TDR 1020 Tiger DIN Rail CPU Module

Version of Product: V1.0

Technical Documentation

1 Introduction

The TDR 1020 CPU module is composed of a powerful TINY-Tiger™ 2, various communication ports and standard analog input ports. It presents an easy way for designing your application with a modular system that will fit to your requirements.

Eight sensors with an 0mA...20mA output, four sensors with an 0V...10V output can be directly connected to the TDR 1020. The various communication ports are allowed to communicate to almost every kind of device. The power supply for the TDR 1020 is fused on board, so no external fuse is necessary at these points.

The TDR 1020 is mounted in your housing just by clipping it on a DIN rail. It can easily be expanded with several input and output modules of the TDR series which are or will be available at Wilke Technology. Expansion modules are clipped right next to the TDR 1020 and pushed together. They are connected at the Tiger X Bus without any cabling or with a standard 1 to 1 25pole DSUB cable.

The TINY-Tiger™2 can be programmed in system over the RS232 or USB port with the powerful, well known and easy to learn Tiger-BASIC™.

The TDR 1020 module have installed a 3V Lithium battery to backup RTC. Wilke Technology is obliged to take back the old batteries and to dispose them in accordance with the provisions of the German Waste Management and Recycling Act.

2 Features

- In circuit programmable TINY-Tiger™ 2 multitasking controller
- Power supply 8...30V DC
- Connector for graphic LCD
- RS232 / USB port
- RS232 / RS485 port
- CAN-Bus 2.0B
- Ethernet connection with module EM03-ETH-P
- 8 analog inputs 0mA...20mA
- 4 analog inputs 0V...10V
- LEDs indicate the states of communication ports
- RESET button and PC-Mode jumper
- Battery buffered RTC
- pluggable connectors
- 512kb I²C EEPROM

Contents

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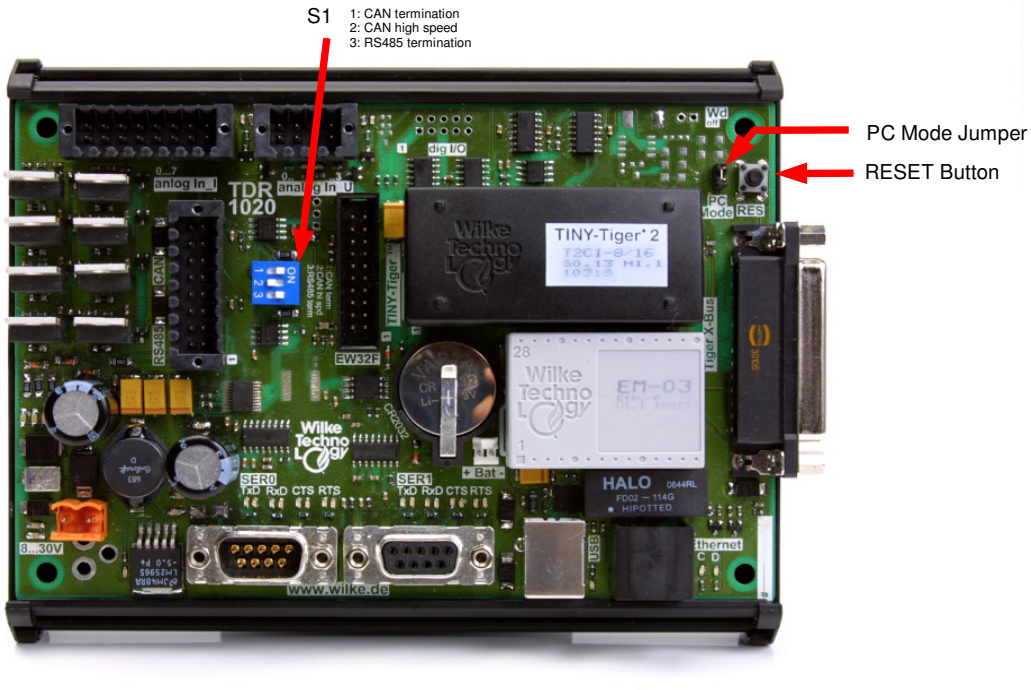

3 Control Elements

RESET Button and RUN/PC Mode Jumper

Pressing the RESET button will restart the user program if the „PC“ Mode Jumper is replaced.
If the mode Jumper „PC“ is connected then the TINY Tiger 2 will enter PC mode after pressing the RESET button.

CAN and RS485 Termination S1

With these switches you can turn the bus termination (120Ω) on or off.
RS485 and CAN are serial data buses which should be terminated at each end of the line.
If the TDR 1020 is connected to one end of the bus then the termination should be switched to „ON“.
Otherwise, if the board is connected to the mid of the bus, then the termination should be switched to „OFF“.

You can also select weather the CAN Bus should operate with a slope control to reduce EMI or not. Do not use the slope control if the CAN Bus operates at high speeds.

DIP No	*Bus*	*Function*
1	CAN	ON: bus termination active OFF: no termination
2	CAN	ON: high speed is possible OFF: slope control active
3	RS485	ON: bus termination active OFF: no termination

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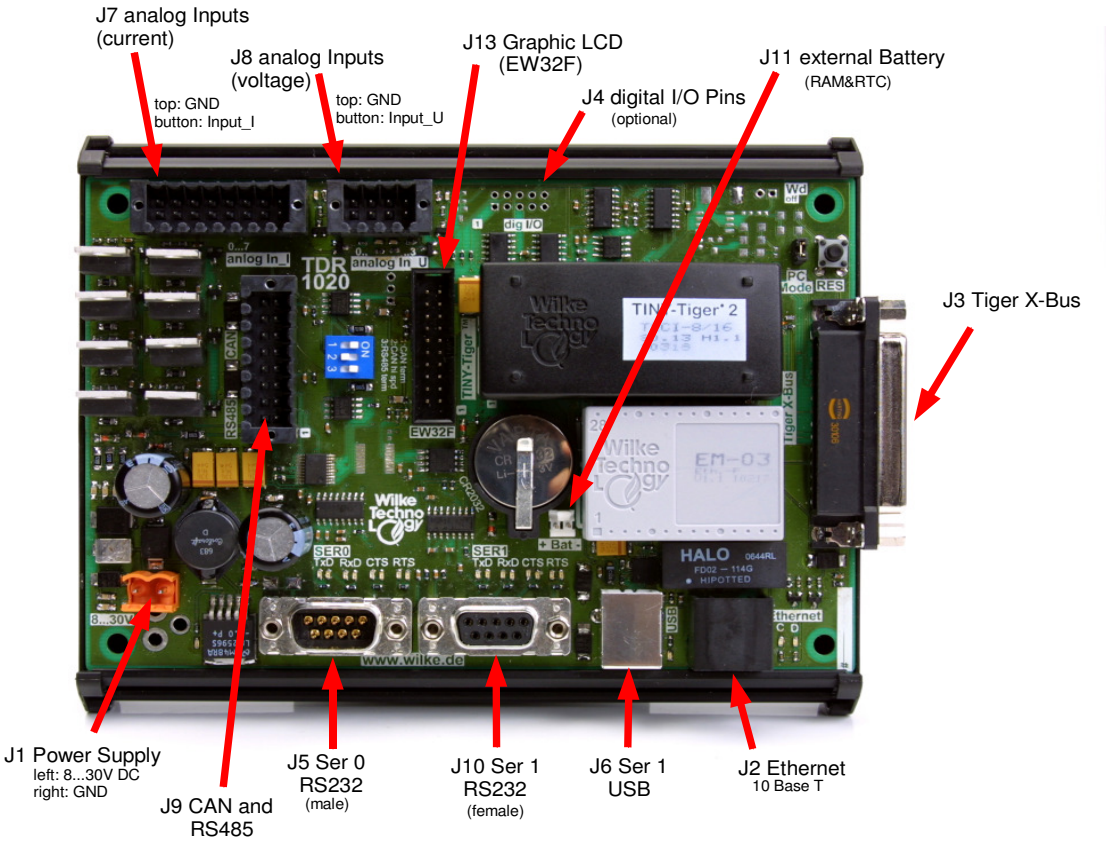
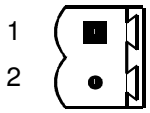


