SBC4010 Single Board Computer

Version of Product 1.1

Technical Documentation

1 Introduction

This single board computer is composed of a high speed multitasking controller TINY-Tiger™.

Four Power open drain FETs can be used for switching loads up to 1A.

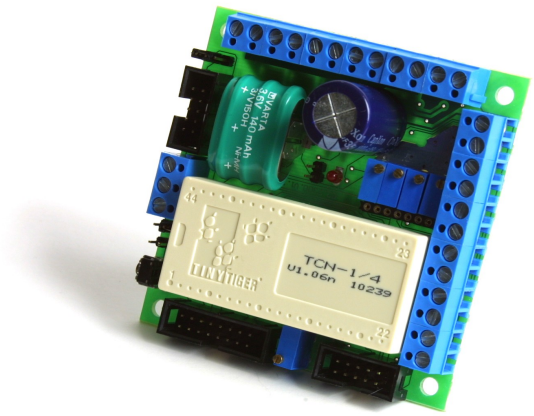
Four analog inputs are available on the SBC4010 for measure analog signals. It is possible to configure it to 0..10V or 0..20mA inputs.

A 4x20 character text display can be plugged in to visualize informations. The back light make sure reading the display in dark rooms, as well.

A 4x4 key matrix can be connected to the SBC4010, as well. It can be used for interact with your own application. This keys are free programmable.

Two different serial ports can be used to communicate with other devices. The RS485 interface is designed to use the SBC4010 in a network. So you can connect several **SBCs** with each other.
For comfortable controlling your network of single board computers we recommend our **TP1000**.

The TINY-Tiger™ can be programmed in system over the RS232 port with the powerful, well known and easy to learn Tiger-Basic™.



3 Features

- In circuit progrmmable TINY-Tiger™ multitasking controller
- Power supply 9...24V DC
- Connector for text LCD with back light
- Connector for 4x4 key matrix
- RS232 port
- RS485 port
- four analog inputs 0...20mA or 0...10V
- four open drain FET outputs
- RESET button and PC-Mode jumper
- battery buffered RTC and RAM of TINY Tiger™

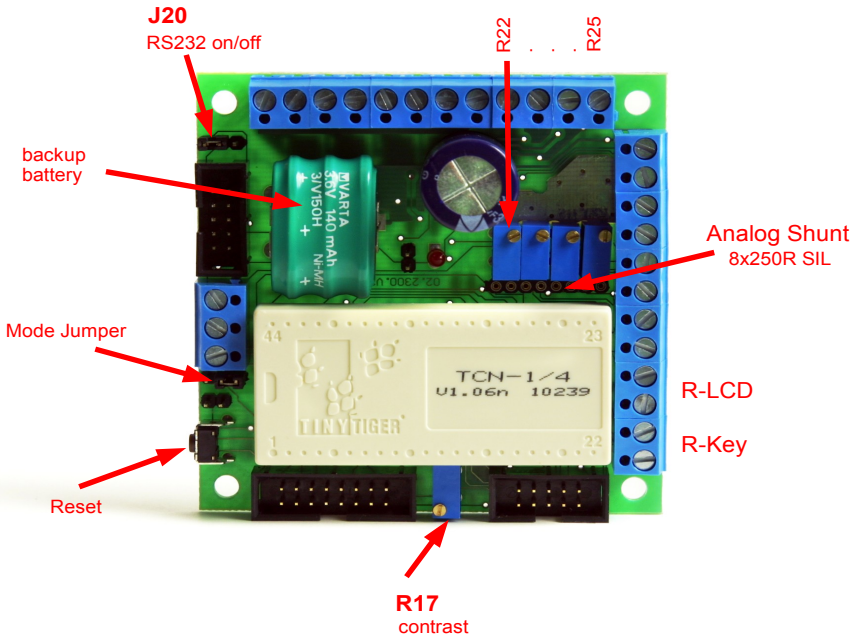
2 Applications

- Analog measurement and local controlling.
- Bus line operation for central data storage and analyses.
- Multiple board mode via RS485 bus available.
- Interact your application via key matrix

Technical Documentation

4 Contents

Technical Documentation



5 Control Elements

5.1 Contrast Adjustment for Text LCD

You can adjust the contrast of the text LC display at R17.

