Now any school classroom or lab can have Extra Sensory Perception!

NeuLog™

Neuron Logger Sensors

Fully Autonomous Experimental Data Management

Scientific Educational Systems

From the R&D laboratories of SES to the learning labs of schools around the world: NEULOG, the next generation in experimental sensors.

Scientific Educational Systems (SES) is an innovator in technological training systems for hands-on education in the sciences, high-tech and industry for grade schools, high schools, universities and vocational schools.

Since 1983, SES product lines have been providing an entry point for school children and adults to explore a wide range of fields, including electronics and telecommunications, CNC, automotive and robotics. The company enjoys an international reputation for crosscultural effectiveness and educational quality, with installations in North America, Latin America, Asia, Europe and the Middle East.

Now SES has fused its educational expertise with wireless technology and microprocessors to develop NEULOG: a line of user-friendly tools that aid scientific and hi-tech experimentation in classrooms, labs and outdoors - anywhere that you can take inquiring minds.

NEULOG is a versatile, simple, cost-effective enhancement for every learning program that collects and uses physical data from an experiment.

The Genius of NEULOG

NeuLog is the most advanced line of experimental data sensors in the educational market today.

The NeuLog instrument is a compact microchip assembly - a programmable real-time data sensor, logger, memory and transmitter all in one - that works automatically with built-in wire and wireless communication.

Each NeuLog plug-and-play module is designed to function independently, either as a stand-alone sensor or linked in a chain of up to 50 sensors. Whether chained or free, all NeuLog sensors operate autonomously, storing the incoming data or relaying it to a remote PC.

Together with the powerful NeuLog software, which can analyze huge amounts of data, the NeuLog sensors extend the horizons of data acquisition and analysis beyond the confines of conventional classroom instruction, to create exciting new educational opportunities.

NeuLog brings the world of scientific data into another dimension for educators and students, children and adults, in all kinds of study environments around the world.

NeuLog in the Service of Learning

NEULOG Automation Leaves Their Hands & Minds Free to Explore

NeuLog provides the educational environment with accurate, real-time data processing that does everything - collects, measures, logs, stores and transmits experimental data to a PC - and does it effortlessly. No special training is needed to operate the sensors, so the students can concentrate on the experiment itself.

NeuLog frees up the learning process in other ways too. The wireless capability of NeuLog does away with the limitations of cables, while its automated processing does away with the element of human error in manual data entry.

Exploration is more creative, more accurate - and more fun.

NEULOG Versatility Lets Them Be Everywhere At Once

The NeuLog sensor/logger system enables data display and analysis in different locations - right on-site with an optional NeuLog battery-powered display monitor, and/or in a remote lab on a standard PC. Field data collected on NeuLog sensors can be saved, brought back to class and uploaded to a central PC through either a wire or wireless (RF) signal.

Not only that, but the NeuLog Software can handle incoming data from any number of sensors simultaneously - creating a data picture from the experimental efforts of an entire class or school.

The educational potential is limitless.

NeuLog in the Service of Pedagogy

NEULOG Capacity Provides an Enhanced Educational Experience

Besides hassle-free operation, the NeuLog technology also features multi-modular linkage capacity, enabling simultaneous data acquisition from the focus of the experiment.

Imagine an experiment that can be tracked in terms of temperature, air pressure, voltage, sound, humidity, light, oxygen and more - all recorded in real-time.

Thanks to NeuLog, a new world of experiential learning opens up, capturing student attention and promoting enthusiasm for the sciences.

NEULOG Analysis Harnesses New Tools for Guidance and Evaluation

The powerful NeuLog software, which interfaces with all popular PC platforms, translates the raw data into graphs, value tables, text and even video clips. NeuLog algorithms can handle data input from an unlimited number of NeuLog sensors.

If desired, NeuLog can organize similar input into one composite picture for advanced educational analysis, giving instructors a birds-eye view of class performance and comprehension of the material.

Instructors, class monitors and evaluators can use NeuLog to track unlimited numbers of student experiments, assessing the success of a course and identifying needs for improvement.

SES NeuLog Data Sensors / Loggers: Wizardry at Work

The NeuLog sensors operate with equal efficiency either in the school lab or out in the field. Powered by a USB or a battery pack, research can be conducted without the hindrance of wires or cables.

The activity of each NeuLog sensor is programmed from a central PC or from the portable NeuLog Monitor Unit. These access the NeuLog Software to configure the parameters for data acquisition, processing, memory and transmission in each NeuLog sensor, independently or synchronized together in a "sensor chain".

