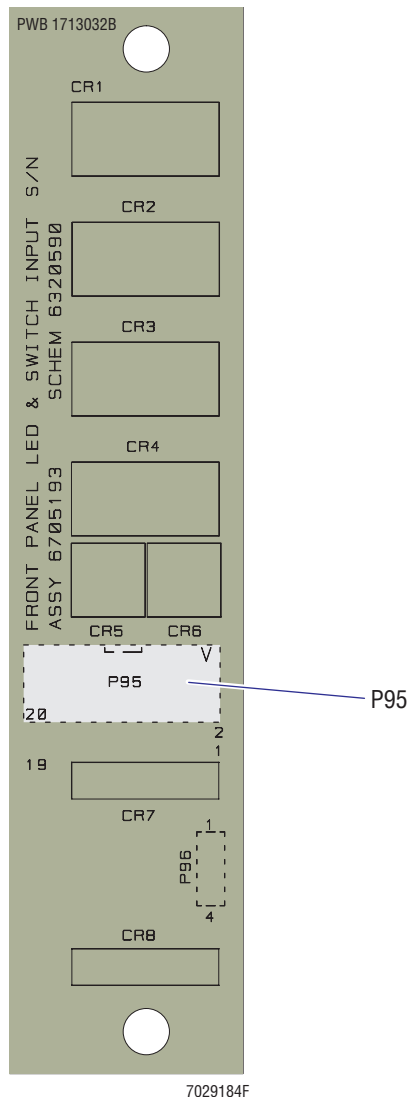
ATTENTION: This card is present only when the MCL option is **not** installed.

Circuit Card Location in the Cytometer

The Front Panel LED and Switch Input card accepts data entry information when the overlay membrane at the manual sample station on an XL flow cytometer is pressed. To locate the Front Panel LED and Switch Input card, see [Figure A.5-11](#).

Component Locations

Figure A.2-8 Front Panel LED and Switch Input Card - Component Locations



Jumpers

N/A

Switches

N/A

Front Panel LED and Switch Input 2 Card

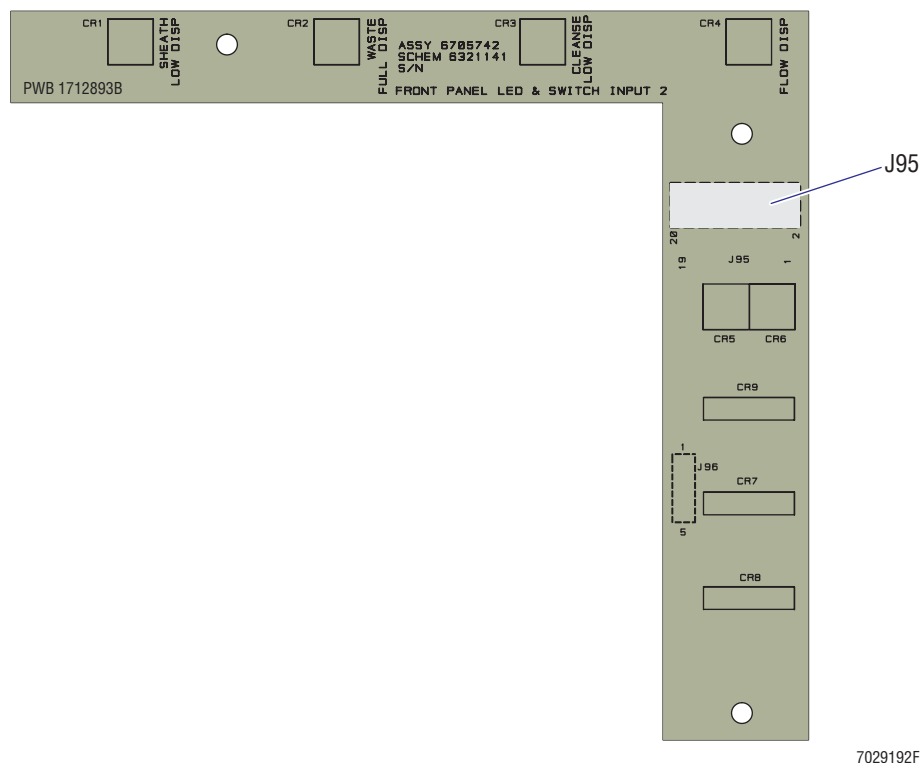
ATTENTION: This card is present only when the MCL option is installed.

Circuit Card Location in the Cytometer

The Front Panel LED and Switch Input 2 card accepts data entry information when the overlay membrane at the manual sample station on an XL-MCL flow cytometer is pressed. To locate the Front Panel LED and Switch Input 2 card, see [Figure A.5-10](#).

Component Locations

Figure A.2-9 Front Panel LED and Switch Input 2 Card - Component Locations



Jumpers

N/A

Switches

N/A

MCL CPU Card

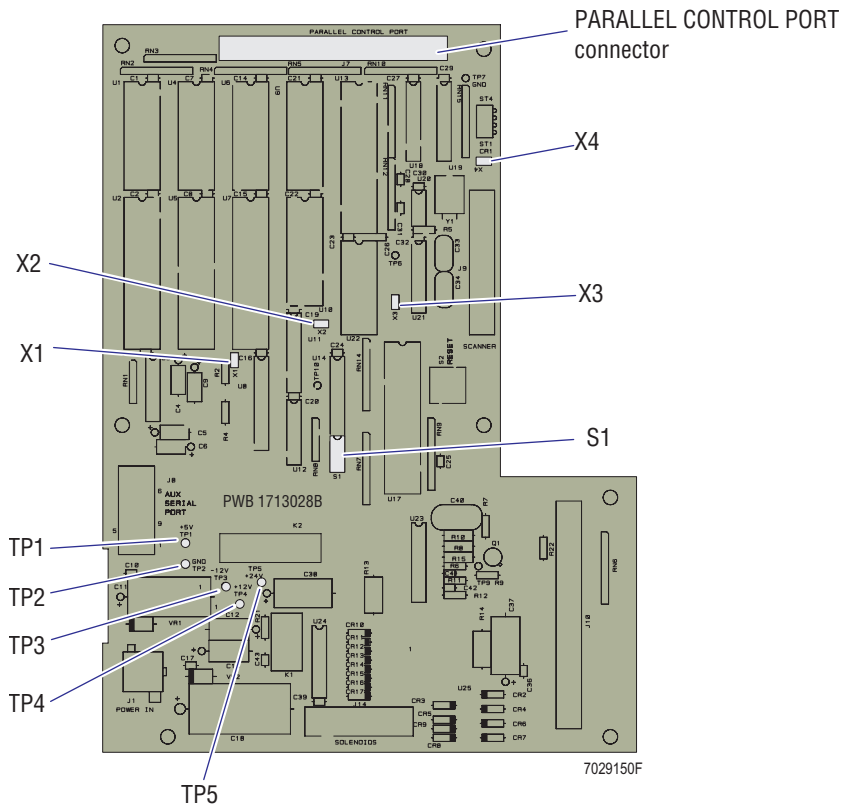
ATTENTION: This card is present only when the MCL option is installed.

Circuit Card Location in the Cytometer

The MCL CPU card is the larger of the two circuit cards attached to the MCL main frame on the left-side of the Cytometer. This circuit card is present only when the MCL option is installed. To locate the MCL CPU card, see [Figure A.5-14](#).

Component Locations

Figure A.2-10 MCL CPU Card - Component Locations



Jumpers

X1, X2, X3, X4

Switches

S1 requires the following settings:

Position 1 = ON

Position 2 = ON

Position 3 = ON

Position 4 = OFF

MCL Interface Card

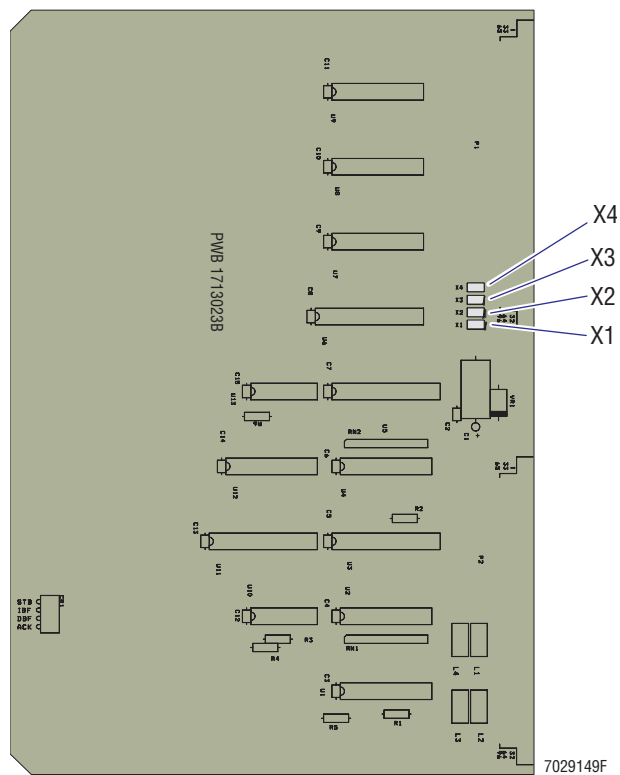
ATTENTION: This card is present only when the MCL option is installed.

Circuit Card Location in the Cytometer

The MCL Interface card occupies the slot labeled MCL INFC in the Data Acquisition card cage. This circuit card is present only when the MCL option is installed. To locate the MCL Interface card, see [Figure A.5-3](#).

Component Locations

Figure A.2-11 MCL Interface Card - Component Locations



Jumpers

X1, X2, X3, X4

Switches

N/A

Opto Transprocessor EXMEM Card (Non-EMC Version)

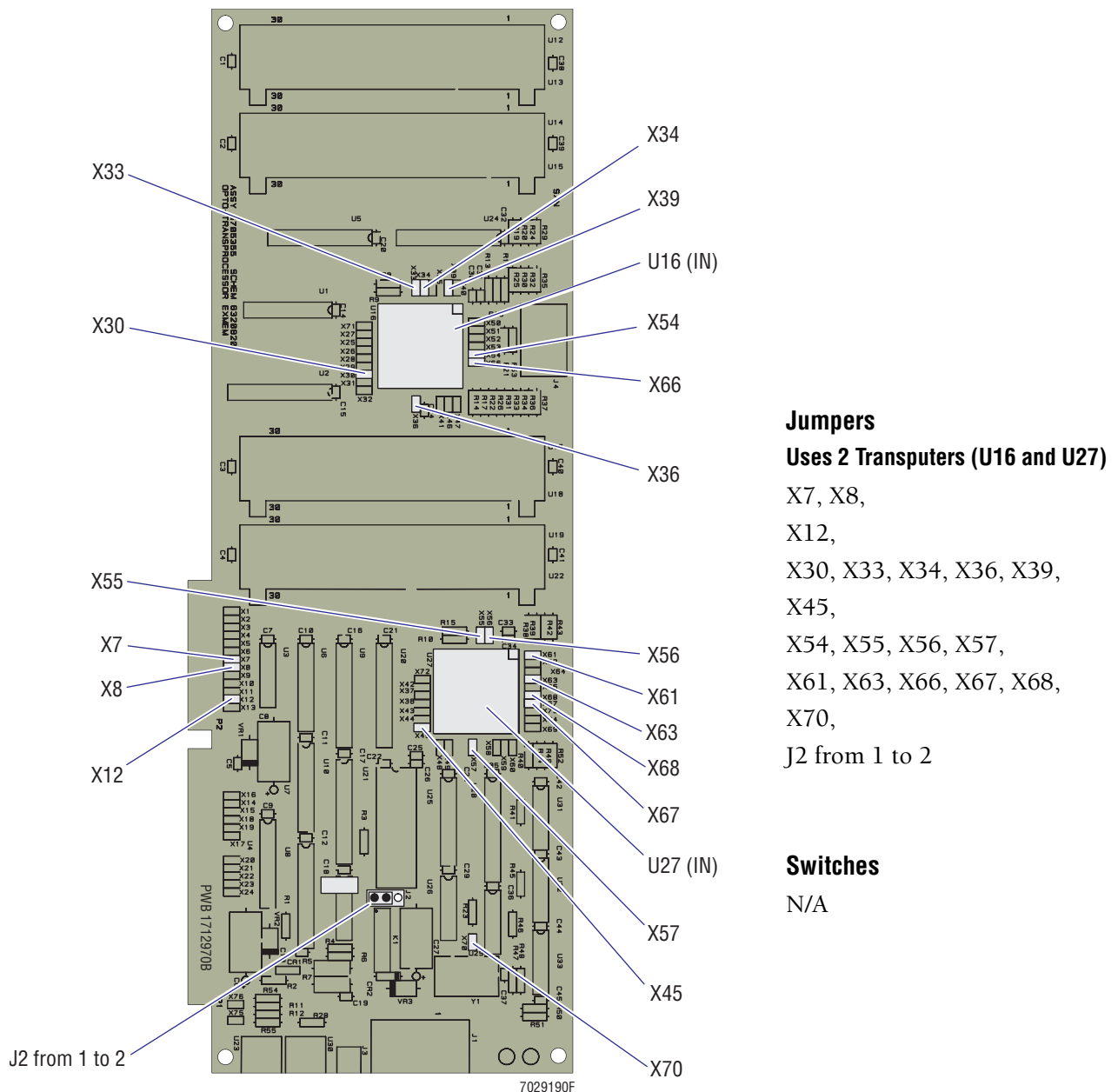
Note: Opto Transprocessor EXMEM is short for Optical Transprocessor Extended Memory card. This circuit card is used in all XL and XL-MCL instruments serial number Z09062 and below.

Circuit Card Location in the Workstation

The Opto Transprocessor EXMEM card is located in the Workstation computer. In the FlowCentre II tower computer, this circuit card is located in the bottom slot. In the original FlowCentre desktop computer, this circuit card is located in far left slot.

Component Locations

Figure A.2-12 Opto Transprocessor EXMEM Card (Non-EMC Version) - Component Locations



Opto Transprocessor EXMEM II Card (EMC Version)

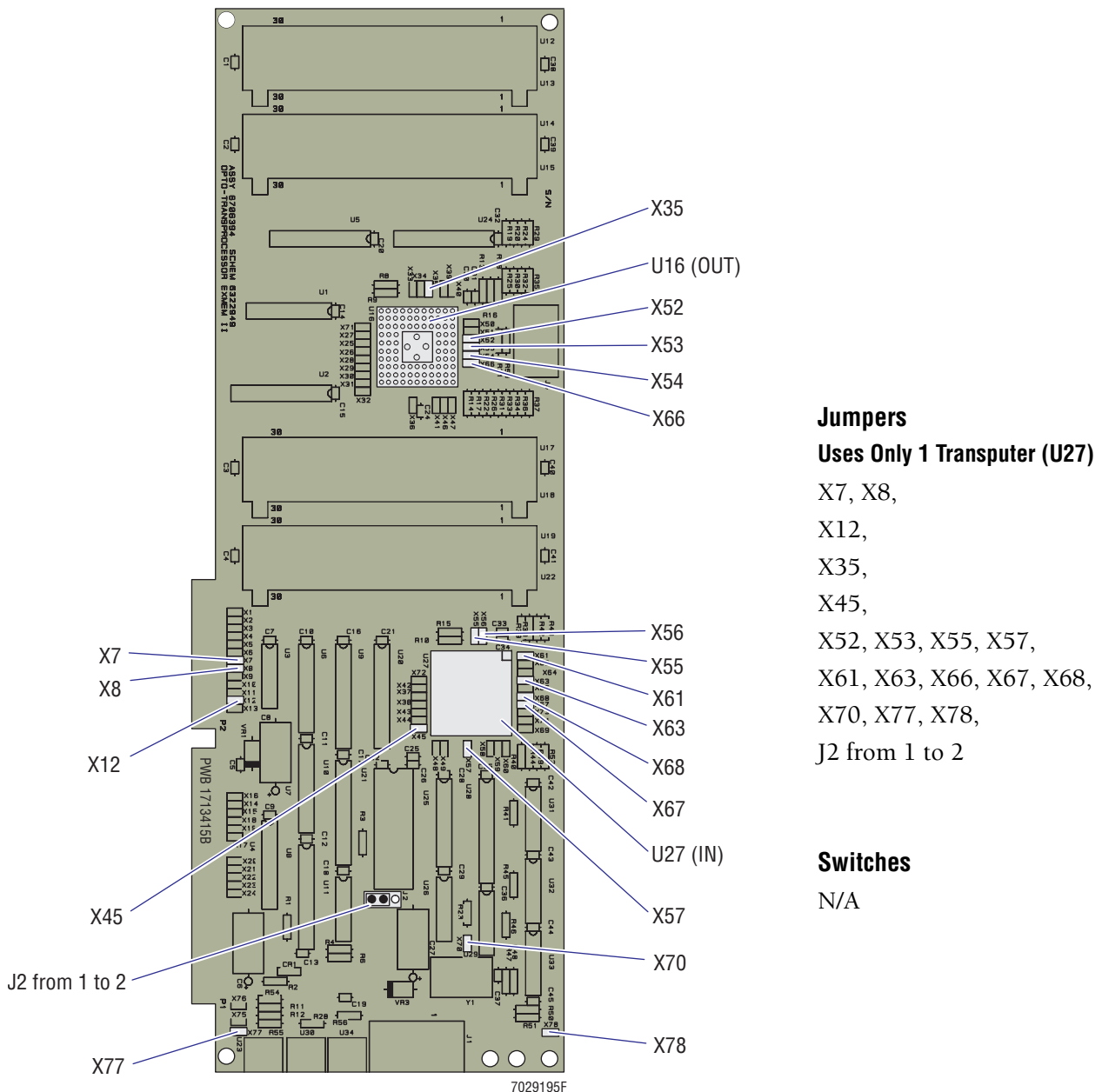
Note: Opto Transprocessor EXMEM II is short for Optical Transprocessor Extended Memory II card. This circuit card is used in all XL and XL-MCL instruments serial number Z09063 and above.

Circuit Card Location in the Workstation

The Opto Transprocessor EXMEM II card is located in the Workstation computer. In the FlowCentre II tower computer, this circuit card is located in the bottom slot. In the original FlowCentre desktop computer, this circuit card is located in far left slot.

Component Locations

Figure A.2-13 Opto Transprocessor EXMEM II Card (EMC Version) - Component Locations



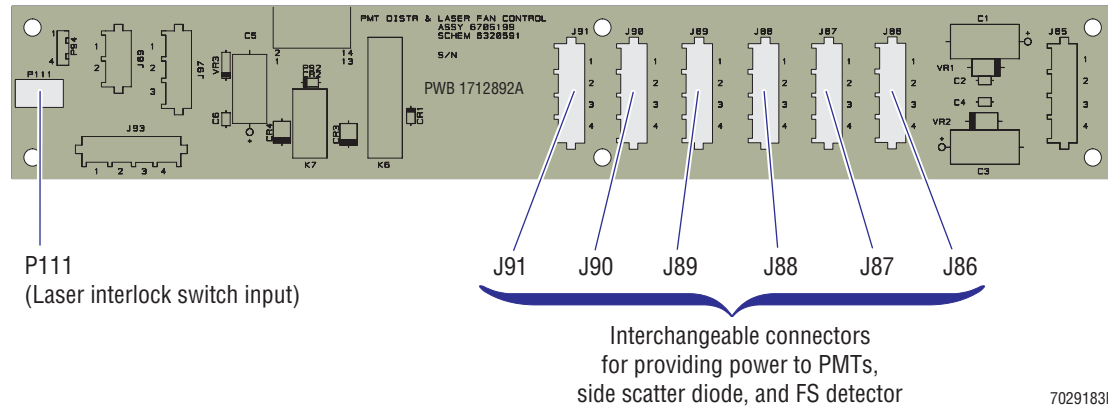
PMT Distribution and Laser Fan Control Card

Circuit Card Location in the Cytometer

The PMT Distribution and Laser Fan Control card is attached to the optical bench inside the Cytometer. To locate the PMT Distribution and Laser Fan Control card, see [Figure A.5-4](#).

Component Locations

Figure A.2-14 PMT Distribution and Laser Fan Control Card - Component Locations



Jumpers

N/A

Switches

N/A

Power Module Control Card (Non-EMC Version)

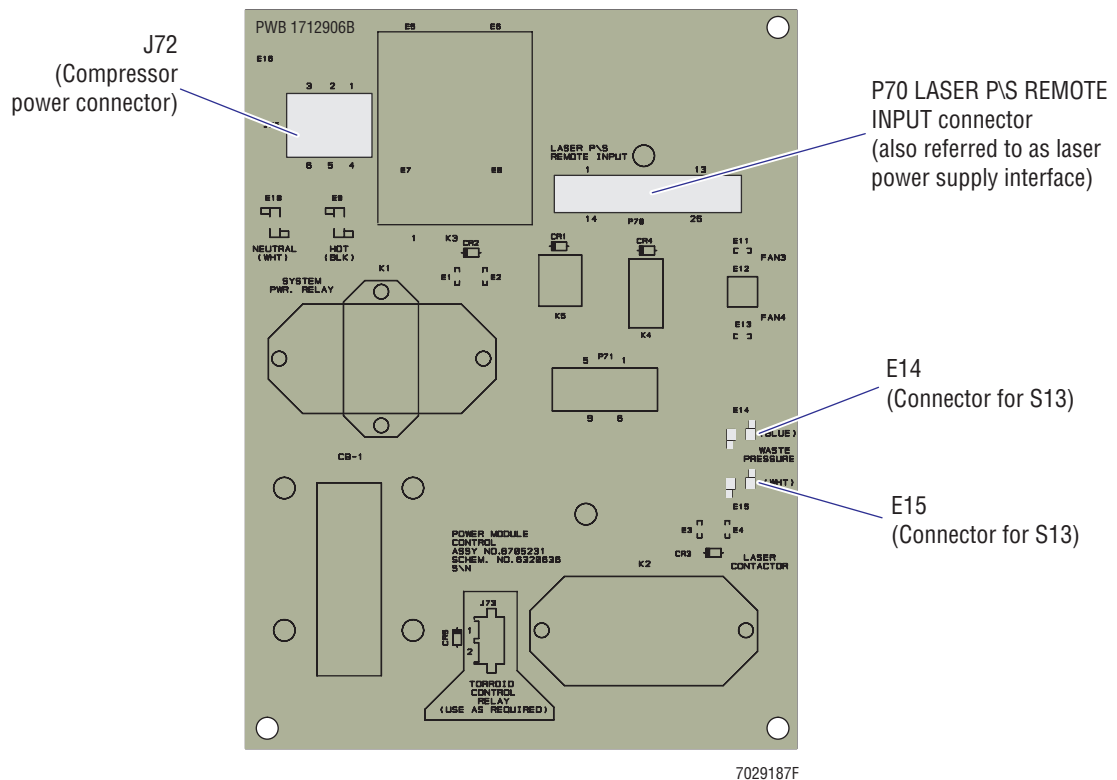
Note: The Power Module Control card is used in XL and XL-MCL instruments with a serial number Z09062 or lower.

Circuit Card Location in the Power Supply Module

The Power Module Control card is inside the Power Supply module. When the three-sided cover is removed from the Power Supply module, the Power Module Control card can be accessed from the left side. The circuit card is attached to the inside rear cover. To locate the Power Control Module card, see [Figure A.6-3](#).

Component Locations

Figure A.2-15 Power Module Control Card (Non-EMC Version) - Component Locations



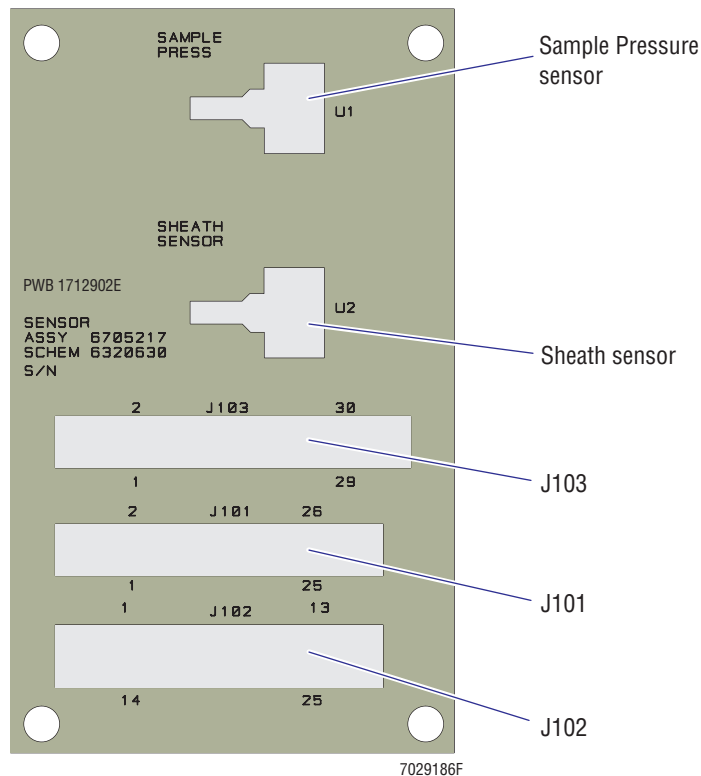
Sensor Card

Circuit Card Location in the Cytometer

The Sensor card is located inside the upper pneumatics drawer. To locate the Sensor card, see [Figure A.5-5](#).

Component Locations

Figure A.2-17 Sensor Card - Component Locations



Jumpers

N/A

Switches

N/A

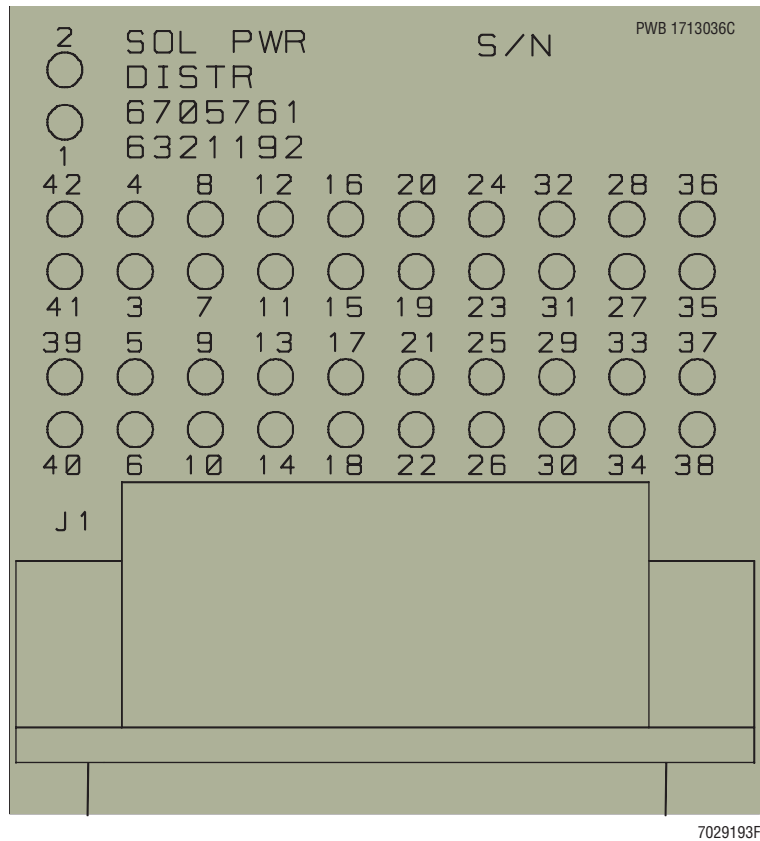
Solenoid Power Distribution Card

Circuit Card Location in the Cytometer

The Solenoid Power Distribution card is located inside the lower pneumatics drawer. To locate the Solenoid Power Distribution card, see [Figure A.5-15](#).

Component Locations

Figure A.2-18 Solenoid Power Distribution Card - Component Locations



Jumpers

N/A

Switches

N/A

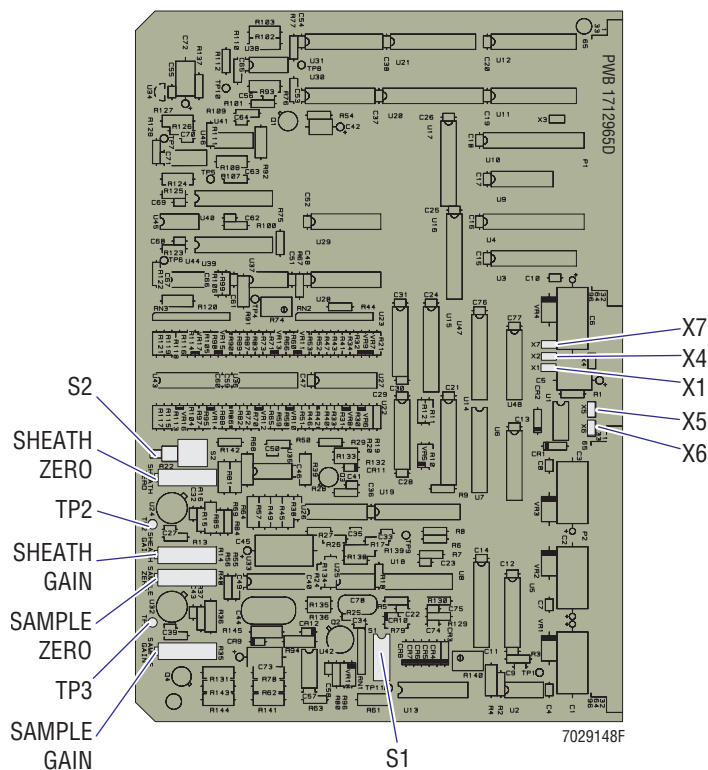
System Interface Card

Circuit Card Location in the Cytometer

The System Interface card occupies the slot labeled SYS INFC in the Data Acquisition card cage. To locate the System Interface card, see [Figure A.5-3](#).

Component Locations

Figure A.2-19 System Interface Card - Component Locations



Jumpers

X1, X4, X5, X6, X7

Switches

S1 requires the following settings:

Position 1 = OFF

Position 2 = OFF

Position 3 = OFF

Position 4 = OFF

Position 5 = ON

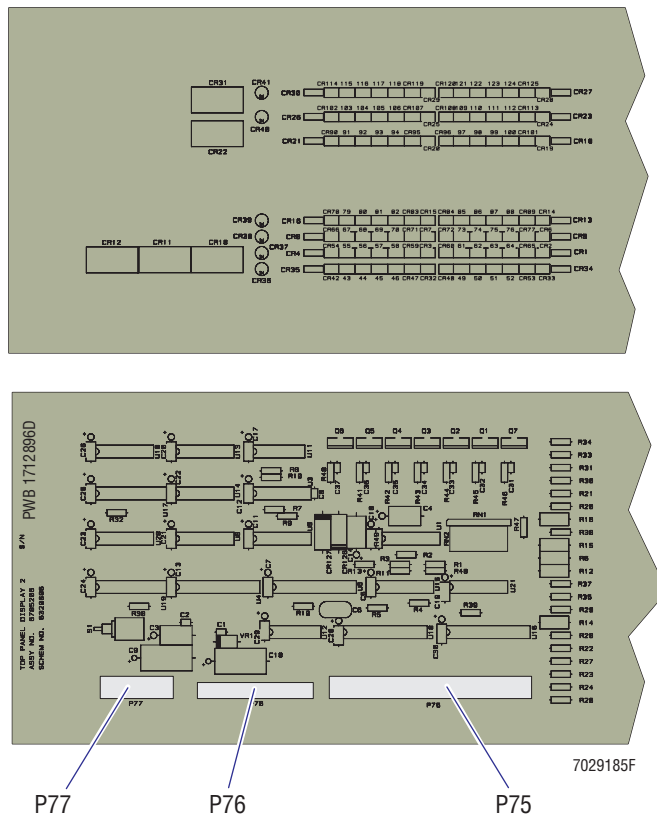
Top Panel Display 2 Card

Circuit Card Location in the Cytometer

The Top Panel Display 2 card is attached to the back of the front display panel. To access this circuit card the front display panel must be lifted. To locate the Top Panel Display 2 card, see [Figure A.5-16](#).

Component Locations

Figure A.2-20 Top Panel Display 2 Card - Component Locations



Jumpers

N/A

Switches

N/A

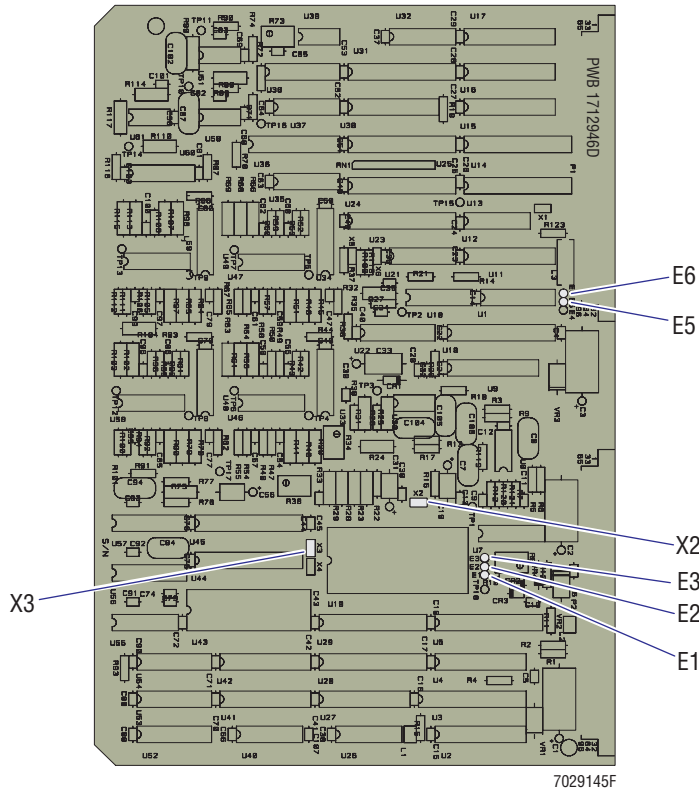
Trans Data Acquisition Card

Circuit Card Location in the Cytometer

The Trans Data Acquisition card occupies the slot labeled DATA AQC in the Data Acquisition card cage. To locate the Trans Data Acquisition card, see [Figure A.5-3](#).

Component Locations

Figure A.2-21 Trans Data Acquisition Card - Component Locations



Jumpers

E1 to E2, X2, X3, E5 to E6

Switches

N/A

Voltage Selector Card

Circuit Card Location in the Power Supply Module

The Voltage Selector card is inside the Power Supply module. When the three-sided cover is removed from the Power Supply module, the Voltage Selector card can be accessed in the upper compartment. To locate the Voltage Selector card, see [Figure A.6-3](#).

The Voltage Selector card selects the proper line voltage for the circuit breaker dedicated to that voltage. The Voltage Selector card selects the proper line voltage for six circuit breakers:

- 24 VOLTS circuit breaker
- COMPRESSOR circuit breaker
- MCL 24 VOLTS circuit breaker
- 5 VOLTS circuit breaker
- 15 VOLTS circuit breaker
- MCL 5 VOLTS circuit breaker

For the location of these circuit breakers, see [Figure A.6-5](#). For more information concerning the selected voltages, see [Table A.6-5](#).

The Voltage Selector card is supply voltage specific. To meet the power requirements for various countries, four versions of this circuit card are available:

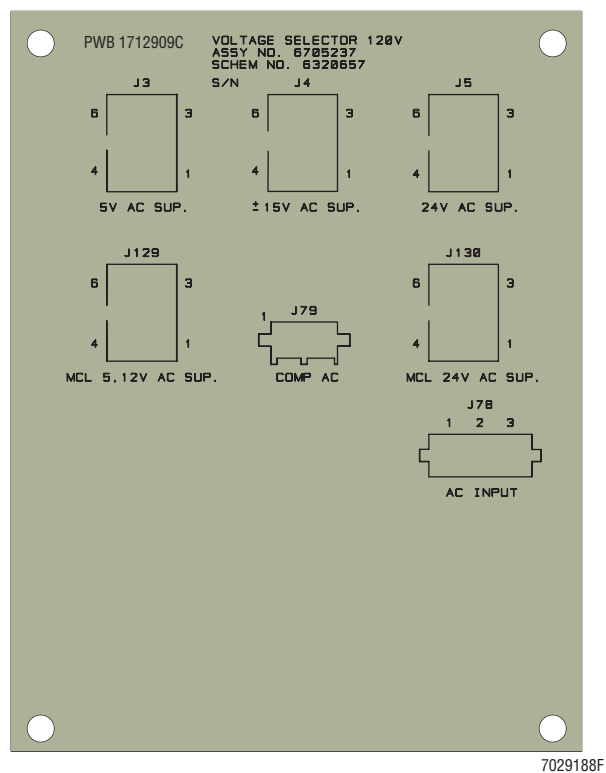
- Voltage Selector card for a 100 Vac system
- Voltage Selector card for a 120 Vac system
- Voltage Selector card for a 220 Vac system
- Voltage Selector card for a 230/240 Vac system

Each circuit card has a unique part number that can be located under Chapter 8, [PARTS LISTS](#).

Since the layout of these circuit cards is similar, only the Voltage Selector card for the 120 Vac system is illustrated. Applicable jumper and switch information is supplied for all versions.

Component Locations

Figure A.2-22 Voltage Selector Card for 120 Vac System - Component Locations



Jumpers

N/A

Switches

N/A

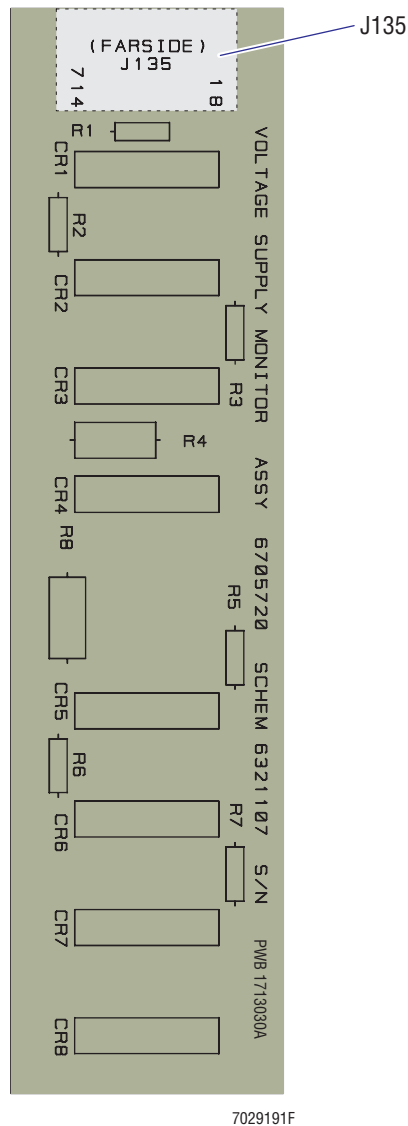
Voltage Supply Monitor Card

Circuit Card Location in the Power Supply Module

The Voltage Supply Monitor card is inside the Power Supply module. When the three-sided cover is removed from the Power Supply module, the Voltage Supply Monitor card can be accessed from the right side. To locate the Voltage Supply Monitor display, see [Figure A.6-2](#). The circuit card is attached to the inside front panel.

Component Locations

Figure A.2-23 Voltage Supply Monitor Card - Component Locations



Jumpers

N/A

Switches

N/A



QUICK REFERENCE INFORMATION

CIRCUIT CARD LAYOUTS WITH KEY COMPONENTS

A.3 PROTOCOL PARAMETERS

CHANNEL 500 Protocol

Table A.3-1 CHANNEL 500 Protocol

Histogram	Parameter	Signals	Gating	Analysis Region
1	Dual	FS vs. SS	RECT GATE	A
2	Single	FS	On region A	B
3	Single	FL1	On region A	C
4	Single	FL2	On region A	D
5	Single	FL3	On region A	E
6	Single	FL4	On region A	F
7	Single	SS	On region A	G

Settings: SAMPLE DELIVERY LOW
 COMPENSATION All signals = 0%
 DISCRIMINATOR FS = 100
 STOP On Histogram 1 for 10,000 events

Switch Point 1 Test

Table A.3-2 LIN/LOG SWITCH POINT 1 TEST Protocol

Histogram	Parameter	Signals	Gain	Gating	Analysis Region
1	Dual	FS vs. SS	N/A	RECT GATE	A
2	Single	FSLOG	100.0	On region A	B
3	Single	SSLOG	1.0	On region A	C
4	Single	FL1LOG	1.0	On region A	D
5	Single	FL2LOG	1.0	On region A	E
6	Single	FL3LOG	1.0	On region A	F
7	Single	FL4LOG	1.0	On region A	G

Settings: DISCRIMINATOR FS = 35
 COMPENSATION All signals = 0%
 STOP On Histogram 1 for 40,000 counts
 FLOW RATE LOW

Acquiring Fluorospheres

Table A.3-3 Protocol to Acquire Fluorospheres

Histogram	Parameter	Signals	Gating	Analysis Region
1	Dual	FS vs. SS	RECT GATE	A
2	Single	FS	On region A	B
3	Single	FL1	On region A	C
4	Single	FL2	On region A	D
5	Single	FL3	On region A	E
6	Single	FL4	On region A	F
7	Single	SS	On region A	G

Settings:

FLOW RATE	LOW
COMPENSATION	All signals = 0%
DISCRIMINATOR	FS = 100
Stop	On Histogram 2 for 5,000 events
Autoprint	ON

A.4 PREFINAL SERVICE SOFTWARE

Table A.4-1 provides a quick reference of available tests that may be accessed when the Prefinal Service software is installed and operated using the guidelines provided under [Heading 4.2, PREFINAL SERVICE SOFTWARE INSTALLATION AND OPERATION](#). The Prefinal tests in [Table A.4-1](#) are listed in alphabetical order.

If you desire more information concerning these tests, go to [Heading 7.2, PREFINAL SERVICE SOFTWARE - A TROUBLESHOOTING TOOL](#) where the various tests available within this software are listed with a more detailed description of the test, the areas of the instrument being checked, and suggestions on what to check if a test should fail.

Available Tests

Table A.4-1 Tests on Prefinal Software Diskette

Test	Function
ADC Zero Adjust	Calibrates ADC zero on Trans Data Acquisition card. See Heading 4.14, TRANS DATA ACQUISITION CARD REPLACEMENT AND/OR CALIBRATION for replacement procedures for the Trans Data Acquisition Card.
Amp Gain Control	Allows control of gain for each Amp/Signal Conditioner card.
Amp Saturation Test	Ensures proper calibration of Amp/Signal Conditioner cards for saturation point. Can not be adjusted in field.
Attenuator Control	Allows control of each Amp/Signal Conditioner card attenuator.
Beeper Test	Tests for proper beeper operation.
Canyon Jumper Test	Ensures ramp jumper installed on Amp/Signal Conditioner card.
Count Rate Test	Tests count rate register on Trans Data Acquisition card.
DMA Acquisition	Not used.
Front Panel Test	Tests Front Panel Display card indicator LEDs.
General Information	Describes operation of function keys.
Grand Canyon Adjust	Adjusts Gap/Spike on Amp/Signal Conditioner cards. Perform test following replacement of any Amp/Signal Conditioner card; refer to Heading 4.15, AMP/SIGNAL CONDITIONER CARD REPLACEMENT AND/OR CALIBRATION .
Grand Canyon Test	Quick test for gap/spike adjustment.
Histogram Test	Checks the histograms generated by the ADC on the Trans Data Acquisition card for gaps between channels of a normal distribution.
Initialize System	Sets a 5 V peak pulse on all Amp/Signal Conditioner cards.
Laser Control	Turns laser on/off. Can be used to check laser current reading.
Laser Warm Up	Provides a graph of the laser current during startup.
Lock Up Test	Not used.
MCL Bar Code Head Test	Perform this test before installing a replacement scanner head.
MCL Bar Code Test	Allows proper adjustment of bar-code head position alignment.
MCL Burn In	Developed for engineering purposes.
MCL Carousel Label	Ensures carousel label is of readable quality.

Table A.4-1 Tests on Prefinal Software Diskette (Continued)







































Test	Function
MCL Carousel Status	Checks quickly for carousel alignment.
MCL Door Switch Test	Checks for proper operation of MCL option door switch.
MCL Finger Test	Allows proper adjustment of finger rotator.
MCL Home Align	Allows user to adjust carousel alignment.
MCL Manual Control	Similar to MCL Terminal but does not require keyboard command codes.
MCL Mix Test	Tests proper operation of mixer motor. Stop test to end mixing.
MCL Pneumatic Status	Quick check of flag sensors.
MCL Power Up Status	Resets MCL option to startup mode.
MCL Probe Align	Allows proper adjustment of probe position in test tube.
MCL ROM Test	Checks CPU for correct ROM revision.
MCL Scan Reliability	Developed for engineering purposes.
MCL Stepper Noise Test	Tests stepper motor for excessive noise.
MCL Terminal	Allows manual control of MCL option through keyboard command codes; refer to Table A.4-2 .
Memory Test	Tests external memory of all four transputers.
Mike's Test	Not used.
New Board	For future hardware development.
Noise Test and Offset	ATTENTION: Use this test only as a reference. Do not make adjustments. Checks the noise and offset of the system.
OPTO DMA Test	Tests DMA transfer of Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card.
OPTO Interrupt Test	Tests Opto Transprocessor interrupt.
OPTO Link Test	Tests fiber optics interface from Computer Workstation to Cytometer.
PMT Voltage Control	Allows control of HV supplies for PMTs.
Pneumatic Sensor Test	Checks for proper operation of System Interface card and pressure sensors.
Pulse RAMP Test	Tests bar graphs on Front Panel Display card and ramp pulse on Trans Data Acquisition card.
ROM Test	Checks ROM on Cyto Transputer card for correct version.
Run Beads	Test allows a sample to be run on the Cytometer to align the optical system using a digital oscilloscope.
Sample Leak Test	Tests both manual and MCL option head for sample pressure leak.
Scope Test	Not used.
Segment Valve Test	Tests for proper rotation of segmenting valve pads.
Set N Transputers	Checks and sets the number of transputers in the system (Cytometer and Workstation computer).
System Parameter Test	Test shows the level variation (noise) on the system parameters of the system.

Table A.4-1 Tests on Prefinal Software Diskette (Continued)

Test	Function
T805 Test	Tests to verify proper T805 chip installed on Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card. Note: Failure of this test may indicate the circuit card has an INS425/INS405 transputer (instead of the INS805 transputer). If the test fails, inspect U16. If the T805 (INS805) is missing or has been replaced by a 400 series device, then disregard the failure.
Temperature Test	Monitors and check the thermistor on the System Interface card.
Valve Burn In	Continuously tests sample stage up/down and rotation of segmenting valve.
Valve Control	Allows manual control of each valve. Used for pneumatic calibration and locating air leak.
Valve Sequence	Allows system to be drained and cleaned for shipping.
VME Addr Bus Test	Tests VME address bus by writing a digital word and reading it back to see if it matches.
VME Data Bus Test	Tests VME data bus by writing a digital word and reading it back to see if it matches.
Waste Chamber Full Test	Checks for proper operation of eyeball sensor by emptying/filling waste chamber. Currently no specification on elapsed time to empty/fill chamber. Remove panels to perform test.
XY Display	Not used.

