



KE24

PC Keyboard Encoder User Manual



Thank you for purchasing the model KE24 Keyboard Encoder.

HAGSTROM ELECTRONICS, INC.

is pleased that you have selected this product for your application.

The KE24 unit is configurable in a variety of ways in order to meet your specific requirements. Please take a few minutes to read this manual before using your KE24.

In addition to this printed manual, other resources are included with the product CD which provide information and tips on using the KE24 and making the most of it's features.

If you have any questions about the use of the KE24 not covered in this manual, please contact us directly.

Send an email to,

sales@hagstromelectronics.com

We respond to all email requests within one business day.

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Introduction to the KE24

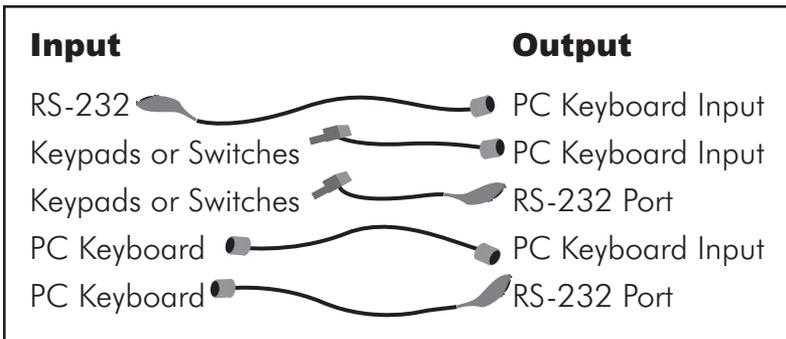
The KE24 Keyboard Encoder is a product designed to interface keypads, switches, or RS-232 to your computer's keyboard input. Additionally, the RS-232 serial communication port may be used in a variety of other ways to create the type of interface that you require.

The KE24 is user programmable. This feature allows you to configure the I/O and select the operating modes for the unit. Nonvolatile memory stores your configuration information.

The KE24 I/O:

The 52 pin header in the KE24 provides 24 I/O signals that can be programmed to scan a matrix or discrete inputs. Any of the 24 I/O pins can be programmed as a Row or Column in a matrix application, or as an individual input. A matrix size from 1x1 to 12x12 can be scanned. I/O pins not assigned as Rows or Columns in a matrix application may be used as discrete inputs. Input from the I/O header may be directed to the PC keyboard input, or to the KE24 RS-232 port.

Modes of KE24 operation:



These modes may be used individually or combined with other modes of operation.

Power:

In applications where the KE24 is attached to the computer's keyboard input, the KE24 gets its power from the computer. If used in other modes, an external 5V power supply is required. See Appendix B for information on connecting an external 5V supply.

Supported Computers:

The KE24 may be used with PCXT, AT, PS/2, 286, 386, 486, Pentium, and compatibles.

Hardware Required:

For programming the KE24 configuration **only**. A serial port (COM1 through COM6) on your PC, and a DB9 serial cable (Male to Female).

Default Settings:

| | |
|---------------------------|---|
| PC Type: | AT |
| Serial Port: | Disabled |
| I/O Header: | Configured as 24 Discrete Inputs. (Connect the input to ground to activate it. Codes directed to the PC keyboard input. Pin "A" emulates the "A" key, input "B" emulates the "B" key, etc.) |
| External Keyboard: | Directed to the PC keyboard input. |

Interfacing to the KE24 I/O Header

The 52 pin header on the KE24 consists of 24 I/O points with ground connections on either end. Each pin of the dual row header is connected in parallel with its adjacent pin. Therefore, each I/O signal is available on two different pins.

Each of the 24 I/O pins may be configured by the KE24Load program. Pins may be independently configured to be either Rows or Columns in a matrix scanning application, or discrete inputs. Activation of an input in a matrix mode requires that a row and column be shorted together to produce a keystroke. Discrete inputs are activated by shorting the desired input to the ground signal located on either end of the dual row header.

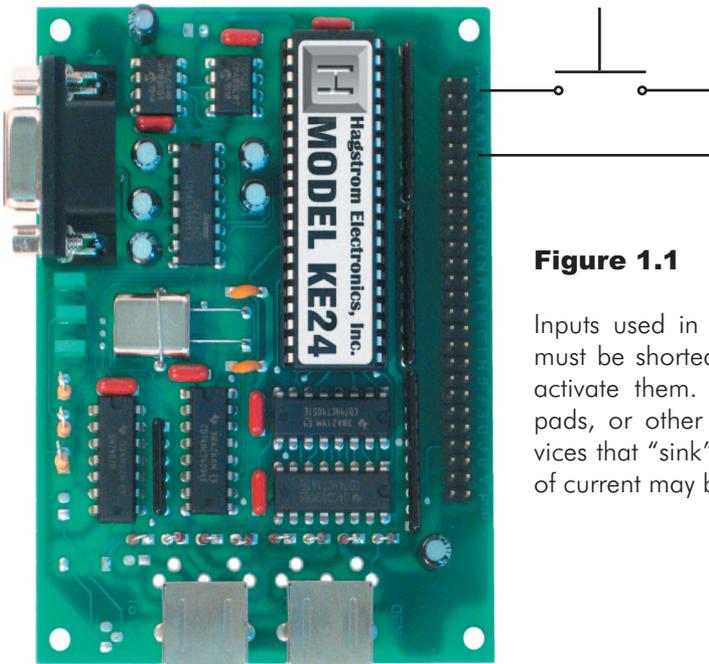


Figure 1.1

Inputs used in discrete mode must be shorted to ground to activate them. Switches, key-pads, or other electronic devices that “sink” at least 1 ma of current may be used.

Figure 1.1 demonstrates how to activate an input that has been programmed to be a discrete input. Although a switch is shown in this diagram, other devices may be used in this mode to

activate the input. Devices such as open collector drivers or any device capable of sinking at least 1 ma can be used to drive discrete inputs. Never connect any signals that exceed the 5 Volt operational voltage of the KE24.

Figure 1.2 is an example of connecting an input to the KE24

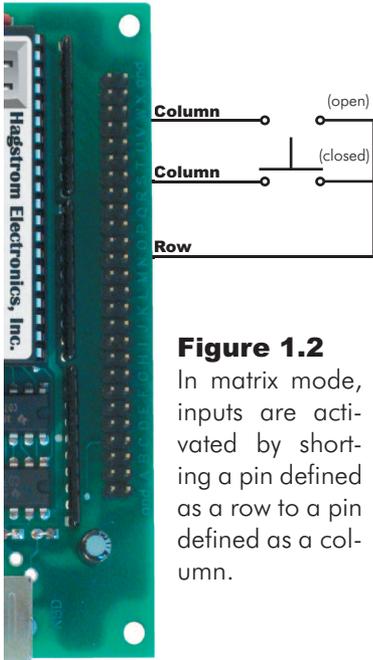


Figure 1.2
In matrix mode, inputs are activated by shorting a pin defined as a row to a pin defined as a column.

