CONTROL IT

OPERATING INSTRUCTIONS

DELTRONICS

91 HEOL-Y-PARC, CEFNEITHIN, LLANELLI, DYFED, SA14 7DL
Tel: 0269 843728

CONTROL IT

This instruction booklet outlines what the Control It buffer box can do, and what its limitations are. It also explains briefly how to use the buffer box for computer control. For a fuller treatment on computer control you should refer to one of the many text books now available on the subject.

Even though many versions of the Control It buffer box are now available, each one is centred around the same circuit board, and the following notes apply, with slight modification, to every version.

The basic Control It buffer box has:

- 8 inputs, with standard input logic
- 8 outputs
- 4 pairs of motor control circuits
- inputs and outputs via 4mm sockets
- lines number 0 to 7
- dual voltage power supply

Alternative versions available have:

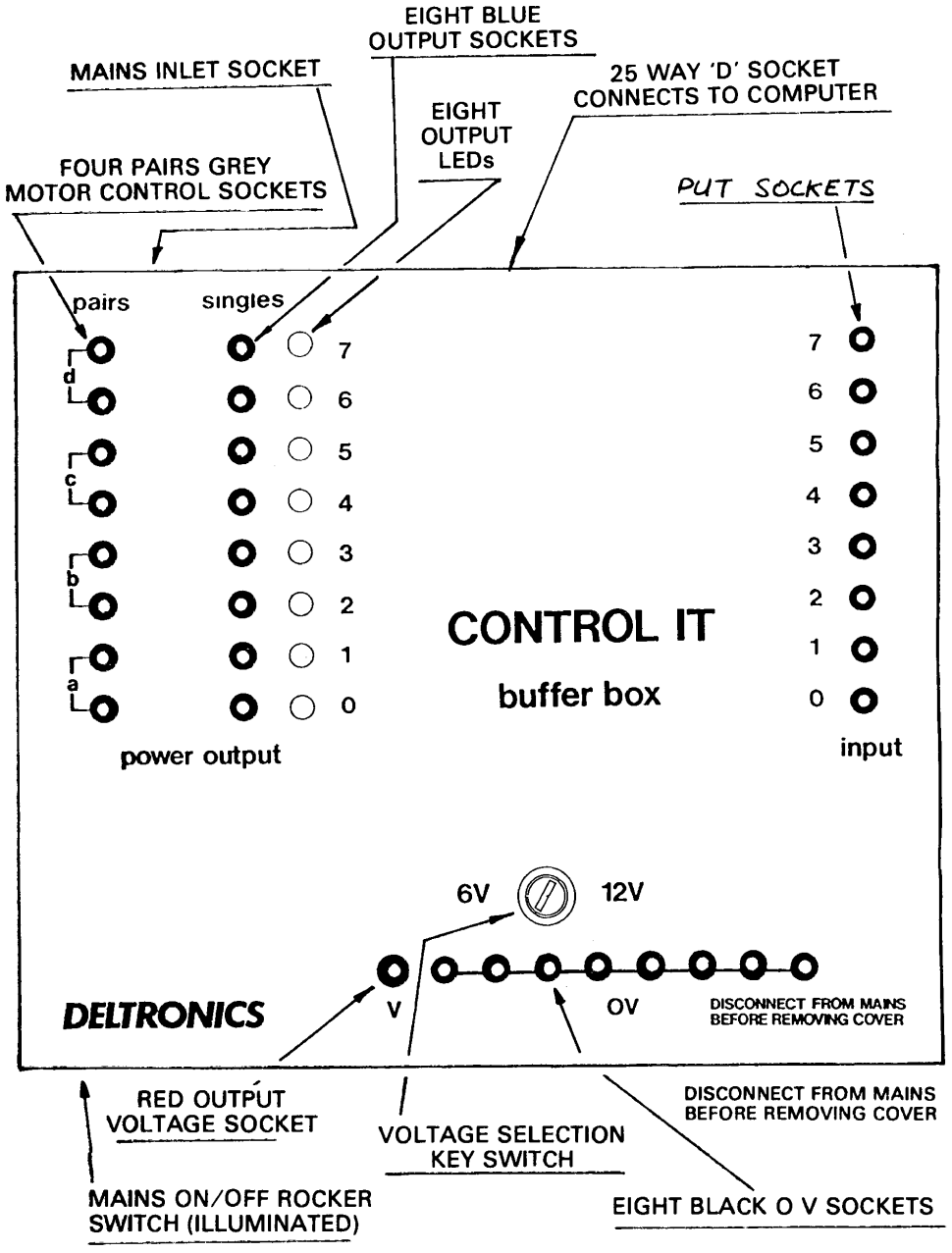
- primary school input logic as an alternative to standard input logic. See section 2 for an explanation of the difference.
- lines numbered 1 to 8 as an alternative to 0 to 7
- no internal power supply
- 2.5 mm jack sockets for the inputs and 3.5 mm jack sockets for the outputs as an alternative to 4 mm sockets (London Borough of Brent version).

