For Iron and Steel Industry

Absocoder®

ABSOCODER CONVERTER for Fuji Electric Co., Ltd. E-SX bus

NCV-220HFEV1R

Specifications & Instruction Manual

Applicable ABSOCODER:
VRE-P061
VRE-P074
VRE-P097
VRE-P101

GENERAL SAFETY RULES

(Please read this safety guide carefully before operation)

Thank you very much for purchasing our product.
Before operating this product, be sure to carefully read this manual so that you may fully understand the product, safety instructions and precautions.

- Please submit this manual to the operators actually involved in operation.
- Please keep this manual in a handy place.

Signal Words

Safety precautions in this guide are classified into DANGER and CAUTION.

Symbol	Meaning
⚠ DANGER	Incorrect handling may cause a hazardous situation that will result in death or serious injury.
⚠ CAUTION	Incorrect handling may cause a hazardous situation that will result in moderate injury or physical damage.

Instructions accompanied by a symbol ⚠CAUTION may also result in serious damage or injury. Be sure to follow the all instructions accompanied by the symbol.

Graphic Symbols

Symbol	Meaning
⊘	Indicates prohibited items.
❗	Indicates items that must be performed to.

Application Limitation

This product is not designed to be used under any situation affecting human life. When you are considering to use this product for special purposes such as medical equipment, aerospace equipment, nuclear power control systems, traffic systems, and etc., please consult with NSD.

1. Handling Precautions

⚠ DANGER

- Do not touch components inside of the controller; otherwise, it will cause electric shock.
- Do not damage the cable by applying excessive load, placing heavy objects on it, or clamping; otherwise, it will cause electric shock or fire.
- Turn the power supply OFF before wiring, transporting, and inspecting the controller; otherwise, it may cause electric shock.
- Provide an external safety circuit so that the entire system functions safely even when the controller is faulty.
- Connect the grounding terminal of the controller; otherwise, it may case electric shock or malfunction.

⚠ CAUTION

- Do not use the controller in the following places; water splashes, the atmosphere of the corrosion, the atmosphere of the flammable vapor, and the side of the combustibility.
  Doing so may result in fire or the controller may become faulty.
- Be sure to use the controller and the ABSOCODER sensor in the environment designated by the general specifications in the manual. Failure to do so may result in electric shock, fire, malfunction or unit failure.
- Be sure to use the specified combination of the ABSOCODER sensor, controller and sensor cable; otherwise, it may cause fire or controller malfunction.

2. Storage

⚠ CAUTION

- Do not store the controller in a place exposed to water, or toxic gas and liquid.
- Be sure to store the controller in designed temperature and humidity range, and do not exposed to direct sunlight.
- Be sure to consult with NSD when the controller is stored for long periods.

3. Transport

⚠ CAUTION

- Do not hold the cable or shaft of ABSOCODER sensor during transport; otherwise, it will cause injury or controller malfunction.

4. Installation

⚠ CAUTION

- Do not step on the ABSOCODER sensor or place heavy objects on the controller; otherwise, it will cause injury.
- Do not block the exhaust port or allow any foreign matter to enter the controller; otherwise, it will cause fire or unit failure.
- Be sure to secure the controller and ABSOCODER sensor with the provided brackets; otherwise, it may cause malfunction, injury, or drop.
- Be sure to secure the specified distance between the main body and the control panel or other equipments; otherwise, it may cause malfunction.

5. Wiring

⚠ DANGER

- Be sure to secure the terminal block firmly; otherwise, it may have risk of fire.
- Be sure to mount the terminal cover provided with the controller, before supplying the power, starting operation after the installation, and wiring; otherwise, it may cause electric shock.

⚠ CAUTION

- Be sure to keep the sensor cable, control cable, and communication cable at least 300 mm away from the main circuit and power line; otherwise it may cause injury or malfunction.
- Be sure to connect all cables correctly; otherwise, it may cause injury or controller malfunction.
- Be sure to firmly connect the external I/O connectors and sensor connectors; otherwise, it may cause incorrect inputs and outputs or injury.

6. Operation

⚠ CAUTION

- Do not change the controller's function switch settings during the operation; otherwise, it will cause injury.
- Do not approach the machine after instantaneous power failure has been recovered.
  Doing so may result in injury if the machine starts abruptly, it will cause injury.
- Be sure to check that the power supply specifications are correct; otherwise, it may caused controller failure.
- Be sure to provide an external emergency stop circuit so that operation can be stopped with power supply terminated immediately.
- Be sure to conduct independent trial runs for the controller before mounting the controller to the machine; otherwise, it may cause injury.
- When an error occur, be sure to eliminate the cause, ensure safety, and reset the error before restarting operation; otherwise, it may cause injury.

7. Maintenance And Inspection

⚠ CAUTION

- Do not disassemble, remodel, or repair the unit; otherwise, it will cause electric shock, fire, and unit malfunction.
- The capacitor of the power line deteriorates through prolonged use. We recommended that the capacitor be replaced every five years to prevent secondary damage.

8. Disposal

⚠ CAUTION

- Be sure to handle the controller as industrial waste while disposing of it.

REVISION HISTORY

The Document No. appears at the upper right of this manual's cover page.

Document No.	Date	Revision Description
ZEF005120400	27, Aug., 2012	1st Edition Japanese document: ZEF005120202
ZEF005120401	6, Jun., 2013	2nd Edition Japanese document: ZEF005120203

CONTENTS

1. OVERVIEW

The NCV-220 converter can connect to the E-SX bus of the programmable controller "MICREX-SX Series" made of Fuji Electric Co., Ltd.. The converter uses with the ABSOCODER sensor and detects the machine position by the absolute value. The programmable controller can read the position data through the E-SX bus.

1-1. Features

● High reliability
An absolute position detection format ensures accurate position detection even if a power interruption or unexpected noise condition occurs. An origin returning operation is not required.

● Superior durability
ABSOCODER sensor is not used electronic parts except coils and resistor, and it features a no-contact construction excepting bearing. This sensor offers problem-free operation, even in environments where it is exposed to vibration, impact shocks, extreme temperatures, oil, and dust.

● Two axes ABSOCODER sensor can connect
The machine positions for two axes can be detected by one converter. The space-saving in the control cabinet can be conducted.

● Compact design
The unit's outside dimensions (39(W) x 155(H) x 93(D)) were miniaturized. DIN rail can be used, so mounting is much easier.

● Less wiring
Most I/O wirings aren't needed by connecting with E-SX bus. The wiring-saving for the system can be conducted.

● High speed response (200μs)
The converter detects machine position every 200μs without being influenced by the scan time of the programmable controller and the update cycle of E-SX bus.

● Current position setting function
The machine position is set at "desirable value" by inputting the current position setting signal from the current position value setting command button on the panel side or the programmable controller.

● Error detection function
An error status can be checked by the monitor LED of the converter when an error occurs. The programmable controller can also read the error status.

● Applicable with JKPEV-S cable
A commercially available cable (JKPEV-S 1.25mm^2 x 5P) can be used between the converter and ABSOCODER sensor.

- MEMO -

2. MODEL SELECTION WHEN ORDERING

The following figure indicates the connection configuration of NCV-220. Before ordering, refer to the connection configuration and model list. Please prepare by customer except 1 to 7 in the connection configuration.

● **Connection configuration**
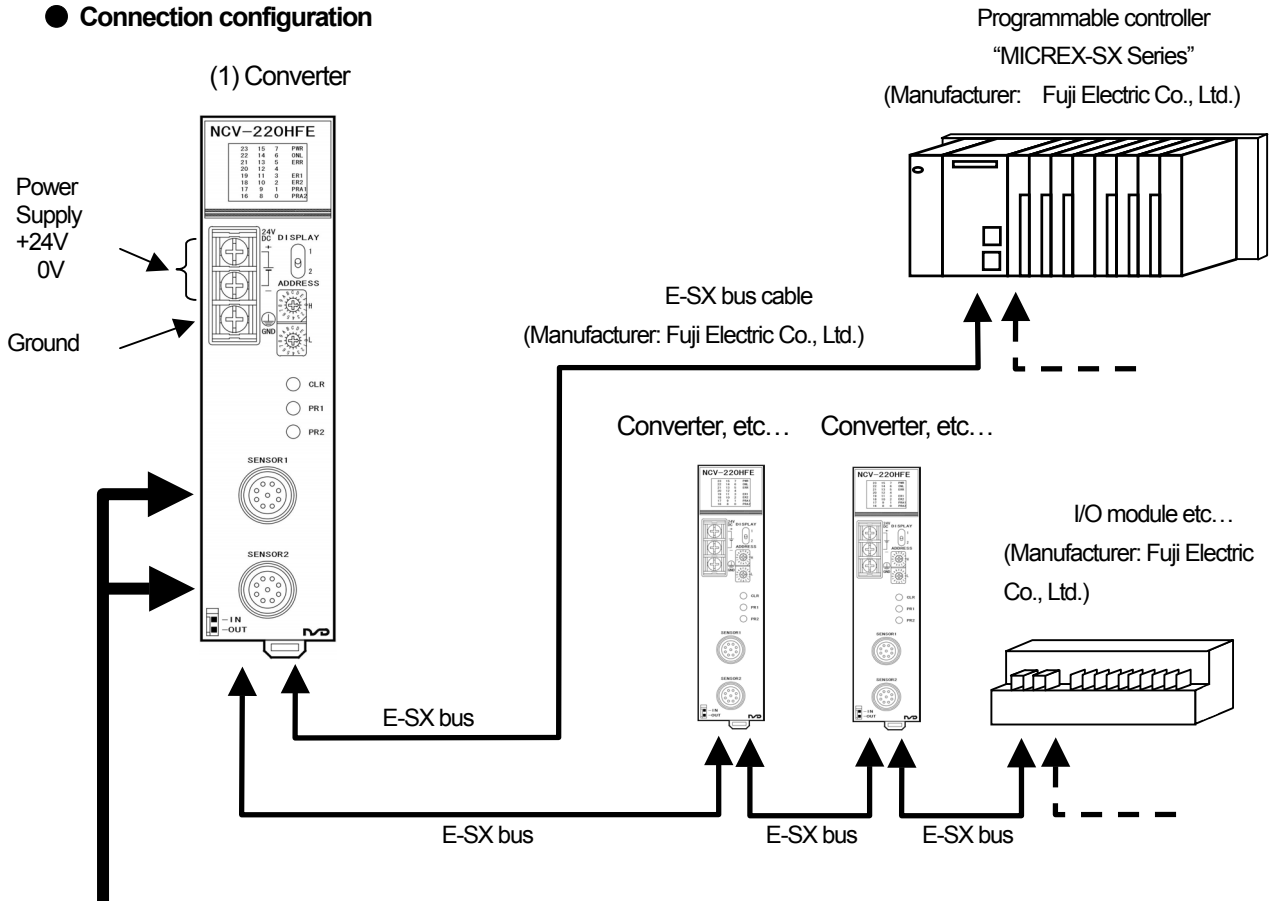
(3) to (6) Extension sensor cable	(2) ABSOCODER sensor	(7) Option
-In the case of using the NSD special cable	Connector type	
(3) 4P-S/RBT/URT-0144-[L] [01] [44]	B	VRE-P061 VRE-P074 VRE-P097 VRE-P101
(3) 4P-S/RBT/URT-0144-[L] [01] [44] (4) 4P-S/RBT/URT/HRT-4344-[L] [43] [44]		RB-01 L type flange for VRE-P061
-In the case of using the commercially available cable		
(5) 4P-S/RBT/URT-0155-[L] [01] [55] JKPEV-S(1.25mm² ×5P) NWPC-4012-Ad14 [27] NWPC-4012-P14 [26]	P	
(6) 4P-S/RBT/URT-0190-[L] [01] [90] JKPEV-S(1.25mm² ×5P)	R	

●Model List

◆ Converter

No.	Model	Descriptions
(1)	NCV-220HFEV1R	For single-turn type ABSOCODER sensor

◆ ABSOCODER sensor

No.	Model	Descriptions
(2)	VRE-P061FK[2]	General environment type Mounting format: Flange-mount type With Interconnecting cable 2m
	VRE-P074[1]K[2][L][-G]	Compact size heavy duty type, SUS
	VRE-P097[1]K[2][L][-G]	Heavy duty type, spheroidal graphite iron castings
	VRE-P101[1]K[2][L][-G]	Heavy duty type, SUS

[1]: Mounting format

  F: Flange-mount type   L: Base-mount type   M: Face-mount type

                                                      (Only available for VRE-P074)

K: Input shaft (sunk key)

[2]: Connector type

    B: Standard connector for the NSD special cable

        (NJW-2012PM8, manufacturer: Nanaboshi Electric Mfg.Co,Ltd.)

    P: Large connector for JKPEV-S cable

        (NWPC-4012-Ad12, manufacturer: Nanaboshi Electric Mfg.Co,Ltd.)