MCL Option Commands

Table A.4-2 MCL Option Commands

Name	Keystrokes	Action
Master Reset	  	Place carousel on turntable before executing this command. Always execute this command before any other command. Resets MCL option, brings carousel out, places it in home position.
Carousel Home	  	Places carousel number label in front of bar-code scanner. Tests carousel home position sensor located under turntable stage.
Carousel In	  	Moves carousel from out position to in position. Checks operation of carousel in/out sensor. If sensor does not see flag moved through sensor, carousel is pushed back out.
Carousel Out	  	Moves carousel from in position to out position.
Carousel Load	  	Places carousel in load-carousel position.
Probe Down	  	Moves pickup probe to down position. Checks probe up/down sensor to ensure change of state occurred. Probe stays down after successful completion of command.
Probe Up	  	Moves pickup probe to up position.
Lifter Up	  	Lifts vortex motor up. Checks lifter sensor for change of state as flag passes through sensor. Lifter stays up after successful completion of command.
Lifter Down	  	Lowers vortex mixer.
Lifter Mix	  	Activates vortex motor. Only active when a tube is sensed.
Finger Out	  	Moves tube rotate finger out.
Finger In	  	Moves tube rotate finger in.
Scanner Enable	 	Activates scanner head.

A.5 CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS

Overview

Most Cytometer functions are accomplished by fluidic components that are interconnected by tubing and controlled by timed solenoid signals. This section briefly describes the functions of these fluidic components and shows their locations.

Main Cytometer Components

To expedite finding the name, location, or description of a component, the illustrations and tables in this section are organized in functional groups. [Figure A.5-1](#) is the anchor illustration from which you can quickly access a specific illustration.

[Figure A.5-1](#) is referred to as the anchor illustration because it serves as the reference point for accessing other illustrations. This anchor illustration uses an alphabetic letter to indicate a portion of the Cytometer that correlates with a location description provided in the Figure Reference column. This description includes the figure reference that illustrates and provides the name of the main components located in this area of the Cytometer.

Locating a Component

To quickly locate a component, always begin at the anchor illustration, [Figure A.5-1](#).

1. On the anchor illustration, locate the area of the Cytometer where the component in question is located and note the associated letter.
2. Locate the associated letter in the **Figure Reference** column and note the figure number that best fits the configuration of the instrument.
3. Go to the referenced figure number.
Note: In the electronic version, each figure reference is in hypertext so that when you select the reference, the illustration quickly appears.
4. Locate the component. The number associated with the component identifies its name and also provides a figure reference for locating the component's function on the associated table. Each table also includes the reference designator for the component, where applicable.

Cytometer Anchor Illustration

Figure A.5-1 XL Cytometer with MCL Option, Anchor Illustration for Locating Components

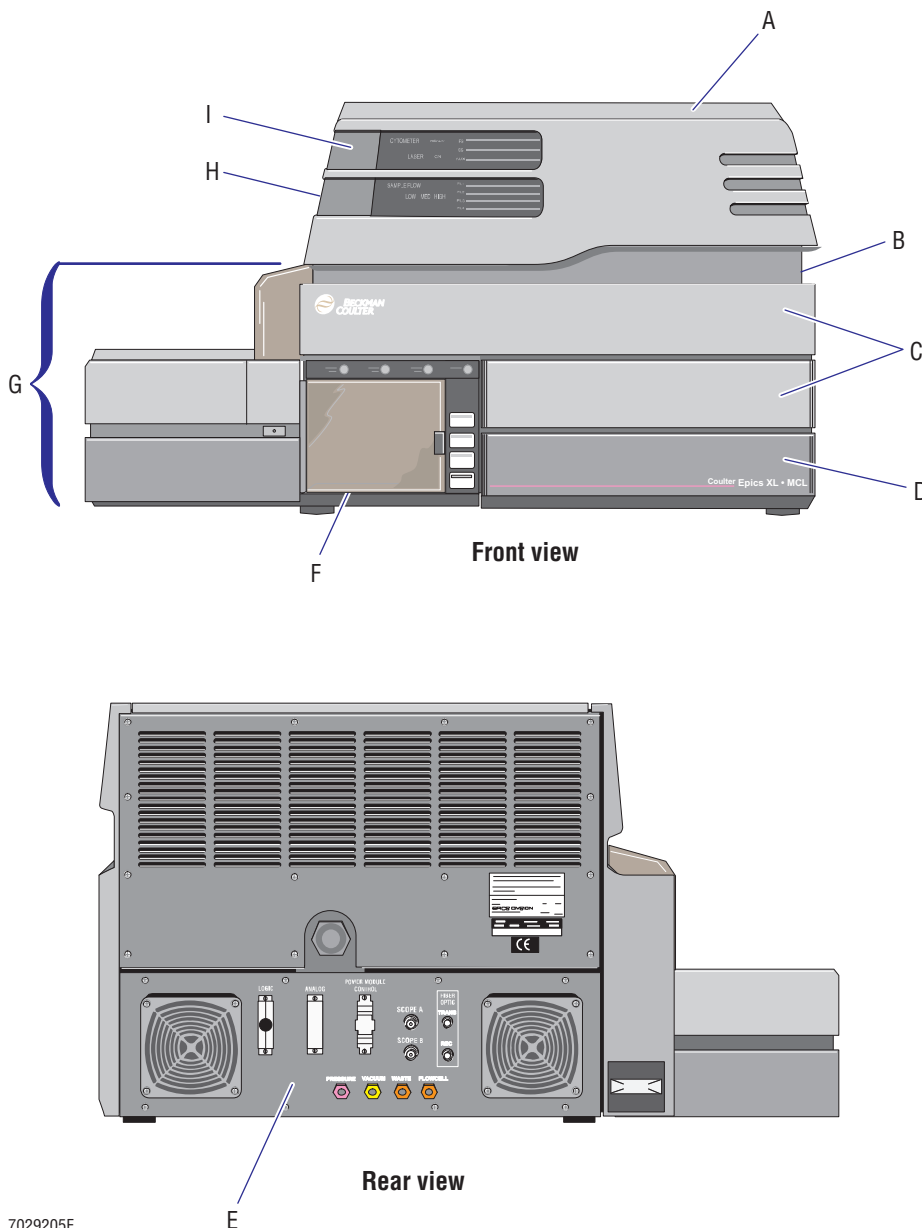


Figure Reference

- A** Components accessed with the top cover removed, [Figure A.5-2](#)
 - Interlock switch, [Figure A.5-2](#)
 - Data Acquisition card cage, [Figure A.5-3](#)
 - Optical collection area, rear view (includes laser and PMTs), [Figure A.5-4](#)
- B** Components accessed with the right side cover removed, [Figure A.5-5](#)
- C** Components accessed with the center front cover removed, [A.5-6](#)
Components accessed with the filter shield removed, [A.5-7](#)
- D** Components inside the reagent drawer, [Figure A.5-8](#)
- E** Rear panel components, [Figure A.5-9](#)
- F** Manual sample station components,
 - Unit **with** MCL option, [Figure A.5-10](#)
 - Unit **without** MCL option, [Figure A.5-11](#)
- Segmenting valve, [Figure A.5-12](#)
- G** MCL option components,
 - Carousel, [Figure A.5-13](#)
 - Components accessed with covers removed, [Figure A.5-14](#)
- H** Components accessed with the left side cover removed including the lower pneumatics drawer, [Figure A.5-15](#)
- I** Front panel display components, [Figure A.5-16](#)

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Table A.5-1 XL Cytometer with MCL Option, Component and Assembly Accessibility

Figure Reference	Main Component or Assembly that is Accessible	To Access Component or Assembly
A.5-1, A	Data Acquisition card cage Optical collection area <ul style="list-style-type: none"> • Argon laser head, plenum, duct • Laser cooling fans • PMT Distribution and Laser Fan Control card • PMT1, PMT2, PMT3, and PMT4 (if a four-color system) 	Must remove the top cover.
A.5-1, B	Upper pneumatics drawer QD13 and QD14 Water trap filter and associated components Cooling coil	Must remove the top cover then the right side cover.
A.5-1, C	Light filters in slots 1 through 9 Neutral density spring-loaded knob	Must remove the center front cover (filter cover).
	Side scatter diode Forward Scatter detector Beamshaper assembly Flow cell and/or fluorescence pickup lens	Must remove the center front cover (filter cover), manual sample station, and the filter shield. If the MCL option is installed, must remove the center front cover (filter cover), unlatched the MCL covers from the Cytometer frame, remove the manual sample station, then remove the filter shield.
A.5-1, D	Sheath liquid filter Sheath liquid filter purge (vent) connections Sheath container Cleaning agent container	Must pull the reagent drawer open.
A.5-1, E	Fans Fiber Optics Interface card CYTO dc power EMI harness cable Pressure, vacuum, and two waste quick-connects	If possible, stand behind the Cytometer. Note: To replace components, it may be necessary to separate the rear panel from the Cytometer frame. <ul style="list-style-type: none"> • If it is necessary to remove the left or right-side cover, the top cover must be removed before the side cover can be removed. • If it is necessary to remove the left side cover and the MCL option is installed, you must remove the top cover, unlatch the MCL from the Cytometer frame, then remove the left side cover.

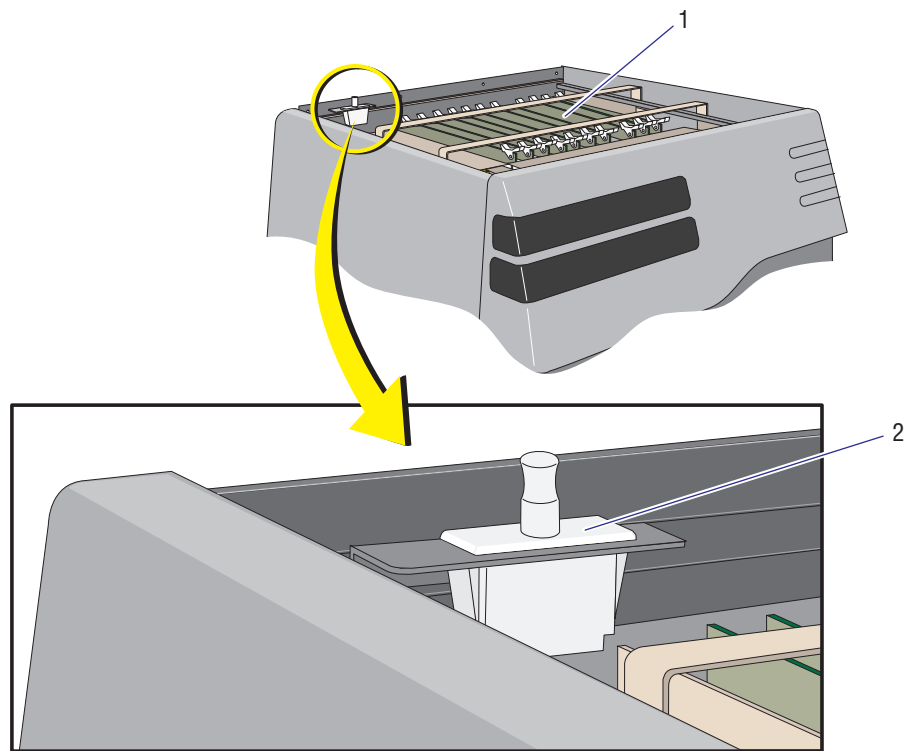
QUICK REFERENCE INFORMATION**CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS****Table A.5-1 XL Cytometer with MCL Option, Component and Assembly Accessibility (*Continued*)**

Figure Reference	Main Component or Assembly that is Accessible	To Access Component or Assembly
A.5-1, F	Data entry membrane switches	Exterior access.
	Sample tube holder	Pull open the manual sample station door.
	Front Panel LED and Switch Input card	Must remove the manual sample station.
	Ribbon cables and latches Segmenting valve	If the MCL option is installed, must remove the center front cover (filter cover), unlatched the MCL covers from the Cytometer frame, then remove the manual sample station.
A.5-1, G	Carousel components	Must open or remove MCL covers.
	MCL main frame assembly	Must remove the top cover, unlatch the MCL from the Cytometer frame, and remove the left side cover.
A.5-1, H	Lower pneumatics drawer	Must remove the top cover then the left side cover.
	Back of mounting plate for laser cooling fans	If the MCL option is installed, must remove the top cover, unlatch the MCL from the Cytometer frame, then remove the left side cover.
A.5-1, I	Front panel display	For observation only.
	Top Panel Display 2 card	Must lift the front panel display door.
	Window display	

Components Accessed with the Cytometer Top Cover Removed

The Cytometer interlock switch and [Data Acquisition Card Cage](#) are accessible when the Cytometer top cover is removed. The rear section of the [Optical Collection Area](#) is accessible when the Cytometer top cover is removed and the Data Acquisition card cage is removed from the center cavity.

Figure A.5-2 Components Accessed with the Cytometer Top Cover Removed (See [Table A.5-2](#))



- 1. Data Acquisition card cage
- 2. Cytometer interlock switch

Optical collection area
(underneath the Data Acquisition card cage)

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Table A.5-2 Components Accessed with the Cytometer Top Cover Removed and Their Functions

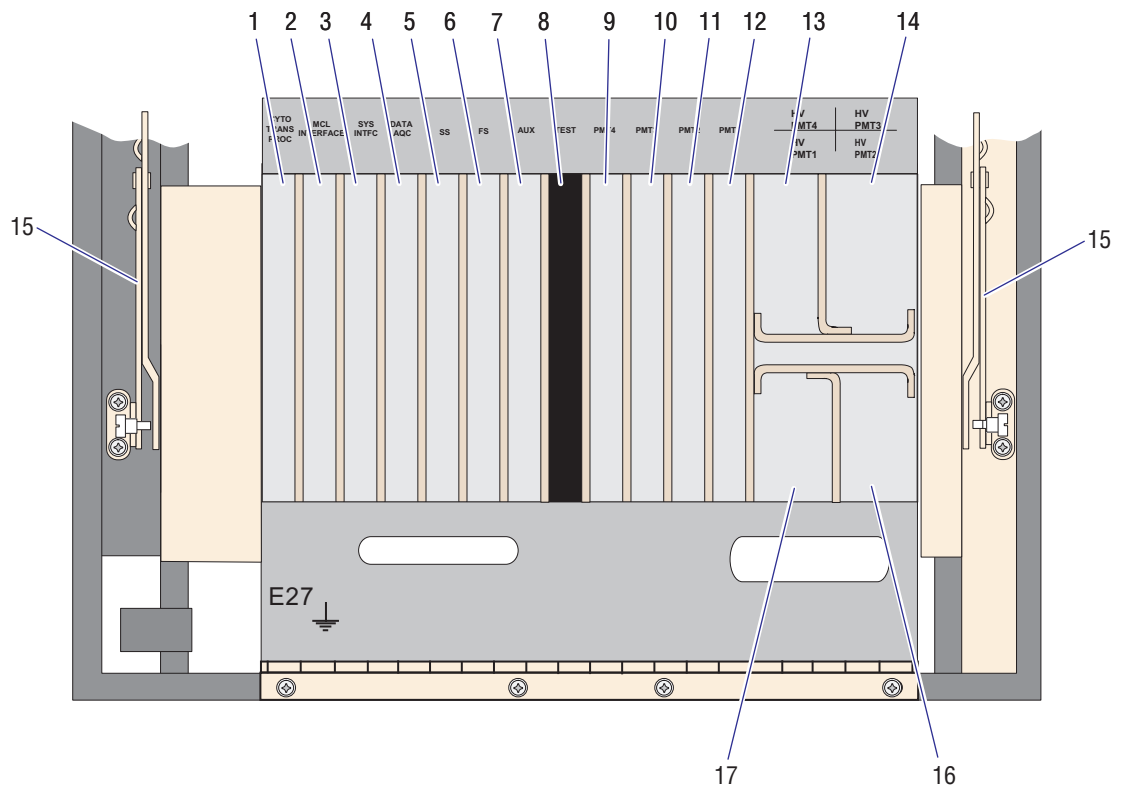
Figure Reference	Component	Function	Reference Designator
A.5-2, 1	Data Acquisition card cage	Houses the electronic circuit cards inside the Cytometer (Figure A.5-3). Most procedures require the card cage be lifted out of the Cytometer and locked in its vertical position. Under Heading 4.3 , see Heading Removing the Data Acquisition Card Cage from the Cytometer Center Cavity for instructions.	
A.5-2, 2	Cytometer interlock switch	<p>Safety interlock to ensure the Cytometer top cover is in place when the Argon laser is on. If the laser is on and the cover is removed, this interlock turns off the power to the Argon laser head.</p> <hr/> <p>WARNING Risk of personal injury. Be very careful when operating the instrument when the safety interlock switch in the Cytometer is defeated, as you may be exposed to the laser beam and/or electric shock. After servicing the instrument, make sure covers are properly reinstalled to reactivate any safety interlock switch that was bypassed while servicing the instrument.</p> <hr/> <p>To override (bypass) this safety interlock, pull the switch up and power is restored to the Argon laser head even though the cover is removed.</p> <p>Always be very careful if you bypass this safety interlock and operate the instrument with the covers off. The interlock switch is reset when the cover is reinstalled.</p>	
A.5-2	Optical collection area	<p>Houses the Argon laser head, flow cell, and the various optical components needed to detect light and fluorescent signals.</p> <p>Rear section is located underneath the Data Acquisition card cage (Figure A.5-4) and the front section is located behind the filter shield (Figure A.5-7). The center front cover (filter cover) must first be removed to access the filter shield.</p> <p>The front section consists of the beamshaping assembly, flow cell, FS detector, SS diode, and various light filters.</p> <p>The rear section consists of the Argon laser head, air ducts, laser blower assembly, PMT Distribution and Laser Fan Control card, and PMTs.</p>	

Data Acquisition Card Cage

The Data Acquisition card cage is accessible when the Cytometer top cover is removed. However, most procedures require the card cage be lifted out of the Cytometer and locked in its vertical position.

Data Acquisition Card Cage, Component Locations

Figure A.5-3 Data Acquisition Card Cage (See Table A.5-3)



1. Cyto Transputer card
2. MCL Interface card
3. System Interface card
4. Trans Data Acquisition card
5. SS Amp/Signal Conditioner card
6. FS Amp/Signal Conditioner card
7. AUX Amp/Signal Conditioner card
8. Empty slot
9. PMT4 Amp/Signal Conditioner card

10. PMT3 Amp/Signal Conditioner card
11. PMT2 Amp/Signal Conditioner card
12. PMT1 Amp/Signal Conditioner card
13. PMT4 HV power supply
14. PMT3 HV power supply
15. Hinge, left and right
16. PMT2 HV power supply
17. PMT1 HV power supply

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Table A.5-3 Data Acquisition Card Cage, Components and Functions

Figure Reference	Component	Function	Reference Designator
A.5-3, 1	Cyto Transputer card	<p>Circuit card located in Slot 1 of the Data Acquisition card cage (left to right orientation).</p> <p>Master processor for the Cytometer that controls the communication among all the circuit cards in the Cytometer. Via the Fiber Optics Interface card attached to the Cytometer lower rear panel, this circuit card serves as the communication link to the Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card located inside the Workstation computer.</p> <p>Receives digital data from the Trans Data Acquisition card and sends this digital data to Fiber Optics Interface card where the digital data is converted to optical data that is sent to the Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card in the Workstation computer where the optical data is converted back to digital data that is used to create the histograms displayed on the Workstation screen.</p>	Refer to PN 6320738
A.5-3, 2	MCL Interface card	<p>If the MCL option is installed, this circuit card is located in Slot 2 of the Data Acquisition card cage (left to right orientation).</p> <p>Communicates command instructions to the MCL CPU card to operate the MCL option.</p>	Refer to PN 6321034
A.5-3, 3	System Interface card	<p>Circuit card located in Slot 3 of the Data Acquisition card cage (left to right orientation).</p> <p>Controls and monitors all system functions, laser ON/OFF, valve activation. Also monitors internal system temperatures.</p>	Refer to PN 6320782
A.5-3, 4	Trans Data Acquisition card	<p>Circuit card located in Slot 4 of the Data Acquisition card cage (left to right orientation).</p> <p>Receives analog signal data from all Amp/Signal Conditioner cards (SS, FS, AUX, PMT4, PMT3, PMT2, and PMT1). Circuit card contains an ADC that converts the analog signal to digital data which is then sent to the Cyto Transputer card.</p>	Refer to PN 6320732
A.5-3, 5	SS Amp/Signal Conditioner card	<p>Circuit card located in Slot 5 of the Data Acquisition card cage (left to right orientation).</p> <p>Receives the analog signal from the side scatter diode and amplifies that signal before sending it to the Trans Data Acquisition card.</p> <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage).</p>	Refer to PN 6320739

Table A.5-3 Data Acquisition Card Cage, Components and Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-3, 6	FS Amp/Signal Conditioner card	<p>Circuit card located in Slot 6 of the Data Acquisition card cage (left to right orientation).</p> <p>Receives the analog signal from the forward scatter detector and amplifies that signal before sending it to the Trans Data Acquisition card.</p> <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage)</p>	Refer to PN 6320739
A.5-3, 7	AUX Amp/Signal Conditioner card	<p>Circuit card located in Slot 7 of the Data Acquisition card cage (left to right orientation).</p> <p>User defined fluorescent channel that receives analog peak voltage pulse signals from either PMT1, PMT2, PMT3, or PMT4. PMT selection is designated by the user via the protocol.</p> <p>When a PMT is selected as AUX on a protocol, peak analog pulses from the designated PMT are simultaneously sent to the AUX Amp/Signal Conditioner card and the corresponding PMT Amp/Signal Conditioner card.</p> <ul style="list-style-type: none"> At the AUX Amp/Signal Conditioner card, the peak signal is amplified then sent to the Trans Data Acquisition card. At the corresponding PMT Amp/Signal Conditioner card, the peak signal is amplified and held in an active integrating mode. The integral pulse is then sent to the Trans Data Acquisition card. <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage)</p>	Refer to PN 6320739
A.5-3, 8	Empty slot	Slot 8 of the Data Acquisition card cage (left to right orientation).	

Table A.5-3 Data Acquisition Card Cage, Components and Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-3, 9	PMT4 Amp/Signal Conditioner card (optional)	<p>Circuit card is located in Slot 9 of the Data Acquisition card cage (left to right orientation) only when the four-color option is installed.</p> <p>Receives Gaussian-shaped analog signals from PMT4. Each analog signal is amplified and held in an active integrating mode to produce an integral pulse that is sent to the Trans Data Acquisition card.</p> <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage)</p>	Refer to PN 6320739
A.5-3, 10	PMT3 Amp/Signal Conditioner card	<p>Circuit card located in Slot 10 of the Data Acquisition card cage (left to right orientation).</p> <p>Receives Gaussian-shaped analog signals from PMT3. Each analog signal is amplified and held in an active integrating mode to produce an integral pulse that is sent to the Trans Data Acquisition card.</p> <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage)</p>	Refer to PN 6320739
A.5-3, 11	PMT2 Amp/Signal Conditioner card	<p>Circuit card located in Slot 11 of the Data Acquisition card cage (left to right orientation).</p> <p>Receives Gaussian-shaped analog signals from PMT2. Each analog signal is amplified and held in an active integrating mode to produce an integral pulse that is sent to the Trans Data Acquisition card.</p> <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage)</p>	Refer to PN 6320739
A.5-3, 12	PMT1 Amp/Signal Conditioner card	<p>Circuit card located in Slot 12 of the Data Acquisition card cage (left to right orientation).</p> <p>Receives Gaussian-shaped analog signals from PMT1. Each analog signal is amplified and held in an active integrating mode to produce an integral pulse that is sent to the Trans Data Acquisition card.</p> <p>Note: All the Amp/Signal Conditioner cards are interchangeable. Addressing for the designated parameter is determined by the location (slot) where the circuit card is inserted into the Analyzer backplane (attached to the rear of the Data Acquisition card cage)</p>	Refer to PN 6320739

Table A.5-3 Data Acquisition Card Cage, Components and Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-3, 13	PMT4 HV power supply (optional)	<p>In the HV power supply section of the Data Acquisition card cage, the PMT4 HV power supply is located in the upper left quadrant when the four-color option is installed.</p> <p>In response to the HV gain setting defined by the operator, provides high voltage (HV) to the PMT4 assembly for amplifying the Gaussian-shaped analog signal before it is sent to the PMT4 Amp/Signal Conditioner card (and AUX Amp/Signal Conditioner card, if applicable).</p> <p>Note: All PMT HV power supplies are interchangeable. Addressing for the designated parameter is determined by the location where the power supply is connected to the Analyzer backplane (attached to the rear of the Data Acquisition card cage).</p>	
A.5-3, 14	PMT3 HV power supply	<p>In the HV power supply section of the Data Acquisition card cage, the PMT3 HV power supply is located in the upper right quadrant.</p> <p>In response to the HV gain setting defined by the operator, provides high voltage (HV) to the PMT3 assembly for amplifying the Gaussian-shaped analog signal before it is sent to the PMT3 Amp/Signal Conditioner card (and AUX Amp/Signal Conditioner card, if applicable).</p> <p>Note: All PMT HV power supplies are interchangeable. Addressing for the designated parameter is determined by the location where the power supply is connected to the Analyzer backplane (attached to the rear of the Data Acquisition card cage).</p>	
A.5-3, 15	Hinge, left and right	<p>These hinges are use to lock the Data Acquisition card cage in a vertical position outside of the Cytometer. To properly lock the card cage:</p> <ol style="list-style-type: none"> 1. With one hand, pull the Data Acquisition card cage forward and hold it in an upright position. 2. With your free hand, lock the hinge on each side of the card cage to secure the card cage in this vertical position. 3. Make sure both hinges are locked before releasing your grip. <p>To lower the card cage back into the center cavity of the Cytometer:</p> <ol style="list-style-type: none"> 1. Stand in front of the Cytometer and grasp the top of the Data Acquisition card cage. 2. With a secure hold on the card cage, unlock the card cage hinges with your other hand. 3. Gently lower the card cage into the center cavity of the Cytometer. 	

Table A.5-3 Data Acquisition Card Cage, Components and Functions (*Continued*)

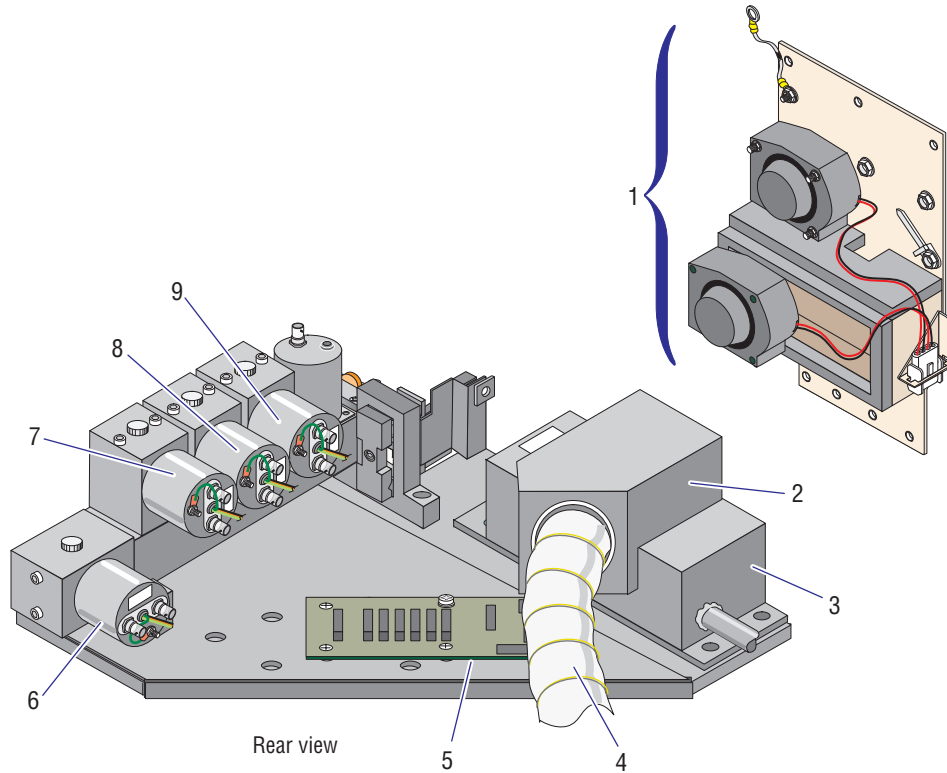
Figure Reference	Component	Function	Reference Designator
A.5-3, 16	PMT2 HV power supply	<p>In the HV power supply section of the Data Acquisition card cage, the PMT2 HV power supply is located in the lower right quadrant.</p> <p>In response to the HV gain setting defined by the operator, provides high voltage (HV) to the PMT2 assembly for amplifying the Gaussian-shaped analog signal before it is sent to the PMT2 Amp/Signal Conditioner card (and AUX Amp/Signal Conditioner card, if applicable).</p> <p>Note: All PMT HV power supplies are interchangeable. Addressing for the designated parameter is determined by the location where the power supply is connected to the Analyzer backplane (attached to the rear of the Data Acquisition card cage).</p>	
A.5-3, 17	PMT1 HV power supply	<p>In the HV power supply section of the Data Acquisition card cage, the PMT1 HV power supply is located in the lower left quadrant.</p> <p>In response to the HV gain setting defined by the operator, provides high voltage (HV) to the PMT1 assembly for amplifying the Gaussian-shaped analog signal before it is sent to the PMT1 Amp/Signal Conditioner card (and AUX Amp/Signal Conditioner card, if applicable).</p> <p>Note: All PMT HV power supplies are interchangeable. Addressing for the designated parameter is determined by the location where the power supply is connected to the Analyzer backplane (attached to the rear of the Data Acquisition card cage).</p>	

Optical Collection Area

The rear section of the optical collection area is accessible when the Cytometer top cover is removed and the Data Acquisition card cage is removed from the center cavity

Optical Collection Area, Component Locations (Rear View)

Figure A.5-4 Optical Collection Area, Rear View (See [Table A.5-4](#))



- 1. Laser blower assembly
- 2. Laser duct out plenum
- 3. Argon laser head
- 4. Flexible duct
- 5. PMT Distribution and Laser Fan Control card

- 6. PMT 4 (optional)
- 7. PMT3
- 8. PMT2
- 9. PMT1

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Table A.5-4 Optical Collection Area, Components and Functions

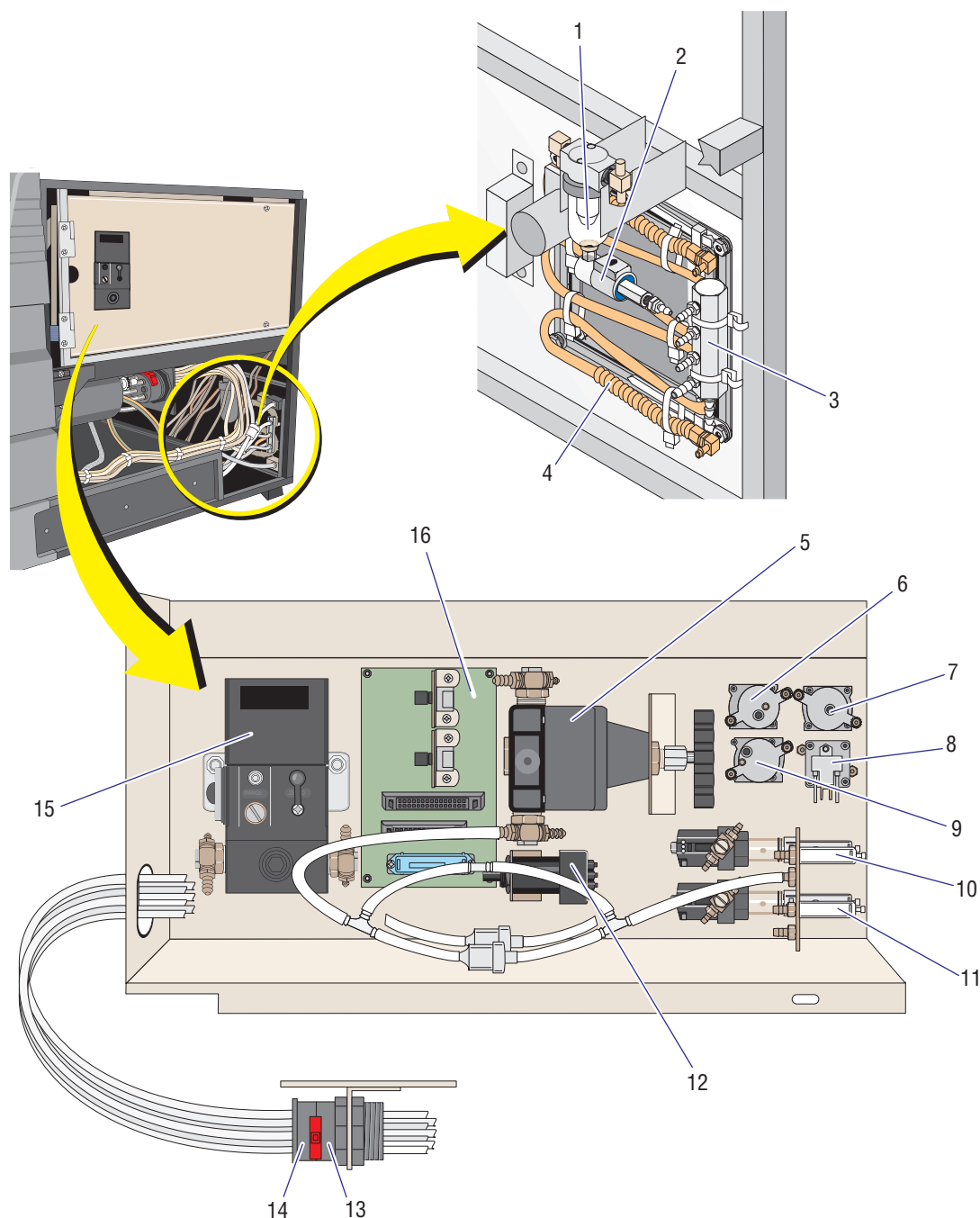
Figure Reference	Component	Function	Reference Designator
A.5-4, 1	Laser blower assembly	Assembly contains two fans that force cooling air across the Argon laser head.	
A.5-4, 2	Laser duct out plenum	Facilitates cooling of the laser head by directing the forced air from the laser blower assembly over the laser tube.	
A.5-4, 3	Argon laser head	Provides the 488 nm laser beam that passes through cross-cylindrical lenses (a vertical and horizontal lens) that shape and focus the laser beam on the sensing area of the flow cell.	
A.5-4, 4	Flexible duct	Provides an exit pathway for the cooling air being forced across the Argon laser by the laser blower assembly to be exhausted out the rear of the Cytometer.	
A.5-4, 5	PMT Distribution and Laser Fan Control card	Provides ± 15 Vdc to the PMTs, controls the laser blower assembly and the laser interlock switch that is activated when the Cytometer top cover is removed.	
A.5-4, 6	PMT4 (optional)	<p>Photomultiplier tube that detects the 675 nm wavelength emitted by the PC5 dye. Light entering PMT4 is converted to a Gaussian-shaped analog pulse that is amplified in response to the PMT4 HV gain setting defined by the operator.</p> <p>Note: PMTs are interchangeable. PC5, a dye that excites at 488 nm and emits at the red end of the spectrum, is used for cell surface marker applications.</p>	
A.5-4, 7	PMT3	<p>Photomultiplier tube that detects the 620 nm wavelength emitted by the ECD dye (energy coupled dye). Light entering PMT3 is converted to a Gaussian-shaped analog pulse that is amplified in response to the PMT3 HV gain setting defined by the operator.</p> <p>Note: PMTs are interchangeable. ECD, a tandem dye that excites at 488 nm and emits at the orange end of the spectrum, is used for cell surface marker applications. A phycoerythrin and Texas red combination is an example.</p>	
A.5-4, 8	PMT2	<p>Photomultiplier tube that detects the 575 nm wavelength emitted by the PE dye (phycoerythrin dye). Light entering PMT2 is converted to a Gaussian-shaped analog pulse that is amplified in response to the PMT2 HV gain setting defined by the operator.</p> <p>Note: PMTs are interchangeable. PE, a dye that excites at 488 nm and emits at the yellow end of the spectrum, is used for cell surface marker applications.</p>	

Table A.5-4 Optical Collection Area, Components and Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-4, 9	PMT1	<p>Photomultiplier tube that detects the 525 nm wavelength emitted by the FITC dye (fluorescein isothiocyanate dye). Light entering PMT1 is converted to a Gaussian-shaped analog pulse that is amplified in response to the PMT1 HV gain setting defined by the operator.</p> <p>Note: PMTs are interchangeable. FITC, a dye that excites at 488 nm and emits at the green end of the spectrum, is used primarily for cell surface marker applications.</p>	

Components Accessed with the Right Side Cover Removed

Figure A.5-5 Right Side View of the Cytometer with the Cover Removed (See [Table A.5-5](#))



- | | |
|------------------------------|-------------------------------|
| 1. Water trap filter | 9. SN8 |
| 2. VL33 | 10. VL22 |
| 3. Manifold | 11. VL21 |
| 4. Cooling coil | 12. Vacuum regulator |
| 5. Sheath pressure regulator | 13. QD14 |
| 6. SN6 | 14. QD13 |
| 7. SN7 | 15. Sample pressure regulator |
| 8. SN9 | 16. Sensor card |

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Table A.5-5 Components in the Right Side of the Cytometer and their Functions

Figure Reference	Component	Function	Reference Designator
A.5-5, 1	Water trap filter	<p>Component may also be referred to as an air/water filter separator. Compressed air (pressure) generated by the compressor portion of the compressor/vacuum pump is hot. As the hot compressed air leaves the compressor portion or the compressor/vacuum pump, it passes through a cooling coil inside the Power Supply module where moisture in the air condenses. As the cooled air moves out of the cooling coil it is sent through the air/water filter separator to filter particles out of the air and to allow the heavier moisture to drop from the air. There is a second cooling coil inside the Cytometer and this water trap filter inside the Cytometer is a second air/water filter separator to further dry the air and prevent internal rusting of components such as solenoids.</p> <p>When power to the Cytometer is on, solenoid VL 33 is energized, blocking the drain pathway into the waste tank. As a result, once every 24 hours, the customer must power off the Cytometer for 30 minutes to allow the moisture collected inside the water trap to drain through the now de-energized VL 33 into the waste tank.</p>	FL 5 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-5, 2	VL33	<p><i>Type of Valve</i> Two-way, normally-open solenoid valve that serves as a dump valve to empty the water trap in the Cytometer.</p> <p><i>Energized</i> - When power to the Cytometer is on, solenoid VL 33 is energized, blocking the drain pathway from the water trap to the waste tank.</p> <p><i>De-energized</i> - Once every 24 hours, the customer must power off the Cytometer for 30 minutes to allow the moisture collected inside the water trap to drain through the now open VL 33 into the waste tank.</p>	VL 33 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-5, 3	Waste manifold	<p>Provides a single point for routing waste from various areas of the Cytometer to the external waste tank.</p> <ul style="list-style-type: none"> • Port 1 - Output from the manifold to the external waste tank. • Port 2 - Input via the normally-closed side of VL22 (located inside the upper pneumatics drawer). • Port 3 - Input via VL33 (when de-energized). • Port 4 - Input from the waste chamber when normally-closed VL7 is energized. • Port 5 - Input from the sheath filter purge valve (VL20 located inside the reagent drawer) when the pinch valve is manually pushed to activate a purge of the sheath filter to remove bubbles. 	MF 1 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886

Table A.5-5 Components in the Right Side of the Cytometer and their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-5, 4	Cooling coil	Copper coil that provides a passageway for the once cooled compressed air (pressure) from the Power Supply module to circulate and cool further as fans blow air across the coils to lower the temperature. As the once cooled compressed air passes through this cooling coil, more moisture in the air condenses. As the cooled air moves out of the cooling coil it is sent through the air/water filter separator to filter particles out of the air and to allow the heavier moisture to drop from the air to prevent internal rusting of components such as solenoids.	COOLING COIL inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-5, 5	Sheath pressure regulator	Mechanical regulator used to regulate sheath pressure. When properly adjusted, provides 4 psi to the sheath and cleanse tanks. The system pressure regulated by this mechanical regulator is commonly referred to as sheath pressure.	RG 2 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 6	SN6	Normally-open vacuum/pressure switch detects when a test tube is placed in the manual sample station. At rest, the sample head has a constant supply of vacuum leaking out to atmosphere. When an operator properly positions a sample tube inside the manual sample station, the tube makes contact with the sample head and seals the vacuum leak. Sufficient vacuum (2 in. Hg) building up inside the tube triggers SN6 to close which in turn triggers the manual stage air cylinder (CL 1) to raise the sample tube up for acquisition.	SN 6 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 7	SN7	Normally-open vacuum/pressure switch monitors the sample pressure inside a sample tube positioned in the manual sample station to make sure the sample pressure inside the sample tube is sufficient to produce the LOW, MEDIUM, or HIGH sample flow rate selected by the operator. If the sample pressure inside the sample tube is not sufficient, a <i>Sample Pressure Error</i> message appears on the Workstation screen to alert the operator. If the MCL option is installed, this switch is used to determine if the sample pressure being supplied to the sample tube via the MCL sample head is holding steady. If it is holding steady, acquisition begins. If it is not holding steady, the lifter assembly attempts making a better seal by lowering and relifting the sample tube.	SN 7 inside the UPPER PNEUMATICS PANEL block on PN 6320886

Table A.5-5 Components in the Right Side of the Cytometer and their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-5, 8	SN9	Normally-closed vacuum/pressure switch monitors the system pressure available to the Cytometer. (This is the system pressure generated by the pressure portion of the dual-head compressor/vacuum pump inside the Power Supply module.) if the system pressure falls below 25 psi, a <i>System Pressure Error</i> message appears on the Workstation screen to alert the operator.	SN 9 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 9	SN8	Normally-closed vacuum/pressure switch monitors the system vacuum available to the Cytometer. (This is the system vacuum created by the vacuum portion of the dual-head compressor/vacuum pump inside the Power Supply module.) if the system vacuum falls below 10 in. Hg, a <i>System Vacuum Error</i> message appears on the Workstation screen to alert the operator.	SN 8 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 10	VL22	<p><i>Type of Valve</i> Pinch valve (double-action, solenoid-actuated) used to control flow of sheath pressure to the sheath and cleanse tanks.</p> <p><i>Actuated</i> - Sheath pressure (regulated by RG 2) flows to the sheath and cleanse tanks. Valve is always actuated except when the Cytometer is placed in the IDLE mode or when power to the Cytometer is turned off.</p> <p><i>De-actuated</i> - Flow of sheath pressure to the sheath and cleanse tanks is blocked. This occurs only when the Cytometer is placed in the IDLE mode or when power to the Cytometer is turned off.</p>	VL 22 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 11	VL21	<p><i>Type of Valve</i> Pinch valve (double-action, solenoid-actuated) used to control sample pressure flow.</p> <p><i>De-actuated</i> - Resting state. Sample pressure is blocked.</p> <p><i>Actuated</i> - When data acquisition begins, sample pressure (regulated by RG 1) is available via VL13 at the sample head.</p> <ul style="list-style-type: none"> • If VL13 is de-actuated, sample pressure is available at the manual sample head. • If VL13 is actuated, sample pressure is available at the MCL sample head. 	VL 21 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 12	Vacuum regulator	<p>Regulates the constant vacuum being supplied to the manual sample head.</p> <p>If the MCL option is installed, vacuum is supplied to the waste port of the MCL sample head. Vacuum is adjusted based on what is required at the manual sample head.</p>	RG 3 inside the UPPER PNEUMATICS PANEL block on PN 6320886

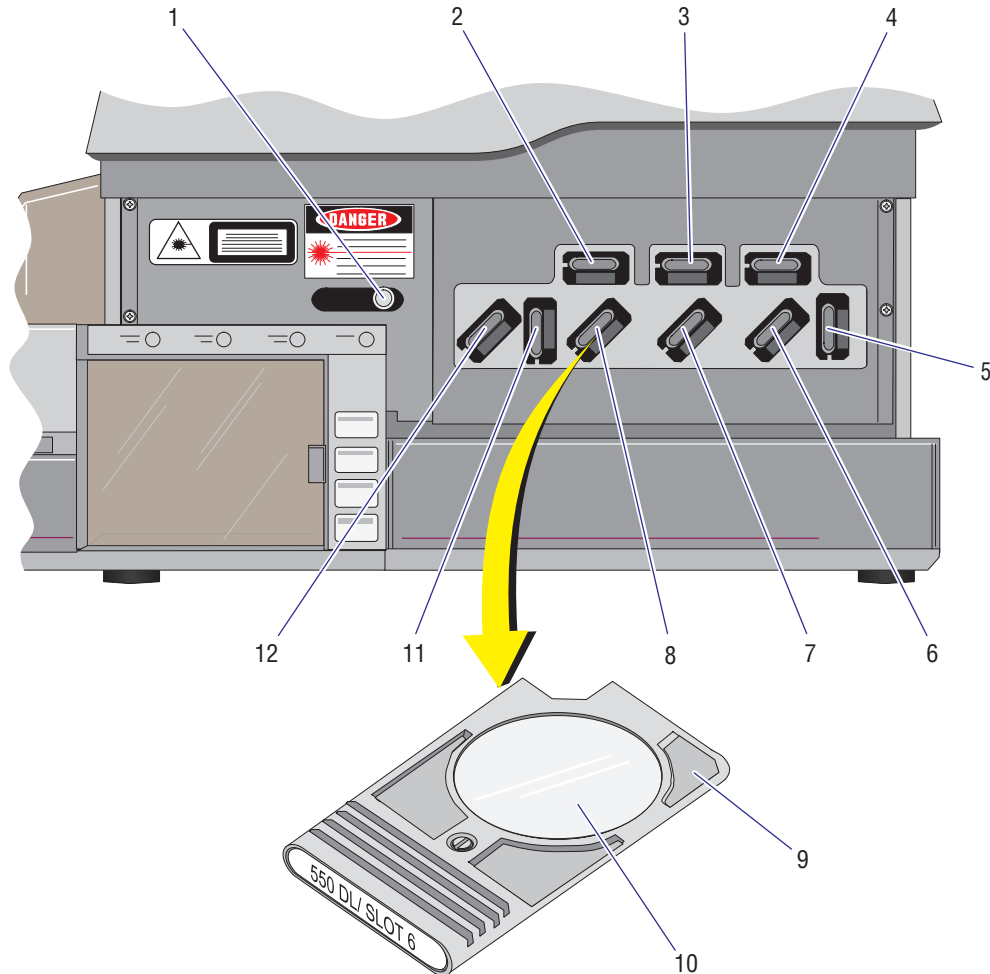
QUICK REFERENCE INFORMATION**CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS****Table A.5-5 Components in the Right Side of the Cytometer and their Functions (Continued)**

Figure Reference	Component	Function	Reference Designator
A.5-5, 13	QD14	Quick-disconnect male coupling that provides one central connector for routing pneumatics to components inside the upper pneumatics drawer and then routing regulated pneumatics to components inside the Cytometer	QD 14 left of the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 14	QD13	Quick-disconnect female coupling that provides one central connector for routing pneumatics to components inside the upper pneumatics drawer and then routing regulated pneumatics to components inside the Cytometer.	QD 13 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 15	Sample pressure regulator	Electronic pressure regulator (electronic transducer) regulates the sample pressure to comply with the LOW, MEDIUM, or HIGH sample flow rate selected by the operator. The system pressure regulated by this electronic pressure regulator is commonly referred to as sample pressure.	RG 1 inside the UPPER PNEUMATICS PANEL block on PN 6320886
A.5-5, 16	Sensor card	Circuit card that: <ul style="list-style-type: none">• Monitors the sheath and sample pressures.• Reports sheath and sample pressure values to the System Interface card.	Refer to PN 6320630

Components Accessed with the Center Front Cover Removed

The center front cover may also be referred to as the filter cover or center front panel.

