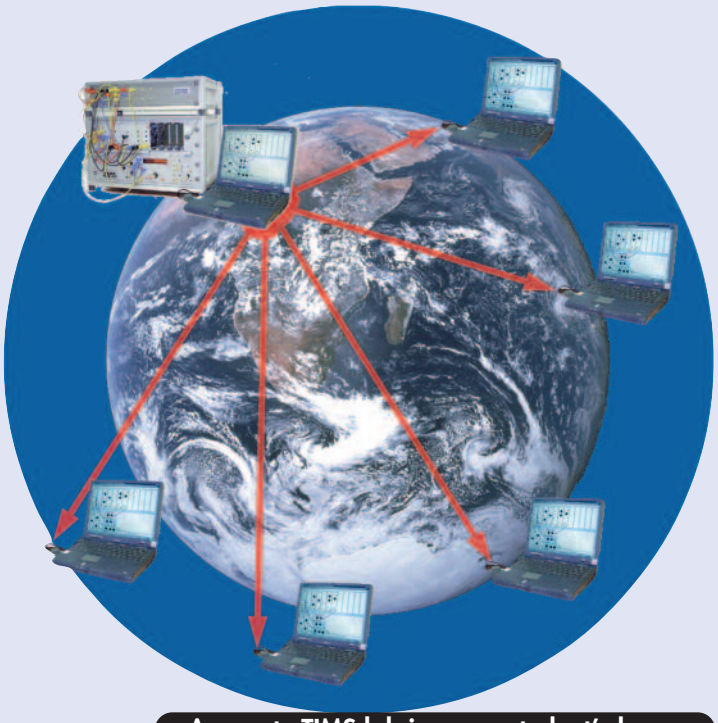
EMONA net*TIMS

TIMS™ Communications Experiments Remotely Controlled via Web Browser

Enhance Student Learning with Remote Controlled Experiments
24/7 Student Access to Communications Experiments

MODULATION AND CODING EXPERIMENTS COVERING THE PRINCIPLES BEHIND:

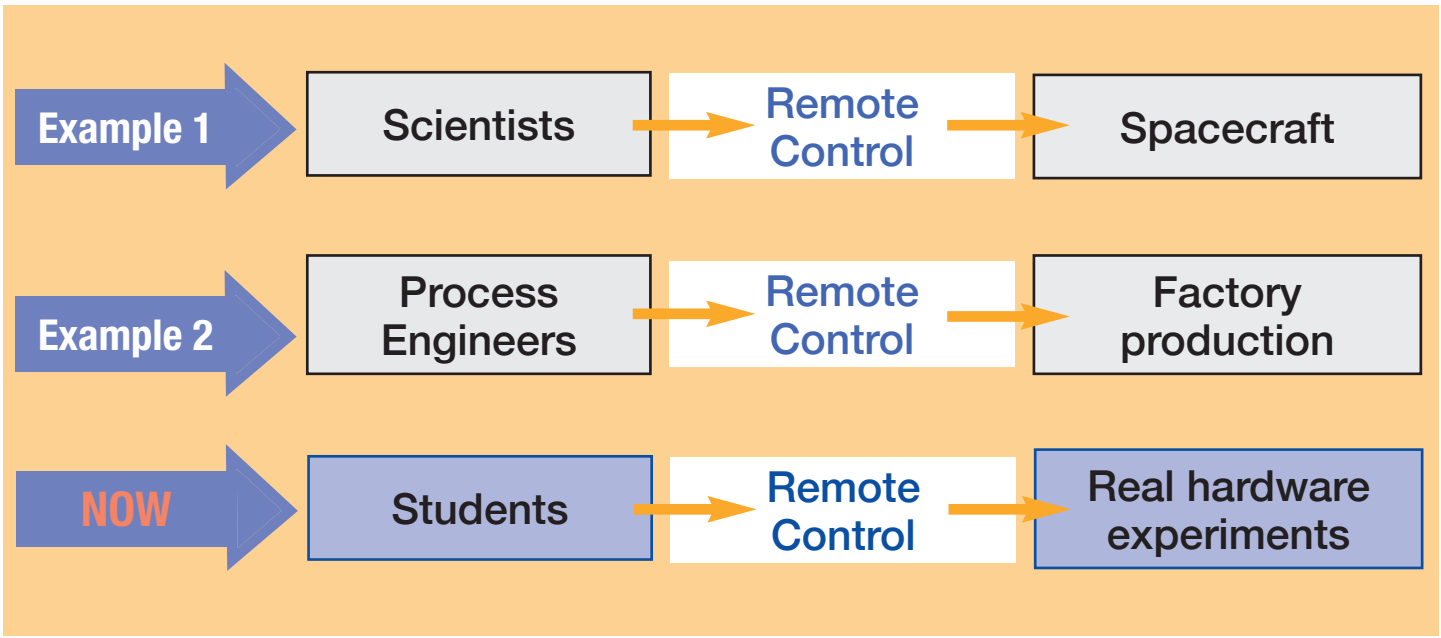
LTE, 4G and 5G
IoT
TETRA
Wideband-CDMA
HSDPA
CDMA2000®
EDGE
cdmaOne (IS-95)
GSM
Wi-Fi
WiMAX
Cordless Telephone
ZigBee™
DECT
Bluetooth®
Near Field Communications
UWB
RFID
Digital Radio DAB
DVB-S
Satellite Modems
Satellite Links
EBEM
Deep Space Telemetry
GPS
RADAR Signals
OFDM (DVB-T, ADSL, WLAN)
Software Defined Radio
plus
Signals & Systems topics
and much more . . .



