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# 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 Page Up to increase the gain or Page Down 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 Page Up |
| To decrease attenuation by 10.0% | Press Page Down |
| To increase attenuation by 1.0% | Press Home |
| To decrease attenuation by 1.0% | Press End |
| To increase attenuation by 0.1% | Press Insert |
| To decrease attenuation by 0.1% | Press Delete |

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 Enter.
  - 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 Esc.

## 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 servos 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 Page Up |
| To decrease laser current by 10.0 Amps | Press Page Down |
| To increase laser current by 1.0 Amp | Press Home |
| To decrease laser current by 1.0 Amp | Press End |
| To increase laser current by 0.1 Amp | Press Insert |
| To decrease laser current by 0.1 Amp | Press Delete |
| **Laser Power Option** | |
| To increase laser power by 10.0 mW | Press Page Up |
| To decrease laser power by 10.0 mW | Press Page Down |
| To increase laser power by 1.0 mW | Press Home |
| To decrease laser power by 1.0 mW | Press End |
| To increase laser power by 0.1 mW | Press Insert |
| To decrease laser power by 0.1 mW | Press Delete |
| **Laser Control Option** | |
| Toggle the laser ON/OFF | Press Enter |

### 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 Enter 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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**Note:** Perform a system reset before running any of these commands.<br>MCL_RESET_CMD (Esc M R)<br>MCL_VER_LEVEL_CMD (Esc M V)<br>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**<br>**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**<br>**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 Page Up |
| To decrease PMT voltage by 100.0 Vdc | Press Page Down |
| To increase PMT voltage by 10.0 Vdc | Press Home |
| To decrease PMT voltage by 10.0 Vdc | Press End |
| To increase PMT voltage by 1.0 Vdc | Press Insert |
| To decrease PMT voltage by 1.0 Vdc | Press Delete |

### 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.<br>**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

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## 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<br>8.2-24 | 12<br>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<br>**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<br>**Note:** O-ring seal, PN 2512031, is not needed with the sheath tank assembly but is needed with the cleanse tank assembly. | 6028526 | 8.2-28<br>8.2-29 | 8<br>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<br>**Note:** Designated as CK 2 and 3 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886. | 6213006 | 8.2-59 | 7 |
| Choke, plastic, grey, 0.016 in. orifice<br>**Note:** Designated as CK 12 on page 1 of the XL System Pneumatic / Hydraulic Layout, PN 6320886. | 6213012 | 8.2-14<br>8.2-59 | 13<br>8 |

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

| Description | Part Number | Figure | Item |
|---|---|---|---|
| Choke, plastic, brown, 0.025 in. orifice<br>**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<br>**Note:** Choke must be oriented as shown in the associated figure when installation is complete. | 6232637 | 8.2-8<br>8.2-10<br>8.2-11 | 15<br>3<br>1 |
| Circuit breaker, 0.5 A, 250 Vac<br>**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<br>**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<br>8.2-57 | 5<br>6 |
| Circuit breaker, 2 A, 250 Vac<br>**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<br>8.2-57 | 3<br>4 |
| Circuit breaker, 3 A, 250 Vac<br>**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<br>8.2-57 | 4<br>5 |
| Circuit breaker, 0.8 A, 250 Vac<br>**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<br>8.2-57 | 6<br>7 |
| Circuit breaker, 4 A, 250 Vac, for 100 Vac and 120 Vac systems<br>**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<br>**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<br>8.2-40 | 1<br>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<br>8.2-4 | 3<br>3 |
| Cover, filter, grey | 6807084 | 8.2-2<br>8.2-4 | 3<br>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<br>8.2-4 | 2<br>2 |
| Cover, right-side, grey | 6807079 | 8.2-2<br>8.2-4 | 2<br>2 |
| Cover, sample station | 6858247 | 8.2-33 | 23 |
| Cover, top, black<br>**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<br>8.2-4 | 1<br>1 |
| Cover, upper rear, black | 1018854 | 8.2-2<br>8.2-4 | 16<br>12 |
| Cover, upper rear, grey | 1025310 | 8.2-2<br>8.2-4 | 16<br>12 |
| Cover, top, grey<br>**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<br>8.2-4 | 1<br>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<br>**Note:** Remove the large nut from the cylinder. Make sure you replace the small cylinder rod nut before installing. | 6232595 | 8.2-9<br>8.2-11 | 15<br>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<br>**Note:** If present, remove and discard the large nut on each end before installing. | 6232591 | 8.2-9<br>8.2-10 | 14<br>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<br>**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<br>**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<br>**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. | 6856490 | 8.2-2<br>8.2-4<br>8.2-12 | 14<br>11<br>7 |
| Door, front panel display, grey<br>**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. | 6807085 | 8.2-2<br>8.2-4<br>8.2-12 | 14<br>11<br>7 |
| Drive, hard, 20 GB minimum, 7200 RPM IDE HDD<br>**Note:** Drive may be used in FlowCentre II tower computer PN 2016874 or FlowCentre computer PN 2016753. | 2016963 | | |
| 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<br>**Note:** Assembly instructions are illustrated in Figure 8.2-62. | 2603060 | 8.2-24<br>8.2-62 | 24<br>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)<br>**Note:** To ensure proper cable length, verify fan orientation before attaching the fan to the Cytometer frame.<br>• 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.<br>• 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. | 2603025 | 8.2-42<br>8.2-43 | 1<br>4 |
| Fan, box, 90 CFM, 24 Vdc, 4.69 square x 1.0 in. thickness, used in Power Supply module<br>**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). | 2603058 | 8.2-47<br>8.2-57<br>8.2-58 | 1<br>13<br>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<br>8.2-43<br>8.2-58 | 5<br>10<br>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<br>8.2-53 | 7<br>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<br>**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. | 6232725 | 8.2-44<br>8.2-47<br>8.2-49 | 12<br>3<br>2 |
| Finger guard, grille for fan air filter on 4-inch box fan<br>**Note:** Raised ribs should face out. | 2603009 | 8.2-5<br>8.2-43<br>8.2-58 | 4<br>9<br>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<br>**Note:** Fitting must be oriented as shown after tightening. | 6232813 | 8.2-38 | 2 |
| Fitting, elbow, hose barb, 0.187 i.d. to 1/8 MPT, brass<br>**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. | 6216128 | 8.2-44<br>8.2-46<br>8.2-48<br>8.2-49 | 13<br>1<br>1<br>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<br>**Note:** Apply a thin line of pipe sealant, PN 1601056, across threads prior to insertion. | 6216004 | 8.2-44 | 9 |

**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, 0125 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<br>**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<br>**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<br>**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)<br>**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<br>8.2-57 | 9<br>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)<br>**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<br>8.2-57 | 6<br>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)<br>**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<br>8.2-57 | 7<br>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<br>**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<br>8.2-46<br>8.2-52 | 11<br>4<br>2 |
| Fitting, T-connector, hose barb, 0.187 i.d. to 0.187 i.d. to threaded, brass<br>**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<br>8.2-60 | 10<br>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<br>**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<br>**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<br>**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<br>8.2-4<br>8.2-25 | 4<br>4<br>2 |
| FRU, regulator, electronic pressure (electronic transducer), for regulating sample pressure<br>**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<br>8.2-30<br>8.2-31 | 9<br>Front view<br>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<br>**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<br>8.2-32 | 9 |
| FRU, sample station, for XL Cytometer without MCL option with grey covers<br>**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<br>8.2-32 | 9 |
| FRU, upper pneumatics drawer assembly | 7000375 | 8.2-14 | |
| FRU, vacuum chamber<br>**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)<br>**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<br>8.2-20<br>8.2-59 | 24<br>6<br>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)<br>**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<br>8.2-54 | 8<br>2 |
| Gauge, 0 to 60 psi, for monitoring system pressure, 1.5-inch diameter, panel mount (includes panel mounting hardware)<br>**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<br>8.2-51 | 5<br>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<br>**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<br>**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<br>**Note:** Assembly instructions are illustrated in Figure 8.2-62. | 1018547 | 8.2-24<br>8.2-62 | 24<br>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<br>**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<br>8.2-23 | 2<br>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<br>**Note:** Use associated figures to verify proper orientation of latch catch and keeper. | 2851859 | 8.2-2<br>8.2-3<br>8.2-4<br>8.2-31<br>8.2-31 | 6<br>12<br>6<br>1<br>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<br>**Note:** Strain relief set for one line cord, PN 6027766. | 6028530 | 8.2-45<br>8.2-57 | 7<br>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<br>**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<br>**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<br>8.2-7 | 4<br>4 |
| Monitor, 22-inch CRT display | 2016951 | | |
| Mount, pull-apart pinch valve | 1017501 | 8.2-15<br>8.2-17<br>8.2-27<br>8.2-38 | 7<br>8<br>13<br>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<br>8.2-41<br>8.2-61 | 10<br>2<br>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<br>8.2-7 | 5<br>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<br>**Note:** Hand tighten only. | 6232501 | 8.2-46<br>8.2-52 | 5<br>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<br>8.2-36 | 13<br>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<br>8.2-32 | 2<br>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<br>8.2-12<br>8.2-13<br>8.2-24<br>8.2-31<br>8.2-43<br>8.2-50<br>8.2-58 | 3<br>9<br>13<br>4<br>10<br>1<br>1<br>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<br>**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<br>**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<br>**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<br>**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<br>**Note:** Card may be use in FlowCentre II tower computer PN 2016874 or FlowCentre computer PN 2016753. | 6706394 | 8.2-6<br>8.2-7 | 10<br>8 |
| PCB, Parallel Port Adapter (computer card requires PCI bus) | 2016883 | | |
| PCB, PCI Sound, for FlowCentre II tower computer PN 2016874<br>**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<br>8.2-50 | 4<br>3 |

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

| Description | Part Number | Figure | Item |
|---|---|---|---|
| PCB, PMT Distribution and Laser Fan Control<br>**Note:** Refers to the two cooling fans mounted on the Cytometer frame. These fans cool the Argon laser. | 6705199 | 8.2-19<br>8.2-24 | 5<br>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<br>**Note:** Attach using instant adhesive, PN 1601082. Apply only one drop. | 1019621 | 8.2-30<br>8.2-32 | 5<br>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<br>**Note:** MCL push-button must be properly positioned before inserting the shoulder screw, PN 2852256 | 6807075 | 8.2-2<br>8.2-31 | 10<br>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, Imagining Utility Boot, 3.5 in. floppy diskette, for the FlowCentre desktop computer PN 2016753<br>**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. | 6417654 | | |
| 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<br>**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<br>**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<br>**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<br>**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)<br>**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. | 2806104 | 8.2-3<br>8.2-14<br>8.2-20 | 11<br>2<br>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<br>8.2-8 | 23<br>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<br>8.2-58 | 11<br>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<br>8.2-43 | 5<br>8 |
| Screw, machine (#6-32 x 0.75 in. long, FL82 flat-head)<br>**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. | 2806084 | 8.2-12 | 8 |
| 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<br>8.2-39 | 13<br>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)<br>**Note:** Apply one drop of adhesive sealant, PN 1601065, to screw threads before insertion. | 2806017 | 8.2-5 | 1 |

**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)<br>**Note:** MCL push-button, PN 6807075, must be properly positioned before inserting this shoulder screw. | 2852256 | 8.2-31 | 5 |
| 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<br>**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<br>8.2-36 | 14<br>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<br>8.2-17<br>8.2-38 | 6<br>7<br>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.<br>**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)<br>**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<br>**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<br>**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<br>**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<br>**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<br>**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, I-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<br>**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<br>8.2-17<br>8.2-37<br>8.2-38 | 4<br>5<br>1<br>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<br>**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<br>8.2-37<br>8.2-59 | 12<br>4<br>1 |
| Valve, check, for 0.062 i.d. to 0.062 i.d. tubing<br>**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<br>8.2-44<br>8.2-59 | 14<br>10<br>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<br>8.2-46 | 3<br>2 |
| Valve, dump, system pressure, for 220/240 Vac system | 6232367 | 8.2-45<br>8.2-46 | 3<br>2 |
| Valve, pressure relief (with plugs), 30 psi | 6208005 | 8.2-47<br>8.2-52 | 6<br>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 | 4 |
| | | 8.2-24 | 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 | 5 |
| | | 8.2-17 | 6 |
| | | 8.2-27 | 4 |
| | | 8.2-38 | 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 | 3 |
| | | 8.2-32 | 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 | 12 |
| | | 8.2-24 | 7 |
| | | 8.2-33 | 4 |
| | | 8.2-43 | 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.

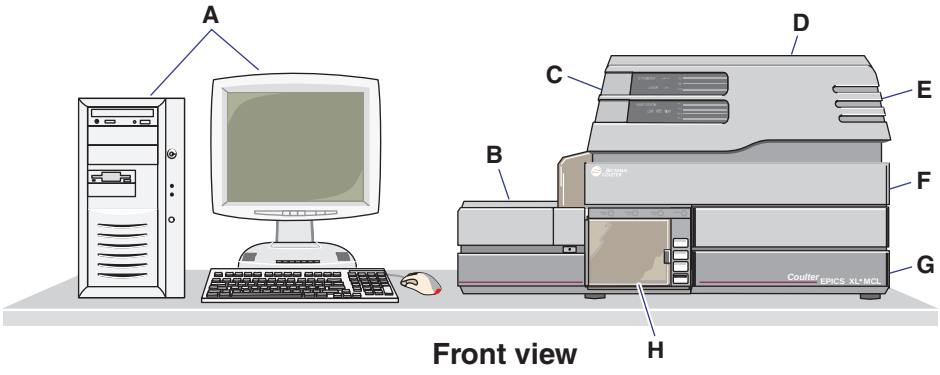
## Locating a Part Number

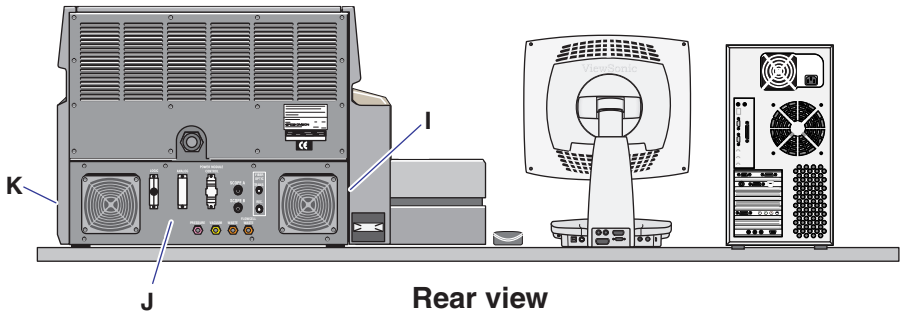
1. To quickly locate a part number, always begin at the anchor illustration, Figure 8.2-1.
   a. Locate the problem area on the anchor illustration and note the associated letter.
   b. Locate the associated letter in the **Figure Reference** column and note the figure number that best fits the configuration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

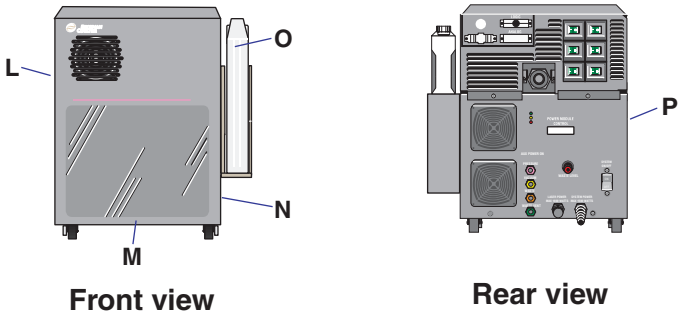
      **Note:** In the electronic version, each figure reference is in hypertext so that when you select the reference, the illustration quickly appears. A single selection may provide the needed illustration; however, it can require up to three selections to see an exploded view of an assembly.

      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**




7029104F

**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

**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)**

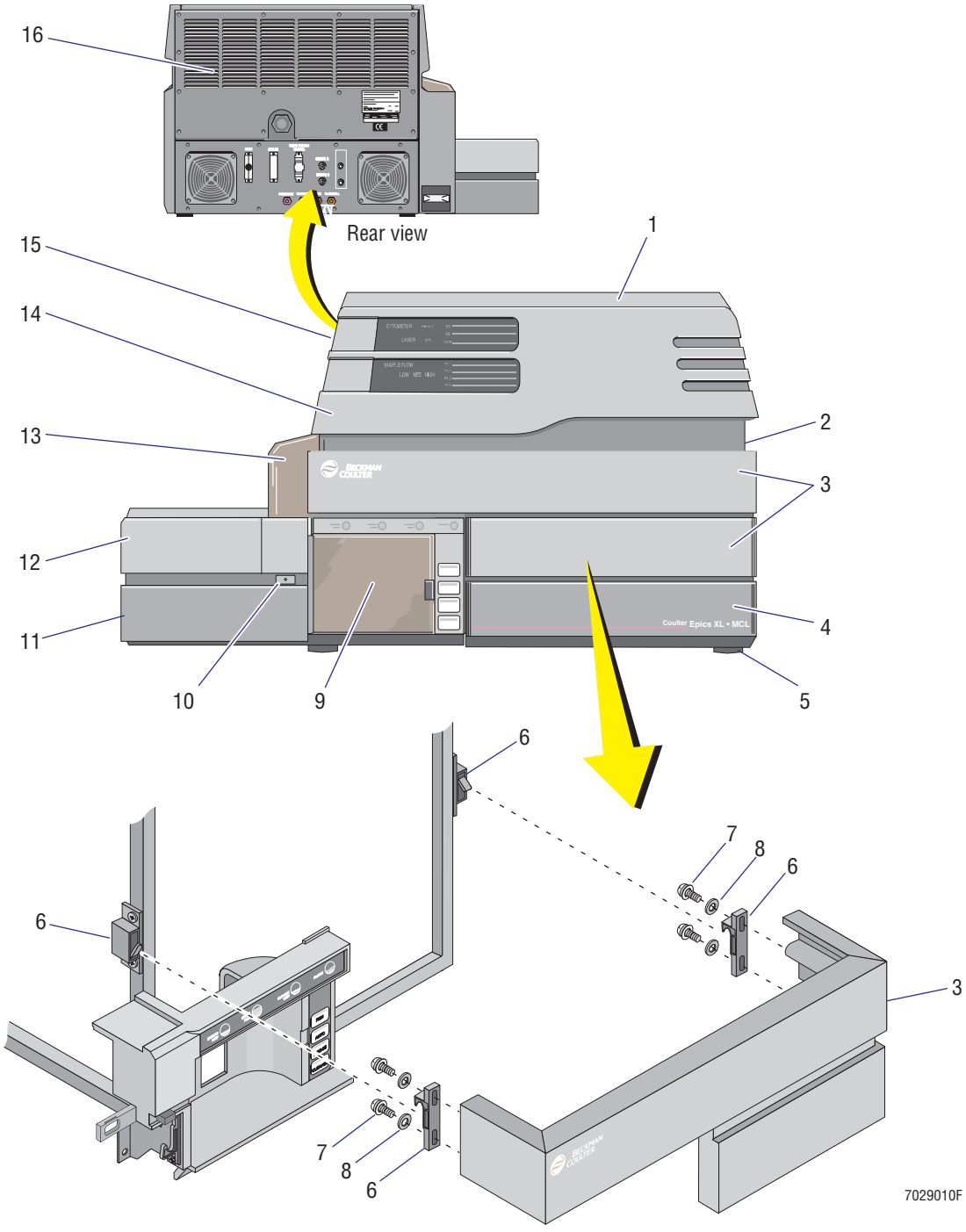


**Table 8.2-2 XL-MCL Cytometer Covers, Doors, and Latches (See Figure 8.2-2)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6807080<br>6858129 | Cover, top, grey<br>Cover, top, black<br>**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<br>6856494 | Cover, right-side, grey<br>Cover, right-side, black |
| 3 | 6807084<br>6856735 | Cover, filter, grey<br>Cover, filter, black |
| 4 | 7000677 | FRU, reagent drawer with slides assembly<br>**Note:** Order front panel separately - for grey flow cytometer order PN 6807088; for black flow cytometer order PN 6855934. |
| 5 | 6858988 | Foot, rubber<br>**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<br>**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<br>7000354 | FRU, sample station, manual, for XL-MCL Cytometer with grey covers<br>FRU, sample station, manual, for XL-MCL Cytometer with black covers<br>**Note:** See Figure 8.2-30 for an exploded view of components. |
| 10 | 6807075<br>6858700 | Push-button, for opening MCL upper base door, grey<br>Push-button, for opening MCL upper base door, black |
| 11 | 7000676<br>7000199 | FRU, MCL lower base cover, grey<br>FRU, MCL lower base cover, black |
| 12 | 7000675<br>7000376 | FRU, MCL door (upper cover), grey<br>FRU, MCL door (upper cover), black |
| 13 | 6858616 | Housing, MCL probe |
| 14 | 6807085<br>6856490 | Door, front panel display, grey<br>Door, front panel display, black<br>**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<br>6858522 | Cover, left-side, for XL-MCL Cytometer, grey<br>Cover, left-side, for XL-MCL Cytometer, black |
| 16 | 1025310<br>1018854 | Cover, upper rear, grey<br>Cover, upper rear, black |

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

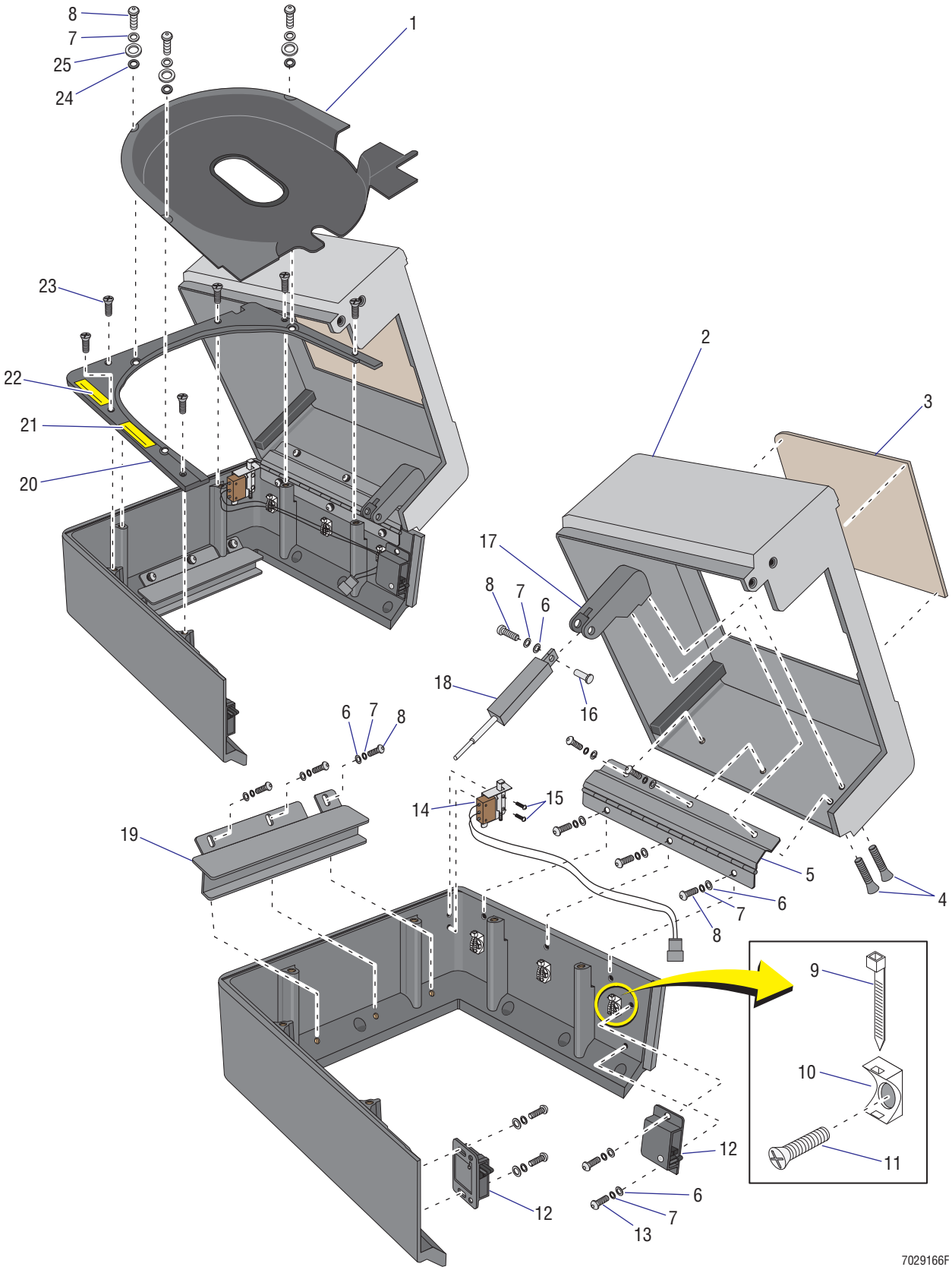


**Table 8.2-3 MCL Covers and Associated Hardware (See Figure 8.2-3)**

| 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<br>**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<br>**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)**

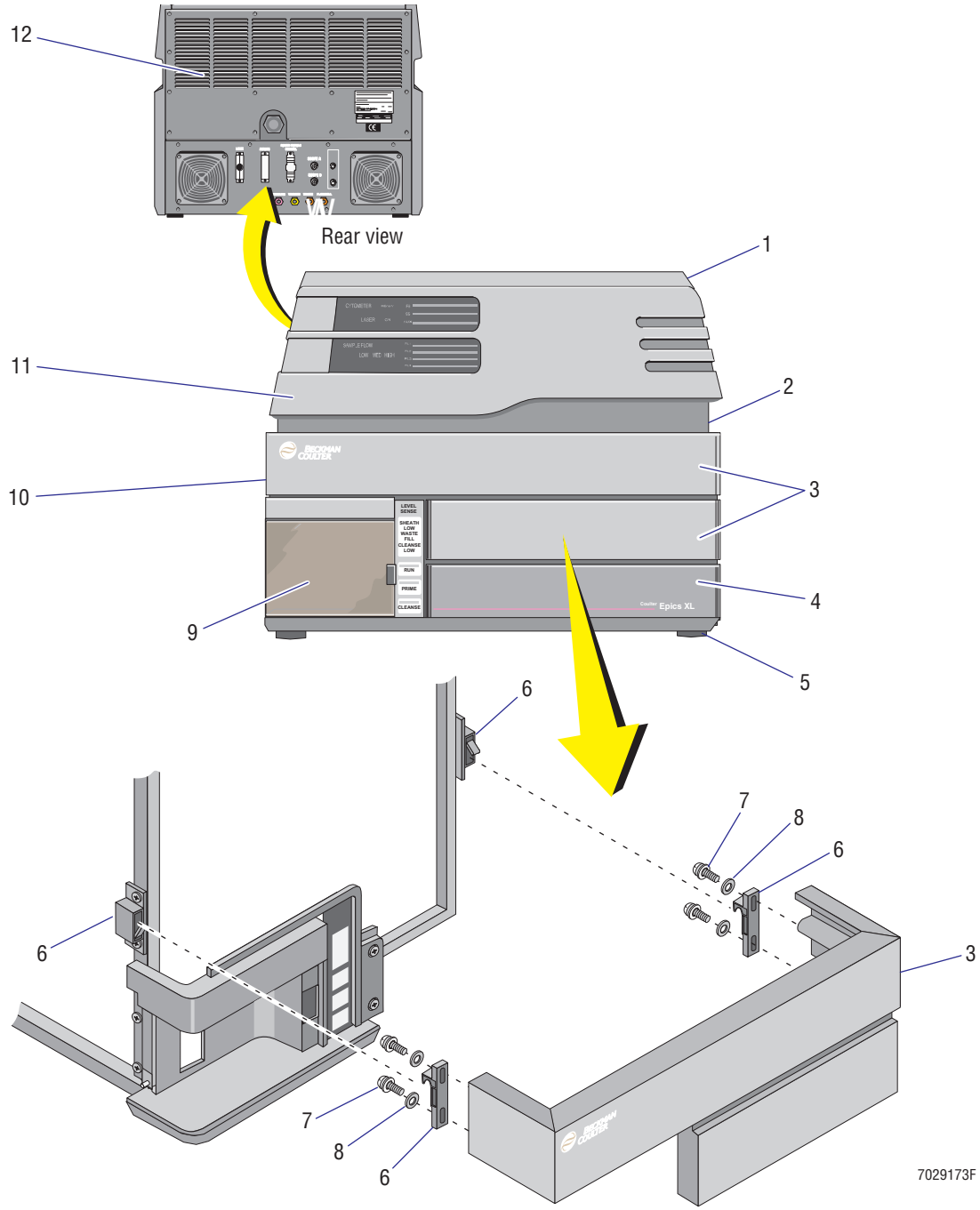


**Table 8.2-4 XL Cytometer Covers, Doors, and Latches (See Figure 8.2-4)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6807080<br>6858129 | Cover, top, grey<br>Cover, top, black<br>**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<br>6856494 | Cover, right-side, grey<br>Cover, right-side, black |
| 3 | 6807084<br>6856735 | Cover, filter, grey<br>Cover, filter, black |
| 4 | 7000677 | FRU, reagent drawer with slides assembly<br>**Note:** Order front panel separately - for grey flow cytometer order PN 6807089; for black flow cytometer order PN 6855934. |
| 5 | 6858988 | Foot, rubber<br>**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<br>**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<br>7000360 | FRU, sample station, for XL Cytometer, grey<br>FRU, sample station, for XL Cytometer, black<br>**Note:** See Figure 8.2-32 for an exploded view of components. |
| 10 | 6807074<br>6856727 | Cover, left-side, for XL Cytometer, grey<br>Cover, left-side, for XL Cytometer, black |
| 11 | 6807085<br>6856490 | Door, front panel display, grey<br>Door, front panel display, black<br>**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<br>1018854 | Cover, upper rear, grey<br>Cover, upper rear, black |

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

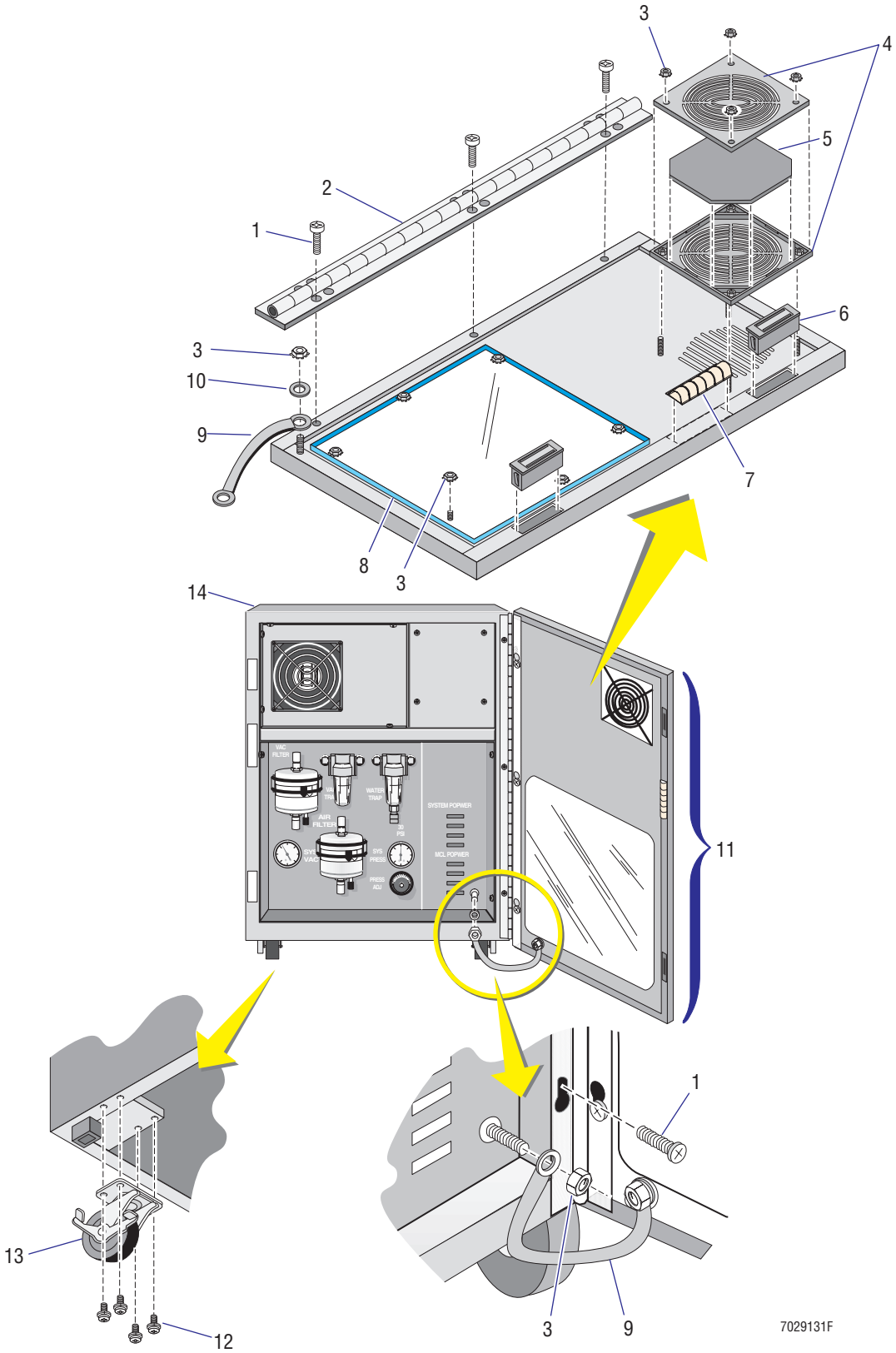


**Table 8.2-5 Power Supply Cover, Door, Latches, and Casters (See Figure 8.2-5)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 2806017 | Screw, machine (#6-32 x 0.38 in. length, pan-head)<br>**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<br>**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<br>6856160 | Assembly, front door, grey<br>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<br>6856369 | Cover, three-surface (left-side, top, right-side), grey<br>Cover, three-surface (left-side, top, right-side), black |

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

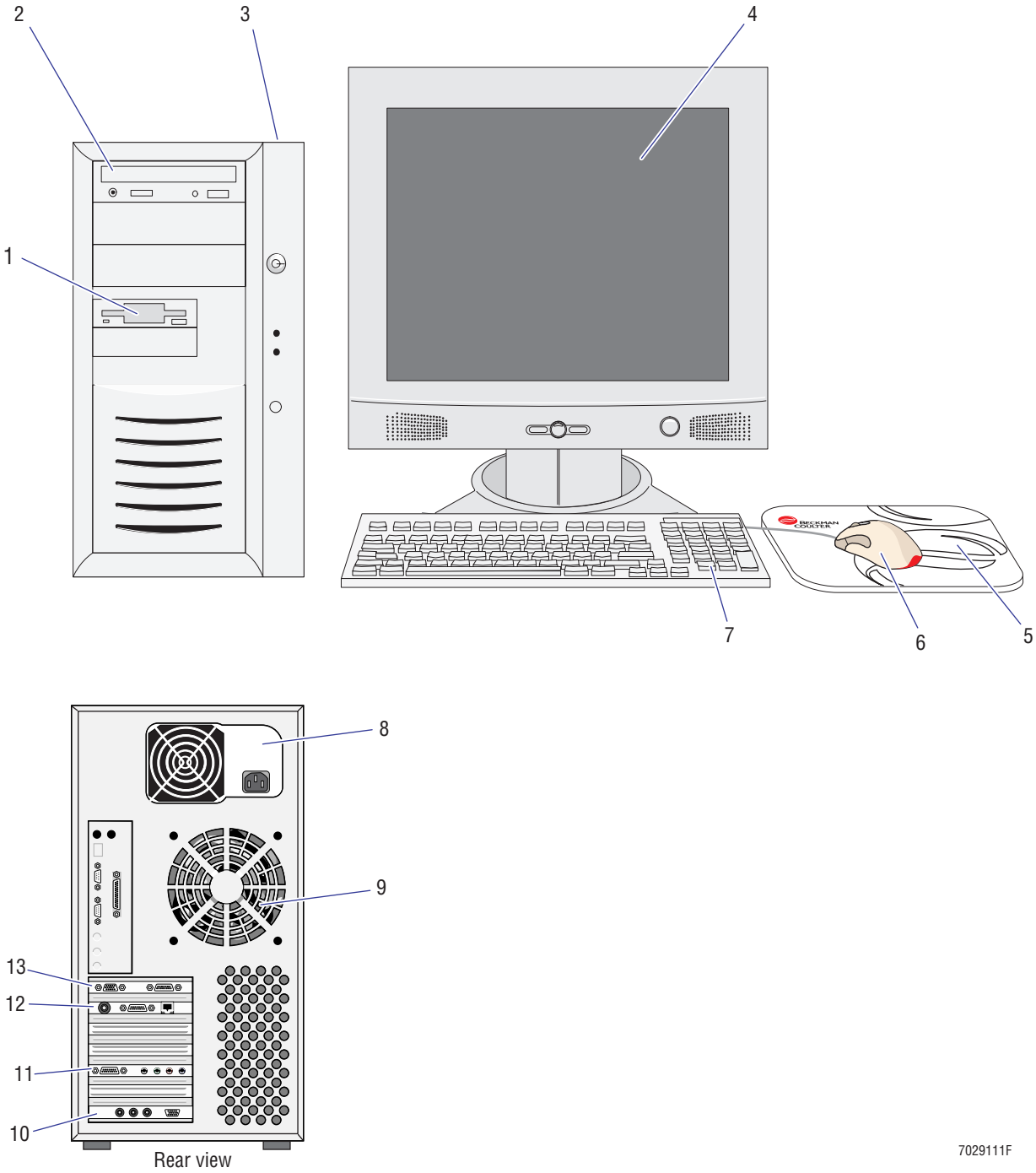


**Table 8.2-6 FlowCentre II Workstation (See Figure 8.2-6)**

| 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<br>2016951 | Monitor, 17-inch display, flat screen<br>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<br>6705355 | Card, Opto Transprocessor EXMEM II, EMC, 3 fiber connectors<br>Card, Opto Transprocessor EXMEM, non-EMC, 2 fiber connectors (not shown)<br>**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<br>**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 EXPO32 Cytometer Acquisition software |

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

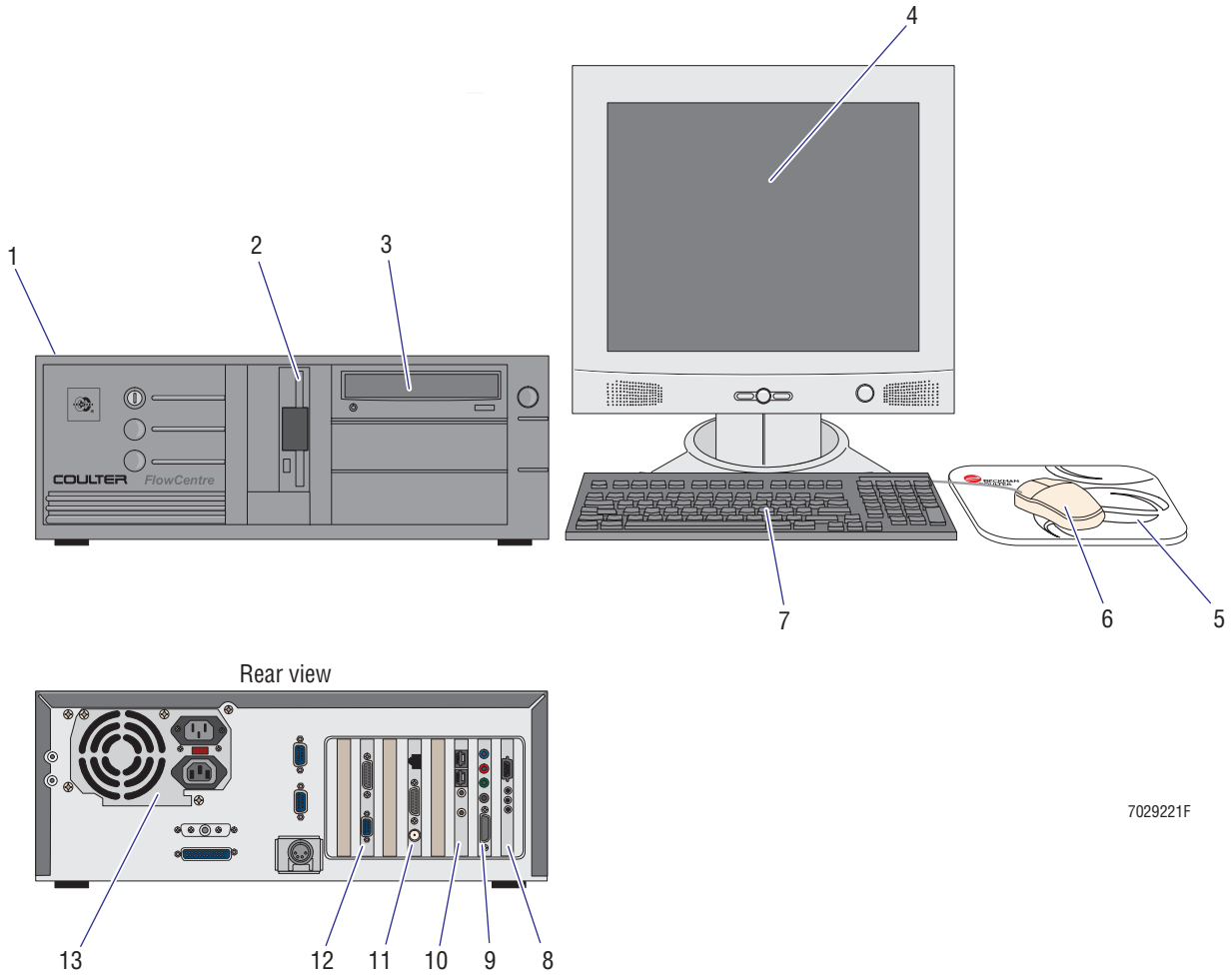


**Table 8.2-7 FlowCentre Workstation (See Figure 8.2-7)**

| 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<br>2016951 | Monitor, 17-inch display, flat screen<br>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<br>6705355 | Card, Opto Transprocessor EXMEM II, EMC, 3 fiber connectors<br>Card, Opto Transprocessor EXMEM, non-EMC, 2 fiber connectors (not shown)<br>**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<br>**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)**

