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**AMSTRAD** 464,664  
& 6128

***FIRST STEPS IN BASIC***

**D. KEDEM & I. KALISKY**







AMSTRAD 464 & 664

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# *Watson's Notes*

## **AMSTRAD 464 & 664**

I.KALISKY & D.KEDEM

### **UNIT 1**

## **First Steps in BASIC**





JULY 1985

All programs in this book have been written expressly to illustrate specific teaching points. They are not warranted as being suitable for any particular application. Every care has been taken in the writing and presentation of this book but no responsibility is assumed by the author or publishers for any errors or omissions contained herein.

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## FOREWORD

In this study unit and in the ones that follow you will learn to write programs covering a variety of areas. For example, drawing on the computer screen, developing computer games, educational games, mathematical exercises and more.

While progressing through the unit you will learn the BASIC of the Amstrad computer. This will be achieved via an active process continually using the computer at your disposal.

This first study unit has two main aims:

- To recognise the terminology of BASIC used in computer programs and to use them in developing interesting graphics programs.
- To teach you the special editing facilities of the Amstrad, through which you will acquire complete control over the computer's keyboard.

With regard to the method of study: from the beginning you are required to think and act. The computer and the unit will provide you with the answers to all the tasks you are asked to perform.

An additional piece of advice: before turning to the answers always try to solve the problems yourself. Do not worry about making mistakes - by being bold learning will be much quicker and will become a pleasant experience.

Dani Kedem and Itzhak Kalisky







## Chapter 1

# THE AMSTRAD AS A TYPEWRITER


The main feature of a computer is its ability to execute computer programs that you will learn to write for it.

Initially however, (in order to become familiar with the computer and the keyboard), you will learn how to display characters on the screen, using most of the keys on the keyboard. This will serve as useful preparation for the programs you will later learn to write.

After switching on the computer, the manufacturer's name appears on the monitor as well as the message 'Ready'. A yellow square appears below the message. This is a signal that the computer is ready to be instructed.



## Displaying Characters

 Type a few characters on the keyboard, first type letters, then numbers.

You will notice that the computer displays whatever you type.

## Note

When you press a key, the computer displays that particular character on the screen in the position of the yellow square.



This yellow square is called the **CURSOR**.

**Cursor**

After displaying the character the cursor moves one space to the right where it waits, ready to display the next character.

## Investigating the Keys

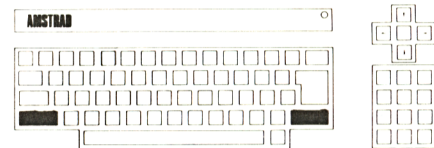


You may have noticed, for instance on the 4 key, a second character, in this case the '\$' symbol.

? How can you print the '\$' character on the screen?

In order to get the second character from a key you must use **SHIFT**. There are two SHIFT keys on the keyboard, you can use either.

**Shift**



□ While holding down SHIFT press the '\$' (4) key.

The \$ appears on the screen.

? How do you print a '!' on the screen?

**Answer 1**

The exclamation mark is on the '1' key.

## Clue

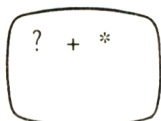
The '!' character is one of the second characters (known as **UPPER CASE** characters) of the top row of keys.



## Rule

In order to print an upper case character, hold down one of the SHIFT keys and at the same time press the appropriate key.

Display the following characters on the screen:



## Upper and Lower Case Letters

Does the computer display letters in upper or lower case?

In other words, does the letter “B” look like “B” or like “b”?

Press the **CAPS LOCK** key.

**CAPS LOCK**



Nothing happened on the screen did it?.

Now continue to press different keys.

Have you noticed the difference between the letters on the screen?

Press the Caps Lock key again, and display several more characters.



## The Number Ø

□ Press the appropriate key to display Ø, (the key is to the right of the number 9).

As expected the computer displays the number Ø on the screen. The computer prints zero in this way, i.e. with a line through it, in order to differentiate it from the letter 'O'.

□ Press the 'O' key (it is next to 'P'), and note how it differs from the 'Ø' on the screen.

## Clearing the Screen

Now there are all sorts of meaningless characters on the screen, you must erase them.

The command you give the computer is **CLS**, which means '**CL**ear the **S**creen and bring the cursor to the top left hand corner of the screen'.

**CLS**

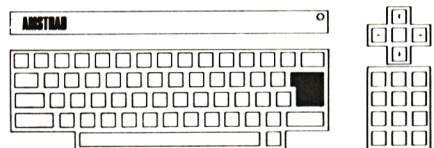
□ After displaying some characters on the screen, type the command CLS, letter by letter.

The computer still has not executed your command. It waits for you to tell it that you have finished your instruction.

⤵ Are you finished?

□ Press the '**ENTER**' key.

**ENTER**



Pressing this key tells to the computer to: 'Carry out the command just typed'.



If, to your surprise, the screen did not clear but instead the message:

■ Syntax error

Syntax error

was displayed it means that there is a spelling mistake made in the command.



What happened?

The computer did not understand the CLS command because preceding it were several meaningless characters it did not understand.

No problem!



Re-type CLS and press ENTER.

The command this time was correct and the computer carried it out and cleared the screen.

## Deliberate Mistakes



Type CLS incorrectly and see how the computer reacts.



For example type:

CKS



What did the computer do after you pressed ENTER?


The computer again announced 'Syntax error'. This means that there is a spelling mistake in the command, the computer does not understand it, and therefore cannot execute it.




## Summary

- The computer displays the characters that correspond to the keys you press.
- The command CLS clears the screen.
- Pressing ENTER tells the computer to carry out your command.
- If there is a spelling mistake in the command, or there are any other incomprehensible characters, the computer will display 'Syntax error'.

## The Space Key

 Clear the screen.

 Type in your first name and surname.


Obviously, you need a space between the two names.

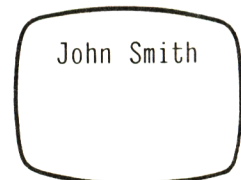


You use the **SPACE KEY** at the bottom of the keyboard for this. Because the space is a much used key it is especially long.

### Space Key

## Task

 Display your first name and your surname in the centre of the screen, e.g.





You had no option but to press the space bar until the cursor reached the centre of the screen, then you typed your name.

There is however another way of moving the cursor to the centre of the screen.

Clear the screen.

## The Editing Keys

Press the key which shows a downward arrow.



In which direction did the cursor move  
Down (up or down)?

How can you move the cursor to the left?

How can you move it to the right?

How can you move it upwards?


Try it!

**Clue:** the other arrow keys will assist you.

## Note

Once you begin typing your name, you cannot move from it in any direction: vertically or horizontally, using the editing keys!



 Try it!


Later on you will understand why.


## Modes

 Enter the following command:


MODE 0

MODE

 Note that you must put a space before the number 0.

 What will happen if you forget the space?

Try it!

 Tell the computer to execute your command.

(Don't remember how, see page 10.)


The computer cleared the screen and printed the message:

Ready

Ready

■ The MODE 0 command transfers the computer to a new 'screen' whose number is 0.


This 'MODE 0' is the LARGE LETTER screen. You can use commands and programs in this MODE as you did previously in MODE 1.

 Type your name.

After typing your name, tell the computer to clear the screen.


(If you do not remember how see page 10.)



 How many letters fit across the screen in MODE 0?

Check this!


Answer 2

 How many letters could you fit across the screen before you executed the command MODE 0?

You probably do not remember.


To check this, tell the computer to revert to the former screen, MODE 1.


Answer 3


 Well then, how many characters fit across the screen in MODE 1?

Answer 4


## Conclusion

 The width of the symbols in screen \_\_\_\_\_ (0 or 1) are twice the width of those on screen \_\_\_\_\_ (0 or 1)?


 Are there any more screens?

 Tell the computer to change to MODE 2.

Answer 5

 How many characters fit across the screen in MODE 2?

Answer 6

 Are there any other modes?

Tell the computer to change to MODE 3.

The computer will display:

Improper argument

Improper argument

This is for the simple reason that there is no such MODE.



## Summary

? When switching the computer on, what MODE is it in \_\_\_\_\_(0 or 1)?

Answer 7a

? In MODE 1 how many letters across the screen are there \_\_\_\_\_(20, 40 or 80)?

Answer 7b

? What must you type in order to move to Large Letters: MODE\_\_\_\_\_?

Answer 7c

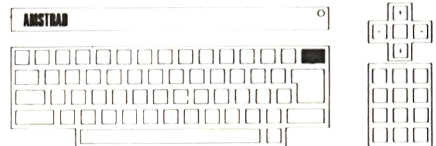
□ Tell the computer to change to MODE 1.

## Erasing and Correcting Errors

Suppose you want to move to MODE 2 and you type, by mistake:

MODE 3 ■

If you have not yet pressed ENTER you can correct the error.



