DataFlow

Control System (Standard)

User Reference Manual

Doc. Rev 3.2

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CHAPTER 1— INSTALLATION PROCEDURES

1.1 Chapter Content

This chapter describes the procedures on how to install the DataFlow System.

1.2 Checklist

After unpacking the DataFlow package, check to ensure that the following materials are included:

1. DataFlow Software Diskette
2. DataFlow (NT) User Reference Manual
3. Digiboard Intelligent Serial Communications Board
4. Interface Box and Interface Box Cable
5. Digiboard Driver Diskette
6. Digiboard User's Manual
7. Software Security Key

1.3 Minimum Requirements for DataFlow System

Before proceeding to install DataFlow, the following system requirements must be met:

1. IBM-PC or compatible with the following configurations:
   - Pentium processor with at least 90Mhz CPU
   - VGA color monitor (high resolution—640 x 480)
   - Microsoft-compatible mouse
   - 64MB of RAM minimum
   - At least 1GB hard-disk space
   - 3-1/2" floppy drive
   - Windows NT 4.0
   - A parallel port and a serial port

2. The Hardware revisions of the Vacuum Controller, Dose Controller, AMU Controller, and Beam Controller must at least meet Datalock II requirements. Please contact Eaton Corporation regarding the controller-software upgrade.

3. DataFlow is designed for the NV10-160 Implanters. The software will also work with the NV10-80 Implanters.

Note: *The free space of the hard disk has to be checked periodically, and backup the snapshot files, the trace files and the log files.*

1.4 Installing DataFlow

1.4.1 Configuring the Hardware

1. Open the back of the IBM-PC (or compatible) computer and insert the Digiboard Intelligent Serial Communications card in one of the free-slots available. The Digiboard must be properly configured before it is inserted in the computer (see the section on Digiboard Configuration).

2. Plug the *Software Security Key* directly into the parallel port of the computer. DataFlow cannot be used unless the *Software Security Key* is installed.

1.4.2 Installing the Software

1. Start Windows NT 4.0.

2. Insert the DataFlow System Setup Diskette in the floppy drive.

3. Click **Start** on the taskbar, then select **Run**. In the open box, type **x:\install** and click the **OK** button.

> *Note:* The "x" drive is the drive containing or running the DataFlow setup diskette.

The installation process will begin. You will be asked to choose the **Installation Directory** and to create a group window. In a few seconds, you will be informed that the software installation is complete.

4. Open the **Control Panel**, and double click the **System** icon. Select **Environment** tab. Type ***GWASDRDIR*** in the field labeled "**Variable**". **Type full path name of DataFlow** installed directory(e.g. ***c:\dataflow***) in the field labeled "**Value**". **Click the Set** button, click the **Apply** button, then press **OK** to exit from system setup. (Note: System reboot is required for the settings to be effective. "Apply" or "OK" dose not make the new setting effective until system reboot.)

5. Click **Start** on the taskbar then select **Run**. In the **Open** box, enter **Z:\installation directory\scrtstup**, then click the **OK** button. (Note: The "Z" drive is the DataFlow installed drive.)

6. Insert the **Digiboard Driver diskette** (label it as Microsoft Windows NT 3.51 and 4x … Intel and Alpha Async Driver) to the floppy drive.

7. Open the **Control Panel** then double click the **Network** icon.

8. Select **Adapters**, click the **Add** button, then the **Have Disk** button. In the input box, type "a:\i386," then click **OK**.

9. Select **Digi PC/8e Adapter** from the list box on the Select OEM Option dialog window, then click the **OK** button.

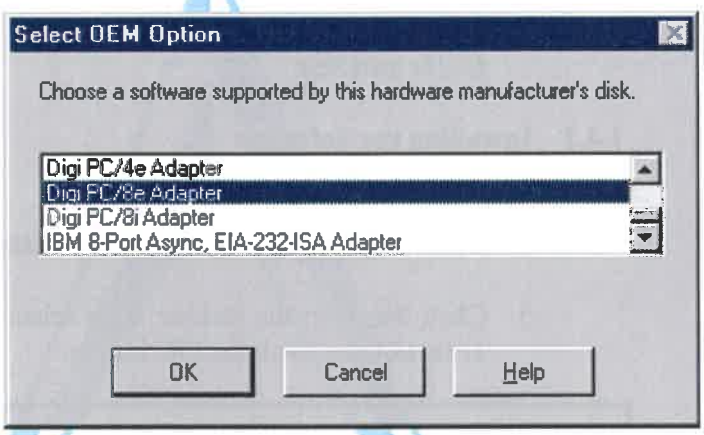


Fig. 1.1 Select OEM Option

10. Set **Port 1** to Com 5, leaving the **Automatically Enumerate** selection checked, then click the OK button in the Ports Configuration Window (see Figure 1.2 on the next page). Make sure that the memory address and the I/O addresses are not in conflict with other components in your computer.

11. Restart the computer.

This completes the software installation.

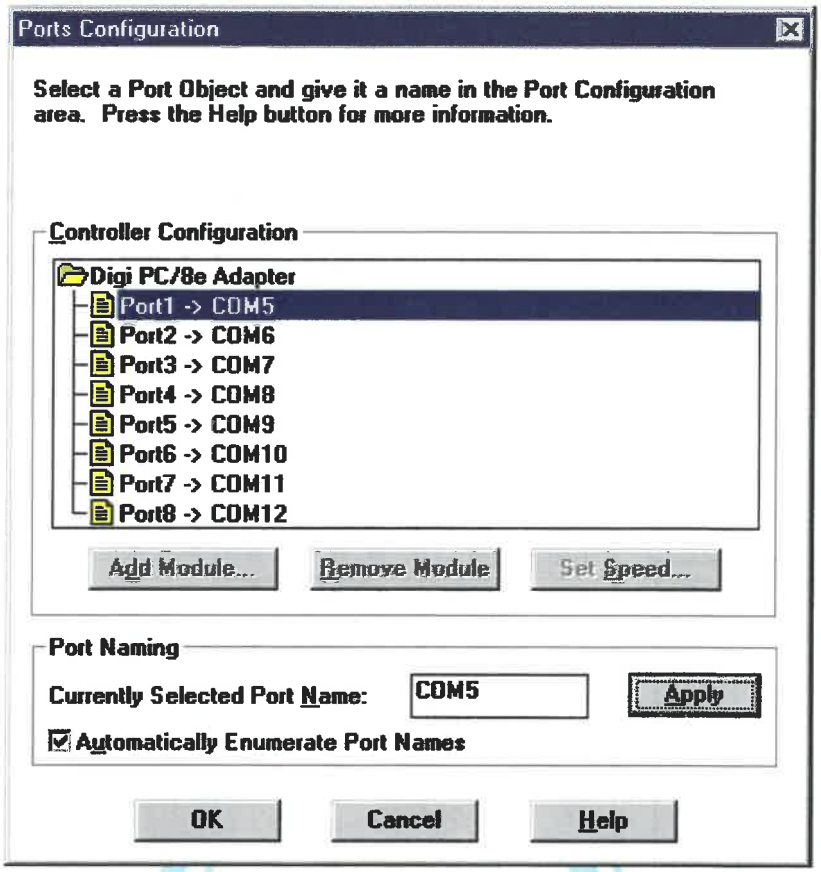


Fig. 1.2 Ports Set Up

Select **DataFlow Standard** from the taskbar to start DataFlow Control System.

1.5 Connecting DataFlow to the Implanter

The DataFlow software communicates with the Implanter via the Interface Box and the Digiboard. The Digiboard interconnect cable is a 8-port cable.

Follow these steps to connect DataFlow to the Implanter:

1. Individually connect the Digiboard cable ports P1, P2, P3, P4 and P5 to the Dose, Vacuum, AMU, Beam/Source and Endstn controller ports on the Interface Box.
2. Connect the other end of the Digiboard cable to the Digiboard port on the computer.

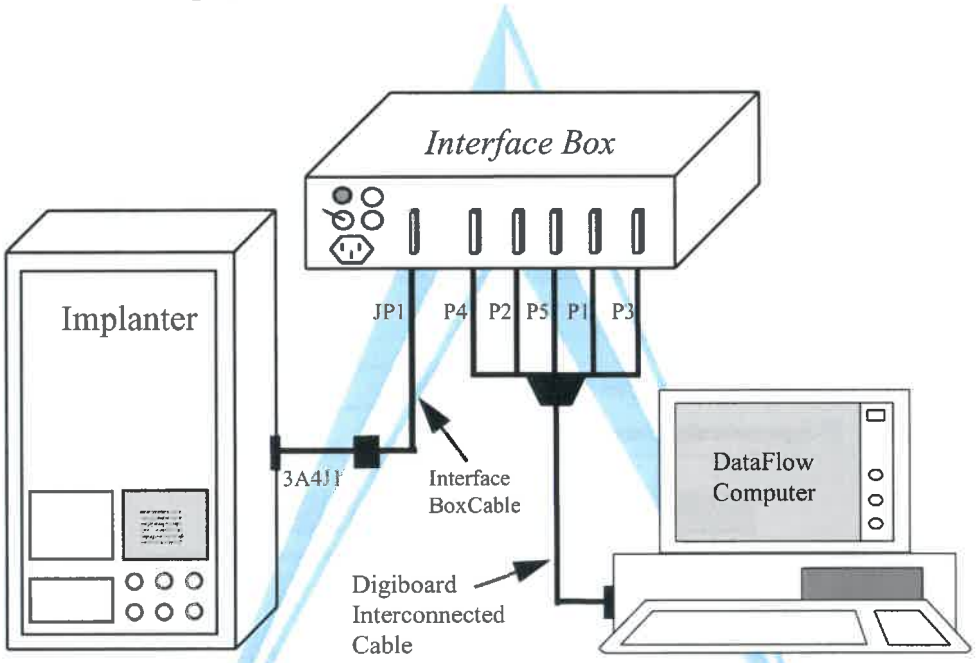


Fig. 1.3 DataFlow System

- Connect one end of the Interface Box Cable to the port marked "JP1" on the Interface Box.
- Connect the other end of the Interface Box Cable to the 3A4J1 connector at the back of the Implanter Controller rack. (You will need to first disconnect the 3A4J1 connector from the Implanter.)

Once all these connections are made, the DataFlow system is ready for use.

CHAPTER 2—OPERATOR FUNCTIONS

2.1 Chapter Content

This chapter describes the basic operational functions of DataFlow for operators handling the Implanter.

2.2 Getting Started

You can start DataFlow from either one of two places in Windows NT. From the Taskbar, choose **Run**, and complete the **Run** dialog box by entering the pathname of DataFlow's executable file (**c:\dataflow\windf.exe** or **:\dataflow\winstd.exe**). From the Taskbar, choose **Program**, **DataFlow System**, and then **DataFlow Base** or **DataFlow Standard**.

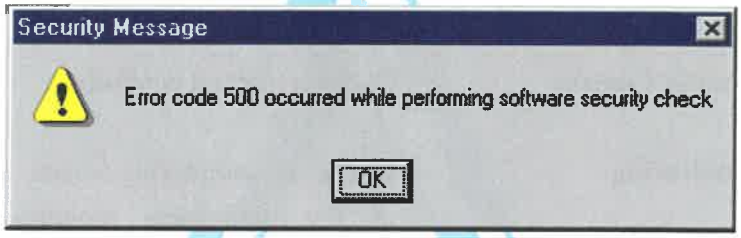


Fig. 2.0 Error message dialog

If the error message (see above) is displayed after DataFlow is started, properly install the software security key in place and press **OK** to continue. The system will attempt this security check and prompt for up to three times. If the security check fails three times, DataFlow will close and return to Windows. Check that all the connections are properly made, and then restart DataFlow.

Once the software is properly loaded, DataFlow is ready for use. DataFlow will prevent any Implant from starting before loading a Process Recipe.

2.3 Pull-down Menus

There are five pull-down menus: **Implant**, **Engineering**, **Recipe_Editor**, **View** and **Help**.

The **Implant** menu enables an operator to perform production functions such as entering the Lot and device information, selecting a process recipe and either displaying all monitored parameters or exiting from DataFlow.

Set Up	Opens the *Setup* screen where you can enter all the information for the process.
Select Recipe	Opens the *Select Recipe* screen, which allows you to select a process recipe.
Disable Control	Disables implant control(s).
Monitoring	Opens the monitoring screen, which displays all of the parameters monitored by the **Dose** controller, **AMU** controller, **Beam** controller, and **Vacuum** controller.
Exit	Closes the DataFlow software.

The **Engineering** menu enables you to perform engineering functions such as configuring the system, etc.

Configure	Opens the DataFlow configuration screen. DataFlow must be properly configured before it is used.
NV_10cfg	Opens the *Implant Configuration* screen. Implant type and controllers must be properly configured before they are used.
Change passwords	Opens the *Change Passwords* screen, which allows you to change the existing passwords.