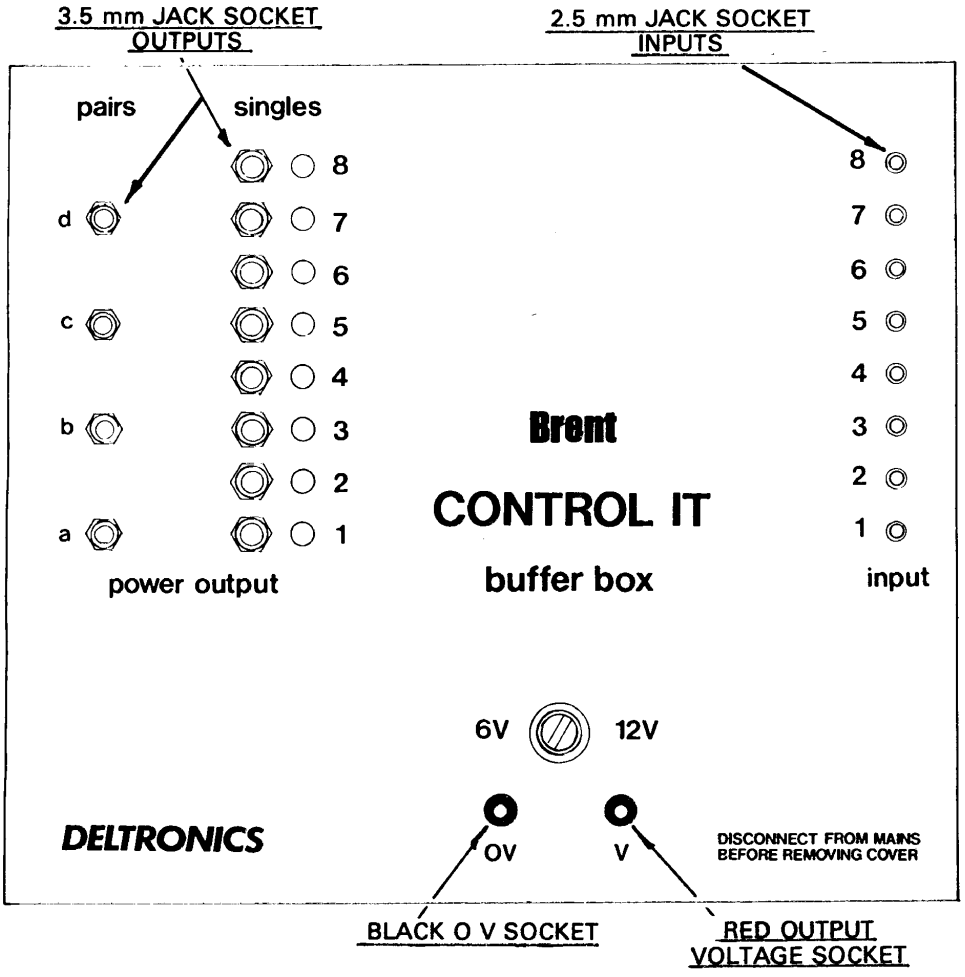
The Control It buffer box is a general-purpose interface that gives you easy and protected access to the computer's user port.

With the correct leads and connectors Control It can be used with the following computers:

- BBC Model B, BBC Plus, BBC Master 128, BBC Master Compact
- RML 380Z, RML 480Z, RML Nimbus
- Sinclair Spectrum

Control It can be used with any computer that has a user port giving access to eight input lines, eight output lines, 5 V and 0 V.