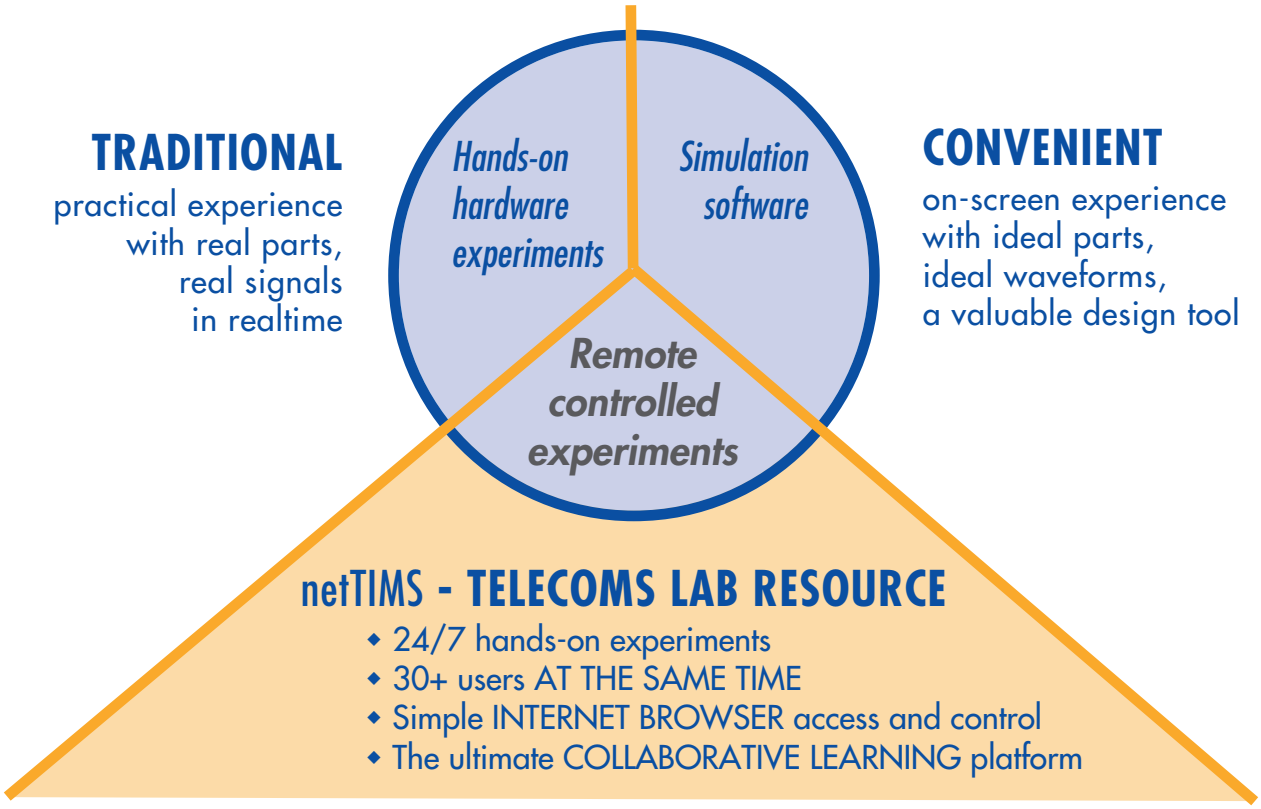
A remote TIMS lab in every student's home