SECS Config	Opens the *SECS II Configuration* screen described below. The password for the *SECS II Configuration* screen is the same as the password for the Configuration Screen (default password: configure).
Reset SECS Port	Allows you to manually reset and initialize the SECS-II port on the PC running DataFlow.
Reset Lot Queue	Allows you to reset the lot queue in Matrix Mode 4. You will need to press this button if you want to abort the current lot queue in process (applicable to Matrix Mode 4 only).

The **Recipe_Editor** menu enables you to create or modify process recipes. The menu launches the recipe editor, which you can use to create and edit new or existing recipes.

The **View** menu enables you to perform miscellaneous functions such as viewing the snapshot files, changing password(s), or printing out all current parameters.

History	Brings up the *Open snapshot file* dialog box where you can open and view previous implant data sets.
Trace	Brings up the *Open trace file* dialog box, which allows you to open and view error messages logged by DataFlow.
Print	Allows you to print information.
Print Setup	Sets up the printer.

Help menu displays the copyright message of DataFlow software, as well as its version number.

2.4 DataFlow Main Screen

The DataFlow Main Screen is divided into four different areas: the *Process Info.*, which is located at the upper-left corner; *Implant Values*, located at the upper-right corner; middle area, which contains status, alarm, and message fields; and the bottom area, which features click buttons. The *Process Info.* area displays all the setup information for batch of wafers that need to be processed. The upper-right corner area displays some key variable values of the Implanter. The middle area displays the system status and alarm messages. The bottom area has four buttons that can be selected by the operator to put the implant on hold and perform pre-implant check, etc. The fields in the DataFlow screen cannot be edited.

Fig. 2.1 The DataFlow main screen

The functions of the individual fields in the DataFlow screen are listed on the next page.

2.4.1 Process Info.

Operator — Displays the name of the operator. This is the same information entered by the operator in the *Set Up* screen.

Lot ID — Displays the unique lot name assigned to the batch of wafers. This is the same information entered by the operator in the *Set Up* screen.

Recipe — Displays the recipe selected by the operator from the *Select Recipe* screen. This is the recipe that will be used by DataFlow for control of the implant.

Batch ID — Displays the batch number. The batch number automatically increments itself at the end of each implant. The batch information is editable on *Set Up* screen. When DataFlow is first booted up, this batch defaults to *one* (1), but the operator can change it to any number. The batch number will be increased from this number on the subsequent implants. It is recommended that the batch number be reset to *one* (1) at the beginning of each lot.

Wafer Count — Displays the total number of wafers for the current lot. This is the information entered by the operator in the *Set Up* screen.

Device ID — This is a descriptive field. Different lots can either have similar or different device IDs.

Disk ID — This is the ID of disk/wheels being used.

Date/Time	Displays the current date and time. DataFlow uses the computer system' s date and time.

2.4.2 Implant Values

Dose	Displays the preset dose that has been entered by the operator on the dose processor. This field is used by DataFlow to perform the pre-implant check. The dose is displayed in ions/sq. cm.
ES Press, torr	Displays the end-station pressure in *torr* as read by the end-station ion gage.
Energy	Displays the output of the extraction power supply. This can be preset to the requested value only when the AMU controller is in the manual mode. DataFlow displays this in thousands of electron volts. (Kev)
AMU	Displays the magnet's current setting and corresponds to the species being analyzed. This field can be set only when the AMU controller is in the manual mode.
Beam 'I', mA	Displays the beam current. The beam current is displayed in milliamperes (mA).
Preset Scans	Displays the total number of scans that have been scheduled for a particular implant. Each scan corresponds to the end-station completing two traverses (down and back up).
Wafer Size	Displays the wafer-size setting that is set on the dose controller. The wafer size is displayed in inches. ☒ **Note**: This is not the same as in the top area.

Holds	Displays the total number of interruptions during the course of an implant.
Pump-Down Time	Displays the time period of waiting implant to start. The time is displayed in second.

DataFlow provides detailed information to the user about the status of the implant. It achieves this through three status fields, which display the active status of the implant. They also provide information relating to recipe violations and also prompt the operator with instructions. These fields display important messages that can aid in the troubleshooting of the system. Although an extensive listing of all the possible messages is not provided, the common features of these status fields are described below:

Implant Status	Displays the status of the following: *implant in progress, on hold, implant complete,* etc. This field also displays the specific controller, which has generated the hold. The hold messages are obtained from the individual controllers.
System Messages	Displays a number of system messages. These messages are generally specific to the DataFlow system. All recipe violations are reported in this field; they enable you to quickly go to the screen that has a parameter in violation. This field also prompts you to load the next recipe after an implant is complete. It also displays the results of the pre-implant check that takes place before the implant is started.

System Alarms	Displays system-level warnings and errors. For example, the field notifies you of control violations due to a recipe violation. Other alarms reported by this field could be operating-system related errors or alarms due to failure of communication with the individual controllers.
SECS Message	Displays messages about SECS.

The DataFlow Main Screen is the main operating screen. During normal operation, the operator will need to use the DataFlow Main Screen only. The operator can have access to a detailed monitoring screen pertaining to the individual controllers–*Monitoring* through simple menu-option selections in the **Implant** menu or using the space-bar hot key to toggle both the Main and Monitoring Screens. You can monitor any parameters for that particular controller in this screen at any time. Notice that the DataFlow Main Screen has information that can also be found in the monitor screen.

2.4.3 Button Selections on the DataFlow Main Screen

The DataFlow Main Screen has a number of buttons to perform certain actions or initiate events. The button selections can be made using the mouse, tab key, or arrow keys.

PRE-IMPL CHK

When this button is selected, DataFlow ensures that all the set-up information is correct as specified by the selected recipe. Note that DataFlow automatically performs a Pre-Implant check each time the recipe is selected from the Select Recipe Screen and at the beginning of each implant. The parameters checked by this button selection are Dose, Energy, Preset Scans, AMU, and Pressure set points (start and stop).

The pre-implant check occurs before the implant begins. If the Pre-Implant check succeeds/fails, a message appears in the System Message and System Alarms indicating the status of the check. If the pre-implant check succeeds, the System Message will prompt, "Pre-Implant Successful--Start Implant." At this time you may start the implant by pressing the **Implant** button on the Implanter. If the Pre-Implant check fails, the System Alarm will prompt, "Pre-Implant Check Failed." The System Message will display the cause of the failure (for example, "No Recipe Loaded."). DataFlow will perform the Pre-Implant check again. Implant cannot begin until the Pre-Implant check is successful.

SET_POINTS	After you have selected the appropriate recipe, set up the Implanter per the recipe and just prior to starting the implant, this button can be selected. When this button is selected, DataFlow sends setpoint messages to Dose, Vac, AMU, and Beam controllers. The set points are automatically downloaded when a new recipe is loaded into the system memory.
HOLD/STOP	The hold/stop button puts the implant on hold. This button is active only when the implant is in progress. If this button is pressed when no implant is in progress, it will not prevent the Implant from being started.
CONTINUE	This button resumes an implant after an interruption or hold due to a recipe violation or if it is initiated by anyone using the *Hold/Stop* button.
LOG	This button is used to check the system alarm logs.

2.5 Set Up Screen

Selecting the **Implant** menu and choosing **Set Up** option opens the *Set Up* screen. This screen has a number of user-entered fields. The following is a description of each of the data-entry fields and objects on this screen and their functions.

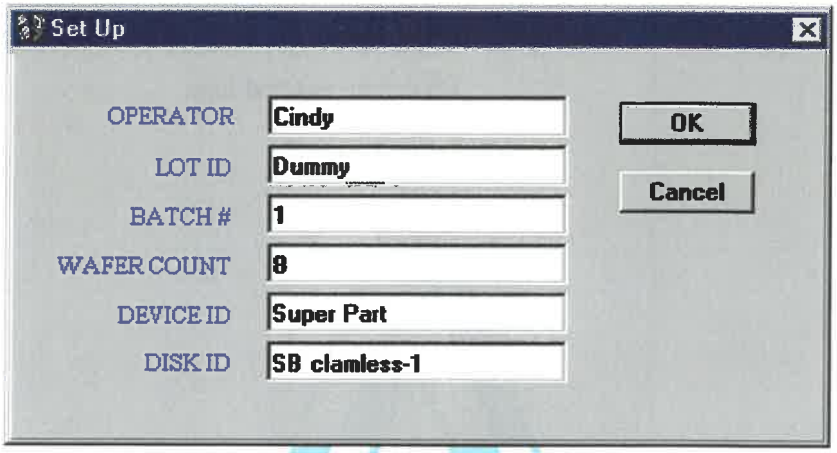


Fig. 2.2 The Set Up Screen

OPERATOR Allows you to enter the name of the operator or Operator ID.

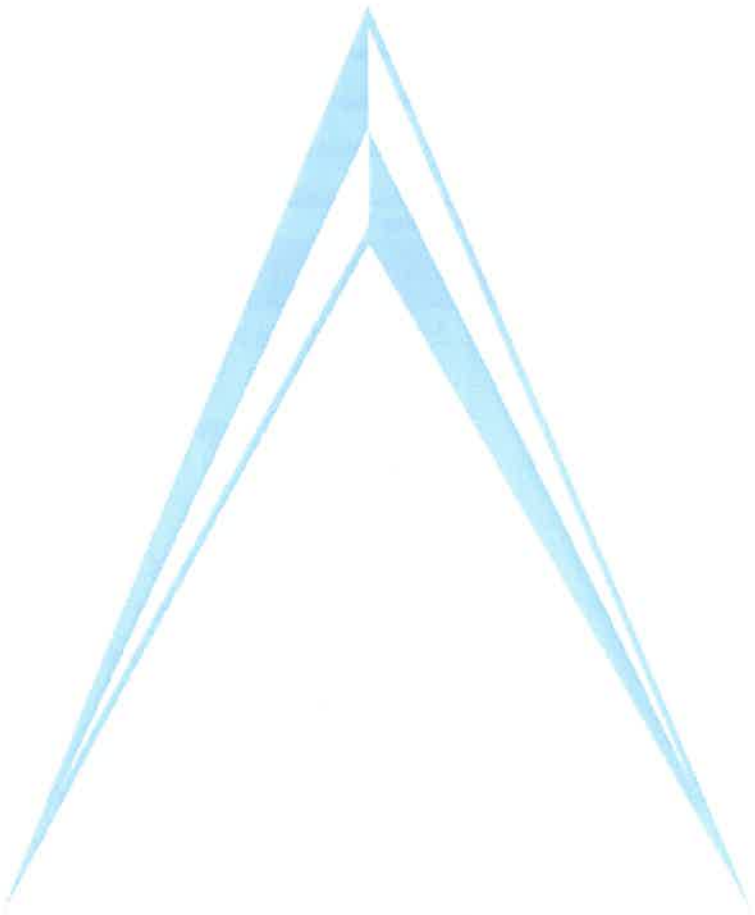
LOT ID Allows you to enter the descriptive ID for the batch of wafers being implanted. Typically, all wafers in each lot of wafers go through the same manufacturing cycle.

BATCH # Enter the batch number in this field. This must be an integer number. At the end of each implant, the batch number gets incremented by *one* (1). You may choose to change this number to another integer. DataFlow will use this new number as the baseline for subsequent implants.

WAFER COUNT Enter the total number of wafers for the entire lot.

DEVICE ID Allows you to enter the specific device or part ID for the wafers being implanted. This is a descriptive field. Different lots can have the same or different device IDs.

DISK ID If the disk/wheels being used have an ID, then the ID can be entered here.



2.6 Select Recipe Screen

Selecting the **Implant** menu and choosing the **Select Recipe** option open up the Select Recipe dialog window. This screen has a list box containing recipe names that enables you to scroll through the available recipes and select an appropriate recipe.

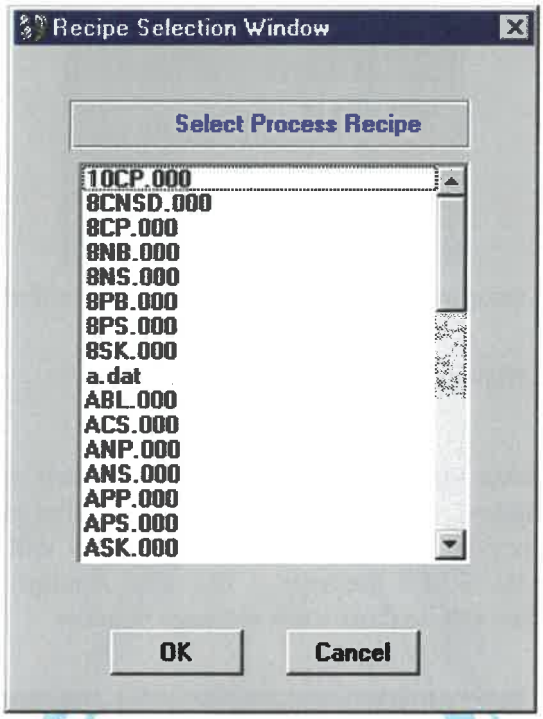


Fig. 2.3 The Select Recipe Screen

On the scrollable list, the recipe selection can be made either by clicking the **OK** button or by double clicking the mouse. Clicking **OK** on the message box will load the recipe. To cancel the selected recipe and to close the dialog window, press **Cancel**. Once the recipe is selected, the recipe name appears in the *Active Recipe* field on DataFlow's **main** window. You need to set up the recipe directory in the configuration screen. If no recipes are displayed or if the names displayed do not correspond to valid recipes, check that the correct recipe directory has been specified in the configuration screen.

