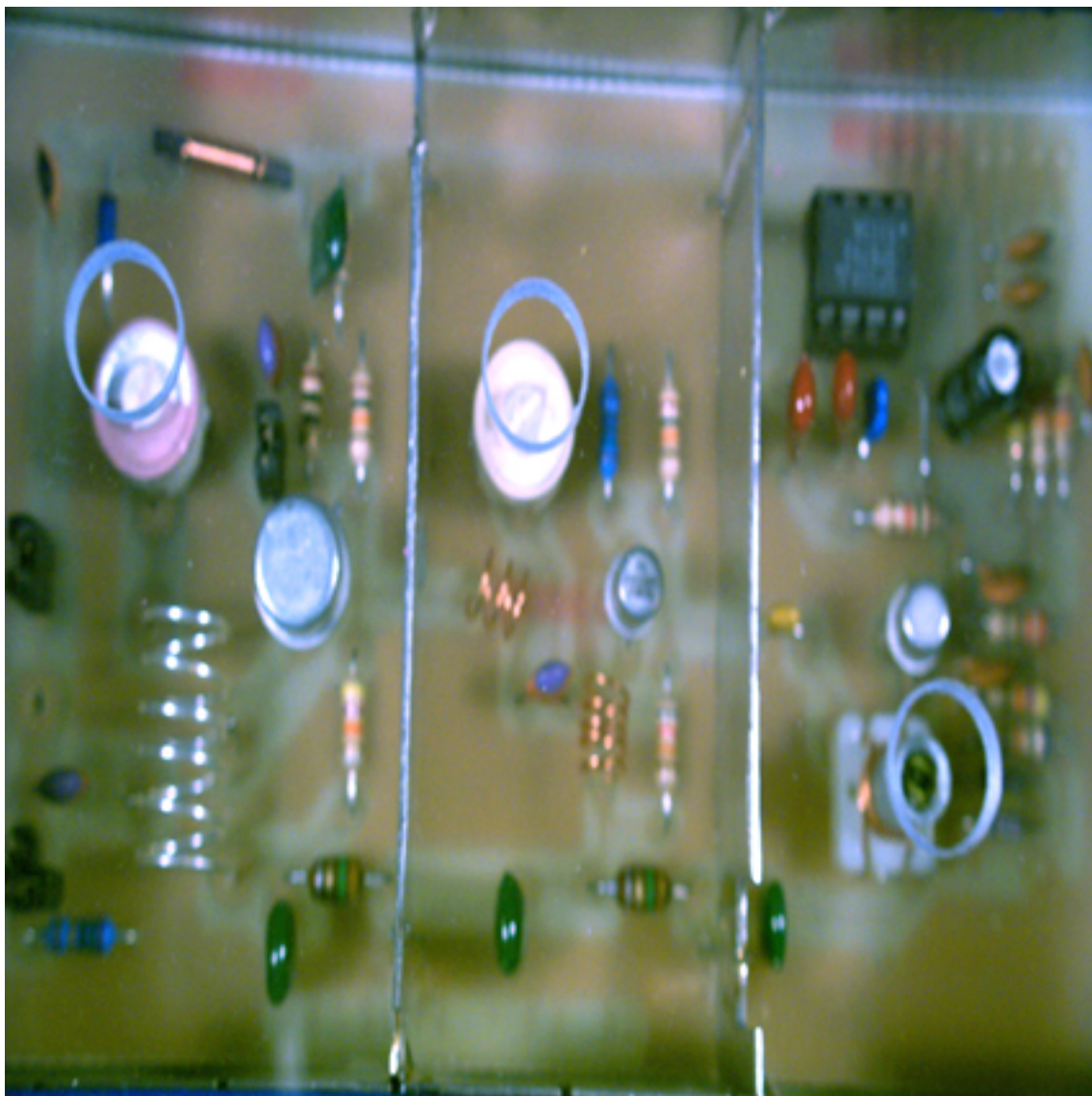


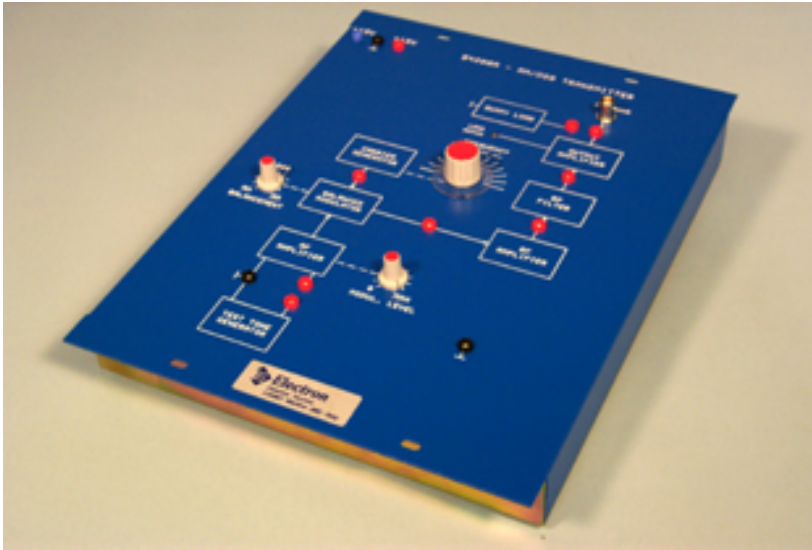
***Electron*** S.R.L.

Design  
Production &  
Trading of  
Educational  
Equipment

**B42 SERIES ADVANCED ANALOG COMMUNICATIONS  
(PANEL VERSION)**



# B4200A – AM/DSB TRANSMITTER



## General:

This panel 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 1600kHz (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 550-1600kHz 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-simulating system for 8 different fault situations. The faults are insertable by the Instructor through concealed

microswitches.

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

Power supply of both the B4200A and B4210A can be made from a stabilized voltage source of +/-15V. The use of the B4192 power supply is recommended.

