VG CONTROLS, Inc.
11 Butternut Dr, Vernon, NJ 07462
Tel (800) 524-6994 Fax (973) 764-6603
www.vgcontrols.com

The Programmable Keypad Encoder USE145

The USE145 Keypad Encoder provides an interface between a matrix-type keypad and a computer system with an RS232 serial port, IBM PC/XT or IBM PC/AT keyboard port. The keypad matrix can be from 1x23 to 12x12, the only constraint being that the total number of leads is not to exceed 24.

It is fully programmable and stores all configuration parameters, such as matrix size, pinout, interface type , Baud rate, and keycodes in the non-volatile memory. Any of these parameters can be changed using the programming utility "**USECON**".

The USE145 is powered up from +5 V DC. It does not need a ± 12 V power supply to get true RS232 compatibility.

In addition, USE145 can work in parallel with a standard IBM AT/XT keyboard.

Operation of the USE145 and its interfaces

The USE145 encoder has two bidirectional interfaces: RS232, and IBM PC/XT or PC/AT. The user can configure the USE145 to operate either as an RS232 keyboard encoder, or as an IBM PC/XT or PC/AT compatible keyboard encoder. Depending upon the mode of operation, the USE145 sends a key code only when a key is pressed ("make"-code), or it can send a code for both key closure and key opening ("make"- and "break"-codes). In RS232 mode only "make"-codes are sent, while IBM PC/XT and PC/AT modes require both "make"- and "break"-codes. In all three modes the USE145 supports "typematic" and "rollover" functions.

DEBOUNCING. The technique used by the USE145 to debounce the keys is simple: the whole matrix is scanned once every 20 milliseconds, and so is every key in the keypad. Once a closure is detected and registered, multiple closures caused by the bounce do not matter. The next scan comes in 20 milliseconds, which is more than enough for any reasonable bounce to subside, yet fast enough to register any possible fast-repeating (manually done) key-closure.

TYPEMATIC. "Typematic" refers to a function in which the encoder repeatedly sends a "make"-code for a key which is held down. When it first detects key closure it sends a key code once, and then waits for a specified period of time (the "typematic delay"). If the key is still held down after the delay expires, it starts sending key codes at a specified rate per second (the "typematic period"). It will stop sending key codes when the key is released or when another key is pressed. Both "typematic delay" and "typematic period" can be defined within USECON. Typematic action can be disabled if necessary by selecting a "typematic

period" equal to infinity (seef USECON manual).

ROLLOVER. "Rollover" refers to a function in which the encoder transmits the "make"-code for a second key if it is pressed and while the first pressed key hasn't been released. If typematic action is in progress when the second key is pressed, the USE145 stops typematic action for the first key, sends a "make"-code for the second key, and starts sending key codes for the second key if it is held down for longer than the "typematic delay". "Rollover" action is not limited to two keys. In fact, any number of keys can be "rolled over".
Rollover function is optional and may be disabled while programming the USE145 from USECON program. If the rollover is disabled and you press a second key without releasing the first one, the encoder will disregard the second pressing. If the typematic action was in effect at that moment, the "make"-code will continue to be repeatedly sent for the first pressed key. It will consider the first key released only when no key is pressed anymore.

There are some differences in the way the USE145 functions in RS232, IBM PC/XT and IBM PC/AT modes. A brief description of these differences follows.

RS232 MODE. In the RS232 mode the USE145 transmits a key code when a key is pressed and transmits nothing when the key