Let's see how:

□ Type the following and do not press ENTER:

MODE 3

In order to erase the '3' and replace it with '2':

□ Press the **DEL** key once.

**DELETE**



The cursor moved one space to the left and erased the number '3'.

MODE ■

Now press the 2 key. So if you now press the ENTER key the computer will move to MODE 2.

## Summary

Pressing the DEL key (DEL is an abbreviation of DELETE) erases the character to the left of the cursor.

## Note

The repetitive pressing of DEL erases a character to the left of the cursor for every press of the key.



Do you wish to prove this?

Press the 1 key repeatedly until there is a long row of 1's across the screen.

Press DEL as many times as there are 1's on the screen. All the 1's will be erased.

## Additional Corrections

Type the following precisely as it is shown here:

CLLS

and do not press Enter.

Erase the extra L using the cursor keys and DEL.

Answer 8

Press Enter and see whether the command was carried out.



## Inserting a Missing Character



What happens when a letter is missing?



Type the following, (but do not press ENTER):

MDE Ø

This time there is an O missing.

In order to insert the missing O:



Move the cursor (if you don't remember how see page13) backwards onto the letter 'D'.

M D E Ø



*Position of cursor*



Now press O.

You will see that the O was inserted to the left of the cursor.



Press ENTER and see whether the computer carries out the command.

### Task



Type:

MOD 4 Ø

Without pressing Enter correct the command so that the computer will change to MODE Ø.

Answer 9

## A Spot of Colour – BORDER

At this stage you can enjoy the varied colours the computer provides.



Tell the computer (in any MODE): /

BORDER 6

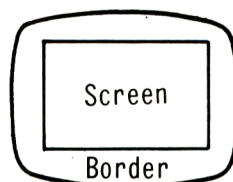


Do not forget the space before the 6.

**BORDER**

? Do not forget to press ENTER to tell the computer to execute the command?

(You do not remember how? See page 10.)



After pressing ENTER, the border of the screen turned a light red colour.

Each colour has a number. The command 'BORDER 6' tells the computer 'change the border in colour number 6'. From this it follows that the computer stores more colours.

Get the computer to colour the BORDER orange.

Colour the BORDER green. *9*

Colour the BORDER blue (a similar colour to that of the screen). *10A2*

## Some Summarising Questions

? How do you get the symbol '='?  
(A clue on page 8.)

? How do you clear the screen?  
(A clue on page 10.)





How do you move the cursor upwards?  
(A clue on page13.)



How do you fit 80 characters across the screen?  
(A clue on page15.)



How do you move to CAPITAL letters?  
(A clue on page 9.)



How do you erase a character to the left of the cursor?  
(A clue on page16.)



How can you insert a missing character?  
(A clue on page18.)



Can the characters and their background be printed in different colours?

Certainly!

However, since the colouring rules are somewhat complex, we shall deal with them at a later stage in this study unit.

## Chapter 2

# THE AMSTRAD AS A POCKET CALCULATOR

## Carrying out Arithmetic Functions

Using the computer as a pocket calculator is the subject of this chapter.

### Addition

Clear the screen.

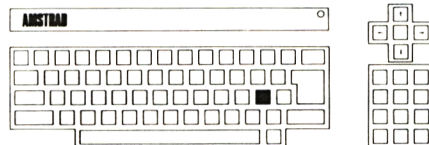
Type in the following line:

PRINT 2+5



You must not forget the space.

PRINT



Do not forget to use the SHIFT key to print the '+' character.

By typing this you have told the computer to display the result of the problem of adding:

2+5

Of course, the computer has not yet executed the command.



You must inform it that your command is complete.

To do this you must press the \_\_\_\_\_ key?

Press \_\_\_\_\_.

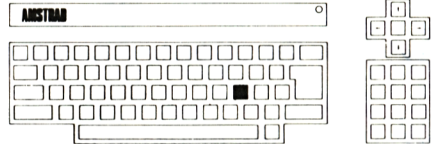
If you acted correctly, the computer will have displayed the result 7.

The computer also printed 'Ready' which means 'ready for further instructions'.

## Multiplication

Continue and tell the computer to calculate:

$$3*5$$

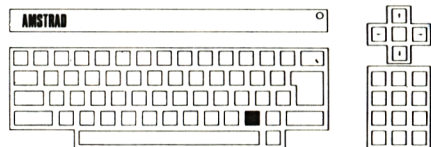


The multiplication sign on the computer is '\*' (asterisk) whose position on the keyboard is shown above.

## Division

Tell the computer to calculate the following sum:

$$20/4$$



The division sign on the computer is '/', and is shown above.

## Note

You can find, near the division character (/) another division symbol (\). Do not become confused between the two.

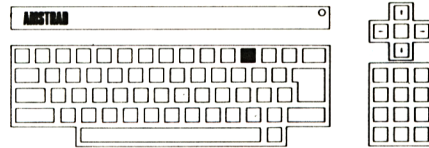
Type:

PRINT 23\5

Have you noticed what has happened?

The computer only displayed the whole number (integer) part of what should have been the result (11.5).

## Subtraction



Tell the computer to calculate the following using the minus sign '-' shown above:

21-7

(If you are familiar with negative numbers you could try the calculation 7-21.)

Now you can do other calculations, as you wish, for example:

What is the result of the following sum:

8-4\*2

Think about it and then tell the computer to make the calculation.

Does the result surprise you?

If it does, consult Appendix: 'The Precedence of Mathematical Operators' on page 81 .



## An Abbreviation for PRINT

Because the PRINT command is so useful on the computer, it has an abbreviation, this is the Question Mark '?'.  
 ?7\*20

(Do not forget to use SHIFT to get a '?')

Type the following on the screen:

?7\*20

Now press ENTER

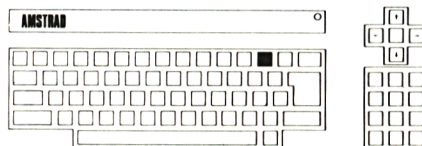
The computer understood the '?', it took it a substitute for the 'PRINT' command. It will probably be easier to use the '?' instead of 'PRINT', you will work more efficiently and also avoid making unnecessary mistakes.

### Task

Type the following:

PRINT 3↑2

Press ENTER



What result did you get?

What is this new function?

What will be the results of the following calculations:

5↑2

2↑5

6↑6

**Answer 10**

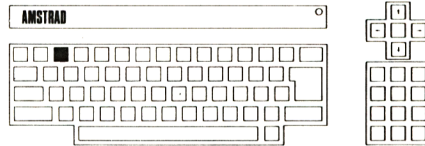
Check these using the computer.

## An Exercise Using Quotation Marks



What will happen if you tell the computer to work out a sum between **Quotation Marks**?

**Quotation Marks**



```
PRINT "2+5"
```

(Do not forget to use the abbreviation of PRINT.)



Type the line and press ENTER.

The computer did not work out the sum, it merely displayed it.

## Remember

When you order the computer to print something inside quotation marks, the computer will simply copy it onto the screen! This feature enables us to get the computer to print on the screen both the exercise and the result.



Type in the following exercise:

```
PRINT "10+25=" 10+25
```



Press ENTER.

The computer printed both the exercise and the result on the screen.



Now get the computer to print on the screen the following exercises and their results:



## Note

- Use the abbreviation of PRINT.
- Don't forget to press ENTER.
- Don't forget the quotation marks.

90-14=

27/11=

26\*29=



Why does the computer leave a space here:

90-14= 76

↑  
space



To understand this, tell the computer to display on the screen the following exercise and it's result:

14-90=



Is it now clear to you why the computer leaves a space?

**Answer 11**

## The Computer has made a Mistake!?

Sometimes people say: "The computer has made a mistake!"

The fact of the matter usually is that the computer programmer has made a mistake.

Let's see how mistakes are made:

PRINT "2+2="2+3



Type this in and tell the computer to display the result.

? What happened?

? Is your computer unable to do arithmetic?

Of course not. It is simply obedient and did exactly what you asked it to. In this situation it copied what you put between quotation marks and also calculated the exercise outside the quotation marks, printing the result.

## The Computer as a Parrot

It is not only figures that the computer copies from quotation marks.

Tell the computer to:

```
PRINT "Your first name"
```

? Did you type the abbreviation for PRINT?

? Did you press ENTER

? Did you remember the Quotation Marks?

Give the computer the same instruction, but without quotation marks, i.e.:

```
PRINT Your first name
```

In response, the computer printed:

```
Ø Ø Ø
```

It seems that the computer did not understand your intention and tried to print the 'value of the three words'. Later on you will understand why the computer specifically printed 'Ø'.

## Conclusion

When you want the computer to copy characters exactly as they are, put them between quotation marks.



## Task



How will the computer respond to the following command?:

```
PRINT "BORDER 13"
```



Try it!

