e-Front runners

MICREX-SX series

SPH

USER'S MANUAL

T-link Master Module (Type: NP1L-TL1)
T-link Interface Module (Type: NP1L-RT1)
T-link Slave Module (Type: NP1L-TS1)

FEH204c

Preface

This User's Manual explains T-link master module, T-link interface module, T-link slave module and T-link specifications of MICREX-SX series. Read this manual carefully to ensure correct operation.
When using modules or peripheral devices, be sure to read the corresponding user's manuals listed below.

<Relative manuals for the SX-Programmer Expert (D300win)>

Title	Manual No.	Contents
User's Manual Instruction, MICREX-SX series	FEH200	Explains the memory, language and system definitions of the MICREX-SX series.
User's Manual Hardware, MICREX-SX series SPH	FEH201	Explains the system configuration, the specifications and operations of modules in the MICREX-SX series.
User's Manual D300win <Reference>, MICREX-SX series	FEH254	Explains the menu and icon of D300winV2 and all of the operations of D300winV2.
User's Manual D300win <Reference>, MICREX-SX series	FEH257	Explains the menu and icon of D300winV3 and all of the operations of D300winV3.
User's Manual D300win LD/FBD Editor Operations MICREX-SX series	FEH257-1	Explains the operating instruction of the LD/FBD editor which is added to D300winV3 as new function.

<Relative manuals for the SX-Programmer Standard (Standard Loader)>

Title	Manual No.	Contents
User's Manual Instruction, MICREX-SX series	FEH588	Explains the memory, language and system definitions of the MICREX-SX series.
User's Manual Hardware, MICREX-SX series SPH	FEH201	Explains the system configuration, the specifications and operations of modules in the MICREX-SX series.
User's Manual SX-Programmer Standard <Reference>, MICREX-SX series	FEH590	Explains the menu and icon of the SX-Programmer Standard and all of the operations of the SX-Programmer Standard.

*This manual is structured to be applicable to both D300win and Standard Loader.
*In addition to the above manuals, the following Fuji Electric FA Components & Systems Co., Ltd. site offers various manuals and technical documents associated with MICREX-SX.

URL http://www.fujielectric.co.jp/fcs/eng/index.html

Notes

(1) This manual may not be reproduced or reprinted in whole or part in any form without permission.
(2) The contents of this manual or the specifications are subject to change without prior notice.
(3) This manual has been prepared carefully. However, if you have found any questions or errors, please contact us at one of the addresses listed on the back of this manual. When contacting us, please let us know the Manual No. described on the front cover of this manual.

Safety Precautions

When using this product, observe the safety precautions.
In this manual, precautions are classified into two levels according to their severities:

⚠ Warning : Failure to observe warnings may result in deaths or serious injuries.

⚠ Caution : Failure to observe cautions may result in slight or medium injuries or physical damages.

Note that precautions marked as **⚠ Caution** may also result in serial conditions, unless observed, according to the situations.
Anyway, be sure to observe warnings and cautions to use the product safely.
Important warnings are given below.

⚠ Warning
◊ Do not touch charged parts such as terminals while the power is ON. Touching such parts may result in electric shocks. ◊ Be sure to turn the power OFF before mounting or removing parts or components, wiring operations, maintenance, or inspection. Working with the power ON may cause electric shocks, malfunctions, or failures. ◊ Configure the emergency stop, interlocking, and other circuits outside the PLC. Otherwise, errors, if any, in the PLC may result in mechanical damages or accidents. ◊ The liquid (liquid crystal) on the liquid crystal display is harmful. If it has been damaged, it must not get into the mouth. If the skin or clothes are stained with it, rinse them.

