

HomeVision[®] and HomeVision-Pro

Multifunction Expansion Board

Installation and Operation Manual

Custom Solutions, Inc.
P.O. Box 33905
Indialantic, FL 32903
<http://www.csi3.com>

Multifunction Expansion Board Overview

The MultiFunction Expansion Board (MFEB) can be used with both HomeVision and HomeVision-Pro. This manual will use “HomeVision” to refer to both, except in cases where differences exist. The HomeVision MFEB (Figure 1) provides these features:

- Eight digital inputs identical to HomeVision port B.
- Two sets of eight digital inputs similar to the input capability of HomeVision port C.
- Any or all of the three sets of eight digital inputs can instead be used as a port extender for HomeVision ports A, B, or C.
- Eight analog inputs.
- Eight zones of infrared output.
- Can connect to 64 digital temperature sensors when used with HomeVision. Digital temperature sensors can be directly connected to HomeVision-Pro – the MFEB is not needed with it.
- I/O board connector to connect to boards made by Sylva Control Systems.
- Up to two MFEBs can be connected to HomeVision.

To use this board, you must:

- 1) Configure the hardware
- 2) Configure the software
- 3) Put the desired commands in your schedule

Multifunction Expansion Board Description

Port 1

Port 1 can be used in either of two modes:

- 1) 8 digital inputs identical to HomeVision port B. All of the information in the HomeVision owner's manual on port B is applicable to this port, so refer to it for more information.
- 2) Port extender for HomeVision port A, B, or C. Connect one of the three provided 10-wire ribbon cables from a HomeVision terminal block to the expansion board, and then wire your I/O to the expansion board terminal block. HomeVision can then be easily unplugged from the expansion board and moved.

Ports 2 and 3

Ports 2 and 3 can each be used in either of two modes:

- 1) 8 digital inputs per port similar to the input capability of HomeVision port C. Ports 2 and 3 have the same electrical input characteristics as port C, so you can refer to the HomeVision owner's manual for details on using these as input ports and how to connect to them. Unlike port C, however, these ports have no digital output capability.
- 2) Port extender for HomeVision port A, B, or C, as described for port 1.