    R: Crimping terminals for JKPEV-S cable and the NSD special cable (R1.25-4)

[L]: Interconnecting sensor cable length (m)

    2: 2m, 5: 5m, 10: 10m, 20: 20m

[-G]: Silicon oil

    -G :Silicon oil injected

    no code: no oil injected

◆ Extension sensor cable

No.	Model	Description	
(3)	4P-S-0144-[L]	Standard cable	[L]: cable length (m)
	4P-RBT-0144-[L]	Robotic cable	[L]: cable length (m)
	4P-URT-0144-[L]	Semi-heat-resistant robotic cable	[L]: cable length (m)
(4)	4P-S-4344-[L]	Standard cable	[L]: cable length (m)
	4P-RBT-4344-[L]	Robotic cable	[L]: cable length (m)
	4P-URT-4344-[L]	Semi-heat-resistant robotic cable	[L]: cable length (m)
	4P-HRT-4344-[L]	Heat-resistant robotic cable	[L]: cable length (m)
(5)	4P-S-0155-[L]	Compatible with JKPEV-S Standard cable	[L]: cable length (m)
	4P-RBT-0155-[L]	Compatible with JKPEV-S Robotic cable	[L]: cable length (m)
	4P-URT-0155-[L]	Compatible with JKPEV-S Semi-heat-resistant robotic cable	[L]: cable length (m)
(6)	4P-S-0190-[L]	Compatible with JKPEV-S Standard cable	[L]: cable length (m)
	4P-RBT-0190-[L]	Compatible with JKPEV-S Robotic cable	[L]: cable length (m)
	4P-URT-0190-[L]	Compatible with JKPEV-S Semi-heat-resistant robotic cable	[L]: cable length (m)

◆ Option

No.	Model	Description
(7)	RB-01	L-type flange for VRE-P061

- MEMO -

3. SPECIFICATIONS

3-1. Converter Specifications

● General Specification

Items	Specifications
Power supply voltage	24VDC±10% (including ripple)
Power consumption	7W or less
Insulation resistance	20 M-Ohms or more between external DC power terminals and ground (by 500 VDC insulation resistance tester)
Withstand voltage	500 VAC, 60Hz for 1 minute between external DC power terminals and ground
Vibration resistance	Half amplitude: 0.15mm, constant acceleration: 19.6m/s^2 Two hours for each of three mutually perpendicular axes, total six hours (IEC61131-2) (*1)
Ambient operating temperature	0 to +55°C (No freezing)
Ambient operating humidity	20 to 95 %RH (no condensation), transport condition: 5 to 95%RH (no condensation)
Ambient operating environment	Free from corrosive gases and excessive dust
Pollution degree	2 (IEC60664-1, IEC61131-2) (*2)
Corrosion immunity	Not stained with organic solvents.
Operating altitude	2000m or less above sea level (transport condition: 70kPa or more)
Ambient storage temperature	-25 to +70°C
Grounding	Must be securely grounded (ground resistance of 100 ohm or less)
Construction	Book-shelf type within enclosure, DIN rail mountable
Cooling	Air cooling
Outside dimension (mm)	39(W) x 155(H) x 93(D) Refer to dimensions for details.
Mass	Approx. 0.4kg

*1: The converter is fixed by screws to the control cabinet. When the converter is mounted to the DIN rail, care must be taken that vibrations or shocks will not occur. In an environment where repetitive or continuous vibration occurs, be sure to take vibration-proofing measures.

*2: Pollution degree 2: This pollution doesn't conduct usually, but under certain circumstances temporary conductivity occurs due to condensation (IEC61131-2).

● Performance specification

Items	Specifications
Applicable sensor	VRE-P061 VRE-P074 VRE-P097 VRE-P101
Total number of divisions	8192 (2^{13})
Position detection format	Absolute position detection
Number of detection axes	2
Position data sampling time	0.2ms
Front panel function	Current position setting, error clear
Switch (on rear face of product)	Sensor setting (enabled/ disable) Position data increase direction setting (CW/CCW) Current position setting (enabled/disable)
Monitor LED	Position data display , power supply status display, E-SX bus communication status display, current position value setting command answerback display, sensor disconnected error display

● Communication specification

Items	Specifications
Compatible CPU module	SPH3000MM
Communication method	E-SX bus communication (Follows the E-SX bus communication specification.)
Number of system	IN, OUT each 1 system
Transmission rate	100Mbps (Follows the E-SX bus communication specification.)
Communication connector	E-SX bus connector (RJ-45 modular jack)
Communication cable	CAT5e STP crossing cable
Occupied words	Input: 6 words, output: 6words
Station number setting function	Available (E-SX bus address setting switch on the converter panel)

3-2. ABSOCODER Sensor Specifications

● VRE-P061, VRE-P074

Items		Specifications	
Sensor model		VRE-P061	VRE-P074
Total number of turns		1	
Number of divisions		8192 (2^{13})	
Mass		1.3kg	Flange-mount type: 3.5+0.1 x cable length (m) kg Base-mount type: 5.5+0.1 x cable length (m) kg Face-mount type: 3.0+0.1 x cable length (m) kg
Linearity error		1° Max.	0.7° Max.
Moment of inertia GD^2/4(J)		6.4 x 10^{-6} kg·m^2 (6.5 x 10^{-5} kgf·cm·s^2)	3.3 x 10^{-5} kg·m^2 (3.4 x 10^{-4} kgf·cm·s^2)
Starting torque		4.9 x 10^{-2} N·m or less (0.5 kgf·cm or less)	9.8 × 10^{-2} N·m or less (1 kgf·cm or less)
Permissible shaft load	Radial	98N (10 kgf)	
	Thrust	49N (5 kgf)	
Permissible mechanical speed		3600r/min	4000r/min
Bearing life		5.5 x 10^4h (at 3600r/min)	8 x 10^4h (at 4000r/min)
Ambient temperature	Operating	-20 to +80°C	-20 to +120°C
	Storage	-30 to +90°C	-30 to +120°C
Vibration resistance		2.0 x 10^2 m/s^2 (20G) 2000Hz, up/down 4 h, forward/back 2 h, conforms to JIS D 1601 standard	2.0 x 10^2 m/s^2 (20G) 200Hz, up/down 4 h, forward/back 2 h, conforms to JIS D 1601 standard
Shock resistance		4.9 x 10^3 m/s^2 (500G) 0.5 ms, up/down/forward/back x 3 times each, conforms to JIS C 5026 standard	
Protection rating		IP65, conforms to JEM 1030 standard	IP67, conforms to JEM 1030 standard
Interconnecting cable		2m	2・5・10・20m
Max. sensor cable length	4P-S	500m	
	4P-RBT/URT /HRT	250m	
	JKPEV-S (1.25mm^2×5P)	300m	
Surface treatment		Electroless nickel plate	Not treated
Material		Steel	Stainless

● VRE-P097, VRE-P101

Items		Specifications	
Sensor model		VRE-P097	VRE-P101
Total number of turns		1	
Number of divisions		8192 (2^{13})	
Mass		6.5+0.1 x cable length (m) kg	
Linearity error		0.7° Max.	
Moment of inertia GD^2/4(J)		3.3 x 10^{-5}kg·m^2 (3.4 x 10^{-4} kgf·cm·s^2)	
Starting torque		9.8 x 10^{-2}N·m or less (1 kgf·cm or less)	
Permissible shaft load	Radial	1.5 x 10^{2}N (15kgf)	
	Thrust	78N (8kgf)	
Permissible mechanical speed		4000r/min	
Bearing life		8 x 10^{4}h (at 4000r/min)	
Ambient temperature	Operating	-20 to +120°C	
	Storage	-30 to +120°C	
Vibration resistance		2.0 x 10^2 m/s^2 (20G) 200Hz, up/down 4 h, forward/back 2 h, conforms to JIS D 1601 standard	
Shock resistance		4.9 x 10^3 m/s^2 (500G) 0.5 ms, up/down/forward/back x 3 times each, conforms to JIS C 5026 standard	
Protection rating		IP67, conforms to JEM 1030 standard	
Interconnecting cable		2・5・10・20m	
Max. sensor cable length	4P-S	500m	
	4P-RBT/URT /HRT	250m	
	JKPEV-S (1.25mm^2 × 5P)	300m	
Surface treatment		Coated (epoxy resin)	Not treated
Material		Cast iron	Stainless

3-3. Extension Sensor Cable Specification

Items	Specifications			
Model code	4P-S	4P-RBT	4P-URT	4P-HRT
Cable type	Standard cable	Robotic cable	Semi-heat-resistant robotic cable	Heat-resistant robotic cable
Diameter	$\phi 8$			
Operating temperature range	-5～+60℃		-5～+105℃	0～+150℃
Insulator	Irradiated cross linked formed polyethylene	ETFE plastic (resin)		
Sheath	Polyvinyl chloride mixture		Heat-resistant polyvinyl chloride mixture	Fluonlex
Construction	8-core, 2 pairs without shield + 2 pairs with shield			
Color of sheath	Gray	Black		
Advantage	Extensible for long distances	Superior flexibility; ideal for moving place		Heat treatment and flexible; ideal for moving place

4. DIMENSIONS

4-1. Converter Dimension

Units: mm
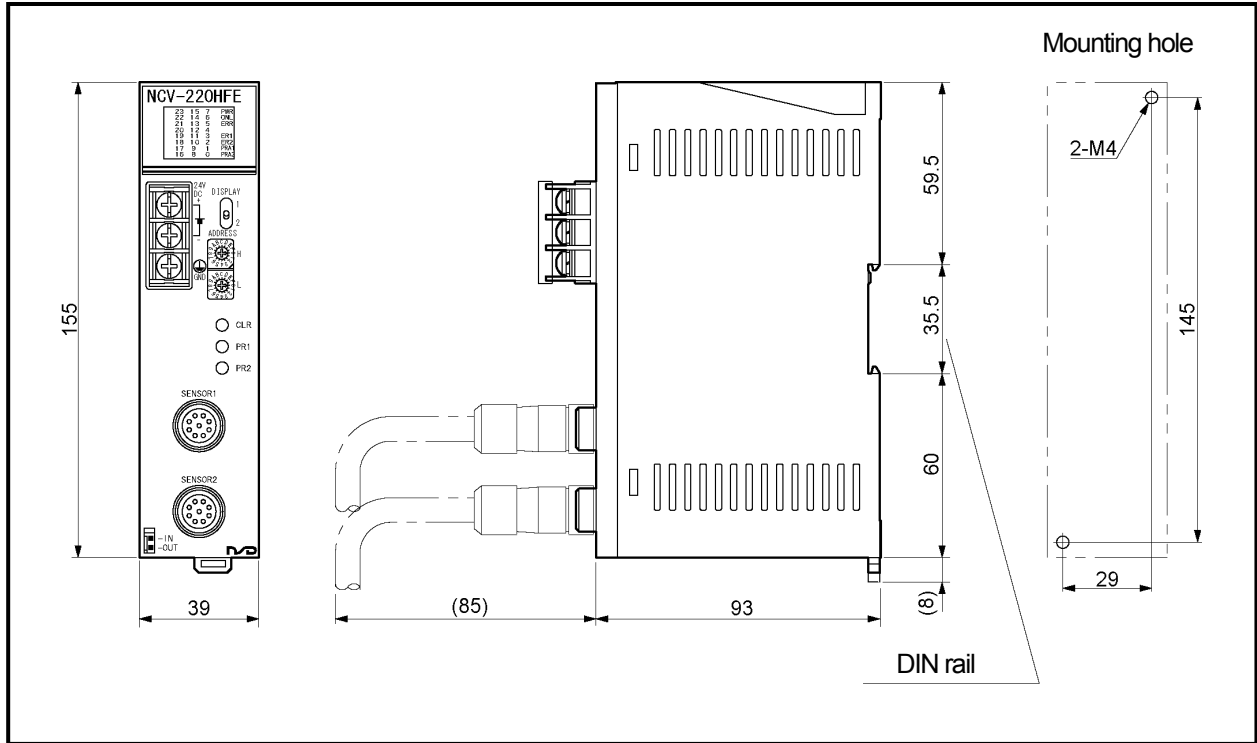
4-2. ABSOCODER Sensor Dimensions

● VRE-P061FK[ ]   (Flange-mounting type)   Units: mm

Heat-resistant Robotic Cable 2m
3P-HRT

Accessory sunk key
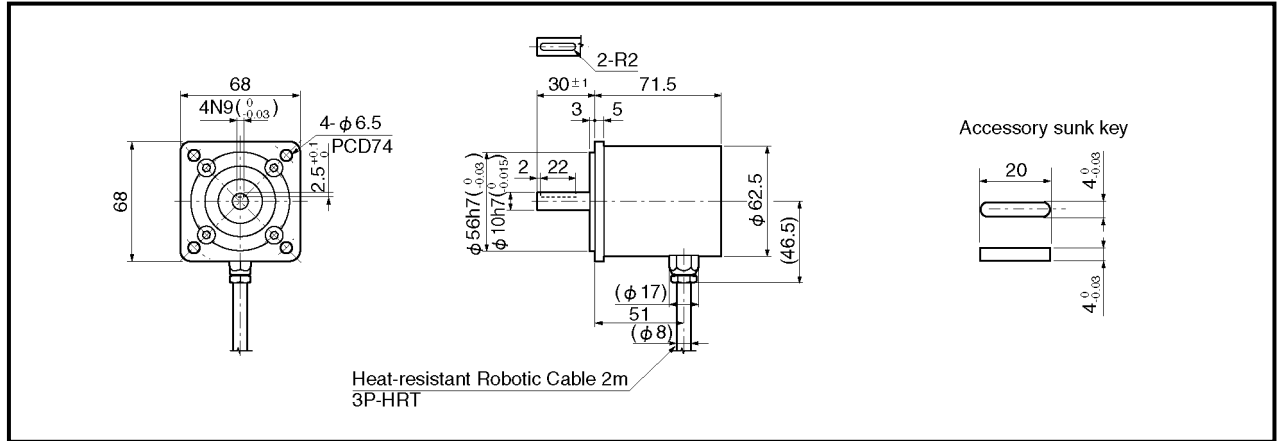
● Option: RB-01
  L-type flange for VRE-P061   Units: mm

