What is Junior Control 2?

Junior Control 2 is a new Control program from Deltronics, specially designed for the Junior Serial Interface.

The main window represents the box. The program can be used with or without an interface. Inputs can be simulated and outputs switched on and off by the click of a mouse.

Procedures can be built, consisting of sequences of commands. Commands can switch outputs and motors on and off, reverse motors, respond to inputs, and read analog sensors. For more complex tasks, procedures can call other procedures (sub-procedures) Simple arithmetic can also be performed.

Junior Control 2 also features Virtual Models, which are on screen simulations of traffic lights, juggling clown etc. which allow experimentation without having to build physical models. (for more on Virtual Models, see later in this manual)

Procedures can be viewed on screen while they are running, and a trace feature allows the progress of the procedure to be followed.

A commands window contains all the key words necessary for building procedures; clicking on the words, makes them appear in the edit window. This cuts down on typing, and reduces errors. This way, procedures that work first time can be built very quickly.

Installation

System requirements

The program will run on any system capable of running Windows 95 or above.
To use an interface, one free COM port is required.

Place the CD in the d: drive and Select **Start Run...**
and type **d:\setup.exe** in the box and click **OK**.

During the setup procedure you will be asked for your name, Company (or School) name, and serial number. The serial number can be found on the CD and on the envelope containing the CD.

Please read the copyright notice on the envelope.

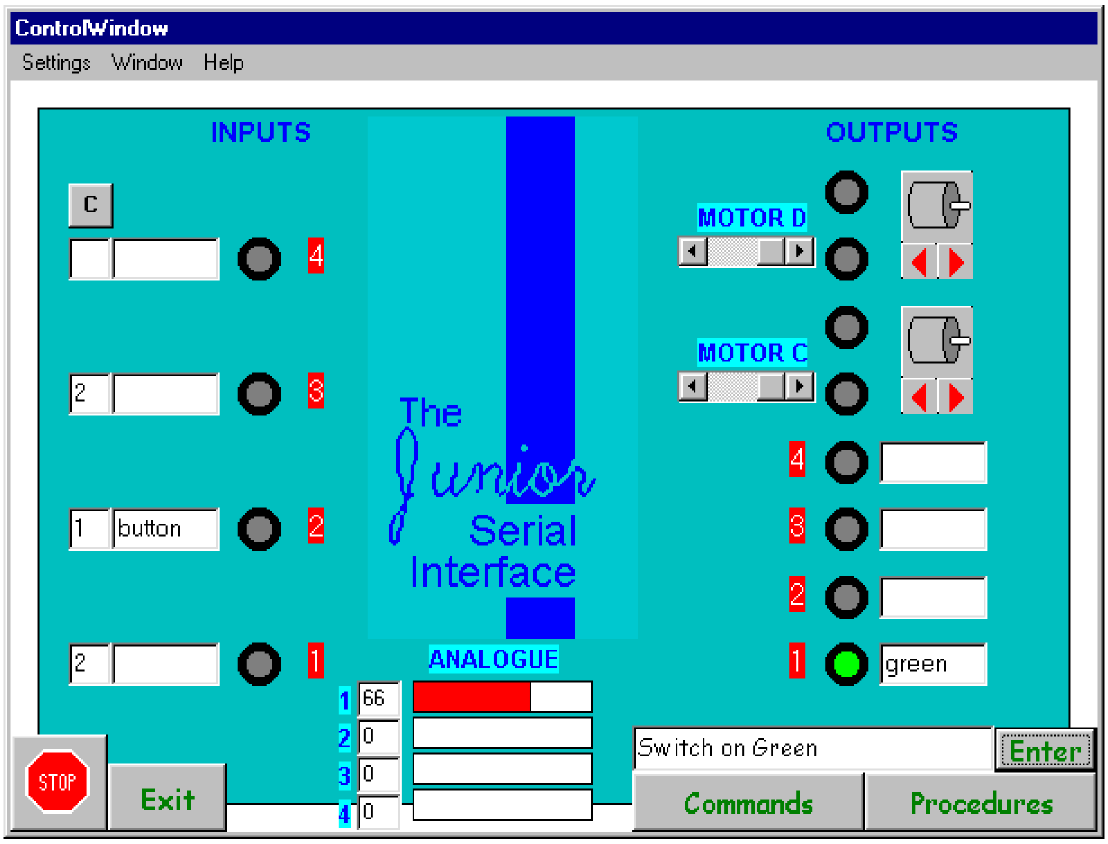
To view the serial number after installation, select **About Junior Control...** from the **Help** menu.

Running Junior Control

Select **Start.. Programs.. Junior Control.. Junior**

There are two Windows, the Main Window and the Procedures Window.

