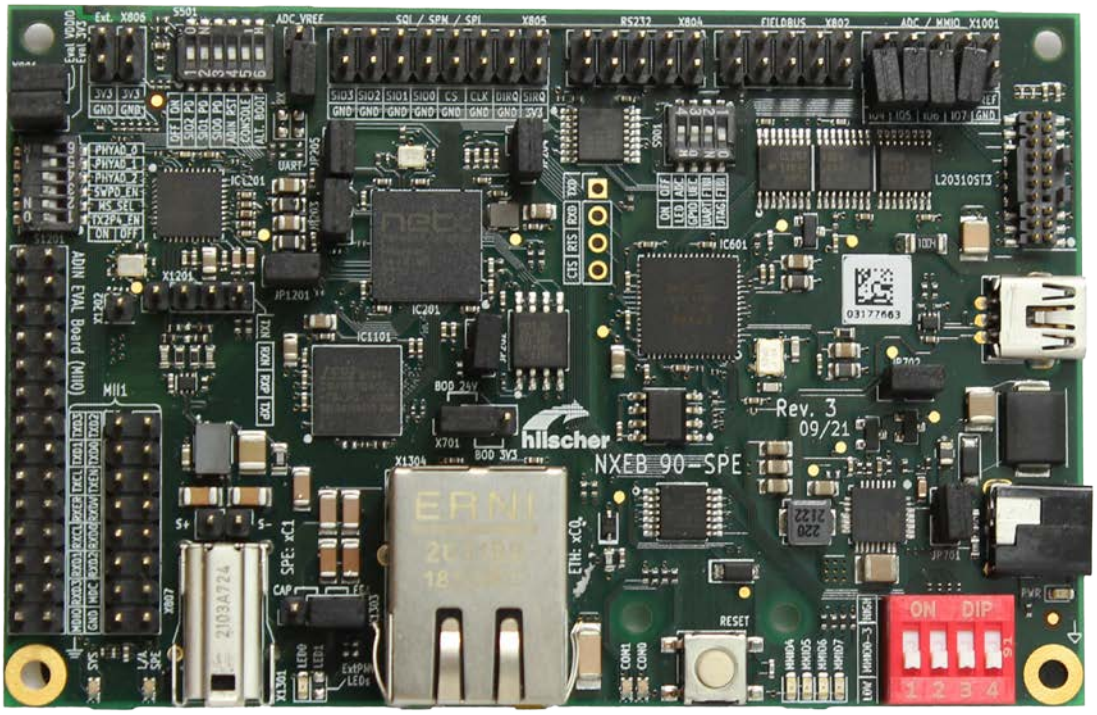
empowering communication

Device description

NXEB 90-SPE

10BASE-T1L Evaluation board



Hilscher Gesellschaft für Systemautomation mbH

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Table of contents

1 Introduction

1.1 About this document

This manual describes the evaluation board NXEB 90-SPE.

1.2 List of revisions

Rev	Date	Chapter	Revision
3	2024-10-18	all	NXEB 90-SPE revision 3 and 4
4	2024-11-01	2	Subsections 2.4, 2.5, and 2.6 reordered.

Table 1: List of revisions

1.3 Reference to hardware

Hardware	Revision	Part Number
NXEB 90-SPE evaluation board	3 and 4	7832.300

Table 2: Reference to hardware

1.4 Terms, abbreviations and definitions

Term	Description
AFE	Analog Front End
DPM	Dual-Port Memory
IEC	International Electrotechnical Commission
MAC	Media Access Controller
MDI	Media Dependent Interface
MII	Media Independent Interface
PHY	Physical Layer Transceiver
PoDL	Power over Data Line
SoC	System on Chip
SPE	Single-Pair Ethernet
SPoE	Single-pair Power over Ethernet
SPoE PD Controller	SPoE Powered Device Controller
SPM	Serial dual-Port Memory

Table 3: Terms, abbreviations and definitions

1.5 Other relevant documentation

Title	Contents	Document ID
Operating instruction manual: netX Studio CDT - netX 90 development	Operating instruction manual for netX 90 SoC development with netX Studio CDT (for software developers)	DOC210103OIxxEN
netX 90 – Technical data reference guide	Describes netX 90 chip functions	DOC160609TRGxxEN
netX 90 – Design-In Guide	Describes the standard circuitry around the netX interfaces (for hardware developers)	DOC180501DGxxEN
netX 90 – Production guide	Describes the software architecture of the netX 90 SoC and explains how to program necessary software components into finished netX devices during end-of-line production	DOC190101PGxxEN
Technical reference: LED descriptions	Descriptions of the LED states for loadable firmware based on netX	DOC090704TRxxEN

Table 4: Additional documentation

2 Description

2.1 Features and use case

While 2-port industrial Ethernet devices offer advantages such as redundancy and enhanced flexibility, 1-port devices are suitable for applications where simplicity, cost-effectiveness, and space efficiency are paramount. As a result, Hilscher offers loadable firmware (LFW) solutions for the netX 90 also as a single endpoint communication device.

The NXEB 90-SPE evaluation board enables users to evaluate the functionality of single endpoint devices as a rapid prototyping platform for all major physical layers as outlined in the following table:

Physical layer	netX 90 connectivity
10BASE-T1L Ethernet port with IEC 63171-6 connector	External ADIN1100 PHY connected to MII1 signals
100BASE-TX Ethernet port with standard RJ45 connector	Port 0 of the chip internal real-time Ethernet PHY
Fieldbus transceiver connector for CAN, PROFIBUS, etc.	External transceiver IC connected to MX0 signals

Table 5: Features and use case

NXEB 90-SPE features

This evaluation board enables to evaluate and test the functionality of:

Featured IC

- netX 90 multiprotocol SoC

Connectivity

- 10BASE-T1L external PHY with IEC 63171-6 SPE connector
  - PHY mode for 2.4 V pk-pk or 1.0 V pk-pk operating mode with DIP switch
- 100BASE-TX standard Ethernet with RJ45
- Ready for CAN, PROFIBUS, DeviceNet, CC-Link via legacy fieldbus connector
- Serial dual-port memory (SPM) host interface

Application

- Evaluation of single endpoint communication
  - Evaluation of 10BASE-T1L communication
  - Evaluation of 100BASE-TX communication
  - Evaluation of fieldbus communication

Limitation

- No parallel dual-port memory (DPM) host interface support

Recommendation

- No on-board Single-pair Power over Ethernet (SPoE) or Power over Data Line (PoDL) support
- Refer to the ADIN1100 PHY reference design for the industrial SPoE PD Controller

Other features

- Capacitive coupled analog 10BASE-T1L frontend with RXN/P / TXN/P header for testing
- On-board 8 MByte SDRAM and 4 MByte SQI Flash
- 24 V / 3V3 selectable brown out detector source
- Debugging via on-board USB debugger or external JTAG adapter
- UART via RS232 adapter or via on-board USB with virtual COM port
- Alternative boot mode / console mode selectable
- Selectable SPE decoupling capacitors
- Assembly option for separate external PHY quartz
- External PHY hardware configuration via bootstrapping
  - PHY address
  - Software power-down
  - 2.4 V transmit enable
  - Master / slave select
- 8 user-definable inputs/outputs (MMIO0…7)
  - 4 inputs with dip switch
  - 4 inputs/outputs on header (for use with netX ADCs)
- Various current measurement test headers
  - netX 90 and internal PHY’s
  - ADIN1100 external PHY
  - DCDC converter input and output
- Status and communication LEDs
- Dimensions: (l) 100 mm x (w) 65 mm
- Supply voltage: 12 V – 43 V (36 V ±20%)
- Operating temperature: 0 °C ... 55 °C

2.2 Block diagram

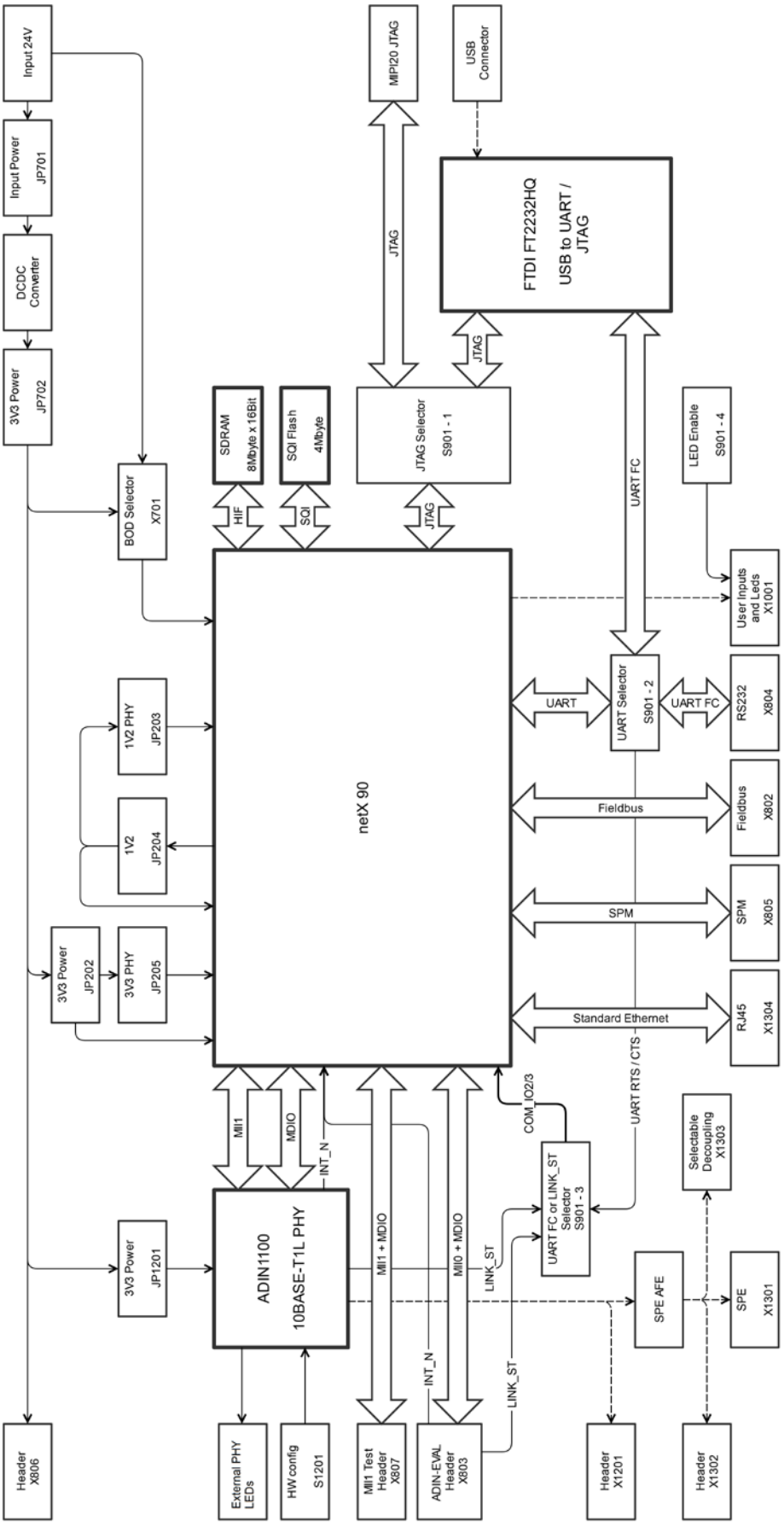


Figure 1: Block diagram of NXEB 90-SPE

2.3 Position of interfaces and operating elements

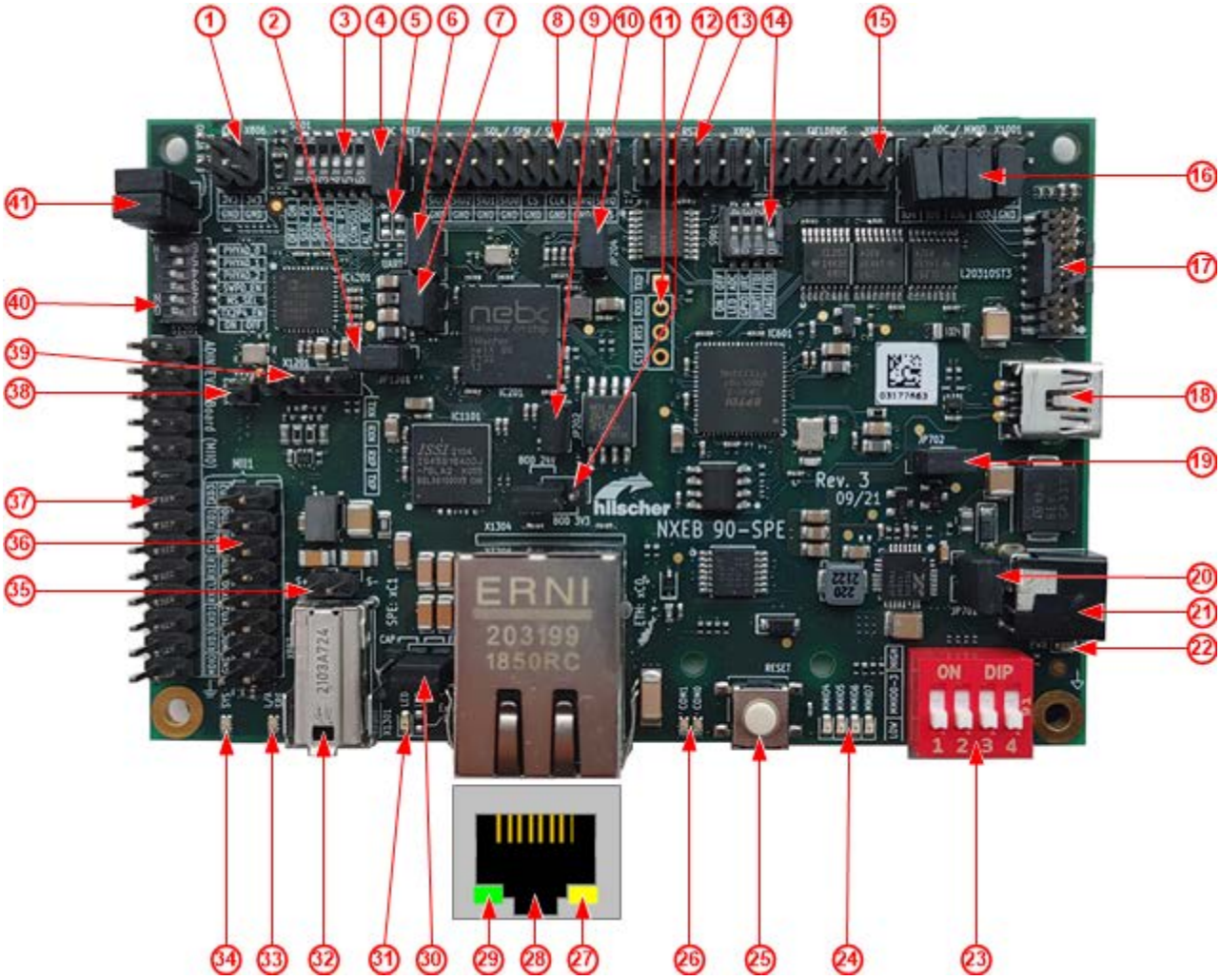


Figure 2: Position of interfaces and connectors

No.	Ref	Description	For details see
(1)	X806	External power connector	External power connector (X806) [page 19]
(2)	JP1201	Current measurement header for external PHY	ADIN1100 PHY current measurement connector (JP1201) [page 29]
(3)	S501	Slide switches for selecting boot options and external PHY reset	Boot options and external PHY reset (S501) [page 12]
(4)	JP201	Selector for internal or external ADC voltage reference	netX ADC reference voltage selector (JP201) [page 16]
(5)	P301	Reserved	Reserved
	P302	Reserved	
(6)	JP205	Current measurement header for netX 90 internal PHY VDDIO (3.3V internal PHY supply) The supply current for this header also flows through JP202	netX internal PHY VDDIO current measurement connector (JP205) [page 27]
(7)	JP203	Current measurement header for netX 90 internal PHY VDDC (1.2V internal PHY supply) The supply current for this header also flows through JP204	netX internal PHY VDDC current measurement connector (JP203) [page 26]
(8)	X805	Serial Dual Port Memory (SPM) host interface connector for SQI/SPI	SPM interface connector (X805) [page 23]

