Technical Manual WD42

For the following variants:

Wheel size 07530, 10030, 12530, 14030

Version: 1.1.0

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1 Document, audience, intended use

Nanotec's *WD42* and this document address to technically trained experts alone, such as developers, application / plant engineers, fitters, and service staff. Only experts may install, commission and run the product. Always required is the qualification for the product's assembly, commissioning and maintenance as part of an *overall* machine / system, as well as:

- Training and experience in working with motors, their control and electrostatically threatened components
- Reading and understanding of this and all applicable documents
- Observing all valid regulations

Place this PDF in valid version always to hand and accessible. Use *WD42* as intended only, within licit technical limits and ambients. For product combinations, please contact Nanotec Sales.

Disclaimer

Product modification / alteration is illicit. Nanotec is not liable for damage / malfunction from installation error, failure to observe this document, or undue repair; nor for product integration in the end system or interaction (= third-party ware). The audience alone is liable for selecting / running / using our products. Our risk analysis for partly completed machinery (if applicable) only rated the hazards of duly installed and networked *single* products. Risks in the *overall* system are exempt and to be rated by the *audience.* The general terms & conditions at *www.nanotec.com* apply (*us.nanotec.com* for clients of Nanotec USA).

2 For your safety

Before product use, please ensure that all users read, understand and follow the instructions in this document fully. Its hazard warnings, alert symbols and signal words mark specific risk levels.

CAUTION!

CAUTION warns of possible injury!

►Describes how you can avoid the dangerous situation.

NOTICE

A NOTICE warns of property / ambiental damage.

►Describes how you can avoid the incorrect operation.

Note: A mere note in the flow text explains or simplifies a single step.

2.1 General safety notes

Protect lives and equipment. Observe these **general** warning messages for **all** our products.

CAUTION!

Electric shock, injury, damage, warranty loss: from opening the product!

►Have only authorized Nanotec partners open the product.

NOTICE

Damage: from thermal overload!

► Observe the allowed ambient temperature; avert heat build-up.

► Keep the product far enough from other parts and duly ventilate / cool it.

► For heat-relevant application: Test the product long enough in real condition.

2.2 Specific safety notes

For due protection, observe the **specific** warning messages that cover **this** specific product.

CAUTION!

Electric arc, jolt, electronic damage: from generative induced voltage!

► Operate the product only as motor (never as generator!).

CAUTION!

Bruise, draw-in, crush: from moving / rotating parts!

► Stay out of range; consider installing a barrier.

CAUTION!

Bruise, crush: from rolling down!

► Secure the product on slopes!

CAUTION!

Scorch: from overload!

► Observe allowed motor limits, voltages and current peaks.

► Avert motor overheating in operation.

► Only touch unpowered, stilled, cooled-off parts.

NOTICE

Damage: from worn / damaged tires (changeable only in diameters ≥ 100 mm)!

► Change the tires if needed.

3 Before you start

Before first use, **do** integrate the product true to standard, by the specified fixing points, interfaces, tools and aids. Avert added hazards, such as abrupt motor travel on defect / inhibition in the **overall** construct, or heat build-up from poor sink.

Check upon receipt

- Packaging / product free of damage?
- Wheel freely rotatable?

Ensure before commissioning

- Product correctly mounted / oriented without jamming?
- Connector correct (see data sheet)? Wiring verified?

Check upon receipt

Ensure before commissioning

- Control correctly parametrized?
- Floor dry and oil-free?

4 Product and installation data

The *WD42* motorized wheel is partly completed machinery as per Directive *2006/42/EG*. Commissioning is illicit until the machine where you install *WD42* fulfills said rulings. *WD42* contains:

- A combination of motor, gearbox and encoder
- A wheel Ø 75 to 140 mm (≥ 100 mm changeable)

Artikel numbers for WD42 variants read like this:

WD**XXX**30-42xx-50-xx	Wheel Ø (mm) **075** | **100** | **125** | **140**
WDxxx**30**-42xx-50-xx	Wheel width (mm)
WDxxx30-**42**xx-50-xx	Gearbox size (mm)
WDxxx30-42**XX**-50-xx	Gear reduction **12:** 11.76 | **15:** 15.45 | **21:** 20.64 | **26:** 25.62
WDxxx30-42xx-**50**-xx	Motor size (mm)
WDxxx30-42xx-50-**XX**	Encoder **E3:** incremental | **E4:** SSI absolute

Ambient conditions

Protection class (= black anodized parts only)	IP54
Air humidity (non-condensing)	≤ 85 %
Ambient temperature (storage) °C (°F)	-10 to +45 °C (14 to +113 °F)
Ambient temperature (operation) °C (°F)	-15 to +40 °C (5 to +104 °F)

Layout (example wheel 75 and 100 mm)

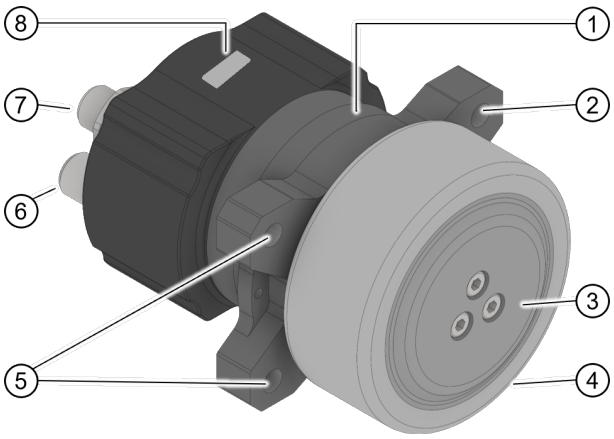


Fig. 1: WD42 with 75-mm no-change tire. Well visible: three of four mounting points (2, 5).

1. Motor
2. Fixing point
3. Planetary gear in rim barrel
4. 75-mm tire (= **not** changeable)
5. Fixing point
6. 4-pin motor connector *M12* (L-coded)
7. Depending on version: 8- or 12-pin encoder connector *M12* (A-coded)
8. Type label, integrated encoder

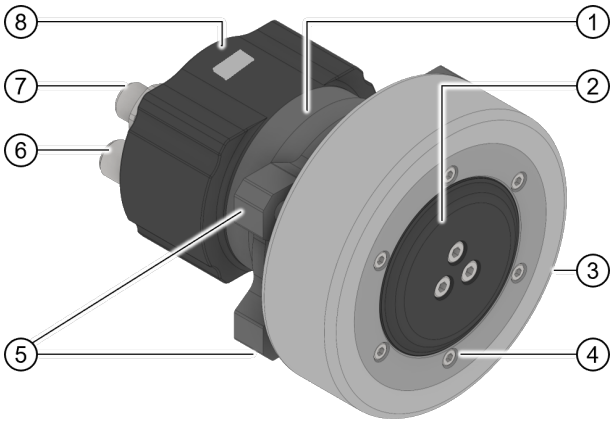


Fig. 2: WD42 with 100-mm wheel. The changeable tire (3) partly covers the mounting points (5); the wheel rim (4) acts as a flange to change the wheel.

1. Motor
2. Planetary gear in rim barrel
3. Tire size ≥ Ø 100 mm (= **changeable**)
4. Wheel flange (= only if changeable tire), removable by six Allen screws (M3)
5. Fixing point
6. 4-pin motor connector *M12* (L-coded)
7. Depending on version: 8- or 12-pin encoder connector *M12* (A-coded)
8. Type label, integrated encoder

Wheel and tire

All WD42 wheels have 30-mm-wide Vulkollan tires of a *92 Shore A* hardness and a 200 kg load capacity. On dry smooth concrete, the friction value µ exceeds 0.25. **NOTICE: Slippage and wear on smooth steel. ► Use wheel size, reduction ratio and torque to calculate the correct traction.**

Gear reduction	11.76 (= **12**)	15.45 (= **15**)	20.64 (= **21**)	25.62 (= **26**)
Rated speed m/s (100-mm wheel)	1.6	1.2	0.9	0.7
Output torque (Rated / max.) Nm	4.88 / 14.64	6.41 / 19.23	8.56 / 25.68	10.63 / 26.28

Motor

Rated voltage	48 VDC
Rated current	5.9 A
Peak current (for max. 5 s)	17.7 A (14.6 for gear ratio 26)
Rated speed at 48 V	35000 rpm

Encoder

The WD42's encoder gives 4096 cpr (16384 ppr) incrementally and 17 bits via SSI (single-turn).