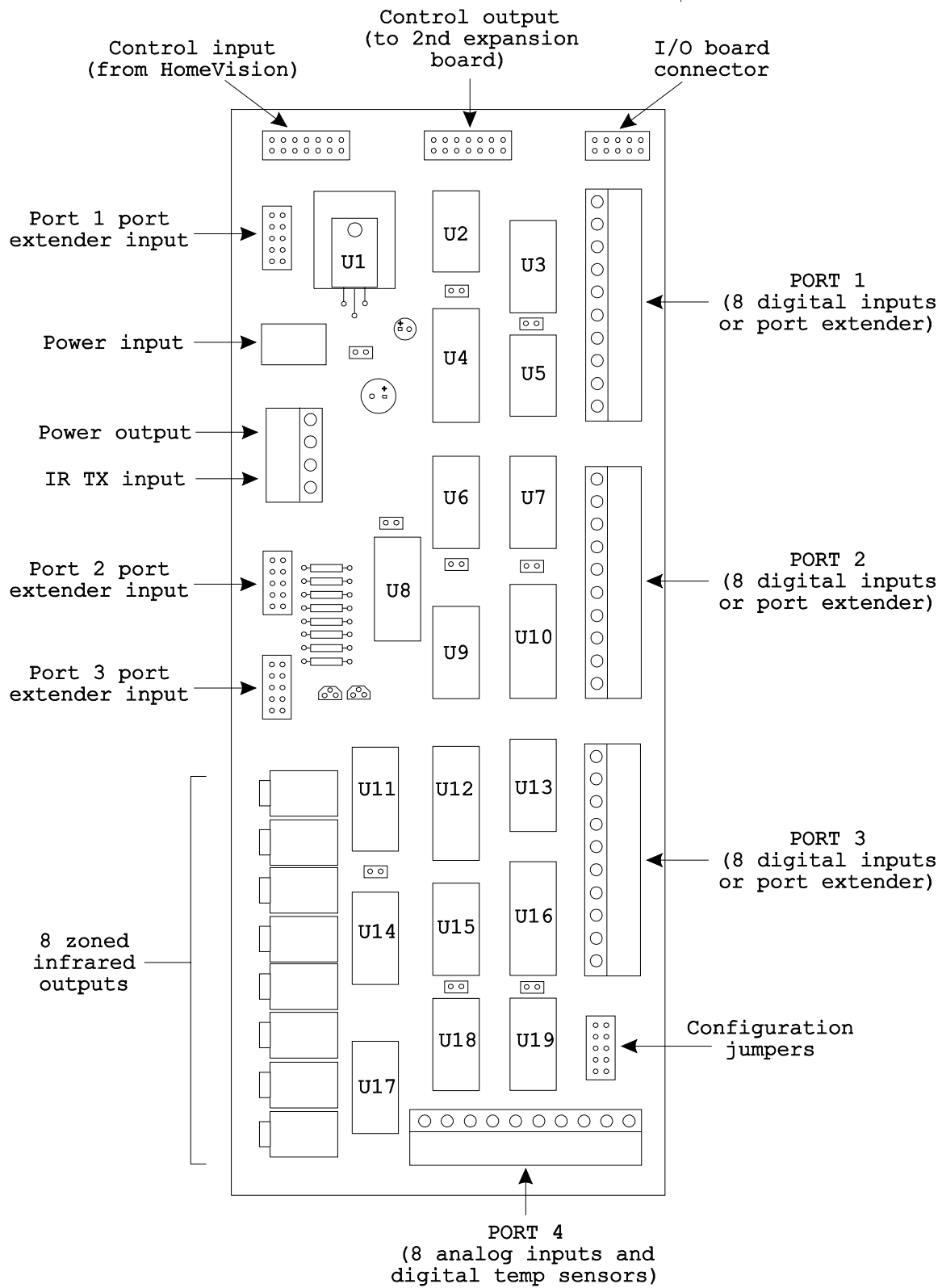


Figure 1 - Multifunction expansion board

Port 4

Port 4 is an analog input port with 8 inputs. It operates from 0 to 5 VDC and provides 8-bit resolution. It provides the same capabilities as the HomeVision-Pro analog inputs.

When an analog input is read, the voltage is converted into a value between 0 and 255 (00h to FFh). This gives a resolution of 19.61mV ($5V \div 255$ steps). To determine the actual voltage from the value read in, multiply the value by 0.01961V. To determine the value that corresponds to a particular input voltage, multiply the voltage by 51 (the reciprocal of 0.01961). The table below shows several input voltages and how they will be read:

| Voltage | Value Read |
|---------|------------|
| 0.000 | 0 |
| 0.020 | 1 |
| 0.040 | 2 |
| 1.000 | 51 |
| 2.500 | 128 |
| 4.980 | 254 |
| 5.000 | 255 |

Zoned Infrared Outputs (IR1 through IR8)

The expansion board connects directly to the HomeVision IR TX jack and provides eight zones of infrared output. The eight 3.5mm jacks can directly drive mini-emitters or connecting blocks. If you don't need IR zoning, you can use these outputs in place of external connecting blocks.

Digital Temperature Sensor Interface

When used with HomeVision, the MFEB board supports digital temperature sensors. Refer to the HomeVision users manual for details on how to use them. When the MFEB is used with HomeVision-Pro, the MFEB digital temperature sensor interface is not used. Instead, HomeVision-Pro connects directly to the sensors – refer to the HomeVision-Pro users manual for details.

I/O Board Connector (H3)

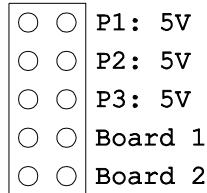
When used with HomeVision, the 10-pin header labeled "I/O Board" can connect to I/O boards made by Sylva Control Systems. Their IO-8O8I board provides 8 relays and 8 opto-isolated inputs. You can connect up to four of these boards to an expansion board (even if you have two expansion boards, you're still limited to four IO-8O8I boards total). Refer to the HomeVision manual for details.

When used with HomeVision-Pro, this header can also connect to the Sylva boards. However, the Sylva boards can also be connected directly to HomeVision-Pro – see the HomeVision-Pro manual for details.

