PHASE SHIFT KEYING MODULATION AND DEMODULATION TRAINER

This trainer provides an opportunity to study carrier modulation of digital signals. There are various carrier modulation techniques required for transmission of digital information. Phase Shift Keying (PSK) is one such modulation scheme. Digital signal is represented by a sequence of '0's and '1's. In PSK, Carrier signal which is in-phase or 180 degrees out of phase is switched depending on whether the Input Data is '1' or '0'. This trainer provides a bit pattern generator and carriers with 0 deg. and 180 deg. Phase difference.

FEATURES:

- Data pattern generators.
- Carriers with variable frequency.
- Low Pass Filters.
- Wave shaping circuits.
- Comparator and Data squaring circuits.
- Various test points to observe the process at various stages.
- Potentiometers to vary the frequency of the signal sources

TECHNICAL SPECIFICATIONS:

- On-board Data sources: 4 no.s of Data Patterns ranging from 500 Hz to 2.5 KHz @ 2.5V pk-pk
- Modulation: Phase Shift Keying Modulation
- On-board carrier frequency Range: 2 KHz to 10KHz adjustable @ 2.5V pk-pk
- Test Points: 7 nos
- Interconnections: 2mm Sockets with patch cords.
Power: External 5V, +12V and -12V

LIST OF EXPERIMENTS:

To Study Phase Shift Keying by connecting to various Data patterns available on-board.

To Study Data recovery by using Wave shaping circuits, filters and Data squaring circuits.

FREQUENCY SHIFT KEYING MODULATION AND DEMODULATION TRAINER

This trainer provides a facility to study carrier modulation of digital signals. There are various carrier modulation techniques required for transmission of digital information. Frequency Shift Keying (FSK) is one such modulation scheme. Digital signal is represented by a sequence of '0's and '1's. In FSK a carrier signal is switched between two frequencies depending on whether the Data bit is '1' or '0'. This trainer provides a bit pattern and carrier generator.

FEATURES:

Data pattern generators.

Low Pass Filters.

XR2206 is used as FSK modulator. This IC is made to output two different frequencies depending on the state of the Input Data.

LM565 is used as a demodulator.

Filters and Comparator as Data squaring circuits at the output.

Test points to observe the process at various stages.

Potentiometers to vary the frequency of the signal sources.

TECHNICAL SPECIFICATIONS:

On-board Data sources: 4 no.s of Data Patterns ranging from 60 Hz to 300 Hz @ 4V pk-pk
Carrier frequency: 2124Hz for DATA =1 and 2975Hz for DATA=0

Modulation: Frequency Shift Keying Modulation

Test Points: 14 nos

Interconnections: 2mm Sockets with patch cords.

Power: External 5V, +12V and -12V

LIST OF EXPERIMENTS:

To Study Frequency Shift Keying by connecting to various Data patterns available on-board.

To Study the output signal by properly tuning the center frequency of PLL (in the Demodulator).

To Study Data recovery by using filters and Data squaring circuits.

PULSE POSITION MODULATION AND DEMODULATION TRAINER

Pulse Position Modulation (PPM) is a basic Pulse Modulation technique. The trainer provides complete set up to the students for performing experiments to learn PPM. They can study Sampling, Pulse Modulation, and Demodulation & Signal reconstruction process. Separate circuits are provided for each stage.

FEATURES:

On-board signal generator.

Low Pass Filters at the output.

Various test points to observe the process at various stages.

Potentiometers to vary the frequency of the signal sources.

TECHNICAL SPECIFICATIONS:

LM3524 is used to convert the Input signal (Sine or DC) to Pulse Width Modulated signal and also to generate sampling clock.
Sampling clock: 20K Hz to 50 KHz (Adjustable)

On-board signal generator:
- Sine wave: 300 Hz to 3 KHz (Adjustable) @ 1V pk-pk
- DC signal: 1.0 V to 2.3 V (Adjustable)

Modulation: Pulse Position modulation

Test Points: 10 nos

Interconnections: 2mm Sockets with patch cords.

Power: External 5V, +12V and -12V

LIST OF EXPERIMENTS:

To Study Pulse Position modulation and de modulation.

To study change in pulse width and pulse position in accordance with Input signal amplitude.

To Study Effect of sampling clock frequency on the modulated and recovered signal.

To Study Data recovery by using filter, buffer and amplifier.

PCM COMMUNICATION USING CODEC

This trainer provides an opportunity to study CODEC. A CODEC has two parts, Encoder and Decoder. Encoder converts the input audio signal sampled at regular intervals into PCM data. Decoder converts the input PCM data to an equivalent analog voltage. While doing this it applies either A-law or Mu-law. It also provides anti-aliasing filter. The trainer uses HD44233P CODEC which is an A-law codec.

