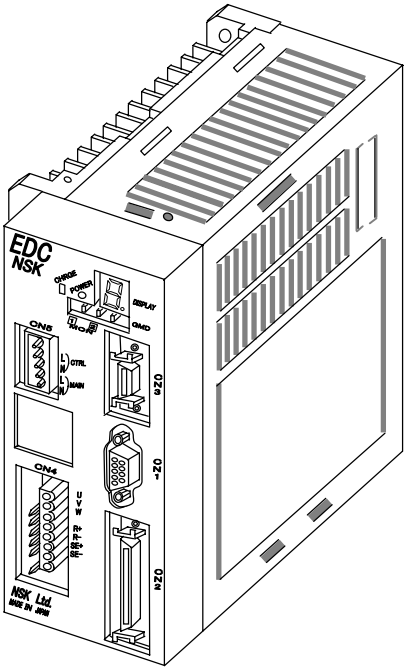
NSK

MEGATORQUE MOTOR™ System User's Manual

(EDC Driver Unit System)

PX series supplemental manual



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NSK Ltd.

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Contents

1. Introduction

- This is the supplementary of the instruction manual “EDC Driver Unit System (Document Number: C20158).” This supplement describes the Megatorque Motor System composed of the EDC Driver Unit and the PX series Megatorque Motor. Please refer to the above mentioned instruction manual (Document No.C20158) for items not described in this document.

1.1. Precautions for Use

⚠ *Warning : Be sure not to activate the dynamic brake in the following conditions. Otherwise the dynamic brake circuit may break and the Motor will enter in a “free run” state, leading to possible injuries.*

◊ Do not activate the dynamic brake in normal operations. Stop the Motor by a control command, not by the dynamic brake. The dynamic brake is an auxiliary function to stop the Motor immediately in an emergency. In the middle of operation, an alarm, a warning or the “Emergency stop” input activates the dynamic brake.

- Warnings that initiate “Servo-off” state are “A3” (Software thermal), “C0” (Position command/Feedback error), “C5” (Field bass error), “F5” (Program error), and “F8” (Automatic tuning error).

◊ The load inertia to a Motor must be 100 times or less than the Motor inertia . In case of an indexing operation, a position command shall be 360 degrees or less, while the maximum speed for continual rotation must be 0.5 [sec^{-1}] or less.
(However, there may be a possibility to exceed the above limits in some cases. Please consult NSK when you require a close investigation on the limits.)

⚠ *Caution: When the Motor is continually accelerating a high inertial load with high acceleration, the system constantly outputs a high torque exceeding the rated torque, and thus likely to activate the warning “A3” (Software thermal). In such a case take a remedy to decrease the load inertia or to lower the speed.*

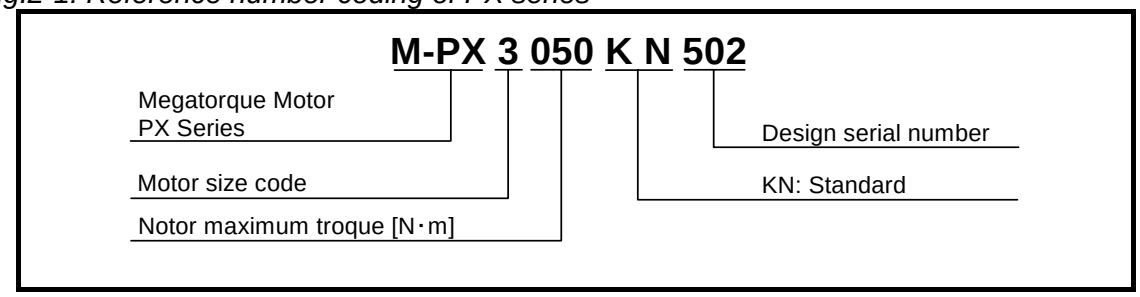
1.2. Note on compliance with UL Standards and CE Mark

⚠ *Caution: PX Series Megatorque Motor and EDC Driver Unit for PX Series Megatorque Motor does not comply with UL Standards or CE Mark.*