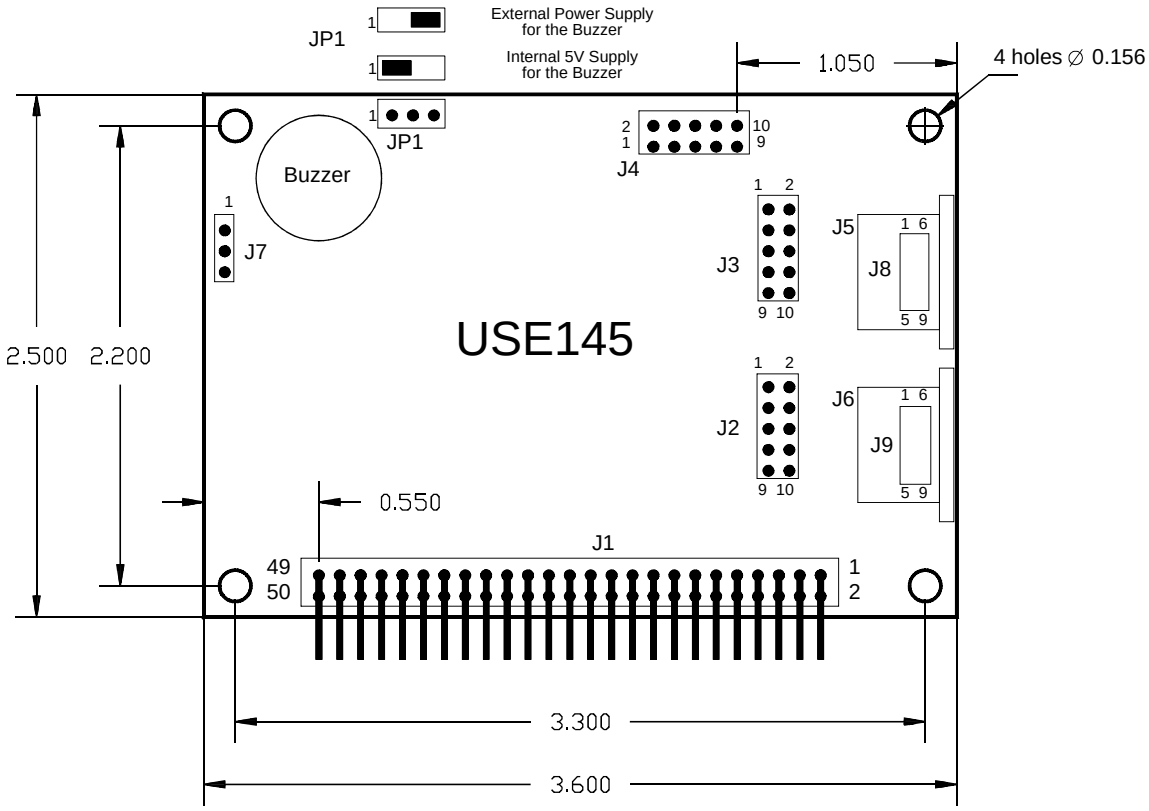

Figure 1

Mechanical dimensions and position of standard and optional connectors

is released. If a key is held down and typematic (or repeating) action is enabled, the USE145 starts sending key code at the rate specified by “typematic period” after “typematic delay” has expired. It will stop sending key code when the key is released or when a different key is pressed.

SHIFT KEYS. In the RS232 mode up to two keys can be designated as shift keys, “Shift1" and ”Shift2". Any key can be selected as a shift key (see “Define Shift Key” in the USECON guide). All other keys have two key codes: normal and shifted. If one (or both) of the Shift key(s) is pressed, the USE145 does not send its code. Instead it sends the second (“shifted”) key code for whatever other key is pressed together with Shift key(s).

PC/XT MODE. In this mode the USE145 treats each key as a Make/Break key. In other words, it sends “make”-code when the key is pressed and it sends “break”-code when the key is released. In PC/XT mode a “make”-code should have its Most Significant Bit (MSB) cleared, meaning that the code should be less than 128. The “break”-code is obtained from the “make” by adding 128 (having the MSB set). If typematic action is enabled, “make”-code is periodically sent while the key is pressed and one “break”-code is sent when the key is released.

