

**THK Electrical Actuator Controller Series
Network unit & Branch unit**

TNU / TJU

INSTRUCTION MANUAL

No.6090-6(0)E

Table of Contents

1. Introduction 1-1	1. Introduction	1-2
	1-1 Acknowledgment	1-2
	1-2 About this manual	1-2
	1-3 How to use this product	1-3
	1-4 About product support	1-3
	1-5 About related instruction manuals	1-3
	1-6 Product and company information	1-3
	2. Safety precautions	1-4
	2-1 About ranks of precautions	1-4
	2-2 About description of precautions	1-4
	2-3 Safety precautions	1-5
	3. System configuration	1-6
	3-1 System configuration diagram (Example)	1-6
	4. Flow until using the product	1-7
	5. Network type	1-8
5-1 CC-Link	1-8	
5-2 EtherCAT	1-8	
5-3 EtherNet/IP	1-8	
5-4 DeviceNet	1-9	
2. Installation 2-1	1. Check products	2-2
	1-1 Check the package contents of TNU	2-2
	1-2 Check the package contents of TJU	2-3
	1-3 Option	2-4
	1-4 Names of individual parts and functions	2-5
	1-5 Store and dispose of products	2-9
	2. How to install	2-10
	2-1 Installation environment	2-10
	2-2 Installation	2-11

Table of Contents

3. Wiring 3-1

1. How to wire	3-2
1-1 Entire wiring	3-3
1-2 Connect peripheral devices to TNU power supply	3-4
1-3 Connect to master devices	3-7
1-4 Connect TJU	3-9
1-5 Connect to PC	3-11
1-6 Connect to TDO	3-11
1-7 Peripheral devices	3-11

4. TNU functions 4-1

1. TNU functions	4-2
1-1 TNU functions	4-2
1-2 Control functions overview	4-3
1-3 Lower-level communication prohibition function	4-11
1-4 Broadcast function	4-11
1-5 Remote MANUAL function	4-11
1-6 Data readout function	4-12
1-7 DVC write status display function	4-15
1-8 DVC function	4-15
2. CC-Link communication specifications	4-16
2-1 CC-Link communication overview	4-16
2-2 CC-Link data mapping	4-16
2-3 Buffer memory allocation correspondence table	4-26
2-4 Number of occupied stations / multiple settings (CC-Link Ver.2.00 only)	4-27
2-5 CSP, CSP+ files (TNU Firmware Ver. 1.2 or later)	4-27
3. EtherCAT communication specification	4-28
3-1 EtherCAT communication overview	4-28
3-2 EtherCAT PDO mapping (I/O allocation correspondence table)	4-28
3-3 ESI files	4-34
4. EtherNet/IP, DeviceNet communication specification	4-35
4-1 Communication overview	4-35
4-2 EtherNet/IP, DeviceNet Data mapping (master -> slave)	4-36

Table of Contents

4. TNU functions 4-1	4-3	EtherNet/IP, DeviceNet communication specification	4-38
	4-4	EDS files	4-41
	5. TACnet communication specifications		4-42
	5-1	TACnet communication overview	4-42
	5-2	TACnet communication status transition diagram	4-42
	5-3	TACnet communication diagram	4-44
5. Operation and Adjustment 5-1	1. Operation mode		5-2
	1-1	I/O mode	5-3
	1-2	PC/TDO mode	5-3
	2. General precautions		5-4
	2-1	About upper-level communication	5-4
	3. Communication parameters		5-5
	3-1	Communication parameters	5-5
	3-2	Net device list	5-8
6. Setup tool D-STEP 6-1	1. Introduction		6-2
	1-1	Standard precautions	6-2
	1-2	Saving programs and parameters (Important)	6-2
	2. Product overview		6-3
	2-1	Product configuration	6-3
	2-2	Application of this manual	6-3
	2-3	Configuration of required devices	6-3
2-4	User support	6-4	

Table of Contents

6. Setup tool D-STEP 6-1	3. Operation method 6-5	
	3-1	Connect start screen 6-5
	3-2	Net device list setting screen 6-6
	3-3	Parameter setting screen 6-7
	3-4	Alarm history display screen 6-10
	3-5	Setting before communication with driver controller (Important) 6-10
	3-6	Offline edit screen selection 6-11
	3-7	Offline net device list setting screen 6-11
	3-8	Offline parameter setting screen 6-12
7. Digital operator TDO 7-1	1. Introduction 7-2	
	1-1	Standard precautions 7-2
	1-2	Saving programs and parameters (Important) 7-2
	1-3	Limit for operation (Important) 7-2
	2. Connection 7-3	
	2-1	Connect to TNU 7-3
	2-2	Initial screen 7-3
	2-3	Connect start screen 7-4
	2-4	Connection failure screen 7-4
2-5	ID selection screen 7-4	
8. Troubleshooting 8-1	1. Alarm lists 8-2	
	1-1	Alarm lists 8-2
	2. Causes and counter measures of alarms 8-3	
	2-1	Causes and counter measures of alarms 8-3
	3. Other troubles 8-5	
	3-1	D-STEP cannot detect the driver controller 8-5
	3-2	The driver controller does not operate even with the lower-level communication authorization switch ON 8-6
	3-3	During DVC pressing operation, position data abnormality occurs 8-6
	3-4	Driver controller input signal is slow 8-6
3-5	Even with driver controller input signal MANU set to ON, operation from D-STEP, TDO is not possible 8-6	

Table of Contents

9. Maintenance and Warranty 9-1

1. Maintenance and inspection 9-2

- 1-1 Periodical inspection 9-2
- 1-2 Standard of durability of consumables for TNU and TJU 9-2

2. Product warranty 9-3

- 2-1 Free warranty period 9-3
- 2-2 Usage conditions (Range) 9-3
- 2-3 Warranty scope 9-3
- 2-4 Exclusion of warranty liability 9-4
- 2-5 Delivery conditions 9-4

10. Technical Materials 10-1

1. Network unit TNU 10-2

- 1-1 Specifications and dimensional drawing 10-2

2. Branch unit TJU 10-3

- 2-1 Specifications and dimensional drawing 10-3

3. Connection cable 10-4

- 3-1 PC communication cable 10-4
- 3-2 TACnet cable 10-4

4. Sample program 10-5

- 4-1 Broadcast sample program 10-5
- 4-2 CC-Link sample program 10-7

5. Memory map 10-8

- 5-1 Memory map 10-8

Appendix

Revision history

1. Introduction

About this chapter

This chapter describes the overview of the product.

This chapter includes information that we want you to check and understand before working with the product.



This section includes introduction about the product and this manual.

1. Introduction	1-2
1-1 Acknowledgment	1-2
1-2 About this manual	1-2
1-3 How to use this product	1-3
1-4 About product support	1-3
1-5 About related instruction manuals	1-3
1-6 Product and company information	1-3



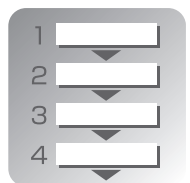
This section includes general precautions to follow when using the product. Be sure to read this section before use and observe the precautions.

2. Safety precautions	1-4
2-1 About ranks of precautions	1-4
2-2 About description of precautions	1-4
2-3 Safety precautions	1-5



This section includes introduction about peripheral devices to be used with this product.

3. System configuration	1-6
3-1 System configuration diagram (Example)	1-6



This section describes installation and setting processes to make this product ready for use.

4. Flow until using the product	1-7
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5. Network type	1-8
5-1 CC-Link	1-8
5-2 EtherCAT	1-8
5-3 EtherNet/IP	1-8
5-4 DeviceNet	1-9

1-1 Acknowledgment

Thank you for purchasing our product.

This product is a communication unit to connect the THK driver controllers TSC, TLC, and THC to industrial networks. We hope our products contribute to your further prosperity.

1-2 About this manual

1-2-1 Intended audience

The person in charge of designing embedded systems of the product and installing, wiring, and maintaining the product, and the person who actually uses the product.

1-2-2 Using This Manual

This manual describes correct handling methods and precautions for the product.

For the maximum performance and long life of the product, carefully read and understand this manual to safely and correctly use the product.

If you access our website or use the printed version of this manual, be sure to keep it in the place that the intended audience can refer to it when needed.

1-2-3 Notice and attention

- Do not use or handle the product in the ways that are not described in this manual.
- Do not reproduce, reprint, or lend the whole contents or a part of this manual without permission.
- Please note that description in this manual is subject to change without prior notice in the future, due to improvements of the product or other reasons.
- We have made all possible efforts to make the content of this manual accurate. However, if you find any mistake or uncertainty in this manual, please contact our Customer Support (refer to back cover).
- Drawings show representative examples, and may differ from your product.
- Note that THK shall not be liable for any result incurred by applying this manual, regardless of the reason.
- This manual can be applied to special types. However, the descriptions defined in the delivery specification drawings or the delivery specification documents of those special types should take precedence over this manual.

* Special types represent the products that have different materials and specifications from those of the standard products on catalogs.

1-2-4 Notation of this manual

Important

- Notes that can lead to unsatisfactory functions, error, or damage of the product if not observed while using the product.

Note

- Supplementary information for the description.

Reference

- Reference information for the description.

1-3 How to use this product

- This product cannot be used for the devices or systems that are used under the situations that can affect human life.
- If you consider using this product for special applications such as passenger movement vehicle, medical, aerospace, nuclear power, and electric power devices or systems, be sure to consult with THK in advance.
- This product is manufactured under the strict quality control, however, that does not mean that the product is free from failure. For applications to the equipment that may suffer serious accidents or loss from the failure of this product, install safety devices or backup devices that prevent such serious accidents or loss.

1-4 About product support

For the following information, please contact our Customer Support (refer to back cover).

- Technical support for this product

1-5 About related instruction manuals

- When you use the network unit TNU, read the following instruction manuals as necessary.

· Controller series	Setup tool D-STEP
· Controller series	Digital operator TDO
· Controller series	Driver controller TSC
· Controller series	Driver controller TLC
· Controller series	Driver controller THC

1-6 Product and company information

To find the latest product and company information, we recommend you to periodically access our website.

- Website URL: <http://www.thk.com/>
- Technical support website URL: <https://tech.thk.com/>

2. Safety precautions

2-1 About ranks of precautions

This manual uses the classifications of "Danger," "Warning," and "Caution" for warning indications for safety matters.



DANGER

Erroneous handling may urgently cause death or serious injury to a person



WARNING

Erroneous handling may cause death or serious injury to a person















CAUTION

Erroneous handling may cause injury to a person or property damage only

2-2 About description of precautions

Precautions are classified as "Prohibition," "Instruction," and "Precaution" according to the action.

 <p>This mark indicates "Prohibition" of the action.</p>	 <p>Prohibited</p>  <p>Do not disassemble</p>
 <p>This mark indicates "Instruction" of the action.</p>	 <p>Obligatory</p>  <p>Provide grounding connection</p>
 <p>This mark indicates "Caution" of the action.</p>	 <p>Caution</p>  <p>Caution - Electrical shock</p>  <p>Caution - Flammable</p>  <p>Caution - High temperature</p>  <p>Caution - Getting caught</p>

2. Safety precautions

2-3 Safety precautions

WARNING



Prohibited

- **While the actuator is operating or operable, do not enter the working area of any moving part including the load.**

Doing so may cause you to touch the moving part and get injured.



Obligatory

- **If the product fails or any abnormality is observed, shut down the power of the driver controllers TSC, TLC, and THC.**

Such abnormality may cause a malfunction of actuator, resulting in damage or injury.



Caution -

Electrical shock

- **Do not touch the internal part of the network unit TNU.**

Doing so may cause electric shocks.

- **Do not damage, tuck, or apply excessive stresses on the cable.**

Doing so may cause electric shocks.



Do not

disassemble

- **Do not modify, disassemble, or alter the product.**

Doing so may cause injury or fault.

Doing so may cause burns.

CAUTION



Prohibited

- **Do not impact the product and do avoid rough handling such as throwing it.**

Doing so may cause the fault or damage that leads to injury.

- **Do not frequently switch the power between on and off.**

Doing so may generate heat from the internal parts of the network unit TNU, which results in fault or burns.

- **Do not set the speed or acceleration setting that exceeds the actuator specification.**

Doing so may cause motor failure, which leads to unexpected accidents or damages.



Obligatory

- **If an alarm is generated, remove the cause, check the safety, deactivate the alarm, and restart the operation. (-> P.8-2)**

Failure to do so may result in failure, which leads to injury.



Caution -

Flammable

- **Use this product with a combination that is specified beforehand.**

Failure to do so may cause fire or fault.

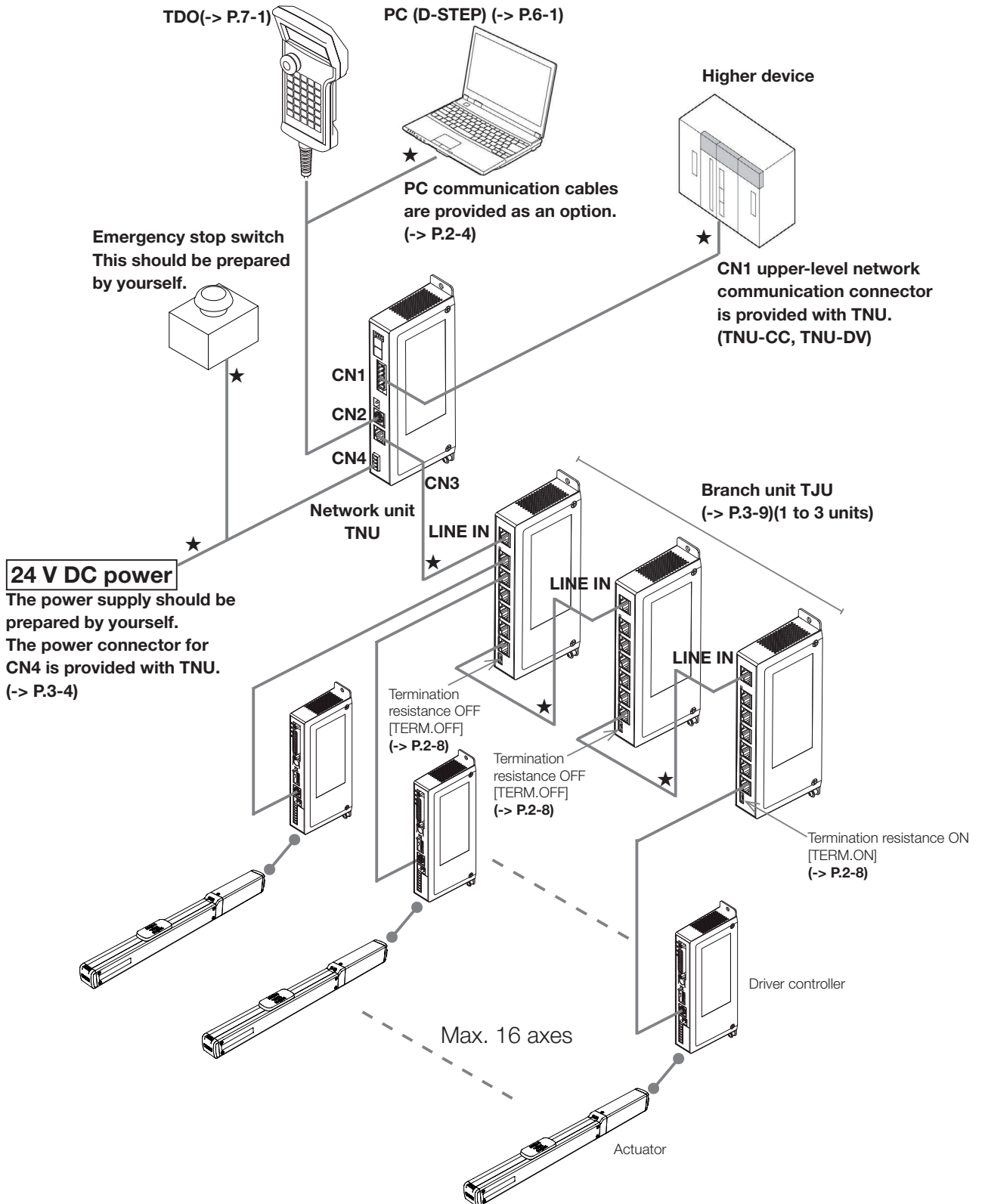
- **Observe the specified input voltage.**

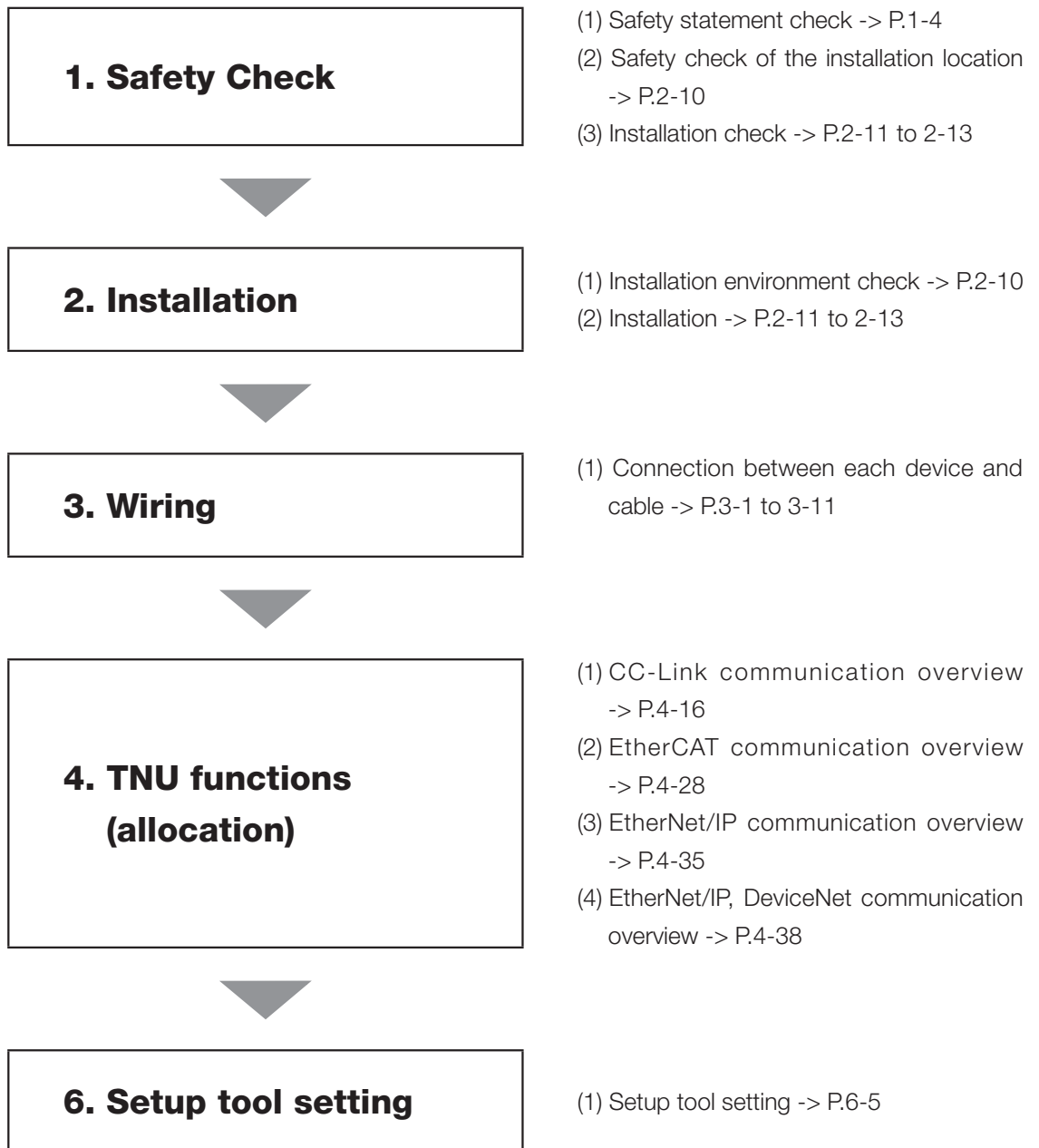
Failure to do so may cause fire or fault.

3. System configuration

3-1 System configuration diagram (Example)

- The following figure is a configuration drawing where the driver controller TSC is 16-axis combined with TNU.
- Cables used for connecting the devices shown with ★ should be prepared by yourself.





5-1

CC-Link

The CC-Link is a serial-based open field network.

This network is operated by the non-profit organization CC-Link Partner Association (CLPA) and has the following features:

1. Achievement of the high-speed and stable I/O response
2. Efficiency promoted by wiring saving
3. Flexible responses to multivendors
4. High reliability realized by RAS (Reliability, Availability, and Serviceability) functions

For detailed information on CC-Link, refer to the documents issued by the CC-Link Partner Association and instruction manual for the master device used.

5-2

EtherCAT

EtherCAT is an open field network compatible with Ethernet.

EtherCAT is an open network designed with the operating principle to realize the high-speed communication and the architecture suitable for motion control, such as a function that synchronizes between highly accurate nodes, featuring the simpler wiring compared to Ethernet without requiring a switching hub.

The structure is supported for the needs of decentralizing I/O devices including the safety. The single network design will also save the wiring within the devices. Not only speeding up, increasing the accuracy of the device control, or improving the device production cycle time, EtherCAT also helps you to lower the cost associated with device installation or maintenance, such as standardizing cable wiring or simplifying the assembly.

For detailed information on EtherCAT, refer to the documents issued by EtherCAT Technology Group and the instruction manual for the master device used.

5-3

EtherNet/IP

EtherNet/IP is a standard industrial Ethernet network which adopts the widely used Ethernet TCP/IP protocol and has CIP (Common Industrial Protocol) installed as the control protocol at the application layer.

It is regulated by IEC Standard IEC 61158.

Making the most of its ability for rapid and wide-range communication of large volumes of control and monitoring data from the field, it promises improved operation rates and quality and reduced TCO.

For detailed information on EtherNet/IP, refer to the documents issued by the ODVA (Open DeviceNet Vendor Association) and instruction manual for the master device used.

5-4

DeviceNet

DeviceNet is a network which uses ISO standard (11898) CAN (Controller Area Network) for its data link layer and part of its physical layer, with additional DeviceNet physical and application layers.

By using serial communication instead of I/O connection to connect with field devices, it enables efficient transmission of large volumes of data. The standardized connection method enables intelligent devices and increased system productivity.

For detailed information on DeviceNet, refer to the documents issued by the ODVA (Open DeviceNet Vendor Association) and instruction manual for the master device used.

2. Installation

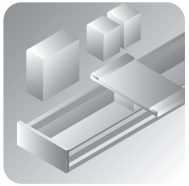
About this chapter

This chapter describes how to check the package contents and to install it to the machine and facilities.
This section is primarily intended for those in charge of installation of this product to a machine and facilities.



This section describes the package contents check and parts of this product.

1.	Check products	2-2
1-1	Check the package contents of TNU	2-2
1-2	Check the package contents of TJU	2-3
1-3	Option	2-4
1-4	Names of individual parts and functions	2-5
1-5	Store and dispose of products.....	2-9



This section describes the installation procedures of this product.

2.	How to install	2-10
2-1	Installation environment	2-10
2-2	Installation	2-11

1. Check products

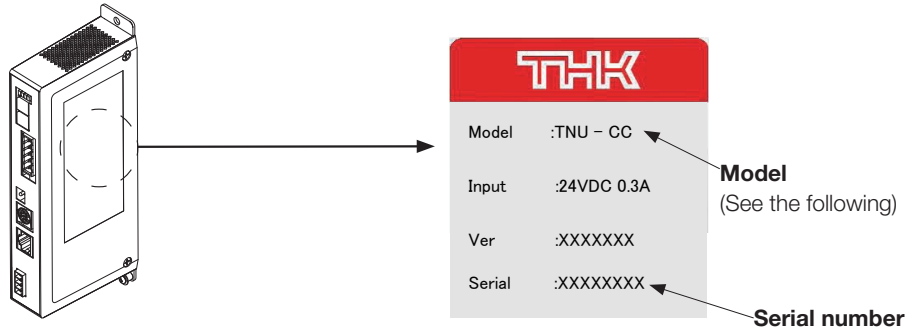
1-1

Check the package contents of TNU

1-1-1

Check the model/type of the product

Check the model indicated on the product label* against the purchase information.



<Model configuration>


TNU - CC
(1) (2)

(1) Model	TNU: Network unit TNU
(2) Network type	CC: CC-Link EC: EtherCAT EP: EtherNet/IP DV: DeviceNet


1-1-2

Checking the type and number of TNU accessories

No cable is provided, so please separately prepare a cable.

Type of parts	Model	Qty.
Network unit	* See the product label	1
Power connector (CN4)	MPC300-38104 	1

• TNU-CC

Type of parts	Model	Qty.
Upper-level network communication connector (CN1)	MSTB2,5/5-ST-5,08 ABFY AU 	1

1-1-3

Check the product for any damage or abnormality

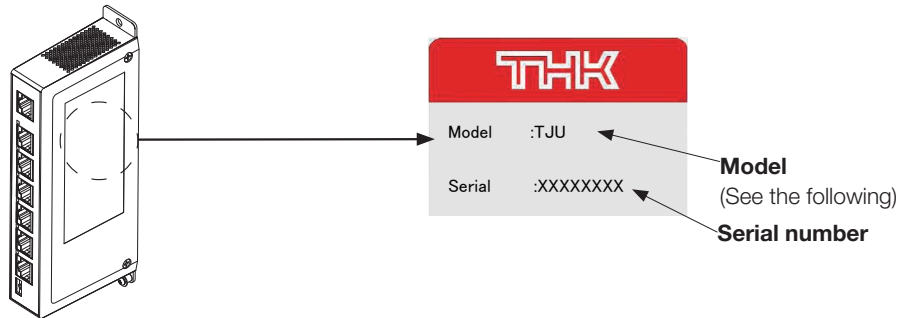
After the checking, keep the product packed in the packaging box until the start of installation work.

1. Check products

1-2 Check the package contents of TJU

1-2-1 Check the model/type of the product

Check the model indicated on the product label* against the purchase information.



<Model configuration>

TJU
(1)

(1) Model

TJU: Branch unit TJU

1-2-2 Checking the type and number of TJU accessories

No cable is provided, so please separately prepare a cable.

* Prepare the cables between TNU and TJU , TJU and TJU by yourself.

Type of parts	Model	Qty.
Branch unit	* See the product label	1

1-2-3 Check the product for any damage or abnormality

After the checking, keep the product packed in the packaging box until the start of installation work.

Reference

- For any special type, check against the delivery specification documents.

1. Check products

1-3 Option

1-3-1 D-STEP

A setup tool. This can be downloaded from our website free of charge.

* Registration with the technical support is required to download.

URL: <https://tech.thk.com/>

In addition, a PC communication cable is required to use D-STEP.

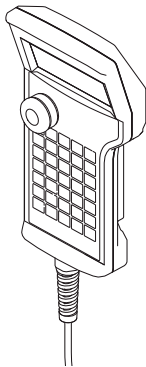
For details, see the separate D-STEP instruction manual.

1-3-2 TDO

The digital operator for driver controller TSC, TLC and THC.

Model number: TDO-N

For details, see the separate TDO instruction manual.

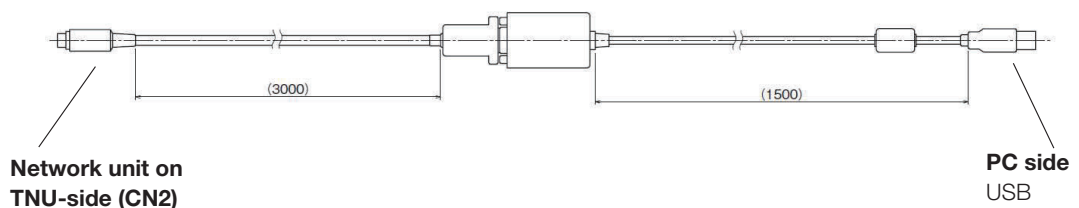


1-3-3 PC communication cable

A PC communication cable for D-STEP.

Model number: CBL-COM-03

For details, see the separate D-STEP instruction manual.

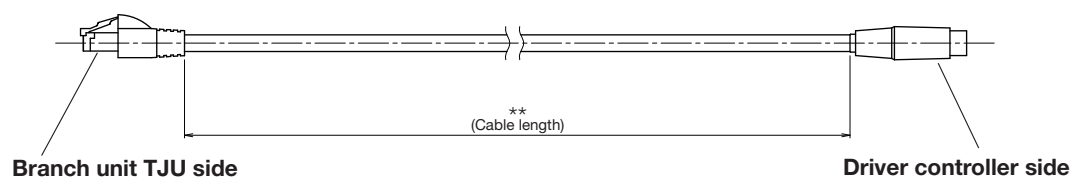


1-3-4 TACnet cable

The cable is used to connect the branch unit TJU and driver controller.

Model: CBL-NW-** (01: 1 m, 03: 3 m)

For details, see the technical documents. (-> P.10-4)



1. Check products

1-4

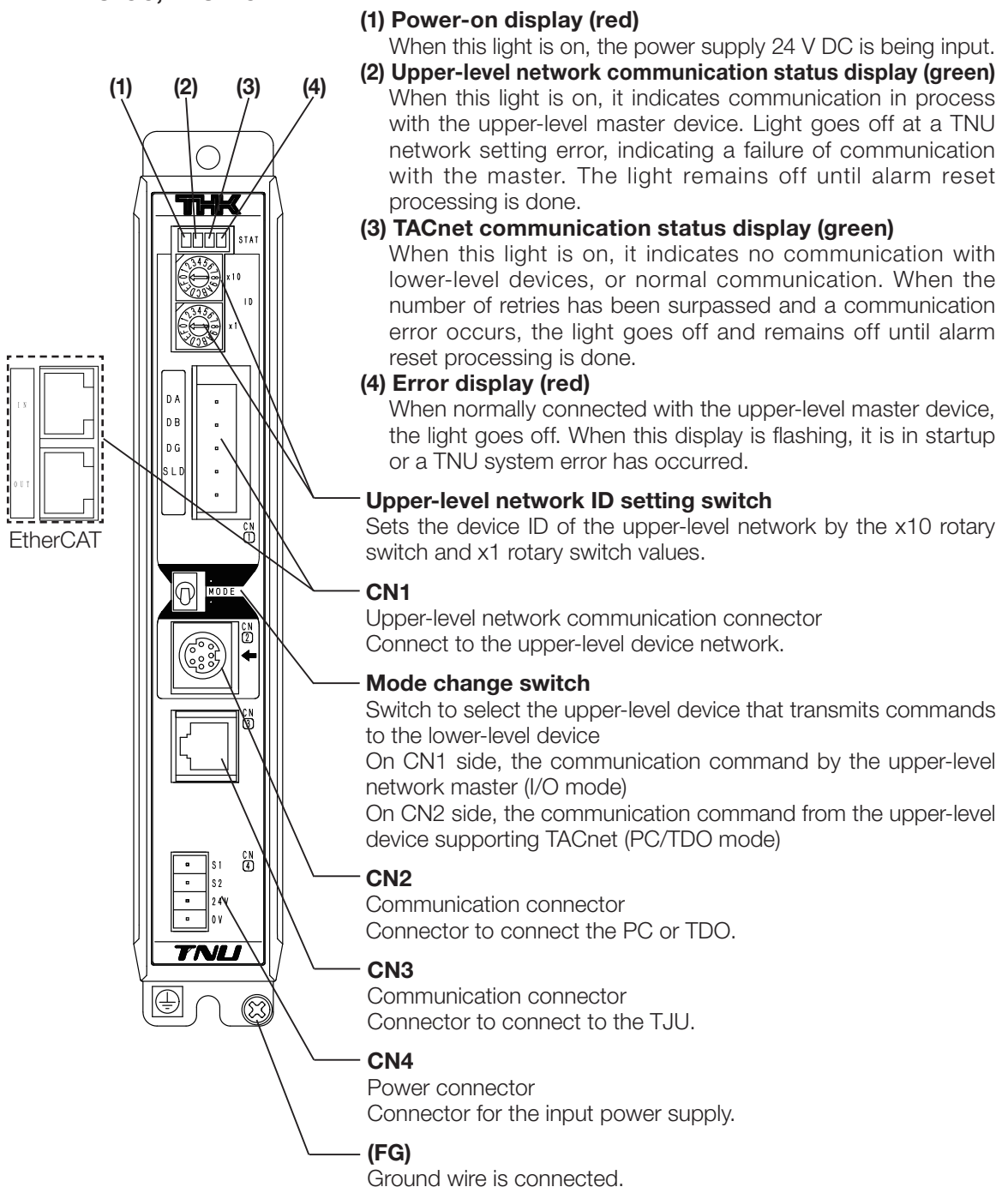
Names of individual parts and functions

1-4-1

Network unit TNU

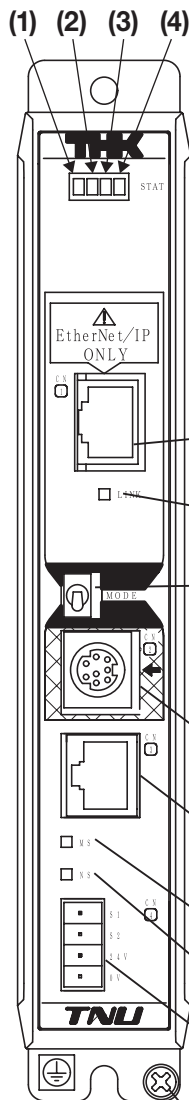
- TNU-CC connectors for CN1 and CN4 are provided with this product. No cable is provided, so please separately prepare it. CN1 connector is not provided with TNU-EC and TNU-EP.
- A cable to connect to CN2 and PC is available as an option. (-> P.2-4)
- Prepare a cable to connect CN3 and TJU by yourself. (-> P.3-9)

TNU-CC, TNU-EC



1. Check products

TNU-EP



(1) Power-on display (red)

When this light is on, the power supply 24 V DC is being input.

(2) Upper-level network communication status display (green)

When this light is on, it indicates communication in process with the upper-level master device. Light goes off at a TNU network setting error, indicating a failure of communication with the master. The light remains off until alarm reset processing is done.

