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# VELA

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Getting started with  
the VELA Versatile  
Laboratory Aid

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## **Preface**

### **August 2011**

I originally created this document when I was an A-Level Chemistry student in July 1992 as a quick getting started guide for my teachers at the Dronfield School.

The VELA data logging device was a complex and generally user unfriendly piece of kit but it did provide some excellent facilities. Due to the steep learning curve, my teachers asked that I write an introductory guide for them so they could work through it and get to know the basics of VELA so they could use it more often than they had done previously. As far as I am aware, I was the first student to actually use the VELA device in the 8 years or so that the school owned it to that point.

Having OCR'd the original document I've now made a few grammatical corrections, re-worked the calculations to ensure clarity and added a few photo's to illustrate particular items throughout the document.

There are places in this getting started guide where I simply stated that the original manual should be referenced and sadly with hindsight, I should have added more detail in those sections.

### **December 2011**

I've now managed to obtain a VELA data logger so I've updated the guide with a few photos and further corrections but I'm still missing the original manuals and software so until I re-learn some of the features that VELA offers, the guide is still limited. Hopefully, over time this will now change.

Paul Vernon

## Setting up and using VELA

### Introduction

VELA can be used to measure voltages between +/-25VDC from four separate experiments, or four different parts of a single experiment.

VELA gives a choice of three input ranges for the voltage, depending upon what types of voltage you expect to be measuring. To alter the range, all you have to do is set the switch on the appropriate channel of input on the machine.

Although the maximum voltage that VELA is able to measure is +/-25VDC, it will not damage VELA if this limit is exceeded. The limit at which VELA will be damaged if exceeded is +/-40VDC.

## Setting VELA up

VELA connects to a power supply of 9 to 12V DC or 7V AC via the power lead that comes with VELA. When VELA is switched on, VELA should say "HELLO". If it doesn't, then check the connections and try again. If VELA still does not work, then try once more and then give up!



Once VELA has said "HELLO", a letter P will appear on the display, this indicates that VELA is ready to be programmed.

To connect any apparatus to VELA, you must make sure VELA is switched off before you plug anything into it. If you don't, you may blow a fuse.

Once all the experimental apparatus is connected, you must choose an appropriate voltage range for VELA to use. This is done by setting the switch on the input channel(s) you are using.

The ranges that you can choose from are +/-25VDC, +/- 2.5VDC and +/-250mVDC.



## Programming VELA

VELA contains 16 different programs in its memory, and all you have to do is choose one!

Each program has a specific two digit number, from 00 to 16. 00 to 15 are standard programs in the VELA unit, 16 is a user definable space allowing a user to define their own program for VELA.

Anyway here is a summary of the seventeen programs in VELA.

- 00 Four channel voltmeter
- 01 Fast analogue recorder (up to 3 mins 20 secs)
- 02 Medium analogue recorder (up to 16 mins 39 secs)
- 03 Slow analogue recorder (up to 11 days 20 hours)
- 04 Frequency meter
- 05 Event timer
- 06 Multi channel timer
- 07 Pulse counter (up to 41 hours 37 mins)
- 08 Statistics of inter pulse times
- 09 Statistics of random events (up to 16 mins 39 secs.)
- 10 Versatile waveform generator (uses the digital port)
- 11 Control sequence generator (uses the digital port)
- 12 Ramp generator
- 13 Decimal to binary converter
- 14 Dual beam oscilloscope
- 15 Data retrieve and transfer
- 16 User definable machine code program (See the technical manual)

## Uses of the Programs

Program 00 is a four channel digital voltmeter. To switch between each channel select which channel you wish to be displayed using the 'CH1', 'CH2', 'CH3' or 'CH4' keys on VELA.

**Remember VELA can accurately measure up to a maximum of 25 volts DC.**

Programs 01 to 03 are the same as each other but take measurements over different lengths of time. These three programs are essentially the same as program 00 but they can additionally store the data that they receive allowing it to be downloaded to a microcomputer for analysis and display in graph form at a later date.

These programs are very versatile, as they can be used to measure pH levels, light or temperature levels, in conjunction with "alpha kits". The possibilities of these programs are limited only by what you can connect to VELA.

Program 04 measures the frequency of pulses or of any regularly shaped waveform.

