

ADVANCED EXPERIMENTS IN MODERN COMMUNICATIONS

**FIBER OPTICS KIT**  
**NEW**

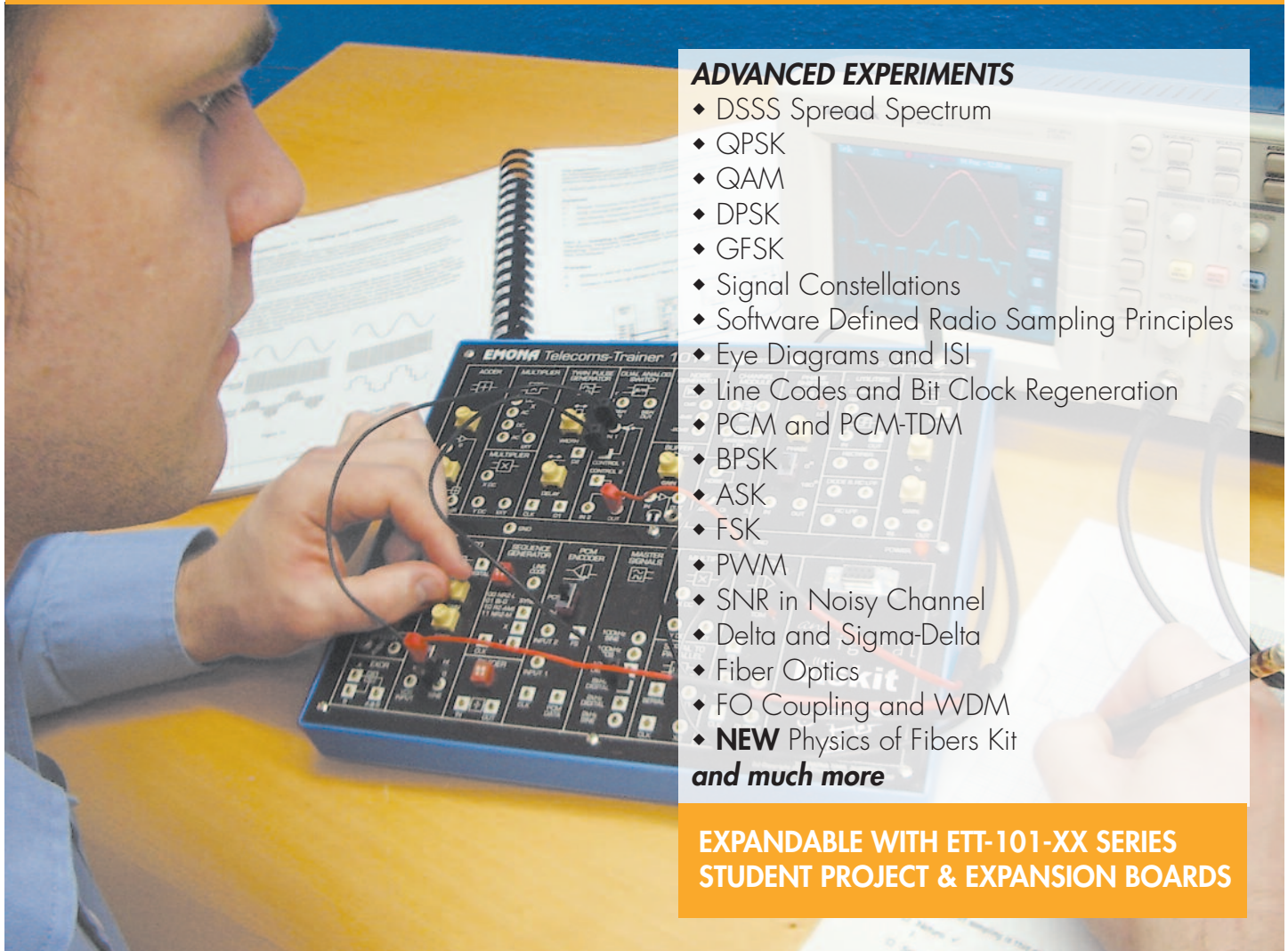
# New Generation Single-Board Telecoms Experimenter for Advanced Experiments