13
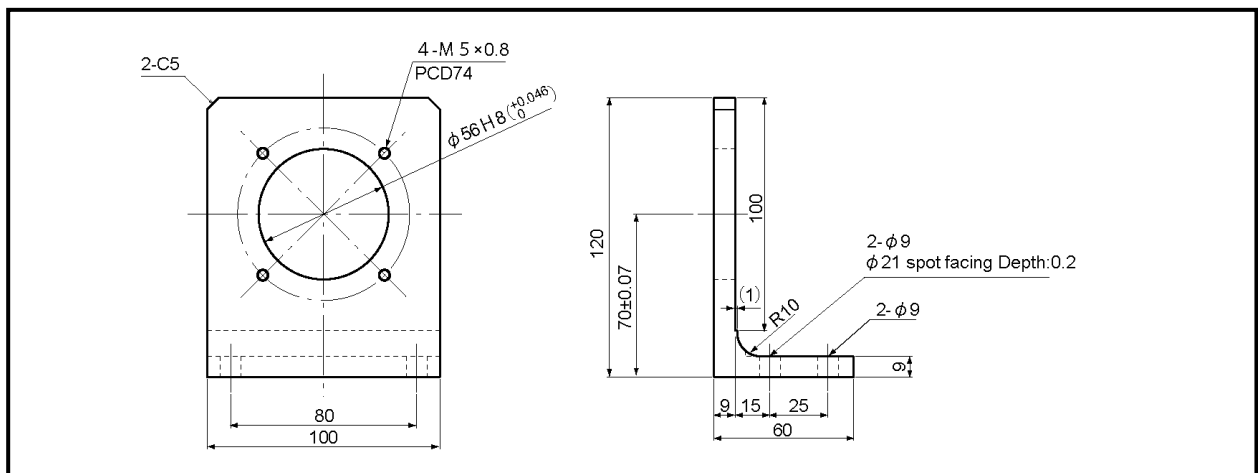
● VRE-P074FK[ ]　(Flange-mount type)　　　　　　　　　　　　　　　　　　　　　　　　Units: mm

80
5 0 -0.03
3 +0.3 0
80
4-φ9
PCD90
M5×0.8 Depth 10

2-R2.5
30
128.5
(2.5)
φ15h7 (0 -0.018)
3
12
5
16
φ56h7 (0 -0.03)
φ74
(62)
φ22
(φ28)
63
(φ8)
Heat-resistant Robotic Cable
2,5,10,20m
3P-HRT

Accessory sunk key
14
5 0 -0.03
5 0 -0.03
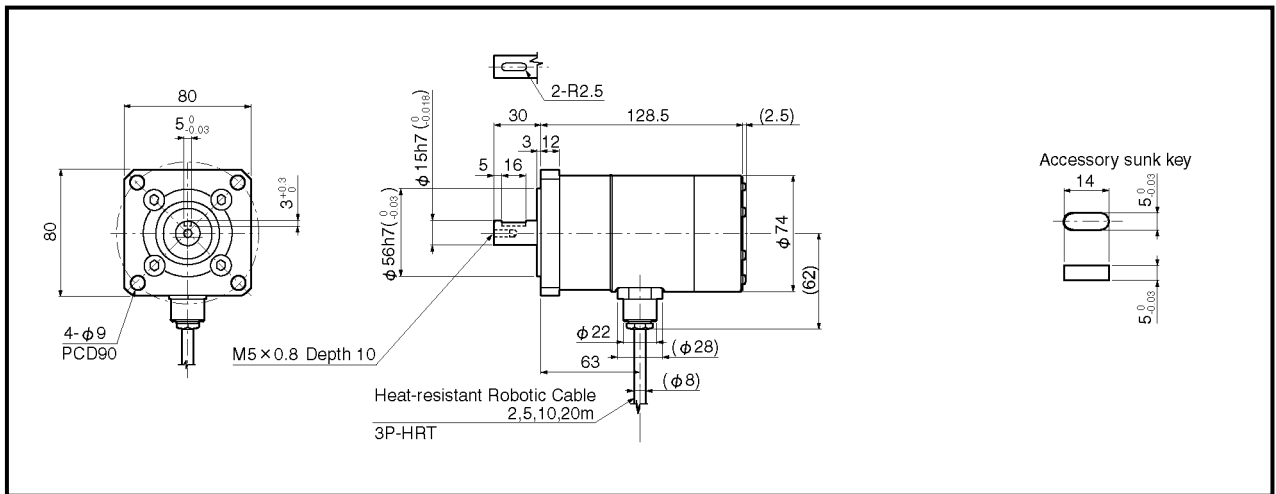
● VRE-P074LK[ ]　(Base-mount type)　　　　　　　　　　　　　　　　　　　　　　　　Units: mm

Heat-resistant Robotic Cable
2,5,10,20m
3P-HRT
5 0 -0.03
2-R2.5
M5×0.8 Depth 10
27
66
131.5
(2.5)
(3)
(14)
5
16
φ15h7 (0 -0.018)
3 +0.3 0
φ40
63 0 -0.5
40
55
(113)
φ74
(φ28)
φ22
(95)
(62)
(113)
(φ8)
(2)
17 +2 0
90
(110)
4-φ9

Accessory sunk key
14
5 0 -0.03
5 0 -0.03
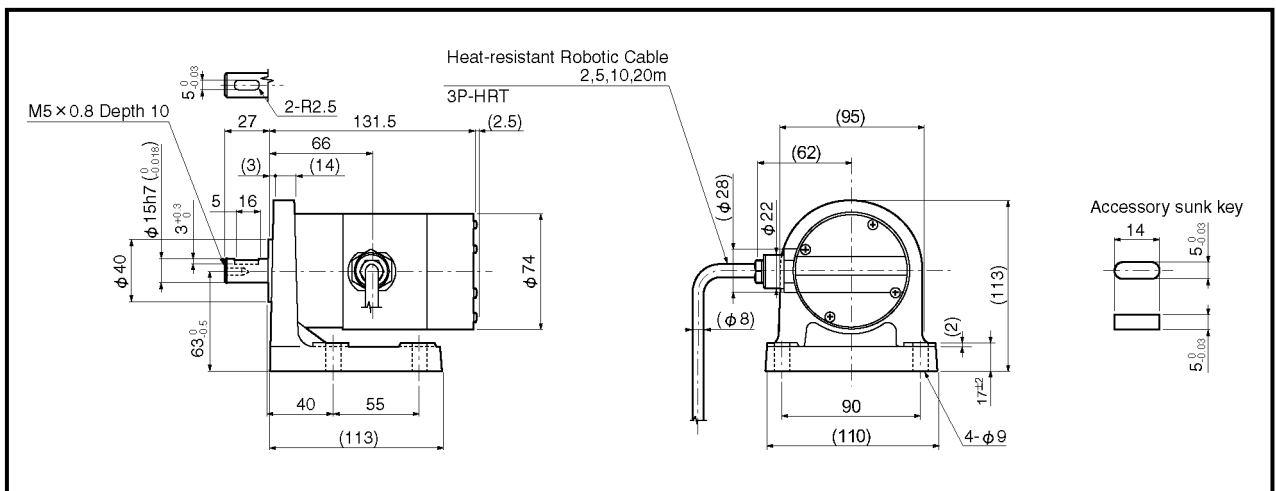
● VRE-P074MK[ ]　(Face-mount type)　　　　　　　　　　　　　　　　　　　　　　　　Units: mm

4-M8×1.25 Depth 20
PCD61
5 0 -0.03
3 +0.3 0
M5×0.8 Depth 10

2-R2.5
42
116.5
(2.5)
5
16
15
φ15h7 (0 -0.018)
φ40h7 (0 -0.025)
R1.5
φ74
(62)
φ22
(φ28)
51
(φ8)
Heat-resistant Robotic Cable
2,5,10,20m
3P-HRT

Accessory sunk key
14
5 0 -0.03
5 0 -0.03

14
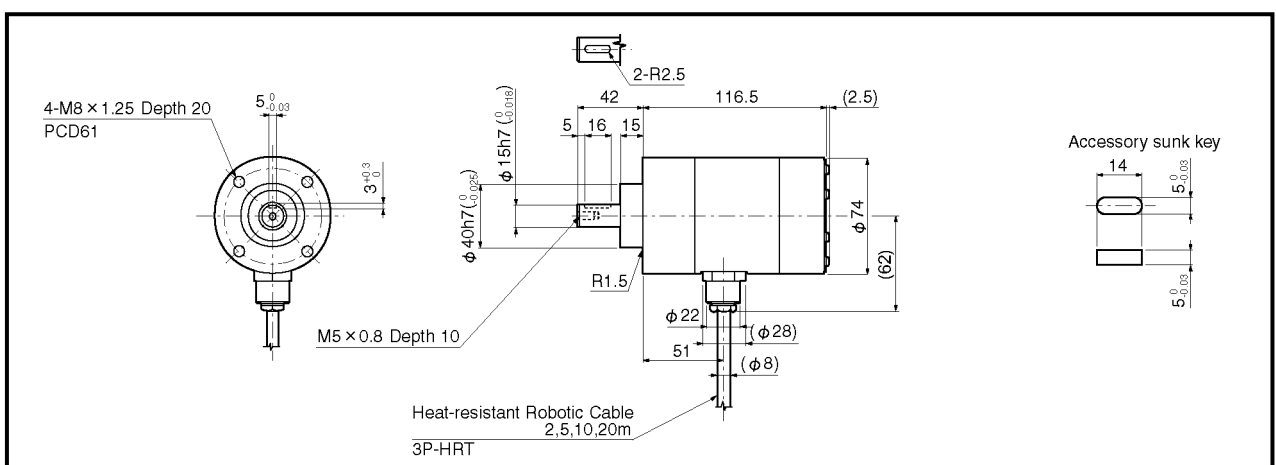
● VRE-P097FK[ ]　(Flange-mount type)　　　　　　　　　　　　　　　　　　　　　Units: mm
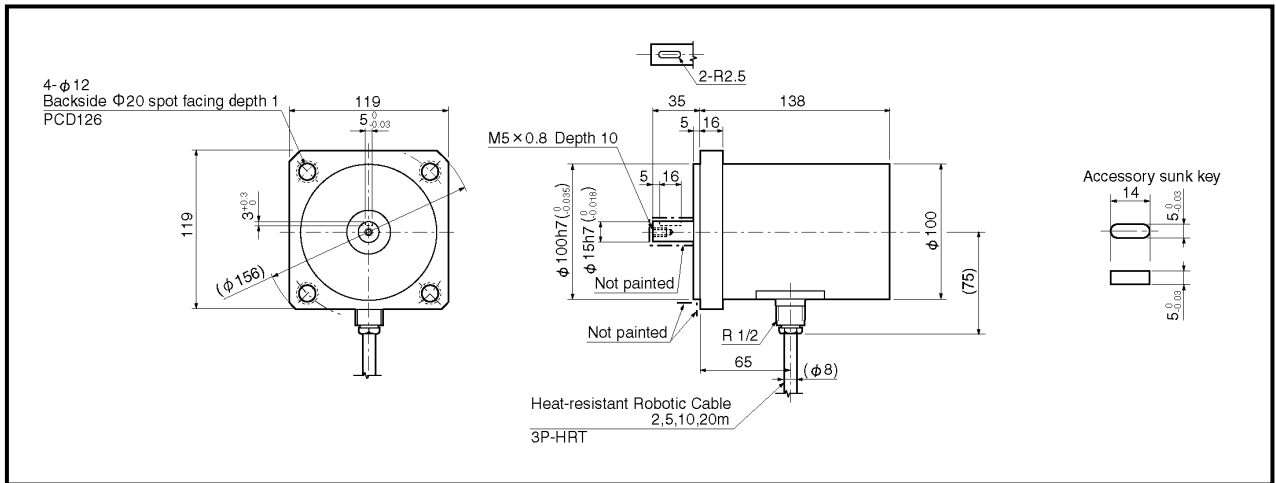
● VRE-P097LK[ ]　(Base-mount type)　　　　　　　　　　　　　　　　　　　　　Units: mm
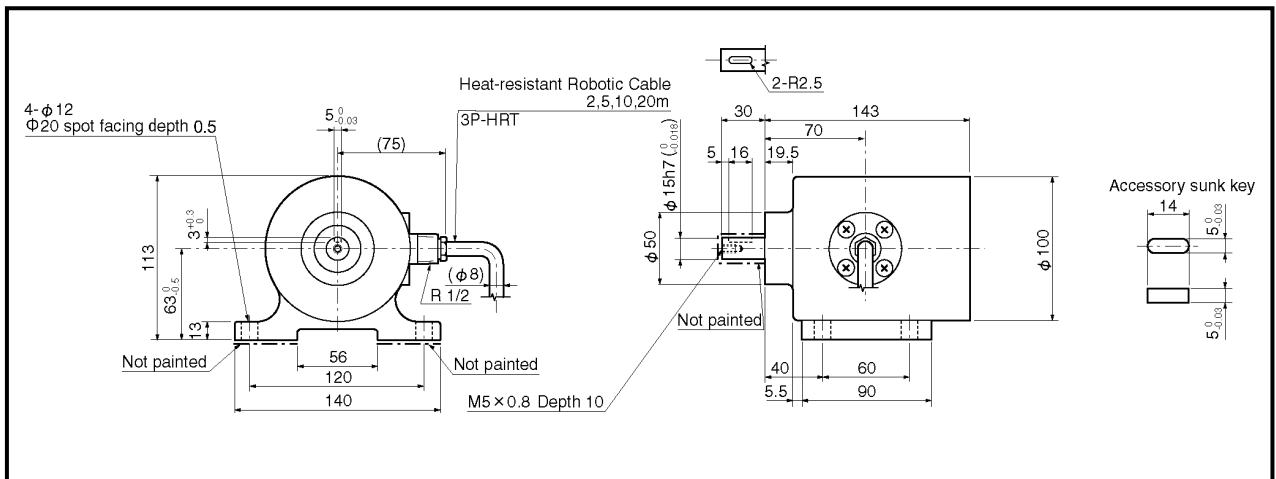
● VRE-P101FK[ ]   (Flange-mount type)   Units: mm