The recipe name shown in the list box is longer than its real recipe filename. Recipe names can be up to 20 characters long. If you copy a recipe file from other computer to the recipe directory, DataFlow initialization will use the recipe file name for both the long recipe name and the real-recipe file name. If you delete a recipe file from the File Manager, and delete the same recipe again from the *listbox*, DataFlow will display an error message and delete the particular recipe name from the *listbox*.

DataFlow checks to ensure that the recipe selected is a valid recipe. If DataFlow detects an error, it will display an error message (see Fig. 2.4). The user will be returned to the selection screen to select a valid recipe.

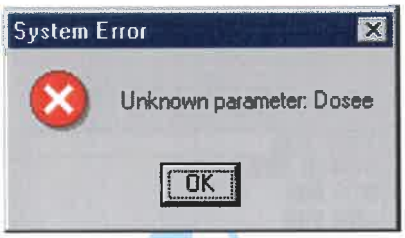


Fig. 2.4 An error message is displayed when an invalid recipe is loaded.

2.7 Host Sends Message to DataFlow

When the server sends S10F3 message to DataFlow, it displays the message on a pop-up window. To delete the message from the screen, click **OK** window. Before the pop-up window is closed, DataFlow will open a new window to show the next S10F3 message. The new window will cover the previous window. Click **OK** to close each message window.

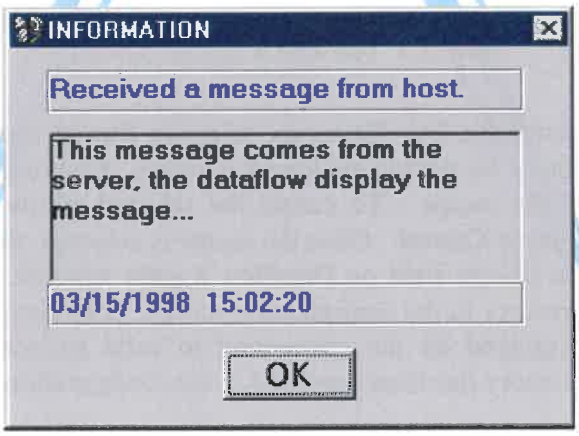


Fig.2.5 Message sent from host

2.8 Monitoring Screen

The Monitoring Screen displays all the parameters monitored by the following controllers: *Dose*, *AMU*, *Beam*, and *Vacuum*. This screen can be activated from the **Monitoring** option on the **Implant** menu. Another way is to activate the screen using the space-bar hot key to toggle both the main and monitoring windows.

The following is a list of parameters monitored by the screen:

Dose/AMU/Vac Controller Table		
Dose	Beam current	Wafer size
Preset Scans	Estimated Time	Actual time
Pressure Compensation	Trim	Energy
AMU	Magnet current	Source Pressure (P1)
Beam Line Pressure (P2)	End-Station Pressure (P3)	Start Pr. Set Point
Stop Pr. Set Point		

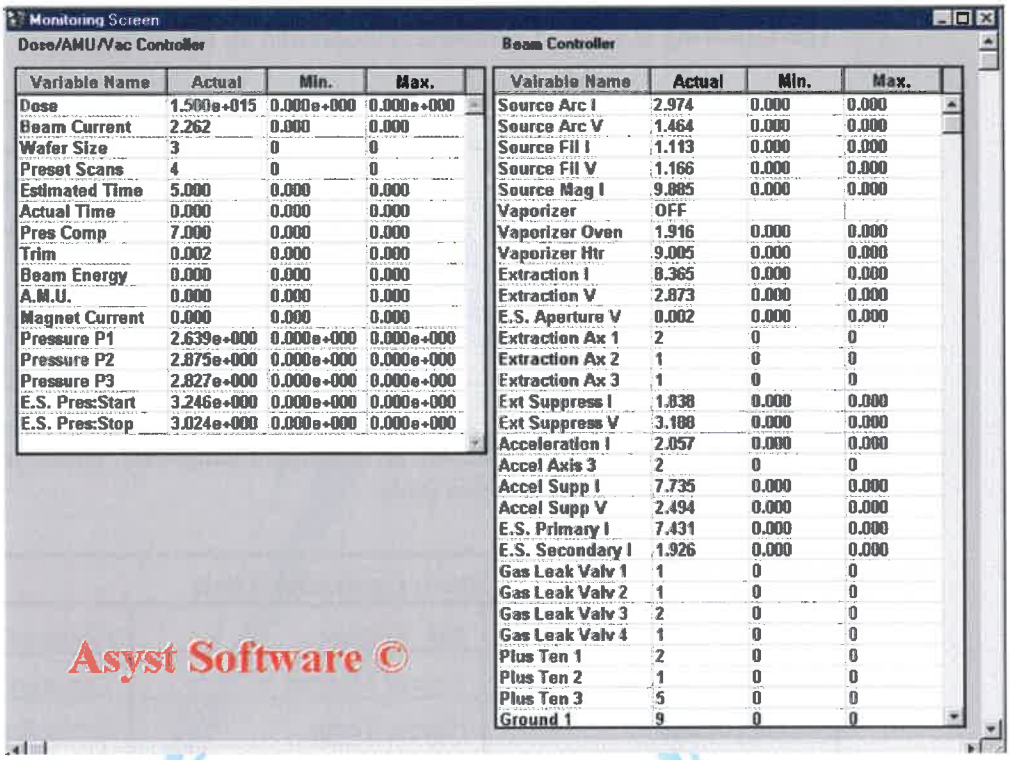
Note: If E. Shower IV is selected, an additional parameter, which is *Gas Flow*, will be displayed on this table.

Beam Controller Table		
Arc Current	Arc Voltage	Filament Current
Filament Voltage	Source Magnet 'i'	Vaporizer
Oven Temp.	Heater Temp.	Extraction—Current
Extraction —Volts	Electron Shwr Apr 'V'	Tilt Axis 1
Side Axis 2	Gap Axis 3	Suppression 'I'
E.S. Secondary 'I'	Gas Leak Valve 1	Gas Leak Valve 2
Gas Leak Valve 3	Gas Leak Valve 4	Plus Ten 1
Plus Ten 2	Plus Ten 3	Vref Gnd Src
Vref Gnd Term	Vref Gnd Accel	

Note: If E. Shower IV is selected, another parameter, which is *% Beam Command*, will be displayed on this table.

If implant type is Auto Tune II, two additional parameters will be displayed in the Beam controller table (See Fig. 2.7):

Disk Current	Post Accel Valts



Variable Name	Actual	Min.	Max.
Dose	1.500e+015	0.000e+000	0.000e+000
Beam Current	2.262	0.000	0.000
Wafer Size	3	0	0
Preset Scans	4	0	0
Estimated Time	5.000	0.000	0.000
Actual Time	0.000	0.000	0.000
Pres Comp	7.000	0.000	0.000
Trim	0.002	0.000	0.000
Beam Energy	0.000	0.000	0.000
A.M.U.	0.000	0.000	0.000
Magnet Current	0.000	0.000	0.000
Pressure P1	2.639e+000	0.000e+000	0.000e+000
Pressure P2	2.875e+000	0.000e+000	0.000e+000
Pressure P3	2.827e+000	0.000e+000	0.000e+000
E.S. Pres:Start	3.246e+000	0.000e+000	0.000e+000
E.S. Pres:Stop	3.024e+000	0.000e+000	0.000e+000

Vairable Name	Actual	Min.	Max.
Source Arc I	2.974	0.000	0.000
Source Arc V	1.464	0.000	0.000
Source Fil I	1.113	0.000	0.000
Source Fil V	1.166	0.000	0.000
Source Mag I	9.885	0.000	0.000
Vaporizer	OFF		
Vaporizer Oven	1.916	0.000	0.000
Vaporizer Htr	9.005	0.000	0.000
Extraction I	8.365	0.000	0.000
Extraction V	2.873	0.000	0.000
E.S. Aperture V	0.002	0.000	0.000
Extraction Ax 1	2	0	0
Extraction Ax 2	1	0	0
Extraction Ax 3	1	0	0
Ext Suppress I	1.838	0.000	0.000
Ext Suppress V	3.188	0.000	0.000
Acceleration I	2.057	0.000	0.000
Accel Axis 3	2	0	0
Accel Supp I	7.735	0.000	0.000
Accel Supp V	2.494	0.000	0.000
E.S. Primary I	7.431	0.000	0.000
E.S. Secondary I	1.926	0.000	0.000
Gas Leak Valv 1	1	0	0
Gas Leak Valv 2	1	0	0
Gas Leak Valv 3	2	0	0
Gas Leak Valv 4	1	0	0
Plus Ten 1	2	0	0
Plus Ten 2	1	0	0
Plus Ten 3	5	0	0
Ground 1	9	0	0

Fig. 2.6 The Monitoring Screen.

If implant type is Auto-Tune II with Electron Shower IV, an additional table will be displayed. (See Fig. 2.7)

Auto Tune II/E.S. Table		
Electron Shower ON	ES Control Mode	Bias Aperture ON
Hi Energy Electrode	Carrier Gas Support	Axis 3 Detune
Magnetic Deflector In		

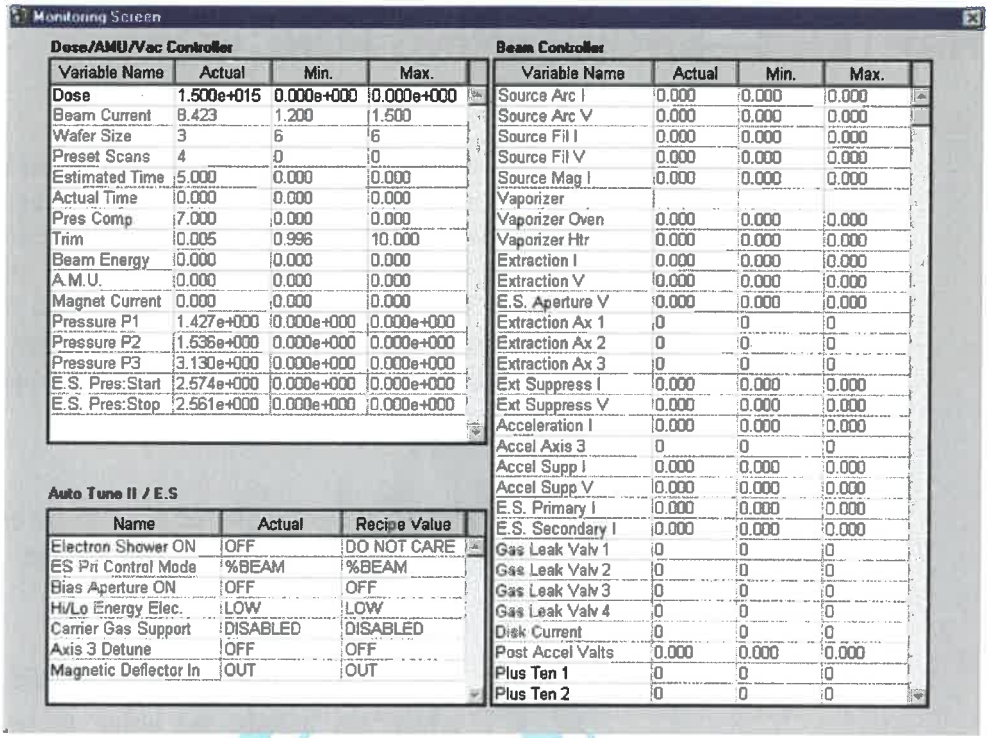


Fig. 2.7 The Monitoring Screen (Auto tune II / E.S).

DataFlow continuously monitors all controllers no matter which monitor screen is being used. DataFlow immediately starts monitoring all parameters after it is booted up.

