Based on information from:

https://github.com/TomVickers/Arduino2keypad // Replace Vista 20P with arduino
https://github.com/Dilbert66/esphome-vistaECP // Replace 6160 KP with ESPHome esp8266

GOAL:
Allow Ademco keypads to be used in Home Assistant

Honeywell Vista control panel speaks to various equipment including:
RF receiver - Address 00?
Keypad AUI - Addresses 01, 02, 05, 06
LRR - long range radio (cellular radio) - Address 03
4286 Voice Module - Address 04
Zone expander - Addresses 07-11 for zones 09-48 (8 zones per address)
Relay module - Addresses 12-15
Keypad Fixed LCD - Addresses 16-23
Keypad Alphanumeric - Addresses 16-23
Keypad voice enabled - Addresses 16-23

HARDWARE:
ECP keypad such as Honeywell 6150 or 6160
ESP8266 module or similar (ESP32, ESP-01, ESP-12S, etc)
Octocouplers and resistors
12Vdc Power Supply with DC 3.3V DC-DC Step Down Buck Converter Power Supply Module
or 5V USB Power Supply with DC 12V DC-DC Step Up Boost Converter Power Supply Module

ADEMCO DEVICE SPECIFICS:
1) 6150 keypad
    a) Binary inputs
        i) 0-9,* , #, (1+*), (*+#), (3+#), A, B, C, D
    b) Binary outputs

i)	ARMED light - red	(B7b7, B8b2)
ii)	READY light - green	(B7b4)
iii)	LCD - backlight	(B12b7, B45b7)
iv)	LCD - ALARM	(B8b1)
v)	LCD - FIRE	(B7b5)
vi)	LCD - AWAY	(B8b2)
vii)	LCD - BYPASS	(B8b4)
viii)	LCD - STAY	(B7b7)
ix)	LCD - CHECK	(B7b1)
x)	LCD - INSTANT	(B8b7)
xi)	LCD - NIGHT	(B6b4)
xii)	LCD - "AC"/ "NO AC"	(B8b3)
xiii)	LCD - PHONE	(B45b5)
xiv)	LCD - TEST	(B45b4)
xv)	LCD - NOT READY	(B7b4)
xvi)	LCD - CHIME	(B8b5)
xvii)	LCD - BAT	(B7b6)
xviii)	LCD - CANCELED	(B6b5)

    c) Variable output
        i) Seven segment display "2188"
            (1) "88" as set by Byte 5, 0-9 + A-F for each character
            (2) "2" toggled by B45b1
            (3) "1" toggled by B45b0
        ii) Tone
            (1) 000 - No tone
            (2) 001 - chime once
            (3) 010 - chime twice
            (4) 011 - chime three times
            (5) 100 - fast repeating tone (used when arm/disarm delay timeout is nearing completion)
            (6) 101 - slow repeating tone (used for arm/disarm delay timeout)
            (7) 110 - same as 101
            (8) 111 - continuous loud tone (alarm triggered)
2) 6160V keypad
    a) Binary inputs
        i) 0-9, *, #, (1+*), (*+#), (3+#), A, B, C, D
    b) Analog input
        i) Microphone (standalone use only)
    c) Binary outputs
        i) ARMED light - red
        ii) READY light - green
        iii) MESSAGE light (standalone use only)
    d) Variable output
        i) 2 line, 16 character alphanumeric display
        ii) Tone
            (1) 000 - No tone
            (2) 001 - chime once
            (3) 010 - chime twice

(4) 011 - chime three times

(5) 100 - fast repeating tone (used when arm/disarm delay timeout is nearing completion)

(6) 101 - slow repeating tone (used for arm/disarm delay timeout)