No.	Ref	Description	For details see
(9)	JP202	Current measurement header for netX 90 main supply (3.3V)	netX +3V3 current measurement connector (JP202) [page 26]
(10)	JP204	Current measurement header for netX 90 internal DCDC converter output (1.2V, NETX_VDDC)	netX DCDC converter output current measurement connector (JP204) [page 27]
(11)	X602	Measurement points for UART via FTDI	FTDI UART test points (X602) [page 24]
(12)	X701	Brown-out detector voltage source selector	Brown-out detector voltage selector (X701) [page 16]
(13)	X804	Connector for NXHX-RS232 adapter module	External UART connector for NXHX-RS232 (X804) [page 24]
(14)	S901	Slide switches for: ▪ Configuring JTAG interface ▪ Configuring UART interface ▪ Enable user LEDs or ADC functionality ▪ Select UART with frame control or GPIO functionality	UART/JTAG multiplexing, LED enable (S901) [page 14]
(15)	X802	Connector for NXHX fieldbus adapter modules	Connector for NXHX fieldbus adapter modules (X802) [page 22]
(16)	X1001	Connector for user IO / ADC inputs	ADC and user inputs/outputs (MMIO4…7) (X1001) [page 25]
(17)	X501	JTAG MIPI-20 connector for external debug interface	JTAG MIPI20 connector (X501) [page 18]
(18)	X601	Mini-B USB connector for debugging and diagnosis via FTDI	USB Mini B connector (X601) [page 19]
(19)	JP702	Current measurement header for 3.3V supply of the whole board	Supply voltage +3V3 rail current measurement connector (JP702) [page 28]
(20)	JP701	Current measurement header for 24V input	Power input current measurement connector (JP701) [page 28]
(21)	X702	Power supply input (24V)	24 V power input (X702) [page 19]
(22)	P701	Power LED	LEDs [page 31]
(23)	S1001	Slide switches for user-defined inputs MMIO0...3	User inputs (S1001) [page 15]
(24)	P1001	User definable LED on MMIO4	LEDs [page 31]
	P1002	User definable LED on MMIO5	
	P1003	User definable LED on MMIO6	
	P1004	User definable LED on MMIO7	
(25)	S502	Reset push button	Reset (S502) [page 14]
(26)	S1402	COM0 LED (communication status, red/green)	LEDs [page 31]
	S1403	COM1 LED (communication status, red/green)	
(27)	X1304B	Multi-pair Ethernet ACT LED, yellow, xC Channel 0	LEDs [page 31]
(28)	X1304	RJ45 connector for multi-pair Ethernet	RJ45 Ethernet connector (X1304) [page 22]
(29)	X1304A	Multi-pair Ethernet LINK LED, green, xC Channel 0	LEDs [page 31]
(30)	X1303	Single-pair Ethernet MDI decoupling selector	SPE MDI decoupling selector (X1303) [page 17]
(31)	P1201	Single-pair Ethernet Activity LED of external PHY, yellow	LEDs [page 31]
(32)	X1301	IEC 63171-6 connector for single-pair Ethernet	SPE IEC 63171-6 connector (X1301) [page 21]
(33)	P1401	Single-pair LINK LED, green, xC Channel 1	LEDs [page 31]
(34)	P501	System status LED (SYS), green/yellow	LEDs [page 31]
(35)	X1302	Single-pair Ethernet MDI test connector	SPE MDI test connector (X1302) [page 30]
(36)	X807	MII1 test connector	MII1 test connector (X807) [page 21]

No.	Ref	Description	For details see
(37)	X803	Expansion header to connect an ADIN1100FMCZ evaluation board **Note:** Reserved for the dual external PHY use case, which is currently not support by the communication firmware.	ADIN evaluation board connector (X803) [page 19]
(38)	X1202	External PHY clock test connector	ADIN1100 PHY clock test connector (X1202) [page 30]
(39)	X1201	External PHY AFE test connector	SPE AFE test connector (X1201) [page 29]
(40)	S1201	External PHY hardware configuration slide switches: ▪ Configure MDIO address of PHY ▪ Enable software power-down after reset ▪ Change preferred transmit amplitude ▪ Select preferred master/slave role	External PHY hardware configuration (S1201) [page 15]
(41)	X801	ADIN1100FMCZ evaluation board power selector **Note:** Reserved for the dual external PHY use case, which is currently not support by the communication firmware.	ADIN evaluation board power selector (X801) [page 17]

Table 6: Position of interfaces and connectors

2.4 Hardware configuration

This chapter describes the board configuration.

2.4.1 Boot options and external PHY reset (S501)

The boot mode selection and external PHY reset control can be set via the slide switch S501 on the NXEB 90-SPE board. For identifying the switches on the board, see position (3) in section *Position of interfaces and operating elements* [page 9].

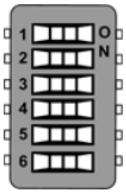
S501	Switch	Signal	Pos	Connects to	Function
	1	SQI_SIO2	ON	GND via 4.7 kΩ	These switches configure the console mode interface. For details, refer to Table 8: Settings for selecting console mode interface.
			OFF	Internal pull-up	
	2	SQI_SIO1	ON	GND via 4.7 kΩ	
			OFF	Internal pull-up	
	3	SQI_SIO0	ON	GND via 4.7 kΩ	
			OFF	Internal pull-up	
	4	EXTPHY_RST_N	ON	GND	Keep external PHY in its reset state
			OFF	GND via 10 kΩ	External PHY reset is controlled by netX 90 RST_OUT_N
	5	RDY_N	ON	GND via 1 kΩ	Enable console mode
			OFF	Internal pull-up	Disable console mode
	6	RUN_N	ON	GND via 1 kΩ	Enable alternative boot mode
			OFF	Internal pull-up	Disable alternative boot mode

Table 7: Boot options and external PHY reset (S501)

Mode	Description	S501A	S501B	S501C
7	UART and Ethernet	ON	ON	ON
6 … 1 (Reserved)	Reserved	-	-	-
0 (Default)	UART	OFF	OFF	OFF

Table 8: Settings for selecting console mode interface

Standard boot mode

In standard boot mode, the ROM code searches for a valid firmware and, if available, starts it. If the ROM code cannot find a valid *regular* firmware, it tries to start the *maintenance* firmware instead. If neither regular nor maintenance firmware has been found, the ROM code automatically enters console mode.

Standard boot mode is active if neither of either console mode or alternative boot mode is selected.

S501 settings for standard boot mode:

Switch 5 = OFF

Switch 6 = OFF

Console mode

The ROM code of the netX 90 features a console mode that enables the handling of the firmware programming depending on the selected console mode interface via UART or Ethernet. Thus you can download a firmware file to the Flash memory of the device, e.g. from your development PC by using the integrated flasher tool of **netX Studio CDT** or the CLI Flasher.

Note: Note that downloading a firmware to the netX 90 is also possible via the JTAG interface, e.g. via the on-board JTAG-to-USB debug interface. For more information on flashing firmware to the netX 90, see the *Flasher* chapter in the operating instruction manual *netX Studio CDT – netX 90 development*, DOC210103OIxxEN.

S501 settings for console mode:

Switch 5 = ON

Switch 6 = ON or OFF

Alternative boot mode

When alternative boot mode is active, the ROM code starts the *maintenance* firmware instead of the *regular* firmware. The maintenance firmware is capable of programming a new firmware (firmware update).

Possible use-cases are:

- Firmware update procedures:

  A new firmware received via web server or host interface is stored either on-chip in `INTFLASH1` or off-chip in an externally connected SQI flash. A software reset cycle initiated by a software command or a hardware reset cycle while switch 6 is at ON position starts a maintenance firmware, which programs the new firmware.

- Multiple firmware versions:

  The netX 90 has a maintenance firmware stored in `INTFLASH1` and holds multiple firmware versions for different Real-Time Ethernet protocols in an externally connected SQI flash. The maintenance firmware programs the firmware selected by the system integrator, e.g. via a rotary DIP-switch (or other ways).

Settings for alternative boot mode:

Switch 5 is OFF

Switch 6 is ON

Note: If console mode and alternative boot mode are both enabled (i.e. if switch 5 and 6 are both in their ON position), the console mode always has priority over the alternative boot mode.

If e.g. a power loss disrupts the programming of the new firmware, the ROM code detects that the procedure is incomplete and re-starts the maintenance firmware without prior selection.

2.4.2 Reset (S502)

For identifying the Reset button on the board, see position (25) in section *Position of interfaces and operating elements* [page 9].

Reset	Signal	Connects to	Function
	RST_IN_N	GND	Resets the netX 90

Table 9: Reset button (S502)

2.4.3 UART/JTAG multiplexing, LED enable (S901)

For identifying the switches on the board, see position (14) in section *Position of interfaces and operating elements* [page 9].

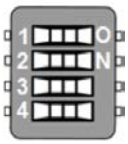
S901	Switch	Signal	Pos	Function
	1	JTAG	ON	Enable JTAG via JTAG connector: Use JTAG-MIPI20 connector for debugging
			OFF	Enable JTAG via FTDI: Use mini USB connector for debugging
	2	UART	ON	Enable UART via RS232 connector: Use NXHX-RS232 adapter at X804 for diagnosis / firmware download
			OFF	Enable UART via FTDI (UART-to-USB): Use mini USB connector for diagnosis / firmware download
	3	GPIO	ON	Connect `COM_IO[3:2]` to external PHY status pins (EVAL_LINK_ST/EXTPHY_LINK_ST)
			OFF	Connect `COM_IO[3:2]` to UART with frame control (CTS / RTS)
	4	LED	ON	Enable on board user LEDs for MMIO0...4
			OFF	Disable on board user LEDs for MMIO0...4 (Enable ADCs)

Table 10: UART/JTAG multiplexing, LED enable (S901)

S901 (1, 2, 3): Schematic *Sheet communication multiplexer* [page 47].

S901 (4): Schematic *Sheet user I/O and ADC* [page 45].

2.4.4 User inputs (S1001)

For identifying the user inputs on the board, see position (23) in section *Position of interfaces and operating elements* [page 9].

User inputs	Switch	Signal	Pos	Function
	1	MMIO0	ON	Pull MMIO0 to high level via 1 kΩ pull up
			OFF	Leave MMIO0 unconnected (use internal pull-down of netX 90)
	2	MMIO1	ON	Pull MMIO1 to high level via 1 kΩ pull up
			OFF	Leave MMIO1 unconnected (use internal pull-down of netX 90)
	3	MMIO2	ON	Pull MMIO2 to high level via 1 kΩ pull up
			OFF	Leave MMIO2 unconnected (use internal pull-down of netX 90)
	4	MMIO3	ON	Pull MMIO3 to high level via 1 kΩ pull up
			OFF	Leave MMIO3 unconnected (use internal pull-down of netX 90)

Table 11: User inputs (S1001)

2.4.5 External PHY hardware configuration (S1201)

For identifying the switches on the board, see position (40) in section *Position of interfaces and operating elements* [page 9].

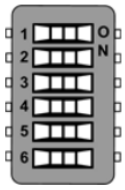
S1201	Switch	Signal	Pos	Function
	1	TX2P4_EN	ON	Set transmit level amplitude to 1V0 pk-pk
			OFF	Set transmit level amplitude to 2V4 pk-pk and 1V0 pk-pk
	2	MS_SEL	ON	Prefer master during auto-negotiation
			OFF	Prefer slave during auto-negotiation
	3	SWPD_EN	ON	Normal operation after power cycle
			OFF	Enter software power-down after power cycle
	4	PHYAD2	ON	Set PHY address bit 2 to `0b1`
			OFF	Set PHY address bit 2 to `0b0`
	5	PHYAD1	ON	Set PHY address bit 1 to `0b1`
			OFF	Set PHY address bit 1 to `0b0`
	6	PHYAD0	ON	Set PHY address bit 0 to `0b1`
			OFF	Set PHY address bit 0 to `0b0`

Table 12: External PHY hardware configuration (S1201)

S1201 in the schematics, see section *Sheet ADIN1100 (10BASE-T1L)* [page 49].

2.4.6 netX ADC reference voltage selector (JP201)

For identifying selector JP201, see position (4) in section *Position of interfaces and operating elements* [page 9].

This jumper selects between +3V3 as ADC reference voltage and the internal netX ADC reference voltage source.

ADC reference voltage is +3V3: Set a jumper between pin 1 and 2 to select +3V3 as ADC reference voltage.

Internal ADC reference: Leave the pins open to use the internal ADC reference of the netX.

ADC reference selector	Pin	Signal	Function
	1	+3V3_NETX	+3V3 supply voltage for netX 90
	2	VREF_ADC	ADC reference voltage

Table 13: netX ADC reference voltage selector pin assignment (JP201)

2.4.7 Brown-out detector voltage selector (X701)

For identifying selector X701, see position (12) in section *Position of interfaces and operating elements* [page 9].

This header selects between the netX brown-out detector voltage source. For normal board operation put **one** jumper in one of the following locations:

+24V: Set a jumper between pin 1 and 2 to select the +24V input voltage as brown-out detector source (default).

+3V3: Set a jumper between pin 2 and 3 to select the +3V3 supply voltage of the board as brown-out detector source.

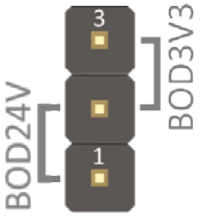
Brown-out detector voltage selector	Pin	Signal	Function
	1	BOD_24V	+24V input voltage resistor divider
	2	BOD	Brown-out detector input of netX 90
	3	BOD_3V3	+3V3 supply voltage via 10 kΩ resistor

Table 14: Brown-out detector voltage selector (X701)

2.4.8 ADIN evaluation board power selector (X801)

For identifying selector X801, see position (41) in section *Position of interfaces and operating elements* [page 9].

When connecting an ADIN1100 evaluation board from *Analog Devices* to connector **X803** (see section *ADIN evaluation board connector (X803)* [page 19]), use two jumpers to connect the external evaluation board to the NXEB 90-SPE power supply:

Set a jumper on pin 1 and 2 to supply +3V3 to the ADIN evaluation board supply voltage rail

Set a jumper on pin 3 and 4 to supply +3V3 to the ADIN evaluation VDDIO voltage rail

ADIN evaluation board power selector	Pin	Signal	Function
	1	EXTPHY_3V3	+3V3 supply voltage for external ADIN evaluation board
	2	+3V3	+3V3 supply voltage
	3	EXTPHY_VDDIO	VDDIO supply voltage for external ADIN evaluation board
	4	+3V3	+3V3 supply voltage

Table 15: ADIN evaluation board power selector (X801)

For more information, see section *Sheet extension header* [page 46].

2.4.9 SPE MDI decoupling selector (X1303)

For identifying selector X1303 on the board, see position (30) in section *Position of interfaces and operating elements* [page 9].

This header selects the decoupling of the SPE MDI shield connection. For normal board operation put **one** jumper in one of the following locations:

Set a jumper between pin 1 and 2 to connect the MDI shield to four 1 nF HV capacitors for decoupling to earth potential.

Set a jumper between pin 2 and 3 to connect the MDI shield directly to earth potential.

SPE MDI decoupling selector	Pin	Signal	Function
	1	SPE_HV_CAPS	HV capacitors for MDI shield decoupling
	2	SPE_SH	MDI shield connection
	3	FE	Connection to earth potential (FE, not Ground)

Table 16: SPE MDI decoupling selector (X1303)

2.5 Interfaces

This chapter describes all external interfaces on the board.

2.5.1 JTAG MIPI20 connector (X501)

For identifying the JTAG MIPI20 connector on the board, see position (17) in section *Position of interfaces and operating elements* [page 9].

To enable this interface, set switch 1 of **S901** to ON. For S901, see section *UART/JTAG multiplexing, LED enable (S901)* [page 14].

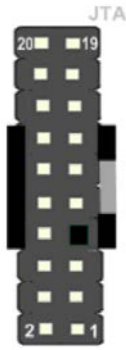
JTAG connector	Pin	Signal JTAG	Signal SWD
	1	+3V3	+3V3
	2	TMS	SWDIO
	3	GND	GND
	4	TCLK	SWDCLK
	5	GND	GND
	6	TDO	TRACE_CTL
	7	Not connected	Not connected
	8	TDI	Not connected
	9	GND	GND
	10	RESET_N	RESET_N
	11	GND	GND
	12	Not connected	TRACE_CLK
	13	GND	GND
	14	MLED0	TRACE_DATA_0
	15	GND	GND
	16	MLED1	TRACE_DATA_1
	17	GND	GND
	18	MLED2	TRACE_DATA_2
	19	GND	GND
	20	MLED3	TRACE_DATA_3

Table 17: JTAG MIPI20 connector (X501)

For more information on JTAG connectors and signals, visit the netX 90 FAQ on the Hilscher knowledge base: https://hilscher.atlassian.net/wiki/x/zDaYC

2.5.2 USB Mini B connector (X601)

For identifying the USB connector on the board, see position (18) in section *Position of interfaces and operating elements* [page 9].

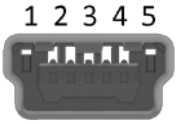
USB	Pin	Signal	Function
	1	VBUS	+5V from USB host
	2	D-	Data line, negative
	3	D+	Data line, positive
	4	-	USB device identification, not connected
	5	GND	Gnd from USB host
	SH	USB_SH	Shield connection to Ground via 1MΩ and 10nF

Table 18: USB Mini B connector (X601)

2.5.3 24 V power input (X702)

For identifying the power input on the board, see position (21) in section *Position of interfaces and operating elements* [page 9].

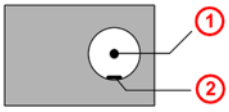
24 V power supply input	Pin	Signal	Function
	1 (Pin)	+24V	+24V input
	2 (Barrel)	GND	Ground

Table 19: 24 V power supply input (X702)

2.5.4 ADIN evaluation board connector (X803)

For identifying connector X803 on the board, see position (37) in section *Position of interfaces and operating elements* [page 9].

This connector is pin-compatible to the connector on an *EVAL-ADIN1100FMCZ* evaluation board from *Analog Devices* and is intended to be used for dual external PHY operation use-cases.

When connecting external evaluation board (for example via a 28-pin ribbon cable), the netX external MII0 will be connected to an external ADIN1100 10BASE-T1L PHY.

Note: Reserved for the dual external PHY use case, which is currently NOT support by the communication firmware.

The external board can furthermore be powered from this connector by setting the jumpers of **X801** accordingly (see section *ADIN evaluation board power selector (X801)* [page 17]).

