

INSTRUCTION MANUAL

NTB-500A/C

MEDIUM SPEED NETWORK TERMINAL BOX

(FOR HARDWARE)

Thank you for purchasing KYOWA's product NTB-500A/C Medium Speed Network Terminal Box.

Read this Instruction Manual carefully in order to make full use of the high performance capabilities of the product.

Do not use the product in methods other than described in this Manual.

This Manual only describes hardware operation of the NTB-500A/C.

For the Dynamic Data Recording Software DCS-100A, refer to the "DCS-100A INSTRUCTION MANUAL (FOR NTB-500A/C OPERATION)."

For software operation other than the DCS-100A, refer to the "NTB-500A/C INSTRUCTION MANUAL (FOR CONTROL FUNCTIONS)."

Windows are trademarks of Microsoft Corporation, registered in the U.S.A. and other countries.

Generally, company names and trade names described in this Instruction Manual are trademarks or registered trademarks of the companies.

This Instruction Manual may not be copied or reproduced, in whole or part, without consent of KYOWA.

Copyright © Kyowa Electronic Instruments Co., Ltd. All rights reserved.

The contents of the Instruction Manual and specifications of the software are subject to change without prior notice.

Kyowa Electronic Instruments Co., Ltd. assumes no liability for any damage resulting from the use of the software.

CONTENTS

STANDARD ACCESSORIES	4
OPTIONAL ACCESSORIES	5
SAFETY PRECAUTIONS	7
PRIOR TO USE	7
SAFETY SYMBOLS	7
LIMITED LIFE PARTS AND PREVENTIVE MAINTENANCE	11
NTB-500A/C REPLACEMENT BEFORE THE END OF SERVICE LIFE	11
NOTATIONS USED IN THE INSTRUCTION MANUAL	14
1. OUTLINE	15
1-1 OUTLINE OF NTB-500A/C	15
1-2 FEATURES	15
1-3 SYSTEM CONFIGURATION	16
2. CONTROLS AND INDICATORS	17
2-1 NTB-500A/C	17
2-1-1 Top panel	17
2-1-2 Side panel (power connector side)	18
2-1-3 Side panel (driver holder side)	18
2-1-4 Side panel (PC connection side)	19
2-1-5 Side panel (NTB-500A/C coupling side)	19
2-1-6 Bottom panel	20
2-1-7 Power connector	21
2-1-8 Status of the POWER LED	21
2-1-9 BOX No. switch	22
2-1-10 Optional DIP switch	23
2-2 NTB-50A (optional accessory)	24
2-2-1 Top panel	24
2-2-2 Side panel	24
2-3 NTB-50B/C (optional accessory)	25
2-3-1 Top panel	25
2-3-2 Side panel	25
2-4 NTB-51A/C (optional accessory)	26
2-4-1 Top panel	26
2-4-2 Side panel	27
2-5 COUPLING AND DISTRIBUTED ARRANGEMENT	28
2-5-1 For mounting NTB-500A/C units by using the coupling plate (optional accessory, model: CN-10A)	30
2-5-2 For mounting NTB-500A/C units (2) to DIN rail	34
2-5-3 For distributed arrangement	37
3. HOW TO INSTALL	39
3-1 INSTALLATION PROCEDURES	39
3-2 MOUNTING THE MEASURING UNIT	40
3-3 CONNECTING THE NTB-500A/C	41
3-3-1 When connecting one NTB-500A/C	41
3-3-2 When coupling multiple NTB-500A/C units	42
3-3-3 When distributing the multiple NTB-500A/C units	43
3-3-4 When connecting one NTB-500A/C and using the automated measurement function	44
3-3-5 When coupling multiple NTB-500A/C units and using the automated measurement function	45
3-3-6 When distributing the multiple NTB-500A/C units and using the automated measurement function	46
3-4 SETTING BOX NO. SWITCH	47

3-5 SETTING THE TERMINATION RESISTOR.....	48
3-6 SETTING THE LENGTH OF THE COMMUNICATION CABLES.....	49
3-7 CONNECT SENSOR AND SET CH MODE	51
3-7-1 Connect Sensor(NTB-50A)	51
3-7-2 Connect sensor (NTB-50B/C)	54
3-7-3 Connect Sensor(NTB-51A/C)	58
3-8 GROUNDING	60
3-9 CONNECTING POWER.....	61
3-9-1 Connecting DC power	61
3-9-2 Connecting AC adapter.....	62
3-10 POWER ON/OFF.....	63
3-10-1 Power ON.....	63
3-10-2 Power OFF.....	63
4. INSTALL AND UNINSTALL THE DEVICE DRIVER FOR THE USB-CAN CONVERTER	64
4-1 INSTALL THE KVASER DRIVERS FOR WINDOWS.....	64
4-2 CONNECT THE USB-CAN CONVERTER TO THE PC	66
4-3 CHECKING AFTER CONNECTING THE USB-CAN CONVERTER	67
4-4 UNINSTALL THE KVASER DRIVERS FOR WINDOWS.....	69
5. WITH THE KYOWA'S EDX SERIES.....	70
5-1 FLOWCHART	70
5-2 SET THE NTB-500A/C	71
5-2-1 Set the communication speed	71
5-2-2 Automated measurement function	72
5-2-3 Factory-configured settings of the CAN communication conditions.....	72
5-2-4 Factory-configured settings of the measuring conditions.....	72
5-3 CAN CONDITIONS OF THE NTB-500A/C.....	73
5-3-1 CAN communication conditions	73
5-3-2 Message ID.....	73
5-3-3 Data type.....	73
5-3-4 Format of the message	74
5-4 WITH THE AUTOMATED PROGRAM "N5H_SetAuto_ xxxx.exe "	75
5-4-1 Changing the CAN communication conditions	78
5-5 WITH THE EDX-100A (DCS-100A).....	79
5-5-1 Required items on the automated program "N5H_SetAuto_ xxxx.exe"	80
5-5-2 Set the CAN conditions (DCS-100A).....	80
6. DETAILS OF OPTIONAL ACCESSORIES	86
7. TROUBLE SHOOTING.....	87
8. TECHNICAL INFORMATION REQUIRED FOR MEASUREMEMT.....	90
8-1 COMPENSATING NONLINEARITY IN STRAIN GAGE (QUARTER BRIDGE METHOD).....	90
8-2 HOW TO COMPENSATE TEMPERATURE INFLUENCE ON LEAD WIRE (3-WIRE SYSTEM CONNECTION).....	91
8-3 COMPENSATING GAGE FACTOR.....	92
8-4 COMPENSATION FOR LONG LEAD WIRE AND CABLE	92
9. SPECIFICATIONS	94
9-1 HARDWARE SPECIFICATIONS OF THE NTB-500A,NTB-500C	94
9-2 HARDWARE SPECIFICATIONS OF THE NTB-50A, NTB-50B, NTB-50C	96
9-3 HARDWARE SPECIFICATIONS OF THE NTB-51A,NTB-51C	97
10. OUTSIDE DRAWING	98
10-1 OUTSIDE DRAWING OF THE NTB-500A/C.....	98
10-2 OUTSIDE DRAWING OF THE NTB-50A (optional accessory).....	99
10-3 OUTSIDE DWARING OF THE NTB-50B/C (optional accessory).....	99

10-4 OUTSIDE DRAWING OF THE NTB-51A/C (optional accessory)..... 100

STANDARD ACCESSORIES

The following accessories are packed with the NTB-500A/C Medium Speed Network Terminal Box (hereinafter referred to as the NTB-500A/C).

When unpacking, check the contents to ensure that all accessories are enclosed.

● Instruction Manual	}	1 (DVD) *1
● Sample Software *3		
● Automated program		
● Device driver for the USB-CAN converter (Kvaser Drivers for Windows)		
● Dynamic Data Recording Software: DCS-100A		
● DCS-100A password sheet		
● Diagram sticker		1
● DC Power Cable: P-76		1
● Ground Wire: P-72		1
● Rubber foot		4
● "Terms and Conditions of New Product Warranty" document:		1
● Driver holder, binding head screws with POM washers attached × 2 (M3×6) and small screwdriver		1 set
● Dummy panel for the NTB-500A/C, binding head screws with POM washers attached × 2 (M3×6)		1 *2

*1 The Dynamic Data Recording Software DCS-100A is a standard accessory for the following model.

- NTB-500A/C

Products other than those described above do not include the DCS-100A and password sheet for installation.

However, you are able to use the DCS-100A trial version without a password.

To use the DCS-100A after the trial period, purchase the DCS-100A and re-install it again.

*2 Dummy panel for the NTB-500A/C

When the NTB-500A/C has free unit, the NTB-500A/C is delivered with dummy panels.

*3 For the sample software, see the NTB-500A/C Instruction Manual (For Control Functions).

OPTIONAL ACCESSORIES

● AC adapter	SA-10A-EDS (100 to 240 VAC)
● Strain Unit (one-touch lock type terminal block)	NTB-50A * Discontinued in 2016. * Only NTB-500A can be mounted.
● Strain unit (one-touch type terminal block)	NTB-50B * Discontinued in 2020. * Only NTB-500A can be mounted. NTB-50C * Only NTB-500C can be mounted.
● Voltage/Thermocouple Unit	NTB-51A * Discontinued in 2020. * Only NTB-500A can be mounted. NTB-51C * Only NTB-500C can be mounted.
● Synchronous-sampling-communication cable	N-119 (cable length: 1 m) H-12349 (cable length: 3m) H-12349 Z5 (cable length: 5 m) H-12349 Z10 (cable length: 10m) H-12349 Z15 (cable length: 15m) H-12349 Z20 (cable length: 20m) H-12349 Z25 (cable length: 25m) H-12349 Z30 (cable length: 30m) H-12349 Z40 (cable length: 40m) H-12349 Z100 (cable length: 100m) * The H-12349 Z*** are custom-made products. Note: When requiring the cable other than the above, contact Kyowa or our representatives.
● Synchronous-sampling Y cable	N-120
● Coupling plate for 2 NTB-500A/C units	CN-10A
● Coupling plate for 4 NTB-500A/C units	CN-11A
● Dummy Panel	NTB500-DUMMY
● Power Supply Unit Box for NTB Series	NTB-20A
● USB Cable	N-38
● Data Analysis Software	DAS-200A

Other Optionals

- USB-CAN converter
Kvaser Inc.
Model: Leaf Light HS (Discontinued product)
Model: Leaf Light HS V2 (Successor)
- Termination resistor
Vector Japan Co., Ltd.
Model: CANterm120
- DIN rail (recommended)
TAKACHI ELECTRONIC INDUSTRIAL Co., Ltd. (35 mm)
- DIN rail mounting plate (recommended)
TAKACHI ELECTRONIC INDUSTRIAL Co., Ltd.
Model: DRA-1

SAFETY PRECAUTIONS

(Do not forget to read the safety precautions prior to use.)

The product is designed to be used according to "9. SPECIFICATIONS."

Do not use the product in an environment exceeding the specifications. Otherwise, it may cause troubles.

PRIOR TO USE

For safe use of the product, do not forget to read the "Safety Precautions" prior to use.

Kyowa Electronic Instruments Co., Ltd. assumes no liability for any damage resulting from the user's failure to comply with the safety precautions.

For safety operation of the product, the following symbol marks are used in the Instruction Manual.

	Indicates "PROTECTIVE GROUND TERMINAL." Be sure to connect the GND terminal to the ground.
---	---

SAFETY SYMBOLS

For safety operation of the product, the following symbol marks are used in the Instruction Manual.

 WARNING	Improper operation of the system will result in death or severe injury to the operator.
 CAUTION	Improper operation of the system may result in injury to the operator and physical damage of the system.
 Prohibited	Prohibited acts



WARNING

- **Power supply**
To prevent a fire hazard, ensure that the power supply voltage specified for the product matches the local line voltage before connecting the system to the DC power. When using the optional AC adapter, check the voltage range of the AC power outlet before connecting.
- **AC adapter**
To prevent an electric shock or fire hazard, use an optional accessory AC adapter (SA-10A-EDS).
- **Avoid using in environment with inflammable gas, etc.**
To prevent the risk of fire hazard or explosion, do not use the product in an environment with inflammable gas, vapor, or dust.
- **If any trouble occurs**
To prevent a fire hazard, if smoke is emerging from the product, immediately turn OFF the power switch and disconnect the DC power cable or AC adapter to terminate the system operation.
- **In case if any foreign matters or water are entered or the product is dropped, immediately turn OFF the power.**
When it started thundering, do not touch the product or cables. Otherwise, it may cause electric shock.
- **Protective ground**
Be sure to connect the GND terminal to the ground. Otherwise, it may cause an electric shock hazard, lower the performance, and cause trouble.

To prevent troubles and accidents caused by erroneous handling and installation, fully understand the operating instructions and operating environment and properly use the product with special care to have the product safely fulfill its performance.



CAUTION

- Do not use the product outdoors.
Otherwise, it may cause an electric shock, fire hazard, lower the performance and cause trouble.
- Before touching terminals of the product, be sure to discharge static electricity from your body.
Otherwise, it may lower the performance and other issues may occur.
- When using the NTB-51A, the following points should be remembered.
Do not use the product in an environment where the wind blows directly to terminals. Otherwise, it may lower the performance and interrupt the measurements. If use under direct wind is inevitable, prepare a windshield or take proper measures.
When soldering lead wires, do not heat the lugs of the soldering, screw-fixed terminal block for a long time by using a soldering iron. Otherwise, it may damage the terminal block plastic and internal PCB.
- Wire the product properly based on the terminal array.
- To prevent short-circuit trouble, fasten screws on a terminal block.
- Use the product with the temperature ranging from -10 to 50°C.
Otherwise, it may lower the performance and other issues may occur.
If use under direct sunlight or in a cold place is inevitable, prepare a sunscreen or take proper measures to keep it warm.
- Use the product in the specified operating humidity range 20 to 85%.
Use in a humid place exceeding the specified range or where it is exposed to splashing water may lower the performance and cause trouble.
- Do not use the product immediately after the change in the environment.
Allow the product adequate time to adjust to the ambient environment prior to use.
In addition, abrupt changes in ambient temperature during transportation, etc. may cause condensation, which may result in lower performance and or damage the system.



CAUTION

- Use the product under environment without excessive vibration or high impact.
Use the product under environment without excessive vibration or high impact.
Do not apply excessive vibration or high impact to the product. Otherwise, it may lower the performance and other issues may occur.
- Do not use the product under dusty environment.
Use the product under environment where the PC may be used.
- Do not use the product in the strong electromagnetic field.
Use the product in a magnetic field environment where the PC may be used.
Performance may be lowered and erroneous operation and troubles may result if it is used near a telemetry system, microwave oven, electronic furnace or any other equipment generating a strong magnetic field.
- Do not use the product under poor conditions.
Use the product in the specified voltage range.
DC power: 11 to 16 VDC
Optional accessory AC adapter (SA-10A-EDS): 100 to 240 VAC (50 Hz/60 Hz)
The power supply used for the product should not experience an instantaneous power failure and be free from noise.
- The specifications of the optional accessory AC adapter (SA-10A-EDS) is as follows.
Input voltage: 100 to 240 VAC (50 Hz/60 Hz)
Output voltage (output current): 12 V (1.5 A)
Operating temperature range: 0 to 40 °C
- The AC adapter (SA-10A-EDS) is a consumable item. Replace it every five years.
- Do not turn ON the power switch immediately after turning it OFF.
After turning OFF the power switch, wait (5 seconds) until the power supply is shut OFF before turning ON the power switch again.
- Do not pull cords and cables.
Lay cords and cables with a certain allowance so that excessive force is not applied to the connections.
Pulling or applying excessive force may cause negatively affect or interrupt the measurement.
- Do not disassemble or modify the product. Otherwise, it may cause electric shock when handling, damage to the system, or other problems. This warranty does not cover any damaged or defective parts that results from disassembling or remodeling.
- Do not insert foreign matters to connectors.
Otherwise, it may cause troubles.
- Avoid installing sensors and products near a welding machine.
Failure to do so will pose the risk of erroneous data, malfunction, and failure.
- Take care when handling the DVD.
Do not expose the DVD to direct sunlight, high temperature, or high humidity.
Do not apply pressure to the DVD by laying object or bending.
Dust, scratches, and fingerprints on either side of the DVD-R can cause write errors.
- Preheat the product before use.
After the power ON, always preheat the product for approximately 5 minutes.
- The measuring unit that can be mounted differs depending on the measuring instrument.
If it is mounted incorrectly, the connector will be damaged and will fail.
Be sure to check the combination of the measuring instrument and the measuring unit that can be mounted.
Measuring instrument: Measuring unit.
NTB-500A: NTB-50A, NTB-50B, NTB-51A
NTB-500C: NTB-50C, NTB-51C

LIMITED LIFE PARTS AND PREVENTIVE MAINTENANCE

The product consists of various electronic components and those components, if not all, have a useful life.

Using them exceeding the years specified according to each part type (useful life) may affect the characteristics of the product, resulting in a malfunction or a failure. You need to replace parts on a regular preventive maintenance schedule.

Please note that we may not be able to accept replacement or repair if the parts are no longer available.

Limited life parts used with the product are as follows.

- Relay
A relay's insulation will inevitably degrade or a relay itself will be damaged.
- Aluminum electrolytic capacitor
The signal-noise ratio will lower due to capacity shortage or smoke will be emitted due to liquid leak, resulting in a malfunction of the product.
- EEPROM
EEPROM will result in malfunctions or degraded performance.
- One-touch lock type terminal block (NTB-50A)
The one-touch lock type terminal block is a consumable item.
The terminal block is made of plastic. Through repeated connections/disconnections, the lock function will gradually wear out and may give a poor connection (unable to be locked or unable to be released).
The one-touch lock type terminal block is considered to be a consumable item. It is not covered under the terms of the warranty.
The replacement frequency is about two years, assuming twice a day (insertion and removal) of use, 20 days a month.
* Due to the discontinuity of the one-touch lock type terminal block, the NTB-50A is discontinued in 2016.
The quantities are limited and not made available to everyone.
After the stock runs out, we will use the NTB-50B/C one-touch type terminal block.
- One-touch type terminal block (NTB-50B/C)
The one-touch type terminal block is a consumable item.
The one-touch type terminal block has leaf springs. Through repeated connections/disconnections, the leaf spring will gradually wear out and retaining force may decrease. The one-touch lock type terminal block is considered to be a consumable item. It is not covered under the terms of the warranty.
The replacement frequency is about two years, assuming twice a day (insertion and removal) of use, 20 days a month.
NTB-50B discontinued in 2020.
- AC adapter (optional accessory)
Heat and smoke will be emitted, resulting in an unstable voltage.

To operate the product normally, finding a sign of the product failure early by daily/periodic inspections and taking the corrective action are required.

For inspection, contact Kyowa or our representatives.

*All components do age and will fail

NTB-500A/C REPLACEMENT BEFORE THE END OF SERVICE LIFE

Preventive maintenance and replacement parts are a cost-effective way of keeping the performance and extending the service life of the product.

Regardless of the replacement parts, the product itself gradually deteriorates with age.

Before the expected service life is reached, consider replacing the product with a new one or the latest series as preventive maintenance.

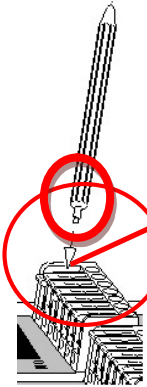
Read this notes carefully in order to make full use of the high performance capabilities of an One-touch Lock Type Terminal Board.

Note that the instructions of the one-touch lock type terminal block are different from that of the one-touch type terminal block.



Notes for using one-touch lock type terminal block (NTB-50A)

• Notes for connecting lead wires



• Press the following position.



Do not press the edge of the lock buttons. Or, the lock buttons may causes troubles such as unable to be locked or unable to be unlocked.

Be sure to press the above position with the accessory small screwdriver.

- For connection, always use the accessory small screwdriver or an object with a fine head.
- If the lock button does not work, insert the lead wire all the way to its end with pressing the lock button.

- Insert the lead wire with its coating peeled off about 10 mm all the way to its end into the round hole of the input terminal. While holding the lead wire, set back the lock button to the original position with your finger. Be sure to insert the lead wire all the way to its end. Or, it will not fix firmly.

- For connecting a strain gage, do not connect gage leads (lead wires directly connected from the strain gage) directly.
- Use a gage terminal and convert the gage leads to the applicable lead wires or use a strain gage with pre-attached lead cables.
- If you connect gage leads directly, gage leads may be broken since they are too thin.

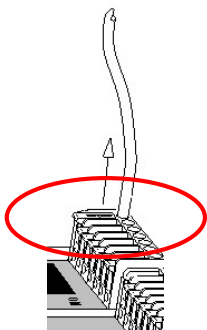
• Available lead wires are as follows.

Solid wire: $\phi 0.4$ mm to $\phi 1.2$ mm (ULAWG16 to 26)

Stranded wire: 0.2 mm^2 to 0.75 mm^2 (ULAWG20 to 24)

Be sure to use the above lead wires. Or, a breaking or connection error will happen.

• Notes for setting back lock buttons



- Never set back the lock buttons violently with your fingers or a small screwdriver.
Terminals will be deformed and the following troubles will happen.
 - The lock buttons will unable to be locked.
 - The lock buttons will unable to be unlocked.
 - The lock buttons will be deformed.
 - The lead wires will fall out.
- Gently set back the lock buttons to the original position with your fingers.

The one-touch lock terminal block is made of plastic. Over time and with use, the lock button will gradually fail. (unable to be locked or unable to be unlocked).

It is not covered under the terms of the warranty.

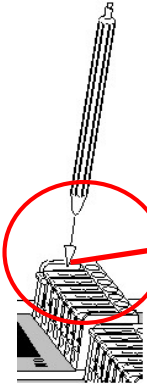
The replacement frequency is about two years, assuming twice a day (insertion and removal) of use, 20 days a month.

Read this notes carefully in order to make full use of the high-performance capabilities of a one-touch type terminal block.
 Note that the instructions of the one-touch lock type terminal block are different from that of the one-touch type terminal block.

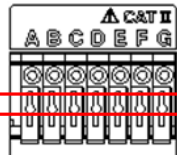


Notes for using one-touch type terminal block (NTB-50B/C)

• Notes for connecting lead wires



- Press the following position.



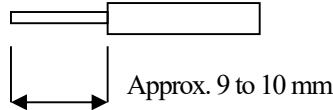
Do not press the edge of the button. Otherwise, it may cause troubles.

Be sure to press the above position with the accessory small screwdriver.

- For connection, always use the accessory small screwdriver or an object with a fine head.
- With pressing the button, insert the lead wire with its coating peeled off all the way to its end into the round hole of the input terminal. Release the button to fasten the lead wire.
- Gently pull the lead wire to check if it is securely fastened.

- Insert the lead wire with its coating peeled off approx. 10 mm all the way to its end into the round hole of the input terminal. The NTB-500A/C has a picture of "actual size" applicable lead wire with its coating peeled off.

Lead wire



- For connecting a strain gage, do not connect gage leads (lead wires directly connected from the strain gage) directly.
- Use a gage terminal and convert the gage leads to the applicable lead wires or use a strain gage with pre-attached lead cables.
- If you connect gage leads directly, gage leads may be broken since they are too thin.

- The available wires are as follows.

Solid wire: $\phi 0.4$ mm to $\phi 1.2$ mm (ULAWG16 to 26)

Stranded wire: 0.2 mm^2 to 0.75 mm^2 (ULAWG20 to 24)

Be sure to use the above lead wires. Or, a breaking or connection error will happen.

The one-touch type terminal block is a consumable item.

The one-touch type terminal block has leaf springs. Through repeated connections/disconnections, the leaf spring will gradually wear out and retaining force may decrease. The one-touch lock type terminal block is considered to be a consumable item. It is not covered under the terms of the warranty.

NOTATIONS USED IN THE INSTRUCTION MANUAL

The following notations are used in the Instruction Manual for convenience.

- Names described on the panel surface

Names described on the panel surface are expressed in double quotation mark " ".

- Informational notes

Certain notations are used as necessary to attract your attention to information that requires special care when handling the product, and to information provided for reference purposes.

Examples of Notations

NOTE

- Essential precautions required when handling the product.

MEMO

- Reference items required when handling the product.

- Abbreviated notation

In this Instruction Manual, cable names are abbreviated as follows.

Synchronous-sampling-communication cable for NTB-500A/C (N-119) → Synchronous communication cable (N-119)

Synchronous-sampling Y cable for NTB-500A/C (N-120) → Synchronous Y cable (N-120)

- NTB-500A/C

The measurement units that can be mounted are different for NTB-500A and NTB-500C. Other functions are the same. The common items are described as NTB-500A/C.

- NTB-50A/B/C

Excluding the terminal block, the NTB-50A (one-touch lock type terminal block) have the same functions as the NTB-50B/C (one-touch type terminal block). The NTB-50A/B/C indicates that the item is common to all.

- NTB-51A/C

The NTB-51A and NTB-51C can be mounted on different measuring instruments. Other functions are the same. The common items are described as NTB-51A/C.

1. OUTLINE

1-1 OUTLINE OF NTB-500A/C

The NTB-500A/C is a measuring instrument that is capable of measuring signal only by connecting the USB-CAN converter (Leaf Light HS V2) to the PC. Up to 8 NTB-500 units (64 channels) can be operated in synchronous operation.

Applicable sampling frequency is 1 Hz (max. 64 channels) to 1 kHz (max. 8 channels). The NTB-500A/C can measure data in a wide range from static to semi-dynamic phenomena.

With the NTB-500A/C, three types of unit are provided; NTB-50A (strain unit) for measuring strain, NTB-50B/C, and NTB-51A/C (voltage/thermocouple unit) for measuring voltage and temperature.

The NTB-50A/C is a one-touch lock type terminal block. The NTB-50B/C is a one-touch type terminal block. Excluding the terminal block, the NTB-50A (one-touch lock type terminal block) has the same functions as the NTB-50B/C (one-touch type terminal block).

* NTB-50A was discontinued in 2016 due to the discontinuation of the one-touch locking terminal block.

* NTB-500A, NTB-50B, and NTB-51A were discontinued in 2020 due to discontinuation of the connector to be connected.

* NTB-500A and NTB-500C can be connected.

.

1-2 FEATURES

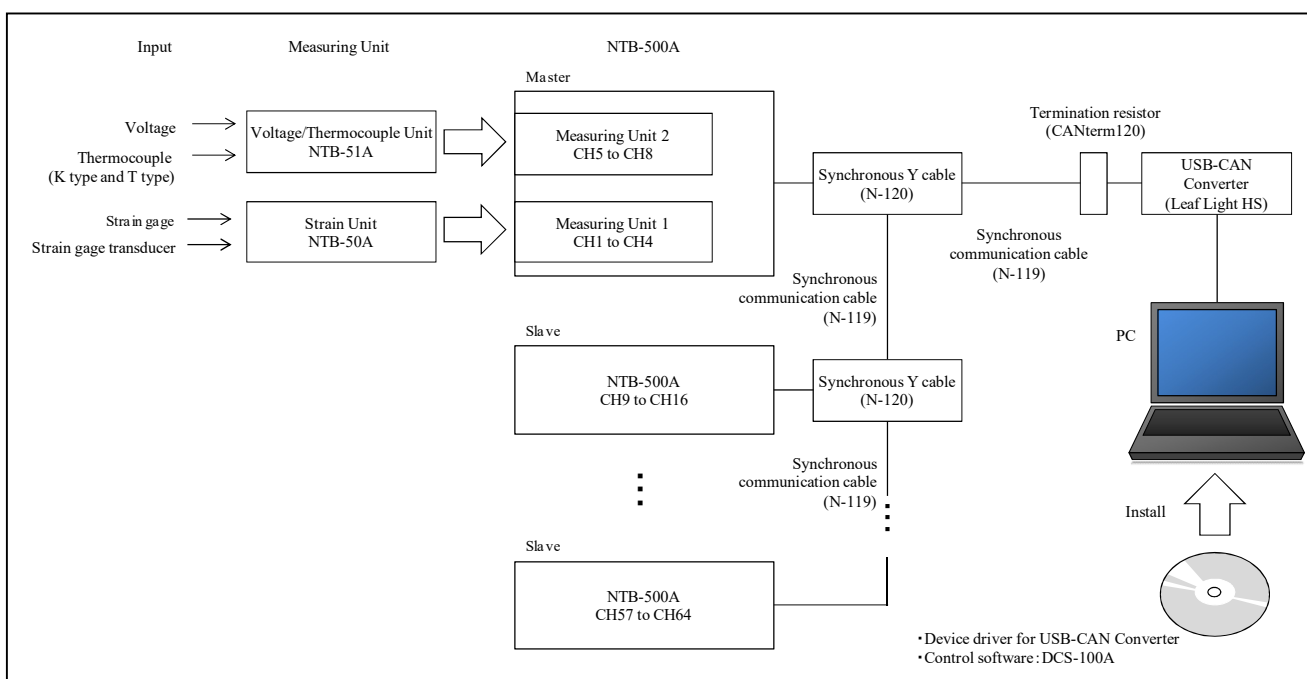
- Simultaneous sampling of all channels, ensuring simultaneity of data
- Applicable sampling frequency is 1 kHz/8 channels (100 Hz/64 channels). The NTB-500A/C can measure semi-dynamic phenomena data.
- Capable of designing the system according to your purpose since measuring units can be changed by every 4 channels.
- The total cable length between the PC and NTB-500A/C units is up to 400m. This allows for flexible NTB-500A/C placement and layout freedom.
- Capable of increasing channels easily by connecting NTB-500A/C units.
- Compact and lightweight, This design allows for closer mounting and the shortening of an individual sensor cable.
- The NTB-50A/B can measure large strain ($\pm 300,000 \mu\text{m/m}$) since it has a built-in bridge box.
- The NTB-51A can measure voltage up to 50 V and can measure temperature of thermocouples (TC/K, TC/T).
- The NTB-51A is isolated between channels.
- Capable of operating and controlling the NTB-500A/C with the Dynamic Data Recording Software DCS-100A.
- The Data Analysis Software DAS-200A is optional software that reproduces and analysis data after recording.
- Capable of connecting the CAN network system easily without using an USB-CAN converter.

1-3 SYSTEM CONFIGURATION

For using the Dynamic Data Recording Software DCS-100A

PC
The system requirements (including the CPU, OS, memory, and display) of the PC is set according to the control software DCS-100A specifications. Check the current DCS-100A specifications on our website.

Peripherals	
Measuring Unit	NTB-50A/B/C (strain unit), NTB-51A/C (voltage/thermocouple unit)
Synchronous communication cable	N-119 (1 m) Note: When requiring the cable other than the above, contact Kyowa or our representatives.
Synchronous Y cable	N-120 (for distributed arrangement)
Termination resistor	Vector Japan Co., Ltd. Model: CANterm120
USB-CAN converter	Kvaser Inc. Model: Leaf Light HS (discontinued product) Model: Leaf Light HS V2 (successor)

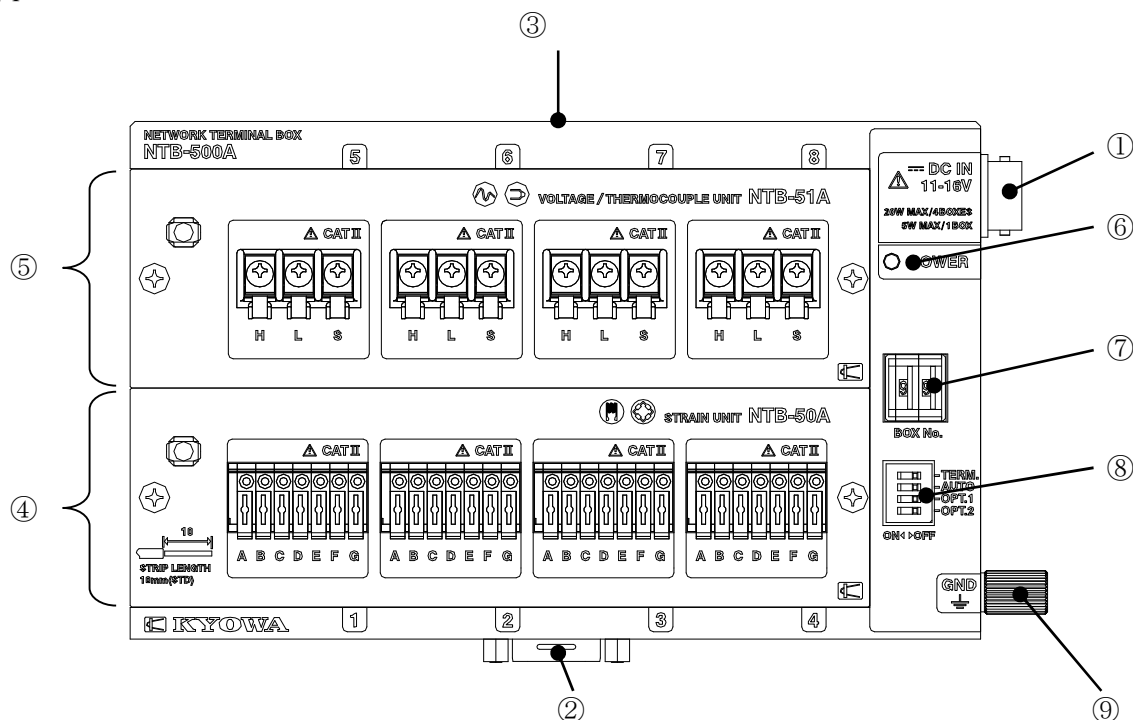


2. CONTROLS AND INDICATORS

2-1 NTB-500A/C

Suppose the NTB-50A/B/C (strain unit) is mounted to the unit 1 and NTB-51A/C (voltage/thermocouple unit) is mounted to the unit 2.

