The Flight 8086 Training System

Training package eases pain of moving from 8 to 16bit based systems

The world's first microprocessor was the Intel 4004 way back in 1971. In 1972 Intel produced the 8008 (the first 8bit microprocessor). Unfortunately it needed at least 20 additional devices to produce a functional cpu. Two years later in 1974 Intel produced the 8080 microprocessor.

It had a much larger instruction set and only required two additional devices to produce a fully functional cpu. It was also the first time nmos technology was used and the device became the first (serious) general purpose microprocessor.

This was soon superseded by the 8085. Around the same time the Motorola (mos) 6502 and MC6800 8bit processors appeared on the market.

In 1978, Intel produced the 8086/88 16bit microprocessors which Motorola soon followed up with the MC68000.

The 8088 was chosen as the microprocessor for the IBMXT model personal computer. The rest, as they say, is history!

The 8086 is a true 16bit machine which means that the ALU (Arithmetic Logic Unit) is designed to work with 16bit numbers and the data bus is also 16bits wide, because the 8088 is hybrid in that the alu is 16bits but the data bus is 8bits. In almost every other respect the two processors are identical. It is possible to address 1 Mbyte of memory with the 20bit address bus. Both devices have time multiplexed address and data buses and some of the control pins have more than one function depending upon whether the device is operated in the min or max mode.

The min mode is designed for small single processor systems whilst in the max mode the device is designed to work in medium or large systems using more than one processor. Incidentally, the 8086 is some 7 to 10 times more powerful than the 8080. To speed up execution time, instructions are pre-fetched or pipelined into the microprocessor thereby almost eliminating instruction fetch time. This has been achieved by incorporating two separate processing units inside the 8086. The bus interface unit (biu) and the execution unit (eu). Basically the biu fetches instructions and the eu executes them.

One of the problems with moving to a new processor is having to learn a completely new set of instructions so that effective assembly language code can be written. Intel has designed its processors so that they are upwardly compatible (all the way up to the 486). Code written for say, an 8085 system will also run on an 8086 system. What you can't guarantee is the reverse since the 8086 has instructions that the 8085 doesn't. But if time is tight, then upgrading to the 8086 does not pose much of a problem or those familiar with the 8080/8085/Z80 microprocessors.

Programs do not have to be written exclusively in assembly language. The processor is designed to provide direct hardware support for programs written in high level languages such as C.

There is now a widespread requirement for 16bit devices to be made available for student use. In the BTEC HNC unit 'Microcomputer Systems H', for example, it specifies the comparison between suitable 8 and 16bit devices. Obviously this can only be achieved if a 16bit device is available.

Other BTECunits such as Microprocessor Based Systems H and Microprocessor Fault Diagnosis H, benefit greatly from the availability of 16bit systems.

Additionally, the City and Guild's RTEEB Microprocessor Fault Finding unit has been successfully taught using 8086 target boards. Interfacing techniques and digital communications can also be explored with the right equipment.

Why Choose the 8086?

The first answer might be — well I'm already familiar with the 8085 and Z80 8bit microprocessors and I need to learn how to use a 16bit system quickly!

Secondly, there is a wealth of support chips designed to interface with this processor and many of them cost less than £5!

Thirdly, the pc market which uses Intel based devices takes up some 60% of the total microprocessor market! The other main processor used by industry is the Motorola 68000 family of mrcroprocessors.

Fourthly, and perhaps most importantly, there is an excellent all round educational package available – namely the Flight 86 from Flight Electronics International.

The major problem facing educators and students is finding a complete (student centred) 16bit microprocessor learning package. When upgrading to a new system it is necessary to consider not just the hardware and software cost but staff expertise and in service training. Ideally, educational establishments require packages that are versatile. Often it is necessary to justify your choice by indicating what range of courses can make use of the chosen system. If, for example the chosen system can be used over a wide range of microprocessors, then the capital expenditure can be more easily justified.

The Flight 86 system is a complete learning package. The 8086 Controller Board is designed to simplify the teaching of the 8086 cpu and some of its commonly used peripherals. It can be linked to most PCs with a simple serial line, so that code may be assembled and debugged in a supportive software environment before being down-loaded into the ram on the board. The board itself may then be linked to other peripherals.

