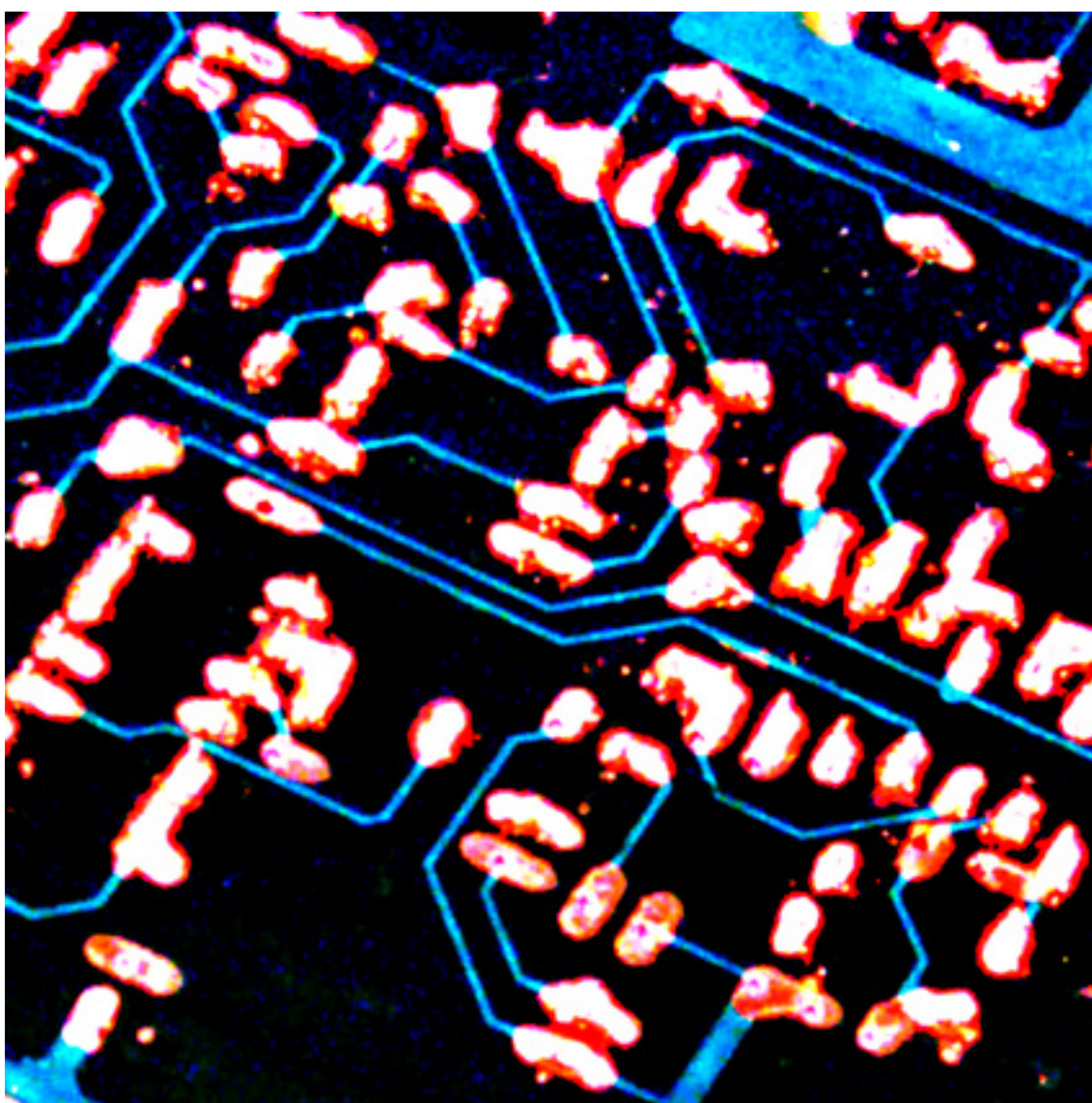


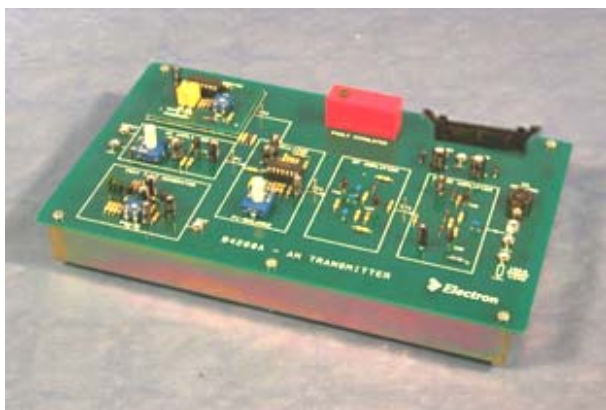
*Electron* S.R.L.

Design  
Production &  
Trading of  
Educational  
Equipment

B42 SERIES - ADVANCED ANALOG COMMUNICATIONS  
(BOARD VERSION)



## B4200A – AM/DSB TRANSMITTER



### General:

This board consists of complete transmitter capable to work on Amplitude Modulation with carrier and with Suppressed Carrier Dual-Side Band modulation (DSB).

The transmitter operates in the frequency range 550 to 1600 kHz (Mid-wave-band) and can therefore inter-work with the B4210A receiver.

### Features:

- On-board test tone generator to be used as a reference source of modulating signal.
- Balanced modulator, AM/DSB (Amplitude Modulation with Dual Side Bands). This modulator is provided with a front-accessible knob allowing the balance to be manually adjusted, so that the transmitter can be made to operate as a standard AM transmitter with carrier or AM/DSB transmitter with partially or totally suppressed carrier.
- Knob-adjustable transmission frequency in the 550-1600 kHz band.
- Limited output power to reduce the risk of disturbance to the Public Broadcasting service. This limit is approx. 100mW.
- On-board dummy load, of the resistive type, to be connected in the place of the antenna any time radiation is to be avoided.
