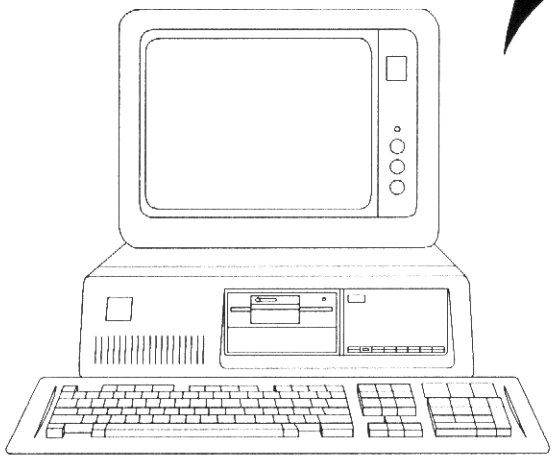
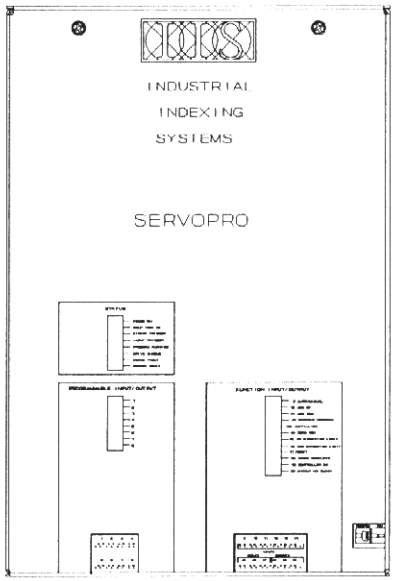
IB-15B002

SINGLE AXIS MOTION CONTROL SYSTEM MARCH 1993

SERVOPRO PC PROGRAMMER INSTRUCTION BOOK





INDUSTRIAL INDEXING SYSTEMS, Inc.

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Notes:

1) Pages 11, 16-18 dated August 1992 supercedes pages 11, 16-18 dated August 1991.
2) Pages 16 thru 19 and page 42 dated September 1993 supercedes pages 16 thru 19 and page 42 dated March 1993.

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SECTION 1 - GENERAL DESCRIPTION

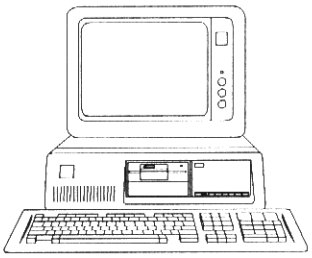
1.1 INTRODUCTION

The Industrial Indexing System ServoPro Motion Control Systems are a family of controller/drive packages, brushless motor assemblies, and transformers specially designed for linear indexing and positioning applications. The **SP Programmer** software program was developed to allow the user to program and run the ServoPro systems from an IBM PC or compatible personal computer.

1.2 ABOUT THIS MANUAL

This document describes a software package used to program the IIS ServoPro Controller from an IBM-PC/XT/AT or compatible personal computer. This software package will be referred to as the **SP Programmer** throughout this document. Please be sure to pay special attention to notes that are in the text boxes since they may contain added information, or in some cases just a note of caution.

1.3 HARDWARE OVERVIEW



The **SP Programmer** is run on an IBM-PC/XT/AT or compatible. The computer must have a minimum 640K of RAM and must be running with a disk operating system MS-DOS v3.1 or later. It must also have at least one (1) 5 1/4" floppy disk drive or one (1) 3 1/2" floppy disk drive.

The **SP Programmer** is available on either 5 1/4" (formatted for 360 Kb) or 3 1/2" (formatted for 720 Kb) floppy disk. Note that the disk used is not copy protected, so a backup copy of this disk should be made and stored in a safe place.

The **SP Programmer** is compatible with the Novell Network (Version 2.15 Rev. C or later) therefore, it may be configured to be used in the list of Network Applications. Although this software may be compatible with other network configurations, no such guarantee is made.

1.4 SOFTWARE OVERVIEW

A description of the **SP Programmer** software is as follows:

- The SP Programmer is a software tool designed to simplify the creation of programs for the ServoPro single axis controller.

- Program development consists of creating and editing a series of motion commands and downloading these commands to the ServoPro controller. Trace functions are provided to allow the user to monitor execution of the commands.

- The SP Programmer provides the user with test functions such as Read/Write I/O, Read Feedback Position, Read Thumbwheels and Read LED status.

- A File Manager is provided to allow organization and storage of SP Programmer files.

1.5 OPERATION OVERVIEW

Descriptions of the main function selections are:

- Block.Step Programming: Provides the user with a way to add, change and delete the commands which will be executed by the ServoPro system.

- Real Time Functions: Allows the user to monitor execution of the program.

- System Hardware Diagnostics: Allows the user to monitor I/O module status, front panel indicators, thumbwheel settings, dip switch settings and transducer feedback. The user is also able to modify the state of output modules.

- File Manager: A complete file maintenance utility that allows the user to save, retrieve, copy, and delete program files on IBM-PC hard or floppy disks, and to upload/download programs between the PC and the ServoPro.

- Setup Parameters: Allows the user to change the ServoPro setup parameters, including Engineering Units, Jog Speed and Ramp, Initialize Speed and Ramp, Execution Mode, Loop Gain, Integral and Damp.

- Program Listings: Allows the user to get a print-out of a partial or complete program.

- SP Programmer Defaults: Allows the user to specify the communications port on the PC to be used to communicate with the ServoPro.

- Monitor Configuration: The user is able to select colors/attributes for each window.

The initial menu that will be displayed when running the **SP Programmer** is shown in Figure 1.1.

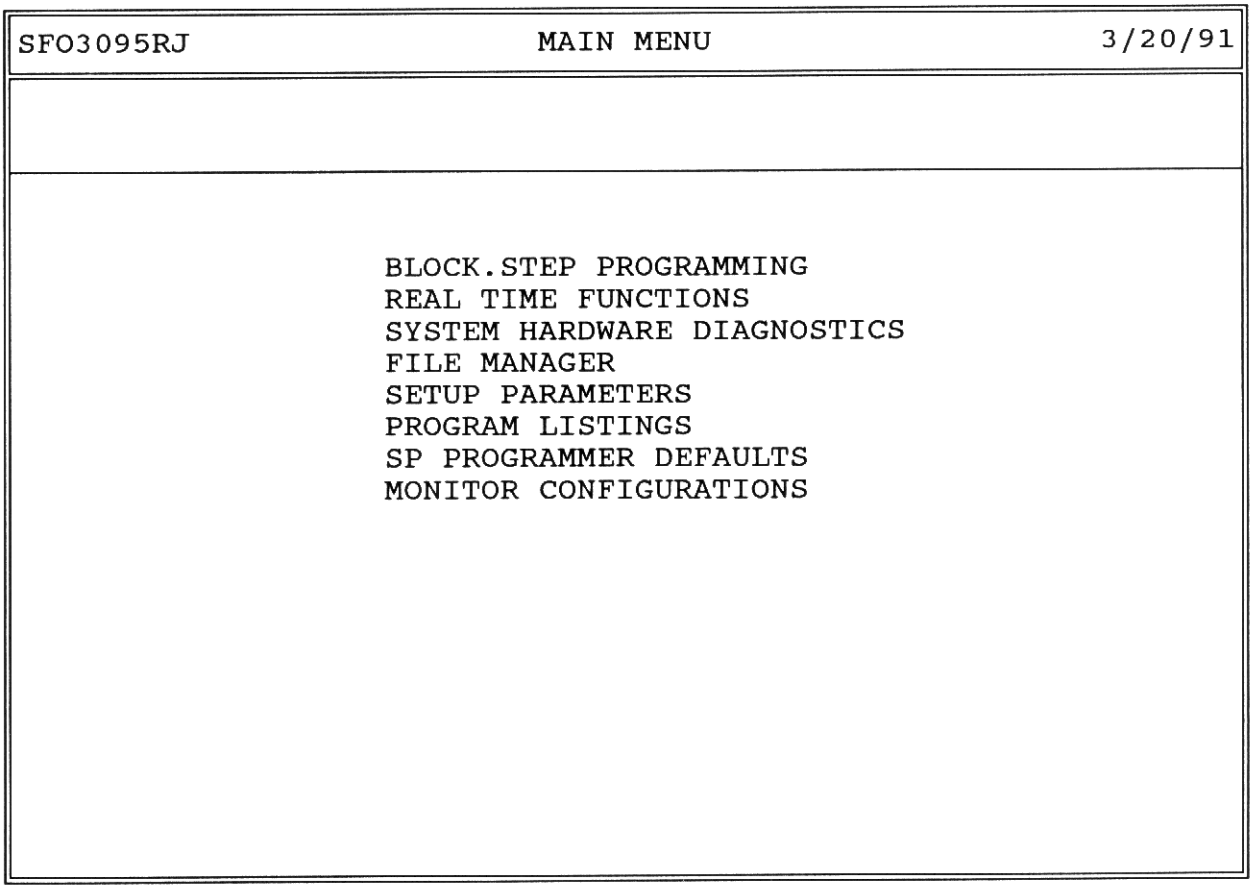


Figure 1.1

NOTES

SECTION 2 - KEYBOARD USAGE

2.1 FUNCTION KEYS

Function keys F1 thru F10 are seldom used since pop-up windows have been incorporated. The following function keys are used universally throughout the SP Programmer:

- F8: Gets the user to the **HELP** function.
- F9: Represents the **PREVIOUS** key.
- F10: Represents the **NEXT** key.

