Optidrive Applications Support Library

Application Note	**AN-ODL-2-081**
Title	**Optidrive P2 Elevator Absolute Encoder Support for PM Motors**
Related Products	**Optidrive P2 Elevator - All Models**
Level **3**	1 – Fundamental - No previous experience necessary 2 – Basic – Some Basic drives knowledge recommended 3 – Advanced – Some Basic drives knowledge required 4 – Expert – Good experience in topic of subject matter recommended

Contents

Overview

As the Elevator industry trend moves towards gearless (Permanent Magnet) motors then so does the requirement for Absolute Encoders, for closed loop operation of Permanent magnet motors the drive requires absolute position information of the rotor, this is where the role of the Absolute encoder comes in.

Which Absolute Encoders are supported?

The Optidrive P2 Elevator currently supports the following Absolute Encoders:

- Heidenhain Endat Absolute Encoders.
  - ECN 1313, ECN 113, ECN 413 (EnDat 2.2/01)
  - ECN 1325, ECN 125, ECN 425 (EnDat 2.2/22)
- Heidenhain SinCos Absolute Encoders.
  - ERN 1387

Connecting the Encoder to the drive

To connect the encoder to the drive a plug-in encoder module is required; an image of the module is shown below:

There are two different plug-in modules to support absolute encoders:

1. Endat Encoder module - **OPT-2-ENDAT-IN**
2. SinCos Encoder module – **OPT-2-SINCOS-IN**

The table below shows the necessary wiring connections for each of the supported Encoders:

Endat Encoders

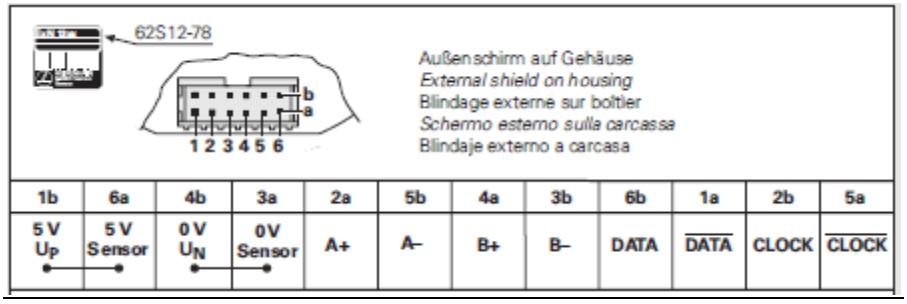
Encoder Module terminal		ECN1313 (as per datasheet)	ECN 113 (as per datasheet)	ECN 413 (as per datasheet)	ECN 1325 (as per datasheet)	ECN 125 (as per datasheet)	ECN 425 (as per datasheet)
1	5V	5V Up	5V Up	Up	Up	Up	Up
2	0V	OV un	OV un	OV	OV	OV	OV
3	DATA	DATA	DATA	DATA	DATA	DATA	DATA
4	DATA/	$\overline{\text{DATA}}$	$\overline{\text{DATA}}$	$\overline{\text{DATA}}$	$\overline{\text{DATA}}$	$\overline{\text{DATA}}$	$\overline{\text{DATA}}$
5	CLK	CLOCK	CLOCK	CLOCK	CLOCK	CLOCK	CLOCK
6	CLK/	$\overline{\text{CLOCK}}$	$\overline{\text{CLOCK}}$	$\overline{\text{CLOCK}}$	$\overline{\text{CLOCK}}$	$\overline{\text{CLOCK}}$	$\overline{\text{CLOCK}}$
7	*A+	A+	A+	A+	N/A	N/A	N/A
8	*A-	A-	A-	A-	N/A	N/A	N/A
9	*B+	B+	B+	B+	N/A	N/A	N/A
10	*B-	B-	B-	B-	N/A	N/A	N/A

*Connections only required if simulated encoder output is required from terminals 12 thru to 16 of the encoder module.