Program 05 is an event timer. See Manual for more information.

Program 06 is a multi channel timer. See user manual for more information.

Program 07 is a pulse counting program, ideally suited for pulses which are given off in a random manner e.g. from a Radioactive source.

Program 08 provides statistics of the arrival of pulses to VELA via an oscilloscope.

Program 09 provides statistics of the arrival of random pulses.

Program 10 is a waveform generator and outputs on the digital port.

Program 11 is a control sequence generator and outputs on the digital port.

Programs 12 to 15 are output programs. See Manual for more information.

Some of the programs need a parameter to be put into the machine in order for the program that you have chosen to work properly. Calculators at the ready!

## Calculating the parameters for VELA's programs

### Program 00

Program 00 does not need a parameter.

### Program 01

Finding the parameter for program 01 (0 - 999):-

Program 01 has a maximum time limit of 3 mins 20 secs.

If for example you want VELA to record 3 minutes of information all you have to do is follow the calculation below :-

$60 * X =$  number of seconds VELA is to operate for, then multiply the product by 5 to give the parameter for VELA.

E.g.  $60 * 3 = 180 * 5 = 900$

Therefore the parameter is 900.

Try a calculation for one and a half minutes, you should arrive at a parameter of 450.

### Program 02

Finding the parameter for program 02 (0 - 999):-

Program 02 has a maximum time limit of 16 mins 39 secs.

Program two parameters are even easier to find! All you have to do is multiply the number of minutes by 60, to gain the parameter.

e.g. 8 mins =  $8 * 60 = 480$  seconds

2 mins 35 seconds =  $2.58 \text{ minutes} * 60 = 155$

Try a 15 minute parameter and you should get a parameter of 900.

### Program 03

Finding the parameter of program 03 (0 - 999):-

Program 03 has a maximum time limit of 11 days 19 hours and 53 mins.

Program two parameters are a little bit tricky to find. If you wished VELA to record data for 32 hours then you would follow this calculation.

1.  $32/24 = 1.33$
2.  $1.33 * 1440 = 1920$
3.  $1920/1023 = 1.876$
4.  $1.876 * 60 = 112.6$

The value of 112.6 is then rounded up to 113 which represents a program time of 32 hours, 6 mins and 39 secs.



Try a time of 192 hours. It should give a parameter of 676.

If you wish to use VELA over a period of days rather than hours, you can miss off the first stage of the calculation.

E.g. ten and a half days

1.  $10.5 * 1440 = 15120$
2.  $15120/1023 = 14.78$
3.  $14.78 * 60 = 886.8$  (887)

### **Program 04**

Program 04 does not need a parameter.

### **Program 06**

Program 06 does not need a parameter.

### **Program 07**

Finding the parameter of program 07 (0 - 999):-

Program 07 has a maximum time limit of 41 hours 37 mins 30 secs.

To find the parameter, simply follow this calculation.

$(\text{Time in hours} / 24) * 360 = \text{parameter}$

Try finding the parameter for one and a half days (36 hours), and you should arrive at a parameter value of 540.

### **Program 09**

Finding the parameter of program 09 (0 - 999):-

To find the parameter for program 09 refer to the calculation for program 02.

