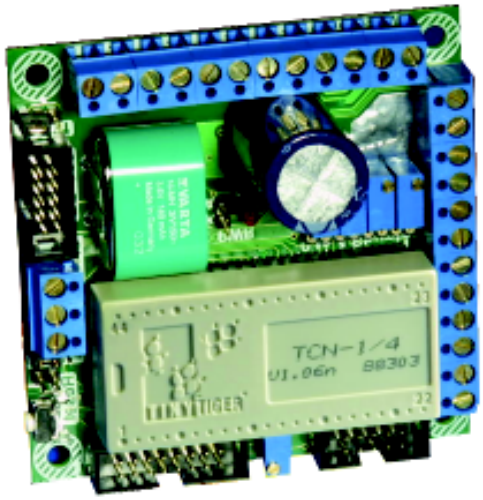
SBC 4010

High Performance Low Cost Single Board Computer

Technical Datasheet



Features:

- High Speed Multitasking Industry Computer **TINY-Tiger**
- SRAM / FLASH memory configurations available:
  128k 512k
  512k 512k
  512k 2M
- Optional battery backup: NiCd battery or GoldCap or Lithium battery (Jumper !)
- Power supply input 9...24V_{DC}, polarity protection
- typical power consumtion: 1.1W with 9V supply
  2.9W with 24V supply
- 1 x RS232
- 1 x RS485
- In-field programmable
- LCD connector for 1:1 flat cable to text display

- Inputs for a 4 x 4 keymatrix P60...67
- 4 analog channels: 0...10V, 0-20 mA (poti calibration)
- Analog Vref = 4V_{DC}
- 2 digital inputs (5...24V)
- 4 outputs 24V / 1A driving capability

- Board size: approx. 80 x 80 x 1.6 mm, 4 assembly holes 4.2 mm
- 2 x 90µ Cu, 10/10 mil datawire, power+GND 80 mil
- High quality screw terminals (I/O): 5.08 mm, 250V_{AC}
  1x DB9 for serial RS232
  Screw terminal for RS485

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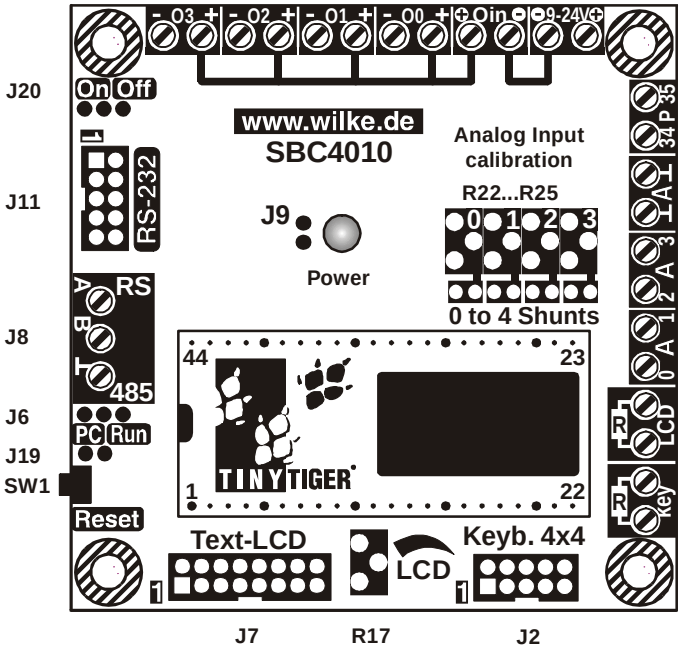

Overview of I/O channels, connectors:

Power	LED indicates power supply
J9	alternative power LED
J6	PC mode jumper switch Setting of RUN/PC mode
SW1	Reset button
J19	alternative Reset input
J11	RS232 interface
J20	RS232 power-on
J8	RS485 interface
J7	Text-LCD
R17	LCD-Contrast
J2	4x4 Keyboard matrix

R22..R25	Calibration 0V..10V
R-Key	connect ext. resistor for keyb. backlight
R-LCD	connect ext. resistor for LCD backlight
A0..A3	analog inputs
A-GND	analog ground
P34..P35	24V dig. inputs
9-24V	9V..24V supply voltage
Oin	OpenCollectorec supply input 24V max.
O0..O3	24V/1A open-collector output

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Power supply

A 9...24V_{DC} / 120mA power supply delivers the operating voltage.

