CONTROL
UPDATE

Our New Home

Bearing an uncanny resemblance to our Company Logo (surely a good omen!) our new premises from 1st May 1985 will be:

**137 Ditton Walk
Cambridge CB5 8QF**

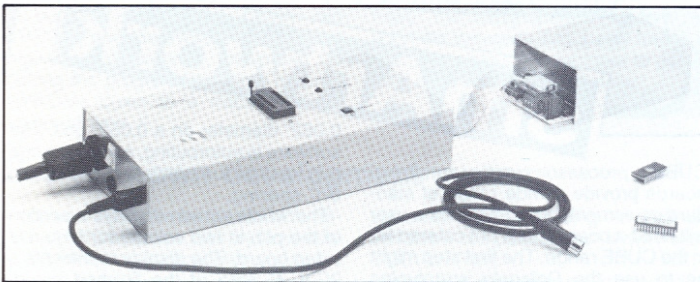**New Sales telephone number (4 lines)
0223 244447**

New General Switchboard Number (6 lines) 0223 244448

**We retain our existing Telex Number
995801 GLOTX-G**

Please use the old address and telephone number until 1st May:
Control Universal Ltd, Andersons Court, Newnham Road, Cambridge CB3 9EZ

Until 1st May 1985:
Telephone for all calls 0223 358757 (10 lines)

CUBULATOR!

Universal Microprocessor Development Tool — use BBC, IBM, FLEX Systems or terminal

— In-Circuit-Emulation
CUBULATOR provides in-circuit-emulation with the target processor still plugged in, ensuring true test validity. Two versions cover a wide range of microprocessors.
  Group A: 6800 6802 6801/3 6805 6809 6502 68008
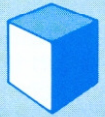 Group B: 8080/5 Z80 NSC800 8088
— ROM Emulation
CUBULATOR has 16kB of RAM to simulate a ROM live on the target.
— EPROM Programming
On-board programmer blows the EPROM developed using CUBULATOR.
See page 3

Real Time BASIC

Completes the Tools for Industrial Control

The fundamental theme of Industrial Control is the ability to handle events. The problem with standard BASIC is that if an event is to be catered for, e.g. fluid reaching the top of a tank, then either much valuable time must be spent unnecessarily checking that input, or else the whole program must wait for the event.

Real Time BASIC overcomes these difficulties by allowing a BASIC command to set up a "trap" for action to be taken upon the condition being satisfied, and then passing on to the next BASIC command. The Real Time Kernel then looks after the checking of the condition in a highly efficient machine code manner, and implements the action when appropriate. BASIC itself is not slowed down at all, and the user finds the technique exceptionally easy to use.

See page 6.

Control NET

Error Checking on CUBE Communication

The first version of Control NET is now being shipped in all EuroBEEBs with version 3 MOS. This version allows simple communication, but without error checking. The second version will be ready in June, and is described on page 7.

New products

CUBE Doublestore FDC — p.8
Now shipping for use with 6502/EuroBEEB and 6809.

CUMEM Selecta — p.8
Provides eight battery-backed out of up to 64 sockets "sideways" memory blocks.

CUBAN-12A — p.9
Now low cost integrating 12-bit analog-digital converter with 16 channels.

CUBAN-12B — p.9
CUBAN-12 redesigned with improved performance and reduced price.

INDIO-II — p.7
Eurocard interface to the industry-standard modular i/o system redesigned for Control BASIC and Real Time BASIC.

BeebFLEX Upgraded — p.4
Always an excellent buy, further upgrading takes it streets ahead.

Twice as fast . . . — p.12
Both 6502 and 6809 CPU's are now being offered in 2MHz versions.

The CUBE Microprocessssor Development Laboratory

New for 1985, Control Universal are making a feature of total support for microprocessor product development.

Both major development systems have been revamped, for 6809/FLEX and 6502/BBC BASIC, with many important innovations:

- Cubulator (see left)
- CUBE Serial Terminal
- 2 MHz operation
- Sideways memory
- Doublestore floppy disk controller
- 3½" disk drives

See page 2.

smArtwork

This Printed Circuit layout package runs on the IBM Personal Computer or compatibles, and provides auto-routing to speed up the artworking process. At an astonishing £895, it costs around a fifth of its rivals.

See page 2.

Development Systems
Full Range Support from
Control Universal

"The CUBE Microprocessor Laboratory"

A full range of microprocessor development tools, concentrating on ease of use and value for money.

- **High Level Languages**
- **Machine Code Assemblers and Compilers**
- **Cross-Assembly for single chip micros**
- **Target System Debugging**
- **EPROM Programming and Erasure**
- **Prototyping Boards**
- **PCB layout**

Upgraded Rack-mounted Development Systems

All CUBE development systems are rack-mounted which has enormous advantages in terms of flexibly configuring the system to the exact requirements of the user. If the user intends to use CUBE cards as all or part of the target systems, the rack provides an environment for debugging both the application and any new hardware that may be developed for use on the CUBE bus.

The upgraded range of the rack-based CUBE Development Systems are now all organised so that the keyboard and video text display are provided by a standard terminal.

2MHz 6809 CUBEFLEX System – now £1595

The CUBEFLEX system is a general purpose microprocessor development system, whose main benefits are the ability to develop code for 6809 systems using the standard editor, assembler and a choice of compilers, and for almost any other processor using a cross assembler.

FLEX software

To further improve 6809 programming throughput, a number of high level languages are available, including PL/9, Pascal and "C". See the Control Universal price list for the complete range.

CUBULATOR support

The CUBEFLEX System supports CUBULATOR, the new in-circuit emulator, ROM emulator and EPROM programmer, and with this tool is particularly suited to single chip microprocessor development – see opposite.

As a target system

A particularly popular aspect of CUBE-FLEX is that its low cost and robust construction make it an attractive proposition as the target system itself, after the development phase is completed. If the target system is rather smaller in scope, CUBEFLEX is the obvious environment for developing an application based on the EuroCUBE-09 cpu card and other CUBE modules.

6809 Flex System Specification

The standard system includes the following upgraded specification

- **Flex operating system with Editor and Assembler.**
- **Paging system can extend memory to 1MB**
- **56kB battery-backed CMOS RAM**
- **Twin disk, total 1.4MB**
- **2MHz operation**
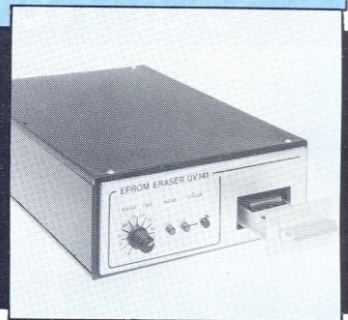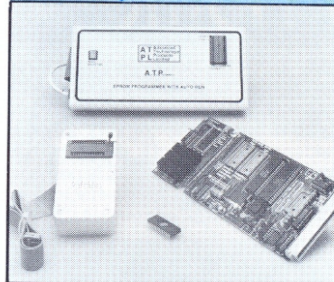- **Six spare slots**

6502/EuroBEEB Systems   *See page 4*

CUBE Standard Terminal

Control Universal have sourced this robust fully-featured serial terminal specifically for use on CUBE development systems. At £475 it represents exceptional value, and is a convenient means of providing a keyboard and video display.

EPROM programmers and Erasers

Apart from the EPROM programming facilities on CUBULATOR, the CUBE range includes three EPROM programmers.

"Softlife" This costs only £65, and plugs into the user port on either the BBC Microcomputer or CU-KEY 99, the CUBE System keyboard. It will program 2764 or 27128 types.

"System CU-PROM" This costs £119, and is much more versatile than the Softlife. It plugs directly into the CUBE rack and can be used with either 6502 or 6809 systems. All types, both 27 and 25 series, from 2716 to 27128 are catered for.

"CU-PROM for BBC" is the same price and has the same features as the System CU-PROM, but is designed for use with the BBC Microcomputer, and is complete in a desk-top case.