Note: If you use either the legacy fieldbus connector X802 or the SPI interface on connector X805, this connector cannot be used to connect another external PHY because some pins share functionality with both of these interfaces. See netX 90 pinning for more information.

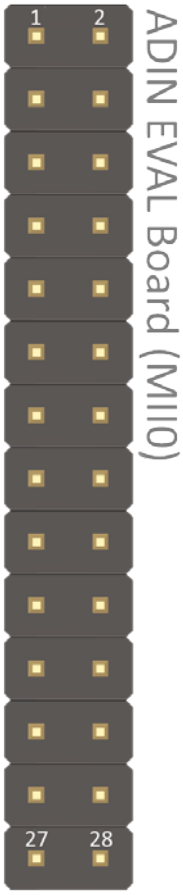
ADIN evaluation board connector	Pin	Signal	Function
	1	EXTPHY_3V3	+3V3 supply voltage for evaluation board
	2	EXTPHY_VDDIO	VDDIO supply voltage for evaluation board
	3	-	Not connected
	4	-	Not connected
	5	-	Not connected
	6	EVAL_LINK_ST	Link status of the external evaluation board
	7	-	Not connected
	8	MII0_TXD3	MII0 transmit data bit 3
	9	MII0_TXD2	MII0 transmit data bit 2
	10	MII0_TXD1	MII0 transmit data bit 1
	11	MII0_TXD0	MII0 transmit data bit 0
	12	MII0_TXCLK	MII0 transmit clock
	13	MII0_TXEN	MII0 transmit enable
	14	-	Not connected
	15	MII0_RXER	MII0 receive data error
	16	MII0_RXDV	MII0 receive data valid
	17	MII0_RXCLK	MII0 receive clock
	18	MII0_RXD0	MII0 receive data bit 0
	19	MII0_RXD1	MII0 receive data bit 1
	20	MII0_RXD2	MII0 receive data bit 2
	21	MII0_RXD3	MII0 receive data bit 3
	22	EXTPHY_MDC	Management data clock (supplied from MII_MDC)
	23	EXTPHY_MDIO	Management data input/output (supplied from MII_MDIO)
	24	PHY_INT_N	Interrupt pin of the external evaluation board
	25	GND	Ground
	26	GND	Ground
	27	GND	Ground
	28	GND	Ground

Table 20: ADIN evaluation board connector pin assignment (X803)

2.5.5 External power connector (X806)

This connector is intended to power external circuitry for evaluation. Do **not** use this connector to power the board!

For identifying connector X806 on the board, see position (1) in section *Position of interfaces and operating elements* [page 9].

External power connector	Pin	Signal	Function
	1	+3V3	+3V3 supply voltage (output)
	2	+3V3	
	3	GND	Ground
	4	GND	

Table 21: External power connector pin assignment (X806)

2.5.6 MII1 test connector (X807)

For identifying connector X807 on the board, see position (36) in section *Position of interfaces and operating elements* [page 9].

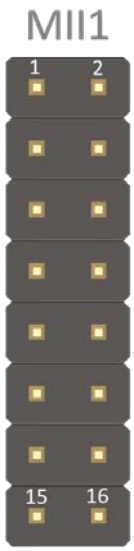
MII1 test connector	Pin	Signal	Function
	1	EXTPHY_TXD_3	MII1 transmit data bit 3
	2	EXTPHY_TXD_2	MII1 transmit data bit 2
	3	EXTPHY_TXD_1	MII1 transmit data bit 1
	4	EXTPHY_TXD_0	MII1 transmit data bit 0
	5	EXTPHY_TX_CLK	MII1 transmit clock
	6	EXTPHY_TX_EN	MII1 transmit enable
	7	EXTPHY_RX_ER	MII1 receive error
	8	EXTPHY_RX_DV	MII1 receive data valid
	9	EXTPHY_RX_CLK	MII1 receive clock
	10	EXTPHY_RXD_0	MII1 receive data bit 0
	11	EXTPHY_RXD_1	MII1 receive data bit 1
	12	EXTPHY_RXD_2	MII1 receive data bit 2
	13	EXTPHY_RXD_3	MII1 receive data bit 3
	14	EXTPHY_MDC	Management data clock (supplied from `MII_MDC`)
	15	EXTPHY_MDIO	Management data input/output (supplied from `MII_MDIO`)
	16	GND	Ground

Table 22: MII1 test connector (X807)

2.5.7 SPE IEC 63171-6 connector (X1301)

For identifying the SPE IEC 63171-6 connector on the board, see position (32) in section *Position of interfaces and operating elements* [page 9].

SPE IEC 63171-6 connector	Pin	Signal	Function
	1	SPE_P	Data positive
	2	SPE_N	Data negative
	SH	SPE_SH	Shield connection to FE

Table 23: SPE IEC 63171-6 connector (X1301)

2.5.8 RJ45 Ethernet connector (X1304)

For identifying the RJ45 Ethernet connector, see position (28) in section *Position of interfaces and operating elements* [page 9].

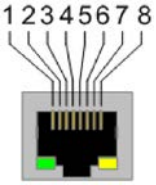
Ethernet connector	Pin	Signal	Function
	1	TX+	Transmit data positive
	2	TX-	Transmit data negative
	3	RX+	Receive data positive
	4	Term_1	Connected and terminated to FE via RC combination (Bob Smith Termination)
	5	Term_1	
	6	RX-	Receive data negative
	7	Term_2	Connected and terminated to FE via RC combination (Bob Smith Termination)
	8	Term_2	

Table 24: RJ45 Ethernet connector pin assignment (X1304)

2.5.9 Connector for NXHX fieldbus adapter modules (X802)

For identifying connector X802 on the board, see position (15) in section *Position of interfaces and operating elements* [page 9].

The following extension modules can be mounted onto this connector:

NXHX-DP for PROFIBUS (see *NXHX-DP PROFIBUS interface* [page 34])

NXHX-CO for CANopen (see *NXHX-CO CAN/CANopen interface* [page 34])

NXHX-DN for DeviceNet (see *NXHX-DN DeviceNet interface* [page 34])

NXHX-CC for CC-Link (see *NXHX-CC CC-Link interface* [35])

Note: Each fieldbus module requires the appropriate fieldbus-specific communication firmware on the netX.

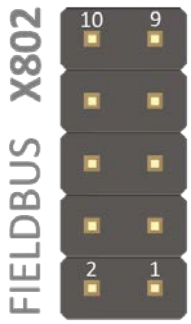
NXHX fieldbus connector	Pin	Signal	Function
	1	XM0_TX	Legacy fieldbus connector, transmit
	2	XM0_RX	Legacy fieldbus connector, receive
	3	XM0_IO0	Legacy fieldbus connector, IO 0
	4	XM0_IO1	Legacy fieldbus connector, IO 1
	5	GND	Ground
	6	+3V3	+3V3 supply voltage
	7	-	Not connected
	8	-	Not connected
	9	-	Not connected
	10	-	Not connected

Table 25: Connector for NXHX fieldbus adapter (X802)

2.5.10 SPM interface connector (X805)

For identifying connector X805 on the board, see position (8) in section *Position of interfaces and operating elements* [page 9].

This header is used for connecting a host to the Serial Dual-Port Memory (SPM) of the netX via SQI/SPI.

Note: If MII0 is used to connect another external PHY (using connector X803) to the netX 90, the SPM interface cannot be used because some pins are shared with MII0. For more information, see netX 90 pin assignment.

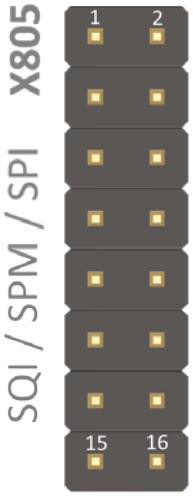
SPM interface connector	Pin	Signal	Function SQI0	Function SPI0
	1	DPM0_SPI_SIRQ	SIRQ_N	SIRQ_N
	2	+3V3	+3V3 supply voltage	+3V3 supply voltage
	3	DPM0_SPI_DIRQ	DIRQ_N	DIRQ_N
	4	GND	Ground	Ground
	5	DPM0_SPI_CLK	CLK	CLK
	6	GND	Ground	Ground
	7	DPM0_SPI_CS_N	CS_N	CS_N
	8	GND	Ground	Ground
	9	DPM0_SPI_MOSI	SIO0	MOSI
	10	GND	Ground	Ground
	11	DPM0_SPI_MISO	SIO1	MISO
	12	GND	Ground	Ground
	13	DPM0_SPI_SIO2	SIO2	Not connected
	14	GND	Ground	Ground
	15	DPM0_SPI_SIO3	SIO3	Not connected
	16	GND	Ground	Ground

Table 26: SPM interface connector (X805)

2.5.11 External UART connector for NXHX-RS232 (X804)

For identifying connector X804 on the board, see position (13) in section *Position of interfaces and operating elements* [page 9].

The following extension modules can be mounted onto this connector:

NXHX-RS232 for UART (see section *NXHX-RS232 serial interface module [page 35]*).

To enable the external UART to use the NXHX-RS232 module mounted onto X804, set switch 2 of **S901** to ON (section *UART/JTAG multiplexing, LED enable (S901)* [page 14]).

Note: If frame control is required (using UART_CTS and UART_RTS), switch 3 on S901 needs to be set to OFF position.

This will disable the ability to read the LINK_ST bit the external ADIN1100 PHY because these functions share the same pins.

NXHX UART connector	Pin	Signal	Function
	1	EXT_UART_TXD	External UART transmit
	2	EXT_UART_RXD	External UART receive
	3	EXT_UART_RTS	External UART ready to send
	4	EXT_UART_CTS	External UART clear to send
	5	GND	Ground
	6	+3V3	+3V3 supply voltage
	7	-	Not connected
	8	-	Not connected
	9	-	Not connected
	10	-	Not connected

Table 27: External UART connector (X804)

For more information, see schematic *Sheet extension* header *[page 46]*.

2.5.12 FTDI UART test points (X602)

For identifying the test points X602, see position (11) in section *Position of interfaces and operating elements* [page 9].

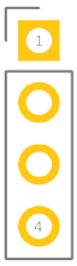
FTDI UART test connector	Pin	Signal	Function
	1	FTDI_UART_TXD	FTDI UART transmit
	2	FTDI_UART_RXD	FTDI UART receive
	3	FTDI_UART_RTS	FTDI UART ready to send
	4	FTDI_UART_CRS	FTDI UART clear to send

Table 28: FTDI UART test connector (X602)

2.5.13 ADC and user inputs/outputs (MMIO4…7) (X1001)

For identifying connector X1101 on the board, see position (16) in section *Position of interfaces and operating elements* [page 9].

Warning: Device destruction by exceeding the allowed reference voltage!

The reference voltage must not exceed 3.3 V. Otherwise the netX 90 will be permanently damaged!

ADC and user inputs/outputs	Pin	Signal	Function
	1	MMIO4	User IO 4 or ADC0 input 0
	2	+3V3	+3V3 supply voltage
	3	MMIO5	User IO 5 or ADC0 input 1
	4	+3V3	+3V3 supply voltage
	5	MMIO6	User IO 6 or ADC1 input 0
	6	+3V3	+3V3 supply voltage
	7	MMIO7	User IO 7 or ADC1 input 1
	8	+3V3	+3V3 supply voltage
	9	GND	Ground
	10	VREF_ADC	Reference voltage for ADCs

Table 29: ADC and user inputs/outputs (X1001)

For more information, see schematic *Sheet user I/O and ADC* [page 45].

2.6 Pin-header (jumpers) for measurement and test

This chapter describes the pin assignments and jumper configurations of all pin headers on the board.

2.6.1 netX +3V3 current measurement connector (JP202)

For identifying connector JP202, see position (9) in section *Position of interfaces and operating elements* [page 9].

This connector connects the netX +3V3 supply voltage to the DCDC converter of the board.

Normal board operation: Put a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of netX 90 including the internal PHYs.

netX +3V3 current measurement connector	Pin	Signal	Function
	1	+3V3	+3V3 supply voltage
	2	+3V3_NETX	+3V3 supply voltage for netX 90

Table 30: netX +3V3 current measurement connector (JP202)

For more information, see schematic *Sheet power supply* [page 39].

2.6.2 netX internal PHY VDDC current measurement connector (JP203)

For identifying connector JP203, see position (7) in section *Position of interfaces and operating elements* [page 9].

This connector connects the +1V2 supply voltage (VDDC) to the netX internal PHYs.

Normal board operation: Set a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of the netX internal PHYs core voltage rail.

netX internal PHY VDDC current measurement connector	Pin	Signal	Function
	1	+1V2	+1V2 supply voltage from netX 90
	2	INTPHY_VDDC	netX internal PHYs core voltage

Table 31: netX internal PHY VDDC current measurement connector (JP203)

For more information, see schematic *Sheet power supply* [page 39].

2.6.3 netX DCDC converter output current measurement connector (JP204)

For identifying connector JP204, see position (10) in section *Position of interfaces and operating elements* [page 9].

This connector connects the internal DCDC converter of the netX to the +1V2 (VDDC) supply voltage rail.

Normal board operation: Set a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of both the netX core circuitry as well as the internal PHYs core circuitry (VDDC).

netX DCDC output current measurement connector	Pin	Signal	Function
	1	DCDC_LX_OUT	netX 90 internal DCDC converter output
	2	+1V2	+1V2 supply voltage

Table 32: netX DCDC output current measurement connector (JP204)

For more information, see schematic *Sheet power supply* [page 39].

2.6.4 netX internal PHY VDDIO current measurement connector (JP205)

For identifying connector JP205, see position (6) in section *Position of interfaces and operating elements* [page 9].

This connector connects the +3V3 supply voltage of the netX to the netX internal PHYs.

Normal board operation: Set a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of the netX internal PHYs VDDIO voltage rail.

netX internal PHY VDDIO current measurement connector	Pin	Signal	Function
	1	INTPHY_VDDIO	netX 90 internal PHY VDDIO supply voltage
	2	+3V3_NETX	+3V3 supply voltage for netX

Table 33: netX internal PHY VDDIO current measurement connector (JP205)

For more information, see schematic *Sheet power supply* [page 39].

2.6.5 Power input current measurement connector (JP701)

For identifying connector JP701, see position (20) in section *Position of interfaces and operating elements* [page 9].

This connector connects the +24V power supply to the DCDC converter on the board.

Normal board operation: Set a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of the whole board.

Power input current measurement connector	Pin	Signal	Function
	1	+24V	+24V supply voltage from external plug pack
	2	VIN_24V	+24V supply voltage to DCDC converter on the board

Table 34: Power input current measurement connector (JP701)

For more information, see schematic *Sheet input power* and power supply [page 44].

2.6.6 Supply voltage +3V3 rail current measurement connector (JP702)

For identifying connector JP702, see position (19) in section *Position of interfaces and operating elements* [page 9].

This connector connects the output of the DCDC converter to the +3V3 supply voltage rail.

Normal board operation: Set a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of the +3V3 supply voltage rail.

DCDC output current measurement connector	Pin	Signal	Function
	1	+3V3_PRE	Output voltage of DCDC converter
	2	+3V3	+3V3 supply voltage rail

Table 35: DCDC converter output current measurement connector (JP702)

For more information, see schematic *Sheet input power* and power supply [page 44].

2.6.7 ADIN1100 PHY current measurement connector (JP1201)

For identifying connector JP1201 on the board, see position (2) in section *Position of interfaces and operating elements* [page 9].

This connector connects the +3V3 supply voltage to the ADIN1100 PHY.

Normal operation: Put a jumper between pin 1 and 2 for normal board operation.

Current measurement: Connect external current measurement equipment to pin 1 and 2 to measure the current consumption of the external ADIN1100 PHY.

The PHY itself is configured in single-supply operation, so only the +3V3 supply voltage is connected to its different supply voltage inputs.

ADIN1100 PHY current measurement connector	Pin	Signal	Function
	1	+3V3	+3V3 supply voltage
	2	EPHY_VDDIO	External ADIN1100 PHY supply voltage rail

Table 36: ADIN1100 PHY current measurement connector pin assignment (JP1201)

For more information, see schematic *Sheet ADIN1100* (10BASE-T1L) [page 49].

2.6.8 SPE AFE test connector (X1201)

For identifying connector X1201 on the board, see position (39) in section *Position of interfaces and operating elements* [page 9].

SPE AFE test connector	Pin	Signal	Function
	1	EXTPHY_TXN	SPE MDI transmit data negative
	2	EXTPHY_RXN	SPE MDI receive data negative
	3	EXTPHY_RXP	SPE MDI receive data positive
	4	EXTPHY_TXP	SPE MDI transmit data positive

Table 37: SPE AFE test connector (X1201)

2.6.9 ADIN1100 PHY clock test connector (X1202)

For identifying connector X1202 on the board, see position (38) in section *Position of interfaces and operating elements* [page 9].

The clock source of the external 10BASE-T1L PHY is dependent on the assembly option used to manufacture the board. In revision 3 and 4 the external PHY has its own 25 MHz quartz crystal.

ADIN1100 PHY clock test connector	Pin	Signal	Function
	1	EXTPHY_XTIN	Clock input of ADIN1100 external PHY

Table 38: ADIN1100 PHY clock test connector (X1202)

2.6.10 SPE MDI test connector (X1302)

For identifying connector X1302 on the board, see position (35) in section *Position of interfaces and operating elements* [page 9].

