# **EMONA Information Sheet**

Telecommunications
Signals & Systems
Lab Equipment

# **EXPERIMENTS COVERING**THE PRINCIPLES BEHIND:

3G, 4G

LTE

**Wideband-CDMA** 

**HSDPA** 

CDMA2000®

EDGE

cdmaOne (IS-95)

**GSM** 

Wi-Fi

**WiMAX** 

**Cordless Telephone** 

**ZigBee**™

DECT

**Bluetooth®** 

**Near Field** 

**Communications** 

**UWB** 

**RFID** 

**Digital Radio DAB** 

Satellite Modems

**Satellite Links** 

**Deep Space Telemetry** 

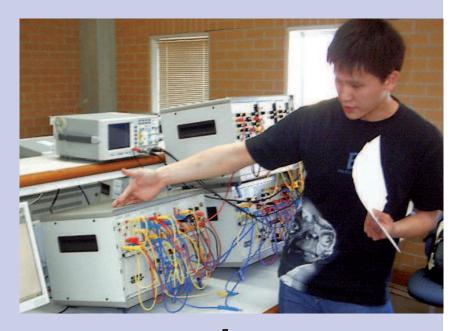
GPS

**OFDM** (DVB-T, ADSL, WLAN)

**Turbo Coding** 

**Software Defined Radio** 

and much more . . .



# **University Level Experiments in**

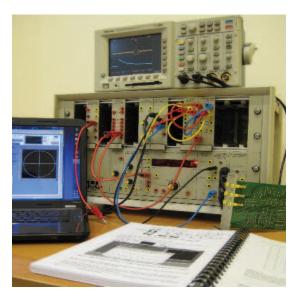
- Wireless Communications
- Signals & Systems
- DSP and SDR
- Fiber Optics
- Student Projects





# THE BEST LAB SOLUTION

TIMS is laboratory hardware & software for experiments in wireless theory, communications systems and signals & systems theory.



TIMS, Telecommunications Instructional Modeling System, is laboratory teaching equipment for EE and EET students in wireless, telecommunications and signal processing courses.

TIMS is a hardware engineering modelling system that can implement practically any form of modulation or coding - keeping pace with the rapid development of telecommunications theory.

## OPEN ENDED & EXPANDABLE ARCHITECTURE

TIMS can implement from the most basic communications systems theory, through to the very latest in coding and modulation - OFDM, Turbo Coding and more.

# SELF CONTAINED

TIMS is self contained requiring only an additional oscilloscope for waveform display and PC for detailed spectrum display and measurements.

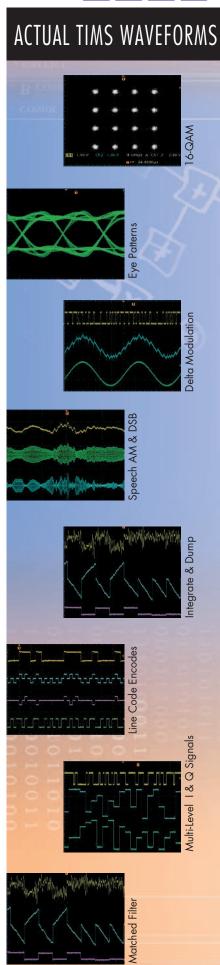
# PC-INTERFACE - INSTRUMENTATION, LabVIEW™ & MATLAB™

As well, TIMS can interface to a PC providing data acquisition and spectrum analysis facilities and a range of supporting math applications.

# STUDENT PROJECTS

TIMS is the ideal system to allow students to conveniently develop, built and analyse the performance of their thesis projects.

TIMS is a 'hands-on' lab system where engineering students learn mathematics "by-doing" through practical experience.



# FOR TEACHING COMMUNICATIONS THEORY

# TIMS is a True Engineering Modeling System .... more than just a "trainer"

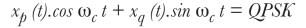
# START WITH MATH OR THEORY . . . . .

Telecommunications text books are full of equations and theories. This is the starting point for a TIMS experiment.

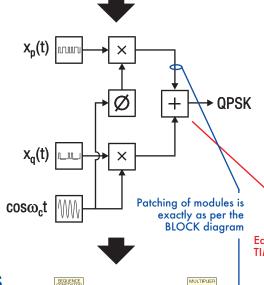


# REPRESENT IT AS A BLOCK DIAGRAM

In telecommunications, Math and Theory is always expressed in the universal language of BLOCK DIAGRAMS.



where  $x_{p}\left(t\right)$  and  $x_{q}\left(t\right)$  are alternate elements of a digital sequence.