The Main Window



		●	4
2		●	3
1	button	●	2
2		●	1

4	●	
3	●	
2	●	
1	●	green

1	66
2	0
3	0
4	0

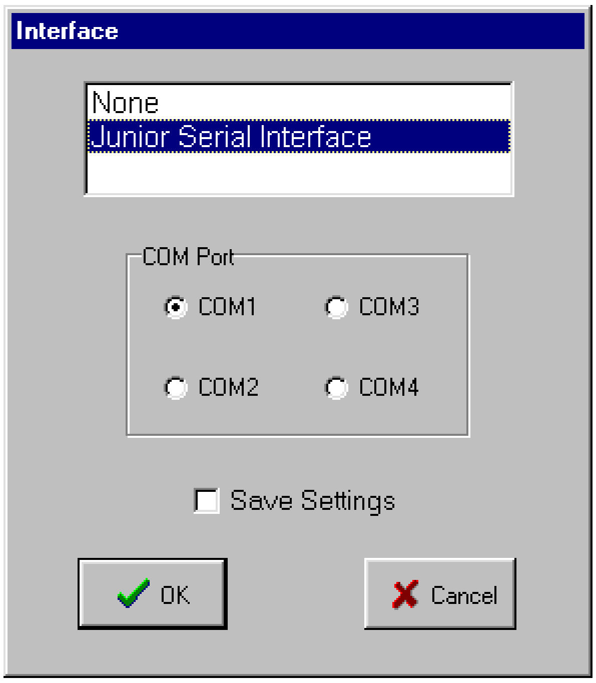
Switch on Green

Inputs

On the left of the window is a row of 4 LEDs corresponding to the input LEDs on the box; each has a label which can be used to identify the input and a counter which can count the number of changes on the input.
If you have a box connected, the LED will indicate the state of the real inputs on the box.

NOTE : When you first run the software, the interface is set to 'none'. To configure the program for your interface, select **Interface...** from the **Settings** Menu, this brings up the Interface dialogue

The Interface dialogue



Select Junior Serial Interface and select the COM port to which you have connected it. The box must be connected and switched on, otherwise you will get an error message To save the settings for future use, check the 'Save Settings' check box. Then you will not have to repeat the process next time you run Junior Control.

Outputs

Back to the Main Window - On the right is another set of LEDs representing the outputs. Click on the centre of the LED to turn it on or off, If you have a box connected and enabled, the output on the box will go on or off as well.
The outputs also have labels which can be used to identify them.

Motors

Also on the right are two Motor Icons; each icon is composed of three controls, the main motor icon turns the motor on and off and the arrow icons determine the direction. Again, if you have a box connected, and a motor connected to it, the motor will turn.

Analogue

At the bottom of the main window there is a numerical and bar graph display of the four analogue channels. (this only appears when the interface is set up and connected)

Buttons

in the bottom left corner are two buttons

Stop - turns off all the outputs and stops any procedure that is running

Exit - Exits the program, if you have un-saved procedures you will be asked if you want to save them first.

Speed (Power) Scroll Bars

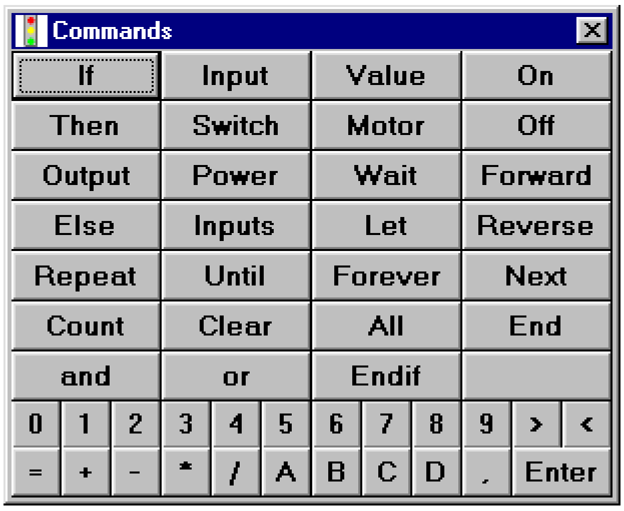
Next to the motors are scroll bars which can be used to set the speed of motors or the brightness of lamps if they are connected to the motor sockets.

The Procedures Window

This is where the procedures are created and edited. To start writing a new procedure, Click the **Procedures** button and select **New...** from the pop-up menu or Select **New...** from the **File** menu in the Procedures window. Type the name of your new procedure and click **OK.**
A window for editing your procedure is opened.

You can have several procedures open at once. To edit a procedure, just click on the title bar of its window, or select the procedure name in the **Window** menu, or click the **Procedures** button and select **Change...** from the pop-up menu.
Click the **Commands** button to bring up the Commands Window, which contains all the key words necessary for building a procedure.

The Commands Window



Try this simple procedure :-

```
Switch On 1
Wait 1
Switch Off 1
Wait 1
Switch On 1
End
```

you can click on the buttons in the commands window, or type on the keyboard. If you are using the keyboard, remember to put spaces in-between each word or number.

To run the procedure, click the Procedures button and select Run... from the pop-up menu, then select the name of the procedure. Alternatively select **Run *name*** from the **Run** Menu (e.g. if your procedure was called test, this menu item will be **Run test**)

Output 1 should go on and off.