Once downloaded, the code may be executed and examined in a system which is accessible to the user. Data may be manipulated on the board and the effects viewed on the pc. The software which handles this two way transfer is supplied with the board, in the form of a monitor program resident on the board in eprom, and a disk containing the 'host' software for the pc.

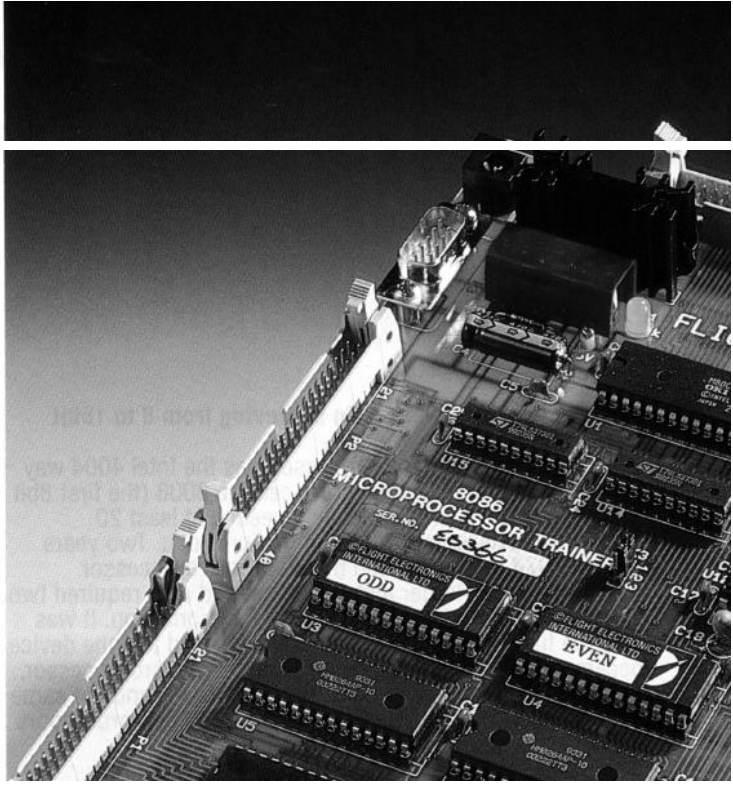
Apart from its use linked to a pc, the board may also be used independently, under the control of the user, either for fault finding on 8086 systems, or for control projects. For fault finding exercises! a number of test routines are supplied with the monitor eprom which enables many faults to be investigated using simple 'scope techniques'. The accessibility of components on the board means that the faults may be easily applied.

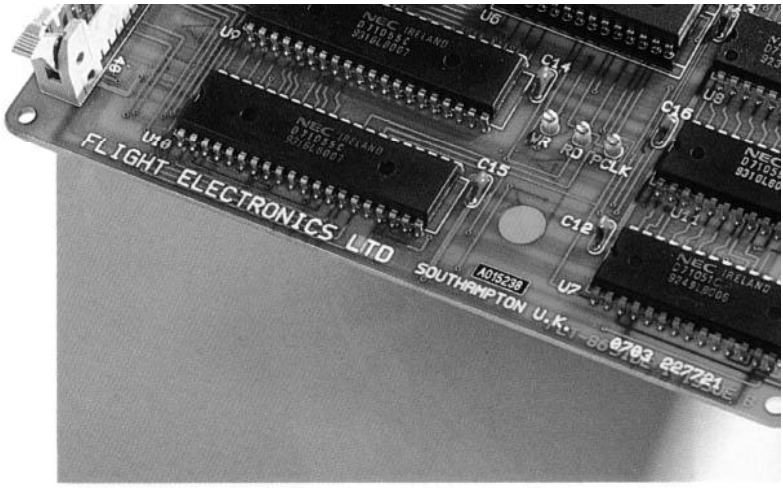
In control applications, the board is ideal for projects from the simple 'flashing led' variety, to sophisticated, real time systems such as floppy disc controllers. The control program can be blown into the board's eproms either in place of, or in addiiton to, the monitor program already present. The board then becomes a powerful stand alone control system. The development and testing of the software is helped enormously by using the system linked to a pc initially, and downloading development code into ram.