TWO MODELS -

**Emona ETT-101 "BiSKIT" Standard**

**Emona ETT-101C "BiSKIT" PC-Enabled**

*Multi-Experiment Telecommunications & Fiber Optics Experimenter for University and Technical College Students*



## ADVANCED EXPERIMENTS

- ◆ DSSS Spread Spectrum
  - ◆ QPSK
  - ◆ QAM
  - ◆ DPSK
  - ◆ GFSK
  - ◆ Signal Constellations
  - ◆ Software Defined Radio Sampling Principles
  - ◆ Eye Diagrams and ISI
  - ◆ Line Codes and Bit Clock Regeneration
  - ◆ PCM and PCM-TDM
  - ◆ BPSK
  - ◆ ASK
  - ◆ FSK
  - ◆ PWM
  - ◆ SNR in Noisy Channel
  - ◆ Delta and Sigma-Delta
  - ◆ Fiber Optics
  - ◆ FO Coupling and WDM
  - ◆ **NEW** Physics of Fibers Kit
- and much more**

**EXPANDABLE WITH ETT-101-XX SERIES  
STUDENT PROJECT & EXPANSION BOARDS**

**OVER 70 EXPERIMENTS WITH ONE BOARD**

**biskit™**

**EMONA INSTRUMENTS**  
[www.ett101.com](http://www.ett101.com)

# DESIGNED FOR ADVANCED TELECOMS EXPERIMENTS

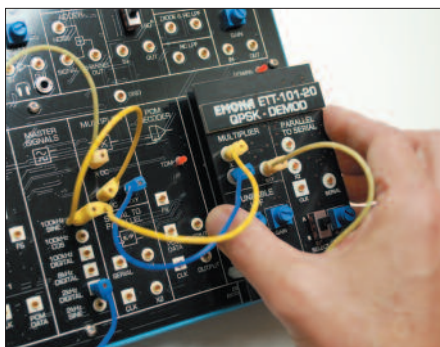
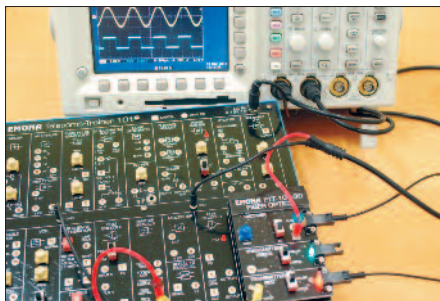
- Unrivalled with a wide range of over 70 ADVANCED communications and fiber optics experiments in one compact experimenter
- Educationally proven experiment method to help students see the relationship between math & the real world

**biskit™** - BUILDING STUDENT KNOWLEDGE IN TECHNOLOGY

COMPACT MULTI-EXPERIMENTER available in 2 models:

- **ETT-101C** with in-built scope, spectrum analyser & function generator
- **ETT-101** base unit, standard experimenter

## STUDENTS BUILD EXPERIMENTS BY PATCHING FUNCTIONAL BLOCKS



*“Students patch together simple building blocks to make real communications systems”*

### LEARNING-BY-DOING

Using the ETT-101, students learn the fundamental concepts by actually building telecommunications experiments at the block diagram level. Theory comes to life as they build the modulation and coding schemes.

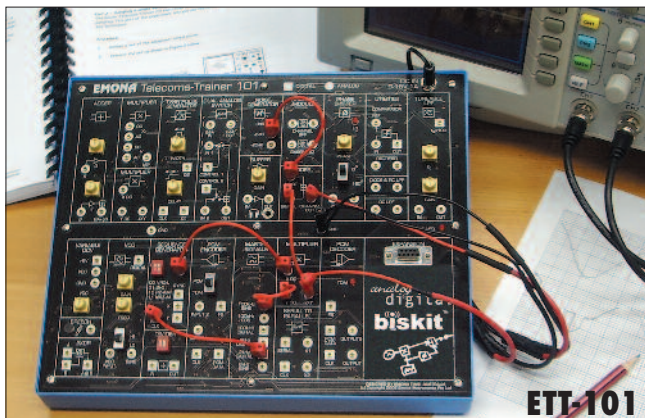
With the ETT-101 students learn by trying “what-if” scenarios (and are free to make mistakes, analyse and self correct) to investigate the telecommunications theory they learn in class. With the ETT-101, your students will learn more, and remember more.