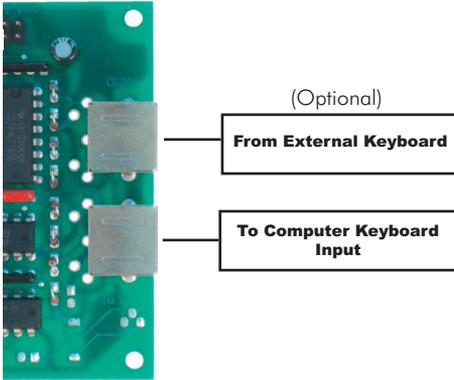
when the I/O pins have been configured for matrix operation. One I/O pin defined as column is shorted to one I/O pin defined as a row. In this mode, the switch or input device must be capable of carrying at least 1 ma. Typically, the device used for activating inputs in this mode are keypads or switches, but other electronic circuits may be used, provided they do not exceed the 5 volt range of the KE24 I/O. Pins defined as Rows in this mode sink current while scanning, and the Columns are used to read the status of the inputs when a column is active.

There are two DIN type connectors located on your KE24. Although the connectors are physically alike, they have different functions.

The connector marked "To PC" is for interface of the KE24 to the computer's keyboard input. Insert one end of the 5 pin DIN (male to male) shielded cable into this port. Connect the other end of the cable into your computer's keyboard input. Always perform this connection with the computer's power off.

The connector marked "KBD" is for using an external keyboard

with the KE24. Plug the end of your keyboard cable into this port



to use it in addition to the KE24. Use of the external keyboard is optional, you do not need to have a keyboard plugged into this port for the KE24 to operate.

Since the KE24 supplies the computer with all the appropriate keyboard signals, you may operate with just the KE24 attached to the computer, or both the KE24 and an external keyboard.

Use of the external keyboard is usually beneficial when developing KE24 applications.

Note: *If you plug the computer into the incorrect port on the KE24, you will receive an error message on your computer. If this happens, turn off the computer and correct the connection.*

The serial port on your KE24 may be used for input and output in several different modes.

- Data received may be sent to the computer's keyboard input.
- Keypads and switches connected to the KE24 I/O header may be programmed to produce serial output codes (codes defined by the user).
- Keystrokes from an external PC keyboard can be directed to the serial port instead of the computer.

The serial port uses an 8 bit, no parity, 1 stop bit protocol. The Baud rate is programmable through the KE24Load program.

Serial Data to PC Keyboard Input

When serial information is received on the KE24 RS-232 port, it may be translated in one of two user selectable manners.

One method allows for receiving ASCII characters on the serial port. Characters are translated into PC keyboard signals and sent directly to the computer. Although this method provides a simple interface, it does not allow for full keyboard functions, or multiple keystroke commands such as Ctr/Alt, etc.

The second method receives codes from 1 to 127, which each correspond to a key on the PC keyboard. The KE24 translates these codes into PC keyboard signals. In addition, each code sent has a “make” and a “break” value for the key. Reception of a “make” code on the serial port produces a signal into the computer that is the equivalent of pressing that key on a keyboard and holding it down (without repeat). In order to simulate the release of that key, you must send a “break” code for the same key. Several “make” codes can be transmitted before their corresponding “break” codes, which allows for emulation of key sequences such as Shift+F1, Ctrl+L, etc.



Connecting the KE24 to a PC

When programmed to receive ASCII characters on the serial port, these are the codes allowed and the keystrokes emulated by that particular code.

ASCII Translation Table

| Value | | Character |
|-------|-----|-----------|-------|-----|-----------|-------|-----|-----------|-------|-----|-----------|
| Dec | Hex | |
| 00 | 00 | none | 32 | 20 | Space | 64 | 40 | @ | 96 | 60 | ` |
| 01 | 01 | none | 33 | 21 | ! | 65 | 41 | A | 97 | 61 | a |
| 02 | 02 | none | 34 | 22 | " | 66 | 42 | B | 98 | 62 | b |
| 03 | 03 | none | 35 | 23 | # | 67 | 43 | C | 99 | 63 | c |
| 04 | 04 | none | 36 | 24 | \$ | 68 | 44 | D | 100 | 64 | d |
| 05 | 05 | none | 37 | 25 | % | 69 | 45 | E | 101 | 65 | e |
| 06 | 06 | none | 38 | 26 | & | 70 | 46 | F | 102 | 66 | f |
| 07 | 07 | none | 39 | 27 | ' | 71 | 47 | G | 103 | 67 | g |
| 08 | 08 | Backspace | 40 | 28 | (| 72 | 48 | H | 104 | 68 | h |
| 09 | 09 | Tab | 41 | 29 |) | 73 | 49 | I | 105 | 69 | i |
| 10 | 0A | none | 42 | 2A | * | 74 | 4A | J | 106 | 6A | j |
| 11 | 0B | none | 43 | 2B | + | 75 | 4B | K | 107 | 6B | k |
| 12 | 0C | none | 44 | 2C | , | 76 | 4C | L | 108 | 6C | l |
| 13 | 0D | Return | 45 | 2D | - | 77 | 4D | M | 109 | 6D | m |
| 14 | 0E | F11 | 46 | 2E | . | 78 | 4E | N | 110 | 6E | n |
| 15 | 0F | F12 | 47 | 2F | / | 79 | 4F | O | 111 | 6F | o |
| 16 | 10 | none | 48 | 30 | 0 | 80 | 50 | P | 112 | 70 | p |
| 17 | 11 | F1 | 49 | 31 | 1 | 81 | 51 | Q | 113 | 71 | q |
| 18 | 12 | F2 | 50 | 32 | 2 | 82 | 52 | R | 114 | 72 | r |
| 19 | 13 | F3 | 51 | 33 | 3 | 83 | 53 | S | 115 | 73 | s |
| 20 | 14 | F4 | 52 | 34 | 4 | 84 | 54 | T | 116 | 74 | t |
| 21 | 15 | F5 | 53 | 35 | 5 | 85 | 55 | U | 117 | 75 | u |
| 22 | 16 | F6 | 54 | 36 | 6 | 86 | 56 | V | 118 | 76 | v |
| 23 | 17 | F7 | 55 | 37 | 7 | 87 | 57 | W | 119 | 77 | w |
| 24 | 18 | F8 | 56 | 38 | 8 | 88 | 58 | X | 120 | 78 | x |
| 25 | 19 | F9 | 57 | 39 | 9 | 89 | 59 | Y | 121 | 79 | y |
| 26 | 1A | F10 | 58 | 3A | : | 90 | 5A | Z | 122 | 7A | z |
| 27 | 1B | Esc | 59 | 3B | ; | 91 | 5B | [| 123 | 7B | { |
| 28 | 1C | none | 60 | 3C | < | 92 | 5C | \ | 124 | 7C | |
| 29 | 1D | none | 61 | 3D | = | 93 | 5D |] | 125 | 7D | } |
| 30 | 1E | none | 62 | 3E | > | 94 | 5E | ^ | 126 | 7E | ~ |
| 31 | 1F | none | 63 | 3F | ? | 95 | 5F | - | 127 | 7F | none |

When a code has been sent to the KE24 serial port, the sending unit must wait for a response from the KE24 before transmission of the next code. This acknowledge response is a "!" character transmitted by the KE24. Once this response has been received, the next code may be sent to the KE24 serial port.