(3) TACnet communication status display (green)

When this light is on, it indicates no communication with lower-level devices, or normal communication. When the number of retries has been surpassed and a communication error occurs, the light goes off and remains off until alarm reset processing is done.

(4) Error display (red)

When normally connected with the upper-level master device, the light goes off. When this display is flashing, it is in startup or a TNU system error has occurred.

CN1

Upper-level network communication connector
Connect to the upper-level device network.

LED (LINK)

Indicates communication status with EtherNet/IP network.

Mode change switch

Switch to select the upper-level device that transmits command to the lower-level device

On CN1 side, the communication command by the upper-level network master (I/O mode)

On CN2 side, the communication command by the upper-level device supporting TACnet (PC/TDO mode)

CN2

Communication connector
Connector to connect the PC or TDO.

CN3

Communication connector
Connector to connect to the TJU.

LED (MS)

Indicates unit operation status.

LED (NS)

Indicates network communication status.

CN4

Power connector
Connector for the input power supply.

(FG)

Ground wire is connected.

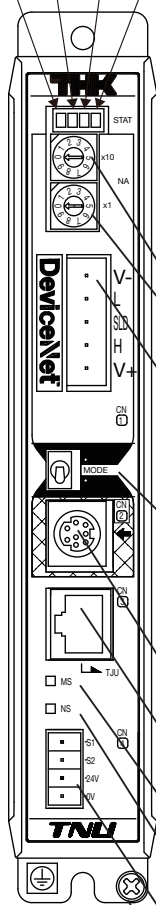
MS/NS LED display

LINK	Link	Lit off	No link, no data communication
		Green lit	Link established
		Green flashing	In data communication
MS	Module status	Lit off	Power OFF
		Green lit	In normal operation
		Green flashing	Unit setting not done
		Red lit	Fatal unit error
		Red flashing	Clearable unit error
NS	Network status	Lit off	Power OFF / IP address unset
		Green lit	Online: connection established
		Green flashing	Online: connection unestablished
		Red lit	IP address overlap (fatal error)
		Red flashing	Communication time out

1. Check products

TNU-DV

(1) (2) (3) (4)



(1) Power-on display (red)

When this light is on, the power supply 24 V DC is being input.

(2) Upper-level network communication status display (green)

When this light is on, it indicates communication in process with the upper-level master device. Light goes off at a TNU network setting error, indicating a failure of communication with the master. The light remains off until alarm reset processing is done.

(3) TACnet communication status display (green)

When this light is on, it indicates no communication with lower-level devices, or normal communication. When the number of retries has been surpassed and a communication error occurs, the light goes off and remains off until alarm reset processing is done.

(4) Error display (red)

When normally connected with the upper-level master device, the light goes off. When this display is flashing, it is in startup or a TNU system error has occurred.

Upper-level network ID setting switch

Sets the device ID of the upper-level network by the x10 rotary switch and x1 rotary switch values.

CN1

Upper-level network communication connector
Connect to the upper-level device network.

Mode change switch

Switch to select the upper-level device that transmits command to the lower-level device

On CN1 side, the communication command by the upper-level network master (I/O mode)

On CN2 side, the communication command by the upper-level device supporting TACnet (PC/TDO mode)

CN2

Communication connector. Connector to connect the PC or TDO.

CN3

Communication connector. Connector to connect to the T.JU.

LED (MS)

Indicates unit operation status.

LED (NS)

Indicates network communication status.

CN4

Power connector. Connector for the input power supply.

(FG)

Ground wire is connected.

MS/NS LED display

LINK	Link	Lit off	No link, no data communication
		Green lit	Link established
		Green flashing	In data communication
MS	Module status	Lit off	Power OFF
		Green lit	In normal operation
		Green flashing	Unit setting not done
		Red lit	Fatal unit error
		Red flashing	Clearable unit error
NS	Network status	Lit off	Power OFF / IP address unset
		Green lit	Online: connection established
		Green flashing	Online: connection unestablished
		Red lit	IP address overlap (fatal error)
		Red flashing	Communication time out

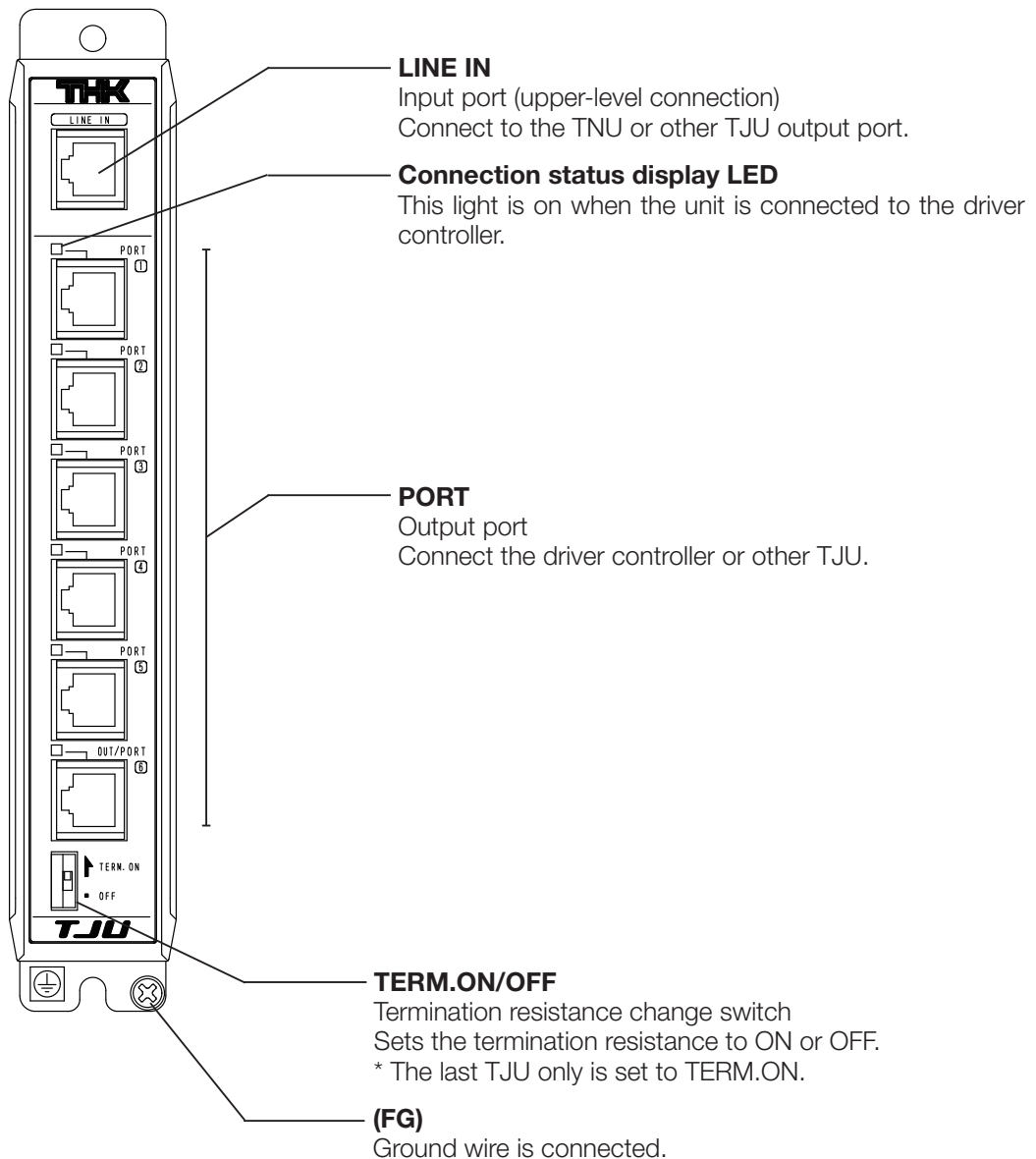
1. Check products

1-4-2 Branch unit TJU

- Prepare a cable to connect TJU and TJU by yourself. (-> P.3-9)
- When using TNU, 1 TJU unit is required. Up to 3 TJU units can be used.
- A cable to connect to TJU and driver controller is available as an option. (-> P.2-4)
- A unit is used when connecting multiple driver controllers to the TNU, including the following functions:
 - 7 ports: Input port x 1, Output port x 6
 - LED to check a connection on the output ports (not lighting up in case of the destination is TJU)
 - Termination resistance change switch

Important

- When configuring a system, only for the TJU that is in the farthest location from the TNU, set its termination resistance change switch to "TERM.ON".
If the termination resistance change switch is not set to "TERM.ON", an error may occur in the TACnet communication.



1. Check products

1-5 Store and dispose of products

1-5-1 For storage

If the product is not used for a while, put the product with packing materials in a packaging box for transportation and store it in the following places:

- Indoor or outdoor at the ambient temperature of -20 to 85°C (no freezing)
- Indoor or outdoor at the ambient humidity of 90% RH or less (no condensation)
- Network unit TNU and branch unit TJU should be stored with the power disconnected
- Place where no direct sunlight nor radiation heat reaches
- Place where the product is not exposed to water
- Place where no flammable substance exists in the vicinity
- Place where no strong electric field nor strong magnetic field develops
- Place where a vibration or shock does not transmit to the product
- Place where liquid containing impurities such as conductive iron dust, powder such as solid abrasive, dust, oil mist, cutting oil, water content, salt content, organic solvent, or corrosive/flammable gas is not generated or does not float

1-5-2 For disposal

The product should be consigned as industrial waste to a certified industrial-waste disposer for disposal.

WARNING

- **Do not put the product into fire to dispose of it.**

Doing so may lead the product to burst, generate noxious gas, or cause injury due to bursting.

- **Do not dispose of the product by yourself.**

Be sure to consign disposal of the product as a industrial waste to a certified industrial-waste disposer.

2-1 Installation environment

WARNING



Caution –
Flammable

- **Do not put the product into fire to dispose of it.**

Doing so may lead the product to burst, generate noxious gas, or cause injury due to bursting.

2-1-1

Installation environment of TNU and TJU

Place it within a control panel that meets the following conditions:

- Indoor or outdoor at the ambient temperature of 0 to 40°C (no freezing)
- Indoor or outdoor at the ambient humidity of 90% RH or less (no condensation)
- Place at an altitude below 1000 m
- Place where the product is not exposed to water
- Place where no flammable substance exists in the vicinity
- Place where a vibration or shock does not transmit to the product
- Place where liquid containing impurities such as conductive iron dust, powder such as solid abrasive, dust, oil mist, cutting oil, water content, salt content, organic solvent, or corrosive/flammable gas is not generated or does not float

2-1-2

Water drop-, oil drop-, and dust-proof

This product does not have a water drop-, oil drop- and dust-proof structure. If the product is to be used in an environment where it is exposed to water content, oil content, powder or dust, take appropriate measures before using it.

Failure to do so may cause injury, fault or fracture.

In addition, please take note that we take no responsibility for any negative effect of using the product without appropriate measures.

2-2

Installation

WARNING



Caution -
Electrical shock

- **TNU and TJU must be installed within the control panel and operated with the door closed.**

Failure to do so may cause electric shocks.

- **Before installing or moving the product with the unit energized, shut off the main circuit power supply of the driver controller.**

Failure to do so may cause an electric shock or malfunction that could lead to injury.



Obligatory

- **Place the emergency stop circuit that stops the operations of the product and disconnects the main circuit power supply of the driver controller in the event of emergency.**

Failure to do so may cause the damage of the product that leads to injury.



Obligatory

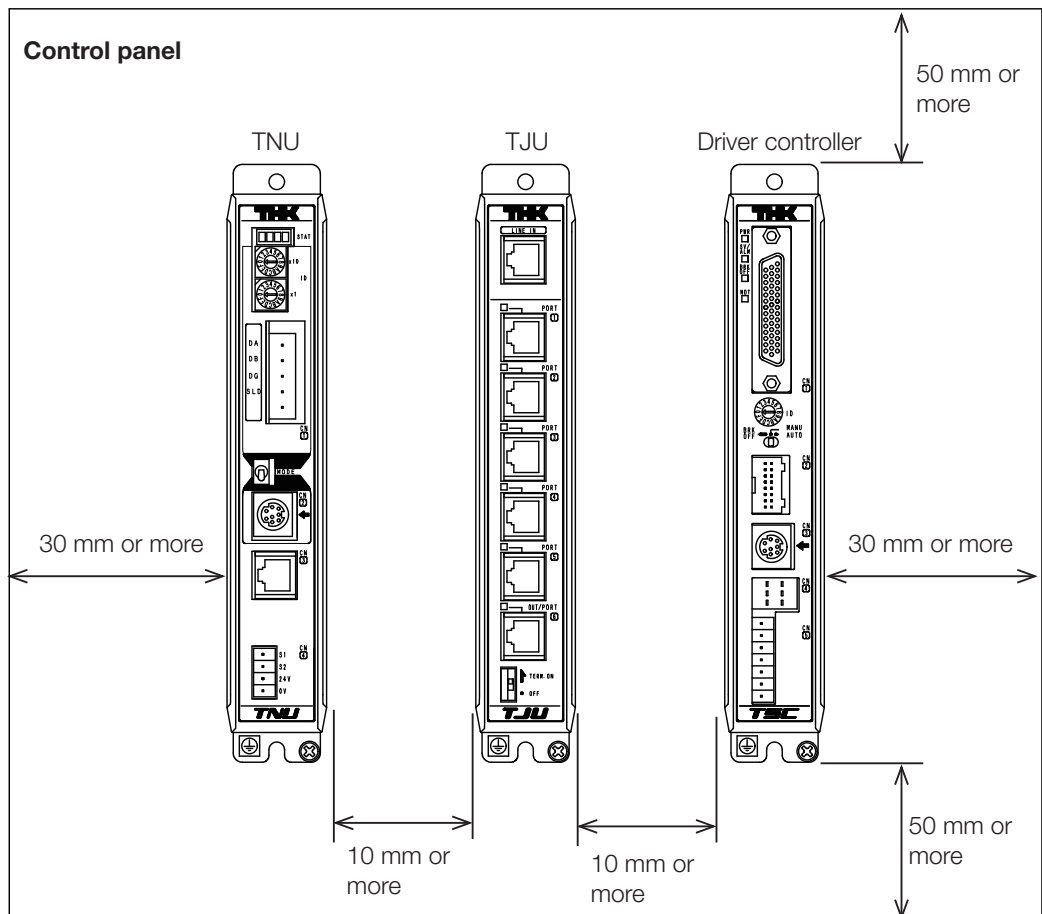
- **Install a safety device such as a breaker for wiring to prepare against short-circuit of the wiring connected to the TNU and TJU.**

Failure to do so may cause an electric shock or fault.

2-2-1 Standards for installation

When installing the TNU and TJU to the control panel, observe the following installation standards:

- Install TNU and TJU onto the wall perpendicularly so that the fronts directly face to the operator.
- The space between TNU and TJU must be 10 mm or more.
- To allow for cooling by fan or natural convection, the space between TNU/TJU and right/left wall must be 30 mm or more.
- To allow for cooling by fan or natural convection, the space above/below TNU or TJU must be 50 mm or more.
- If the temperature in the control panel exceeds 40°C, install cooling fan(s).



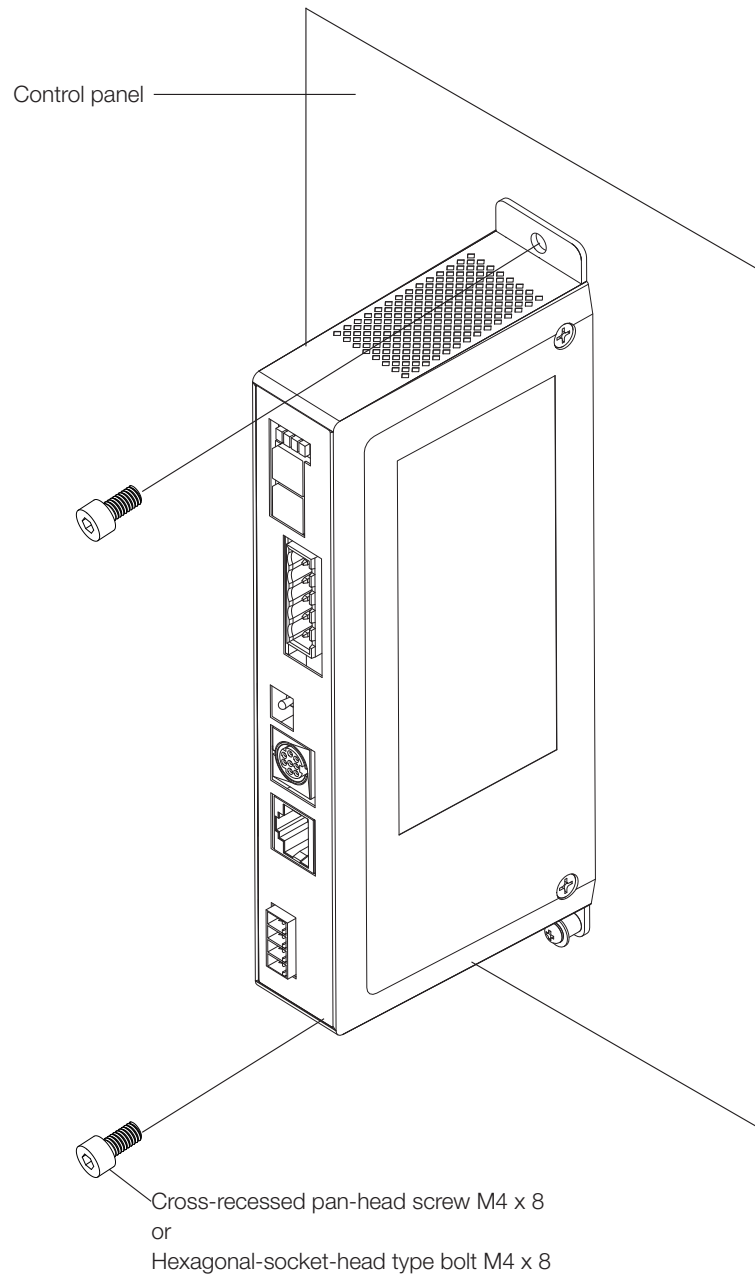
2-2-2 How to install

- Mount TNU and TJU, inserting the fixing bolts to the two mounting holes of the mounting brackets. The installation direction is vertical only (the panel display is upright). Do not perform tilt, horizontal, or up-side-down installation which disturbs heat discharge.
- To prevent effects of external noise, be sure to perform single-point ground for TNU and TJU frame ground (FG).

* Prepare bolts and tools to be used separately.

- **Fixing bolt:** Cross-recessed pan-head screws or hexagonal-socket-head type bolts M4 x 8 (2 pcs.)
- **Tools to use:** According to bolt types

<Installation to the front>



3. Wiring

About this chapter

This chapter describes the procedures of the connection and wiring and handling of the cable.



Connect to peripherals to operate the actuator.

1.	How to wire.....	3-2
1-1	Entire wiring	3-3
1-2	Connect peripheral devices to TNU power supply	3-4
1-3	Connect to master devices	3-7
1-4	Connect TJU	3-9
1-5	Connect to PC	3-11
1-6	Connect to TDO	3-11
1-7	Peripheral devices	3-11

1. How to wire

⚠ WARNING



Do not disassemble

- **Do not extend or shorten the provided cables.**

Doing so may cause malfunctions or impair the performance.



Provide grounding connection

- **Be sure to perform single-point ground for the FG terminal of this product.**

Connect the grounding electrode according to the laws, ordinances, and regulations applied in respective regions and countries.

Fault or electric leakage may cause an electric shock.

- **Do not ground the earth to the following locations:**

- Gas pipe...Explosion or fire may occur.
- Conductor rod or telephone line... It poses a danger in the event of ground discharge.
- Water line...It causes an electric shocks. In addition, the earth does not function if its middle section is made of plastic.



Caution - Electrical shock

- **Do not change the wiring or remove/insert the cables and connectors while the devices are energized.**

Doing so may cause abnormal operation, fault and electric shock.



Caution - Electrical shock

- **Do not damage, tuck, place a heavy object on or apply excessive stress on the cable.**

Doing so may cause an electric shock.

- **Do not touch the energized parts within the product.**

Doing so may cause an electric shock.

- **The wiring works must be performed by electric work experts.**

Failure to do so may cause an electric shock.



Caution - Flammable

- **Be careful to wire the power connectors properly.**

Otherwise, fault, fire, or injury may result.



Obligatory

- **Perform wiring as described in this manual.**

Otherwise, you may be injured due to malfunction.

- **The TACnet cable is not a robot cable.**

Fix the cable before using it.

⚠ CAUTION



Prohibited

- **Do not connect to TNU and TJU or network devices other than TSC, TLC, and THC.**

Doing so may cause damage or fault.



Obligatory

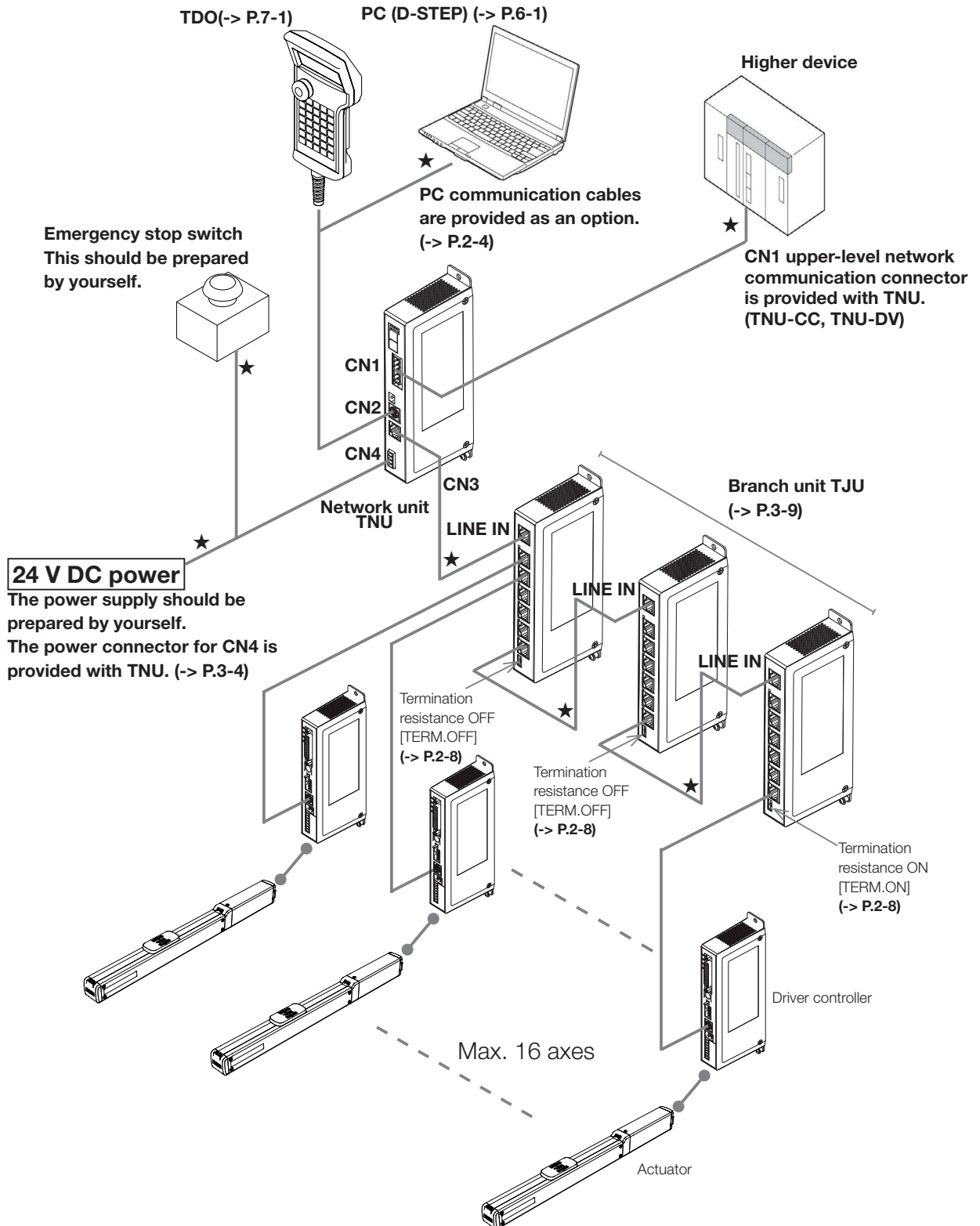
- **Do not connect the CN5 (1) pin (S1) to TSC and TLC.**

Doing so may disable the emergency stop and cause damage or fault.

1-1 Entire wiring

See the wiring example below.

- The cables to be connected to the CN1 to 4 connectors with ★ mark or between TJUs are not provided, so please separately prepare them by yourself. (-> P.3-4) (-> P.3-9)
- A cable to connect to TJU and driver controller is available as an option. (-> P.2-4)



1-2 Connect peripheral devices to TNU power supply

1-2-1 How to connect connectors for CN4 power supply

The power supply (CN4) connector to be connected to the TNU is provided with TNU as standard. (-> P.2-2)

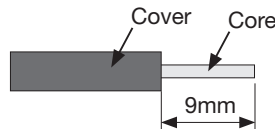
Input power supply	Power (CN4) connector type
24 V DC \pm 10% (max. 0.3 A)	MPC300-38104 (DECA)

► Prepare the power supply cable.

- Use the power supply cable with permissible current, making allowance for the usage conditions (the ambient temperature, number of the core, number of binding wires, and duct storage, etc.) at 1.25 mm² (AWG16) or below.

* To supply power to multiple units, be careful about the current capacity of the wire rod.

- Strip length of core: 9 mm



- Terminal treatment:

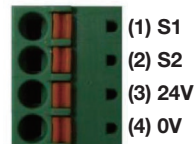
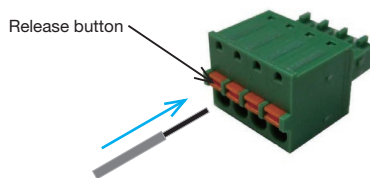
- Twist the wires appropriately to prevent them from not spreading.
- Do not apply solder plating to the core, doing so causes poor contact.
- Do not twist more than one wire together, doing so may cause a fall.

- Wiring and routing:

- Twist the electric wires of 24 V and 0 V (to exclude noise).
- Separate the electric wires from strong electric lines (Do not bind them together or place them in the same duct).

- Connect to the connector:

- Insert the electric wires, pressing the release button of the connector by a tapering screwdriver. Insert the electric wires to the bottom, and release the release button.
- Lightly pull the electric wires to ensure that it would not fall off.
- Once the entire wiring is completed, check that there is no short-circuit caused by two adjacent wires.



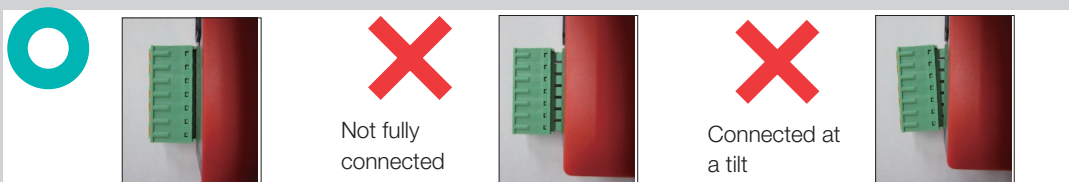
* The numbers represent the pin numbers.

Important

- Prepare materials used for the power supply cable (the wire rod, and crimping terminal, etc.).

Important

- Unless the connector is fully connected, the product will not operate properly.

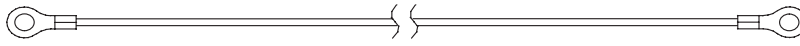


1. How to wire

1-2-2 Connection of FG wire

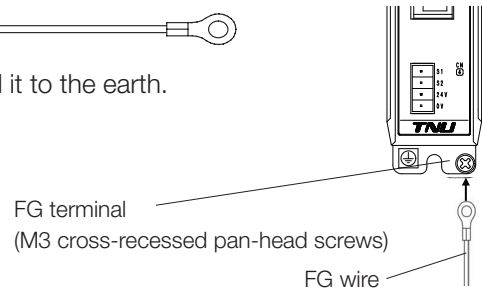
▶ Production of FG cable example(Prepare it by yourself.)

- Recommended electric wire: 1.25 mm² (AWG16)



Connect the FG wire to the FG terminal, and ground it to the earth.

* Process the FG wire for both TNU and TJU.

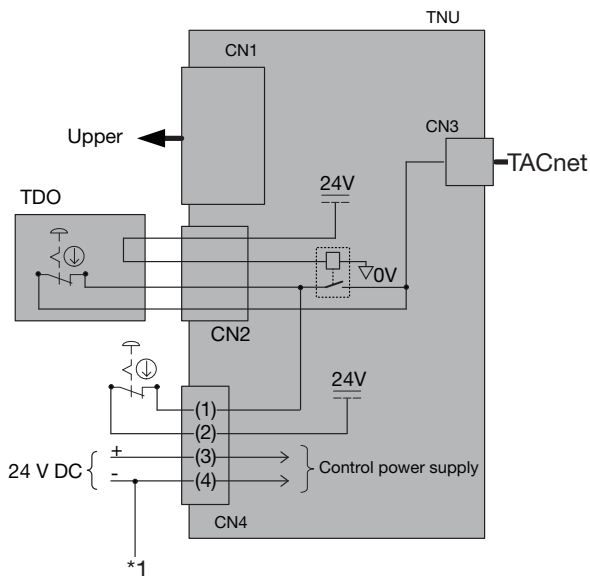


1-2-3 Wiring diagram

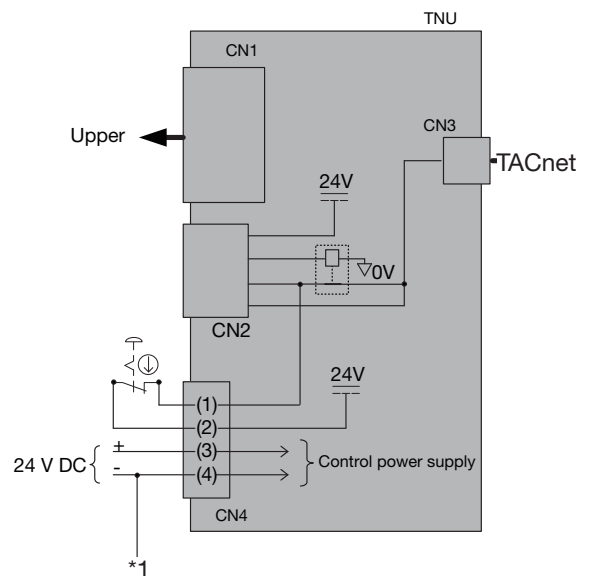
● TNU CN4 wiring

- Connecting TDO will open the internal relay K1, and the TDO emergency stop switch is activated.
- While TDO is not connected, the internal relay K1 is closed.

● TDO is connected



● TDO is not connected



Important

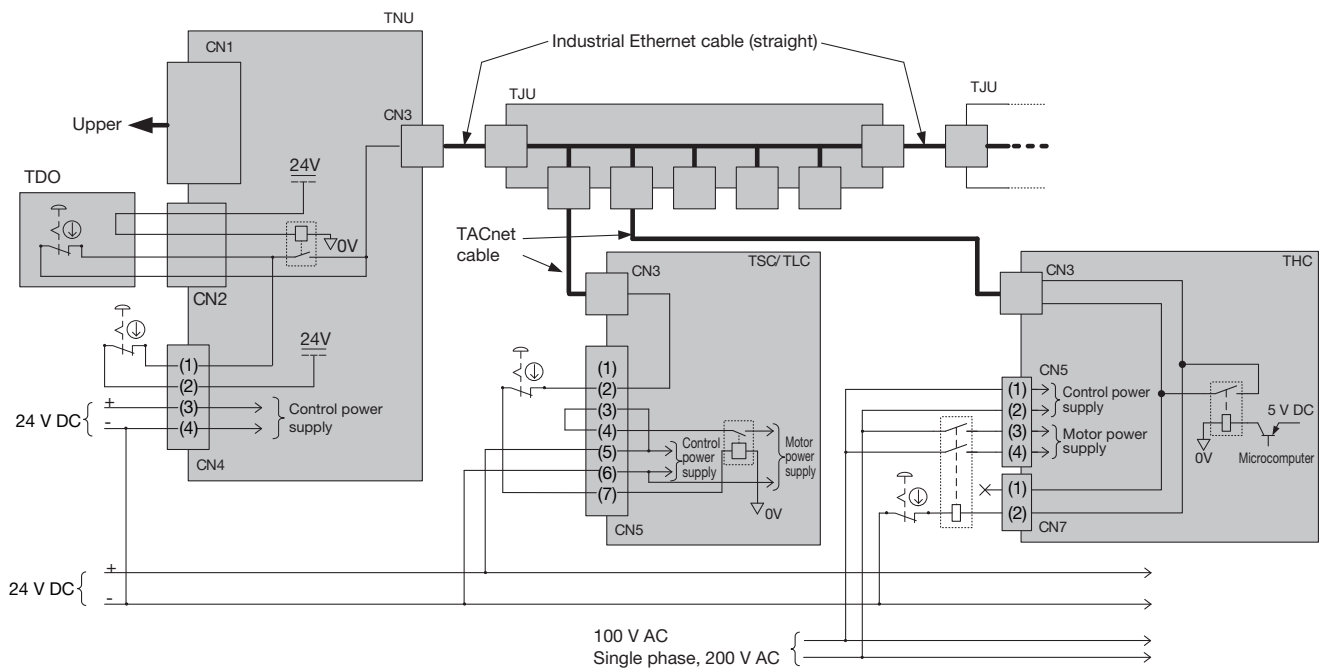
- * 1: Be sure to set the DC of TNU, rSC, TLC, and THC to 0 V respectively. Otherwise, the communication may not be established.

● Wiring example of each driver controller

- Connecting TDO will open the internal relay K1, and the TDO emergency stop switch is activated.
- While TDO is not connected, the internal relay K1 is closed.
- When TDO or the emergency stop of the CN4 (1) and (2) pins is input to TNU, the emergency stop is entered in all the driver controllers connected to the TJU.
- To enter the emergency stop individually to each driver controller, install an emergency stop circuit to each driver controller.

