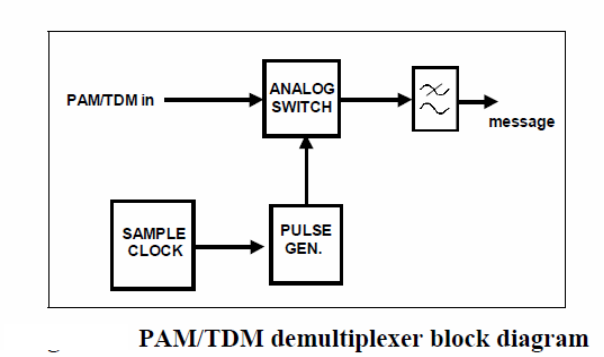
EXPERIMENT 5: TDM (Time Division Multiplexing)

Pre-Lab:

1) Student Text Vol-A1 pages: 137-140.

Purpose: Learn how to combine two signals by interleaving in time (time division multiplexing, TDM), and how to recover them (demultiplexing).

Illustration of signal recovery:



PAM/TDM demultiplexer block diagram

In-Lab:

1) Build the model in Figure 1 on the next page. The TDM signal we are using is the interleaving of two sample pulse trains. The sample trains are derived from the same audio oscillator signal, sampled at different times.

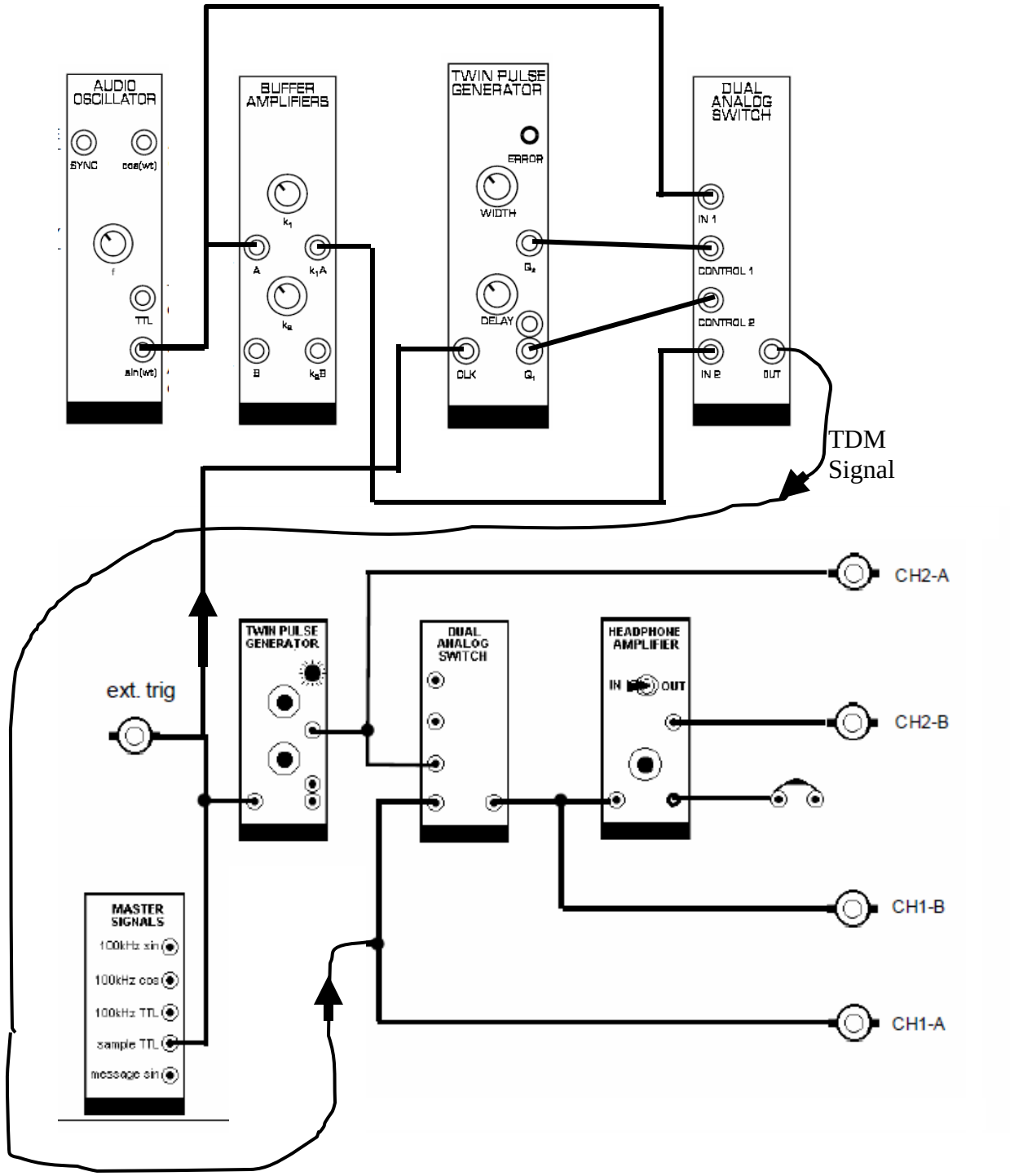

AUDIO OSCILLATOR
SYNC
cos(wt)
f
TTL
sin(wt)
BUFFER AMPLIFIERS
A
B
TWIN PULSE GENERATOR
ERROR
WIDTH
DELAY
CLK
DUAL ANALOG SWITCH
IN 1
CONTROL 1
CONTROL 2
IN 2
OUT
TDM Signal
CH2-A
CH2-B
CH1-B
CH1-A
ext. trig
HEADPHONE AMPLIFIER
IN
OUT
MASTER SIGNALS
100kHz sin
100kHz cos
100kHz TTL
sample TTL
message sin

