

Section 1

Using the PAT Microcomputer

Chapter 1.1 Using the PAT Microcomputer

Objectives of this Chapter

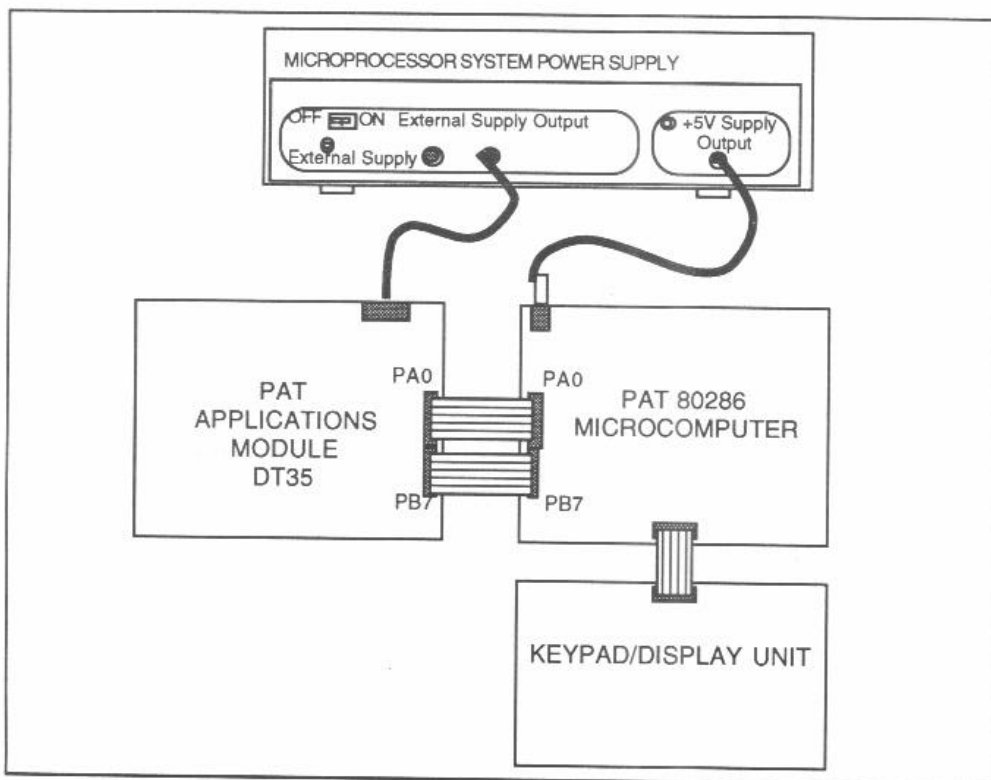
Having studied this chapter you will be able to:

- Connect power to the PAT Microcomputer
- Connect the DT35 Applications Module to the PAT Microcomputer
- Run the Applications Module demonstration program
- Select each section of the Applications Module demonstration program:
 - Analog to Digital Conversion
 - Optical Link
 - Proximity Detector
 - Distance Measurement
 - Constant Motor Speed Control
 - Variable Motor Speed Control
 - Beam Interruption
 - Optical Feedback

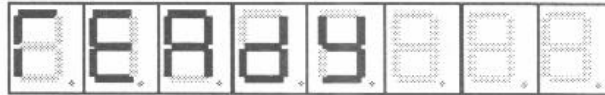
Introduction

This chapter is designed to introduce you to running programs on the PAT, and to familiarize you with the transducers available on the DT35 Applications Module. The PAT Microcomputer system should be connected by following the procedure given below:

- Use the special key provided to remove the cover from the Switched Faults.
- Check that all of the switches are set to the off position.
- Connect the Keypad/Display Unit to the PAT Microcomputer Board.
- Connect the Applications Module to the PAT Microcomputer Board.
- Ensure that the power supply is switched off
- Connect the power supply to the Applications Module and the PAT Microcomputer Board as shown below.