At present all of this seems rather silly. You type and the computer copies....

Later on you will realise the value behind this simple function.

## Summarising Questions



What is the multiplication character on the computer \_\_\_\_\_?



What is the division character on the computer \_\_\_\_\_?



The ↑ character on the computer is the symbol for \_\_\_\_\_?



The abbreviation of the PRINT command is which character \_\_\_\_\_?



When a sum is put between quotation marks the computer \_\_\_\_\_(copies/solves) it.

- We recommend that at this stage you move on to study the Appendix, 'The Precedence of Mathematical Operators'.


## Note


Before you continue to the next chapter switch off the computer.

## Chapter 3

# THE FIRST PROGRAM


### A Program Line


 Clear the screen and type the following command on the computer:


 Take care to type the 10 before the instructions.

```
10 PRINT "5+7="5+7
```

Program Line

 Do not forget the line number.

 Press ENTER

 Did the computer execute the command?


No, the computer did not execute the command, it seems the computer ignored it.

However it did not ignore it at all!

You typed in a tiny program for the computer, a single line program, line 10.

When there is a number in front of a command, the computer sees it as a line in a program. After pressing ENTER the computer transfers the line into its MEMORY, and stores it there, but it does NOT YET execute the command.


### Running a Program

 When will the computer carry out the command?




The computer's command '**RUN**' is the answer to this. **RUN**

RUN means 'carry out (execute) the commands in the program'.


 So, type:

RUN


and press ENTER.


 What happened?


Only now did the computer carry out the program which had been stored in its memory.

 Clear the screen.

The short program (line 10) disappears from the screen.

 Was the program also erased from the computer's memory?


 In order to answer this question repeat the command RUN (to execute the program).

 Did the computer carry out the program \_\_\_\_\_(Yes or No)?

## Conclusion

A program remains in the computer's memory even after it has been cleared from the screen.

## Listing a Program

 Can you view the program stored in the computer's memory?

Certainly!

Type:

LIST

(Without forgetting ENTER)

This means 'Display the program'.

The short, one line, program appeared on the screen.

By the way, even if you type PRINT in the abbreviated form "?", the computer will still display 'PRINT' in full in the **LIST**ed program.

Add the following line to the program:

```
20 PRINT "your first name"
```

(Do not forget to end with \_\_\_\_\_?)

LIST the program again.

How many lines are there now in the program \_\_\_\_\_(1,2,3)?

You see that the new line, line 20, did not replace the first line (10), but followed it.

Now the computer's memory stores a two line program.

Clear the screen and RUN the program.

(Don't remember how? See page 30.)

Which program line did the computer carry out first \_\_\_\_\_(10, 20)?

Add another line to the program

```
5 PRINT "your surname"
```

Clear the screen and LIST the program.



? Does line 5 appear at the beginning or at the end of the program?

## Remember!

The computer arranges the lines of the program in numerical order!

It does not matter which line you type first.

Clear the screen and RUN the program.

? Which of these figures does your screen resemble?

```

READY
RUN
SURNAME
FIRSTNAME
5+7=12
READY
■

```

A

```

READY
RUN
FIRSTNAME
5+7=12
SURNAME
READY
■

```

B

```

READY
RUN
SURNAME
5+7=12
FIRSTNAME
READY
■

```

C

If your answer is C all is well.

We see that the computer executes the commands in the order in which they appear in the program.

- Firstly line 5
- Then line 10
- Finally line 20

Tell the computer to LIST the program on the screen.

(You don't remember how? See page 31.)

## Inserting a Line in a Program

Between line 10 and 20 insert a line which will tell the computer to calculate the sum  $5*40$ .

## Hint

Complete the following line:

```
_____ "5*40="5*40
```

After inserting the line clear the screen and RUN the program.

Which of the "screens" were displayed?

```
READY
RUN
SURNAME
5+7=12
FIRSTNAME
5*40=200
READY
█
```

A

```
READY
RUN
SURNAME
5+7=12
5*40=200
FIRSTNAME
READY
█
```

B

```
READY
RUN
SURNAME
5*40=200
5+7=12
FIRSTNAME
READY
█
```

C

If your answer is NOT 'B', you have a small problem.

You did not know what number to give the new line.

Here is an additional hint:

```
5 _____
10 _____
```

*The new line should be inserted here.*

```
20 _____
```

**Answer 12**

Can you, from what you have learnt so far, think why the line numbers are, to start with given in intervals of (for example) 10 and not 1, 2, 3...?

Well, this allows the insertion of extra lines when necessary, as you have just done with line 15.

## Clearing the Screen in a Program

LIST the program on the screen.

Previously we asked you to clear the screen before typing the names and numbers.

? How will you do this in a program?

Answer 13

LIST the program.

? Was the new line placed in its proper position within the program?

If so, RUN the program.

Have you noticed how quickly the screen was cleared and all the names and numbers were printed at the top left hand corner of the screen?

## Replacing a Line with a New One

? What will happen to the existing line 10 if you type in the following line:

```
10 PRINT "30/6="30/6
```

Enter the line in the program and then LIST the program.

You see now that the new line simply replaced the previous line 10.

The computer now stores the new line, while the former line was simply replaced and does not exist any more.

RUN the program and see for yourself.



## Erasing a Line from the Program

? What will happen to line 15 in the program, if you replace it with a blank line 15?

Type:

15

Press ENTER

Try and find out!

LIST the program and check what happened to line 15.

You will see that line 15 was erased from the program. The computer replaced line 15 by a blank line, therefore line 15 was erased from the program.

? In the same way, erase line 20 from the program.

Answer 14

## Altering Lines using Edit

LIST the program.

Your program now comprises of lines 3 and 5.

Now we want you to add your first name to line 5, e.g.

```
5 PRINT "first name surname"
```

? How can you add your first name to line 5? *EDIT 5*

You can of course retype the line into the computer, (instead of the existing line 5). But, you can also change the existing line 5.



How?



Type:

EDIT 5

EDIT



If you have not forgotten to put the space in the appropriate place and you pressed \_\_\_\_\_, the computer displayed line 5 on the screen with the cursor at the beginning of the line.



Move the cursor to the right until it rests on the first letter of your surname.



Now type your first name. (Do not forget to insert a space.)



After putting your first name in the correct place in the line ENTER it into memory by pressing \_\_\_\_\_.



LIST the program.

(If you do not remember how, See page 31.)



You will see that the amended line replaced the old line.



RUN the program.

## Summary

When you want to make a change to an existing line, one of the methods available to you is to use EDIT.



With the EDIT method you enter the changes and press \_\_\_\_\_ in order to replace the former line with the EDITed line.

The alternative to editing a line is typing the line again.

Now we want to add the following line to the program:


```
20 PRINT "30*6="30+6
```

It is of course possible to type the line in from scratch, but line 20 is very similar to line 10 which already exists in the program.

```
10 PRINT "30/6="30/6
```

The arrows point to the 3 differences between lines 10 and 20.

## Task


 How can you type line 20 into the program using line 10?

Try it!

**Answer 15**

List the program and check whether line 20 has been included correctly.

RUN the program.


 Is the following line written correctly?

```
30 BORDER15
```

Surely you notice that there is a mistake. There is no space between BORDER and 15.

Let's see what happens when an incorrect line is used in a program.

Copy line 30 as it is shown above (with the mistake).

 What happened after you pressed ENTER?

The computer copied the incorrect line directly into it's memory.



? What will happen when you RUN the program?

Try it!

The computer carries out the program up to line 30. When it reaches line 30 it discovers the error and informs you that there is a:

Syntax error

The computer presents the line in EDIT mode, so you can make the necessary corrections.

Correct the line and press ENTER.

RUN the program

Is the border coloured orange?

## ESC: The ESCAPE Key

Tell the computer you wish to make a change to line 10.

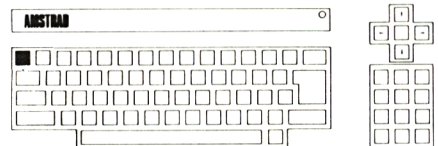
Type the following but do not press ENTER:

```
10 PRINT "20/5="20/5
```

Now, assume that before pressing ENTER you have changed your mind and you do not wish to change line 10. Must you re-change the line to its former form so as you can press ENTER and therefore leave the line as it was?


The answer to this is NO. Instead, the AMSTRAD designers thought of this possibility, and found an answer to this problem:

Using the **ESC** key.



Press the red **ESC**ape key once. The computer printed \*BREAK\* at the end of the line and the cursor moved to a new line.

**ESC**

 Check the program and see whether line 10 has changed.

## Summary

If you begin to type or EDIT a line and then change your mind, pressing the ESC key will get you out of the situation.


## Erasing a Whole Program


It is now time to move onto different programs. The program stored in memory must be erased.