EIGHT BLUE
OUTPUT SOCKETS
MAINS INLET SOCKET
25 WAY 'D' SOCKET
CONNECTS TO COMPUTER
EIGHT
OUTPUT
LEDs
FOUR PAIRS GREY
MOTOR CONTROL SOCKETS
PUT SOCKETS
pairs
singles
d
c
b
a
7
6
5
4
3
2
1
0
CONTROL IT
buffer box
power output
input
6V
12V
V
OV
DISCONNECT FROM MAINS
BEFORE REMOVING COVER
DELTRONICS
RED OUTPUT
VOLTAGE SOCKET
VOLTAGE SELECTION
KEY SWITCH
DISCONNECT FROM MAINS
BEFORE REMOVING COVER
MAINS ON/OFF ROCKER
SWITCH (ILLUMINATED)
EIGHT BLACK O V SOCKETS



JACK SOCKET VERSION OF CONTROL IT
WITH POWER SUPPLY
LINES NUMBERED 1 - 8

The buffer box has four sections, namely:

1. Power Supply
2. Input Circuits
3. Output Circuits
4. Motor Control Circuits

1. Power Supply

The dual voltage power supply is stablised and protected internally against overloads and short circuits. Should the supply be overloaded it will cut out, normal operation will resume on removal of the overload.

The nominal supply voltages are either 12 V or 6 V. The required voltage is selected using the key switch.

Because of the voltage drop across the buffer box internal circuitry the voltages available at the blue and grey output sockets will be less than the above supply voltages. With the outputs high, the voltages are:

	6 V Range	12 V Range
Blue to Black sockets	5.25 V	11.25 V
Grey to Grey sockets	4.5 V	10.5 V

The full supply voltage is available between the red and black sockets at all times and can be used to power external equipment.

The values of voltage drop given above are approximate only, and are for moderate values of load current (up to about 500 mA). At higher load currents the internal volt drop increases, however, this increase will not in general effect the normal operation of the buffer box.

The maximum current which the power supply can deliver is approximately 1.5 A.

The mains transformer is of the toroidal type and the mains fuses are 3 A in the plug top and 500 mA in the buffer box. The buffer box fuse is located in the mains inlet socket, and for reasons of safety, cannot be removed when the mains cable is connected to the buffer box. Later versions of Control It also have a 3 A fuse mounted on the printed circuit board.

If you have a version of the buffer box without a power supply, power for external devices, motors, etc. has to be supplied from an external source. This power is supplied through the red and black 4 mm sockets on the top of the box, with the red positive, or through the 3.5 mm jack socket at the side of the box, with the central terminal positive. The power supply used should have some form of current limiting facility, set at a value not greater than about 2.5 A.

In both versions power for the LEDs and internal logic is drawn from the computer. The LEDs showing the state of the output lines can be used without the power supply being swiched on, or in the case of the model without a power supply, without external power being supplied.

2. Input Circuits

The eight 4 mm yellow sockets on the buffer box provide access to the computer's input lines. A series resistor, parallell zener diode protects the computer from damage that could be caused by accidental application of over-voltage or reverse voltage.

The input circuitry of your buffer box will be either what we refer to as standard input logic or primary school input logic.

With **standard input logic**, when there is no connection between the yellow input sockets and the black 0 V sockets, the inputs "float high", i.e. the yellow sockets and hence the computer's input lines are "high" and have a potential of +5 V.

If a switch connected between a yellow input socket and a black 0 V socket is closed, the corresponding computer input line becomes "low".

With **primary school input logic**, when there is no connection between the yellow input sockets and the black 0 V sockets, the inputs "float low", i.e. the yellow sockets and hence the computer's input lines are "low" and have a potential of 0 V. If a switch connected between a yellow input socket and a black 0 V socket is closed, the corresponding computer input line becomes "high" i.e. the concept of operating a switch to turn something on.

The type of input logic you require will depend upon the software you use. A buffer box can easily be converted from one type of input logic to another simply by changing two I.C.s fitted in sockets in the box. For further details contact Deltronics. **However, the conversion can much more easily be achieved by modifying the software, usually the addition of one line is all that is required.**

Some softwares have a "software switch" and can cope with either type of input logic.

3. Output Circuits

The eight blue output sockets on the buffer box reflect the state of the computer's output lines, i.e. if a computer output line is "high" the corresponding blue output socket will, depending upon the setting of the voltage selection switch, be at a voltage of either 5.25 V or 11.25 V above the black 0 V sockets.

The states of the outputs are indicated by the LEDs alongside the blue sockets, a line is "high" when the LED is on and "low" when the LED is off.

Lamps, buzzers, etc. can be operated by connecting them between the blue and black sockets. Small d.c. motors can also be operated in this manner, but with one direction of rotation only.

The maximum current that can be supplied by these output circuits is limited by the power supply to a total of about 1.5 A. This total current can be drawn from one socket if required. No damage will result if a blue socket is "shorted" to a 0 V black socket.

4. Motor Control Circuits

Using the motor control section of the buffer box (grey sockets), up to four small d.c. motors can be controlled simultaneously.

