TP3000 10.4” Color Touch Panel Computer

Version of Product: 1.1

Technical Documentation

1 Introduction

The TP3000 is a Color Touch Panel Computer with a 10.4” graphic TFT-Display designed to be integrated in the door of a control cabinet, a control desk or the housing panel of your device.
The unit is based on the TINY-Tiger™-2 Multitasking Computers which can be easily programmed in Tiger-BASIC™. It can store and display several menus, graphics and machine states due to its large RAM and Flash memory. The user can interact with the displayed graphics touching directly on it. For programming graphics and touch panel functions we supply a library, which includes many subroutines for creating control elements and graphs, text output with graphic fonts or showing dynamically created graphics.
The inputs and machine states can be transfered from or to your application by the communication ports.

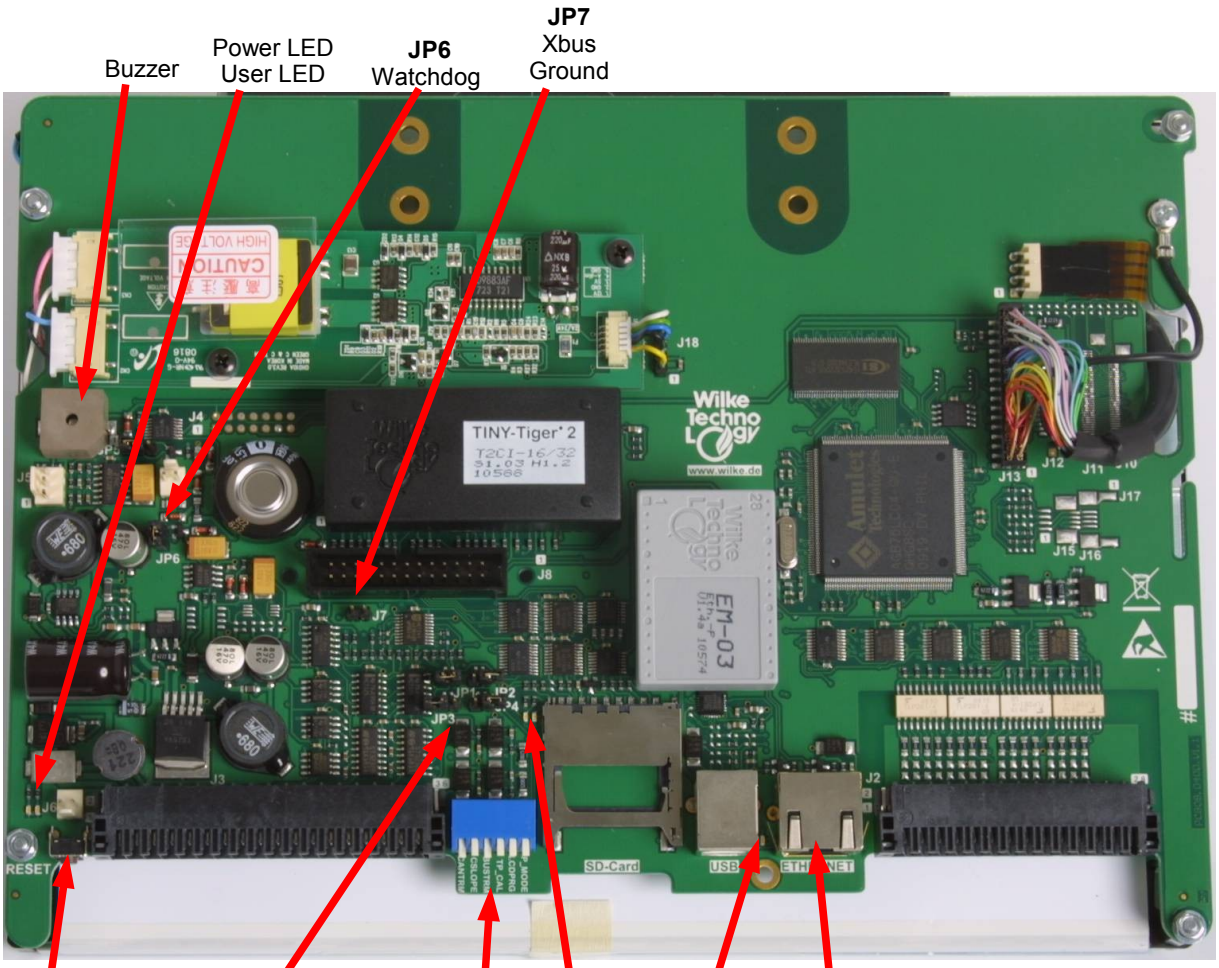
2 Applications

- Touchpanel Terminals
- Operating Units
- Laboratory Apparatus
- Machine Controls
- Data Bus Bridges
- Vending Machines
- Measurement Devices
- Dataloggers
- Info-Points
- ... and many more

3 Features

- Analog touch panel 214mm x 162mm
- With or without front panel frame
- 10.4” Color TFT display with 640 x 480 pixels (18 bit color)
- Switchable display backlight (on / off)
- Display brightness adjustable
- Exchangeable Multitasking Computer Modules
- 512kB...4 MByte FLASH for program or user data
- 4 MBytes FLASH for graphic images
- 512kB...1 MByte SRAM with backup battery Input
- RS232, RS485/422
- Ethernet 10 base T
- USB Slave
- CAN-Bus, V. 2.0B, active, 11/29 Bit Identifier
- Battery Buffered Real Time Clock
- Power Supply Input 15...30V DC
- 8 opto isolated inputs
- 8 opto isolated outputs
- MF2 keyboard support
- Buzzer
- Sound Output
- 6 Control LEDs
- Group-Wise Pluggable Terminals / Connectors
- Tiger X-Bus I/O Extension Bus up to 64k/16M Ports
- SD-card reader
- Analog Inputs 12 x 0...3.75 V (optional)

4 Contents



5 Control Elements

5.1 RESET button

If the PC/RUN-Mode switch S1 is turned to PC-Mode, the TINY-Tiger™-2 will enter the PC-Mode after pressing the RESET button.

If the PC/RUN-Mode switch S1 is turned to RUN-Mode, the TINY-Tiger™-2 will restart the user program after the button is released again.

Additionally you can connect an external RESET button to J6, as well. Please refer chapter connectors for more details.

5.2 Watchdog Jumper (optional)

A watchdog circuit is available if this jumper is assembled.
In this case the watchdog will send a RESET every 20 seconds to the board, if the watchdog is not restarted. For restarting the watchdog you have to toggle pin L86 (with duty cycle equal 1) four times per minute at least.

