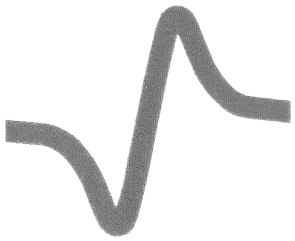

MPS User's Manual

Stopped/Quenched Flow Module - MPS V 1.16 software manual

Table of Contents

1. Introduction

This chapter contains the MPS software description. The MPS software drives the SFM-2/S, SFM-3/S, SFM-3/Q, SFM-4/S, SFM-4/Q, QFM-5 and SFM-5/C devices on manual and automatic mode.
This software runs under WINDOWS 3.1x and WINDOWS 95 operating systems.

2. Installation

You must have the following material :

- A stopped-Flow or Quenched-Flow device of the following model : SFM-2/S, SFM-3/S, SFM-3/Q, SFM-4/S, SFM-4/Q or QFM-5. These instruments have to be driven by the MPS-51/W model power supply.
- A PC computer 386 or preferably 486 grade with WINDOWS 3.10 or 3.11 installed.

Installation steps

1 - Connect the MPS-51/W power supply to one of the serial port of the computer (COM 1, 2, 3 or 4)
2 - Load WINDOWS
3 - Run the MPS setup program :
  - Insert the MPS disk in drive A:
  - Choose **File** then **Execute** in the WINDOWS menu
  - Answer A:SETUP.EXE in the dialogue box
4 - Alternatively use the file manager and click on A:SETUP.EXE

The installation creates a MPS group, with the MPS program icon inside. Double click on the program icon (figure 1) to run the software.

Figure 1

3. General presentation

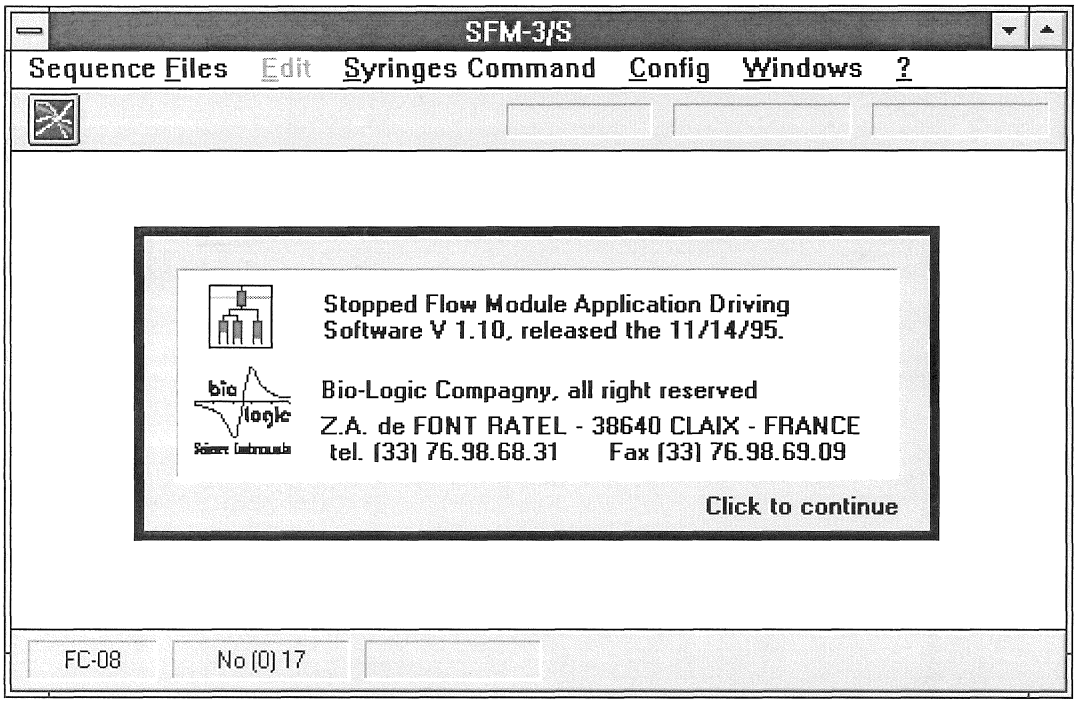

Figure 2 : MPS Software menu

Note : In all examples that follows, is shown the SFM-3/S configuration that drives the SFM-3/S device. The general window header displays the device name : "SFM-3/S". This will be entirely similar for other configurations.
The features that are configuration specific will be indicated in the text.

After a few seconds, or if you start working, the initial panel clears by itself. If you want to display it again, click on **?** in general menu. The others commands are the followings :

Sequence Files, New/Load/Save and **Save As...** : manage sequence files. The file format of former DOS version of the driver software can be read, but they will be saved in the new format only.

Print : prints the file name, the sequence file, the syringes contents, the comments and the selected delay lines and cuvette (if any), on the default printer (selected from the printer manager of Windows).

Exit : exit program (you can also exit the program by a double click in the main window upper left corner).

Edit, Cut/Copy/Paste : used to edit the Program sequence (only available if a program sequence is loaded).

Insert/Remove Phase : used to add or remove the Program sequence(s) (only available if a program sequence is loaded). The maximum number of columns (phases) is limited to 20.

Syringes Command, Load : Load the Syringes Command window.

Config : Displays the configuration windows :

Devices : Select the device that will be used .

Syringes : Syringe model installation

Cuve : Cuvette installation (Stopped-Flow Only, this installation has no effect on the run parameters, it is used only to give the user an estimation of the dead-time).

Serial Port : Used to select a serial port and establish the connection with MPS-51/W device.

Limits : Used to set speed limits for each syringe and also the valve or hard-stop lead.

Windows, Cascade/Tile : arrange the Syringes Command and Program windows.