Note: You can reduce the contrast of the display down to no contrast. If you can't see your outputs at the display increase the contrast. If the screen is too black, reduce the contrast.

5.2 Back light for Text LCD and Key Matrix

The back light of the text LCD and key matrix can be controlled by the TINY Tiger™ pin L33. A 'high' on this pin turn the back light on. A 'low' level on L33 turn it off again. Controlling the back light of LCD and key matrix separate is not possible.

5.3 Back light resistors

You have to figure out the right value of resistor for your back light of text LCD and key matrix. It depends of your power supply voltage (U_{in}) and the used back light (I_{LED}, U_{LED}). The resistor R can be calculated with following equation:

$R=(U_{in} - U_{LED})/I_{LED}$

Typical values for back light of text LCDs are I_{LED}=120mA and U_{LED}=4.2V. If you use a 9V Power Supply you can chose a 40Ω resistor for back light.

For the back light of the key matrix you can choose a different value. The back light of LCD and key matrix can be used at same time.

5.3.1 R-LCD

You have to plug in the resistor R to the position 'R-LCD' of connector J2 if you connect the back light LED to the connector J4 (Text LCD).

5.3.2 R-Key

You have to plug in the resistor R to the position 'R-Key' of connector J2 if you connect the back light LED to the connector J3 (key matrix).

5.4 RESET Button and RUN/PC Mode Jumper

Pressing the RESET button will restart the user program if the Mode Jumper is set to 'run'.
If the mode Jumper is set to 'pc', the TINY Tiger™ will enter PC mode after pressing the RESET button.

5.5 Disable serial port 1

It is possible to disable the serial port 1 with jumper J20. Set jumper J20 to position 1-2 or remove this jumper disabling. In this case no updates of the TINY Tiger™ program is possible! In position 2-3 of jumper J20 serial port 1 is enabled. In this position downloads to the TINY Tiger™ are possible.

J20	discription
1-2	Disable Ser. 1
2-3	Enable Ser. 1
No jumper	Disable Ser. 1

5.6 Configure Analog Inputs

The SBC4010 includes four analog inputs (0...3). Each input can be individually set to 0...10V. To calibrate the 0...5V range apply 2.5V to the analog inputs 0...3 and read it out. Adjust with R22...R25 until you read 512.

Likewise usable as 20mA current input if a 8x250Ω SIL array is placed on the on the shunt connector.

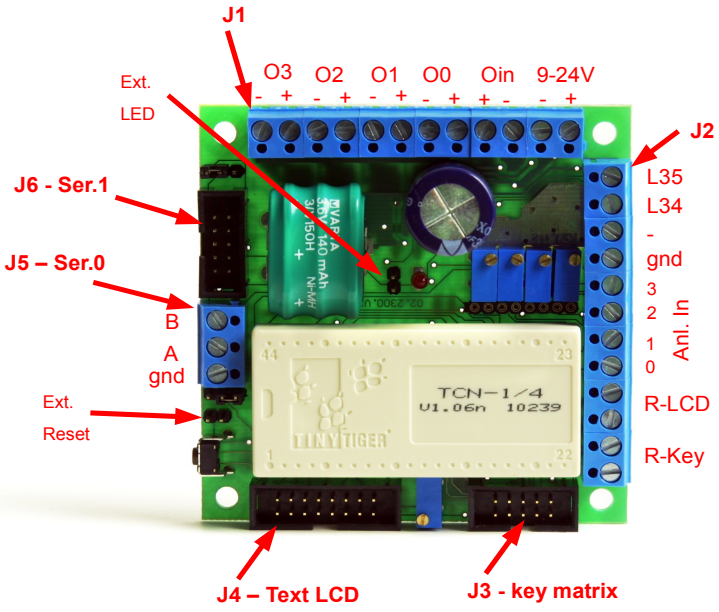
5.7 Backup Battery (optional)

Optional a backup battery is available for the SBC4010. It backup the RTC and data stored in RAM of the TINY Tiger™ up to 14 days if the power supply shut down.