If the watchdog jumper JP6 is placed you will disable the watchdog circuit.

In case of open the watchdog jumper JP6 it will be enabled.

5.3 Internal Buzzer

A on board buzzer is available on the TP3000, too. It can be used to signal every kind of events. You can signal a touch on the display for example.

A high level on TINY-Tiger™ 2 pin L42 turns the buzzer on. A low level turns it off again.

```
dir_pin 4, 2, 0       ' L42 output
out 4, mask(2), 000h ' buzzer off
out 4, mask(2), 0FFh ' buzzer on
```

5.4 Status LEDs

The TP3000 serves six status LEDs. These LEDs indicate several kinds of functions or malfunctions.

5.4.1 Power LED

The green Power LED will light up if power supply is connected.

5.4.2 User LED

Using L14 you can turn on the yellow user LED, which is also led to the connector J5.

5.4.3 Ethernet Status LEDs

These two LEDs are integrated in the RJ45-connector and show you the state of your Ethernet link. The green connect LED will be light, if the Ethernet is connected to a network. The yellow data LED will be light, if data are received or transmitted.

5.4.4 USB LED

The yellow LED beside the USB slave port indicates if cable and driver are successfully installed.

5.5 DIP Switch S1

On DIP switch S1 you can configure the following features of the TP3000:

DIP Switch	tag	function
1	CANTRM	ON: CAN-bus termination 120R activated
		OFF: no termination
2	CSLOPE	ON: CAN high speed possible
		OFF: slope control active
3	BUSTRM	ON: RS485/422 bus termination 120R activated
		OFF: no termination
4	TP_CAL	ON: Touch panel calibration mode.
		OFF: Operating mode
5	LCDPRG	ON: Display programming
		OFF: Operating mode[1]
6	P_MODE	ON: PC-Mode
		OFF: RUN-Mode

Note: If LCDPRG is ON, the Tiger cannot access the graphic interface. Use this setting to program the graphic chip directly through Ser1.

Note: If LCDPRG is ON, you cannot access the the Tiger for programming or debugging.

5.5.1 CAN bus

The CAN Bus should be terminated at both ends in its characteristic line impedance. You can do this with DIP switch 1.
Using DIP switch 2, you can also select whether the CAN Bus should operate with a

1 Set OFF for Tiger programming/debugging

slope control to reduce EMI or not. Do not use the slope control if the CAN Bus operates at high speeds.

5.5.2 RS485/RS422 Termination

The RS485 Bus should be terminated at both end (for RS422 bus only receive line) in its characteristic line impedance. You can turn this termination on or off with DIP switch 3.

5.5.3 Mode Switch

Turn DIP switch 4 on, to enter the PC-Mode, after pressing the RESET button or after power-on-RESET. In PC-Mode you can download and debug new programs using SER1 or the USB port.

Turn DIP switch 4 off, to enter RUN-Mode, after pressing the RESET button or after power-on-RESET. Use RUN-Mode to start the user program. In this mode SER1 or the USB Port can be used for own applications.

5.5.4 Calibrating the touch panel

Turn on switch 5 to force a calibration after the next reset or power-up. For normal operating mode, it is recommended to turn off this switch.

5.5.5 Programming slave device selection

Using DIP switch 6, you can choose the programming target. Switched on, the display controller is selected (by USB or RS232). Switch it off for normal operating mode or to select the Tiger-2 for debugging or program downloads.

5.6 RS485 / RS422 Selection

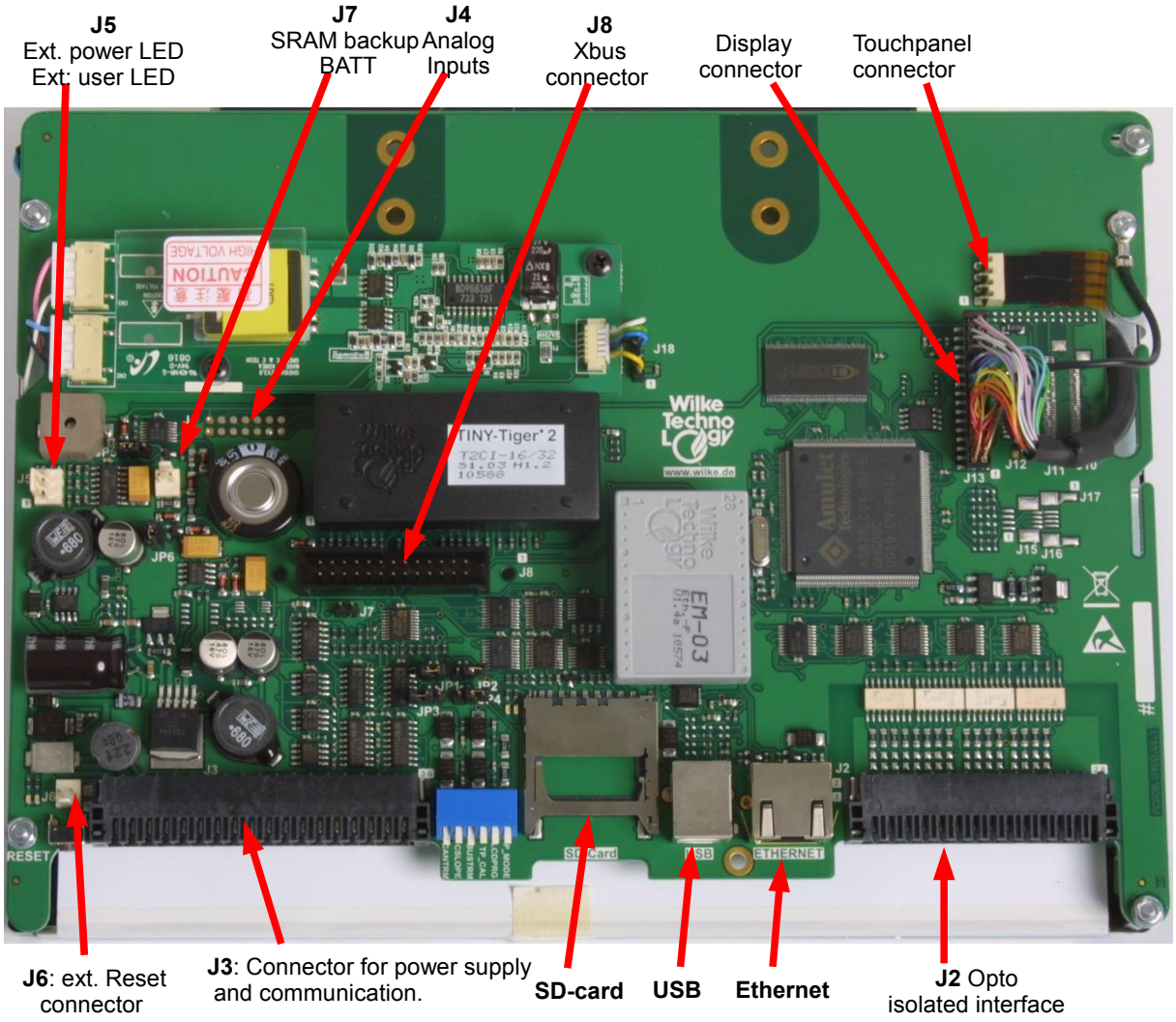
The serial port 2 can be used as RS485 or RS422[1]. It can be configured with JP1...4.