When NeuLog sensors are chained together, they work from the same power source, but each sensor performs its task and logs its data based on its own custom configurations. They are not affected by the order of their attachment, or interrupted by the addition and removal of other sensors.

At any time, the programming of an individual sensor can be updated from the central PC, and those with variable measuring ranges can be changed digitally. Calibration is equally simple, in some cases performed digitally without the need for a potentiometer.

In the interest of promoting education worldwide, all NeuLog sensors are available in one competitively priced package.

SES NeuLog Data Sensors / Loggers: Technical Features

- Operation can be mastered even by grade-school children.
- Each sensor is instantly recognized by NeuLog software.
- All sensors can be configured independently or together in a "sensor chain".
- Up to 50 sensors can be chained to one power source - in any combination and order.
- Adding or removing sensors from a chain is easy and unrestricted.
- Performance is reliable, indoors or outside, in all kinds of weather.

Sensor parameters that can be customized with NeuLog Software:

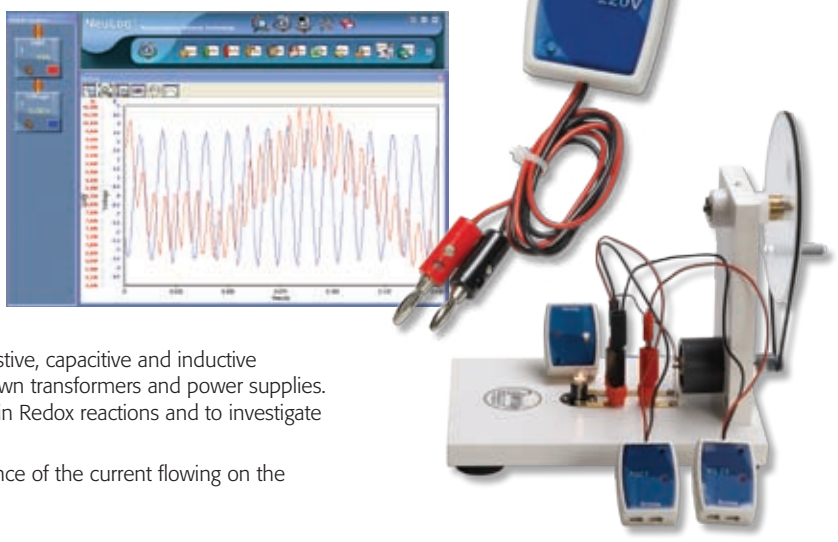
- Data acquisition activation / deactivation
- Data measurement ranges
- Processing speed
- Digital signal range
- Sample rate over time (20/Hr to 20,000/sec)
- Sample duration (25 msec to 31 days)
- Memory retention (up to 64,000 bytes per sensor, and for a chain of 10 sensors up to 640,000 bytes)
- Data transmission to PC
- Data sharing with other NeuLog sensors

The SES NeuLog Product Line

NeuLog SENSORS are the most comprehensive line of programmable sensors in the world, and the only sensors that independently log and store incoming data.

NUL-101
Voltage Logger Sensor

- Shows DC levels
- Operates in two modes (fast/slow)
- Range +/- 20 V
- ADC Resolution 10 bit
- Accuracy +/- 1%
- Resolution 0.02V
- Sample Rate 100 (slow) to 3000 (fast)
- Duration 50 msec to 31 days

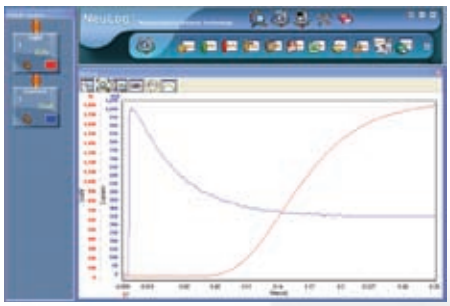


Applications: Voltages can be measured across various resistive, capacitive and inductive components, as well as in photovoltaic cells, batteries, step-down transformers and power supplies. This sensor can also be used to measure electrode potentials in Redox reactions and to investigate the charging and discharging of capacitors.

When used with the Current Sensor (NUL-102), the dependence of the current flowing on the applied voltage can be studied in various electric circuits.