Key Number Translation Table - When programmed to receive key numbers on the serial port, these are the keys emulated for each individual key number.

| Key | Make | Break |
|------|------|-------|
| `~ | 01 | 129 |
| ! | 02 | 130 |
| 2@ | 03 | 131 |
| 3# | 04 | 132 |
| 4\$ | 05 | 133 |
| 5% | 06 | 134 |
| 6^ | 07 | 135 |
| 7& | 08 | 136 |
| 8* | 09 | 137 |
| 9(| 10 | 138 |
| 0) | 11 | 139 |
| -_ | 12 | 140 |
| =+ | 13 | 141 |
| BS | 15 | 143 |
| Tab | 16 | 144 |
| Q | 17 | 145 |
| W | 18 | 146 |
| E | 19 | 147 |
| R | 20 | 148 |
| T | 21 | 149 |
| Y | 22 | 150 |
| U | 23 | 151 |
| I | 24 | 152 |
| O | 25 | 153 |
| P | 26 | 154 |
| [{ | 27 | 155 |
|]} | 28 | 156 |
| \ | 29 | 157 |
| Caps | 30 | 158 |
| A | 31 | 159 |
| S | 32 | 160 |
| D | 33 | 161 |
| F | 34 | 162 |
| G | 35 | 163 |
| H | 36 | 164 |

| Key | Make | Break |
|----------|------|-------|
| J | 37 | 165 |
| K | 38 | 166 |
| L | 39 | 167 |
| :: | 40 | 168 |
| "" | 41 | 169 |
| Enter | 43 | 171 |
| L Shift | 44 | 172 |
| Z | 46 | 174 |
| X | 47 | 175 |
| C | 48 | 176 |
| V | 49 | 177 |
| B | 50 | 178 |
| N | 51 | 179 |
| M | 52 | 180 |
| ,< | 53 | 181 |
| .> | 54 | 182 |
| /? | 55 | 183 |
| R Shift | 57 | 185 |
| L Ctrl | 58 | 186 |
| L Alt | 60 | 188 |
| Space | 61 | 189 |
| R Alt | 62 | 190 |
| R Ctrl | 64 | 192 |
| L Win | 70 | 198 |
| R Win | 71 | 199 |
| Win APL | 72 | 200 |
| Insert | 75 | 203 |
| Delete | 76 | 204 |
| L Arrow | 79 | 207 |
| Home | 80 | 208 |
| End | 81 | 209 |
| Up Arrow | 83 | 211 |
| Dn Arrow | 84 | 212 |
| Page Up | 85 | 213 |
| Page Dn | 86 | 214 |

| Key | Make | Break |
|-------------|------|-------|
| R Arrow | 89 | 217 |
| NumLock | 90 | 218 |
| 7 (Num) | 91 | 219 |
| 4 (Num) | 92 | 220 |
| 1 (Num) | 93 | 221 |
| / (Num) | 95 | 223 |
| 8 (Num) | 96 | 224 |
| 5 (Num) | 97 | 225 |
| 2 (Num) | 98 | 226 |
| 0 (Num) | 99 | 227 |
| + (Num) | 100 | 228 |
| 9 (Num) | 101 | 229 |
| 6 (Num) | 102 | 230 |
| 3 (Num) | 103 | 231 |
| - (Num) | 104 | 232 |
| = (Num) | 105 | 233 |
| + (Num) | 106 | 234 |
| Enter (Num) | 108 | 236 |
| Esc | 110 | 238 |
| F1 | 112 | 240 |
| F2 | 113 | 241 |
| F3 | 114 | 242 |
| F4 | 115 | 243 |
| F5 | 116 | 244 |
| F6 | 117 | 245 |
| F7 | 118 | 246 |
| F8 | 119 | 247 |
| F9 | 120 | 248 |
| F10 | 121 | 249 |
| F11 | 122 | 250 |
| F12 | 123 | 251 |
| Prt Scr | 124 | 252 |
| Scrl Lk | 125 | 253 |
| Pause/Break | 126 | 254 |

As in the ASCII mode, the sending unit must wait for a response from the KE24 after the transmission of each code. This acknowledge response is a "!" character transmitted by the KE24 and signifies that the KE24 can receive more data.

PC Keyboard to Serial Port (key #)

When the KE24 is programmed to direct the external PC keyboard data to the serial port, the codes in the table below are sent. When the key on the keyboard is pressed, the corresponding “make” code is sent. If programmed to send a “break” code, the KE24 transmits the same code plus 128 (decimal) when the key is released.

| Key | Make | Break |
|------|------|-------|
| `~ | 01 | 129 |
| ! | 02 | 130 |
| 2@ | 03 | 131 |
| 3# | 04 | 132 |
| 4\$ | 05 | 133 |
| 5% | 06 | 134 |
| 6^ | 07 | 135 |
| 7& | 08 | 136 |
| 8* | 09 | 137 |
| 9(| 10 | 138 |
| 0) | 11 | 139 |
| -_ | 12 | 140 |
| =+ | 13 | 141 |
| BS | 15 | 143 |
| Tab | 16 | 144 |
| Q | 17 | 145 |
| W | 18 | 146 |
| E | 19 | 147 |
| R | 20 | 148 |
| T | 21 | 149 |
| Y | 22 | 150 |
| U | 23 | 151 |
| I | 24 | 152 |
| O | 25 | 153 |
| P | 26 | 154 |
| [{ | 27 | 155 |
|]} | 28 | 156 |
| \ | 29 | 157 |
| Caps | 30 | 158 |
| A | 31 | 159 |
| S | 32 | 160 |
| D | 33 | 161 |
| F | 34 | 162 |
| G | 35 | 163 |
| H | 36 | 164 |

| Key | Make | Break |
|----------|------|-------|
| J | 37 | 165 |
| K | 38 | 166 |
| L | 39 | 167 |
| :: | 40 | 168 |
| "/ | 41 | 169 |
| Enter | 43 | 171 |
| L Shift | 44 | 172 |
| Z | 46 | 174 |
| X | 47 | 175 |
| C | 48 | 176 |
| V | 49 | 177 |
| B | 50 | 178 |
| N | 51 | 179 |
| M | 52 | 180 |
| ,< | 53 | 181 |
| .> | 54 | 182 |
| /? | 55 | 183 |
| R Shift | 57 | 185 |
| L Ctrl | 58 | 186 |
| L Alt | 60 | 188 |
| Space | 61 | 189 |
| R Alt | 62 | 190 |
| R Ctrl | 64 | 192 |
| L Win | 70 | 198 |
| R Win | 71 | 199 |
| Win APL | 72 | 200 |
| Insert | 75 | 203 |
| Delete | 76 | 204 |
| L Arrow | 79 | 207 |
| Home | 80 | 208 |
| End | 81 | 209 |
| Up Arrow | 83 | 211 |
| Dn Arrow | 84 | 212 |
| Page Up | 85 | 213 |
| Page Dn | 86 | 214 |