4. Configuration and Installation

Before using the MPS software, you must configure it correctly to your own device, syringes, cuvette (if you have a Stopped-Flow Module), serial port, and limits.
This configuration and files directories are saved in the WINDOWS 3.10 WIN.INI file. This configuration will then be used again at each load of the MPS program unless you decide to change this configuration.
Note : All configuration's windows are modal, i.e. once they are loaded you do not have access to the main program window. To unload them click on OK or Cancel buttons or in the upper left corner.

4.1. Device

Choose **Config, Device** to load the Config Device window (figure 3). Click on the appropriate device or use the keyboard arrow keys to move the selection. Then click on the OK button to validate the selection, Cancel to abort. Double click on the list name selects the device and validate the choice directly. For Quenched-Flow Modules the Hard-Stop option is not available. For Stopped-Flow Module check the Hard-Stop option to use a hard-stop.
The selected device is displayed as the application title (see figure 0, page 3, where the SFM-3/S device was selected).

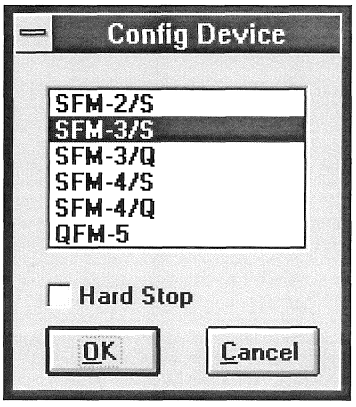

Figure 3

Note 1: Because hard-stop and collect valves are using the synchro 2 output of the MPS-51/W, the synchro 1 only will be available in the quenched-flow mode or in the stopped-flow mode with a hard-stop option selected.
Note 2 : If the-hard stop option is checked, "Hard-Stop" will be written in the status panel (see figure 9).

Note 3 : If both MPS and Bio-Kine softwares are loaded, changing the current device (into MPS) will cut the link between the two softwares (see 5.6. Link with Bio-Kine software, page 15). Then the two applications have to be stopped and restarted to establish the link again.

4.2. Syringes

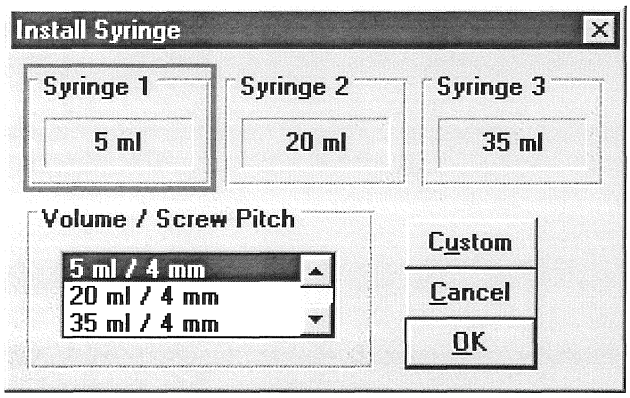

Figure 4

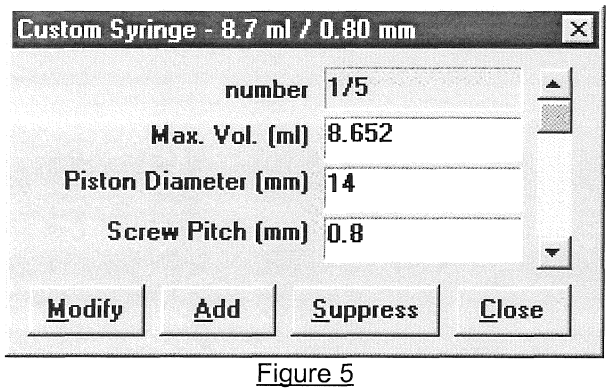

Figure 5

Choose **Config, Syringes** to load the Install Syringe window (figure 4). Click on the syringe frame (or use <key left> and <key right>) to select the one you want to modify. Then choose its volume with the mouse or with the arrow keys.

The following syringes are available :
For SFM-*/* :
5 ml (piston diameter 8 mm)
20 ml (piston diameter 17 mm)
35 ml (piston diameter 22 mm)
For QFM-5 :
4 ml (piston diameter 10 mm)
8 ml (piston diameter 14.1 mm)
Note : with keyboard, use <Tab> to change the focus between syringes frames, volume and buttons.

Nevertheless we can make special syringes on customers needs. To enter these customs syringes, click on the **Custom** button, this will load the custom syringe window (see figure 0). Then click on the **Add** button to define a new syringe, enter the volume, piston diameter, the screw pitch and validate with the **Modify** button.

4.3. Cuvette

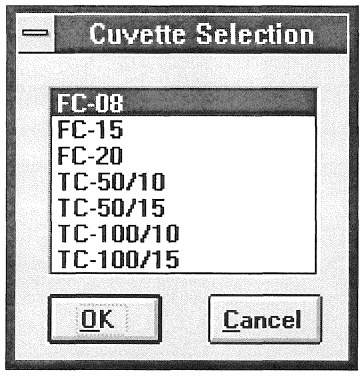

Figure 6

If you have a Stopped-Flow Module choose **Config, Cuve** to load the Cuvette selection window (figure 6). Double click on the cuvette you want or select it in the list and click on the OK button.

This choice will have no effect on the driving sequence. It will only be used to give an estimation of the dead time in the last running phase of the stopped-flow (see figure 13 page 11).
Note 1 : the selected cuvette will be displayed into the main window state panel (see figure 0, page 3).
Note 2: the cuvette used will also be recorded in the comment section of the file recorded by Bio-Kine software.