The ETT-101 accessories kit includes: 20 x stackable patch cords, User Manual, Experiments in Modern Analog and Digital Telecommunications Volume-1 and Volume-2, and a 12V plug pack. Five optional add-on boards expand the ETT-101’s experiment capability.

### FAST and SIMPLE EXPANSION

ETT-101-XX ADD-ON BOARDS simply plug into the ETT-101 EXPANSION slot. ADD-ON BOARDS add functionality in experiment capabilities as well as STUDENT PROJECT capabilities.

# FLEXIBLE AND EXPANDABLE, TELECOMMUNICATIONS EXPERIMENTING



**ETT-101**

## ETT-101 standard EXPERIMENTER

Completely self contained within a single, low-profile case, the ETT-101 requires only a standard 12V DC plug-pack. Provides a comprehensive suite of independent functional blocks to build a wide variety of experiments. With expansion socket for a range of add-on boards.

Waveforms can be displayed on whatever equipment is available to the student, such as: a low cost lab oscilloscope, or a PC-based virtual instrument.



**ETT-101C PC-Enabled**

## ETT-101C all-in-one PC-ENABLED UNIT

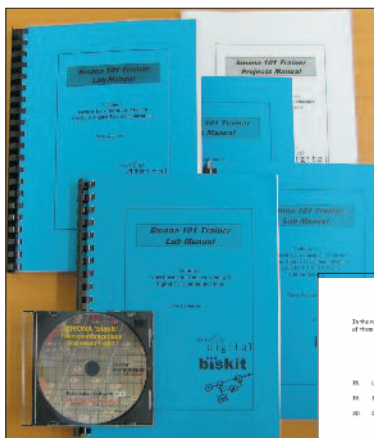
Includes all the experiment and expansion capabilities of the ETT-101 STANDARD EXPERIMENTER, plus an in-built PC-based multi-instrument, providing:

- OSCILLOSCOPE - 2 Channel, 100MS/s, full featured
- SPECTRUM DISPLAY - 2 Channel, 10MHz bandwidth
- FUNCTION GENERATOR with Arbitrary Waveform Generator

USB interface to PC, running the powerful PicoScope instrument display software.

## ETT-101 - 5 VOLUMES OF EXPERIMENT MANUALS

OVER 1,200 PAGES OF TELECOMMUNICATIONS & FIBER OPTICS EXPERIMENTS



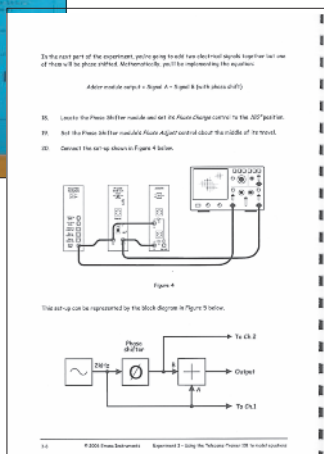
The ETT-101 Laboratory Manuals (Vol.1, Vol.2, Vol.3, Vol.4 and Electronic Circuit Projects Manual) provide a turn-key solution for the teacher and student alike.

These lab manuals are specially written to guide students through hands-on experiments and help them grasp the fundamental concepts of telecommunications.

Each chapter includes background information which relates the experiment content to real-world applications.

Since telecommunications text books represent the math and concepts of telecommunications theory as "block diagrams", the "ETT-101" Lab Manuals make extensive use of block diagrams throughout.

Associated with each block diagram are detailed, step-by-step patching diagrams. Each chapter is carefully paced and constant use is made of questions to verify the student's understanding and provide feedback to the teacher.