(7) 110 - same as 101

(8) 111 - continuous loud tone (alarm triggered)

e) Voice output

    i) Would benefit to monitor its communication with Vista alarm panel

3) 4219 Zone Expander

a) Reed switch acting as tamper detection

b) DIP switch selectable address 0-15

    i) Jumper available to disable reed switch tamper reporting

c) Terminals for 8 zones

    i) 4 common posts

    ii) Looking for 1kohm end-of-line resistance

d) Does NOT respond to F6 message requests

    i) Would benefit to monitor its communication with Vista alarm panel

COMMUNICATION:
1. General
    a. 4800 baud serial
    b. 8E2 bidirectional except for polling process
    c. LSB first
    d. Signals and voltages inverted
    e. Alarm initiated sequences
2. Polling - Who wants to talk?
    a. Alarm sends volts 13ms low, 9 bits high, 1ms low, 9 bits high, 1ms low, 9 bits high, 1ms low, high
    b. During this, bus devices respond as follows

Yellow Line - from Alarm Panel / ESP	Green Line - Response from devices
12V - Signal Low - Normal State	0V - Signal High - Standby - Normal State
0V - Signal High - 13ms - prep polling	0V - Signal High - Prep to answer polling calls
12V - Signal Low - polling start bit	12V - Signal Low - IF addr < 8 has update
12V - Signal Low - poll 1 bit 1	0V - Signal High
12V - Signal Low - poll 1 bit 2	12V - Signal Low - IF AUIkp addr 1 has update
12V - Signal Low - poll 1 bit 3	12V - Signal Low - IF AUIkp addr 2 has update
12V - Signal Low - poll 1 bit 4	12V - Signal Low - IF LRR addr 3 has update
12V - Signal Low - poll 1 bit 5	12V - Signal Low - IF 4286 module addr 4 has update
12V - Signal Low - poll 1 bit 6	12V - Signal Low - IF AUIkp addr 5 has update
12V - Signal Low - poll 1 bit 7	12V - Signal Low - IF AUIkp addr 6 has update
12V - Signal Low - poll 1 bit 8	12V - Signal Low - IF expander addr 7 has update
0V - Extended stop bit - 1ms	0V - Signal High
12V - Signal Low - polling start bit	12V - Signal Low - IF addr < 16 has update
12V - Signal Low - poll 2 bit 1	12V - Signal Low - IF expander addr 8 has update
12V - Signal Low - poll 2 bit 2	12V - Signal Low - IF expander addr 9 has update
12V - Signal Low - poll 2 bit 3	12V - Signal Low - IF expander addr 10 has update
12V - Signal Low - poll 2 bit 4	12V - Signal Low - IF expander addr 11 has update
12V - Signal Low - poll 2 bit 5	12V - Signal Low - IF relay addr 12 has update
12V - Signal Low - poll 2 bit 6	12V - Signal Low - IF relay addr 13 has update
12V - Signal Low - poll 2 bit 7	12V - Signal Low - IF relay addr 14 has update
12V - Signal Low - poll 2 bit 8	12V - Signal Low - IF relay addr 15 has update
0V - Extended stop bit - 1ms	0V - Signal High
12V - Signal Low - polling start bit	12V - Signal Low - IF addr < 24 has update

12V - Signal Low - poll 3 bit 1	12V - Signal Low - IF kp addr 16 has update
12V - Signal Low - poll 3 bit 2	12V - Signal Low - IF kp addr 17 has update
12V - Signal Low - poll 3 bit 3	12V - Signal Low - IF kp addr 18 has update
12V - Signal Low - poll 3 bit 4	12V - Signal Low - IF kp addr 19 has update
12V - Signal Low - poll 3 bit 5	12V - Signal Low - IF kp addr 20 has update
12V - Signal Low - poll 3 bit 6	12V - Signal Low - IF kp addr 21 has update
12V - Signal Low - poll 3 bit 7	12V - Signal Low - IF kp addr 22 has update
12V - Signal Low - poll 3 bit 8	12V - Signal Low - IF kp addr 23 has update
0V - Extended stop bit - 1ms	0V - Signal High
12V - Signal Low - Normal State	0V - Signal High - Standby - Normal State

Possibly extended to addr 28 for RF receiver?

