



Danfoss OPTBE Board Functional Extensions User Manual

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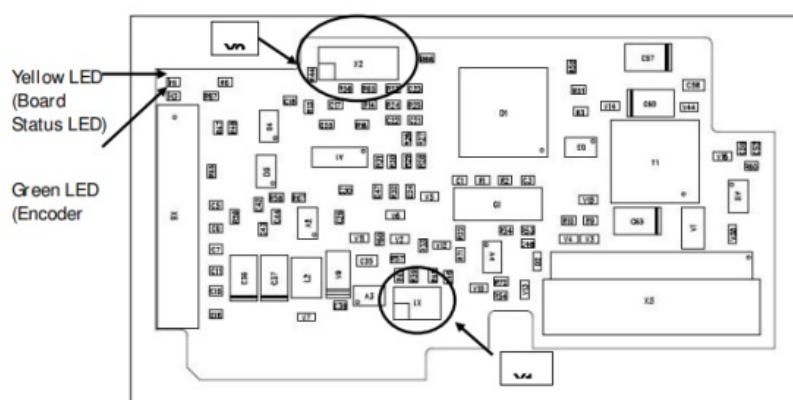
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ENDAT/ SSI , SIN- COS OPTION BOARD OPTBE

OPTBE layout and description



Description: Encoder board for **VACON® NXP** with an input for *EnDat/SSI* absolute encoder and *Sin/Cos* 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: X1 and X2 (see page [5](#))

Board parameters: Yes (see page [7](#))

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 AC drive in motor control and position control applications.

Sin/ Cos encoder produces a pair of analog sinusoidal signals. There are several sine cycles (for example 1024 or 2048) per mechanical revolution.

Encoder cable	Heidenhain cable Max. length 100m It is recommended to use a cable which contains individual shield f or each twisted pair.
Encoder voltage	5V, 12V or 15V Max. current consumption 300mA
Measuring steps/ revolution	4.2 billion (max. 32bit)
Distinguishable revolutions	0 65535 (max. 16bit)
Sin/Cos signal periods/revolution	1 65535
EnDat and SSI data transfer rate	200 kHz

EnDat is a bidirectional synchronous serial interface for encoders. For example, the absolute 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 (Synchronous Serial Interface) 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>.

OPTBE j u m p e r s

NOTE! It is recommended to use a 12 V or 15 V supply voltage instead of 5 V. OPTBE interface does not support “sense” function to compensate voltage drop with a long cabling. Therefore with 5 V supply voltage the cable length limit is about 60 meters with 0.5 mm² wire section. With 5 V supply voltage it is recommended to use two or more wires in parallel for the supply connection. Jumper X1 selects encoder supply voltage on the OPTBE board, see jumper settings below:

		
5V (Default)	12V	15V

Jumper X2 selects Sin/Cos signals connection on the OPTBE board, see jumper settings below:

	
Sin/Cos signals connected Note! This setting can only be used in slot C.	Sin/Cos signals not connected (Default) Note! This setting must be used in slots B, D and E.

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

OPTBE LEDs

There are two LEDs on the OPTBE board:

- Yellow LED (Board Status LED)
Slow blinking –> Board state is ready Fast blinking –> Board state is faulted
- Green LED (Encoder LED)

ON –> Encoder serial communication is OK OFF –> No serial connection to encoder

1.2 I / O terminals on OPTBE, encoder terminals X6

Terminal		Heidenhain colour code	Technical data
1	DATA+	Grey	Data line 120W/RS-485
2	DATA	Pink	
3	CLOCK+	Violet	Clock line 120W/RS- 485 (200kHz)
4	CLOCK	Yellow	
5	A+, COS+	Green/black	1Vpp ($\pm 0.5V$); impedance 120W; Max. input 350 kHz
6	A, COS-	Yellow/black	
7	B+, SIN+	Blue/black	1Vpp ($\pm 0.5V$); impedance 120W; Max. input 350 kHz
8	B, SIN-	Red/black	
9	GND	White/green	Input ground
10	Encoder voltage	Brown/green	Selectable encoder voltages: 5V, 12V and 15V Max. current consumption 300mA

Analog Sin/Cos signals deserve some more precautions for noise immunity than pulse encoders. It is recommended to use a cable which contains individual shield for each twisted pair. Use one pair for SIN+/SIN- signals, another pair for COS+/COS- signals, another pair for DATA+/DATA- signals and another pair for CLOCK+/CLOCK- signals.

