



Figure 2.7 Prototype hardware for the keyboard conversion.

and the scope of the specification as a way of giving an overview of the project, followed by detailed criteria in all the important areas. Figure 2.7 shows the prototype keyboard converter which needs to be redesigned.

Some aspects of this project are discussed in section 2.5.1 which concerns cost-effective manufacturing decisions.

Computer keyboard converting system for young children

Contents

- 1 Background information
- 2 Scope of the specification
- 3 Relevant authorities to be consulted
- 4 Performance
- 5 Ergonomics
- 6 Aesthetics, appearance and finish
- 7 Materials
- 8 Quantity – scale of production
- 9 Manufacture
- 10 Maintenance
- 11 Life in service – product life
- 12 Safety
- 13 Testing
- 14 Packaging
- 15 Product costs
- 16 Time scales

1 Background information

A number of software programs for the BBC micro have been developed for use in primary schools, but due to the unfamiliarity of the QWERTY keyboard layout and the small size of keys in relation to children's dexterity, the application and acceptance of this software has been limited. A keyboard converter, using larger keys with clearly defined functions, was designed to overcome the problems caused by a compact, complicated keyboard. A prototype of the converter was produced to test

children's reactions. As a result of the success of the initial trials a further ten prototypes are to be produced for deeper and wider evaluation, with the aim of marketing the software and appropriately designed hardware for use in both the school and, eventually, the home environment. The current objective is to design a fully marketable version of the keyboard converting system.

2 Scope of the specification

The software programs developed require the use of specific key combinations on the BBC model B microcomputer. It is hoped that the design of the hardware will also be adaptable for use with the BBC Master series.

The following areas are to be considered in this specification:

- 2.1 The overall key pad adapter – the converter body to which individual key pads for the various games are fixed in order to act on the appropriate BBC keys.
- 2.2 The design of the individual key pad layouts.
- 2.3 The design of the key mechanisms.
- 2.4 The overall product image.

3 Relevant authorities to be consulted

- 3.1 The Local Education Authority advisor for computing should be consulted concerning the trials and use of this product in schools.

4 Performance

The software programs developed require the use of specific key combinations. Each game requires a different keyboard configuration; the specific BBC micro keys referenced by the software could be altered, but this would be a major task and there would have to be very obvious benefits to make it worthwhile.

- 4.1 The money game, a basic mathematical game simulating the use of coins to pay for an ice cream, requires seven keys for different coin denominations: 1 p – *, 2 p – L, 5 p – J, 10 p – G, 20 p – D, 50 p – A and £1 – CAPS LOCK. Control/enter key – RETURN.
- 4.2 The snap game requires 2 large keys (Q and P).
- 4.3 The colour recognition / memory game requires four different coloured keys (5, 8, V and M), which the child has to press in a specific sequence. Additional software is being developed which will require the same four keys to be used in a directional mode (as cursor keys).
- 4.4 The music keyboard program allows the BBC micro to be used as a musical instrument with 16 white keys and 11 black keys (the third and second rows of the keyboard respectively). The whole key pad should be movable, to provide compatibility with other music software.
- 4.5 The keyboard layouts for sections 4.1–4.4 should be easily interchangeable.
- 4.6 The converter system should protect the BBC micro's keyboard from both damage and incorrect use as well as ensuring the correct location of the key pads.
- 4.7 The key action should not be able to exert a force of more than 30 N on the BBC micro's keyboard.
- 4.8 The system must be able to cope with the school environment and all the associated use and abuse.

5 Ergonomics

- 5.1 The main aim of the system is to make the BBC keyboard easy to use by the 4–7 year-old age range.

- 5.2 The key pad layouts should be compatible with anthropometric data associated with the 4–7 year-old age range, that is, the span width and reach of the hands.
- 5.3. The key mechanisms should be compatible with the strength and dexterity of 4–7 year-olds. The force required to activate the keys should not be greater than 20 N.
- 5.4 The design of the keyboard converting system should allow for adult (teacher) use.
- 5.5 Any instructions for use must bear in mind the ability of 4–7 year-olds to read and understand instructions and, recognise symbols.

6 Aesthetics, appearance and finish

- 6.1 The shapes, key sizes, colour, texture and overall image should be designed for the intended age range of users (4–7 years).
- 6.2 Teachers will ultimately decide whether or not the converting system should be bought and whether or not the children should use it, so the product must also appeal to teachers and appear suitable for its function.
- 6.3 The system should be aesthetically compatible with the BBC micro. This must be taken into account when selecting the colour, materials, textures and surface finishes.
- 6.4 The system must fit into both the school and home environments, hopefully being marketed for home use as well as school use.
- 6.5 Wooden keys would be preferred for the music keyboard, and the design of the converter body should be sympathetic to this requirement.

7 Materials

- 7.1 Any materials used should be nontoxic, due to the contact with small children and school safety requirements.
- 7.2 The materials selected must be durable i.e. have sufficient hardness and impact strength, resistance to abrasion and wear, good dimensional stability and resistance to corrosion and chemicals.
- 7.3 The materials should be easy to clean.
- 7.4 The materials must have no adverse effects on the BBC micro system such as causing static or interference problems.

8 Quantity – scale of production

- 8.1 The required production volume is 4000 to 10 000 units, manufactured in batches of 100 to 1000 units.

9 Manufacture

- 9.1 Appropriate manufacturing processes should be selected for the scale of production.
- 9.2 The manufacturing processes selected should take account of the complexities of the design and the accuracy with which the component parts are to be assembled.
- 9.3 The manufacture of the overall product is intended to be contracted out to a manufacturer with the appropriate facilities.
- 9.4. The client would prefer the music keyboard to be manufactured from wood by CNC (computer numerically controlled) machining.

10 Maintenance

- 10.1 The general maintenance of the keyboard converter should be minimised.
- 10.2 There should be no need for repairs or replacement of parts, but adult users should be able to replace buttons, if necessary, with minimal instruction.

11 Life in service – product life

- 11.1 The product life need not exceed that of the BBC micro.

12 Safety

- 12.1 The product must meet all the safety standards for use of equipment within schools, particularly with respect to toxicity and fire resistance.
- 12.2 The design of any mechanisms must not allow fingers (especially those of children) to be admitted or trapped. This is particularly important for electrical apparatus.
- 12.3 Sharp corners and edges should be avoided

13 Testing

- 13.1 Testing of the product will be carried out by building a prototype and observing its performance in the classroom environment.

14 Packaging

- 14.1 The packaging must help sell the product and therefore be of interest to both teachers and children.
- 14.2 The packaging should be designed to appeal primarily to teachers rather than children.
- 14.3 For mail order, the packaging needs to give good protection, as well as meeting weight and size restrictions.

15 Product costs

- 15.1 The target retail price for the complete converter kit including the minimum software is £99.95. It is considered psychologically important from a marketing point of view not to exceed £100.

16 Time scales

- 16.1 Engineering drawings need to be available so that manufacture of the tooling can begin three months after the project starts in October.
- 16.2 The product must reach the market in the late spring or early summer when most educational orders are placed.