	SSI (= RS422-compatible)	**Incremental**
Rated voltage	9 to 30 VDC	4,5 to 5,5 VDC
No-load consumption (typ.)	≤ 40 mA @ 12 V	≤ 50 mA @ 5 V
Sensor type	Magnetic	Magnetic
Resolution	17 bit *single-turn*	4096 cpr / 16384 ppr

5 Tooling and assembly

NOTICE

ESD-sensitive module damage: from electrostatics!

►Observe ESD safety regulations.

NOTICE

Electronic damage: from lack of reverse polarity protection!

►Assign pins correctly.

►Use correct connector types.

For product installation, please use the dimensional drawing from our website: Just use *Products > [Product group]* to scroll to the results list, then click on *WD[variant]42 > Dimensions*, select a download format, and use the cloud button to save it. You also need:

- 4 M8x1.25 screws ISO 4762-8.8: thread depth (advised) 12-14 mm
- Torque tool: 20.8 Nm (tightening torque advised for the above-listed thread depth
- Motor cable: with *M12* plug L-coded
- Encoder cable: with *M12* plug A-coded (SSI 8-pin; incremental 12-pin)

Observe the pinouts for motor and encoder

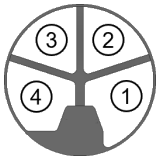


Fig. 3: ***Motor:*** *L-coded M12 male (some pins no function).*

1: U **2:** V **3:** W **4:** n/c

NOTICE

Earlier versions feature a 5-pin motor connector. The 5th pin is not used. The function and position of other 4 pins are the same in all versions.

Fig. 4: ***Incremental encoder:*** *A-coded M12 male.*

1: UB[1]	**5:** B	**9:** H2
2: A\	**6:** I\	**10:** H3
3: A	**7:** I	**11:** Preset
4: B\	**8:** H1	**12:** GND[2]

[1]Voltage supply. [2]Not connected to motor housing.

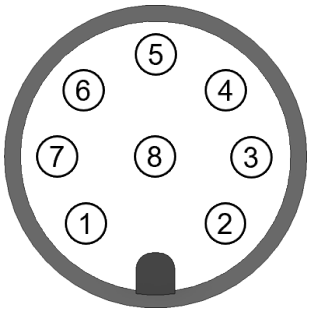


Fig. 5: ***SSI encoder:*** *A-coded M12 male.*

1: Clk+[1]	**4:** Data-	**7:** n/c
2: Clk-[1]	**5:** GND[2]	**8:** UB[3]
3: Data+	**6:** Preset	

[1]120 Ω between Clk+ und Clk- internal. [2]Not connected to motor housing. [3]Voltage supply.

Install and connect

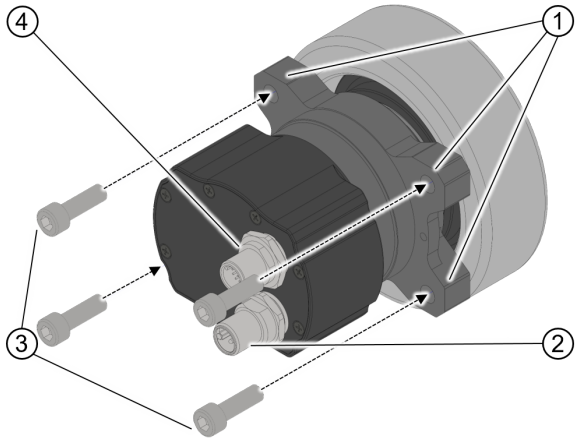


Fig. 6: Three of the four mounting points. (1)

1. Using suitable screws / tightening torques (3): fix the WD42 to your carry work at all four mounting points (1).
2. Connect the control cables for encoder (4) and motor (2).
3. Calculate the correct traction.