| Key | Make | Break |
|-------------|------|-------|
| R Arrow | 89 | 217 |
| NumLock | 90 | 218 |
| 7 (Num) | 91 | 219 |
| 4 (Num) | 92 | 220 |
| 1 (Num) | 93 | 221 |
| / (Num) | 95 | 223 |
| 8 (Num) | 96 | 224 |
| 5 (Num) | 97 | 225 |
| 2 (Num) | 98 | 226 |
| 0 (Num) | 99 | 227 |
| * (Num) | 100 | 228 |
| 9 (Num) | 101 | 229 |
| 6 (Num) | 102 | 230 |
| 3 (Num) | 103 | 231 |
| . (Num) | 104 | 232 |
| - (Num) | 105 | 233 |
| + (Num) | 106 | 234 |
| Enter (Num) | 108 | 236 |
| Esc | 110 | 238 |
| F1 | 112 | 240 |
| F2 | 113 | 241 |
| F3 | 114 | 242 |
| F4 | 115 | 243 |
| F5 | 116 | 244 |
| F6 | 117 | 245 |
| F7 | 118 | 246 |
| F8 | 119 | 247 |
| F9 | 120 | 248 |
| F10 | 121 | 249 |
| F11 | 122 | 250 |
| F12 | 123 | 251 |
| Prt Scr | 124 | 252 |
| Scr Lk | 125 | 253 |
| Pause/Break | 126 | 254 |

Note: Keyboard information cannot be sent to the RS-232 port if you are using an XT type keyboard. Only AT type keyboards may be used in this mode.

PC Keyboard to Serial Port (ASCII)

The KE24 may be programmed to send data from the PC keyboard to the KE24 serial port in ASCII representation.

If programmed to send the key data from the PC keyboard in ASCII, the corresponding ASCII code is transmitted by the KE24 for each press of a key. If a “break” code is selected to be sent when the key is released, the same ASCII code is preceded by a hex “F0”.

KE24 I/O Data to Serial Port

The KE24 may be programmed to send data from keypads or switches connected to the I/O header. When detected, the user programmed code is transmitted when the input is “made.”

In addition to the “make” code for the input, the KE24 may be programmed in this mode to send a “break” code when the key is released. If selected, a “break” code consisting of “F0” hex preceding the “make” code for that key is transmitted when the input is released.

Use the KE24Load configuration program to specify the codes to be transmitted for the various key positions. The serial characters are always 8 bit, no Parity, and 1 stop bit. The Baud rate may be programmed in increments from 300 to 19200 baud.

Note: *When using the KE24 in modes where no connection to a PC is required (keyboard to RS-232 or I/O header to RS-232), you must supply 5 Volts to the unit. Refer to Appendix B for details of this connection.*

The KE24Load Program

The disk shipped with your unit contains the program "KE24Load" for configuring the KE24. The program may be run from your diskette drive, but copying the program to its own directory on a hard drive is recommended.

Through use of this program, the user may set the number of Rows and Columns to be scanned, response keystrokes for each input, and other various options.

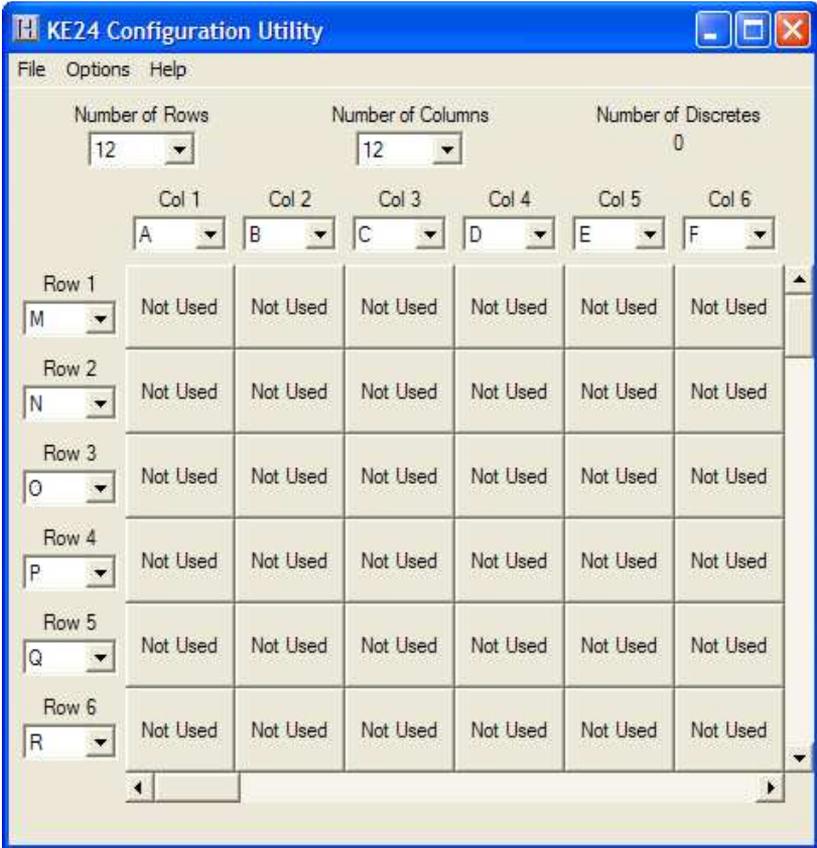
The normal course of events for configuring your KE24:

1. Start the configuration program by typing KE24Load.
2. Choose the matrix and discrete input configuration to be used, and assign the pins according to the functions (Row, Column, Discrete Input) that you want them to have.
3. Program the Options for direction of the port data, baud rate, etc (refer to page 17).
4. Edit matrix tables and your discrete input tables. Program each input to emulate the keys you have selected for your application.
5. Save your configuration to disk.
6. Download the configuration to the KE24.

The KE24 configuration is re-programmable, so you may experiment and change your configuration as required. After being programmed, the KE24 will run according to that configuration each time it is powered up.

In certain situations a programming jumper is needed to program the KE24. See appendix C: Placing KE24 in PROGRAM Mode.

The Program Screen



The KE24Load program allows the user to create a configuration for the KE24. The following is a list of the selections and how they pertain to the KE24 setup. Use your mouse to change the various options.

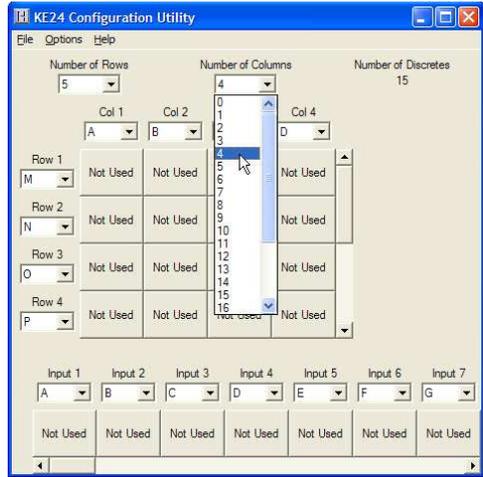
Number of Rows

If your application is using a matrix, program the number of rows in the highlighted area. This number may be from 0 to 23. Use 0 if all of the KE24 inputs are to be used as discrete (individual) inputs.