"Erasers . .": Just a simple but essential tool, the GP EPROM Eraser is available with or without a timer, at £95 and £85 respectively, and will erase 14 EPROMs.
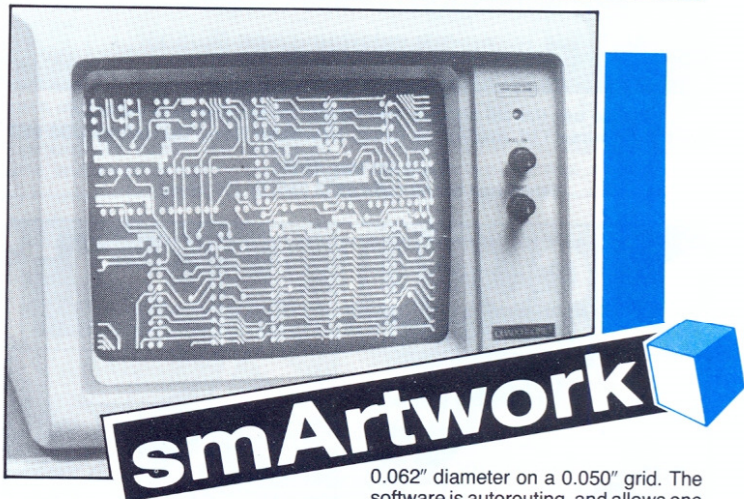
smArtwork

CUBE processor and peripheral boards provide a wide range of standard equipment, but sometimes a user will need a board that is not catered for in the CUBE range. The first step might be to use the Delegate prototyping board with has a VIA i/o port and address decoding on ⅓rd of the board, and prototyping trackwork on the other ⅔rds.

When a design is proven to work, you may wish to produce proper pcb artwork, and smArtwork is a powerful piece of software which does for £895 the pcb layout jobs that we have found only rivalled by other packages costing at least five times as much.

smArtwork can produce single or double sided boards up to 10" × 16". Tracks can be down to 0.012", or up to any multiple of 0.050". Minimum track spacing is 0.019", and pads start at 0.062" diameter on a 0.050" grid. The software is autorouting, and allows one thin track to run between two pads on 0.1" spacing.

The whole screen displays a section of the pcb in two colours for a double sided board. The display represents a 2" × 4" area of the finished board. Common DIP and SIP footprints are supplied in a library.

It runs on an IBM personal computer with DOS 2.0 or later, at least 192kB of RAM, two 360kB disk drives and the colour graphics extension board.
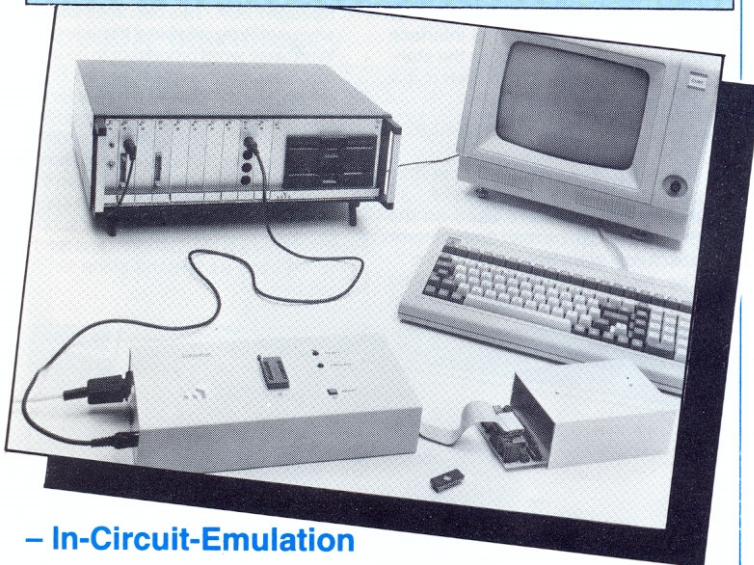
PCB layout plots are produced in a form suitable for prototype work on the Epson FX/RX/MX series of dot matrix printer, and for production runs on a suitable pen plotter (eg. Houston DMP-41 or Hewlett-Packard HP7475A). The software supports the Microsoft mouse for faster input of data.

CUBULATOR!

Universal Microprocessor Development Tool for Real-Time Software Debugging

How to Develop on Single-Chip Microprocessors using FLEX and CUBULATOR

The technique would be much the same for a conventional multi-chip systems, but for this example, suppose that the product to be developed is based on one of the new CMOS single chip microcomputers, eg. the Hitachi HM6303Y. The CUBEFLEX system is a particularly suitable micro-processor development system, because of the cross-assemblers that are available for it. Single chip micro-computers have to be developed using cross-assemblers, as there are, by definition, no development systems based on the single chip processors themselves.

Source Code Development and Assembly

The programmer creates his source code using the editor, on the terminal. He then invokes the cross-assembler, which creates an object file on disk.

In-Circuit-Emulation

The CUBULATOR EPROM cable is plugged into the EPROM socket of the target system. This may be an exter-nal socket or a "piggy-back" arrange-ment. CUBULATOR's communication cable is plugged into an extra serial port on the CUBEFLEX system, and the CUBULATOR program called from disk. This requests the programmer to specify the processor being used, and the type of EPROM being simulated (anything from 2716 to 27128). The next instruction is to press the reset button on the CUBULATOR, and power-up or reset the target system. If all is well the "emulate" light on the CUBULATOR comes on.

The programmer can now call the object file from disk by name, and it will load into the 16kB RAM space on the CUBULATOR. However, this RAM is now being treated by the target system as its own ROM. The program-mer can now run the code, setting up to four break points at will, examining and changing code in hex format, and examining or changing the registers. Amended code can be saved back to the disk under a different filename.

EPROM Programming

When the programmer is satisfied with the code, an EPROM can be blown directly from the code that has been proven to work in the CUBULATOR RAM. A blank EPROM is simply placed in the ZIF socket, and the choice made between fast and slow programming algorithms. The fast version considerably improves on the 14 minutes normally taken for a 27128, but not all manufacturers guarantee long-term integrity if this method is used, so the standard algor-ithm is also provided. Note also that the computer is released while EPROM programming takes place, allowing the user get on with the next job.

Standard Processors

Use of CUBULATOR with standard, multi-chip systems
Most general purpose computers use multi-chip systems, i.e. they have at least the CPU, ROM, RAM and i/o on separate chips. Usually, such systems have more than one ROM socket. From the point of view of CUBULA-TOR, the important socket is the one in which the processor expects to find the power-on reset vectors, as it is through these vectors that CUBULA-TOR gains control. This is the socket which is used for in-circuit-emulation.

ROM Emulation

In a multi-chip system there is very likely another ROM socket that needs code to be developed. In this case the principal ROM, now developed and blown into ROM, is used to power up the system, and the CUBULATOR EPROM cable is plugged into the secondary ROM socket. The code for this socket is then developed using the same editor and assembler or cross-assembler as before, and again transferred as object code to a disk file.

– In-Circuit-Emulation

A unique, patented system allows the CUBULATOR to provide in-circuit-emulation with the target processor still plugged in. This ensures true test validity, and is achieved through the ROM socket of the target micropro-cessor system. Each version is cap-able of supporting one of two wide ranges of microprocessors.

Group A: 6800 6802 6801/3 6805 6809 6502 68008
Group B: 8080/5 Z80 NSC800 8088

In its ICE mode CUBULATOR allows up to 16kB of object code to be treated as the ROM containing the system vectors. This memory is actually RAM in the CUBULATOR, and replaces the ROM from the socket the CUBULA-TOR is plugged into. The CUBULA-TOR RAM may be examined and changed at will from the host system. In addition, all the other memory and i/o ports fitted to the target system may be examined. RAM memory and ports may be changed to new values. Note that even ports that are not memory mapped, such as those on a Z80, are accessible by CUBULATOR.

– ROM Emulation

CUBULATOR provides 16kB of RAM which can be downloaded from any host computer with a serial port and which can then be run, debugged and modified "live", while developing the code.

– EPROM Programming

CUBULATOR finally provides for the de-bugged code to be blown into EPROM, and the system includes the new "fast algorithm", invaluable for cutting the programming time of large EPROMs down to a fraction of the standard time.

In addition, use of the CUBULATOR frees the development system as soon as the code has been transfer-red. This allows the engineer to get on with another job immediately.

Use your own development system

– Drivers available for standard termi-nal, BBC Micro or Flex System now
– IBM PC and compatibles soon

The CUBULATOR communicates with a host device through its serial port. This may be a standard terminal with RS232/423, or through the serial port on a BBC, BeebFLEX or CUBEFLEX system. By early summer there will be software drivers allowing an IBM or suitable compatible to work with CUBULATOR.
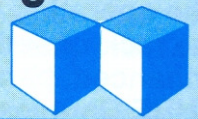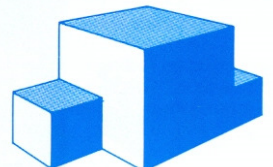
Each of these alternatives provides the keyboard and video display; the computers additionally provide assembly/cross assembly facilities and disk storage for up and down loading to and from the RAM in CUBULATOR.

IBM compatibles may also be used, but care must be taken that they are really compatible in all the necessary factors. A list of recommended com-patibles is available on request, and a demonstration disk is available on loan to test out your machine. We have found that the Sanyo PC series allows smArtwork to perform satisfactorily, at about half the price of an IBM. These systems are available from Control Universal.