NUL-102
Electric Current Logger Sensor

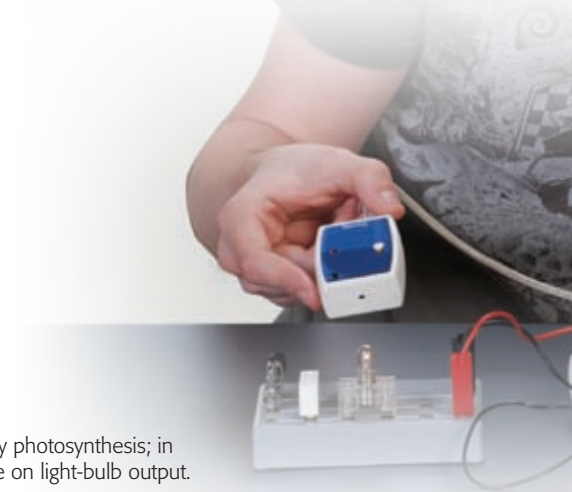
- Shows DC levels
- Operates in two modes (fast/slow)
- Range +/- 2.5 A
- ADC Resolution 10 bit
- Accuracy +/- 1%
- Resolution 0.003A
- Sample Rate 100 (slow) to 3000 (fast)
- Duration 50 msec to 31 days



Applications: This sensor can be used to measure the current in parallel or series low voltage AC and DC circuits, and investigate the dependence of the current flow through components on the voltage across them. With its 4mm plugs it can easily be connected into electric circuits.

NUL-104
Light Logger Sensor

- Construction: plastic case with detection window port
- Measures average light levels in slow mode
- Displays light waves in fast mode
- Illumination Range 0 to 1000 Lx, 0 to 6000 Lx, 0 to 150,000 Lx
- Signal Range 0 to 1000 Lx, 0 to 6000 Lx, 0 to 150,000 Lx
- ADC Resolution 12 bit
- Resolution 1 Lx, 6 Lx, 150 Lx
- Sample Rate 100/sec max (illumination), 3000/sec max (signals)
- Duration 50 msec to 31 days



Applications: This sensor is very versatile for the natural sciences. In Biology, it can be used to study photosynthesis; in Chemistry, to study light-emitting chemical reactions; in Physics, to study the effect of changing voltage on light-bulb output.

With three ranges, it can be used to measure Illumination in low-light environments such as a classroom, or high-light environments like outdoor daylight. Fast and slow modes can measure fast light changes, such as those produced by light bulbs connected to an AC supply, as well as the near-steady levels outside on a sunny day.

NUL-103
Temperature Logger Sensor

- Construction: stainless steel tube (180mm long, 3.2mm diameter)
- Measures Centigrade and Fahrenheit
- Range -25°C to 110°C (-13°F to 230°F)
- ADC Resolution 12 bit
- Accuracy +/- 1°C (+/- 2°F)
- Resolution 0.1°C (0.1°F)
- Sample Rate 100/sec max
- Duration 1 second to 31 days

Applications: This is one of the most versatile sensors, able to measure solids, liquids and gases. It can be used in Biology to monitor ecological systems, to study photosynthesis or to study the effect of temperature on enzymes; in Chemistry, to study exothermic or endothermic reactions, and in Physics, to study heat/energy transfer.

