

## Emona Telecoms-Trainer 202 Experiment Capabilities:

### Analog Basics

#### 1. Amplitude Modulation (AM)

- modulation: 2 methods
- envelope detection
- product detection (coherent)
- AM in a noisy channel

#### 2. Double Side Band (DSB)

- suppressed carrier
- product detection (coherent)
- DSB in a noisy channel

#### 3. Single Sideband (SSB)

- generation only (upper & lower)

#### 4. Phase Modulation (PM)

- Armstrong's Phase modulator

#### 5. Phase Division Modulation (PDM)

- phase division demodulation

#### 6. Frequency Modulation (FM)

- generation by VCO (wideband)
- demodulation by PLL
- demodulation by zero crossing method

#### 7. Pulse Amplitude Modulation (PAM)

- sampling theorem / Nyquist
- aliasing and -reconstruction
- time division multiplexing (TDM) only

#### 8. Speech and Audio messages

- message inversion
- message translation

### Intro to Advanced Analog

#### 9. Carrier Acquisition using PLL

#### 10. Signal to Noise Ratio (SNR) -

- Introduction to SNR

#### 11. AM & DSB in the Frequency

- Domain

#### 12. FM Generation using the Harmonic

- Multiplier Method

### Digital Basics

#### 13. Sampling and Reconstruction

#### 14. Pulse Code Modulation (PCM)

- encoding
- decoding & reconstruction
- sampling rate
- aliasing, undersampling and oversampling
- synchronisation
- Signal-to-Noise Ratio (SNR)

#### 15. Time Division Multiplexing

- (PCM-TDM)

#### 16. Amplitude Shift Keying (ASK)

- modulation
- envelope recovery
- synchronous recovery

#### 17. Binary Phase Shift Keying (BPSK)

- modulation
- demodulation

#### 18. Frequency Shift Keying (FSK)

- modulation using VCO
- modulation using switching method
- envelope recovery

#### 19. Pulse Width Modulation (PWM)

#### 20. Introduction to GFSK

#### 21. Data recovery

- data recovery in a noisy channel

#### 22. Intersymbol Interference (ISI)

- eye patterns/diagrams
- Signal-to-Noise Ratio

### Intro to Advanced Digital

#### 23. Delta Modulation & Demodulation

#### 24. Delta-sigma Mod and Demod

#### 25. Quadrature Phase Shift Keying

- (QPSK)
- modulation
- demodulation

#### 26. Spread Spectrum (SS)

- introduction to direct sequence spread spectrum (DSSS)

#### 27. Line coding

- NRZ-L
- Alternate Mark Inversion (AMI)
- Manchester (Bi-phase)
- Differential encoding (NRZ-M)
- Bit Clock Regeneration

#### 28. PN sequence spectrum display

#### 29. Noise generation

#### 30. Undersampling in Software Defined Radio

### Additional Experiment Capabilities

- Introduction to Control Systems
- Using LabVIEW™ to control external electronic circuits
- Controlling DAtEX remotely across the Internet

ERRORS & OMISSIONS EXCEPTED

### Distributor:

**Emona Instruments Pty Ltd**

78 Parramatta Road

Camperdown NSW 2050 AUSTRALIA

Tel: +61-2-9519-3933 Fax: +61-2-9550-1378

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

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

# Emona Telecoms-Trainer ETT-202

Multi-Experiment Single Board Telecommunications Trainer for the popular NI ELVIS™ Platform



**DAtEX** : Digital Analog Telecommunications Experimenter

**DAtEX**™

**EMONA INSTRUMENTS**  
[www.emona-datex.com](http://www.emona-datex.com)

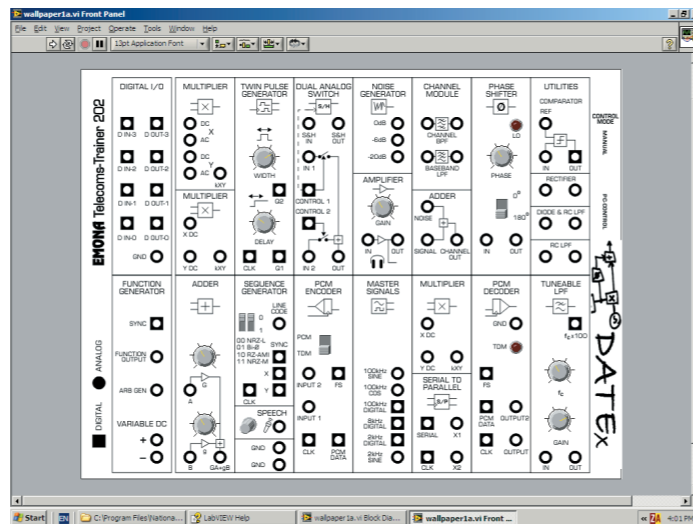
# COMPACT AND FLEXIBLE, A BREAKTHROUGH IN MODERN TELECOMMUNICATIONS EXPERIMENTING

**Emona Telecoms-Trainer 202, known as DATEx**  
Plugs into the NI ELVIS™ platform, operating in local mode and under LabVIEW™

- An excellent “hands-on” experiment system, implementing the well established “block diagram approach” to building telecommunications experiments
- Unrivalled with a wide range of modern communications topics in one compact trainer
- Local control and also remote control via the ETT-202 SFP virtual instrument on LabVIEW™

## DESIGNED FOR NI ELVIS™

The Emona Telecoms-Trainer 202 extends the functionality of your NI ELVIS™ platform and LabVIEW™ software with a plug and play telecommunications board to teach the fundamentals of modern communications theory.