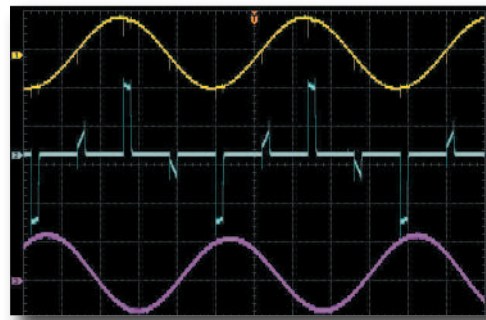
# 70+ DIFFERENT EXPERIMENTS CAN BE IMPLEMENTED ON THE ETT-101 - REPLACING 8 OR MORE "SINGLE PANEL" TRAINERS

## EXAMPLES OF HOW THE ETT-101 CAN IMPLEMENT 70+ EXPERIMENTS

### SAMPLING and RECONSTRUCTION



Patching a sampling & reconstruction experiment uses 4 of the ETT-101's functional blocks:  
MASTER SIGNALS, TWIN PULSE GENERATOR,  
DUAL ANALOG SWITCH and TUNEABLE LPF

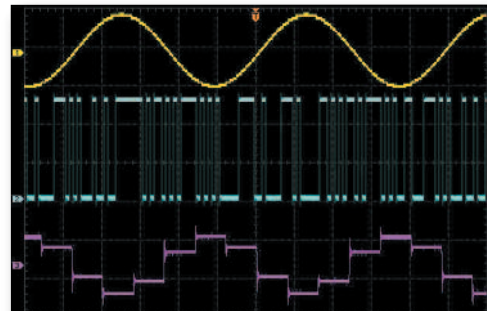


*Actual sampling & reconstruction waveforms.*

### PCM ENCODING and PCM DECODING



Patching a PCM encoding & decoding experiment uses 3 of the ETT-101's functional blocks:  
MASTER SIGNALS, PCM ENCODER and PCM DECODER.



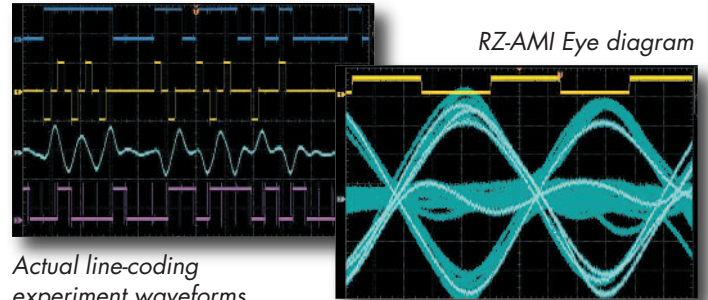
*Actual PCM encoding & decoding waveforms.*

## LINE-CODE ENCODING, DECODING and EYE DIAGRAMS



Patching a line-code encoding & decoding experiment with signals passing through a noisy bandlimited channel uses 6 of the ETT-101's functional blocks:

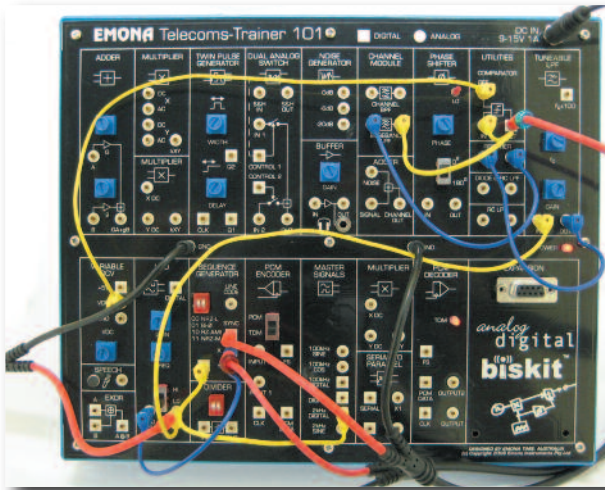
SEQUENCE GENERATOR/LINE-CODE ENCODER, MASTER SIGNALS, NOISE GENERATOR, CHANNEL FILTER, CHANNEL ADDER and LINE-CODE DECODER.



Actual line-coding experiment waveforms.

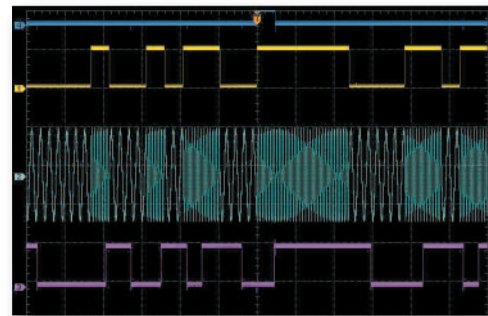
RZ-AMI Eye diagram

## FSK MODULATION and FSK DEMODULATION



Patching an FSK modulation and demodulation experiment uses 7 of the ETT-101's functional blocks:

VCO, SEQUENCE GENERATOR, MASTER SIGNALS, BANDPASS FILTER, UTILITIES, VARIABLE DC V and TUNEABLE LPF.