2. Reference Number and Coding

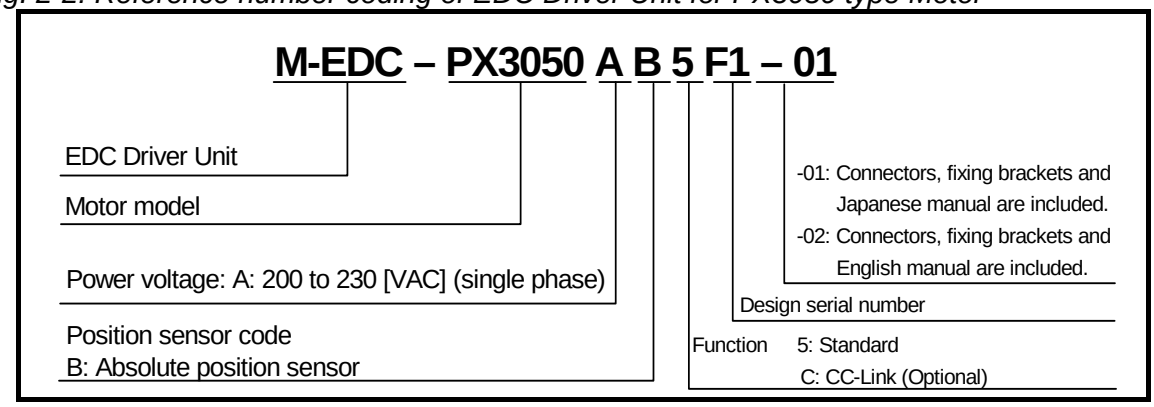
2. 1. PX Series Megatorque Motor

Fig.2-1: Reference number coding of PX series



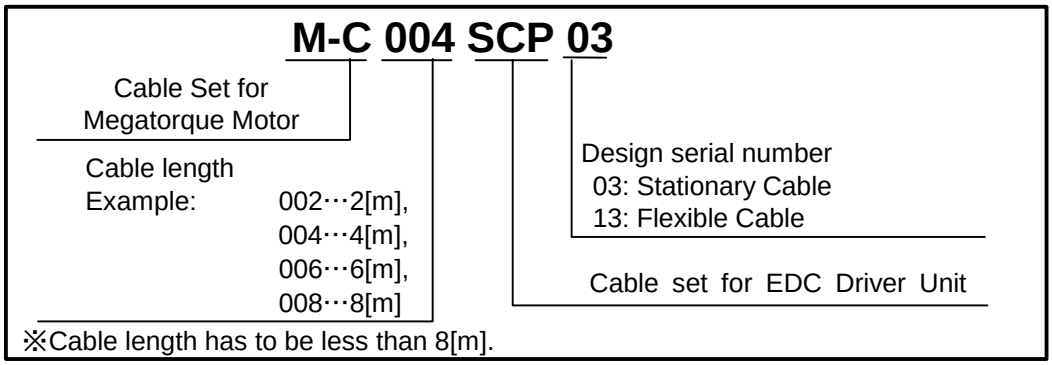
2. 2. EDC Driver Unit for PX Series Megatorque Motor

Fig. 2-2: Reference number coding of EDC Driver Unit for PX3050 type Motor



2.3. Cable Set

Fig 2-3: Reference number coding of Cable Set

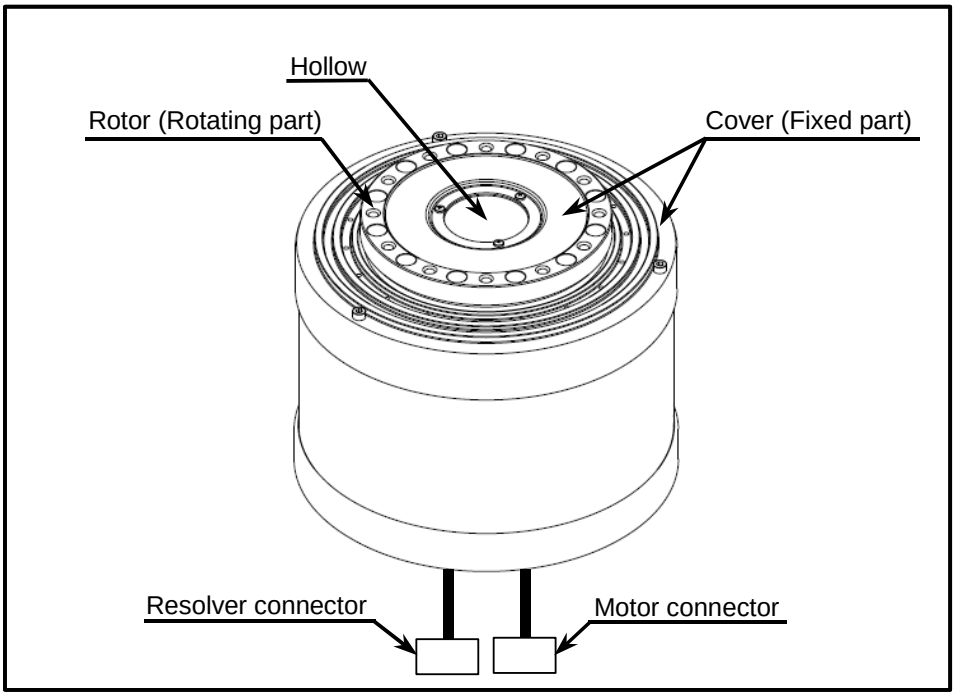


2.4. Handy Terminal

Fig 2-4: Reference number coding of Handy terminal

3. Name of Each Part

Fig 3-1: PX3050 type Motor



4. Combination of Motor and Driver Unit

Table4-1: Combination of PX3050 type Motor and Driver Unit

Motor diameter [mm]	Motor reference number	Driver Unit reference number ∗∗: Code for specification of bundled items.	Power voltage [VAC]	Cable reference number	Remarks
ø160	M-PX3050KN502	M-EDC-PX3050AB5F1-∗∗	200 to 230	M-C0∗∗SCP03 (Stationary cable) M-C0∗∗SCP13 (Flexible cable) ∗∗: Cable length in meters 01: 1 [m] 02: 2 [m] 03. 3 [m] 04: 4 [m] 05: 5 [m] 06: 6 [m] 08: 8 [m]	• Pulse train input
		M-EDC-PX3050ABCF1-∗∗	200 to 230		• CC-Link

5. Motor Specifications

Table 5-1: Specifications of PX series Megatorque Motor

Item [Unit] \ Reference number		M-PX3050KN502
Motor outside diameter	[mm]	ø160
Maximum output torque	[N•m]	50
Rated output torque	[N•m]	14
Motor height	[mm]	130
Motor hollow diameter	[mm]	35
Maximum velocity	[s^{-1}]	10
Rated velocity	[s^{-1}]	4
Resolution of position sensor	[count/revolution]	2 621 440
Absolute position accuracy	[arc-sec]	90 *1 (Interchangeable type)
Repeatability	[arc-sec]	±2
Allowable axial load	[N]	1 000 *2
Allowable radial load	[N]	820 *3
Allowable moment load	[N]	28
Rotor inertia	[kg•m^2]	0.0028
Allowable range of inertia	[kg•m^2]	0.0028 to 0.28
Mass	[kg]	9.5
International protection code		IP30 equivalent
Environmental conditions		Ambient temperature: 0 to 40[°C] Humidity: 20 to 80 [%], In door use only. Free from condensation, dust and corrosive gas.

