med associates inc

instrumentation and software for research

DRUG SELF INFUSION APPLICATION

MED-STATE™ NOTATION PROCEDURE

SOF-700RA-10

USER'S MANUAL

DOC-027
Rev. 1.4

Med Associates Inc.
P.O. Box 319
St. Albans, Vermont 05478

Phone: 802.527.2343
Fax: 802.527.5095
www.med-associates.com

notes

Table of Contents

CHAPTER 1 | INTRODUCTION

The latest version of MED-PC® IV and off-the-shelf programs such as the Drug Self Infusion Application make it easier than ever to run experiment protocols without developing a separate MedState Notation program. This manual explains the process of running the standard protocol and provides examples of editing and modifying the code. The manual also includes detailed explanations of all the elements in the raw data.

Refer to the **MED-PC IV User's Manual** for the installation of the MED-Associates interface drivers, the MED-PC IV Software, and the Delphi® Compiler, and for instructions on "Hardware Configuration." Hardware Configuration is a software utility that comes with MED-PC and is used to assign the inputs and outputs in the interface cabinet. Data file structure, file saving format, and other related options are also determined by this utility. Refer to the **MED-PC IV Programmer's Manual** for detailed instructions on translating and compiling an application. Trans IV must be run on the file Drug Self Infusion.mpc or any .mpc file supplied for SOF-700RA-10 before launching MED-PC for the first time.

Before proceeding with this manual, print a copy of the .mpc file (Drug Self Infusion.mpc). In the protocol, lines beginning with a backslash "\" indicates comments that help identify key elements of the code and explain the function of each program step.

CHAPTER 2 | PROTOCOL OVERVIEW

The standard experimental chamber for this procedure includes a drug-infusion catheter, lever-press device, house light, and stimulus light. During the procedure, the stimulus light is illuminated to signal the availability of reinforcement and drug infusion is administered following the completion of a user-defined fixed-ratio (FR) schedule. Drug infusion is followed by a timeout period during which the stimulus light is off and no reinforcement is available. The house light remains on throughout the entire procedure.

The default FR schedule is set to deliver reinforcement after 10 responses. The timeout period following drug infusion is set to 60 seconds. This value is defined in seconds; if a timeout of 10 minutes is desired, then the timeout should be set to 600. Set this value to zero if no timeout is desired. Responses are recorded during the timeout period, but these responses will not count toward the FR schedule.

The default session-time is 30 minutes, and the default maximum number of infusions is set to 10. The session will end when one of these two conditions is met.

Infusion time is automatically set to 2 seconds. Remember that this value is defined in seconds when modifying it.

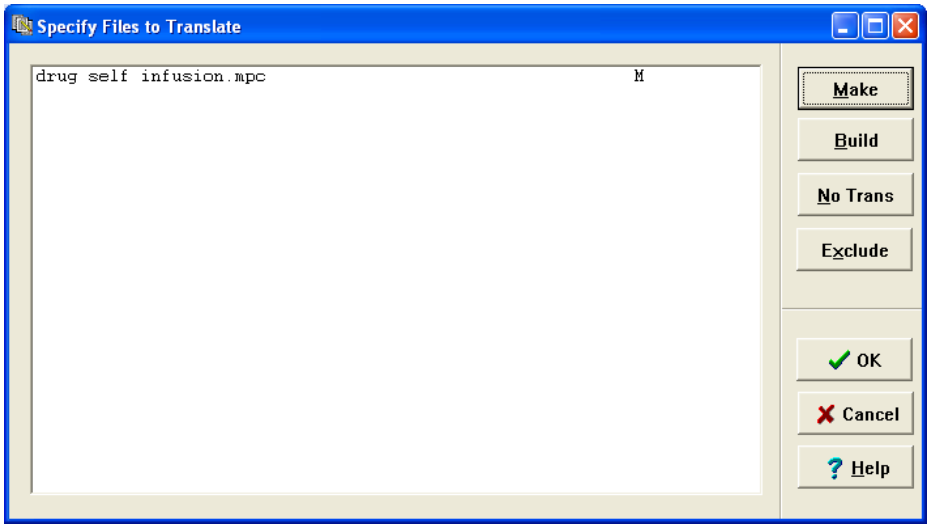
By default, the lever presses and rewards are recorded in the C-array for later viewing in Med Associates' Soft Cumulative Recorder (SoftCR Pro). Correct lever presses are recorded as steps, rewards as pips, and incorrect lever presses as event pens.

