Introduction

The E-blocks™ range has grown so much in the last couple of years that we have decided to give it a whole brochure of its own for 2006. In these pages you will find details of the 40 hardware E-blocks™ boards, 6 CD ROMs, 36 sensors, 14 training solutions, and numerous accessories that currently make up the E-blocks™ range. Our goal for the E-blocks™ range remains simple: to provide a suite of resources suitable for teaching many subjects within modern electronics courses. This year you can really see that goal come to fruition there are now E-blocks™ products for traditional Electronics subjects - microcontroller programming, CPLD programming, Digital Signal Processing, Digital communications etc. - as well as resources for new technologies our students must learn, like Automotive Electronics with our CAN and LIN bus products.

The success of the E-blocks™ range has also been a welcome boost. E-blocks™ software is now available in 5 languages, and the products are sold across Europe, North America, and the Middle East. We are now able to give online demonstrations of most of our products: If you want further information then please give me a call.

John Dobson
Managing Director
E: john@matrixmultimedia.co.uk
T: 0870 700 1831

Other products from Matrix Multimedia…

E-blocks™ were designed in conjunction with Huddersfield University Engineering department as part of a Knowledge Transfer Partnership project.
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I have been very satisfied with my project students who have used Flowcode and the PICmicro development board – to the extent that the equipment is now being incorporated into core modules on embedded systems. More importantly, the students have been enthusiastic about using the systems and really seemed to progress quickly. It is one of the few ranges of software and hardware products that integrate very well with superb on-line tutorials.

Tony Grenan MIEE CEng
Dublin Institute of Technology

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I can strongly recommend the Matrix Multimedia PIC based hardware and software as a primary resource for the teaching of microelectronics in Colleges at National and Higher National level. The newer Flowcode and E-blocks™ offer the potential to make the learning of Microprocessor Systems and Electronics far more interesting.

Malcolm Newton
Course coordinator, Higher National Diploma in Engineering
Isle of Man College

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I and my colleagues have been helping Matrix Multimedia develop the E-blocks™ range of products, over the last two years, into what I believe is a truly world class resource for teaching modern electronics and related subjects. We now use Matrix products in several areas including student projects, undergraduate micro-programming modules, and music technology and they have become a core part of our lab equipment. I am very pleased with the collaboration with Matrix Multimedia and immensely proud of what the company and the University have produced.

Dr Stephen Lockwood
University of Huddersfield

---

I would like to congratulate you on the excellent solution you have developed to the problem of teaching and learning PICmicro Programming. Your PICmicro development boards and sensors, Flowcode and Asm4PIC software, have provided us with a complete course in programming the PICmicro controller for both high-level and low-level programming. We have found that the tutorials and simulations, in your solution, have provided us with an excellent aid to the delivery of Mechatronics modules on our engineering courses. They have also made it easier for our students to develop and design the prototypes for their projects and have reduced the cost per student of projects in our department.

Dr Violeta Holmes
BSc Computing Programme Leader
ELIHE, Blackburn College

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Dr Violeta Holmes
BSc Computing Programme Leader
ELIHE, Blackburn College

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E-blocks™ have revolutionised the way we teach Microelectronics/Electronics at Plymouth College of Further Education as we can easily adapt the resource to suit different levels of course such as National Certificate/Diploma, 1st Diploma and even Foundation Degree.

Alan Crookes BSc Ceng MIEE
Head of Technology & Computing
Plymouth College

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We have found Matrix Multimedia products to be an effective and enjoyable learning resource for our students studying PIC Microcontrollers.

Stewart Sinclair
School of Science and Technology
Bell College, Hamilton

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E-blocks™ are an excellent approach to teaching modern, systems-based electronics courses.

Jeff Cowey
Leeds Metropolitan University
What are E-blocks™?

E-blocks™ are small circuit boards each of which contains a block of electronics that you would typically find in an electronic system. The E-blocks™ range consists of around 150 separate items which can be combined to make an enormous variety of electronic systems offering a wide range of learning opportunities.

...combine with our range of software utilities and CD ROM based courses...

...to develop fully functional electronic systems like this mobile phone.
• Technology studies
• Automotive electronics
• Microprocessor system design
• Microcontroller programming
• Digital Electronics
• Data communications and networks
• Programmable Logic Controller technology

E-BLOCKS™
...for flexibility...

Within Technology, Electronics and Computer Science E-blocks™ have a wide range of learning and teaching applications in a range of fields: from fundamental logic skills training to PID motor control.

• Control technology
• Programmable Logic Devices and VHDL
• Control systems and automation
• Optical fibre communications
• Mobile communication systems
• Digital Signal Processing
Our curriculum is written by practising teachers, who understand students’ conceptual difficulties and help us develop tools to overcome them. Curriculum is HTML based which provides a familiar user interface and easy distribution.

Getting your program into the programmable device usually just involves one click of the mouse.

Networkable versions of our software are guaranteed to work on your network and we will give you unlimited support if you, or your technical team have problems.

Computer-based curriculum means that on-screen simulation can be used to explain how processes work. Shown is our unique PICmicro microcontroller simulation tool.

Networkable versions of our software are guaranteed to work on your network and we will give you unlimited support if you, or your technical team have problems.

Our policy is to provide you with all of the software tools you need. This means that CD ROMs are supplied with all compilers, download software and learning resources you need.

For our more advanced equipment we provide you with teacher’s manuals which show you how to set up the equipment and give you ideas on how to use it in the lab.

Many students are also keen to continue to learn at home and we produce reduced rate CD ROMS to accommodate this.

Our experience in education has taught us that the real value of a product is determined by how well it is supported. We endeavour to take all institution, and student, requirements into account during the development cycle.
This medical electronics project shows an ECG sensor in an E-blocks™ system. ECG data is gathered using a sensors board and PICmicro Multiprogrammer, and then fed directly to a PC using an RS232 board. A Keypad and LCD display provide control of the system.

This is an electronic bug using mobile phone technology. A small patch board contains a microphone and amplifier that feeds into a Sony GSM module with SIM card. A PICmicro Multiprogrammer is used to detect an incoming call and then channel local sound to the incoming caller who can then hear what is going on in the room. Keypad and LCD allow various set ups with dial out at pre-determined times.