Now select **Trace** from the **Run** menu, and run the procedure again; this time the lines in the procedure will be highlighted as the program encounters them.
To turn off Trace, select it again in the Run menu.

Inputs - using the If statement

Type in the following procedure :-

```
Repeat Forever
   If input 1 On then Switch On 4
   If input 1 Off then Switch Off 4
next
end
```

We ask the program to check the state of an input and do something as a result, using the **If ... Then...** statement

The program only does this once, so if you want to continuously monitor an input you have to put the statement inside a loop. That is the function of the **Repeat Forever** and **Next** commands

Run the procedure. Output 4 should go on when input 1 is on and off when input 1 is off.

To stop the program, press the **STOP** button in the bottom left of the Control Window.

You can simplify this procedure by writing :-

```
Repeat Forever
   If input 1 on switch on 4
   Else switch off 4
next
end
```

this is an **If... Then... Else...** statement. The program performs the **Else** part if the **If** part is **NOT** true; in this case if input 1 is not on.
Notice that the **Then** word has been left out, that is because it is optional.

Saving procedures

To save a procedure, first, select it by clicking in its window title bar, or by selecting it in the **Window** menu. Then select **Save/Save as...** in the File menu. Select the destination folder and click OK. To save the Input and Output labels with the procedure, make sure the **Save Labels** item is ticked.

Repeat Loops

Repeat loops are very useful elements in building most procedures. With a repeat loop you can make the procedure repeat a series of commands a fixed number of times, or until a certain event happens or forever (until the STOP button is pressed)

The basic forms are :-

```
Repeat
  [Statement]
  [Statement]
  .....
  .....
Until [Condition]
```

For Example

```
Repeat
   Switch On 1
   Wait 5
   Switch Off 1
   Wait 5
Until Input 3 On
```

This flashes Output 1 on and off until input 3 is on.

```
Repeat n
  [Statement]
  [Statement]
  .....
  .....
Next
```

e.g.

```
Repeat 4
   Motor C Forward
   wait 2
   Motor C Off
   wait 2
Next
```

The commands in-between **Repeat** and **Next** are repeated four times. Notice that they have spaces in front of them to put them further to the right, this helps to make your procedure more readable by clearly identifying which parts are inside the loop and which parts are not. This is known as indenting.
The program ignores spaces, but obviously not inside key words e.g. Sw itch is not allowed.

Finally there is the Repeat Forever statement

```
Repeat Forever
  [Statement]
  [Statement]
  .....
  .....
Next
```

This repeats everything in-between Repeat and Next 'Forever' i.e. until you press the **STOP** button.

Output Labels - Giving names to the outputs

You can label an output by clicking on it and then typing the name. You can then refer to it by that name in a procedure. For example, if you label some outputs Red, Amber and Green, this procedure will implement a traffic light sequence.

```
Switch Off All
Switch On Red
Wait 5
Switch On Amber
Wait 1
Switch Off All
Switch On Green
Wait 5
Switch Off Green
Switch On Amber
Wait 1
Switch Off Amber
Switch On Red
End
```

NOTE: The wait values should be set to seconds (Select **General...** from the **Settings** menu to change the wait values to Seconds or Tenths).
The procedure should go through the sequence from red to green and back to red again. The first line makes sure that all the outputs are off before starting.

Example - Pelican crossing

This example should help illustrate some of the basic features of the Junior Control language. For simpler examples see the Examples section.

DELTRONICS can supply a Pelican crossing model.

Specification -

We all know what a pelican crossing does, but it helps to put it down in black and white before we start trying to write any procedures.

Normally, the traffic lights are on Green, and the red man is on.

If the button is pressed, the traffic lights will go to amber, and then to red.

The red man then goes off and the green man comes on.

After a delay, the traffic lights go to flashing amber while the green man flashes.

Finally the traffic lights go to green while the green man goes off and the red man comes on.

This example is best done using sub procedures, that way we can break the task down into smaller parts which are easier to program.

These are the procedures

Pelican - The main procedure

sequence - goes through the whole sequence from red to green and back again.

Flash - flashes the amber light and green man

Bleep - sounds the bleeper while it is safe to cross.

Because there aren’t enough outputs on the Junior Serial Interface to do everything, we have to use the motor sockets for the red and green man. Motor C is the green man, and motor D, the red man.

Here's the main procedure - Pelican

```
Switch Off All
Switch On Green
Motor D Forward
Repeat Forever
   if input 1 on then sequence
Next
```

The first line switches off all the outputs so that everything is in a known state. Then the green light and red man are switched on.

Then we simply go round in a loop testing input 1, if it is on, we go through the sequence.