SPE MDI test connector	Pin	Signal	Function
	1	SPE_F_P	SPE MDI data positive (after CMC)
	2	SPE_F_N	SPE MDI data negative (after CMC)

Table 39: SPE MDI test connector (X1302)

2.7 LEDs

This chapter gives an overview of the LEDs used on the board.

2.7.1 Overview

The NXEB 90-SPE is equipped with the following LEDs:

Ref.	Name	LED function	Color	Signal	Position
P501	SYS	System status	(green)	RUN_N	(34)
			(yellow)	RDY_N	
P701	PWR	Power status	(green)	+3V3	(22)
P1402	COM0	Communication status of xC channel 0	(green)	MLED0	(26)
			(red)	MLED0	
P1403	COM1	Communication status of xC channel 1	(green)	MLED1	
			(red)	MLED2	
X1304B	ACT	Activity on xC channel 0 (Ethernet at RJ45 jack)	(yellow)	MLED2	(27)
X1304A	LINK	Link status on xC channel 0 (Ethernet at RJ45 jack)	(green)	MLED2	(29)
P1201	ADIN_ST	Activity LED of ADIN1100 external PHY	(yellow)	EXTPHY_LED	(31)
P1401	-	Not used	(yellow)	MLED3	(33)
	LINK	Link status on xC channel 1 (SPE on ADIN1100 PHY)	(green)	MLED3	
P1001	MMIO4	User definable LEDs	(yellow)	MMIO4	(24)
P1002	MMIO5		(yellow)	MMIO5	
P1003	MMIO6		(yellow)	MMIO6	
P1004	MMIO7		(yellow)	MMIO7	
P301	UART_TX	netX 90 shared UART transmit activity (not equipped)	(yellow)	UART_TXD	(5)
P302	UART_RX	netX 90 shared UART receive activity (not equipped)	(yellow)	UART_RXD	

Table 40: LEDs on the NXEB 90-SPE

Note: The meaning of **COM0**, **COM1**, **LINK** and **ACT** LEDs depends on the communication protocol that is used on the NXEB 90-SPE board.

Section *Position of interfaces and operating elements* [page 9] shows the positions of each LED.

2.7.2 System LED (SYS)

For identifying the SYS LED on the board, see position (34) in section *Position of interfaces and operating elements* [page 9].

The following table describes the meaning of the system LED.

SYS	Color	State	Meaning
SYS	(green)	On	Firmware is running
	(yellow)	Blinking yellow (on and off)	No firmware found, device has automatically entered console mode
	(yellow)	Alternating between darker and brighter yellow	Device has entered console mode after console mode was selected at **S501** (see section *Boot options and external PHY reset (S501) [page 12]*)
	(off)	Off	Power supply is off

Table 41: System LED

2.7.3 User definable LEDs MMIO4…7

For identifying the user definable LEDs on the board, see position (24) in section *Position of interfaces and operating elements* [page 9].

The user definable LEDs are connected to MMIO[7:4] pins of the netX 90 and are intended for programming by the user of the NXEB 90-SPE board. Their meaning is therefore not described in this document.

To enable the user definable LEDs, put switch 4 of **S901** into its ON position (see section *UART/JTAG multiplexing, LED enable (S901)* [page 14]).

3 Accessories

This chapter describes the extension modules that can be mounted on the NXEB 90-SPE to expand its functionality. To identify the position of the components listed here refer to chapter *2.3 - Position of interfaces and operating elements [page 9]*.

3.1 Fieldbus interface adapter modules

The legacy fieldbus connector **X802** (see chapter *0 - For* more information, see section *Sheet extension header* [page 41].

[page 17]) accepts a variety of modules that add fieldbus connectivity to the NXEB 90-SPE. The general layout of these modules is as follows:

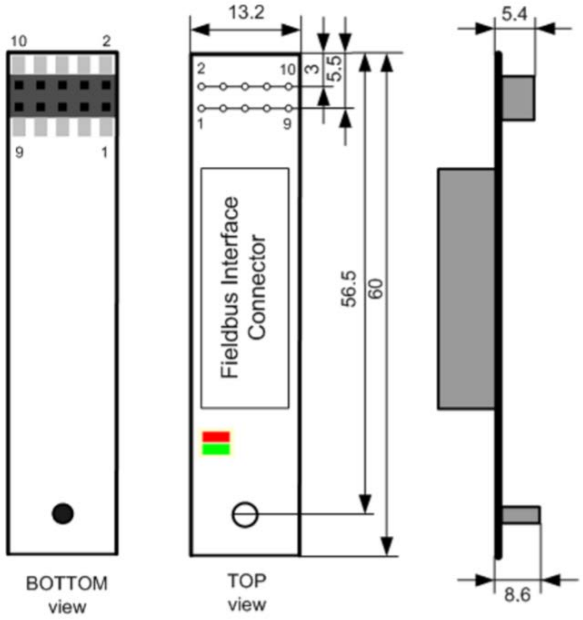


Figure 3: Fieldbus module dimensions (in mm)

3.1.1 NXHX-DP PROFIBUS interface

The NXHX-DP adds PROFIBUS (RS-485) connectivity to the NXEB 90-SPE. It features a non-isolated 9-pin D-Sub connector. Part number: 7923.410

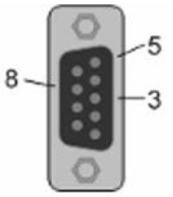
PROFIBUS interface	Pin	Signal	Function
 9 pin D-Sub, female	3	RX/TX+	Receive- / transmit data positive
	5	GND	Data ground
	8	RX/TX-	Receive- / transmit data negative
	1, 2, 4, 6, 7, 9	-	Not connected

Table 42: PROFIBUS interface

3.1.2 NXHX-CO CAN/CANopen interface

The NXHX-CO adds CAN / CANopen connectivity to the NXEB 90-SPE. It features a non-isolated 9-pin D-Sub connector. Part number: 7923.500

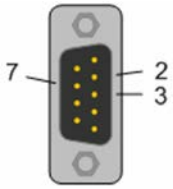
CAN/CANopen interface	Pin	Signal	Function
 9 pin D-Sub, male	2	CAN L	CAN bus low
	3	GND	Ground
	7	CAN H	CAN bus high
	1, 2, 4, 6, 7, 9	-	Not connected

Table 43: CAN/CANopen interface

3.1.3 NXHX-DN DeviceNet interface

The NXHX-DN adds DeviceNet connectivity to the NXEB 90-SPE. It features a non-isolated 5-pin COMBICON MSTBA 2.5 connector. Part number: 7923.510

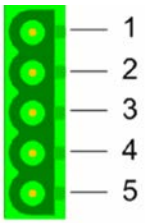
DeviceNet interface	Pin	Signal	Function
	1	DGND	Ground
	2	CAN L	CAN bus low
	3	-	Not connected
	4	CAN H	CAN bus hight
	5	DN V+	+24V DeviceNet power supply

Table 44: DeviceNet interface

3.1.4 NXHX-CC CC-Link interface

The NXHX-DN adds *CC-Link* connectivity to the NXEB 90-SPE. It features a non-isolated 5-pin COMBICON MSTBA 2.5 connector. Part number: 7923.740

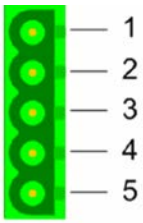
CC-Link interface	Pin	Signal	Function
 COMBICON socket, female	1	DA	Data positive
	2	DB	Data negative
	3	DG	Data ground
	4	SLD	Shield, internally connected to FG and PE. Also internally connected to DG via 3.3nF capacitor.
	5	FG	Field ground, internally connected to SLD and PE. Also internally connected to DG via 3.3nF capacitor.

Table 45: CC-Link interface

3.2 NXHX-RS232 serial interface module

The NXHX-RS232 adds a serial RS232 interface to the NXEB 90-SPE. It can be mounted on connector **X804** (see section *For* more information, see section *Sheet extension header* [page 41].

[page 17]). It features a non-isolated 9-pin D-Sub connector. Part number: 7923.010

To enable the NXHX-RS232 adapter module, put switch 2 of **S901** into its ON position (see chapter *0 -*

UART/JTAG multiplexing, LED enable (S901) *[page 14]).*

Note: If frame control shall be used (with `UART_CTS` and `UART_RTS`), switch 3 on **S901** needs to be in its ON position as well. This will disable the ability to read the `LINK_ST` bit the external ADIN1100 PHY because these functions share the same pins.

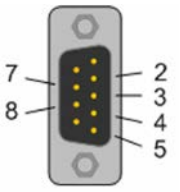
Serial RS-232 interface	Pin	Signal	Function
 9 pin D-Sub, male	2	RXD	Receive data
	3	TXD	Transmit data
	4	DTR	Data terminal ready
	5	GND	Ground
	7	RTS	Ready to send
	8	CTS	Clear to send
	1, 6, 9	-	Not connected

Table 46: NXHX-RS232 serial interface

For more information, see schematic *Sheet extension* header [page 46].

4 Getting started

Initial board configuration

Before supplying power to the board, the current measurement points have to be closed with jumpers in order for the board to power up. Set a jumper on **JP1201** (2), **JP202** (9), **JP203** (7), **JP204** (10), **JP205** (6), **JP701** (20) and **JP702** (19). For identifying the jumpers on the board, see section *Position of interfaces and operating elements* [page 9]. For more information on current measurement headers, see section *Pin-header (jumpers) for measurement and test* [page 26].

Select a reference voltage (3V3 or 24V) for the brown-out detector via **X701** (12)
(see section *Brown-out detector voltage selector (X701)* [page 16]).

Select the way of decoupling the SPE shield connection via **X1303** (30)
(see section *SPE MDI decoupling selector (X1303) [page 17]*).

Configure the following hardware options via their respective dip switches as required:

- Select the debug/programing port (USB or MIPI-JTAG header) via **S901** (14)
  (see section *UART/JTAG multiplexing, LED enable (S901)* [page 14])
- Enable user LEDs on this switch as well, if needed
- If UART with frame control is required, select this here as well
- Select standard boot bode. If console mode or alternative boot mode is needed, select the respective one via **S501** (2) (see section *Boot options and external PHY reset (S501) [page 12]*)
- Configure the external ADIN1100 PHY with **S1201** (40)
  (see section *External PHY hardware configuration (S1201)* [page 15]
- Select MDIO address for this PHY and enable or disable PHY modes as required
- PNSV5 10BASE-T1L Single-Port evaluation firmware has PHY Address = 3
- Apply power to the board with a 24V power supply and start developing

After successful power up the Power LED **P701** is on. For more information about LEDs, see section *LEDs* [page 31].

The following figure shows the initial board configuration. The white rectangles show the closed jumpers JP1201, JP202, JP203, JP204, JP205, JP701, and JP702 for the board to power up.

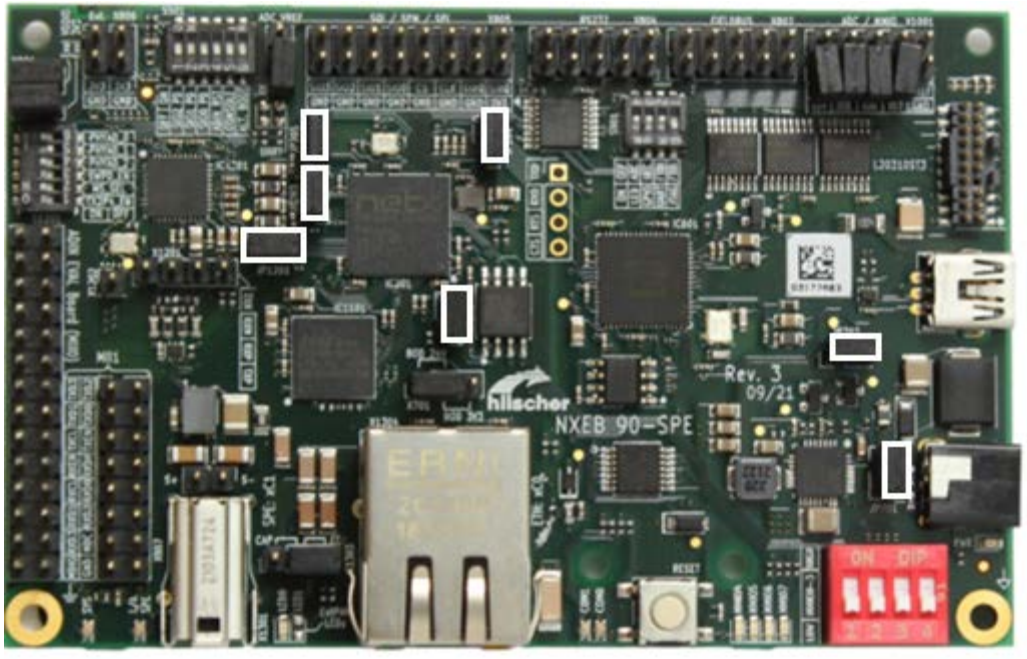


Figure 4: Getting started: Initial board configuration

5 Schematics

This section provides the schematics of the NXEB 90-SPE board.