2-1-1 Top panel



① Power connector

Power connector.
Power voltage range is 11 to 16 VDC.

② Communication connector

For connecting the PC.

③ Coupling connector

For coupling the other NTB-500A/C units.

④ Unit 1

For mounting a measuring unit. (CH1 to CH4)

⑤ Unit 2

For mounting a measuring unit. (CH5 to CH8)

⑥ “POWER” LED

Lights up while the NTB-500A/C is ON.

⑦ “BOX No.” switch

Digital switch for setting the “BOX No.”

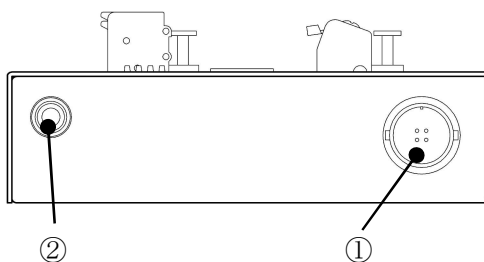
⑧ Optional DIP switch

For function settings.

⑨ “GND” Terminal

“GND” terminal (protective grounding)
Be sure to ground the “GND” terminal.

2-1-2 Side panel (power connector side)



① Power connector

Power connector.
Power voltage range is 11 to 16 VDC.

② “GND” terminal

“GND” terminal (protective grounding).
Be sure to ground the “GND” terminal.

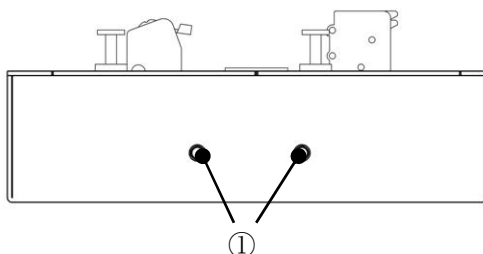
NOTE

- Before connecting the DC power, check the power voltage.
The power voltage range is 11 to 16 VDC.
If the power voltage exceeds the above specified voltage range, do not connect the DC power.
Or, it may cause trouble or damage to the NTB-500A/C.
Use the DC power cable P-76 (accessory) for connecting the DC power.

MEMO

- Use the following AC adapter (optional accessory).
AC adapter: SA-10A-EDS (100 to 240 VAC)

2-1-3 Side panel (driver holder side)



① Fixing hole for for driver holder

Used for fixing the accessory driver holder.

MEMO

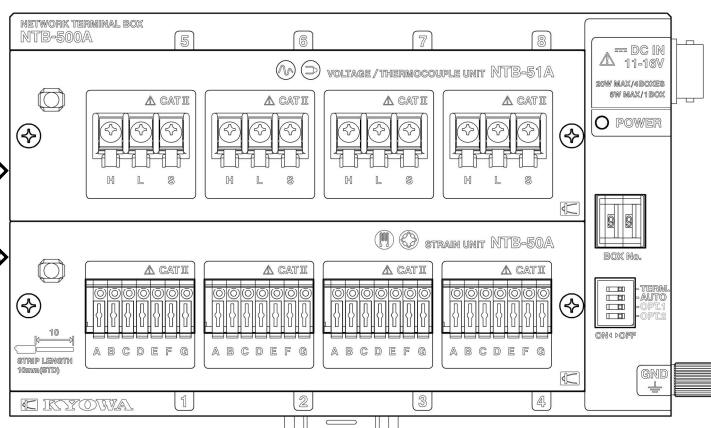
- When mounting the driver holder, use the accessory screws (binding head screw with POM washer attached, M3×6).

MEMO

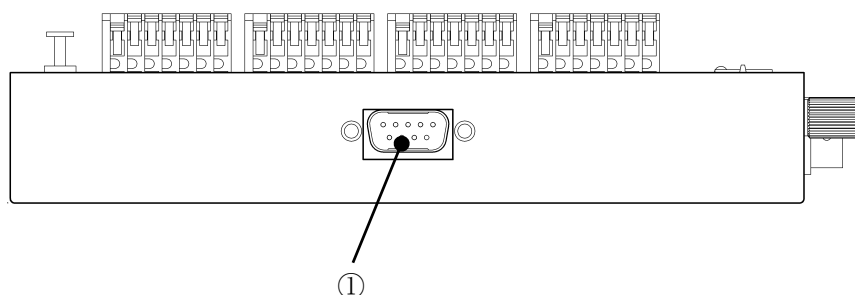
- Mount the driver holder as follows.

Binding head screw with POM washer attached, M3×6

Driver holder



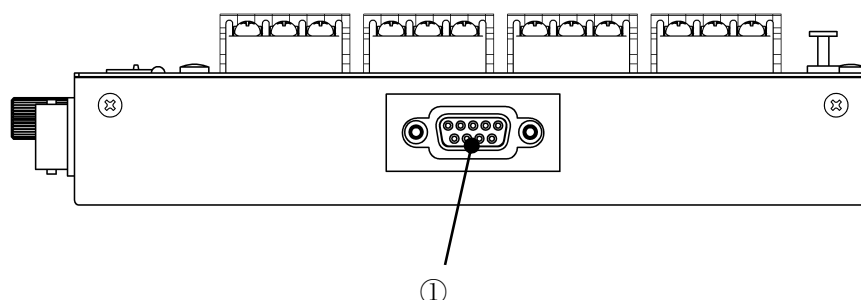
2-1-4 Side panel (PC connection side)



① Communication connector

For connecting the PC.

2-1-5 Side panel (NTB-500A/C coupling side)



① Coupling connector

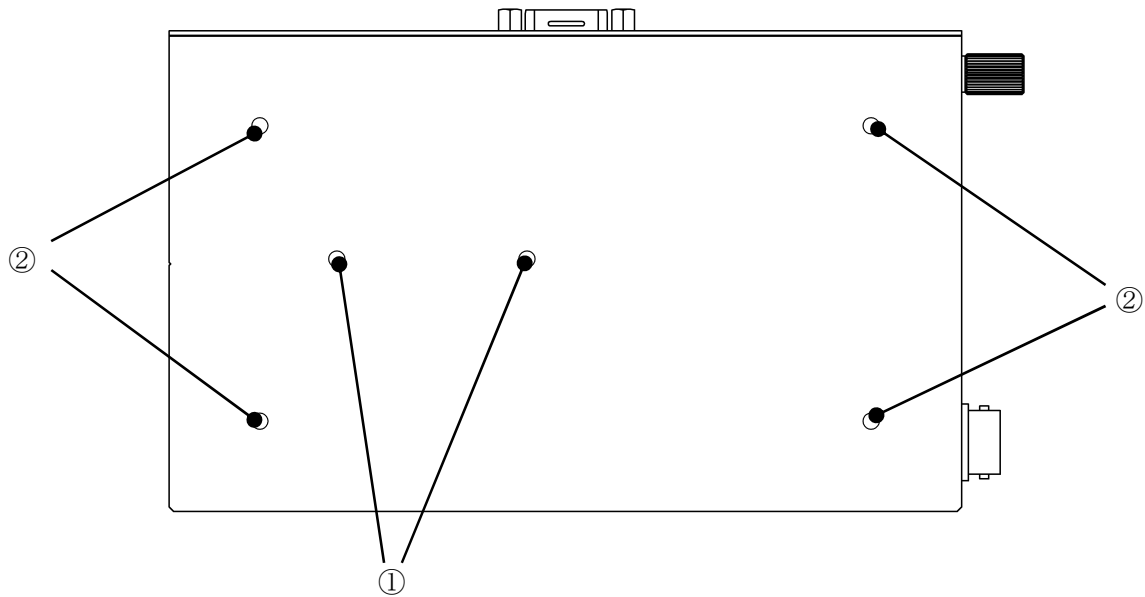
For coupling the other NTB-500A/C units.

* NTB-500A and NTB-500C can be connected.

NOTE

- Do not connect the PC to the coupling connector.
- You cannot couple the NTB-100A series, NTB-201A, and NTB-21A.

2-1-6 Bottom panel



- | | |
|---|---|
| ① Fixing hole for coupling the NTB-500A/C units | Used for coupling the NTB-500A/C units.
(When not using the DIN rail) |
| ② Fixing hole for DIN rail mounting plate | Used for fixing the NTB-500A/C to the DIN rail.
(Width between the holes: 42 mm) |

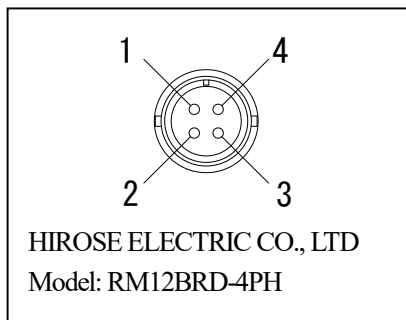
NOTE

- For the CN-10A, use flat head machine screws (M3 × 6).
- For the CN-11A, use binding head machine screws (M3 × 6).
- When mounting the optional DIN rail mounting plate or coupling plate, use the accessory screws.
- For the DIN rail mounting plate, use binding head machine screws (M3 × 6).

2-1-7 Power connector

Model and pin No. of the power connector are described as follows.

Pin No.	Name
1	+DC IN
2	
3	-DC IN
4	



NOTE

- Before connecting the DC power, check the power voltage.
The power voltage range is 11 to 16 VDC.
If the power voltage exceeds the above specified voltage range, do not connect the DC power. Or, it may cause trouble or damage to the NTB-500A/C.
Use the DC power cable P-76 (accessory) for connecting the DC power.

MEMO

- Use the following AC adapter (optional accessory).
AC adapter: SA-10A-EDS (100 to 240 VAC)

2-1-8 Status of the POWER LED

Status of the "POWER" LED are described as follows.

Status of the "POWER" LED	Operation of the NTB-500A/C
Lights out	Power OFF
Lights up (green)	Power ON (master)
Lights up (orange)	Power ON (slave)
Lights up (red)	Communication error
Blinking (green)	Measuring (master)
Blinking (orange)	Measuring (slave)
Blinking (red)	"BOX No." switch error

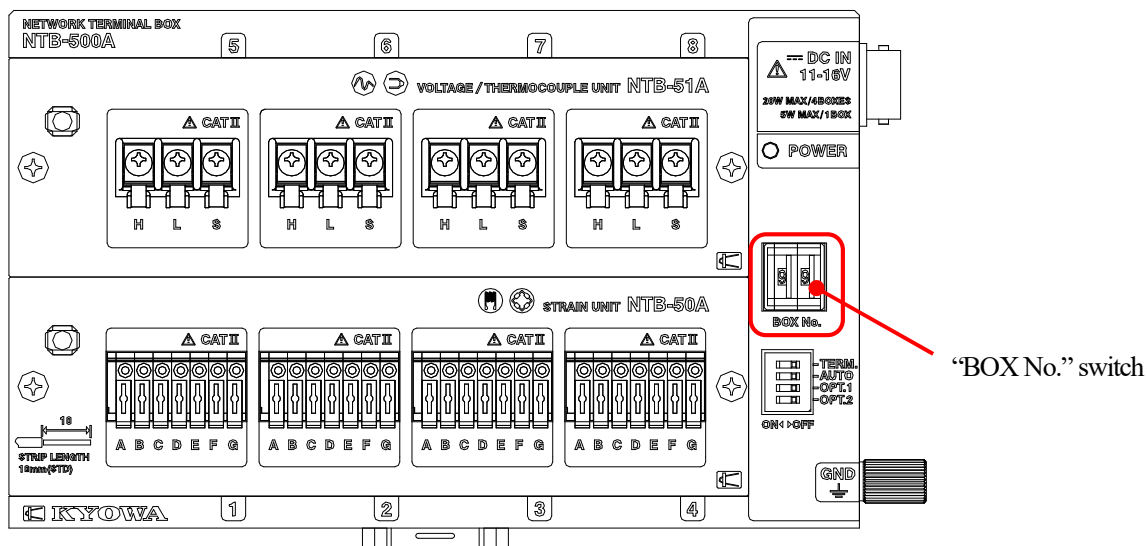
2-1-9 BOX No. switch

The “BOX No.” switches are for identifying the NTB-500A/C.

Rotate the “BOX No.” switch downward to increase the “BOX No.” or upward to decrease the “BOX No.”.

Do not set the same “BOX No.” in the same networks.

Applicable “BOX No.” is 01 to 08.



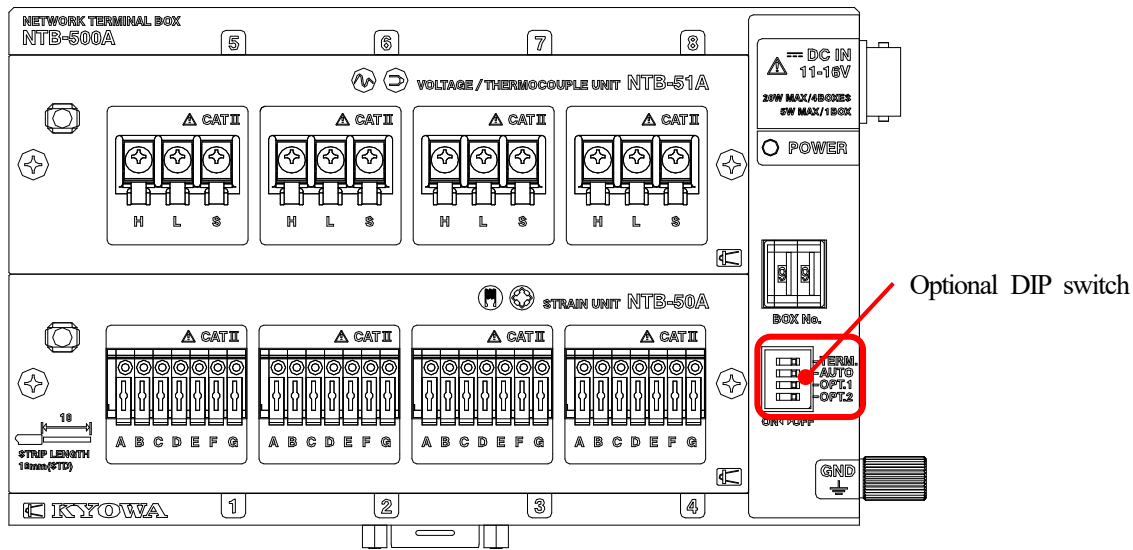
For details, see “3-4 SETTING BOX NO. SWITCH.”

NOTE

- Do not set 00 to the “BOX No.” switch. Neither communication nor measurement can be executed. The “POWER” LED blinks red.

2-1-10 Optional DIP switch

Functions of the optional DIP switches are described as follows.



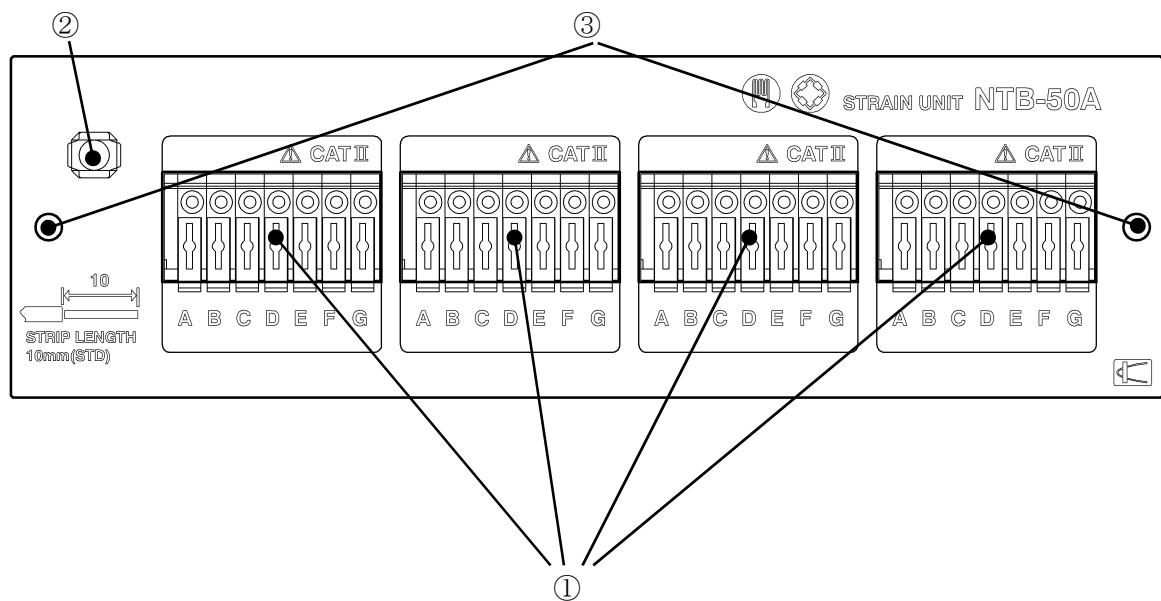
“TERM.” (SW4)	For setting the termination resistor. ON: Termination resistor ON OFF: Termination resistor OFF			
“AUTO” (SW3)	For setting the automated measurement function. ON: For sending the measured data automatically into the CAN bus after the start up OFF: For using the Dynamic Data Recording Software DCS-100A			
“OPT.1” (SW2)	For setting the length of the communication cables. See as follows.			
“OPT.2” (SW1)		“OPT.1”	“OPT.2”	Length of the communication cables
		OFF	OFF	20 m
		ON	OFF	80 m
		OFF	ON	100 m
		ON	ON	400 m
*The communication cable length of 400 m can be used with the main unit FIRM Version 01.05 or later.				

NOTE

- When coupling or distributing the multiple NTB-500A/C units, turn ON the termination resistor (“TERM.”) of the endmost NTB-500A/C.
For details, see “3-5 SETTING THE TERMINATION RESISTOR.”
- When connecting the multiple NTB-500A/C units, every “AUTO”, “OPT.1” and “OPT.2” needs to be the same for all the NTB-500A/C units. Or, the measuring system does not operate properly.
- For the automated measurement function, see “5. WITH THE KYOWA’S EDX SERIES.”
- The setting of the optional DIP switch is loaded after turning ON the NTB-500A/C.
If you change the settings, turn OFF and ON the power.

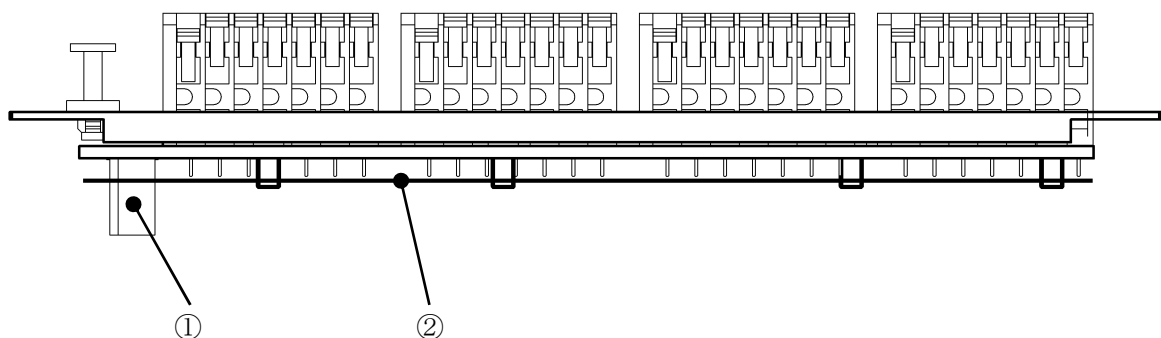
2-2 NTB-50A (optional accessory)

2-2-1 Top panel



- ① Input terminal
Input terminal block (one-touch lock type terminal block) for strain measurements
- ② Knob
To remove the measuring unit from the NTB-500A, grab the knob and pull straight up.
- ③ Fixing screw hole
For fixing the measuring unit.
When fixing a measuring unit, use the accessory screws (binding head screw with POM washer attached, M3×6) attached to the measuring unit.

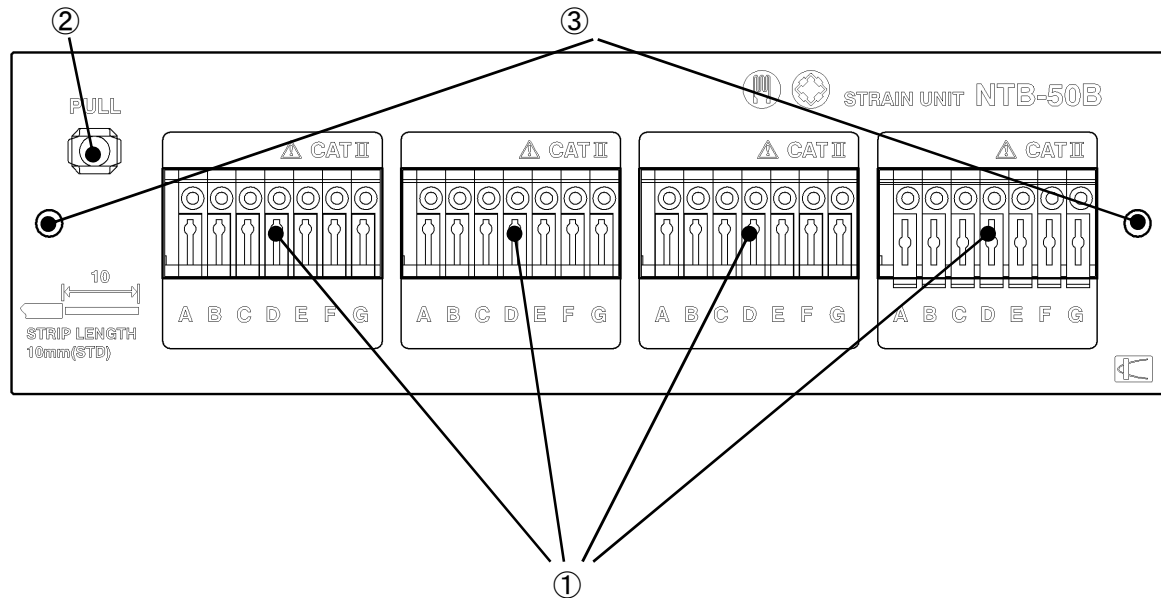
2-2-2 Side panel



- ① Connection connector
For connecting the NTB-500A.
*NTB-50A can be connected only to NTB-500A.
- ② Protective film
To avoid touching PCB with bare hands.

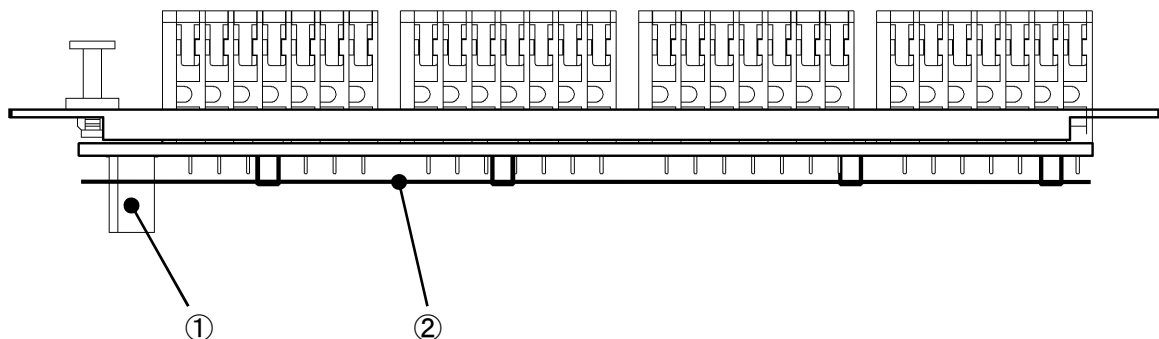
2-3 NTB-50B/C (optional accessory)

2-3-1 Top panel



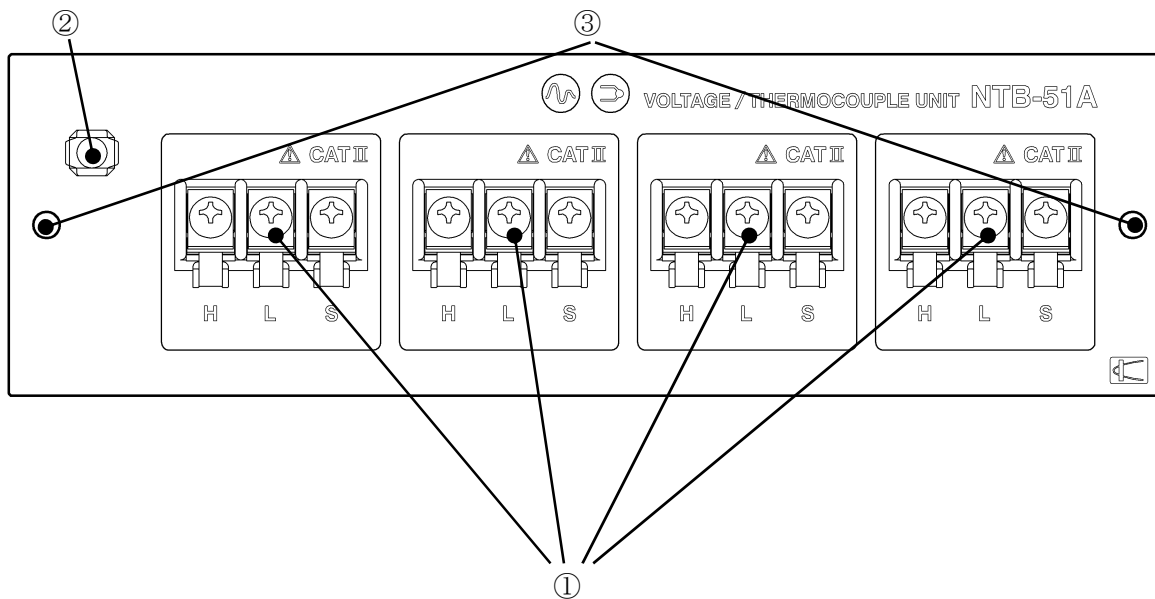
- ① Input terminal
Input terminal block (one-touch type terminal block) for strain measurements
- ② Knob
To remove the measuring unit from the NTB-500A/C, grab the knob and pull straight up.
- ③ Fixing screw hole
For fixing the measuring unit.
When fixing a measuring unit, use the accessory screws (binding head screw with POM washer attached, M3×6) attached to the measuring unit.

2-3-2 Side panel



- ① Connection connector
For connecting the NTB-500A/C.
*NTB-50B can be connected only to NTB-500A.
*NTB-50C can be connected only to NTB-500C.
- ② Protective film
To avoid touching PCB with bare hands.

2-4-1 Top panel



① Input terminal

Input terminal block (soldering, screw-fixed terminal block) for voltage/thermocouple measurements

①-1 Screw and a metal plate

The tapped hole diameter is M3.

The screws have a metal plate for binding cables.

The recommended tightening torque for the screws is $0.49 \text{ N} \cdot \text{m}$.

When using the solderless terminal, the outside dimension should be 6.5 mm or less.

①-2 Soldering lug

Solders cables.

The surface tensions on the right and left edges prevent the solder from flowing to the screws.

② Knob

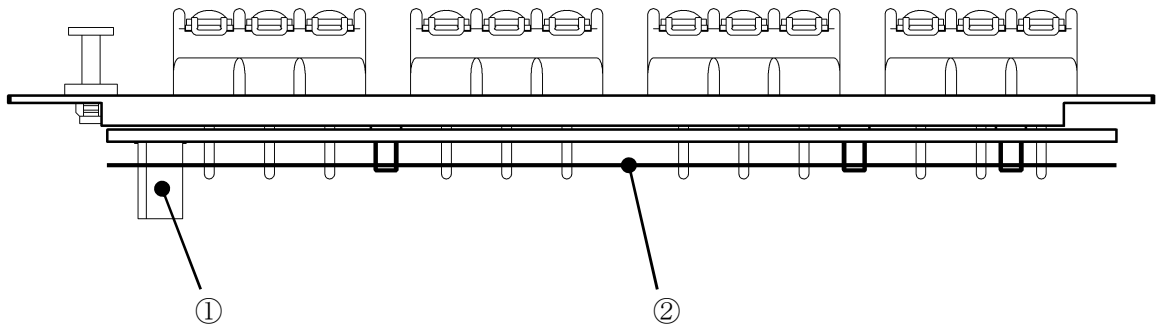
To remove the measuring unit from the NTB-500A/C, grab the knob and pull straight up.

③ Fixing screw hole

For fixing the measuring unit.

When fixing a measuring unit, use the accessory screws (binding head screw with POM washer attached, M3×6) attached to the measuring unit.

2-4-2 Side panel



① Connection connector

For connecting the NTB-500A/C.

*NTB-51A can be connected only to NTB-500A.

*NTB-51C can be connected only to NTB-500C.

② Protective film

To avoid touching PCB with bare hands.

2-5 COUPLING AND DISTRIBUTED ARRANGEMENT

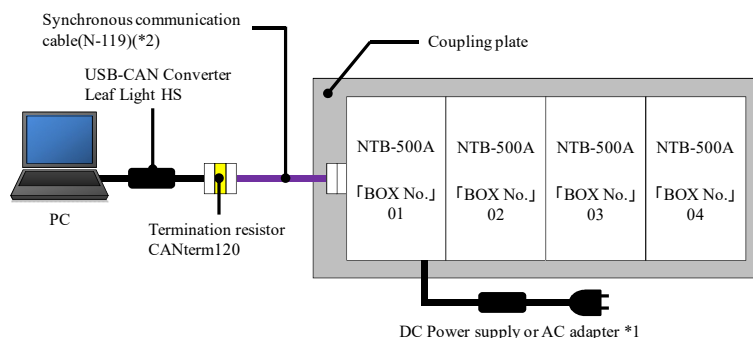
Capable of coupling the NTB-500A/C units by using the coupling connectors.

If coupled, wire-saving layout can be obtained since the coupled NTB-500A/C units require DC power, USB-CAN converter, termination resistor, and communication cable each. Use the DIN rail (optional accessory) or coupling plate (optional accessory, model: CN-10A or CN-11A) for coupling.

For distributed arrangement, use the Synchronous Y cable (optional accessory, model: N-120) and Synchronous communication cable (optional accessory, model: N-119) for connecting NTB-500A/C units.

At that time, every NTB-500A/C requires power supply.

■ For coupling



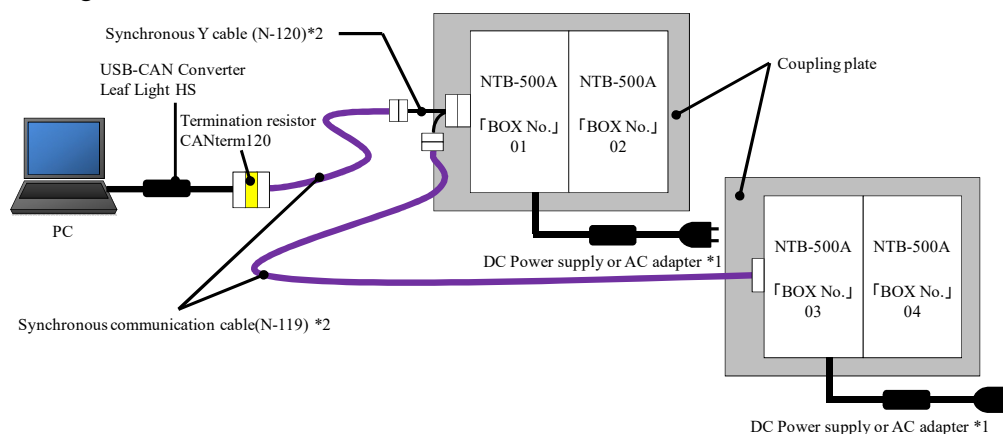
*1 With the AC adapter SA-10A-EDS (optional accessory), up to 4 NTB-500A/C units.

*2 The total length of the Synchronous communication cables are up to 400 m.

When the EMC standard is applied, keep the synchronous communication cable between devices within 30 m.

When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

■ For distributed arrangement



*1 With the AC adapter SA-10A-EDS (optional accessory), up to 4 NTB-500A/C units.

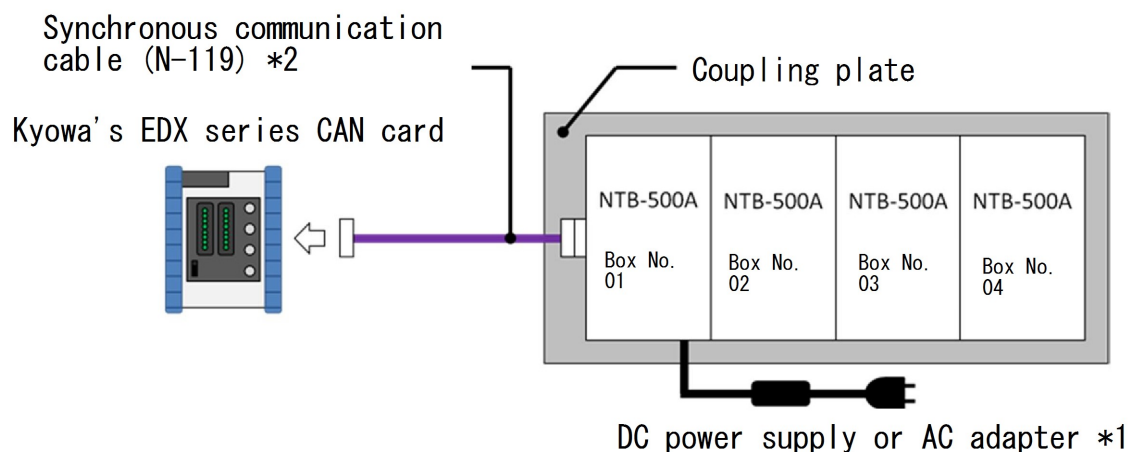
*2 The total length of the Synchronous communication cables are up to 400 m.