4 Connectors and Screw-Terminals

Power Supply

You can connect the power supply 8V...30V DC at connector J1



Connector J1

Terminal no	*Signal*
1	GND
2	8V...30V DC

Analog Input 0mA...20mA

You can directly connect sensors with current outputs of 0mA...20mA to connector J7 of the TDR 1020. The current is measured over a 182Ω resistor. As the board presents a 3.75V reference voltage, you'll get values between 0 and 994 using the device driver „ANALOG1.TD2“. (0.02A * 182Ω *1024 / 3.75V)

Signal	*Used analog channel of Tiger*
I_In0	0
I_In1	1
I_In2	2
I_In3	3
I_In4	4
I_In5	5
I_In6	6
I_In7	7

Note: If TINY Tiger 1 is plugged in the TDR1020 CPU module support only four analog Inputs (I_In0...3)

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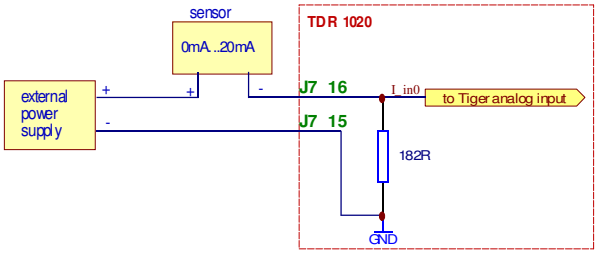

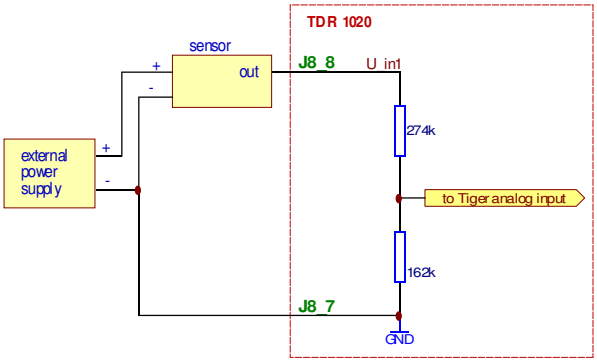

1	GND		I_In7	2
3	GND		I_In6	4
5	GND		I_In5	6
7	GND		I_In4	8
9	GND		I_In3	10
11	GND		I_In2	12
13	GND		I_In1	14
15	GND		I_In0	16

Connector J7

1	GND		I_In3	2
3	GND		I_In2	4
5	GND		I_In1	6
7	GND		I_In0	8

Connector J8

Analog Voltage Inputs 0V...10V

At the analog voltage inputs 0V...10V you can connect sensors with a voltage output. The voltage inputs are available at the connector J8.

The input voltage is devided by a voltage devider and the resulting signal is connected through an amplifier to the analog inputs of the TINY-Tiger™ 2. As the TDR 1020 presents a 3.75V reference voltage, you'll get values between 0 and 1015 using the device driver „ANALOG1.TD2“.

10V * 162kΩ / (162kΩ+274kΩ) * (1024 / 3.75V)

Signal	*Used analog channel of Tiger*
U_In0	8
U_In1	9
U_In2	10
I_In7	11

Note: If TINY Tiger 1 is plugged in the TDR1020 CPU module do not support this feature.

Digital I/O Pins

For special user applications you can use the digital I/O Pins on the optional assembled connector J4. This Pins are connected to the TINY-Tiger™ 2 of your TDR 1020. For specifications take a look at latest datasheet of TINY-Tiger™ 2. This pins are voltage protected up to 24 V DC (Alarm output pin is unprotected!).

Note: The cable length should not exceed 1.5m.

J4 Pin No	*Signal*
1	L36 of TINY-Tiger™ 2
2	L37 of TINY-Tiger™ 2
3	L82 of TINY-Tiger™ 2
4	L42 of TINY-Tiger™ 2
5	Alarm Pin of TINY-Tiger™ 2
6	Battery for RAM[1]
7	Battery for RTC[1]
8	Vcc

1 Don't use it to connect an external Battery. It's only allow to use it as output.

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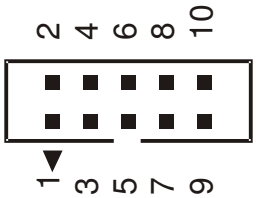
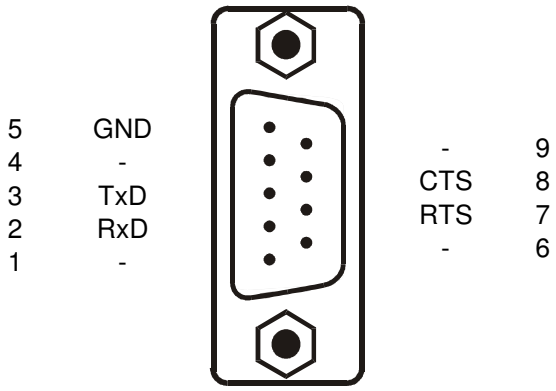
J4 Pin No	Signal
9	GND
10	GND





Connector J5 (Ser0: RS232 (MALE))

SER0

The serial port 0 can use as RS485 on connector J9 or as RS232 on connector J5. For switching you have to use the TINY-Tiger™ 2 Pin L40.

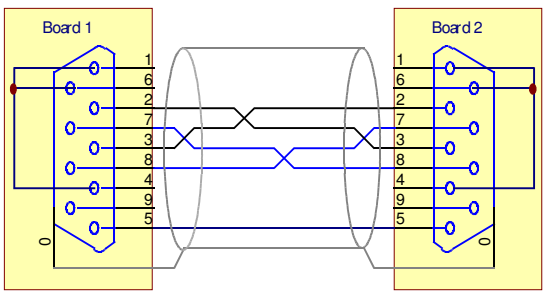
L40	Ser 0
0	RS232
1	RS485

Ser0:RS232

In case of using RS232 port you can have a full duplex point to point connection to another device, e.g. you can connect the TDR 1020 to a modem or LED Panel with a straight 1 to 1.

Eight LEDs (LED1...8) show you the status of the TxD, RxD, RTS and CTS signal. The yellow LED mean 'mark' and the green one mean 'space'.

To connect the TDR 1020 board you have to use a cross linked cable with female connectors.



Cross linked cable for RS232

Ser0:RS485

In case of using the serial port 0 of the TINY-Tiger™ 2 as RS485 the RS232 port on connector J5 is disabled. Use the device driver „SER1b.td2“ to communicate via the serial port.

The RS485 signals are available at the connector J9

J9 Pin No	Signal
1 and 2	RS485_A positive RS485 signal
3 and 4	RS485_B negative RS485 signal
5 and 6	GND
7 and 8	Shield connection connected though a 1MΩ resistor parallel to a 100nF capacitor to GND

With the RS485 port a bus connection of multiple boards 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.

CAN-Bus

The CAN-Bus is available at J9, too.

With the CAN-Bus port a bus connection of multiple boards is possible. The hardware of the

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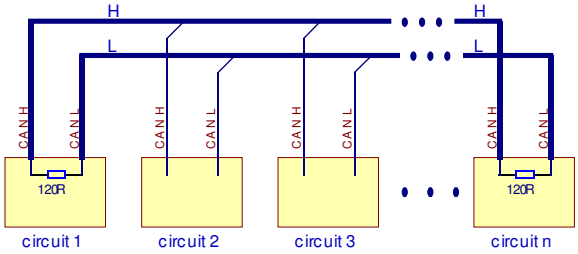
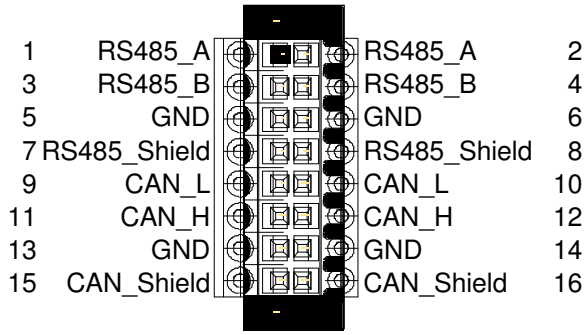
TINY-Tiger™ 2 supports the CAN 2.0A and 2.0B protocol.

Use the device driver „CAN1_K8.td2“ to communicate via CAN-Bus.

J9 Pin No	*Signal*
9 and 10	CAN L
11 and 12	CAN H
13 and 14	GND
15 and 16	Shield connection connected though a 1MΩ resistor parallel to a 100nF capacitor to GND





Connector J9

SER1

The serial port 1 of the TINY-Tiger™ 2 is used as RS232 (J10) or USB slave port (J6). If a USB slave device is plugged in the RS232 is disabled automatically.