## Study topics :

- System architecture and structure of AM transmitters
- System operation
- 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 Panel version, shown in the picture, where the circuits are enclosed in a sturdy aluminium cabinet (340x260x40mm size).

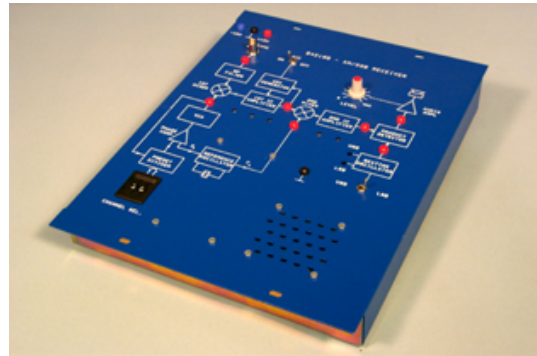
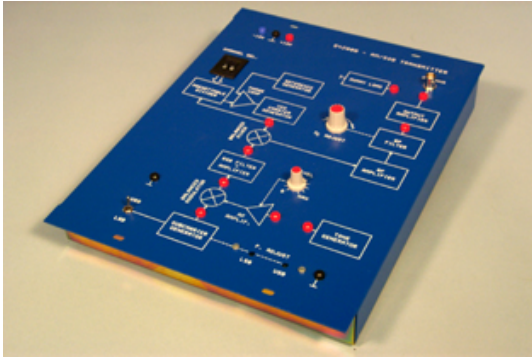
The other version is an open Board one, with components in view.

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

## Ordering code:

B4200A-P (Panel 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

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

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

Transmitter and receiver are power-supplied from stabilized sources at +15V and -15V. The use of the B4192 power supply is recommended.