When the EMC standard is applied, keep the synchronous communication cable between devices within 30 m.

When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

The coupling method and connection method are described “3-3 CONNECTING THE NTB-500A/C” or later.

■ For coupling (when using the Kyowa's EDX series CAN card)



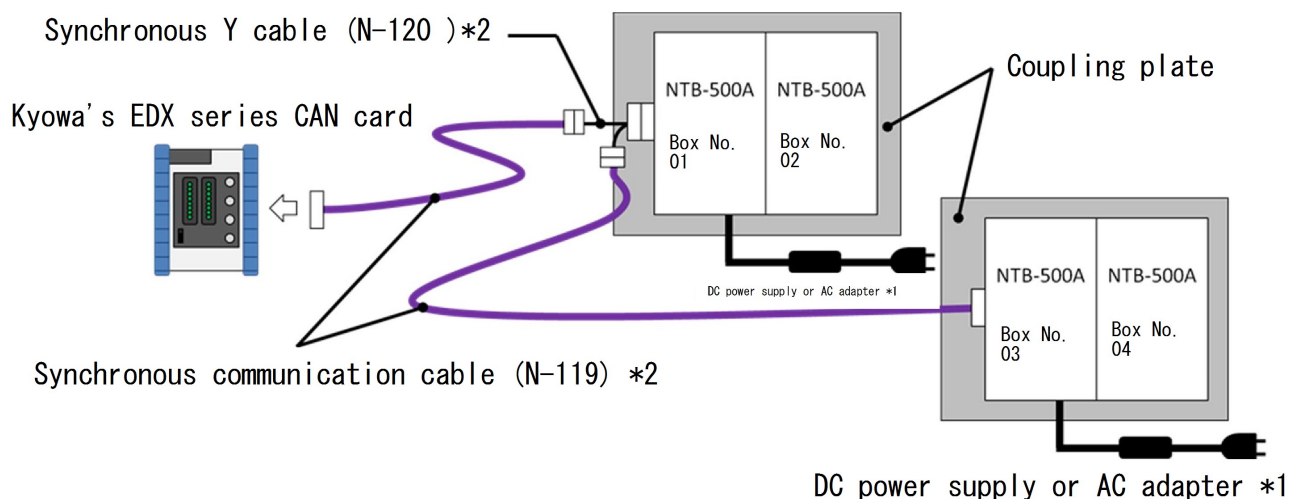
*1 With the AC adapter SA-10A-EDS (optional accessory), up to 4 NTB-500A/C units.

*2 The total length of the Synchronous communication cables are up to 400 m.

When the EMC standard is applied, keep the synchronous communication cable between devices within 30 m.

When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

■ For distributed arrangement (when using the Kyowa's EDX series CAN card)



*1 With the AC adapter SA-10A-EDS (optional accessory), up to 4 NTB-500A/C units.

*2 The total length of the Synchronous communication cables are up to 400 m.

When the EMC standard is applied, keep the synchronous communication cable between devices within 30 m.

When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

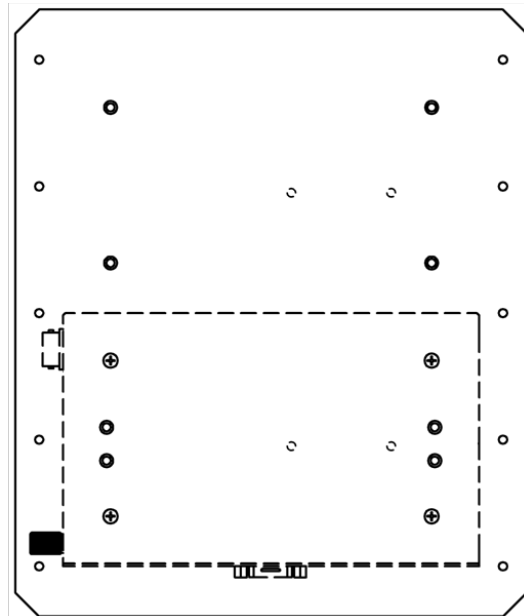
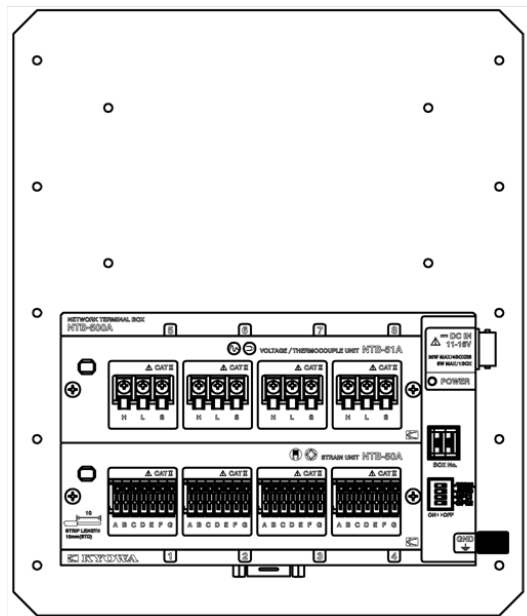
The coupling method and connection method are described “3-3 CONNECTING THE NTB-500A/C” or later.

2-5-1 For mounting NTB-500A/C units by using the coupling plate (optional accessory, model: CN-10A)

The following is an example of coupling 2 NTB-500A/C units by using the coupling plate (optional accessory, model: CN-10A).

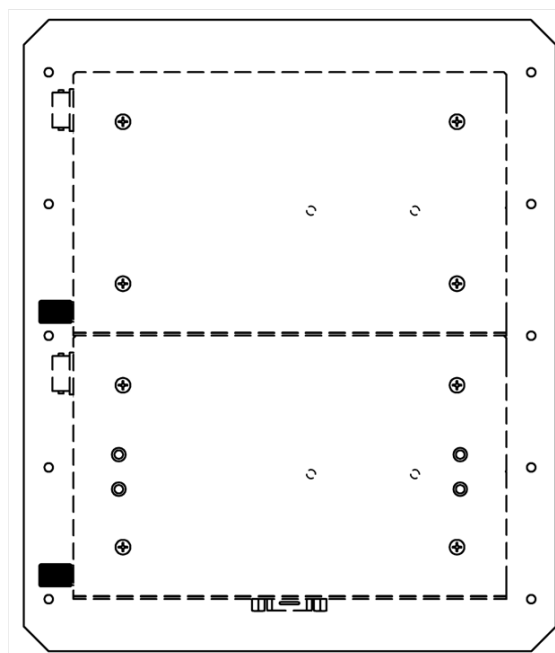
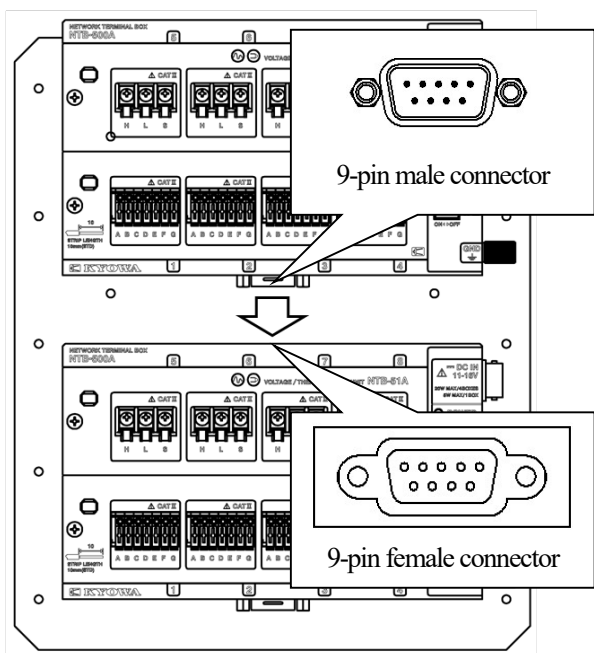
(1) Mount the 1st NTB-500A/C on the coupling plate.

Fix the NTB-500A/C to the coupling plate with screws from the rear of the coupling plate.



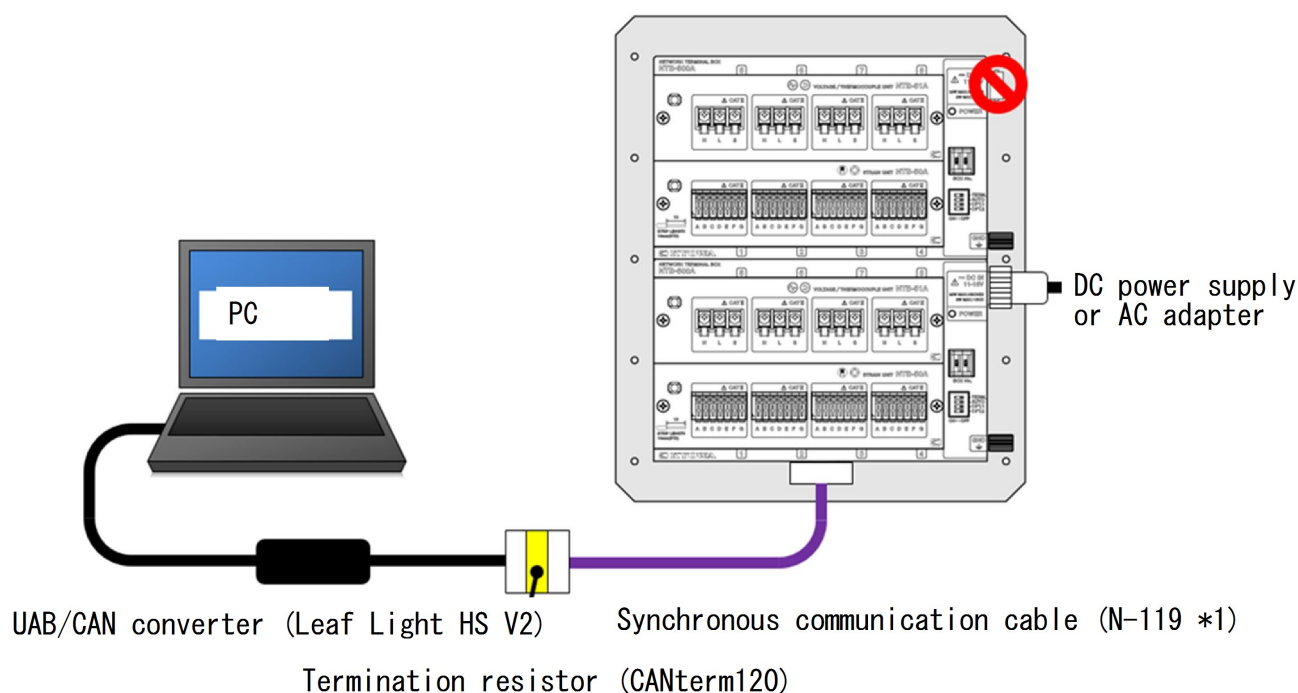
(2) Connect the coupling connector of the 1st NTB-500A/C, mounted on the coupling plate, and communication connector of the 2nd NTB-500A/C.

Fix the 2nd NTB-500A/C to the coupling plate with screws from the rear of the coupling plate.



(3) Connect the DC power to the 1st unit.

Connect the termination resistor and USB-CAN converter with the synchronous-sampling-communication cable (N-119 *Note) to the 1st unit.



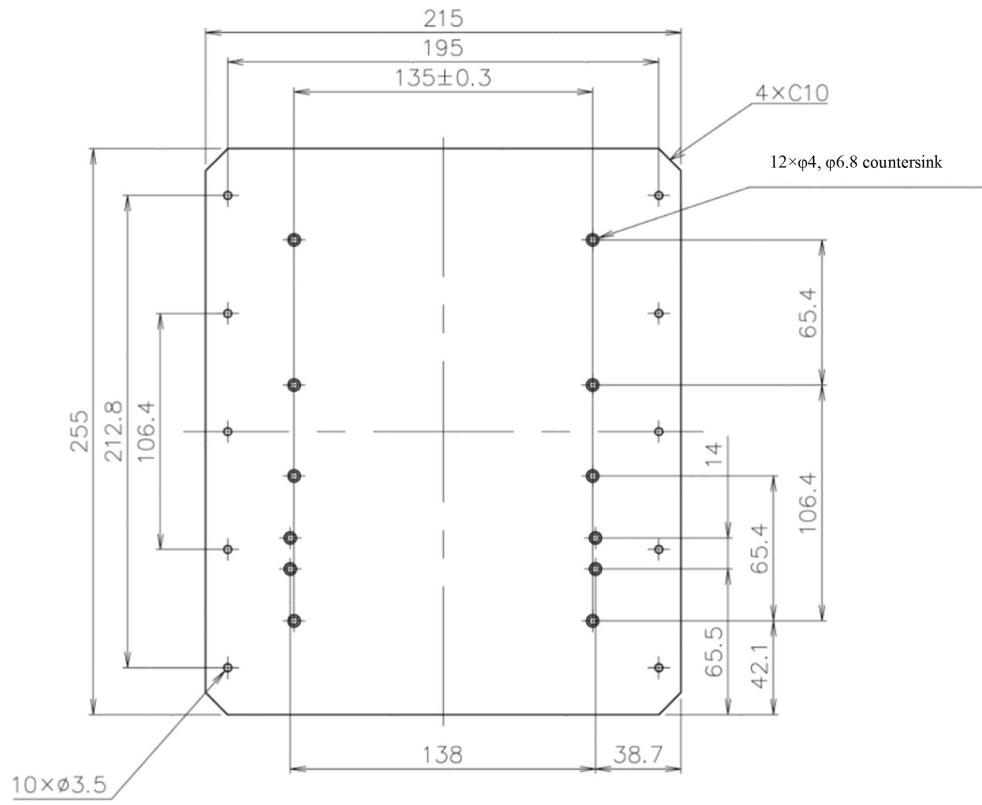
*1 When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

NOTE

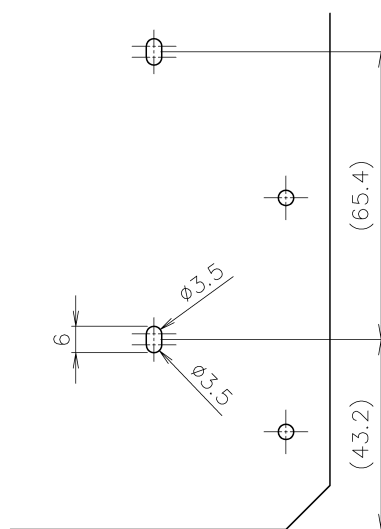
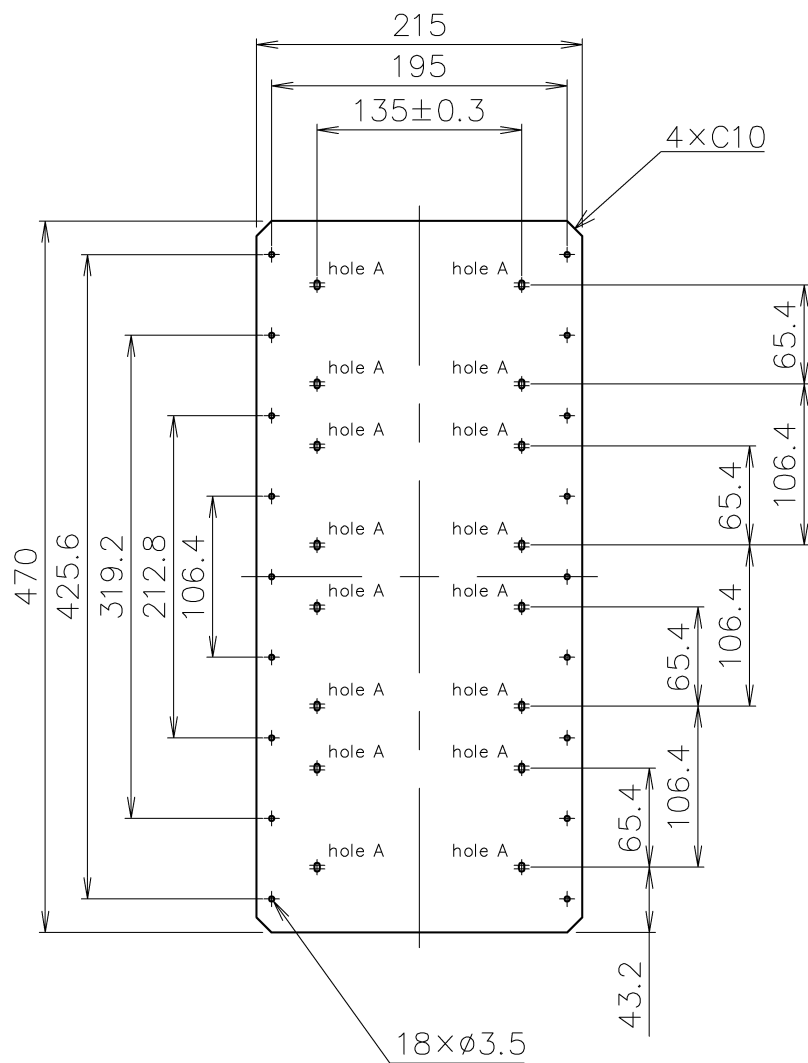
- When using the multiple NTB-500A/C units by coupling or in a same network, set the “TERM.” of the NTB-500A/C units of both sides in the network to ON.
For details, see “3-5 SETTING THE TERMINATION RESISTOR.”
- When coupling the multiple NTB-500A/C units, do not set the same “BOX No.”
- If you change the settings, turn OFF and ON the power.
- When mounting the optional coupling plate, use the accessory screws.
For the CN-10A, use flat head machine screws (M3 × 6).
For the CN-11A, use binding head machine screws (M3 × 6).

MEMO

- Specifications of the coupling plate (optional accessory, model: CN-10A)



● Specifications of the coupling plate (optional accessory, model: CN-11A)

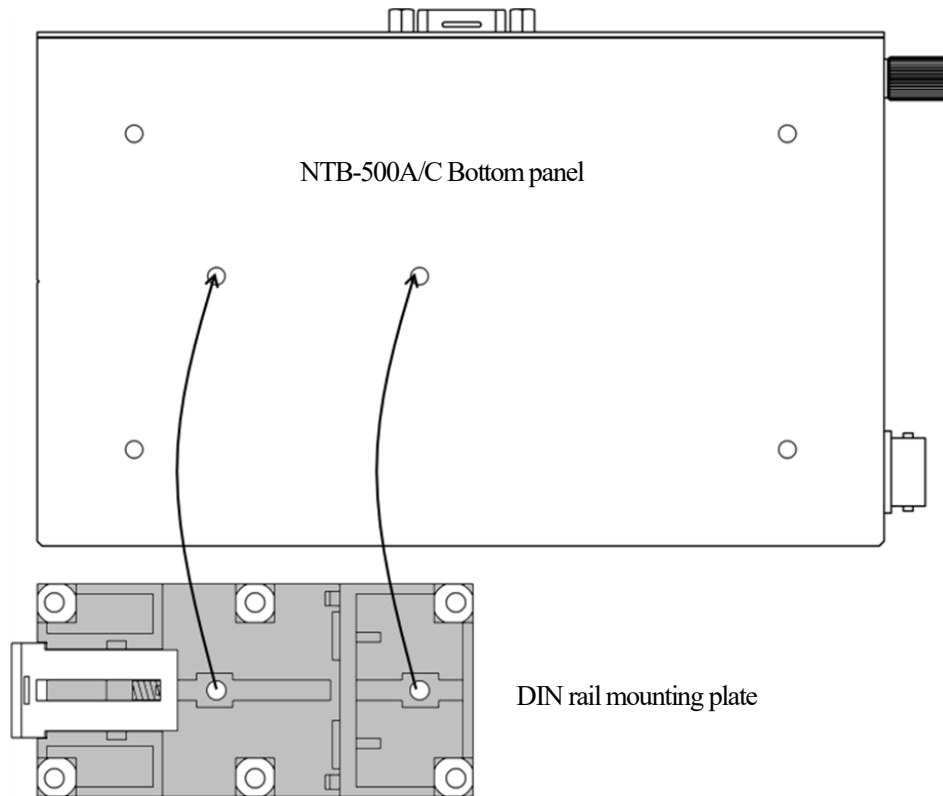


hole A detail view
(1 : 1)

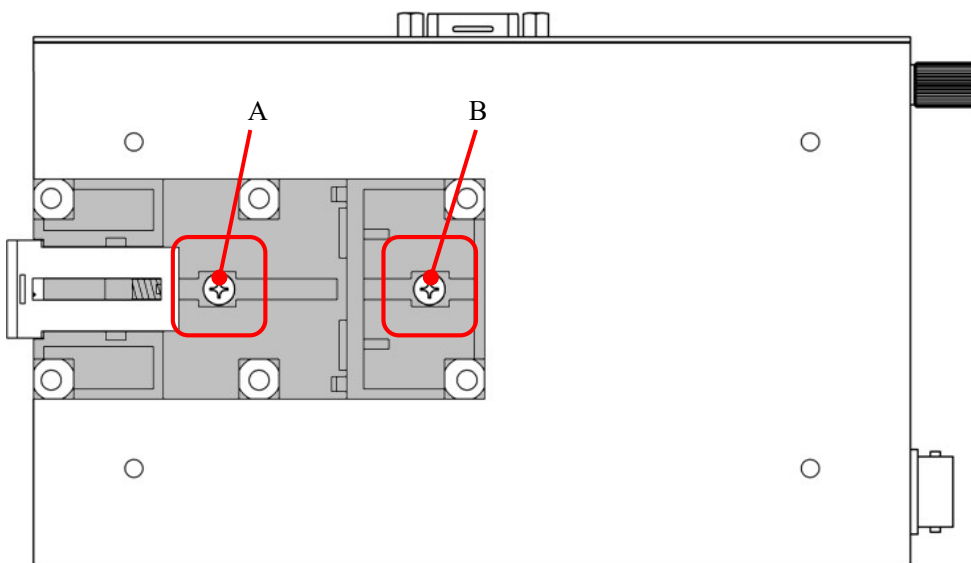
2-5-2 For mounting NTB-500A/C units (2) to DIN rail

The following is an example of mounting DIN rail when using 2 NTB-500A/C units.

(1) Set the DIN rail mounting plate (optional accessory) to the bottom panel of the NTB-500A/C.

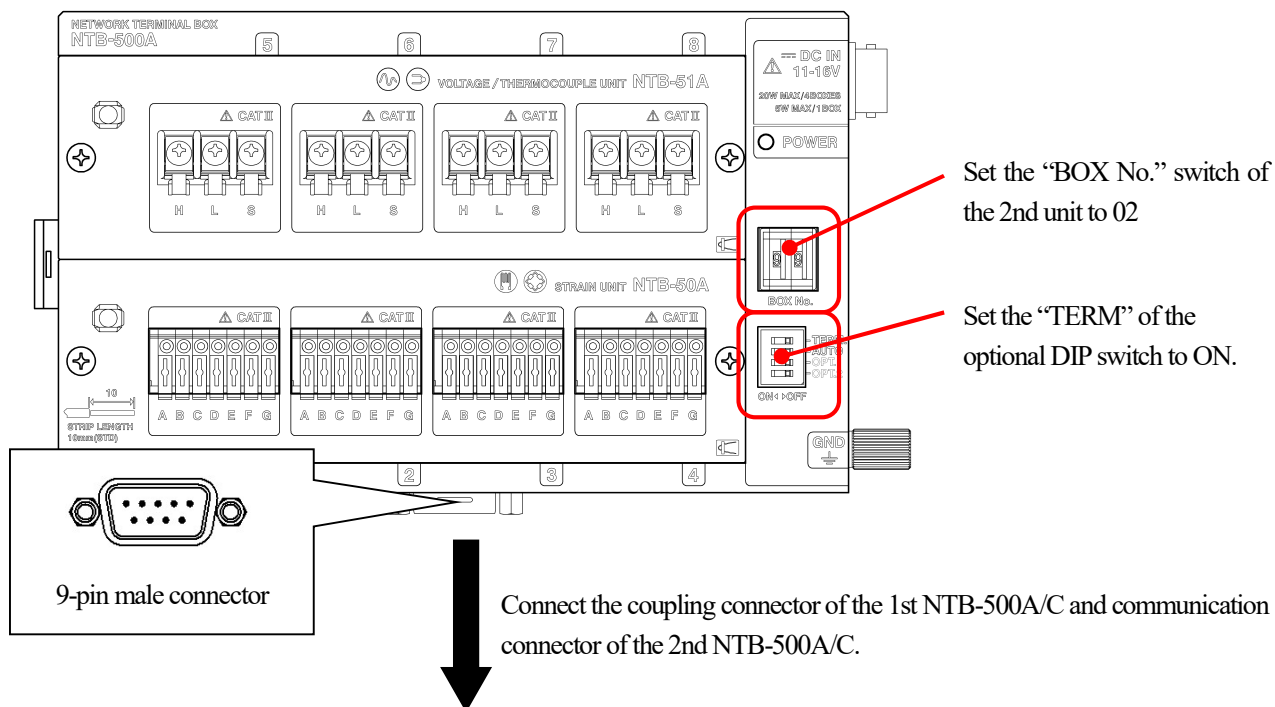


(2) Fasten the screws of the DIN rail mounting plate to the NTB-500A/C. (Fasten the A and B screws in the following.)

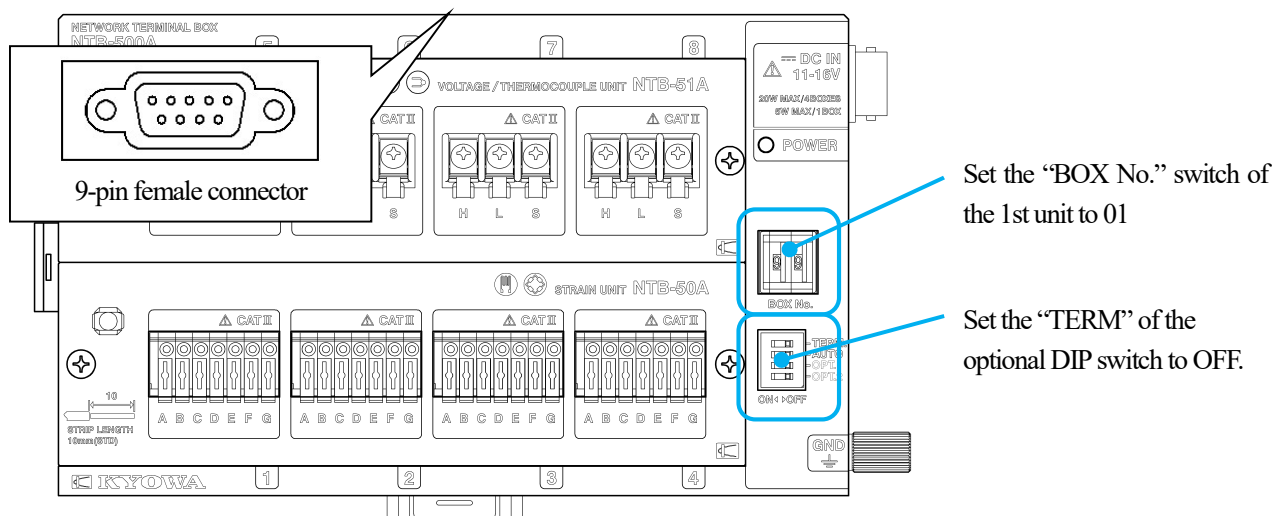


(3) Connect the coupling connector of the 1st NTB-500A/C and communication connector of the 2nd NTB-500A/C.

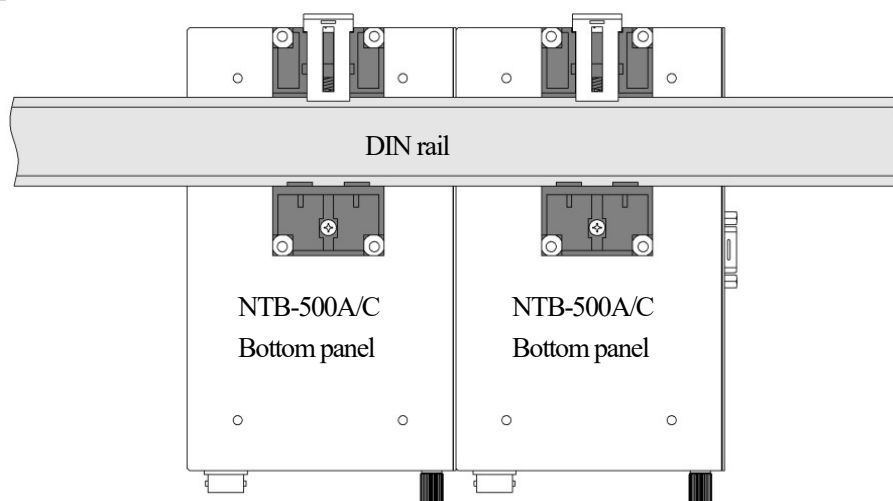
● NTB-500A/C (2nd unit)



● NTB-500A/C (1st unit)

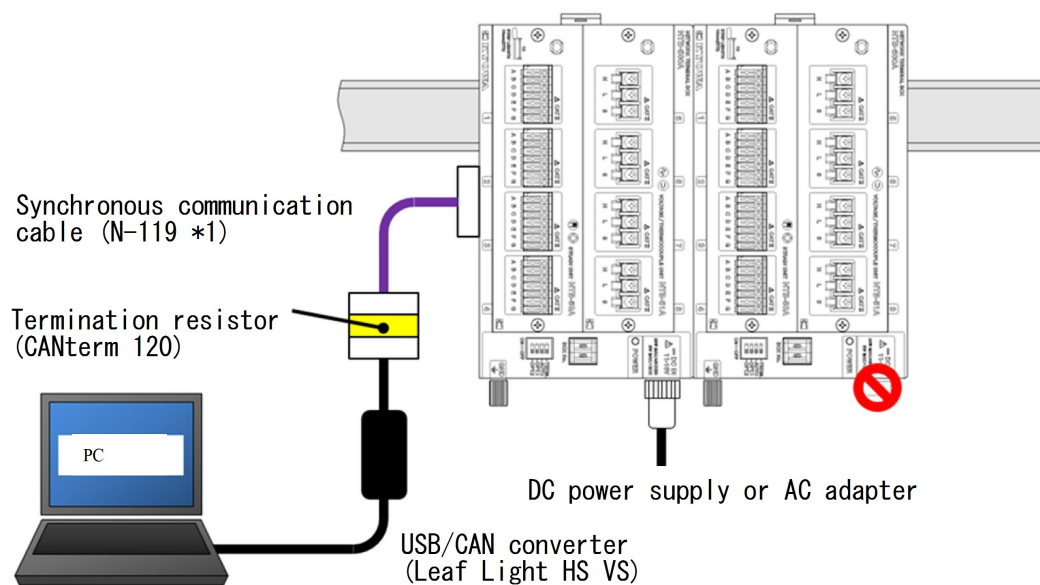


(4) Mount the coupled NTB-500A/C units to the DIN rail.



(5) Connect the DC power to the 1st unit. Connect the termination resistor and USB-CAN converter with the Synchronous communication cable (N-119 *1) to the 1st unit.

*1 When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.



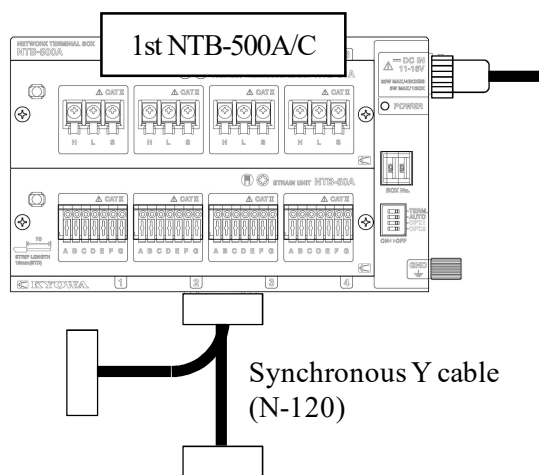
NOTE

- When using the multiple NTB-500A/C units by coupling or in a same network, set the “TERM.” of the NTB-500A/C units of both sides in the network to ON.
For details, see “3-5 SETTING THE TERMINATION RESISTOR.”
- When coupling the multiple NTB-500A/C units, do not set the same “BOX No.”
- If you change the settings, turn OFF and ON the power.
- When mounting the optional DIN rail mounting plate, use the accessory screws.
For the DIN rail mounting plate, use binding head machine screws (M3 × 6).

