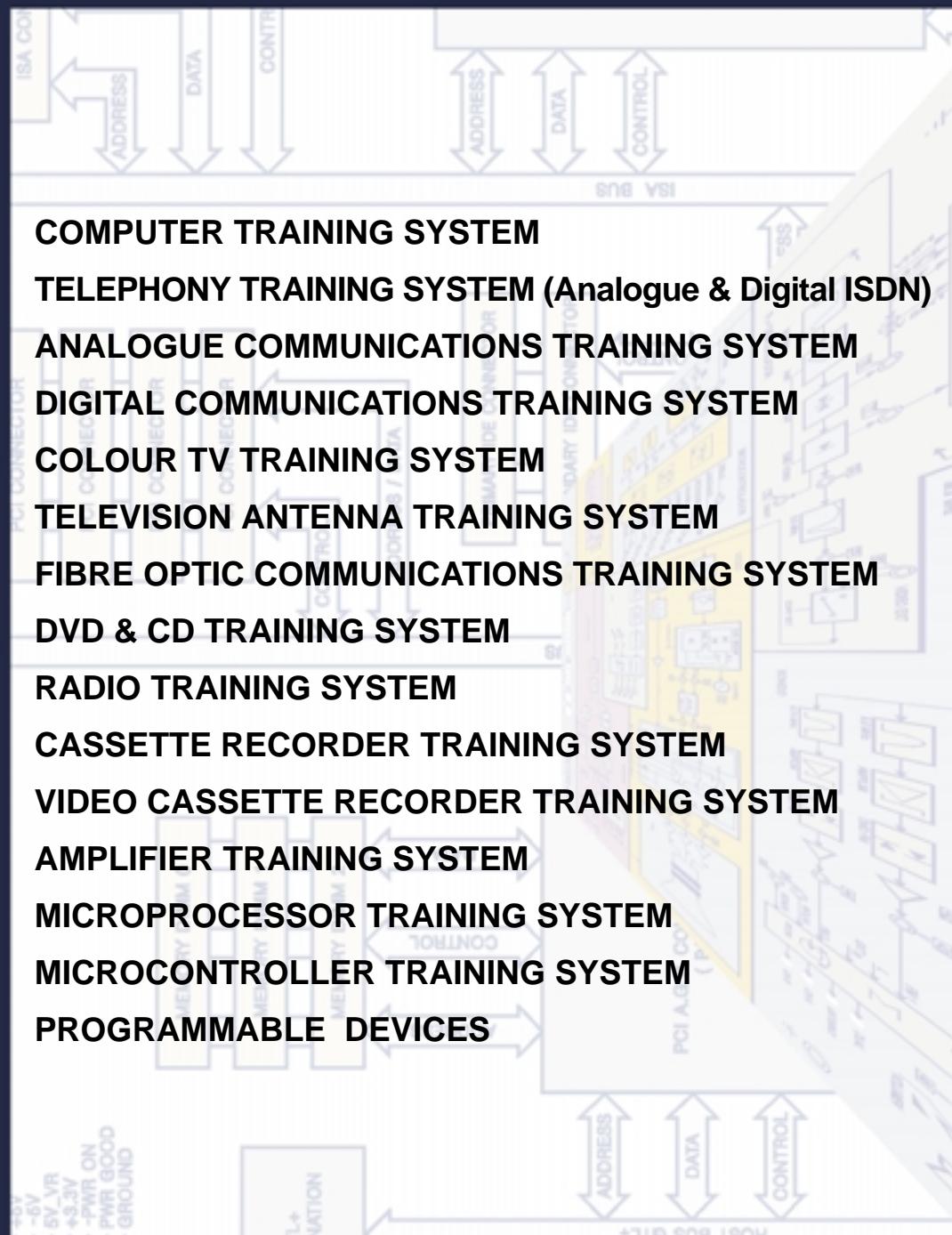




ELECTRONIC TRAINING EQUIPMENT



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.

PERSONAL COMPUTER TRAINING SYSTEM



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

The system is designed with the maximum safety measures in order to guarantee student integrity

The **EO-865** training system comes with the XP Home Edition® O.S. Also different products are supplied in order the student familiarises himself with PC maintenance tasks:

- Diagnostic and repair software to certificate the correct operation of the PC.
- Analysis, diagnostic and repair kit (for emergency situations, when it is not possible to boot the PC).