All other supply voltages are created onboard: +5V

The Power-LED indicates whether power supply is connected to SBC4010.
A second LED can be connected to **J9**.
LED specification: 2V/3mA

Battery Backup Option

A 3.6V/140mAH battery/akku can be mounted onboard to backup RAM and RealTimeClock data.

Serial Interface:

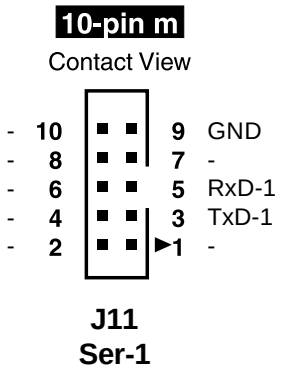
The SBC offers two serial interfaces:

J11: The interface Ser1 of the Tiger is lead to the DB9 connector through a V24 interface driver chip as RS232 without handshake.
J11 is used as programming interface for the Tiger module in PC mode. Set **J6** for PC-Mode.

J20: En-/disables RS232 to save power when not used

J8: The interface Ser0 of the Tiger is lead out as RS485 signal and can easily be tapped on the industrial plug.

Connection diagram serial connector:



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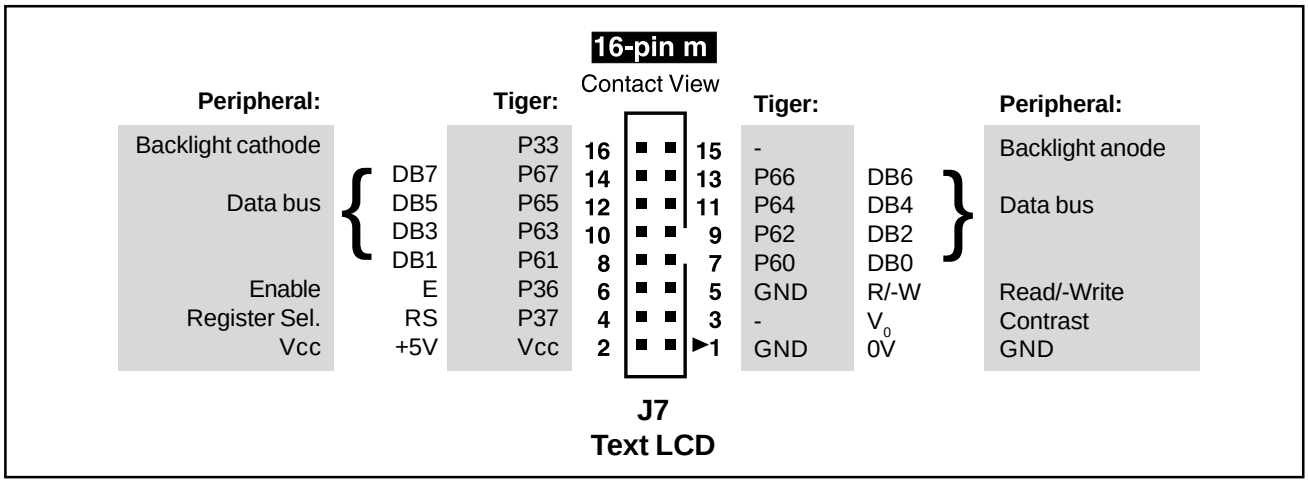
Connection diagram Text LCD connector:



The connector J7 connects an alphanumerical LCD with HD44870 controller,. The transferred functions of this connector contain:

- Power supply of LCD
- Data transfer to LCD
- LCD lighting
- LCD contrast setting

Text-LCD type: 4 x 20, 2 x 20, 2 x 16 ... and many more with controller HD44870 (and compatible).

LCD backlight: Is activated by setting bit LED-LCD **P33**.
(Bit is shared with keyb. backlight)
Use ext. resistor for backlight supply.

$$R = \frac{24V - \text{backlight voltage}}{\text{backlight current}}$$

LCD contrast: Contrast adjustment with on-board potentiometer **R17**.