4.4. Delay lines

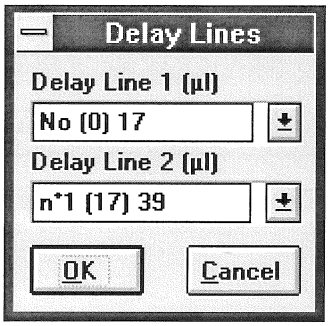

figure 7

For devices others than SFM-2/S and SFM-5/C, it is possible to load the Delay line window. SFM-3/S and SFM-3/Q devices, have only one delay line, but for SFM-4/S, SFM-4/Q and QFM-5 devices there are 2 delay lines. Choose **Config, Delay Line** to load the delay line window (figure 7). Selecting the delay lines has no effect on the driving sequence. The delay line information is used, for stopped flows devices only to calculate the **dead Time** (see the sequence program window, figure 0 page 10).

Note : the selected delay lines are displayed into the main window state panels (see figure 0, page 3).

SFM-3/S	Delay line volumes (in µl)						
Flow line number	n°1(17)	n°2 (40)	n°3 (90)	n°4 (140)	n°5 (190)	n°6 (500)	n°7 (1000)
Nominal Volume	19.43	35.83	92.39	144.28	192.6	498.68	1003.43
Mixer 1 to 2	47.4	63.8	120.4	172.3	220.6	526.7	1031.4

SFM-3/Q	Delay line volumes (in µl)						
Flow line number	n°1(17)	n°2 (40)	n°3 (90)	n°4 (140)	n°5 (190)	n°6 (500)	n°7 (1000)
Nominal Volume	19.43	35.83	92.39	144.28	192.6	498.68	1003.43
Mixer 1 to 2	43.8	60.2	116.7	168.6	216.9	523.0	1027.8

SFM-4/S	Delay line volumes (in µl)							
Flow line number	no	n°1(17)	n°2 (40)	n°3 (90)	n°4 (140)	n°5 (190)	n°6 (500)	n°7 (1000)
Nominal Volume	0	19.43	35.83	92.39	144.28	192.6	498.68	1003.43
Mixer 1 to 2	25.5	43.1	59.5	116.1	168.0	216.3	522.4	1027.1
Mixer 2 to 3	31.7	47.4	63.8	120.4	172.3	220.6	526.7	1031.4

SFM-4/Q	Delay line volumes (in µl)							
Flow line number	no	n°1(17)	n°2 (40)	n°3 (90)	n°4 (140)	n°5 (190)	n°6 (500)	n°7 (1000)
Nominal Volume	0	19.43	35.83	92.39	144.28	192.6	498.68	1003.43
Mixer 1 to 2	25.5	43.0	59.4	116.0	167.9	216.2	522.3	1027.0
Mixer 2 to 3	27.6	43.7	60.1	116.7	168.6	216.9	523.0	1027.7

QFM-5	Delay line volumes (in µl)				
Flow line number	n°1	n°2	n°3	n°4	n°5
Nominal volume	7	20	50	100	200
Mixer 1 to 2	19	32	62	112	212
Mixer 2 to 3	24	37	67	117	217

4.5. Serial Port

The communication with the MPS-51/W device is established in a two-step procedure. Firstly, a serial port is opened. Secondly, if the serial port communication is possible, a signal is send through the port and the connected device will give an answer. If the answer is correct the communication is established. After connection has been established, the computer will send messages to MPS-51/W device at regular time intervals (55 ms) to check the communication continuously. So if the answer is not correct (MPS-51/W turned off or any other event) the computer will inform the user of the defect (in status panel, see figure 9).

Upon program loading the communication is not established. The program attempt to open the communication automatically by itself when this becomes necessary (i.e. to use manual mode or run a sequence). The user also has the possibility to open and test the connection, in particular to select the active serial port at the first loading of the program or for any change in configuration of the microcomputer :
choose main menu, **Config, Serial Port** to load the Config Serial Port window (see figure 8)

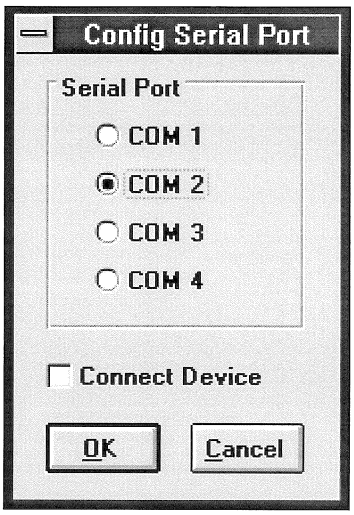

Figure 8

- Select a serial port (without checking "Connect Device"), and click on OK button. This will attempt to open the serial port. If the operation succeeds the port number is written in the status panel, (see figure 9), if it fails : "error port" is written.
- If the serial port is opened, then click on "Connect Device" to check the option, and click on OK button (or press <Enter> on keyboard) to establish communication with MPS-51/W device. If the operation succeeds, "MPS On Line" is written in status panel.(see figure 9)
Note 1 : Config Serial Port window is unloaded when connection is established (or if the user click on upper left corner, or on Cancel button or press <Esc> key).
Note 2: If program the program fails in attempting to establish connection by itself, a message will be displayed and the Config Serial Port panel will show (see figure 8) to allow user to change or check the serial port.