So far we know of two ways of doing this:

- Switching the computer off and then on again.
- Erasing one line after another, until all lines are erased.

To make this process simpler you will probably realise that there is a command to achieve this purpose.

 Clear the screen.

 LIST the program.

 Type:


NEW


**NEW**


and press ENTER.

Apparently, nothing happened, but actually, a great deal did.

The program no longer exists in the computer's memory.

 Do you need to be convinced?

 Try to LIST the program again.

 Try to RUN it.

The computer refuses to LIST the program for the simple reason that the NEW command erased the program from it's memory.

## A Lost Program Recalled – the COPY Key

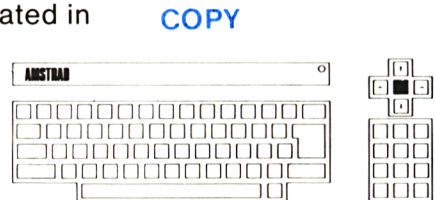
In this situation the program is still on the screen and so can be re-used.

Hold down SHIFT and at the same time press the 'up arrow' (↑) key.

Surprisingly, one cursor (we shall call it the REAL cursor) remains in its place, and an additional cursor (we shall call it the **COPY** cursor) begins to rise upwards.

Bring the COPY cursor to the first line of the program, line 3 (still holding down SHIFT).

Now press the **COPY** key, (it is situated in the middle of the cursor keys.



You see that pressing this key made the computer copy the character under the COPY cursor.

Using the COPY key, copy the entire line 3.

Line 3 moved (was copied) down.

Press ENTER

In the same way copy all the lines in the program.

RUN the program.



LIST it on the screen.

You see that by using the COPY key you were able to re-enter the previously lost program.

## Summary

- By using the COPY key it is possible to copy whatever is printed on the screen.

? In order to move the COPY Cursor the SHIFT key is held, while also pressing one of the ↑ keys.

? In order to copy the line press the COPY key.

? In order to store the copied line in memory one must press the ENTER key.

Later on in this Unit you will learn more useful and varied functions of the COPY key.

Again, erase the program from memory.

Clear the screen.

## Summary

In this chapter you have learned to recognise a computer program.

- You learned to write a program, RUN it, LIST it and erase it from memory.
- You understood that a program consists of lines. Each line has a number which is followed by the instructions for the computer.
- The computer carries out the program in the numerical order of the lines.

- You learned to make changes in the program:

To insert a line in the program.

To replace one line with another.

To erase a line from the program.


To EDIT existing lines.

Granted the program that you wrote was very simple. Later on though, as your knowledge grows, you will be able to write more complex programs.


## Chapter 4

# A PROGRAM OF PATTERNS


### The GOTO Command

 Examine the following program:


```
1Ø PRINT "your name"
2Ø GOTO 1Ø
```

 The **GOTO** command instructs the computer to go to line number \_\_\_\_\_.


**GOTO**

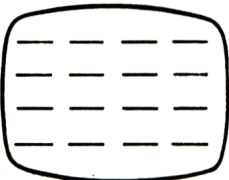
 Can you guess what will appear on the screen when you RUN the program?

If you can't, don't worry.

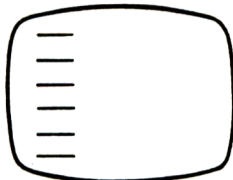
 Type the program into the computer and RUN it.

(Do not forget the space after GOTO.)

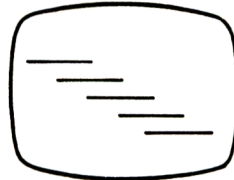
 What will appear on the screen A, B or C?




A



B



C

 Do you now understand what GOTO does in this program?



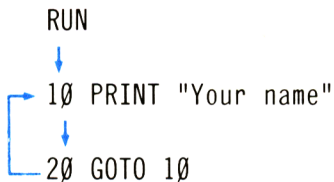
? The computer first carries out line \_\_\_\_\_ (10 or 20) and prints your name on the screen.

? Which line does it then move to \_\_\_\_\_ (10 or 20)?

? Here it receives an interesting command telling the computer to GOTO line \_\_\_\_\_ (10 or 20).

? Obediently, the computer returns to line \_\_\_\_\_ (10,20) and again carries out the instruction there.

It re-displays your name, below that already on the screen and then proceeds to line 20. From there it is again redirected to line 10 and so on, filling the whole screen.



The arrows show that the computer moves between lines 10 and 20, inside a LOOP.

? Is the computer still moving between lines 10 and 20?

Of course!

After all, the computer has not yet received a command to stop it from moving back and forth between the two lines, so it continues to move in this way inside the loop.

(Note that the cursor does not appear.)

It is hard to see that the computer is moving inside the loop, because the whole screen is covered, in fact all the time it keeps printing your name further down the screen.



How can you tell the computer to stop moving in this manner?



Press ESC once.

The computer has stopped, and the cursor has appeared. The message:

Ready

has not yet appeared though.



Press ESC once more.

The message:

Break in 20

Ready



Break in ..

This means that the program has stopped running in line 20 of the program, the computer now being ready for further instruction.



If the computer said:

Break in 10

this would have meant that the program stopped running when it was in line \_\_\_\_\_.

## Forming Patterns on the Screen

We shall now introduce a small change in the program.

We shall add a **SEMI-COLON (;)** at the end of line 10:

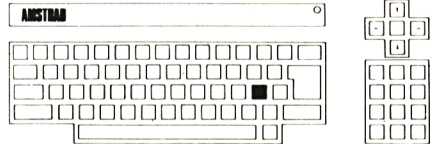
**Semi-Colon**

```
10 PRINT "your name";
```

- Insert the change without retyping the whole line, using the EDIT command.

Answer 16

Take care not to confuse semi-colon (;) with colon(:)



The semi-colon is on the + key.

- LIST the program and check whether the change was made.

You may be curious to know what effect this small change will have.

- RUN the program.

This time the computer fills the whole screen. This is because, as it continues to carry out the program, it keeps printing new lines which 'push' the earlier ones up.

- Stop the program RUNNING.

(If you don't remember how see page 38.)

Notice that with the addition of the semi-colon (;), the computer prints your name continuously on the same line. When the line is full it moves to a new line and continues printing.

- ? What will happen if you press the ESC key once and then you press a different key?

- Try it!

You see that pressing any key after pressing ESC, causes the computer to resume running the program from the point at which it stopped due to the first pressing of the ESC key.



## Conclusion

A semi-colon (;) at the end of a PRINT instruction tells the computer to continue printing on the same line immediately to the right of the previous item it PRINTed (if there is still room on the line).

Without a semi-colon, the PRINT command will print the next item at the beginning of a new line.

## Inserting Additional Characters in the Line

You see that the computer prints your name continuously, with no separation.

Make a small change in the program so that your name will be printed on the screen like this:

Answer 17

```
* Your Name * Your Name
* Your Name *....
```

Add a line to the program so that the computer will operate in Large Letters MODE.

Answer 18

RUN the program.

Add a line to turn the BORDER purple.

Tell the computer to show a 'pattern' of your name in MODE 2.

## Summary

In this chapter you have learnt to use one of the important commands in the language BASIC, 'GOTO'.

The GOTO command directs the computer to an appropriate line in the program set by the user. By using this command and the semi-colon (;) you managed to form a pattern made up from your name, on the screen.

## A Mental Challenge



What will happen if you run the following line on the computer:

```
10 GOTO 10
```



Think it out, then check it on the computer. When you have finished, stop the computer, erase the program from its memory and move on to the next chapter.

## Chapter 5

# COLOURFUL PATTERNS

You have seen already that it is possible to colour the border of the screen different colours.



Is it possible to change the colour of the screen as well as that of the letters?

Certainly!



Change to MODE 1



Now tell the computer to display in a different colour.



Type on the computer :

PEN 2



Do not forget the space after the **PEN** command and also to press the ENTER key.

PEN

If you acted correctly, the computer printed the word 'Ready' in light blue, the colour of the cursor also changed to this colour.



Display a few characters on the screen.



Press ENTER

You can see that all the letters as well as the computer's messages are now displayed in light blue.



## Conclusion

You see that with the use of the PEN command you can control the colour in which the computer displays characters on the screen.



Does the command PEN 2 mean that the computer prints in colour number 2?

(See the colour number chart on page 14.)



To check this tell the computer to change the BORDER of the screen to colour number 2.



Do the border and the cursor both have the same colour?



If you think that they do, then give the computer the instruction:

```
BORDER 2Ø
```

Now you see that the border and the screen blend, that means that they are the same colour.

