



Connection Teknomotor to Omron MX2

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ZFU.1P0400.V.OM
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ZFU.1P2200.V.OM
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ZFU.3P4000.V.OM
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Connection of Teknomotor spindle and Omron MX2 frequency inverter



In this manual we explain how to connect your milling spindle to the Omron frequency converter MX2 and how to enter the associated parameters.

The frequency inverter is required to control the desired speed of the milling spindle.

The Omron MX 2 offers the following options for speed preselection:

- Integrated keys
- Analog 0 ... 10 V input signal to the control terminals
- Poti regulation on the control terminals

Procedure

The connection and the setting of the Omron MX2 converter and the milling spindle are done as follows:

- Connection of the braking resistor
- Connection of the frequency inverter with the 230 VAC / 400 VAC network
- Programming the frequency inverter
- Disconnection of mains power for some minutes
- Connection of the milling spindle
- Test run



Attention Danger

It is expressly pointed out that the electrical connection is the responsibility of the electrician!

In particular, the correct connection of the protective conductor of the motor spindle as well as the subsequent protective conductor test must be carried out by **electrotechnically qualified personnel** in accordance with the relevant national regulations!



Attention

The information contained in this description is only a recommendation. The Sorotec GmbH cannot be held responsible for your installation specifications and possible damage.

Connection of the braking resistor

A braking resistor is used to absorb rotational energy in order to reduce the braking time of the spindle. The braking resistor above all is needed when short reaction times are required, such as for an emergency stop or an automatic tool change. If you do not install a braking resistor, the spindle overrun times are very long.

We generally recommend using a braking resistor.



Figure 1: Braking resistor with heat sink

Attach wire end sleeves or cable lugs to the connection wires of the braking resistor and connect them to terminal RB and terminal P / + of the frequency inverter.

The bridge between PD / + 1 and P / + must not be removed!

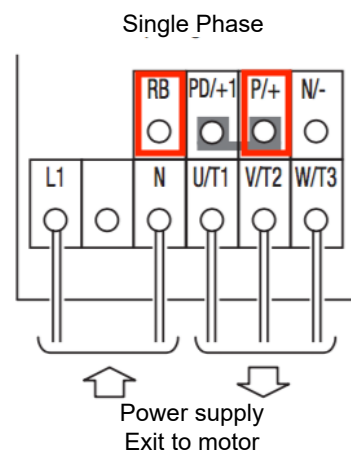


Figure 2:
Connection of the braking resistor to terminal RB and terminal P / + of the frequency converter.

Mains connection of the Frequency converter

Remove the plastic cover on the front of the Omron MX2. On the following pages you will find information on connecting the frequency converter to the 230 VAC or 400 VAC power supply.

However, the connection description in the operating instructions of the device has priority in any case. Be sure to follow the instructions there!

It is important that the 230 VAC / 400 VAC plug used is earthed, that you connect a fuse upstream and that a separate main switch is available.

Power supply

You should always install the frequency converter in a suitable housing. The frequency converter should be connected to a separate power outlet that has no electronic devices plugged into it. A line filter must always be connected upstream of the frequency converter.



Attention

NEVER use the switched 230 VAC socket of your CNC control for the frequency converter! The supply to the frequency converter MUST be taken from a separate connection in your house distribution! See Fig. 3 on the following page.



Attention Danger

Frequency converters contain several powerful capacitors. The device is therefore still live for some time after being disconnected from the mains. Great care must be taken when working on the cabling - you should therefore wait a few minutes after disconnecting from the mains until the capacitors in the frequency converter are completely discharged.