### **Program 10**

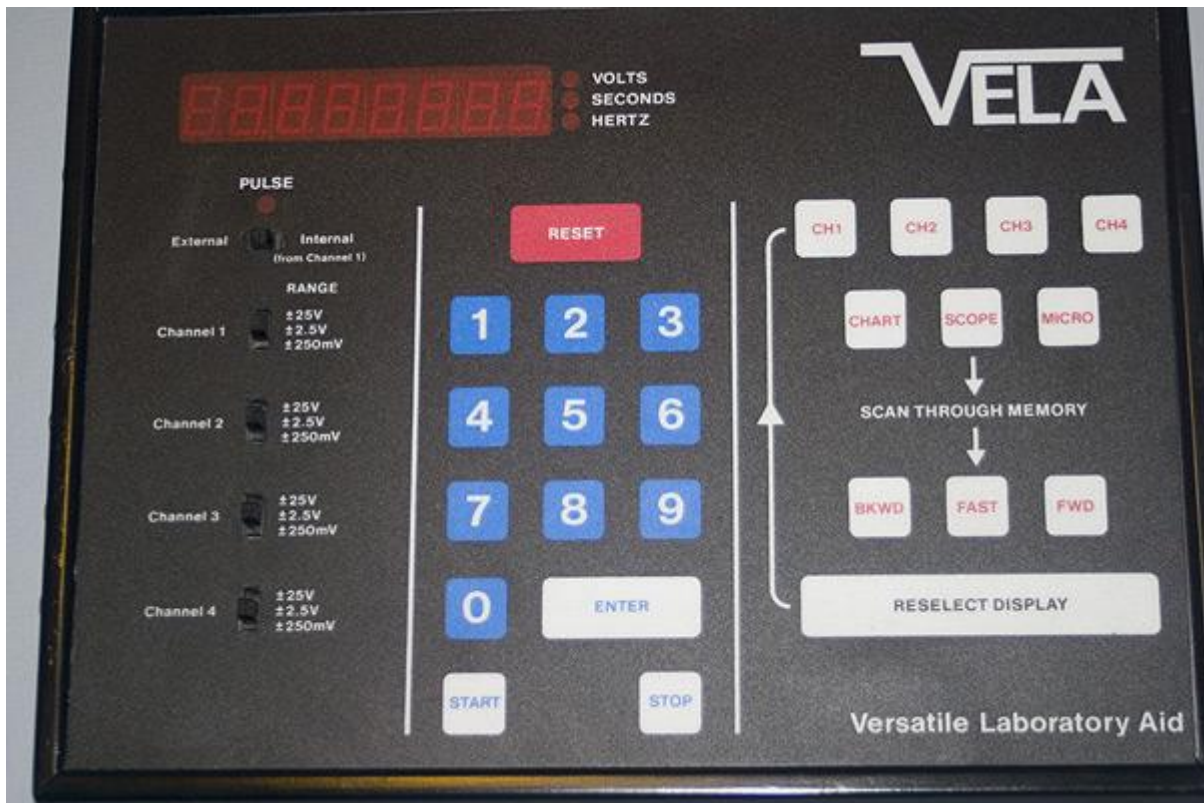
The interval between the presentation of binary codes onto the digital port B lines can be selected to be any time between 1 and 999ms. On pressing "START" the sequence of codes is continuously executed until the RESET key is pressed.

### **Program 11**

The interval between codes is now in seconds, 1 to 999, and the sequence is placed on the output lines once and can be repeated by pressing the "START" key.

## Entering Programs and parameters into VELA

Once you have chosen the correct program, and found the parameter for it if necessary, enter the figures into VELA using the keypad and press the 'ENTER' button on VELA at which point, VELA's display will go blank. When you are ready for VELA to start monitoring the experiment, press the 'START' button on VELA's front panel. If at any time you wish to stop VELA, press the 'STOP' button.



E.g. If you want to enter a program 3 with a parameter of 42 then you would enter the following commands using the VELA keypad.

03 042 ENTER

If you make a mistake while entering the figures and VELA doesn't have any data stored in its memory, press the RESET button, otherwise press the RESELECT DISPLAY button, and enter the figures again.

If you wish to use a program that does not need a parameter, like program 00 then enter the program number then press the ENTER key on VELA.

This type of program will start working immediately, without pressing the START key, and can be stopped with the STOP key.

## Transferring DATA to a BBC Micro

Once VELA has finished storing all the DATA the display will then begin flashing 'O - P' which tells us VELA is ready to transfer DATA.

Make sure VELA is connected to a computer via the cable provided with VELA using the Digital connection.



Load the VELAAnalysis program into the computer from disk, and select the transfer menu by pressing the first letter of the option Transfer. i.e. 'T'

You will then be asked if you wish to transfer data from VELA or from disk.

Before you press 'V', VELA has to be prepared to transfer its data to the computer.

To prepare VELA select the channel that you wish to send to the computer.

E.g. If data was stored in channel 1, press the button marked 'CH1' on VELA.

Now press the 'V' key on the computer followed by the 'MICRO' key on VELA's front panel. The data transfer should then commence.

Once the transfer is complete, you can manipulate the data using the VELAAnalysis program. See the VELAAnalysis manual for all the options that the program gives.