

# Communications Technologies Training Systems 8087

**FESTO**

**LabVolt Series**

Datasheet



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## General Description

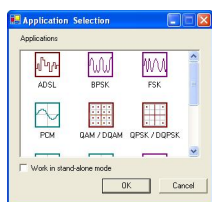
The Communications Technologies Training Systems are specifically designed for hands-on training in a wide range of communication technologies. Training starts from the basic pulse modulation techniques (PAM, PWM, PPM, PCM, DPCM, and delta modulation), covers the various digital modulation schemes used in data transmission (ASK, FSK, BPSK, QPSK, and QAM), and extends to modern, spectrally efficient, digital communication techniques such as the asymmetric digital subscriber line (ADSL) and spread spectrum technologies (direct-sequence spread spectrum and frequency-hopping spread spectrum).

The courseware consists of a series of student manuals covering the different technologies, as well as instructor guides that provide the answers to procedure step questions and review questions. The training systems and the accompanying courseware provide a complete study program.

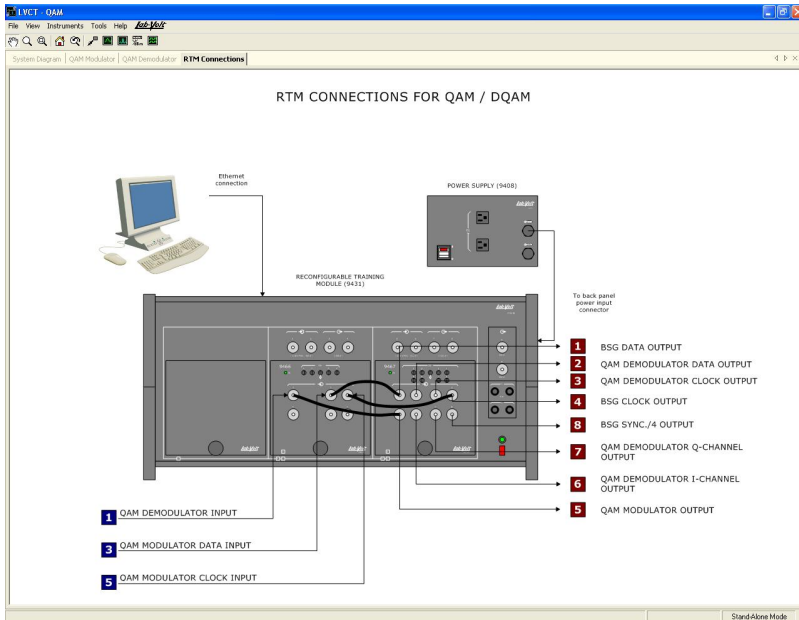
Through the study of ADSL, the training systems also introduces various essential underlying technologies such as discrete multi-tone (DMT) modulation, orthogonal frequency division multiplexing (OFDM), data scrambling, convolutional coding, trellis-coded modulation (TCM), forward error correction (FEC) using Reed-Solomon codes, data interleaving, and Viterbi decoding. Similarly, study of the spread spectrum technologies using the training systems allows coverage of several other relevant topics such as the principles of code-division multiple access (CDMA), Gold code sequence generation, auto-correlation and cross-correlation properties of code sequences, as well as an introduction to modern applications of these technologies such as CDMA-based cellular telephony, Global Positioning System (GPS), residential cordless telephone sets, Bluetooth specification for wireless personal area networks (WPAN), etc. Whenever possible, the systems are designed to reflect the standards commonly used in modern communications systems. Unlike conventional, hardware-based training systems that use a variety of physical modules to implement different technologies and instruments, the Communications Technologies Training Systems are based on a Reconfigurable Training Module (RTM) and the Communications Technologies (LVCT) software, providing tremendous flexibility at a reduced cost.