The sequence procedure

```
Switch off Green
Switch on Amber
Wait 30
Switch Off Amber
Switch On Red
Motor D Off
Motor C Forward
Bleep
Switch Off Red
Flash
Motor D Forward
Switch On Green
end
```

First, the light goes from green to amber, then a pause of three seconds (Wait 30) this assumes that the wait value is set to tenths of a second. Select **General...** from the **Settings** menu to bring up a dialogue to set this.
Then from amber to red, and the man goes from red to green.
Then call another sub procedure, Bleep which operates the bleeper (the number and duration of bleeps will determine the time allowed to cross the road)
Then switch off the red light and call another sub procedure Flash which flashes the green man and the amber light.
Finally, switch on the red man and the green light, to return to the original state.
Notice that all procedures must end in an end statement. when the procedure gets to the end statement, it returns to the procedure that called it.

Now we need to write the procedures Bleep and Flash

Bleep

```
Repeat 20
  Switch on Bleeper
  Wait 5
  Switch off Bleeper
  Wait 5
Next
End
```

Flash

```
Repeat 10
   Switch On Amber
   Motor C Forward
   Wait 5
   Switch Off Amber
   Motor C Off
   Wait 5
Next
End
```

Remember that the wait values must be set to tenths. Select **General...** from the **Settings** menu.

Also, remember to label all the outputs - Red, Green, Amber, Bleeper.

Examples

The following pages contain eight examples which introduce most of the features of the Junior Control language.

Any additional features can be found in the command reference and in the program help.

1. Lighthouse

This is a simple procedure for turning a light on and off. Build the lighthouse from Lego or similar and attach a bulb to the top. Connect the bulb to one of the output sockets on the Control It or Serial Interface.

Build the following procedure (call it 'light')

```
Switch On 2
Wait 1
Switch Off 2
Wait 1
Switch On 2
Wait 1
Switch Off 2
End
```

The procedure assumes that Output 2 will be used. Make sure that the wait values are set to Seconds (select **General...** in the **Settings** Menu). Run the procedure. (Remember to select the interface from the Configure Menu) The light should flash on and off twice.

Loops - making the procedure repeat

You can make the procedure repeat any number of times by using Repeat.

Change the procedure to: -

```
Repeat 10
   Switch On 2
   Wait 1
   Switch Off 2
   Wait 1
Next
End
```

Lighthouse (continued)

Run the procedure, and the light will flash on and off ten times.

Using Repeat, the light flashed ten times instead of twice, but has used one less line to do it. The word Next indicates the end of the loop.

You can put any number after Repeat or you can use Repeat Forever, to make the light flash continuously. In this case the program can be stopped by using the **STOP** button.

Labels - giving names to the Outputs.

Click on the label next to Output 2 and type the word LAMP.

Now change the procedure to: -

```
Repeat 10
   Switch On Lamp
   Wait 1
   Switch Off Lamp
   Wait 10
Next
End
```

Saving the Procedure.

Select the procedure by clicking on its title bar or by selecting it from the **Window** menu Select **Save/Save As** from the **File** Menu. Select the destination folder and click OK.

2. Traffic lights

This procedure goes through a traffic light sequence.

First, label the lower three outputs, Red, Amber and Green. Then build this procedure :-

```
Switch Off All
Switch On Red
Wait 4
Switch  On Amber
Wait 1
Switch Off Red
Switch Off Amber
Switch On Green
Wait 4
Switch Off Green
Switch On Amber
Wait 1
Switch Off Amber
Switch On Red
```

Run the procedure, and it should go through the sequence from Red to Green and back to Red again. The first line makes sure that all the lights are off before starting.

To make the sequence repeat continuously, use Repeat as follows:-

```
Switch Off All
Repeat Forever
   Switch On Red
   ........
   ........
   ........
   Switch Off Amber
Next
End
```

3. Using Inputs - A Simple Alarm

For this procedure, you will need a buzzer and a magnetic proximity switch or a microswitch.

Attach the proximity switch to a door or window so that the switch is **On** when the door is shut and **Off** when it is open. Connect it to one of the inputs, say Input 1. Connect the buzzer to one of the outputs, say Output 4; you can label the Output, 'Buzzer'.

Build the following procedure :-

```
Repeat Forever
   If Input 1 On Then Switch Off Buzzer
   Else Switch On Buzzer
Next
End
```

Run the procedure, and the buzzer should sound when the door is opened. You can use labels on the inputs as well, therefore if you label Input 1 as 'Door' , you can say :-

```
If Door On Then Switch Off Buzzer
```

Using Sub Procedures.

Suppose you want the buzzer to go on and off instead of sounding a continuous tone.

Build this procedure (call it Buzz)

```
Repeat Forever
   Switch On Buzzer
   Wait 5
   Switch Off Buzzer
   Wait 5
Next
End
```

Alarm   (continued)

Then modify the Alarm procedure to :-

```
Repeat Forever
  If Door On then Switch Off Buzzer
  Else Buzz
Next
End
```

Adding other inputs

You can add other sensors to the alarm. for example a pressure mat. Connect the pressure mat to one of the inputs, and label that input 'Mat'.

Modify the procedure to

```
Repeat Forever
    If Door On Then Switch Off Buzzer
    Else Buzz
    If Mat Off Then Switch Off buzzer
    Else Buzz
Next
End
```

Notice that the pressure mat is normally 'Off' but goes to 'On' when it is stepped on.