5.1 Sheet Main page

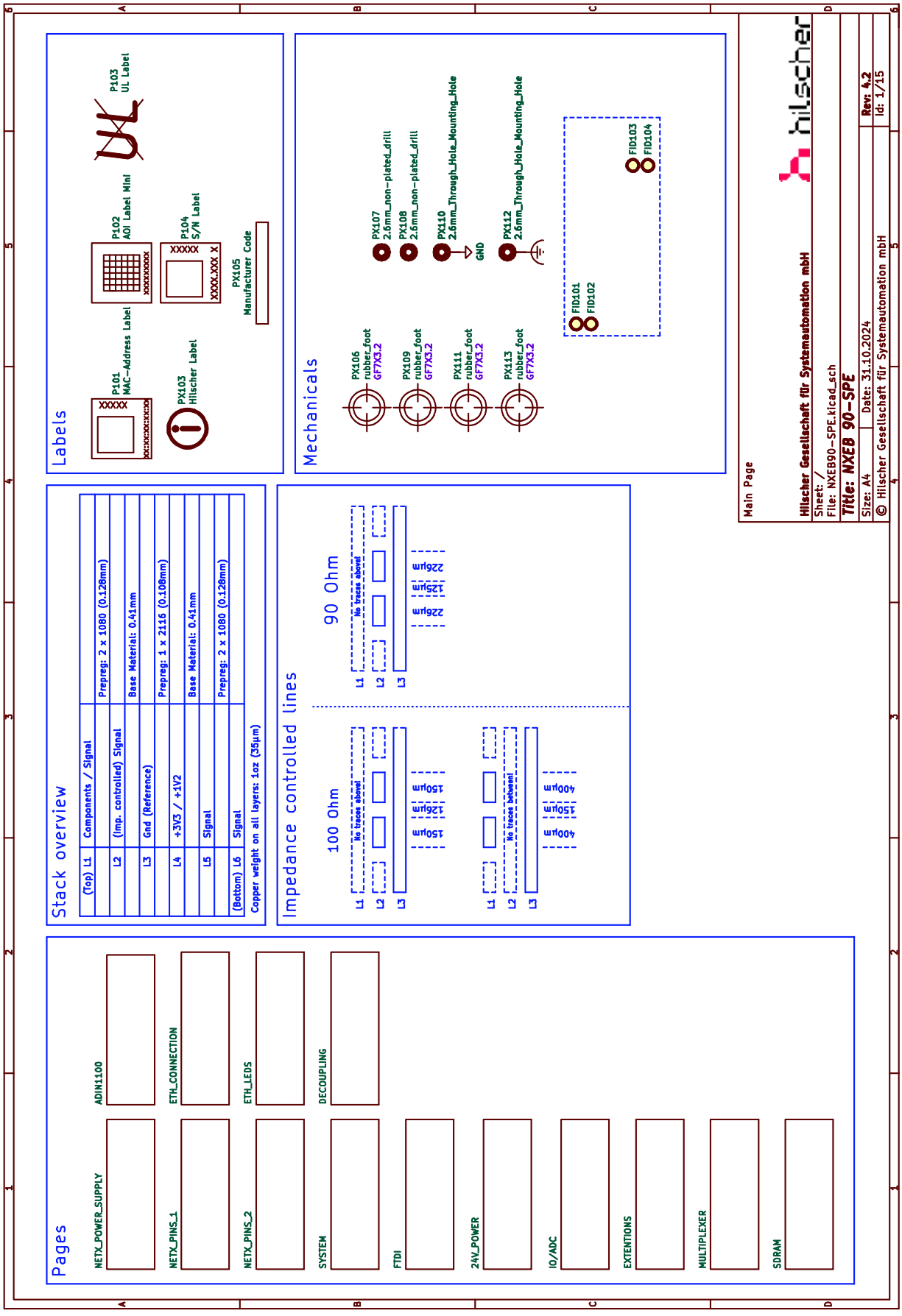


Figure 5: NXEB 90-SPE schematic page 1 - Main page

5.2 Sheet power supply

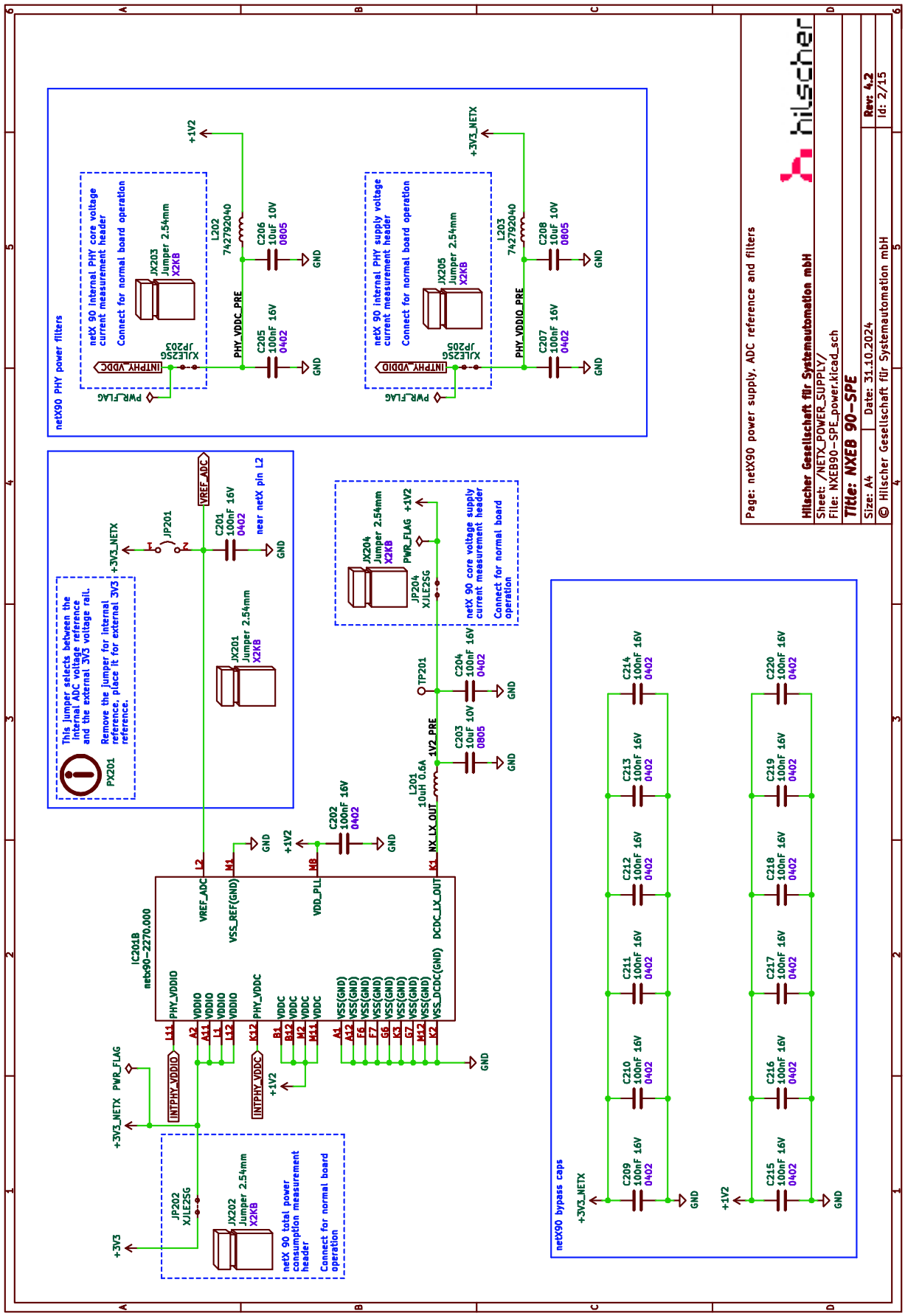


Figure 6: NXEB 90-SPE schematic page 2 - netX90 power supply, ADC reference and filters

