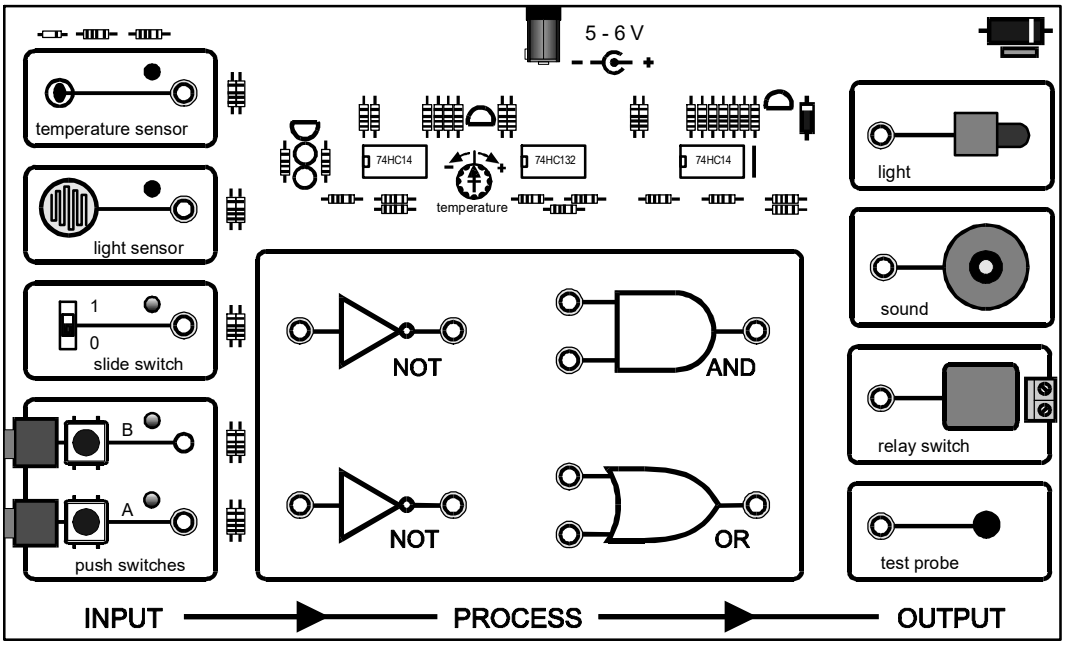
Investigating Electronic Systems



with the Angus Systems Board

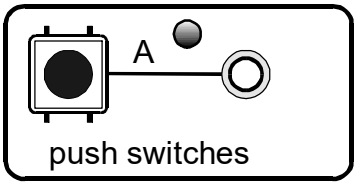
Investigating Inputs

Inputs are the "senses" of an electronic system. The input must give an electronic signal when it senses some change in the environment - a sound, a change of temperature, a switch pushed.

Investigate each of the inputs in turn, and complete the pupil record sheet for each one.

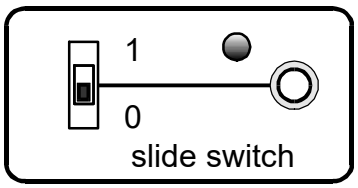
1. Push Switch

Switches are probably the simplest inputs. They let you - the user - tell an electronic system to do something.
Investigate one of the push switches - how do you generate an "on" signal ("logic 1")?



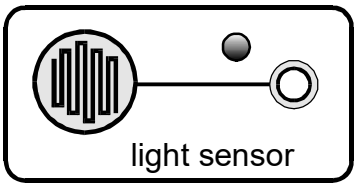
2. Slide Switch

Investigate the slide switch. How do you generate a "logic 1" signal? How is the slide switch different from the push switch ?



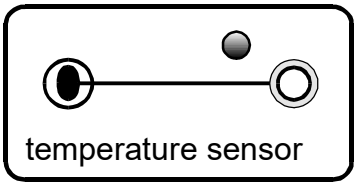
3. Light Sensor

Investigate the light sensor. Do you recognise the component which does the sensing? How do you generate a "logic 1"?