2.2 ALPHANUMERIC KEYS

The numeric keys [0] thru [9], decimal point [.] and negative sign [-] are used for data input.

2.3 KEYPAD KEYS

The numeric keys [0] thru [9], decimal point [.] and negative sign [-] on the keypad are also used for entering data, if available.

2.4 OTHER

The following keyboard keys are also used:

- BACKSPACE: moves the cursor back one space when entering or modifying data, and will erase that character.
- ENTER: is used to select a function from a menu. Also, accepts the value entered for a parameter and moves the cursor to the next input field.
- CURSOR UP/DOWN: used to position the cursor bar up or down.
- PGUP/PGDN: scrolls through the listings in a window page-by-page.
- CURSOR LEFT/RIGHT: used to position the cursor left or right within a cursor field during data entry.
- ESC: used to cancel the current function. It is also used to terminate program execution and return to MS-DOS.

- TAB: accepts the value of the parameter (much like the ENTER key) and advances the cursor to the next input field in a window.

- SHIFT/TAB: positions the cursor at the previous field in an input window.

- DEL: deletes one character.

SECTION 3 - HELP FEATURES

3.1 ACCESSING THE HELP SCREENS

Function key **F8** is used to access the **HELP** screens. The help feature provides the user with detailed information regarding the current function on the screen. Page/up and Page/down keys are used to advance thru the **HELP** file.

Pressing the ESC key will exit the HELP function.

NOTES

SECTION 4 - SP PROGRAMMER DEFAULTS

4.1 BEEP OPTION

The **SP Programmer** will sound an audio 'beep' whenever an error or warning message is displayed. The user has the option of disabling this feature.

4.2 COMMUNICATIONS PORT

The **SP Programmer** uses a serial communications port when communicating with the ServoPro. The available ports are COM1 and COM2.

4.3 ENTRIES

- Using the cursor up and down arrow key, move the cursor bar until 'SP PROGRAMMER DEFAULTS' is highlighted, then press ENTER.

- A window indicating the current values of the 'beep' option and the communication port is displayed.

- The 'beep' option is ON by default. To change the BEEP option, press either the NEXT key (F9) or PREVIOUS key (F10) to select an option, then press ENTER to input the value. The cursor will move to the next data field, which is the COMM PORT value.

- To change the communications port, again press the NEXT key (F9) or PREVIOUS key (F10) until the desired port appears, then press ENTER. The values are entered in memory and the program returns to the MAIN MENU.

NOTES

SECTION 5 - SETUP

5.1 DESCRIPTION

SETUP mode lets the user modify parameters that are usually entered once. These are parameters that will be used, throughout the entire program.

5.2 ENTRIES

The following is a list of **SETUP** parameters which may be modified:

- Engineering Units (Units per turn)
- Jog Speed and Ramp rate
- Initialize Speed and Ramp rate
- Execution Mode
- Loop Gain, Integral and Damp

> **« NOTE »**
> The description, allowable entry range, and default values can all be found in the ServoPro User's Guide IB-15B001.

- When entering Setup values for the first time, all parameters will be set to their default values.

- To modify the parameters, from the MAIN MENU select 'SETUP PARAMETERS', then press ENTER. A screen will appear, resembling Figure 5.1, displaying the default or current values in memory along with the parameter ranges.

- Type in the value for each parameter, then press ENTER. The cursor bar will then move to the next data field for entry.

- Note that all parameters use numeric values for their data, with the exception of the Execution Mode. The value for Execution Mode is Input Trigger or Binary Trigger. To select the execution mode, use the F9 and F10 function keys to display the selected mode, then press ENTER. Function key F1 will reset the SETUP values to their default values.

- When all the parameter values are acceptable and entered, press the ESC key to return to the MAIN MENU.

SFO3095RJ SETUP PARAMETERS 3/20/91

PARAMETER	CURRENT	RANGE MIN.	RANGE MAX.	DEFAULT
ENGINEERING UNITS	1.000			1.000
JOG SPEED	1	1	3600	1
JOG RAMP	1	1	800	1
INITIALIZE SPEED	1	-3600	3600	1
INITIALIZE RAMP	1	1	800	1
MODE	INPUT TRIGGER MODE			1
LOOP GAIN	16	0	255	16.00
INTEGRAL	0	-127	127	0
DAMP	0	-127	127	0

Figure 5.1

- The SETUP values that are in the memory of the PC may be different from the values stored in the ServoPro system. Also, SETUP values are stored with the BLOCK.STEP data when saved in a file. These values are downloaded to the ServoPro system with the BLOCK.STEP data (see section 7.9 'Downloading the Program' for more information).

« WARNING »

Downloading ServoPro program values from the PC to the Servopro system will redefine or overwrite any setup values in the ServoPro memory.

SECTION 6 - BLOCK.STEP PROGRAMMING

6.1 DESCRIPTION

BLOCK.STEP PROGRAMMING provides the user with the means to create and/or modify a servo motion program.

Each ServoPro program consists of one or more program BLOCKs. A program BLOCK is a series of motion control STEPs. The BLOCK number, in input trigger mode, is the number of the I/O (1-8) which will signal the ServoPro to begin execution of the BLOCK. For example, BLOCK #1 will be executed when I/O #1 is energized. In Binary trigger mode, the block number is the sum of the binary weights of the I/O (1-7) which will signal the ServoPro to begin execution of the BLOCK.

For example, if the BLOCK number is 15:

I/O #	Binary Weight	State
1	1	ON
2	2	ON
3	4	ON
4	8	ON
5	16	OFF
6	32	OFF
7	64	OFF
8	Used To tell the ServoPro to read the state of the first seven inputs, sum the binary weights of the modules in the ON state to get the BLOCK number, and execute the BLOCK.	

In the example above, modules 1-4 are ON and the sum of their binary weights is 15.

Each BLOCK may have a variable number of STEPs. A STEP is a command to the ServoPro controller to do a function related to motion (such as Index, Position, or turn I/O ON). The total number of STEPs may not exceed 127.

6.2 EDITING A BLOCK

- Select BLOCK.STEP PROGRAMMING from the MAIN MENU by positioning the cursor bar with the cursor 'up and cursor 'down' keys, then press ENTER. The user will be prompted to enter the BLOCK number (the default is 1 if it is a first time entry).

- Type in the block number, then press ENTER.

- To change the block number, press F1 (New Block), or press F9 (Next) or F10 (Previous) until the desired block number appears.

- All BLOCKs are stored in the PC's memory as they are edited.

- Function key F5 may be used to create a new program. The program in PC memory should be saved prior to selecting this function. A prompt will appear when pressing the F5 function key, asking "ARE YOU SURE (Y/N)".

> **≪ WARNING ≫**
> When the New Program option is selected, all data values in PC memory will be erased.

- The ESC key will exit BLOCK programming.

- Each new block to be added will have at least one exisiting step, the END OF BLOCK step (see Figure 6.1).

SFO3095RJ BLOCK.STEP PROGRAMMING 3/20/91

BLOCK.STEP	COMMAND	COMMENT
1.1	END OF BLOCK	xxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Figure 6.1

- BLOCKS that have more than one step will still have the END OF BLOCK step as their last step (see Figure 6.2).