CHAPTER 3 | TRANSLATE AND COMPILE

Programs written in MedState Notation need to be translated into PASCAL before they can be run in the Drug Self Infusion Application. The **MED-PC IV Programmer's Manual** explains how to accomplish this translation in more detail. Make sure that a copy of the file Drug Self Infusion.mpc, or whatever file is being translated, is present in the directory C:\MED-PC IV\MPC\. Double click the Trans IV icon on the **Start | Programs** list or desktop and select **Translation** | **Translate and Compile** to produce the screen shown in Figure 3-1.

Highlight the files to translate then click **Make**. Once the desired files are selected, click **OK** to start the translator. It should automatically parse the MedState Notation and then open to a DOS screen to compile the Pascal code. Depending on the speed of the computer, each of these steps may not be visible. If any problems are encountered during this process, refer to the on-screen help menu, the **MED-PC IV Programmer's Manual**, the **MED-PC IV User's Manual**, or contact MED Associates, Inc. for assistance.

Figure 3-1– Trans IV Control Panel for Translating and Compiling MedState Notation Code



CHAPTER 4 | RUNNING THE PROTOCOL

First time users may choose to use the Load Wizard, while more experienced users may prefer to go directly to the run-time screen to load the Drug Self Infusion application. Clicking the MED-PC IV icon from the **Start | Programs** list or desktop brings up the MED-PC Experiment Loading Wizard's Welcome screen, shown in Figure 4-1. If it is not necessary to run Load Wizard, then deselect the box labeled "Run this expert automatically when starting MED-PC." Close this screen by clicking the **Close** button. Closing this screen immediately reveals the MED-PC Run Screen shown in Figure 4-9. Click **Next** to proceed with the wizard. The display shown in Figure 4-2 will appear.

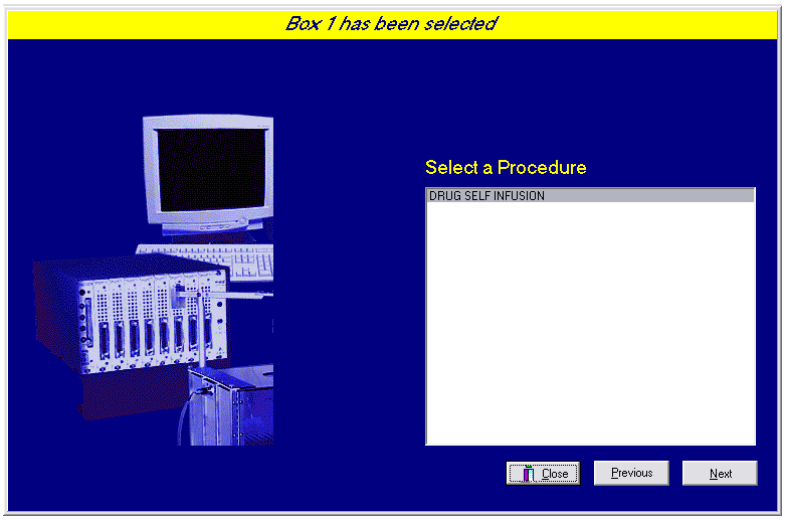
Figure 4-1 – Load Wizard Main Screen

Select the boxes to load and click **Next**.

Figure 4-2 – Box Selection

This is where the procedure to be run is selected. The screen displays a list of all the currently compiled procedures. Select the procedure to be run, and then click **Next**.

Figure 4-3 – Select a Procedure to Load

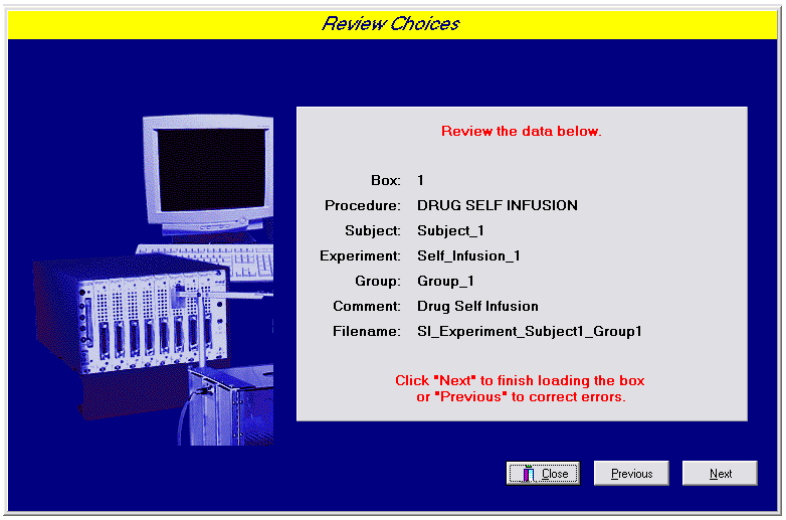


The Box/Procedure Selected Screen will display next, as shown in Figure 4-4. The purpose of this screen is to allow annotations to be added to the data file that is produced by MED-PC IV. These annotations will help identify the Subject, Experiment, and Experiment Group upon which data was collected. Comments can be added here as well, and the data file can be given a customized file name to help identify it from other data files. Enter the information desired, and click **Next**.