Most importantly it comes with a comprehensively written (and easy to read) Technical Reference Manual and a set of well documented and technically accurate experiment books taking one through from simple rom/ram testing to multiple interrupt routines, using Flight's experiment board.

To justify that initial capital expenditure the FLIGHT-86 can be used over a wide range of courses.

FLT-86, 8086 Training System 131-200





The Intel 8086 is probably the most commonly used 16-bit microprocessor of all time, and the heart of many personal computers.

The Flight-86 system, designed by top British educationalists and built in the UK by Flight Electronics, is specifically intended for teaching all aspects of the 8086 microprocessor and many of its commonly used peripheral devices, to students and engineers.

The system hardware, housed in a sturdy book-style case, is serially linked to a PC allowing code to be assembled and debugged in a software supportive environment before downloading to the on-board RAM.

Powerful expansion options

Hardware interfacing of peripheral devices is achieved by two parallel I/O ports which are pin compatible with existing Flight products. Further expansion is possible via the processor bus connector.

Extensive hardware features

- Full address decoding
- External processor bus expansion
- Dual 16-bit (8255) programmable I/O ports
- Programmable interrupt controller (8259A)
- 7 levels of prioritised interrupts
- 3 channel programmable counter/timer (8253)
- Fully buffered programmable serial port (USART 8251A)
- 16Kbyte EPROM expandable to 64 Kbyte
- 16Kbyte RAM expandable to 64 Kbyte
- Non-maskable interrupt button
- Hardware rest
- I/O connections compatible with other Flight products
- Power supply included
- Sturdy book-style case

Monitor Features

- Help - lists all monitor commands
- Line assembler
- Dissassembler
- Examine/alter any register
- Examine/alter memory
- Full specified memory area
- Set breakpoint
- Single Step
- Trace
- Upload Intel extended) hex
- Printer on/off
- Download Intel (extended) hex
- Test command (for ROM, RAM, baud rate and console mode)

Documentation

In our opinion, it is essential that a high quality product is supported by documentation of the same calibre.

The Flight-86 technical reference manual has been written by specialists in teaching microprocessor technology at all levels. Its well thoughtout layout and careful expansions offer a step-by-step guide to the hardware and software option.

Monitor source code listing and circuit diagrams are fully detailed and comprehensive data on all the major chips is also included.

Ordering Information

Description	Part No.
Flight 86, 8086 Training System	131-200
Switch & Lamp Unit	461-004
Applications Board	010-042
4 mm I/O Module	611-001
BTEC 'H' Level Course	136-001
2500AD Macro Cross Assembler	131-201
Programming the 8086/8088 Manual	266-011

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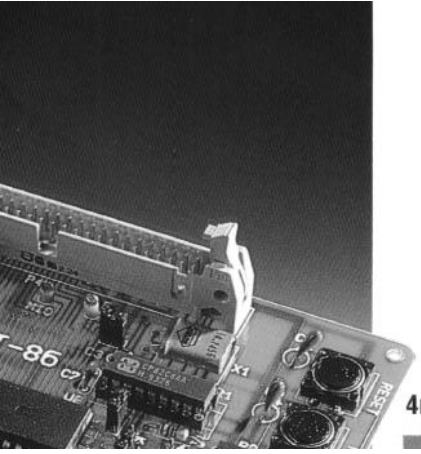
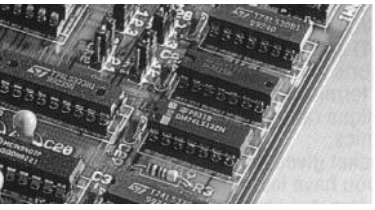
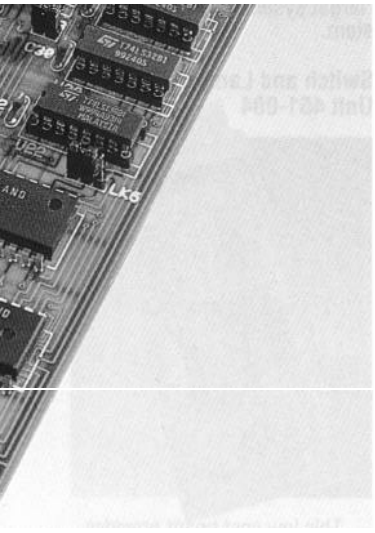
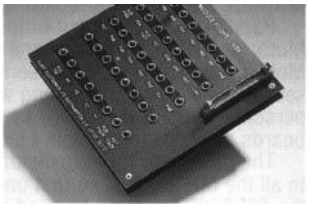






Made in U.K.