SFO3095RJ BLOCK.STEP PROGRAMMING 3/20/91

BLOCK.STEP	COMMAND	COMMENT
1.1	TURN ON/OFF	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.2	. . .	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.3	. . .	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.4	. . .	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.5	. . .	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.6	. . .	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.7	. . .	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.8	WAIT TIME	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.9	INDEX	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
1.10	END OF BLOCK	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Figure 6.2

6.3 ADDING A STEP

- When in BLOCK.STEP programming mode, press the INSERT key to add a new STEP to the BLOCK. Note that the step to be inserted will be placed ahead of the step highlighted by the cursor bar.

- Select the desired command from the list provided (see Figure 6.3) by using the cursor 'up' and cursor 'down' keys. Then press the ENTER key.

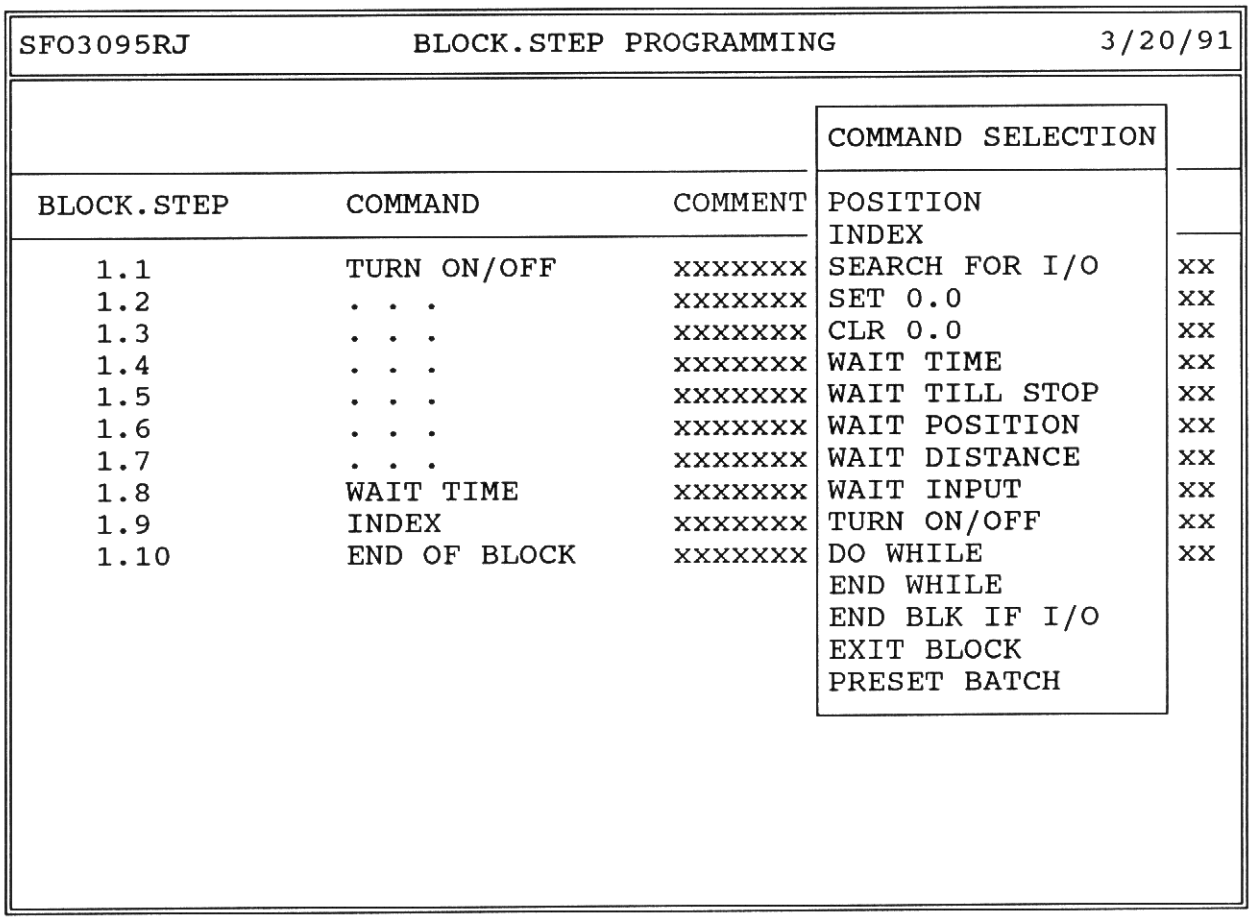


Figure 6.3

- After the command has been selected, a window will appear showing the parameters to be entered (see Figure 6.4).

- Type in the necessary values for each parameter and press ENTER. The cursor will advance to the next data field. Continue until all values are entered for that STEP, then press ENTER to return to the list of BLOCK.STEPs.

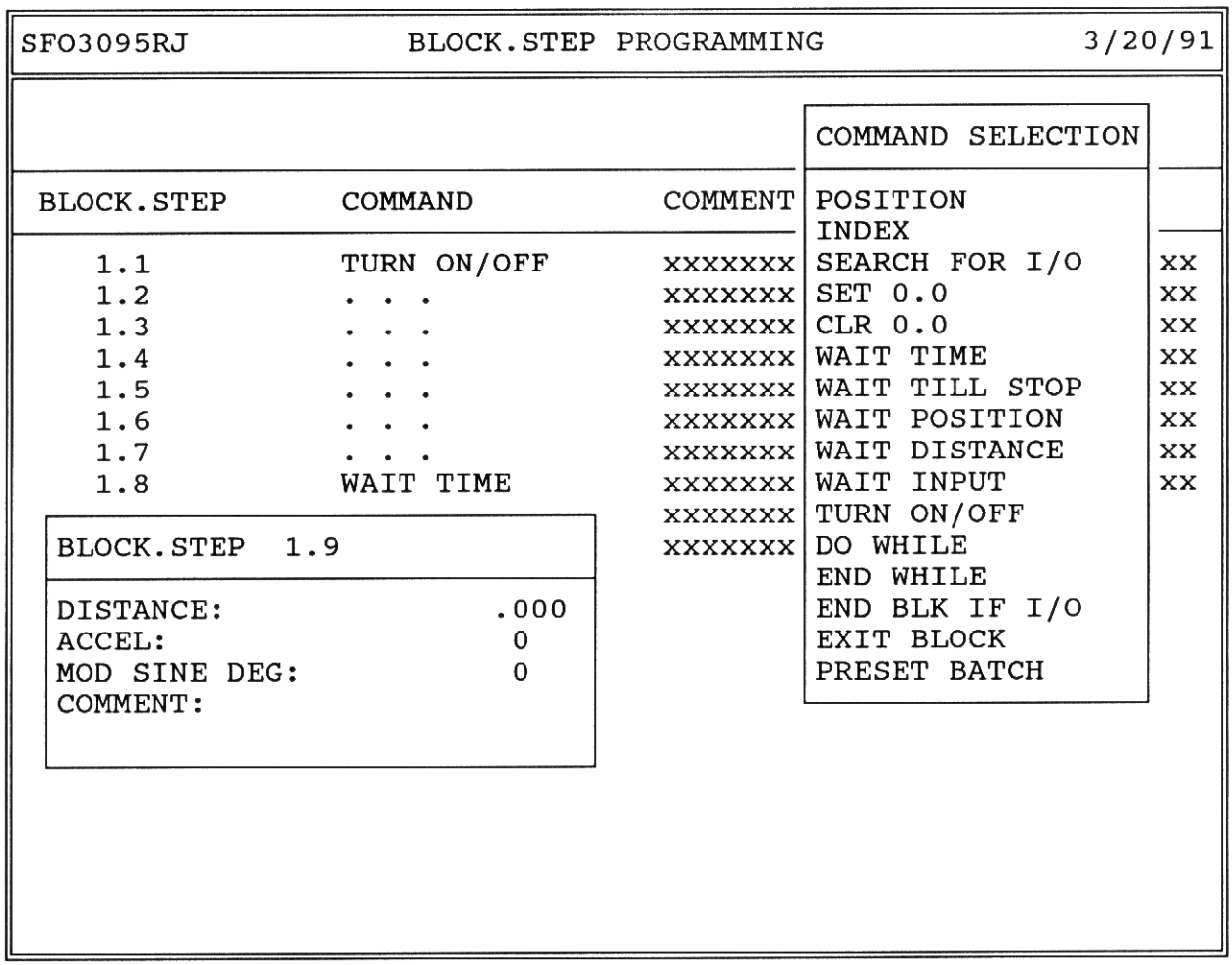


Figure 6.4

- Function keys F9 and F10 are used if an optional device (thumbwheel or keypad) is used for data entry during program execution. These keys will display the previous and the next available device. If 'KEYPAD' is selected, the user will be prompted to enter the initial value to be used during execution of the step.