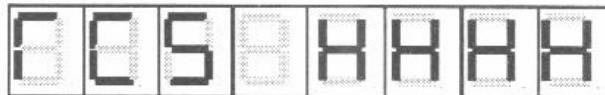


The power may now be switched on. The PAT display should now show:



If this does not happen, switch the power off, check the connections and try again.

Press the **R** key once and then press the **+** key **nine** times. The display will now show:



These segments may show any hexadecimal number

Note that the last four segments could show **any** hexadecimal number.

Press **F 0 0 0** and the display will show:



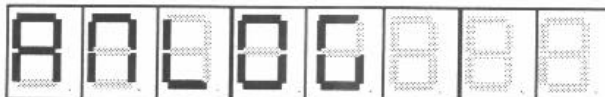
Now press **G**, followed by **6 0 0 0**.

Press **G** again to run the program.

The messages "RUNNING" and then "APPLICAtIONS" will move quickly across the display, followed by the word "SELEct" for about one second. thus:



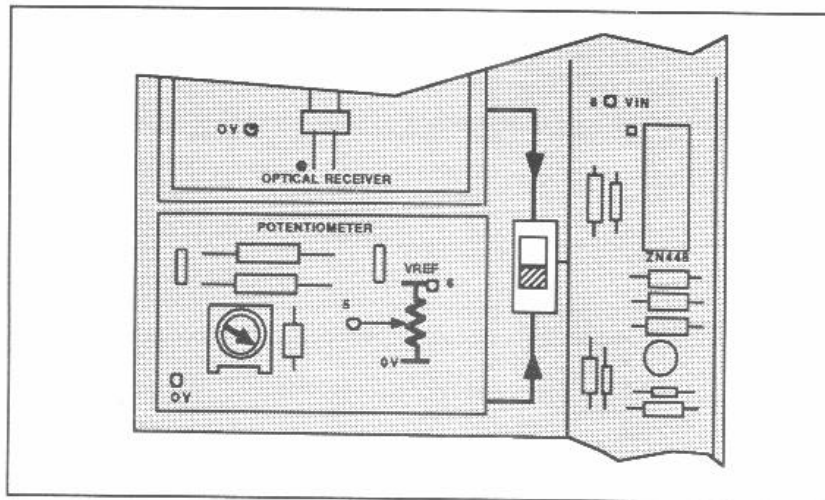
This is followed by the static display:



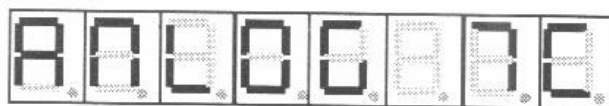
This indicates that the first of the demonstration programs has been selected. Other demonstration programs can be selected by using the **+** or **-** keys.

Analog to Digital Conversion

The Analog to Digital Conversion Demonstration Program will continually sample the potentiometer output, via the ADC and display a hexadecimal value between 00 and FF, depending upon the position of the potentiometer wiper. It is important that the slider switch next to the ADC is set to its **lower** position so that the potentiometer is connected to the ADC.



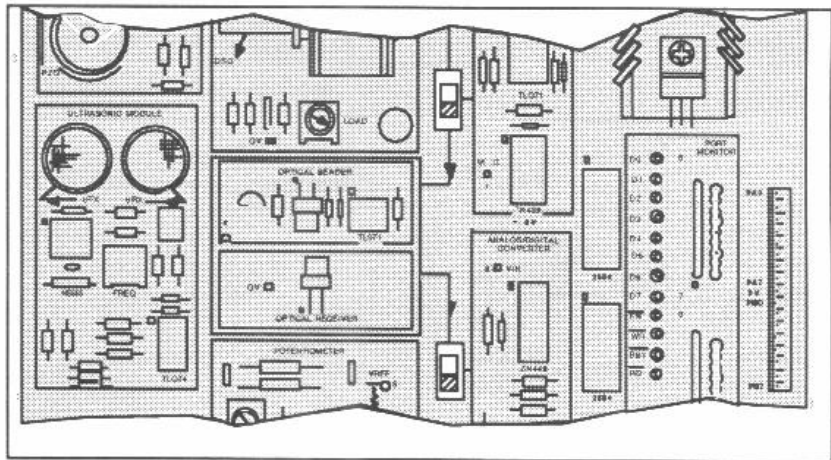
Having set the slider switch the Analog to Digital Conversion Demonstration Program can be executed thus: Use the $\boxed{+}$ or $\boxed{-}$ keys to select "AnLoG" and press the \boxed{G} key once. Adjust the potentiometer over its full range. The display will vary between 00H and FF. A typical display might be:



