

**SCOTTISH SCHOOLS SCIENCE  
EQUIPMENT RESEARCH CENTRE**



**Bulletin No. 160**

**June 1988**

## A D D R E S S   L I S T

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Educational Electronics Ltd. (for VELA and motion detector), 28 Lake Street, Leighton Buzzard, Beds. LU7 8RX; Tel. (0525) 373666.

Mackay & Lynn Ltd., 2 West Bryson Road, Edinburgh EH11 1EH; Tel. 031 337 9006.  
Also at 17-18 Tait's Lane, Dundee DD2 1DZ; Tel. (0382) 645145.

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Mr. P. McGregor (MAPOSE booklet), Town Hall, Tweedy Road, Bromley BR1 1SB.

NEMEC (& ex MEP) publications from : Mrs Beth Bevis, Ronsella, Lordswood, Highbridge, Eastleigh, Hants. SO5 7HR; Tel. (0703) 617627. (Payments to "NEMEC").

Philip Harris Limited, Lynn Lane, Shenstone, Staffs. WS14 0EE; Tel. (0543) 480077.

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RS Components Limited, PO Box 99, Corby, Northants., NN17 9RS; Tel. (0563) 201201.

Technology Teaching Systems Ltd. (LEGO parts), Penmore House, Hasland Road, Hasland, Chesterfield S41 0SJ; Tel. (0246) 78993.

Unilab Limited, Clarendon Road, Blackburn BB1 9TA; Tel. (0254) 57643.

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## INTRODUCTION

### Summer Saturdays

As in other years, we will be suspending Saturday morning opening over the school Summer holiday period. The last time we will so open this session will be the morning of Saturday, 18th June having also been open on the 11th. Barring re-organisational disasters we will re-start Saturday opening on Saturday 3rd of September. Thereafter we should be open 9 a.m. to 1 p.m. on the first two Saturdays of each month until further notice.

### Biotechnology symposium

#### Advance notice

Some readers may recall that we were involved in 1987 with an ad-hoc group in an abortive attempt to organise a national meeting on biotechnology in schools and non-advanced FE. At the time the (whisper it) 'great dispute' was only just grumbling to an end and we had to be content with co-operating with the Institute of Biology and the Society for General Microbiology in having an educational component in the first day of their September '87 meeting on "Scottish Biotechnology and its Impacts".

The same ad-hoc steering group is trying again, this time for a 2½-3 day symposium come course probably at St. Andrew's College, Bearsden, Glasgow from the morning of Monday the 19th to the afternoon of Wednesday the 21st of September 1988. The programme will include practical workshops as well as discussion and seminar sessions with contributions from Scottish biotechnology education activists in schools, colleges and TVEI projects.

The meeting is attracting non-EA sponsors and the costs to delegates are not likely to be outrageous. At the time of writing provisional notices and programmes are being sent via the proper, in-service and other, channels. If you are interested in the possibility of attending you should keep an eye out for those materials coming into school. Please do not yet contact us or the College directly.

cont./next column.

Please note also the change of dates from those given in the provisional notices circulated in early May. Originally the meeting was to run Wednesday to Friday (21-23rd). The Friday clashes with a local holiday, hence the move to earlier in the week.

### Readers' letter

We (okay I, your Editor) recently received the following well deserved but nicely put rebuke from the staff of the Physics department at Perth High School:

"Dear Sir,

Ballot Items : Bulletin No. 159

If it is not too late, please may we indicate our wish to purchase 4 packs of 24 cells (Item 616).

We also wonder if you will include epigrams in a future ballot? There is obviously a great surplus of these, since they are beginning to clog up every editorial, and obscure what is otherwise a very worthwhile message.

We do feel, however, that these epigrams should be disposed of carefully, since if they are allowed out into the environment, they may multiply uncontrollably.

We suggest you contact your EPS (Epigram Protection Supervisor) for details of their safe disposal.

Yours faithfully,

Physics Staff."

**Mea culpa!** (Pretentious - moi?)

There I go again!

\* \* \*

## O P I N I O N

### S E B P a n e l s ' C o m m e n t s

#### (Bulletin 159)

We print below, unedited, the whole of a letter dated 12th May and jointly signed by the Scottish Examination Boards' Conveners of the Biology and Physics Panels.

If we replied in full to this letter then the hare we started in Bulletin 159 could run and run. We wish to avoid that prospect. It seems that of late we may have said enough that is contentious in these columns - some might say more than enough (see p.1). We certainly wish to avoid the "Bulletin" becoming the "Private Eye" of Scottish Science Education.

There are however two specific points we must make, one in reply to something said in the letter and both drawing attention to things left unsaid. These comments we reserve to the end after the Conveners have exercised, untrammelled, their right of reply. Otherwise it is left entirely to the reader to consider whether our original central point has been answered.

"Dear .....,

On behalf of the Biology and Physics Panels of the Scottish Examination Board, we would wish to make the following points in response to the article entitled "Marketable mediocrity" which appeared in the March 1988 Bulletin issued by SSSERC.

First it has to be said that the opinions expressed by the author of the article show a lack of understanding of the processes which precede the issue of Arrangements documents. The Short Life Working Group Reports in both Biology and Physics were subject to full consultation across a wide range of interested bodies, with the result that detailed, and generally constructive, comments were submitted for the consideration of the respective Short Life Working Groups and Board Panels. The finalised Arrangements which were approved by the Board for issue in March 1988 incorporated changes to the consultative documents which reflected views submitted by teachers' associations and other organisations.

It is indeed a great pity that SSSERC, which was one of the interested bodies consulted by the Board in this connection, did not take the opportunity to submit its views on the proposals for Biology and Physics on the Standard Grade for consideration by the Board at the appropriate time, but reserved comment for its own Bulletin.