Step 1 - Hardware Setup

Jumper Installation

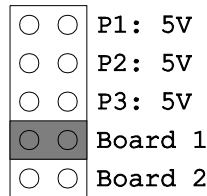
There are five jumpers located on the board in the area labeled "Board Configuration", as shown:



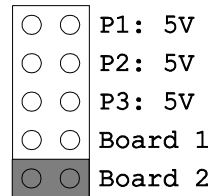
WARNING: Do not insert jumpers on both the "Board 1" and "Board 2" locations simultaneously while power is applied, as this will short power to ground.

- The jumpers labeled "Board 1" and "Board 2" are used to set the board's ID number. If you are using a single expansion board, set it to board 1. If you add a second board, set it to board 2.

To set a board to ID # 1, insert a jumper on the "Board 1" location and leave the "Board 2" jumper empty. This is the default position as the board is shipped from the factory. To set a board to ID # 2, insert a jumper on the "Board 2" location and leave the "Board 1" jumper empty.



Board 1 Setting



Board 2 Setting

- The other three jumpers are used to supply 5 volts to the digital input ports 1, 2, and 3. The ninth location on each port's terminal block is labeled "5V or open". Inserting a jumper applies 5V to the corresponding terminal block. This allows you to power external devices from the terminal block. Removing the jumper leaves the position open (tied to neither 5V nor ground). The settings are summarized in the following table

| Jumper | Affected Terminal Block Position | Voltage When Jumper is in Place | Voltage When Jumper is Removed |
|--------|----------------------------------|---------------------------------|--------------------------------|
| P1: 5V | Port 1, position 9 | 5 volts | Open circuit |
| P2: 5V | Port 2, position 9 | 5 volts | Open circuit |
| P3: 5V | Port 3, position 9 | 5 volts | Open circuit |

Power Connections

WARNING: All connections and jumpers should be in place before applying power to the HomeVision controller or the expansion boards.

The expansion board uses the same power supply as the HomeVision controller. Connect power as follows:

- Using the cable that came with the expansion board, connect the expansion board's power output to HomeVision. The power output is on the 4-position terminal block locations labeled "9-12VDC". The striped wire on the cable goes in the "+" location, and the other wire goes into the "-" location. The other end of the cable is a 2.1mm plug that plugs directly into HomeVision's power jack.
- Plug the power supply that came with HomeVision into the power input jack on the expansion board.
- If you're using two expansion boards, connect them in series, then into HomeVision:
 - 1) Power supply into either expansion board's power jack.
 - 2) From that expansion board's terminal block into the second board's power jack.
 - 3) From the second board's terminal block into the HomeVision power jack.

NOTE: The order of connection does not matter.

Control Connections

HomeVision and HomeVision-Pro control the MFEB using the supplied 14-wire ribbon cable. Connect one end to the 14-pin header labeled "Control Input" on the MFEB. Note the proper orientation of the connectors. Pin 1 on the cable is noted by the red wire. On the MFEB board, the pin 1 end is noted by the white line and the number "1". Connect the other cable end as follows:

- For HomeVision, connect to the 14-pin header (J6) on the HomeVision circuit board. This requires removing the HomeVision cover. The pin 1 end of the connector goes towards the closest edge of the card (nearer the heatsink).
- For HomeVision-Pro, connect to either of the two 14-pin headers labeled "Expansion Headers". The pin 1 end of the connector is noted by the white line and the number "1" on the circuit board.

If you're using two expansion boards, connect HomeVision or HomeVision-Pro to board 1 as described above. Then, connect the two expansion boards together with the other ribbon cable. Connect the cable from the "Control Output" header on board 1 to the "Control Input" header on board 2. Again, note the pin 1 markings on the board and cable.

Infrared Transmit Connections

NOTE: If you're not using the board's IR transmit capability, you do not need to make these connections.

Use the supplied cable to connect the HomeVision infrared transmit output to the expansion board's infrared input. The infrared input is on the 4-position terminal block locations labeled "IR IN". The striped wire on the cable goes in the "+" location, and the other wire goes into the "-" location. The other end of the cable is a 3.5mm plug that plugs directly into HomeVision's IR TX jack.

If you're using two expansion boards, connect HomeVision to one of the boards as described above. Then, connect the two expansion boards together (with the "IR IN +" positions tied together and the "IR IN -" positions tied together). You can use any two-conductor wire for this purpose. You can also cut the 3.5mm plug off of one of the supplied cables and use it.