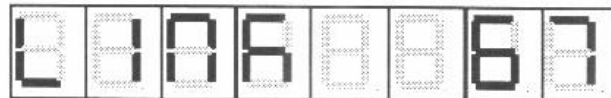
If the \boxed{G} key is held down then released, this program is halted. Another demonstration program can be selected, using the $\boxed{+}$ and $\boxed{-}$ keys. The other demonstration programs are explained on the pages following.

Optical Link

This demonstration program will continually sample the potentiometer output, via the ADC and then output the current value to the DAC. This analog output is then passed to the Optical Sender LED. The hexadecimal value output will also be displayed. Both the ADC and DAC slider switches should be set to their **lower** positions.



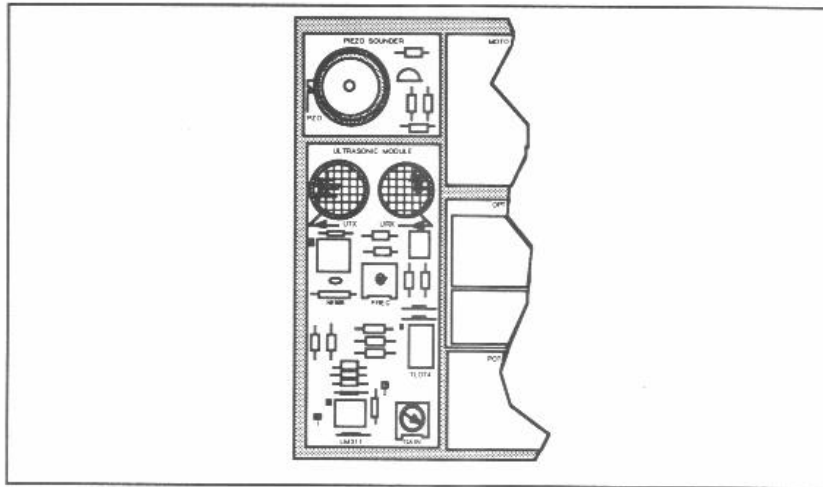
Use the + or - keys to select "LnK" and press the G key. Adjust the potentiometer over its full range. The display will vary between 00 and FF. A typical display might be:



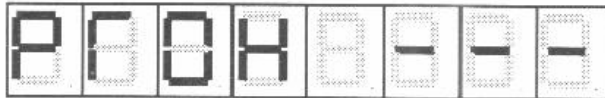
Note that the brightness of the optical sender LED will also vary correspondingly. Notice that the LED's D0 to D7 show the data output from the PAT to the optical sender. This is the binary equivalent of the hexadecimal value on the PAT display. If the G key is held down then released, this program is halted. Another demonstration program can be selected, using the + and - keys.

Proximity Detector

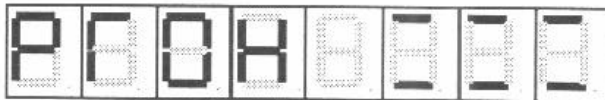
This demonstration program uses the ultrasonic transmitter and receiver as a proximity detector. The piezo sounder functions as an alarm and the display changes as an object is detected. The sensitivity of the detector can be adjusted using the "gain" potentiometer.