We want E-blocks™ to be at the heart of whatever students want to make, whether it is a simple electronic switch, or a mobile phone combined with GPS receiver and MP3 player.

The ‘stumbler’ combines a mobile phone system, based on a PICmicro microcontroller, with GPS receiver and SD card reader to form a system that is capable of taking a large number of readings of phone antenna signal strength whilst moving in a car. This allows a pattern of geographical signal strength data of local antennae to be collected and mapped.

This simple MP3 player can be created from a PICmicro Multiprogrammer, an SD card reader, and an MP3 decoder. A keypad and LCD provide control of the unit which stores up to 125 songs.
Change in student skills
In the Western World nearly 50% of students go on to further or higher education, yet a decreasing percentage of these now have the background mathematics and physics skills for rigorous engineering courses. E-blocks™ presents many teaching and learning opportunities in Technology, Electronics and Computer Science.

Feeding the technically creative mind
20 years ago students with a technically creative mind took up electronics as a hobby. Today these students develop programs on a computer. E-blocks™ presents an easy-to-use suite of tools and system blocks which presents new learning opportunities in Computing, Electronics and Technology.

Student motivation
Our youngsters are obsessed with all things electronic, like mobile phones and MP3 players, and yet we seem to fail to take advantage of that interest. E-blocks™ shows students how modern electronic systems work, and teaches them electronics in a modern context.

Changing industry requirements
Few practising engineers now solder discrete components together to make a circuit - they are much more likely to be using a computer to program some kind of device. E-blocks™ allows a systems approach to electronics to be taught - a skill that industry needs.

...catering for change...
The market for technology and electronics courses is changing – with a trend where Computer Science, Electronics and Technology are merging to offer new courses to students. E-blocks™ facilitates the development of modern courses which can attract students to your institution.
You can connect E-blocks™ systems to the internet using our Internet board. This board includes a full software stack which allows a wide variety of internet communications to take place - not just web page and email serving, but a wide number of other internet communications including MAC data transfer, TCP, and IP.

Quartus II is a System On Chip design tool from Altera which allows you to combine digital logic, a processor core, ROM containing your program, RAM, PLLs, DSP blocks onto a single FPGA device. Quartus II is supported in our Programmable Logic Techniques CD ROM and by our CPLD board and the FPGA board.

All of our PICmicro microcontroller programming and development tools are compatible with Microchip’s professional MPLAB suite of tools which includes a full assembler, and text based debugger.

We have tried to ensure that E-blocks™ give you choice. However you want to work, whatever you want to make, whichever software packages you want to work with. And the range is growing...

TINA (Transient Integrated Network Analysis) software is directly compatible with E-blocks™. TINA allows you to combine conventional circuit components with logic circuitry, VHDL, or microcontroller running your code, and simulate the entire system on-screen. From there you can download the appropriate files to E-blocks™ components and build a prototype of your system.

LabVIEW™ embedded operates on 32 bit RISC processors like our ARM device on the EB040 board. This provides you with all the power of LabVIEW™ on a single chip, and gives you access to a wide range of on-chip mathematical and analysis functions.

If you are using Visual Basic, Visual C++ or any other PC based application you can now easily combine it with E-blocks™ using our USB232 board, supplied with virtual COM port, which provides a fast data transfer link between E-blocks™ and your PC.
Why Matrix Multimedia?

As a publisher of 30 educational CD ROMs and with more than 10 years experience in the education sector, Matrix has an acknowledged track record in providing quality educational resources.

Award winning products
In 2004 our PICmicro Microcontroller programming resources received a British Educational Teaching Technology award.

Latest technology
Our team of engineers – based in Halifax, England – are world leaders in the development of educational resources for teaching electronics and technology. The impressive results include our USB Multiprogrammer, shown below, which programs an 8k PICmicro in just 8 seconds.

Value for money
Our company policy is simple: we want you to come back for more. Volume purchasing and low overheads means that our prices are amongst the lowest in our industry, and we offer unparalleled value for money.

Training and support
Once you have bought one of our products we offer unlimited technical support on the phone to make sure our products work in your systems. We also offer training courses to get you and your colleagues up-to-speed with the technology, our equipment and how to get the best from it.
Three options are open to you when you want to purchase E-blocks™:

- You can build up your own set of boards and make up your own kit
- You can buy a starter pack for learning how to program one of the range of supported microcontrollers or CPLD/FPGA/DSP boards
- Or you can buy a ready-made training solution which is designed for teaching a particular topic.

The advantages of buying a training solution from us should not be underestimated:

- Solutions are assembled and tested before despatch
- All circuit boards are fitted with clear acrylic covers to protect boards, and prevent chips and links being removed
- Circuit boards are mounted onto metal backplanes which make the solution more rugged
- Teacher’s manuals are provided with teaching and learning exercises
- Solutions are shipped with all software needed
- Solutions are shipped in rugged trays for storage and transport
What does it do?
Starter packs include a selection of E-blocks™ boards that are suitable for a wide range of applications in microcontroller programming - from technicians to postgraduates.

Benefits
- Offers a very wide range of project possibilities
- Can be used with different types of students - from technician up
- Can be used across many subjects in Engineering and Computer Science
- Complete courses for teaching programming are available

Features
- A range of microcontroller types are supported
- Includes utility software for downloading code
- Comprehensive courses with compilers and IDEs available
- Supplied in rugged storage trays with cables, backplane and accessories

Description
E-blocks™ starter packs contain a metal backplane for mounting E-blocks™, a power supply, a collection of individual E-blocks™ and utility software, rugged plastic storage trays and accessories like nuts and bolts, cables and IDC connectors. These starter packs include a selection of up to 20 E-blocks™ boards which can be used to form a large number of electronic systems, for learning or for project work, and additional E-blocks™ boards can be added to these systems as you need them.

The starter packs are all supplied with free software which allows you to download your program into the appropriate 'upstream' programmer board, additional courses in flowchart programming, C programming or assembly code programming are available as extras.

For 2006 the E-blocks™ mix for these products has changed slightly. Please see datasheets for further details. Covers not included.

Learning objectives
A very wide range of learning objectives is supported by these collections of E-blocks™; from novice programming and logic skills through to advanced programming of microcontrollers using interrupts. Please see the specifications of the software packages for further details.