*1. This accuracy is guaranteed at the temperature of 25 ±5 [°C].

*2. Under no radial load.

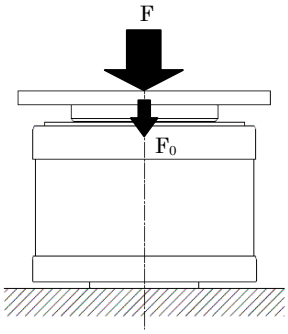
*3. Under no axial load.

SI Unit System	1N = 0.102 [kgf]
	1N•m = 0.102 [kgf•m]

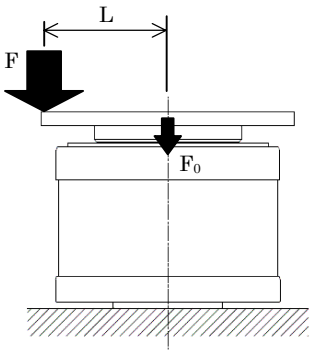
- Cable length for PX series is up to 8[m].
- Please consult with NSK in case of a simultaneous application of axial load, radial load and moment load to a Motor.
- For an oscillating operation less than 45 [°], turn the Motor 90 [°] or more at least once a day.
- Conditions outside the allowable range of inertia may be applicable, depending on operating conditions. Contact NSK for details.
- Do not drive the load less than the allowable range of inertia.

⚠ *Caution : Axial load Fa and Radial load Fr and Moment load M shall be less than the limits specified in the above table.*

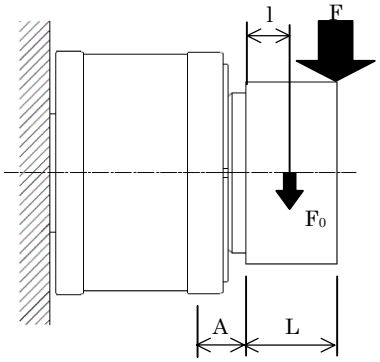
Fig. 5-1: Loads applied to a Motor



1) When F is an external force
- Axial load: $F_a=F+F_0$
- Moment load: M=0



2) When F is an external force
- Axial load: $F_a=F+F_0$
- Moment load: M=F×L



3) When F is an external vertical load
- Radial force: $F_r=F+F_0$
- Moment load: M=F×(L+A)+F_0×(l+A)

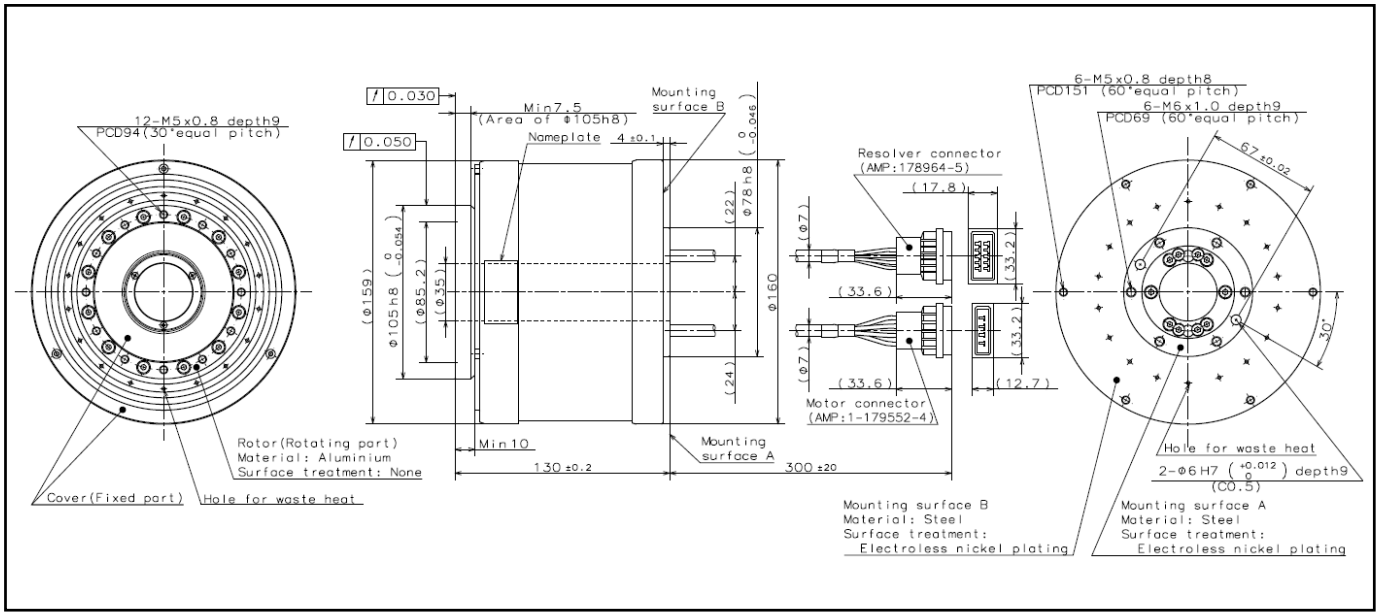
Table 5-2：Dimension A (distance between the bearing and the rotor)

Motor reference number	M-PX3050KN502
A [mm]	30.4

6. External Dimensions

6.1. PX Series Megatorque Motors

Fig. 6-1: PX3050 type Motor



⚠ *Caution: Set up the motor on either the surface A or B.*

⚠ *Caution: If you use the surface A, the width of fit (ø78h8) is less than 3.5[mm].*

⚠ *Caution: The Bend radius of the motor cable lead and the resolver cable lead should be R30 [mm] or more.*

⚠ *Caution: Do not use the leads of the motor cable and resolver cable with flexing motion.*