Use the $\boxed{+}$ or $\boxed{-}$ keys to select "ProX" and press the \boxed{G} key. Adjust the gain control **clockwise** until the alarm sounds, then turn it counter-clockwise until the alarm is just switched off. The display will read:



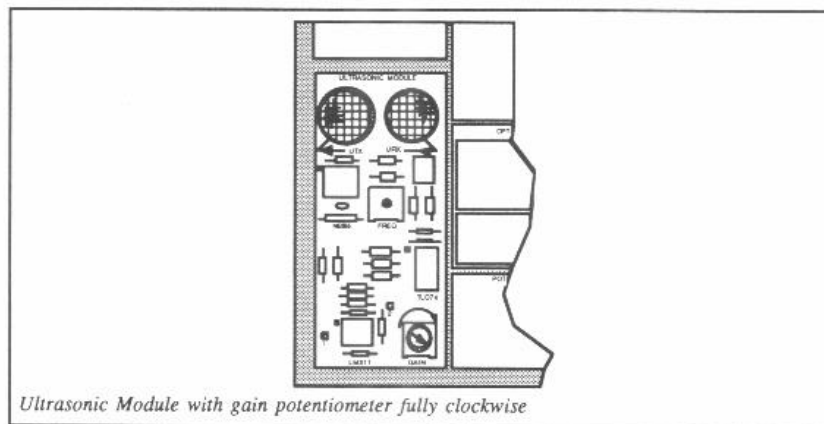
An object placed directly above the ultrasonic receiver and transmitter will be detected up to a distance of approximately 20cm. When an object is detected, the display will change to:



If the \boxed{G} key is held down then released, this program is halted. Another demonstration program can be selected, using the $\boxed{+}$ and $\boxed{-}$ keys.

Distance Measurement

This demonstration program uses the ultrasonic transmitter and receiver to measure the distance of an object above the board. The program calculates the distance by measuring the time delay between the transmission of an ultrasonic pulse and its reflection being received. The "gain" potentiometer should normally be set fully **clockwise**.



Ultrasonic Module with gain potentiometer fully clockwise

Initially, the display should show:



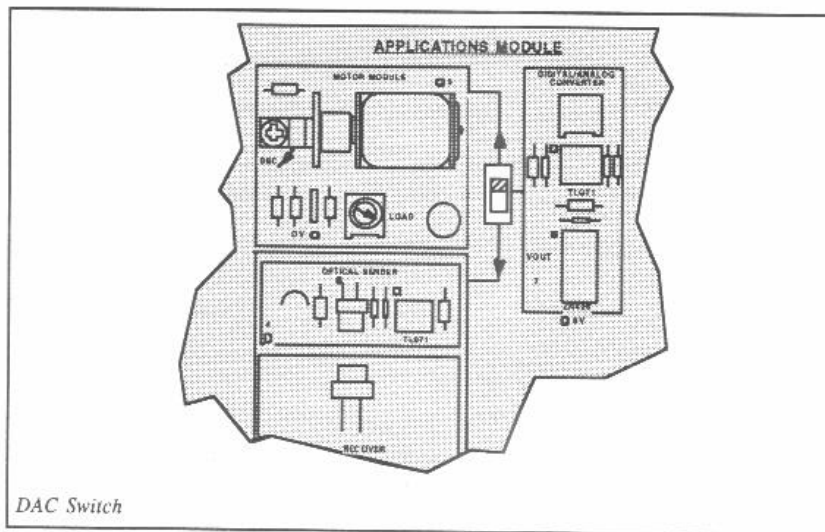
The potentiometer setting may be adjusted if difficulties with false reflections are encountered. Use the $+$ or $-$ keys to select "dISt" and press the G key. The display may show a value at this stage. This will be the height of the ceiling above the board (in centimeters). The display will now show the height of an object above the board. For example:



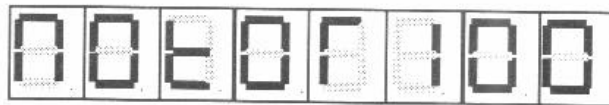
If the G key is held down then released, this program is halted. Another demonstration program can be selected, using the $+$ and $-$ keys.

Constant Motor Speed Control

This demonstration program will cause the motor to run at a constant speed of 100 revolutions per second (rps). The motor "load" potentiometer can be used to vary the motor load. The program will compensate for these variations in load by changing the value sent to the DAC. This will allow the speed to be maintained at a constant 100 rps. The LED's D0 to D7 display the data being sent from the PAT Microcomputer to the DAC. The DAC slider switch should be set to its **upper** position.