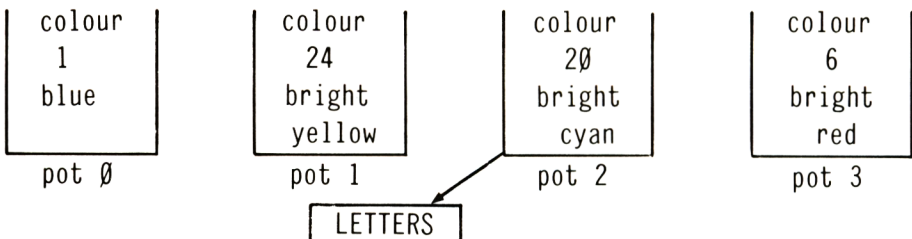


Why then did you not get colour number 2 when you typed in the instruction PEN 2?

## Colour 'Pots'


When you are in MODE 1 you can use 4 **COLOUR 'POTS'**:

Pots



Once you type 'PEN 2' the cursor takes it's colour from 'pot' number 2, and so do all the letters and characters that are thereafter displayed.

When you switch the computer on, colour 'pot' 2 contains a light green/blue colour (cyan), whose number is 20.

 Examine the yellow letters on the screen, from which colour pot do they take their colour?

Answer 20

Tell the computer to display characters using the bright red colour (number 6).


(Use the list of colour pots above.)

Answer 21

By the way the colour pots are professionally called 'registers'. For your convenience we shall still call them colour pots.

## A Riddle


The screen (background) colour is blue.

 What will happen if you tell the computer to display the characters in blue i.e. tell the character's to extract their colour from pot number 0

Think about it, and then tell the computer to extract the letter's colour from 'pot' number 0.

Answer 22

The cursor has disappeared, if you press keys on the keyboard you will see nothing appear on the screen!

 Does the computer still execute your instructions?

Press ENTER and type:

CLS

You will have seen nothing happen but the screen was cleared.

## Explanation

Once you type:

PEN 0

the computer begins to display in blue, which of course is also the colour of the screen. Naturally, blue characters over a blue background are invisible. Therefore, although the computer continues to receive and execute commands, you cannot see anything happen on the screen.

Reset the display colour to a bright yellow.

Answer 23

## A Multi-Coloured Pattern

Write a program that will produce the following pattern:

```

your  your  your  your
name  name  name  name
↑     ↑     ↑     ↑
bright yellow  red  bright cyan  bright yellow
  
```

RUN the program in MODE 1.

There are many identical lines, duplicate them using either the EDIT or COPY facilities.

Answer 24

RUN the program and check whether you receive the expected pattern, (with the required colours).

Stop the program.

? What colour did the computer use for its messages?

RUN the program again and check in which colours the computer prints its messages.

? Why does the computer use different colours for its messages?



How can you revert the character colour to yellow again?

Answer 25



Clear the screen but do not erase the program.

## The PAPER Command

You may have guessed already that if the computer has a 'PEN' it must have 'PAPER' too.

PAPER



You can tell the computer to use light yellow by typing:

PAPER 3

Don't press ENTER yet!



Can you guess what will happen on the screen?

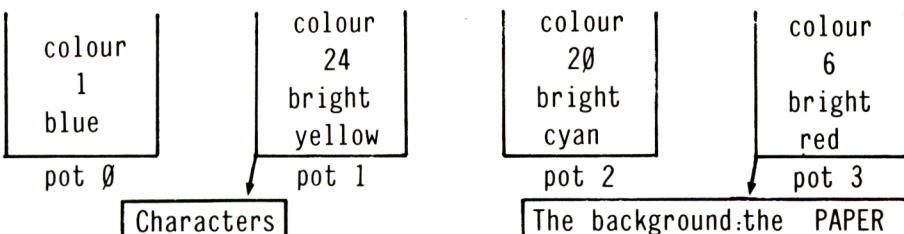


Now press ENTER

The 'Ready' message on the screen was printed in light yellow on a light red background. From now on, every letter and character you type will be printed in the same colours: light yellow on a light red background.

## Explanation

By typing PAPER 3 you tell the computer to take the background colour (on which the characters will be displayed), from pot number 3.





? When you switch the computer on, from which pot does the background colour come from?

Answer 26

? What will the computer display when you press SPACE?

Try it!

## Conclusion

When the computer displays a SPACE it prints a square in the colour that is used for the background at that time.

? What will happen if you type:

CLS

Think about it and then try it!

The computer prints spaces on the whole screen. That is, the computer clears the screen by 'printing' the background colour across it.

Tell the computer to display characters in blue on a yellow background.

Answer 27

Reset the computer's colours to what they were originally.

## Task

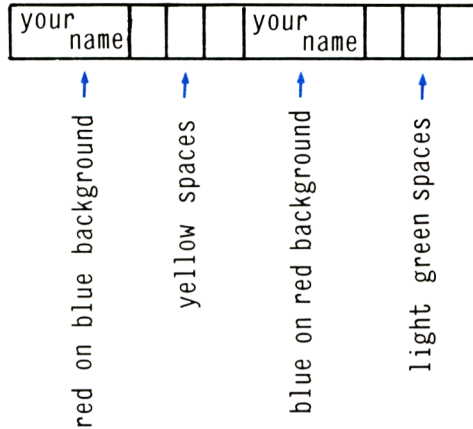
As you know, your program is still stored.

LIST the program.

RUN the program.

Change the program to present the following pattern:

Answer 28



How many different colours can be displayed on the screen at the same time in MODE 1?

Answer 29

In MODE 1, is it possible to use colours that are different from those now in the 4 colour pots?

The answer to this is yes, and you will soon learn how to do this.

## Changing the Colours in the 'Pots'

You already know that in MODE 1 the characters and the background extract their colours from the 4 colour pots 0, 1, 2 and 3.

There is a special command which will enable you to change the colours in the various pots.

Leave the pattern on the screen and type:

INK 1,15


After pressing ENTER you probably noticed that the sections of the screen which were yellow have now turned orange.

Why did this happen?

## Explanation

The command **INK 1,15** made the computer change the colour in pot 1 from yellow to orange (15). Therefore all the areas on the screen which extracted their colour from pot 1 changed immediately to orange.

INK


 Tell the computer to change the dark blue colour to purple.


## Playing with the Colours


Now, you can change the colours in the pots and make a pattern of different colours from those that were in the pots originally.


However, there still exists the problem that in MODE 1 you can have only 4 different colours on the screen at the same time.

## Summary

 In MODE 1 the computer extracts colour from \_\_\_\_\_ (2, 3 or 4) pots.

 The \_\_\_\_\_ command makes the computer print the symbols in the colour whose number appears in the command.

 The \_\_\_\_\_ command causes the computer to display the background in the colour whose number appears in the command.

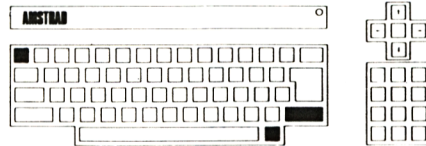
 It is possible to change the colour in a pot using the \_\_\_\_\_ command. The first number in the command determines the pot number, the second number determines the new colour that will be put in the pot.

## Resetting the Computer

Now you must erase the 'pattern program' stored in memory and reset the pots to their original colours. However, before you do this, it would be a good idea to tell you how you can perform both these functions at once.

We can now reveal to you that these functions:

- Erasing the program.
- Resetting colours to their original state can be done in an instant!



Using your right hand, press the SHIFT and CTRL keys.

At the same time with your left hand, (unless you have very long fingers) press the ESC key.

The computer resets itself to it's original state, as though it had just been switched on. The computer resumes printing in the original colours.

Try to RUN the program.

You realise now, that pressing the 3 keys together erases the program from the computer's memory.

## Remember

Pressing the 3 keys is as good as switching the computer off! Do it **only if** you are ready to lose the program stored in memory.



## Using Colours in Mode 0

In Mode 0 you can use 16 colour pots: 0 to 15.

? From this it follows that \_\_\_\_\_ colours can appear on the screen simultaneously.

This is a list of the 16 original colours stored in the pots:

Pot 0	Colour 1
Pot 1	Colour 24
Pot 2	Colour 20
Pot 3	Colour 6
Pot 4	Colour 26
Pot 5	Colour 0
Pot 6	Colour 2
Pot 7	Colour 8
Pot 8	Colour 10
Pot 9	Colour 12
Pot 10	Colour 14
Pot 11	Colour 16
Pot 12	Colour 18
Pot 13	Colour 22
Pot 14	Flashing 1,24
Pot 15	Flashing 16,11

Tell the computer to move into MODE 0.

(If you don't remember how see page 14.)

? Which colour pot do the characters use in MODE 0?

Answer 30

## Coloured Stripes in Mode 0

? Type in a three line program that will make the computer draw a black (number 0) stripe across the screen.

Answer 31



## Editing and Copying Lines using Copy

□ Add lines to the program so that immediately after the black stripe, the computer will draw a light blue (number 2) stripe. But, before you do this we shall use COPY to duplicate these lines.

You can retype the new lines from scratch, or type them in using the lines that already exist in memory.