5.3 Sheet netX 90 core 1

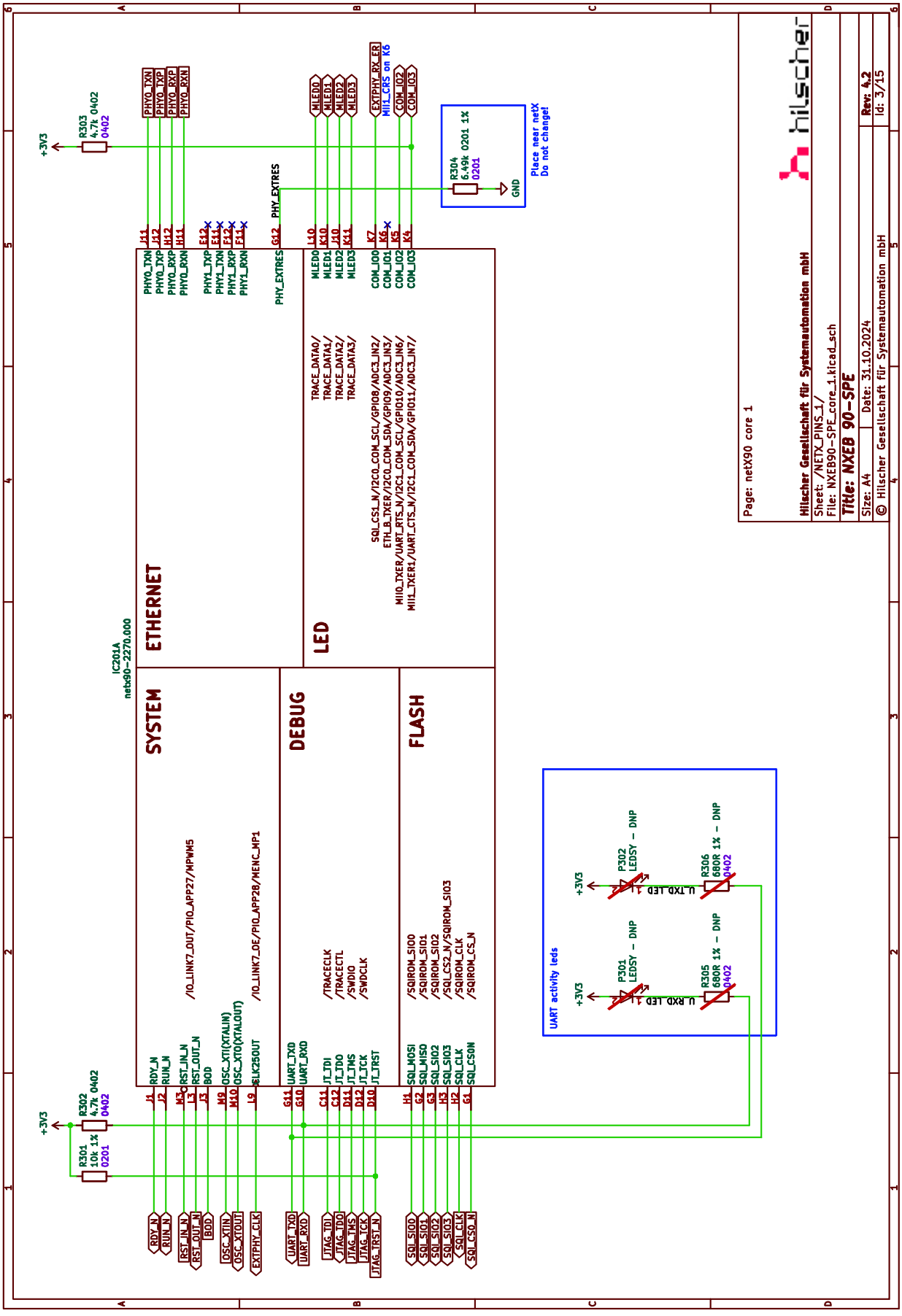


Figure 7: NXEB 90-SPE schematic page 3 - netX 90 core 1

5.4 Sheet netX 90 core 2

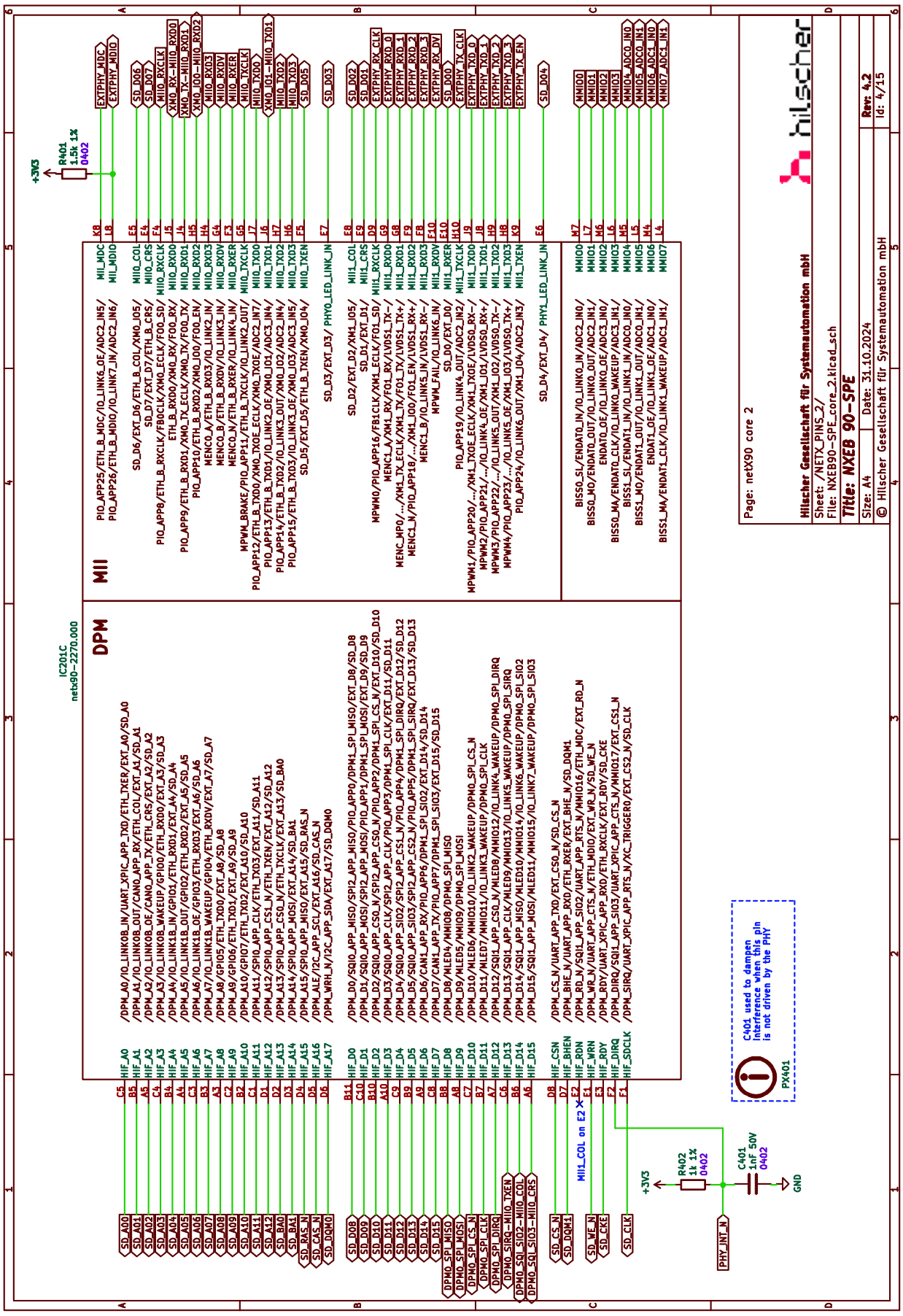


Figure 8: NXEB 90-SPE schematic page 4 - netX 90 core 2

5.5 Sheet system

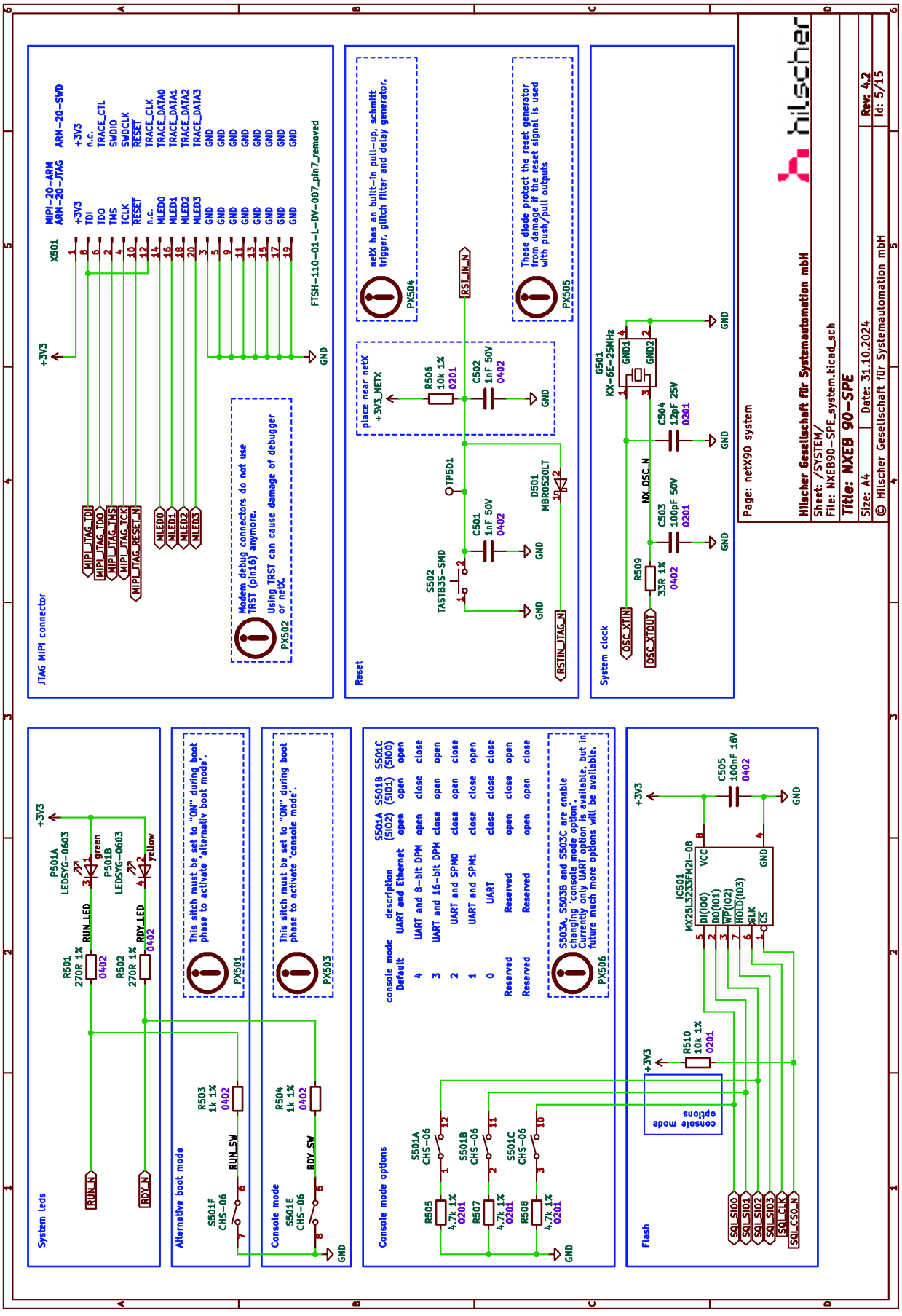


Figure 9: NXEB 90-SPE schematic page 5 - netX90 system

5.6 Sheet FTDI

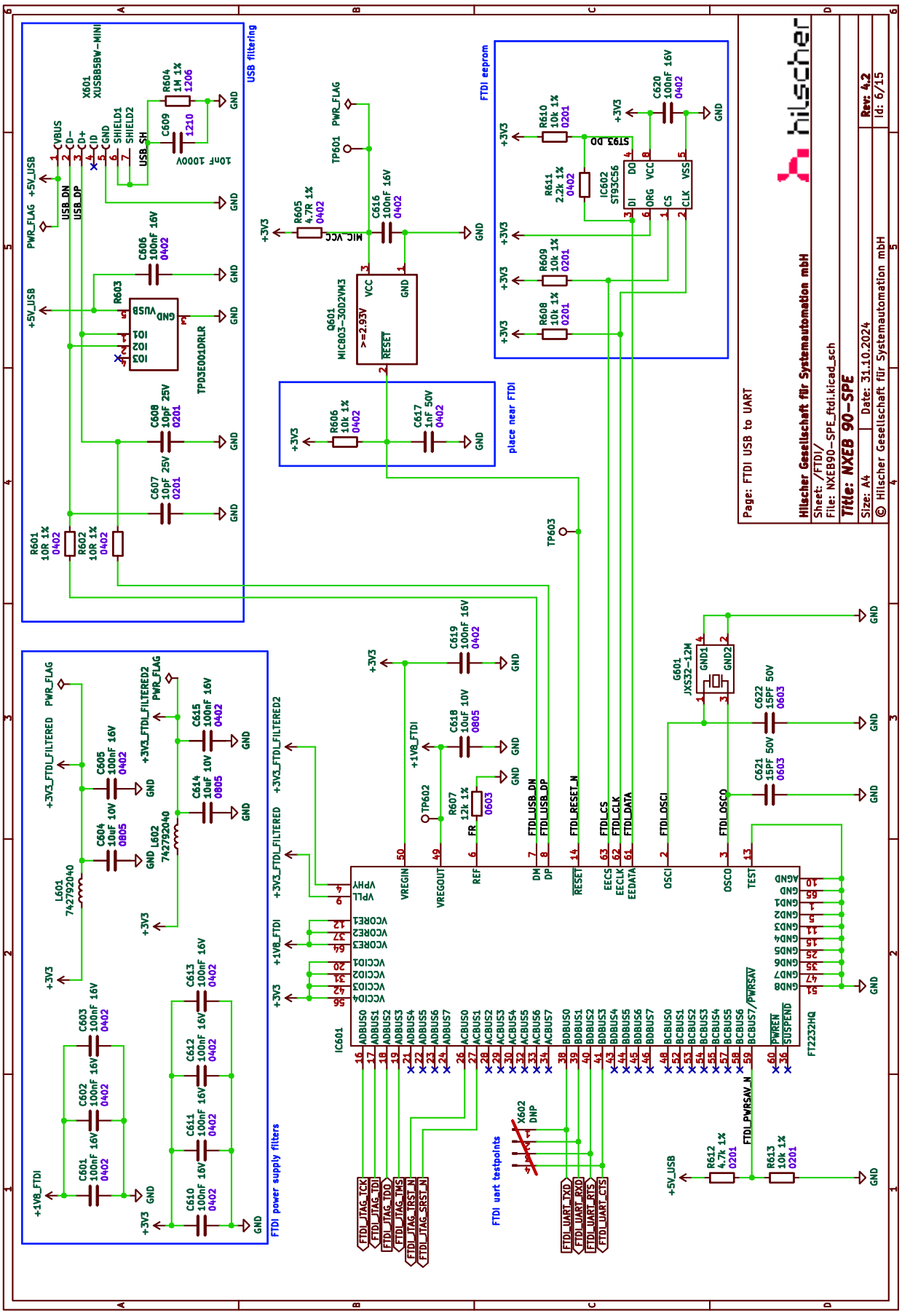


Figure 10: NXEB 90-SPE schematic page 6 - FTDI USB to UART/JTAG

5.7 Sheet input power and power supply

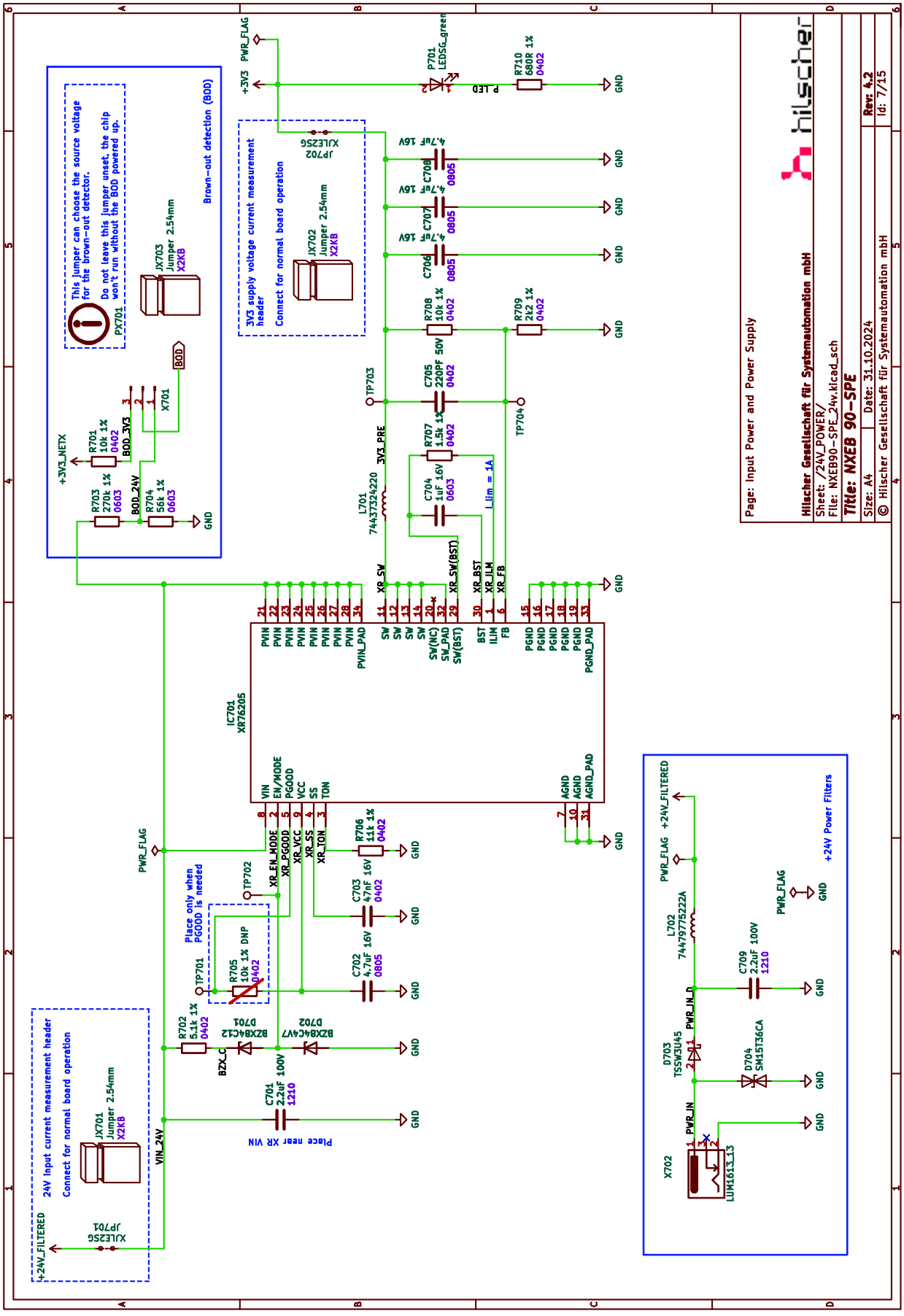


Figure 11: NXEB 90-SPE schematic page 7 - Input power and power supply

5.8 Sheet user I/O and ADC

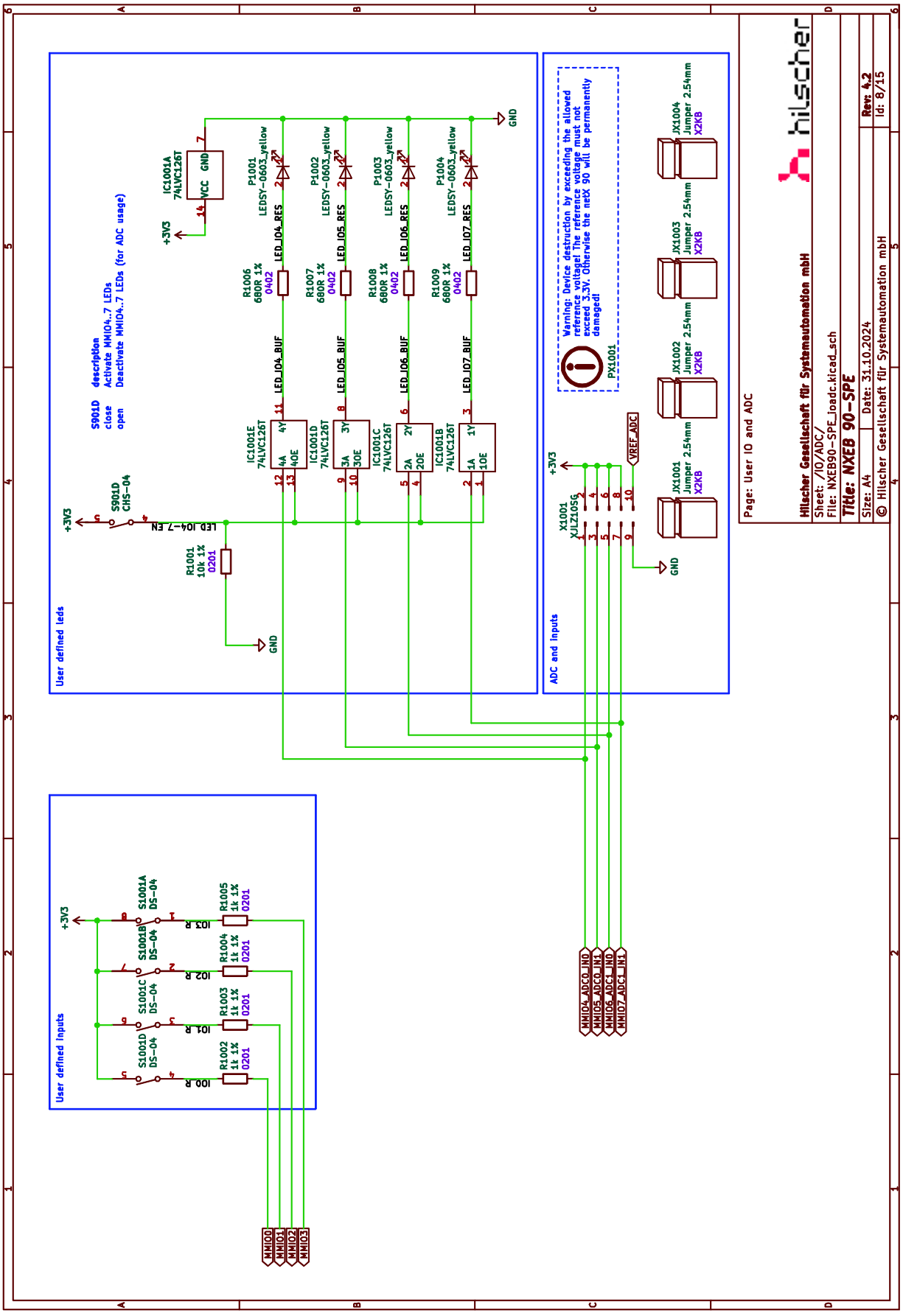


Figure 12: NXEB 90-SPE schematic page 8 - Extension headers

5.9 Sheet extension header

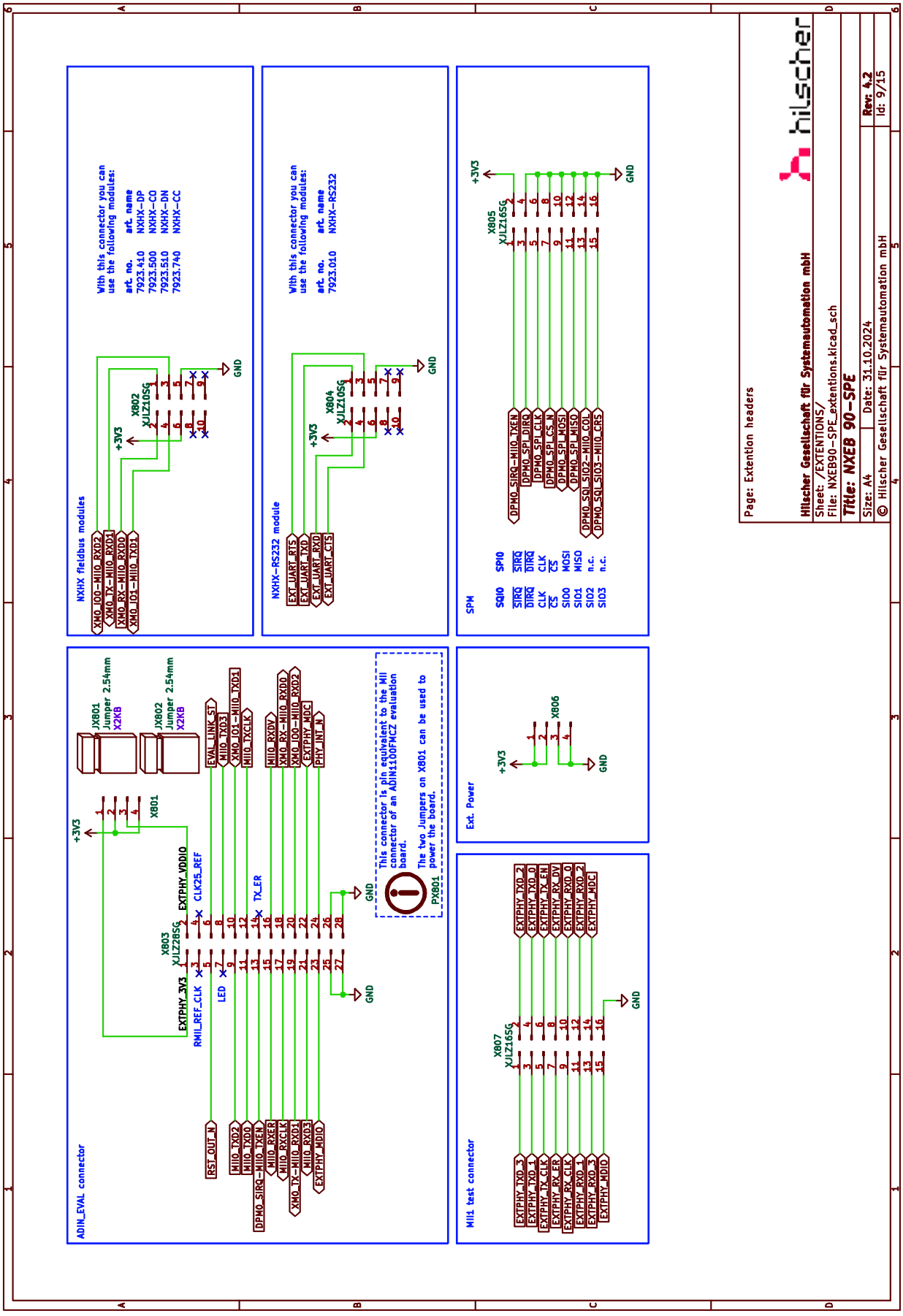


Figure 13: NXEB 90-SPE schematic page 9 - Communication multiplexer

5.10 Sheet communication multiplexer

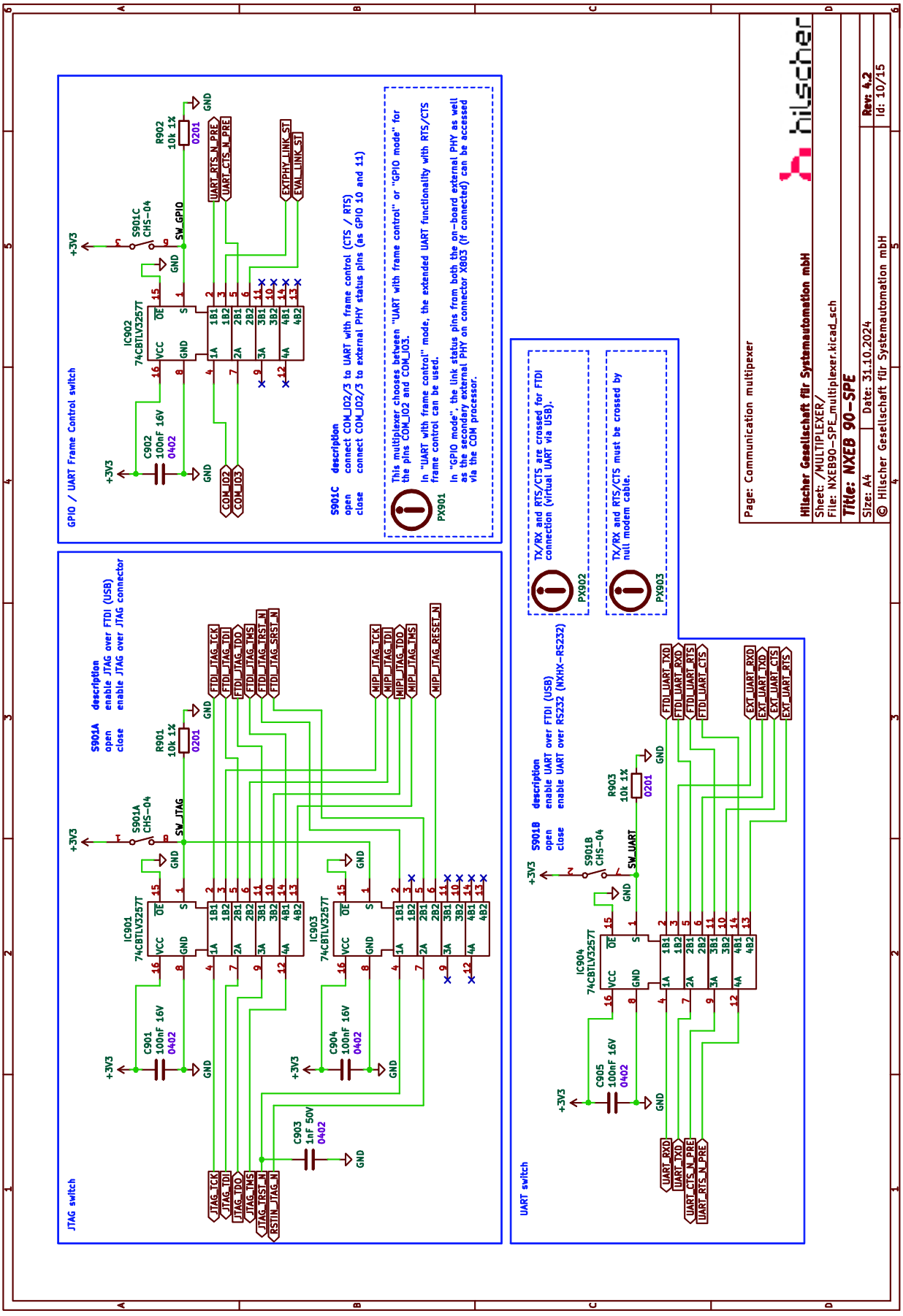


Figure 14: NXEB 90-SPE schematic page 10 - User IO and ADC

5.11 Sheet SDRAM

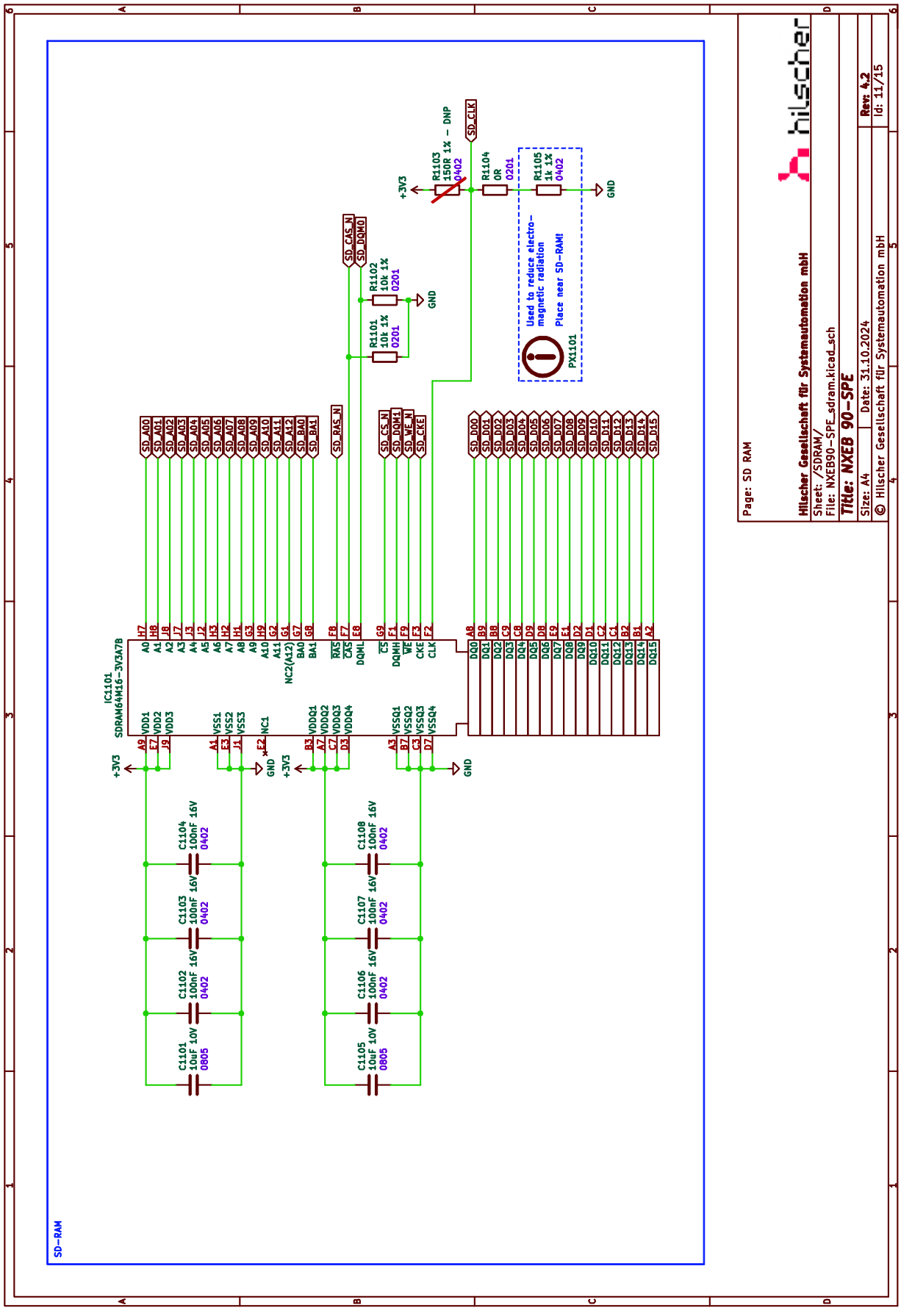


Figure 15: NXEB 90-SPE schematic page 11 - SD RAM

5.12 Sheet ADIN1100 (10BASE-T1L)

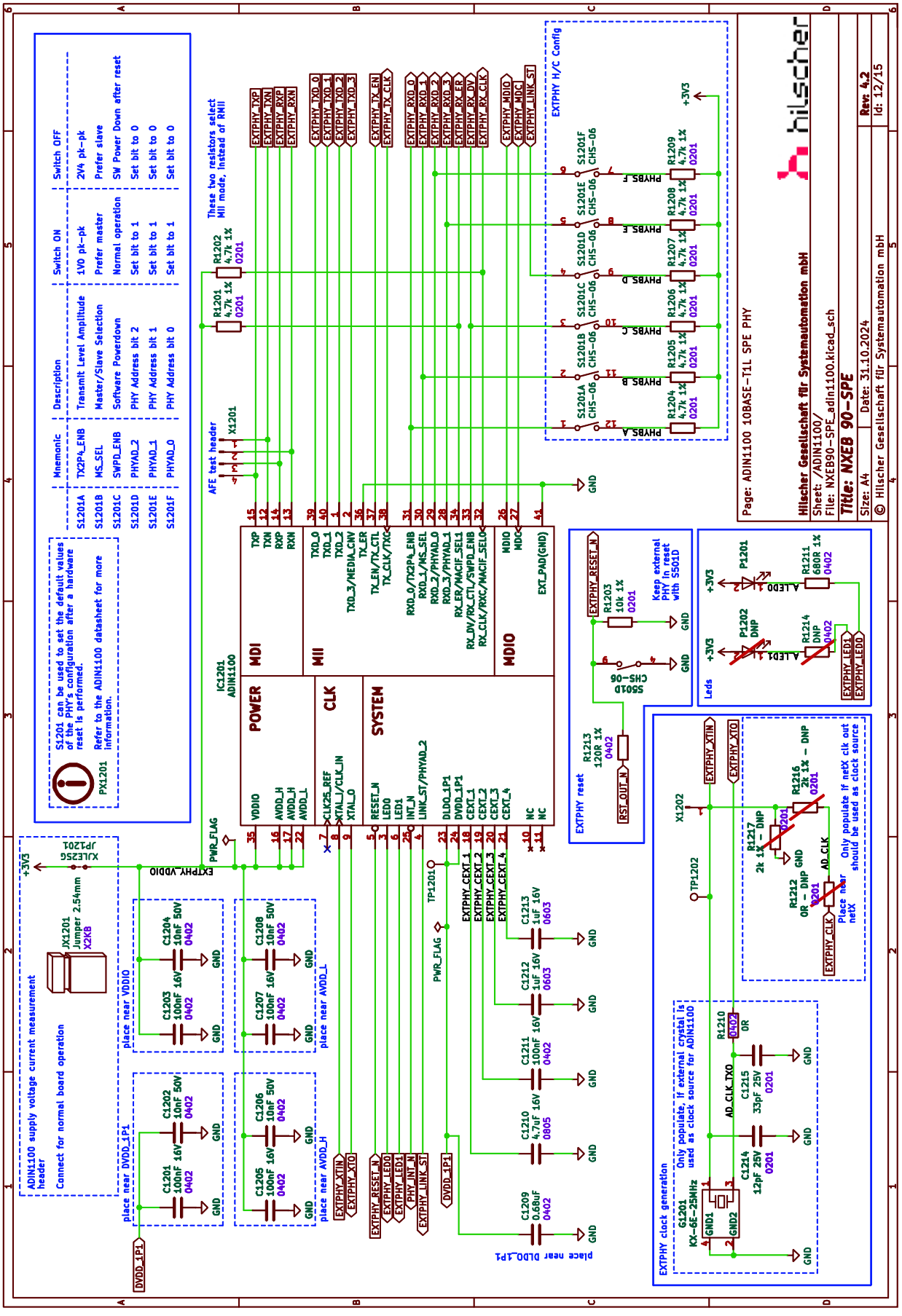


Figure 16: NXEB 90-SPE schematic page 12 - ADIN1100 10BASE-T1L SPE PHY

5.13 Sheet Ethernet and SPE connectors

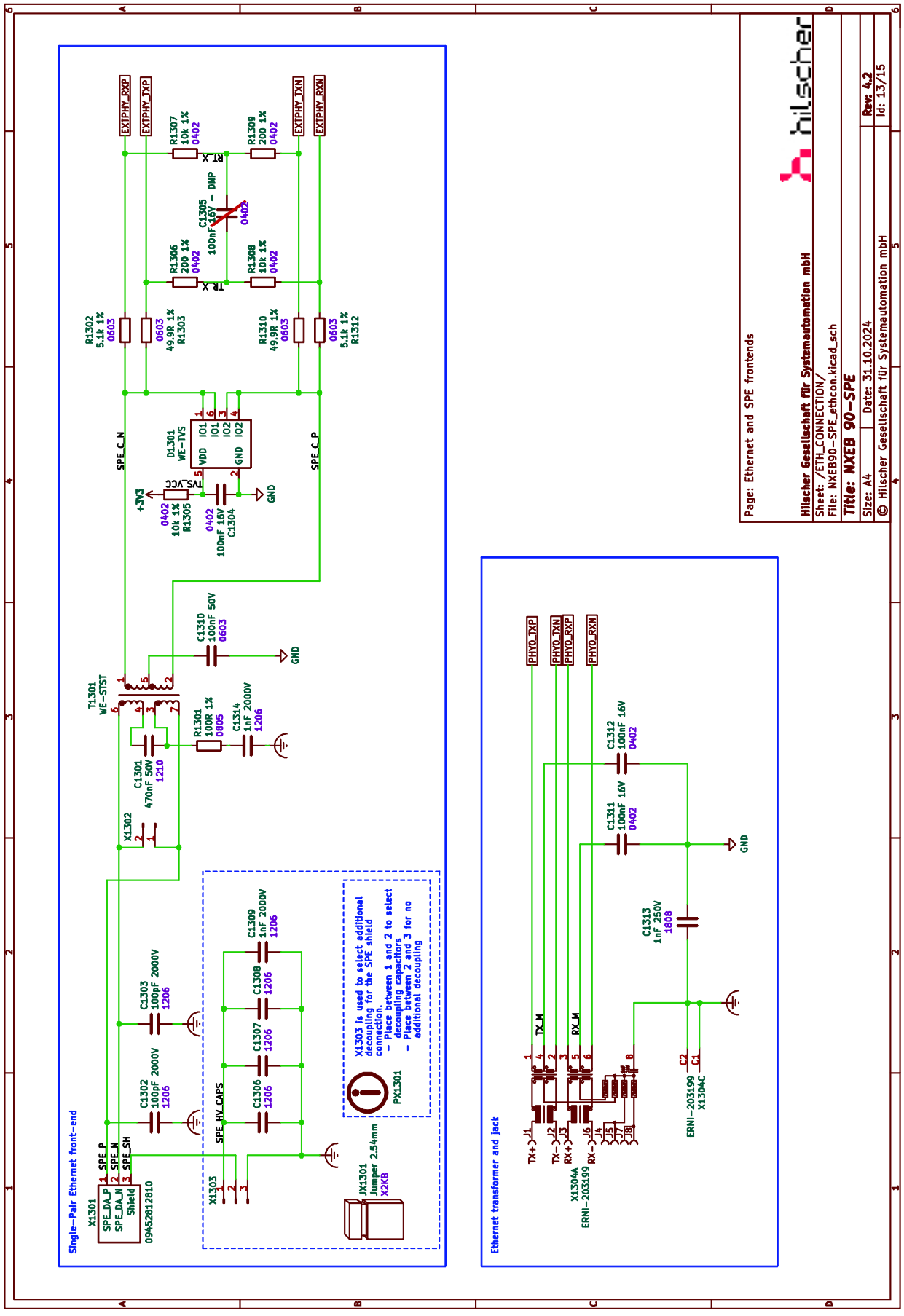


Figure 17: NXEB 90-SPE schematic page 13 - Ethernet and SPE frontends

5.14 Sheet Ethernet LEDs

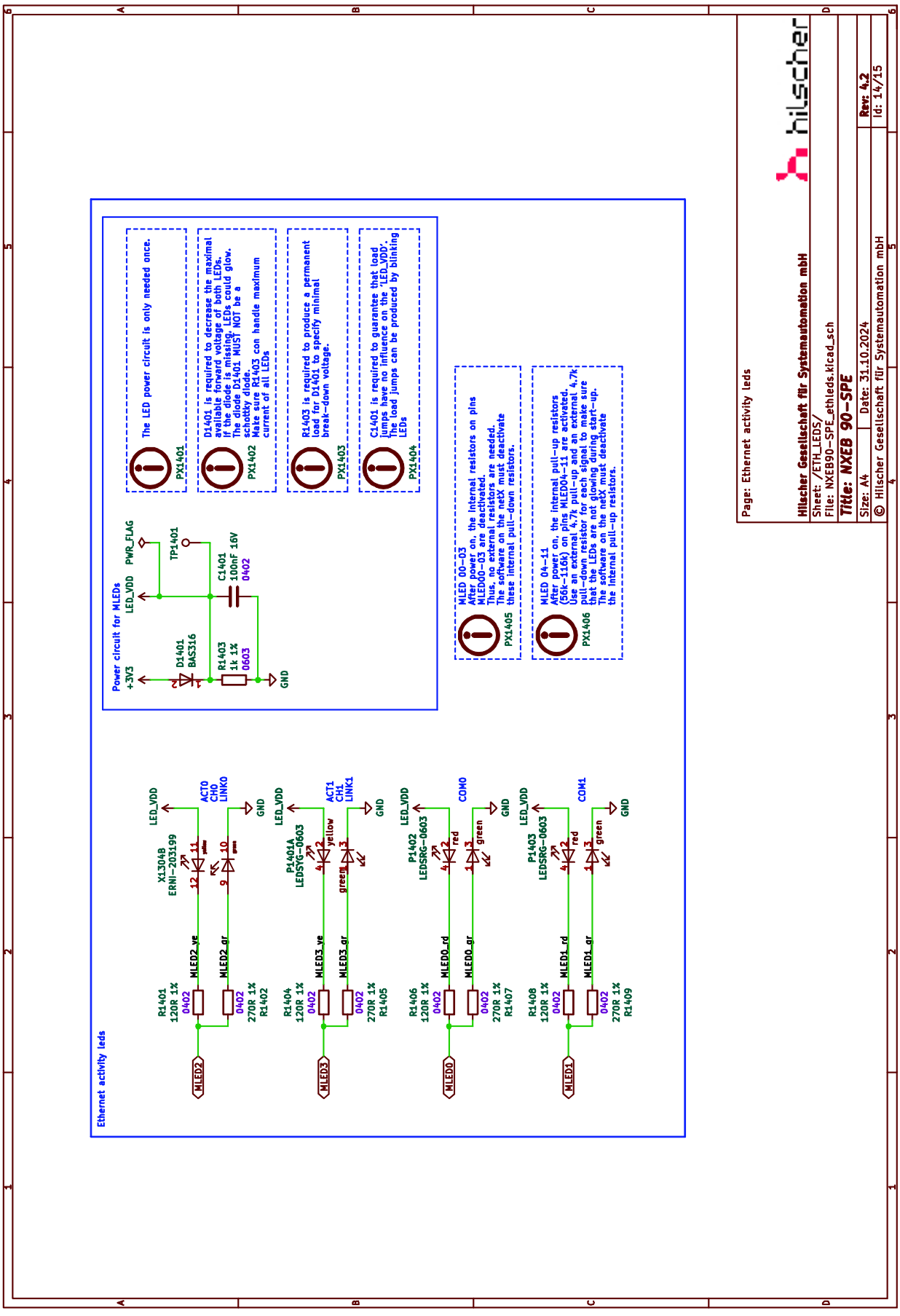


Figure 18: NXEB 90-SPE schematic page 14 - Ethernet activity LEDs

5.15 Sheet decoupling capacitors

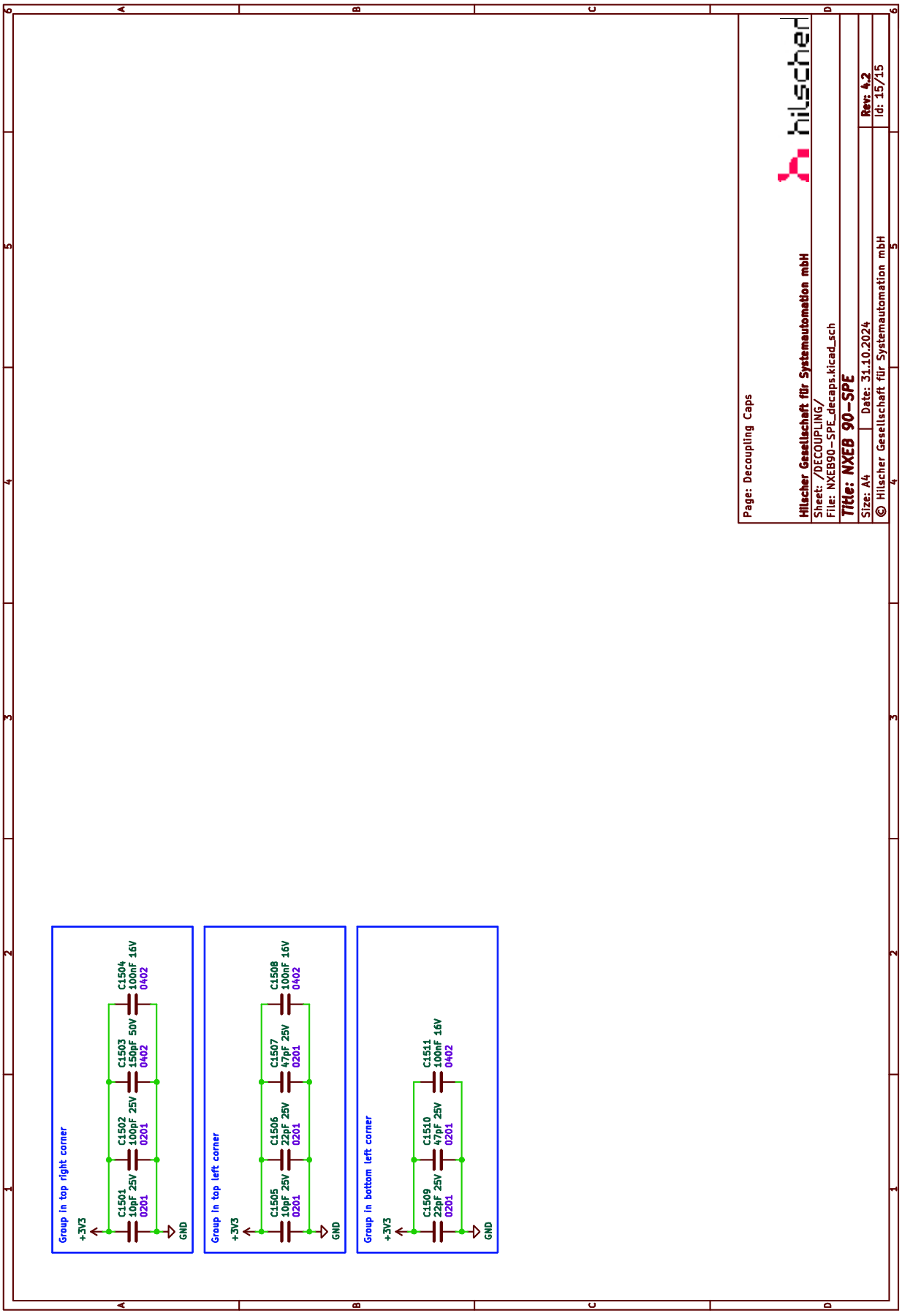


Figure 19: NXEB 90-SPE schematic page 15 - Decoupling capacitors

6 Appendix

6.1 Bill of materials

No	Ref	Value	Manufacturer	Item	Qty
1	C201, C202, C204, C205, C207, C209, C210, C211, C212, C213, C214, C215, C216, C217, C218, C219, C220, C505, C601, C602, C603, C605, C606, C610, C611, C612, C613, C615, C616, C619, C620, C901, C902, C904, C905, C1102, C1103, C1104, C1106, C1107, C1108, C1201, C1203, C1205, C1207, C1211, C1304, C1311, C1312, C1401, C1504, C1508, C1511	100nF 16V	Würth	885012205037 MLCC: X7R0402104K016DFCT10000	53
2	C203, C206, C208, C604, C614, C618, C1101, C1105	10uF 10V	Samsung	37.71.79 CL21B106KPQNNNE	8
3	C401, C501, C502, C617, C903	1nF 50V	Murata Elektronik	35.00.48 GRM1555C1H102JA01D	5
4	C702, C706, C707, C708, C1210	4.7uF 16V	Murata Elektronik	47.64.54 GRM21BR71C475KE51L	5
5	C1306, C1307, C1308, C1309, C1314	1nF 2000V	NIC Components Europe	H1206X7R102K2KVTRPLPF	5
6	C607, C608, C1501, C1505	10pF 25V	Murata Elektronik	81-GRM0335C1E100JA1J GRM0335C1E100JA01J	4
7	C1202, C1204, C1206, C1208	10nF 50V	Würth	885012205067 MLCC: X7R0402103K050DFCT10000	4
8	C704, C1212, C1213	1uF 16V	Murata Elektronik	36.51.43 GRM188R71C105KA12D	3
9	C504, C1214	12pF 25V	Kemet	CBR02C120F3GAC	2
10	C621, C622	15PF 50V	Murata Elektronik	30.71.56 15pF 50V SMD0603	2
11	C701, C709	2.2uF 100V	Samsung	38.68.34 = 46.24.17 CL32B225KCJSNNE	2
12	C1302, C1303	100pF 2000V	Würth	885342208022	2
13	C1506, C1509	22pF 25V	Murata Elektronik	81-GJM0335C1E220JB1D GJM0335C1E220JB01D	2
14	C1507, C1510	47pF 25V	Murata Elektronik	39.08.37 GRM0335C1E470JA01D	2
15	C503	100pF 50V	Murata Elektronik	37.93.12 GRM0335C1H101JA01D	1
16	C609	10nF 1000V	AVX	KKK12486 1210AC103KAT1A	1
17	C703	47nF 16V	Yageo	44.17.48 CC0402JRX7R7BB473	1
18	C705	220PF 50V	Murata Elektronik	33.35.03 GRM155R71H221KA01D	1
19	C1209	0.68uF	Murata	81-GCM155C71A684KE8D GCM155C71A684KE38D	1
20	C1215	33pF 25V	Murata Elektronik	GRM0335C1E330JA01D	1
21	C1301	470nF 50V	Samsung	CL32B474KBFNNNE	1
22	C1310	100nF 50V	Murata Elektronik	GRM188R71H104KA93D	1
23	C1313	1nF 250V	Syfer	843-1808YA250102JSU 1808YA250102JXTSPU	1

No	Ref	Value	Manufacturer	Item	Qty
24	C1502	100pF 25V	Murata Elektronik	GRM0335C1E101JA01D GRM0335C1E101JA01D	1
25	C1503	150pF 50V	Samsung	32.63.26 CL05C151JB5NNNC	1
