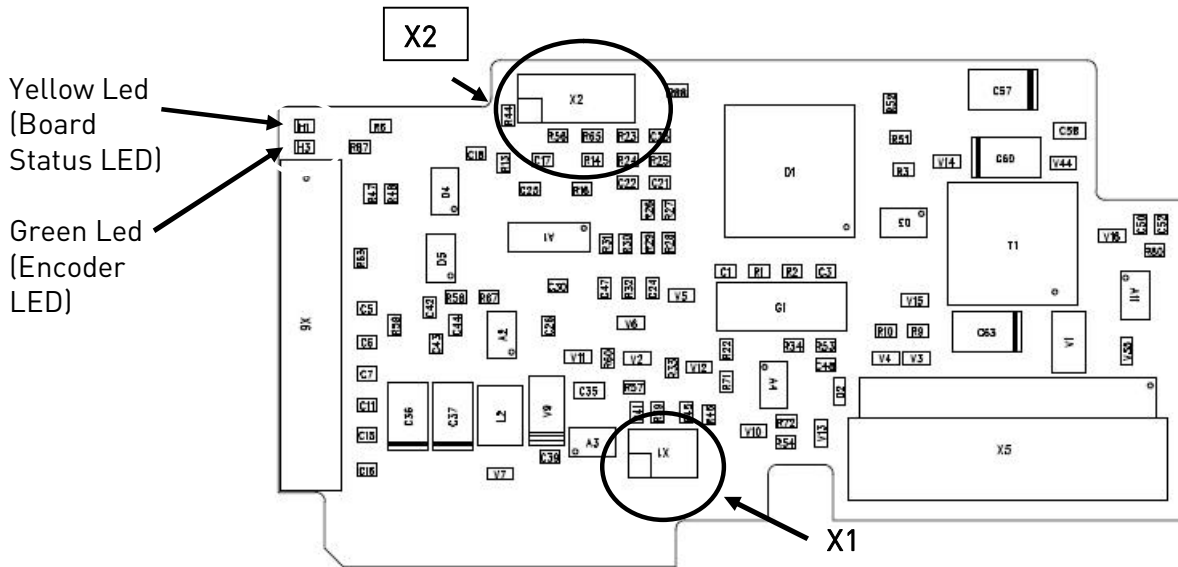# VACON

DRIVEN BY DRIVES

USER'S MANUAL

NX FREQUENCY CONVERTERS

ENDAT/SSI OPTION BOARD
OPT-BE
SIN-COS OPTION BOARD
OPT-AK

1.   ENDAT/SSI OPTION BOARD OPT-BE (DRAFT)

1.1   OPT-BE layout and description

Description:	Absolute encoder board for **Vacon NXP** with inputs for an *Endat/SSI* type encoder.

Allowed slots:	C, D, E (Sin/cos signals can only be used in slot C)
Type ID:	16965
Terminals:	One terminal block; Screw terminals (M2.6); No coding.
Jumpers:	1; X1, X2 (see page 4)
Board parameters:	Yes (see page 6)

An **absolute encoder** is a type of encoder capable of specifying its absolute position. The position data is retained even during a power failure or breakdown. The position data carried by the absolute encoder can be used by the frequency converter motor control in the control of a synchronous motor.

Encoder cable	Heidenhain cable; Max. length 100m
Encoder voltage	5V, 12V or 15V Max. current consumption 300mA
Measuring steps/ revolution	4,2 billion (max. 32bit)
Distiguishable revolutions	0—65535 (max. 16bit)
SinCos signal periods/revolution	1—65535
Endat and SSI data transfer rate	200 kHz

ENDAT is a bidirectional synchronous serial interface for absolute encoders. For example, the encoder position data can be read and encoder parameters can be set via the ENDAT connection. It also forwards the messages related to the encoder functions.
All Endat connections are available in terminal X6. The board uses Endat version 2.1.

SSI
(Syncronous Serial Interface) SSI is a single directional interface for transmitting absolute position value.

The absolute position value beginning with the Most Significant Bit (MSB first) is transferred on the DATA lines in synchronism with a CLOCK signal transmitted by the control. The SSI standard data word length for single turn absolute encoders is 13 bits, and for multiturn absolute encoders 25 bits.

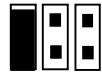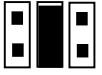More information on Endat/SSI : http://www.heidenhain.com.
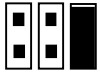
1.2 OPT-BE jumpers

NOTE!
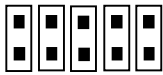It is recommended to use a +12 or +15 supply voltage instead of 5 V.
This is because our interface does not support the "sense" function to compensate voltage drop which results in a cable length limit of about 60 m with 0.5 mm2 wire section for the supply. This problem does not exist with 12 or 15 v supply.

