PRODUCT GUIDE

Hollow Shaft Encoder - VLZ Product Line

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1. VLZ Series Encoders

Netzer Precision Poison Sensors has long been a trailblazer in the field of precision encoders, redefining the standards of motion control technology with unparalleled innovation and engineering expertise. Among its groundbreaking product families, the VLZ series stands out as a true embodiment of technological advancement, reliability, and versatility. Designed with cutting-edge capacitive technology and a holistic approach to position sensing, the VLZ encoders deliver exceptional precision, durability, and adaptability across a wide spectrum of applications, making them the preferred choice for industries demanding high performance and uncompromising accuracy.

Unlike conventional single or dual read-head systems, the VLZ family employs a revolutionary holistic design, capturing position data across the entire surface of the encoder. This approach provides unmatched accuracy and resolution by eliminating localized errors and ensuring a more stable and reliable signal. Engineered to excel in the most challenging environments, these encoders demonstrate exceptional resilience against temperature extremes, vibrations, and electromagnetic interference (EMI). The lightweight, compact, and contactless design not only enhances durability and reduces maintenance but also positions the VLZ family as the optimal choice for demanding applications in aerospace, robotics, defense, and medical devices.

Netzer's holistic design philosophy sets the VLZ series apart as more than just a product line - it's a transformative innovation that redefines motion control. By delivering seamless integration capabilities and a superior approach to position sensing, the VLZ encoders empower engineers to tackle complex challenges with unprecedented ease and precision. The VLZ family encapsulates Netzer's commitment to excellence, offering a complete solution for industries that demand not only technical superiority but also long-term reliability and value.

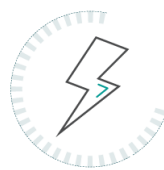## Unique Values
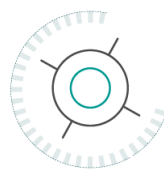
HIGH PRECISION