Also consider...
Our range of high quality CD ROMs for teaching programming in flowcharts, C and Assembly code. See page 24.

Further information:
Datasheet, Online demo of all products, Online movies of C for PICmicros, ASM for PICmicros and Flowcode, Detailed contents lists

Ordering information
Deluxe PICmicro starter pack ......................................................... EB110
Standard PICmicro starter pack ..................................................... EB215
Deluxe AVR starter pack ............................................................... EB219
Standard AVR starter pack ............................................................ EB343
Deluxe ARM starter pack ............................................................... EB131
Standard ARM starter pack ........................................................... EB139
Student starter pack ................................................................. EB542

E-blocks™ Range 2006/07

12
E-blocks™ CPLD / FPGA starter packs

What does it do?
Flexible training solutions for learning programmable logic technology and for project work.

Benefits
• Complete solution available including courseware, hardware, and programming software
• Students use on-screen tutorials to teach themselves which saves preparation and teaching time

Features
• Two starter packs are available – one for studying CPLD technology and one for FPGA+CPLD technology
• 128 macrocell CPLD board / 4000 Logic Element FPGA board
• Snap together boards allow projects based on programmable logic devices to be easily constructed
• Compatible with Programmable logic techniques CD ROM which includes courseware on programming in block diagram, VHDL and Verilog formats
• Supplied in storage trays with cables, backplane and accessories.

Description
These CPLD/FPGA development starter packs allow your students to investigate modern programmable logic technology using the superb Quartus II design software from Altera. A selection of E-blocks™ is included and more can be added as needed. The accompanying CD ROM course takes students through the design process using conventional design, VHDL and Verilog.

The 128 macrocell CPLD E-block™ board provides a great introduction to modern digital electronics technology. The FPGA board is suitable for more advanced users: this contains a 4000 element device which is suitable for very large designs including embedded processors and DSP tasks. The FPGA board is designed as a leaded component which can be used in students’ own projects.

Learning objectives
• Combinational and Sequential logic
• Advanced digital electronics and microprocessor architecture
• VHDL and Verilog programming
• System On Chip technology

Further information:
Online demo, Powerpoint presentation, Article about CPLDs, Datasheet, Detailed contents list

Also consider...
Our new ECAD package - TINA - allows you to design VHDL and simulate it with LEDs, interactive switches, displays etc - at the same time as all your other circuitry. A separate brochure is available for TINA. Not available outside the UK.

Ordering information
CPLD solution .................................................. EB287
FPGA solution .................................................. EB940
Programmable logic techniques ....................... ELPLDSI
TINA ECAD ...................................................... call

E-blocks™ Range 2006/07 13
Automotive Electronics - CAN bus solution

What does it do?
Provides a solution for teaching and learning about CAN bus technology for all levels of student - Automotive and beyond.

Benefits
• Allows students to investigate CAN at a high level without getting bogged down in programming detail
• Flowchart software allows students to concentrate on CAN strategy and protocol

Features
• Allows rapid development of CAN systems
• Suitable for investigation of the CAN protocol
• Includes full CAN diagnostic and message generation tools
• Complete suite of hardware modules and sensors
• CAN Flowcode macros available
• Includes Flowcode

Description
This training solution is designed to facilitate the development and investigation of systems that use the CAN bus protocol for communications. The solution is comprised of four fully programmable CAN nodes which mimic Electronic Control Units (ECUs) in an automotive application. These are mounted on rugged backplanes and are fitted with ancillary circuit boards which mimic the functions of indicator lamps, switches and sensors. The software supplied allows students to program each of the four nodes in flow charts to form a fully functioning CAN system. The solution is suitable for automotive students who simply need to understand how CAN works, and for electronic students who want to understand more details of the CAN protocol. The software supplied operates at several levels so that different types of student are exposed to only the relevant details of the CAN system. A CAN bus analyzer, message generator, and PC-based diagnostic software is supplied with the solution.

Learning objectives
• To understand the structure of an ECU
• To understand that ECUs can be reprogrammed and that faults can be hardware or software faults
• To understand the basics of the CAN protocol
• To understand CAN message structure
• To assemble a fully working CAN system with a pseudo Higher Level Protocol
• To gain further insight into CAN message structure.

Further information:
Online demo, Powerpoint presentation, Article about CAN bus, Datasheet, Detailed contents list

Ordering information
CAN solution .................................................................................. EB237
Automotive Electronics - LIN bus add-on

What does it do?
Provides a solution for teaching and learning about LIN bus technology for all levels of student.

Benefits
• Allows students to investigate LIN at a high level without getting bogged down in programming detail
• Flowchart software allows students to concentrate on LIN strategy and protocol

Features
• Allows rapid development of LIN systems
• Suitable for investigation of the LIN protocol
• Includes full LIN diagnostic and message generation tools
• Complete suite of hardware modules and sensors
• LIN Flowcode macros provided

Description
Whereas CAN bus is a high data rate, high reliability bus, on twisted pair wires, the LIN bus is a low data rate bus where communication takes place on only a single wire. LIN bus is used in more cost sensitive automotive applications.
The LIN bus add-on panel provides LIN bus functionality to the CAN bus training solution. The solution consists of three separate LIN bus nodes with simple LEDs and switches which can be programmed individually. These interface to node 4 of the CAN bus training system to provide a fully working CAN/LIN bus system.
The solution also contains a LIN bus analyzer which allows you to monitor the traffic on the LIN bus and also generate LIN messages.

Learning objectives
• To understand the LIN bus message structure
• To assemble a fully working LIN bus system
• To evaluate how CAN and LIN bus ECUs work together

Further information:
Datasheet, Detailed contents list

Ordering information
LIN bus add-on .................................................. EB413

E-blocks™ Range 2006/07 15
Communications - Bluetooth solution

**What does it do?**

Provides a motivating platform for learning about microcontroller programming and Bluetooth operation.

**Benefits**

- Highly motivating
- Accessible to all levels of student
- Fully functioning Bluetooth system

**Features**

- Complete Bluetooth training solution
- Allows investigation of Bluetooth communication and profiles
- Includes a range of E-blocks boards
- Programmable with Flowcharts - key macros supplied
- Includes Flowcode with Bluetooth macros
- 2 complete Bluetooth systems
- Operates with existing Bluetooth systems (e.g. mobile phones)

**Description**

This training solution, built from E-blocks™ technology, allows students to carry out investigations into the Bluetooth standard using high level macros written in Flowcode. The solution consists of two fully working Bluetooth systems - made up from E-blocks™ - with Bluetooth transceivers and CODEC boards. Students use these two systems and Flowcode macros to investigate various Bluetooth protocols.