SinCos Encoders

Encoder Module terminal		ERN1387 (as per datasheet)
1	5V	Up
2	0V	OV
3	C+	C+
4	C-	C-
5	D+	D+
6	D-	D-
7	A+	A+
8	A-	A-
9	B+	B+
10	B-	B-

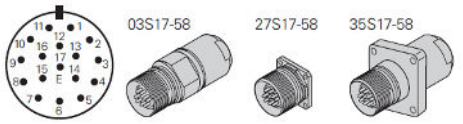
ECN 1313 Manual extract



1b	6a	4b	3a	2a	5b	4a	3b	6b	1a	2b	5a
5 V U_P	5 V Sensor	0 V U_N	0V Sensor	A+	A–	B+	B–	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$

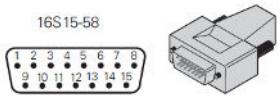
ECN 113 Manual extract

ECN 113 EnDat01



Außenschirm auf Gehäuse
External shield on housing
Blindage externe sur boîtier
Schermo esterno sulla carcassa
Blindaje externo a carcasa

7	1	10	4	15	16	12	13	14	17	8	9	11
5 V U_P	5 V sensor	0 V U_N	0 V sensor	A+	A–	B+	B–	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$	1)
br/gn *BN/GN*	bl *BL*	ws/gn *WH/GN*	ws *WH*	gn/sw *GN/BK*	ge/sw *YL/BK*	bl/sw *BL/BK*	rt/sw *RD/BK*	gr *GY*	rs *PK*	vio *VI*	ge *YL*	



Außenschirm auf Gehäuse
External shield on housing
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4	12	2	10	1	9	3	11	5	13	8	15	6
5 V U_P	5 V sensor	0 V U_N	0 V sensor	A+	A–	B+	B–	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$	1)
br/gn *BN/GN*	bl *BL*	ws/gn *WH/GN*	ws *WH*	gn/sw *GN/BK*	ge/sw *YL/BK*	bl/sw *BL/BK*	rt/sw *RD/BK*	gr *GY*	rs *PK*	vio *VI*	ge *YL*	

ECN 413 Manual extract

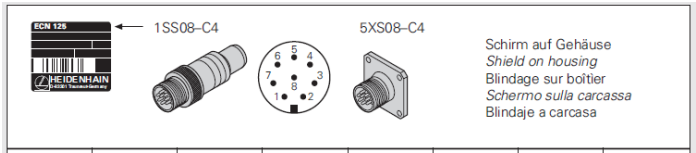
	Power supply					Incremental signals				Absolute position values			
	U_P	**Sensor U_P**	**0 V**	**Sensor 0 V**	**Inside shield**	**A+**	**A–**	**B+**	**B–**	**DATA**	**$\overline{\text{DATA}}$**	**CLOCK**	**$\overline{\text{CLOCK}}$**
	Brown/ Green	Blue	White/ Green	White	/	Green/ Black	Yellow/ Black	Blue/ Black	Red/ Black	Gray	Pink	Violet	Yellow

ECN 1325 Manual extract

8-pin M12 coupling

	Power supply				Absolute position values			
	2	8	1	5	3	4	7	6
	U_P [1)]	U_P	0 V [1)]	0 V	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$
	Blue	Brown/Green	White	White/Green	Gray	Pink	Violet	Yellow

ECN 125 Manual extract

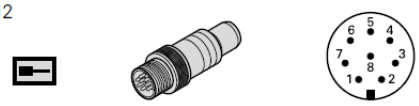


2	8	1	5	3	4	7	6
U_P 1)	U_P	0V 1)	0 V	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$
bl *BL*	br/gn *BN/GN*	ws *WH*	ws/gn *WH/GN*	gr *GY*	rs *PK*	vio *VI*	ge *YL*

ECN 425 Manual extract

ECN 425 pin layout

8-pin coupling, M12



	Voltage supply				Absolute position values			
	8	2	5	1	3	4	7	6
	U_P	**Sensor** Up	**0 V**	**Sensor** 0 V	**DATA**	$\overline{\text{DATA}}$	**CLOCK**	$\overline{\text{CLOCK}}$
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

ERN 1387 Manual extract

ERN 1387 pin layout

17-pin coupling or flange socket M23

14-pin PCB connector

	Voltage supply					Incremental signals					
	7	1	10	4	11	15	16	12	13	3	2
	1b	7a	5b	3a	/	6b	2a	3b	5a	4b	4a
	U_P	**Sensor** U_P	**0 V**	**Sensor** 0 V	**Internal shield**	**A+**	**A–**	**B+**	**B–**	**R+**	**R–**
	Brown/ Green	Blue	White/ Green	White	/	Green/ Black	Yellow/ Black	Blue/ Black	Red/ Black	Red	Black