If 5V is used, it is recommended to use two or more wires in parallel for supply connection.
There are two jumpers, X1 and X2, on the OPT-BE board. See the settings below:

Jumper X1, encoder supply voltage selection:

5V (Default)	12V	15V

Jumper X2

SIN/COS singlnals connected **Note!** This setting can only be used in slot C	SIN/COS singlnals not connected (Default)

NOTE! Be careful with the jumper settings, wrong settings may damage the encoder

1.3 OPT-BE leds

There are two leds on the OPT-BE board:

1)   Yellow Led (Board Status LED)
        Slow blinking-> Board state is ready
        Fast blinking-> Board state is faulted

2)   Green Led (Encoder LED)
        ON->Encoder serial communication is OK
        OFF->No serial connection to encoder

1.4 I/O terminals on OPT-BE, encoder terminal X6

	Terminal	Heidenheim colour code	Technical data
1	DATA+	Grey	Data line 120Ω/RS-485
2	DATA–	Pink	
3	CLOCK+	Violet	Clock line 120Ω/RS-485 (200kHz)
4	CLOCK–	Yellow	
5	A+, SIN+	Green/black	1Vpp (±0,5V); impedance 120Ω; Max.input 350 kHz
6	A–, SIN-	Yellow/black	
7	B+, COS+	Blue/black	1Vpp (±0,5V); impedance 120Ω; Max.input 350 kHz
8	B–, COS-	Red/black	
9	GND	White/green	Input ground
10	Encoder voltage	Brown/green	Selectable encoder voltages: 5V, 12V and 15V Max.current consumption 300mA

Sinus signals deserve some precautions for noise immunity that may be a little more demanding than conventional square wave encoders. Use of twisted pairs (possibly with individual shielding of each pair) is recommended. Use one pair for sinus+ and sinus-, another pair for cosinus+ and cosinus-, another pair for data+ data- of the absolute serial channel, another pair for clock+ and clock- of absolute channel.
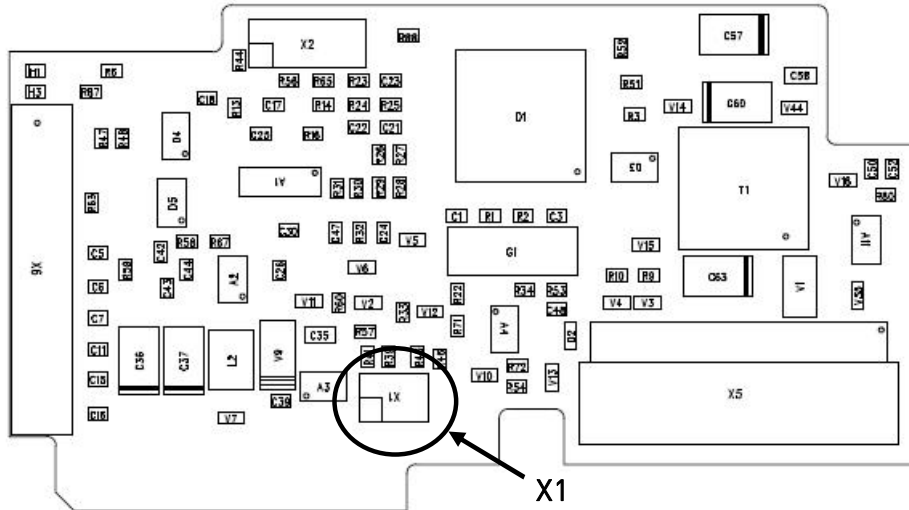
1.5 OPT-BE Parameters

Number	Parameter	Min	Max	Default	Note
7.x.1.1	Operating Mode	4	8	4	**4**= Endat + SIN/COS (default) **5**= Endat Only **6**= SSI+SinCos **7**= SSI Only **8**= SinCos Only **Note:** In modes **5** and **7**, only the absolute serial information is used. In modes **4** and **6**, also sin/cos signals are used. The selection of the correct mode depends on the control mode. E.g. Closed Loop motor control requires sin/cos information.
7.x.1.2	Pulse/revolution	1	65535	1024	
7.x.1.3	Invert direction	0	1	0	**0** = No **1** = Yes
7.x.1.4	Reading rate	0	4	1	Time used to calculate speed actual value. **Note:** Use value **1** in Closed Loop mode. **0** = No **1** = 1 ms **2** = 5 ms **3** = 10 ms **4** = 50 ms
7.x.1.5	Interpolation	0	1	0	If activated, the sinusoidal incremental pulses are used to calculate the polar angle in order to optimize the encoder accuracy **0**=No **1**=Yes
7.x.1.6	SSI data coding	0	1	1	**0**=Binary **1**=Gray
7.x.1.7	SSI total bits	0	55	13	
7.x.1.8	SSI revol bits	0	16	0	

1.6 OPT-BE monitored values

Code	Monitored value	Unit	Description
7.x.2.1	Encoder frequency	Hz	Encoder frequency in Hz
7.x.2.2	Encoder speed	rpm	Encoder Speed in rpm
7.x.2.3	Com Counter		Message counter for serial encoder communication 0-65535
7.x.2.4	Revolution counter		In case mutliturn encoders this monitored value counts the revolutions. 0-65535
7.x.2.5	Absolute position Hi word		absolute position up from 16 bits to 32bits
7.x.2.6	Absolute position Lo word		absolute position up to 16 bits

2.   SIN-COS OPTION BOARD OPT-AK

2.1   OPT-AK layout and description

X1

Description: Absolute encoder board for **Vacon NXP** with inputs for an *Sin/Cos* type encoder. Programmable control voltage.