- Fault simulation by 8 microswitches concealed under a cover accessible to the instructor.

In addition to this manual fault simulating system the trainer is fully compatible with the B1180-WS Laboratory Student Workstation.

The B1180-WS provides a PC based fault simulation system, virtual instrumentation (optional) and all the power supplies required for the trainer. A dedicated system CD is supplied containing the software for fault simulation and trainer documentation.

In cases where the advanced features of the B1180-WS are not required, a simple power supply delivering +15/-15V stabilized should be provided. Use of the B4192 power supply is recommended.

The B4200A trainer is recommended for use with its companion B4210A, AM/DSB receiver, although it can inter-work with any standard AM receiver.

### Study topics :

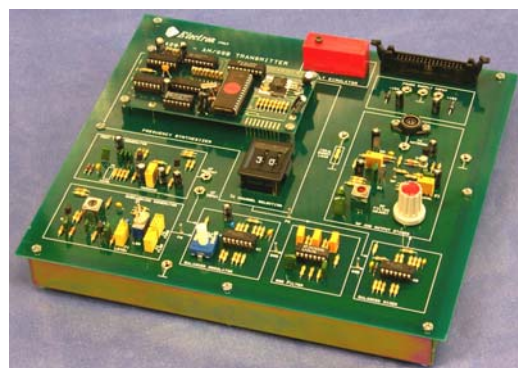
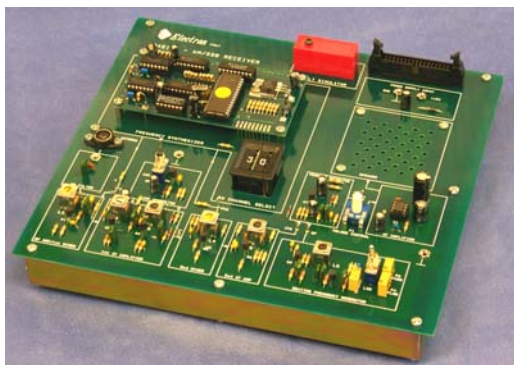
- System architecture, structure and operation of AM transmitters
- Analysis of AM waveform and sidebands
- Modulation index
- Modulation linearity
- Power
- Output impedance of the RF stage
- Troubleshooting

The trainer is available in two versions. One is the Board version with the components in view, shown in the picture. The other version is the Panel one, where the circuits are enclosed in a sturdy aluminum cabinet (340 x 260 x 40mm size).

Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Panel series for further details.

**Ordering code:** B4200A-B (Board type)

## B4200B – AM/SSB TRANSMITTER B4210B – AM/SSB RECEIVER



### General:

The two modules are designed to be used jointly to implement a complete transmission/reception system capable to work on Amplitude Modulation with Single Side Band.

The trainer is recommended for use in both basic level and advanced courses in telecommunications.

### Features:

The operation is programmable by appropriately interconnecting the circuit sub-modules provided on the panels, which are:

For the transmitter:

- Modulating amplifier with input level control
- Subcarrier generator
- Carrier frequency synthesizer
- SSB generator (balanced modulator and filter)
- Converter, RF and power stages
- On-board test tone oscillator

For the receiver:

- RF input amplifier, with super-heterodyne local oscillator/converter
- IF amplifier with automatic gain control
- SSB detector demodulating Frequency oscillator
- Audio amplifier and on-board loudspeaker

Both trainers include fault simulation by 8 microswitches concealed under a cover accessible to the instructor. Fault simulation under PC control is possible

In addition to this manual fault simulating system the trainer is fully compatible with the B1180-WS Laboratory Student Workstation. The B1180-WS provides a PC based fault simulation system, virtual instrumentation (optional) and all the power supplies required for the trainer.

A dedicated system CD is supplied containing the software for fault simulation and trainer documentation.

In cases where the advanced features of the B1180-WS are not required, a simple power supply delivering +15/-15V stabilized should be provided. Use of the B4192 power supply is recommended.

The system operates in the midwave band (550 to 1600 kHz).

The transmitter output power is limited to less than 200mW, to prevent interferences with other services (Broadcasting).

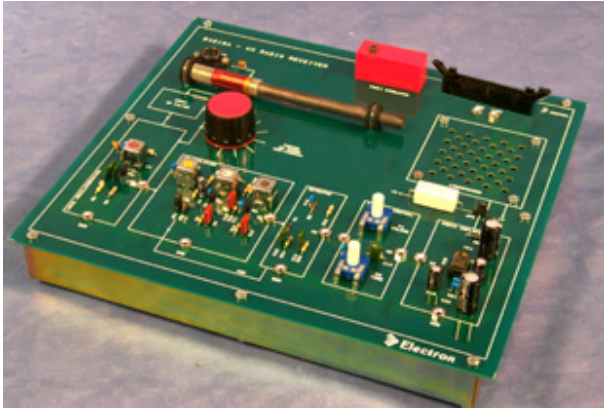
### Study topics:

- Operation of AM/SSB transmitters and receivers
- Functional study of each stage
- Experimenting and measuring the performance of each stage
- Calibration and tuning-up procedures on transmitters and receivers
- Measurements of system-level quality parameters
- Trouble-shooting techniques

### Ordering codes:

- B4200B-B (Board type)
- B4210B-B (Board type)

## B4210A – AM RADIO RECEIVER



### General:

This board consists of an AM receiver of modern design, operating in the Midwave band (550 to 1600kHz).

It can be used as a stand-alone trainer or in conjunction with the B4200A - AM/DSB TRANSMITTER, to make up a complete didactic transmission/reception system.

Fault simulation by 8 microswitches concealed under a cover accessible to the instructor.

In addition to this manual fault simulating system the trainer is fully compatible with the B1180-WS Laboratory Student Workstation. The B1180-WS provides a PC based fault simulation system, virtual instrumentation (optional) and all the power supplies required for the trainer.