Preset function

With the preset function, you can set the internal index or the zero position of the encoder to a new position. The electronics of the encoder then stores this position and in the future then outputs the index signal or the zero position at this position.

CAUTION! Injury from uncontrolled motor movements! ►Before preset: Turn the control off. ►After preset: Restart your controller. ►If needed: Recalibrate the encoder or perform another auto-setup.

1. To set a new index / zero position: Move to the needed point.
2. To start the preset: Apply the encoder's voltage supply to the preset pin (≥ 4 sec).
3. De-energize the encoder.
4. After new switch-on: The encoder sends the index signal at the new zero mark.

Tire change (if allowed)

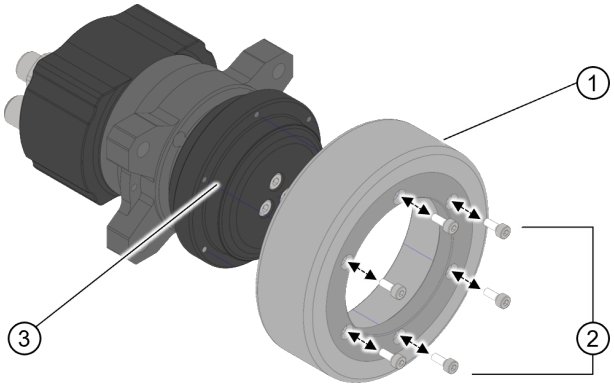


*Fig. 7: Six secured **ISO 4762 M3x10** Allen screws (2) hold the change tire (1) on the wheel rim (3).*

NOTICE: Damage from wrong wheel tightening. ►Apply correct torque. Recommended screw (in case of loss): six M3x10 (ISO 4762-8.8).

1. De-energize the motor (3).
2. Use a 2-mm Allen key to loosen the six fixing screws (2) on the wheel flange.
3. Change and re-tighten the tire (1) with **1.31 Nm** (2) on the wheel rim (3).
4. Secure the screws (2); duly recycle the old tire.

6 Sensor data format

Depending on type, the WD42's encoder sends the motor position either incrementally via two channels **A, B** plus index **I** or, single- / multi-turn as a 23-bit packet, via **s**ynchronous **s**erial **i**nterface (SSI).

Incremental output

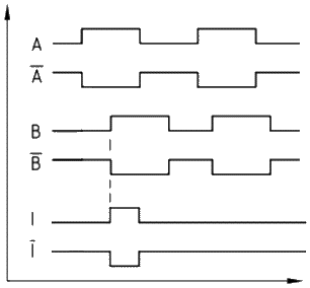


Fig. 8: If the motor shaft rotates clockwise (seen from front), channel A's signal leads channel B by 90° (electrical). The 90°-wide index signal is in sync with channel B's edge.

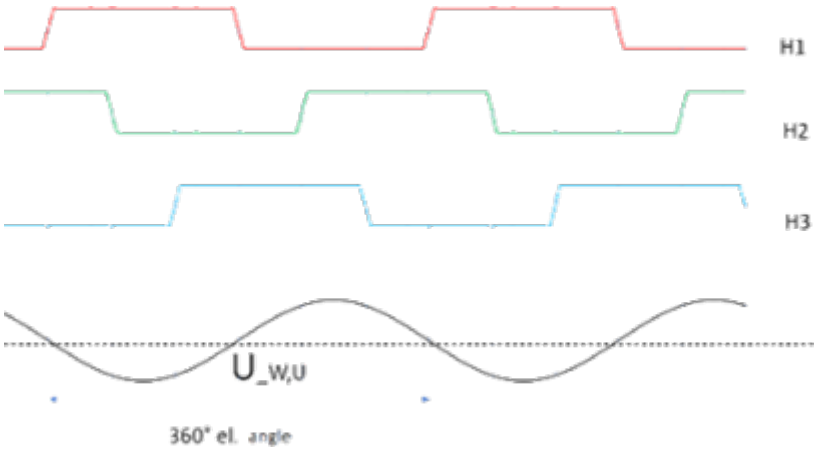


*Fig. 9: For Hall signals, the H1 edges rise **and** fall at the zero crossings of the back EMF voltage $U_{w,\,u}$ (phase voltage W ↔ U).*