The article's main criticisms centred on the assessment schemes for Designing and Carrying out Investigations in Biology, and Planning and Carrying out Investigations in Physics. Unfortunately, the author appears to have lost sight of the fundamental need for any assessment scheme to be reliable and valid, and also workable. It is the belief of both Panels that the schemes for assessment detailed in the Arrangements documents satisfy these criteria and give appropriate emphasis to both the planning and conduct of investigations. It is also important to distinguish the identification of differentiating factors, which form the basis of the grade related criteria on which awards are made, from the advice and encouragement given in the Arrangements documents to involve all pupils actively in investigatory work, including the carrying out of investigations, as part of normal classroom practice.

Standard Grade Developments encompass both learning and assessment. The arrangements for Biology and Physics, we believe, will require much greater attention to be paid to practical skills in the classroom, and to valid and reliable assessment of these skills, than at present.

Yours sincerely,  
etc. etc."

### E d i t o r i a l C o m m e n t s

#### General

We make no apologies for defending the principles on which our criticisms were based. On reflection we are sorry that the piece was not shorter and the language more temperate. That neither were so is merely an indication of how dearly those principles are held.

## Specific

### 1. Consultation - Paras. 2 & 3.

After many years of corresponding with the Board we fully understand how the consultation process works both in theory and in practice. We examined with care the Joint Working Party and the Short Life Working Group Documents and saw nothing within or outwith our strict remit where, from our experience of the consultative process, formal comment was necessary or likely to have any effect. More importantly "it is indeed a great pity", to echo the conveners' phrase, that the details of which we complained in Bulletin 159 were not in the consultative documents.

The "advice and encouragement" bits we were happy about and we accept the criticism that we did not say so formally. The "differentiating factors" detail was not there. We cannot offer comment on what is not said. It would clearly be illogical for us to accept criticism on the basis that we did not respond "at the appropriate time" to something which was not even there.

We did subsequently hear informally of the likely mechanism for differentiation. We did then comment informally in strong terms via NDOs and others. We did offer and discuss alternative models. Some of those models we have already exposed, in practical workshops, to criticism from teachers and others. Third parties had already independently published accounts of similar approaches to our own.

### 2. Two out of three.

It should be noted that both the original critical article and the SEB letter refer only to arrangements for two out of the three separate science courses. Chemistry is conspicuously absent. We have to ask why that is so and why the Chemistry SLWG and Panel apparently took a different, more cautious and we would say wiser, view?

#### Editor's Note:

The letter was addressed to me, personally. I have to point out that "Opinion" articles, although usually drafted by one professional staff member, often put forward an agreed staff view. They may also articulate in public concerns more widely, but nevertheless privately, expressed.

As Editor and of my own volition, I would also point out that such views are not to be taken as expressions of official Centre policy nor as the joint view of the wider SSSERC consortium.

\* \* \* \* \*

Continuous recording of velocity

**Abstract**

By coupling a precision motor, which is used as a generator, to one of the wheels of a dynamics trolley and taking the output signal to a data logger a continuous record of velocity versus time can be obtained.

**Technical description**

The motor should have two properties: (1) a linear transfer function (or in other words an output voltage which is directly proportional to speed); and (2) very low frictional torque. Precision made, ironless rotor motors have both these properties. The model we currently stock in Surplus, Item 594, is the one on which these Notes are based. In principle, other models of this type may also be suitable.

there can be no slippage. We find that LEGO wheels with tyres (spoked hub and tractor tyre, LEGO part 1323) make suitable drives: the central hole in the hub fits snugly on the shaft of the motor, and the tyre has just the right degree of firmness to rub without slipping on a wheel of the trolley.

Rather than only use a dynamics trolley it is suggested that experimentation might also be carried out with a buggy made of LEGO parts. The motor should be driven by gearwheels (40 toothed wheel, LEGO part 1319), one on an axle of the buggy turning another on the pinion of the motor. Care is required in the choice of vehicle. It depends on the purpose of the investigation. A dynamics trolley has a mass of 1 kg whereas a LEGO buggy might have a mass of around 250 g. Frictional forces have a relatively greater effect on the less massive vehicle. Over and above that, frictional forces in LEGO bearings are actually larger than in trolley bearings.

Were you investigating the effects of friction the LEGO buggy would be the vehicle to use. If however you want to ignore friction then use the traditional trolley.

Lightweight flying leads (2 m long, 10/0.1 mm wire twisted by hand) take the signal to the datalogger. The motor should have a 47  $\mu$ F bipolar capacitor connected across its terminals. This smooths out noisy irregularities in the signal.

**Calibration**

Looking initially at the performance of our motor we find that if loaded with 1 M $\Omega$  (the usual impedance of a digital voltmeter) the transfer function is 150 mV/Hz. At 400 r.p.m. the motor generates 1 V.

If the gearing ratio is 1:1 (i.e. the drive wheel on the motor has the same diameter as the vehicle's wheels) the transfer function works out conveniently at around 1 V/ms.

A rough and ready calibration can be done by pushing the vehicle along a measured metre at what you judge to be a constant velocity. A helper measures the time to travel the metre and estimates the voltage output. This should be repeated at different velocities.