ETT-202 Soft Front Panel (SFP) instrument display

Students are free to learn by trying “what-if” scenarios to investigate the telecommunications theory they learn in class. With the ETT-202, your students will learn more, and remember more.

## COMPACT and EASY FOR TEACHERS

The system is completely self contained: all that is required is the ETT-202, NI ELVIS™ and LabVIEW™ running on a PC.

The ETT-202 accessories kit includes:  
20 x stackable patch cords,  
User Manual, Digital and Analog Basic

Telecommunications Experiments Manual Volumes-1, 2 & 3 and the ETT-202 SFP CD-ROM.

## ADDITIONAL EXPERIMENT CAPABILITIES

Given that the ETT-202 provides a wide array of fundamental electronic building blocks, controllable using LabVIEW™, the ETT-202 can also be used as a general purpose applications board to investigate topics such as systems control and integration of LabVIEW applications with electronic hardware.

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

## DATEx EXPERIMENT CAPABILITIES - LABORATORY MANUALS

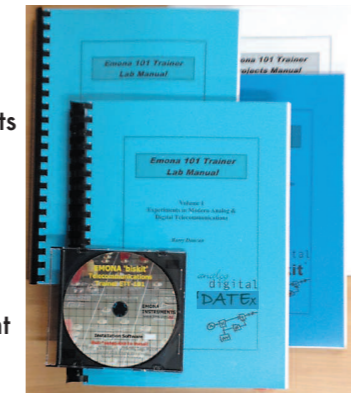
### 3 VOLUMES OF TELECOMMUNICATIONS EXPERIMENTS

The ETT-202 Laboratory Manuals, Volumes 1, 2 and 3, provide a turn-key solution for the teacher and student alike.

The first 2 Volumes are specially written to guide students through hands-on experiments and help them grasp the fundamental concepts of telecommunications.

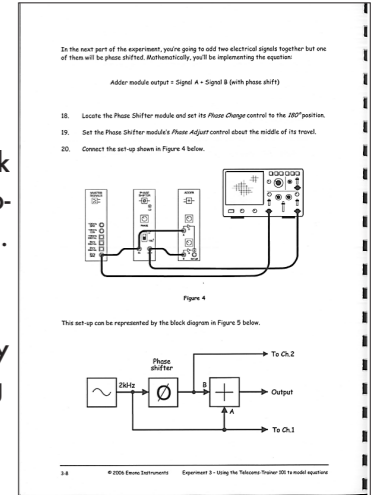
Volume 3 introduces students to LabVIEW programming tasks.

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-202” 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 students understanding and provide feedback to the teacher.



### ETT-202 LAB MANUAL - Volume 1 (22 Chapters, 406 pages)

- An introduction to the NI ELVIS™ II test equipment
- An Introduction to DATEx experimental add-in module
- An Introduction to the DATEx Soft Front Panel control
- Using DATEx to Model Equations
- Amplitude Modulation AM
- Double Sideband DSB Modulation
- Observations of AM and DSBSC signals in the frequency domain
- 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-202 LAB MANUAL - Volume 2 (18 Chapters, 338 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
- FM Generation using the harmonic multiplier method

### ETT-202 LAB MANUAL - Volume 3 (11 Chapters, 64 pages)

- Introduction
- LabVIEW Control of DATEx Hardware Using Prewired Backgrounds on the DATEx MAIN SFP
- Saving Screen Space with the DATEx Toolbar SFP
- Low Level DATEx VIs

- Programming Amplitude Control Blocks
- Programming Frequency Control Blocks
- Programming Phase Control Blocks
- Programming Timing Control Blocks
- Programming Mode Control Blocks: PCM/TDM block, SEQUENCE GENERATOR/LINE CODE block
- Sequencing and Combining the DATEx Blocks
- Using NI ELVIS Instruments on the DATEx
- Building LabVIEW Controlled DATEx Experiments: Automatic nulling using the PHASE SHIFTER; Viewing filter responses using FFTs; Analyzing noise circuit performance; Automatic gain control; Introducing complex I/Q modulation using LV Modulation Toolkit; Armstrongs phase modulator using the LV Modulation Toolkit; MSK modulation using the LV Modulation Toolkit; FM generation using the LV Modulation Toolkit
- Further LabVIEW Programming Tasks
- Controlling DATEx remotely across the Internet

Waveform displays and measurements are on-screen using LabVIEW™ Control is either via the front panel knobs and switches, or through the PC via the ETT-202 Soft Front Panel (SFP) instrument.

## BLOCK DIAGRAM APPROACH

Using the ETT-202, students learn fundamental concepts by actually building telecommunications experiments at the block diagram level. Theory comes to life as they build the modulation and coding schemes in carefully guided steps.