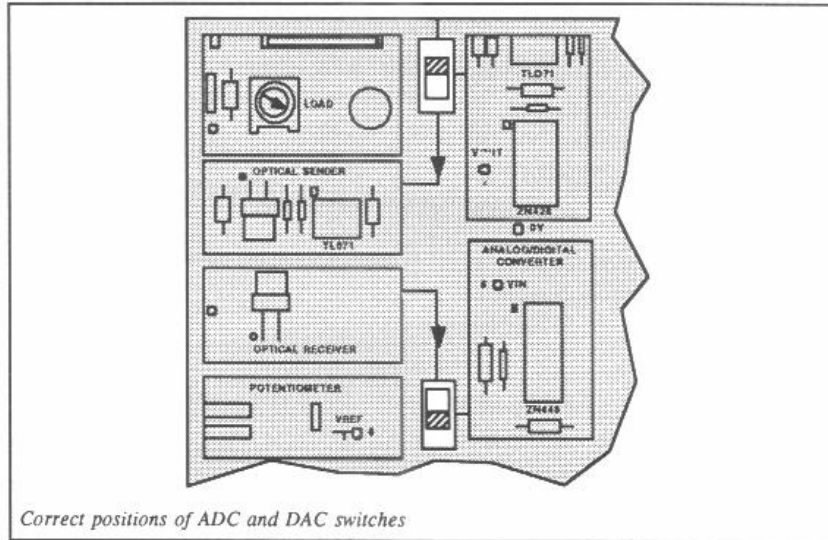
Use the or keys to select "Motor" and press the key. Use the motor "load" potentiometer to vary the loading on the motor. Notice that the speed is kept constant at 100 rps although the input to the DAC (as indicated by D0 to D7) varies as the program compensates for load variations.



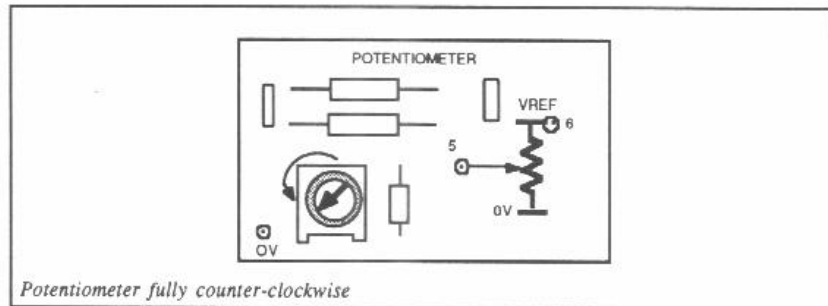
If the key is held down then released, this program is halted. Another demonstration program can be selected, using the and keys.

Variable Motor Speed Control

This demonstration program will cause the motor to run at a desired set speed, depending upon the setting of the potentiometer. The DAC slider switch should be set to its **upper** position and the ADC slider switch to its **lower** position.



Turn the potentiometer fully counter-clockwise.



Use the + or - keys to select "rPS" and press the G key.

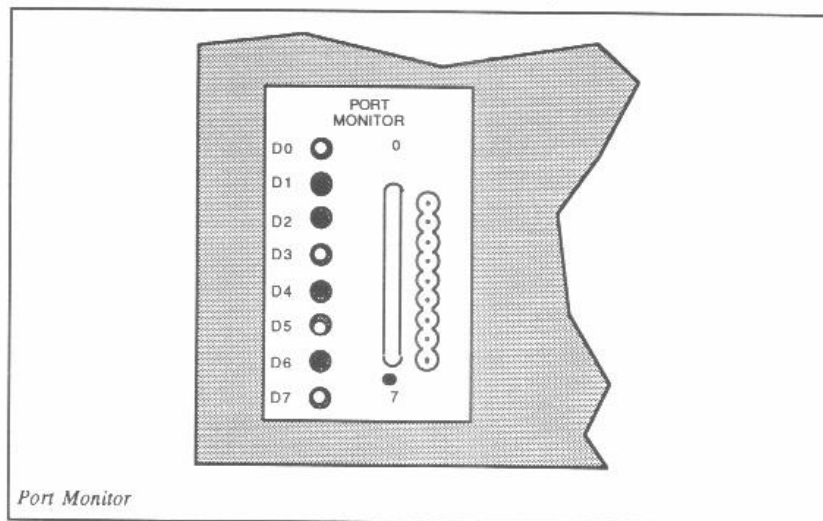
The display will show "000" and the motor will not rotate.