A CODEC interface for transmitting digital audio signals is included. All aspects of the Bluetooth device, such as page scanning, authentication, identification, pairing and SCO channel setup are easily controlled via AT commands and/or device registers.

**Learning objectives**

The Bluetooth solution is a motivating application which can be used for many areas of investigation including:

- AT command structure and programming strategy in AT controlled systems
- Bluetooth visibility, device discovery, and connection establishment
- Device pairing
- Data communication in Bluetooth systems
- Audio SCO establishment
- Data communication between microcontroller and PC
- Implementation of headset profile (requires Bluetooth compatible mobile phone)
- Implementation of audio gateway

**Further information:**

Online demo, Powerpoint presentation, Datasheet, Detailed contents list

**Ordering information**

Bluetooth solution .................................................. EB860

The solution includes two Bluetooth transceivers...

...as well as two voice CODEC boards.
What does it do?
Provides a motivating solution for learning about microcontroller programming within a mobile phone context.

Benefits
• Highly motivating
• Accessible to all levels of student
• Fully functioning mobile phone

Features
• Extremely rapid development for mobile phone technology
• Flowcode and mobile phone macros included
• Teacher’s manual with task suggestions
• Protective covers supplied

Description
This system has been put together from E-blocks™ to facilitate rapid access to mobile telephony technology. The solution makes use of Flowcode as the main programming language, and a number of Flowcode software components are included which allow students access to the AT command structure that is commonly used in telecoms systems. The Flowcode macros, and examples provided, allow students to control the mobile phone without getting bogged down in the coding details. This is particularly relevant to students who find learning about electronics within a mobile phone context highly motivating. The solution can be programmed using flow charts, C or assembly code to develop a fully working mobile telephone that can be used for voice, data and text messaging. Additional E-blocks™ (provided as part of the kit) can be connected to this core system to make it applicable to individual applications: for example the addition of a pH sensor can be used to simulate the use of telemetry in water quality monitoring stations.

Learning objectives
The mobile phone is a motivating application in which many aspects of programming can be studied including:
• Fundamentals of flow chart programming
• A/D conversion, RS232, communications, keypad information entry, arrays, D/A technology and sound waveform generation
• AT command structure and programming strategy within AT controlled systems
• Cell signal strength, available cells, and positional variation of signal strength can be studied from mid 2006.

Further information:
Online demo, Datasheet, Detailed contents list

Ordering information
Mobile phone solution .......................................................... EB118
GPS board ............................................................................. EB037
SD card reader ................................................................. EB042
Digital communications - Internet solution

What does it do?
The internet solution allows students to construct embedded systems that send emails and serve web pages, and teaches students the fundamentals of modern digital communications within an OSI model context.

Benefits
- Extremely economical solution to learning internet protocol and digital communications.
- Teaches many aspects of OSI model technology in an electronics context.
- Highly motivating resource that allows surprisingly functional systems to be created.

Features
- Includes two web server boards
- Allows students to explore MAC, IP, ARP, UDP and TCP protocols
- Allows students to set up a firewall

Description
This extraordinary training solution allows students to carry out a wide variety of investigations into digital communications technology in an internet technology context.

The solution can be used at two levels: at technician level very high level Flowcode macros allow students to easily incorporate email and web page construction technology – integrated with Flowcode variables – which provides a highly motivating platform for a wide variety of programming tasks.

At a higher academic level, when used in conjunction with a PC and a web browser, this equipment allows students to conduct a range of experiments that builds understanding of modern digital communications protocols including Ethernet, DLC, MAC, ARP, TCP, IP, UDP, ICMP, HTTP and POP3 protocols and their relative position in the OSI model.

The solution consists of a pack of E-blocks™ that forms an embedded internet solution – including two web servers. Students use the hardware and four sets of Flowcode macros that allow students to access at the MAC, UDP, TCP and IP layers. Students progress through a number of exercises to build their understanding: starting with byte-by-byte packet construction at the MAC layer, and building up to constructing advanced systems including an email server, web page server, and firewall using Flowcode macros at the TCP layer.

Learning objectives
- Fundamentals of flow chart programming in an internet context
- Construction of embedded internet systems with web page server and email functions
- Understanding of packet structure, and construction, at MAC and all higher protocol layers
- Understanding of communication strategy and information flow at MAC and higher protocol layers

Further information:
Online demo, Powerpoint presentation, Article on digital comms, Datasheet, Detailed contents list

Ordering information
Internet solution .................................................. EB643
Individual items in the E-blocks™ range
Description

This flexible development board is an ideal platform for both learning how PICmicros are programmed and also for project work. The development boards programs a range of 8, 14, 18, 28, and 40 pin devices from the 12, 16 and 18 series PICmicro ranges. After programming the chip is reset and your code starts running. The on-board LEDs, switches and displays can be used with one of our range of CD ROM based courses, or with Microchip’s MPLAB software. The board also has two E-blocks™ ports (on ports C and D) which makes it compatible with our large range of E-blocks™ add-ons and sensors. The board also links directly to the Actuators panel for experimentation with motors. Download software (PPP) is included, and a clear acrylic cover - which prevents chips and links from being removed - is available.

Development board or E-blocks™?

We are frequently asked whether a customer should opt for a development board or an E-blocks™ approach. The answer is: “it depends.” E-blocks™ can be used to make up the equivalent of a development board with a cost premium of around 30%. The V3 development board has the advantage of small desktop footprint, and lower cost, but a disadvantage is the fact that some pins are shared by many peripherals which compromises the pins’ electrical performance. The E-blocks™ approach has the advantage of greater flexibility, and the fact that students gain understanding about electronic system architecture by going through the process of building the system itself, and the simplicity of the E-blocks™ concept has great appeal.

Also consider...

The actuators panel can be used for training on a variety of motors...

...and you can bolt this board down to a metal backplane with other boards and store them in our rugged plastic trays.

Ordering information

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<td>Clear acrylic cover</td>
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What does it do?