4. Temperature Sensor

Investigate the temperature sensor. Do you recognise the component which does the sensing? How do you generate a "logic 1"?



Inputs Report

Push Switch

The sensing component is a ....

To generate a “logic 1” signal you must .....

.....

Switch	Signal
release	
push	

Slide Switch.

The sensing component is a ....

To generate a “logic 1” signal you must .....

.....

This is different from the push switch because .....

.....

Switch	Signal
down	
up	

Light Sensor.

The sensing component is an .....

To generate a “logic 1” signal you must .....

.....

Light	Signal
dark	
bright	

Temperature Sensor.

The sensing component is a .....

To generate a “logic 1” signal you must .....

.....

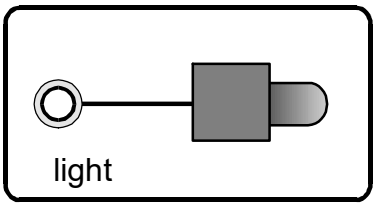
Temp.	Signal
cold	
hot	

Investigating Outputs

Electronic systems work with electrical signals.
The job of the output is to turn the electrical signals into something we can understand - a sound, a light, a movement.

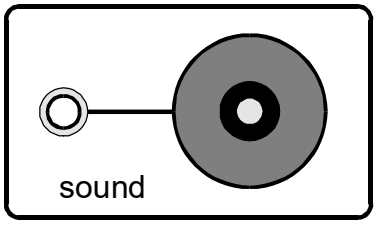
Connect a push switch to each of the outputs in turn to investigate their operation. Complete the pupil record sheet for each output.

1. Light



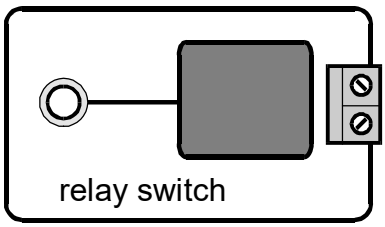
What is the actual component in the light output?
What is the energy conversion in this component?

2. Sound



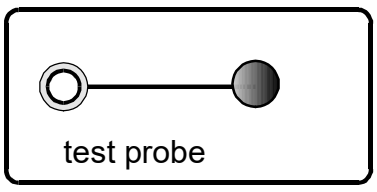
What is the actual component in the sound output?
What is the energy conversion in this component?

3. Relay Switch



The relay is an electromagnetic switch which allows electronic circuits to control other electric circuits. You should be able to hear the relay "click" as it switches. Your teacher may show you how an external appliance is controlled by the relay.

4. Test Probe



This is another light output, intended for testing systems. How does the probe show you when a signal is "high" or "logic 1"?

Outputs Report

Light

The output device is an .....

Complete the diagram to show the energy conversion in this component.

Sound

The output device is a .....

Complete the diagram to show the energy conversion in this component.

Relay Switch

The relay's job is to control other electric circuits off the board.

.....

.....

List some appliances the relay can control.

.....

Test Probe

The indicator is an .....

Complete the table to show how the probe indicates "logic 0" and "logic 1" signals.

Signal	LED
0	
1	

Investigating Process

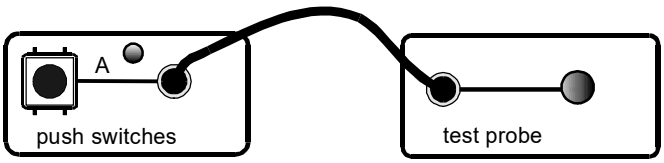
The process circuits are the "decision makers" in an electronic system. They monitor the inputs and decide when to operate the output device.

The simplest process circuit of all is "direct connection". Use this where you want an output device to operate if an input device gives a "logic 1" signal.

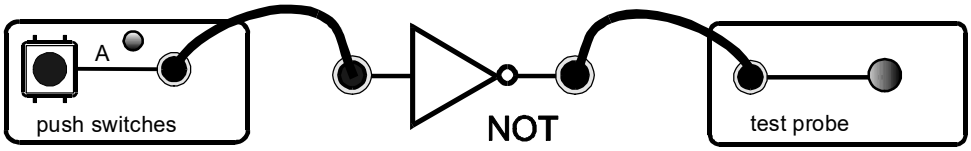
More advanced decisions are made by "Logic Gates". There are three types of logic gate on the board.