A better CUBEFLEX – MOSF. 3

The operating system used on CUBEFLEX, the rack-based 6809 FLEX system, has been enhanced, particularly to allow it to work with CUBE Doublestore, the new floppy disk controller card.

- 2MHz operation is introduced as standard and in the process disk accesses become typically twice as fast.
- CUBE Doublestore replaces CU-STOR as the floppy disk controller card. This has the additional advantage of providing two pageable memory sockets, which can be used as either two 16kB ROMs or one 16kB RAM area.

- The date can be read automatically from the real time clock at the time of booting FLEX.
- A test for "drive ready" is performed before making a disk access, and thus the system will not hang up if, for example, a disk door is left open.
- The CU-DRAM dynamic memory RAM card is replaced by CU-MEM populated with battery-backed CMOS RAM, making the data non-volatile if required.

FLEX documentation

While the strong dollar has pushed the price of FLEX up from £65 to £75, Control Universal are now including the Advanced Programmers Guide with every CUBEFLEX MOSF. 3 system at no extra cost.

3½″ drives at no extra cost

In the first issue of Control Update, 3½″ drives were announced as available, but at a premium. This premium has now been swept aside, and CUBE-FLEX systems are available with the 3½″ option at no extra charge.

There are two advantages of 3½″ drives: the first is their compactness. Each drive occupies 2 rack slots, and the FDC occupies one. The single and twin 5¼″ drive units occupy seven rack slots. The second advantage is the robustness of the media – the self closing robust plastic-cased diskettes are ideal for shop floor use.

To maintain the ability to read 5¼″ disks, which is the international FLEX standard, each rack is fitted with rear disk data and power connections. A standard BBC 40 or 80 track drive is plugged into this socket, which becomes drive 3. (A twin can be used, as drives 3 and 4).

Silicon Disk Soon

The CUBE paged memory technique (see page 8) lends itself to a "RAM-DISK" filing system, where RAM mimics the action of a disk drive. This operates typically 5 times faster than disk – i.e. up to 15 times faster than the 1MHz disk system and significantly faster than most Winchester systems, and all with battery back-up! The hardware (CU-MEM Selecta) is available now; the software will be ready in July.

BeebFLEX Upgraded

BeebFLEX, as a concept, exists to provide 6809 FLEX as an extension to the BBC Microcomputer. It is provided in a small rack with the processor card and 64kB of DRAM memory, and a built-in power supply. Working voltages of ±15V (for analog and serial interface cards) are supplied as well as the standard +5V. The price of this system is a highly competitive £359.

General Advantages of BeebFLEX:

- Low Cost
- The BBC Micro retains full normal operation
- If 40 track drives are used on the BBC, disks can be read and written in *absolutely standard* FLEX format.
- The highly refined screen editing facilities of the BBC can be used within FLEX; for example, in this way simple EXEC files can be edited just using the BUILD command without going to the trouble of using EDIT.
- BBC files can be read into the 6809 through FLEX. This becomes especially useful by allowing the low-cost Wordwise word processor to be used to create source files for the 6809 assembler. Wordwise is easier to learn than FLEX's EDIT or Screditor, and is much cheaper than Screditor.
- Being supplied in a rack the system is ready to accept other cards from the CUBE range for developing an application, and with its own power supply the system is independent and ready to be used as a stand-alone target system.

BeebFLEX-Plus

The new BeebFLEX-Plus upgrades the processor card from a CU-NINE to a EuroCUBE-09 and as a result includes the following new features:

- **Serial port – essential for use with Cubulator**
- **Four byte-wide memory sockets,** of which two are entirely spare, with battery back-up facilities if CMOS RAM is used.

The price of BeebFLEX-plus is £399.

N.B. MOSG. 2, the operating system on the BeebFLEX, does not support the real time clock, and clocks are not supplied on BeebFLEX-plus EuroCUBE-09's.

Bus extender, Delegate Prototyper
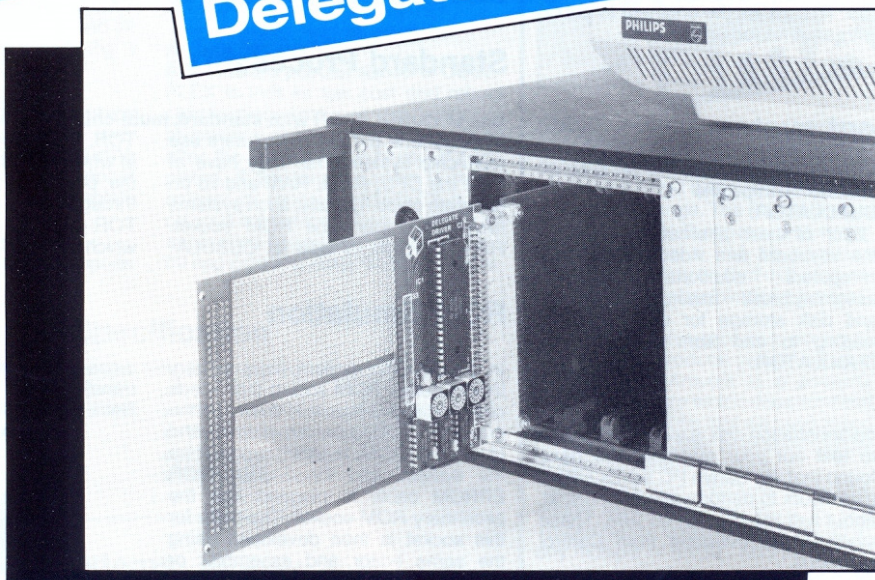
If you are working on a new card with a CUBE-type bus connector, or on the Delegate prototype, or just want to make live adjustments to a standard card, the Bus Extender is a simple but invaluable tool that allows the card to appear entirely at the front of the rack.

So many special purpose cards are just a variation on the theme of inputs and outputs, and start off as a VIA decoded in memory. The Delegate prototyper provides a VIA with three decoder switches, allowing it to be decoded down to 16 bytes. This takes one third of the card. The remainder of the card is provided with a matrix of tracks and holes so that a prototype or special circuit can be built up by the user. Generally Control BASIC and Real Time BASIC can be expected to work with your special design, as these languages are designed to cope with i/o, and the VIA is just treated as 16 channels.

The CU-BUSEX bus extender costs £25, and the Delegate Prototyping board £57.

EuroBEEB Development/Target Systems

One of the often-quoted advantages of EuroBEEB systems is that they include the development tools in the target system, so allowing the minimum of expenditure. Among the four main approaches to standard target systems below, the BBC Micro is seen as a low-cost and elegant means of providing those tools needed only at the development stage, and which the user probably has already.

BEEBSYS-1
2MHz EuroBEEB/MOSM.3/Mini-rack
£490 *(excluding BBC Micro System)*

The EuroBEEB is now available in a 2MHz standard, and all cards except CUBAN-8 and CU-GRAPH will work at this speed.

This 16kB RAM small system costs £465 including the development pack, which includes the utilities disk, the communication ROM (★Euro), the serial cable and full documentation.

Without the development pack, and with only 8kB RAM, as a second and subsequent target system, EuroBEEB in a mini-rack costs £418, with, of course, quantity discounts available.

The BBC package requires just a disk and disk interface, and a video screen, total cost about £700, if the user does not already have one.

BEEBSYS-2
2MHz EuroBEEB/MOSM.3/Double Density Disk/32kB RAM/19″ Rack
£1225 *(excluding BBC Micro System)*

Again, if keyboard and video are not required in the final application, the BBC Micro provides these tools economically, especially if one is already available.

At 2MHz, the new CUBE Doublestore is capable of working in double density, so raising the storage capacity of the single 80 track double sided drive to 640kB. The system is supplied with 32kB RAM and costs £1225 including the development package.

The BBC system requires a monitor, but no disk, so costing only about £460.

BEEBSYS-3
1MHz EuroBEEB/MOST.3/Keyboard Teletext Video/Single Disk/32kB RAM
£1485 *complete*

These two systems are complete and can be used to develop applications without any other equipment, except a £65 EPROM programmer if required.

The keyboard provides the same elegant editing features as the BBC, and indeed the Acornsoft "View" word-processor works ideally as a means of generating both assembly source and BASIC programs.

Both the Teletext and CU-GRAPH cards are complete with monochrome and colour video outputs and cabling, and the keyboard provides a numeric/hexadecimal pad as well as a standard

BEEBSYS-4
1MHz EuroBEEB/MOSC.3/Keyboard CU-GRAPH Video/Single Disk/32kB RAM
£1765 *complete*

layout similar to that of the BBC Micro.