	JP1	JP2	JP3	JP4
RS485	open	close	close	close
RS422	close	open	open	open

1 RS485 full duplex

5.7 Xbus ground JP7

To avoid noise through multiple ground loops, the ground pins of the Xbus connector are not connected to ground. Using JP7 you can connect them to ground.



6 Connectors

6.1 All-in-one connector J3

The connector J3 joins the major connections on just one plug. This simplifies the connecting and disconnecting of unit and peripherals.

J3 contains the power supply, the CAN bus, two serial ports, I²C bus, sound/beeper, and supports a keyboard. One serial port optional can be used as RS232, RS485 or RS422.

The power supply should be 15...30V DC. A green LED light up if power supply is connected. The main power supply input is fused on board, so no external fuse is necessary at this point.

The plug connector J3 is designed for using wires with cross section from 0.08 to 1.0 mm².

Note: To prevent malfunctions and noise, you should connect all devices to the same power supply line. Keep the supply lines short.

The connections of J3 are shown in the table below.

Pin	Funktion
1-2	GND (power supply)
3-4	V_{in} (power supply, 15...30V $_{DC}$)
5	GND (keyboard)
6	MF2-keyboard clock
7	MF2-keyboard data
8	VCC output (keyboard) (+5V)
9	I²C SDA (data)
10	I²C SCL (clock)
11	GND (I²C)
12	Audio-out
13	GND (audio / beeper)
14	Beeper
15	GND (RS485)
16	RS485 / RS422 B (SER2)
17	RS485 / RS422 A (SER2)
18	RS422 Z (SER2)
19	RS422 Y (SER2)
20	RS485 shield
21	GND (CAN)
22	CAN LOW
23	CAN HIGH
24	CAN shield
25	GND (SER1)
26	CTS1 (SER1)
27	RTS1 (SER1)
28	RxD1 (SER1)
29	TxD1 (SER1)
30	SER1 shield
31	GND (SER2)
32	CTS2 (SER2)
33	RTS2 (SER2)
34	RxD2 (SER2)
35	TxD2 (SER2)
36	SER2 Shield

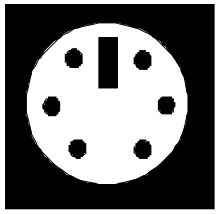
6.1.1 Power supply

The power supply should be 15..30V$_{DC}$. The consumption of the TP3000 is up to 15W. In normal operating mode, it will be about 8W. Use pins 1 and 2 for ground. Please connect pins 3 and 4 with the supply voltage.

6.1.2 MF2 keyboard support

The TP3000 supports MF2 keyboards. This way it is possible to connect a common PC keyboard to the TP3000.

For the connection of a MF2 keyboard two pins of the TINY-Tiger™-2 are needed. Those are L36 (data) and L37 (clk) of the Tiny-Tiger™ module. These two pins and the corresponding power supply should lead to a PS/2 jack.



PS/2 jack

If you do not use MF2 driver, pins L36 and L37 may be used for other purpose. These pins are pulled up with 4.7kΩ.

Please include the device driver “MF2_3736.TD2” in your source code for using a MF2 keyboard.

```
INSTALL_DEVICE #KEYB, "MF2_3736.TD2"
```

6.1.3 Audio line output

You can use a headphone or active speakers for playing sounds on PWM0 output. Simply connect the audio line output on J3 with your amplifier.

The pulse width is controlled by the timer. Include the device drivers TIMERA.TD2 and PWM2.TD2 for audio output.

```
install_device #TA,   "TIMERA.TD2", 2, 69
 ' 9057Hz
install_device #PWM2, "PWM2.TD2",&
  0, &' Channel
  8, &' Resolution
  0, &' Frequency
  0, &' Oversample
  0, &' reserved, always 0
  0, &' Shifts
  1   ' Pre-Scaler
```

6.1.4 I²C

The TINY-Tiger™-2 is able to communicate with I²C devices and uses the following pins for data and clock:

Signal	IO state at the TINY-Tiger™	Description
L70	IO, pull up open collector	Clock line
L71	IO, pull up open collector	Data line

L70 is used as serial clock line (SCL) and L71 as serial data line (SDA). Each line is pulled up to 5V with a 2k2 resistor.

Note: Please be careful when using 3.3V I²C devices with this CPU module. Special care must be taken using device drivers which may use L70 or L71 as output.

Please do not install devices outside of the case of the TP3000.

Call the i2cl_setup function when using I²C.

```
i2cl_setup(
7, &' Port
0, & ' Clock Pin
1, & ' Data Pin
1 )  ' Speed 1=fastest..20=slowest
```

6.1.5 RS485 / RS422

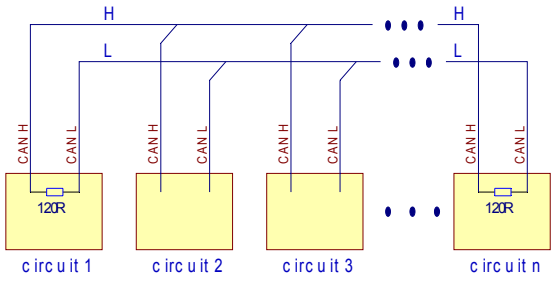
Serial port 2 can be configured and used as RS485 or RS422. Further details you can find in the chapter “serial inferfaces”.

