COMPUTER TRAINING SYSTEM
TELEPHONY TRAINING SYSTEM (Analogue & Digital ISDN)
ANALOGUE COMMUNICATIONS TRAINING SYSTEM
DIGITAL COMMUNICATIONS TRAINING SYSTEM
COLOUR TV TRAINING SYSTEM
TELEVISION ANTENNA TRAINING SYSTEM
FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM
DVD & CD TRAINING SYSTEM
RADIO TRAINING SYSTEM
CASSETTE RECORDER TRAINING SYSTEM
VIDEO CASSETTE RECORDER TRAINING SYSTEM
AMPLIFIER TRAINING SYSTEM
MICROPROCESSOR TRAINING SYSTEM
MICROCONTROLLER TRAINING SYSTEM
PROGRAMMABLE DEVICES
For two decades now, PROMAX ELECTRONICA has been designing education related instruments. Over the last few years, we have assigned a laboratory specifically for designing a range of latest-generation educational instruments to help train future professionals in the analysis and repair of communications and consumer electronic instruments, among many others.

Our interests are mainly centred on providing the student with the tools to learn the theory and perform exercises so that he may be capable of localising breakdowns and repair instruments.

Below we present a brief list of our Educational range products.

The EO-865 is an advanced educational instrument, designed to illustrate the theoretical and practical aspects of the following areas: PC assembly, installation and configuration; hardware architecture and operation and PC testing and diagnosis tasks; allowing, furthermore, the ability to introduce real hardware and software faults and virus for its later elimination.

The EO-865 permits the assembly, installation and configuration of all the components composing a multimedia PC of latest generation. It is composed of widely spread and high reliability hardware components manufactured with the latest technology.

The EO-865 incorporates a blocks diagram showing the functional modules of a PC. Its multiple Test Points enable the main signals of the PC hardware and its peripherals to be measured, with the aim that the student may establish failure diagnostic and repairing methods. The training system includes software and hardware methods to simulate faults over the different modules of the computer.

In order to access and evaluate internal signals, the EO-865 is provided with the requisite hardware to:
- View POST codes
- Bus PCI evaluation
- Test ports

PC HARDWARE CHARACTERISTICS:
- Intel Pentium® IV processor 1.6 GHz or greater
- Intel® circuit board with AGP and CNR port
- 256 MB SDRAM DIMM or greater
- AMI BIOS in flash ROM
- 1 AGP slot (64 bits)
- 3 PCI slots
- 1 CNR slot
- 6 USB connectors (4 accessible connectors externally)
- 2 Series ports (1 accessible port externally)
- 1 Infrared (IrDA) series connector (accessible internally)
- 1 Parallel port
- 1 AGP 32 MB video board (64 bits) or greater
- AC’97 sound system
- 1 Floppy disk drive 3 1/2 1.44 MB
- Hard disk drive 20 GB or greater
- 1 CD-ROM drive, X52 or greater
- 1 15" colour monitor 0.28 1024/768
- 1 WIN keyboard
- 1 loudspeakers set
- 1 Internal modem of 56k or greater*
- 1 Mouse

Included software:
- XP Home Edition® operating system
- Virus simulation software
- Diagnosis and repair software*

Diagnosis and Repair Hardware:*  
- POST codes detector module
- Series port testing module
- Parallel port testing module

(CD-ROM) Supplied Documentation:  
- Training System User’s Manual
- Training Manual
- Teacher’s Manual
- Technical Documentation

OPT-01 OPTION
The telephony training system ET-835 allows the theory and practice of PABX and internal telephone networks to be covered. It incorporates a PABX exchange, internal telephone lines and external lines, charging generator modules, fault simulator and connection points for analogue and digital (ISDN) terminals.

The ET-835 has block diagrams of each of its constituent modules, and also of its wiring. In the same block diagrams it is possible to measure the signals of the ISDN and analogue lines.

The trainer can be connected by modem or directly to a PC from which the operation of the PABX exchange can be managed and configured, in order to initiate the student in the principles of programming of internal telephone networks.

The ET-835 simulates the external analogue lines of the exchange, and so it is possible to generate calls from or to the exterior without the need to have actual external lines.

It moreover incorporates a pulse generator module which manages the rating of the external calls and in which different situations are simulated which allow the student to observe the effect of defective reception of the charging pulses.

Different faults can be simulated either in the PABX exchange, in the transmission lines or in the analogue terminal. The student can thus diagnose and trace faults in a telephone network.

It is presented in a casing stackable with the other units of the range in order to aid its storage.

**GENERAL FEATURES OF THE TRAINING SYSTEM**

**ISDN/ Analogue Telephone Exchange of latest generation**
- Number of external analogue lines: 2
- Number of internal analogue lines: 2
- Number of internal basic ports So (B+B+D): 4 internal
- Maximum number of lines: 96 considering both ISDN and analogue lines

**Telephone terminals:**
- 1 ISDN terminal with alphanumeric display
- 1 analogue terminal
- 1 analogue terminal that can be used to simulate failures

**Block diagrams with test points and telephone connection points, consisting of the following subsystems:**
- External Urban Telephone Exchange (2 lines)
- Billing circuits
- ISDN / Analogue Telephone Exchange
- External distributor
- Internal distributor
- Telephone Terminal that can be used to simulate failures
- Wiring

**Simulation of breakdowns in the following subsystems:**
- External Urban Telephone Exchange
- Billing Circuits
- ISDN/ Analogue Telephone Exchange
- Wiring
- Telephone terminals

**Composition of the ISDN/ Analogue Telephone Exchange:**
- Processing Unit (CU) consisting of:
  - Processor 80C186
  - 1 MB Flash EPROM (software memory)
  - 256 KB RAM Stable (operating memory)
  - 256 KB Flash EPROM (data memory)
  - Control unit of communication ESCC2 (Enhanced Serial Communication Controller).
  - Control of the connection area EPIC (Extended PCM Interface Controller).
  - DSP (Digital Signal Processor)
- Modem, CCITT V21 standard

**Switching power supply**
- Primary voltage: 115 V/230 V (configurable), ±10 %, 50/60 Hz

**Internal ISDN lines unit**
- 4 basic ports So (CCITT I.430) stimulation mode (B+B+D)
- Possible connection to the same basic access of the 2 ISDN terminals with a different consumer’s number.
- Powering of the terminals (-48 V)