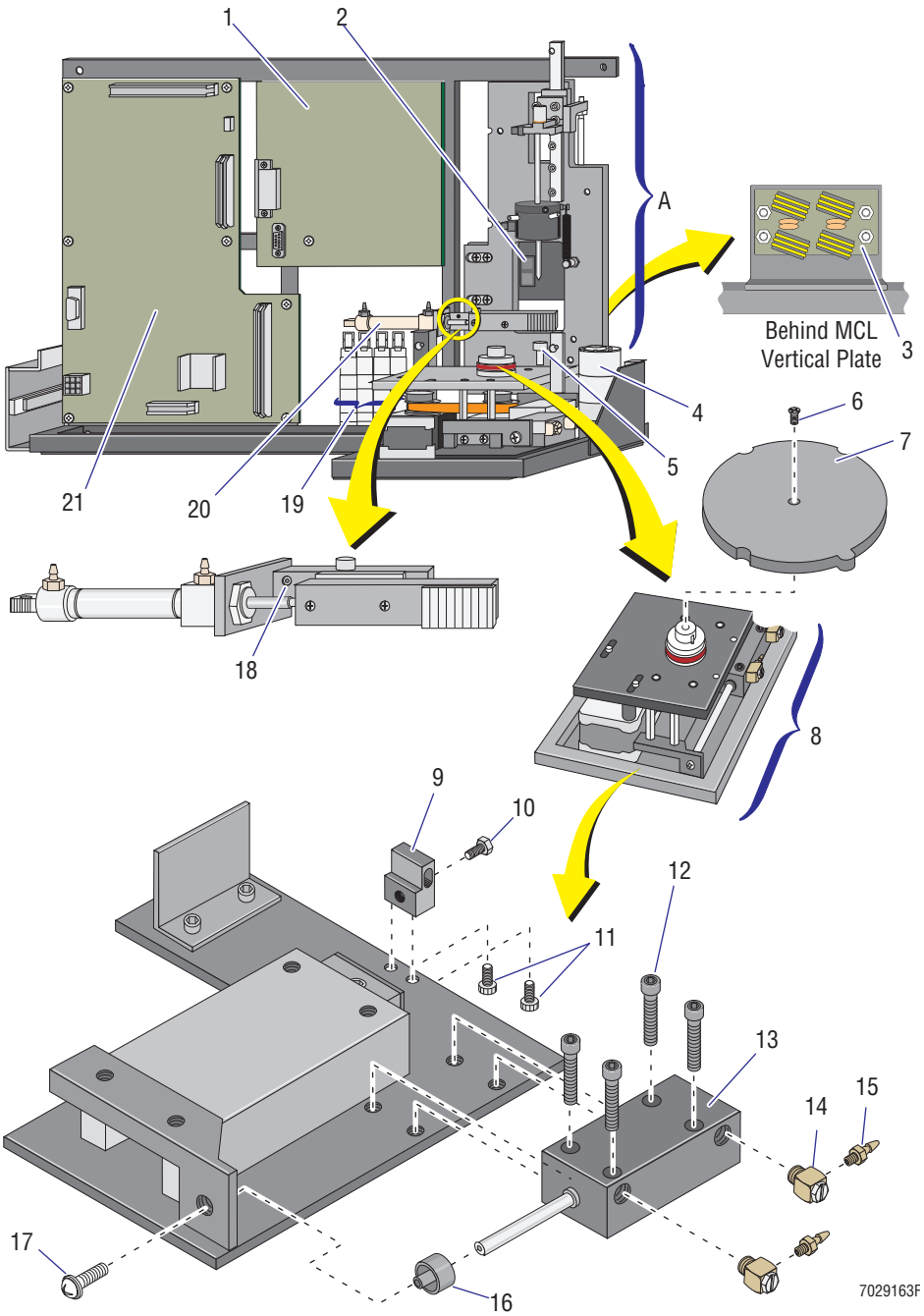



**Figure Reference**

**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)<br>**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<br>**Note:** Choke must be oriented as shown when installation is complete. |
| 16 | 2523700 | Coupling joint, cylinder rod end, 8-32 fastening, black oxide<br>**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<br>**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)**

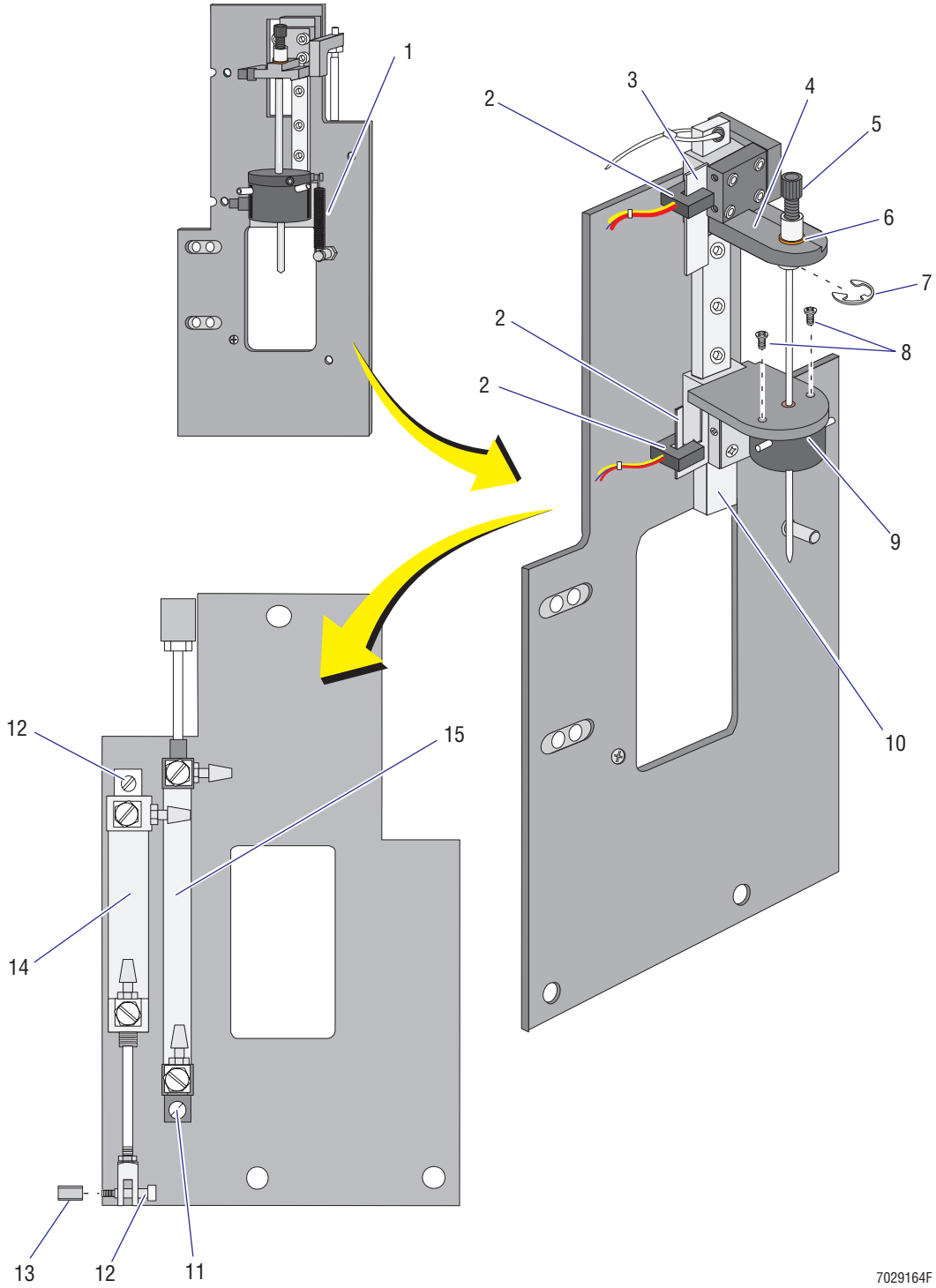


**Table 8.2-9 MCL Vertical Plate Components (See Figure 8.2-9)**

| 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<br>**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)**

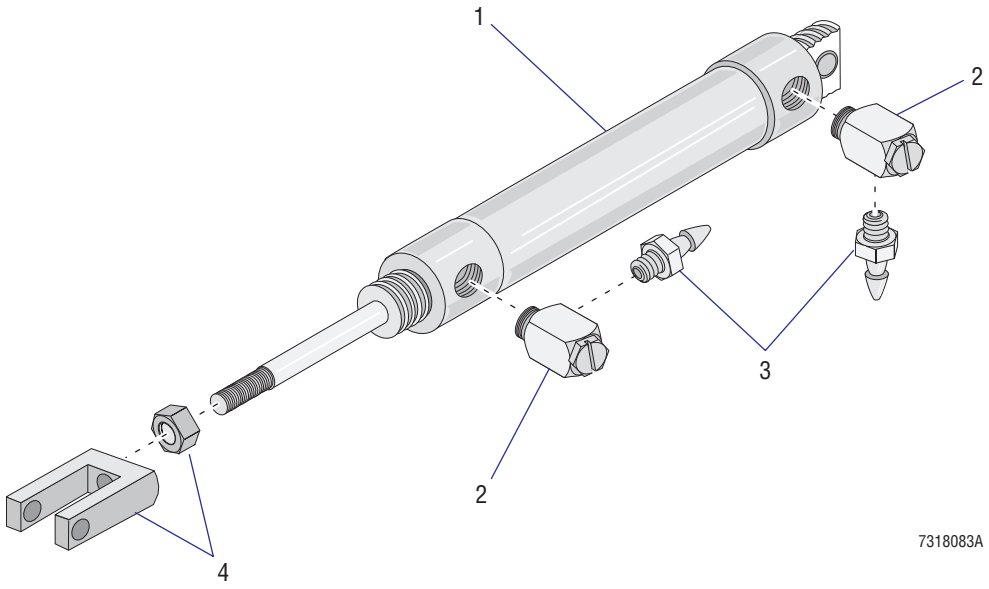



**Table 8.2-10 Lifter Air Cylinder and Attachments (See Figure 8.2-10)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6232591 | Cylinder, lifter air, double acting, 250 psi, 0.56 bore, stud mount each end<br>**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<br>**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)**

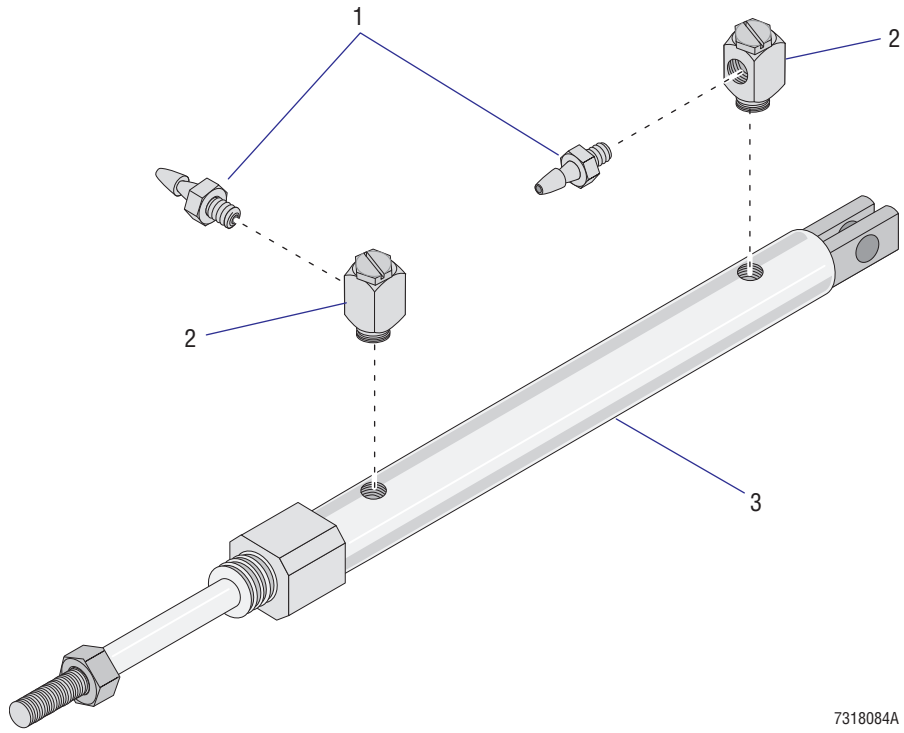



**Table 8.2-11 Probe Up/Down Air Cylinder and Attachments (See Figure 8.2-11)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6232637 | Choke, pneumatic, 0.0102 diameter, 0.062 barb and 10-32 threaded connections, brass<br>**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<br>**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)**

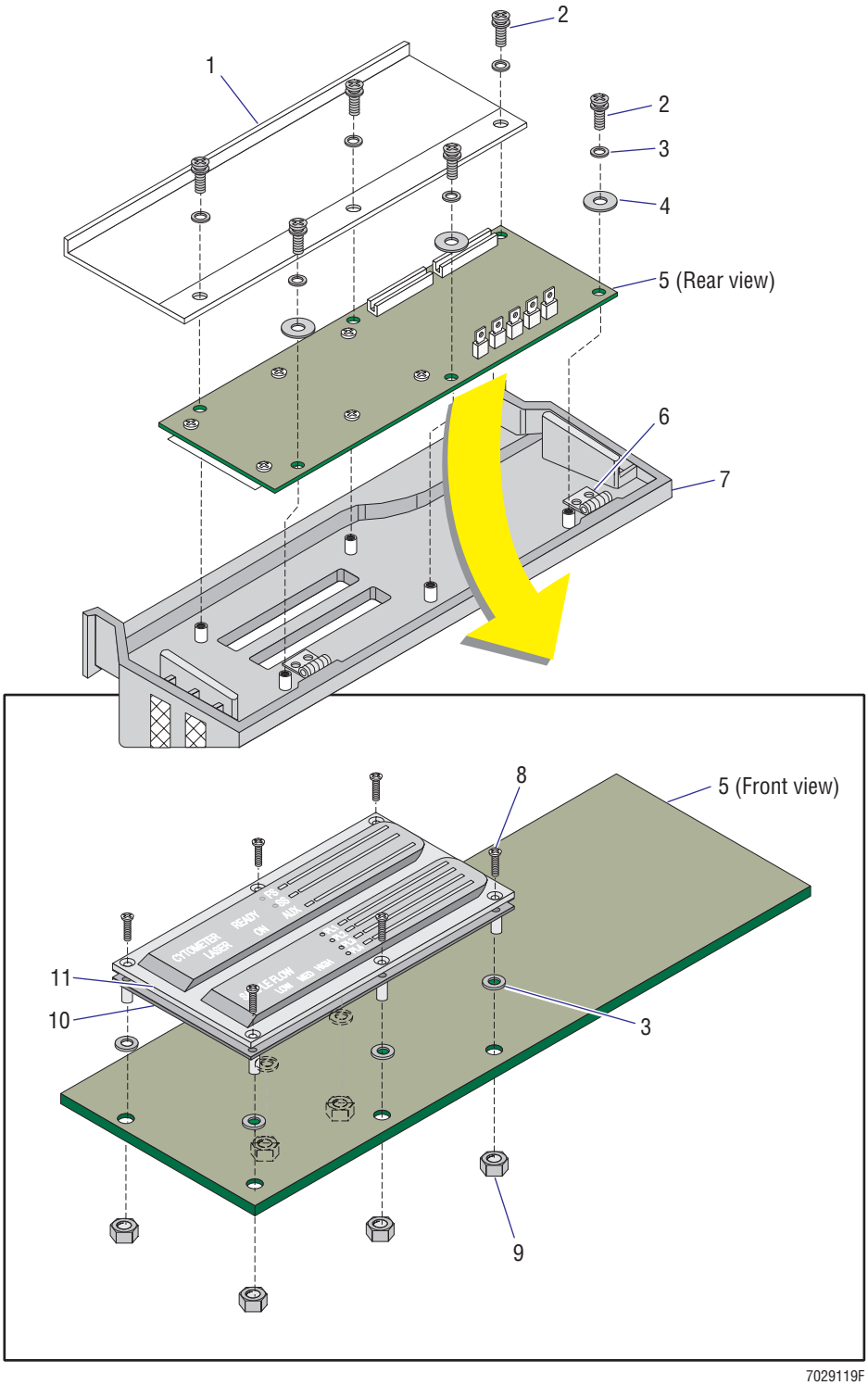


**Table 8.2-12 Front Display Panel (See Figure 8.2-12)**

| 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<br>**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<br>6856490 | Door, front panel display, grey<br>Door, front panel display, black |
| 8 | 2806084 | Screw, machine (#6-32 x 0.75 in. long, FL82 flat-head)<br>**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<br>**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)**

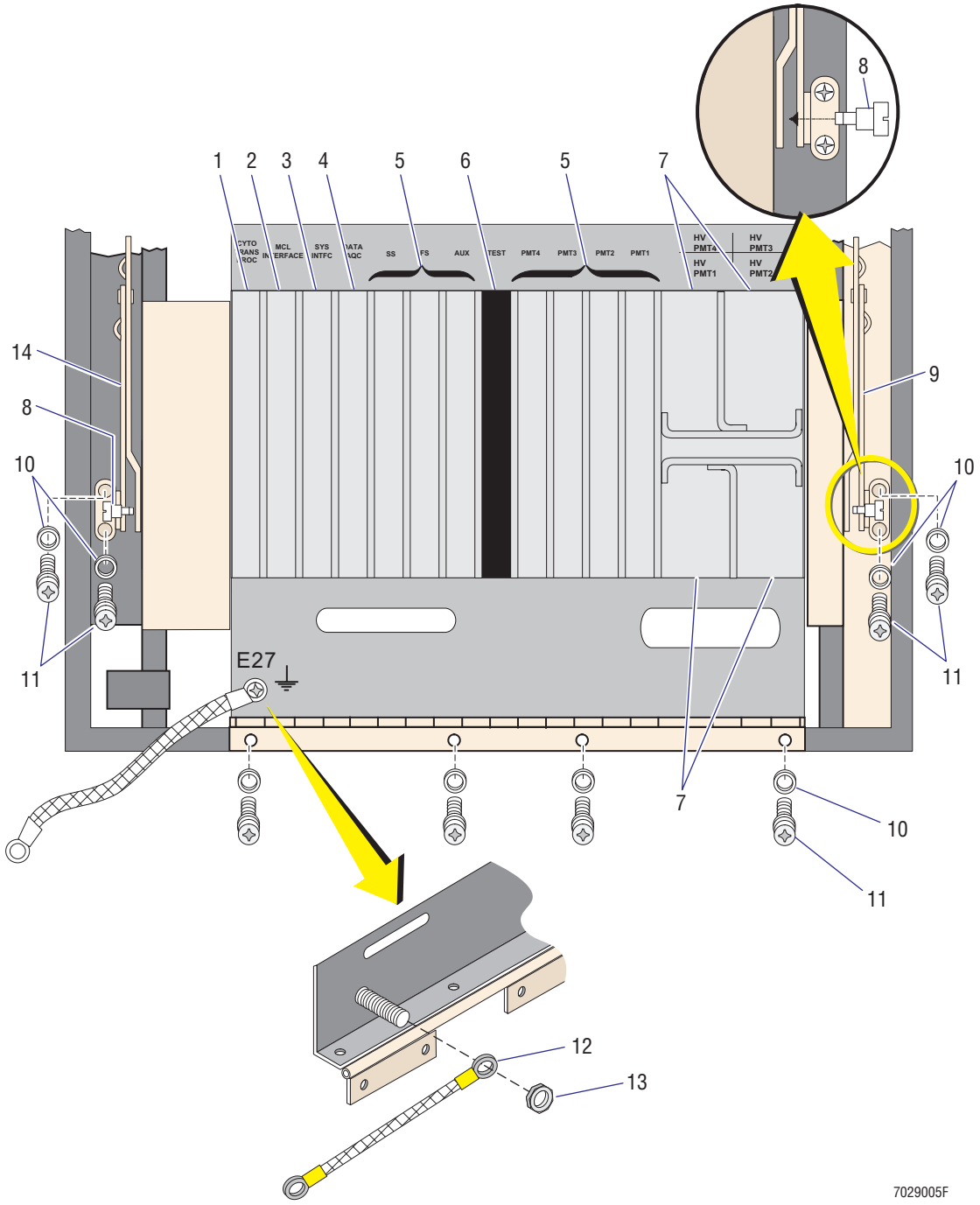


**Table 8.2-13 Data Acquisition Card Cage (See Figure 8.2-13)**

| 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)**

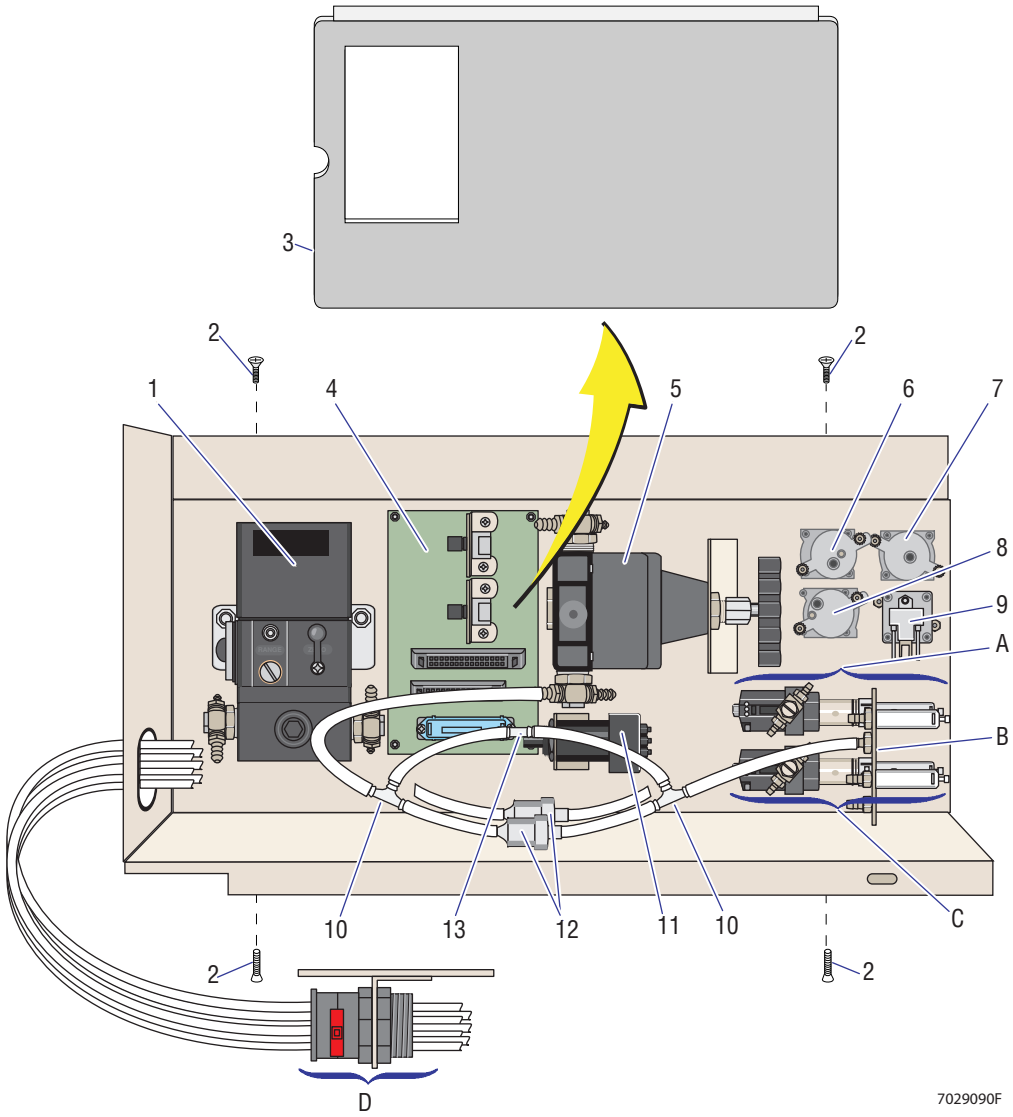



**Figure Reference**

**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

**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<br>**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<br>**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<br>**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<br>**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<br>**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<br>**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)**

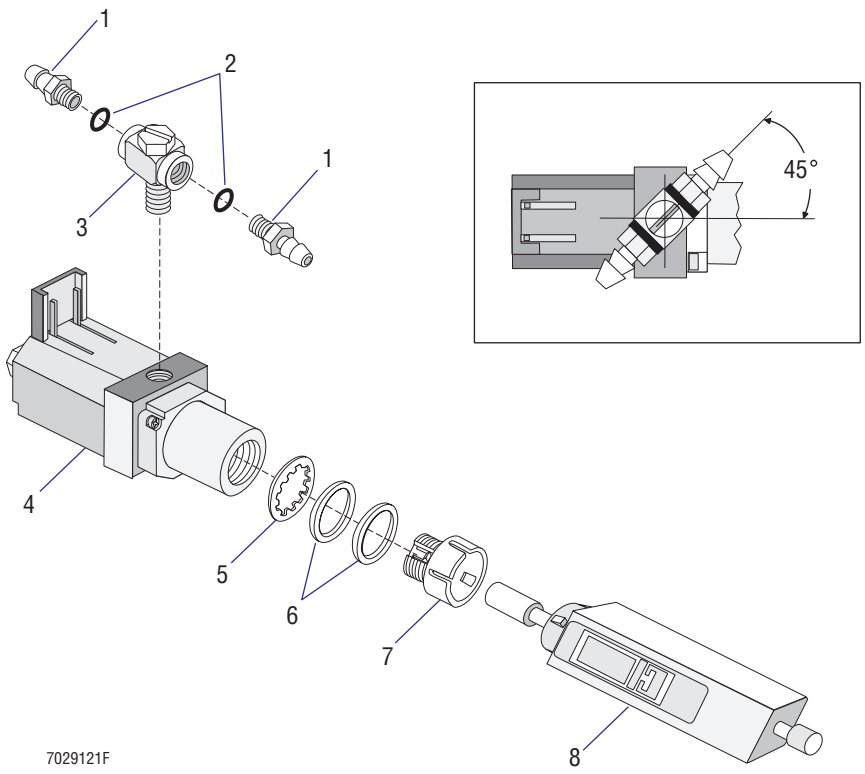



**Table 8.2-15 VL22 - Exploded View of Upper Valve (See Figure 8.2-15)**

| 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)**

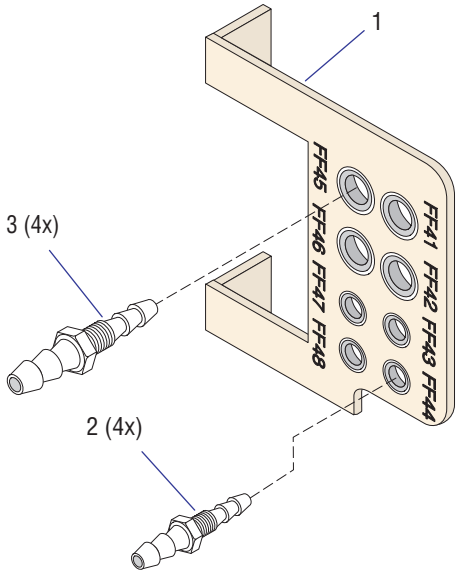



**Table 8.2-16 Bracket and Fittings - Upper Pneumatics Drawer (See Figure 8.2-16)**

| 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)**

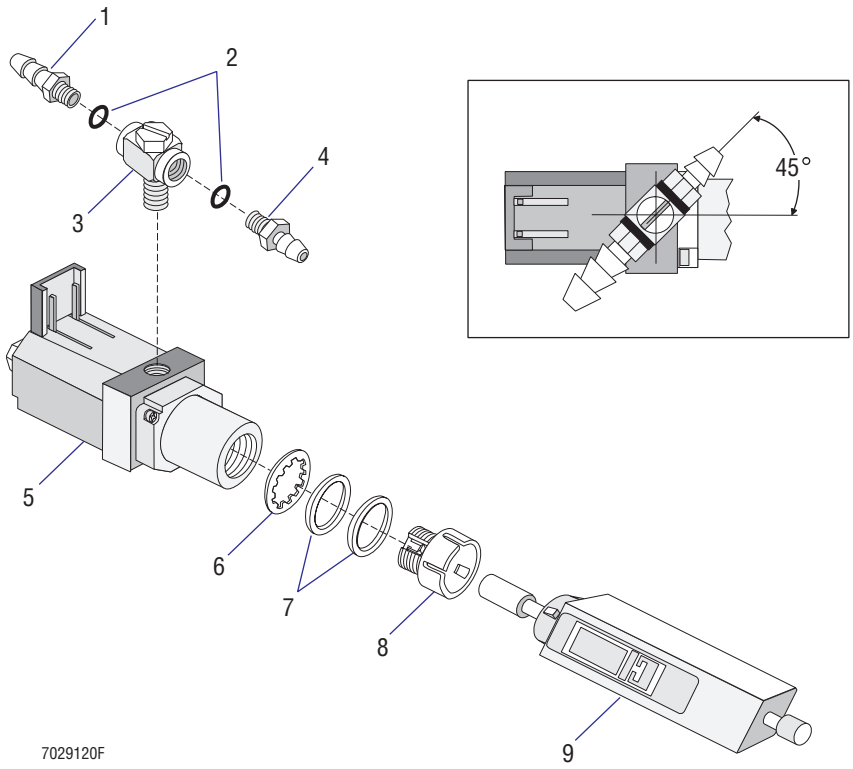



**Table 8.2-17 VL21 - Exploded View of Lower Valve (See Figure 8.2-17)**

| 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)**

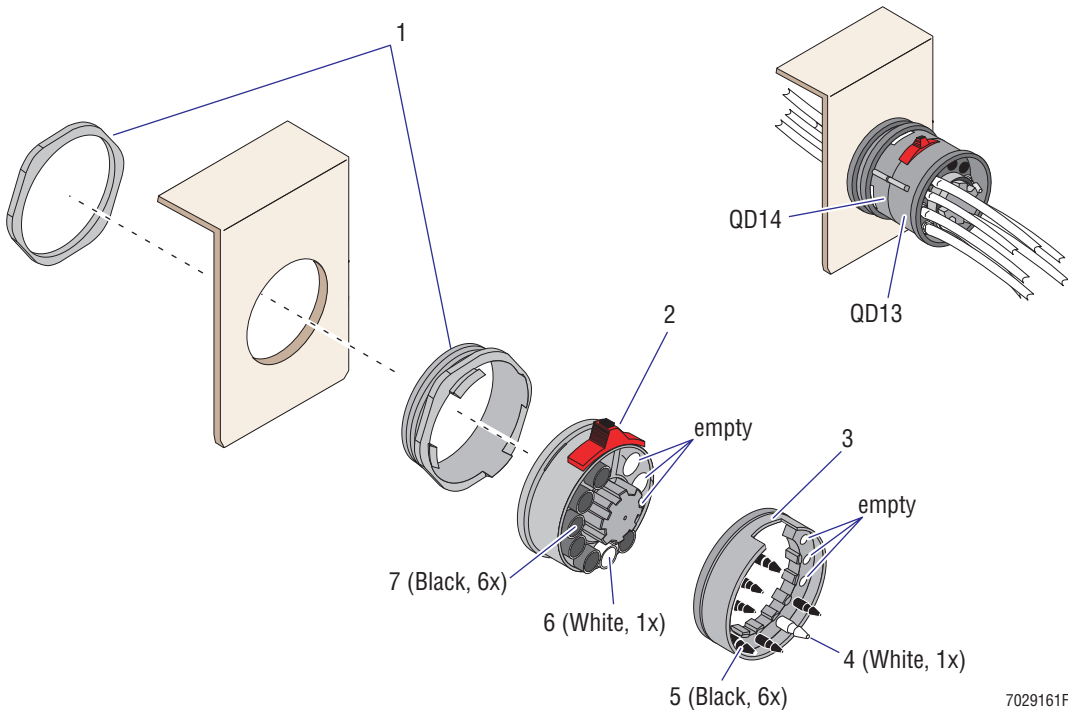



**Table 8.2-18 Quick Disconnects Below Upper Pneumatics Drawer (See Figure 8.2-18)**

| 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)**

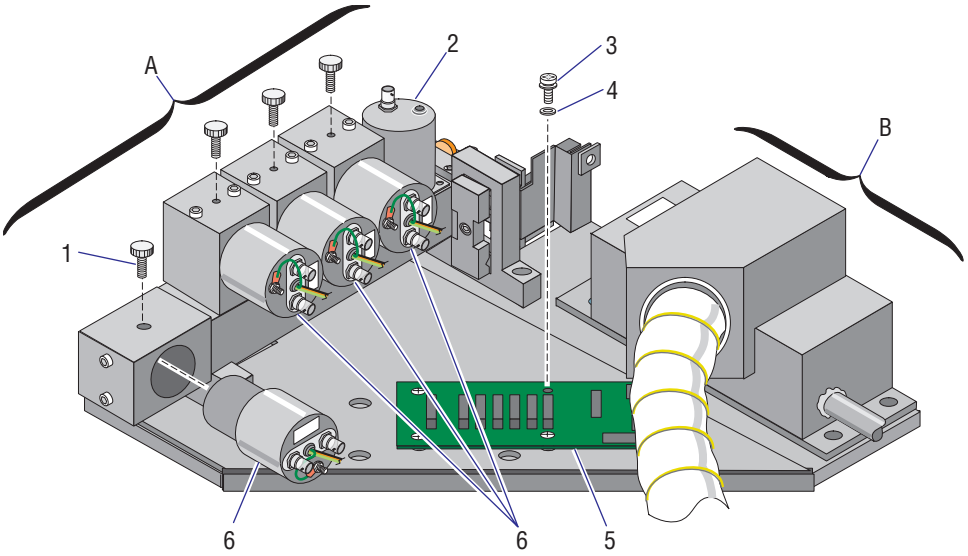



**Figure Reference**

**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)**

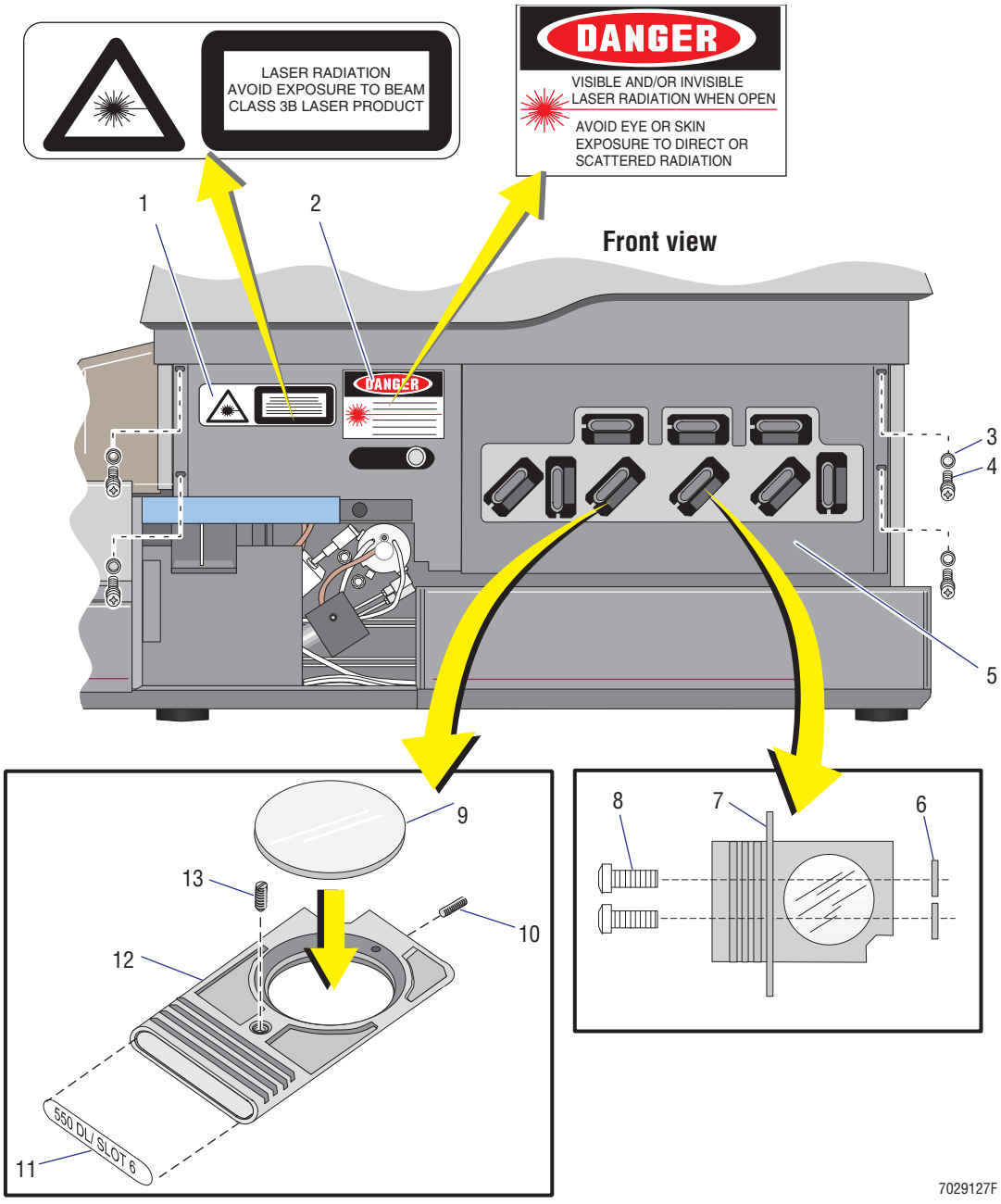


**Table 8.2-20 Optical Collection Area, Front View (See Figure 8.2-20)**

| 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)**

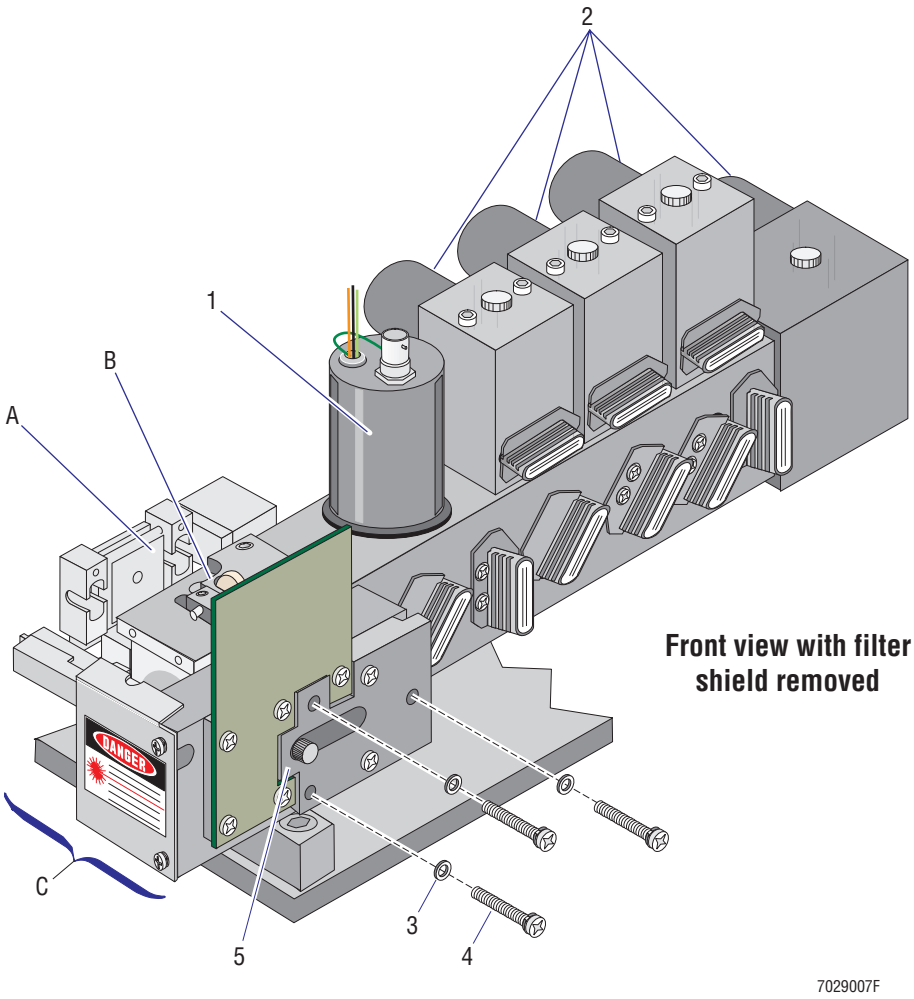



**Figure Reference**

**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)**

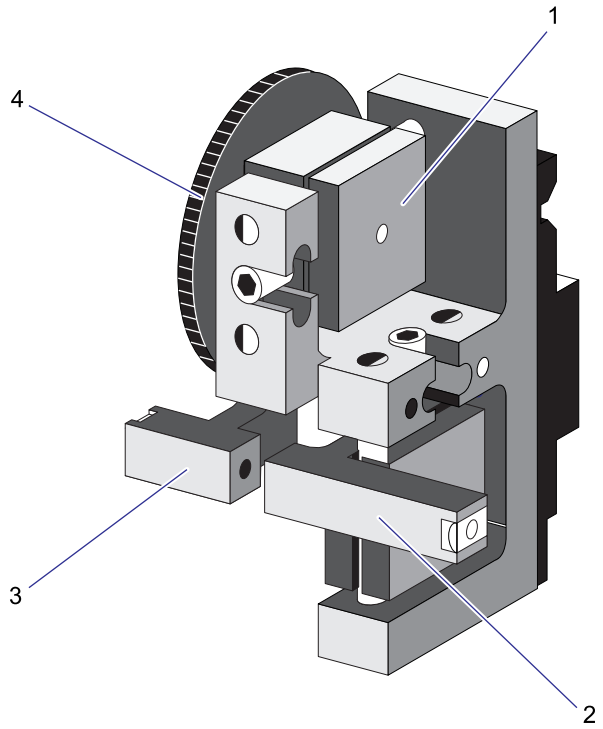



**Table 8.2-22 Beam-Shaping Stage Components (See Figure 8.2-22)**

| 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)**

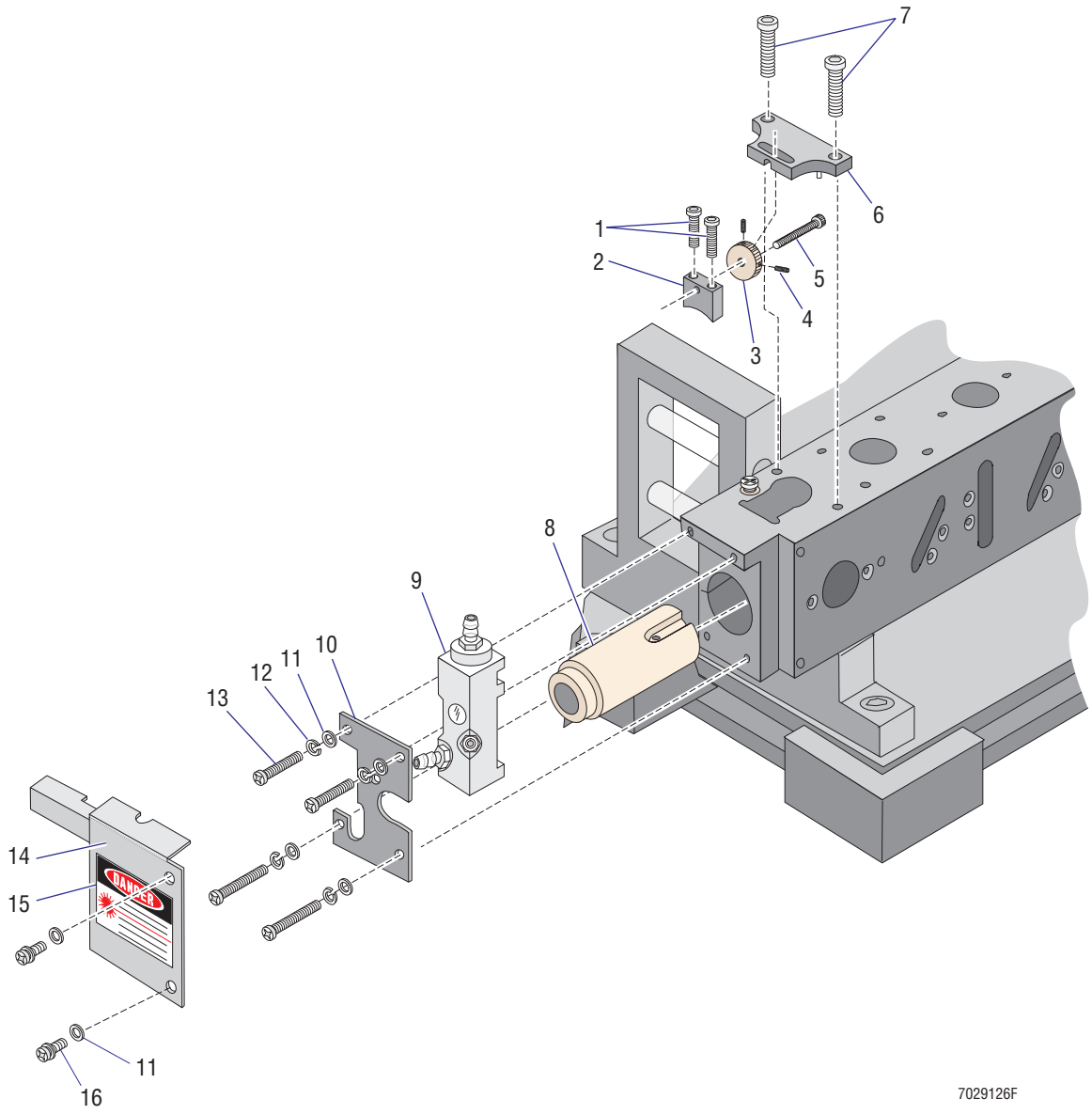


**Table 8.2-23 Flow Cell and Fluorescence Pickup Lens with Associated Hardware (See Figure 8.2-23)**

| 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)**

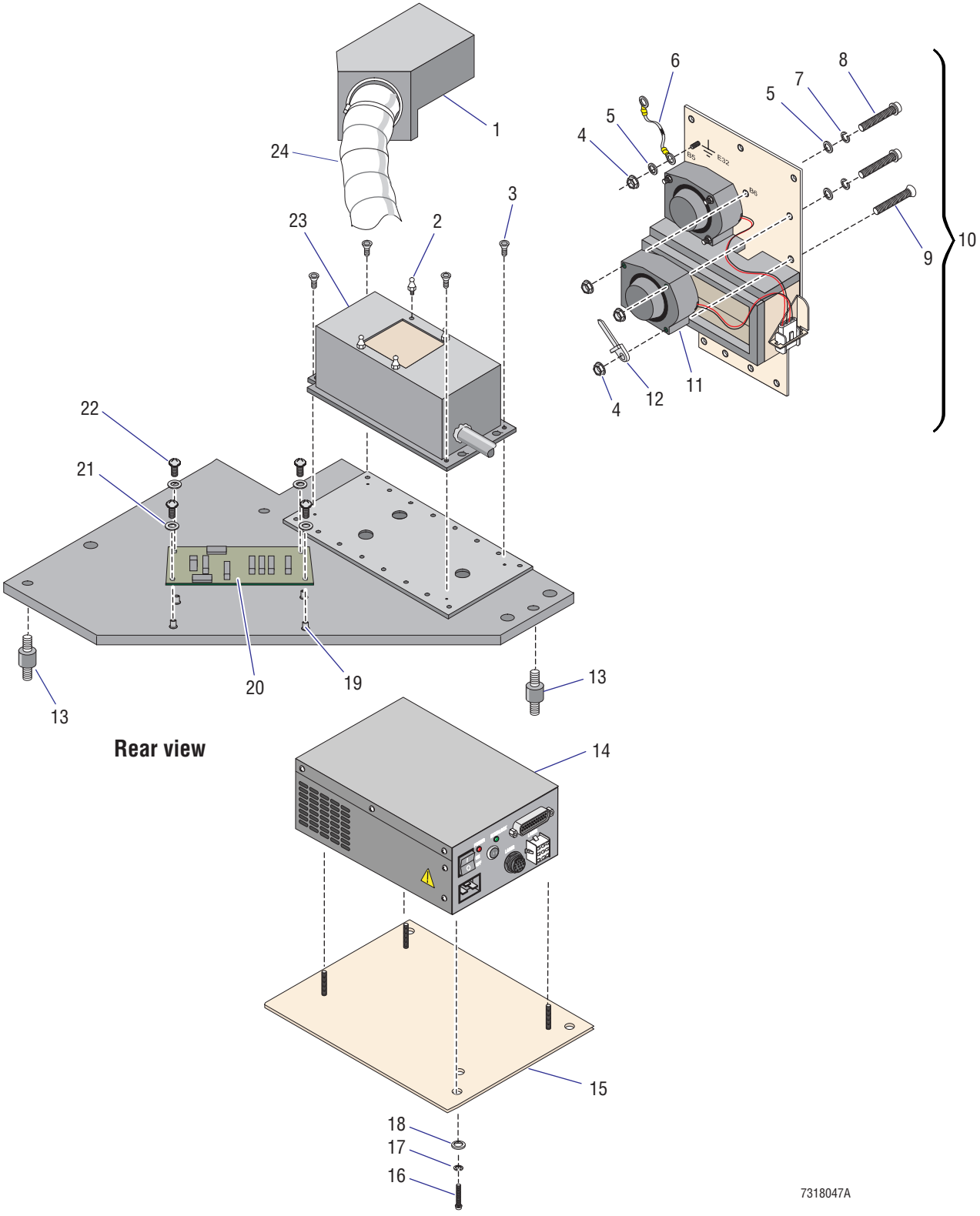


**Table 8.2-24 Argon Laser, Power Supply, and Mounting Hardware (See Figure 8.2-24)**

| 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<br>**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)<br>**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)**