EMONA INSTRUMENTS
www.emona-tims.com

Remote Controlled Experiments - A Well Proven Solution



Remote Engineering Labs



2 OPTIONS

- Advanced Experiments - net*TIMS-System
- Basic Experiments - net*TIMS-FreeWire

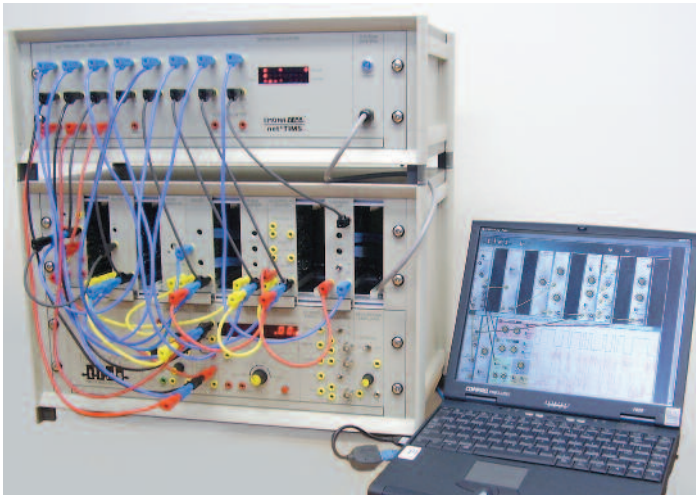
OPTION1 - netTIMS-System

Easily expandable experiment platform for advanced experiments. Completely customizable experiments, pre-wired by the professor and remotely controlled by the student.

Over 200 advanced experiments covering analog and digital modulation, coding plus signals & systems topics.

Emona net*TIMS offers real TIMS telecommunications and signals & systems hardware experiments, delivered simultaneously to 30+ students across LAN & Internet, in real-time.

- **Remote control of hardware via internet browser**
- **24/7 access to real TIMS hardware experiments**
- **Real-time logging of student experiment progress and access**



OPTION2 - netTIMS-FreeWire

Basic analog & digital communications experiments. Each experiment is wired by the student, on the fly.

netTIMS-FreeWire allows students to log-on and wire 38+ basic analog and digital modulation experiments.

Emona netTIMS-FreeWire offers real TIMS telecommunications hardware experiments, delivered simultaneously to multiple students across LAN & Internet, in real-time.

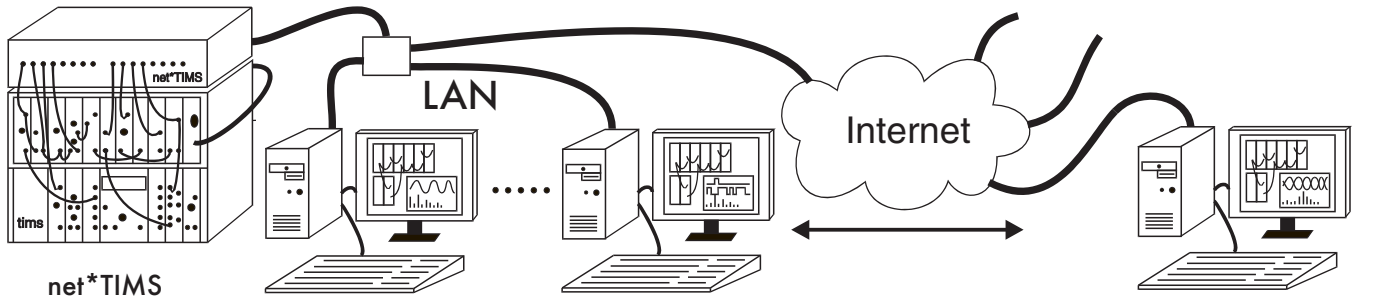
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OPTION 1 - netTIMS-System

Easily expandable experiment platform for advanced experiments. Completely customizable experiments, pre-wired by the professor and remotely controlled by the student.

Over 200 advanced experiments covering analog and digital modulation, coding plus signals & systems topics.



net*TIMS hardware experiment in the lab.

Each student PC on the LAN has a unique student experiment session.

Each student on the INTERNET has a unique student experiment session.

- **Students control real TIMS hardware from their PC and obtain immediate PC-scope display of the real signals**
- **Remote control of hardware via GUI**
- **Flexible experiment patching**
- **Fault insertion capability for student debugging**
- **24/7 access to real TIMS hardware experiments via browser/client**
- **Real-time logging of student experiment progress and access**
- **Collaborative learning Environment for students**

EMONA net*TIMS-System

net*TIMS allows professors to set-up real TIMS telecommunications experiments in their own laboratory, which students can then **access and control from within the lab and at a distance**, to carry out the experiments.

net*TIMS-enabled modules have switches and potentiometers which are remotely controlled via Ethernet. The net*TIMS-enabled modules are plugged into a standard Emona TIMS-301 System Unit and are patched to the net*TIMS Server, which is **connected to the LAN/Internet via an Ethernet port**.