Figure A.5-6 Inside View of the Cytometer with the Center Front Cover Removed (See [Table A.5-6](#))



- 1. ND1 filter positioning knob
- 2. 525 BP light filter
- 3. 575 BP light filter
- 4. 620 BP light filter
- 5. 675 BP light filter
- 6. 645 DL light filter

- 7. 600 DL light filter
- 8. 550 DL light filter
- 9. Filter holder
- 10. Light filter
- 11. 488 BK light filter
- 12. 488 DL light filter

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Table A.5-6 Components Behind the Center Front Cover and their Functions

Figure Reference	Component	Function	Reference Designator
A.5-6, 1	ND1 filter positioning knob	<p>ND1 is short for a neutral density 1 filter.</p> <p>This filter is already located in the sensing area. The operator positions the filter for use by sliding the spring-loaded knob along a track. When the knob is at the right end of its track, the filter is not used.</p> <p>Note: Neutral density filters do not discriminate light by wavelength; they block all wavelengths equally. The ND1 filter is used primarily in those laboratories that analyze large particles such as plant cells. This filter blocks the larger forward scatter particles that emit brighter scattered light to prevent detector saturation.</p>	
A.5-6, 2	525 BP light filter	<p>Fluorescent band pass filter that transmits emissions in the 525 nm region (filter passes 515 nm to 535 nm wavelengths).</p> <p>Note: Band pass filters pass a narrow band of wavelengths and block all others. These filters are used to pass fluorescence light from a single dye, while blocking light from other dyes.</p>	
A.5-6, 3	575 BP light filter	<p>Fluorescent band pass filter that transmits emissions in the 575 nm region (filter passes 567.5 nm to 582.5 nm wavelengths).</p> <p>Note: Band pass filters pass a narrow band of wavelengths and block all others. These filters are used to pass fluorescence light from a single dye, while blocking light from other dyes.</p>	
A.5-6, 4	620 BP light filter	<p>Fluorescent band pass filter that transmits emissions in the 620 nm region (filter passes 610 nm to 630 nm wavelengths).</p> <p>Note: Band pass filters pass a narrow band of wavelengths and block all others. These filters are used to pass fluorescence light from a single dye, while blocking light from other dyes.</p>	
A.5-6, 5	675 BP light filter	<p>Fluorescent band pass filter that transmits emissions in the 675 nm region (filter passes 660 nm to 690 nm wavelengths).</p> <p>Note: Band pass filters pass a narrow band of wavelengths and block all others. These filters are used to pass fluorescence light from a single dye, while blocking light from other dyes.</p>	

Table A.5-6 Components Behind the Center Front Cover and their Functions (*Continued*)

Figure Reference	Component	Function	Reference Designator
A.5-6, 6	645 DL light filter	Dichroic long pass filter used to pass 655 nm to 725 nm fluorescent emissions while reflecting 607 nm to 630 nm wavelengths. Note: The filter occupying this slot is actually a 640 DL filter labeled as 645 DL. Dichroic long pass filters pass longer wavelengths and reflect shorter ones. These filters are identified by their 50% transmittance wavelength and must be placed in a diagonal position.	
A.5-6, 7	600 DL light filter	Dichroic long pass filter used to pass 612 nm to 725 nm fluorescent emissions while reflecting 550 nm to 590 nm wavelengths. Note: Dichroic long pass filters pass longer wavelengths and reflect shorter ones. These filters are identified by their 50% transmittance wavelength and must be placed in a diagonal position.	
A.5-6, 8	550 DL light filter	Dichroic long pass filter used to pass 560 nm to 725 nm fluorescent emissions while reflecting 500 nm to 540 nm wavelengths. Note: Dichroic long pass filters pass longer wavelengths and reflect shorter ones. These filters are identified by their 50% transmittance wavelength and must be placed in a diagonal position.	
A.5-6, 9	Filter holder	Plastic assembly that holds the round glass filter.	
A.5-6, 10	Light filter	Optical grade filter used for signal processing.	
A.5-6, 11	488 BK light filter	Long pass laser blocking filter that blocks scattered laser light in the 488 nm region from entering the optical collection area where the PMTs are housed (filter passes fluorescent light 505 nm to 725 nm wavelengths). Note: Blocking filters pass light at all wavelengths except for a narrow band of blocked wavelengths. The filters are identified by the laser line they most effectively block; they typically pass about 0.01 to 1.0% of those wavelengths. Blocking filters are used in the detector compartment to block intense laser light scatter.	
A.5-6, 12	488 DL light filter	Dichroic long pass filter used to pass 510 nm to 725 nm fluorescent emissions while reflecting the 488 nm wavelength. Note: Dichroic long pass filters pass longer wavelengths and reflect shorter ones. These filters are identified by their 50% transmittance wavelength and must be placed in a diagonal position.	

Components Accessed with the Filter Shield Removed

Figure A.5-7 Inside View of the Cytometer with the Filter Shield Removed (See [Table A.5-7](#))

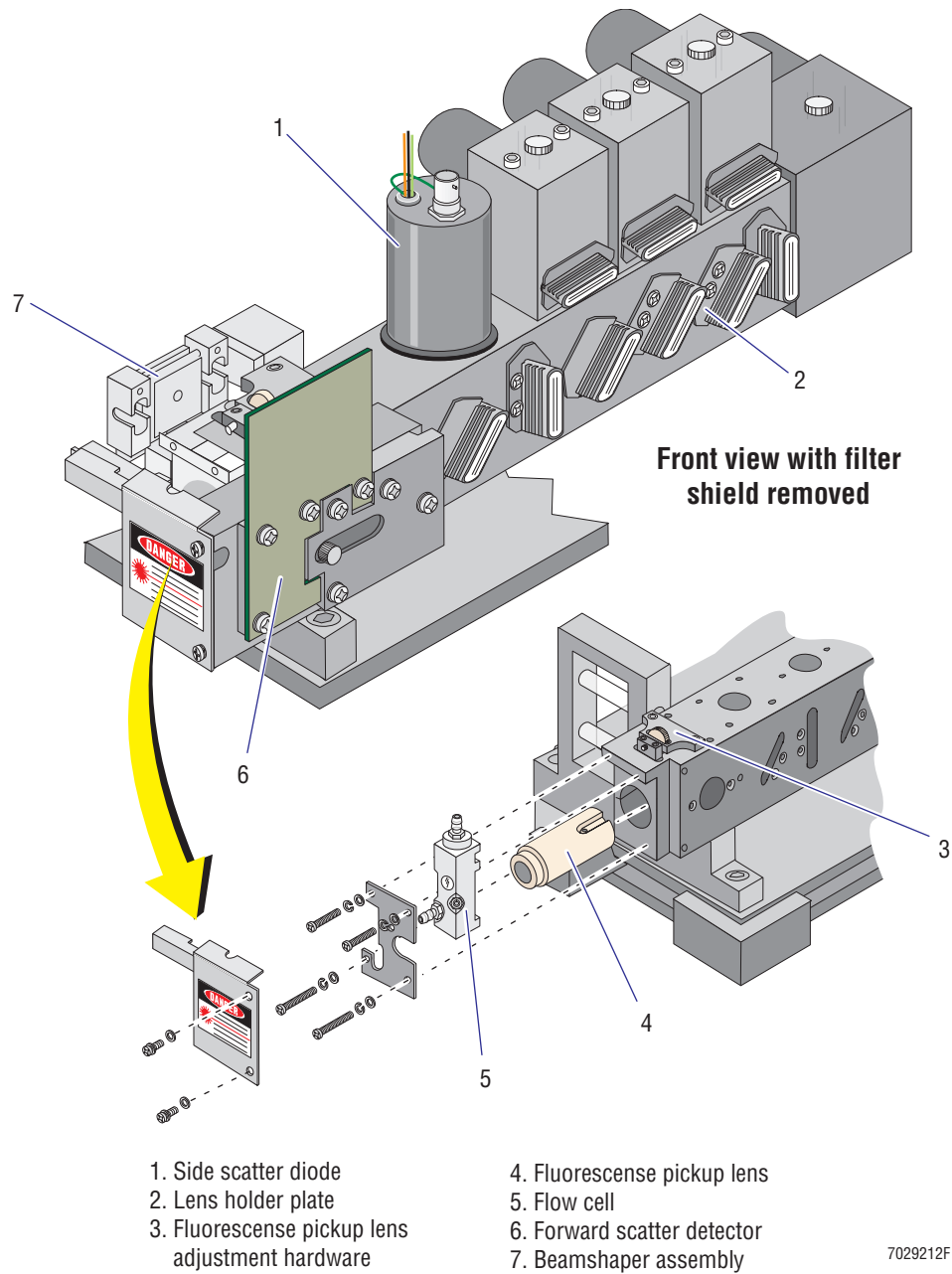


Table A.5-7 Components Behind the Filter Shield and their Functions

Figure Reference	Component	Function	Reference Designator
A.5-7, 1	Side scatter diode	Also referred to as SS diode, SS sensor, or SS detector. Collects the laser light that is scattered at about a 90° angle to the axis of the laser beam as a particle passes through the laser beam. The amount of laser light scattered is referred to as side scatter (SS) and is proportional to the granularity of the cell that scattered the laser light. Note: SS is used to differentiate between lymphocytes, monocytes, and granulocytes.	
A.5-7, 2	Lens holder plate	Blocks ambient light from entering the optical filter block. Also secures filter holder when two screws are properly installed.	
A.5-7, 3	Fluorescence pickup lens adjustment hardware	Provides an easy way to move the pickup lens to maximize the fluorescent signals.	
A.5-7, 4	Fluorescence pickup lens	Collimates fluorescent light emitted by the sample as it is excited by the laser.	
A.5-7, 5	Flow cell	Contains the sensing area where the individual cells are intersected by the laser beam. A process called hydrodynamic focusing ensures the cells move through the laser beam one at a time, along the same path. The flow cell sensing area consists of a 250-μ square quartz channel with an integral lens mounted with a vertical (upward) flow path. A stream of sheath fluid, pressurized at a constant 4 psi, enters the channel at the lower end and flows upward. While the sheath stream is flowing through the channel, sample pressure is applied to push a stream of sample from the bottom of the flow cell upward, injecting the sample into the middle of the sheath stream. Because the pressure being applied to the sheath differs from the pressure being applied to the sample stream, the two streams are traveling at different rates so that the sheath stream surrounds, but does not mix, with the sample stream. The pressure of the sheath stream focuses the sample stream so that cells flow through the sensing area (the center of the 250-μ square quartz channel) single file (one at a time).	FC 1 on PN 6320886

Table A.5-7 Components Behind the Filter Shield and their Functions (*Continued*)

Figure Reference	Component	Function	Reference Designator
A.5-7, 6	Forward scatter detector	<p>Also referred to as FS detector, FS sensor or forward scatter sensor.</p> <p>Collects the laser light that is scattered at narrow angles to the axis of the laser beam as a particle passes through the laser beam. The amount of forward scatter (FS) is proportional to the size of the cell that scattered the laser light.</p> <p>When the light reaches the FS detector, the detector generates voltage pulse signals that are proportional to the intensity of light the detector received.</p> <p>These signals are processed to measure the characteristics of the cells that scattered the light.</p>	
A.5-7, 7	Beamshaper assembly	<p>Contains two cross-cylindrical lenses that shape and focus the laser beam produced by the laser head. The first lens controls the width of the beam; the second, the height.</p> <p>The cross-cylindrical lenses shape the round laser beam into an elliptical beam and focus the laser beam into the flow cell chamber. Focusing keeps the beam perpendicular to the sample stream flow while making the beam small enough to illuminate only one cell at a time.</p>	

Components Inside the Reagent Drawer

Figure A.5-8 View of an Open Reagent Drawer (See [Table A.5-8](#))

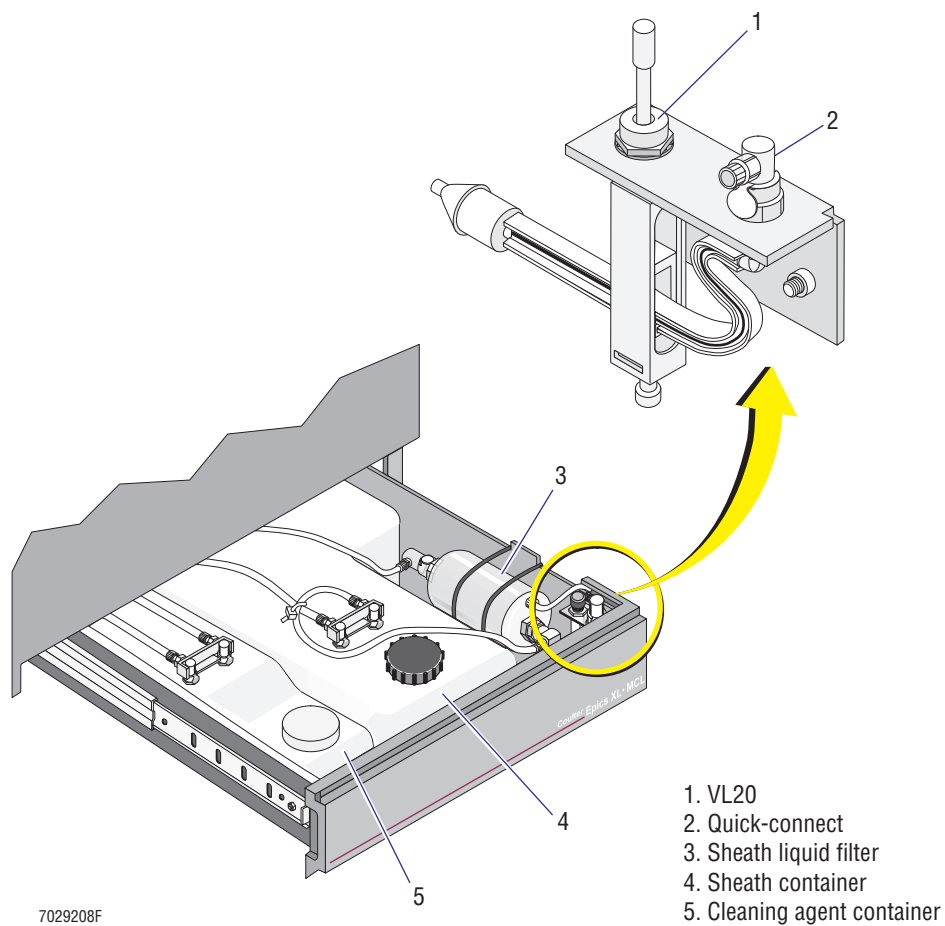
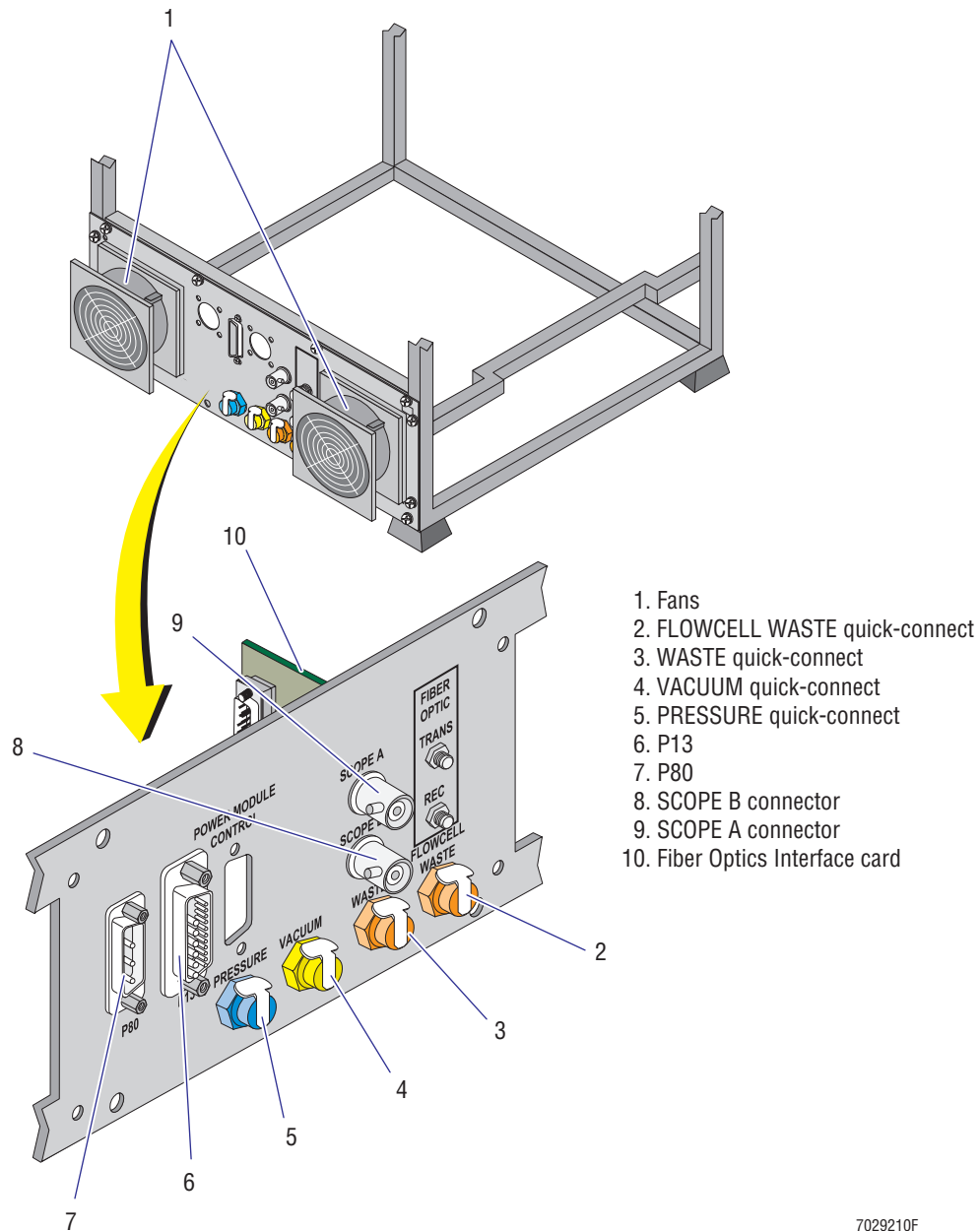


Table A.5-8 Components Inside the Reagent Drawer and their Functions

Figure Reference	Component	Function	Reference Designator
A.5-8, 1	VL20	Commonly referred to as the sheath filter purge valve. Normally-closed pinch valve that is manually pushed to activate a purge of the sheath filter to remove bubbles.	PV 20 inside the BOTTLE DRAWER block on PN 6320886
A.5-8, 2	QD35	90° quick-connect (external male elbow) connects VL20 with the vent port on the sheath liquid filter to facilitate replacement of sheath filter purge components.	QD 35 inside the BOTTLE DRAWER block on PN 6320886
A.5-8, 3	Sheath liquid filter	Disposable 0.2 micron hydrophilic filter used to remove particles 0.2 µm or larger from the sheath fluid.	FL 6 inside the BOTTLE DRAWER block on PN 6320886
A.5-8, 4	Sheath container	May also be referred to as sheath tank or sheath bottle. Holds fluid used to create the hydrodynamic focus for sample analysis referred to as sheath flow. IsoFlow™ sheath fluid, a non fluorescent, balanced electrolyte solution, or its equivalent is the recommended reagent. The sheath container has a working capacity of about 2 L. The amount of sheath fluid the container holds beyond the working capacity is for pressurization and level sensing.	SHEATH BOTTLE or RS 1 inside the BOTTLE DRAWER block on PN 6320886
A.5-8, 5	Cleaning agent container	May also be referred to as the cleanse tank or cleanse bottle. Holds cleaning agent for cleaning the sample lines and flow cell. COULTER CLENZ® cleaning agent or its equivalent is recommended to flush the sample tubing and to help reduce protein buildup and particle accumulation in the instrument. Each cleanse cycle uses about 15 mL of cleaning agent. The cleaning agent container has a working capacity of about 500 mL. That is enough cleaning agent to use the Cleanse mode once a day for one month. The amount of cleaning agent the container holds beyond the working capacity is for pressurization and level sense.	DETERGENT BOTTLE or RS 2 inside the BOTTLE DRAWER block on PN 6320886

Rear Panel Components

Figure A.5-9 Rear Panel Components, Exterior View (See [Table A.5-9](#))



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CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS

Table A.5-9 Components Attached to the Rear Panel and their Functions, Exterior View

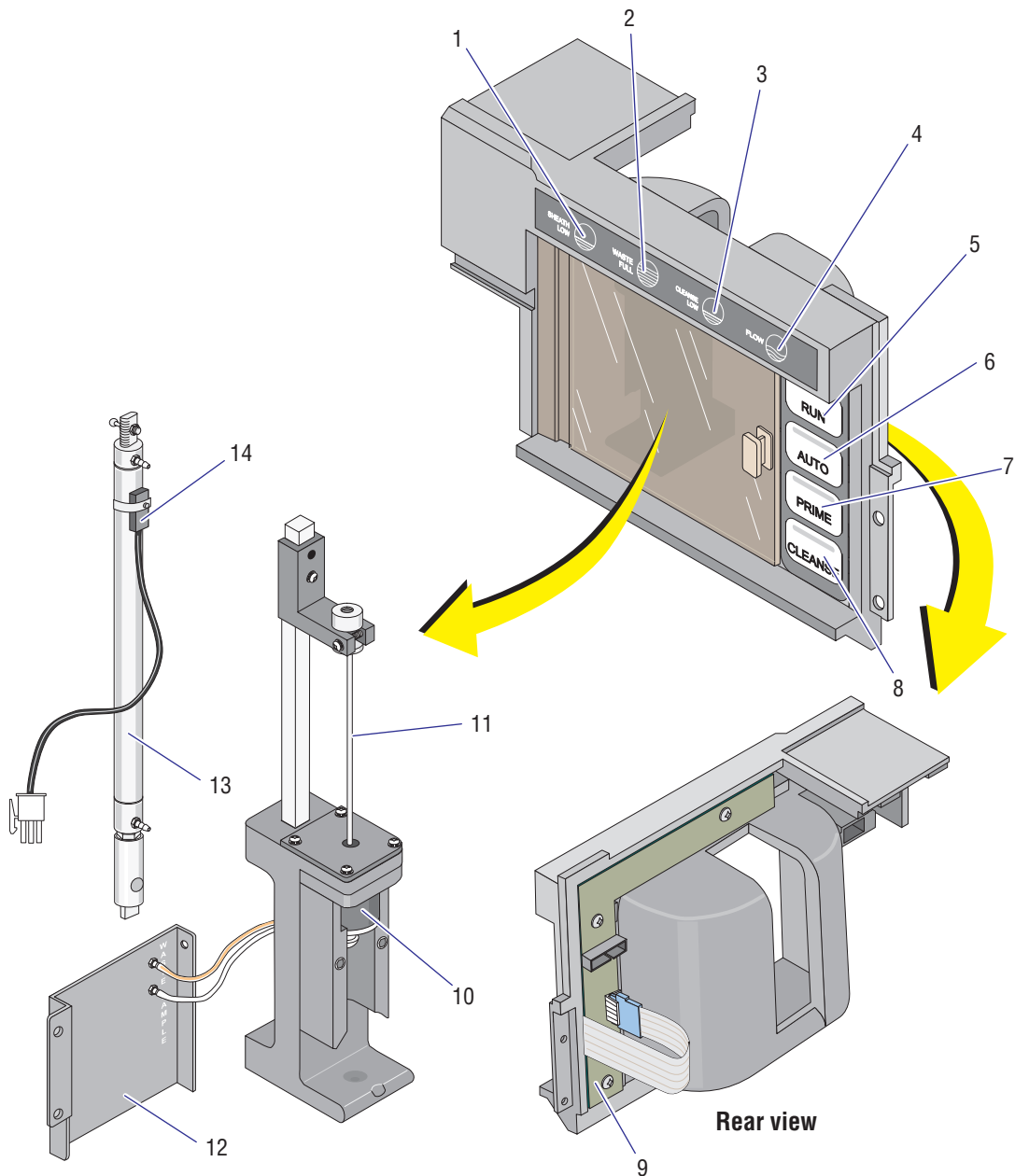
Figure Reference	Component	Function	Reference Designator
A.5-9, 1	Fans	When power to the Cytometer is turned on, these fans provide a constant flow of room air into the Cytometer to keep the electronic components inside the Cytometer from overheating.	
A.5-9, 2	FLOWCELL WASTE quick-connect (orange)	Female panel mount quick-connect that when coupled with QD26 (orange male quick-connect) provides a pathway to the external waste container for the sample waste that exits the flow cell during acquisition analysis.	QD 18 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-9, 3	WASTE quick-connect (orange)	Female panel mount quick-connect that when coupled with QD25 (orange male quick-connect) provides a pathway to the external waste container for emptying waste routed through the waste manifold (MF1). Note: To locate the waste manifold, refer to Figure A.5-5 , item 3.	QD 17 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-9, 4	VACUUM quick-connect (yellow)	Female panel mount quick-connect that when coupled with QD24 (yellow male quick-connect) provides an input to supply vacuum created in the Power Supply module to the Cytometer.	QD 16 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-9, 5	PRESSURE quick-connect (blue)	Female panel mount quick-connect that when coupled with QD23 (blue male quick-connect) provides an input to supply 30 psi (generated and regulated in the Power Supply module) to the cooling coils and water trap filter inside the Cytometer. Note: To locate the cooling coils and water trap filter inside the Cytometer, refer to Figure A.5-5 , items 4 and 1 respectively.	QD 15 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886
A.5-9, 6	P13	Connector for CYTO dc power EMI harness cable	
A.5-9, 7	P80	Connector for CYTO dc power EMI harness cable	
A.5-9, 8	SCOPE B connector	May be used by the Service representative to connect an oscilloscope to measure the FL3 signal.	
A.5-9, 9	SCOPE A connector	May be used by the Service representative to connect an oscilloscope to measure the signal assigned to the discriminator.	

Table A.5-9 Components Attached to the Rear Panel and their Functions, Exterior View (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-9, 10	Fiber Optics Interface card	<p>Circuit card converts the digital data received from the Cyto Transputer card to optical data then sends that optical data to the Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card inside the Workstation computer.</p> <p>Two fiber optic cables are connected to this circuit card. This fiber optic cables are joined together as one cable with two terminal posts (with a locking nut) at each end. One cable is labeled RX and the other is labeled TX. The terminal posts on one end of the cable are inserted into jacks on the Cytometer and the terminal posts on the other end of the cable are inserted into jacks on the Opto Transprocessor EXEM or Opto Transprocessor EXMEM II card in the Workstation computer.</p> <ul style="list-style-type: none"> • At the rear of the Cytometer: <ul style="list-style-type: none"> ▸ The terminal post labeled RX goes in the jack labeled FIBER OPTIC REC. ▸ The terminal post labeled TX goes in the jack labeled FIBER OPTIC TRANS. • At the rear of the tower computer: <ul style="list-style-type: none"> ▸ The terminal post labeled TX goes in the outer left jack labeled XMIT on the edge of the Opto Transprocessor EXMEM II card (in the bottom slot). ▸ The terminal post labeled TX goes in the inner (middle) jack labeled REC on the edge of the Opto Transprocessor EXMEM II card. <p>If installed incorrectly, the Cytometer powers up but the Workstation comes up in listmode.</p>	

Manual Sample Station Components, Cytometer with MCL Option

Figure A.5-10 XL-MCL Manual Sample Station Components (See [Table A.5-10](#))



1. SHEATH LOW level sense indicator
2. WASTE FULL level sense indicator
3. CLEANSE LOW level sense indicator
4. FLOW indicator
5. RUN push button and indicator
6. AUTO push button
7. PRIME push button

8. CLEANSE push button
9. Front Panel LED and Switch Input 2 card
10. Manual sample head
11. Manual sample probe
12. Sample and waste connect panel
13. Manual stage air cylinder
14. Manual stage position sensor

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Table A.5-10 XL-MCL Manual Sample Station Components and their Functions

Figure Reference	Component	Function	Reference Designator
A.5-10, 1	SHEATH LOW level sense indicator	<p>Red symbol when the sheath fluid is low.</p> <p>During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red.</p> <p>When the indicator glows red, the operator must fill the sheath container before the instrument can be cycled again. The fill the sheath container, the Cytometer needs to be in the Idle mode.</p>	
A.5-10, 2	WASTE FULL level sense indicator	<p>Red symbol when the external waste container is full.</p> <p>During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red.</p> <p>When the indicator glows red, the operator must empty the external waste container before the instrument can be cycled again.</p>	
A.5-10, 3	CLEANSE LOW level sense indicator	<p>Red symbol when the cleaning agent is low.</p> <p>When the indicator glows red, the operator must fill the cleanse container before starting the cleanse cycle. The fill the cleaning agent container, the Cytometer needs to be in the Idle mode.</p>	
A.5-10, 4	FLOW indicator	<p>Green symbol means the sample tube is pressurized and sample is going through the flow cell.</p>	
A.5-10, 5	RUN push-button and indicator	<p>Micro contact switch used to place the Cytometer in the Idle or Run mode.</p> <p>Press once to use the Run mode.</p> <p>Press again for Idle mode.</p> <p>The indicator color shows the Cytometer operating mode.</p> <ul style="list-style-type: none"> • Glowing (solid) green indicates the Cytometer is in the Run mode. Cytometer is waiting for the operator to insert a sample tube. • Flashing green indicates the Cytometer is in the Idle mode. • Glowing (solid) orange indicates the Run mode during sample analysis. 	
A.5-10, 6	AUTO push-button	<p>Available only if the MCL option is installed.</p> <p>Micro contact switch for MCL operation.</p> <p>Press to use the optional Automatic mode.</p> <p>Press again to use the Manual mode.</p> <p>Glowing (solid) green indicator means the Cytometer is in the Auto mode and a carousel is in the MCL.</p>	

Table A.5-10 XL-MCL Manual Sample Station Components and their Functions (Continued)

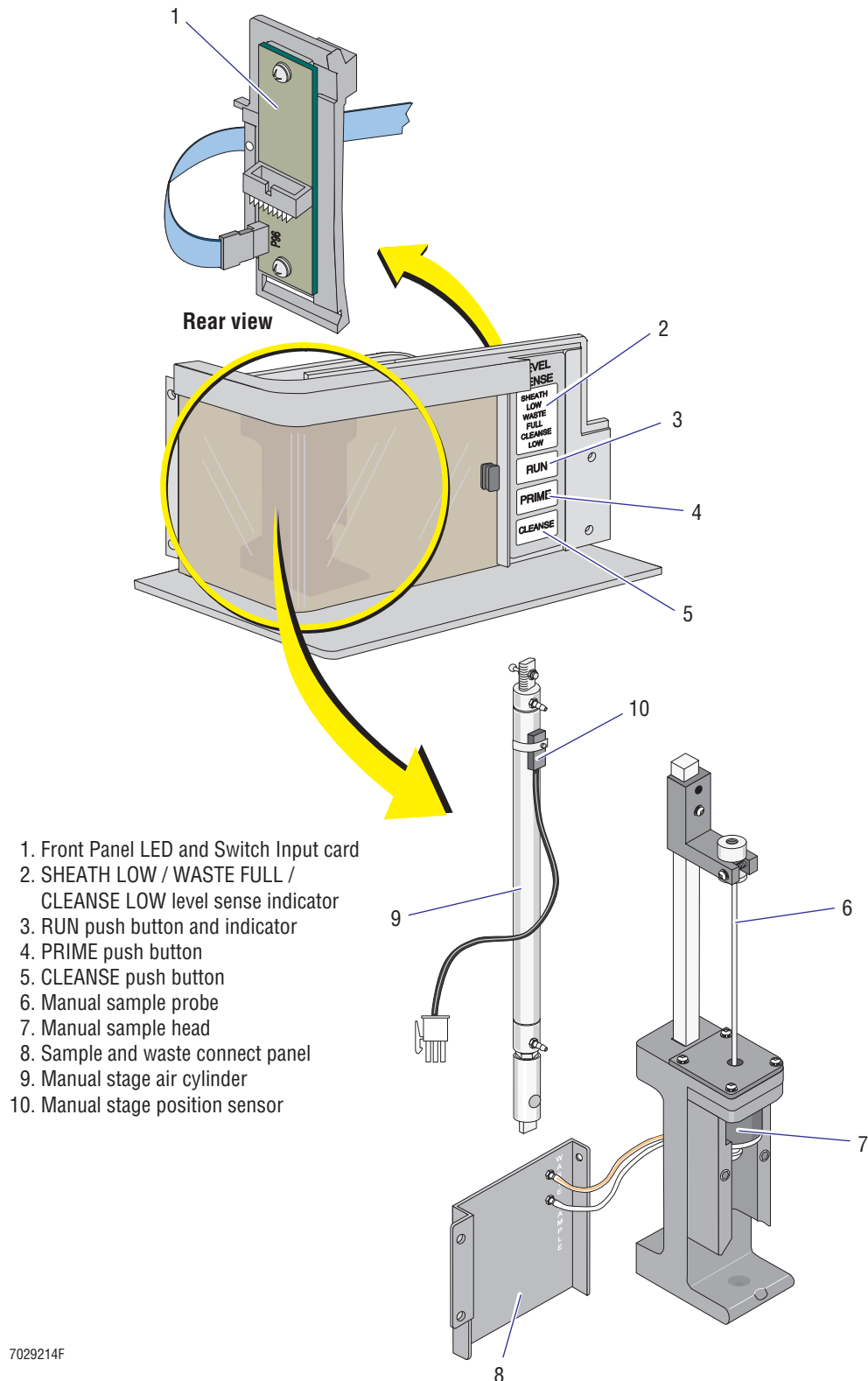
Figure Reference	Component	Function	Reference Designator
A.5-10, 7	PRIME push-button	Micro contact switch used to initiate the Prime cycle. Press to flush the flow cell with sheath fluid. Data acquisition pauses until the prime cycle is done. During the 10-second cycle, indicator is green.	
A.5-10, 8	CLEANSE push-button	Micro contact switch used to initiate the Cleanse cycle. Press to flush the flow cell with cleaning agent. During the 60-second cycle, indicator is green. There must not be a tube on the sample stage.	
A.5-10, 9	Front Panel LED and Switch Input 2 card	Used only on instruments with the MCL option, this circuit card contains the microswitch membrane switches used to initiate the RUN, AUTO, PRIME, or CLEANSE functions and illuminate the corresponding indicators. It also contains the circuitry for illuminating the FLOW indicator or the SHEATH LOW, WASTE FULL, CLEANSE LOW level sense indicators as directed by the Top Panel Display 2 card.	
A.5-10, 10	Manual sample head	At rest, the sample head has a constant supply of vacuum leaking out to atmosphere. When an operator properly positions a sample tube inside the manual sample station, the tube makes contact with the sample head and seals the vacuum leak. Sufficient vacuum (2 in. Hg) building up inside the tube triggers SN6, a normally-open vacuum/pressure switch, to close which in turn triggers the manual stage air cylinder (CL1) to raise the sample tube up. The vacuum supply is shut off and sample pressure enters the tube. SN7, a normally-open vacuum/pressure switch, monitors the sample pressure inside the tube to make sure the sample pressure inside the sample tube is sufficient to produce the LOW, MEDIUM, or HIGH sample flow rate selected by the operator for data acquisition. If the sample pressure inside the sample tube is not sufficient, a <i>Sample Pressure Error</i> message appears on the Workstation screen to alert the operator. Note: To locate SN6 or SN7, refer to Figure A.5-5 , items 6 and 7.	
A.5-10, 11	Manual sample probe	Provides a pathway for the pressurized sample (in the test tube) to move out of the test tube towards the flow cell.	
A.5-10, 12	Sample and waste connect panel	Panel that contains two fittings - SAMPLE for connecting the tubing that provides vacuum (from RG3) to the manual sample head and WASTE for connecting the tubing that provides a pathway from the manual sample head to the waste chamber (VC1).	

Table A.5-10 XL-MCL Manual Sample Station Components and their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-10, 13	Manual stage air cylinder	Solenoid-actuated / spring-return air cylinder used to raise or lower the manual sample stage. Operation controlled via a solenoid (VL14) in the lower pneumatics drawer. Note: To locate VL14, refer to Figure A.5-15 , item 11.	CL 1 inside the SAMPLE STATION block on PN 6320886
A.5-10, 14	Manual stage position sensor	Verifies the manual sample stage is in the proper position - raised or lowered.	SN 4 inside the SAMPLE STATION block on PN 6320886

Manual Sample Station Components, Cytometer without MCL Option

Figure A.5-11 XL Manual Sample Station Components (See [Table A.5-11](#))



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Table A.5-11 XL Manual Sample Station Components and their Functions

Figure Reference	Component	Function	Reference Designator
A.5-11, 1	Front Panel LED and Switch Input card	Used only on instruments without the MCL option, this circuit card contains the microswitch membrane switches used to initiate the RUN, PRIME, or CLEANSE functions. It also contains the circuitry for illuminating the SHEATH LOW / WASTE FULL / CLEANSE LOW level sense indicator as directed by the Top Panel Display 2 card.	
A.5-11, 2	SHEATH LOW / WASTE FULL / CLEANSE LOW level sense indicator	<p>Red means the sheath fluid or cleaning agent is low or the external waste container is full.</p> <ul style="list-style-type: none"> If the sheath fluid is low: During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red. When the indicator glows red, the operator must fill the sheath container before the instrument can be cycled again. The fill the sheath container, the Cytometer needs to be in the Idle mode. If the external waste container is full: During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red. When the indicator glows red, the operator must empty the external waste container before the instrument can be cycled again. If cleaning agent is low: When the indicator glows red, the operator must fill the cleanse container before starting the cleanse cycle. The fill the cleaning agent container, the Cytometer needs to be in the Idle mode. 	
A.5-11, 2	FLOW indicator	Green means the sample tube is pressurized and sample is going through the flow cell.	
A.5-11, 3	RUN push-button and indicator	<p>Micro contact switch used to place the Cytometer in the Idle or Run mode.</p> <p>Press once to use the Run mode.</p> <p>Press again for Idle mode.</p> <p>The indicator color shows the Cytometer operating mode.</p> <ul style="list-style-type: none"> Glowing (solid) green indicates the Cytometer is in the Run mode. Cytometer is waiting for the operator to insert a sample tube. Flashing green indicates the Cytometer is in the Idle mode. Glowing (solid) orange indicates the Run mode during sample analysis. 	

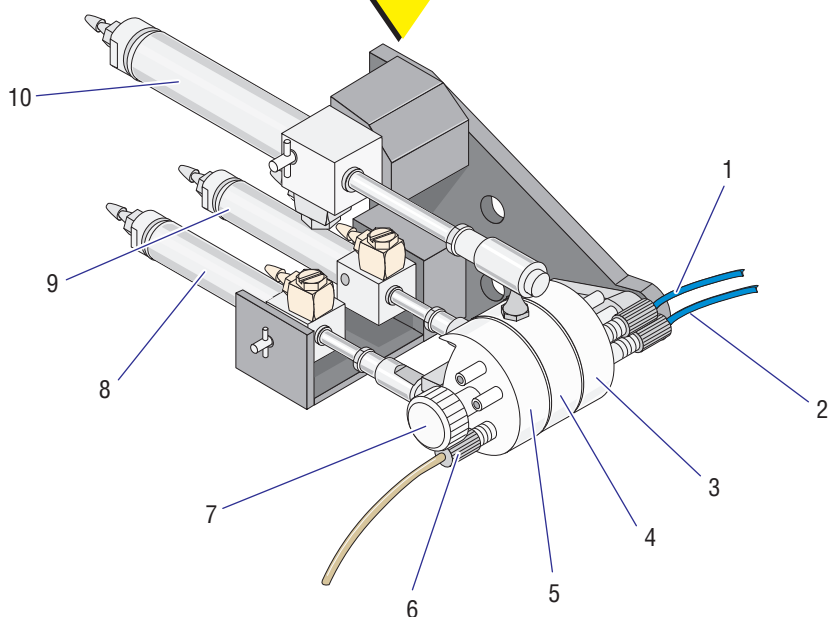
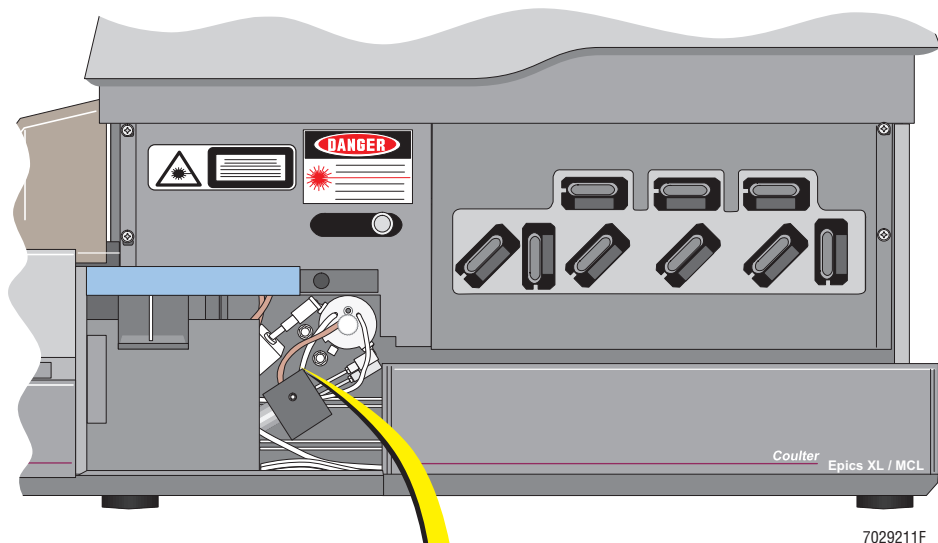
Table A.5-11 XL Manual Sample Station Components and their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-11, 4	PRIME push-button	Micro contact switch used to initiate the Prime cycle. Press to flush the flow cell with sheath fluid. Data acquisition pauses until the prime cycle is done. During the 10-second cycle, indicator is green.	
A.5-11, 5	CLEANSE push-button	Micro contact switch used to initiate the Cleanse cycle. Press to flush the flow cell with cleaning agent. During the 60-second cycle, indicator is green. There must not be a tube on the sample stage.	
A.5-11, 6	Manual sample probe	Provides a pathway for the pressurized sample (in the test tube) to move out of the test tube towards the flow cell.	
A.5-11, 7	Manual sample head	At rest, the sample head has a constant supply of vacuum leaking out to atmosphere. When an operator properly positions a sample tube inside the manual sample station, the tube makes contact with the sample head and seals the vacuum leak. Sufficient vacuum (2 in. Hg) building up inside the tube triggers SN6, a normally-open vacuum/pressure switch, to close which in turn triggers the manual stage air cylinder (CL1) to raise the sample tube up. The vacuum supply is shut off and sample pressure enters the tube. SN7, a normally-open vacuum/pressure switch, monitors the sample pressure inside the tube to make sure the sample pressure inside the sample tube is sufficient to produce the LOW, MEDIUM, or HIGH sample flow rate selected by the operator for data acquisition. If the sample pressure inside the sample tube is not sufficient, a <i>Sample Pressure Error</i> message appears on the Workstation screen to alert the operator. Note: To locate SN6 or SN7, refer to Figure A.5-5 , items 6 and 7.	
A.5-11, 8	Sample and waste connect panel	Panel that contains two fittings - SAMPLE for connecting the tubing that provides vacuum (from RG3) to the manual sample head and WASTE for connecting the tubing that provides a pathway from the manual sample head to the waste chamber (VC1).	
A.5-11, 9	Manual stage air cylinder	Solenoid-actuated / spring-return air cylinder used to raise or lower the manual sample stage. Operation controlled via a solenoid (VL14) in the lower pneumatics drawer. Note: To locate VL14, refer to Figure A.5-15 , item 11.	CL 1 inside the SAMPLE STATION block on PN 6320886
A.5-11, 10	Manual stage position sensor	Verifies the manual sample stage is in the proper position - raised or lowered.	SN 4 inside the SAMPLE STATION block on PN 6320886

Segmenting Valve Components

Figure A.5-12 Segmenting Valve Components (See [Table A.5-12](#))

Front view



1. PEEK tubing to manual sample probe
2. PEEK tubing to MCL sample probe
3. Segmenting valve rear pad
4. Segmenting valve middle pad
5. Segmenting valve front pad

6. PEEK tubing to flow cell
7. Segmenting valve knob
8. Air Cylinder for front segmenting valve pad
9. Air Cylinder for rear segmenting valve pad
10. Air Cylinder for middle segmenting valve pad

QUICK REFERENCE INFORMATION*CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS***Table A.5-12 Segmenting Valve Components and Their Functions**

Figure Reference	Component	Function	Reference Designator
A.5-12, 1	Peek tubing to MCL	Provides a pathway for sample flow from the MCL sample probe to the segmenting valve rear pad.	MCL inside the PROBE NORMAL block on PN 6320886
A.5-12, 2	Peek tubing to manual sample probe	Provides a pathway for sample flow from the manual sample probe to the segmenting valve rear pad.	PROBE inside the PROBE NORMAL block on PN 6320886
A.5-12, 3	Segmenting valve rear pad	Switches between manual and MCL. Pad has cleaning channel and rotates during the cleaning cycle.	
A.5-12, 4	Segmenting valve middle pad	Only used with SYSTEM II operating system to perform the Stop On Volume function.	
A.5-12, 5	Segmenting valve front pad	Provides pathway to the flow cell. Pad has cleaning channel and rotates during the cleaning cycle.	
A.5-12, 6	Peek tubing to flow cell	Provides a pathway for sample flow from the segmenting valve rear pad to the flow cell.	FLOWCELL inside the PROBE NORMAL block on PN 6320886
A.5-12, 7	Segmenting valve knob	When properly tightened, this knob provides sufficient tension to secure the segmenting pads so that they rotate smoothly without leaking.	
A.5-12, 8	Air Cylinder for front segmenting valve pad	<p>Double action air cylinder controlled by 30 psi provided by either VL15 or VL18.</p> <p>VL18 is normally energized to hold the front pad in its normal position.</p> <p>When VL15 is energized, the front pad rotates for cleaning.</p> <p>Note: To locate VL15 or VL18, refer to Figure A.5-15, items 10 and 7 respectively.</p>	CYL 2 inside the PROBE NORMAL block on PN 6320886