Provides a flexible and low cost PICmicro development board for learning and projects.

Benefits

- Single board with low cost and small footprint
- Tight integration with programming courses provides an effective learning solution

Features

- Ultra-fast programming via USB
- Can be powered via USB (no need for power supply)
- E-blocks™ compatible
- Compatible with Microchip’s ICD2 programmer/debugger
- Removable crystal / faster crystal as standard
- Fitted with the advanced 16F88 device
- Large range of add-ons available
PICmicro® Multiprogrammer

What does it do?
The E-blocks™ PICmicro Multiprogrammer programs a wide range of PICmicro devices.

Description
This new PICmicro microcontroller programmer connects to your PC via USB to provide you with one of the World’s lowest cost and most flexible PICmicro microcontroller programmers. This board can be used with Assembly, C or Flowcode programming utilities provided by Matrix Multimedia. The board will program most 8, 14, 18, 28 and 40 pin flash PICmicro microcontroller devices using the flexible programming software provided – PPP - and provides ‘clean’ access to all I/O lines on the relevant PICmicro MCU devices. The boards have 5 E-blocks™ ports to which you can connect a variety of downstream boards. Code in the target PICmicro immediately starts running once programmed.

Features
- E-blocks™ compatible
- Fast programming – 1k/s
- Used as a programmer and as a development board
- Programs a wide range of PICmicro MCU devices
- Full suite of programming software available
- RC or Xtal operation
- 5 I/O ports
- In-Circuit Debugging via MPLAB® ICD2
- Powered from USB or external PSU

Ordering information
PICmicro MCU Multiprogrammer .................................................. EB006
Clear protective acrylic cover .................................................. EB706

dsPICmicro® Multiprogrammer

What does it do?
Provides an ideal platform for learning Digital Signal Processing and for DSP projects.

Description
The low cost dsPICmicro devices contain a 16 bit RISC architecture processor with a powerful 17 bit mathematical coprocessor that can carry out fast analysis, and manipulation, of input signals, and are ideal for teaching and learning DSP. The processor has 84 assembly code instructions and can be used in conjunction with Microchip’s MPLAB development environment or with a number of C compilers. A range of free utilities for DSP development is available free of charge from Arizona Microchip. A matching audio CODEC board (EB041) is available.

Features
- E-blocks™ compatible
- USB programmable
- 32 I/O lines
- Audio CODEC board available
- Ideal for introducing students to DSP

Compatible devices
DSPIC30F2010, DSPIC30F3011, DSPIC30F3012, DSPIC30F3014, DSPIC30F4011, DSPIC30F4013

Ordering information
dsPICmicro Multiprogrammer .................................................. EB040
Clear protective acrylic cover .................................................. EB740
Atmel AVR Multiprogrammer

What does it do?
This upstream board programs a range of microcontrollers from the Atmel AVR range.

Description
The AVR Multiprogrammer includes everything you need to both program AVR microcontrollers (via serial port) as well as to develop AVR projects. The Multiprogrammer includes a CD ROM containing development tools, an In-System Programmer (ISP) and an AVR board with 4 E-blocks™ ports. Code in the target microcontroller immediately starts running once programmed.

Features
- A complete AVR development solution
- Programs 20 and 40 pin AVR microcontrollers
- Includes free IDE and C compiler
- Removable crystal
- 4 E-blocks™ ports

List of compatible devices

Ordering information
Atmel AVR Multiprogrammer ............................................................ EB194
Clear protective acrylic cover ......................................................... EB719

ARM programmer

What does it do?
This upstream board acts as a development platform for the Atmel ARM 7 microcontroller.

Description
This E-blocks™ board is a development tool for the powerful SAM 7 microcontroller from Atmel. The SAM 7 is 32 bit RISC device running at an internal frequency of 36MHz, and having 128K ROM and 32K static RAM as well as 2 USARTs, 4 x 10 bit A/D converters and a native USB bus. This incredibly powerful microcontroller can be used for a range of advanced E-blocks™ projects and is compatible with the new LabVIEW™ embedded software. The board has 5 E-blocks™ ports and the processor itself is housed on a removable daughter board (ARM processors are only available in SMD technology) so that the ARM can be incorporated into custom PCBs.

Features
- 32 bit RISC processor with 128K ROM and 32K SRAM
- USB programmable with boot loader
- 5 x E-blocks™ ports, 32 I/O lines
- Compatible with most downstream boards
- Native USB and SPI buses
  This processor operates off 3.3V. Please check the downstream boards you need are 3.3V compatible.

Ordering information
ARM programmer ................................................................. EB031
ARM daughter board ................................................. EB034
**CPLD programmer**

**What does it do?**
Provides a platform for CPLD development and programming in VHDL and Verilog.

**Description**
This CPLD Board connects to your PC via a standard parallel port cable to provide you with a flexible CPLD development board and programmer. The board is fully compatible with a wide range of E-blocks™ which makes it an extremely flexible platform for learning and developing projects. The board includes a EMP7128S device from Altera, (128 flip-flops and combinational logic) which can be used as a basis for a range of courses in Digital Electronics and investigations into computer architecture. The board is compatible with Altera’s Quartus II web edition software.

**Features**
- E-blocks™ compatible
- Used as a programmer and as a development board
- Compatible with the free Quartus II Web edition programming software (inc VHDL and Verilog)
- 25MHz removable crystal
- 7 full I/O ports
- Compatible with our Programmable logic techniques CD ROM.

**Ordering information**
- CPLD development board: EB006
- Programming cable: HPPBL
- Clear protective acrylic cover: EB720

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**FPGA programmer**

**What does it do?**
Provides a platform for FPGA experiments and programming in VHDL and Verilog.

**Description**
This FPGA daughter board sits on top of the CPLD programming board (EB020) to provide 7 full E-blocks™ ports which can interface to other E-blocks™. The FPGA device used is Altera’s EP1C3 FPGA, from the Cyclone family, which contains 3000 flip-flops, associated combinational logic and other internal resources. A 6000 logic element version is also available. The FPGA board connects to the CPLD board using double row IDC header. This effectively makes the FPGA board a leaded component which can be inserted into custom PCBs for project work.