6.1.6 CAN bus

Use the device driver „CAN1_Kx.TDD“ to communicate via CAN-Bus. Install this driver in your source code for full support of CAN bus:

```
install_device #CAN, "CAN1_K1.TDD", &' 500MHz
  "6D 55 D9 98 & ' access code
   FF FF FF FF & ' access mask
   00 &' bustim0
   &    '  bit 0-5  baud rate prescaler-1
   &    '  bit 6+7  synchronisation jump width
   5C &' bustim1
   &    '  bit0-3   Tseg1-1
   &    '  bit4-6   Tseg2-1
   &    '  bit 7    sample rate(low=1,high=3)
   08 &' mode
   &    '  bit 4=high single filter
   1A"%' outctrl
   'baud rate=
   '    1/[0.1*samples*BRP*(1+Tseg1+Tseg2)]
```

With the CAN bus port a bus connection of multiple boards is possible. The hardware of the TINY-Tiger™-2 supports the CAN 2.0A and 2.0B protocols.



Note: The line should be terminated at both ends in its 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!

The slew rate can be changed to reduce EMI by configuring the jumper block.

6.1.7 Serial Port 1

Serial port 1 is a volatile interface. In program mode, the SER1 is necessary for program uploads and debugging the TINY-Tiger™-2 on the TP3000. Further, depending on the switch S1.6 the SER1 is used for uploading images into the graphic chip as well.

In normal operation mode, the SER1 can be used as a general purpose serial port to connect with peripheral devices.

SER1 supports bit rates up to 115kBaud.

6.1.8 Serial Port 2

Serial port 2 is a shared interface. You can you it as R232, RS485 or RS422. For further details please read chapter 8.3 (Serial port SER2).

This serial port is provided by a software driver. It supports baud rates up to 9600 baud.

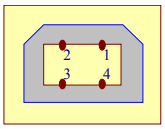
6.2 Ser 1: USB J9

In case of using the USB slave port, the RS232 port is automatically disabled.

Please install the virtual COM Port driver (**TP3000_USB_driver**) for connecting the TP3000 to your PC via USB cable.

The yellow LED beside the USB slave port should be lit if cable and driver are successfully installed.

All functions of SER1 are redirected to the USB port, including the programming /debugging of the TINY-Tiger™-2 and the upload to the graphic controller.

2	D-		V_{Bus}	1
3	D+		GND	4

Connector J9 Ser1: USB

6.3 Ethernet J5

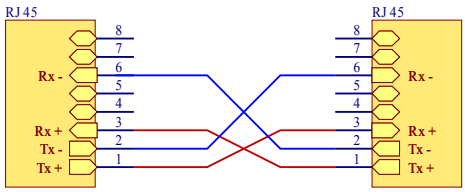
The EM03-ETH-P Ethernet module supports protocols like ARP, IP, TCP, DHCP, DNS, UDP, SNTP. Some more protocols are already implemented in BASIC language. Please take a look at the latest version of the EM03-ETH-P documentation.

The board presents a 10 BASE-T Ethernet connection. The RJ45 connector includes 2 status LEDs: Green for link, yellow for traffic.

You can connect 2 boards with a cross linked cable or connect with a straight cable to an existing network using a hub or switch.

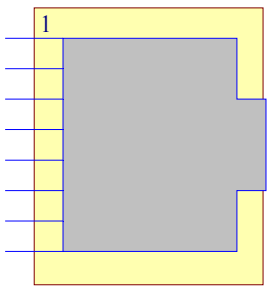
As the board supports TCP/IP you can easily connect your application to an intranet or to the Internet via a gateway.

Possible applications are for example web browser controlled devices or devices which send e-mails if a defined event occurs. With this CPU board you can design measurement devices which will send results to the hard disk drive of an Internet service provider via FTP to get world wide access to the measured values.



Cross linked cable for Ethernet

1	Tx+
2	Tx-
3	Rx+
4	-
5	-
6	Rx-
7	-
8	-



Connector J5

For the use of the ethernet library follow these two steps:

Step 1: Copy the configuration file C:\Programme\Wilke Technology\Tiger Basic 5.4\Libraries\Ethernet_Web\ts_conf.inc in your project directory and activate the following definition:

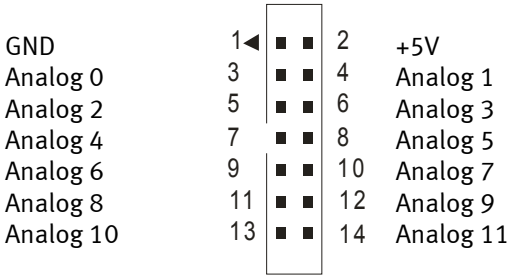
```
#define        TS_EM_03
```

Step 2: Include the ethernet library as follows:

```
#project_path "C:\Programme\Wilke
Technology\Tiger Basic 5.4\Libraries"
#include Ethernet_Web\ts_coinc.inc
```

6.4 Analog inputs J4 (optional)

The TP3000 is optional available with 12 analog input channels. The input voltage range is 0...3.75V. It's designed for connecting directly to analog voltage.



Connector J19

Using the device driver „ANALOG1.TDD“ you get values between 0 and 1015. As the reference voltage is also 3.75V, the measured voltage is the returned value multiplied with (3.75V/1024=) 3.6621mV.

6.5 SRAM backup battery J7

On connector J7 a backup battery can be connected.
In case of using TINY-Tiger™-2 only SRAM is buffered by this external battery. The RTC is buffered by the on board GoldCap capacitor.

Please use only 3...5V batteries on connector J7.

Pin Signal

1 BATT -
2 BATT +

Connector J7

Note: Please refer to the datasheet of the used TINY-Tiger™-2 module for electrical specification.

6.6 Optical isolated I/Os on J2

The TP3000 provides 8 optical inputs and 8 optical outputs. These I/Os are implemented as 2 on-board Xbus devices.

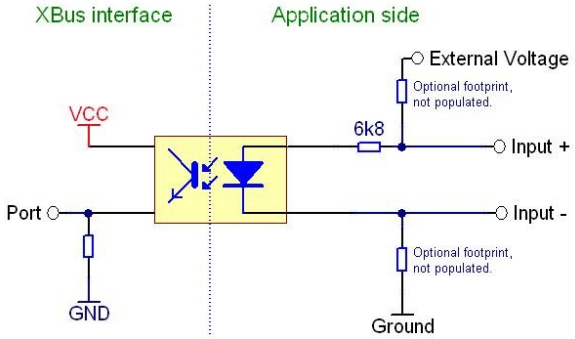
Pin	Signal
1-2	External ground
3-4	External power 5-30V
5	Input-Channel 0 (+)
6	Input-Channel 0 (-)
7	Input-Channel 1 (+)
8	Input-Channel 1 (-)
9	Input-Channel 2 (+)
10	Input-Channel 2 (-)
11	Input-Channel 3 (+)
12	Input-Channel 3 (-)
13	Input-Channel 4 (+)
14	Input-Channel 4 (-)
15	Input-Channel 5 (+)
16	Input-Channel 5 (-)
17	Input-Channel 6 (+)
18	Input-Channel 6 (-)
19	Input-Channel 7 (+)
20	Input-Channel 7 (-)
21	Output-Channel 0
22	Output-Channel 1
23	Output-Channel 2
24	Output-Channel 3

25	Output-Channel 4
26	Output-Channel 5
27	Output-Channel 6
28	Output-Channel 7

The optical interface has an isolation up to 2.5kV.