The eight infrared output jacks can connect to mini-emitters, connecting blocks, or other infrared devices. If you don't need IR zoning, you can still use these outputs. All eight outputs can transmit the same signal, so you can use them in place of external connecting blocks and power supplies if you need multiple outputs.

When using two expansion boards, the IR zones on each board are the same. That is, when zone 1 is active, the signal is transmitted from the zone 1 output of each board.

Analog Input Connections

Connect analog inputs to the eight inputs on port 4. The terminal block also provides 5V and ground connections to power external devices. Whenever possible, power the external devices from here because it improves the signal measurement accuracy.

Digital Input Connections

Connections to the digital input ports (1, 2, and 3) are similar to the HomeVision controller ports. Refer to the HomeVision owner's manual for details.

Make note of the terminal block positions labeled "5V or open". They can provide 5V to power external devices, or can be left open. The selection is made by a jumper, as discussed earlier. There are three jumper positions labeled "P1: 5V", "P2: 5V", and "P3: 5V". When a jumper is inserted, the corresponding terminal block (i.e., port 1, 2, or 3) will be connected to 5V. When the jumper is left off, the position is left open (unconnected). If you need 5V at the terminal block, insert the appropriate jumper.

Using Ports 1, 2, or 3 as Port Extenders

Ports 1, 2, and 3 can independently be used as port extenders for HomeVision ports A, B, or C. **When used for this purpose, a port cannot be used for digital inputs.**

Step 1 - Connect ribbon cable

To use a port as a port extender, connect one of the supplied 10-wire ribbon cables from the desired HomeVision terminal block to one of the expansion board input port headers. The end of the ribbon cable without a connector connects to the HomeVision terminal block. Separate the 10 wires for a distance of 2"-3" using your fingers or pliers. Strip off about 1/4" of insulation from each wire. Connect the 10 wires to the 10 positions of the HomeVision terminal block. The red wire is wire #1 and connects to the first (left) position of the terminal block. The other wires connect in order from left to right.

The other end of the ribbon cable contains a connector. Connect it to the expansion board's 10-pin header for the desired port:

| Expansion port to use as expander | Connect to this 10-pin header |
|-----------------------------------|-------------------------------|
| Port 1 | "Port 1 input" |
| Port 2 | "Port 2 input" |
| Port 3 | "Port 3 input" |

When making this connection, note the correct orientation of the connector. Pin 1 on the connector is noted by the red wire. The pin 1 location on the board is noted by the white line and the number "1".

Step 2 - Remove jumper

When using a port as a port extender, the corresponding terminal block configuration jumper ("P1: 5V", "P2: 5V", or "P3: 5V"), must be removed.

The port 1, 2, and 3 terminal blocks each have a position labeled "5V or open". The voltages on these locations are controlled by the three jumpers labeled "P1: 5V", "P2: 5V", and "P3: 5V". When a jumper is inserted, the corresponding terminal block (i.e., port 1, 2, or 3) will be connected to 5V. When the jumper is left off, the position is left open (unconnected). Make sure this jumper is removed so that line 9 of the corresponding HomeVision terminal block is not tied to the expansion board's 5V supply.

Step 3 - Remove parts

It is also necessary to remove some parts from the expansion board to prevent them from being damaged or affecting the circuit. Refer to figure 1 for the circuit locations.

- When using port 1 as a port extender, remove parts U2, U3, and U5.
- When using port 2 as a port extender, remove parts U7 and U10.
- When using port 3 as a port extender, remove parts U13 and U16.

NOTE: You can leave in the parts on ports 2 and 3 if the applied voltages are always 5V or less.

Step 4 - Connect your inputs/outputs

Once set up as a port extender, the port functions just like the corresponding port on the HomeVision controller. The 10 positions on the expansion board terminal block are directly connected to the 10 positions on the corresponding HomeVision terminal block. Wire to the terminal block just as if you were connecting directly to the HomeVision controller port.

Step 2 - Software Setup

Once you've set up the hardware, you must configure your schedule to work with the expansion board(s).

Configure for Expansion Boards

Select "Expansion Boards" from the "Configure" menu. Check the box(es) to enable 1 (or 2) expansion boards.

