# **Quick Start Guide.**

K4 drive system development kit.

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### Attention

The K4 motor controller is designed to meet the requirements of ES1 (SELV) according to EN62368-1:2014. It is for use only as part of the development kit and not suitable to be incorporated into finished product. Only ebm-papst K4 development motors should be used with this controller.

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## What's in the box

1x Motor or Motor/gearbox selection (prewired)



1x K4 Motor Controller

1x RS485 USB Cable

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1x RS485 Comms Wiring Cable



1x RS485 Driver CD



1x Black Power Cable



1x RS485 Adapter



1x Red Power Cable



1x Yellow Power Cable

## Wiring Diagrams

### Wiring diagram 1: 24V DC Motor

or

48V DC Motor





### Wiring diagram 2: RS485 to PC/Laptop



### Out of the Box Standard operation

The motor is factory set to Velocity Mode, this gives variable **or** a choice of fixed speeds in both clockwise and counter clockwise direction.

- 1. Connect the motor to the **K4 Motor Controller**.
- Connect Power supply using Power Cables (Red, Black and Yellow) as shown in wiring diagram 1 depending on 24V DC or 48V DC Motor.

#### Note: – Ensure correct voltage is selected Note: - Isolated power supply (24v and/or 48v) with minimum 10A rated should be used

3. Select inputs on **K4 Controller** as shown below to run the motor functions.

INA	INB	IN1	IN2	AIN1	Function	
0	0	0	0	х	Free Wheeling	
1	0	0	0	Variable	Variable CW Direction	
0	1	0	0	Variable	Variable CCW Direction	
1	0	1	0	х	Fixed Speed 1 CW Direction (Factory Default 1000rpm)	
1	0	0	1	х	Fixed Speed 2 CW Direction (Factory Default 4000rpm)	
1	0	1	1	х	Fixed Speed 3 CW Direction (Factory Default 10,000rpm*)	
0	1	1	0	х	Fixed Speed 1 CCW Direction (Factory Default 1000rpm)	
0	1	0	1	х	Fixed Speed 2 CCW Direction (Factory Default 4000rpm)	
0	1	1	1	х	Fixed Speed 3 CCW Direction (Factory Default 10,000rpm*)	
1	1	х	х	х	Electronic Brake Activated	

\*This speed may be beyond maximum capability of the motor

The Factory Default outputs are as follows:

OUT 1	Motor Ready
OUT 2	Speed Signal
OUT 3	Speed Signal

## driveSTUDIO Connection

#### 1. Install and open driveSTUDIO Software on PC/Laptop.

(https://www.ebmpapst.com/en/info-center/downloads/downloads.html#listsoftware)

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- 2. Install the supplied **RS485 driver software** onto PC/Laptop following the manufacturer's instructions.
- 3. **Connect RS485 Adapter** to PC/Laptop and the K4 Motor Controller–see **wiring diagram 2**.
- 4. Connect **the motor** to the **K4 Motor Controller**.
- Connect to Power supply using Power Cables as shown in Wiring diagram 1 - 24VDC or 48VDC.

Note: – Ensure correct voltage is selected Note: - Isolated power supply (24v and/or 48v) with minimum 10A rated should be used

6. Click the **Connect** Icon to begin communication with the motor.



## Demo Mode

This is a basic introduction to **driveSTUDIO**.

#### Service Interface

This enables the user to run the motor with basic functionality via the driveSTUDIO software.

Digital Inputs	Service In	terface		
Velocity mode	<< Left	Right >>		
Position mode		<<-Relative+>>	Position	100000 [counts]
		,	Motor shaft - 1	rev. = 65535[counts]

#### Velocity Mode

- 1. Ensure the Motor is enabled by setting either INA or INB to High (1) on the K4 Motor Controller.
- 2. Click and hold the Left or Right Icon to run the Motor Clockwise or Counter Clockwise.

#### **Position Mode**

- 1. Ensure the Motor is enabled by setting either INA or INB to high (1) on the **K4 Motor Controller**.
- Enter required rotation, 1 revolution of the motor output shaft = 65535 counts.

#### Note: - Any gearbox ratio is not accounted for in this calculation

- 3. Enter postion figure (+ figure clockwise shaft rotation, figure anticlockwise shaft rotation).
- 4. Click <<-Relative+>> to activate motor.

## Note: - The direction of rotation from the output of the motor shaft. The direction may be altered if a gearbox is fitted.

#### **Digital Inputs**

This enables the user to change the parameters and run the motor via its Digital inputs (i.e. **K4 Motor Controller**) while monitoring and if required recording the actual motor values i.e. out of the box mode.