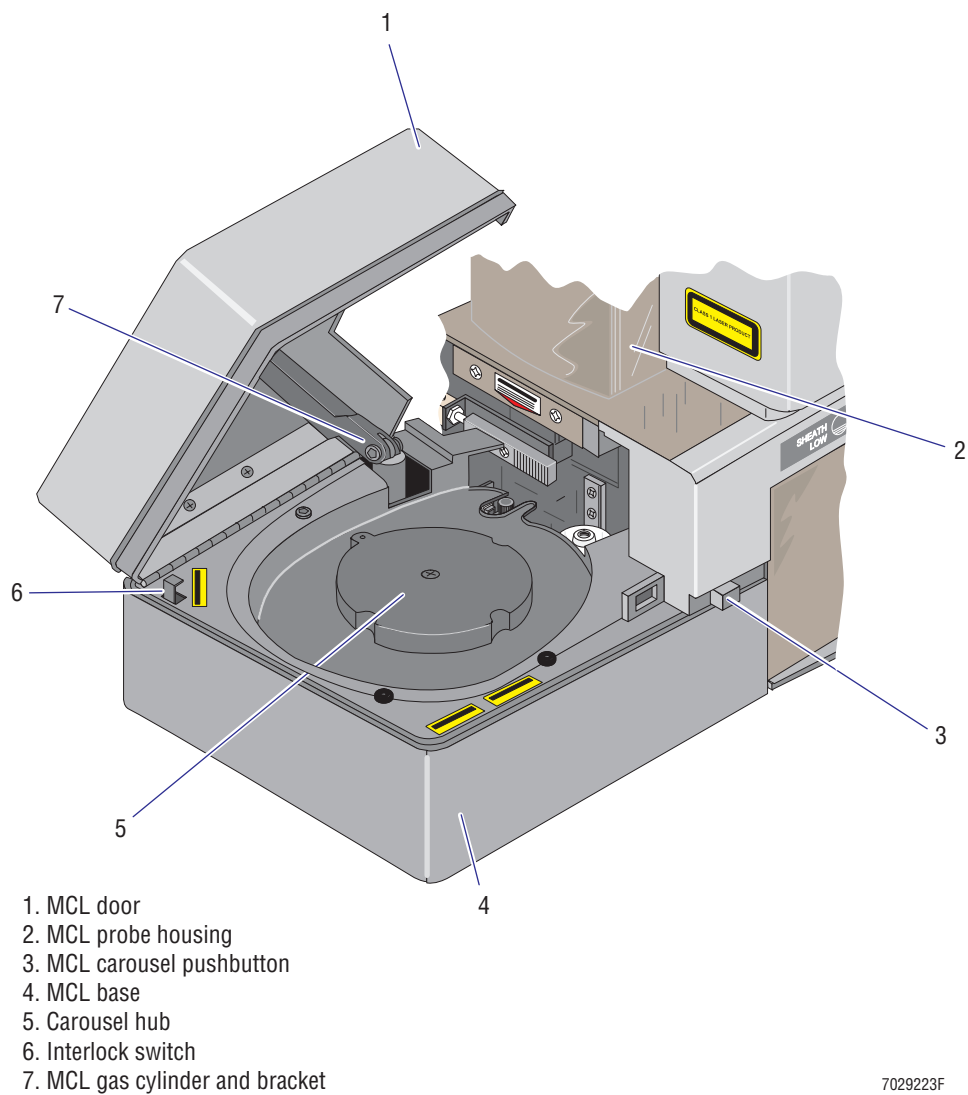
Table A.5-12 Segmenting Valve Components and Their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-12, 9	Air Cylinder for rear segmenting valve pad	<p>Double action air cylinder controlled by 30 psi provided by either VL17 or VL20.</p> <p>VL17 is normally energized to hold the rear pad in its normal position that allows sample flow through the PROBE port.</p> <p>When VL20 is energized, the rear pad rotates to allow sample flow through the MCL port.</p> <p>Note: To locate VL17 or VL20, refer to Figure A.5-15, items 8 and 5 respectively.</p>	CYL 4 inside the PROBE NORMAL block on PN 6320886
A.5-12, 10	Air Cylinder for middle segmenting valve pad	<p>Double action air cylinder controlled by 30 psi provided by either VL16 or VL19.</p> <p>VL16 is normally energized to hold the middle pad in its normal position.</p> <p>When VL19 is energized, the middle pad rotates to perform the Stop On Volume function.</p> <p>Note: To locate VL16 or VL19, refer to Figure A.5-15, items 9 and 6 respectively.</p>	CYL 3 inside the PROBE NORMAL block on PN 6320886

Components on the MCL Option

Carousel Components

Figure A.5-13 Carousel Components (See [Table A.5-13](#))



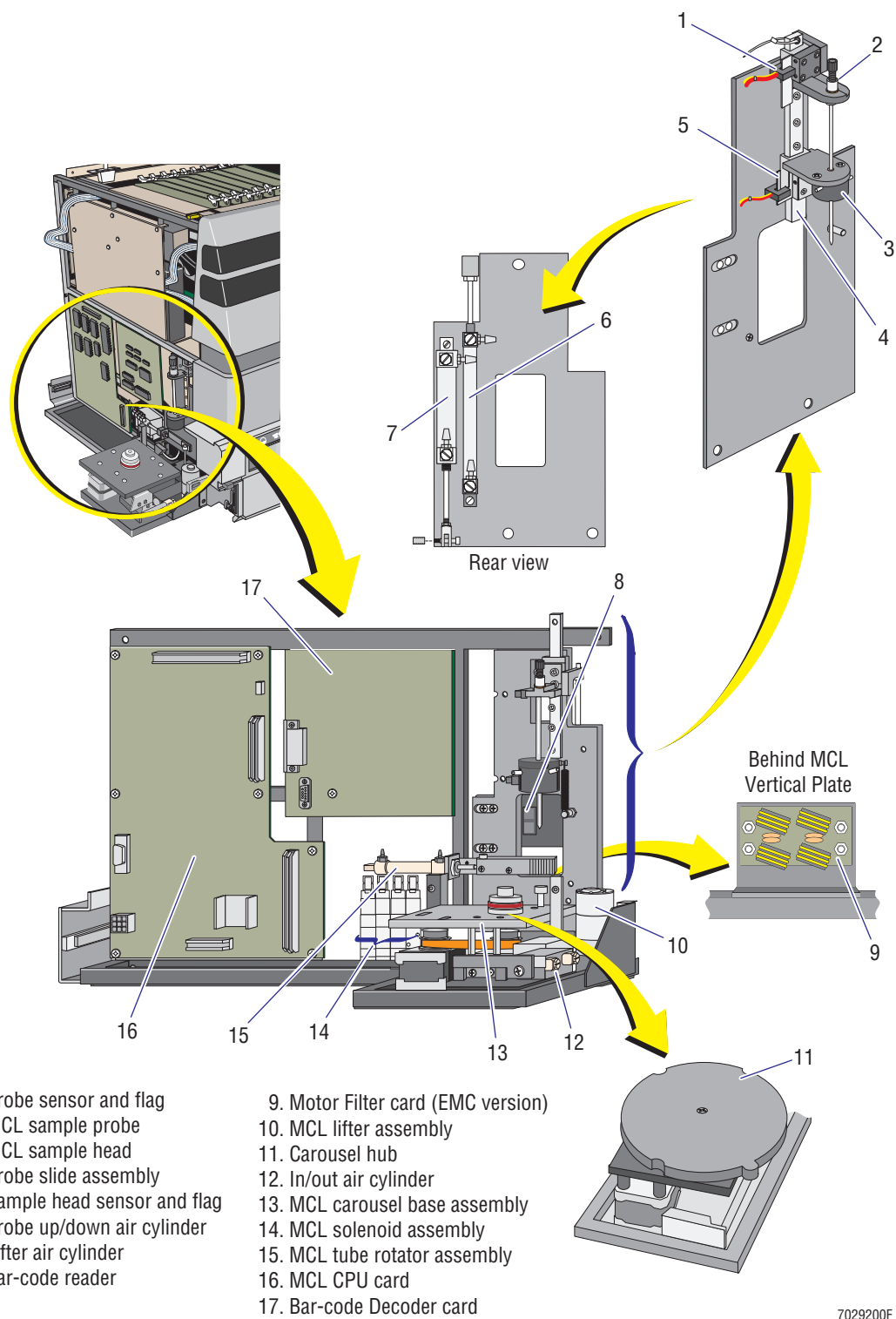
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Table A.5-13 Carousel Components and Their Functions

Figure Reference	Component	Function	Reference Designator
A.5-13, 1	MCL door	Exterior cover also referred to as the MCL lid or MCL upper lid and may also be referred to as MCL cover or MCL upper cover. When lifted, the tube carousel can be positioned on or removed from the carousel hub. To open this door, the push-button (A.5-13, item 3) must be pressed to release the latch. When the latch is released, the MCL gas cylinder (A.5-13, item 7) controls the door's movement as it opens automatically.	
A.5-13, 2	MCL probe housing	Protective covering for the MCL sample probe and sample head attached to the vertical plate (Figure A.5-14).	
A.5-13, 3	MCL carousel push-button	Press this push-button to release the latch that opens the MCL door (upper base cover).	
A.5-13, 4	MCL base	Houses carousel base assembly and lifter assembly. This base must unlatched before removing the left-side cover.	
A.5-13, 5	Carousel hub	Hub for securing and indexing the carousel.	
A.5-13, 6	Interlock switch	<p>Safety interlock to ensure the MCL door is closed during operation. If the door is open, an <i>MCL Door Open error</i> or <i>MCL Door Open Warning</i> message appears on the Workstation screen. Operation is halted until the door is closed.</p> <hr/> <p>WARNING Risk of personal injury. Be very careful when operating the instrument when the MCL interlock switch is defeated, as you may be exposed to moving components. After servicing the instrument, make sure the MCL door is properly closed to reactivate the safety interlock switch if it was bypassed while servicing the instrument.</p> <hr/> <p>To override (bypass) this safety interlock, pull the switch up and operation resumes even though the door is open.</p> <p>Always be very careful if you bypass this safety interlock and operate the instrument with the door open. The interlock switch is reset when the door is closed.</p>	
A.5-13, 7	MCL gas cylinder and bracket	Controls the opening movement of the MCL door when the push-button (A.5-13, item 3) is pressed and unlatches the door.	

MCL Components Accessible with Covers Removed

Figure A.5-14 MCL Components Accessible with Covers Removed (See [Table A.5-14](#))



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Table A.5-14 MCL Components Accessible with Covers Removed and Their Functions

Figure Reference	Component	Function	Reference Designator
A.5-14, 1	Probe sensor and flag	Used to monitor the position of the MCL sample probe.	
A.5-14, 2	MCL sample probe	Provides a pathway for the pressurized sample (in the test tube) to move out of the test tube towards the flow cell.	
A.5-14, 3	MCL sample head	<p>When a sample tube makes contact with the MCL sample head, sample pressure enters the tube.</p> <p>SN7 is used to determine if the sample pressure being supplied to the sample tube via the MCL sample head is holding steady. If it is holding steady, acquisition begins. If it is not holding steady, the lifter assembly attempts making a better seal by lowering and relifting the sample tube.</p> <p>If the sample pressure inside the sample tube is not sufficient, a <i>Sample Pressure Error</i> message appears on the Workstation screen to alert the operator.</p> <p>Note: To locate SN7, refer to Figure A.5-5, item 7.</p>	
A.5-14, 4	Probe slide assembly	Provides smooth up/down travel for the MCL sample probe.	
A.5-14, 5	Sample head sensor and flag	Used to detect if a sample tube is underneath the MCL sample head for sample processing.	
A.5-14, 6	Probe up/down air cylinder	Double action air cylinder controlled by 30 psi and venting used to lower the MCL sample probe into the sample tube and raise the MCL sample probe out of the sample tube.	
A.5-14, 7	Lifter air cylinder	Double action air cylinder controlled by 30 psi and venting used to raise and lower the lifter assembly.	
A.5-14, 8	Bar-code reader	Used to read the bar-code labels placed on the sample tubes for specimen identification and to read the MCL carousel to verify correct position during operational rotations.	
A.5-14, 9	Motor Filter card (EMC version)	Circuit card that suppresses EMC interference for CE certification.	
A.5-14, 10	MCL lifter assembly	Used to lift and vortex sample to the MCL sample head.	
A.5-14, 11	Carousel hub	Resting place for MCL carousel.	
A.5-14, 12	In/out air cylinder	Double action air cylinder controlled by 30 psi and venting used to move the carousel base assembly in or out to position the sample tube over the lifter and under the MCL sample head.	
A.5-14, 13	MCL carousel base assembly	Contains the mechanical and electrical hardware to rotate and locate the carousel position.	
A.5-14, 14	MCL solenoid assembly	Used to control the probe up/down, lifter, and in/out air cylinders, as well as the air cylinder in the MCL tube rotator assembly.	

QUICK REFERENCE INFORMATION**CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS****Table A.5-14 MCL Components Accessible with Covers Removed and Their Functions (Continued)**

Figure Reference	Component	Function	Reference Designator
A.5-14 , 15	MCL tube rotator assembly	Double action air cylinder controlled by 30 psi and venting used to move the finger in and out to rotate the sample tube for reading the bar-code label and guides the tube as it is being lifted to the MCL sample head.	
A.5-14 , 16	MCL CPU card	Circuit card that controls all MCL functions.	
A.5-14 , 17	Bar-code Decoder card	Circuit card that controls and decodes input from the bar-code reader.	

Components in the Left Side of the Cytometer

The main assembly located in the left side of the Cytometer is the lower pneumatics drawer. To access the lower pneumatics drawer, the left side cover must first be removed. If the MCL option is installed, access is more time consuming because the entire MCL option must be removed to access the lower pneumatics drawer. This removal not only involves removing the MCL covers but also removing the manual sample station to facilitate removal of the MCL main frame assembly from the Cytometer frame.

The left side cover must also be removed to replace a laser cooling fan. If the MCL option is installed, the MCL covers must be unlatched, not removed, from the Cytometer frame to remove the left side cover. It is not necessary to remove the MCL main frame assembly from the Cytometer frame.

QUICK REFERENCE INFORMATION

CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS

Figure A.5-15 Lower Pneumatics Drawer Components (See [Table A.5-15](#))

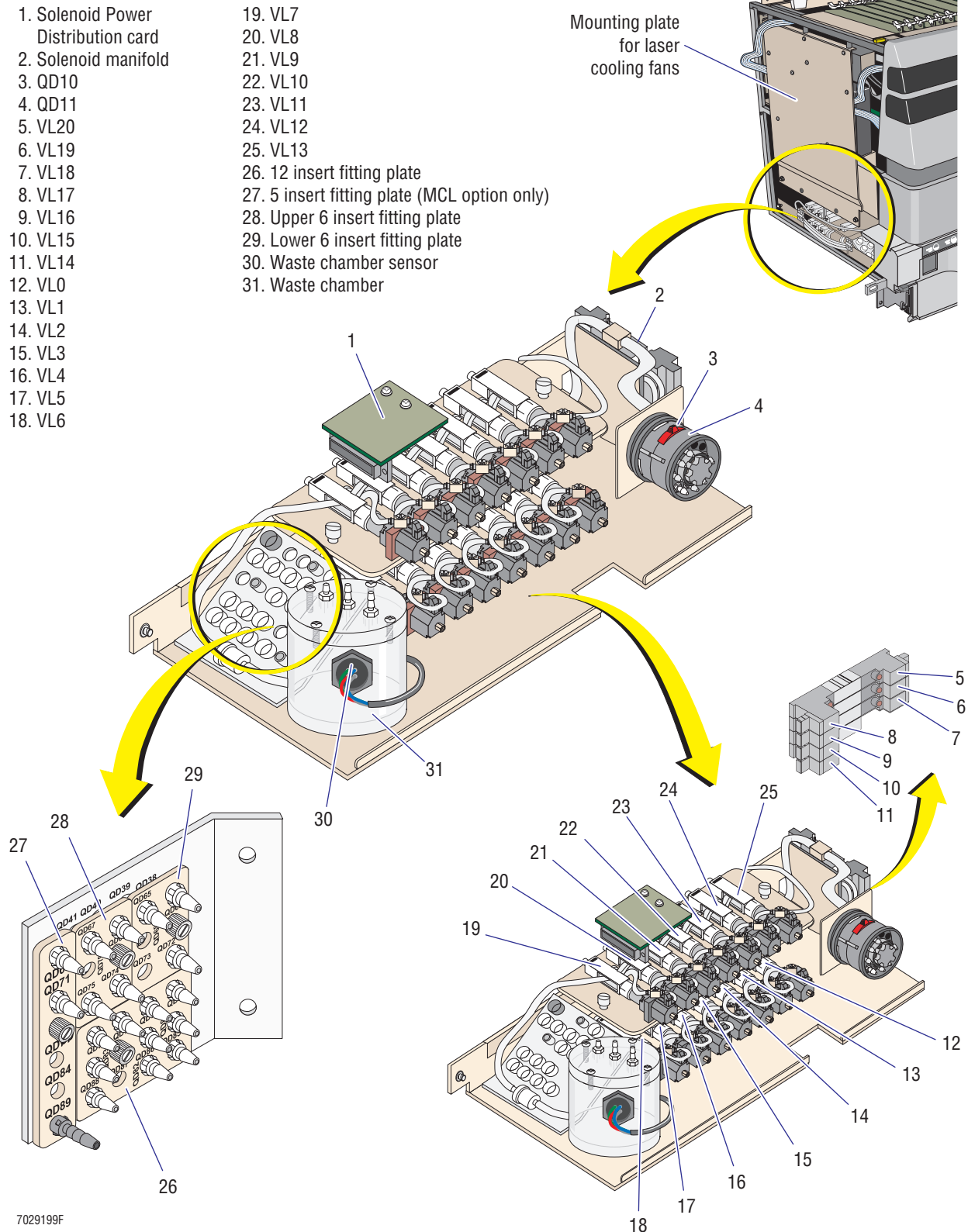


Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions

Figure Reference	Component	Function	Reference Designator
A.5-15, 1	Solenoid Power Distribution card	Circuit card that provides the 24 Vdc needed to operate the various solenoid valves.	Refer to PN 6321192
A.5-15, 2	Solenoid manifold	Provides 30 psi to the pilot actuators.	
A.5-15, 3	QD10	Quick-disconnect female coupling that provides one central connector for routing pneumatics to components inside the lower pneumatics drawer and then routing solenoid-controlled pneumatics to components inside the Cytometer.	QD 10 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 4	QD11	Quick-disconnect male coupling that provides one central connector for routing pneumatics to components inside the lower pneumatics drawer and then routing solenoid-controlled pneumatics to components inside the Cytometer.	QD 11 is to the right of the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 5	VL20	<p>One of two solenoids that provide the 30 psi needed to operate the double action air cylinder (CYL 4) that controls movement of the segmenting valve rear pad.</p> <p>VL17 is normally energized to hold the rear pad in its normal position that allows sample flow through the PROBE port.</p> <p>When VL20 is energized, the rear pad rotates to allow sample flow through the MCL port.</p> <p>Note: To locate the air cylinder (CYL 4), refer to Figure A.5-12, item 9.</p>	VL 20 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 6	VL19	<p>One of two solenoids that provide the 30 psi needed to operate the double action air cylinder (CYL 3) that controls movement of the segmenting valve middle pad.</p> <p>VL16 is normally energized to hold the middle pad in its normal position.</p> <p>When VL19 is energized, the middle pad rotates to perform the Stop On Volume function.</p> <p>Note: To locate the air cylinder (CYL 3), refer to Figure A.5-12, item 10.</p>	VL 19 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 7	VL18	<p>One of two solenoids that provide the 30 psi needed to operate the double action air cylinder (CYL 2) that controls movement of the segmenting valve front pad.</p> <p>VL18 is normally energized to hold the front pad in its normal position.</p> <p>When VL15 is energized, the front pad rotates for cleaning.</p> <p>Note: To locate the air cylinder (CYL 2), refer to Figure A.5-12, item 8.</p>	VL 18 inside the LOWER PNEUMATICS DRAWER block on PN 6320886

Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-15, 8	VL17	<p>One of two solenoids that provide the 30 psi needed to operate the double action air cylinder (CYL 4) that controls movement of the segmenting valve rear pad.</p> <p>VL17 is normally energized to hold the rear pad in its normal position that allows sample flow through the PROBE port.</p> <p>When VL20 is energized, the rear pad rotates to allow sample flow through the MCL port.</p> <p>Note: To locate the air cylinder (CYL 4), refer to Figure A.5-12, item 9.</p>	VL 17 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 9	VL16	<p>One of two solenoids that provide the 30 psi needed to operate the double action air cylinder (CYL 3) that controls movement of the segmenting valve middle pad.</p> <p>VL16 is normally energized to hold the middle pad in its normal position.</p> <p>When VL19 is energized, the middle pad rotates to perform the Stop On Volume function.</p> <p>Note: To locate the air cylinder (CYL 3), refer to Figure A.5-12, item 10.</p>	VL 16 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 10	VL15	<p>One of two solenoids that provide the 30 psi needed to operate the double action air cylinder (CYL 2) that controls movement of the segmenting valve front pad.</p> <p>VL18 is normally energized to hold the front pad in its normal position.</p> <p>When VL15 is energized, the front pad rotates for cleaning.</p> <p>Note: To locate the air cylinder (CYL 2), refer to Figure A.5-12, item 8.</p>	VL 15 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 11	VL14	<p>Controls the up/down movement of the manual sample stage via a solenoid-actuated / spring-return air cylinder (CL 1) referred to as the manual stage air cylinder.</p> <p><i>Energized</i> 30 psi is routed to the air cylinder to raise the sample stage.</p> <p><i>De-energized</i> 30 psi is no longer available to the air cylinder. The air cylinder vents as the spring returns the internal piston to its resting position which lowers the manual sample stage.</p>	VL 14 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 12	VL0	<p>Controls the flow of sheath to the flow cell.</p> <p><i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)</p>	VL 0 inside the LOWER PNEUMATICS DRAWER block on PN 6320886

Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-15, 13	VL1	Controls the flow of cleaning agent to the flow cell. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 1 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 14	VL2	Controls flow cell flush waste during the Prime cycle. Tubing from this pinch valve is attached to the waste port on the flow cell opposite the sheath port so that when VL2 is energized during the Prime cycle, sheath fluid flows through the flow cell and out the waste port to quickly remove (flush) air bubbles from the flow cell. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 2 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 15	VL3	Controls the flow of waste from the flow cell to the external waste container. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 3 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 16	VL4	Controls the flow of waste from the flow cell to the waste chamber. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 4 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 17	VL5	Controls the flow of waste from the sample head to the waste chamber. <i>Type of Valve</i> Normally open pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 5 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 18	VL6	Controls waste fill to the waste chamber. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 6 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 19	VL7	Controls the flow of waste from the waste chamber. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 7 inside the LOWER PNEUMATICS DRAWER block on PN 6320886

Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-15, 20	VL8	Controls pushing sheath for Stop on Volume. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 8 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 21	VL9	Opens pathway from the segmenting valve waste loop to the waste chamber. <i>Type of Valve</i> Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 9 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 22	VL10	Provides the pushing sheath to the segmenting valve input waste loop. <i>Type of Valve</i> Normally open pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 10 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 23	VL11	Supplies (via VL 7) vacuum or sheath pressure to control the filling and draining of the waste chamber. Normally-open side provides a supply of vacuum to VL7. When VL7 is energized, the vacuum pulls liquid into the waste chamber. Normally-closed side provides sheath pressure for draining the waste chamber. <i>Type of Valve</i> Double-action pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 11 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 24	VL12	Controls vacuum on sample head waste. <i>Type of Valve</i> Double-action pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 12 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 25	VL13	Controls sample pressure to heads. <i>Type of Valve</i> Double-action pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve)	VL 13 inside the LOWER PNEUMATICS DRAWER block on PN 6320886

Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions (Continued)

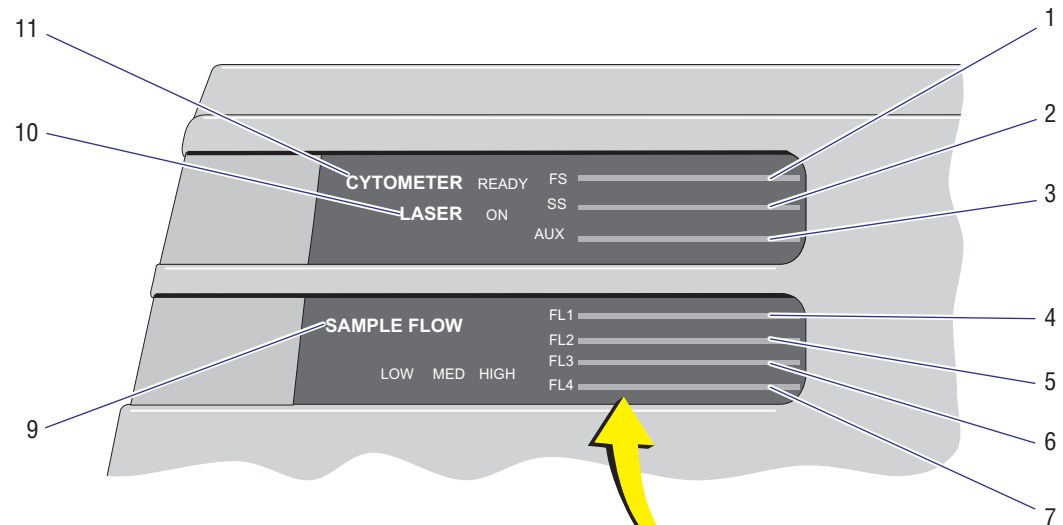
Figure Reference	Component	Function	Reference Designator
A.5-15, 26	12 insert fitting plate	<p>Plate contains a captive knurl knob with fitting inserts at QD76, QD77, QD78, QD79, QD81, QD82, QD83, QD85, QD86, and QD88.</p> <ul style="list-style-type: none"> • QD76 couples with QD50 on the 45° angled bracket • QD77 couples with QD51 on the 45° angled bracket • QD78 couples with QD52 on the 45° angled bracket • QD79 couples with QD53 on the 45° angled bracket • QD81 couples with QD55 on the 45° angled bracket • QD82 couples with QD56 on the 45° angled bracket • QD83 couples with QD57 on the 45° angled bracket • QD85 couples with QD59 on the 45° angled bracket • QD86 couples with QD60 on the 45° angled bracket • QD88 couples with QD62 on the 45° angled bracket <p>Note: The opening at QD87 is empty. The knurl knob occupies QD83.</p>	QD 76, QD 77, QD 78, QD 79, QD 81, QD 82, QD 83, QD 85, QD 86, and QD 88 are to the right of the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 27	5 insert fitting plate	<p>Only used if the MCL option is installed.</p> <p>Plate contains a captive knurl knob with fitting inserts at QD68, QD71, and QD89.</p> <ul style="list-style-type: none"> • QD68 couples with QD42 on the 45° angled bracket • QD71 couples with QD45 on the 45° angled bracket • QD89 couples with QD63 on the 45° angled bracket <p>Note: The openings at QD80 and QD84 are empty.</p>	QD 89, QD 68, and QD 71 are to the right of the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 28	Upper 6 insert fitting plate	<p>Plate contains a captive knurl knob with fitting inserts at QD66, QD67, QD74, and QD75.</p> <ul style="list-style-type: none"> • QD66 couples with QD40 on the 45° angled bracket • QD67 couples with QD41 on the 45° angled bracket • QD74 couples with QD48 on the 45° angled bracket • QD75 couples with QD49 on the 45° angled bracket <p>Note: The opening at QD70 is empty. The knurl knob occupies the remaining opening.</p>	QD 66, QD 67, QD 74, and QD 75 are to the right of the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15, 29	Lower 6 insert fitting plate	<p>Plate contains a captive knurl knob with fitting inserts at QD64, QD65, and QD72.</p> <ul style="list-style-type: none"> • QD64 couples with QD38 on the 45° angled bracket • QD65 couples with QD39 on the 45° angled bracket • QD72 couples with QD46 on the 45° angled bracket <p>Note: The openings at QD69 and QD73 are empty. The knurl knob occupies the remaining opening</p>	QD 64, QD 65, and QD 72 are to the right of the LOWER PNEUMATICS DRAWER block on PN 6320886

QUICK REFERENCE INFORMATION**CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS****Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions (Continued)**

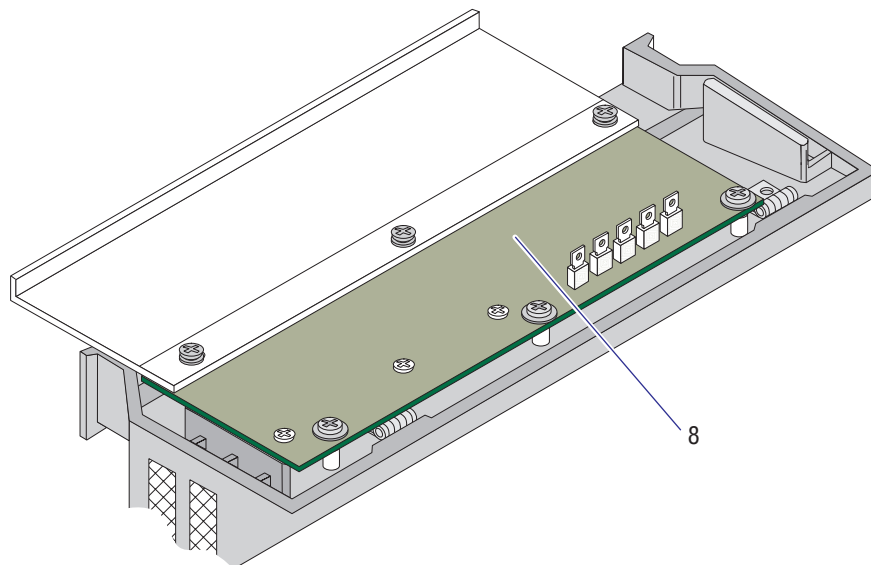
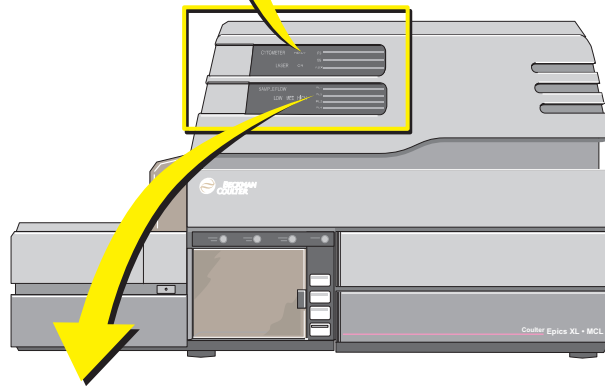
Figure Reference	Component	Function	Reference Designator
A.5-15 , 30	Waste chamber sensor	Often referred to as the eyeball sensor. Optical sensor monitors the level of sample waste from the sample head and flow cell. As the waste chamber is filling, the optical sensor is monitored. If the liquid level reaches the sensor, the fill operation should cease to prevent overfilling of the waste chamber.	SN 12 inside the LOWER PNEUMATICS DRAWER block on PN 6320886
A.5-15 , 31	Waste chamber	Collects and isolates waste from the waste line of the sample heads until it can be routed to the external waste container.	VC 1 inside the LOWER PNEUMATICS DRAWER block on PN 6320886

Front Panel Display Components

Figure A.5-16 Front Panel Display Components (See [Table A.5-16](#))



1. FS bar graph display
2. SS bar graph display
3. AUX bar graph display
4. FL1 bar graph display
5. FL2 bar graph display
6. FL3 bar graph display
7. FL4 bar graph display
8. Top Panel Display 2 card
9. SAMPLE FLOW selection
(LOW / MEDIUM / HIGH)
10. LASER status
11. CYTOMETER status



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Table A.5-16 Front Panel Display Components and Their Functions

Figure Reference	Component	Function	Reference Designator
A.5-16, 1	FS bar graph display	<p>Forward scatter signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> • Low, off-scale signals are yellow. • On-scale signals are green. • High, off-scale signals are red. <p>Note: If the indicator to the left of the FS label is green, the FS signal is assigned to AUX.</p>	
A.5-16, 2	SS bar graph display	<p>Side scatter signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> • Low, off-scale signals are yellow. • On-scale signals are green. • High, off-scale signals are red. <p>Note: If the indicator to the left of the SS label is green, the SS signal is assigned to AUX.</p>	
A.5-16, 3	AUX bar graph display	<p>Auxiliary signal amplitude indicator. This is defined by the operator. Once defined, the indicator to the left of the parameter label glows green, indicating that signal is assigned to AUX.</p> <p>The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> • Low, off-scale signals are yellow. • On-scale signals are green. • High, off-scale signals are red. 	
A.5-16, 4	FL1 bar graph display	<p>Fluorescence 1 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> • Low, off-scale signals are yellow. • On-scale signals are green. • High, off-scale signals are red. <p>Note: If the indicator to the left of the FL1 label is green, the FL1 signal is assigned to AUX.</p>	
A.5-16, 5	FL2 bar graph display	<p>Fluorescence 2 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> • Low, off-scale signals are yellow. • On-scale signals are green. • High, off-scale signals are red. <p>Note: If the indicator to the left of the FL2 label is green, the FL2 signal is assigned to AUX.</p>	

Table A.5-16 Front Panel Display Components and Their Functions (Continued)

Figure Reference	Component	Function	Reference Designator
A.5-16, 6	FL3 bar graph display	<p>Fluorescence 3 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> Low, off-scale signals are yellow. On-scale signals are green. High, off-scale signals are red. <p>Note: If the indicator to the left of the FL3 label is green, the FL3 signal is assigned to AUX.</p>	
A.5-16, 7	FL4 bar graph display	<p>Only appears when the 4-color option is installed.</p> <p>Fluorescence 4 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.</p> <ul style="list-style-type: none"> Low, off-scale signals are yellow. On-scale signals are green. High, off-scale signals are red. <p>Note: If the indicator to the left of the FL4 label is green, the FL4 signal is assigned to AUX.</p>	
A.5-16, 8	Top Panel Display 2 card	<p>This circuit card provides a visual display for each parameter via LEDs mounted in a row format. As these LEDs glow, they reflect the direct signal amplitude in an image commonly referred to as a bar graph. The intensity of the parameter signal correlates with the number of LEDs glowing, which in turn, affects the length of the bar graph. A weak signal produces a short bar graph (because few LEDs are glowing); an intense signal produces a long bar graph (because more LEDs are glowing).</p> <p>This circuit card also provides visual indicators for selecting the rate of SAMPLE FLOW (Figure A.5-16, item 9), LASER status (Figure A.5-16, item 10), and CYTOMETER status (Figure A.5-16, item 11).</p> <p>A blue-ribbon cable connects the Top Panel Display 2 card to the Analyzer backplane. A 24 Vdc and 5 Vdc power connector are also attached to this circuit card.</p>	

QUICK REFERENCE INFORMATION**CYTOMETER COMPONENT LOCATIONS AND FUNCTIONS****Table A.5-16 Front Panel Display Components and Their Functions (*Continued*)**

Figure Reference	Component	Function	Reference Designator
A.5-16 , 9	SAMPLE FLOW selection (LOW / MED / HIGH)	<p>Sample flow rate indicators.</p> <p>When, at the Workstation, the operator chooses a flow rate to control the speed of the sample delivery to the flow cell, the corresponding indicator (LOW / MED / HIGH) glows green at the Cytometer.</p> <p>When, at the Workstation, the user chooses a flow rate they are actually choosing the sample tube pressurization which in turn controls the speed of sample delivery to the flow cell. Approximations of the sample pressure and sample volume delivery when the sample pressure is properly calibrated (controlled electronically) follow:</p> <p>LOW = 3.72 psi MED = 3.92 psi HIGH = 4.12 psi.</p>	
A.5-16 , 10	LASER status	When the ON indicator glows green, the laser is on.	
A.5-16 , 11	CYTOMETER status	When the READY indicator glows green, the Cytometer can be put in an operating mode.	

A.6 POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS

Overview

The Power Supply module provides and monitors the main electronic and pneumatic power (vacuum and pressure) to the Cytometer. This section identifies the main components and/or assemblies in the Power Supply module, briefly describing their functions and showing their locations.

Main Power Supply Module Components

To expedite finding the name, location, or description of a component, the illustrations and tables in this section are organized according to major areas of the Power Supply module.

[Figure A.6-1](#) is the anchor illustration from which you can quickly access a specific illustration.

[Figure A.6-1](#) is referred to as the anchor illustration because it serves as the reference point for accessing other illustrations. This anchor illustration uses an alphabetic letter to indicate a portion of the Power Supply module that correlates with a location description provided in the Figure Reference column. This description includes the figure reference that illustrates and provides the name of the main components located in this area of the Power Supply module.

Locating a Component

To quickly locate a component, always begin at the anchor illustration, [Figure A.6-1](#).

1. On the anchor illustration, locate the area of the Power Supply module where the component in question is located and note the associated letter.
2. Locate the associated letter in the **Figure Reference** column and note the figure number.
3. Go to the referenced figure number.
Note: In the electronic version, each figure reference is in hypertext so that when you select the reference, the illustration quickly appears.
4. Locate the component. The number associated with the component identifies its name and also provides a figure reference for locating the component's function on the associated table. Each table also includes the reference designator for the component, where applicable.

Power Supply Module Anchor Illustration

Figure A.6-1 Power Supply Module, Anchor Illustration for Locating Components

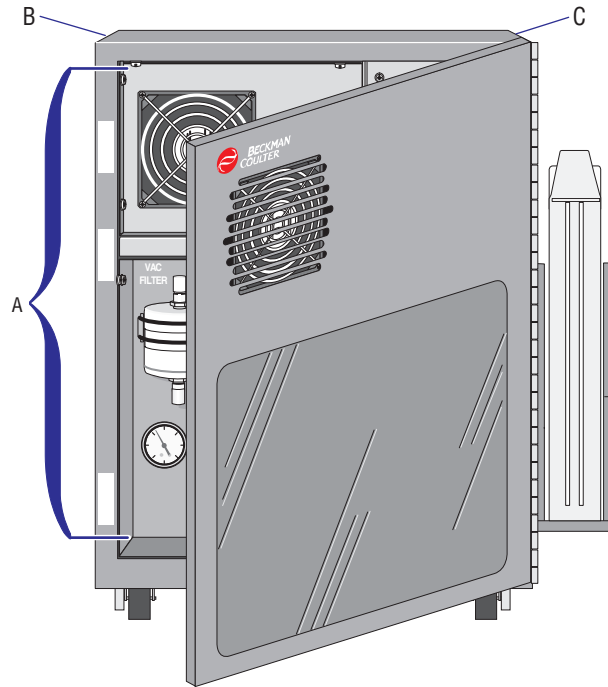


Figure Reference

- A** Components behind the front door, [Figure A.6-2](#).
- B** Components in the left-side compartment, [Figure A.6-3](#)
- C** Components in the right-side compartment, [Figure A.6-4](#)
- D** Components on the rear panel, [Figure A.6-5](#)

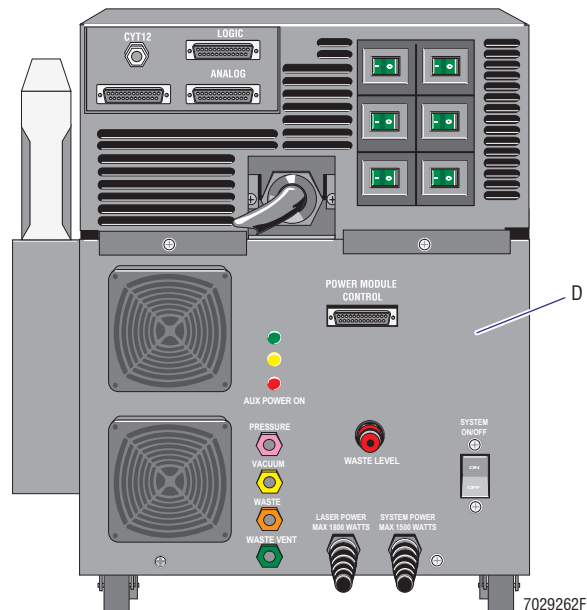
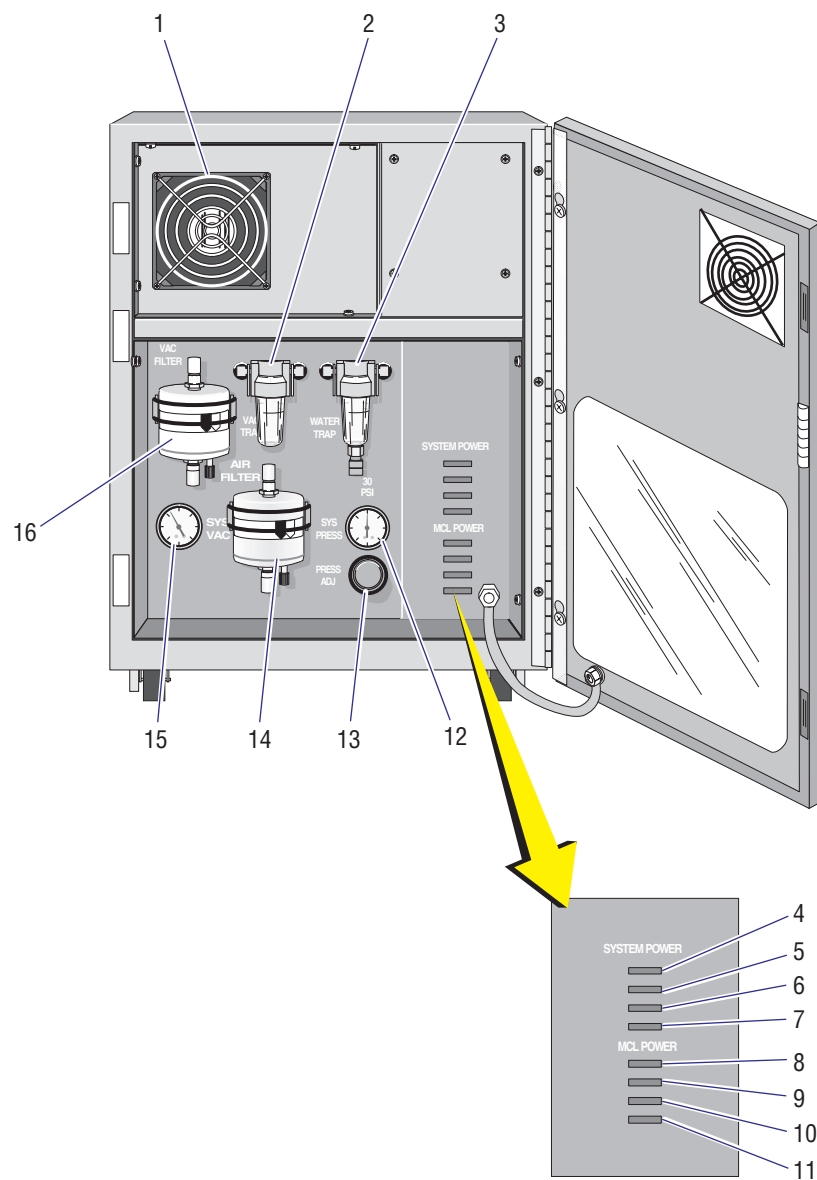


Table A.6-1 Power Supply Module, Component and Assembly Accessibility

Figure Reference	Main Component or Assembly that is Accessible	To Access Component or Assembly
A.6-1, A	<p>Various pneumatic components including:</p> <ul style="list-style-type: none"> • Vacuum and water traps • System pressure and system vacuum gauges • System pressure adjust knob • Air and vacuum filters <p>Voltage supply indicators for:</p> <ul style="list-style-type: none"> • System power (+5 V, +15 V, -15 V, +24 V) • MCL power (+5 V, +12 V, -12 V, +24 V) 	Open the front door.
A.6-1, B	<p>Argon laser power supply</p> <p>Various pneumatic components including:</p> <ul style="list-style-type: none"> • Compressor • VL31, VL30, VL32 <p>Transient Voltage Suppressor 2 card</p> <p>Power Module Control or Power Module Control II card</p> <p>Voltage Selector card</p>	Remove the three-sided cover.
A.6-1, C	<p>Interlock bypass switch</p> <p>Cooling coil</p> <p>Power supplies including:</p> <ul style="list-style-type: none"> • +24 Vdc system power supply • +5 Vdc system power supply • ± 15 Vdc system power supply • +5 and ± 12 Vdc MCL power supply • +24 Vdc MCL power supply 	Remove the three-sided cover.
A.6-1, D	<p>Connectors for MCL, CYT12, LOGIC, ANALOG, POWER MODULE CONTROL, and WASTE LEVEL</p> <p>Circuit breakers for:</p> <ul style="list-style-type: none"> • +24 Vdc system power supply • +5 Vdc system power supply • ± 15 Vdc system power supply • +5 (and ± 12 Vdc) MCL power supply • +24 Vdc MCL power supply • compressor <p>CYT12 ACTIVE, COMP ON, and AUX POWER ON indicators</p> <p>SYSTEM POWER cables</p> <p>PRESSURE, VACUUM, VENT, and WASTE quick-connects</p> <p>Cooling fans</p> <p>Laser umbilical cord</p>	Exterior components that may require interior access for replacement.

Components Located Behind the Front Door of the Power Supply Module

Figure A.6-2 View of the Power Supply Module with the Front Door Open (See [Table A.6-2](#))



1. Argon laser power supply
2. Vacuum trap
3. Water trap
4. SYSTEM POWER +5 V supply indicator
5. SYSTEM POWER +15 V supply indicator
6. SYSTEM POWER -15 V supply indicator
7. SYSTEM POWER +24 V supply indicator
8. MCL POWER +5 V supply indicator

9. MCL POWER +12 V supply indicator
10. MCL POWER -12 V supply indicator
11. MCL POWER +24 V supply indicator
12. System pressure gauge
13. System pressure adjust knob
14. Air filter
15. System vacuum gauge
16. Vacuum filter

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Table A.6-2 Components behind the Front Door of the Power Supply Module

Figure Reference	Component	Function	Reference Designator
A.6-2, 1	Argon laser power supply	Provides control and ac voltages to the Argon laser head.	
A.6-2, 2	Vacuum trap	Safety device to prevent liquid from entering the vacuum pump in the compressor/vacuum pump. As liquid (most likely from the vacuum chamber, VC 1, in the lower pneumatics drawer) fills the bowl, the float rises and occludes the high vacuum line. With the high vacuum line physically occluded, liquid cannot get pulled into the vacuum pump. However, if the float should get stuck and does not rise to occlude the opening, liquid can then enter the vacuum pump causing irreparable damage. The compressor/vacuum pump must be replaced.	FL 3 inside the POWER MODULE block on PN 6320886
A.6-2, 3	Water trap	Component may also be referred to as an air/water filter separator. Compressed air (pressure) generated by the compressor portion of the compressor/vacuum pump is hot. As the hot compressed air passes through the cooling coil, moisture in the air condenses. As the cooled air moves out of the cooling coil it is sent through the air/water filter separator to filter particles out of the air and to allow the heavier moisture to drop from the air to prevent internal rusting of components such as solenoids. When power to the Cytometer is on, solenoid VL 31 is energized, blocking the drain pathway into the waste tank. As a result, once every 24 hours, the customer must power off the Cytometer for 30 minutes to allow the moisture collected inside the water trap to drain through the now de-energized VL 31 into the waste tank.	FL 4 inside the POWER MODULE block on PN 6320886
A.6-2, 4	SYSTEM POWER +5 V voltage supply indicator	Indicates the presence or absence of +5 Vdc to the system. When +5 Vdc is available for use in the system, the SYSTEM POWER +5 V LED is lighted. If power is turned on and this LED is not lighted, either the +5 Vdc linear power supply has a problem or the SYSTEM POWER +5 V LED on the Voltage Supply Monitor card is defective.	
A.6-2, 5	SYSTEM POWER +15 V supply indicator	Indicates the presence or absence of +15 Vdc to the system. When +15 Vdc is available for use in the system, the SYSTEM POWER +15 V LED is lighted. If power is turned on and this LED is not lighted, either the ± 15 Vdc linear power supply has a problem or the SYSTEM POWER +15 V LED on the Voltage Supply Monitor card is defective. Note: If the SYSTEM POWER -15 V LED is also out, the problem most likely involves the ± 15 Vdc linear power supply.	

