MICROCONTROLLER BASED SINUSOIDAL PULSE WIDTH MODULATION (SPWM) SIGNAL GENERATOR
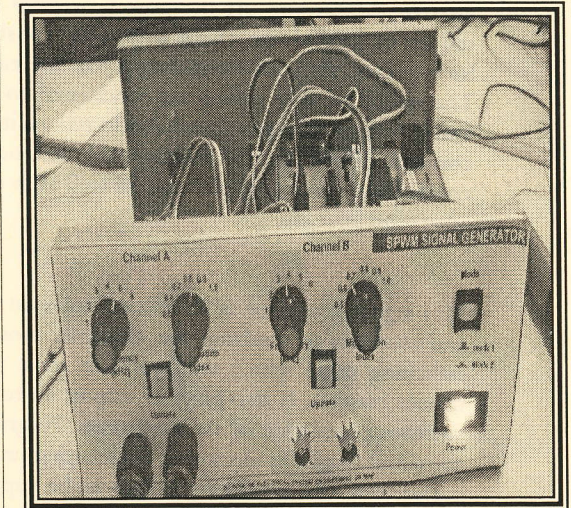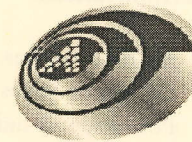
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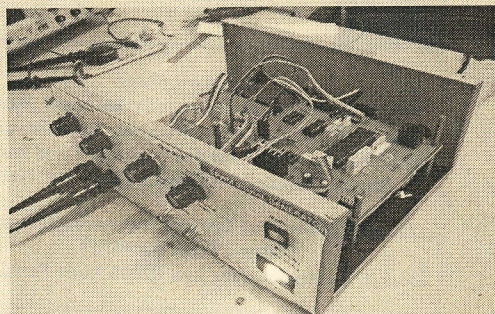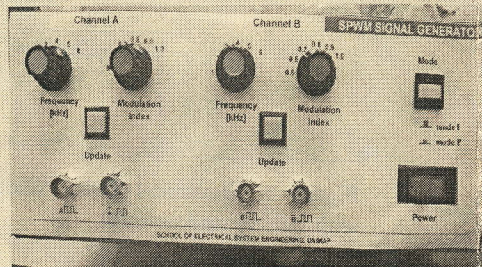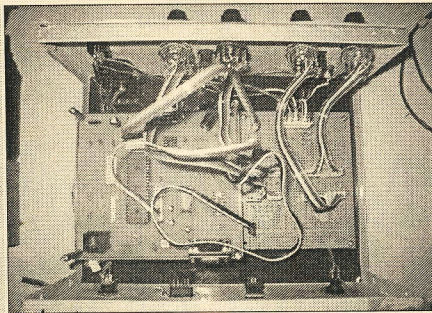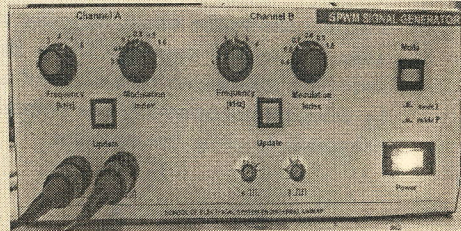
Introduction

Currently in the market, most of signal generator products can only produce standard square-wave pulse. With the new invent of SPWM signal generator, it able to produce sinusoidal PWM signals which give more advantage in data analysis and troubleshooting in the related fields. SPWM or sinusoidal pulse width modulation is widely used in power electronics to digitize the power so that a sequence of voltage pulses can be generated by the on and off the power switches. The techniques in SPWM are characterized by constant amplitude pulses with different duty cycle for each period. The width of this pulses are modulated to obtain inverter output voltage control and to reduce its harmonic content. SPWM is the mostly used method in motor control and inverter application as well as in engineering education learning.

This signal generator is developed to assist researchers and students in studying the characteristics of SPWM switching pulse which emphasize in most power electronics courses. It also plays an important role in testing switching hardware of the converter. To grasp the fundamental taught in electronic engineering undergraduate curriculum, this product emerges to be supporting and complementing in the laboratory practices.

Product Descriptions

Product Specifications:

Modulation index	: 20%-100%
Frequency carrier	: 1kHz-20kHz
Signal reference	: 50Hz sinusoidal
Output voltage	: 5V TTL unipolar signal
Processor	: PIC18F452, 20MHz

Product Features:

- Multiple choice of SPWM switching frequency
- Modulation Index selector
- Two pairs of SPWM Channel
- Operating mode – independent / parallel
- Simple and easy to use

Product Applications:

- AC motor drives
- DC motor drives
- Power supply unit
- DC-AC Inverters
- AC-DC Converters

Product Advantages:

- Assist researchers and students in studying the characteristics of SPWM switching pulse which emphasize in most power electronics courses
- Investigate the harmonic content with varying frequency and modulation index.
- Suitable for undergraduate's laboratory especially power electronics course.
- Important role in testing switching hardware of the converter

Background Theory

SPWM Switching Pulses Development Technique

Figure 1 shows the sinusoidal pulse width modulation with volt-second concept. Using this technique the switching pulses can be calculated and implemented by using microcontroller. The switching pulses can be calculated by using this equation:

$$\alpha_k = \alpha_n - \delta_k$$

$$\alpha_{k+1} = \alpha_n + \delta_{k+1}$$

Where:

$$\beta_k = m_a \sin(\alpha_n - \delta_0)$$

Figure 1: Sinusoidal Pulse Width Modulation with volt-second concept
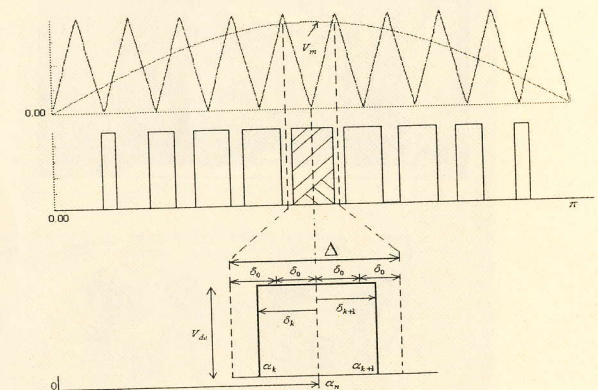
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