2-R2.5

35   138
5   16

4-φ12
PCD126

5
0
-0.03

M5×0.8 Depth 10

5   16

φ100h7 (0, -0.035)
φ15h7 (0, -0.018)

φ100

(75)

3 +0.3, 0

(φ156)

R 1/2

65   (φ8)

Heat-resistant Robotic Cable
2,5,10,20m
3P-HRT

Accessory sunk key

14
5
0
-0.03

5
0
-0.03
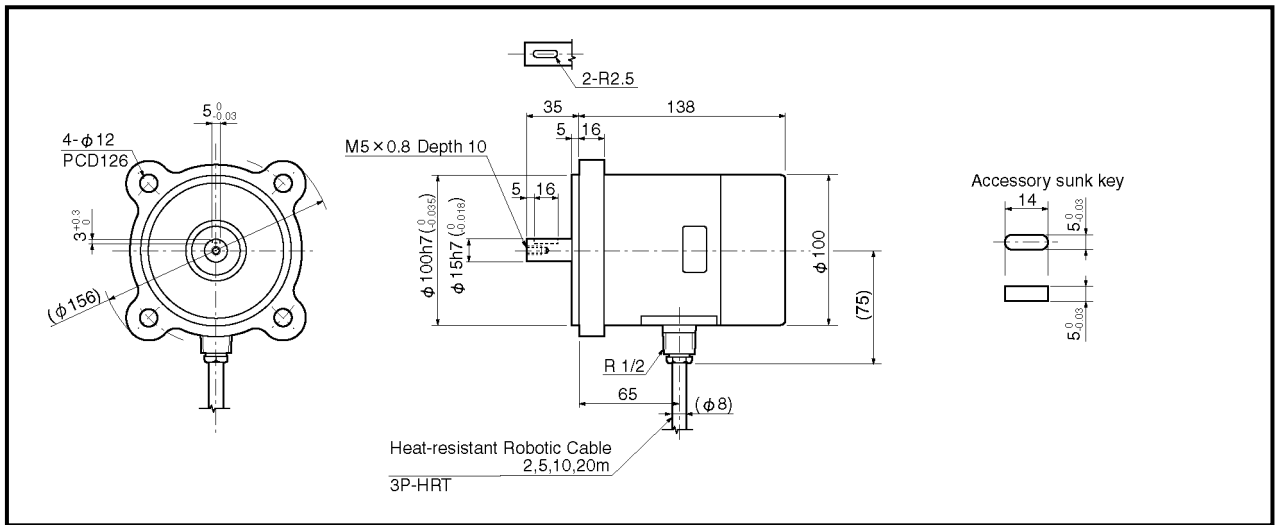
● VRE-P101LK[ ]   (Base-mount type)   Units: mm

Heat-resistant Robotic Cable
2,5,10,20m
3P-HRT

2-R2.5

5
0
-0.03

(75)

30   143
70

5   16   19.5

φ15h7 (0, -0.018)

φ50

φ100

3 +0.3, 0

113
63
0
-0.5

13

(φ8)
R 1/2

M5×0.8 Depth 10

56
120
140

4-φ12

40   60
5.5   90

Accessory sunk key

14
5
0
-0.03

5
0
-0.03

16
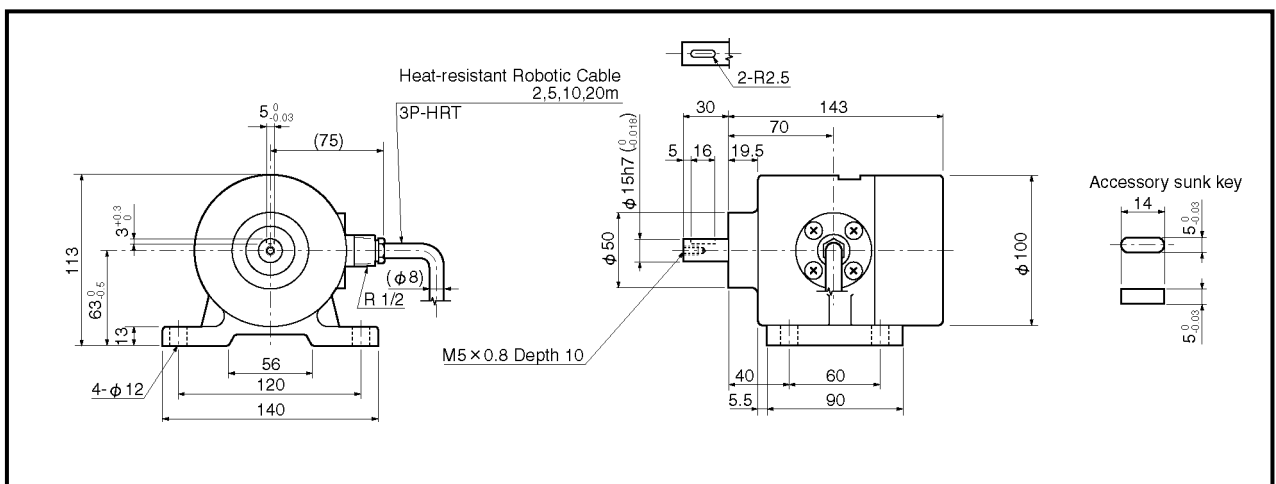
4-3. Extension Sensor Cable Dimensions

● 4P-S/RBT/URT-0144-[L]   Units: mm

R04-PB9M8.0A   NJW-2012-AdF8

φ16 φ11   φ8   M22×1 φ26

(42)   L   (60)

NOTE: [L] is given in terms of meter.
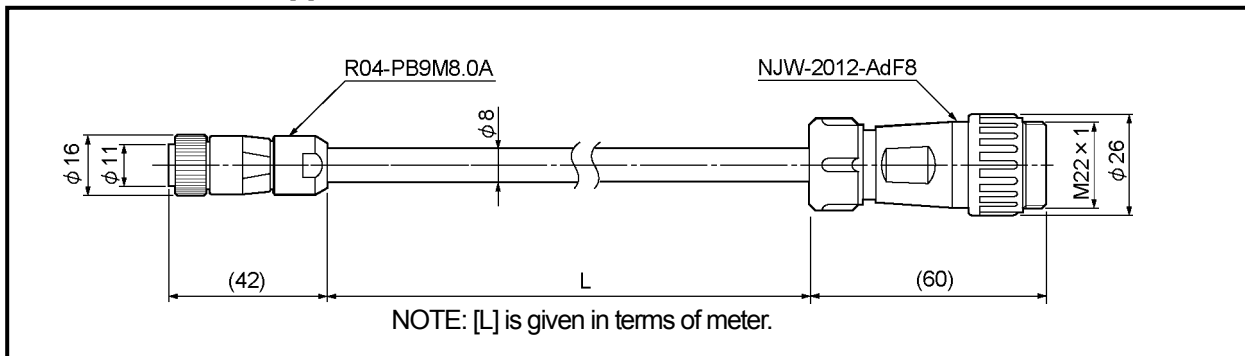
● 4P-S/RBT/URT/HRT-4344-[L]   Units: mm

NJW-2012-PM8   NJW-2012-AdF8

φ26 φ16   φ8   M22×1 φ26

(60)   L   (60)

NOTE: [L] is given in terms of meter.
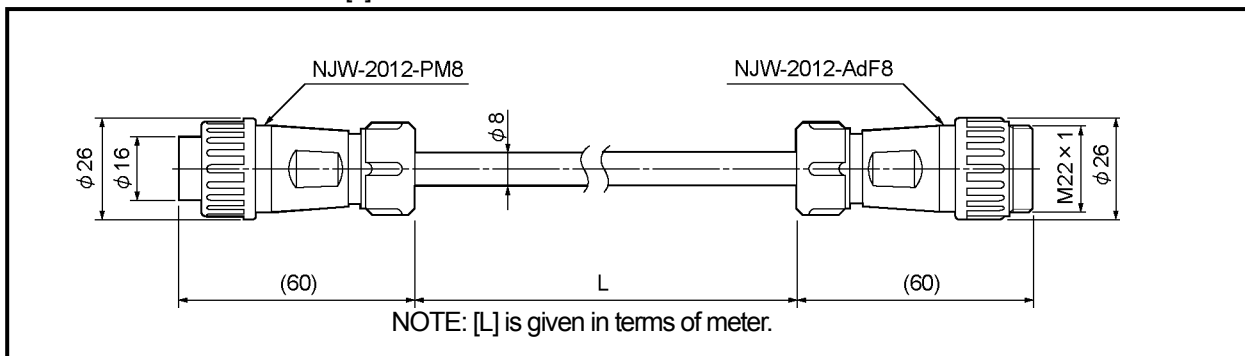
● 4P-S/RBT/URT-0155-[L]   Units: mm

R04-PB9M8.0A   NWPC-4012-P12

φ16 φ11   φ8   φ35 φ47

(42)   L   (94)

NOTE: [L] is given in terms of meter.
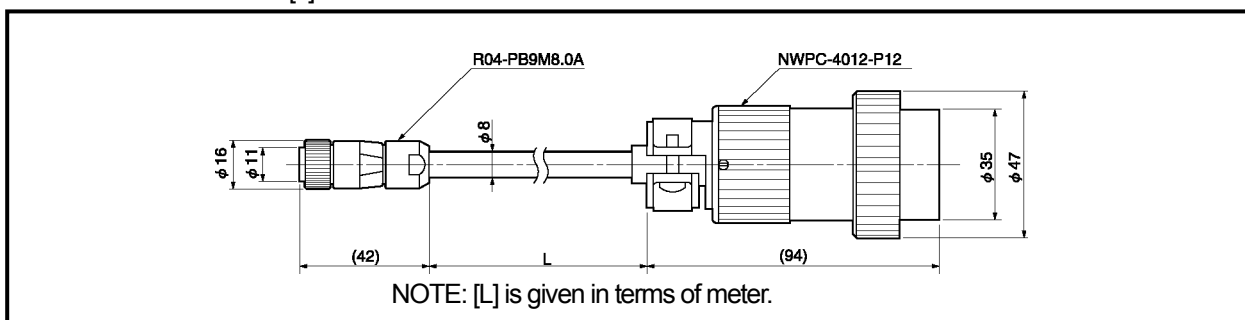
● 4P-S/RBT/URT-0190-[L]   Units: mm

Terminals (JIS C 2805)   R1.25-4
Insulation tubes
(Signal names printed on)
R04-PB9M8.0A   (30)

φ16 φ11   φ8

(10)

(42)   L   (200)

NOTE: [L] is given in terms of meter.