Important

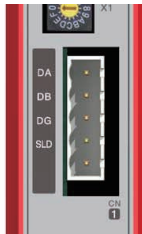
- **Do not connect the driver controller TSC and TLC to the CN5 (1) pin (S1).**
Doing so may disable the emergency stop and cause damage or fault.
- **Be sure to set the DC of TNU, TSC, TLC, and THC to 0 V respectively.**
Otherwise, the communication may not be established.
- **To enter the emergency stop to THC, install an external relay and disconnect the CN5 (3) and (4) pins of the THC.**



1-3 Connect to master devices

1-3-1 Connect to master devices

1. Connect a CN1 connector-compliant cable according to the network type.



TNU-CC

Pin number	Terminal name
1	DA
2	DB
3	DG
4	SLD
5	-



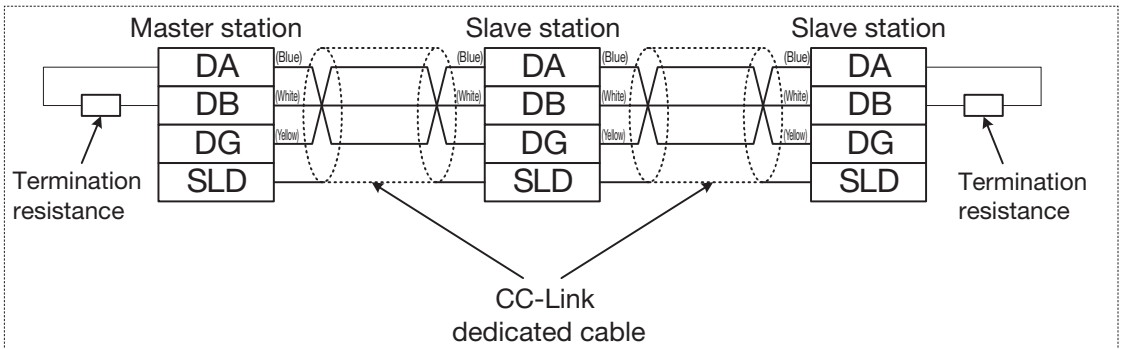
TNU-EC



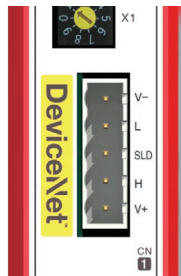
TNU-EP

*** Please prepare the cable by yourself.**

The cable connected must be the shielded cable of CAT5e or higher. The following industrial Ethernet cables are recommended.
 EtherCAT: XS6 Series (OMRON Corporation)
 EtherNet/IP: XS5 Series (OMRON Corporation)

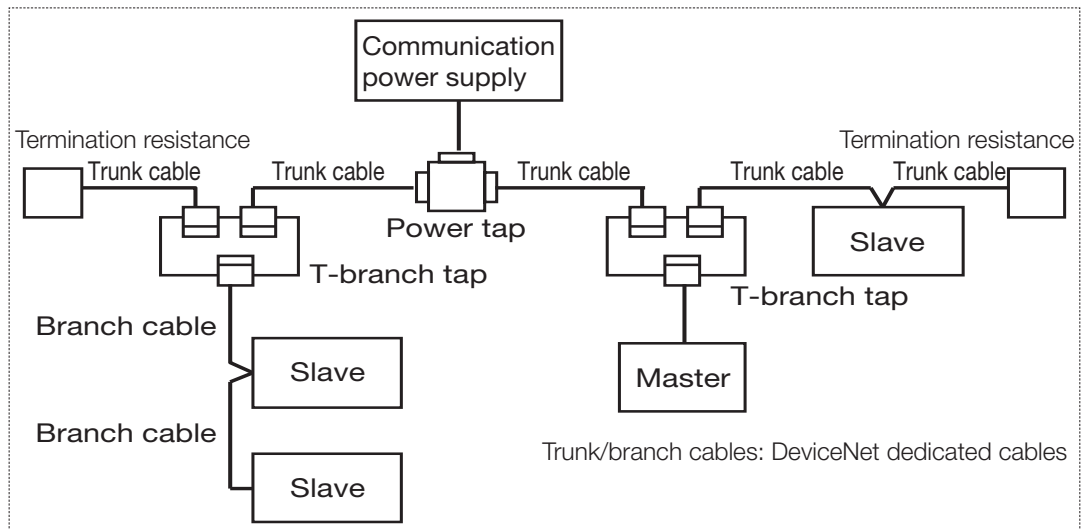


TNU-CC wiring diagram



TNU-DV

Pin number	Terminal name
1	V-
2	L
3	SLD
4	H
5	V+

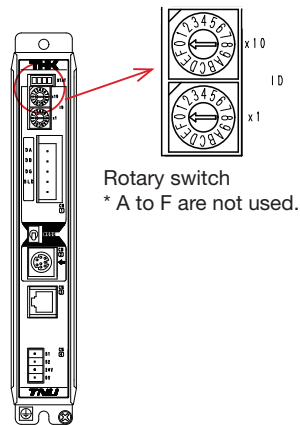


TNU-DV connection example

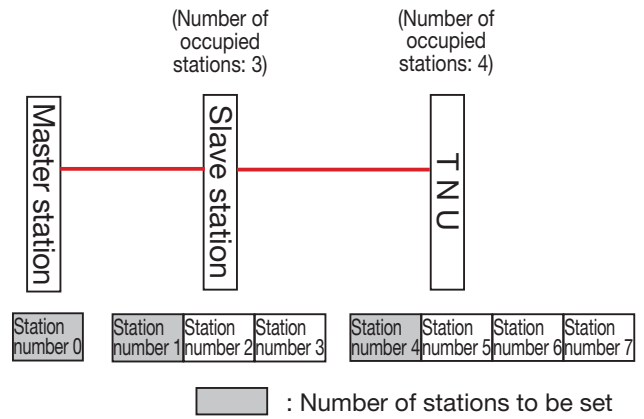
2. Set the TNU station number.

Set the station number by the TNU rotary switch.

Network	Setting range	Notes
CC-Link	1 to 61	0 and 62 or greater cannot be set by user
EtherCAT	1 to 98	0 and 99 or greater cannot be set by user
DeviceNet	0 to 63	64 or greater retain the value during last correct operation.
Ethernet/IP	-	Rotary switch not included.



Example



1-4 Connect TJU

1-4-1 Connection between TNU and TJU or TJU and TJU

► **Prepare a cable by yourself.**

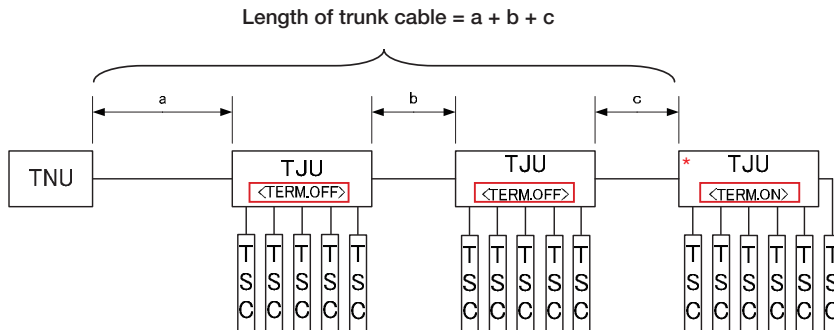
- The cables between TJU and TNU and between TJUs should be Ethernet ones of CAT5e and above. The following industrial Ethernet cables are recommended:

Important

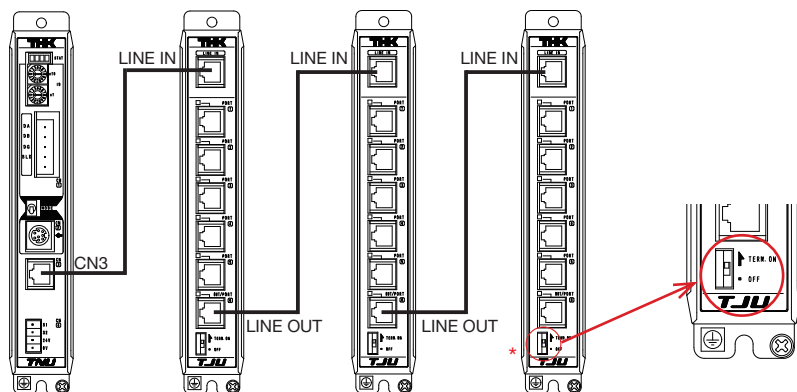
- **Use an Ethernet straight cable.**
Using a cross cable may cause damage or fault.

Manufacturer	Model	Length
Nihon Electric Wire & Cable Co., Ltd.	IETP-SB001M	1m
	IETP-SB005M	5m
	IETP-SB010M	10m
National Instruments Corporation	151733-02	2m
	151733-05	5m
	151733-10	10m

- Please prepare the cable whose length according to the system (maximum length of trunk cable 20 m: See the following figure).



- Connection between TNU and TJU: Connect the TNU's CN3 to the TJU's LINE IN.
- TJU-TJU connection: Connect the TJU's LINE OUT and TJU's LINE IN.



Important

- At the end of TJU, turn the termination resistance ON (TERM.ON) (* mark in the figure above).

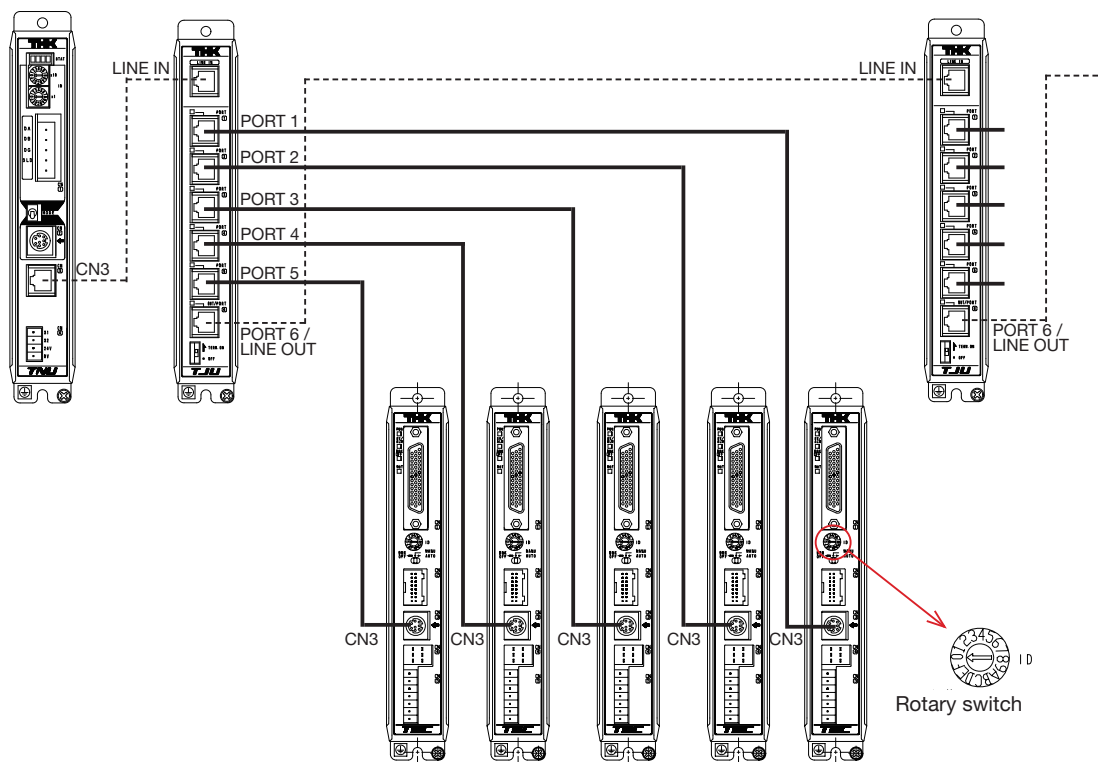
1. How to wire

1-4-2 Connection between TJU and driver controller

- Connect the TJU ports (1) through (6) to the driver controller's CN3 by the TACnet cable.
 - * If there is the next TJU, use the port (6) as OUT and connect to the next TJU's LINE IN.
- A cable to connect to TJU and driver controller (TACnet cable) is available as an option. (-> P.2-4)
- Set the ID of each driver controller by the rotary switch so that one ID does not overlap with the others.
 - IDs need not be set continuously, and vacant numbers pose no problem.

Important

- Match the ID of the rotary switch of each driver controller to that in the net device list (-> P.6-6). An inconsistency will prevent I/O and data interaction.



1. How to wire

1-5 Connect to PC

1-5-1 How to connect

- Connect with the separately-sold communication cable (CBL-COM-03). (-> P.2-4)
- If the PC has only the USB port instead of the RS-485 port, use the provided conversion cable. Operations with other than this conversion cable cannot be guaranteed.

1. Insert the cable to the CN2 of TNU, aligning the arrow of the plug with the one of TNU.

If you insert the plug while rotating it, the connection pins may be damaged.



1-6 Connect to TDO

1-6-1 How to connect

1. Insert the cable to the CN2 of TNU, aligning the arrow of the plug with the one of TNU.

If you insert the plug while rotating it, the connection pins may be damaged.



1-7 Peripheral devices

1-7-1 Breaker for wiring

- For your safety, attach an electric leakage breaker appropriate for the DC power supply onto the primary side (the AC input side) of the DC power supply to supply the power for the TNU.

4. TNU functions

About this chapter

This chapter describes the network unit TNU's functions.



This section describes the overview of the TNU functions.

1.	TNU functions	4-2
1-1	TNU functions	4-2
1-2	Control functions overview	4-3
1-3	Lower-level communication prohibition function ...	4-11
1-4	Broadcast function	4-11
1-5	Remote MANUAL function	4-11
1-6	Data readout function.....	4-12
1-7	DVC write status display function	4-15
1-8	DVC function.....	4-15



This section describes the overview of the CC-Link communication of TNU.

2.	CC-Link communication specifications.....	4-16
2-1	CC-Link communication overview	4-16
2-2	CC-Link data mapping	4-16
2-3	Buffer memory allocation correspondence table ...	4-26
2-4	Number of occupied stations / multiple settings (CC-Link Ver.2.00 only)	4-27
2-5	CSP and CSP+ files (TNU Firmware Ver.1.2 or later)	4-27



This section describes the overview of the EtherCAT communication of TNU.

3.	EtherCAT communication specifications.....	4-28
3-1	EtherCAT communication overview	4-28
3-2	EtherCAT PDO mapping (I/O allocation correspondence table) ...	4-28
3-3	ESI files	4-34



This section describes the overview of the EtherNet/IP communication of TNU.

4.	EtherNet/IP, DeviceNet communication specifications... ..	4-35
4-1	Communication overview	4-35
4-2	EtherNet/IP, DeviceNet Data mapping (master -> slave)	4-36
4-3	EtherNet/IP, DeviceNet Communication Specifications	4-38
4-4	EDS files	4-41



This section describes the overview of the TACnet communication of TNU.

5.	TACnet communication specifications.....	4-42
5-1	TACnet communication overview	4-42
5-2	TACnet communication status transition diagram	4-42
5-3	TACnet communication diagram.....	4-43

1. TNU functions

1-1

TNU functions

TNU ver.	I/O communication	Direct Value Control	Remote MANUAL	Broadcast	Data read
1.00 to 1.11	○	×	×	×	×
1.20	○	○	○	○	×
1.30	○	○	○	○	○

versions can be confirmed by the product label on the side surface of the TNU.

As well, driver controller versions supporting TNU Ver.1.20 are as follows.

TSC: Ver.1.22 or later

TLC: Ver.1.07 or later

THC: Ver.1.07 or later

1. TNU functions

1-2 Control functions overview

I/O communication is the function that uses communication to control the driver controller's input/output function from the upper-level master device.

Further, Direct Value Control (hereafter DVC) is a function which, in addition to I/O communication, designates values for target position, speed, etc. directly from the upper-level master device to operate the actuator.

As well, data for current position, present current, and current speed can be read from the upper-level master device.

Set one of types 0, 1, 2, or 3 for the driver controller function mode. Types 4 and 5 are not supported.

- DVC function supporting models
TNU Ver 1.20 or later
- DVC function types
The DVC functions include the following 3 types of input mode.
The input mode can be set for each driver controller, and input can also be mixed within a range not exceeding the link point count according to stations and multiple settings.

Functions list		Input mode	I/O communication	Simple DVC	Half DVC	Full DVC
I/O communication			○	○	○	○
Numerical designation	Target position ^{*1}		×	○	○	○
	Speed		×	×	○	○
	ACC		×	×	○	○
	DCC		×	×	Same value as ACC	○
	Positioning completion width		×	×	○	○
	Current limit on pressing ^{*2}		×	×	○	○
	Load current threshold value		×	×	×	○
	P area A P area B		×	×	×	○
Reading items	Current position		×	○	○	○
	Present current		×	×	○	○
	Present speed		×	×	○	○
	Status signals		×	○	○	○
Maximum number of connectable axes ^{*3}	CC-Link		16 axes	16 axes	8 axes	4 axes
	EtherCAT					
	EtherNet/IP		16 axes	16 axes	15 axes	8 axes
	DeviceNet					

*1 The target position is designated with absolute coordinates only, and operation will take place with absolute coordinates even if relative coordinates are designated for the operation pattern.

*2 When using DVC functions to carry out pressing operation, if the DVC switch is left ON, a position data error will occur at pressing completion. For this reason, when carrying out pressing operation through DVC, turn the DVC switch OFF until operation completion.

As well, position data errors also occur when pressing operation commands are given for stop modes other than full servo control (SERVO).

*3 The maximum connectable axis number for all axes simultaneous input mode. (Differs when modes are mixed)

- What is Simple DVC?

It is a mode in which the target position values are designated with the upper-level master device to operate the actuator.

When designating target position values, by designating the STEP No. of the operation pattern previously programmed into the driver controller, it is possible to designate operation conditions (speed, acceleration, positioning width etc.) other than the target position.

When an operation pattern is not programmed into the designated STEP No., values other than the target position will use those set with driver controller parameters.

As well, the current position can be read from the upper-level master device.

Setting item	Set value
Relative / Absolute	Absolute (fixed)
Speed	Speed initial value (Parameter no.: 8)
ACC/DCC rate	ACC/DCC rate initial value (Parameter no.: 9)
Positioning width	Positioning completion width initial value (Parameter no.: 10)
Pressing, threshold, P area A, P area B, ACC/DCC mode, stop mode, standby time,	0 (fixed) ACC/DCC mode: Trapezoidal Stop mode initial value (Parameter no.: 25)
Repetition	1 (fixed)
JUMP	E (fixed)

- What is Half DVC?

It is a mode in which values for target position, positioning completion width, speed, acceleration and deceleration rate, and current limit of pressing are designated with the upper-level master device to operate the accelerator.

By designating the STEP No. of the operation pattern, it is possible to designate operation conditions (P area A, P area B etc.) other than the above.

When an operation pattern is not programmed into the designated STEP No., values other than the above will use those set with driver controller parameters.

However, when values for speed are set to 0 or values for acceleration/deceleration rate are set to 9 or below, the driver controller position data error alarm will activate.

As well, current position, present current, and current speed can be read from the upper-level master device.

Setting item	Set value
Relative / Absolute	Absolute (fixed)
Threshold, P area A, P area B, ACC/DCC mode, standby time	0 (fixed) ACC/DCC mode: Trapezoidal
Stop mode	Stop mode initial value (Parameter no.: 25)
Repetition	1 (fixed)
JUMP	E (fixed)

- About Full DVC

It is a mode in which values for target position, positioning completion width, speed, acceleration rate, deceleration rate, current limit of pressing, P area A, P area B, and load current threshold value are designated with the upper-level master device to operate the accelerator.

By designating the STEP No. of the operation pattern, it is possible to designate operation conditions (stop mode, standby time, etc.) other than the above.

When an operation pattern is not programmed into the designated STEP No., values other than the above will use those set with driver controller parameters.

However, when values for speed are set to 0 or values for acceleration/deceleration rate are set to 9 or below, the driver controller position data error alarm will activate.

As well, current position, present current, and current speed can be read from the upper-level master device.

Setting item	Set value
Relative / Absolute	Absolute (fixed)
ACC/DCC mode, standby time	0 (fixed) ACC/DCC mode: Trapezoidal
Standstill mode	Stop mode initial value (Parameter no.: 25)
Repeat	1 (fixed)
JUMP	E (fixed)

- Mixed Input Modes

Input modes for driver controllers connected to the TNU can be selected from I/O, simple DVC, half DVC, and full DVC. These input modes can be set differently for each axis. When using mixed input modes, the total required link point count for each driver controller input mode must not exceed the link points allocated by number of stations / multiple settings.

* For link point count, refer to the various communication standards.

Important

● The TNU maps the data area of each ID through the Input Mode set in the net device list. In order to enable the Device set to the highest ID at this time, if a Device set to "unconnected" exists among the intermediate IDs, that Device will also require a link point count corresponding to the Input Mode.

[TNU-CC setting example]

Number of occupied stations / multiple settings: 4 stations, 2 times

Net device list: ID 0 = Simple DVC, ID 1 = Half DVC, ID 2 = Full DVC, ID 3 = IO

[1] Link point count for number of occupied stations / multiple settings: 32 words

[2] Total link point count required for each driver controller: 3+8+14+1=26 words

Set unconnected axes to "Unconnected". When set to "Any", the axes will be in connected status, and communication will take time in some cases.

Connection is possible, being within the range of [2] ≤ [1].

- Individual DVC switch (Ver. 1.30 and later) description

Use the DVC switch when wanting to operate each individual axis.

- DVC operation time chart

A DVC operation example is shown in the time chart.

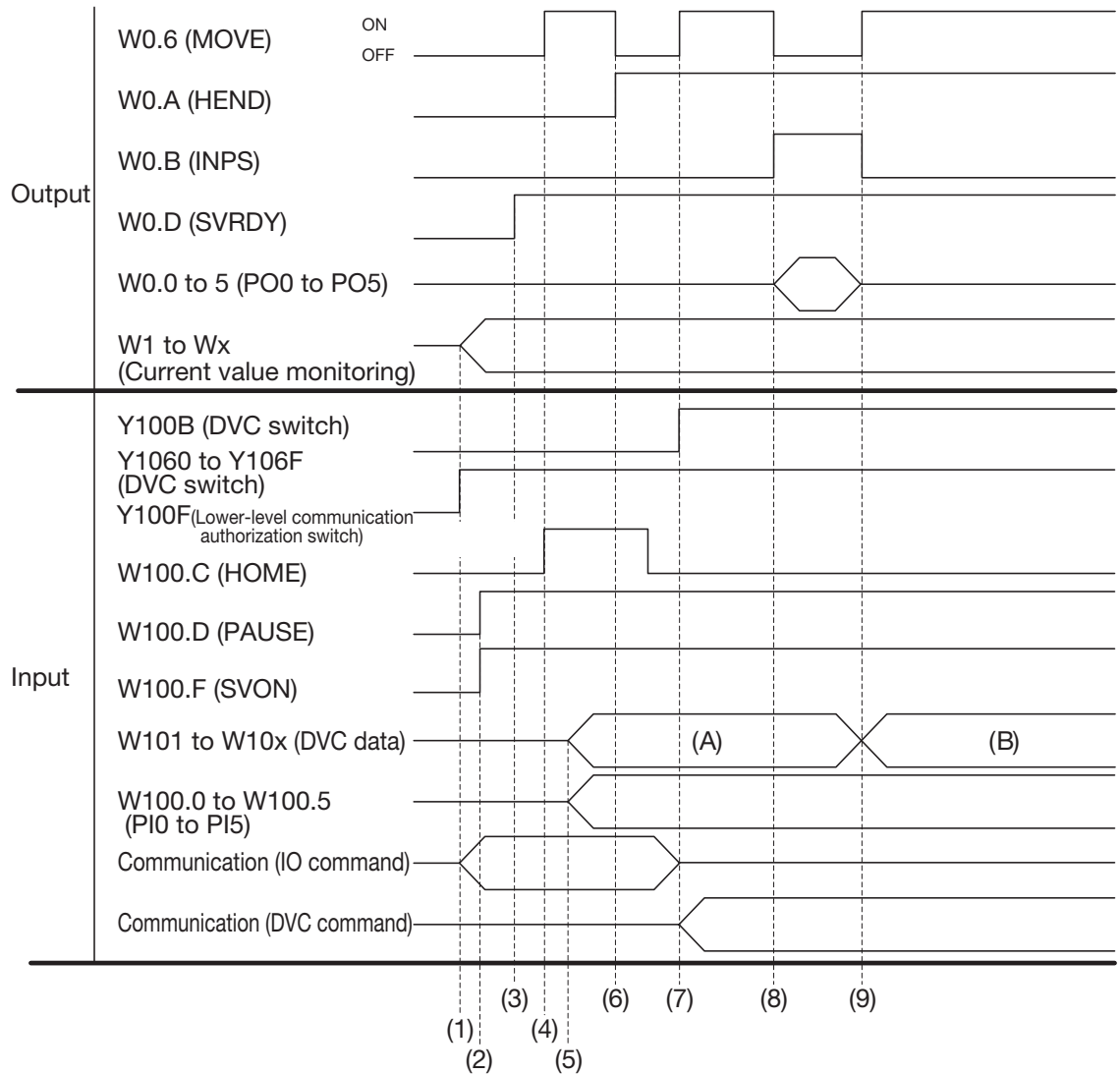
*1 Carry out servo on / return to origin with the DVC switch OFF.

*2 The time chart shows the case of a 1-axis driver controller. Communication for 1 axis requires 20 ms, so when operating multiple axes there will be a delay of 20 ms x number of axes. As well, more time may be required when there is a lag after driver controller startup or due to driver controller internal processing such as servo on/off or EEPROM access.

- Time chart

When driver controller function mode is type 0

CC-Link device allocation information	
Remote input (RX)	X1000
Remote output (RY)	Y1000
Remote register (RW _r)	W0
Remote register (RW _w)	W100



1. TNU functions

No.	Input	Output	Status	Remarks
(1)	Lower-level communication authorization switch	Current value monitoring (W1 to W2)	-	TNU / driver controller communication start
(2)	Servo on (SVON)	-	Servo on	
(3)	-	Servo on completed (SVRDY)	Servo on in-progress Returning to origin	
(4)	Origin return command (HOME)	Moving (MOVE)		
(5)	STEP No. designation (Program No.) & DVC data input (A)	-	During origin return	
(6)	-	Origin return completed (HEND)		
(7)	DVC switch or DVC switch	Moving (MOVE)	During positioning operation (A)	Turn DVC switch ON
(8)	-	(A) Positioning completed (INPS) & End position display (PO0 to PO5)	-	
(9)	DVC data change (B)	Moving (MOVE)	During positioning operation (B)	

- DVC data write function

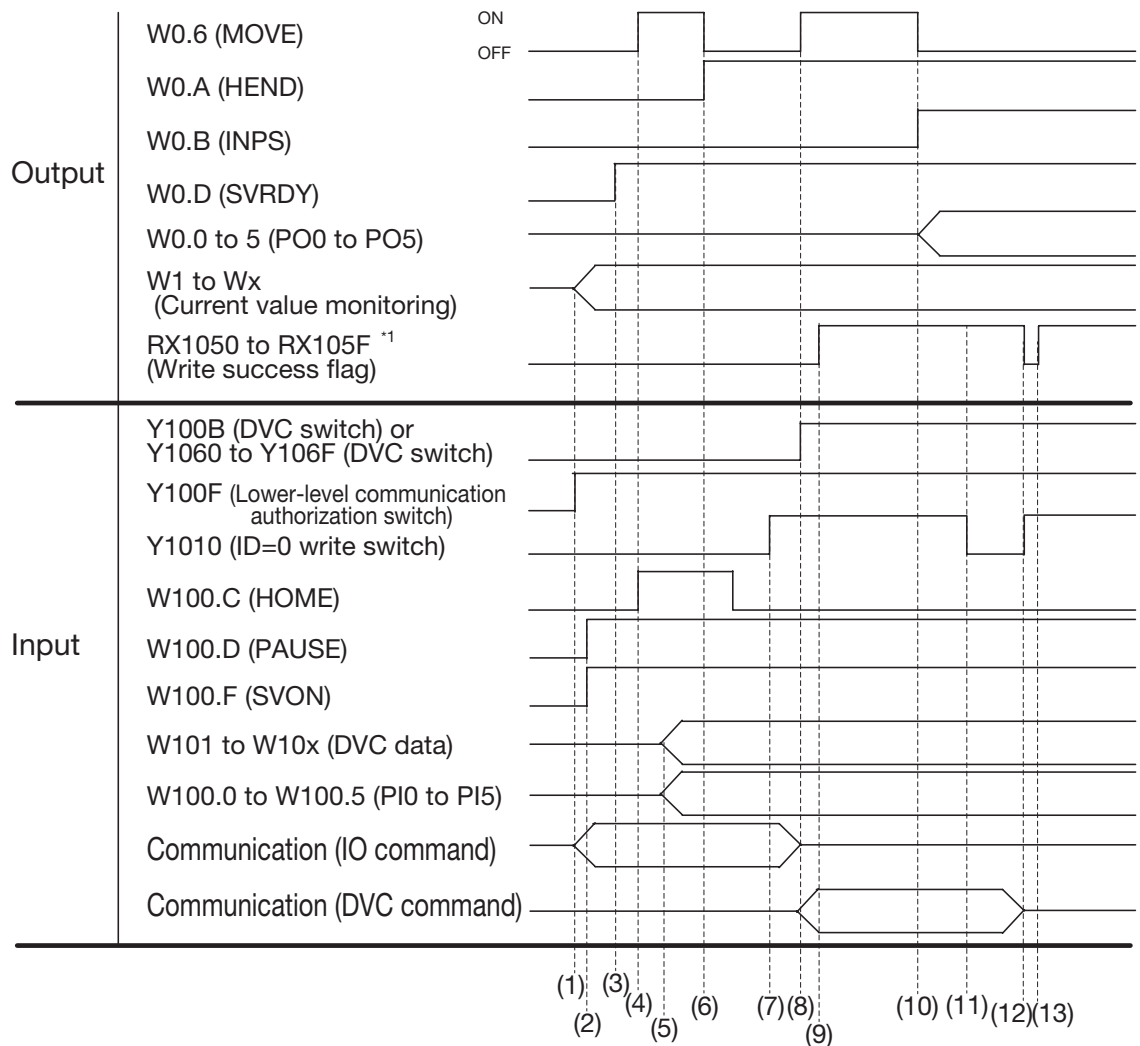
The DVC data write function is a function which enables writing numerical data input with the DVC to a designated STEP No. The DVC data write function is enabled when both the DVC switch and DVC write switch are turned on. Because the DVC write switch operates after detecting startup, when writing again, it must be turned OFF and then ON again.

By setting each bit from RY10 to 1F to ON, writing can be designated for each axis.

RX1050 to 105F relating to each axis will turn ON upon successful write operation.

RX1040 to 104F relating to each axis will turn ON upon successful write operation.

- Time chart



^{*1} RX1040 will turn ON if the DVC data write operation fails.

No.	Input	Output	Status	Remarks
(1)	Lower-level communication authorization switch	Current value monitoring (W1 to W2)	-	TNU / driver controller communication start
(2)	Servo on (SVON)	-	Servo on	
(3)	-	Servo on completed (SVRDY)	Servo on During origin return	
(4)	Origin return command (HOME)	Moving (MOVE)		
(5)	STEP No. designation (program number) & DVC data input (A)	-	During origin return	
(6)	-	Origin return completed (HEND)		
(7)	Write switch ON	-	-	-
(8)	DVC switch or DVC switch	Moving (MOVE)	Positioning operation is going on	DVC switch or Turn DVC switch ON
(9)	-	Write success flag ON	-	
(10)	-	Positioning completed (INPS) & end position display (P00 to P05)	-	
(11)	Write switch OFF	-	-	
(12)	Write switch ON	Write success flag OFF		
(13)		Write success flag ON		

Precautions

- For DVC write, the EEPROM of the controller used will be ATMEL's "AT24V256C-SSHL". Note that the upper limit of the write count is approximately 100,000 times.
- Because the write switch operates after detecting startup, when writing again, it must be turned OFF and then ON again.
- When writing to vacant STEP No. of the driver controller, initial values will be written to areas without value input from the DVC.
- When using DVC functions with driver controller function mode 1 (external unit input instruction type), turn OFF the input signals No.7 (JOG/INCHING) and No.8 (JOG P) in the buffer memory allocation correspondence table.
- It is possible to change positioning position by changing RWw positioning data while the actuator is operating (before positioning completion), but if a positioning position in which motor rotation direction will be reversed is designated, alarms may activate or unforeseen operation occur. For operations in which the motor rotation direction will be reversed, make sure to change values after positioning completion.
- If the "DVC switch" is turned ON at servo off or incomplete return to origin, alarms will activate for servo off movement command or incomplete return to origin operation command. Carry out servo on / return to origin with the "DVC switch" OFF.
- The DVC functions support absolute position only. Relative position is not supported.
- When using DVC functions, set one of types 0, 1, 2, or 3 for the driver controller function mode. Types 4 and 5 are not supported.