4. Car Park

This procedure counts the cars going into and coming out from a car park. You can use a microswitch or a light switch to detect the cars going in and out. Two bulbs are needed for the 'SPACES' and 'FULL' signs.

Build this procedure:-

```
Repeat Forever
   Let A = Count 1
   Let B = Count 2
   If (A-B) > 9 Then FullSign
   Else SpacesSign
Next
End
```

and the Sub Procedures FullSign :-

```
Switch On Full
Switch Off Spaces
End
```

and SpacesSign :-

```
Switch On Spaces
Switch Off Full
End
```

Label one of the outputs 'Spaces' and another 'Full'. The program assumes that there are ten spaces in the car park.

Car Park (continued)

This procedure uses two variables A and B. Variables are used whenever you need to store or remember a number or perform calculations - in this case A is the number of cars that have entered the car park and B is the number of cars that have left. Here, the **'If'** command is used to test the result of a comparison. i.e. "is (A-B) greater than 9 ?"
You can read more about how Junior Control performs arithmetic and comparisons in the Arithmetic section.

Note that the sub procedures FullSign and SpacesSign, only have two lines each (excluding the end statement) The Car Park program could have been written as one procedure like this :-

```
Repeat Forever
   Let A = Count 1
   Let B = Count 2
   If (A-B) > 9 Then
      Switch On Full
      Switch Off Spaces
   Else
      Switch On Spaces
      Switch Off Full
   EndIf
Next
End
```

Car Park (continued)

This is the long form of the **If... Then... Else..** construction which is :-

```
If [condition] Then
  [statement]
  [statement]
  .....
  .....
Else
  [statement]
  [statement]
  .....
EndIf
```

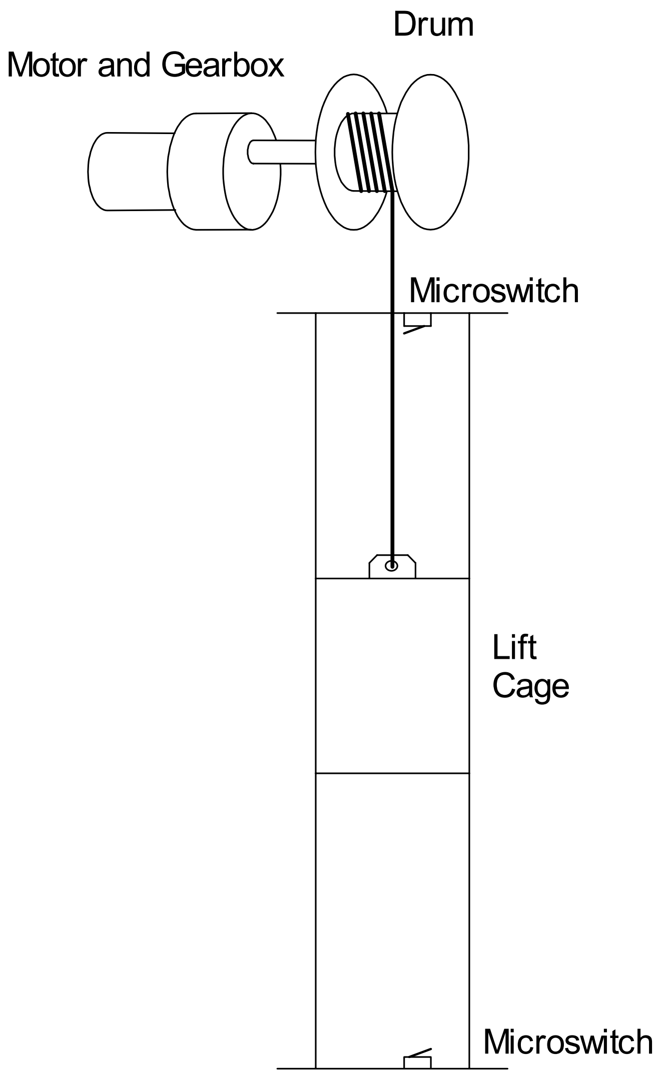
The important rule is that the first statement in each block must be on the line after the **'If'** or the line after the **'Else'**.
The **EndIf** statement must also be present.

The **Else** block is optional. i.e. you can have :-

```
If [condition]
    [statement]
    [statement]
    .....
EndIf
```

5. Lift

This program operates a simple two floor lift.



To build the lift you will need a motor (geared) and a pulley or drum (cotton reel or similar). The lift cage will need to run smoothly in a set of guides. You will also need two microswitches or magnetic proximity switches. DELTRONICS can supply a lift model.

Lift (continued)

First write a simple procedure to send the lift to the top. Connect the motor to Motor C and the top microswitch to Input 2.