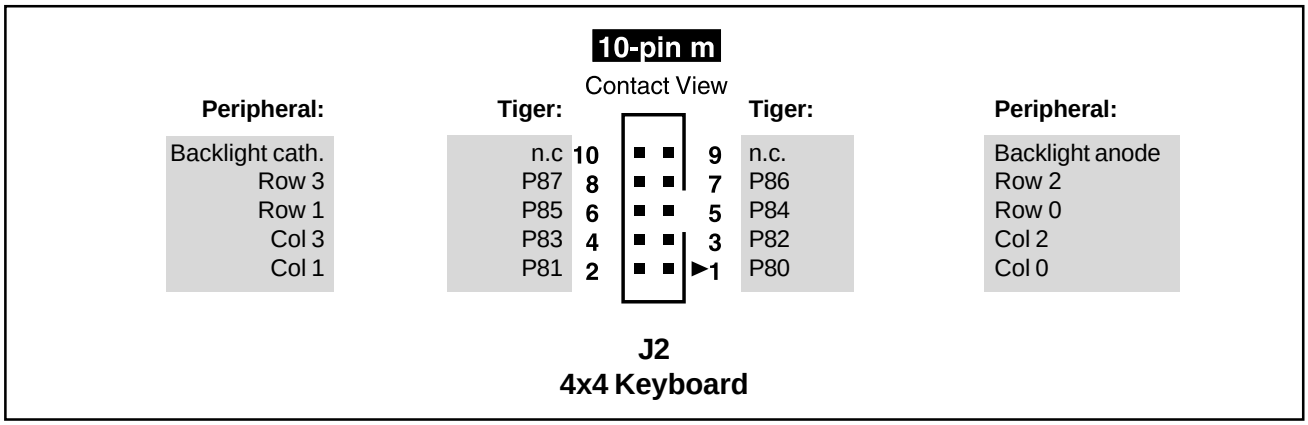
The LCD is usually controlled by device driver LCD1.TDD, which offers a large number of options and functions for text and quasi-graphic outputs.

Further and detailed description is given in Tiger-BASIC™ manual “Device Driver“.

Connections:

Data-Bus:	Data I/O	DB0...DB7	P60...P67
CTRL-Bus:	Register Select	RS	P36
	Chip Enable	E	P37

Connection diagram 4x4 keyboard connector:



The connector J2 may be used to connect a
4x4 Keyboardmatrix or as 8 additional 5V dig. I/O:

Keyb. backlight: Activated by setting bit
LED-LCD **P33**.
(Bit is shared with LCD backlight)
Use ext. resistor for backlight supply.

$$R = \frac{\text{24V - backlight voltage}}{\text{backlight current}}$$

All pins of J2 are protected with varistors to GND.

See sample program for 4x4 keyboard (supplied on disk).

This program demonstrates how to read a 4 x4 keyboard matrix from a Tiger I/O port (here: port 8) without any additional components. Use P80..83 for input and P84...P87 for output.

```
'------------------------------------------------------------------------
' Name: 4x4_MATRIX.TIG, Tiger-BASIC source code
'------------------------------------------------------------------------
USER_VAR_STRICT

STRING KEYBUF$ (64)                       ' keyboard buffer (global)


TASK MAIN

BYTE X
STRING USER$ (100)

INSTALL_DEVICE #1, "LCD1.TDD"                     ' install LCD (4 x 20)

DIR_PORT 8, 255                                   ' all pins as input
OUT 8, 0FFH, 0FFH                                 ' set input pins of port 8 to "pull-up"

KEYBUF$ = ""                                      ' clear keyboard buffer
RUN_TASK SCAN_KEY                                 ' Start task to read keyboard

USER$ = ""                                        ' reset user string
PRINT #1, "<1>";                                  ' clear LCD screen
FOR X = 0 TO 0 STEP 0                             ' endless loop
  WHILE LEN(KEYBUF$) <> 0                         ' s.th. in keyboard buffer?
    USER$ = LEFT$(KEYBUF$, 1)                     ' read "oldest" character
    PRINT #1, USER$;                              ' output it on LCD
    KEYBUF$ = RIGHT$ (KEYBUF$, LEN(KEYBUF$)-1)    ' delete it from buffer
  ENDWHILE
NEXT

END

'------------------------------------------------------------------------
' this task continuously checks the port 8 for pressed keys
'------------------------------------------------------------------------
TASK SCAN_KEY

BYTE EVER, X, KEY_NO, OLD_KEY_NO
BYTE BITVAL, INVAL, OUTVAL
STRING KEYS$(16)

KEYS$ = "ABCDEFGHIJKLMNOP"                        ' the 16 keys of the keyboard,
                                                  ' starting with key no. 0
OLD_KEY_NO = 255                                  ' set compare to "no key"
WAIT_NEXT 30                                      ' initialize 30 ms wait

FOR EVER = 0 TO 0 STEP 0                          ' endless loop
  WAIT_NEXT                                       ' release task time

  FOR X = 4 TO 7                                  ' bits for keyboard columns
    BITVAL = EXP (2, X)                           ' Create value for bit x (16, 32, 64 or 128)
    OUTVAL = 255 - BITVAL                         ' Create mask for DIR_PORT (239, 223, 191, 127)
    DIR_PORT 8, OUTVAL                            ' Set new pin directions
    OUT 8, 255, 255 - BITVAL                      ' Set output pin "low" = 0, all others "high" = 1
    IN 8, INVAL                                   ' read port 8
    INVAL = INVAL BITAND 15               ' use only lower 4 bits
    SWITCHI INVAL
      CASE 15: KEY_NO = 255               ' no key in column pressed
      CASE 14: KEY_NO = ((X-4)*4)                 ' calculate key no.
               X = X - 1                          ' same column again
      CASE 13: KEY_NO = ((X-4)*4) + 1             ' calculate key no.
               X = X - 1                          ' same column again
      CASE 11: KEY_NO = ((X-4)*4) + 2             ' calculate key no.
               X = X - 1                          ' same column again
      CASE 7:  KEY_NO = ((X-4)*4) + 3             ' calculate key no.
               X = X - 1                          ' same column again
      DEFAULT: X = X - 1                          ' same column again
    ENDSWITCH

    IF KEY_NO <> OLD_KEY_NO THEN                  ' if new key(value) detected
      OLD_KEY_NO = KEY_NO                         ' save it for comparing
      IF KEY_NO <> 255 THEN               ' if not "no key"
        KEYBUF$ = KEYBUF$ + MID$(KEYS$,KEY_NO,1)  ' add key to keyboard buffer
      ENDIF
    ENDIF

  NEXT                                            ' next column
NEXT

END
```