The CU-GRAPH system is indicated if high resolution colour graphics with 80 column text are required; Teletext is appropriate for 40 column text in 8 colours, with simple "chunky" graphics.

The disk provided is 80 track double sided, giving 400kB of storage capacity at single density.

A high resolution colour graphics display monitor costs about £500, and a monochrome monitor (green screen) is priced at £95.

EuroBEEB Firmware

With Doublestore and Selecta providing full sideways ROM facilities (see page 8), EuroBEEB has access to the wide range of software ROMs produced for the BBC microcomputer.

Generally speaking, there are two restrictions governing whether a ROM will work with EuroBEEB. First, it must obey all the operating system rules, and not, for example, like Wordwise, write directly to the screen. Secondly it must have the right keyboard and screen. If the BBC Micro is being used as a development terminal, naturally these conditions are satisfied. CU-KEY-99 provides the correct interface, and CU-GRAPH and Teletext provide 80 column and 40 column displays respectively, according to which mode is required.

We have tested a number of standard ROMS, and those below have been found to be well worth recommending.

1 Real Time BASIC £75

Controlling Events as They Happen
Industrial control systems are largely oriented to responding to events whose timing and order of occurrence are not known in advance. Programmable Controllers cope with this by scanning all inputs hundreds of times a second, but this technique is expensive, and leaves very little scope for the processor to do much apart from setting outputs in a logical relationship to the inputs. CUBE Industrial Control Computers seek to do much more, in particular to provide floating point arithmetic, the control of analog values, disk storage, and text and graphics displays, i.e. all the areas in which programmable controllers are weak.

Real Time BASIC adds to these virtues the necessity of direct reaction to a real time event, as an extension to standard BBC BASIC, without any modification, restrictions or speed degradation compared to the BBC Microcomputer.

When . . .
Control BASIC added a number of words to make the control of inputs and outputs easier – TURNON, TURN-OFF, FLIP, etc., and extended the use of ADVAL to control all the CUBE analog interfaces. All of these facilities are retained in Real Time BASIC.

Real Time BASIC adds several more new words and constructs, of which the most important is WHEN.

The use of the word WHEN sets up a "trap" which is executed only when the event specified occurs. The program takes no action when it passes the WHEN statement in the course of executing the whole program, but just sets up the conditions for response.

The structure is:

WHEN . . .
<event> . . . PROC<procname>

"Events" are defined occurrences that are catered for by Real Time BASIC, and are:
– Real Time Clock reaching a stated time and day of month.
– A key being pressed on the keyboard.
– An error being signalled on Control Net.
– 1 of 32 Digital input channels changing state.
– 1 of 8 Analog input channels passing a set limit.
– 1 of 8 Interval Timers timing out.
– 1 of 32 Remote Stations on Control Net having a message.
– 1 of 5 Serial Ports receiving data.

A "User" event can be realised by setting a timer to generate a regular event, say ten times a second, which then performs a user procedure to check the user event.

The use of WHEN means the end of having to make provision in the program to scan any of these event generators. Once the contingency statement has been set up, Real Time BASIC looks after the scanning.

Real Time BASIC consists of an 8kB ROM and an 8kB RAM which are used together in a 16kB sideways block on Doublestore or Selecta. This product will be available in June 1985 and will be priced at £75 for ROM, RAM and book.

2 Control Forth £65

Multitasking at high speed
Control Forth is derived from Skywave Forth, and is completely compatible with it. Forth forms a bridge between the speed and efficiency of machine code and the convenience of BASIC, and in multitasking, Control Forth becomes particularly suitable for control applications.

Features of Control Forth
- **Up to 28 concurrent tasks (multitasking).**
- **More compact and much faster than BASIC.**
- **ROMable for low-cost target applications.**
- **Built-in standard Forth editor and 6502 assembler.**
- **Supports interrupt handling and OS calls.**
- **Transportable to and from other computers with Forth 83 standard.**
- **Expandable – any new function required is simply defined as a new word.**

Although Forth is often criticised as "difficult", in fact there is really only one major hurdle to cope with, and that is the unusual ("reverse Polish") order of putting things, which is related to the use of the "stack" as the main processing tool. Look at this example.

```
0   (Vessel control routine)
1
2   : PRESTART
3       HEATER1 TURNON
4       VALVE-1 OFF IF CHANNEL-A TURNOFF
5                    ELSE 15 MINS DELAY ;
6
7   : CATALYST
8       BURNER TURNOFF
9       105 MIX-TEMP < IF FILL-TUBE
A                        4 MINS DELAY
B                        ELSE VENT OPEN
C                        4 MINS DELAY
D                        THEN EMPTY ;
E
F   –>
```

Control Forth is very well documented, and the User manual gives a great deal of help in getting used to Forth in general.

The price is £65 for the 16kB ROM and manual, and is available now. For large scale target applications normal OEM discounts apply, or a licence can be negotiated.

3 DDFS £40

Double-density Disk Filing System
DDFS is the firmware for the Euro-BEEB disk system, and runs on CUBE Doublestore (see page 8). The disk format is fully compatible with the BBC micro. DDFS includes the following features:

– Auto-selection of single or double density
– Utilities, including format, in the ROM
– Random File Access
– 128 files per side

4 Sidemon £20

Machine Code De-bugging
This is the standard CUBE machine code monitor which is included in MOSM.3, i.e. with EuroBEEB not fitted with video or Jobber drivers. When any of these drivers is fitted there is no longer room for a monitor, and Sidemon is then available as a sideways ROM to provide these features:

– Memory examine and change
– Hexadecimal and alphanumeric memory dump
– Set breakpoints and go
– Display registers and continue
– Memory copy, verify and checksum (CRC)
– EPROM programmer software

Supplied on its own, Sidemon is charged at £20.

5 ASM £35

6502 Assembly
Control Universal can recommend this assembler for medium to large jobs, having produced over 30kB of object code with it over more than 12 months.

ASM will assemble 6502 code from a source file produced using View, and in addition to the usual symbolic assembly supports the following features:
– Standard 6502 Mnemonics
– Macro definitions (e.g. 65C02 instructions)
– Integer Arithmetic
– More than 20 pseudo-operations
– Conditional Assembly

6 Cross Assemblers £50 each
For a range of single and multi-chip processors

This is a range of disk to disk assemblers which work from standard BBC BASIC but substitute other processor mnemonic sets into the assembler. These complement CUBULATOR (see page 3) in the development of other processor types using BBC and EuroBEEB.

Cross-assembly packages ready now include:
1. 6800, 6801, 6802, 6803, 6301, 6303, 6303X
2. 6805
3. 6809
4. Z80
5. 8080A/8085
The 68008 is promised soon.

7 View £52

Elegant Wordprocessing

View is a fine word processing program designed for the BBC, and in its standard form works eminently well on EuroBEEB. It is particularly useful in an engineering environment for preparing source code for an assembler (see above, no. 5, ASM) and works extremely well with BASIC. Line numbers are then not required, and the program can be laid out in a much clearer fashion using TABs and extra line spaces. Absence of line numbers then discourages the use of GOTO statements, and so supports good structured programming. The source list should have the word AUTO at the beginning, and then the View file is simply called as ∗EXEC<filename>. All TABs and extra line spaces are stripped off when the file is EXEC'ed, and the resulting program can then be re-saved under a different name.

8 View-Sheet £52

View-compatible Spreadsheet

Not yet evaluated, but potentially useful for displaying results from data collection applications. View-Sheet is compatible with the View word processing program (see above).

9 StarBASE £75

Database filing system

The StarBASE ROM provides a disk-based filing system with sort and retrieve facilities, and a utilities disk which provides BASIC procedures which can be called directly from a user's program. This makes it suitable for a self-running data collection system such as the CUBE ADCU (Analog and Digital Collection Unit) or other data-logging applications.

Control NET
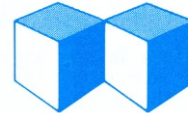
EuroBEEB's Distributed Control System over Distances up to 2kM

The high cost of cabling inputs and outputs to and from a single centralised master computer, and the vulnerability of that cabling to damage and noise have created a strong demand for as much control as possible to be localised. The central computer then performs only supervisory and co-ordinating tasks.

Control NET is a software feature incorporated into the machine operating system (MOS) of EuroBEEBs, which allows them to make use of the serial port on EuroBEEB or the Serio card to communicate between a master unit and up to 32 slaves. The link may conform to either RS423 or RS422; RS422 has the advantage of being more noise immune, and capable of reliable transmission over twice the distance, i.e. 2kM.

Version I

The first version of Control NET was announced in issue 1 of Control Update, and this is being shipped in current deliveries of EuroBEEBs. It provides software to allow simple transmission and reception of data between CUBE systems, but without error checking, and without taking advantage of the features of Real Time BASIC.