The GUI at the user PC mimics the experiment front panels and displays acquired real signals, using a digital 2 channel oscilloscope from 8 different points in the experiment for each channel. 4 trigger points are also available.

All waveforms can be viewed in both the time and frequency domain.

SIMPLE BROWSER LOG-ON

A user logs on to the net*TIMS Server **using their web browser**. They receive a JAVA-based client screen, as shown to the right, corresponding to the particular experiment set up on the net*TIMS System.

Why consider remote controlled hardware experiments instead of lower cost simulation software?

Because students do learn better: they find the results obtained from hardware systems more believable.

Experience shows that students don't believe and question the validity of unexpected results obtained from simulation software.

"Hardware is real"

The student can simultaneously access other course material provided by the professor and also transfer actual experimental results between the net*TIMS screen and other applications to create Lab reports.

The user can switch, insert or by-pass hardware modules in the experiment, as set-up by the professor, for multi-stage experiments.

MULTI-USER
The net*TIMS Server manages a **multi-user environment**, allowing several students, each at a different location, to be logged onto the same net*TIMS Server and independently carrying out their own session of the same experiment.

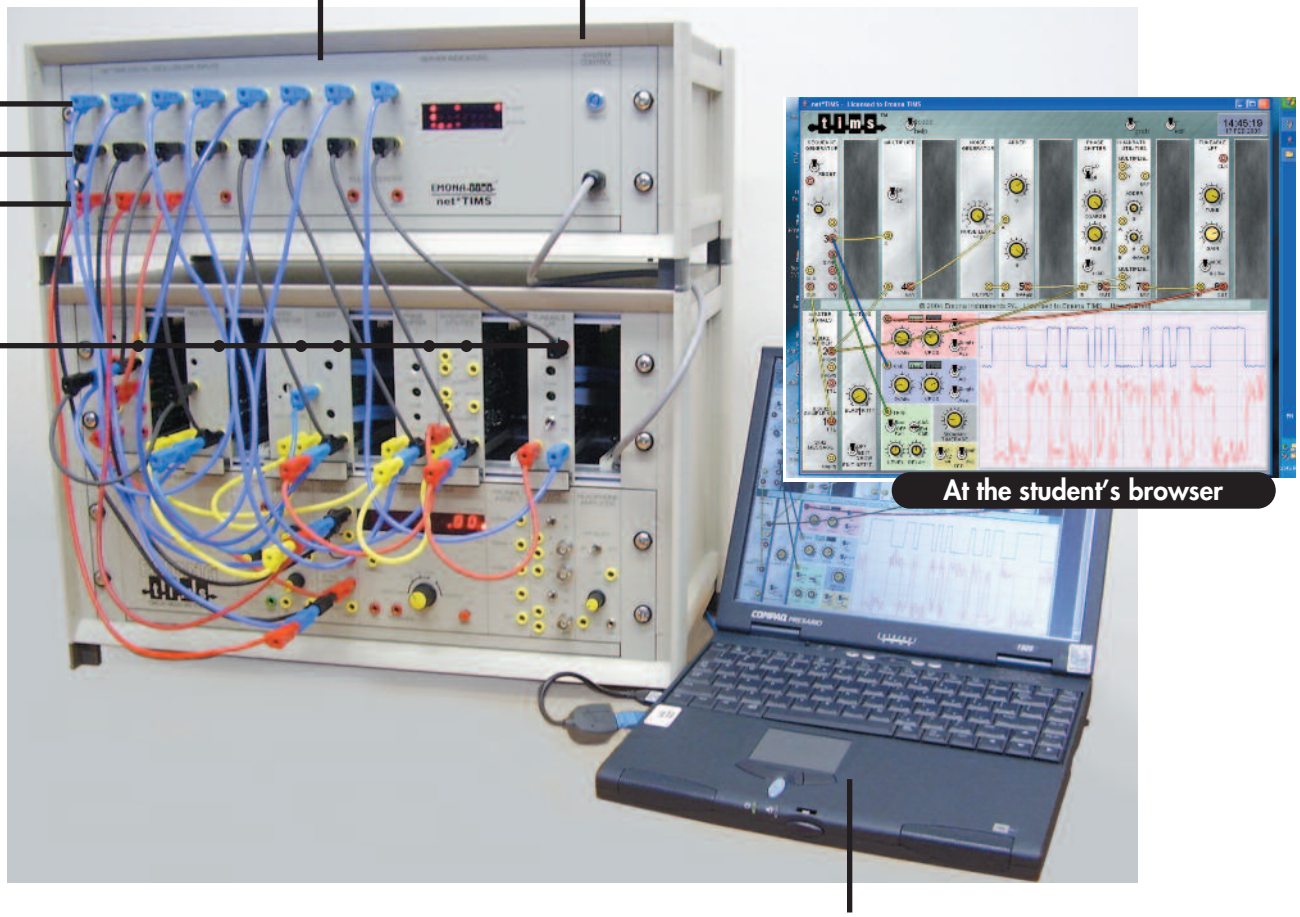
COURSE MANAGEMENT
The net*TIMS Server provides gate-keeping access and a log of all student activities. The professor can manage the net*TIMS Server from a password protected administration page via their browser.