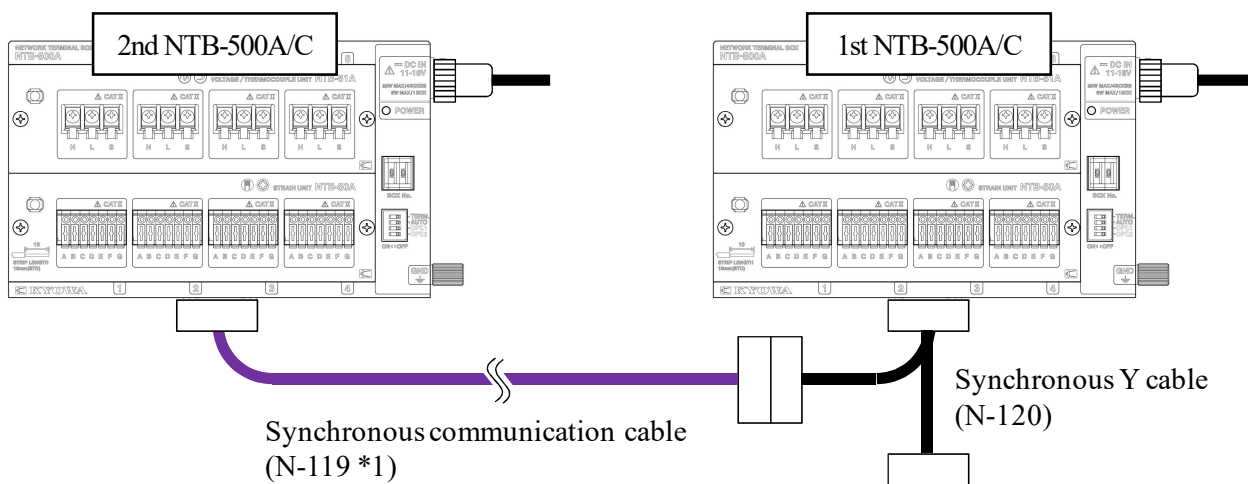
2-5-3 For distributed arrangement

Note: When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

(1) Connect the Synchronous Y cable (N-120) to the communication connector of the 1st NTB-500A/C.

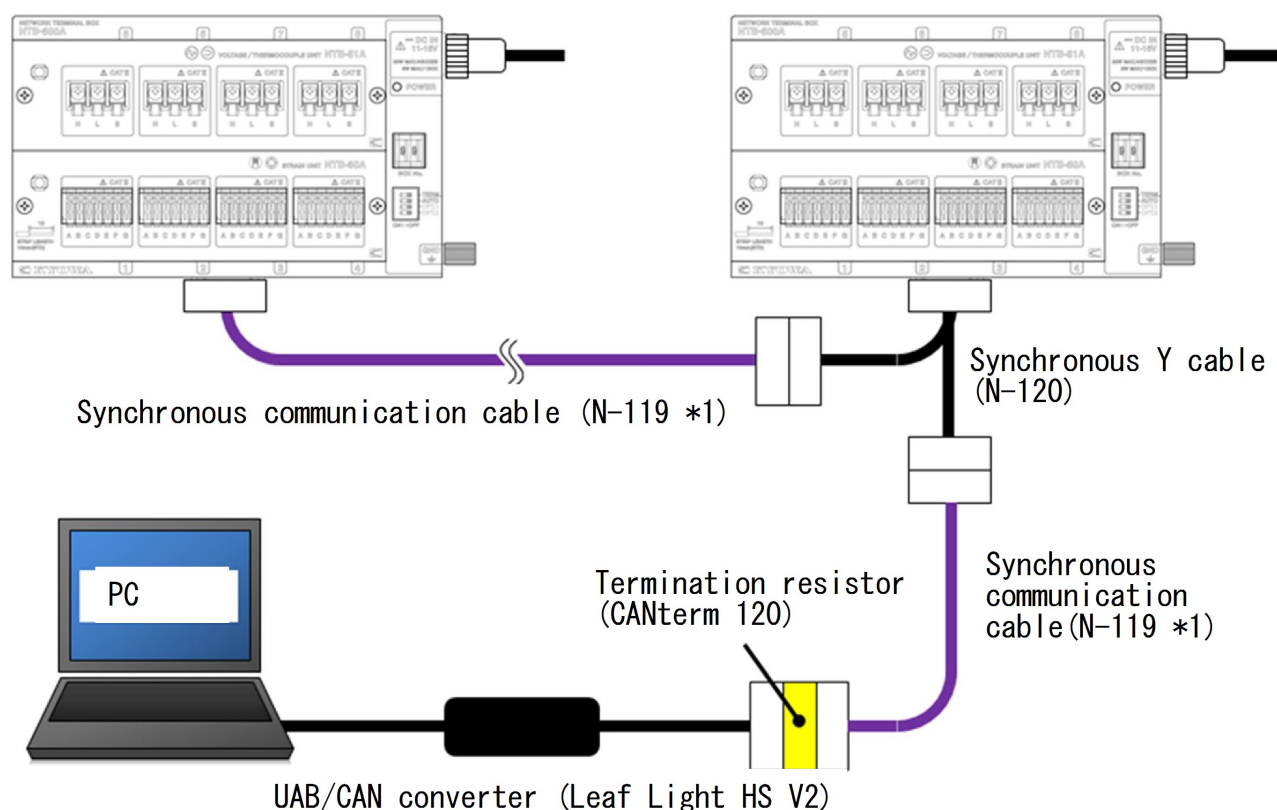


(2) Connect the communication connector of the 2nd NTB-500A/C and one end of the Synchronous Y cable (N-120) of the 1st NTB-500A/C by using the Synchronous communication cable (N-119 *1).



*1 When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

(3) Connect the Synchronous communication cable (N-119 *1) to another end of the Synchronous Y cable (N-120). Connect the termination resistor to another end of the Synchronous communication cable (N-119 *1) and USB-CAN converter. Connect the PC to the USB-CAN converter.



*1 When requiring the Synchronous communication cable other than the N-119(1 m), contact Kyowa or our representatives.

(4) Connect the DC powers to every NTB-500A/C.

NOTE

- When using the multiple NTB-500A/C units by coupling or in a same network, set the “TERM.” of the NTB-500A/C units of both sides in the network to ON.
For details, see “3-5 SETTING THE TERMINATION RESISTOR.”
- When coupling the multiple NTB-500A/C units, do not set the same “BOX No.”
- If you change the settings, turn OFF and ON the power.

3. HOW TO INSTALL

3-1 INSTALLATION PROCEDURES

This section describes necessary operations from installation to measurement.

Follow the procedures as far as possible.

Be sure to install the device driver for the USB-CAN converter in advance. For details, see “4. INSTALL AND UNINSTALL THE DEVICE DRIVER FOR THE USB-CAN CONVERTER.”

Section 3-2	Mounting the measuring unit	Mount the measuring unit.
	↓	
Section 3-3	Connecting the NTB-500A/C	Connect and set the NTB-500A/C.
	↓	
Section 3-4	Setting “BOX No.” switch	Set the “BOX No.” of the NTB-500A/C.
	↓	
Section 3-5	Setting the termination resistor	Set the termination resistor.
	↓	
Section 3-6	Setting the length of the communication cables	Set the length of the communication cables.
	↓	
Section 3-7	Connect the sensor	Connect various sensors.
	↓	
Section 3-8	Grounding	Ground the NTB-500A/C.
	↓	
Section 3-9	Connecting power	Connect the DC power or AC adapter.
	↓	
Section 3-10	Power ON/OFF	Turn ON/OFF the NTB-500A/C.
	↓	
*Note	With the Dynamic Data Recording Software DCS-100A	Measure data with the Dynamic Data Recording Software DCS-100A.
Section 5	With the Kyowa's EDX series	Measure data with the Kyowa's EDX series.

*Note: When measuring data with the Dynamic Data Recording Software DCS-100A, see the DCS-100A Instruction Manual (For NTB-500A/C Operation).

Always turn OFF the NTB-500A/C before mounting the measuring unit.

- To remove the measuring unit from the NTB-500A/C, hold the NTB-500A/C with one hand, grab the knob and pull straight up with the other.

- Arrange the measuring units in due order from the fronts side (CH1 to CH4).



- Always turn OFF the NTB-500A/C before mounting the measuring unit.
Or, damage on the measuring unit or NTB-500A/C may result in.
- Be sure to check the mountable combinations of the measurement instrument and the measurement unit.
If you try to forcibly mount the unit in a combination that cannot be mounted, the connector will be damaged and the unit will fail.
- When mounting or removing the measuring unit in/from the NTB-500A/C, do not touch any component parts on the PCB.Or, system failure or damage may result in.

- If you have difficulty with mounting a measuring unit, move the measuring unit to the correct position. Push the terminal block down from the top.

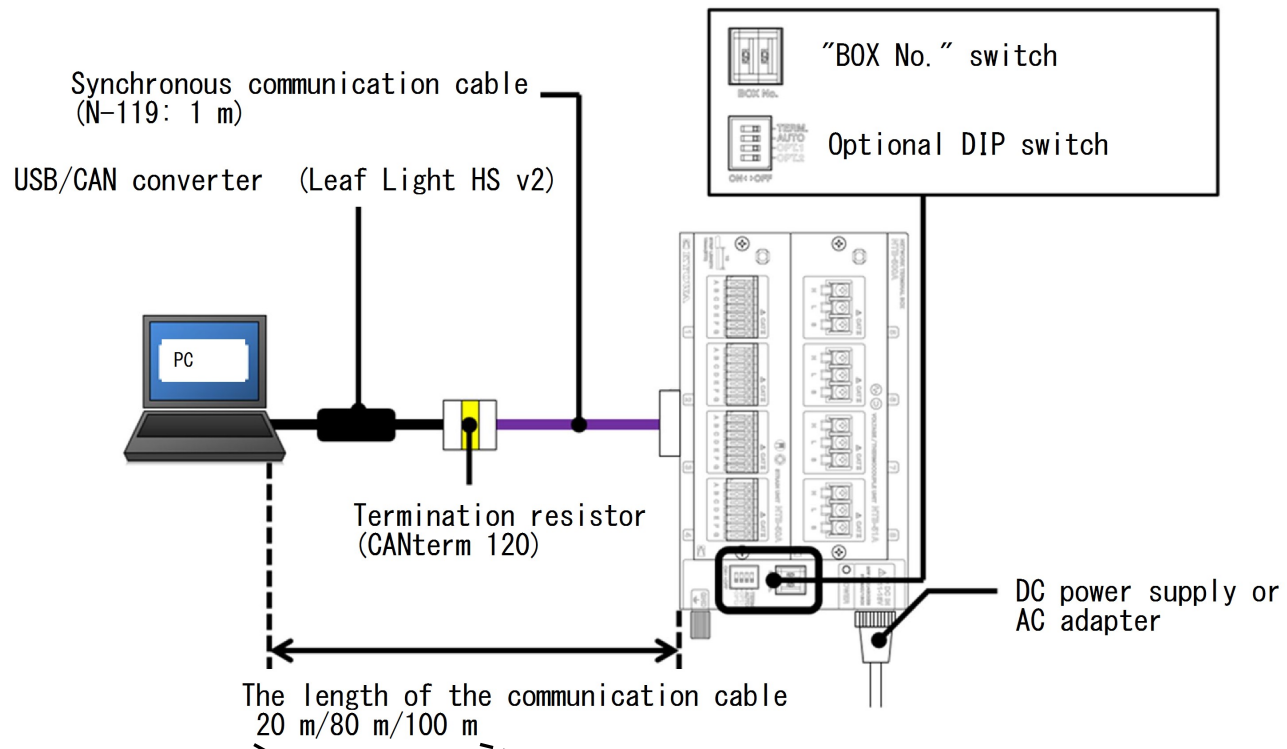


3-3 CONNECTING THE NTB-500A/C

This section describes how to connect and set the NTB-500A/C.

3-3-1 When connecting one NTB-500A/C

Before using the NTB-500A/C, be sure to set the “BOX No.” switch and optional DIP switch.
Set as follows.

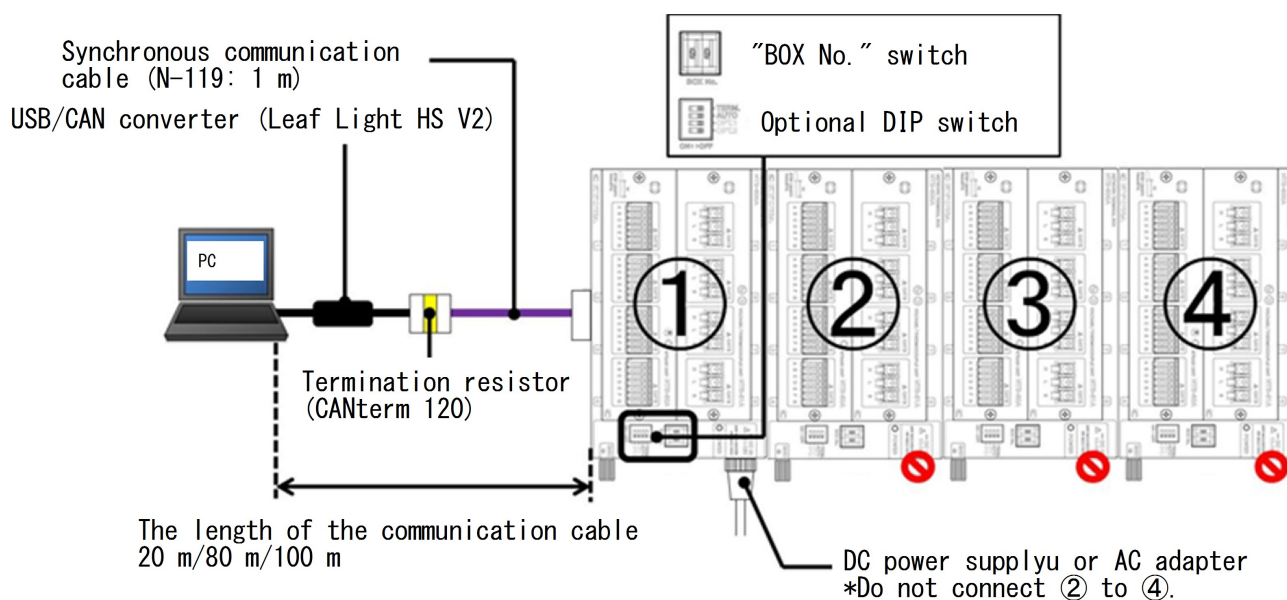


The length of the comm. cable		20 m		80 m		100 m	
“BOX No.” switch		01		01		01	
Optional DIP switch	“TERM.”: Term resistor	ON		ON		ON	
	“AUTO”: Auto function	OFF		OFF		OFF	
	“OPT.1”: Comm. cable	OFF		ON		OFF	
	“OPT.2”: Comm cable	OFF		OFF		ON	

3-3-2 When coupling multiple NTB-500A/C units

Before using the NTB-500A/C, be sure to set the “BOX No.” switch and optional DIP switch. Set as follows.

For coupling



The length of the comm. cable: 20 m		①	②	③	④
“BOX No.” switch		01	02	03	04
Optional DIP switch	“TERM.”: Term resistor	OFF	OFF	OFF	ON
	“AUTO”: Auto function	OFF	OFF	OFF	OFF
	“OPT.1”: Comm. cable	OFF	OFF	OFF	OFF
	“OPT.2”: Comm. cable	OFF	OFF	OFF	OFF

The length of the comm. cable: 80 m		①	②	③	④
“BOX No.” switch		01	02	03	04
Optional DIP switch	“TERM.”: Term resistor	OFF	OFF	OFF	ON
	“AUTO”: Auto function	OFF	OFF	OFF	OFF
	“OPT.1”: Comm. cable	ON	ON	ON	ON
	“OPT.2”: Comm. cable	OFF	OFF	OFF	OFF

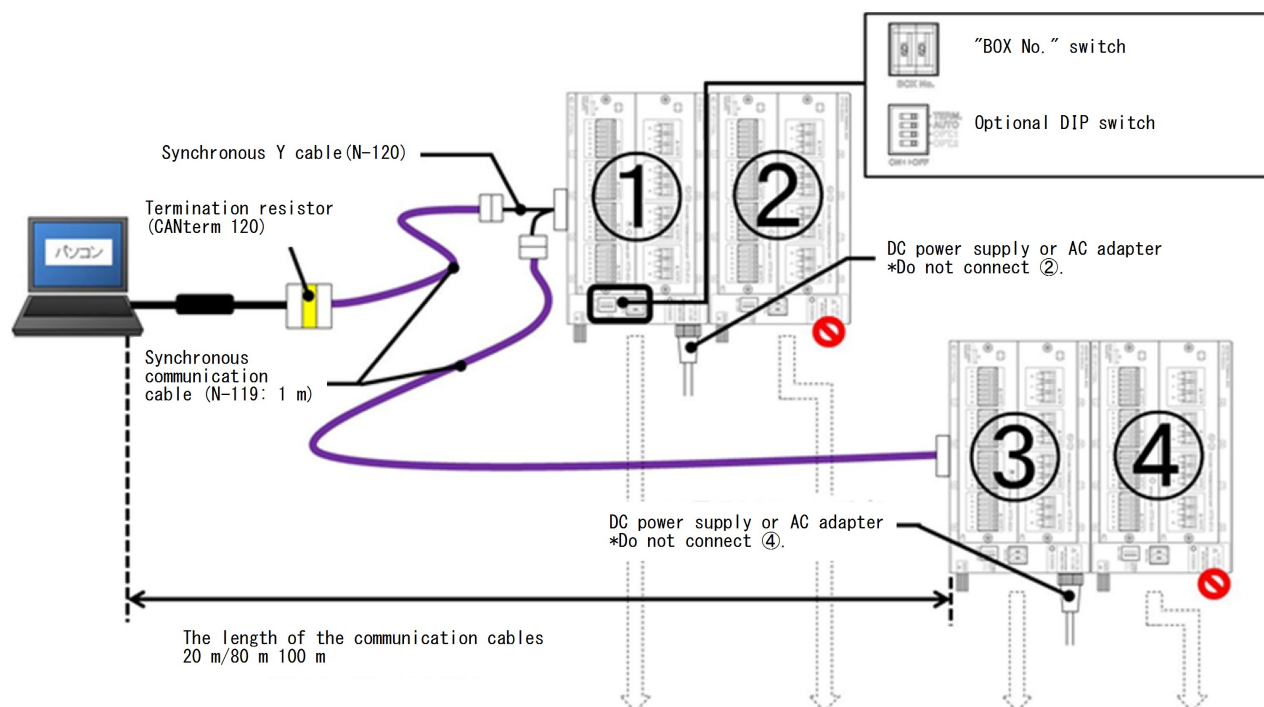
The length of the comm. cable: 100 m		①	②	③	④
“BOX No.” switch		01	02	03	04
Optional DIP switch	“TERM.”: Term resistor	OFF	OFF	OFF	ON
	“AUTO”: Auto function	OFF	OFF	OFF	OFF
	“OPT.1”: Comm. cable	OFF	OFF	OFF	OFF
	“OPT.2”: Comm. cable	ON	ON	ON	ON

*For details on how to set the 400 m communication cable length, refer to 2-1-10 “Optional DIP switch”.

3-3-3 When distributing the multiple NTB-500A/C units

Before using the NTB-500A/C, be sure to set the “BOX No.” switch and optional DIP switch. Set as follows.

For distributed arrangement



The length of the comm. cable: 20 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	OFF		OFF		OFF		OFF	
	“OPT.1”: Comm. cable	OFF		OFF		OFF		OFF	
	“OPT.2”: Comm. cable	OFF		OFF		OFF		OFF	

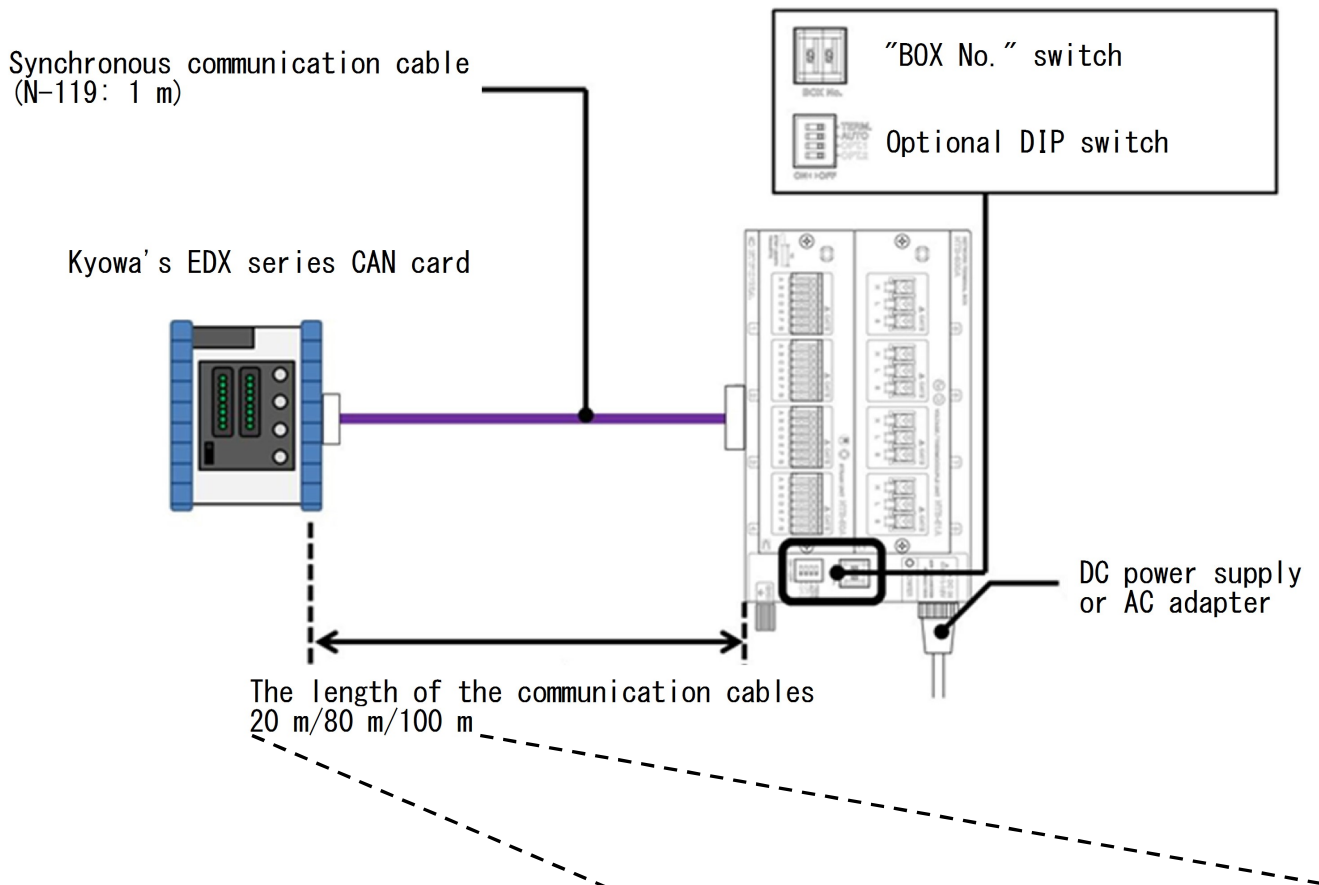
The length of the comm. cable: 80 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	OFF		OFF		OFF		OFF	
	“OPT.1”: Comm. cable	ON		ON		ON		ON	
	“OPT.2”: Comm. cable	OFF		OFF		OFF		OFF	

The length of the comm. cable: 100 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	OFF		OFF		OFF		OFF	
	“OPT.1”: Comm. cable	OFF		OFF		OFF		OFF	
	“OPT.2”: Comm. cable	ON		ON		ON		ON	

*For details on how to set the 400 m communication cable length, refer to 2-1-10 "Optional DIP switch".

3-3-4 When connecting one NTB-500A/C and using the automated measurement function

Before using the NTB-500A/C, be sure to set the “BOX No.” switch and optional DIP switch. Set as follows.

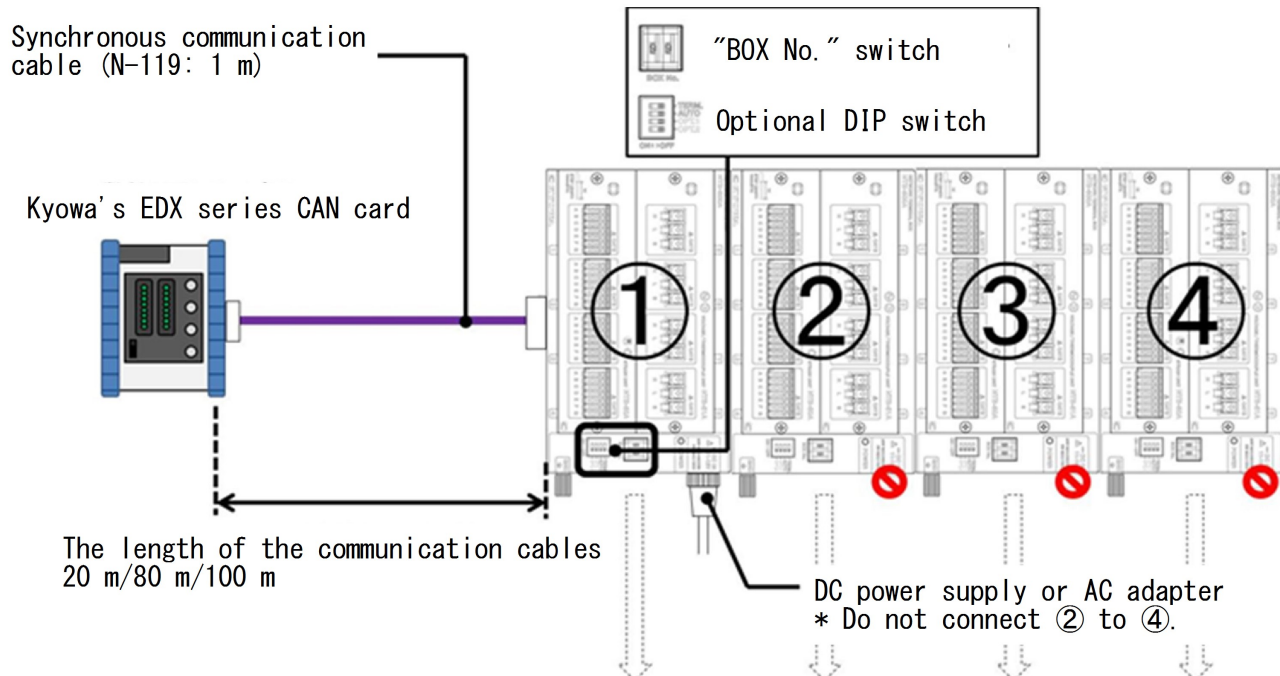


The length of the comm. cable		20 m		80 m		100 m	
“BOX No.” switch		01		01		01	
Optional DIP switch	“TERM.”: Term resistor	ON		ON		ON	
	“AUTO”: Auto function	ON		ON		ON	
	“OPT.1”: Comm. cable	OFF		ON		OFF	
	“OPT.2”: Comm. cable	OFF		OFF		ON	

3-3-5 When coupling multiple NTB-500A/C units and using the automated measurement function

Before using the NTB-500A/C, be sure to set the “BOX No.” switch and optional DIP switch. Set as follows.

For coupling



The length of the comm. cable: 20 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	ON		ON		ON		ON	
	“OPT.1”: Comm. cable	OFF		OFF		OFF		OFF	
	“OPT.2”: Comm. cable	OFF		OFF		OFF		OFF	

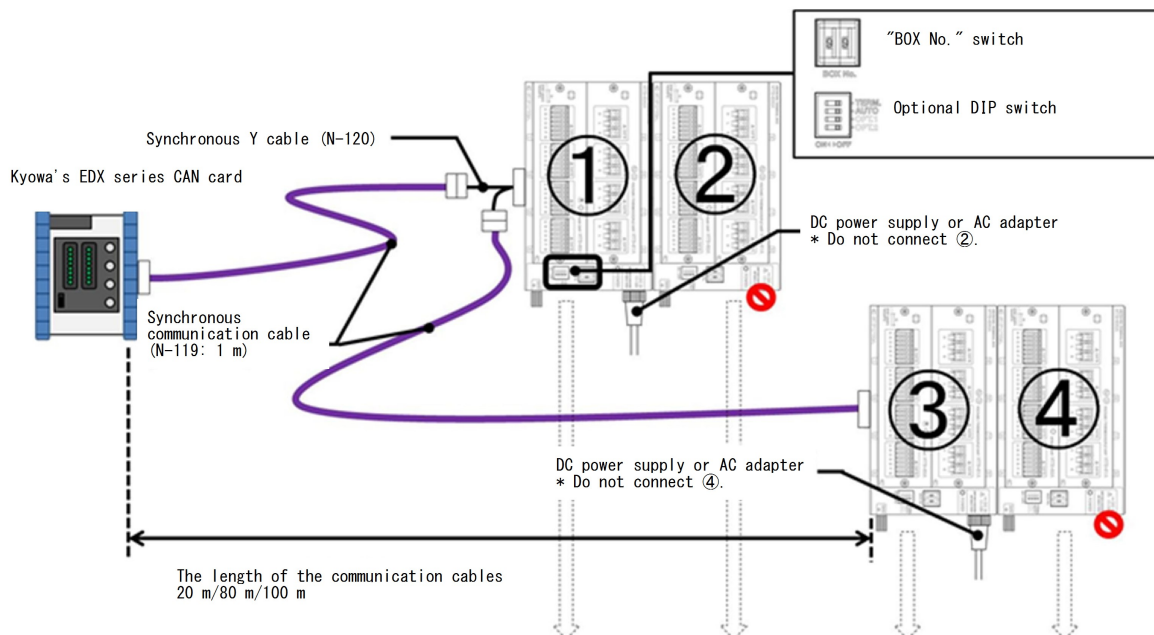
The length of the comm. cable: 80 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	ON		ON		ON		ON	
	“OPT.1”: Comm. cable	ON		ON		ON		ON	
	“OPT.2”: Comm. cable	OFF		OFF		OFF		OFF	

The length of the comm. cable: 100 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	ON		ON		ON		ON	
	“OPT.1”: Comm. cable	OFF		OFF		OFF		OFF	
	“OPT.2”: Comm. cable	ON		ON		ON		ON	

3-3-6 When distributing the multiple NTB-500A/C units and using the automated measurement function

Before using the NTB-500A/C, be sure to set the “BOX No.” switch and optional DIP switch. Set as follows.

For distributed arrangement



The length of the comm. cable: 20 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	ON		ON		ON		ON	
	“OPT.1”: Comm. cable	OFF		OFF		OFF		OFF	
	“OPT.2”: Comm. cable	OFF		OFF		OFF		OFF	

The length of the comm. cable: 80 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	ON		ON		ON		ON	
	“OPT.1”: Comm. cable	ON		ON		ON		ON	
	“OPT.2”: Comm. cable	OFF		OFF		OFF		OFF	

The length of the comm. cable: 100 m		①		②		③		④	
“BOX No.” switch		01		02		03		04	
Optional DIP switch	“TERM.”: Term resistor	OFF		OFF		OFF		ON	
	“AUTO”: Auto function	ON		ON		ON		ON	
	“OPT.1”: Comm. cable	OFF		OFF		OFF		OFF	
	“OPT.2”: Comm. cable	ON		ON		ON		ON	

*For details on how to set the 400 m communication cable length, refer to 2-1-10 "Optional DIP switch".

3-4 SETTING BOX NO. SWITCH

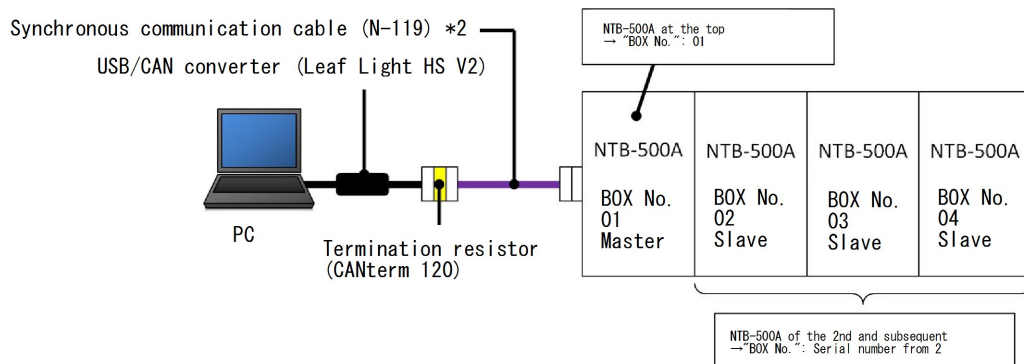
Always disconnect the power before setting the “BOX No.” switch.

Set the “BOX No.” switch on the NTB-500A/C top panel.

“BOX No.” switch	01	02 to 08	09 to 99
Function	Master	Slave	(For extension)

Example: When coupling 4 NTB-500A/C units

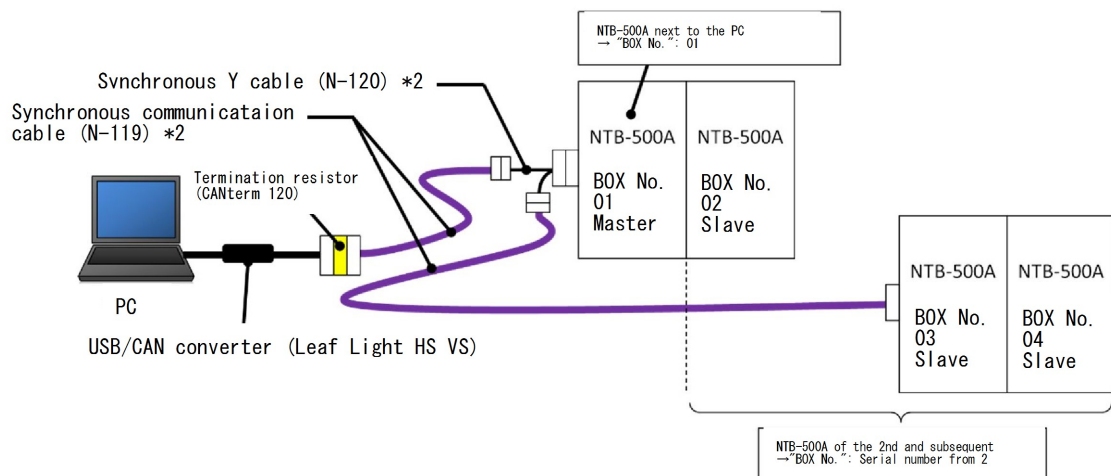
When coupling multiple NTB-500A/C units, to operate the 1st NTB-500A/C as the master, set the “BOX No.” switch of the 1st NTB-500A/C to 01. Set the “BOX No.” switch of the slave NTB-500A/C units in serial numbers starting from 01.