Ser1:RS232

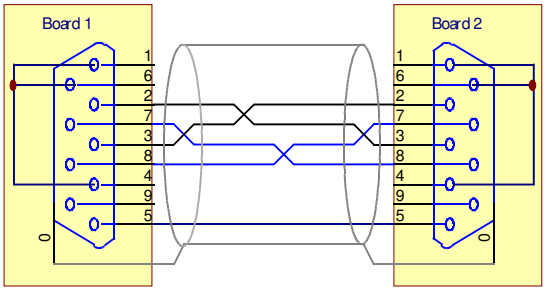
In case of using RS232 port you can have a full duplex point to point connection to another device.

If the TDR 1020 is started in PC Mode then this RS232 port is used as download and debug port.

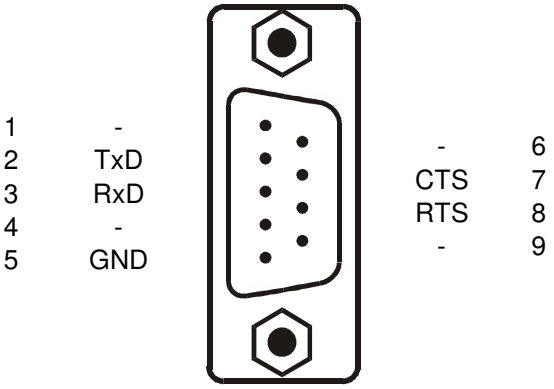
Eight LEDs (LED1...8) show you the status of the TxD, RxD, RTS and CTS signal. The yellow LED mean 'mark' and the green one mean 'space'.

Note: If TINY Tiger 1 is plugged in the TDR1020 CPU module do not support CTS and RTS.

To connect two TDR 1020 boards you have to use a cross linked cable with male connectors.



Cross linked cable for RS232



Connector J10 (Ser1: RS232 (FEMALE))

Ser1: USB

In case of using the USB slave port (J6) the RS232 port will disabled automatically.

To connect the TDR1020 to your PC via USB cable you have to install the virtual COM Port Driver shipped with the board on your PC.

The yellow LED (LED2) beside the USB slave port sign on if cable and driver successful installed.

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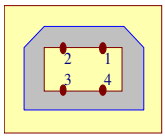
2	D-	V_{Bus}	1
3	D+	GND	4



Connector J6 (Ser1: USB)

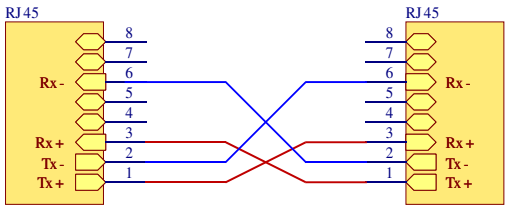
Ethernet

The EM03-ETH-P Ethernet module on the TDR 1020 is implemented which supports protocols like ARP, IP, TCP, DHCP, DNS, UDP, SNTP. Some more protocols are ready designed 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. You can connect 2 boards with a cross linked cable or connect to an existing network using a hub or switch.

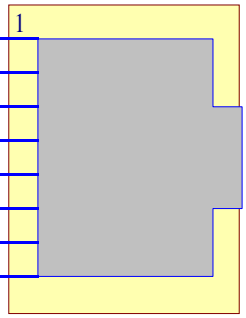
As the board supports TCP/IP you can easily connect your application to an intranet or to the internet via a gateway.

Possible applications are for example web browser controlled devices or devices which send e-mails if a defined event occurs. With the TDR 1020 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+	1	
2	Tx-		
3	Rx+		
4	-		
5	-		
6	Rx-		
7	-		
8	-		

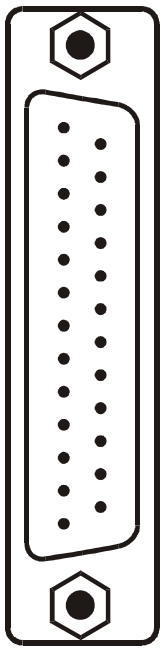


Connector J2 (Ethernet)

Tiger X-Bus

The Tiger X-Bus is used to connect expansion modules to the TDR 1020. The expansion module is clipped to the DIN rail at the right hand side of the TDR 1020 or at the right hand side of an already connected expansion module. Push the expansion module to the left to contact the Tiger X-Bus. It's also possible to connect am expansion module with a 25 pole 1:1 cable with sub D connectors. The cable length should not exceed 1.5m.

1	XB_L33_Aclk	XB_L34_Dclk	14
2	XB_L35_/INE	L73-PWM1	15
3	L87_EN1	L72-PWM0	16
4	L77_EN2	L76-SPI-MOSI	17
5	GND	L75-SPI-MISO	18
6	GND	L74-SPI-CLK	19
7	GND	L71-SDA	20
8	L70-SCL	L67	21
9	XB_INTM1	L66	22
10	XB_/RESET	L65	23
11	L64	L63	24
12	L62	L61	25
13	L60		



Connector J3 (Tiger X Bus)

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During installation of the TDR 1020 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.

Tiger X-Bus Signal Name	*Used IO Port of TINY-Tiger*	*Input / Output*	*Pin No*	*Description*
XB_L33_Aclk_L	L33	Output	1	address clock low byte high active If this signal is high then the address at L60...L67 is valid. IO Modules should latch the address
XB_L34_Dclk	L34	Output	14	Data clock (high active). If this signal is high then the data at L60...L67 is valid
XB_L35_/INE	L35	Output	2	Input Enable (low active). If this signal is low then the input module which address is selected should put it's data to L60..L67
L60	L60	IO	13	Used as multiplexed address and data bus line.
L61	L61	IO	25	Used as multiplexed address and data bus line.
L62	L62	IO	12	Used as multiplexed address and data bus line.
L63	L63	IO	24	Used as multiplexed address and data bus line.
L64	L64	IO	11	Used as multiplexed address and data bus line.
L65	L65	IO	23	Used as multiplexed address and data bus line.
L66	L66	IO	22	Used as multiplexed address and data bus line.
L67	L67	IO	21	Used as multiplexed address and data bus line.
L70-SCL	L70	IO, pull-up open collector	8	I^2C clock line. To use this line an external pull-up resistor is neccessary.
L71-SDA	L71	IO, pull-up open collector	20	I^2C data line. To use this line an external pull-up resistor is neccessary.
L72-PWM0	L72	Output	16	PWM output channel 0.
L73-PWM1	L73	Output	15	PWM output channel 1.
L74-SPI-CLK	L74	Output	19	SPI clock line. SPI devices should be enabled using a bit of an extended port.

Tiger X-Bus Signal Name	Used IO Port of TINY-Tiger	Input / Output	Pin No	Description
L75-SPI-MISO	L75	Input	18	SPI data input line. SPI devices should be enabled using a bit of an extended port
L76-SPI-MOSI	L76	Output	17	Serial Peripheral Interface (SPI) data output line. SPI devices should be enabled using a bit of an extended port.
XB_L77_Aclk_M	L77	Output	4	Address clock mid byte high aktive. If the signal is '1', then L60…L67 is latched as mid byte of an 24 bit address for Xport functions
XB_L87_Aclk_H	L87	Output	3	Address clock high byte high aktive. 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	9	Expansion modules can pull up this signal to initiate a BASIC interrupt 1.
XB_/RESET	INTM3	IO open collector pull-up 360Ω	10	If the Reset button is pressed or at power up the TDR 1000 pulls this signal low. If any IO module pulls this signal low, the user program can recognize this using BASIC interrupt 3.

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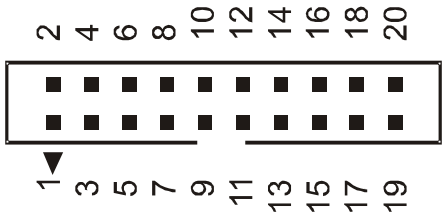
Graphic LCD Type EW32F...

This connector is designed to connect a LC display of type EW32F... or compatible types with an adapter. The contrast voltage should be generated at the adapter or at the LCD.

Note: Do not connect displays with different voltage levels, because the display and the TDR 1020 may be permanently damaged!
Do not use Graphic LCDs of type EW32F... and other Graphic LCDs at the same time!

The cable length connected here should not exceed 0.5m.