Emona net*TIMS-System overview

net*TIMS SERVER
A web server unit which 'serves' the net*TIMS EXPERIMENT SCREEN to each user 'client' software, as well as housing the digital scope and multiplexer used to capture actual signals for display.

net*TIMS Scope Inputs
Real, multichannel digital storage scope. Captures users' waveforms.

Ethernet Port
The ethernet port at the rear of the net*TIMS Server provides user access via PC, or LAN, or Internet.



net*TIMS Enabled Plug-in Modules
Hardware modules are patched together following exactly the experiment as displayed by the net*TIMS CLIENT software. All knobs and switches are controlled on-screen by the student via the net*TIMS CLIENT running on their PC.

Professor's PC
Connected via ethernet port to the LAN, to access the net*TIMS experiment and also the Server's ADMIN pages.

netTIMS CUSTOM CIRCUITS PROJECT Module

Remotely control your own electronic circuits via net*TIMS.



INPUT/OUTPUT Fn1

INPUT/OUTPUT Fn2

INPUT/OUTPUT Fn3

k1: POTENTIOMETER

k2: POTENTIOMETER

RADIO BUTTONS:
4 x SPST switches

TOGGLE SWITCHES:
2 x DPDT switches

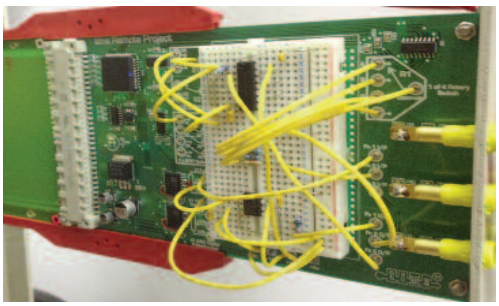
ROTARY SWITCH:
1 x SP4T switch

REMOTE PROJECT module - on-screen representation

Easy to use, easy to adapt to your own circuits and easy to deliver to multiple students at once, for remote labs or MOOCs. The REMOTE PROJECT module can be used alongside any other net*TIMS plug-in module.

This photograph shows an example of the REMOTE PROJECT module in use, plugged into the TIMS System.

Easy to implement. No programming required.



net*TIMS REMOTE PROJECT specifications

INPUT 3 x analog/digital signals, up to ±12V
OUTPUT 3 x analog/digital signals, up to ±12V
SWITCHES
SPST x 4 displayed as radio buttons
DPDT x 2 displayed as toggle switches
SP4T x 1 displayed as a rotary switch
POTENTIOMETERS
10kR x 2 independent digital potentiometers
BREADBOARD/WIREWRAP CIRCUIT AREA
80x55mm area with 21 x 30 of 0.1"wirewrap matrix or solderless breadboard

netTIMS Experiment Capabilities

TIMS DOCUMENTED EXPERIMENTS:

- ❒ Adaptive Delta Modulation
- ❒ AM - Amplitude Modulation
- ❒ Armstrong's Phase Modulator
- ❒ ASK - Modulation & Demodulation
- ❒ Bit Clock Regeneration
- ❒ Block Coding and Decoding
- ❒ BPSK - Introduction
- ❒ BPSK and BER
- ❒ Carrier Acquisition - PLL
- ❒ CDMA - 2 Channel
- ❒ CDMA - Introduction
- ❒ CDMA - Multichannel
- ❒ CDMA at Carrier Frequencies
- ❒ Convolutional Coding
- ❒ Costas Loop
- ❒ Delta Demodulation
- ❒ Delta Modulation
- ❒ Delta-sigma Modulation
- ❒ Digital Signal Recovery
- ❒ DPSK and BER
- ❒ DPSK and Carrier Acquisition
- ❒ DSBSC - Generation & Demodulation
- ❒ DSSS - Spread Spectrum
- ❒ Envelopes and Envelope Detection
- ❒ Eye Patterns & BER
- ❒ FDM - Frequency Division Multiplex
- ❒ FHSS: Fast & Slow Hopping
- ❒ FHSS and Bit Error Rate Performance
- ❒ Fiber Optic Transmission, Splitting and Combining
- ❒ Fiber Optic - Bidirectional Transmission
- ❒ Fiber Optic - WDM Transmission
- ❒ FM - Demodulation by PLL
- ❒ FM - Demodulation by Zero Crossing Counting
- ❒ FM - Deviation Multiplication
- ❒ FM, Wideband - Generation by VCO
- ❒ FM - Synchronous Demodulation
- ❒ Frequency Synthesis with the PLL
- ❒ FSK - Generation & Envelope Demodulation
- ❒ GFSK - Gaussian FSK
- ❒ Line-Coding & Decoding
- ❒ Matched Filter Detection
- ❒ MSK, OQPSK, π/4-QPSK, π/4-DQPSK
- ❒ Modeling Equations
- ❒ Modem: Multi-Level Data via Voiceband
- ❒ Modem: Data Rates & Voiceband Modems
- ❒ Multi-level QAM & PSK
- ❒ **Multi-path - Time-invariant fading channel characteristics**
- ❒ Noisy Channel
- ❒ Noise Generation - Binary Sequences
- ❒ OFDM Principles - Introduction
- ❒ PAM & TDM
- ❒ PCM & Bit Clock Regeneration
- ❒ PCM Encoding & Decoding
- ❒ PCM TDM
- ❒ PDM - Phase Division Multiplex
- ❒ PLL - Phase Lock Loop
- ❒ PPM - Pulse Position Modulation
- ❒ PRBS Messages & Sequence Synchronization
- ❒ Product Demodulation
- ❒ Pulse Shaping - Introduction
- ❒ Pulse shaping for band-limited channels
- ❒ PWM - Pulse Width Modulation
- ❒ QAM - Generation & Demodulation
- ❒ QAM and 4-PSK
- ❒ QASK - Modulation & Demodulation
- ❒ QPSK - Modulation & Demodulation
- ❒ Sampling & Reconstruction
- ❒ Sampling with Sample-&-Hold
- ❒ Signal Constellations 4/8/16QAM and 4/8/16PSK
- ❒ SNR in AM Demodulated Signals
- ❒ SNR performance of SSB and DSBSC
- ❒ Spread Spectrum Principles
- ❒ Speech in Telecommunications
- ❒ SSB Generation and Demodulation
- ❒ SSB Linear Amplifier Measurements
- ❒ Superheterodyne
- ❒ TCM - Coding Gain
- ❒ TCM - Trellis Coding
- ❒ TDM
- ❒ **Turbo coding**
- ❒ UWB - Pulse Shapes & Spectra
- ❒ UWB - with BER
- ❒ UWB - Multiband Modulation
- ❒ UWB - Multiple Access Orthogonal Pulse Modulation with MHP
- ❒ UWB - OOK, PPM, BPM & OPM
- ❒ Weaver's SSB Mod and Demodulator

SIGNALS & SYSTEMS EXPERIMENTS MANUALS:

- ❒ Special Signals - characteristics and applications
- ❒ Modeling Linear and Non-linear Systems
- ❒ Unraveling Convolution
- ❒ Integration, correlation & matched filters
- ❒ Exploring complex numbers and exponentials
- ❒ Comparing Responses in the Time and Frequency Domains
- ❒ A Fourier Series Analyzer
- ❒ Spectrum Analysis of Various Signals
- ❒ Poles and Zeros in the Laplace Domain
- ❒ Sampling and Aliasing
- ❒ Analog-Digital Conversion
- ❒ Discrete-Time Filters - Finite Impulse Response
- ❒ Poles and Zeros in the z plane: Discrete-time Filters