Example: When distributing 4 NTB-500A/C units

When distributed arrangement, to operate the NTB-500A/C (closest to the PC) as the master, set the “BOX No.” switch of the NTB-500A/C to 01.

Set the “BOX No.” switch of the slave NTB-500A/C units in serial numbers starting from 01.



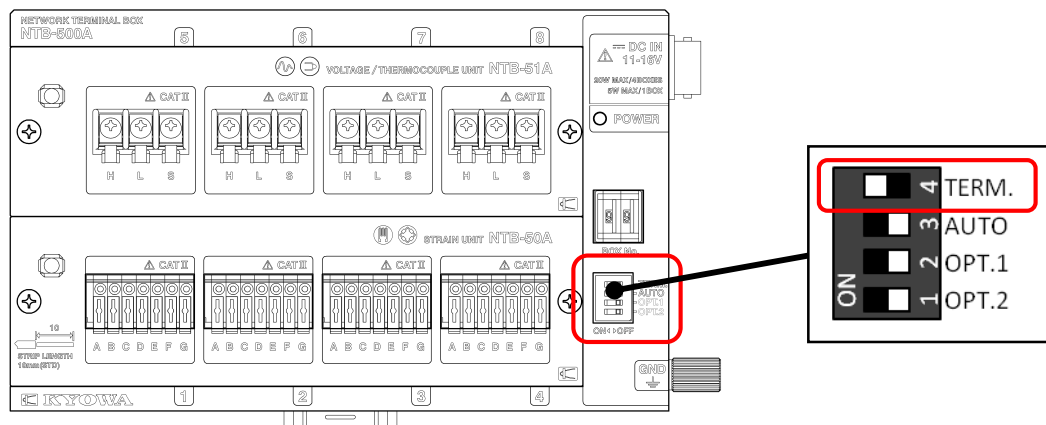
NOTE

- The “BOX No.” switch is loaded after turning ON the NTB-500A/C.
Always disconnect the power before setting the “BOX No.” switch.
- Applicable “BOX No.” is 01 to 08. Do not set 00 to the “BOX No.” switch.
- Do not set the same “BOX No.”.

3-5 SETTING THE TERMINATION RESISTOR

Always disconnect the power before setting the termination resistor.

Set the termination resistor by using the optional DIP switch "TERM." on the NTB-500A/C.



When using one NTB-500A/C : Set the "TERM." to ON.

When using 2 or more NTB-500A/C units : Set the "TERM." of the NTB-500A/C, the farthest from the PC, to ON.

NOTE

- The setting of the optional DIP switch is loaded after turning ON the NTB-500A/C.
Always disconnect the power before setting the length of the communication cables.

MEMO

What is termination resistor?

It is required to terminate at both ends of the pair signal lines (CAN_H and CAN_L).

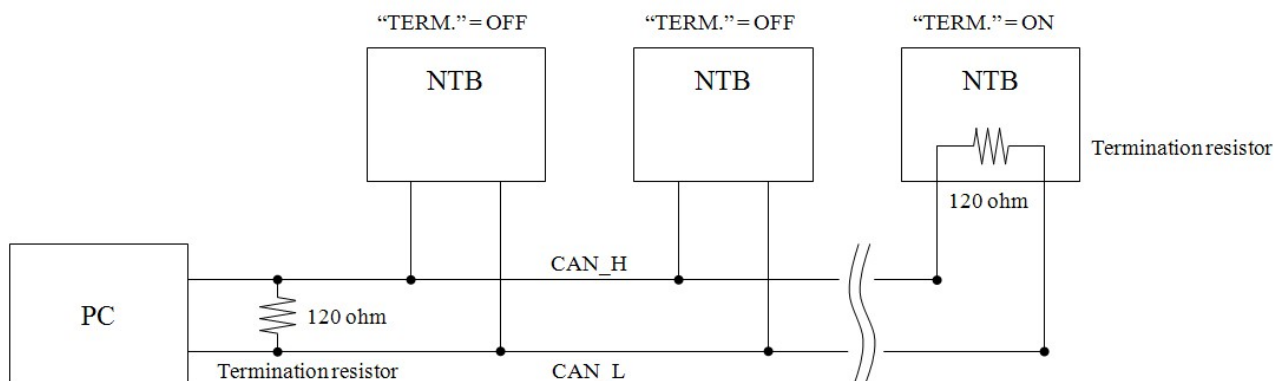
That is because the CAN bus allows bidirectional communication.

In a standard 9-pin D-sub connector, a CAN_L: pin2 and CAN_H: pin7.

The terminator on the cable should be match with the nominal impedance of the cable.

Since the ISO 11898 requires a cable with nominal impedance 120 ohm, the resistor of the 120 ohm should be used for the terminal.

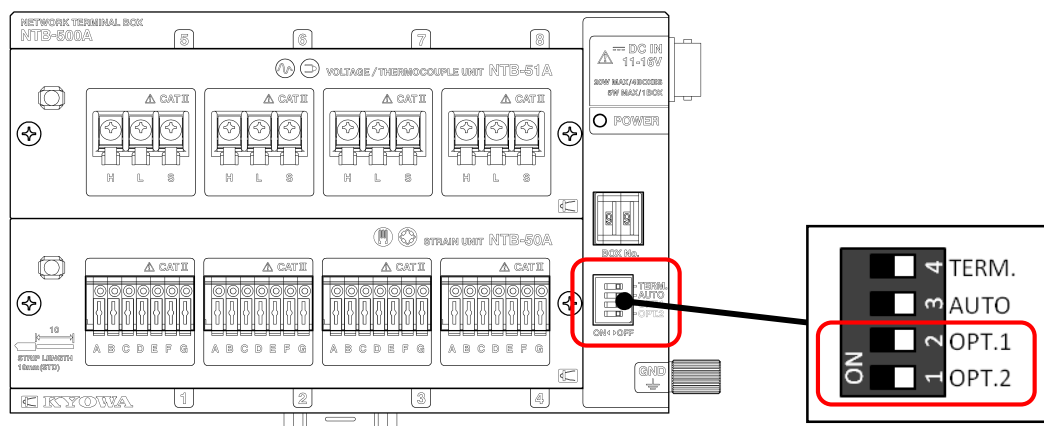
When installing multiple devices on the cable, the devices on the both end of the cable require terminator. Example of the termination method is described as follows.



3-6 SETTING THE LENGTH OF THE COMMUNICATION CABLES

Always disconnect the power before setting the length of the communication cables.

The length of the communication cables, the number of channels, and sampling frequency are as follows.



Set the length of the communication cables by using the “OPT. 1” and “OPT. 2”.

The “OPT. 1” and “OPT. 2” vary with the length of the communication cables.

Length of the communication cables	“OPT.1”	“OPT.2”	Optional DIP switch
20 m	OFF	OFF	
80 m	ON	OFF	
100 m	OFF	ON	
400 m	ON	ON	

NOTE

- The setting of the optional DIP switch is loaded after turning ON the NTB-500A/C.
Always disconnect the power before setting the length of the communication cables.
- The communication cable length of 400 m can be used when the FIRM version of the main unit is 01.05 or later.
When the FIRM version of the main unit is 01.00 to 01.04, the communication cable length is 20 m.

The length of the communication cables, the number of channels, and sampling frequency are as follows.

Sampling frequency (Hz)	The number of channels			
	Length of the communication cables = 20 m	Length of the communication cables = 80 m	Length of the communication cables = 100 m	Length of the communication cables = 400 m
1 k	8	4	--	--
500	16	8	4	--
200	40	20	8	4
100	64	40	20	8
50	64	64	40	20
20 to 1	64	64	64	64

3-7 CONNECT SENSOR AND SET CH MODE

3-7-1 Connect Sensor(NTB-50A)

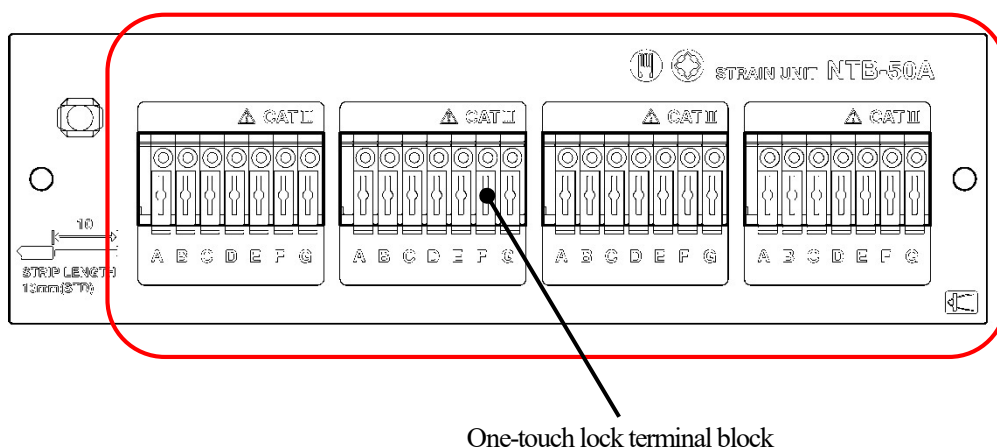
Before connecting the sensor, disconnect the power.

For connecting the lead wire with no connector at the tip of the lead wire such as strain gage, etc., peel off the tip of the lead wire about 9 to 10 mm in advance for connection.

For connecting the lead wire with a NDIS connector at the tip such as the strain gage transducer, use the connection cable (receptacle with lead wire, option: N-97, N-70, U-25, U-26) for connection.

■ Types and features of the input terminal block

[NTB-50A]



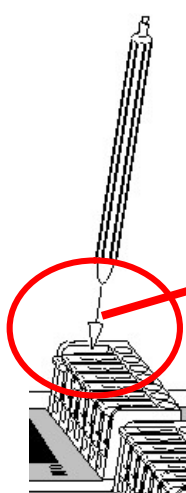
- One-touch lock terminal block: Push the lock button with the accessory small screwdriver or object with a fine head and connect the sensor.
After that, set back the lock button with your finger.
TEDS-compatible.
For the connection method, see “3-7-3-1 CH modes and connection methods of NTB-51A/C(Connecting to a voltage output transducer).”

MEMO

- Available lead wires are as follows.
Solid wire: $\phi 0.4$ mm to $\phi 1.2$ mm (ULAWG16 to 26)
Stranded wire: 0.2 mm² to 0.75 mm² (ULAWG20 to 24)

■ Connection method for the one-touch lock terminal

- 1) Push the lock button until it is locked with the accessory small screwdriver.



NOTE

- Press the following position.
Or, the lock buttons may causes troubles such as unable to be locked.



Be sure to press the above **position with the accessory small screwdriver.**

- For connection, always use the accessory small screwdriver or an object with a fine head.
- If the lock button does not work, insert the lead wire all the way to its end with pressing the lock button.

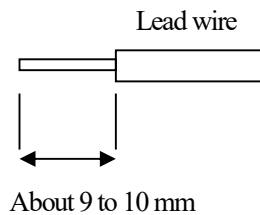
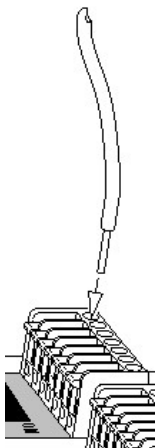
MEMO

- Available lead wires are as follows.
Solid wire: $\phi 0.4$ mm to $\phi 1.2$ mm (ULAWG16 to 26)
Stranded wire: 0.2 mm^2 to 0.75 mm^2 (ULAWG20 to 24)
Be sure to use the above lead wires. Or, a breaking or connection error will happen.

NOTE

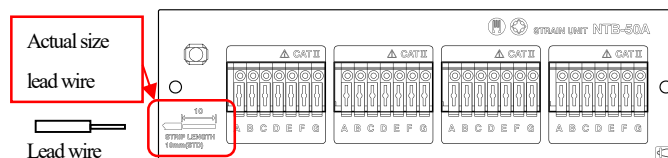
- For connecting a strain gage, do not connect gage leads (lead wires directly connected from the strain gage) directly.
- Use a gage terminal and convert the gage leads to the applicable lead wires or use a strain gage with pre-attached lead cables.
- If you connect gage leads directly, gage leads may be broken since they are too thin.
- The one-touch lock terminal block (NTB-50A) is made of plastic.
Over time and with use, the lock button will gradually fail (unable to be locked or unable to be unlocked).
The one-touch lock terminal block (NTB-50A) is considered to be a consumable item.
It is not covered under the terms of the warranty.
The replacement frequency is about two years, assuming twice a day (insertion and removal) of use, 20 days a month.

- 2) Insert the lead wire with its coating peeled off about 10 mm all the way to its end into the round hole of the input terminal.

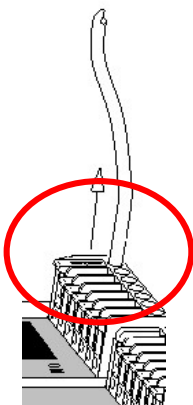


MEMO

- Lead wire peel-off length The NTB-500A has a picture of "actual size" applicable lead wire with its coating peeled off. You can check your lead wire whether it is correctly peeled off for 10 mm by using the picture.



- 3) While holding the lead wire, set back the lever to the original position with your finger.



NOTE

- Never set back the lock buttons violently with your fingers or a small screwdriver. Terminals will be deformed and the following troubles will happen.
 - The lock buttons will unable to be locked.
 - The lock buttons will unable to be unlocked.
 - The lock buttons will be deformed.
 - The lead wires will fall out.
- Gently set back the lock buttons to the original position with your fingers.

- 4) Gently pull the lead wire to check if it is securely inserted.
If the lead wire comes out, try again from the item 1).

3-7-2 Connect sensor (NTB-50B/C)

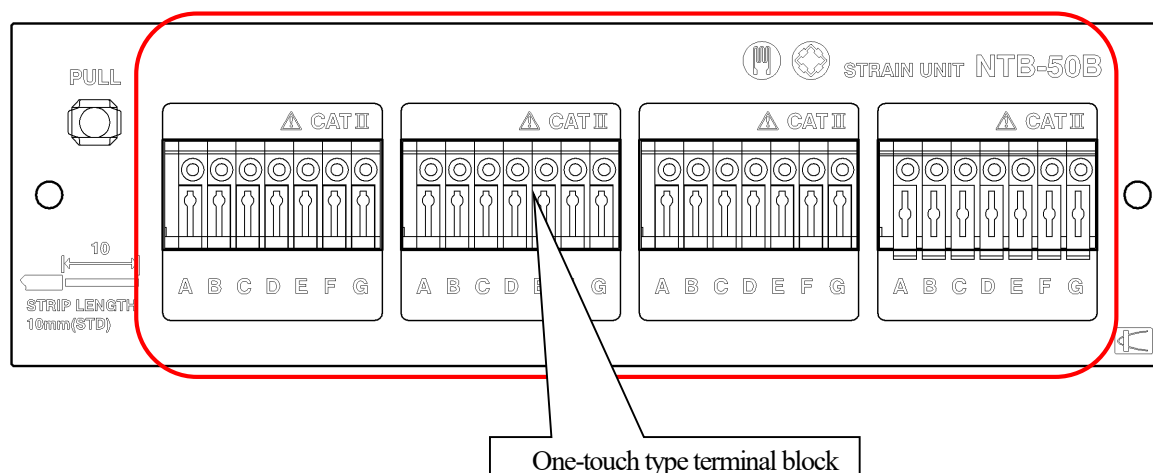
Before connecting the sensor, disconnect the power.

For connecting the lead wire with no connector at the tip of the lead wire such as strain gage, etc., peel off the tip of the lead wire about 9 to 10 mm in advance for connection.

For connecting the lead wire with an NDIS connector at the tip such as the strain gage transducer, use the connection cable (receptacle with lead wire, option: N-97, N-70, U-25, U-26) for connection.

■ Type and features of the input terminal block

[NTB-50B/C]



One-touch type terminal block

Push the lock button with the accessory small screwdriver or object with a fine head and connect the sensor.

TEDS-compatible

For the connection method, see “3-7-3-1 CH modes and connection methods of NTB-51A/C(Connecting to a voltage output transducer).”

MEMO

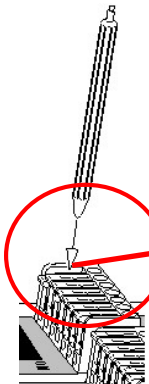
The available wires are as follows.

Solid wire: $\phi 0.4$ mm to $\phi 1.2$ mm (ULAWG26 to 26)

Stranded wire: 0.2 mm^2 to 0.75 mm^2 (ULAWG20 to 24)

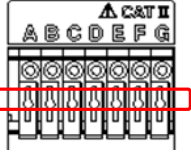
■ Connection method for the one-touch type terminal block

- ① Push the button with the accessory small screwdriver to open the round hole.



NOTE

- Press the following position.



Do not press the edge of the button. Otherwise, it may cause troubles.

Be sure to press the above position with the accessory small screwdriver.

- For connection, always use the accessory small screwdriver or an object with a fine head.

MEMO

The available wires are as follows

Solid wire: $\phi 0.4$ mm to $\phi 1.2$ mm (ULAWG26 to 26)

Stranded wire: 0.2 mm^2 to 0.75 mm^2 (ULAWG20 to 24)

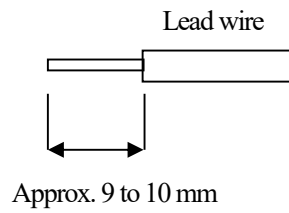
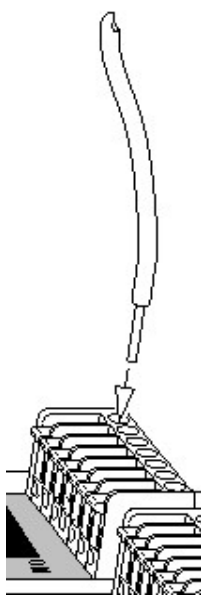
Be sure to use the above lead wires. Or, a breaking or connection error will happen.

NOTE

The one-touch type terminal block is a consumable item.

The one-touch type terminal block has leaf springs. Through repeated connections/disconnections, the leaf spring will gradually wear out and retaining force may decrease. The one-touch lock type terminal block is considered to be a consumable item. It is not covered under the terms of the warranty.

- ② Insert the lead wire with its coating peeled off approx. 10 mm all the way to its end into the round hole of the input terminal.

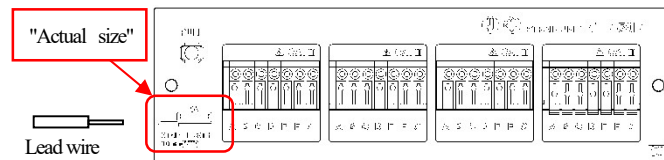


MEMO

- Lead wire peel-off length

The NTB-500A has a picture of "actual size" applicable lead wire with its coating peeled off.

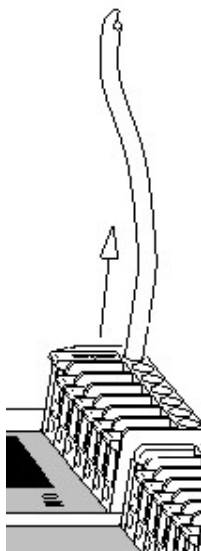
You can check your lead wire whether it is correctly peeled off for 10 mm by using the picture.



- ③ Release the small screwdriver.

The round hole closes to fasten the lead wires.

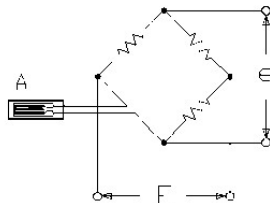
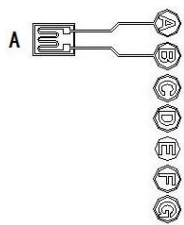
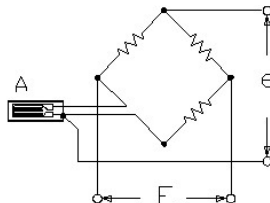
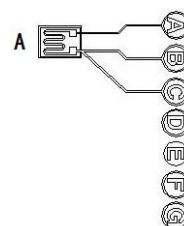
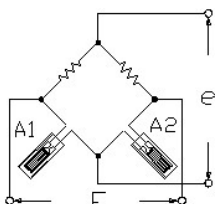
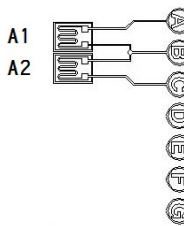
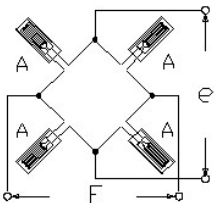
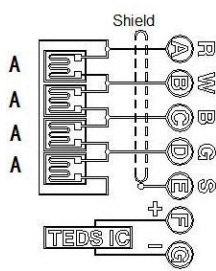
Be sure to insert the lead wire all the way to its end. Otherwise, it will not fix firmly.



- ④ Gently pull the lead wire to check if it is securely inserted.

If the lead wire comes out, try again from the item ①.

3-7-2-1 Modes and connection methods of NTB-50A/B/C

Measuring Method	Bridge Circuit  : Strain gage  : Built-in fixed resistor A : Active gage E : Bridge exciter e : Bridge output	Connection Method	DCS-100A	
			Mode	Range
Quarter bridge method (2-wire system connection) Gage resistance: 120 ohm			1G120_2W	30k um/m
				300k um/m
Quarter bridge method (3-wire system connection) Gage resistance: 120 ohm			1G120_3W	30k um/m
				300k um/m
Half bridge method (Active-active method) Gage resistance: 120 ohm to 1000 ohm			2G	30k um/m
				300k um/m
Full bridge method (Strain gage transducer) Gage resistance: 120 ohm to 1000 ohm			4G	30k um/m
				300k um/m

MEMO

- For the quarter bridge method, it is recommended to adopt a “3-wire system” connection method that has less error factors such as temperature influence due to gage lead wire, dislocation of the initial value, etc.
- For the wiring, use the Kyowa shielded low-noise lead wire (L-13, L-14, L-15, L-16) and 4-conductor shielded wire.
In addition, keep the NTB-500A/C off from the power line or noisy wiring.
- For the instability of the measurement value, connect (ground) the GND of the NTB-500A/C to the earth.

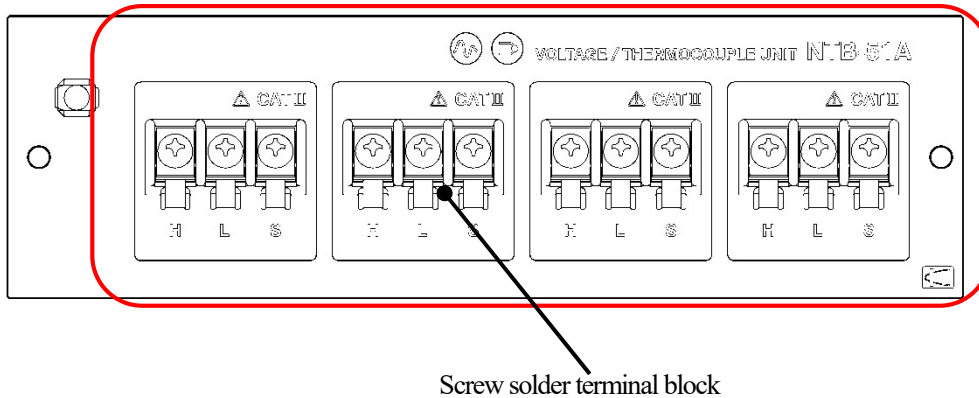
3-7-3 Connect Sensor(NTB-51A/C)

Before connecting the sensor, disconnect the power.

Before connecting lead wires, peel off the lead wire about 9 to 10 mm in advance.

■ Types and features of the input terminal block

[NTB-51A/C]



● Screw solder terminal block:

After loose a screw with a phillips-head screwdriver, connect the sensor.

Then, fasten the screw.

The tapped hole diameter is M3. The screws have a metal plate for binding cables.

The recommended tightening torque for the screws is 0.49 N · m.

When using the solderless terminal, the outside dimension should be 6.5 mm or less.

Solders cables.

The surface tensions on the right and left edges prevent the solder from flowing to the screws.

When soldering lead wires, do not heat the lugs of the soldering, screw-fixed terminal block for a long time by using a soldering iron.

Otherwise, it may damage the terminal block plastic and internal PCB.

For the connection method, see “3-7-3-1” and “3-7-3-2.”

NOTE

Before touching terminals of the product, be sure to discharge static electricity from your body.

3-7-3-1 CH modes and connection methods of NTB-51A/C(Connecting to a voltage output transducer)

Measuring Method	Connection Method	DCS-100A	
		Mode	Range
Voltage measurement		Voltage	10V
			50V

MEMO

- For the instability of the measurement value, connect (ground) the GND of the NTB-500A/C to the earth.

3-7-3-2 CH modes and connection methods of NTB-51A/C(Connecting to a thermocouple)

Measuring Method	Connection Method	DCS-100A	
		Mode	Range
Temperature measurement using thermocouples		TC/K	1230.0°C
		TC/T	400°C

MEMO

- For the temperature measurement, adapt the NTB-500A/C to the using environment and make terminal temperatures stable. Do not expose the NTB-500A/C to direct sunlight or wind from air conditioners. If temperature gradient occurs, it may cause temperature error.
- Install the NTB-500A/C as horizontally as possible. If the NTB-500A/C is installed vertically or is propped against wall etc., temperature gradient occurs and it may cause measurement error.
- Use shielded and twisted pair thermocouples. If parallel or unshielded thermocouples are used, measurement errors caused by the effect of external noise are generated.
- Never connect thermocouples directly to the target with larger potential than the earth. Or, it may cause trouble or measurement errors.
- For the instability of the measurement value, connect (ground) the GND of the NTB-500A/C to the earth.

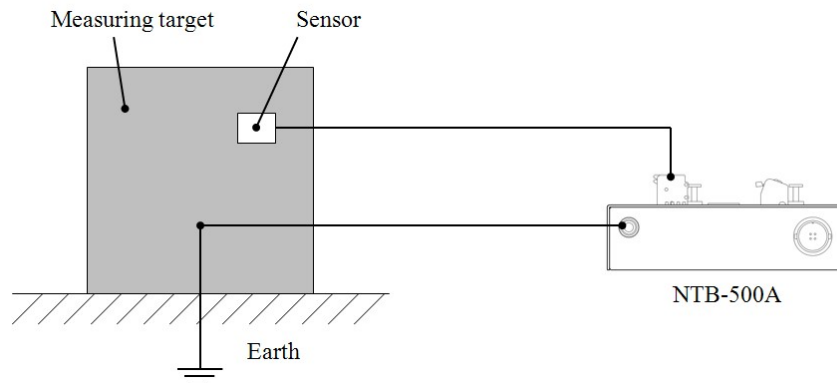
Always disconnect the power before connecting the “GND” terminal.

Ground the “GND” terminal (PROTECTIVE GROUND TERMINAL) on the side panel (power connector side).

(1) Example 1 When measuring target is grounded

After checking the measuring target (Specimen) is securely grounded, connect the “GND” terminal by referring to the following figure.

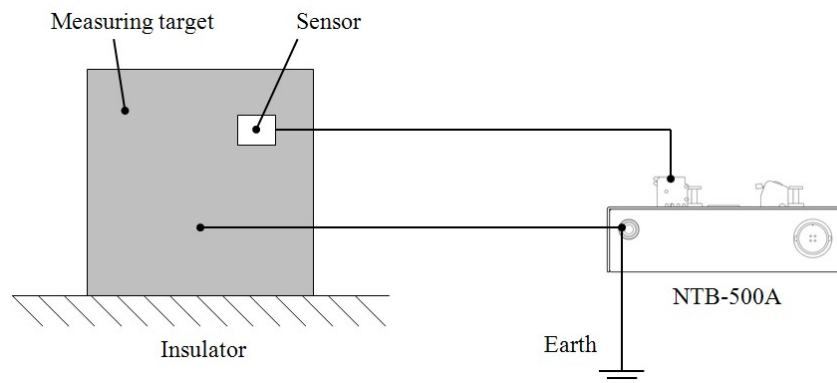
- ① Connect the measuring target (Specimen) and “GND” terminal (ground) of the NTB-500A/C with the accessory ground wire.



(2) Example 2 When measuring target is insulated from the earth

After checking the measuring target (Specimen) is securely insulated from the earth, connect the “GND” terminal by referring to the following figure.

- ① Connect the “GND” terminal of the NTB-500A/C and earth (ground) with the accessory ground wire.
- ② Connect the measuring target (Specimen) and “GND” terminal (ground) of the NTB-500A/C with the green colored heat-resistance vinyl coated wire.



NOTE

- Ground the “GND” terminal to prevent the NTB-500A/C from being affected by noise as well as receiving electric shock due to leaks in the electric current. Be sure to ground the “GND” terminal.
- Always use the accessory ground wire for grounding.
- If the length or the numbers of the accessory ground wires are not enough, use the green colored heat-resistance vinyl coated wire having nominal cross section 0.75 mm^2 or more.
- Basically 1 point grounding is required. If 2 or more groundings are made, take special care of the ground wires or, they may be looped and are easily affected by noise.
- Grounding should be independently made from the power system 300 V or more.

3-9 CONNECTING POWER

3-9-1 Connecting DC power

Before connecting the DC power, check the power voltage.

The power voltage range of the NTB-500A/C is 11 to 16 VDC. Be sure to keep the voltage range.

Use the DC power 20W or more. (Capable of coupling the 4 NTB-500A/C units with 20W.)

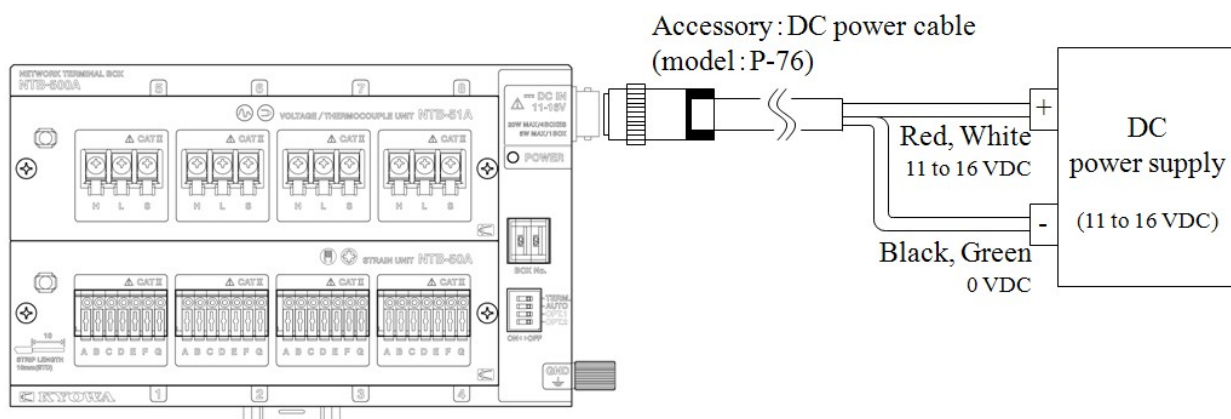
Supply DC power with the accessory DC power cable (model: P-76).

Connect a connector side of the DC power cable to the NTB-500A/C.

Connect black and green wires at the end of the DC power cable to the – side of the DC power.

Connect red and white wires at the end of the DC power cable to the + side of the DC power.

Connection diagram of the DC power is described as follows.



NOTE

- If the power voltage exceeds the above specified voltage range or if the positive side (+) and negative side (–) are connected adversely, it may cause trouble or damage to the NTB-500A/C.

3-9-2 Connecting AC adapter

Supply power by connecting the optional AC adapter (SA-10A-EDS) to the power connector on the side panel.

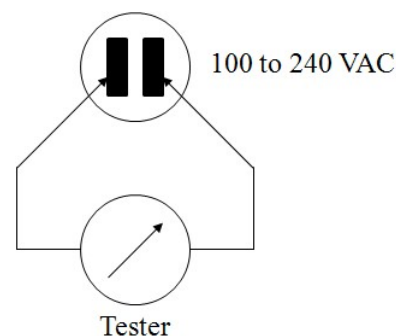
Before connecting the AC power cable of the AC adapter to the AC power outlet, check the power voltage.

The power voltage range of the AC adapter is 100 to 240 VAC. Be sure to keep the voltage range.

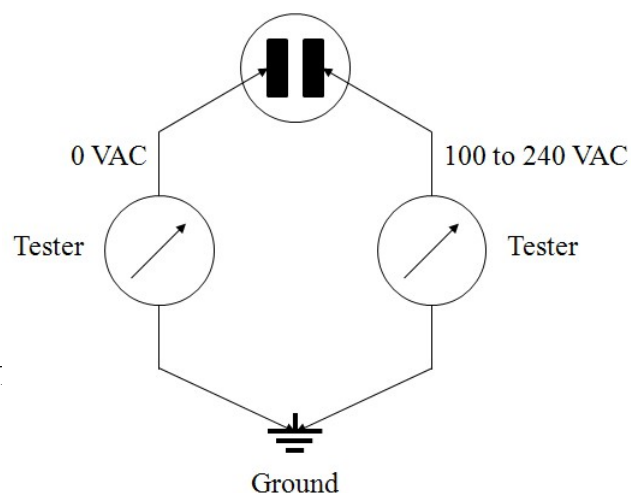
If the power voltage exceeds the above specified voltage range or if a voltage between each terminal and the grounding has a potential exceeding power voltage, do not connect the AC power. Or, it may cause trouble or damage to the NTB-500A/C.