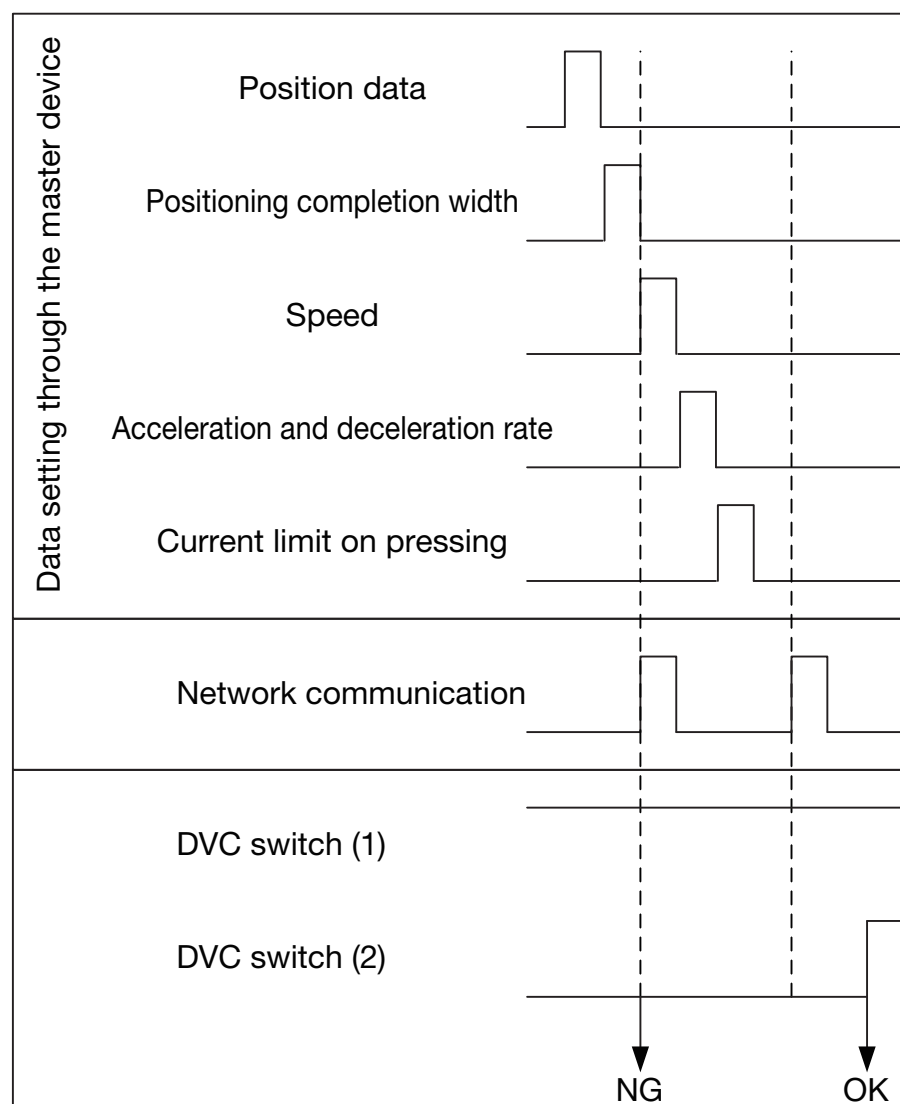
1. TNU functions

- Because the DVC function transmits large volumes of data, the upper-level master device requires a function that guarantees data identity and synchronicity. When controlling with an upper-level master device without this guarantee, operation unforeseen by the designer may take place.

For example, as in the NG timing in the figure below, if network communication (1) takes place during setting of half DVC values, position data and positioning completion width data are overwritten, but for speed, acceleration and deceleration rate, and pressing current limit values, the pre-update data is transmitted and leads to unforeseen operation.

For this reason, it is necessary to select a device with a function such that communication will not take place as in the timing (1) in the graph, or to turn the DVC switch OFF while setting data.

As well, the same applies when using the DVC data write function.



1. TNU functions

1-3

Lower-level communication prohibition function

- What is the lower-level communication prohibition function?

The lower-level communication prohibition function is a function which enables switching ON and OFF the communication between the TNU and the driver controllers through the upper-level master device.

When the TNU is started up with lower-level communication ON, it will carry out transmission and reception of data with the upper-level network at the point when it has completed connection with the upper-level master device after finishing the startup sequence. The lower-level communication function prevents unforeseen data transmission at this point.

When the lower-level communication prohibition function is enabled with D-STEP, lower-level communication will not take place even with the TNU in IO mode, unless the RYOF bit is ON.

1-4

Broadcast function

- What is the broadcast function?

The broadcast function is a function that sends the same command simultaneously to all driver controller axes connected to the TNU. The TNU detects the broadcast bit startup and sends the 16-bit control information designated in the ID:0 input area to all axes.

Regardless of the status of each driver controller, the broadcast command is issued only once when bit startup is detected, after which each axis returns to individually processed communication.

Confirm driver controller status in each axis's signal area.

Sample program(-> P.10-5)

Precautions

When going to servo on as a batch for all axes, in addition to the broadcast bit and the ID:0 servo on bit, turn each axis's servo on bit ON as well. Because the broadcast command is issued only once, when returning to the standard communication cycle, if each axis's servo on bit is not turned ON, each axis will immediately receive a servo off command and go to servo off.

When the driver controller is in servo on/off operation, or carrying out higher-priority work, such as EEPROM writing, than command reception, the broadcast response may be delayed.

When turning the broadcast bit ON, maintain it for at least 40 ms.

For TNU-DV, when turning the broadcast bit ON, maintain ON for the time shown below:

125 kbps: 100 msec or more, 250 kbps: 50 msec or more, 500 kbps: 40 msec or more

1-5

Remote MANUAL function

- About the remote MANUAL function

The remote MANUAL function is a function which transfers the TNU to PC mode and the driver controller to MANUAL at a command from the upper-level master device.

By turning the remote MANUAL bit ON, the TNU can be set to PC/TDO mode and the driver controller to MANUAL mode without changing hardware switches. By turning the allocated bit OFF, the hardware switch status will be reestablished.

Precautions

When this bit is turned ON, it sends a command switching the TNU to PC/TDO mode and each driver controller to MANUAL mode. It takes 40 ms x number of axes (when there is no communication error) for all axes to finish switching. It is possible to confirm switching to MANU mode in the driver controller status area. This function is carried out after detecting bit startup, and does not carry out retries. When the mode does not switch to MANU, eliminate the cause of the communication error and once again turn the bit OFF and then ON. Driver controller status RX60 to 6F is the dedicated area for output of MANU switching commands. When not using the remote MANUAL function, or when operating the hardware switch, in order to maintain the immediately previous status, note that the status may differ from the actual state.

When the TNU power is turned ON again with the remote MANUAL mode enabled, the TNU will not communicate normally with driver controllers even if set to I/O mode. Set driver controller AUTO status by turning remote MANUAL from ON to OFF, or moving the driver controller toggle switch from AUTO to MANU to AUTO.

1-6 Data readout function

- About the data readout function

The data readout function is a function for displaying the TNU / driver controller parameters or driver controller program data on the PLC.

Entering the parameter readout command (0x24) or the program readout command (0x1F) into the PLC and turning the command transmit switch ON results in the commanded data being displayed on the PLC.

The parameter readout function displays the parameter data from RX30 to RX4F.

The data that can be read using the program readout function depends on the DVC mode.

[Readable data for each DVC mode]

Simple DVC mode : Position

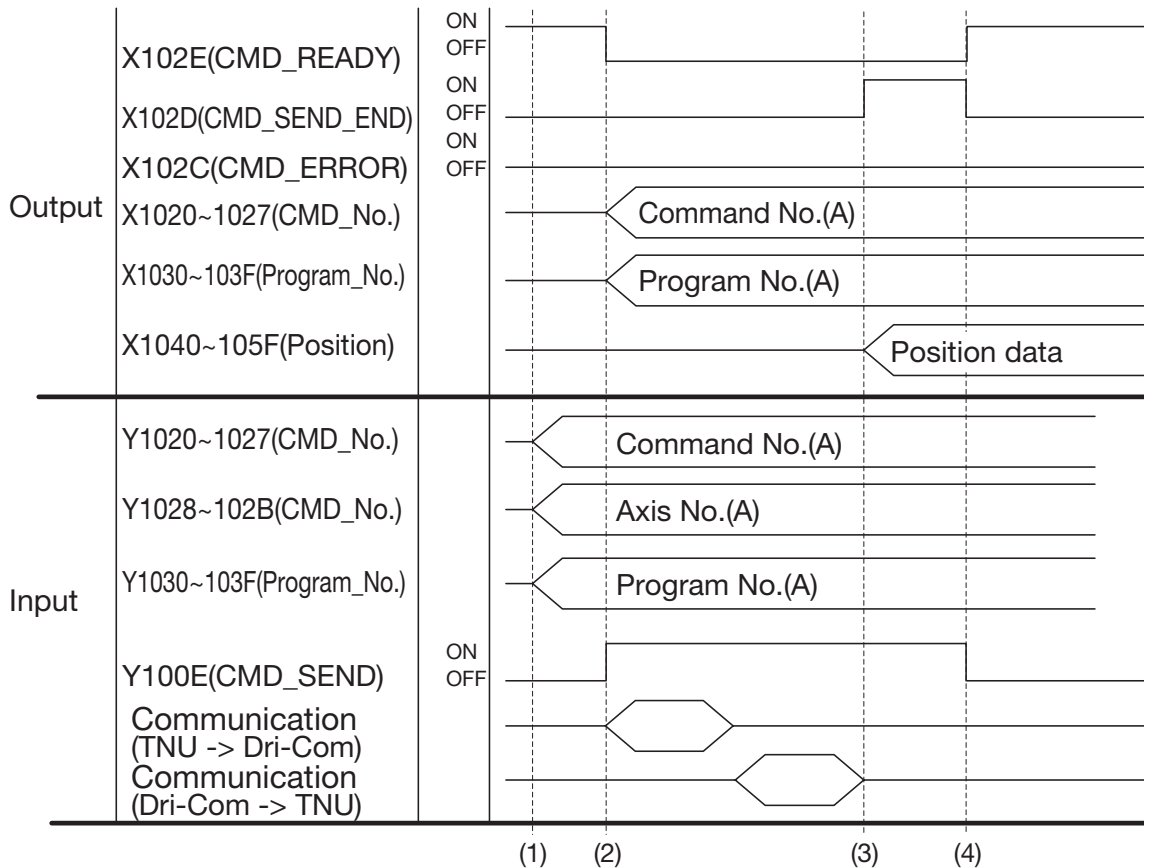
Half DVC mode : Position, positioning completion width, speed, acceleration and pressing current limit

Full DVC mode : Position, positioning completion width, speed, P area A, P area B, acceleration, deceleration, pressing current limit, load current threshold value

*1 When command transmission switch is ON: turn on for 20ms or more.

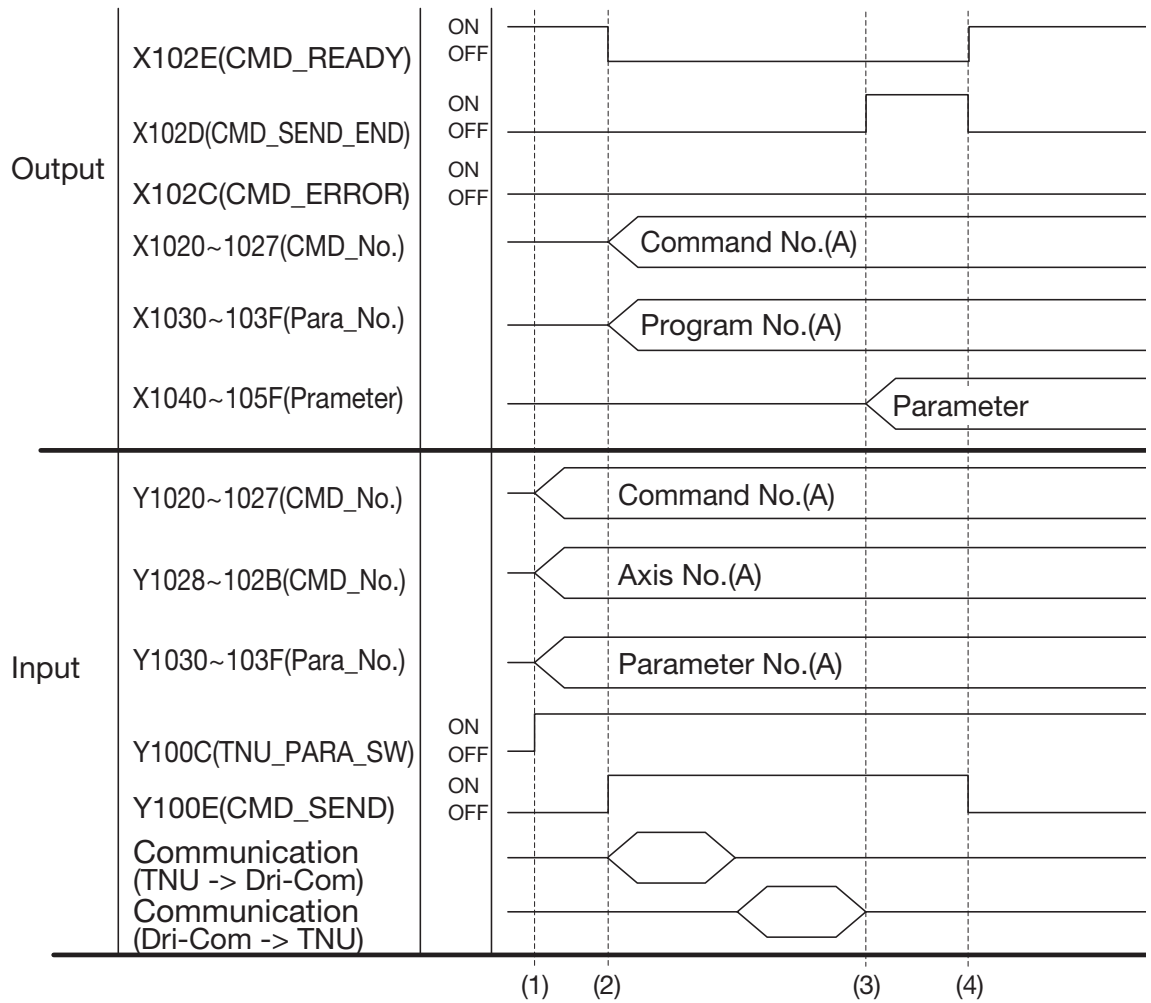
*2 Refer to the RWr section of the CC-Link Communication Specifications for details about program data readout locations.

- Time chart



No.	Input	Output	Status	Remarks
(1)	Command No. (0x1F) Axis No. Program No.	-	-	Program readout is only enabled when TNU is in PC mode
(2)	Command transmission switch ON	Command ready OFF Program No.	-	
(3)	-	Command reply complete ON Positioning data *1	-	
(4)	Command transmission switch OFF	Command ready ON Command reply complete OFF	-	

*1 This time chart shows the result of program readout when in simple DVC mode.



No.	Input	Output	Status	Remarks
(1)	TNU parameter SW ON Command No. (0x24) Axis No. Parameter No.	-	-	Parameter readout is only enabled when TNU is in PC mode
(2)	Command transmission switch ON	Command ready OFF Parameter No.	-	
(3)	-	Command reply complete ON Parameter	-	
(4)	Command transmission switch OFF	Command ready ON Command reply complete OFF	-	

- Parameter list (driver controller)

No.	Parameter name	TSC	TLC	THC	Unit
1	Max. area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1 μm
2	Min. area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1 μm
3	Soft limit +	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1 μm
4	Soft limit -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1 μm
6	ORG offset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1 μm
7	Push judgment time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ms
8	Default speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	mm/s
9	Default ACCEL/DECEL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1m/s ²
10	(Initial value of positioning completion width)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.1 μm
11	Cur. limit at stop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	%
12	Cur. limit at origin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	%
13	Move command type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0: level 1: edge
14	Zero return method	-	-	<input type="radio"/>	0: pressing 1: sensor
15	Push speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	mm/s
16	Jog speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	mm/s
17	Auto servo OFF 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	s
18	Auto servo OFF 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	s
19	Auto servo OFF 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	s
20	Speed override	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	%
21	I/O jog speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	mm/s
22	I/O inching distance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	μm
23	Judgment time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ms
24	Judgment range	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0 = Invalid, 1 = Valid
25	Initial value in standstill mode	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0: Invalid 1: Automatic turn off 1 2: Automatic turn off 2 3: Automatic turn off 3 4: Full servo
26	Ball screw lead	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	μm
28	Cur. select at miss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0 = Current limit on stop status 1 = Limit for pressing
29	Max. speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	mm/s
30	Position deviation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	μm
31	Inching distance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	μm
33	Selection of invalid for pause input	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0 = Invalid, 1 = Valid
34	Communication speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0: 38400bps 1: 57600bps 2: 115200bps
35	Selection of servo ON input method	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0: External input 1: Always ON
36	Function mode	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0: Type 0 1: Type 1 2: Type 2 3: Type 3 4: Type 4 5: Type 5
37	(Positioning completion signal output method)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0: PEND 1: INP

1. TNU functions

No.	Parameter name	TSC	TLC	THC	Unit
38	Inhibit MANU input	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0 = Invalid, 1 = Valid
40	Position gain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1/s
41	Speed loop P gain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hz
42	Speed loop I gain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0.01ms
43	Reduction ratio numerator	-	<input type="radio"/>	<input type="radio"/>	-
44	Reduction ratio denominator	-	<input type="radio"/>	<input type="radio"/>	-
47	(Encoder type)	-	<input type="radio"/>	<input type="radio"/>	0 = Incremental 1 = Absolute
48	TDO enable function	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0 = Invalid, 1 = Valid
119	Load inertia ratio	-	<input type="radio"/>	<input type="radio"/>	0.001

* The data type is a signed 32-bit integer.

• Parameter list (TNU)

No.	Parameter name	Unit
2	Interval of interrupting communications	ms
3	Communication speed (upper-level)	1: 38400bps 2: 57600bps 3: 115200bps
4	Communication speed (lower-level)	1: 38400bps 2: 57600bps 3: 115200bps
5	Broadcast delay time	ms
6	Number of retries	-
19	Lower-level communication prohibition function	0 = Invalid, 1 = Valid

1-7

DVC write status display function

• About the DVC write status display function

The DVC write status display function is a function for displaying the success or failure of a write operation on the PLC when writing program data to the driver controller EEPROM when in DVC mode.

A successful write is displayed in the RX50 to 5F area, while a failed write is displayed in the RX40 to 4F area.

1-8

DVC function

• About the DVC function

The DVC function is a function for sending DVC data to only the specified ID.

Setting driver controller ID 0 to F in RY60 to 6F and pressing the DVC switch allows DVC data to be sent to only the specified ID.

2-1

CC-Link communication overview

- The CC-Link communication overview is as follows.

Communication standard	CC-Link Ver.1.10	CC-Link Ver.2.00
Communication speed	10Mbps/5Mbps/2.5Mbps/625kbps/156kbps	
Communication method	Broadcast polling method	
Synchronization system	Frame synchronization	
Coding system	NRZI system	
Transmission channel type	Bus type (EIA RS-485 compliant)	
Transmission format	HDLC compliant	
Error control method	CRC-CCITT ($X^{16}+X^{12}+X^5+1$)	
Number of occupied stations	Remote device stations 4 stations	Remote device stations 1, 2, 3, 4 stations
Expanded cyclic setting	-	1 time, 2 times, 4 times, 8 times
Communication cable length	Communication speed (bps): 10M/5M/2.5M/62K/156K Total cable length (m): 100/160/400/900/1200	
Communication cable	CC-Link dedicated cable	

2-2

CC-Link data mapping

- The CC-Link address configuration of TNU-CC is as follows.
The offset address is an offset value for the start address allocated to the TNU by the master unit.
Memory map(->P.10-8)

2-2-1 TNU Firmware Ver. 1.3 or later

- RY section (master -> slave: in PC/TDO mode)

Offset address	Name	Reference
0x00 to 0F	TNU control area	Table (1)
0x10 to 1F	DVC write switch	Table (2)
0x20 to 2F	Control command	Table (3)
0x30 to 3F	Program No. / Parameter No.	Table (4)
0x40 to 5F	Reserved	-
0x60 to 6F	DVC switch	Table (5)
"0xm0 to mF" * m: Value determined by number of occupied stations / multiple settings m = 7 1 station 8 times, 4 stations 1 time = B 2 stations 4 times = 17 2 stations 8 times = 9 3 stations 2 times = 13 3 stations 4 times = D 4 stations 2 times = 1B 4 stations 4 times	CC-Link system area	-

- RY section (master -> slave: in IO mode)

Offset address	Name	Reference
0x00 to 0F	TNU control area	Table (1)
0x10 to 1F	DVC write switch	Table (2)
0x20 to 5F	Reserved	-
0x60 to 6F	DVC switch	Table (5)
"0xm0 to mF" * m: Value determined by number of occupied stations / multiple settings m = 7 1 station 8 times, 4 stations 1 time = B 2 stations 4 times = 17 2 stations 8 times = 9 3 stations 2 times = 13 3 stations 4 times = D 4 stations 2 times = 1B 4 stations 4 times	CC-Link system area	-

[Table (1)]

Bit	Name	Set value	Signal
b0	Alarm reset	1 = Alarm reset	Edge
b1	Alarm history reset	1 = Alarm history reset	Edge
b2	Remote MANUAL	0=AUTO, 1=MANU	Level
b3 to b9	Reserved	Access invalid	-
b10	Broadcast	1 = Broadcast	Edge
b11	DVC switch	0 = IO mode, 1 = DVC mode	Level
b12	TNU parameter switch	0 = Driver Controller, 1 = TNU	Level
b13	Reserved	Access prohibited	-
b14	Command transmission switch	1 = Command transmission	Edge
b15	Lower-level communication authorization switch	0 = Lower-level communication prohibited, 1 = Lower-level communication authorized	Level

[Table (2)]

Bit	Name	Set value	Signal
b0	ID0 DVC: write	0 = Invalid, 1 = Valid	Edge
b1	ID1 DVC: write	0 = Invalid, 1 = Valid	Edge
...	...		-
b14	IDE DVC: write	0 = Invalid, 1 = Valid	Edge
b15	IDF DVC: write	0 = Invalid, 1 = Valid	Edge

[Table (3)]

Bit	Name	Set value	Signal
b0 to b7	Command No.	Enter 0x1F (program readout) 0x24 (parameter readout)	Level
b8 to b11	Driver controller ID	Enter the driver controller ID from which data should be read	Level
b12 to b15	Reserved	Access invalid	-

[Table (4)]

Bit	Name	Set value	Signal
b0 to b15	Program No. / Parameter No.	Enter the Program No. parameter from which data should be read	Level

[Table (5)]

Bit	Name	Set value	Signal
b0	ID0 (DVC switch)	0 = IO mode, 1 = DVC mode	Level
b1	ID1 (DVC switch)	0 = IO mode, 1 = DVC mode	Level
...	-
b14	IDE (DVC switch)	0 = IO mode, 1 = DVC mode	Level
b15	IDF (DVC switch)	0 = IO mode, 1 = DVC mode	Level

● **RWw section (master -> slave)**

- When Input Mode is IO

As indicated in the following figure, the inputs from each driver controller (slave) of ID 0 through F are allocated to the ward device area, or the bits comprising each ward device are allocated to the driver controller inputs.

Offset address	Name	Reference
0x (n)	Driver controller input	Table (6)

[Table (6)]

Bit	Driver controller input signal No.
b0 to b15	Input signal No.: 0 to F

* For signal names, etc., see **"2-3 Buffer memory allocation correspondence table" (->P.4-26)**

- Input mode: For simple DVC, half DVC, and full DVC

In addition to driver controller input, input areas for values of position, speed, etc. are allocated.

* Under DVC command, STRT/PWRT signals are invalid.

* For value data maximum and minimum values, confirm with the instruction manual of the driver controller.

Important ● Do not input value data outside the range. Otherwise, it may cause errors, malfunctions, or unforeseen operation.

<Simple DVC>

Offset address	Name	Unit	Data type
0x (n)	Driver controller input	-	-
0x (n+1)	Position data (L) *	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H) *		

(L) indicates the lower 16 bits of the 32-bit integer and (H) the upper 16 bits.

* Setting to a value smaller than the number of digits displayed by D-STEP/TDO is possible, but the value displayed on D-STEP/TDO will round off the smallest digit (the third decimal place, if the D-STEP/TDO display shows two decimal places).

As well, when saving data to a file, the value displayed on D-STEP will be saved.

<Half DVC>

Offset address	Name	Unit	Data type
0x (n)	Driver controller input	-	-
0x (n+1)	Position data (L) *	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H) *		
0x (n+3)	Positioning completion width (L) *	0.1 μm	Signed 32-bit integer
0x (n+4)	Positioning completion width (H) *		
0x (n+5)	Speed	mm/s	Unsigned 16-bit integer
0x (n+6)	ACC/DCC rate *	0.01m/s ²	Unsigned 16-bit integer
0x (n+7)	Current limit on pressing	%	Unsigned 16-bit integer

(L) indicates the lower 16 bits of the 32-bit integer and (H) the upper 16 bits.

* Setting to a value smaller than the number of digits displayed by D-STEP/TDO is possible (position data errors will occur if the speed value is specified as 0 or the acceleration/deceleration value as 9 or below), but the value displayed on D-STEP/TDO will round off the smallest digit (the third decimal place, if the D-STEP/TDO display shows two decimal places).
As well, when saving data to a file, the value displayed on D-STEP will be saved.

<Full DVC>

Offset address	Name	Unit	Data type
0x (n)	Driver controller input	-	-
0x (n+1)	Position data (L) *	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H) *		
0x (n+3)	Positioning completion width (L) *	0.1 μm	Signed 32-bit integer
0x (n+4)	Positioning completion width (H) *		
0x (n+5)	Speed	mm/s	Unsigned 16-bit integer
0x (n+6)	P area A (L) *	0.1 μm	Signed 32-bit integer
0x (n+7)	P area A (H) *		
0x (n+8)	P area B (L) *	0.1 μm	Signed 32-bit integer
0x (n+9)	P area B (H) *		
0x (n+A)	ACC *	0.01m/s ²	Unsigned 16-bit integer
0x (n+B)	DCC *	0.01m/s ²	Unsigned 16-bit integer
0x (n+C)	Current limit on pressing	%	Unsigned 16-bit integer
0x (n+D)	Load current threshold value	%	Unsigned 16-bit integer

* n is the top address of each axis.

(L) indicates the lower 16 bits of the 32-bit integer and (H) the upper 16 bits.

* Setting to a value smaller than the number of digits displayed by D-STEP/TDO is possible (position data errors will occur if the speed value is specified as 0 or the acceleration/deceleration value as 9 or below), but the value displayed on D-STEP/TDO will round off the smallest digit (the third decimal place, if the D-STEP/TDO display shows two decimal places).
As well, when saving data to a file, the value displayed on D-STEP will be saved.

2. CC-Link communication specifications

● RX section (master -> slave: in PC/TDO mode)

Offset address	Name	Reference
0x00 to 0F	TNU signal area 1	Table (7)
0x10 to 1F	TNU signal area 2	Table (8)
0x20 to 2F	Driver controller ID response command	Table (9)
0x30 to 3F	Program No. / Parameter No.	Table (10)
0x40 to 4F	Data (L)	Table (11)
0x50 to 5F	Data (H)	Table (12)
0x60 to 6F	Driver controller status	Table (13)
"0xm0 to mF" * m: Value determined by number of occupied stations / multiple settings m = 7 1 station 8 times, 4 stations 1 time = B 2 stations 4 times = 17 2 stations 8 times = 9 3 stations 2 times = 13 3 stations 4 times = D 4 stations 2 times = 1B 4 stations 4 times	CC-Link system area	-

● RX section (master -> slave: in IO mode)

Offset address	Name	Reference
0x00 to 0F	TNU signal area 1	Table (7)
0x10 to 1F	TNU signal area 2	Table (8)
0x20 to 3F	Reserved	-
0x40 to 4F	DVC write failure status display	Table (14)
0x50 to 5F	DVC write success status display	Table (15)
0x60 to 6F	Driver controller status	Table (13)
"0xm0 to mF" * m: Value determined by number of occupied stations / multiple settings m = 7 1 station 8 times, 4 stations 1 time = B 2 stations 4 times = 17 2 stations 8 times = 9 3 stations 2 times = 13 3 stations 4 times = D 4 stations 2 times = 1B 4 stations 4 times	CC-Link system area	-

[Table (7)]

Bit	Name	Set value
b0	ID:0 TACnet communication error	0=Normal,1=Error
b1	ID:1 TACnet communication error	0=Normal,1=Error
...
b14	ID:E TACnet communication error	0=Normal,1=Error
b15	ID:F TACnet communication error	0=Normal,1=Error

[Table (8)]

Bit	Name	Set value
b0	Mode change switch status	0 = PC/TDO mode, 1 = I/O mode
b1	TACnet device connection status	0: Consistent to the net device list 1: Inconsistent to the net device list
b2 to b14	Reserved	Access invalid
b15	TNU status	0=Normal,1=Error

[Table (9)]

Bit	Name	Set value
b0 to b7	Command No. (8bit)	
b8 to b11	Access invalid	-
b12	Command send/receive error	0 = Normal, 1 = Error
b13	Command send/receive completed	0 = Not complete, 1 = Complete
b14	Command reception error	0 = Not possible, 1 = Possible
b15	Access invalid	-

[Table (10)]

Bit	Name	Set value
b0 to b15	Program No. / Parameter No.	Enter Program No. or Parameter No.

[Table (11)]

Bit	Name	Set value
b0 to b15	Data (L)	Display parameter readout result (lower 16bits)

[Table (12)]

Bit	Name	Set value
b0 to b15	Data (H)	Display parameter readout result (upper 16bits)

[Table (13)]

Bit	Name	Set value
b0	ID:0 AUTO/MANUAL	0=AUTO, 1=MANU
b1	ID:1 AUTO/MANUAL	0=AUTO, 1=MANU
...
b14	ID:E AUTO/MANUAL	0=AUTO, 1=MANU
b15	ID:F AUTO/MANUAL	0=AUTO, 1=MANU

[Table (14)]

Bit	Name	Set value
b0	ID: 0 DVC write failure status display	0 = Not processed, 1 = failure
b1	ID: 1 DVC write failure status display	0 = Not processed, 1 = failure
...
b14	ID: E DVC write failure status display	0 = Not processed, 1 = failure
b15	ID: F DVC write failure status display	0 = Not processed, 1 = failure

[Table (15)]

Bit	Name	Set value
b0	ID: 0 DVC write success status display	0 = Not processed, 1 = Success
b1	ID: 1 DVC write success status display	0 = Not processed, 1 = Success
...
b14	ID: E DVC write success status display	0 = Not processed, 1 = Success
b15	ID: F DVC write success status display	0 = Not processed, 1 = Success

● **RWr section (slave -> master)**

- When Input Mode is IO

As indicated in the following figure, the inputs from each driver controller (slave) of ID 0 through F are allocated to the ward device area, or the bits comprising each ward device are allocated to the driver controller inputs.

Offset address	Name	Reference
0x (n)	Driver controller output	Table (15)

[Table (15)]

Bit	Driver controller input signal No.
.b0 to .b15	Output signal No.: 0 to F

* For signal names, etc., see "2-3 Buffer memory allocation correspondence table"(->P.4-26)

- Input mode: For simple DVC, half DVC, and full DVC

The data to be input depends on the TNU mode.

I/O mode : Stores the DVC data.

PC/TDO mode : Stores the program readout data.

<Simple DVC (in IO mode)>

Offset address	Name	Unit	Data type
0x (n)	Driver controller input	-	-
0x (n+1)	Position data (L)	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H)		

<Simple DVC (in PC/TDO mode)>

Offset address	Name	Unit	Data type
0x (n)	Reserved	-	-
0x (n+1)	Position data (L)	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H)		

<Half DVC (in IO mode)>

Offset address	Name	Unit	Data type
0x (n)	Driver controller output	-	-
0x (n+1)	Current position	0.1 μm	Signed 32-bit integer
0x (n+2)			
0x (n+3)	Present current	%	Unsigned 32-bit integer
0x (n+4)			
0x (n+5)	Present speed	mm/s	Unsigned 16-bit integer
0x (n+6)	Reserved	-	-
0x (n+7)	Reserved	-	-

<Half DVC (in PC/TDO mode)>

Offset address	Name	Unit	Data type
0x (n)	Reserved	-	-
0x (n+1)	Position data (L)	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H)		
0x (n+3)	Positioning completion width (L)	0.1 μm	Signed 32-bit integer
0x (n+4)	Positioning completion width (H)		
0x (n+5)	Speed	mm/s	Unsigned 16-bit integer
0x (n+6)	ACC/DCC rate	0.01m/ s ²	Unsigned 16-bit integer
0x (n+7)	Current limit on pressing	%	Unsigned 16-bit integer

<Full DVC (in IO mode)>

Offset address	Name	Unit	Data type
0x (n)	Driver controller output	-	-
0x (n+1)	Current position	0.1 μm	Signed 32-bit integer
0x (n+2)			
0x (n+3)	Present current	%	Unsigned 32-bit integer
0x (n+4)			
0x (n+5)	Present speed	mm/s	Unsigned 16-bit integer
0x (n+6) to (n+D)	Reserved	-	-

<Full DVC (in PC/TDO mode)>

Offset address	Name	Unit	Data type
0x (n)	Reserved	-	-
0x (n+1)	Position data (L)	0.1 μm	Signed 32-bit integer
0x (n+2)	Position data (H)		
0x (n+3)	Positioning completion width (L)	0.1 μm	Signed 32-bit integer
0x (n+4)	Positioning completion width (H)		
0x (n+5)	Speed	mm/s	Unsigned 16-bit integer
0x (n+6)	P area A (L)	0.1 μm	Signed 32-bit integer
0x (n+7)	P area A (H)		
0x (n+8)	P area B (L)	0.1 μm	Signed 32-bit integer
0x (n+9)	P area B (H)		
0x (n+A)	ACC	0.01m/ s ²	Unsigned 16-bit integer
0x (n+B)	DCC	0.01m/ s ²	Unsigned 16-bit integer
0x (n+C)	Current limit on pressing	%	Unsigned 16-bit integer
0x (n+D)	Load current threshold value	%	Unsigned 16-bit integer

2-3

Buffer memory allocation correspondence table

- The I/O pin number and CC-Link buffer memory allocation of each driver controller are as follows.
- RWw represents the top address of the device allocated to RWw, and id represents the ID number of the driver controller.

Example: To allocate RWw to W100 and turn PAUSE signal ON by TSC of ID: 1, turn W101.b13 ON.