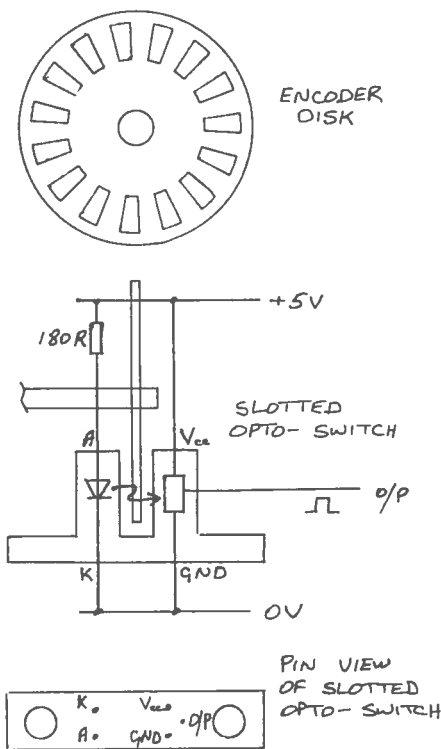


Fig.1 - Calibration of motor

A Terry clip is used to mount the motor on the trolley. A drive wheel mounted on the 3 mm diameter pinion of the motor links to one of the wheels on the trolley. This drive wheel should bear down firmly on the trolley wheel so that

A more accurate calibration can be obtained by temporarily taking the motor out of the vehicle and fitting an optical encoder disk (Surplus Item 378) (Fig.1) on the motor's pinion. A slotted opto-switch sends out a pulsed signal whose frequency corresponds to that of the disk.

The motor generator is then driven at different speeds by a second motor to obtain a set of calibration figures. Frequency can be measured on either a VELA (from Educational Electronics), or frequency meter, or scaler, or some form of digital counter with gating. Taking into account the gearing ratio and wheel diameter, velocity is then derived from frequency.

### Datalogging

The output of the motor is bipolar; its output signal is likely to range between +2 V and -2 V. The voltage is related to motor speed and the

polarity to the direction of rotation. This explains our use in this article of "velocity" in preference to "speed".

The nature of this output means that any recording device must have bipolar inputs. One such suitable device is the Unilab Interface together with its Grapher software. This has analysis features such as integration and gradient finding which should be exploited in this context. The VELA is another suitable device whose bipolar +/- 2.5 V setting covers the likely range for most bench velocities. VELA program <O2> should be used.

The examples shown in Fig.2a - c used VELA, the data being transferred to the BBC Micro using Otadisc software in order to print out data in graphical form. Velanalysis II software could be used for this transfer but, in our opinion, more awkwardly.

### Sample graphs

The transfer function in these examples was a handy 1 V/ms

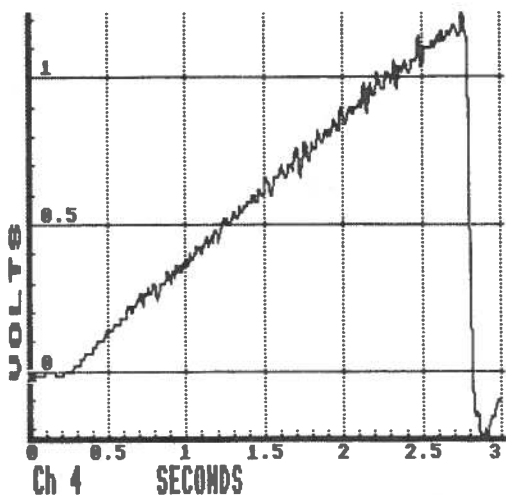


Fig.2a

[a] The LEGO buggy was allowed to run from rest down a 1.5 m uniform incline of 4.6° slope. There is obvious correspondence (Fig.2a) between the distance travelled (1.5 m), time of journey (2.5 s) and average velocity ( $0.6 \text{ ms}^{-1}$ ).

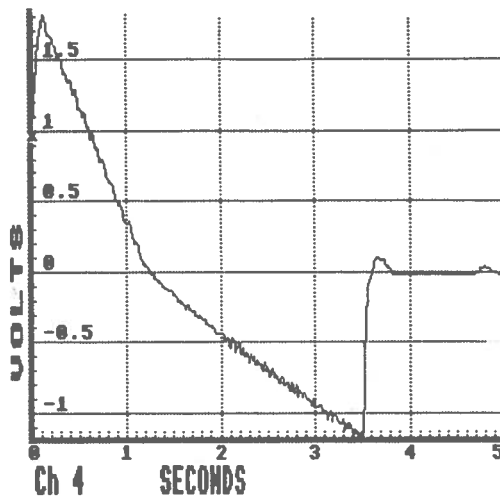


Fig.2b

[b] The buggy started at the foot of a uniform incline where it was given a strong shove up the slope. Data capture began once the signal exceeded 1 V. The graph (Fig.2b) shows the tail-end of the uphill acceleration, the uphill deceleration to rest, the downhill acceleration, and the abrupt halt. Clearly the accelerating forces on the uphill and downhill sections differ. Going up, gravity and friction combine additively; coming down, subtractively.

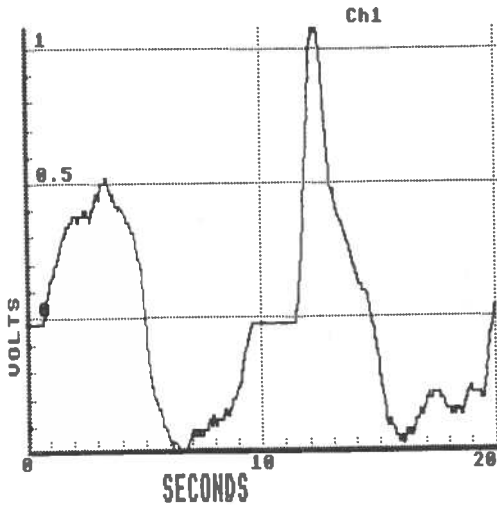


Fig.2c

[c] To and fro movement along a track (Fig.2c).