Figure 4-4 – Box/Procedure Selected

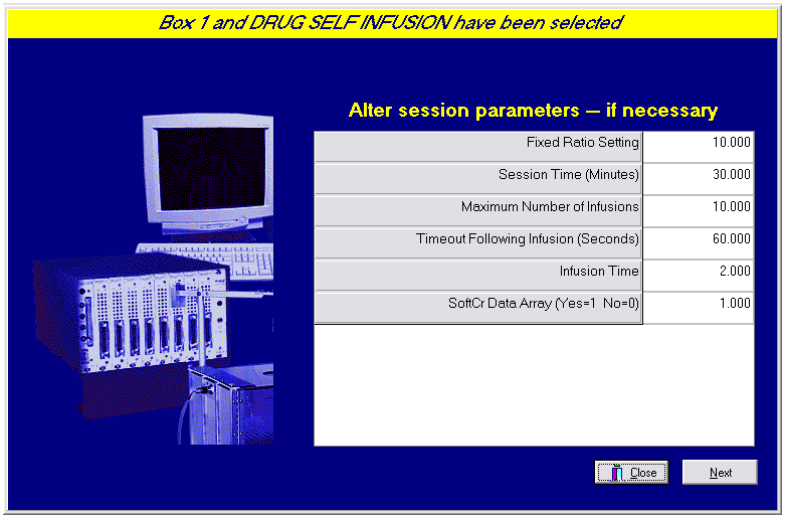
The next screen to appear is the Review Choices screen, as seen in Figure 4-5. This is a method of confirming that the information entered is correct. If it is not correct, select **Previous**, and edit the information. If it is correct, select **Next** to continue.

Figure 4-5 – Review Choices Screen



The Alter Session Parameters Screen, shown in Figure 4-6, is the next screen to appear, and is an important screen for the researcher. The Alter Session Parameters screen allows the researcher to alter the parameters by which a procedure executes. Any of the variables may be changed on this form. Simply highlight the value to change, and then enter the desired value. The Send Start Command Screen appears next.

Figure 4-6 – Alter Session Parameters Screen



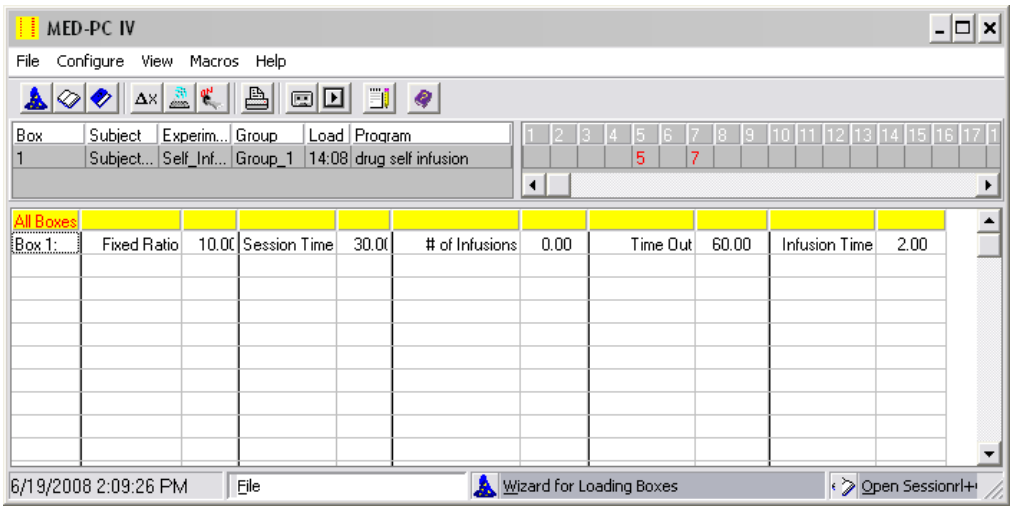
In this example only 1 box is described in the Hardware Configuration, so Figure 4-7 will appear next. If more than 1 box is in the Hardware Configuration, then Figure 4-8 will appear. In both cases, the screens are where the researcher decides to either load more boxes, send a start signal to boxes that are already loaded, or enter the MED-PC IV run-time environment without

sending a start signal by selecting “I am finished with the wizard”. This option results in the screen shown in Figure 4-9.

