NSD

Toshiba Corporation

Unified Controller

nv Series

ABSOCODER CONVERTER for TC-net I/O

AB935N

Specifications and Instruction Manual

Applicable sensor

VLS-8SM

CE KC

CONTENTS

CONTENTS

INTRODUCTION

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.

RELATED MANUALS

AB935N is a module intended to be used with TC-net I/O.

You should read the following manuals related to the Toshiba Corporation Unified Controller nv Series together with this manual.

- Controller Unit Instruction Manual (6F8C1220)
- Functional Manual (6F8C1221)
- High-speed Serial I/O System TC-net I/O Instruction Manual (6F8C1240)

COPYRIGHT

The Unified Controller nv Series is a registered trademark of Toshiba Corporation.

Other companies' and products' names are the trademark or registered trademark of each company.

GENERAL SAFETY RULES

● Application Limitation

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

This product is designed to be used under the industrial environments categorized in Class A device. The supplier and user may be required to take appropriate measures.

● 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.

1. Handling Precautions

⚠ DANGER	
🚫	- Do not touch components inside of the module; 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 modules; otherwise, it may cause electric shock. - Provide an external safety circuit so that the entire system functions safely even when the module is faulty. - Connect the grounding terminal of the module; otherwise, it may cause electric shock or malfunction.

⚠ CAUTION	
🚫	- Do not use the module 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 module may become faulty.
❗	- Be sure to use the module 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, module and sensor cable; otherwise, it may cause fire or module malfunction.

2. Storage

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

3. Transport

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

4. Installation

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

5. Wiring

	⚠ DANGER
❗	- Be sure to secure the terminal block firmly; otherwise, it will cause fire. - Be sure to mount the terminal cover provided with the module, 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 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 module'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
❗	- Be sure to check that the power supply specifications are correct; otherwise, it may cause module 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 module before mounting an ABSOCODER sensor to the machine; otherwise, it may cause injury. - When an error occurs, 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 module or the ABSOCODER sensor 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
ZEF004781000	20, Nov., 2009	1st Edition Japanese document: ZEF004780600
ZEF004781001	8, Jan., 2010	2nd Edition Japanese document: ZEF004780601
ZEF004781002	27, Jul., 2010	3rd Edition Japanese document: ZEF004780602
ZEF004781003	12, May., 2011	4th Edition Japanese document: ZEF004780603
ZEF004781004	5, Oct., 2011	5th Edition Japanese document: ZEF004780604
ZEF004781005	19, Dec., 2012	5th Edition Japanese document: ZEF004780605
ZEF004781006	5, Jun., 2013	6th Edition Japanese document: ZEF004780606
ZEF004781007	2, Feb., 2015	7th Edition Japanese document: ZEF004780607
ZEF004781008	15, Mar., 2016	8th Edition Japanese document: ZEF004780608

1. OVERVIEW

1-1. Overview

The AB935N module is an ABSOCODER converter for the TC-net I/O System of the Toshiba Corporation Unified Controller nv Series. Combine the module with a linear type ABSOCODER sensor (VLS-8SM) to have the detected position data converted into binary codes.

1-2. Features

The AB935N module has the following features:

(1) ABSOCODER sensors can be connected to two axes
One module can perform position detection for two axes. This contributes to space saving inside the control cabinet.

(2) 200 μ s high-speed response
Position detection will be run every 200 μ s regardless of the PLC scan time and the TC-net I/O updating timing.

(3) Origin setting function
Any required machine position can be registered as the origin, by using the "Origin setting" switch on the panel or with an external-input origin setting signal.

(4) Error detection function
When an error occurs, the monitor LED on the module panel will indicate error information.
In addition, status data input is provided so that error information can be retrieved into the host controller.

(5) Compliance with CE standards
The AB935N module complies with CE (EMC Directive) standards.

(6) Compliance with KC mark (Korea Certification Mark)
The AB935N module complies with KC mark. (It is only certified under the Radio Waves Act of South Korea.)
KC mark is the same directives as CE marking. For more details, refer to "APPENDIX 1. CE MARKING".

1. OVERVIEW

1-3. Terminology

(1) ABSOCODER

"ABSOCODER" is a generic name referring to the type of sensing device that detects rotational and linear displacement as well as speed and acceleration in an absolute format and outputs them digitally (or analogously). "ABSOCODER" comprises a detection unit that converts displacement into a variation in magnetic resistance and a conversion unit that inputs an alternating-current energization signal into the detection unit and then issues an absolute-format data according to the output signal returned from the detection unit. ABSOCODER sensors can be divided into two types, the rotary type that detects rotational position and the linear type that detects linear position. The module has a built-in conversion unit so as to be able to use an ABSOCODER sensor.

(2) Position Data "Increase Direction

The position data increases or decreases according to the ABSOCODER sensor's rod travel direction.
Use the "Position Data Increase Direction" parameter switch on the back of the module to change the direction in which the position data value increases.

CW:　The position data value will increase when a rod travels in the CW direction.
CCW: The position data value will increase when a rod travels in the CCW direction.
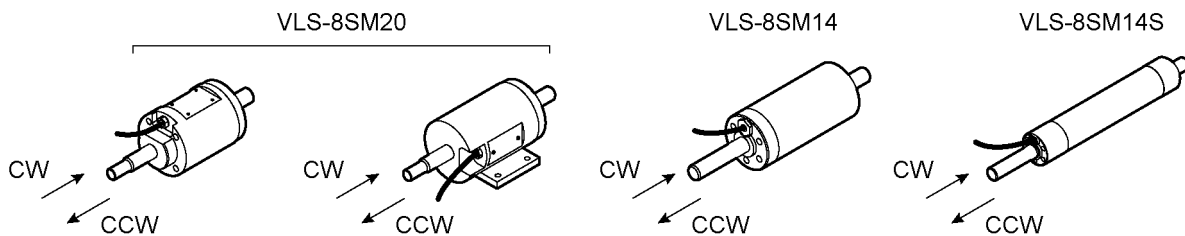
1. OVERVIEW

(3) Semi-absolute format

The AB935N module detects the machine position in a semi-absolute format.

In the semi-absolute format, "standard pitch" of the sensor rod is detected in absolute value. (Absolute detection range)

Furthermore, the pitch is counted by the software.

1 pitch	2 pitches	3 pitches
Absolute detection pitch (standard pitch)	Absolute detection pitch (standard pitch)	Absolute detection pitch (standard pitch)

Stroke
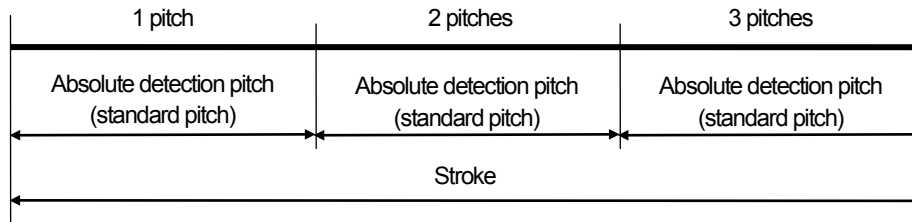
Absolute detection range (standard pitch) : 8.192 mm

(4) Position data

"Position data" refers to a value which indicates where within the detection range the machine is currently located.   The position data is expressed as a 24-bit binary code.

```
          Absolute detection pitch    Absolute detection pitch    Absolute detection pitch
                 = 8192                      = 8192                      = 8192
                 1 pitch                    2 pitches                   3 pitches
```

Position data = 0	8191	8192	16383	16384	24575	24576
(0H)	(1FFFH)	(2000H)	(3FFFH)	(4000H)	(5FFFH)	(6000H)

2. SYSTEM CONFIGURATION

2-1. System Configuration

The following chart shows the system configuration of the Toshiba Corporation Unified Controller nv Series with a AB935N module installed.

To use any other type of system configuration, contact NSD Corporation.

For details about TC-net I/O, refer to the High-speed Serial I/O System TC-net I/O Instruction Manual (Toshiba Corporation).

Figure 2.1 System Configuration

*1: SA911 can be replaced with SA912.   For more details, contact your NSD representative.

> ⚠ **NOTES**
>
> Use the general I/O base unit BU902 for the AB935N module.
>
> Do not use any other types of base units.

2. SYSTEM CONFIGURATION

2-2. Connection Configuration

The following figure indicates connecttion configuration of the AB935N module.

●**Connection configuration**
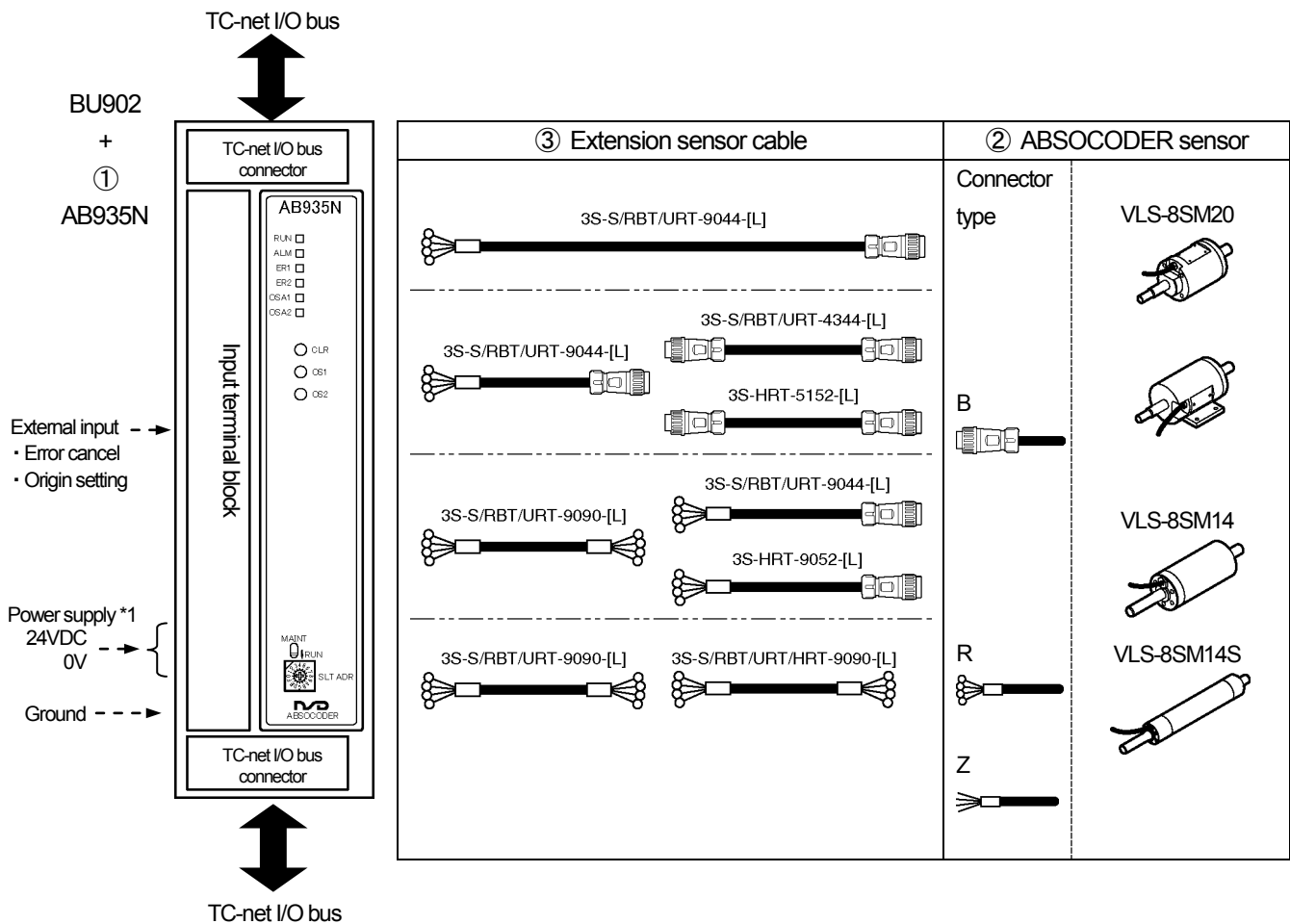
*1: The 24VDC power supply on the input terminal block is intended for both exrrernal inputs and sensors.
Be sure to provide 24VDC even if no external input is used.