2.9 Alarm and Interlock Functions

The monitor screen displays the minimum and maximum limits of a parameter. These are the selected values stored in the Active Recipe. When a parameter is outside the minimum/maximum limit, a recipe violation occurs. Depending on whether the parameter is set with **"Interlock" or "Alarm"** option, the corresponding parameter is highlighted. If there is a recipe violation on a parameter that has interlock, the appropriate field for that parameter is highlighted in red and the implant goes on hold and will not resume until the violation is cleared. If there is a recipe violation on a parameter that has alarm and no interlock, the appropriate field for that parameter is highlighted in yellow. The system fields display a warning, but the implant does not go on hold. The failing parameter(s) stay highlighted until the implant is restarted or until the DataFlow **Continue** button is pressed. Set the Interlock and Alarm options see the section 3.6.

CHAPTER 3—ENGINEERING FUNCTIONS

3.1 Chapter Content

This chapter describes the various engineering functions that can be performed using DataFlow. The engineering functions are broadly categorized in the following: *DataFlow Configure, NV-10 Configure, Change Passwords, SECS II Configure, Recipe Editor,* and *History*. The Configure utility allows the user to customize DataFlow per the requirements of the user. The Recipe Editor allows you to create and edit recipes. The recipes can be created either online or offline. The History utility allows the user to view prior Implant-snapshot data.

3.2 DataFlow Configuration

The following section describes all the settings that need to be configured for proper operation of DataFlow. Most of the default settings may remain unchanged.

Recipe Directory

Specify the name and path of the directory in which the recipes are going to be created and stored. DataFlow uses this directory when loading recipe files into the Select Recipe Screen and into the Recipe Editor.

Snapshot Directory 1/2

Two directory names can be specified for storing the implant data. The names must be specified in the appropriate field. DataFlow automatically saves the data file to either the hard disk or floppy drive, or both (if two directories are specified) at the completion of an implant. Note that if two directories are specified, two copies of the same dataset will be stored in the specified location. For instance, the Snapshot-2 directory can be used to create a backup copy of the snapshot data on a floppy, tape drive, etc.

Min/Max Tolerance, %

This parameter *relaxes* the min./max. check limits by the specified percentage value. The actual upper-check limit is above the *max.* according to the specified percentage of the maximum value. The actual lower-check limit, on the other hand, is

below the *min.* by the same percentage of the minimum value.

E.S. Primary I, mA (pre) DataFlow check E.S. Primary current is larger than this value even before the implant starts. ***This value should be set to 1.0ma as minimum. Each user should make sure the item is properly set to their needs.*** After starting the implant, DataFlow will check the values read from the recipe file for E.S. Primary current.

Auto Print Report Selecting this option automatically sends the implant snapshot to the specified printer after the completion of an implant.

Resize Screen Enable Selecting this option can minimize or resize the main screen.

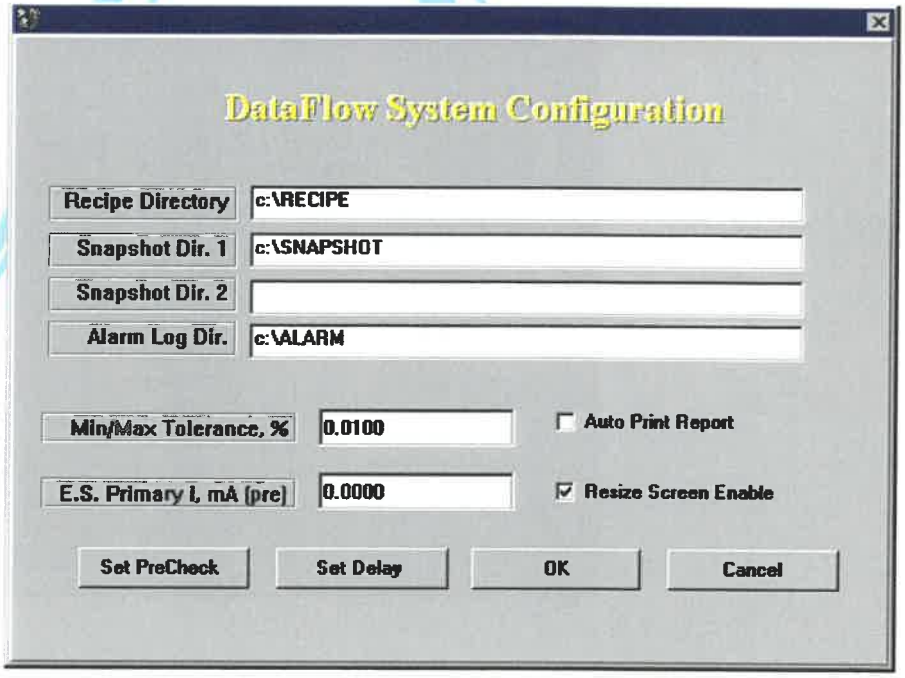


Fig. 3.1 DataFlow Configuration Screen.

3.3 Button Selections on the DataFlow Configuration Screen

Set Precheck — Pressing this button will open **Set Precheck Parameters** Screen, which allows you to set all the parameters that need to be checked via the Pre_Implant check.

Set Delay — Press this button to open the **Set Parameters Delay** Screen. You can set all the parameters that need to be checked after a period of time when the implant starts (i.e., Beam I).

Once all the configuration parameters are set, press either the **OK** button to save the configuration changes made or press **Cancel** to return to the old configuration parameters. In either case, the DataFlow Main Screen will be displayed.

3.2.2 Set Precheck Parameter Screen

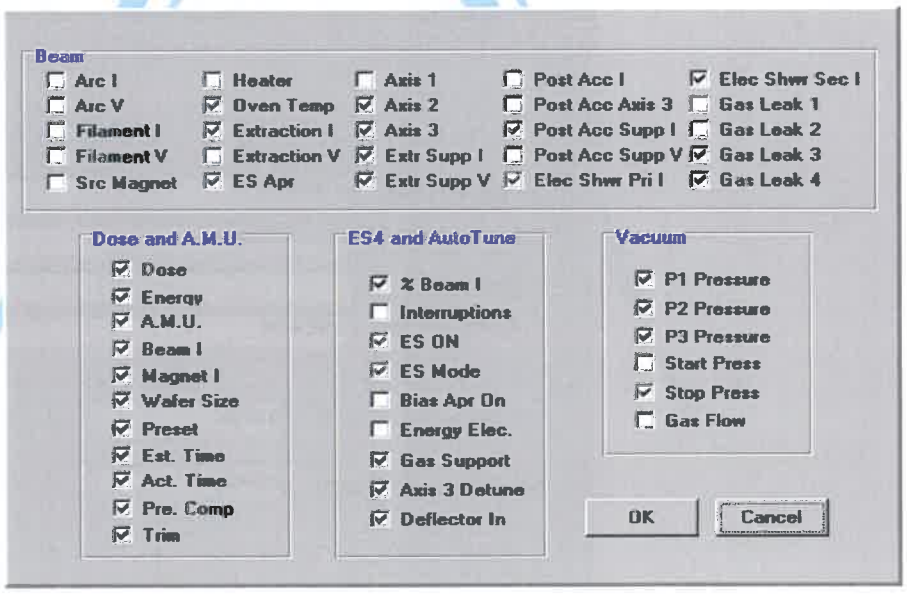


Fig. 3.2 Set Precheck Parameter Screen.

3.2.3 Set Delay Parameter Screen

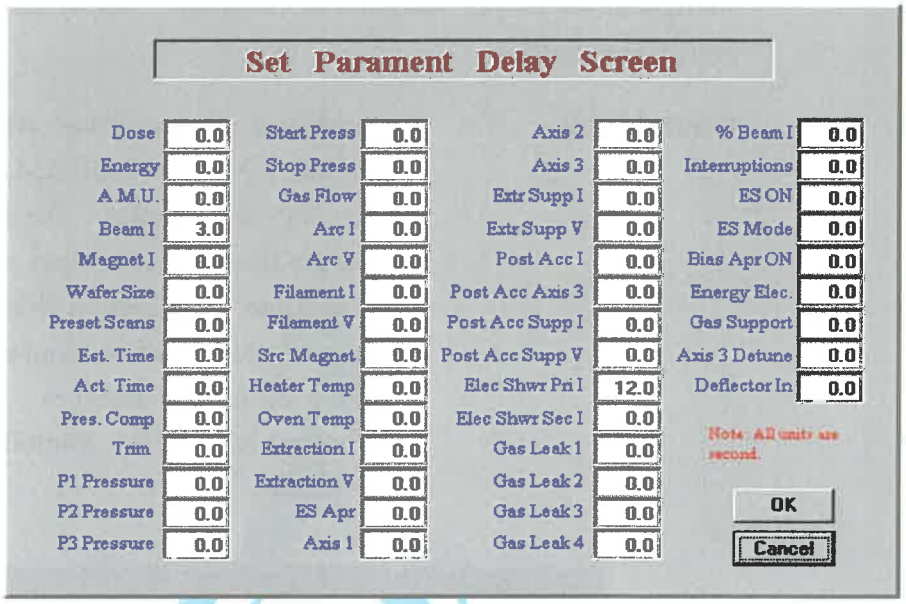


Fig. 3.3 Set Parameter Delay Screen.

3.3 NV-10 Configuration

The following section describes all the configuration settings that need to be configured for proper operation of DataFlow. All of the settings remain the same when finished.

Control Ports

DataFlow communicates with six controllers--DOSE, AMU, VAC, BEAM, AT-4, and EMO of the NV-10 Implanter. The default selection has all the first four controllers enabled, and without AutoTune and Electron Shower IV. DataFlow can be configured to communicate with one or more of these controllers. When AutoTune is checked, the EMO controller is automatically selected.

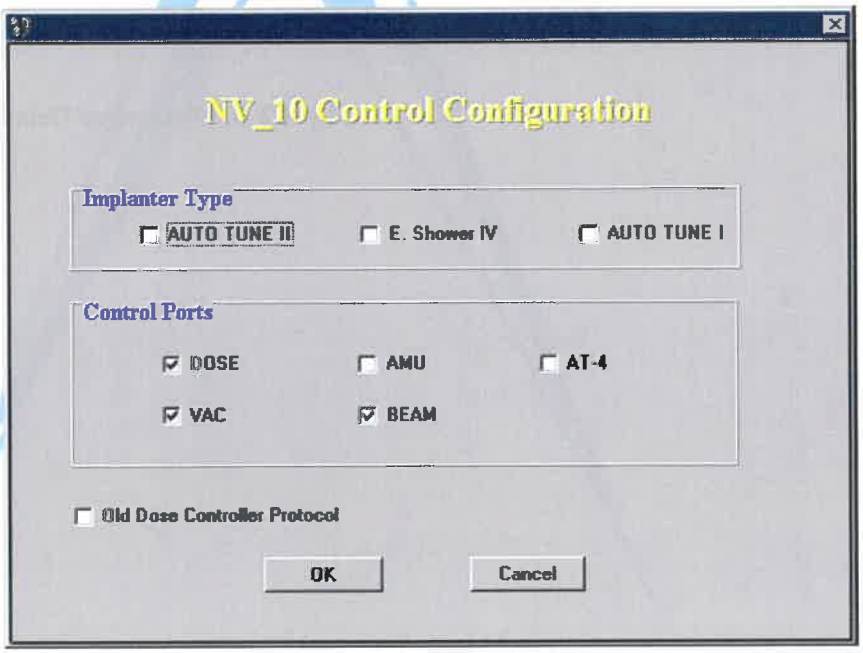


Fig. 3.4 The NV-10 Configuration Screen.

Old PT Protocol

New PT Protocol sends one more setpoint (Trim) to Dose controller. (Mark this button if your implant is using an old PT protocol.) This check

box is only displayed when AutoTune is not selected.

3.4 Change Password(s)

You can change password(s) by selecting the **Change Passwords** item on the **Engineering** menu. When this item is selected, the **Change Passwords** Screen appears. DataFlow provides three passwords.

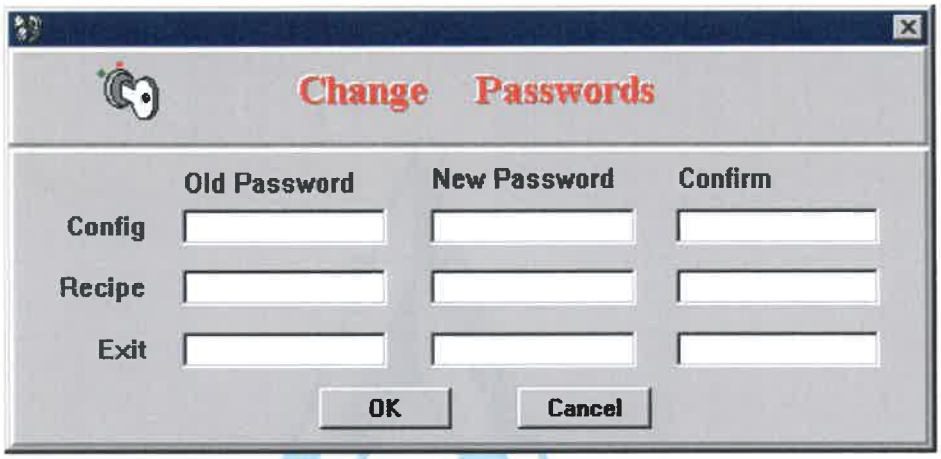


Fig. 3.5 The Change Password(s) Screen.

