

Keypad / Input Module 10b

Hardware Reference

Release 1.4 (June 17, 2016)

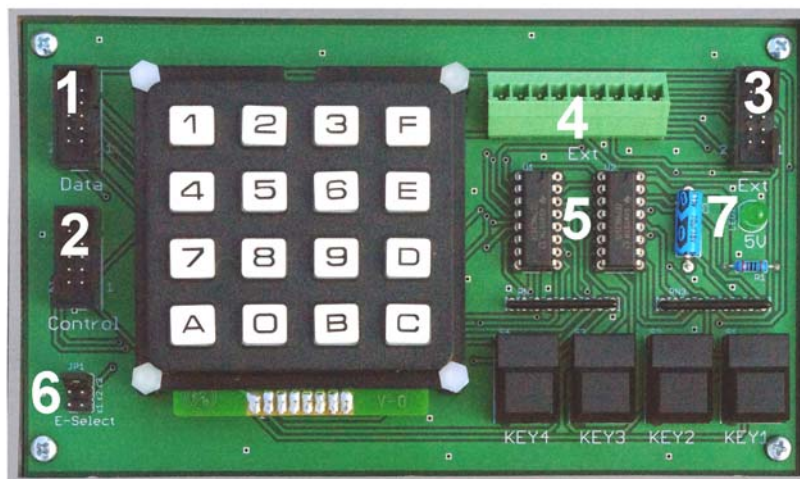
Purpose:

Platform to carry a keypad and four additional keys and to facilitate attachment of up to eight input signals from outside.

- PCB dimensions: approx. 92 by 156 mm (approx. 4" by 6 6,3").
- PCB fits on a sloped enclosure TEKO 362 and on frames for DIN rail mounting.
- PCB can be stacked upon other modules having the same dimensions.
- Microcontroller interface: two 8-bit ports. One port data bus (bidirectional), one port control signals (outputs).
- Supply voltage: up to 5 V, depending on the multiplexer ICs inserted.

Principles of Operation

The interface comprises two 8-bit ports. One port is an 8-bit data bus, the other carries five selection and three enable signals. Input signal selection is done via two multiplexers with three-state outputs. The interfaces of the keypad/input module 10b and the LCD module 10a are matched together. Each of these modules allows for selecting one of the three enable signals by appropriately setting a jumper. A typical configuration comprises two LCD modules (one with a dot-matrix, one with a graphic LCD) and one keypad/input module.



- | | | | |
|---|-------------------------------------|---|-----------------------------|
| 1 | Data bus header | 5 | Multiplexers |
| 2 | Selection and enable signals header | 6 | Enable-signal select jumper |
| 3 | External inputs header | 7 | Power LED |
| 4 | External inputs terminal strip | | |

Fig. 1 The Keypad / Input Module 10b.

