TUG

TANGERINE USERS GROUP

16 Iddesleigh Road Charminster
Bournemouth Dorset U.K. BH3 7JR
Telephone (0202) 294393

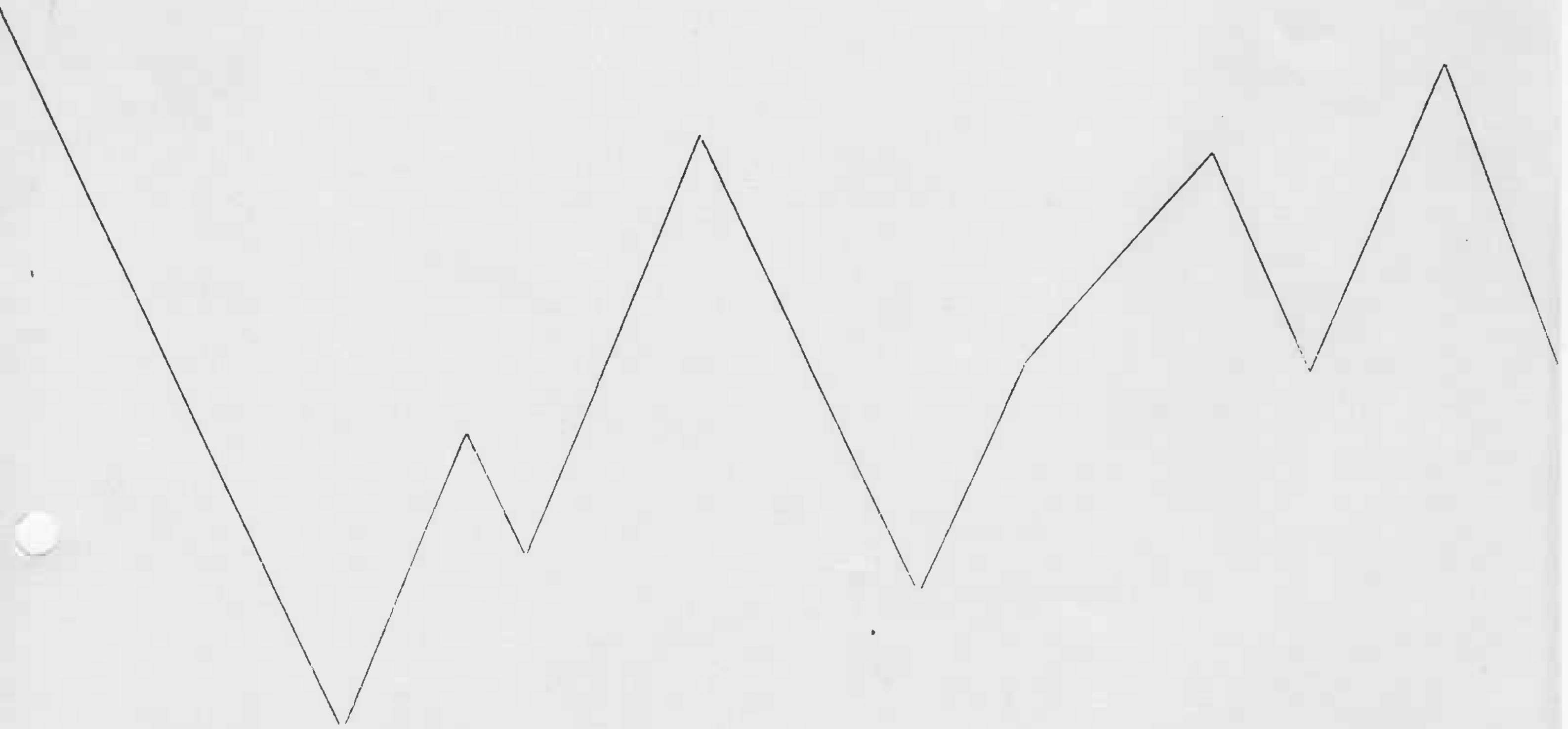
Tyrella, Manor Lea Road
Milford, Nr. Godalming
Surrey. GU8 5EF
Godalming 7152

T H E
* * *

P R O G R A M M A B L E

G R A P H I C

M O D U L E



Tangerine Users Group Limited Directors. Robert B. Green V. Green
Registered Office: Epworth House 25/35 City Road London EC1Y 2DE Registered in England No. 1529652

THE

P.G.M.

CONTENTS:

AN INTRODUCTION

Unlike most high definition graphic modules for microcomputers, our P.G.M. has been designed with the object in mind of bringing to the user, a 256 x 256 definition card to enable him to explore the exciting world of the high resolution capability on the popular Microtan 65 system cheaply.