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

TELEPHONY TRAINING SYSTEM

ET-835



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)

ANALOGUE COMMUNICATIONS TRAINING SYSTEM

EC-696


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

Signal inputs

CO1 and CO2	Input from a generator
Maximum level	± 3 V
Bandwidth	DC to 20 kHz
Input impedance	≥ 20 kΩ (1 kHz)
MIC1 and MIC2	Microphone inputs
Sensitivity	6 mVpp, adjustable
Input impedance	≥ 20 kΩ (1 kHz)

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

Duty cycle

Bandwidth	DC to 20 kHz
FDM/FM Modulator	Voltage-controlled oscillator
Carrier frequency	300 kHz or 100 kHz, selectable
Channel bandwidth	DC to 20 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	By LED Photodetector
Emission	650 nm (red colour)
Emitting band	By LED Photodetector
Infrared ray transmitter	950 nm
Emission	
Emitting band	
27 MHz Emitter	0 dBm
Output level	50 %
Modulation index	1.5 m cable Monopole
Antenna	

RECEIVER MODULE EC-696/R

Signals processed by the **EC-696/E** can be received and demodulated by the **EC-696/R**. This system is configured by four pushbuttons and a logic control, the same way as in the emitter.

The demodulated and separate signals received can be displayed on the screen of an oscilloscope or monitored by means of earphones.

RECEIVER MODULE

Receivers

Bifilar cable receiver	Direct, without processing
Coaxial cable receiver	Direct, without processing
Fibre optics receiver	
Type	(PIN) type Photodiode
Receiving band	400 to 1100 nm (90% efficiency)
Infrared receiver	
Type	PIN type photodiode
Receiving band	800 to 1000 nm (50% efficiency)
Radio receiver	
Peak detector	
Receiving band	27 MHz
Antenna	1.5 m Cable

FM Demodulator

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	300 Hz to 20 kHz (fibre, infrared and radio)
Carrier frequency	DPLL type
Multiplex bandwidth	300 or 100 kHz selectable
	DC to 20 kHz (bifilar and coaxial)
	300 Hz to 20 kHz (fibre, infrared and radio)

Output specifications

Earphone output	AB Class
Output stage	Independent for left and right channels
Volume control	200 mW over 32 Ω (3 Vpp in C)
Output power	
Oscilloscope S1 and S2 outputs	≥ 400 m Vpp (3 Vpp in A)
Output level	

Demodulator specifications

AM Demodulator	Fast detector
Bandwidth	DC to 20 kHz (bifilar and coaxial)

DIGITAL COMMUNICATIONS TRAINING SYSTEM

EC-796

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 μ s
- 11 bits frame: 1 start, 8 data, 1 stop and 1 parity.
- Antialiasing 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 antialiasing 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 antialiasing 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 50Ω : 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

COLOUR TV TRAINING SYSTEM


ET-891

COLOUR TV RECEIVER

- 14" screen
- PAL B/G/I and SECAM B/G/L/L' systems.
- Euroconnector
- Zweiton system
- NICAM audio digital system (PAL G, PAL I, SECAM L)
- Teletext with FLOF function *
- On screen messages (OSD)
- Tuning by synthesis of manual voltage or autostore through search and automatic memorisation
- Infrared remote control
- Advanced hybrid technology: conventional components and SMD

BLOCK DIAGRAMS

The block diagrams are composed of the following functional modules:

- Power supply
- IF and demodulator
- Video
- Sound
- Microcontroller

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.

- Teletext
- Deflection

FAULT SIMULATOR

A set of 48 microswitches allows to cause a large number of failures. These have been divided into the different functional stages of the receiver.

TUTOR FOR THE I²C BUS

A set of microswitches allows the start and stop bits to be modified, in addition to the words of the data which are sent to the integrated circuits connected. The words received by the ICs are displayed by a series of LEDs.

DOCUMENTATION INCLUDED

- User's Manual
- Training Manual
- Technical Documentation Manual

TELEVISION ANTENNA TRAINING SYSTEM

EA-815


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.

TELEVISION ANTENNA TRAINING SYSTEM

EA-815

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.

