# Microcontroller Trainer FLT-8032/51



The Intel 8030/8050 series of microcontrollers are widely recognised as standard computers for incorporation into a range of products from electronic washing machines and vending machines through to Programmable Logic Controllers (PLCs).

Their simplicity makes them ideal for situations where it is necessary to quickly set up a control system. There are 32 I/0 lines, memory addressing for up to 64K and optional RAM, EPROM or masked programmed ROM n these range of controllers.

The 8032AH microcontroller chip chosen for the Flight-32 training system has 256 bytes of internal RAM but no ROM. In addition, the Flight-32 has 8K x 8bits of RAM (expandable to 32K) on board, and a monitor EPROM. This arrangement was chosen for maximum flexibility to allow a selection of EPROM-based languages and applications to be utilised. The assembly language for the 8032AH is identical to that for the other members of the family, including a range of processors made by Philips, Siemens and Harris. Experience with the Flight-32 will give students a thorough grounding in industrial microcontroller technology.

Although the Flight-32 is supplied with the 8032 chip, the 8031, 8051 and 8052 chips can easily be substituted or ordered, as can the 8052 BASIC version. This facility gives extra operational and teaching flexibility to the system.

The monitor is delightfully simple to use and has been written in a style comparable with the Flight 68K monitor. So for those who already use the 68K, there is no need to learn another set of command conventions. There is also an alternative FIRMWARE ROM available called HITOP51 lite (see software available).

Everything you need to get up and running, including a power supply and cable to connect the Flight-32 to a terminal or to a PC running terminal emulation software, is included.

Also supplied with this training system is a full set of documentation, comprising:

- User Manual Contains details of the hardware and software. Includes a list of monitor commands and assembler mnemonics, carefully explaining the operation of each.
- Manufacturer's IC data sheets -Data is included on the 8032AH and the 8255 PIA to allow the user to exploit the system hardware to the full.

Hardware Features

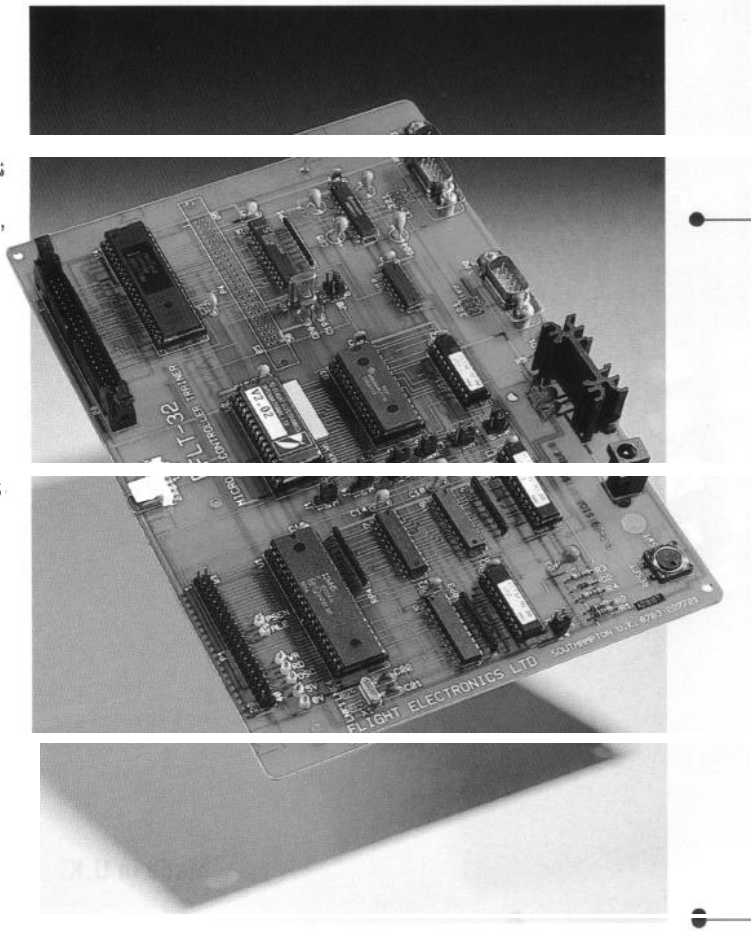
- 8K x 8 bits RAM expandable to 32K on board
- 2 full specification RS232 ports
- 24 bits of parallel I/O on board
- Bus signals brought out to socket
- Test points for system timing, oscillator, read, write, ALE and P SEN

Monitor Features

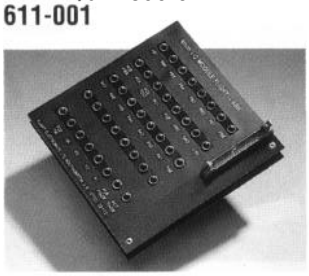
- Comprehensive 'Help' system
- Line assembler
- Disassembler
- Break points
- Single stepping
- Registers display/change

Optional Software/Firmware
NOW AVAILABLE:

- 8051 PC based cross assembler and C compiler




4mm 1/0 Module
611-001



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

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

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

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

Ordering Information

| Description | Part No. |
|---|---|
| Flight-32 Training System | 131-300 |
| 8052 BASIC Version of processor | 131-001 |
| Application Board | 010-044 |
| Switch & Lamp Unit | 461-004 |
| 4mm I/O Module | 611-001 |
| HITOP 51 LITE | 477-059 |
| 8051 PSDA | 250-020 |
| HITOP Graphical Monitor | 250-021 |
| ANSI C-Compiler | 250-022 |

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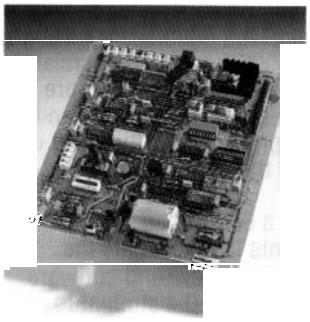
## Application Board 010-044
(see page 2)

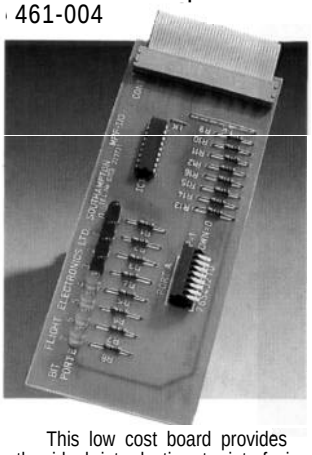


This popular product is designed to teach microprocessor interfacing and control principles.