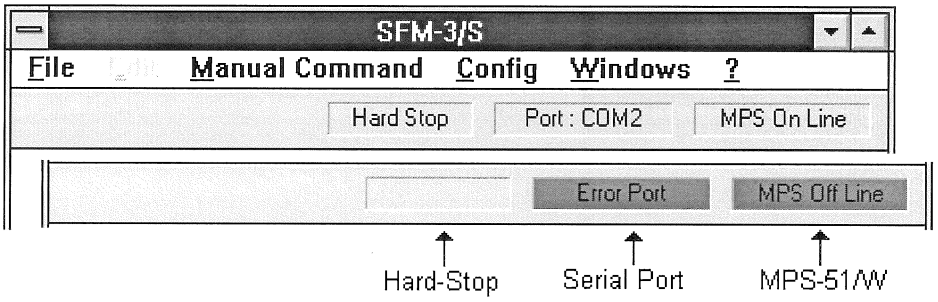

Figure 9 :
Status panel

4.6. Limits

Choose **Config, Limits** to load the Limits window. This panel permits the user to change the limits of flow-rate that can be programmed in the AUTOMATIC MODE. Default values of the low and high flow-rate are automatically set when installing a new syringe model (see figure 4 page 5) or when clicking on "Default values". Other upper and lower flow rate may be entered by the user within values that can be accepted by the software. This panel allow also the setting of the Valve lead (hard-stop lead for Stopped-Flow, Collect valve lead for Quenched-Flow modules) and acceleration phases (see the acceleration phases paragraph for explanations on this subject).

- Valve Lead (for hard-stop or collect valve lead) values must be within [1 to 5 ms]. The default value is 3 ms.
- Flow rate high and low limits depends on syringes type. Absolute limits are as follows :
SFM-*/* :
in [0.01 ; 2.094 ml/s] for 5 ml syringe
in [0.044 ; 9.457 ml/s] for 20 ml syringe
in [0.073 ; 15.838 ml/s] for 35 ml syringe
QFM-5 device :
in [0.03 ; 5 ml/s] for 4 ml syringe
in [0.06 ; 10 ml/s] for 8 ml syringe

Note 1 : Attempts to enter an out of range limit (for example 0 or 100 ml/s) will generate the display of a message and the return to default values.

Note 2 : In fact all motors have the same limit speed in term of µs by µ steps (high speed corresponds to 57 µs / µ step, low speed limit to 6553 µs / µ step). This gives different values in ml/s because of the differences in the syringes cross sections (see figure 4 page 5).

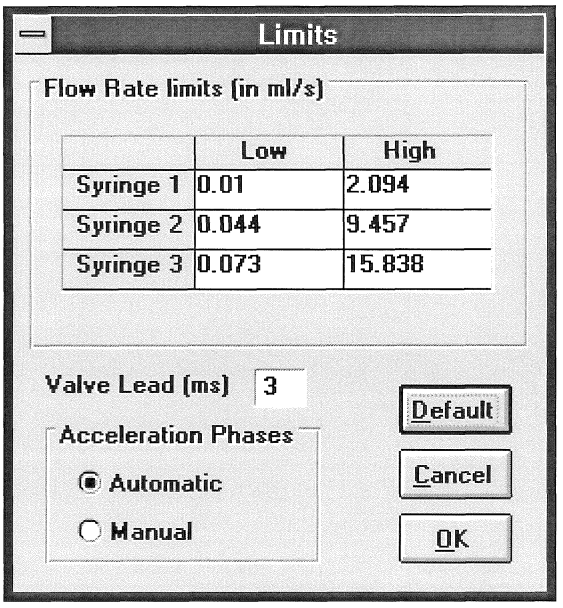

figure 10

4.7. Manual control of the syringes

Once the configuration has been made, it is possible to drive the MPS-51/W device in the manual or automatic mode. Thus manual mode will be used to fill and empty the syringes manually, the automatic mode will be used to run the actual stopped-flow experiment.

From the main menu choose **Syringes Command, Load** (Click on main menu or press **<Alt>** + **<S>, <L>**). This will load the Syringes Command window (figure 11) and establish connection with MPS-51/W device if it was not done before.

Note 1 : If the connection fails, the Serial Port window (see figure 8 page 7) will be loaded. If the communication can then be established, the Syringes Command window will show. In case of unsuccess verify the serial port number or verify that MPS-51/W device is turned on and connected correctly.
Note 2 : If the communication becomes interrupted during the course of the experiment the Syringes Command window will be unloaded.
Note 3 : In absence of connection with the computer (or with the PC turned-off), the MPS-51/W unit is automatically set in the manual mode. It is therefore possible to drive the syringe and wash the instrument without being connected.

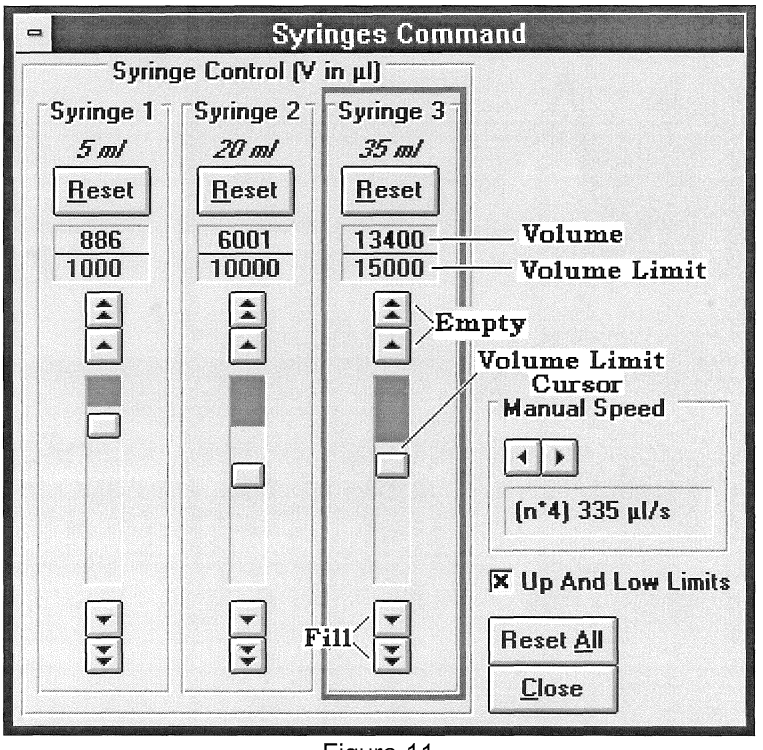

Figure 11

From the Syringes Command window, it is possible to :
- select the active syringe
- execute syringes reference
- fill or empty the syringes
- change the manual speed

The motors can be also controlled directly from the MPS-51/W front panel.