Pin no.	*Signal name*	*Description*
1	Vss	power supply (GND)
2	Vdd	power supply (+)
3	-	not used
4	A0	A0
5	/WR	data write
6	/RD	data read
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	/CE	chip enable
16	/RST	RESET
17	-	not used
18	SEL1	H:6800 L:8080
19	VLED	supply for backlight
20	VLSS	supply for backlight

External Battery

On Connector J11 you can plug in a external Battery or Accumulator. It backup SRAM and RTC of TINY Tiger 2.
In case of using this connector the installed 3V Lithium battery for backup RTC is not necessary anymore.

Connector J11

Note: Please use only batteries with 3...5V.

5 I²C Bus

The TINY-Tiger™ 2 can communicate with I²C devices and use 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

The clock and data line are connected to the Tiger X-Bus too and pulled up to Vcc (5V) with 2k2 resistors.

Note: Please be careful when using 3.3V I²C devices with the TDR1020.

EEPROM

An 512 kbit (64kB) EEPROM of type M24512 is connected to the I²C bus. To communicate with the EEPROM you have to use the device address 1010 100x.

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

RTC

Optional for TINY-Tiger™ 1 user is an external real time clock of type RTC-8564JE installed. This clock can read and write at I²C bus at all.

For communication with the RTC use the device address 1010 001x.

6 Used IO Ports of the TINY-Tiger 2

TINY-Tigers IO	*used for:*
L14	Output enable signal (RTS) for Ser0
L15	Output enable signal (RTS) for Ser1
L33	on Tiger X Bus as XB_L33_Aclk_L and intern as address clock signal for the extended ports. *high active output*
L34	on Tiger X Bus as XB_L34_Dclk and intern as data clock signal for the extended ports. *high active output*
L35	on Tiger X Bus as XB_L35_/INE and intern as input enable signal for the extended ports. *low active output*
L36	digital I/O Pin for user application
L37	digital I/O Pin for user application
L40	Switching Ser0 (0:RS232 <-> 1:RS485)
L41	PC mode jumper input.
L42	digital I/O Pin for user application
L60 to L67	multiplexed data and adress lines used by Tiger X Bus, LCD, Ethernet module
L70	Tiger X Bus L70-SCL EEPROM I²C RTC I²C
L71	Tiger X Bus L71-SDA EEPROM I²C RTC I²C
L72	Tiger X Bus L72-PWM0
L73	Tiger X Bus L73-PWM1
L74	Tiger X Bus L74-SPI-CLK EEPROM SPI-CLK SD-Card SPI-CLK
L75	Tiger X Bus L75-SPI-MISO
L76	Tiger X Bus L76-SPI-MOSI
L77	Tiger X Bus XB_L77_Aclk_M
L80	Graphic LCD read signal *low active output*
L81	Graphic LCD write signal *low active output*
L82	digital I/O Pin for user application
L83	Graphic LCD command/data select signal *output*
L84	Graphic LCD enable signal *low active output*
L85	Graphic LCD reset signal *low active output*
L86	Watchdog
L87	Tiger X Bus XB_L87_Aclk_H
L90	Data out line for Ser0
L91	Data in line for Ser0
L92	CTS0 (RS232)
L93	Data out line for Ser1
L94	Data in line for Ser1
L95	CTS1 (RS232/USB)
L96	CAN Bus transmit line
L97	CAN Bus receive line
INTM1	Connected to the Tiger X Bus signal XB_INTM1
INTM3	Connected to the Tiger X Bus signal XB_/RESET

7 Used Analog Input Pins

TINY-Tigers analog inputs	*used for:*
A/D Ref Low	GND
A/D Ref High	3.75V
Analog in 0	0mA...20mA input I_in0
Analog in 1	0mA...20mA input I_in1
Analog in 2	0mA...20mA input I_in2
Analog in 3	0mA...20mA input I_in3 [1]
Analog in 4	0mA...20mA input I_in4 [1]
Analog in 5	0mA...20mA input I_in5 [1]
Analog in 6	0mA...20mA input I_in6 [1]
Analog in 7	0mA...20mA input I_in7 [1]
Analog in 8	0V...10V input U_in0 [1]
Analog in 9	0V...10V input U_in1 [1]
Analog in 10	0V...10V input U_in2 [1]
Analog in 11	0V...10V input U_in3 [1]

1 not available by using TINY Tiger 1

8 Technical Specifications

Absolute Maximum and Minimum Ratings

(beyond which permanent damage may occur)

maximum supply voltage U_in (screw terminal 1 in respect of GND)	30V DC
maximum external battery voltage	10V DC
input voltage at analog inputs 0V...10V	-0.3...30V
input voltage at analog inputs 0mA...20mA	-0.3...30V
Input voltage at digital I/O Pins	0...5V
Output voltage at digital I/O Pins	0...3.3V [1]
operating temperature	-20°C...70°C

Do not connect any signal connector of the TDR 1020 directly to wires which are outside a building.
Replace fuses only with fuses which have the same technical characteristics.

Electrical Specifications

supply voltage U_in	8V...30V DC
supply current at 8V input voltage at 30V input voltage at 8V input voltage with graphic LCD connected at 30V input voltage with graphic LCD connected	 200mA 50mA 340mA 86mA
external backup battery current at 3V at 5V	 21µA$_{typ}$ 81µA$_{typ}$
Tolerances of analog inputs at 25°C temperature drift	 < 1.0% *NOTE 1 < 50ppm/°C *NOTE 1
Input resistance of 0V...10V analog inputs	436kΩ
FUSES: F1	 0.5A PolySwitch

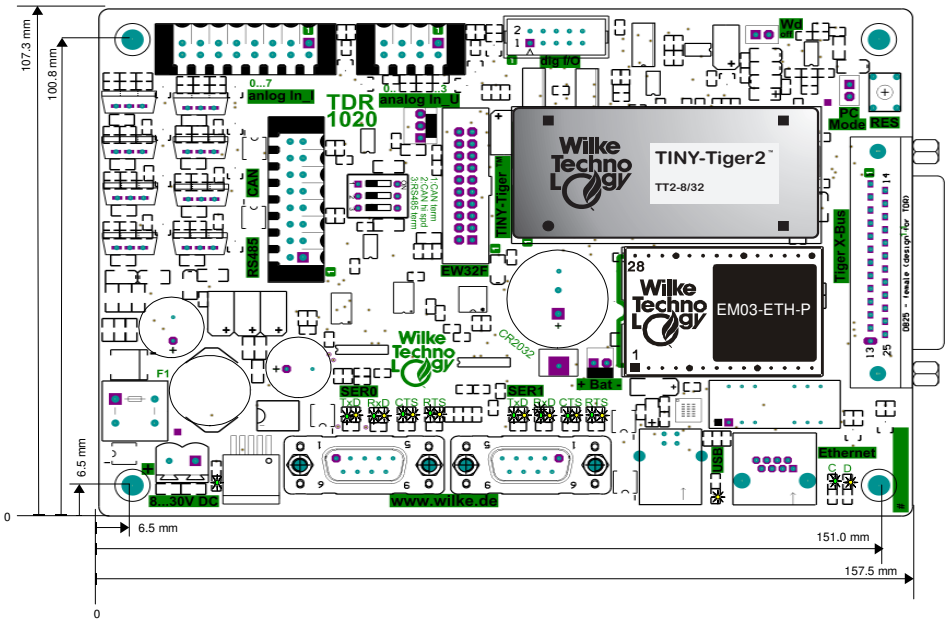
*NOTE 1: refered to the maximum input value, plus input tolerance of TINY-Tiger 2