**Features**
- Designed for educational use
- Free Quartus II programming and simulation software – for block diagrams, VHDL or Verilog
- Large range of existing IPR – including microprocessor cores
- Compatible with our Programmable logic techniques CD ROM.

The FPGA operates off 3.3V. Please check the downstream boards you need are 3.3V compatible.

**Ordering information**
- FPGA daughter board - 3000: EB030
- FPGA daughter board - 6000: EB049
Flowcode for PICmicros

Description
Flowcode allows students to develop complex, and motivating, electronic systems - like mobile phones, complex robotics or control systems - without getting bogged down in the coding details. Flowcode allows those with no programming experience to develop code for microcontrollers in a matter of minutes. Flowcode achieves this in three steps: firstly students drag and drop flowchart symbols onto the screen, and fill in the dialog boxes when prompted. Then Flowcode compiles the flow chart into code for a PICmicro – and students can see the C code generated during this process which helps explain how C programming works. From the C code Flowcode generates assembly code and then hex, which is sent directly into the 8, 18, 28 and 40 pin PICmicro microcontroller of your choice.

The great strengths of Flowcode are its simplicity and its power: whilst it can be used by complete novices, it is a powerful language that uses macros to facilitate the control of complex devices like 7-segment displays, serial LCD displays and even a complete internet server board. These complex devices are available in our E-blocks range and many are complemented by on-screen simulations within Flowcode, which helps students debug programs and understand programming techniques.

Flowcode is used in several of our solutions to teach how complex digital electronic systems operate: students can understand system and program design without the need to understand long programs written in C or assembly code. Some of the macros and integrated hardware systems available in Flowcode include:

- Quad 7- segment display
- IrDA
- Keypad
- Internet - inc MAC, UDP, TCP, IP
- Easy email
- EEPROM
- RS232
- CAN bus
- LCD (16x2)
- Web page server
- SPI bus
- D/A
- D/A

What does it do?
Allows those with no programming skills to design complex electronic systems.

Benefits
- Allows students to understand programming strategies without getting bogged down in coding details.
- Provides access to electronics technology for all levels of student.
- Introduces students to the concepts used in C and assembly code programming.
- Motivates students through the use of real electronic systems like mobile phones.

Features
- Requires no programming experience.
- Allows complex programs for PICmicro microcontrollers to be developed quickly.
- On-screen simulation aids understanding.
- Integrates tightly with E-blocks™.
- Supports most 12 and 16 series PICmicros.
- CD ROM includes a full course.
- 30 example files included.

Some examples of high level macros in Flowcode...

IrDA communication - The IrDA communications plug-in and macros allows data to be sent to a lap top or PDA with IrDA port.

Web server - The web server plug-in and Flowcode macros allow simple web pages to be published and other TCP/IP communications to take place.

Ordering information

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C programming courses

What does it do?
These four CD ROMs contain complete tutorial courses on programming the relevant microcontroller in C, as well as a range of software utilities - including full C compiler - for actually programming the microcontroller itself.

Benefits
• Simulations shorten learning curves
• Complete solution - including all software utilities needed

Features
• Includes a HTML based course in C programming
• Includes full C compiler and IDE
• Includes full Integrated Development Environment and compiler
• Examples and exercises included
• Integrates tightly with E-blocks™

Description
These four CD ROMs - written by David and Rob Miles of Durham and Hull Universities - provide you with a complete solution to teaching and learning C programming for the PICmicro, Atmel AVR and Atmel ARM microcontrollers.

The courses are structured in two parts: firstly students are taken through the fundamentals of C programming in a series of on-screen tutorials that makes use of our virtual microcontroller to explain to students how C works. This well proven methodology centres around a simulation of the microcontroller which allows students to clearly see the effects on the chip and internal variables and registers as each line of C code executes.

Once students have understood the basics they carry out a series of labs using the Integrated Development Environment and compiler provided, to help build on their understanding. Tests and exercises to reinforce learning are provided. Once the students have build sufficient expertise in C programming they are able to use the software tools supplied on the CD for a wide range of projects.

Note that the C compiler on the C for PICmicros CD ROMs is only licensed for educational use.

How the virtual microcontroller helps learning...
Students read through the tutorials... ...then they simulate the program onscreen...
... compile the source code in the IDE... ...and verify the program on the E-blocks™ system.

Ordering information

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IDE / Compiler

Typical tutorial screen

E-blocks™ Range 2006/07
Assembly for PICmicros

What does it do?
A complete CD ROM based course for learning assembly code programming.

Description
This CD ROM contains a complete course in programming the PICmicro microcontroller. The clearly written tutorials start with fundamental concepts and extend up to complex programs including watchdog timers, interrupts and sleep modes. The CD ROM includes unique simulation tools which help students overcome key problems in programming in assembly code, and a simplified development environment is included.

Benefits
- Supports a tutorial system of teaching assembly programming that saves hours of preparation and chalkboard time
- Unique simulation tools shorten the learning cycle

Features
- Comprehensive instruction through 39 tutorial sections
- Includes a Virtual PICmicro microcontroller: a fully functional graphical simulator
- Tests, exercises and projects covering a wide range of PICmicro applications
- Suite of programming tools included

Ordering information
Single user ................................................................. ELPICSI3
10 user .................................................................. ELPICT10
Site licence ............................................................... ELPICSL3

Programmable logic techniques

What does it do?
A complete course in CPLD / FPGA programming.

Description
This CD ROM gives a thorough introduction to CPLD and FPGA programming using Altera’s Quartus II Web Edition software. The CD starts with an introduction to designing with Quartus II using block diagrams, at basic and intermediate levels. Then the CD ROM takes students through the process of developing combinational and sequential logic designs using both Verilog and VHDL descriptor languages. The CD is suitable for those who have some experience of digital logic and want to get to grips with modern CPLD and FPGA techniques. A number of example projects in block diagrams, Verilog and VHDL are included.

Benefits
- Supports a tutorial system of teaching CPLD programming in block diagrams, VHDL and Verilog
- Includes all software and courseware needed

Features
- Complete guide to logic design using Quartus II
- Includes example projects
- Includes courses in both Verilog and VHDL
- A modern way to learn digital electronics design
- Includes Quartus II web edition design software

Ordering information
Single user ................................................................. ELPLDSI1
10 user .................................................................. ELPLD10
Site licence ............................................................... ELPLDSL
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</tr>
<tr>
<td>PS2 / VGA board</td>
<td>EB033</td>
<td>£9.95</td>
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**Prototype board**

This E-block™ contains a small prototype board for developing circuits and projects. Connectors for two E-block™ ports allow prototype wires and leads to be connected to the rows and columns on the prototype board.