ANTENNAS

- 27 elements UHF antenna (channels 21-69)
- Parabolic antenna containing:
 - Reflector
 - 1 m OFF-SET
 - LNB 4 outputs: HBB, VBB, HBA, VBA
 - Accessories: rods and power accessories

MECHANICAL ACCESSORIES

- 150 cm mast for terrestrial antenna
- 80 cm mast for parabolic antenna
- Mobile stand for antennas with wheels

HEAD END EQUIPMENT

- MATV

- Set of 7 programmable UHF amplifiers
- VHF amplifier
- Power supply

- SMATV (analogue and digital) for RF

- Programmable IF-UHF (stereo) internal units
- Universal programmer
- Power supply for internal units

- SMATV (analogue and digital) for IF

- Adjustable IF amplifiers (x4) with terrestrial signal mixing and amplification
- Power supplies for LNBS and IF amplifiers

COLLECTIVE AND INDIVIDUAL MATV DISTRIBUTION

- Splitters/combiners
- Taps
- Through outlets and end outlets
- Splitter outlets

COLLECTIVE AND INDIVIDUAL SMATV DISTRIBUTION (ANALOGUE AND DIGITAL) BY INTERMEDIATE FREQUENCY

- IF splitters
- H and V commutable IF splitters
- IF outlets

COLLECTIVE AND INDIVIDUAL SMATV DISTRIBUTION (ANALOGUE AND DIGITAL) BY CHANNEL PROCESSING

MIXED COLLECTIVE AND INDIVIDUAL SMATV DISTRIBUTION

COLLECTIVE CATV DISTRIBUTION

- CATV line amplifier with attenuator, equaliser and pre-emphasiser
- Active return channel with gain control

USER EQUIPMENT

- Analogue Tuner
- Remote control

ACCESSORIES FOR AIMING ANTENNAS

- Inclinometer
- Compass

ACCESSORIES AND CABLES

- Markers for the white board

OTHER ACCESSORIES

- Load adapters
- Bridges
- Polarising connector

DOCUMENTATION

- User's Manual
- Training Manual
- Technical documentation
- Assembly instructions

FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM

EF-970-E

CLASS 1
LASER PRODUCT



TRANSMITTER MODULE



RECEIVER MODULE

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 (75Ω) (external)
- 3- AC analogue input (75Ω) (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 LF 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 photoemitter. The channel to be measured is selected with the "A METER CH1/CH2" button.



FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM

EF-970-E

Optical outputs

The emitter kit has six cyclically selectable photoemitters. Two photoemitters may be activated at the same time for the WDM application.

The photoemitters have a protection circuit to limit optical power.



Laser feedback

The nature of the LASER means that its optical power may be influenced by external factors such as temperature, ageing, etc.

The feedback circuit is able to maintain a stable and unalterable optical power no matter what the external conditions are.



The system can operate with the feedback circuit ON or OFF so to test its efficiency and the problems caused by its disconnection and/or malfunction.

RECEIVER KIT WITH OPTICAL POWER METER

Receiver

The receiver kit principally consists of two independent blocks (except for the input circuits: photodetectors and switches), one for the signal and the other for measuring.

The signal block contains two channels, also independent, one for receiving analogue signals and the other for digital signals.

The measuring block contains the power meter, enabling operation in four different modes: analogue, digital, 1 kHz and DC.

Optical inputs

The receiver has four incorporated photodetectors and an external photodetector (optional) that connects to the "EXT. SENSOR" input by a coaxial cable (optional).



The signal block possesses a switch to select the type of coupling, DC or AC, applied to the first amplifier input and to the analogue channel output section.

The audio section consists of an independently-adjustable low-pass for regulating the level of the signal applied to the internal speaker or headphones.

Digital channel signal block

The signal entering the digital channel follows a series of filtering and amplification processes for subsequent comparison with a reference level.



The amplitude of the channel output may be selected as either TTL level or RS-232 level.

Optical power meter

This block performs the absolute or relative measurement of the received optical power. The optical meter possesses four measuring modes, selected by the user.

ANALOG (monitoring mode)

DIGITAL (monitoring mode)

1 kHz (precision mode, for measuring the 1 kHz component)

DC (precision mode)

The resolution of the power meter in the monitoring modes is 0.1 dB, and 0.01 dB in the precision modes.



Analogue channel signal block

The analogue channel has a gain of 40 dB, using two 20 dB amplifier stages.