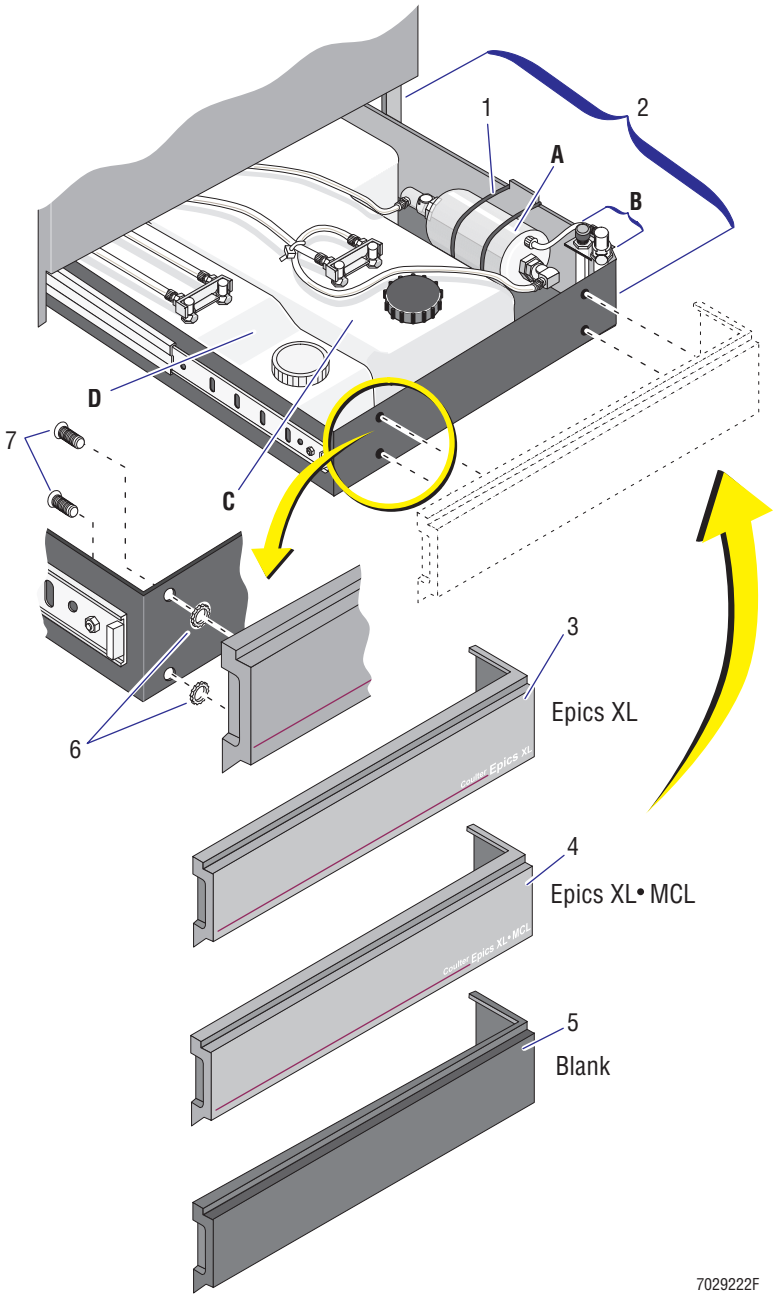



**Figure Reference**

**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

**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)**

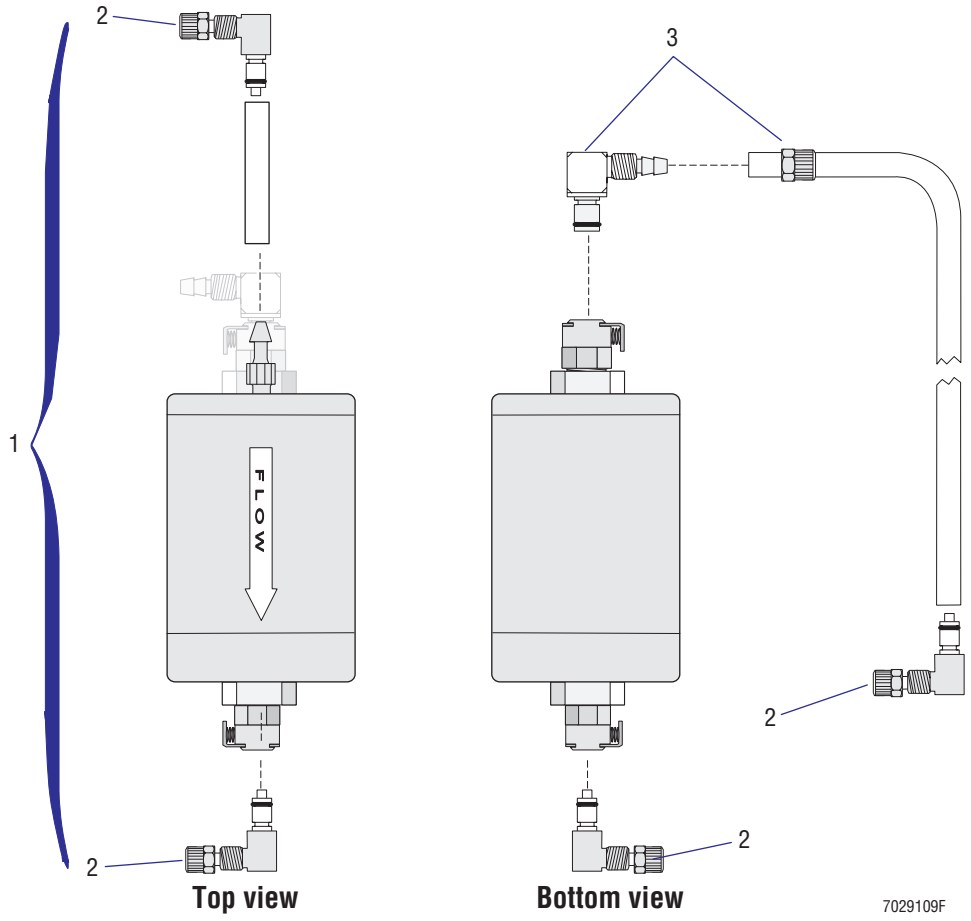


**Table 8.2-26 Sheath Liquid Filter (See Figure 8.2-26)**

| 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)**

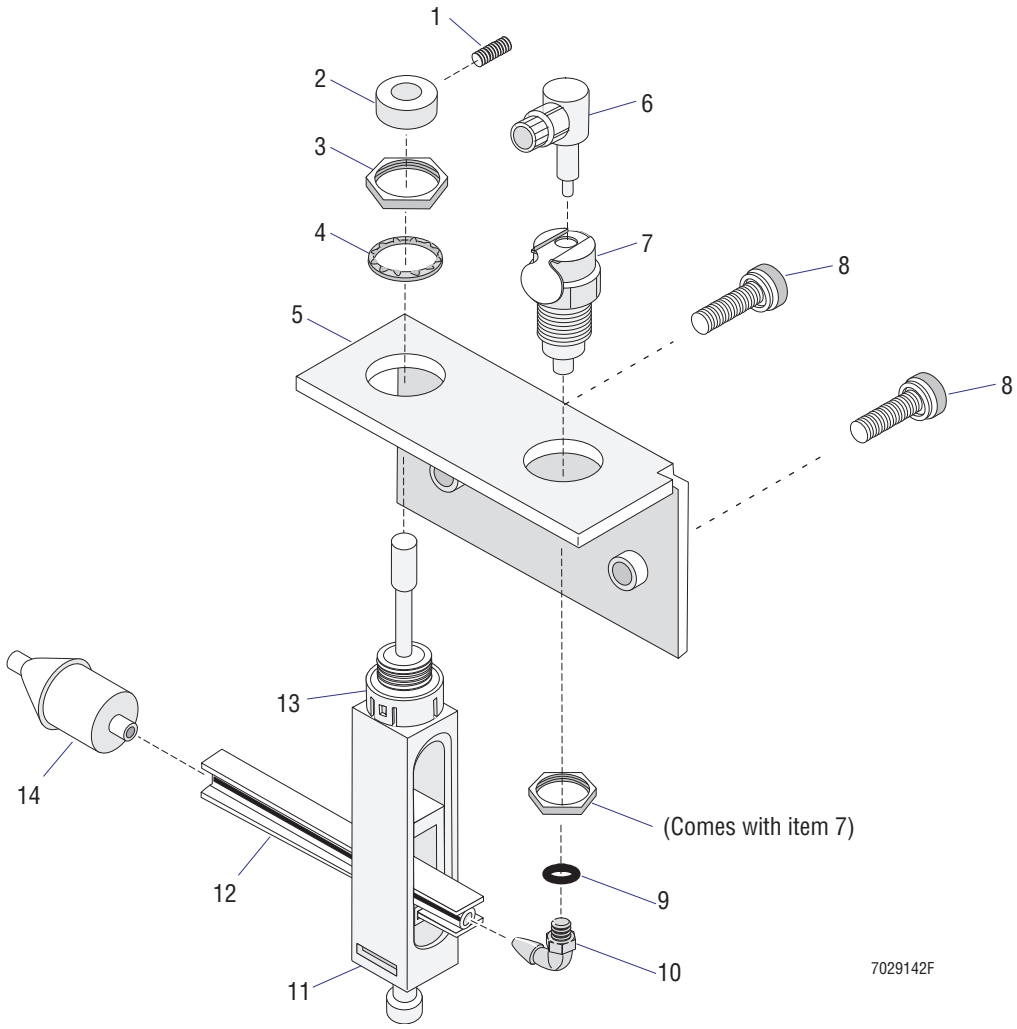


**Table 8.2-27 Sheath Liquid Filter Purge (Vent) Connections (See Figure 8.2-27)**

| 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<br>**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)**

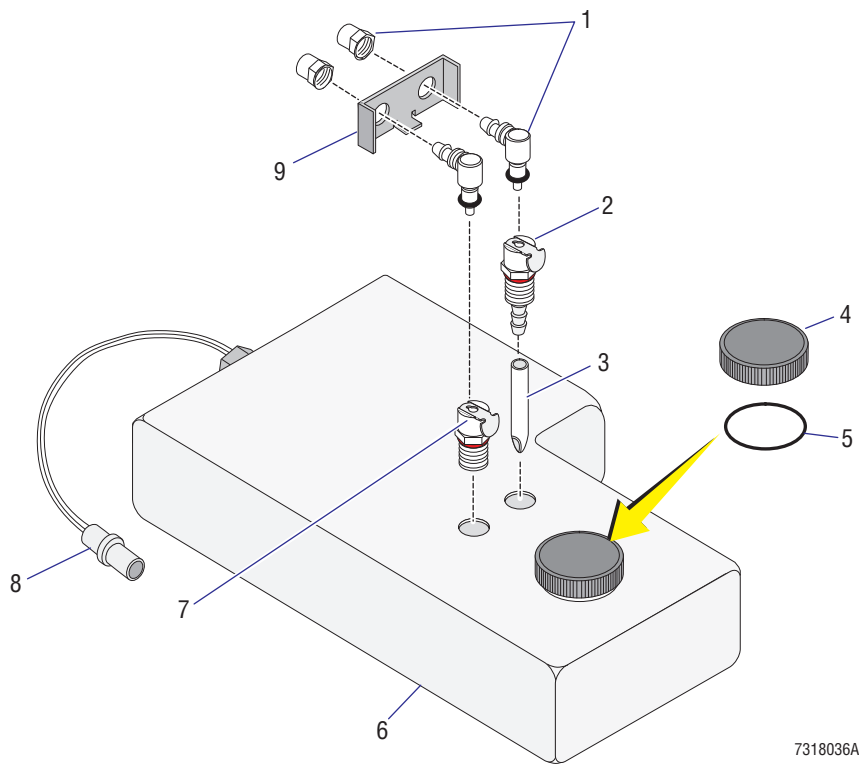



**Table 8.2-28 Sheath Container (See Figure 8.2-28)**

| 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)**

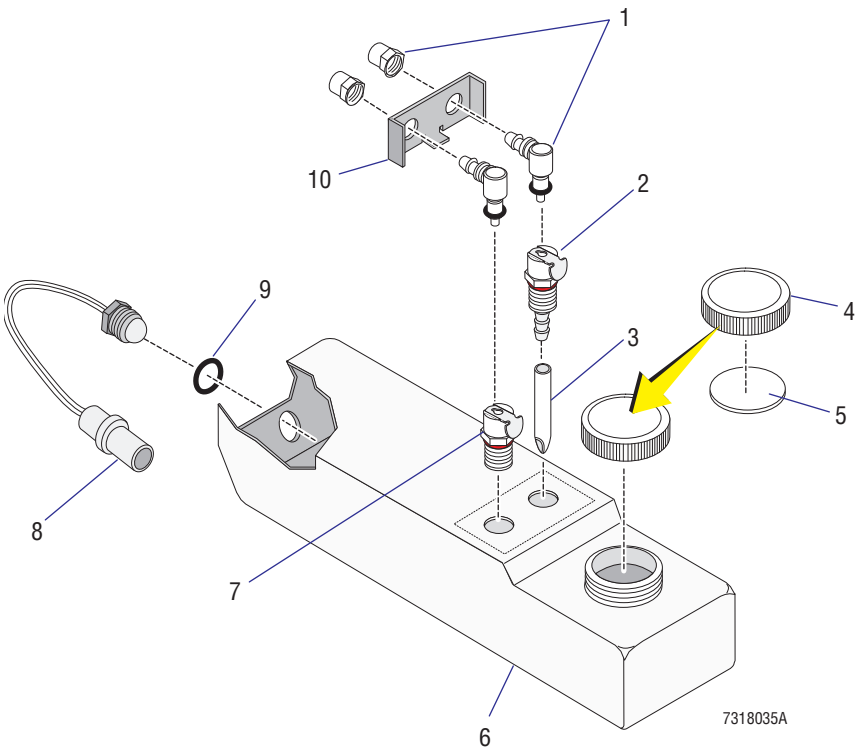
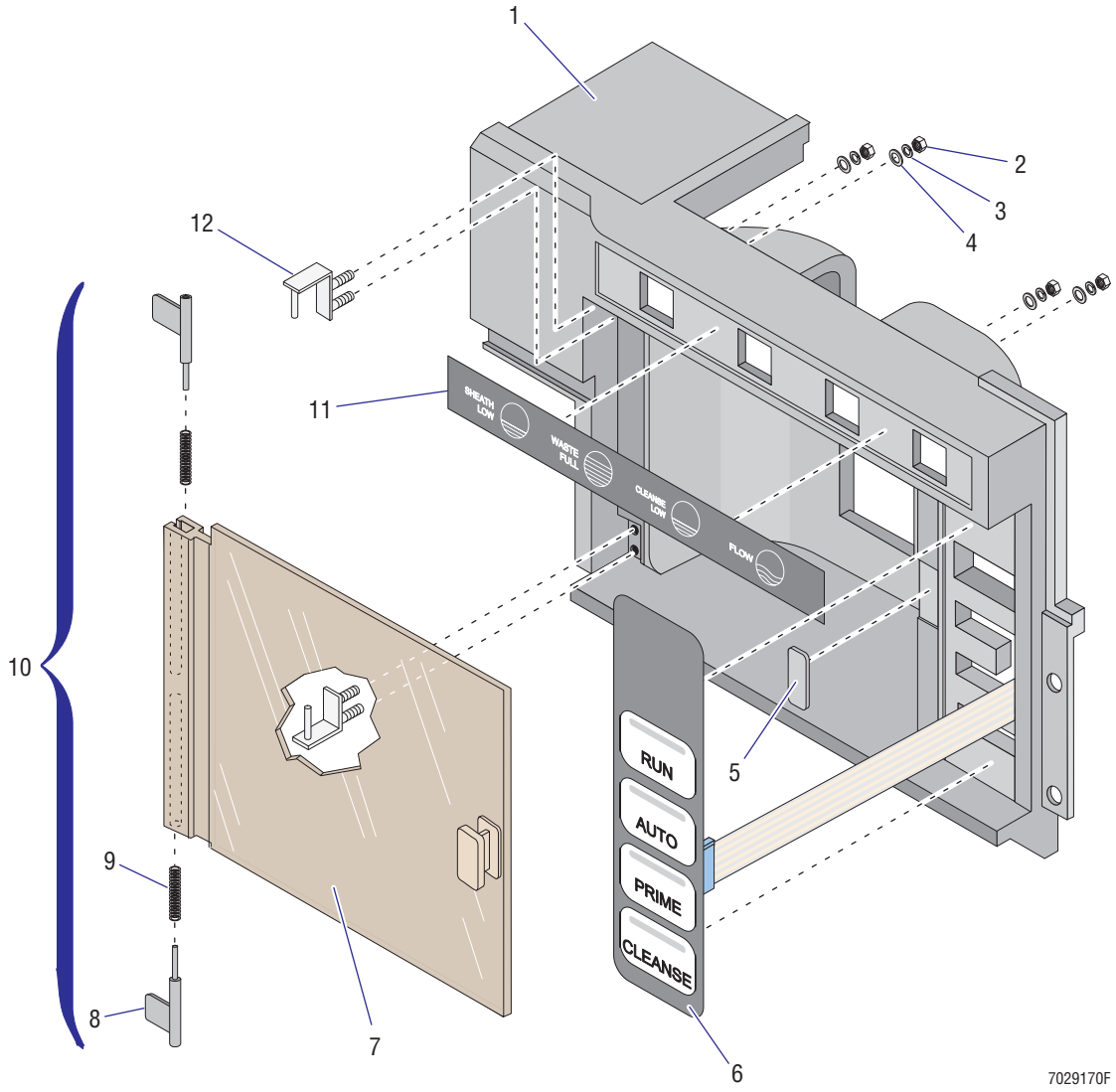



**Table 8.2-29 Cleaning Agent Container (See Figure 8.2-29)**

| 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<br>**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)**

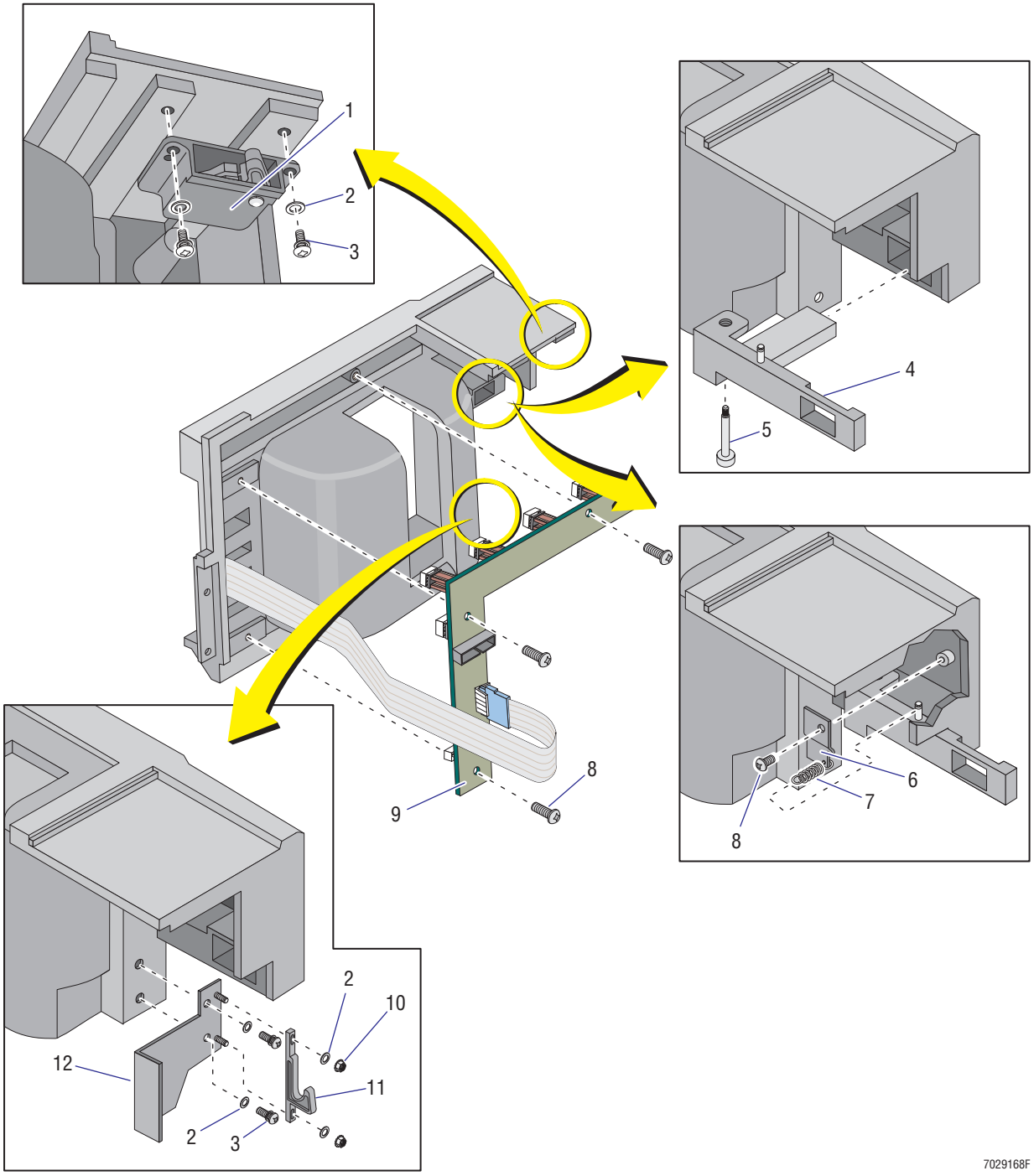



**Note:** See Figure 8.2-31 for the rear view of the manual sample station on an XL-MCL flow cytometer.

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

| Item | Part Number | Description |
|---|---|---|
| | 7000678<br>7000354 | FRU, manual sample station, for XL-MCL Cytometer with grey covers<br>FRU, manual sample station, for XL-MCL Cytometer with black covers |
| 1 | 6807081<br>6858518 | Sample station, for an XL-MCL with grey covers<br>Sample station, for an XL-MCL with black covers<br>**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<br>**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<br>**Note:** Verify proper orientation before attaching. |

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




**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<br>7000354 | FRU, manual sample station, for XL-MCL Cytometer with grey covers<br>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<br>**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<br>**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)<br>**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.<br>**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<br>**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)**

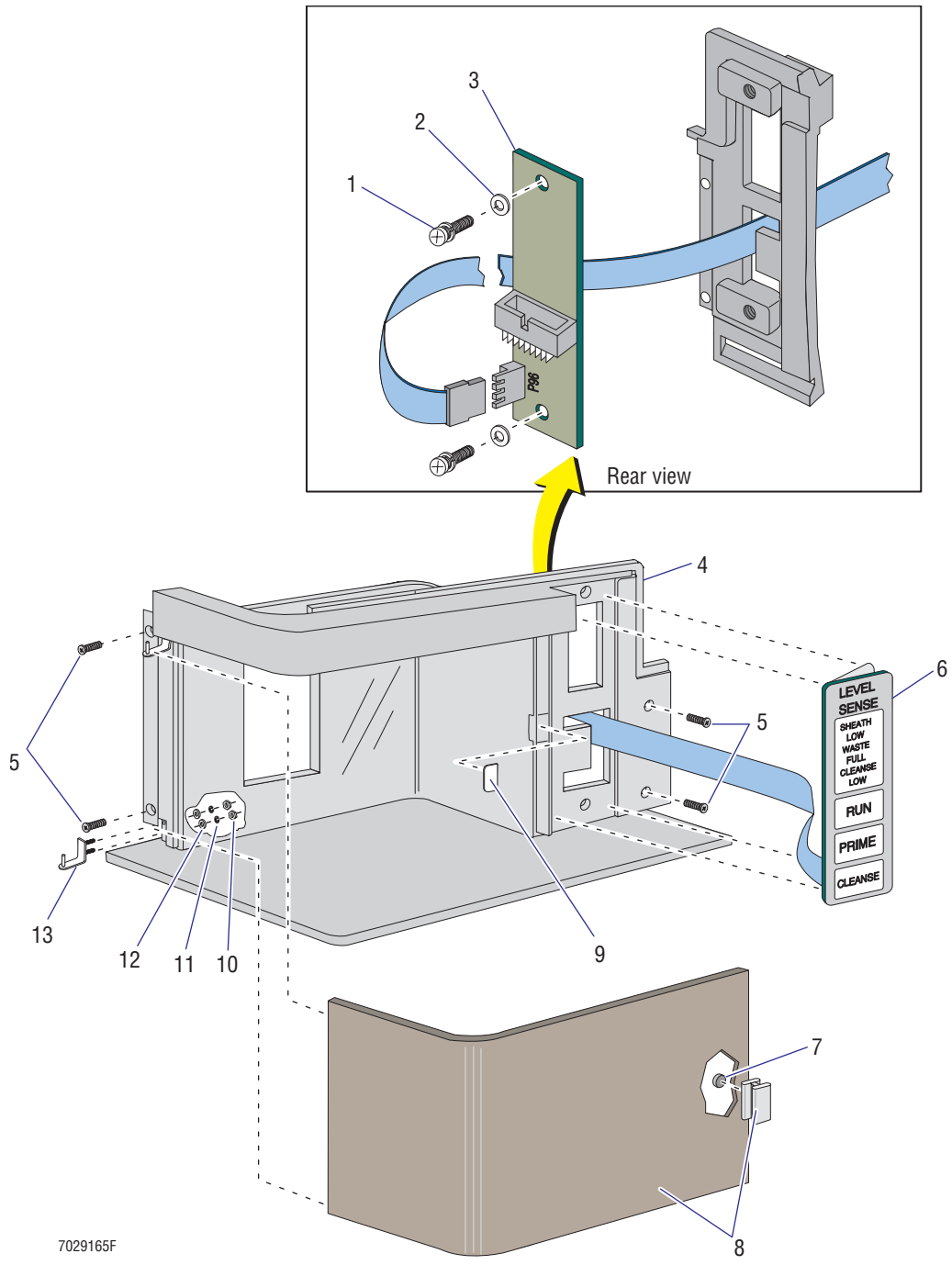


**Table 8.2-32 Sample Station for XL Cytometer (See Figure 8.2-32)**

| Item | Part Number | Description |
|---|---|---|
| | 7000679<br>7000360 | FRU, sample station assembly, for XL Cytometer with grey covers<br>FRU, sample station assembly, for XL Cytometer with black covers<br>**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<br>6856869 | Sample station, for an XL with grey covers<br>Sample station, for an XL with black covers<br>**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<br>**Note:** Before installation, remove paper backing. |
| 7 | 2523394 | Magnet, disk, rare earth, 0.187 o.d. x 0.063 thickness<br>**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<br>**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)**

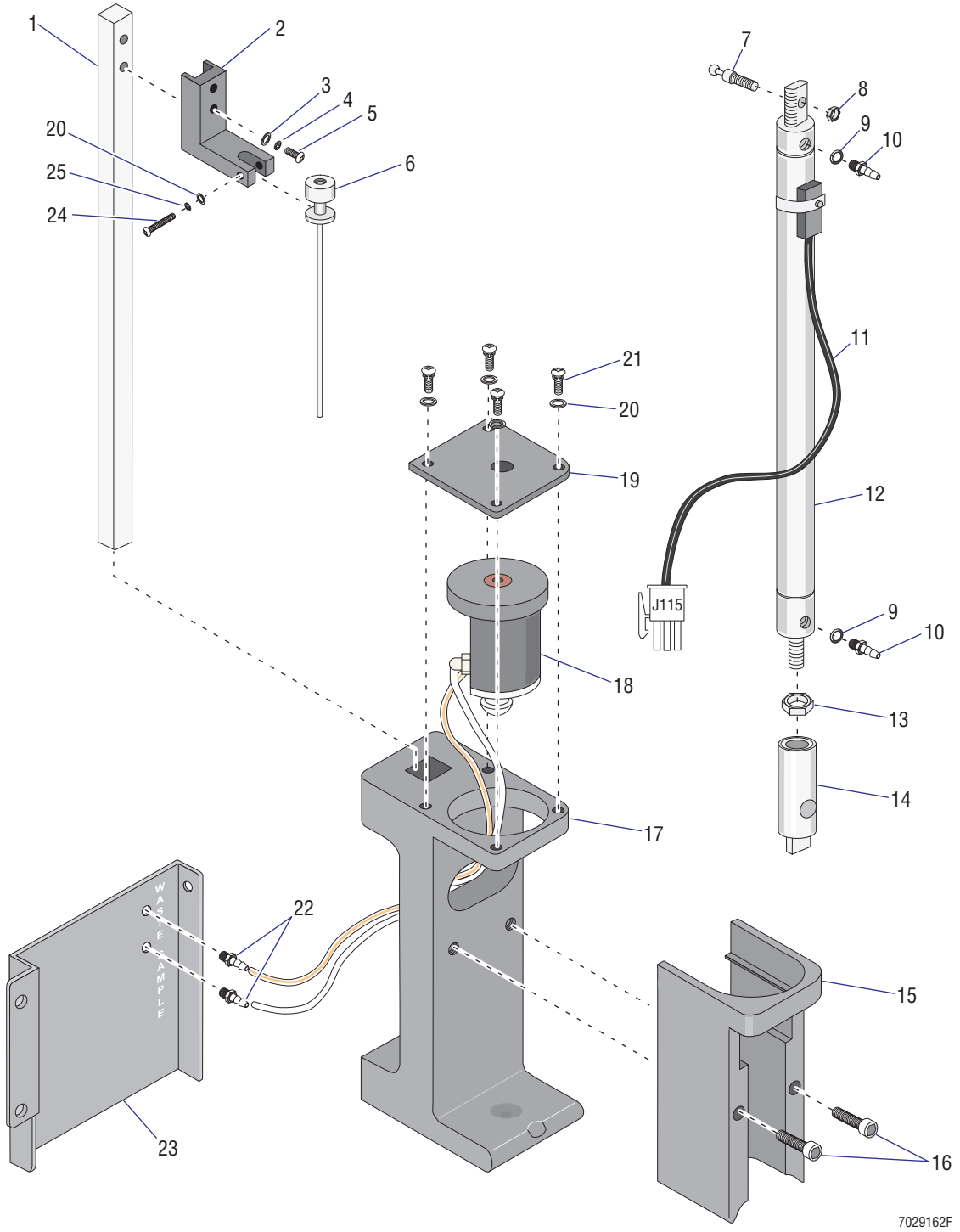


**Table 8.2-33 Sample Station for XL-MCL and XL Cytometers - Mechanical Assembly (See Figure 8.2-33)**

| 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)<br>**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)**

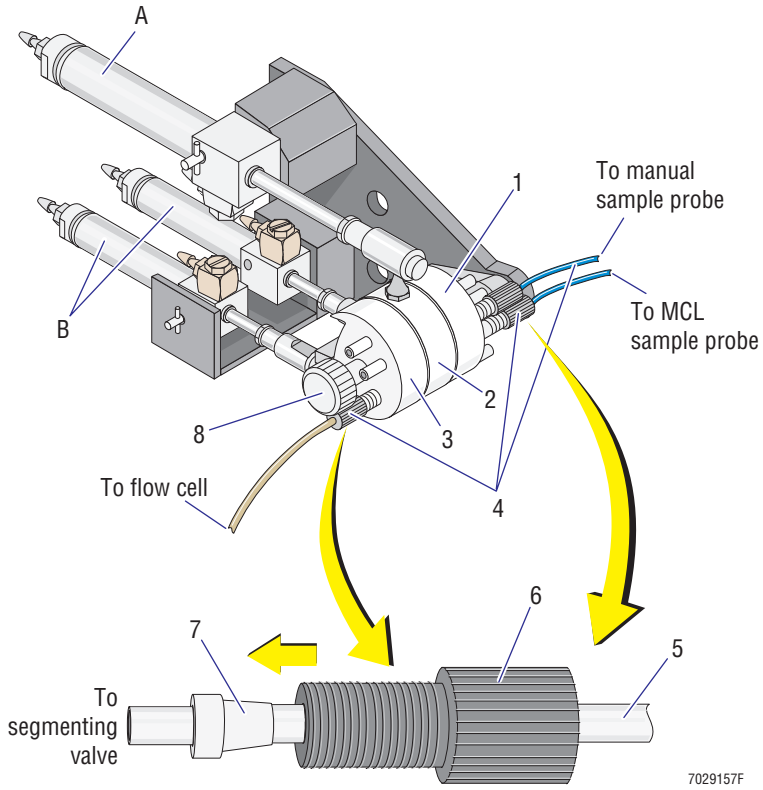



**Figure Reference**

**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)**

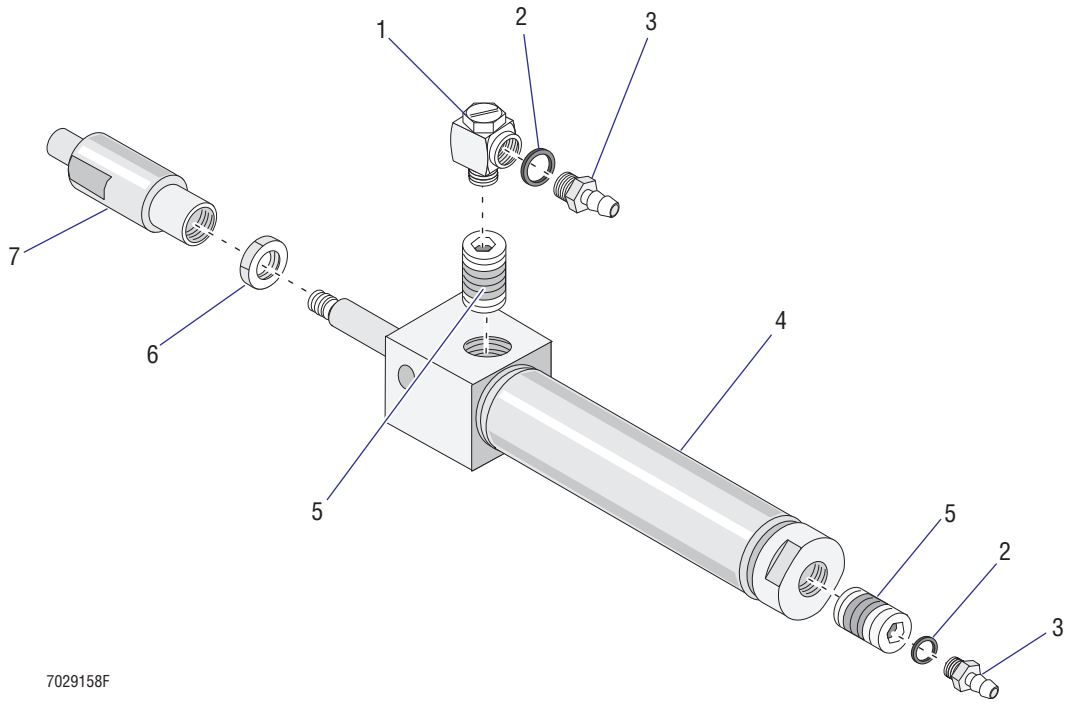



**Table 8.2-35 Air Cylinder and Related Hardware for Segmenting Valve Middle Pad (See Figure 8.2-35)**

| 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)**

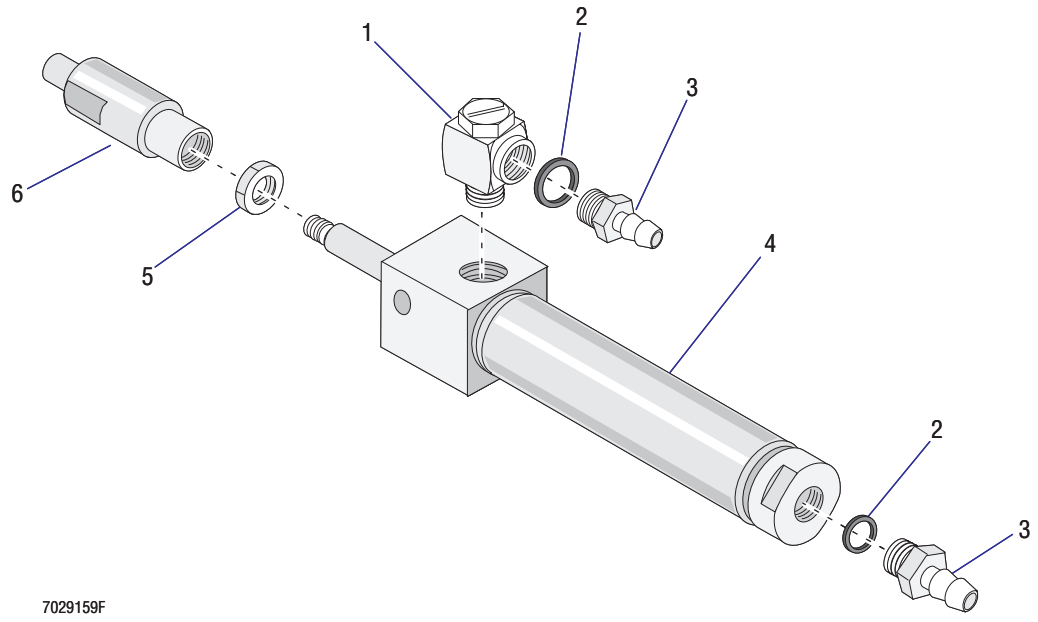



**Table 8.2-36 Air Cylinder and Related Hardware for Front and Rear Segmenting Valve Pads (See Figure 8.2-36)**

| 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)**

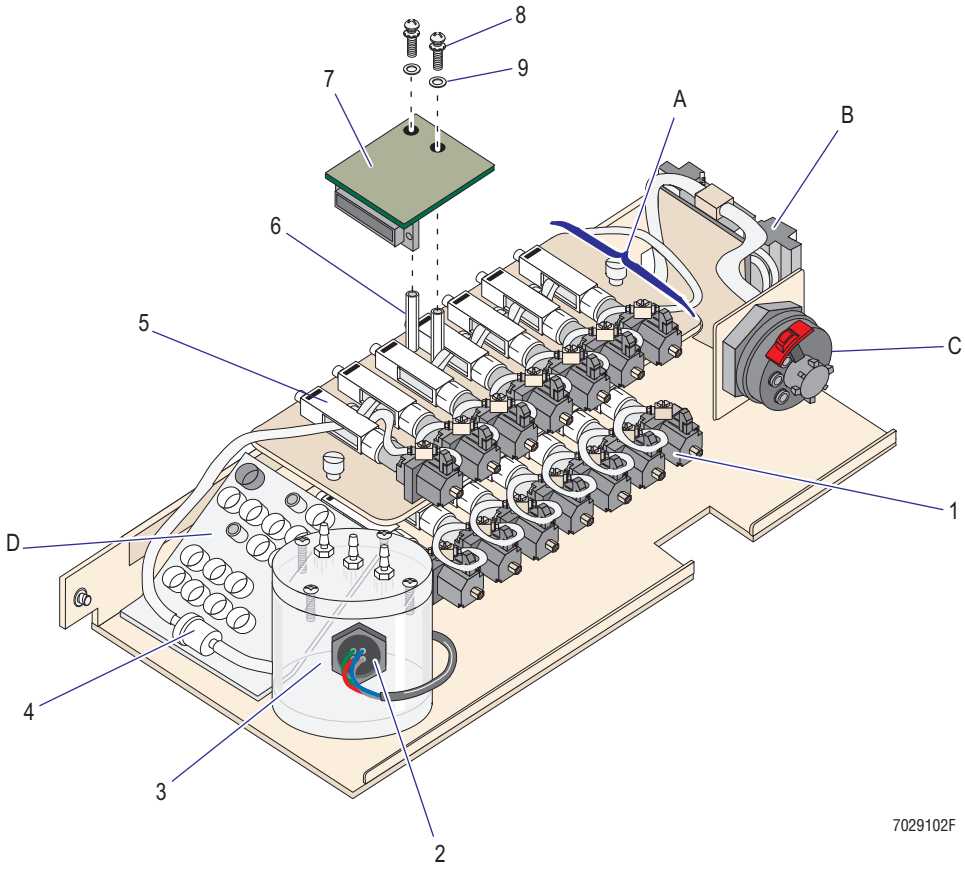



**Figure Reference**

**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

**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<br>**Note:** Attach using two self-lock screws (#6-32 x 0.37 in. length, pan-head), PN 2839039. |
| 2 | 6028599<br>2512031 | Sensor, waste chamber, with undercut O-ring groove<br>O-ring, silicone seal, 0.364 i.d. x 0.070 width (not shown)<br>**Note:** Replace the original rubber gasket with O-ring seal, PN 2512031. Discard the original rubber gasket. |
| 3 | 7000373 | FRU, vacuum chamber<br>**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<br>**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)**