Check the power voltage as follows.

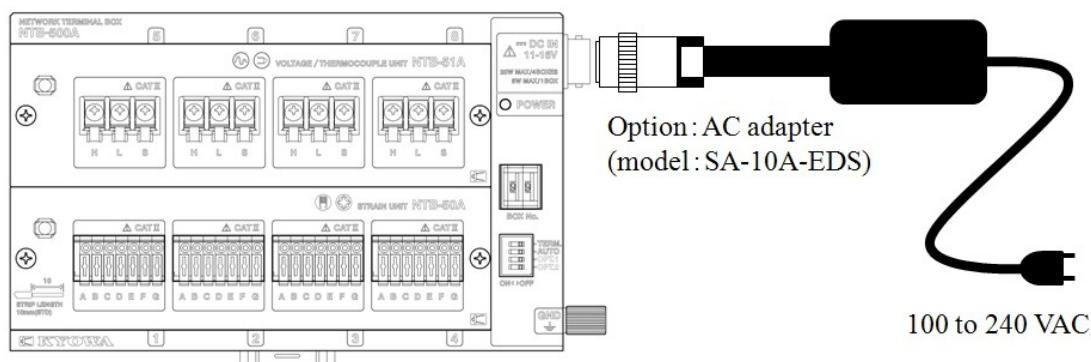
- (1) Use the tester to measure the voltage between the AC power outlet terminals and ensure that the voltage is within the range of 100 to 240 VAC.



- (2) Use the testers to measure the voltage levels between the ground and each of the AC power outlet terminals to ensure that one voltage level is 0 V and the other is within the range of 100 V to 240 VAC.



- (3) If the NTB-500A/C is used at job site where induction motors, electric welder and other devices that generate noise are used, power supply condition may be insufficient due to noise. It is recommended to use Kyowa's insulation transformer or noise cut transformer.



- (4) If the power voltage excessively varies, use regulated power supply.

3-10 POWER ON/OFF

3-10-1 Power ON

To turn ON the NTB-500A/C, connect the power supply to the power connector.

The “POWER” LED lights up (master: green, slave: orange) while the NTB-500A/C is ON.

NOTE

- Always disconnect the power before setting the “BOX No.” switch.
- When the “BOX No.” switch is 00 and when turning ON the NTB-500A/C, the “POWER” LED blinks red.
The NTB-500A/C will not move.
Applicable “BOX No.” is 01 to 08.
Set the “BOX No.” switch in serial numbers starting from 01.
- Preheat the NTB-500A/C for approximately 30 minutes after the power ON.

3-10-2 Power OFF

Make sure that the NTB-500A/C is not measuring data or is not setting conditions. Disconnect the power supply from the power connector.

4. INSTALL AND UNINSTALL THE DEVICE DRIVER FOR THE USB-CAN CONVERTER

4-1 INSTALL THE KVASER DRIVERS FOR WINDOWS

NOTE

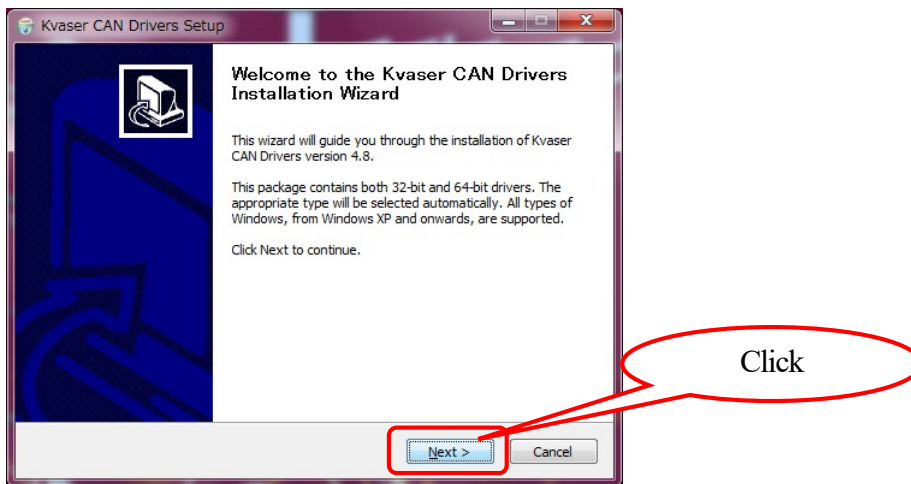
- **Do not connect the USB-CAN converter to the PC yet.**
Be sure to install the Kvaser Drivers for Windows in advance.

(1) Set the accessory DVD of the NTB-500A/C to the DVD drive.

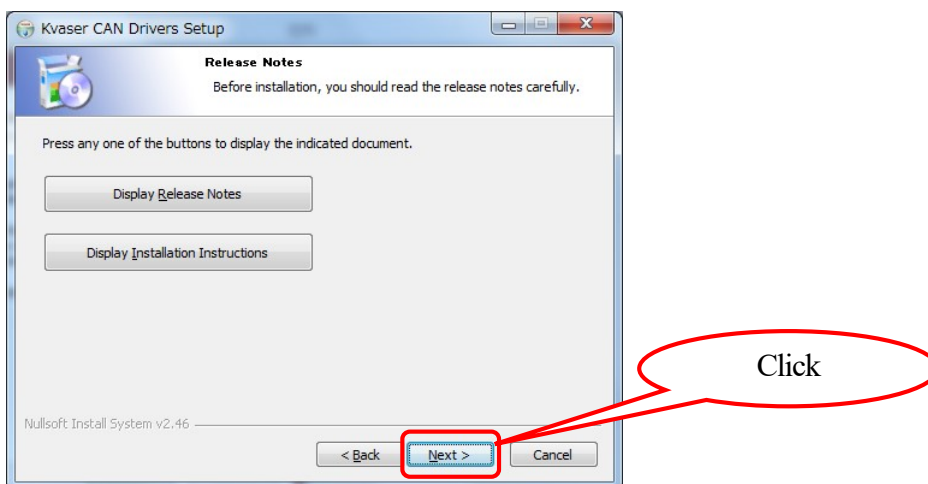
(2) Run the following program within the DVD.

[DRIVERS] - [KVASER] - [kvaser_drivers_setup.exe]

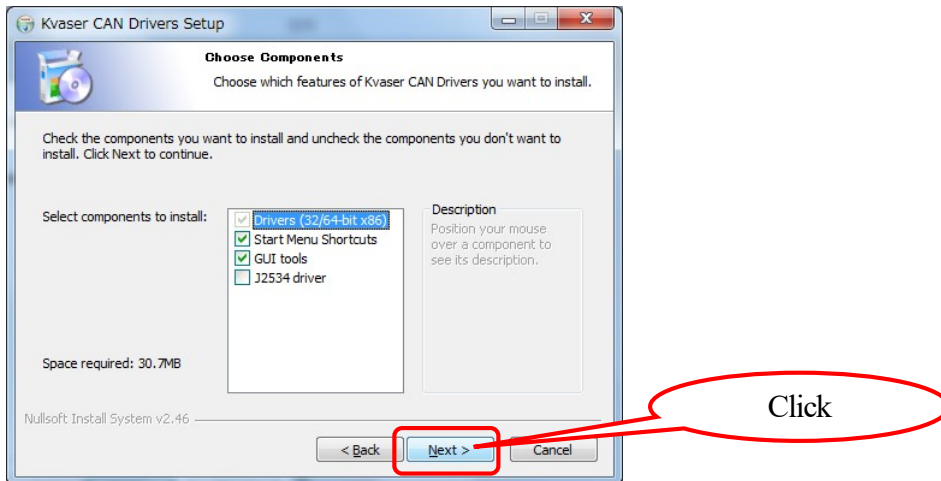
(3) Click the **Next** button.



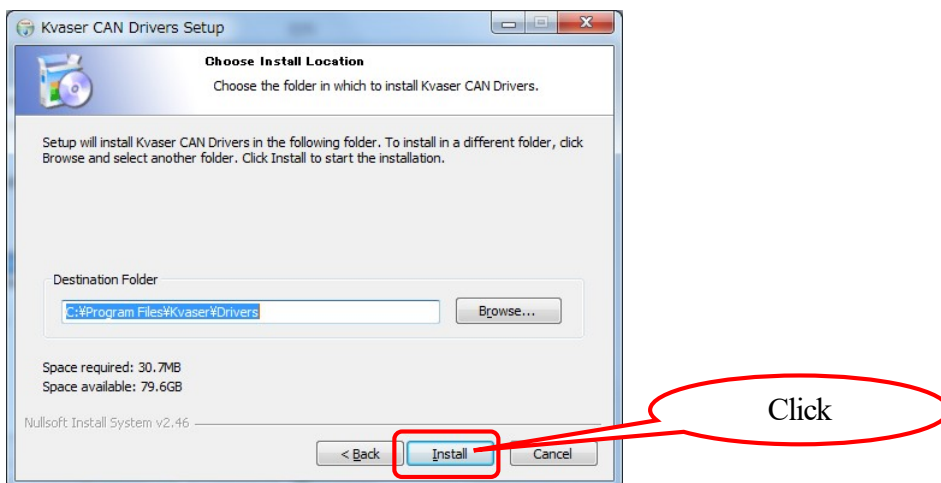
(4) Click the **Next** button.



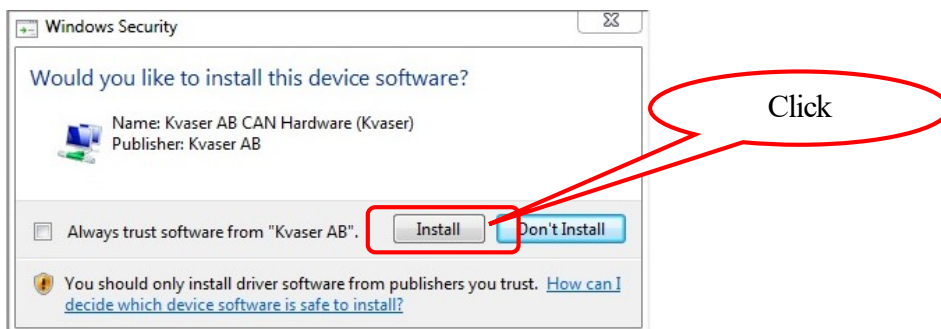
(5) Click the **Next** button.



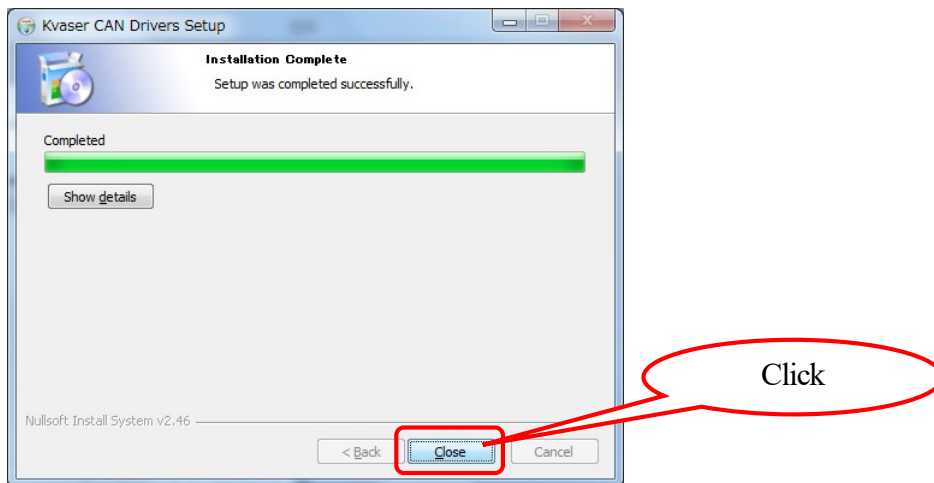
(6) Click the **Install** button.



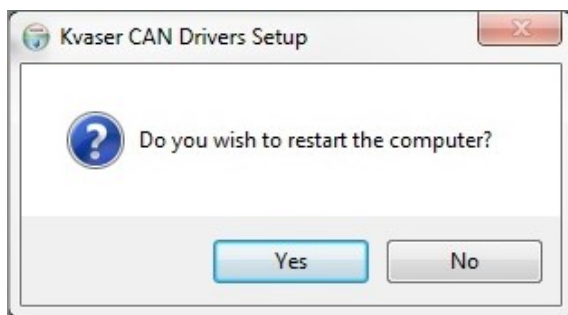
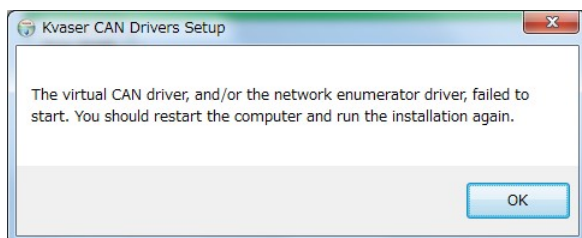
(7) If the Windows Security dialog box appears, click the **Install** button.



Click the **Close** button for completing the driver installation.



(9) Restart your PC.



4-2 CONNECT THE USB-CAN CONVERTER TO THE PC

Connect the USB-CAN converter to the USB port of the PC, installed in the 4-1. The installation starts automatically.

4-3 CHECKING AFTER CONNECTING THE USB-CAN CONVERTER

This section describes how to check that the USB-CAN converter is correctly recognized.

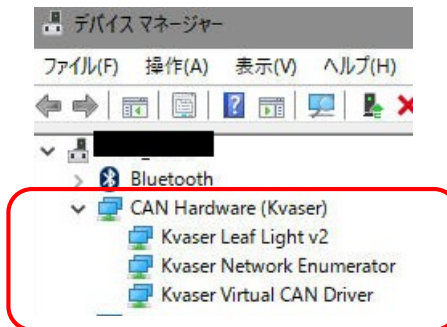
(1) Open the Device Manager.

- For Windows® 10

Right click .

Click the Device Manager.

*When the User Account Control window appears, click **Continue** button.



- For Windows® 8.1

Right click .

Click the Device Manager.

*When the User Account Control window appears, click **Continue** button.

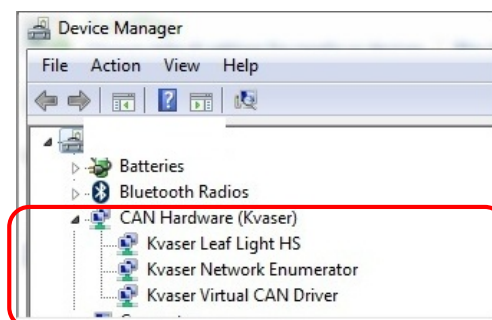


- For Microsoft Windows 7

Click [Start] - [Control Panel].

Click the Device Manager.

When the User Account Control window appears, click **Continue** button.



- For Microsoft Windows Vista

Click [Start] - right click [Computer].

Click the [Property].

Click the Device Manager.

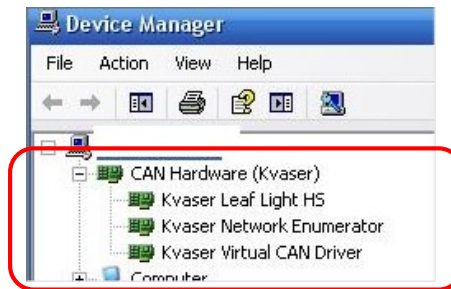
When the User Account Control window appears, click **Continue** button.

- For Microsoft Windows XP

Click [Start] - right click [My Computer].

Click the [Hardware] tab.

Click the Device Manager.



(2) After checking, close the window.

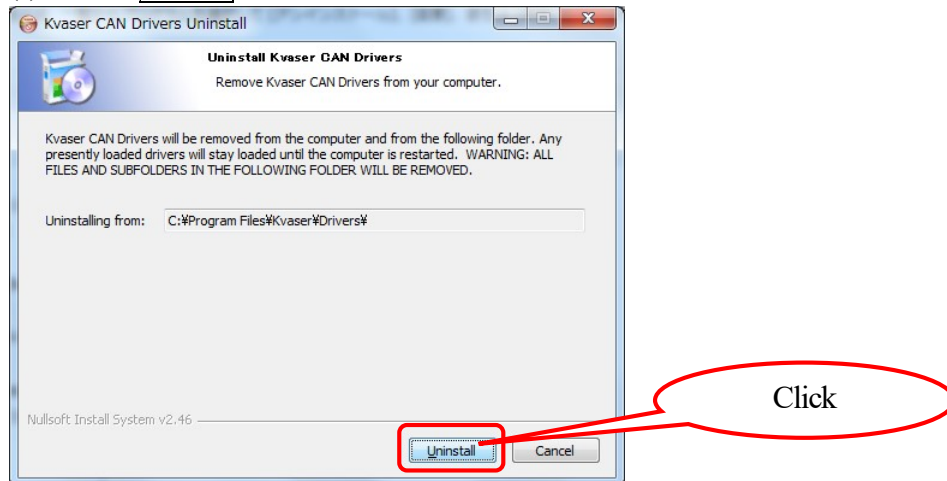
4.4 UNINSTALL THE KVASER DRIVERS FOR WINDOWS

(1) Click [Start] - [Control Panel].

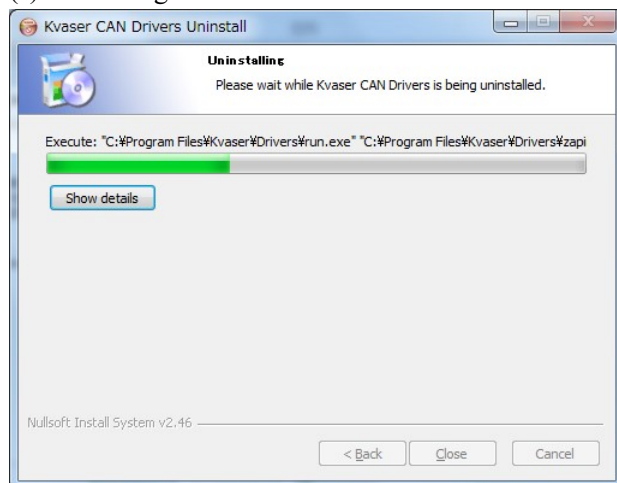
(2) Click Add or Remove Programs.

Add or Remove programs window appears. Click Kvaser CAN Drivers. Click **Delete** button.

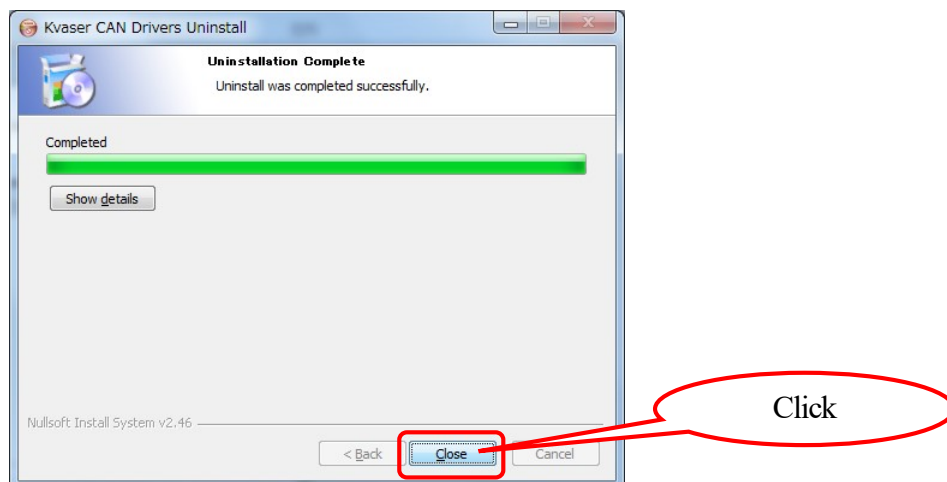
(3) Click the **Uninstall** button.



(4) Uninstalling window



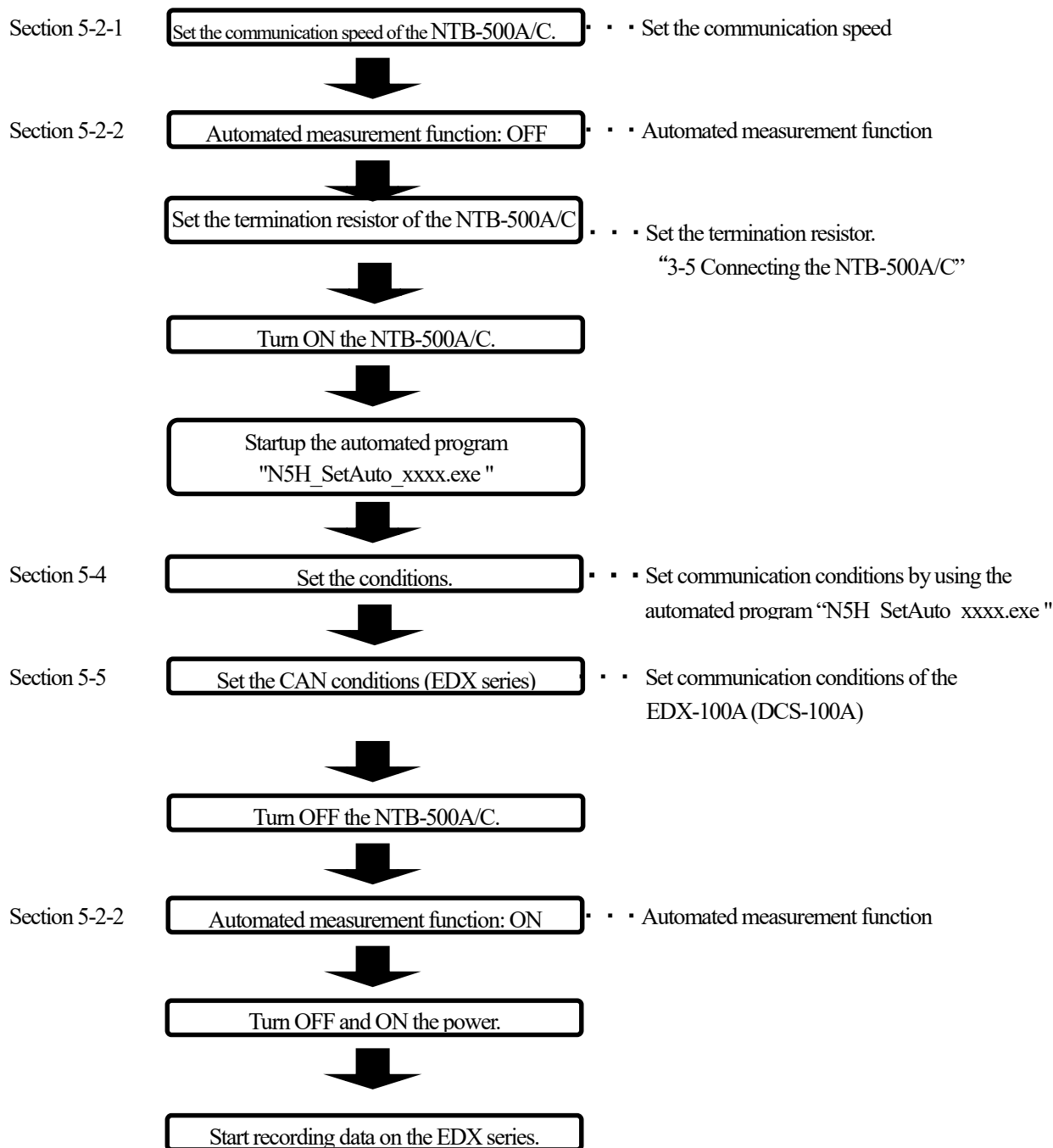
(5) After completing the uninstallation, **Close** button becomes valid. Click the **Close** button for finishing the driver uninstallation.



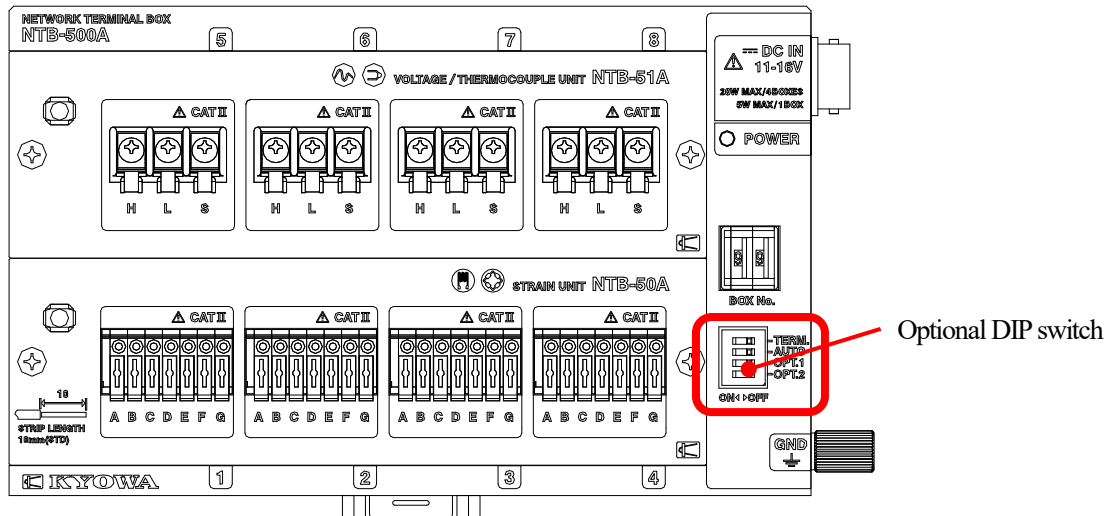
5. WITH THE KYOWA'S EDX SERIES

With the automated measurement function of the NTB-500A/C, you can record data by using the Kyowa's EDX series CAN card. With the automated program "N5H_SetAuto_ xxxx.exe", you can set the byte order, frame format, and ID of the NTB-500A/C. When coupling or distributing the multiple NTB-500A/C units with the automated measurement function, simultaneity of data is not ensured.

5-1 FLOWCHART



5-2 SET THE NTB-500A/C



5-2-1 Set the communication speed

To communicate the Kyowa's EDX series CAN card, be sure to match the communication speed of the NTB-500A/C to that of the Kyowa's EDX series CAN card. Set the communication speed of the NTB-500A/C by using the optional DIP switch.

See the following table.

Communication speed	OPT.1	OPT.2	Optional DIP switch	Communication speed on the DCS-100A
1 Mbps(20 m)	OFF	OFF		1000(kbps)
500 kbps(80 m)	ON	OFF		500(kbps)
250 kbps(100 m)	OFF	ON		250(kbps)
125 kbps(400 m)	ON	ON		125(kbps)

NOTE

- The setting of the optional DIP switch is loaded after turning ON the NTB-500A/C. Always disconnect the power before setting the communication speed.

5-2-2 Automated measurement function

Set the automated measurement function (ON/OFF) of the NTB-500A/C by using the optional DIP switch. See the following table.

AUTO (SW3)	Optional DIP switch	Operating Status
Automated measurement function: ON		For sending the measured data automatically into the CAN bus after the start up. Used for retrieving the data by using the Kyowa's EDX series CAN card.
Automated measurement function: OFF		Used for the automated measurement function (OFF) or for customizing conditions of the automated measurement function by using the automated program.

NOTE

- The setting of the optional DIP switch is loaded after turning ON the NTB-500A/C.
Always disconnect the power before setting the communication speed.

5-2-3 Factory-configured settings of the CAN communication conditions

CAN communication conditions of the NTB-500A/C are as follows.

Setting Items	Setting contents
Message ID	Every Message ID is set automatically by using the BOX No. For details, see “5-3-2 Message ID.”
Byte order	Big endian
Data Type	Float (fixed)
Transmission format	Standard format
Measurement start setup	Automatic

5-2-4 Factory-configured settings of the measuring conditions

Measuring conditions of the NTB-500A/C are as follows.

Setting Items	Setting contents
Sampling Frequency	100 Hz
Reference junction compensation	Internal reference junction compensation
Mode	NTB-50A/B/C: 4G NTB-51A/C: Voltage
Range	NTB-50A/B/C: 30k μ m/m NTB-51A/C: 10V

5-3 CAN CONDITIONS OF THE NTB-500A/C

5-3-1 CAN communication conditions

Communication standard: High speed CAN

Communication speed: Set the communication speed by using the optional DIP switch (1 Mbps, 500 kbps, 250 kbps, 125 kbps)

5-3-2 Message ID

With the CAN protocol, all messages are sent in the fixed format.

To determine which NTB-500A/C is sending data, set an original Message ID to every NTB-500A/C. Every NTB-500A/C uses maximum 4 Message IDs, starts from the pre-set Message ID, for sending data. When using multiple NTB-500A/C units, pay attention to Message IDs. You can set Message IDs by using the automated program "N5H_SetAuto_xxxx.exe".

By default, every Message ID is set automatically by using the BOX No. See the following table.

"BOX No." switch	CH No.	Message ID
01	1	0x100
	2	0x101
	3	0x102
	4	0x103
02	1	0x104
	2	0x105
	3	0x106
	4	0x107
03	1	0x108
	2	0x109
	3	0x10a
	4	0x10b
04	1	0x10c
	2	0x10d
	3	0x10e
	4	0x10f

5-3-3 Data type

The data, sent from the NTB-500A/C, is physical quantity (Float), the byte order of the big-endian.

Physical quantity, mounting the NTB-50A/B/C or NTB-51A/C, is as follows.

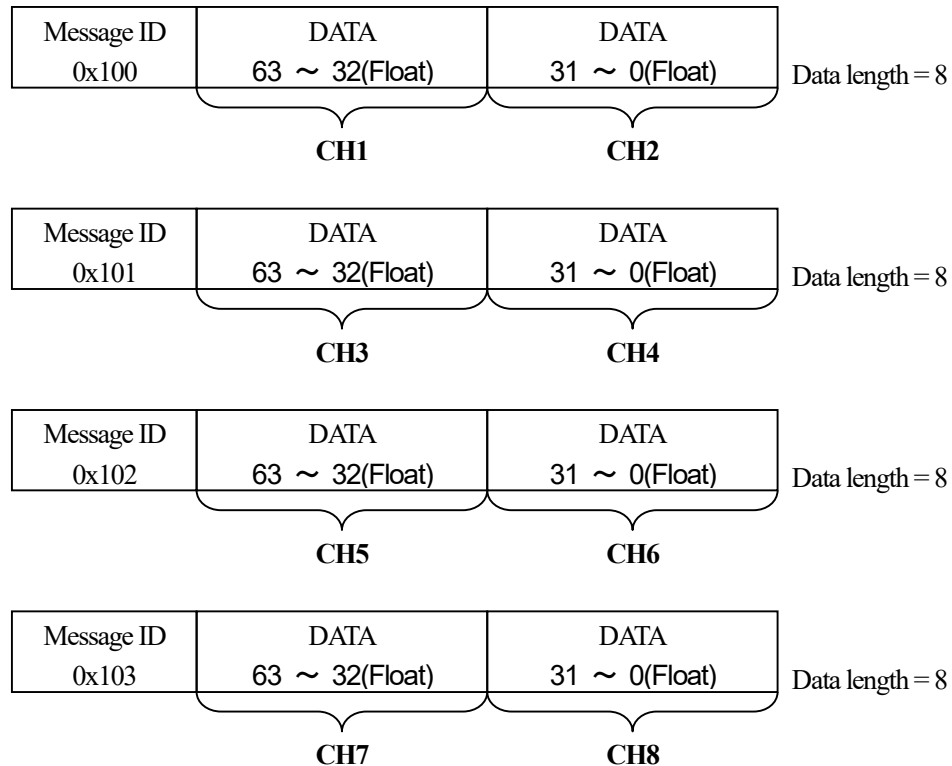
Model	Measuring Target	Physical quantity
NTB-50A/B/C	Strain	Strain ($\mu\text{m}/\text{m}$)
NTB-51A/C	Voltage (10 V/50 V)	Voltage (V)
	Thermocouple (TC/K, TC/T)	Temperature [$^{\circ}\text{C}$]

5-3-4 Format of the message

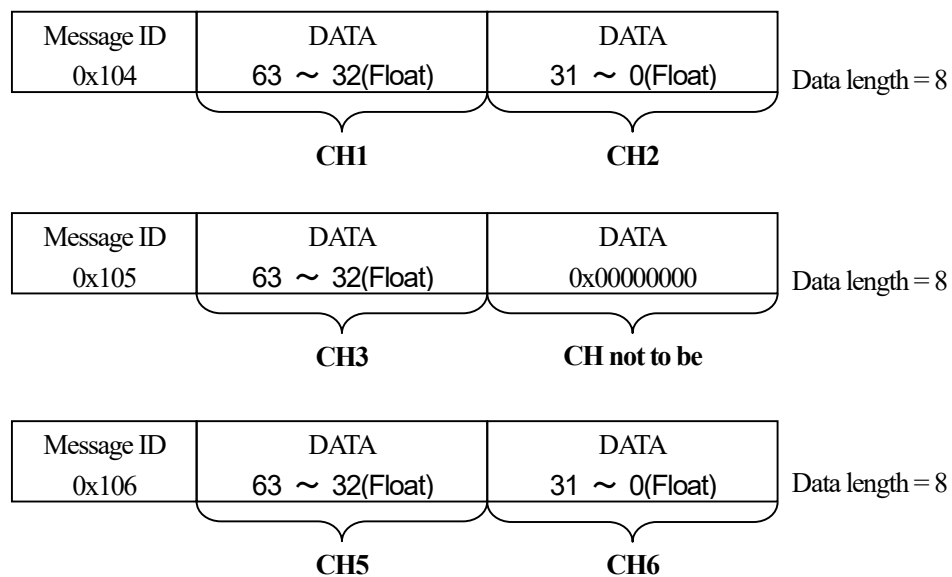
One NTB-500A/C sends maximum 2-channel data per one message. One NTB-500A/C sends maximum 8-channel data (4 Message IDs). Zero (0) is sent as the data of the CH not to be measured.