A dedicated system CD is supplied containing the software for fault simulation and trainer documentation.

In cases where the advanced features of the B1180-WS are not required, a simple power supply delivering +15/-15V stabilized should be provided. Use of the B4192 power supply is recommended.

The board is recommended for use in telecommunications courses at all levels, including vocational courses.

### Features:

- Receiver front end with loopstick antenna
- Combined RF amplifier, local oscillator, mixer (Autodyne converter)
- IF amplifier with automatic gain control and AM detector
- Audio amplifier
- Loudspeaker

### Study topics:

- Study of the receiver's front-end
- Multi-stage selective amplifier (IF amplifier)
- Audio amplifier IC
- Alignment and calibration procedures
- Measurements on all stages and on the whole system
- Troubleshooting techniques

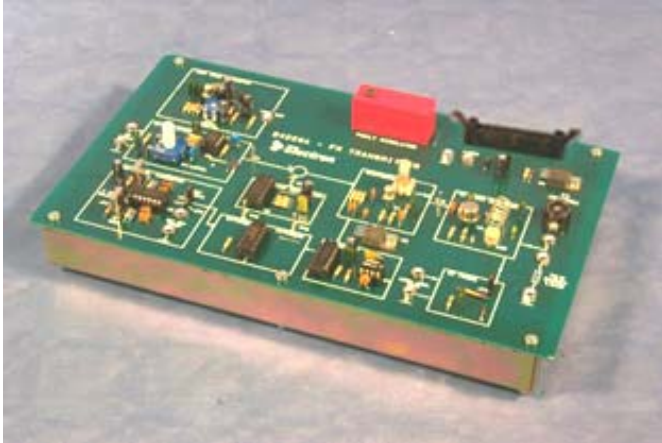
The trainer is available in two versions. One is the Board version with the components in view, shown in the picture. The other version is the Panel one, where the circuits are enclosed in a sturdy aluminum cabinet (340 x 260 x 40mm size).

Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Panel series for further details.

### Ordering code:

B4210A-B (Board type)

## B4220A – FM TRANSMITTER



### General:

This trainer consists of a transmitter, operating in the 88-108MHz band, on a jumper-selectable frequency. The trainer can be used to demonstrate phase and frequency modulation as well as the principle of modern FM transmitters.

Although the board can inter-work with any FM receiver, its use with the B4220B FM receiver is recommended, to implement a complete educational FM transmitter-receiver system.

The architecture of the transmitter is centered around a PLL system operating at VHF frequency whose reference is generated on-board by means of a crystal oscillator and dividers.

The VCO frequency can be modulated, to produce the FM wave to be sent to the driver and power stages.

Use of board is recommended in telecommunications courses at both basic and advanced levels.

### Features:

- Audio amplifier
- Varicap modulator, acting as a VCO in a phase locked-loop carrier generator
- Prescaler and jumper-programmable divider to determine the carrier frequency
- Crystal-controlled reference oscillator for the PLL
- RF output amplifier
- Fault simulation by 8 microswitches concealed under a cover accessible to

the instructor.

In addition to this manual fault simulating system the trainer is fully compatible with the B1180-WS Laboratory Student Workstation.

The B1180-WS provides a PC based fault simulation system, virtual instrumentation (optional) and all the power supplies required for the trainer. A dedicated system CD is supplied containing the software for fault simulation and trainer documentation.

In cases where the advanced features of the B1180-WS are not required, a simple power supply delivering +15/-15V stabilized should be provided. Use of the B4192 power supply is recommended.

The output power of the transmitter is limited to less than 150mW to avoid disturbance to Commercial Broadcasting.