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Four 0V...10V analog Inputs:

Analog 0...3: Basic Tiger analog inputs with impedance converter, analog values 0...5V possible. Likewise usable as 20mA current input if a 8x250Ω SIL array is placed on the shunt connector.

Calibration: Each input can be individually set to 0...10V. To calibrate the 0...5V range apply 2.5V to the analog input port and read it out. Adjust with R22...25 until you read 512.
To calibrate the 0...10V range apply 5V to the analog input and proceed as above.

Reference: Tiger Vref is 4V from 3.9V zener diode.

Analog GND: All analog inputs have common AGND. AGND is normally connected to Tiger-GND. To seperate remove **R35.**

Two digital Inputs (5V-24V):

Dig. Inputs: The 2 digital inputs are connected to Tiger pins P34 & P35.
Onboard are 3.9V zener diodes to prevent damage on Tiger inputs when voltages > 5V are connected to board input.
Those digital inputs get read as usual Tiger inputs.
To use pins P34 & P35 as counter inputs implement one of the new device drivers "CNT1_345.TDD" or "CNT1_354.TDD" supplied on disk.

Four Open Collector Outputs:

OC 0...3: The Open Collector outputs are connected to Tiger pins P70...P73.
OC3 & OC4 are conneted to the PWM outputs of the Tiger and can be used for this.

Specification: 24V / 1A driving capability MOSFET technology.

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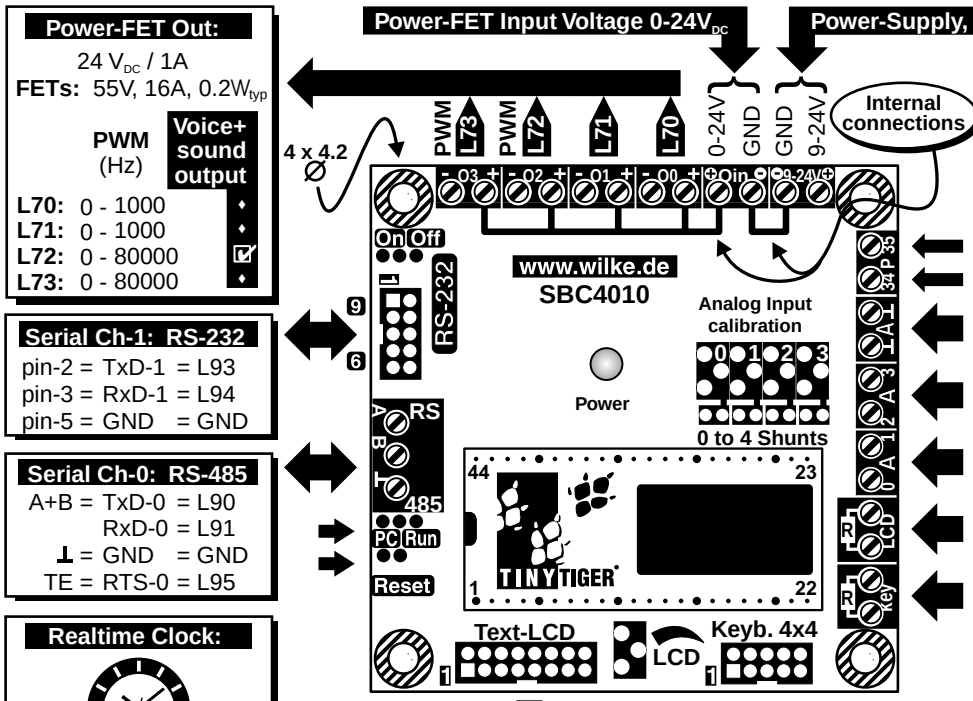

