Specification Example

Definitions

lineidle   The phone is hung up or "on hook." In a traditional phone, this means the handset is lying in the cradle, but your phone uses the **end** key instead.

lineactive   The phone is picked up or "off hook." In a traditional phone, this means the handset is not in the cradle (it is "off hook"), but your phone uses the **talk** key instead.

ring signal   A +/- 24 volt AC signal sent over the phone line, which causes a traditional phone to ring. The phone company only sends a ring signal if it detects the lineidle state.

System Specification

TELEPHONE COMPONENTS

- Handset (includes both speaker and microphone)

- 24-character display

- Answering machine

- Keypad with keys labeled **talk**, **redial**, **ansmachine**, and **end**.

  *Simplification: The keypad also has 0 through 9, but in this exercise, you can ignore how those keypresses are handled. When the **talk** key is pressed, the digits previously entered by the user are delivered to the control software (much like a cellular phone). The **redial** key does not deliver any numbers. There is no hook or cradle as with a traditional phone, just the keys.*

FUNCTIONS

- The user places a call by pressing **talk** or **redial**. The user answers a call by pressing **talk**.

  Simplification: Your phone is not required to handle call waiting.

- The user begins using the answering machine by pressing **ansmachine** on the handset.

  Simplification: In this exercise, you will not be asked to specify the answering machine's behavior during message review.

- The user presses **end** to end a call or to stop using the answering machine.

REQUIREMENTS

- The display must show the appropriate information at all times.
  - If idle   show "READY"
  - If a ring signal is being sent
    by the phone company   show the caller ID information of the caller
  - If connected to an incoming call   show the caller ID information of the caller
  - If connected to an outgoing call   show the number being called
  - If using the answering machine   show "ANSWERING MACHINE"

- If a ring signal is delivered, the telephone must ring and show the caller ID of the caller. If the user doesn't answer the call within 2 rings, the answering machine must pick it up.

System Architecture

The telephone has the following components. The messages that may be exchanged between the handset controller and the other components are labeled in the diagram. Analog audio links are shown with dashed lines. Switches (represented by $\otimes$) either make or break audio connections.
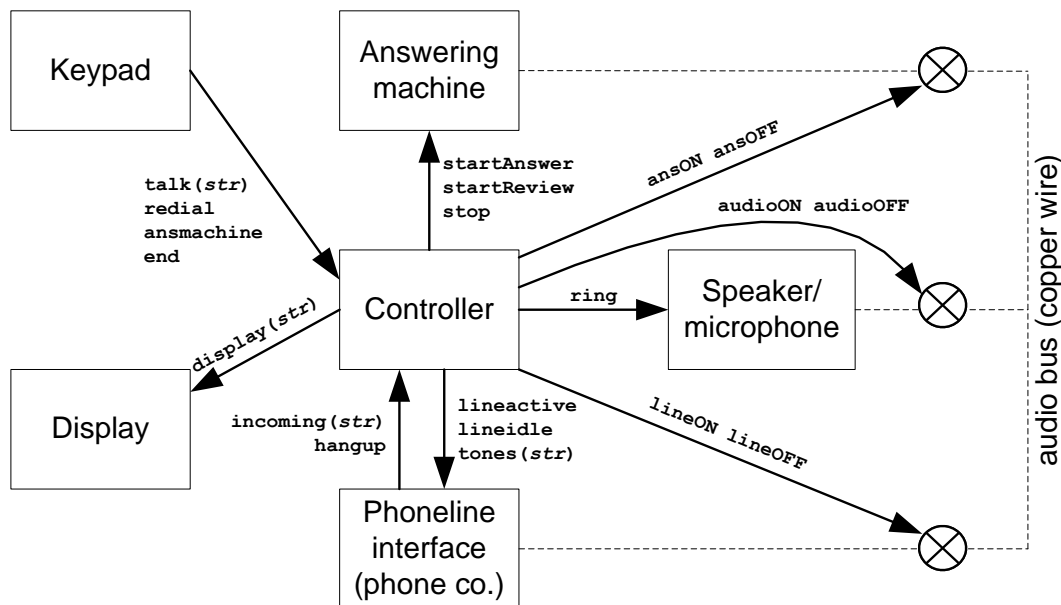
talk(*string*)	The user typed the digits in the argument string and then pressed **talk**
redial	The user pressed **redial**
ansmachine	The user pressed **ansmachine**
end	The user pressed **end**
display(*string*)	Makes the LCD display show the characters in *string*, a 24-character string
startAnswer	Play outgoing message and record the caller's message
startReview	Play back recorded messages and perform other user interactions
stop	Stop answering machine functions, return to idle state
incoming(*string*)	The phone company sent a ring signal with *string* as caller ID information. This message is repeatedly sent (every 6 seconds) until the call is answered or the caller hangs up.
hangup	The phone company indicates that the remote party has hung up
lineactive	Put the resistance across the phone line that indicates the phone is active
lineidle	Put the resistance across the phone line that indicates the phone is idle
tones(*string*)	Send the digits in *string* out over the phoneline as touch-tones
ring	Causes the speaker to play one ring tone
ansON ansOFF	Connect/disconnect the answering machine to the audio bus
audioON audioOFF	Connect/disconnect the speaker and microphone to the audio bus
lineON lineOFF	Connect/disconnect the phoneline to the audio bus

Simplification: Messages among telephone components are never lost or corrupted.