2. SYSTEM CONFIGURATION

● **Model List**

◆ **Converter**

No.	Model	Description
①	AB935N	Position data 24bit binary code output A Toshiba base unit BU902 is required. It should be separately provided by the user.

◆ **linear type ABSOCODER sensor**

No.	Model	Description
②	VLS - 8 SM 20 - [1] F A [2] [L]	Flange-mount type
	VLS - 8 SM 20 - [1] L A [2] [L]	Base-mount type
	VLS - 8 SM 14 - [1] F B [2] [L]	Flange-mount type
	VLS - 8 SM 14S - [1] F B [2] [L]	Flange-mount type
	[1]: Stroke VLS-8SM20 : 50, 100, 150, 200, 250, 300, 350 VLS-8SM14(S) : 50, 100, 150, 200 [2]: Connector type B: Standard connector (NJW-2012PM8, manufacturer: Nanaboshi Electric Mfg.Co,Ltd.) Contact your NSD representative for VLS-8SM14 and VLS-8SM14S R: Crimping terminals (R1.25-4) Z: No connector [L]: Interconnecting sensor cable length (m): 2, 5,10, 20	

◆ **Extension sensor cable**

No.	Model	Description
③	3S-S-9044-[L]	Standard cable, standard connector
	3S-RBT-9044-[L]	Robotic cable, standard connector
	3S-URT-9044-[L]	Semi-heat-resistant robotic cable, standard connector
	3S-S-4344-[L]	Standard cable, standard connector
	3S-RBT-4344-[L]	Robotic cable, standard connector
	3S-URT-4344-[L]	Semi-heat-resistant robotic cable, standard connector
	3S-HRT-5152-[L]	Heat-resistant robotic cable, standard connector
	3S-S-9090-[L]	Standard cable, crimping terminal
	3S-RBT-9090-[L]	Robotic cable, crimping terminal
	3S-URT-9090-[L]	Semi-heat-resistant robotic cable, crimping terminal
	3S-HRT-9090-[L]	Heat-resistant robotic cable, crimping terminal
	3S-HRT-9052-[L]	Heat-resistant robotic cable, standard connector

2. SYSTEM CONFIGURATION

2-3. Internal Block Diagram

Shown below is the internal block diagram of an AB935N module.

Figure 2.2 Internal block diagram
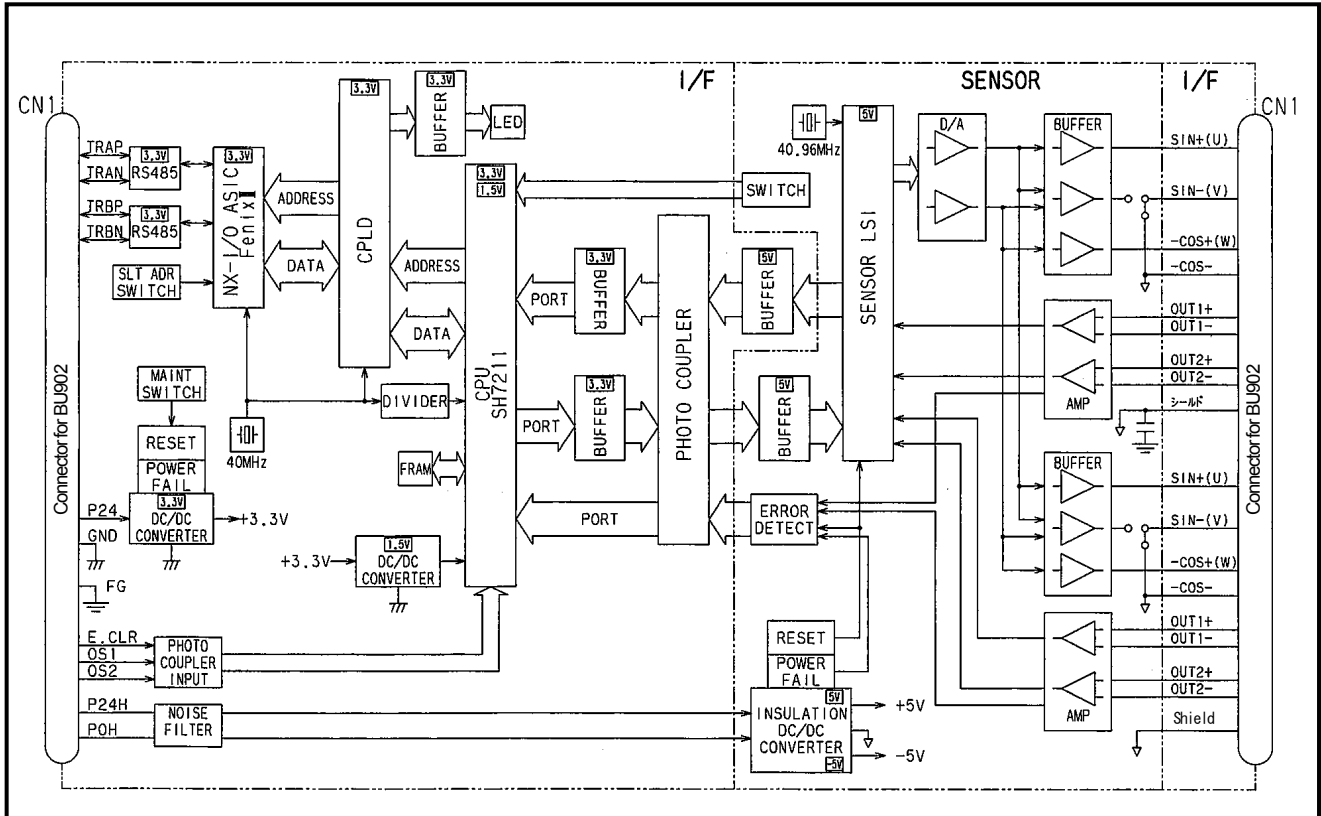
3. INSTALLATION CONDITIONS and PRECAUTIONS

Installation procedures and precautions for AB935N modules and ABSOCODER sensors are described.

For details about base unit installation, TC-net I/O bus cable connection and the startup and shutdown procedures, refer to the High-speed Serial I/O System TC-net I/O Instruction Manual (Toshiba Corporation).

3-1. AB935N Module Installation Conditions and Precautions

When installing AB935N modules, 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 10 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) Avoid dropping or making a major impact on the AB935N module.
(2) Do not remove the AB935N module's printed circuit board from the case.
(3) During cable connection, be careful not to allow cable debris or any other foreign objects to get inside the
     AB935N module.
(4) Install inside the control cabinet.
(5) In order to improve noise resistance, install as far away as possible from high-voltage and power cables.

3. INSTALLATION CONDITIONS and PRECAUTIONS

3-2. Installing the AB935N Module

This section explains about the installation of an AB935N module to the base unit (BU902).

●**Installation**
    (1) Hook the module to the slot on the bottom of the AB935N module in the lower part of the base unit, and rotate it to fit the connector.
    (2) Secure it to the base unit with the fixing screw on the top of the AB935N module.

Base unit
BU902

AB935N
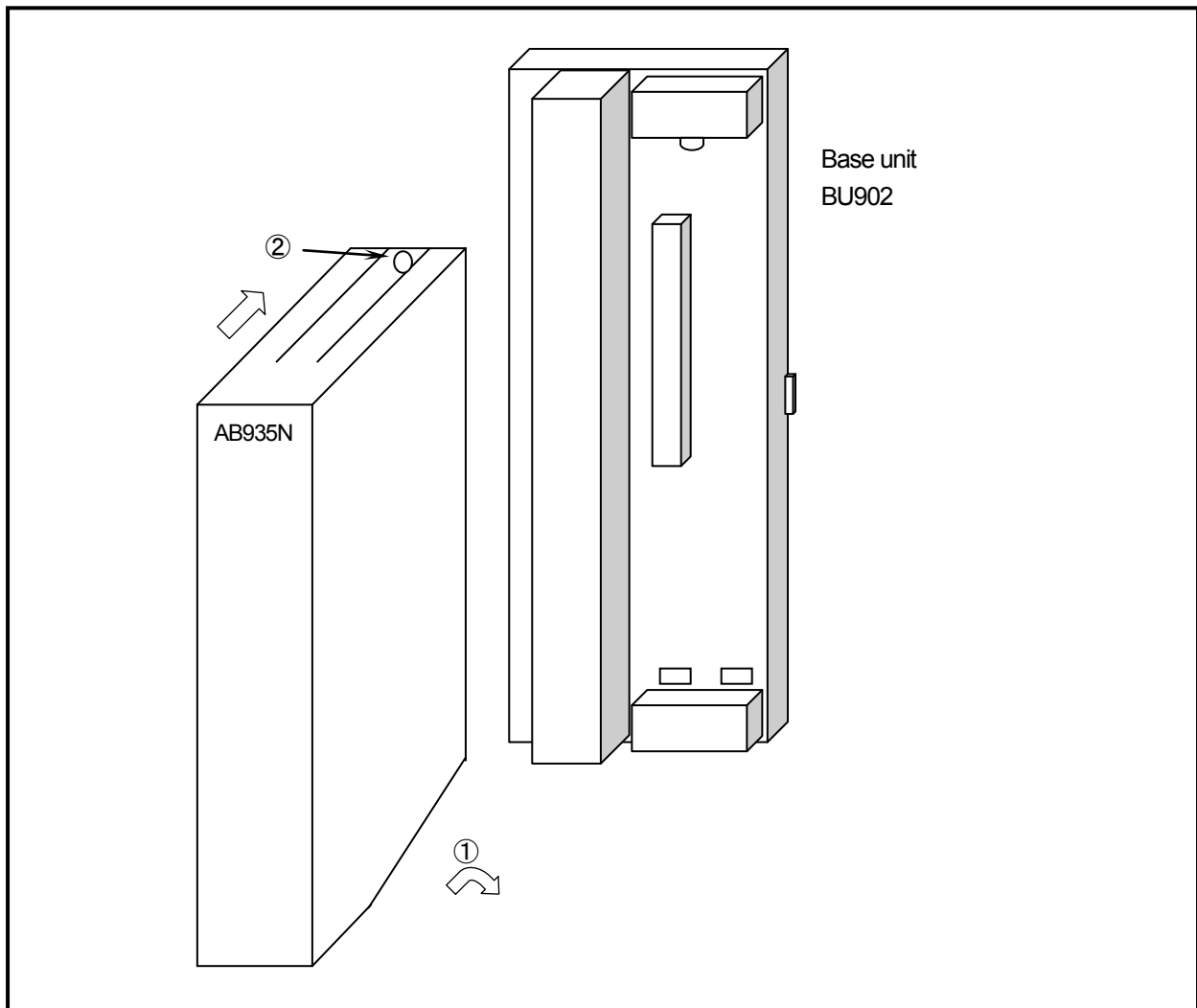
3. INSTALLATION CONDITIONS and PRECAUTIONS

3-3. ABSOCODER Sensor Installation Conditions and Precautions

The installation conditions and precautions for ABSOCODER sensor are described in this section.

(1) Do not apply excessive forces to the cable port, and avoid damaging the cable.
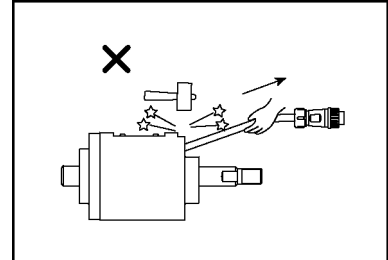
(2) The part of a machine mounted the sensor rod must travel in the same direction as the sensor rod extends and contracts.