6.6.1 Input circuit

The optical inputs are attached through the X-Bus to the Tiger. The device address is $0x80_h$.



The input circuit supports many ways to connect an external device. The resistor limits the current through the opto coupler. There are two 0805 footprints to solder one of them with a 0Ω resistor.

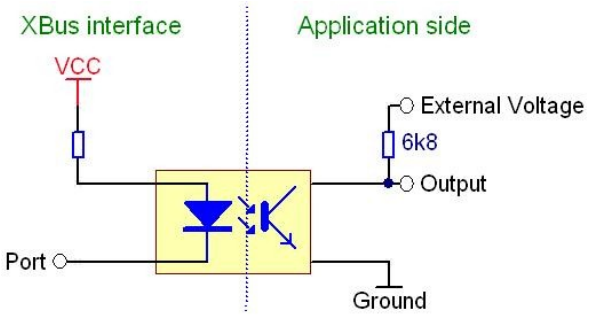
Using the inputs pins, the switching level is at about 2.5V. Below this level, the input signal is inactive and the port state is read as “0”. - Above 2.5V the state is high and the port sate is read as “1”.

Program sample for input:

```
byte blIn
blIn = xin( 080h )
```

6.6.2 Output circuit

The optical output port is mapped on port address $0x08_h$.



The output circuit is quite simple. The pull-up resistor sets the inactive high level to the external voltage level.

Note: If no external voltage is connected to the optical isolated interface, all outputs are related through the pull-up resistors.

Program sample for output:

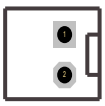
```
xout( 08h, 01010101b )
```

6.7 External Reset J6

Use connector J6 to connect a external RESET button, the internal button is always active.

Pin Signal

1 Reset In
2 GND



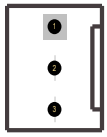
Connector J6

6.8 External Power LED J5

An external power LED can be directly connected to connector J5.

Pin Signal

1 GND (Cathode)
2 UserLED (Anode)
3 Data LED(Anode)

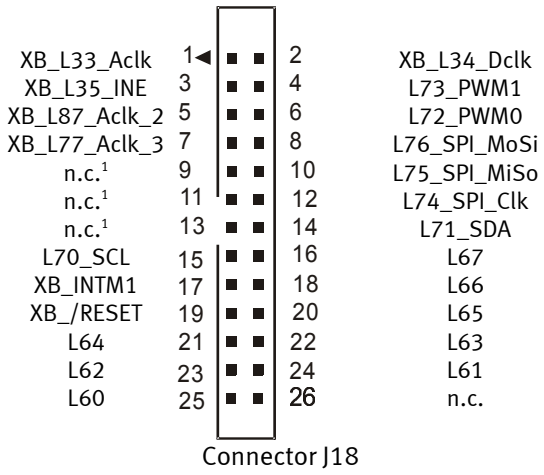


Connector J5

6.9 Tiger X-Bus J8

The Tiger X-Bus is used to connect expansion modules of the **TDR series** to the TP3000. The expansion module is clipped to the DIN rail and is connected with a short ribbon 1:1 cable with a female header connector at one side

and a female 25 pole sub D connector at the other side. The cable length must not exceed 0.5m.



Connector J18

During installation of the TP3000 or expansion modules the power of all devices should be turned off.

The signals of the Tiger X Bus are connected to, or controlled by the TINY-Tiger™-2 I/O ports. The functions of the signals are listed below. To avoid conflicts between expansion modules the signals of the Tiger X-Bus should only be used as described.

Please take a look at our **application notes** for connecting our EP expansion modules to the TP3000 by using the Tiger X-Bus.

Note: We strictly recommend to take a look at **schematics of TP3000** in case of using the Tiger X Bus pins for other purposes in your application. Using the Tiger X Bus pins for other purposes is at your own risk!

Tiger X-Bus Signal	Used IO Port of TINY-Tiger	Input / Output	Description
XB_L33_Aclk	L33	Output	Address clock low byte (high active) If this signal is high the address at L60...L67 is valid. IO modules should latch the address.
XB_L34_Dclk	L34	Output	Data clock (high active). If this signal is high the data at L60...L67 is valid.
XB_L35_/INE	L35	Output	Input Enable (low active). If this signal is low the input module whose address is selected should put its data to L60..L67.
L60	L60	IO	Used as multiplexed address and data bus line.
L61	L61	IO	Used as multiplexed address and data bus line.
L62	L62	IO	Used as multiplexed address and data bus line.
L63	L63	IO	Used as multiplexed address and data bus line.
L64	L64	IO	Used as multiplexed address and data bus line.
L65	L65	IO	Used as multiplexed address and data bus line.
L66	L66	IO	Used as multiplexed address and data bus line.
L67	L67	IO	Used as multiplexed address and data bus line.

1 Can be optional connected to GND

Tiger X-Bus Signal	Used IO Port of TINY-Tiger	Input / Output	Description
L70-SCL	L70	IO, pull-up open collector	I²C clock line. To use this line an external pull-up resistor is necessary.
L71-SDA	L71	IO, pull-up open collector	I²C data line. To use this line an external pull-up resistor is necessary.
L72-PWM0	L72	Output	PWM output 0
L73-PWM1	L73	Output	PWM output 1
L74-SPI-CLK	L74	Output	SPI clock line. SPI devices should be enabled using a bit of an extended port.
L75-SPI-MiSo	L75	Input	SPI data input line. SPI devices should be enabled using a bit of an extended port.
L76-SPI-MoSi	L76	Output	Serial Peripheral Interface (SPI) data output line. SPI devices should be enabled using a bit of an extended port.
XB_L77_Aclk_3	L77	Output	Address clock high byte (high active). If the signal is '1', then L60...L67 is latched as mid byte of an 24 bit address for Xport functions.
XB_L87_Aclk_2	L87	Output	Address clock mid byte (high active). If the signal is '1', then L60...L67 is latched as high byte of an 24 bit address for Xport functions.
XB_INTM1	INTM1	Input pull-up	Expansion modules can pull up this signal to initiate a BASIC interrupt 1.
XB_/RESET	INTM3	IO open collector pull-up 470Ω	If the reset button is pressed, at power up and using the peripheral reset line L85 the X-Bus devices could be resettet. If any IO module pulls this signal low, the user program can recognize this using BASIC interrupt 3.
Optional GND	-	-	Can be optional connected to GND with 0R resistor.

