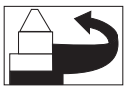
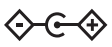
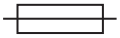
BIOPROFILE® FAST CDV

BioProfile® *FAST* CDV Instructions for Use Manual

nova® biomedical

NOVA BIOMEDICAL SYMBOL DIRECTORY

CE	Product meets requirements of applicable EU Regulation(s)/Directive(s)	90	Discard 90 days after opening		Date Opened (Control and Linearity Solution Vial)
	Caution, consult Instructions for Use	30	Do not use 30 days after opening		Discard Date
	Consult Instructions for Use	CONT	Contents		Polarity
	Biological Risk		Manufactured by		On/Off
 Xi	Irritant	CONTROL	Control		Indoor, Dry Location Only
REF	Catalog Number	SOLN	Solution		Double Insulated
LOT	Batch code	LEVEL	Level		Ethernet Network
SN	Serial Number		This Side Up		AC (Alternating Current)
	Temperature limitation		Fragile, Handle With Care		DC (Direct Current)
	Upper Limit of Temperature		Keep Dry		Fuse
 AAAA - MM	Use by (last day of the month)		Operator (By)		

BioProfile® FAST CDV Instructions for Use Manual

Ordering Information

The *BioProfile® FAST CDV Instructions for Use Manual* can be ordered from Nova Biomedical Order Services. Write or call:

Nova Biomedical Corporation
200 Prospect Street
Waltham, MA 02454 U.S.A.

Telephone: 1-800-822-0911
Website: www.novabiomedical.com

Technical Assistance

For technical assistance inside the United States and Canada, call Nova Biomedical Technical Services at:

U.S.A.: 1-800-545-NOVA 1-781-894-0800

Canada: 1-800-263-5999

For technical assistance outside the United States and Canada, call your local Nova subsidiary or authorized distributor.

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Contents

1 Introduction

This manual provides all necessary instructions for the routine operation and upkeep of the BioProfile *FAST* CDV Analyzer. Please read this manual carefully. It has been prepared to help you attain optimum performance from your analyzer.

WARNING: ***Cell culture samples are potential sources of infectious agents. Handle all sample and Flow Path components with care. Gloves and protective clothing are recommended.***

This section introduces the analyzer and covers requirements, tests performed, procedural limitations, and sample handling.

This section also covers the installation requirements and assembly procedures for the BioProfile *FAST* CDV Analyzer.

Note: ***Under the BioProfile Warranty, a qualified Nova service representative will install this equipment for you.***

1.1 About This Manual

This manual is for the Nova Biomedical BioProfile *FAST* CDV Analyzer.

Throughout this manual:
Note indicates especially important information.
CAUTION indicates information that is critical to avoid instrument damage or incorrect results.
WARNING indicates possible hazard to the operator.

1.2 Safety

Personnel operating the BioProfile *FAST* CDV must be proficient in the operating and maintenance procedures of the analyzer. The following safety procedures must be followed.

General Safety

1. Read the safety and operating instructions before operating the analyzer.
2. Retain the safety and operating instructions for future reference.
3. Observe all warnings on the analyzer and in the operating instructions.
4. Follow all operating and use instructions.
5. Do not use the analyzer near water, *e.g., near a sink, etc*.
6. Use only on a bench or stand that is recommended by the manufacturer.

7. Place the analyzer so that its location or position does not interfere with its proper ventilation.
8. Place the analyzer away from heat sources.
9. Connect the analyzer to a power supply only of the type described in the operating instructions or marked on the analyzer.
10. Do not defeat the safety purpose of the polarized or grounding type plug.
11. Route power cords so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, power sockets, and at the point where they exit from the analyzer.
12. The analyzer should be cleaned only as recommended by the manufacturer.
13. Take care not to let objects or liquids fall into the analyzer.
14. The analyzer should be serviced only by qualified service personnel.
15. Do not attempt to service the analyzer beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.
16. Do not attempt to override the door latch safety switch unless instructed by a trained Nova Representative.

Electrical Requirements

	120 VAC	**240 VAC**
Operating Voltage Range:	90–264 VAC *(Selected during install)*	90–264 VAC *(Selected during install)*
Operating Frequency:	47–63 Hz	47–63 Hz
Input Current:	2.1 Amps (Max)	1.7 Amps (Max)
Input Power:	138 Watts (Max)	221 Watts (Max)
Input Volt–Amps	250 VA (Max)	406 VA (Max)

Electrical Compliance: Low Voltage Directive, EMC Directive, 93/68/EEC, Measurement, Control, and Laboratory Equipment.

Note: ***It is recommended that the FAST CDV Analyzer is connected to an 1100–1200VA Universal Power Supply to maintain the power load in the event of a power outage.***

Fuse requirements

2-5x20mm 250V 8A slo-blo at 100–120, 220–240 Volt AC line.

Electrical Safety

1. To reduce the risk of electric shock, do not remove the cover.
2. There are **NO** operator serviceable parts inside the analyzer.
3. Servicing must be done only by qualified service personnel.
4. Before changing the fuses, unplug the power cord.

5. Replace the fuses with only the same type and rating.
6. To reduce the risk of fire or electric shock, do not expose the analyzer to water.
7. The analyzer is supplied with a main, non-rewireable plug for the intended country.
8. Ensure that the wall outlet receptacle is properly wired and earth grounded.
9. Do not use a 3-to-2 wire plug adapter.
10. Do not use a 2-wire extension cord or a 2-wire multiple-outlet power strip.

Chemical and Biological Safety

1. Observe all precautionary information printed on the original solution containers.
2. Operate the analyzer in the appropriate environment.
3. Take all necessary precautions when using toxic materials to prevent the generation of aerosols.
4. Wear appropriate laboratory attire, *e.g., safety glasses, gloves, lab coat, and breathing apparatus, when working with hazardous materials*.
5. The *FAST* CDV Reagent Cartridge contains a waste bag where biological material will be collected. This is considered a biohazard and should be disposed of according to company and/or local procedures. SDS sheets for *FAST* CDV reagents are available upon request.

Working Area Requirements (Environmental)

The BioProfile *FAST* CDV should be operated indoors. Keep the working area around the system free of dirt and debris, corrosive fumes, vibration, and excessive temperature changes.

CAUTION: The analyzer should not be installed on the same bench top or within close proximity to any high-speed centrifuge systems. Since these systems can often create a significant amount of vibration, placement of the FAST CDV near or on the same bench top may impact sample results.

Installation category (II)
Pollution degree (2)

Dimensions

Height:	22.25 in (57 cm)
Width:	17.5 in (45 cm)
Depth:	22 in (56 cm)

Operating Distance

Clearance Right Side:	12 in (30 cm)
Clearance Left Side:	2 in (5 cm)
Clearance Behind the Analyzer:	7.9 in (20 cm)
Clearance Above the Analyzer:	0.5 in (1 cm)

Weight
Less than 45 lbs. (20.4 kg) without reagent packs
Less than 52 lb (23.6 kg) with reagent packs

Operating Environment

Operating Temperature Range:	15–30ºC (59–86ºF)
Operating Relative Humidity Range:	20–80%
Operating Altitude:	≤ 12,000 feet

Acoustic Noise Level

Peak Sound Pressure Level:	< 75 dBA (right at Fan Discharge)
Average Sound Pressure Level:	≤ 65 dBA

Lifting the Analyzer:

1. Two people are needed to lift the analyzer.

CAUTION: ***Never use the control panel or door (open or closed) to assist you in lifting the analyzer. They cannot support the weight of the analyzer.***

2. From the left side, Person #1 places right-hand and left-hand fingertips under the finger ridge.
3. Tilt the analyzer so that both hands (one at a time) can grip under the analyzer (approximately 4 centimeters in from the front and back).
4. From the right side, Person #2 places right hand on the back of the machine to steady it as Person #1 tilts the analyzer backward.
5. Person #2 can now grip under the analyzer (approximately 4 centimeters in from the front) with the left hand. Then remove right hand from the back and grip under the analyzer (approximately 4 centimeters in from the back).
6. The analyzer now can be lifted from floor or bench and moved to a new location. If on the floor, position the analyzer to lift with your legs and not your back.
7. Reverse the directions to place the analyzer back down.

Note: ***The analyzer should always be recalibrated after it has been lifted or moved. If the analyzer has been validated for use in a GMP setting, it is the responsibility of the End User to determine if re-validation is necessary after the system has been moved from one location to another.***

1.3 Intended Use and Tests Performed

Intended Use

The BioProfile *FAST* CDV Analyzer is intended for the quantitative determination of Total Cell Density **(TCD)**, Viable Cell Density **(VCD)**, Cell Viability (%), and Live Cell Diameter of cell culture samples by biotechnology professionals in both Process Development and GMP environments, and students studying in Chemical Engineering/Bioprocessing.

1.4 The Sample

This section covers sample requirements and reference values for the Nova BioProfile *FAST* CDV.

Sample Volume: minimum 100 µL (Load-and-Go Carousel)
125 µL (96-Well Plate)

1.4.1 Handling Requirements

Ensure that all samples have been obtained and stored following accepted protocols. It is particularly important to ensure that samples are well mixed before introduction into the analyzer. Nova Biomedical recommends that you analyze the sample immediately to prevent changes in viability.

1.4.2 Dilution of Cell Density/Viability Samples Above the Measurement Range

If an operator is running a sample that may generate Cell Density/Viability results above the published measurement range, the BioProfile *FAST* CDV can be programmed to make an increased dilution of the sample. This dilution increases the operating range of the analyzer.

- From within the Analysis menu, change the Cell Density Configuration Dilution Ratio to 1:1, 1:2, or 1:4 to accommodate the sample.
- When a dilution ratio is selected, the BioProfile *FAST* CDV performs the dilution of the sample. No pre-dilution is required.
- A pre-dilution multiplier feature allows an operator to enter a dilution factor if the sample has been diluted externally before being analyzed by the BioProfile *FAST* CDV. At the end of the sample analysis, the BioProfile *FAST* CDV will factor any pre-dilution multiplier value into reported results.

1.5 Operation Overview

The BioProfile *FAST* CDV Analyzer uses a touch screen monitor with on-screen keyboard and wireless BLE keyboard for menu navigation and data entry. The Analysis screen has selectable buttons on the bottom Command bar: Destinations, Keyboard, Clear Tray, Clear Selected, Suspend, Cancel, and Analyze.

The Destinations button  in the left-hand corner of the screen brings up an overlay to access the options shown in Figure 1.1.

Figure 1.1 Destinations Overlay

The status of the reagent packs and information regarding the timing of upcoming events can be found across the top of the screen. There are 32 positions on the Load-and-Go Tray. Twelve samples can be loaded as 20 positions are not accessible due to proximity to the probe. The analyzer also supports the use of a 96 Well Microtiter Plate. Nova Biomedical recommends the following criteria with respect to 96-well plate type:

Type:	WebSeal 96-Well Non-coated Plastic Microplates
Source:	ThermoFisher (or similar supplier)
Catalog No.:	601-80-P100
Height Total:	31.6 mm
Material:	Polypropylene
Volume Total:	1,300 uL
Profile:	U-Shape, 8 mm Diameter

Sample specifics, including sample ID, vessel ID, etc., can be entered to distinguish the samples being analyzed. After all sample analysis specifics have been chosen and specific information relating to the dilution ratio and cell type are entered for each sample location on the carousel, the CDV sample analysis can begin with the simple touch of the "Analyze" button found on the bottom right of the Analysis screen.

1.6 User Interface

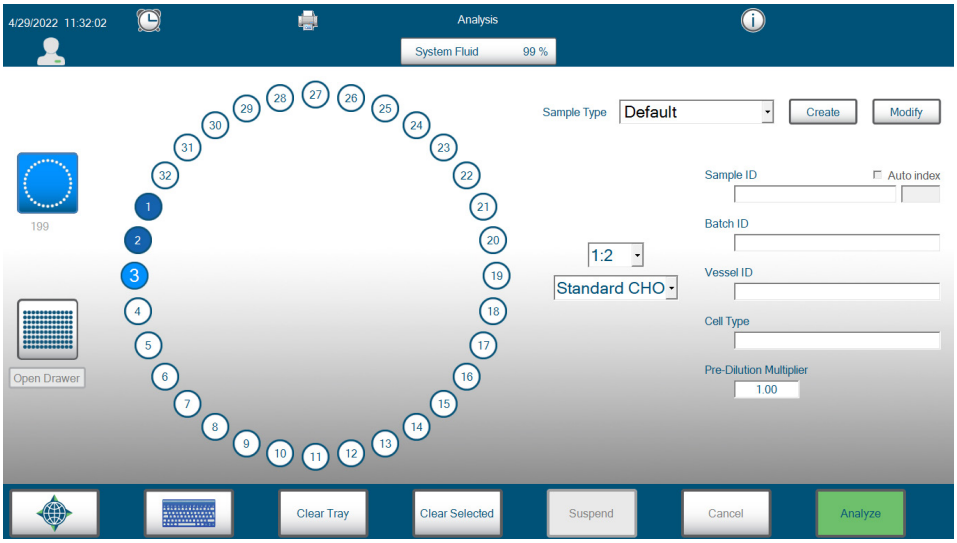

Figure 1.2 User Interface Screen

Analyzer Status – The Status bar at the top of the screen displays symbols that indicate the status of the analyzer.

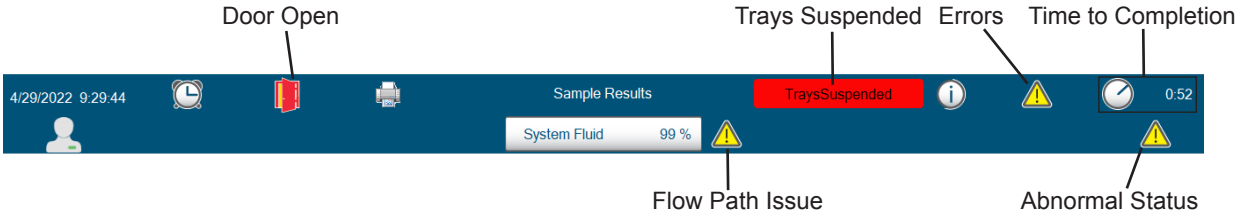

Figure 1.3 Analyzer Status Symbols

Date and Time – The current date and time are displayed in the upper left corner of the User Interface.

System Fluid Remaining – Displays the percent (%) fluid remaining for the reagent pack.

Figure 1.4 System Fluid Status

***FAST* CDV Reagent Pack:** Information is displayed as percent remaining for the reagent pack. The *FAST* CDV pack expires for whichever comes first: the shelf-life date is reached, the 60-day use-life day is reached, or up to 500 samples have been analyzed. The *FAST* CDV System reagent pack consists of 2 separate packs that are installed on the system at the same time: a smaller Bottle Pack and a larger reagent cartridge.

Waste Container Cups – Displays how many cups the waste container can hold before emptying is required. The container can hold 500 cups.

Scheduled Events – The scheduled events button displays the next event scheduled to take place as well as all scheduled events and when the events are scheduled to occur. This screen can display the following scheduled events:

- Adjust Intensity
- System DePro
- Database Backup

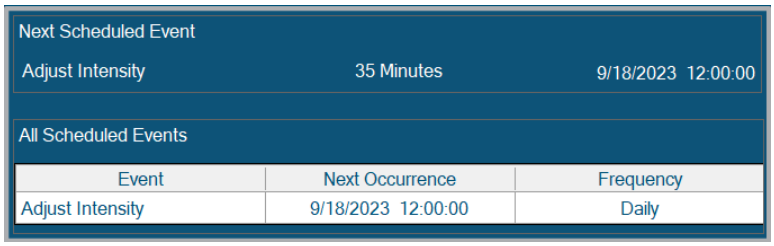

Figure 1.5 Scheduled Events

User Functions – Selecting the User button displays the following options:

Change Password: This option allows the currently logged in user to change their password.

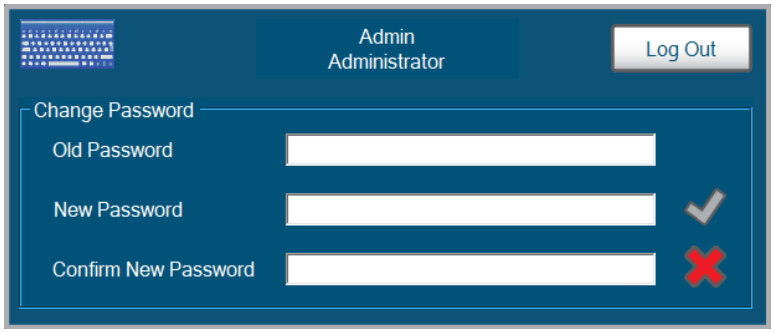

Figure 1.6 Change Password Dialog Box Screen

Log out: Selecting this item allows the user to log out of the *FAST* CDV application. The Login dialog box will then appear for the next user to log in.

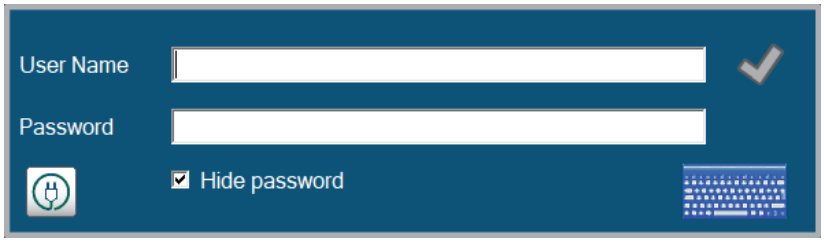

Figure 1.7 Login Dialog Box Screen in.

The analyzer can be shut down by pressing the electrical cord icon . See Section 1.7 for proper shutdown instructions.

System Fluid – Selecting the System Fluid status overlay button allows the user to check the analyzer status for Flow Path A and Flow Path B.