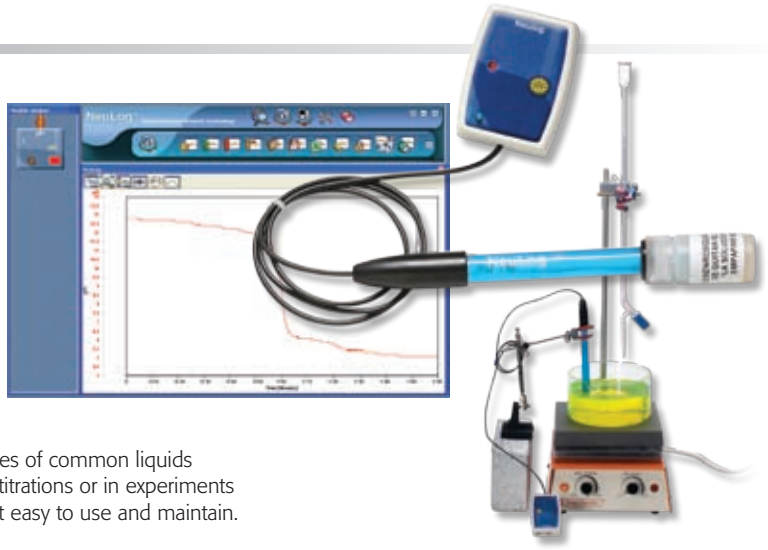
NUL-105
Oxygen Logger Sensor

- Construction: electrode polarographic (Clark Type) design with silver anode/gold cathode/anode system, Delrin body and PTFE membrane (150mm long, 12mm diameter); stainless steel thermistor case; two membrane cap assemblies
- Auto calibration (20.9% at sea level) at the press of a button
- Detects levels in gas or liquid solution
- Range 0 to 25% in air, 0 to 100% dissolved, 0 to 12.5 mg/L dissolved
- Range/Output 0-20 ppm dissolved (0-200% saturation), output 0-40mA / 0-400mA
- ADC Resolution 10 bit
- Resolution 0.02% (in air)
- Sample Rate 100/sec max
- Response Time 98% of full response in 60 seconds at 25°C
- Duration 1 second to 31 days

Applications: This sensor can be used to make measurements of the level of free oxygen in air or dissolved oxygen in water. It employs easy-to-use polarographic (Clark) technology and replaceable membranes. Its integral thermistor provides dependable temperature-compensated measurements and fast readings.

The free-oxygen-in-air mode measures changes in oxygen levels during combustion or in reactions that produce oxygen (such as hydrogen peroxide decomposition). The dissolved-oxygen mode is useful in the study of photosynthesis. Modes are changed by Neulog Software (PC) or via the Monitor Display Unit, and calibration can be performed digitally via Neulog Software if desired.

NUL-106
pH Logger Sensor



- Construction: epoxy body (150mm long, 12mm diameter), round glass bulb ASG VIII pH, sealed gel-filled single-junction reference with fiber frit, Ag/AgCl wire, ATC
- Auto calibration (pH 7) at the press of a button in standard buffer solution
- Range/Output 0 to 14pH, mV output with isopotential point at 0+/-20mv at pH 7
- ADC Resolution 16 bit
- Resolution 0.02
- Sample Rate 100/sec max
- Response Time 98% of full response in 30 seconds at 25°C
- Duration 1 second to 31 days

Applications: This sensor can be used to measure the static pH values of common liquids (water, milk, soft drinks, vinegar, etc.) as well as the changing values in titrations or in experiments on the effect of antacids. Its sealed reference system and gel fill make it easy to use and maintain. Sensor can be calibrated digitally by Neulog Software if desired.

NUL-107
Humidity Logger Sensor

- Construction: plastic case with detection vent
- Range 0 to 95% RH
- ADC Resolution 16 bit digital
- Accuracy +/- 5%
- Resolution 1%
- Sample Rate 100/sec max
- Duration 1 second to 31 days

Applications: Measuring Relative Humidity, this sensor can record the variation in weather conditions, and the biological effect on organisms such as seedlings and insects.

NUL-108
Heart Rate Logger Sensor

- Construction: plethysmograph-based electrode, infrared LED transmitter, matched infrared phototransistor receiver
- Attaches to finger or earlobe
- Tracks both heartbeats and pulse rate
- Displays pulse waves and BPM (beats per minute)
- Range 30 to 240 BPM, 0-1024 analog values
- ADC Resolution 10 bit
- Accuracy +/- 1 analog value
- Resolution 2 BPM, 1 analog value
- Sample Rate 100 BPM/sec max, 10,000 analog values/sec max

Applications: This sensor can be used to monitor and compare pulse rates under various exercise and rest conditions. Users can choose to see the pulse wave showing changes of blood volume/flow in the finger or earlobe with time (and calculate the pulse), or get the value of the pulse rate directly via the software.

NUL-109
Light Gate Logger Sensor

- Construction: strong plastic frame with infrared light emitting diode (LED) on one side and infrared-sensitive phototransistor on the other side
- Provides four operational modes
- Operation Ranges: Single timing-card with one photogate, Double timing-card with one photogate, Single timing-card with two photogates, Digital status one photogate
- ADC Resolution 16 bit digital
- Accuracy +/- 100 µS
- Resolution 100 µS
- Sample Rate 10,000/sec max
- Voltage output near 5V (status 1) to near 0V (status 0)

Applications: This sensor can be used to study various kinds of motion. Time, velocity or acceleration can be measured with one or two photogates and associated timing-cards, as well as showing pictorially the status (digital 1 or 0) of the voltage output of the photogate as timing cards pass through it. Operational mode is switched by one click.