The default passwords are:

- **Recipe**--for the Edit Recipe file
- **Exit**--for the Exit from DataFlow file
- **Configure**--for all other files.

3.5 SECS II Configuration Screen

The SECS II Configuration Screen, accessed from the Engineering Functions screen, allows you to modify the following SECS-related configuration parameters:

System Configuration Parameters:

RECIPE LOC	Select the location where recipes are stored. If the recipes are stored in the Host, it is responsible for downloading the recipes to DataFlow. If the recipes are locally stored, the Host provides DataFlow with the filename of the recipe. DataFlow will then search and load the specified recipe from the Recipe Directory Setup menu in the Configuration Screen.
MODEL	If **NV10-80** is selected, many parameters will display *empty* since the **NV10-80** parameter set is smaller.
OPERATION MODE	Select *Remote* to communicate with a Host via the SECS II protocol. Select *Local* to operate DataFlow in a stand-alone environment.
WHEEL CAPACITY	Show the number of wafers per wheel.
Show SECS Driver WIN	If deselect, DataFlow will hide the SDR window, You can't see the SDR window from Start bar, you can't see the SDR task from Task Manager => Application window, but you can see the SDR.EXE process from Task Manager => Processes. (Don't end this process!!!)

SECS Link Parameters:

Note: Changes made to the following parameters will not take effect until DataFlow is restarted.

DEVICE ID	The SECS Device ID of the Implanter.
COM PORT	The Serial port used for SECS link.
RETRIES	The SECS RTY (Retry Count Limit) value.

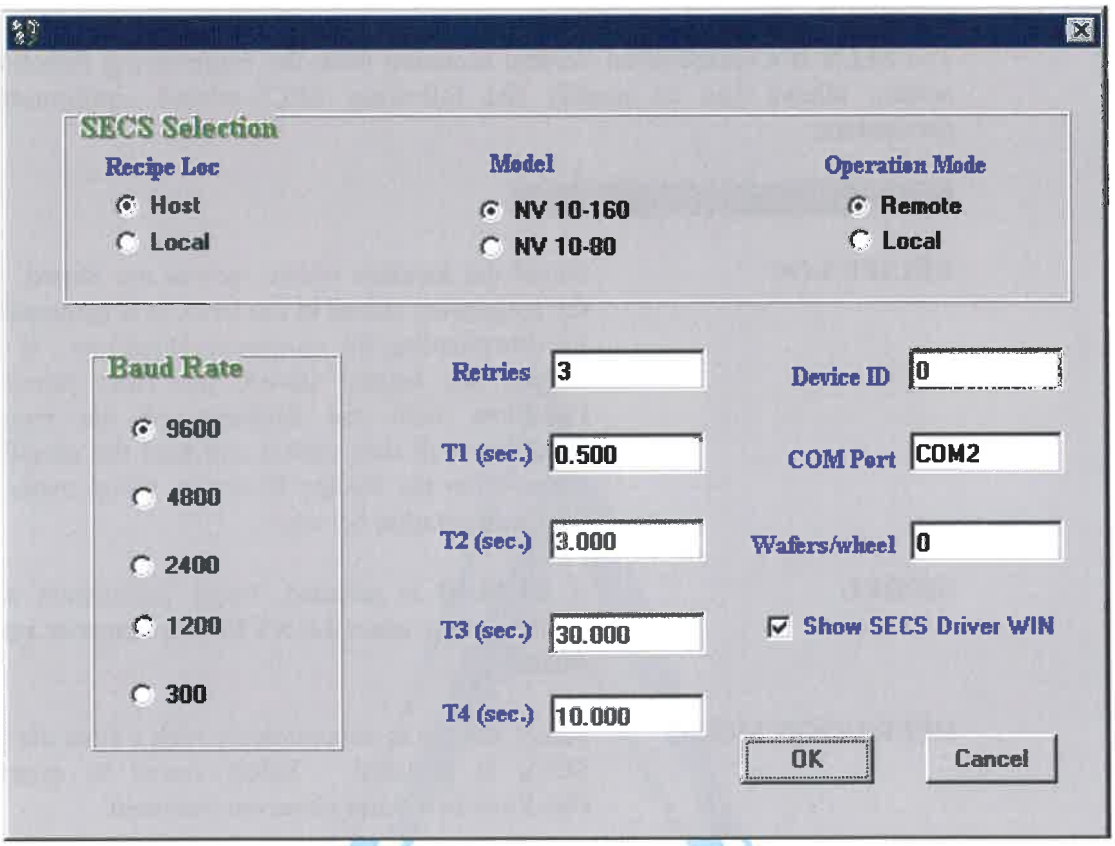


Fig. 3.6 SECS II Configuration Screen

T1	The T1 time-out for SECS messages.
T2	The T2 time-out for SECS messages.
T3	The T3 time-out for SECS messages.
T4	The T4 time-out for SECS messages.
BAUD RATE	The baud rate of the RS232 SECS port. The available choices are 9600, 4800, 2400, 1200, and 300 bauds. The default value is 9600 baud.

After all parameter changes have been made, press either the **OK** button to save the changes, or press the **Cancel** button to disregard the changes made. In either case, the application will take you back to the DataFlow Main Screen.

3.6 Recipe Editor

The following section describes the procedures on how to create a new process recipe, edit an existing process recipe, and save the process recipe for the DataFlow software to use.

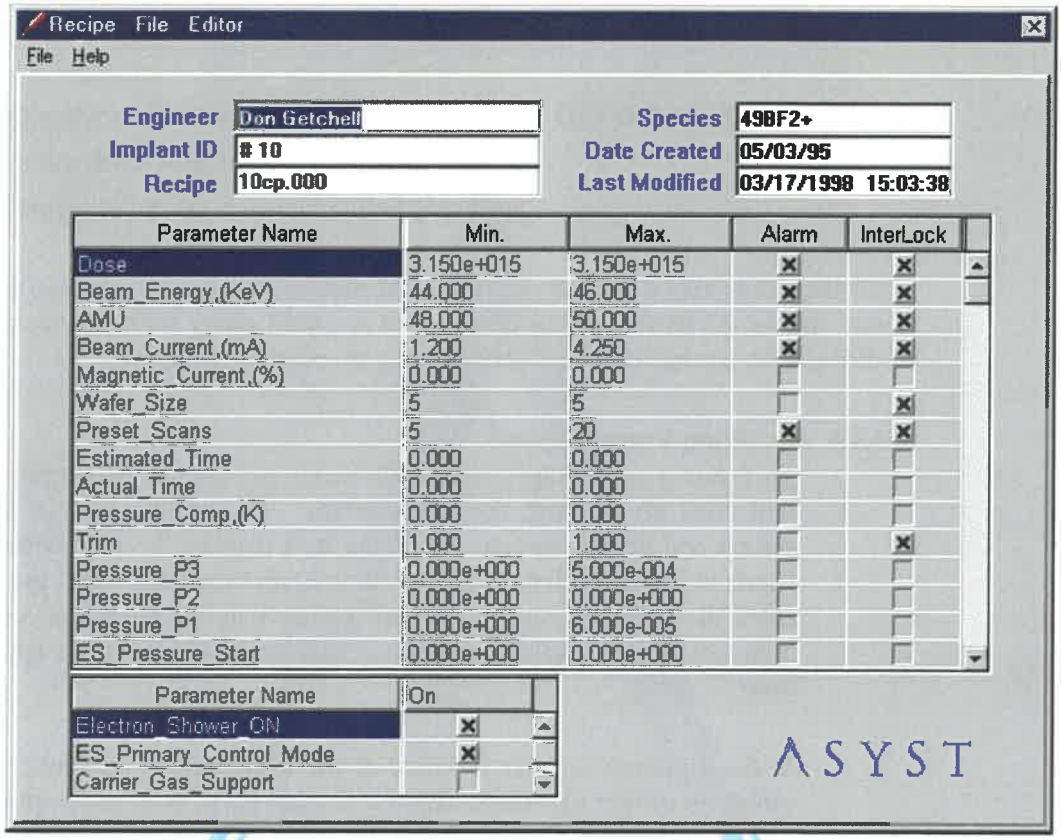


Fig. 3.7 The Main Screen of the Process Recipe Editor.

Selecting the **Recipe Editor** menu will display the Recipe Editor screen. The top area in the Recipe Editor's main screen has the following information:

NAME OF ENGINEER Allows you to enter the engineer's name.

IMPLANTER ID This field is used to identify the specific Implanter that the recipe is being written for.

RECIPE This field displays the name of the current recipe that is being edited. If you are editing a new recipe, this field is going to remain blank.

SPECIES This field is used to enter the category for which the recipe has been created.

DATE CREATED This field is used to enter the date the recipe was created on.

DATE LAST MODIFIED This field is used to enter the date when the recipe is last modified. DataFlow will automatically enter this field when user saves the recipe file.

All the fields above are for informational purposes only and will not affect the way the recipe works. This information is saved along with the recipe. The information can be retrieved when editing an existing recipe.

3.6.1 Creating a new Recipe

To create a new recipe, select **File** menu and choose **New** option. This will clear all fields in the recipe editor. The bottom area of the main screen and all the screens following will display the parameter, which needs to be controlled. Adjacent to the parameter are fields provided to enter the minimum and maximum values that the parameter can have. You can set the Interlock and Alarm options by checking the appropriate box.

If the Interlock option is enabled for a specific parameter, a recipe violation of that parameter (during implant) will stop the implant. The parameter will be highlighted in red on the appropriate monitor screens. If the Alarm option is enabled for a specific parameter, then a recipe violation of that parameter during implant will *not* stop the implant. The appropriate parameter will be highlighted in yellow and the operator will be notified through the system alarms and messages that an *alarm violation* has occurred. If both the Alarm and Interlock options are chosen, then the interlock option will be considered over the other.

The default settings for a new recipe are set wherein the parameters are not interlocked or alarmed. When the Interlock or Alarm option is chosen, the corresponding button will have a check mark. Absence of a check mark indicates that the parameter is not being interlocked or alarmed.

Care must be taken to use consistent units. The units that DataFlow uses are specified along side the name of the parameter. When entering the min./max. value(s) for a set-point like Dose or Wafer Size, enter the same value for both the minimum and maximum values. Once equal, DataFlow interprets the parameter to be a set point. DataFlow will control the monitored values within the specified limit subject to the tolerance factor (Min/Max tolerance) as specified in the configuration screen. It is important that the tolerance factor be a practical number (i.e., 0.01 %), since making the tolerance too tight will cause the implant to go on hold out of normal variation of a parameter due to the inherent system electronics of the individual controllers. This is especially important for the set-up parameters.

The recipe editor consists of five screens. You can navigate between screens using the arrow-key buttons at the bottom of the screen. Navigating from one screen to the other will not cause the information to be lost. This will enable you to fill in fields in any order or sequence. You can also go to the monitor screens to get nominal values for some of the parameters without losing any of the information in the recipe being edited. Save the recipe before exiting the recipe editor.

3.6.2 Editing an Existing Recipe

This section describes the procedure on editing an existing recipe or creating a new recipe based on an existing recipe.

To edit an existing recipe, select the **File** menu and choose **Open**. This will display a scrollable list of all the recipes in the directory set up as **Recipe Directory** in the *Configuration* screen. Select the appropriate recipe name and validate it by pressing the **OK** button or clicking the mouse twice. Press **Cancel** at any time to undo the selection.

The recipe being edited will be displayed in all fields. Make any changes or modifications that need to be made. Use the tab key to move from one field to the next one. If the fields being validated are far apart, then use the mouse and click the field that needs to be changed. The mouse will position the cursor in the field that it has highlighted. Use the *backspace* or *delete* key on the keyboard to delete existing data. To backtrack on the previous fields, press the *Tab* key while holding down the *Shift* key.

Once all the editing is complete, go back to the main screen to save all the changes that are made on the recipe.

3.6.3 Saving Recipes

This section describes the procedure on saving created or edited process recipes using the Recipe Editor.

To save a *new* recipe, select the **File** menu and choose the **Save As** option. A dialog box will appear, prompting you to enter the name of the new recipe. Type the name and press the **Enter** key. The Active Recipe field will display the new recipe name. Select the **File** menu and choose **Open** to verify that the recipe has been saved.

To save an *existing* recipe, select the **File** menu and choose **Save**.