Build this procedure (call it 'Up')

```
Repeat
   Motor C Forward
Until Input 2 On
Motor C Off
End
```

This procedure uses a simple example of feedback, i.e. the effect of an Output is monitored by an input in order to decide when to switch the output on or off .
Add two push buttons; one for up and one for down. Connect them to Inputs 3 and 4, then write the overall lift procedure as follows :-

```
Repeat Forever
   If Input 3 On then Up
   If Input 4 On Then Down
Next
End
```

Before you run this, you should also write the procedure 'Down' which is very similar to 'Up'

```
Repeat
   Motor C Reverse
Until Input 1 On
Motor C Off
End
```

(Input 1 should be connected to the bottom microswitch)

Lift (continued)

Improvements – try adding a light to each floor which comes on when the lift arrives.

6. Street Lights

This procedure automatically switches on a street light when it becomes dark. It uses the Analogue Inputs. You will need a light level sensor.

Connect the sensor to Analogue Channel 1, and a light bulb representing the street light to Output 1.

Build this procedure:-

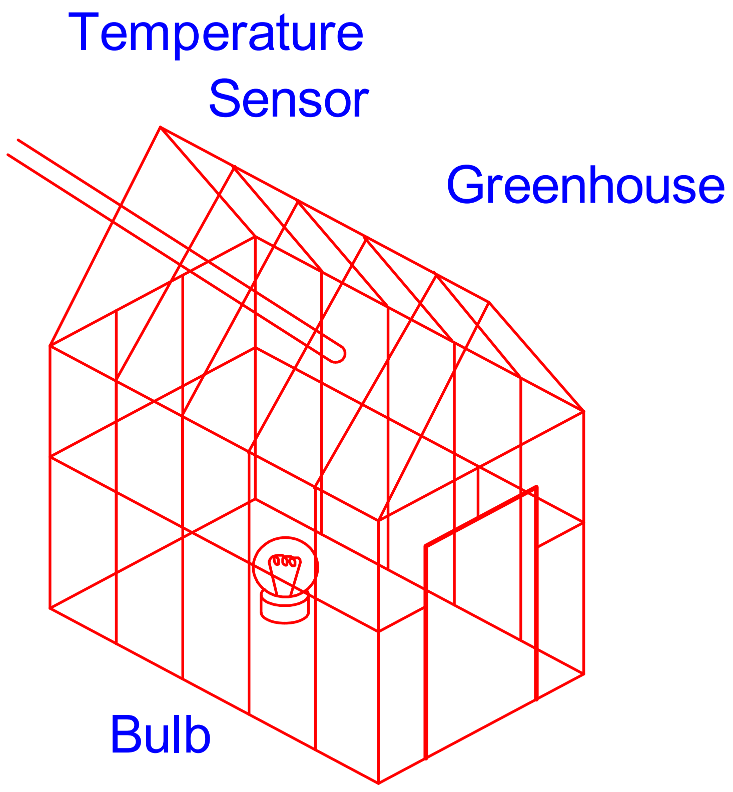
```
Repeat Forever
    If Value 1 < 50 Then Switch On 1
    Else Switch Off 1
Next
End
```

When you cover the light sensor the light should come on; uncover it and the light should go out. (You may have to experiment with the value in line 2 to get it right).

7. More analogue - Temperature Control - A Greenhouse

This procedure is a temperature control system for a greenhouse. You will need a 5W bulb as a heater (the small bulbs in the Deltronics accessory pack are not suitable for this) and a temperature sensor.

Build a model greenhouse (don't make it too large or it will take a long time to warm up) and place the bulb and temperature sensor inside it. Ideally, for demonstration purposes the temperature sensor should be located at the top,
above the lamp, so that it warms up quickly. In a real greenhouse it should be located low down so that the whole greenhouse warms up before the heater switches off.



Connect the bulb to Output 1 and label it 'Heater'. Connect the temperature sensor to Analogue Channel 1. Select **General...** from the **Settings** Menu and set degrees C instead of 0 to 100% .

Greenhouse (continued)

Build this procedure:-

```
Repeat Forever
   If Value 1 > 24 then Switch Off Heater
   Else Switch On Heater
Next
End
```

It will take a few minutes to observe the system switching on and off, but eventually it should stay within a degree or two of the value that you set.

8. Level Crossing

This program operates a level crossing barrier and lights. You will need a train set (or at least a short length of track), a magnetic proximity switch or microswitch to detect the train coming past a certain point on the track, a motor and gearbox for the barrier, another switch to detect when the barrier is down, some bulbs and a buzzer.

Connect the train detecting switch to, say Input 1, the barrier motor to motor A and the 'barrier down' switch to Input 2.

Write the following procedure:-

```
Repeat
Until Input 1 On
Motor C Forward
Repeat
   Flash
Until Input 2 On
Motor C Off
Repeat 20
   Flash
Next
Motor C Reverse
Wait 20
Motor C Off
End
```

Sub procedure 'Flash'

```
Switch On 3
Wait 3
Switch Off 3
Wait 3
End
```

Level crossing (continued)

For these procedures, the wait values should be set to tenths of a second. (select **General...** from the **Settings** Menu)

The first two lines wait for the train to activate the switch. The next part starts winding down the barrier and flashing the lights. The barrier motor is stopped when the 'barrier down' switch is activated, but the lights continue to flash twenty more times. The motor is then reversed to wind up the barrier. (The wait value here will depend on the speed of the motor)

The number of repeats after the barrier has come down should be enough to let the train go past.