Overview

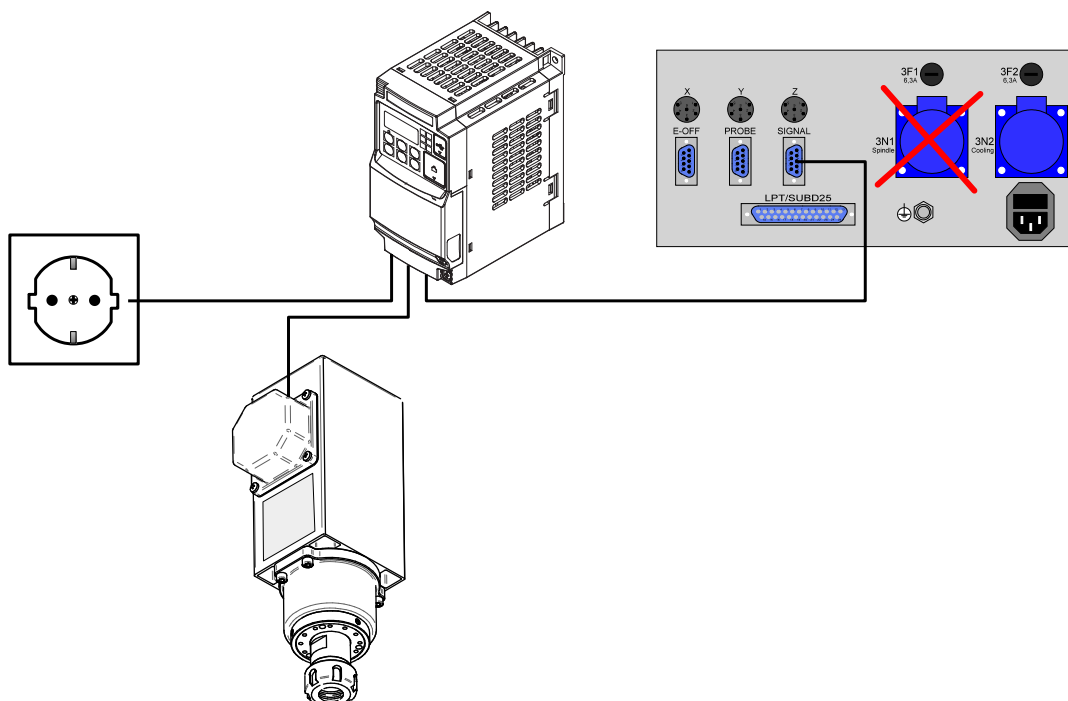


Figure 3: Wiring overview. Do not use the spindle socket of the control to connect the frequency converter!

Connection of single-phase systems

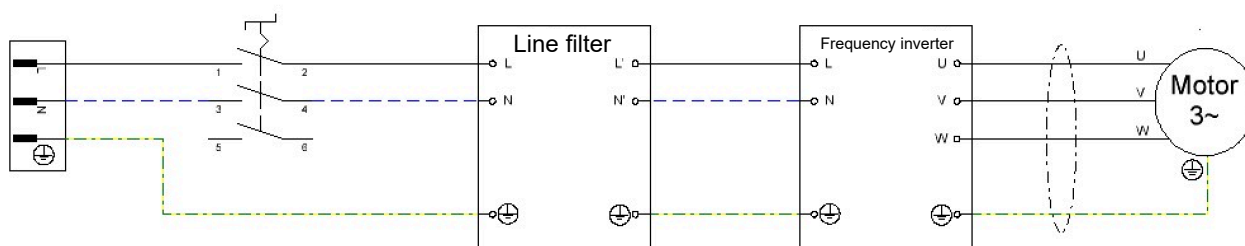


Figure 4: Single-phase connection diagram

Cable color		Connection terminal FI
Brown		L1
Blue		N
Green/Yellow		Ground / Protection

Attach wire end sleeves or cable lugs to the connection wires of the supply line and connect them to terminals L1 and N of the frequency inverter according to the cable color. Connect the protective conductor to the earth terminal.