Process recipes often differ from each other only in very few parameters. It will be much easier for you to modify an existing process recipe and save the modified recipe to a new file. This can be easily accomplished by following the same procedure as described in the previous paragraph. It is recommended that you create a template file on the basis of which other recipes can be easily created.

Note: All files in the recipe directory that are created through the recipe will appear in the scrollable list in the *Select Recipe* screen.

3.6.4 Deleting Recipes

To delete recipe files, go to the **File** menu and choose **Delete**. Recipe Editor will prompt you to verify the deletion of the currently opened recipe file. The recipe file will be deleted if the user presses the **OK** button.

3.6.5 Printing Recipes

To print recipes, go to the **File** menu and choose **Print.** The recipe must be saved before it is printed. Changes made to a recipe will not be printed until the modified recipe has been saved.

WARNING!

Do not edit recipes during implant. Editing recipes during implant may cause time delays in the monitoring of implant data, and may affect the DataFlow software's performance. Recipe Editor can work offline. You may copy the following files to edit the recipe file: *RCPEDIT.EXE, DTBL32.DLL, PVPLUS32.DLL*, and *WINCTL32.DLL.*

3.7 Viewing Implant Datasets (History)

You can view data pertaining to past implants by selecting the **History** item on the **View** menu. When this item is selected, the *Open Snapshot File* screen appears.

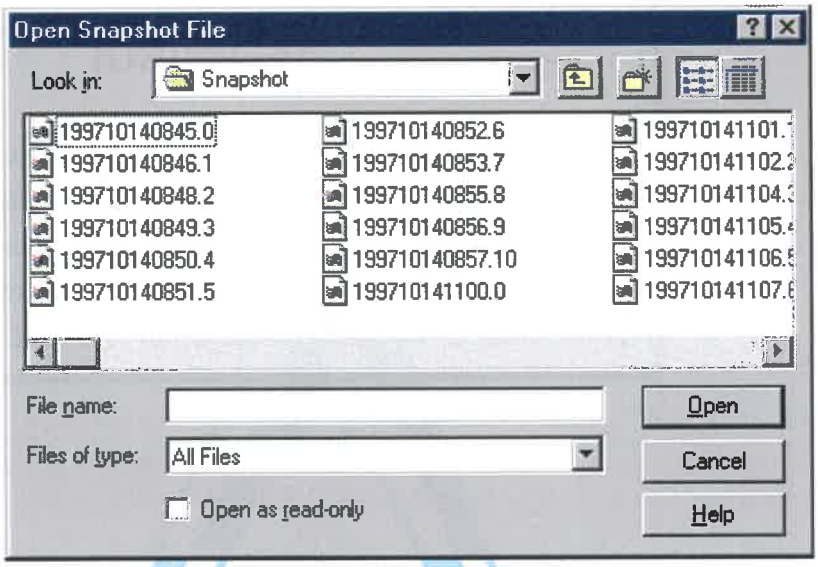


Fig. 3.8 The Open Snapshot File Screen.

The current directory is the default Lot History Directory (selected in the Configuration Screen). Select the directory in the dialog box if you want to view data in a directory that is different from the one displayed. Directory names must be names of previously created directories within the operating-system environment. At this point, you can select a data file. Press **OK** to view it or choose **Cancel** to cancel the selection. Pressing the **OK** button will launch a window with the implant data displayed in it. The window has vertical and horizontal scroll bars, which allow you to scroll through the data file if it is necessary.

Caution: You will be able to edit the data file as it appears on the screen. Should you accidentally edit part of the data file, select the *exit item* from the menu to exit from the display window without saving the file. Now re-select the data file. The original data file will be displayed again without any modifications. Figure 3.8 is an example of a typical Implant data file.

Once you have viewed the data file, you can select the **Exit Item** from the menu, which will close the display window. This will bring up the *DataFlow Main* screen.

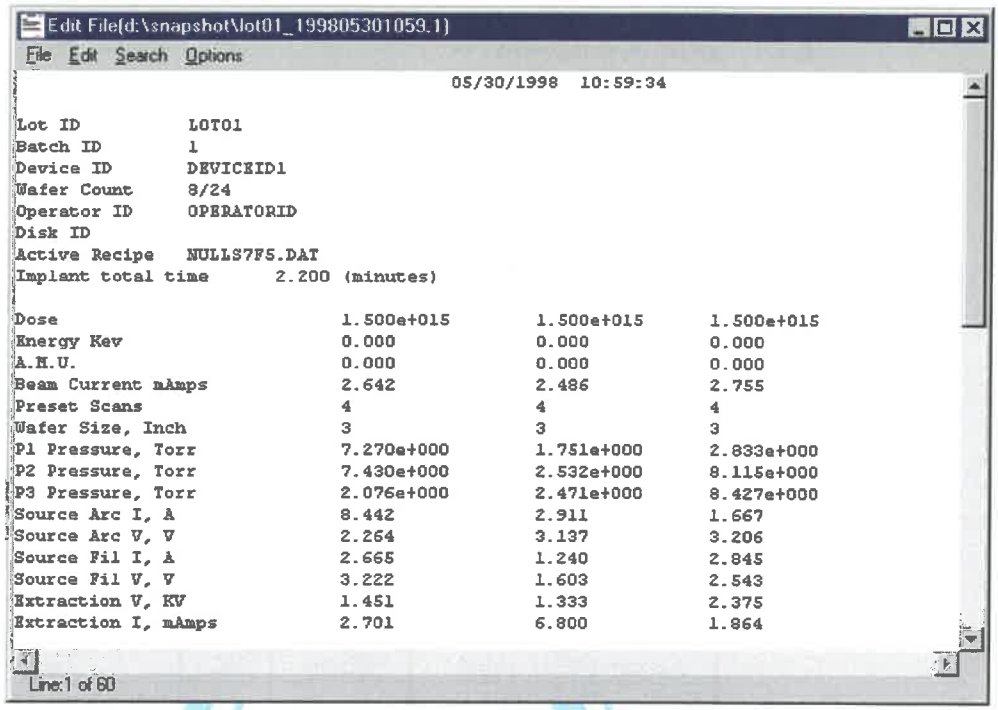


Fig. 3.9 Display Window where the Implant Data file can be viewed.

CHAPTER 4—APPENDIX

4.1 Message Summary

4.1.1 Host to DataFlow

This section describes primary SECS messages sent by the Host, and the associated reply messages from the DataFlow.

In the column headed "R" (see table below), the messages marked with "R" are permitted only when the Control State is *Remote.* The DataFlow will refuse these primary messages from the Host when the Control State is *local.*

In the column headed "Matrix," the messages marked with a number are permitted only when Matrix mode is set to that number. DataFlow will refuse these primary messages from the Host when Matrix mode does not match. None of the numbers in the cell is for any of the modes.

Host-to-DataFlow Transactions				
Primary	*Reply*	*Matrix*	*R*	*Description*
S1F1	S1F2			"Are You There?"
S1F3	S1F4			Selected status
S2F21	S2F22		R	Remote Command
S2F27	S2F28			Initiate Processing
S3F13	S3F14	1,2,3		Set Material ID
S3F73	S3F74	1,2,3		Set Material ID
S5F3	S5F4			Enable/Disable Alarm
S7F1	S7F2	1,3,4		Process Program Inquire/Grant
S7F3	S7F4	1,3,4		Unformatted Process Program Send
S7F5	S7F6			Unformatted Process Program Request
S7F15	S7F16			Set Matrix mode
S7F65	S7F66	1,3,4		Long Process Program Send
S7F67	S7F68	1,3,4		Long Process Program Request

4.1.2 DataFlow to Host

This section describes primary SECS Messages sent by the DataFlow, and the associated reply messages from the Host.

DataFlow-to-Host Transactions				
Primary	*Reply*	*Matrix*	*R*	*Description*
S1F1	S1F2			"Are you there?"
S2F17	S2F18			Data and Time Request
S5F1	S5F2			Alarm Report
S6F5	S6F6			Multi-Block Data Send Inquire/Grant
S6F9	S6F10			Snapshot Data Send

For SECS message detail, please refer to the "Eaton Corporation SECS II Message Definitions NV-10 High Current Implanter" manual.

4.1.3 Status Variables

The following status variables exist on the DataFlow.

SVID	*Format*	*Name*
1	Float	Source Arc I
2	Float	Source Arc V
3	Float	Source Fil I
4	Float	Source Fil V
5	Float	Vaporizer Oven Temp
6	Float	Vaporizer Heater Temp
7	Float	Source Magnet I
8	Float	Gas Leak Valve 1
9	Float	Gas Leak Valve 2
10	Float	Gas Leak Valve 3
11	Float	Gas Leak Vavle 4
12	Float	Extraction Suppress V
13	Float	Extraction Suppress I
14	Float	Extraction Axis 1
15	Float	Extraction Axis 2
16	Float	Extraction Axis 3
17 *	Float	Extraction V
18	Float	Extraction I
19 *	Float	Post Accel Supp V
20 *	Float	Post Accel Supp I
21	Float	Electron shower primary I
22	Float	Electron shower secondary I
SVID	*Format*	*Name*
23 *	Float	Post Accel Axis 3

24 *	Float	Post Accel I
25	Float	Dose
26	Float	Beam I
27	Float	Wafer Size
28	Float	Preset Scans
29	Float	Estimated Time
30	Float	Actual Time
31	Float	Analyzer Mag I
32	Float	A.M.U.
33	Float	Beam Energy
34	Float	P1 pressure
35	Float	P2 pressure
36	Float	P3 pressure
37	Float	Interruptions
38 *	Float	Post Accel voltage
39	Float	P3 start pressure
40	Float	P3 stop pressure
41	Float	Dose pressure compensation
42	Float	Bias aperture voltage
43	Float	Dose trim factor
44	Float	% beam current
45	Float	ES4 implant gas flow
101	Boolean	Control power on
102	Boolean	Source power on
103	Boolean	Extraction power supply on
104	Boolean	Extraction power supply off
105	Boolean	Ext. power supply overload
106	Boolean	Ext. power supply interlocked
107 *	Boolean	Post-accel power supply on
108 *	Boolean	Post-accel power supply off
109 *	Boolean	Pst-accel power supply overload
110 *	Boolean	Pst-accel power supply interlocked
111	Boolean	Gas Enable
112	Boolean	Gas switch 1
113	Boolean	Gas switch 2
114	Boolean	Gas switch 3
115	Boolean	Gas switch 4
116	Unsigned integer	Vapor switch
117	Unsigned integer	Shower switch
118	Boolean	Shroud up sense made
119	Boolean	Shroud down sense made
120	Boolean	Local mode (vs remote)
121	Boolean	Bias aperture ON/OFF

122	Boolean	Electron shower IV mode (primary / %beam)
123	Boolean	Electron position HI/LO energy
124	Boolean	Vaporizer carrier gas support
125	Boolean	Axis 3 detune option
126	Unsigned integer	Implant status
130	ASCII	Date/time (format YYMMDDHHMMSS)
131	ASCII	Active recipe
132	ASCII	Lot ID
133	ASCII	Operator
134	ASCII	Disk ID
135	ASCII	Device ID
136	ASCII	Batch ID

* Not available for the NV-10-80.

4.1.4 Alarms

The following table lists the alarms that may occur on DataFlow.

Alarm Table		
ALID	*ALCD*	*ALTX*
220	7	Implant is in progress
221	7	Implant is on hold
222	7	Implant complete
223	7	Implant initializing
224	7	Lot complete
226	7	xxx-Lot ID changed
227	7	xxx-Operator ID changed
240	7	Online
241	7	Offline
250	7	Lot queue is empty

4.1.5 SECS II Operating Modes

There are four Matrix Modes supported by the DataFlow Control Standard System: Matrix Modes 1-4. Matrix Modes 1 through 3 are the same as those defined in Eaton's NV-10 SECS II Message Definitions. Matrix Mode 4 is specific to DataFlow.

When DataFlow is launched, it defaults to Matrix Mode 2. The Host is responsible for resetting the Matrix Mode back to 2 after the process is complete under other modes.

Matrix Mode 1

Matrix Mode 1 is the Host-source Mode. In this mode, the Host selects the recipe for the next lot. If the recipe is locally stored, the Host will simply select the recipe by name. The Host will download the recipe to DataFlow if the recipe is stored on the Host. After it has selected/downloaded the recipe, you can still select a different recipe from the local storage if you do not wish to use the recipe selected by the Host.

Matrix Mode 2

Matrix Mode 2 is the Local-source mode. It operates just like the DataFlow Basic version, except that DataFlow reports snapshot data and alarms to the Host. However, in this mode, the Host cannot select recipes. You select all the recipes.

Matrix Mode 3

Matrix Mode 3 is the Host-immediate mode. It operates similar to Matrix Mode 1 except that the operator cannot change the recipe selected by the Host.