To select the active syringe : Click on the corresponding frame, or press **<Left>** or **<Right>** arrows keys on keyboard, or use MPS-51/W front panel switch. The new selected syringe appears surrounded with a red rectangle (for exeample on figure 11, syringe 3 is selected).

To fill/empty a syringe : Click on ▲, ⏫, ▼ and ⏬ buttons with the mouse or press **<Up>**, **<PageUp>**, **<Down>** and **<PageDown>** keys on the keyboard. ▲ and **<Up>** arrow move the piston upwards by one elementary movement. ⏫ and **<PageUp>** arrow move the piston upwards by larger steps (10 elementary movement). By the same way ▼, **<Down>**, ⏬ and **<PageDown>** move the piston downwards. Maintaining the key or the mouse button down will continue the mouvement until the key or the button is released.
It is also possible to use the MPS-51/W front panel to move the syringes pistons.

Volume Limit : an upper limit can be set for all the syringes volumes. Then, if **Up And Low Limits** is checked, the piston can only be running within 0 µl and this limit. If unchecked the piston can be moved outside these limits.
The default volume limit corresponds to the maximum syringe contents. It can be changed by dragging the volume limit cursor, or directly by typing its value into the volume limit panel (see figure 11) and validate with the **<Enter>** key.
Warning : if you are filling syringes with Up an Low limits option unchecked, or from the MPS-51/W front panel the piston may be pulled out of the syringe. This may result in a loss of the syringe contents.
Note : when the focus is on a Volume Limit Panel the **<Left>** and **<Right>** keys are moving the cursor within this panel and do not change the active syringe. Samely the other shortcurts are not available. The **<Enter>** key must be hit (to validate the limit) so that the focus will be set on the Syringes Command window again (and then the shortcuts will be active). Nevertless it is possible to change the active syringe when the focus is on a volume limit panel with the **<Tab>** and **<Shift>** + **<Tab>** keys.

Manual Speed : Click on ◀ and ▶ buttons, or type the speed number (1, 2, 3, 4 or 5) to change the manual speed. The mechanical speed setting is the same for all the syringes. However, the display shows the speed in flow rates that depends on the syringes cross section.

4.8. Syringes Initialisation

The microprocessor of the MPS-51/W integrates the syringes movement, so that the actual residual volumes of each of the syringes can be displayed continuously on the screen. In order for these displayed volumes to be accurate the syringe positions have to be initialised (referenced) at start-up, or eventually during syringe refilling. To do this select the syringe to be initialised and raise its plunger (with the Up and Low Limits unchecked) UNTIL THE SYRINGE REACHES ITS UPPERMOST POSITION. There is no real danger in raising the plunger to the very end. Once hitting the end of its course, the motor will oscillate and vibrate; as it becomes out of phase with the driving pulses, it will completely lose its torque. (There is however, no reason to unnecessarily prolong this treatment). Stop the motor and click on the **Reset** button or press **<Alt>** + **<r>** (answer OK to confirming message). This will set to zero the volume of the active syringe. To do all syringes references, click on the **Reset All** button or press **<Alt>** + **<a>**.

4.9. Filling the syringes

Utmost care should be exercised during this operation. Normal operation of the system requires that no bubbles be present in the injection syringe : should this occur, the buffer flow through the observation chamber will not be controlled correctly by the plunger movement.

The syringes can be driven and refilled independently in the manual mode. Filling may be performed with disposable plastic syringes inserted into the filling port. Filling is performed with the valves pointing to the (**R**) labels.

While refilling, exert a gentle manual pressure on the plunger of the reservoir syringe. This will prevent a negative pressure in the reservoir during pumping, witch could result in bubble formation.

Bubbles in the drive syringes may be eliminated simply by driving the drive syringe up and down several times when they are connected to the reservoir. One or two shots in the observation cuvette will then be

sufficient to definitively eliminate any bubbles remaining in the valves and the mixer. In all cases, it is strongly recommended that buffers be degazed and filtered.

IMPORTANT!

Take precaution when not all syringes are used :

-The mixing has to occur in the last mixer, so use the latest syringes is mandatory-

The unused syringes and their flow lines should be filled with buffer as carefully as the other syringes. After filling and washing the flow lines, turn the valve of the unused syringes to the (C) position (cuvette), and make a few manual pushes in the upward direction to ensure that the flow line between the valve and the mixer is correctly filled with buffer. Turn the valve back to the (R) position.

The Stopped Flow/Quenched Flow Module is ready for operation.

5. Automatic mode

Choose **Sequence File, New** to load the sequence program window (see figure 12).