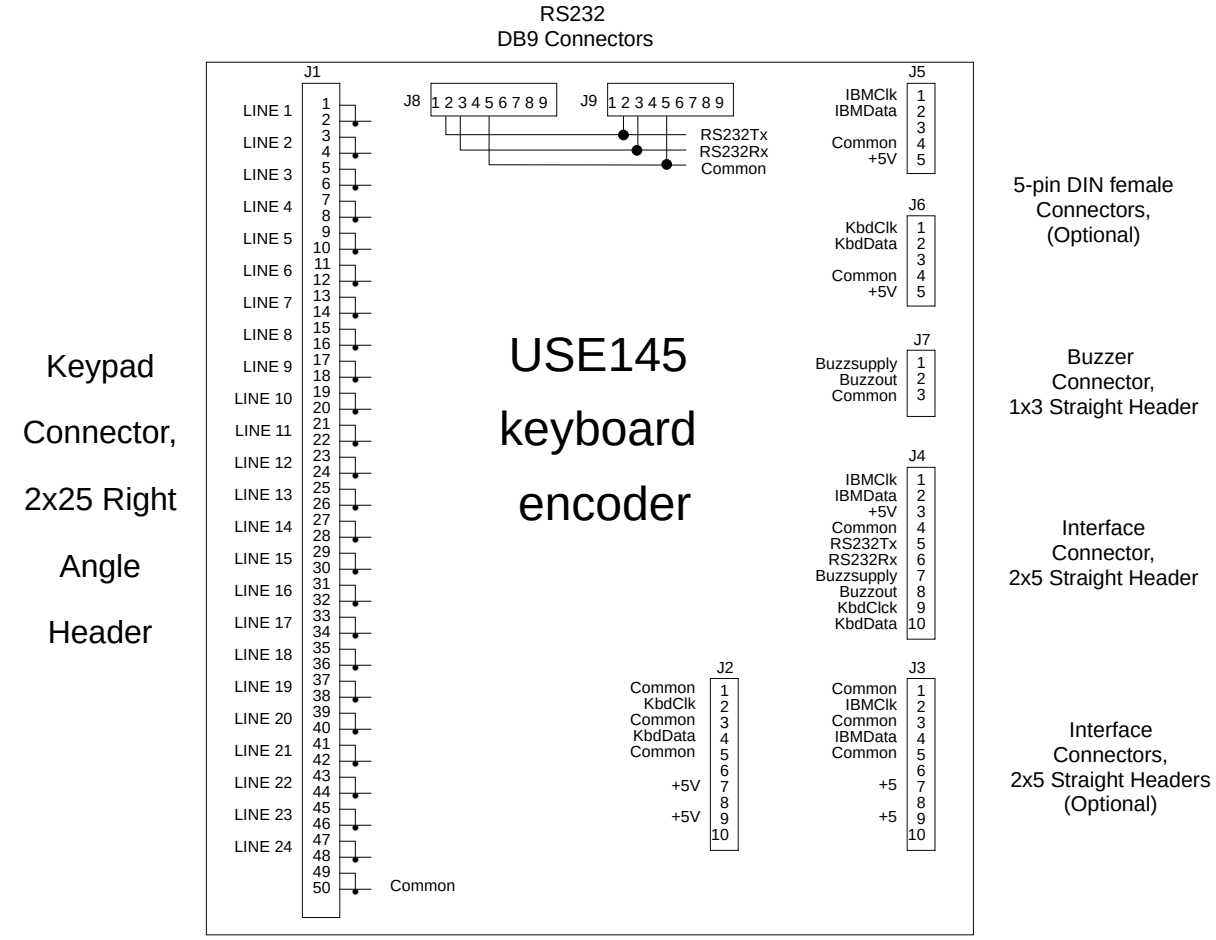

Figure 2
USE145 Connection Diagram

PC/AT MODE. In PC/AT mode the USE145 also handles each key as Make/Break, but here the “break”-code consists of two bytes: a special “break”-prefix (hex F0) and the “make”-code for that key. The typematic action is similar to that of PC/XT mode.

Please note that although both PC/AT and PC/XT modes have the same connector pinout there are substantial differences between the two protocols. The USE145 must always be configured for the type of computer it is connected to.