FEATURES:

On-board signal generator.

Various test points to observe the process at various stages.
Potentiometers to vary the frequency of the signal sources.

Two numbers HD44233P CODEC is used as modulator demodulator for both way communication.

Amplifiers at the output.

**TECHNICAL SPECIFICATIONS:**

On-board signal generator:

- Sine wave: 2 nos. 300 Hz to 3 KHz (Adjustable) @ 1.5V pk-pk

Test Points: 12 nos

Interconnections: 2mm Sockets with patch cords.

Power: External 5V, +12V and -12V

List of Experiments:

To Study PCM communication with CODEC

**PULSE AMPLITUDE MODULATOR AND DEMODULATOR TRAINER**

Pulse Amplitude Modulation (PAM) is a basic Pulse Modulation technique. The trainer provides complete set up to the students for performing experiments to learn PAM. They can study Sampling, Pulse Modulation, and Demodulation & Signal reconstruction process. Separate circuits are provided for each stage.

**FEATURES:**

On-board signal generator

Low Pass Filters at the output.

Various test points to observe the process at various stages.

Potentiometers to vary the frequency of the signal sources.
Adjustable Sampling rate.

**TECHNICAL SPECIFICATIONS:**

- Sampling clock: 20 K Hz to 70K Hz (Adjustable)
- On-board signal generator:
  - Sine wave: 300 Hz to 3 KHz (Adjustable) @ 1V pk-pk
  - DC signal: -2.0 V to 2.0 V (Adjustable)
- Modulation: Pulse Amplitude modulation
- Test Points: 8 nos
- Interconnections: 2mm Sockets with patch cords.
- Power: External 5V, +12V and -12V

**LIST OF EXPERIMENTS:**

- To Study Pulse Amplitude modulation and de-modulation.
- To study change in pulse amplitude in accordance with Input signal amplitude.
- To Study Effect of sampling clock frequency on the modulated and recovered signal
- To Study Data recovery by using filter, buffer and amplifier.

**PULSE WIDTH MODULATOR AND DEMODULATOR TRAINER**

Pulse Width Modulation (PWM) is a basic Pulse Modulation technique. The trainer provides complete set up to the students for performing experiments to learn PWM.
They can study Sampling, Pulse Modulation, and Demodulation & Signal reconstruction process. Separate circuits are provided for each stage.

**FEATURES:**

- On-board signal generator
- Low Pass Filters at the output.
- Various test points to observe the process at various stages.
- Potentiometers to vary the frequency of the signal sources.

**TECHNICAL SPECIFICATIONS:**

- LM3524 is used to convert the Input signal (Sine or DC) to Pulse Width Modulated signal and also to generate sampling clock.
- Sampling Clock: 5 KHz to 40 KHz (Adjustable)
- On-board signal generator:
  - Sine wave: 300 Hz to 3 KHz (Adjustable) @ 1.5V pk-pk
  - DC signal: 1.3 V to 3.7 V (Adjustable)
- Modulation: Pulse Width modulation
- Test Points: 8 nos
- Interconnections: 2mm Sockets with patch cords.
- Power: External 5V, +12V and -12V

**LIST OF EXPERIMENTS:**

- To Study Pulse Width modulation and de modulation.
- To study change in pulse width in accordance with Input signal amplitude.
- To study effect of sampling clock frequency on the modulated and recovered signal.
- To Study of Data recovery by using filter, buffer and amplifier.
QUADRATURE PHASE SHIFT KEYING MODULATOR AND DEMODULATOR

The modulation is characterised by the fact that the information carried is contained in the phase. In particular, in quadrature phase shift keying, the phase of the carrier takes on one of four equally spaced values such as 0, 90°, 180° and 270°. Each possible value of the phase corresponds to a unique pair of bits called dibit.

In this trainer the carrier signal is a sinusoidal wave with fixed frequency and amplitude. The modulating signal is binary DATA pattern.

FEATURES:

- On-board inphase and quadrature phase for QPSK modulation
- On-board data generation using 8 line DIP switch and parallel to serial converter.
- Dibit code generation from the serial DATA.
- Unipolar to Bipolar conversion
- Serial to parallel converter, Comparator and 8 no.s of LEDs in the receiver.