Version II

The second version will be available in June 1985, and provides full integration of Control NET into the Real Time BASIC environment, allowing transmissions on the net to be treated as real time events, and providing full transmission validation and error reporting.

Version II combines all of the low-level communication commands of Version I in new operating system calls using the conventional OSWORD and OSBYTE structures, to perform the following tasks:

Select a station
Turn off all stations
Poll a station
Send data to a station
Receive data from a station

Real Time BASIC

Version II works with both Control BASIC and Real Time BASIC, but in Control BASIC the programmer must use the operating system calls. Real Time BASIC provides a highly condensed method of making communications, as these examples show:

Sending a message . . .
STATION Fred = "Hello, how are you?"
Receiving a message . . .
PRINT STATION FRED

The benefits of Real Time BASIC (RTB) become particularly marked when dealing with the receipt of data. Without RTB, the program in the receiving station must either wait for the message to arrive, or poll the input buffer regularly. Either way the duty that the receiving station should be performing will be stopped entirely or considerably slowed down. Under RTB, the program states just once.

WHEN STATION Boss PROCreceive (Boss)
_
_
DEFPROCreceive(A%)
PRINT STATION A%
ENDPROC

and returns. The expected incoming message needs no attention until it arrives and generates an interrupt, in which case it is typically dealt with in 5 mS.

Version II, like Version I, is supplied without extra charge, as a standard part of the machine operating system of EuroBEEB.

Control NET is not yet available for 6809.

Delegate INDIO – Heavy Duty I/O in Real Time Control

INDIO has been a successful member of the CUBE range, providing an interface to the industry standard heavy duty input/output system of the Opto 22/Gentech/Gordos type. Delegate INDIO is introduced to bring the card into line with the standard CUBE Delegate specification, and to make the card compatible with Real Time BASIC.

All the advantages of Control BASIC and Real Time BASIC can now be used with this i/o system which allows inputs to be read and up to 3amp to be switched on 24vdc, 50vdc, 110vac and 240vac systems.

The card costs £67 and is available now.
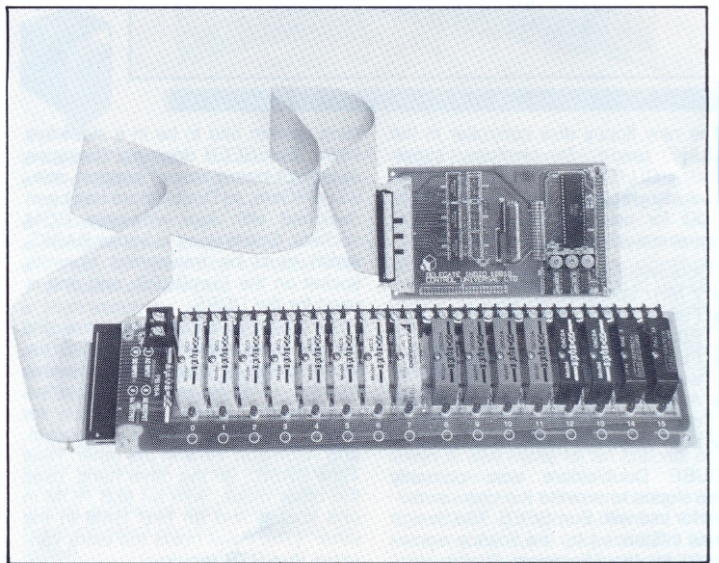
Paging – the SIDEWAYS Idea

Eight-bit microcomputers are very well suited to control applications – they are more than fast enough for most purposes; the wealth of software, especially languages, and their highly economical nature make them ideal for tucking away in a corner, and forgetting, while they do a job reliably for years.

Extending the memory map

However eight bit computers do have an annoying handicap in one area – the limitation of a 64kB memory map. By the time today's sophisticated operating system has demanded 16kB, and some RAM, an advanced high level language has taken the same, and peripherals have demanded some space, the user can be left with little more than a quarter of the total for an application.

EuroBEEB – BASIC and DDFS

Paging is not a new technique; its use in the BBC Microcomputer did much to popularise it, and shows just how well it can overcome memory space limitation. In both the BBC micro and in EuroBEEB, the area selected for paging is hex 8000 to BFFF, which contains, as the most usual paged ROMs, BBC BASIC and the disk filing system (DDFS). Further discussion on sideways ROMs can be found on pages 6 and 7.

CUBE Doublestore

The choice of Microware was influenced by its support of the Western Digital controller chip, which is used on the Doublestore DFS. This remarkable card not only provides the disk controller, but also has four sideways memory sockets. Typically, one is used for BBC BASIC, one for the DFS, and the other two can be combined as an 8kB ROM with Real Time BASIC and an 8kB RAM which contains the special variables needed by Real Time BASIC. Alternatively, these last two sockets can contain two 8KB RAM chips combined into a 16kB RAM area into which sideways ROM software can be read from disk, or as two independent 16kB ROMs. A further possibility is exploited in BEEBSYS-2,3 and 4 (see page 5) and uses these two sockets to contain 16kB of linear RAM, so extending the user RAM to 32kB.

Sideways specifications

The CUBE sideways system supports 64 sideways blocks, which are called in the EuroBEEB with special operating systems calls, and the 6809 FLEX systems by writing to a specified latch.

CUMEM Selecta

CUMEM Selecta provides the carrier upon which sideways ROMs and RAMs can be used. As with the standard CUMEM, the eight sockets are divided into two banks, each of which can be arranged as battery-backed CMOS RAM, as two areas of 16kB, or as four ROM devices of up to 16kB each.

Paging with 6809

There is no paging management provided by FLEX, but the CUBE memory paging system allows the user memory to be extended by up to sixty-four 16kB blocks. These may be ROM or battery-backed RAM, and when selected are treated as part of the main processor map, between 8000 and BFFF.

Paging is exploited by the CUBE-FLEX RAMdisk or Silicon Filing System, due for release in July 1985. (See page 4, under MOSF.3).

CUBE Doublestore

CU-MEM Selecta
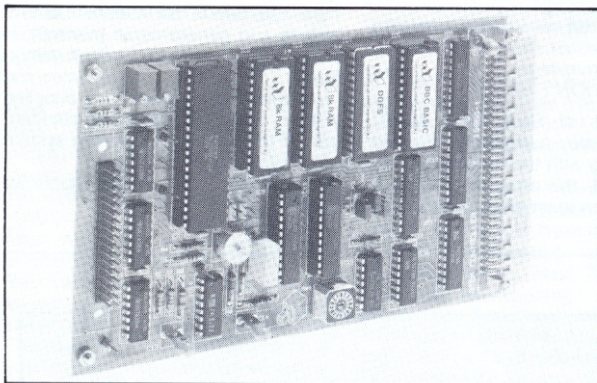
The new floppy disk controller in the CUBE range, Doublestore, supersedes CU-STOR for use with 6809 and also replaces the obsolete 8271 FDC for use with 6502. CU-STOR remains available as a spare only.

Doublestore introduces:
- 2 MHz operation
- Full operation with BBC BASIC on EuroBEEB
- Full compatibility in single density with BBC disks
- Auto-selection of double or single density
- Four sideways memory sockets

CUBE Doublestore was primarily developed to provide the disk controller for use with EuroBEEB. The design was influenced by the licence agreement for the Microware Double-density Disk Filing System (DDFS), and uses the Western Digital 2793 FDC chip.

As part of the EuroBEEB system, the filing system had to be in a sideways ROM. EuroBEEB does not (because of lack of board space) support sideways ROMs. so Doublestore has been designed with four sideways ROM sockets. One is used to house BASIC, which must be transferred from its socket on the EuroBEEB, and one is used for the DDFS.

The other two sockets are spare, and can be used either for two 16kB devices, or as a pair of 8kB devices making 16kB in total. The first arrangement could support, for example, Control Forth in one socket, and Acornsoft View in the other. Real Time BASIC, on the other hand, uses the other mode, with an 8kB ROM in one socket and an 8kB RAM in the other. (The RAM holds the extra variables that RTB requires).

6809 FLEX use of Doublestore takes over entirely from CU-STOR, and leaves two of the sockets free for the user. The main memory in the CUBE
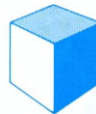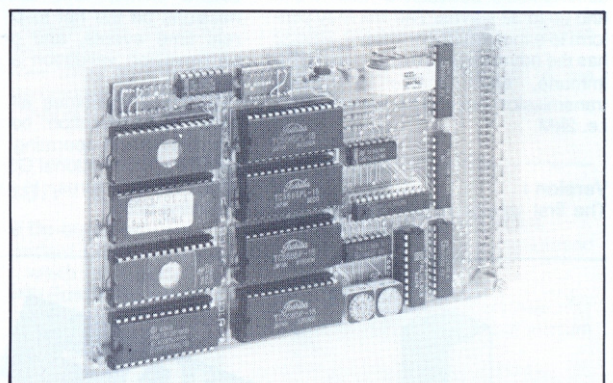
"Selecta" is so named to suggest the ability of this new product to select between the eight memory devices it can carry. It forms part of the Euro-BEEB "sideways" paged memory system, and as such is permanently selected at address 8000 to BFFF.