PARALLEL KEYBOARD. Keypads are usually designed to be used in equipment where speedy typing is not the way of entering information (like in industrial controllers, medical equipment, etc.). However, some applications do require regular typing along with entering special information from a keypad.

Another example is an industrial device where a designer wants to give an operator only limited access to a system’s resources while a field service engineer will need more access to run diagnostics or make reconfigurations.

For such cases an external keyboard handling capability is extremely useful.The USE145 can be connected as a “wedge” device with IBM keyboard plugged into it for both AT and XT interface modes. The USE145 provides bi-directional retranslating of information between computer and the keyboard. If the user presses a key on a keypad, the USE145 will send its own keycodes as well. This way, both the USE145 and a standard keyboard can operate at the same time (or in “parallel”).The retranslating is fully transparent so the keyboard operates as usual, including LED indicators. Another USE145 can be plugged in instead of the keyboard. Actually, any number of them can be daisy-chained.

This feature allows you to have multiple keypads in different locations connected to the same computer.

To plug an external keyboard into the USE145 use either J6 DIN5 connector (allows to plug keyboard directly) or pins assigned for this purpose in J2 or J7 connectors (then you will have to make an adaptor-cable).

BUZZER. This option allows you to produce a beep (or another audible signal) for every key-closure on the keypad (but not on the parallel keyboard). Optionally the beep can be either on first key-closure only or every time the “make” code is sent when the typematic action is in progress.

Both on board and external “self-drive” type buzzers can be used. In the first case you can either use an external power supply (BUZZSUPPLY input, see Fig. 2), or 5V already used in the USE145. The USE145 board can accommodate buzzers with lead spacing of either 0.2” or 0.3” such as **TMB** or **HMB** types from **STAR MICRONICS** or similar. The external/internal power supply option is selected by the jumper JP1.

If you use an external buzzer, the USE145 provides an “open collector” output “BUZZOUT”, (Fig. 2) which allows you to connect a buzzer with maximum ratings up to 20 V/100 mA. The output provides a single negative pulse 60 msec duration.You can also use this output to control other types of signaling devices.

POWER SUPPLY. The USE145 requires a single + 5 V DC power supply. Typical current consumption is 25 mA.

STANDARD CONNECTORS. There are two dual-row 0.1" headers – J1 and J4, and two DIN 5-pin female connectors – J5 and J6 (the same type used in the IBM PC/XT and PC/AT).

J1 is a 2x25 right-angle header that provides connections to a keypad. The pins in both rows are connected in parallel so that a keypad with two connector tails, or two or more separate keypads can be connected to the USE145 without mechanical restrictions.

J4 is a straight 2x5 header. It provides for the RS232, PC/XT or PC/AT interfaces to computer, and power supply connections. Pin #9 has been removed to serve as a key.

OPTIONAL CONNECTORS. J2 and J3 (2x5 headers) provide direct connection for **Ziatech** industrial computers.

J7 (1x3 header) has the output for the external buzzer and the input for an external power supply for optional built-in buzzer.

J8 (RJ11) has outputs for RS232 and XT/AT interfaces.

J9 (DB9 female) is a standard RS232 receptacle.

Connectors J2, J3 and J4 can optionally be selected as latching headers to be vibration-proof.

Figure 1 shows the position of all the connectors, together with the mounting dimensions for the USE145, **Figure 2** shows their pinouts

PROGRAMMING THE ENCODER. The USE145 is programmed with **USECON** (**USE**145 **CON**figuration utility) to set or change any its parameters, such as interface type, Baud rate, keypad pinout, etc. It also allows users to save or recall all parameters to or from a disk file. The programming is done through COM1/COM2 serial port.

PROGRAMMING ADAPTOR. A programming adaptor is available for the USE145. It comes with a power supply and all required connections. This adaptor plugs into connector J4 on the USE145 and into the male 9-pin DB9 port connector of the PC's serial port.