Safety Precautions

⚠ Caution

◊ Do not use the product or parts found damaged or deformed when unpacking. If done, fire, malfunctions, or failures may occur.
◊ Do not give shock to the product by dropping or turning it over. If done, the product may be damaged or failures may occur.
◊ When mounting the product, follow the directions given in the User's Manual and other manuals. The product incorrectly mounted may be dropped or cause malfunctions or failures.
◊ Use the rated voltage and current specified in the User's Manual and other manuals. Otherwise, fire, malfunctions, or failures may occur.
◊ Use or keep the product under the environmental conditions described in the User's Manual and other manuals. Use or storage of the product under high temperature, high humidity, dew condensation, dust, corrosive gas, oil, organic solvent, or excessive vibration or shock may result in electric shock, fire, malfunctions, or failures during operation.
◊ Select wires with the size appropriate to the applied voltage and current and tighten the wire terminals with the specified torque. Inappropriate wiring or tightening may cause fire, dropping of the product, malfunctions, or failures.
◊ Mount the product so that no foreign matters such as dust, wire chips, or iron powder do not enter it. Otherwise, fire, accidents, malfunctions, or failures may occur.
◊ After wiring, be sure to remove the dust cover from the module and unit. Using the product without removing the dust cover may cause fire, accidents, malfunctions, or failures.
◊ Periodically check that the terminal and mounting screws are securely tightened. Using the product with the screws not securely tightened may cause fire or malfunctions.
◊ Be sure to place the attached connector cover on a connector unused. Otherwise, malfunctions or failures may occur.
◊ Completely check safety when transferring screen data during system operation. Otherwise, incorrect operation might cause a machine damage or accident. Operation errors, if any, may suddenly start the machine resulting in accidents or damages to the machine.
◊ Insert the loader connectors in the correct direction. Wrong connections may cause malfunctions.
◊ Before operating the PLC, touch a grounded metallic object, etc. to discharge static electricity from your body. Excessive static electricity may cause malfunctions or failures.
◊ Carry out wirings securely and correctly, observing the instructions described in the User's Manual and other manuals. Incorrect wirings may cause fire, malfunctions, or failures.
◊ Do not hold the cord when disconnecting the plug from the receptacle. Otherwise, the cable may be broken resulting in fire or failures.
◊ Do not press the key switches with tweezers, a tool or other thing having a sharp edge, nor press them too strongly. Otherwise, they might be flawed or damaged.
◊ If the product has a trouble, contact us for repair; never attempt to repair it in the field. When replacing the battery, be careful of the connecting directions. Wrong connections may cause fire, accidents or failures.
◊ Do not remodel or reassemble the product. Doing so may cause failures.
◊ When discarding the product, handle it as industrial waste observing the related regulations.
◊ The product described in this User's Manual has not been designed or manufactured for purposes of use in equipment or systems which involve human lives.
◊ If you intend to use the product described in this User's Manual for nuclear energy control, aerospace, medical treatment, transportation, or passenger vehicles or special purposes of such systems, please consult your nearest Fuji Electric agent.
◊ When using the product described in this User's Manual for equipment or systems which, in case of failures, may lead to loss of human lives or serious damages, be sure to provide protective measures.

Revisions

*Manual No. is shown on the cover.

Printed on	*Manual No.	Revision contents
Sep. 1998	FEH204	First edition
Mar. 2004	FEH204a	• Specifications for T-link slave module were added. • T-link expansion function was added. • RAS information was added. • The operating method when the SX-Programmer Standard is used was added.
Nov. 2005	FEH204b	• I/O expansion mode was added. (NP1L-TL1) • T-link slave module can be mounted on T-link interface module base. (NP1L-RT1) • Max. number of I/O stations are expanded to 64. • Error code "D3 to D8" are added.
May 2008	FEH204c	• Section 2-2-1 Added restriction of the number of ports for transmitting message instructions. • Section 1-4 Added "Restriction of combination during using I/O expansion system". • Section 1-5 SPH2000 was added to the description of supported version (5) Added supported version information for mounting high-speed counter on NP1L-RT1 base • Section 2-4 Changed description of LED indication (For T/R display, "turns on" was changed to "blinks quickly") • Section 3-1-1 Added precautions for mounting high-speed counter module on NP1L-RT1 base. Added restriction of number of I/O words mounting on NP1L-RT1 base • Section 3-2-2 Added "Cautionary note regarding the concept of even addresses" • Section 5-2 Changed crimp terminal manufacturer and model