⚠ *Caution: Do not add stress (tension, vibration, etc) to the joint of the leads and the connector. It causes the disconnection and the loose connection.*

6.2. EDC Driver Unit

Fig. 6-2 EDC Driver Unit for PX3050 type Motor

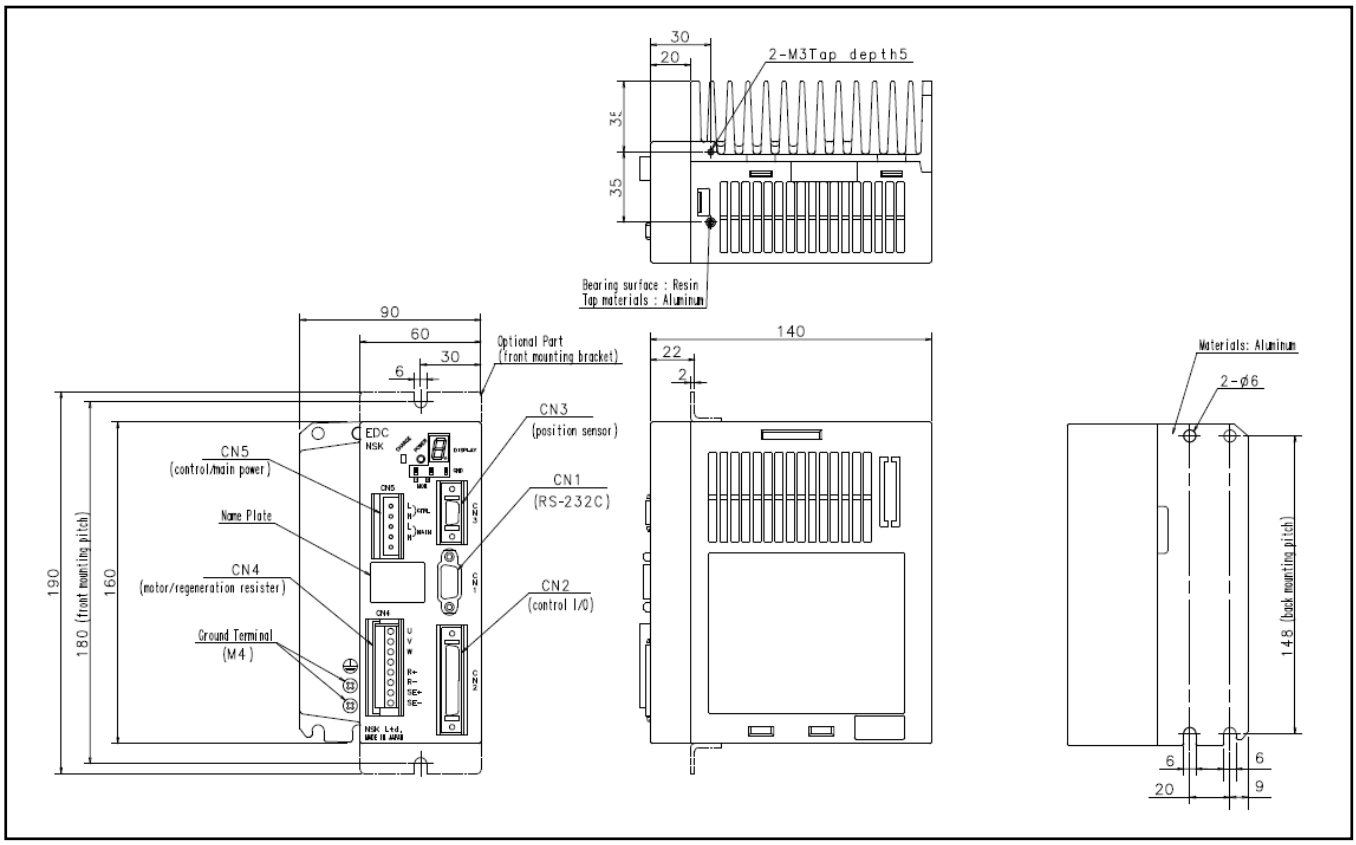
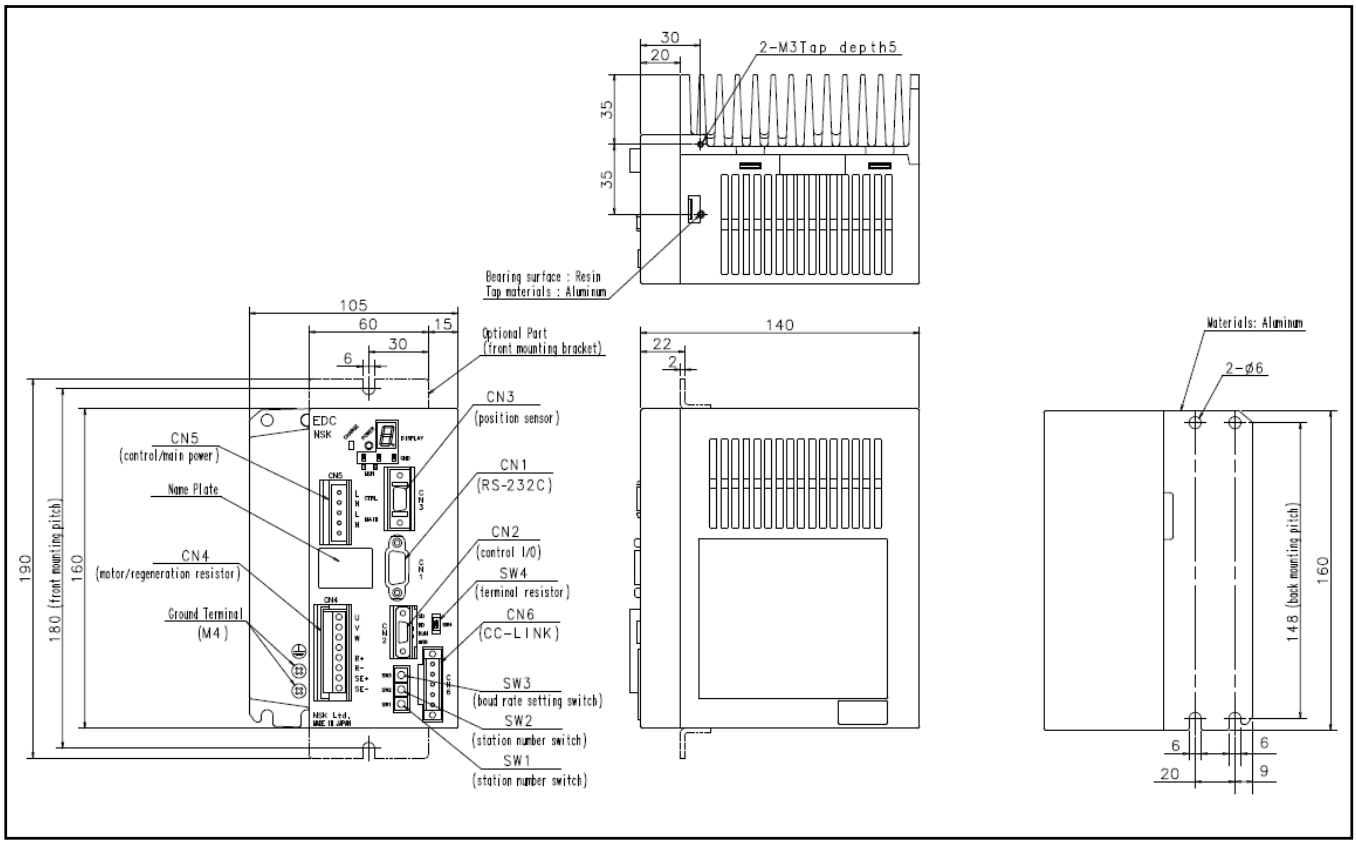