You also need to tell HomeVision whether expansion ports 1, 2, and 3 are being used as digital inputs or port extenders. Place a check in the box for each port that you're using for digital inputs. Any ports used as port extenders must be left unchecked.

Infrared Transmit Zones

If you're using the infrared zoning capability, select "IR Transmit Zones" from the "Configure" menu. You can then name any or all of the eight available zones.

Digital Inputs

The expansion board's digital inputs are configured in exactly the same manner as HomeVision input ports B and C. Use the "Input Ports" screen under the "Objects/Events" menu to configure them.

Analog Inputs

To configure the analog inputs, select "Analog Inputs" from the "Objects/Events" menu. For each input you can enter the following:

- Name
- Description
- Gain and Offset Value. These values are used to automatically adjust the analog input voltage value. One major use is to convert the raw value read in (0 to 255) to a more meaningful value (like temperature in degrees F). This often requires multiplication or addition, and can be accomplished with the gain and offset values. If you're sure of how to use these values, simply leave them at their default settings.

HomeVision multiplies the input value (0-255) by the gain, then adds (or subtracts) the offset value. Mathematically:

$$\text{Final value} = (\text{Input Value} \times \text{Gain}) + \text{Offset Value}$$

where:

- The gain can range from 0 to 2.55 in increments of 0.01. The default value is 1.
- The offset voltage can range from +127 to -128. The default value is 0.

Note: If the result of this calculation is greater than 255, it is set to 255. If the result is less than 0, it is set to 0.

Example

Assume:

Gain = 2.00
Offset value = 30
Input voltage = 1V

HomeVision reads the 1V input and converts it to a value of 51 (as described earlier). It then multiplies it by 2 (the gain), giving a value of 102. Finally, it adds the offset of 30, giving the result of 132.

Step 3 - Using the Expansion Board

This section provides some notes on using the expansion board in your schedule.

Infrared Transmit Zones

When HomeVision restarts after a power failure, it defaults to making all eight zones active. Any place in your schedule you want to limit the output to fewer zones, use this infrared command:

Select IR Transmit Zones: #, #, # ...

This command selects (enables) the specified infrared transmit zones. You can select any number of zones (0 to 8). After this command is run, subsequent infrared transmissions from HomeVision will only be output on the selected

zones of the expansion board. Then you can use another "Select IR Transmit Zones" command to change zones again.

NOTE: This command does not affect the infrared transmitter built into the HomeVision controller. It always transmits regardless of which zones are active.

Analog Inputs

To use an analog input in your schedule, use this variable command:

Variable "XXX" = Value of Analog Input ##

This command reads the analog input specified by ## and puts its value in variable "XXX". This is the only command related to the analog inputs. After putting the value into a variable, use any of the other variable commands or conditions to work with it.

Digital Inputs

The expansion board's digital inputs are used in exactly the same manner as HomeVision input ports B and C. Refer to the HomeVision owner's manual for details.

Digital Temperature Sensors

Refer to the HomeVision users manual for information on how to use these sensors.

Error Messages

Software errors will occur if the controller is configured to use an expansion board that is not properly connected. You can check for errors use the status screen under the "Other" menu. The error meanings are provided in the following table.

| Error # | Meaning |
|-----------|---|
| 102 (66h) | Set when presence pulse is missing from digital temp sensor |
| 103 (67h) | Set when digital temp sensor read fails |
| 106 (6Ah) | Expansion board #1, analog input IC U18 not responding |
| 107 (6Bh) | Expansion board #1, analog input IC U19 not responding |
| 108 (6Ch) | Expansion board #2, analog input IC U18 not responding |
| 109 (6Dh) | Expansion board #2, analog input IC U19 not responding |
| 110 (6Eh) | Expansion board #1, zoned IR circuit not responding |
| 111 (6Fh) | Expansion board #2, zoned IR circuit not responding |
| 117 (75h) | An illegal Sylva I/O board number command was encountered in your schedule |
| 118 (76h) | Error reading digital temp sensor (probably a wrong address was defined for it) |
| 119 (77h) | Digital temp sensor read fails |
| 120 (78h) | Digital temp sensor address fails |
| 121 (79h) | Digital temp sensor access fails in multi-drop mode |
| 122 (7Ah) | No digital temp sensors respond |
| 123 (7Bh) | Digital temp sensor data is invalid |