**External Analogue Lines Unit**
- 2 analogue lines
- Dialling by impulse or multi-frequency
- Temporal switching from impulses to multi-frequency
- Flash Signals
- Control of the loop voltage
- Billing at 12 kHz
- Call detection at 25/50 Hz
- Maximum call voltage 150 Veff
- Protection against polarity inversion and overvoltage
- Galvanised insulation from the mains

**Components of the ET-835 Training System**
- Telephone terminals:
  - 1 ISDN terminal with alphanumeric display
  - 1 analogue terminal
  - 1 analogue terminal that can be used to simulate failures

- Documentation:
  - User’s Manual
  - Teacher’s Manual
  - Training Manual

- Accessories:
  - 1 mounting pliers
  - 20 meters of 4-wired telephone cable
  - 1 cable Exchange-PC (9 pin connector)
  - 1 cable Training system-Terminal that can be used to simulate failures (25 pin connector)
  - Telephone Connectors

- Software:
  - Configuration Software (1 diskette)
  - Software for failures (1 diskette)
  - Software for Exchange (4 diskettes)
The analogue communications training system **EC-696** has several types of emitters, transmission channels, receivers, modulators and demodulators, in order to shape a transmission system easily. For instance, it permits to compare the advantages of several transmission systems to others, including those fibre-optics based, or to analyse interference phenomena.

Easy to use and the capability to measure the electrical signals throughout the equipment has been taken into account by means of a series of test points. To this end, circuitry is located into a desk-like cabinet, with a transparent fold-down cover for a complete access. The equipment is composed of one Emitter set and one Receiver set, to be linked during training, by the selected transmission method.

**EMITTER MODULE EC-696/E**

The **EC-696/E** emitting system is provided with several inputs where generators or microphones can be connected. A set of sequential controls allows the equipment to be configured quickly, by selecting the input, modulation (AM, FM, PWM) or transmission modes through five different channels: twin cable, coaxial, fibre-optic, infrared or radio.

### EMITTER MODULE

<table>
<thead>
<tr>
<th>Signal inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 and CO2</td>
<td>Input from a generator</td>
</tr>
<tr>
<td>Maximum level</td>
<td>± 3 V</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>DC to 20 kHz</td>
</tr>
<tr>
<td>Input impedance</td>
<td>≥ 20 kΩ (1 kHz)</td>
</tr>
<tr>
<td>MIC1 and MIC2</td>
<td>Microphone inputs</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>6 mVpp, adjustable</td>
</tr>
<tr>
<td>Input impedance</td>
<td>≥ 20 kΩ (1 kHz)</td>
</tr>
</tbody>
</table>

### Modulators

| AM Modulator | Voltage-controlled gain amplifier |
| Carrier frequency | 100 kHz |
| Modulation index | 0 to 100% |
| Bandwidth | DC to 20 kHz |
| FM Modulator | Voltage-controlled oscillator |
| Carrier frequency | 100 kHz |
| Frequency deviation | ± 50 kHz |
| Bandwidth | DC to 20 kHz |
| Pulse Modulator (PWM) | Carrier frequency 100 kHz |

### Emitters

| Bifilar cable transmitter | Output through operational amplifier |
| Maximum level | ± 3 V |
| Coaxial cable transmitter | Output through operational amplifier |
| Maximum level | ± 3 V |
| Fibre optic transmitter | Emission |
| Emission band | By LED Photodetector |
| Infrared ray transmitter | 650 nm (red colour) |
| Visible light | 950 nm |

### DEMODULATOR SPECIFICATIONS

| AM Demodulator | Fast detector |
| Carrier frequency | DC to 20 kHz (bifilar and coaxial) |
| Bandwidth | 300 Hz to 20 kHz (fibre, infrared and radio) |

| FM Demodulator | DPLL type |
| Carrier frequency | 100 kHz |
| Bandwidth | DC to 20 kHz (bifilar and coaxial) |
| Pulse demodulator (PWM) | Integrator type |
| Carrier frequency | 100 kHz |
| Bandwidth | DC to 20 kHz (bifilar and coaxial) |
| FDM/FM Demodulator | DPLL type |
| Carrier frequency | 300 or 100 kHz selectable |
| Multiplex bandwidth | DC to 20 kHz (fibre, infrared and radio) |

<table>
<thead>
<tr>
<th>Output specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Earphone output</td>
<td>AB Class</td>
</tr>
<tr>
<td>Output stage</td>
<td>Independent for left and right channels</td>
</tr>
<tr>
<td>Volume control</td>
<td>200 mW over 32 Ω (3 Vpp in C)</td>
</tr>
<tr>
<td>Output power</td>
<td></td>
</tr>
<tr>
<td>Oscilloscope S1 and S2 outputs</td>
<td>Output level</td>
</tr>
<tr>
<td>Output level</td>
<td>≥ 400 m Vpp (3 Vpp in A)</td>
</tr>
</tbody>
</table>
The EC-796 is an ideal equipment for teaching digital transmission systems. It allows to cover the theory and practice of the different stages of a transmission system with ease: sampling, quantification, modulation, simulation of channel and reception; essential to lay the foundations for the modern telecommunication digital network.

The Emitter and Receiver modules have a test points prepared for the monitoring of the signals.

The EC-796 allows the development of experiments at five levels:
- Analysis of the sampling and quantification of analogical signals, with acoustic and visual experimentation of the effect of the sampling frequency (aliasing) and of the number of bits used in the generation of the PCM signal.
- Study of digital modulations on continuous wave in amplitude, frequency and phase.
- Experimentation of the characteristics of circuit alternatives in the emission and reception modules.
- Analysis of the effect of disturbance in the channel (interference, noise, bandwidth and attenuation) on the different modulations.
- Experimentation on different means of transmission: coaxial cable, two-wire, infrared, radio and optical fibre.

The EC-796 is presented in stackable desks, very easy to set up, designed both for graphic demonstrations of the theory explained in class, and for the student to carry out very attractive practices with basic instrumentation.

The instruments recommended for operation are a function generator and an oscilloscope.

**Signal inlets and outlets**

- Inlets for Function Generator, TTL signals and microphone.
- Outlet for headphone and connectors for oscilloscope.

**PCM signal, base band**
- Sampling and quantification:
  - Clock: 1.333 MHz
  - T bit: 12 µs
  - 11 bits frame: 1 start, 8 data, 1 stop and 1 parity.
  - Anti-aliasing filter BW 3dB: 280-3400 Hz
  - Comander and expander for microphone.