We have produced this module to meet the requirements for high resolution without the need for large amounts of Ram, thereby reducing the overall costs of components and making assembly very easy.

By producing the module in a basic p.c.b. format it will allow the end user to adopt a method and plan of construction which is more suitable for individual requirements and thereby allowing a greater freedom of choice for applications.

This manual will explain the basic concept of the P.G.M. its construction and general use.

The Microtan 65 system has since its birth been subject to the chunky graphic display. This is now our opportunity to bring to you our contribution to the Microtan story.

TUG ON!!

Exploring the graphical potential of the module can only be achieved by a clear understanding of the methods used.

The Microtan system uses the Hexadecimal codes 20 - 7F for the Ascii character set. Increasing the count beyond 7F the entire ascii character set will again be accessed and repeated.

The module has been designed to use the potential of the character generator to create a user definable set of programmable graphics, characters or symbols including a user defined CURSOR.

This unused portion of the existing space within the character generator can be utilized from character 80 (Hex) to 9F (Hex) and from EØ to FF (Hex) allowing a total of 64 special programmable characters under user defined control. This set once programmed can be accessed in the normal manner set aside for the original ascii character set, e.g. LDA #$80.

By using this method of character data storage we are able to select our user defined data under either program, disk, tape or eprom control allowing considerable flexibility in our programming techniques.

The limitations imposed on using this method of graphical data storage is minimal considering that when large amounts of ram are used for high definition displays much of the screen ram is unused for most of the time and therefore wasted. Animated graphics can be programmed because the CPU has access to the ram only when the onboard circuitry is not using it. One original thought would be likened to a roll of film where one frame at a time is displayed when a minor alteration occurs to the existing exposure and is displayed accordingly.

BITS & BYTES

As an aid for the programmer we have included a simple explanation for binary codes.

The Microtan system requires an eight bit binary code to function. These eight bits are divided into two four bits which are then called a BYTE.

For the microprocessor to function, it must recognize the bytes as individuals, therefore each byte is designated with a further code depending where its position may be in the eight bit binary instruction.

For example see figure 1.

AA represents the eight bit code being made up from two four bit bytes. The leftmost A will now represent the HIGH BYTE whilst the rightmost A will represent the LOW BYTE. By adding these two values together we now have an eight bit binary code which is understood by the processor. Ø is taken as a four bit byte.

Figure 1 will show these eight bits in correct format.

READY RECKONER:-

HEX	BITS (BYTE)(High or Low depending upon position)
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

For example:- Hex B2 = 10110010 Binary = B high & 2 low.

It can be seen that the existing character cell has been divided into individual binary cells of 8 x 16 giving a possible resolution of screen display of 256 x 256.

The cells are adressed using a binary code and is easily understood as follows:-

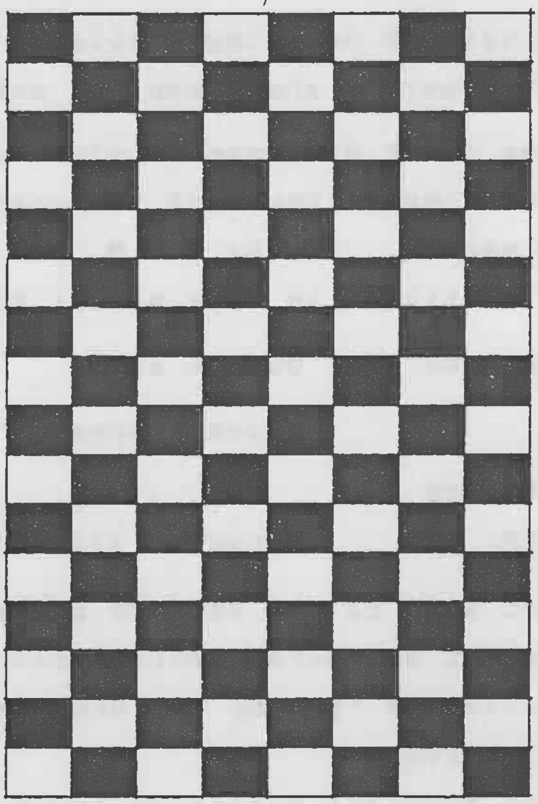
Each binary cell is lit when BIT 1 addresses in the code.

1 = cell on

Ø = cell off

Figure 1 shows how a graphic character can be defined by inputting the correct binary code in hexidecimal code.