1 By using TINY Tiger 1 **0...5V**

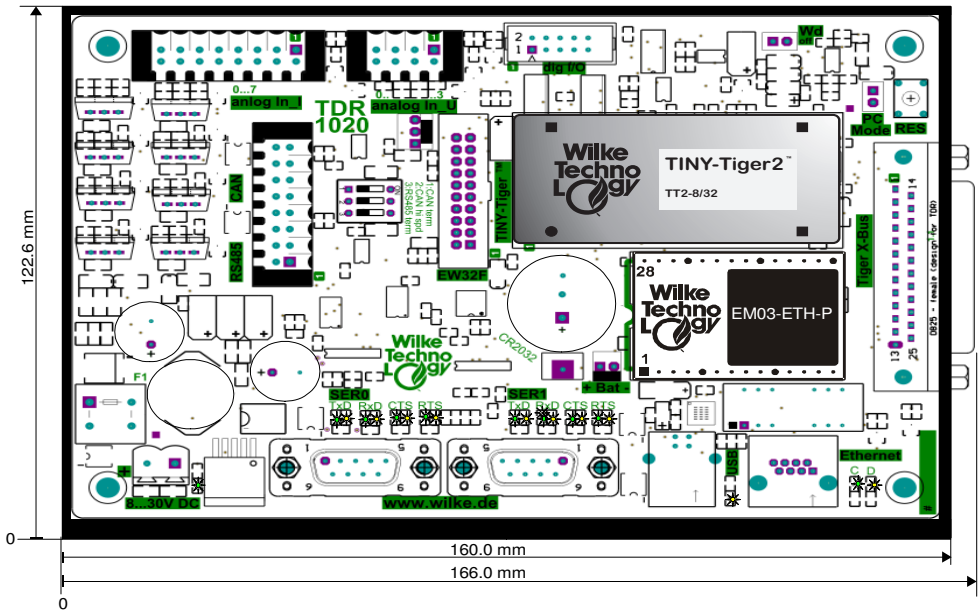
Technical Documentation

Module Dimensions

Board Dimensions



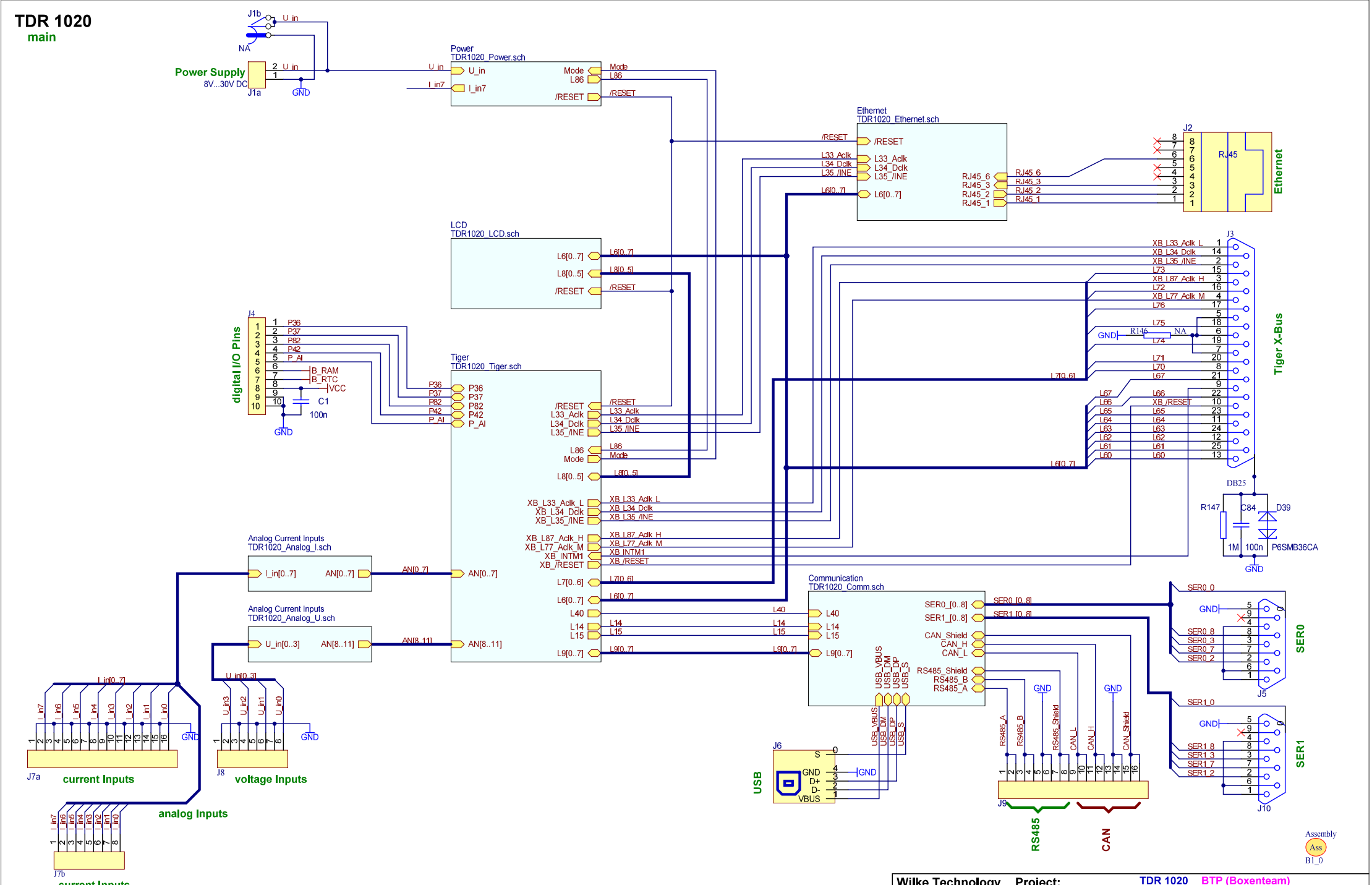
DIN Rail Dimensions



9 Documentation History

Version of Documentation	*Board Version*	*Description / Changes*
V000	V1.0	preliminary version
V001	V1.1	Add specifications and pictures
V002	V1.1	Add specifications
V003	V1.2	Chance specifications

TDR 1020
main



Wilke Technology	Project:	TDR 1020	BTP (Boxenteam)	
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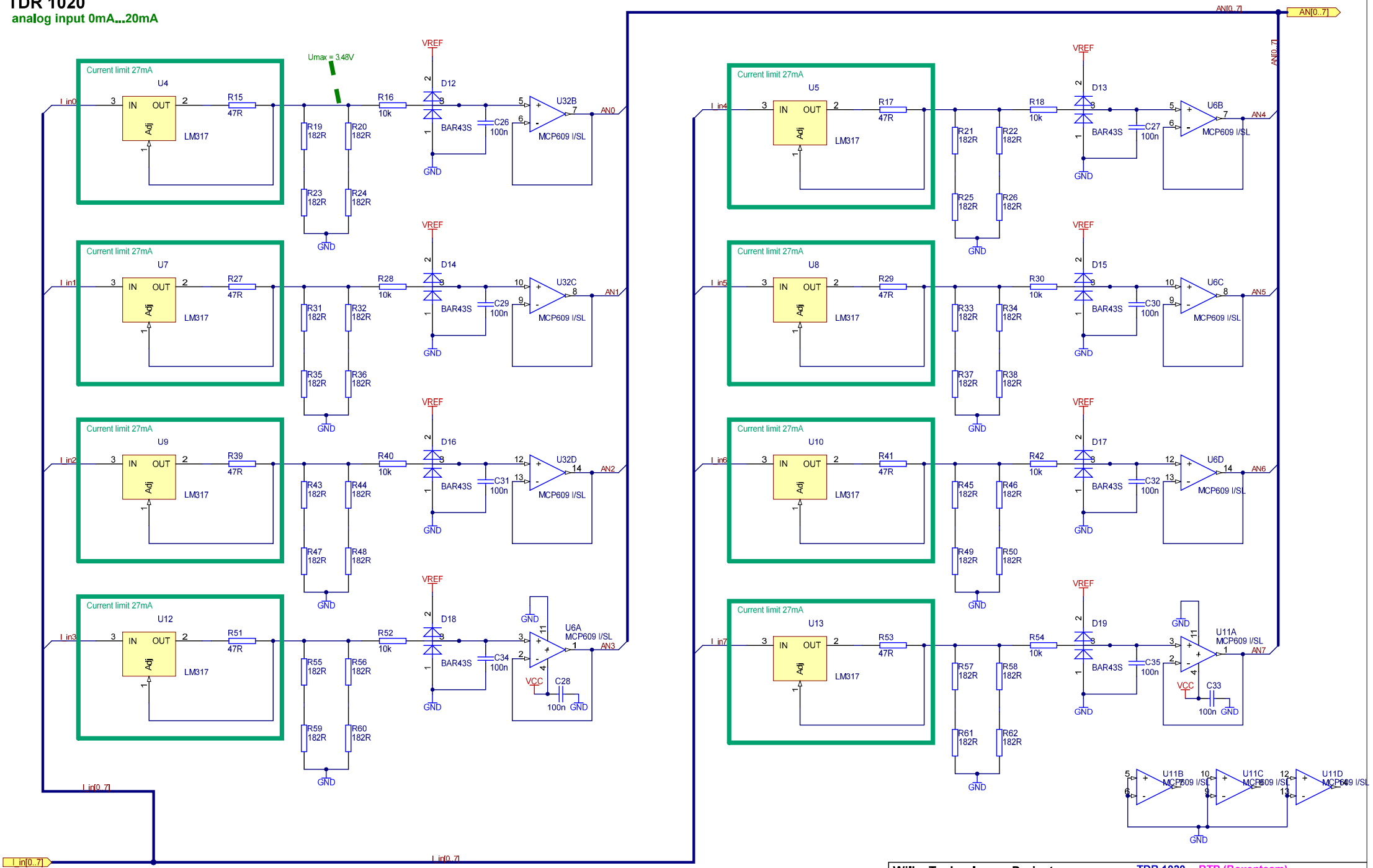
File: P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\PCB_Board_1\Source\V1.2\TDR1020_Main.sch				

