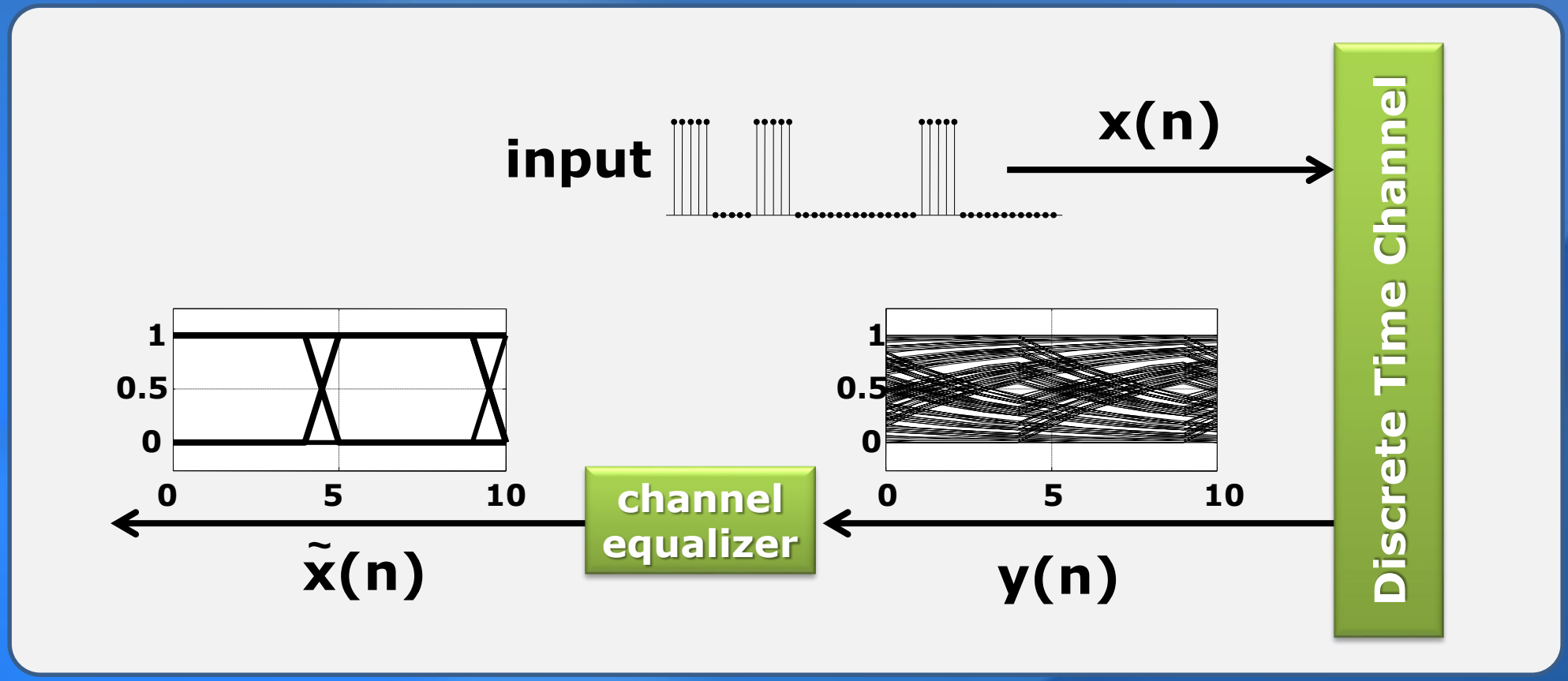
Intuition for Equalizer

Motivation: Equalization

- The channel introduces intersymbol interference, which causes the "eye" to close.
- The goal of a channel equalizer is to undo the effect of the channel.
- This will cause the "eye" to open.



Modeling the Channel

- In order to reverse the effect of the channel, we start with a model of the effect of a channel on the input
- We have seen that the response of the channel to an input x(n) can be described (modeled) in two equivalent ways
  - Model 1:
    - Channel is linear and time invariant
    - Channel has step response