Pin number*1	Input/ output signal No.	Buffer memory allocation	Signal name						
			Function mode 0	Function mode 1	Function mode 2	Function mode 3	Function mode 4	Function mode 5	
			Position 64	External input instruction	Position 256	Position 512	Solenoid 1	Solenoid 2	
3	Input	0	RWw+(id).b0	PI 0	PI 0	PI 0	PI 0	ST 0	ST 0
4		1	RWw+(id).b1	PI 1	PI 1	PI 1	PI 1	ST 1	ST 1
5		2	RWw+(id).b2	PI 2	PI 2	PI 2	PI 2	ST 2	ST 2
6		3	RWw+(id).b3	PI 3	PI 3	PI 3	PI 3	ST 3	---
7		4	RWw+(id).b4	PI 4	PI 4	PI 4	PI 4	ST 4	---
8		5	RWw+(id).b5	PI 5	PI 5	PI 5	PI 5	ST 5	---
9		6	RWw+(id).b6	---	MODE	PI 6	PI 6	ST 6	---
10		7	RWw+(id).b7	---	JOG/INCHING	PI 7	PI 7	---	---
11		8	RWw+(id).b8	---	JOG P	---	PI 8	---	---
12		9	RWw+(id).b9	BKRL	JOG N	BKRL	BKRL	BKRL	BKRL
13		A	RWw+(id).b10	STRT	STRT/PWRT	STRT	STRT	---	---
14		B	RWw+(id).b11	MANU	MANU	MANU	MANU	MANU	MANU
15		C	RWw+(id).b12	HOME	HOME	HOME	HOME	HOME	HOME
16		D	RWw+(id).b13	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE
17		E	RWw+(id).b14	REST	REST	REST	REST	REST	REST
18	F	RWw+(id).b15	SV-ON	SV-ON	SV-ON	SV-ON	SV-ON	SV-ON	
19	Output	0	RWr+(id).b0	PO 0	PO 0	PO 0	PO 0	PE 0	LS 0
20		1	RWr+(id).b1	PO 1	PO 1	PO 1	PO 1	PE 1	LS 1
21		2	RWr+(id).b2	PO 2	PO 2	PO 2	PO 2	PE 2	LS 2
22		3	RWr+(id).b3	PO 3	PO 3	PO 3	PO 3	PE 3	---
23		4	RWr+(id).b4	PO 4	PO 4	PO 4	PO 4	PE 4	---
24		5	RWr+(id).b5	PO 5	PO 5	PO 5	PO 5	PE 5	---
25		6	RWr+(id).b6	MOVE	MOVE	PO 6	PO 6	PE 6	---
26		7	RWr+(id).b7	AREA	MODE S	PO 7	PO 7	AREA	AREA
27		8	RWr+(id).b8	P AREA	P AREA	P AREA	PO 8	P AREA	P AREA
28		9	RWr+(id).b9	MANU S	MANU S	MANU S	MANU S	MANU S	MANU S
29		A	RWr+(id).b10	HEND	HEND	HEND	HEND	HEND	HEND
30		B	RWr+(id).b11	INPS	INPS	INPS	INPS	INPS	---
31		C	RWr+(id).b12	LOAD/TRQS	WEND	LOAD/TRQS	LOAD/TRQS	LOAD/TRQS	---
32		D	RWr+(id).b13	SVRDY	SVRDY	SVRDY	SVRDY	SVRDY	SVRDY
33*2		E	RWr+(id).b14	EMGS*2	EMGS*2	EMGS*2	EMGS*2	EMGS*2	EMGS*2
34		F	RWr+(id).b15	ALM	ALM	ALM	ALM	ALM	ALM

*1. The pin number is the pin number of the I/O input/output signal for CN1 of the driver controller.

*2. The pin number 33 is EMGS for TSC, but it will be BALM for TLC and THC.

2-4

Number of occupied stations / multiple settings (CC-Link Ver.2.00 only)

With CC-Link Ver.2.00, the number of occupied stations and multiple settings can be selected. Net device list settings are possible within a range not exceeding the link point count capacity for number of stations and multiple settings.

The RWw / RWr link point (word) count for each number of occupied stations / multiple settings and that required for each mode are as follows.

List of RWw / RWr link point counts for each number of occupied stations / multiple settings

Multiple settings \ Number of occupied stations	Multiple settings			
	1 time	2 time	4 time	8 time
1 stations				32
2 stations			32	64
3 stations		24	48	
4 stations	16	32	64	

List of RWw / RWr link point counts for each input mode

	IO	Simple DVC	Half DVC	Full DVC
Required link point count	1	3	8	14

2-5

CSP and CSP+ files (TNU Firmware Ver.1.2 or later)

CSP and CSP+ files contain information on TNU specifications and device allocation, etc. (You can download this free program from the electrical actuator site: <https://tech.thk.com/>)

3. EtherCAT communication specifications

3-1 EtherCAT communication overview

- The EtherCAT communication overview is as follows:

Communication standard	EtherCAT
Communication speed	100Mbps
Communication method	Conforming to IEEE802.3
Transmission channel type	Line / Star / Tree / Ring
Communication cable length	Distance between stations: 100 m
Communication cable	Ethernet cable of category 5e or above

- EtherCAT link point count

The link point (word) count usable with EtherCAT is a maximum of 120. Plan your design so that the total link point count of devices connected to TACnet is no more than 120.

List of input mode link point counts

	IO	Simple DVC	Half DVC	Full DVC
Required link point count	1	3	8	14

3-2 EtherCAT PDO mapping (I/O allocation correspondence table)

- Refer to the CC-Link Communication Specifications and buffer memory allocation chart for information about the I/O allocation chart.
- About the I/O allocation chart in the ESI file that can be downloaded from the THK website.

The driver controller input is registered to Index#2002.

The driver controller output is registered to Index#2004.

3-2-1 TNU Firmware Ver. 1.30 or later

- TNU control input section (master -> slave: in PC/TDO mode)

Offset address	Name	Reference
0x0	TNU control area	Table (1)
0x1	DVC write switch	Table (2)
0x2	Control command	Table (3)
0x3	Program No. / Parameter No.	Table (4)
0x4 to 5	Reserved	-
0x6	DVC switch	Table (5)
0x7	Reserved	-

- TNU control input section (master -> slave: in IO mode)

Offset address	Name	Reference
0x0	TNU control area	Table (1)
0x1	DVC write switch	Table (2)
0x2 to 5	Reserved	-
0x6	DVC switch	Table (5)
0x7	Reserved	-

- About the TNU control input in the ESI file that can be downloaded from the THK website section

The TNU control input is registered to Index#2001.

[Table (1)]

Bit	Name	Set value	Remarks
b0	Alarm reset	1 = Alarm reset	Edge
b1	Alarm history reset	1 = Alarm history reset	Edge
b2	Remote MANUAL	0=AUTO, 1=MANU	Level
b3 to b9	Reserved	Access invalid	-
b10	Broadcast	1 = Broadcast	Edge
b11	DVC switch	0 = IO mode, 1 = DVC mode	Level
b12	TNU parameter switch	0 = Driver Controller, 1 = TNU	Level
b13	Reserved	Access prohibited	-
b14	Command transmission switch	1 = Command transmission	Edge
b15	Lower-level communication authorization switch	0 = Lower-level communication prohibited, 1 = Lower-level communication authorized	Level

3. EtherCAT communication specifications

[Table (2)]

Bit	Name	Set value	Remarks
b0	ID:0 DVC: write	0 = Invalid, 1 = Valid	Edge
b1	ID:1 DVC: write	0 = Invalid, 1 = Valid	Edge
...
b14	ID:E DVC: write	0 = Invalid, 1 = Valid	Edge
b15	ID:F DVC: write	0 = Invalid, 1 = Valid	Edge

[Table (3)]

Bit	Name	Set value	Remarks
b0 to b7	Command No.	Enter 0x1F (program readout) 0x24 (parameter readout)	Level
b8 to b11	Driver controller ID	Enter the driver controller ID from which data should be read	Level
b12 to b15	Reserved	Access invalid	-

[Table (4)]

Bit	Name	Set value	Remarks
b0 to b15	Program No. / Parameter No.	Enter the Program No. parameter from which data should be read	Level

[Table (5)]

Bit	Name	Set value	Remarks
b0	ID0 (DVC switch)	0 = IO mode, 1 = DVC mode	Level
b1	ID1 (DVC switch)	0 = IO mode, 1 = DVC mode	Level
...	-
b14	IDE (DVC switch)	0 = IO mode, 1 = DVC mode	Level
b15	IDF (DVC switch)	0 = IO mode, 1 = DVC mode	Level

- **Driver controller input section (master -> slave)**

Refer to the RWw section of the CC-Link Communication Specifications.

- **TNU control output section (slave -> master: in PC/TDO mode)**

Offset address	Name	Reference
0x0	TNU signal area 1	Table (6)
0x1	TNU signal area 2	Table (7)
0x2	Driver controller ID response command	Table (8)
0x3	Program No. / Parameter No.	Table (9)
0x4	Data (L)	Table (10)
0x5	Data (H)	Table (11)
0x6	Driver controller status	Table (12)
0x7	Reserved	-

- **TNU control output section (slave -> master: from PC/TDO mode to IO mode)**

Offset address	Name	Reference
0x0	TNU signal area 1	Table (6)
0x1	TNU signal area 2	Table (7)
0x2	Reserved	-
0x4	DVC write failure status display	Table (13)
0x5	DVC write success status display	Table (14)
0x6	Driver controller status	Table (12)
0x7	Reserved	-

- **About the TNU control input in the ESI file that can be downloaded from the THK website section**

The TNU control input is registered to Index#2003.

[Table (6)]

Bit	Name	Set value
b0 to b7	Command No. (8bit)	
b8 to b11	Access invalid	-
b12	Command send/receive error	0 = Normal, 1 = Error
b13	Command send/receive completed	0 = Not complete, 1 = Complete
b14	Command reception error	0 = Not possible, 1 = Possible
b15	Access invalid	-

3. EtherCAT communication specifications

[Table (7)]

Bit	Name	Set value
b0	ID:0 TACnet communication error	0=Normal,1=Error
b1	ID:1 TACnet communication error	0=Normal,1=Error
...
b14	ID:E TACnet communication error	0=Normal,1=Error
b15	ID:F TACnet communication error	0=Normal,1=Error

[Table (8)]

Bit	Name	Set value
b0	Mode change switch status	0 = PC/TDO mode, 1 = I/O mode
b1	TACnet device connection status	0: Consistent to the net device list 1: Inconsistent to the net device list
b2 to b14	Reserved	Access invalid
b15	TNU status	0=Normal,1=Error

[Table (9)]

Bit	Name	Set value
b0 to b15	Program No. / Parameter No.	Enter Program No. or Parameter No.

[Table (10)]

Bit	Name	Set value
b0 to b15	Data (L)	Display parameter readout result (lower 16bits)

[Table (11)]

Bit	Name	Set value
b0 to b15	Data (H)	Display parameter readout result (upper 16bits)

[Table (12)]

Bit	Name	Set value
b0	ID:0 AUTO/MANUAL	0=AUTO, 1=MANU
b1	ID:1 AUTO/MANUAL	0=AUTO, 1=MANU
...
b14	ID:EAUTO/MANUAL	0=AUTO, 1=MANU
b15	ID:FAUTO/MANUAL	0=AUTO, 1=MANU

[Table (13)]

Bit	Name	Set value
b0	ID: 0 DVC write failure status display	0 = Not processed, 1 = failure
b1	ID: 1 DVC write failure status display	0 = Not processed, 1 = failure
...
b14	ID: E DVC write failure status display	0 = Not processed, 1 = failure
b15	ID: F DVC write failure status display	0 = Not processed, 1 = failure

[Table (14)]

Bit	Name	Set value
b0	ID: 0 DVC write success status display	0 = Not processed, 1 = Success
b1	ID: 1 DVC write success status display	0 = Not processed, 1 = Success
...
b14	ID: E DVC write success status display	0 = Not processed, 1 = Success
b15	ID: F DVC write success status display	0 = Not processed, 1 = Success

● **Driver controller output section (slave -> master)**

Refer to the RWr section of the CC-Link Communication Specifications.

3-3

ESI files

ESI files contain information on TNU specifications and device allocation, etc.

You can download this free program from the THK technical support website: <https://tech.thk.com/>.

Download the file matching the TNU version for use.

4-1 Communication overview

4-1-1 EtherNet/IP communication overview

Communication standard	EtherNet/IP
Communication speed	10/100Mbps
Communication method	Conforming to IEEE802.3, IEEE802.3u
Transmission channel type	Line/star/tree
Communication cable length	Distance between nodes: 100 m
Communication cable	Ethernet cable of category 5 or above

- EtherNet/IP link point count

The link point (word) count usable with EtherNet/IP is a maximum of 120. Plan your design so that the total link point count of devices connected to TACnet is no more than 120.

List of input mode link point counts

	IO	Simple DVC	Half DVC	Full DVC
Required link point count	1	3	8	14

4-1-2 DeviceNet communication overview

Communication standard	DeviceNet compliant	
Communication speed	125kbps/250kbps/500kbps	
Communication method	DeviceNet communication	
Transmission channel type	Multi-drop method, T-branch	
Communication cable length	Thick cable	500 m (at 125 kbps) 250 m (at 250 kbps) 100 m (at 500 kbps)
	Thin cable	100 m (at all communication speeds)
Communication cable	DeviceNet dedicated cable	

- DeviceNet link point count

The I/O ports (words) usable with DeviceNet is limited to 120. Plan your design so that the total link point count of devices connected to TACnet is no more than 120.

4-2

EtherNet/IP, DeviceNet Data mapping (master -> slave)

● TNU control input section (master -> slave: in PC/TDO mode)

Offset address	Name	Reference
0x0	TNU control area	Table (1)
0x1	DVC write switch	Table (2)
0x2	Control command	Table (3)
0x3	Program No. / Parameter No.	Table (4)
0x4 to 5	Reserved	-
0x6	DVC switch	Table (5)
0x7 to 0x80	Reserved	-

● TNU control input section (master -> slave: in IO mode)

Offset address	Name	Reference
0x0	TNU control area	Table (1)
0x1	DVC write switch	Table (2)
0x2 to 5	Reserved	-
0x6	DVC switch	Table (5)
0x7	Reserved	-
0x8 to 0x80	Driver controller input area ^{*4}	-

*4 Driver controller input area:

The driver controller input area is the area in which commands for the driver controllers for each axis should be input. This area differs depending on the input mode configured in the net device for the driver controller for each axis. For details about input mode, please refer to the RWw section of the CC-Link Communication Specifications.

[Table (1)]

Bit	Name	Set value	Remarks
b0	Alarm reset	1 = Alarm reset	Edge
b1	Alarm history reset	1 = Alarm history reset	Edge
b2	Remote MANUAL	0=AUTO, 1=MANU	Level
b3 to b9	Reserved	Access invalid	-
b10	Broadcast	1 = Broadcast	Edge
b11	DVC switch	0 = IO mode, 1 = DVC mode	Level
b12	TNU parameter switch	0 = Driver Controller, 1 = TNU	Level
b13	Reserved	Access prohibited	-
b14	Command transmission switch	1 = Command transmission	Edge
b15	Lower-level communication authorization switch	0 = Lower-level communication prohibited, 1 = Lower-level communication authorized	Level

[Table (2)]

Bit	Name	Set value	Remarks
b0	ID0 DVC: write	0 = Invalid, 1 = Valid	Edge
b1	ID1 DVC: write	0 = Invalid, 1 = Valid	Edge
...
b14	IDE DVC: write	0 = Invalid, 1 = Valid	Edge
b15	IDF DVC: write	0 = Invalid, 1 = Valid	Edge

[Table (3)]

Bit	Name	Set value	Remarks
b0 to b7	Command No.	Enter 0x1F (program readout) 0x24 (parameter readout)	Level
b8 to b11	Driver controller ID	Enter the driver controller ID from which data should be read	Level
b12 to b15	Reserved	Access invalid	-

[Table (4)]

Bit	Name	Set value	Remarks
b0 to b15	Program No. / Parameter No.	Enter the Program No. parameter from which data should be read	Level

[Table (5)]

Bit	Name	Set value	Remarks
b0	ID0 (DVC switch)	0 = IO mode, 1 = DVC mode	Level
b1	ID1 (DVC switch)	0 = IO mode, 1 = DVC mode	Level
...
b14	IDE (DVC switch)	0 = IO mode, 1 = DVC mode	Level
b15	IDF (DVC switch)	0 = IO mode, 1 = DVC mode	Level

4-3

EtherNet/IP, DeviceNet Communication Specifications

● TNU control output section (slave -> master: in PC/TDO mode)

Offset address	Name	Reference
0x0	TNU signal area 1	Table (6)
0x1	TNU signal area 2	Table (7)
0x2	Driver controller ID response command	Table (8)
0x3	Program No. / Parameter No.	Table (9)
0x4	Data (L)	Table (10)
0x5	Data (H)	Table (11)
0x6	Driver controller status	Table (12)
0x7	Reserved	-
0x8 to 0x80	Program readout display area *5	

*5 Program readout display area:

The area in which the program readout data is displayed. See the supplementary information for details about program readout data.

● TNU control output section (slave -> master: in IO mode)

Offset address	Name	Reference
0x0	TNU signal area 1	Table (6)
0x1	TNU signal area 2	Table (7)
0x2	Reserved	-
0x4	DVC write failure status display	Table (13)
0x5	DVC write success status display	Table (14)
0x6	Driver controller status	Table (12)
0x7	Reserved	-
0x8 to 0x80	Driver controller output area *6	

*6 Driver controller output area:

The driver controller output area is the area in which driver controller data for each axis is displayed. This area differs depending on the input mode configured in the net device for the driver controller for each axis. For details about input mode, please refer to the **RWr section of the CC-Link Communication Specifications**.

[Table (6)]

Bit	Name	Set value
b0	ID:0 TACnet communication error	0=Normal,1=Error
b1	ID:1 TACnet communication error	0=Normal,1=Error
...
b14	ID:E TACnet communication error	0=Normal,1=Error
b15	ID:F TACnet communication error	0=Normal,1=Error

[Table (7)]

Bit	Name	Set value
b0	Mode change switch status	0 = PC/TDO mode, 1 = I/O mode
b1	TACnet device connection status	0: Consistent to the net device list 1: Inconsistent to the net device list
b2 to b14	Reserved	Access invalid
b15	TNU status	0=Normal,1=Error

[Table (8)]

Bit	Name	Set value
b0 to b7	Command No. (8bit)	
b8 to b11	Access invalid	-
b12	Command send/receive error	0 = Normal, 1 = Error
b13	Command send/receive completed	0 = Not complete, 1 = Complete
b14	Command reception error	0 = Not possible, 1 = Possible
b15	Access invalid	-

[Table (9)]

Bit	Name	Set value
b0 to b15	Program No. / Parameter No.	Enter Program No. or Parameter No.

[Table (10)]

Bit	Name	Set value
b0 to b15	Data (L)	Parameter readout result (lower 16bits) display

[Table (11)]

Bit	Name	Set value
b0 to b15	Data (H)	Parameter readout result (upper 16bits) display

[Table (12)]

Bit	Name	Set value
b0	ID:0 AUTO/MANUAL	0=AUTO, 1=MANU
b1	ID:1 AUTO/MANUAL	0=AUTO, 1=MANU
...
b14	ID:EAUTO/MANUAL	0=AUTO, 1=MANU
b15	ID:FAUTO/MANUAL	0=AUTO, 1=MANU

[Table (13)]

Bit	Name	Set value
b0	ID: 0 DVC write failure status display	0 = Not processed, 1 = failure
b1	ID: 1 DVC write failure status display	0 = Not processed, 1 = failure
...
b14	ID: E DVC write failure status display	0 = Not processed, 1 = failure
b15	ID: F DVC write failure status display	0 = Not processed, 1 = failure

[Table (14)]

Bit	Name	Set value
b0	ID: 0 DVC write success status display	0 = Not processed, 1 = Success
b1	ID: 1 DVC write success status display	0 = Not processed, 1 = Success
...
b14	ID: E DVC write success status display	0 = Not processed, 1 = Success
b15	ID: F DVC write success status display	0 = Not processed, 1 = Success

4-4

EDS files

EDS (Electronic Data Sheet) files contain information on TNU specifications and input/output point count setting, etc.

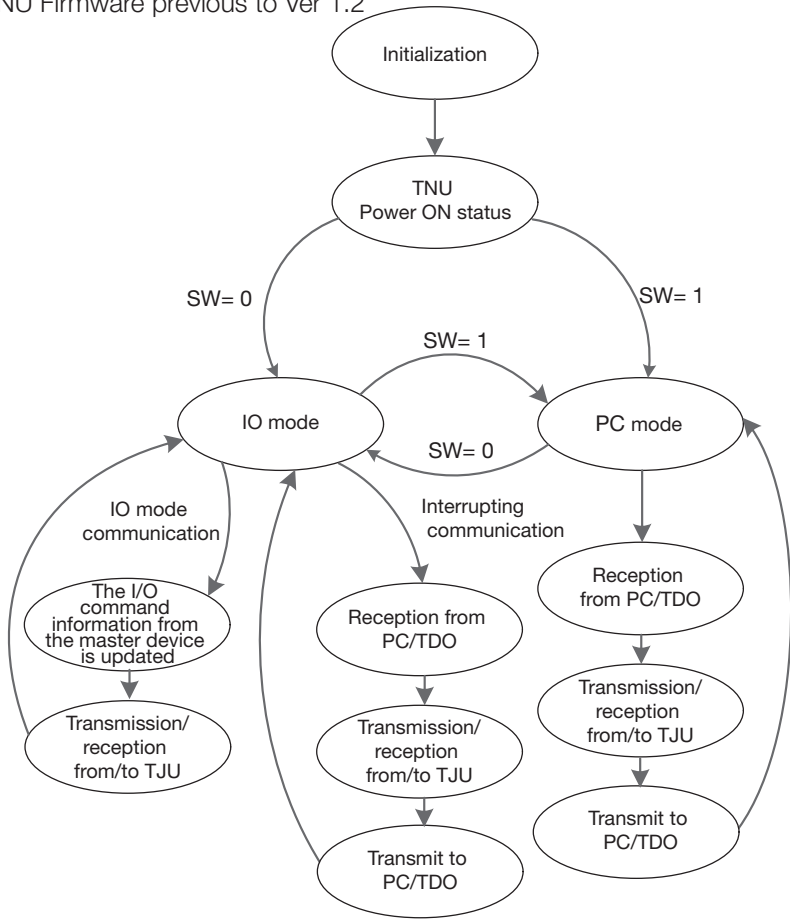
(You can download this free program from the THK technical support website: <https://tech.thk.com/>).

5-1 TACnet communication overview

Communication speed	38.4 kbps, 57.6 kbps, 115.2 kbps (Standard: 115.2 kbps)
Communication cycle	20 msec (per axis)
Communication method	Half-duplex Broadcast method
Retry	None
Transmission channel type	RS-485
Error control method	No parity, CRC-CCITT ($X^{16}+X^{12}+X^5+1$)

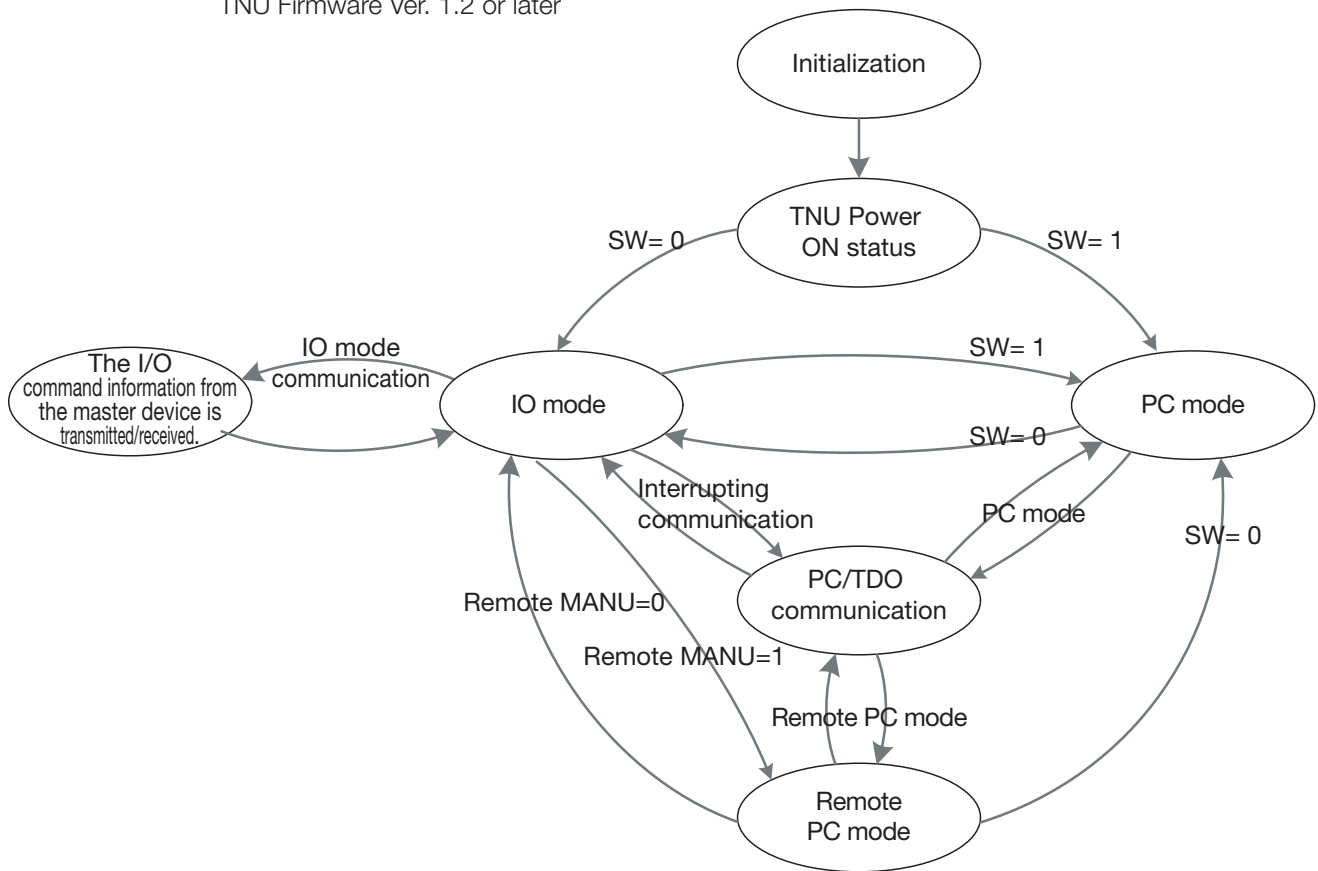
5-2 TACnet communication status transition diagram

- The TNU status transits by the mode change switch (-> P.5-3).
 SW = 0 indicates the IO mode (up), SW = 1 indicates PC/TDO mode (down).
 In the IO mode, there is regular transmission/reception of the I/O information from each slave, and an interrupting communication is conducted (-> P.4-44).
 at the regular transmission/reception of the interval of interrupting communications.
 * Interrupting communication decreases the time required for regular transmission/reception.
 TNU Firmware previous to Ver 1.2



5. TACnet communication specifications

TNU Firmware Ver. 1.2 or later



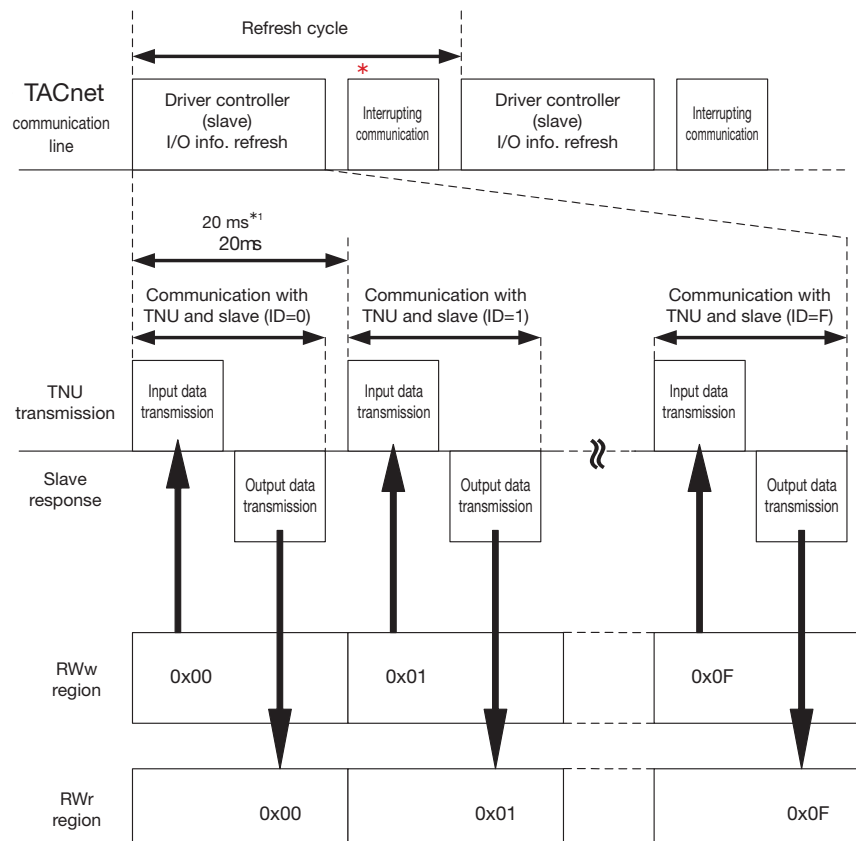
5. TACnet communication specifications

5-3 TACnet communication diagram

5-3-1 I/O mode

The case of CC-Link is provided for reference. This also applies to the cases of EtherCAT, EtherNet/IP and DeviceNet.

- Transmit the input information set to the CC-Link remote register RWw area to each slave, and store the returned output information in the RWr area.



Important

- The * interrupting communication is a communication with D-STEP or TDO. When a communication with D-STEP or TDO is conducted during industrial network communication in the I/O mode, an update of the information monitor is delayed. (-> P.5-5)

- Lower-level communication speed

The standard communication cycle with the driver controller varies according to communication speed. When not otherwise indicated in this manual, the setting is 115200 bps.

The communication cycle becomes longer than the standard communication cycle when the driver controller is writing to EEPROM, operating with servo on, or processing alarms etc.

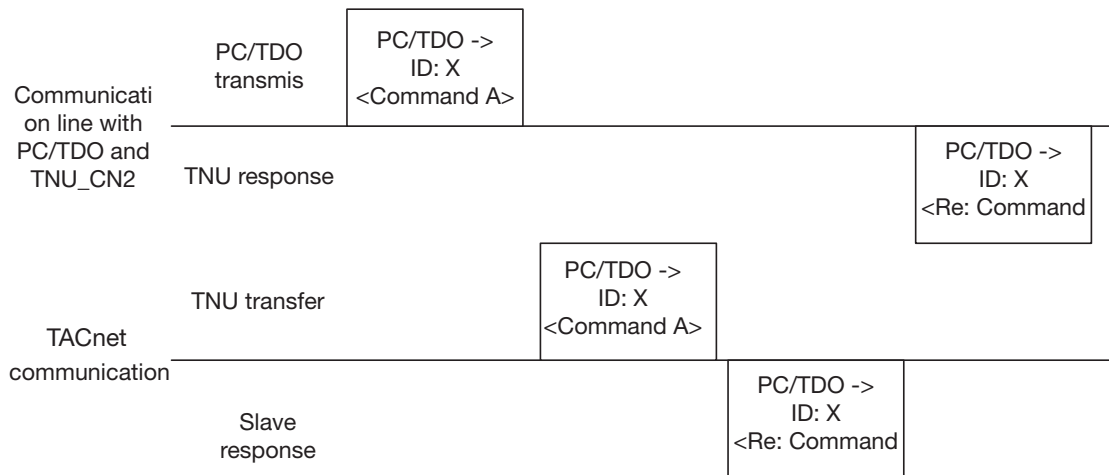
Lower-level communication speed [bps]	Standard communication cycle [ms]
115200	20
57600	40
38400	60

5. TACnet communication specifications

5-3-2 PC/TDO mode

- The command transmitted from the PC (D-STEP) or TDO is received by TNU, and it is transferred to TACnet.

The slave that received the command returns a response to TACnet, and the TNU forwards the response to the PC (D-STEP) or TDO.



5. Operation and Adjustment

About this chapter

This chapter describes the operation and adjustment.



This section describes the operation mode details.

1. Operation mode.....	5-2
1-1 I/O mode	5-3
1-2 PC/TDO mode	5-3



This section describes the standard precautions.

2. General precautions.....	5-4
2-1 Upper-level communication	5-4

This section describes the communication parameter details.

3. Communication parameters	5-5
3-1 Communication parameters.....	5-5
3-2 Net device list	5-8

1. Operation mode

WARNING



Obligatory

- **To prevent unexpected accidents, make sure to install the emergency stop switch and have the machine ready to be shut down at any time before performing operation.**

Failure to do may cause damages or injuries.

- **If any abnormal heating, odor, smoke or fire is observed in TNU, TJU, the driver controller and the actuator, shut the power off immediately since there is a risk of fire etc.**

Failure to do so may cause burns due to high temperature, damages or injuries. Please contact us after confirming that the abnormal condition is stopped.



Prohibited

- **Do not remove/insert the connector while energizing.**

Doing so may cause the malfunction or failures.

CAUTION



Obligatory

- **Configure and check appropriate settings of TNU parameter before trial run.**

Otherwise, unexpected operation may occur.

- **If an alarm is generated, remove the cause, ensure the safety, and reset the alarm.**

Failure to do so may cause damages or injuries. When a part generates heat, restart the operation after taking sufficient cooling time.

- **In case of any failure, do not continue operations without eliminating the cause.**

Doing so may cause malfunction, resulting in damage and injury.



Prohibited

- **If the alarm is reset when operation signals are input, it may suddenly restart. So do not enter into the moving range of the unit.**

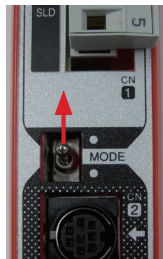
Doing so may cause damages or injuries.