The duration of flashes should be kept short, otherwise the barrier could over-run before it is switched off.

What happens if the train slows down or stops after it has triggered the switch but before it has reached the crossing?

To overcome this problem, put another switch on the far side of the crossing and change Repeat 20 to Repeat .... Until Input n On where n is the input to which the sensor is connected.

Improvements

Modify the procedure 'Flash' to operate two lights to flash alternately (as in a real level crossing). You could also add a buzzer here.

<u>Command Reference</u>

Clear

Clear, clears a specific input counter,

e.g.
```
Clear 3
```

Count

Count represents a count of the number of Off to On transitions on an input since the last **Clear** (either by command or by the on screen button) The form is **Count *n*** , where ***n*** is the input number.

Count can be used in any arithmetic expression or logical expression

e.g.
```
If Count 3 > 20 Then Switch Off 2

Let X = Count 3

Let Y = Count 1 + Count 2
```

Else

(see **If**)

End

Every procedure must end in an **end** command. In the main procedure, it tells the procedure to stop. In a sub procedure, it tells the procedure to return to where it was called from. If you leave out **End**,
the compiler will assume it, but it is good practice to put and end statement after all your procedures.

EndIf	(see **If**)
EndWhile	(see **While**)
EndLoop	(see **Loop**)

Forever

Forever is a keyword used in conjunction with **Repeat** (see **Repeat**)

Forward

Forward is a keyword used in conjunction with **Motor** (see **Motor**)

If

If, along with **Then** is used to construct conditional statements. The general form is:-

```
If [Condition] then [Command]
```

e.g.
```
If Input 1 On Then Switch On 3
If Value 4 < 40 Then Motor C Reverse
```

The '**Then**' is optional, i.e.

```
If Input 1 On Switch On 3
```

is the same as:
```
If Input 1 On Then Switch On 3
```

You can test more than one input at once using the 'and' and 'or' keywords e.g.

```
If Input 1 On and Input 2 On Switch on 2
If Input 3 On or Input 2 On Motor C forward
```

If you want to perform more than one action in an **If** command, you can use the long form of the **If** statement which has the form:-

```
If [condition]
    [statement]
    [statement]
    ....
EndIf
```

The statements **must** start on the line **after** the If [condition], otherwise the compiler will treat it as the short form. You **must** include the **EndIf** to show where the block of statements ends, and the rest of the procedure begins.

An **If** statement can be used on its own or with an **Else** statement.

Else

Else is always used in conjunction with an **If** statement. An **If**.. **Then**.. **Else**.. construction carries out one action if the '**if**' condition is true or another if it is false.

e.g.
```
If Input 1 on then Switch on 4
Else Switch off 4
```

The **Else** must be on the line which immediately follows the **If**.

Long form of If.. Then.. Else..

If.. **Then**.. **Else**.. also has a long form which is:-

```
If [condition]
    [statement]
    [statement]
    ....
Else
    [statement]
    [statement]
    ....
EndIf
```

The statements following **Else** must start on the line after the else, and you must include the **EndIf**.

Input

Input is always used in conjunction with **If**, **Until** or **While** to test the state of an input bit.

e.g.
```
If Input 2 On Then ....

If Input 2 Off Then ....

Until Input 4 On
```

You can test more than one input at once using the '**and**' and '**or**' keywords e.g.

```
If Input 1 On and Input 2 On Switch on 4
If Input 3 On or Input 4 On Motor D forward
```

Inputs

Inputs is used to check the state of all the inputs at once, and is always used in conjunction with **If**, **Until** or **While**

e.g.
```
If Inputs = 12 Then Switch on 3
Else Switch off 3
```

If the binary byte represented by the inputs is '12 decimal' then output 3 will be switched on.

'>' and '<' are not allowed with this command, only '='.

Let

Let is used to assign a value to a variable. Variable names can consist of numbers and letters, but must start with a letter.

The general form is :-

```
Let [Variable] = [expression]
```

Variable is any variable name, and expression can be a constant, another variable, or an arithmetic expression,

e.g.
```
Let floor = 1
Let items = items + 1
Let B = F / 3
```

Let is optional, i.e.

```
                    floor = 1
is the same as :    Let floor = 1
```

See the section on Arithmetic for more details.

Loop

Loop can be used to construct a continuous loop, and is an alternative form of a **Repeat Forever** loop (see **Repeat**)

The form is :-

```
Loop
    [statement]
    [statement]
    ....
EndLoop
```

The only way to stop a Loop is to press the **STOP** button.

Motor

Motor is used to set the state of one of the two motors to **Off**, **Forward** or **Reverse**,

e.g.
```
Motor D Forward
Motor C Reverse
Motor D Off
```

Next

Next is used in conjunction with **Repeat** (see **Repeat**)

Off

Off is used in conjunction with **Input**, **Switch** or **Motor** (see the relevant commands)

On

On is used in conjunction with **Input** or **Switch** (see **Input** and **Switch**)

Or

Or can be used when testing inputs e.g.

```
If input 1 on or Input 2 On Then Switch on 4
```

Switches output 4 on if either input 1 **or** input 2 is on.