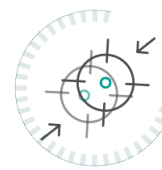LOW PROFILE

ISO 13485

MTBF 15 YEARS

EXTENDED TEMP RANGE

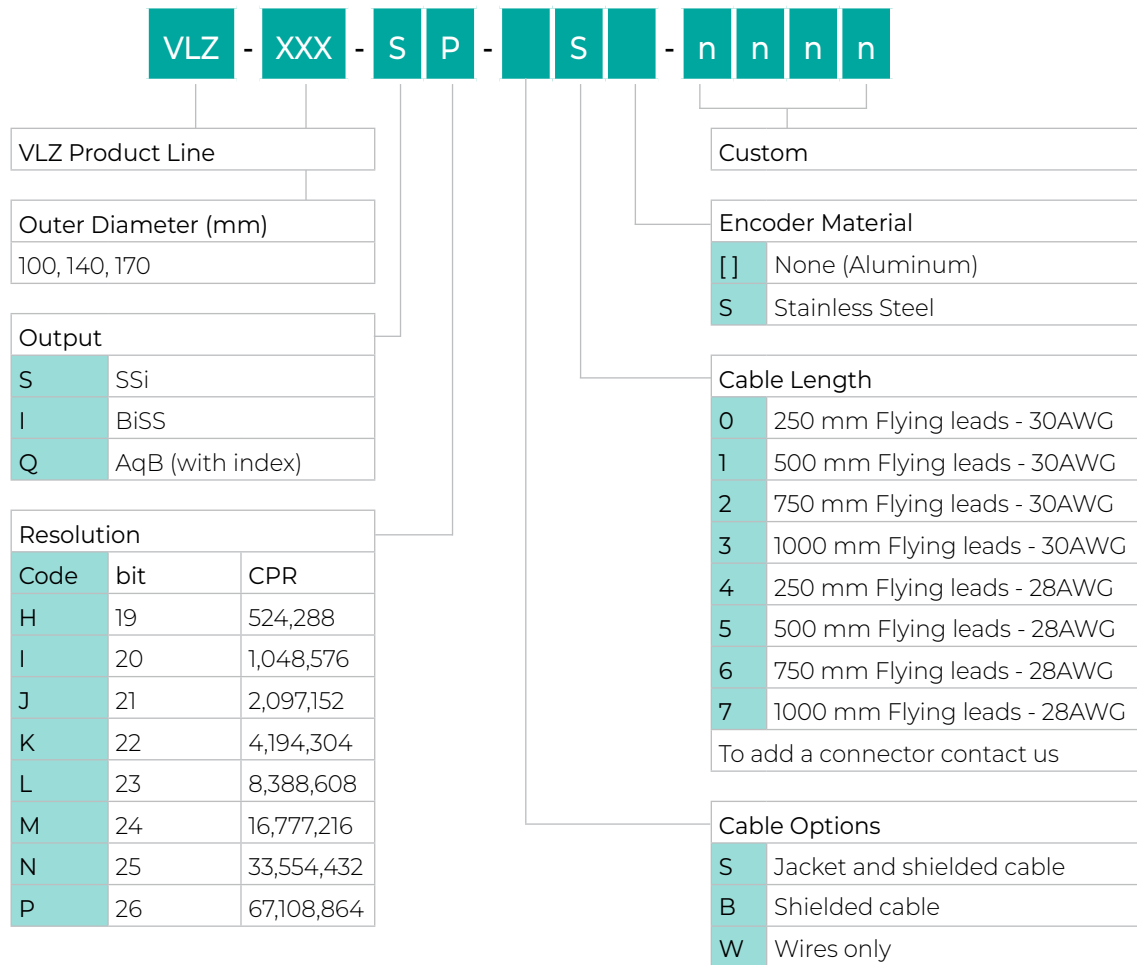NO CALIBRATION ON POWER UP

RESISTANCE TO ELECTRIC SHOCKS

REPEATABILITY

WIDE MOUNTING TOLERANCE

2. Ordering Code

VLZ - **XXX** - **S** **P** - **S** - **n** **n** **n** **n**

VLZ Product Line

Outer Diameter (mm)

100, 140, 170

Output	
S	SSi
I	BiSS
Q	AqB (with index)

Resolution		
Code	bit	CPR
H	19	524,288
I	20	1,048,576
J	21	2,097,152
K	22	4,194,304
L	23	8,388,608
M	24	16,777,216
N	25	33,554,432
P	26	67,108,864

Custom

Encoder Material	
[ ]	None (Aluminum)
S	Stainless Steel

Cable Length	
0	250 mm Flying leads - 30AWG
1	500 mm Flying leads - 30AWG
2	750 mm Flying leads - 30AWG
3	1000 mm Flying leads - 30AWG
4	250 mm Flying leads - 28AWG
5	500 mm Flying leads - 28AWG
6	750 mm Flying leads - 28AWG
7	1000 mm Flying leads - 28AWG
To add a connector contact us	

Cable Options	
S	Jacket and shielded cable
B	Shielded cable
W	Wires only

* The combination of Resolution and Shaft-turn Counter should not exceeded more than 31 bit (at SSi).

3. Technical Specifications

Electrical

Supply voltage	Current consumption	Communication	Clock frequency	Material (stator / rotor)
5V ±5%	~250 mA	SSi / BiSS-C / AqB/ RS485 / SPI	0.1- 5.0 MHz	FR4 + Stainless Steel / Aluminum

Environment

EMC	Operating temp.	Storage temp.	Relative humidity	
IEC 6100-6-2, IEC 6100-6-4	-45° C to +85° C	-55° C to +100° C	98% Non condensing	
Protection	Vibration		Shock	
IP 40	7.7grms @ 20 to 2000 Hz per MIL-810G Category 24		100g 6msec saw-tooth per IEC 60068-2-27:2009 40g 11msec saw-tooth per MIL-810G	

VLZ-100

OD / ID mm	Height mm	*Weight gr.	Resolution	Accuracy	*Rotor inertia
105 / 48	12.5	450 / 410	19-26 bit	±0.001°	61,320 / 51,191 gr · mm²
Repeatability		Max. Operational speed		Position update rate	
0.278 mdeg / 1 Arcsec		up to 6,000 rpm		50 kHz	