17
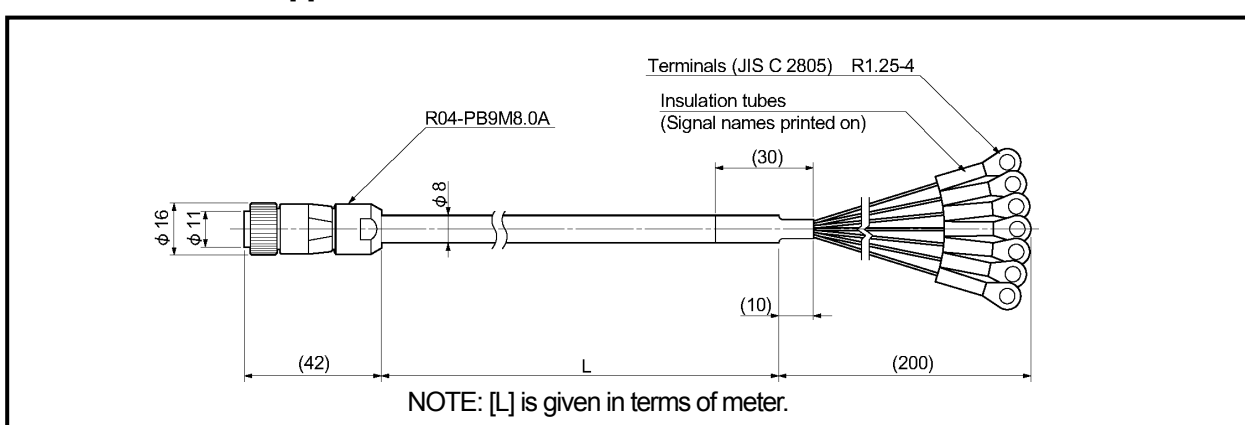
5. INSTALLATION

5-1. Converter Installation Conditions and Precautions

When installing the converter, the following conditions and precautions should be observed.

-Installation Site

(1) Avoid sites where the unit is exposed to direct sunlight.

(2) The ambient temperature should never exceed a 0 to 55°C range.

(3) The ambient humidity should never exceed a 20 to 95% RH range.

(4) Do not install the unit in areas where condensation is likely to
occur (high humidity with extreme temperature changes).

(5) Avoid sites where dust is excessive.

(6) Do not install in areas with an excessive amount of salt and/or metal chips.

(7) Do not install in areas where flammable and / or corrosive gases are present.

(8) Avoid areas where splashing water, oil or chemicals are likely to occur.

(9) Avoid areas where vibration and shocks are excessive.

-Installation cautions

(1) Install inside the control cabinet.

(2) Install in a vertical direction so that the characters are visible.

(3) If a DIN rail mounting format is used, insert until the latch mechanism catches with an audible click.
Secure between end plates at both sides.

(4) In high vibration areas, secure tightly with 2 M4 screws.

(5) Install as far from high voltage lines and power lines as possible in order to minimize noise influences.

(6) Allow 85mm or more space at the converter's front side for plugging in and unplugging the connector.

(7) Peripheral components should be arranged so as not to obstruct converter installation, removal, and
connector plugging/unplugging.

(8) Space out 10mm or more betweeen the converter and peripheral components in order not to obstruct the
converter's heat dissipation.

85mm or more

Other Products   NCV-220HFE   Other Products

10mmor more   10mmor more
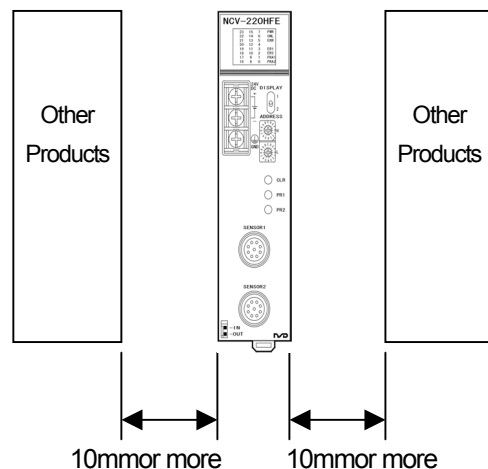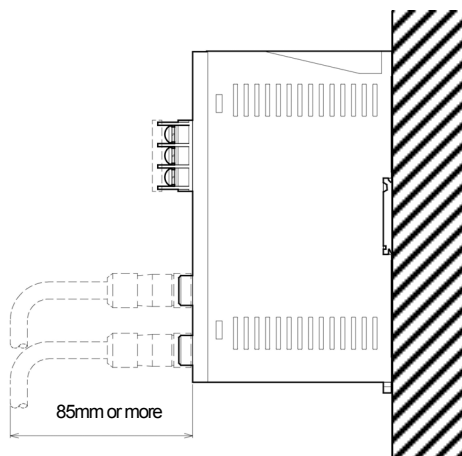
5-2. ABSOCODER Sensor Installation Conditions and Precautions

The ABSOCODER installation procedures and precautions are described in this section.
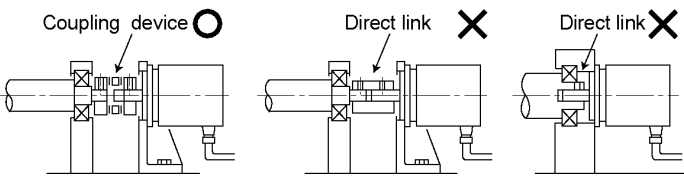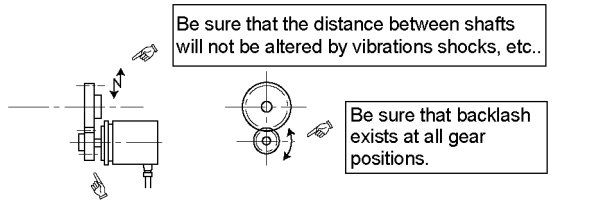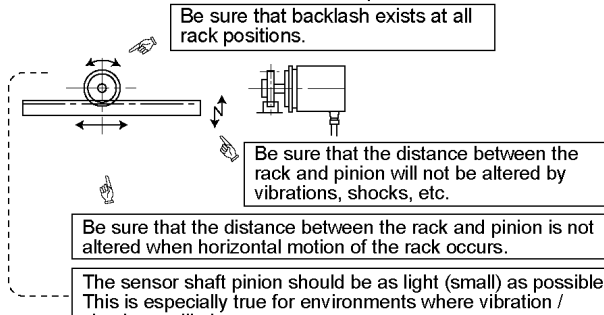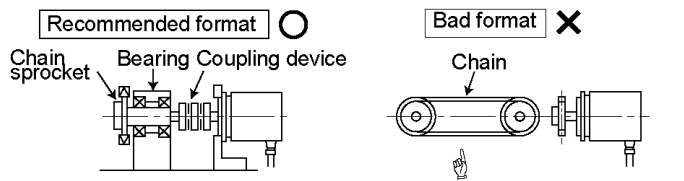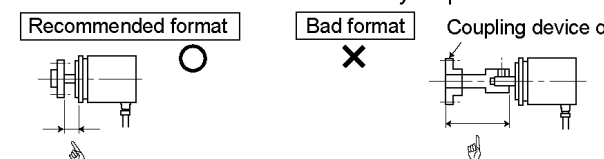
● Handling of Turn-type ABSOCODER Sensor

Item	Explanation
(1) Main unit	Never drop the Sensor, or subject it to excessive forces or shocks.
(2) Cable	Avoid stepping on, or applying excessive stress to the cable.

● Mounting of Turn-type ABSOCODER Sensor

Item	Explanation	Precaution
(1) Mounting	For details regarding mounting dimensions, refer to each ABSOCODER dimensions.	
(2) Cable port	Cable port should face downward. R40 mm or more. R40 mm or more. Cable port should face downward. Use a cable clamp, etc., to secure the cable.	
(3) Cable	The bend radius for movable parts should never be less than 75 mm(ϕ150) (robotic cable). R75 or more	Do not use the standard cable for movable parts. (Use robotic cable.)
(4) Wiring	The sensor cable should be located at least 300mm away from power lines and other lines which generate a high level of electrical noise. 300mm or more	

● Mounting of Turn-type ABSOCODER Sensor

Item	Explanation	Precaution
(1) Coupling of machine shaft and sensor shaft	Be sure to use a coupling device to link the 2 shafts. Coupling device ○　　Direct link ✗　　Direct link ✗	A "direct-link" format will result in shaft fatigue and / or breakage after long periods. Therefore, be sure to use a coupling device to link the shafts.
(2) For gear-type linkage	If a gear linkage is used, be sure that some backlash exists. Be sure that the distance between shafts will not be altered by vibrations shocks, etc.. Be sure that backlash exists at all gear positions. The sensor shaft pinion should be as light (small) as possible. This is especially true for environments where vibration / shock are likely.	Incorrect gear mounting can result in shaft bending or breakage.
(3) For rack and pinion type linkage	Be sure that backlash exists at all rack positions. Be sure that backlash exists at all rack positions. Be sure that the distance between the rack and pinion will not be altered by vibrations, shocks, etc. Be sure that the distance between the rack and pinion is not altered when horizontal motion of the rack occurs. The sensor shaft pinion should be as light (small) as possible. This is especially true for environments where vibration / shocks are likely.	Incorrect rack and pinion mounting can result in shaft bending or breakage.
(4) Chain or timing belt linkage	When a chain or timing belt linkage format is used, there is an inherent risk of the shaft's load being increased by the resulting tension. Therefore, a bearing should be used, with the shafts being linked by a coupling device immediately behind the bearing. Recommended format ○　　Bad format ✗ Chain sprocket　Bearing Coupling device　　Chain This linkage format is also applicable to the "rack-and-pinion" and "gear" methods shown above.　Even a small amount of tension can produce a considerable load on the shaft.	
(5) Shaft mounting position	The shaft should be attached to the coupling device or gear at a point which is as near to the sensor body as possible. Recommended format ○　　Bad format ✗　　Coupling device or This distance should be as short as possible. When this distance is short, the load placed on the beaning by vibrations / shocks is slight.　Never use an extended shaft format.	

● **Coupling of Turn-type ABSOCODER Sensor**

Item	Explanation	Precaution
(1) Coupling device selection precaution	1. When selecting a coupling, consider factors such as the design mounting error, the coupling tolerance error, and the sensor's permissible shaft load. $\boxed{\text{Mounting error}} < \boxed{\text{Coupling tolerance error}} \qquad \boxed{\text{Coupling shaft permissible load}} < \boxed{\text{Sensor shaft load}}$ 	The selection of a larger coupling than necessary will increase the shaft load which is caused by the mounting error amount. Excessive force applied to the shaft can deform the coupling and reduce durability.
	2. If the selected coupling device is larger than necessary (When used in high vibration/shock environments), the load which is applied to the shaft by the vibrations/shocks will be increased by the weight of the coupling device.	
	3. Be sure to select a coupling device with an adequate transmission torque surplus relative to the sensor shaft's torque.	
(2) Coupling device installation precaution	Avoid bending or damaging the coupling. 	

6. WIRING

6-1. Connection between Converter and ABSOCODER Sensor

The maximum extension sensor cable length varies according to the ABSOCODER sensor and cable model being used. For more details refer to "3-2. ABSOCODER Sensor Specifications".

-Wiring Precautions

(1) The sensor cable should be clamped as shown in the right figure to prevent excessive tension from being applied to the cable connectors.

(2) The sensor cable should be located at least 300mm away from power lines and other lines which generate a high level of electrical noise.

(3) If the cable is moved under the state of bending like a horseshoe, a robotic cable should be used. The bend radius should never be less than 75 mm.

6-1-1. Connection configure example of the sensor cable

● **In the case of using the NSD special cable**

Converter   Extension sensor cable   ABSOCODER sensor

NCV-220HFE

4P-S/RBT/URT-0144-[L]

[01]   [44]

4P-S/RBT/URT-0144-[L]   4P-S/RBT/URT/HRT-4344-[L]

[01]   [44]   [43]   [44]

● **In the case of using the commercially available cable (JKPEV-S 1.25mm^2 × 5P) and connecting with crimping terminals**

Converter

NCV−220HFE

NSD special cable

4P-S/RBT/URT-0190-[L]

[01]   [90]

Crimping
terminal
(R1.25-4)

Please install the crimping
terminals by customers

JKPEV-S Cable cross section

Commercially available cable

JKPEV-S(1.25mm^2 ×5P)

Crimping terminal
(R1.25-4)

ABSOCODER sensor

Crimping terminal
(R1.25-4)

NSD special cable
Wire color

Wire color	Signal names
Brown	SIN＋
Red	SIN−
Orange	−COS＋
Yellow	−COS−
Green	OUT1＋
Blue	OUT1−
Violet	−
Gray	−
−	−
−	−
Shield	Shield

JKPEV-S cable
Wire No. and wire color

Wire No.(pair)	Wire color	Signal names
1	White	SIN＋
	Black	SIN−
2	White	−COS＋
	Black	−COS−
3	White	OUT1＋
	Black	OUT1−
4 (Not used)	White	−
	Black	−
5 (Not used)	White	−
	Black	−
	Shield	Shield

ABSOCODER sensor
Wire color

Wire color	Signal names
Brown	SIN＋
Red	SIN−
Orange	−COS＋
Yellow	−COS−
Green	OUT1＋
Blue	OUT1−
−	−
−	−
−	−
−	−
Shield	Shield

Cautions for the connection by the crimping terminal

1: The wire No. of JKPEV-S cable is printed on the surface of the white wire.