Date:	Revision:	Designer:	Release of PCB for Prototype	pilot series	series	Changes documentated in:
25.Juli.2006	V1.0 V2.0	M.Dicke	X			P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc
20.Okt.2006	V1.1 V2.1	M.Dicke	X			P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc
14.Feb.2007	V1.2 V2.2	M.Dicke		X		P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020

analog input 0mA...20mA



Wilke Technology	**Project:**	**TDR 1020**	**BTP (Boxenteam)**	
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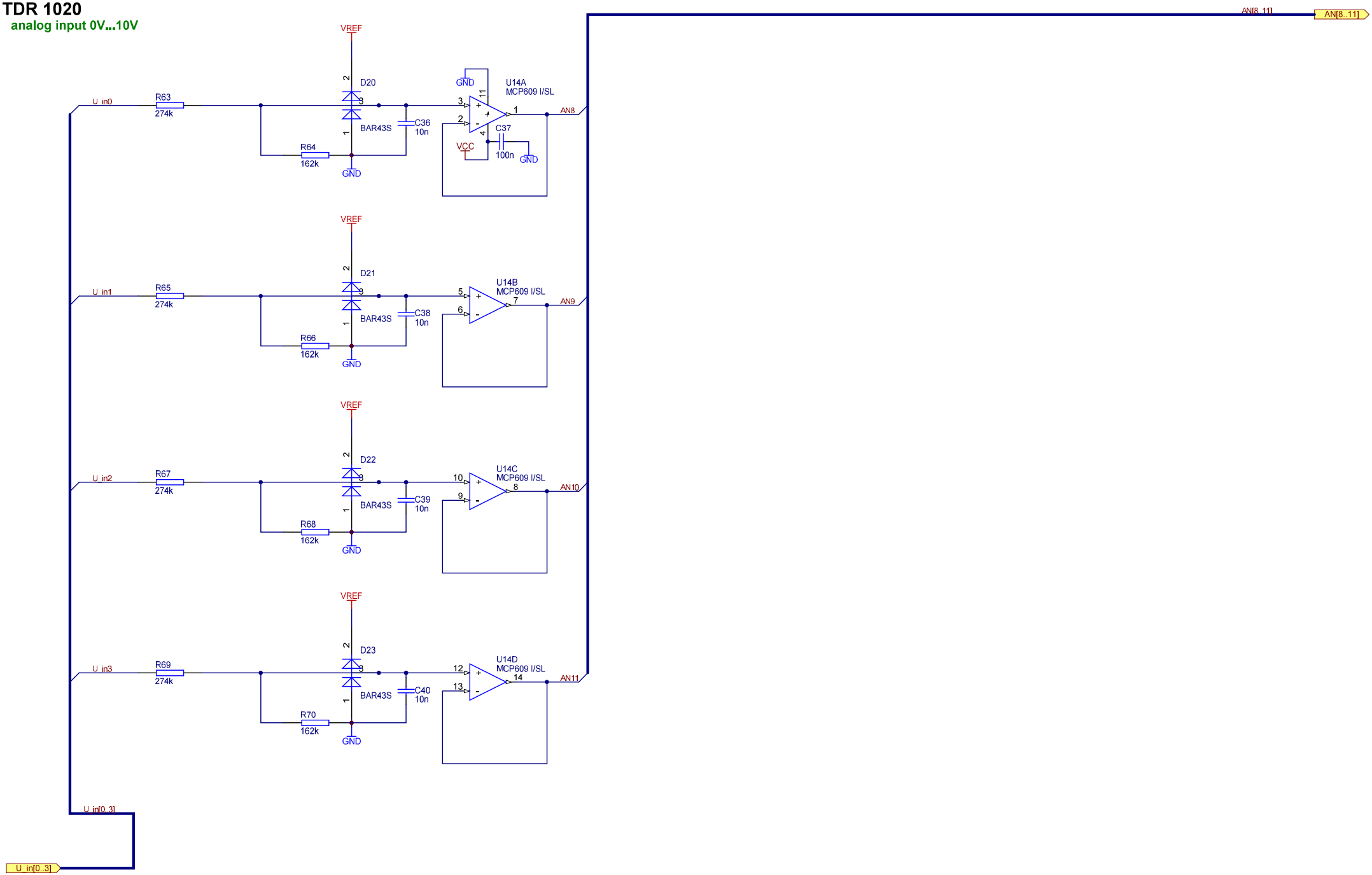
20.Okt.2006	V1.1 V2.1	M.Dicke	X	P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc
14.Feb.2007	V1.2 V2.2	M.Dicke	X	P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020

analog input 0V...10V



Wilke Technology	Project:	TDR 1020	BTP (Boxenteam)	
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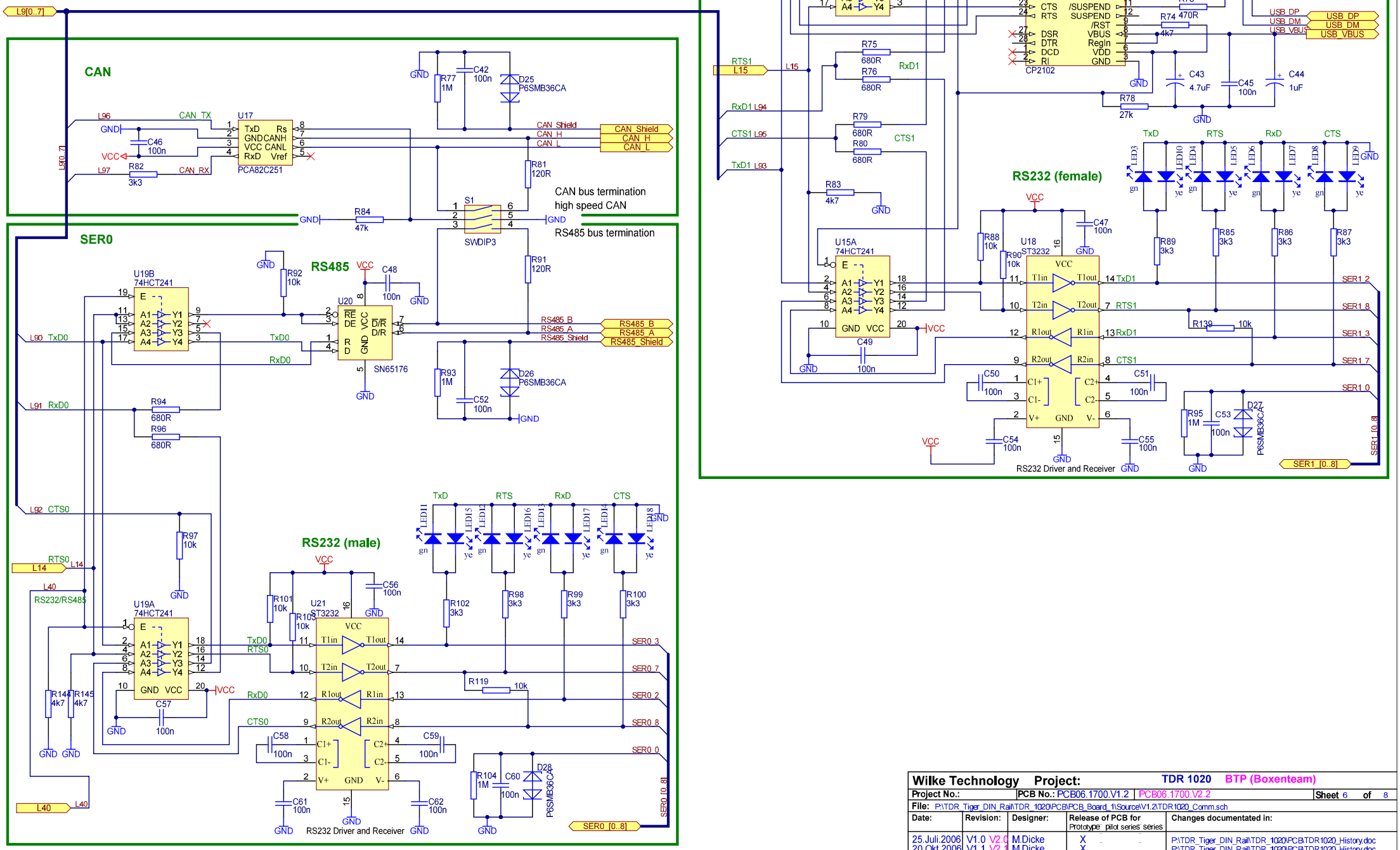
25.Juli.2006	V1.0 V2.0	M.Dicke	X	P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc
20.Okt.2006	V1.1 V2.1	M.Dicke	X	P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc
14.Feb.2007	V1.2 V2.2	M.Dicke	X	P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020
Communication