4mm I/O module 611-001



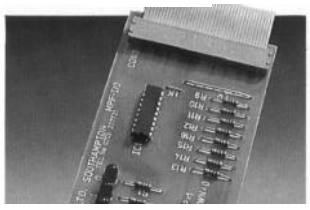
The 4mm I/O Module enables the I/O connectors on our range of microprocessor training systems, to be brought out onto clearly labelled 4mm sockets.

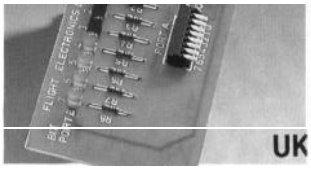
This enables our systems to be easily linked to peripheral units using the 4mm standard.

The extremely robust design will give many years of reliable service.

This means you can now connect all of our products easily and efficiently to other manufacturers systems that you may have already purchased.

Switch and Lamp Unit. 461-004

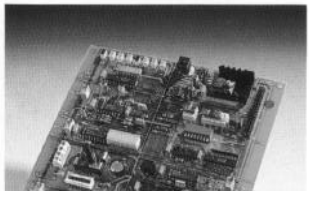




This low cost board provides the ideal introduction to interfacing microprocessors. Eight large LEDs give a clear indication of output conditions, and eight lever switches enable data to be fed directly to the computer in digital form.

For engineers or advanced students this board provides a useful way of simulating I/O conditions for program debugging purposes.

Applications Board 010-042 (see page 2)



This popular product is designed to teach microprocessor interfacing and control principles.

The board is supplied with a mains adaptor, user's manual and experiment manual with exercises and worked examples. Interfacing with the entire range of Flight Electronics microprocessor training systems, the board contains the following components:

- 8 digital input switches
- Temperature sensor
- Light sensor
- Motor with optical revolutions detector
- Potentiometer
- Analogue input/output
- 8 LEDs for output
- DC motor
- Analogue
- Heater for temperature control applications

MANUALS AVAILABLE

BTEC 'H' level course – Microprocessor systems 136-001

Unit reference:
Weighting: 1 unit

Comprising two experiment and two answer books, this course is designed to give students 'hands-on', practical experience of the 8086 microprocessor, as well as associated peripheral chips. This course is tailormade for use in conjunction with the Flight-86 training system.

A series of graded experiments takes students through various tasks from conception to implementation. Because it is an 'H' level unit, the course assumes some previous knowledge of microprocessors. Subject areas include: program development techniques, 8- and 16-bit microprocessors, design methodology and solutions to engineering problems.

Programming the 8086/ 8088. 266-011 Publisher: Sybex.

This book will teach you how to get the most from the 8086 and 8088 microprocessors - from the internal architecture to the advanced addressing modes. Specifically, you will learn:

- Basic concepts of microprocessor programming
- The internal structure
- Memory organisations
- The complete interrupt structure
- Input and output techniques
- How to use the 8088 to control the IBM PC and much more.

Sample programs make the instructions provided easy to understand.

The specific difference and similarities between the 8086 and 8088 are covered in detail.

This book is recommended for advanced users of the FLIGHT 8086 based microprocessor trainer.

SOFTWARE AVAILABLE

2500AD 131-201

Each 2500AD Compiler includes the C Compiler, Macro Cross Assembler, Linker, Librarian, High Level Simulator/Debugger and Object Libraries.

Summary

Whether teaching a simple control application such as flashing an LED or understanding the sophistication of real time control of floppy disks, the Flight-86 offers a **low cost,** readily expandable **target board.** When using the on-board ROM, the Flight-86 becomes a powerful, stand-alone control system.

By using your existing PC, the Flight-86 represents a highly cost-effective development system which benefits from the availability of a large selection of off-the-shelf software.

With the introduction of the fully compatible BTEC 'H' level course books, the Flight-86 fault finding course books and existing Flight peripherals, customers' total 8086 microprocessor training system requirements are now available from a single source.

Flight Electronics International Limited