<ul> <li>Digital Inputs</li> </ul>	Service Int	terface		
Velocity mode	<< Left	Right >>		
Position mode		< <- Relative + > >	Position	100000 [counts]
		1	Motor shaft - 1	rev. = 65535[counts]

### Parameters

This enables the user to begin changing the motor parameters to customise the operation and functionality.

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293 Table 000	West Controller	_	
Temperature (* 1910) Annung specification (* 1946) Annung specific			

- **Read** Read the existing motor settings
- **Write** Write any updated settings to the motor's temporary memory (these settings will be lost if power is removed from the motor)
- **Save** Save settings to the motor memory (these settings will remain if the power is removed from the motor)

#### To read, write or save all digital inputs to the motor must be set to low (0)

#### **Basic Settings**

This enables the user to set the basic motor parameters including the required functionality and thresholds of the motor outputs.

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#### Position Mode, Velocity Mode & Current Mode

These are pre-set modes enabling the user to quick set required parameters for specific drive sets and applications.

#### Parameters

This enables the user to modify all available parameters to fully customise the motor solution.

## Service

This enables the user to factory reset the motor and update Firmware.

## Examples

#### Velocity Mode – Driving Set 11

Driving set 11 is the factory default mode but a number of parameters can be further optimised.

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- 1. Click Parameters and then Velocity Mode.
- 2. Click Read.
- 3. Click Driving Set Drop down menu and select option **2. In1: Fixed Speed or dyn. Speed / IN 2: Direction change.**

#### To change default motor fixed speeds

- 1. Set Fixed Speed N1, N2, N3 to required rpm value example
- 2. Write to motor.

Fixed Speed N1	100	[rpm]
Fixed Speed N2	500	[rpm]
Fixed Speed N3	1000	[rpm]
cut-off frequency	25	[Hz]
cut-off frequency	15000	[Hz]

#### To change motor Acceleration/Deceleration rate

- 1. Set Acceleration/Deceleration clockwise/counter clockwise to required ms/1000rpm value.
- 2. Write to motor.



To change analogue input speed range (fixed speed settings will remain as per set values)

- 1. Set Advanced parameter Speed characteristic \_Y2 to required rpm.
- 2. Write to motor.

Speed characteristic_X1	0	
Speed characteristic_X2	1023	
Speed characteristic_X3	1023	
Speed characteristic_Y0	0	[rpm]
Speed characteristic_Y1	0	[rpm]
Speed characteristic_Y2	1000	[rpm]
Speed characteristic_Y3	4000	[rpm]
Speed characteristic_Y4	4000	[rpm]

Click save to store settings to the motor – Operation is as per function table at the start of this guide.

Positional Mode – Driving Set 36

- 1. Click Parameters and Position Mode.
- 2. Click Read.
- 3. Click Driving set drop down menu and select option **3 In 1: Travel** distance / In **2: Direction change.**

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....steps continued overleaf.

#### .....continued

- 4. Set required distance 1 revolution of the motor output shaft = 65535 counts (excluding gearbox ratio).
- 5. Set maximum position speed to required rpm.
- 6. Set Acceleration/Deceleration Clockwise/Counter clockwise to required ms/1000rpm.
- 7. Set Position Controller KP\_H to > 0.
- 8. Write to motor.

Basic settings Position mode V	elocity mode	Current Mode	Parameters		
Save	Read	Write			
Driving set 3. IN 1: Travel distance	e / IN 2: Dire	ction change	×		
Standard parameters					
Distance	1000000	[counts]	Speed controller	KP 128	11
Max.Positioning speed	2000	[rpm]	Speed controller	KI 16	
Acceleration clockwise	250	[ms/1000rpm]	Position controller K	(H 0	
Deceleration clockwise	250	[ms/1000rpm]	Position controller KP	H 1	
Acceleration counter clockwise	250	[ms/1000rpm]	Fixed Speed	N2 4000	[npm]
Deceleration counter clockwise	250	[ms/1000rpm]	PWM: lower cut-off frequen	ky 25	[Hz]
			PWM: upper cut-off frequer	ky 15000	[Hz]
<ul> <li>Advanced parameters</li> </ul>					
Speed characteristic_X1	0		Overrun clockw	ise 0	[counts]
Speed characteristic X2	1023		Overrun counter clockw	ise 0	[counts]

9. Select inputs as shown below to run the motor.

INA	INB	IN1	IN2	AIN1	Function
0	0	0	0	*	Free Wheeling
1	0	0	0	Variable	Continuous operation variable speed CW Direction
0	1	0	0	Variable	Continuous operation variable speed CCW Direction
1	1	1	0	Variable	Set distance variable speed CW direction
1	1	1	1	Variable	Set distance variable speed CCW direction



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