26	R301, R506, R510, R606, R608, R609, R610, R613, R701, R708, R901, R902, R903, R1001, R1101, R1102, R1203, R1305, R1307, R1308	10k 1%	Yageo, Samsung	WRC39342 RC0201FR-0710KL, RC1005F103AS	20
27	R505, R507, R508, R612, R1201, R1202, R1204, R1205, R1206, R1207, R1208, R1209	4.7k 1%	Bourns	RC0201FR-074K7L	12
28	R402, R503, R504, R1002, R1003, R1004, R1005, R1105, R1403	1k 1%	Samsung, Bourns, Yageo	RC1005F101CS / RC1005F102CS, CR0201-FW-1001GLF, WRC32599 RC0603FR-071KL	9
29	R501, R502, R1402, R1405, R1407, R1409	270R 1%	Yageo	47.89.02 RC0402FR-07270RL	6
30	R710, R1006, R1007, R1008, R1009, R1211	680R 1%	Yageo	47.91.60 RC0402FR-07680RL	6
31	R1213, R1401, R1404, R1406, R1408	120R 1%	Yageo	40.53.11 RC0402FR-07120RL	5
32	R702, R1302, R1312	5.1k 1%	Vishay, Panasonic	2140831RL CRCW04025K10FKED, 75.40.45 ERJ3EKF5101V	3
33	R302, R303	4.7k 0402	Yageo	36.88.62 RC0402FR-074K7L	2
34	R401, R707	1.5k 1%	Yageo	47.88.07 RC0402FR-071K5L	2
35	R601, R602	10R 1%	Yageo	47.86.89 RC0402FR-0710RL	2
36	R1104, R1210	0R	Yageo	RC0201JR-070RL, 47.94.22 RC0402JR-070RL	2
37	R1303, R1310	49.9R 1%	Yageo	47.98.78 RC0603FR-0749R9L	2
38	R1306, R1309	200 1%	Vishay	1469695RL CRCW0402200RFKED	2
39	R304	6.49k 0201 1%	Yageo	47.84.65 RC0201FR-076K49L	1
40	R509	33R 1%	Yageo	RC0402FR-0733RL	1
41	R603	TPD3E001DRLR	Texas Instruments	296-21885-6-ND TPD3E001DRLR	1
42	R604	1M 1%	Yageo	48.12.73 RC1206FR-071ML	1
43	R605	4.7R 1%	VISHAY	CRCW04024R70FKED	1
44	R607	12k 1%	Samsung	31.30.09 12K, 1%, 100mW, SMD0603	1
45	R611	2.2k 1%	Yageo	47.89.21 RC0402FR-072K2L	1
46	R703	270k 1%	Yageo	47.96.74 RC0603FR-07270KL	1
47	R704	56k 1%	Yaego	RE0603FRE0756KL	1
48	R706	11k 1%	Yageo	47.87.01 RC0402FR-0711KL	1
49	R709	2k2 1%	Yageo	47.89.21 RC0402FR-072K2L	1
50	R1301	100R 1%	Firstohm	CP12 0805 100R 1% TK50	1
51	L202, L203, L601, L602	742792040	Würth	742 792 040R 600 Ohm, 2A, SMD0805, RoHS	4
52	L201	10uH 0.6A	Würth	744 383 231 00	1
53	L701	74437324220	Würth	744 373 242 20 22µF, 1A, 500mohm, 14MHz	1
54	L702	74479775222A	Würth	744 797 752 22A 2.2µH, 0.7A, 200mOhm, 50MHz	1
55	D501	MBR0520LT	ON Semiconductor	MBR0520LT1G MBR0520LT1G	1

No	Ref	Value	Manufacturer	Item	Qty
56	D701	BZX84C12	Nexperia (früher PHI, PSH)	BZX84-C12,215	1
57	D702	BZX84C4V7	Diodes Inc.	BZX84-C4V7	1
58	D703	TSSW3U45	Taiwan Semiconductor	TSSW3U45 RVG	1
59	D704	SM15T36CA	ST Microelectronics	STMSM15T36CA SM15T36CA	1
60	D1301	WE-TVS	Würth	82400152	1
61	D1401	BAS316	NXP, Phillips (ab 2017 Qualcomm)	BAS316,115	1
62	X802, X804, X1001	XJLZ10SG	FJH Steckerverbindung GmbH	102.113.010.26 11.3mm	3
63	X701, X1303	XJLE3SG	FJH Steckerverbindung GmbH	101.113.003.26 11.3mm	2
64	X801, X806	XJLZ4SG	FJH Steckerverbindung GmbH	102.113.004.26 11.3mm	2
65	X805, X807	XJLZ16SG	FJH Steckerverbindung GmbH	102.113.016.26 11.3mm	2
66	X501	FTSH-110-01-L-DV-007_pin7_removed	Samtec	FTSH-110-01-L-DV-007-K	1
67	X601	XUSBB5BW-MINI	Molex	054819-0519 Molex 0548190519	1
68	X702	LUM1613_13	CUI INC.	CP-014C-ND CONN POWER JACK 1MM; PJ-014C	1
69	X803	XJLZ28SG	Amphenol	77313-124-28LF	1
70	X1201	XJLE4SG	FJH Steckerverbindung GmbH	101.113.004.26 11.3mm	1
71	X1202	XWLE1SG	FJH Steckerverbindung GmbH	101.113.001.26 Stiftleiste 1*1pol. H: 11.3mm	1
72	X1301	09452812800	Harting	09452812800 T1 Industrial Jack AH IP20	1
73	X1304	ERNI-203199	Erni	203199	1
74	JX201, JX202, JX203, JX204, JX205, JX701, JX702, JX703, JX801, JX802, JX1001, JX1002, JX1003, JX1004, JX1201, JX1301	Jumper 2.54mm	FJH Steckerverbindung GmbH	301.202.001.1 schwarz ges.	16
75	JP201, JP202, JP203, JP204, JP205, JP701, JP702, JP1201, X1302	XJLE2SG	FJH Steckerverbindung GmbH	101.113.002.26, 101.113.002.26 11.3mm	9
76	IC901, IC902, IC903, IC904	74CBTLV3257T	Texas Instruments	SN74CBTLV3257PWR	4
77	G501, G1201	KX-6E-25MHz	Geyer electronic	12.86591 KX-6E, 25MHZ Quarz SMD	2
78	S501, S1201	CHS-06	Copal	570110173 CHS-06TA	2
79	G601	JXS32-12M	Jauch	231717 Q 12,0-JXS32-12-30/50-T1-LF	1
80	IC201	netx90-2270.000	Hilscher	2270.000	1

No	Ref	Value	Manufacturer	Item	Qty