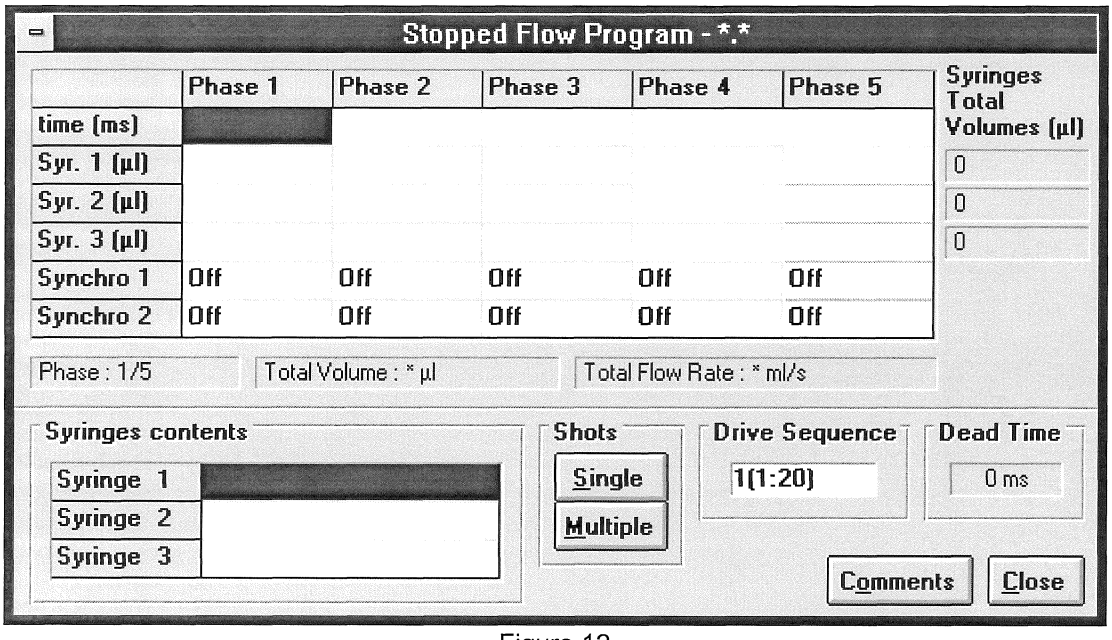

Figure 12

Note : the configuration is SFM-3/S without hard-stop in this example (see figure 3 page 4 for configuration). For another configuration, you may encounter some differences :

- SFM-n/S without hard-stop : n syringes, and 2 lines for synchronising pulses.
- SFM-n/S with hard-stop : n syringes, and one line of synchronising pulse.
- SFM-n/Q : n syringes, a collect valve control line and one line of synchronising pulse.
- QFM-5 : 5 syringes and one line of synchronising pulse.

For the quenched-flow modes (SFM-*/Q and QFM-5) a drive sequence setting will be displayed (see next chapter macro sequences)

For the stopped-flow mode only, an evaluation of the dead time in the last driving phase is displayed. This evaluation will be accurate provided the correct cuvette has been selected (see next chapter)

5.1. Creating a program sequence

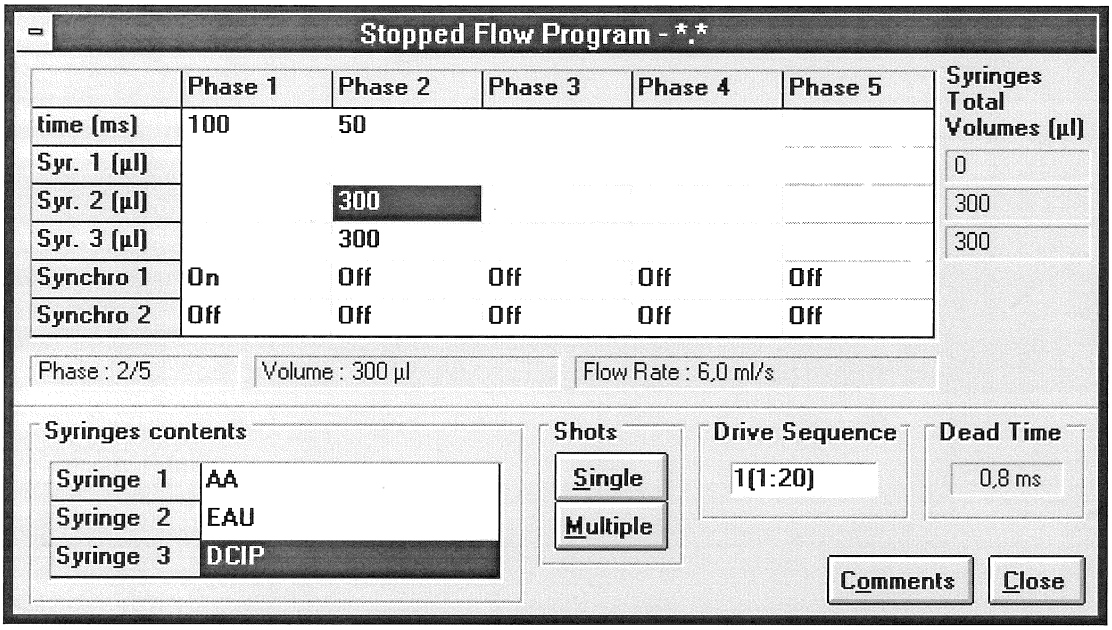

Figure 13

The program sequence is divided into different phases, like in a spreadsheet grid. Each active phase has to given a time duration on the first line. The volume delivered by each of the syringes during each phase are entered in the other lines. The units are milliseconds for the duration and microliters for the volumes. To enter times and volumes, select the corresponding cell (click on it or use the keyboard arrows keys), press ENTER to edit, change value, and validate with ENTER again. Use BACKSPACE for correction and DEL key to clear a value. To change the synchros labels type the letters "o" to write "On" and "f" (or any other letter) to write "Off" into a synchro cell. Identically type "c" or "w" to write "Collect"/"Waste" into Quenched-Flows sequences.
Cut/Copy and **Paste** operations operations inside the sequence program grid are available through main menu **Edit**. This menu permits the cut and paste operations within the MPS program but also between the MPS program and most usual spreadsheet (like EXCEL, LOTUS 1.2.3, ...). To perform a copy/paste operation, select the area to be copied or cut by mouse dragging or push **<Shift>** + arrows key. Then choose **Edit, Copy** or **Cut**. This will store the selection into the Windows clipboard. To paste the clipboard content back onto the grid, select the paste area with the mouse and choose **Edit, Paste**. If the copy area is bigger than the paste area, the operation is done only for values that can fit inside the paste area, else the copy will be complete.