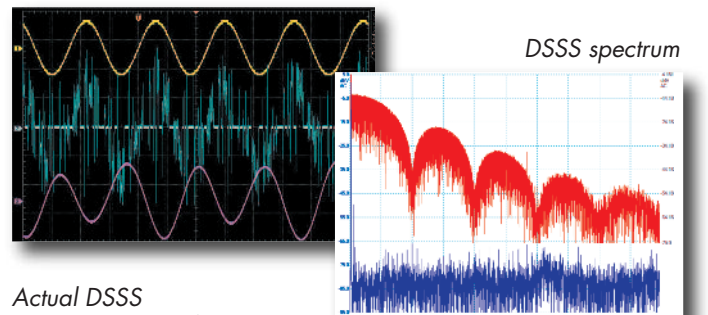


Actual FSK experiment waveforms.

## DSSS SPREAD SPECTRUM MODULATION and DEMODULATION



Patching an DSSS modulation and demodulation in a noisy channel experiment uses 8 of the ETT-101's functional blocks: SEQUENCE GENERATOR, MASTER SIGNALS, MULTIPLIER (x2), NOISE GENERATOR, ADDER, CHANNEL GAIN and TUNEABLE LPF.



Actual DSSS experiment waveforms.

DSSS spectrum

# ETT-101 DESIGNED FOR EXPANSION - EXPAND EXPERIMENT CAPABILITIES USING ETT-101-XX ADD-ON BOARDS

## ETT-101-20 : QPSK EXPERIMENT BOARD



The ETT-101-20 QPSK Experiment expansion board includes three independent functional blocks. When added to the ETT-101 it will allow a complete QPSK modulation / QPSK IQ-branch demodulation experiment to be implemented.

Detailed experiments documented in the ETT-101 Volume 3 Lab Manual include:

- QPSK modulation and IQ-branch demodulation in a noisy channel;
- Signal Constellations.

Functional blocks include:  
MULTIPLIER, TUNEABLE LPF, and  
PARALLEL-TO-SERIAL CONVERTER WITH USER ADJUSTABLE  
BIT ALIGNMENT.

## ETT-101-21 : LINE-CODING & PLL BOARD



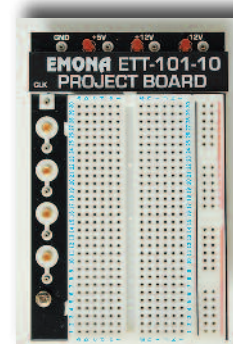
The ETT-101-21 Line-Coding & PLL Experiments expansion board includes three independent functional blocks for implementing Line-Code Decoding, DPSK demodulation, and FM PLL demodulation experiments.

Detailed experiments documented in the ETT-101 Volume 3 Lab Manual include:

- Line-Code Decoding and decision making in a noisy baseband channel;
- DPSK in a noisy passband channel;
- FM demodulation using the PLL.

Functional blocks include:  
MULTIPLIER, VCO, and  
LINE-CODE DECODER (4 codes), WITH USER ADJUSTABLE BIT  
ALIGNMENT.

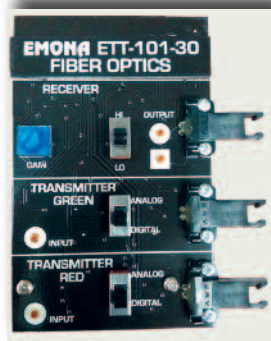
## ETT-101-10 : ELECTRONIC CIRCUITS PROJECT BOARD



The ETT-101-10 Electronic Circuits Project Experiment board allows students to build their own analog and digital electronic circuits and interface them with the ETT-101 functional blocks. Example circuits include passive and active filters and oscillators.