VLZ-140

OD / ID mm	Height mm	*Weight gr.	Resolution	Accuracy	*Rotor inertia
145 / 94	12.5	596 / 239.3	19-26 bit	±0.001°	295,345 / 132,375 gr · mm²
Repeatability		Max. Operational speed		Position update rate	
0.278 mdeg / 1 Arcsec		up to 6,000 rpm		50 kHz	

VLZ-170

OD / ID mm	Height mm	*Weight gr.	Resolution	Accuracy	*Rotor inertia
175 / 110	12.5	773.7 / 316.1	19-26 bit	±0.001°	576,270 / 250,580 gr · mm²
Repeatability		Max. Operational speed		Position update rate	
0.278 mdeg / 1 Arcsec		up to 6,000 rpm		50 kHz	

* Stainless Steel / Aluminum

NOTE: Technical data might change from time to time, please refer to website. Specific data concerning mounting and tolerances can be found on website in the technical drawings.

4. Cable Options

Cable options

Netzer Cat No.	CB-00452
Cable type	5 X 30AWG
Conductor Material	Tinned Copper
Color Code	Red X Black, Gray X Blue, White X Orange, Green X Yellow, Purple X Brown
Braid Material	Tinned Copper 95% min coverage
Diameter	Ø 4mm max

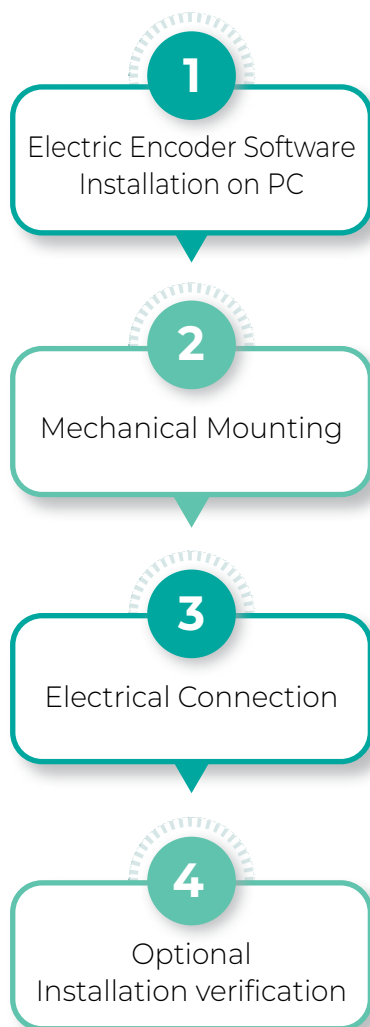| Netzer Cat No.	CB-00458
Cable type	5 X 28AWG
Conductor Material	Tinned Copper
Color Code	Red X Black, Gray X Blue, White X Orange, Green X Yellow , Purple X Brown
Braid Material	Tinned Copper 95% min coverage
Diameter	Ø 4.2mm max

Netzer Cat No.	CB-00027
Cable type	4 X 30AWG
Conductor Material	Tinned Copper
Color Code	Red X Black, Gray X Blue, White X Orange, Green X Yellow
Braid Material	Tinned Copper 95% min coverage
Diameter	Ø 3.7mm max

Netzer Cat No.	CB-00148
Cable type	4 X 28AWG
Conductor Material	Tinned Copper
Color Code	Red X Black, Gray X Blue, White X Orange, Green X Yellow
Braid Material	Tinned Copper 95% min coverage
Diameter	Ø 3.7mm max

5. Installation Flow Chart

1

Electric Encoder Software Installation on PC

2

Mechanical Mounting

3

Electrical Connection

4

Optional Installation verification

6. Storage and Handling

Storage temperature: -55°C to +100 °C

Humidity: up to 98% non-condensing

7. ESD Protection

As usual for electronic circuits, during product handling do not touch electronic circuits, wires, connectors or sensors without suitable ESD protection. The integrator / operator shall use ESD equipment to avoid the risk of circuit damage.

> **ATTENTION!   OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES**

8. Electric Encoder Software Installation

The Electric Encoder Explorer (EEE) software:

- Verifies correct mounting for an adequate signal amplitude
- Calibration of offsets
- General set up and signal analysis

This section describes the steps associated with installing the EEE software application.