**Modulators**

**ASK (OOK)**
- Bandwidth modulator: DC - 60 kHz.

**FSK**
- Bandwidth modulator:
  - DC - 60 kHz (DFD reception)
  - DC - 100 kHz (FSK reception)

**BPSK and DBPSK**
- Bandwidth modulator: DC - 45 kHz

**QAM, QPSK and DQPSK**
- Bandwidth modulator: DC - 45 kHz
- Levels: 8

**Demodulators**

**ASK (OOK)**
- Type: Band pass filter, detector of envelope and comparator.

**FSK**
- Types:
  - Dual band pass filters
  - PLL direct detector

**BPSK and DBPSK**
- Pass band:
  - Referring to the microphone and signal input: all the anti-aliasing filter.
  - Referring to the TTL input: DC - 45 kHz

**QPSK, DQPSK and QAM (AFK)**
- Pass band:
  - Referring to the microphone and signal input: all the anti-aliasing filter.
  - Referring to the TTL input: DC - 45 kHz

**EMITTER CHARACTERISTICS**

**Twin Cable Emitter:**
- Output level (measured at connector):
  - receiver not connected: 0 at ±4 V (according to modulation)
  - receiver connected: 0 at ±3 V (according to modulation)
- Connector: banana female adapter

**Coaxial Cable Emitter:**
- Output level (measured at connector):
  - receiver not connected: 0 at ±4 V (according to modulation)
  - receiver connected: 0 at ±3 V (according to modulation)
- Connector: BNC female adapter

**Fibre Optic Emitter:**
- Emission by LED
- Emission wave-length: 850 nm (red)

**Infrared Emitter:**
- Emission by LED
- Emission wave-length: 950 nm

**27 MHz Emitter:**
- Output level on 50 Ω: 10 dBm
- Antenna: Monopole. 5 mm cable and 150 cm length
- Connector: BNC female
- Carrier frequency: 27 MHz (crystal)
- Modulation on AM: Modulation index of 10 to 40%, according to selected modulator signal

**RECEIVER CHARACTERISTICS**

**Twin-Line Cable Receiver:**
- Type: Direct
- Connector: Banana adapter

**Coaxial Cable Receiver:**
- Type: Direct
- Connector: BNC adapter

**Fibre Optic Receiver:**
- Type: Photo-diode (PIN).
- Reception band: 400 - 1.100 nm (for 90% efficiency)
- FSMA connector

**Infrared Receiver:**
- Type: Photo-diode (PIN).
- Reception band: 800 - 1.000 nm (for 50% efficiency)

**27 MHz Receiver:**
- Type: Envelope detector
- Reception band: 27 MHz
- Antenna: Monopole. 5 mm cable, 150 cm length
- Connector: BNC female adapter

**Accessories and documentation included**
- Antenna connection cables
- Optical fibre PMMA with FSMA connectors
- Headphone and dynamic microphone
- User’s Manual
- Theory Manual
- Training Manual
- Electric diagrams and Technical Documentation
The ET-891 is an ideal piece of training equipment to teach the operation of colour TV receivers, which allows the student to familiarise himself with the most advanced technological innovations. The tutor includes a fault generation module and a trainer for the I2C communications Bus.

The block diagrams of the ET-891 intuitively shows the different modules which make up the colour TV receiver. Its large number of test points allow the analysis and monitoring of the electric signals in the different functional blocks of the receiver. It is safe to operate since all the test points are protected against possible accidental short-circuits.

Using the fault module it is possible to simulate the most common faults which can occur in the receiver with thus establishing methods of diagnosis and tracing.

The trainer moreover incorporates a microcontroller which makes it possible to carry out practices related to the operation of the I2C communications BUS.

Special attention has been paid to its design, obtaining a small-sized functional piece of equipment. Moreover, in its rest position, it can be used as a domestic desktop TV.

The EA-815 Universal Antenna trainer for MATV (Master Antenna Television), SMATV (Satellite Master Antenna Television) and CATV (Cable Television) system is designed for study and training on installations.

The main purpose of the EA-815 is to enable the student to calculate, install, configure, adjust, alter, analyse and localise breakdowns in distribution networks using:

- Terrestrial television (MATV)
- Analogue and digital satellite television (SMATV)
- Cable television (CATV)

The EA-815 trainer offers a flexibility which enables an endless number of real MATV, SMATV (analogue and digital) and CATV installations to be reproduced. It is possible to recreate the more common breakdowns and problems the student will come across on the field. It allows him furthermore to test and compare the efficiency of the different solutions available to him.

The student will be able to familiarise himself with the professional equipment used in real installations and advanced instruments.
The work book presents practical exercises designed to facilitate the learning process. The proposed exercises have the aim of calculating and performing measurements on different types of installations and localising the more common problems which the student will come across in future installations.

The trainer components are laid out on an erasable board, which allows the teacher to draw the configuration of the reception, amplification and distribution system the student has to set up. This diagram will be used by the student as a guide and from it he can easily assemble the installation.

The white board may be used as a note pad by the student to write down the measurements taken beside each component when analysing an installation or trying to localise a breakdown, so that he can immediately determine the attenuation of the each section of the installation.