Messages, sent from the NTB-500A/C, are as follows.

Example 1: Suppose the channels to be measured are CH1 to CH8 (Message ID = 0x100(BOX No.01))



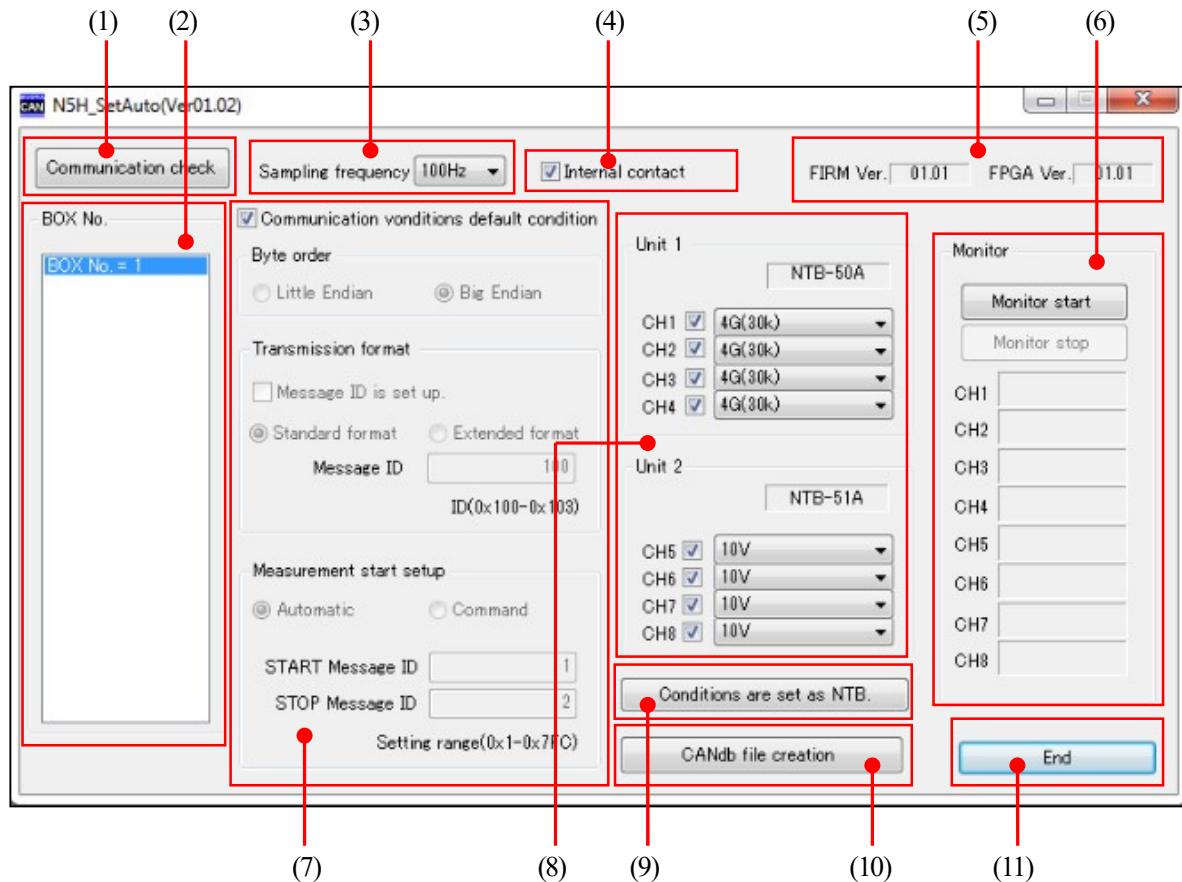
Example 2: Suppose the channels to be measured are CH1 to CH3, CH5 and CH6 (Message ID = 0x104(BOX No.02))



In the example 2, the CH7 and CH8 are not the target channels. No data is sent from the NTB-500A/C.

5-4 WITH THE AUTOMATED PROGRAM "N5H_SetAuto_xxxx.exe "

You can customize the data, output from the NTB-500, by using the “N5H_SetAuto_xxxx.exe” (xxxx: version).



(1) Communication check: Required

Click the **Communication check** button to obtain the CAN communication conditions and measuring conditions of the connected NTB-500A/C. The items (2), (3), (4), (5), (7), (8) and (9) appear.

NOTE

- When using the automated program “N5H_SetAuto_xxxx.exe”, be sure to use the USB-CAN converter Kvaser Leaf Light HS V2.
- When using the automated program “N5H_SetAuto_xxxx.exe”, be sure to connect one USB-CAN converter Kvaser Leaf Light HS V2.
- When connecting the multiple NTB-500A/C units, every AUTO (SW3), OPT.1 (SW2) and OPT.2 (SW1) needs to be the same for all the NTB-500A/C units.
Or, the measuring system does not operate properly.
- You can connect up to 8 NTB-500A/C units at one time.

(2) BOX No.: Required

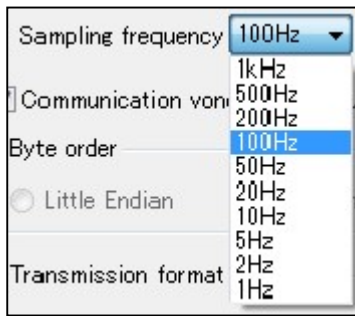
Select the NTB-500A/C.

When connecting multiple NTB-500A/C units, select the NTB-500A/C in which you want to customize the conditions of the automated measurement function.

CAN communication conditions and measuring conditions of the NTB-500A/C will appear.

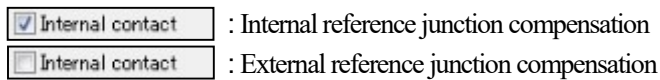
(3) Sampling Frequency: If necessary

Set the sampling frequency of the automated measurement function. Applicable sampling frequency is 1 Hz to 1 kHz.



(4) Internal contact: If necessary

Set the reference junction compensation for measuring temperature.



(5) Version information: Confirmation only

Version information of the NTB-500A/C, firmware, and FPGA.

(6) Monitor: If necessary

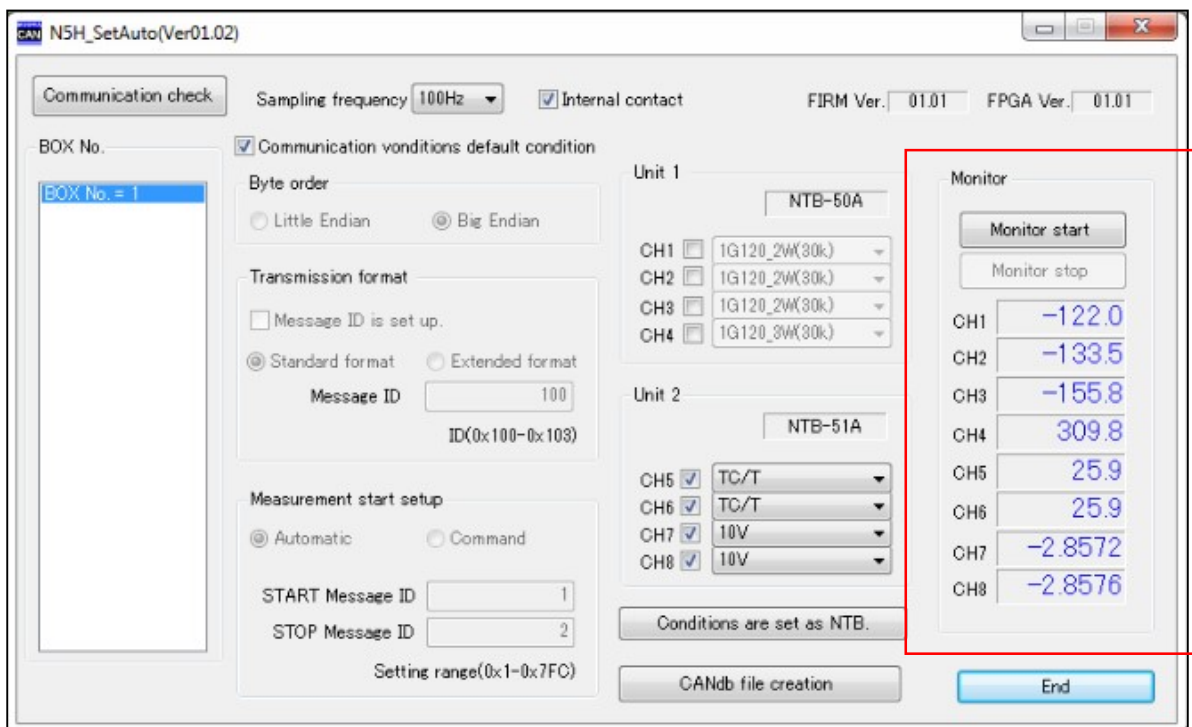
You can check the data on the window based on the pre-set conditions.



button: Start monitoring data



button: Stop monitoring data.



While monitoring data, the above window appears.

(7) CAN communication conditions: If necessary

Set the CAN communication conditions.

In general, use the factory-configured settings.

For changing, see “5-4-1 Changing the CAN communication conditions.”

(8) Measuring conditions: If necessary

For displaying and changing the measuring conditions of the NTB-500A/C.

Put a checkmark (to be measured) or release a checkmark (not to be measured) in the box next to the target channel.



: ON (to be measured)



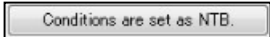
: OFF (not to be measured)

Select the channel mode by using the dropdown list.

See the following table.

Model	Channel Mode	Measuring Range	Measuring Target
NTB-50A/B/C (strain unit)	1G120_2W(30k)	0 to $\pm 30,000 \mu\text{m/m}$	Quarter bridge system (2-wire)
	1G120_2W(300k)	0 to $\pm 300,000 \mu\text{m/m}$	
	1G120_3W(30k)	0 to $\pm 30,000 \mu\text{m/m}$	Quarter bridge system (3-wire)
	1G120_3W(300k)	0 to $\pm 300,000 \mu\text{m/m}$	
	2G(30k)	0 to $\pm 30,000 \mu\text{m/m}$	Half bridge system
	2G(300k)	0 to $\pm 300,000 \mu\text{m/m}$	
	4G(30k)	0 to $\pm 30,000 \mu\text{m/m}$	Full bridge system
	4G(300k)	0 to $\pm 300,000 \mu\text{m/m}$	
NTB-51A/C	10V	0 to $\pm 10 \text{ V}$	DC voltage
	50V	0 to $\pm 50 \text{ V}$	
	TC/K	-200 to $+1230^\circ\text{C}$	K-type thermocouple
	TC/T	-200 to $+400^\circ\text{C}$	T-type thermocouple

(9) Conditions are set as NTB.: Required

Click the  button to set the items (3), (5), (7), and (8) to the NTB-500A/C.

When connecting multiple NTB-500A/C units, items (3), (5), (7) and (8) are set to the all NTB-500A/C units at once.

After the setting is completed, you can create the CANdb file.

The CANdb file can be set easily by using the DCS-105A.

(10) CANdb file creation: If necessary

If you didn't create the CANdb file in the item (9), you can create the CANdb file later.

(11) Click the button to exit the program.

5-4-1 Changing the CAN communication conditions

Operation of the NTB-500A/C

▪ Byte order

Select the byte order from the Little endian (Intel processor) and Big endian (Motorola processor).

Little endian: The lower-order byte of the number is stored in memory at the lowest address, and the high-order byte at the highest address

Big endian: The high-order byte of the number is stored in memory at the lowest address, and the low-order byte at the highest address.

To communicate the Kyowa's EDX series CAN card, be sure to match the byte order of the NTB-500A/C to that of the Kyowa's EDX series CAN card. Or, the NTB-500A/C cannot obtain correct data.

▪ Transmission format

Set the Message ID, standard format, and extension format.

Setting Message ID	Format	Message ID
☐ Message ID is set up.	Standard format (fixed)	Message IDs are assigned automatically by using the BOX No. “BOX No. ” switch = 1, 0x100 to 0x103 “BOX No. ” switch = 2, 0x104 to 0x107 • • • “BOX No. ” switch = 99, 0x360 to 0x363
☒ Message ID is set up.	Standard format	You can set Message IDs within 0x1 to 0x7FC.
	Extension format	You can set Message IDs within 0x1 to 0x1FFFFFFC.

MEMO

- When using multiple NTB-500A/C units, pay attention to Message IDs.

▪ Measurement start setup

Select the NTB-500A/C operation with the automated measurement function ON.

Automatic	The NTB-500A/C starts sending the measured data based on the pre-set conditions after the start up.
Command	After the start up, the NTB-500A/C is in measurement stop mode. The NTB-500A/C starts measurement by using the pre-set START Message ID and stops measurement by using the pre-set STOP Message ID. After starting measurements by using the pre-set START Message ID, the NTB-500A/C starts sending the measured data based on the pre-set conditions.

5-5 WITH THE EDX-100A (DCS-100A)

When measuring data by using the Kyowa's EDX series CAN card, see Instruction Manuals of EDX series for setting CAN conditions.

Suppose the NTB-50A/B/C (strain unit) is mounted to the unit 1 and NTB-51A/C (voltage/thermocouple unit) is mounted to the unit 2, automated measurement function ON, the number of channels to be measured is 8.

Table 5-1 indicates the required items on the automated program "N5H_SetAuto_ xxxx.exe"

Table 5-2 indicates the required items on the automated program "N5H_SetAuto_ xxxx.exe" and DCS-100A.

Conditions of the automated measurement function are described in the "Required Items" column.

Table 5-1 Required items on the automated program "N5H_SetAuto_ xxxx.exe "

Setting Items	Required Items
Sampling	100Hz
Internal contact	Internal
Measured start setup	Automatic
Mode and range of CH1	1G120_2W(30k)
Mode and range of CH2	1G120_2W(30k)
Mode and range of CH3	1G120_2W(30k)
Mode and range of CH4	1G120_3W(30k)
Mode of CH5	TC/T
Mode of CH6	TC/T
Mode of CH7	10V
Mode of CH8	10V

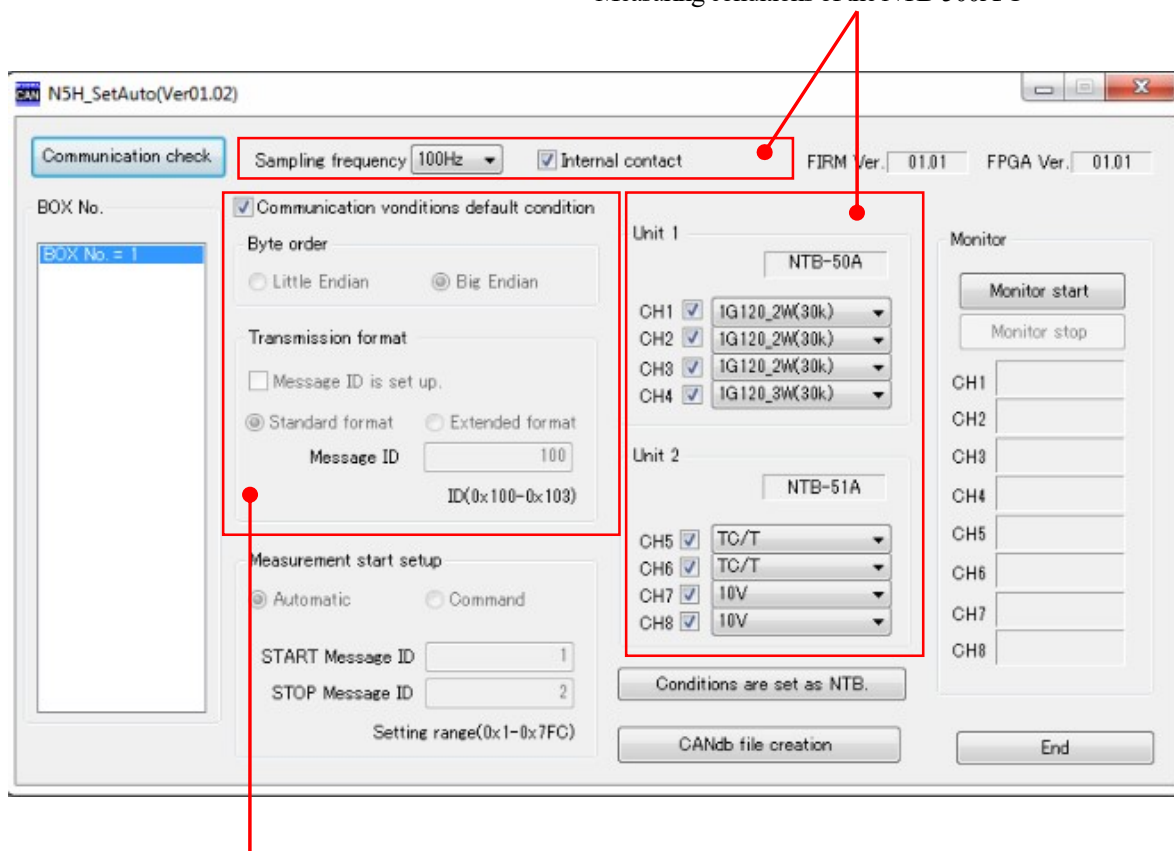
Table 5-2 Required items on the automated program "N5H_SetAuto_ xxxx.exe" and DCS-100A

Setting Items	Required Items (factory-configured settings)	EDX-100A (DCS-100A)
Byte order	Big Endian	CAN-ID conditions: Big Endian
Data type	Float (fixed)	CAN-CH conditions: Float
Transmission format	(1) Standard format (2) No Message ID 0x100 to 0x103 of the Message ID 0x100: CH1 of the BOX No. 01 : CH2 of the BOX No. 01 0x101: CH3 of the BOX No. 01 : CH4 of the BOX No. 01 0x102: CH5 of the BOX No. 01 : CH6 of the BOX No. 01 0x103: CH7 of the BOX No. 01 : CH8 of the BOX No. 01	(1) CAN-ID conditions: Standard format (2) Data frame ID in the CAN-ID conditions: 100 to 103 100: CH1 of the BOX No. 01 : CH2 of the BOX No. 01 101: CH3 of the BOX No. 01 : CH4 of the BOX No. 01 102: CH5 of the BOX No. 01 : CH6 of the BOX No. 01 103: CH7 of the BOX No. 01 : CH8 of the BOX No. 01

5-5-1 Required items on the automated program “N5H_SetAuto_xxxx.exe”

Required items on the automated program “N5H_SetAuto_xxxx.exe” are as follows.

Measuring conditions of the NTB-500A/C



Required items on the Kyowa's EDX series CAN card

5-5-2 Set the CAN conditions (DCS-100A)

Before recording the CAN data, set the CAN communication conditions, CAN-ID conditions, and CAN-CH conditions.

Set the CAN conditions in due order from the CAN communication conditions → CAN-ID conditions → CAN-CH conditions.

NOTE

- Make sure the Kyowa's EDX series CAN card is correctly mounted in the EDX-100A.

MEMO

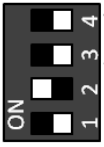
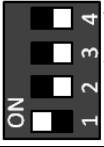
- For details, see the CANdb sample file in the DVD, “NTB-500AC folder” - “CANdb folder” - “NTB-500AC(CANdb).dbc” attached to the DCS-100A (version 04.19 and after).
- For details, see the CAN condition sample file in the DVD, “NTB-500AC folder” - “EDX_CAN folder” - “NTB-500AC(CANdb).dbc” attached to the DCS-100A (version 04.19 and after).

5-5-2-1 CAN communication conditions (DCS-100A)

Select the CAN Comm. tab on the Set CAN Condition window for settings.

Communication standard: High speed CAN *Low speed CAN is not available.

Communication speed: Match the communication speed of the NTB-500A/C.

Communication speed	OPT.1	OPT.2	Optional DIP switch	Communication speed on the DCS-100A
1 Mbps (20 m)	OFF	OFF		1000(kbps)
500 kbps (80 m)	ON	OFF		500(kbps)
250 kbps (100 m)	OFF	ON		250(kbps)
125 kbps (400 m)	ON	ON		125(kbps)

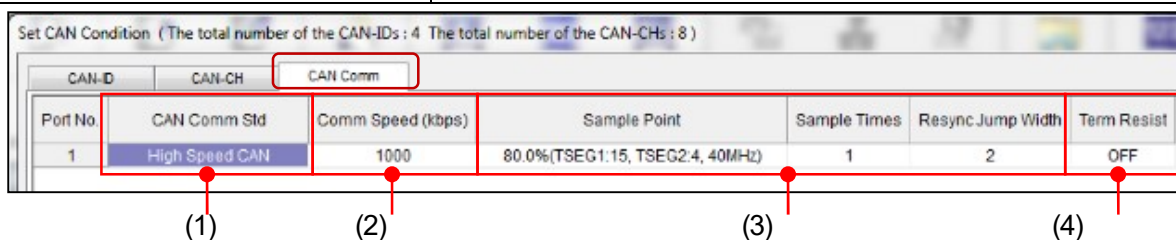
NOTE

- The setting of the optional DIP switch is loaded after turning ON the NTB-500A/C.
Always disconnect the power before setting the communication speed.
- The communication cable length of 400 m can be used when the FIRM version of the main unit is 01.05 or later.
When the FIRM version of the main unit is 01.00 to 01.04, the communication cable length is 20 m.

Sample point: Default value for general purpose.
Sample times: Default value for general purpose.
Resync. jump width: Default value for general purpose.
Termination resistor: ON (OFF got the terminated system)

Factory-configured settings are as follows.

	High speed CAN
communication speed (kbps)	500
Sample point	80%(TSEG1:15, TSEG2:4, 40MHz)
Sample times	1
Resync. jump width (SJW)	2
Termination resistor	OFF



- (1) Be sure to set the high speed CAN.
- (2) Be sure to match the communication speed of the NTB-500A/C
- (3) Factory-configured settings are available.
- (4) Be sure to set ON.

5-5-2-2 CAN-ID conditions (DCS-100A)

Select the CAN-ID tab on the Set CAN Condition window for settings.

This section describes data frame conditions on the CAN bus.

Measurement: ON/OFF

Put a check mark to the check box next to the CAN-ID to be measured.

The DCS-100A monitors and records data frame IDs with a check mark on the Measurement column.

Format: Standard (if there is no check mark next to the ☐ CAN-ID is set up.)

Flame ID: 100 to 103

100: CH1 and CH2 of the BOX No. 01

101: CH3 and CH4 of the BOX No. 01

102: CH5 and CH6 of the BOX No. 01

103: CH7 and CH8 of the BOX No. 01

Data length: 8

Byte order : Big Endian

LSB/MSB: LSB

Number of CAN-CHs:

Displays the number of channels to be measured (with a check mark on the Measurement column) on the CAN-CH tab. (Editing not allowed.)

CAN-ID Name: Input the name of the data frame. (Within 40 characters).

Set CAN Condition (The total number of the CAN-IDs : 4 The total number of the CAN-CHs : 8)

CAN-ID		CAN-CH	CAN Comm							
CAN-ID	Measurement	Port No.	Format	Frame ID	Data Length (Byte)	Endian	LSB/MSB	Number of CAN-CHs	CAN-ID Name	
1	☒	1	Standard	100	8	Big	LSB	2	NTB500A_BOX1_1	
2	☒	1	Standard	101	8	Big	LSB	2	NTB500A_BOX1_2	
3	☒	1	Standard	102	8	Big	LSB	2	NTB500A_BOX1_3	
4	☒	1	Standard	103	8	Big	LSB	2	NTB500A_BOX1_4	
5	☐	1	Standard	000	8	Big	LSB	0		

5-5-2-3 CAN-CH conditions

Select the CAN-CH tab on the Set CAN Condition window for settings.

This section describes how to cut out data in data frames on the CAN bus.

The data from the NTB-500A/C includes 2 data in one data frame (Data length: 8 bytes, Big Endian).

63	32 31
CH1/CH3/CH5/CH7	CH2/CH4/CH6/CH8

	Start Bit	The number of bits
CH1/CH3/CH5/CH7	32	32
CH2/CH4/CH6/CH8	0	32

Set CAN-CH conditions of the CAN-ID1 to CAN-ID4.

① To cut out the CAN-CH data with bit.

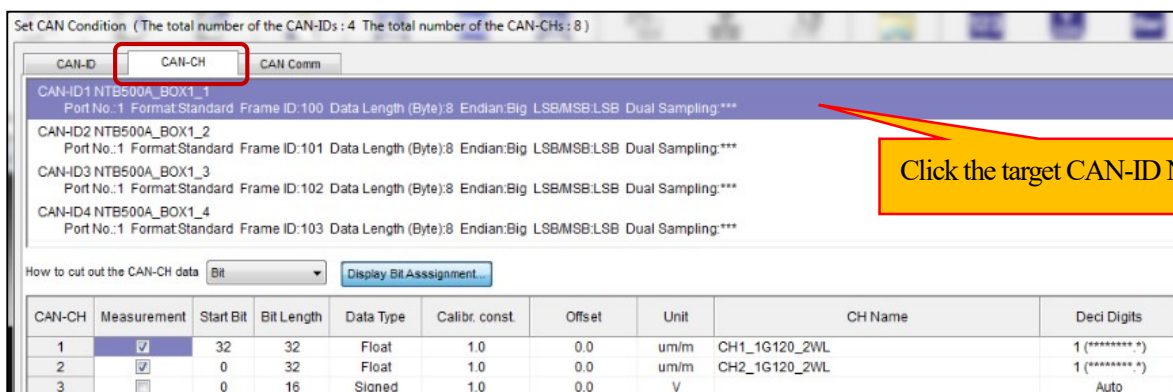
Click the CAN-ID1.

●CH1/CH3/CH5/CH7

Start Bit 32
 Bit Length 32
 Data type Float
 Calibration coefficient Set 1.0 for thermocouples.
 For others, set the appropriate option.
 Offset Set the appropriate option.
 Unit Set degC for thermocouples.
 For others, set the appropriate option.

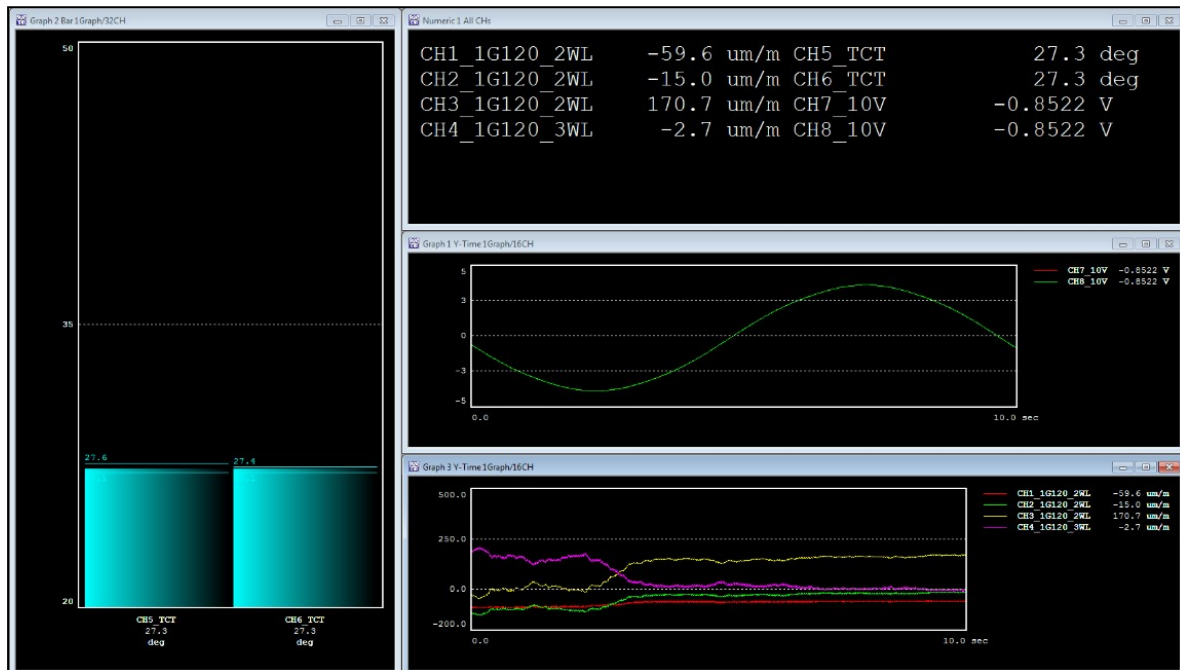
●CH2/CH4/CH6/CH8

Start Bit 0
 Bit Length 32
 Data type Float
 Calibration coefficient Set 1.0 for thermocouples.
 For others, set the appropriate option.
 Offset Set the appropriate option.
 Unit Set degC for thermocouples.
 For others, set the appropriate option.



Set the CH3 to CH8 into the CAN-ID2 to CAN-ID4 in the same manner.

While monitoring CAN data, the following window appears.



6. DETAILS OF OPTIONAL ACCESSORIES

For details of the optional accessories that are used in combination with the NTB-500A/C, see the following table.

Name	Model	Function
Strain Unit	NTB-50A NTB-50B NTB-50C	● For measuring strain gage and strain gage transducer ● Capable of measuring 4 channels per unit. ● The terminal blocks are as follows. NTB-50A: One-touch lock type terminal block Only NTB-500A can be connected. NTB-50B: One-touch type terminal block Only NTB-500A can be connected. NTB-50C: One-touch type terminal block Only NTB-500C can be connected.
Voltage/Thermocouple Unit	NTB-51A NTB-51C	● For measuring voltage and temperature (with a thermocouple) ● Capable of measuring 4 channels per unit. NTB-51A: Only NTB-500A can be connected. NTB-51C: Only NTB-500C can be connected.
AC adapter	SA-10A-EDS	● For supplying power to the NTB-500A/C. The power voltage range of the AC adapter is 100 to 240 VAC (50 Hz/60 Hz).
Synchronous-sampling-communication cable (1 m)	N-119	● For distributed arrangement Note: When requiring the cable other than the left, contact Kyowa or our representatives.
Synchronous-sampling Y cable	N-120	● For using multiple NTB-500A/C units in the distance.
Coupling plate for 2 NTB-500A/C units	CN-10A	● For coupling the NTB-500A/C units without the DIN rail.
Coupling plate for 4 NTB-500A/C units	CN-11A	
USB-CAN converter	Leaf Light HS V2 (Kvaser Inc.)	● For connecting the PC and NTB-500A/C. ● The Dynamic Data Recording Software DCS-100A, accessory sample software, and automated program are operated by this interface.
Termination resistor	CANterm120 (Vector Japan Co., Ltd.)	● Before connecting the communication cable, be sure to connect the termination resistor to the USB-CAN converter. (essential)
DIN rail (recommended)	(TAKACHI ELECTRONIC INDUSTRIAL Co., Ltd.)	
DIN rail mounting plate (recommended)	DRA-1 (TAKACHI ELECTRONIC INDUSTRIAL Co., Ltd.)	● For fixing the NTB-500A/C to the DIN rail.

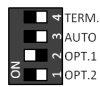
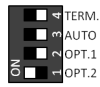
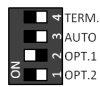
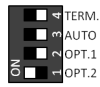
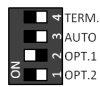
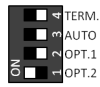
7. TROUBLE SHOOTING

In the event that the product does not operate as expected or in a stable manner, you should trace the factor(s) that may be causing such a condition before concluding that the system has failed.

If troubles are not solved despite countermeasures, contact Kyowa or our representatives.

Trouble	Checked Items and countermeasures
(1) Power ON but no power is supplied to the product. (Cannot turn ON the POWER LED.)	● Make sure the DC connector has the specified voltage. ● Make sure the both ends of the AC power cable are connected correctly. ● Make sure the power connector is connected correctly. ⇒ Check the connection and securely connect it.
(2) The POWER LED blinks red after turning ON the power.	● The "BOX No." switch is 00. ⇒ Applicable "BOX No." switch is 01 to 08. For details, see "3-4 SETTING BOX NO. SWITCH."
(3) Operation stops and accepts no instruction at all.	● The operation failed due to noise. ⇒ Turn OFF the power and turn ON again. If the same phenomenon still generates due to noise, take appropriate countermeasures for removing the noise from operating environment, power supply, etc.
(4) The measured value varies.	● Make sure the GND terminal is connected to the ground. ⇒ See "3-8 GROUNDING" and ground correctly. When using a strain gage, connect the measuring target, on which the strain gage is mounted, and GND terminal of the product to decrease noise. ● The operation failed due to noise. ⇒ Turn OFF the power and turn ON again. If the same phenomenon still generates due to noise, take appropriate countermeasures for removing the noise from operating environment, power supply, etc. ● Make sure the input lead wires and input cables are connected to the input terminals correctly. ⇒ If the connections to the input terminals (soldering, screwing) are not stable, the measured values vary. Check the connection and securely connect it.
(5) The measured value is incorrect.	● Make sure the input lead wires and input cables are connected to the input terminals correctly. ⇒ If the connections to the input terminals (soldering, screwing) are not correct, the measured values vary. Check the connection and correctly connect them.
(6) Cannot change the optional functions by using the optional DIP switch.	● After turning ON the power, the NTB-500A/C loads the setting of the optional DIP switch. ⇒ Turn OFF the power and turn ON again.
(7) Cannot operate the NTB-500A/C.	● Make sure the termination resistors are set correctly. ⇒ When using one NTB-500A/C: Set the TERM (SW4) to ON. ⇒ When using 2 or more NTB-500A/C units: Set the TERM (SW4) of the NTB-500A/C, the farthest from the PC, to ON. For details, see "3-5 SETTING THE TERMINATION RESISTOR." ● Make sure the "BOX No." switches are set correctly. ⇒ See "3-4 SETTING BOX NO. SWITCH" and set correctly. ● Make sure the PC and NTB are connected correctly. ⇒ Check the connection and securely connect it.