QUICK REFERENCE INFORMATION*POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS***Table A.6-2 Components behind the Front Door of the Power Supply Module (Continued)**

Figure Reference	Component	Function	Reference Designator
A.6-2, 6	SYSTEM POWER -15 V supply indicator	Indicates the presence or absence of -15 Vdc to the system. When -15 Vdc is available for use in the system, the SYSTEM POWER -15 V LED is lighted. If power is turned on and this LED is not lighted, either the ± 15 Vdc linear power supply has a problem or the SYSTEM POWER -15 V LED on the Voltage Supply Monitor card is defective. Note: If the SYSTEM POWER +15 V LED is also out, the problem most likely involves the ± 15 Vdc linear power supply.	
A.6-2, 7	SYSTEM POWER +24 V supply indicator	Indicates the presence or absence of +24 Vdc to the system. When +24 Vdc is available for use in the system, the SYSTEM POWER +24 V LED is lighted. If power is turned on and this LED is not lighted, either the +24 Vdc linear power supply has a problem or the SYSTEM POWER +24 V LED on the Voltage Supply Monitor card is defective.	
A.6-2, 8	MCL POWER +5 V supply indicator	Indicates the presence or absence of +5 Vdc to the MCL. When +5 Vdc is available for use by the MCL, the MCL POWER +5 V LED is lighted. If power is turned on and this LED is not lighted, either the MCL +5 Vdc linear power supply has a problem or the MCL POWER +5 V LED on the Voltage Supply Monitor card is defective. Note: If the MCL POWER +12 V and -12 V LEDs are also out, the problem most likely involves the MCL power supply. However, be aware that the ± 12 Vdc section of the power supply may be operational even when the +5 Vdc portion is defective	
A.6-2, 9	MCL POWER +12 V supply indicator	Indicates the presence or absence of +12 Vdc to the MCL. When +12 Vdc is available for use by the MCL, the MCL POWER +12 V LED is lighted. If power is turned on and this LED is not lighted, either the MCL +12 Vdc linear power supply has a problem or the MCL POWER +12 V LED on the Voltage Supply Monitor card is defective. Note: If the MCL POWER -12 V and/or +5 V LEDs are also out, the problem most likely involves the MCL power supply. However, be aware that the +12 Vdc and -5 Vdc sections of the power supply may be operational even when the +12 Vdc portion is defective	

Table A.6-2 Components behind the Front Door of the Power Supply Module (Continued)

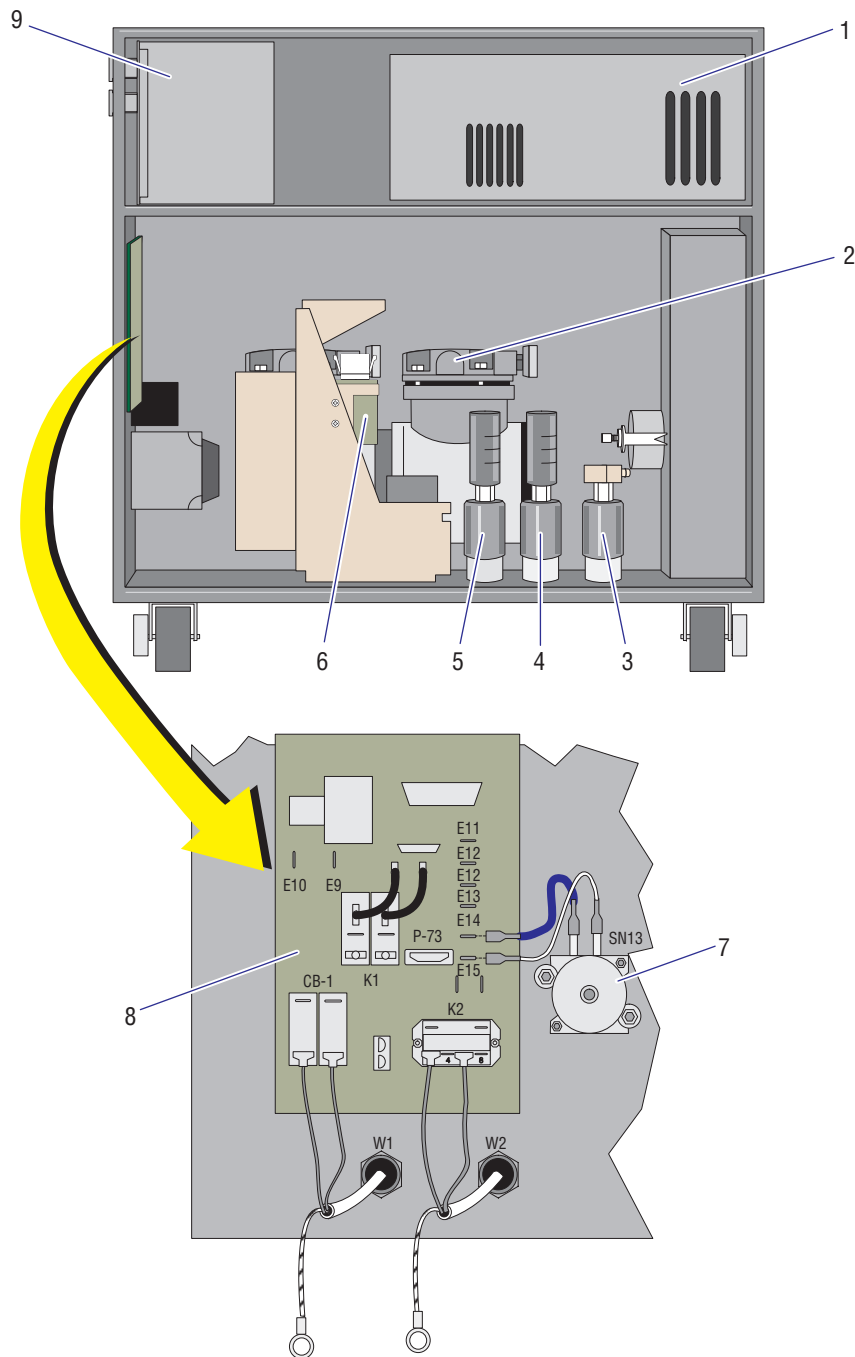
Figure Reference	Component	Function	Reference Designator
A.6-2, 10	MCL POWER -12 V supply indicator	Indicates the presence or absence of -12 Vdc to the MCL. When -12 Vdc is available for use by the MCL, the MCL POWER -12 V LED is lighted. If power is turned on and this LED is not lighted, either the MCL -12 Vdc linear power supply has a problem or the MCL POWER -12 V LED on the Voltage Supply Monitor card is defective. Note: If the MCL POWER +12 V and/or +5 V LEDs are also out, the problem most likely involves the MCL power supply. However, be aware that the +12 Vdc and +5 Vdc sections of the power supply may be operational even when the -12 Vdc portion is defective	
A.6-2, 11	MCL POWER +24 V supply indicator	Indicates the presence or absence of +24 Vdc to the MCL. When +24 Vdc is available for use by the MCL, the MCL POWER +24 V LED is lighted. If power is turned on and this LED is not lighted, either the MCL +24 Vdc linear power supply has a problem or the MCL POWER +24 V LED on the Voltage Supply Monitor card is defective.	
A.6-2, 12	System pressure gauge	External 0 to 60 psi gauge for monitoring the system pressure output from the compressor portion of the compressor/vacuum pump. 30 psi is the recommended pressure for normal operation. If the pressure falls below 28 psi, the <i>System Pressure Error</i> message appears on the Workstation screen to alert the operator.	GA 2 inside the POWER MODULE block on PN 6320886
A.6-2, 13	System pressure adjust knob	Knob used to manually adjust the pressure release valve (VL34). Adjusting VL34 produces a controlled air leak that lowers the 60 psi output from the compressor portion of the compressor/vacuum pump to the pressure registered on the system pressure gauge. Acceptable pressure for operation (that is, the pressure input needed to the Cytometer for proper operation) is 28 to 32 psi.	VL 34 inside the POWER MODULE block on PN 6320886
A.6-2, 14	Air filter	Hydrophobic gas filter removes contaminants in the air being displaced as waste from the Cytometer enters the waste container (waste tank).	FL 1 inside the POWER MODULE block on PN 6320886
A.6-2, 15	System vacuum gauge	External 0 to 30 in. Hg gauge for monitoring the system vacuum created by the vacuum portion of the compressor/vacuum pump. A minimum 17 in. Hg is recommended for normal operation. If the vacuum is too low for proper operation, the <i>System Vacuum Error</i> message appears on the Workstation screen to alert the operator.	GA 1 inside the POWER MODULE block on PN 6320886

QUICK REFERENCE INFORMATION**POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS****Table A.6-2 Components behind the Front Door of the Power Supply Module (*Continued*)**

Figure Reference	Component	Function	Reference Designator
A.6-2 , 16	Vacuum filter	Hydrophobic gas filter removes any particles or moisture in the vacuum line before it reaches the system vacuum gauge and the vacuum head of the compressor/vacuum pump.	FL 2 inside the POWER MODULE block on PN 6320886

Components in the Left Side of the Power Supply Module

Figure A.6-3 Left Side View of the Power Supply Module with Cover Removed (See Table A.6-3)



- | | |
|-----------------------------|---|
| 1. Argon laser power supply | 6. Transient Voltage Suppressor 2 card |
| 2. Compressor | 7. SN13 |
| 3. VL31 | 8. Power Module Control card or
Power Module Control II card |
| 4. VL30 | 9. Voltage Selector card |
| 5. VL32 | |

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QUICK REFERENCE INFORMATION**POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS****Table A.6-3 Components in the Left Side of the Power Supply Module**

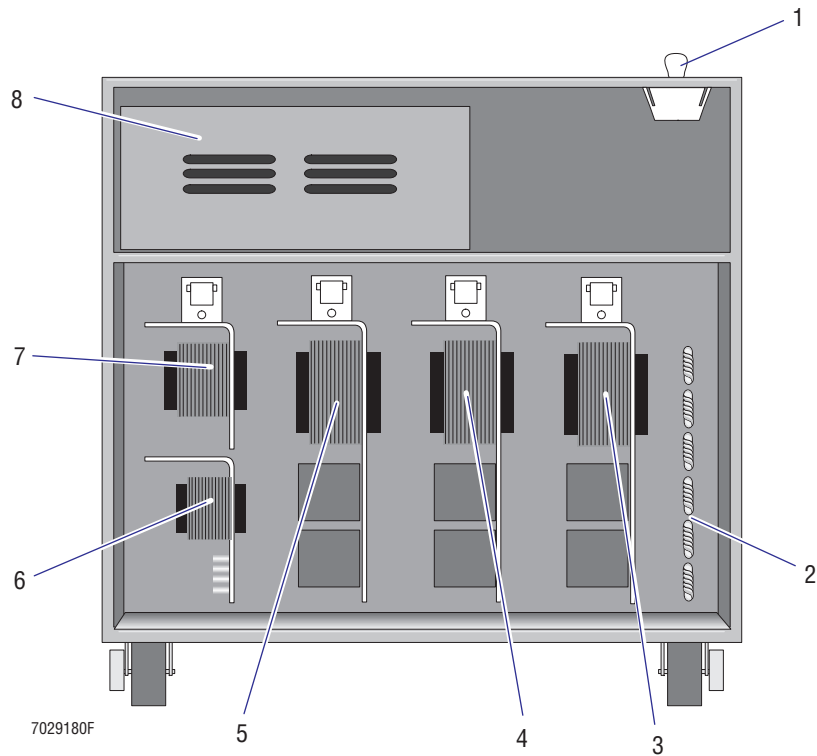
Figure Reference	Component	Function	Reference Designator
A.6-3, 1	Argon laser power supply	Provides control and ac voltages to the Argon laser head.	
A.6-3, 2	Compressor	Dual-head compressor/vacuum pump. The compressor head supplies the 60 psi that is regulated to the 30 psi and the vacuum head supplies the high vacuum (at least 17 in. Hg) needed for proper operation of the Cytometer.	PM 1 inside the POWER MODULE block on PN 6320886
A.6-3, 3	VL31	Two-way, normally-open solenoid valve that serves as a dump valve to empty the water trap. <i>Energized</i> - When power to the Cytometer is on, solenoid VL 31 is energized, blocking the drain pathway from the water trap to the waste tank. <i>De-energized</i> - Once every 24 hours, the customer must power off the Cytometer for 30 minutes to allow the moisture collected inside the water trap to drain through the now open VL 31 into the waste tank.	VL 31 inside the POWER MODULE block on PN 6320886
A.6-3, 4	VL30	Two-way, normally-open solenoid valve that serves as a dump valve to quickly release pressure from the system to the atmosphere when the power to the Cytometer is turned off. <i>Energized</i> - When power to the Cytometer is on, solenoid VL 30 is energized to block the pressure release pathway to atmosphere so that proper system pressure can be maintained. <i>De-energized</i> - When power to the Cytometer is turned off, air pressure inside the system is allowed to quickly escape to atmosphere through the now open VL 30.	VL 30 inside the POWER MODULE block on PN 6320886
A.6-3, 5	VL32	Two-way, normally-open solenoid valve that serves as a dump valve that allows air to enter the system and equalize residual vacuum to the current atmospheric pressure when the power to the Cytometer is turned off. <i>Energized</i> - When power to the Cytometer is on, solenoid VL 32 is energized to block air from entering the system so that proper system vacuum can be maintained. <i>De-energized</i> - When power to the Cytometer is turned off, atmospheric air is allowed to enter the system through the now open VL 32. Residual vacuum is quickly equalized to the current atmospheric pressure.	VL 32 inside the POWER MODULE block on PN 6320886

Table A.6-3 Components in the Left Side of the Power Supply Module (*Continued*)

Figure Reference	Component	Function	Reference Designator
A.6-3, 6	Transient Voltage Suppressor 2 card	Also referred to as the Transient Absorber EMC card, this small circuit card is mounted to the ac line filter bracket. This card protects the internal system from high voltage transients that may occur on the ac voltage input provided by the laboratory's power source. Note: This circuit card is found in XL and XL-MCL instruments with the serial number Z09063 or higher. If the compressor assembly is replaced on XL and XL-MCL instrument with the serial number Z09062 or lower, this circuit card is part of the assembly but it is not connected.	
A.6-3, 6	SN13	Normally-open vacuum/pressure switch is used to detect a plug in the filtered waste tank (or container) vent line. Waste entering the waste tank displaces air inside the container through the air filter (labeled F1 on PN 6323706) on the front of the Power Supply module. If this air filter becomes clogged, the pressure building up inside the waste tank triggers SN13 and the <i>Waste Backpressure Error</i> message appears on the Workstation screen to alert the operator.	SN 13 inside the POWER MODULE block on PN 6320886
A.6-3, 7	Power Module Control card or Power Module Control II card	Circuit card that: <ul style="list-style-type: none"> • Provides power to the Voltage Selector card. • Interfaces the Cytometer to the Power Supply module. • Provides a relay for supplying ac to the Argon laser power supply. The same relay supplies ac to the HeNe power supply, if this option is installed. 	
A.6-3, 8	Voltage Selector card	Selects the proper line voltage for the circuit breaker dedicated to that voltage.	

Components in the Right Side of the Power Supply Module

Figure A.6-4 Right Side View of the Power Supply Module with Cover Removed (See [Table A.6-4](#))



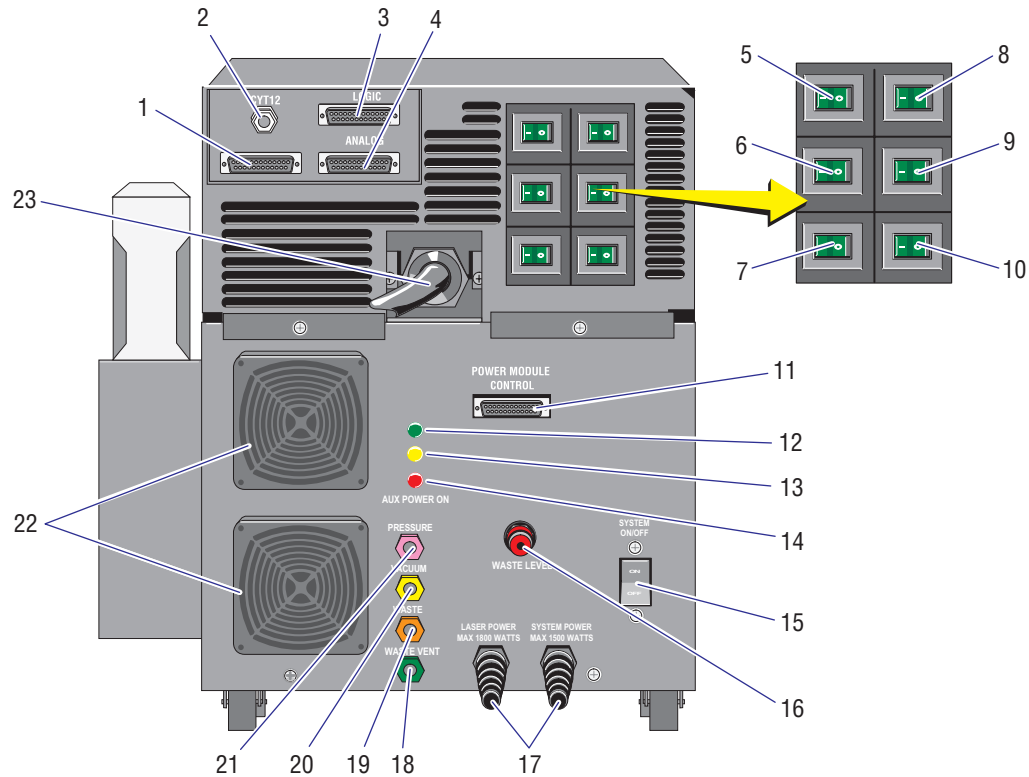
- | | |
|--------------------------------|---|
| 1. Interlock bypass switch | 5. ± 15 Vdc system power supply |
| 2. Cooling coil | 6. +5 and ± 12 Vdc MCL power supply |
| 3. +24 Vdc system power supply | 7. +24 Vdc MCL power supply |
| 4. +5 Vdc system power supply | 8. Argon laser power supply |

Table A.6-4 Components in the Right Side of the Power Supply Module

Figure Reference	Component	Function	Reference Designator
A.6-4, 1	Interlock switch	<p>Safety interlock to ensure the three-sided cover is covering the components inside the Power Supply module when the power is on. If the power is on and the cover is removed, this interlock turns off the power to the Power Supply module and the Cytometer.</p> <hr/> <p>WARNING Risk of personal injury. Be very careful when operating the instrument when the safety interlock switch in the Power Supply module is defeated, as you may be exposed to electric shock. After servicing the instrument, make sure the three-sided cover is properly reinstalled to reactivate the safety interlock switch if it was bypassed while servicing the instrument.</p> <hr/> <p>To override (bypass) this safety interlock, pull the switch up and power is restored to the Power Supply module and the Cytometer even though the cover is removed.</p> <p>Always be very careful if you bypass this safety interlock and operate the instrument with the covers off. The interlock switch is reset when the cover is reinstalled.</p>	
A.6-4, 2	Cooling coil	Copper coil that provides a passageway for the hot compressed air (pressure) generated by the compressor portion of the compressor/vacuum pump to circulate while fans blow air across the coils to lower the temperature. As the hot compressed air passes through this cooling coil, moisture in the air condenses. As the cooled air moves out of the cooling coil it is sent through the air/water filter separator to filter particles out of the air and to allow the heavier moisture to drop from the air to prevent internal rusting of components such as solenoids.	COOLING COIL inside the POWER MODULE block on PN 6320886
A.6-4, 3	+24 Vdc system power supply	Receives ac supply voltage input and converts it to the +24 Vdc needed to power the solenoids and fans.	
A.6-4, 4	+5 Vdc system power supply	Receives ac supply voltage input and converts it to the +5 Vdc needed for the digital logic circuitry.	
A.6-4, 5	±15 Vdc system power supply	Receives ac supply voltage input and converts it to the +15 Vdc and -15 Vdc required to operate the analog devices, such as PMTs, DACs, and op amps.	
A.6-4, 6	+5 and ±12 Vdc MCL power supply	Receives ac supply voltage input and not only converts it to the +5 Vdc needed for the MCL CPU digital logic circuitry but also converts it to the +12 Vdc and -12 Vdc required to operate the bar-code scanner (or bar-code reader head).	
A.6-4, 7	+24 Vdc MCL power supply	Receives ac supply voltage input and converts it to the +24 Vdc needed to power the MCL solenoids.	
A.6-4, 8	Argon laser power supply	Provides control and ac voltages to the Argon laser head. Key must be in and rotated for the laser power to come on.	

Components on the Rear Panel of the Power Supply Module

Figure A.6-5 Rear View of the Power Supply Module (See [Table A.6-5](#))



- | | |
|------------------------------------|-----------------------------------|
| 1. MCL connector | 13. COMP ON indicator lamp |
| 2. CYT12 connector | 14. AUX POWER ON indicator lamp |
| 3. LOGIC connector | 15. SYSTEM ON/OFF rocker switch |
| 4. ANALOG connector | 16. WASTE LEVEL connector |
| 5. 24 VOLTS circuit breaker | 17. SYSTEM POWER cables |
| 6. COMPRESSOR circuit breaker | 18. VENT quick-connect (green) |
| 7. MCL 24 VOLTS circuit breaker | 19. WASTE quick-connect (orange) |
| 8. 5 VOLTS circuit breaker | 20. VACUUM quick-connect (yellow) |
| 9. 15 VOLTS circuit breaker | 21. PRESSURE quick-connect (blue) |
| 10. MCL 5 VOLTS circuit breaker | 22. Fans |
| 11. POWER MODULE CONTROL connector | 23. Laser umbilical cord |
| 12. CYT12 ACTIVE indicator lamp | |

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Table A.6-5 Components on the Rear Panel of the Power Supply Module

Figure Reference	Component	Function	Reference Designator
A.6-5, 1	MCL connector	Provides the external interface from the Power Supply module to the MCL assembly. The cable attached to this connector passes +5 Vdc, ±15 Vdc, +24 Vdc, and ±12 Vdc. The CYT12 signal, which is also looped in this connector, enables a relay that provides power to the Cytometer.	
A.6-5, 2	CYT12 connector	Connector for the fiber optics cable that provides the external CYT12 interface between the computer system and the Power Supply module. When powering up the Cytometer, a signal is sent to the computer and to the Power Supply module enabling them to power up. If the CYT12 cable connecting the Workstation computer and the Power Supply module is loose or disconnected, the system will not power up the Cytometer and the Workstation comes up in listmode.	
A.6-5, 3	LOGIC connector	Provides the external connection from the Power Supply module to the Cytometer. The cable attached to this connector provides the +5 Vdc digital voltage and ground, as well as the connection for the Power Supply module safety interlock.	
A.6-5, 4	ANALOG connector	Provides the external connection from the Power Supply module to the Cytometer. The cable attached to this connector provides the analog system power, ±15 Vdc, +24 Vdc, ground, and the power supply sense lines.	
A.6-5, 5	24 VOLTS circuit breaker	Protects the Cytometer if a short occurs in the +24 Vdc supply circuitry. This is an electromagnetic breaker so it must be switched off then back on again to reset the circuit.	
A.6-5, 6	COMPRESSOR circuit breaker	Protects the compressor/vacuum pump if a short occurs in the ac supply lines or on the Power Module Control card. This is an electromagnetic breaker so it must be switched off then back on again to reset the compressor/vacuum pump.	
A.6-5, 7	MCL 24 VOLTS circuit breaker	Protects the MCL if a short occurs in the MCL +24 Vdc supply circuitry. This is an electromagnetic breaker so it must be switched off then back on again to reset the circuit.	
A.6-5, 8	5 VOLTS circuit breaker	Protects the Cytometer if a short occurs in the +5 Vdc supply logic circuitry. This is an electromagnetic breaker so it must be switched off then back on again to reset the circuit.	
A.6-5, 9	15 VOLTS circuit breaker	Protects the Cytometer if a short occurs in either the +15 Vdc or -15 Vdc supply circuitry. This is an electromagnetic breaker so it must be switched off then back on again to reset the circuit.	

QUICK REFERENCE INFORMATION*POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS***Table A.6-5 Components on the Rear Panel of the Power Supply Module (Continued)**

Figure Reference	Component	Function	Reference Designator
A.6-5, 10	MCL 5 VOLTS circuit breaker	Protects the MCL if a short occurs in the MCL +5 Vdc, +12 Vdc, or -12 Vdc supply circuitry. This is an electromagnetic breaker so it must be switched off then back on again to reset the circuit.	
A.6-5, 11	POWER MODULE CONTROL connector	Provides the external connection from the Power Supply module to the Cytometer. At the Power Supply module, the cable attached to this connector provides a in-line connection with the Power Module Control card and the Argon laser (and HeNe laser, if installed) power supply. The cable interface provides the following signals: <ul style="list-style-type: none"> • Interlock • Laser Discharge • Idle On/Off • Light/Current • Laser Power Out • Laser Current Out • Laser Power In • Laser Current In • Compressor On • Laser Start 	
A.6-5, 12	CYT12 ACTIVE indicator lamp	Indicates CYT12 is connected and active.	
A.6-5, 13	COMP ON indicator lamp	Indicates signal was sent to start the compressor.	
A.6-5, 14	AUX POWER ON indicator lamp	Indicates ac power to system.	
A.6-5, 15	SYSTEM ON/OFF rocker switch	Used to turn the Power Supply module on or off. <ul style="list-style-type: none"> • To supply ac to the Power Supply module, press the rocker switch to ON, position I. • To stop the supply of ac to the Power Supply module, press the rocker switch to OFF, position O. 	
A.6-5, 16	WASTE LEVEL connector	Monitors level of system waste inside the external waste container.	
A.6-5, 17	SYSTEM POWER cables	Provides ac input to the Power Supply module and Argon laser power supply (as well as the optional HeNe power supply, if installed).	
A.6-5, 18	VENT quick-connect (green)	Provides back pressure vent to the external waste container.	QD 22 inside the POWER MODULE block on PN 6320886

Table A.6-5 Components on the Rear Panel of the Power Supply Module (Continued)

Figure Reference	Component	Function	Reference Designator
A.6-5, 19	WASTE quick-connect (orange)	Provides a pathway to the waste container for emptying waste that accumulates in the air/water separator (located on the front of the Power Supply module).	QD 20 inside the POWER MODULE block on PN 6320886
A.6-5, 20	VACUUM quick-connect (yellow)	Provides vacuum to the Cytometer.	QD 21 inside the POWER MODULE block on PN 6320886
A.6-5, 21	PRESSURE quick-connect (blue)	Provides 30 psi to the Cytometer.	QD 19 inside the POWER MODULE block on PN 6320886
A.6-5, 22	Fans	Provide air flow for cooling the inner compartments of the Power Supply module.	
A.6-5, 23	Laser umbilical cord	Connects the Argon laser head to the Argon power supply.	

QUICK REFERENCE INFORMATION

POWER SUPPLY MODULE COMPONENT LOCATIONS AND FUNCTIONS











A.7 HOT KEYS AVAILABLE WITH SYSTEM II™ SOFTWARE

ATTENTION: Hot Keys are not functional when the Acquisition screen is accessed using EXPO32™ software.

Acquisition Screen

The following Hot Keys are available when the Acquisition screen is displayed using SYSTEM II software.










Table A.7-1 Hot Keys Available When the Acquisition Screen is Displayed

Hot Keys	Access
	Cytosettings
	Run regions
	Panel
	Protocol
	Archive Status pop-up box
	Protocol
	Run
	Displays the current version of SYSTEM II software, the operating system, and Cytometer code for the XL or XL-MCL flow cytometer
	Worklist
	Displays system error messages

Listmode Screen

The following Hot Keys are available when the Listmode screen is displayed using SYSTEM II software.

Table A.7-2 Hot Keys Available When the Listmode Screen is Displayed

Hot Keys	Access
	Analysis regions
	Analysis
	File information
	Panel
	Protocol
	Archive Status pop-up box
	Protocol
	Analysis
	Displays the current version of SYSTEM II software, the operating system, and Cytometer code for the XL or XL-MCL flow cytometer



QUICK REFERENCE INFORMATION

HOT KEYS AVAILABLE WITH SYSTEM II™ SOFTWARE

B.1 FlowCentre™ II MULTIMEDIA WORKSTATION COMPUTER CONFIGURATION

The FlowCentre II Multimedia Workstation is a dual-boot system that features both Windows 98 and MS-DOS 6.22. The XL SYSTEM II software is loaded in MS-DOS 6.22 only and is not supported in the Windows 98 operating system.

The FlowCentre II computer chassis is now in a tower, not a desktop case. The computer consists of the following hardware as standard:

- AMI Megarum II Dual Pentium motherboard, utilizing the 440GX chipset, installed with one Pentium® III, 550 or 600 MHz processor (processor contains 512K of internal Cache)
- 100 MHz front side Bus
- 128 MB of PC100 System RAM, ECC correctable, registered
- 400 Watt power supply
- Two on-board IDE channels, supporting up to four hard drives
- Seven total expansion slots: one ISA slot, three PCI 32 bit slots, one PCI 64 bit slot, and one shared PCI 64 bit slot / PCI 32 bit slot

Installed Peripherals

- On-board SCSI channel, providing up to 80 MB per second transfer and supporting up to seven SCSI Devices (two SCSI Channels, only one will be utilized)
- 32 MB dual head display AGP video display adapter, providing support for up to two monitors
- Network Interface card, providing either 10 or 100 MB per second connectivity
- PCI Sound card

Installed Drives

- 13 GB Ultra ATA hard drive (installed as Ultra DMA Mode 2, 33 MB per second data transfer) minimum
- 1.44 MB 3.5-inch floppy drive
- 40x IDE CD-ROM drive minimum

Preloaded Software

- Windows 98 Operating System and MS-DOS 6.22 Operating System, with dual-boot menu
- XL SYSTEM II version 3.0

BIOS SETUP Defaults

The BIOS setup default is preset at the factory for optimal operation. If the BIOS setup information has been changed and is suspected of causing a problem, it can be restored to original factory default by selecting the option **AUTO CONFIGURATION WITH OPTIMAL SETTINGS** in the Main Menu of the system BIOS. To access the system BIOS, press **Delete** during boot up.

DEFAULT Settings for the System BIOS

Standard CMOS Setup

Floppy Drive A:	1.44 MB 3½
Floppy Drive B:	Not Installed
Pri Master (Primary Master Disk):	Auto
Pri Slave (Primary Slave Disk):	Not Installed
Sec Master (Secondary Master Disk):	Auto
Sec Slave (Secondary Slave Disk):	Not Installed
Boot Sector Virus Protection:	Disabled

Advanced CMOS Setup

Primary Display:	VGA / EGA
PS/2 Mouse Support:	Enabled
Display BIOS P. O. S. T. Messages:	Yes
Pause-On Configuration Screen:	2 sec
BootUp Num-Lock:	On
Password Check:	Setup
Boot to OS/2:	No
S.M.A.R.T. for Hard Disks:	Enabled
Quick Boot:	Enabled
1st Boot Device:	Floppy
2nd Boot Device:	ATAPI CDROM
3rd Boot Device:	1st IDE-HDD
4th Boot Device:	Disabled
Try other Boot Devices:	Yes
C000, 16K Shadow:	Cached
C400, 16K Shadow:	Cached
C800, 16K Shadow:	Cached
CC00, 16K Shadow:	Disabled
D000, 16K Shadow:	Cached
D400, 16K Shadow:	Cached
D800, 16K Shadow:	Cached
DC00, 16K Shadow:	Cached

Advanced Chipset Setup

USB Function:	Enabled
Onboard SCSI-1:	Enabled
Onboard SCSI-2:	Disabled
BX Master Latency Timer (Clks):	64
Multi-Trans Timer (Clks):	32
Graphics Aperture Size:	64MB
AGP Mlti-Trans Timer (AGP Clks):	32
AGP Low-Priority Timer (AGP Clks):	16

Power Management Setup

ACPI Aware O/S:	No
Power Management / APM:	Disabled
Power Button Function:	On/Off
Green PC Monitor Power State:	Off
Video Power Down Mode:	Disabled
Hard Drive Power Down Mode:	Disabled
Hard Drive Time Out (Minute):	Disabled
Power Saving Type:	POS
Standby/Suspend Timer Unit:	4 min
Standby Time Out:	Disabled
Suspend Time Out:	Disabled
Slow Clock Ratio:	50% - 62.5%
Display Activity:	Ignore
Device 6 (Serial port 1):	Ignore
Device 7 (Serial port 2):	Ignore
Device 8 (Parallel port):	Ignore
Device 5 (Floppy disk):	Ignore
Device 0 (Primary master IDE):	Ignore
Device 1 (Primary slave IDE):	Ignore
Device 2 (Secondary master IDE):	Ignore
Device 3 (Secondary slave IDE):	Ignore

PCI / Plug and Play Setup

AMI RAID Express Installed:	No
Plug and Play Aware O/S:	Yes
PCI VGA Palette Snoop:	Disabled
Allocate IRQ to PCI VGA:	No

Primary Bus Options

USB Device Latency:	64
PCI Slot-1 Latency:	64
PCI Slot-2 Latency:	N/A
PCI Slot-3 Latency:	N/A
PCI Slot-4 Latency Timer:	64
AGP Slot IRQ Priority:	Auto
USB Device IRQ Priority:	Auto
PCI Slot-1 IRQ Priority:	Auto
PCI Slot-2 IRQ Priority:	N/A
PCI Slot-3 IRQ Priority:	N/A
PCI Slot-4 IRQ Priority:	Auto

Secondary Bus Options

PCI SCSI-1 Latency:	64
PCI SCSI-2 Latency:	N/A
PCI Slot-5 Latency:	N/A
PCI Slot-6 Latency:	N/A
PCI SCSI-1 IRQ Priority:	IRQ 10
PCI SCSI-2 IRQ Priority:	N/A
PCI Slot-5 IRQ Priority:	N/A
PCI Slot-6 IRQ Priority:	N/A

Bus IRQ Resource Owner

IRQ3:	PnP
IRQ4:	PnP
IRQ5:	ISA
IRQ7:	ISA
IRQ9:	Primary PCI
IRQ10:	Secondary PCI (greyed out)
IRQ11:	ISA
IRQ12:	PnP

IRQ14:	PCI
IRQ15:	PCI

DMA Resource Owner

DMA Channel 0:	PnP
DMA Channel 1:	PnP
DMA Channel 3:	PnP
DMA Channel 5:	PnP
DMA Channel 6:	PnP
DMA Channel 7:	PnP

ISA Memory Resource

Reserved ISA Card Memory Size:	16K
Reserved ISA Card Memory Address:	CC000

Peripheral Setup

OnBoard Floppy Controller:	Enabled
OnBoard Primary/Secondary IDE:	Both
IDE Bus Mastering:	Enabled
Primary Prefetch:	Disabled
Secondary Prefetch:	Disabled
OffBoard PCI/ISA IDE Card:	N/A
Primary/Secondary:	N/A
PCI IDE Card Primary IRQ:	N/A
PCI IDE Card Secondary IRQ:	N/A
OnBoard Serial Port1 IRQ:	IRQ 4
Serial Port1 Address:	3F8h
Serial Port1 FIFO:	Disabled
OnBoard Serial Port2 IRQ:	IRQ 3
Serial Port2 Address:	2F8h
Serial Port2 FIFO:	Enabled
Serial Port2 Mode:	Normal
IR Duplex Mode	N/A
IrDA Protocol:	N/A

OnBoard Parallel Port IRQ:	Disabled
Parallel Port Address:	N/A
Parallel Port Mode:	N/A
Parallel Port DMA Channel:	N/A
EPP Version:	N/A

WINDOWS 98 Configuration from Device Manager

Note: To access, select the Windows **Start** button ► **Settings** ► **Control Panel** ► **System** ► **Device Manager**.

Control Panel Setup, Device Manager, Computer

IRQ 00:	System Timer
IRQ 01:	Std 101/102 Key Keyboard
IRQ 02:	Programmable Interrupt Controller
IRQ 03:	Comm Port 2
IRQ 04:	Comm Port 1
IRQ 05:	Printer Port (LPT1)
IRQ 06:	Std Floppy Disk Controller
IRQ 07:	System Reserved
IRQ 08:	System CMOS / RTC
IRQ 09:	PCI Sound card
IRQ 09:	PCI Network Interface card
IRQ 09:	AGP Display Adapter
IRQ 10:	On Board SYMBIOS SCSI 1 Channel
IRQ 11:	System Reserved
IRQ 12:	PS/2 Mouse
IRQ 13:	Numeric Data Processor
IRQ 14:	Dual PCI-IDE Controller
IRQ 14:	Primary IDE Controller (DUAL FIFO)
IRQ 15:	Dual PCI-IDE Controller
IRQ 15:	Secondary IDE Controller (DUAL FIFO)

CONFIG.SYS Configuration

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE NOEMS X=D100-DCFF
BUFFERS=63,0
FILES=60
DOS=UMB

FCBS=4,0
REM DEVICE=C:\OAKCDROM.SYS /D:MSCD000
DOS=HIGH

REM THE NEXT 2 LINES ARE FOR LANTASTIC NETWORKING
REM DEVICEHIGH=C:\LANTASTI\PROTMAN.DOS /I:C:LANTASTI
REM DEVICEHIGH=C:\LANTASTI\EL90X.DOS
REM DEVICEHIGH /L:2,12048 =C:\DOS\SETVER.EXE
SHELL=C:\DOS\COMMAND.COM /P /E:1024
REM DEVICE=C:\LANTASTI\PROTMAN.DOS /I:C:\LANTASTI
REM DEVICE=C:\LANTASTI\EL90X.DOS

LASTDRIVE=Z
```

AUTOEXEC.BAT Configuration

```
@echo off
REM VERIFY ON
LH C:\APPS\MOUSE\MOUSE
REM THE NEXT LINE IS THE CD-ROM DRIVER
REM C:\DOS\MSCDEX.EXE /D:MSCD000
REM THE NEXT LINE ENABLES THE FONT FOR THE ELITE/ALTRA SOFTWARE
C:\MATROX\UTIL\VBEXT.EXE
PATH=C:;\;C:\DOS;C:\XL;C:\APPS\MOUSE;C:\RTSQL
REM THE NEXT LINE IS FOR THE LANTASTIC NETWORK OPTION
REM call C:\LANTASTI\STARTNET.BAT

REM *** DATABASE ENVIRONMENT ***
SET SQLCONNECT=DBA,SQL,,
SET SQLPATH=C:\RTSQL
SET SQLSTART=C:\RTSQL\rtstart /q C:\XL\DBF\xl2.db
SET WSQL=C:\RTSQL
SET DOS16M=:3M

CD \XL
XL2
```

B.2 FlowCentre™ MULTIMEDIA WORKSTATION COMPUTER CONFIGURATION

The FlowCentre Multimedia Workstation is a dual-boot system that features both Windows 95 and MS-DOS 6.22. XL SYSTEM II software is loaded in MS-DOS 6.22 only and is not supported in the Windows 95 operating system.

In the FlowCentre computer, an Ultra ATA controller replaces the Caching controller used in the INTEL® Pentium® 166 processor. The Ultra ATA Controller features a 33 MB per second data transfer rate, to and from the PCI Bus to the Hard Drive.

The FlowCentre computer chassis is in a desktop case that contains an AMI ATLAS PCI III Motherboard with:

- 200 MHz INTEL Pentium processor
- 512 K pipeline burst cache
- 32 MB System Parity RAM (2 to 16 MB SIMMS@ 70 nS RAS), expandable up to 256 MB memory
- Three PCI, three ISA slots and one shared PCI/ISA slot (PCI bus conforms to the PCI 2.1 Specification)
- Four 72-pin memory SIMM sockets supporting up to 256 MB of Fast Page, ECC or EDO Ram
- Two on-board PCI-IDE connectors, supporting up to four large hard drives
- Two serial ports
- One bi-directional parallel port
- Two 4-pin connectors for a Universal Serial Bus
- PS/2 Mouse Support option
- One Keyboard Port
- AMI Plug and Play BIOS

Installed Peripherals

- PCI Ultra ATA Controller with 33 MB per second transfer rate
- PCI Video Display Adapter with 4 MB W-RAM
- PCI SCSI Host Adapter with support for optional Maxoptix Tahiti Optical Drives, 90/150 MB Bernoulli Drives or an optional Sony Sprespa External Recordable CD-ROM Drive
- PCI Network Interface card (combo card) providing a maximum transfer rate of 10 MB per second
- Soundblaster Compatible Sound card with Wavetable Synthesis
- 33,600 BAUD FAX/Modem (requires an analog line at the Customer's Account)
- Black Windows 95 full-size keyboard
- PS/2 mouse

Installed Drives

- 32X Internal IDE CD-ROM drive
- 3.2 Gigabyte IDE hard drive, (mode 4)
- 1.44 MB floppy drive, 3.5-inch

Preloaded Software

- Windows 95 Operating System and MS-DOS 6.22 Operating System, with dual-boot menu
- XL SYSTEM II version 3.0
- Adaptec EZ-SCSI version 4.x (SCSI Host Adapter software are loaded in C:\SCSI.)
- Matrox Millenium PowerDesk (Software for Video Display Adapter.)
- 16 Bit Sound card software (Files for sound card are loaded in C:\PROGRAM FILES.)
- CONFIG.SYS and AUTOEXEC.BAT files (Backup CONFIG.SYS and AUTOEXEC.BAT files for XL are loaded in C:\XLCONFIG directory.)
- CONFIG.DOS and AUTOEXEC.DOS files (MS-DOS configuration files used when booting into MS-DOS 6.22.)
- FNT8X14 (Loads the 8X14 font for Video card.)
- MOUSE.SYS (Mouse driver for MS-DOS is loaded in C:\APPS\MOUSE.)
- ALTRA version 1.0

Circuit Card Locations

Slot	Circuit Card
PCI Slot 1 (slot closest to the Power Supply)	PCI Video Display Adapter
PCI Slot 2	PCI Ultra ATA Controller
PCI Slot 3	PCI SCSI Host Adapter
PCI Slot 4	PCI Network Interface
ISA Slot 1 (slot closest to the edge of the Motherboard)	Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II (slot is free in the stand-alone Workstation)
ISA Slot 2	16 Bit Sound
ISA Slot 3	Modem
ISA Slot 4 (shared slot with PCI Slot)	Empty

BIOS Password

The BIOS is password protected. The password is AUER.

AMI WIN BIOS Configuration

Standard Setup

Pri Master (Primary Master Disk):	Auto
Pri Slave (Primary Slave Disk):	Not Installed
Sec Master (Secondary Master Disk):	Not Installed
Sec Slave (Secondary Slave Disk):	Not Installed
Floppy A: Drive:	1.44 MB 3½
Floppy B: Drive:	Not Installed

Advanced Setup

System Keyboard:	Present
Primary Display:	VGA / EGA
PS/2 Mouse Support:	Enabled
Setup Color Scheme:	LCD
Display BIOS P. O. S. T. Messages:	Yes
Display Add-On ROM Messages:	Yes
Pause-On Configuration Screen:	2 sec
BootUp Num-Lock:	On
Password Check:	Setup
Boot to OS/2:	No
Floppy Drive Seek:	Enabled
Floppy Drive Swap	Disabled
Floppy Access Control:	Read-Write
Hard drive Access Control:	Read-Write
S.M.A.R.T. for Hard Disks:	Enabled
1st Boot Device:	Floppy
2nd Boot Device:	CDROM
3rd Boot Device:	IDE-0
4th Boot Device:	Disabled
Try Other Boot Devices:	Yes
External Cache:	WriteBack
System BIOS Cacheable:	Enabled
Caching Controller:	Absent
Video Shadow C000, 32K:	Cached
Shadow C800, 16K:	Disabled

Shadow CC00, 16K:	Disabled
Shadow D000, 16K:	Disabled
Shadow D400, 16K:	Disabled
Shadow D800, 16K:	Disabled
Shadow DC00, 16K:	Disabled

Chipset Setup

Memory Hole:	Disabled
DRAM ECC Mode:	Enabled
USB Function:	Disabled
USB Keyboard / Mouse Legacy Support:	Disabled

Power Mgmt (Power Management) Setup

Power Management / APM:	Enabled (by default from DRAM ECC mode)
Instant-On Timeout (Minute):	N/A
Green PC Monitor Power State:	Standby
Video Power Down Mode:	Disabled
Hard Drive Power Down Mode:	Disabled
Hard Drive Time Out (Minute):	Disabled
Suspend Time Out:	Disabled
Slow Clock Ratio:	1:8
IRQ3:	Monitor
IRQ4:	Monitor
IRQ5:	Ignore
IRQ7:	Ignore
IRQ9:	Ignore
IRQ10:	Ignore
IRQ11:	Ignore
IRQ12:	Monitor
IRQ13:	Ignore
IRQ14:	Monitor
IRQ15:	Monitor

PCI / PnP Setup

PCI VGA Palette Snoop:	Disabled
PCI Slot-1 Latency Timer:	64
PCI Slot-2 Latency Timer:	64
PCI Slot-3 Latency Timer:	Empty Slot
PCI Slot-4 Latency Timer:	64
USB Device Latency Timer:	Disabled
USB Device IRQ Preference:	Disabled
PCI Slot-1 IRQ Preference:	Auto
PCI Slot-2 IRQ Preference:	Auto
PCI Slot-3 IRQ Preference:	Empty Slot
PCI Slot-4 IRQ Preference:	Auto
IRQ3:	PnP
IRQ4:	ISA
IRQ5:	PnP
IRQ7:	ISA
IRQ9:	PCI / PnP
IRQ10:	ISA
IRQ11:	ISA
IRQ12:	PnP
IRQ14:	PCI
IRQ15:	PCI / PnP
DMA CHANNEL 0:	PnP
DMA CHANNEL 1:	PnP
DMA CHANNEL 3:	PnP
DMA CHANNEL 5:	PnP
DMA CHANNEL 6:	PnP
DMA CHANNEL 7:	PnP
Reserved ISA Card Memory Size:	16K
Reserved ISA Card Memory Address:	CC000

Peripheral Setup

OnBoard Floppy Controller:	Enabled
OnBoard Primary/Secondary IDE:	Primary
OnBoard IDE BusMaster:	Enabled
IDE Bus Mastering:	Enabled
OnBoard Primary Prefetch:	Disabled
OnBoard Secondary Prefetch:	N/A
OffBoard PCI/ISA IDE Card:	N/A
OffBoard Primary/Secondary:	N/A
OffBoard PCI IDE Primary IRQ:	N/A
OffBoard PCI IDE Secondary IRQ:	N/A
Serial Port1 IRQ:	Disabled
Serial Port1 Address:	N/A
Serial Port1 FIFO:	N/A
Serial Port2 IRQ:	IRQ 3
Serial Port2 Address:	2F8h
Serial Port2 FIFO:	Enabled
Parallel Port IRQ:	IRQ 5
Parallel Port Address:	378h
Parallel Port Mode:	EPP
Parallel Port DMA Channel:	N/A
EPP Version:	1.7

Supervisor

Supervisor Password:	AUER
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WINDOWS 95 Configuration from Device Manager

Note: To access, select the Windows **Start** button ► **Settings** ► **Control Panel** ► **System** ► **Device Manager**.

Control Panel Setup, Device Manager, Computer

IRQ 00:	System Timer
IRQ 01:	Std 101/102 Key Keyboard
IRQ 02:	Programmable Interrupt Controller
IRQ 03:	Comm Port 2
IRQ 04:	Comm Port 1
IRQ 05:	Printer Port (LPT1)
IRQ 06:	Std Floppy Disk Controller
IRQ 07:	Not to be allocated by Windows 95, must remain available
IRQ 08:	System CMOS / RTC
IRQ 09:	PCI ULTRA ATA Controller
IRQ 09:	PCI Network Interface card
IRQ 09:	PCI VGA Display Adapter
IRQ 10:	16 Bit Sound card
IRQ 11:	Not to be allocated by Windows 95, must remain available
IRQ 12:	PS/2 Mouse
IRQ 13:	Numeric Data Processor
IRQ 14:	Dual PCI-IDE Controller
IRQ 14:	Primary IDE Controller (Single FIFO)
IRQ 15:	PCI SCSI Host Adapter

CONFIG.SYS Configuration

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE NOEMS X=CA00-CAFF
BUFFERS=63,0
FILES=60
DOS=UMB
LASTDRIVE=Z
FCBS=4,0
REM DEVICE=C:\DOS\SETVER.EXE
DOS=HIGH
SHELL=C:\DOS\COMMAND.COM /P /E:1024

REM THE NEXT LINE ACTIVATES THE INTERNAL CD-ROM DRIVE
REM DEVICE=C:\SONY_CD\ATAPI_CD.SYS /D:MSCD000 /Q /I:0
REM DEVICEHIGH /L:1,40800 =C:\OAKCDROM.SYS /D:MSCD000

REM THE NEXT 2 LINES ARE FOR THE LANTASTIC NETWORK
REM DEVICE=C:\LANTASTI\PROTMAN.DOS /I:C\LANTASTI
REM DEVICE=C:\LANTASTI\EL90X.DOS

DEVICEHIGH /L:1,12048 =C:\DOS\SETVER.EXE
REM DEVICE=C:\LANTASTI\PROTMAN.DOS /I:C\LANTASTI
REM DEVICE=C:\LANTASTI\EL90X.DOS
```

AUTOEXEC.BAT Configuration

```
@ECHO OFF
REM C:\DOS\SMARTDRV.EXE /X
PROMPT $P$G
SET TEMP=C:\DOS
PATH=C:\;C:\XL;C:\DOS;C:\RTSQL

REM THE NEXT LINE INSTALLS THE MOUSE DRIVER, V11.00
LH /L:0 C:\APPS\MOUSE\MOUSE
REM LH /L:1,27952 C:\DOS\MSCDEX.EXE /D:MSCD000
REM THE NEXT LINE IS FOR THE LANTASTIC NETWORK OPTION
REM call C:\LANTASTI\STARTNET.BAT
REM THE STARTNET.BAT FILE

REM C:\DOS\MSCDEX.EXE /D:MSCD000 /M:12 /V

REM *** DATABASE ENVIRONMENT ***
SET SQLCONNECT=DBA,SQL,,
SET SQLPATH=C:\RTSQL
SET SQLSTART=C:\RTSQL\rtstart /q C:\XL\DBF\xl2.db
SET WSQL=C:\RTSQL
SET DOS16M=:3M

CD \XL
XL2
```


B.3 INTEL® PENTIUM® 166 PROCESSOR CONFIGURATION

The INTEL Pentium 166 processor contains an AMI ATLAS PCI III Motherboard with:

- 166 MHz INTEL Pentium processor
- 512 K pipeline burst cache
- 16 MB system parity RAM (2 to 8 MB SIMMS at 70 ns RAS), expandable to 256 MB memory
- 3 PCI, 3 ISA slots and 1 shared PCI/ISA slot (PCI bus conforms to the PCI 2.1 Specification)
- 4, 72-pin memory SIMM sockets
- 2 on-board PCI-IDE controllers
- 2 serial ports
- 1 bi-directional parallel port
- Support for a Universal Serial Bus
- PS-2 Mouse Support Option (used only on the FlowCentre Multimedia Workstation)
- 1 keyboard port
- AMI Plug and Play BIOS.