1. Operation mode

1-1 I/O mode

- Pull the mode change switch toward the CN1 connector to establish communication with the upper-level communication as a master.
- Set the MANU/AUTO change switch to AUTO for each driver controller.

TNU setting



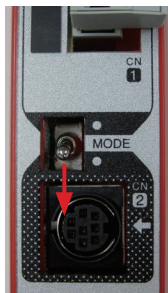
Setting of each driver controller



1-2 PC/TDO mode

- Pull the mode change switch toward the PC/TDO connector (CN2) to establish communication with the PC/TDO communication as a master.
- Set the MANU/AUTO change switch to MANU for each driver controller.

TNU setting



Setting of each driver controller



2. General precautions

2-1

Upper-level communication

- Since TNU is a device that relays the communication between the upper-level master device and the driver controller, there should be a delay between the master device command and response from the driver controller.

Therefore, for I/O operations by the upper-level master device, check that the transmitted command is securely executed and create a control program that transmits the command as following.

Example) When the SV-ON bit is risen, the next processing will not be executed until the SVRDY bit is effectuated.

When operating the driver controller from D-STEP via TNU

- Select "Invalid" for driver controller parameter No. 48 "TDO Enable Function". When it is set to "Valid", origin return and positioning operation cannot be performed from D-STEP. After operation, return it to "Valid" for safety reasons.

3. Communication parameters

3-1 Communication parameters

3-1-1 TNU Firmware Ver. 1.3 or later

No.	Parameter details	Detailed description
1	Comment	Enter a comment to distinguish multiple TNUs.
2	Interval of interrupting communications	Generation interval of interrupting communication If the I/O information update time is longer than the interval of interrupting communications, the I/O information update takes the priority and interrupting communication will be conducted after the update. (-> P.4-44)
3	Broadcast delay time	Setting by manufacturer (not to be set by yourself)
4	Number of retries	Number of retransmitted commands from the TNU when there is no response from driver controllers. Remote MANUAL and broadcast do not carry out retries.
5	Communication speed (upper-level)	Communication speed with PC/TDO.
6	Communication speed (lower-level)	Communication speed with driver controller.
7	Lower-level communication prohibition function	Function which prohibits automatic start of lower-level communication at power ON. When invalid, lower-level communication starts automatically after TNU startup.

No.	Parameter details	Unit	Default setting	Input range
1	Comment	-	None	16 one-byte alphanumeric characters
2	Interval of interrupting communications	ms	200	0 to 65535
3	Broadcast delay time	ms	20	20 to 65535
4	Number of retries	-	3	0 to 65535
5	Communication speed (upper-level)	bps	115200	38400/57600/115200
6	Communication speed (lower-level)	bps	115200	38400/57600/115200
7	Lower-level communication prohibition function	-	Invalid	Invalid/Valid

Important

- A restart (re-insertion of power) may be required in order to enable parameter changes.

3. Communication parameters

● CC-Link

No.	Parameter details	Detailed description
1	External network type	Applicable network type and name. Online user setting not allowed.
2	Communication speed (CC-Link)	Communication speed of CC-Link.
3	Number of occupied stations, multiple settings	Number of CC-Link occupied stations, multiple settings. Settable values vary depending on CC-Link version.
4	CC-Link version	Version of CC-Link.

No.	Parameter details	Unit	Default setting	Input range
1	External network type	-	-	-
2	Communication speed (CC-Link)	bps	156k	156k/625k/2.5M/5M/10M
3	Number of occupied stations, multiple settings *1	Stations, times	4 stations 1 time	See *1
4	CC-Link version	-	V1.10	V1.10/V2.00

*1 Settable number of occupied stations / multiple settings by CC-Link version are as follows.
For link point count for each setting, see "Number of occupied stations / multiple settings" (-> P.4-27).

V1.10	V2.00
4 stations 1 time	1 station 8 times
	2 stations 4 times
	2 stations 8 times
	3 stations 2 times
	3 stations 4 times
	4 stations 1 time
	4 stations 2 times
	4 stations 4 times

● EtherCAT

No.	Parameter details	Detailed description
1	External network type	Applicable network type and name. User setting not allowed.

No.	Parameter details	Unit	Default setting	Input range
1	External network type	-	-	-

3. Communication parameters

- EtherNet/IP

No.	Parameter details	Detailed description
1	External network type	Applicable network type and name. Online user setting not allowed.
2	IP Address	IP address setting
3	Subnet Mask	Subnet mask setting
4	DHCP	DHCP (IP address automatic allocation) setting
5	Communication speed (EtherNet/IP)	Communication speed of EtherNet/IP
6	Default Gateway	Default gateway setting

No.	Parameter details	Unit	Default setting	Input range
1	External network type	-	-	-
2	IP Address	-	192.168.0.1	0.0.0.0 to 255.255.255.254
3	Subnet Mask	-	255.255.255.0	0.0.0.0 to 255.255.255.254
4	DHCP	-	Invalid	Invalid/Valid ¹⁾
5	Communication speed (EtherNet/IP)	Mbps	Auto	Auto/10HDX/10FDX/100HDX/100FDX ²⁾
6	Default Gateway		0.0.0.0	0.0.0.0 to 255.255.255.254

1) If DHCP = Valid, unforeseen IP address changes may take place, so we recommend setting DHCP = Invalid and setting IP addresses manually.

2) HDX half-duplex / FDX full-duplex

- DeviceNet

No.	Parameter details	Detailed description
1	External network type	Applicable network type and name Online user setting not allowed
2	Communication speed	DeviceNet communication speed

No.	Parameter details	Unit	Default setting	Input range
1	External network type	-	-	-
2	Communication speed	bps	Autoband	125k/250k/500k/ Autoband

3. Communication parameters

3-2 Net device list

- Set the driver controller to be connected to TNU.
This is set to "Any" upon shipping and communicates with all the 16 shafts. By setting a driver controller connected to each ID, communication with shafts that are not connected can be omitted to improve the communication performance.
Setting is performed using the setup tool D-STEP (-> P.6-6). Setting values can be selected from the following items.
When not concerned with the type of driver controller connected, or when connecting to new models in the future, "Any" can be selected.

Type
Not connected
TSC
TLC
THC
Any

- Input Mode
Sets the input mode for the driver controller connected to each ID.
It is set to "IO" before shipment and input mode can be set for each ID.

Input Mode
IO
Simple
Half
Full

6. Setup tool D-STEP

About this chapter

This chapter describes the setup tool D-STEP.

Only TNU related information are described for functions, so please refer to the separate instruction manual of D-STEP for details.



This section describes the precautions on use of this product.

1. Introduction	6-2
1-1 Standard precautions	6-2
1-2 Saving programs and parameters (Important)	6-2



This section describes the overview of the product.

2. Product overview	6-3
2-1 Product configuration	6-3
2-2 Application of this manual	6-3
2-3 Configuration of required devices	6-3
2-4 User support	6-4



This section describes the operation method of the product.

3. Operation method	6-5
3-1 Connect start screen	6-5
3-2 Net device list setting screen	6-6
3-3 Parameter setting screen	6-7
3-4 Alarm history display screen	6-10
3-5 Setting before communication with driver controller (Important)	6-10
3-6 Offline edit screen selection	6-11
3-7 Offline net device list setting screen	6-11
3-8 Offline parameter setting screen	6-12

1. Introduction

- Thank you for purchasing the setup tool D-STEP.
- This manual describes the correct methods for using, installing, and operating the PC setup tool D-STEP.
- Carefully read and understand this manual before using the product to safely and correctly handle the product.
- Be sure to keep this manual after reading it so that you can refer to it when needed.
- Please visit THK technical support website (user registration is required) to check the latest manual. <URL: <https://tech.thk.com/>>
- Please ensure this document is provided to the end users.
- This document describes only information related to TNU of D-STEP. For details of D-STEP, refer to the instruction manual of D-STEP.

1-1

Standard precautions

- Duplication or reproduction of the whole or part of this manual without permission is prohibited.
- Please note that the contents of this manual is subject to change without prior notice.
- We have made all possible efforts to make the content of this manual accurate. However, if you find any mistake or uncertainty in this manual, please contact us.
- Some screen display and illustration in this manual may differ from actual products.
- If descriptions in this manual differ from the actual operation of the product, the actual operation should be treated as correct, and THK shall not be responsible for matching the actual operation with the description.
- Note that THK shall not be liable for any result incurred by applying the product and this manual, regardless of the reason.
- Windows XP, Vista, and 7 are the trademarks of Microsoft Corporation in the United States.
- When changing TNU setting, use the latest version above D-STEP Ver 1.20.

1-2

Saving programs and parameters (Important)

- Please save programs and parameters of the driver controller in preparation for possible loss by failures or operation errors and for fast recovery on the product replacement.
- To save the data, use this software to execute "Save" for "File" on the "PROGRAM" and "Parameter" screens.

For more information, see the instruction manual of the D-STEP.

2-1 Product configuration

- Product model number: D-STEP
(You can download this free program from the electrical actuator site: <https://tech.thk.com/>)
- To use this product, install the PC setup tool D-STEP on your PC, and use the PC communication cable (sold separately, the model number: CBL-COM-03) to connect to TNU when RS-485 port is provided on your PC.
- When your PC does not have RS-485 port, connect the connection cable to the USB port via the included conversion cable.
- Parameter setting for TNU, program input and parameter setting for the driver controller, various monitors of the driver controller provided by this software enables efficient adjustment, program creation and operation check through combining with actuator.

2-2 Application of this manual

- The contents of this manual is for setup tool D-STEP.
- The screens shown in this manual are the examples when the product is used on Windows XP. The screens for other Windows versions are slightly varied but basically the same.

2-3 Configuration of required devices

2-3-1 PC

- 32 bit OS: Japanese version Microsoft Windows XP SP-3, Vista, 7
English version, Chinese version
64 bit OS: Japanese version Microsoft Windows XP SP-3, Vista, 7
English version, Chinese version
This product does not guarantee operations on Windows Emulator.
- The hardware specifications that allow adequate performance of each Microsoft Windows version
- This program occupies about 200 MB of HDD capacity.
- RS-485 port (D-sub 9 pin). Make sure to check the COM port sequence beforehand.
When there is no RS-485 port, connect to the USB port via the conversion cable.
- USB port (when there is no RS-485 port). Using the included conversion cable with the connection cable enables communication with the PC.
Check the COM port sequence when the cable is connected to the USB port beforehand.
- A display unit that can display 1024 x 768 pixels (XGA) or more, and 32 bit color.

2-3-2 PC communication cable

- To connect your PC to TNU, you need to prepare the dedicated communication cable (model number: CBL-COM-03).
- When your PC does not have RS-485 port, connect the connection cable to the USB port using the included conversion cable.

2-4

User support

- For any question regarding this product and this manual, please contact us.
The contact information is described on the back cover.
- For inquiry, please provide the information provided on affixed label to the product.
- We do not provide support for any third-party product including your PC and peripheral device, etc. Please check the support information of the respective products or contact the PC or peripheral device manufacturers.

- This document describes only information related to TNU of D-STEP. For details of D-STEP, refer to the instruction manual of D-STEP.
- Network communication takes the priority in the D-STEP acquisition screens (PROGRAM and Monitor screens), so screen refresh may be delayed. The waveform of acquisition screen (logging) cannot be used.

3-1 Connect start screen

- (1) Connection button: Search for devices connected to the PC. If TNU is connected, TNU button shown as (2) will be valid.
- (2) TNU connection button: Opens the parameter setting screen of TNU.
- (3) Offline Edit button: Opens the offline edit screen.



3-2 Net device list setting screen

Pressing TNU connection button described in **3-1 Connect Start screen (-> P.6-5)** will open TNU setting screen.

- (1) Set the devices connected to each ID.
- (2) Read button: Reads the net device list stored in TNU into the D-STEP.
- (3) Write button: Write the net device list set by D-STEP into TNU.

In addition to setting Device connected to each ID, Input Mode (I/O, Simple, Half, Full) can be selected.

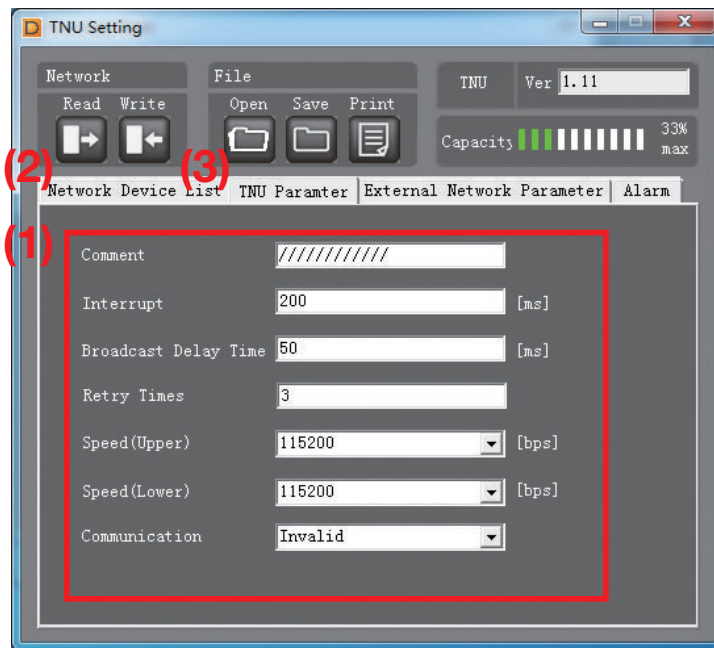
For Device and Input Mode, see P.5-8.

The screenshot shows the 'TNU Setting' window. At the top right, a box labeled 'TNU: Software version is displayed.' points to the 'TNU Ver 1.11' field. Below it, a 'Capacity' gauge is shown at 33% max, with a callout box stating 'Connection capacity: The usage capacity of the input mode set can be confirmed with the gauge.' The main area contains a table with columns for 'Device' and 'Input Mode' for IDs 0 through F. A red box labeled '(1)' highlights the entire table area. A blue box labeled '(2)' highlights the 'Read' button, and a green box labeled '(3)' highlights the 'Write' button. At the bottom, two callout boxes explain 'Device: Designates the type of driver controller connected to each ID.' and 'Input Mode: Sets the operation mode of the driver controller.'

ID	Device	Input Mode	ID	Device	Input Mode
ID:0	TLC	Half Value	ID:8	Unlink	Simple Value
ID:1	TLC	Full Value	ID:9	Unlink	Simple Value
ID:2	THC	Full Value	ID:A	Unlink	Simple Value
ID:3	TSC	Simple Value	ID:B	Unlink	Simple Value
ID:4	Unlink	I/O Simple Value	ID:C	Unlink	Simple Value
ID:5	Unlink	Half Value	ID:D	Unlink	Simple Value
ID:6	Unlink	Full Value	ID:E	Unlink	Simple Value
ID:7	Unlink	Simple Value	ID:F	Unlink	Simple Value

3-3 Parameter setting screen

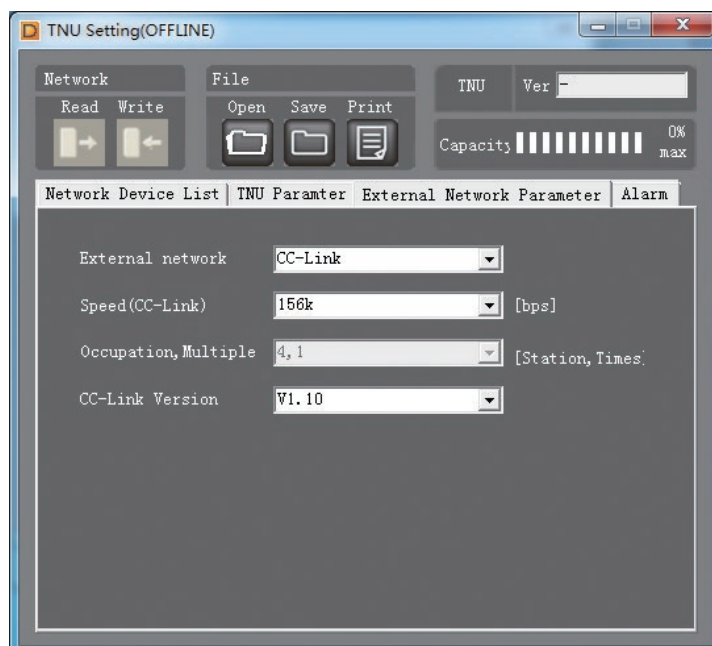
- TNU parameters
 - (1) Setting of each parameter is allowed.
 - * Setting of external network type cannot be modified.
 - (2) Read button: Reads the parameters stored in TNU into the PC.
 - (3) Write button: Write the parameters set by D-STEP into TNU.



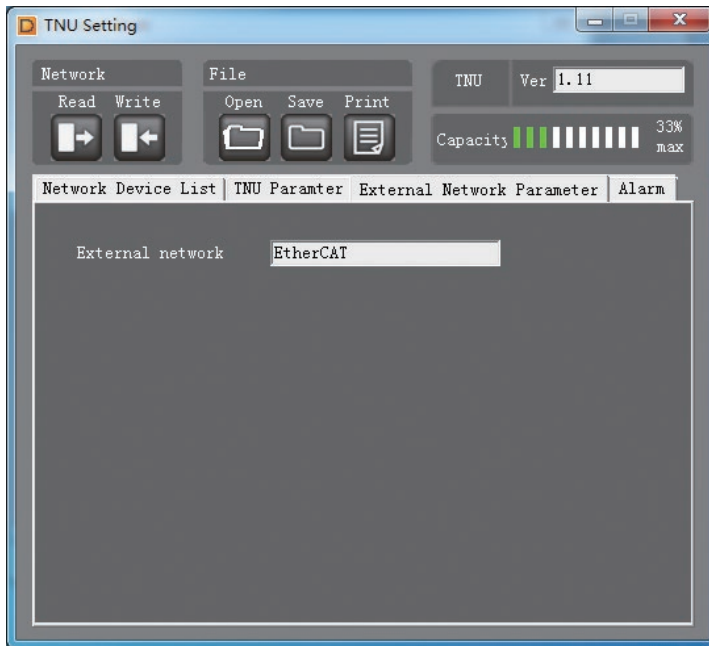
- External network

Screen switches by type of external network.

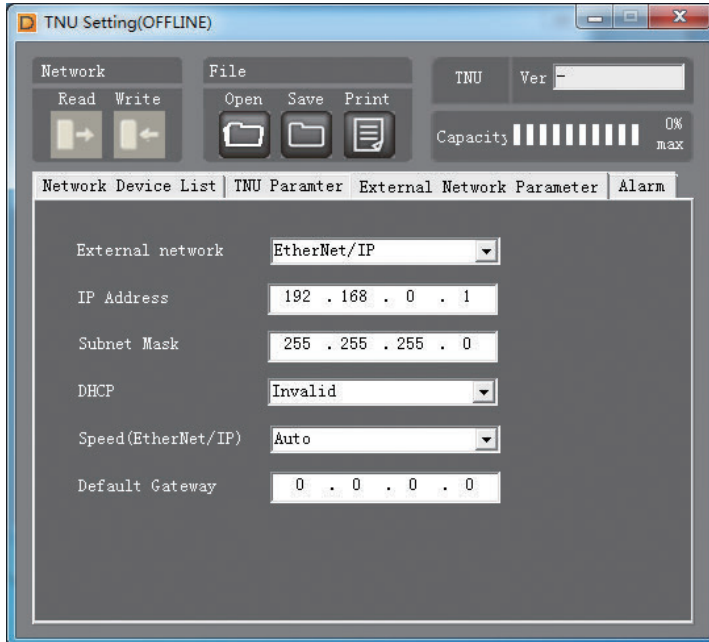
 - CC-Link



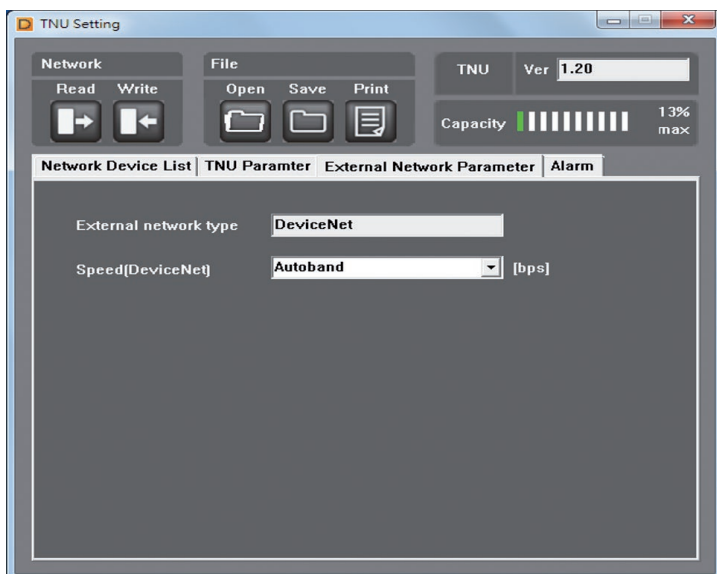
- EtherCAT



- EtherNet/IP



- DeviceNet

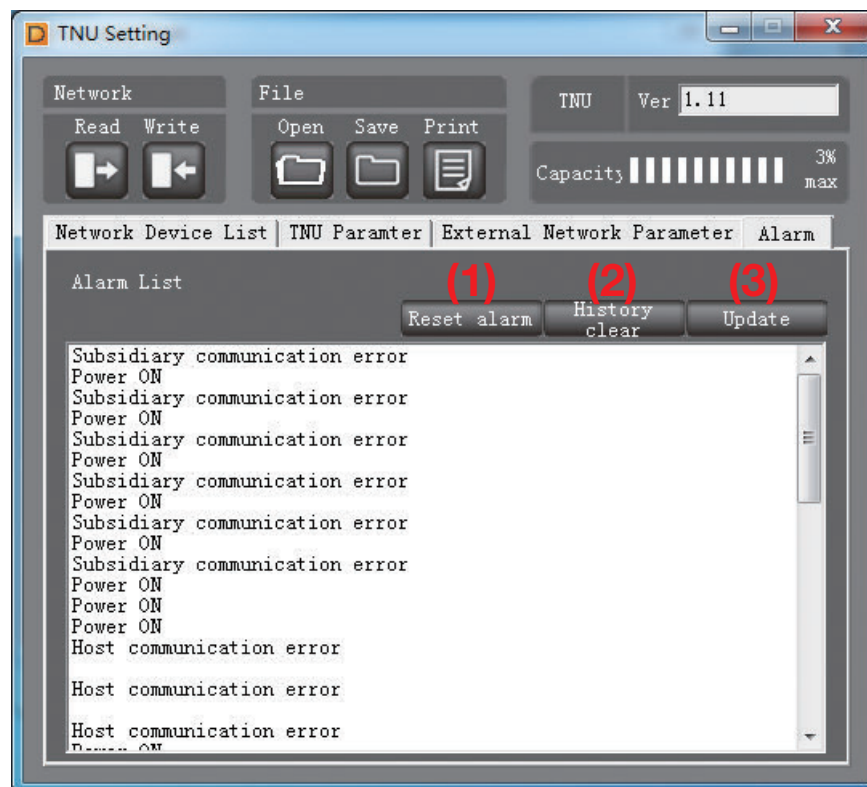


3-4 Alarm history display screen

- (1) Reset alarm : Reset the generated alarm.
- (2) History clear : Deletes the alarm history from TNU memory.
- (3) Update : Loads the alarm history from TNU memory to D-STEP.

For alarm contents, see the alarm list (-> P.8-2).

The alarm history saves 50 past alarms and power ON information.



3-5 Setting before communication with driver controller (Important)

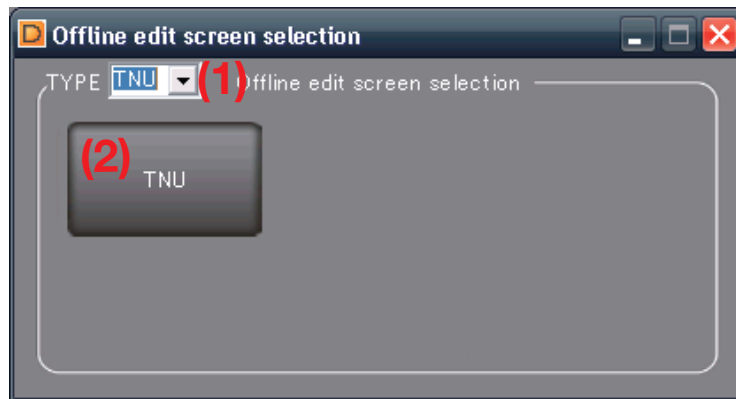
Important

- From D-STEP, be sure to set the parameter No.48 TDO enable function to "Invalid" before performing the program edit and operation command of each driver controller.

If it keeps "Valid", communication cannot be established. In addition, return back to "Valid" to do it from TDO.

3-6 Offline edit screen selection

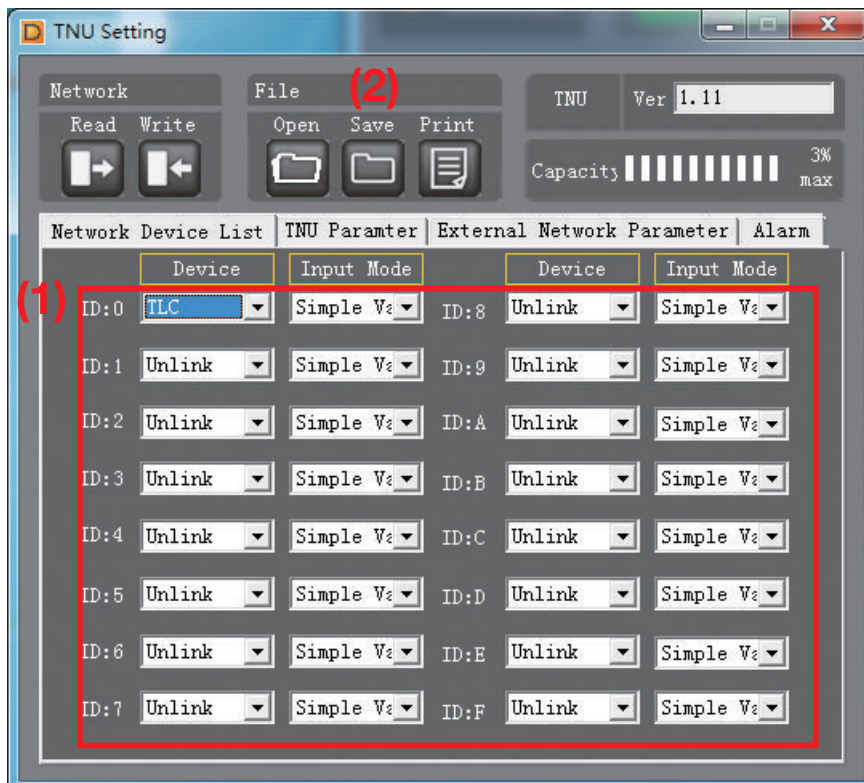
- (1) TYPE: Selects TYPE of the driver controller and network unit to be edit.
- (2) Network unit selection: Select TNU.



3-7 Offline net device list setting screen

- (1) Set the devices connected to each ID.
- (2) File: You can open, save and print the settings.

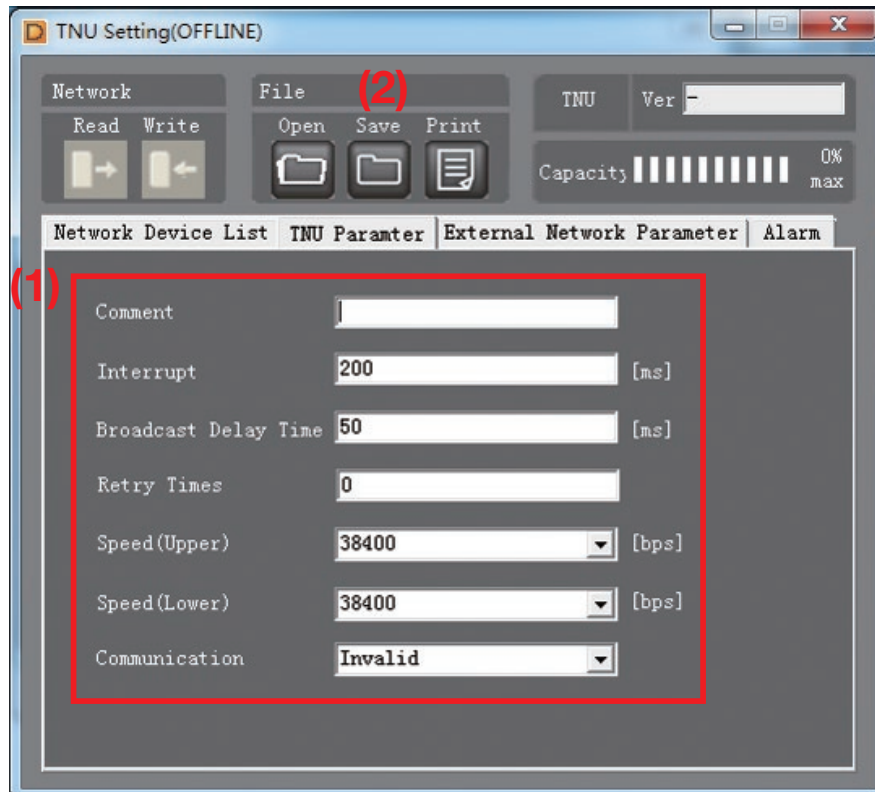
Offline net device list setting screen



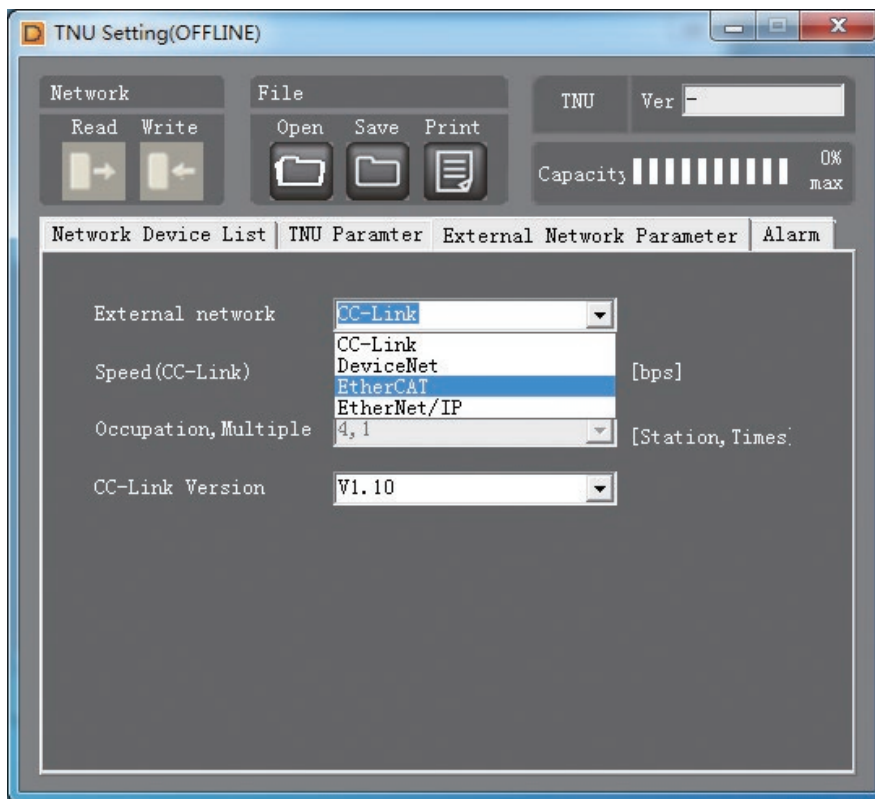
3-8 Offline parameter setting screen

- (1) Setting of each parameter is allowed.
 - * Setting of external network type cannot be modified online.
- (2) File: You can open, save and print the settings.

Offline TNU parameter setting screen



Offline external network parameter setting screen



7. Digital Operator TDO

About this chapter

This chapter describes the digital operator TDO.

Only TNU related information are described for functions, so please refer to the separate instruction manual of TDO for details.



This section describes the precautions on use of this product.

1. Introduction 7-2

1-1 Standard precautions 7-2

1-2 Saving programs and parameters (Important)
..... 7-2

1-3 Limit for operation (Important)..... 7-2



This section describes the product overview.

2. Connection 7-3

2-1 Connect to TNU 7-3

2-2 Initial screen 7-3

2-3 Connect start screen 7-4

2-4 Connection failure screen 7-4

2-5 ID selection screen 7-4

1. Introduction

- Thank you for purchasing the digital operator TDO.
- This manual describes the correct methods for handling and operating the digital operator TDO, and precautions for this product.
- Carefully read and understand this manual before using the product to safely and correctly handle the product.
- Be sure to keep this manual after reading it so that you can refer to it when needed.
- Please visit THK technical support website (user registration is required) to check the latest manual. URL: <https://tech.thk.com/>
- Please ensure this document is provided to the end users.
- This document contains the information only on TNU of TDO. Before using TDO, please make sure to read the TDO Instruction Manual provided separately.
- Note that you cannot confirm/change TNU parameter settings by TDO.

1-1

Standard precautions

- Duplication or reproduction of the whole or part of this manual without permission is prohibited.
- Please note that the contents of this manual is subject to change without prior notice, due to improvements of the product or other reasons.
- We have made all possible efforts to make the content of this manual accurate. However, if you find any mistake or uncertainty in this manual, please contact us.
- Some photo, screen display, outline drawing, or illustration in this manual may differ from actual products.
- If descriptions in this manual differ from the actual operation of the product, the actual operation should be treated as correct, and THK shall not be responsible for matching the actual operation with the description.
- Note that THK shall not be liable for any result incurred by applying the product and this manual, regardless of the reason.
- Usage or operation of the product that is not described in this manual is prohibited.

1-2

Saving programs and parameters (Important)

- Please save programs and parameters in preparation for possible loss by failures or operation errors of the driver controller and for fast recovery on the product replacement.
- Use the setup tool D-STEP to save the data. Execute "Save" for "File" on the "PROGRAM" and "Parameter" screens.

1-3

Limit for operation (Important)

- You can perform "Program Edit" and "Parameter Edit" of each driver controller by TDO, but cannot edit TNU parameters. To edit TNU parameters, use the D-STEP.