<table>
<thead>
<tr>
<th>ANTENNAS</th>
<th>MECHANICAL ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 27 elements UHF antenna (channels 21-69)</td>
<td></td>
</tr>
<tr>
<td>- Parabolic antenna containing: - Reflector</td>
<td></td>
</tr>
<tr>
<td>- 1 m OFF-SET</td>
<td></td>
</tr>
<tr>
<td>- LNB 4 outputs: HBB, VBB, HBA, VBA</td>
<td></td>
</tr>
<tr>
<td>- Accessories: rods and power accessories</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 150 cm mast for terrestrial antenna</td>
</tr>
<tr>
<td></td>
<td>- 80 cm mast for parabolic antenna</td>
</tr>
<tr>
<td></td>
<td>- Mobile stand for antennas with wheels</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEAD END EQUIPMENT</th>
<th>- MATV</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Set of 7 programmable UHF amplifiers</td>
<td></td>
</tr>
<tr>
<td>- VHF amplifier</td>
<td></td>
</tr>
<tr>
<td>- Power supply</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>- SMATV (analogue and digital) for RF</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Programmable IF-UHF (stereo) internal units</td>
</tr>
<tr>
<td>- Universal programmer</td>
</tr>
<tr>
<td>- Power supply for internal units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>- SMATV (analogue and digital) for IF</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Adjustable IF amplifiers (x4) with terrestrial signal mixing and amplification</td>
</tr>
<tr>
<td>- Power supplies for LNBs and IF amplifiers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COLLECTIVE AND INDIVIDUAL MATV DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Ssplitters/combiners</td>
</tr>
<tr>
<td>- Taps</td>
</tr>
<tr>
<td>- Through outlets and end outlets</td>
</tr>
<tr>
<td>- Splitter outlets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COLLECTIVE AND INDIVIDUAL SMATV DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ANALOGUE AND DIGITAL) BY INTERMEDIATE FREQUENCY</td>
</tr>
<tr>
<td>- IF splitters</td>
</tr>
<tr>
<td>- H and V commutable IF splitters</td>
</tr>
<tr>
<td>- IF outlets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COLLECTIVE AND INDIVIDUAL SMATV DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ANALOGUE AND DIGITAL) BY CHANNEL PROCESSING</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MIXED COLLECTIVE AND INDIVIDUAL SMATV DISTRIBUTION</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>COLLECTIVE CATV DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>- CATV line amplifier with attenuator, equaliser and pre-emphasiser</td>
</tr>
<tr>
<td>- Active return channel with gain control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USER EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Analogue Tuner</td>
</tr>
<tr>
<td>- Remote control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACCESSORIES FOR AIMING ANTENNAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Inclinometer</td>
</tr>
<tr>
<td>- Compass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACCESSORIES AND CABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Markers for the white board</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OTHER ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Load adapters</td>
</tr>
<tr>
<td>- Bridges</td>
</tr>
<tr>
<td>- Polarising connector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOCUMENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>- User’s Manual</td>
</tr>
<tr>
<td>- Training Manual</td>
</tr>
<tr>
<td>- Technical documentation</td>
</tr>
<tr>
<td>- Assembly instructions</td>
</tr>
</tbody>
</table>
The EF-970E trainer is an innovative system designed for training, demonstration and experimentation with the Fibre Optics communication systems, the phenomenon related to light and the principles of transmission through Optical Fibres; as well as the latest tendencies like LASER and WDM (wavelength multiplexing).

The equipment consists of:
- Emitter module, two independent channels with photo-emitters and LASER.
- Receptor module with optical power measurements.
- Accessories.
- A set of Optic Fibres
- Documentation.

**Emitter Kit, Consisting of Two Independent Channels with LED and Laser-Photoemitters**

8 Inputs

The instrument possesses eight selectable inputs. The input signal may be selected, either channel 1 (CH 1) or channel 2 (CH 2), the same input may also be used for both channels.

1- LF generator: sinusoidal, triangular or square (internal) signal
2- DC analogue input (75 Ω) (external)
3- AC analogue input (75 Ω) (external)
4- Microphone (monophonic) (external)
5- Digital input (External)
6- Inverted digital input (External)
7- Digital input permanently on “1” (internal)
8- Digital switch “1” / “0”, using the TL1 key (internal)

**Channel 1 and 2**

The emitter kit consists of 2 independent channels (channel 1 and channel 2) that enable signals to be transmitted from any optical input and control the amplification of the input signal level. Includes channel overload or saturation indicator.

**LF Generator (square, triangular, sinusoidal)**

The BF generator possesses four control buttons to select the wave form (square, triangular or sinusoidal) and the frequency

**Milliammeter**

The emitter kit consists of a digital milliammeter showing the polarisation current flowing through the chosen photomitter. The channel to be measured is selected with the “A METER CH1/CH2” button.
**光学输出**

发射器套件具有六个循环可选的光探测器。两个光探测器可以同时激活，用于WDM应用。

光探测器有一个保护电路来限制光学功率。

**激光反馈**

激光的性质意味着其光学功率可能受到温度、老化等外部因素的影响。

反馈电路能够保持稳定且不可改变的光学功率，无论外部条件如何。

系统可以运行反馈电路开启或关闭，以测试其效率以及断开和/or故障可能产生的问题。

**接收器**

接收器套件主要由两个独立的模块组成（除了输入电路：光探测器和开关），一个用于信号，另一个用于测量。

信号模块包含两个独立的通道，一个用于接收模拟信号，另一个用于数字信号。

测量模块包含功率计，使其能够在四种不同模式下运行：模拟、数字、1 kHz和DC。

**光学输入**

接收器有四个集成的光探测器，还有一个可选的外部光探测器，通过同轴电缆连接到“EXT. SENSOR”输入。

**模拟通道信号模块**

该模拟通道有一个40 dB的增益，使用两个20 dB放大器级。

**数字通道信号模块**

该通道的信号遵循一系列过滤和放大过程，以与参考水平进行比较。

该通道输出信号的幅度可以被选为TTL等级或RS-232等级。

该模块具有一种开关，用于选择第一级放大器输入以及模拟通道输出部分的直流或交流耦合。

音频部分包括一个单独可调节的低通滤波器，用于调节内部扬声器或耳机的信号应用水平。

**光功率计**

该模块执行接收光学功率的绝对或相对测量。光功率计具有四种测量模式，由用户选择。

**模拟（监控模式）**

**数字（监控模式）**

1 kHz（精度模式，用于测量1 kHz分量）

**直流（精度模式）**

该功率计在监控模式下的分辨率是0.1 dB，在精度模式下的分辨率是0.01 dB。

**光学功率计**

该模块执行接收光学功率的绝对或相对测量。该模块在监控模式下的分辨率为0.1 dB，在精度模式下的分辨率为0.01 dB。

**DANALOG（监控模式）**

**DIgital（监控模式）**

1 kHz (精度模式，用于测量1 kHz分量)

**DC（精度模式）**

该模块执行接收光学功率的绝对或相对测量。该模块在监控模式下的分辨率为0.1 dB，在精度模式下的分辨率为0.01 dB。
BASIC FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM

The EF-970 FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM is a simplified version of the EF-970-E, including five photo-emitters and two photo-detectors. The rest of features are the same as those of the EF-970 E. If desired, the EF-970 can be upgraded to the EF-970 E with the OP-970-EU option.