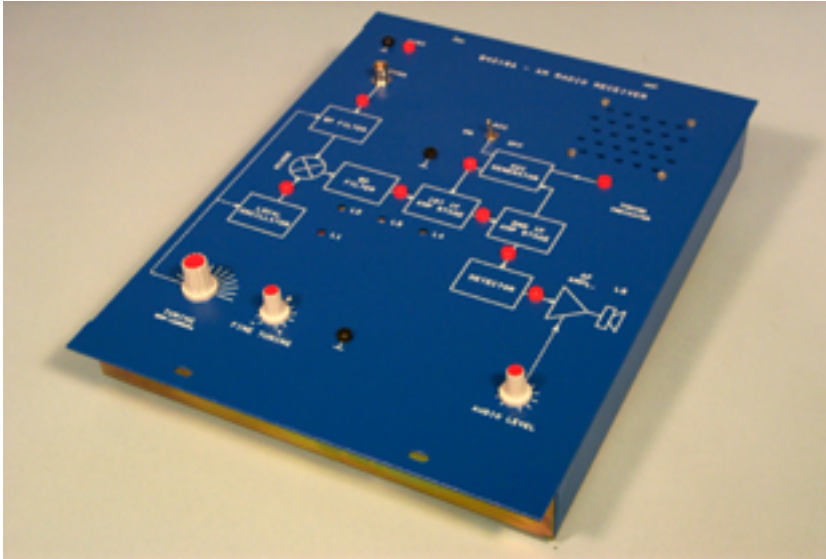
### Study topics:

- 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

### Ordering codes:

- B4200B-P (Panel type)
- B4210B-P (Panel type)

## B4210A – AM RADIO RECEIVER



### General:

This panel 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.

The panel is provided with a microswitch-activated fault simulating system. 8 different fault situations are provided.

The panel 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

The panel requires a power supply of +15, -15V DC. The use of the B4192 power supply is recommended.

### 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

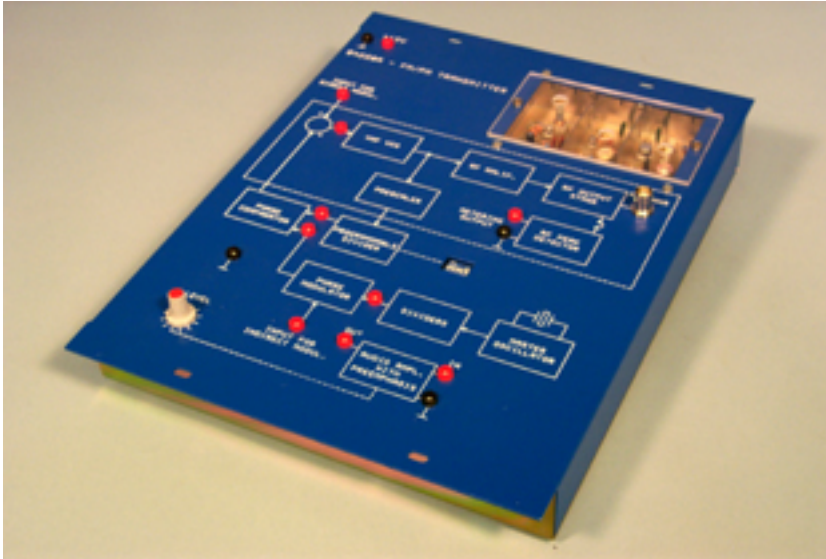
The trainer is available in two versions. One is the Panel version, shown in the picture, where the circuits are enclosed in a sturdy aluminium cabinet (340x260x40mm size). The other version is an open Board one, with components in view.

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

### Ordering code:

B4210A-P (Panel type)

## B4220A – FM TRANSMITTER



### General:

This trainer consists of a transmitter, operating in the 88-108 MHz 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 panel 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 panel 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

The transmitter is to be power-supplied from an external stabilized source at +15V. The 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 Panel version, shown in the picture, where the circuits are enclosed in a sturdy aluminium cabinet (340x260x40mm size).