Gradually turn the potentiometer clockwise and the motor will rotate at the speed set by the potentiometer position.



The LED's D0 to D7 show the data output from the PAT to the DAC.

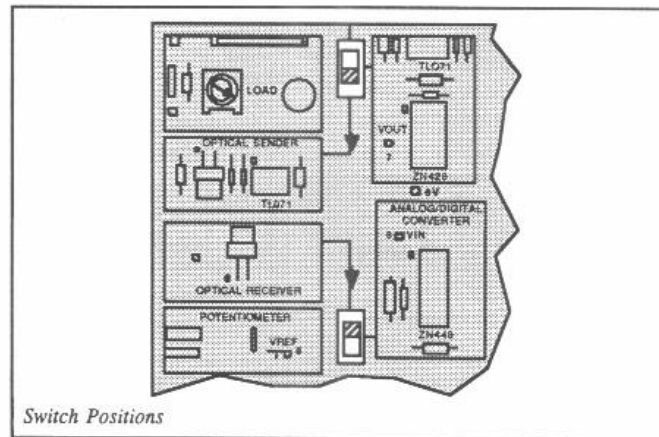


Port Monitor

If the G key is held down then released, this program is halted. Another demonstration program can be selected, using the + and - keys.

Beam Interruption

In this demonstration program the PAT uses the DAC to fully turn on the optical sender LED. The optical receiver output is returned, via the ADC, to the PAT. A hexadecimal value is displayed by the PAT to indicate the intensity of light falling upon the optical receiver. The program will compare this hexadecimal value with the arbitrary value 15_{16} and use the piezo sounder as an alarm signal if the light level falls below this value. The DAC slider switch should be set to the **lower** position and the ADC slider switch to the **upper** position.



Use the $+$ or $-$ keys to select "bEAM" and press the G key. The display might typically look like the one below, although the number displayed may be different:

6E800026

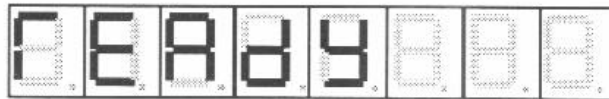
The alarm will sound if the optical link is broken (eg. by placing a piece of paper between the sender and receiver). The light intensity is displayed by the PAT as a hexadecimal value.

6E800006

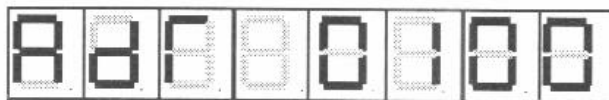
If the ambient lighting level is high, the light level at the receiver may exceed the threshold, even when the sender is blocked off. Fortunately the demonstration program allows the user to change the threshold level from its initial value of 15_H.

The procedure is as follows:

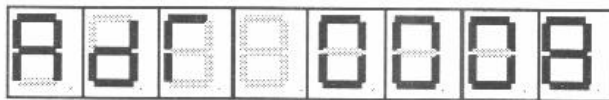
- Press and release the RESET key on the PAT main board. The display will show:



- Press **M** and the display will show :

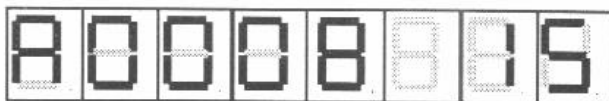


- Use the Hexadecimal Keypad to change the display to



by pressing the following keys in sequence: **0 0 0 8**

- Press **M** again and the display will show:

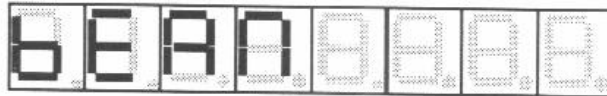


The last two digits are the threshold value 15_H.