2. Connection

! WARNING



Prohibited

- **While the actuator is operating, do not install or remove this product.**
Malfunction may cause damage to the devices and leading to injury.

! CAUTION



Obligatory

- **Be sure to use the supplied cable to connect with TNU, and do not fabricate or modify the cable (change the length etc.) by yourself.**

Otherwise, unexpected behavior may occur.

- **Be sure to hold the connector when disconnecting the cable.**

Unplugging the cable by forcibly pulling it may cause cable disconnection.



Prohibited


- **Do not bend or tension the cable.**

- **When inserting the round connector to CN2 of TNU, do not insert while turning around to check the mate location of concavity and convexity.**

Doing so may cause damage to the pin.

2-1

Connect to TNU

- Align the arrow of the connector with the arrow of TNU panel at CN2 of TNU before inserting.
- If you insert the plug while rotating it, the connection pins may be damaged.
- Do not detach and attach the actuator while executing program though there is no problem detaching and attaching while energizing. Wait for the termination of the program or stop the program with the  key or enable key before detaching and attaching it.
* "Execute" display flashes at the bottom row while program execution.
- It cannot be simultaneously used with D-STEP by connecting PC because it is altogether connected to the CN2 of TNU.

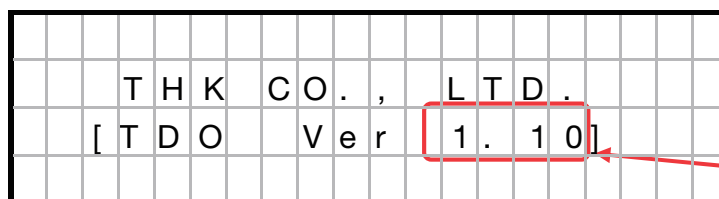
Important

- **When you use the cable by extending the length, the product may fail to operate correctly because the extended cable can be largely influenced by the exogenous noise. In addition, even when the cable is not extended, a high level of noise may prevent normal operation.**

2-2

Initial screen

- The screen immediately after connection. It starts the connection operation after this screen is displayed for three seconds.



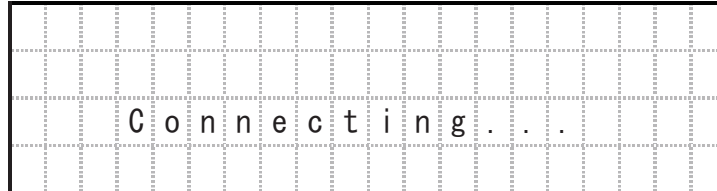
TDO Ver. Display

- TDO version can be also checked from "3 => Ver Display" of Monitor Mode "MONI".
- Use the newest version of TDO Ver 1.10 or later.

2. Connection

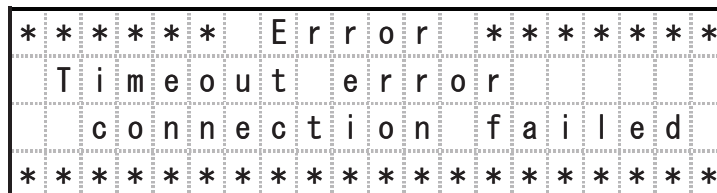
2-3 Connect start screen

- The following screen is displayed until the connection is established.



2-4 Connection failure screen

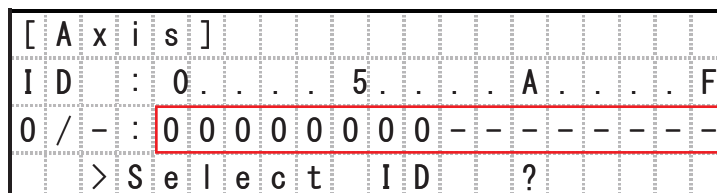
- The following screen is displayed when a connection is failed.



- Turn on the power again, and retry the connection. If the communication is still not established, there is a possibility of equipment failure or cable disconnection.

2-5 ID selection screen

- For IDs whose connection is confirmed, 0 is indicated. (in red frame)



- When selecting the ID and pressing Enter key, you can connect to the driver controller with the ID number.
In addition, if you connect to a driver controller with a different ID number after the connection, press and hold the Axis button to return to the connect start screen.

8. Troubleshooting

About this chapter

This chapter describes the causes and counter measures when an alarm is displayed or other failure occurs on TNU.



This section describes the alarm lists.

1. Alarm lists 8-2

1-1 Alarm lists 8-2



This section describes causes and handling of alarms.

2. Causes and counter measures of alarms 8-3

2-1 Causes and counter measures of alarms 8-3



This section describes other troubles and handling.

3. Other troubles 8-5

3-1 D-STEP cannot detect the driver controller ... 8-5

3-2 The driver controller does not operate even with the lower-level communication authorization switch ON..... 8-6

3-3 During DVC pressing operation, position data abnormality occurs 8-6

3-4 Driver controller input signal is slow 8-6

3-5 Even with driver controller input signal MANU set to ON, operation from D-STEP, TDO is not possible8-6

1-1

Alarm lists

- Alarm functions of TNU are as follows:
- The method to check the alarm is described in **3-4 Alarm history display screen (-> P.6-10)**.

No.	Alarm name	Content	STAT LED
1	Net device list collapse	A value out of the setting range is contained in the net device list upon start-up.	
2	Device error	TNU is out of order.	
3	Rotary SW setup error	After the start-up, the rotary SW was changed.	
4	Upper-level communication error*	Timeout or communication error was detected in the upper-level communication.	
5	TACnet communication error (Lower-level communication error)	Timeout or communication error were detected in TACnet communication.	

: Red flashing

* On the D-STEP screen, CC-Link, EtherCAT, EtherNet/IP or DeviceNet communication error and TACnet communication error are indicated as, respectively, upper-level communication error and lower-level communication error.

2-1

Causes and counter measures of alarms

No.	Alarm name	Generation status	Causes	Counter measures
1	Net device list collapse	While energizing	Data in TNU flash rom were corrupted	Replace TNU with new one
2	Device error	While energizing	TNU is out of order	Replace TNU with new one
3	Rotary SW setup error	While energizing	After the start-up, the rotary SW value was changed	Restore the rotary SW value to a normal state and turn on the power again
4	Upper-level communication error	In communication	Inconsistency between master and TNU external network parameter settings.	Match parameter settings.
			Cables between TNU and master are disconnected or misconnected.	Replace the cables or connect them correctly.
5	TACnet communication error (Lower-level communication error)	In communication	The CRC error was detected in the returned data	Eliminate the noise source from the set environment
			Communication data was corrupted due to noise	Eliminate the noise source from the set environment
			Cable is not properly connected	Connect the cable in proper way
			Cable is disconnected	Replace the cable with new one
			Connector is not properly connected	Connect it in proper way
			The driver controller is broken	Replace the driver controller with new one
			The driver controller is not power-up	Check if the power of the driver controller is turned on
			There is some driver controller of the duplicate ID over the network	Change to a non-duplicate ID and turn on the power of the driver controller and TNU again.
			No driver controller is connected to the ID set for the net device list.	Set the net device list in proper way. Or connect the driver controller.
			The communication speed with the driver controller is not aligned	Set the communication speed in proper way
TJU's termination resistance setting is wrong	Set the termination resistance in proper way			

* On the D-STEP screen, CC-Link, EtherCAT, EtherNet/IP or DeviceNet communication error and TACnet communication error are indicated as, respectively, upper-level communication error and lower-level communication error.

2. Causes and counter measures of alarms

Driver controller alarm list

When a driver controller alarm activates, an alarm code is output to PO0 to PO5.

●: ON ○: OFF

No.	Alarm name	PO0	PO1	PO2	PO3	PO4	PO5
1	Motor overvoltage	●	○	○	○	○	○
2	Control overvoltage	○	●	○	○	○	○
3	Control low-voltage	●	●	○	○	○	○
4	Motor supply voltage drop	○	○	●	○	○	○
5	Serial communication error	●	○	●	○	○	○
11	Parameter error	●	●	○	●	○	○
21	Move comm. at SV OFF	●	○	●	○	●	○
22	Move comm. before ORG	○	●	●	○	●	○
23	ORG time out	●	●	●	○	●	○
24	Writing error on move	○	○	○	●	●	○
25	Position data anomaly	●	○	○	●	●	○
31	Position comm. error	●	●	●	●	●	○
32	Excessive position deviation	○	○	○	○	○	●
33	SoftWare limit over	●	○	○	○	○	●
34	Push & hold operation range over-error	○	●	○	○	○	●
35	Encoder communication error	●	●	○	○	○	●
36	Encoder error	○	○	●	○	○	●
37	Battery error	●	○	●	○	○	●
38	Low battery	○	●	●	○	○	●
51	EEPROM error	●	●	○	○	●	●
52	Detection error	○	○	●	○	●	●
53	Motor overload	●	○	●	○	●	●
54	Servo error	○	●	●	○	●	●
55	Overheat in driver controller	●	●	●	○	●	●
56	Electronic thermal error	○	○	○	●	●	●
57	Motor overcurrent	●	○	○	●	●	●
58	Abnormal operation	○	●	○	●	●	●
59	System alarm	●	●	○	●	●	●
61	Regenerative overload	●	○	●	●	●	●
62	Fault in IPM module	●	○	●	●	●	●
63	Emergency stop	●	●	●	●	●	●

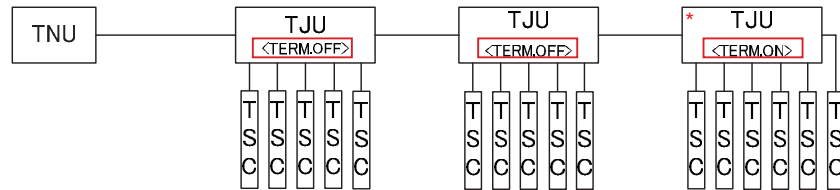
3. Other troubles

3-1

D-STEP cannot detect the driver controller

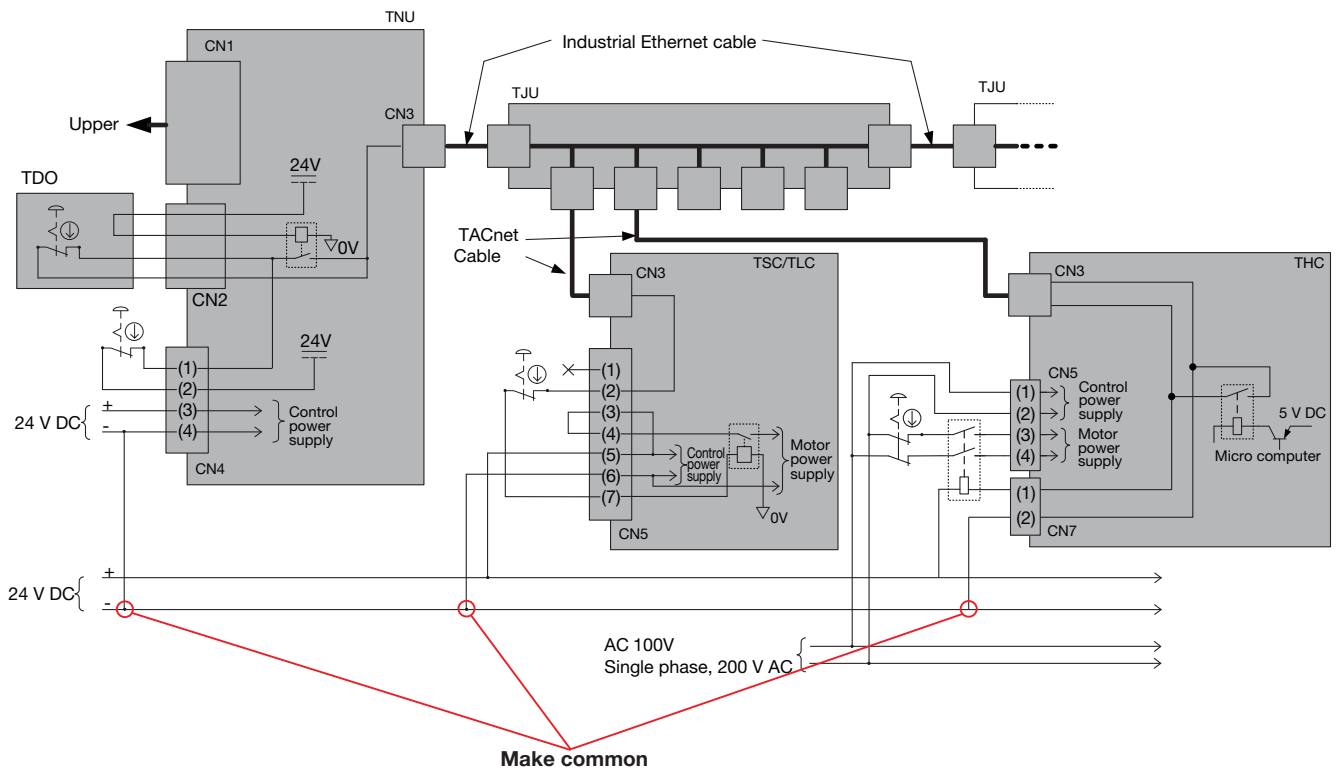
- If D-STEP cannot detect the driver controller, or if the alarm goes off when the driver controller is connected to TNU but not for the driver controller alone, confirm the following.

1) Properly set the termination resistance of the branch unit TJU (TERM.ON/OFF).



* The last TJU should have the termination resistance ON.

2) Make 0 V of TNU, TSC and TLC common.



3. Other troubles

3-2

The driver controller does not operate even with the lower-level communication authorization switch ON

- (1) The driver controller and TNU are not connected. Or the power is not on.
-> Connect correctly.
- (2) TNU's termination resistance setting is wrong.
-> Set correctly. **(-> P.2-8)**
- (3) The driver controller settings are incorrect.
-> Check the ID and communication speed settings.
- (4) The TNU mode change switch is set to PC/TDO mode.
-> Set the mode change switch to I/O mode.
- (5) The net device list setting is different from the actual connection.
-> Check that the driver controller model and input mode are consistent with the net device list.
- (6) The driver controller switch is set to MANU.
-> Switch it to AUTO.
- (7) The TNU power was turned ON again in remote MANUAL status.
-> Turn remote MANUAL from ON to OFF. Or move the driver controller toggle switch from AUTO to MANU to AUTO.
- (8) Inconsistency between upper-level master and data area and TNU data area settings.
-> Check the upper-level master and TNU settings.

3-3

During DVC pressing operation, position data abnormality occurs

When the DVC switch is left ON during pressing operation, because the driver controller receives a command that reverses the motor operating direction immediately after pressing completion, the position data error alarm activates. During pressing operation, use with the DVC switch OFF.

3-4

Driver controller input signal is slow

On the net device list, unconnected IDs are set to Any.

3-5

Even with driver controller input signal MANU set to ON, operation from D-STEP, TDO is not possible

TNU mode is IO mode.

Set the mode switch to the CN2 side for PC/TDO mode, or use the remote manual function.

9. Maintenance and Warranty

About this chapter

This chapter describes the maintenance, repair and replacement procedures of this product, and warranty.



Perform correct maintenance works regularly as it could minimize the incidence of troubles.

1. Maintenance and inspection

.....	9-2
1-1 Periodical inspection	9-2
1-2 Standard of durability of consumables for TNU and TJU	9-2



This chapter describes the warranty of this product.

2. Product warranty 9-3

2-1 Free warranty period	9-3
2-2 Usage conditions (Range)	9-3
2-3 Warranty scope	9-3
2-4 Exclusion of warranty liability	9-4
2-5 Delivery conditions	9-4

1. Maintenance and inspection

! WARNING



Obligatory

- Before conducting maintenance and inspection works, be sure to stop the machine and shut off the power supply. Take security measures like locking, etc. to ensure any unauthorized person cannot turn the power ON.

Otherwise, injury caused by unexpected behavior may occur.

1-1 Periodical inspection

1-1-1 Periodical inspection of TNU and TJU

Perform the following inspection works once every 6 to 12 months.

Inspection items	Inspection Procedures	Actions
Cleaning of the body unit	There shall be no dust, particles or oil content adhered on the unit.	Clean it with cloth or the like.
Loose connector/screw	There shall be no loose connectors or fixing screws.	Securely re-connect or re-tighten.
Abnormality of unit parts	There should be no discoloration, damage or disconnection due to heating.	Replace with new one.

1-2 Standard of durability of consumables for TNU and TJU

1-2-1 Standard of durability of consumables for TNU

- Parts listed in the table below are subject to aged deterioration. The periods indicated in the durability are only for reference.

Consumables	Location	Durability
Contact relay	TDO connection circuit (with TDO connected)	100,000 cycles

Important

- We do not provide repair service for TNU and TJU out of the warranty period. Please prepare a spare TNU and TJU in advance or purchase new ones.

2. Product warranty

Described in this section are the details of the warranty applicable to the product you purchased.

2-1 Free warranty period

The warranty period shall be 12 months from the product delivery date or 18 months from the date of shipping (based on the manufacture date), whichever is earlier.

If the free warranty period has been expired at the time of receiving notice of any defect, repair works will be charged.

2-2 Usage conditions (Range)

The normal usage conditions (range) specified in our catalogs and/or instruction manuals shall apply.

2-3 Warranty scope

2-3-1 Failure diagnosis

Please inform our Customer Support (⇒ refer to back cover) of the trouble description, content, and model and serial number indicated on the product label. Then we will perform the initial diagnosis of the product failure.

When we recognize that the failure occurred within the free warranty period set forth above and the responsibility of the cause rests on us, the warranty is applied without charge. Otherwise any repair or replacement will be charged.

The final judgment of the warranty qualification is determined when we check the product in our site.

2-3-2 Consumables and spare parts

- It is recommended to prepare spare parts for cables, network unit TNU and branch unit TJU and other peripherals.

2. Product warranty

2-3-3 Repair

We will perform free repair works or replacement for any failure occurred within the free warranty period set forth above.

However, it is our discretion whether we provide repair or replacement.

Free warranty is not applicable even within the warranty period for any of the following cases:

- Failure arising out of improper storage or handling by the customer, or software and/or hardware installed by the customer.
- Failure arising out of any alteration of our products by the customer.
- Failure arising out of any use of our products out of the usage conditions set forth in section 2-2 of this manual.
- Failure arising out of any use of the product without taking appropriate water-, oil-, and dust-proof measures.
- Lack of maintenance works specified in our instruction manual.
- Wearing caused by usage conditions.
- Wearing of consumables including cables.
- Failure arising out of any convulsion of nature such as earthquake, lightening, flood and wind damage.
- Failure arising out of any factor that is not recognized as our responsibility.

* In case of any free repair work within the free warranty period, the warranty period of the pertinent product shall still be the period set forth in section 2-1, not the period originating from the time of free repair work.

* In case of any paid repair work, the warranty period of the repaired section shall be 6 months from the repair work regardless of the warranty period of the product itself.

* Repair works are performed in our plant. Whether free or paid repair work, cost of returning the product to our site shall be customer's responsibility.

The cost of delivering the repaired or replacing product to customer's site is our responsibility in case of free warranty, or included in the repair charge in case of a paid repair service. However, the destination must be in Japan.

2-3-4 Repair period

For network unit TNU and branch unit TJU, we do not support repair services out of the warranty coverage. Please prepare a spare TNU and TJU in advance or purchase new ones.

2-4 Exclusion of warranty liability

- Regardless of whether it is within the free warranty period or not, any damage to the equipment other than our products and opportunity loss incurred by the customer due to the failure of the products are not covered by the warranty.
- We hold no responsibility for removal of the product for repair work, reinstallation after repair work and the other costs caused thereby.
- We hold no responsibility for any damage arising out of any use of the product without taking appropriate water-, oil-, and dust-proof measures.

2-5 Delivery conditions

Delivery products will be shipped by mixed cargo and passed on the car.

Unpacking, transportation, installation, on-site adjustment and commissioning after delivery are not our responsibility.

10. Technical Materials

About this chapter

This chapter summarizes the technical information including specifications and dimensional diagrams of this product. When using this product, refer to this chapter for any details you want to know.



This section describes the TNU.

1. Network unit TNU	10-2
1-1 Specifications and dimensional drawing	10-2



This section describes the TJU.

2. Branch unit TJU.....	10-3
2-1 Specifications and dimensional drawing	10-3



This section describes the connection cable.

3. Connection cable	10-4
3-1 PC communication cable	10-4
3-2 TACnet cable.....	10-4



This section describes the sample program.

4. Sample program	10-5
4-1 Broadcast sample program	10-5
4-2 CC-Link sample program	10-7

5. Memory map	10-8
5-1 Memory map.....	10-8

1. Network unit TNU

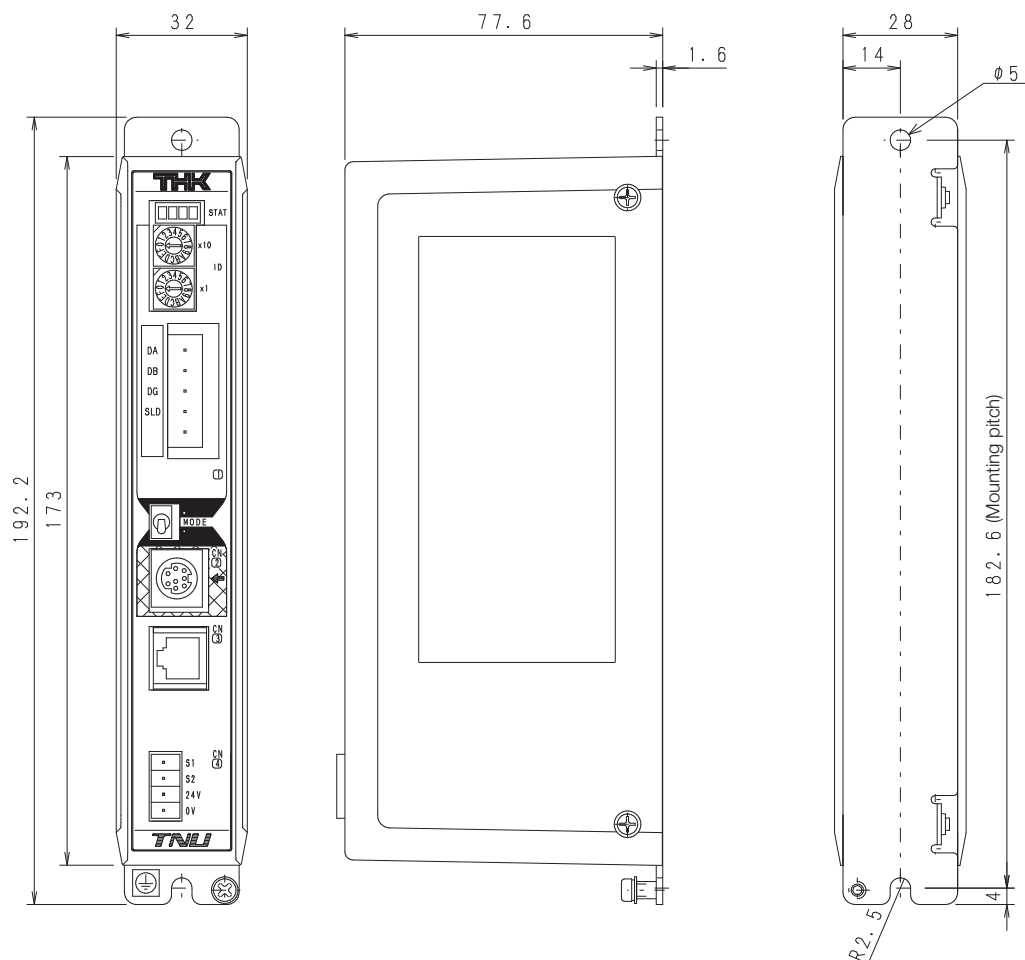
1-1

Specifications and dimensional drawing

● Specifications

Type		TNU-CC		TNU-DV	TNU-EC	TNU-EP
Field bus	Communication standard	CC-Link Ver.1.10	CC-Link Ver.2.00	DeviceNet	EtherCAT	EtherNet/IP
	Communication speed	10Mbps/5Mbps/2.5Mbps/ 625kbps/156kbps		500kbps/250kbps/ 125kbps	100M	10M/100M
	Number of occupied stations	Remote device stations 4 stations	Remote device stations 1, 2, 3, 4 stations	Number of occupied nodes: 1 Number of occupied channels: Input 128 CH, output 128 CH	-	-
Applicable controllers		TSC/TLC/THC				
THK network	Transmission channel type	RS-485				
	Communication speed [bps]	38.4k/57.6k/115.2k				
	Communication method	Half-duplex method				
	Maximum main line length [m]	20				
	Maximum number of shafts connected	16				
Input power supply		24 V DC \pm 10% max. 0.3 A				
Operating temperature/Storage temperature		0 to 55°C (no freezing)/-20 to 85°C (no freezing)				
Ambient condition		Indoor (without exposure to direct sunlight) with no corrosive gas, flammable gas, oil mist or dust particles				
Protective function		Upper-level network communication error, communication error, and system error				
Weight [g]		240 (TJU: 220)				

● Dimensions



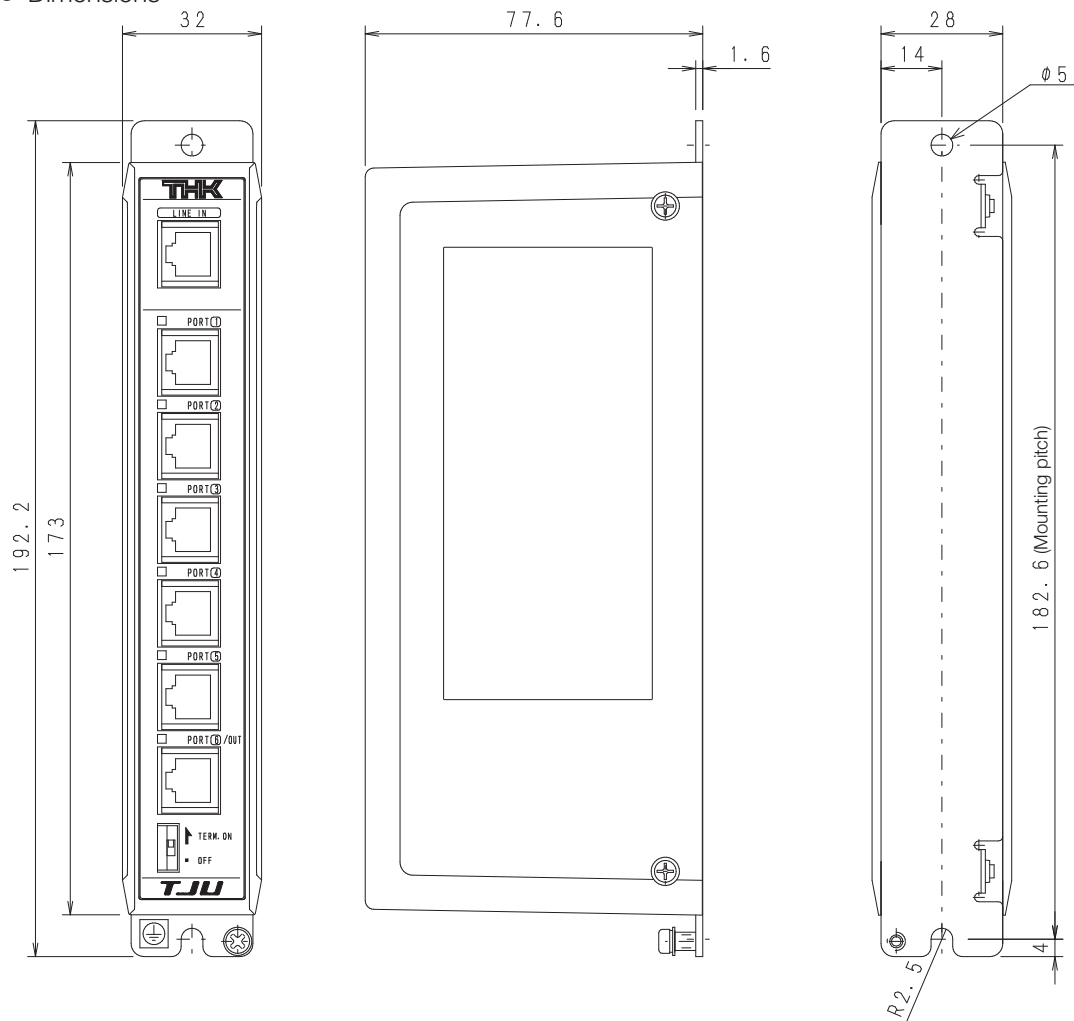
2. Branch unit TJU

2-1 Specifications and dimensional drawing

- Specifications

Models	TJU
Port count	7 (Input 1, Output 6)
Termination resistance	Built in (switchable)
Dimensions[mm]	32x192.2x77.6
Weight[g]	220

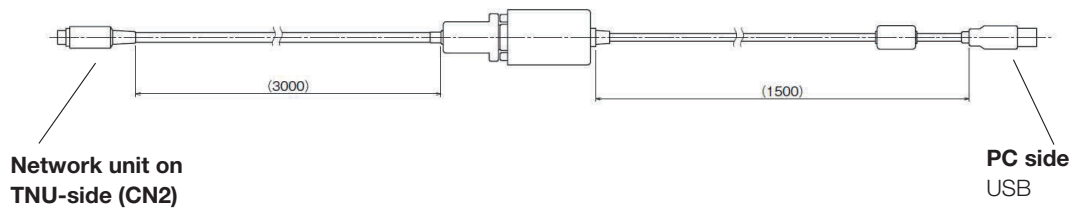
- Dimensions



3. Connection cable

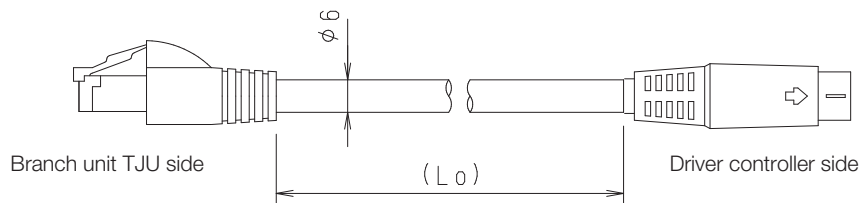
3-1 PC communication cable

- A PC communication cable for D-STEP.
Model: CBL-COM-03

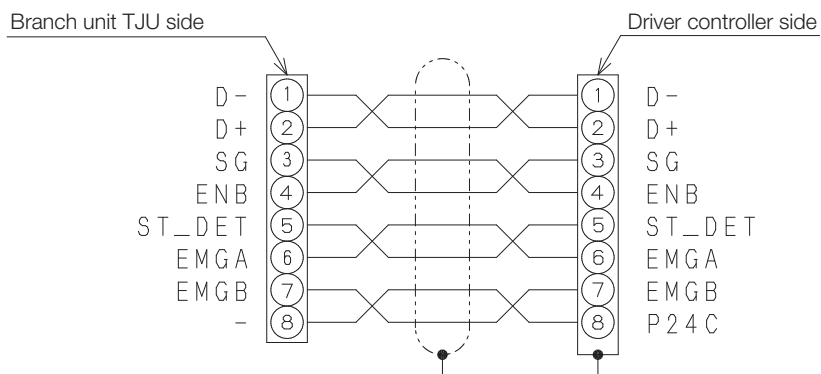


3-2 TACnet cable

- The cable is used to connect the branch unit TJU and driver controller.
Model: CBL-NW-** (01: 1 m, 03: 3 m)