**Bluetooth board**

The Bluetooth E-block™ allows you to add Bluetooth capability to any microcontroller with UART functionality.

**Patch board kit**

This E-block™ contains a small patch board for developing circuits and projects. This E-block™ is used where there is a requirement to set up a permanent circuit to add to your E-blocks™ system. D-type connectors need to be soldered into place.

**CAN bus board**

This board allows you to add CAN bus functionality to any microcontroller with an SPI interface. The board includes both a CAN Controller and a CAN Transceiver. (Clear protective acrylic cover - EB718)

**Lin board**

This board allows you to construct a fully working LIN bus interface from any microcontroller with a serial port. Available April 2006.

**MIDI interface**

With MIDI in, out and thru ports, this E-block™ allows any microcontroller to generate, process or respond to any MIDI datastream. Available April 2006.

**X10 home automation**

This E-block™ provides signal conditioning and protection which allow you to add X10 mains-borne communication to your system. A standard RJ11 cable provides connection between the a standard X10 transceiver and your microcontroller/ FPGA.

**Motors board**

This E-block™ board is based on the L298 device which can drive two motors operating off up to 46V at up to 4A each. The board can be used in a variety of motor control configurations including PID control.

**Voice CODEC board**

This audio coder-decoder board allows students to investigate Bluetooth systems that use audio. The board is based on a Freescale MC145483 linear 13 bit Codec which allows voice digitisation and reconstruction as well as pre and post filtering.

**Internet board**

This board adds Ethernet functionality to a microprocessor / FPGA system without the need for developing a TCP/IP software stack. It supports 10/100 connection UDP, IP, ARP, ICMP, DHCP, ARP, DLC and MAC. (Clear protective acrylic cover - EB723)

**PS2 / VGA board**

This board allows you standard keyboards, mice and VGA monitors to an E-blocks™ system. Whilst tricky with 8 bit processors, larger 32 bit processors and FPGA’s can take advantage of low cost keyboards and old CRT based monitors to make flexible computing systems based on E-blocks™.
Opto-isolator board ........................................ EB035 £1.37
This Opto-isolator board contains 4 separate isolated inputs to your E-blocks™ system for telecoms and Programmable Logic Controller applications.

GPS board .................................................. EB035 £1.37
This E-block™ allows any UART-enabled microcontroller to receive configurable text-based NMEA or binary SIRF data containing various location, altitude, timing and speed information. Available April 2006.

MMC card reader board .............................. EB037 £2.37
This MMC card reader sits on the serial port of a microcontroller and provides up to 512MB of memory to an E-blocks™ system. A MMC card reader must be bought separately.

MP3 decoder board .................................... EB044 £2.37
This E-block™ has an onboard MP3 decoder that converts an incoming bitstream from a microcontroller into a high quality audio output. MP3, WAV or PCM data can be decoded. Inbuilt volume and bass-enhancement functions. Available June 2006.

Relay board ................................................. EB038 £1.37
This relay board contains 4 relays (choose high nibble or low nibble) which are each rated at 250V and 6A. This is ideal for building PLC type applications. Note that we do not recommend that you connect the relay board to mains voltages.

EB232 board .............................................. EB039 £2.37
The USB232 board allows you to connect a microcontroller with a USART back to a PC via USB. A virtual COM port driver is supplied for interfacing to PC software applications.

CODEC board .............................................. EB041 £1.37
The AC97-compatible CODEC board is designed to work with our dsPIC board. The onboard chip combines a 16-bit ADC with a 20-bit DAC to provide high quality audio input and output using sample rates up to 48kHz. Available June 2006.

Flowcode macros from April 06

Flowcode macros available

Enhanced LCD display board ...................... EB043 £2.37
Add an attractive visual display (with backlight) to projects with this 132×132 pixel, 65535 colour, 1.5” graphical LCD display. Only 4 i/o lines are required to drive the inbuilt controller chip, which automatically refreshes the display and provides an inbuilt character table. Available April 2006.
E-blocks™ - downstream boards

Terminal board
This small circuit board allows connection to all 8 pins of a standard E-blocks™ port with bare wires using screw terminals.

Version 2 development board adapter
This small circuit board can be connected to the version 2 PICmicro microcontroller development board using a 40 way ribbon cable (HPBCAB). The E-block™ adaptor will make four ports (A, B, C, D) available on 9 way D-type sockets so that you can connect E-blocks™ infrared, RS232, keypad and other E-block™ subsystems to your V2 development board.

Sensor board
This E-block™ contains a variable resistor and a simple light sensor which can be used for simple analogue experiments. It also contains sockets which allow users to interface to our range of more than 30 professional sensors including pH, temperature, distance, g etc. (Clear protective acrylic cover - EB703)

Power board
The Power board contains two L293 quad push pull driver chips which provide power outputs for driving lamps or motors - including stepper motors. The board supplies 8 outputs which sink or source 500mA at up to 36V. Each output is protected with an inline resettable fuse. (Clear protective acrylic cover - EB711)

LED board
This board has 8 LEDs which show the status of each bit on the port. Upstream and downstream E-blocks™ connectors allow this board to be used in bus configuration. (Clear protective acrylic cover - EB704)

IR / IrDA transceiver board
This board provides a complete solution to infrared communications - with both standard IR and IrDA protocol for communication with laptops or PDAs. (Clear protective acrylic cover - EB712)

LCD board
This E-block™ contains a 16 character, 2 line alphanumeric LCD display on a 5 wire serial bus.