As indicated above, the CUBE sideways system supports up to 64 sideways 16kB blocks. However, the largest popular RAM chip is the 5565, which is only 8kB. To overcome this problem, either of the two banks of four devices can be selected to act as two pairs of sockets, into each of which can be placed an 8kB device, one to form the lower half of the 16kB, the other the higher. A cunning form of decoding means that these pairs still take up consecutive sideways areas, so use of this facility does not reduce the number of sideways areas available.

Banks not selected for RAMs can each take four 16kB ROMs.

As in all CU-MEMs, battery back-up is provided, so if CMOS RAMs are fitted they are maintained in a non-volatile state after loss of power.

FLEX system is provided on a standard CU-MEM with linear memory from 0000 to 7FFF. The user then has the choice of either putting 16kB RAM in two of the Doublestore sockets, or putting the same RAM chips in the second bank of CU-MEM. Either way they provide linear RAM from 8000 to BFFF, but if on the Doublestore they can be switched out and another sideways area paged in. This could be another pair of 8kB RAMs or two 16kB ROM areas on Doublestore, or any area on CU-MEM Selecta.

Reading Analog Signals by CUBE

Successive Approximation

This is the technique used by the analog to digital converter (ADC) in the old CUBAN-12, and the new CUBAN-12B which replaces it. It works by using a digital to analog converter (DAC) with a comparator and a successive approximation register (SAR). The DAC progresses one bit at a time, starting with the most significant, until the best match is obtained with the incoming signal.

This is an inherently high speed approach, requiring only as many trials as there are bits to be resolved. Both the CUBAN-12 and the CUBAN-12B use a device with a typical conversion speed of 25μs. It is this speed which is the major attraction of this type of converter, and which justifies its price. CUBAN-12B achieves the same accuracy as the old CUBAN-12, of ±1 bit.

Successive approximation converters have a relatively high cost compared to their resolution. This is because of the number of components which have to be of very high quality in order to avoid tolerance errors, including the DAC, the comparator, and even the chip's internal resistors, which must be very stable as temperature changes.

One method of improving performance is to place a sample and hold device in front of the ADC, as has been done in the new CUBAN-12B. This has the effect of "freezing" the exact value of the analog signal the moment it is sampled. Without such a device, the ADC can be trying to measure a moving target, and may return an inaccurate result. See below for CUBAN-12B's other improvements.

N.B. For complete hardware and software compatibility with the old CUBAN-12, the sample-and-hold circuit can be disabled.

Integrating Conversion

This is the technique used by the ADC in the new CUBAN-12A, whose purpose is to provide a larger number of analog inputs on one card, at a lower price than CUBAN-12B. CUBAN-12A has a maximum of 30 conversions per second, with a recommended optimum of 12.5 conversions per second for best 50Hz (mains) noise rejection.

In circumstances where speed is less critical the integrating technique has significant virtues including inherently excellent noise rejection because the approach is essentially an averaging method. Thus a sample and hold is not necessary; the mean value is the one that will be recorded. Secondly, this approach can be realised at much lower cost, and CUBAN-12A offers twice as many inputs for little over 80% of the price. The other features are listed below.

Integrating analog conversion, in this case, uses the dual-slope method. The ICL7109 device first performs an auto-zero, and then the input signal charges a capacitor during a fixed time period. From this moment the capacitor is discharged through a known load and the time measured until the voltage reaches zero. The time taken is proportional to the input voltage, and can be measured easily, accurately and with good temperature stability.

A further advantage of integrating ADC's is their accuracy – the ICL7109 is specified at ±0.5 bits, with ±25ppm/deg C as its temperature stability. In addition it produces a sign bit, providing effectively a thirteenth bit.

CUBAN-12B Fast Analog Interface from £295
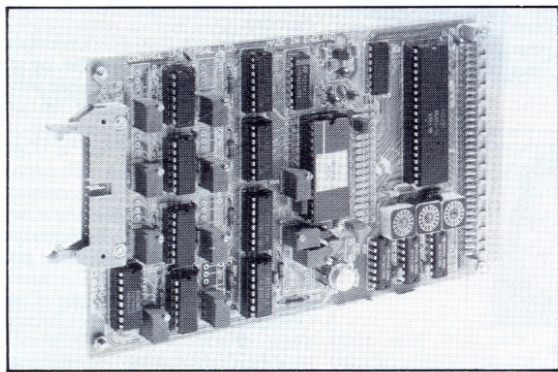
- 12 bit, Accuracy: ±1 lsb
- 8 channels single-ended
- 25μs conversion time (typ) accuracy
- Fully compatible with CUBAN-12
- Can take four 12-bit DAC's
- From £295 one off (with ADC)
- Unipolar or bipolar operation
- Sample and hold for AC
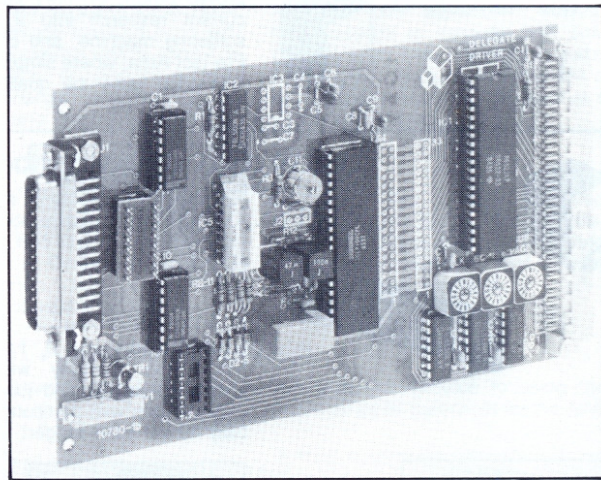- Optional DAC bipolar operation
- DAC's set to 0v on reset

CUBAN-12B is the successor to the very popular CUBAN-12. This entirely new design uses a standard Delegate interface as with the CUBAN-12A, and makes several major and numerous minor improvements.

Perhaps the most important is the provision of sample and hold which allows more accurate reading of fast changing signals. In addition, the Digital to Analog outputs (DAC's) now set to 0v on reset, and now feature optional bipolar operation, with a maximum range from −10v to +10v.

At the same time it has been possible to reduce the price by rather more than 10%

CU-DAC 12 Twelve-bit Analog Output Card

CU-DAC 12 is derived from CUBAN-12B, and offers a choice of two or four 12 bit digital to analog converter (DAC) channels, at £155 and £215 respectively.

N.B. The ADC chip cannot be retrofitted to CU-DAC 12.

CUBAN-12A – Integrating ADC £245

- 12 bit + sign bit
- 16 channels single-ended or 8 differential
- Convenient 1mV/bit
- Alterable down to 0.1mV/bit
- 25-way "D" connector for round wire or ribbon cable inputs
- High accuracy: ±½lsb
- Sign and over-range signals
- Optional minus 5v converter
- Input overvoltage protection
- Excellent noise rejection
- Optimum 12.5 conv/sec

CUBAN-12A is the result of much customer demand for a lower cost accurate 12-bit analog interface. It uses the integrating technique (see above) to achieve excellent accuracy and noise rejection.

The user can just switch from single-ended to differential mode, and then uses two adjacent input lines for the signal.

Both Real Time BASIC and Control BASIC support CUBAN-12A, simply by using ADVAL, followed by the channel number.

The common mode capability in the differential mode allows the signal low to float by ±3v with respect to the card analog ground. The card is supplied ready set to make 12.5 conversions per second, for optimum protection from mains (50Hz) effects. This setting can be altered up to 30 conv/s.

CUBAN-12A requires a −5v supply; all CUBE racks have this supply, but provision is also made for an optional on-board converter.

When supplied, the input scaling is set to ±4.095v, giving a convenient 1mV/bit over a full scale range of 8192 bits; this can be changed down to ±0.4095v for reading small signals.

PEOPLE

New Jobs

Sue Sebborn

Promoted to Commercial Manager from Personnel Manager, she retains her personnel duties, but takes on the running of the Customer Services Department, which includes the Sales Office, whose duties include sending quotations, processing orders, handling progress calls, and shipping the goods. This department also looks after repairs.