Investigate the process circuits in turn, and complete the process report sheet for each one.

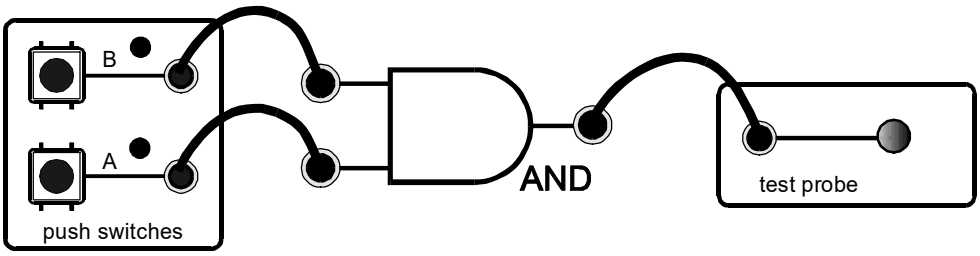
1. Direct Connection



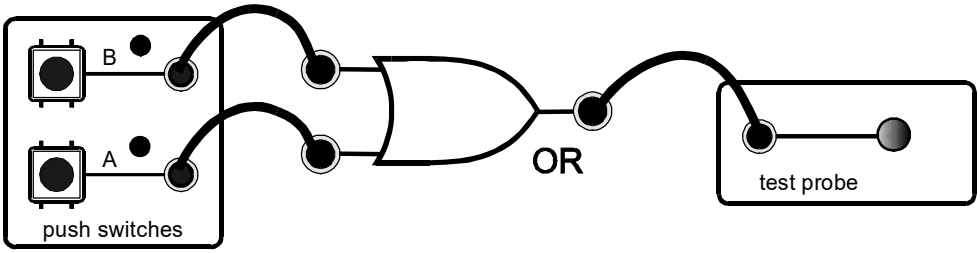
2. NOT Gate



3. AND Gate



4.OR Gate



Process Report

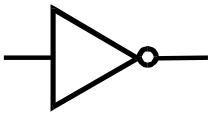
Direct Connection

When the input is 0 the output is .....

When the input is 1 the output is .....

Input	Output
0	0
1	1

NOTGate



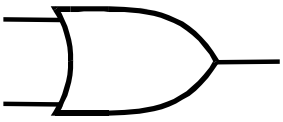
When the input is 0 the output is .....

When the input is 1 the output is .....

The output is N..... the input

Input	Output
0	
1	

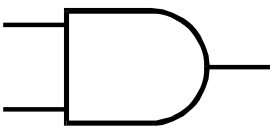
ORGate



Inputs A	Inputs B	Output
0	0	
0	1	
1	0	
1	1	

The output is 1 when input A ..... input B is 1.

AND Gate

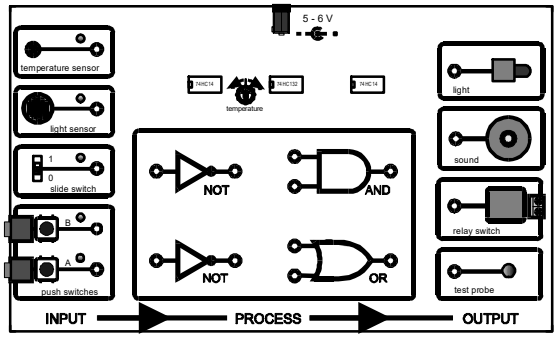


Inputs A	Inputs B	Output
0	0	
0	1	
1	0	
1	1	

The output is 1 when input A ..... input B are 1.

Electronic System Design

You have investigated each of the **Inputs**, **Processes** and **Outputs** in turn. Now you are going to connect these together to make E**lectronic Systems**. Electronic systems are built to solve real life problems. You are going to be a **systems engineer**, taking a step by step approach to solving some problems.