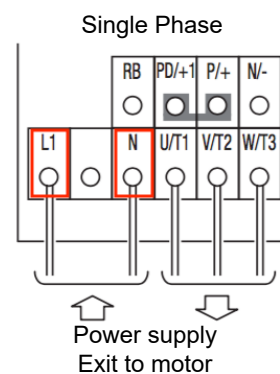


Figure 5: Connection of the mains cable to terminal L1 and terminal N of the frequency inverter.

Connection of three-phase systems

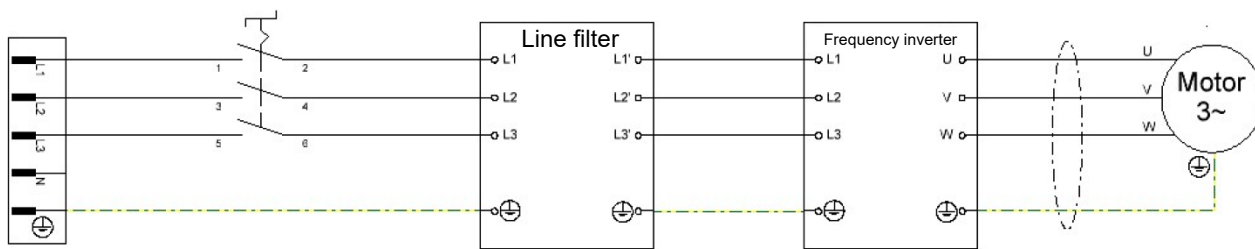


Figure 6: Three-phase connection diagram

Cable color		Connection terminal FI
Brown		L1
Black		L2
Grey		L3
Blue		N (Unavailable)
Green/Yellow		Ground / Protection

Attach wire end sleeves or cable lugs to the connecting wires of the supply line and connect them to terminals L1, L2 and L3 of the frequency inverter according to the cable color. Connect the protective conductor to the earth terminal.

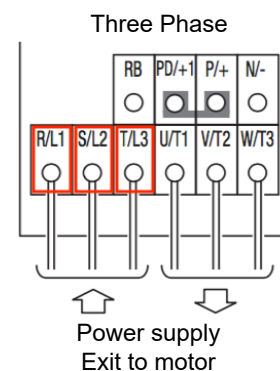


Figure 7: Connection of the mains cable to terminals L1, L2 and L3 of the frequency inverter.

Cable cross-sections

Please refer to the table of recommended cable cross-sections on page 5.

Cable cross-sections

For the sake of simplicity, we have created a table with the recommended cable cross-section and the design of the fuse. This makes it easier for you to get an overview.

The information in the table was created based on the following assumptions:

- This information is intended exclusively for the Teknomotor spindles. If you want to use the frequency converter for another application, these values may possibly be wrong!
- Your power cables are shorter than 15 meters. If you want to use a longer power cord, choose a larger cross-section to compensate.

Frequency Inverter	Phases & Voltage	Cross-section power cable mm ²	Cross-section to spindle mm ²	Power consumption
Omron FU 0.4 kW	1 / 230 V	0.75 mm ²	0.75 mm ²	ca. 2 A
Omron FU 0.75 kW	1 / 230 V	0.75 mm ²	0.75 mm ²	ca. 4 A
Omron FU 1.5 kW	1 / 230 V	0.75 mm ²	0.75 mm ²	ca. 6 A
Omron FU 2.2 kW	1 / 230 V	1.5 mm ²	1.5 mm ²	ca. 10 A
Omron FU 2.2 kW	3 / 400 V	1.5 mm ²	1.5 mm ²	ca. 5 A
Omron FU 4.0 kW	3 / 400 V	1.5 mm ²	1.5 mm ²	ca. 10 A
Omron FU 5.5 kW	3 / 400 V	2.5 mm ²	2.5 mm ²	ca. 13 A

Connection of control- and monitoring components

The other components are connected to the upper terminal block of the frequency inverter. For orientation, compare the circuit diagram valid for your system with Figure 8 and the following table.