### Other applications

This is essentially a simple, and we hope you agree an elegant, way of logging velocity versus time and leads directly into the heart of mechanics. We think it is a technique worth exploiting.

It can be taken further. Our work with motor tachogenerators described here was sparked off by a description [1] of the usage of an ultrasonic motion sensor. In that description the author relates how he asks his students to work interactively with physical principles. From his ideas the sort of laboratory exercises that could be set with our modified dynamics trolley or buggy could include:

1. Produce data to make a graph that looks like the shape in figure 3. Try to get the times right and the velocities right.

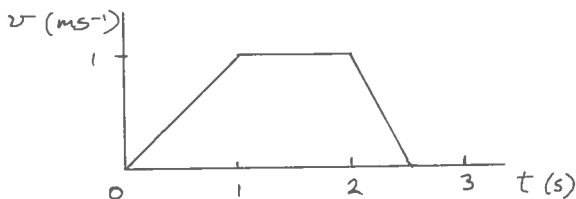


Fig.3

2. You are going to push a trolley a distance of 1 metre along the bench, the journey time taking 2 s. Halt for 2 s. Then return to the starting point taking a further 1 s.

(a) Predict what the velocity-time graph will look like.

(b) Now try it out. See if it agrees.

These exercises relate to trolleys moving on trolley boards or bench tops. How much more direct would be the experience if the moving body were in fact a human body! For that, you would need an ultrasonic transducer, one of which has recently been introduced by Educational Electronics (The Motion Detector, price £55, including software).

### Apparatus and components

Item	Supplier	Part no.	Price (£)
Portescap motor	SSSERC	594	3.20
encoder disk	SSSERC	378	0.50
slotted opto-switch	RS	304-560	3.21
capacitor, 47 $\mu$ F, bipolar	Maplin	FB10L	0.68
LEGO hub & tyre set	T.T.S.	1323	2.08
LEGO gear set	T.T.S.	1319	2.23
Grapher software	Unilab	532.052	17.00
Datadisc software	Harris	A29017	26.00

T.T.S. stands for Technology Teaching Systems Ltd. The hub and tyre set 1323 is all you need for driving the motor from a trolley wheel. However if you were to build a buggy many parts in addition to those listed above would be required.

### Reference

[1] Thornton R. K. 1987 "Tools for scientific thinking - microcomputer-based laboratories for physics teaching" 'Physics Education' 22.

\* \* \* \* \*

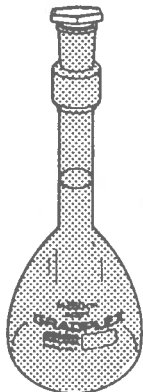


## SAFETY NOTES

### **Ionising radiations**

#### **The protactinium generator - stoppering the flask**

Some of the flasks in our equipment list in Bulletin 159 [1] were reported to us as leaking at the stopper. This is item no. FDF 018 (Azlon catalogue), a 50 cm<sup>3</sup> polypropylene Gradplex flask (Fig.1) stocked by Mackay & Lynn. We bought a further batch for testing and found that some of these did indeed leak at their stoppers. What we also found, however, is that if the flasks are restoppered, taking care to grind the stopper to and fro into the neck of the bottle, leakage ceases.



**Fig.1 - Gradplex flask**

What is the scale of the problem? Of the eleven flasks we tested, eight have never leaked. Of the three that did, one was cured by restoppering once, the second by restoppering twice, and the third by restoppering four times. The flasks have subsequently withstood eight weeks continuous inversion. We thus think that these flasks are reasonably safe provided due care is taken while stoppering.

#### **Recommended procedure**

If you do make a protactinium generator (please check with your radiation protection adviser that your authority allows this), the procedure to

follow after filling the flask according to the directions in Appendix IV of the Explanatory Notes [2] is:

1. Stopper the flask taking care to grind the stopper to and fro into the neck of the flask; invert and check for leakage; if no leakage occurs shake and invert repeatedly over a drip tray for about a minute; recheck for leakage; if leakage occurs restopper & repeat procedure.
2. Leave the flask inverted within a beaker in a drip tray for one hour; shake and recheck for leakage; if leakage occurs go back to stage 1 and restopper.
3. Leave the flask inverted for a further day; if leakage occurs go back to stage 1; if no leakage occurs the flask may be assumed safe to use.

Trustfully, you will not find yourself in an endless loop. Were you to be so entrapped then after four times round we suggest you replace the flask. Claim a replacement from the supplier. Dispose of the contents, if necessary, according to the instructions in the Explanatory Notes [3].

It is not recommended that any form of sealant be applied to the stopper.

The long term integrity of the flask is not known. We prepared our original generator two years ago; it remains leak free. Polypropylene, the material of the flask, is inert to both hydrochloric acid and the organic solvent. We are confident that provided the precautions in stoppering described above are followed, provided the flask is stored in a glass beaker, provided it is inspected for leakage before and after use, and provided its ten year lifespan is adhered to, the flask is reasonably safe.

#### **References**

- [1] Physics Notes, pp 15,16, Bulletin 159, SSSERC 1988.
- [2] Appendix IV.8, Protection against ionising radiation in science teaching - Explanatory Notes, SSSERC 1987.
- [3] Section 62, *ibid*.

## Abstract

This section contains two articles: one on minimal, acceptable standards for interfacing software and a piece on publications which support training in the use of interfaces for instrumentation and control. (An interfacing application which involves the novel use of a precision motor for velocity measurements can be found in the Physics Notes of this issue).

## Software Standards

### Introduction

In Bulletin 137, September 1983, we published reviews of commercial data capture equipment together with our first attempt at general specifications for such devices. In that first review we stressed the need for good, and as the jargonists have it, user-friendly software.