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Section 1 General

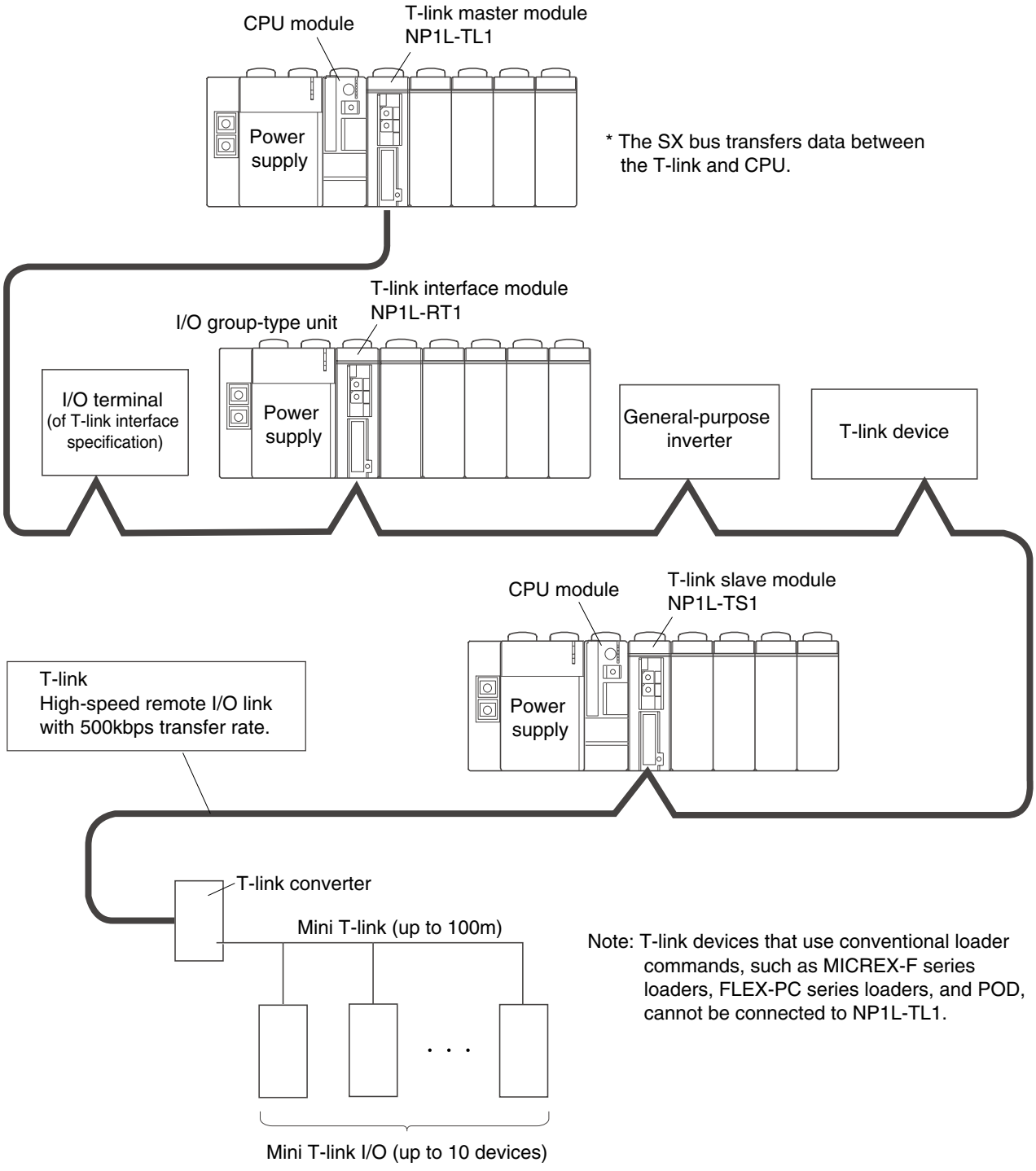
Page

T-link master module “NP1L-TL1” is the communication module that has the master function and enables us to construct one T-link system, or Fuji Electric’s original device level network, with one unit of it.

NP1L-RT1 is the T-link interface module that is used to construct a T-link I/O group-type unit.

T-link slave module “NP1L-TS1” is the communication module that is used to connect via T-link to other programmable controller having the T-link master function.