2: Unused wires of JKPEV-S cable should be severed at both ends.

3: Twist the signal wire for preventing noises.

  Combinations of the twist are following:

  SIN+ and SIN−, −COS+ and −COS−, OUT1+ and OUT1−

4: The shield wire shouldn't be grounded.

● **In the case of using the commercially available cable (JKPEV-S 1.25mm^2×5P) and connecting with a connector**

Converter

NCV-220HFE

NSD special cable
4P-S/RBT/URT-0155-[L]
[01]　[55]

Please install the connector
by customers

JKPEV-S Cable cross section

Commercially available cable
JKPEV-S(1.25mm^2×5P)

NWPC-4012-Ad14
[27]

NWPC-4012-P14
[26]

ABSOCODER sensor

NWPC-4012-Ad12

NSD special cable
Connector pin No.
and wire color

Pin No.	Wire color	Signal names
1	Brown	SIN＋
2	Red	SIN－
3	Orange	－COS＋
4	Yellow	－COS－
5	Green	OUT1＋
6	Blue	OUT1－
7	Violet	－
8	Gray	－
9	－	－
10	－	－
11	Shield	Shield
12	－	－

JKPEV-S cable
Connector pin No. and wire color

Pin No.	Wire No. (pair)	Wire color	Signal names
1	1	White	SIN＋
2		Black	SIN－
3	2	White	－COS＋
4		Black	－COS－
5	3	White	OUT1＋
6		Black	OUT1－
7	4	White	－
8	(Not used)	Black	－
9	5	White	－
10	(Not used)	Black	－
11		Shield	Shield
12	－	－	－

ABSOCODER sensor
Connector pin No.
and wire color

Pin No.	Wire color	Signal names
1	Brown	SIN＋
2	Red	SIN－
3	Orange	－COS＋
4	Yellow	－COS－
5	Green	OUT1＋
6	Blue	OUT1－
7	－	－
8	－	－
9	－	－
10	－	－
11	Shield	Shield
12	－	－

Cautions for the connection by the connector

1: The wire No. of JKPEV-S cable is printed on the surface of the white wire.

2: Unused wires of JKPEV-S cable should be severed at both ends.

25

6-2. Power Supply Connection

The power supply should be connected as described below:

● **Power Supply**

- Choose the power supply capacity which is more than
  twice the power consumption of the converter.
  The power consumption of the converter is 7W or less.

-The input power supply should be isolated from the
 commercial power supply.

- The power cable should be as thick as possible to
  minimize voltage drops.

-Twist the power cable for preventing noises.

-Use the M4 size crimp lug terminals with insulating sleeves
 in order to prevent short circuit caused by loose screws.

-The terminal block tightening torque is 1.8 N·m (16 lb·in).
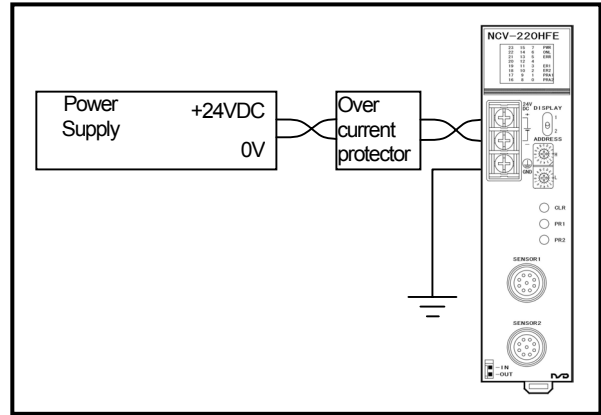
●**Ground**

-The unit should be securely grounded (ground resistance of 100ohm or less) to prevent electrical shocks.

-The ground wire should be connected to the ground terminal directly.

-The terminal block tightening torque is 1.8 N·m (16 lb·in).
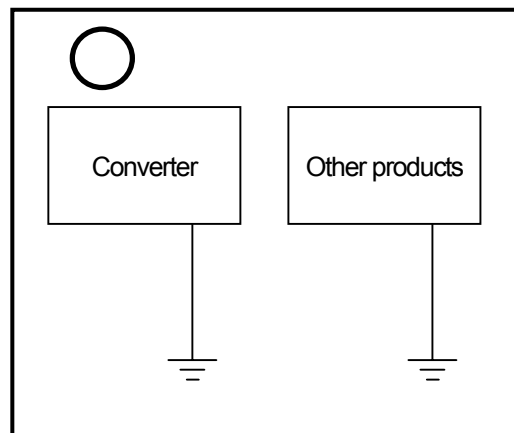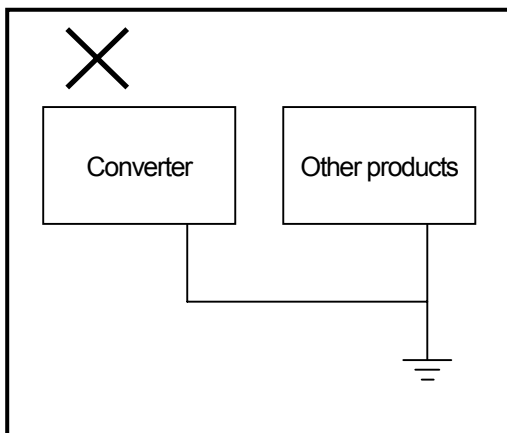
6-3. Connection of the Programmable Controller

A connection of the converter and programmable controller or modules (I/O or etc...) manufactured by Fuji Electric Co., Ltd. is described in this section.

Uses the E-XS bus cable for the connection between the converter and the programmable controller or modules (I/O or etc...).

● Between the converter and the programmable controller should be connected by either method in the below.
  - IN side of the converter should be connected to OUT side of the programmable controller.
  - OUT side of the converter should be connected to IN side of the programmable controller.

● Between the converter and modules (I/O or etc...) should be connected by either method in the below.
  - IN side of the converter should be connected to OUT side of the module.
  - OUT side of the converter should be connected to IN side of the module.

Connection example

Bottom of the converter

Programmable controller "MICREX-SX Series"
Manufacturer: Fuji Electric Co., Ltd.

E-SX bus cable
Manufacturer: Fuji Electric Co., Ltd.

OUT side

IN side

OUT side

E-SX bus cable
Manufacturer: Fuji Electric Co., Ltd.

IN side

OUT side

Converter, I/O module manufactured by Fuji Electric Co., Ltd., or device which is compatible with E-SX bus communication

7. NOMENCLATURE

7-1. Part Identification

Front face

(1) Monitor LEDs

NCV-220HFE

23	15	7	PWR
22	14	6	ONL
21	13	5	ERR
20	12	4	
19	11	3	ER1
18	10	2	ER2
17	9	1	PRA1
16	8	0	PRA2

(7) Parameter switch

Rear face

ON

(2) Axis display
selection switch

24V DC DISPLAY

Power terminal block
(M4 screw)

ADDRESS

H

GND

L

(3) E-SX bus address
setting switch

(4) Error clear button

CLR

PR1

(5) Axis-1 current position
setting command button

PR2

(6) Axis-2 current position
setting command button

SENSOR1

Axis-1 sensor connector

SENSOR2

Axis-2 sensor connector

—IN
—OUT

MD

Bottom face

IN side
E-SX bus connector

OUT side
E-SX bus connector

7-2. Function and Name of Display and Setting Area

(1) Monitor LED

Name	Description
PWR	LED turns ON when the power supply is normal status.
ONL	LED turns ON when the E-SX bus operates normal or the E-XS bus has a nonfatal fault. *1 LED blinks during initializing the E-SX bus".
ERR	LED turns ON when the E-SX bus has an error. *1
ER1	LED turns ON when the axis-1 sensor is disconnected. *1
ER2	LED turns ON when the axis-2 sensor is disconnected. *1
PRA1	This is a monitor of the current position setting command answerback signal for the axis-1. LED turns ON during the current position setting for the axis-1. LED turns ON when the current position setting command button for the axis-1 is pressed on the panel or the current position setting command for the axis-1 in the output data is "1".
PRA2	This is a monitor of the current position setting command answerback signal for the axis-2. LED turns ON during the current position setting for the axis-2. LED turns ON when the current position setting command button for the axis-2 is pressed on the panel or the current position setting command for the axis-2 in the output data is "1".
0 to12	Indicates a position data in a binary code. The axis-1 position data is displayed when the axis display selection switch is "1". The axis-2 position data is displayed when the axis display selection switch is "2".
13 to 23	OFF

*1: The converter status can be checked by the lighting status of ONL, ERR, ER1, and ER2.
For more details, refer to "9-2-1. Check the error status".

(2) Axis display selection switch (DISPLAY)
Selects the position data which is displayed on the monitor LED on the panel.
- The axis-1 current position data is displayed on monitor LED when the switch is "1".
- The axis-2 current position data is displayed on monitor LED when the switch is "2".

(3) E-SX bus address setting switch (ADDRESS)

Designates the address of the E-SX bus.

The switch value when the power supply is turned ON is set as the address of the E-SX bus.

The operation isn't influenced even though the address is changed during the operation.

Setting	Description
00 h	The value is valid as the address of the E-SX bus. The converter address is set as the same value which is set at E-SX bus station number in the system configuration definition of the programming support tool manufactured by Fuji Electric Co., Ltd..
01 h to EE h	The value is valid as the address of the E-SX bus. The value should be the same value as the E-SX bus station number in the system configuration definition of the programming support tool manufactured by Fuji Electric Co., Ltd..
EF h to FF h	The value is invalid as the address of the E-SX bus. An error occurs in the system configuration.

(4) Error clear button (CLR)

An error of the converter is cleared by pressing the button after removing a cause of the error.

(5) The axis-1 current position setting command button (PR1)

The position data for the axis-1 is set as the axis-1 current position setting value when pressing this button.

The current position setting should be enabled by the parameter switch on the rear face in advance when using this button.

For more details, refer to "8-4. Current Position Setting Operation".

(6) The axis-2 current position setting command button (PR2)

The current position data for the axis-2 is set as the 2-axis current position setting value when pressing this button.

The current position setting should be enabled by the parameter switch on the rear face in advance when using this button.

For more details, refer to "8-4. Current Position Setting Operation".

(7) Parameter Switch (rear face of the converter)

The switch status is set as the parameter when the power supply turns ON.

The operation isn't influenced even though the switch setting is changed during the operation.

SW No	Parameter Name	Switch setting	Description	Factory setting
1	Axis-1 (enabled / disabled)	ON : disabled OFF : enabled	When this switch is set to the ON position, error will not occur even if the axis-1 sensor is not connected. The axis-1 position data and the axis-1 status of the input data are "0" when turning ON.	OFF
2	Axis-1 position data increase direction	ON : CCW OFF : CW	Specify the direction in which the axis-1 position data should increase. *1	OFF
3	Reserved	Fixed at OFF	Keep this switch in the OFF position. The correct operation cannot be guaranteed if this switch is set to the ON position.	OFF
4	Current position setting	ON : enabled OFF: disabled	The current position setting function is enabled when the setting is ON. The position data of no current position setting (raw sensor data) is stored when the setting is OFF.	ON
5	Axis-2 (enabled / disabled)	ON : disabled OFF : enabled	When this switch is set to the ON position, error will not occur even if the axis-2 sensor is not connected. The axis-2 position data and the axis-2 status of the input data are "0" when turning ON.	OFF
6	Axis-2 position data increase direction	ON : CCW OFF: CW	Specify the direction in which the axis-2 position data should increase. *1	OFF
7	Reserved	Fixed at OFF	Keep this switch in the OFF position. The correct operation cannot be guaranteed if this switch is set to the ON position.	OFF
8	Reserved	Fixed at OFF	Keep this switch in the OFF position. The correct operation cannot be guaranteed if this switch is set to the ON position.	OFF

*1: The position data increases or decreases according to the ABSOCODER sensor's shaft rotative direction.