Figure 8: Assignment of the control terminals including additional options PTC and electric fan

Terminal	Assignment
Above	
5, PLC, L	Temperature monitor PTC spindle, PLC / L bridged
1, P24	Relay spindle start, potential-free contact, control via CNC control
Middle	
O	0 ... 10 V Analog input speed
L	GND Analog input speed
CM2	Common connection transistor outputs, connection for minus of 24 V power supply unit
11	Transistor-Ausgang, Ansteuerung Relais für Spindel-Elektrolüfter, Minus von CM 2 wird durchgeschaltet
Bottom left	
AL2	Alarm output, potential-free contact normally open
AL1	Alarm output, potential-free contact normally closed
AL0	Alarm output Common

Teknomotor Base and Max frequency

The base frequency is the frequency at which the maximum voltage is reached. The maximum frequency is the frequency at which the spindle reaches the max. speed (max rpm).

The vector control of the frequency converter achieves a high torque at a lower speed.

In the table on the next page you will find the parameters that need to be adjusted. Then we explain how you can change each parameter.

300 Hz / 400 Hz

The maximum frequency depends on the spindle used. The parameters can be found on the nameplate on the spindle.

An 18,000 rpm HF spindle has a maximum operating frequency of 300 Hz. For an HF spindle with 24,000 rpm, the maximum frequency is 400 Hz.



Attention

Before operating the Teknomotor spindle, the base and max frequencies must be set in the frequency converter, otherwise the spindle will be destroyed.

IEC 34.1 - THREE PHASE INDUCTION MOTOR					
P.N.	COM414/0585				
S.N.	170004				
kW	2.0	Cos ϕ		Duty C.	S1
Volt Y	380	Amp. Y	5.0	Ins. Cl.	F
Volt Δ	220	Amp. Δ	8.6	IP	54
Base Freq.	300	Base rpm	18000		
Max Freq.	400	Max rpm	24000		
Fan W	10	Fan Volt	24		

Figure 9:
Nameplate of a milling spindle with information on base and max frequency and the associated speeds.

