

Digital Communications Training System

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 and to understand more complex modulations, such multicarrier modulations which are the basis of Digital Video Broadcasting (DVB-T), ADSL, WiFi...



The **emitter** and **receiver** modules have a number of 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 analogue 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.

SIGNAL INLETS AND OUTLETS

- Inlets for Function Generator, TTL signals and microphone (monophonic 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.
- Compander and expander for microphone.

MODULATORS

ASK (OOK)

- Modulator bandwidth: DC - 60 kHz

FSK

- Modulator bandwidth:
 - DC - 60 kHz (DFD reception).
 - DC - 200 kHz (FSK reception).

BPSK and DBPSK

- Modulator bandwidth: DC - 45 kHz.

QPSK and DQPSK

- Modulator bandwidth: DC - 45 kHz.

QAM

- 8 levels.
- Bandwidth: DC - 45 kHz.

DEMODULATORS

ASK (OOK)

- Types: band-pass filter, envelope detector, comparison circuit.

FSK

- Dual band pass filters, detectors and comparison circuit.
- PLL direct detector.

BPSK

- Phase ambiguity detector, automatically or manually.

DBPSK

QPSK

- Phase ambiguity detector, automatically or manually.

DQPSK

QAM

- Phase ambiguity detector, automatically or manually.

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EMITTER CHARACTERISTICS

Twin Cable Emitter:

- Output level (measured at connector):
- Receiver not connected: 0 to ± 4 V (according to modulation).
 - Receiver connected: 0 to ± 3 V (according to modulation).
- Connector: banana female adapter.

Coaxial Cable Emitter:

- Output level (measured at connector):
- Receiver not connected: 0 to ± 4 V (according to modulation).
 - Receiver connected: 0 to ± 3 V (according to modulation).
- Connector: BNC female adapter.

Fibre Optic Emitter:

- Emission by LED.
- Emission wave-length: 850 nm (red).
- Connector: FSMA.

Infrared Emitter:

- Emission by LED.
- Emission wave-length: 950 nm.

27 MHz Emitter:

- Output level at 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 - 1100 nm (for 90% efficiency).
- FSMA connector.

Infrared Receiver:

- Type: Photo-diode (PIN).
- Reception band: 800 - 1000 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 cables for radio transmission/reception.
- Optical fibre PMMA with FSMA connectors.
- Two wire and coaxial cables.
- Headphone and dynamic microphone.
- User's Manual.
- Theory Manual.
- Instruction manual and technical data.



Recommended equipment:

Digital Oscilloscopes

Series OD-4xx, OD-57x, OD-59x

Signal generators

GF-230, GF-232, GF-941