Information available from within the System Fluid overlay includes:

- Flow Path A and B Status (Calibration Status, Intensity, Background Level, Primed, Status)
- Flow Times (Last Analysis and Calibration)
- System Fluid Pack Status (Lot Number, Expiration Date, Install Date, Sample Remaining)
- Well Status (Flow Path A and B and Waste Well - Clear/Blocked)
- Connection Status - True/False

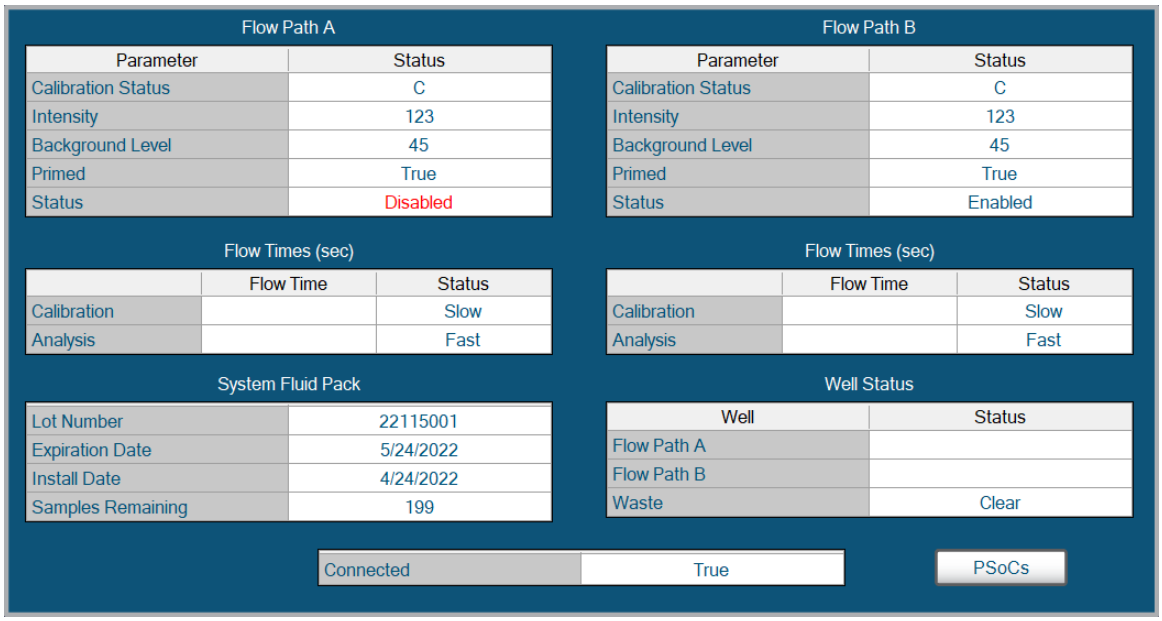

Figure 1.8 System Fluid Screen

Printer Status – Selecting the Printer Status button shows connected printers and the status of any print jobs in process. The Printer Status overlay also provides access to the Remote Desktop for users with the appropriate privilege level.

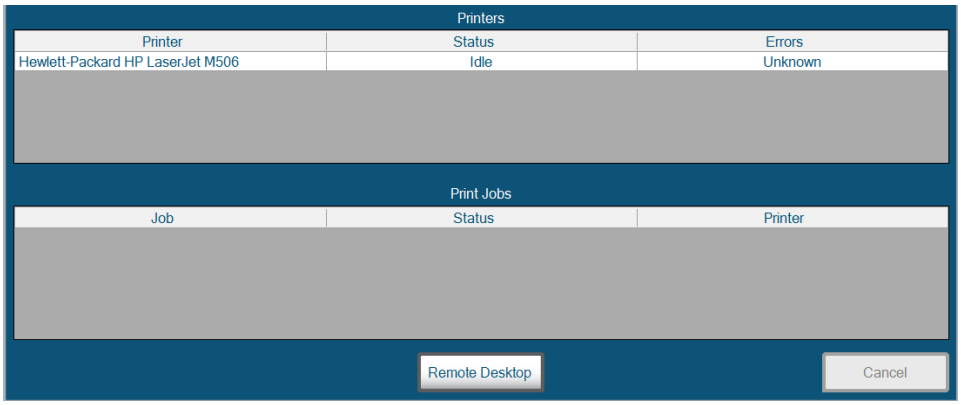

Figure 1.9 Printer Status Screen

1.7 Analyzer Shut Down

To shut down the BioProfile *FAST* CDV, select the electrical cord icon on the login dialog box that appears after logging out. This initiates proper shutdown of the software and hardware within the Host Computer. Once the User Interface screen goes dark, toggle the power switch on the rear of the analyzer to the off position.

CAUTION: Do not turn off the rear power switch without first selecting the electrical cord icon and waiting for the User Interface to darken. Doing so can cause improper shutdown and may result in damage to the analyzer.

CAUTION: If the system is to be shut down for more than 72 hours, a Long-Term Shutdown should be performed. The Long-Term Shutdown purges all of the residual fluid in the internal tubing and flowpaths. Failure to complete a Long-Term Shutdown may result in reagent crystallization and internal tubing blockages which may require service to resolve. See Maintenance section 4.2.4 for instructions on performing a Long-Term Shutdown.

2 Destinations Menu

This section describes how to set up the analyzer to test different types of samples. Use the options in the Destinations menu to adapt the analyzer to your requirements.

This section describes the following items in the Destinations menu, which is reached by pressing the Destinations icon  located in the bottom left-hand corner of the User Interface. It is always visible in the Command Bar as an operator navigates through the various menus of the User Interface.

When selected, a subset of the other available User Interface menu icons are displayed. To navigate, select the desired icon:

- Logs
- Database
- Service
- QC
- Configuration
- Calibrate

2.1 Logs

The following logs can be viewed by selecting the Logs button in the Destinations menu:

- Audit Log
- Calibration Log
- Error Log
- Maintenance Log

Export

An operator can export log entries by selecting a time frame using the Set Dates button in the Command Bar, highlighting the entries of interest (or pressing Select All), then pressing the Export button. The log can be exported to the Bridge Computer Shared Folder or a USB drive as a .csv file.

2.1.1 Audit Log

The Audit Log serves as an electronic trail of the changes, actions, and/or updates made to the setup of your BioProfile *FAST* CDV. The Audit Log documents the date and time, user, and action performed. To view the audit log, select **Audit Log** from the options on the left side of the screen. The operator cannot delete or modify entries captured in the Audit Log. Notations in the Audit Log can be sorted by Date & Time or User by selecting the header of the desired column.

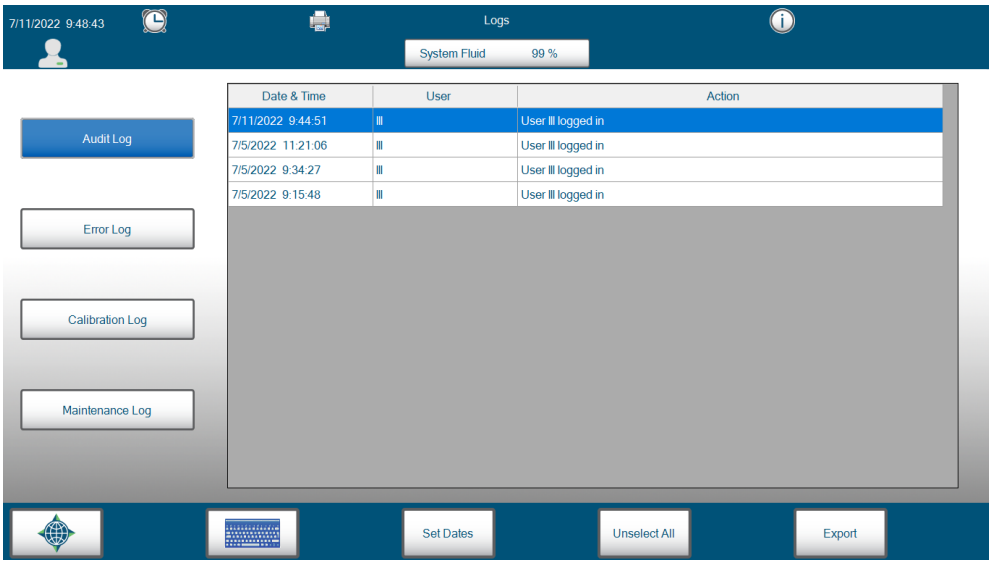

Figure 2.1 Audit Log

The following is a list of actions that are stored in the Audit Log if performed by a BioProfile *FAST* CDV operator:

Action	Output
AnalysisRun	Executed Sample Analysis Sample ID {sample_ID} Sample Time {sample_time} Sample Type {sample_type} Batch ID {batch_ID} Vessel ID {vessel_ID} Cell Type {cell_type}
QcAnalysisRun	Executed QC Analysis for Lot {lot_number} Level {level} Sample Time {sample_time}
AnalysisResultsImageReAnalysis	Re-Analyzed Sample Time {sample_time} Changed {field_name} from {old_value} to {new_value}
NoChangesReAnalysis	Re-Analyzed Sample Time {sample_time}
AnalysisResultsReCalculate	Re-Calculated Sample Time {sample_time} Changed {field_name} from {old_value} to {new_value}
AnalysisResultsEdited	Changed Sample Time {sample_time} {field_name} from {old_value} to {new_value}
QcAnalysisCanceled	Canceled QC Analysis for Lot {lot_number} Level {level} Reason: {reason}
AnalysisCanceled	Canceled Sample Analysis Sample ID {sample_ID} Reason: {reason}
MicrotiterTrayKeyParameter SkippedOrStopped	Microtiter Tray {skipped_or_stopped_at} Cup {cup_id} Due to Key Parameters Error in Sample Type {sample_type}
DatabaseArchive	ArchivedDatabase up to {date} completed
DatabaseBackup	Database Backup completed
DatabaseBackupStart	Database Backup started
DatabaseBackupFailed	Database Backup failed
DatabaseRestored	Database Restore completed
Login	User {user_name} logged in

Action	Output
Deactivation	User {user_name} deactivated for exceeding maximum number of login attempts
Logout	User {user_name} logged out
CellInspectionSettings	Changed {cell_inspection_name} {field_name} from {old_value} to {new_value}
GeneralSettings	Changed {field_name} from {old_value} to {new_value}
Selected12HoursTimeFormat	Selected 12 Hours Time Format
Selected24HoursTimeFormat	Selected 24 Hours Time Format
SelectedEuroNumericFormat	Selected European Numeric Format
SelectedUsNumericFormat	Selected US Numeric Format
ChangedParameterUnitsOf Measure	Changed CDV Units from {old_value} to {new_value}
ScheduledEvent_Active	{event_type} Scheduling Active
ScheduledEvent	Changed {event_type} Scheduling {field_name} from {old_value} to {new_value}
ScheduledEvent_Inactive	{event_type} Scheduling Inactive
ExportUsers	Export Users
ChangedDate	Changed Date from {old_value} to {new_value}
ChangedTime	Changed Time from {old_value} to {new_value}
SystemShutdown	System Shut Down
ChangedUserPassword	Changed User {username} Password
ChangedUserStatus	Changed User {username} Status from {old_value} to {new_value}
ChangedUserPrivilege	Changed User {username} Privilege Level from {old_value} to {new_value}
ChangedUserPasswordDuration	Changed User {username} Password Expiration Days from {old_value} to {new_value}
ChangedUserLoginAttempts	Changed User {username} Login Attempts from {old_value} to {new_value}
AddedNewUser	Added New User {new_username} with Privilege Level {privilege_level}
ExportedGrowthCalculation	Exported Growth Calculation with BatchID {batch_ID} Parameter {parameter} Elapsed Time Unit {elapsed_time_unit}
ImportUsers	Import Users
PrintedLiveCellHistogramReport	Printed Live Cell Histogram Report for Sample Time {sample_time}
QcConfigurationCreatedNewLot	Created new QC Lot {lot_number} in External Control Level {level} Expiration Date {expiration_date}
QcConfigurationNewLot ParameterLimit	New QC Lot {lot_number} Parameter {parameter_name} Lower Limit {lower_limit} {units} Upper Limit {upper_limit} {units}

Action	Output
QcConfigurationExpirationDate	ChangedExpiration Date in Lot {lot_number} External Controls Level {level} from {old_expiration_date} to {new_expiration_date}
QcConfigurationParameter LowerLimit	Changed Lower QC Limit for {parameter_name} in Lot {lot_number} {module} Level {level} from {old_value} {units} to {new_value} {units}
QcConfigurationParameter UpperLimit	Changed Upper QC Limit for {parameter_name} in Lot {lot_number} {module} Level {level} from {old_value} {units} to {new_value} {units}
PrintedCellDensityImageReport	Printed Cell Density Image Report for Image Number {image_number} Sample Time {sample_time}
ExportedImage	Exported Image
ExportedAllImages	Exported All Images
SampleTypeSettings_Created	Created Sample Type {sample_type_name}
SampleTypeSettings	Changed {sample_type_name} {parameter_name} {field_name} from {old_value} {units} to {new_value} {units}
SampleTypeSettings_EsmVolume	Changed {sample_type_name} ESM Volume from {old_value} to {new_value}
SampleTypeSettings_Deactivated	Deactivated Sample Type {sample_type_name}
SampleTypeSettings_IncludedExcludedModule	{included_excluded} Module {module} for Sample Type {sample_type_name}
SampleTypeSettings_CellInspection	Changed {sample_type_name} Cell Inspection from {old_value} to {new_value}
SampleTypeSettings_CdvDilutionRatio	Changed CDV Dilution Ratio for Sample Type {sample_type_name} from {old_value} to {new_value}
SampleTypeSettings_ChemistryDilutionRatio	Changed Chemistry Dilution Ratio for Sample Type {sample_type_name} from {old_value} to {new_value}
ChangePassword	User {username} changed password
TrayAnalysisSettingsChanged_ClearTray	Cleared all {tray_type} Tray Cups
TrayAnalysisSettingsChanged_UnselectCup	Unselected {tray_type} Tray Cup {cup_id}
TrayAnalysisSettingsChanged_SampleType	Changed {tray_type} Tray Settings Sample Type from {old_sample_type} to {new_sample_type} for Cup {cup_id}
TrayAnalysisSettingsChanged_SelectCup	Selected {tray_type} Tray Cup {cup_id} with Sample Type {sample_type}
TrayAnalysisSettingsChanged	Changed {tray_type} Tray Settings {field_name} from {old_value} to {new_value} for Cup {cup_id}
TrayAnalysisSettingsChanged_SampleIdIndex	Changed {tray_type} Tray Settings Sample ID Index from {old_value} to {new_value} for Cup {cup_id}
TraySuspended	Tray Suspended
TrayResumed	Tray Resumed

Action	Output
CalculateFlowcellThickness Changed	Calculate Flowcell Thickness from {old_value} to {new_value} for flow path {flow_path}
ViewedHistoricalResult	Viewed Historical Result for Sample Time {sample_time}
ExportedHistoricalResult	Exported Historical Result for Sample Time {sample_time}
PrintedHistoricalResult	Printed Historical Result for Sample Time
ExportedQcResult	Exported QC Result for Sample Time {sample_time}
PrintedQcResult	Printed QC Result for Sample Time {sample_time}
ChangedSampleIdIndex	Changed Initial Sample ID index from {old_value} to {new_value}
PrintedHistoricalQcResult	Printed Historical QC Result for Sample Time {sample_time}
ExportedHistoricalQcResult	Exported Historical QC Result for Sample Time {sample_time}
PrintedSampleProfileReport	Printed Sample Profile Report for Sample Time {sample_time}
EnterServiceScreen	User {username} entered service screen
ExitServiceScreen	User {username} exited service screen
TimeChange	Network time changed from {old_time} to {new_time}
TimeZoneChange	Time Zone Changed from {old_zone} UTC {old_offset} to {new_zone} UTC {new_offset}
Calibrate	Calibrate
UpdatedHostSoftware	Updated Host Software from {old_version} to {new_version}
UpdatedBridgeSoftware	Updated Bridge Software from {old_version} to {new_version}
ActivatedTemporaryOPCLicense	Activated Temporary OPC License
OPCLicenseRequested	OPC License Requested
InstalledOPCLicense	Installed OPC License
NetworkLogin	Changed {field_name} from {old_value} to {new_value}
SampleTypeSettings_ UseEnhancedMixing	Changed Use Enhanced Mixing for Sample Type {sample_type_name} from {old_value} to {new_value}
UseEnhancedMixing	Use Enhanced Mixing
InstallSoftware	Install Software version {version}
CalibrateSystem	Calibrate System
SampleInformation	Changed Sample Time {sample_time} {field_name} from {old_value} to {new_value}

2.1.2 Error Log

The Error Log serves as an electronic trail of the errors generated and reported by the BioProfile *FAST* CDV. The Error Log documents the date and time and description of the error that occurred. To view the error log, select **Error Log** from the options on the left side of the screen. The operator cannot delete or modify the Error Log. Notations in the Error Log can be sorted by Date & Time or Description by selecting the header of the desired column.

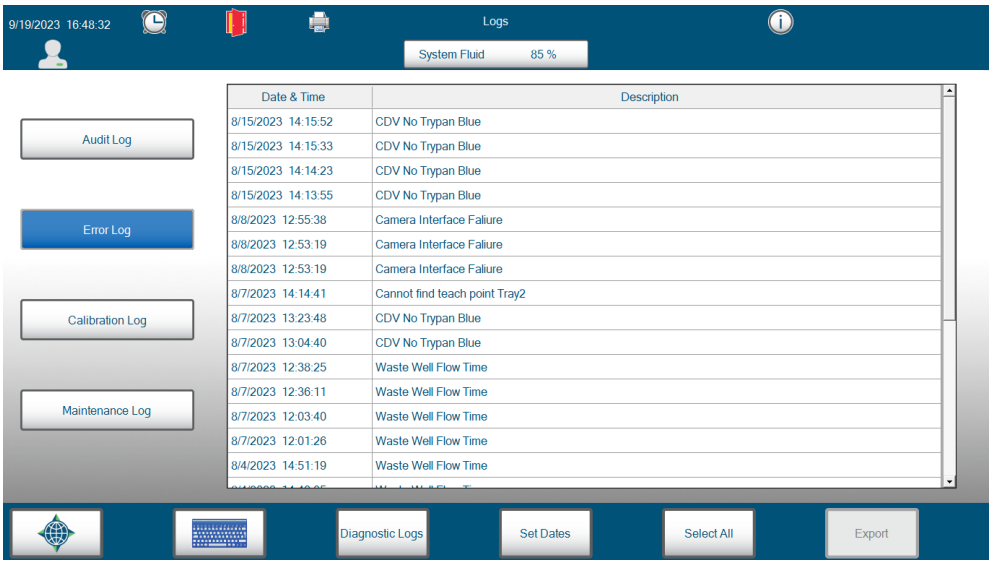

Figure 2.2 Error Log

2.1.3 Calibration Log

The Calibration Log serves as an electronic trail of the calibrations performed on your BioProfile *FAST* CDV. The Calibration Log documents the date and time of the calibration event, Flow Path (A or B), status, and Lot Number of the *FAST* CDV Reagent Cartridge used for calibration. To view the calibration log, select **Calibration Log** from the options on the left side of the screen. The operator cannot delete or modify entries captured in the Calibration Log. Notations in the Calibration Log can be sorted by Date & Time, Flow Path, Status, or Lot Number by selecting the header of the desired column.