TECHNICAL SPECIFICATIONS:

- Carrier: Sine wave
- DATA: DATA clock and Byte Clock
- Data pattern selection: 8 bit DIP switch
- Output: 8 numbers of LEDs corresponding to each bit in the DIP switch
- Test Points: 8
- Interconnections: 2mm Sockets with patch cords.
Power: External 5V, +12V and -12V

LIST OF EXPERIMENTS:

A) Study of QPSK Modulation & Demodulation for various DATA patterns

FREQUENCY MODULATION AND DEMODULATION TRAINER

Frequency modulation (FM) conveys information over a carrier wave by varying its frequency. In analog applications, the instantaneous frequency of the carrier is directly proportional to the instantaneous value of the input signal. A simple form of FM often used for digital communications is FSK. Digital Data can be sent by shifting the carrier's frequency among a set of discrete values, a technique known as Frequency Shift Keying (FSK). In FSK frequency changes abruptly in contrast to FM.

FEATURES:

- On-board signal generator.
- Low Pass Filters at the output.
- Various test points to observe the process at various stages.
- Potentiometers to vary the frequency of the signal sources.
- XR2206 is used for modulation.
- LM565 is used as a demodulator.

TECHNICAL SPECIFICATIONS:

- On-board signal generator:
  - Sine wave: 500 Hz to 1.5 KHz (Adjustable) @ 3.5V pk-pk
  - DC signal: 0 V to 5.0 V (Adjustable)
  - Carrier: sine wave in the frequency range of 53K Hz to 84 KHz
  - Modulation: Frequency Modulation
- Test Points: 9 nos
- Interconnections: 2mm Sockets with patch cords.
- Power: External 5V, +12V and -12V

**LIST OF EXPERIMENTS:**

- To Study change in frequency of the modulator output in accordance with the DC level of the input signal.

- To Study the output signal by properly tuning the center frequency of PLL (in the Demodulator).

- To Study Data recovery by using filters and Data squaring circuits.

**AMPLITUDE MODULATION AND DEMODULATION TRAINER**

Amplitude modulation (AM) conveys information over a carrier wave by varying its amplitude. In analog applications, the instantaneous amplitude of the carrier is directly proportional to the instantaneous value of the input signal. A simple form of AM often used for digital communications is ON-OFF keying, a type of Amplitude Shift Keying (ASK) by which binary data is represented as the presence or absence of a carrier wave.

**FEATURES:**

- On-board signal generator.
- Low Pass Filters at the output.
- Various test points to observe the process at various stages.
- Potentiometers to vary the frequency of the signal sources.
- Transistors and Tuned circuits are used as modulator.
- A simple diode is used as a demodulator.
**TECHNICAL SPECIFICATIONS:**

On-board signal generator:
- Sine wave: 200 Hz to 2 KHz (Adjustable)
- Amplitude of sine wave: 1V to 12V (Adjustable)

On-board Carrier: sine wave tuned to 100 KHz

Amplitude of Carrier: 3V to 5V (Adjustable)

Modulation: Amplitude Modulation

Test Points: 8 nos

Interconnections: 2mm Sockets with patch cords.

Power: External 5V, +12V and -12V

**LIST OF EXPERIMENTS:**

To Study Modulation Index of the modulated signal.

To study effect of over modulation

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**DIFFERENTIAL PHASE SHIFT KEYING MODULATION AND DEMODULATION TRAINER**

This trainer provides an opportunity to study carrier modulation of digital signals. There are various carrier modulation techniques required for transmission of digital information. Differential Phase Shift Keying (DPSK) is one such modulation scheme. It is similar to PSK. In PSK before keying, DATA is not conditioned. In DPSK the Input DATA is conditioned to NRZM format before keying. After demodulation, the DATA is reconditioned to get back the original DATA.

This trainer provides a bit pattern generator and carriers with 0 deg. and 180 deg. Phase difference.

**FEATURES:**

Data pattern generators.
Carriers with variable frequency.

Low pass Filters.

Wave shaping circuits.

Comparator and Data squaring circuits.

Various test points to observe the process at various stages.

Potentiometers to vary the frequency of the signal sources

TECHNICAL SPECIFICATIONS:

- On-board Data sources: 4 no.s of Data Patterns ranging from 500 Hz to 2 KHz @ 20K Hz carrier
- Carrier: sine wave - 2 KHz to 20 KHz (Adjustable)
- Modulation: Differential Phase Shift Keying Modulation
- Test Points: 22 nos
- Data formatting de-formatting circuits.
- Interconnections : 2mm Sockets with patch cords.
- Power: External 5V,+12V and -12V

LIST OF EXPERIMENTS:

To Study Differential Phase Shift Keying by connecting to various Data patterns available on-board.