Allowed slots: C (Sin/cos signals can only be used in slot C)

Type ID: 16715

Terminals: One terminal block; Screw terminals (M2.6); No coding.

Jumpers: 1; X1 (see page 8)

Board parameters: Yes (see page 9)

2.2 OPT-AK jumper settings

NOTE!
It is recommended to use a +12 or +15 supply voltage instead of 5 V.
This is because our interface does not support the "sense" function to compensate voltage drop which results in a cable length limit of about 60 m with 0.5 mm^2 wire section for the supply. The problem does not exist with +12 or +15 v supply.

There is one jumper, X1 (encoder supply voltage selection) on the OPT-AK board. See jumper settings below:

5V (Default)	12V	15V

NOTE! Be careful with the jumper settings, wrong settings may damage the encoder

2.3 I/O terminals on OPT-AK, encoder terminal X6

Terminal		Technical data
1	N.C.	Not Connected
2	N.C.	
3	R+	1Vpp (±0,5V); impedance 120Ω; Max.input 350 kHz, Reference mark signal
4	R-	
5	SIN+	1Vpp (±0,5V); impedance 120Ω; Max.input 350 kHz,
6	SIN-	
7	COS+	1Vpp (±0,5V); impedance 120Ω; Max.input 350 kHz
8	COS-	
9	GND	Input ground
10	Encoder voltage	Selectable encoder voltages: 5V, 12V and 15V Max.current consumption 300mA

Sinus signals deserve some precautions for noise immunity that may be a little more demanding than conventional square wave encoders. Use of twisted pairs (possibly with individual shielding of each pair) is recommended. Use one pair for sinus+ and sinus-, another pair for cosinus+ and cosinus-, another pair for data+ data- of the absolute serial channel, another pair for clock+ and clock- of absolute channel.
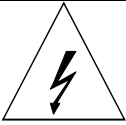
2.4   OPT-AK parameters

Number	Parameter	Min	Max	Default	Note
7.3.1.1	Pulse/revolution	1	65535	1024	
7.3.1.2	Invert direction	0	1	0	**0** = No **1** = Yes
7.3.1.3	Reading rate	0	4	1	Time used to calculate speed actual value. **Note:** Use value **1** in Closed Loop mode. **0** = No **1** = 1 ms **2** = 5 ms **3** = 10 ms **4** = 50 ms
7.3.1.3	Interpolation	0	1	0	If activated, the sinusoidal incremental pulses are used to calculate the polar angle in order to optimize the encoder accuracy **0**=No **1**=Yes

2.5   OPT-AK monitored values

Code	Monitored value	Unit	Description
7.3.2.1	Encoder frequency	Hz	Encoder frequency in Hz
7.3.2.2	Encoder speed	rpm	Encoder Speed in rpm

3.   INSTALLATION

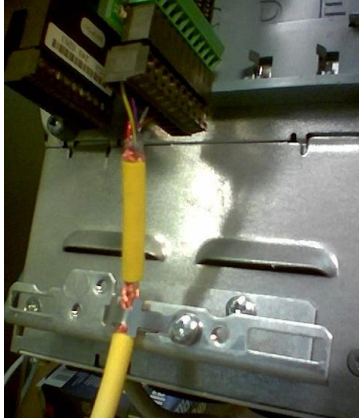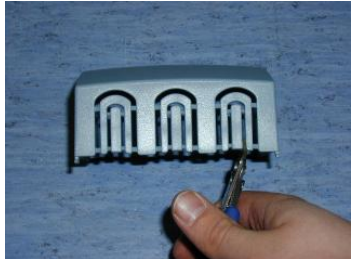| ⚠ WARNING!	*Internal components and circuit boards are at high potential when the frequency converter is connected to the power source. This voltage is extremely dangerous and may cause death or severe injury if you come into contact with it.*

3.1   Installing the option board

The option boards OPT-BE and OPT-AK can only be used with Vacon **NXP** drives.

The option board OPT-AK can be connected to **slot C**. The OPT-BE board can be connected to **slots E, C or D**, but sin/cos signals can only be used in slot C. If the OPT-BE board is connected to slots B, E or D, the sin/cos signals have to be disconnected using the jumpers (see chapter 1.2)
Disconnect the drive from the mains before starting the installation.

A	Vacon NXP frequency converter	
B	Remove the cable cover.	

C	Open the cover of the control unit.	
D	Install the option board in slot C on the control board of the frequency converter. Make sure that the grounding plate fits tightly in the clamp. Strip the cable at such distance from the terminal that you can fix it to the frame with the grounding clamp.	
E	Make a sufficiently wide opening for your cable by cutting the grid as wide as necessary.	
F	Close the cover of the control unit and the cable cover.	

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