Sue is assisted by Rosemary Toull, Pat Summers and Jane Coppola.

Peter Watson

Peter is now Marketing Manager, having been deputy Sales Manager. His duties cover all promotional activity, including exhibitions, advertising, brochures, technical manuals and the catalogue. Customers will notice his impact first in the excellent new technical documentation, in which the efforts of his team, Keith Hodson, Janine Lettau, Philip Mann and Rachael McLean have been invaluable.

Russell McDonnell

Russell has moved from Test to Production, where he evaluates and improves production methods, such as current research into a new flow soldering machine, and controls the Pre-test Area, where simple tests and inspection raise the quality of work passing to Test.
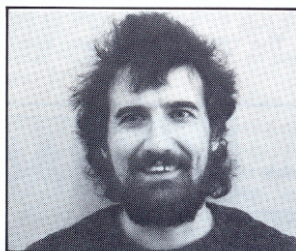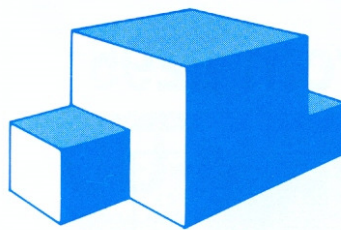
Rosemary Toull

Rosemary becomes Customer Services Supervisor, which, compared to her previous role of Shipping Supervisor, gives her a much wider role for chasing the progress of an order through the system from receipt to shipment. Rosemary will be able to give authoritative answers on orders progress wherever they may be in the system, and will ensure that they don't get stuck.

Lesley Monshall

Lesley, who is the company's longest serving employee, now works with Russell in the pre-test department. She was formerly a Technician with Engineering.

New People

Rachael McLean

Rachael is a school leaver providing the Marketing Department with general clerical services, and in particular looking after the customer data base.

Ken Fullbrook

Ken joins the Sales Team, led by Richard Baker, as Sales Engineer for the South and West Area. This includes southern England, from Central London westward, and South Wales. He was formerly an Engineer with Imperial Tobacco, and has been a CUBE user for many years.

Linda Evans

Linda was formerly with Addenbrookes Hospital, and joins the Accounts Team with particular responsibility for the sales ledger.

Chris Johnson

Chris joins us from Croydon College, as a Technician in the Engineering department.

Chris Tucker

Chris was formerly with the University of London, and joins us as a Software Engineer.

Jane Coppola

Jane is on a temporary assignment with us before going on to University. She is helping Personnel and Engineering with their clerical tasks.

Carl Whisken

Carl is from a retail background, and now assists Doug Nelson in the Stores.
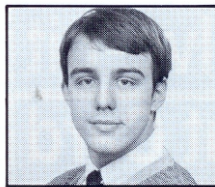
Pip Luscher

Pip was a former Test Engineer with Vaughan Systems, and has spread his wings and joined the company as a Junior Internal Sales Engineer.

Barclaycard and VISA Deleted

In common with many other companies, we have been unable to agree with Barclaycard their levels of commission and their terms and conditions, which we consider unreasonable.

Control Universal therefore gave notice to Barclaycard, and closed their account. We regret any inconvenience that this may cause to customers. Access remains entirely acceptable.

Eurocheques

We would also draw your attention to the new Eurocheque system. Eurocheques are guaranteed up to £100 each, and may be drawn in Sterling on both UK banks and participating European banks, no matter what currency the account is held in. There is no limit to the number of cheques that can be used for one transaction, and we can therefore accept the necessary number of Eurocheques for immediate delivery on goods of any value.

REPAIRS

Things you should know about our repairs procedure.

1. Return the goods marked "Repair" and accompany them with full details of the problems. PLEASE LABEL THE GOODS WITH YOUR NAME.

2. If the repair is to be carried out under guarantee, please include the date of delivery and the invoice number.

3. Repairs are then acknowledged by us with a note of the Log No. by which the goods will be known while with us, and whether the repair is under warranty or not.

4. If the repair is not a Control Universal product, we will generally return the goods to the manufacturer or importer, and will therefore take a little longer. If you wish to check on the progress of non-CU repairs, please ask to be put through to Purchasing.

5. Any progress calls on Control Universal repairs will be put through to Test.

6. When the repair is finished a Service Report will be completed and, if not under warranty, time taken on repair and parts used will be indicated, and sent back to the customer with the despatch note.

7. All Control Universal products not under warranty will be charged for repairs at £20.00 per hour plus parts.

8. Non Control Universal products not under warranty will be charged the rate the supplier charged us plus a handling charge.

9. All repairs must be sent to us at your expense. Warranty repairs will be returned carriage paid.

Progress Calls

Orders
Please ask for Rosemary Toull or Pat Summers

Warranty Repairs
Please ask for Test

Non-Warranty Repairs
Please ask for Purchasing

Complaints (Surely not!)
Please ask for Sue Sebborn. Calls will not be put directly through to the Directors, but Sue will refer any matters to them.

Company History

Part 1: Origins – AIM 65 – Cubit

Jon Dane in 1977

Dave Hunt
ITT "Director" Programmable Controller project.

Control Universal was founded in Harlow, in November 1978, when Jon Dane resigned his leadership of the

ITT Director Programmable Controller

The decision to create Director had been taken when, in 1975, a story appeared in the technical press claiming that microprocessors would drop in price below £10 the following year. Dane realised that there was potential here for replacing electronic timers and relays in automation projects, with which he was involved at the time. Al Jenkins, the ITT Group General Manager, had the foresight to back the

project, and within eighteen months the Director was on sale, and within three years was selling at the rate of $1M a year.

However, Dane felt that his role in this product had been fulfilled, and decided to take an independent line, and started a company whose very name epitomised its belief in the future of microprocessors in Industrial Control – Control Universal.

1979: Rockwell AIM-65

The first intention was to provide a programming service to customers of the Director, and to work with Tony Odell and Rod Morgan in the Morgan-Odell Partnership, an industrial design firm.

However, work did not come in quickly enough: Dane was working

from a back bedroom, and without resources, and it was necessary to create a turnover quickly. Pelco had just introduced the Rockwell AIM-65 into the UK. Dane recognised its virtues, and arranged with Pelco to sell this new microcomputer.

The first manufacture

It soon became apparent that the AIM-65 needed a case and power supply, and more memory. The first two were soon produced, and sold to companies and colleges, particularly Imperial

College. A supplier of extension memory boards, "The Computerist" was found in the USA, and CU started importing them and fitting them to AIM-65's.

Bye-bye back bedroom

By September, 1979, there was enough going on, with AIM-65, cases and power supplies, and Dartmaster, to necessitate some proper premises, and the first move, into 250 square

feet, was to a room above Texas Homecare, in Harlow Town Centre. Hunt joined the company full time at this point.

"Dartmaster"

In the summer of 1980, Control Universal was approached with a view to producing an electronic darts scorer for use in pubs. Dane approached a former colleague at ITT, Dave Hunt,

who agreed to perform the development. This was done on an AIM-65, using cassette to cassette assembly, with only 4kB of RAM memory.
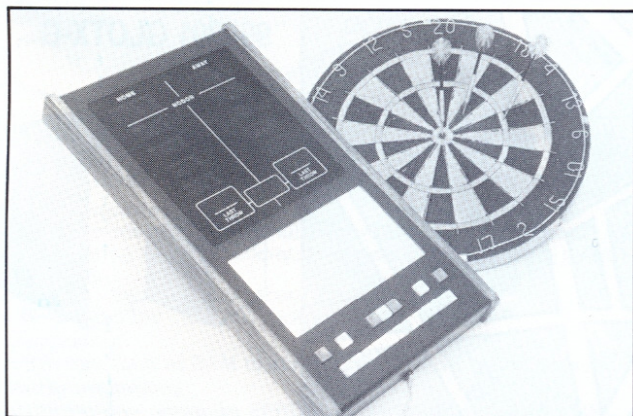
*Nodor Dartmaster*

1980: Move again

Production of the Dartmaster necessitated the first move, into the luxury of 400 square feet, above a trophy shop, in Bush Fair, also in Harlow. About 400 were eventually made, and to

cope with this production Lesley Monshall joined the company, to assemble them, and Derek Sapsworth, to test them.

Bush Fair 1981

BCCI Foreign Exchange Calculators
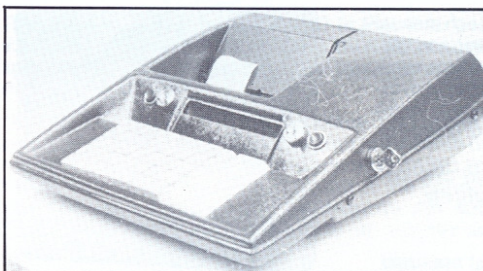
BCCI Forex Calculator

In the largest job up to that time, a city bank, BCCI, commissioned 24 units based on AIM-65, with special keyboards, battery-backed CMOS RAM, and an enormous machine code program. Their purpose was to speed up the calculation of over-the-counter foreign exchange dealings in the Bank's City and West End branches.