Installed Peripherals

- PCI caching controller with 4 MB cache provides a sustained data transfer rate of 12 MB/sec
- PCI video display adapter with 2 MB W-RAM

Installed Drives

- 1.2 GB IDE hard drive (mode 4)
- 3.5 in. 1.44 MB floppy diskette drive card location.

Preloaded Software

- MS-DOS 6.22 Operating System
- MOUSE.SYS mouse driver

BIOS Password

The BIOS is password protected. The password is AUER.

AMI WIN BIOS Configuration

Standard Setup

Floppy A: Drive:	1.44 MB 3½
Floppy B: Drive:	Not Installed
Pri Master (Primary Master Disk):	Auto
LBA/LARGE Mode:	On
Block Mode:	Off
32-Bit Mode	Off
PIO Mode:	Mode 4
Pri Slave (Primary Slave Disk):	Not Installed
Sec Master (Secondary Master Disk):	Not Installed
Sec Slave (Secondary Slave Disk):	Not Installed

Advanced Setup

System Keyboard:	Present
Primary Display:	VGA / EGA
Setup Color Scheme:	LCD
Pause-On Configuration Screen:	2 sec
PS/2 Mouse Support	Disabled
BootUp Num-Lock:	On
Display BIOS P. O. S. T. Messages:	Yes
Password Check:	Setup
Boot to OS/2:	No
Floppy Drive Seek at Boot:	Enabled
Floppy Drive Swap	Disabled
Floppy Access Control:	Read-Write
Hard drive Access Control:	Read-Write
S.M.A.R.T. for Hard Disks:	Disabled
1st Boot Device:	IDE-0
2nd Boot Device:	Floppy
3rd Boot Device:	Disabled
4th Boot Device:	Disabled
Try Other Boot Devices:	No
External Cache:	WriteBack
System BIOS Cacheable:	Enabled

Caching Controller:	Present
Video Shadow C000, 32K:	Cached
Shadow C800, 16K:	Disabled
Shadow CC00, 16K:	Disabled
Shadow D000, 16K:	Disabled
Shadow D400, 16K:	Disabled
Shadow D800, 16K:	Disabled
Shadow DC00, 16K:	Disabled

Chipset Setup

Memory Hole:	Disabled
DRAM ECC Mode:	Enabled
USB Function:	Disabled
USB Keyboard / Mouse Legacy Support:	No Selection

Power Mgmt (Power Management) Setup

Power Management / APM:	Enabled (by default from DRAM ECC mode)
Video Power Down Mode:	Disabled
Hard Drive Power Down Mode:	Disabled
Hard Drive Time Out (Minute):	Disabled
Standby Time Out (Minute):	Disabled
Suspend Time Out:	Disabled

PCI / PnP Setup

PCI VGA Palette Snoop:	Disabled
PCI Slot-1 Latency Timer:	64
PCI Slot-2 Latency Timer:	64
PCI Slot-3 Latency Timer:	Empty Slot
PCI Slot-4 Latency Timer:	Empty Slot
USB Device Latency Timer:	No Selection
USB Device IRQ Preference:	No Selection
PCI Slot-1 IRQ Preference:	Auto
PCI Slot-2 IRQ Preference:	Auto
PCI Slot-3 IRQ Preference:	Empty Slot
PCI Slot-4 IRQ Preference:	Empty Slot
IRQ3:	No Selection
IRQ4:	No Selection
IRQ5:	No Selection
IRQ7:	ISA
IRQ9:	ISA
IRQ10:	PCI / PnP
IRQ11:	ISA
IRQ12:	PCI / PnP
IRQ14:	No Selection
IRQ15:	No Selection
DMA CHANNEL 0:	PnP
DMA CHANNEL 1:	PnP
DMA CHANNEL 3:	PnP
DMA CHANNEL 5:	PnP
DMA CHANNEL 6:	PnP
DMA CHANNEL 7:	PnP
Reserved ISA Card Memory Size:	16K
Reserved ISA Card Memory Address:	CC000

Peripheral Setup

OnBoard Floppy Controller:	Enabled
OnBoard Primary/Secondary IDE:	No Selection
OnBoard IDE BusMaster:	No Selection
OffBoard PCI/ISA IDE Card:	PCI Slot 1
OffBoard Primary/Secondary:	Both
OffBoard PCI IDE Primary IRQ:	Disabled
OffBoard PCI IDE Secondary IRQ:	Hardwired
Serial Port1 IRQ:	IRQ 4
Serial Port1 Address:	3F8h
Serial Port1 FIFO:	Disabled
Serial Port2 IRQ:	IRQ 3
Serial Port2 Address:	2F8h
Serial Port2 FIFO:	Enabled
Parallel Port IRQ:	IRQ 5
Parallel Port Address:	378h
Parallel Port Mode:	Normal
Parallel Port DMA Channel:	No Selection

Supervisor

Supervisor Password:	AUER
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B.4 LANTastic® NETWORK OPERATING SYSTEM MINIMUM REQUIREMENTS

The following are the minimum requirements for the LANTastic network operating system (NOS) as provided by Artisoft, Inc. These are for a dedicated network server and do not include support for SYSTEM II software installed on the server.

DOS Requirements

- IBM® PC or compatible - 8086 or higher
- 640K available RAM (DOS)
- MS-DOS - 5.0 and higher
- Artisoft LANTastic NOS - 8.0
- 9.5 MB free hard disk space.

Windows Requirements

- IBM PC or compatible - 486/66 processor or higher
- 8 MB available RAM - minimum (16 MB recommended)
- Windows 95 or 98
- Artisoft LANTastic NOS - 8.0
- 12.5 MB free hard disk space.

B.5 Sybase® SQL ANYWHERE™ MINIMUM REQUIREMENTS

The following are the minimum requirements for the Sybase SQL Anywhere PC database server software as provided by Sybase, Inc. These are for a dedicated network server and do not include support for SYSTEM II software installed on the server.

Client Requirements

- IBM® PC or compatible
- MS-DOS - 3.3 and higher
- Windows 95 or higher (Windows 3.x, Windows NT 3.x, or OS/2 version 2.x or higher are also acceptable)
- 12 MB free hard disk space for DOS operating system
- 9 MB free hard disk space for Windows 95 or higher operating system.

Database Server Requirements

- IBM PC or compatible
- Intel 80386 or higher processor
- 8 MB available RAM
- MS-DOS - 3.3 and higher
- Windows 95 or higher (Windows 3.x, Windows NT 3.x, Novell NetWare version 3.11 or higher, DOS version 3.3 or higher, or OS/2 version 2.x or higher are also acceptable)
- 14 MB free hard disk space.

Network Requirements

- NetBIOS, TCP/IP, or Novell NetWare IPX (DOS clients support NetBIOS and IPX only).



C.1 WORKSHEETS

Field Engineer Worksheet

	FS		FL1		FL2		FL3		FL4	
Run #	HP CV	Mean Channel	HP CV	Mean Channel	HP CV	Mean Channel	HP CV	Mean Channel	HP CV	Mean Channel
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
Add lines 0 through 9 to get TOTALS										
Totals										

Network Configuration Worksheet

Serial Number _____

Network Node Name _____

Server Attached To _____

CPU Type _____ RAM Size _____

PRINTER TYPE _____

LPT1 _____

LPT2 _____

DISK DRIVES

A: _____

B: _____

C: _____

D: _____

E: _____

MS DOS Version _____

Cytometer Software Version _____

Network Node ID _____

NETWORK INTERFACE CARD

Manufacturer _____

Address _____

IRQ _____

I/O DEVICES

Device Name	Base I/O	IRQ

D.1 CLIENT FLOW CYTOMETER

Config.sys

```

DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH
DEVICE=C:\DOS\SETVER.EXE
FILES=60
BUFFERS=30
LASTDRIVE=Z
DEVICE=C:\APPS\MOUSE\MOUSE.SYS
DEVICE=C:\LAN\PROTMAN.DOS /I:C:\LAN
DEVICE=C:\LAN\ELNK3.DOS

```

Autoexec.bat

```

SET CGIPATH=C:\XL\GSS
@ECHO OFF
PROMPT $p$g
PATH C:\DOS
SET TEMP=C:\DOS
call C:\LAN\STARTNET.BAT
C:
kwcaf 500,100
cd \XL
XL2

```

Startnet.bat

```

@echo off
C:
cd C:\LAN

SET LAN_CFG=C:\LAN

rem If LANtastic is disabled, skip everything.
IF EXIST DISABLED GOTO :STARTNET_DONE

@echo ===== Begin LANtastic configuration =====

PATH C:\LAN;%PATH%

LOADHIGH AI-NDIS BIND_TO=ELNK3_NIF
AILANBIO @STARTNET.CFG

REDIR MYRA @STARTNET.CFG

NET USE S: \\JEEVES\E-DRIVE
NET USE T: \\Research_Lab\D-DRIVE
NET USE LPT2: \\Research_Lab\@PRINTER

rem If CONNECT.BAT exists, run it to set up connections.
IF EXIST CONNECT.BAT GOTO :CONNECT

```

```
rem Otherwise set up connections specified during install.
NET LPT TIMEOUT 10
GOTO :CONNECT_DONE

:CONNECT
@echo Setting up LANtastic connections from CONNECT.BAT
rem Build CONNECT.BAT like this: "NET SHOW/BATCH > C:\LAN\CONNECT.BAT"
rem (or run the batch file SETNET.BAT)
call CONNECT.BAT

:CONNECT_DONE
NET POSTBOX

@echo ===== End LANtastic configuration =====

:STARTNET_DONE
cd \
```

XI_graph.cng

```
V=TS41024
S=SYS16.FNT
M=SYS24.FNT
L=P7x9.FNT
K=ROMANTRL.FNT
N=NET SHOW
```

D.2 FILE SERVER

Config.sys

```

DEVICE=C:\CORELDRV\ASPIDRV.SYS

DEVICE=C:\DOS\SETVER.EXE
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH
FILES=100
BUFFERS=30
STACKS=9,256
LASTDRIVE=Z

DEVICEHIGH=C:\CORELDRV\UNI_ASP.SYS

DEVICE=C:\LANTASTI\PROTMAN.DOS /I:C:\LANTASTI
DEVICE=C:\LANTASTI\ELNK3.DOS

rem DEVICE=C:\CORELDRV\CUNI_ASP.SYS

```

Autoexec.bat

```

C:\DOS\SMARTDRV.EXE /X
@ECHO OFF
PROMPT $p$g
PATH c:\wsql40\win;C:\WINDOWS;C:\DOS
SET MSINPUT=C:\MSINPUT
C:\MSINPUT\MOUSE\MOUSE.EXE /Q
SET TEMP=C:\DOS
call C:\LANTASTI\STARTNET.BAT
cd c:
SET PATH=%PATH%;C:\CORELDRV
REM C:\CORELDRV\CORELCDX
c:\dos\doskey
SET WSQL=c:\wsql40
win c:\wsql40\win\dbserveview -x netbios -n XL20_DATABASE c:\wsql40\xl2.db

```

Startnet.bat

```

@echo off
C:
cd C:\LANTASTI

SET LAN_CFG=C:\LANTASTI

rem If LANtastic is disabled, skip everything.
IF EXIST DISABLED GOTO :STARTNET_DONE

```

```
@echo ===== Begin LANtastic configuration =====

PATH C:\LANTASTI;C:\LANTASTI\NW;%PATH%
SET LAN_DIR=C:\LANTASTI.NET
SET NWDBPATH=C:\LANTASTI\NW

LOADHIGH AI-NDIS BIND_TO=ELNK3_NIF
AILANBIO @STARTNET.CFG

REDIR RESEARCH_LAB @STARTNET.CFG

net use S: \\jeeves\le-drive

IF EXIST NOSHARE GOTO :NOSHARE
SERVER C:\LANTASTI.NET @STARTNET.CFG
NET LOGIN \\RESEARCH_LAB
GOTO :CONTINUE

:NOSHARE
@echo LANtastic server was installed but turned off.

:CONTINUE

rem If CONNECT.BAT exists, run it to set up connections.
IF EXIST CONNECT.BAT GOTO :CONNECT

rem Otherwise set up connections specified during install.
NET USE LPT1: \\RESEARCH_LAB\@PRINTER
NET LPT TIMEOUT 10
GOTO :CONNECT_DONE

:CONNECT
@echo Setting up LANtastic connections from CONNECT.BAT
rem Build CONNECT.BAT like this: "NET SHOW/BATCH > C:\LANTASTI\CONNECT.BAT"
rem (or run the batch file SETNET.BAT)
call CONNECT.BAT

:CONNECT_DONE
NET POSTBOX

@echo ===== End LANtastic configuration =====

:STARTNET_DONE
cd \
```


E.1 802.3

Table E.1-1 802.3 Specifications

Item	10BASE5	10BASE2	10BASE-T
Data rate (MBPS)	10	10	10
Signaling type	Baseband/Manchester	Baseband/Manchester	Baseband/Manchester
Maximum segment length (meters)	500	185	100
Media	COAX (thick) 50 ohm RG-8, RG-11	COAX (thin) 50 ohm RG-58	UTP
Topology	Bus Requires transceivers	Bus Requires terminators	Star Requires a hub device
Number of nodes per segment/length	100 2.5 meters apart	30 0.5 meters apart	1 100 meters apart

F.1 BAR-CODE LABELS

A bar code consists of black lines (bars) and white lines (spaces), which are called elements. There are narrow elements (NE) and wide elements (WE). The bar-code symbology determines their arrangement.

IMPORTANT Possible incorrect sample identification. When sample tube bar-code labels do not follow the specification in this section, incorrect sample identification can occur. To prevent incorrect sample identification, your sample tube bar-code labels must follow the specifications listed in this section.

The XL-MCL flow cytometer supports preprinted labels (See [Heading 8.1, MASTER PARTS LISTS, Table 8.1-9](#) for part numbers.)

Acceptable Bar Codes

The XL-MCL flow cytometer and the optional hand-held bar-code scanner automatically distinguish the bar-codes in [Table F.1-1](#) with the specifications shown.

Table F.1-1 Acceptable Bar Codes

Bar Code	Specification
Code 39®	7 characters - maximum 6 data characters + 1 check character
Codabar	10 characters - maximum 9 data characters + 1 check character
Interleaved 2 of 5	14 characters - fixed 13 data characters + 1 check character
Code 128B	8 characters - maximum alphanumeric
Code 128C	16 characters - maximum numeric

Optical Characteristics of Bar-Code Labels

- Print Contrast Signal (PCS) - 80% minimum
- Reflectivity of Media (RW) - 80% minimum
- Reflectivity of Ink (RB) - 16% maximum
- No spots or voids; no ink smearing
- Edge roughness is included in the bar and space tolerances.

$$PCS = (RW - RB)/RW \times 100\%$$

Table F.1-2 Code-Related Specifications

Code	Interleaved 2-of-5*	Codabar*	Code 39*	Code 128 *
Narrow element (NE) width	0.010 in. \pm 0.001 in.	0.010 in. \pm 0.001 in.	0.010 in. \pm 0.001 in.	0.010 in. \pm 0.001 in.
Wide element/narrow element ratio (WE/NE)	3:1	N/A	3:1	N/A
Intercharacter gap	No	0.010 in. minimum	\geq NE	No
Data digits	14†	1 to 10†	1 to 7†	2 to 16

* See AIM® USA uniform Symbology specification, Rev. 1993 for detailed specification.

† Includes check sum character.

NE (Narrow Elements) Width

0.01 in.

WE/NE (Wide Elements/Narrow Elements) Ratio

3:1

Printing Methods

Optional bar-code Printer. See [Heading 3.11, BAR-CODE PRINTER OPTION](#) for installation information.

Check Sum Algorithm

Use of bar codes is an extremely accurate and effective method of positive patient identification. Certain features, such as check sum digits, maximize accuracy in reading Codabar, Code 39 and Interleaved 2-of-5 labels. In one study, the use of check sum digits detected 97% of misread errors.

Beckman Coulter strongly recommends the use of bar-code check sums to provide automatic checks for read accuracy. Use check sums to provide protection against occasional misread errors caused by problems such as damaged or misapplied labels. If you must use bar codes without check sums, Beckman Coulter recommends that you verify each bar-code reading to assure correct patient identification.

F.2 MCL BAR-CODE SCANNER

Types of Scanners

The XL-MCL flow cytometer uses a visible laser-type scanner containing a Class II laser, operating at 670 nm, with a maximum power output of 1 mW. The MCL bar-code scanner is used on the XL-MCL flow cytometer only.

A hand-held bar-code scanner is available for use with either the XL or XL-MCL flow cytometer. The hand-held scanner uses a visible laser-type reader containing a Class II laser, operating at 670 nm, with a maximum power output of 1 mW. For more information, refer to [Heading F3, HAND-HELD BAR-CODE SCANNER OPTION](#).

Decoding

The XL-MCL flow cytometer sends a “GS” ASCII character (hexadecimal 1D) to the decoder to begin operation.

The decoder:

- Turns the scanner on.
- Decodes information that comes from the scanner.
- Keeps the scanner on for up to four seconds.
- Turns the scanner off.
- Sends the decoded information (or no-read message) to the XL-MCL flow cytometer.

Communication Protocol

Communication protocol is determined by the EEPROM (labelled U13) installed on the Bar-Code Decoder card. Two versions of this EEPROM are currently in use. The upgrade version, referred to as the ALL CODES EEPROM, has the OEM part number 35-213064-11 printed on the chip. The part number for the original version ends with 10 (OEM part number 35-213064-10).

For an Instrument with the ALL CODES EEPROM Installed

If the XL-MCL flow cytometer has the ALL CODES EEPROM (OEM part number 35-213064-11) installed on the Bar-Code Decoder card, use the following AUX port settings:

Bits per second:	9600
Parity:	None
Data bits:	8
Stop bits:	1
Flow control:	Xon/Xoff

For an Instrument with an Original EEPROM Installed

If the XL-MCL flow cytometer has the original EEPROM (OEM part number 35-213064-10) installed on the Bar-Code Decoder card, use the following AUX port settings:

Bits per second: 1200
Parity: Odd
Data bits: 8
Stop bits: 1
Flow control: Xon/Xoff

MCL Bar-Code Scanner Setup

IMPORTANT Risk of sample misidentification if the parameters for Code 128 bar-code symbology are changed to a setting other than default. Code 128 is used to identify sample tube positions in the MCL. If the default parameter settings are altered, sample tube positions may be misread. Do not reprogram the Code 128 bar-code symbology.

Default Configurations for the EEPROM

Table F.2-1 MCL Bar-Code Scanner - Default Configuration

Item	Bar-Code Symbology				
	Code 39	Codabar	Interleaved 2 of 5	UPC	Code 128*
Code type	Enabled	Enabled	Enabled	Disabled	Enabled
Fixed length	Disabled	Disabled	N/A	N/A	Disabled
Code length #1	7	10	14	N/A	16
Code length #2	N/A	N/A	0	N/A	N/A
Check digit	Enabled	Enabled	Enabled	N/A	N/A
C/D output	Disabled	Disabled	Disabled	N/A	N/A
C/D aim	N/A	Enabled	N/A	N/A	N/A
Intercharacter gap	Disabled	Disabled	N/A	N/A	N/A
S/S match	N/A	Disabled	N/A	N/A	N/A
S/S output	N/A	Disabled	N/A	N/A	N/A
EAN	N/A	N/A	N/A	N/A	N/A
Narrow margins	Enabled	Enabled	Enabled	Enabled	Enabled

* Do not reprogram this symbology.

Symbologies

IMPORTANT Possible incorrect identification of sample tubes. If sample tube bar-code labels use FNC1, FNC4, and FS (hexadecimal 1C) characters in the bar-code information, incorrect identification of sample tubes can occur. To prevent incorrect identification of sample tubes, do not use FNC1, FNC4, and FS (hexadecimal 1C) characters in your bar-code information.

The XL-MCL has the ability to read bar-code symbologies of Code 39, Interleaved 2 of 5, Codabar, and Code 128. These configurations were chosen to optimize the maximum read rate and fit the maximum number of characters on a label so that the label does not interfere with MCL operation.

Special Considerations

When using one of these bar-code symbologies, consider the following:

- CODE 39 - Make sure the label does not interfere with carousel operation.
- Interleaved 2 of 5 - Character length must be an even number of characters, with or without the check digit.
- CODABAR - Make sure the label does not interfere with carousel operation.
- CODE 128 - Must always be enabled to read the carousel identification and tube position bar-code labels.

F.3 HAND-HELD BAR-CODE SCANNER OPTION

Types of Scanners

The hand-held bar-code scanner uses a visible laser-type reader containing a Class II laser, operating at 670 nm, with a maximum power output of 1 mW. This optional scanner may be attached to an XL or XL-MCL flow cytometer.

The XL-MCL flow cytometer also uses a visible laser-type scanner containing a Class II laser, operating at 670 nm, with a maximum power output of 1 mW. For more information, refer to [Heading F2, MCL BAR-CODE SCANNER](#).

Hand-Held Bar-Code Scanner Setup Parameters

Default Configurations

Table F.3-1 Hand-Held Bar-Code Scanner - Default Configuration

Item	Bar-Code Symbology				
	Code 39	Codabar	Interleaved 2 OF 5	Code 93	Code 128
Code type	Enabled	Enabled	Enabled		Enabled
Fixed length	Disabled	Disabled	N/A	N/A	Disabled
Code length #1	7	10	14	12	16
Code length #2	N/A	N/A	0	N/A	N/A
Check digit	Enabled	Enabled	Enabled	N/A	N/A
C/D output	Disabled	Disabled	Disabled	N/A	N/A
C/D aim	N/A	Enabled	N/A	N/A	N/A
Intercharacter gap	Disabled	Disabled	N/A	N/A	N/A
S/S match	N/A	Disabled	N/A	N/A	N/A
S/S output	N/A	Disabled	N/A	N/A	N/A
EAN	N/A	N/A	N/A	N/A	N/A
Narrow margins	Enabled	Enabled	Enabled	Enabled	Enabled

General Parameters

Table F.3-2 Hand-Held Bar-Code Scanner - General Parameters

Item	Code*	Function
AUTOSENSE OPERATION	NN	Disabled
WEDGE MODE	CE	Enabled
BEEPER OPERATION	AD	Beeper ON; volume LOUD
INTERCHARACTER DELAY	GA	No intercharacter delay
PREFIX	IA	None
SUFFIX	MC	Suffix CR
TERMINAL ID	JA	Disabled
CODE IDENTIFIER	FA	Disabled
PREAMBLE	KA	None
POSTAMBLE	LA	None
POWER CONSUMPTION	@A	Enable full power
LASER REDUNDANCY	BE	Enable four times laser redundancy
SET LASER TIMEOUT	BH	Set scan beam timeout to six seconds

* Scan this code from the OEM User's Manual.

Serial Communication Parameters

Not applicable.

Symbologies

IMPORTANT Possible incorrect identification of sample tubes. If sample tube bar-code labels use FNC1, FNC4, and FS (hexadecimal 1C) characters in the bar-code information, incorrect identification of sample tubes can occur. To prevent incorrect identification of sample tubes, do not use FNC1, FNC4, and FS (hexadecimal 1C) characters in your bar-code information.

Table F.3-3 Hand-Held Bar-Code Scanner - Symbologies

Item	Code*	Function
UPC (A & E)	QA	Disable UPC (both A & E)
EAN/JAN	RA	Disable EAN/JAN
CODE 39	OB	Enable standard CODE 39
CODE 39 CHECK CHARACTER	OE	Enable MODULO 43 check character
CODE 39 MINIMUM LENGTH	OH	Minimum length = 01
CODE 39 MAXIMUM LENGTH	OI	Maximum length = 06
CODE 39 START/STOP CHAR.	OF	Do not XMIT START/STOP character
CODE 39 CHECK CHARACTER	OK	Disable transmit of check character

* Scan this code from the OEM User's Manual.

Table F.3-3 Hand-Held Bar-Code Scanner - Symbolologies (Continued)

Item	Code*	Function
CODE 1-2 OF 5	PC	Enable 1-2 of 5 with check digit
CODE 1-2 OF 5 MINIMUM LENGTH	PD	Minimum length = 14
CODE 1-2 OF 5 MAXIMUM LENGTH	PE	Maximum length = 14
CODE 1-2 OF 5 START/STOP CHAR.	P0	Disable 1-2 of 5 check digit transmission
CODE 2 OF 5 STANDARD	PF	Disable standard CODE 2 of 5
CODE 128	TB	Enable CODE 128
CODE 128 MINIMUM LENGTH	TC	Minimum length = 01
CODE 128 MAXIMUM LENGTH	TD	Maximum length = 10
CODABAR	VB	Enable CODABAR
CODABAR CHECK CHARACTER	VJ	Do not transmit check character
CODABAR CHECK CHARACTER	VI	Enable CODABAR check character
CODABAR MINIMUM LENGTH	VE	Minimum length = 01
CODABAR MAXIMUM LENGTH	VF	Maximum length = 09
CODABAR START/STOP XMIT	VC	Disable START/STOP XMIT
SYMBOLGY IDENTIFIERS	FA	Disable XMIT of symbology identifiers

* Scan this code from the OEM User's Manual.

Wand Emulation Parameters

Not applicable.

Keyboard Wedge Parameters

Table F.3-4 Hand-Held Bar-Code Scanner - Keyboard Wedge Parameters

Item	Code*	Function
WEDGE MODE	CE	WEDGE MODE enable
TERMINAL TYPE	CF	Enable PC-AT, PS/2 and 50/60/80
ALPHABETIC CHARACTERS	EP	Normal alphabetic characters

* Scan this code from the OEM User's Manual.

Memory Module Set Up

Not applicable.

Supplemental Programming Symbols

Not applicable.



BAR-CODE SPECIFICATIONS

HAND-HELD BAR-CODE SCANNER OPTION

F.4 BAR-CODE PRINTER

Table F.4-1 Bar-Code Printer - DIP Switch Settings

Switch	Setting	Position	Function
1	OFF	Right	
2	OFF	Right	Sets BAUD rate to 9600
3	OFF	Right	
4	ON	Left	Sets Data Bit length to 8
5	ON	Left	Sets Parity to Disabled
6	ON	Left	
7	OFF	Right	Sets X ON/OFF Flow Control
8	OFF	Right	Sets no error detection

[ABBREVIATIONS](#), ABBREVIATIONS-1

[GLOSSARY](#), GLOSSARY-1

The following list is a composite of the abbreviations, acronyms and reference designators used in this manual. When the same abbreviation (or reference designator) is used for more than one word (or type of component), all meanings relevant to this manual are included.

SYMBOLS

> - greater than
 < - less than
 ≥ - greater than or equal to
 % - percent
 + - plus
 - - minus
 ± - plus or minus
 °C - degrees Celsius
 °F - degrees Fahrenheit
 ® - registered trademark
 ™ - trademark
 μ - micron
 μL - micro liter
 μs- microsecond

A

A - ampere
 ac - alternating current
 ADC - analog-to-digital conversion
 AMI - American Megatrends, Inc.
 Amp - amplifier
 AMPL. - amplifier
 ANSI - American National Standards Institute
 ASA - American Standards Association
 ASCII - American Standard Code for Information Interchange
 AUI - thick coaxial cable
 AUX - auxiliary

B

baud - bits per second
 BIOS - basic input/output system
 BNC connector - bayonet Neil-Concelman connector

C

C - centigrade
 CAR - carousel sensor
 CD - collision detection
 CD-ROM - compact disc - read only memory
 CDRH - National Center for Devices and Radiological Health
 CHL - channel
 CLKS - clocks
 cm - centimeter
 CMOS - complimentary metal oxide semiconductor
 COM - communication
 CPU - central processing unit
 CR - carriage return
 CRBC - chicken red blood cells
 CSMA - carrier sense multiple access
 CTRL - control
 CV - check valve; coefficient of variation
 CYT - cytometer connector
 Cyto - cytometer

D

DACs - digital-to-analog converters
 dba - decibels a-weighted
 DBUS - data bus
 dc - direct current
 DCN - document control number
 DEC - Digital Equipment Corporation
 DET - detector
 DIN - Deutsche International Norm (German specification)
 DIP switch - dual in-line package switch
 DISTR. - distributor
 DMA - direct memory address
 DNA - deoxyribonucleic acid

DOS - disk operating system
DPI - dots per inch
DRAM - direct random access memory
DVM - digital volt meter

E

E - receptacle connector
ECC - electronic cycle check
EMI - electromagnetic interference
EEPROM - electronically erasable
programmable read-only memory
EPROM - electronically programmable
read-only memory
Err - error
ESD - electrostatic discharge
ETL - Electrical Testing Labs
EXMEM - extended memory

F

F - fahrenheit
FF - fitting
FIFO - first in, first out
FL - fluorescent light; fluorescent light
sensor; fluorescent light signal
FRU - field replaceable unit
FS - forward scatter; forward scatter sensors;
forward scatter signals
ft - feet

G

gal. - gallon
G.F.C.I. - ground fault circuit interrupt
GND - ground

H

HM - home sensor
Hg - mercury
HISTO - histogram
HP - Hewlett Packard; half peak
HP CV - half peak coefficient of variation

HV - high voltage
Hz - hertz

I

i.d. - internal diameter
I/O - input/output
ID - identification
IDE - integrated drive electronics
IEEE - Institute of Electrical Engineers
in. - inches
in. Hg - inches/mercury
INTF - interface
IRQ - interrupt request
ISA - industry standard architecture
ISO - IsoFlow

J

J - receptacle connector

K

K - constant; thousand
KYBD - keyboard

L

lb/in. - pounds per inch
LAN - local area network
LBA - large block access
LCD - liquid crystal display
LED - light emitting diode; Artisoft line
editor
LIS - laboratory information systems
LPT - parallel communications port
LPTINT - parallel communications port
interrupt
LS - light scatter
LV - sensor; solenoid

M

M - Mega
 MB - megabyte
 MBPS - megabytes per second
 MCL - multi-tube carousel loader
 MHz - mega hertz
 MIMD - multiple instruction multiple data
 mL - milliLiter
 mm - millimeter
 MS-DOS - Microsoft-disk operating system
 mV - milliVolts
 mW - milliwatts

N

na - not applicable
 ND - neural density filter
 NDIS - Network Driver Interface Specification
 NE - narrow elements
 NEMA - National ELectronics Manufacturing Association
 NIC - Network Interface card
 nm - nanometer
 NOS - network operating system
 ns - nanosecond
 Num - number

O

OEM - original equipment manufacturer
 Opto - optical

P

P - receptacle connector; test point
 PC - personal computer
 PCB - printed circuit board
 PCMCIA - Personal Computer Memory Card International Association
 PCS - print contrast signal
 PIO - programmed input/output

PMI - preventative maintenance inspection
 PMT - photo-multiplier tube
 PN - part number
 PNP - plug and play
 pot - potentiometer
 PPM - pages per minute
 PROM - programmable read-only memory
 psi - pounds per square inch

R

R - potentiometer; resistor
 RAM - random access memory
 RAS - remote access services
 RB - reflectivity of ink
 REM - remark or comment
 RG - pressure regulator
 ROM - read only memory
 RW - reflectivity of media

S

S - switch
 SCSI - small computer system interface
 SER - serial
 SIMMs - single inline memory module
 SQL - structured query language
 SS - side scatter; side scatter sensor; side scatter signal
 SVP - system verification procedure
 SW - software; switch

T

TCP/IP - telecommunications protocol/Internet protocol
 TEMP - temperature
 TB - tube-position sensor
 TP - test point
 T.P. - twisted pair cable
 Trans and Rec - transmit and receive

U

U - integrated circuit package
UL - Underwriter's Laboratory
UPC - universal product code
USB - universal serial bus

V

V - volts
Vac - volts alternating current
Vdc - volts direct current
VDI - video display interface
VGA - video graphics array

W

WAN - wide area network
WE - wide elements

X

X - receptacle connector
XMITTER - transmitter

This glossary is a collection of specialized terms, with their meanings. If a term has more than one meaning, all meanings relevant to this manual are included.

μL - Microliter, a unit of volumetric measurement equal to 10⁻⁶ liter.

μm - Micron or micrometer, a unit of linear measurement equal to 10⁻⁶ meter.

absorbance filter - A glass filter with a dye embedded in the glass. The dye converts the energy of certain wavelengths to heat and, under higher intensity, fluorescence.

acridine orange - A dye that binds to DNA and fluoresces green, or RNA and fluoresces orange. AO, the acronym for acridine orange, may be used interchangeably.

ADC - Advanced Digital Compensation is a feature of EXPO32™ ADC software, a software option available for XL and XL-MCL flow cytometer systems. This ADC feature allows the operator to set optimal voltages for the given application, monitor the voltages with Flow-Set fluorospheres, and set appropriate color compensation based on those voltages. The EXPO32 ADC system holds these cytosettings (2 color, 3 color or 4 color) in an ADC Settings file that can easily update other sample protocols when prompted.

ADC or A/D - The analog to digital conversion of a voltage level (0 to 10 volts) to a representative channel height (on the XL or XL-MCL flow cytometer from 0 to 1024). Also referred to as A to D.

allophycocyanin - An orange exciting, red fluorescing dye binding to protein. APC, the acronym for allophycocyanin, may be used interchangeably.

ambient temperature - Temperature in the surrounding environment.

amorphous region - An irregular plot encircling a portion of a two parameter histogram used to identify a population for gating or analysis.

analog-to-digital - The conversion of a voltage level (0 to 10 volts) to a representative channel height. Also referred to as A to D, A/D, or ADC.

antibody - A molecule produced by a B lymphocyte which binds very specifically to a binding site on an antigen that's on the surface of a cell.

antigen - A cell or part of living tissue foreign to the body such as a cell, virus, or bacteria.

AO - Acridine orange, a dye that binds to DNA and fluoresces green, or RNA and fluoresces orange.

APC - Allophycocyanin, an orange exciting, red fluorescing dye binding to protein.

aspheric lens - A lens whose shape departs slightly from a spherical form and is free from defects which distort the image of an object seen through the lens. It is generally used to collimate diverging light or focus collimated light. An example used is as a fluorescence pickup lens.

assay values - Values for a control established by extensive repeat testing of that control.

A to D - The analog-to-digital conversion of a voltage level (0 to 10 volts) to a representative channel height. Also referred to as A/D or ADC.

attenuation - A variable gain adjustment used typically with photocells.

autoexec.bat - Tells the computer how to start up and typically is used to execute the most commonly used program.

- Echo on displays the command currently executed.
- Verify on checks to see if data has been correctly written to disk and returns error message if not.
- Set path tells the computer where to search for command instructions.
- Prompt \$p\$g tells the system to display default drive followed by a > as a prompt.
- Commands load a particular program.

Aux signal - Auxiliary acquisition pathway that allows either control of simultaneous Linear and Log signals or acquisition of a Peak signal.

background count - Measure of the amount of electrical or particle interference.

band block filter - An optical filter that passes all colors except a narrow range of colors.

band pass filter - An optical filter that passes a narrow group of wavelengths and blocks the rest. Also referred to as a BP filter.

BK filter - A laser-blocking optical filter that passes the fluorescence wavelengths but does not pass the laser wavelength.

BP filter - A band-pass optical filter that passes a narrow group of wavelengths and blocks the rest.

block - A section of a disk track between two sectors (see format).

button - A named area on the Workstation screen (for example, a rectangle labeled Yes) that an operator selects to tell the instrument what to do.

channel - In an analog-to-digital converter, the number of equally spaced divisions of the amplified input signal voltage. All XL or XL-MCL flow cytometer signals are resolved into 1024 channels. For dual-parameter histograms, the number of channels is reduced to 64 or 256.

cleaning agent - A detergent used to flush sample from tubing and eliminate protein buildup.

click - To press and release a mouse button.

cm - Centimeter, a unit of linear measurement.

confocal - Having the same focal point; two lenses placed together with the same focal point would be referred to as confocal.

coefficient of variation (CV)

- An expression, in percent (%), of the data spread (variation) as related to the mean value. The standard formula for calculation:

$$CV = \frac{SD}{Mean} \times 100$$

- A measure of the variability in signal intensity that is generated as particles pass repeatedly through the laser beam. This variability is expressed as a percentage of the average signal intensity.

config.sys - Sets up search paths for devices and drivers.

- Buffers sets blocks for the computer to store data.
- Files sets the number of files the system may have open at the same time.
- Device drivers tell the operating system where to locate or search for the information to drive some external devices such as a mouse or optical drive.
- Any statement beginning with REM will not be executed. These statements are reminders to the programmer.

control - A substance with predetermined values used to monitor the performance of an analytical process (for example, CYTO-TROL™ control cells).

controls and indicators - Instrument controls are the mechanisms an operator uses to communicate with the instrument. Indicators are the mechanisms the instrument uses to communicate with the operator. Controls and Indicators is the first chapter of the Operator's Guide.

cross-cylindrical lenses - Used in the Cytometer to focus the laser beam and form an elliptical beam spot.

CV (coefficient of variation)

- Expressed as a percentage (%), is a measure of the data variation (data spread) as related to the mean value. The standard formula for calculation:

$$CV = \frac{SD}{Mean} \times 100$$

- A measure of the variability in signal intensity that is generated as particles pass repeatedly through the laser beam. This variability is expressed as a percentage of the average signal intensity.

cylindrical lens - A lens which looks like half a cylinder generally used to focus a laser beam.

Cytometer - The system component that analyzes the sample, and contains the sheath fluid and cleaning agent bottles.

CYTO-TROL™ control cells - Control cells with assayed values for certain antibodies which can be used as part of a quality control program for the cell surface marker application.

defaults - Original settings for the instrument. An operator may change these settings to customize the instrument for their laboratory.

deionized water - Water freed of salt and some organisms by an ion-exchange process. This water can be used interchangeably with distilled water in procedures. Also referred to as DI H₂O.

dichroic - A filter placed at a 45 degree angle to the incident light used to separate such light into two color bands, one reflected off and the other passing through the filter.

directory - A list, usually referring to items stored on a disk.

discriminator - A voltage level for a parameter measurement at or above which an event will be accepted and included in the data collected. Events below this level are discarded to eliminate signals caused by debris.

DISC SAT EXT - A discriminator satisfied extension is an operator set extension of the peak pulse discriminator window to ensure the integral signals will be properly captured.

distilled water - Water freed of solids and organisms by distillation. This water can be used interchangeably with deionized water in procedures.

DL filter - A dichroic, long-pass optical filter that directs light in different spectral regions to different detectors.

DOS - disk operating system, the basic computer software which allows the computer to recognize commands from the mouse or keyboard.

dynodes - Metal plates within a photomultiplier tube which help to generate a current flow proportional to the amount of light entering the tube.

ECD - Energy coupled dye, a tandem dye exciting at 488 nm and emitting at the orange end of the spectrum used with cell surface markers. For example, a phycoerythrin and Texas red combination.

electron - An elementary particle having a negative charge and found in the region around the nucleus of the atom.

emission curve - A plot of the relative fluorescent light intensity from a dye versus the wavelength of the light.

energy coupled dye - A tandem dye exciting at 488 nm and emitting at the orange end of the spectrum used with cell surface markers. ECD, the acronym for energy coupled dye, may be used interchangeably.

epitope - A binding site on the surface of a cell.

excitation curve - A plot of the amount of light energy absorbed by a dye versus the wavelength of the light.

EXPO32™ ADC software - A software option available for XL and XL-MCL flow cytometer systems. This acquisition, analysis, and Cytometer control software product with an Advanced Digital Compensation feature was developed by Applied Cytometry System (ACS) exclusively for Beckman Coulter. The software may also be used for data analysis on a stand alone PC that has Windows 95 or higher as its operating system.

FITC - Fluorescein isothiocyanate, a 488 nm excitable dye fluorescing in the green end of the spectrum used primarily for cell surface marker applications.

FL - Fluorescent light, the emission of electromagnetic radiation that occurs when the emitting body absorbs radiation from some other source. For example, when a fluorescent dye is excited (absorbs radiation), it emits fluorescent light at a wavelength that is different from the wavelength of the light that excited it.

flow cell - A device used to guide particles pass through a laser beam one at a time in a stream of fluid called sheath. This sheath fluid aligns the sample with the center of the flow cell.

flow cell tip - A removable device attached to the end of a flow cell which varies the sensing characteristics of a system.

Flow-Check™ fluorospheres - A 10 µm bead with a bright imbedded full-spectrum dye used to check the alignment of a flow system. Also referred to as Flow-Check beads.

Flow-Count™ fluorospheres - A 10 µm bead of known concentration that can provide an absolute count that is used to help an operator calculate the concentration of an unknown.

flow cytometry - A process for measuring the characteristics of cells or other biological particles as they pass through a measuring apparatus in a fluid stream.

Flow-Set™ fluorospheres - A 3.6 µm bead product with an imbedded dye used as a standard for cell surface marker type applications. Only 2% as bright as Flow-Check fluorospheres. Forward scatter (FS) and side scatter (SS) simulate lymphocytes. May be used to verify PMT operation. Also referred to as Flow-Set beads.

fluorescein isothiocyanate - A 488 nm excitable dye fluorescing in the green end of the spectrum used primarily for cell surface marker applications. FITC, the acronym for fluorescein isothiocyanate, may be used interchangeably.

fluorescence - The property of emitting electromagnetic radiation usually as visible light resulting from and occurring only during the absorption of radiation from some other source.