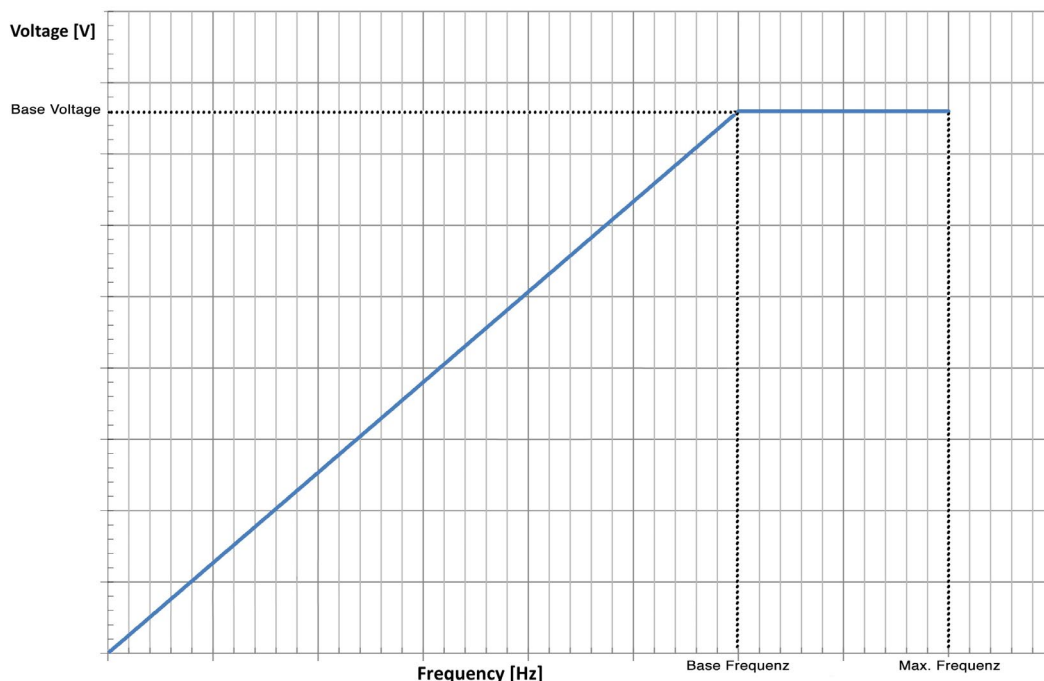


Figure 10:
Relationship between voltage and frequency in vector control.

Setting the parameters

This example explains how to change the parameters. To do this, please connect the frequency converter to the power supply (the spindle must NOT be connected).

1. Press the **blue button** to get to the desired parameter level.
The order of the parameter levels is defined as follows: F, A, b, C, H, P, U and d
2. Use the white arrow keys to navigate to the desired value.
3. The value can be changed by pressing the **yellow button** (PRG LED active). The value itself is changed with the white arrow keys
4. The changed value is confirmed by pressing the **yellow button** (PRG LED inactive) and you get back to the parameter level.
5. Pressing the **blue button** takes you back to the previous level without changing the value.
6. Pull out the mains plug, wait until the capacitors are discharged. Connect the spindle.
7. Test run.



Abbildung 11:
Bedienfeld des Omron MX2

Parameter

Vector controlled Omron converters offer many parameters for individual configuration. A complete overview can be found in the manual.

The following parameters must be set as a minimum requirement for the operation of Tekno motors with an Omron MX2 drive.

Parameter	Name	Value
A001	Frequency setpoint specification (1 = 0 ... 10 V / 2 = Buttons)	1
A002	Start / Stop command (1 = 0 ... 10 V / 2 = Buttons)	1
A003	Base Frequency	Nameplate
A004 *1)	Max. Frequency (must be placed before any frequency information)	Nameplate
A020	Base Frequency	100
A044 *2)	Working method	3
A051	DC brake	1
A052	DC brake switch-on frequency	2,00
A055	DC braking time	0,3
A082	Max. Output voltage	Nameplate
B012	Electric motor protection	Nameplate
B090 *3)	Braking resistor – Duty cycle	10
B095 *3)	Enable braking resistor	1
C021	Function digital output 11	0
C022	Digital output 12	21
C032	Digital output 12 normally open / closed	0
F002	Run-up time (without braking resistor the time increases)	3,00
F003	Run-down time (without braking resistor the time increases)	3,00
H002 *2)	Motor data	2
H003	Motor power	Nameplate
H004	Number of motor poles	2
H005	Speed controller	100

*1) The parameter A004 (end / max. frequency) must be set before all other frequency parameters. Otherwise it is not possible to set the specified frequencies.

*2) Vector control is not possible with all spindle models, which can be read from parameter A044. Only the models with A044 = 3 are suitable for this. H002 may only be set to 2 after autotuning has been carried out (see setting vector control)

*3) When operating without a braking resistor: deactivate the braking resistor (B090=0, B095=0)



Attention

Failure to adhere to the parameters marked in yellow will destroy the spindle when it is switched on!

Optional equipment

PTC thermocouple

Some Teknomotor spindles have a PTC thermocouple that can be used for internal temperature monitoring in order to set the frequency converter to alarm mode in the event of the spindle overheating. The thermocouple (blue wires) is connected to terminals 5 and L of the frequency converter.

In order to be able to use the temperature monitoring, the frequency converter must be configured according to the operating instructions.

External speed control via 0 ... 10 V analog signal

The speed signal can be transmitted to the frequency converter via the analog 0 ... 10 V signal from the control. To do this, the signal must be applied to terminals O (+ 0 ... 10 V) and L (GND) of the frequency converter.

In order to be able to use the speed control, the frequency converter must be configured according to the operating instructions.