INCLUDED ACCESSORIES

Both EF-970-E and EF-970 include the following accessories:
- 3 ST adapters for the photodetectors
- Cleaning elements for optical components
- 3 1-m pieces of optical fibre
- 1 1-m piece of optical fibre without protective covering
- 1 50-m optical fibre
- 2 ST-ST adapters
- 1 magnifying lens
- 1 microphone
- 1 headphones

OPTIONS

OPT-970-01: Exercises kit
- 1 2-m piece of optical fibre
- 1 2-m piece of optical fibre without protective covering
- 1 set of modal filters (cylindrical hoops with various radiuses)
- 2 clips for modal filters
- 1 set of plaques for generating high-density microcurves
- 1 set of plaques for generating low-density microcurves
- 1 optical fibre arm
- 2 fixed WDM devices
- 1 white light source (powered by two LR03 1.5 V alkaline batteries, not supplied)
- 1 set of neutral optical filters
- 1 universal bracket (# 1)
- 1 universal bracket (# 2)
- 1 variable attenuator
- 1 ST adapter for 650 nm filter photo-detectors
- 1 ST adapter for 850 nm filter photo-detectors
- 1 shutter (diaphragm)
- 1 reflection sensor
- 1 reflecting lamina
- 1 U-sensor
- 1 liquid container
- 1 external photo-detector (1 mm Si PIN)
- 1 measurement adapter (for external photo-detector)
- 1 shielded connector cable for external photo-detector
- 1 screwdriver

OP-970-02: Connection kit
- 1 tool for removing the protective covering from optical fibre
- 1 ST crimping tool
- 1 polishing disk
- 1 set of abrasive laminas
- 1 elastic polishing pad
- 1 rigid pad
- 1 liquid container
- 1 10- m optical fibre cable
- 10 ST connectors

OP-970-03: Microscope
- 1 Universal Microscope (ST, FC, SC) x 100

OP-970-EU: Extension kit for basic fibre optic communications training system (Factory assembly)
- Upgrades the basic Fibre Optics Trainer (EF-970) to the same characteristics as the EF-970-E
  Photo-emitter 1300 nm Led
  1 mm InGaAs PIN photo-detector
  0.1 mm Ge APD (variable internal gain photo-detector)
FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM
SPECIFICATIONS

Emitter module

The emitter kit for the simultaneous transmission of two independent channels of up to 10 MHz consists of the following blocks:

Inputs
- Analogue (separate DC and AC)
- Functions generator (internal)
- Microphone
- Digital (with possibility of inversion)

Emitter stage
- Channel 1
- Channel 2, with actionable laser feedback

Amperimeter, for adjusting photoemitter polarisation current

Photoemitters
- 526 nm Led
- 590 nm Led
- 660 nm Led
- 850 nm Led
- 1300 nm Led
- 650 nm Laser

Fault simulator

RECEIVER MODULE

Photo-detectors
- 1mm Si PIN
- 1mm InGaAs PIN
- 0.1 mm Ge APD (variable internal gain photodetector)
- 2.5 mm Si PIN

Precision measurements channels
- 1 kHz, to prevent influence from external optical sources
- Very low DC noise, for very precise measurements

Receptor stages (with variable inverse polarisation)
- Analogue channel
- Digital channel

Optical power meter (dBm and mW) with absolute and relative measurements

Outputs
- Analogue (high or low impedance)
- Digital (TTL or RS-232)
- Speaker (internal) and headphones

Fault simulator

CD-ROM supplied documentation
- User’s Manual
- Training Manual

Partial list of exercises

EF-970
- Measuring optical power (suggested EF-970-E)
- Measuring the attenuation of an optical fibre. Insertion losses method (suggested EF-970-E)
- Spectral dependence of an optical fibre
- Influence of ambient light
- Connecting optical fibre using ST-ST adapters
- Measuring repeatability
- Measuring the P/I characteristics of photo-emitters
- Measuring the V/I characteristics of photo-emitters
- Frequency characteristics of photo-emitter modulation
- Spectral dependence of photo-detectors (suggested EF-970-E)
- Inverse voltage in photo-detectors
- Bandwidth of photo-detectors
- Transmission of analogue signals
- Transmission of audio signals
- Transmission of video signals
- Transmission of digital signals
- RS-232 transmission by optical fibres

EF-970-E
- Optical power measurement
- Measuring the attenuation of an optical fibre. Insertion losses method (suggested EF-970-E)
- Measuring the attenuation of an optical fibre
- Spectral dependence of the attenuation of an optical fibre
- Influence of ambient light
- Connecting optical fibre using ST-ST adapters
- Measuring repeatability
- Measuring the P/I characteristics of photo-emitters
- Measuring the optical stability of photo-emitters
- Measuring the V/I characteristics of photo-emitters
- Frequency characteristics of photo-emitter modulation
- Spectral dependence of photo-detectors (suggested EF-970-E)
- Inverse voltage in photo-detectors
- Bandwidth of photo-detectors
- Transmission of analogue signals
- Transmission of audio signals
- Transmission of video signals
- Transmission of digital signals
- RS-232 transmission by optical fibres

OP-970-01 Exercises kit
- Sensitivity of optical fibre to curvature (Macrocurves)
- Sensitivity of optical fibre to microcurvature
- Radiation characteristics of optical fibre. Measuring numeric aperture
- Measuring sliding in optical fibre connections
- Characteristics of a fixed WDM device
- Characteristics of a variable WDM device
- Measurements with neutral optical fibres
- Measuring insertion loss by the variable optical attenuator
- WDM: multiplexation and demultiplexation
- WDM system
- WDM transmission
- Transmission sensor
- Reflection sensor
- Liquid level sensor
- Spectral dependence insertion loss by the variable optical attenuator (EF-970-E needed)
- Comparing noise characteristics between PIN and APD photo-detectors (EF-970-E needed)

OP-970-02 Connection kit
- Connections with the optical fibre connector tool kit EF-970 or EF-970-E

OP-970-03 Microscope
- Recommended even to use with OP-970-02
**DVD & CD PLAYER TRAINER (Region 2)**

The ED-845 DVD & CD Player Trainer is an educational instrument designed for the theoretical/practical study of the workings of a DVD & CD player, as well as the operation of DVD-format digital video and audio signals, and digital audio in CD format. The functional structure of the equipment enables its internal composition to be observed, the various signals involved in its operation analysed by means of a block diagram and faults introduced, all in order to aid the student learn diagnostic methods and how to locate breakdowns.

The trainer includes a DVD & CD player using the latest digital signal processing technology, and offering the best features found on the market today. In the training Manual, the theoretical aspects and the description of the circuits are also included basic that compose the equipment.

The instrument is backed up by extensive documentation (which includes a Training Manual, Teacher's Manual and Technical Documentation Manual), a Test DVD disk, a Test CD disk*, an infra-red remote control (batteries included) and an audio/video connector cable.