BASIC FIBRE OPTIC COMMUNICATIONS TRAINING SYSTEM

EF-970

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

INCLUDED ACCESSORIES

OPTIONS

OPT-970-01: Exercises kit

- | | |
|--|---|
| <ul style="list-style-type: none"> - 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 radiiuses) - 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 fixed WDM device - 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) | <ul style="list-style-type: none"> - 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 |
|--|---|



Optical fibre arm

Variable optical attenuator

Variable WDM device

OP-970-02: Connection kit

- | | |
|---|--|
| <ul style="list-style-type: none"> - 1 tool for removing the protective covering from optical fibre - 1 ST crimping tool - 1 polishing disk - 1 set of abrasive laminas | <ul style="list-style-type: none"> - 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

EF-970
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**)
- 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 photoemitters
- 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)
- Bandwidth of photo-detectors
- Transmission of analogue signals
- Transmission of audio signals
- Transmission of video signals
- Transmission of digital signals
- RS-232 transmission using 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 photodetectors (**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, Euroconector, 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 (Except Theory Manual and DVD Operating Manual)

- User's Manual
- Training Manual
- Teacher's Manual
- Technical documentation Manual

ACCESSORIES INCLUDED

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

ED-845



* (In German)

ER-832



RADIO TRAINING SYSTEM

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

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.

FAULT SIMULATOR

The fault simulator manipulates electric points of the tuner, allowing to simulate real faults.

ACCESSORIES AND DOCUMENTATION INCLUDED

- User's Manual
- Electric diagrams and Technical Documentation
- Auto-amplified speakers
- AM Antenna
- FM Antenna
- Connection cables

EG-833



CASSETTE RECORDER TRAINING SYSTEM

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

BLOCK DIAGRAMS

The block diagrams consist of the following functional modules:

- Input section
- Recording process section
- Playback process section
- Output section
- Noise reduction systems: Dolby[®] B and C
- Control system
- Servos
- Automatic Music Search (AMS)
- Power supply
- Fluorescent visualiser

FAULT SIMULATOR

The fault simulator manipulates electric points of the cassette deck, allowing to simulate real faults.

Each one of the functional sections has several test points which permit the analysis and monitoring of the main electrical signals of the cassette deck. It is 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
- Auto-amplified speakers
- Test Tape
- Connection cables

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

BLOCK DIAGRAMS

The block diagrams consist of the following functional modules, each with the test points of the most important electric signals involved in its operation:

- Tuning

EV-830

- 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

DOCUMENTATION CD-ROM INCLUDED

- Video Pattern Tape
- Connection cables

AMPLIFIER TRAINING SYSTEM

EP-834



BLOCK DIAGRAMS

The block diagrams consist of the following functional modules:

- Input signal source
- Input signal source control
- Equalisers
- Loudness filter
- Power section
- Speakers protections
- 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.

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

FAULT SIMULATOR

The fault simulator manipulates electric points of the amplifier, allowing to simulate a large number of real faults.

ACCESSORIES AND DOCUMENTATION INCLUDED

- User's Manual
- Training Manual
- Electric diagrams and Technical Documentation
- Speakers
- Loads
- Remote control

MICROCONTROLLER TRAINING SYSTEM

TM-311

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.



- | | |
|--|--|
| <ul style="list-style-type: none"> - 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 | <ul style="list-style-type: none"> the microcontroller I/O ports - Communication with PCs by RS-232C (2 ports) or RS-485 |
| FEATURES | |
| <ul style="list-style-type: none"> - Assembler, diagnosis and simulator software - RS-232C cable | <ul style="list-style-type: none"> - Technical Documentation - Software and Training Manual |

(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.

TM-683

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



APPLICATION PROGRAMMING AND DEVELOPMENT TRAINER WITH PROGRAMMABLE LOGIC DEVICES


TM-530

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:

- | | |
|--|--|
| <ul style="list-style-type: none"> - Wiring configuration and programming software - PLD application design, compilation and simulation software | <ul style="list-style-type: none"> - 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.

Documentation consists of an User's Manual, a Training Manual and a Teacher's Manual.