Electric fan

A separate 24 V power supply unit is required to operate spindles with an electric fan (depending on the version). The electric fan is connected via the red & blue wire on the spindle.

Start-stop signal

The frequency converter requires a start or stop signal to start or stop the spindle. The control switches the signal to the frequency converter between terminals P24 and 1.

Here too, the frequency converter must be configured in accordance with the operating instructions.

Setting the vector control

The sensorless vector control enables a high torque at low frequencies. The vector control is set using the frequency converter's autotuning process. To carry out the autotuning, the parameters listed in the table must be preset. It is also possible to operate and tune only those spindles with vector control for which parameter A044 = 3.

Before starting autotuning, the spindle has to warm up. In order for the tuning and the warm-up to take place, parameters A001 and A002 must be set to value 2 for operation via the keyboard. After the warm-up has taken place, the desired mode of the autotuning process (2: autotuning in motion) must be set using parameter H001.

Parameter	Name	Options	Default	Act. value
A001	Frequency setpoint specification	01: Input O/OI 02: F001/A020	1	2
A002	Start / stop command	01: Input FW/RV 02: RUN-Button	1	2
H001	AUTOTUNING Mode	0: No AUTOTUNING 1: at standstill 2: in motion	0	2

Autotuning

Start the autotuning process by pressing the button



After successful AUTOTUNING the message
_ _ _ _ appears in the display.

Stop the autotuning process by pressing the key



Now the determined data must be activated by
parameterizing H002 = 2.

Parameter	Name	Options	Default	Act. Value
H002	Motor data	0: Standard Data 2: AUTOTUNING Data	0	2

To reconnect the FI to the CNC control, parameters A001 and A002 must be reset to their default value 1.

Parameter	Name	Options	Default	Act. Value
A001	Frequency setpoint specification	01: Input O/OI 02: F001/A020	1	1
A002	Start / stop command	01: Input FW/RV 02: RUN-Button	1	1

Connecting the spindle to the frequency inverter

The Teknomotor spindle can either be operated in star or delta mode. Tekno motors are factory set in star configuration for 400 VAC. If the motors are operated with 230 V, the bridges in the terminal board must be arranged accordingly.

- Cut your 4-core cable (see table on page 5 for cross-section) to the required length.
- If necessary, remove the outer insulation from both cable ends so that the individual lines are visible.
- Guide the cable through the cable gland on the black spindle cover.
- Attach the ring cable lugs on both sides. Now mount the cables as shown in the schematic drawings.

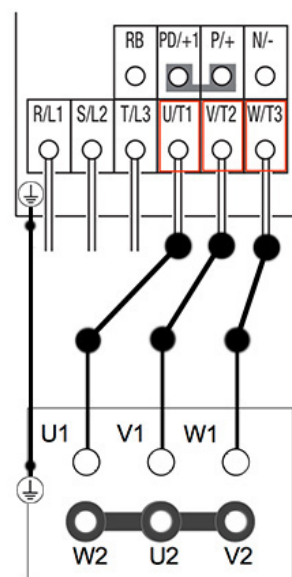


Figure 12:
Connection of the spindle to the frequency converter

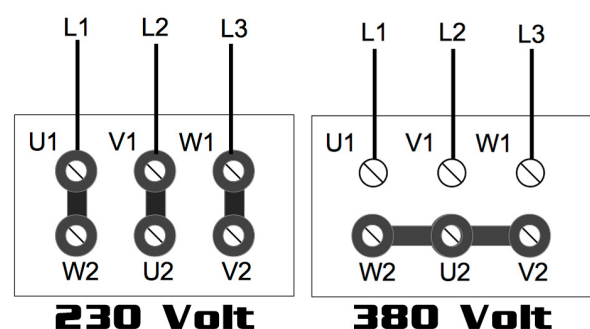


Figure 13: Jumpers in the terminal board of the spindle