HIGH BYTE / LOW BYTE



Hex code: ADDRESS		Binary code:
8400	AA	1010/1010
8401	55	0101/0101
8402	AA	1010/1010
8403	55	0101/0101
8404	AA	1010/1010
8405	55	0101/0101
8406	AA	1010/1010
8407	55	0101/0101
8408	AA	1010/1010
8409	55	0101/0101
840A	AA	1010/1010
840B	55	0101/0101
840C	AA	1010/1010
840D	55	0101/0101
840E	AA	1010/1010
840F	55	0101/0101

FIG 1. CHARACTER CELL 8 x 16

Shaded cells on.

Although this example is not to scale and is used only to demonstrate the enormous potential of possible uses such as this method of graphical data storage achieves. It is feasible to store predetermined data i.e. A deck of cards for example, their graphical data predesigned and stored and being called only when required.

THE USER DEFINABLE CURSOR

With the Programmable Graphic Module on line and activated, the Cursor which we are familiar with will be replaced by a graphic character of a spurious nature. This is simply due to the fact that the Microtan system only partially decodes the character generator I.C.'s and they therefore transmit the value 'FF' for the cursor instead of '7F' as the true value of the Ascii cursor. This can be turned to our advantage if we consider that it is now possible with the aid of the P.G.M. to define our own cursor shape. It is a matter of preference therefore that the user can decide the shape of the cursor in his system.

With new monitor systems becoming available we are a short step away from full cursor shape control automatically.

For the time being the P.G.M. can supply a user defined cursor by the user simply inputting the correct code manually in the following manner. If the P.G.M. has been decoded at the addresses mentioned in this manual for the example.

Hex Address:	87F0	00	Output all
	:		Blank spaces
	87FE	00	
	87FF	FF	Output 11111111 = '__'

It so happens that this is the Authors prefered design for a cursor, it need not be yours. This cursor shape will continue to be called as 'FF' by the Microtan system as long as the system is activated.
The reason for the spurious cursor on power up is due to the spurious values resident in memory when power is applied to the board.

This seems an appropriate time to consider a standard which can be set to reduce or eliminate non standard graphic sets for general use with the P.G.M. We will be pleased to hear from you any ideas at any time.

NOW TRY 'SHOOTDOWN' !!!!! WITH AN X-WING FIGHTER ??

Another useful feature to use would be the user defined Cursor, this is very easily obtained by inputting the data in the form of the binary code 'FF' i.e. 11111111. This data can then be stored in the appropriate location, if the last positional address was chosen, the result would be '_'.

At machine code speeds there is no reason why several of these cells cannot be predesigned and called, plotted in their respective positions of the overall design.

It is quite impossible to cover all the potential uses of plotting routines in this manual. The basic rules are that the overall cell can be programmed manually or under software control from a main calling programme or subroutine, erased or reprogrammed time and again.

As the user grows with experience, a basic library of subroutines is quickly established, output routines, plotting routines and soforth, these with modern storage of data methods available cheaply, makes the concept of this type of design quite viable for the average user to adopt. There is no reason why, that the data required for the graphical display cannot be stored along with the main programme on either tape or disk or even eprom.

Needless to say that a whole new exciting world of possibilities is now becoming reality for us all.

Referring to Fig 1. this particular graphic design has been determined and may be output to the screen using a routine similar to that of a clear screen but loading the graphic design 80 (Hex).
In this particular case the screen will appear grey as the contrast will show every other binary or (BIT) alight.
Under some circumstances this would be very acceptable for background displays etc.
Different shades may be achieved with use of the binary count, being just a matter of choice and experimentation.

Please Note: Screen displayed graphics are not affected by adverse Basic commands, unlike the present graphics available on the Microtan system.

P.G.M. DEMO:

Two very simple demonstration routines are offered to provide the constructor with test material. The last sixteen memory locations should be loaded with the required data to form a test pattern, the following programme should then be keyed in and run. 87E0 - 87FF

G0400 (CR)

```
0400 A9 FF        LDA +$FF       ; Load Cursor
0402 A0 00        LDY +$00       ; Load count
0404 99 00 02     STA $0200,Y    ; Upper half of screen
0407 99 00 03     STA $0300,Y    ; Lower half of screen
040A 88           DEY            ; Decrease count
040B D0 F7        BNE $0404      ; DO IT!
040D 60           RTS  Optional
```

This routine will turn the screen grey, lighter or darker shades are possible depending upon the resident data in the graphic character 'FF' or cursor.

The second demonstration programme is supplied on tape. Load the file: 'PGM' under the Basic interpreter.

It can be seen from the listing of the program that data is being Poked into the PGM memory and subsequently output to the screen.

This is just a simple demo tape which has been supplied simply as test material. With the aid of graph paper, many graphic characters can be designed with ease, refer to Fig 1.

Tangerine Users Group Library is offering the budding programmer an ideal opportunity to publish their works in the software listings. If you think that you have anything to offer that could be of interest to others, let us know, we do pay very well for our programmes.