81	IC501	MX25L3233FM2I-08	Macronix	MX25L3233FM2I-08G MX25L3233FM2I-08G	1
82	IC601	FT2232HQ	Future Technology Devices Int.	FT2232HQ FT2232HQ-REEL	1
83	IC602	ST93C56	ST Microelectronics	M93C56-WMN6TP M93C56-WMN6P	1
84	IC701	XR76205	Exar (Maxlinear)	XR76205EL-F	1
85	IC1001	74LVC126T	NXP, Phillips (ab 2017 Qualcomm)	74LVC126APW118	1
86	IC1101	SDRAM64M16-3V3A7B	ISSI	IS45S16400J-7BLA2 IS45S16400J-7BLA2-TR	1
87	IC1201	ADIN1100	Analog Devices	ADIN1100CCPZ	1
88	Q601	MIC803-30D2VM3	Microchip	576-3808-6-ND MIC803-30D2VM3-TR	1
89	S502	TASTB3S-SMD	Omron	B3S1000-P Omron B3S1000-P	1
90	S901	CHS-04	Copal	570110069 CHS-04TA	1
91	S1001	DS-04	Diptronics	41.78.66 NDS-04V, DIP-Schiebeschalter-4 Pol	1
92	T1301	WE-STST	Würth	74930000	1
93	P1001, P1002, P1003, P1004, P1201	LEDSY-0603_yellow	Everlight	LED11503 19-213/Y2C-CN1P2B/3T	5
94	P501, P1401	LEDSYG-0603	Avago (Broadcom)	HSMF-C166	2
95	P1402, P1403	LEDSRG-0603	Avago (Broadcom)	HSMF-C165	2
96	P101	MAC-Address Label	-	-	1
97	P102	AOI Label Mini	-	-	1
98	P103	UL Label	-	-	1
99	P104	S/N Label	-	-	1
100	P701	LEDSG_green	Everlight	LED25107 19-213/G6C-BM1N2/3T	1

Table 47: Bill of material

6.2 Labels

To identify the position of the components listed here refer to chapter *2.3 - Position of interfaces and operating elements [page 9]*.

6.2.1 AOI Label

The NXEB 90-SPE board is equipped with an AOI Label. This label consists of a 2D code (Data Matrix Code) and the information contained therein in plain text (eight-digit AOI number).

Figure 20: AOI label example

The AOI number enables a unique identification of the device even after loss of the matrix label (ensuring traceability of the device). The parameters article number, hardware revision and serial number are encoded in the AOI number. The position of the AOI label on your device is indicated in the device overview.

6.2.2 Matrix Label

The NXEB 90-SPE board is equipped with a matrix label.

Figure 21: Matrix label example

The label shows the following information:

Part number (1)

Hardware revision (2)

Serial number (3)

6.3 Legal notes

Copyright

Important notes

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6.4 List of tables

6.5 List of figures

6.6 Contacts

Headquarters

Germany
Hilscher Gesellschaft für Systemautomation mbH
Rheinstraße 15
D-65795 Hattersheim
Phone: +49 (0) 6190 9907-0
Fax: +49 (0) 6190 9907-50
E-mail: info@hilscher.com
Support
Phone: +49 (0) 6190 9907-990
E-mail: hotline@hilscher.com

Subsidiaries

China
Hilscher Systemautomation (Shanghai) Co. Ltd.
200010 Shanghai
Phone: +86 (0) 21-6355-5161
E-mail: info@hilscher.cn
Support
Phone: +86 (0) 21-6355-5161
E-mail: cn.support@hilscher.com

France
Hilscher France S.a.r.l.
69800 Saint Priest
Phone: +33 (0) 4 72 37 98 40
E-mail: info@hilscher.fr
Support
Phone: +33 (0) 4 72 37 98 40
E-mail: fr.support@hilscher.com

India
Hilscher India Pvt. Ltd.
Pune, Delhi, Mumbai, Bangalore
Phone: +91 8888 750 777
E-mail: info@hilscher.in
Support
Phone: +91 8108884011
E-mail: info@hilscher.in

Italy
Hilscher Italia S.r.l.
20090 Vimodrone (MI)
Phone: +39 02 25007068
E-mail: info@hilscher.it
Support
Phone: +39 02 25007068
E-mail: it.support@hilscher.com

Japan
Hilscher Japan KK
Tokyo, 160-0022
Phone: +81 (0) 3-5362-0521
E-mail: info@hilscher.jp
Support
Phone: +81 (0) 3-5362-0521
E-mail: jp.support@hilscher.com

Republic of Korea
Hilscher Korea Inc.
13494, Seongnam, Gyeonggi
Phone: +82 (0) 31-739-8361
E-mail: info@hilscher.kr
Support
Phone: +82 (0) 31-739-8363
E-mail: kr.support@hilscher.com

Austria
Hilscher Austria GmbH
4020 Linz
Phone: +43 732 931 675-0
E-mail: sales.at@hilscher.com
Support
Phone: +43 732 931 675-0
E-mail: at.support@hilscher.com

Switzerland
Hilscher Swiss GmbH
4500 Solothurn
Phone: +41 (0) 32 623 6633
E-mail: info@hilscher.ch
Support
Phone: +41 (0) 32 623 6633
E-mail: support.swiss@hilscher.com

USA
Hilscher North America, Inc.
Lisle, IL 60532
Phone: +1 630-505-5301
E-mail: info@hilscher.us
Support
Phone: +1 630-505-5301
E-mail: us.support@hilscher.com