Figure 4-7 – Send Start Command Screen for Single Box Configuration

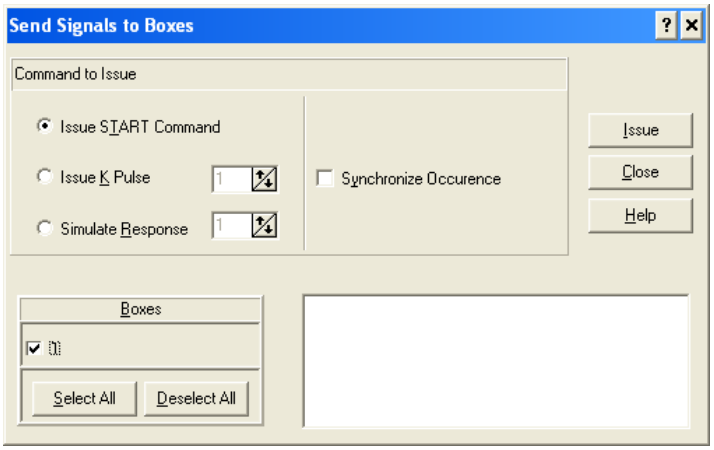
Figure 4-8 – Send Start Command Screen for Multiple Box Configuration

Figure 4-9 – MED-PC IV Runtime Screen



If all settings are correct, a **Start** command may be issued in one of two ways. One is to select C**onfigure** | **Signals**, and the other is to click the 5th tool-bar item that resembles a keyboard to reveal the window shown in Figure 4-10. To make additional changes to the variable values, proceed to the next section.

Figure 4-10 - Send Start Signals to Boxes

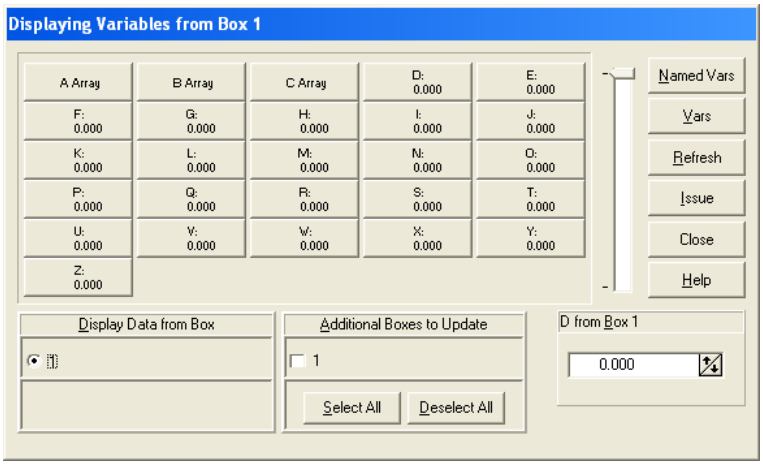


Click a single box, multiple boxes, or **Select All** followed by the **Issue** button to start the procedure. Click **Close** to remove the window from the screen. There is no reason to select **Synchronize Occurrence**.

Viewing/Changing Variable Values

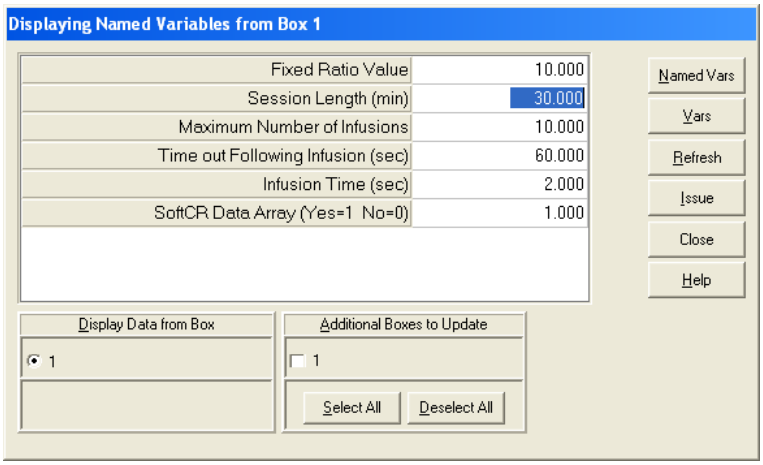
To change variables prior to issuing the **Start** command select **Configure** | **Change Variables**, or click the 4th tool bar item **Δ X**, to reveal the window shown in Figure 4-11. If a blank table is first presented, click the box number that is being used in the "Display Data from Box" area of the screen. By clicking additional boxes in the "Additional Boxes to Update" section, changes made to a single box are automatically loaded on all of the boxes selected.