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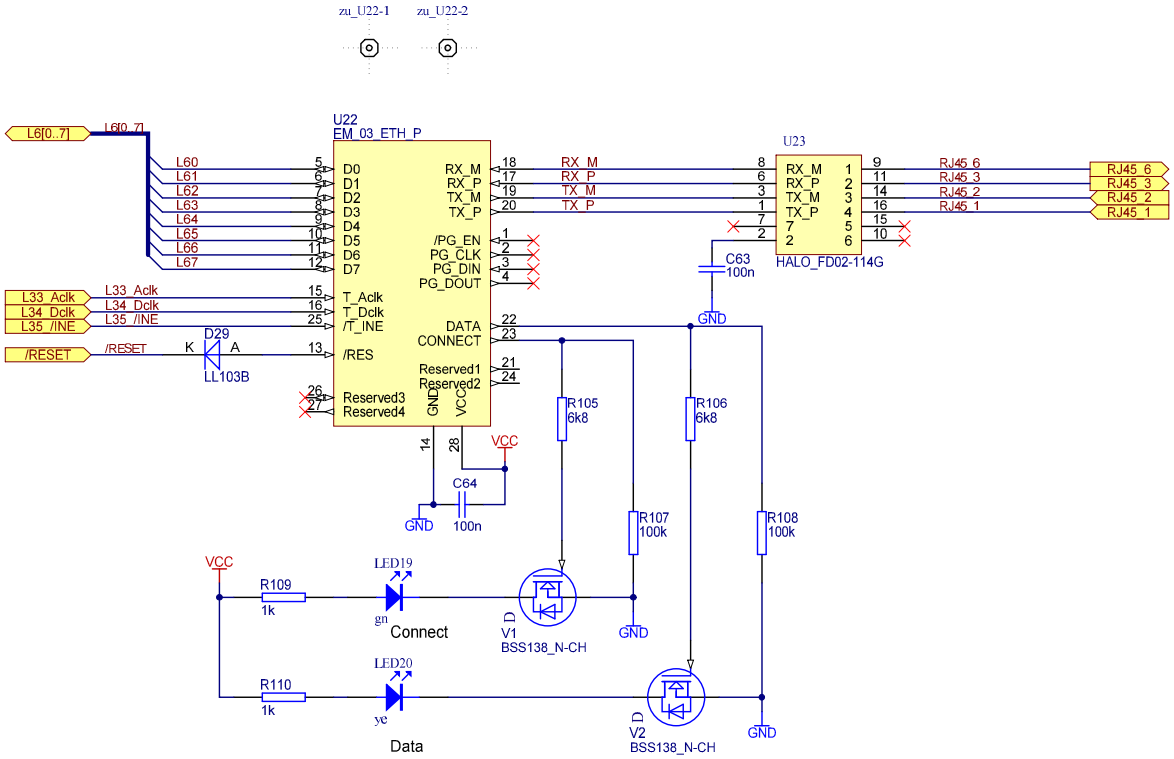
14.Feb.2007	V1.2 V2.2	M.Dicke		X		P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020

Ethernet



Ethernet

Wilke Technology	Project:	TDR 1020	BTP (Boxenteam)	
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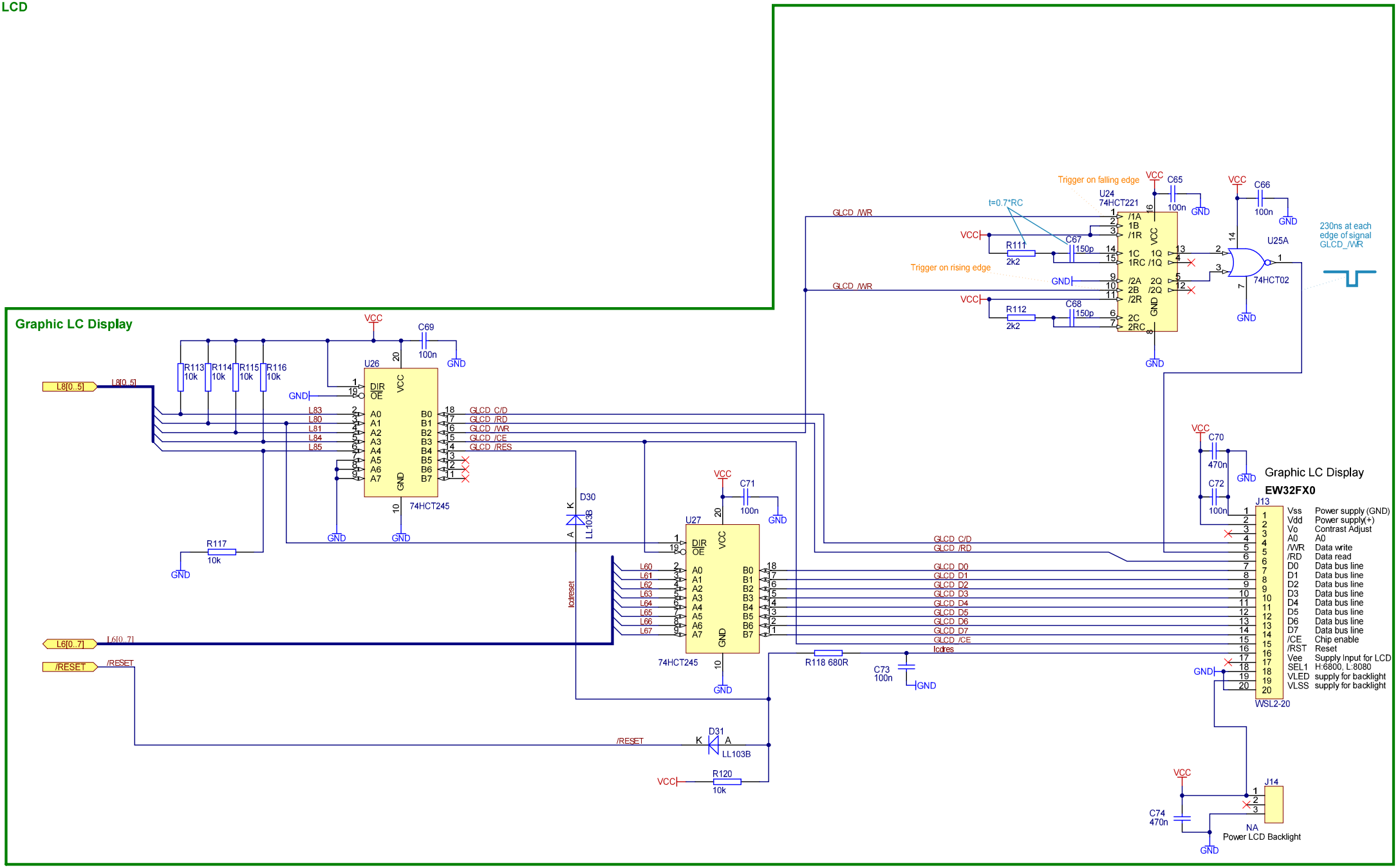
20.Okt.2006	V1.1 V2.1	M.Dicke	X			P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc
14.Feb.2007	V1.2 V2.2	M.Dicke		X		P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020