	Other signals					
	14	17	9	8	5	6
	7b	1a	2b	6a	/	/
	C+	**C–**	**D+**	**D–**	**T+** 1)	**T–** 1)
	Gray	Pink	Yellow	Violet	Green	Brown

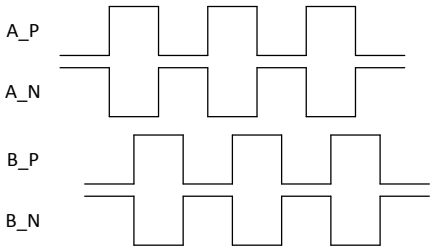
Simulated Encoder Output

Simulated encoder output signals (as often required by the lift controller) are available providing the encoder has Incremental signals available (e.g. ECN 113 as shown above).

- The simulated encoder output signals are from terminals 12 thru to 16, example output signals are shown below :

Encoder Module terminal	
12	0V
13	A_P
14	A_N
15	B_P
16	B_N
17	Shield/Screen

Complementary Encoder Output Signals



*Outputs shown with respect to 0V.

- The simulated encoder output resolution is as per the resolution of the Incremental signals of the connected encoder.

Encoder Offset Angle.

For correct operation of PM motors in closed loop, the angular difference between the zero point of the encoder and electrical zero point of the motor winding must be obtained.

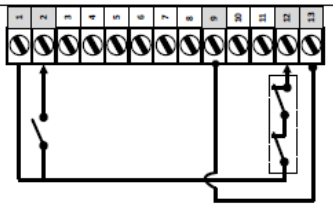
In some cases motor manufacturers mount the encoder to a set angle (e.g. 0 deg's) and provide the angle on the motor datasheet, however more often than not the Encoder offset angle is not available, in this case the drive can be used to measure the angle as set out in the user manual extract below :

10.14.2. Manual Encoder offset value Method.

In applications where an absolute encoder (Endat for example) is being used it is vitally important that the correct value of "Encoder offset (Entered in degrees)" is entered into parameter P6-09, failure to do so can result in abnormal motor operation (motor vibration, motor over-current trips), ideally the value provided by the motor manufacturer should be entered.

The below procedure is a method for measuring the Encoder offset value in instances where the value is not available.

Note : The below procedure should be carried out with the ropes and motor brake off.

Step		Action	Notes
1	Motor Nameplate data entry	Set P1-14 to 201	Opens Advanced parameter group access.
		Set P4-01 to 2	Motor control mode enhanced V/F
		Enter Motor Rated Voltage into P1-07	Obtained from Motor nameplate or datasheet or alternatively it can be calculated as per section 10.14.1
		Enter Motor Rated Current into P1-08	Obtained from Motor nameplate (Amps)
		Enter Motor Frequency into P1-09	Obtained from Motor nameplate (Hz)
		Enter Motor Speed into P1-10	Obtained from Motor nameplate (rpm).
2	Encoder data entry	Set P6-05 to 1	Enables Encoder Feedback
		Enter 65535 Value into P6-06	Absolute Encoder Identifier
		Enter Speed error trip level in P6-07 (default=5%)	Defines the maximum allowed speed error % between the encoder feedback of motor speed and the expected speed of the motor. If the error exceeds this level, the drive will trip "Enc-02"
3	Close Safe Torque off inputs (T12/T13)		Drive should show "StoP" when the STO inputs are closed.
4	Start Drive (T1 to T2)		Motor Shaft will move slightly whilst the encoder offset measurement is being carried out.
5	Record the Encoder offset value	The Encoder offset value is shown in P0-78 index 2 in the range 0-360 degrees (Index 2 indicated by lit upper segment)	 e.g. 55 degrees
6	Disable the drive		Drive should show "StoP"
7	Proceed to section 10.13 "Permanent Magnet Motors-With Encoder Feedback" and use the value obtained above for parameter P6-09.		

Start up and Commissioning www.InvertekDrives.com

It is important to record the value of Encoder offset angle so that in the instance of the drive needing to be replaced the value can be directly entered into the Encoder offset parameter (**P**6-09).

Encoder Offset Angle Check.

The offset angle can be checked by running the motor at levelling speed (5.0Hz for example) on no load, and checking that the real-time motor current value as shown on the display is close to Zero Amps.

Note: incorrect values in Encoder offset angle can result in reduced torque and/or vibrational operation.

Appendix:

Revision History			
Version	Comments	Author	Date
1.00	First Release	JW	15/5/2014