Figure 4-11 - Change Variables Screen



The value of any simple variable or data element may be viewed from this screen. Click an array on the table and each element in that array can be viewed. To change a value, simply highlight and replace the value in the lower right hand box or use the up/down arrows to increment by 1. For the change to take effect, click **Issue**. Click **Named Variables** to produce the display shown in Figure 4-12. Edit these variables to best suit the experiment.

Figure 4-12 - Named Variables Display



Macros

To create a macro, commands will be entered manually and then the keyboard functions will be recorded. Once the commands are recorded as a macro, a number of macros can be created with the macro editor. The following example illustrates how to load "Box 1" and change "Session Time" to 60 minutes.

Begin by opening MED-PC IV and then go directly to the "run time" screen. Close the Load Wizard, if present. Before loading or opening the procedure, click **Macro** on the main menu and select **Turn On Macro Recorder**, or click the 8th tool bar item (cassette tape icon). A note on the bottom of the display indicates that the recorder is running. Proceed to load "Drug Self Infusion.mpc." To do this, click **Files** on the main menu and select **Open Session**, or click the 2nd tool bar item (open book icon). Change the variables using any of the methods described above. When all settings have been made, turn the recorder off again by using the main menu or tool bar. Save the macro with a distinctive, easily recognizable name. The example in Figure 4-13 is named "Drug Self Infusion60min.mac" since it changes the session time to 60 minutes.

Figure 4-13 - Drug Self Infusion60min.mac

```
LOAD BOX  1 SUBJ 0 EXPT 0 GROUP 0 PROGRAM DRUG SELF INFUSION
   SET "Session Length (min)" VALUE 60 MAINBOX 1 BOXES  1
```

Once this macro is built, use the macro editor to make changes to timeout periods or the maximum number of infusions. Review the Help file on-screen or the **MED-PC IV Programmer's Manual** for more information on macros and the features offered. A **Start** command, or message box followed by the **Start** command, can be added to the macro.

CHAPTER 5 | MODIFYING THE MEDSTATE NOTATION™

Permanent changes may also be made to the MedState-Notation code. To make the same change to the stimulus duration as shown above in the Macros section, complete the following steps:

1. Open Trans IV and select **File | Open** from the main menu to place "Drug Self Infusion.mpc" into the text editor.
2. Scroll down to approximately line 90 (note the line counter in the lower right hand corner of the editor) to reveal the code shown in Figure 5-1.

Figure 5-1 - Drug Self Infusion.mpc Lines 87-90

```
S.S.1,
S1,     \ Set default values for Fixed Ratio, Session Length,
        \ Maximum Number of Infusions, Time Out, and Infusion Time.
  0.001": SET A(0) = 10, A(1) = 30, A(2) = 10, A(3) = 60, A(4) = 2, A(5) = 1 ---> S2
```

3. Change A(1) = 30 to A(1) = 60 and save the changes with the same or a new file name such as "Drug Self Infusion_60min.mpc." Remember if a new .mpc file name is created and a macro is being used to load boxes, the file name in the macro also must be changed.
4. Translate and compile the new or changed file as described previously, and run MED-PC IV. Use the Change Variables screen to view/confirm the new values.

CHAPTER 6 | UNDERSTANDING THE DATA

Selecting **Annotated** on the File options page during hardware installation produces a raw data file similar to the one shown below. Data files are located in C:\MED-PC IV\Data\ unless an alternate path was defined during hardware installation. They may be opened with note pad, word pad, or any word processor; however, be sure they are always saved unformatted in case a data extraction utility such as MPC2XL might ever be used. The header information should be self-explanatory. Data File Formats are explained in detail in the **MED-PC IV User's Manual**.