The incremental signal levels (20 mA load at 5 V) are:

High	Low
≥ 2.4 V	≤ 0.4 V

The Hall signal levels (4 mA load at 5 V) are:

High	Low
≥ 4 V	≤ 0.5 V

SSI-Output

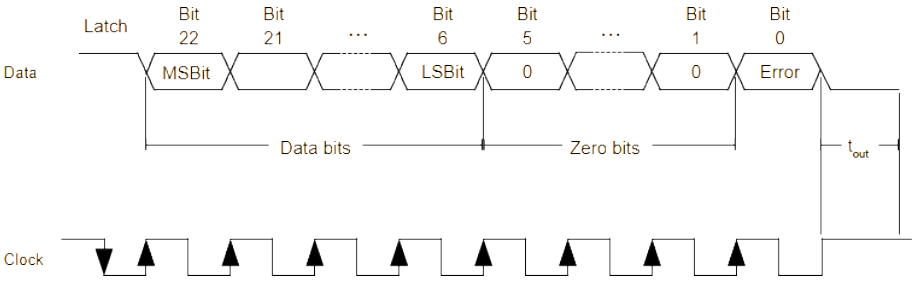


Fig. 10: SSI signal curve, binary-coded from a total of 23 bits.

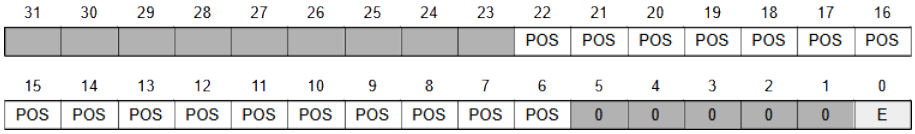
Latch: Data do flow as of the first falling clock signal edge; first bit is 1.

Data bits (position value): The actual position transmits as of the next rising clock signal edge = data transfer (17 bits) with the highest value bit (MSB) first, each bit on the rising clock signal edge.

Zero bits: Five zero bits follow the data bits. **Error bit:** This end bit tells if internal errors occurred (= *0*) or not (= *1*). After a **20-µs timeout** (t_{out}), you can fetch a new data packet by clock signal. Ex works, the absolute encoder zero position is at the zero crossing of the back EMF voltage $U_{w,\,u}$ (phase voltage W ↔ U).

Prepare the SSI for *Nanotec CPB* controllers

Edit the $33B0_h$ **sub-inidices** below so that the *Nanotec CPB* controllers in *Autosetup* (see controller manual) duly process the encoder and its data:



- **Bit 0** (= error): value *1* if no error occurred
- **Bit 1-5**: always value *0*

*Fig. 11: WD42 uses full 23 bits: **E** for error, 17 **POS**ition bits and 5 zero bits.*

Edit the $33B0_h$ **sub-inidices** below so that the *Nanotec CPB* controllers in *Autosetup* (see controller manual) duly process the encoder and its data:

1. Set **$33B0_h$:06_h** to *2625000* (baud rate in Hz).
2. Set **$33B0_h$:05_h** to *23* (number of bits).
3. Set **$33B0_h$:07_h** to *$7FFFC0_h$* (position data: *POS* bits 6 to 22).
4. Set **$33B0_h$:09_h** to *1* (error bit 0).
5. Set **$33B0_h$:$0B_h$** to *1* (error bit needs the value *1*).
6. To store the object: Insert *65766173_h* in **1010_h:06_h**.
7. Restart the controller.

7 Imprint, conformities, versions

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Document	**++ Added │ >> Changed │ ## Fixed**
1.0.0 2023.09	Release
1.0.1 2023.12	withdrawn
1.1.0 2026.09	Motor connector changed.