The battery will be charge if power supply is plugged in again.

The SBC4010 have installed a 3.6V/140mAh accumulator to backup RTC and RAM. Wilke Technology is obliged to take back the old accumulators and to dispose them in accordance with the provisions of the German Waste Management and Recycling Act.

Technical Documentation



6 Connectors

6.1 Connector J1

6.1.1 Power Supply

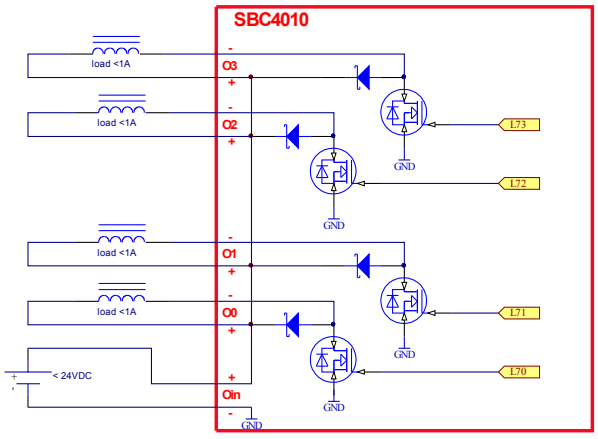
You can connect the power supply 9...24V DC at connector J1 ('- 9-24V +'). A red LED light up if power supply is detected.

Note: Please notice this power input is unfused! You have to use a fused power supply.

6.1.2 Power open drain FETs

The SBC4010 includes four powerful open drain FETs. Each channel is able to switch current up to 1A. The input voltage is limited to 24V DC. A on board recovery diode protect the FET for switching inductive loads. The FETs can be switched by the TINY Tiger™ pins L70 to L73. L70 controlled open drain FET output 0 and L73 controlled FET output 3. A high level on this pins turn the load on and a low level turn it off again.

Note: L72 (O2) and L73 (O3) can be used as PWM outputs.



6.2 Connector J2

6.2.1 R-Key

Here you can connect the resistor for the back light LED, available on connector J3 (key matrix).

Please refer chapter '*Control Elements*' for more details.

6.2.2 R-LCD

Here you can connect the resistor for the back light LED, available on connector J4 (Text LCD).

Please refer chapter '*Control Elements*' for more details.

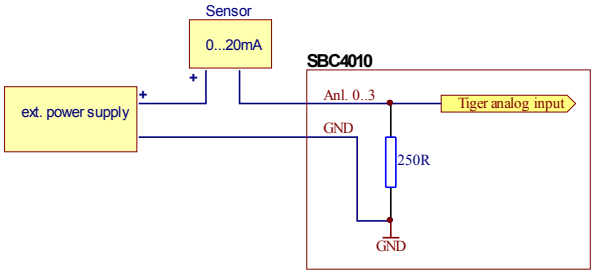
6.2.3 Analog Inputs

The SBC4010 supported four analog inputs of the TINY Tiger™. It can be configured as voltage or current input. Please refer chapter '*Control Elements*' for more details.

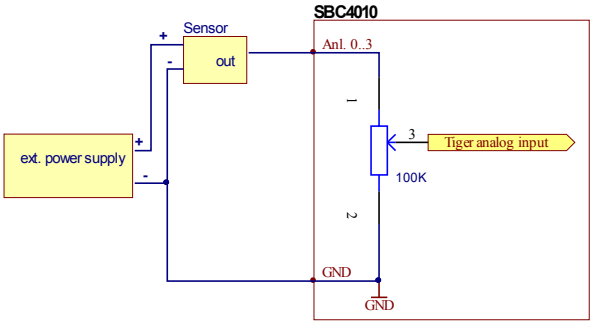
Sensors with 0...10V or 0...20mA outputs can be directly connected to the SBC4010 on connector J2. Please don't forget connect GND of the sensor to the SBC4010.