Sample Data File

```
File: C:\MED-PC IV\DATA\!2008-11-31_16h37m.Subject 0

Start Date: 11/31/08
End Date: 11/31/08
Subject: 0
Experiment: 0
Group: 0
Box: 1
Start Time: 8:54:35
End Time: 9:40:38
MSN: Drug Self Infusion
D:      24.000
E:       0.000
F:    6000.000
G:     200.000
H:       0.000
I:      78.000
J:       0.000
K:       0.000
L:       0.000
M:       0.000
N:       0.000
O:       0.000
P:       0.000
Q:       0.000
R:       0.000
S:       0.000
T:    3964.000
U:       0.000
V:       0.000
W:       0.000
X:       0.000
Y:       0.000
Z:       0.000
A:
     0:       10.000       30.000       10.000       60.000        2.000
     5:        1.000
B:
     0:       20.000        4.000        3.000       20.000        0.000
     5:        4.000      250.000        2.000        0.000        0.000
    10:        0.000
C:
     0:        0.500      742.600        0.500      194.600        0.500
     5:     5965.100      460.100       15.100     2164.100      206.100
    10:       18.100      456.600        0.500     6034.600        0.500
    15:       47.600        0.500       14.600        0.500       15.600
    20:        0.500       16.600        0.500       37.600        0.500
    25:       31.600        0.500      207.600        0.500       62.600
    30:        0.500      583.600       41.100       34.100       22.100
    35:        0.200       13.100       16.100       94.100      885.100
    40:     3717.600        0.500      429.600        0.500     3034.100
```

Breakdown of Sample File

Working Variables

The following working variables are shown immediately following the header information:

```
D:       24.000    - Session Count Down Timer in minutes (will be 0 at the end of the session
                       unless B(7) = 10)
E:        0.000    - Not Used
F:     6000.000    - Time Out in MED Ticks (tick = 10ms = 0.01 sec; 6000 ticks = 60 seconds)
G:      200.000    - Infusion Time in MED Ticks (tick = 10ms = 0.01 sec)
H:        0.000    - Not Used
I:       78.000    - Subscript for the IRT Array C (indicates number of elements in "I" array)
J:        0.000    - Not Used
K:        0.000    - Not Used
L:        0.000    - Not Used
M:        0.000    - Not Used
N:        0.000    - Not Used
O:        0.000    - Not Used
P:        0.000    - Not Used
Q:        0.000    - Not Used
R:        0.000    - Not Used
S:        0.000    - Not Used
T:     3964.000    - Elapsed Time in 0.01-second Increments for SoftCR Pro Data
U:        0.000    - Not Used
V:        0.000    - Not Used
W:        0.000    - Not Used
X:        0.000    - Not Used
Y:        0.000    - Not Used
Z:        0.000    - Not Used
```

Arrays

The arrays are presented in rows of 5 elements each. The first row begins with element 0 and ends with element 4; the second row begins with element 5 and ends with element 9, etc. Each row begins with an element marker followed by a colon, 0:, 5:,10:, 15:, 20:, 25:, 30:, etc. Size of Array C was set to 10000 with the DIM command, which means that Array C was defined for 10001 data points. Under MED-PC Version IV, this array may be enlarged up to 1 million elements; however, 10,000 should be more than adequate for this application. An end-of-array seal -987.987 will limit the saved file to only those elements used during the running of the procedure.

Each array has been defined in the comments section at the beginning of the .mpc file. That information was used to add the following labels to each array. The lines were expanded to make room for the labels. See MPC2XL for producing labeled data files with all or just some of the information below.

Array A – Definitions of Control Variables

Array A contains the values of each of the control variables. The default values for each of these variables are shown below.

```
A:
     0:        10.000        30.000        10.000        60.000         2.000
    5:        1.000
```

Array A – With Labels

	A(0)	A(1)	A(2)	A(3)	A(4)
Row Marker	Fixed Ratio Value	Session Length (min)	Max Number of Infusions	Time Out Following Infusion (sec)	Infusion Time (sec)
0:	10.000	30.000	10.000	60.000	2.000

	A(5)
Row Marker	SoftCR Data Array (Yes=1, No=0)
5:	1.000

Array B - Raw Data

Array B is used for counters for data variables and may change as the session runs. All elements will be incremented according to animal's responses.

```
B:
     0:        20.000         4.000         3.000        20.000         0.000
     5:         4.000       250.000         2.000         0.000         0.000
    10:         0.000
```

Array B - With Labels

	B(0)	B(1)	B(2)	B(3)	B(4)
Row Marker	Right Lever Responses at FR	RL Responses at infusion	RL Responses at Time out	Left Lever Responses at FR	LL Responses at Infusion
0:	20.000	4.000	3.000	20.000	0.000

	B(5)	B(6)	B(7)	B(8)	B(9)
Row Marker	LL Responses at Timeout	Time in Fixed Ratio (in seconds)	Number of Infusions	Lever Responses/minute (at Fixed Ratio)	*Not used*
5:	4.000	250.000	2.000	0.000	0.000

	B(10)
Row Marker	*Not used*
10:	0.000

Array C - SoftCR Pro Data

Array C contains summary information for SoftCR Pro. The value of every variable conforms to the Data Element Format described in the **SoftCR Pro User's Manual**. "nnnn.5yz" indicates that the event pen is set to level 0 (down or at baseline). In this program, event pen is set to level 0 every time a response on inactive left lever occurs. Nnnn.1yz= response, nnnn.2yz = reinforcement, nnnn.6yz=set event pen to level 1 ("up").