Do not use a floating joint.
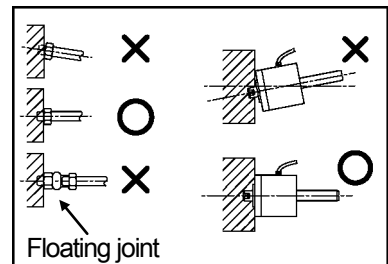
(3) When the cable port is exposed, a shielding plate should be installed as shown in the right figure.
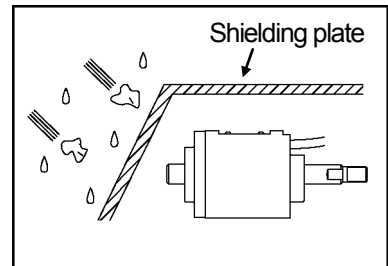
3. INSTALLATION CONDITIONS and PRECAUTIONS

3-4. Replacing the AB935N Module

This section provides precautions when replacing an AB935N module.

(1) AB935N modules can be replaced while the system is energized or not energized.
   When replacing them while the system is energized, set the maintenance switch to the up (MAINT) position for the AB935N module.
   When the maintenance switch is set to MAINT, the AB935N module stops communication. It is just like removing the AB935N module in terms of the signal.   Therefore, major failure occurs in the AB935N module.

(2) If the module parameter is set for "I/O node fallback is not operated", the controller will shut down as soon as the AB935N module's maintenance switch is set to the upper position ("MAINT"). To avoid this, set the parameter for "I/O node fallback is operated".

(3) Loosen the fixing screw on the top of the AB935N module, and rotate the module downward to pull it off.

(4) Upon replacement, note the following.
   - Make sure that the replaced AB935N module is the same model.
   - Make sure to use the same setting for the hexadecimal rotary switch (SLT ADR) and parameter switches on the back of the module as before replacement.
   - After installing the AB935N module, set the maintenance switch to the down (RUN) position.

(5) Make sure to carry out origin setting after replacing the AB935N module.
   Refer to 5-5 about the origin setting.

⚠ **NOTES**

Do not install a non-AB935N module to a base unit set up for AB935N.
Do not install an AB935N module to a base unit set up for a non-AB935N module.
The module and/or the sensors may become damaged or fail.

⚠ **NOTES**

Before touching the AB935N module or inserting or removing the transmission cable, wear a wrist strap and white cotton gloves.   Ground the wrist strap to remove static electricity.
Otherwise, it may cause damage or failure of the module.

⚠ **NOTES**

When placing the AB935N module during replacement, use a conductive mat.
Ground the conductive mat.
Otherwise, it may cause damage or failure of the AB935N module.

⚠ **NOTES**

When setting the maintenance switch to MAINT, specify "Fallback is operated" to prevent the controller from going down.
When the maintenance switch is set to MAINT, the AB935N module communication stops and major failure occurs.
The controller goes down if no fallback is specified.

4. EXTERNAL WIRING

The power supply, ABSOCODER sensors and the external input signals should be connected to the base unit (BU902).　Shown below is the BU902 terminal block configuration.

Terminal No.	Signal Names	Wire Color *1		Descriptions
1	U	Brown		
2	V	Red		
3	W	Orange		
4	—	—	Axis 1 sensor signal	Connect the Axis 1 ABSOCODER sensor.
5	OUT1＋	Green		
6	OUT1－	Blue		
7	OUT2＋	Violet　*2		
8	OUT2－	Gray　*2		
9	Shield	Shield		
10				
11				
12				
13				
14	NC			Do not connect anything.
15				
16				
17				
18				
19	U	Brown		
20	V	Red		
21	W	Orange		
22	—	—	Axis 2 sensor signal	Connect the Axis 2 ABSOCODER sensor.
23	OUT1＋	Green		
24	OUT1－	Blue		
25	OUT2＋	Violet　*2		
26	OUT2－	Gray　*2		
27	Shield	Shield		
28				
29	NC			Do not connect anything.
30				
31				
32	Error cancel		Input signal	This signal is used for error cancelling. Error status will be cancelled when the signal input comes on.
33	Axis 1 origin setting			This signal is used for origin setting. Axis 1 position data value will be set to "0" when the signal input comes on.
34	Axis 2 origin setting			This signal is used for origin setting. Axis 2 position data value will be set to "0" when the signal input comes on.
35	P24		Power supply	Connect the power for external inputs and the sensors.
36	Z24			

*1: A wire color indicates the color of the NSD extension sensor cable.

*2: Both violet and gray wire aren't used.

⚠ **NOTES**

The power supply (P24, Z24) is intended for both external inputs and the sensors.

Be sure to provide 24VDC even if no input signal is used.

⚠ **NOTES** | Observe the tightening torque.

If it is too loose, it may come off.　If the tightening torque is out of specified range, it may be broken off.

M3.5 screw : 0.8 to 1.2 N·m

4. EXTERNAL WIRING

4-1. ABSOCODER Sensor Connection

This section explains about ABSOCODER sensor connection.

4-1-1. Sensor Cable Wiring Precautions

●**Sensor cable length**
The length of the extendable cable has a limitation depending on the models of ABSOCODER sensor and sensor cable.　For more details, refer to "8-2. 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.	Cable clamp R40 or more R40 or more　Cable clamp
(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.	300mm or more
(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.	R75 or more

4. EXTERNAL WIRING

4-1-2. Connection Configure Example of the Sensor Cable

The following are examples of sensor cable connection.

● **Using connectors**

Terminal No. and wire color		
BU902 Terminal No.	Wire Color	Signal Names
1 [19]	Brown	U
2 [20]	Red	V
3 [21]	Orange	W
4 [22]	—	—
5 [23]	Green	OUT1＋
6 [24]	Blue	OUT1－
7 [25]	Violet *1	OUT2＋
8 [26]	Gray *1	OUT2－
9 [27]	Shield	Shield

Shown in [ ] are Axis 2 terminal numbers.

*1: Both violet and gray wire aren't used.
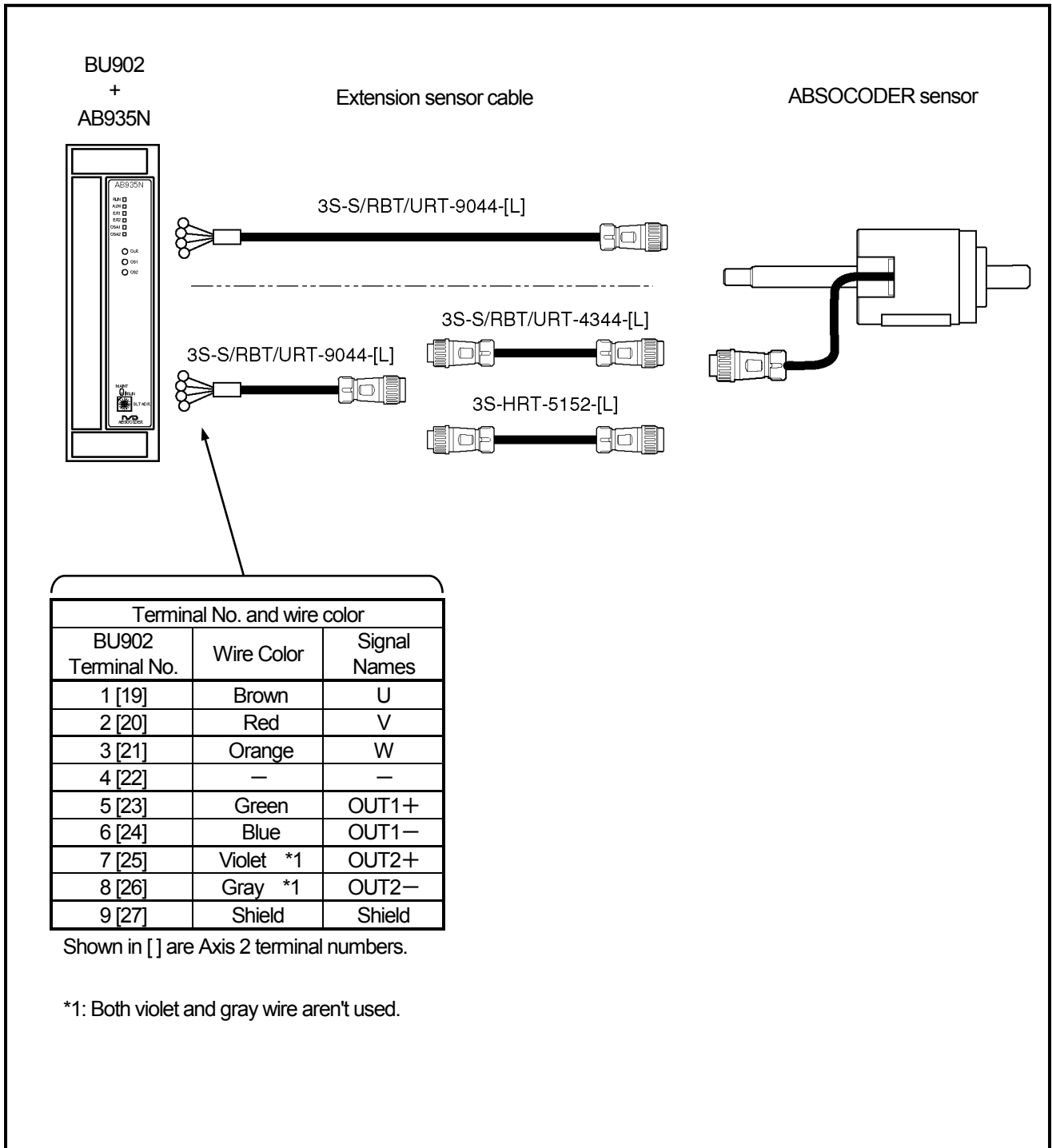
4. EXTERNAL WIRING

● **Using crimping terminals**

BU902
+
AB935N

Extension sensor cable

ABSOCODER sensor

AB935N

3S-S/RBT/URT-9090-[L]

Crimping terminal
(R1.25-4)

3S-S/RBT/URT/HRT-9090-[L]

Crimping terminal
(R1.25-4)

Crimping terminal
(R1.25-4)

BU902 Terminal No.	Wire color	Signal names
1 [19]	Brown	U
2 [20]	Red	V
3 [21]	Orange	W
4 [22]	—	—
5 [23]	Green	OUT1＋
6 [24]	Blue	OUT1－
7 [25]	Violet *1	OUT2＋
8 [26]	Gray *1	OUT2－
	—	—
	—	—
9 [27]	Shield	Shield

Wire color	Signal names
Brown	U
Red	V
Orange	W
—	—
Green	OUT1＋
Blue	OUT1－
Violet *1	OUT2＋
Gray *1	OUT2－
—	—
—	—
Shield	Shield

Wire color	Signal names
Brown	U
Red	V
Orange	W
—	—
Green	OUT＋
Blue	OUT－
—	—
—	—
—	—
—	—
Shield	Shield

Shown in [ ] are Axis 2 terminal numbers.

Cautions for the connection by the crimping terminal

1: Twist the signal wire for preventing noises.
   Combinations of the twist is following:
   U/V/W combination, and OUT1＋/ OUT1－ combination

2: The shield wire shouldn't be grounded.

*1: Both violet and gray wire aren't used.

15

4. EXTERNAL WIRING

4-2. Input Signal Wiring

For input signal wiring, make sure to use a cable sized in the range of 0.75 to 2 mm^2.

4-3. Power Supply Connection

Describes about the power supply connection.

(1) The power supply should be isolated from the commercial power supply.
(2) Choose the power supply capacity which is more than twice the power consumption.
(3) Avoid sharing the power supply with a magnet, solenoid or any other type of device that can potentially cause electrical noise.
(4) Twist the power cable for preventing noises.
(5) The power cable should be as thick as possible to minimize voltage drops.

5. FUNCTION

5-1. Function List

As shown in table 5.1, the AB935N module functions.

Table 5.1 Function List

Items	Descriptions
Position data detection function	The machine position will be detected using the ABSOCODER sensor.

Origin setting function	The position data value will be corrected to "0" upon any of the following actions:
	  - Turning the external-input "origin setting" signal ON.
	  - Pressing the "Origin setting" switch on the panel.
	  - Operating the control program to set the "origin setting command" output bit (OS) to "1".