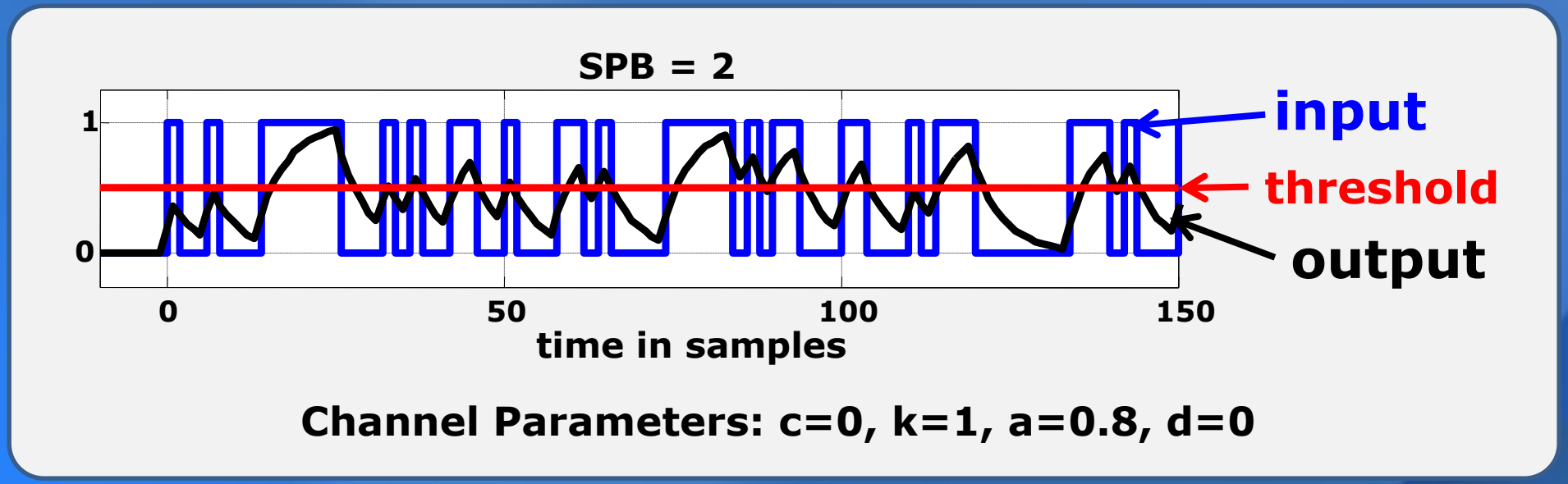
$$s(n) = k(1-a^{n+1})u(n)$$

  - Model 2:
    - If x(n) is the channel input and y(n) is the output,

$$y(n) = a \cdot y(n-1) + (1-a) \cdot k \cdot x(n)$$

Intuition for Equalizer

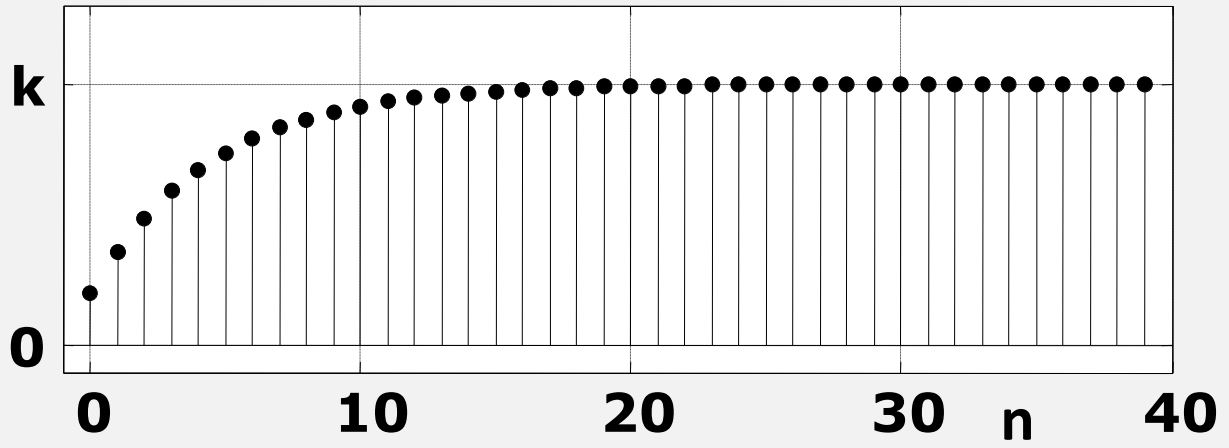
- Due to ISI, the output does not always move far enough to cross the threshold in response to a change in the bit.



- Thus, looking at the value (or level) of the output is not a reliable way to determine the input bit.

Intuition for Equalizer

- When the input goes from zero to one,
  - The channel output does not move immediately to k
  - Rather, the output starts to change from zero to k.



$$s(n) = k(1-a^{n+1})u(n)$$

$$0 < a < 1$$

- Can we do better by looking at how the output is changing, rather than the output level?
- How might we combine this information with the output level?