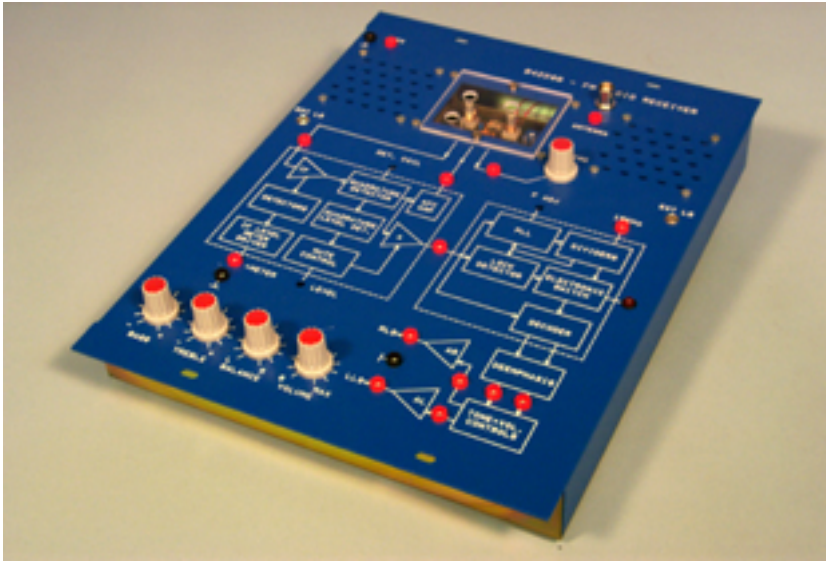
The other version is an open Board one, with components in view.

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

### Ordering code:

B4220A-P (Panel type)

## B4220B – FM RADIO RECEIVER



### General:

This panel 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 panel 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 system, actuated by microswitches concealed by a cover accessible to the instructor only. 8 fault situations are provided

The panel is to be operated by means of a power supply at +15V. The 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

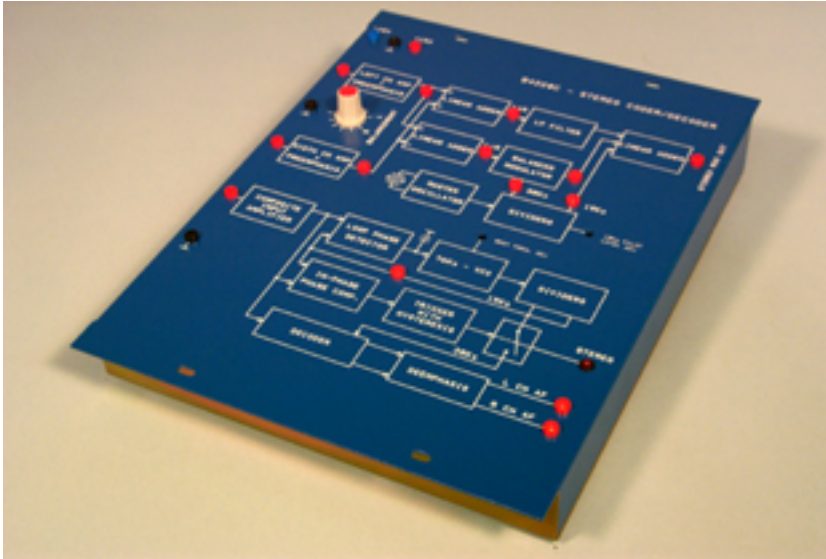
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Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Board series for further details.

### Ordering code:

B4220B-P (Panel type)

## B4220C – STEREO CODING/DECODING TRAINER



### General:

This panel deals with the technique of combining two audio signals into a single stereo multiple signal and vice-versa.

The panel can be regarded as a self standing unit to demonstrate and study stereo coding but also as a complement to the B4220 FM transmitter, thus enabling this last to perform as an FM stereo transmitter.

The trainer is available in two versions. One is the Panel version, shown in the picture, where the circuits are enclosed in a sturdy aluminium cabinet (340x260x40mm size).

The other version is an open Board one, with components in view.