Switch setting	Position data transition
OFF: CW direction The position data value will increase when the shaft turns in the clockwise direction as viewed from the shaft end.	
ON :CCW direction The position data value will increase when the shaft turns in the counterclockwise direction as viewed from the shaft end.	
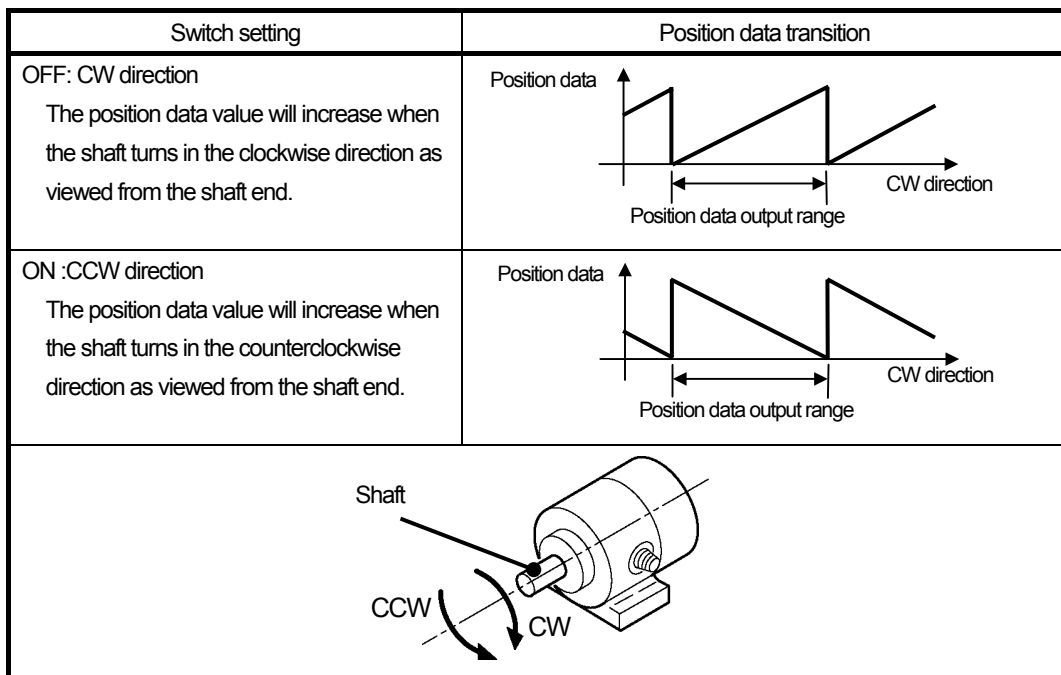
8. OPERATION

8-1. Operation Sequence

```
┌─────────────────────────────────────────────┐
│                    START                      │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Mounting the ABSOCODER sensor**            │  ・・・ For more details, refer to "5-2".
│ Mount the ABSOCODER sensor to the machine.   │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Parameter switch setting**                 │  ・・・For more details, refer to "7-2".
│ Set the parameter switch on the rear face of │
│ the converter.                               │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Setting the E-SX bus address setting switch** │  ・・・For more details, refer to "7-2".
│ Set the E-SX bus address setting switch on   │
│ the panel.                                   │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Mounting the converter**                   │  ・・・ For more details, refer to "5-1".
│ Mounting the converter on the control cabinet. │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Connecting ABSOCODER sensor to the converter** │  ・・・ For more details, refer to "6-1".
│ Connect ABSOCODER sensor to the converter.   │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Power supply connection**                  │  ・・・ For more details, refer to "6-2".
│ Connect the converter to the power supply.   │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Connection of the programmable controller** │  ・・・ For more details, refer to "6-3".
│ Connect the converter to the programmable    │
│ controller.                                  │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Setting the programmable controller**      │  ・・・ For more details, refer to "8-2".
│ Set the system configuration definition of   │
│ the programmable controller.                 │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Current position setting**                 │  ・・・ For more details, refer to "8-4".
│ Check the machine position and execute the   │
│ current position setting.                    │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Test run**                                 │  ・・・ For more details, refer to "8-3".
│ Check the operation and position data that   │
│ can be read out correctly.                   │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│ **Run (operation)**                          │
│                                              │
└─────────────────────────────────────────────┘
                       │
┌─────────────────────────────────────────────┐
│                    END                        │
└─────────────────────────────────────────────┘
```

8-2. Programmable Controller Setting

Set the programmable controller in order to communicate the converter and the programmable controller normally.

⚠ **Note**

The programming support tool manufactured by Fuji Electric Co., Ltd. is used to set the programming controller. Refer to the programming support tool manual for how to use the tool.

(1) Connect the programmable controller to the computer which is installed the programming support tool manufactured by the Fuji Electric Co., Ltd..

(2) Start the programming support tool, and display the screen which is set the system configuration definition.

(3) Select the E-SX bus connector connected with the converter from either "IN side terminal" or "OUT side terminal".

(4) Display the screen which for adding a module.

(5) Check the box to "I/O terminal", and select type of the converter from the outline specification.

(6) Input the value that is set the E-SX bus address setting switch of the converter to "E-XS bus station number" .

(7) Download the system configuration definition to the programmable controller.

8-3. Input/output Data of the E-SX bus

The programmable controller can read the data which is memorized in the converter by reading the input data of the E-SX bus. Moreover, it is able to control the converter by writing the data to the output data.

Data	Description	Numbers of the occupation word
Input data	The programmable controller reads the data from the converter.	6 words
Output data	The programmable controller writes the data to the converter.	6 words

8-3-1. Input data (converter to programmable controller)

Add-ress	Input data *1	Bit															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0W	Axis-1 position data (Low)	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0 LSB
1W	Axis-1 position data (High)	A31 MSB	A30	A29	A28	A27	A26	A25	A24	A23	A22	A21	A20	A19	A18	A17	A16
2W	Axis-2 position data (Low)	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
3W	Axis-2 position data (High)	B31 MSB	B30	B29	B28	B27	B26	B25	B24	B23	B22	B21	B20	B19	B18	B17	B16
4W	Status	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
5W	Switch/button monitor	M15	M14	M13	M12	M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0

*1: Reading is enabled, but writing is prohibited.

● Axis-1 position data   Low / High
   Axis-1 position data is stored in binary codes. Data size is 13-bit.

● Axis-2 position data   Low / High
   Axis-2 position data is stored in binary codes. Data size is 13-bit.

> ⚠ **Note**
>
> The position data is unstable when an error occurs.
> Check the ready signal of the input data is set "1" when reading the position data.

● Status

Bit	Signal name	Data	Description
S0	Axis-1 current position setting command answerback	1: Current position setting command 0: No current position setting command	This is the answerback signal of the current position setting command. The status is "1" when the current position setting command of the output data is "1" or the current position setting command button on the panel is "ON".
S1	Axis-2 current position setting command answerback		
S2	Axis-1 sensor disconnected error	1: Error (disconnected) 0: Normal	The status is "1" when corresponding axis of the sensor is not connected. *1
S3	Axis-2 sensor disconnected error		
S4	Memory error	1: Error 0: Normal	The status is "1" when the memory for the data storage has an error. *1
S5	Internal power supply error	1: Error 0: Normal	The status is "1" when the power supply for the sensor has an error. *1
S6	Reserved	0: Fixed	Reserved
S7	Reserved		
S8	Axis-1 ready	1: Normal 0: Error	The status is "1" when the position data of corresponding axis is normal.
S9	Axis-2 ready		
S10	Axis-1 current position setting enabled	1: Current position setting is enabled. 0:Current position setting is disabled.	The status is "1" when the current position setting of corresponding axis can be enabled.
S11	Axis-2 current position setting enabled		
S12	Axis-1 position data increase	1: Position data is increasing. 0: Position data is stopping or decreasing.	The status is "1" when the position data of corresponding axis is increasing. The position data is evaluated as "increasing" when the position data increases more than 3-bit in 0.1 second. *2
S13	Axis-2 position data increase		
S14	Axis-1 position data decrease	1: Position data is decreasing 0: Position data is stopping or increasing	The status is "1" when the position data of corresponding axis is decreasing. The position data is evaluated as "decreasing" when the position data decreases more than 3-bit in 0.1 second. *2
S15	Axis-2 position data decrease		

*1: Refer to "9-2-1. Check the error status" for the details of the error status.

*2: The evaluation speed during the position data is increasing or decreasing is 0.22 r/min.

● Switch / button monitor

Bit	Signal name	Data	Description
M0	Axis-1 (enabled / disabled)	1: ON 0: OFF	The status of the parameter switch located on the rear face of the converter is monitored. For more details of the parameter switch, refer to "7-2. Function and Name of Display and Setting Area".
M1	Axis-1 position data increase direction		
M2	Reserved		
M3	Current position setting		
M4	Axis-2 (enabled / disable)		
M5	Axis-2 position data increase direction		
M6	Reserved		
M7	Reserved		
M8	Error clear (CLR)	1: ON (hold down) 0: OFF	The status of the button located on the converter panel is monitored. For more details of the button, refer to "7-2. Function and Name of Display and Setting Area".
M9	Axis-1 current position setting command (PR1)		
M10	Axis-2 current position setting command (PR2)		
M11	Reserved	0: Fixed	Reserved
M12	Reserved		
M13	Reserved		
M14	Reserved		
M15	Reserved		

8-3-2. Output data (programmable controller to converter)

Add-ress	Output data *1	Bit															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0W	Axis-1 current position setting value (Low)	G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0 LSB
1W	Axis-1 current position setting value (High)	G31 MSB	G30	G29	G28	G27	G26	G25	G24	G23	G22	G21	G20	G19	G18	G17	G16
2W	Axis-2 current position setting value (Low)	H15	H14	H13	H12	H11	H10	H9	H8	H7	H6	H5	H4	H3	H2	H1	H0 LSB
3W	Axis-2 current position setting value (High)	H31 MSB	H30	H29	H28	H27	H26	H25	H24	H23	H22	H21	H20	H19	H18	H17	H16
4W	Command	C15	C14	C13	C12	C11	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1	C0
5W	Reserved	R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0

*1: Both reading and writing are enabled.

● Axis-1 current position setting value   Low / High
   Axis-1 current position setting value is stored in binary codes. Data size is 13-bit.

● Axis-2 current position setting value   Low / High
   Axis-2 current position setting value is stored in binary codes. Data size is 13-bit.

● Command

Bit	Signal name	Data	Description
C0	Axis-1 current position setting command	1: Enabled 0: Disable	The position data is changed to the current position setting value when this bit is set to "1" The position data will not change from the current position setting value while this bit is "1". The current position setting command is a level detection.
C1	Axis-2 current position setting command		
C2	Error clear	1: Enabled 0: Disable	After removing an error cause, the error is cleared when this bit is set to "1" This bit is the same between Axis-1 and Axis-2. The error clear is a level detection.
C3 to C15	Reserved	0: Fixed	Reserved Set this bit to "0".

● Reserved
   Set this bit to "0".

8-4. Current Position Setting Operation

The current position data can be changed to a value which is corresponding to the machine position by executing the current position setting procedure.
The current position setting should be done when the power supply is turned ON for the first time after purchasing.
The setting isn't needed when restarting the power supply.

⚠ **Note**

> The position data of no current position setting (raw sensor data) is read when the power supply is turned ON for the first time after purchasing.

● Procedures of the current position setting

The current position setting is executed by following procedures below.

(1) Check the current position setting enabled of the input data is set to "1".
   Check the following if it is set to "0".
     - Check the current position setting of the parameter switch. If it is turned OFF, turn it ON.
     - If an error occurs, clear the error.

(2) Set the current position setting value of the output data that represents the current machine position.

⚠ **Note**

> The current position setting value of the output data should be written into the converter from the programmable controller each time when executing the current position setting.

(3) The current position setting is executed by one of the following operations.
     - Press the current position setting command button (PR1" and/or "PR2) on the converter panel.
     - Set the current position setting command of the output data to "1".

(4) Check that the position data is changed to the current position setting value.

(5) If the current position setting command of the output data is set to "1" in the procedure (3), restore the value to "0".

⚠ **Note**

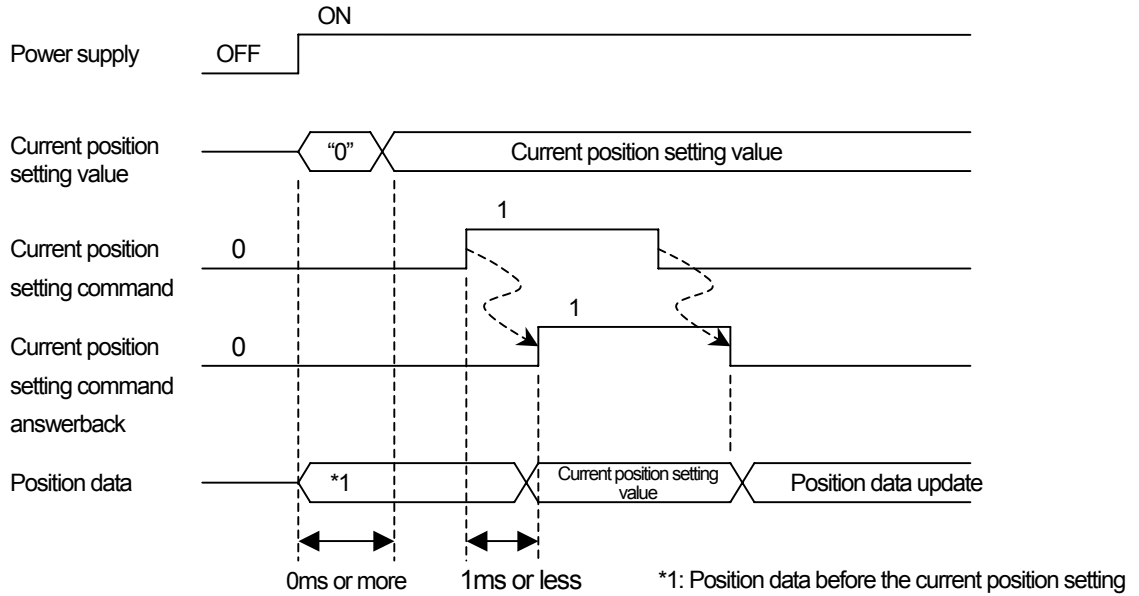> The current position setting command wouldn't be accepted if the error isn't removed.
>
> The position data isn't changed from the current position setting value in the following cases.
>   - In the case of keeping being pressed the "current position setting command button" on the panel
>   - In the case of being not restoring the current position setting command of the output data from "1" to "0"

● Timing chart of the current position setting

The chart below indicates the current position setting timing.