Digital meter mode allows individual measurements to be displayed together with their units and average values.
Time & Velocity mode and Acceleration mode can log repeated passes and their values, together with an average value.
Acceleration mode offers a multi-gate option, for tracking passage through two photogates in succession.
Status graph mode produces a graph of Digital Status (1 for interrupted beam, or 0 for uninterrupted beam) against Time.

NUL-110
Pressure Logger Sensor

- Construction: housed in plastic case, attached to small stainless steel tube
- Multi-scale capacity
- Range 0 to 7 atm, 1 to 100 PSI, 0 to 700 kPa, 0 to 7 Bar
- ADC Resolution 10 bit
- Accuracy +/-1% at 20-30°C
- Resolution 0.005 atm, 0.07 PSI, 0.5 kPa, 0.005 bar
- Sample Rate 100/sec max
- Duration 1 second to 31 days

Applications: This sensor can be used to monitor chemical reactions that involve gases, and to investigate both Boyle's Law and the Pressure Law for ideal gases. It can also prove useful in studies of weather phenomena. Sensor is designed for connection to pressure sources as well, such as a syringe.

NUL-111
Force Logger Sensor

- Auto calibration (0) at the press of a button
- Range +/- 10 N or +/- 50 N
- ADC Resolution 10 bit
- Resolution 0.08 N
- Sample Rate 3000/sec max
- Duration 50msec to 31 days

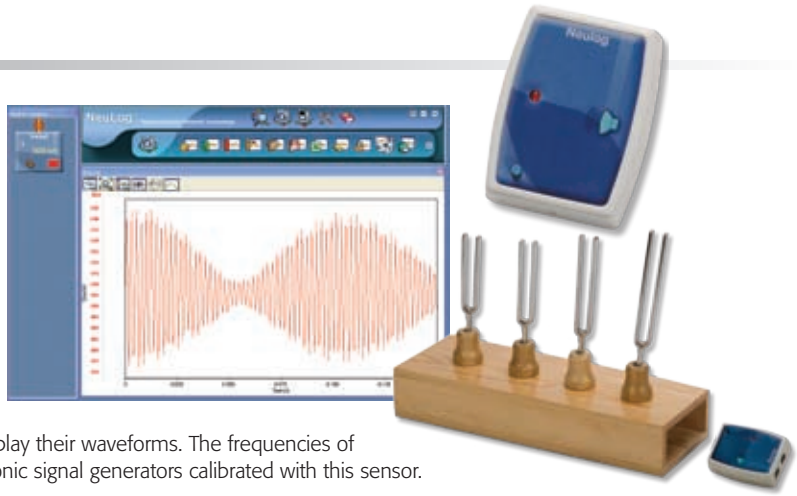
Applications: This sensor can measure the mass-to-weight relationship and study how different pulley systems affect the effort needed to lift weights. It can also be used to measure push/pull forces and impacts. Calibration can be performed via Neulog Software if desired.

The force sensor is contained in a metal box with a hook at the bottom that can be connected to various pulling loads. A simple bumper (for push/impact measurements) can be made and attached using a bolt placed through a length of plastic tubing.

The sensor can be hung from a universal laboratory stand via a rod through the hole in its box. It can be operated facing upward, downward, horizontal and any intermediate position.

NUL-112
Sound Logger Sensor

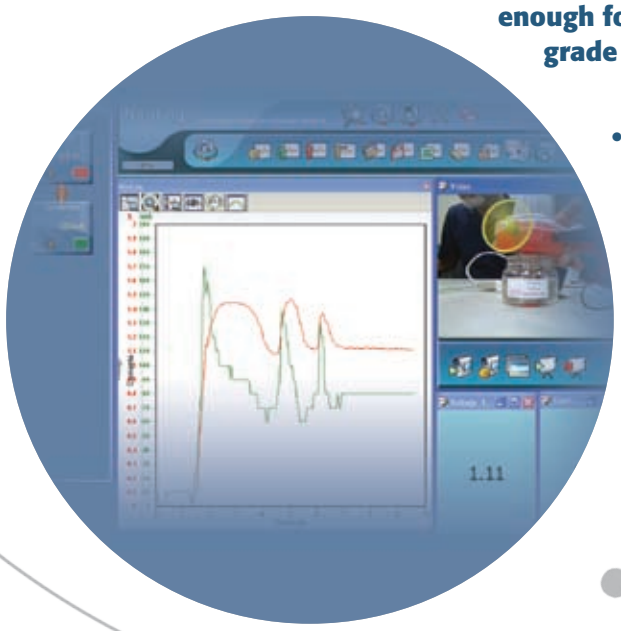
- Construction: plastic case with sound detection port
- Measures sound levels in slow mode
- Displays sound waves in fast mode
- Range 40 to 100 dB (levels), 0-1024 (signals)
- ADC Resolution 10 bit
- Accuracy +/-2 dB, +/-1 signal
- Resolution 0.1 dB, 1 signal
- Sample Rate 100/sec max (levels), 10,000/sec max (signals)
- Duration 25msec to 31 days