(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):

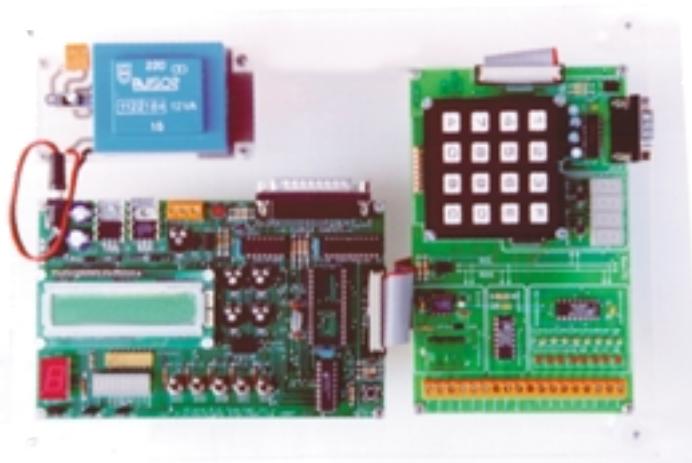
- Basic gates: NOT, AND, OR, NAND, NOR, XOR, NXOR
- Multiplexer/ Demultiplexer
- Encoder/Decoder
- bit adder 4, 8, ...
- Comparator
- Registries
- Counter
- Sequence detector

Requirements:

- PC-PENTIUM II[®] or greater
- Windows 98[®] O.S.
- Parallel port

MICROPICTRAINER PLUS BASIC PICS TRAINER (16F84 family)

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


IC-003

The **IC003** consists of:

- **MICROPICTRAINER**: Development system
- **MICROPICTRAINER 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 **MICROPICTRAINER 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 **MICROPICTRAINER** and **MICROPICTRAINER PLUS** tools, in combination with either the SIMUPIC'84 or the MPLAB simulator.

MICROPICTRAINER

- 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.

MICROPICTRAINER PLUS

- Direct connection to the **MICROPICTRAINER** 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 **MICROPICTRAINER**.
- **Subject 3** New Peripherals and the I2C Bus. Collection of exercises using the **MICROPICTRAINER** and the **MICROPICTRAINER 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)

ADVANCED PIC TRAINER EXTENSION (16F87x family)

IC-004

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 **MICRO PIC 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

recorded demonstration program, the latest version of the PICMETR program and documentation.

PICS II DESIGN COURSE

Contents index

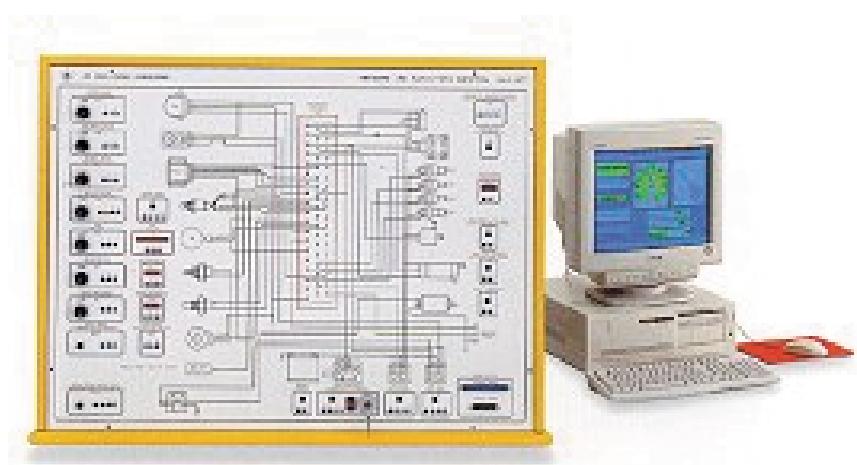
- **Subject 1** Programming the **PIC16F87x** and its Architecture.
Exercises with I/O ports
- **Subject 2** Timer 1. Exercises
- **Subject 3** Timer 2. Exercises
- **Subject 4** Capture and Comparison Module. Exercises
- **Subject 5** PWM Module. Exercises
- **Subject 6** The Analogue/Digital Converter. 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

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Audio Analyser

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Device Programmers

CRT Rejuvenators

Sound Level Meter

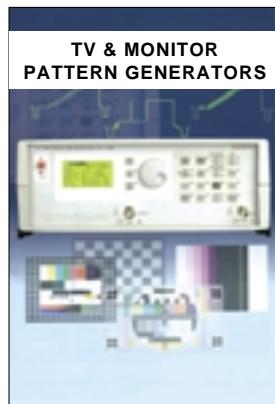
RF Wattmeters



TELECOMMUNICATIONS TEST EQUIPMENT



TV & MONITOR PATTERN GENERATORS



TEST & MEASUREMENT



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