

# CHAPTER VII - DISPLAY PROGRAM

The Display programs provide a means of programming a sequence of actions for the robot arm while displaying the current status of the direction control valves, the speed restrictor control valves, and the position values of the axis as the robot performs the requested actions.

These programs are provided on a self loading 5 1/4 diskette labeled "Display Program - Apple II" provided as a part of the "Instructor's Manual". The disk carries both interpreted and compiled Basic versions of the program.

Students can verify the increased speed of a compiled program by running a program in its compiled version and comparing the speed of operation to the interpreted version of the same program.

An IBM-PC version of this diskette is likely to become available in Fall of 1985.

General copyright notwithstanding, colleges are authorized to modify these programs for their individual, legitimate instructional use on campus with other computers not directly supported by Feedback.

The purpose of these programs is to provide students with several realistic robot control programs for experimental use.

The programs provided on the diskette are shown by this explanation of the disk catalog:

<b>START</b>	the program that loads ROUTINES and then loads and runs BOOT . OBJ
<b>ROUTINES</b>	loaded by START; contains routines used by both ARM and ARMX
<b>ARM</b>	the interpreted version of ARM, stored as an Applesoft Basic file.
<b>ARM . OBJ</b>	the compiled version of ARM, stored as a binary file
<b>ARMX</b>	the interpreted version of ARMX, stored as an Applesoft Basic file.

- ARMX . OBJ** the compiled version of ARMX, stored as a binary file
- BOOT . OBJ** this program lets you select and load ARM, ARM . OBJ, ARMX, or ARMX . OBJ; stored as a binary file, loaded and run by START
- HELP 1** a text file of notes to help you, automatically called by the ARM program when needed.
- HELP 2** a text file of notes to help you, automatically called by the ARMX program when needed.

When the **BOOT . OBJ** program is loaded and run by the **START** program **BOOT . OBJ** will let you select a program by the numbers 1 to 4. The robot control program that you select is then loaded and run by the **BOOT . OBJ** program. The screen that you would normally see is shown below with some added comments in lower case.

**SELECT 'DISPLAY' PROGRAM :**

**1 = COMPLEMENTED ADC**

- **INTERPRETED** ( the ARM program in the catalog )  
The interpreted version ( plain Applesoft Basic ) with the  
binary numbers input from the ADC inverted in value.

**2 = COMPLEMENTED ADC**

- **COMPILED** ( the ARM . OBJ program in the catalog )  
The compiled version ( a Basic program "turned into machine  
code" ) with the binary numbers input from the ADC inverted  
in value.

**3 = NONCOMPLEMENTED ADC**

- **COMPILED** ( the ARMX . OBJ program in the catalog )  
The compiled version ( a Basic program "turned into machine  
code" ) with the binary numbers input from the ADC not  
inverted in value.

**4 = NONCOMPLEMENTED ADC**

- **INTERPRETED** ( the ARMX program in the catalog )  
The interpreted version ( plain Applesoft Basic ) with the  
binary numbers input from the ADC not inverted in value.

**ENTER SELECTION:**

When the **COMPLEMENTED ADC - INTERPRETED** program is running, ( the ARM program in the catalog ) it will show a list of the axes on the left side of the screen and give headings for the parameters of each axis across the top of the screen. The headings are the A/D value for each axis ( A/D OUT ), the destination you have programmed for each axis ( DEST. ), the current state of the solenoid direction control valve for each axis ( SOL. ), and the state of the restrictor valve for each axis ( RES. ).

**To Exit a Program:** when you have finished using a control program it can be stopped by holding down the Shift and Control keys while pressing the Reset key. This will return you to Basic ( as shown by the ] prompt ) and if you want to run a different control program just enter **RUN START** and select the new program in the standard way.

### **Setup Information**

The 946 MICA interface card should be set to an address of **49312** ( all switches off, the standard setting ) or you will need to change line **45020** of the program to match the base address of the MICA interface card in use. The short blue ribbon cable jumper should be removed and the MICA interface cable should be plugged into the connector marked I/O.

### **General notes on using the Display Programs**

The programs are all used in the same way, so these notes will apply to the use of all four programs.

To start with, make sure the Arm has plenty of room. Destination values should start out in the range of **110** to let the arm clear the table.

The Hand Deadband should be set high, to **+/- 50** or more, and the Restrictor Limits for the Hand Rotation and the Hand should also be set high, to **+/- 150** or so.

Don't be surprised that the arm does a bit of hunting to get to a position - these programs are a bit slow in reading the ADC and the arm will often overshoot the destination a number of times.

To correct a number do not use the Backspace Key, just use the left Cursor control arrow and reenter the number.

The Move to Destination command ( M ) does not store the position, in effect this is a "preview" position command.

After you have entered a Destination Position you will use the Edit Position List command ( E ) to start the process that will save the position to computer memory. If you change the destination number before the Destination Position is saved all the numbers will be wiped out.

The Edit Position List command ( E ) lets you save a position to computer memory that you have entered in the Destination Column under the current Destination Position \* ( Number).

After you have entered E ( Edit Position List ) select S ( Save Position ) to replace the old contents of a position (all zeros for a position used for the first time) with the current values of the position you have entered. The I ( Insert ) command will insert a new position between two old positions without changing the old positions, while the R ( Replace ) command will replace a selected old position with the new position.

When you have saved a sequence of positions to computer memory then you can save the positions in computer memory to disk.

### **Why is there a COMPLEMENTED And NONCOMPLEMENTED version of each program ?**

The Armdraulic robot can be used under control of a MICA parallel port or under RS -232 serial control. Because the Armdraulic robot system is designed to be used by as many different computers as possible there are some minor changes in the way the arm responds when under serial or parallel control.

When the arm is in the "Home High" position the ADC value read on the RS - 232 line is in effect inverted from the ADC value that would be read on the parallel port with the arm in the same position.

As a result, we are providing two versions of each type of display program, one version that inverts the data (complements it), and another version that does not invert the data coming from the Armdraulic robot.

You will now be able to select the correct type of program to match the results of the software you are currently using.