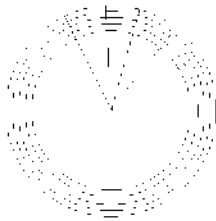
fluorescent compensation - When multiple dyes are used, one dye may interfere with another dye's measurement. If filters are unable to remove the interference, the interference can be removed electronically by subtracting a portion of one signal from another. Compensation can only be performed after filters are installed and high voltage to the PMTs is set.

fluorescent light - The emission of electromagnetic radiation that occurs when the emitting body absorbs radiation from some other source. For example, when a fluorescent dye is excited (absorbs radiation), it emits fluorescent light at a wavelength that is different from the wavelength of the light that excited it.

focal plane - A plane perpendicular to the axis of a lens or mirror and passing through the focal point of the lens or mirror.

focal point - A point at which the rays of light converge or from which they diverge; for example, light rays as they pass through a lens may converge on a point referred to as the focal point of the lens.

format - To lay out a disk in specific tracks, sectors, and blocks so that information can be systematically stored and retrieved to and from the disk.



forward scatter - Light primarily from the surface of a particle as it passes through a laser beam deflected at low angles and traveling in the same direction as the beam. The amount of scattered light is generally proportional to the size of the particle that scattered the laser light. FS, the acronym for forward scatter, may be used interchangeably.

forward scatter sensor - Collects the forward scatter and generates voltage pulse signals. Also referred to as the FS sensor.

FS - Forward scatter, laser light scattered at narrow angles to the axis of the laser beam traveling in the same direction as the beam. The amount of scattered light is generally proportional to the size of the particle that scattered the laser light.

ft - Foot or feet, a unit of linear measurement.

g - Gram, a unit of weight.

gain - The amount of amplification applied to a signal such as a pulse. In this case, a gain of 10 means the pulse height would be increased by a factor of 10. In linear amplification, all of a sensor's signals are increased by the same amount. Contrast with logarithmic amplification.

gating - The use of some criteria that must be met before an event is included in a specific histogram.

Gaussian distribution - A normal or symmetrical distribution; for example, a bell-shaped curve.

ground state - The energy level having the least energy of all its possible states and greatest stability. For example, the resting state of an atom is referred to as its ground state.

high voltage - Can be adjusted to change the sensitivity of a fluorescent light sensor.

histogram - The plot of the count of the number of pulses versus the corresponding channel heights (single parameter) or the plot of count of the number of events versus two channel height measurements simultaneously (two parameter).

histogram, light-scatter - A two dimensional graphic presentation of multidimensional accumulated data. Usually the X-axis is set to Side Scatter and the Y-axis is set to Forward Scatter.

hot keys - A shortcut for changing screens. Instead of using the menu bar to change screens, you can press and hold down ALT while pressing a certain letter key. For example, pressing ALT and F simultaneously displays the File menu.

hydrodynamic focusing - A process that focuses the sample stream through the flow cell. It involves the alignment and narrowing of a sample stream using a second coaxial liquid called sheath to ensure that cells move through the laser beam one at a time, along the same path.

HV - High voltage, a voltage (up to 2000 volts) applied to a PMT to adjust the sensitivity of the PMT.

Hz - Hertz, a unit of frequency.

IMMUNO-BRITE™ standard kit - A five level bead fluorescence product used to check the function of the log amplifiers.

immunofluorescence - Fluorescence as the result of, or identifying, an immune response.

immunophenotyping - Process of identifying/categorizing cells through the use of cell surface antigen marking.

in. - Inch, a unit of measure.

integral signal - A voltage pulse of which height and area are proportional to the total amount of fluorescent material in a cell.

integral pulse - The voltage level created as a particle passes through the beam representing the total amount of light generated by the particle. This pulse is created from the peak pulse and reaches its highest point as the particle exits the beam.

interference filter - A coated piece of glass in which certain wavelengths are reflected off the surface while others pass through.

ion - A charged particle.

kg - Kilogram, a unit of weight equal to 1,000 grams.

laminar flow - The flow of two liquids side by side in which one does not mix with the other.

laser - Light amplification by stimulated emission of radiation.

lb - Pound, a unit of weight.

linear amplification - See gain.

linear amplifier - A circuit which multiplies all pulses by the same amount (gain). Usually the amount is selected by the operator.

linear region - A channel range identifying a portion of a single parameter histogram to be used for analysis or gating purposes.

listmode - The digitized pulses for each parameter for each event; e.g. the raw data.

logarithmic amplification - A method of increasing the gain and dynamic range of a signal. A larger gain is applied to a sensor's smaller signals than to the sensor's larger signals. Also see gain.

long pass filter - A filter that reflects or absorbs short-wavelength light, but passes long-wavelength light. The long pass filter blocks wavelengths of light shorter than a designated reference wavelength and transmits wavelengths longer than the designated reference wavelength. These filters are identified by their 50% transmittance wavelengths. May also be referred to as an LP filter.

LP filter - A long-pass filter reflects or absorbs short-wavelength light, but passes long-wavelength light. The long pass filter blocks wavelengths of light shorter than a designated reference wavelength and transmits wavelengths longer than the designated reference wavelength. These filters are identified by their 50% transmittance wavelengths.

macro - A list of stored keystrokes which are used to reduce the number of operator selections when doing repetitive tasks.

mean - Arithmetic average of a group of data, such as the average channel value. Also see standard deviation and coefficient of variation.

menu - On a Workstation screen, a list of items from which you can choose.

metafile - A stored graphic representation of a screen display.

microprocessor - The integrated circuitry for electronically controlled devices.

mg - Milligram, a unit of weight equal to 10^{-3} gram.

mL - Milliliter, a unit of volumetric measurement equal to 10^{-3} liter.

mm - Millimeter, a unit of linear measurement equal to 10^{-3} meter.

monoclonal antibodies - Antibodies produced by a single cell or its identical progeny, specific for a given antigen.

mW - Milliwatt, a unit of power equal to 10^{-3} watt.

neutral density filter - A filter which equally reduces the intensity of all wavelengths of light. It is usually named by its power of ten reduction in the light intensity; for example, ND1 would reduce the light to 1/10 (10 to the -1 power) its original intensity. Also referred to as an ND filter.

ND filter - A neutral density filter which equally reduces the intensity of all wavelengths of light. It is usually named by its power of ten reduction in the light intensity; for example, ND1 would reduce the light to 1/10 (10 to the -1 power) its original intensity.

nm - Nanometer, a unit of linear measurement equal to 10^{-9} meter.

normalization - Applied to linear statistics from different histogram resolutions to ensure results are comparable. Scales to 1024.

optical filters - Mediums, such as glass, that separate fluorescent light by wavelength, which is measured in nanometers (nm). Also see BK, BP, and DL filters.

panel - A set of protocols to be used in sequence.

PE - Phycoerythrin, a dye exciting at 488 nm and emitting in the yellow end of the spectrum primarily used in cell surface marker applications.

peak channel - Channel on a histogram with the highest count.

peak pulse - The voltage generated by a sensor as a particle passes through a laser beam which rises to its highest point when the particle is at the center of the beam and falls to zero as the particle exits the beam. The pulse height indicates the maximum light produced by the particle and the width indicates the time necessary to pass through the beam.

peak signal - A voltage pulse of which height is proportional to the amount of light the cell scatters or fluoresces.

photocell - An optoelectrical device which generates an electrical voltage when light strikes it.

photodiode - Same as a photocell.

photomultiplier tube - A light-sensitive device that converts light energy into electrical current and generates a voltage pulse signal. Usually these devices are adjustable by setting a high voltage to optimize for the available light. This optoelectrical device generates an electric current proportional to the amount of light striking it and is connected to a circuit that converts the current pulse to a voltage pulse. Also referred to as a PMT.

phycoerythrin - A dye exciting at 488 nm and emitting in the yellow end of the spectrum primarily used in cell surface marker applications. Also referred to as PE.

PI - Propidium iodide, a DNA binding dye exciting at 488 nm and emitting in the orange end of the spectrum.

pickup lens/spatial filter assembly - Collects side scatter and fluorescent light from only the sensing area of the flow cell and collimates it.

PMT - Photomultiplier tube, a light-sensitive device that converts light energy into electrical current and generates a voltage pulse signal. Usually these devices are adjustable by setting a high voltage to optimize for the available light. This optoelectrical device generates an electric current proportional to the amount of light striking it and is connected to a circuit that converts the current pulse to a voltage pulse.

precision - A measure of the ability of the instrument to reproduce similar results when a sample is run repeatedly. May also be referred to as reproducibility.

prism - to separate out:

- Triangular glass used to separate multicolored light into the component colors or redirect a single color light to a different location.
- A circuit which separates multiple cell surface marker measurements into the possible marker phenotypes.
- Phenotype parameter for multicolor analysis.

propidium iodide - A DNA binding dye exciting at 488 nm and emitting in the orange end of the spectrum. Also referred to as PI.

protocol - A set of instructions; for example, a set of instructions to a computer on how to run a sample. A set of instructions that tells the Cytometer what and how to acquire data and relay listmode data.

psi - Pounds per square inch, a unit of pressure measurement.

QC - Quality control is a comprehensive set of procedures a laboratory sets up to ensure that an instrument is working accurately and precisely.

quad-stat - A set of two cursors dividing a two parameter histogram into four sections or quadrants.

quality control - A comprehensive set of procedures a laboratory sets up to ensure that an instrument is working accurately and precisely. QC, the acronym for quality control, may be used interchangeably.

queue - A list of selected items in a specific order.

RD1 - Red dye 1, a PE derivative.

rectilinear region - A box with four sets of channel coordinates describing a portion of a two parameter histogram to be used for analysis or gating.

reflection - Act of bending back; for example, the return of light from a surface.

refraction - Deflection from a straight path undergone by a light ray or energy wave in passing obliquely from one medium to another.

reproducibility - A measure of the ability of the instrument to recover similar results when a sample is run repeatedly. May also be referred to as precision.

resolution - The process or capability of distinguishing the individual components making up a data set. On a histogram, it refers to the ability to separate populations within the histogram.

ratio - A new parameter created by dividing the pulse height of one parameter by another. The resulting histogram scale is 0 to 1.

scattergram - A method of simultaneous pulse display of two parameters in which one parameter is displayed along the X-axis and the other along the Y-axis yielding a plot within the center of the screen.

scopegram - Same as scattergram.

scroll bar - The bar with an up and down arrow on the left of a window. The bar's arrows let you move (scroll) the window's content up or down so that you can see other parts of it. For example, the scroll bar in the Protocol Select window lets you scroll through the entire list of protocol names.

SD - Standard deviation, a measure of deviation from the mean. For example, a measure of the range of channel deviation within a measurement.

$$SD = \sqrt{\frac{\sum (\bar{x} - x)^2}{N - 1}}$$

sector - A specific radius of a disk (see format).

select - At the Workstation, select means to position the mouse cursor on an item, and then press and release a mouse button to choose that item. At the Cytometer screen, select means to touch the designated box.

sensitivity - The ability of the instrument to distinguish very low levels of light scatter and fluorescence from background light or electronic noise.

sheath - A liquid which surrounds and aligns another liquid.

sheath fluid - A balanced electrolyte solution.

short pass filter - A filter that reflects long-wavelength light, but passes short-wavelength light. The short pass filter blocks wavelengths of light longer than a designated reference wavelength and transmits wavelengths shorter than the designated reference wavelength. These filters are identified by their 50% transmittance wavelengths. May also be referred to as an SP filter

side scatter - The amount of laser light measured at about a 90° angle to the axis of the laser beam. The amount of side scatter is proportional to the granularity of the particle that scattered the laser light. May also be referred to as SS.

side scatter sensor - Collects the side scatter and generates voltage pulse signals. May also be referred to as the SS sensor.

SP filter - A short-pass filter reflects long-wavelength light, but passes short-wavelength light. The short pass filter blocks wavelengths of light longer than a designated reference wavelength and transmits wavelengths shorter than the designated reference wavelength. These filters are identified by their 50% transmittance wavelengths.

SS - Side scatter is the amount of laser light measured at about a 90° angle to the axis of the laser beam. The amount of side scatter is proportional to the granularity of the particle that scattered the laser light.

Standard Deviation - A measure of deviation from the mean. For example, a measure of the range of channel deviation within a measurement. SD, the acronym for standard deviation, may be used interchangeably.

$$SD = \sqrt{\frac{\sum (\bar{x} - x)^2}{N - 1}}$$

Texas red - A dye exciting at 595 nm and fluorescing in the orange end of the spectrum usually used with the cell surface marker application. TR, the acronym for Texas red, may be used interchangeably.

thiozole orange - An RNA binding dye exciting at 488 nm and fluorescing in the green end of the spectrum. TO, the acronym for thiozole orange, may be used interchangeably.

TO - Thiozole orange, an RNA binding dye exciting at 488 nm and fluorescing in the green end of the spectrum.

TR - Texas red, a dye exciting at 595 nm and fluorescing in the orange end of the spectrum usually used with the cell surface marker application.

track - A circular location on a disk (see format) where information is stored.

V - Volt, a unit of electrical potential difference measurement.

Vac - Alternating current voltage.

Vdc - Direct current voltage.

vernier - An additional scale to the main scale that allows for accurate fractional reading of the smallest division on the main scale. Allows for fine adjustments of the forward light scatter.

voltage pulse signals - The signals that the forward scatter, side scatter, and fluorescence sensors generate. They are proportional to the intensity of light the sensor received.

W - Watt, a unit of power.

Workstation - The system component that runs the software that lets an operator control the instrument. It displays sample results and other information.

Numerics

- 488 BK light filter
 - function, [A.5-23](#)
- 488 DL light filter
 - function, [A.5-23](#)
- 4-color PMT upgrade
 - Amp/Signal Conditioner card
 - calibration, [3.9-3](#)
 - hardware installation, [3.9-1](#)
 - PMT filter locations, illustration, [3.9-2](#)
 - PMT operational alignment, [3.9-3](#)
 - tools/supplies needed, [3.9-1](#)
 - upgrade kit part number, [3.9-1](#)
 - verification, [3.9-3](#)
- 525 BP light filter
 - function, [A.5-22](#)
- 575 BP light filter
 - function, [A.5-22](#)
- 600 DL light filter
 - function, [A.5-23](#)
- 620 BP light filter
 - function, [A.5-22](#)
- 645 DL light filter
 - function, [A.5-23](#)
- 675 BP light filter
 - function, [A.5-22](#)
- 802.3 network standard
 - Beckman Coulter supported, [2.5-5](#)
 - specifications, [2.5-5](#)
 - specifications, table, [E.1-1](#)

A

- ADC Zero Adjust, Prefinal software
 - circuit card tested, [7.2-2](#)
 - description, [7.2-1](#)
 - response to failure, [7.2-2](#)
- air cylinder
 - in/out. *See* in/out air cylinder
 - lifter. *See* lifter air cylinder
 - manual stage. *See* manual stage air cylinder
 - probe up/down. *See* probe up/down air cylinder
 - segmenting valve. *See* segmenting valve
- Amp Gain Control, Prefinal software
 - circuit cards tested, [7.2-2](#)
 - description, [7.2-2](#)
 - response to failure, [7.2-2](#)
- Amp Saturation Test, Prefinal software

- circuit cards tested, [7.2-2](#)
- description, [7.2-2](#)
- response to failure, [7.2-2](#)
- Amp/Signal Conditioner card
 - amplifier analog bus interface, block diagram, [2.2-7](#)
 - amplifier block diagram, [2.2-6](#)
 - AUX card function, [A.5-9](#)
 - calibration, procedure, [4.15-2](#)
 - calibration, unacceptable histograms, illustration, [4.15-5](#)
 - calibration, verifying acceptable histograms, [4.15-4](#)
 - component locations, [A.2-2](#)
 - controlling attenuators, [A.4-1](#)
 - controlling gain, [A.4-1](#)
 - description, [2.2-6](#)
 - engineering schematic, part number, [6.1-1](#)
 - FS card function, [A.5-9](#)
 - in 4-color PMT upgrade, [3.9-2](#)
 - jumper settings, [A.2-2](#)
 - jumpers, [A.4-1](#)
 - location of PMT HV power supplies, [2.2-7](#)
 - location, illustration, [8.2-24](#)
 - locations in the Cytometer, [A.2-2](#)
 - offset adjustment, [4.15-1](#)
 - part number, [8.1-23](#), [8.2-25](#)
 - PMT1 card function, [A.5-10](#)
 - PMT2 card function, [A.5-10](#)
 - PMT3 card function, [A.5-10](#)
 - PMT4 card function, [A.5-10](#)
 - replacement, [4.15-1](#)
 - replacement and/or calibration, tools/supplies needed, [4.15-1](#)
 - replacement and/or calibration, verification, [4.15-6](#)
 - replacement and/or calibration, when to perform, [4.15-1](#)
 - SS card function, [A.5-8](#)
 - testing with Prefinal Service software, [A.4-1](#)
 - troubleshooting, [2.2-7](#)
- Analyzer backplane
 - cards connected to, [2.2-5](#)
 - component locations, [A.2-3](#), [A.2-4](#)
 - description, [2.2-5](#)
 - engineering schematic, part number, [6.1-1](#)
 - front view, [A.2-3](#)

- function by plane, table, [2.2-6](#)
 - function in Cytometer, [2.2-1](#)
 - location in the Cytometer, [A.2-3](#)
 - rear view, [A.2-4](#)
 - anchor illustrations
 - for Cytometer component locations and functions, [A.5-2](#)
 - for Cytometer illustrated parts, [8.2-2](#)
 - for exterior Cytometer cover removal and reinstallation procedures, [4.3-2](#)
 - for instrument illustrated parts, [8.2-2](#)
 - for interior Cytometer access procedures, [4.3-3](#)
 - for MCL option component locations and functions, [A.5-2](#)
 - for Power Supply module component locations and functions, [A.6-2](#)
 - for Power Supply module cover removal and reinstallation procedures, [4.3-4](#)
 - for Power Supply module illustrated parts, [8.2-2](#)
 - Argon laser
 - beam description, [2.2-4](#)
 - function, laser head, [A.5-14](#)
 - function, laser power supply, [A.6-10](#)
 - head replacement, [4.4-1](#)
 - power supply replacement, [4.4-1](#)
 - replacement, procedure, [4.4-1](#)
 - when to perform a replacement, [4.4-1](#)
 - ATTENTION
 - definition, [1.1-4](#)
 - Attenuator Control, Prefinal software
 - circuit cards tested, [7.2-3](#)
 - description, [7.2-3](#)
 - response to failure, [7.2-3](#)
 - AUTO push-button
 - function in an XL-MCL flow cytometer, [A.5-33](#)
 - autoexec.bat file
 - client flow cytometer setup file
 - example, [D.1-1](#)
 - editing for LANtastic Client/Server software V6.0 installation, [3.17-3](#)
 - editing for LANtastic Client/Server software V7.0 installation, MS-DOS, [3.16-2](#)
 - editing for LANtastic Client/Server software V8.0 installation, [3.15-2](#)
 - file server setup file example, [D.2-1](#)
- ## B
- bar-code
 - acceptable, table, [F1-1](#)
 - specifications, [F1-1](#)
 - Bar-Code Decoder card
 - component locations, [A.2-5](#)
 - function, [A.5-46](#)
 - location in the Cytometer, [A.2-5](#)
 - part number, [8.1-23](#), [8.2-17](#)
 - bar-code hand-held scanner
 - description, [F3-1](#)
 - general parameters, table, [F3-2](#)
 - installation, default configuration
 - table, [3.12-1](#), [F2-2](#), [F3-1](#)
 - installation, procedure, [3.12-1](#)
 - installation, tools/supplies needed, [3.12-1](#)
 - installation, verification, [3.12-2](#)
 - keyboard wedge parameters, table, [F3-3](#)
 - part number, [3.12-1](#), [8.1-19](#)
 - setup parameters, [F3-1](#)
 - symbology table, [3.12-1](#), [F3-2](#)
 - bar-code labels
 - adjusting lightness/darkness, [3.11-5](#)
 - adjusting tear-off position, [3.11-4](#)
 - adjusting top-of-label position, [3.11-5](#)
 - in bar-code hand-held scanner
 - installation, [3.12-2](#)
 - part number, [3.11-1](#), [8.1-19](#)
 - bar-code Printer
 - part number, [3.11-1](#), [8.1-25](#)
 - switch settings and functions, table, [F4-1](#)
 - bar-code Printer installation
 - ac power line location, illustration, [3.11-2](#)
 - adjusting label tear-off position,
 - procedures, [3.11-4](#)
 - adjusting printer thermal head,
 - procedures, [3.11-5](#)
 - adjusting top-of-label, procedures, [3.11-5](#)
 - calibration, procedures, [3.11-3](#)
 - connection, procedures, [3.11-4](#)
 - DIP switches location, illustration, [3.11-2](#)
 - DIP switches settings and functions,
 - table, [3.11-2](#)
 - DIP switches settings, illustration, [3.11-2](#)
 - how to tell when Printer is ready, [3.11-2](#)
 - power on/off switch location,
 - illustration, [3.11-2](#)
 - ribbon replacement procedures, [3.11-5](#)
 - serial interface cable location,

- illustration, [3.11-2](#)
 - setup procedures, [3.11-1](#)
 - testing procedures, [3.11-4](#)
 - threading and adjustment components,
 - illustration, [3.11-3](#)
 - tools/supplies needed, [3.11-1](#)
 - when to adjust label tear-off position
 - adjustment, [3.11-4](#)
 - when to adjust thermal head, [3.11-5](#)
- bar-code Printer media calibration
 - when to perform, [3.11-3](#)
- bar-code Printer ribbon
 - Beckman Coulter
 - recommendation, [3.11-5](#)
- bar-code reader
 - function, [A.5-45](#)
- bar-code scanner
 - MCL setup parameters, [F2-2](#)
- bar-code scanner EEPROM custom
 - programming
 - component locations, illustration, [4.23-2](#)
 - computer setup, [4.23-2](#)
 - custom programming sequence, [4.23-3](#)
 - preparation, [4.23-1](#)
 - tools/supplies needed, [4.23-1](#)
 - verification, [4.23-5](#)
- bar-code scanners
 - description, [2.1-4](#), [F2-1](#)
- bar-code, MCL EPROM
 - part number, [8.1-19](#)
- baseband
 - definition, [2.5-1](#)
- beamshaper assembly
 - function, [A.5-26](#)
 - illustrated parts listing, [8.2-37](#)
 - part number, [8.1-15](#), [8.2-37](#)
 - replacement/alignment, [4.5-1](#)
- Beckman Coulter service tool kit
 - part number, [3.3-1](#), [8.1-31](#)
- Beckman Coulter-supported networking
 - 802.3 network standard, [2.5-5](#)
 - bus topology, [2.5-3](#)
 - star topology, [2.5-2](#)
- Beeper Test, Prefinal software
 - circuit card tested, [7.2-3](#)
 - description, [7.2-3](#)
 - response to failure, [7.2-3](#)
- biological
 - hazards, [1.2-2](#)
- bounded media

- definition, [2.5-1](#)
- bridge
 - definition, [2.5-4](#)
- bus networking topology
 - definition, [2.5-3](#)
 - illustration, [2.5-3](#)

C

- cables
 - connecting, illustration, [3.5-1](#)
 - connecting, procedures, [3.5-1](#)
 - part numbers, XL flow cytometer, [8.1-4](#)
 - part numbers, XL-MCL flow
 - cytometer, [8.1-3](#)
- Caching Disk Controller card
 - location on motherboard, [B.2-2](#)
- Canyon Jumper Test, Prefinal software
 - circuit cards tested, [7.2-4](#)
 - description, [7.2-4](#)
 - response to failure, [7.2-4](#)
- cards
 - Amp/Signal Conditioner. *See* Amp/Signal Conditioner card
 - Bar-code Decoder card. *See* Bar-code Decoder card
 - CYT12 Receiver EMC. *See* CYT12 Receiver EMC card
 - Cyto Transputer. *See* Cyto Transputer card
 - Fiber Optics Interface. *See* Fiber Optics Interface card
 - Front Panel LED and Switch Input 2. *See* Front Panel LED and Switch Input 2 card
 - Front Panel LED and Switch Input. *See* Front Panel LED and Switch Input card
 - MCL CPU. *See* MCL CPU card
 - MCL Interface. *See* MCL Interface card
 - Motor Filter. *See* Motor Filter card
 - Opto Transprocessor EXMEM II. *See* Opto Transprocessor EXMEM II card
 - Opto Transprocessor EXMEM. *See* Opto Transprocessor EXMEM card
 - part numbers, XL flow cytometer, [8.1-23](#)
 - PMT Distribution and Laser Fan Control.
 - See* PMT Distribution and Laser Fan Control card
 - Power Module Control II. *See* Power Module Control II card

- Power Module Control. *See* Power Module Control card
- Sensor. *See* Sensor card
- Serial/Parallel Adapter Interface. *See* Serial/Parallel Adapter Interface card
- Solenoid Power Distribution. *See* Solenoid Power Distribution card
- System Interface. *See* System Interface card
- Top Panel Display 2. *See* Top Panel Display 2 card
- Trans Data Acquisition. *See* Trans Data Acquisition card
- Voltage Selector. *See* Voltage Selector card
- Voltage Supply Monitor. *See* Voltage Supply Monitor card
- carousel hub
 - function, [A.5-43](#), [A.5-45](#)
- carousel tube-position sensor adjustment
 - in MCL option field
 - adjustment, [4.12-2](#), [4.12-4](#)
 - in/out screw adjustment,
 - illustration, [4.12-2](#)
 - tube-position screw adjustment,
 - illustration, [4.12-3](#)
- carryover test
 - acceptable
 - results, [4.8-2](#), [4.8-3](#), [5.1-3](#), [5.1-4](#)
 - HIGH/LOW protocol, table, [4.8-1](#)
 - procedure, [4.8-1](#)
 - tools/supplies needed, [4.8-1](#)
- CAUTION
 - definition, [1.1-4](#)
- check valves
 - illustrated parts listing, [8.2-95](#)
- chokes
 - illustrated parts listing, [8.2-95](#)
- circuit breakers
 - location, illustration, [8.2-80](#), [8.2-92](#)
 - part numbers, [8.1-6](#), [8.2-93](#)
- cleaning agent
 - container, illustrated parts listing, [8.2-49](#)
 - part number, [3.2-1](#)
- cleaning agent container
 - function, [A.5-28](#)
 - other names, [A.5-28](#)
- cleanse low indicator
 - how to read, table, [7.1-1](#)
- CLEANSE push-button
 - function in an XL flow cytometer, [A.5-38](#)
 - function in an XL-MCL flow cytometer, [A.5-34](#)
- CMOS
 - settings for Serial/Parallel Adapter Interface card installation, [3.13-2](#)
- components
 - accessed with the Cytometer center front cover removed, illustration, [A.5-21](#)
 - accessed with the Cytometer center front cover removed, table, [A.5-22](#)
 - accessed with the Cytometer top cover removed, illustration, [A.5-5](#)
 - accessed with the Cytometer top cover removed, table, [A.5-6](#)
 - anchor illustration for locating in an XL flow cytometer, [A.5-2](#)
 - anchor illustration for locating in an XL-MCL flow cytometer, [A.5-2](#)
 - anchor illustration for locating Power Supply module components, [A.6-2](#)
 - attached to Cytometer rear panel,
 - illustration, [A.5-29](#)
 - attached to Cytometer rear panel,
 - table, [A.5-30](#)
 - attached to rear panel of Power Supply module, illustration, [A.6-14](#)
 - attached to rear panel of Power Supply module, table, [A.6-15](#)
 - front panel display, illustration, [A.5-55](#)
 - front panel display, table, [A.5-56](#)
 - how to find part numbers, [8.1-1](#)
 - in the Data Acquisition card cage,
 - illustration, [A.5-7](#)
 - in the Data Acquisition card cage,
 - table, [A.5-8](#)
 - in the optical collection area,
 - illustration, [A.5-13](#)
 - in the optical collection area, table, [A.5-14](#)
 - located behind the filter shield,
 - illustration, [A.5-24](#)
 - located behind the filter shield,
 - table, [A.5-25](#)
 - located in left-side compartment of the Power Supply module,
 - illustration, [A.6-9](#)
 - located in left-side compartment of the Power Supply module, table, [A.6-10](#)
 - located in right-side compartment of the

- Power Supply module,
 - illustration, [A.6-12](#)
- located in right-side compartment of the Power Supply module, table, [A.6-13](#)
- located in the Cytometer right-side compartment, illustration, [A.5-16](#)
- located in the Cytometer right-side compartment, table, [A.5-17](#)
- located inside the reagent drawer, illustration, [A.5-27](#)
- located inside the reagent drawer, table, [A.5-28](#)
- located on the Power Supply module front panel, illustration, [A.6-4](#)
- located on the Power Supply module front panel, table, [A.6-5](#)
- lower pneumatics drawer, illustration, [A.5-48](#)
- lower pneumatics drawer, table, [A.5-49](#)
- manual sample station, XL flow cytometer, illustration, [A.5-36](#)
- manual sample station, XL flow cytometer, table, [A.5-37](#)
- manual sample station, XL-MCL flow cytometer, illustration, [A.5-32](#)
- manual sample station, XL-MCL flow cytometer, table, [A.5-33](#)
- MCL option, carousel, illustration, [A.5-42](#)
- MCL option, carousel, table, [A.5-43](#)
- MCL option, components accessible with covers removed, illustration, [A.5-44](#)
- MCL option, components accessible with covers removed, table, [A.5-45](#)
- segmenting valve, illustration, [A.5-39](#)
- segmenting valve, table, [A.5-40](#)
- upper pneumatics drawer, illustration, [A.5-16](#)
- upper pneumatics drawer, table, [A.5-17](#)
- Computer Workstation
 - components, [2.1-3](#)
 - in SVP, [5.1-1](#), [5.1-6](#)
 - options, [2.4-2](#)
 - standard configuration, [2.4-1](#)
 - supported printers, [2.4-2](#)
- computers
 - part numbers, [8.1-6](#)
 - part numbers, FlowCentre Multimedia Workstation, [8.1-19](#)
- config.sys file
 - client flow cytometer setup file example, [D.1-1](#)
- editing for LANtastic Client/Server software V6.0 installation, [3.17-2](#)
- editing for LANtastic Client/Server software V7.0 installation, MS-DOS, [3.16-3](#)
- editing for LANtastic Client/Server software V8.0 installation, [3.15-2](#)
- file server setup file example, [D.2-1](#)
- how to edit, [3.17-2](#)
- connections
 - cabling, [3.5-1](#)
 - Laser Power Supply to Cytometer, illustration, [3.5-1](#)
 - Power Supply module to Cytometer, illustration, [3.5-7](#)
 - reagent bottles to Cytometer, illustration, [3.5-7](#)
 - reagent bottles to Power Supply module, illustration, [3.5-7](#)
 - tubing, [3.5-5](#)
 - Workstation computer to Cytometer, illustration, [3.5-1](#)
- cooling coil
 - function in the Cytometer, [A.5-18](#)
- COULTER CLENZ cleaning agent
 - part number, [3.2-1](#), [8.1-7](#)
- COULTER CYTO-TROL control cells
 - part number, [3.2-1](#)
- Count Rate Test, Prefinal software
 - circuit cards tested, [7.2-4](#)
 - description, [7.2-4](#)
 - response to failure, [7.2-4](#)
- cover removal and reinstallation procedures
 - exterior Cytometer covers, anchor illustration, [4.3-2](#)
 - interior Cytometer access, anchor illustration, [4.3-3](#)
 - Power Supply module, anchor illustration, [4.3-4](#)
- customer manuals
 - part numbers, [1.1-1](#)
- customer training
 - prior to instrument installation, [3.2-1](#)
- CYT12 Receiver EMC card
 - component locations, [A.2-6](#)
 - engineering schematic, part number, [6.1-1](#)
 - location in the Power Supply module, [A.2-6](#)

- Cyto Transputer card
 - block diagram, [2.2-10](#)
 - component locations, [A.2-7](#)
 - description, [2.2-10](#)
 - engineering schematic, part number, [6.1-1](#)
 - function, [A.5-8](#)
 - jumper settings, [A.2-7](#)
 - location in the Cytometer, [A.2-7](#)
 - location, illustration, [8.2-24](#)
 - part number, [8.1-23](#), [8.2-25](#)
 - relationship to Opto Transprocessor EXMEM or Opto Transprocessor EXMEM II card, [2.2-10](#)
 - testing with Prefinal Service software, [A.4-2](#)
- Cytometer
 - anchor illustration for component locations and functions, [A.5-2](#)
 - anchor illustration for illustrated parts, [8.2-2](#)
 - arrival at customer site, [3.1-3](#)
 - block diagram, [2.2-5](#)
 - component locations accessed with center front cover removed, illustration, [A.5-21](#)
 - component locations with filter shield removed, illustration, [A.5-24](#)
 - components, [2.1-2](#)
 - components accessed with top cover removed, illustration, [A.5-5](#)
 - components accessed with top cover removed, table, [A.5-6](#)
 - components attached to rear panel, table, [A.5-30](#)
 - components behind center front cover, table, [A.5-22](#)
 - components behind the filter shield, table, [A.5-25](#)
 - components inside the reagent drawer, table, [A.5-28](#)
 - Data Acquisition card cage component locations, illustration, [A.5-7](#)
 - Data Acquisition card cage components, table, [A.5-8](#)
 - description, [2.2-1](#)
 - front display panel component locations, illustration, [A.5-55](#)
 - front panel display components,
 - table, [A.5-56](#)
 - function, illustration, [2.2-1](#)
 - in initial installation, [3.3-2](#), [3.3-3](#)
 - in SVP, [5.1-1](#)
 - lower pneumatics drawer component locations, illustration, [A.5-48](#)
 - lower pneumatics drawer components, table, [A.5-49](#)
 - manual sample station component locations, illustration of XL flow cytometer, [A.5-36](#)
 - manual sample station component locations, illustration of XL-MCL flow cytometer, [A.5-32](#)
 - manual sample station components (XL flow cytometer), table, [A.5-37](#)
 - manual sample station components (XL-MCL flow cytometer), table, [A.5-33](#)
 - MCL carousel component locations, illustration, [A.5-42](#)
 - MCL carousel components, table, [A.5-43](#)
 - MCL component locations accessed with covers removed, illustration, [A.5-44](#)
 - MCL components accessed with covers removed, table, [A.5-45](#)
 - optical collection area component locations, illustration, [A.5-13](#)
 - optical collection area components, table, [A.5-14](#)
 - reagent drawer component locations, illustration, [A.5-27](#)
 - rear panel component locations, illustration, [A.5-29](#)
 - rear panel fan assembly, illustrated parts listing, [8.2-72](#)
 - rear panel, illustrated parts listing, [8.2-70](#), [8.2-71](#)
 - right side component locations, illustration, [A.5-16](#)
 - right side components, table, [A.5-17](#)
 - right side, illustrated parts listing, [8.2-75](#)
 - segmenting valve component locations, illustration, [A.5-39](#)
 - segmenting valve components, table, [A.5-40](#)
 - upper pneumatics drawer component locations, illustration, [A.5-16](#)
 - upper pneumatics drawer component

- locations, table, [A.5-17](#)
- XL-MCL flow cytometer, illustrated parts listing, [8.2-4](#), [8.2-6](#), [8.2-8](#), [8.2-10](#)
- CYTO-TROL control cells
 - part number, [3.2-1](#), [8.1-7](#)

D

- Data Acquisition card cage
 - component locations, illustration, [A.5-7](#)
 - components, table, [A.5-8](#)
 - description, [2.2-4](#)
 - function, [A.5-6](#)
 - illustrated parts listing, [8.2-24](#)
 - in Cytometer functioning, illustration, [2.2-1](#)
 - in initial installation, [3.3-12](#)
- dedicated server
 - definition, [2.5-5](#)
- DIP switches
 - location on bar-code Printer, [3.11-1](#)
 - location on bar-code Printer, illustration, [3.11-2](#)
- DMA Acquisition, Prefinal software
 - description, [7.2-4](#)

E

- engineering schematics
 - location of latest version, [6.1-2](#)
 - part numbers, [6.1-1](#)
 - pneumatic/hydraulic layout, part number, [6.1-1](#)
 - recommended for troubleshooting, [6.1-1](#)
- error messages, [7.1-1](#)
 - MCL Tube Load Error, [2.1-5](#)
- ESD kit (static-dissipative field kit)
 - part number, [3.3-1](#)
- EXPO32 ADC software option
 - installation, procedure, [3.19-1](#)
 - installation, tool/supplies needed, [3.19-1](#)

F

- fan assembly
 - Cytometer, rear panel, illustrated parts listing, [8.2-73](#)
- fan, power supply
 - illustrated parts listing, [8.2-94](#)
- fans

- function in the Cytometer, [A.5-30](#)

- Fiber Optic Interface card
 - component locations, [A.2-8](#)
 - description, [2.2-14](#)
 - engineering schematic, part number, [6.1-1](#)
 - jumper settings, [A.2-8](#)
 - location in the Cytometer, [A.2-8](#)
- Fiber Optics Interface card
 - function, [A.5-31](#)
- field engineer worksheet, [C.1-1](#)
- filter assembly
 - illustrated parts listing, [8.2-34](#)
- filter locations, illustration, [A.5-21](#)
- filters
 - part numbers, [8.1-11](#), [8.2-34](#)
- finger adjustment
 - finger screw adjustment, illustration, [4.12-3](#)
 - in MCL option field adjustment, [4.12-3](#)
- fittings
 - part numbers, [8.1-12](#)
- flexible duct
 - function, [A.5-14](#)
- flexible duct components
 - illustrated parts listing, [8.2-98](#)
- flow cell
 - description, [2.2-2](#)
 - function, [A.5-25](#)
 - illustration, [2.2-3](#)
- flow cell and beamshaper
 - replacement/alignment
 - alignment, illustration, [4.5-5](#)
 - alignment, procedure, [4.5-4](#)
 - beamshaper components, illustration, [4.5-4](#)
 - correct laser reflection positioning, illustration, [4.5-3](#)
 - flow cell and beamshaper components, illustration, [4.5-2](#)
 - tools/supplies needed, [4.5-1](#)
 - when to perform, [4.5-1](#)
- flow cell replacement/alignment
 - removal, [4.5-1](#)
- FLOW indicator
 - function in an XL flow cytometer, [A.5-37](#)
 - function in an XL-MCL flow cytometer, [A.5-33](#)
- FLOWCELL WASTE quick connect
 - function in the Cytometer, [A.5-30](#)

- FlowCentre II computer
 - configuration, [B.1-1](#), [B.2-1](#)
 - FlowCentre II Multimedia Workstation
 - part number, [3.10-1](#)
 - procedures for upgrade, [3.10-1](#)
 - FlowCentre II Multimedia Workstation upgrade installation
 - keyboard connection, [3.10-2](#)
 - mouse connection, [3.10-1](#)
 - SYSTEM II software installation, [3.10-4](#)
 - tools/supplies needed, [3.10-1](#)
 - verification, [3.10-5](#)
 - Flow-Check fluorospheres
 - part number, [3.2-1](#), [8.1-7](#)
 - Flow-Set fluorospheres
 - part number, [8.1-7](#)
 - fluorescence pickup lens
 - function, [A.5-25](#)
 - fluorospheres
 - part number, [3.2-1](#)
 - forward scatter detector. *See* FS detector
 - forward scatter. *See* FS
 - front panel display
 - component locations, illustration, [A.5-55](#)
 - components, table, [A.5-56](#)
 - Front Panel Display card
 - testing with Prefinal Service software, [A.4-1](#)
 - Front Panel LED and Switch Input 2 card
 - component locations, [A.2-10](#)
 - engineering schematic, part number, [6.1-1](#)
 - function, [A.5-34](#)
 - location in the Cytometer, [A.2-10](#)
 - Front Panel LED and Switch Input card
 - component locations, [A.2-9](#)
 - engineering schematic, part number, [6.1-1](#)
 - function, [A.5-37](#)
 - location in the Cytometer, [A.2-9](#)
 - Front Panel Test, Prefinal software
 - circuit cards tested, [7.2-5](#)
 - description, [7.2-4](#)
 - response to failure, [7.2-5](#)
 - FS
 - description, [2.2-4](#)
 - FS detector
 - description, [2.2-4](#)
 - function, [A.5-26](#)
 - location, illustration, [4.5-4](#)
 - FS mask alignment
 - correct/incorrect positioning, illustration, [4.6-3](#)
 - procedure, [4.6-2](#)
 - FS sensor. *See* FS detector
- ## G
- gas cylinder
 - function in the MCL, [A.5-43](#)
 - General Information, Prefinal software
 - description, [7.2-5](#)
 - Grand Canyon Adjust, Prefinal software
 - circuit cards tested, [7.2-6](#)
 - description, [7.2-6](#)
 - response to failure, [7.2-6](#)
 - Grand Canyon Test, Prefinal software
 - circuit cards tested, [7.2-6](#)
 - description, [7.2-6](#)
 - response to failure, [7.2-6](#)
 - guidelines for servicing the instrument, [4.1-1](#)
- ## H
- hazards
 - biological, [1.2-2](#)
 - headings, special
 - definitions, [1.1-3](#)
 - Histogram Test, Prefinal software
 - description, [7.2-7](#)
 - Hot Keys, [A.7-1](#)
 - available when Acquisition screen displayed, table, [A.7-1](#)
 - available when Listmode screen displayed, table, [A.7-1](#)
- ## I
- illustrated parts listing
 - beamshaper, [8.2-37](#)
 - check valves, [8.2-95](#)
 - chokes, [8.2-95](#)
 - cleaning agent container, [8.2-49](#)
 - Cytometer, rear panel, [8.2-71](#)
 - Cytometer, rear panel fan
 - assembly, [8.2-72](#)
 - Cytometer, right side, [8.2-74](#)
 - Data Acquisition card cage, [8.2-24](#)
 - fan, power supply, [8.2-94](#)

- flexible duct components, [8.2-98](#)
- lifter air cylinder, [8.2-20](#)
- lower pneumatics drawer, [8.2-62](#)
- MCL vertical plate components, [8.2-18](#)
- mounting hardware, [8.2-97](#)
- Power Supply module, left side, [8.2-76](#)
- Power Supply module,
 - rear, [8.2-80](#), [8.2-92](#)
- Power Supply module, right side, [8.2-89](#)
- probe air cylinder, [8.2-21](#)
- segmenting valve assembly, [8.2-58](#)
- sheath filter, [8.2-44](#)
- sheath filter, vent connections, [8.2-46](#)
- sheath fluid container, [8.2-48](#)
- tie wraps, [8.2-97](#)
- upper pneumatics drawer, [8.2-26](#)
- upper pneumatics drawer, brackets and fittings, [8.2-29](#)
- upper pneumatics drawer, quick disconnects, [8.2-31](#)
- VL21, [8.2-30](#)
- VL22, [8.2-28](#)
- VL30, VL31, VL32, [8.2-78](#)
- waste container, [8.2-91](#)
- Workstation, [8.2-12](#), [8.2-14](#)
- IMPORTANT
 - definition, [1.1-4](#)
- in/out air cylinder
 - function, [A.5-45](#)
- initial installation
 - Cytometer, [3.3-3](#)
 - filling the reagent containers, [3.3-15](#)
 - initial system verification, [3.7-3](#)
 - operational checks, [3.7-1](#)
 - oscilloscope settings, table, [3.7-3](#)
 - tools/supplies needed, [3.7-1](#)
 - Power Supply module, [3.3-2](#)
 - procedure, [3.3-1](#)
 - software, [3.6-1](#)
 - SYSTEM II software, [3.6-1](#)
 - tools/supplies needed, [3.3-1](#)
 - unpacking
 - Cytometer, [3.3-1](#)
 - Power Supply module, [3.3-1](#)
- initial installation. *See* requirements, initial installation
- Initialize System, Prefinal software
 - circuit cards tested, [7.2-7](#)
 - description, [7.2-7](#)
 - response to failure, [7.2-7](#)
- installation
 - 4-color PMT upgrade, [3.9-1](#)
 - EXPO32 ADC software option, [3.19-1](#)
 - EXPO32 software options, [3.19-1](#)
 - LANtastic Client/Server software
 - option, [3.15-1](#)
 - optional Sybase Client/Server SQL software, [3.18-1](#)
- instrument
 - anchor illustration for illustrated parts, [8.2-2](#)
 - circuit cards. *See* cards
 - components, [2.1-1](#)
 - overview, [2.1-1](#)
 - power up/down using EXPO32 ADC software, [4.1-6](#)
 - power up/down using SYSTEM II software, [4.1-3](#)
 - preinstallation checks, [3.2-1](#)
 - preparing for shipment, procedure, [4.16-1](#)
 - preparing for shipment, tools/supplies needed, [4.16-1](#)
 - shutdown, procedures, [4.17-1](#)
 - shutdown, tools/supplies needed, [4.17-1](#)
- interconnect diagrams
 - MCL, part number, [6.1-1](#)
 - safety interlock, part number, [6.1-1](#)
- interlock switch
 - function in the Cytometer, [A.5-6](#)
 - function in the MCL, [A.5-43](#)
- interlocks
 - safety precautions, [1.2-1](#)
- IsoFlow sheath fluid
 - part number, [3.2-1](#), [8.1-7](#)
- J**
- jumpers
 - Serial/Parallel Adapter Interface card. *See* Serial/Parallel Adapter Interface card
- L**
- labels
 - part numbers, [8.1-20](#)
- labels, bar-code
 - optical characteristics, [F.1-1](#)
 - part numbers, [8.1-19](#)
 - specifications, [F.1-1](#)
- LAN

- definition, [2.5-1](#)
- LANtastic Client/Server software V6.0
 - installation, LED line editor, [3.17-1](#)
 - installation, NIC, [3.17-3](#)
 - installation, NIC relationship, [3.17-1](#)
 - installation, procedure, [3.17-1](#)
 - installation, running LANCHECK, [3.17-3](#)
 - installation, tools/supplies needed, [3.17-1](#)
- LANtastic Client/Server software V7.0
 - installation, MS-DOS, [3.16-2](#)
 - installation, MS-DOS, SQL database software, [3.16-3](#)
 - installation, tools/supplies needed, [3.16-1](#)
 - installation, Windows 95, [3.16-1](#)
- LANtastic Client/Server software V8.0
 - 2- to 10-user license, part number, [3.15-1](#)
 - installation, Client setup, [3.15-1](#)
 - installation, procedure, [3.15-1](#)
 - installation, Server setup, [3.15-5](#)
 - installation, tools/supplies needed, [3.15-1](#)
 - single-user license, part number, [3.15-1](#)
- LANtastic NOS
 - minimum requirements, [B.4-1](#)
- laser
 - Argon head, removal, [4.4-2](#)
 - Argon power supply, location, illustration, [8.2-76](#)
 - Argon, beam, [2.2-4](#)
 - Argon, installation, [4.4-3](#)
 - Argon, power supply, removal, [4.4-1](#)
 - description, [2.2-2](#)
 - in flow cell and beamshaper
 - replacement/alignment, [4.5-3](#)
 - part number for Argon laser head, [8.1-15](#)
 - part number for Argon laser power supply, [8.1-15](#), [8.2-41](#), [8.2-77](#)
 - replacement, procedure, [4.4-1](#)
 - warning, [4.5-3](#)
 - when to perform a replacement, [4.4-1](#)
- laser beam steering in optical alignment
 - beam-shaping stage components, illustration, [4.6-2](#)
 - oscilloscope settings, table, [4.6-1](#)
 - procedure, [4.6-1](#)
- laser blower assembly
 - function, [A.5-14](#)
- laser certification label
 - location, illustration, [1.2-6](#)
- Laser Control, Prefinal software
 - components tested, [7.2-8](#)
 - description, [7.2-8](#)
 - response to failure, [7.2-8](#)
- laser duct out plenum
 - function, [A.5-14](#)
- laser head
 - Argon, installation in laser replacement, [4.4-3](#)
 - Argon, removal in laser replacement, [4.4-2](#)
 - function, [A.5-14](#)
 - replacement, procedure, [4.4-1](#)
 - when to perform a replacement, [4.4-1](#)
- laser power supply
 - Argon, installation in laser replacement, [4.4-2](#)
 - Argon, removal, [4.4-1](#)
 - Argon, removal in laser replacement, [4.4-1](#)
 - replacement, procedure, [4.4-1](#)
 - when to perform a replacement, [4.4-1](#)
- Laser Warm Up, Prefinal software
 - description, [7.2-9](#)
- laser warning labels
 - location, illustration, [1.2-4](#), [1.2-5](#), [1.2-6](#), [1.2-7](#)
- level sense indicators
 - CLEANSE LOW function in an XL-MCL flow cytometer, [A.5-33](#)
 - interpreting, [7.1-1](#)
 - SHEATH LOW function in an XL-MCL flow cytometer, [A.5-33](#)
 - SHEATH LOW/WASTE FULL/CLEANSE LOW function in XL flow cytometer, [A.5-37](#)
 - WASTE FULL function in an XL-MCL flow cytometer, [A.5-33](#)
- lifter air cylinder
 - function, [A.5-45](#)
 - illustrated parts listing, [8.2-20](#)
- Linear Power supply
 - components, [2.3-4](#)
 - XL flow cytometer power supplies
 - location, illustration, [2.3-4](#)
 - XL-MCL flow cytometer power supplies
 - location, illustration, [2.3-4](#)
- Lock Up Test, Prefinal software
 - description, [7.2-9](#)
- lower pneumatics drawer