8.1 Minimum requirements

- Operating system: MS windows 7/ 10, (32 / 64 bit)
- Memory: 4MB minimum
- Communication ports: USB 2
- Windows .NET Framework, V4 minimum

8.2 Installing the software

- Run the Electric Encoder™ Explorer file found on Netzer website: Encoder Explorer Software Tools.
- After the installation you will see **Electric Encoder Explorer software icon** on the computer desktop.
- Double click on the Electric Encoder Explorer software **icon** to start.
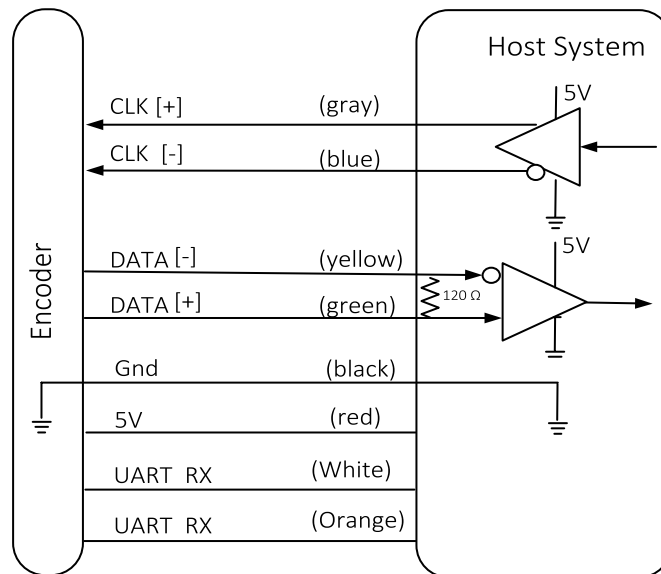
9. Electrical Connection

This chapter reviews the steps required to electrically connect the encoder with digital interface (SSi or BiSS-C).

Connecting the encoder

The encoder has two operational modes:

## 9.1 Absolute position over SSi or BiSS-C

This is the power-up default mode

SSi / BiSS interface wires color code

Name	Color	Function
Clock +	Grey	Clock
Clock -	Blue	
Data -	Yellow	Data
Data +	Green	
GND	Black	Ground
+5V	Red	Power supply
UART RX	White	IMU
UART TX	Orange	

SSi / BiSS output signal parameters

Cable	Cable
Output code	Binary
Serial output	Differential RS-422
Clock	Differential RS-422
Clock frequency	0.1 ÷ 5.0 MHz
Position update rate	50 kHz (Optional - up to 375 kHz)

9.2 Absolute Position Over AqB
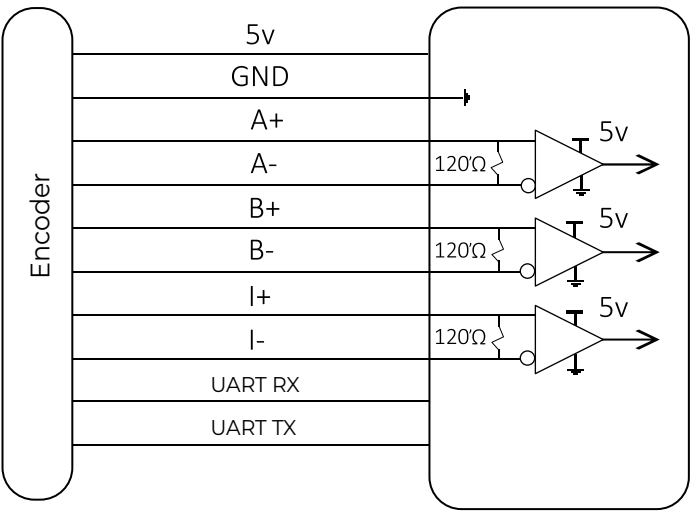
AqB Interface Wires Color Code

Name	Color	Function
A+	Purple	Quad A
A-	Brown	
B+	Blue	Quad B
B-	Gray	
I+	Green	Index
I-	Yellow	
Power	Red	5V
Ground	Black	GND
UART RX	White	IMU
UART TX	Orange	