Using the block diagram, which shows the generic structure of a DVD & CD player, the student can access the main signals involved. The block diagram consists of the following stages:

- Optical Unit (Pickup)
- RF Block
- Servosystems
- Drivers
- Digital Processor
- Video Processor
- Audio Processor
- System Control
- Keyboard, Remote Control, Display
- Power Supply

The breakdown simulator enables malfunctions to be introduced into the DVD & CD player, thereby simulating a large number of real breakdowns.

**SPECIFICATIONS**

**Signal Format:** PAL/NTSC (without transcoding)

**Disk Player:** DVD VIDEO, CD VIDEO, CD AUDIO

**Outputs:** Coaxial Digital Out, Audio Line Out, Video Line Out, Euroconnector, S Video

**Disk player:** DVD VIDEO, VIDEO CD and AUDIO CD

**Outputs:** Digital Out Coaxial, Line Out Audio, Line Out Video, Euroconnector, S Video

**Digital audio outputs:** DTS, Dolby Digital, MPEG

**Fault simulator**

The simulator of failures manipulates electrical points of the DVD allowing to cause a large number of failures.

**DOCUMENTATION CD-ROM INCLUDED**

- User’s Manual
- Exercise Manual
- Teacher’s Manual
- Technical Documentation Manual
- CD & DVD Player User’s Manual

**ACCESSORIES INCLUDED**

- Remote control
- Test DVD disk*
- Test CD disk
- Connection cables

* (In German)
The **ER-832** has been designed from a stereo radio tuner equipped with the Radio Data System (RDS) and with the most advanced reception circuits. From among its characteristics we can highlight:

- **Radio Data System (RDS).** Incorporated functions:
  - Name of the broadcast station
  - Alternative Frequency (AF)
  - Current Time display (CT)
  - Broadcast station search according to program type (PTY)
  - Digital signal level meter (display range from 16 to 70 dBmV)
  - Frequency range (FM, MW, LW)

- **FM:** 87.5 – 108 MHz
- **AM:** 522-1611 kHz, 144-288 kHz
- **30 pre-set memories**
- **Direct tuning through frequency introduction**
- **Automatic broadcast station search**
- **Automatic alphabetical ordering of the broadcast stations**
- **Menu selection system**
- **Display personalization**

**BLOCK DIAGRAMS**
The block diagrams consist of the following functional modules:

- AM radio-frequency input section
- AM intermediate frequency amplifier
- AM oscillator and mixer section
- AM detection
- PLL synthesiser and frequency divider
- FM radio-frequency input section
- FM intermediate frequency amplifier
- FM oscillator and mixer section
- FM demodulator
- Multiplex decoder
- RDS demodulator
- Output section
- System control
- Automatic tuning system and memories section
- Audio section
- Power supply

**FAULT SIMULATOR**
Each one of the functional sections has several test points which permit the analysis and monitoring of the main electrical signals of the tuner. All the test points are protected against possible accidental short-circuits.

**ACCESSORIES AND DOCUMENTATION INCLUDED**
- User’s Manual
- Electric diagrams and Technical Documentation
- Auto-amplified speakers
- AM Antenna
- FM Antenna
- Connection cables

The **EG-833** has been designed from a stereo cassette deck equipped with DOLBY B and C noise reduction systems. From among its characteristics we can highlight:

- **3 heads**
- **1 Motor**
- **Dolby® B and C**
- **Automatic Tape Selector (ATS)**
- **Automatic recording level adjustment of the (ARL)**
- **Gradual increasing and fading function**
- **Insertion of blank spaces**
- **Signal level indicator**
- **Automatic Music Search (AMS)**
- **Selectable MPX filter**
- **A1-II Control**
- **Headphones output**
- **Synchronous recording**

**CASSETTE RECORDER TRAINING SYSTEM**
The fault simulator manipulates electric points of the cassette deck, allowing to simulate real faults.

**ACCESSORIES AND DOCUMENTATION INCLUDED**
- User’s Manual
- Training Manual
- Electric diagrams and Technical Documentation
- Auto-amplified speakers
- Test Tape
- Connection cables
THE EV-830 VIDEO CASSETTE RECORDER TRAINING SYSTEM

The EV-830 video trainer is a teaching equipment intended for training Professional students in an easy and enjoyable manner, which makes them possible to assimilate the operation and the repair techniques of VHS video equipment. It is accompanied by extensive documentation which includes User’s Manual, Training Manual, Block Diagrams and Technical Documentation.

The EV-830 has been designed on a multifunctional support which aids the analysis of the most important electric signals in the different modes of operation of the video, the inspection of all the movements of the mechanical elements and the simulation of the most frequent faults. Under the upper cover of the equipment, there are block diagrams of the video with a large number of test points which allow the visualisation and monitoring of the different electric signals in any mode of operation. All the test points are protected against possible accidental short-circuits.

The units can be stacked with the rest of the range and in their rest position they can be used as domestic desktop instruments.

VIDEO RECORDER-PLAYER

The EV-830 incorporates a video recorder manufactured with the most advanced technology, equipped with a high level of features and with a wide diffusion on the market. From among its characteristics we can highlight:
- PAL system
- Automatic tuning
- Two heads
- Self-cleaning
- Auto-tracking digital
- Euroconnector
- Frame-by-frame and pause
- Automatic System for failure detection

- Video
- Sound
- Servosystems
- Control System
- Power supply

FAULT SIMULATOR

The fault simulator manipulates electric points of the video, allowing a large number of test points to be simulated.

DOCUMENTATION CD-ROM INCLUDED

- User’s Manual
- Training Manual
- Electric diagrams and Technical Documentation

- Video Pattern Tape
- Connection cables

AMPLIFIER TRAINING SYSTEM

The EP-834 has been designed from a high end power amplifier equipped with the most advanced technology and design.

From among its characteristics we can highlight:
- DIN power output (4Ω at 1 kHz): 70 W + 70 W
- Protection against short circuits
- Tone control: bass and treble
- Loudness control
- Balance adjustment
- Subsonic filter
- 6 audio inputs
- Source Direct (to listen directly to the input signal)
- Tape monitor
- EON-LINK connection (switch to EON programme with RDS broadcast stations)
- Headphone output
- Non-vibration chassis
- Total harmonic distortion: less than 0.008% (at 10 W output)
- Frequency response:
  - PHONO (20 Hz - 20 kHz): RIAA equalisation curve ± 0.5 dB
  - TUNER, CD, AUX, TAPE1/DAT, TAPE2/MD:
    - 7 Hz - 70 kHz ± 0.3 dB
  - S/N ratio:
    - PHONO: 80 dB
    - TUNER, CD, AUX, TAPE1/DAT, TAPE2/MD:105 dB

- Equalisers
- System control
- Power supply

Each one of the functional sections have several test points which permit the analysis and monitoring of the main electrical signals of the amplifier. Safe to operate, all the test points are protected against possible accidental short-circuits.