TUG ON !!!

GENERAL CONSTRUCTION

We have supplied a high quality double sided card for our High Definition Graphic Module, constructional expertise and personal requirements will dictate the quality of the finished project. Only quality intergrated circuits and general components should be used for optional results.

The card has been designed to be assembled using pcb pins. The use of these pins allow us to bring to you a product at lower costs, making this a favourably priced package for all.

Construction should start with the identification of the I.C. positions as marked on the board, and the positions of the six capacitor.

Install all those pins required for 'Plating through' before the installation of the other components. When complete, identify and install the i.c. sockets (or soldercon pins if used), complete by installing the 64 way edge connector and the six capacitors.

If you are connecting the module to the Micron system see Fig 4 for details.

On completition of the construction, thoroughly check the board for solder bridges, dry joints etc, before power on.

On power up, the screen display will include unusual data in some areas, this should be expected as some spurious data will be present in the P.G.M. memory. The most important feature, the Cursor, will indicate a spurious graphic shape.

Load and run the demostation programme supplied.

HAVE FUN!

Connections to the Microtan 65 should commence with the modification of the 16 way ribbon cable.

Assuming that a double ended plug cable is used, remove the 16 pin plug from one end, (this end should now be marked '65'). It is now required that the cable with the exception of lead to pin 16 be shortened by approximately 3 inches, (this should now leave the pin 16 lead 3" longer than the others). Remove the pin 16 from the plug completely as no connection is required to the socket by this lead.

Replace the plug to the existing 16 way cable with the 16 pin lead running free. This free lead can now be deinsulated and tinned to ¼".

The '65' plug can now be inserted into the relevant socket according to fig 2. The free (tinned) lead can now be inserted into the correct pin location on the 2114 Ram socket.

It should be noted that the 2114 Ram chip should be removed, the free lead end should be inserted, and the 2114 replace with the utmost care. A more permanent connection can be made to the board if the constructor requires.

Figure 2 illustrates both Microtan 65 MK I & MK II models. For the purpose of easy identification, the Microtan 65 MK II will have a 2K 2716 Eprom as the Monitor 'Tanbug'.

<u>NOTE</u>:

MK I '65. The 16 way P.G.M. plug inserts into socket 'D2' on the c.p.u. board, and the free lead is located into the socket marked 'F3' at location PIN 14.

MK II '65 The 16 way P.G.M. plug inserts into socket 'E4' on the c.p.u. board, and the free lead is located into the socket marked 'G3' at location PIN 11.

See Fig: 2,3.

MEMORY PAGE SELECTION

The module has been designed to be memory page selectable, these memory pages being selected by enabling the addresses required via the linking available on the p.c.b. We will assume that the module has been decoded for the addresses 8400 - 87FF inclusive. (1K).

As a further example to figure 1 the data is stored in the same manner as per normal storage programming, the data in figure 1 is stored from 8400 - 840F. The next data store being from 8410 - 841F and soforth.

Graphic data can be accessed by loading the appropriate character via the registers:

Address	character	Address	character
8400	80	8600	E0
8410	81	8610	E1
. etc;	.	. etc;	.
85E0	9E	87E0	FE
85F0	9F	87F0	FF
= 32 Graphic Chars		= 32 Graphic Chars	

Total 64 (1K)

The memory page selection addresses:

0
2400 - 27FF 2
4400 - 47FF 4
6400 - 67FF 6
8400 - 87FF 8
A400 - A7FF
E400 - E7FF

Memory page selection is obtained by linking the appropriate selectors indicated on the p.c.b,. It is not reccomended that the 0400 page be used.

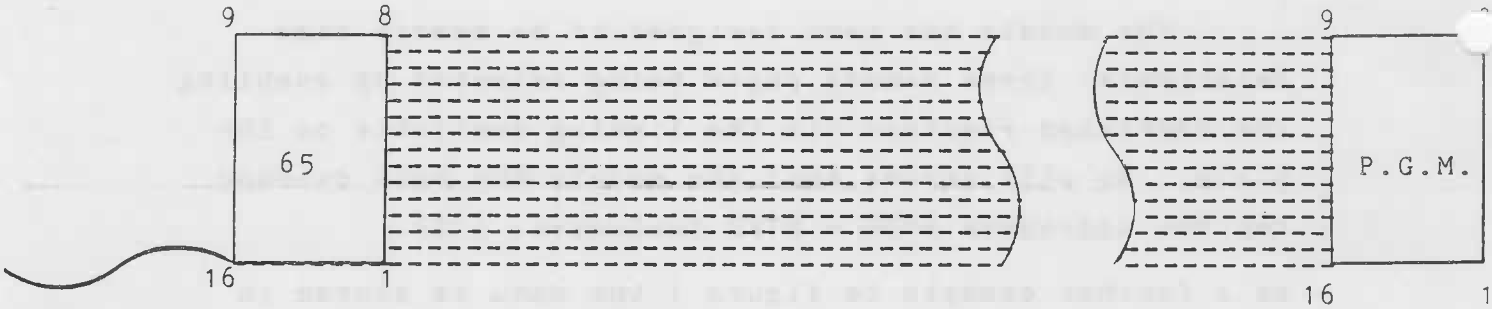


Fig 3.