For read out the analog inputs use the device driver “analog1.tdd”.

Analog current inputs:



Analog voltage inputs:



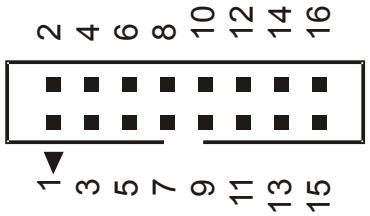
6.2.4 digital Inputs L34, L35

The SBC4010 includes two digital CMOS inputs. It can be used for read out digital inputs up to 24V. This inputs are connected to the TINY Tiger™ pin L34 and L35. Use the '`in`' commando for read out:

```
dir_pin 3,4,1          'L34 set to input
in 3, value            'read out port 3
if (bit(value,4)=1) then
       'do s.th. If L34 is high
else
       'do s.th. If L34 is low
endif
```

6.3 Text LCD

Connect your text LCD on Connector J4. Use the device driver LCD1.tdd.
The cable length connected here must not exceed 0.5m.



Connector J4

Pin	Signal	Description
1	Vss	power supply (GND)
2	Vdd	power supply (+)
3	Vo	contrast adjust
4	RS	register select
5	R/W	read /write
6	E	enable
7	D0	data bus line
8	D1	data bus line
9	D2	data bus line
10	D3	data bus line
11	D4	data bus line
12	D5	data bus line
13	D6	data bus line
14	D7	data bus line
15	BLA	back light anode
16	BLK	back light cathode

Technical Documentation

6.4 Key matrix

The SBC4010 supported a 4x4 key matrix. So you can read out up to 16 keys. The four rows and columns are directly connected to port 8 of TINY Tiger™. The key matrix can be plug in to connector J3:

Peripheral	Tiger			Tiger	Peripheral
Col 0	L80	1◀	2	L81	Col 1
Col 2	L82	3	4	L83	Col 3
Row 0	L84	5	6	L85	Row 1
Row 2	L86	7	8	L87	Row 3
back light K		- 9	10	-	back light A

Connector J3 (key matrix)

6.5 Serial ports

The SBC4010 includes two different serial ports for communication with other devices. Please use our latest serial device driver and include the following source code in your application:

```
INSTALL_DEVICE #SER, "SER1B_K1.TDD", &
  BD_38_400, DP_8N, YES, &    'SER0
  BD_38_400, DP_8N, YES, &    'SER1
  00100000b, 9, 0          'L95 = RTS0
```

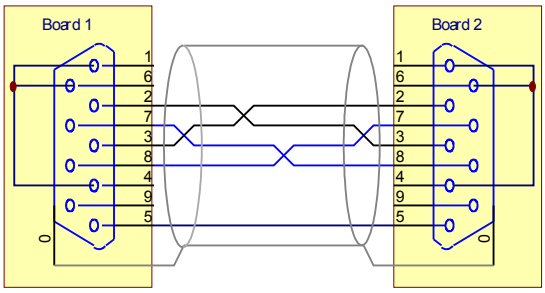
6.6 Ser1: RS232

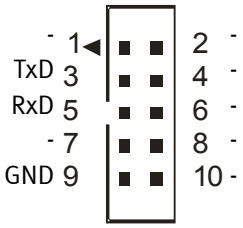
On RS232 port you can have a full duplex point to point connection to another device.

If the SBC4010 is started in PC Mode then this RS232 port can used as download and debug port.
Please check also jumper J20. Set it to position 2-3 to enable serial port 1!

To connect two SBC4010 boards you have to use a cross linked cable with male connectors.