Although the code was written by John van Someren at the bank, Control Universal assembled it, using the AIM-65's own assembler, working from cassette to cassette with only 12kB of RAM. This took an hour and a half for each iteration, and needed a lot of finger-crossing to ensure that it did not fail halfway through.

High technology – disk drives!

Clearly, the inefficient method of machine code assembly, using cassette tapes, had to be improved, and CU bought a Computerist system, costing nearly £1000, until then, the biggest investment ever made by the

company. This greatly improved Hunt's ability to create new products, and he and Dane started considering how to better extend the AIM-65 than the Computerist approach.

The first Acorn connection

An Acorn System-1 single board computer had been bought for the Dartmaster project, but had not been used,

and was the stimulus to using the Acorn range of Eurocards for the AIM.

Cubit: The range begins

The means of linking the AIM-65 to Acorn units was to remove the AIM's processor (a 6502, the same as Acorn used, most conveniently) and use long wire-wrap tails on a socket on the Cubit to pick up all the processor connections. The Cubit board then provided an extra 4kB of RAM, another 4kB ROM socket and a VIA. Finally, all the processor lines were taken to a 64 way DIN connector, where a ribbon cable could link them to the Acorn bus. The most important decision of all, perhaps, was to include an oscillator on the Cubit (which was designed as an extension and interface board) so that, when removed from the AIM-65, it could function as an independent computer.

In starting to manufacture computer boards, particularly a cpu board, Control Universal, by then a limited com-
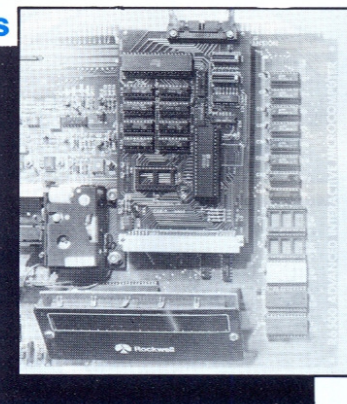
Cubit as an extension to AIM-65

pany since June 1980, was taking the important first steps towards becoming a substantial industrial computer manufacturer.

Next Issue: Scripcounter, Audiometers, CUMEM, and the move to Cambridge.

New Documentation

In addition to the list shown in Control Update issue 1, the following new and revised documentation has been released.
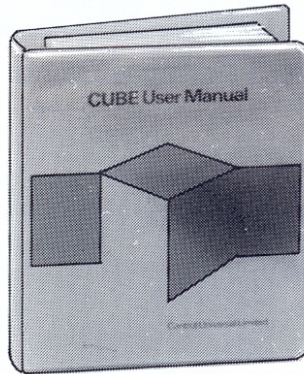
Free technical manuals

	Issue No.	Date	Order code
CUBE Doublestore	2	4.85	CU2000D
CU-MEM Selecta	1	4.85	CU0501D
Jobber Interface Card	2	4.85	CU4900D
MOSB.3 (incl. Control BASIC)	1	4.85	CU6602D
MOSF.2 Monitor	1	1.85	CU6602D
Teletext Peripheral Driver	1	11.84	CU4002D
Watchdog	2	3.85	CU1800D

New levels of excellence

Starting with the manuals listed below, the standard of document presentation is dramatically improved. Each manual is supplied with a card cover and clip, and punched with standard 8cm spacing holes. A plastic ring binder is available for holding these manuals, which is of course supplied without charge on each system.

The following, substantially extended manuals will be available shortly:

New chargeable technical manuals

	Issue No.	Date	Order Code	Price
EuroBEEB SBC	3	4.85	CU6599D	£10.00
CUBAN-8	3	4.85	CU0800D	£5.00
CUBE Teletext	3	4.85	CU4000D	£5.00
Delegate INDIO	3	4.85	CU1301D	£5.00
A5 PVC ring binder	–	–	CB000AA	£5.00

New Product Leaflets (no charge)

CUBE EuroBEEB 6502 Development System	CA652DS
CUBEFLEX 6809 Development System	CA689DS
CUBE Control FORTH	CA650CF
CUBULATOR	CA430AA
CUBE Serial Terminal	CA642AA
CUBE Development Workstations	CA000WS
CUBE Range of Eurocards	CA000CE

New Part Numbers

Sorry to do this to you, but we have changed all CUBE part numbers, hopefully to improve clarity for everybody. Enclosed with this issue of Control Update is a full new price list with new and old part numbers, and current prices.

New Blue EuroCards – The 2MHz Standard

With immediate effect most of the CUBE range is being upgraded to 2MHz performance, sometimes without extra charge, sometimes with a small premium. Those cards capable of running at 2MHz will be produced on blue coloured pcb's, so making the 2MHz CUBE range distinguished in every way.

Those cards not capable of running at 2MHz are CU-GRAPH and CUBAN-8, because the makers of the main chip used on these products do not supply 2MHz versions. Obsolete products (see below) will also not be upgraded to 2MHz.

Obsolete Products

CUBIT, CU-NINE, 8271 FDC, CU-STOR, single sided backplane, and all non-current issues of current products are obsolete.

However, Control Universal recognises that its customers may sometimes wish to obtain obsolete products in order to maintain exact continuity with products already in the field. It is our policy to help where possible, although we may be restricted by chip availability, and we reserve the right to quote an economic price for a special production run, and to quote a minimum quantity.

New Backplane

To ensure reliable operation at 2MHz, there is a new (issue 3) backplane. This places all the data tracks on the same side of the board, and covers the entire other side of the board with two very wide copper planes; the wider one is ground, and carries the voltage returns, and the other is at 5v, and, being designed for 2MHz, this new backplane is, of course, blue.

wide, ensures a minimum volt drop between one end of the backplane and the other.

In addition, the data lines are terminated with resistors to further insure against unwanted noise effects. Being designed for 2MHz, this new backplane is, of course, blue.
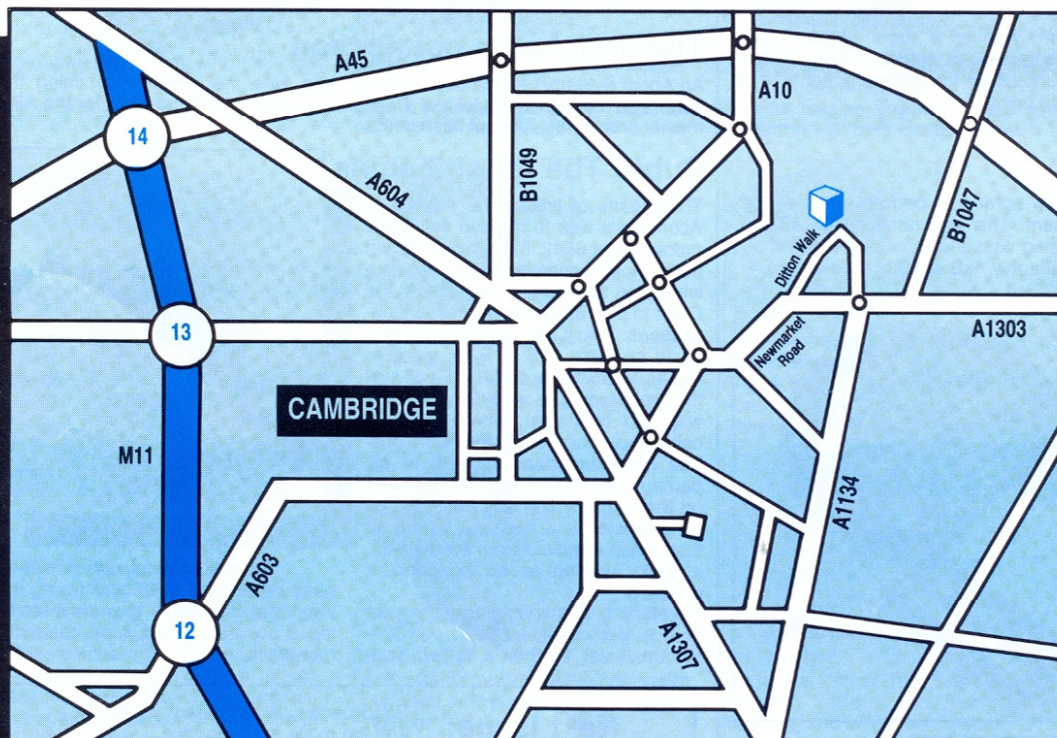
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