- If an invalid entry is made, a window indicating the error message and the allowable range for entries will be displayed (see figure 6.5). Press the ESC key, enter the correct value, then press ENTER to accept the new value.

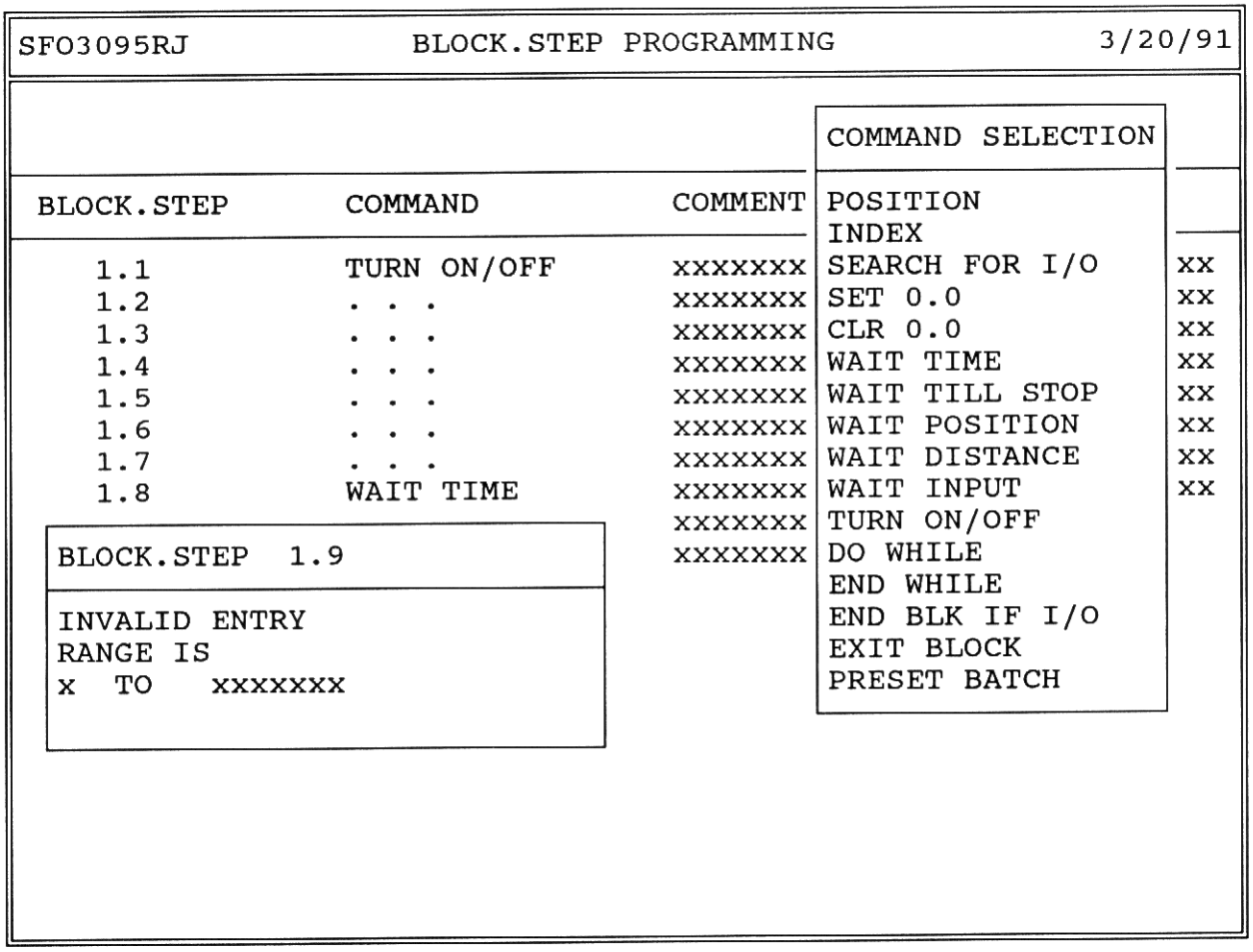


Figure 6.5

6.4 EDITING A STEP

- To edit an existing STEP, position the cursor bar on the STEP to be edited, then press ENTER (see Figure 6.3).

- A window will be displayed with the exisiting parameters for the selected STEP. These values are currently in memory and may be modified.

- Type in the new value and press ENTER. The cursor will then move to the next data field. Function keys F9 and F10 may be used to select an optional input device (thumbwheel or keypad).

- If an invalid entry is made, a window indicating the error message and the allowable range for entries will be displayed (see figure 6.5). Press the ESC key, enter the correct value, then press ENTER to accept the new value.

6.5 DELETING A STEP

- To delete an existing STEP, position the cursor bar on the STEP that is to be deleted.

- Press the DEL key. A window will appear requesting verification that the step is to be deleted.

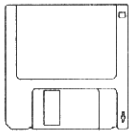
- Type a 'Y' to continue to delete the STEP, or 'N' to cancel the function.

6.6 ENTRIES

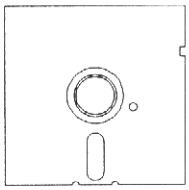
- TAB will accept the entry in a field, the same as pressing ENTER. The cursor will move to the next field in the window.

- SHIFT TAB will move the cursor to the previous field in the window.

All field entries or values will be verified upon entry. Should any value be out of range, an error message will be displayed (see Figure 6.5). This will show the minimum and maximum allowed value. Press the ESC key to exit the error window, then re-enter the value within range.



SECTION 7 - FILE MANAGER



7.1 DESCRIPTION

The **SP Programmer** allows the user to maintain ServoPro programs on hard or floppy disk. It provides a simple method of storing and then retrieving programs.

« NOTE »

When program files are saved, the program BLOCK.STEPS as well as the current SETUP values are all stored together. When program files are retrieved, the previously stored BLOCK.STEPS and SETUP values are retrieved together.

When the FILE MANAGER option is selected, a screen resembling Figure 7.1 will be displayed.

The FILE MANAGER has the following main options:

- LOAD FILE FROM DISK → the ability to **retrieve** files from hard or floppy disk
- SAVE FILE TO DISK → the ability to **save** files to hard or floppy disk
- DELETE A DISK FILE → the ability to **delete** files
- RENAME A DISK FILE → the ability to **rename** files
- COPY A DISK FILE → the ability to **copy** the contents of an existing file to a new file
- DEFINE THE STORAGE DEVICE → the ability to define the **data drive** and **path**
- DOWNLOAD A PROGRAM TO SERVOPRO → the ability to **transmit** the program to a ServoPro Controller.
- UPLOAD A PROGRAM FROM SERVOPRO → the ability to **retrieve** the program from a ServoPro Controller.

7.2 FILE CONTENTS

The following information (setup data) will be saved in each program file:

- Engineering Units [4 bytes]
- Jog Speed [2 bytes]
- Jog Ramp [2 bytes]
- Initialize Speed [2 bytes]
- Initialize Ramp [2 bytes]
- Execution Mode [2 bytes]
- Loop Gain [2 bytes]
- Integral [2 bytes]
- Damp [2 bytes]

The following information will be stored with each BLOCK.STEP.