Project board functions include:  
SOLDERLESS BREADBOARD (81 mm x 52mm) with one 48 tie point distribution strip and one 360 tie point component board.  
DC POWER SUPPLY OUTPUTS of +5V, +12V and -12V, (all outputs protected).  
MASTER DIGITAL CLOCK of 1MHz.  
4 x SINGLE WIRE SOCKET to 2mm SOCKET ADAPTORS.

## ETT-101-30 : FIBER OPTICS BOARD



The ETT-101-30 FIBER OPTICS Experiment expansion board includes three independent functional blocks, providing an electrical-optical and optical-electrical interface for the ETT-101. When added to the ETT-101 it will allow a complete optical link to be established, for analog or digital signals.

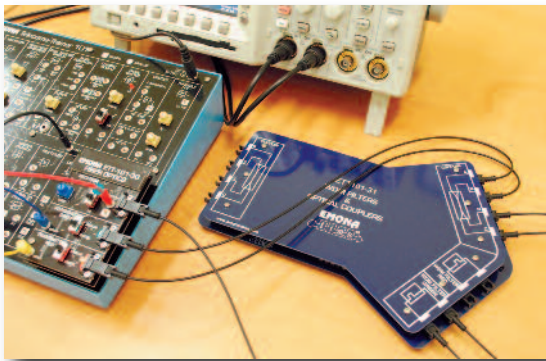
Detailed experiments documented in the ETT-101 Volume 4 Lab Manual include:

- Transmission and reception of analog and digital signals;
- ETT-101 PCM-TDM implementation of a "T1" optical link.

Functional blocks include:

RED WAVELENGTH TRANSMITTER  
GREEN WAVELENGTH TRANSMITTER  
OPTICAL RECEIVER

## ETT-101-31 : FIBER OPTICS COUPLER & WDM BOARD



The ETT-101-31 FIBER OPTIC COUPLERS and WDM FILTERS Experiment expansion board includes four independent functional blocks. When added to the ETT-101 and ETT-101-31 it will allow a complete bi-directional and WDM fiber optic links to be implemented.

Detailed experiments documented in the ETT-101 Volume 4 Lab Manual include:

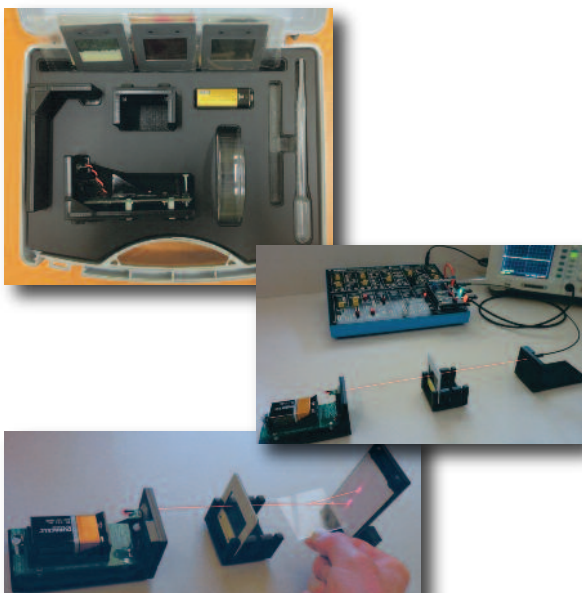
- Optical signal splitting and combining;
- Fiber optic bi-directional communications;
- Wave Division Multiplexing optical link.

Functional blocks include:

2 x FOUR PORT COUPLER  
RED WAVELENGTH FILTER  
GREEN WAVELENGTH FILTER

## ETT-101-32 : PHYSICS OF FIBERS ACCESSORY KIT

**NEW**



The ETT-101-32 PHYSICS OF FIBERS ACCESSORY KIT is used together with the ETT-101 and the ETT-101-30 FIBER OPTICS expansion board.