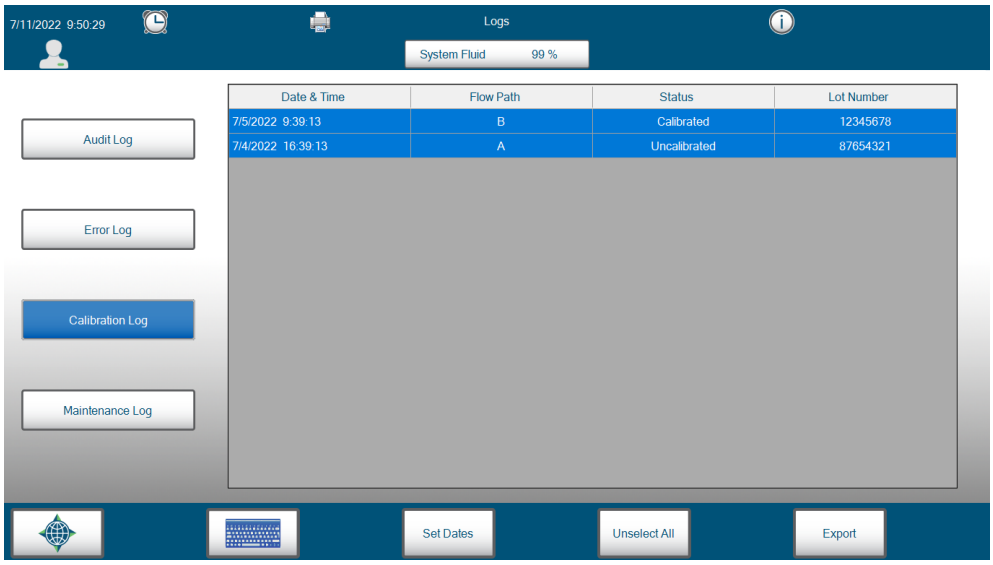

Figure 2.3 Calibration Log

2.1.4 Maintenance Log

The Maintenance Log serves as an electronic trail of the maintenance activities performed on your BioProfile *FAST* CDV, *i.e., replacing reagent cartridges, Pump Tubing, or performing onboard maintenance actions*. The Maintenance Log documents the date and time of the action, the user who performed the action, maintenance activity performed, and Lot/Part Number of the part installed (when applicable). To view the maintenance log, select **Maintenance Log** from the options on the left side of the screen. The operator cannot delete or modify entries captured in the Maintenance Log. Notations in the Maintenance Log can be sorted by Date & Time, User, Maintenance Activity, or Lot Number/Part Number by selecting the header of the desired column. When certain activities are performed from within the Maintenance menu, the system may present a pop-up allowing the user to enter in the Lot Number or Part Number for consumable components that can be replaced.

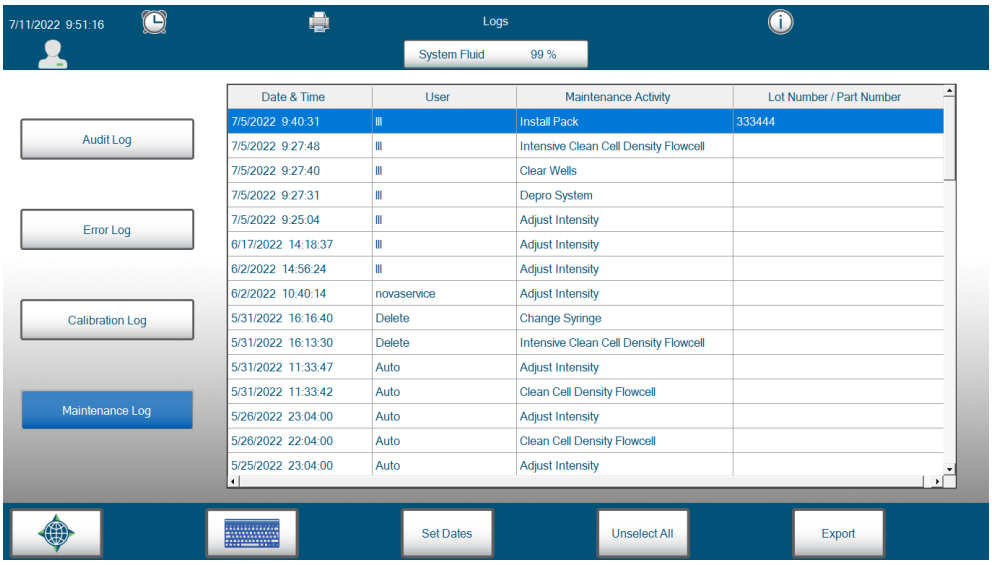

Figure 2.4 Maintenance Log

The following is a list of actions that are stored in the Maintenance Log if performed by a BioProfile *FAST* CDV operator:

Name	Description
AdjustIntensity	Adjust Intensity
InstallFastCDVPack	Install Pack
IntensiveCleanCellDensityFlowcell	Intensive Clean Cell Density Flowcell
SystemDepro	Depro System
ClearWells	Clear Wells
CalibrateProbe	Calibrate Probe
CDV_CalculateFlowcellThickness	Calculate Flowcell Thickness
PrimeCDVFlowCell	Prime Cell Density Flow Cell
ChangeSyringe	Change Sample Syringe
ChangeProbe	Change Probe
LongTermPackShutDown	Long-Term Shutdown
ChangeCleanoutSyringe	Change Cleanout Syringe
ChangePumpTubingSets	Change Pump Tubing Sets

2.2 Database

After selecting **Database** from the Destinations menu, the user has the option to either **Backup** or **Restore** the *FAST* CDV database. When using functions in the Database menu, the database is backed up to and restored from the Bridge Computer. Backup can also be scheduled to occur automatically at regular intervals (See Section 2.5.4).

2.2.1 Backing up the Database

Backing up the database will create a group of encrypted files that store the following information in the event a database becomes corrupt or needs to be replaced:

- Sample/QC Analysis Data
- CDV Images
- Audit Logs
- All Other Logs
- User Accounts
- Sample Types
- Cell Inspection Types
- Scheduled Maintenance and Tasks
- General Settings

The database will be backed up to the **C:\Export\Database** directory of the *FAST* CDV Bridge Computer. Select **Backup** from the Database menu to begin the backup process.

On the Bridge Computer, the **C:\Export\Database** folder will now contain a folder titled "Backup_YYYY-MM-DD_HHMMSS" for the time and date the backup was generated. This sub-directory contains a **DatabaseBackup.dbb** file, a Persist.dbb file, and an images directory.

The DatabaseBackup.dbb file, Persist.dbb file, and images directory folder must be kept together within their respective backup folder. Any existing backup files will be overwritten with the newest backup. Nova Biomedical recommends regularly moving or copying backups from the Bridge Computer to a secure network location for redundancy.

2.3 Service

The Service menu is only accessible by qualified Nova Biomedical Field Support Personnel.

2.4 QC

Selecting the QC button from the Destinations menu allows an operator with appropriate privileges to setup Quality Control ranges for total density.

Available QC Control Levels for the BioProfile *FAST* CDV are as follows:

Level 8: Cell Density (Low)
Level 9: Cell Density (High)

All information necessary to setup QC is provided in the insert sheets included with each box of quality control material. This information includes Lot Number, Expiration Date, Storage Conditions, and Reference Ranges for the BioProfile *FAST* CDV.

2.4.1 QC Setup

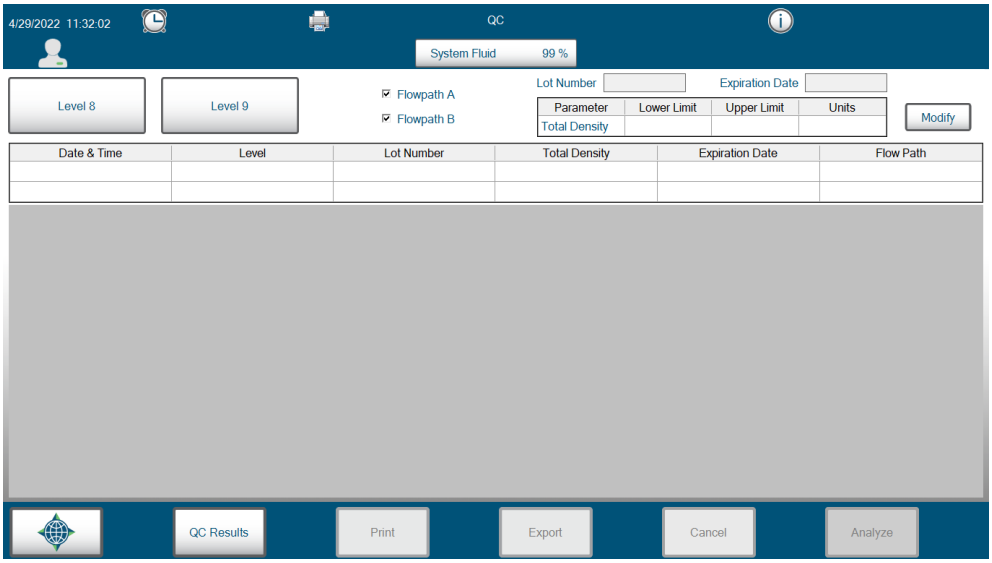

Figure 2.6 QC Screen

To setup QC ranges for each QC level, select the desired level, then select **Modify** from the top right of the QC screen.

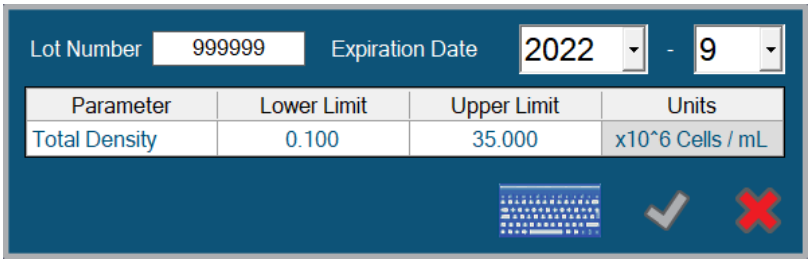

Figure 2.7 Modify QC Pop-up

1. In the overlay that appears, Enter the QC Lot Number in the space provided.
2. Select the QC lot's Expiration Year from the drop-down list
3. Select the QC lot's Expiration Month from the drop-down list.
4. Select the Lower Limit field and enter the Lower Limit from the control's insert sheet.
5. Select the Upper Limit field and enter the Upper Limit from the insert sheet.
6. Select the check mark to save the programmed QC Level information.

Note: The default Lower Limit and Upper Limit are the measurement range of the analyzer at the 1:1 onboard dilution.

2.5 Configuration

Select Configuration from the Destinations menu to display the Configuration screen with the following options:

- General
- Users
- Cell Inspections
- Scheduling
- OPC

2.5.1 General

An operator with appropriate privileges is able to do the following:

- Enter an Analyzer ID
- Enter a Location for the analyzer
- Enable Auto Logoff
- Enable Sample Results Auto Export
- Change the Units of Measure
- Enable/Disable the two flow paths
- Select the Date Format and Date Separator
- Select the Numeric Format (decimal point or comma)
- Select the Time Format (12 or 24 Hours)

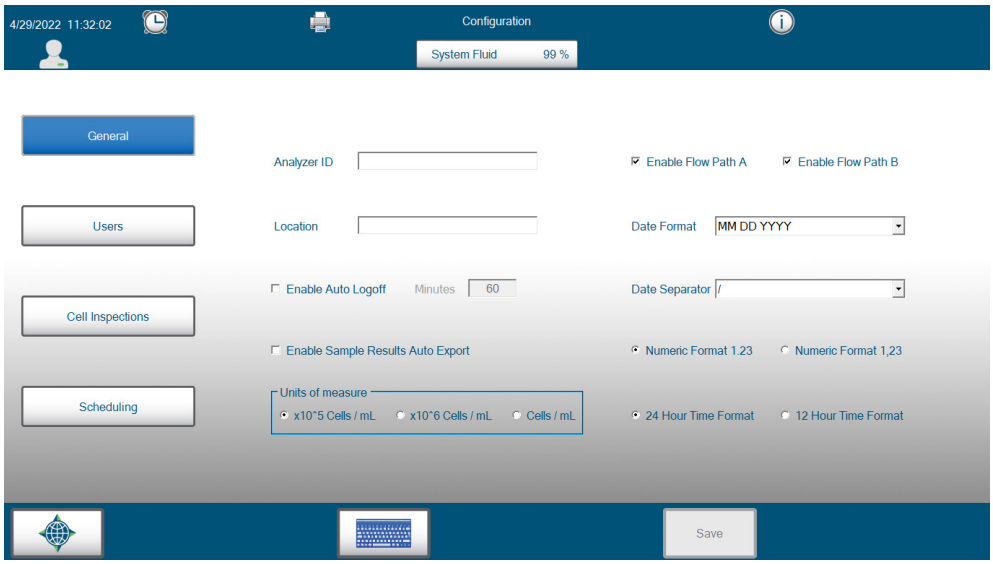

Figure 2.8 General Configuration Screen

Auto Logoff

This feature allows a user to set a scheduled Auto Logoff time for the BioProfile *FAST* CDV system.

To set the Auto Logoff feature:

1. Check the box marked “Enable Auto Logoff.”
2. Select the interval (minutes).
3. Save changes.

Once the Auto Logoff feature is set and enabled, the system will automatically log the current user off if the analyzer detects no external activity for the set interval.

Enable Sample Results Auto Export
By checking the Enable Sample Results Auto Export box the data will be automatically exported to the Bridge computer after each sample analysis.

- Files are sent as .csv read-only files.
- Only sample data for samples analyzed after the feature is enabled will be exported. All samples analyzed prior to enabling of this feature will not be automatically exported. However, these samples can be manually exported.
- At the beginning of each month, a new file is created and named SampleResults<*Year*>-<*Month*>.csv.
- Each time a sample is analyzed, a new file is sent in its entirety to ensure that a communication error does not lose any of the previous data. The file is "closed" at the end of each month.

2.5.2 Users

From within the Configuration screen, select **Users**. An operator with Administrator privileges is able to do the following:

- Create/deactivate a user
- Change Password
- Apply/Add privileges to a user

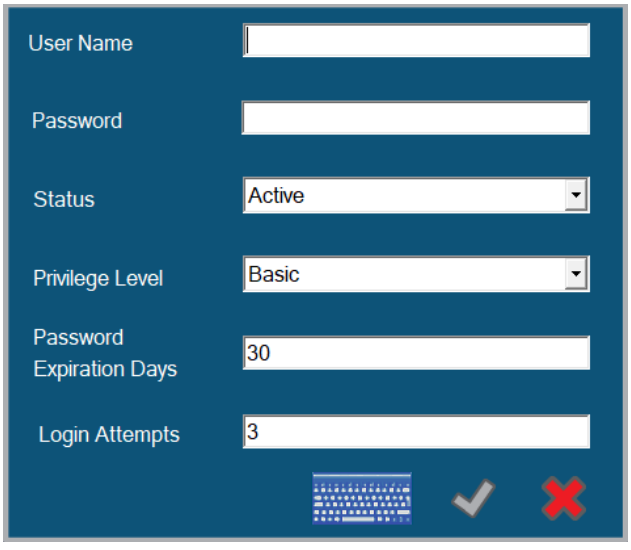

Figure 2.9 Add/Edit Users Screen

To Create a New User:

- Enter a User Name. The User Name must be 3 - 25 characters. User names are not case-sensitive. User names cannot begin or end with a blank space and cannot contain special characters.
- Enter a password for this user that contains at least one upper case alpha character, one lower alpha character, and one numeric value. Passwords must be 8 - 25 characters.
- In the dropdown, select the User Status (active or inactive).

Note: Inactive User Accounts cannot log in to the system.

- In the next dropdown box, select the Privilege Level (Basic, Intermediate, Advanced, Administrator) for the User Account. The available functions for each privilege level are outlined in the table that follows.

Privilege Level Table

	Basic Privilege	Intermediate Privilege	Advanced Privilege	Admin. Privilege	Admin. Account
File					
View Audit Log	X	X	X	X	X
Export Audit Log Entries	X	X	X	X	X
Export Print Screen Images	X	X	X	X	X
Shut Down Host Computer	X	X	X	X	X
Backup The Database				X	X
Install Analyzer Software*	X	X	X	X	X
Service					
View Error Log	X	X	X	X	X
Export Error Log	X	X	X	X	X
Setup					
View/Edit Analyzer Information		X	X	X	X
Configure Units of Measure		X	X	X	X
View/Edit/Configure Cell Inspection Types			X	X	X
Configure Scheduled Maintenance		X	X	X	X
Configure Scheduled Database/Image Backups		X	X	X	X
Configure QC Levels			X	X	X
Configure Auto Indexing		X	X	X	X
Configure Auto Export		X	X	X	X
Configure Date & Time				X	X
Configure Auto Logout		X	X	X	X
Create/Edit Users				X	X
Help					
Export Diagnostic Logs	X	X	X	X	X

Privilege Level Table					
	Basic Privilege	Intermediate Privilege	Advanced Privilege	Admin. Privilege	Admin. Account
User Functions					
Change Personal Password				X	X
View Privilege Level	X	X	X	X	X
Log Out	X	X	X	X	X
View Scheduled Events	X	X	X	X	X
View System Details	X	X	X	X	X
Analyze					
Run a Sample Analysis	X	X	X	X	X
Create/Modify Sample Types			X	X	X
Configure a Sample Analysis		X	X	X	X
Results					
View Results & Images	X	X	X	X	X
Export/Print Results & Images	X	X	X	X	X
Export Histogram	X	X	X	X	X
View/Export Growth Calculations	X	X	X	X	X
Edit Sample Information		X	X	X	X
Re-Analyze A Sample			X	X	X
QC					
Run QC Analysis	X	X	X	X	X
View/Export/Print QC Results	X	X	X	X	X
Calibration					
Perform Calibration	X	X	X	X	X
Maintenance					
Install Reagent Pack	X	X	X	X	X
Adjust Intensity	X	X	X	X	X
System Depro	X	X	X	X	X
Clear Wells	X	X	X	X	X
Prime	X	X	X	X	X
Intensive Cleaning	X	X	X	X	X
Empty Waste Container	X	X	X	X	X
Open Drawer	X	X	X	X	X
Initialize Carousel Tray	X	X	X	X	X
Change Sample Syringe	X	X	X	X	X
Change Cleanout Syringe	X	X	X	X	X
Long-Term Shutdown	X	X	X	X	X
Change Pump Tubing Sets	X	X	X	X	X

***Procedures should only be performed by trained Nova Service Personnel**

- Set the number of days after which the password will expire. Setting this number to 0 gives the password no expiration.
- Set the number of failed login attempts that a user can try before the account is made inactive, Setting this number to 0 means there is no limit

to the number of failed logins. It can only be made active again by a user with Administrator privileges.

