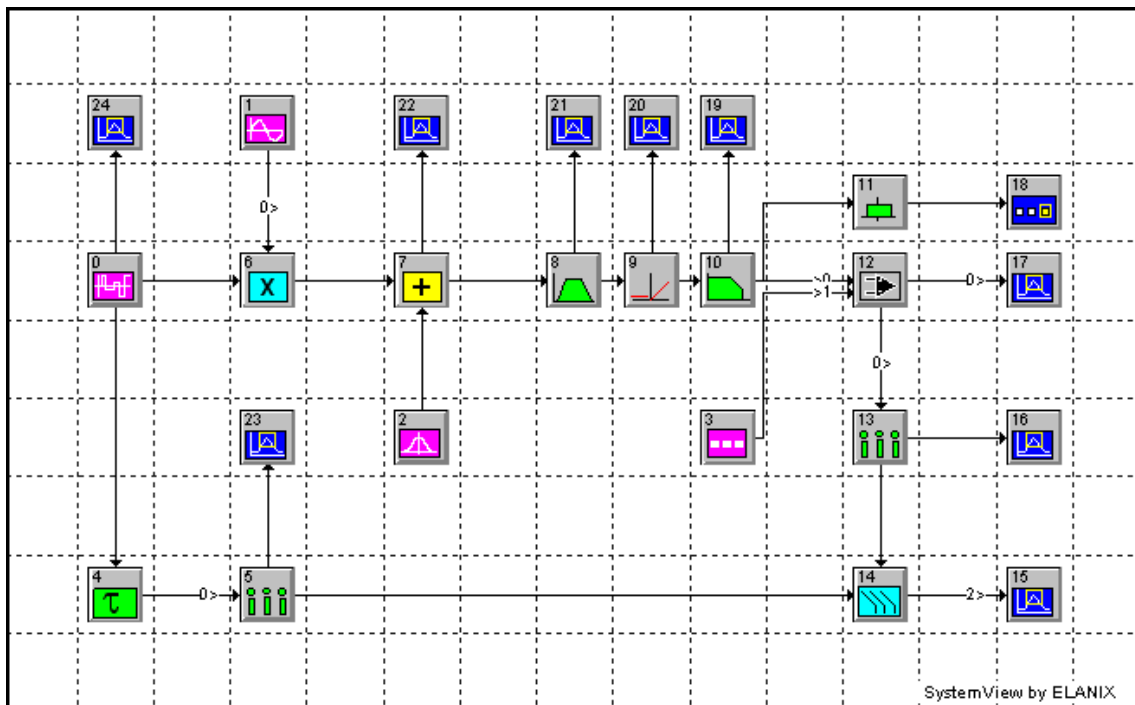
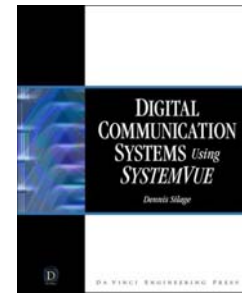


## Noncoherent Demodulation of Binary Amplitude Shift Keying

In this exercise the performance of noncoherent demodulation of binary amplitude shift keying (BASK) (with on/off keying OOK) is assessed in simulation. The noncoherent BASK (OOK) digital communication system is given in Figure 3.35 and described on pages 220-221 of the *SystemVue* text.



The noncoherent BASK (OOK) system receiver uses a *bandpass filter* (Token 8) with an initial bandwidth of  $2/T_b$  Hz centered on the carrier frequency  $f_c$ . The noncoherent envelope detector is a *half-wave rectifier* (Token 9) followed by a *low pass filter* (Token 10) with a bandwidth of  $2/T_b$  Hz. An analog comparator (Token 12) whose threshold voltage is set by a custom source (Token 3) outputs the estimate of the received binary data. This noncoherent BASK demodulator is not optimal because the envelope detector and comparator are not equivalent to correlation.

Setting the threshold  $\tau$  *analytically* requires the analysis of the transient response of the BPF and envelope detector to the binary ASK signal, which is somewhat involved. With *no additive noise*, the threshold  $\tau = 0.83$  V for the particular BPF and LPF parameters and used to set the threshold for the analog comparator. When noise is added the threshold actually varies, as shown in Table 3.19.

You can use the initial parameters of  $T_b$ ,  $A_C$  and  $f_C$  of the noncoherent BASK (OOK) digital communication system. The BPF and LPF remain 9-pole Butterworth filters and the following exercises can be performed:

1. Change the threshold  $\tau$  as listed in Table 3.19 for each of the AWGN  $N_o$  and determine the observed BER performance and theoretical  $P_b$  here as in Table 3.18. Does the performance improve with a variable threshold?
2. Change the both BPF and LPF bandwidths to  $3/T_b$  Hz. A new threshold  $\tau$  should be determined with no additive noise. Utilize this threshold for each AWGN  $N_o$  and determine the observed BER performance and theoretical  $P_b$  here as in Table 3.18. What is the performance of this noncoherent BASK (OOK) verses that when the BPF and LPF bandwidths were both  $2/T_b$  Hz?