Fig. 6-3 CC-Link Compatible EDC Driver Unit for PX3050 type Motor



7. Driver Unit Specifications

Table 7-1: Specifications of EDC Driver Unit

Item			PX3050
Output current	Rated output［Arms］		3.9
	Maximum output［Arms］		14.9
Power input	Rated capacity［kVA］		1.0
	Max. capacity ［kVA］		5.2
	Control power source		Single phase 200 to 230 [VAC]
	Main power source		Fluctuation of power voltage: ±10[%]
Position sensor resolution [count/rev]			2 621 440
Maximum velocity [s^{-1}]			10
Positioning operation mode			Program operation (256 channels), Pulse train input, RS-232C serial communication command, Jog, Home Return
Input signal	Pulse train command		Photo coupler input: Maximum pulse frequency: 1 [MHz] Input format: CW/CCW, Pulse and direction, ΦA/ΦB Electronic gear A/B multiple available (1 000 to 5 242 880 [count/rev])
	Control input		Photo coupler input (±Common available), 17 input ports, 24 [V] input voltage Emergency stop, Alarm clear, Over travel limit +/-, Servo ON, Program operation start, Stop, Internal program 内 channel switching (0 to 7), Jog, Jog direction, (Hold, Velocity override, Integration OFF, Home return start and Home position limit)*1
Output signal	Position feedback signal		Signal format: ΦA/ΦB/ΦZ line drive, Free resolution setting to ΦA/ΦB available. Resolution of ΦA/ΦB: • Shipping set: 20 480 [count/rev.] (Quadrupled: 81 920 [count/rev]) • Maximum 1 310 720 [count/rev] (Quadrupled: 5 242 880 [Count/rev]) * The maximum signal frequency is limited to 781 [kHz] and thus the setting of resolution limits the maximum revolution speed. (Maximum speed: [s^{-1}] = 781 [kHz]/Resolution of ΦA [or ΦB] Resolution of ΦZ: 80 [count/rev]
	Control output		Photo coupler output (±Common available), 7 output ports. Maximum switching capacity: 24 [VDC]/50 [mA] Driver unit ready, Warning, Over travel limit detection +/- direction, Servo state, Busy, In-position, Target proximity A (Target proximity B, Zone A•B•C, Travel limit +/-, Normal, Position error under/over, Velocity error under/over, Torque command under/over, Thermal loading under/over, Home return complete, Home position defined)*1
Alarm			Excess error, Program error, Automatic tuning error, Position command/Feedback error, Field bus warning, Software thermal error, Home position undefined, Main AC line under voltage, Travel limit over, RAM error, ROM error, System error, Interface error, ADC error, Emergency stop, CPU error, Fieldbus error, Position sensor error, Absolute position error, Motor cable disconnected, Excess velocity, Resolver excitation amplifier alarm, Commutation error, Overheat, Main AC line over voltage, Excess current, Control AC line under voltage, Power module error
Monitors			Analog monitor ×2 (Free range and offset setting), RS-232C monitor
Communication			RS-232C serial communication (Asynchronous, 9 600 [bps])
Data backup			EEPROM (Overwriting and deleting of parameters are limited to 100 000 times.)
Others			• Automatic tuning • Function setting to Input/Output port • Temporal parameter setting by a program operation. • Individual setting of acceleration and deceleration • Acceleration profiling (Modified sine, Modified trapezoid, Cycloid and Half sine)
Fieldbus			CC-Link Ver.1.10 compatible (Optional EDC Driver Unit compatible to CC-Link is required.)
Environ-ment	• Ambient temperature • Storage temperature		• Ambient temperature: 0 to 50[℃] • Storage temperature －20 to 70[℃]
	Ambient/storage humidity		90[％] or less (No condensation)
	Vibration resistance		4.9 [m/s^2]
Built-in function	Regeneration		Optional dump resistor available when the regeneration current is beyond the capacity of built-in resistor. (M-E014DCKR1-100, M-E014DCKR1-101) • Connect to R+,R-,SE+ and SE-. (Never short-circuit them.)
	Dynamic brake		Functions at the state of Power-off, Servo-off and Warning. The command KB terminates the dynamic brake function. (Refer to "9.2. Glossary of Command and parameter.)
Compatible safety regulation	UL		-
	CE Marking	LVD	-
		EMC	-
Connectors	RS-232C	CN1	D-sub 9 pins
	Control I/O	CN2	Standard: half pitch connector 50 pins CC-Link compatible: Half pitch 10 pins
	Position sensor	CN3	Half pitch connector 14 pins
	Motor/Optional dump resistor	CN4	Plastic connector (UL and CE qualified)
	Control/Main power	CN5	Plastic connector (UL and CE qualified)
	CC-Link	CN6	Plastic connector 5 pins
Mass [kg]			Standard: 1.8 CC-Link compatible: 2.0