5. FUNCTION

5-2. Operation Sequence

```
                    ┌─────────────────────────────┐
                    │           START             │
                    └─────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ Parameter switch setting                     │         ------- Refer to section 5-3-6
│                                              │
│  Set the parameter switches on the back of   │
│  the AB935N module.                          │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ Slot address setting                         │         ------- Refer to section 5-3-5
│                                              │
│  Set the slot address setting switch (SLT    │
│  ADR).                                        │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ Device installation                          │         ------- Refer to section 3
│                                              │
│  (1) Install the AB935N module to the base   │
│      unit BU902.                             │
│  (2) Install the ABSOCODER sensors to the    │
│      machine.                                │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ External wiring                              │         ------- Refer to section 4
│                                              │
│  Connect the ABSOCODER sensors, the 24VDC    │
│  power supply and the external input signals │
│  to the BU902 terminal block.                │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ Origin (position data) adjustment            │         ------- Refer to section 5-5
│  Carry out origin setting.                   │
│  The origin becomes unset at each power-on.  │
│  Be sure to complete origin setting after    │
│  turning the power-on.                       │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ Test run                                     │         ------- Refer to section 5-4-2
│  Verify operation.                           │
│  Check that position data input can be       │
│  retrieved.                                  │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
┌─────────────────────────────────────────────┐
│ Operation                                    │
│  Execute operation.                          │
└─────────────────────────────────────────────┘
                                  │
                                  ▼
                    ┌─────────────────────────────┐
                    │            END              │
                    └─────────────────────────────┘
```

5. FUNCTION

5-3. NOMENCLATURE

This section explains about the AB935N module component names and functions.

5-3-1. Component Names

Front of the panel

AB935N

Module state display LED
- RUN
- ALM
- ER1
- ER2
- OSA1
- OSA2

Function switch
- CLR
- OS1
- OS2

Back

Parameter switch

Maintenance switch

MAINT
RUN

Slot address setting switch

SLT ADR

NSD
ABSOCODER
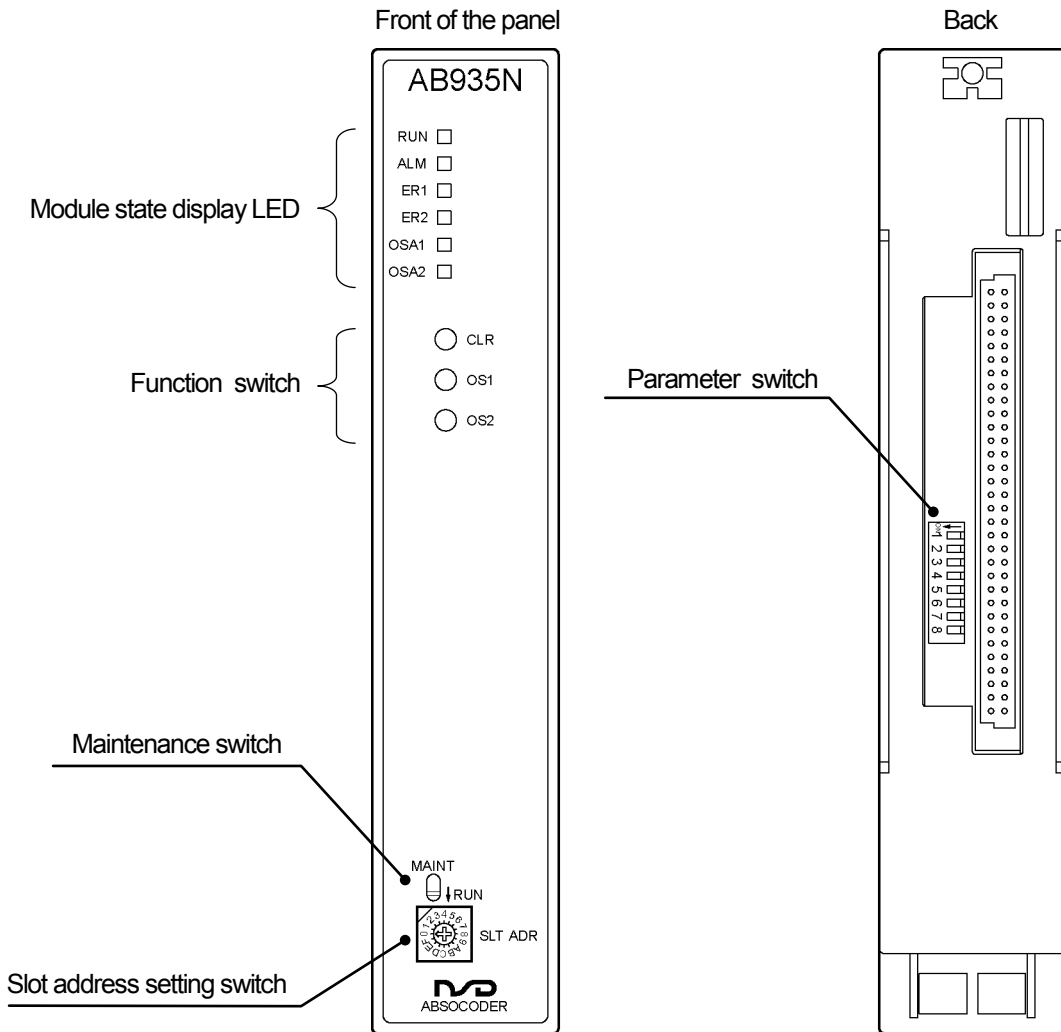
5. FUNCTION

5-3-2. Module State Display LED

Shown below is the list of LEDs provided on the AB935N module panel and the description of what each LED indicates.   Refer to 7-1 for the details of the errors indicated.

LED name		Description	
RUN	Normal	ON	: Module is normal or in maintenance (maintenance switch in the upper position)
		Blinking	: Waiting for setting
ALM	Alarm	ON	:Transmission error or in maintenance (maintenance switch in the upper position)
ER1	Axis 1 error	ON	: Axis 1 sensor disconnected error
		Slow blinking	: Sensor power supply error
		Fast blinking	: Axis 1 position data error or origin unset
		OFF	: Axis 1 normal
ER2	Axis 2 error	ON	: Axis 2 sensor disconnected error
		Slow blinking	: Sensor power supply error
		Fast blinking	:Axis 2 position data error or origin unset
		OFF	: Axis 2 normal
OSA1	Axis 1 origin setting answerback	ON	: During Axis 1 origin setting (The LED will remain on while the external input signal, the switch on the panel or the output bit is ON.)
OSA2	Axis 2 origin setting answerback	ON	: During Axis 2 origin setting (The LED will remain on while the external input signal, the switch on the panel or the output bit is ON.)

REMARKS

If ER1, ER2, OSA1 and OSA2 come ON all at the same time, it indicates that a CPU watch dog timer error has occurred.

5-3-3. Function Switch

This section explains about the function switches on the AB935N module panel.

Switch Name		Description
CLR	Error cancel	Pressing this switch will cancel the current AB935N module error.
OS1	Axis 1 origin setting	Pressing this switch will set the Axis 1 position data value to "0".
OS2	Axis 2 origin setting	Pressing this switch will set the Axis 2 position data value to "0".

Refer to 5-5 for origin setting timing.

5. FUNCTION

5-3-4. Maintenance Switch (MAINT)

This switch is used only when the module is inserted or removed online.

Insertion or removal is performed when the switch is set to the up (MAINT) position to separate the module from the system.

When insertion is complete, the switch is returned to the down (RUN) position for normal operation.

Attempting to insert or remove the module in the online status with the maintenance switch in the RUN position may result in erroneous data detection.

To avoid wrong operation, use a precision screwdriver to operate the maintenance switch that is behind the front panel.

5-3-5. Slot Address Setting Switch (SLT ADR)

A slot address for each I/O module is set to a different value.   Up to 16 units of I/O module can be connected to the same TC-net I/O bus using setting values from 0 to F.

The values of the slot address setting switches of the I/O module connected to the same TC-net I/O bus must be set to different values.   If the same setting value is used, it will not function normally.

5. FUNCTION

5-3-6. Parameter Switch (back of the panel)

This section explains about AB935N module parameter switches

SW No.	Parameter Name	Switch setting	Description
1	Axis 1 disabled	ON : Disabled OFF : Enabled	When this switch is set to the ON position, error will not occur even if Axis 1 sensor is not connected. *1
2	Axis 1 position data increase direction	ON : CCW direction OFF : CW direction	Specify the direction in which the Axis 1 position data should increase.
3	Reserved	Fixed at OFF	Keep this switch in the OFF position. Correct operation cannot be guaranteed if this switch is set to the ON position.
4	Reserved	Fixed at OFF	Keep this switch in the OFF position. Correct operation cannot be guaranteed if this switch is set to the ON position.
5	Axis 2 disabled	ON : Disabled OFF : Enabled	When this switch is set to the ON position, error will not occur even if Axis 2 sensor is not connected. *1
6	Axis 2 position data increase direction	ON : CCW direction OFF : CW direction	Specify the direction in which the Axis 2 position data should increase.
7	Reserved	Fixed at OFF	Keep this switch in the OFF position. Correct operation cannot be guaranteed if this switch is set to the ON position.
8	Reserved	Fixed at OFF	Keep this switch in the OFF position. Correct operation cannot be guaranteed if this switch is set to the ON position.

*1: When "Axis Disabled" (SW1, 5) is "ON: Disabled", both the position and the status inputs of the correspondent axis will be "0".

●**Factory setting**

In the factory setting, all the switches are prepared in the OFF position.

● **Position data increase direction setting (Switches No. 2 and No. 6)**

The position data increases or decreases according to the ABSOCODER sensor's rod travel direction.

Description	Position data transition
OFF: CW direction The position data value will increase when a rod travels in the CW direction.	Position data / CW direction / Position data output range
ON :CCW direction The position data value will increase when a rod travels in the CCW direction.	Position data / CW direction / Position data output range

VLS-8SM20   VLS-8SM14   VLS-8SM14S

5. FUNCTION

5-4. Input and Output Data

5-4-1. I/O Word List

Each of the input data and output data into the AB935N module are separately assigned to one of the I/O word numbers listed below.

I/O word No.	Input data (AB935N to PLC)	I/O word No.	Output data (PLC to AB935N)
0	Axis 1 position data lower	0	Reserved
1	Axis 1 position data higher, status	1	Axis 1 command
2	Axis 2 position data lower	2	Reserved
3	Axis 2 position data higher, status	3	Axis 2 command

REMARKS

When "Axis Disabled" (SW1, 5) of the parameter switch is "ON: Disabled", both the position and the status inputs of the correspondent axis will be "0".

5-4-2. Input Data

The absolute position data (0 to 8191: 8192 divisions) and the number of pitches detected by the ABSOCODER sensor will be stored in the 24-bit binary code format.   Error information will be stored in the Status bits.

Axis 1 data

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	No. of pitches			Absolute detection pitch												
	Position data															

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	/ER	PF	SE	DE	RDY	OSR	0	BOS	D23	D22	D21	D20	D19	D18	D17	D16
	Status							No. of pitches								
								Position data								

Axis 2 data

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	No. of pitches			Absolute detection pitch												
	Position data															

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3	/ER	PF	SE	DE	RDY	OSR	0	BOS	D23	D22	D21	D20	D19	D18	D17	D16
	Status							No. of pitches								
								Position data								

⚠ **NOTES**

When an error is present, the position data will become unstable. Before retrieving a position data, check that the RDY signal input is "1: Normal".

5. FUNCTION

●**Status**

The "Status" bits store error information,
Refer to 7-1 for the details of the errors indicated.

Bit	Signal Name (Status Name)	Indication	Description
8	BOS Origin unset	1: Unset 0: Set	The origin is unset. *1
9	Reserved	0: Fixed	
10	OSR Origin setting possible	1: Origin setting possible 0: Origin setting impossible	Origin setting can be performed.
11	RDY Position data normal	1: Normal 0: Error	The position data is normal. *2
12	DE Position data error	1: Error 0: Normal	Position data error has been caused by noise, impact etc.
13	SE Sensor disconnected error	1: Error 0: Normal	Sensor cable is not connected.
14	PF Sensor power supply error	1 : Error 0 : Normal	Sensor power has error.
15	/ER Error	1: Normal 0: Error	Error "DE", "SE" or "PF" has occurred.