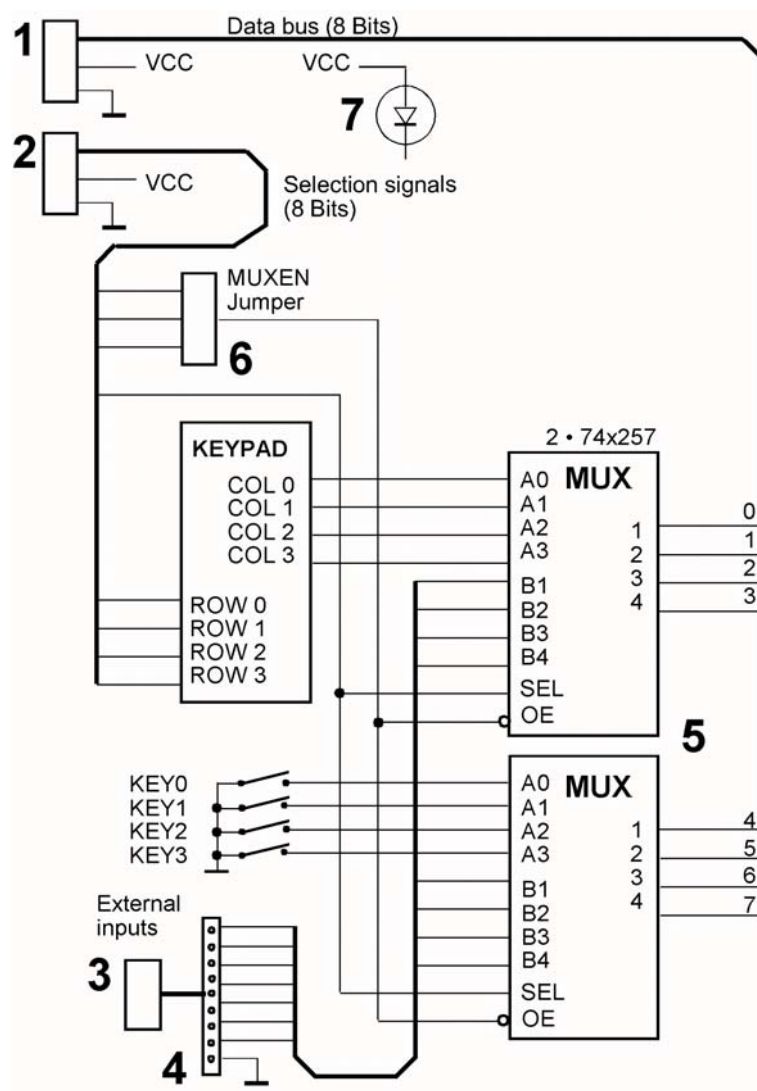


Fig. 2 Keypad / Input Module 10b block diagram.

Power Supply

Power must be supplied from outside. The board has no voltage regulator. The nominal maximum supply voltage is 5 V. The module can be operated with 3.3 V, provided the multiplexers belong to an appropriate CMOS family (for example, SN74HC or 74AC). Power is fed to the module via the I/O connectors.

I/O connectors (1), (2), (3)

The I/O connectors are pin headers with 10 pins in two rows and a pin pitch of 2,54 mm (100 mil). Various types can be inserted (horizontal or vertical, on the component side or on the soldering side, shrouded or not and so on). The assignment of the I/O signals, GND and VCC corresponds to the industry standard of the Atmel starter kits and the like. The GND and VCC contacts may be used to supply the module.

I/O port connectors (1), (2)

The upper port (1) is the data bus, the port (2) below comprises the selection and enable signals.

External Inputs (3), (4)

Up to eight external inputs may be connected via header (3) or terminal strip (4). The terminal strip has 9 pins with a pin pitch of 3,81 mm (150 mil). External input connectors may be omitted, if not required. The multiplexers (5) and the corresponding pull-up resistor SIPs must be inserted, however.

The external input signals must be contacts, which connect the signal to ground, or they must be digital signals complying to the level specification of the multiplexers (5).

Multiplexers (5)

The multiplexers are used to select the input signals and to act as tri-state drivers on the data bus. The basic type is 74x257 (quadruple 2-line to 1-line, tri-state outputs). The logic family (LS, ALS, HC, AC) is to be selected according to the power supply voltage of the application (5 V or less). Speed (propagation delay) does not matter.

Enable-signal select jumper (6)

The OE-inputs of the multiplexers must be connected to an external enable signal (E-signal). Three of the eight control signals of the //O port (2) can be used as E-signals. One of these signals is to be selected by appropriately inserting a jumper. A maximum of three modules can be operated at one bus attached to two microcontroller ports. Each module must have its jumper inserted in a different position.

The LCD Module 10a has the same selection provisions. Beyond that, these modules have double I/O connectors, allowing for daisy-chaining. The keypad / input module must be the last module of such a a daisy-chain.

Caution:

The keypad / input module requires the E-signal active Low, the LCD module active High.

Power LED (7)

One of the most basic troubleshooting aids is an indication, whether a device is powered or not.