Applications: This sensor has two modes of operation: slow mode can measure sound-pressure level in decibels, fast mode can compare different sources of sound and display their waveforms. The frequencies of tuning forks and wind-chimes can be determined, and simple electronic signal generators calibrated with this sensor.

With two sound sensors, the velocity of sound propagation in various media can be determined by timing a pulse travelling between them.

NeuLog SOFTWARE provides data analysis that is sophisticated enough for university research, yet flexible enough to adapt to grade school levels.



- Simple installation and operation
- Functions in on-line and off-line modes
- Recognizes all sensors as soon as they are activated
- Controls digital range of each sensor
- Configures sensor data collection, logging, memory and sharing
- Coordinates unlimited numbers of sensors and incoming data
- Displays & analyzes data in graphs and tables
- Features video recording and playback
- Enables file searching and correlation
- Exports data in popular file formats

NeuLog ACCESSORIES increase the mobility and range of the Sensor/Logger line, enabling new areas and levels of experimentation.

USB Module:
Connects NeuLog sensors as individuals or chains to PC for upload/download and/or as a power source. Operates with Windows 98(SE), XP and Vista. Equipped with a USB cable on one side and two Neulog sockets on the other side.

RF Communication Module:
Allows remote operation of a single sensor or a chain of sensors. Connects to Battery Module for direct power, or to a PC via the USB Bridge module. Wireless capacity is self-contained; no need for either Bluetooth™ or Wi-fi™ capacity. Can be used with a second RF Communication module to operate remotely with the Monitor Display Unit, as well as with other RF units to connect more chains of sensors.

- Technical Specs:
- Frequency: 2.4GHz DSSS (Direct-sequence spread spectrum)
- Bit Rate: 1Mbps
- Maximum distance of use in open space: 30m

Mobile Monitor Unit:
Durable LCD display screen and keyboard for sensor control in locations beyond PC range. Sensors are connected to the MDU via its USB socket. Remote connection is also possible by plugging one RF Communication module into MDU, and another into the sensor or sensor chain.
Mobile Monitor Features:

- Automatic recognition of sensors.
- Power supply for sensors.
- Uses preset experiment parameters for easy initiation.
- Communicates with sensors individually or collectively.
- Controls each sensor's range and measurement units.
- Mode for viewing sensor values in real time – up to two at a time.
- Can freeze readings to view values at a specific time.
- Works with internal rechargeable batteries (2 NiMH AA cells 2300mAH).
- Internal charging circuit for plug-in recharge, with LED indicator and battery status check.
- Automatic Power-Off for longer battery life.

Battery Module: Powers the Monitor, Sensor and/or Sensor Chain for extended periods, with or without RF Communication modules. Uses 4 AA batteries with battery auto-test button.

Quick Facts about SES

- Established 1983.
- Makers of creative training systems for the vocational and high-tech fields.
- Offers flexible modular curricula that have been successfully integrated into existing school programs.
- Hands-on methods are adapted to cultures around the world, with or without computers or lab support.
- Serves the educational market, from grade school through university levels, including open universities, self-study programs and the military.
- Educational quality recognized by government ministries and international industries.
- Installations in Asia, Europe, the Middle East, North America and Latin America.
- All SES products certified ISO-9001.

Fields Represented in SES Training Programs

- Sciences (theory and experiments)
- Technology Preparation (to close learning gaps)
- Technological Skills
- Electricity & Electronics
- Microprocessors & Micro-controllers
- Telecommunication
- Mechatronics & Robotics
- Automation & Process Control
- Refrigeration & Air Conditioning
- Automotive Technology

Other Products and Services Provided by SES

- Turnkey (off the shelf) modular training programs, complete with instructor software and user manuals
- Built-in test equipment
- Vocational training plans for school districts, cities and regions
- Custom curriculum design, from needs definition through instructor training
- Installation of educational equipment on site
- Integration of PC networks and multiple workstations for SES courses
- Follow-up support and troubleshooting

Scientific Educational Systems

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