Each of the communications technologies to be studied is provided as an application that can be selected from a menu. Once loaded into the LVCT software, the selected application configures the RTM to implement the communications technology, and provides to students a specially designed user interface. A wide variety of applications are available, covering many current and evolving communications technologies. Because the Communications Technologies Training Systems are open, reconfigurable systems, they can be upgraded at any time to cover additional technologies simply by purchasing additional applications. The LVCT software provides settings for full user control over the operating parameters of each communications technology application. Functional block diagrams for the circuits involved are shown on screen. The digital or analog signals at various points in the circuits can be viewed and analyzed using the virtual instruments included in the software. In addition, the most important of these signals are made available at physical connectors on the RTM and can be displayed and measured using conventional instruments.

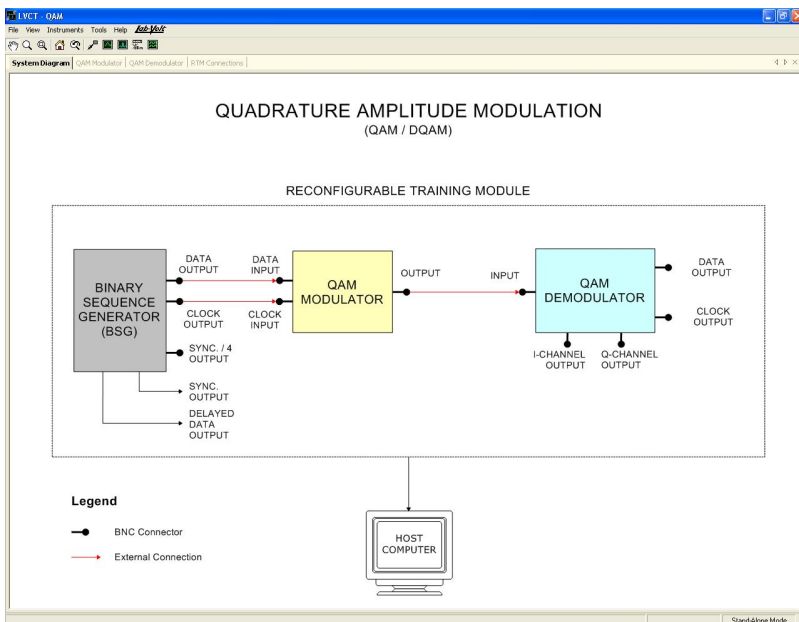
## Detailed Screenshots of the Application



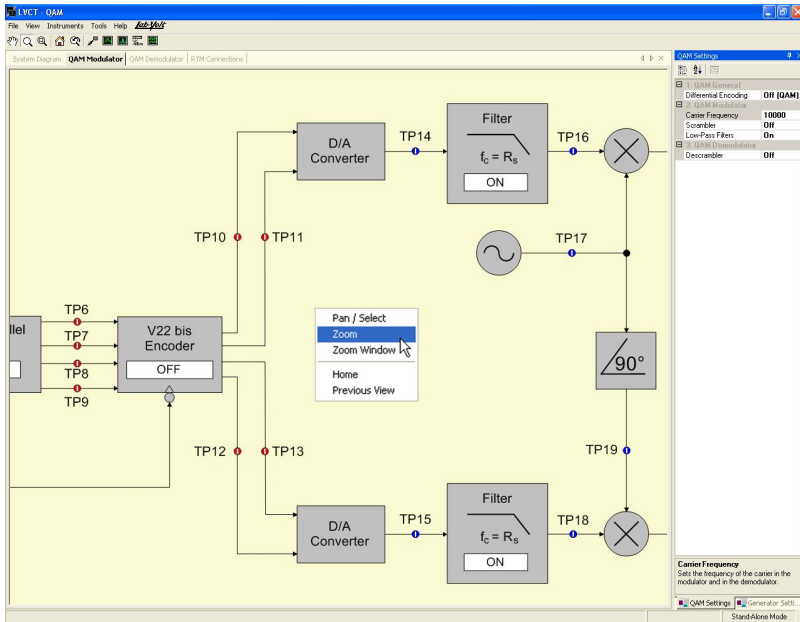
On start-up, the user selects a communications technology application to be studied.