AqB Output Signal Parameters

Cable	Cable
A Signal	Binary
B Signal	Differential RS-422
Index Signal	
IPS (Increment per second)	20MHZ

9.3 Digital SSi Interface

Synchronous Serial Interface (SSi) is a point to point serial interface standard between a master (e.g. controller) and a slave (e.g. sensor) for digital data transmission.
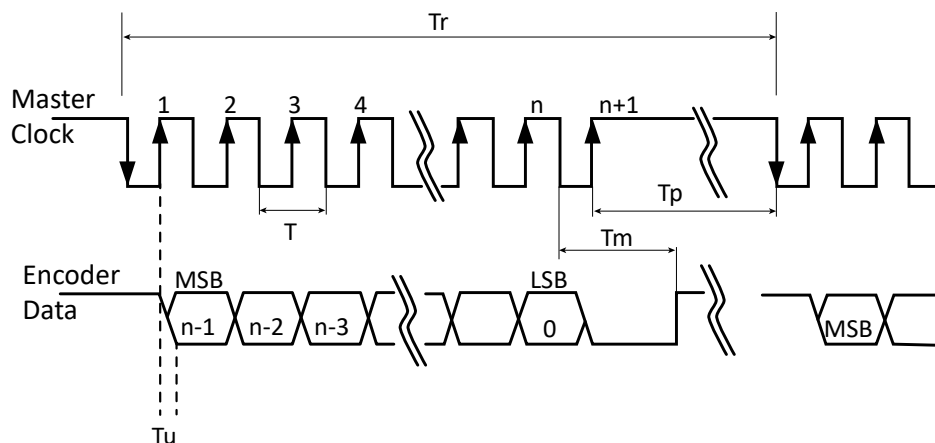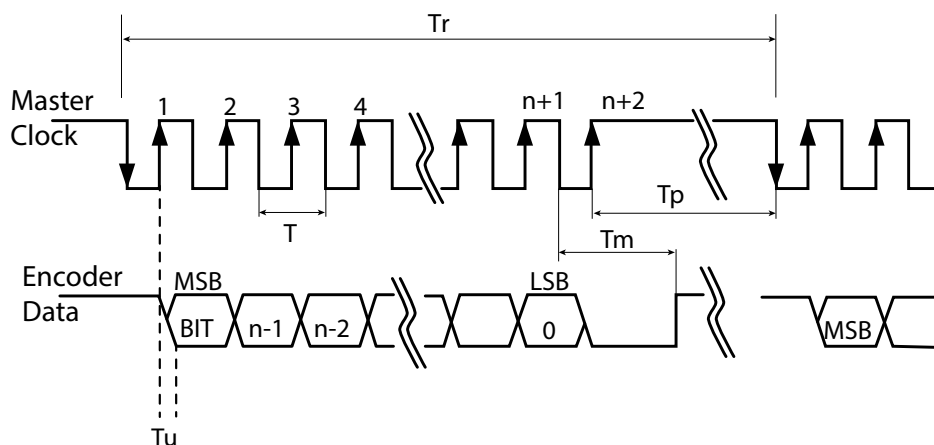

Built In Test option (BIT)
The BIT indicates critical abnormality in the encoder internal signals.
'0' – the internal signals are within the normal limits, '1' – Error
The Part Number of the encoder indicates whether the encoder includes BIT. If no BIT is indicated in the PN, there is no additional error bit.

	Description	Recommendations
n	*Position resolution	12-23
T	Clock period	
f= 1/T	Clock frequency	0.1-5.0 MHz
Tu	Bit update time	90 nsec
Tp	Pause time	26 - ∞ μsec
Tm	Monoflop time	25 μsec
Tr	Time between 2 adjacent requests	Tr > n*T+26 μsec
fr=1/Tr	Data request frequency	

*Position resolution consistent with the resolution of the ordered encoder.

9.4 Digital BiSS-C Interface

BiSS-C Interface is unidirectional serial synchronous protocol for digital data transmission where the Encoder acts as "slave" transmits data according to "Master" clock. The BiSS protocol is designed in B mode and C mode (continuous mode). The BiSS-C interface as the SSi is based on RS-422 standards.