- 12 insert fitting plate connections, [A.5-53](#)
 - 5 insert fitting plate connections, [A.5-53](#)
 - component locations, illustration, [A.5-48](#)
 - components, table, [A.5-49](#)
 - illustrated parts listing, [8.2-62](#)
 - in initial installation, [3.3-12](#)
 - lower 6 insert fitting plate
 - connections, [A.5-53](#)
 - part number, [8.1-15](#), [8.2-63](#)
 - upper 6 insert fitting plate
 - connections, [A.5-53](#)
- M**
- manual
 - conventions, [1.1-4](#)
 - electronic vs. printed, [1.1-2](#)
 - intended audience, [1.1-1](#)
 - Notice of Information Update,
 - function, [1.1-1](#)
 - numbering format, [1.1-3](#)
 - scope, [1.1-1](#)
 - manual sample head
 - function in an XL flow cytometer, [A.5-38](#)
 - function in an XL-MCL flow
 - cytometer, [A.5-34](#)
 - manual sample probe
 - function in an XL flow cytometer, [A.5-38](#)
 - function in an XL-MCL flow
 - cytometer, [A.5-34](#)
 - manual sample station
 - components, XL flow cytometer,
 - table, [A.5-37](#)
 - components, XL-MCL flow cytometer,
 - table, [A.5-33](#)
 - manual sample station (XL flow cytometer)
 - component locations, illustration, [A.5-36](#)
 - manual sample station (XL-MCL flow
 - cytometer)
 - component locations, illustration, [A.5-32](#)
 - manual stage air cylinder
 - function in an XL flow cytometer, [A.5-38](#)
 - function in an XL-MCL flow
 - cytometer, [A.5-35](#)
 - manual stage position sensor
 - function in an XL flow cytometer, [A.5-38](#)
 - function in an XL-MCL flow
 - cytometer, [A.5-35](#)
 - manual, field service
 - safety warnings, [1.2-1](#)
 - manuals, customer
 - part numbers, [1.1-1](#)
 - master parts list
 - categories, [8.1-1](#)
 - common names, [8.1-1](#)
 - component names, [8.1-1](#)
 - how to use, [8.1-1](#)
 - MCL
 - vertical plate components, illustrated
 - parts listing, [8.2-18](#)
 - voltages, test point adjustments,
 - table, [4.20-7](#), [A.1-1](#)
 - MCL Bar Code Head Test, Prefinal software
 - description, [7.2-9](#)
 - MCL Bar Code Test, Prefinal software
 - description, [7.2-9](#)
 - MCL Burn In, Prefinal software
 - description, [7.2-10](#)
 - Error Index Numbers, [7.2-10](#)
 - MCL carousel
 - component locations, illustration, [A.5-42](#)
 - MCL carousel base assembly
 - function, [A.5-45](#)
 - MCL Carousel Label, Prefinal software
 - description, [7.2-10](#)
 - MCL Carousel Status, Prefinal software
 - description, [7.2-11](#)
 - response to failure, [7.2-11](#)
 - test sequence, [7.2-11](#)
 - MCL CPU card
 - component locations, [A.2-11](#)
 - engineering schematic, part
 - number, [6.1-1](#)
 - function, [A.5-46](#)
 - jumper settings, [A.2-11](#)
 - location in the Cytometer, [A.2-11](#)
 - location, illustration, [8.2-16](#)
 - part number, [8.1-23](#), [8.2-17](#)
 - switch settings, [A.2-11](#)
 - switch settings, table, [3.8-2](#)
 - test point adjustments,
 - table, [4.20-6](#), [A.1-1](#)
 - MCL Door Switch Test, Prefinal software
 - description, [7.2-11](#)
 - response to failure, [7.2-11](#)
 - MCL Finger Test, Prefinal software
 - description, [7.2-11](#)
 - MCL head sensor, part
 - number, [8.1-16](#), [8.2-19](#)
 - MCL Home Align, Prefinal software

- description, [7.2-11](#)
- MCL interconnect
 - engineering schematic, part number, [6.1-1](#)
- MCL Interface card
 - block diagram, [2.2-11](#)
 - component locations, [A.2-12](#)
 - description, [2.2-11](#)
 - engineering schematic, part number, [6.1-1](#)
 - function, [2.1-4](#), [A.5-8](#)
 - in Cytometer upgrade, [3.8-2](#)
 - jumper settings, [A.2-12](#)
 - location in the Cytometer, [A.2-12](#)
 - location, illustration, [8.2-24](#)
 - part number, [8.1-23](#), [8.2-25](#)
- MCL lifter assembly
 - function, [A.5-45](#)
- MCL Manual Control, Prefinal software
 - description, [7.2-12](#)
 - sensor status, [7.2-12](#)
- MCL Mix Test, Prefinal software
 - description, [7.2-12](#)
- MCL option
 - carousel components, table, [A.5-43](#)
 - commands, table, [A.4-4](#)
 - component locations, illustration of components accessed with covers removed, [A.5-44](#)
 - components accessed with covers removed, table, [A.5-45](#)
 - field adjustment, MCL TERMINAL program setup, [4.12-1](#)
 - field adjustment, tools/supplies needed, [4.12-1](#)
 - field adjustment, when to perform, [4.12-1](#)
 - illustrated parts listing, [8.2-16](#)
 - part number, [8.1-21](#), [8.2-17](#)
 - sample probe adjustment, illustration, [4.12-4](#)
 - theory of operation, [2.1-3](#)
- MCL option installation
 - procedures, [3.8-1](#)
 - tools/supplies needed, [3.8-1](#)
 - upgrade kit in black part number, [3.8-1](#)
 - upgrade kit in grey part number, [3.8-1](#)
 - verification, [3.8-4](#)
- MCL Pneumatic Status, Prefinal software
 - description, [7.2-12](#)
 - response to failure, [7.2-12](#)
 - sensor status, [7.2-12](#)
- MCL POWER UP Status, Prefinal software
 - description, [7.2-13](#)
 - response to failure, [7.2-13](#)
- MCL Probe Align, Prefinal software
 - description, [7.2-13](#)
- MCL probe housing
 - function, [A.5-43](#)
- MCL probe sensor and flag
 - function, [A.5-45](#)
- MCL probe slide assembly
 - function, [A.5-45](#)
- MCL ROM Test, Prefinal software
 - description, [7.2-13](#)
 - response to failure, [7.2-13](#)
- MCL sample head
 - function, [A.5-45](#)
- MCL sample head sensor and flag
 - function, [A.5-45](#)
- MCL sample probe
 - function, [A.5-45](#)
- MCL sample probe adjustment
 - illustration, [4.12-4](#)
- MCL Scan Reliability, Prefinal software
 - description, [7.2-13](#)
- MCL solenoid assembly
 - function, [A.5-45](#)
- MCL Stepper Noise Test, Prefinal software
 - description, [7.2-13](#)
 - response to failure, [7.2-13](#)
- MCL Terminal, Prefinal software
 - description, [7.2-14](#)
- MCL Tube Load Error*
 - reasons for receiving, [2.1-5](#)
- MCL tube rotator assembly
 - function, [A.5-46](#)
- MCL upgrade
 - procedures, [3.8-1](#)
- Memory Test, Prefinal software
 - circuit cards tested, [7.2-17](#)
 - description, [7.2-17](#)
 - response to failure, [7.2-17](#)
- mesh networking topology
 - definition, [2.5-2](#)
 - illustration, [2.5-2](#)
- messages, error
 - cause/symptom/action, table, [7.1-2](#)
- Mike's Test, Prefinal software

- description, [7.2-18](#)
- mixer motor
 - testing with Prefinal Service software, [A.4-2](#)
- monitors
 - 17-inch TFT (LCD), [3.4-2](#)
 - 22-inch CRT, [3.4-3](#)
 - part
 - numbers, [8.1-9](#), [8.1-21](#), [8.2-13](#), [8.2-15](#)
- motherboard
 - AMI ATLAS PCI III description, table, [B.2-2](#)
- Motor Filter card
 - function, [A.5-45](#)
- Motor Filter EMC card
 - engineering schematic, part number, [6.1-1](#)
- motors
 - mixer. *See* mixer motor
 - stepper. *See* stepper motor
 - vortex. *See* vortex motor
- mounting hardware
 - illustrated parts listing, [8.2-97](#)

N

- ND1 filter positioning knob
 - function, [A.5-22](#)
- Network Configuration Worksheet
 - copy to use, [C.1-2](#)
- networking
 - 802.3, [2.5-1](#)
 - Beckman Coulter's implementation, [2.5-1](#)
 - bridges, [2.5-4](#)
 - carrier sense multiple access, [2.5-5](#)
 - collision detection, [2.5-5](#)
 - dedicated vs. non-dedicated server, [2.5-5](#)
 - description, [2.5-1](#)
 - encoding techniques, [2.5-1](#)
 - LAN, [2.5-1](#)
 - media, [2.5-1](#)
 - repeaters, [2.5-4](#)
 - routers, [2.5-4](#)
 - signals used, [2.5-1](#)
 - topologies, bus, [2.5-3](#)
 - topologies, description, [2.5-2](#)
 - topologies, mesh, [2.5-2](#)
 - topologies, ring, [2.5-4](#)
 - topologies, star, [2.5-2](#)
 - WAN, [2.5-4](#)

- New Board, Prefinal software
 - description, [7.2-18](#)
- NIC
 - installation, tools/supplies needed, [3.14-1](#)
 - part number, [8.1-24](#)
 - role in LANtastic Client/Server software V6.0 installation, [3.17-1](#)
- Noise Test and Offset, Prefinal software
 - circuit cards tested, [7.2-18](#)
 - description, [7.2-18](#)
 - response to failure, [7.2-18](#)
- non-dedicated server
 - definition, [2.5-5](#)
- Note
 - definition, [1.1-4](#)

O

- on-site close out
 - in SVP, [5.1-6](#)
- optical alignment
 - tools/supplies needed, [4.6-1](#)
 - when to perform, [4.6-1](#)
- optical collection area
 - component locations, illustration, [A.5-13](#)
 - components, table, [A.5-14](#)
 - function, [A.5-6](#)
- optics system
 - beam shaping, description, [2.2-2](#)
 - beam shaping, illustration, [2.2-2](#)
 - description, [2.2-2](#)
- OPTO DMA Test, Prefinal software
 - circuit cards tested, [7.2-19](#)
 - description, [7.2-19](#)
 - response to failure, [7.2-19](#)
- OPTO Interrupt Test, Prefinal software
 - circuit cards tested, [7.2-19](#)
 - description, [7.2-19](#)
 - response to failure, [7.2-19](#)
- OPTO Link Test, Prefinal software
 - circuit cards tested, [7.2-20](#)
 - description, [7.2-20](#)
 - response to failure, [7.2-20](#)
- Opto Transprocessor EXEM card
 - location on motherboard, [B.2-2](#)
 - part number (non-EMC version), [8.1-24](#)
 - testing with Prefinal Service software, [A.4-3](#)
- Opto Transprocessor EXEM II card
 - location on motherboard, [B.2-2](#)

- part number (EMC version), [8.1-24](#)
 - testing with Prefinal Service software, [A.4-3](#)
 - Opto Transprocessor EXMEM card
 - block diagram, [2.2-12](#)
 - component locations, [A.2-13](#)
 - description, [2.2-12](#)
 - engineering schematic, part number, [6.1-1](#)
 - jumper settings, [A.2-13](#)
 - location in the Workstation, [A.2-13](#)
 - Opto Transprocessor EXMEM II card
 - component locations, [A.2-14](#)
 - description, [2.2-12](#)
 - engineering schematic, part number, [6.1-1](#)
 - jumper settings, [A.2-14](#)
 - location in the Workstation, [A.2-14](#)
- P**
- part numbers
- Amp/Signal Conditioner card, [8.1-23](#), [8.2-25](#)
 - Argon laser power supply, [8.1-15](#), [8.2-41](#), [8.2-77](#)
 - Bar-Code Decoder card, [8.1-23](#), [8.2-17](#)
 - beamshaper, [8.1-15](#), [8.2-37](#)
 - cables, [8.1-4](#)
 - cards, XL flow cytometer, [8.1-23](#)
 - cards, XL-MCL flow cytometer, [8.1-23](#)
 - circuit breakers, [8.1-6](#), [8.2-93](#)
 - components, [8.1-3](#)
 - computers, [8.1-6](#)
 - COULTER CLENZ cleaning agent, [8.1-7](#)
 - Cyto Transputer card, [8.1-23](#), [8.2-25](#)
 - CYTO-TROL control cells, [8.1-7](#)
 - electronic manual on CD-ROM, [1.1-1](#)
 - filters, [8.1-11](#), [8.2-35](#)
 - FlowCentre Multimedia Workstation, [8.1-19](#)
 - Flow-Check fluorospheres, [8.1-7](#)
 - Flow-Set fluorospheres, [8.1-7](#)
 - how to find, [8.1-1](#)
 - IsoFlow sheath fluid, [8.1-7](#)
 - labels, [8.1-20](#)
 - lower pneumatics drawer, [8.2-62](#)
 - MCL CPU cards, [8.1-23](#), [8.2-17](#)
 - MCL Interface card, [8.1-23](#), [8.2-25](#)
 - MCL option, [8.1-16](#), [8.2-17](#)
 - monitors, [8.1-9](#)
 - online manual on CD-ROM, [8.1-31](#)
 - optional items, supplies, tools, [8.1-19](#)
 - Power Module Control card, [8.1-24](#), [8.2-77](#)
 - power supplies, XL flow cytometer, [8.1-16](#)
 - power supplies, XL-MCL flow cytometer, [8.1-16](#)
 - Printers, [8.1-25](#)
 - schematics, engineering, [6.1-1](#)
 - Sensor card, [8.1-24](#), [8.2-27](#)
 - sensors, XL flow cytometer, [8.1-28](#)
 - sensors, XL-MCL flow cytometer, [8.1-29](#)
 - software, [8.1-29](#)
 - Solenoid Power Distribution card, [8.1-24](#), [8.2-63](#)
 - System Interface card, [8.1-24](#), [8.2-25](#)
 - Trans Data Acquisition card, [8.1-24](#), [8.2-25](#)
 - tubing, [8.1-31](#)
 - valves, [8.1-32](#)
 - Voltage Selector cards, [8.1-24](#), [8.2-77](#)
- PEEK tubing
- function in manual sampling, [A.5-40](#)
 - function in MCL, [A.5-40](#)
- PEEK tubing replacement
- connections, illustration, [4.9-2](#)
 - installation, [4.9-3](#)
 - preparation, [4.9-1](#)
 - removal, [4.9-1](#)
 - tools/supplies needed, [4.9-1](#)
 - verification, [4.9-5](#)
 - when to perform, [4.9-1](#)
 - with ferrule and ferrule nut, illustration, [4.9-2](#)
 - with ferrules, illustration, [4.11-1](#)
- Pentium processor
- configuration, [B.3-1](#)
 - installed peripherals, [B.3-1](#)
 - part number, [8.1-6](#), [8.1-7](#), [8.2-13](#), [8.2-15](#)
 - part numbers, [8.1-6](#)
- pinhole assembly
- description, [2.2-3](#)
- PMI
- procedures, [5.2-1](#)
 - tools/supplies needed, [5.2-1](#)
- PMT Distribution and Laser Fan Control card
- component locations, [A.2-15](#)
 - engineering schematic, part

- number, [6.1-1](#)
 - function, [A.5-14](#)
 - in 4-color PMT upgrade, [3.9-2](#)
 - location in the Cytometer, [A.2-15](#)
- PMT filters
 - locations in 4-color PMT system, illustration, [3.9-2](#)
- PMT Voltage Control, Prefinal software
 - circuit cards tested, [7.2-21](#)
 - description, [7.2-21](#)
 - response to failure, [7.2-21](#)
- PMT1
 - function, [A.5-15](#)
- PMT3
 - function, [A.5-14](#)
- PMT4
 - function, [A.5-14](#)
- Pneumatic Sensor Test, Prefinal software
 - circuit cards tested, [7.2-21](#)
 - description, [7.2-21](#)
 - response to failure, [7.2-22](#)
- pneumatic/hydraulic layout
 - engineering schematic, part number, [6.1-1](#)
- power down
 - instrument using EXPO32 ADC software, [4.1-6](#)
 - instrument using SYSTEM II software, [4.1-3](#)
- Power Module Control card
 - component locations, [A.2-16](#)
 - engineering schematic, part number, [6.1-1](#)
 - in Power Supply module, [2.3-1](#)
 - location in Power Supply module, [A.2-16](#)
 - location, illustration, [8.2-80](#), [8.2-92](#)
 - part number, [8.1-24](#), [8.2-77](#), [8.2-93](#)
- Power Module Control II card
 - component locations, [A.2-17](#)
 - engineering schematic, part number, [6.1-1](#)
 - location in Power Supply module, [A.2-17](#)
- power on/off switches
 - on bar-code Printer, illustration, [3.11-2](#)
- power supplies
 - +15 Vdc voltage verification and adjustment, procedures, [4.20-4](#)
 - +24 Vdc voltage verification and adjustment, procedures, [4.20-1](#)
 - +5 Vdc voltage verification and adjustment, procedures, [4.20-4](#)
 - 15 Vdc voltage verification and adjustment, procedures, [4.20-4](#)
 - location, illustration, [8.2-89](#)
 - MCL voltage verification and adjustment, procedures, [4.20-6](#)
 - part numbers, [8.1-16](#), [8.2-89](#)
 - part numbers, MCL, [8.1-16](#), [8.2-89](#)
 - part numbers, XL flow cytometer, [8.1-16](#)
 - part numbers, XL-MCL flow cytometer, [8.1-16](#)
 - PMT1 HV function, [A.5-12](#)
 - PMT2 HV function, [A.5-12](#)
 - PMT3 HV function, [A.5-11](#)
 - PMT4 HV function, [A.5-11](#)
 - replacement, preparation, [4.19-1](#)
 - replacement, procedures, [4.19-1](#)
 - replacement, tools/supplies needed, [4.19-1](#)
 - replacement, verification, [4.19-2](#)
 - replacement, when to perform, [4.19-1](#)
 - replacement/adjustment, tools/supplies needed, [3.10-1](#)
 - voltage verification and adjustment, tools/supplies needed, [4.20-1](#)
 - voltage verification and adjustment, when to perform, [4.20-1](#)
- Power Supply module
 - anchor illustration for component locations and functions, [A.6-2](#)
 - anchor illustration for illustrated parts, [8.2-2](#)
 - block diagram, [2.3-1](#)
 - circuit breakers location, illustration, [2.3-3](#)
 - circuit breakers, location, [2.3-1](#)
 - components, [2.1-2](#), [2.3-1](#)
 - description, [A.6-1](#)
 - front door open, components, table, [A.6-5](#)
 - front door open, illustration, [A.6-4](#)
 - front view, [2.3-2](#)
 - in initial installation, [3.3-2](#)
 - in SVP, [5.1-1](#)
 - interlock, [2.3-1](#)
 - left side, components, table, [A.6-10](#)
 - left side, illustrated parts listing, [8.2-76](#), [8.2-77](#)
 - left side, illustration, [A.6-9](#)
 - left-side view, [2.3-3](#)
 - placement, [2.3-1](#)

- Power Module Control card flow
 - diagram, [2.3-2](#)
- power ON/OFF switch location,
 - illustration, [2.3-3](#)
- rear panel, components, table, [A.6-15](#)
- rear panel, illustration, [A.6-14](#)
- rear view, [2.3-3](#)
- rear, illustrated parts
 - listing, [8.2-80](#), [8.2-92](#)
- right side, components, table, [A.6-13](#)
- right side, illustrated parts listing, [8.2-89](#)
- right side, illustration, [A.6-12](#)
- upgrade, [3.8-2](#)
- Voltage Selector card location,
 - illustration, [2.3-3](#)
- power up
 - instrument using EXPO32 ADC
 - software, [4.1-6](#)
 - instrument using SYSTEM II
 - software, [4.1-3](#)
- powerup test
 - in SVP, [5.1-2](#)
- Prefinal Service software
 - diskette part number, [4.2-1](#), [4.16-1](#), [7.2-1](#)
 - guidelines for using, [4.2-3](#)
 - in preparing instrument for shipment, [4.16-1](#)
 - in Trans Data Acquisition card
 - replacement and/or calibration, [4.14-2](#)
 - installation/operation, procedures using EXPO32 ADC software, [4.2-2](#)
 - installation/operation, procedures using SYSTEM II software, [4.2-1](#)
 - tests available, table, [A.4-2](#)
 - tools/supplies needed, [4.2-1](#), [7.2-1](#)
- pre-installation requirements
 - table, [3.1-1](#)
- PRESSURE quick connect
 - function in the Cytometer, [A.5-30](#)
- PRIME push-button
 - function in an XL flow cytometer, [A.5-38](#)
 - function in an XL-MCL flow cytometer, [A.5-34](#)
- printer, optional, [3.4-3](#)
- Printers
 - part numbers, [8.1-25](#)
- probe air cylinder
 - illustrated parts listing, [8.2-21](#)
- probe up/down air cylinder
 - function, [A.5-45](#)
- procedures
 - +15 Vdc power supply voltage verification and adjustment, [4.20-4](#)
 - +24 Vdc power supply voltage verification and adjustment, [4.20-1](#)
 - +5 Vdc power supply voltage verification and adjustment, [4.20-4](#)
 - 15 Vdc power supply voltage verification and adjustment, [4.20-4](#)
 - acquisition, CV analysis and carryover check, [5.1-2](#)
 - Amp/Signal Conditioner card calibration
 - in 4-color PMT upgrade, [3.9-3](#)
 - Amp/Signal Conditioner card replacement and/or calibration, [4.15-1](#)
 - Argon, laser head replacement, [4.4-2](#)
 - Argon, laser power supply replacement, [4.4-1](#)
 - bar-code hand-held scanner
 - installation, [3.12-1](#)
 - bar-code Printer installation
 - testing, [3.11-4](#)
 - bar-code Printer label tear-off position
 - adjustment, [3.11-4](#)
 - bar-code Printer media calibration, [3.11-3](#)
 - bar-code Printer ribbon
 - replacement, [3.11-5](#)
 - bar-code Printer thermal head
 - adjustment, [3.11-5](#)
 - bar-code Printer top-of-label position
 - adjustment, [3.11-5](#)
 - bar-code scanner EEPROM custom programming, [4.23-1](#)
 - beamshaper replacement and/or alignment, [4.5-1](#)
 - carousel tube-position sensor
 - adjustment, [4.12-1](#)
 - carryover test, [4.8-1](#)
 - connecting bar-code Printer, [3.11-4](#)
 - connecting cables, [3.5-1](#)
 - connecting tubing, [3.5-5](#)
 - cover removal and reinstallation, locating a procedure, [4.3-1](#)
 - cover removal and reinstallation,
 - overview, [4.3-1](#)
 - Cytometer upgrade for MCL option, [3.8-1](#)
 - editing config.sys and startnet.bat files for LANtastic Client/Server software V6.0

- installation, [3.17-2](#)
 - flow cell and beamshaper replacement
 - and/or alignment, [4.5-1](#)
 - flow cell replacement and/or alignment, [4.5-1](#)
 - FlowCentre II Multimedia Workstation
 - upgrade installation, [3.10-1](#)
 - FS mask alignment, [4.6-2](#)
 - general instructions, [4.1-2](#)
 - guidelines for service and repair, [4.1-1](#)
 - hardware installation in 4-color PMT
 - upgrade, [3.9-1](#)
 - initial installation, [3.3-1](#)
 - initial setup of bar-code Printer, [3.11-1](#)
 - instrument performance
 - verification, [4.1-3](#)
 - instrument Power Down/Power Up using EXPO32 ADC software, [4.1-6](#)
 - instrument Power Down/Power Up using SYSTEM II software, [4.1-3](#)
 - instrument shutdown, [4.17-1](#)
 - LANtastic Client/Server software V6.0
 - installation, [3.17-1](#)
 - LANtastic Client/Server software V7.0
 - installation, MS-DOS, [3.16-2](#)
 - LANtastic Client/Server software V7.0
 - installation, Windows 95, [3.16-1](#)
 - LANtastic Client/Server software V8.0
 - installation, [3.15-1](#)
 - LANtastic V8.0 software, Client
 - setup, [3.15-1](#)
 - LANtastic V8.0 software, Server
 - setup, [3.15-5](#)
 - laser beam steering in optical
 - alignment, [4.6-1](#)
 - MCL option installation, [3.8-1](#)
 - MCL power supply voltage verification
 - and adjustment, [4.20-6](#)
 - MCL sample probe adjustment, [4.12-4](#)
 - MCL TERMINAL program setup, [4.12-1](#)
 - PEEK tubing replacement, [4.9-1](#)
 - PMI, [5.2-1](#)
 - PMT operational alignment in 4-color
 - PMT upgrade, [3.9-3](#)
 - Power Supply module upgrade, [3.8-2](#)
 - power supply replacement, [4.19-1](#)
 - power up tests, [5.1-2](#)
 - Prefinal Service software
 - installation/operation using EXPO32 ADC software, [4.2-2](#)
 - Prefinal Service software
 - installation/operation using SYSTEM II software, [4.2-1](#)
 - preparing instrument for shipment, [4.16-1](#)
 - re-imaging FlowCentre computers, [4.21-1](#)
 - reverse/shorted ground/neutral
 - test, [4.18-2](#)
 - sample and sheath sensor
 - calibration, [4.7-1](#)
 - segmenting valve cleaning, [4.11-1](#)
 - Serial/Parallel Adapter Interface card
 - installation, [3.13-1](#)
 - sheath pressure/sample station vacuum
 - calibration, [4.10-1](#)
 - static test, [5.1-1](#)
 - SVP, [5.1-1](#)
 - Sybase Client/Server SQL software
 - installation, [3.18-1](#)
 - SYSTEM II software installation, [3.6-1](#)
 - testing Computer Workstation, [5.1-6](#)
 - three-wire circuit analyzer test, [4.18-1](#)
 - tool requirements for service and repair, [4.1-3](#)
 - Trans Data Acquisition card replacement
 - and/or calibration, [4.14-1](#)
 - universal CD-ROM driver setup, [4.22-1](#)
 - vortexer foot assembly
 - replacement, [4.13-1](#)
 - protocols
 - Acquire Fluorospheres, table, [A.3-2](#)
 - carryover test HIGH/LOW, table, [4.8-1](#)
 - CHANNEL 500, [4.6-2](#)
 - Channel 500, table, [A.3-1](#)
 - LIN/LOG Switch Point 1 Test, table, [4.15-5](#), [A.3-1](#)
 - Pulse RAMP Test, Prefinal software
 - components tested, [7.2-22](#)
 - description, [7.2-22](#)
 - response to failure, [7.2-22](#)
- ## Q
- QD10
 - function, [A.5-49](#)
 - QD11
 - function, [A.5-49](#)
 - QD13
 - function, [A.5-20](#)
 - QD14

function, [A.5-20](#)
 QD35
 function, [A.5-28](#)

R

reagent drawer
 component locations, illustration, [A.5-27](#)
 components, table, [A.5-28](#)
 rear panel
 component locations, illustration, [A.5-29](#)
 components, table, [A.5-30](#)
 re-imaging FlowCentre computers
 tools/supplies needed, [4.21-1](#)
 repeater
 definition, [2.5-4](#)
 requirements, initial installation
 ambient temperature, [3.1-3](#)
 customer training, [3.2-1](#)
 environmental, [3.1-3](#)
 heat dissipation into room, [3.1-3](#)
 humidity, [3.1-3](#)
 laser power, [3.1-2](#)
 noise level, [3.1-3](#)
 operating clearances, [3.1-1](#)
 optional printer or monitor, [3.2-1](#)
 power, [3.1-2](#)
 space, [3.1-1](#)
 supplies, [3.2-1](#)
 temperature stability, [3.1-3](#)
 unloading and moving, [3.1-3](#)
 reverse/shorted ground/neutral test
 procedure, [4.18-2](#)
 tools/supplies needed, [4.18-2](#)
 right side
 component locations, illustration, [A.5-16](#)
 ring networking topology
 definition, [2.5-4](#)
 illustration, [2.5-4](#)
 ROM Test, Prefinal software
 circuit card tested, [7.2-22](#)
 description, [7.2-22](#)
 response to failure, [7.2-22](#)
 router
 definition, [2.5-4](#)
 Run Beads, Prefinal software
 description, [7.2-22](#)
 RUN push-button and indicator
 function in an XL flow cytometer, [A.5-37](#)
 function in an XL-MCL flow

cytometer, [A.5-33](#)

S

safety interlock interconnect
 engineering schematic, part
 number, [6.1-1](#)
 safety precautions
 biological, [1.2-2](#)
 during segmenting valve cleaning, [4.11-1](#)
 during troubleshooting, [1.2-7](#), [4.9-1](#)
 electrical, [1.2-1](#)
 instrument covers and interlocks, [1.2-1](#)
 instrument doors, covers, and
 panels, [1.2-1](#), [4.3-1](#)
 laser warning labels,
 illustration, [1.2-4](#), [1.2-5](#), [1.2-6](#), [1.2-7](#)
 sample and sheath sensor calibration
 operational verification, [4.7-4](#)
 procedure, [4.7-1](#)
 role of System Interface card, [4.7-2](#)
 tools/supplies needed, [4.7-1](#)
 when to perform, [4.7-1](#)
 sample and waste connect panel
 function in an XL flow cytometer, [A.5-38](#)
 function in an XL-MCL flow
 cytometer, [A.5-34](#)
 sample flow
 psi selections, [2.1-1](#), [4.7-4](#), [A.5-58](#)
 Sample Leak Test, Prefinal software
 components tested, [7.2-23](#)
 description, [7.2-23](#)
 response to failure, [7.2-23](#)
 sample pressure regulator
 function, [A.5-20](#)
 sample probe adjustment
 in MCL option field adjustment, [4.12-4](#)
 schematics, engineering
 location of latest version, [6.1-2](#)
 part numbers, [6.1-1](#)
 recommended for troubleshooting, [6.1-1](#)
 SCOPE A connector
 function, [A.5-30](#)
 SCOPE B connector
 function, [A.5-30](#)
 Scope Test, Prefinal software
 description, [7.2-23](#)
 Segment Valve Test, Prefinal software
 description, [7.2-23](#)
 response to failure, [7.2-23](#)

- segmenting pads
 - in initial installation, [3.3-13](#)
 - in PEEK tubing replacement, [4.9-3](#)
- segmenting valve
 - assembly, illustrated parts listing, [8.2-58](#)
 - cleaning the shaft, [4.11-3](#)
 - cleaning, preparation, [4.11-1](#)
 - cleaning, segmenting pad
 - installation, [4.11-3](#)
 - cleaning, segmenting pad removal, [4.11-1](#)
 - cleaning, tools/supplies needed, [4.11-1](#)
 - cleaning, verification, [4.11-4](#)
 - cleaning, when to perform, [4.11-1](#)
 - component locations, illustration, [A.5-39](#)
 - components, table, [A.5-40](#)
 - front air cylinder function, [A.5-40](#)
 - front pad function, [A.5-40](#)
 - front segmenting pad connections,
 - illustration, [4.11-2](#)
 - illustration, pad connections, [4.11-2](#)
 - knob function, [A.5-40](#)
 - middle air cylinder function, [A.5-41](#)
 - middle pad function, [A.5-40](#)
 - part number, [8.2-58](#)
 - rear air cylinder function, [A.5-41](#)
 - rear pad function, [A.5-40](#)
 - rear segmenting pad connections,
 - illustration, [4.11-2](#)
- Sensor card
 - component locations, [A.2-18](#)
 - description, [2.2-14](#)
 - engineering schematic, part
 - number, [6.1-1](#)
 - function, [A.5-20](#)
 - location in the Cytometer, [A.2-18](#)
 - location, illustration, [8.2-26](#)
 - part number, [8.1-24](#), [8.2-27](#)
- sensors
 - MCL head sensor, part
 - number, [8.1-16](#), [8.2-19](#)
 - XL flow cytometer, part numbers, [8.1-28](#)
 - XL-MCL flow cytometer, location,
 - illustration, [8.1-16](#), [8.2-17](#)
 - XL-MCL flow cytometer, part
 - numbers, [8.1-29](#)
- Serial/Parallel Adapter Interface card
 - CMOS settings, table, [3.13-2](#)
 - in bar-code Printer installation, [3.11-4](#)
 - installation, [3.13-1](#)
 - installation, tools/supplies needed, [3.13-1](#)
 - installation, verification, [3.13-2](#)
 - jumper settings, illustration, [3.13-1](#)
 - part number, [3.13-1](#), [8.1-24](#)
 - removal, [3.13-1](#)
- servers
 - types, [2.5-5](#)
- service and repair procedures
 - instrument Power Down/Power Up using
 - EXPO32 ADC software, [4.1-6](#)
 - instrument Power Down/Power Up using
 - SYSTEM II software, [4.1-3](#)
- Set N Transputers, Prefinal software
 - description, [7.2-23](#)
- setup files examples
 - client flow cytometer, autoexec.bat, [D.1-1](#)
 - client flow cytometer, config.sys, [D.1-1](#)
 - client flow cytometer, startnet.bat, [D.1-1](#)
 - client flow cytometer,
 - XL_graph.cng, [D.1-2](#)
 - file server, autoexec.bat, [D.2-1](#)
 - file server, config.sys, [D.2-1](#)
 - file server, startnet.bat, [D.2-1](#)
- sheath container
 - function, [A.5-28](#)
 - other names, [A.5-28](#)
- sheath filter
 - illustrated parts listing, [8.2-44](#)
 - vent connections, illustrated parts
 - listing, [8.2-46](#)
 - vent connections, illustrated parts listing,
 - table, [8.2-47](#)
- sheath flow
 - setting, [2.1-1](#)
- sheath fluid
 - container, illustrated parts listing, [8.2-48](#)
 - part number, [3.2-1](#)
- sheath liquid filter
 - function, [A.5-28](#)
- sheath low indicator
 - how to read, table, [7.1-1](#)
- sheath pressure regulator
 - function, [A.5-18](#)
- sheath pressure/sample station vacuum
 - calibration
 - procedure, [4.10-1](#)
 - tools/supplies needed, [4.10-1](#)
 - verification, [4.10-1](#)
 - when to perform, [4.10-1](#)
- side scatter diode
 - function, [A.5-25](#)

- side scatter. *See* SS
- SN6
 - function, [A.5-18](#)
- SN7
 - function, [A.5-18](#)
- SN8
 - function, [A.5-19](#)
- SN9
 - function, [A.5-19](#)
- software
 - part numbers, [8.1-29](#)
- Solenoid Control card
 - description, [2.2-14](#)
- solenoid manifold
 - function, [A.5-49](#)
- Solenoid Power Distribution card
 - component locations, [A.2-19](#)
 - description, [2.2-14](#)
 - engineering schematic, part
 - number, [6.1-1](#)
 - function, [A.5-49](#)
 - location in the Cytometer, [A.2-19](#)
 - location, illustration, [8.2-62](#)
 - part number, [8.1-24](#), [8.2-63](#)
- specifications
 - 802.3 network standard, [2.5-5](#)
 - 802.3 network standard, table, [E.1-1](#)
 - bar-code, [F.1-1](#)
- SS
 - description, [2.2-4](#)
- SS sensor
 - function, [A.5-25](#)
- star networking topology
 - definition, [2.5-2](#)
 - illustration, [2.5-3](#)
- startnet.bat file
 - client flow cytometer setup file
 - example, [D.1-1](#)
 - editing for LANTastic Client/Server
 - software V6.0 installation, [3.17-2](#)
 - editing for LANTastic Client/Server
 - software V7.0 installation,
 - MS-DOS, [3.16-3](#)
 - file server setup file example, [D.2-1](#)
- static test
 - in SVP, [5.1-1](#)
- stepper motor
 - description, [2.1-4](#)
- SVP
 - at the end of installation, [3.7-6](#)
 - in 4-color PMT upgrade, [3.9-3](#)
 - in Amp/Signal Conditioner card
 - replacement and/or calibration, [4.15-6](#)
 - in FlowCentre II Multimedia Workstation
 - upgrade installation, [3.10-5](#)
 - in MCL option installation, [3.8-4](#)
 - in optical alignment, [4.6-4](#)
 - in PEEK tubing replacement, [4.9-5](#)
 - in PMI, [5.2-2](#)
 - in power supply replacement, [4.19-2](#)
 - in Prefinal Service software installation
 - and operation, [4.2-4](#)
 - in sample and sheath sensor
 - calibration, [4.7-5](#)
 - in sheath pressure/sample station vacuum
 - calibration, [4.10-1](#)
 - in Trans Data Acquisition card
 - replacement and/or calibration, [4.14-4](#)
 - procedures, [5.1-1](#)
 - tools/supplies needed, [5.1-1](#)
- switches
 - bar-code Printer. *See* bar-code Printer
 - DIP. *See* DIP switches
 - power on/off. *See* power on/off switch
- Sybase client
 - minimum requirements, [B.5-1](#)
- Sybase Client/Server SQL software
 - installation, procedure, [3.18-1](#)
 - installation, tools/supplies needed, [3.18-1](#)
- Sybase database server
 - minimum requirements, [B.5-1](#)
- Sybase network
 - minimum requirements, [B.5-1](#)
- System Interface card
 - block diagram, [2.2-9](#)
 - component locations, [A.2-20](#)
 - description, [2.2-9](#)
 - engineering schematic, part
 - number, [6.1-1](#)
 - function, [A.5-8](#)
 - in sample and sheath sensor
 - calibration, [4.7-2](#)
 - jumper settings, [A.2-20](#)
 - location in the Cytometer, [A.2-20](#)
 - location, illustration, [8.2-24](#)
 - part number, [8.1-24](#), [8.2-25](#)
 - switch settings, [A.2-20](#)
- System Parameter Test, Prefinal software

description, [7.2-23](#)

T

T805 Test, Prefinal software

circuit cards tested, [7.2-24](#)

description, [7.2-24](#)

response to failure, [7.2-24](#)

Temperature Test, Prefinal software

description, [7.2-24](#)

test tube

part number, [4.16-1](#)

three-wire circuit analyzer

part number, [4.18-1](#)

test, limitations, [4.18-1](#)

test, procedure, [4.18-1](#)

test, tools/supplies needed, [4.18-1](#)

test, troubleshooting table, [4.18-1](#)

tie wraps

illustrated parts listing, [8.2-97](#)

tools

part numbers, [8.1-31](#)

Top Panel Display 2 card

component locations, [A.2-21](#)

engineering schematic, part

number, [6.1-1](#)

function, [A.5-57](#)

location in the Cytometer, [A.2-21](#)

training. *See* customer training

Trans Data Acquisition card

block diagram, [2.2-8](#)

calibration, [4.14-2](#)

component locations, [A.2-22](#)

description, [2.2-8](#)

engineering schematic, part

number, [6.1-1](#)

function, [A.5-8](#)

jumper settings, [A.2-22](#)

location in the Cytometer, [A.2-22](#)

location, illustration, [8.2-24](#)

offset adjustment, [4.14-1](#)

part number, [8.1-24](#), [8.2-25](#)

relationship to Amp/Signal Conditioner card, [2.2-8](#)

relationship to Cyto Transputer card, [2.2-8](#)

replacement, [4.14-1](#)

replacement and/or calibration, preparation, [4.14-1](#)

replacement and/or calibration,

procedures, [4.14-1](#)

replacement and/or calibration, tools/supplies needed, [4.14-1](#)

replacement and/or calibration, verification, [4.14-4](#)

replacement and/or calibration, when to perform, [4.14-1](#)

testing with Prefinal Service software, [A.4-1](#)

Transient Absorber EMC card

engineering schematic, part

number, [6.1-1](#)

transputers

description, [2.2-12](#)

troubleshooting

for three-wire circuit analyzer test, [4.18-1](#)

tubing

connecting, illustration, [3.5-7](#)

connecting, procedures, [3.5-5](#)

part numbers, [8.1-31](#)

waste container to Cytometer, illustration, [3.5-7](#)

U

universal CD-ROM driver setup

driver installation, [4.22-1](#)

preparation, [4.22-1](#)

tools/supplies needed, [4.22-1](#)

upper pneumatics drawer

brackets and fittings, illustrated parts listing, [8.2-29](#)

illustrated parts

listing, [8.2-27](#), [8.2-43](#), [8.2-51](#), [8.2-53](#), [8.2-55](#), [8.2-57](#), [8.2-62](#), [8.2-81](#), [8.2-82](#), [8.2-83](#), [8.2-84](#), [8.2-85](#), [8.2-86](#), [8.2-87](#), [8.2-88](#), [8.2-93](#)

part number, [8.1-17](#), [8.2-26](#), [8.2-27](#)

quick disconnects, illustrated parts listing, [8.2-31](#)

V

VACUUM quick connect

function in the Cytometer, [A.5-30](#)

vacuum regulator

function, [A.5-19](#)

Valve Burn In, Prefinal software

description, [7.2-24](#)

Valve Control, Prefinal software

- circuit card tested, [7.2-25](#)
- description, [7.2-25](#)
- response to failure, [7.2-25](#)
- Valve Sequence, Prefinal software
 - description, [7.2-26](#)
- valves
 - part numbers, [8.1-32](#)
- VL0
 - function, [A.5-50](#)
- VL1
 - function, [A.5-51](#)
- VL10
 - function, [A.5-52](#)
- VL11
 - function, [A.5-52](#)
- VL12
 - function, [A.5-52](#)
- VL13
 - function, [A.5-52](#)
- VL14
 - function, [A.5-50](#)
- VL15
 - function, [A.5-50](#)
- VL16
 - function, [A.5-50](#)
- VL17
 - function, [A.5-50](#)
- VL18
 - function, [A.5-49](#)
- VL19
 - function, [A.5-49](#)
- VL2
 - function, [A.5-51](#)
- VL20
 - function, [A.5-28](#), [A.5-49](#)
- VL21
 - function, [A.5-19](#)
 - illustrated parts listing, [8.2-30](#)
- VL22
 - function, [A.5-19](#)
 - illustrated parts listing, [8.2-28](#)
- VL3
 - function, [A.5-51](#)
- VL30, VL31, VL32
 - illustrated parts listing, [8.2-79](#)
- VL33
 - function, [A.5-17](#)
- VL4
 - function, [A.5-51](#)

- VL5
 - function, [A.5-51](#)
- VL6
 - function, [A.5-51](#)
- VL7
 - function, [A.5-51](#)
- VL8
 - function, [A.5-52](#)
- VL9
 - function, [A.5-52](#)
- VME Addr Bus Test, Prefinal software
 - circuit cards tested, [7.2-26](#)
 - description, [7.2-26](#)
 - response to failure, [7.2-26](#)
- VME Data Bus Test, Prefinal software
 - circuit cards tested, [7.2-27](#)
 - description, [7.2-26](#)
 - response to failure, [7.2-27](#)
- Voltage Selector card
 - component locations, [A.2-24](#)
 - engineering schematic, part
 - number, [6.1-1](#)
 - location in Power Supply module, [A.2-23](#)
 - location, illustration, [2.3-3](#), [8.2-76](#)
 - part numbers, [8.1-24](#), [8.2-77](#)
- Voltage Supply Monitor card
 - component locations, [A.2-25](#)
 - engineering schematic, part
 - number, [6.1-1](#)
 - location in Power Supply module, [A.2-25](#)
- vortex motor
 - operational commands, [A.4-4](#)
- vortexer foot assembly
 - components, illustration, [4.13-2](#)
 - location, illustration, [4.13-2](#)
 - replacement, [4.13-2](#)
- vortexer foot assembly replacement
 - components, illustration, [4.13-2](#)
 - installation, [4.13-2](#)
 - preparation, [4.13-1](#)
 - removal, [4.13-1](#)
 - tools/supplies needed, [4.13-1](#)
 - verification, [4.13-3](#)
 - when to replace, [4.13-1](#)

W

- WAN
 - definition, [2.5-4](#)
- WARNING

- definition, [1.1-4](#)
- waste chamber
 - function, [A.5-54](#)
- Waste Chamber Full Test, Prefinal software
 - components tested, [7.2-27](#)
 - description, [7.2-27](#)
 - response to failure, [7.2-27](#)
- waste chamber sensor
 - function, [A.5-54](#)
- waste container
 - illustrated parts listing, [8.2-91](#)
- waste full indicator
 - how to read, table, [7.1-1](#)
- waste manifold
 - function, [A.5-17](#)
- WASTE quick connect
 - function, [A.5-30](#)
- water trap filter
 - function, [A.5-17](#)
- worksheets
 - Field Engineer, copy to use, [C.1-1](#)
 - network configuration, copy to use, [C.1-2](#)
- Workstation
 - illustrated parts listing, [8.2-12](#), [8.2-14](#)
 - initial setup, [3.4-1](#)
 - keyboard connection, [3.4-2](#)
 - monitor connection, [3.4-2](#)
 - mouse connection, [3.4-2](#)

X

- XL_graph.cng file
 - client flow cytometer setup file
 - example, [D.1-2](#)
- XL-MCL flow cytometer
 - components, [2.1-3](#)
 - voltage settings, connectors, pins,
 - table, [A.1-1](#)
- XL-supported networking
 - AUI media, [2.5-1](#)
 - baseband, [2.5-1](#)
 - coaxial media, [2.5-1](#)
 - Ethernet Manchester Encoding
 - Scheme, [2.5-1](#)
 - twisted pair media, [2.5-1](#)
- XY Display, Prefinal software
 - description, [7.2-27](#)

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