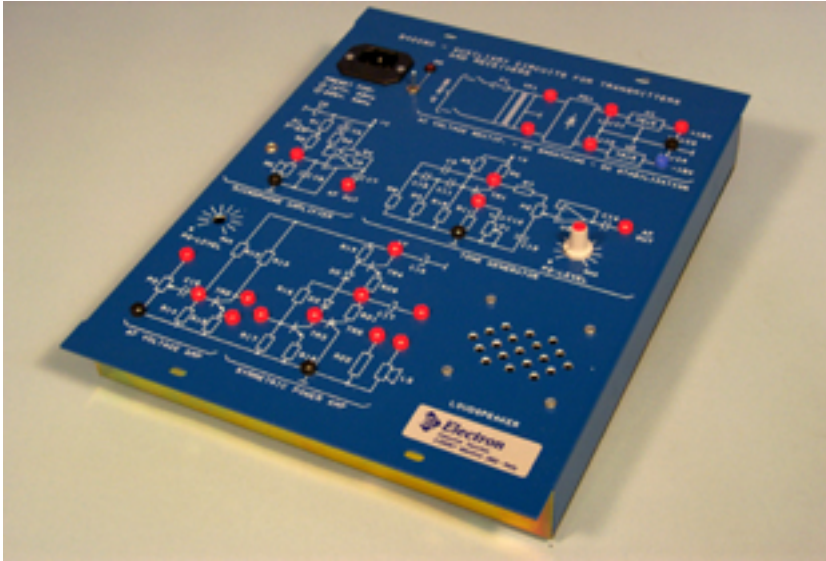
Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Board series for further details.

The panel is to be powered at +15/-15V DC, from a stabilized source. The use of the B4192 power supply is recommended.

### Ordering code:

B4220C-P (Panel type)

## B4220D - AUXILIARY CIRCUITS FOR TRANSMITTERS AND RECEIVERS



### General:

This panel contains auxiliary facilities to be used with the AM and FM transmitters and receivers.

The facilities are substantially optional to make the work easier and/ or to complete the range of study topics allowed.

### Features:

- Power supply model, with transformer, rectifier, smoothing capacitors, IC voltage stabilisers
- Phase-shift sine-wave oscillator, low-frequency, with output voltage follower and adjustable level

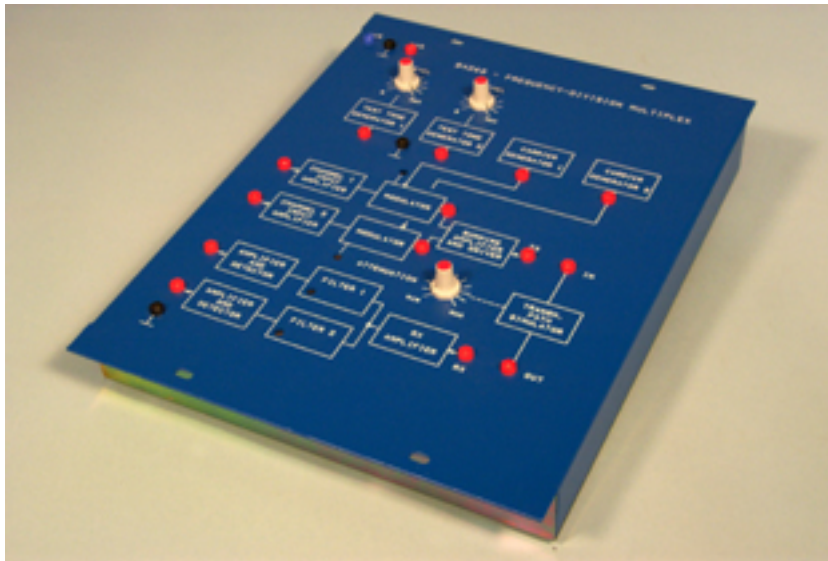
- Microphone amplifier, with ELECTRET-type microphone and Jack cord, 1 m long
- AF Voltage amplifier with transistor
- Symmetric power amplifier stage, with complementary transistors
- On-board loudspeaker and loading resistor for output power measurements

The panel is to be powered at +15/-15V DC, from a stabilized source. The use of the B4192 power supply is recommended.

### Ordering code:

B4220D

## B4260 – FREQUENCY-DIVISION MULTIPLEX PANEL



### General:

This panel presents a simple but complete frequency-division multiplex (FDM) system to show how two voice-frequency signals can be combined to share the same transmission facility and subsequently reconstructed at the receiving end.

The panel includes also the essential auxiliary items to work the experiments easy, such as carrier generators, test tone oscillators etc..

### Features:

- Two signal amplifiers performing as impedance and level adapters
- Two AM modulators to produce the necessary frequency-band translation of the two test signals
- One Adder/transmission amplifier
- One receiving amplifier
- Two channel filters with AM de-modulators
- Two channel amplifiers

- Two carrier generators, derived from an unique precise source
- Two test tone generators

The panel is to be powered at +15/-15V DC, from a stabilized source. The use of the B4192 power supply is recommended.