To Study Data recovery by using Wave shaping circuits, filters and Data squaring circuits.
This trainer provides an opportunity to study PCM. In order to send analog signals over a digital communication system, we need to convert analog signals to digital ones. The process is performed by analog-to-digital-converter (ADC). The analog signal is sampled (i.e. measured at regularly spaced instants) and then quantized (i.e. converted to discrete numeric values. The converse actions to ADC converting digital signal to its analog equivalent) is performed by digital-to-analog-converter (DAC) Sampling is done by a sample/hold (S/H) amplifier that stores the analog value on a capacitor at the instant of measurement. It provides a quantizing resolution of 1 in 256 using 8-bit ADC. Each analog sample is matched to the nearest binary level.

TECHNICAL SPECIFICATIONS:

On-board signal generator:

- Analog signal:
  - Sine wave: 200Hz to 1KHz (Adjustable)
  - amplitude :0 to 2 V(Adjustable)
- Digital Signal: DC 0V to 5V (Adjustable).

Byte rate: 4KHz

Sampling Clock: 32KHz.

Test Points : 13 nos

Interconnections: 2mm Sockets with patch cords.

Power: External 5V, +12V and -12V

LIST OF EXPERIMENTS:

To study PCM code for various DC levels.

To study coding with respect to Byte and Clock.

To study Demodulation.
In this trainer the sine wave signal available on the trainer is sampled at regular intervals to produce amplitude modulated signal. The sampling frequency can be selected from 4 different sampling rates. It is also possible to change the duty cycle of the sampling clock from 0% to 100% using DIP switches. It is possible to select between Flat sampling type of output or Natural sampling type of output using a jumper. Finally in the demodulator it is possible to choose either a single two pole filter or two no.s of two pole filters connected in cascade.

**FEATURES:**

- Sampling clocks: 4 nos: 16 KHz, 8KHz, 4 KHz and 2 KHz.
- Signal: 1 KHz sine wave with 3 V pk-pk
- Sampling duration: 0% to 100% in steps of 10%
- Flat and natural sampling option
- Low pass Filters: 2 no.s of two pole filters
- Various test points to observe the process at various stages.

**TECHNICAL SPECIFICATIONS:**

- Modulation: Pulse Amplitude Modulation
- On-board sampling clock: adjustable
- Test Points: 11 nos
- Interconnections: 2mm Sockets with patch cords.
- Power: External 5V, +12V and -12V

**LIST OF EXPERIMENTS:**

- Study of flat and natural sampling of the Pulse amplitude Modulated signal.
- Study of the demodulated signal for various sampling rate, sampling duty cycle and filtering stages.
- To study and prove Nyquist theory.
DELTA MODULATIONS AND DEMODULATION TRAINER

In order to send messages to far off places, it is important to use any of the modulation techniques. In the case of Amplitude and Frequency modulation techniques, the modulated signal is in the analogue form. This analogue signal, while being transmitted, is subject to various kinds of distortions. In communication systems, such distortions in the transmission path can be avoided by coding the information signal and then transmitting it as pulse patterns of 0 and 1, or in other words digitizing it. Delta modulation is one such technique. In this the analog signal is sampled regularly at fixed intervals and the previous sample is compared with the present sample. If the present sample is more in amplitude compared to the previous sample it is coded as 1 otherwise, 0. Since it carries only the difference information rather than the full information unlike PCM, it utilizes a very small bandwidth. This trainer is built on the concept of linear delta modulation. It is called linear because the local decoder producing the feedback signal is a linear network.

FEATURES:

- Transmitter and Receiver on same board
- Clock generation using NE555 timer
- Jumper selectable sampling rates
- On-board signal generator
- Adjustable integrator input level
- On board 2nd order Butter worth low pass filter
- Unipolar to Bipolar converter on board

TECHNICAL SPECIFICATIONS:

- Sampling Clock Frequency: 64KHz, 32 KHz, 16 KHz, 8KHz (Jumper selectable)
- On board Generator: Sine Wave Generator of 100hz -1KHz adjustable.
- Integrator: Input to integrator is adjustable using Potentiometer
- Low Pass Filter: Second order Butter worth (Cut Off Frequency 1 KHz)
- Test Points: 8 nos
- Interconnections: 2mm Sockets with patch cords.
- Power: External 5V, +12V and -12V

**LIST OF EXPERIMENTS:**

- Linear Delta Modulation & Demodulation.
- Effect of slope overload and increased integrator input in Delta Modulation.

**FEATURES:**

- Analog and Digital signal generation
- PCB: Descriptive legends in well-defined blocks.
- Test points for observation of Waveforms.
- Potentiometers for setting up different Input conditions
- Interconnections: 2mm Sockets with patch cords.
- Power: External 5V, +12V and -12V
- Dimensions (mm): L = 315, W = 230, H = 55
- Weight: 1 Kg (max.)
- BOX: Injection molded light box with detachable top cover.