6.10 Display connectors J10 ... J13

The TP3000 board supports different kinds of TFT-color displays[1]. Depending on the cable and the pin mapping, there are these 4 footprints for various connectors. Usually, there is just one connector populated matching to the included display.

6.11 Touch Panel connectors J14 ... J17

The TP3000 board has also 4 footprints for different touch panels with various pin mapping. By default, there is just one footprint soldered belonging to the included touch panel.

The pin mapping can optional be changed by alternative soldering.

7 SD-Card Reader

The TP3000 board includes a SD card reader, where you can plug in your SD card.

Note: Please don't remove the card, while it is mounted and the access LED is lit.

The SD Memory Card provides application designers with a low cost mass storage device, implemented as a removable card, that supports high security level for copyright protection and a compact, easy-to-implement interface.

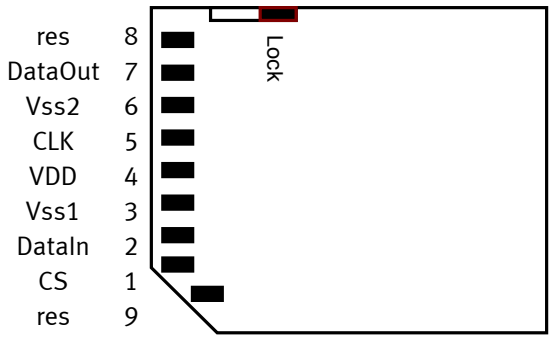
The SPI compatible communication mode is designed to communicate with a SD Memory Card.

1 TTL interface

As any other SPI device the SD Memory Card SPI channel consists of the following four signals:

CS:	Chip Select signal
CLK:	clock signal
DataIn:	Tiger to card data signal
DataOut:	card to Tiger data signal

7.1 SD-Card Pad Definition (SPI Bus Mode)



SD-Card (bottom)

Pin No	*Signal*	*description*	*status*	
0	Access	Equal CS (Chip Select)	0	Card mounted (LED on)
			1	Card unmounted (LED off)
1	Error	Show any kind of error	0	No error (LED off)
			1	Error (LED on)
2	Power	Turn Power on or off	0	Power on
			1	Power off
6	wri	Write protection	0	Write unprotected
			1	Write protected
7	det	Card detection	0	Card detected
			1	Card not detected

For the use of the memory cards library include the file fs_coinc.inc and make definitions as follows:

```
#define SD_SPI_PORT           7 ' SPI port
#define SD_SPI_DATA_IN_PIN    5
        ' MiSo (Tiger - In, Card - Out)
#define SD_SPI_DATA_OUT_PIN   6
        ' MoSi (Tiger - Out, Card - In)
#define SD_SPI_CLOCK_PIN      4
        ' Clock
#define SD_XP_ADDRESS        00F8h
        ' X-Port Address for Control Lines
#define SD_XP_POWER_OFFSET    0
     ' Offset to X-Port Address for Power Line
#define SD_XP_SDCARD_DETECT   7
        ' Bit of X-Port for Card Detect Line
#define SD_XP_WRITE_PROTECT   6
        ' Bit of X-Port for Write Protect Line
#define SD_XP_POWER           2
        ' Bit of X-Port for Power Line
#define SD_XP_ERROR_INDICATOR 1
     ' Bit of X-Port for Error Indication Line
#define SD_XP_CHIP_SELECT     0
        ' Bit of X-Port for Chip Select Line
#project_path "C:\Programme\Wilke
Technology\Tiger Basic 5.4\Libraries"
#include
     Memory_Cards\File_System\fs_coinc.inc
```

7.2 Access LED

Beside the card reader slot, there are two LEDs showing the current status of the SD-Card device. The yellow Access LED lights up on any read or write access. The LED is connected to signal '*chip selected*' of the card.

7.3 Error LED

The red Error LED is designed for signaling every kind of error when using the SD-Card. E.g. if you want to write on a write protected card, this LED will light up.

The SD-Card adapter is associated with the Tiger using the X-Bus. The X-Port address is **0xF8** and is used to control the SD Memory Card and display the status of the card.

You can read or set data with the X-Port by using address $F8_{hex}$. The following table shows the defined pin numbers and the purpose of signal:

Portaddress physical address	*bits*	*used for:*
$F8_{hex}$ (SD-Card)	0	Chip select
	1	Err LED
	2	Power on
	3	-
	4	-
	5	-
	6	Write protection
	7	Card detection

For reading and writing to the SD-Card you can free download our library with or without FAT system.

Note: By using FAT system the card capacity is limited to 2GB.

8 Serial interfaces

The TP3000 has three serial ports. Two of them are led out, one is for the serial communication with the graphic interface.

Use the device driver „SER1B_Kx.TDD“ to communicate via serial port 0 and 1. Install the device driver in your source code for full support of Ser0 and Ser1.

```
#ifdef TIGER_2
INSTALL_DEVICE #SER, "SER1B_K1.TDD", &
BD_9_600, DP_8N, YES, & 'Ser.0
BD_9_600, DP_8N, YES, & 'Ser.1
00010000b, 1, 0 'RS485 set L14 to RTS0
#endif
#ifdef TIGER_1
INSTALL_DEVICE #SER, "SER1B_K1.TDD", &
BD_9_600, DP_8N, YES, & 'Ser.0
BD_9_600, DP_8N, YES, & 'Ser.1
00100000b, 9, 0 'RS485 set L95 to RTS0
#endif
```

8.1 Serial port SER0

The serial port Ser0 is directly connected to the graphic chip. In normal operation mode, the Tiger can control the graphic.

Additional the Tiger can program the graphic sources into the chip. Set L84 high to enable the program mode of the graphic chip. Clear L84 for normal operation.

8.2 Serial port SER1

Serial port Ser1 is used for program upload and debugging. It is led to the connector J3 and supports baud rates up to 115 kb/s.

Plugging in the USB port, the serial port is automatically switched to USB mode and the RS232 will be disabled.

Use jumper block S1.4 to set the Tiger to program mode. Switch S1.6 to set the graphic chip to program mode.

8.3 Serial port SER2

Ser2 is a multipurpose serial interface. You can use it as a RS485, RS422 or RS232.

The RS232 is always connected on J3. The jumper JP1, JP2, JP3 and JP4 will configure RS485/RS422. Switch S1.3 can be set to terminate the RS485 with a 120Ω resistor.