On-off, directional and some degree of speed control can be obtained.

The grey sockets are in pairs, i.e. pairs 'a', 'b', 'c' and 'd'.

The grey sockets should always be used as a 'pair'. A single grey socket should not normally be related to a 0 V, black socket. However, no damage to the buffer box will result if such a connection is made.

If a motor is connected to pair 'a' then the state of the computer output bit 0 determines whether the motor is 'on' or 'off', whilst the state of the output bit 1 determines the direction of the rotation, e.g.

STATE OF COMPUTER OUTPUT		STATE OF MOTOR
Bit 0	Bit 1	
Low	Low	Off
High	Low	On — forward
High	High	On — reverse
Low	High	Off

i.e. for the motor to turn bit 0 must be "high".

The motor control function of each of the computer output lines is as follows:

OUTPUT BIT NO:	FUNCTION
0	Motor 'a' stop/start
1	Motor 'a' forward/reverse
2	Motor 'b' stop/start
3	Motor 'b' forward/reverse
4	Motor 'c' stop/start
5	Motor 'c' forward/reverse
6	Motor 'd' stop/start
7	Motor 'd' forward/reverse

Voltage Selection

If you have a version of the buffer box with a power supply, select, using the key, the buffer box voltage, either 6 V or 12 V that is nearest to the rated voltage of your motor. As there is a volt drop of about 1.5 V across the internal circuitry of the buffer box the voltage across a pair of grey sockets will in each case be approximately 4.5 V and 10.5 V respectively. You need not match the buffer box voltage exactly with the rated voltage of your motor, as most small d.c. motors will operate over a range of voltage around the rated voltage. If the voltage you apply to the motor is slightly higher than the rated voltage then the motor will run faster than normal and slower than normal if the voltage is below the rated voltage.

If your buffer box has no power supply then in order to run motors, the appropriate voltage must be applied between the red and black sockets, with the red positive. Alternatively the supply voltage can be applied to the 3.5 mm jack socket at the side of the buffer box, the central terminal being positive. Again the internal volt drop of about 1.5 V should be taken into consideration.

Speed Control

Some degree of motor speed control can be achieved by pulsing the stop start bit, thus switching the motor on and off repeatedly, the inertia of the motor's rotating parts maintaining the motion. In effect the average voltage applied to the motor is reduced, thus reducing the speed of rotation. Controlling the mark-space ratio of the pulse controls the speed of the motor. Speed control is possible because the Control It buffer box uses solid state circuitry for motor control and not relays. Note that with some motors the motion may not be smooth when operated in this mode.

Current Rating

The maximum current that can be supplied by the motor control circuits is limited by the power supply to a total of about 1.5 A. This total current can be drawn from one pair of sockets if required. No damage will result if the grey sockets are "shorted" together.

USING CONTROL IT

Power

The buffer box is connected to the mains supply by means of the mains lead provided.

Mains power is switched on using the illuminated rocker switch located on the left-hand side of the front of the box.

Using the key switch on top of the box select the required output voltage i.e. 6 V or 12 V.

If you have a version of the buffer box without power supply apply the appropriate direct voltage as described in section 1.

BBC Computers

Plug the 25 way D plug fitted to the cable provided into the 25 way D socket located at the rear of the buffer box. Plug the 20 way IDC socket fitted to one ribbon cable into the computer's user port and the 26 way IDC socket fitted to the other ribbon cable into the printer port. The buffer box is now ready for use.

If you are using a BBC Master Compact you will require a Master Compact Companion and a Control It cable for the Master Compact, having a 24 way Centronics plug on the printer port lead.

RML 380Z and 480Z

The cable for the RML 380Z and 480Z has a 25 way D plug at each end, the end marked green/yellow connects to the buffer box, the other end plugs into the parallel user port of the computer.

RML Nimbus

For the Nimbus you require:

an RML Piconet Parallel Module and a Control It RML cable — connect as for the RML 480Z

or an RML Parallel I/O Port and a Control It BBC cable — connect as for BBC computers.

Sinclair Spectrum

For the spectrum you require a Spectrum Interface Module, available from Deltronics, and a Control It RML cable — connect as for the RML 480Z.