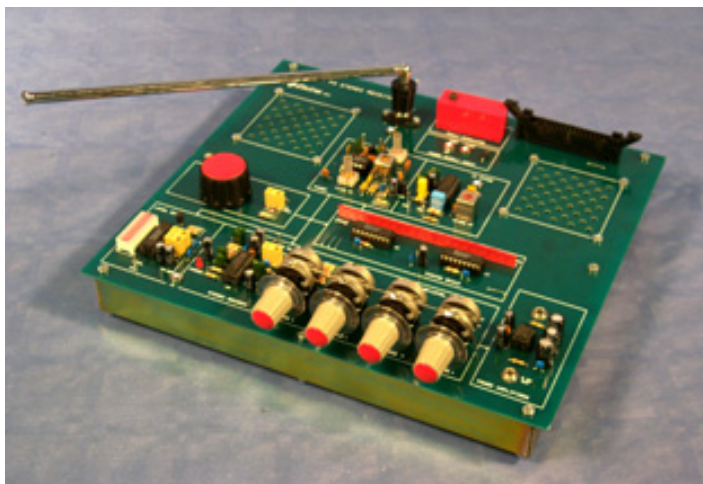
The trainer is available in two versions. One is the Board version with the components in view, shown in the picture. The other version is the Panel one, where the circuits are enclosed in a sturdy aluminum cabinet (340 x 260 x 40mm size).

Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Panel series for further details.

### Ordering code:

B4220A-B (Board type)

## B4220B – FM RADIO RECEIVER



### General:

This board consists of an FM receiver operating in the standard FM Broadcasting band (88-108MHz). The receiver can also work with the B4220A transmitter to demonstrate the operation of FM systems.

The board can be used in telecommunications courses at basic and advanced levels, as well as in vocational courses.

### Features:

- RF amplifier/local oscillator/mixer, built around an advanced-feature IC
- Varicap tuning and AFC control
- IF pre-amplifier with piezo-ceramic filter
- IF amplifier/AGC control/FM detector
- Stereo decoder with de-emphasis circuits and pilot carrier LED indicator
- Dual audio amplifier with tone and volume controls
- On-board small-size loudspeakers and facilities to connect external audio boxes
- Fault simulation by 8 microswitches concealed under a cover accessible to the instructor.

In addition to this manual fault simulating system the trainer is fully compatible with the B1180-WS Laboratory Student Workstation.

The B1180-WS provides a PC based fault simulation system, virtual instrumentation (optional) and all the power supplies required for the trainer. A dedicated system CD is supplied containing the software for fault simulation and trainer documentation.

In cases where the advanced features of the B1180-WS are not required, a simple power supply delivering +15/-15V stabilized should be provided. Use of the B4192 power supply is recommended.

### Study topics:

- Study of FM Super-heterodyne receiver operation
- Measurements and calibration of each section of the receiver
- Troubleshooting techniques

The trainer is available in two versions. One is the Board version with the components in view, shown in the picture. The other version is the Panel one, where the circuits are enclosed in a sturdy aluminum cabinet (340 x 260 x 40mm size).

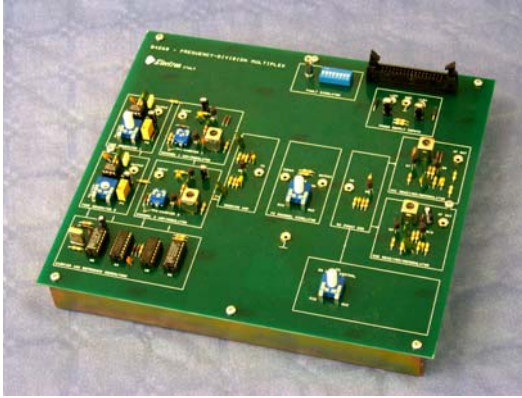
Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Panel series for further details.

### Ordering code:

B4220B-B (Board type)



## B4260 – FREQUENCY-DIVISION MULTIPLEX TRAINER



### General:

This trainer consists of a sample FDM system of two channels. The system is structured as simply as possible, to allow the student to focus on the essential aspects of FDM and clearly understand the principles.