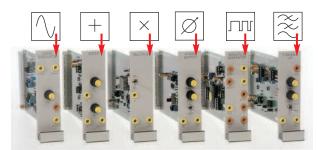


# STUDENTS BUILD IT USING TIMS MODULES

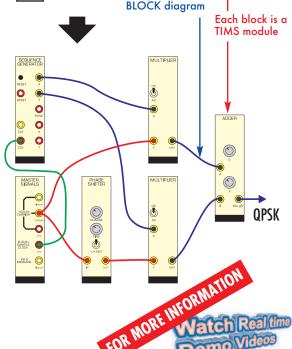
Students patch the BLOCK DIAGRAMS based on communications theory - then view and measure real-time signals.



# ONE MODULE FOR EACH BLOCK



60+ FUNCTIONAL BLOCKS TO CHOOSE FROM



www.youtube.com/EmonaTIMS

# **EMONA TIMS GUARANTEE OF SATISFACTION**

WELL ESTABLISHED

Used daily in hundreds of universities\* for over 25 years. Modules and experiments added every year. TIMS is always up to date.

Contact Emona for user lists near you.

HIGH RELIABILITY

TIMS plug-in modules are hot-swappable & TIMS is covered by a 24 month warranty with a proven history of lifetime customer support.

This diagram is a summary of the schemes

which TIMS currently implements.

DECODING

















CHANNEL

MODULATION

ENCODING







+ Distortion/non-

+ Noise

AM / DSB / SSB / ISB

Sinusoidal and speech

ASK, FSK, GFSK

linearity

**BPSK, QPSK, 4/8/16-PSK** 

Jelta, Adaptive Delta

QAM, 4/8/16-QAM

Sequence Generation

& Gold Codes

**Distributor:** 

Pseudo Random

messages

Corresponding decoder

for each encoder

+ Filter characteristics + SNR measurements + Band limiting

Product demodulation

Envelopes

LPF & reconstruction

filters

- + Multipath Channel **Baseband channel** 1/4-DPSK, GMSK, OQPSK Sigma Delta, CVSD
  - JWB Ultra Wideband TDM, FDM, PDM Multiplexing: **OFDM** 
    - Duobinary
  - NRZ-M, Uni-RZ, Bip-RZ Manchester), Dicode, ine codes: NRZ-L, RZ-AMI, Bi-Phase
    - **Convolutional codes** Block Interleaving PCM, companding Block codes
      - **Trellis: TCM encoding** SDH / SONET frames **Furbo Coding**

tims is a registered trade mark of Emona TIMS Pty Ltd

Student Projects with DSP, CPLD & Circuits

Student Projects with

Undersampling

Digital Radio -

DSP, CPLD & Circuits

Nyquist theorem

DSP, CPLD & Circuits Student Projects with

Student Projects with

**TIMS Trunks channel** 

Wireless antenna

Sampling and aliasing

PAM, PWM, PPM

Armstrong's phase

WB-FM, NB-FM

modulator

DSP, CPLD & Circuits Student Projects with Viterbi Algorithm

Bit Clock Regeneration

bit clock and frame

Synchronization:

ntegrate & Dump Superheterodyne Fundamentals of

Matched Filters

Constellations

Costas Loop and PLL

Carrier Acquisition:

WDM along single fiber;

Fiber Optic channel:

Bandpass channel

Bidirectional comm's

DSSS, CDMA, FHSS, Hybrid

Spread Spectrum:

along a single fiber

Pulse shaping - RRC, Linear Phase, Bessel

**Equalization for ISI** 

Phasing of local

oscillator

iming Jitter

**Baseline Wander** 

**SNR** measurements

Bit Error Rate vs

decision thresholds

Eye Patterns &

for each modulator

System fault finding

DSP, CPLD & Circuits

# Copyright 2016 Emona Instruments Pty Ltd. Printed in Australia (09/2016 rev:3.0).

# **Emona Instruments Pty Ltd**

RANSMITTED

MESSAGE

Camperdown NSW 2050 AUSTRALIA Tel: +61-2-9519-3933 Fax: +61-2-9550-1378 URL: www.tims.com.au Email: sales@emona-tims.com

78 Parramatta Road