*1: These functions become effective by changing some functional allocation of control Input/Output.

8. Installation

8.1. Environmental Conditions of Motor

- Use the Motor in the indoor conditions free from dust and corrosive gas.
- The operating ambient temperature of the Motor shall be 0 to 40[°C].
- The PX series Megatorque Motors are neither dust-proof nor waterproof.
  Do not expose the Motor to water or oil from any source.
- It is essential to securely fix the Motor to a mounting base of which rigidity is sufficient enough.
  Otherwise, mechanical resonance may occur.

⚠ *Warning : When fixing the Motor, use bolt holes on its bottom.*

- The flatness of the mounting surface for the Motor shall be 0.02 mm or less.
- The Motor can be mounted vertically or horizontally.
- The table bellow shows the tightening torque of bolt and thread depth for each Motor type.

Table 8-1 : Tightening torque of bolt and thread depth

Motor type	PX3050	
Mounting surface	A(bolt holes:M6)	B(bolt holes:M5)
Tightening torque [N・m]	14 or less	9.0 or less
Thread depth [mm]	7 to 8.5	6 to 7.5

⚠ *Caution: Set up the motor on either the surface A or B.*

⚠ *Caution: If you use the surface A, the width of fit(⌀78h8) is less than 3.5[mm].*

⚠ *Caution: Do not connect the outgoing lines of the Motor cable and resolver cable of the PX type Motor to a moving part. The bending radius of the outgoing lines shall be R30[mm] or more.*

8.2. Coupling Load to the Motor

⚠ *Warning : Fix the load using the bolt holes on the rotor surface. Be sure to fasten the bolts firmly.*

- The table bellow shows the tightening torque of bolt and thread depth for each Motor type.

Table 8-2 : Tightening torque of bolt and thread depth

Motor type	PX3050
Tightening torque [N・m]	4.4 or less
Thread depth [mm]	7 to 8.5

8.3. Confirmation of Use Conditions

- In case of the Megatorque Motor system, the moment of inertia of load is extremely higher than that of the rotor. The table bellow shows the allowable moment of inertia for each Motor type.

Table 8-3 : Allowable moment of inertia for Motor

Motor type	Moment of inertia of the rotor [kg·m^2]	Allowable moment of inertia [kg·m^2]
PX3050	0.0028	0.0028 to 0.28

⚠ *Caution: Be sure to confirm the allowable moment load and axial load and radial load to the Motor under the use conditions.*

- Please refer to “5. Motor Specifications” for the allowable moment load and axial load and radial load for each Motor.

Appendix 1: How to Check Motor Condition

■ Examine the resistance and the insulation resistance of the Motor winding to check if the Motor is in normal condition. It can be regarded as it is normal if all check results are within the specifications.

■ First, check the winding resistance including the Motor cable. If the result is not satisfactory, check the Motor only.

1. Resistance check of Motor winding

Fig A-1: Check with the cable set

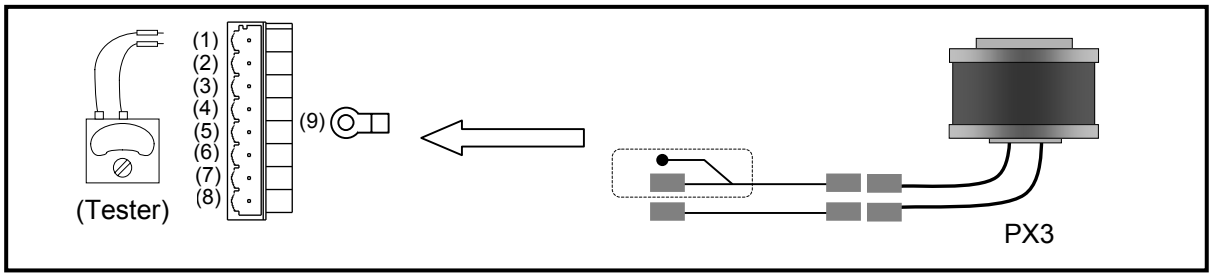
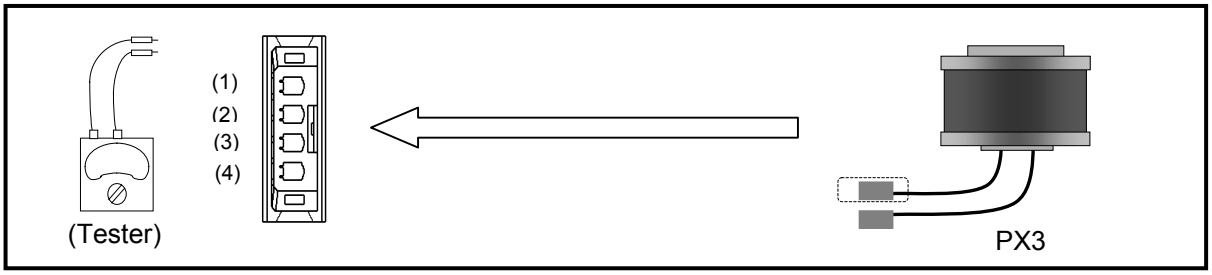


Fig A-2: Check with the Motor only



● Do not turn the rotor while checking the Motor winding.