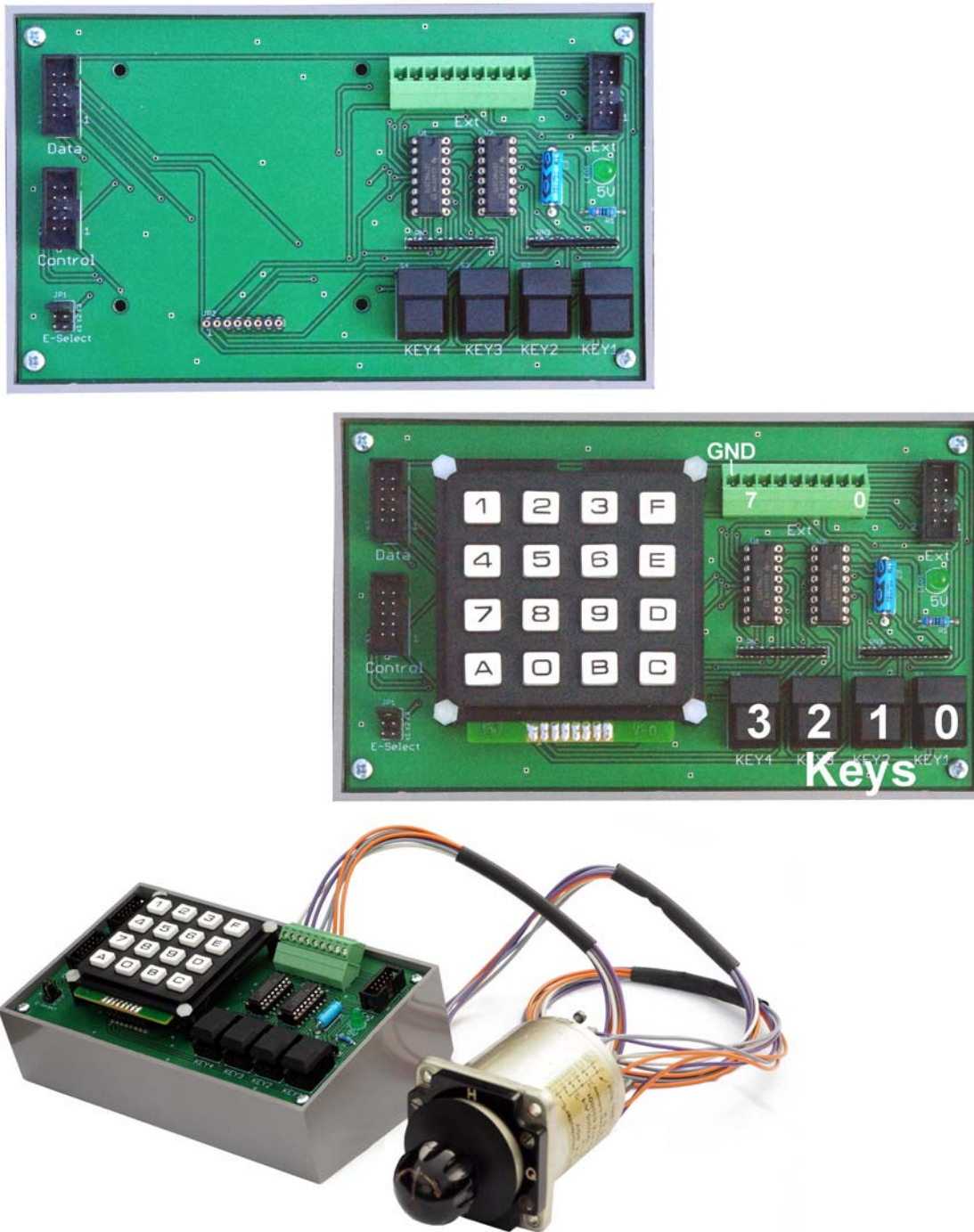


Fig. 3 The Keypad / Input Module 10b.