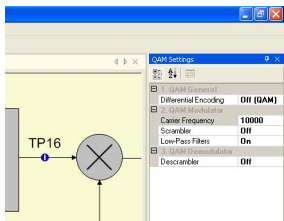
The RTM Connections diagram identifies the RTM inputs and outputs and shows the external connections.



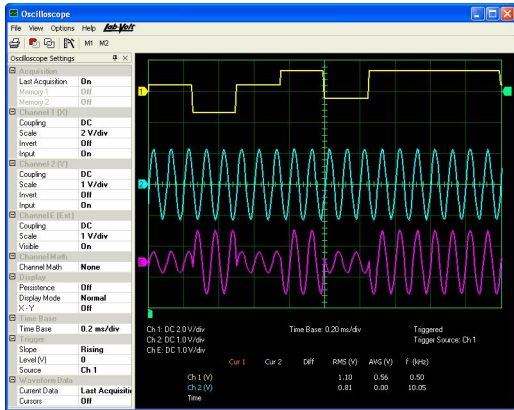
The System Diagram shows the overall system and interconnections for the selected application.



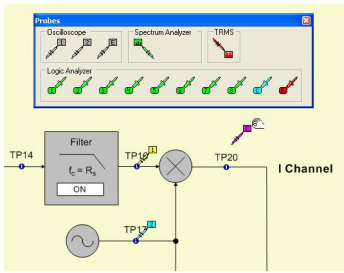
Circuit diagrams show the functional blocks of each circuit. Pan and Zoom functions allow easy navigation.



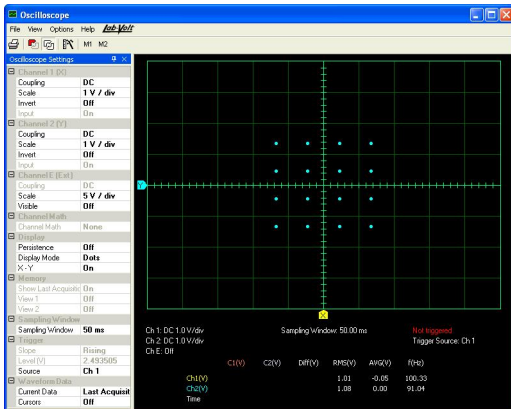
Settings tables provide full control of operating parameters.



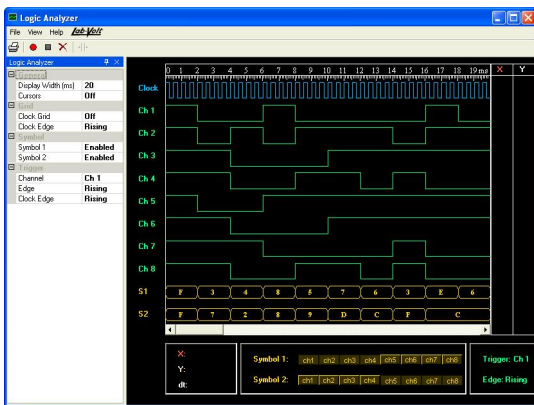
The virtual Oscilloscope allows observation and measurement of analog and digital signals.



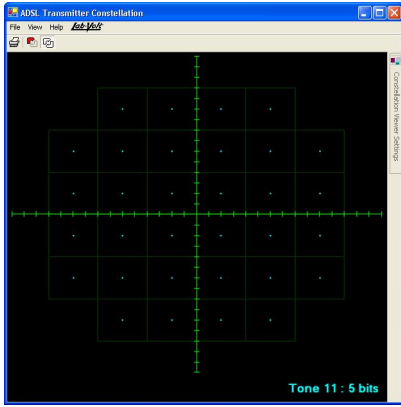
Probes can be dragged from the Probes bar and connected to circuit Test Points (TPs) in order to observe signals using the virtual instruments.