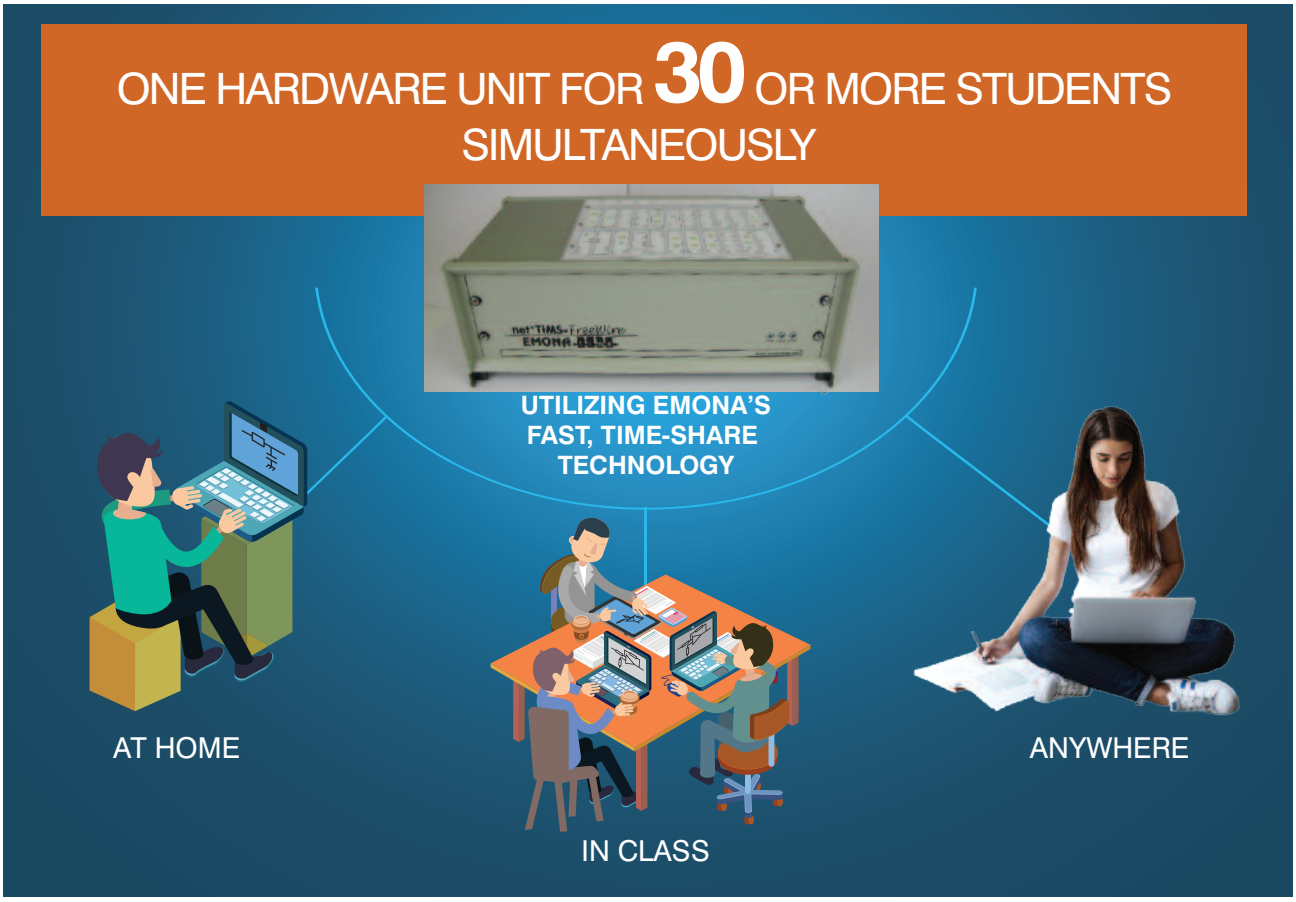
STUDENT PROJECT CAPABILITIES:

- ❒ Building electronic circuits with the T**IMS-820 Wire-wrapping Project Module**
- ❒ Programming DSP implementations with the **TIMS-DSP-6713 Module**

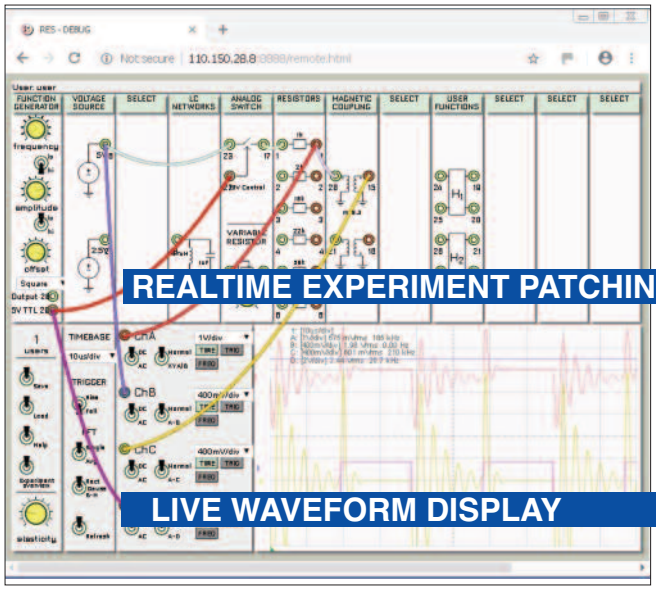
OPTION2 - netTIMS-FreeWire

Basic analog & digital communications experiments. Each experiment is wired by the student, on the fly.

netTIMS-FreeWire allows students to log-on and wire 38+ basic analog and digital modulation experiments.