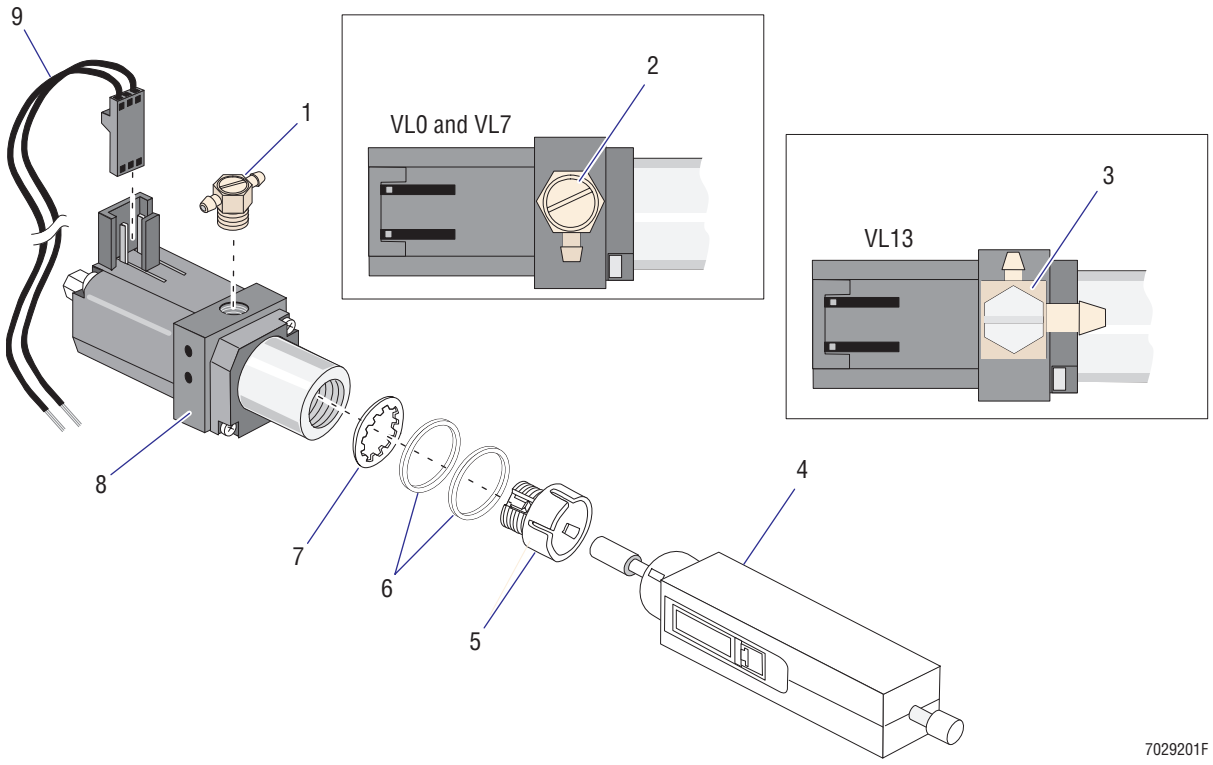


**Table 8.2-38 Pinch Valve and Associated Components, Lower Pneumatics Drawer (See Figure 8.2-38)**

| 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<br>**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<br>**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<br>**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)**

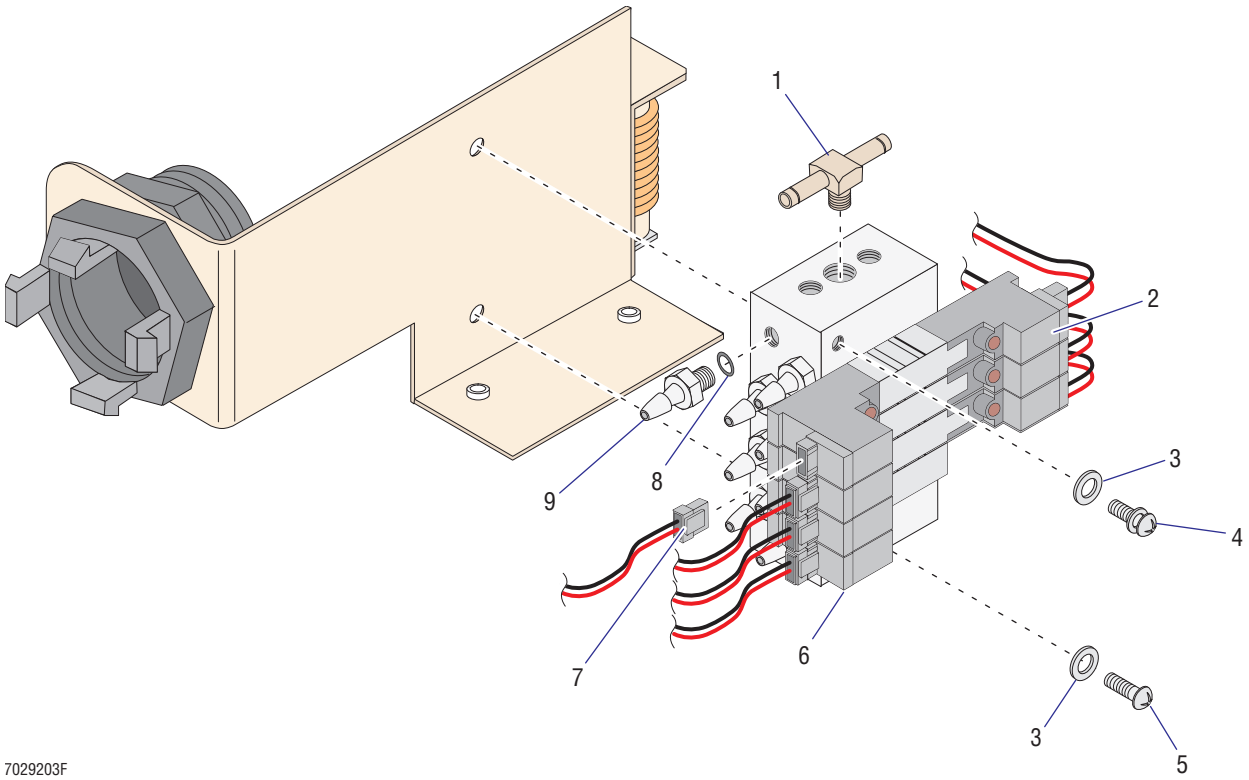



**Table 8.2-39 Solenoid Manifold, Lower Pneumatics Drawer (See Figure 8.2-39)**

| 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<br>**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)**

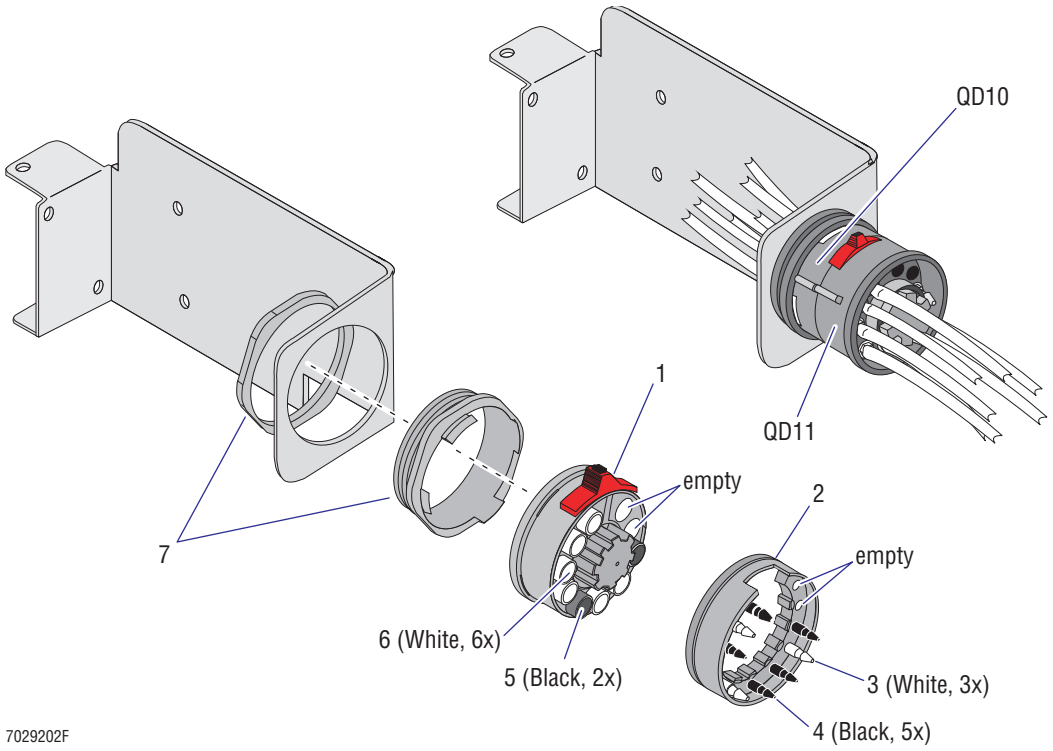



**Table 8.2-40 QD10 and QD11 (Coupling and Fittings), Lower Pneumatics Drawer (See Figure 8.2-40)**

| 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)**

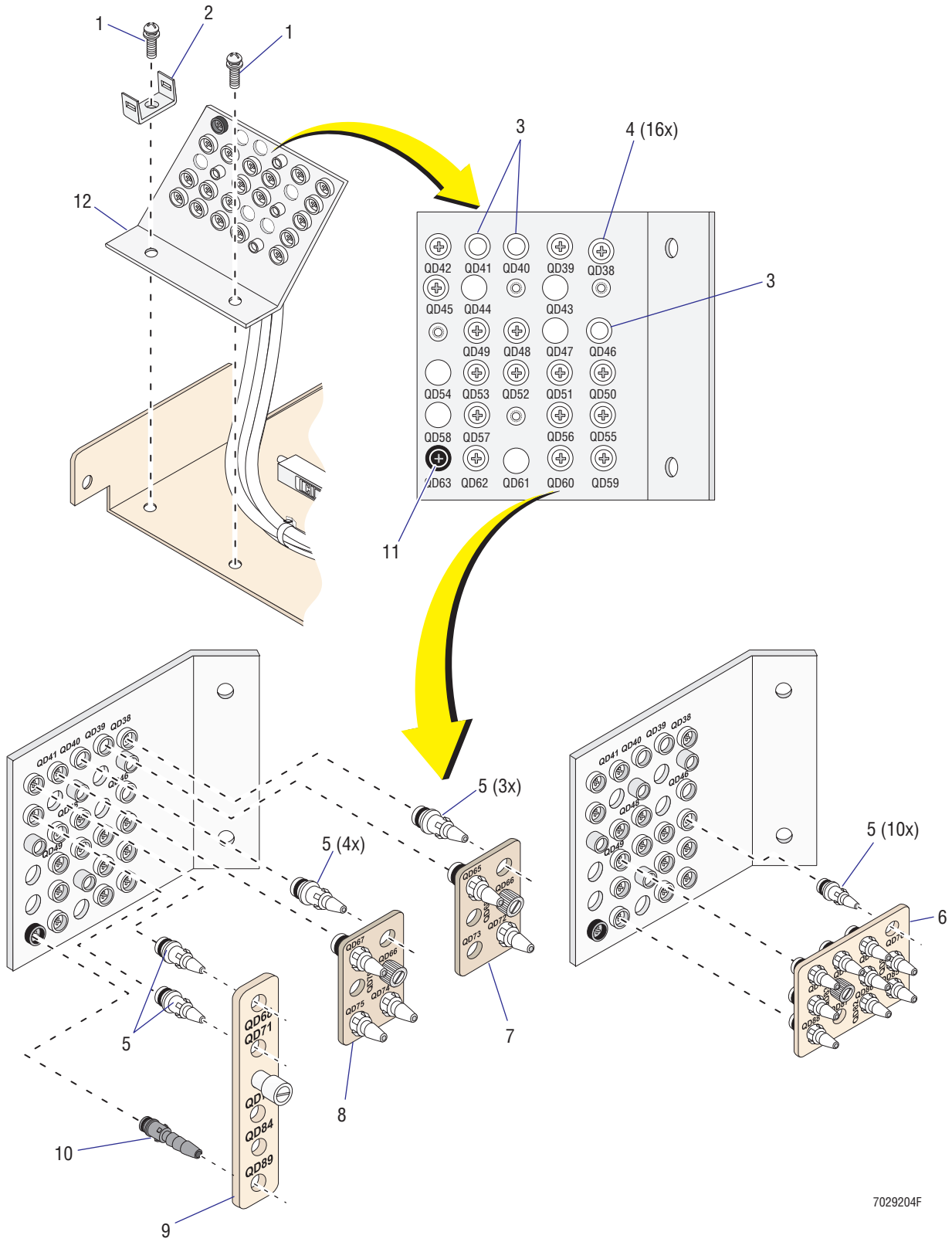


**Table 8.2-41 Quick-Disconnect Fittings and Brackets, Lower Pneumatics Drawer (See Figure 8.2-41)**

| 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)**

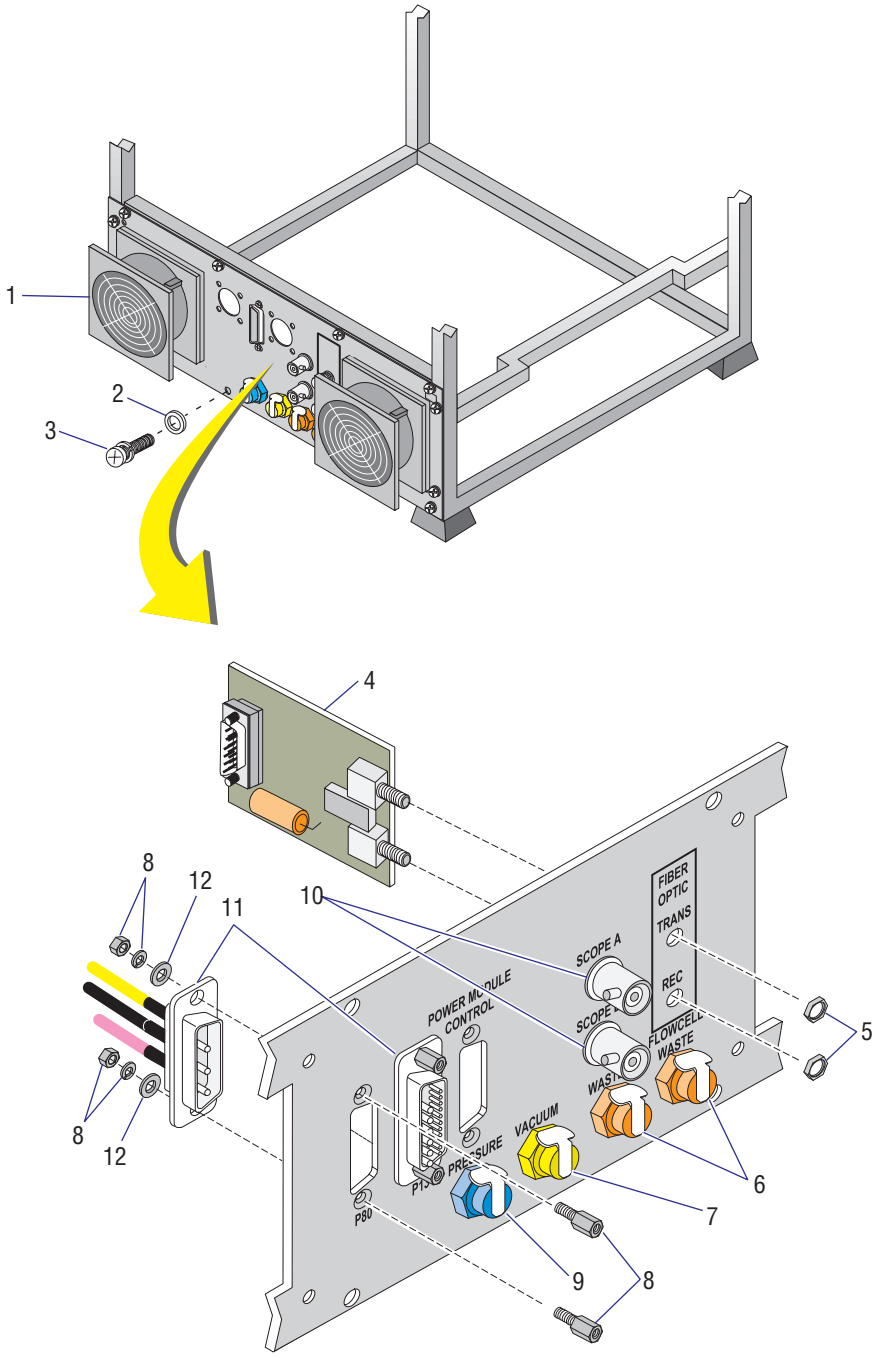


**Table 8.2-42 Cytometer Rear Panel, Lower (See Figure 8.2-42)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 2603025 | Fan, box, 106 CFM, 24 Vdc (4.68 square x 1.5 thickness)<br>**Note:** To ensure proper cable length, verify fan orientation before attaching the fan to the Cytometer frame.<br>• 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.<br>• 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<br>**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)<br>**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)<br>**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)<br>**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)**

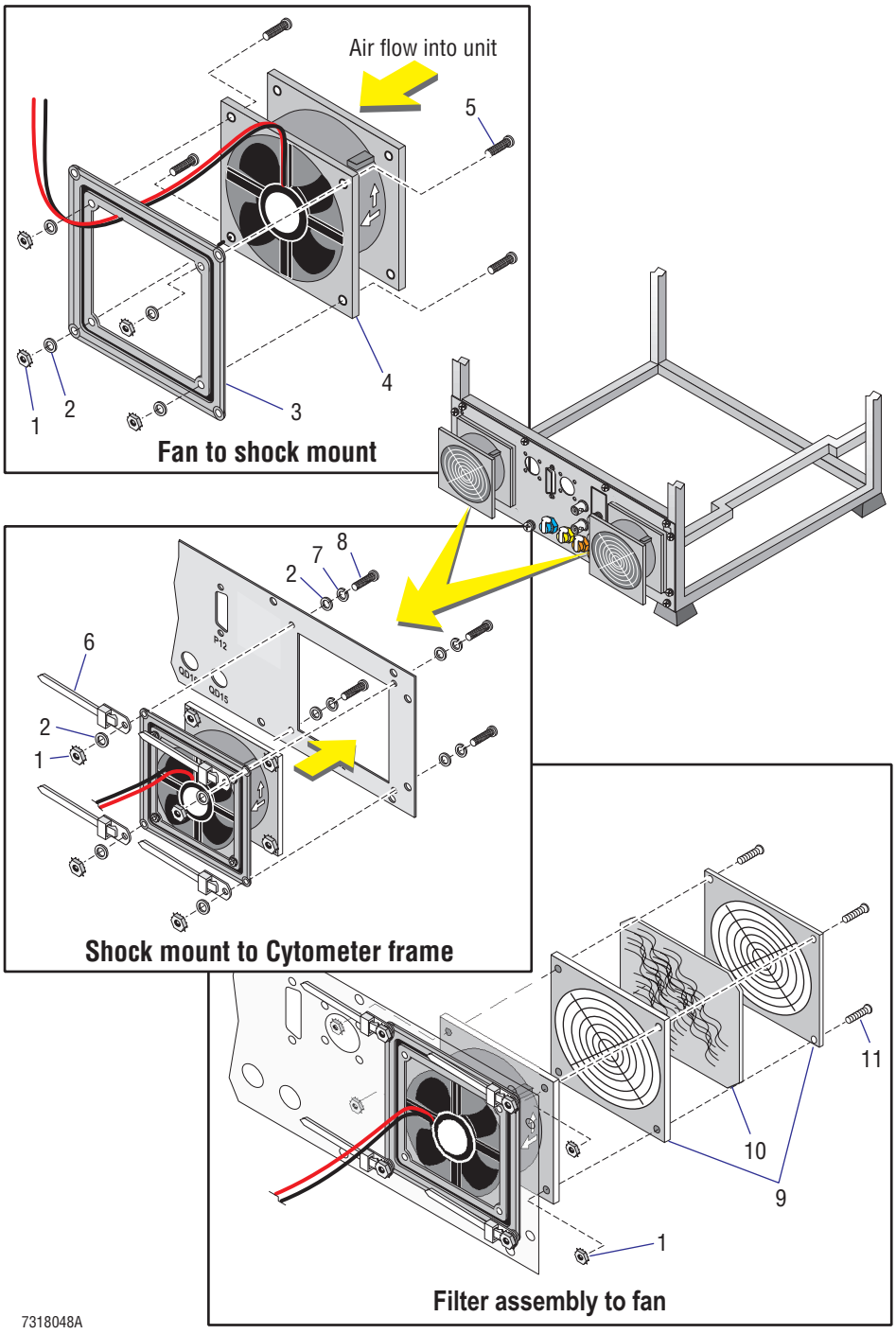


**Table 8.2-43 Fan Assembly, Cytometer Rear Panel (See Figure 8.2-43)**

| 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 | Fan, box, 106 CFM, 24 Vdc (4.68 square x 1.5 thickness)<br>**Note:** To ensure proper cable length, verify fan orientation before attaching the fan to the Cytometer frame.<br>• 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.<br>• 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 | Finger guard, grille for fan air filter on 4-inch box fan<br>**Note:** Raised ribs should face out. |
| 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)**

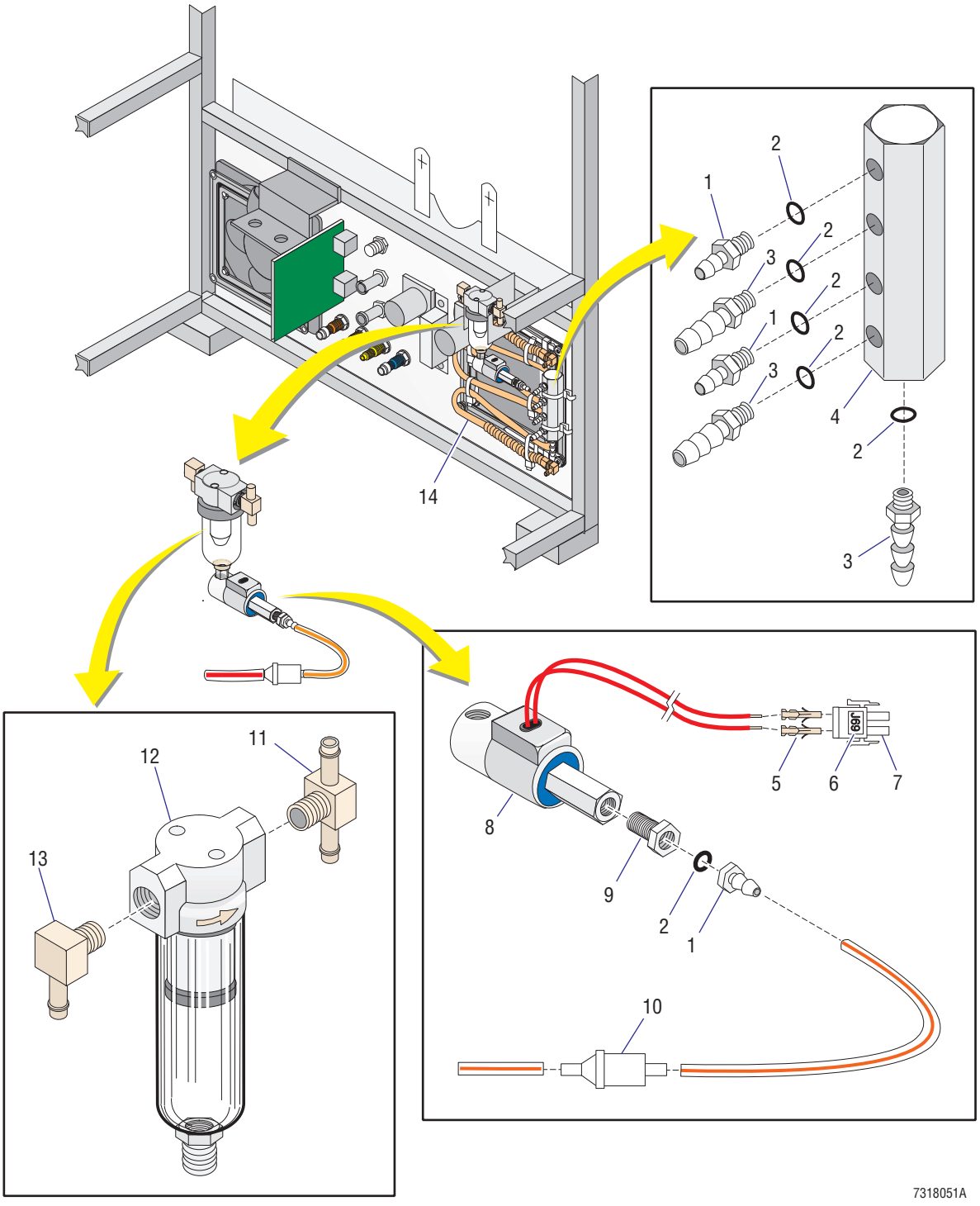


**Table 8.2-44 Cytometer Right Side Compartment (See Figure 8.2-44)**

| 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<br>**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<br>**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<br>**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<br>**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)**

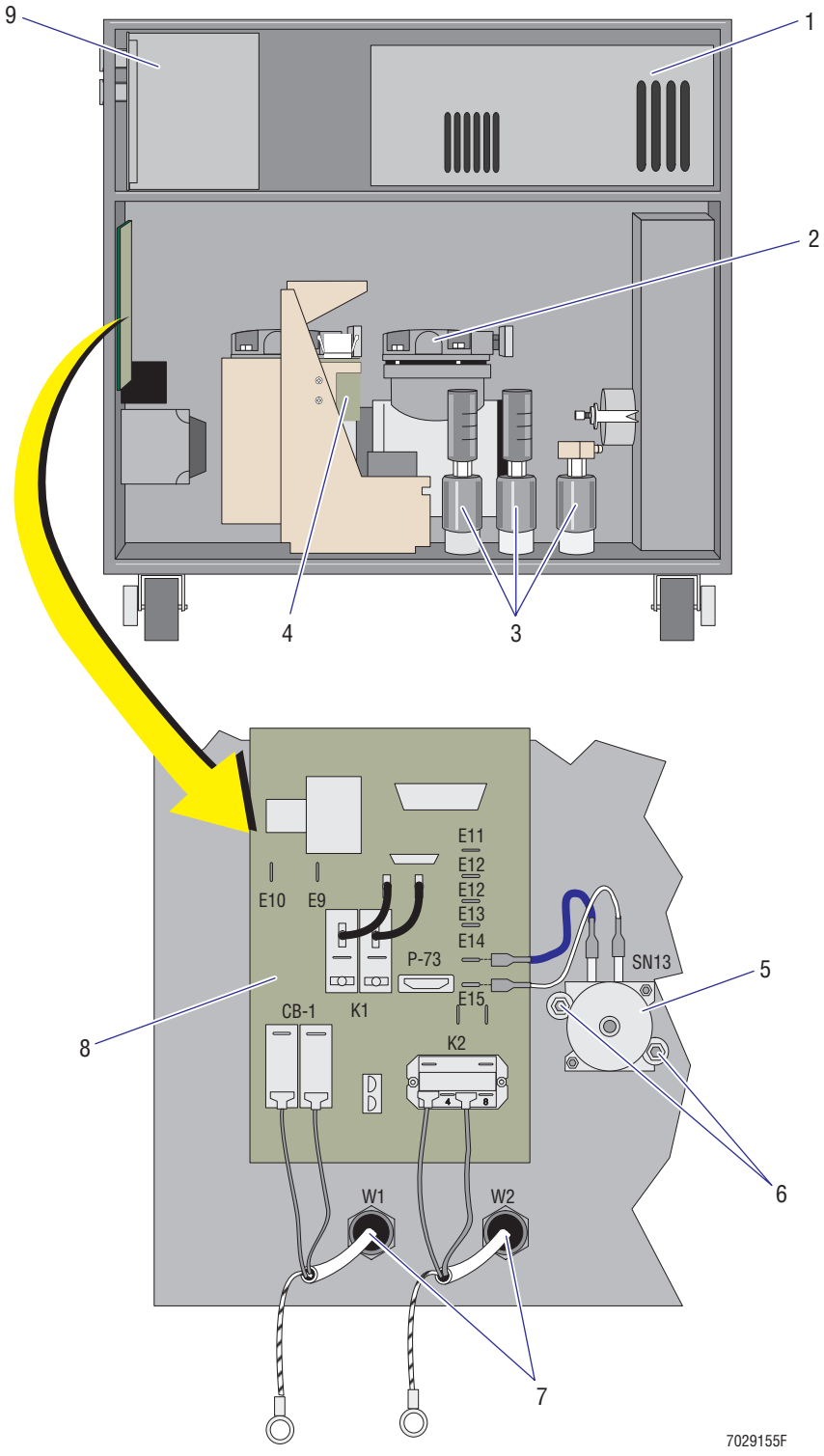


**Table 8.2-45 Power Supply Module - Left Side with Cover Removed (See Figure 8.2-45)**

| 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<br>**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<br>**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)**

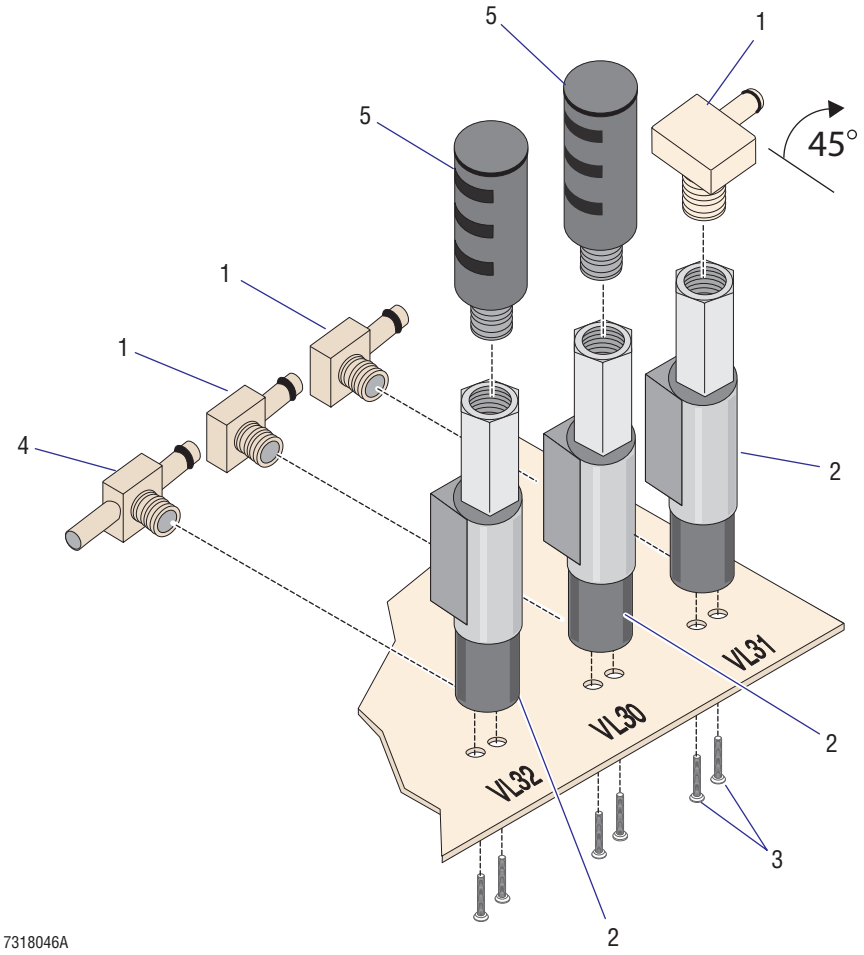


**Table 8.2-46 VL32, VL30, and VL31 - Exploded View (See Figure 8.2-46)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6216128 | Fitting, elbow, hose barb, 0.187 i.d. to 1/8 MPT, brass<br>**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<br>6232367 | Valve, dump, system pressure, for 100/120 Vac system<br>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<br>**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<br>**Note:** Hand tighten only. |

**Figure 8.2-47 Power Supply Module - Front Panel Components (See Table 8.2-47)**

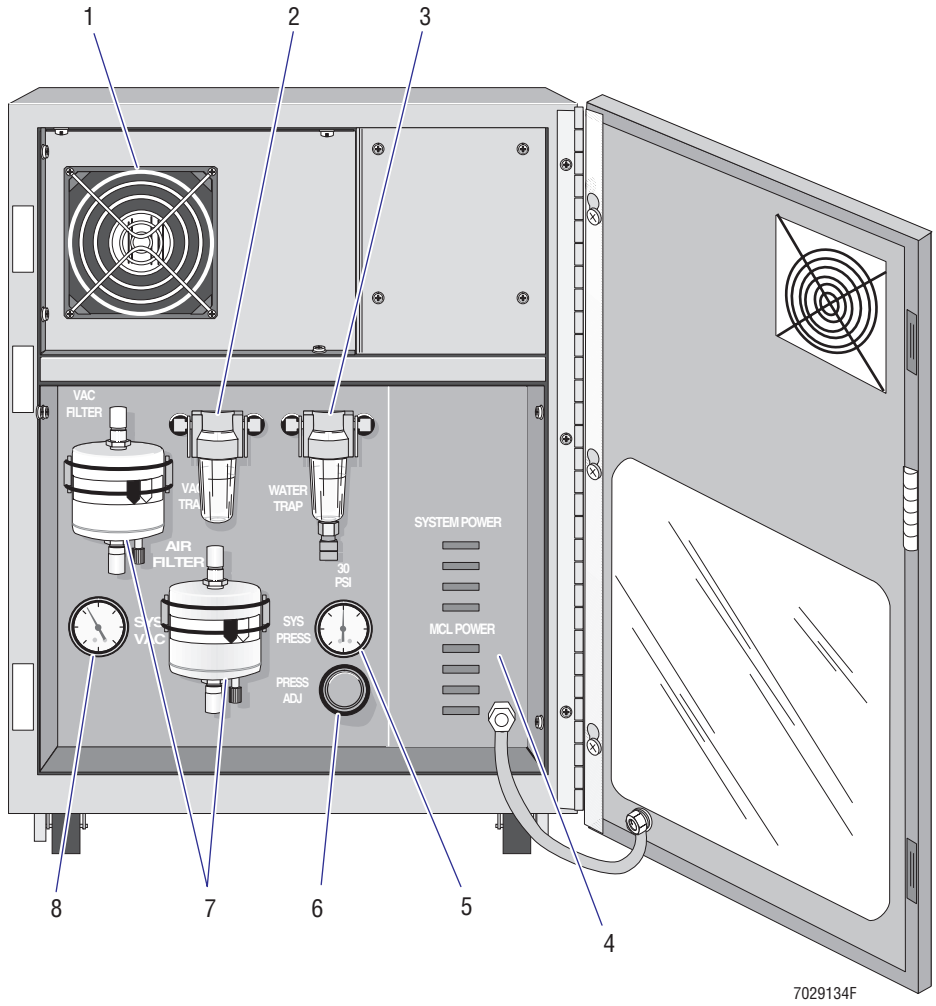


**Table 8.2-47 Power Supply Module - Front Panel Components (See Figure 8.2-47)**

| 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 micon, 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)**

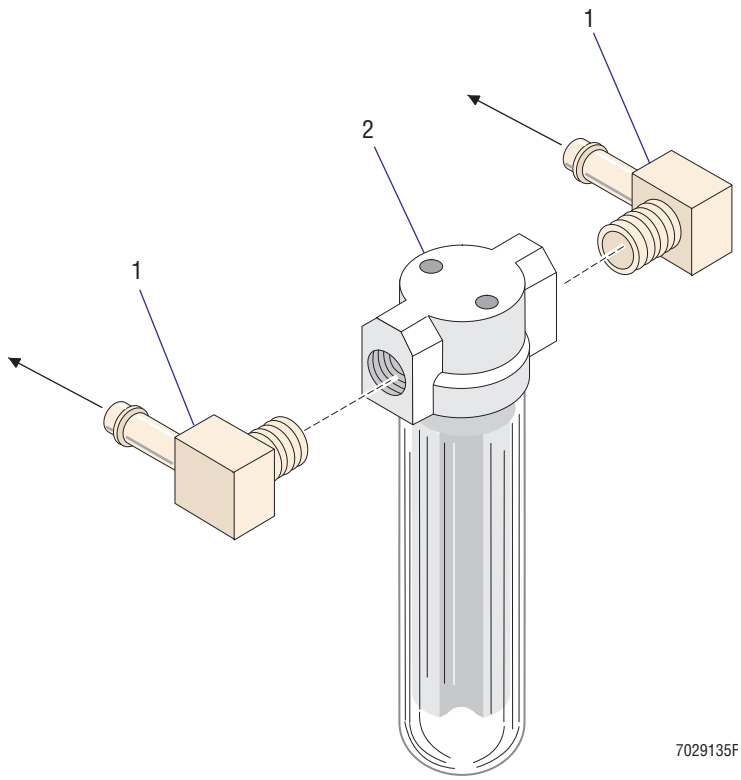



**Table 8.2-48 Vacuum Trap and Related Components (See Figure 8.2-48)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6216128 | Fitting, hose barb, elbow, 0.187 i.d. to 1/8 MNPT, brass<br>**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)**

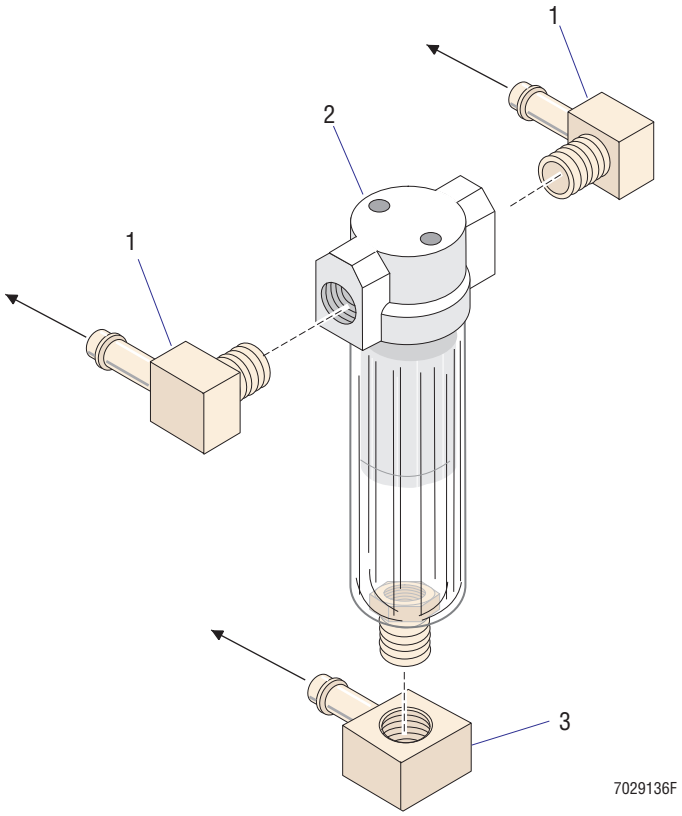



**Table 8.2-49 Water Trap (Air/Water Filter Separator) and Related Components (See Figure 8.2-49)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6216128 | Fitting, hose barb, elbow, 0.187 i.d. to 1/8 MNPT, brass<br>**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<br>**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<br>**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)**

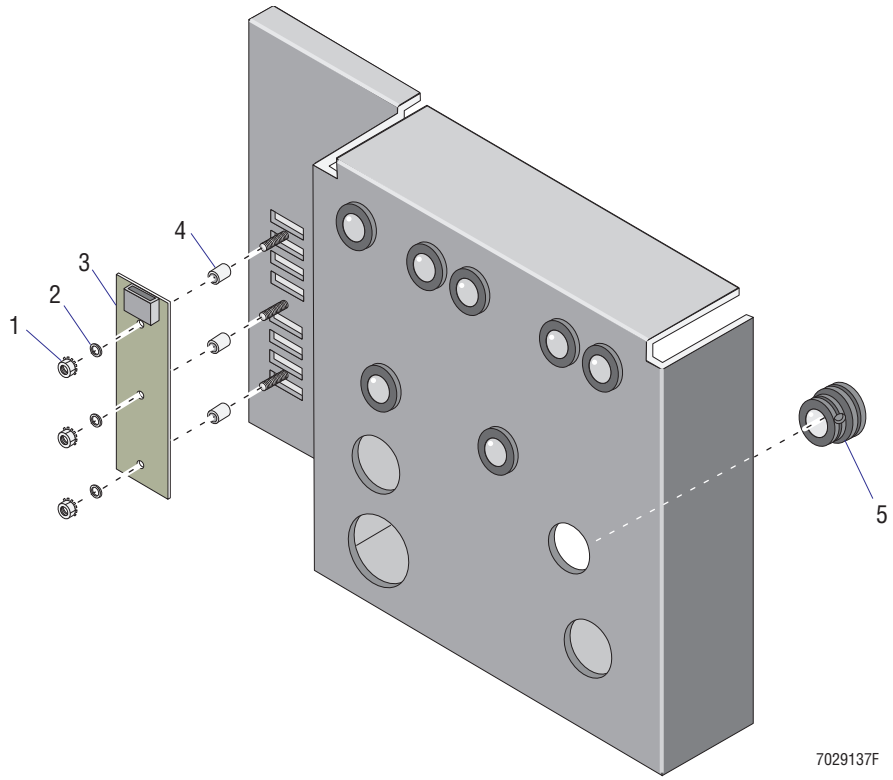



**Table 8.2-50 Front Panel including Voltage Supply Monitor Card and Hardware (See Figure 8.2-50)**

| 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)**

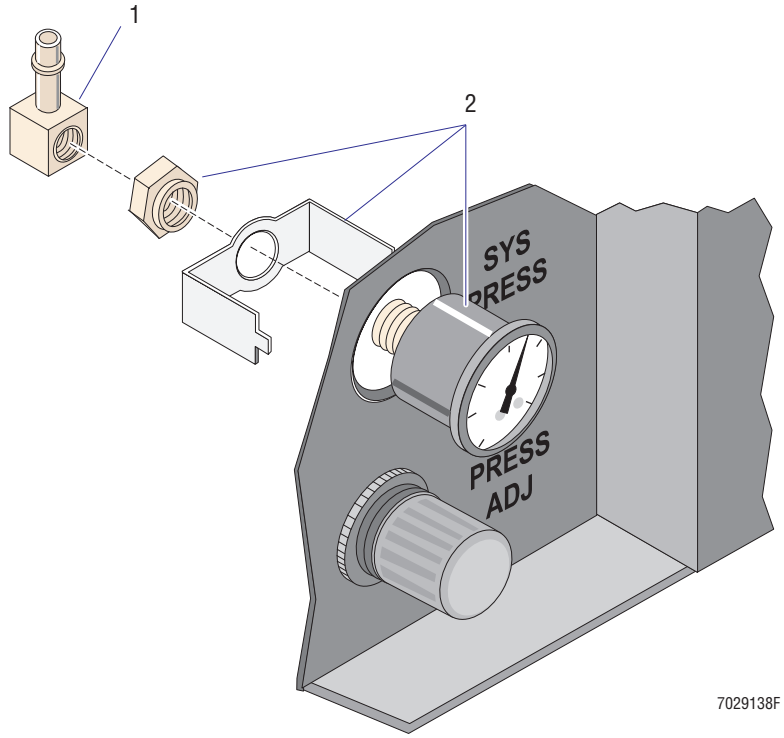



**Table 8.2-51 System Pressure Gauge and Related Components (See Figure 8.2-51)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6232214 | Fitting, hose barb, elbow, 0.187 i.d. to 1/8 FPT, nickel-plated brass<br>**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)<br>**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)**