- Use the Hexadecimal Keypad to change the threshold value (15_H) to the desired level (higher or lower). For example, to make the threshold value 25_H., press **2 5**.

- To run the program again press **G**, followed by **6** **0** **0** **0** and then **G** again.

Use the **+** or **-** keys to select



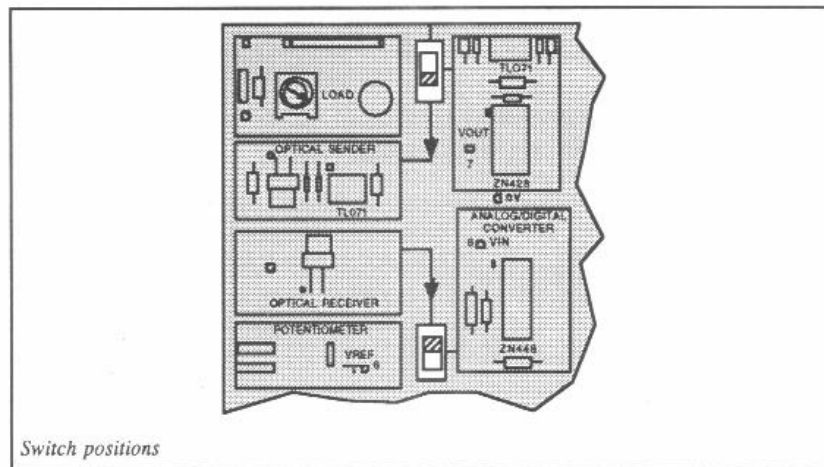
and press the **G** key again to run the program with the modified threshold value.

The significance of this procedure will be explained in subsequent chapters.

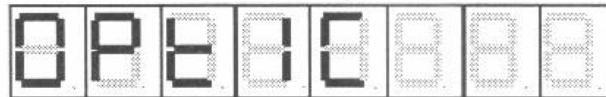
If the **G** key is held down then released, this program is halted. Another demonstration program can be selected, using the **+** and **-** keys.

Optical Feedback

This demonstration program will use the optical sender LED to maintain the light level at the receiver at a preset value, under conditions of varying ambient lighting. The ADC slider switch should be set to the **upper** position and the DAC slider switch to the **lower** position.

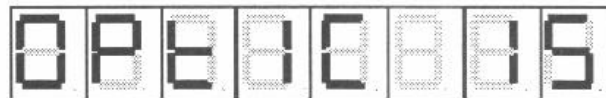


Use the + or - keys to select :



and press the G key.

The display will show the current light level at the receiver as a hexadecimal value. This will gradually increase to 15_H (the preset level to be maintained).



If the sender and receiver are covered so that the ambient light level falls, the program will increase the brightness of the sender LED to compensate and return the received value to 15_H. Conversely, if a bright light source is brought close to the sender and receiver, the brightness of the sender LED is reduced to return the received value to 15_H.

The preset level can be adjusted by the user in a similar fashion to the broken beam detector program:

- Press and release the RESET key on the PAT main board. The display will show:

- Press **M** and the display will show :

- Use the Hexadecimal Keypad to change the display to

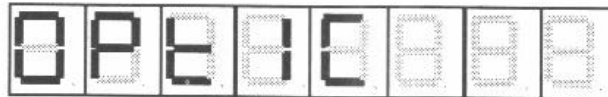
by pressing the following keys in sequence: **0** **0** **0** **8**

- Press **M** again and the display will show:

The last two digits are the threshold value 15_H .

- Use the Hexadecimal Keypad to change the threshold value (15_H) to the desired level (higher or lower). For example, to make the threshold value 25_H , press **2** **5**.
- To run the program again press **G**, followed by **6** **0** **0** **0** and then **G** again.

Use the + or - keys to select



and press the G key again to run the program with the modified threshold value.

If the G key is held down then released, this program is halted. Another demonstration program can be selected, using the + and - keys.

Turn off the power supply before continuing to the next chapter.

Notes:

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