The Lower case character generator removed from either D2 or E4 may now be transfered to the P.G.M. module and inserted in the appropriate socket.

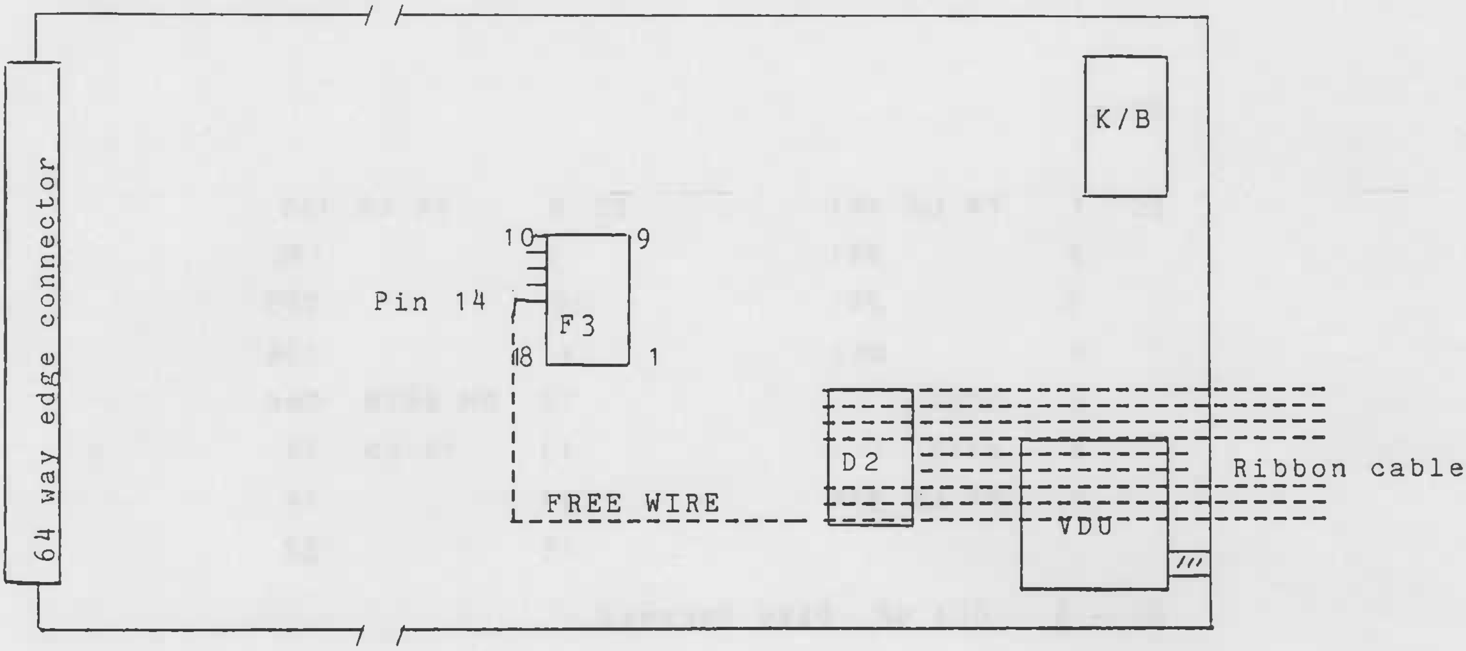
Memory page selection cont:

During the final construction of the module, it is advisable to link all memory page selector links and cut only those unwanted ones. This will then allow simple page selection of different ram areas at a later date.

If the module is used with Tanram, it should be noted that the Basic memory sensing routine will erased all previous data in the P.G.G. ram, thereby causing the original cursor etc to be corrupted. If the P.G.M. ram mapping coincides with any Tanram memory mapping, it would be an advantage to remove the Tanram ram and allow access to the P.G.M. ram. This can be an enormous advantage as this would then allow the P.G.M. to occupy the memory mapping of the entire ram contents of Tanram thereby allowing a greater freedom of programming ability.