3. F6 Message - Polling Response - Keypads
    a. Alarm initiates communication
        i. Signal high (0V) for 4ms
        ii. Send 0xF6
        iii. Send (hex)addr (i.e. 0x10 for addr 16)
    b. Keypad responds in one of following formats:
        i. Keypress response follows format:
            1. Byte 0
                a. Bit 0&1, increment with each message from keypad
                b. Bits 2-5, Keypad address
                c. Bits 6&7, zeros
            2. Byte 1
                a. Number of bytes to follow (N)
            3. Byte 2 through (N-1)
                a. Key presses (values):
                    i. 0-9 are 0x00-0x09
                    ii. * is 0x0A
                    iii. # is 0x0B
                    iv. 1+* is 0x0C
                    v. *+# is 0x0D
                    vi. 3+# is 0x0E
                    vii. Function keys 0x1C-0x1F
            4. Byte N (last byte)
                a. Checksum byte
        ii. First message after keypad powerup follows format:
            1. Byte 0
                a. Bits 0-3, Keypad address
                b. Bits 4-7, unknown
            2. Byte 1
                a. 0x87
            3. Bytes 2-7
                a. 6150 keypad: 0x00, 0x10, 0x04, 0x04, 0x04, 0x00
                b. 6160V keypad: 0x00, 0x00, 0x04, 0x04, 0x04, 0x00
            4. Byte 8 (last byte)

- a. Checksum byte
- c. Alarm acknowledges
  - i. Signal high (0V) for 4ms
  - ii. Send first byte received from device
4. F2 Message - Unknown purpose
   - a. See referenced projects for more information
   - b. Starts with 0xF2, ends with checksum
   - c. Hopefully not necessary for this project
5. F7 Message - Keypad updates - 48 bytes
   - a. Byte 00 - 0xF7
   - b. Byte 01 - Bitmask of keypads to receive message. LSB for addr 0, MSB for addr 7. 0xFF for all)
   - c. Byte 02 - Bitmask of keypads to receive message. LSB for addr 8, MSB for addr 15. 0xFF for all)
   - d. Byte 03 - Bitmask of keypads to receive message. LSB for kp addr 16, MSB for kp addr 23. 0xFF for all keypads)
   - e. Byte 04 - Bitmask of keypads to receive message. LSB for kp addr 24, MSB for kp addr 31. 0xFF for all keypads)
   - f. Byte 05 - Zone (possibly zone number to display on 6150 kp?)
   - g. Byte 06 - Bitmask
     - i. Bits 0-2 - keypad tones
       1. 000 - No tone
       2. 001 - chime once (6160Vkp vocalize "Disarmed Ready to Arm")
       3. 010 - chime twice
       4. 011 - chime three times
       5. 100 - fast repeating tone (used when arm/disarm delay timeout is nearing completion)
       6. 101 - slow repeating tone (used for arm/disarm delay timeout)
       7. 110 - same as 101
       8. 111 - continuous loud tone (alarm triggered)
     - ii. Bit 3 -
     - iii. Bit 4 - Binary toggle - LCD "NIGHT"
     - iv. Bit 5 - Binary toggle - LCD "CANCELED"
     - v. Bit 6 - must be 0 or else incompat. conn. Error + BEEPING
     - vi. Bit 7 -
   - h. Byte 07 - Bitmask
     - i. Bit 0 - Binary toggle - Repeated 3 beeps for fire alarm
     - ii. Bit 1 - Binary toggle - LCD "CHECK"
     - iii. Bit 2 - Binary toggle - Hide ones zone digit
     - iv. Bit 3 - Binary toggle - Hide tens zone digit
     - v. Bit 4 - Binary toggle - (1) GREEN READY LED or (0) LCD " NOT READY"
     - vi. Bit 5 - Binary toggle - LCD "FIRE"
     - vii. Bit 6 - Binary toggle - LCD "BAT"
     - viii. Bit 7 - Binary toggle - LCD "STAY" + RED ARMED LED
   - i. Byte 08 - Bitmask
     - i. Bit 0 - Binary toggle - Repeating dual tone sound
     - ii. Bit 1 - Binary toggle - LCD "ALARM"
     - iii. Bit 2 - Binary toggle - LCD "AWAY" + RED ARMED LED
     - iv. Bit 3 - Binary toggle - LCD "AC"(1) / "NO AC"(0)
     - v. Bit 4 - Binary toggle - LCD "BYPASS"
     - vi. Bit 5 - Binary toggle - LCD "CHIME"
     - vii. Bit 6 - Binary toggle -
     - viii. Bit 7 - Binary toggle - LCD "INSTANT"
   - j. Byte 09 - Programming mode enabled if bit 0 set. 0x00
   - k. Byte 10 - Prompt position. Used for programming. 0x00