If the fixed ratio is 10 (default value), then an infusion takes place after every 10 presses on the active lever. Response time values are represented in SoftCR Pro ticks. To calculate when a response has occurred in real time, multiply the number by 0.01 sec since SoftCR Pro's resolution is 10ms (0.01 sec). For example, value in C (1) is 742 ticks. 742 multiplied by 0.01 sec yields 7.42 seconds. This is when the first response occurred in real time after the program had started.

```
C:
      0:        0.500      742.600        0.500      194.600        0.500
      5:     5965.100      460.100       15.100     2164.100      206.100
     10:       18.100      456.600        0.500     6034.600        0.500
     15:       47.600        0.500       14.600        0.500       15.600
     20:        0.500       16.600        0.500       37.600        0.500
     25:       31.600        0.500      207.600        0.500       62.600
     30:        0.500      583.600       41.100       34.100       22.100
     35:        0.200       13.100       16.100       94.100      885.100
     40:     3717.600        0.500      429.600        0.500     3034.100
```

Array C - With Labels

Data is shown through row marker 15 only.

	C(0)	C(1)	C(2)	C(3)	C(4)
Row Marker	SoftCR is activated	Inactive lever is pressed	Set Pen to Level 0	Inactive Lever is pressed	Set Pen to Level 0
0:	0.500	742.600	0.500	194.600	0.500
	C(5)	**C(6)**	**C(7)**	**C(8)**	**C(9)**
Row Marker	Active Lever is pressed	Active Lever is pressed	Active Lever is pressed	Active Lever is pressed	Active Lever is pressed
5:	5965.100	460.100	15.100	2164.100	206.100
	C(10)	**C(11)**	**C(12)**	**C(13)**	**C(14)**
Row Marker	Active Lever is pressed	Inactive Lever is pressed	Set Pen to Level 0	Inactive Lever is pressed	Set Pen to Level 0
10:	18.100	456.600	0.500	6034.600	0.500
	C(15)	**C(16)**	**C(17)**	**C(18)**	**C(19)**
Row Marker	Inactive Lever is pressed	Set Pen to Level 0	Inactive Lever is pressed	Set Pen to Level 0	Inactive Lever is pressed
15:	47.600	0.500	14.600	0.500	15.600

CHAPTER 7 | USING SOFTCR™ PRO

The Drug Self Infusion procedure stores IRT data in array C that may be used by the SoftCR™ Pro Cumulative Recorder program to generate a graphical record on screen or to print a Cumulative Record after the data has been collected. Each element in this "Cumulative Record" data array consists of two components. The integer value or value to the left of the decimal point is the time component. The decimal value or value to the right of the decimal point is a SoftCR Pro code component. Refer to the **SoftCR Pro User's Manual** for further information.

Time Components

Time components may be Relative or Absolute. In a Relative file, the time component of a given data element is equal to the elapsed time since the previous element. In an Absolute file, it is equal to the elapsed time since the beginning of the Record. The elements used in Drug Self Infusion are all Relative with a resolution of 0.01 seconds (10 milliseconds).

Control Code Components

The control code component indicates whether the element is a Response Step, Reinforcement Pip, Pen Reset, Event Pen Up, or Event Pen Down element. Up to 10 Event Pens (0 - 9) and 10 Trace Pens (0 - 9) may be specified in MED-PC. In addition, Resets may be made with the Pen "Up" (no vertical tracing) or "Down." Additional coded information may be possible in the future.

Data Element Format

Each data element must conform to the following format:

nnnnn.xyz

Where:

nnnnn = Time Component

xyz = Control Code Component

x = Datum Type

y = Datum Index

z = Don't Care Digit

NOTE: If there are more than three numbers past the decimal point, then the array will be considered invalid and will be ignored by SoftCR Pro.