Figure 1

Adjust the frequency of AUDIO OSCILLATOR to 2 kHz. The signal is peak to peak 4 V. Adjust the BUFFER AMPLIFIER to get a second signal of peak to peak 8 V from the same AUDIO OSCILLATOR. These will be the two signals to be multiplexed.

2) Make sure that the onboard switch on the TWIN PULSE GENERATOR is set to TWIN as you will use two different pulses (refer to TIMS-301 Basic Modules User Manual pages: 21, 22). Adjust the DELAY and WIDTH controls on the TWIN PULSE GENERATOR to make sure that the samples from the two signals are as far as away from each other as possible. You will get the two signals TDM'ed at the output of the first DUAL ANALOG SWITCH as seen in Figure 2 **(Save figure)**.

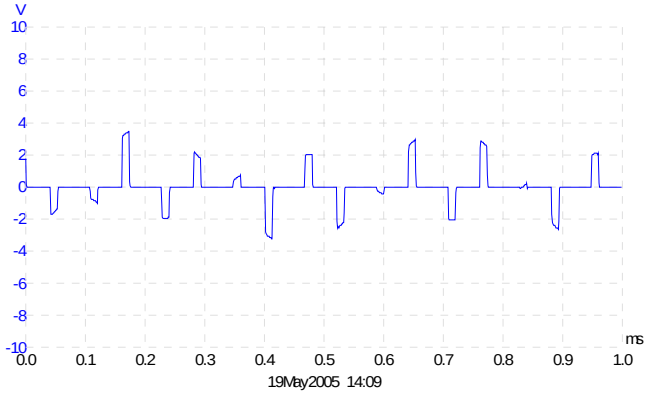


Figure 2

3) Make sure that the WIDTH and DELAY controls are same for the two TWIN PULSE GENERATORS. CH2A is patched to the Q2 output of the second TWIN PULSE GENERATOR. This means that the signal sampled with Q2 pulse stream of the first TWIN PULSE GENERATOR will be reconstructed. If you look at CH2A you will see:

Using Q2 at the second TWIN PULSE GENERATOR (which means signal with 4 V peak to peak) **(Save the figure)**

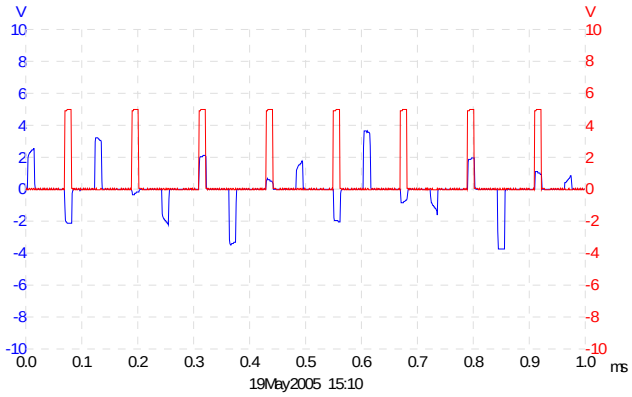


Figure 3

Using Q1 at the second TWIN PULSE GENERATOR (which means signal with 8 V peak to peak) (**Save the figure**)

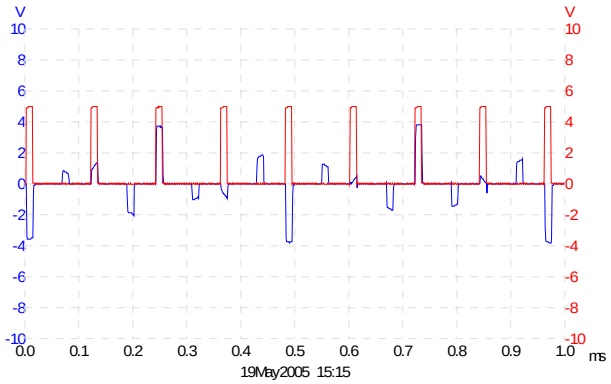


Figure 4

4) HEADPHONE AMPLIFIER will be used as LPF for reconstruction. The amplitude of the reconstructed signal may be low, therefore BUFFER AMPLIFIER can be used at the output of the LPF.

As a result, second TWIN PULSE GENERATOR output sockets of Q2 and Q1 are used as a switch to select between the two signals that are multiplexed. If you use Q2 you will reconstruct the signal with 4 V peak to peak, and if you use Q1 you will reconstruct the signal with 8 V peak to peak. (Do not forget to adjust the WIDTH and DELAY controls of the two TWIN PULSE GENERATORs identically.)