We outline here our minimal requirements for software sold commercially for use with sensors, interfaces and control devices. The intention is to inform both suppliers and potential customers as to acceptable professional program standards.

### Minimal professionalism

Four and a half years on we still occasionally receive commercial interfacing software for evaluation which, frankly, is not worth spending time on. In such instances we have refused to provide a full evaluation report because to do so would have been so time consuming that it would have been easier to re-write the programs from scratch. Poor software and indeed documentation have a knock-on effect on the interface hardware and may devalue an otherwise excellent device.

If software does not meet minimal professional standards it is extremely difficult to provide constructive criticism on program structure, bugs, missing error-traps, and inconsistencies in menu formats and terminology. We therefore pity any naive purchaser of such software who has bought on spec. or has been seduced by glossy advertising blurb.

### They do it for money

Where amateur software accompanies some much broader package - such as a weather satellite receiver - and where fair warning is given in the documentation that certain errors may lead to fatal crashes, we are prepared to be a little more forgiving.

However, when amateurish software is professionally advertised, promoted and sold as though as it were to full commercial standards then this should not lightly be forgiven.

### What we will, and what you should, do.

We currently intend writing to relevant suppliers advising them of our minimal requirements for science and technology education software for real-time applications. Packages which do not meet such requirements will be debarred from full review. Any enquirer to SSSERC entitled to confidential technical advice will be clearly warned off buying such packages.

We would also suggest dear readers that you avoid buying, or having bought, return and request a refund for any package which does not meet the basic requirements listed below.

### Minimal requirements

#### 1. Robustness

##### 1.1 Crash prevention

Accidental fatal crashes into the program language (usually BASIC) or to operating system level should be prevented as far as is reasonably practicable by:

- disabling all keys bar those which at that point in the program may be legally typed (particularly <BREAK> and <ESCAPE> see below).
- error trapping and reporting where there has been or is likely to be an operator system error.

The worst which could be tolerated would be:

A plain English error report - not some cryptic message from the machine operating system or, where a package is disk and menu-driven, automatic reloading of the program.

Best of all is a routine which takes the user back to the point immediately before the error was made with some advice on preventing a repetition of the error.

### 1.2 User transfer to program language or operating system

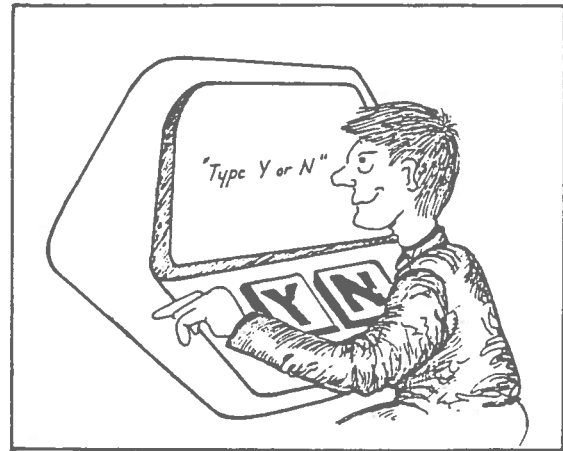
This is effectively an extension of 1.1. Such a transfer should require a deliberate menu choice or command entry (such as \*B. or \*FX on the Beeb) by the user. It should be impossible to accidentally enter the default program language, e.g. BASIC, or the operating system because of faulty menus or other routines. If an incorrect choice, or wrongly sequenced key press, returns a program line such as "No such variable at line XXX" then the software is of an unacceptable standard. Documentation which advises the user what to do should this occur merely adds insult to injury.

## 2. Consistency

### 2.1 Moves between menus or major routines

Moves at any one level should involve consistent use of any of the following alternatives:

- the <ESCAPE> key.
- <M> for 'Menu'.
- a legal menu choice such as of an item in a list designated by its number in that list or by a single key press of its initial letter.
- pressing a key (or the spacebar) when a desired option is displayed.
- selection and entry of <Y> (yes) or <N> (you guessed it - no).



We also recognise the need to look ahead and not to inhibit development of newer techniques. 'WIMP' type environments (Windows, Icons, Mouse and Pull-down menus) can markedly improve the user-friendliness of software. Even with these new types of program 'front-end' the general principles of minimal standards still apply. The over-riding consideration is that any selection techniques be consistently applied and that at any point all illegal selections be disabled.

The corollary is that, as far as is practicable, all legal options should be displayed on screen. With older computers of limited memory capacity we recognise that this may not be practicable when, for example, a graph is being displayed. Modern software would simply call up a pull-down menu for temporary display on screen.

### 2.2 INKEY and INPUT

For the non-micros we had better explain the difference before stating the requirement. INKEY and equivalent commands involve the computer in scanning the keyboard looking for a specific keypress. Once the looked-for key is depressed the action it initiates will usually follow without any need for the user to press <RETURN>.

INPUT and its equivalents require the typing of a letter, number or string and for that to be deliberately entered by pressing <RETURN> or on some computers an equivalent which is an <ENTER> key.

There is no reason why a program should not employ both techniques. What it should not do is mix them indiscriminately for the same level of task. Any package which suffers from such faults should be rejected.

Where INKEY is used so that a keypress is needed to make a choice out of several items then the result of that action should be displayed on-screen. Users should not be required to remember which choice was made and, as a result, where within the program they have been taken.

Where the INPUT technique is used it is helpful to provide an on-screen cue of the type - "Select X,Y or Z and press <RETURN>".

### 2.3 Titles and headers

These must be used consistently from screen to screen. If a menu choice is described in a certain way a different description, no matter how similar, must not appear as the title of the next screen which executes that task or option.