- Command [2 bytes]
- Parameter #1 [4 bytes]
- Parameter #2 [4 bytes]
- Parameter #3 [2 bytes]

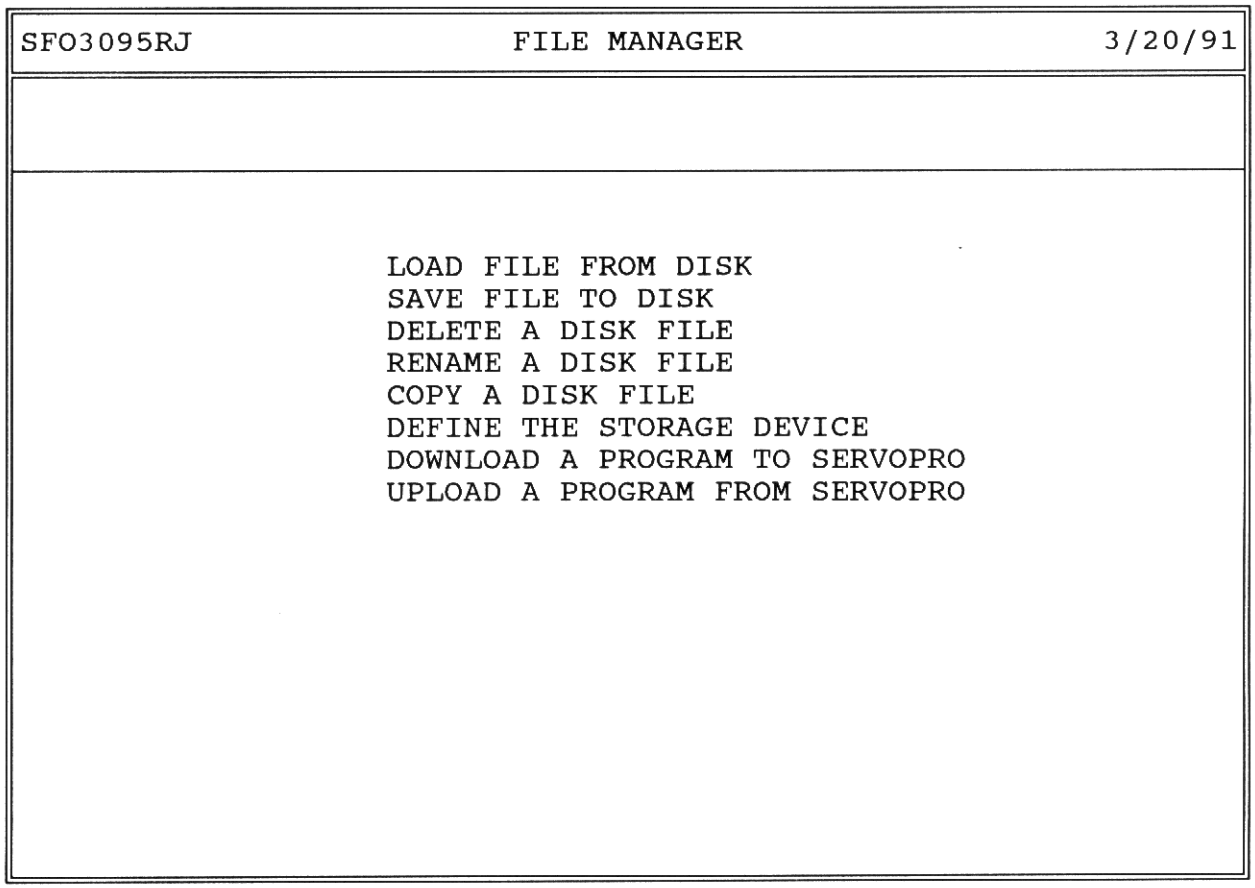


Figure 7.1

- Parameter #4 [2 bytes]
- Parameter #5 [2 bytes]
- Input Device - Parameter #1 [2 bytes]
- Input Device - Parameter #2 [2 bytes]
- Input Device - Parameter #3 [2 bytes]
- Block.Step # [2 bytes]

7.3 DEFINING THE STORAGE DEVICE

The SP Programmer will need to know the location of the program files. The drive and directory path must be defined in order to access the program files.

- When this option is selected for the first time, the current data drive and path will be displayed. Press the ENTER key to save these settings. To change this data, type in the the new disk drive and directory pressing ENTER after typing in each value. The drive and directory path will then be verified.

- If an incorrect drive or path was entered, a message will be displayed indicating the error. Press the ESC key and enter the correct drive and path. To exit this function without modifying the drive and path, press ESC.

7.4 RETRIEVING FILES

- Select LOAD FILE FROM DISK from the FILE MANAGER and press ENTER.

- The ServoPro program files have the file extension **.SPF** and will be displayed in a format resembling Figure 7.2 (the file extension will not be displayed).

- Move the cursor bar with the cursor 'up' and cursor 'down' keys and/or the page up and page down keys to the desired filename, then press ENTER to select and retrieve the file. The file is then loaded into memory.

« WARNING »

If a file is already loaded into memory, be sure to save it before retrieving another file. When loading a new file into memory, the previous file is erased from the PC's memory.

SFO3095RJ FILE MANAGER 3/20/91

PROGRAM NAME	DATE CREATED	TIME CREATED	PROGRAM SIZE (BYTES)
file0001	03/17/91	08:25	2120
file0002	03/17/91	08:25	2120
file0003	03/17/91	08:25	2120
file0004	03/17/91	08:25	2120
file0005	03/17/91	08:25	2120
file0006	03/17/91	08:25	2120
file0007	03/17/91	08:25	2120
file0008	03/17/91	08:25	2120
. . . .	. . . .	. . .	. . .

Figure 7.2

7.5 SAVING FILES

- A program file can be saved by first selecting the SAVE FILE TO DISC function from the FILE MANAGER and pressing ENTER. Type in the file name and press ENTER. The filename will be checked for invalid characters.

- Note that the file names are in MS-DOS format, therefore, a maximum of eight characters may be entered and must follow MS-DOS rules. It is not necessary to the enter file extension, since this is done by the SP Programmer.

- If the file name entered is not a valid filename, an error message will be displayed. Re-enter the file name and press ENTER.

- If the file name entered does not currently exist, the file will automatically be saved by the SP Programmer without additional prompting. Figure 7.2 will then be displayed.

- If the file name entered already exists, a message will be displayed stating that it already exists. Type 'Y' to overwrite the existing file or 'N' to cancel.

7.6 DELETING FILES

- A program file may be deleted by selecting DELETE A DISK FILE from the FILE MANAGER. Position the cursor bar over the filename to be deleted from the displayed list (see Figure 7.2), then press ENTER.

- A message window will appear asking if you are sure that you want to delete the file. Type a 'Y' to delete the file, or 'N' to cancel.

- Once a file has been deleted, the current list of existing ServoPro program files will be redisplayed (see Figure 7.2).

7.7 RENAMING FILES

- A program file can be renamed by selecting RENAME A DISK FILE from the FILE MANAGER. Position the cursor bar over the filename from the displayed list (see Figure 7.2), then press the ENTER key to select the desired file.

- Type in the new file name, then press ENTER.

- Remember not to include the .SPF extension. The existing ServoPro program files will be displayed in a format similar to Figure 7.2.

- If the file name entered is not a valid MS-DOS filename, an error message will be displayed. Check the file name for any errors that may have occured when typing in the file name.

- If the file name entered does not currently exist, the selected file will automatically be renamed by the SP Programmer without additional prompting. Figure 7.2 will be displayed.

- If a file name entered already exists, a message will appear stating that the file already exists. The user may type in 'Y' to rename the current file or 'N' to cancel.

- After a file has been renamed, the current list of existing ServoPro program files will be redisplayed (see Figure 7.2).

7.8 COPYING FILES

- A program file may be copied to another file by selecting COPY A DISK FILE from the FILE MANAGER. Position the cursor bar over the filename to be copied (see Figure 7.2) then press ENTER.

- Type the new file name and press ENTER.

- If the file name entered does not currently exist, the new file will be created by the SP Programmer without additional prompting. Figure 7.2 will then be displayed.

- If the file name entered already exists, a message will appear stating that the file already exists. The user may type a 'Y' to rename the current file or 'N' to cancel and enter another name.

- After a file has been copied, the current list of program files is redisplayed (see Figure 7.2). Press ESC to return to the FILE MANAGER menu.

7.9 DOWNLOADING THE PROGRAM

- Once entered or retrieved from disk, ServoPro programs may be transmitted (downloaded) to the ServoPro Controller.

- Programs may only be transmitted if a valid communications setup is established (ServoPro power ON, correct cable, Comm Port, etc.).

- The ServoPro system must be in the Program Mode when downloading a program. If it is not, turn the key to the Program mode.

- From the FILE MANAGER screen, select DOWNLOAD A PROGRAM TO SERVOPRO.

- A message will be displayed in the upper left corner of the screen while the program is being transmitted.

- When program transmission is complete, the message will be cleared and the user will be returned to the FILE MANAGER menu.

- The SP programmer will attempt to communicate with the ServoPro controller on three (3) successive tries. If unsuccessful, an error message will be displayed. Check for loose cable connections, and make sure the correct communication port has been configured (see SP Programmer Defaults).

« NOTE »

When a program is transmitted to the ServoPro system, the SETUP values will always be transmitted along with the PROGRAM STEPS. Transmitting a program to the ServoPro causes all data values currently stored in the ServoPro (BLOCK.STEP data and SETUP data) to be erased.