On page 13 you learnt to use EDIT in order to copy lines. Now we shall see how it is possible to do this by using the COPY key.

□ LIST the two lines that draw the black stripe.

We want to create line 30 from line 10 using COPY.

If you remember how to recall lost lines by copying them from the screen then continue, otherwise refresh your memory by looking at page 40.

□ Move the COPY cursor to line 10.

(Don't forget to use SHIFT).

□ Press the 3 key and the number 3 is printed, the real cursor being displayed to the right of it.

□ Now hold down SHIFT and press the right arrow cursor key (→). The COPY cursor moved to the right, beyond the 1 (which was not copied).

□ Continue pressing COPY until the number 5 is reached.

□ Press the 6 key.

Now you only have to press ENTER in order to put the new line into memory.

## Note

If, while doing this line copying you pressed an unwanted key you can of course erase it using the DEL key.

You should similarly try to write line 40 using line 20.

(Do you remember the task to draw another stripe in colour 2?)

## Summary

The Amstrad computer offers you facilities for editing lines. You can make most changes by using either EDIT or COPY. Later on it is up to you to choose the method you prefer.

Add lines which will take colour from pot 7.

What must you do in order to make the computer display these stripes repeatedly?

Answer 32

Add the necessary line and RUN the program.

Stop the program running.

(If you don't remember how see page 38.)

What must you do to instruct the computer to change the black stripes to green (colour 9) instantly?

Answer 33

## Surprise

Change line 50 to:


50 PAPER 14

Use either EDIT or COPY.

RUN the program.

Now all the stripes that take their colour from pot 14 are flashing.


Pots 14 and 15 are most interesting. The 2 colours in these pots alternate constantly.

 Watch the screen and decide which two colours alternate in pot 14.

Answer 34


 What, in your opinion, will happen if you type:

INK 14,9,3

 Try it!


## Explanation

Performing this command makes the computer alternate the colours in pot 14 between 9 (green) and 3 (red).


 Do you remember what you must do to reset the computer to MODE 1, the original colours in the pots and erase the program?

(If you do not remember see page 57.)

## Colours in Mode 2

 What happens to these colours if you try to run the program in MODE 2?

In MODE 2 there are only 2 colour pots for your use: numbers 0 and 1.

 Write a program which will display a pattern of your name in MODE 2. The name should appear in black on a purple background.

Answer 35



## Finally

In this chapter you learnt to use the various Amstrad colours, in order to produce a colourful pattern.

You learnt that the characters and the background on the screen derive their colours from colour 'pots'.

↳ In MODE 0 there are \_\_\_\_\_ colour pots.

↳ In MODE 1 there are \_\_\_\_\_ colour pots.

↳ In MODE 2 there are \_\_\_\_\_ colour pots.

↳ What is special about pots 14 and 15 in MODE 0?

↳ The colour pots are called professionally \_\_\_\_\_.

↳ Using the \_\_\_\_\_ command you can change the colour in every pot.

↳ Using the \_\_\_\_\_ command you can command the computer to display characters using colours from any pot.

↳ Using the \_\_\_\_\_ command you can tell the computer to colour the background with a colour from any pot.

# Chapter 6

## DRAWING ROBOTS

### The LOCATE Command

Here is ROBERT.

At the end of this chapter Robert will appear on your screen!

(In the next chapter he will be doing his morning exercises!)

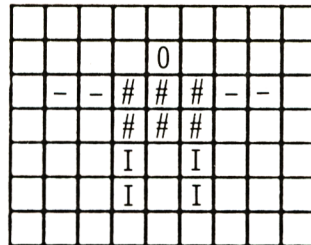
You can create ROBERT using the **LOCATE** command.

This command enables you to tell the computer exactly where on the screen you want it to print something.

Type the following program into the computer:

```
10 CLS
20 LOCATE 7,2
30 PRINT "Y"
```

RUN the program.



**LOCATE**

### Explanation

The screen is divided into a grid of small squares. The size of each square is the same as the size of the cursor.







Add lines to the program so that the 'K' in the grid will appear in it's position on the screen.

30 \_\_\_\_\_

**Answer 36**

You can see that the LOCATE command enables you to print what you want where you want it on the screen.

Add one more line which will print the 'ABC' where it appears on the grid above.

## Hint

Type in the location of the first letter only, the computer will do the rest.

**Answer 37**

Add another line which will print the line of 'X's' (be careful of the spacing!).

**Answer 38**

Add 3 more lines to the program so that the 'Z' pyramid will be displayed on your screen.

**Answer 39**

## By the way:

Do you copy similar lines or do you retype them?

It is best to copy them.  
(If you don't remember how see page 59.)

Add one more line to the program so that after printing all the letters on the screen the computer will erase the letter 'Y' only!

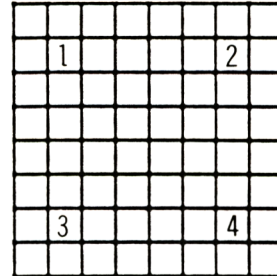
**Hint:** if you want to erase something, print a space over it.

**Answer 40**

Erase the program from memory and proceed.

## Task

Write a 3 line program which will arrange the numbers 1,2,3,4 in a square:



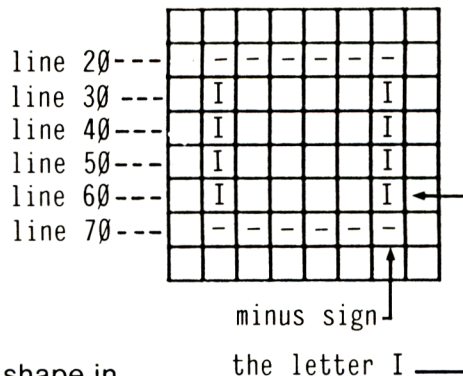
**Useful advice:** before writing the program study the MODE 1 grid in the Amstrad User Guide Appendix VI. You can pencil in these numbers on the grid in the positions you wish the numbers to appear, then write the program to put them in these positions on the screen.

10 \_\_\_\_\_  
 20 \_\_\_\_\_  
 30 \_\_\_\_\_  
 40 \_\_\_\_\_

**Answer 41**

## Task

Write a 7 line program which will draw the following shape in the centre of the screen:



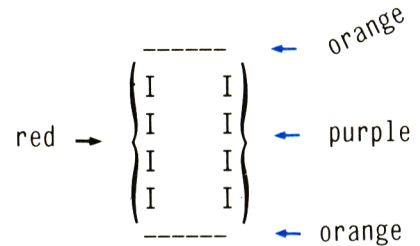
Before writing the program, draw the shape in pencil on the appropriate grid in the Amstrad User Guide, It will make the writing of the program easier.

Note that the lines are nearly identical. Make use of this while writing the program.

**Answer 42**

## Colouring the Squares

Change the program so that the picture will be in the following colours:



**Note:** you can use the LOCATE command to print on the screen in any mode.

Each MODE on the Amstrad has its own unique screen planning grid.

Before proceeding, maybe you should try to draw the same shape in the other modes.

## Robert the Robot Continued

Erase all previous programs from memory.

Write a program that will display Robert's head in the centre of the screen.

In the first line of the program clear the screen.

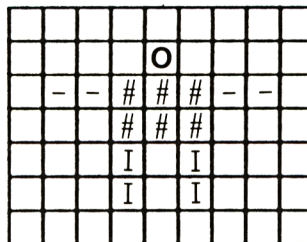
Before writing the program, we suggest you draw the robot on the planning grid once again.

**Note:** ROBERT's head is made of the capital letter 'O'.

His body is made of the '#' sign, which is on the '3' key.

His arms and hands are the '-' character.

His legs are the letter 'I'.



Proceed and write the program which will draw the robot.

## Note:

After writing each line RUN the program to see if you are satisfied with the result. If you are not change the line until you are:

1Ø \_\_\_\_\_  
 2Ø \_\_\_\_\_  
 3Ø \_\_\_\_\_  
 4Ø \_\_\_\_\_  
 5Ø \_\_\_\_\_  
 6Ø \_\_\_\_\_

**Answer 44**

## Robert's Father

Display Robert in MODE Ø, and you will see Robert's father. If necessary, change the position of the robot so that it will be displayed in the centre of the screen.

If you intend to move now to the next chapter, do not erase Robert ! In the next chapter he will be doing his morning exercises!





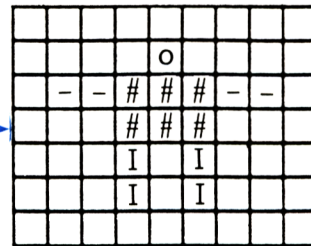
## Chapter 7

# ROBERT DOING EXERCISES

### Movement on the Screen

Our friend Robert likes his morning exercises.