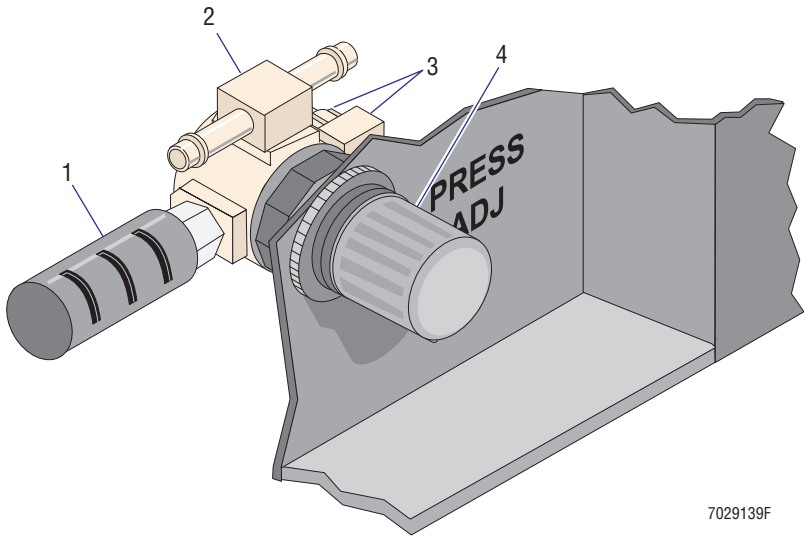



**Table 8.2-52 System Pressure Adjustment Knob and Related Components (See Figure 8.2-52)**

| 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<br>**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<br>**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)**

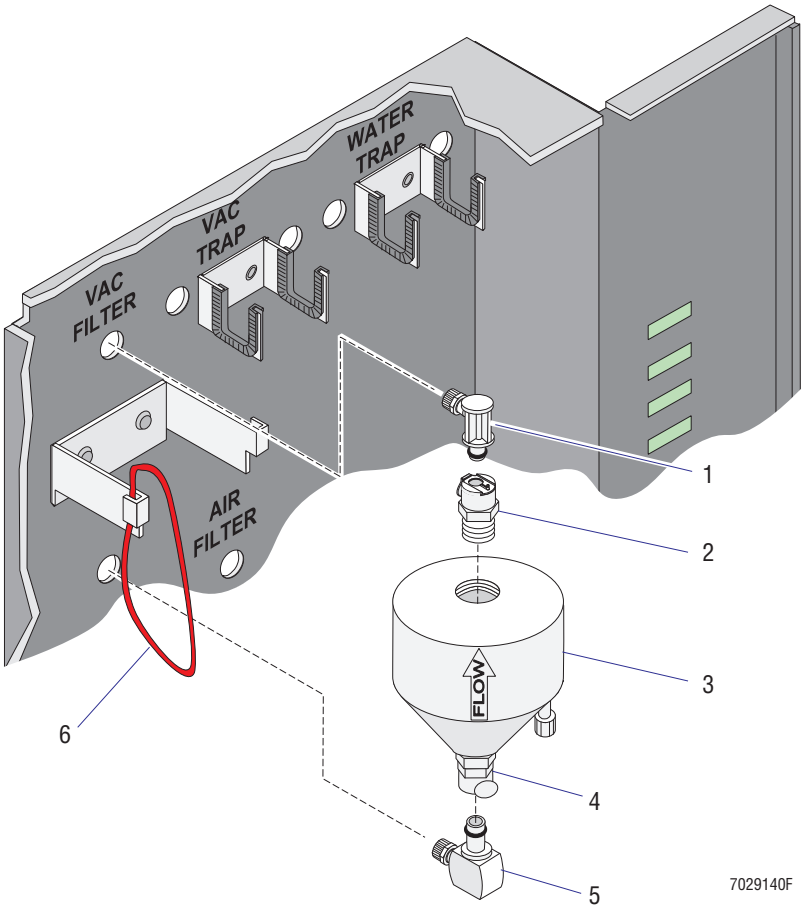



**Table 8.2-53 Vacuum and Air Filters with Related Components (See Figure 8.2-53)**

| 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 micon, 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)**

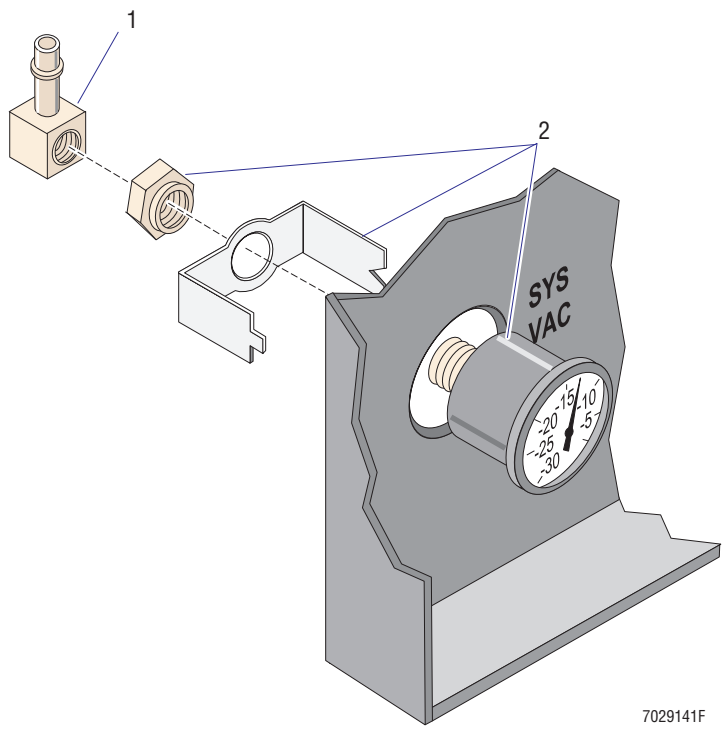



**Table 8.2-54 System Vacuum Gauge and Related Components (See Figure 8.2-54)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6232214 | Fitting, hose barb, elbow, 0.187 i.d. to 1/8 FPT, nickel-plated brass<br>**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)<br>**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)**

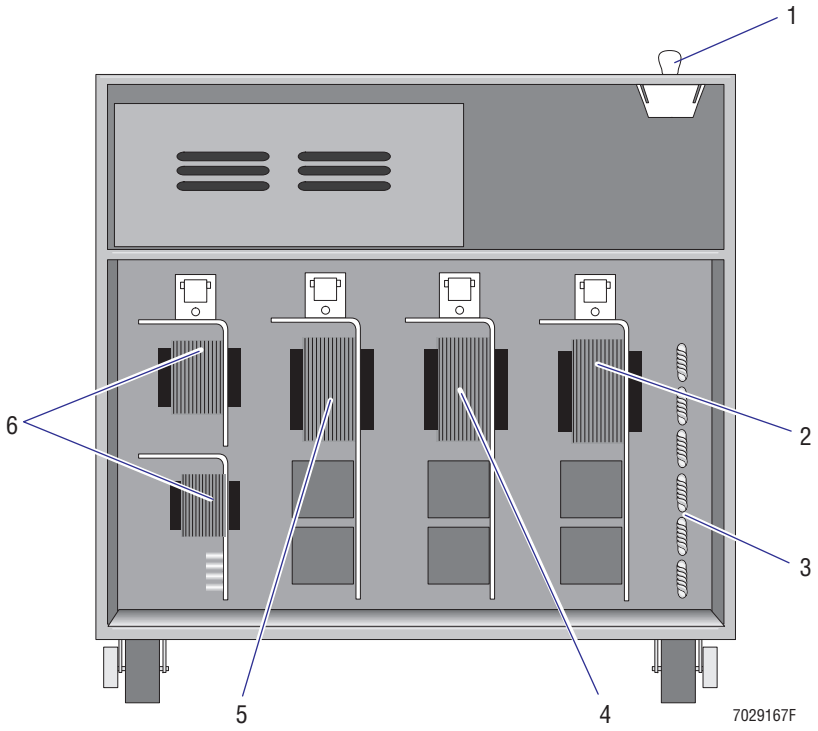



**Table 8.2-55 Power Supply Module - Right Side with Cover Removed (See Figure 8.2-55)**

| 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)**

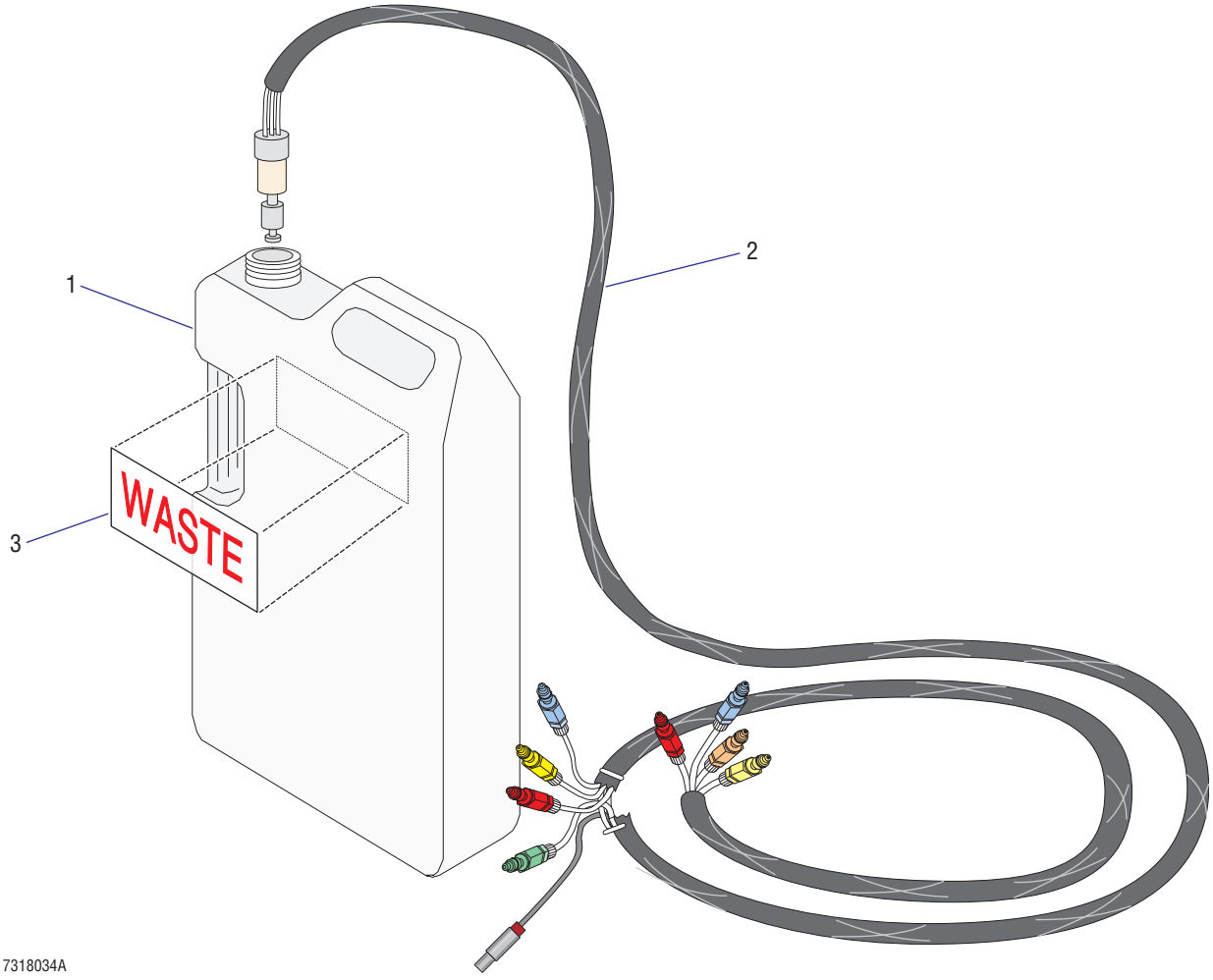


**Table 8.2-56 Waste Container (See Figure 8.2-56)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 2523697 | Tank, waste, I-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)**

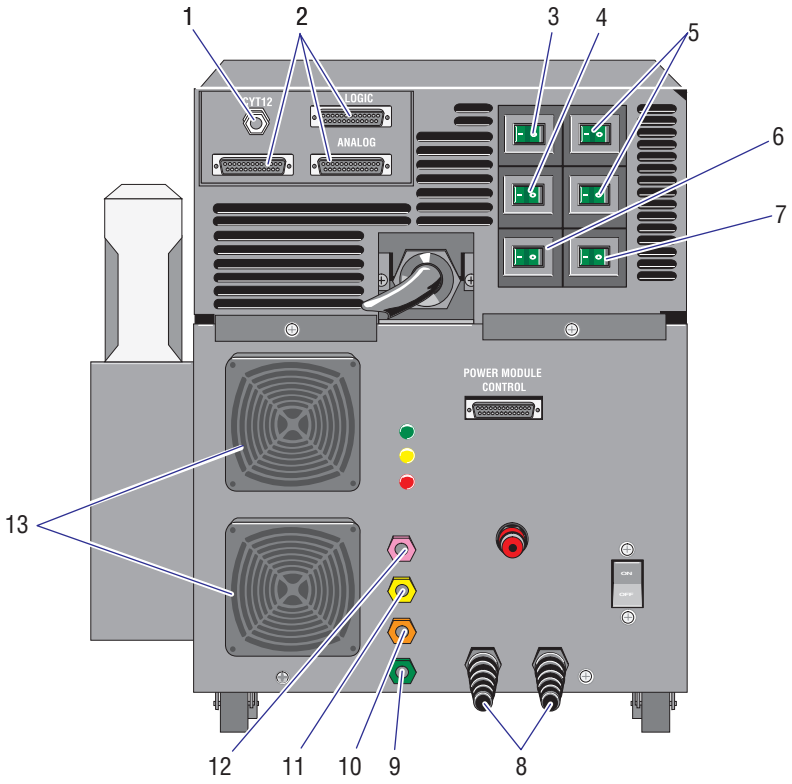


**Table 8.2-57 Power Supply Module - Rear Panel Components (See Figure 8.2-57)**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6706391 | Card, CYT12 Receiver, EMC<br>**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<br>**Note:** Attach using three female screw lock assembly kits for D-type connectors, PN 2104261. |
| 3 | 5120229<br>5120227 | Circuit breaker, 4 A, 250 Vac, for 100 Vac and 120 Vac systems<br>Circuit breaker, 2 A, 250 Vac, for 220 Vac and 240 Vac systems |
| 4 | 5120228<br>5120227<br>5101025 | Circuit breaker, 3 A, 250 Vac, for 100 Vac systems<br>Circuit breaker, 2 A, 250 Vac, for 120 Vac systems<br>Circuit breaker, 1 A, 250 Vac, for 220 Vac and 240 Vac systems |
| 5 | 5120228<br>5101026 | Circuit breaker, 3 A, 250 Vac, for 100 Vac and 120 Vac systems<br>Circuit breaker, 1.5 A, 250 Vac, for 220 Vac and 240 Vac systems |
| 6 | 5101026<br>5101027 | Circuit breaker, 1.5 A, 250 Vac, for 100 Vac and 120 Vac systems<br>Circuit breaker, 0.8 A, 250 Vac, for 220 Vac and 240 Vac systems |
| 7 | 5101027<br>5101028 | Circuit breaker, 0.8 A, 250 Vac, for 100 Vac and 120 Vac systems<br>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<br>**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<br>**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)**

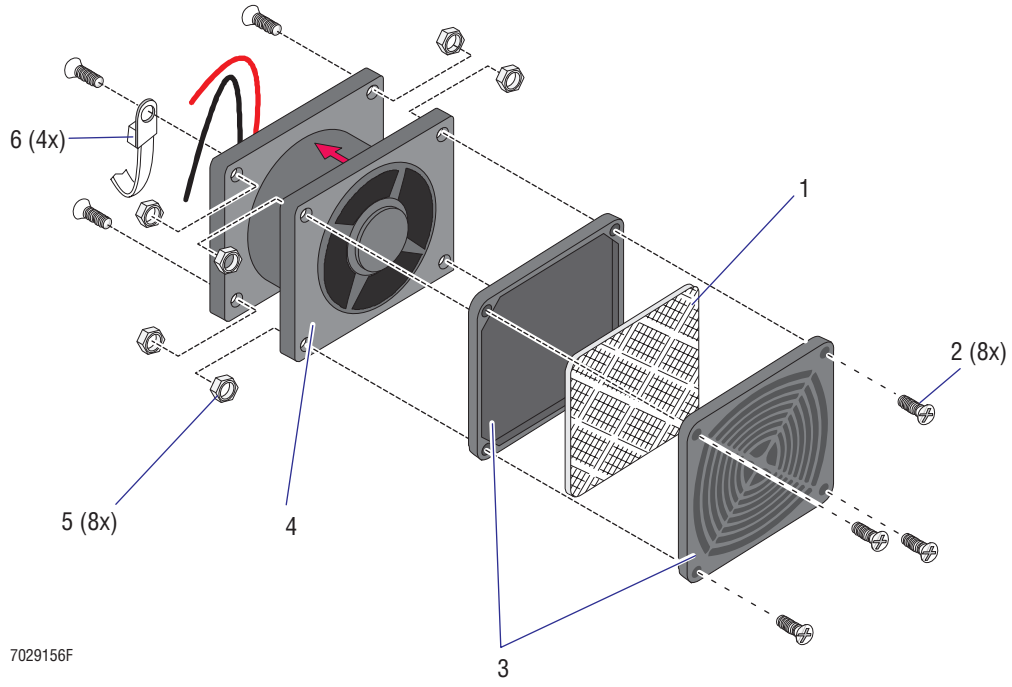



**Table 8.2-58 Box Fan with Related Hardware (See Figure 8.2-58)**

| 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<br>**Note:** Raised ribs should face out. |
| 4 | 2603058 | Fan, box, 90 CFM, 24 Vdc, 4.69 square x 1.0 in. thickness<br>**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)**

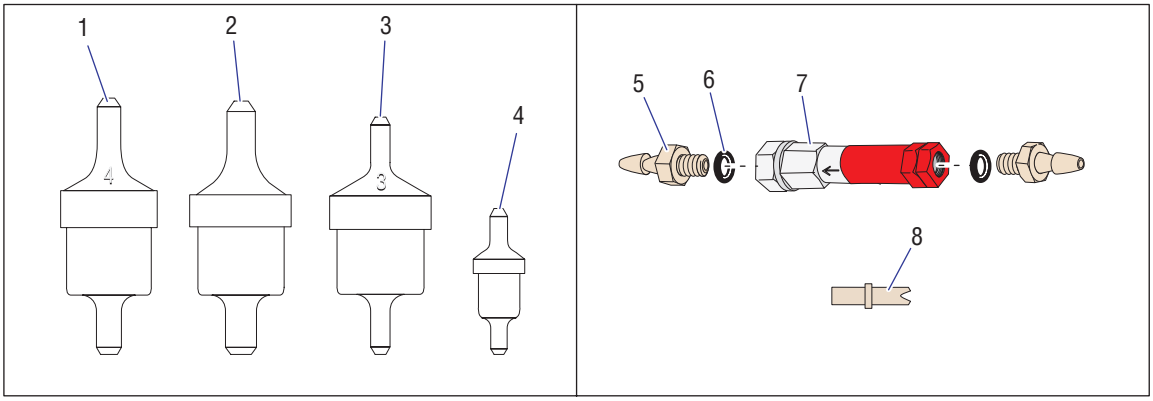



**Table 8.2-59 Check Valves and Chokes with Related Components (See Figure 8.2-59)**

| 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)**

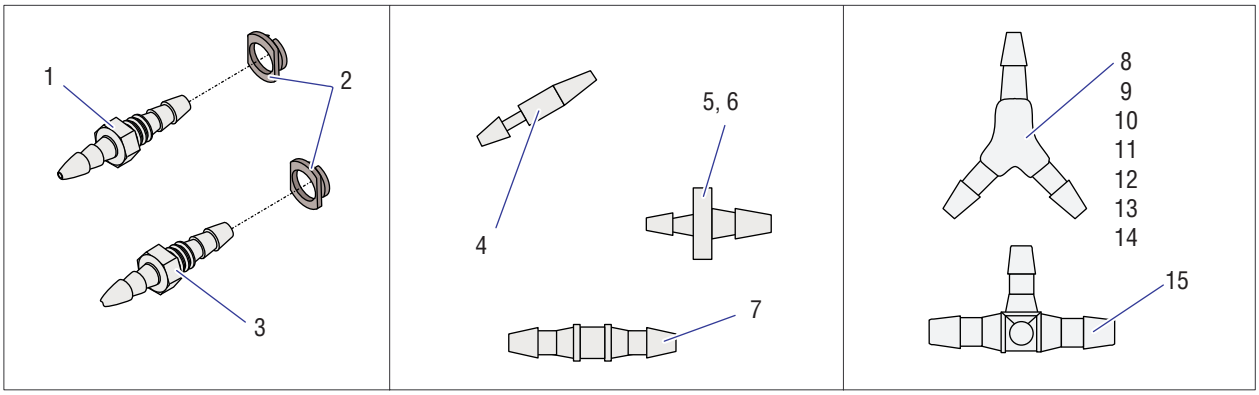
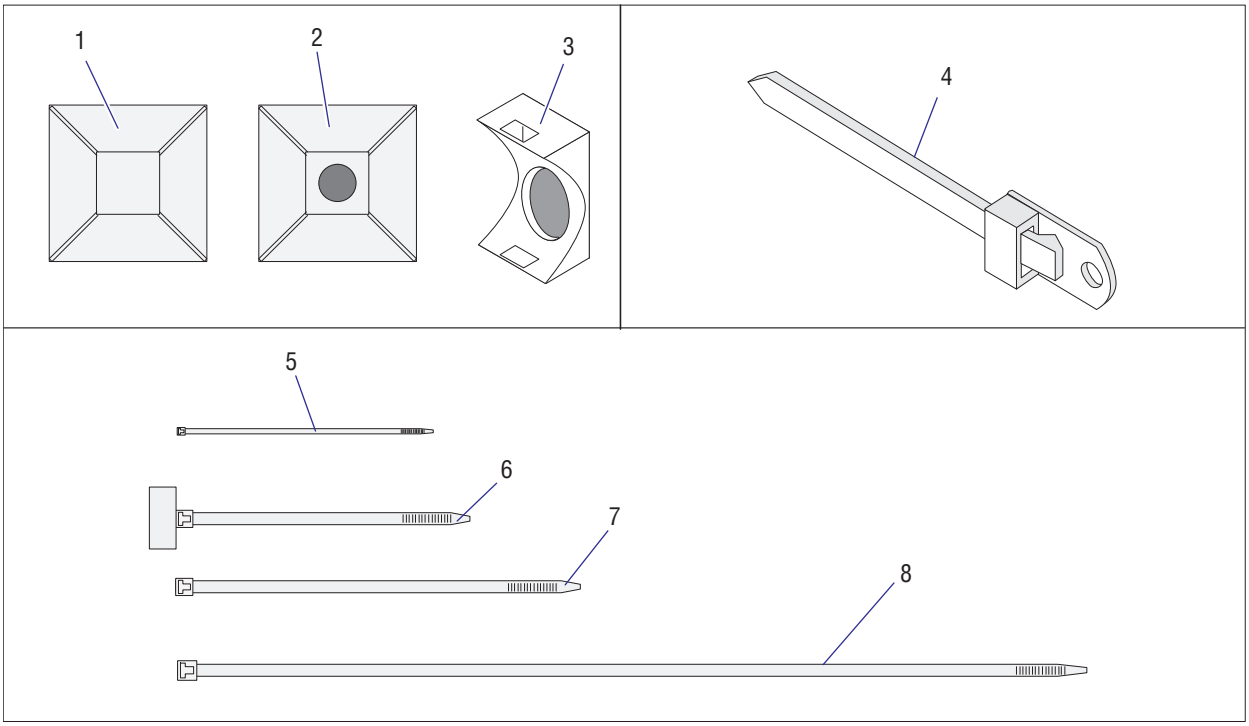



**Table 8.2-60 Fittings (See Figure 8.2-60)**

| 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)**




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)**

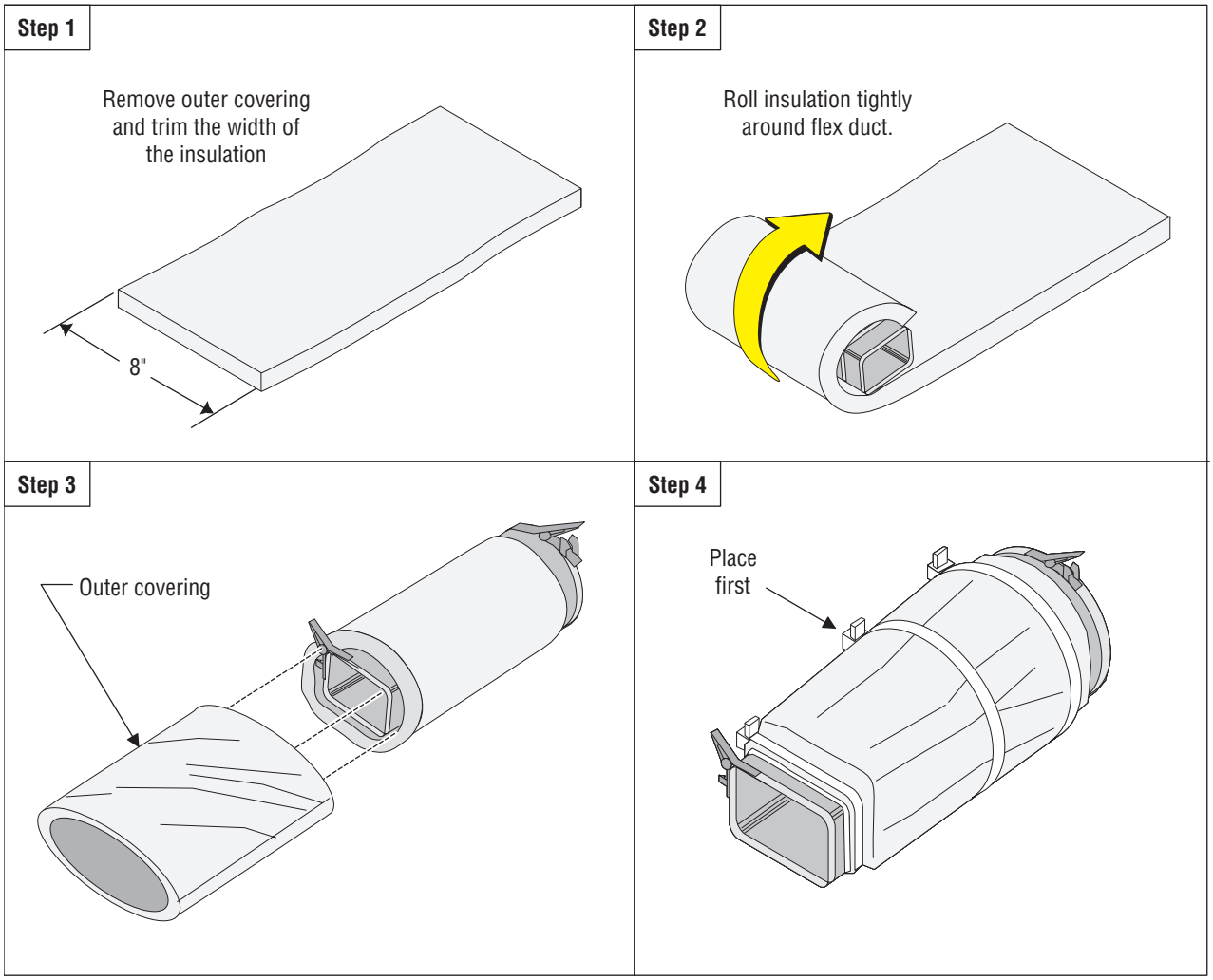



**Table 8.2-62 Flexible Duct Components and Assembly Instructions (See Figure 8.2-62)**

| 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 |

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# 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 |
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| 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 |
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| 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 |

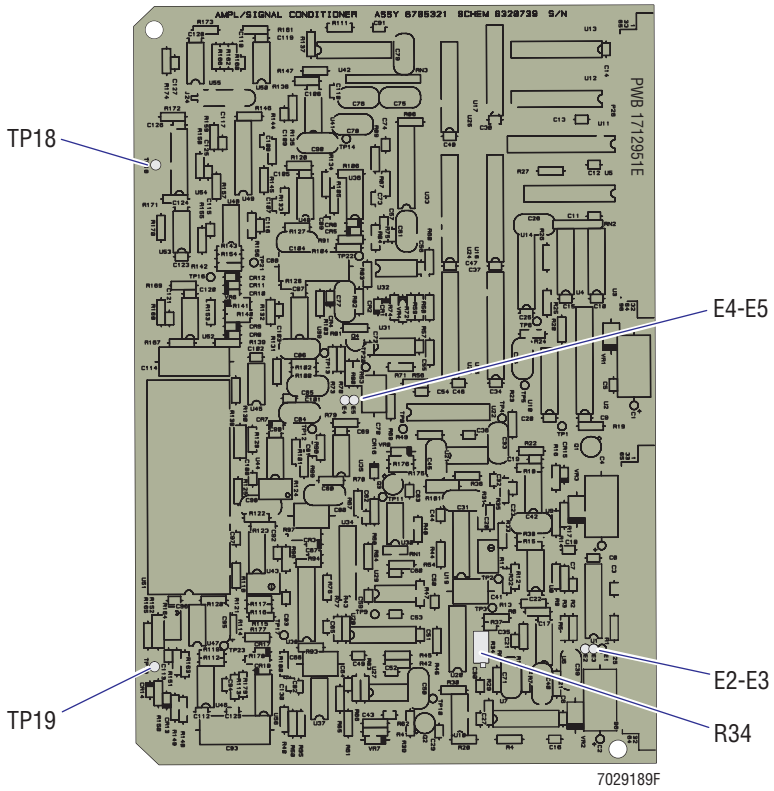
## Amp / Signal Conditioner Card

### 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

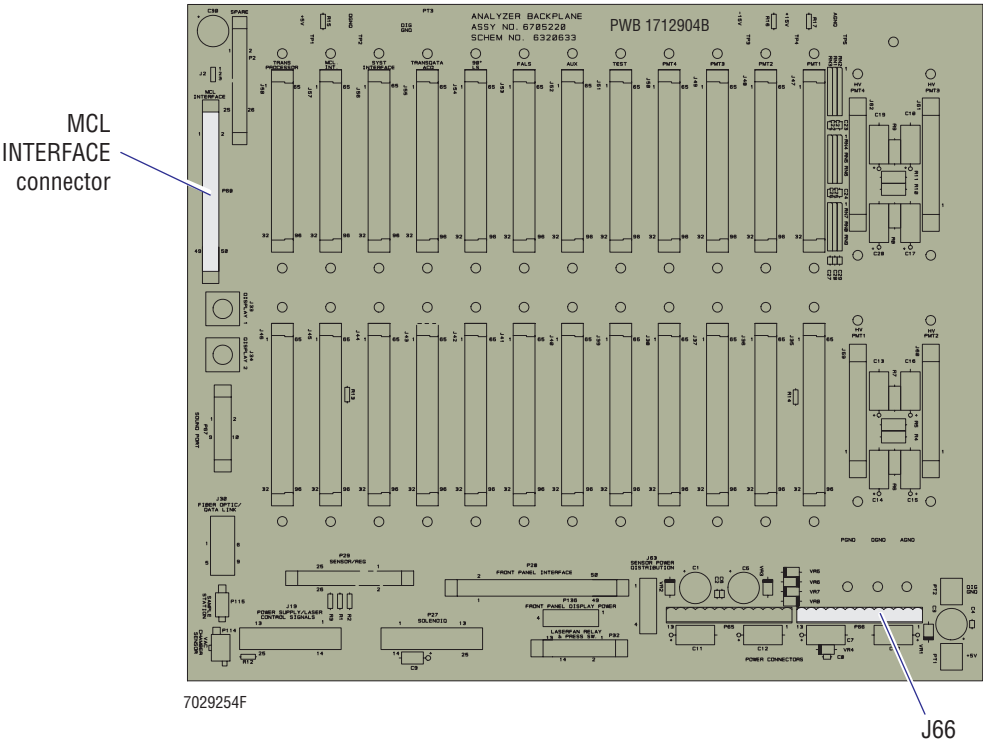
The Analyzer backplane is attached to the rear of the Data Acquisition card cage. Most of this backplane is behind the Data Acquisition card cage so that only those components on the lower portion of this backplane are easily accessible.

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

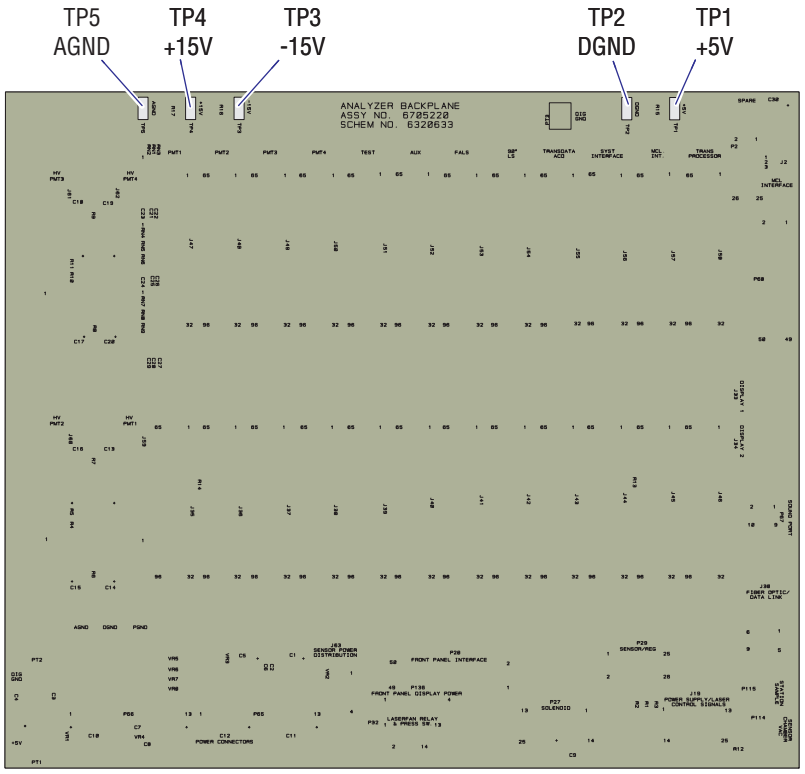
## Analyzer Backplane - Rear View

### Backplane Location in the Cytometer

The Analyzer backplane is attached to the rear of the Data Acquisition card cage. To access the rear of the Analyzer backplane, remove the Cytometer front door and lock the Data Acquisition card cage in its upright position outside the Cytometer.

### Component Locations

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




7318082A

### Jumpers

N/A

### Switches

N/A

## Bar-Code Decoder Card

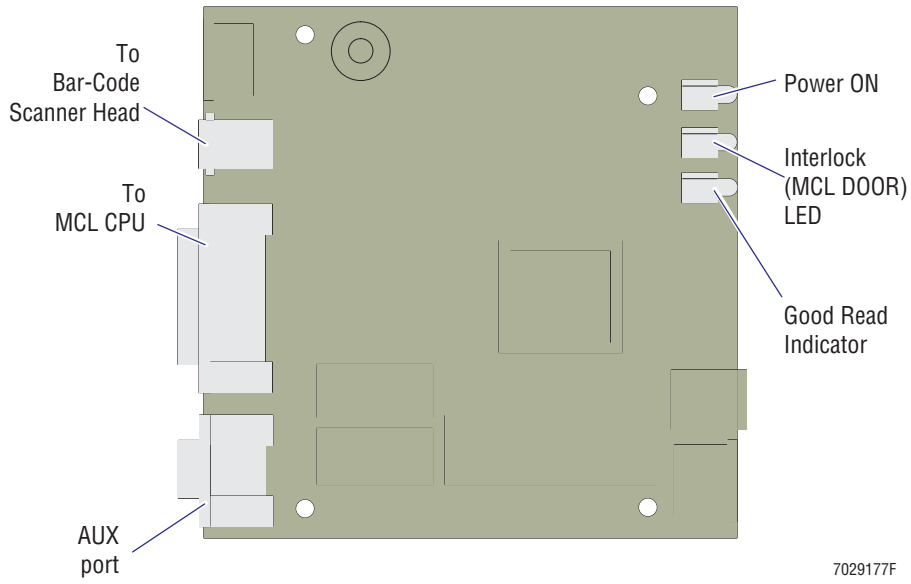
**ATTENTION:** This card is present only when the MCL option is installed.

### 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

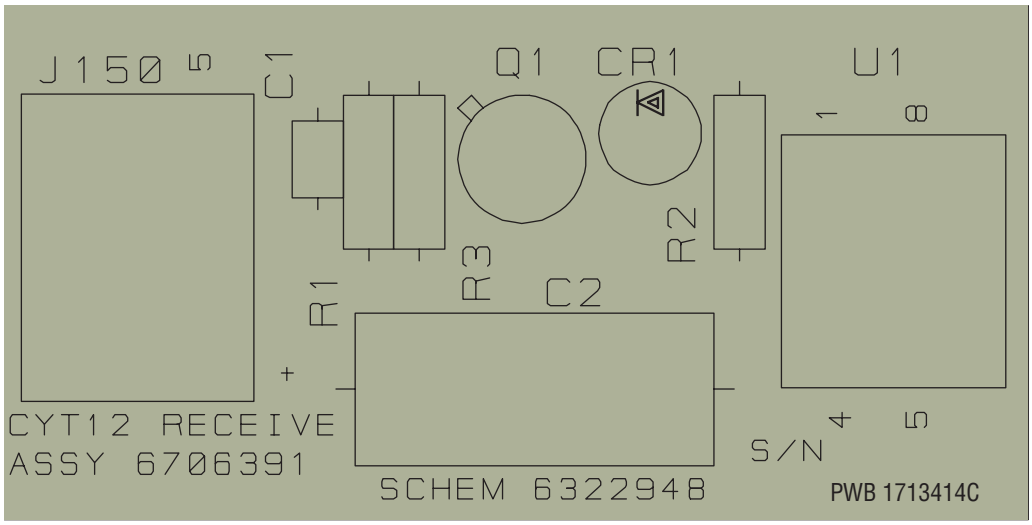
**ATTENTION:** This circuit card is only used in XL and XL-MCL instruments with the serial number Z09063 or higher. XL and XL-MCL instruments with the serial number Z09062 or lower do not use this circuit card.

### 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

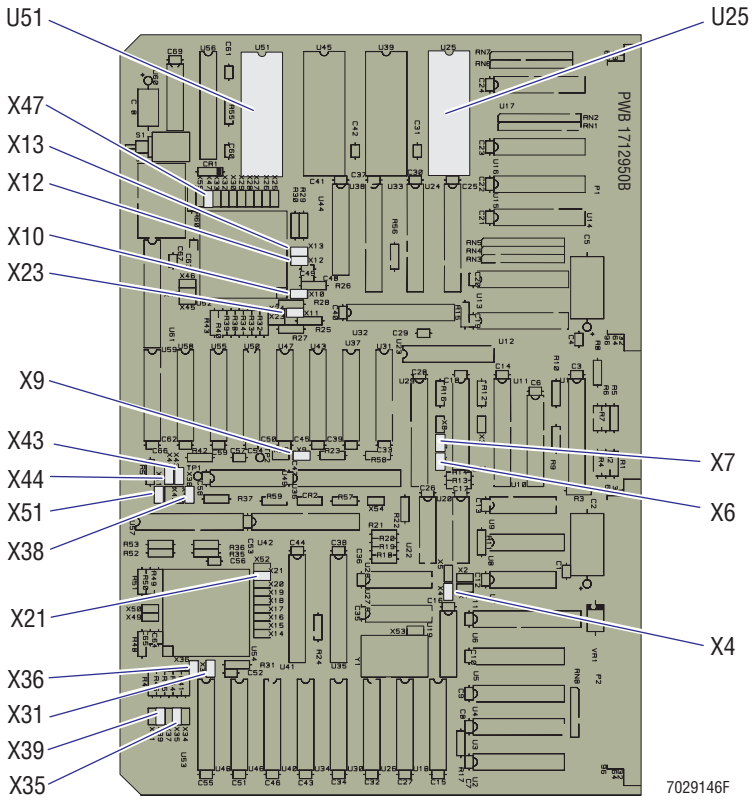
## Cyto Transputer Card

### 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

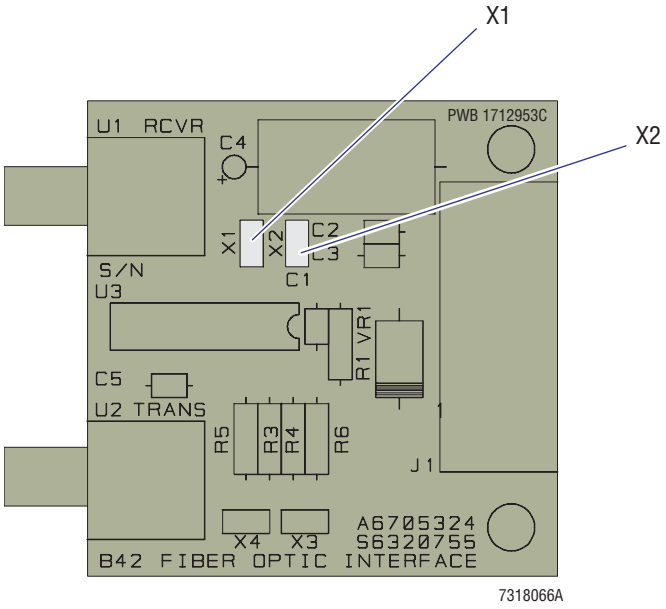
## Fiber Optic Interface Card

### 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

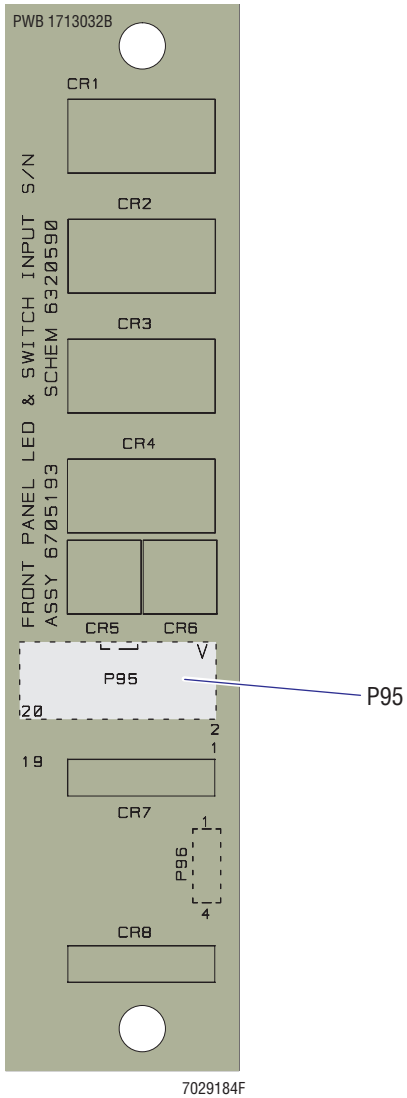
**ATTENTION:** This card is present only when the MCL option is **not** installed.