SPI bus D/A and memory board
This E-block™ adds serial memory (8k) and D/A functions (8 bit with amplifier and headphone socket) to any microcontroller/FPGA with an SPI (Serial Peripheral Interface) interface. (Clear protective acrylic cover - EB713)

Switch board
This board contains 8 push-to-make switches. Upstream and downstream E-blocks™ connectors allow this board to be used in bus configuration. (Clear protective acrylic cover - EB707)

Keypad board
A simple 4x3 keyboard that allows data entry into bus based systems. (Clear protective acrylic cover - EB714)

Dual 7-segment display
This board has a quad 7-segment common anode display with anodes controlled via one port and cathodes controlled by the other. (Clear protective acrylic cover - EB708)

RS232 board
This E-block™ provides an RS232 interface which can be used to facilitate communication between a microcontroller/FPGA and third party devices like PC serial ports, projectors etc. (Clear protective acrylic cover - EB715)
E-blocks™ Range 2006/07

E-blocks™ - accessories

**Actuators training panel**
- **What does it do?** Allows students to carry out experiments with motors.
- **Features**
  - Stepper motor
  - Servo motor
  - DC motor with feedback
- **Description**
  This is a general purpose training panel that allows students to carry out experiments with motors. The actuators on the panel include: A 7.5 degree/step stepper motor, a 120 degree servo motor, and a bidirectional DC motor with gearbox and rotational feedback. Worksheets and operating instructions are included. An E-blocks™ compatible port facilitates connection with upstream boards.

**Alex animated head kit**
- **What does it do?** A build yourself kit which forms a complete animatronic head.
- **Features**
  - Working animatronic head based on servo motors
  - Based on a PICmicro
- **Description**
  Build this working animatronic head which turns and nods, whose eyes swivel and whose lips move from the supplied kit (circuit board fully built and tested). Alex can be used at two levels: The animate card supplied with Alex allows students to record a sequence of movements and sync them to a recorded voice. Once students have understood the basic operation of Alex they can then connect him to the PICmicro board using the Actuator Training Panel (code HPACT). This opens up a whole range of activities that can be carried out using PICmicro programming. Kit includes all body parts, servos, hardware, microphone, loudspeaker and instruction manual.

**PICmicro buggy kit**
- **What does it do?** A small PICmicro based buggy for experimentation in robotics.
- **Features**
  - Centrally located wheels for maximum mobility
  - Based on a PICmicro
  - Reprogrammable PIC16F627
- **Description**
  This buggy is a small mobile robot powered by 4 AA cells and controlled by a PIC16F627 PICmicro® microcontroller. The buggy has two microswitch sensors which act as bumper switches, two LED eyes, a piezo sounder and two worm drive gearbox powered by high quality motors. Circuit board is built and tested with only final assembly required.

**IDC cable**
- **What does it do?** This 9 way D-type plug to 9 way D-type socket is used to link upstream and downstream E-blocks™ ports together where a snap fit is not possible. Cable length is 12 cm.

**Dual IDC cable**
- **What does it do?** A dual IDC connector for E-blocks™. Allows two E-blocks™ to be connected to the same programmer port (or to any other upstream E-block™).

**Metal backplane**
- **What does it do?** This backplane can be used to bolt PICmicro microcontroller development tools and E-blocks™ together to form a rigid backplane. This will extend the life of development tools, facilitate storage and increase security. The usable area is 270 by 350mm and these backplanes fit into our standard trays.

**Storage tray**
- **What does it do?** These black trays are ideal for storage of E-blocks™ and accessories like leads, power supplies etc.
  - Plastic tray
  - Foam layer insert
  - 4 section insert

**Adjustable power supply**
- **What does it do?** This switched mode power supply provides regulated outputs at 3, 6, 7.3, 9 and 13.5V. Output is selected by a small screw switch. The supply can be configured for all countries in the world by slating on appropriate mains supply connectors.

**Plastic tray**
- **What does it do?** Storage trays can be mounted into one of our tray trolleys - supplied in kit form.
  - 12 tray trolley
  - 18 tray trolley
E-blocks™ - compatible sensors

Sensors for experimentation

The 40 sensors you can see here allow you to carry out a very wide range of projects with your E-blocks™ hardware and software. All sensors plug directly into your sensor board (EB903) and into the PICmicro development board (HP488). If you want to give students an experience of different sensor technologies then the sensors we recommend are the Heart rate sensor, the Temperature sensor, the Motion detector and the Photogate with smart pulley. These four sensors all use different techniques for measuring real world values.

- Accelerometers
  - +/- 5g
  - +/- 25g
  - Three axis +/-5G
- Barometer
  - Air pressure: 0.8 - 1.05 atm
- Blood pressure
  - Absorbance of solutions: 0.05 - 0.550
- Charge sensor
  - Charge: +/- 10V - +/- 100nC
- CO2 Gas
  - CO2 in air: 0-5000 ppm
- Colourimeter
  - Absorbance of solutions: 0.05 - 0.550
- Conductivity
  - Conductivity of solutions: 0 - 20,000 uS/cm
- Current
  - Current: +/- 0.6A
- Differential voltage
  - Voltage: +/- 4V
- Dissolved oxygen
  - Current: 0-14mg/L
- Drop counter
  - Flow rate: 0 - 3.5 m/s
- EKG sensor
  - Force: +/- 50N
- Force plate
  - Force: -800 to +3500 N
- Flow rate
  - Flow rate: 0 - 3.5 m/s
- Gas pressure
  - Pressure: 0 to 210 kPa
- Hand dynamometer
  - Force: 0-600 N
- Heart rate - hand grip
  - Distance: -0.4 - 6m
- Heart rate - wearable
  - Humidity: 0% to 95%
- Instrumentation
  - 6 ranges from 0-20mV, to ±1 V
- Ion sensitive electrodes
  - Calcium: HSCA
  - Chloride: HSCL
  - Ammonium: HSNH4
  - Nitrate: HSNO3
- Magnetic field
  - Magnetic field: -6.4 mT to +6.4 mT
- Microphone
  - Humidity: 0% to 95%
- Motion detector
  - Distance: 0 - 4 m
- Oxygen
  - Oxygen in air: 0 to 27% (0 to 270 ppt)
- pH
  - pH: 0 to 14
- Photogate
  - Accessories: Picket fence, smart pulley, bar tape
- Radiation
  - Rotary motion sensor
- Relative humidity
  - Humidity: 0% to 95%
- Respiratory
  - Volume: 0 to 270 L
- Salinity
  - Salt in water: 0 - 50 ppt (0 - 50,000)
- Spirometer
  - Temperature: -40 to 135°C
- Thermocouple
  - Temperature: -200 to 1400°C
- Turbidity
  - Turbidity: 0 to 200 NTU