- Select the check mark button to save the user account.

To Change a User Account:

- Select the User Account from the list at the top of the menu.
- Edit the Password, Status, Privilege Level, Expiration Days, or Login Attempts.
- Select the check mark to save the changes.

User Privilege Levels:
The system supports user privilege levels including basic, intermediate, advanced, administrator privilege, and administrator account.

Basic Privilege:
Users with basic privileges have access to the basic functions of the analyzer including calibration, perform QC analysis, and run samples.

Intermediate Privilege:
Users with the Intermediate Privilege are able to to perform all functions that can be done by a user with the basic privileges plus have the ability to edit sample information, configure a sample analysis, and view/edit analyzer information.

Advanced Privilege:
Users with the Advanced Privilege are able to perform all functions that can be done by a user with the Intermediate Privileges plus create/modify sample types and access/edit quality control levels and cell inspection types.

Administrator Privilege:
Users with the Administrator Privilege are able to perform all functions that can be done by a user with the Advanced Privileges. Additionally, an administrator can create and edit user accounts.

Administrator Account:
The system supports an account with the username Administrator which has all administrator privileges. This account cannot be deactivated or exported.

Account Status:
The system supports two levels of account status: active and inactive.

- A system Administrator can manually deactivate a user either within the Users screen directly or by file importation.
- A system Administrator can manually re-activate a user either within the Users screen directly or by file importation.

Password Expiration:
The administrator can set the number of days a password is active.

Login Attempts:
The administrator can set the number of invalid login attempts (incorrect password for an established user) before the user account is deactivated.

Exporting and Importing User Accounts:
An end user with appropriate privileges can export and import User Accounts and settings from one system to another.

- Insert a USB drive into an available USB port on the analyzer.
- In the Create/Edit Users Menu, select **Export**, then select the USB drive that the file will be exported to.
- Insert the USB drive on another system. From the Create/Edit Users Menu, select **Import** and the appropriate USB drive location to import the user account settings.

2.5.3 Cell Inspections

Assay Description
Cell Density and/or Cell Viability (CDV) is the measurement of the total number of cells in suspension and a proportional determination of live and dead cells. To best understand how results are calculated and the parameters that affect CDV measurement, it helps to have an overview of how the analyzer works.

1. A sample is aspirated by the sample probe and dispensed into the analysis well.
2. The sample is mixed with Trypan Blue and advanced to the imaging cuvette.
3. The camera takes 100 vertical images at 20 cuvette locations for analysis.
4. These 100 images are stitched together to generate a composite image that is then analyzed to determine Total Count, Live Count, Diameter, etc.
5. The sample is discarded as waste. The analysis well, tubing lines, and imaging cuvette are cleaned in preparation for the next sample.
6. While one Flowpath is being cleaned in preparation for the next sample, the other Flowpath will be utilized for analysis. This interleaving mechanism allows for faster analysis of multiple samples.
7. The analysis is performed by the onboard imaging system, and the raw images are stored uncompressed on the operating system computer hard drive for potential re-analysis. Compressed images are also saved for later viewing.
8. At the completion of the imaging process, the BioProfile *FAST* CDV displays virtual slides that can be enlarged by the user for closer inspection.

These images are subjected to analysis using the Cell Density Inspection Type Parameters. As digital images, they are not subject to degradation and can be reanalyzed with new parameters at any time within 30 calendar days of imaging. The BioProfile *FAST* CDV applies the parameters to the images and presents

the user with both a graphical and numerical representation of the results. Eight separate parameters can be configured including brightness thresholds, size, aggregate area, and debris size threshold.

Note: ***After 30 days, uncompressed bitmaps are deleted. Compressed JPEGs are present in a database at the completion of the analysis. The images are stored and can be viewed but once compressed, the images can no longer be reanalyzed.***

2.5.3.1 Live and Dead Cell Identification

Trypan Blue Exclusion

The Trypan Blue Exclusion test is used to determine the number of viable cells present in a cell suspension. It is based on the principle in which, unlike dead cells, live cells possess intact cellular membranes that exclude Trypan Blue dye. A cell suspension mixed appropriately with Trypan can be visually examined to determine whether individual cells take up or exclude dye. Viable cells have clear cytoplasm whereas nonviable cells have blue cytoplasm.

Programmed Cell Death

Apoptosis is typically a passive, degenerative process, which is characteristically different from cell necrosis in morphology and biochemistry. Apoptosis results in the condensation of the nucleus and decrease in cellular volume, eventually leading to the fragmentation and blebbing of the cell. These smaller constituents (apoptotic bodies) may be confused for individual small dead or live cells. The life cycle within a properly maintained cell culture typically follows natural cell growth and death via apoptosis. Observable cellular morphology coupled with Trypan exclusion allows the CDV to correctly ascertain the differences between live and dead cells.

2.5.3.2 Configuring the Cell Density Module

Cell Inspection

The BioProfile *FAST* CDV allows you to configure 8 parameters that can affect how the sample is read and interpreted. These parameters include: Live Cell Brightness Threshold, Live Cell Minimum Size, Dead Cell Brightness Threshold, Dead Cell Minimum Size, Average Dead Cell Diameter, Dead Cell Aggregate Area, Debris Size Threshold, and Cell Density Multiplier. All parameters can be readjusted and used to reanalyze prior images to allow for optimum cell inspection configuration.

To review/edit an existing Cell Inspection Type or to create a new one:

1. From the Destinations menu select **Configuration**.
2. Select **Cell Inspections**.
3. With the proper user privileges, all of these inspection types can be modified except "Standard CHO" and "QC."
4. New inspection types can be created by selecting **Add**.

Note: ***You may base your new inspection type on any existing type by selecting the cell inspection type you want to base the new type on, then selecting "Add." This will populate the new cell inspection type with the same parameter values as the selected type, and further modifications can be made from there.***

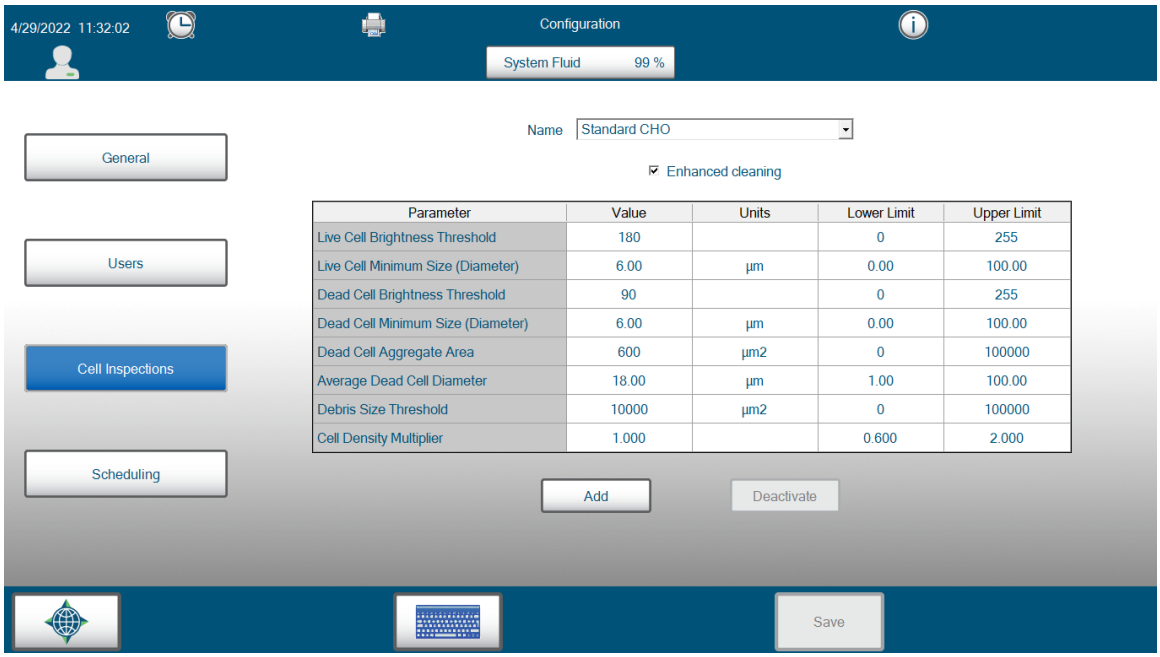

Figure 2.10 Cell Inspections Configuration Screen

5. Cell Inspection Parameters

   The "Standard CHO" cell inspection type was based on numerous cell lines tested at Nova Biomedical. While this is a good starting point, it is not intended as a final inspection type. Customization of an inspection type will greatly improve the accuracy of your cell count.

   a. Live Cell Brightness Threshold

      i. Live Cell Brightness is measured from 0 to 255 on a scale where zero is black and 255 is white. The normal background of a Trypan stained slide is around 127.

      ii. Changing this parameter results in changes to the minimum allowable brightness threshold of a live cell. For example, a slightly dark live cell may not be counted at a setting of 200 but is counted correctly at a setting of 180.

b. Live Cell Minimum Size (Diameter)

i. Changing this parameter increases or decreases the minimum size allowable to distinguish a live cell.

ii. Using your knowledge of your own cell lines, set this number to the size you feel is adequate for a small live cell. For example, if the average CHO cell is 12.5 µm, you may find a setting of 8-9 may work best to include small viable cells while excluding smaller apoptotic bodies.

iii. Decrease this number if live cells are bright, slightly small and not counted as live.

c. Dead Cell Brightness Threshold

i. Dead Cell Brightness is measured from 0 to 255 on a scale where zero is black and 255 is white. This setting sets the upper limit for dead cell brightness.

ii. Increase this number if dead cells are light in color and are not counted as dead.

d. Dead Cell Minimum Size (Diameter)

i. This parameter sets the minimum size (0.00-100.00 µm) a cell needs to be in order to be distinguished as dead.

ii. If debris from lysed cells are counted as dead cells, increasing this number excludes the smaller non-cell items.

iii. Decrease this number if small dead cells are not counted.

f. Dead Cell Aggregate Area

i. This parameter sets the minimum area (0-1x10^5 μm^2) the BioProfile *FAST* CDV counts as an aggregate of dead cells. Dead cell aggregates are identified with orange numbers. The orange number placed over the aggregate, or clump, is the calculated number of dead cells in the clump based on the combination of the dead cell aggregate area and the average dead cell diameter settings.

ii. This number approximates the area taken by 2 or more dead cells in a clump.

iii. Increase this number if single dead cells are counted as multiple dead cells.

e. Average Dead Cell Diameter

i. This number is used to calculate the number of dead cells in an aggregate clump (1-100.00 µm).

ii. Typically this number is 2-3 µm smaller than the average live cell diameter.

iii. Change this number if aggregate clumps of dead cells are not being counted correctly. For example, if you have a clump made up of what appears to be 10 dead cells, yet the orange aggregate count is 25 you need to increase the Average Dead Cell Diameter.

iv. Increasing this number will decrease the number of dead cells presented by the orange number for the aggregate. Decreasing this number will increase the orange number for the aggregate.

g. Debris Size Threshold

i. This number sets the minimum area the BioProfile *FAST* CDV counts as debris. An image with debris present is excluded from the analysis.

ii. Increasing this number allows smaller debris to be present without excluding the image from the analysis.

iii. Setting this number too low may cause images with small debris and/or small clumps of live or dead cells to be excluded from the analysis as invalid images.

h. Cell Density Multiplier

i. This parameter allows the user to set a multiplier (0.6 - 2.0) that adjusts the total and viable densities when correlating to a reference analyzer.

6. After you have entered values in the inspection data, save your settings by selecting **Save**.

2.5.4 Scheduling

The BioProfile *FAST* CDV allows you to schedule automated maintenance cycles and backups. By selecting **Scheduling**, the user is able to automate the Clean Cell Density Flowcell, Adjust Intensity, and Depro Wells sequences, as well as scheduling automatic Database Backups.

Program your BioProfile *FAST* CDV to perform these automated sequences by checking the box next to "Active" for the desired sequences, then change the Start Date, Start Time, and Frequency for each. Select **Save** to initiate the new settings.

These maintenance routines can all be performed manually as well through the Maintenance menu.

Clean Cell Density Flowcell

- The Clean Cell Density Flowcell sequence is a cleaning routine performed using the reagents contained in the BioProfile *FAST* CDV Reagent Pack. This cleaning can be performed as often as necessary.
- The Clean Cell Density Flowcell sequence takes approximately 10 minutes to complete.
- It is recommended that the Clean Cell Density Flowcell sequence be performed daily whenever cell samples are run.

Adjust Intensity

- The BioProfile *FAST* CDV uses the Trypan Blue exclusion assay to determine Total Cell Density and Cell Viability. Trypan Blue Dye is known to precipitate as it ages. The dye can become lighter or darker depending on the volume remaining in the cartridge and the amount of precipitation that occurs while the pack is installed. The light intensity that creates the background for cell imaging in the Cell Density flowcell assembly needs to remain constant for consistent CDV analysis. The LED light that provides the background light intensity can be adjusted to normalize this setting as the Trypan Blue ages or changes color. The BioProfile *FAST* CDV will automatically run an Adjust Intensity sequence whenever a new *FAST* CDV Reagent Cartridge is installed and when the system is calibrated, but the Adjust Intensity sequence should also be run regularly.
- It is recommended that the Adjust Intensity procedure is performed on a weekly basis or, if necessary, more frequently.

Depro Wells

- The Depro Wells sequence is a cleaning routine performed using the Deproteinizing solution found in the BioProfile *FAST* CDV Reagent Pack.
- It is recommended that the Depro Wells sequence be performed weekly or, if necessary, more frequently.

Database Backup

- The Database Backup allows the operator to program a scheduled frequency to automatically backup the database or backup CDV images to the internal Bridge computer.
- Sample images can also be exported manually to a USB drive. If exporting to a USB drive is not desired, external USB ports can be physically blocked.
- Additional Manual Exports available include:
    1. Audit Log
    2. Error Log
    3. QC Results
    4. Growth Calculations

5. User Interface Diagnostic Logs
6. Maintenance Log
7. Calibration Log
8. User Accounts

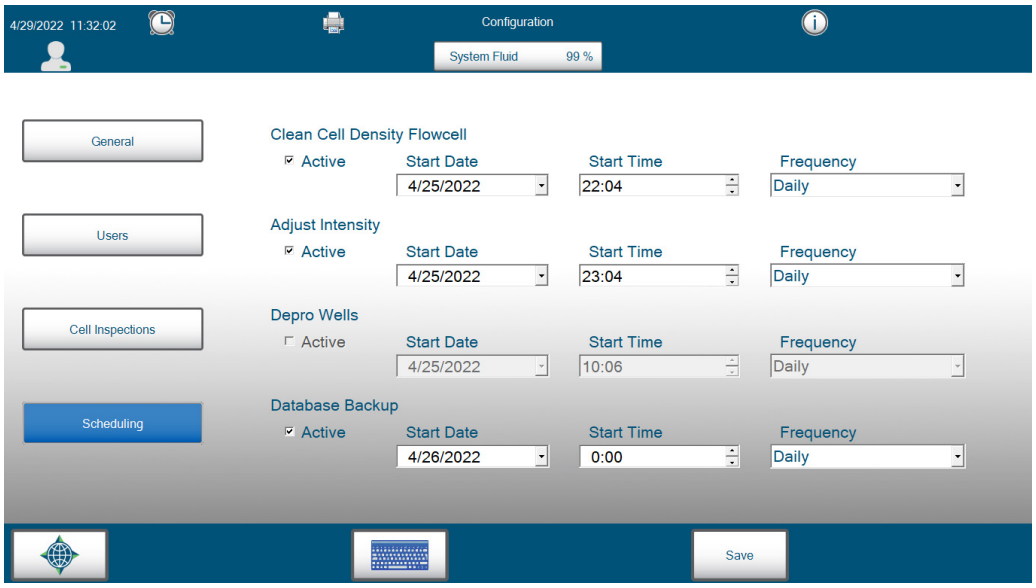

Figure 2.11 Scheduling Configuration Screen

2.6 Calibrate

The CDV Calibration is used to calibrate the focus and light intensity of the camera system. During calibration, the beads from the cell density calibrator solution are delivered to the CDV module cuvette assemblies. As the software establishes focal range, the bead images go in and out of focus. Optimal focus is established for each section of the Cell Density cuvette.

Select **Calibrate** from the Destinations menu to display the Calibration screen. Follow the instructions on the screen to begin calibration.

To perform a CDV module calibration:

1. Remove any cups from the carousel tray.
2. Select one or both Flow Paths to calibrate.
3. Press **Start** to position the carousel tray.
4. To prepare the calibrator solution, vortex the calibrator ampule for 10 seconds just prior to transferring it to the sample cups. If no vortex is available, gently invert the ampule 10 times prior to transferring it. Once this is completed, open the ampule and using a pipette, transfer 100 µL to two separate sample cups.

5. When the tray is in position, place a sample cup with calibrator solution in Location 1 (to calibrate one Flow Path) or Locations 1 and 2 (to calibrate both Flow Paths).
6. Press **Aspirate**.
7. After the focus and light intensity have been established, the screen will display 20 image frames for each flowpath as small picture tiles. These images are the background on which the sample images will appear.
8. Each of these 20 images should be inspected for dark spots, debris, or imperfections. Images containing any of these items can be deselected so that their locations will not be used when running CDV sample analyses and will not apply to CDV results. Up to 3 images can be deselected. To deselect an image, select it, and the image will expand to a larger viewing size. Tapping the enlarged image will then place a red X through it, indicating it has been deselected.
9. When each calibration image has been inspected, select **Done** to complete the calibration.