Number of Columns

For use of a matrix, program the number of columns in the highlighted area. This number may be from 0 to 23. Use 0 if all of the KE24 inputs are to be used as discrete (individual) inputs.

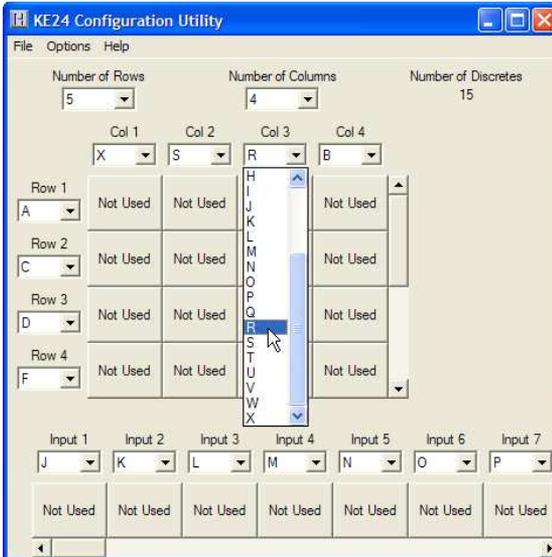
Note: *The total number of Rows and Columns may not be more than 24.*



Number of Discretes

This number is the total number of individual inputs available in your configuration. Pins not used as rows or columns may be used as discrete inputs. This number is determined by the Row and Column numbers and cannot be entered directly.

Column Assignments



For each Column in your application, you must assign an I/O pin from the KE24 to that Column. You may specify any pin (A-X) as a Column.

Note: *Take care not to assign the same pin to two different Rows, Columns, Inputs, or combination of these, as this will cause an error. Each pin may only be assigned once.*

Row Assignments

For each Row in your application, you must assign an I/O pin from the KE24. You may specify any header pin (A-X) as a Row.

Note: Take care not to assign the same pin to two different Rows, Columns, Inputs, or combination of these, as this will cause an error. Each pin may only be assigned once.

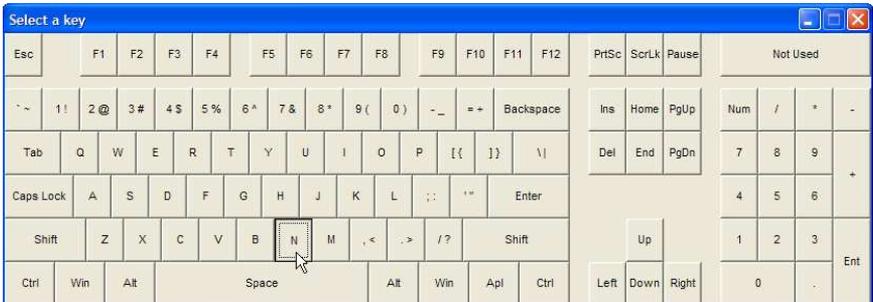
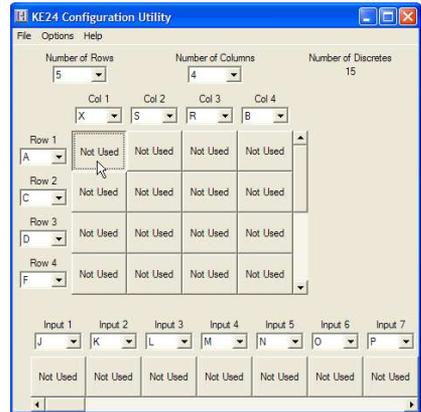
Input Assignments

For each Input in your application, you must assign an I/O pin from the KE24. You may specify any header pin (A-X) as an Input.

Note: Take care not to assign the same pin to two different Rows, Columns, Inputs, or combination of these, as this will cause an error. Each pin may only be assigned once.

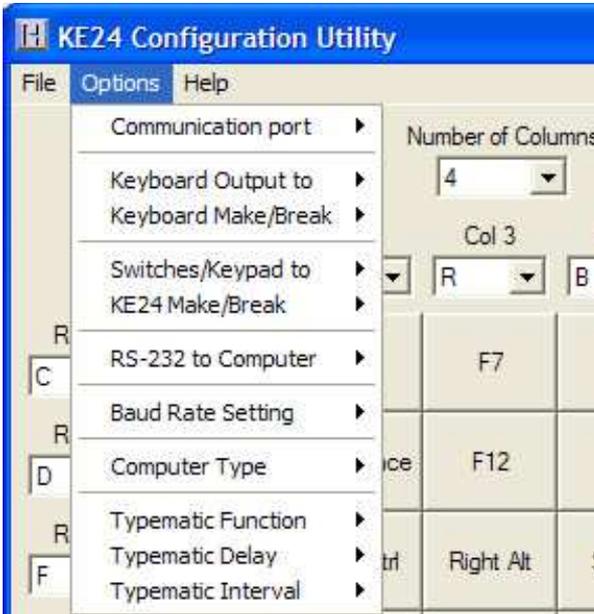
Key Assignment

To assign a key, click on the appropriate matrix or discrete input position. This will bring up a representation of a keyboard. Click on the key you wish to assign. To create a macro, Ctrl+Click on the input position to which you would like to assign the macro. For more information, see the section on programming macros.



Options

Click the Options header on the menu bar to change options.



Communication Port

Change this option to select the port that will be used to program the KE24. Configurations may be loaded through the keyboard port or the serial port (COM1 through COM6). It is highly recommended to use the Keyboard port to program the KE24.

Keyboard Output To:

This option controls where input from an external keyboard connected to the KE24 sends its data. If set to COMPUTER, the data from the external keyboard is sent to the PC. (This allows the full use of the keyboard with the PC.) If set to RS-232 port as ASCII, the data from the external keyboard is sent to the RS-232 port as ASCII data (see table in the serial port section). This option may also be set to RS-232 Key #, which sends a key number to the serial port which corresponds to the key pressed (see table in the serial port section).

Keyboard Make/Break:

The standard PC keyboard sends a "Make" code when a key is pressed, and a "Break" code when a key is released. When the external keyboard data is being directed to the PC, this setting must be "Make/Break," meaning both "Make" and "Break" codes are sent to the PC.

If the external keyboard data is being sent to the serial port, in either ASCII mode or Key # mode, this option may be changed. If programmed to be "Make/Break," the KE24 will send the corresponding code to the serial port when the key is "made," and the same code + 128 decimal when the key is released. (See the section on the KE24 serial port.)

Switches/Keypad To:

This option controls where input from devices connected to the KE24 I/O header will be output. If set to COMPUTER, the programmed response codes will be sent to the PC. If set to RS-232, the codes will be sent to the KE24 serial port.