### 2.4 Strict sequencing

Sequenced options or operations should not normally be offered simultaneously on screen. If a task requires a key to be pressed or a character or number to be entered to enable an option and then another to be selected to execute that option, then the second selection shall not be legal until it can have the desired effect.

This somewhat tortuous requirement may appear less complex if we give a concrete example. Suppose options A, B, C and D are offered and are to be selected by a single keypress and executed by pressing the spacebar. The message "Press spacebar to continue" should not appear on screen until after one out of A, B, C or D has been pressed.

We have recently seen commercial packages which fail to observe such simple conventions. The result may be a spectacular crash to BASIC as the program takes a flying leap into oblivion whilst attempting to execute the impossible and disappears up its own "No such variable".

## 3. Pre-requisites, system and other

Where a menu, option or utility cannot be executed because of some unfulfilled prior condition there should be a plain-English report and instruction as to how to meet the pre-requisite. The user must not be presented with an operating system message or be trapped in a loop.

Such prerequisites could include any or all of the following:

- set up a disk drive for data.
- specify a printer (type and on/off).
- take some readings before setting up a library of data files.

An example of an unacceptable 'loop-trap' is presented by one package, from a major supplier, which allows access to a file maintenance and handling routine without steering the user to first take some readings so as to be offered an opportunity to create some data file(s). This results in an endless loop of questioning of the type:

"Which drive for data?"

"No files available"

"Which drive for data?"

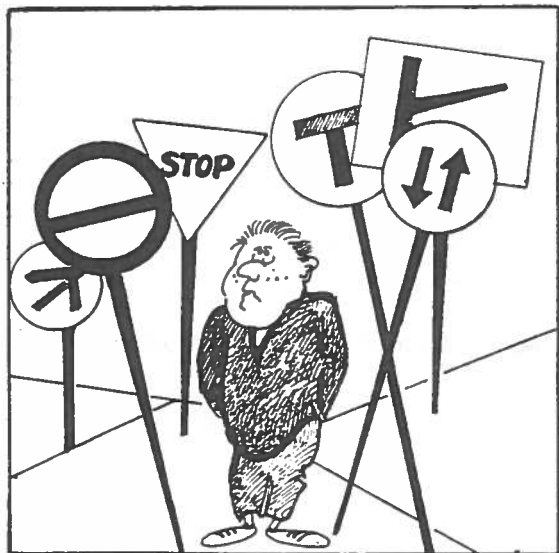
Et.seq. ad infinitum with no way out bar, literally, <ESCAPE>-ing!

Programs which suffer from this type of fault should be rejected, especially if the documentation suffers from the same error.

## 4. Documentation

We have insufficient space to detail requirements for documentation. In any case, useful standards were suggested years ago by EAs such as Fife Region and then by agencies such as SM DP (as it then was).

SSSERC's broad requirements include structured documentation which first outlines the overall system and follows this with task oriented instructions. These should illustrate examples of applications. The system outline can usefully be diagrammatic and show how the parts of the software relate to the whole. Thereafter clear routes are provided for particular tasks or sequences of tasks. An example of such a sequence would be to capture raw data, display it, manipulate it mathematically, re-display that data and save to disk or dump to a printer.



Again we should be looking ahead to increasingly friendly packages where on-screen operations are so obvious that there is minimal need for supporting documentation. We would however add the rider that screens should not be forever cluttered up with technical detail or other throw-away information on ancilliary hardware. We are back to pull-down menus again!

We have in mind here things such as setting up instructions which should be mastered by a user. They simply do not need to appear on screen every time the software is used. As memory capacity increases such features may cease to be the major irritation they can be on the Beeb B where screen memory is too precious to be so wasted.

## 5. Structured programming

The irony here is that good structured programming may not be easily detected. This is because it is the hallmark of the professional. Such a programmer is more likely also to effectively protect his or her programs so that they are not open to inspection. Some 'commercial' data-capture packages we have inspected recently were not so protected. Nor were they structured - hardly a 'PROC' related statement in sight. Lack of proper structure should not be accepted in a program sold for money. Any recent BBC BASIC commercial program with a plethora of GOTOs and similar hackers' hallmarks should be rejected.

The excuse may be offered that the program is unprotected or lightly protected to allow the enthusiast to adapt it. This is a lame excuse if the program lacks structure as well as protection. It may prove extremely difficult to adapt hacked software which has 'evolved' at the keyboard rather than having been properly designed and then coded.

### Endpiece

It is a while since first we attended conferences where the educationalists' catchphrase related to software was:

"The d-i-y, amateur, days are over!".

There is still a place for early development work by enthusiasts but most teachers seem to have got the message that it needs effective professionals to bring a software product to the market place. It is well past the time that some supply houses also received and acted on that same message. Another unfortunate consequence is that some teachers' programming energies seem to be channelled into illicit copying of software which helps no-one in the long term.

### Acknowledgement

Our thanks to Walter Beveridge, then HMI and now exalted to HMCI, who started us thinking seriously about "Educational computer package evaluation and design". He did that with his 1982 SMDP paper so entitled. Our thanks also to him as author and to SCET now joint copyright holder for permission to reproduce two cartoons from that paper.

## Interfacing publications : support for training and users

### Introduction

In Bulletin 159 we listed a number of publications to help teachers get more from their VELAs. There has undoubtedly been a similar lack of communication regarding user and training support materials for a wider range of interfacing equipment. Indeed, it is surprising the number of CDOs, Advisers and TVEI co-ordinators who contact us regarding the availability of such material only to find out that a nearby Scottish EA or TRIST project has produced something which meets their needs.

