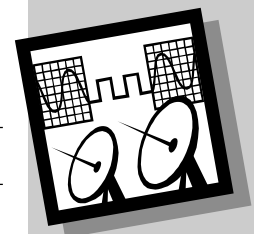
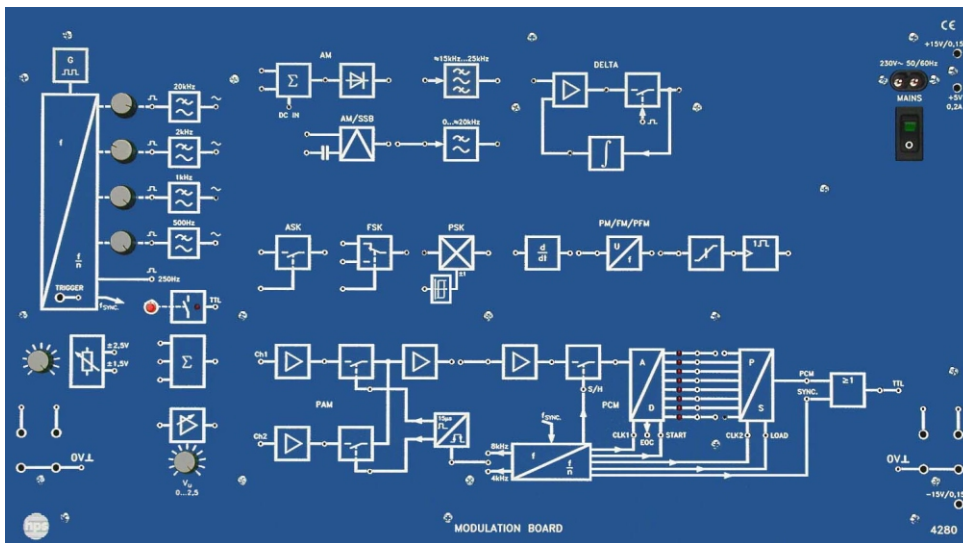


# Communications



## MODULATION BOARD

Type 4280



Front view of the MODULATION BOARD

- All the important modulations on one Board
- Experiment setup time reduced to a minimum
- Built-in signal source (short-circuit-proof)
- Integrated clock generator with synchronised carrier and modulation Frequencies to provide static oscilloscope images
- Expandable with the DEMODULATION BOARD

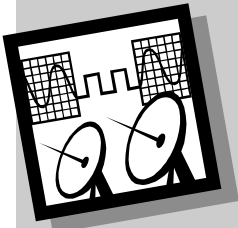
With the MODULATION BOARD, hps SystemTechnik offers a training and demonstration system for the major analog and digital modulation techniques. Its use in the whole field of communications technology begins with simple modulation techniques and extends to PAM / PCM technology.

The following modulation techniques can be studied with the MODULATION BOARD:

- Amplitude Modulation (AM)
- Single Sideband Modulation (SSB)
- Frequency Modulation (FM)
- Phase Modulation (PM)
- Pulse Amplitude Modulation (PAM)
- Pulse Code Modulation (PCM)
- Pulse Frequency Modulation (PFM)
- Pulse Phase Modulation (PPM)
- Delta Modulation (DM)
- Amplitude Shift Keying (ASK)
- Frequency Shift Keying (FSK)
- Phase Shift Keying (PSK)

The Board is divided into two sections. The first section contains the following function groups:

- Clock generator (quartz-controlled) with frequency dividers for generating the carrier and modulation signals. The signals are therefore in synchronisation and enable „frozen“ images to be displayed with the oscilloscope. They can be tapped as squarewave and sine wave signals and can be altered in amplitude. The clock generator also supplies a trigger signal, a switching signal for the delta modulator and a synchronised signal for the process control of the PCM modulator.
- Signal button, for simple examination of the digital modulation techniques, with electronic debounce and optical indication by an LED.
- DC voltage source, adjustable, for generating static, analog modulation signals.



## MODULATION BOARD

Type 4280

- Summer, for adding up to 3 signals.
- Amplifier, variable gain, for matching external modulation signals such as from the microphone for example.

The second section of the MODULATION BOARD contains the modulators with all the necessary measuring points.

The MODULATION BOARD has a built-in power supply unit for the internal power supply. The  $\pm 15$  V and 5 V operating voltages for external devices can be tapped at additional jacks.

To conduct the experiments, the MODULATION BOARD is placed on a table or suspended in an hps rack for demonstration purposes.

Subject to technical modifications.

## Communications

The MODULATION BOARD can be converted into a portable training unit by simply screwing it into a Box (Type 4280.20):

All the experiments can be conducted directly in the Box. Dust-free storage and protection against transport damages are further advantages of the Box version.

### Accessories Recommended

- Set of Accessories (Type 4280.1), consisting of connecting plugs and leads
- DEMODULATION BOARD (Type 4281)
- TRANSMITTER BOARD (Type 4282)
- RECEIVER BOARD (Type 4283)
- Experiment manual: „Modulation Techniques – Modulators“ (Type V 0130)

## Technical Data

### Mains connection

- Voltage: 230 V AC / 115 V AC (110 V); 50...60 Hz; 50 VA

### DC voltage output (Short-circuit-proof)

- $\pm 15$  V / 0.15 A ; +5 V / 0.2 A;  
for connecting external devices

### Signal source

- Sinewave:  $U_{pp} = 5$  V;  $f = 0.5 / 1 / 2 / 20$  kHz
- Squarewave:  $U_p = 5$  V;  $f = 0.25 / 0.5 / 1 / 2 / 20$  kHz
- Trigger signal: 250 Hz

### Summer

- With three inputs, short-circuit-proof output

### DC voltage, adjustable

- 0 ... approx.  $\pm 2.5$  V
- 0 ... approx.  $\pm 1.5$  V

### Signal button

- With TTL output

### Amplifier, variable gain

- $V_u = 0 \dots 2.5$

### PAM / PCM

- Two channels
- AD converter; 8 bits with LED indicator. Bits  $2^0$  and  $2^7$  can be switched off.
- Frame frequency: approx. 16 kHz
- Sampling frequency: approx. 8 kHz

### AM

- $U_{in PP} = 5$  V
- Bandpass: 15 ... 25 kHz / Low pass: 0 ... 20 kHz

### FM / PM / PFM

- $f_o = 20$  kHz /  $f_n = DC \dots 3.4$  kHz

### Adapter field

- Serves for adapting 4 mm to 2 mm connections and for plugging two adapters (BNC socket two 4 mm connectors)

### Mechanical data

- The front panel of the MODULATION BOARD is made of 5 mm thick laminate, matt blue in colour with white engraving representing the built-in function groups. The rear of the Board is protected with a grey plastic cover. Its shape allows the Board to be placed at an ergonomically favourable angle for example on a table.

### Dimensions and weights

- Board version (Type 4280): 532 x 297 x 90 mm (w x h x d); weight: 3.6 kg
- Box version (Type 4280 and Type 4280.20): 580 x 450 x 155 mm; Weight: 6.8 kg