### Features:

- A Quartz-controlled Master Oscillator: Use of a quartz-controlled oscillator is made in order to ensure the adequate precision of two modulating carriers that are derived from the oscillator.
  - Carrier Generators: These are derived from the Master oscillator.
  - Two Modulators that are of the Transistor AM Modulator type.
  - Two Output Filters consisting of tunable transformers which are adjusted to the carrier frequency.
  - A Summing Amplifier: The signal from the two modulator/filter blocks are added up here, to form the composite signal to be transmitted at the TX terminal.
  - A Receiving Amplifier with adjustable gain.
  - A Channel Amplifiers/Filters: The received multiple signal is demultiplexed by this stage.
  - Two Demodulators: These are simple envelope demodulators.
  - Two Output Amplifiers: These perform as buffers for the demodulated channel signals.
  - Two Tone Generators: Two Low-Frequency generators are provided on board to facilitate the execution of the experiments.
- A Transmission Channel Simulator: This block is not normally part of an FDM system, but is rather an auxiliary facility included on the panel to experiment the effects of attenuation on the system operation.
  - A Fault Simulator: The trainer allows the insertion of 8 simulated faults in the system, for the purpose of training the students in troubleshooting techniques. The Instructor can insert the faults by setting one of 8 microswitches concealed by the plastic cover. In addition to this manual fault simulating system the trainer is fully compatible with the B1180-WS Laboratory Student Workstation. The B1180-WS provides a PC based fault simulation system, virtual instrumentation (optional) and all the power supplies required for the trainer. A dedicated system CD is supplied containing the software for fault simulation and trainer documentation.

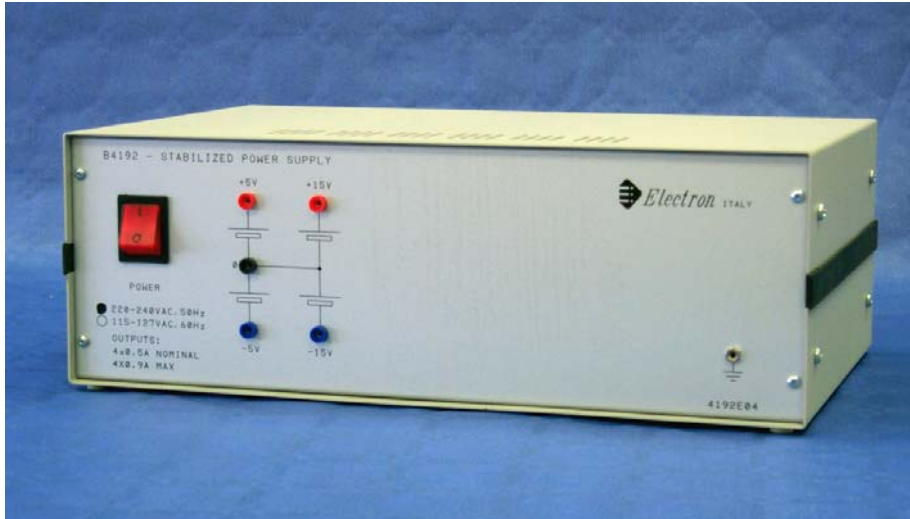
In cases where the advanced features of the B1180-WS are not required, a simple power supply delivering +15/-15V stabilized should be provided. Use of the B4192 power supply is recommended.

The trainer is available in two versions. One is the Board version with the components in view, shown in the picture. The other version is the Panel one, where the circuits are enclosed in a sturdy aluminum cabinet (340 x 260 x 40mm size).

Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Panel series for further details.

**Ordering code:** B4260-B (Board type)

## B4192 – POWER SUPPLY



This power supply is implemented in a desk-top cabinet enclosure, and has the following characteristics:

- Stabilized +5, -5, +15, -15V outputs
- Max nominal current of 500mA on each output
- Max overload current of 900mA on each output
- Overload current limitation: approx. 900mA

- Foldback short-circuit current limiting (approx. 200mA I<sub>cc</sub>)
- Output ripple: better than 50mV RMS

The B4192 operates from the AC mains: 110 to 250V, 50-60Hz (please specify while ordering).

Ordering code:

B4192