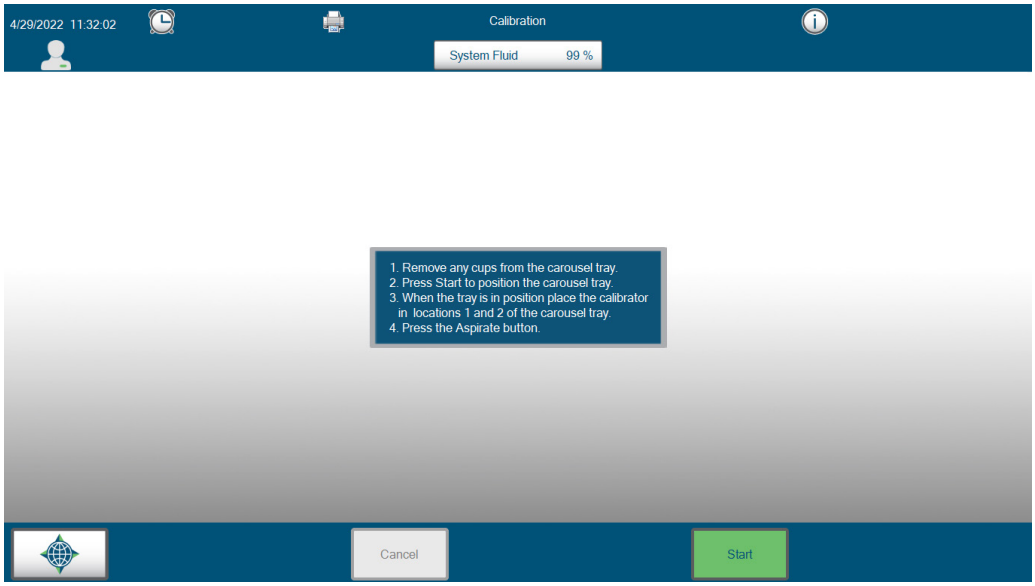

Figure 2.12 Calibration Screen

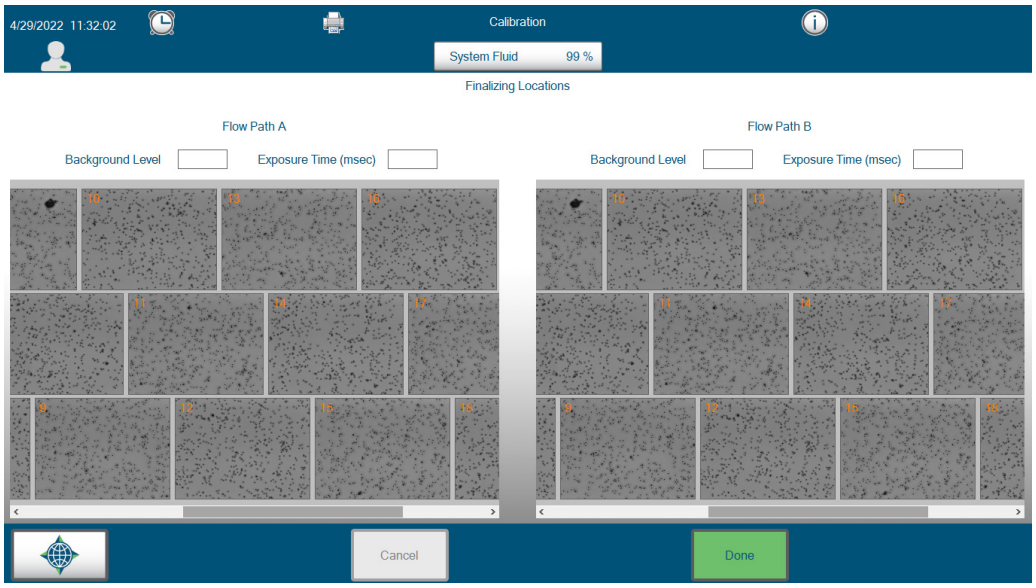

Figure 2.13 Location Calibration Screen

Figure 2.14 Intensity Calibration Screen

2.7 Connecting to Printers

The BioProfile *FAST* CDV Analyzer can be connected to external network printers. This allows the operator to print results directly from the *FAST* CDV User Interface.

Nova Biomedical recommends Enterprise-type printers with Web-based Enterprise Management (WBEM) capabilities. To install printer drivers and troubleshoot printer errors, press the Printer Status icon and select **Remote Desktop** to log in to the Bridge PC.

2.8 Date and Time

The Date and Time menu allows the operator to program the correct date and time for the BioProfile *FAST* CDV analyzer. The date and time are recorded in the Sample Results each time a sample is analyzed. To change the Date and Time, click the date or time in the status bar at the top of the screen, which will bring up the Change Date and Time screen (Figure 2.15). Select the correct date and time.

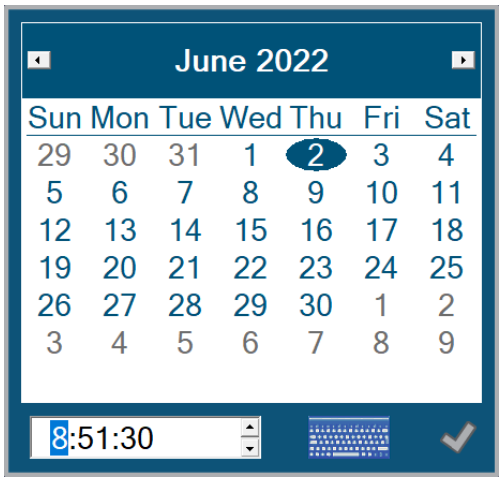

Figure 2.15 Change Date and Time Screen

3 Operation

This section describes how to operate the analyzer. The BioProfile *FAST* CDV Components consist of the following items:

1. Touch Screen Monitor and Wireless BLE Keyboard
2. Customer Provided Printer (Not included/provided by Nova Biomedical)
3. Analytical Compartment

3.1 Monitor and Wireless BLE Keyboard

The analyzer's touchscreen display shows information on system functions, how to access system functions, and output sample results. The analyzer also has an on-screen keyboard that can be accessed by selecting the keyboard button  , or the operator can use the included wireless BLE keyboard.

3.2 Printer

The BioProfile *FAST* CDV does not come with a printer. A USB or network printer can be installed by the operator.

3.3 Pumps

A sample syringe pump is used to aspirate and mix the sample as well as move it through the analyzer.

A cleanout syringe pump and three peristaltic pumps work to move the sample through flow paths A and B and remove waste.

3.4 Reagent Packs

The *FAST* CDV Reagent Pack consists of 2 separate packs: the System Fluid Pack and the Reagent Bottle Pack. Both packs are installed as a pair and contain enough reagent fluid for up to 500 samples.

a. The Reagent Bottle Pack contains 4 bottles necessary for cell density analysis.
b. The Bottle Pack caps, but not seals, must be removed before installing the pack.
c. A Radio-Frequency Identification (RFID) tag on the Reagent Pack stores pack information (Remaining Volume, pack Lot Number, Install Date, Shelf-Life) and communicates the pack status to the analyzer.
d. The pack can easily be disassembled for reagent disposal.

3.5 Calibration

Calibration options can be accessed by selecting the **Calibrate** button in the Destinations menu. The Calibration screen is displayed.

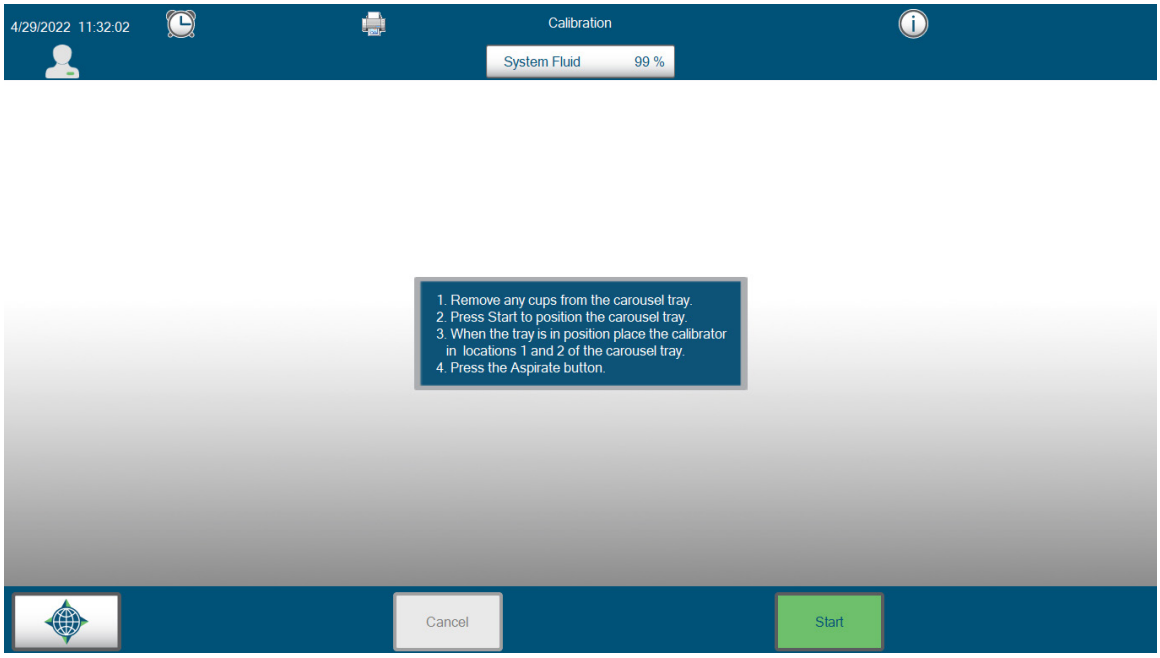

Figure 3.1 Calibration Screen

After choosing the Calibrate button, select the green **Start** button in the lower right hand corner. Calibrations can be cancelled at any time by selecting the **Cancel** button. If a calibration is terminated, the system will return to an uncalibrated state.

3.6 Waste Container

After each analysis (QC, Calibration, and Sample Analysis), the spent sample cup is deposited into the waste container located behind the door. The waste container can hold up to 500 discarded cups. To empty, remove the container and discard the cups.

WARNING: ***The cups are considered a biohazard and should be discarded in accordance with your institution's standard operating procedure.***

When the waste container is reinstalled, a prompt will ask if the waste container has been emptied. Selecting **Yes** will reset the waste container cups back to 500 remaining.

3.7 Programming Quality Control Levels

When a new Lot of BioProfile External QC material is to be used, the information from the Control Level Assay Data Sheet must be entered into the BioProfile *FAST* CDV prior to use.

Configure the QC material using the following steps:

1. Select **QC** from the Destinations menu.
2. Select the QC Level that you wish to configure by clicking on the respective button for **Level 8** or **Level 9**.
3. Select which Flow Path(s) to run QC on by checking the box for Flow Path A, Flow Path B, or both.

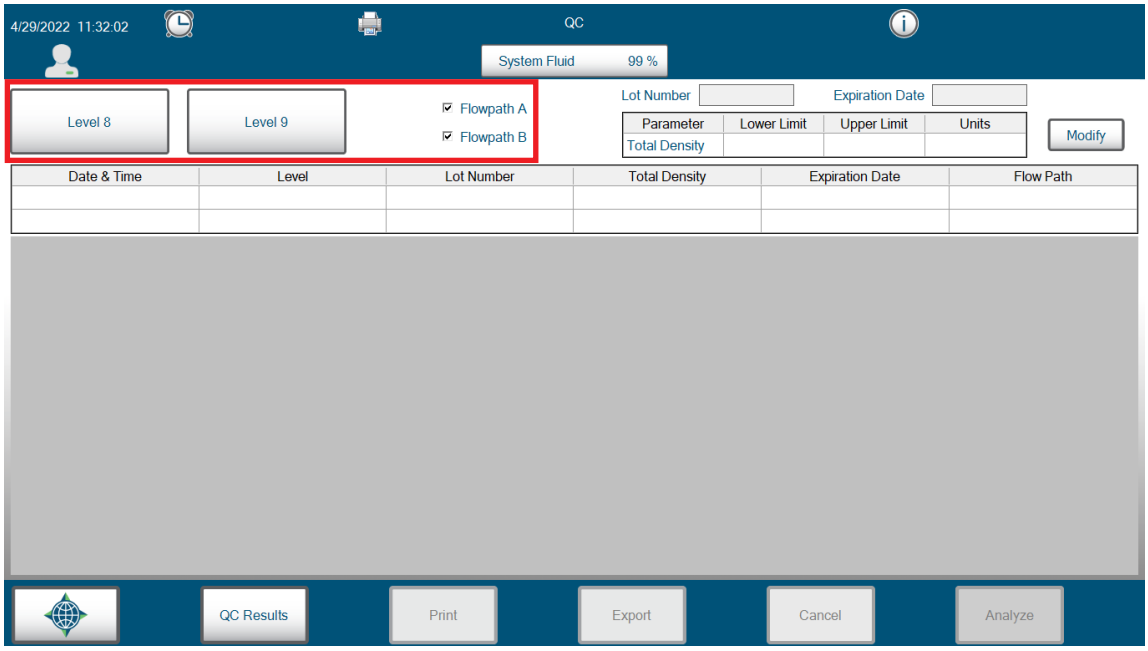

Figure 3.2 Configure QC Levels

4. Select **Modify** to configure the appropriate Lot Number, Expiration Date, and the Lower and Upper Limits of the QC Total Density range, found on the Assay Data Sheet that comes with the QC material.

Note: ***A minimum of 6 digits must be entered into the Lot Number field for the ranges to be applied.***

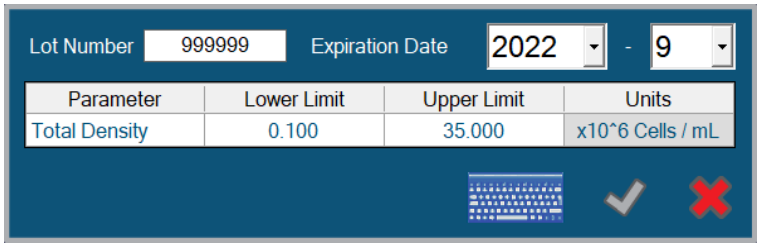

Figure 3.3 Modify QC Information

5. Once all of the QC information has been entered, select the check mark to save the information. The QC information for that specific Lot will now be programmed into the BioProfile *FAST* CDV and will be available when testing that level of QC material.

3.8 Running Quality Control

To run Quality Control samples:

1. Select the **QC** button from the BioProfile *FAST* CDV Analysis Screen. This will bring up the QC Screen.
2. Select the Level of Quality Control (Level 8 or 9) that will be tested.

Note: ***The Quality Control material must first be configured under the Setup menu.***

3. Select the **Analyze** button to begin the Quality Control analysis.
4. Using a pipette, deposit 0.1 mL of vortexed QC material into the appropriate sample cup(s).
   a. When running QC on both Flow Paths, deposit QC material into two cups and place them in carousel positions 1 and 2.
   b. When only running QC on one Flow Path, only deposit QC material into one cup and put the cup into carousel position 1.
5. When the cup(s) are in the proper position(s), select **Aspirate**.

Quality Control data will be populated in the QC Results screen. The QC screen will indicate whether the Level of Quality Control being tested passes or fails according to the information found in the Quality Control Insert Sheet.

Note: ***QC images can be viewed when the analysis has completed by selecting the image. Each bead within the image should have a green circle around the perimeter indicating it was counted.***

Figure 3.5 Quality Control Screen

3.9 Running Sample Analysis

The BioProfile FAST CDV offers two default methods of sampling: a 32-position Load-and-Go Carousel Tray, and a 96-Well Plate.

Load-and-Go Carousel Sampling

To run a sample on the 32-position Load-and-Go Carousel Tray:

1. Select **Analysis** from the Destinations menu.
2. Select the Load-and-Go Carousel icon .
3. Select the cup location you will be loading by tapping the corresponding cup number on the screen. The cup will change color, indicating it has successfully been selected for configuration.
4. Select a pre-configured Sample Type from the Sample Type dropdown menu, or use the Default Sample Type.
5. Configure the appropriate Onboard Dilution Ratio and Cell Inspection Type, depending on your Cell Type and approximate Cell Density.
6. When your sample configuration is complete, load your cup(s) into your selected cup locations.
7. Pipette 100 µL of sample into each cup.

CAUTION: Pipette in a slow and careful motion to ensure no air bubbles are introduced into the sample.

8. When all samples are loaded, press **Analyze** to start analysis.

96-Well Plate Sampling

The 96-Well Plate is a Microtiter plate with 96 sampling positions, each of which can individually configured.

To run a sample on the 96-Well Plate:

1. Select **Analysis** from the Destinations menu.
2. Select the 96-Well Plate icon .
3. Select each well location you will be loading to configure it. When a well location is selected, it will turn light blue and can then be configured for the desired Sample Type, Onboard Dilution Factor, and Cell Inspection Type. You can also add your desired sample information. After the well location has been configured and a different location is selected, the configured well location will turn dark blue.
4. Pipette the samples into the 96-Well Plate locations that were configured on the FAST CDV screen. Pipette 125 µL into each configured well.

CAUTION: Pipette carefully to avoid creating air bubbles or gaps in the wells that could impact results.

5. When all samples have been properly pipetted into their respective wells, press **Open Drawer**. When the drawer opens, insert the 96-Well Plate into position with the A1 location positioned on top of the silver pin at the top right of the drawer. This is the only orientation that will fit. Select **Close Drawer**, then select **Analyze**.