If Tanram is not used any memory page area may be used without corruption from Basic.

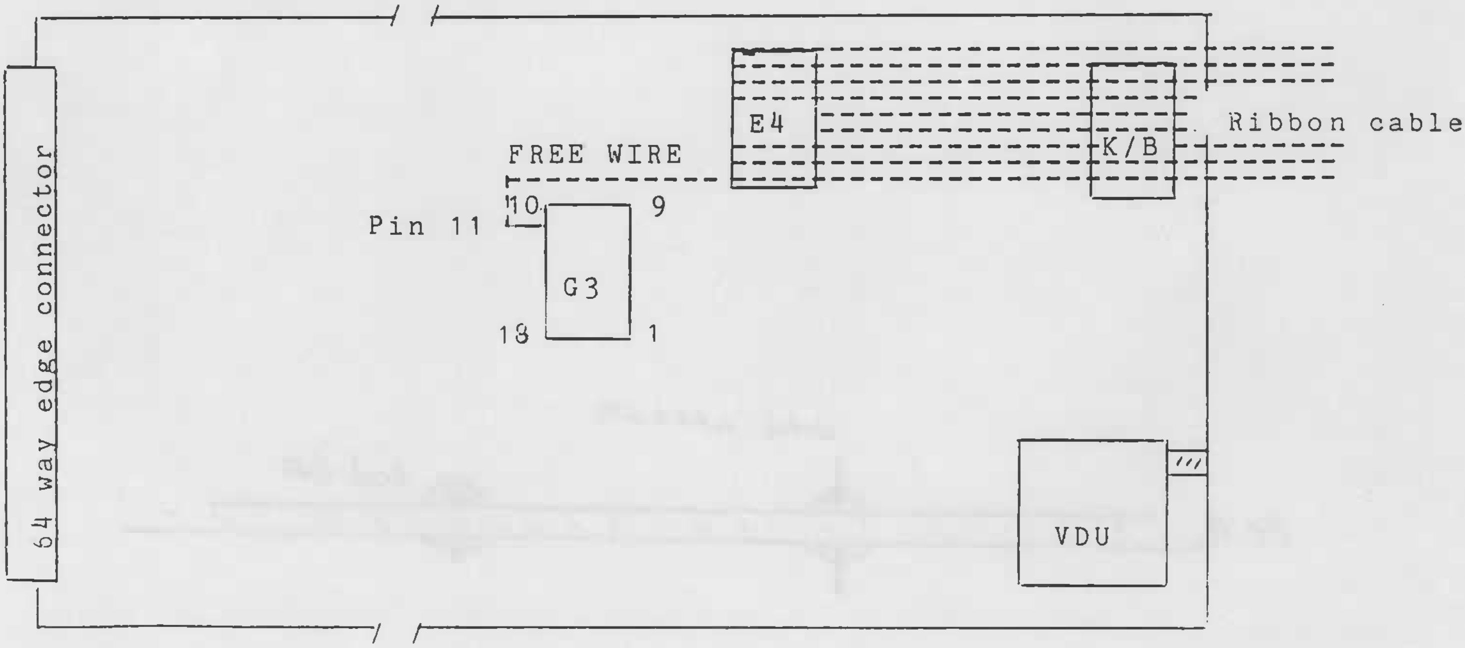
MICROTAN 65 MK I



COMPONENT VIEWS

Fig: 2.

MICROTAN 65 MK II



**Drawing not to scale:

COMPONENTS LISTING

IC's

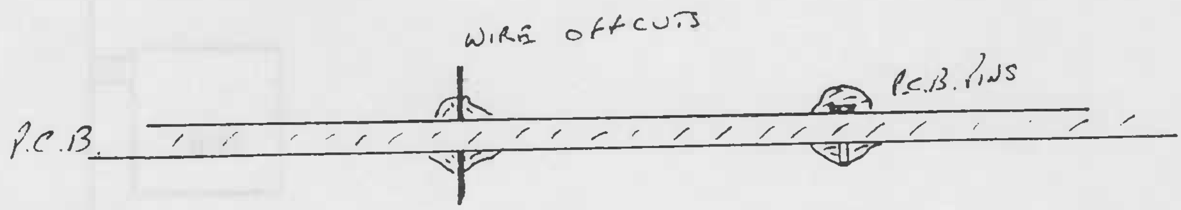
IC	1	74 LS 161	IC	8	74 LS 165
	2	241		9	125
	3	241		10	245
	4	241		11	138
	5	2114		12	DM 8678 CAE
	6	2114		13	74 LS 74
	7	74 LS 374		14	14
				15	32

C1 - 6 0.1 uF Disc Ceramic

Note: IC 12 DM 8678 CAE is available from C.P.U. board Microtan 65.