Cross linked cable for RS232





Connector J4 (Ser.1 - male)

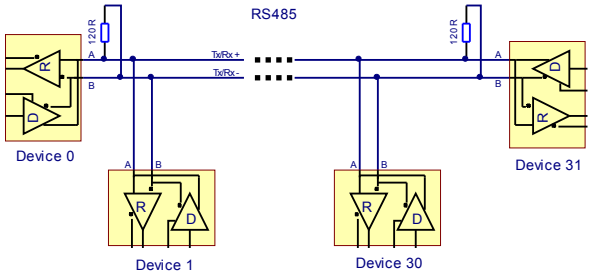
6.6.1 Ser 0: RS485

The serial port 0 of the TINY-Tiger™ is used as RS485 port. Bit 5 of port 9 is used as transmit enable pin of the RS485 bus driver. With print/put or get you can easily send or receive messages from the RS485 bus. For example send 'Hello World' to an other device:

```
PRINT #SER, #0, "Hello World"
```

The RS485 signals are available at the connector J5.

With the RS485 port a bus connection of multiple boards up to 32 devices is possible. You should implement a software protocol to prevent that more than one circuit is writing to the bus at the same time. All circuits must use the same baud rate.



Note: The line should terminated at both ends in it characteristic impedance. Stub lengths off the main line should be kept as short as possible.
You have to connect GND to each module if a separate power supply is used!

7 Used Tiger Pins

TINY-Tigers I/O	used for:
L33	Turn back light on/off
L34	Digital Input up to 24V
L35	Digital Input up to 24V
L36	enable signal for text LCD *high active output*
L37	register select for text LCD
L41	PC mode jumper input.
L60 to L67	data lines used by text LCD
L70 to L73	Open drain FETs 0...3
L80	Key matrix, column 0
L81	Key matrix, column 1
L82	Key matrix, column 2
L83	Key matrix, column 3
L84	Key matrix, row 0
L85	Key matrix, row 1
L86	Key matrix, row 2
L87	Key matrix, row 3
L90	TxD0 (RS485)
L91	RxD0 (RS485)
L92	Not used, but connected to gnd
L93	TxD1 (RS232)
L94	RxD1 (RS232)
L95	RTS0 (transmit enable RS485)

8 Used Analog Inputs

TINY-Tiger analog inputs	used for:
A/D Ref Low	GND
A/D Ref High	4V
Analog in 0	0...10V or 0...20mA
Analog in 1	0...10V or 0...20mA
Analog in 2	0...10V or 0...20mA
Analog in 3	0...10V or 0...20mA

9 Technical Specification

9.1 Absolute maximum Ratings

(beyond which permanent damage may occur)

supply voltage U_in (screw terminal 1 in respect of GND)	9...24V DC
maximum current at each FET output	1A
maximum voltage at FET outputs	24V DC
input voltage at digital inputs	-0.3...24V DC
operating temperature without backup battery with backup battery	 -20...80°C 0...60°C

Do not connect any signal connector of the SBC4010 directly to wires which are outside a building.