*1: The origin will be unset in any of the following situations:
- Immediately after power-on
- When the maintenance switch has been switched from "MAINT" to "RUN"
- When an error is present

*2: When the origin is unset, the RDY bit will store "0" (Error).

Errors other than "Origin Unset" can be cancelled by one of the following actions:
- Pressing the function switch "CLR" on the module panel.
- Turning the external-input error cancelling signal ON.
- Setting the RES command output to "1".

To resolve an "Origin Unset" error, move the machine to the desired origin position (0 position) and set the origin by one of the following methods.
- Pressing the function switch "OS1" or "OS2" on the module panel.
- Turning the external-input origin setting signal ON.
- Setting the OS command output to "1".

5-4-3. Output Data

Axis 1 data

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	OS1	RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Axis 1 command													

Axis 2 data

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

I/O word No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3	OS2	RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Axis 2 command													

●**Command**

Commands can be used for origin setting or error cancelling.

Bit	Signal Name (Command Name)	Indication	Description
8 to 13	Reserved	0: Fixed	
14	RES Error cancel	1: Enabled 0: Disabled	Resolve the error cause and set this bit to "1" to change the "Status" error indicator (DE, SE or PF) to "Normal" (level detection). The error for both axes will be cancelled when Bit 14 (RES command) of either a Axis 1 or Axis 2 is set to "1:Enabled".
15	OS (OS1, OS2) Origin setting command	1: Enabled 0: Disabled	The position data value will change to "0" when this bit is set to "1" (level detection). The position data value will not change from "0" while this bit is "1".

> ⚠ **NOTES**
>
> - Origin setting attempts will not be accepted when error remains unresolved (/ER=0).
> - To have RDY return to Normal, origin setting needs to be performed after resolving the error cause.

5-5. Origin Setting Operation

Completing the origin setting operation will change the position data value to "0".

In the following situations, the origin will be unset and therefore origin setting needs to be performed.
- Immediately after power-on
- When the maintenance switch has been switched from "MAINT" to "RUN"
- When an error is present

The Origin Unset (BOS) bit will change to "0" upon origin setting completion.

To set the origin, move the machine to the desired origin position ("0" position) and perform any of the following:
- Press the function switch "OS1" or "OS2" on the module panel.
- Turn the external-input origin setting signal ON.
- Set the OS command output to "1".

Turning the origin setting signal ON (or setting the OS command to "1") will cause the position data to change to "0". The position data will not change from "0" while the signal is ON.

Refer to the following steps when generating a control program:
- (1) Move the machine to the desired origin position.
- (2) Check that the OSR input is "1" and then set the OS command output to "1".
- (3) Check that the position data value is "0" and then set the OS command back to "0".

> ⚠ **NOTES**
>
> Origin setting can also be carried out by performing any of the following actions with the origin setting signal ON.
> - Turning the power-on.
> - Switching the maintenance switch from "MAINT" to "RUN".
>
> However, origin setting attempts will not be accepted when error remains unresolved (/ER=0).

● **Timing chart**

The chart below indicates the origin setting timing:
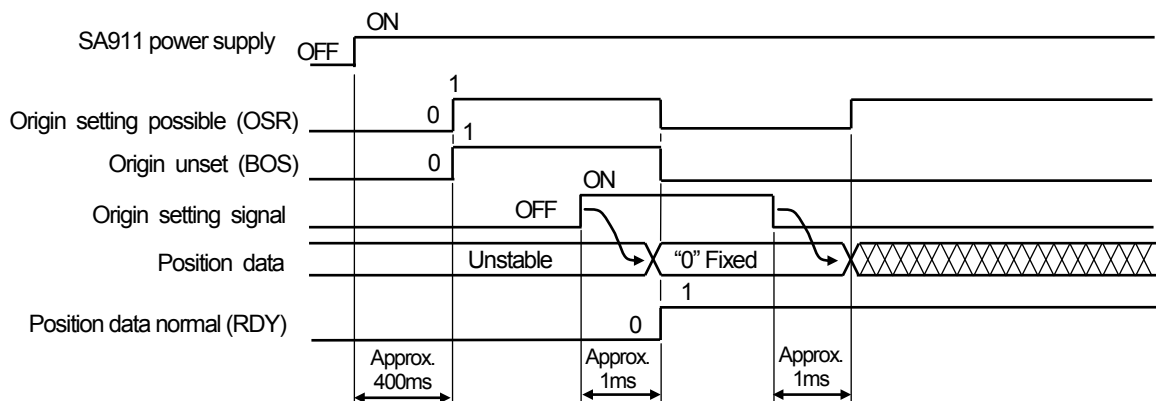
5. FUNCTION

5-6. Error Cancelling Operation

Errors other than "Origin Unset" can be cancelled by performing one of the following actions after resolving the error cause:

- Pressing the function switch "CLR" on the module panel.
- Turning the external-input error cancelling signal ON.
- Setting the RES command output to "1".

The response time is approximately 1ms when cancelling the error.

To cancel an "Origin Unset" error, refer to 5-5.

6. INSPECTIONS

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 of the power supply to determine if it is within the prescribed range.	Within 20.4 to 26.4VDC	Tester
Ambient Conditions	Check the ambient temperature.	ABSOCODER sensor: -10 to $+80°C$ Converter: 0 to $+55°C$	Thermometer
	There should be no accumulation of dust.	None	Visual Inspection
Mount Conditions	Verify that the sensor is securely mounted.	There should be no looseness.	Visual Inspection
	Verify that the sensor rod is securely coupled to the machine shaft.	There should be no looseness.	
	Check for severed cables.	Cable should appear normal.	
	Is sensor cable connector securely connected?	There should be no looseness.	
	Are sensor cable connection terminal screws tightly fastened?	There should be no looseness.	
	Are BU902 terminal screws tightly fastened?	There should be no looseness. Tightening torque M3.5 screw : 0.8 to 1.2 N·m	

7. TROUBLESHOOTING

Error causes and countermeasures are described below.

7-1. Error List

When an error has occurred related to the AB935N module or the ABSOCODER sensor, the module state display LED "ER1" or "ER2" will come on (or blink) and the input data states will change.
Refer to the following list to resolve the error.

Bit	Status (input data) Signal Name	Status (input data) Indication	Module state display LED ER1, ER2	Probable cause	Detection timing	Error cancel procedure
8	BOS Origin unset	1: Unset 0: Set	Fast blinking	The Origin Unset error occurs every time after power is turned on.	After power-on Upon error occurrence	Complete origin setting
				Maintenance switch has been switched from "MAINT" to "RUN"		
9	Reserved	0: Fixed				
12	DE Position data error	1: Error 0: Normal	Fast blinking	Sensor connector is loose.	Any time	Perform error canceling after resolving the error cause.
				Sensor cable crimp terminal is loose.		
				ABSOCODER sensor was shocked excessively.		
				Wiring has a noise source		
				Sensor cable is severed.		
13	SE Sensor disconnected error	1: Error 0: Normal	ON	Sensor connector is loose.	Any time	Perform error canceling after resolving the error cause.
				Sensor cable crimp terminal is loose.		
				ABSOCODER sensor failure		Replace the sensor.
				AB935N module failure		Replace AB935N.
14	PF Sensor power supply error	1: Error 0: Normal	Slow blinking	Sensor power is not on.	Any time	Perform error canceling after resolving the error cause.
				Sensor power supply has been delayed.		
				Sensor power has been instantaneously off.		
				Sensor power has failed		Replace the power supply.
				AB935N module failure		Replace AB935N.
15	/ER Error	1:Normal 0: Error	—	Error "DE", "SE" or "PF" has occurred.	Any time	Perform error canceling after resolving the error cause.
—	Watchdog timer error	—	ER1, ER2, OSA1 and OSA2 on	AB935N module failure	Any time	Replace AB935N.

7. TROUBLESHOOTING

⚠ **NOTES**

The origin will become unset after an error is cancelled (BOS = 1).
Be sure to perform origin setting after cancelling an error.

About error cancelling and origin setting methods, refer to 5-6, "Error Cancelling Operation", and 5-5, "Origin Setting Operation".
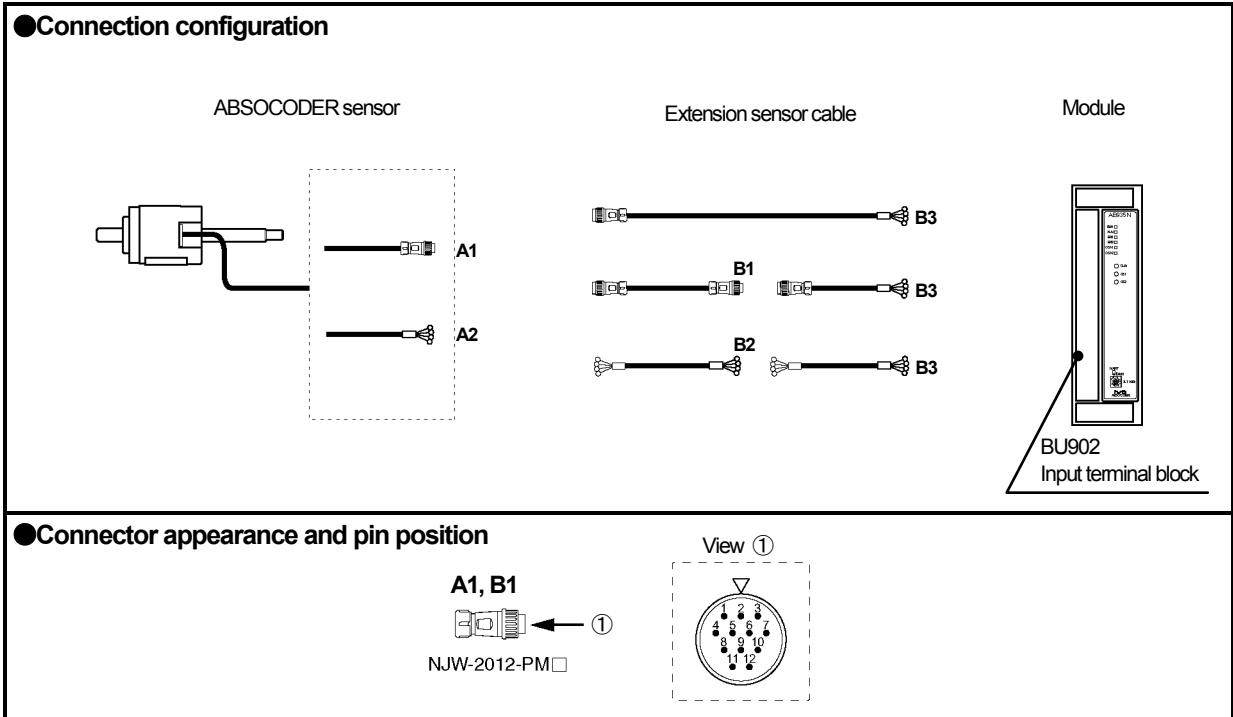
⚠ **NOTES**

1. The error status will be automatically cancelled as soon as the error cause is resolved with the error cancel signal ON.
2. If "DE" is detected with the error cancel signal ON, the DE status will not change but "BOS" will change to "1: Unset".
3. When error "SE" or "PF" is present, the SE or PF status will be "1: Error" even if the error cancel signal is ON.