7.10 UPLOADING THE PROGRAM

- The user will have the ability to retrieve (upload) a ServoPro program from a ServoPro controller.

- Programs may only be uploaded after a valid communications setup is established (ServoPro power ON, correct cable, Comm Port, etc.).

- The ServoPro system must be in Program mode when downloading a program. If it is not, turn the key to the Program mode.

- From the FILE MANAGER screen, select UPLOAD A PROGRAM FROM SERVOPRO.

- A message will be displayed in the upper left corner of the screen while the program, is being transmitted.

- When program transmission from the ServoPro system is complete, the message will be cleared and the user will be returned to the FILE MANAGER menu.

- The SP programmer will attempt to communicate with the ServoPro Controller on three (3) successive tries. If unsuccessful, an error message will be displayed. Check for loose cable connections, and make sure the correct communication port has been configured (see SP Programmer Defaults).

≪ NOTE ≫

When a program is retrieved from a ServoPro system, the SETUP values will always be retrieved along with the PROGRAM STEPS. All data (both BLOCK.STEP data and SETUP data) values in the PC memory will be erased.

SECTION 8 - REAL TIME FUNCTIONS

8.1 OVERVIEW

The **SP Programmer** provides the user with the ability to monitor program execution and/or modify values as commands are being executed.

> **« NOTE »**
> The keyswitch must be in the **RUN** mode in order to use the Real Time functions.

- Once the program file is in the ServoPro memory, select REAL TIME FUNCTIONS from the MAIN MENU.

- A message will appear in the top left corner of the screen stating 'Program checksum in progress...'. The **SP Programmer** calculates a checksum on BLOCK.STEP data in the ServoPro memory and in the PC memory.

- If the checksums do not match, a prompt will be displayed asking to upload the program from the ServoPro memory to the PC memory. Type a 'Y' to upload the program from the ServoPro's memory into the PC, or 'N' to cancel. If 'N' is pressed, REAL TIME functions will not be executed.

- Once communications have been established, a request will be sent to the ServoPro controller for certain status information. This information will be displayed at the bottom of the screen, and the following list of options will be displayed:

  - SINGLE STEP MONITOR
  - MULTI STEP MONITOR
  - MODIFY BLOCK.STEP PARAMETERS
  - READ POSITION

8.2 SINGLE STEP MONITOR

This option allows the user to trace each occurrence of a selected BLOCK.STEP as it is being executed. Information will be displayed on the screen showing the current status of the ServoPro program.

- Select SINGLE STEP MONITOR from the list of options, then press ENTER.

- A window will be displayed requesting the BLOCK number. Type in the BLOCK number, then press ENTER. If the BLOCK number does not exist, then an error message will be displayed. Press ESC and re-enter the BLOCK number.

- Another window will be diplayed requesting the STEP number. Type in the STEP number, then press ENTER. If the STEP number does not exist, an error message will be displayed. Press ESC and re-enter the STEP number.

- The screen will display the step, it's parameters, and a counter which is incremented each time the step is executed.

- The ServoPro controller will be repeatedly polled until the user exits monitoring. At that point, the user can re-enter another BLOCK.STEP or edit the function.

8.3 MULTI-STEP MONITOR

This option allows the user to trace BLOCK.STEPs executed over a period of time. A buffer will store up to 128 BLOCK.STEP commands as they are executed. Once full, the monitor buffer will automatically be displayed on the screen. Press ESC to terminate the trace at any time and display the trace buffer.

- Select MULTI-STEP MONITOR from the list of options. Select one of the three types of multi-step traces:

  - Trace Current - Begins an immediate trace of steps as they are executed by the ServoPro.

  - Trace after BLOCK.STEP - Waits for a specified BLOCK.STEP to be executed, then begins filling the trace buffer.

  - Display Trace - The last trace executed is saved in memory and the user may return to this function for further review. This data is lost when the execution of the PC Programmer is terminated.

8.4 MODIFY BLOCK.STEP PARAMETERS

This option allows the user to modify BLOCK.STEP parameters during program execution, but only those values entered with KEYPAD as the optional device.

- Select this option and press ENTER. The first parameter which may be modified will be displayed.

- To edit this value, press ENTER, change the value and press ENTER again to accept the value.

- If there is more than one BLOCK.STEP parameter which may be modified, use Function keys F9 and F10 to select the parameter to be modified.

8.5 READ POSITION

This function will display the commanded motor position in user units.

NOTES

SECTION 9 - HARDWARE DIAGNOSTICS

9.1 OVERVIEW

The **SP Programmer** will provide the user with the ability to monitor ServoPro system status, I/O status, dip switch settings and other values such as thumbwheel inputs and resolver position. Once communications have been established, a request will be sent to the ServoPro controller for certain status information. Communications status, Firmware revision, etc.. will be displayed at the bottom of the screen as well as the following list of options:

- SYSTEM STATUS INDICATOR
- I/O STATUS INDICATOR
- THUMBWEEL STATUS
- DIP SWITCH SETTINGS
- RESOLVER POSITION AND MARKER STATUS

9.2 SYSTEM STATUS INDICATORS

Selecting this option will poll the ServoPro system for the status of the 8 LED indicators. The ServoPro controller will be repeatedly polled until the user exits the option.

9.3 I/O STATUS INDICATORS

Selecting this option will poll the ServoPro for the state of the 12 dedicated and 8 programmable I/O modules. Figure 9.3 shows how this information will be displayed. The ServoPro controller will be repeatedly polled until the user exits the option. Select this option, then press ENTER.

- The cursor block will automatically be placed over the first OUTPUT module that may be changed. Of the modules listed, only FUNCTION modules 18 thru 20 and PROGRAMMABLE modules 1 thru 8 may be modified.

- Pressing Function keys F9 or F10 will change the state (from ON to OFF or OFF to ON) of the selected output module. Press the ESC key to exit from this window.

« WARNING »

Of the 8 programmable I/O only those which are OUTPUTS should be modified. Unpredictable results may occur if an INPUT is modified by this function.

9.4 THUMBWHEEL STATUS

Selecting this option will display the status of the 4 thumbwheel modules. The ServoPro controller will be repeatedly polled until the user exits the option. Select this option to display the current thumbwheel status.

9.5 RESOLVER POSITION & MARKER STATUS

Selecting this option will poll the ServoPro for the absolute state of the resolver. A value from 0 to 4095 will be returned/displayed. Also, the state of the marker pulse will also be displayed (either ON or OFF). The ServoPro controller will be repeatedly polled until the user exits the option. Select this option, then press ENTER to display this information.

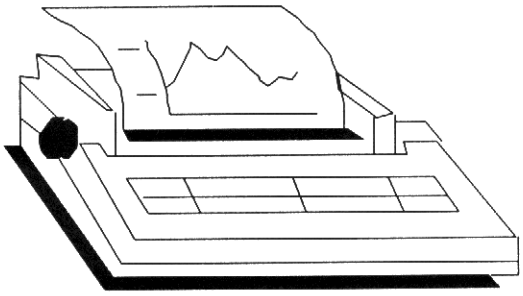
9.6 DIP SWITCH SETTINGS

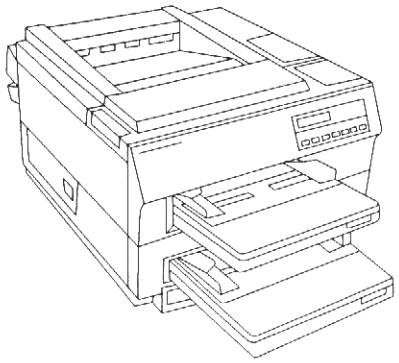
Selecting this option will poll the ServoPro for the current state of the dip switches located on the ServoPro controller board. The ServoPro controller will be continously polled until the ESC key is pressed.

SECTION 10 PROGRAM LISTINGS

10.1 PURPOSE

The SP Programmer will provide the user with the ability to print an IBM-PC memory resident program to a hardcopy device, such as a dot-matrix printer or a laser printer.





The main options provided in the PROGRAM LISTINGS mode are:

- The ability to print one or more programs to a hardcopy device (printer), or to the IBM-PC screen.
- The ability to print the entire program.
- The ability to print selected blocks within the program.