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 bargraph
- Heater for temperature control applications

## 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.

## SOFTWARE AVAILABLE

### 8051 Professional Software Development System (PSDS) 255-020

The 8051 Professional Software Development System for DOS provides high level and assembler level programming support for the FLT-32. The package includes:

- optimising C compiler and supportlibraries
- relocatable macro cross assembler
- relocating linker
- library manager
- Unix-like make utility
- terminal emulator
- editor/workbench environment
- on-line help utility

The C compiler supports floating point arithmetic, interrupt routines, in-line assembler code and many ANSI features. The cross assembler generates fully segmented, relocatable code and places unresolved complex expressions in the object file for evaluation during the link phase. The linker combines the object modules created from both C and assembler source and object code libraries to create a single executable program that can be immediately downloaded to the FLT-32. The editor/workbench provides full support for the development process including multi-window, multi-file text editing, integration of the compiler, assembler, linker and terminal emulator, and hot-key access to the help utility.

### HITOP 51 lite 470-059

The HiTOP51lite monitor is a fully windowed monitor which allows you to debug assembler or High Level Languages such as C or PLM at source level. It boasts all the same features as the full HiTOP51 but is limited to a maximum of 4K application of code.

With the Hitop51 monitor you can single step in assembler or HLL, set breakpoints and run code.

The monitor allows you to examine and change any memory area of the 8051. Special watch and examine windows can also be used to display program variables including advanced types such as arrays and structures. All variables and memory areas can be examined while the code is running.

A set of user windows allow you to examine and control each oerioheral of the 8051 and its more advanced variants.

The monitor includes an in-line assembler so that simple machine code programs can be entered without having to use an editor assembler of linker.

### ANSI 'C' Compiler for the 8051 255-021

'C' is a general purpose programming language which combines structured programming, versatile data structures, code efficiency and a wide variety of mathematical logical and string applications. The availability of C for many of the common microprocessors allows the use of generic 'C' code in many different applications with little or no modification.

The Keil ANSI 'C' compiler offers a way to program in 'C' which truly matches assembly programming in terms of code efficiency and speed. The Keil C51 compiler may be used for all members of the 8051 family.

Keil C51 provides full support for the 8051 architecture and can address all the system components. Each variable can be explicitly located in any memory type. Frequently used variables can be located in internal memory to yield faster access times and larger data structures can be directed to external memory.

Interrupt service routines for the 8051 peripherals may also be written directly in 'C'. The compiler will generate efficient entry and exit code, accommodate register bank switching and generate code for the interrupt vector.

The Keil Compiler can produce code in the Intel Object Format (OMF51) and includes complete symbolic information making it compatible with the HiTOP Monitor.

#### Features:

ANSI approved 'C' Compiler
Supports All members of the 8051 family

#### Includes:

Utility Software
LIB51 Library Manager
OHS51 object file convertor to intel HEX format
SHELL Support shell for DOS

Comes complete with six run time libraries with over 100 Functions.

#### Also Available

"C51 Primer" An in-depth guide to the Keil C51 compiler all the tricks and tips you need to know to get the most from this compiler.

"C & The 8051" A complete embedded systems course based on the Keil compiler and the 8051 microcontroller. This text starts with a guide to planning the software and hardware of a project and works its way up to multitasking and distributed processing on the 8051.

### HiTOP Graphical Monitor Interface 252-022

The HiTOP monitor is a windowed graphical interface which may be added to existing flight trainer boards. The HiTOP monitor gives you many of the features normally associated with a full in circuit emulator but at a fraction of the cost.

With the HiTOP monitor you can download Assembler or high level language programs to your target hardware, single step in assembler or HLL, set break points and run code at full speed.

Unlike most monitors the HiTOP monitor allows you to view and change your program variables as the program is running Complex variables such as array's structures and unions are also supported with a set of special windows which help to demonstrate advanced programming concepts.

All of your target microcontroller peripherals are supported by a set of configurable user windows which show the condition of each peripheral in the data book format, dialogue boxes then allow you to select the configuration required, thus the on chip peripherals may be configured via the monitor allowing students to explore all the features of the controller without having to write any code.

The CPU registers are also supported by a separate window and may set to initilised, incremented or decremented. The user stack can also be displayed as a column of values which change colour and value as the program is stepped. Large areas of memory can also be viewed/changed and there is even a built in assembler which allows you to patch your code from within the monitor.

Demonstration software is available on request.

#### Features:

Assembler and HLL support
Flexible Windowed Environment
Mouse and/or Keyboard control. Pull down menus with local choice lists
Context sensitive help system Full Manual, quick start guide and demo software.

#### Supported Microcontrollers:

**Motorola 68HCII**
The HiTOP Monitor is available for the Motorola 68HC11 microcontroller and may be added to the miniCONHC11 training board (see page 13).

**Intel 8031 Family**
The HiTOP Monitor is available for Intel 8031 family of microcontrollers and may be fitted to the Flight 32 Training board.

Flight Electronics International Limited