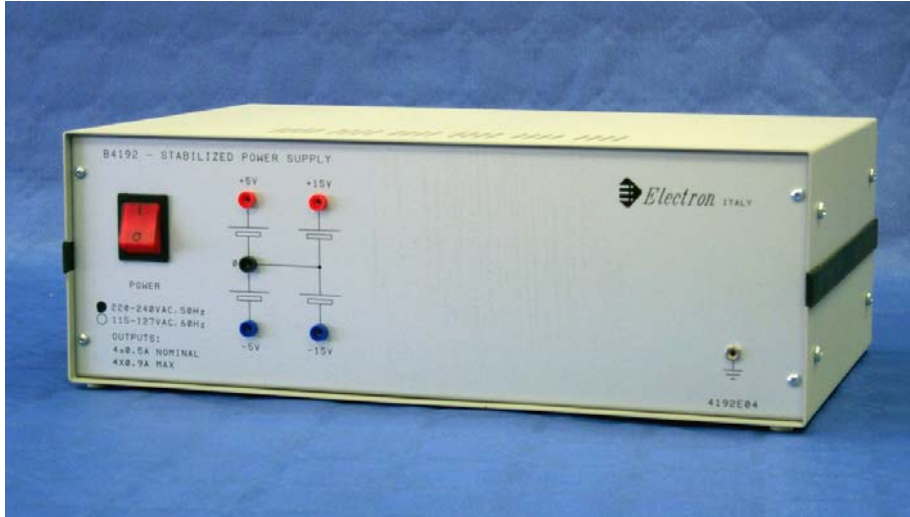
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Both versions have substantially the same technical characteristics and allow the same study topics. Please refer to the Electron catalogue section for the Board series for further details.

### Ordering code:

B4260-P (Panel type)

## B4192 – POWER SUPPLY



This power supply is implemented in a desktop 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

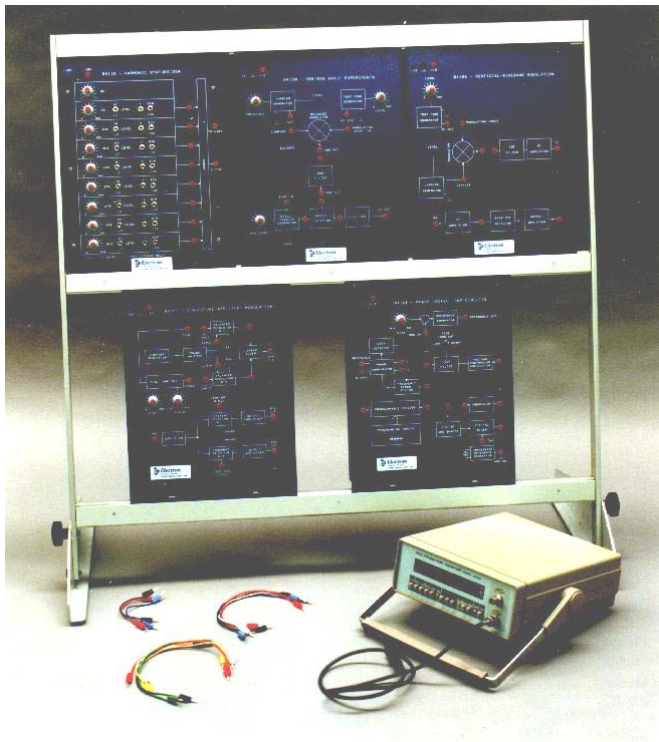
- Foldback short-circuit current limiting (approx. 200mA I<sub>cc</sub>)
- Output ripple: better than 50mV RMS

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

Ordering code:

B4192

## B4195 - FRAMEWORK FOR PANELS



This accessory is suitable to hold up to 6 training panels, in two levels of 3, so that they may be used for class demonstration (vertical position) or student use (inclined position).

Structure and rails are in aluminium profile, specially designed for quick insertion of all the laboratory modules