Table A-1: Checking points

	Cable connector	Motor connector	Result
Phase UV	(1) ↔ (2) (U) (V)	(1) ↔ (2) (U) (V)	
Phase VW	(2) ↔ (3) (V) (W)	(2) ↔ (3) (V) (W)	
Phase WU	(3) ↔ (1) (W) (U)	(3) ↔ (1) (W) (U)	

Table A-2: Resistance specification of Motor winding

Motor type	Winding resistance [Ω]	Specification
PX3050	2.2	1. ± 30[%] of the value in the left 2. Variation between each phase UV, VW, and WU is less than 15[%]

● Please ask NSK for a Motor with special winding specifications or a Cable longer than 4 m.

2. Resistance check of the resolver winding

Fig A-3: Check with the Cable set

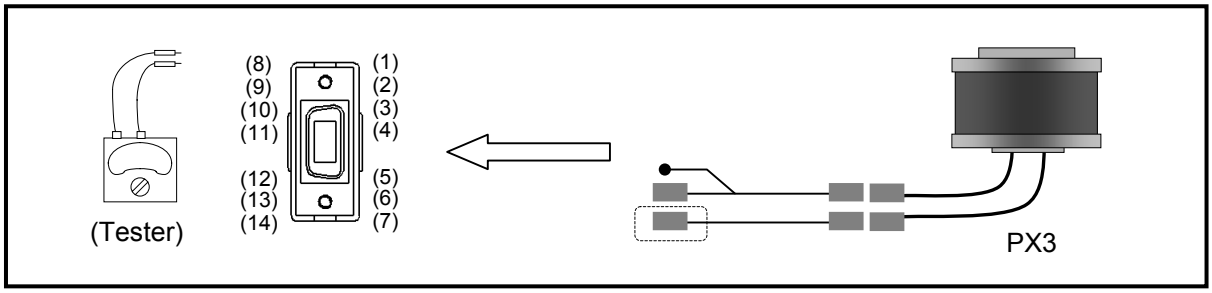


Fig A-4: Check with the Motor only

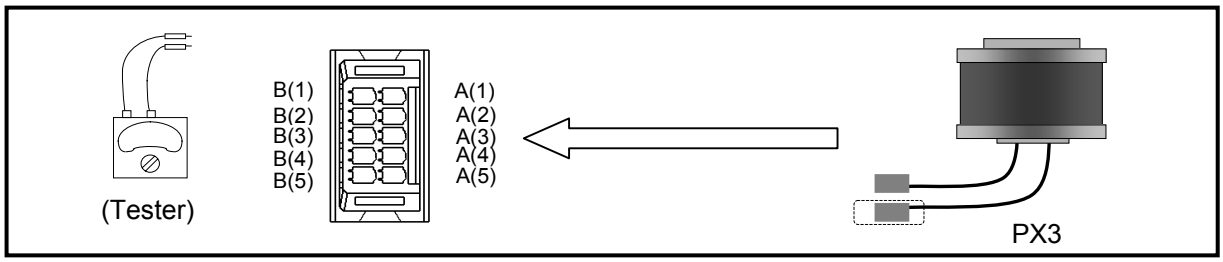
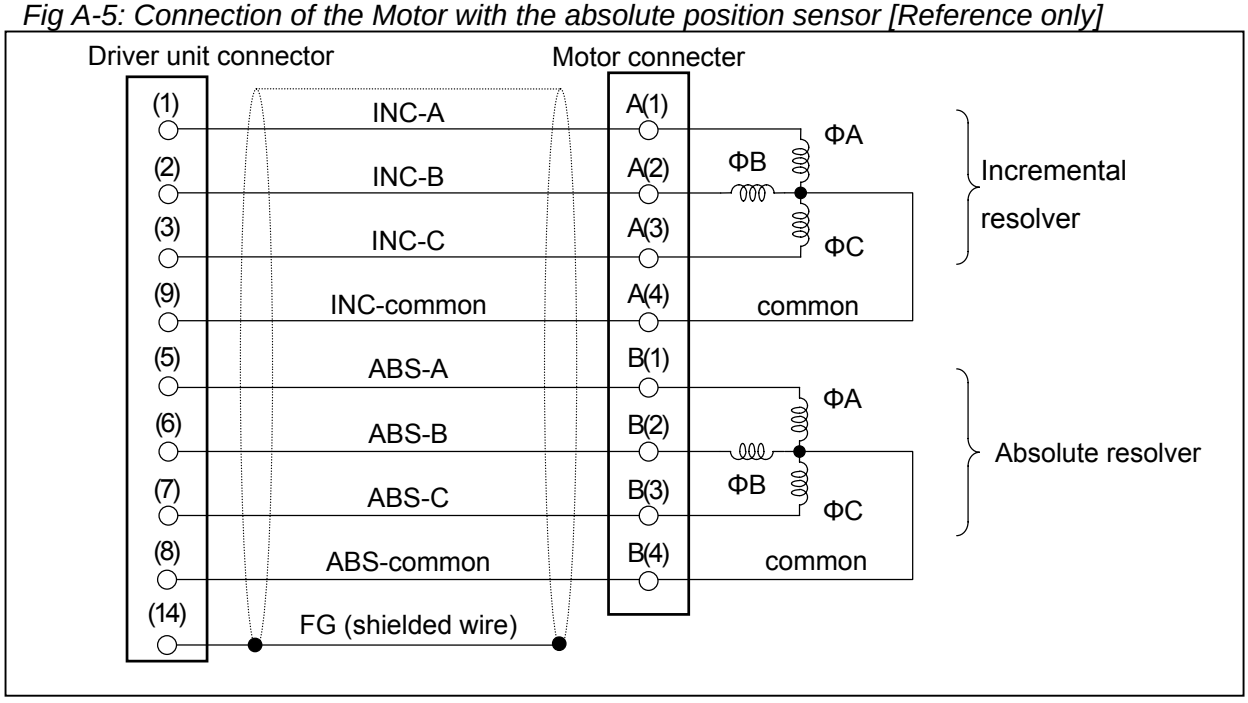