Select the PROGRAM LISTINGS option from the MAIN MENU, then press ENTER. The following options are then shown on the screen:

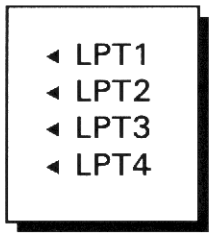
- PRINTER DEVICE SELECTION
- PRINTER SETUP STRING
- LIST ENTIRE PROGRAM
- LIST SELECTED BLOCKS

10.2 PRINTER DEVICE SELECTION

This function allows the user to select the printer to be used.

- From the PROGRAM LISTINGS menu, select PRINTER DEVICE SELECTION and press ENTER. A window with the list of the available printer devices is displayed.

- The user is given a choice of four printer devices, they are;



- Move the cursor bar up or down to select the proper printer device, then press ENTER. The PROGRAM LISTINGS menu is then displayed again. This data may be changed later if needed.

10.3 PRINTER SETUP

In this Mode, the user will be able to enter a series of characters which will define the manner in which the printer is to be used. This series of characters will be referred to as the 'setup string'. Some key points regarding the use of the setup string are:

- The current state of the printer will remain unchanged if no characters have been entered into the setup string.

- The string length cannot exceed 30 characters.

- Non-printable characters will be entered by framing the ASCII value of the character using the < > characters. If either the < or > characters are part of the setup string, the decimal value of those characters should be included within the framing characters.

To enter the printer setup string;

- From the PROGRAM LISTINGS menu, select PRINTER SETUP STRING, then press ENTER.

- A window will be displayed requesting the printer setup string. Type in the string with respect to the conditions above, press ENTER to accept the data.

- If no setup string is required, the data field in the window can be left blank. Pressing ENTER with no data or ESC will leave the setup string blank.

- The PROGRAM LISTINGS menu will then be displayed again.

10.4 LIST ENTIRE PROGRAM

This function allows the user to print the entire program that is currently in the memory of the PC to the selected printer.

- From the PROGRAM LISTINGS menu, select the LIST ENTIRE PROGRAM option and press ENTER to begin printing.

- A message will be displayed in the upper left corner of the screen stating that it is printing the report. The message will be cleared when printing is complete.

- If program printing was unsuccessful;

  - A message will be displayed, indicating that an error has occurred.

  - Press the ESC key to terminate this function.

  - Check for loose or improper cables. Also, verify if the printer setup functions are correct.

  - Repeat this process.

10.5 LIST BLOCK(S)

This function allows the user to print a range of blocks from 1 to 127 of the program which is currently in memory.

- From the PROGRAM LISTINGS menu, select the LIST BLOCKS option and press ENTER.

- A window will be displayed asking for the range of blocks to be printed.

- Enter in the values beginning with the first BLOCK to be printed through the last block to be printed, press ENTER to begin printing.

- A message will be displayed in the upper left corner of the screen stating that it is printing the report. The message will be cleared when printing is complete.

- This function will print only the BLOCKs which have been programmed within the specified range.

  - If a program that is currently in memory contains 13 BLOCKs, and the user enters a range of BLOCKS from 1 to 10, then only BLOCKs 1 through 10 including 1 and 10 will be printed.

  - If a program that is currently in memory contains 13 BLOCKs, and the user enters a range of BLOCKS from 1 to 51, then only BLOCKs 1 through 13 including 1 and 13 will be printed since there are only 13 BLOCKS in the program.

- Remember to only enter values that are in range of the function (1 to 127). If any errors occur, press the ESC key and repeat the previous steps.

SECTION 11 - MONITOR CONFIGURATION

11.1 PURPOSE

Due to the many variations in PC Monitors, it may be necessary to define screen colors and attributes for the windows displayed throughout the program. There are several windows used and a different color or attribute may be configured for each window. This information only needs to be entered once, but may be modified later, and is stored in a data file named 'PC.CLR'.

To configure colors and attributes of the monitor windows:

- From the MAIN MENU, select the MONITOR CONFIGURATION option, and press ENTER.

- A series of windows and window names will appear in order to recognize which window is currently being configured, and will be identified by an arrow pointing to it, such as; ↑, ↓, →, ←.

- Move the arrow to the window to be configured with the F9 (next) and/or F10 (previous) keys.

- Press ENTER, then again use the F9 (next) and/or F10 (previous) keys to change the colors and attributes.

- Press ENTER when complete and the arrow will proceed to the next window. The selection arrow may be moved to the desired window to be configured or reconfigured.

- When all configurations and modifications are complete, press the ESC key to return to the MAIN MENU.

All configuration data is saved when the ESC key is pressed.

NOTES

SECTION 12 - SERIAL COMMANDS

Serial commands allow the user to modify certain data variables in a BLOCK.STEP from a device such as a Programmable Logic Controller (PLC).

All communications are transferred at 9600 Baud with 8 data bits and 1 stop bit. Parity is not used.

The host must initiate all serial commands.

The Serial commands described in this section use a "Packet" concept over the RS-232 communications port.

12.1 BINARY PACKET COMMUNICATIONS

A Binary Packet consists of header information, a stream of binary data (body), followed by a checksum. The body may contain both ASCII characters and Binary data.

DATA TRANSFER PROTOCOL

This Protocol allows data to be sent between the ServoPro and a host, with checksum and retransmission should communication errors occur.

In data communications, the protocol defines the rules for the electrical, physical, and functional characteristics of the communications link. The Protocol contains procedures required to ensure an orderly exchange of information through the link, to and from the executing programs.

When the host or the ServoPro has a block of data to send, the sender will increment a block sequence number and waits for the communications link to become available. When the link is free and available, the packet with header and checksum is transmitted.

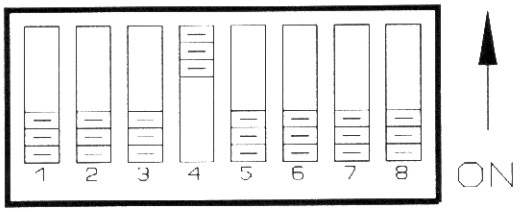
If a negative acknowledgement or timeout is received, the packet is sent again using the same block sequence number. The transmission will be retried up to three (3) times.

RECEIVE PROTOCOL

When the host or the ServoPro begins receiving a packet, the message type is identified as well as the block sequence number. If the packet has the same block sequence number as a previously received packet, the packet is assumed to be a duplicate and is ignored. If the block sequence number is not the expected number or the previous number, the receiving device responds with a negative acknowledgement character (NAK-15H), and resets the block count to 0.
If a block with an incorrect checksum is received or if the transmission fails to complete within a given period of time (time-out), the receiver sends a negative acknowledgement character (NAK,15H) to the transmitter.

« NOTE »

To disable checksum verification of data, set DIP switch #4 on the ServoPro controller to the ON position



If a packet is received successfully, the receiver responds with an acknowledgement character (ACK,06H).

PACKET STRUCTURE (Refer to figure 12.1 for a diagram of the packet protocol).

1) The first byte is the STX (02H) and is used to signal the beginning of a packet.

2) The second byte defines the message type. This byte should always be set to 1, indicating the message type "DATA".

3) The next two bytes define the length of the data area (the header and checksum are not included). The length is given in bytes and may be an odd or even value. The most significant byte of the length is transmitted first.

4) The next two bytes define the block sequence number. This counter is incremented after each successful packet transmission and is used for sequencing control. To facilitate error recovery, a block number of zero (0) will always be accepted and will result in the reset of the block sequence counter. The starting block is determined by the first valid packet received. The high order byte of the sequence number is transmitted first.

5) The variable length data is next. The maxixmum length of the data area is two (2) bytes.

6) Following the data area, there is a two-byte field which contains the checksum for the packet. The checksum is calculated by summing the contents of each byte of the packet, beginning with the message type field, and continuing through the last byte of the message body. The high order byte of the checksum is transmitted first.