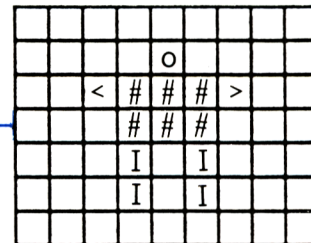
Position A: Arms outstretched



*Reverts to position B*

*Reverts to position A*

Position B: Arms folded



You will find the symbols for the 'folded arms' on the comma and full stop keys.

You are about to write a program which will make ROBERT do his exercises on the screen. However, before you embark on writing the program, let us plan it in advance.

(By the way: professional programmers first plan the structure of their programs before writing them out.)

## Question regarding planning:

In order to move from position A (arms outstretched) to position B (arms folded), is it necessary to re-display the whole robot?

Certainly not!

It is enough to write one line (with LOCATE), which will print only the folded arms of the robot, at the same time erasing the remainder of the outstretched arms.

Continue the robot drawing program, by writing a line which will give the robot folded arms (position B).

Answer 45

RUN the program.

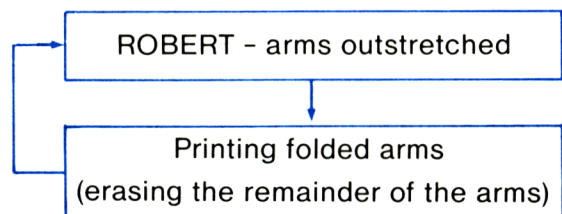
Robert quickly moves to the folded arms position.

Now you must move Robert back to position A, arms outstretched.

? Will you write, this time, a line which will print 'arms outstretched', or will you instruct the computer to draw the whole robot in position A?

Answer 46

The program layout, therefore, must look like this:




Complete the program so that it will follow this structure.

Answer 47

RUN the program.

If you acted correctly, the Robert on the screen is performing exercises at an extremely fast rate. You can actually see the 'outstretched arms' and the 'folded arms' at the very same time!

 Stop the the program running.

## There is a Bug in the Program

You wrote a program which does not fulfill your intention. You must be patient, look for errors and for the sections that need improvement!

Even professional programmers cannot devise programs that work perfectly first time! Usually, after running the program, they discover faults.

The professional term for these faults is '**BUGS**'. They do not despair, they rack their brains until they find the 'bug' and remove it.

### Bugs

You too must be patient. After writing the program, or a part of it, RUN it. If you find that it does not do what you want, find it's 'bugs'.

(Many programmers consider 'de-bugging' one of the more challenging aspects of the profession.)

Our program has quite a serious bug: Robert is doing his exercises at a murderous speed, the result is that on the screen we cannot see his movements very clearly.

## Improving the Program

Robert' must be told to slow down.

 How?

In the appropriate sections of the program you must introduce a delay, which will make Robert pause before changing positions.

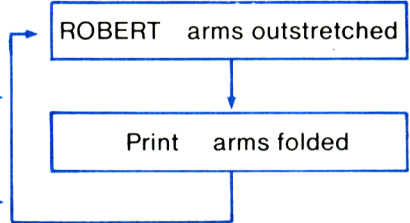


In front of you is the original program

? Where in the program would you introduce the pauses in the exercise?

? Will you put a pause here? →

? Will you put a pause here? →



## Sound Pause

In order to get Robert to do his exercises at a reasonable speed we will use a **SOUND** pause.

**SOUND**

□ Type in the following program without erasing the existing one:

```

500 SOUND 1,200,100
510 PRINT "ABC"
520 SOUND 1,100,100
530 PRINT "1234"
550 GO TO 500
  
```

In order to run the program section which begins with 500, we type:

```

RUN 500
  ↑
space
  
```

The computer started running the program from line 500.

At this stage you can hear sounds coming from your computer (not from your TV). On the right hand side of the computer, next to the on/off switch, you will find the volume control switch. Turn it until you hear the sound.

---

## Investigating the Sound Command

### The First Number

At this stage we shall not dwell on the first number which appears in the sound command. We shall say this only: imagine a trio of singers appearing together. The computer, too, has 3 'singers' who can produce sounds simultaneously and create varied musical effects.

The first number indicates the singers' number. For the time being we shall use only singer 1.

### The Second Number

While running the program, examine lines 500 and 520. You must have noticed that they are different.



Do you think that the second number affects:

1. The Duration of the sound?
2. The Pitch of the sound?



Which of the two numbers determine a higher pitch?



Think of how you can check your answer.

After checking whether you were correct, compare it with the answer.

**Answer 48**


### The Third Number

The number that appears third in both commands, is identical.



What will happen if you change the third number in one of the lines?


Check this. (Change the number and RUN the program.)


 What, in your opinion, does the third number in SOUND command control?

Answer 49

## Concluding the Investigation

SOUND 1, second number, third number

 The second number in the SOUND command determines the \_\_\_\_\_(duration/pitch) of the sound.

 The third number in the SOUND command determines the \_\_\_\_\_(duration/pitch) of the sound.

Answer 50

## Returning to Robert

Now you can return to the exercising robot and introduce pauses in the program, so that the robot will move at the speed you want. (See page 73.)

Add lines to the program so that at the arms outstretched position a high pitched sound will be heard, and at the arms folded position a low pitched sound will be heard.

Answer 51

## Robert's Father does Exercises

ROBERT'S father wants to do exercises in MODE 0. Make him do this.

## Colouring Robert's Father'

No doubt you remember the variety of the Amstrad's colours.

Change the program so that the robots' head, arms, body and legs will appear on the screen in different colours, in MODE 0.

Do not forget to RUN the program after introducing each change, to check whether your intention has been carried out.

Did you find any bugs?

If you did remove them.

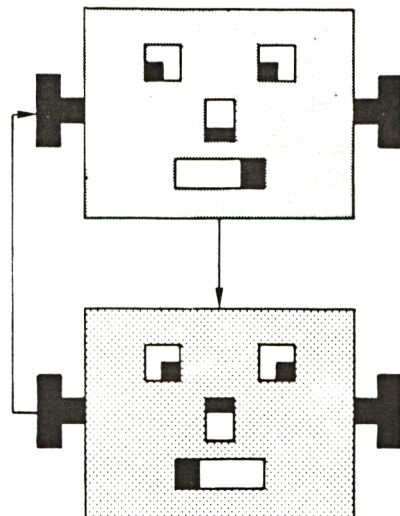
## Final Challenge

We now present you with a challenge.

You must develop the program, locate the bugs and improve the program. You must use all the knowledge you have acquired so far. This time we will not provide an answer. You must face all the problems that will arise on your own.

Draw this face on the computer so that it will:

- Move its eyes.
- Moves its tongue.
- Twitch its nose.
- Change colours.
- Perform any action you command.





## Summary Index

In front of you is a list of the terms you learnt in this unit. Go over it and check whether you remember them.

(You can refresh your memory by consulting the relevant pages, whose numbers appear alongside each term.)

The Cursor (8)	Copy (40)
Shift (8)	<b>GOTO</b> (45)
Caps Lock (9)	Semi-Colon (;) (45)
<b>CLS</b> (10)	<b>PEN</b> (49)
Enter (10)	Pots (50)
Space Key (12)	<b>PAPER</b> (53)
<b>MODE</b> (14)	<b>INK</b> (56)
Delete (16)	<b>LOCATE</b> (63)
<b>BORDER</b> (19)	Colon (:)(64)
<b>PRINT</b> (21)	Bugs (73)
Quotation Marks (25)	<b>SOUND</b> (74)
Program Lines (29)	
<b>RUN</b> (30)	Computer messages:
<b>LIST</b> (31)	
<b>EDIT</b> (36)	Syntax error (11)
Esc (38)	Ready (14)
<b>NEW</b> (39)	Improper argument (15)
	Break in ..(45)

## Finally

You have reached the end of this first learning unit. We hope you have tasted enough of the subject and begin to feel that you can control the computer, which is in fact not quite so difficult.

- You learned to draw 'patterns' and 'robots'. But indeed, you have learned much more...
- You wrote simple programs on the computer.
- You learned all the secrets of editing.
- You corrected and improved programs.
- You made calculations, using the computer.

If all this still intrigues you further, move on to Unit 2, details of which, together with the other units, can be found on the back cover.



## Appendix

# THE PRECEDENCE OF ARITHMETIC OPERATORS.


So far, we have discovered that the computer can perform five arithmetic operations, these being:


- 1) Addition: '+'
- 2) Subtraction: '-'
- 3) Multiplication: '\*'
- 4) Division: '/'
- 5) To the Power of: '^'


 What, in your opinion, will the computer display if you instruct it to:

```
PRINT 2+3*4
```

 Will it display 20 or 14?

 Try it.

 In response, the computer displayed the number \_\_\_\_\_.

 Which operation did the computer carry out first,  $3*4$  or  $2+3$ ?