Here are our initial attempts at identifying what is available, on a national basis, to support interfacing for instrumentation and control on the BBC B and Master. We do not claim that the list of resources detailed below is exhaustive. It has proved both difficult and time-consuming just to identify relevant staff in EAs and TVEI projects and then to pin down details of the nature, source and price of any particular resource. The list is thus an interim affair. We would be pleased to hear from others who can offer similar support. Does everyone send this information to NERIS?

### Resource List

#### Support for commercial packages

##### 1. "Interfacing with Datadisc" :

Author : Phillip Strange, Argyll TVEI.

Source : SSSERC Price : £1.50 per copy.

Outline : An excellent basis for an introductory practical workshop course for teachers and technicians coming for the first time to the Philip Harris 'Datadisc' package. Assumes no prior computer usage.

##### 2. "Unilab Interface Workshop"

Authors : SSSERC Source : SSSERC

Price : £2 per copy

Outline : Produced by SSSERC for technician and teacher in-service. Re-set by Lothian TRIST. A series of graded exercises for initial training on the Unilab interface and software packages including 'Grapher' and UNICOS. Covers simple digital input and output for control as well as data capture via the analogue inputs.

##### 3. "An Intro. to 'Grapher' on the Unilab Interface"

Origin : Highland TVEI, TRIST material.

Source : Curriculum Development Centre,  
Penneth Street, Inverness.

Price : £2.50 per copy.

Outline : Beginners' guide to datalogging using the Grapher software and the Unilab interface.

##### 4. "Computer Related Apparatus in Science"

Origin & Source : Technician Service,  
Woodlands Centre, Glasgow.

Price : Send A4 size S.A.E. + 40p stamp.

Outline : Designed for a beginners' in-service course. Covers VELA; Unilab interface & 'Grapher' software; 'Datadisc' and 'Signal Box'. Assumes no previous experience.

##### 5. "MAPOSE" ["Microcomputers as part of science experiments"]

Authors : Group of teachers in the London  
Borough of Bromley

Source : Mr.P.McGregor, Town Hall, Tweedy  
Road, Bromley BR1 1SB

Price : £5 per copy.

Outline : An 82 page collection of interfaced experiments using the Philip Harris 'Datadisc' package; Velanalysis II; the Cherlyn electronic balance and a range of other sensors. Assumes little or no prior computer usage.

## General information

### 6. "Microcomputers in the Science Laboratory"

Authors : Lothian TRIST.

Source : SSSERC.

Price : £1 per copy.

Outline : General information produced as part of a wider Lothian TRIST project.

### 7. "MEP Sensor Manual"

Authors : Sunderland Evaluation  
& Development Centre

Source : NEMEC Publications

Price : £19.50 per copy.

Outline : General discussion on the potential of sensors in practical science lessons with emphasis on the implications for design if activities are to be pupil based. Also includes a number of sensor designs for analogue interfacing. It gives circuit diagrams and constructional details and thus merges partly with the d-i-y section below. However commercial versions and variants of many of the 'MEP Range' of sensors have come on the market since publication of the manual.

Please note that although the address for NEMEC publications cited in Bulletin 159 was correct, NEMEC now have their own banking arrangements. Cheques should no longer be payable to the "Romsey Printing Company" but to "NEMEC".

### 8. "Computers in Chemistry"

Authors : SSSERC

Source : SSSERC

Price : £2 per copy.

Outline : Produced for the National Course for Standard Grade Chemistry, January 1988. Contains an information/discussion paper; experimental applications; problem solving exercises; 'Techniques Sheets' and a thermistor bridge design for chemistry applications.

### 9. "New Technologies & Training"

Authors : SSSERC

Source : SSSERC

Price : £2 per copy.

Outline : Produced for the National Course for Standard Grade Biology, February 1988. An information and discussion paper.

### Largely d-i-y

Despite our quote in the previous article that "The d-i-y days are over" there is still interest in this field, largely because of economic considerations. We thus include a few items on d-i-y techniques.

### 10. "Using the BBC microcomputer in School Science Experiments"

Author : M.Tebbut

Source : Publications Dept. A.S.E.  
ISBN 0 86537 048 8

Price : £5 per copy.

Outline : Deals largely with d-i-y use of the Beeb analogue port but includes suggestions for interfacing existing instruments with analogue outputs. Gives program listings but a disk of programs is also available from the author (see Address List inside front cover of this Bulletin).

### 11. "D-i-y interfacing with the BBC Microcomputer"

Authors : SSSERC

Source : SSSERC

Price : £2 per copy.

Outline : A collection of reprints from Bulletins 135, 136 and 140. Reset on Apple Mac and Laserwriter by Lothian TRIST. Overall title is self-explanatory.

## 12. "Simple BBC Interfacing Experiments"

Author : G.S.Macnaught of Montrose Academy

Source : SSSERC

Price : £1-50 per copy.

Outline : As used at in-service courses for chemistry teachers at Edinburgh University by Dr.J. Ponton. Describes simple circuit diagrams and provides short programs for applications in chemistry.

**Package 2 (Mechanics)** - relates to velocity, acceleration, momentum, energy and Newton's 2nd Law. A sensor detects the displacement of a air track vehicle (package almost ready for distribution).

**Package 3 (Optical Spectrometer)** - investigation of prisms, diffraction gratings and double slit (package unfinished).

\* \* \* \* \*

## 13. "Microcomputer Interfacing using A-D Conversion in Chemistry"

Author : Dr.R.G.Brown

Source : Dr.Brown at Chemistry Dept.  
Trinity College, Dublin 2

Price : 50p per copy  
(Software also available)

Outline : Deals with computer display of experimental data with some simple chemical applications.