Table A-3: Checking points of the resolver with an absolute position sensor and winding resistance

	Cable connector	Motor connector	Result	Specification
INC-A	(1) ↔ (9) (INC-A) (INC･COM)	A(1) ↔ A(4) (INC-A) (INC･COM)		1.Resistance •PX3 : 8.3±1 [Ω] 2. Variation between each phase A, B and C shall be 1.0 [Ω]or less.
INC-B	(2) ↔ (9) (INC-B) (INC･COM)	A(2) ↔ A(4) (INC-B) (INC･COM)		
INC-C	(3) ↔ (9) (INC-C) (INC･COM)	A(3) ↔ A(4) (INC-C) (INC･COM)		
ABS-A	(5) ↔ (8) (ABS-A) (ABS･COM)	B(1) ↔ B(4) (ABS-A) (ABS･COM)		1.Resistance • PX3 type: 8.3 ±1 [Ω] 2. Variation between each phase A, B and C shall be 1.0 [Ω] or less.
ABS-B	(6) ↔ (8) (ABS-B) (ABS･COM)	B(2) ↔ B(4) (ABS-B) (ABS･COM)		
ABS-C	(7) ↔ (8) (ABS-C) (ABS･COM)	B(3) ↔ B(4) (ABS-C) (ABS･COM)		

* Please ask NSK for the specifications of the Motor with special winding, and the Cable longer than 4 [m].

Fig A-5: Connection of the Motor with the absolute position sensor [Reference only]



3. Insulation resistance check of Motor winding

Caution: Disconnect the Motor from the Driver Unit when checking insulation resistance of the Motor.

Caution: Checking voltage must be 500[VDC] or less.

Fig A-6: Check with the Cable

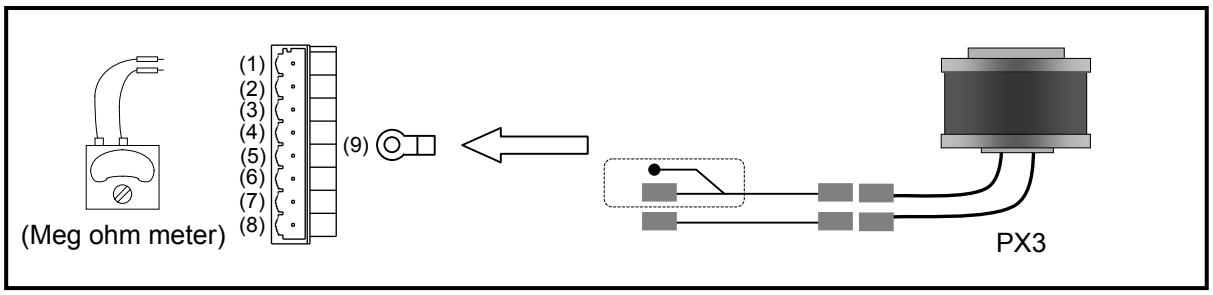


Fig A-7: Check the Motor only

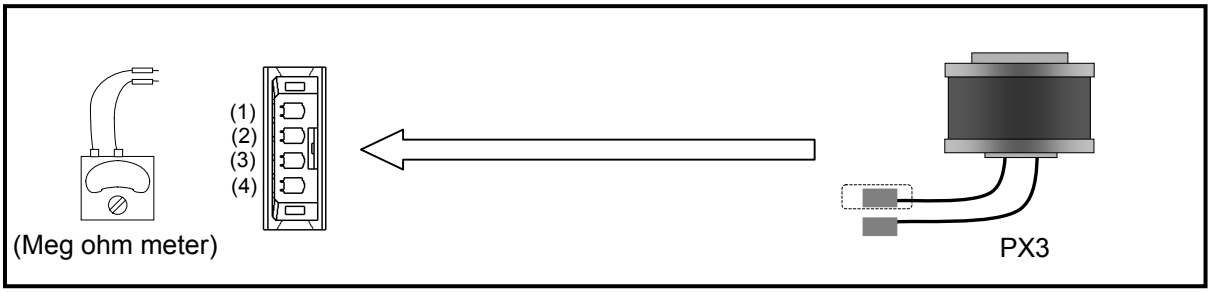


Table A-4: Checking point

	Cable connector	Motor connector	Result
øU – PE	(1) ↔ (9) (U) (PE)	(1) ↔ (4) (U) (PE)	
øV – PE	(2) ↔ (9) (V) (PE)	(2) ↔ (4) (V) (PE)	
øW – PE	(3) ↔ (9) (W) (PE)	(3) ↔ (4) (W) (PE)	

Table A-5: Specification of insulation resistance (Common to all type of Motor)

	Specification
With cable	1 [MΩ] or over
Motor only	2 [MΩ] or over

4. Visual check of the Motor and the Cables

- Check the Motor for any damage.
- Check the cable for any damage on the cable insulation.

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User's Manual

(EDC Driver Unit)

PX series supplemental manual

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