7-2. ABSOCODER Sensor Check List

●**Applicable ABSOCODER sensor models**

VLS-8SM20

VLS-8SM14

VLS-8SM14S

●**Connection configuration**

ABSOCODER sensor

Extension sensor cable

Module

A1

A2

B1

B2

B3

B3

B3

BU902
Input terminal block

●**Connector appearance and pin position**

View ①

A1, B1

← ①

NJW-2012-PM□

●**Connector pin position and standard coil resistance ranges (at 25℃)**

Check position				Signal names	Standard coil resistance [Ω]	
A1, A2, B1, B2		B3			VLS-8SM20	VLS-8SM14 VLS-8SM14S
Pin No.	Wiring color	Terminal No. *1	Wiring color			
1	Brown	1 [19]	Brown	U	114 to 154	132 to 152
2	Red	2 [20]	Red	V		
3	Orange	3 [21]	Orange	W		
4	—	4 [22]	—	—	—	—
5	Green	5 [23]	Green	OUT1＋	162 to 202	150 to 180
6	Blue	6 [24]	Blue	OUT1－		
7	—	7 [25]	Violet	—		
8	—	8 [26]	Gray	—		
9	—	—	—	—		
10	—	—	—	—		
11	Shield	9 [27]	Shield	Shield		
12	—	—	—	—		

*1: These are BU902 terminal numbers. Shown in [ ] are Axis 2 terminal numbers.

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.

7. TROUBLESHOOTING

● **Circuit resistance check**

[Measurement method]

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

Have Point A connected to measure at 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 should be in the range of the standard coil resistance. *1	Between brown and green	∞
Between brown and orange		Between brown and shield	
Between red and orange		Between green and shield	
Between green and blue			
		Between frame and each wire or shield	

*1: If a check is done at Point B, the measurement value wil 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).

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 megger.

[Check details]

Refer to the previous page for the connector pin number.

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

⚠ **NOTES**

1. Make sure to disconnect the ABSOCODER sensor from the AB935N module 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 AB935N module.

8. SPECIFICATIONS

8-1. AB935N Module Specifications

8-1-1. General Specification

Items		Specifications
Power supply voltage	For TC-net I/O (supplied to SA911)	24VDC (＋10%, －15%)
Power consumption		0.1A or less (at 24VDC)
Power supply voltage	For sensors and external inputs (supplied to BU902)	24VDC (＋10%, －15%)
Power consumption		0.2A or less (at 24VDC)
Allowable instantaneous blackout time		1ms or less
Withstand voltage		500 VAC, 60Hz for 1 minute between external DC power terminals and ground
Vibration resistance		$5 \leqq f < 9\,Hz$: Half amplitude 3.1 mm $9 \leqq f < 150\,Hz$: Constant acceleration 9.8m/s^2
Ambient operating temperature		0 to +55°C (No freezing)
Ambient operating humidity		10 to 95 %RH (No condensation)
Pollution degree *1		2 or less
Ambient operating environment		Free from corrosive gases and excessive dust
Ambient storage temperature		－40 to ＋70 ℃
Ambient storage humidity		10 to 95 %RH (No condensation)
Operating altitude *2		2000m or less
Grounding		Must be securely grounded (ground resistance of 100 Ω or less)
Construction		Inside control cabinet
Outside dimension		35mm(W) × 185mm(H) × 95mm(D) [Refer to dimensions for details.]
Mass		Approx. 0.4kg

*1: This index indicates the degree to which conductive material is generated in the environment where the equipment is used. In pollution degree 2, only non-conductive pollution occurs. Temporary conductivity may be produced due to condensation.

*2: Do not use or store this module under pressure higher than the atmospheric pressure of altitude 0m. Failure to observe this may cause a malfunction.

8. SPECIFICATIONS

## 8-1-2. Performance Specification

Items	Specifications
Number of detection axes	2
Position detection format	Semi-absolute format
Isolation format	Photo-coupler isolation (between TC-net I/O circuit and sensor circuit)
Resolution	1 μ m (8.192 mm / 8192 divisions)
Total number of divisions	Standard pitch x number of pitches [8192 divisions (2^{13}) x 2048 pitches = 16777216(2^{24})]
Function	Position data detection function, Origin setting function
Error detection function	Sensor disconnected error (SE), Sensor power supply error (PF), Origin unset (BOS), position data error(DE), CPU watchdog timer error
Module state display LED	RUN(green), ALM(red), ER1(red), ER2(red), OSA1(green), OSA2(green)
Position data sampling time	0.2ms
Number of I/O channels	Input: 4 words, Output: 4words
External connection	Connect to BU902 terminal block
Applicable standard	CE Marking (EMC directive) KC mark (Korea Certification Mark)

8. SPECIFICATIONS

8-1-3. External Input Specification

Items		Specifications
Number of input points		3 points (Origin setting: 2, Error cancel: 1)
Isolation format		Photo-coupler isolation
Rated input voltage		24VDC (＋10%, －15%)
Input voltage range		20.4 to 26.4VDC *1
Rated input current		5.2 mA
ON voltage		16.8VDC or more
OFF voltage		6VDC or less
Response time	OFF→ON	0.04 ms
	ON→OFF	0.2 ms
Input Circuit		
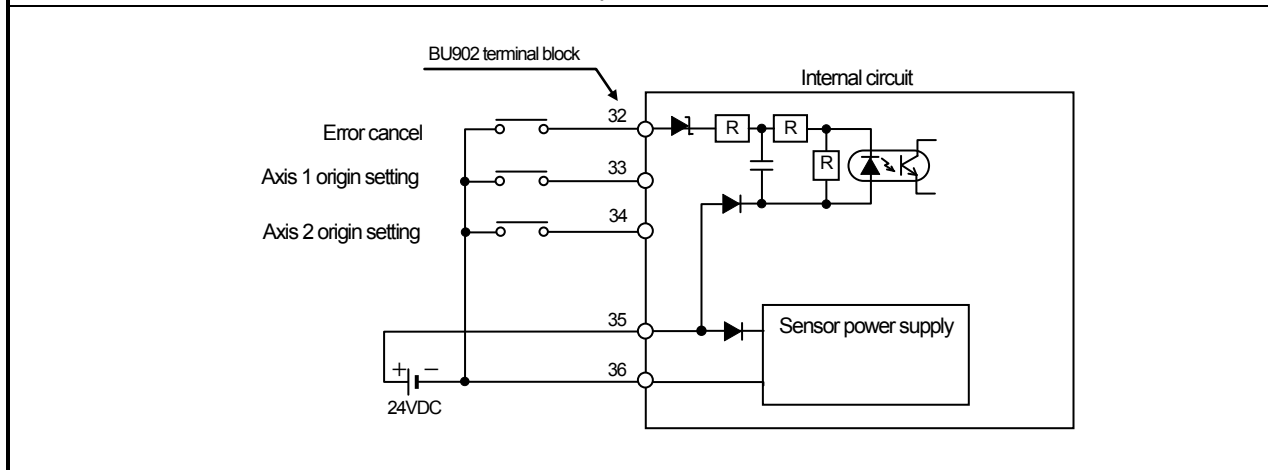
*1: This power is intended for both external inputs and sensors.

8. SPECIFICATIONS

8-2. ABSOCODER Sensor Specifications

(1) VLS-8SM20

Items		Specifications
Model		VLS-8SM20
Max. detection stroke		350 mm
Absolute detection range		8.192 mm
Resolution		1 μm(8.192mm/8192)
Linearity error		Customer's Special Specifications
Mass	Head	4.5+0.15 x [cable length(m)]　kg
	Rod	0.4+0.0025 x [stroke (mm)]　kg
Sliding resistance		69 N or less (7kgf or less)
Permissible mechanical speed		1000 mm/s
Ambient temperature	Operating	-10 to +80°C
	Storage	-10 to +80°C
Ambient operating humidity		—
Vibration resistance		2.0 x 10^2 m/s^2 (20G) 200Hz up/down 4h, forward/back/left/right 2h each, conforms to JIS D 1601 standard
Shock resistance		4.9 x 10^3 m/s^2 (500G) 0.5ms, up/down x 3 times, conforms to JIS C 5026 standard
Protection rating		IP67, conforms to JEM1030 standard
Interconnecting cable		2・5・10・20m
Max. sensor cable length	Standard cable	3S-S 200m
	Robotic cable	3S-RBT 100m
Surface	Head	Electroless nickel plated
	Rod	Hard chromium electro plated
Material	Head	Steel
	Rod	Steel

8. SPECIFICATIONS

(2) VLS-8SM14, VLS-8SM14S

Items		Specifications	
Model		VLS-8SM14	VLS-8SM14S
Max. detection stroke		200 mm	
Absolute detection range		8.192 mm	
Resolution		1μm(8.192mm/8192)	
Linearity error		Customer's Special Specifications	
Mass	Head	1.1+0.07 x [cable length(m)]　kg	0.8+0.07 x [cable length(m)]　kg
	Rod	0.0012 x ([rod length (mm)]　kg	
Sliding resistance		15 N or less (1.5kgf or less)	
Permissible mechanical speed		1000 mm/s	
Ambient temperature	Operating	-10 to +80°C	
	Storage	-10 to +80°C	
Ambient operating humidity		—	
Vibration resistance		2.0×10^2 m/s^2(20G) 200Hz up/down 4h, forward/back 2h, conforms to JIS D 1601 standard	
Shock resistance		4.9×10^3 m/s^2(500G) 0.5ms, up/down x 3 times, conforms to JIS C 5026 standard	
Protection rating		IP67, conforms to JEM1030 standard	
Interconnecting cable		2・5・10・20m	
Max. sensor cable length	Standard cable	3S-S 200m	
	Robotic cable	3S-RBT 100m	
Surface	Head	Electroless nickel plated	
	Rod	Hard chromium electro plated	
Material	Head	Steel	
	Rod	Steel	

8. SPECIFICATIONS

8-3. Sensor Cable Specification

| Items	Specifications			
Model code	3S-S	3S-RBT	3S-URT	3S-HRT
Cable type	Standard cable	Robotic cable	Semi-heat-resistant robotic cable	Heat-resistant robotic cable
Diameter	ϕ8			ϕ9.5
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	7-core, 1 triple with shield + 2 pairs with shield			
Color of sheath	Dark brown	Blue		Black
Advantage	Extensible for long distances	Superior flexibility; ideal for moving place		Heat treatment and flexible; ideal for moving place

REMARKS

Contact your NSD representative when the extension cable combines different types of cables.