Step 1 - Specify the problem - Write in your own words a description of what the system must do. Make up a system table to show what the system will do.

Step 2 - Choose the Input, Process and Output parts you will need and decide how they will be connected together.

Step 3 - Build your system and test it.

Step 4 - Evaluation - Does your system work to your specification? Are there any improvements you could make?

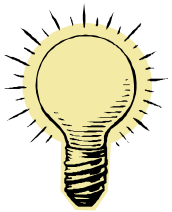
System Design Problems

1. Air Conditioning

A student wishes to have an electronic system which will automatically switch on a cooling fan when the temperature in her room gets too hot

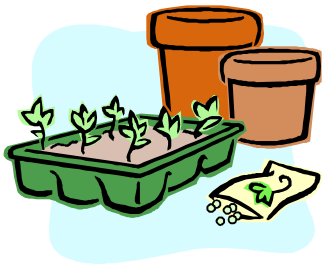
2. Night Light

A mother wants an automatic lamp which will give a gentle background light when it is dark in her baby's bedroom.



3. Pot Plants

A gardener waters pot plants by sitting them in a saucer of water. She requires an alarm to warn when the water has dried up.



4. Security Light

A security light must switch on when a visitor's body heat is detected, but only when it is dark

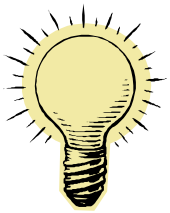
5. Burglar Alarm

The crown jewels are going on display in a museum. The museum must protect against thieves. One protection will be a light beam across the entrance door - the alarm should sound if this beam is interrupted. A second protection will be a magnetic "proximity switch" to sense the presence of the jewels - the alarm should sound if the jewels are removed.

System Design Problems

1. Night Light

A mother wants an automatic lamp which will give a gentle background light when it is dark in her baby's bedroom.



2. Ice Alert

A car designer needs an electronic system to light a warning LED on the dashboard when the outside temperature falls below a certain level.

DANGER
ICE

3. Air Conditioning

A teacher wants an electronic system to automatically switch on a cooling fan when the temperature in her room gets too hot, but only when the lights are on in her classroom.

4. Photographic Film

A photographer stores film in a dark, cool cupboard. The film will be spoiled if light hits it, or if it gets too hot. The photographer wants an electronic system to sound an alarm if light gets in, or if it gets too hot.

Photographic Film

PROTECT FROM LIGHT

KEEP COOL

5. Security Light

A security light must switch on when a visitor's body heat is detected, but only when it is dark

System Design Report - Title :

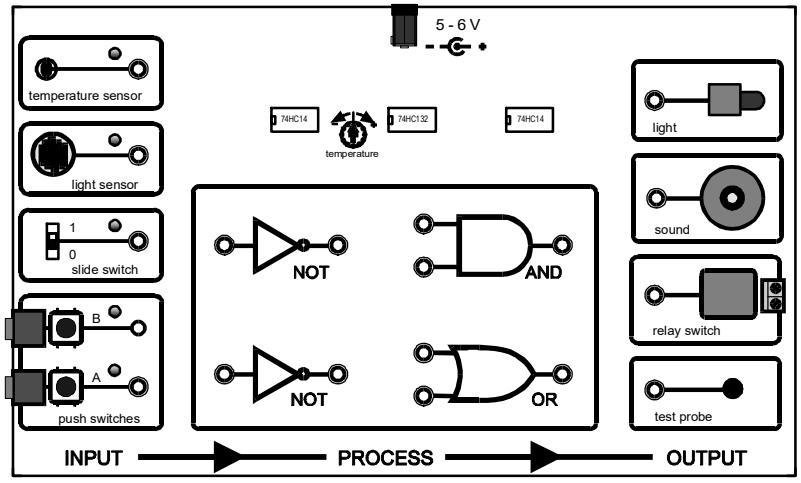
Specification -

Design -

temperature	
light	
slide switch	
push switch B	
push switch A	

direct connection	
NOT gate	
NOT gate	
AND gate	
OR gate	

light	
sound	
relay	
test probe	



Evaluation -