7	6	5	4	3	2	1	0
E3#	E2#	ROW3#	ROW2#	ROW1#	E0#	ROW0#	SEL

Fig. 4 The selection and enable signals. One of the E-signals is to be selected by jumper.

7	6	5	4	3	2	1	0
EXT7	EXT6	EXT5	EXT4	EXT3	EXT2	EXT1	EXT0

Fig. 5 The external inputs.

7	6	5	4	3	2	1	0
KEY3#	KEY2#	KEY1#	KEY0#	COL3#	COL2#	COL1#	COL0#
EXT7	EXT6	EXT5	EXT4	EXT3	EXT2	EXT1	EXT0

Fig. 6 The data bus. If SEL = 0, then the internal signals KEY3...COL are selected. If SEL = 1, then the external inputs EXT7...EXT0 are selected.

Signal levels

The enable signals are low active. The four keys are low active. The keypad scanning signals (row inputs, column outputs) are low active. Unconnected external inputs are held on a high level by pull-up resistors.

Scanning the keypad:

1. Pull down a row select signal.
2. Sense the column signals. A depressed key will cause its column line to be pulled low, too.
3. Repeat 1. and 2. for all rows.
4. Keep care of intricacies, like contact bounce and phantom keys (ghosting). Generate an appropriate scan code to be returned to the application program.

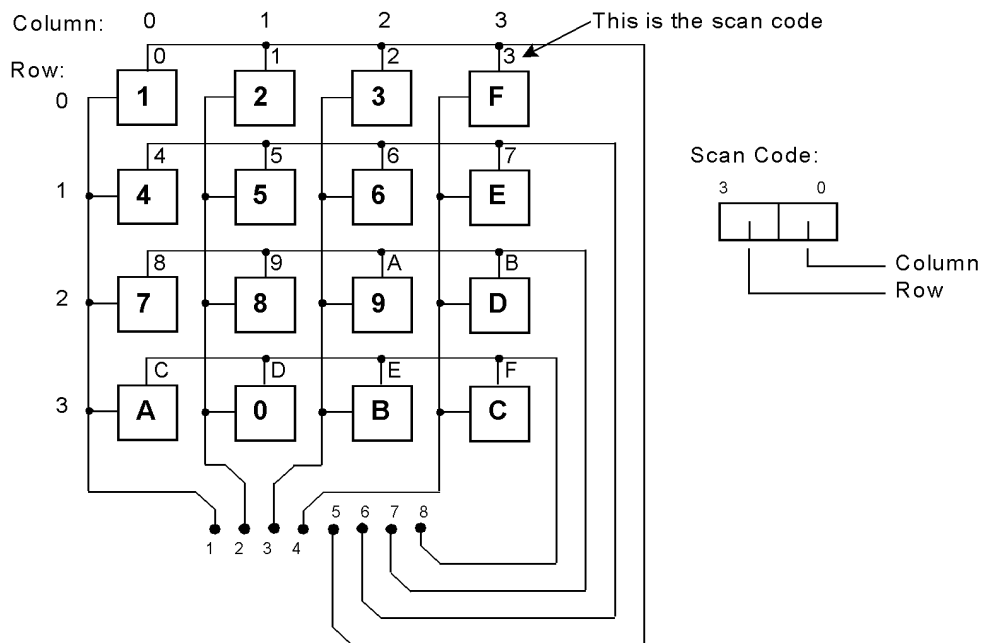


Fig. 7 Scanning the keypad.

Note:

It is always to be expected, that two or more keys are depressed simultaneously. To avoid short circuit currents between row select signals, these signals must be driven from open drain output stages. The I/O ports of Atmel AVR microcontrollers can be programmed appropriately. However, the built-in pull-up resistors have quite high values of resistance. Thus the rise time of the signals will be considerably long. Hence the row select signals are to be connected to additional pull-up resistors.

Engineering Change Order (ECO)

Boards with release number 1.3 or less need rework:

1. Add the missing decoupling capacitors.
2. Add the missing MUX enable signal connection.
3. Add the pull-up resistors of the row select signals.