In order to calculate the answer 14, the computer had to multiply  $3*4$  first to get 12, it then added the 2 to this 12 to calculate the answer 14.

Had the computer added the 2 and 3 first the result would have been 20.

## Conclusion

When the computer executes expressions which involve both multiplication and addition, it always carries out the multiplication first, and only afterwards the addition, even when the multiplication follows the addition in the expression.

? What result will the following expression give:

```
PRINT 3+4*3+5*3
```

Check your answer on the computer.

? What happens when we have division instead of multiplication?

Look at this example:

```
PRINT 3+3/3
```

? What, in your opinion, is the answer \_\_\_\_\_ (2 or 4)?

The computer will always divide first, even when division follows addition in the expression.

## Subtraction

? What happens when the expression includes both subtraction and multiplication?

Execute an expression with both multiplication and subtraction in it, and decide whether the computer multiplies or subtracts first.

## Conclusion

You should have reached the conclusion that multiplication has priority over subtraction, regardless of multiplication's position in the expression.



## Multiplication and Division

? What does the computer execute first in an expression which contains both multiplication and division?

□ Solve the following two expressions:

$$15/5*6=$$

$$5*6/15=$$

? Which operation did the computer perform first in the first exercise \_\_\_\_\_(multiplication or division)?

? Which operation did the computer perform first in the second exercise \_\_\_\_\_(multiplication or division)?

## Conclusion

When multiplication and division are present in an expression, the computer performs them in the order that they are met.

In the first exercise, the division was first so the answer was 18, but in the second exercise the multiplication was first so the answer was therefore 2.

? What will happen when both addition and subtraction are present in an expression?

As in the case of multiplication and division, the computer performs them in the order in which they are presented in the expression.

## Task

Enter the appropriate arithmetic operations between the following 4 numbers:

$$4 \quad 5 \quad 3 \quad 7=12$$

so that the answer equals 12.

□ Do the same with the following exercise:

$$6 \quad 3 \quad 3 \quad 3=$$

and check your answers on the computer.

## To the Power Of



What result will the following expression produce:

PRINT  $2 * 3 \uparrow 2$



Will the result be 18 or 36?



Check your answer on the computer.

## Conclusion

The 'to the power of' operation always has priority over multiplication.



Can you guess what the situation is regarding division?

## Task



Can you guess the result of the following expression:

$2 + 3 * 8 / 2 \uparrow 2 - 8 = \underline{\hspace{2cm}}$ ?

## Summary

When an expression involves all the five arithmetic operations:

The computer will first perform the \_\_\_\_\_ operation.

Then, in the order presented, the \_\_\_\_\_ and \_\_\_\_\_ operations,

And finally, the \_\_\_\_\_ and \_\_\_\_\_ operations in the order presented.

## Brackets



What is the result of the following expression:

PRINT  $(2 + 3) * 5$



Check your answer on the computer.

## Conclusion

The computer will always deal with the contents of the brackets first, executing the operations in the normal manner.



What will the following expression produce:

PRINT ((1+3)\*2)↑2



In this case, the computer first performs the \_\_\_\_\_, then the \_\_\_\_\_ and finally, the \_\_\_\_\_ operation.



Enter brackets into the following expressions in order to receive the results given:

$$2+9/3*4↑2=196$$

$$3+1↑2*5=80$$

$$4+16/4-2*4=12$$



# Answers

## Answer 1

To display an exclamation mark on the screen, hold down SHIFT and press the '1' key.

## Answer 2

MODE 0 allows for 20 letters across the screen.

## Answer 3

Type:

MODE 1

and press ENTER.

## Answer 4

MODE 1 allows for 40 letters across the screen.

## Answer 5

Type:

MODE 2.

## Answer 6

MODE 2 allows for 80 letters across the screen.

## Answer 7

a. When switched on, the computer is in MODE 1.



b. Mode 1 allows for 40 letters across the screen.

c. In order to move into Large Letters MODE, type:

MODE 0

## Answer 8

Move the cursor using the '→' key, on the letter 'S'.

Press DEL key once.

## Answer 9

Using the '→' key bring the cursor to the digit 0.

Erase the '4' using DEL.

Type 'E'.

Put in a space using the space key.

## Answer 10

$$5 \uparrow 2 = 5 * 5$$

$$2 \uparrow 5 = 2 * 2 * 2 * 2 * 2$$

$$6 \uparrow 6 = 6 * 6 * 6 * 6 * 6 * 6$$

## Answer 11

The computer leaves a space to allow for a minus sign in a negative answer.

## Answer 12

```
15 PRINT "5*40="5*40
```

## Answer 13

3 CLS

## Answer 14

Type:

2Ø

## Answer 15

Type:

EDIT 1Ø

Bring the cursor to Ø and erase the '1' using DEL

Press:

2

Erase the first division sign using DEL.

Press:

\*

Do as above, with the second division sign.

## Answer 16

Type:

EDIT 1Ø

Bring the cursor to the end of the line.

Type in a semi-colon.

## Answer 17

Change line 10 to:

```
10 PRINT "Your Name*";
```

## Answer 18

Add:

```
5 MODE 0
```

## Answer 19

```
BORDER 2
```

## Answer 20

The yellow letters on the screen get their colour from pot number 1.

## Answer 21

```
PEN 3
```

## Answer 22

```
PEN 0
```

## Answer 23

```
PEN 1
```

## Answer 24

```
5 CLS
10 PEN 1
20 PRINT "ROBERT";
30 PEN 3
4 PRINT "ROBERT";
50 PEN 2
60 PRINT "ROBERT";
100 GOTO 10
```

## Answer 25

```
PEN 1
```

## Answer 26

When switched on, the screen's background colour comes from pot number 1, blue.

## Answer 27

```
PEN 0
PAPER 1
```

## Answer 28

```
5 CLS
10 PEN 3
15 PAPER 0
20 PRINT "ROBERT";
25 PAPER 1
27 PRINT "□□□□";
30 PEN 0
35 PAPER 3
40 PRINT "ROBERT";
45 PAPER 2
50 PRINT "□□□□ ";
100 GO TO 10
```





## Answer 36

```
30 LOCATE 8,13: PRINT "K"
```

## Answer 37

```
40 LOCATE 9,12: PRINT "ABC"
```

## Answer 38

```
50 LOCATE 11,9: PRINT "*** □ * □ □ * □ □ □ *"
```

## Answer 39

```
60 LOCATE 23,14: PRINT "Z"
70 LOCATE 22,15: PRINT "Z □ Z"
80 LOCATE 21,16: PRINT "Z □ □ □ Z"
```

## Answer 40

```
90 LOCATE 7,2: PRINT " □ "
```

## Answer 41

```
10 CLS
20 LOCATE 10,10: PRINT "1 □ □ □ □ 2"
30 LOCATE 10,15: PRINT "3 □ □ □ □ 4"
```

## Answer 42

```
10 CLS
20 LOCATE 15,10: PRINT "- - - - -"
30 LOCATE 15,11: PRINT "I □ □ □ □ I"
40 LOCATE 15,12: PRINT "I □ □ □ □ I"
50 LOCATE 15,13: PRINT "I □ □ □ □ I"
60 LOCATE 15,14: PRINT "I □ □ □ □ I"
70 LOCATE 15,15: PRINT "- - - - -"
```

## Answer 43

```
10 CLS
20 INK 1,15: PEN 1
30 LOCATE 15,10: PRINT "-----"
40 INK 2,3: PEN 2
50 LOCATE 15,11: PRINT "I"
60 LOCATE 15,12: PRINT "I"
70 LOCATE 15,13: PRINT "I"
80 LOCATE 15,14: PRINT "I"
90 INK 3,7: PEN 3
100 LOCATE 20,11: PRINT "I"
110 LOCATE 20,12: PRINT "I"
120 LOCATE 20,13: PRINT "I"
130 LOCATE 20,14: PRINT "I"
140 INK 1,15: PEN 1
150 LOCATE 15,15: PRINT "-----"
```

## Answer 44

```
10 CLS
20 LOCATE 15,8: PRINT "0"
30 LOCATE 12,9: PRINT "--###--"
40 LOCATE 14,10: PRINT "###"
50 LOCATE 14,11: PRINT "I □ I"
60 LOCATE 14,12: PRINT "I □ I"
```

## Answer 45

```
70 LOCATE 12,9: PRINT "□<###>□"
```

## Answer 46

Simply draw the robot with arms outstretched.

## Answer 47

```
100 GOTO 20
```

## Answer 48

Line 520 causes a higher pitched sound than line 500.

## Answer 49

The third number in the SOUND command determines the duration of the sound.

## Answer 50

The second number in SOUND command determines the pitch of the sound.

The third number in SOUND command determines the duration of the sound.

## Answer 51

Add:

```
65 SOUND 1,200,100
```

```
80 SOUND 1,100,100
```

## NOTES

---





## NOTES

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