9. OUTER DIMENSIONS

9-1. AB935N Module

Units: mm
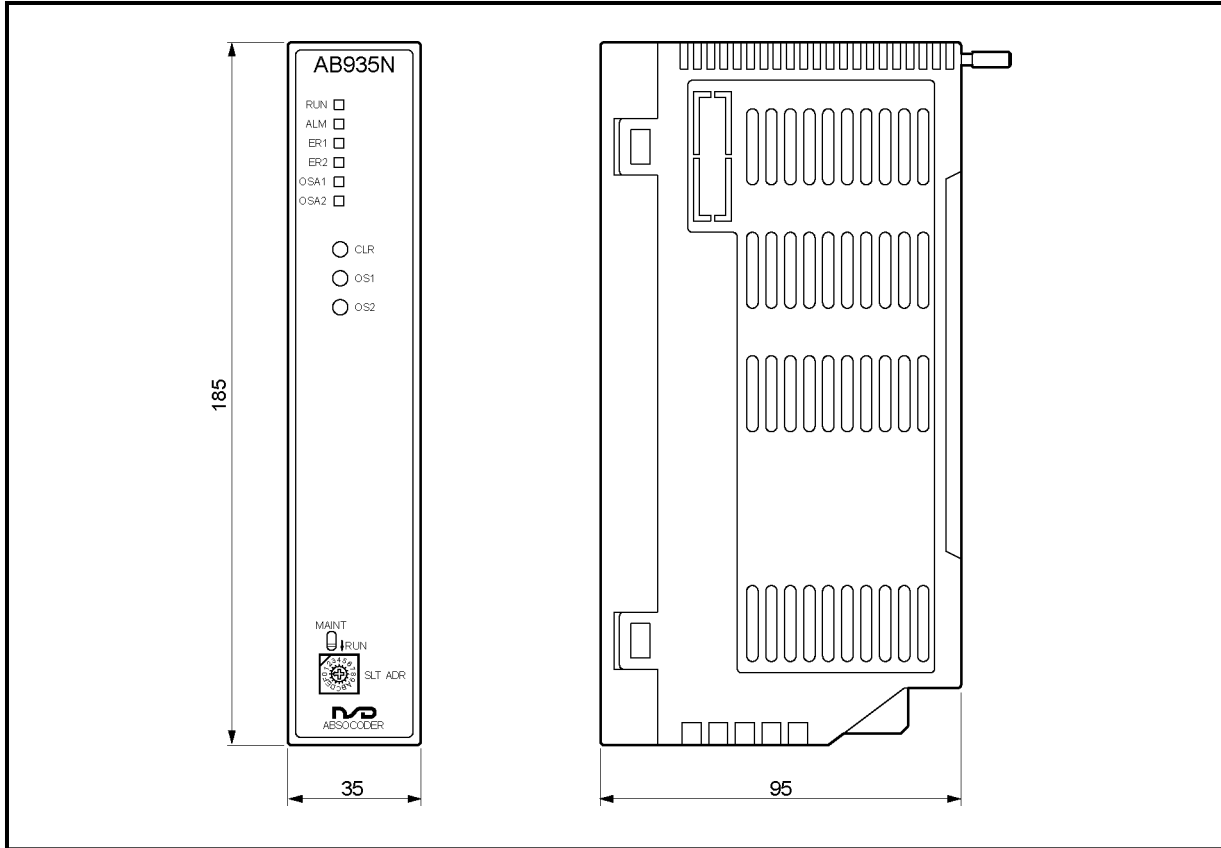
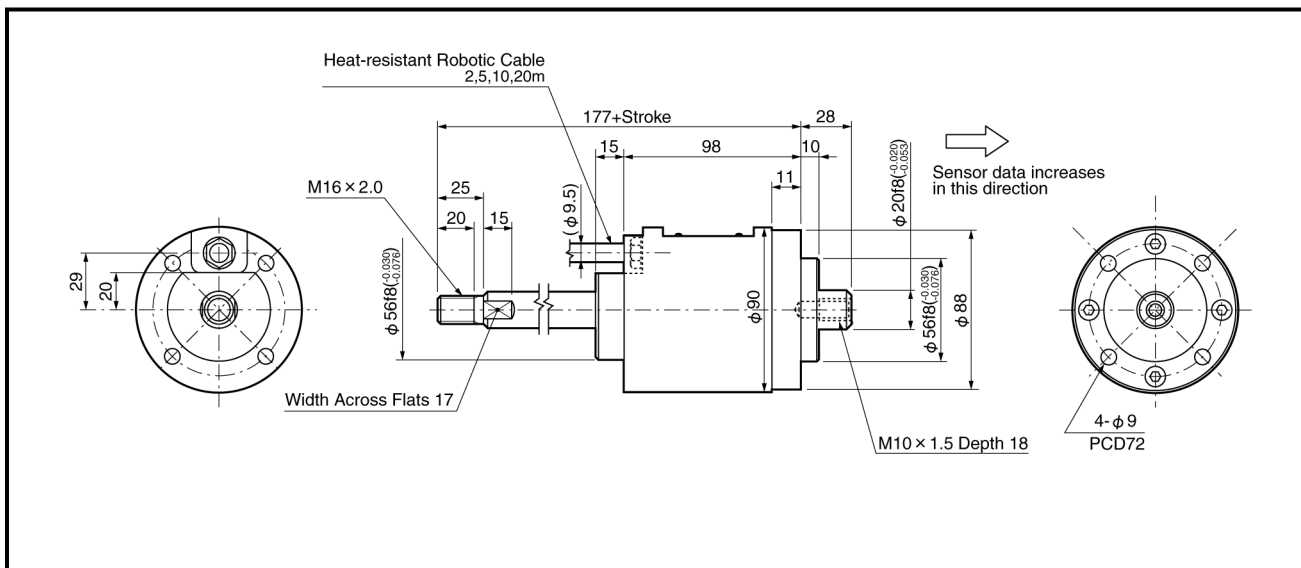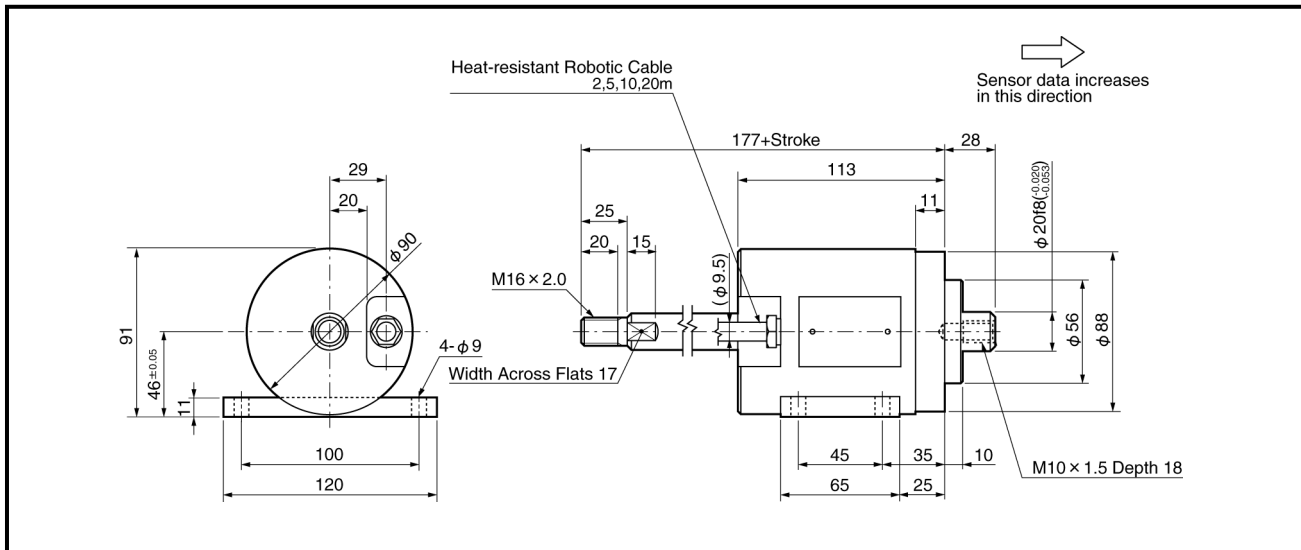# 9. OUTER DIMENSIONS

9-2. ABSOCODER Sensor

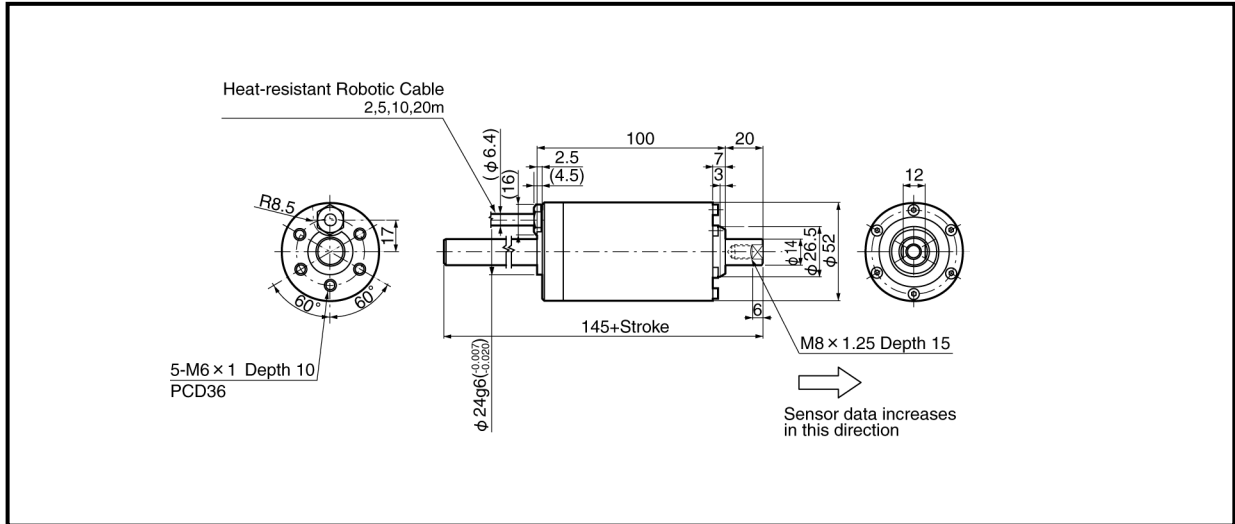**(1)VLS-8SM20-[ ]FA[ ] (Flange-mount type)**　　　　　　　　　　　　　　　**Units: mm**
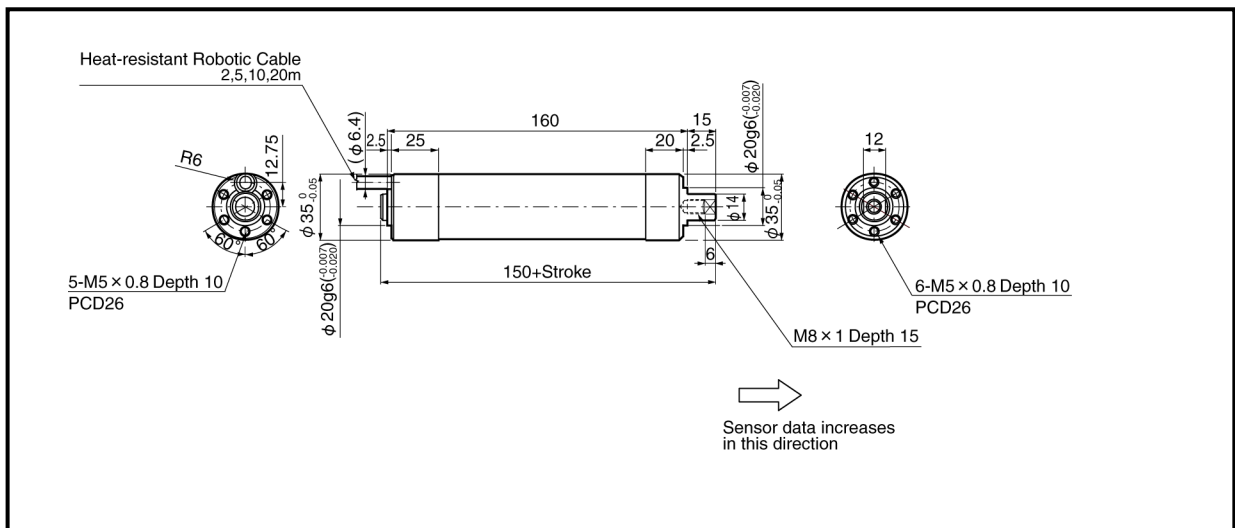

(2)VLS-8SM20-[ ]LA[ ] (Base-mount type)

9. OUTER DIMENSIONS

(3)VLS-8SM14-[ ]FB[ ] (Flange-mount type)　　　　　　　　　　　　　　　　　　　**Units: mm**

Heat-resistant Robotic Cable
2,5,10,20m

R8.5

5-M6 × 1 Depth 10
PCD36

100
20
2.5
(4.5)
7
3
(φ 6.4)
(16)
17
12
φ 14
φ 26.5
φ 52
6
145+Stroke
φ 24g6(-0.007/-0.020)
60° 60°

M8 × 1.25 Depth 15

Sensor data increases
in this direction

(4)VLS-8SM14S-[ ]LB[ ] (Flange-mount type)

Heat-resistant Robotic Cable
2,5,10,20m

R6

5-M5 × 0.8 Depth 10
PCD26

160
15
25
20
2.5
2.5
(φ 6.4)
12.75
φ 35 0/-0.05
φ 20g6(-0.007/-0.020)
φ 14
φ 35 0/-0.05
φ 20g6(-0.007/-0.020)
6
150+Stroke
12
60° 60°

6-M5 × 0.8 Depth 10
PCD26

M8 × 1 Depth 15

Sensor data increases
in this direction

9. OUTER DIMENSIONS

9-3. Extension Sensor Cable

(1) 3S-S-9044-[L] / 3S-RBT-9044-[L] /3S-URT-9044-[L]　　　　　　　　　　　　Units: mm

Terminals　R1.25-4 (JIS C 2805)