Built In Test option (BIT)
The BIT indicates critical abnormality in the encoder internal signals.
'1' – the internal signals are within the normal limits, '0' – Error
The Part Number of the encoder indicates whether the encoder includes BIT. If no BIT is indicated in the PN, the error bit is always 1.
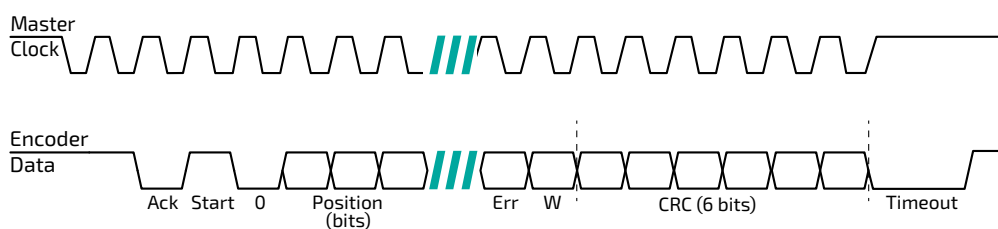
25bit	26bit		Description	Default	Length
35	36	Ack	Period during which the encoder calculates the absolute position, one clock cycle	0	1/clock
34	35	Start	Encoder signal for "start" data transmit	1	1 bit
33	34	"0"	"Start" bit follower	0	1 bit
8...32	8...33	AP	Absolute Position encoder data		Per resolution
7	7	Error	BIT (Built In Test option)	1	1 bit
6	6	Warn.	Warning (non active)	1	1 bit
0...5	0...5	CRC	The CRC polynomial for position, error and warning data is: $x^6 + x^1 + x^0$. It is transmitted MSB first and inverted. The start bit and "0" bit are omitted from the CRC calculation.		6 bits
		Timeout	Elapse between the sequential "start"request cycle's		25 µs

9.5 AqB Incremental Interface

The Netzer encoder is an absolute capacitive encoder that provides precise real-time angular position. Based on the current and next absolute angle samples, the encoder internally calculates the incremental position change and generates corresponding digital pulses on Channels A and B. Each pulse represents a small incremental step derived from the encoder's high-resolution absolute measurement.

The AqB interface outputs these incremental signals as two differential square-wave channels (A and B), using RS-422 electrical levels for improved noise immunity and reliable long-distance transmission.

The two channels are phase-shifted by 90 degrees (quadrature), enabling direction detection:

- Channel A leading Channel B indicates clockwise rotation
- Channel B leading Channel A indicates counter-clockwise rotation

Each rising or falling edge represents one incremental movement, supporting accurate tracking of dynamic motion.

Index (Z) Pulse

The AqB interface may include an optional Z (index) pulse. The Z pulse is generated once per mechanical revolution and marks the mechanical zero position, providing a reference for system homing and synchronization.
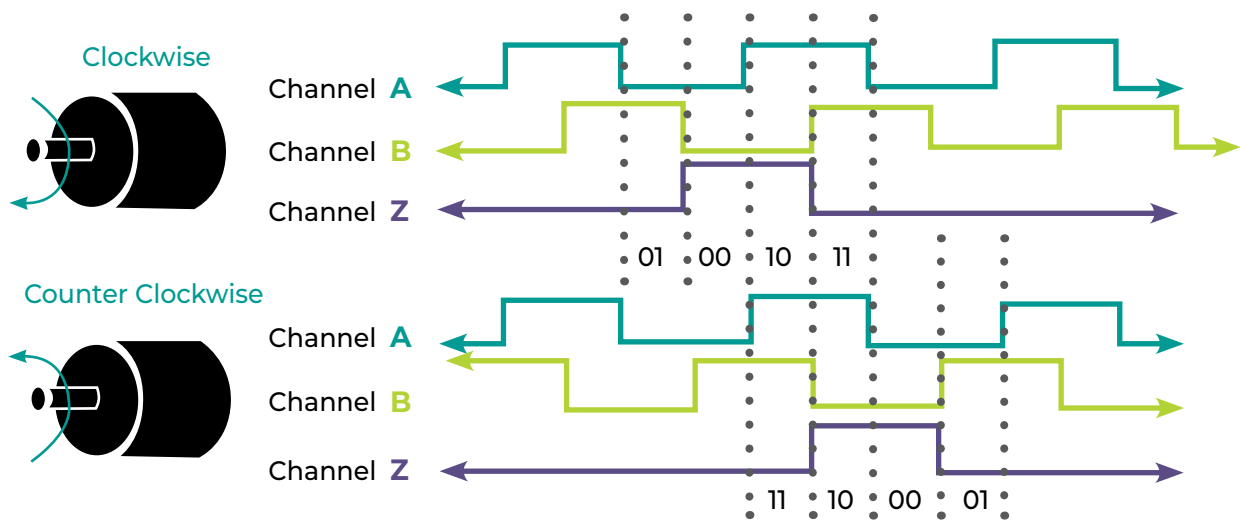
9.6 Serial Connection