Or is also used in relational expressions (see Arithmetic section)

Output

Output is used to output a byte to the outputs,

e.g. **Output 14** causes the binary equivalent of 14 to appear on the outputs, overriding any previous **Switch On** or **Switch Off** commands. Constants or variables can be used,

i.e.
```
Let A = 14
Output A
```

Has the same effect as `Output 14`

See the section on Arithmetic for more information on variables.

Power

Power is used to set the power (speed) of one of the eight outputs or one of the four motors. It can be used to control motor speed or lamp brightness, if the lamp is connected to the motor sockets.

The general form is :-

```
Power [n] [p]
```

n is the motor reference and p is the power,

e.g.

```
Power C 15
Power D 31
```

Power values can range from 0-31. 0 is stationary and 31 is full speed.

Note: The relevant Motor must be switched on before this command can take effect.

Repeat

Repeat is used along with **Until** or **Next** to construct loops.

There are three general forms:-

(a)

```
Repeat
   [statement]
   [statement]
   ....
   ....
Until [Condition]
```

This repeats all the statements until the condition becomes true.

Condition can be a reference to Inputs, Input counts or Values, or an arithmetic expression.

e.g.
```
Until Value 2 > 28
Until Count 3 = 100
Until A = 7
Until X=Y+3
Until Input 2 On
```

(b)
```
Repeat n
    [statement]
    [statement]
    ....
Next
```

This repeats all the statements in-between **Repeat** and **Next**, ***n*** times. For example:-

```
Repeat 4
    Switch on 1
    Wait 1
    Switch off 1
    Wait 1
Next
```

Flashes output 1 on and off four times.

(c)
```
Repeat Forever
    [statement]
    [statement]
    ....
Next
```

Repeats all the statements in-between **Repeat** and **Next**, 'Forever' i.e. until the STOP button is pressed.

Reverse

Reverse is used in conjunction with **Motor** (see Motor)

Switch

Switch is used to switch on or off one of the outputs. Constants or variables can be used, e.g.

```
Switch On 2
Switch Off 4

X=3
Switch On X
```

is the same as: `Switch On 3`

You can also switch on or off more than one output at a time e.g.

```
Switch On 2,4,1
```

Then (see **If**)

Until (See **Repeat**)

Value

Value is used to read one of the four analogue channels and is always used in conjunction with **If**, **Until**, **While** or **Let**

e.g. `If Value 1 > 50 Then Switch On 3`

Value returns values of 0-100 for an input voltage range of 0 to 1.8V. You can make the Value command return a value in Degrees C

Select **General...** from the **Settings** menu and check the Degrees C button in the Analogue Values box.
Analogue values can also be assigned to variables (See Arithmetic).

Wait

Wait causes the program to wait for a specified number of tenths of a second or seconds.
To set Tenths or seconds, Select **General...** from the **Settings** menu and select Tenths or Seconds in the Wait Values Box.

e.g.
```
Wait 20
```

While

While is used in conjunction with **EndWhile** to construct loops. The general form is :-

```
While [condition]
    [statement]
    [statement]
    ....
EndWhile
```

Condition can be a reference to Inputs, Input counts or Values, or an arithmetic expression.

e.g.
```
While Input 2 On
While Count 3 < 100
While A = 0
While X<Y+3
```

The program will repeat the set of statements *while* the condition is true ie *until* the condition becomes false.

Arithmetic

Junior Control can perform simple arithmetic.

Variables

Variables are created using the Let command (see Command Reference). You must first create a variable before you can use it, otherwise you will get a 'Variable not found' error.

e.g. `Let A = B + 4`

would result in an error if B had not previously been created using a Let command.

The general form of an arithmetic statement is :-

```
Let [variable] = [expression]
```

expression can be a constant e.g. `Let A = 6`

Or another variable e.g. `Let A = B`

Or a general expression.

e.g. a simple expression has the form

[operand] [operator] [operand]

Each operand can be a variable or constant and operator can be one of

+ - * /

The operators perform addition, subtraction, multiplication and integer division respectively. (Integer division discards the remainder e.g. 9 / 4 = 2)

The Let command can be used to assign one of the Analogue values to a variable.

e.g. `Let V = Value 2`

or `Let V = Value 1 + 12`

Variables can be used as parameters for certain commands.

e.g.
```
Let VAR = 3
Switch On VAR
```

Or

```
Output VAR
```

Relation Operators

Relation operators can be used in **If**, **Until** or **While** to test for various conditions e.g. X **>** 6

The four relational operators are **>, <, =** and **#.**

>	-	"Greater Than"
<	-	"Less Than"
=	-	"Equals"
#	-	"Not Equal to"

Examples -

```
If Count 1 > 10
Until X=Y*(A+3)
If Floor # 1
```