Insulation tubes
(Signal names printed on)

NJW-2012-AdF8

(30)

φ8

M22 × 1

φ26

(10)

(200)

L

(60)

NOTE: [L] is given in terms of meter.
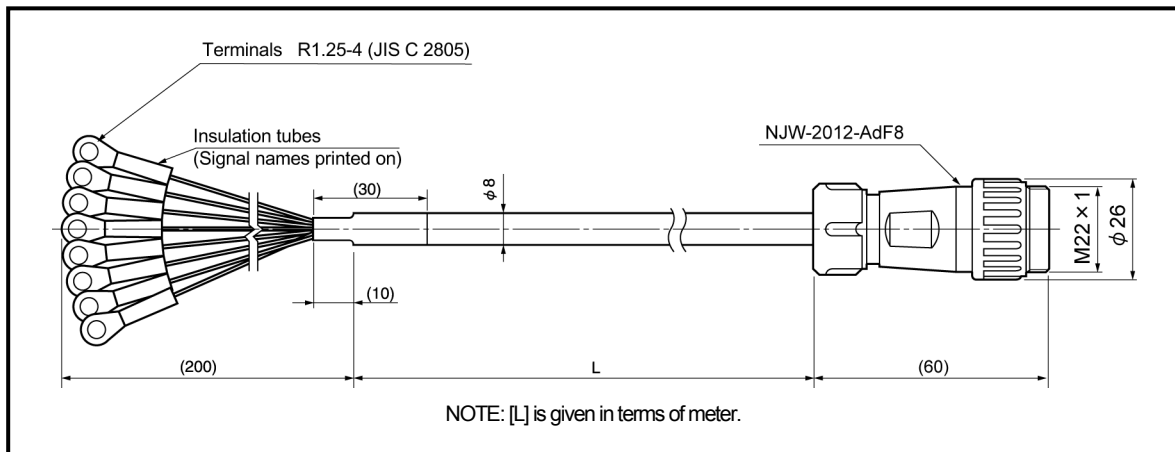
(2) 3S-S-4344-[L] / 3S-RBT-4344-[L] / 3S-URT-4344-[L]

NJW-2012-PM8

NJW-2012-AdF8

φ26

φ16

φ8

M22 × 1

φ26

(60)

L

(60)

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

(3) 3S-HRT-5152-[L]

NJW-2012-PM10

NJW-2012-AdF10

φ26

φ16

φ9.5

M22 × 1

φ26

(60)

L

(60)

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

42
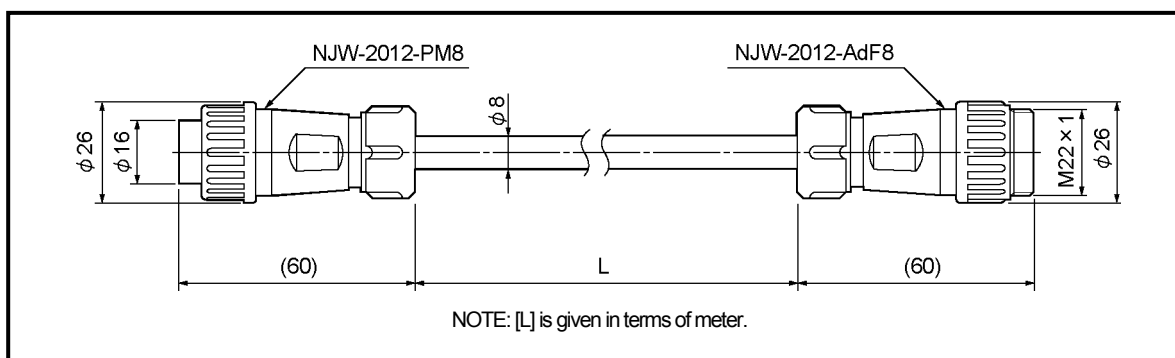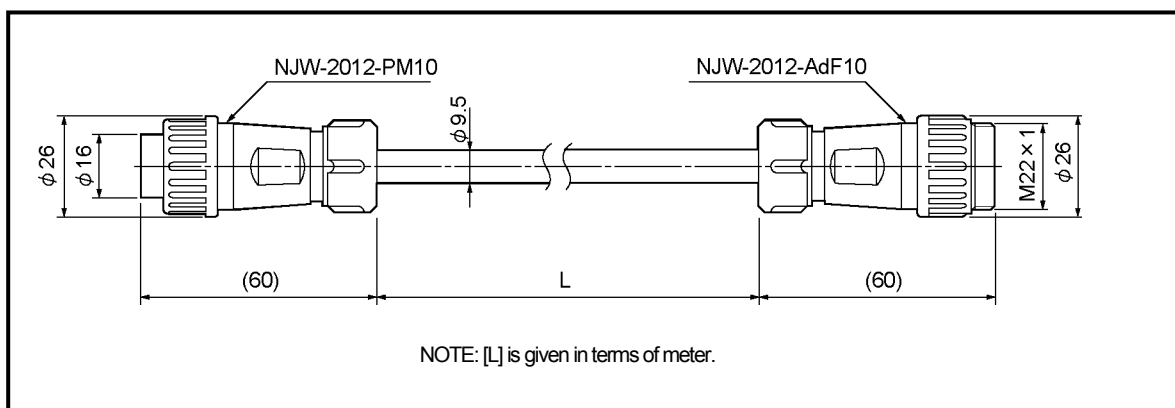
9. OUTER DIMENSIONS

(4) 3S-S-9090-[L] / 3S-RBT-9090-[L] / 3S-URT-9090-[L]   **Units: mm**

Terminals   R1.25-4 (JIS C 2805)   Terminals   R1.25-4 (JIS C 2805)

Insulation tubes
(Signal names printed on)

Insulation tubes
(Signal names printed on)

$\phi 8$

(30)   (30)

(10)   (10)

(200)   L   (200)

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

(5) 3S-HRT-9090-[L]

Terminals   R1.25-4 (JIS C 2805)
(Shield wire : R2-4)

Terminals   R1.25-4 (JIS C 2805)
(Shield wire : R2-4)

Insulation tubes
(Signal names printed on)

Insulation tubes
(Signal names printed on)

$\phi 9.5$

(30)   (30)

(10)   (10)

(200)   L   (200)

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

(6) 3S-HRT-9052-[L]

Terminals   R1.25-4 (JIS C 2805)
(Shield wire: R2-4)

Insulation tubes
(Signal names printed on)

NJW-2012-AdF10

$\phi 9.5$

(30)

M22 × 1 $\phi 26$

(10)

(200)   L   (60)

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

43

9. OUTER DIMENSIONS

- MEMO -

APPENDIX 1. CE MARKING

The AB935N module conforms to EMC directive.

APPENDIX 1-1. EMC Directives

It is necessary to do CE marking in the customer's responsibility in the state of a final product.
The customer should confirm EMC compliance of the machine and the entire device because EMC changes configuration of the control cabinet, wiring, and layout.

APPENDIX 1-2. EMC Directive and Standards

Conforms to Table 01 (see below) of EMC standards and testing.

Table 01 EMC Standard and Testing

Standard No.	Testing item	Name
EN61000-6-4	EN55016-2-3	Radiated disturbance
EN61000-6-2	EN61000-4-2	Electrostatic Discharge
	EN61000-4-3	Radiated, Radio frequency, Electromagnetic Field
	EN61000-4-4	Electrical Fast Transient / Burst
	EN61000-4-5	Surge Immunity
	EN61000-4-6	Conducted Disturbances, Induced by Radio-Frequency Fields
	EN61000-4-8	Power Frequency Magnetic Field

APPENDIX 1-3. Low Voltage Directive

The low voltage directive is out of the range because the AB935N module is activated by 24VDC power supply.

APPENDIX 1-4. Measures for EMC Compliance and Restriction

In this section, restrictions are described for conforming the AB935N module to the EMC Directive.
For conforming the Toshiba Corporation Unified Controller nv Series to the EMC Directive, contact Toshiba Corporation.

①Install the zippertubing around the cable when the sensor cable is used in 30m or more.
　The shield of zippertubing should be grounded.

Recommendation zippertubing

Mounting location	Model	Manufacturer
Sensor cable	MTFS 20ϕ	ZIPPERTUBING(JAPAN), LTD.

②The length of input cable must be under 30m.

③Install the electrolytic capacitor between 24V terminal and 0V terminal of the base unit for the TC-net I/O adapter.

Recommendation electrolytic capacitor

Mounting location	Model	Manufacturer
Base unit	UPM1V102MHD6	NICHICON CORPORATION
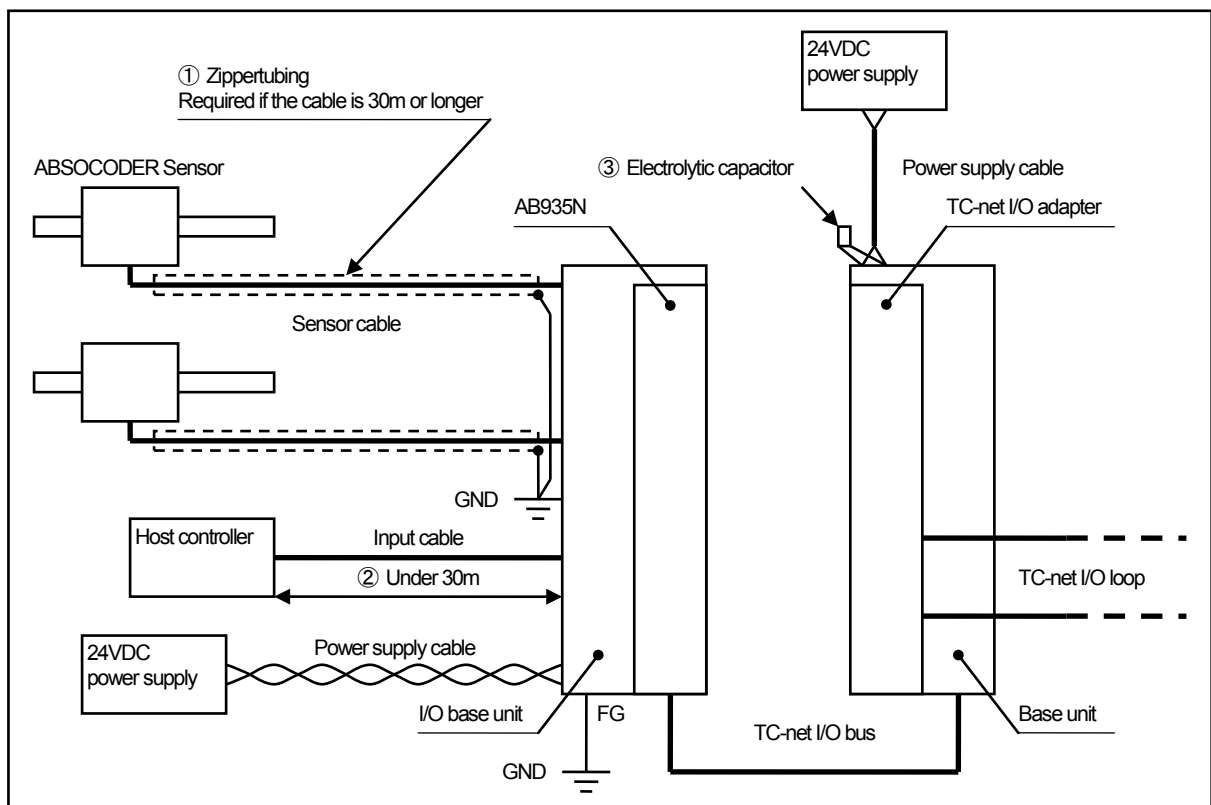
NSD Group

Manufacturer
NSD Corporation   3-31-28, OSU, NAKA-KU, NAGOYA, JAPAN 460-8302

Distributor
NSD Trading Corporation   3-31-23, OSU, NAKA-KU, NAGOYA, JAPAN 460-8302
Phone: +81-52-261-2352   Facsimile: +81-52-252-0522
URL: www.nsdcorp.com   E-mail: foreign@nsdcorp.com