1 off DIP Jumper 16 way ribbon cable with low profile plugs Double Ended.

1 off 64 way edge connector



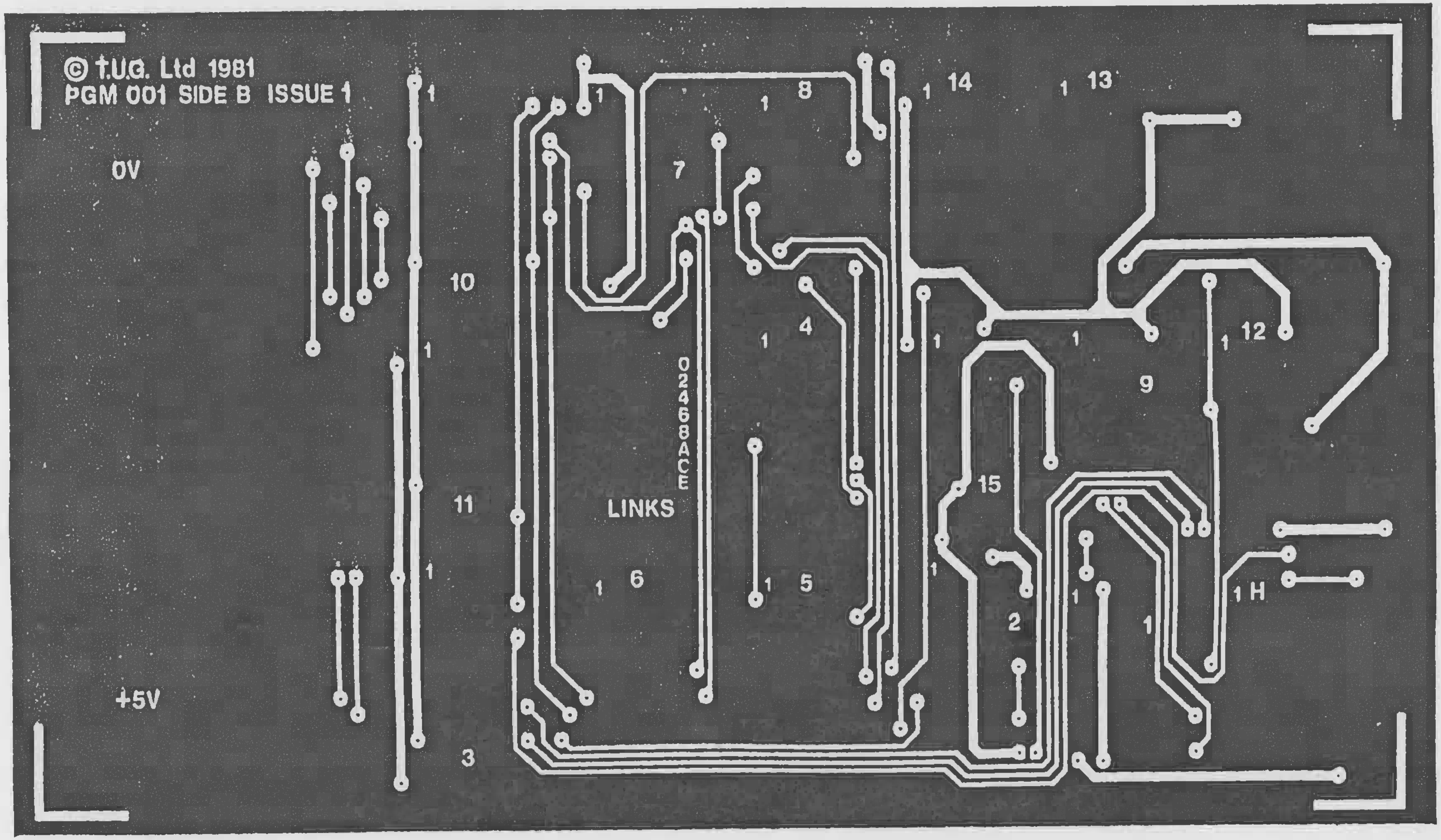
MICRON SYSTEM CONNECTION

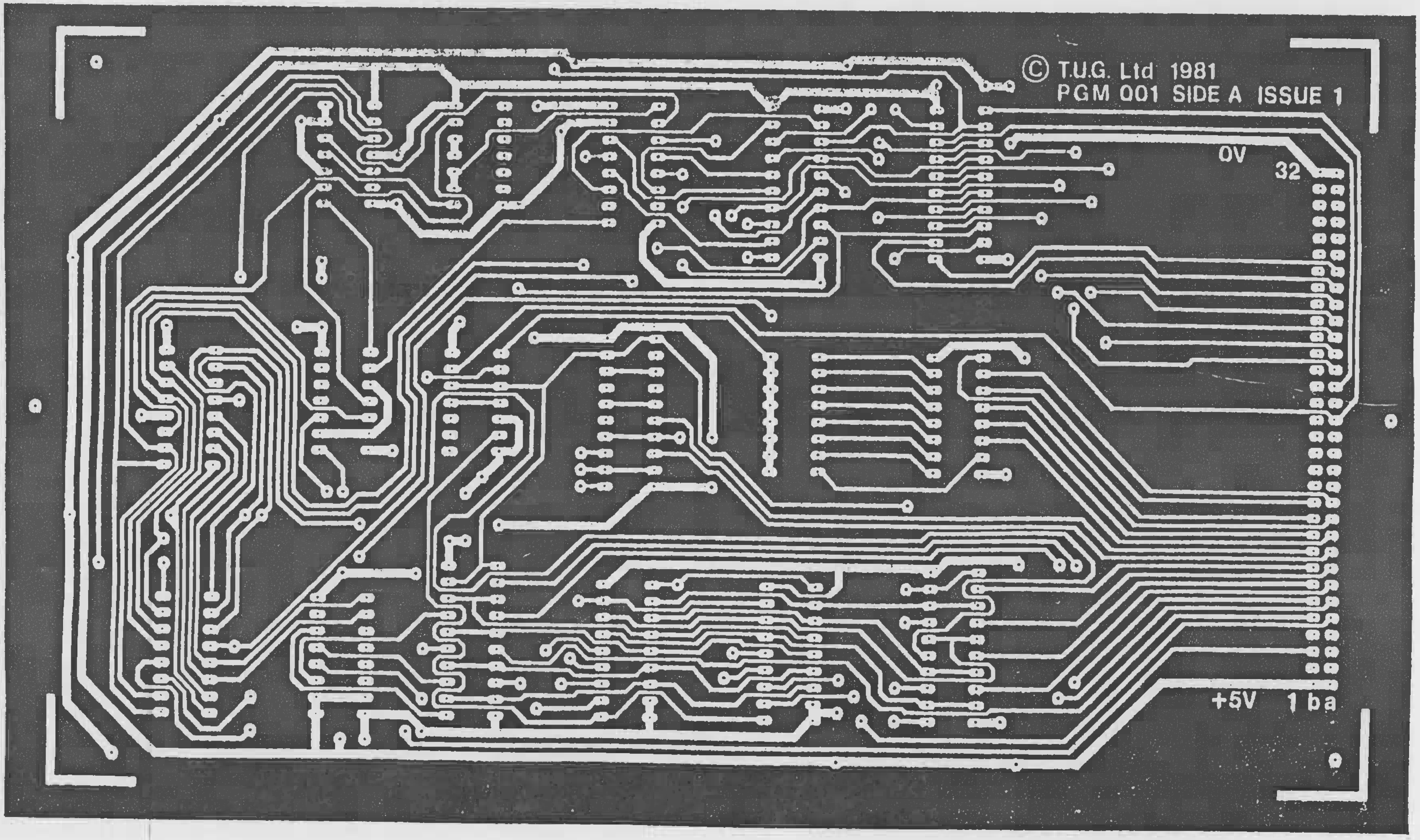
The P.G.M. may be connected to the system by way of the connections taken from the rear of the min mother board at the Tanex socket. Care should be taken as these terminals are very close together.

Fig: 4. PIN CONNECTIONS

TANEX		P.G.M.
A 1.	----------------------------	A 1.
7.	----------------------------	5.
8.	----------------------------	6.
9.	----------------------------	7.
10.	----------------------------	8.
11.	----------------------------	9.
12.	----------------------------	10.
13.	----------------------------	11.
14.	----------------------------	12.
19.	----------------------------	17.
B. 21.	----------------------------	B. 19.
22.	----------------------------	20.
23.	----------------------------	21.
24.	----------------------------	22.
25.	----------------------------	23.
26.	----------------------------	24.
27.	----------------------------	25.
28.	----------------------------	26.
32.	----------------------------	32.
5.	----------------------------	3.
7.	----------------------------	5.
8.	----------------------------	6.
9.	----------------------------	7.
10.	----------------------------	8.
11.	----------------------------	9.
12.	----------------------------	10.
13.	----------------------------	11.
14.	----------------------------	12.

COMPONENT SIDE: I.C. POSITIONS ARE NUMBERED 1-15.   H = Ribbon Cable Socket.





© T.U.G. Ltd 1981
PGM 001 SIDE A ISSUE 1
0V
32
+5V
1 ba