The default size of the grid (with **Sequence File, New** command), is of 5 phases. This is also the minimum number of phases. It is possible to add new phases up to a maximum of 20 phases. To do so, select the position of insertion of the new phase and use **Edit, Insert Phase**. This will add the new phase before the selection. In the same way, use **Edit, Remove Phase** to remove the selected area.
Note 1 : blank and not numeric values are considered as zero values.
Note 2 : If one phase time is set to zero, this phase will not be executed in the sequence run, whatever is the volume entered.

Each time a cell of the current program grid is changed. New information on the current syringe or on the current phase is displayed below and to the right of the grid :

- current phase number and total phases number
- volume delivered by the current syringe during the current phase, or current phase total volume.
- flow rate delivered by the current syringe during the current phase, or current phase total flow rate.
- total volume for the drive sequence for each syringe.

The contents of the syringes can be entered and edited from the keyboard in the Syringes Contents frame by the same way as times ands volumes.

Additionnaly, comments can be entered by clicking on the Comments button. This will open the next widow (figure 1), that allow comments edition. Click on the OK button to validate comments. Then the comments will be saved into the file at the File, Save or File, Save As... command.

Figure 1

For the Stopped-Flow Modules only, an indication of the **dead time** is displayed. This value is calculated for the last valid phase, according to its flow rate and of the cuvette dead volume.

A **macro sequence** with phases repetitions can be programmed. The user can edit this macro sequence to run the phases or run repetition of phases in a different order that of the grid. The syntax is described below :

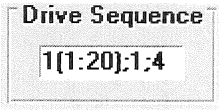

Figure 14

The drive sequence is a suite of single sequences, separated by ";" characters, and has the following syntax :

<Drive sequence> = <Single sequence>; <Single sequence>; ...

<Single sequence> = p or n(p:q)

Values within < and > are symbolic names, p and q are phases numbers and n the number of repeat of phase p to q.

Examples :5;1;3 will run phases 1, 3 and 5 in the following way : 5 - 1 - 3.

2(5:9) will run two times the phases 5 to 9 in the following way : 5 - 6 - 7- 8 - 9 - 5 - 6 - 7- 8 - 9

3;1(2:5);8 will run the phases as follows : 3 - 2 - 3 - 4 - 5 - 8

By default, the drive sequence is set to 1(1:20), this correspond to a chronological order equal to the numeric order set in the grid.

5.2. Acceleration phases

With ordinary aqueous solutions, the motor can drive instantaneously the syringe at speeds up to 6 ml/s (for a 20 ml syringe) Above this speed an acceleration phase has to be added. In its default setting the MPS program creates this acceleration phase automatically each time a flow rate higher than 6ml/s is programmed.

In the example shown in the figure 14 below, a phase of 50 ms is set with a volume of 400 µl to be delivered by the syringe N°2 (flow rate of 8 ml/s). The reach this speed, program will design a short phase of 5 ms with a volume of 25 µl (6 ml/s) then followed by a phase of 45 µl and a flow of 360 µl as described in the table N°1 below.

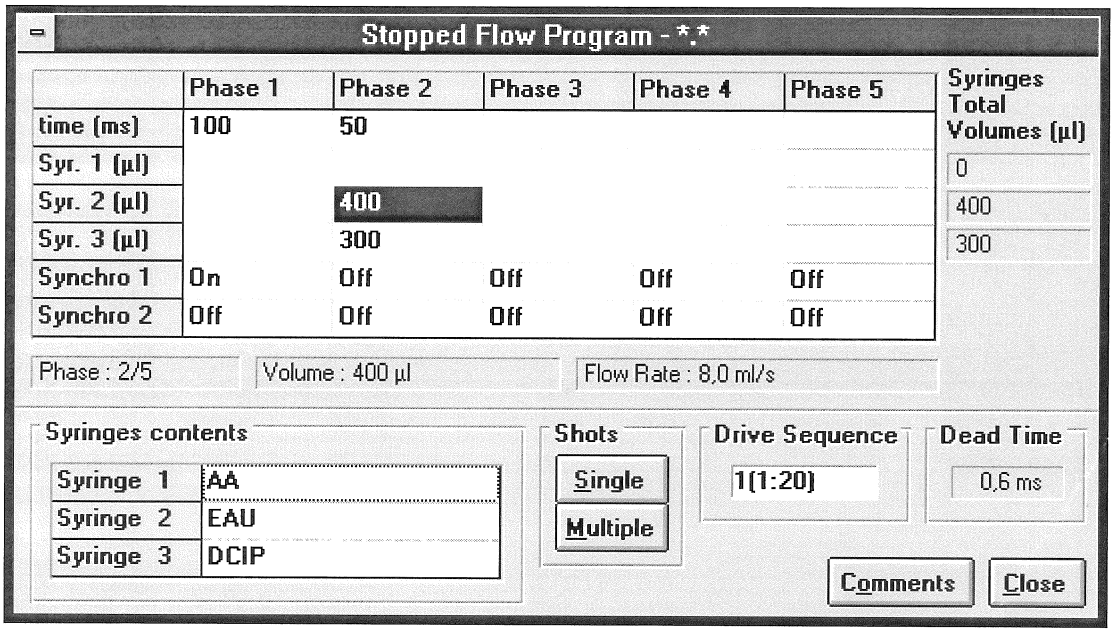

Figure 15

The effective drive sequence will be :

	Phase 1	Phase 2	Phase 3
Time	100 ms	5 ms	45 ms
Syr. 1	0 µl	0 µl	0 µl
Syr. 2	0 µl	25 µl (5ml/s)	360 µl (8 ml/s)
Syr. 3	0 µl	30 µl (6 ml/s)	270 µl (6 ml/s)
Synchro 1	On	Off	Off
Synchro 2	Off	Off	Off

Table 16

This new sequence will not be apparent on the screen, it respects the duration of 50 ms programmed by the user, this respects also the final desired flow rate of 8 ml/s, but the volume programmed will be of 385 µl instead of the desired 400 µl.. This is a little importance for stopped-flow experiments where the important parameter is the actual flow rate at the time of stop. The reduced flow rate at the initial part of the phase will have to be taken into account in quenched-flow experiments.
In case of successive phases above 6 ml/s, the automatic acceleration phase will be acting only at the first phase that has been programmed above 6 ml/s.