Power supply	OFF	ON
Current position setting value		"0" Current position setting value
Current position setting command	0	1
Current position setting command answerback	0	1
Position data		*1 Current position setting value Position data update

0ms or more　　1ms or less　　*1: Position data before the current position setting

8-5. Error Clear Operation

Errors can be cleared by performing the following actions after resolving the error cause:
- Press the error clear button (CLR) on the converter panel.
- Set the error clear bit of the output data to "1"
- Restart the converter

⚠ **Note**

The error wouldn't be cleared if an error cause isn't removed.

9. MAINTENANCE AND INSPECTIONS

9-1. Inspection

The inspection should be conducted once every 6 months to a year.
Any inspected items which do not satisfy the criteria shown below should be repaired.

Inspection item	Inspection Description	Criteria	Remark
Power supply	Measure the voltage fluctuation at the power supply terminal block to determine if it is within the prescribed range.	Within 21.6V to 26.4VDC range	Tester
Ambient Conditions	Check the ambient temperature.	ABSOCODER sensor VRE-P061: −20 to +80°C VRE-P074: −20 to +120°C VRE-P097: −20 to +120°C VRE-P101: −20 to +120°C Converter: 0 to ＋55°C	Thermometer
	There should be no accumulation of dust.	None	
Mount Conditions	Verify that the sensor is securely mounted.	There should be no looseness.	Visual Inspection
	Verify that the sensor shaft is securely coupled to the machine shaft.	There should be no looseness.	
	Check for severed cables.	Cable should appear normal.	
	Verify that the sensor cable connector is plugged in all the way.	There should be no looseness.	
	Verify that the connector of E-SX bus cable is plugged in all the way.	There should be no looseness.	

9-2. Trouble Shooting

The error status can be checked by the LED status of the monitor LED on the panel. In addition, the error status can also be checked by reading the status of the input data from the programmable controller. The system RAS can be displayed at the failure diagnosis if the programmable controller is connected to the computer which has been installed the programming support tool manufactured by the Fuji Electric Co., Ltd.. The error can be checked by the system RAS.

Take the proper measures after checking the error status. For the proper measures of the error, refer to "9-2-2. Measures for each error".

9-2-1. Check the error status

● E-SX bus error

E-SX bus status can be checked by the monitor LED status on the panel.

Error status	Failure diagnosis	Monitor LED					
	Converter status	PWR	ONL	ERR	ER1	ER2	0 to 23
Initializing E-SX bus	Normally running	ON	Blinks	OFF	OFF	OFF	OFF
E-SX bus fatal fault ①	Fatal fault	ON	ON	OFF			
E-SX bus fatal fault ②	Fatal fault	ON	Blinks *1	OFF	Indetermination		
E-SX bus nonfatal fault ①	Nonfatal fault	ON	OFF	OFF			
E-SX bus nonfatal fault ②	Nonfatal fault	ON	ON	ON			

*1: If "ONL" of the monitor LED doesn't change from "blinking" to "ON" (after several seconds), the error status will be "E-SX bus fatal fault ②".

● Converter error

The converter operation status can be checked by the monitor LED on the panel or programmable controller when the E-SX bus operates normally.

Error status	Status		Failure diagnosis		Monitor LED					
	Bit	Data	System RAS	Converter status	PWR	ONL	ERR	ER1	ER2	0 to 23
Normal operation	―	―	0x80	Normally running	ON	ON	OFF	OFF	OFF	Position Data
Axis-1 sensor disconnected error	S2	1: Error 0: Normal	0xDE	Nonfatal fault	ON	ON	ON	ON	OFF	OFF
Axis-2 sensor disconnected error	S3	1: Error 0: Normal	0xDE	Nonfatal fault	ON	ON	ON	OFF	ON	OFF
Memory error	S4	1: Error 0: Normal	0x5C	Fatal fault	ON	OFF	ON	Blinks twice	Blinks twice	OFF
Internal power supply error	S5	1: Error 0: Normal	0x50	Fatal fault	ON	OFF	ON	ON	ON	OFF
Watchdog timer error	―	―	0x5F	Fatal fault	ON	OFF	ON	OFF	OFF	OFF
Power supply error (Low power supply)	―	―	0xD0	Nonfatal fault	ON	ON	ON	Blinks once	Blinks once	OFF
Power supply error (Power supply OFF)	―	―	0xD0	Nonfatal fault	OFF	OFF	OFF	OFF	OFF	OFF

9-2-2. Measures for each error

● E-SX bus error

Error status	Probable cause	Measure
E-SX bus fatal fault ①	The setting of the E-SX bus address setting switch isn't proper.	Set the E-SX bus address setting switch the same value as E-SX bus station number which was set by the programming support tool manufactured by the Fuji Electric Co., Ltd., and then restart the power supply for the converter.
E-SX bus fatal fault ②	The power supply of the programmable controller was turned ON, and then the programmable controller detected an error. After that, the power supply of the controller was turned ON.	Clear the communication error. *1
E-SX bus nonfatal fault ①	The E-SX bus cable is disconnected.	Clear the communication error after removing an error cause. *1
	The E-SX bus cable is severed.	Replace the E-SX bus cable.
E-SX bus nonfatal fault ②	The E-SX bus cable is disconnected.	Clear the communication error after removing an error cause. *1

*1: A communication error can be cleared by the following procedures.
- Restart the power supply for the programmable controller.
- Reset the programmable controller by the programming support tool manufactured by the Fuji Electric Co., Ltd..

● Converter error

| Error status	Probable cause	Measure
Axis-1 sensor disconnected error Axis-2 sensor disconnected error	Sensor connector is disconnected or loose.	Conduct the communication error clear operation after removing an error cause.*2
	Terminal part of the sensor cable is loose.	
	Sensor cable is severed.	Replace the sensor cable.
	ABSOCODER sensor failure	Replace the ABSOCODER sensor.
	Converter failure	Replace the converter.
Memory error	Converter failure	Replace the converter.
Internal power supply error	Converter failure	Replace the converter.
Watch dog timer error	Converter failure	Replace the converter.
Power supply error (Low power supply)	The voltage which is supplied to the converter is low.	Replace the power supply.
Power supply error (Power supply OFF)	The voltage which is supplied to the converter is low.	Replace the power supply.
	Converter failure	Replace the converter.

*2: Errors can be cleared by performing the following actions after resolving the error cause:
- Press the Error clear button (CLR) on the converter panel.
- The error clear of the output data should be set to "1".
- Restart the converter

10. ABSOCODER SENSOR CHECK LIST

● **Applicable ABSOCODER sensor models**

VRE-P061, VRE-P074, VRE-P097, VRE-P101

● **Connection configuration**

● **Connector appearance and pin position**
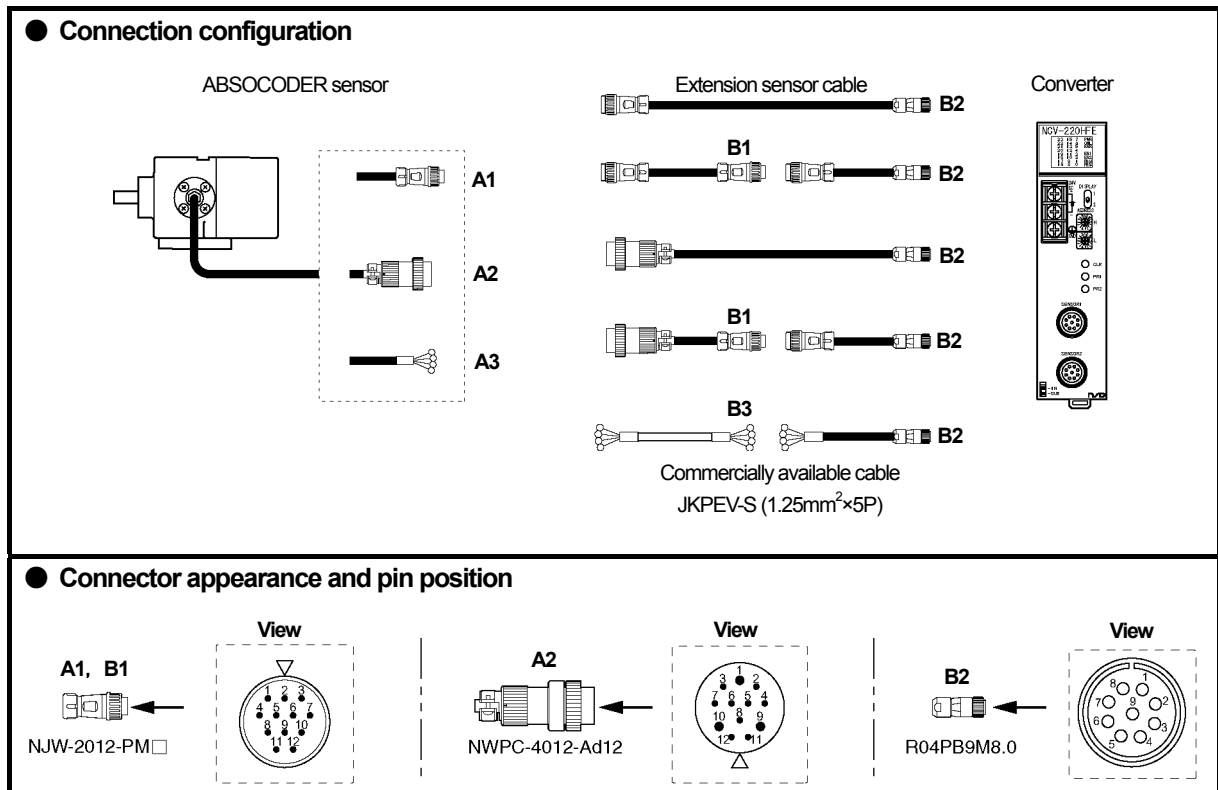
● **Connector pin position and standard coil resistance ranges (at 25°C)**

Check position						Signal names	Standard coil resistance [Ω]	
A1, A2, A3, B1		B2		B3			VRE-P061	VRE-P074 VRE-P097 VRE-P101
Pin No.	Wiring color	Pin No.	Wiring color	Wire No. (pair)	Wiring color			
1	Brown	1	Brown	1	White	SIN＋	219 to 229	227 to 243
2	Red	2	Red		Black	SIN－		
3	Orange	3	Orange	2	White	－COS＋	219 to 229	227 to 243
4	Yellow	4	Yellow		Black	－COS－		
5	Green	5	Green	3	White	OUT1＋	3.5 to 5.5	28.5 to 40.5
6	Blue	6	Blue		Black	OUT1－		
7	—	7	Violet	4	White	—		
8	—	8	Gray		Black	—		
9	—	—	—	5	White	—		
10	—	—	—		Black	—		
11	Shield	9	Shield	—	Shield	Shield		
12	—	—	—	—	—	—		

The above standard coil resistance ranges are referential data to assist wiring disconnection diagnosis and are not product specification values. There may be no wiring disconnection even when the resistance measurement is out of the standard resistance range.

● **Continuity check**

[Measurement method]

Measure resistance at Point A or B using a circuit tester or other appropriate device.

Have Point A connected to measure Point B.

If the connector is off, identify the line by the wiring color.

[Check details]

Refer to the previous page for the connector pin number.

Check position	Criterion	Check position	Criterion
Between brown and red	The measured value	Between brown and orange, green, shield	
Between orange and yellow	should be in the range of	Between orange and green, shield	∞
Between green and blue	the standard coil resistance.	Between green and, shield	
	*1	Between frame and each wire or shield	

*1: If a check is done at Point B, the measurement value will be [Standard coil resistance + extension sensor cable resistance].

Extension sensor cable resistance value

The resistance value of the NSD special cable is 0.2Ω/m (loop resistance).

The resistance value of the JKPEV-S cable is 0.034Ω/m (loop resistance).

Consider resistance variations due to temperature, which, relative to the standard temperature (25°C), increases 0.4% when the temperature rises 1°C and decreases 0.4% when the temperature falls 1°C.

● **Insulation check**

[Measurement method]

Measure using a 500 VDC insulation tester.

[Check details]

Refer to the previous page for the connector pin number.

Check position	Criterion
Between brown and orange, green, shield	
Between orange and green, shield	10MΩ or more
Between green and, shield	
Between frame and each wire or shield	

⚠ **Note**

1. Make sure to disconnect the ABSOCODER sensor from the NCV-220 before carrying out insulation checks.
2. If there is a risk that energization may cause damages to the electronic circuits in and around the machine, remove the ABSOCODER sensor from the machine.
3. After completing the checks, short-circuit between the pins to discharge remaining voltage before connecting the ABSOCODER sensor to the NCV-220.