Model	Lo: Length (mm)
CBL-NW-01	1 0 0 0
CBL-NW-03	3 0 0 0



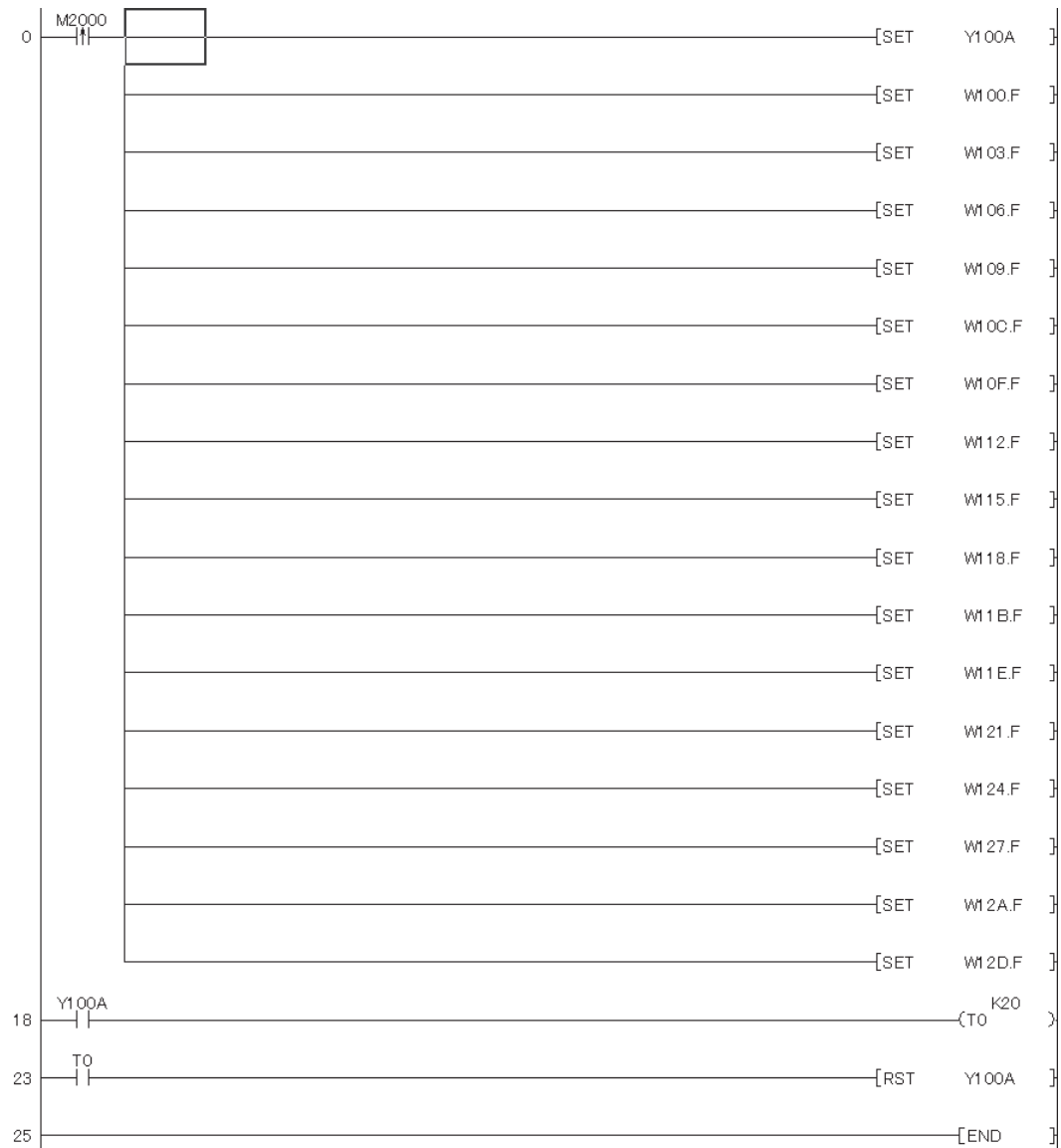
4. Sample program

4-1 Broadcast sample program

- Broadcast function

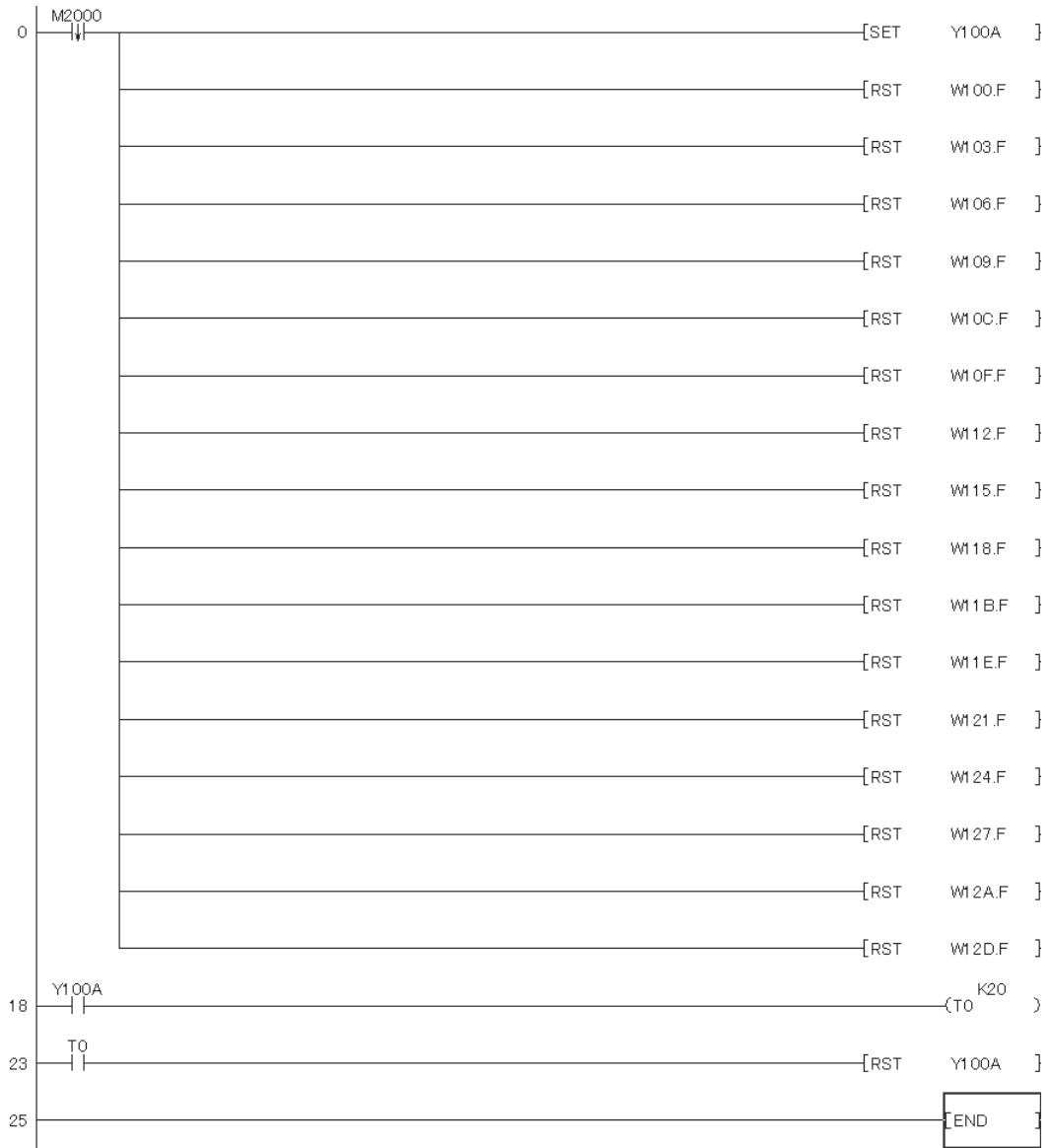
This is an example of a servo on ladder program which sets all 16 axes at once through broadcast.

The startup of internal relay M2000 works as the trigger for all axes servo on.



4. Sample program

This is an example of a servo off ladder program which sets all 16 axes at once through broadcast. The stand-down of internal relay M2000 works as the trigger for all axes servo off.



4. Sample program

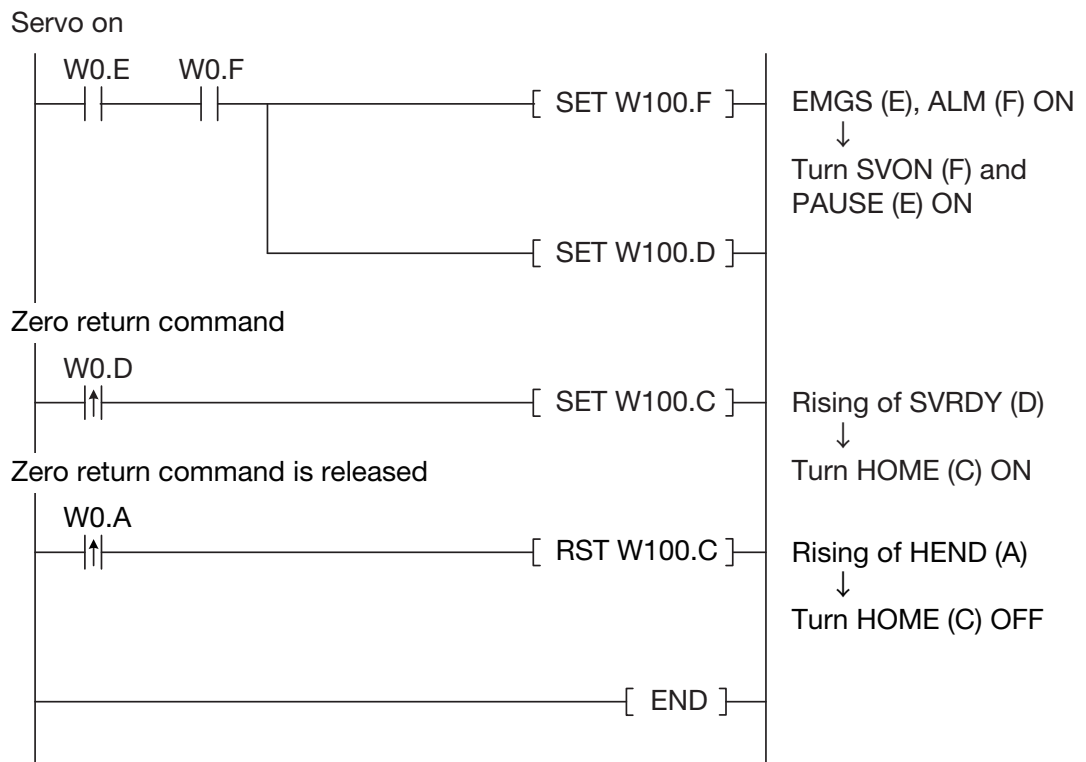
4-2 CC-Link sample program

- This section describes the sample program to operate the driver controller connected to the TNU from the upper-level PLC.

4-2-1 Procedures to driver controller operations

Configuration	Type	Manufacturer	Remark
PLC	Q02HCPU	Mitsubishi Electric Corporation	-
CC-Link master	QJ61BT11N	Mitsubishi Electric Corporation	-
Network unit (remote device)	TNU-CC	THK	Station number 1
I/O unit (remote IO)	AJ65SBTB32-BDT2	Mitsubishi Electric Corporation	Station number 5
Branch unit	TJU	THK	-
Driver controller	TSC	THK	ID=0

CC-Link device allocation information	
Remote input (RX)	X1000
Remote output (RY)	Y1000
Remote register (RW _r)	W0
Remote register (RW _w)	W100

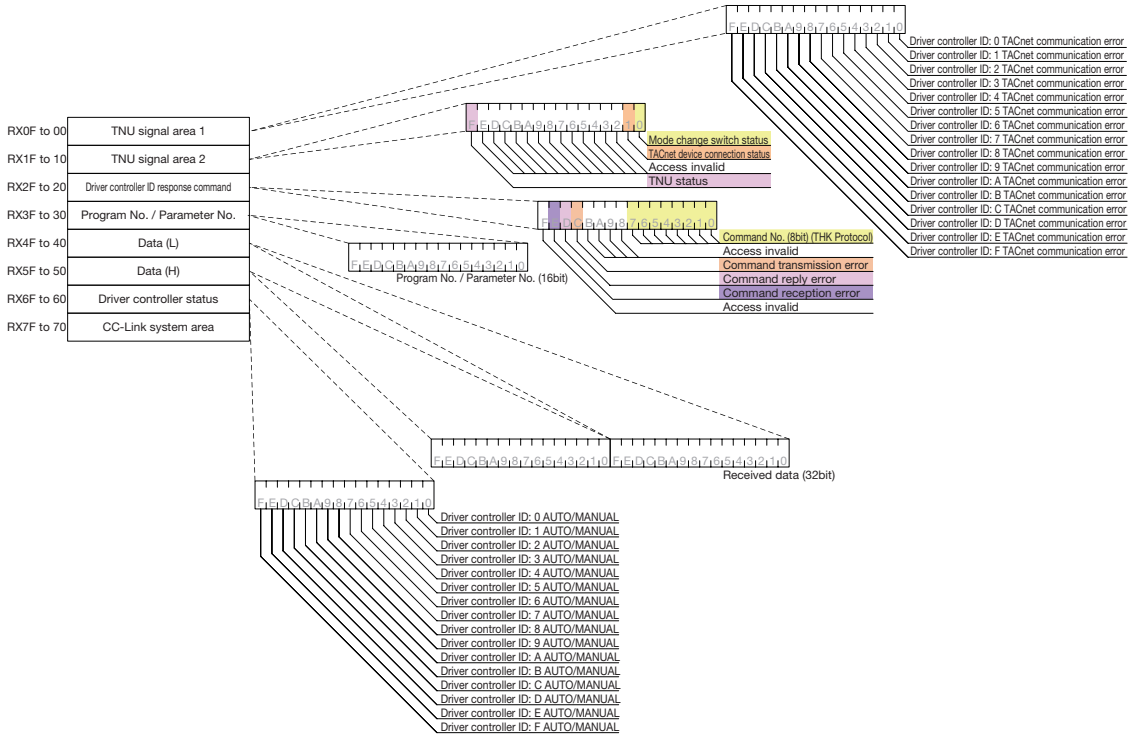


5. Memory map

5-1 Memory map

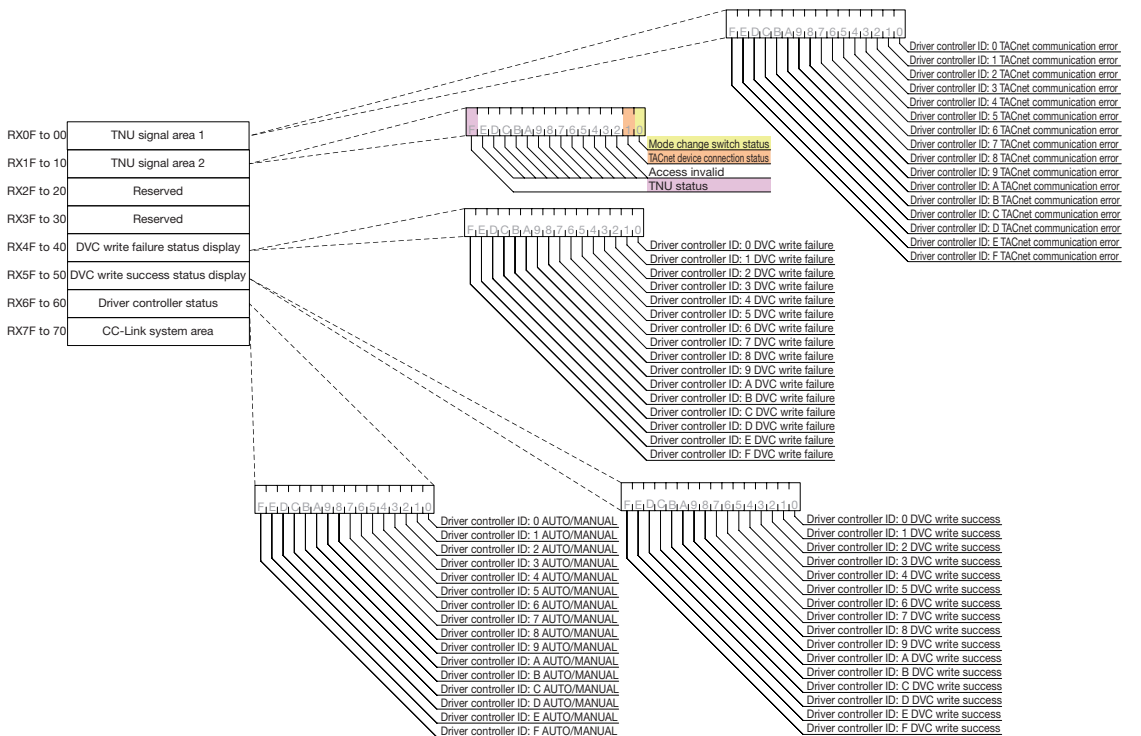
[Ver1.3 or later RX (in PC/TDO mode)]

[PC/TDO mode RX]



[Ver1.3 or later RX (in PC/TDO mode)]

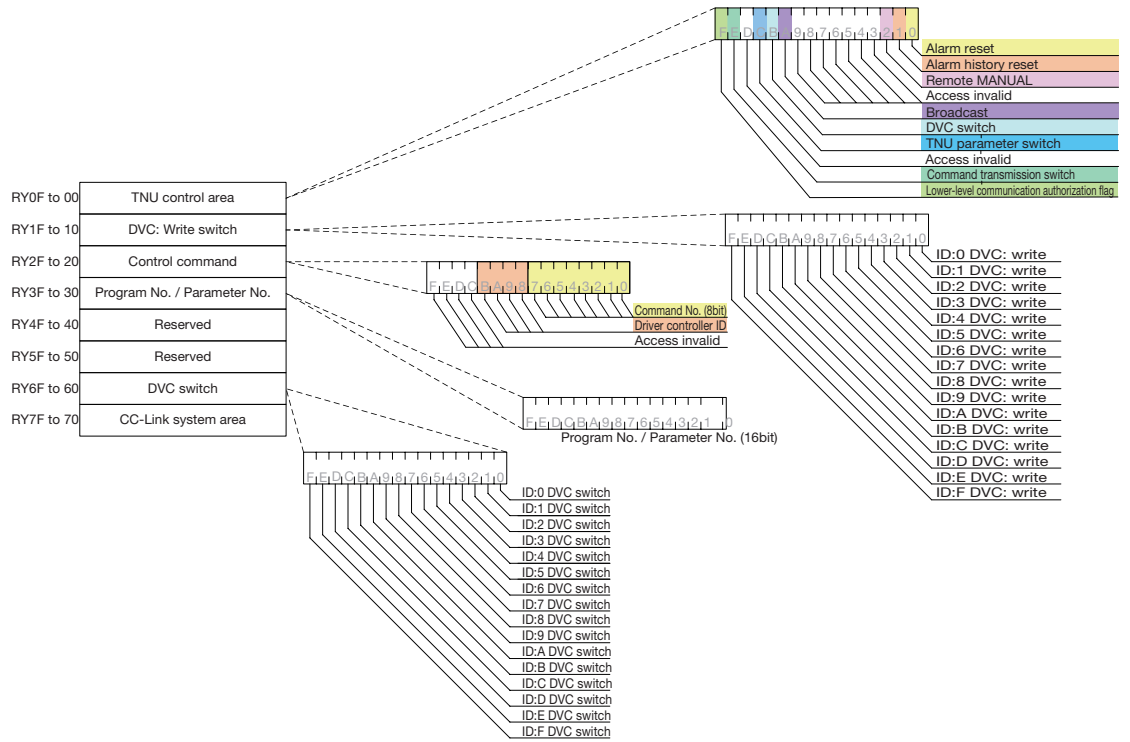
[IO mode RX]



5. Memory map

[Ver1.3 or later RY (in PC/TDO mode)]

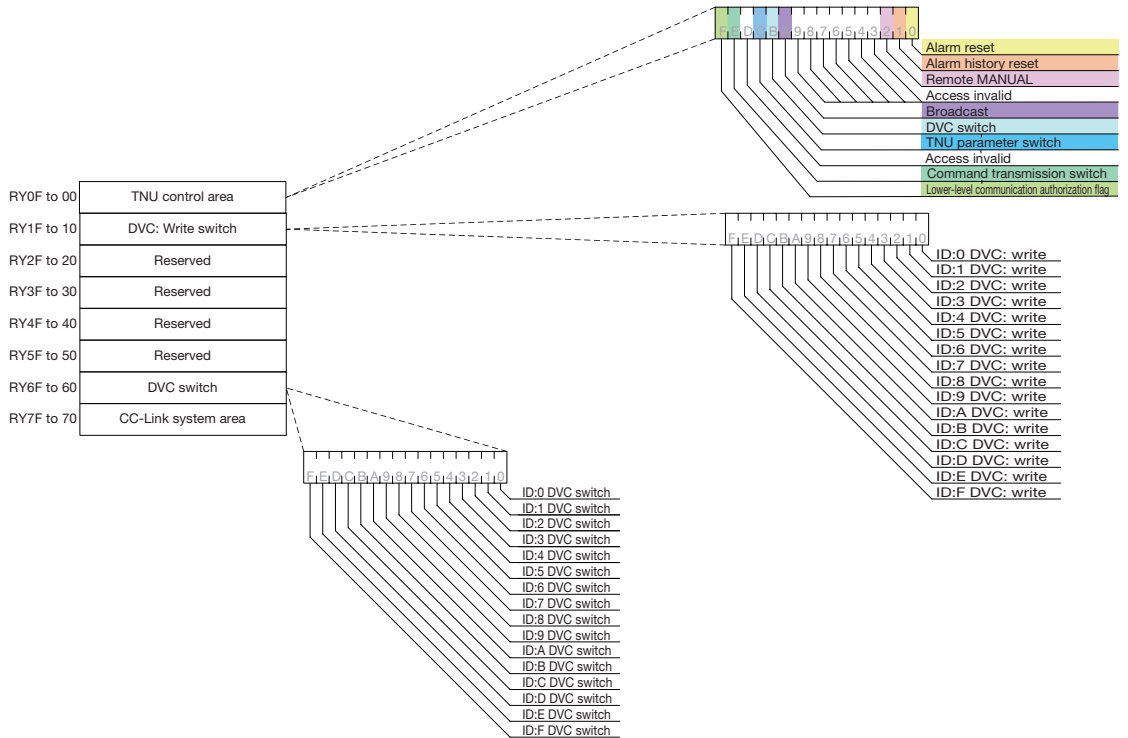
[PC/TDO mode RY]



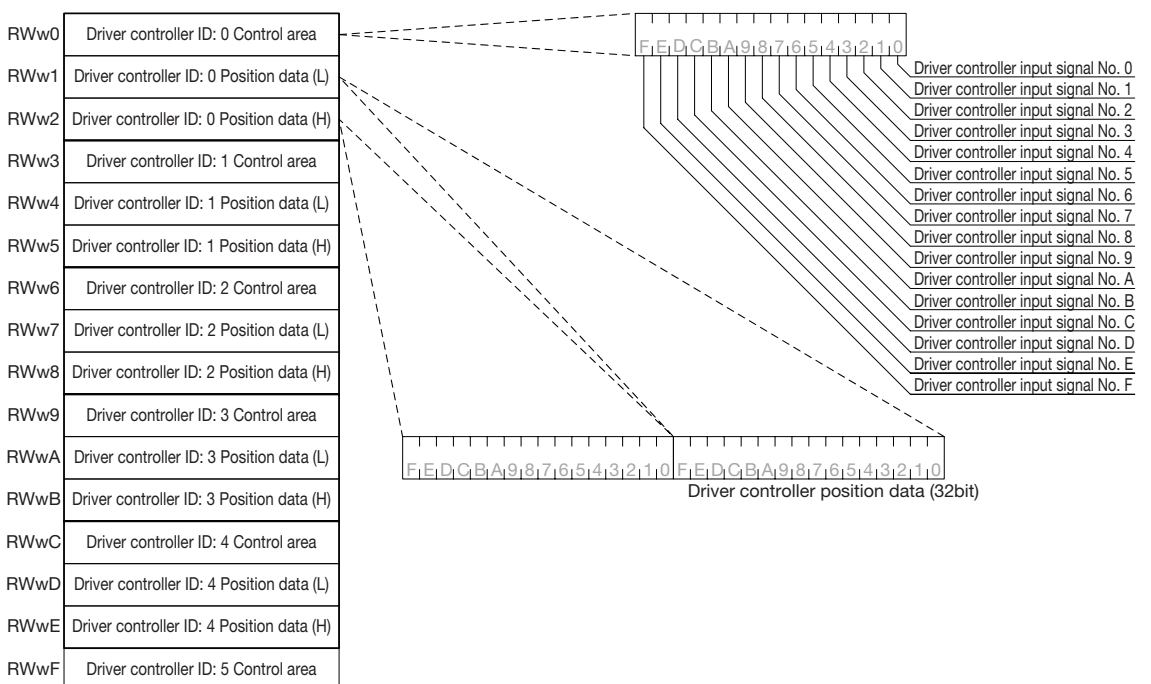
5. Memory map

[Ver1.3 or later RY (in IO mode)]

[IO mode RY]

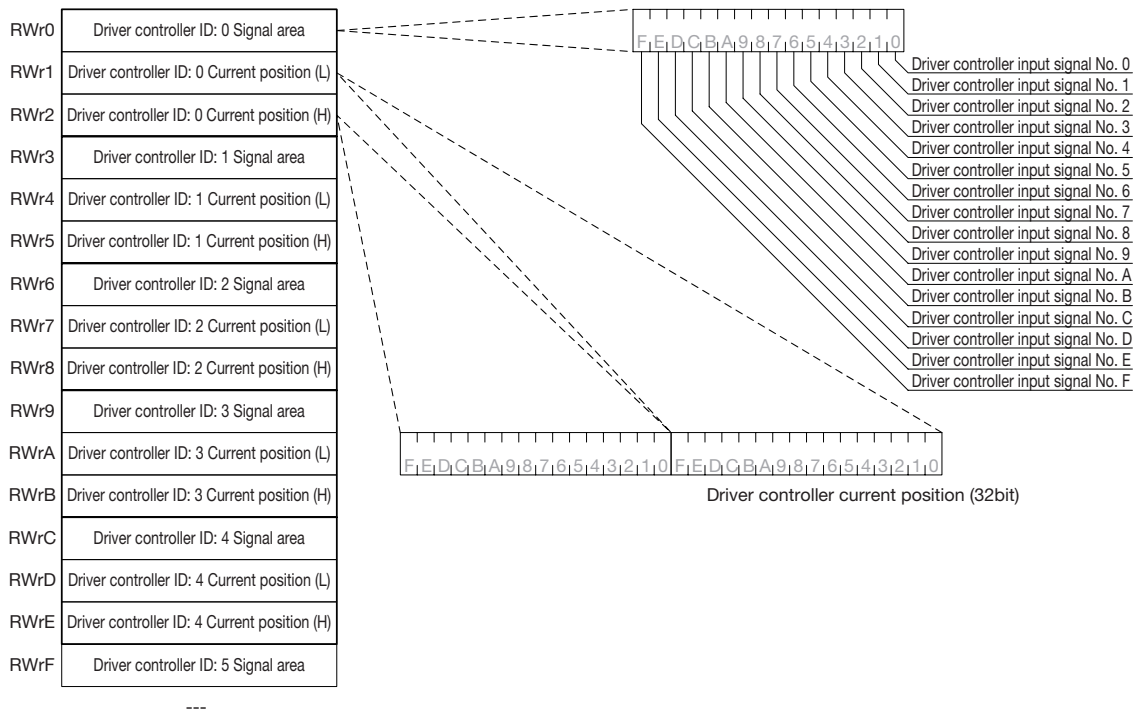


[Simple DVC RWw]

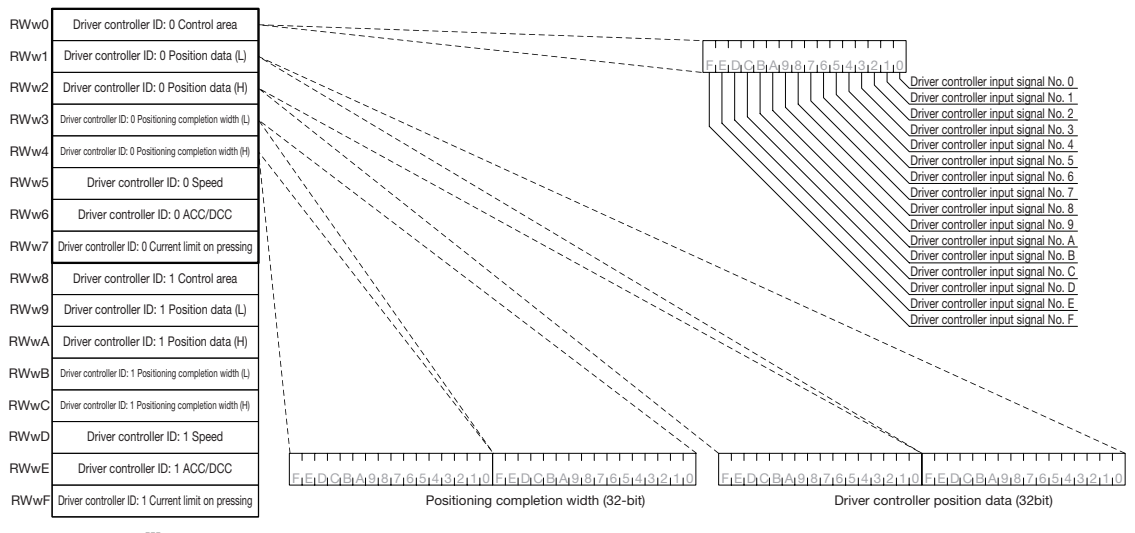


5. Memory map

[Simple DVC RWr]

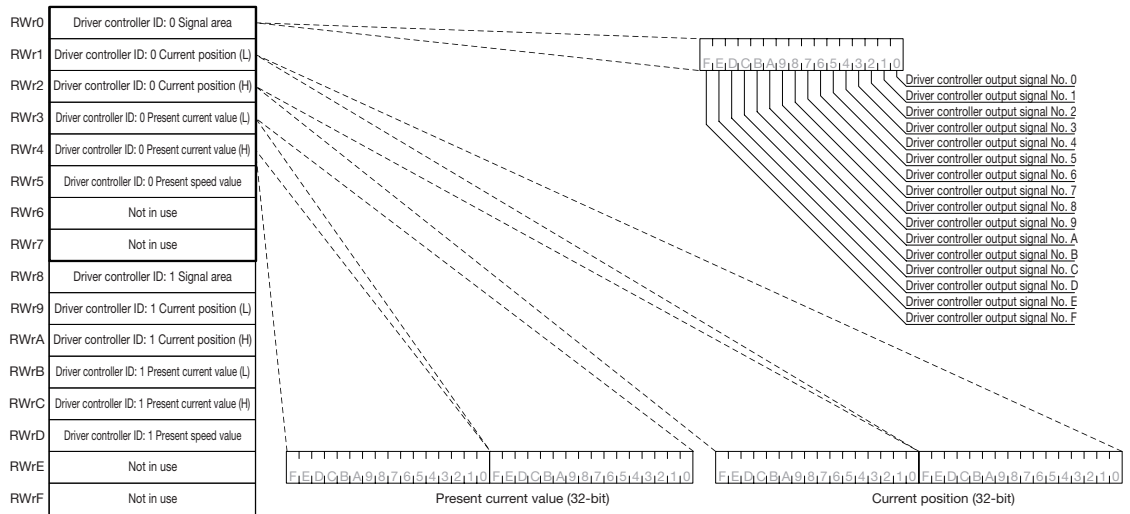


[Half DVC RWw]

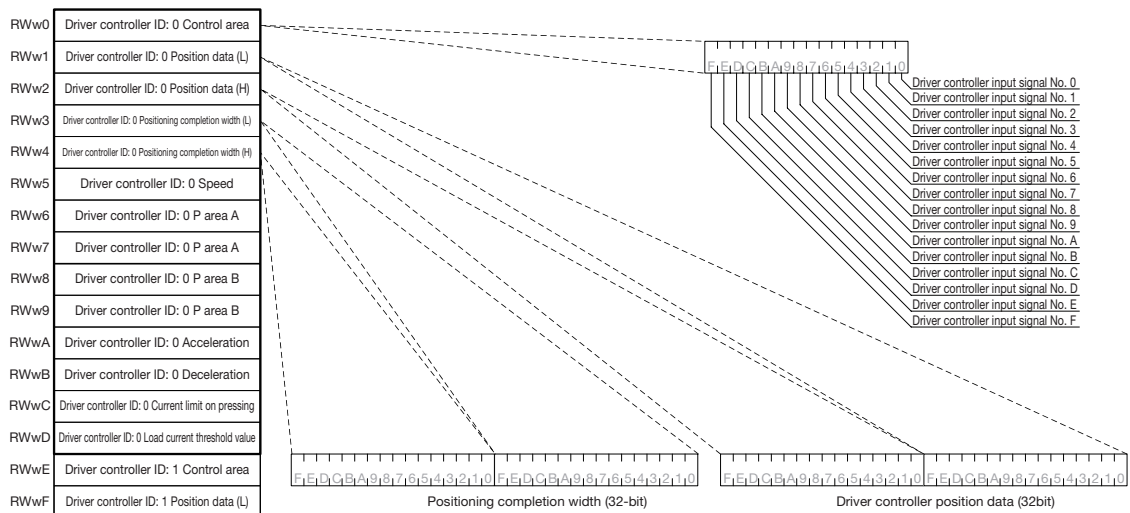


5. Memory map

[Half DVC RWr]

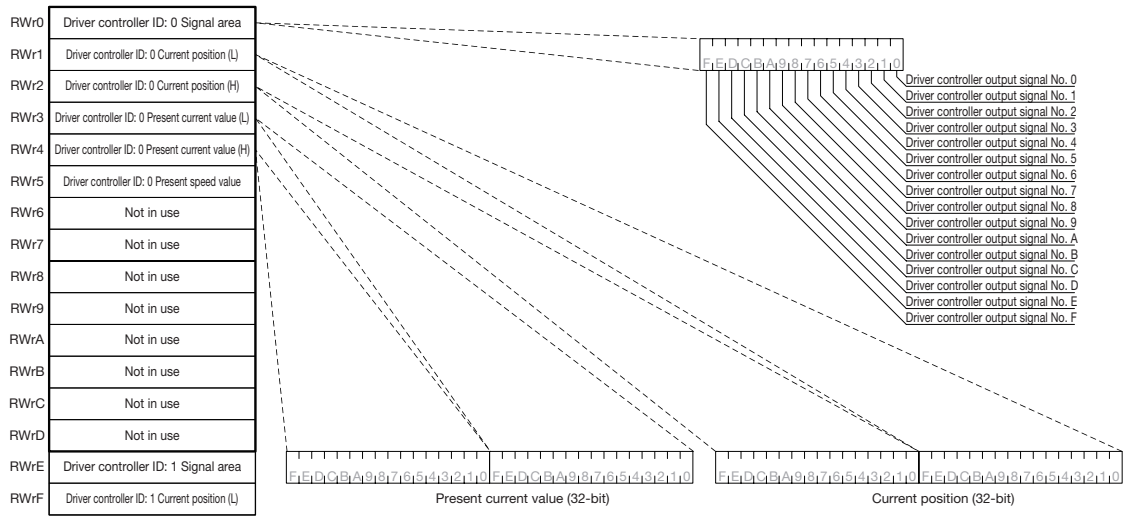


[Full DVC RWw]



5. Memory map

[Full DVC RWr]

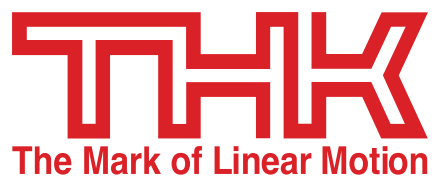


Appendix

Revision history

The instruction manual No. is described on the back cover.

Date of issue	Instruction manual No.	Details
January 2013	No.6090-1(0)E	First edition
November 2013	No.6090-2(0)E	Added the TNU-EC products
February 2014	No.6090-2(1)E	Correction of erroneous description
Jun 2014	No.6090-2(2)E	Correction of erroneous description
February 2015	No.6090-3(0)E	Added the EtherNet/IP
March 2015	No.6090-4(0)E	Added DeviceNet
April 2016	No.6090-5(0)E	Addition of functions (individual DVC function, data readout function)
April 2018	No.6090-6(0)E	Errors corrected, notes added



**THK Electric Actuator Controller Series
Network unit & Branch unit**

TNU / TJU

INSTRUCTION MANUAL