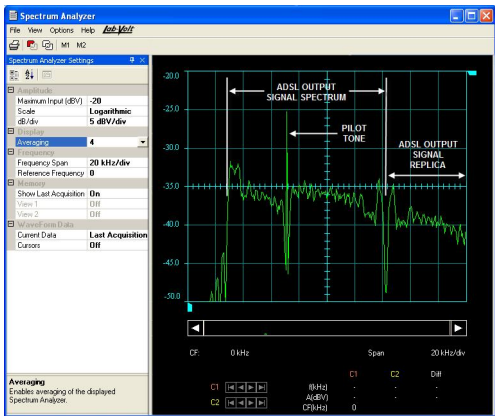
In the X-Y mode, the Oscilloscope can display the signal constellation, such as this 16-QAM constellation.



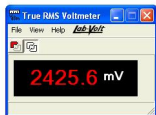
The Logic Analyzer records and displays digital data from multiple test points.



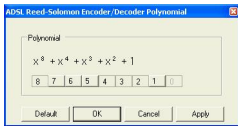
The Constellation Viewer in the ADSL application displays complex signal constellations.



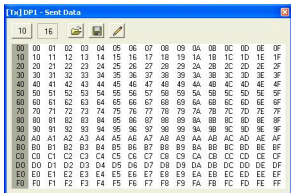
The Spectrum Analyzer displays frequency spectra, such as this spectrum of an ADSL signal.



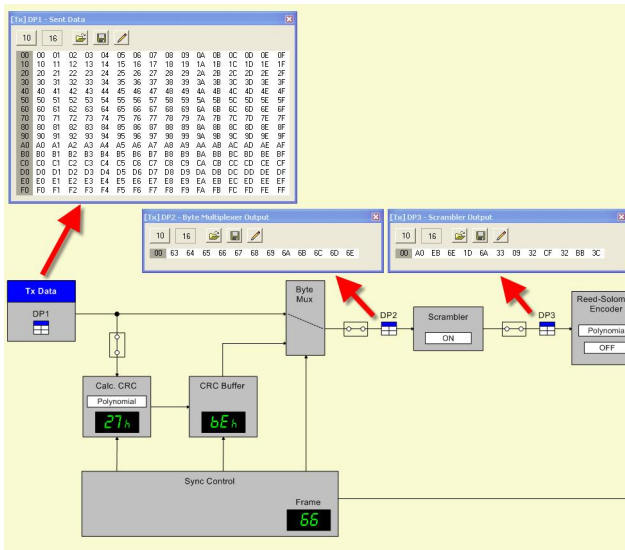
The True RMS Voltmeter displays signal levels in volts or dBm.



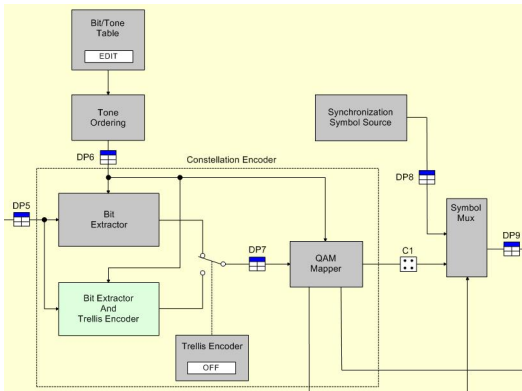
The system is highly configurable. This dialog box allows changing the polynomial used for the ADSL Reed-Solomon Encoder and Decoder.



The data at some Data Points can be edited, saved in a MATLAB<sup>®</sup>-compatible file, or loaded from a file.



Data Points are provided where digital data is present in a circuit. Double-clicking a Data Point opens a table displaying the data as decimal or hexadecimal values.