### 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

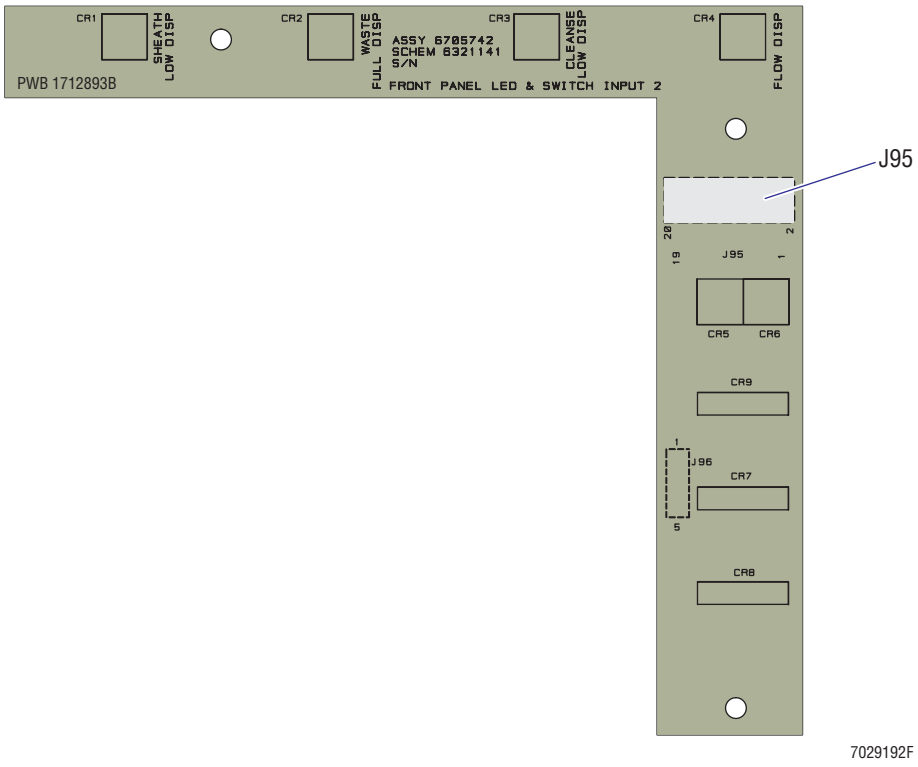
**ATTENTION:** This card is present only when the MCL option is installed.

### 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

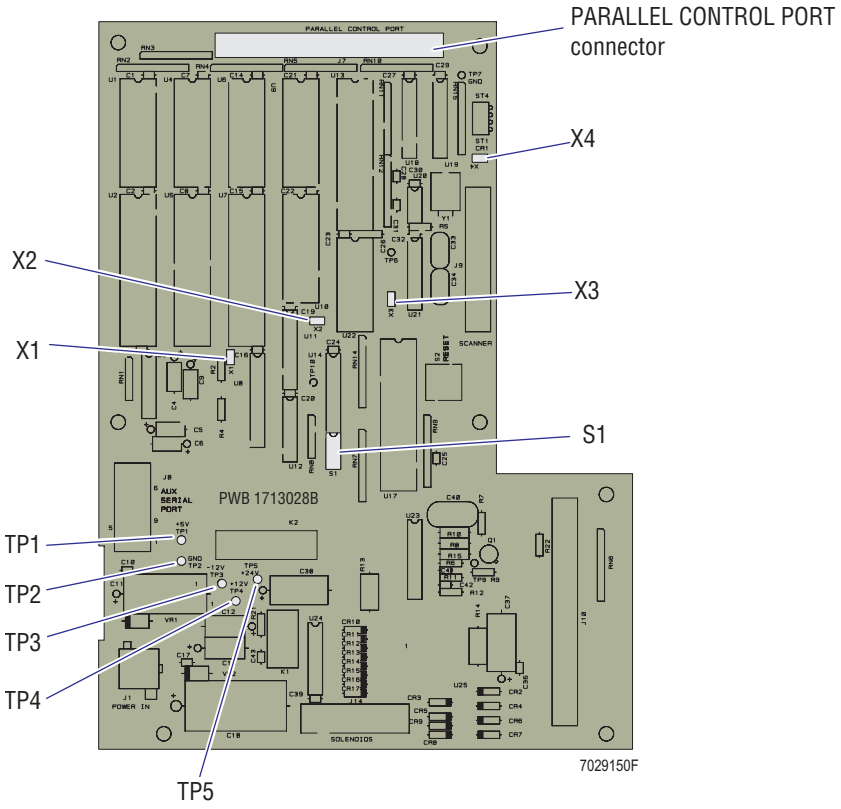
**ATTENTION:** This card is present only when the MCL option is installed.

### 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

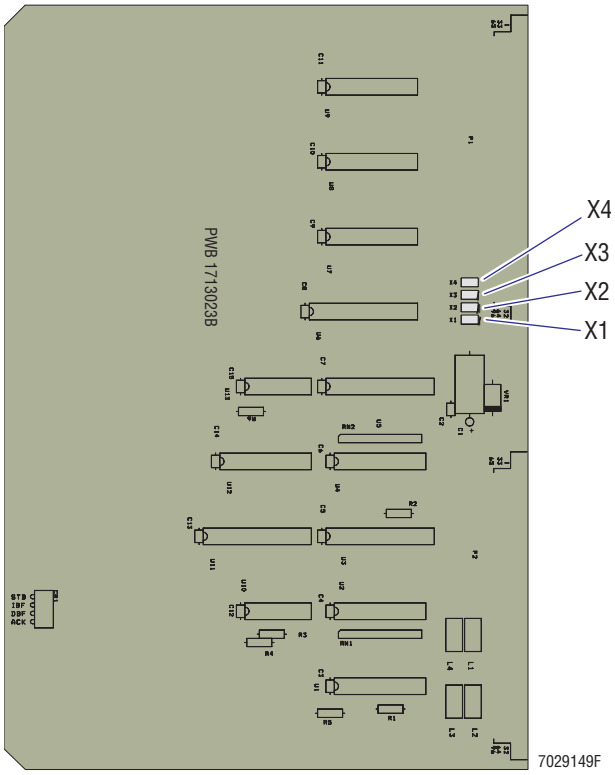
**ATTENTION:** This card is present only when the MCL option is installed.

### 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)

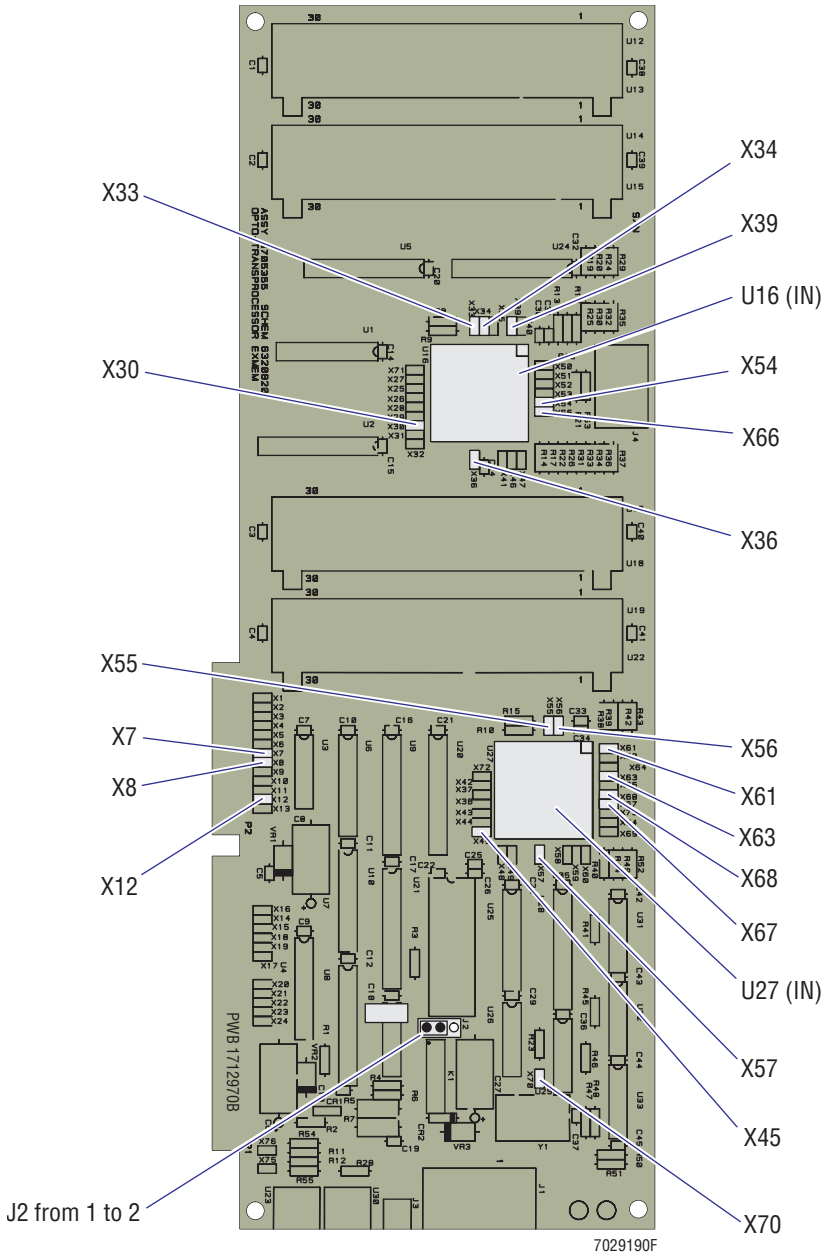
**Note:** Opto Transprocessor EXMEM is short for Optical Transprocessor Extended Memory card. This circuit card is used in all XL and XL-MCL instruments serial number Z09062 and below.

### 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**




### Jumpers

**Uses 2 Transputers (U16 and U27)**

X7, X8,
X12,
X30, X33, X34, X36, X39,
X45,
X54, X55, X56, X57,
X61, X63, X66, X67, X68,
X70,
J2 from 1 to 2

### Switches

N/A

## Opto Transprocessor EXMEM II Card (EMC Version)

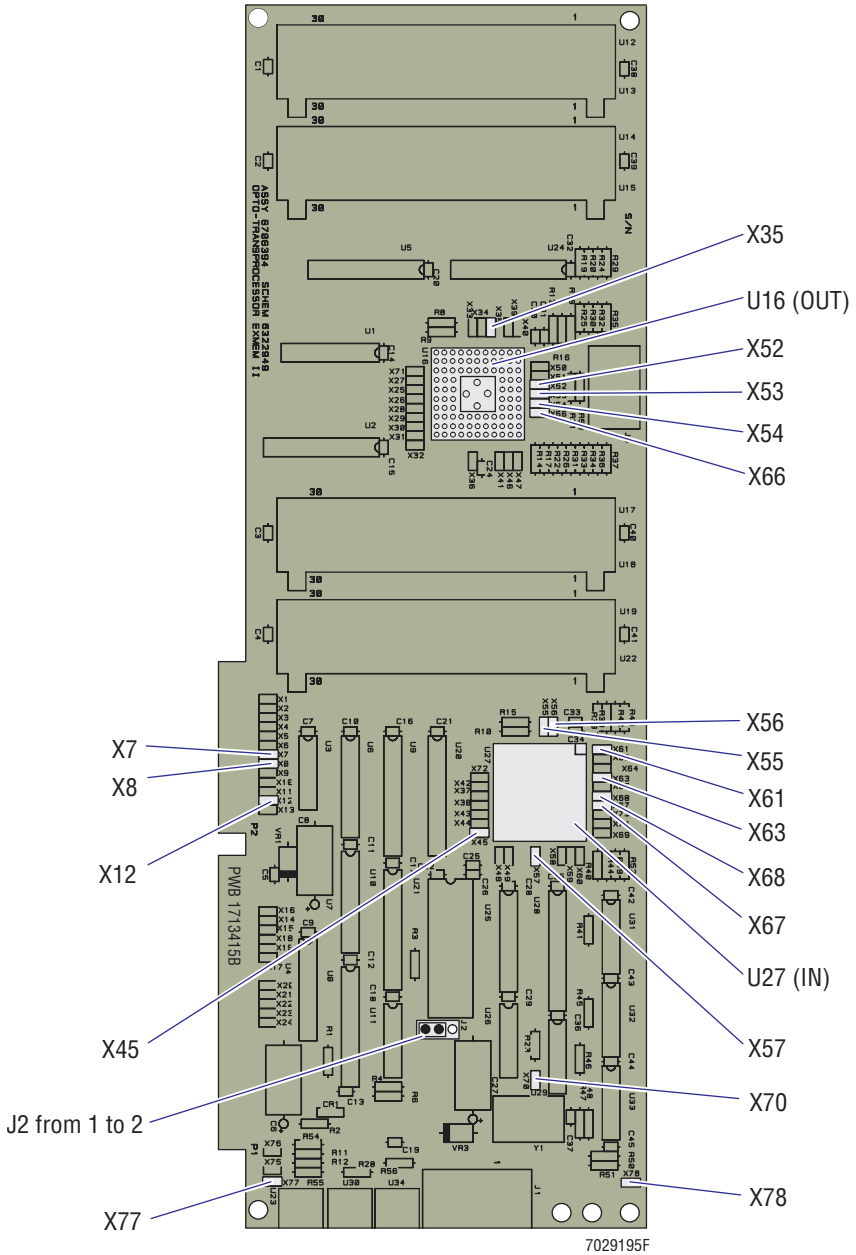
**Note:** Opto Transprocessor EXMEM II is short for Optical Transprocessor Extended Memory II card. This circuit card is used in all XL and XL-MCL instruments serial number Z09063 and above.

### 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**




### Jumpers

**Uses Only 1 Transputer (U27)**

X7, X8,
X12,
X35,
X45,
X52, X53, X55, X57,
X61, X63, X66, X67, X68,
X70, X77, X78,
J2 from 1 to 2

### Switches

N/A

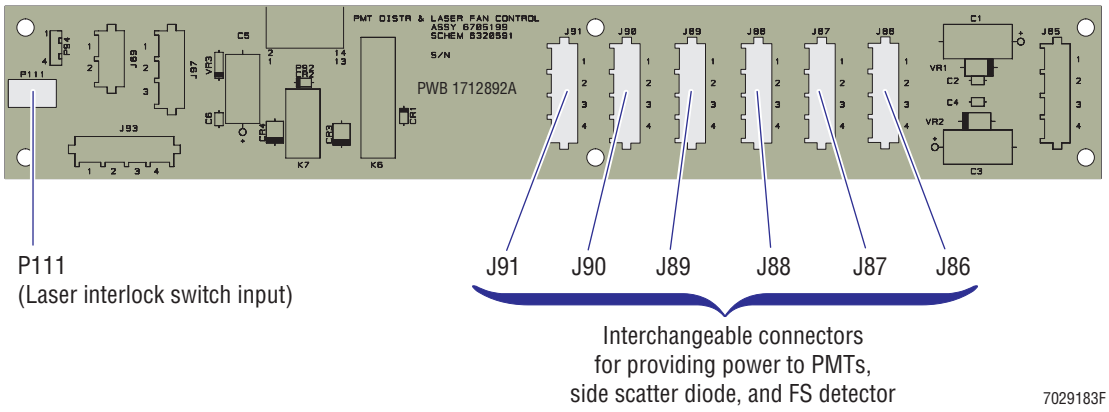
## PMT Distribution and Laser Fan Control Card

### 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)

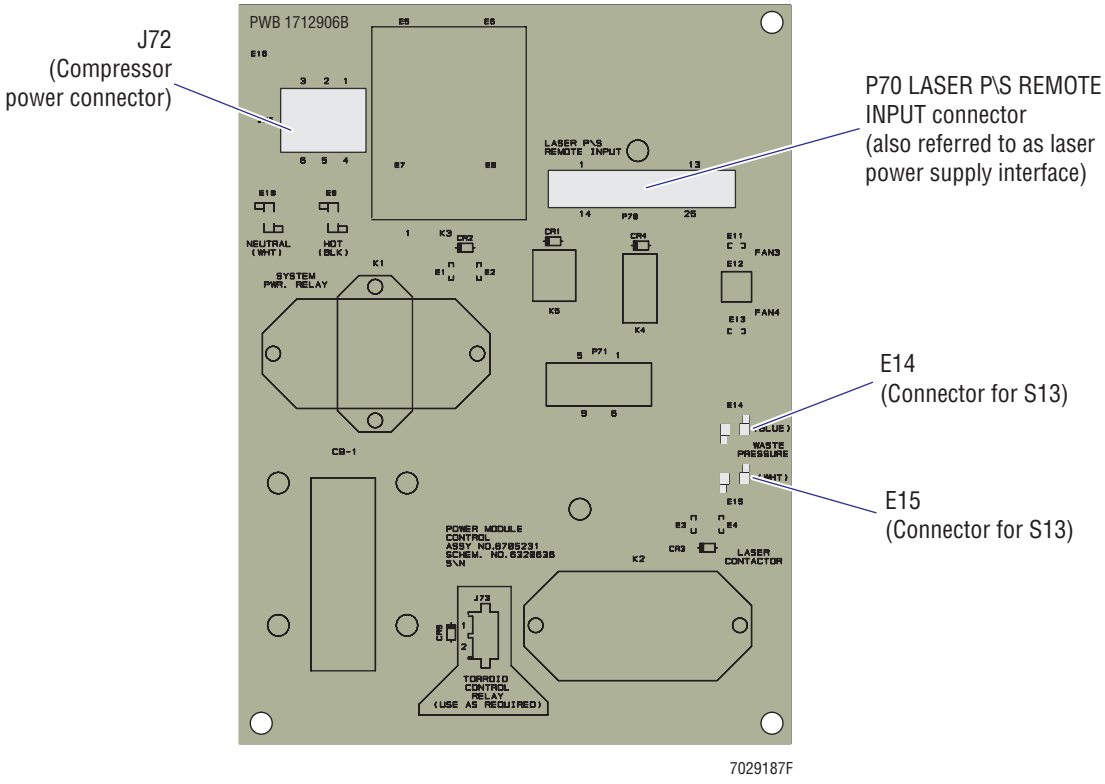
**Note:** The Power Module Control card is used in XL and XL-MCL instruments with a serial number Z09062 or lower.

### 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**




### Jumpers

N/A

### Switches

N/A

## Power Module Control II Card (EMC Version)

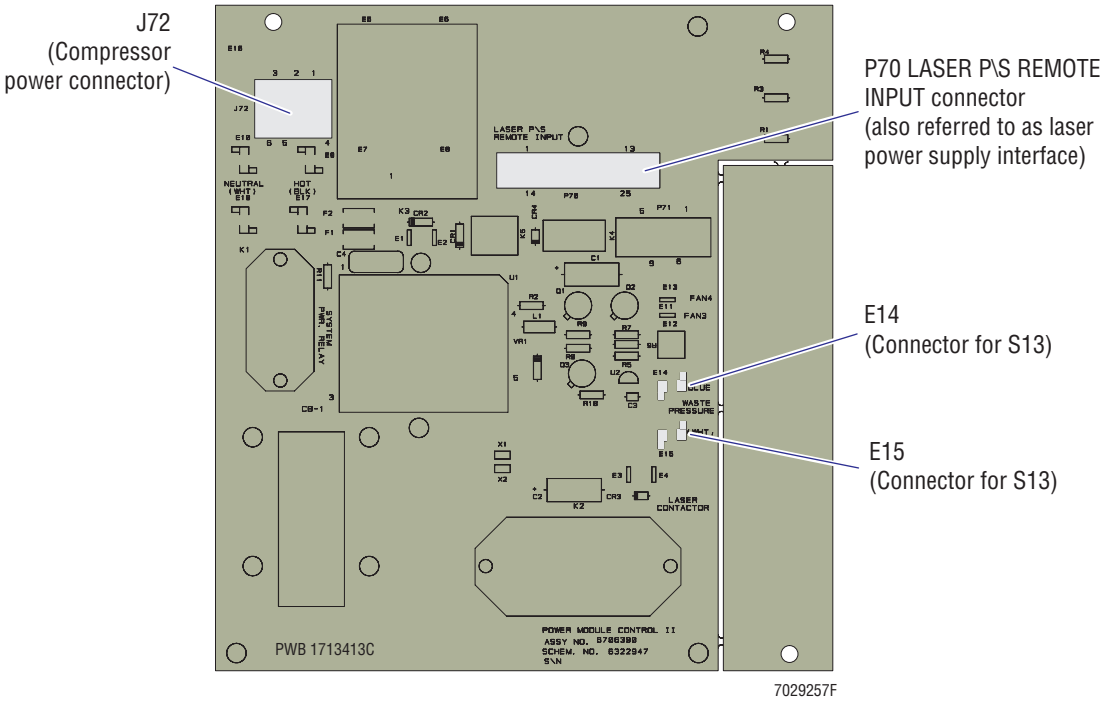
**Note:** The Power Module Control II card is used in XL and XL-MCL instruments with a serial number Z09063 or higher.

### Circuit Card Location in the Power Supply Module

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

### Component Locations

**Figure A.2-16 Power Module Control II Card (EMC Version) - Component Locations**




### Jumpers

N/A

### Switches

N/A

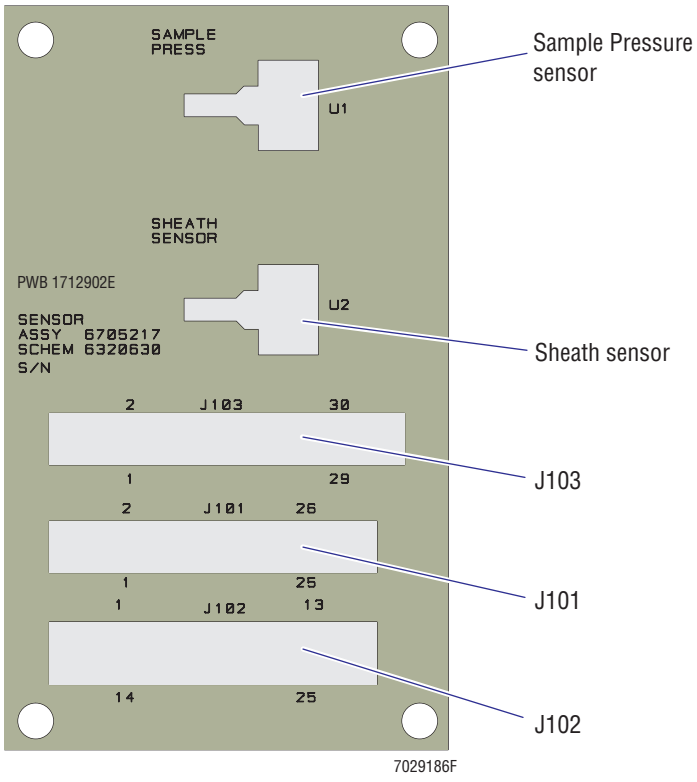
## Sensor Card

### 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

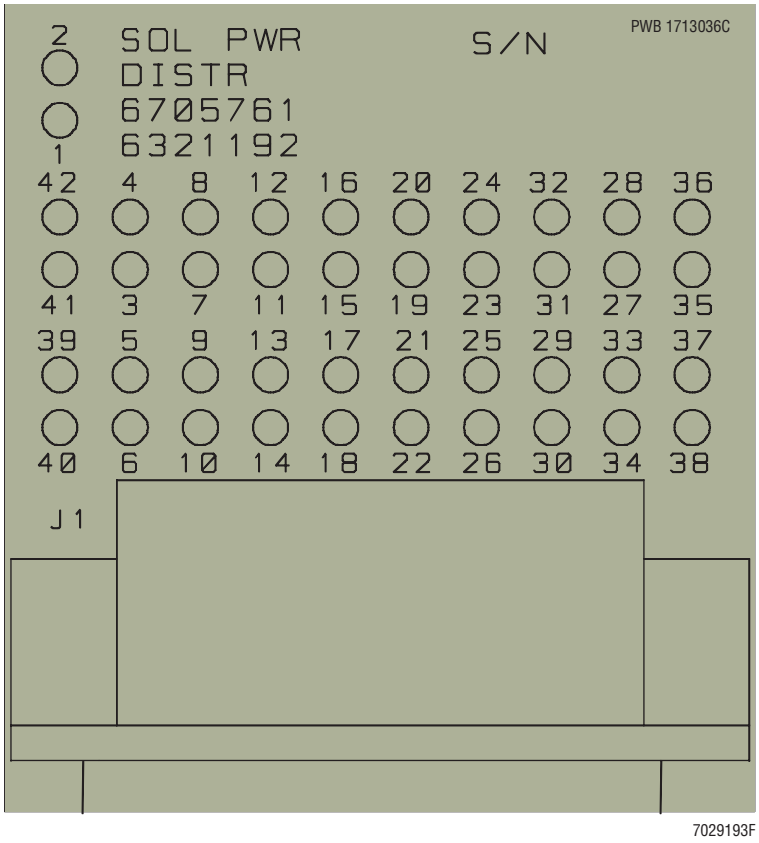
## Solenoid Power Distribution Card

### 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

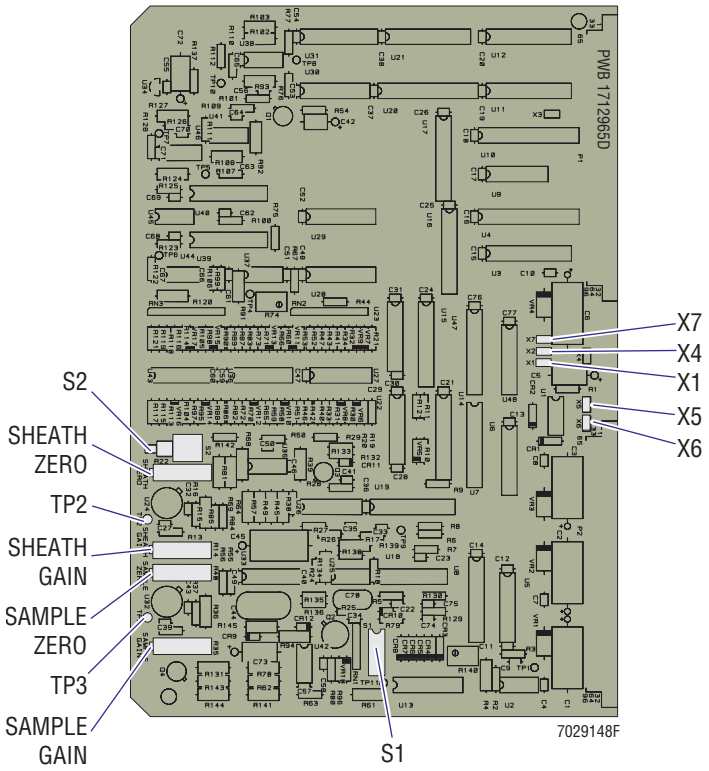
## System Interface Card

### 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

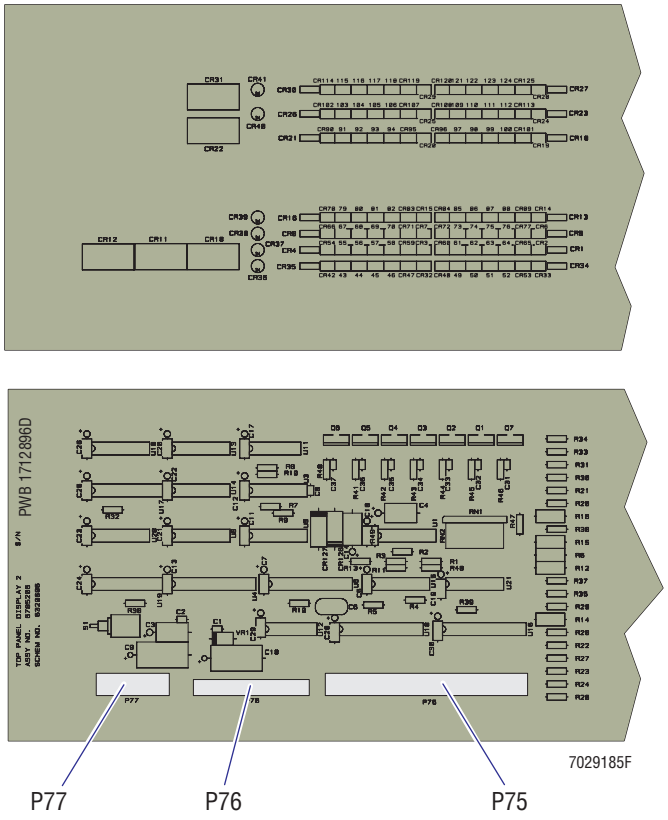
## Top Panel Display 2 Card

### 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

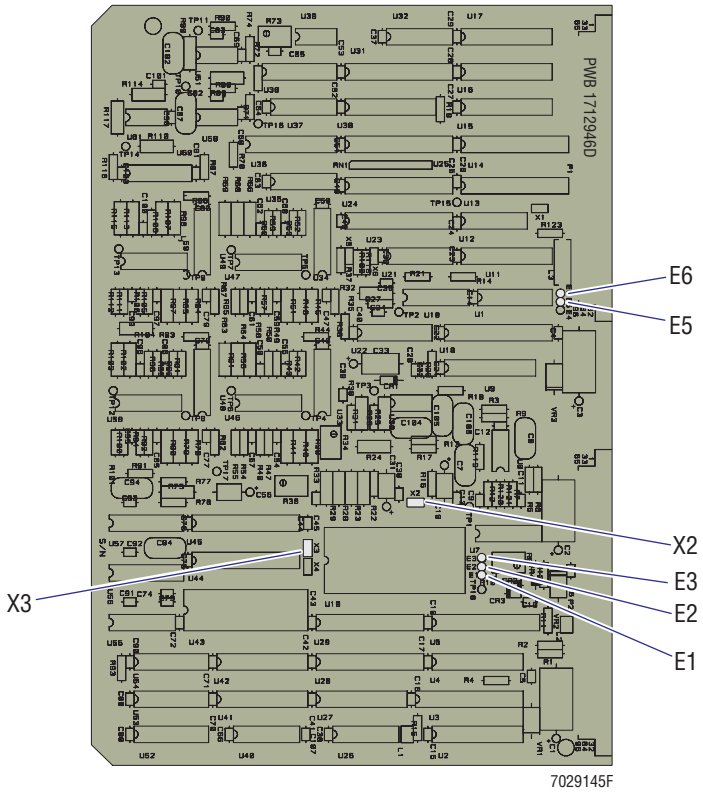
## Trans Data Acquisition Card

### 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

E1to 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:

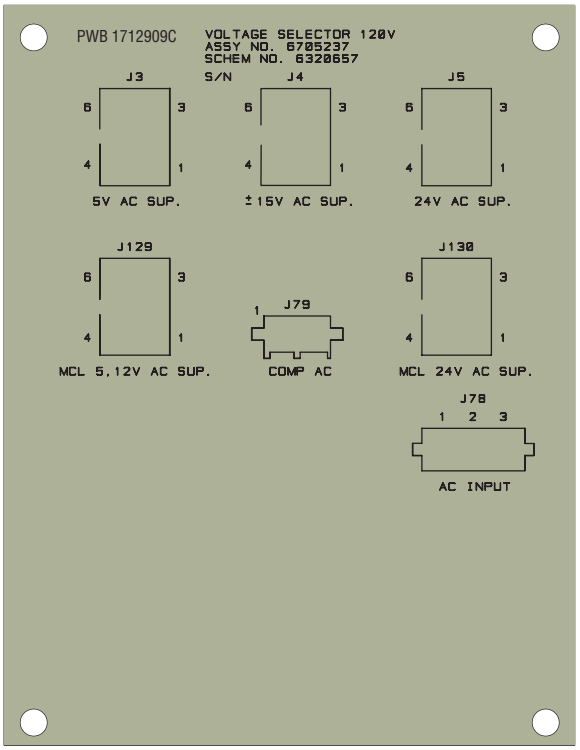
- Voltage Selector card for a 100 Vac system
- Voltage Selector card for a 120 Vac system
- Voltage Selector card for a 220 Vac system
- Voltage Selector card for a 230/240 Vac system

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**




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## Jumpers

N/A

## Switches

N/A

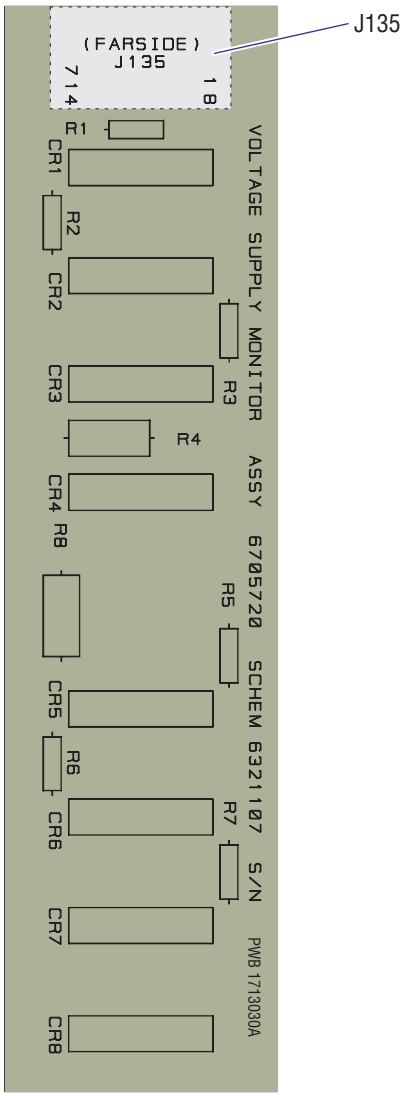
## Voltage Supply Monitor Card

### 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**




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### Jumpers

N/A

### Switches

N/A

# 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.<br>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.<br>**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 | Esc M R | Place carousel on turntable before executing this command. **Always execute this command before any other command.**<br><br>Resets MCL option, brings carousel out, places it in home position. |
| Carousel Home | Esc C H | Places carousel number label in front of bar-code scanner.<br><br>Tests carousel home position sensor located under turntable stage. |
| Carousel In | Esc C I | Moves carousel from out position to in position.<br><br>Checks operation of carousel in/out sensor. If sensor does not see flag moved through sensor, carousel is pushed back out. |
| Carousel Out | Esc C O | Moves carousel from in position to out position. |
| Carousel Load | Esc C L | Places carousel in load-carousel position. |
| Probe Down | Esc P D | Moves pickup probe to down position.<br><br>Checks probe up/down sensor to ensure change of state occurred. Probe stays down after successful completion of command. |
| Probe Up | Esc P U | Moves pickup probe to up position. |
| Lifter Up | Esc L U | Lifts vortex motor up.<br><br>Checks lifter sensor for change of state as flag passes through sensor. Lifter stays up after successful completion of command. |
| Lifter Down | Esc L D | Lowers vortex mixer. |
| Lifter Mix | Esc L M | Activates vortex motor.<br><br>Only active when a tube is sensed. |
| Finger Out | Esc X N | Moves tube rotate finger out. |
| Finger In | Esc X O | Moves tube rotate finger in. |
| Scanner Enable | Esc G | 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

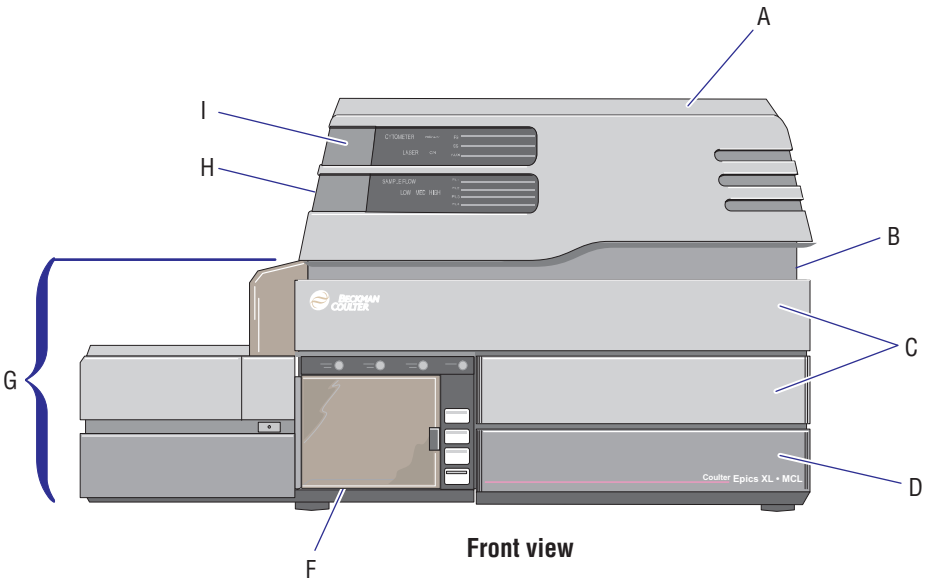
To quickly locate a component, always begin at the anchor illustration, Figure A.5-1.

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.

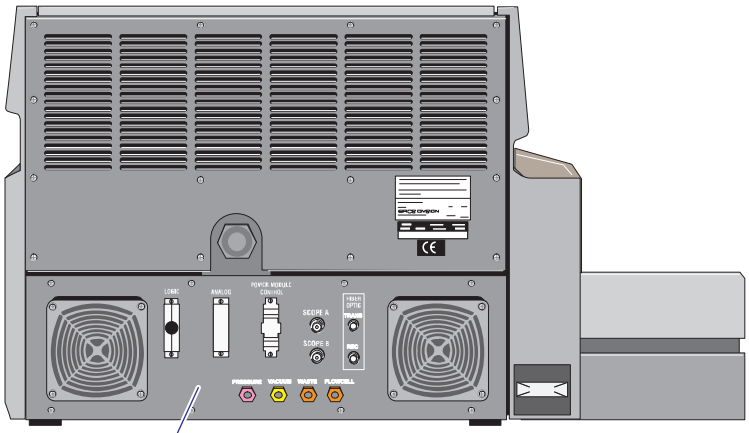
   **Note:** In the electronic version, each figure reference is in hypertext so that when you select the reference, the illustration quickly appears.
4. Locate the component. The number associated with the component identifies its name and also provides a figure reference for locating the component's function 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**




**Front view**




**Rear view**

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### 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

**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<br>Optical collection area<br>• Argon laser head, plenum, duct<br>• Laser cooling fans<br>• PMT Distribution and Laser Fan Control card<br>• PMT1, PMT2, PMT3, and PMT4 (if a four-color system) | Must remove the top cover. |
| A.5-1, B | Upper pneumatics drawer<br>QD13 and QD14<br>Water trap filter and associated components<br>Cooling coil | Must remove the top cover then the right side cover. |
| A.5-1, C | Light filters in slots 1 through 9<br>Neutral density spring-loaded knob | Must remove the center front cover (filter cover). |
| | Side scatter diode<br>Forward Scatter detector<br>Beamshaper assembly<br>Flow cell and/or fluorescence pickup lens | Must remove the center front cover (filter cover), manual sample station, and the filter shield.<br>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<br>Sheath liquid filter purge (vent) connections<br>Sheath container<br>Cleaning agent container | Must pull the reagent drawer open. |
| A.5-1, E | Fans<br>Fiber Optics Interface card<br>CYTO dc power EMI harness cable<br>Pressure, vacuum, and two waste quick-connects | If possible, stand behind the Cytometer.<br>**Note:** To replace components, it may be necessary to separate the rear panel from the Cytometer frame.<br>• 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.<br>• 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. |

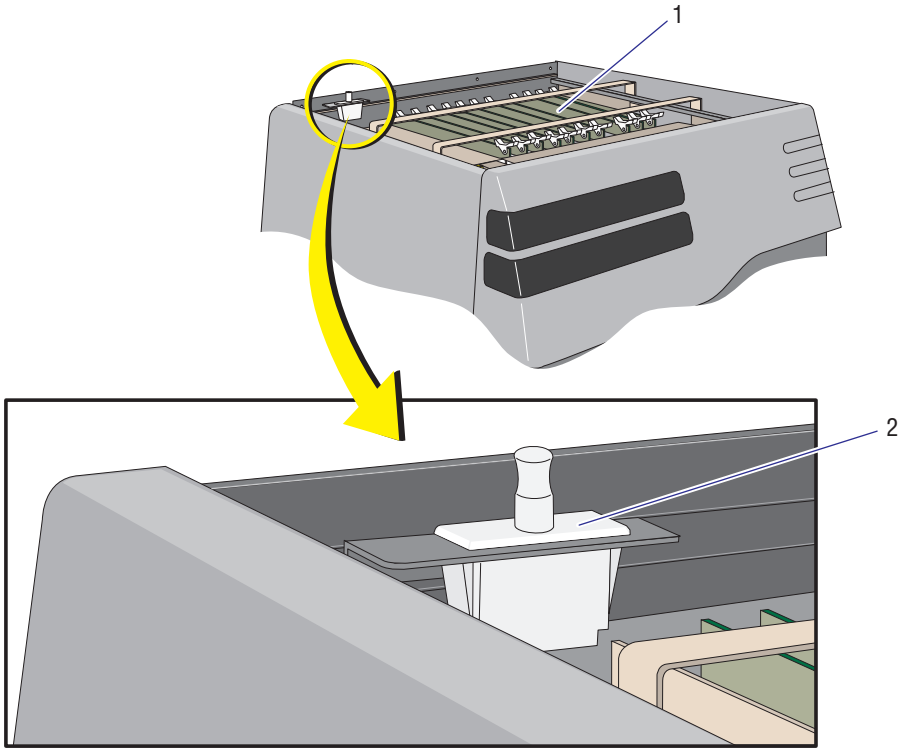
**Table A.5-1 XL Cytometer with MCL Option, Component and Assembly Accessibility *(Continued)***

| 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<br>Ribbon cables and latches<br>Segmenting valve | Must remove the manual sample station.<br>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<br>Back of mounting plate for laser cooling fans | Must remove the top cover then the left side cover.<br>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<br>Window display | Must lift the front panel display door. |

## 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**

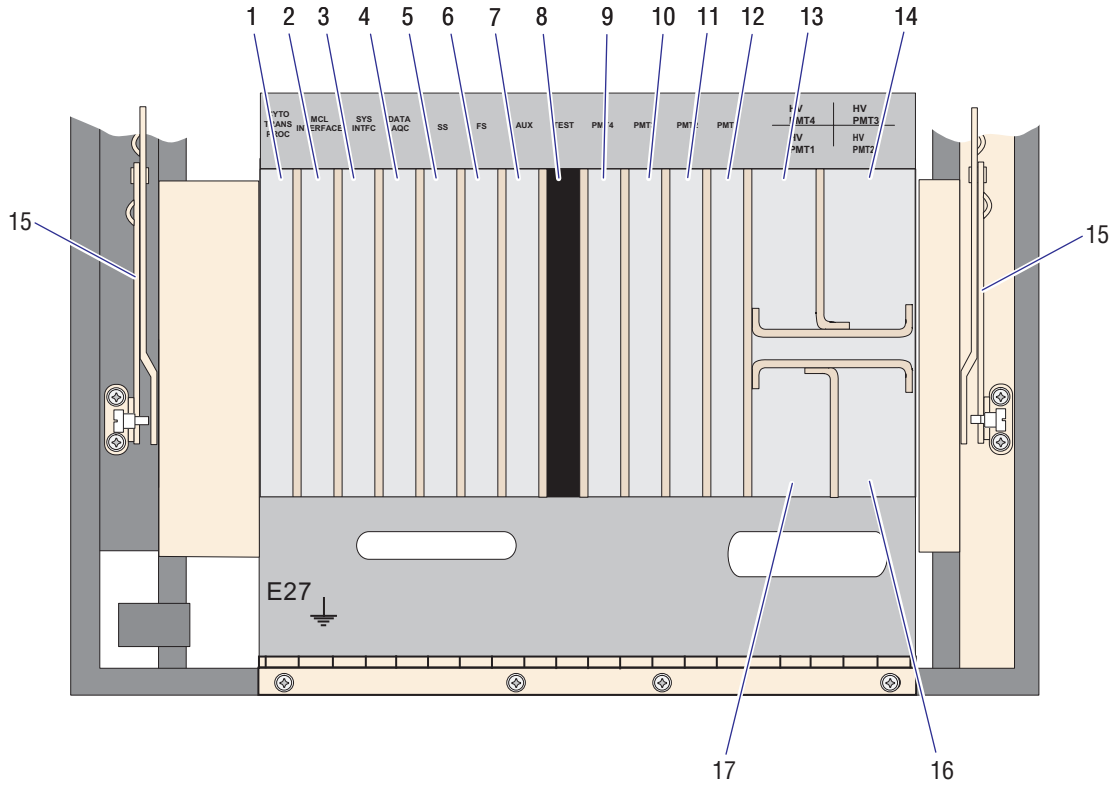
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-2, 1 | Data Acquisition card cage | Houses the electronic circuit cards inside the Cytometer (Figure A.5-3). Most procedures require the card cage be lifted out of the Cytometer and locked in its vertical position. 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 | 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.<br><br>**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.<br><br>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.<br><br>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. | |
| A.5-2 | Optical collection area | Houses the Argon laser head, flow cell, and the various optical components needed to detect light and fluorescent signals.<br><br>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.<br><br>The front section consists of the beamshaping assembly, flow cell, FS detector, SS diode, and various light filters.<br><br>The rear section consists of the Argon laser head, air ducts, laser blower assembly, PMT Distribution and Laser Fan Control card, and PMTs. | |