Note : The program cannot add an acceleration phase for phases that have a duration less than 5 ms. So MPS program will ask you to enter a higher value when you click on Run button.

The automatic acceleration phase system of the MPS program can be disabled. Load the limits window (choose **Config, Limits**) and select **Acceleration Phases, Manual** (see chapter 4.5 and figure N°9).
In this case the motor will hardly be able to sustain flow higher than 6 ml/s. The acceleration phase can however be set directly by the user. The recomended limits and the recomended flow rate in the acceleration phases are shown below:

Device	Syringe (ml)	Limit of unaccelerated flow rate (ml/s)	Flow rate in the acceleration phase (ml/s)
SFM*/*	5	1.3	1.1
	20	6	5
	35	10.1	8.4
QFM-5	4	4.1	3.5
	8	8.3	7

Table 17

Note : In all cases, **we recommend that you test any newly designed sequence using inexpensive buffer solutions** of the same viscosity as that will be used in real experiment.

5.3. Saving or loading the experimental parameters

The created sequence can be saved on files. A series of experimental conditions can thus be prepared before the experiment, and subsequently loaded while the experimental program is progressing.
Once you have edited a sequence and set the solutions name, you can save them into a file. Choose **Sequence Files, Save** or **Sequence Files, Save As...** to save sequence program, solutions names (and drive sequence for Quenched-Flow). This can be loaded back by using, **Sequence File, Load**.
Note : Files from the former DOS versions of the drive software can be loaded but the data will then be saved with a format specific of the Windows version.
To unload the Sequence window : click on **Close** button, or choose menu **Sequence File, Close**, or double click in the upper left corner of the window.
To clear values, choose **Sequence File, New** in main menu.
To load a sequence, choose **Sequence File, Load** and enter the sequence file name in the input file window.

5.4. Programmable synchronising pulses

The MPS-51/W power supply can be programmed to deliver synchronising pulses (trigger). The timing of theses pulses with respect to the drive sequence can be programmed from the Program Sequence Window . One or two pulses can be used depending on the configuration (see chapter 4). These pulse are TTL pulse (0 or 5 Volt) delivered from BNC connector on the front panel of the MPS-51/W.

The default value of the pulse is "Off" for all phases, this mean that 0 Volt will be always present on the BNC connectors. Double click on the synchro cell to change its value to "On", or move to the synchro cell with arrows key, and type "o" (or "O") on the keyboard. Double clicking again or typing any other key will reset synchro value to "Off". During the automatic run of the sequence, 5 Volt pulses will be generated from the synchro output when executing the phases set as "On". The duration of the pulse will be equal to the phase duration.

The main use of the synchronising pulses is to trigger the data acquisition at a precise time before or during the flow or at the flow stop. If the Bio-Kine software is being used for data collection, acquisition will start on the falling edge of the synchronising pulse (i.e. at the end of the first active phase set as "On"). For example, with the sequence shown on figure 15 page 12, acquisition will start at the end of phase 1 (beginning of phase 2).
Other pulses can be programmed on the same synchronising line for triggering other devices such as : flash, T-Jump etc..
For the Stopped-Flow devices, in cases where the hard-stop is disabled, a second trigger pulse can be programmed for another application.

5.5. Running the automatic mode

Once satisfying, the sequence will be transferred to the MPS-51/W unit to be executed in the automatic mode. Click on the **Shots, Multiple or Single** button. This will download the run parameters to the MPS-51/W processors. At the time of transfer, the sequence is checked for compatibility with respect to flow rate and volume limits. In case of inadequacy explicit messages will be issued for correction. The single shot button allows only one shot, that can be usefull when using radio-active solutions (for security reasons).

Before running the automatic mode, verify that the manual valves corresponding to the active syringes are set in the right position (i.e. pointing to (**C**)).

Figure 18

Program Run window is loaded (figure 18), indicating that the automatic mode is set.
This window shows the number of shots available with the current syringe contents. It also indicates whether the instrument is running a sequence or is if it is ready for the next shot.
When ready, click on the **run** button (or type <r> on the keyboard) to run the sequence. The run can also be activated from the MPS-51/W front panel, or from an external trigger signal sent to the trigger input of the MPS-51/W. In case of necessity, the sequence can be terminated by clicking on the **stop** button (or entering <s> on keyboard).
When no more shot is available (because of insufficient syringe volume, or after one shot with single shot mode), the window clears by itself and the MPS-51/W is set back in the manual mode.
This return on the manual mode can also be made by clicking on the **Exit** button.

5.6. Link with Bio-Kine software

This is possible to link the MPS software with Bio-Kine software throught the  button (that represent the Bio-Kine icon). Clicking on this button will load Bio-Kine if it is not loaded, or switch to Bio-Kine if it has already been loaded. There is a similar button (with MPS icon) into Bio-Kine (on the kinetics acquisition window) that load/switch to MPS. If MPS run sequence window is loaded, then clicking on Bio-Kine button will load a copy of these window into Bio-Kine. This allows to run the Stopped-Flow shots directly from the acquisition software.
Note 1 : to guarantee a good functioning of the link, MPS and Bio-Kine software must have been run once separately and MPS device must be correctly set.
Note 2 : for user's that do not have Bio-Kine program, the Bio-Kine button on MPS program does not perform any action.

Index