Trouble	Checked Items and countermeasures
(8) The strain measured value is incorrect.	● The E terminal of the NTB-50A/B/C is connected to the A-COM (2.5V) of the PCB. When the E terminal of a sensor is connected to the FG (chassis), and when the sensor chassis is connected to the GND terminal, the measured values are incorrect since the A-COM (2.5V) and GND terminal (0 V) are connected. In this case, follow the instructions as below. ①Disconnect the E terminal of the sensor. It is acceptable since the shield of most sensors is not connected to the chassis. ②Connect the E terminal of the sensor to the GND terminal of the NTB chassis. When the sensor chassis is connected to the GND terminal, pay attention to the noise and electrical loop due to the two-point grounding.
(9) The thermocouple temperature is incorrect.	● When the thermocouple tip is connected to the object to be measured electrically, the measured values are incorrect since thermocouples measure minute voltages. Be sure to cover the thermocouple tip by using an insulator. When the object to be measured has a potential in contrast to the grounding, the potential flows into the input terminal through the thermocouple and may cause troubles. Make sure the object to be measured has the common potential as the GND terminal by using a tester.
(10) Cannot measure data by using multiple units.	● The “BOX No.” switches are overlapping. ⇒ Set the “Box No.” switches so as not to overlap with each other. ● Make sure the NTB-500A/C units are connected correctly. ⇒ Check the connection and securely connect it.
(11) The communication is unstable.	● Make sure the cable length (in total) of the distributed NTB units is correct in the DCS-100A and is within the Specifications. The cable length (in total), sampling frequency, and the number of channels are limited by the amount of information Tx and Rx available on the CAN communication. When increasing the cable length (in total), decrease the communication speed by lowering the sampling frequency or by reducing the number of channels for reducing the amount of information.

Trouble	Checked Items and countermeasures															
(12) Cannot measure data by using the CAN cards of the EDX series.	● Make sure the optional DIP switch “AUTO (SW3)” is ON. ⇒ Set the optional DIP switch “AUTO (SW3)” to ON. The product outputs the data automatically and continuously. ● Make sure the termination resistors are set correctly. ⇒ Check the settings. For details, see “3-5 SETTING THE TERMINATION RESISTOR.” ● Make sure the communication standards is the high-speed CAN. (on the EDX series) ⇒ Check the settings. ● When using the CAN-40A, make sure the high-speed CAN port is connected. ⇒ Check the settings. ● Make sure the communication speeds are set correctly. (on the EDX series) ⇒ Set the communication speed based on the communication cable length, pre-set on the optional DIP switch “OPT.1” and “OPT. 2.”															
	<table><tr><th>Length of the communication cables</th><th></th><th>Communication speed</th></tr><tr><td>20 m</td><td></td><td>1 Mbps</td></tr><tr><td>80 m</td><td></td><td>500 kbps</td></tr><tr><td>100 m</td><td></td><td>250 kbps</td></tr><tr><td>400 m</td><td></td><td>125 kbps</td></tr></table>	Length of the communication cables		Communication speed	20 m		1 Mbps	80 m		500 kbps	100 m		250 kbps	400 m		125 kbps
	Length of the communication cables		Communication speed													
	20 m		1 Mbps													
	80 m		500 kbps													
	100 m		250 kbps													
	400 m		125 kbps													
	● Make sure the ID formats are standard. (on the EDX series) ⇒ Check the settings. ● Make sure the IDs are set correctly in the hexadecimal format. (on the EDX series) ⇒ See “5-5 WITH THE EDX-100A (DCS-100A)” and check the settings. ● Make sure the data length is 8. (on the EDX series) ⇒ Check the settings. ● Make sure the byte order is Little. (on the EDX series) ⇒ Check the settings. ● Make sure the data type is Float. (on the EDX series) ⇒ Check the settings. ● Make sure the channel conditions of the CAN are correct. (on the EDX series) ⇒ Check the settings.															

NOTE

The communication cable length of 400 m can be used when the FIRM version of the main unit is 01.05 or later.
When the FIRM version of the main unit is 01.00 to 01.04, the communication cable length is 20 m.

8. TECHNICAL INFORMATION REQUIRED FOR MEASUREMENT

8-1 COMPENSATING NONLINEARITY IN STRAIN GAGE (QUARTER BRIDGE METHOD)

An ideal bridge output in strain measurement can be obtained by the following equation.

$$\text{Output Voltage} \quad e = \frac{1}{4} K_s \cdot \varepsilon \cdot E$$

where, K_s : Gage factor
 ε : Strain value
 E : Excitation voltage

Assume that only one side of the Wheatstone bridge is regarded as the strain gage and when only the said side changes, nonlinearity generates between the strain value and output voltage.

Nonlinearity generated in relation between strain value and output voltage. The output voltage at that time is obtained by the following equation resulting to cause error as shown in the following table.

$$\text{Output Voltage} \quad e = \frac{\varepsilon}{1 + \varepsilon}$$

True Strain Value	Error
1,000 $\mu\text{m/m}$	-0.1%
10,000 $\mu\text{m/m}$	-1.0%
100,000 $\mu\text{m/m}$	-9.1%

MEMO

- The NTB-500A automatically conducts compensation calculation for the output voltage to obtain the true strain value.

$$\text{true strain value} \quad \varepsilon = \frac{e}{1 - e}$$

Compensation equation regarding mode in strain measurement is described in the following table.

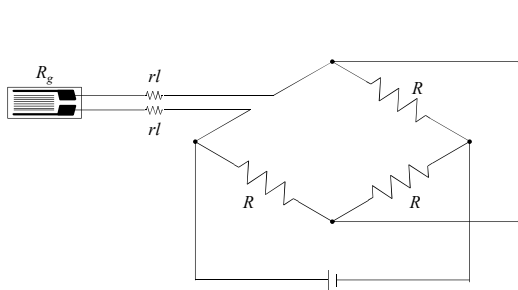
Measuring Method	Mode	Compensation Equation	Compensation
Quarter bridge method (2-wire system connection) (3-wire system connection)	1G120_2W 1G120_3W	$\varepsilon = \frac{e}{1 - e}$	Compensated
Half bridge method (Active-active method)	2G	$\varepsilon = e$	Not compensated
Full bridge method	4G	$\varepsilon = e$	Not compensated

8-2 HOW TO COMPENSATE TEMPERATURE INFLUENCE ON LEAD WIRE (3-WIRE SYSTEM CONNECTION)

When a lead wire is extended from the gage to a bridge circuit using a SELCOM gage as shown in the following, resistance change of the lead wire caused by temperature is viewed as an apparent strain.

With this state, it is not available to fully exert effective features of the SELCOM gage in strain measurement.

An apparent strain caused by temperature effect on the lead wire can be obtained by the following equation.



$$\varepsilon = \frac{\Delta R}{R} \cdot \frac{1}{K_s} = \frac{r \cdot 2l \cdot \alpha}{R_g + r \cdot 2l} \cdot \Delta t \cdot \frac{1}{K_s}$$

where, R_g : Gage resistance value (ohm)

α : Resistance temperature coefficient of lead wire ($\frac{\Delta R}{R} / ^\circ\text{C}$)

Δt : Temperature change ($^\circ\text{C}$)

l : Lead wire length (m)

r : Resistance value of 1-m long lead wire (ohm/m)

K_s : Gage factor = 2.00

For example, when one way of parallel vinyl coated wire having cross-section 0.3 mm^2 in 10 meter (Resistance value: 0.062 ohm/m , Resistance temperature coefficient: $3.93 \times 10^{-3}/^\circ\text{C}$) is 10 m, an apparent strain per degree temperature change shall be obtained by the following expression.

$$\varepsilon = \frac{0.062 \times 2 \times 10 \times 3.93 \times 10^{-3}}{120 + 0.062 \times 2 \times 10} \times 1 \times \frac{1}{2} \doteq 20 \text{ } \mu\text{m/m}$$

In the same manner, the apparent strains for 20 meter and 50 meter lead wires are obtained as follows resulting to have large difference.

20 m : $40 \text{ } \mu\text{m/m}/^\circ\text{C}$

50 m : $96.5 \text{ } \mu\text{m/m}/^\circ\text{C}$

In addition, when a parallel vinyl coated wire having cross-section 0.08 mm^2 in diameter (Resistance value: 0.239 ohm/m , Resistance temperature coefficient: $3.93 \times 10^{-3}/^\circ\text{C}$) is used and calculated in the same manner, the apparent strain shall be obtained by the following expression.

10 m : $75 \text{ } \mu\text{m/m}/^\circ\text{C}$

20 m : $145 \text{ } \mu\text{m/m}/^\circ\text{C}$

50 m : $326 \text{ } \mu\text{m/m}/^\circ\text{C}$

As a result, an apparent strain generates that is larger than the parallel vinyl coated wire with cross-section 0.3 mm^2 .

Thus, the smaller the cross-section of the lead wire and longer the length of the lead wire, the larger it becomes the temperature influence.

As a method for removing the temperature effect on the lead wire, 3-wire system connection is currently widely adopted in strain meter measuring instrument.

Principle of the 3-wire system connection is described in the following.

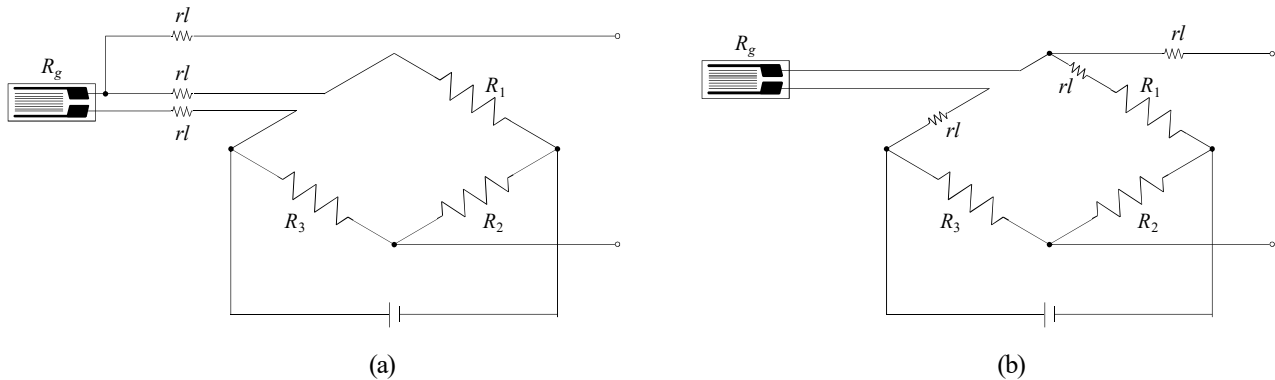
In the following figures, R_g represents a strain gage, R_1 , R_2 , and R_3 represent internal fixed resistance, and rl represents lead wire resistance. Figure (b) is a simplified figure of a basic circuit of figure (a).

In the above figures, the 3-wire system connection is configured by using 3 lead wires for strain gage lead wire to have one lead wire resistor provided to the adjacent side.

With this connection method, temperature effect on lead wire is cancelled and ignored.

As essential precautions when using the 3-wire system connection method, in order to have the same temperature effect on the lead wire, the 3 lead wires should be of same type, should have the same length, cross section, and coating color.

To satisfy the above requirements, a 3-wire parallel vinyl coated wire is applicable.



8-3 COMPENSATING GAGE FACTOR

The NTB-500A/C is designed to conduct measurement with gage factor 2.00. When the gage factor of the current gage is not 2.00, it is required to compensate the strain gage.

- When using the Dynamic Data Recording Software DCS-100A, click the “Set CH Condition” – “Gage Factor”. Input the gage factor. The gage factor is compensated automatically.
- When not using the Dynamic Data Recording Software DCS-100A, compensate the gage factor by using the following expression.

$$\text{True strain gage} = \text{Measured strain gage} \times \frac{2.00}{\text{Gage factor of the current strain gage}}$$

The above calculation can be carried out by using the coefficient calculation function.

8-4 COMPENSATION FOR LONG LEAD WIRE AND CABLE

If the length of the lead wire is extended in quarter bridge method and half bridge method connections, bridge circuit of the strain gage may be structured with unnecessary lead wire resistance in series and gage factor of the apparent strain lowers.

$$\text{True strain gage} = \text{Measured strain gage} \times \frac{\text{Gage resistance} + \text{Lead wire resistance}}{\text{Gage resistance}}$$

The above resistance of the lead wire is resistance of the whole lead wire (Round-trip resistance).

However, for the 3-wire system connection method, substitute one-way resistance.

If the length of the cable is extended full bridge method (transducers), bridge circuit may be structured with unnecessary cable resistance in series and sensitivity is deteriorated due to decrease in excitation voltage.

$$\text{True strain gage} = \text{Measured strain gage} \times \frac{\text{Bridge resistance} + \text{Cable resistance}}{\text{Bridge resistance}}$$

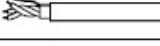
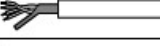
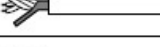
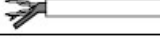
The above cable resistance is resistance of the whole cable (Round-trip resistance).

The above expression can be obtained by coefficient calculation function.

Example of round-trip resistance per meter for lead wire and cable is described in the following table.

The resistance may slightly vary with the wire rod actually used. If you can check the resistance of the actually used wire rod, use the correct value.

● L-type Leadwire Cables

Operating Temperature Range	Model	Type	Conductor Material	Nominal Cross Section of Conductor (mm ²)	Number of Strands/Wire Diam. (mm)	Reciprocating Resistance per meter (Ω)	Coated Wire Diameter (mm)	Unit Length
Room temp. to 350	L-1	 High-temperature leadwire	CuNi alloy wires	0.07	1/0.30	14.20	0.50	50m
-10 to 80	L-2	 Vinyl-coated flat 3-wire cable	Copper wires	0.30	12/0.18	0.12	2.30	100m
-269 to 250	L-3	 Fluoroplastic-coated high/low-temp. 3-wire cable	Silver-plated copper wires	0.14	7/0.16	0.28	0.98	50m
Room temp. to 350	L-4	 High-temperature leadwire	Nickel-clad copper wires	0.20	1/0.50	0.18	0.70	30m
-10 to 80	L-5	 Vinyl-coated flat 2-wire cable	Copper wires	0.50	20/0.18	0.07	2.50	100m
-10 to 80	L-6 ^{*1}	 Vinyl-coated flat 2-wire cable	Copper wires	0.08	7/0.12	0.44	1.00	100m
-10 to 80	L-7 ^{*2}	 Vinyl-coated flat 3-wire cable	Copper wires	0.08	7/0.12	0.44	1.00	100m
-10 to 80	L-9 ^{*1}	 Vinyl-coated flat 2-wire cable	Copper wires	0.11	10/0.12	0.32	1.00	100m
-10 to 80	L-10 ^{*2}	 Vinyl-coated flat 3-wire cable	Copper wires	0.11	10/0.12	0.32	1.00	100m
-100 to 150	L-11	 Middle-temperature 2-wire cable	Silver-plated copper wires	0.08	7/0.12	0.50	0.86	100m
-100 to 150	L-12	 Middle-temperature 3-wire cable	Silver-plated copper wires	0.08	7/0.12	0.50	0.86	100m
-10 to 80	L-13	 Vinyl-coated normal-temp. low-noise 3-wire cable	Tin-plated copper wires	0.09	7/0.13	0.46	3.50	100m
-50 to 90	L-14	 Chloroprene-coated normal-temp. low-noise 4-wire cable	Tin-plated copper wires	0.08	7/0.12	0.48	4.00	100m
-269 to 250	L-15	 Fluoroplastic-coated high/low-temp. low-noise 3-wire cable	Silver-plated copper wires	0.08	7/0.12	0.48	2.50	10m
-269 to 250	L-16	 Fluoroplastic-coated high/low-temp. low-noise 4-wire cable	Silver-plated copper wires	0.08	7/0.12	0.48	3.30	10m
-269 to 350	L-17	 High/low-temperature 3-wire cable	Nickel-plated copper wires	0.07	1/0.30	0.50	0.38	30m

*1. These models have a suffix R, W, G, Y or B indicating the coating color; red, white, green, yellow or black. e.g. L-6B: Black vinyl coated.

*2. These models have a suffix WR, WL or WY indicating the stripe color; red, blue or yellow on white vinyl coating. e.g. L-7WR: Red stripe on white coating.

9. SPECIFICATIONS

9-1 HARDWARE SPECIFICATIONS OF THE NTB-500A, NTB-500C

(1) Measuring instrument

Measuring instrument Model	Name	Dynamic Data Recording Software DCS-100A
NTB-500A	MEDIUM SPEED NETWORK TERMINAL BOX	Standard accessory
NTB-500C		
NTB-500A-0		Optional
NTB-500C-0		

(2) Mountable measurement unit

Measuring instrument Model	Mountable measurement unit		
	Model	Name	Terminal block type
NTB-500A	NTB-50A	Strain Unit	one-touch lock
	NTB-50B		one-touch
	NTB-51A	Voltage/Thermocouple Unit	soldering, screw-fixed
NTB-500C	NTB-50C	Strain Unit	one-touch
	NTB-51C	Voltage/Thermocouple Unit	soldering, screw-fixed

* NTB-50A was discontinued in 2016 due to the discontinuation of the one-touch locking terminal block.

* NTB-500A, NTB-50B, and NTB-51A were discontinued in 2020 due to discontinuation of the connector to be connected.

* NTB-500A and NTB-500C can be connected.

(3) Measuring target and measuring unit

Measuring target		Measuring unit	Strain unit NTB-50A/B/C	Voltage/Thermocouple unit NTB-51A/C
Strain gage	Quarter bridge system	2-wire	●	-
	120 ohm	3-wire	●	-
Strain gage transducer	Half bridge system	Active/Active method	●	-
	Full bridge system	Full bridge method	●	-
Voltage		±10.0000 V	-	●
		±50.000 V	-	●
Temperature	Thermocouple	K(CA)	-	●
		T(CC)	-	●

(4) The number of channels Max. 8 channels/NTB-500A/C (Up to 2 measuring units are available.)

(5) Synchronous operation Max. 8 NTB-500A/C units (64 channels)

(6) Automated measurement function Set the measurement conditions in advance using the automatic measurement condition setting software.
CAN data output starts after power-on
No data synchronization between Measuring instrument

(7) Sampling frequency 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k Hz (Simultaneous sampling of all channels)

Sampling frequency (Hz)	The number of channels			
	Length of the communication cables = 20 m	Length of the communication cables = 80 m	Length of the communication cables = 100 m	Length of the communication cables = 400 m
1k	8	4	-	—
500	16	8	4	—
200	40	20	8	4
100	64	40	20	8
50	64	64	40	20
20 to 1	64	64	64	64

*The communication cable length of 400 m can be used with the main unit FIRM Version 01.05 or later.

(8) Length of the communication cables Max. 100 m (The total cable length between the PC and NTB-500A/C units)

(9) TEDS function When mounting the NTB-50A/B/C (strain unit)

- Loading function from the TEDS sensor
- CH name writing function (For the manufacture ID: Kyowa only)

(10) Interface Bosch2.0B active (ISO-11898 compliant, High speed CAN)

(11) Storage data Measured data can be stored into the PC
(the NTB-500A/C cannot store the measured data).

(12) Operating temperature range -10 to 50°C

(13) Operating humidity range 20 to 85% (Noncondensing)

(14) Power supply 11 to 16 VDC

(15) Consumption current (when operating 12 VDC)

Mounting measurement unit	When measuring	When waiting
With the 2 NTB-50A/B/C units	230 mA or less	200 mA or less
With the 2 NTB-51A/C units	300 mA or less	250 mA or less

(16) Dimensions 175 (W) × 28.7 (H) × 106.4 (D) mm (excluding protrusions)

(17) Weight Approx. 490 g

(18) Compliance Directive 2014/30/EU (EMC) (within 30m between devices)
Directive 2011/65/EU,(EU)2015/863(10 restricted substances) (RoHS)
※NTB-500C only

9-2 HARDWARE SPECIFICATIONS OF THE NTB-50A, NTB-50B, NTB-50C

(1) Measurement unit

Model	Name	Terminal block type	Mountable Measuring instrument
NTB-50A	Strain Unit	one-touch lock	NTB-500A
NTB-50B		one-touch	
NTB-50C			NTB-500C

* NTB-50A was discontinued in 2016 due to the discontinuation of the one-touch locking terminal block.

* NTB-500A, NTB-50B, and NTB-51A were discontinued in 2020 due to discontinuation of the connector to be connected.

(2) The number of input channels

4

(3) Measuring target

Strain gage
Strain Gage Transducer

(4) Applicable gage

Quarter bridge system (2-wire and 3-wire) 120 ohm
Half bridge system, full bridge system 120 to 1000 ohm

(5) Applicable gage factor

2.00 fixed

(6) Bridge excitation

2 VDC $\pm$ 1%

(7) Check function

Sensor checking

(8) TEDS function

Loading function from the TEDS sensor
CH name writing function (For the manufacture ID: Kyowa only)

(9) Measuring range, resolution, range accuracy

Measuring range	Resolution	Range accuracy
30k μ m/m	0.1 μ m/m	$\pm$ 0.1%FS
300k μ m/m	1 μ m/m	

(10) Response frequency

DC to 100 Hz (deviation: +1 dB to -3 dB)

(11) Dimensions

152.2 (W) $\times$ 6.1 (H) $\times$ 45.0 (D) mm (excluding protrusions)

(12) Weight

Approx. 85 g

(13) Compliance

Directive 2014/30/EU (EMC) (within 30m between devices)
Directive 2011/65/EU, (EU)2015/863(10 restricted substances) (RoHS)
※NTB-50C only

9-3 HARDWARE SPECIFICATIONS OF THE NTB-51A,NTB-51C

(1) Measurement unit

Model	Name	Terminal block type	Mountable Measuring instrument
NTB-51A	Voltage/Thermocouple Unit	soldering, screw-fixed	NTB-500A
NTB-51C			NTB-500C

* NTB-500A, NTB-50B, and NTB-51A were discontinued in 2020 due to discontinuation of the connector to be connected.

(2) The number of input channels 4

(3) Measuring target Voltage, thermocouple (K type and T type)

(4) Check function Burnout checking

(5) TEDS function None

(6) Measuring range, resolution, range accuracy

Voltage measurement:

Measuring range	Resolution	Range accuracy	Input resistance
10V	100 μ V	$\pm 0.1\%$ FS	Approx. 1 Mohm
50V	1 mV		

Thermocouple measurement

Type	Measuring range	Accuracy		Resolution
		External reference junction	Internal reference junction Ambient temperature (25 $\pm$ 10) $^{\circ}$ C	
K	-200.0 to + 1230.0 $^{\circ}$ C	$\pm(0.5\% \text{rdg} + 1.0)^{\circ}$ C	$\pm(0.5\% \text{rdg} + 2.0)^{\circ}$ C	0.1 $^{\circ}$ C
T	-200.0 to + 400.0 $^{\circ}$ C		(At the input terminal equilibrated with ambient temperature.)	

- The accuracy of thermocouples are not included.
- The reference junction compensation can be set to the internal or external.
- Resistance of the thermocouples are 1 kohm or less.

(7) Response frequency

Voltage measurement	: DC to 100 Hz (deviation: +1 dB to -3 dB)
Thermocouple measurement	: DC to 10 Hz (deviation: +0.5 dB to -1 dB)

(8) Insulation

Between channels	: 500 VDC, 50 Mohm or more
------------------	----------------------------

(9) Dimensions

152.2 (W) $\times$ 6.1 (H) $\times$ 45.0 (D) mm (excluding protrusions)

(10) Weight

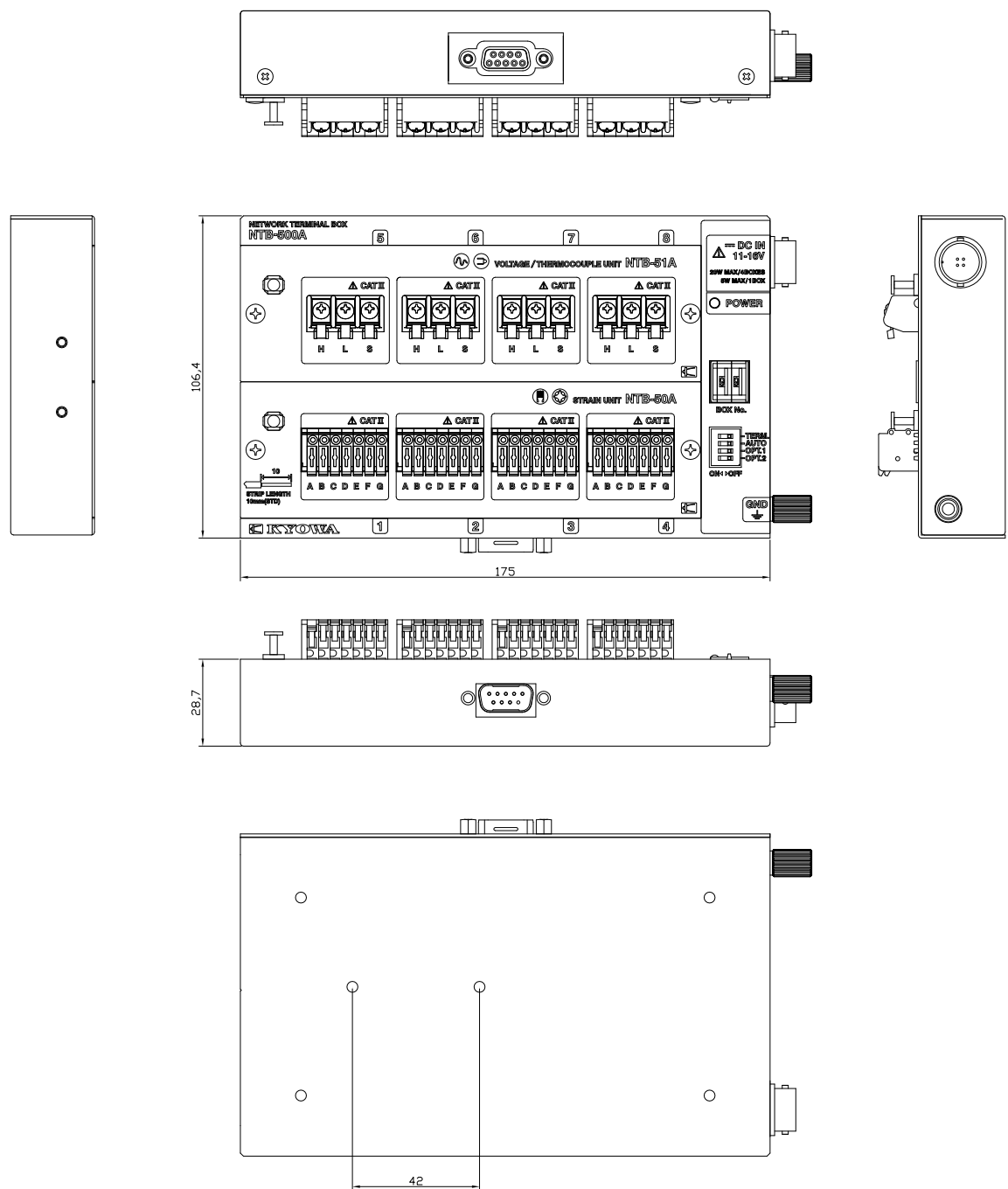
Approx. 95 g

(13) Compliance

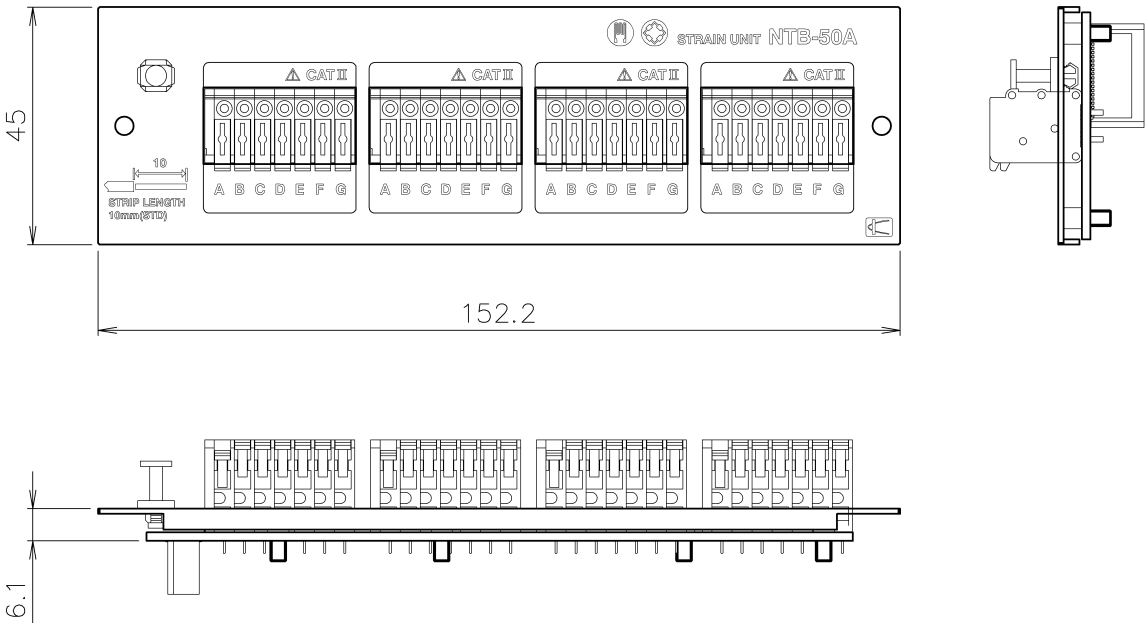
Directive 2014/30/EU (EMC) (within 30m between devices)
 Directive 2011/65/EU,(EU)2015/863(10 restricted substances) (RoHS)
 ※NTB-51C only

10. OUTSIDE DRAWING

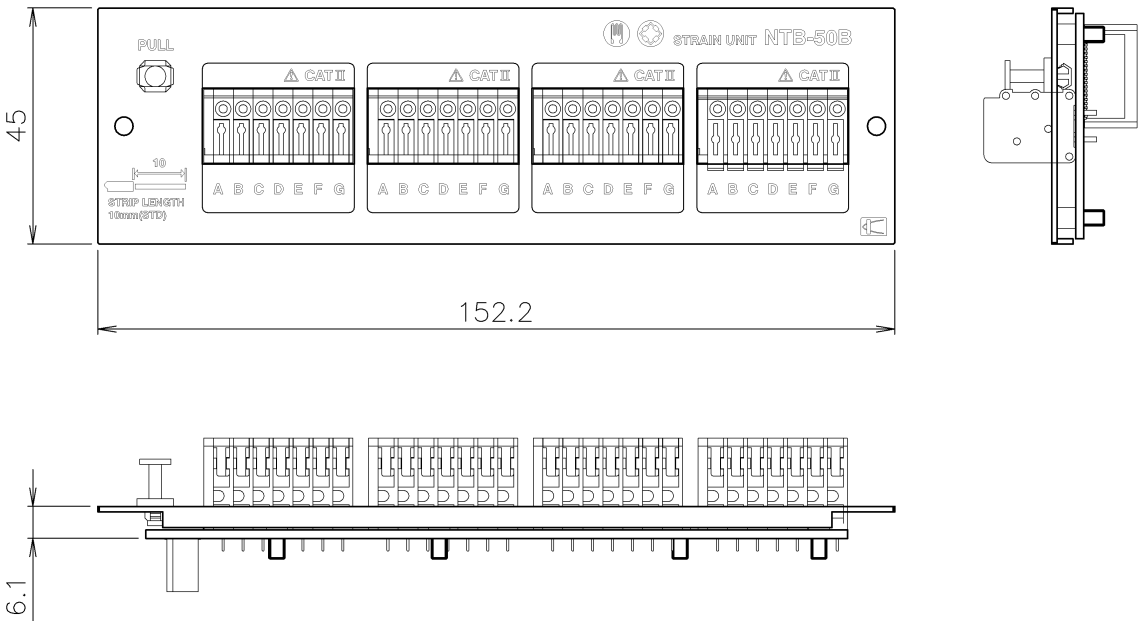
10-1 OUTSIDE DRAWING OF THE NTB-500A/C



10-2 OUTSIDE DRAWING OF THE NTB-50A (optional accessory)



10-3 OUTSIDE DWARING OF THE NTB-50B/C (optional accessory)



10-4 OUTSIDE DRAWING OF THE NTB-51A/C (optional accessory)