The ADSL application performs constellation encoding with or without Trellis Coding and allows modifying the number of bits allocated to each tone (subcarrier).



Model	Name	Included in System 8087-X				
		-1	-2	-3	-4	-5
9408	Power Supply	•	•	•	•	•
9431-1	Reconfigurable Training Module (RTM)	•	•	•	•	•
9466	Data Acquisition Interface	•	•	•	•	
9467	Analog/Digital Output Interface	•	•	•	•	•
9468	Vocoder					•
9483	Cables and Accessories	•	•	•	•	•
9432	LVCT Software	•	•	•	•	•
39862-E	Communications Technologies Training System User Guide	•	•	•	•	•
9432-1	PAM / PWM / PPM Applications					
39862	Student Manual	•	•	•	•	•
39862-1	Instructor Guide					
9432-2	PCM / DPCM / Delta Modulation Applications					
39863	Student Manual		•	•	•	•
39863-1	Instructor Guide					
9432-3	ASK / FSK / BPSK Applications					
39864	Student Manual			•	•	•
39864-1	Instructor Guide					
9432-4	QPSK / QAM / ADSL Applications					
39865	QPSK Student Manual					
39865-1	QPSK Instructor Guide					
39866	QAM Student Manual					
39866-1	QAM Instructor Guide				•	•
39866-P	QAM Quick Start Guide					
39867	ADSL Student Manual					
39867-1	ADSL Instructor Guide					
39867-P	ADSL Quick Start Guide					
9432-5	DSSS / FHSS / CDMA Applications					
85031	Spread Spectrum Student Manual					•
85031-1	Spread Spectrum Instructor Guide					

Note: A separate copy of the LVCT software and of each desired application package must be purchased for each RTM. One copy of the User Guide is included with the LVCT software. Every application package includes one copy of each of the associated manuals.

## Topic Coverage

- Pulse Modulation and Sampling (PAM / PWM / PPM)
- Digital Modulation (PCM / DPCM / Delta)
- Basic Modems and Data Transmission (ASK / FSK / BPSK)
- Quadrature Phase Shift Keying (QPSK / DQPSK)
- Quadrature Amplitude Modulation (QAM / DQAM)
- Asymmetric Digital Subscriber Line (ADSL)
- Spread Spectrum (DSSS/FHSS/CDMA)
- Troubleshooting

## Features & Benefits

- Provides hands-on, system-level training in communications technologies
- Real system and real frequencies, not simulations, reflecting the standards commonly used in modern communications systems
- Flexible, open system using a high performance DSP-based Reconfigurable Training Module (RTM)
- A variety of communications technology applications allow studying many different communications technologies
- Comprehensive courseware provides theory and step-by-step laboratory procedures for each technology
- Fault-insertion capability allows the teaching of troubleshooting
- MATLAB<sup>®</sup> Import/Export in ADSL applications
- Short-circuit-proof, low-power for safety and compatibility
- Front-panel access to signals
- Windows-based Communications Technologies (LVCT) software provides the user interface and configures the RTM to implement the communications technology selected by the user

### Description

**Manual  
number**

## Additional Equipment Required to Perform the Exercises (Purchased separately)

### Qty Description

**Model  
number**

1 Communications Technologies Host Computer \_\_\_\_\_ 587467 (9695-A0) <sup>1</sup>

## Optional Equipment Description

### Communications Technologies Host Computer (Optional) 587467 (9695-A0)

The Communications Technologies Host Computer is a Pentium-type personal computer running under a Windows<sup>®</sup> operating system with the LVCT software preinstalled. A dual-output display adapter (video card) and two color monitors are included. This Host Computer is linked to the Reconfigurable Training Module (RTM) through a high-speed data link (Ethernet link with TCP/IP protocol).

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<sup>1</sup> Refer to the Computer Requirements in the System Specifications section of this datasheet if the computer is to be provided by the end-user.

Reflecting the commitment of Festo Didactic to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

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