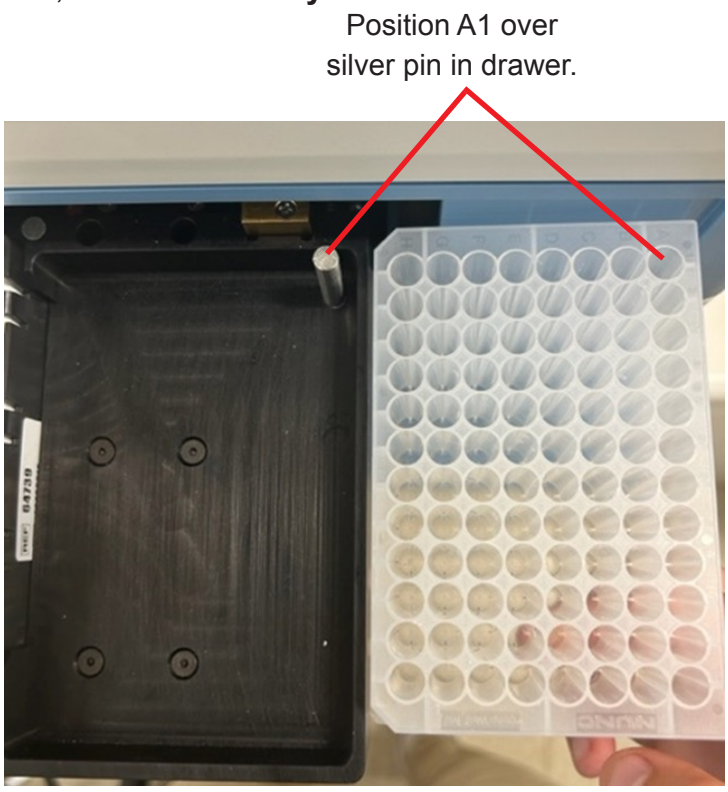

Figure 3.6 96-Well Plate Positioning in Drawer

Figure 3.7 Sample Information Configuration

Please be aware of the following minimum sample volume requirements when preparing/presenting a sample:

- Exactly 100 µL is required for Load-and-Go Carousel samples.
- Exactly 125 µL is required for 96-Well Plate samples.

Note: ***Nova recommends the use of a vortex when mixing both samples and QC material. Follow the QC Insert Sheet for complete instructions when analyzing QC material.***

The BioProfile *FAST* CDV offers 3 dilution options (1:1, 1:2, and 1:4) for high-density cell culture samples. If a dilution is selected, the BioProfile *FAST* CDV will perform the dilution and the results reported are calculated to correct for the dilution. While it is not necessary to externally dilute samples, the BioProfile *FAST* CDV also provides the option to add a pre-dilution multiplier for the analyzer to correct calculations for external dilution.

The Analysis Screen will transition to the Results Screen. Upon completion of the sample analysis, the screen displays each image.

Figure 3.8 Sample Results

Each image can be enlarged by first selecting it from the others and then selecting the image located in the results section to the left. Selecting an individual image to review presents you with information for that slide as well as the entire group of slides. Selecting the **LIVE** and/or **DEAD** buttons next to the preview visually identifies cells the BioProfile *FAST* CDV has counted as live (green circle) or dead (red "X") as well as clumps of dead cells (orange numbers).

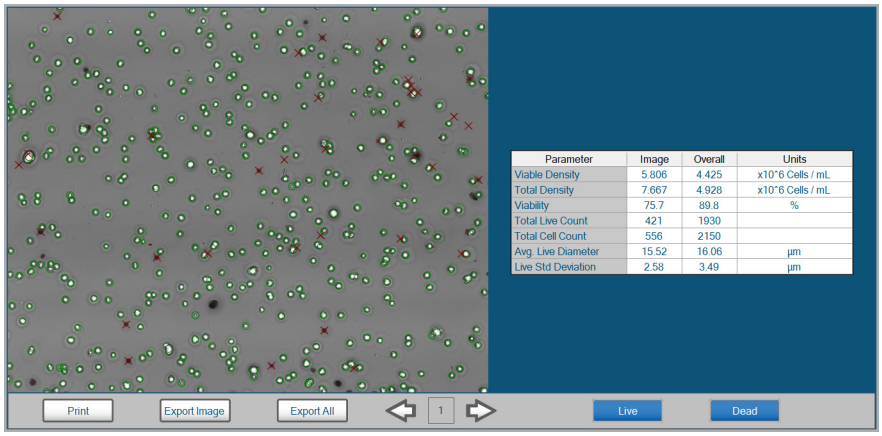

Figure 3.9 Individual Image Results

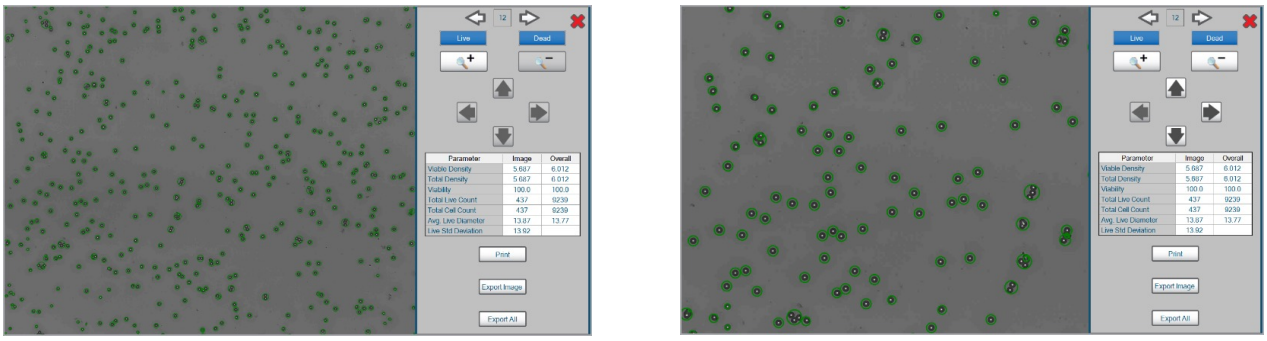

Figure 3.9 Individual Image Results

The zoom feature allows you to zoom in on your image to look more closely at the cells. To zoom, select the icon under the "Live" button. To inspect different parts of the image, use the arrow keys to travel up, down, left, or right on the image. To zoom back out, select the icon.

Note: ***Additional samples can be added to the carousel during an analysis from the Analysis Screen.***

Suspending the Carousel to Add Samples

The *FAST* CDV analyzer allows for continuous loading of the carousel. As a sample is being analyzed, more samples can be configured by suspending the carousel.

To add more samples, from the current sample analysis screen, select the cup locations you wish to add to the current sequence. This will automatically suspend the current analysis. Configure the additional cup locations and load the new samples in the corresponding locations. Press **Resume** to continue the original sample analysis, which will be followed by the analysis of the newly added samples.

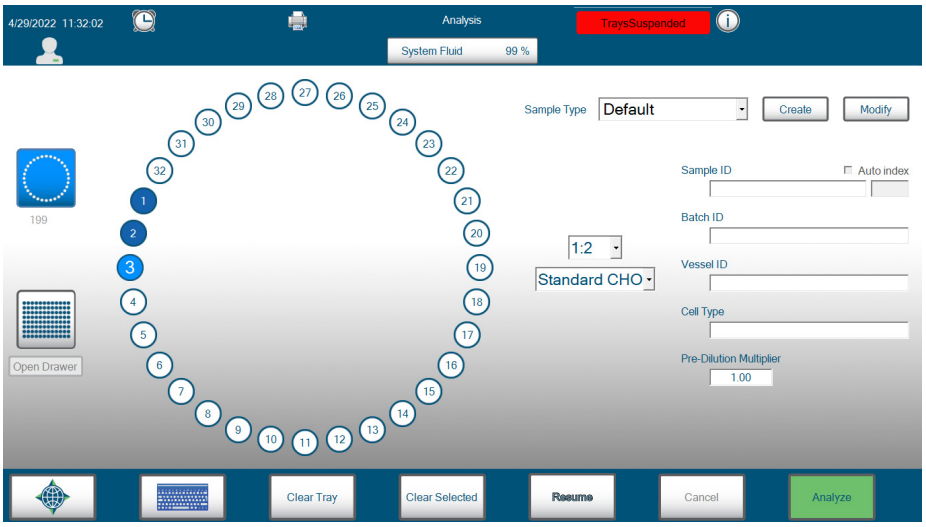

Figure 3.10 Suspended Carousel

Reviewing Cell Density Data

- Viable Density – The total number of live cells in suspension expressed in cells per milliliter (cells/mL).
- Total Density – The total number of cells in suspension expressed in cells per milliliter (cells/mL).
- Viability – The percentage of total cells in the suspension that are viable. (e.g. 850 live cells in suspension containing 1000 cells are calculated to have a viability of 85%.)
- Total Live Count – The total number of live cells counted during the analysis.
- Total Cell Count – The total number of live and dead cells counted during the analysis.
- Average Live Diameter – The average diameter of live cells measured in micrometers (µm).
- Live Standard Deviation – A calculation of the SD of live cell diameter is measured over the entire sample and for each slide individually.
- % Aggregate – The measurement of the number of cells aggregated (clumped) as a percentage of the total number of cells in a sample.

Reanalyzing CDV Data

CDV samples run in the last 30 days may be reanalyzed using alternative cell inspection types.

To reanalyze, follow these steps:

1. From the Historical Results screen, select the sample you wish to reanalyze.
2. Select **View Selected**.
3. Select the **green triangle** ▼ next to the Sample ID to access the Reanalysis dropdown menu.
4. Choose the Cell Inspection Type you would like to reanalyze with from the resulting dropdown menu.

Note: ***If changes were made to the original Cell Inspection Type, selecting the same Cell Inspection Type will reanalyze the sample with the new changes.***

5. Make any desired changes to the Sample ID, Batch ID, Vessel ID, and Cell Type sections.
6. Select **Reanalyze**, then select the **green check mark**.

Note: ***Reanalyzing a sample will not change or overwrite the original sample result. When a sample is reanalyzed, a new sample entry is generated in the Historical Results with a new date and timestamp, as well as new information and/or data depending on the sample information changes that were made. The new sample result maintains the original sample record's date and timestamp in the Sample Time column for traceability.***

Figure 3.11 Reanalyze Menu

3.9.1 Entering Sample Information

Sample Information is not required in order to run an analysis but can be inserted for identification purposes. The sample information can include the following:

a. **Vessel ID** – any combination of alphanumeric characters (30 Maximum)
b. **Batch ID** – any combination of alphanumeric characters (30 Maximum)
c. **Cell Type** – any combination of alphanumeric characters (30 Maximum)
d. **Sample ID** – any combination of alphanumeric characters (30 Maximum)

Note: ***Sample information can be input using alphanumeric characters plus underscore, dash and space. As information is entered, previously used ID's autopopulate in the selected field.***

Module Configuration

In order to run an analysis, the following 2 options must be specified:

1. **Cell Inspection Type –** Select the down arrow to choose from any of the available cell inspection types. These inspection types are programmed from within the Configuration menu. Once an inspection type is selected, it will be used for subsequent samples unless a new inspection type is selected. The default inspection type is "STANDARD CHO."
2. **Dilution Ratio –** Select the down arrow to choose from the available dilution ratios. If your sample is expected to contain a total density of cells near or above 35 million cells/mL, the image may be overcrowded, which reduces counting accuracy and slows processing time. Selecting the correct/appropriate dilution ratio may improve module performance when cell densities are above the default range. Using a higher onboard dilution ratio can also help remove unwanted debris from images.

   Use the guidelines below to select the appropriate dilution range:

Dilution	Total Density
1:1	0.05 - 35 million cells/mL
1:2	0.1 - 70 million cells/mL
1:4	0.2 - 140 million cells/mL

Note: ***The reported result accounts for the dilution; no additional calculation is necessary.***

3.10 Reviewing Results

1. After the **Aspirate** button is selected, the results screen is displayed.

Figure 3.12 Current Sample Results Screen

2. While an analysis is in progress, the time left to complete the analysis is shown in the top right of the screen.

Figure 3.13 Time to Completion Display

3. The Sample Results Screen shows the following:
   a. **Sample Information** – At the top of the Sample Results screen, the *Sample ID*, *Flow Path* used, *Date & Time* of the sample analysis, and the *Operator* logged in at the time of the analysis are displayed.

Note: ***When changes are made to the sample information, the sample gets re-saved in the database with the date and time that the sample was edited. However, the original sample time is conserved and listed on the results tab as "sample time."***

   b. **Image Gallery** – Displays thumbnails of the images collected from the most recent sample. Sample analysis must be completely finished before you can browse the images. Selecting any one of these thumbnails automatically displays a larger version of the image under the results section. Below an enlarged image are 3 buttons:
      i. **Print** – prints the enlarged image.
      ii. **Export Image** – Exports the enlarged image as a .jpg file to a USB drive (user provided).
      iii. **Export All** – Exports all images of the sample analysis as .jpg files to a USB drive (user provided).

   Below both the image gallery and an enlarged image, there are two buttons:
      i. **Live button** – selecting this option highlights the live cells (as determined by the inspection software) in a green outline. Selecting this option again eliminates the green outlines.
      ii. **Dead button** – selecting this option highlights the dead cells (as determined by the inspection software) with a red "X." If a clump of dead cells is detected, the number (orange) of dead cells within that clump is displayed instead of the "X."

c. **Results** – Below the image gallery is a table with the following calculated results:

Viable Density	Total Live Count
Total Density	Total Cell Count
Viability	Live Std Deviation
Avg. Live Diameter	

d. **Menu Bar** – In addition to the Destinations Menu and Analysis/ Cancel buttons, there are two buttons specific to the Sample Results Screen.

i. **Print** – selecting this button prints the selected image.

ii. **Historical Results** – selecting this button transitions to the Historical Results screen, which displays a list of previous sample results.

3.11 Historical Results

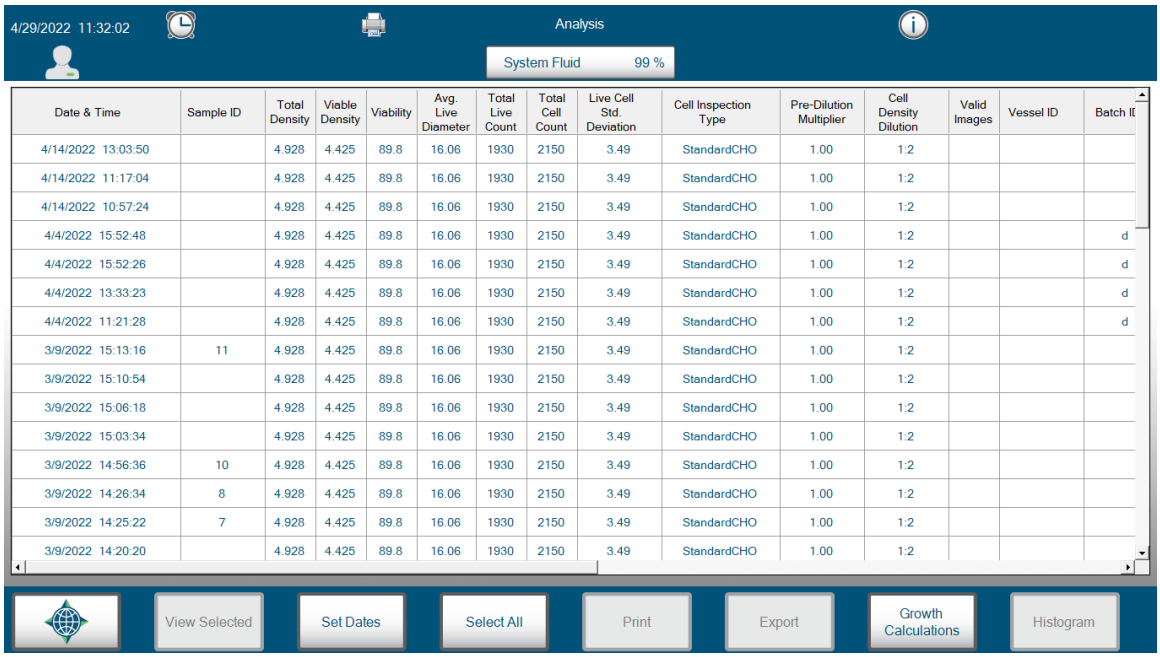

Figure 3.13 Historical Results Screen

To access the sample results stored within the BioProfile *FAST* CDV software, select the **Historical Results** button from the Destinations menu.The results are organized by date and time in reverse chronological order, with the most recent sample displayed at the top. Use the scroll bar at the right to scroll through all the results. Use the scroll bar at the bottom to view additional sample information.

On the bottom of the Historical Results screen are 7 buttons (in addition to the Destinations Menu button):

1. **View Selected** – if selected, allows an operator to view the details of a selected sample. Unless a single entry is selected, this button is disabled.
    a. To view the details of a particular sample, select one of the sample rows displayed. The row will be highlighted. The View Selected button should now be active. Only one sample can be chosen at a time.

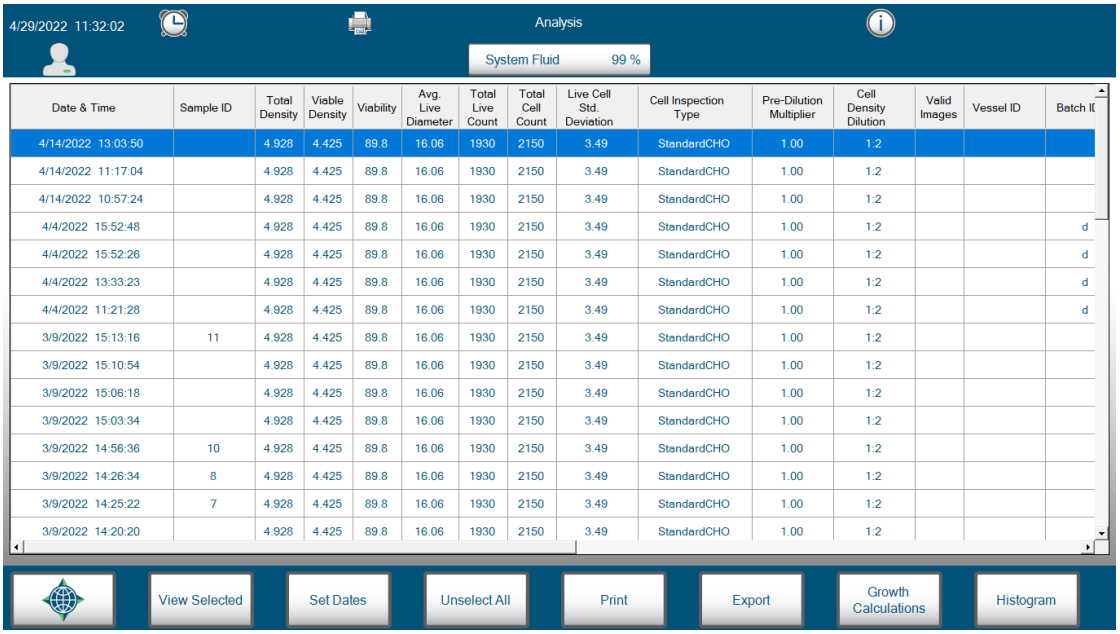

Figure 3.14 View Selected Activated Screen

    b. Select the **View** button to see sample details. Results, sample information, and cell density images are displayed.
    c. This detailed information can be printed by selecting the **Print** button displayed at the bottom of the screen.
    d. Selecting the **Historical Results** button at the bottom of the screen takes you back to the Results Recall screen.