1.3 OPTBE Parameters

Notes for selecting Operating Mode:

In modes “EnDat + Sin/Cos” and “SSI+Sin/Cos” Sin/Cos signals and absolute serial information are used:

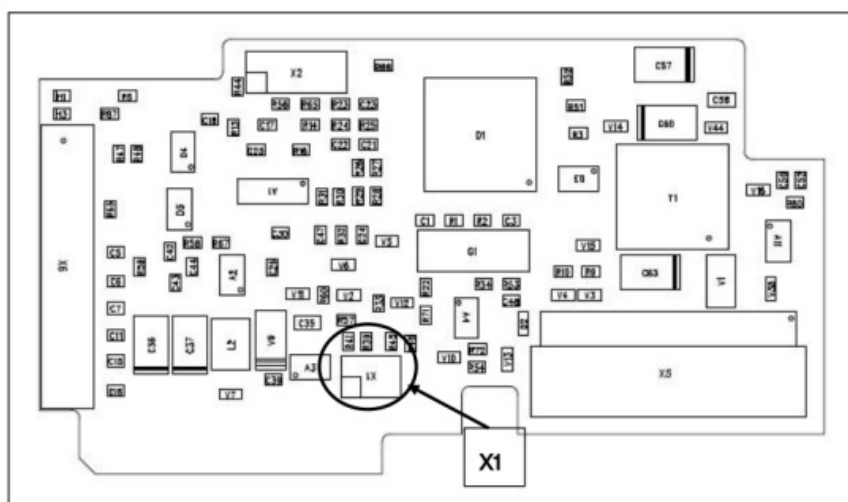
- Modes can be used in VACON@NXP option board slot
- Closed loop motor control mode can be
- Jumper X2 is installed into OPTBE board because Sin/Cos signals are In modes “Endat Only” and “SSI Only”, only the absolute serial information is used:
- Modes can be used in VACON@NXP option board slots C, D and
- Closed loop motor control mode cannot be Usage of closed loop in these modes causes Fault 43 (Encoder fault) with Subcode 10.
- Jumper X2 is removed from OPTBE board because Sin/Cos signals are not

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+Sin/Cos 7 = SSI Only 8 = Sin/Cos Only
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	

1.4 OPTBE monitored values

Code	Monitor ed value	Unit	Descr iption
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 multiturn encoders this monitored value counts the revolutions. 0- 65535
7.x.2.5	Absolute position Hi wo rd		absolute position up from 16 bits to 32bits
7.x.2.6	Absolute position Lo wo rd		absolute position up to 16 bits

SI N- COS OPTI ON BOARD OPTAK OPTAK l a y o u t a n d d e s c r i p t i o n



Description: Encoder board for **VACON® NXP** with an input for *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: X1 (see page [10](#))

Board parameters: Yes (see page 11)

Sin/Cos encoder produces a pair of analog sinusoidal signals. There are several sine cycles (for example 1024 or 2048) per mechanical revolution.

OPTAK jumper settings

NOTE! It is recommended to use a 12 V or 15 V supply voltage instead of 5 V. OPTAK interface does not support “sense” function to compensate voltage drop with a long cabling. Therefore with 5 V supply voltage the cable length limit is about 60 meters with 0.5 mm2 wire section. With 5 V supply voltage it is recommended to use two or more wires in parallel for the supply connection. Jumper X1 selects encoder supply voltage on the OPTAK board, see jumper settings below:

		
5V (Default)	12V	15V

NOTE! Be careful with the jumper setting, wrong voltage may damage the encoder.

2.3 I/O terminals on OPTAK, encoder terminals X6

Terminal		Technical data	
1	N.C.	Not Connected	
2	N.C.		
3	R+	Max 10Vpp ($\pm 5V$), Min 1Vpp ($\pm 0.5V$). Typically signal is ~2.5Vpp ($\pm 1.25V$): at reference	
		mark moment positive signal, other time negative signal.	
4	R-	Impedance 120 Ω	
		Max input 350 kHz	
		Reference mark signal	
5	SIN+	1Vpp ($\pm 0.5V$); impedance 120 Ω ; Max. input 350 kHz,	
6	SIN-		
7	COS+	1Vpp ($\pm 0.5V$); impedance 120 Ω ; Max. input 350 kHz	
8	COS-		
9	GND	Input ground	
10	Encoder voltage	Selectable encoder voltages: 5V, 12V and 15V Max. current consumption 300mA	

NOTE! Analog Sin/Cos signals deserve some more precautions for noise immunity than pulse encoders. It is recommended to use a cable which contains individual shield for each twisted pair. Use one pair for SIN+/SIN- signals, another pair for COS+/COS- signals and another pair for R+/R- signals.

2 . 4 OPTAK p a r a met er s

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 OPTAK 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

INSTALLATION

3.1 Installing option boards

Option boards OPTBE, OPTAK and OPTAR can only be used with **VACON® NXP** drives.

OPTAK and OPTAR can be connected to **slot C**. OPTBE board can be connected to **slots C, D or E**, but Sin/Cos signals can only be used in slot C. If OPTBE board is connected to slots D or E, 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 AC drive 
B	Remove the cable cover. 
C	Open the cover of the control unit. 
D	Install the option board in correct slot on the control board of the AC drive. 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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