The NCP protocol is a proprietary communication protocol developed by Netzer for encoder configuration and diagnostics. It enables access to internal parameters, setup functions, and real-time status information. The NCP interface can operate in parallel with the standard output interfaces, including SSI, BiSS, and AqB, allowing full encoder monitoring and configuration without interrupting normal operation.
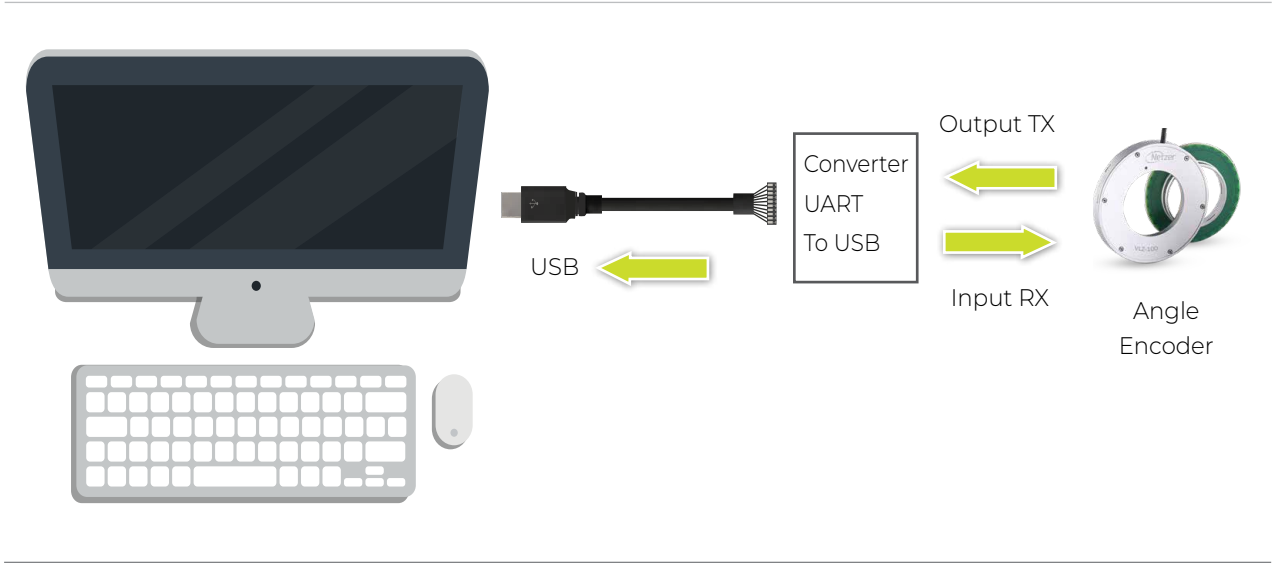
Serial Communication Signal Parameter

Output Code	Binary
Serial Output	RS-232
Bound rate	921600 BPS
Input Trash hold ?	VT+ = 2V (high)
	VT- = 0.8V (Low)
Max Input Voltage	5.5V
Output Voltage	5V

## 9.7 Setup mode over NCP (Netzer Communication Protocol)

This service mode provides access via USB to a PC running Netzer Encoder Explorer application (on MS Windows 10). Communication is via Netzer Communication Protocol (NCP) over RS-422 using the same set of wires.