LCD

Graphic LC Display



Wilke Technology	**Project:**	**TDR 1020**	**BTP (Boxenteam)**	
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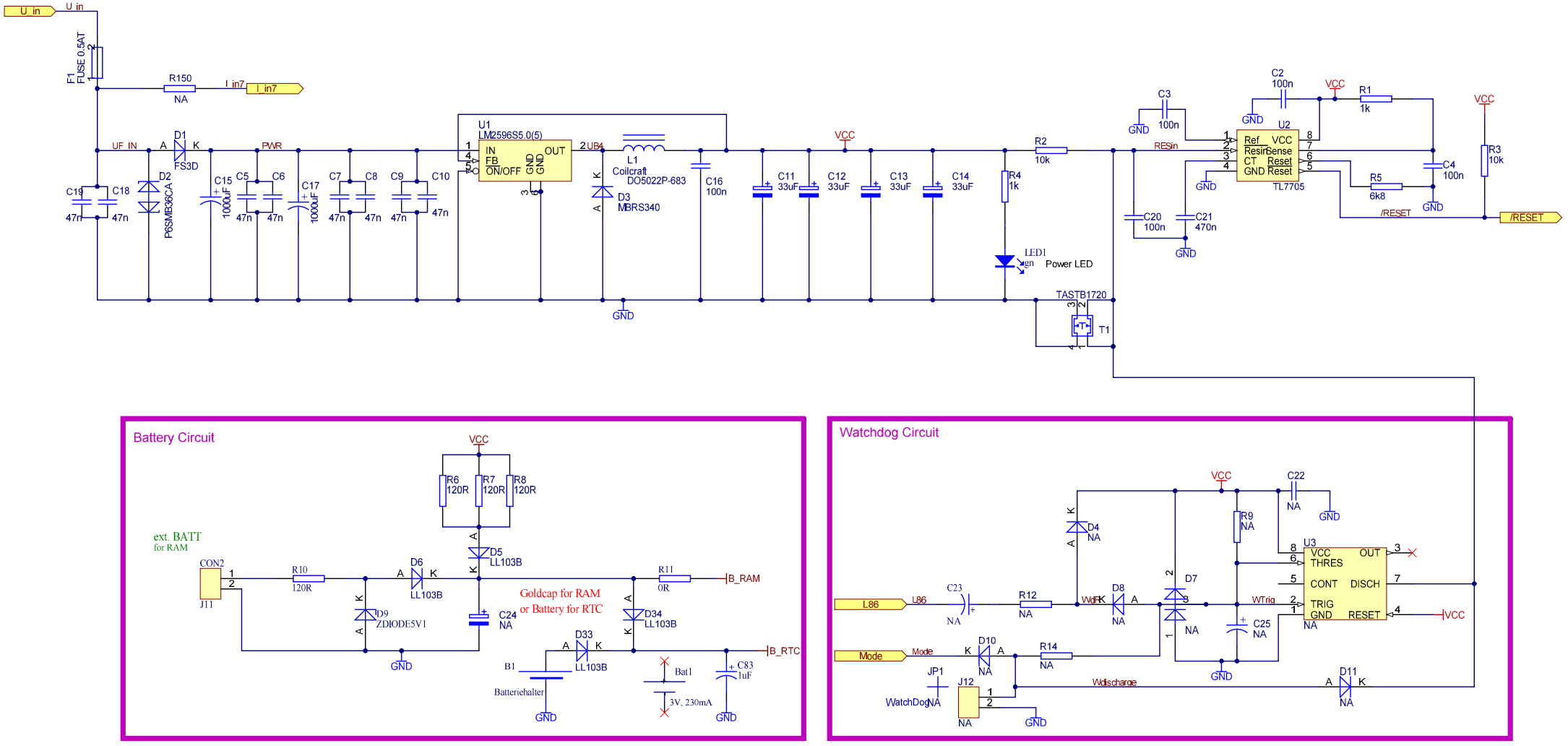
14.Feb.2007	V1.2 V2.2	M.Dicke	X	P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020

power supply



Wilke Technology	Project:	TDR 1020	BTP (Boxenteam)	
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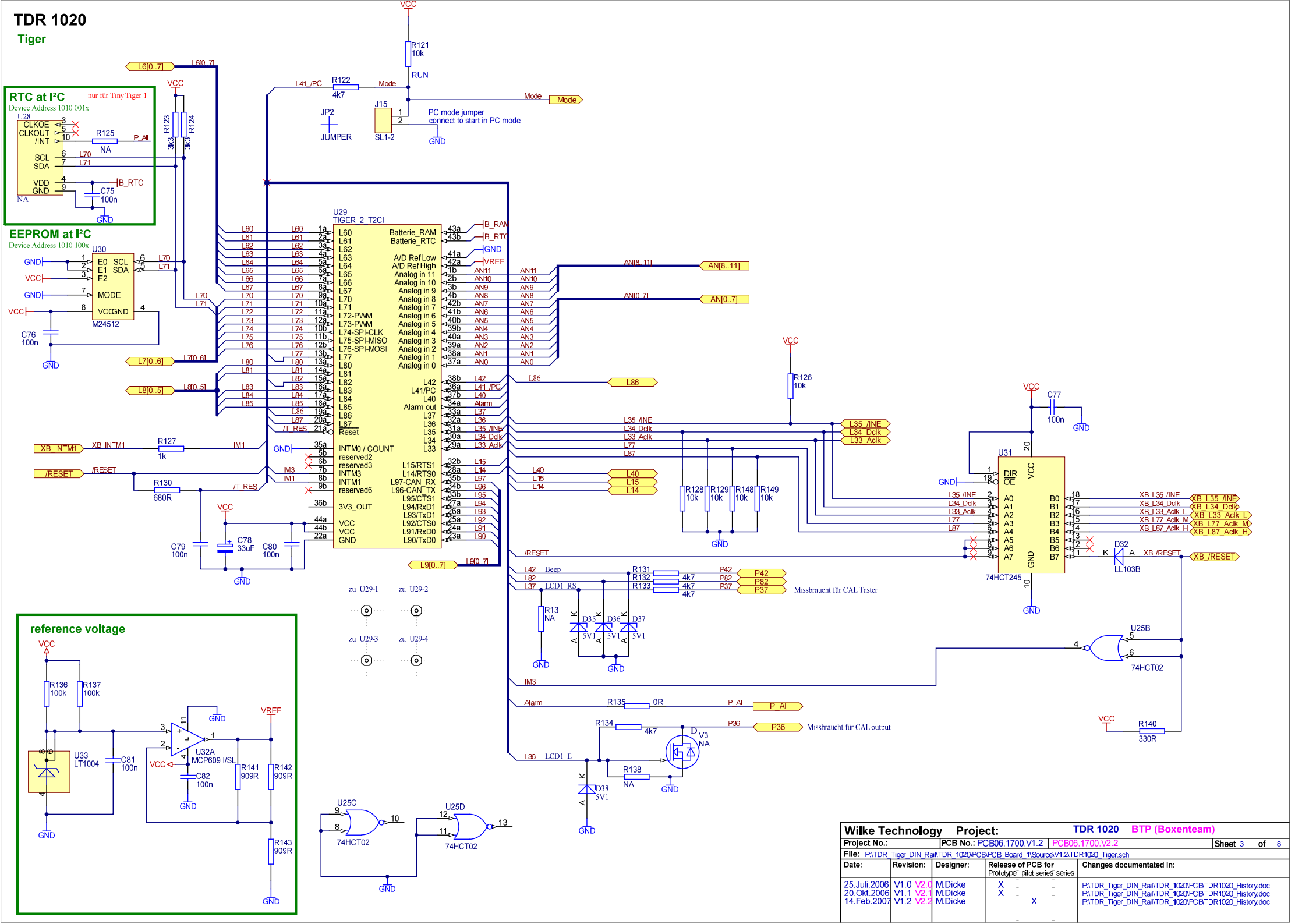
14.Feb.2007	V1.2 V2.2	M.Dicke		X		P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc

TDR 1020

Tiger



Wilke Technology	Project:	TDR 1020	BTP (Boxenteam)	
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14.Feb.2007	V1.2 V2.2	M.Dicke		X		P:\TDR_Tiger_DIN_Rail\TDR_1020\PCB\TDR1020_History.doc