KE24 Make/Break:

The response from KE24 inputs will send a "Make" code when the input is first "made," then a "Break" code when the input is released, when sending the data to the PC. If the data is being directed to the serial port on the KE24, this setting may be either "Make" or "Make/Break." If "Make" is selected, the KE24 will send the response code which you have programmed for that input when the input becomes active. No response will be sent when the input is released.

If "Make/Break" is selected, the programmed code will be sent to the KE24 serial port when the input is "made." When the input is released, the KE24 will send a hex "F0" code followed by the same "make" code for that key, indicating it has been released.

RS-232 to Computer:

This option may be programmed to one of three settings. If set to "Disabled," data received on the RS-232 port is ignored.

When selected as "ASCII Input," characters received on the serial port are sent to the PC as the corresponding ASCII character. See the section on the KE24 serial port for a list of valid ASCII codes in this mode.

The "Key # Input" setting allows the reception of characters on the RS-232 port which correspond to any key from the standard 101 key keyboard. See the section on the KE24 serial port for the key numbers to send for emulating the various keyboard buttons. In this mode, the user must send a code for the "Make" of the key, as well as the "Break" code. This method allows for the creation of multiple keystrokes such as "Ctrl"+"F1."

Baud Rate Setting:

Program the Baud rate to be used for the KE24 serial port communication. Rates from 300 to 19,200 are available. The KE24 uses 8 Bit characters, No Parity, and 1 Stop Bit.

Computer Type:

Set the type of computer that you will be using with the KE24. Select XT for 8088 based machines and XT compatibles. Choose AT for 286, 386, 486, Pentium, and PS/2 applications.

Typematic Function:

Enable or Disable the repeat function of devices connected to the KE24 I/O header. If enabled, the KE24 will begin to repeat a key based on the Delay and Interval settings when an input is held "active." If disabled, the key will never repeat. This setting pertains to the KE24 I/O header interface, and not to the use of an External Keyboard.

Typematic Delay:

This value is the time between when a key is first pressed and when it begins to repeat (if repeat is enabled). This parameter pertains to devices connected to the KE24 I/O header, and not the external keyboard.

Typematic Interval:

This value is the rate at which characters are sent once a key has begun to repeat. This parameter pertains to devices connected to the KE24 I/O header, and not the external keyboard.

Note: *The typematic settings programmed here are the values that the KE24 will use upon power up. A computer program can change these settings at power up or during execution of an application. Consult your computer or software manual information regarding the change of typematic rates.*

New

To create a new configuration, go to the File menu and select New. This will return the configuration to its default settings.

Open

Choose this selection to open a configuration file previously saved on your computer.

Save

Use this selection to save the configuration to a file on your computer.

Read from KE24

With a KE24 unit connected to the selected port you may upload the unit's current configuration. This function is available in the File menu. Make sure that the unit is connected to the correct port before entering this selection.

Write to KE24

Once you have created your configuration, you may choose this selection from the File menu to load the configuration to the KE24. Be sure to have the correct port selected. To select the port click the Options header on the menu and then select the communication port. Programming via the keyboard port avoids the requirement for a serial cable and is recommended.

Programming Macros

The KE24 supports Macros for the inputs connected to the I/O header. A single input from either a matrix or discrete input configuration may be programmed to send a series of keystrokes to the computer.

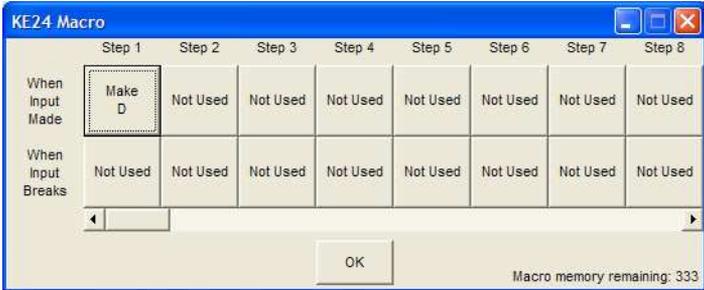
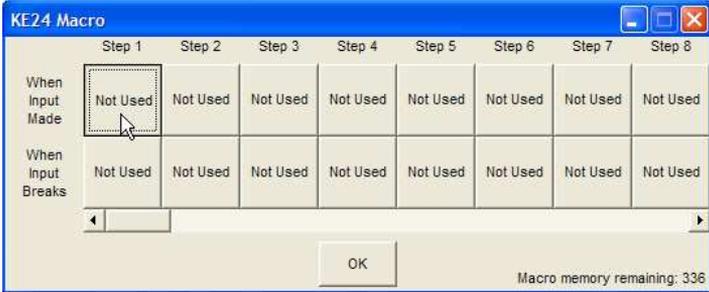
In order to understand how to correctly create a Macro, you should first understand how the PC keyboard sends its information to the PC.

When you press a key on your computer keyboard, the keyboard sends a "Make" code as soon as it sees the key pressed. When the key is released, the keyboard sends a "Break" code to the computer to let it know that the key has been released.

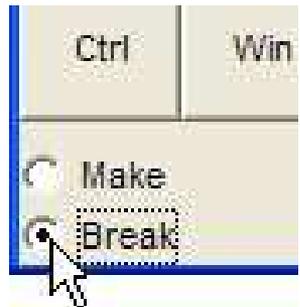
When programming Macros, you create a series of these "Make" and "Break" codes to create the desired sequence. It is important that for each "Make" code programmed, there is a corresponding "Break" code transmitted at a later time. Macros that leave keys "Made" could cause the computer to misunderstand further keystrokes.

When editing the Matrix or Discrete Input Table, a macro may be created by Ctrl+clicking on a cell in the table. The macro dialog will then appear for that input. Click on a cell in the macro dialog

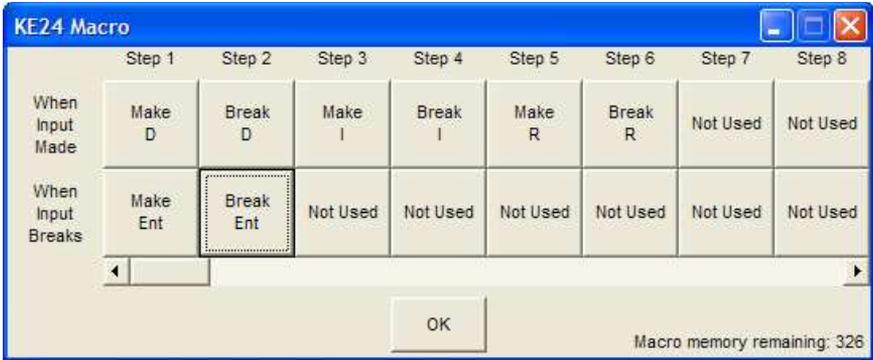
to assign a key using the keyboard representation, as shown below.



The Macro dialog has two areas, the MAKE section and the BREAK section. The MAKE section contains the keystrokes that you want to KE24 to send when the input becomes active. The BREAK section contains the keystrokes to be sent when that input is released. Although keys in the MAKE and BREAK sections default to



“Make” and “Break” codes respectively, this may be changed by selecting the desired setting in the lower left corner of the keyboard representation.