Ser2 provides up to 9600 baud by software.

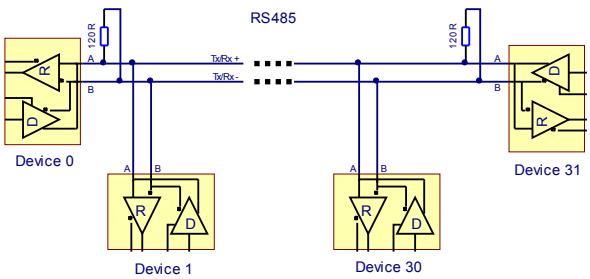
Use the device driver SER2_80_Kx.TD2 for the soft serial communication.

Mind to install the timer with the frequency = baudrate * Rx Oversampling!

```
install_device #TA, "TIMERA.TDD", 1, 87
       '28736Hz for 9600bd
install_device #SER2, "SER2_80_K1.TDD", &
    8, &  ' data bits       1..8bits
    0, &  ' parity 0=no,    1=space,
    &                2=even, 3=odd, 4=mark
    0, &  ' bit inversion   0=true, 1=invers
    3, &  ' tx Prescaler    0=no transmitter
    &                       1..255=factor
    3, &  ' rx Oversample   0,1,2=no receiver
    &                       3..255=factor
    1, &  ' reserved        1
    100b  ' transmit enable RS485
    ' 000b=no handshake pins
    ' 001b=CTS (input,  controls transmission
    '           activity)
    ' 010b=RTS (output, free buffer RxD)
    ' 011b=RTS+CTS
    ' 100b=transmit enable RS485 (output,
              free buffer TxD)
```

8.3.1 RS485 Mode

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.



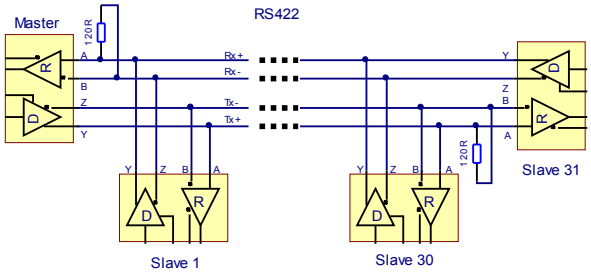
Note: The line should be terminated at both ends in its characteristic impedance. Stub lengths off the main line should be kept as

short as possible.
You have to connect GND to each module if a separate power supply is used!

The RS485 port can be used to expand your TP3000 with relay outputs, digital inputs , PT1000 temperature sensors or many things more. Please take a look for our **SBC30xx** and **SBC40xx**!

8.3.2 RS422 Mode

With the RS422[1] port a multi slave, single master bus connection of boards (up to 32 devices) is possible. You should implement a software protocol to prevent that more than one slave is writing to the master at the same time. All circuits must use the same baud rate.



Note: The transmit line should be terminated in its 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!

9 TFT display

The display itself has a solution of 640 x 480 pixels. It supports up to 18 bit color depth. The display is associated to the graphic controller. A html-coded image can be prepared and stored in the graphic device. The graphic chip is controlled by the Tiger using the serial port 0.

The backlight of the display is switchable with the Tiger-2 pin L40.

```
dir_pin 4, 0, 0      ' L40 output
out 4, mask(0), 000h' user LED off
out 4, mask(0), 0FFh' user LED on
```

10 TFT backlight brightness

The brightness of the TFT display can be adjusted by the PWM channel-1 (L73) output.

```
install_device #AD1, "PWM1.TDD"

 […]

put #AD1,#1, 123 '0..255
```

Setting the value to “0” for maximum brightness and “255” for lowest brightness.

Match the brightness to the surrounding light conditions.

The backlight of the display is switchable. A high level on TINY-Tiger™-2 pin L40 turns the backlight on. A low level on this pin turns it off again.

Please turn the backlight on for better TFT brightness adjustment.

11 Touch Panel

The TP3000 includes a 10.4” touch panel. It is controlled by the graphic chip. So, there is no need of an extra device driver.

In normal operational mode, the touch panel does not have to be calibrated. After a programming sequence the touch controller requests a new calibration at the first run.

Depending on switch S1.5, the touch panel forces a calibration procedure after each start.

The calibration procedure is easy: It starts with a circle in the upper left corner. Touch this circle in the center. It will disappear. Another circle appears at the lower right corner. After touching this in the center, it with disappear too. Finally, touch another circle in the middle of the screen.

1 RS485 full duplex

12 EEPROM

An 64 kByte EEPROM of type M24512 is connected to the I²C bus. To communicate with the EEPROM you have to use the device selection byte $0xA9_{hex}$ for read access and $0xA8_{hex}$ for write access.

Data such as calibration information can be stored here. The data will be available even after any program updates.

13 RTC

The real time clock is part of the TINY-Tiger™-2. On board, there is a gold-cap capacitor instead of a commercial battery or accumulators. The advantage is:

- no “memory effect”
- no change necessary
- no toxic waste

This goldcap capacitor is charged as the TP3000 is connected to power supply. - When power is not connected, the capacitor supplies the RTC for many weeks.

```
install_device #RTC, "RTC1.TDD"
```

14 Buzzer

The buzzer is controlled by the Tiger pin L42.

```
dir_pin  4,2,0 'Set direction output
out 4, mask(2), 000h' buzzer on
out 4, mask(2), 0FFh' buzzer off
```