ACCESSORIES AND DOCUMENTATION INCLUDED

- User’s Manual
- Training Manual
- Electric diagrams and Technical Documentation
- Speakers
- Loads
- Remote control
MICROCONTROLLER TRAINING SYSTEM

The **TM-311** microcontroller trainer has been specifically designed to teach programming and use of the most commonly used commercial microcontrollers on the market, quickly and efficiently. The instrument is based on the 80537 microcontroller whose main characteristic is its complete compatibility with the 8031/8051 range of microcontrollers, widely distributed throughout industry. This is the basic starting point for training future microcontroller experts. Furthermore, the 80537 being a much more up-to-date microcontroller, it includes a multitude of improvements that make it more powerful and easier to use, such as: 9 I/O ports, 12 analogue inputs, programmable reference voltage and multiple data pointers.

- Equipped with a 80537 microcontroller, 100% compatible with software for the 8031/8051 range of microcontrollers.
- 32 k EPROM for program code.
- 32 k static RAM for program code.
- 32 k static RAM for data.
- Microcontroller bus expansion connector
- Connector allowing access to the microcontroller I/O ports
- Communication with PCs by RS-232C (2 ports) or RS-485

**FEATURES**

- Equipped with a 80537 microcontroller, 100% compatible with software for the 8031/8051 range of microcontrollers.
- 32 k EPROM for program code.
- 32 k static RAM for program code.
- 32 k static RAM for data.
- Microcontroller bus expansion connector
- Connector allowing access to the microcontroller I/O ports
- Communication with PCs by RS-232C (2 ports) or RS-485

(The Documentation only available in Spanish language)

16 bits MICROPROCESSOR TRAINING SYSTEM

The **TM-683 MICROINSTRUCTOR** is intended for developing and debugging application programs related with the 68000 Microprocessor, by using a personal computer or a terminal as control elements. Definite features have been considered in its design so to produce a prominent training equipment in fields covered by microprocessors and, specifically by the 68000, its structure and programming.

The software supplied is a three-module structure: Monitor, Simulator and Assembler programs. Working with the **TM-683** is efficient and user-friendly.

**SOFTWARE FEATURES**
- Handling of the **TM-683** memory
- Handling of the CPU registers
- Executing an user program
- File handling (Motorola S28 format)
- Further specific functions of system
- Memory handling menu
- Block handling menu
- Port handling menu
- Execution options menu
- Assembler program

**HARDWARE FEATURES**
- **CPU** Uses the 68000 µP at 8 MHz without wait states
- **Memory** Provided with 64 k words of 16 bits in SRAM (128 kbytes)
- **EPROM** memory for 32 k words of 16 bits, expandable up to 64k
- Inputs and outputs
- Connectability and expansion
- 68000 own signals
- Microprocessor control signal
- Signals for decoding memory and peripherals
- Communication with terminal
The TM-530 trainer is an innovative educational tool specifically created for easily learning the design, programming and development of applications using programmable logic devices (PLD). It may also be used professionally as an agile testing instrument for designing logic circuits without the need of creating connections or welding, or wasting time building circuits.

The instrument consists of:
- Wiring configuration and programming software
- PLD application design, compilation and simulation software
- Hardware module + ISP devices (in system programmable)
- Documentation (CD-ROM)

The configuration software enables PLD connections to be graphically assigned to the various components that make up the hardware module, without the need of the student to physically having to create the connections. The same software loads the application files (previously generated by the design software) onto the hardware module ISP device, "in system programmable".

Using the PLD application design, compilation and simulation software, the student enters the logic circuit design with diagrams or ABEL-HDL to generate the JEDEC file, which is then recorded in the PLD. Operation of the design may be functionally simulated before recording. The hardware module is then used by the student to test the real operation of the application. The hardware module includes two Lattice devices (ispGAL22V10 and ispLSI1024), null insertion socket for GAL devices and a wide range of inputs/outputs (micro-switches, buttons, clocks, LEDs, displays and A/D and D/A converters, etc.) assigned by the configuration software. It also has a parallel bus output.


(The Documentation only available in Spanish language)

SPECIFICATIONS

Graphic User Interface
Programming GAL-type logic devices: 16V8, 20V8 and 22V10
Null insertion sockets for GAL’s
Programming ispGAL22V10 and ispLSI1024 logic devices on boards
Flexible input/output software assignation of the logic device according to application

Available inputs/outputs:
- 1, 8-bit D/A converter
- 1, 8-channel, 8-bit A/D converter
- 2, 7-segment displays
- 2 relay outputs
- 16 switches
- 1 variable oscillator
- 16 led diodes
- 2 buttons
- 1 hexadecimal keyboard
- 1 application connector

Output compatible with PROMAX series MM-6XX educational modules
Communication between the trainer/programmer and a PC using the parallel port
Included power supply

Exercises (extract):
- Basic gates: NOT, AND, OR, NAND, NOR, XOR, NXOR
- Multiplexer/ Demultiplexer
- Encoder/Decoder
- bit adder 4, 8, ...
- Comparator
- Registries
- Counter
- Sequence detector

Requirements:
- PC-PENTIUM II® or greater
- Windows 98® O.S.
- Parallel port
MICROPIC LAB PLUS BASIC PICS TRAINER  
(16F84 family)

The MICROPIC LAB PLUS is an instrument for use by professional and higher educational laboratories, as well as by PIC microcontroller design and engineering firms.

The IC003 consists of:
- MICROPIC TRAINER: Development system
- MICROPIC TRAINER PLUS: Peripherals expansion card
- PICS I DESIGN COURSE: PIC design practical course

The whole thing is mounted on a methacrylate board for easy use, transport and storage.

The MICROPIC LAB PLUS allows for training on and the design of projects ranging from the simplest ideas to the most spectacular applications using a multitude of peripherals and advanced communications protocols such as RS-232 and I2C buses.

In industrial design tasks, the instrument provides all the hardware and software resources that are normally required for the development of any system. The device includes a practical design course employing PICs, which has been specifically created for those who are beginning microcontroller design, in mind. All the exercises are carried out using the PIC16F84 and the MICROPIC TRAINER and MICRO PIC TRAINER PLUS tools, in combination with either the SIMUPIC’84 or the MPLAB simulator.