Detailed experiments documented in the ETT-101 Volume 4 Lab Manual include:

- Guiding Light Using Total Internal Reflection
- Losses in Fiber Optic Networks
- Polarization
- Bending Losses in Fiber Optic Systems
- Connectors

All Kit components included in a compact carry case:

ETT-101-32S laser source; Fiber holder stand; Slide holder; Semicircular Perspex block; Screens; Clear plastic light guide; Clear Perspex slide; Green reflective-absorption slide; Scattering slide; Polarizer slides; Polarizer disc; Quarter-wave plate slide; Stripped optical patch lead; Adapted bulkhead connector; Spacers; Water-drops dispenser

# ETT-101 LAB MANUALS

## 5 VOLUMES COVERING ANALOG, DIGITAL, FIBER OPTICS and ELECTRONIC CIRCUITS EXPERIMENTS

### ETT-101 LAB MANUAL - Volume 1

(20 Chapters, 310 pages)

- Setting-up an Oscilloscope
- An Introduction to the ETT-101
- Modelling Equations
- Amplitude Modulation AM
- Double Sideband DSB Modulation
- AM Demodulation
- DSB Demodulation
- SSB Modulation & Demodulation
- FM Modulation
- FM Demodulation
- Sampling & Reconstruction
- PCM Encoding
- PCM Decoding
- BW Limiting & Restoring Signals
- ASK Modulation & Demodulation
- FSK Modulation & Demodulation
- BPSK Modulation & Demodulation
- QPSK Modulation & Demodulation
- Introduction to Spread Spectrum - DSSS modulation
- Undersampling in Software Defined Radio

### ETT-101 LAB MANUAL - Volume 2

(22 Chapters, 456 pages)

- AM Method 2 & Product Detection
- Noise in AM Communications
- PCM and TDM
- Armstrong's Phase Modulator
- Phase Division Multiplex
- Pulse-Width Modulation & Demod.
- Message Translation & Inversion
- Carrier Acquisition using the PLL
- SNR and Eye Diagrams

- PCM and SNDR
- ASK Demod using Product Detect.
- FSK (switching method) & Demod.
- Principles of GFSK
- PN Spectra and Noise Generation
- Line Coding and Bit Clock Regen
- Delta Modulation & Demodulation
- Delta-Sigma Mod & Demod
- Observations of AM & DSBSC in the Frequency Domain
- Principles of superheterodyne
- Frequency synthesis with digital PLL
- Differential phase shift keying (DPSK)
- PAM-time division multiplexing (TDM)

### ETT-101 LAB MANUAL - Volume 3

(5 Chapters, 144 pages)

- Full (IQ branch) Demodulation of a QPSK Signal
- Line Code Decoding and Hard Decision Making
- DPSK Modulation and Demod with a Noisy Channel
- FM Demodulation using the Phase-Locked Loop
- Signal constellation Diagrams

Vol.3 experiments require the ETT-101-20 or ETT-101-21 add-on boards

### **NEW** ETT-101 FIBER OPTICS LAB MANUAL - Volume 4

(11 Chapters, 280 pages)

- An Introduction to Fiber Optic Signal Transmission and Reception

- Guiding Light Using Total Internal Reflection \*
- Losses in Fiber Optic Networks \*
- Polarization \*
- Bending Losses in Fiber Optic Systems \*
- Connectors \*
- PCM-TDM 'T1' Implementation
- Optical Signal Filtering, Splitting & Combining \*\*
- Fiber Optic Bi-directional Communication \*\*
- Wave Division Multiplexing (WDM) \*\*
- Optical Losses \*\*

\* Experiments require the ETT-101-32 Physics of Fibers Accessory Kit.

\*\* Experiments require the ETT-101-31 Coupler and Filters board.

### ETT-101-10 ELECTRONIC CIRCUITS PROJECTS MANUAL

(14 Projects, 50 pages total)

- RC Circuits
- RL Circuits
- RC & RL Low-Pass Filters
- RC High -Pass Filters
- RC & RL Filters, Cut-off Frequency
- Measuring Filter Roll-off
- Measuring Filter Phase Response
- Series & Parallel RLC B-P Filters
- RLC Band-Stop Filters
- Effect of Components on Centre Freq. of Band-Pass & Band-Stop Filters
- Effect of Component Values on Bandwidth of Band-Pass Filters
- The Hartley Oscillator
- The Colpitts Oscillator
- The Clapp Oscillator

Available from:

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Camperdown NSW 2050 AUSTRALIA

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URL: [www.emona-tims.com](http://www.emona-tims.com)

Email: [sales@emona-tims.com](mailto:sales@emona-tims.com)

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