## 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 | Circuit card located in Slot 1 of the Data Acquisition card cage (left to right orientation).<br>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.<br>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. | Refer to PN 6320738 |
| A.5-3, 2 | MCL Interface card | If the MCL option is installed, this circuit card is located in Slot 2 of the Data Acquisition card cage (left to right orientation).<br>Communicates command instructions to the MCL CPU card to operate the MCL option. | Refer to PN 6321034 |
| A.5-3, 3 | System Interface card | Circuit card located in Slot 3 of the Data Acquisition card cage (left to right orientation).<br>Controls and monitors all system functions, laser ON/OFF, valve activation. Also monitors internal system temperatures. | Refer to PN 6320782 |
| A.5-3, 4 | Trans Data Acquisition card | Circuit card located in Slot 4 of the Data Acquisition card cage (left to right orientation).<br>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. | Refer to PN 6320732 |
| A.5-3, 5 | SS Amp/Signal Conditioner card | Circuit card located in Slot 5 of the Data Acquisition card cage (left to right orientation).<br>Receives the analog signal from the side scatter diode and and amplifies that signal before sending it to the Trans Data Acquisition card.<br>**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). | 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 | Circuit card located in Slot 6 of the Data Acquisition card cage (left to right orientation).<br>Receives the analog signal from the forward scatter detector and amplifies that signal before sending it to the Trans Data Acquisition card.<br>**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 | Refer to PN 6320739 |
| A.5-3, 7 | AUX Amp/Signal Conditioner card | Circuit card located in Slot 7 of the Data Acquisition card cage (left to right orientation).<br>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.<br>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.<br>• At the AUX Amp/Signal Conditioner card, the peak signal is amplified then sent to the Trans Data Acquisition card.<br>• 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.<br>**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 | 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) | 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.<br>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.<br>**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 | Refer to PN 6320739 |
| A.5-3, 10 | PMT3 Amp/Signal Conditioner card | Circuit card located in Slot 10 of the Data Acquisition card cage (left to right orientation).<br>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.<br>**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 | Refer to PN 6320739 |
| A.5-3, 11 | PMT2 Amp/Signal Conditioner card | Circuit card located in Slot 11 of the Data Acquisition card cage (left to right orientation).<br>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.<br>**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 | Refer to PN 6320739 |
| A.5-3, 12 | PMT1 Amp/Signal Conditioner card | Circuit card located in Slot 12 of the Data Acquisition card cage (left to right orientation).<br>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.<br>**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 | 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) | 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.<br>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).<br>**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. | |
| A.5-3, 14 | PMT3 HV power supply | In the HV power supply section of the Data Acquisition card cage, the PMT3 HV power supply is located in the upper right quadrant.<br>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).<br>**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. | |
| A.5-3, 15 | Hinge, left and right | 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:<br>1. With one hand, pull the Data Acquisition card cage forward and hold it in an upright position.<br>2. With your free hand, lock the hinge on each side of the card cage to secure the card cage in this vertical position.<br>3. **Make sure both hinges are locked before releasing your grip.**<br>To lower the card cage back into the center cavity of the Cytometer:<br>1. Stand in front of the Cytometer and grasp the top of the Data Acquisition card cage.<br>2. With a secure hold on the card cage, unlock the card cage hinges with your other hand.<br>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)***

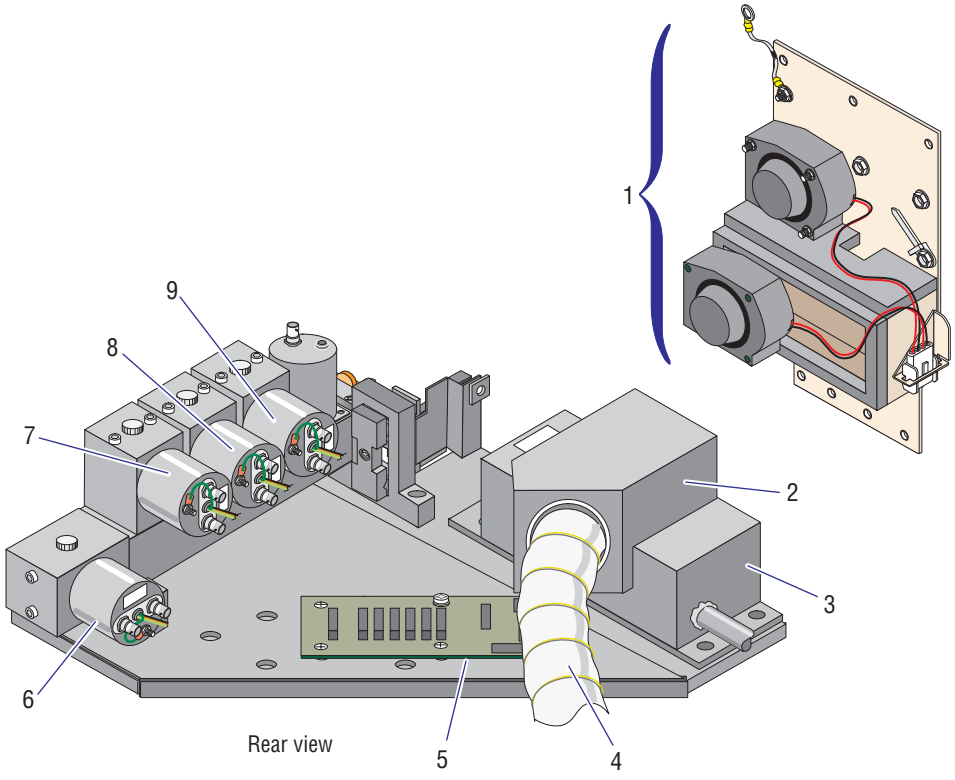
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-3, 16 | PMT2 HV power supply | In the HV power supply section of the Data Acquisition card cage, the PMT2 HV power supply is located in the lower right quadrant.<br>In response to the HV gain setting defined by 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).<br>**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. | |
| A.5-3, 17 | PMT1 HV power supply | In the HV power supply section of the Data Acquisition card cage, the PMT1 HV power supply is located in the lower left quadrant.<br>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).<br>**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. | |

## 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**

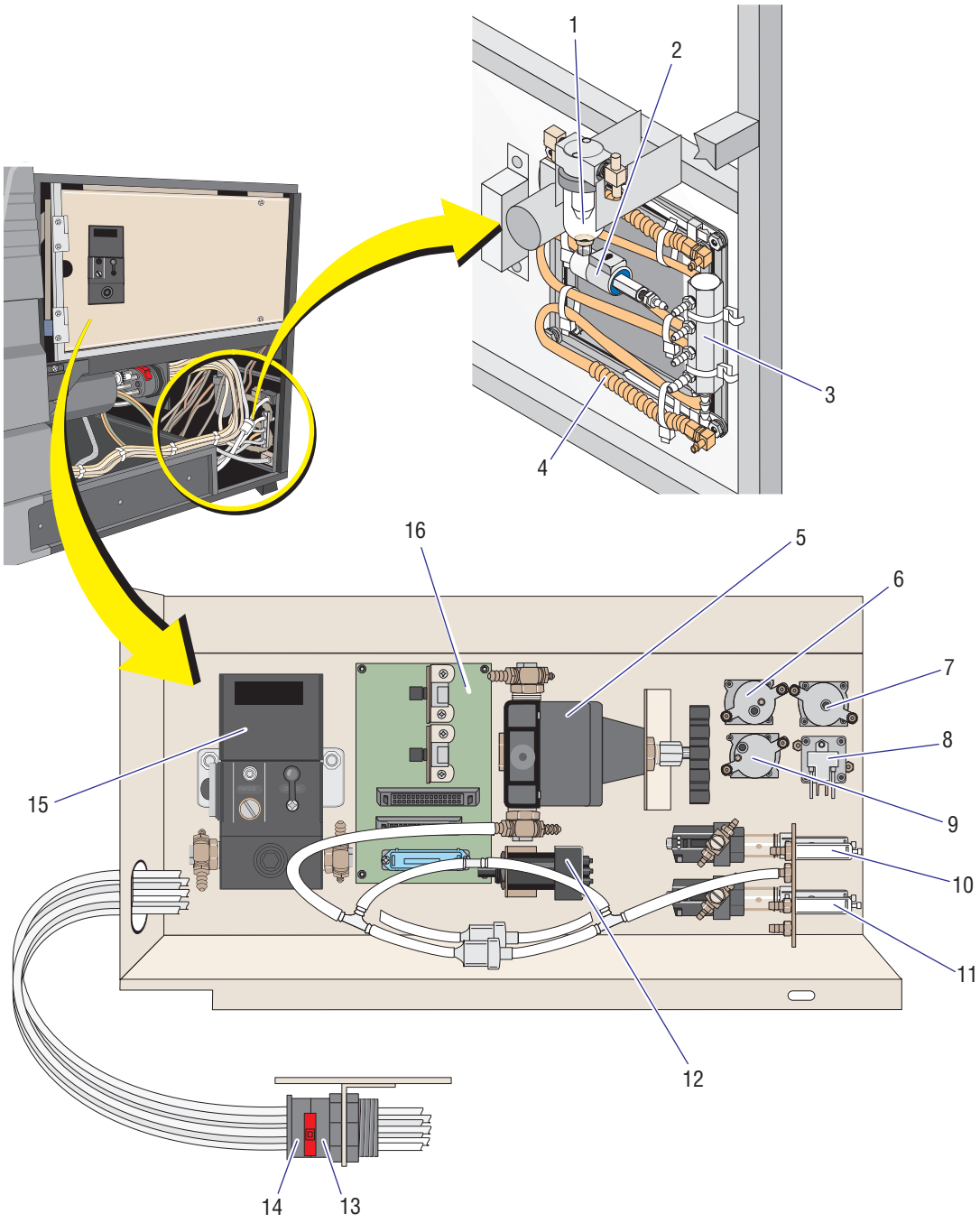
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-4, 1 | Laser blower assembly | Assembly contains two fans that force cooling air across the Argon laser head. | |
| A.5-4, 2 | Laser duct out plenum | Facilitates cooling of the laser head by directing the forced 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) | 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.<br>**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. | |
| A.5-4, 7 | PMT3 | 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.<br>**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. | |
| A.5-4, 8 | PMT2 | 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.<br>**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. | |

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

| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-4, 9 | PMT1 | 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.<br>**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. | |

## 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
2. VL33
3. Manifold
4. Cooling coil
5. Sheath pressure regulator
6. SN6
7. SN7
8. SN9
9. SN8
10. VL22
11. VL21
12. Vacuum regulator
13. QD14
14. QD13
15. Sample pressure regulator
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 | 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.<br>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. | FL 5 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886 |
| A.5-5, 2 | VL33 | *Type of Valve* Two-way, normally-open solenoid valve that serves as a dump valve to empty the water trap in the Cytometer.<br>*Energized* - When power to the Cytometer is on, solenoid VL 33 is energized, blocking the drain pathway from the water trap to the waste tank.<br>*De-energized* - 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. | VL 33 inside the FAN / CONNECTOR REAR PANEL block on PN 6320886 |
| A.5-5, 3 | Waste manifold | Provides a single point for routing waste from various areas of the Cytometer to the external waste tank.<br>• Port 1 - Output from the manifold to the external waste tank.<br>• Port 2 - Input via the normally-closed side of VL22 (located inside the upper pneumatics drawer).<br>• Port 3 - Input via VL33 (when de-energized).<br>• Port 4 - Input from the waste chamber when normally-closed VL7 is energized.<br>• 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.<br>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 *Sample Pressure Error* message appears on the Workstation screen to alert the operator.<br><br>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 *System Pressure Error* 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 *System Vacuum Error* 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 | *Type of Valve* Pinch valve (double-action, solenoid-actuated) used to control flow of sheath pressure to the sheath and cleanse tanks.<br>*Actuated* - 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.<br>*De-actuated* - 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. | VL 22 inside the UPPER PNEUMATICS PANEL block on PN 6320886 |
| A.5-5, 11 | VL21 | *Type of Valve* Pinch valve (double-action, solenoid-actuated) used to control sample pressure flow.<br>*De-actuated* - Resting state. Sample pressure is blocked.<br>*Actuated* - When data acquisition begins, sample pressure (regulated by RG 1) is available via VL13 at the sample head.<br>• If VL13 is de-actuated, sample pressure is available at the manual sample head.<br>• 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 | Regulates the constant vacuum being supplied to the manual sample head.<br>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. | RG 3 inside the UPPER PNEUMATICS PANEL block on PN 6320886 |

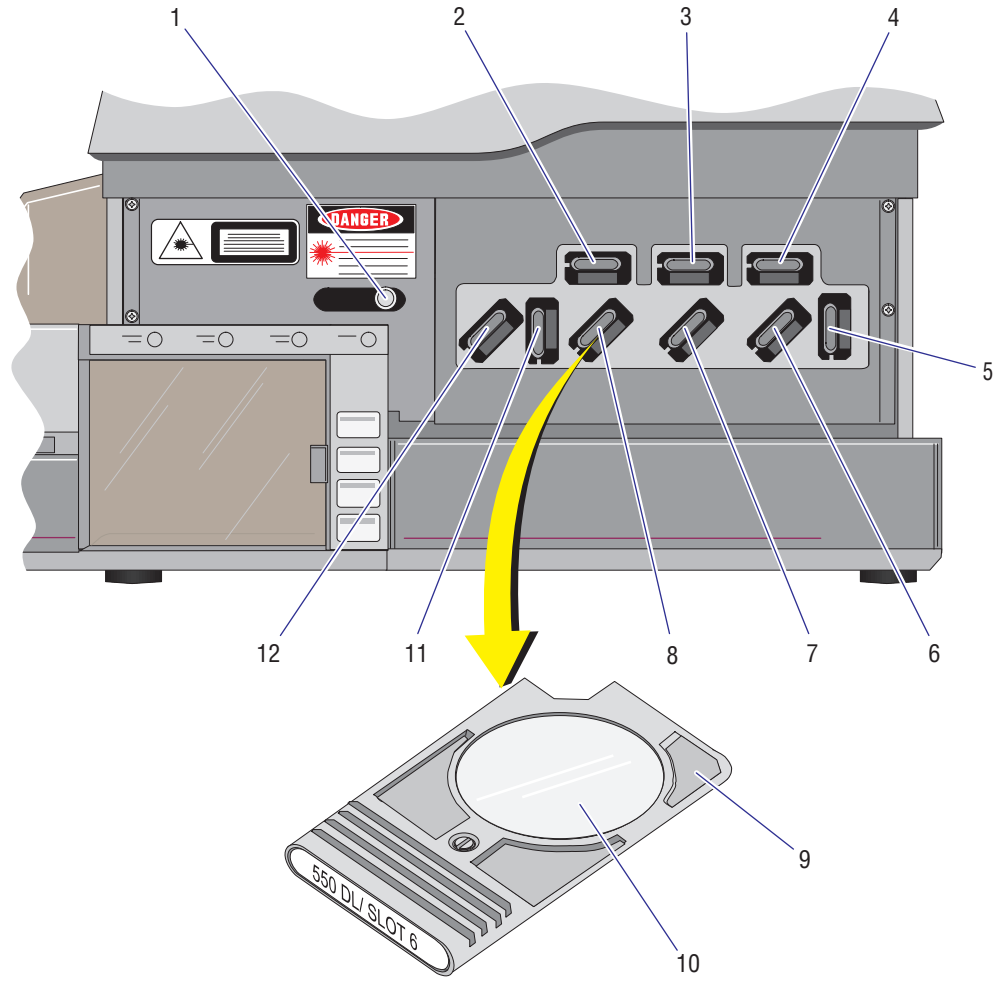
**Table A.5-5 Components in the Right Side of the Cytometer and their Functions *(Continued)***

| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-5, 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.<br>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:<br>• Monitors the sheath and sample pressures.<br>• 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 postioning 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**

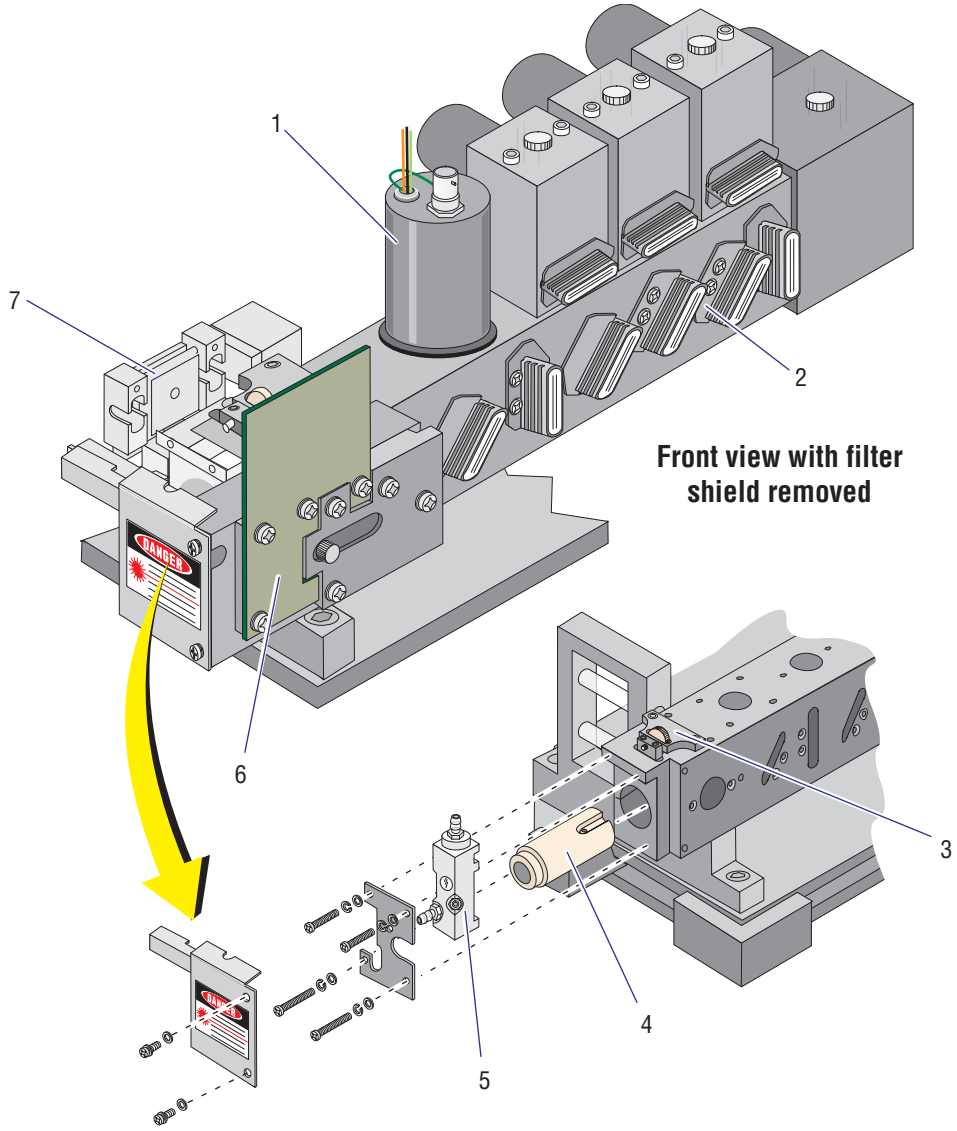
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-6, 1 | ND1 filter positioning knob | ND1 is short for a neutral density 1 filter.<br>This filter is already located in the sensing area. The operator positions the filter for use by sliding the spring-loaded knob along a track. When the knob is at the right end of its track, the filter is not used.<br>**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. | |
| A.5-6, 2 | 525 BP light filter | Fluorescent band pass filter that transmits emissions in the 525 nm region (filter passes 515 nm to 535 nm wavelengths).<br>**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. | |
| A.5-6, 3 | 575 BP light filter | Fluorescent band pass filter that transmits emissions in the 575 nm region (filter passes 567.5 nm to 582.5 nm wavelengths).<br>**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. | |
| A.5-6, 4 | 620 BP light filter | Fluorescent band pass filter that transmits emissions in the 620 nm region (filter passes 610 nm to 630 nm wavelengths).<br>**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. | |
| A.5-6, 5 | 675 BP light filter | Fluorescent band pass filter that transmits emissions in the 675 nm region (filter passes 660 nm to 690 nm wavelengths).<br>**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. | |

**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.<br>**Note:** The filter occupying this slot is actually a 640 DL filter labeled as 645 DL.<br>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.<br>**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.<br>**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).<br>**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.<br>**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)**




1. Side scatter diode
2. Lens holder plate
3. Fluorescense pickup lens adjustment hardware
4. Fluorescense pickup lens
5. Flow cell
6. Forward scatter detector
7. Beamshaper assembly

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

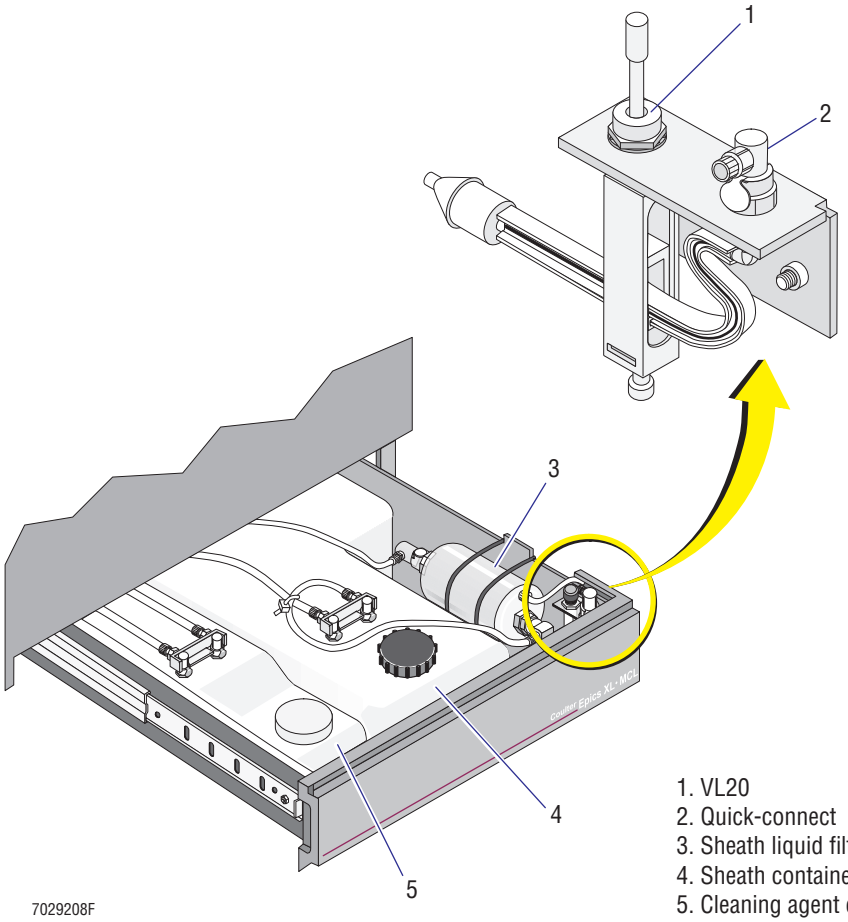
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-7, 1 | Side scatter diode | Also referred to as SS diode, SS sensor, or SS detector.<br>Collects the laser light that is scattered at about a 90° angle to the axis of the laser beam as a particle passes through 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.<br>**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.<br>A process called hydrodynamic focusing ensures the cells move through the laser beam one at a time, along the same path.<br>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.<br>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 | Also referred to as FS detector, FS sensor or forward scatter sensor.<br>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.<br>When the light reaches the FS detector, the detector generates voltage pulse signals that are proportional to the intensity of light the detector received.<br>These signals are processed to measure the characteristics of the cells that scattered the light. | |
| A.5-7, 7 | Beamshaper assembly | 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.<br>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. | |

## Components Inside the Reagent Drawer

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



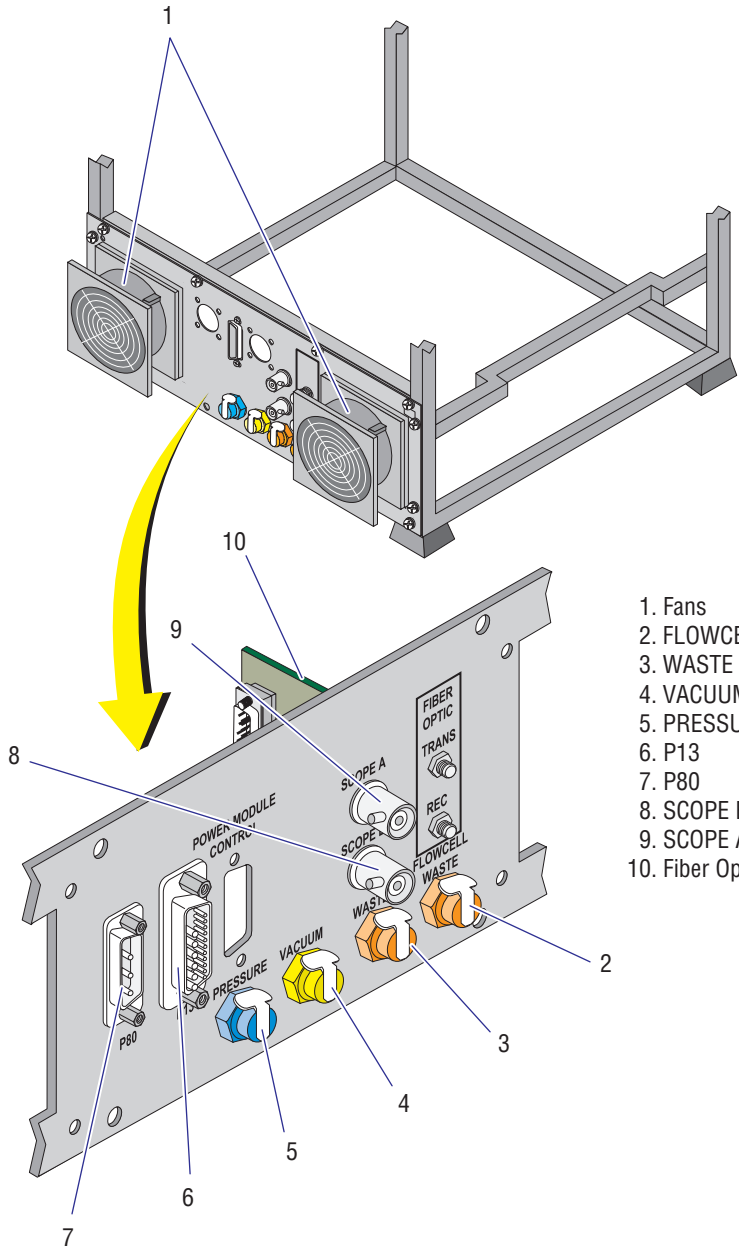

1. VL20
2. Quick-connect
3. Sheath liquid filter
4. Sheath container
5. Cleaning agent container

**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.<br>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.<br>Holds fluid used to create the hydrodynamic focus for sample analysis referred to as sheath flow.<br>IsoFlow™ sheath fluid, a non fluorescent, balanced electrolyte solution, or its equivalent is the recommended reagent.<br>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.<br>Holds cleaning agent for cleaning the sample lines and flow cell.<br>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.<br>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)**




1. Fans
2. FLOWCELL WASTE quick-connect
3. WASTE quick-connect
4. VACUUM quick-connect
5. PRESSURE quick-connect
6. P13
7. P80
8. SCOPE B connector
9. SCOPE A connector
10. Fiber Optics Interface card

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

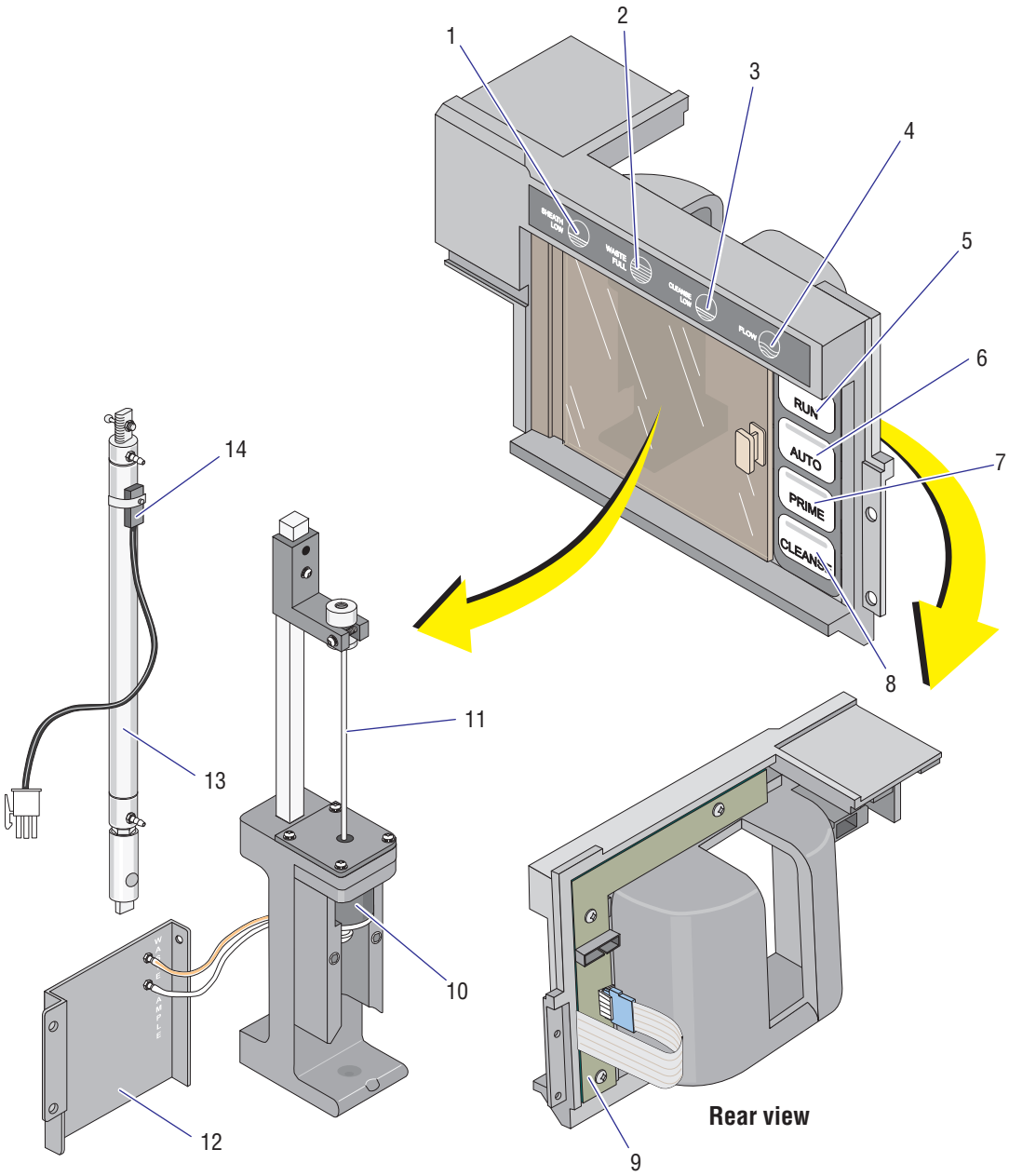
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-9, 1 | Fans | When power to the Cytometer is turned on, these fans provide a constant flow of room air into the Cytometer to keep the electronic components inside the Cytometer from overheating. | |
| A.5-9, 2 | 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).<br>**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.<br>**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 | 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.<br>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.<br>• At the rear of the Cytometer:<br>▸ The terminal post labeled RX goes in the jack labeled FIBER OPTIC REC.<br>▸ The terminal post labeled TX goes in the jack labeled FIBER OPTIC TRANS.<br>• At the rear of the tower computer:<br>▸ 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).<br>▸ The terminal post labeled TX goes in the inner (middle) jack labeled REC on the edge of the Opto Transprocessor EXMEM II card.<br>If installed incorrectly, the Cytometer powers up but the Workstation comes up in listmode. | |

## 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 | Red symbol when the sheath fluid is low.<br>During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red.<br>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. | |
| A.5-10, 2 | WASTE FULL level sense indicator | Red symbol when the external waste container is full.<br>During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red.<br>When the indicator glows red, the operator must empty the external waste container before the instrument can be cycled again. | |
| A.5-10, 3 | CLEANSE LOW level sense indicator | Red symbol when the cleaning agent is low.<br>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.5-10, 4 | FLOW indicator | Green symbol means the sample tube is pressurized and sample is going through the flow cell. | |
| A.5-10, 5 | RUN push-button and indicator | Micro contact switch used to place the Cytometer in the Idle or Run mode.<br>Press once to use the Run mode.<br>Press again for Idle mode.<br>The indicator color shows the Cytometer operating mode.<br>• Glowing (solid) green indicates the Cytometer is in the Run mode. Cytometer is waiting for the operator to insert a sample tube.<br>• Flashing green indicates the Cytometer is in the Idle mode.<br>• Glowing (solid) orange indicates the Run mode during sample analysis. | |
| A.5-10, 6 | AUTO push-button | Available only if the MCL option is installed.<br>Micro contact switch for MCL operation.<br>Press to use the optional Automatic mode.<br>Press again to use the Manual mode.<br>Glowing (solid) green indicator means the Cytometer is in the Auto mode and a carousel is in the MCL. | |

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

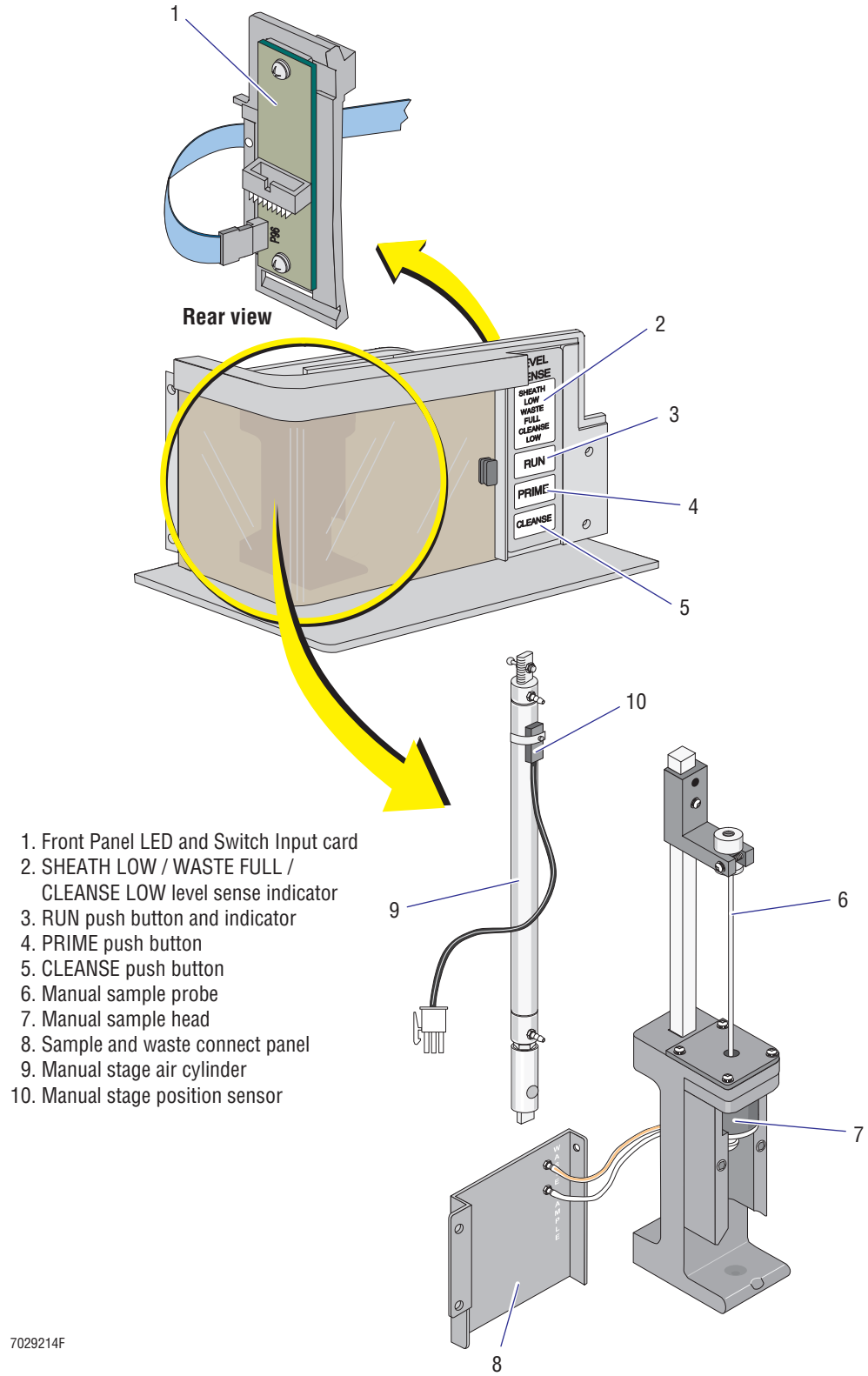
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-10, 7 | PRIME push-button | Micro contact switch used to initiate the Prime cycle.<br>Press to flush the flow cell with sheath fluid. Data acquisition pauses until the prime cycle is done. During the 10-second cycle, indicator is green. | |
| A.5-10, 8 | CLEANSE push-button | Micro contact switch used to initiate the Cleanse cycle.<br>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.<br>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.<br>If the sample pressure inside the sample tube is not sufficient, a *Sample Pressure Error* message appears on the Workstation screen to alert the operator.<br>**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.<br>**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)**




1. Front Panel LED and Switch Input card
2. SHEATH LOW / WASTE FULL / CLEANSE LOW level sense indicator
3. RUN push button and indicator
4. PRIME push button
5. CLEANSE push button
6. Manual sample probe
7. Manual sample head
8. Sample and waste connect panel
9. Manual stage air cylinder
10. Manual stage position sensor

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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 | Red means the sheath fluid or cleaning agent is low or the external waste container is full.<br>• If the sheath fluid is low:<br>During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red.<br>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.<br>• If the external waste container is full:<br>During sample analysis, the operator has 5 minutes to finish analyzing the current sample after the indicator starts flashing red.<br>When the indicator glows red, the operator must empty the external waste container before the instrument can be cycled again.<br>• If cleaning agent is low:<br>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 | Micro contact switch used to place the Cytometer in the Idle or Run mode.<br>Press once to use the Run mode.<br>Press again for Idle mode.<br>The indicator color shows the Cytometer operating mode.<br>• Glowing (solid) green indicates the Cytometer is in the Run mode. Cytometer is waiting for the operator to insert a sample tube.<br>• Flashing green indicates the Cytometer is in the Idle mode.<br>• Glowing (solid) orange indicates the Run mode during sample analysis. | |

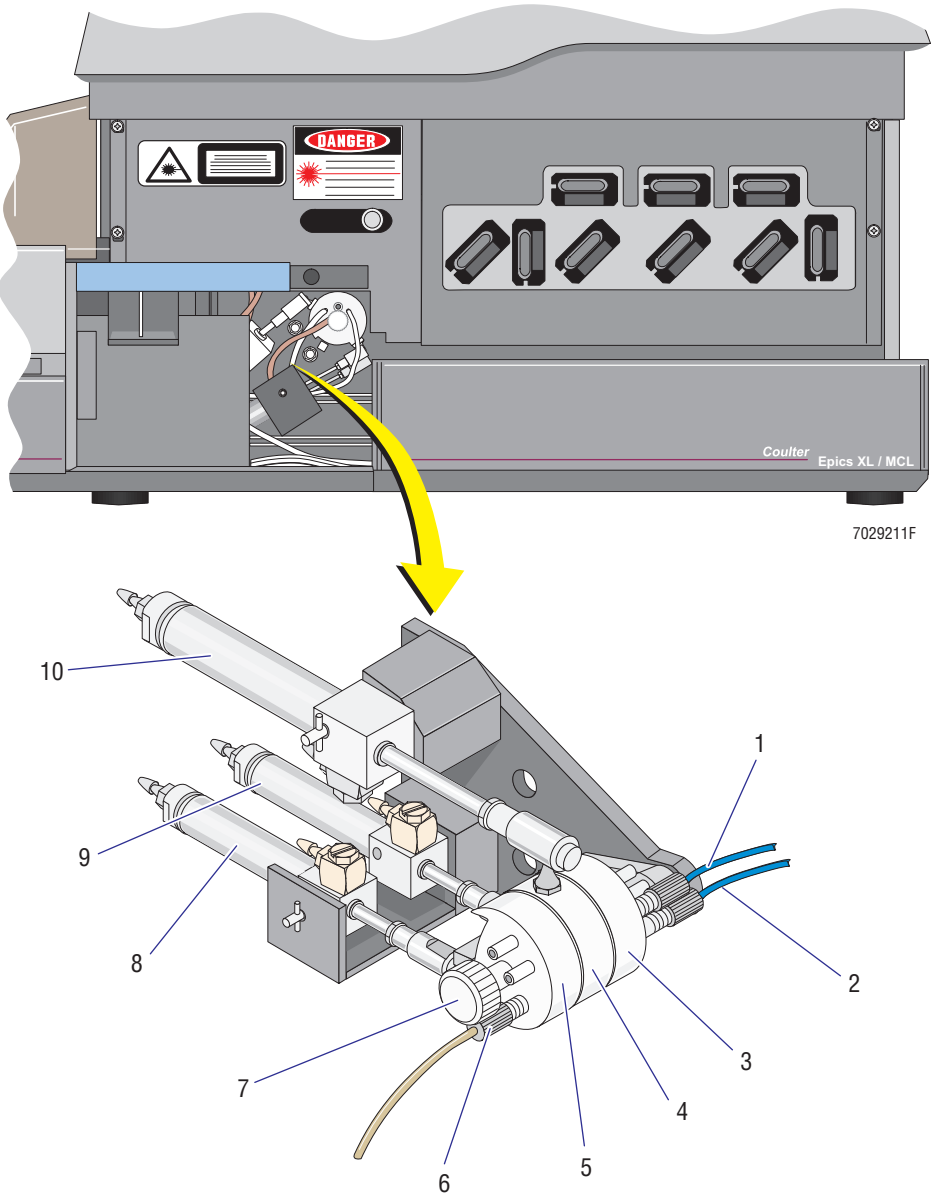
**Table A.5-11 XL Manual Sample Station Components and their Functions *(Continued)***

| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-11, 4 | PRIME push-button | Micro contact switch used to initiate the Prime cycle.<br>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.<br>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.<br>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.<br>If the sample pressure inside the sample tube is not sufficient, a *Sample Pressure Error* message appears on the Workstation screen to alert the operator.<br>**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.<br>**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

**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 | Double action air cylinder controlled by 30 psi provided by either VL15 or VL18.<br>VL18 is normally energized to hold the front pad in its normal position.<br>When VL15 is energized, the front pad rotates for cleaning.<br>**Note:** To locate VL15 or VL18, refer to Figure A.5-15, items 10 and 7 respectively. | CYL 2 inside the PROBE NORMAL block on PN 6320886 |