MICROPIC TRAINER

- Diskette containing the control software and applications
- In-circuit PIC recorder.
- PIC eraser with EPROM and FLASH memories.
- 4 MHz quartz-crystal oscillator and Reset button.
- Cable for connection to the PC parallel port.
- Peripherals to emulate applications: LCD screen, 7-segment display, potentiometers to simulate analogue inputs, switches and LED diode bar.
- PICBUS expansion connector to adapt to the other modules.
- User manual, with a full tutorial for assembly, set up and handling. Contains various training programs
- Various types of adapters and complementary resources to meet the user’s needs and the wide range of PIC models.

MICROPIC TRAINER PLUS

- Direct connection to the MICROPIC TRAINER with the included 26-line flat cable and the PICBUS connector.
- RS-232 communications channel with standard connector. If the employed PIC has USART installed, use lines RC6 and RC7, if it is controlled by the software, use RB4 and RB5.
- I2C interface controlled by lines RC3 and RC4 in PICs using an integrated module, and by lines RB6 and RB7 when controlled by the software.
- 4-digit display of 7 segments controlled by integrated circuit I2C, model SAA1064.
- Four AD conversion channels and one DA, supported by the PCF8591 device.
- 8-digital-line I/O port through I2C device PCF8574.
- Diode bars giving information on the state of the digital lines.
- Real time Clock/Calendar with PCF8583 I2C device powered by a rechargeable Ni/Cd battery that also holds 240 bytes of non-volatile RAM memory.

PICS I DESIGN COURSE

Contents index

- Subject 1 Programming the PIC16F84 and its Architecture. Collection of exercises using Simupic’84 and/or MPLAB.
- Subject 2 Main Resources: Timer, Switches, I/O, etc. Collection of exercises using the MICROPIC TRAINER.
- Subject 3 New Peripherals and the I2C Bus. Collection of exercises using the MICROPIC and the MICROPIC TRAINER PLUS.
- Annexes: 7 Containing the communications programs and routines, I2C Modules C Programs, etc.
- DISKETTE Contains the solutions to all the given exercises in Assembler and C languages.

(The documentation for these instruments is only available in Spanish Language)
There is a wide range of classic applications that are used in industry: motor governors, power control, analogue parameter manipulation, wave train generation, relay activation, etc. Certain specific resources are employed to support these requirements, therefore the microcontrollers involved in these processes are to be found in a chip.

The average range of PICs contains models with the particular devices needed to accomplish a specific industrial task already installed in the silicone chip. Special mention should be made of the PIC16F87X which includes AD converters, various timers, a UART series channel, an I2C bus, capture and comparison modules, pulse width modulation, etc.

The IC004 consists of:
- MICROPIC IO: Advanced peripherals card (sensors and industrial actuators)
- F87x SOCKET: Kit for performing exercises with PIC 16F873
- PIC II DESIGN COURSE: Advanced PIC design practical course

MICROPIC IO
The MICROPIC IO card, connected directly to basic PIC trainer IC003, makes an excellent test bed to analyse and debug the routines which control the peripherals and resources commonly used in industry.

In order to help the user get the most out of his MICROPIC IO card, an advanced PIC design practical course is included which contains various exercises, programs and projects, as well as a selection of industrial control routines that may be applied to the MICRO PIC IO modules.

The course is aimed at users with a knowledge of the basic principles involved in PIC design laid out in the first part and who now want to learn more about the new, powerful resources contained in the latest models of the PIC16F87x family. All the exercises in this part are carried out using the PIC16F873. These require the MICROPIC TRAINER, the ZOC87x adapter socket, the MICROPIC TRAINER PLUS and the MICROPIC IO card. The 9 subjects begin with a brief summary of each device and then propose a series of exercises to demonstrate its operation. Special emphasis is given to motor control, the control of analogue sensors using converters, wave generation, power control using triacs, relay activation, FLASH and EPROM program and data recording, etc.

Note: This kit of extension, requires the basic trainer PIC’S I C003 to work.

SPECIFICATIONS
MICROPIC IO
- DC motor speed control
- Optical encoder to control motor rotation and speed
- Multiple wave generator
- Power control using the Triac firing angle
- Illumination control
- Oscillator
- Analogue light and temperature sensors
- Two microrelays
- Piezoelectronic buzzer
- 12 VAC power supply
- Stabilised power source
- Two PICBUS connectors for adapting to other tools
- User’s Manual

ZOC F87x SOCKET
- This is a kit that allows you to control the latest PIC16F87x resources in the MICROPIC TRAINER using a FLASH memory. Furthermore the adapter socket also includes a PIC16F873 with a

PICS II DESIGN COURSE
Contents index
- Subject 1 Programming the PIC16F87x and its Architecture. Exercises with I/O ports
- Subject 2 Timer 1. Exercises
- Subject 3 Timer 2. Exercises
- Subject 4 Capture and Comparison Module. Exercises
- Subject 5 PWM Module. Exercises
- Subject 6 The Analogue/Digital Converter. Exercises
- Subject 7 The MSSP Series Port: UART Mode. Exercises
- Subject 8 Series Communications using the I2C Bus. Exercises
- Subject 9 Programming and Handling the EPROM and FLASH. Exercises.
- Annexes

N.B.: The documentation for these instruments is only available in Spanish language
ELECTRONIC TRAINING EQUIPMENT

TRAINING EQUIPMENT RANGE

- ELECTRONIC & TELECOMMUNICATIONS TRAINING EQUIPMENT
- TECHNIQUES OF ELECTRICAL SYSTEMS
- STUDY OF THE AUTOMOBILE TECHNOLOGIES
- PRACTICES OF PROCESS CONTROL
- REFRIGERATION TRAINING AND CONDITIONED AIR

www.promax.es
TELECOMMUNICATION TEST EQUIPMENT
TV&Satellite Level Meters
Cable TV Analysers
Satellite TV Analysers
Optical Fibre Instruments

TV GENERATORS
Analogue TV signal Generators
Digital TV signal Generators
Monitor Test Generators

TEST AND MEASUREMENT
Spectrum Analysers
Logic Analysers
Radio communications Analyser
Network Analysers
Frequency Counters
Power supplies
Generators
RF Generators
Electrical Measurements
Audio Analyser
Components Tester
Digital Multimeters
Oscilloscopes
Device Programmers
CRT Rejuvenators
Sound Level Meter
RF Wattmeters

The design and specifications of all the instruments are subject to changes without prior warning.