15 Used Tiger Pins

I/O of TINY-Tiger™ 2	Pin No	used for:
L14	28a	UserLED (yellow) and let out on J5.2.
L15	32b	RTS1 (RS232)
L33	29a	Low byte of address clock
L34	30a	on Tiger X Bus as XB_L34_Dclk and intern as data clock signal for the extended ports. high active output
L35	31a	on Tiger X Bus as XB_L35_/INE and intern as input enable signal for the extended ports. low active output
L36	32a	Keyboard data line
L37	33a	Keyboard clock line
L40	37b	TFT backlight (high active)
L41	36a	Run / PC Mode
L42	38b	Buzzer
L60 to L67	1a to 8a	multiplexed data and address lines used by Tiger X Bus, LCD, Ethernet module and extended ports
L70	9a	SCL signal connected to I^2C-EEPROM and J17 low active-pull up 2k2
L71	10a	SDA signal connected to I^2C-EEPROM and J17 low active-pull up 2k2
L72	11a	Tiger X Bus L72-PWM0 Audio line out.
L73	12a	Tiger X Bus L73-PWM1 TFT display brightness control.
L74	10b	Tiger X Bus reserved for L74-SPI-CLK, available with TINY-Tiger™ 2
L75	11b	Tiger X Bus reserved for L75-SPI-MiSo, available with TINY-Tiger™ 2
L76	12b	Tiger X Bus reserved for L76-SPI-MoSi, available with TINY-Tiger™ 2
L77	13b	reserved for high byte of address clock, available with TINY-Tiger™ 2
L80	13a	TxD2 (RS232, RS485, RS422)
L81	14a	RxD2 (RS232, RS485, RS422)
L82	15a	CTS2(in) (RS232) or Transmitter enable (RS485)
L83	16a	RTS2(out) (RS232)
L84	17a	Graphic chip program mode
L85	18a	Graphic chip reset (low active)
L86	19a	Trigger watchdog
L87	20a	reserved for mid byte of address clock
L90	23a	Data out line for RS485/RS422
L91	24a	Data in line for RS485/RS422
L92	25a	CTS0 not used but pulled down by a resistor
L93	26a	TxD1 (RS232)
L94	27a	RxD1 (RS232)
L95	33b	CTS1 (RS232)
L96	34b	L96_CAN_TX CAN Bus transmit line
L97	35b	L97_CAN_RX CAN Bus receive line
INTM1	8b	Connected to Tiger X-Bus signal XB_INTM1
INTM3	7b	Connected to Tiger X-Bus signal XB_/RESET

16 Used X-Port Addresses

Phy. Address	bit	used for:
$0x08_{hex}$ (output)	0..7	Optical isolated output lines
$0x80_{hex}$ (input)	0..7	Optical isolated input lines
$0xF0...0xF4_{hex}$ (output)	0..7	Ethernet module EM03-ETH-P
$0xF8_{hex}$ (output)	0..7	SD card modul

17 Used Analog Inputs (optional)

analog inputs of TINY-Tiger™ 2	used for:
A/D Ref Low	GND
A/D Ref High	3.75V
Analog in 0	Connector J4.3
Analog in 1	Connector J4.4
Analog in 2	Connector J4.5
Analog in 3	Connector J4.6
Analog in 4	Connector J4.7
Analog in 5	Connector J4.8
Analog in 6	Connector J4.9
Analog in 7	Connector J4.10
Analog in 8	Connector J4.11
Analog in 9	Connector J4.12
Analog in 10	Connector J4.13
Analog in 11	Connector J4.14

18 Technical Specification

18.1 Absolute Maximum And Minimum Ratings

(beyond which permanent damage may occur)

maximum supply voltage U_in (in respect of GND)	30V DC
maximum voltage at GND (in respect of GND at power supply)	5V DC
maximum input voltage at SRAM backup BATT at analog inputs 0...3.75V (on connector J4)	 10V DC 5V DC
input voltage at any TINY-Tiger™-2 pins	-0.5...5.5V DC
operating temperature with RTC battery	0...60°C
operating temperature without RTC battery	-10...70°C

Do not connect any signal connector of the TP 3000 directly to wires which are outside a building.

18.2 Electrical Specifications

supply voltage U_in	15...30V DC
power consumption at 15...30V: TP3000, backlight TFT (bright) without Tiger, without Ethernet module TP3000, backlight TFT (dark) without Tiger, without Ethernet module TP3000, backlight TFT (disabled) without Tiger, without Ethernet module TP3000, backlight TFT (disabled) without Tiger, with Ethernet module TP3000, backlight TFT (disabled) with Tiger and Ethernet module TP3000, backlight TFT (bright) with Tiger and Ethernet module TP3000, backlight TFT (dark) with Tiger and Ethernet module	 11.1W +/-200mW 6.5W +/- 500mW 3.5W +/-200mW 4.5W +/-200mW 4.7W +/-200mW 12.5W +/-200mW 7.1W +/-200mW
recommend operating temperature	0...50°C

19 Order Informations

19.1 Part Number Scheme

TP3000	-	[front panel]	-	[Computer module and additional features]	-	[LCD]
product name always **TP3000**		**X:** no frontpanel **R:** domed frontpanel aluminum varnished ***F:**[1]* *planar frontpanel aluminum anodized*		**T2B:** TINY-Tiger™ 2 Mutitasking Computer TTI-T2CI-8/32-R 1MByte SRAM, 4MByte FLASH programmable in Tiger-BASIC™ USB client CAN-BUS Ethernet module EM03-ETH-P serial EEPROM with I²C-Bus Real Time Clock is buffered with on board Li-battery RAM can be buffered through the Battery input connector		**c:** VGA color display

*[1] available on request

Note: See Matrix of Features for preferred products, other variations are available on request.

Note: Please order the corresponding connectors separately!

19.2 Example

TP3000-R-T2B-c

- c: 10.4” VGA color display
- T2B: TINY-Tiger™ 2 Mutitasking Computer type TTI-T2CI-8/32-R with 1MByte SRAM 4MByte FLASH, programmable in Tiger-BASIC™, USB, CAN-BUS, Ethernet, serial EEPROM and a goldcap buffered real time clock.
- R: a domed frontpanel,
- TP3000: Touch Panel Computer type TP3000,

19.3 Matrix of Features

Product / Feature	TP3000-X-T2B-b	TP3000-R-T2B-b
Softline Frontpanel, domed, powder coated, RAL9007	-	●
Analog Touchpanel, 211mm x 159mm active area	●	●
10.4” VGA TFT, 640x480 Pixel, 18bit color	●	●
TINY-Tiger™ 2, TTI-T2CN 8/32, 1MB SRAM, 4MB FLASH	●	●
Fast Boot < 1s	●	●
In Field Programmable	●	●
Battery Buffered Real Time Clock	●	●
Backup Battery Input for SRAM	●	●
Ethernet Module EM03-ETH-P	●	●
RS232, RS485 / R422	●	●
USB Client	●	●
CAN-Bus, Version 2.0B, active, 11bit / 29bit Identifier	●	●
MF2 Keyboard support	●	●
serial EEPROM, 64 K byte	●	●
Internal / External Buzzer	●	●
Sound Output	●	●
2 Internale / External Control LEDs	●	●
Group Wise Pluggable Terminals / Connectors	●	●
Tiger X-Bus Modules	○	○

●: implemented ○: can be plugged in -: not impemented

20 Document History

Version of Documentation	Product Version	Description / Changes
V000	V1.0 beta	Pre release
V001	V1.0 beta	preliminary version, several specifications added
V002	V1.1	preliminary version, Data sheet updated due to a circuit revision
V003	V1.1	Brightness values changed