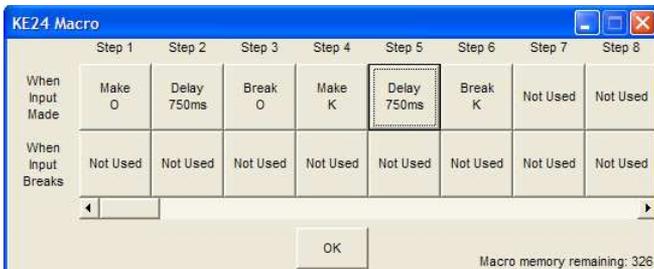


You do not need to send a response for both MAKE and BREAK sections. For example, if you want the KE24 to send an “A” keystroke to the computer when your input is released, program a “Make” code for that key in the first section step 4 under the BREAK area, and the “Break code for the key in the second BREAK section.

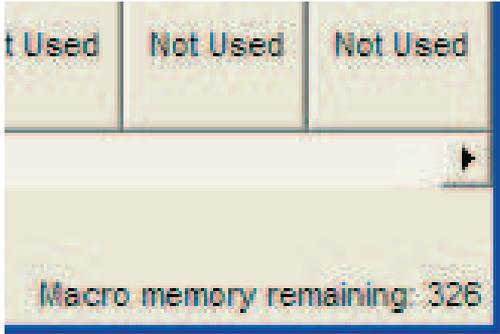


To create a delay between steps in a macro, click on an unused step in the macro dialog, then click DELAY at the bottom of the keyboard representation.

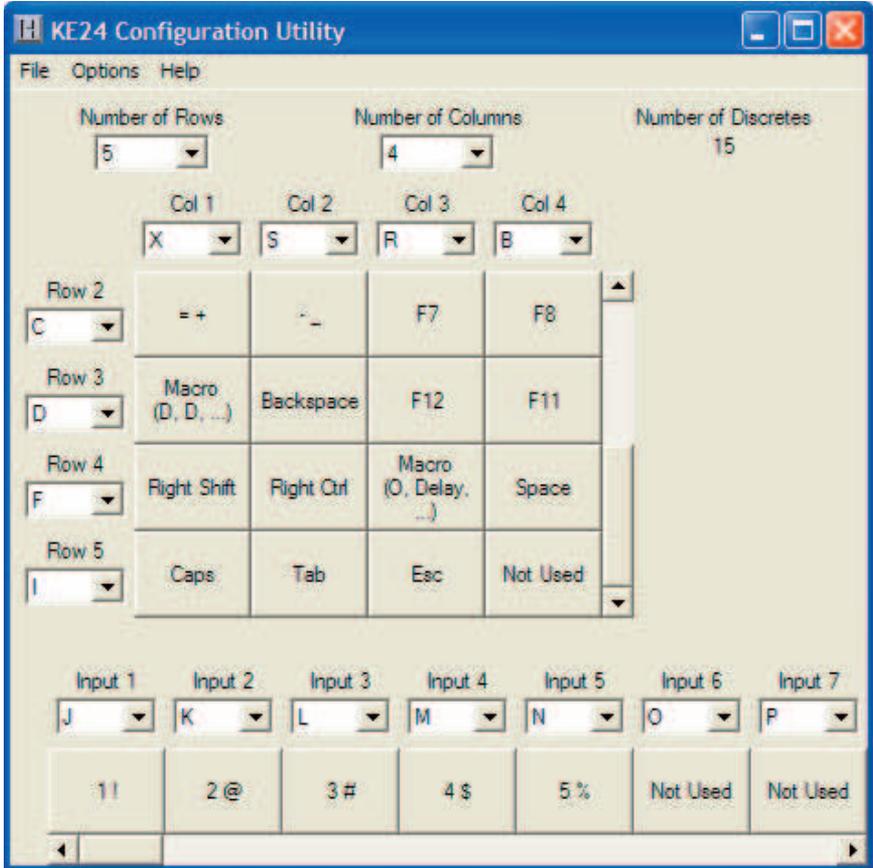
Enter the desired delay time in the window that appears. Delay times may be set in 10 msec increments from 10 to 2550 msec.



The lower right corner of the screen displays the amount of Macro memory available. Each keystroke occupies one position in the Macro memory. When the Macro memory is full, you may not create any more Macros.

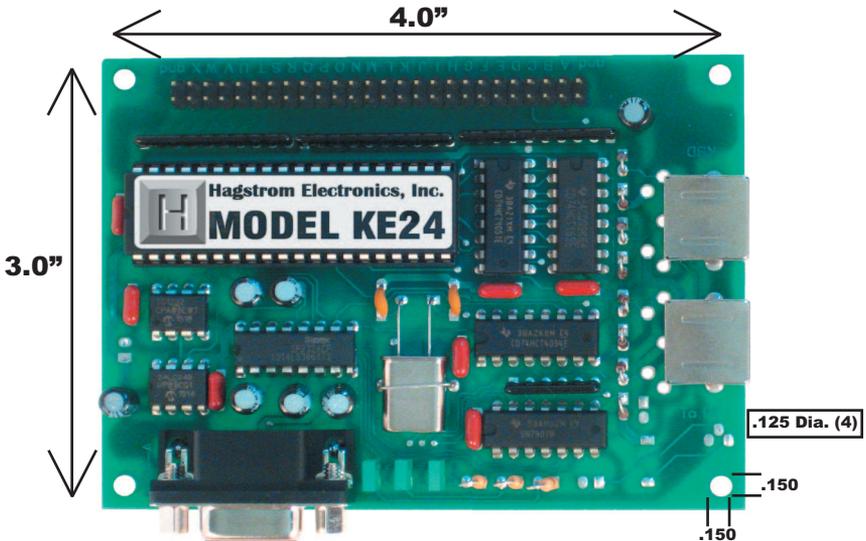


Below is an example of a completed matrix and set of inputs.



Appendix A: KE24 Specifications

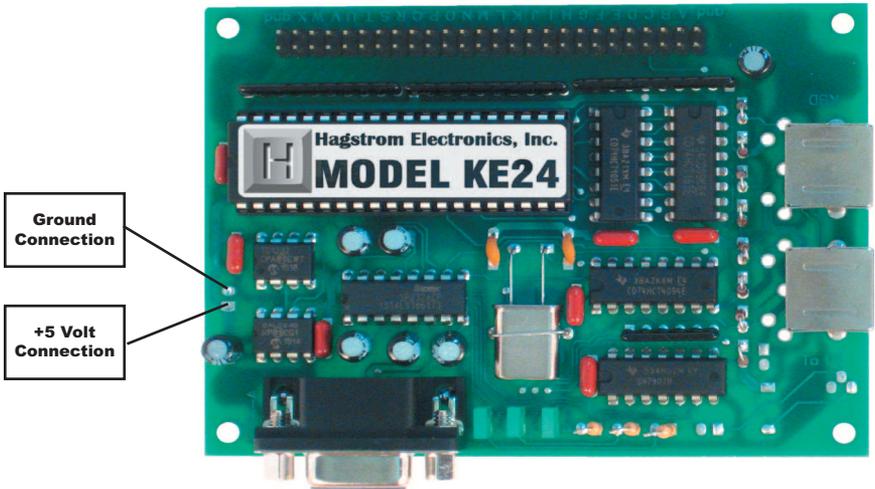
| | |
|---------------------------|---|
| Operating Voltage | 5 Volts DC +/- 5% |
| Operating Current | 65 ma Typical |
| Operating Temp. | 0 to 70 degrees C |
| PC Interface | XT or AT PC Compatible (5 pin DIN) |
| Keyboard Interface | XT or AT Compatible (5 pin DIN) |
| Serial Port | RS-232, 300 Baud to 19,200 (8, N, 1) |
| I/O Header | 24 I/O, up to 12x12 Matrix (programmable) |
| Req. Input Current | 1 ma of sink current in for discrete inputs |