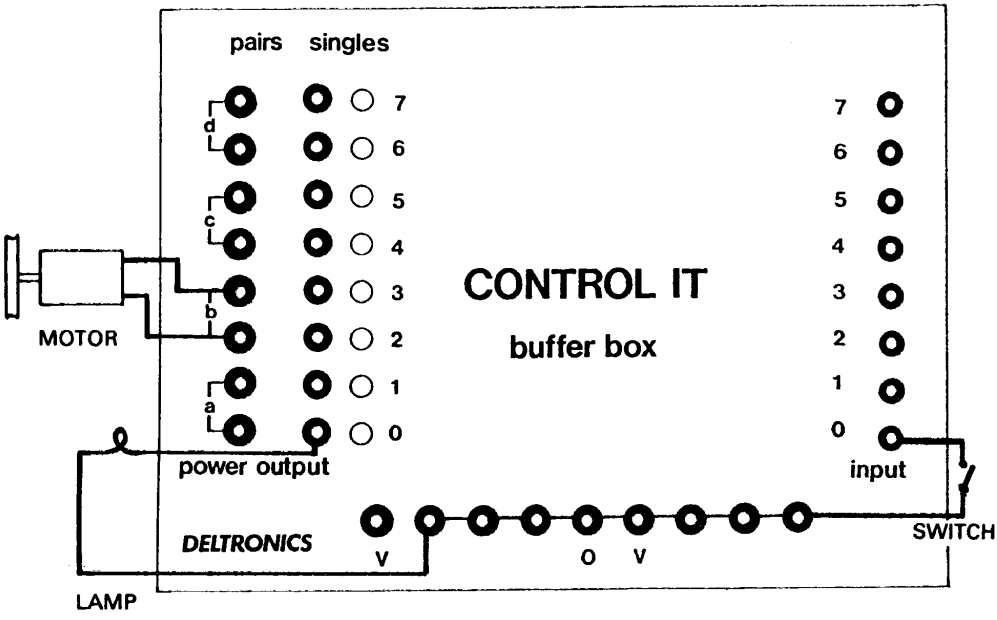
Simple Applications

Switches are connected between the yellow input sockets and the black "ground" or 0 V sockets. If you have a Control It pack match the colours of the plugs on the switches to those of the sockets on the buffer box.

Output devices such as lamps and buzzers are connected between the blue output sockets and the black "ground" or 0 V sockets. Again match the colours of the plugs and sockets if you have the Control It pack.

Motors are connected to the grey motor control sockets i.e. 4 motors can be run, one connected to each of the pairs a, b, c and d.

With the jack socket version of the Control It buffer box a single jack socket in effect replaces two 4 mm sockets.



CONNECTION OF DEVICES
TO CONTROL IT BUFFER BOX

CONTROL IT BUFFER BOX WITHOUT POWER SUPPLY
(CONNECTIONS TO EXTERNAL POWER SOURCE NOT SHOWN FOR REASONS OF CLARITY).

The above diagram shows a switch, a lamp and a motor connected to a Control It buffer box — without power supply. Input and output devices are connected to the version with internal power supply in a similar manner.

In order to use Control It only a few lines of very simple program are required.

The listings to perform the following tasks are given below for both the BBC and RML 480Z.

(i) Responding to the closure of a switch connected beween a yellow input socket and a black O V socket.

(ii) Light lamp connected between output 5 and a black O V socket.

(iii) Turn on motor connected to pair 'a' on buffer box.

(iv) Reverse motor connected to pair 'a' on buffer box.

(v) Light lamp connected to output 3 using a switch connected to input 2, i.e. reflecting from input to output.

BBC Computer

(i)

```
10 CLS
20 VDU 23 1 0
30 X =?&FE60
40 PRINT X;"  "
50 VDU 11
60 GOTO 30
```

(ii)

```
10 ?&FE61=32
```

(iii)

```
10 ?&FE61=1
```

(iv)

```
10 ?&FE61=3
```

(v)

```
10 ?&FE61=0
20 X=?&FE60
30 Y=X AND 4
40 IF Y=0 THEN ?&FE61=8 : GOTO 20
50 ?&FE61=0 : GOTO 20
```

RML 480Z

(i)

```
10 PRINT CHR$(12), CHR$(22)
20 PUT 21
30 X=INP(29)
40 PRINT CHR$(22) : PRINT X;"  "
50 GOTO 30
```

(ii)

```
10 OUT 29,32
```

(iii)

```
10 OUT 29,1
```

(iv)

```
10 OUT 29,3
```

(v)

```
10 OUT 29,0
20 X=INP(29)
30 Y=X AND 4
40 IF Y=0 THEN OUT 29,8 : GOTO 20
50 OUT 29,0
60 GOTO 20
```

The above examples are for standard input logic, with lines numbered 0 to 7.

Whilst the above are very simple examples of computer control they form a basis for more advanced work.

It is recommended that you use one of the many excellent control software packages now on the market.