2. **Set Dates** – Opens a menu to set a date range of historical results to display.
3. **Select/Unselect All** – Selects all of the entries. If any samples are selected, this button will unselect them.
4. **Export** – Transfers (exports) data in a form that is available to another software program, such as a spreadsheet.
    a. To export sample data, select the row(s) of data that you wish to export. The Export button should now be active.

b. Select the **Export** button. The Export Results dialog box displays. The BioProfile *FAST* CDV software will export data to a USB device. The file name is created by the BioProfile *FAST* CDV software and cannot be changed. The file name is always in the format "SampleResultsSNyyyy-mm-dd_hhmmss.csv," where SN is the Serial Number of the instrument.

c. All available locations are displayed in the box next to Drives. Select the location where you want to export.

d. Select the **Export** button. The data are written to the selected device. The data will be in comma-delimited format for easy import into a spreadsheet.

5. **Print** – Several rows of sample data can be selected simultaneously for printing. The printed format is similar to the format the data is displayed in on this screen.

6. **Histogram** – Selecting this button displays a histogram showing a comparison of Total Live Cell Count versus Live Cell Diameter. The histogram can be printed using the Print button at the bottom right of the pop-up.

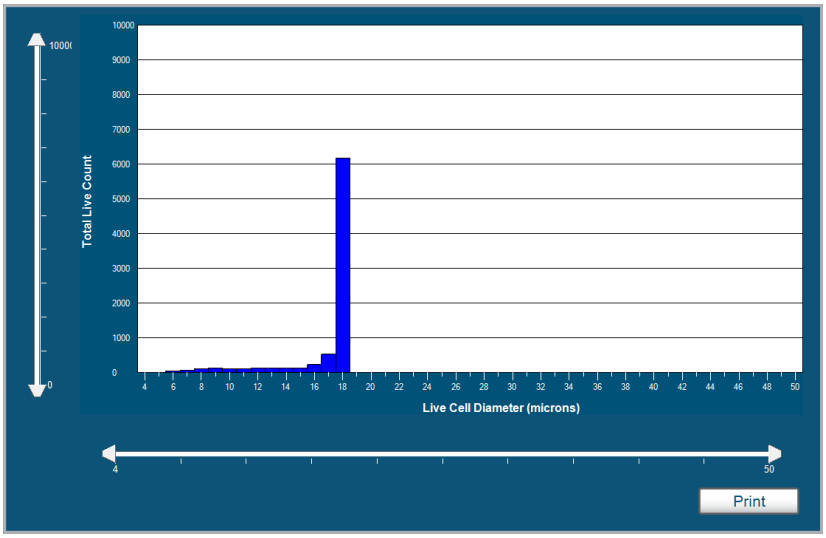

Figure 3.15 Histogram Pop-up

7. **Growth Calculations** – In addition to the Histogram, the analyzer can also display growth calculations for a range of samples configured with the same Batch ID. By selecting the **Historical Results** button from the Destinations menu, the Growth Calculations button becomes available. The user can then choose the Batch ID name from the dropdown, and the applicable samples are listed.

Figure 3.16 Growth Calculations

Growth Calculations can be exported by the user by selecting the **Export** button, then the destination. Growth calculations are exported as .CSV files, which can be plotted using any standard graphing technique.

4 Maintenance

The following sections provide detailed information and directions to operate and to maintain the BioProfile *FAST* CDV Analyzer. From the Destinations Menu, select **Maintenance**. Some of the maintenance actions can only be performed by operators with appropriate privilege levels through the Advanced Maintenance menu, which can be accessed by selecting **Advanced Maintenance** from the bottom of the Maintenance screen.

WARNING: ***Cell culture samples are potential sources of infectious agents. Handle all sample and Flow Path components with care. Gloves and protective clothing are recommended.***

It is important to perform preventive maintenance as scheduled.

Note: ***All maintenance functions are performed from within the Maintenance Screen. The options in the Maintenance Screen are accessed by selecting the Maintenance button at the bottom of the Destinations Menu.***

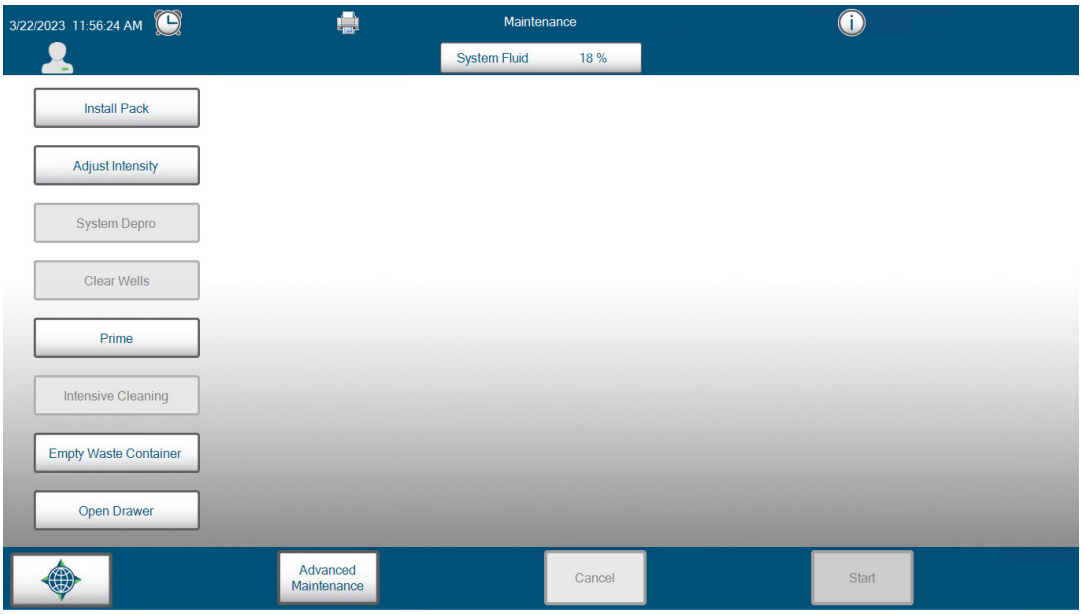

Figure 4.1 Maintenance Screen

4.1 Maintenance Menu

4.1.1 Install Reagent Pack

1. Select **Install Pack**.

WARNING: Trypan Blue is a known carcinogen. Handle with care.

2. Follow the instructions displayed on the screen:
   a. Open the analyzer door and remove the old BioProfile *FAST* CDV Reagent Cartridge.
   b. Install the new BioProfile *FAST* CDV Reagent Cartridge. When inserting a new cartridge into the pack bay, tilt the cartridge so the needle fitments on the back of the cartridge are facing downward (Figure 4.3). Push the cartridge in firmly to ensure that the needle shrouds at the rear of the pack bay engage the fitments on the back of the Reagent Cartridge. The cartridge should sit firmly inside the pack bay (Figure 4.4).
   c. Close the analyzer door.
   d. Press **Start**. This will open the drawer.
   e. Remove the old BioProfile *FAST* CDV Bottle Pack.
   f. Insert the new Bottle Pack so it is sitting firmly in the Bottle Pack compartment (Figure 4.5).

CAUTION: Bottle caps must be removed for the Bottle Pack to fit properly in the Bottle Pack bay.

   g. Press the **Close Drawer** button.
   h. Press **Continue**.

Figure 4.3
Installing a new BioProfile FAST CDV Reagent Cartridge

Figure 4.4
Installed BioProfile FAST CDV Reagent Cartridge

Figure 4.5
Installed BioProfile FAST CDV Bottle Pack

Note: ***The BioProfile FAST CDV Bottle Pack bottles contain Trypan Blue. These bottles can easily be removed from the pack by bending out the two tabs while holding the bottle in place. In addition, all BioProfile FAST CDV waste empties into the System Fluid pack. Therefore, the System Fluid pack will also contain Trypan Blue when removed from the system. The pack can be easily disassembled, and the waste pouch can be removed for disposal.***

Note: ***The analyzer automatically adjusts the background color intensity when a new BioProfile FAST CDV Reagent Pack is installed. Additionally, the system will automatically adjust the background intensity each time an individual bottle of Trypan Blue becomes empty and the probe moves to a new bottle of Trypan Blue.***

4.1.2 Adjust Intensity

The BioProfile *FAST* CDV uses the Trypan Blue solution in the reagent Bottle Pack to set the background value of the CDV cuvettes. As the Trypan Blue reagent is consumed, the dye becomes more concentrated and the dye itself may actually become darker in color. To adjust for this change in the color of the dye, the light source for the cuvette can be increased or decreased (Adjust Intensity). The Adjust Intensity procedure should be run weekly at a minimum to correct for reagent evaporation/consumption.

1. Select **Adjust Intensity**.
2. Select **Start** at the lower right corner of the screen.
3. The Adjust Intensity procedure takes approximately 200 seconds to complete. During this time, the Measured Intensity and Exposure Time will be determined for the CDV imaging system.

4.1.3 System DePro

The System DePro maintenance function uses the Deproteinizing solution from the BioProfile *FAST* CDV Reagent Pack and delivers it to the Waste Well and CDV wells. Once delivered to the wells, the DePro solution is allowed to soak in the well and fluidic lines for an extended period of time. The purpose of this procedure is to remove any protein build-up and/or blockages that may accumulate as samples are run. The BioProfile *FAST* CDV system should be deproteinized weekly at a minimum.

1. Select **System DePro**.
2. Select **Start** to DePro the Flowpath and Wells.

4.1.4 Clear Wells

The Clear Wells function is used to check the proper operation of the Waste Well, Valves, and Flow Paths after a maintenance action is performed, such as the removal of an obstruction.

1. Select **Clear Wells**.
2. Select **Start** to clear a blocked Well.
3. If the problem persists, call Nova Technical Support for assistance.

Note: ***System fluid is aspirated out of the System Fluids pack by the syringe pump. The fluid is then delivered to the Waste Well and CDV wells and is pumped through each flow path.***

4.1.5 Prime

The Prime function uses System Fluid to prime the CDV Flow Path and cuvettes.

To perform a Prime sequence:

1. Select the **Prime** button.
2. Select **Start** to prime the CDV Flow Path and cuvettes.

4.1.6 Intensive Cleaning

An intensive cleaning sequence using Nova Depro Solution and/or Advanced Cleaning Solution can help mitigate extreme circumstances where cuvettes become dirty with cellular debris.

Note: ***Before cleaning, all sample cups must be removed from the tray. Any that are not removed will be deposited into the sample cup waste bin.***

1. Select **Intensive Cleaning**.
2. Select **Start** at the bottom right of the screen. The carousel will move so that position 1 is facing the user. Place a sample cup into position 1 and fill with 1 mL of Depro Solution then select continue. The solution will soak for 30 minutes in the cuvette and fluidic lines.

4.1.7 Empty Waste Container

The Waste Container should be emptied when the it is reaching or has reached capacity (500 cups).

To empty the Waste Container:

1. Select the **Empty Waste Container** button.
2. Select **Start**.
3. Take out the Waste Container from behind the analyzer door and empty it.
4. Clean out any residual cell culture material inside the Waste Container with warm water and soap, then dry the Waste Container.
5. Put the Waste Container back in position and close the door.
6. Select **Continue**.

Note: ***Two Waste Containers ship with the system so one can be cleaned while the other is in use.***

4.1.8 Open Drawer

The Open Drawer function is used when inserting a 96-Well Plate for analysis or changing out the CDV Bottle Pack.

1. Select the **Open Drawer** button.
2. Select **Start**. The drawer will open.
3. Insert the 96-Well Plate or new CDV Bottle Pack.

CAUTION: ***Ensure the caps are removed from the new CDV Bottle Pack to prevent system damage.***

4. Select **Close Drawer**.

Note: ***The 96-Well Plate can only be inserted in one orientation. A small bar at the back rear of the drawer ensures this.***

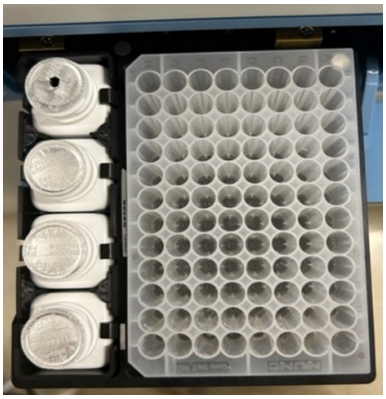

Figure 4.6 Correct Orientation of the 96-Well Plate

4.2 Advanced Maintenance Menu

To access the Advanced Maintenance menu, select the **Advanced Maintenance** button in the command bar on the *Maintenance* menu.

Figure 4.6 Advanced Maintenance Button

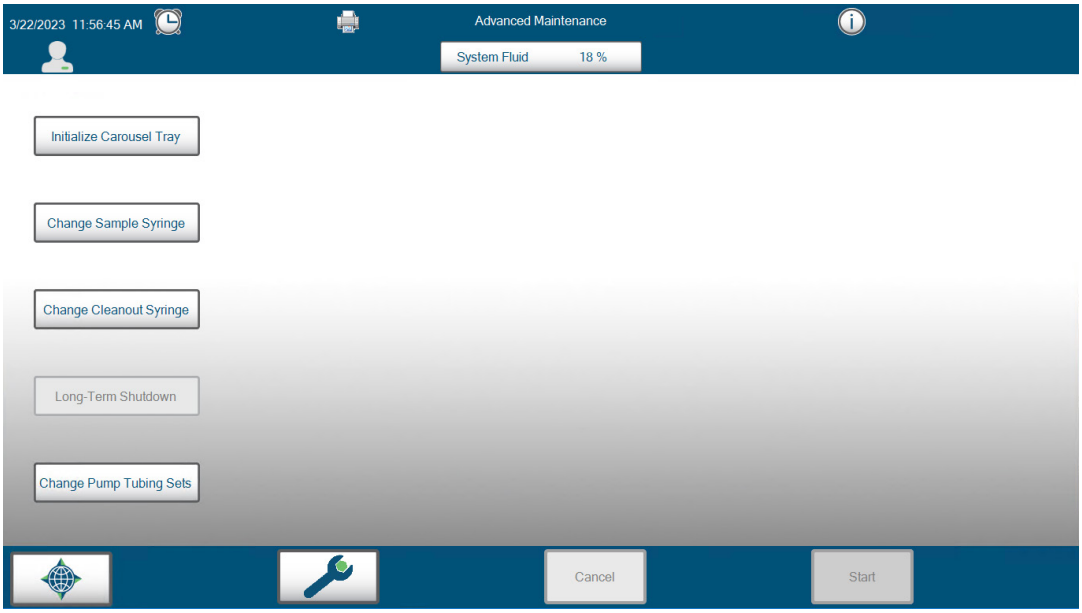

Figure 4.7 Advanced Maintenance Screen

4.2.1 Initialize Carousel Tray

Initialize Carousel Tray checks the tray and moves it so that positions #1 and #2 are in the 6 o'clock position. This must be done when the instrument is first turned on.

Note: ***Remove any unused cups from the carousel tray prior to initializing, as any cups in the tray will be discarded during this action.***

4.2.2 Change Sample Syringe

Change Sample Syringe allows you to change out the Sample Syringe, if necessary. It is located on the right side of the analyzer.

To replace the Sample Syringe:

1. Remove the access panel from the right side of the analyzer by removing the two captive screws with a flathead screwdriver.
2. From the *Advanced Maintenance* menu, select **Change Sample Syringe**.
3. Select **Start**.

4. Enter the Part Number of the new Sample Syringe for tracking purposes *(optional)* and select the **green check mark** to begin the sequence. The analyzer will remove any remaining fluid from the syringe and position the plunger at the bottom of its axis.
5. When the syringe plunger is all the way down and the Continue button appears, remove the syringe by loosening the thumb screw at the bottom, then unthread the syringe from the valve assembly to remove it.
6. Install the new syringe, making sure to secure the threaded connections.
7. When the new syringe is installed, select **Continue** to prime the syringe pump.

4.2.3 Change Cleanout Syringe

Change Cleanout Syringe allows you to change out the Cleanout Syringe, if necessary. It is located on the left side of the analyzer.

To replace the Cleanout Syringe:

1. Remove the cover from the left side of the analyzer by removing the six captive screws with a flathead screwdriver.
2. From the *Advanced Maintenance* menu, select **Change Cleanout Syringe**.
3. Select **Start**.
4. Enter the Part Number of the new Cleanout Syringe for tracking purposes *(optional)* and select the green check mark to begin the sequence. The analyzer will remove any remaining fluid from the syringe and position the plunger at the bottom of its axis.
5. When the syringe plunger is all the way down and the Continue button appears, remove the syringe by loosening the thumb screw at the bottom, then unthread the syringe from the valve assembly to remove it.
6. Install the new syringe, making sure to secure the threaded connections.
7. When the new syringe is installed, select **Continue** to prime the syringe pump.

4.2.4 Long-Term Shutdown

The Long-Term Shutdown function should be used if the BioProfile *FAST* CDV must be shut down for more than 72 hours. This procedure ensures that no reagents or fluids will remain in the fluid lines while the BioProfile *FAST* CDV is powered down. By removing all reagents and fluids, salt build-up and blockages are less likely to form and cause damage to the analyzer.

To properly shut down the analyzer, proceed as follows:

1. Remove the BioProfile *FAST* CDV Reagent Pack from the *FAST* CDV Reagent Pack bay and insert the BioProfile *FAST* CDV Shutdown Cartridge into the bay.

2. Remove the BioProfile *FAST* CDV Bottle Pack.
   a. From the *Destinations* menu, select **Maintenance**.
   b. Select **Open Drawer**, then press **Start**.
   c. Remove the Bottle Pack after the drawer opens and dispose of it. Select **Close Drawer**.