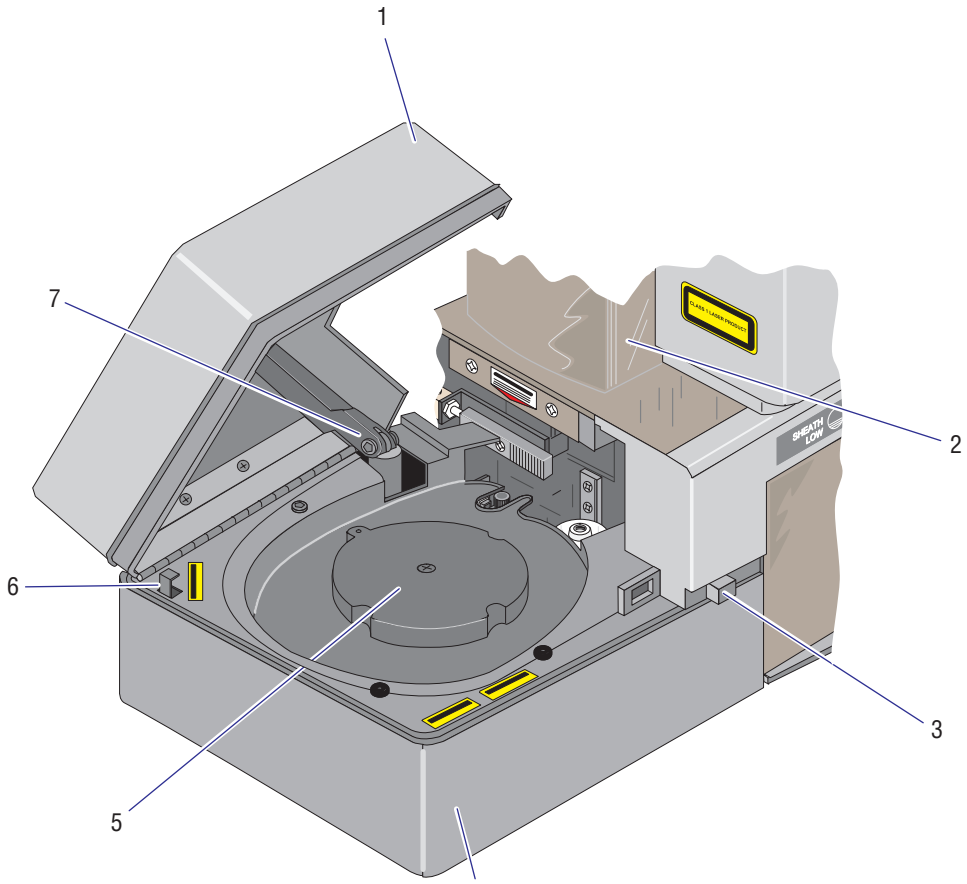
**Table A.5-12 Segmenting Valve Components and Their Functions *(Continued)***

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




1. MCL door
2. MCL probe housing
3. MCL carousel pushbutton
4. MCL base
5. Carousel hub
6. Interlock switch
7. MCL gas cylinder and bracket

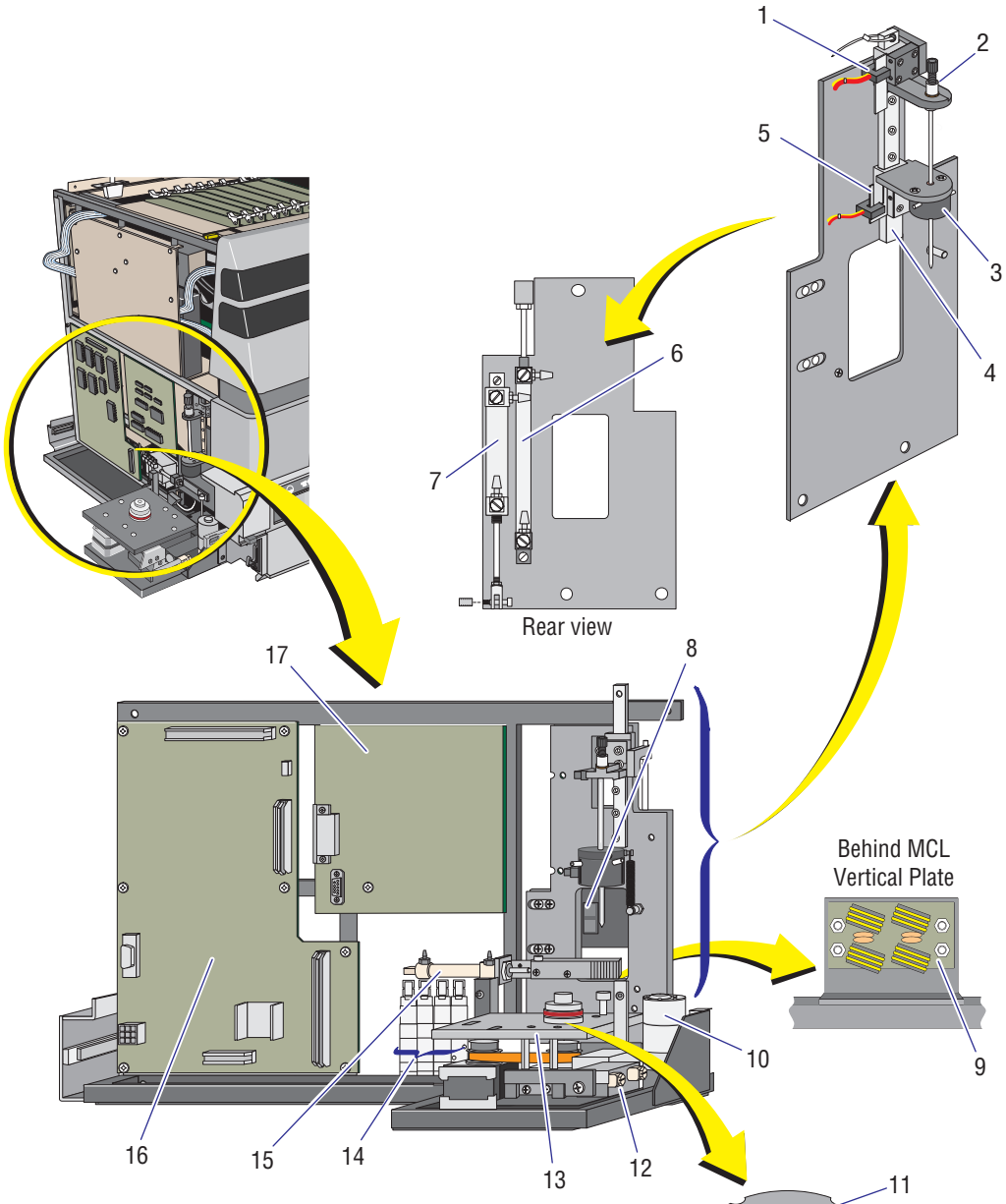
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**Table A.5-13 Carousel Components and Their Functions**

| 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 | Safety interlock to ensure the MCL door is closed during operation. If the door is open, an *MCL Door Open error* or *MCL Door Open Warning* message appears on the Workstation screen. Operation is halted until the door is closed.<br><br>**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.<br><br>To override (bypass) this safety interlock, pull the switch up and operation resumes even though the door is open.<br><br>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. | |
| 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)**




1. Probe sensor and flag
2. MCL sample probe
3. MCL sample head
4. Probe slide assembly
5. Sample head sensor and flag
6. Probe up/down air cylinder
7. Lifter air cylinder
8. Bar-code reader
9. Motor Filter card (EMC version)
10. MCL lifter assembly
11. Carousel hub
12. In/out air cylinder
13. MCL carousel base assembly
14. MCL solenoid assembly
15. MCL tube rotator assembly
16. MCL CPU card
17. Bar-code Decoder card

**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 | When a sample tube makes contact with the MCL sample head, sample pressure enters the tube.<br>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.<br>If the sample pressure inside the sample tube is not sufficient, a *Sample Pressure Error* message appears on the Workstation screen to alert the operator.<br>**Note:** To locate SN7, refer to Figure A.5-5, item 7. | |
| 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. | |

**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.

**Figure A.5-15 Lower Pneumatics Drawer Components (See Table A.5-15)**

1. Solenoid Power Distribution card
2. Solenoid manifold
3. QD10
4. QD11
5. VL20
6. VL19
7. VL18
8. VL17
9. VL16
10. VL15
11. VL14
12. VL0
13. VL1
14. VL2
15. VL3
16. VL4
17. VL5
18. VL6
19. VL7
20. VL8
21. VL9
22. VL10
23. VL11
24. VL12
25. VL13
26. 12 insert fitting plate
27. 5 insert fitting plate (MCL option only)
28. Upper 6 insert fitting plate
29. Lower 6 insert fitting plate
30. Waste chamber sensor
31. Waste chamber

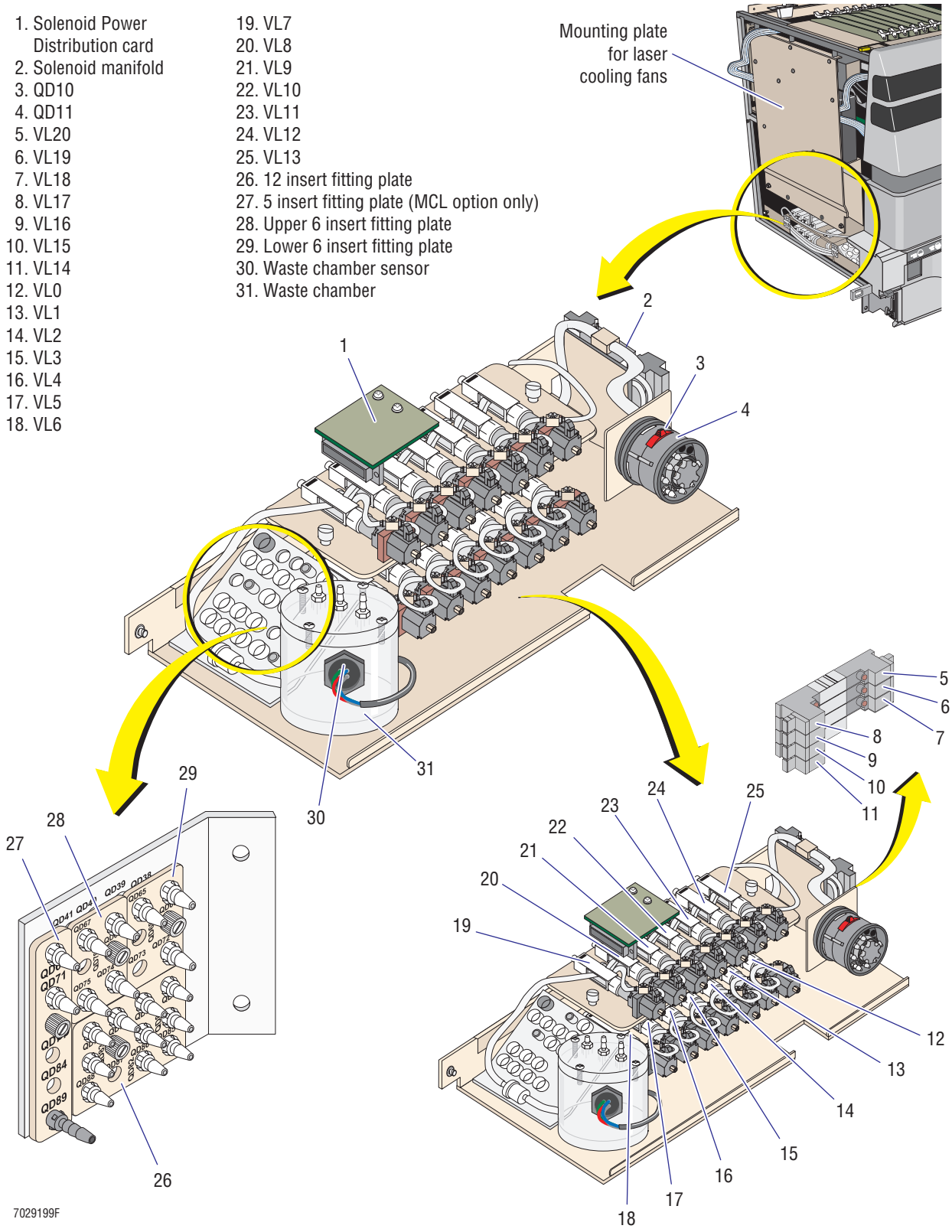


**Table A.5-15 Components in the Lower Pneumatics Drawer and Their Functions**

| 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 | 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.<br>VL17 is normally energized to hold the rear pad in its normal position that allows sample flow through the PROBE port.<br>When VL20 is energized, the rear pad rotates to allow sample flow through the MCL port.<br>**Note:** To locate the air cylinder (CYL 4), refer to Figure A.5-12, item 9. | VL 20 inside the LOWER PNEUMATICS DRAWER block on PN 6320886 |
| A.5-15, 6 | VL19 | 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.<br>VL16 is normally energized to hold the middle pad in its normal position.<br>When VL19 is energized, the middle pad rotates to perform the Stop On Volume function.<br>**Note:** To locate the air cylinder (CYL 3), refer to Figure A.5-12, item 10. | VL 19 inside the LOWER PNEUMATICS DRAWER block on PN 6320886 |
| A.5-15, 7 | VL18 | 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.<br>VL18 is normally energized to hold the front pad in its normal position.<br>When VL15 is energized, the front pad rotates for cleaning.<br>**Note:** To locate the air cylinder (CYL 2), refer to Figure A.5-12, item 8. | 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 | 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.<br>VL17 is normally energized to hold the rear pad in its normal position that allows sample flow through the PROBE port.<br>When VL20 is energized, the rear pad rotates to allow sample flow through the MCL port.<br>**Note:** To locate the air cylinder (CYL 4), refer to Figure A.5-12, item 9. | VL 17 inside the LOWER PNEUMATICS DRAWER block on PN 6320886 |
| A.5-15, 9 | VL16 | 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.<br>VL16 is normally energized to hold the middle pad in its normal position.<br>When VL19 is energized, the middle pad rotates to perform the Stop On Volume function.<br>**Note:** To locate the air cylinder (CYL 3), refer to Figure A.5-12, item 10. | VL 16 inside the LOWER PNEUMATICS DRAWER block on PN 6320886 |
| A.5-15, 10 | VL15 | 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.<br>VL18 is normally energized to hold the front pad in its normal position.<br>When VL15 is energized, the front pad rotates for cleaning.<br>**Note:** To locate the air cylinder (CYL 2), refer to Figure A.5-12, item 8. | VL 15 inside the LOWER PNEUMATICS DRAWER block on PN 6320886 |
| A.5-15, 11 | VL14 | 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.<br>*Energized* 30 psi is routed to the air cylinder to raise the sample stage.<br>*De-energized* 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. | VL 14 inside the LOWER PNEUMATICS DRAWER block on PN 6320886 |
| A.5-15, 12 | VL0 | Controls the flow of sheath to the flow cell.<br>*Type of Valve* Normally closed pinch valve controlled by an electro-pneumatic valve (solenoid/pilot actuator combination valve) | 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>Normally-open side provides a supply of vacuum to VL7. When VL7 is energized, the vacuum pulls liquid into the waste chamber.<br>Normally-closed side provides sheath pressure for draining the waste chamber.<br>*Type of Valve* 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.<br>*Type of Valve* 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.<br>*Type of Valve* 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)***

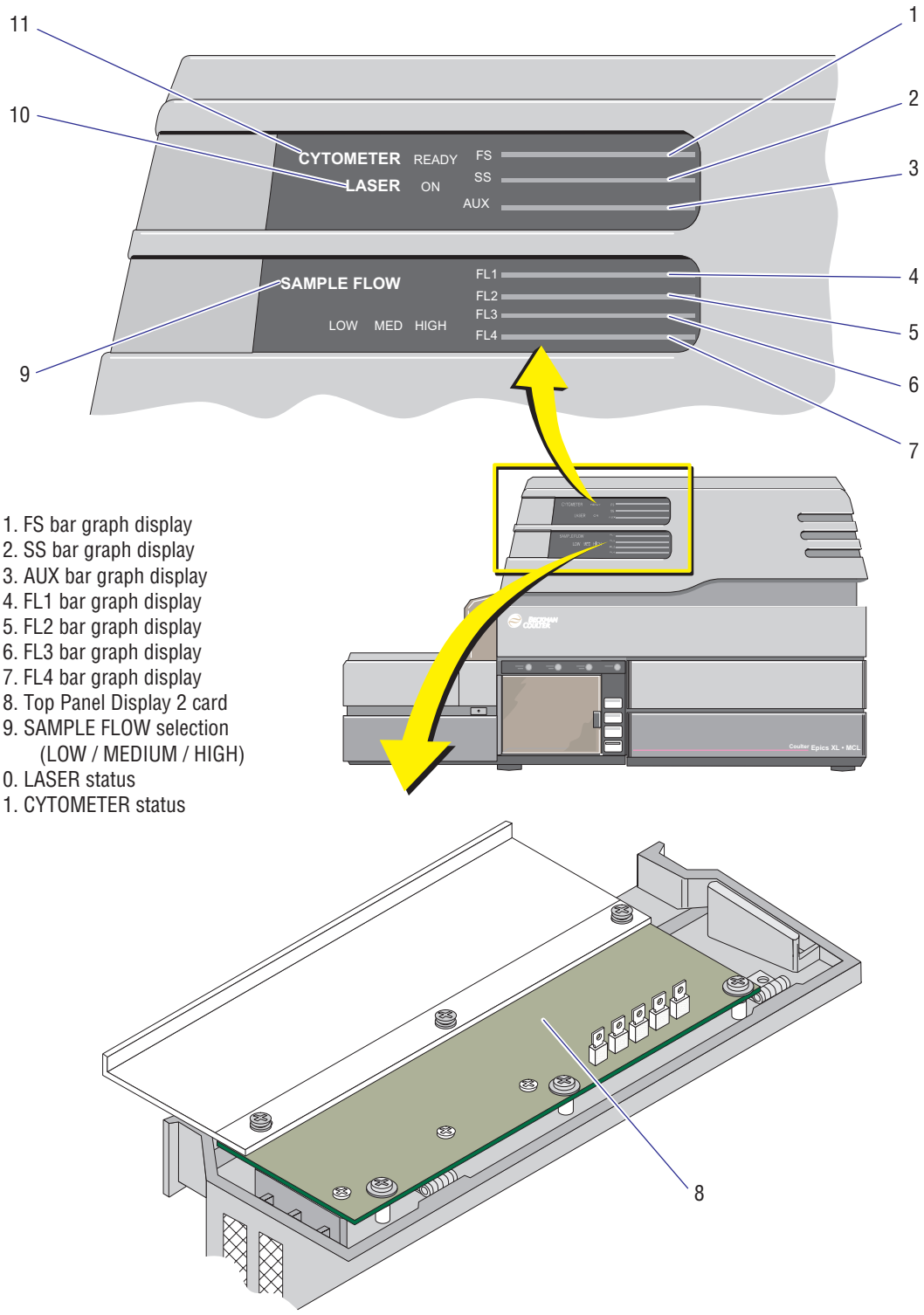
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.5-15, 26 | 12 insert fitting plate | Plate contains a captive knurl knob with fitting inserts at QD76, QD77, QD78, QD79, QD81, QD82, QD83, QD85, QD86, and QD88.<br>• QD76 couples with QD50 on the 45° angled bracket<br>• QD77 couples with QD51 on the 45° angled bracket<br>• QD78 couples with QD52 on the 45° angled bracket<br>• QD79 couples with QD53 on the 45° angled bracket<br>• QD81 couples with QD55 on the 45° angled bracket<br>• QD82 couples with QD56 on the 45° angled bracket<br>• QD83 couples with QD57 on the 45° angled bracket<br>• QD85 couples with QD59 on the 45° angled bracket<br>• QD86 couples with QD60 on the 45° angled bracket<br>• QD88 couples with QD62 on the 45° angled bracket<br>**Note:** The opening at QD87 is empty. The knurl knob occupies QD83. | 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 | Only used if the MCL option is installed.<br>Plate contains a captive knurl knob with fitting inserts at QD68, QD71, and QD89.<br>• QD68 couples with QD42 on the 45° angled bracket<br>• QD71 couples with QD45 on the 45° angled bracket<br>• QD89 couples with QD63 on the 45° angled bracket<br>**Note:** The openings at QD80 and QD84 are empty. | 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 | Plate contains a captive knurl knob with fitting inserts at QD66, QD67, QD74, and QD75.<br>• QD66 couples with QD40 on the 45° angled bracket<br>• QD67 couples with QD41 on the 45° angled bracket<br>• QD74 couples with QD48 on the 45° angled bracket<br>• QD75 couples with QD49 on the 45° angled bracket<br>**Note:** The opening at QD70 is empty. The knurl knob occupies the remaining opening. | 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 | Plate contains a captive knurl knob with fitting inserts at QD64, QD65, and QD72.<br>• QD64 couples with QD38 on the 45° angled bracket<br>• QD65 couples with QD39 on the 45° angled bracket<br>• QD72 couples with QD46 on the 45° angled bracket<br>**Note:** The openings at QD69 and QD73 are empty. The knurl knob occupies the remaining opening | QD 64, QD 65, and QD 72 are to the right of 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, 30 | Waste chamber sensor | Often referred to as the eyeball sensor.<br>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 | Forward scatter signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red.<br>**Note:** If the indicator to the left of the FS label is green, the FS signal is assigned to AUX. | |
| A.5-16, 2 | SS bar graph display | Side scatter signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red.<br>**Note:** If the indicator to the left of the SS label is green, the SS signal is assigned to AUX. | |
| A.5-16, 3 | AUX bar graph display | 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.<br>The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red. | |
| A.5-16, 4 | FL1 bar graph display | Fluorescence 1 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red.<br>**Note:** If the indicator to the left of the FL1 label is green, the FL1 signal is assigned to AUX. | |
| A.5-16, 5 | FL2 bar graph display | Fluorescence 2 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red.<br>**Note:** If the indicator to the left of the FL2 label is green, the FL2 signal is assigned to AUX. | |

**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 | Fluorescence 3 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red.<br>**Note:** If the indicator to the left of the FL3 label is green, the FL3 signal is assigned to AUX. | |
| A.5-16, 7 | FL4 bar graph display | Only appears when the 4-color option is installed.<br>Fluorescence 4 signal amplitude indicator. The bar graph shows the intensity of the signal that particles generate during sample analysis.<br>• Low, off-scale signals are yellow.<br>• On-scale signals are green.<br>• High, off-scale signals are red.<br>**Note:** If the indicator to the left of the FL4 label is green, the FL4 signal is assigned to AUX. | |
| A.5-16, 8 | Top Panel Display 2 card | 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).<br>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).<br>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. | |

**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) | Sample flow rate indicators.<br>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.<br>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:<br>LOW = 3.72 psi<br>MED = 3.92 psi<br>HIGH = 4.12 psi. | |
| 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

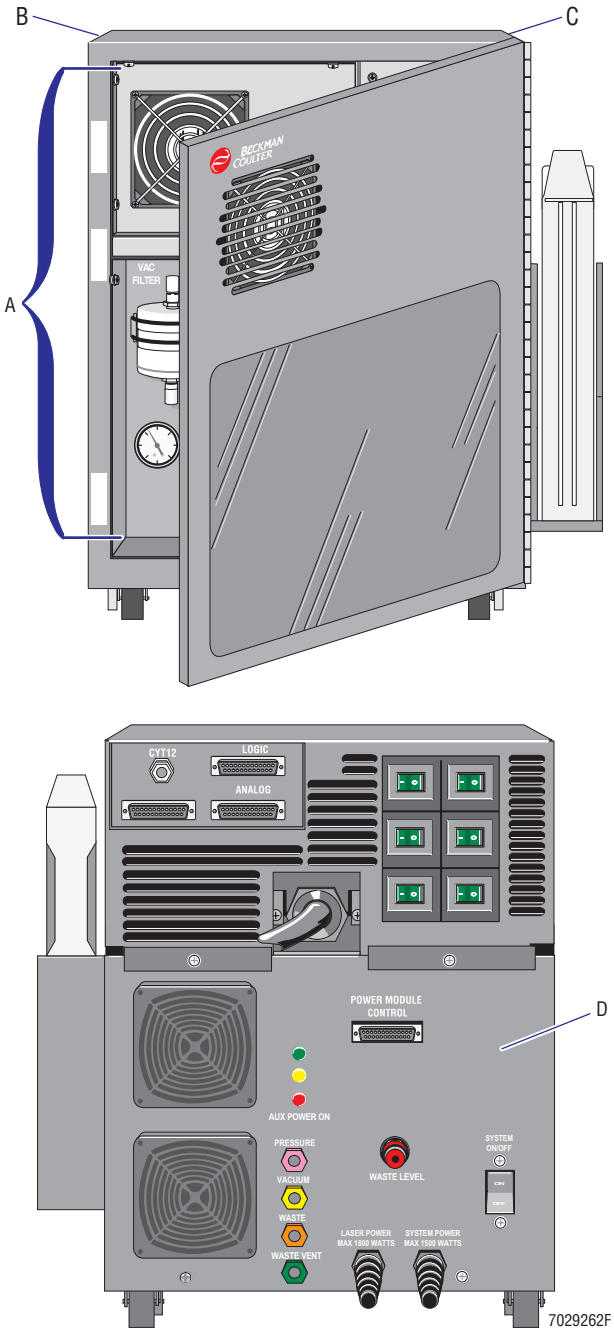
To quickly locate a component, always begin at the anchor illustration, Figure A.6-1.

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

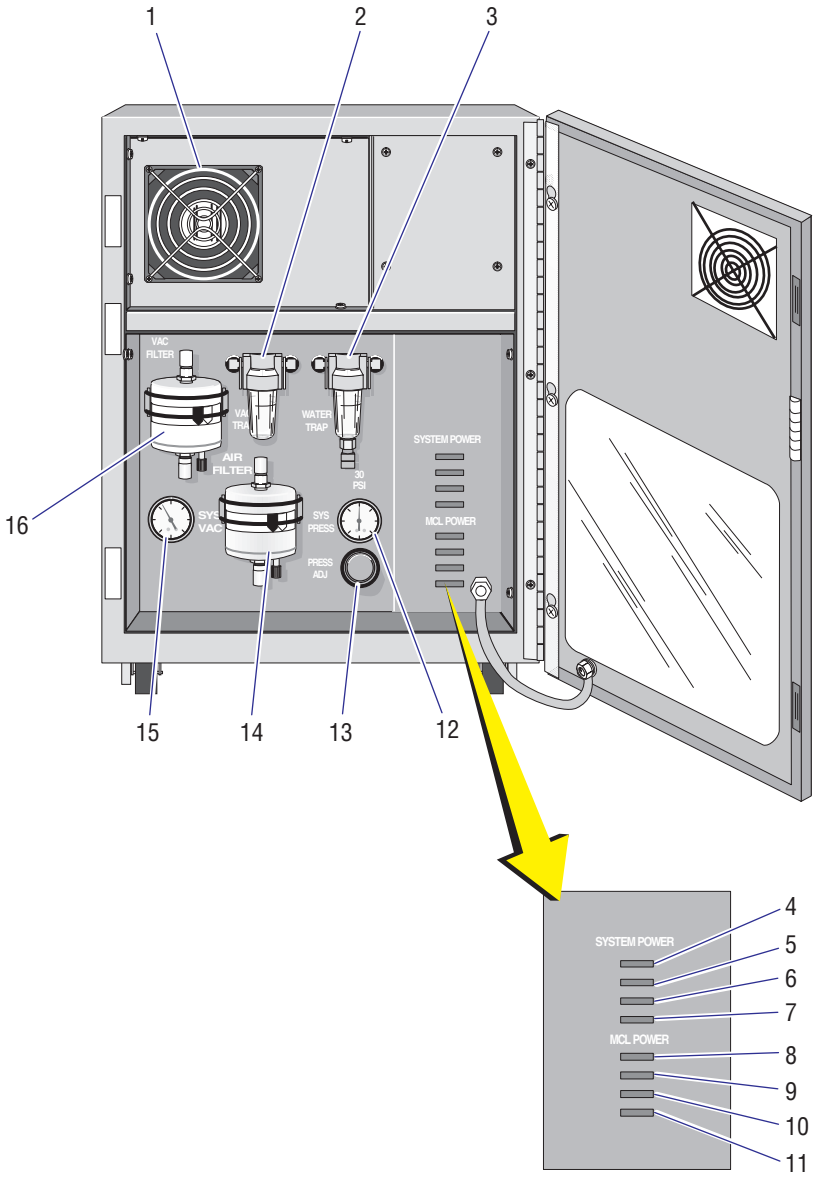
**D** Components on the rear panel, Figure A.6-5

**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 | Various pneumatic components including:<br>• Vacuum and water traps<br>• System pressure and system vacuum gauges<br>• System pressure adjust knob<br>• Air and vacuum filters<br>Voltage supply indicators for:<br>• System power (+5 V, +15 V, -15 V, +24 V)<br>• MCL power (+5 V, +12 V, -12 V, +24 V) | Open the front door. |
| A.6-1, B | Argon laser power supply<br>Various pneumatic components including:<br>• Compressor<br>• VL31, VL30, VL32<br>Transient Voltage Suppressor 2 card<br>Power Module Control or Power Module Control II card<br>Voltage Selector card | Remove the three-sided cover. |
| A.6-1, C | Interlock bypass switch<br>Cooling coil<br>Power supplies including:<br>• +24 Vdc system power supply<br>• +5 Vdc system power supply<br>• ±15 Vdc system power supply<br>• +5 and ±12 Vdc MCL power supply<br>• +24 Vdc MCL power supply | Remove the three-sided cover. |
| A.6-1, D | Connectors for MCL, CYT12, LOGIC, ANALOG, POWER MODULE CONTROL, and WASTE LEVEL<br>Circuit breakers for:<br>• +24 Vdc system power supply<br>• +5 Vdc system power supply<br>• ±15 Vdc system power supply<br>• +5 (and ±12 Vdc) MCL power supply<br>• +24 Vdc MCL power supply<br>• compressor<br>CYT12 ACTIVE, COMP ON, and AUX POWER ON indicators<br>SYSTEM POWER cables<br>PRESSURE, VACUUM, VENT, and WASTE quick-connects<br>Cooling fans<br>Laser umbilical cord | 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.<br>**Note:** If the SYSTEM POWER -15 V LED is also out, the problem most likely involves the ±15 Vdc linear power supply. | |

**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.<br>**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.<br>**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.<br>**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)***

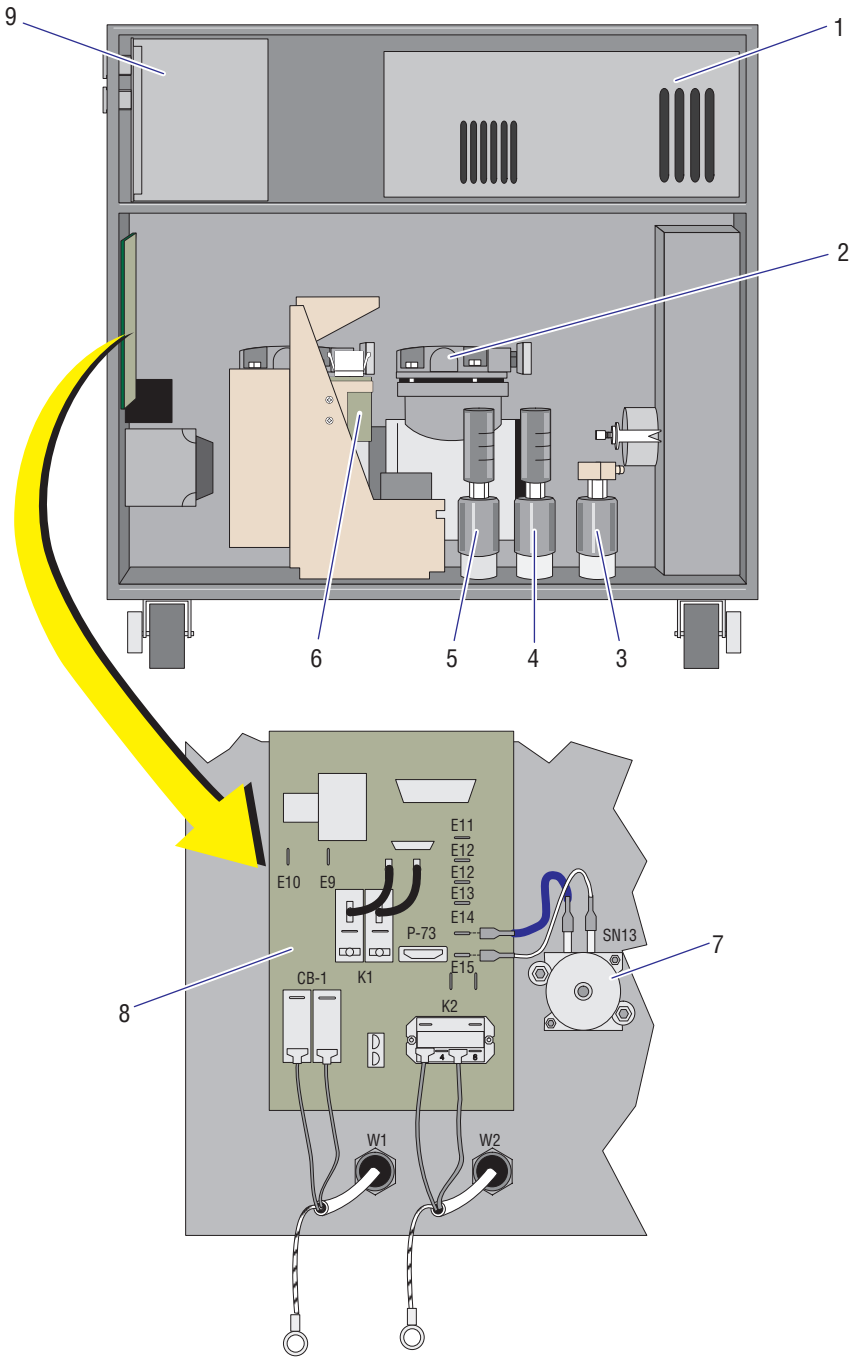
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.6-2, 10 | MCL POWER -12 V supply indicator | Indicates the presence or absence of -12 Vdc to the MCL. When -12 Vdc is available for use by the MCL, the MCL POWER -12 V LED is lighted. If power is turned on and this 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.<br>**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 *System Pressure Error* 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 *System Vacuum Error* message appears on the Workstation screen to alert the operator. | GA 1 inside the POWER MODULE block on PN 6320886 |

**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
2. Compressor
3. VL31
4. VL30
5. VL32
6. Transient Voltage Suppressor 2 card
7. SN13
8. Power Module Control card or Power Module Control II card
9. Voltage Selector card

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

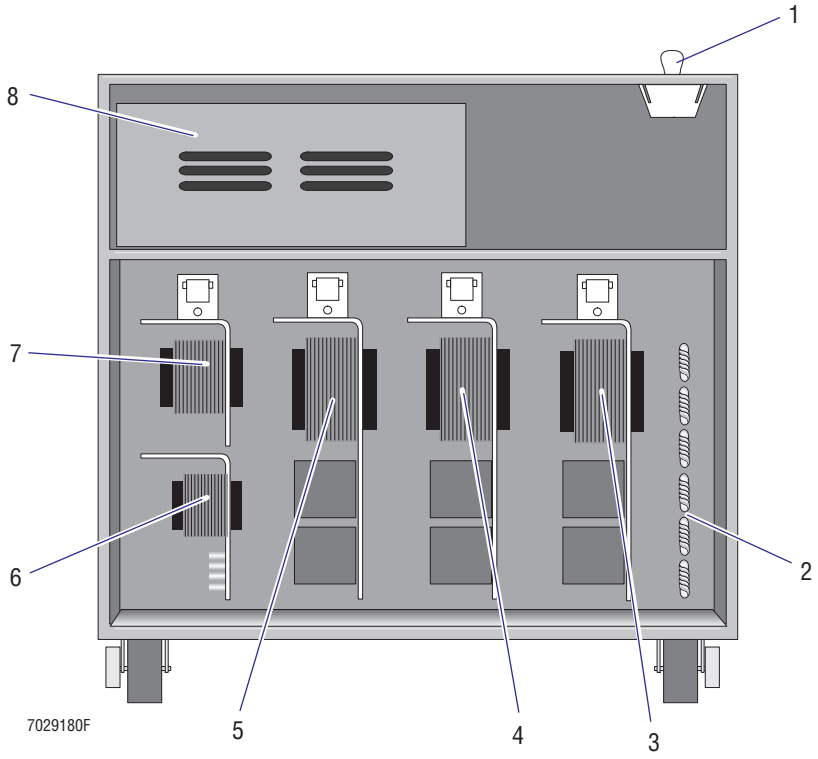
| Figure Reference | Component | Function | Reference Designator |
|---|---|---|---|
| A.6-3, 1 | Argon laser power supply | Provides control and ac voltages to the Argon laser head. | |
| A.6-3, 2 | Compressor | Dual-head compressor/vacuum pump. The compressor head supplies the 60 psi that is regulated 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.<br>*Energized* - When power to the Cytometer is on, solenoid VL 31 is energized, blocking the drain pathway from the water trap to the waste tank.<br>*De-energized* - 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.<br>*Energized* - 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.<br>*De-energized* - 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.<br>*Energized* - 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.<br>*De-energized* - 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.<br>**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 *Waste Backpressure Error* 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:<br>• Provides power to the Voltage Selector card.<br>• Interfaces the Cytometer to the Power Supply module.<br>• 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)**



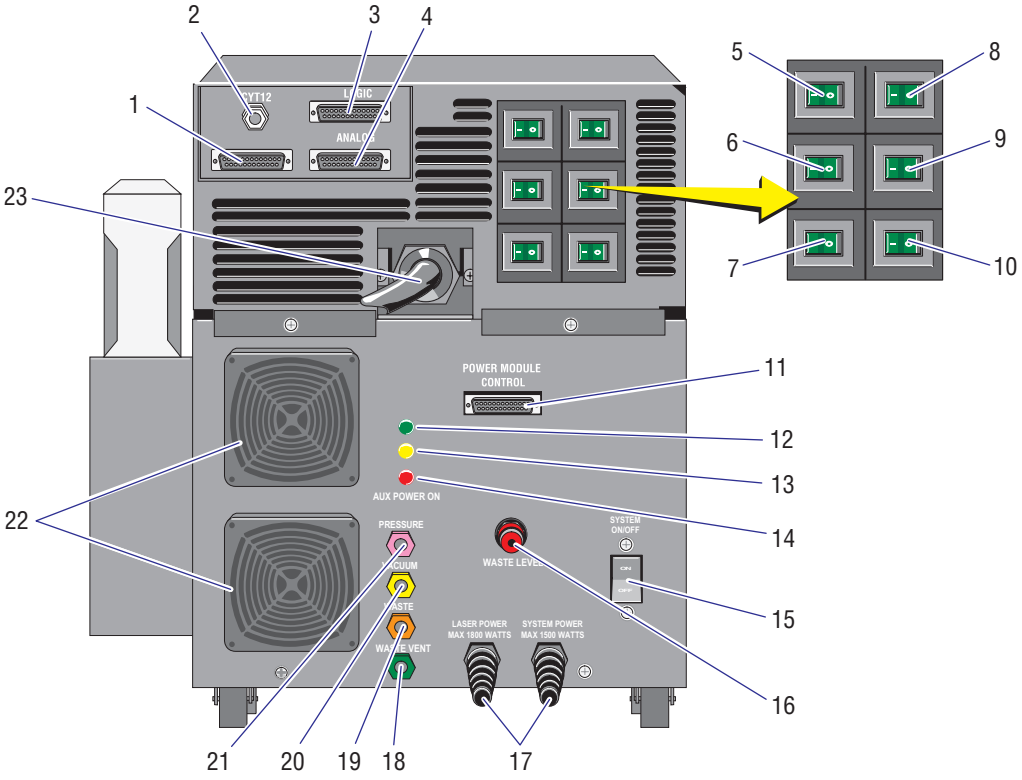

1. Interlock bypass switch
2. Cooling coil
3. +24 Vdc system power supply
4. +5 Vdc system power supply
5. ±15 Vdc system power supply
6. +5 and ±12 Vdc MCL power supply
7. +24 Vdc MCL power supply
8. Argon laser power supply

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

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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. | |

**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:<br>• Interlock<br>• Laser Discharge<br>• Idle On/Off<br>• Light/Current<br>• Laser Power Out<br>• Laser Current Out<br>• Laser Power In<br>• Laser Current In<br>• Compressor On<br>• 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.<br>• To supply ac to the Power Supply module, press the rocker switch to ON, position **I**.<br>• 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. | |

# 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 |
|---|---|
| Alt C | Cytosettings |
| Alt G | Run regions |
| Alt N | Panel |
| Alt P | Protocol |
| Alt R | Archive Status pop-up box |
| Alt T | Protocol |
| Alt U | Run |
| Alt V | Displays the current version of SYSTEM II software, the operating system, and Cytometer code for the XL or XL-MCL flow cytometer |
| Alt W | Worklist |
| Alt Z | 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 |
|---|---|
| Alt G | Analysis regions |
| Alt H | Analysis |
| Alt I | File information |
| Alt N | Panel |
| Alt P | Protocol |
| Alt R | Archive Status pop-up box |
| Alt T | Protocol |
| Alt U | Analysis |
| Alt V | Displays the current version of SYSTEM II software, the operating system, and Cytometer code for the XL or XL-MCL flow cytometer |

## 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 Spressa 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<br>(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<br>(slot closest to the edge of the Motherboard) | Opto Transprocessor EXMEM or<br>Opto Transprocessor EXMEM II<br>(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<br>(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 |

## 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<br>(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 |

## 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=ROMANTRI.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\dbservew -x netbios -n XL20_DBASE 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\e-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)<br>50 ohm<br>RG-8, RG-11 | COAX (thin)<br>50 ohm<br>RG-58 | UTP |
| Topology | Bus<br>Requires transceivers | Bus<br>Requires terminators | Star<br>Requires a hub device |
| Number of nodes per segment/length | 100<br>2.5 meters apart | 30<br>0.5 meters apart | 1<br>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<br>6 data characters + 1 check character |
| Codabar | 10 characters - maximum<br>9 data characters + 1 check character |
| Interleaved 2 of 5 | 14 characters - fixed<br>13 data characters + 1 check character |
| Code 128B | 8 characters - maximum<br>alphanumeric |
| Code 128C | 16 characters - maximum<br>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. ±0.001 in. | 0.010 in. ±0.001 in. | 0.010 in. ±0.001 in. | 0.010 in. ±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 | ≥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 F.3, 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**

| | Bar-Code Symbology | | | | |
|---|---|---|---|---|---|
| **Item** | **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 F.2, MCL BAR-CODE SCANNER.

## Hand-Held Bar-Code Scanner Setup Parameters

### Default Configurations

**Table F.3-1 Hand-Held Bar-Code Scanner - Default Configuration**

| | Bar-Code Symbology | | | | |
|---|---|---|---|---|---|
| **Item** | **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 | 0B | Enable standard CODE 39 |
| CODE 39 CHECK CHARACTER | 0E | Enable MODULO 43 check character |
| CODE 39 MINIMUM LENGTH | 0H | Minimum length = 01 |
| CODE 39 MAXIMUM LENGTH | 0I | Maximum length = 06 |
| CODE 39 START/STOP CHAR. | 0F | Do not XMIT START/STOP character |
| CODE 39 CHECK CHARACTER | 0K | Disable transmit of check character |

** Scan this code from the OEM User's Manual.*

**Table F.3-3 Hand-Held Bar-Code Scanner - Symbologies *(Continued)***

| Item | Code* | Function |
|---|---|---|
| CODE I-2 0F 5 | PC | Enable I-2 of 5 with check digit |
| CODE I-2 OF 5 MINIMUM LENGTH | PD | Minimum length = 14 |
| CODE I-2 OF 5 MAXIMUM LENGTH | PE | Maximum length = 14 |
| CODE I-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 |
| SYMBOLOGY 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.

## 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

## CONTENTS

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 replacable 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 $H_2O$.

**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.

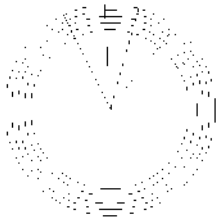
**fluorescent compensation** - When multiple dyes are used, one dye may interfere with another dye's measurement. If filters are unable to remove the interference, the interference can be removed electronically by subtracting a portion of one signal from another. Compensation can only be performed after 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 increase 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.

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