Use the following pin assignment to connect the encoder to a 9-pin D-type connector to the RS-422/ USB converter CNV-00035 or the NanoMIC.

Electric encoder interface, D Type 15 pin Female

Description	Color	Function	Pin No
SSi Clock / NCP RX	Gray	Clock / RX +	2
	Blue	Clock / RX -	1
SSi Data / NCP TX	Yellow	Data / TX -	4
	Green	Data / TX +	3
Ground	Black	GND	5
Power supply	Red	+5V	8
NCP-RX	White	RX	7
NCP-TX	Orange	TX	6

Connect Netzer encoder to the converter, connect the converter to the computer and run the Electric Encoder Explorer Software Tool.

USB   SSI/BISS/AqB   Angle Encoder
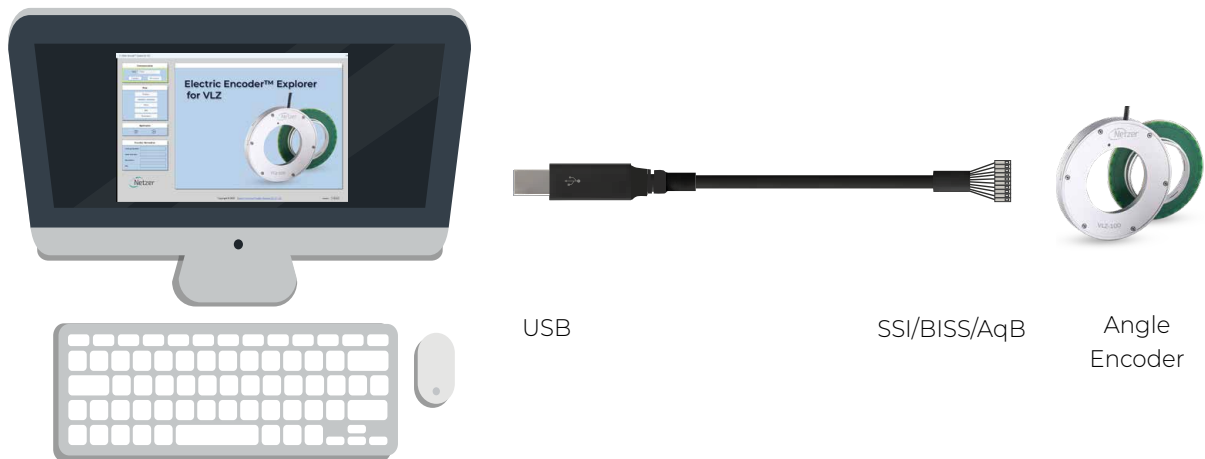
9.8 Electrical connection and grounding

Observe the following grounding consideration:

1. The cable shield is not grounded by default. (Optional accessories items)
2. Make sure the chassis is grounded.
3. It's highly recommended to keep the motor PWM wires electrically shielded and/or kept away from the encoder.
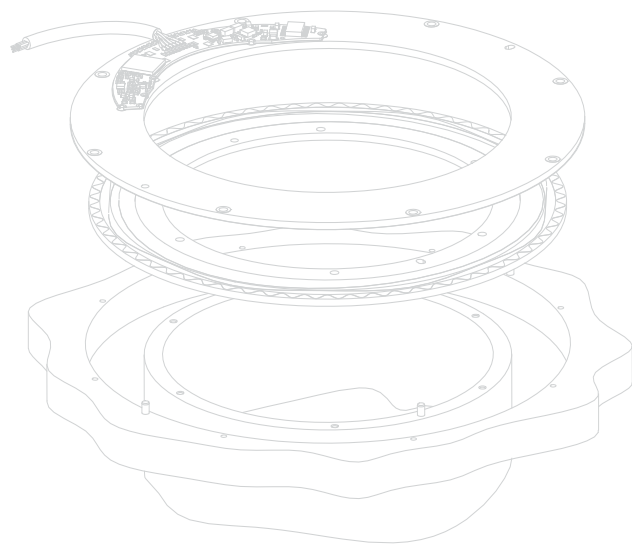
Note: 4.75 to 5.25 VDC power supply required

Netzer

ISRAEL

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VLZ-PG-V01

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