WARNING: ***The BioProfile FAST CDV Bottle Pack contains Trypan Blue dye. Trypan Blue is a known carcinogen. Take appropriate precautions when handling and disposing of the Bottle Pack; gloves and protective clothing are recommended.***

3. Close the analyzer door. From the *Destinations* menu, select **Maintenance**, then select **Advanced Maintenance** at the bottom of the *Maintenance* menu.
4. Select **Long-Term Shutdown**, then press **Start**.
5. The Long-Term Shutdown process will begin. Upon completion of the sequence (indicated by a flashing screen) use the toggle switch on the rear of the analyzer to power off the BioProfile *FAST* CDV.
6. Once the power has been switched off, release the Pump Tubing clamps.

4.2.4.1 Restarting BioProfile FAST CDV After Long Term Shut Down

1. Replace the BioProfile *FAST* CDV Reagent Pack (System Fluids and Bottle Pack).
2. Reinstall the Pump Tubing sets and engage the pressure plates.
3. Turn on the analyzer and the computer.
4. Wait for the analyzer to initialize and load.
5. From the *Maintenance* menu, select **Initialize Tray**.

A Waste Well Blockage error will most likely occur upon start up.

Note: ***Air detectors throughout the analyzer are expecting to detect fluid at certain times. Because the system was stored dry, there is currently no fluid in the lines for the air detectors to detect.***

6. Run the **Clear Wells** function in the *Maintenance* menu about 3 to 4 times until an Air Detector calibration can be completed without producing any errors. This primes some lines with fluid, allowing the air detectors to work once again.
7. Calibrate the BioProfile *FAST* CDV as needed.
8. Test Quality Control Levels 8 and 9 before sample testing.

4.2.5 Change Pump Tubing Sets

Change Pump Tubing Sets allows you to change out the three sets of Pump Tubing behind the door.

Note: All three sets of Pump Tubing should be changed at the same time.

To replace the Pump Tubing:

1. Open the analyzer door.
2. From the *Advanced Maintenance* menu, select **Change Pump Tubing Sets**.
3. Select **Start**.
4. Enter the Lot Number of the new Pump Tubing for tracking purposes *(optional)* and select the **green check mark** to begin the Change Pump Tubing sequence. The analyzer will purge fluid from the flow path. When "Start" changes to "Continue," it is safe to open the analyzer door.
5. The Pump Tubing Sets will initialize. Press the **white button** on each Pump Tubing Set to open the clamp for removal.
6. Unlock the black and white quick connect fittings on the Pump Tubing for each individual set and disconnect the tubing.
7. Put the new set of tubing around the Peristaltic Pump.
8. Install the new set of Pump Tubing by connecting the black and white quick connect fittings and closing the clamp.
9. Select the **Continue** button. The new sets of Pump Tubing will initialize.

5 Troubleshooting

This section describes the error codes and explains the troubleshooting procedures for the BioProfile *FAST* CDV Analyzer.

WARNING: ***Cell culture samples are potential sources of infectious agents. Handle all sample and Flow Path components with care. Gloves and protective clothing are recommended.***

5.1 Troubleshooting Procedures

The recommended troubleshooting procedures use the most logical and direct steps to resolve the error code. The solutions are set up in a block format that lists groups of steps to perform in order to restore analyzer operation. The steps are also organized to prevent unnecessary parts replacement, such as sample probe and tubing, until the more common causes for an error have been checked.

If the recommendations given here do not resolve the problem, contact Nova Technical Support for troubleshooting assistance. When calling Technical Support, it is helpful to have written down the analyzer Serial Number, the error messages, and flow times.

FOR TECHNICAL ASSISTANCE, CALL TOLL FREE:

USA	1-800-545-NOVA (6682)
Canada	1-800-263-5999
Other Countries	Contact your local Nova Biomedical Sales Office or Authorized Nova Biomedical Distributor

5.2 Error Solutions

The following is a list with page references for the Error Solutions.

CDV No Trypan Blue

During the last analysis or maintenance sequence, the Trypan Blue was not aspirated properly.

Recommended Solutions:

1. Verify the percent remaining in the CDV Reagent Cartridge Set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.
2. Call Nova Biomedical Technical Support.

Camera Initialization Failed

During the last calibration or analysis, the camera system failed to initialize.

Recommended Solutions:

1. Perform a calibration of the *FAST* CDV.
2. Perform a power cycle of the instrument and recalibrate.
3. Call Nova Biomedical Technical Support.

Camera Interface Failure

During the last calibration or analysis, the camera system interface experienced an issue.

Recommended Solutions:

1. Perform a calibration of the *FAST* CDV.
2. Perform a power cycle of the instrument and recalibrate.
3. Call Nova Biomedical Technical Support.

Cannot Find Start Point

During the last analysis, calibration, or maintenance sequence, the probe failed to find its starting point.

Recommended Solutions:

1. Call Nova Biomedical Technical Support.

Cannot Find Teach Point

During the last sample probe calibration, the probe failed to find its teach point.

Recommended Solutions:

1. Call Nova Biomedical Technical Support.

Door Position Is Too Low To Find Bottom Of The Carousel Tray

The door is not positioned properly in relation to the bottom of the carousel tray.

Recommended Solutions:

1. Open the analyzer door and check for any obstructions that are affecting the postioning of the door. Remove them and close the door.
2. Call Nova Biomedical Technical Support.

Drawer Failed To Close

During the last Open Drawer sequence, the drawer failed to open/close properly.

Recommended Solutions:

1. Run an Open Drawer sequence from the Maintenance menu. Verify that the CDV Bottle Pack is properly installed. Verify that the 96-Well Plate is properly installed in the correct configuration. Select Close Drawer after opening.
2. Call Nova Biomedical Technical Support.

Flowpath A Flow Fast Error

During the last analysis, calibration, or maintenance sequence, the cell density flow time exceeded the specified limits. Please note: no action is required if this message occurs infrequently.

Recommended Solutions:

1. Verify the percent remaining in the *FAST* CDV Reagent Cartridge set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.
2. Run a Prime sequence from the Maintenance menu.
3. Replace the *FAST* CDV Pump Tubing Harness set.
4. Call Nova Biomedical Technical Support.

Flowpath B Flow Fast Error

During the last analysis, calibration, or maintenance sequence, the cell density flow time exceeded the specified limits. Please note: no action is required if this message occurs infrequently.

Recommended Solutions:

1. Verify the percent remaining in the *FAST* CDV Reagent Cartridge set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.
2. Run a Prime sequence from the Maintenance menu.
3. Replace the *FAST* CDV Pump Tubing Harness set.
4. Call Nova Biomedical Technical Support.

Flowpath A Flow Slow Error

During the last analysis, calibration, or maintenance sequence, the cell density flow time exceeded the specified limits. Please note: no action is required if this message occurs infrequently.

Recommended Solutions:

1. Verify the percent remaining in the *FAST* CDV Reagent Cartridge set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.

2. Remove the access panel on the left side of the analyzer and verify Sample Transfer Well (A) is empty.
   a. If the well is not empty, run the Clear Wells sequence from the Maintenance menu.
   b. If the well is empty, run a Prime sequence from the Maintenance menu.
3. Run a System Depro sequence from the Maintenance menu.
4. Run an Intensive Clean Cell Density Flowcell sequence from the Maintenance menu.
5. Replace the *FAST* CDV Pump Tubing Harness set.
6. Call Nova Biomedical Technical Support.

Flowpath B Flow Slow Error

During the last analysis, calibration, or maintenance sequence, the cell density flow time exceeded the specified limits. Please note: no action is required if this message occurs infrequently.

Recommended Solutions:

1. Verify the percent remaining in the *FAST* CDV Reagent Cartridge set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.
2. Remove the access panel on the left side of the analyzer and verify Sample Transfer Well (B) is empty.
   a. If the well is not empty, run the Clear Wells sequence from the Maintenance menu.
   b. If the well is empty, run a Prime sequence from the Maintenance menu.
3. Run a System Depro sequence from the Maintenance menu.
4. Run an Intensive Clean Cell Density Flowcell sequence from the Maintenance menu.
5. Replace the *FAST* CDV Pump Tubing Harness set.
6. Call Nova Biomedical Technical Support.

Flowpath A Sample Flow Error

During the last analysis, calibration, or maintenance sequence, the cell density sample flow experienced an issue. Please note: no action is required if this message occurs infrequently.

Recommended Solutions:

1. Verify the percent remaining in the *FAST* CDV Reagent Cartridge set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.

2. Run a Prime sequence from the Maintenance menu.
3. Run a Clear Wells sequence from the Maintenance menu.
4. Replace the *FAST* CDV Pump Tubing Harness set.
5. Call Nova Biomedical Technical Support.

Flowpath B Sample Flow Error

During the last analysis, calibration, or maintenance sequence, the cell density sample flow experienced an issue. Please note: no action is required if this message occurs infrequently.

Recommended Solutions:

1. Verify the percent remaining in the *FAST* CDV Reagent Cartridge set. If there is less than 10% remaining or a cartridge is within 1 day of expiration, replace the set.
2. Run a Prime sequence from the Maintenance menu.
3. Run a Clear Wells sequence from the Maintenance menu.
4. Replace the *FAST* CDV Pump Tubing Harness set.
5. Call Nova Biomedical Technical Support.

Frame Grabber Initialization Failed

During the last calibration or analysis, the camera system frame grabber failed to initialize.

Recommended Solutions:

1. Perform a calibration of the FAST CDV.
2. Perform a power cycle of the instrument and recalibrate.
3. Call Nova Biomedical Technical Support.

Waste Well Flow Time

During the last analysis, calibration, or maintenance sequence, the well flow time exceeded the specified limits.

Recommended Solutions:

1. Remove the access panel on the left side of the analyzer and verify that the waste well is empty.
   a. If the well is not empty, run the Clear Wells sequence from the Maintenance menu.
   b. If the well is empty, run a Prime sequence from the Maintenance menu.
2. Run a System Depro sequence from the Maintenance menu.
3. Call Nova Biomedical Technical Support.

5.3 Service Errors

The following is a list of Service Errors. If you experience any of the following errors, please contact Nova Biomedical Technical Support.

Cell Density Interlock Failure
Cell Density Fluid Sense
Cell Density X Motor
Cell Density Z Motor
Door Latch Failure
Host Communications Failure
IPD Communications Failure
Syringe Pump Action Failure
Syringe Pump Communications Failure
System Probe X Motor
System Probe Y Motor
System Probe Z Motor
System Probe

A Instrument Specifications

This section includes instrument specifications for the Nova BioProfile *FAST* CDV.

A.1 Instrument Specifications

Measurement Range: Cell Density(CD) 50,000 - 140,000,000 cells/mL

Note: ***The upper limit for CDV can be extended using one of the dilution options available for this parameter.***

Extended CDV Measurable Range Using a Dilution:

1:1	***350.0 x 10^5***
1:2	***700.0 x 10^5***
1:4	***1400.0 x 10^5***

Analysis Rate:	Time to complete first sample:	Less than 130 seconds
	Time to complete subsequent results (in queue samples):	Less than 85 seconds
Sample Volume:	100 µL (Load-and-Go Carousel) 125 µL (96-Well Plate)	
Reagents:	One BioProfile *FAST* CDV Reagent Pack Includes: System Fluid Pack Reagent Bottle Pack	
Dimensions:	Height: 22.25 in (56.5 cm) Width: 17.5 in (44.5 cm) Depth: 22 in (55.9 cm)	
Weight:	Less than 45 lb (20.4 kg) without reagent packs Less than 52 lb (23.6 kg) with reagent packs	
Power:	100-120, 220-240 VAC, 50/60 Hz, 700W	
Bridge Computer:	512 GB Solid-State Drive (SSD) 4 GB of Memory Microsoft Windows® 10 IoT Enterprise 2021 LTSC (ESD)	

Cleaning:

Nova Biomedical understands that cleaning and disinfection of the laboratories where BioProfile analyzers are installed is an essential industry requirement. Cleaning of walls, floors, ceilings, and lab benches in the proximity of the analyzers could introduce short-term and long-term problems with the analyzer electronics. This can especially occur when chemicals labeled at corrosive to metals are aerosolized.

Cleaning chemicals and solutions not listed in the IFU should never be sprayed directly onto or into any BioProfile system or accessory device. Extreme caution should be used when using these chemicals within the lab as well. The instrument should be removed from the laboratory prior to disinfection if chemical cleaners are to be used. Nova Biomedical is not responsible for damage incurred to the analyzers caused by chemical attack of certain disinfectants and cleaners.

Nova Biomedical Corporation recommends using 70% Reagent Alcohol (V/V) or Isopropyl Alcohol (IPA) for cleaning the various analyzer surfaces or components when required. Use a lint-free cloth or Kimwipe® lightly dampened with the cleaning reagent to wipe down analyzer surfaces. Never spray or pour reagent directly onto or into the analyzer. Once wiped down, all residual fluid should be dried with a lint-free cloth or Kimwipe®.

Certifications and Standards:

Agency Testing Standards	
Radiated Emissions:	EN 55011 FCC Part 15 ICES-003 AS/CISPR 11
Conducted Emissions:	EN 55011 FCC Part 15 ICES-003 AS/CISPR 11
ESD Immunity:	EN 61000-4-2
Radiated Immunity:	EN 61000-4-3
EFT Immunity:	EN 61000-4-4
Surge Immunity:	EN 61000-4-5
Conducted Immunity:	EN 61000-4-6
Magnetic Immunity:	EN 61000-4-8
Voltage Dips and Drops:	EN 61000-4-11
Voltage Harmonics:	EN 61000-3-2
Voltage Flicker:	EN 61000-3-3

Safety Certifications and Electrical Compliance

EN 61000-1:2010/A1:2019
EN IEC 61010-2-081:2020
CSA C22.2 No. 61010-1:2012/A1:2018-11
CSA C22.2 No. 61010-2-081:2019
UL 61010-1:2012/R:2019-07
UL 61010-2-081:2019
IEC 61010-1:2010
IEC 61010-1:2010/AMD 1:2016
IEC 61010-2-081:2019

Quality Systems Certification

EN ISO 13485:2016

General Systems Standards

21 CFR Part 11 Compliant
OPC Compliant
PAT Compatible

A.2 Spare Parts and Supplies List

You can order the following parts and supplies from Nova Biomedical and its distributors.

Description	Part Number
BioProfile *FAST* CDV Reagent Pack	64739
BioProfile *FAST* CDV Shutdown Pack (Single Use)	65419
Cell Density Module Calibration Solution (30 ampules/box)…	43034
Deproteinizing Solution (30 ampules/box)…	12704
BioProfile Control Level 8 (30 ampules/box)…	43472
BioProfile Control Level 9 (30 ampules/box)	43473
FAST CDV Pump Tubing Harness	65791
FAST CDV Sample Cups 100µL (500/bag)	65269
FAST CDV Sample Cup Tray (20 Cup Positions)	65057
FAST CDV Sample Cup Replacement Waste Bin	65938
Replacement S-Line Probe Assembly	55288
Replacement Syringe (Barrel and Plunger)	42400
FAST CDV Backflush Kit	65870
CDV Advanced Cleaning Solution	63940
Instructions for Use Manual, BioProfile *FAST* CDV	65655

A.3 Warranty

Subject to the exclusions and upon the conditions specified below, Nova Biomedical or the authorized Nova Biomedical distributor warrants that they will correct free of all charges including labor, either by repair, or at its election, by replacement, any part of an instrument which fails within one (1) year after delivery to the customer because of defective material or workmanship. This warranty does not include normal wear from use and excludes: (A) Service or parts required for repair to damage caused by conditions, electric current fluctuations, work performed by any party other than an authorized Nova representative or any force of nature; (B) Work which, in the sole and exclusive opinion of Nova, is impractical to perform because of location, alterations in the Nova equipment or connection of the Nova equipment to any other device; (C) Specification changes; (D) Service required to parts in the system contacted or otherwise affected by expendables or reagents not manufactured by Nova which caused shortened life, erratic behavior, damage or poor analytical performance; (E) Service required because of problems, which, in the sole and exclusive opinion of Nova, have been caused by any unauthorized third party; or (F) instrument refurbishing for cosmetic purposes. All parts replaced under the original instrument warranty will be warranted only until the end of the original instrument warranty. All requests for warranty replacement must be received by Nova or their authorized distributor within thirty (30) days after the component failure. Nova Biomedical reserves the right to change, alter, modify or improve any of its instruments without any obligation to make corresponding changes to any instrument previously sold or shipped. All service will be rendered during Nova's principal hours of operation. All requests for service outside of Nova's principal hours of operation will be rendered by the prevailing weekend/holiday rates after receipt of an authorized purchase order. Contact Nova for specific information.

The following exceptions apply:

1. Consumable items, including calibrator packs, tubing, and external standards are warranted to be free of defects at time of installation. The item must be placed into service prior to the expiration date printed on the packaging. All defects must be promptly reported to Nova Biomedical in writing. This warranty is invalid under the conditions specified after item 2.
2. Freight is paid by the customer.

The warranties are invalid if:

1. The date printed on the package label has been exceeded.
2. Non-Nova Biomedical reagents or controls are used, as follows: Nova Biomedical will not be responsible for any warranties on consumables or other parts if these parts are used in conjunction with and are adversely affected by reagents, controls, or other material not manufactured by Nova but which contact or affect such parts. Reagent formulations not manufactured by Nova Biomedical may contain acids, concentrated salt solutions, and artificial preservatives that have been shown to cause problems such as shortened electrode life, electrode membrane damage, electrode drift, erratic analytical results, and inaccurate instrument performance.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT BY LAW AND STATE OUR ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM OF DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATION. NOVA BIOMEDICAL WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH THE LIABILITY IS CLAIMED.
IN ORDER FOR THE WARRANTY TO BE EFFECTIVE, THE WARRANTY CARD MUST BE SENT TO NOVA BIOMEDICAL, 200 PROSPECT STREET, WALTHAM, MASSACHUSETTS, 02454, USA.

B Theory

This section explains the instrument theory of the BioProfile *FAST* CDV Analyzer.

B.1 Cell Density

The BioProfile *FAST* CDV measures cell density and cell viability using the Trypan Blue Dye Exclusion method. Live cells with intact cell membranes are selective in the compounds that can pass through the membrane. In a viable cell, Trypan Blue is not absorbed, and the cells appear unstained. However, Trypan Blue traverses the membrane in a dead cell, and the cells stain a distinctive blue color.

The BioProfile *FAST* CDV Analyzer automates the Trypan Blue Dye Exclusion method and acquires digital images at optical magnification. The cells are counted, measured, and categorized as Live or Dead, using sophisticated image processing software.