## 14. "Computer Interfacing in the Physics Laboratory"

Authors : RGIT Project.

Source : Dr. M.A.S. Sweet,  
School of Physics,  
Robert Gordon's Institute  
of Technology.

Price : on application to above.

Outline : Three packages written for CSYS Physics and 1st year tertiary education but may be suited to S4 and S5 where the sensors may have many applications. Each package includes its sensor, interface (diy construction) and software. Printed circuit boards are available.

**Package 1 (Young's Modulus)** - contains a very interesting displacement transducer (package ready for distribution).



BULLETIN INDEX NOS. 150 - 159

'AIDS: Guidance for Educational Establishments in Scotland', notice of SED publication, 1987	156,2
AIDS, addendum to Bulletin 156	157,4
Aquadag, method for mixing	151,13
Amplifier, x25, for type K thermocouple	158,13
Balances, electronic, review & market survey of instruments & software	155,5
Biotechnology application, nutrient film technique	152,15
Block and tackle, demo. of the underlying physics	151,10
Brachistochrone	153,7
Bridge circuits, linearising out of balance voltage, applications	150,14
Broken bunsens mended, (Kincorth method) for Flamefast burners	159,20
Bunsen flame temperature profiles with type K thermocouple and human eye pyrometer	158,8
Burning gloves	152,2
Chemiluminescence, reaction with luminol	157,11
Cold light source using optical fibres	151,12
Cost Index	152,1;155,1;158,3
Conductivity meters, review of test reports	150,11
Conductivity probes (DIY), for distinguishing strong & weak electrolytes	159,13
Curie point motor	153,9
Current (a.c.) measurement, comments on Bulletin 149 article	151,6
'Datadisc' interface & software, review	154,14
Data Protection Act	151,2
D-to-A and A-to-D conversion (notes for CSYS Physics)	153,11
Digital meters (stand-alone & multimeters), review & market survey	152,3
Electric heating mantles - notice of withdrawal of some models	159,7
Electrolysis cells which give off oxygen, DIY method using lead electrodes	156,5
Energy conversions, (peanut power, chemiluminescence, lemon and fuel cell, hydro)	157,7;11;13;15
Environmental notes, conductivity and pH measurement	150,11
Fuel cell	157,13
'g', measurement using reed switches,	151,10
Gas taps, anti-rotation ('Liverpool') plates	159,8
Glass thermometers, protection using heat-shrink sleeving	153,5
Heat resistant cable for soldering irons	155,2
History Notes, review of 21 years of SSSERC activities	150,31
H.T. transmission lines model	158,17
Hydroponics, nutrient film technique	152,15
Hydro power, overshot water-wheel	157,15
Impulse, measurement using Kynar film	155,24
Infra-red radiation (long wave), measurement using Kynar film	155,32
Interfacing, review of developments (1983-1986)	154,10
Ionising Radiation, opinion article on management of risk	158,1
Ionising Radiation, radioactive decay using protactinium generator	158,14
Ionising Radiation, note on implementing new Regulations	159,15

Jig for sharpening screw-drivers	151,12
Jupiter's moons	158,21
Kynar film, a novel transducer	155,22
Learning Outcomes	156,1;157,1
Lemon cell	157,11
Nutrient film technique	152,15
Oscillator circuit (2 MHz), design using quartz crystal	151,8
Paper problem solving, opinion article	159,1
pH meters and probes, market survey & review	153,12
Piezo film, (Kynar)	155,22
Protactinium cow, description of construction & use	158,14
Quartz crystal oscillator	151,8
Radioactive decay, experiment using protactinium-234	158,14
Resolution of masses and the human senses	156,11
Resistive sensors, review of types	150,21
Ring mains, two models using lamps or heaters	158,20
Safety notice, HSE pro-forma policy statement and 'First aid at work'	157,5
Safety notice, HSE leaflet 'Storage & Use of Highly Flammable Liquids in Educational Establishments'	151,4
Safety, science teacher fined	156,3
Science and Special Needs	159,5
Sizing cells, use of leather punch	155,3
Sizing cells, a follow-up	156,4
Solar cells, availability	152,2
Solar cells, peanut-power application	157,8
Stirrer, magnetic (portable)	150,8
Stream flow, measurement of velocities	159,9
Sulphur dioxide canisters, corrosion on unused canisters	155,2
Surplus, Conditions of sale	158,22
Surplus offers, non-ballot items	155,34;158,23;159,17
Thermistor bridge circuits, linearising temp. vs. voltage output	150,14
Thermistor bridge design, computer program offer for calculating bridge resistance values	156,12
Thermocouple (type K), flame temperature profile application	158,8
Thermocouple (type K), x25 amplifier for use with multimeter	158,13
Ultraviolet light, simple way of showing its presence in white light	156,10
Unilab interface & software, review	154,20
VELA, notice of establishing of a central Scotland Centre	157,19
Video equipment in science teaching	154,4
Vital capacity apparatus, simple 'two plastic container' version	151,5
Voltmeter, poor man's version using lead electrodes and disposable pipettes	156,8
Waterwheel, overshot	157,15



S . S . S . E . R . C .

BULLETIN 160

CONTENTS

June 1988

	<b>Page</b>
<b>Introduction</b>	
-Summer Saturdays	1
-biotechnology symposium	1
-readers' letter	1
<b>Opinion</b>	
-SEB Panels' comments on Bulletin 159	2
<b>Physics Notes</b>	
-continuous recording of velocity	4
<b>Safety Notes</b>	
-the protactinium generator: stoppering the flask	7
<b>Interfacing Notes</b>	
-software standards	8
-interfacing publications: support for training & users	12
<b>Bulletin Index</b>	
-numbers 150 to 159	15