SERVOPRO PACKET PROTOCOL FORMAT

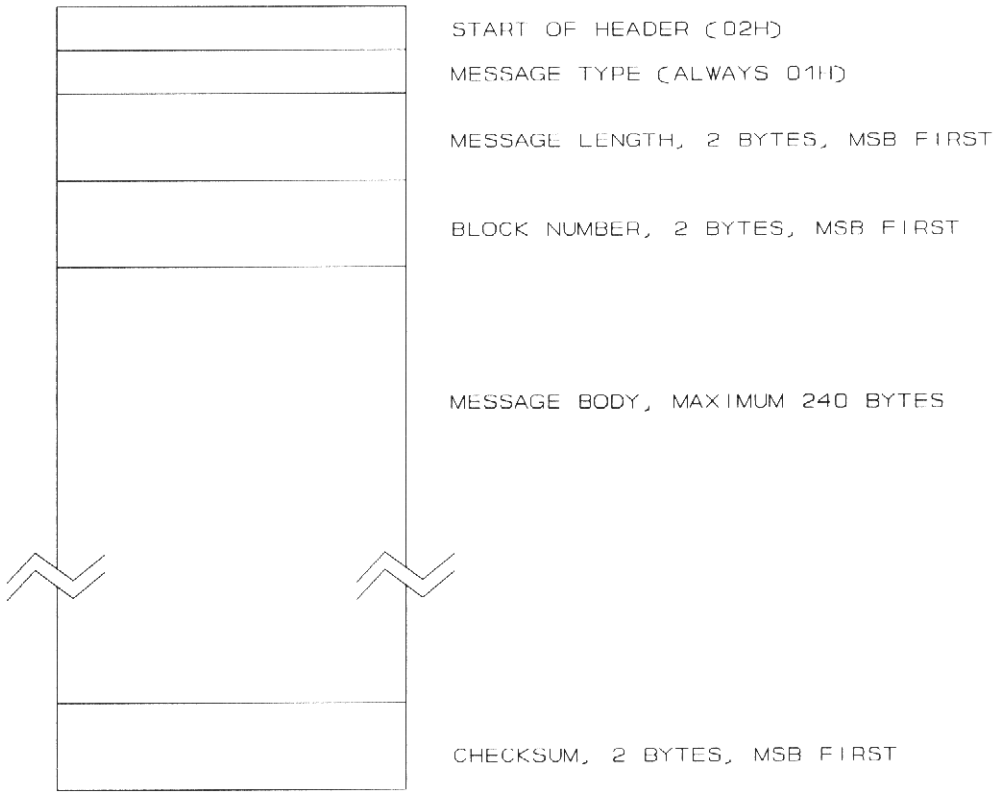


FIGURE 12.1 - Packet Protocol Diagram

Serial commands consist of two basic types. Some commands serve only to transmit information to the ServoPro and receive no response. Other commands request information from the ServoPro after it has responded with its acknowledgement to the commmand.

Each serial command consists of ASCII characters followed by a comma (,) and optionally followed by one or more data values. The complete command must be formatted into a packet by replacing the appropriate header information in the packet, followed by the command which is in turn followed by the appropriate checksum.

If the command requires a response from the ServoPro, then the ServoPro will return the response in the same packet format. Further, the ServoPro will place the command name and the comma in the packet. Details for each serial command follow. In the format description for each packet, [Header] represents the packet header, and [Checksum] represents the packet checksum. The brackets themselves are for clarity purposes and are not part of the actual packet. All numbers in binary format are most significant byte first, followed by least significant byte(s).

RQSTAT

The RQSTAT serial command will be used by the remote computer to request ServoPro status information.

Format: [HEADER]RQSTAT,[Checksum]

Response: The ServoPro will respond with the following:

[HEADER]RQSTAT,32 bytes of data,[Checksum]

where the 32 bytes of ServoPro status information contain the following data:

integer	LED Status	2 bytes
long	I/O Status	4 bytes
integer	TW 1 read	2 bytes
integer	TW 2 read	2 bytes
integer	TW 3 read	2 bytes
integer	TW 4 read	2 bytes
long	Resolver pos	4 bytes
integer	marker status	2 bytes
integer	switch status	2 bytes
long	Commanded position	4 bytes
char string	firmware revision	10 bytes

PUT_DATA

The PUT_DATA serial command is used to transmit a new value for a program step variable from the host to the ServoPro.

Format:

[Header]PUT_DATA,[bs][dt][dddd][Checksum]

where **bs** is a two-byte value containing the Block and Step number to be modified (Block number is in the most significant byte and Step number is in the least significant byte) and **dt** is a two-byte value that refers to the data type:

01 - position (in user units)
02 - speed (in RPM)
03 - accel/decel rate (in revs/sec/sec)
04 - distance (in user units)
05 - search distance (in user units)
06 - post distance (in user units)
07 - time (in milliseconds)
08 - counts (do_while counts)

dddd is a four-byte sign extended value containing the data

« NOTE »

Data variables containing distance or position information must be scaled properly so that they match the engineering units in the ServoPro setup data. For example, if engineering units are 1.000 (3 decimal places) and the index distance is 1 unit, then the correct value to transmit in the data variable is 1000.

GET_DATA

The GET_DATA serial command is used to request the value of a program step variable from the ServoPro.

Format: [Header]GET_DATA,[bs][dt][Checksum]

where **bs** is a two-byte value containing the requested Block and Step number (Block number is in the most significant byte and Step number is in the least significant byte) and **dt** is a two-byte value that refers to the data type:

01 - position (in user units)
02 - speed (in RPM)
03 - accel/decel rate (in revs/sec/sec)
04 - distance (in user units)
05 - search distance (in user units)
06 - post distance (in user units)
07 - time (in milliseconds)
08 - counts (do_while counts)

Response: [Header]GET_DATA,[bs][dt][dddd][Checksum]

where **bs** is a two-byte value containing the Block and Step number to be requested (Block number is in the most significant byte and Step number is in the least significant byte) and **dt** is a two-byte value refers to the data type:

01 - position (in user units)
02 - speed (in RPM)
03 - accel/decel rate (in revs/sec/sec)
04 - distance (in user units)
05 - search distance (in user units)
06 - post distance (in user units)
07 - time (in milliseconds)
08 - counts (do_while counts)

dddd is a four-byte sign extended value containing the data

12.2 ASCII PACKET COMMUNICATIONS

An ASCII Packet consists of a stream of ASCII data.

DATA TRANSFER PROTOCOL

This Protocol allows data to be sent to the ServoPro from a simple ASCII communication host.

In data communications, the protocol defines the rules for the electrical, physical, and functional characteristics of the communications link. The protocol contains procedures required to ensure an orderly exchange of information through the link, to and from the executing programs.

PUT_DATA

The PUT_DATA serial command is used to transmit a new value for a program step variable from the host to the ServoPro.

Format: [PUT_DATA,block,step,dt,dddd]

Where the "[" character signifies the start of an ASCII packet command, "PUT_DATA" is the command to be performed, "block" is an ASCII string representing the Block number to be modified, "step" is an ASCII string representing the Step number to be modified, and **dt** is an ASCII string representing value that refers to the data type:

01 - position (in user units)
02 - speed (in RPM)
03 - accel/decel rate (in revs/sec/sec)
04 - distance (in user units)
05 - search distance (in user units)
06 - post distance (in user units)
07 - time (in milliseconds)
08 - counts (do_while counts)

dddd is a four-byte sign extended value containing the data

≪ NOTE ≫

Data variables containing distance or position information must be scaled properly so that they match the engineering units in the ServoPro setup data. For example, if engineering units are 1.000 (3 decimal places) and the index distance is 1 unit, then the correct value to transmit in the data variable is 1000.

SECTION 13 - REFERENCES

More detailed information concerning any of the commands that are used in the SP Programmer can be found in individual text documents that are included with the program disk. These files have the file extension .DOC, and can be read from any text editor and/or sent to the printing device for a hard copy. If you would like a hard copy of a list of *.DOC files, then at the DOS prompt, with the program directory being the current directory that includes these files, type in the following:

```
→DIR *.DOC > PRINTDOC.SP
→PRINT PRINTDOC.SP
→DEL PRINTDOC.SP
```

This will only give you a list of the directory, not what is in the files. However, these files are ASCII files and may be printed individually.

NOTES

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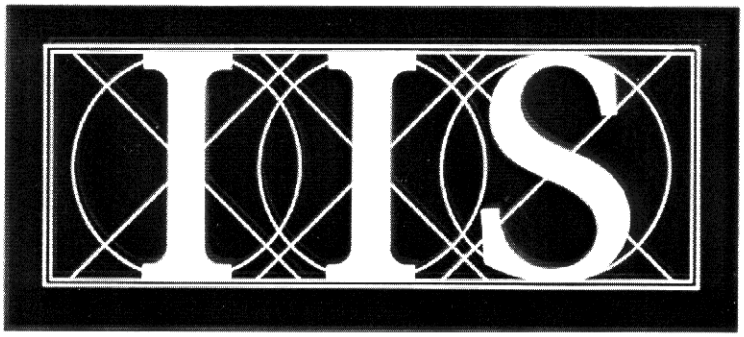
IB-15B002



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