Matrix Mode 4

Matrix Mode 4 is the Lot-queue mode. This mode is available only on implanters equipped with an AT-4 End Station. Using this mode, the Host can instruct DataFlow to process a queue of lots as long as all the lots use the same recipe. There can be a maximum of 4 lots in the "lot queue." In order to set up a lot queue, the Host must provide the following information for each lot in the lot queue: number of wafers, mid (Lot ID), and ppid (recipe).

4.2 SECS II Message Sequences

The following describes the sequence of SECS-II messages that will be sent between DataFlow and the Host in the four Matrix Modes supported by DataFlow. The format of the SECS-II streams and functions supported by DataFlow is identical to the format specified in Eaton Corporation's NV-10 SECS II Message Definitions. Furthermore, DataFlow has made the following additions to support Matrix Mode 4:

1. S7F15: Added Mmode = 4 Matrix Mode 4
2. SECS messages added:
   S2F27/28 Initiate Processing Request
   S3F13/14 Material ID Send

4.2.1 Matrix Mode 1

Phase	*Host*		*DataFlow*	*Comment*
Initialization	S1F1	==>		"Are you there?" request from Host
		<==	S1F2	
	or			
Initialization		<==	S1F1	"Are you there?" request from DataFlow
	S1F2	==>		
Optional setup	S5F3	==>		Enable/Disable alarms
		<==	S5F4	(All alarms are enabled at boot-up)
Optional setup	S1F3	==>		Get SVs
		<==	S1F4	
Process setup	S7F15	==>		Set Matrix Mode = 1
		<==	S7F16	
		.....		
Material ID	S3F13	==>		Set material ID (lot number) [optional].
(Lot Number)		<==	S3F14	
		.....		

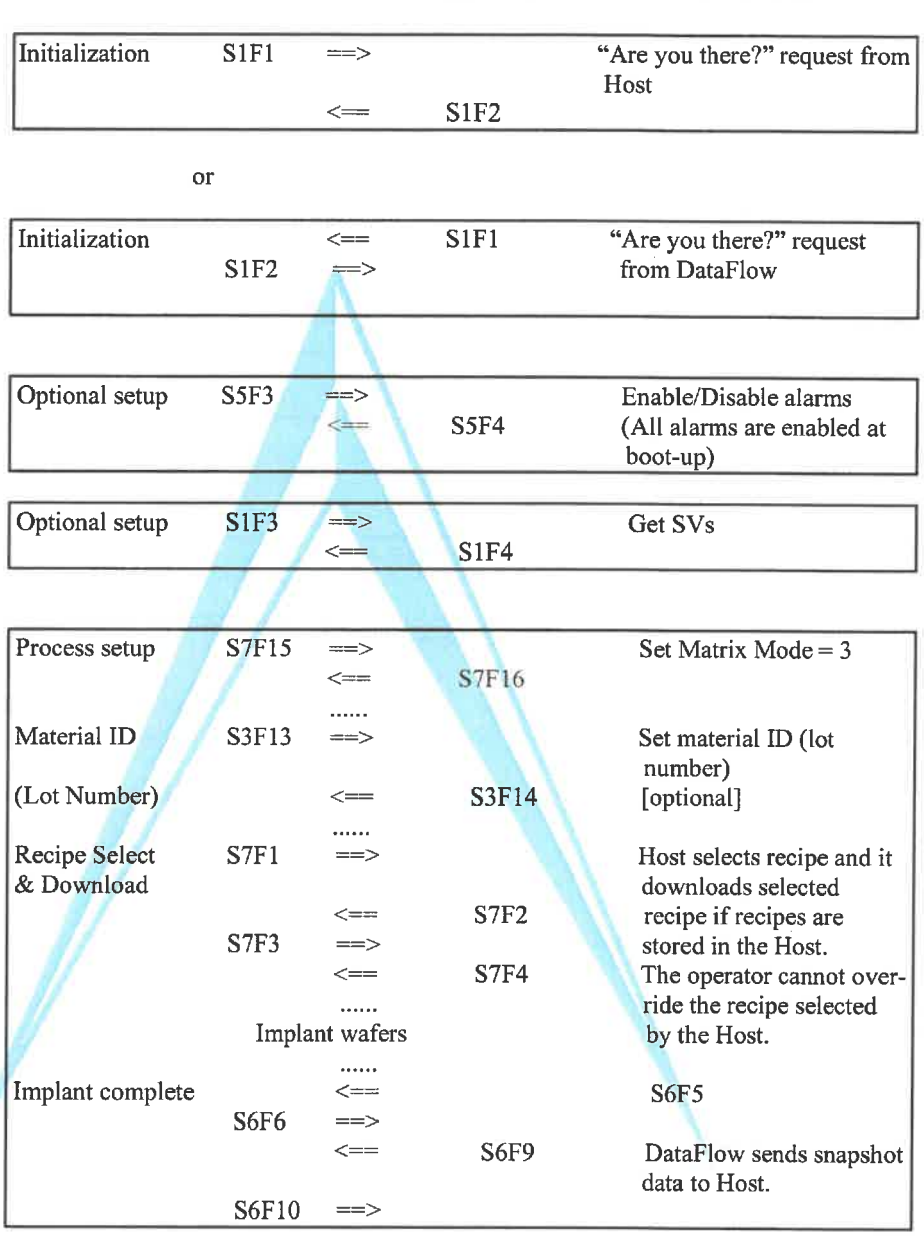
(Continued on the next page.)

Recipe Select	S7F1	==>		Host selects recipe and downloads
		<==	S7F2	slected recipe if recipes are stored
	S7F3	==>		in the Host. The operator may
over-		<==	S7F4	ride the Host's selected recipe.
		.....		
		Implant wafers		
		.....		
Implant complete		<==	S6F5	
	S6F6	==>		
		<==	S6F9	DataFlow sends snapshot data to Host.
	S6F10	==>		

4.2.2 Matrix Mode 2

Phase	*Host*		*DataFlow*	*Comment*
Initialization	S1F1	==>		"Are you there?" request from Host.
		<==	S1F2	
	or			
Initialization		<==	S1F1	"Are you there?" request from DataFlow.
	S1F2	==>		
Optional setup	S5F3	==>		Enable/Disable alarms
		<==	S5F4	(All alarms are enabled at boot-up)
Optional setup	S1F3	==>		Get SVs
		<==	S1F4	
Process setup	S7F15	==>		Set Matrix Mode = 2
		<==	S7F16	
		.....		
		Implant wafers		
		.....		
Implant complete		<==	S6F5	
	S6F6	==>		
		<==	S6F9	DataFlow sends snapshot data to Host.
	S6F10	==>		

4.2.3 Matrix Mode 3



4.2.4 Matrix Mode 4

Phase	*Host*	*DataFlow*	*Comment*
Initialization	S1F1 ==>		"Are you there?" request from Host
	<==	S1F2	
Initialization	<==	S1F1	"Are you there?" request from DataFlow
	S1F2 ==>		
Optional setup	S5F3 ==>		Enable/Disable alarms
	<==	S5F4	(All alarms are enabled at boot-up)
	or		
Optional setup	S1F3 ==>		Get SVs
	<==	S1F4	
Process setup	S7F15 ==>		Set Matrix Mode = 4
	<==	S7F16	
	.....		
Recipe Download (Optional)	S7F1 ==>		If recipes are stored on Host, Host downloads the recipe to be used for the lot queue. This does not select the recipe to be used for the lot queue.
	<==	S7F2	
	S7F3 ==>		
	<==	S7F4	
	.....		
Set lot queue	S2F27 ==>		Host instructs DataFlow to add a lot, to The lot queue, with a number of wafers set above, and with mid (lot number) and ppid set with this message.
	<==	S2F28	
	.....		
	Implant wafers		
	.....		
Implant complete	<==	S6F5	
	S6F6 ==>		
	<==	S6F9	DataFlow sends snapshot data to Host.
	S6F10==>		

Note: The lot queue can hold up to four lots at any time. However, if the Host wants to implant more than four lots with the same recipe, then it can move a fifth lot into the lot queue when the first lot is complete. It can also move a sixth lot into the lot queue when the second lot is complete (and so on) until all the lots have been processed.

If the Host sends an S2F27 with a *ppid,* which is different from the *ppid* of the current lot queue in process, then DataFlow will reply (S2F28) with "Invalid PPID."

If the operator clears the lot queue (by pressing the *Reset Lot Queue* on the Miscellaneous Screen), then DataFlow will clear all lots from the lot queue and will send S5F1 with ALID=250 and ALCD=7 to the Host.

The following messages can occur at any time.

Phase	*Host*		*DataFlow*	*Comment*
Anytime	S1F1	==>		"Are you there?"
		<==	S1F2	
	or			
		<==	S1F1	
	S1F2	==>		
Anytime	S1F3	==>		Get SVs
		<==	S1F4	
Anytime		<==	S5F1	Alarm
Anytime		<==	S9F1-13	Error Condition
Anytime	S5F3	==>		Enable/Disable alarms
		<==	S5F4	

Messages added by DataFlow to Eaton's SECS-II message set:

S2,F27 Initiate Processing Request (IPR)

```
L,3
        <B 'PTN'>                   *1 byte Binary (will always be 0 when non AT4 mode)
        <A 'PPID'>                  *Recipe Name. ASCII (16 bytes max.)
        L
                <A 'MID'>           *LOT ID. ASCII (16 bytes max.)
                <A 'OPERATOR'>      *OPERATOR ID
                <U2 "BATCH ID">     *Suggest value = 1
                <U2 "WAFER COUNT">
                <U2 "WAFER SIZE">
                <A "DEVICE ID">
```

S2, F28 Initiate Processing Acknowledge (IPA)

<CMDA>	1 byte Binary

CMDA definition:
- 0 = Completed or Done
- 1 = Command does not exist
- 2 = Cannot perform now
- 3 = PPID does not exist
- 4 = Invalid PPID
- 5 = Lot queue full
- 6 = Repeat Lot

S3, F13 Material ID Send

L,2

<PTN>	1 byte Binary (default = 1)
<MID>	ASCII (16 bytes max.)

S3, F14 Material ID Acknowledge

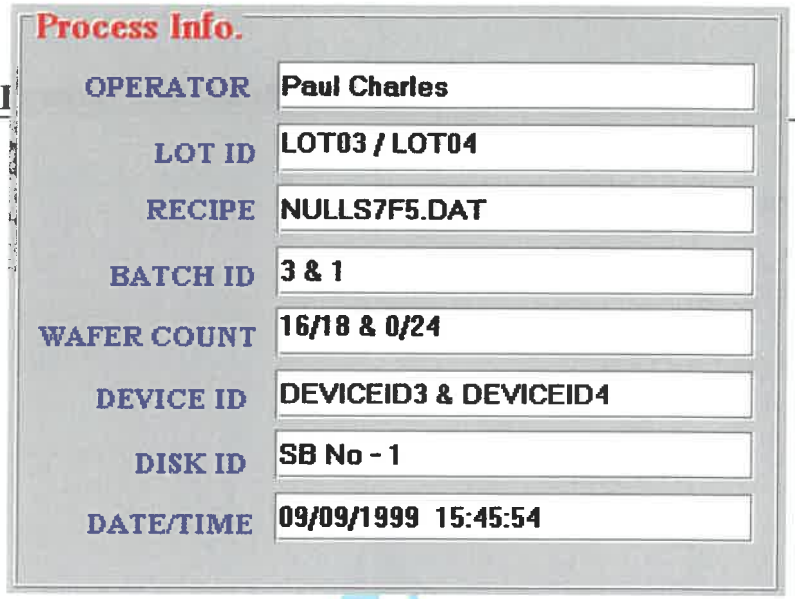
<MIDAC>	1 byte Binary (0 = command accepted)

4.3 Additional remarks for the MM4

Matrix Mode 4 is one of the operating modes of DataFlow controller. In this mode, DataFlow controller computes and provides batch and lot queue management information to machine operator and automation host on behalf of AT-4 controller. Using this mode, the host can instruct DataFlow to process a queue of multiple lots using the same recipe.

In Matrix Mode 4, DataFlow controller will compute the number of wafers allowed for each batch according to the wafer size specified by the Host. It will compute and report to operator the numbers of processed wafers and total wafers in each lot, the sequential index number(s) of the batch currently being processed, and the lot number(s) currently processed, as illustrated in the figure below. Such information is shown in an operator screen (DataFlow Main Screen shown below).

The **LOT ID** field shows which lot is being processed. The **BATCH ID** field shows the processing batch indices for the currently processed lot(s). The **WAFER COUNT** field shows the completed wafer counts over total wafer counts within the lot(s). When a batch contains wafers from multiple lots, multiple LOT IDs and BATCH IDs are shown, where different BATCH IDs indicate different counting indices of the same batch in different lots.