      l.   Byte 11 -

    m. Byte 12 - First char of line1 LCD ascii text. MSB set to 1 turns on backlight

    n.   Byte 13-27 - Remaining 15 chars of line 1 LCD ascii text

    o.   Byte 28-43 - 16 chars of line2 LCD ascii text

    p.   Byte 44 - Message checksum

    q. Byte 45 - Bitmask

          i.   Bit 0 - Binary toggle - LCD "1" in 2188 seven segment display

         ii.   Bit 1 - Binary toggle - LCD "2" in 2188 seven segment display

        iii.   Bit 2 - Binary toggle -

        iv.   Bit 3 - Binary toggle -

         v.   Bit 4 - Binary toggle - LCD "TEST"

        vi.   Bit 5 - Binary toggle - LCD "PHONE" and blinks green LED

       vii.   Bit 6 - Binary toggle -

      viii.   Bit 7 - Binary toggle - Backlight

    r.   Byte 46-47 pad bytes 0x00

6. F8 Message - Unknown purpose

    a.   See referenced projects for more information

    b.   Starts with 0xF8, ends with checksum

    c.   Hopefully not necessary for this project

7. F9 Message - Long Range Radio Message

    a.   See referenced projects for more information

    b.   Starts with 0xF9, ends with checksum

    c.   Hopefully not necessary for this project

VOCALIZATIONS

- 6160 Will say "Disarmed, Ready to Arm" <u>once</u> when tone=1(byte06) IF B8b3=1(AC on) and RED ARMED light recently off
- One byte or more should be available to send voice descriptors. Byte 11 or 45+? Or not part of F7? 😳
- From Vista programming manual:

ALPHA VOCABULARY LIST (For Entering Zone Descriptors)