- The netTIMS-FreeWire Control Unit is located in your lab or office.
- Fast and easy implementation. No software to install and no setting up required.
- Secure access for professor to all ADMIN functions including student records and tracking.
- Each student can build the experiment of THEIR CHOICE. Any experiment can be built by each student.
- Students access experiments via their web browser. No software to download: simple USERNAME and PASSWORD access.
- Professor has web access to the secure Server Administration pages for student set-up, management and monitoring usage.

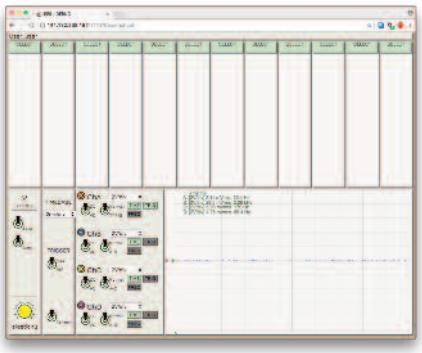


EACH STUDENT HAS UNIQUE EXPERIMENT

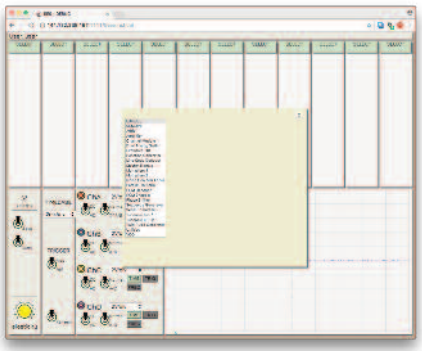
netTIMS-FreeWire - how students wire experiments

Students patch together experiments with a selection of 22 TIMS modules to build 38+ telecoms experiments.

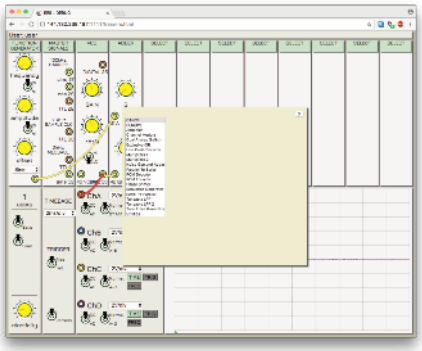
Start > Select > Wire > Measure > Explore



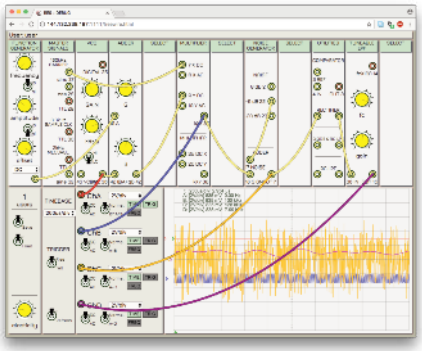
• **START:** log-on with a blank screen



• **SELECT:** select MODULES required for the experiment



• **WIRE:** Patch outputs/inputs to build experiment



LIVE DISPLAY with 4 CHANNEL OSCILLOSCOPE and SPECTRUM DISPLAY

• **MEASURE & EXPLORE:** adjust, measure, review

netTIMS-FreeWire Experiment Capabilities

Intro to netTIMS-FreeWire
Modeling equations
DSBCS generation
Product demodulation
AM method I
AM method II
Envelope detection
Armstrong's phase modulator
FM - WBFM modulation by VCO
FM demo by zero crossing
Sampling and reconstruction
Phase division Multiplex
Phase division demultiplex
PWM mod and demod
Carrier acquisition by PLL
Complex analog messages
PCM encoding
PCM decoding
ASK modulation
ASK demodulation
BPSK modulation
BPSK demodulation
QPSK modulation
QPSK demodulation
FSK modulation
Signal constellations
Eye patterns
The noise channel
Line coding and decoding
QAM modulation
QAM demodulation
BPSK in a noisy passband channel
PCM-TDM
Intro to PAM-TDM
Intro to QASK
Noise generation using binary sequences
Principles of spread spectrum
AM demodulation and SNR

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