Note: Maximum Height = .91

Appendix B: Connection of an External 5 Volt Supply

When using the KE24 in an application that does not require connection to a PC (such as an RS-232 keypad interface), an external 5 volt power supply must be used. The KE24 has a connection point that is dedicated for this purpose.



Two solder points are supplied for attaching external wires or a connector to the KE24 to supply the 5 volts.

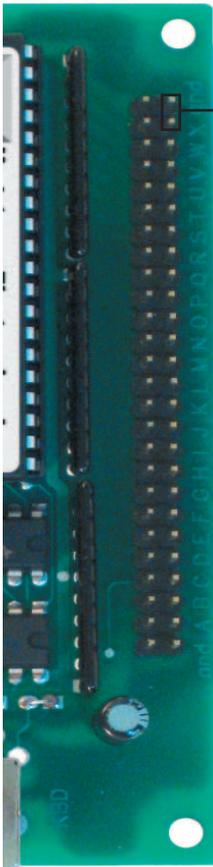
Special care must be taken to assure the proper polarity of the voltage. The supply must be within 4.75 to 5.25 volts DC.

Note: *Reverse connection of the supply voltage will permanently damage the unit. Use 5 volt source only. Do not attempt this connection if you are uncertain of your power supply voltage or polarity.*

NEVER attach a KE24 that is powered from an external source to a PC, as this may damage the KE24, the computer, and/or your supply.

Appendix C: Placing KE24 in PROGRAM Mode

This section does not apply if the KE24 is set up to be programmed through the keyboard port. In most other KE24 configurations, a straight through 9 Pin Male/Female cable is required between the KE24 serial port and the Computer serial port (COM1 through COM6). If your KE24 setup runs the serial port at a Baud rate other than 9600 you must use the following sequence with the programming jumper:



Note: The programming jumper is only needed in certain situations as described above. When using the jumper, the KE24 must be powered up with this programming jumper in place to enter the program mode.

When programming the KE24, the user normally connects the serial cable as described above, and uses the KE24Load program that comes with the unit to set up the KE24 with no jumper required.

1. With power off, place the enclosed jumper from Pin X on the I/O header to the ground pin next to it (see diagram).
2. Plug the KE-MM6-mini connecting cable from the KE24 connector marked "To PC" to your computer's keyboard input.
3. Connect your own keyboard to the KE24 connector marked "KBD."
4. Attach a 9 pin D type (male to female) cable from your KE24 RS-232 port to a serial port on your computer (COM1 through COM6) .
5. Turn on the PC. The KE24 will now be in PROGRAM mode, and will communicate with the KE24Load configuration program.

Note: In the program mode, the KE24 passes information from the external keyboard to the computer. While in this mode, the KE24 will only work with AT or PS/2 and compatible computers.

Appendix D: KE24 Operating Tips

In the event that you are experiencing difficulty in using your KE24, please check the following items before contacting us:

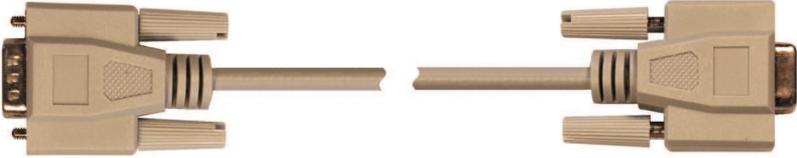
- When connecting the KE24 to a PC and keyboard, make sure they are plugged into the proper ports. The connector marked "To PC" on the KE24 must be connected to the PC keyboard input. Attach your computer keyboard to the KE24 connector marked "KBD." The KE24 will not function properly if these connections are reversed.
- Check your KE24 configuration. Be sure to select the type of computer that you are using (XT or AT compatible). Check your I/O configuration for the number of columns and rows, etc. Review your matrix or discrete input table for the desired responses.
- If you are having trouble getting your PC keyboard to work with the KE24, make sure that the keyboard itself is configured for the type of computer you have specified in the configuration (XT or AT compatible).
- The maximum recommended cable length from your computer to the KE24 is 10 feet. This distance is also the maximum length that you should use on connections from the switches or keypads in your applications to the KE24 I/O header.
- If your KE24 will not communicate with the KE24Load program, check the COM port selection. Also be sure to power up the KE24 with the programming jumper in place. Refer to page 12 for more information on programming the KE24 unit.
- If you cannot get the KE24 to respond to your configuration, make sure that you have removed the programming jumper and powered the unit back up without the jumper in place.

If you have any questions that are not answered in this manual, please send us an email.

sales@hagstromelectronics.com

Accessories

We offer several accessories for connecting our keyboard encoders to your PC.



KE-DB9MF

9 pin serial DB9 cable. 6 ft., Male to Female configuration



KE-MM6-mini

Connect from Encoder to PC 6 pin mini connector



MTA-100-13-12

Cable set connects to KE24 header. Brings each pin to a discrete wire 12 in. long

To order...

E-mail sales@hagstromelectronics.com
Log on to our website at www.hagstromelectronics.com

Warranty

HAGSTROM ELECTRONICS, INC. warrants this product against defects in material or workmanship for a period of ONE YEAR from the original purchase date. We will repair or replace (at our option) the returned defective unit at no charge during this warranty period.

No responsibility is assumed for any special, incidental, or consequential damage resulting from the use of or inability to use this product. In no case is **HAGSTROM ELECTRONICS, INC.** to be liable for any amount which exceeds the purchase price of the unit, regardless of the claim.

No other warranty, written or verbal, is authorized. This warranty is applicable only to units sold in the United States. Units sold outside the United States are covered by a similar warranty.

Depending on the state in which you live, you may have additional rights.

Great care has been taken during the assembly, testing, and burn-in of your KE24 to ensure its performance. If you have any questions, please send us an email.

customer service email: [**sales@hagstromelectronics.com**](mailto:sales@hagstromelectronics.com)

NOTICE: The KE24 product is designed to be used by technically oriented computer users. When the KE24 is in use, your computer's signals and voltages are present on the unit. Prudent handling and packaging is necessary to prevent damage to your computer.



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V. 02.21