#	Word		#	Word		#	Word		#	Word		#	Word
000	(Word Space)	•	057	DOOR •			– L –			– R –			– V –
	– A –	•	059	DOWN	•	106	LAUNDRY •		155	RADIO		209	VALVE
•	001 AIR	•	060	DOWNSTAIRS	•	107	LEFT	•	156	REAR		210	VAULT
•	002 ALARM •		061	DRAWER		108	LEVEL		157	RECREATION		212	VOLTAGE
	004 ALLEY	•	062	DRIVEWAY	•	109	LIBRARY •		159	REFRIGERATION			– W –
	005 AMBUSH	•	064	DUCT	•	110	LIGHT		160	RF		213	WALL
•	006 AREA			– E –		111	LINE	•	161	RIGHT		214	WAREHOUSE
•	007 APARTMENT	•	065	EAST	•	113	LIVING •	•	162	ROOM •	•	216	WEST
•	009 ATTIC •		066	ELECTRIC	•	114	LOADING		163	ROOF	•	217	WINDOW •
	010 AUDIO		067	EMERGENCY •		115	LOCK			– S –	•	219	WING
	– B –		068	ENTRY		116	LOOP		164	SAFE		220	WIRELESS
•	012 BABY •	•	069	EQUIPMENT		117	LOW		165	SCREEN			– X –
•	013 BACK •	•	071	EXIT •	•	118	LOWER		166	SENSOR		222	XMITTER
•	014 BAR		072	EXTERIOR			– M –	•	167	SERVICE			– Y –
•	016 BASEMENT •			– F –	•	119	MACHINE	•	168	SHED •		223	YARD
•	017 BATHROOM •	•	073	FACTORY		121	MAIDS		169	SHOCK			– Z –
•	018 BED		075	FAMILY		122	MAIN •	•	170	SHOP •		224	ZONE (No.)
•	019 BEDROOM •	•	076	FATHERS	•	123	MASTER •		171	SHORT	•	225	ZONE •
	020 BELL	•	077	FENCE	•	125	MEDICAL •	•	173	SIDE •	•	226	0
•	021 BLOWER	•	079	FIRE •		126	MEDICINE		174	SKYLIGHT	•	227	1
•	022 BOILER	•	080	FLOOR •		128	MONEY		175	SLIDING •	•	228	1ST •
	023 BOTTOM		081	FLOW		129	MONITOR	•	176	SMOKE •	•	229	2
	025 BREAK		082	FOIL	•	130	MOTHERS	•	178	SONS	•	230	2ND •
•	026 BUILDING	•	083	FOYER	•	131	MOTION •		179	SOUTH	•	231	3
	– C –		084	FREEZER		132	MOTOR		180	SPRINKLER	•	232	3RD •
	028 CABINET	•	085	FRONT •			– N –	•	182	STATION	•	233	4
•	029 CALL			– G –	•	134	NORTH		184	STORE	•	234	4TH
	030 CAMERA	•	089	GARAGE •		135	NURSERY	•	185	STORAGE •	•	235	5
	031 CAR	•	090	GAS			– O –		186	STORY	•	236	5TH
	033 CASH		091	GATE	•	136	OFFICE •		190	SUPERVISED •	•	237	6
	034 CCTV	•	092	GLASS	•	138	OPEN •		191	SUPERVISION	•	238	6TH
	035 CEILING		093	GUEST		139	OPENING		192	SWIMMING	•	239	7
	036 CELLAR		094	GUN	•	140	OUTSIDE		193	SWITCH	•	240	7TH
•	037 CENTRAL			– H –		142	OVERHEAD			– T –	•	241	8
	038 CIRCUIT	•	095	HALL •			– P –		194	TAMPER	•	242	8TH
•	040 CLOSED •	•	096	HEAT		143	PAINTING		196	TELCO	•	243	9
•	046 COMPUTER		098	HOLDUP	•	144	PANIC •		197	TELEPHONE	•	244	9TH
	047 CONTACT		099	HOUSE •		145	PASSIVE	•	199	TEMPERATURE			
	– D –		100	INFRARED	•	146	PATIO •		200	THERMOSTAT		245	Custom Word #1
•	048 DAUGHTERS	•	101	INSIDE •		147	PERIMETER	•	201	TOOL		246	Custom Word #2
	049 DELAYED		102	INTERIOR	•	148	PHONE		202	TRANSMITTER		247	Custom Word #3
•	050 DEN •		103	INTRUSION		150	POINT			– U –		248	Custom Word #4
	051 DESK			– J –	•	151	POLICE •	•	205	UP		249	Custom Word #5
•	052 DETECTOR •		104	JEWELRY		152	POOL •	•	206	UPPER		250	Custom Word #6
•	053 DINING •			– K –	•	153	POWER	•	207	UPSTAIRS •		251	Custom Word #7
	054 DISCRIMINATOR	•	105	KITCHEN				•	208	UTILITY •		252	Custom Word #8
	055 DISPLAY											253	Custom Word #9
												254	Custom Word #10

Note: Bulleted (•) words in **boldface type** are those that are also available for use by the 4286 Phone Module. If using a Phone module, and words other than these are selected for Alpha descriptors, the module will not provide annunciation of those words.
Italicized words followed by an asterisk indicate those words supported by the 6160V/6150V Voice Keypads