In order to set up a lot queue, the Host must provide, through SECS II message (S2F27), the following information for each lot in the lot queue: number of wafers, Lot ID (mid), and recipe name (ppid). The lot queue can hold up to four lots at a time. Additional lots can be added into the queue when the slots in the queue become available after some lots have been processed. For example, the host can move the fifth lot into the lot queue when the first lot is completed and the sixth lot into the lot queue when the second lot is completed.

In addition to operator screen information, DataFlow controller also notifies the host with batch completion, batch start and lot start events via SECS messages (S5F1). At each batch completion, a process variable snapshot message (S6F9) is sent to the host. The snapshot message includes the corresponding LOT ID(s) as well as process variable snapshots.

All information contained in the snapshot message and operator screen is archived in snapshot history files. When a batch contains wafers from more than one lot, each batch and lot combination has its own file.

4.4 Sample of the SECS format

```
* Are You There
S1F1 W .

* On Line Data
S1F2
        <L [2]
        <A 'HOST00' >
        <A '930622' >
        > .

* Selected Equipment Status Request
S1F3 W
        <U1 126>. *Implant status
S1F3a: 'S1F3' W
        <U1 25 33 37>. *Dose, Beam Energy, Interruptions
S1F3b: 'S1F3' W
        <L
                <U1 27> *Wafer Size
                <U1 116> *Vapor switch
        >.
S1F3c: 'S1F3' W
        <U2 [0]> .              *For all SVs.

* New Equipment Constant Send

S2F15A: 'S2F15' W
<L [4]
        <L [2]
                <U1 2>
                <U1 255>
        >
        <L [2]
                <U1 3>
                <U1 0>
        >
        <L [2]
                <U1 5>
                <U1 0>
        >
        <L [2]
                <U1 6>
                <U1 0>
        >
> .
```

```
S2F15B: 'S2F15' W
<L [4]
        <L [2]
                <U1 2>
                <U1 25>
        >
        <L [2]
                <U1 3>
                <U1 1>
        >
        <L [2]
                <U1 5>
                <U1 1>
        >
        <L [2]
                <U1 6>
                <U1 1>
        >
> .

S2F15C: S2F15 W
<L [1]
        <L [2]
                <U1 2>
                <U1 15>
        >
> .

S2F15D: S2F15 W
<L [1]
        <L [2]
                <U1 3>
                <U1 0>
        >
> .
```

* New Equipment Constant Acknowledge

```
S2F16
        <B 0> .
```

* Reset/Initialize Send

```
S2F19: S2F19 W
        <U1 1>.
```

```
* Remote Command
S2F21A: S2F21 W
        <U1 1>.
S2F21B: S2F21 W
        <U1 7>.
S2F21C: S2F21 W
        <U1 8>.
S2F21D: S2F21 W
        <U1 10>.
S2F21E: S2F21 W
        <U1 11>.

*Remote Command Ack
S2F22
        <U1 0>.

*String Diagnostic Request
S2F25a: 'S2F25' W
        <B 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F>.

S2F25b: 'S2F25' W
        < B     0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07
                0x08 0x09 0x0A 0x0B 0x0C 0x0D 0x0E 0x0F
                0x10 0x11 0x12 0x13 0x14 0x15 0x16 0x17
                0x18 0x19 0x1A 0x1B 0x1C 0x1D 0x1E 0x1F
                0xF0 0xF1 0xF2 0xF3 0xF4 0xF5 0xF6 0xF7
                0xF8 0xF9 0xFA 0xFB 0xFC 0xFD 0xFE 0xFF> .


* Initiate Processing Request
S2F27A: 'S2F27' W
        <L [3]
                <B 0>           *PTN: 1 byte Binary (will always be 0 when non AT4 mode)
                <A 'NULLS7F5.DAT   '>           *Recipe name.(16 bytes max.)
                <L
                        <A 'LOT01          '>           *Lot ID.(16 bytes max.)
                        <A 'OPERATORID     '>      *(16 bytes max.)
                        <U2 1>                          *Batch ID. (suggest 1)
                        <U2 24>                         *Wafer count.
                        <U2 6>                          *Wafer size.
                        <A 'DEVICEID1      '>       *(16 bytes max.)
                >
        > .
S2F27B: 'S2F27' W
        <L [3]
```

```
                <B 0>
                <A 'NULLS7F5.DAT   '>          *Recipe (16 bytes max.)
                <L
                        <A 'LOT02        '>    *Lot ID.(16 bytes max.)
                        <A 'OPERATORID   '>
                        <U2 1>                 *Batch ID. (suggest 1)
                        <U2 22>                *Wafer count.
                        <U2 6>                 *Wafer size.
                        <A 'DEVICEID2    '>
                >
        > .

* Initiate Processing Acknowledge
S2F28
<U1 0> .

* Material ID Send
S3F13A: S3F13 W
        <L [2]
                <B 1>
                <A 'LOT01'>
        > .

* Material ID Acknowledge
S3F14
        <B 00> .
* Formatted Material Status Transfer Request
S3F67A: 'S3F67' W
        <U1 1> .
S3F67B: 'S3F67' W
        <U1 2> .
```

Note:

1) - Request messages: H ---> E
S3F67 W: <U1 1> Cassette status table (MAPID=1).
S3F67 W: <U1 2> Spindle wafer map (MAPID=2).

2) - Reply messages: E ---> H
2.1) - S3F68

```
<L
        <U1 1>                  MAPID = 1.
        <L
                <U1 0 0 0 0 1 1 1 1>  CCST1...CCST8 (See below)
                <L
                        <A  MID1 Material ID >
                        <A  MID2 Material ID >
                        <A  MID3 Material ID >
                        <A  MID4 Material ID >
                        <A  MID5 Material ID >
                        <A  MID6 Material ID >
```

```
                                    <A  MID7 Material ID >
                                    <A  MID8 Material ID >
                                >
                        >
                        <U1 0>     DPSS Dummy Product Switch Status.
                >.

                CCST = 0:    No cassette present.
                CCST = 1:    Empty cassette present.
                CCST = 2:    Cassette partialy loaded or unloaded.
                CCST = 3:    Full Cassette;

                DPSS = 0:    Product.
                DPSS = 1:    Dummy.
                DPSS = 255:  Not yet available from AT4.

2.2) - S3F68
        <L
                <U1 2>     MAPID = 2.
                <L
                        <A    MID1>: Material ID for MIDC = 1.
                        <A    MID1>: Material ID for MIDC = 2.
                        <A    MID1>: Material ID for MIDC = 3.
                        <A    MID1>: Material ID for MIDC = 4.
                >
                <L
                        <CASN1...CASNn>          n = 10 for 5" disk.
                        <MIDC1...MIDCn>          n = 10 for 5" disk.
                        <SLOTN1...SLOTNn>        n = 10 for 5" disk.
                >
        >.

        CASN:  Cassette number: n = Number of pad in disk.
        MIDC:  Material ID code:n = Number of pad in disk.
        SLOTN: Slot number ( 1 < SLOTn < 25).
```

```
* Material ID Request Ack.
S3F72A: 'S3F72'
        < L [2] < B 1> < B 0 >> .
S3F72B: 'S3F72'
        < L [2] < B 1> < B 1 >> .

* Material ID Send
S3F73A: 'S3F73' W
        <L [2]
                <B 01>
                <A 'LOT01'>
        > .
* Stream 4 Abort
S4F0 .

S4F1: 'S4F1'
< L [2] < B1> < A ' '>> .

S4F3: 'S4F3'
< L [2] < B1> < A ' '>> .

S4F5: 'S4F5'
< L [2] < B1> < A ' '>> .

S4F7: 'S4F7'
< L [2] < B1> < A ' '>> .

S4F9: 'S4F9'
< L [2] < B1> < A ' '>> .

S4F11: 'S4F11'
 < L [2] < B1> < A ' '>> .

S4F13: 'S4F13'
 < L [2] < B1> < A ' '>> .

S4F15: 'S4F15'
 < L [2] < B1> < A ' '>> .

S4F67: 'S4F67'
< L [2] < B1> < A ' '>> .

S4F69: 'S4F69'
< L [2] < B1> < A ' '>> .

S4F72A: 'S4F72'
```

```
<L [2]
        <U1 1>
        <U1 0>
>.
S4F72B: 'S4F72'
<L [2]
        <U1 2>
        <U1 0>
>.

S4F74A: 'S4F74'
<L [2]
        <U1 1>
        <U1 0>
>.
S4F74B: 'S4F74'
<L [2]
        <U1 2>
        <U1 0>
>.
S4F74C: 'S4F74'
<L [2]
        <U1 5>
        <U1 0>
>.
S4F74D: 'S4F74'
<L [2]
        <U1 6>
         <U1 0>
>.
S4F74E: 'S4F74'
<L [2]
        <U1 7>
         <U1 0>
>.
S4F74F: 'S4F74'
<L [2]
        <U1 8>
        <U1 0>
>.

* Alarm Report Acknowledge
S5F2
        <B 0> .

* Enable/Disable Alarm Send
```

```
S5F3 W
        <L [2]
                <B 80>
                <U2 1>
        > .


* Enable/Disable Alarm Acknowledge
S5F4
        <B 0> .

* Multi-block data send enquire
S6F5 W
        <L
                <U1 2>
                <U2 824>
        > .

S6F6
        <B 0> .

S6F10
        <B 0> .

* Process Program Load Inquire
S7F1 W
        <L
                <A 'TESTS7F5.DAT '>
                <I2 511>
        >.
S7F1a: S7F1 W
        <L [2]
                <A 'AVLSI1.DAT'>
                <U2 512>
        > .

* Process Program Load Grant
S7F2
        <B 0> .
```

```
* Process Program download to test recipe (TESTRCP.DAT) uploaded with S7F5
        S7F3a: S7F3 W
          <L
           <A 'TESTS7F5.DAT    '>
            <B 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
               20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
               20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
               20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
```

```
   20 20 20 20 30 41 20 00 00 41 A0 00 00 41 F0 00 00 42 20
   00 00 42 48 00 00 42 70 00 00 42 8C 00 00 42 A0 00 00 43
   9B 00 00 43 A0 00 00 43 A5 00 00 43 AA 00 00 43 02 00 00
   43 0C 00 00 43 66 00 00 43 70 00 00 43 7A 00 00 43 82 00
   00 43 87 00 00 43 8C 00 00 43 91 00 00 43 96 00 00 48 DB
   BA 00 48 E0 9C 00 3E 19 99 9A 3E 23 D7 0C 43 AF 00 00 43
   B4 00 00 43 B9 00 00 43 BE 00 00 43 C3 00 00 43 C8 00 00
   47 D6 D8 01 47 EA 60 01 3D B8 51 ED 3D CC CC CD 48 4D 14
   01 48 56 D8 01 3E 42 8F 5E 3E 4C CC CD 3E D1 EB 87 3E D7
   0A 3F 3E DC 28 F6 3E E1 47 B0 43 EB 00 00 43 F0 00 00 3E
   FA E1 48 3F 00 00 00 58 63 5F A9 58 63 5F A9 3A 03 12 6F
   3B 23 D7 0B 40 80 00 00 40 80 00 00 40 00 00 00 41 A0 00
   00 3F 80 00 00 41 70 00 00 3F 80 00 00 41 70 00 00 41 F0
   00 00 42 0C 00 00 42 04 00 00 42 30 00 00 47 9C 40 01 47
   EA 60 01 36 06 37 BD 38 BC BE 62 33 D6 BF 95 38 51 B7 17
   33 D6 BF 95 3A 1D 49 52 BF 80 00 00 BF 80 00 00 BF 80 00
   00 BF 80 00 00 37 A7 C5 AC 37 A7 C5 AC 37 FB A8 82 38 12
   CC F7 41 C0 00 00 41 C0 00 00 BF 80 00 00 BF 80 00 00 3F
   80 00 00 3F 80 00 00 BF 80 00 00 BF 80 00 00 BF 80 00 00
   BF 80 00 00 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
   FF 00 00 00 00 00 00 00 00>
>.
```

* Process Program Acknowledge
S7F4
        <B 0> .

* Recipe Upload to Host
S7F5A: 'S7F5' W
        <A 'nwell1.000'>.
S7F5B: 'S7F5' W
        <A 'small.dat'>.

* Matrix Mode Select Send
S7F15a: S7F15 W
        <B 1> .
S7F15b: S7F15 W
        <B 2> .
S7F15c: S7F15 W
        <B 3> .
S7F15d: S7F15 W
        <B 4> .

* Matrix Mode Select Acknowledge
S7F16
        <B 00> .

*Terminal display.
S10F3
        <L [2]
                <B 1>
                <A 'Comes from the server, the dataflow display the message...'>
        >.