Power-FET Out:

24 V_{DC} / 1A

FETs: 55V, 16A, 0.2W_{typ}

	PWM (Hz)	Voice+ sound output
L70:	0 - 1000	
L71:	0 - 1000	
L72:	0 - 80000	☑
L73:	0 - 80000	

Serial Ch-1: RS-232

pin-2 = TxD-1 = L93
pin-3 = RxD-1 = L94
pin-5 = GND = GND

Serial Ch-0: RS-485

A+B = TxD-0 = L90
RxD-0 = L91
⊥ = GND = GND
TE = RTS-0 = L95

Realtime Clock:

Power-Fail:

Battery Backup for RTC + SRAM up to 3 month.

Power fail detect through L34 or L35 input and controlled shutdown within 300ms (24V)

Text-LCD (HD 44780)

Pin		Pin	
1	GND	2	Vcc(+5V)
3	V0	4	RS (L37)
5	R/-W (0)	6	EN (L36)
7	D0 (L60)	8	D1 (L61)
9	D2 (L62)	10	D3 (L63)
11	D4 (L64)	12	D5 (L65)
13	D6 (L66)	14	D7 (L67)
15	Anode	16	Kathode

Digital In-/Output

5V CMOS I/O Lines:
L80-L87 pin by pin as in- or outputs settable.
$I_{max-out}$: +1.6mA / -3.5mA

FLASH:	SRAM:
☐512 KB	☐128 KB
☐ 2 MB	☐512 KB

Digital-Inputs:

L35: Digital In: 5-24 V_{DC}
L34: Digital In: 5-24 V_{DC}

Analog-Inputs:

1V...10V or 20mA
as calibrated
and Shunt-Resistors
Impedance = 100 KW
8, 10 or 12 Bit res.

ext. Resistor for LCD LED-illumination

ext. Resistor for Keyb. LED-illumination

LED illumination:

L33=0=**off** / L33=1=**ON**

Keyboard-Matrix:

pin-1 = Col-0 = L80
pin-2 = Col-1 = L81
pin-3 = Col-2 = L82
pin-4 = Col-3 = L83
pin-5 = Row-0 = L84
pin-6 = Row-1 = L85
pin-7 = Row-2 = L86
pin-8 = Row-3 = L87
pin-9 = Anode (ext-R)
pin-10 = Kath. (switched)

I/O Ports

L33 = LED Illumination
L34 = Digital IN 5-24V
L35 = Digital IN 5-24V
L36 = EN of LCD
L37 = RS of LCD

L60 = Data bus LCD
L61 = Data bus LCD
L62 = Data bus LCD
L63 = Data bus LCD
L64 = Data bus LCD
L65 = Data bus LCD
L66 = Data bus LCD
L67 = Data bus LCD

L70 = Output 24V / 1A
L71 = Output 24V / 1A
L72 = Output 24V / 1A
L73 = Output 24V / 1A

L80 = Col-0
L81 = Col-1
L82 = Col-2
L83 = Col-3
L84 = Row-0
L85 = Row-1
L86 = Row-2
L87 = Row-3

Keyboard or 8 CMOS I/O pins

L90 = TxD-0 (RS-485)
L91 = RxD-0 (RS-485)
L92 = CTS-0 = GND
L93 = TxD-1 (RS-232)
L94 = RxD-1 (RS-232)
L95 = RTS-0 (TE)

80 x 80 x 45 mm, 180 gr.

www.wilke-technology.com • support@wilke-technology.com • +49 (241) 918 900 • fax: +49 (241) 918 9044