9.2 Electrical Specifications

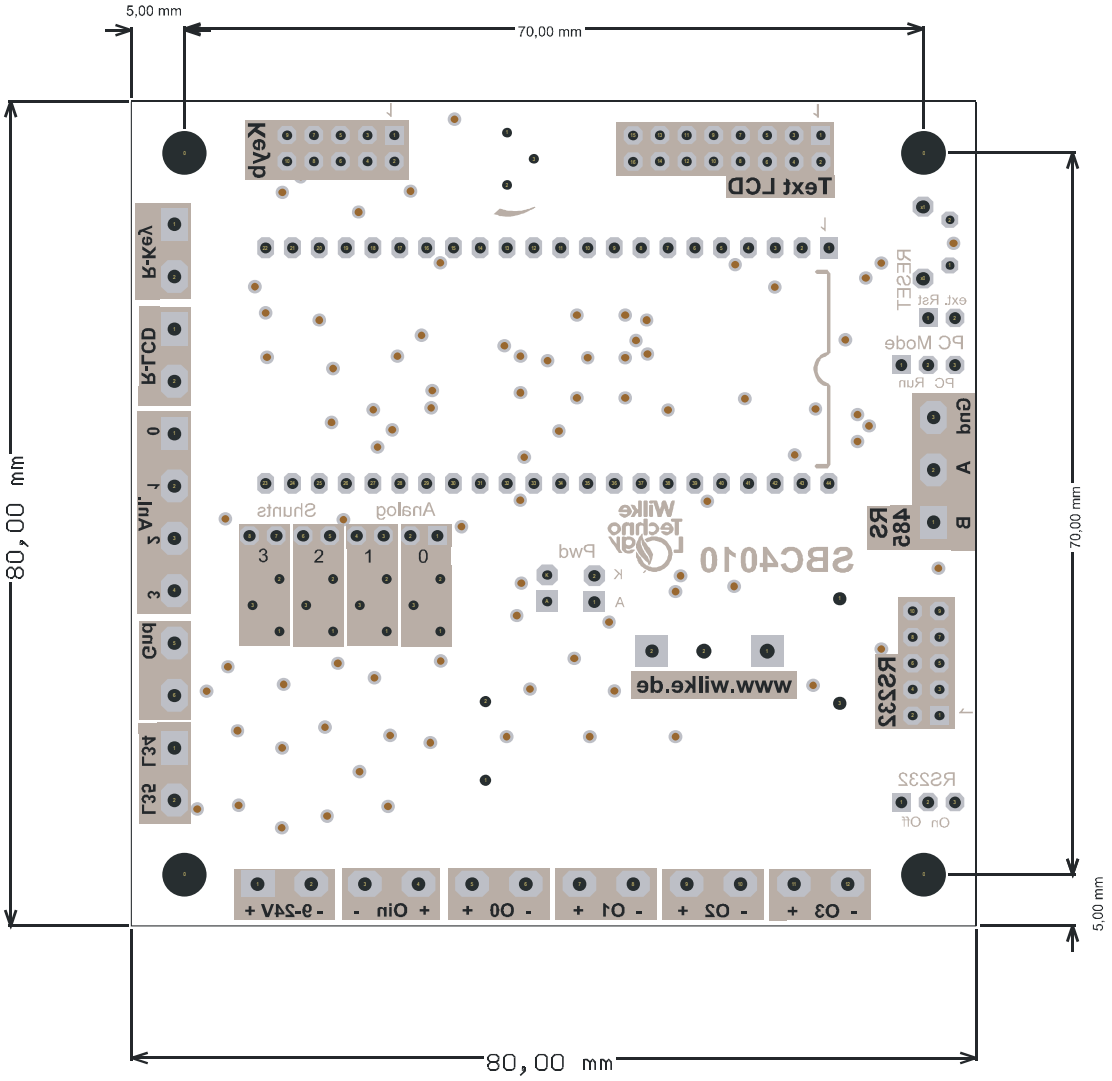
supply voltage U_in	9V...24V DC
supply current at 9V input voltage at 24V input voltage at 9V input voltage with text LCD connected at 24V input voltage with text LCD connected	 125mA 120mA 225mA 220mA
Tolerances of analog inputs at 25°C temperature drift	 < 1.0% *NOTE 1 < 50ppm/°C *NOTE 1
CMOS logic levels high input V_{IH} low input V_{IL}	 › 3.5V ‹ 0.8V

*NOTE 1: refered to the maximum input value, plus input tolerance of TINY-Tiger™.

Technical Documentation

9.3 Mechanical Specifications

The PCB has dimensions of width = 80mm, long = 80mm and height = 30mm. It can be mounted with four screws M3x8 (min) considering thickness of the board 1.6mm and spacers between the board and the mounting pad of at least 4mm.



10 Document History

Version of Documentation	Board Version	Description / Changes
V011	V1.1	Starting document history
V012	V1.1	Correct picture of connectors