Allowed datum types and indices are:

NNNNN.1YZ	=	RESPONSE OR STEP
		y = Index (0 - 9) for Multi-Trace Files
		"NULL" for Single Trace Files
NNNNN.2YZ	=	REINFORCEMENT OR PIP
		y = Index (0 - 9) for Multi-Trace Files
		"NULL" for Single Trace Files
NNNNN.3YZ	=	UNUSED
nnnnn.4yz	=	Unused
nnnnn.5yz	=	Set Event Pen To Level 0 ("Down" or at baseline), where
		y = Event Pen Number (0 - 9)
nnnnn.6yz	=	Set Event Pen To Level 1 ("Up"), where
		y = Event Pen Number (0 - 9)
nnnnn.7yz	=	Unused
nnnnn.8yz	=	Unused
nnnnn.9yz	=	Unused

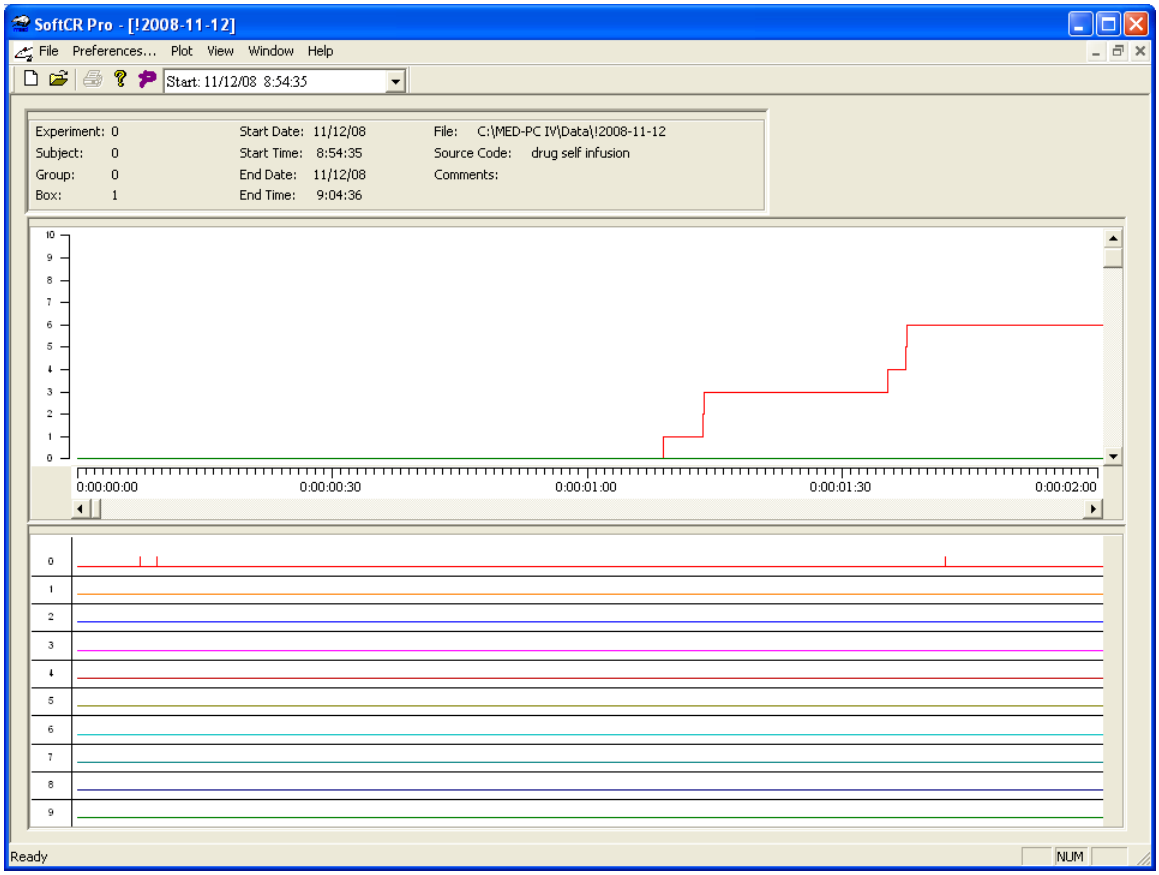
Data in the array being plotted that does not conform to the above rules will be ignored.

Example of SoftCR Pro

Figure 7-1 is an example of what Drug Self Infusion will look like in SoftCR after an experiment is run. The red line records a Step for every correct response that is made. Since this is a Fixed Ratio of 10 schedule the subject was reinforced after 10 responses on the Right Lever. A reward is recorded as a Pip, or a hash mark on the red line.

The colored traces at the bottom of the screen are called Event Pens and can be used in a variety of ways for a number of purposes. The Event Pens can go up and down, creating quick spikes like the ones seen here, or long plateaus that represent certain periods of time during an experiment. Here, the Event Pen 0 records a Spike for every incorrect response that is made.

Figure 7-1 - Example of a Drug Self Infusion Schedule Shown in SoftCR Pro



Appendix A | Contact Information

Please contact MED Associates, Inc. for information regarding any of our products.

Visit our website at www.med-associates.com for contact information.

For technical questions, email support@med-associates.com.