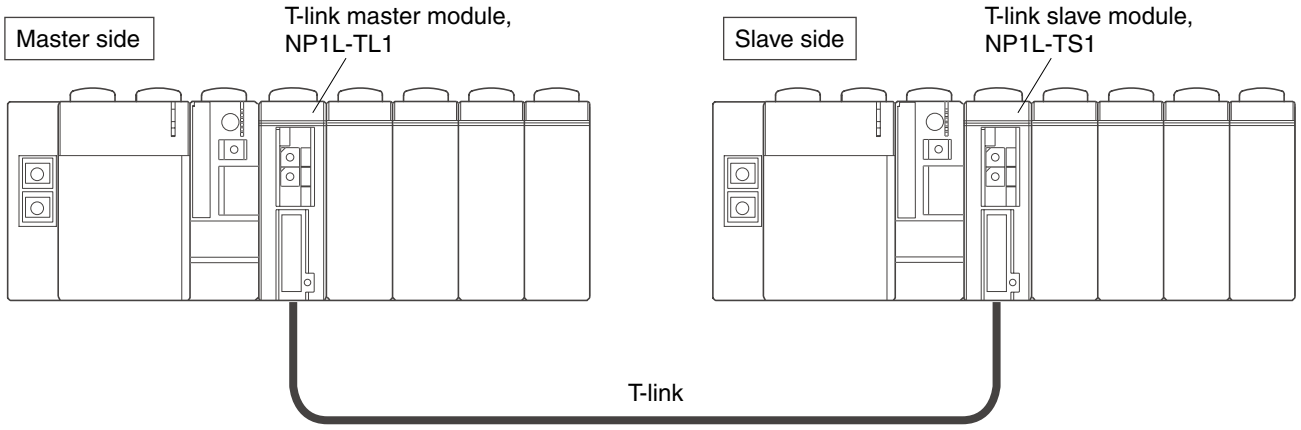
1-1 T-link System Configuration

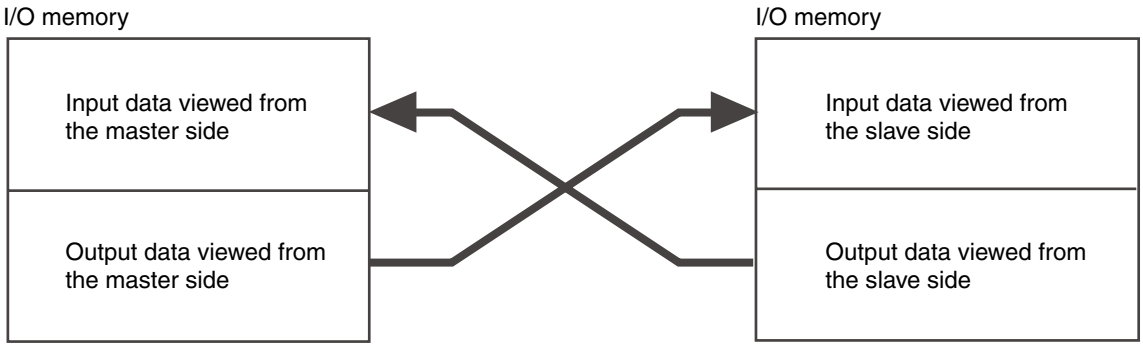


Note: T-link devices that use conventional loader commands, such as MICREX-F series loaders, FLEX-PC series loaders, and POD, cannot be connected to NP1L-TL1.

1-2 Communication System Using the T-link Slave Module

By connecting a T-link slave module to the SX bus, you can communicate with other PLC system having the T-link master function via T-link.
Communication using the T-link slave module is suitable for simply communicating a comparatively small volume of data with existing PLC system having the T-link master function.

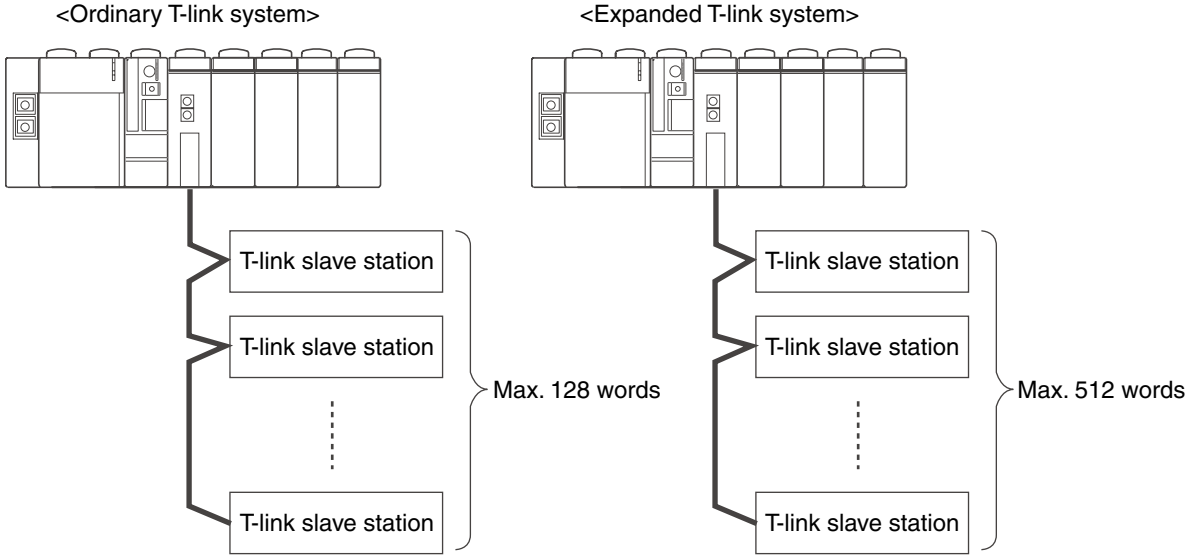




The sending and receiving of data during communication using the T-link slave module is in reality the I/O data communication using I/O memory. Therefore, the input data area viewed from the master side is the output area viewed from the slave side.

The T-link expansion function expands the total number of I/O words for the T-link devices that can be connected to one unit of T-link master module from maximum 128 words (2048 points) to maximum 512 words (8192 points).

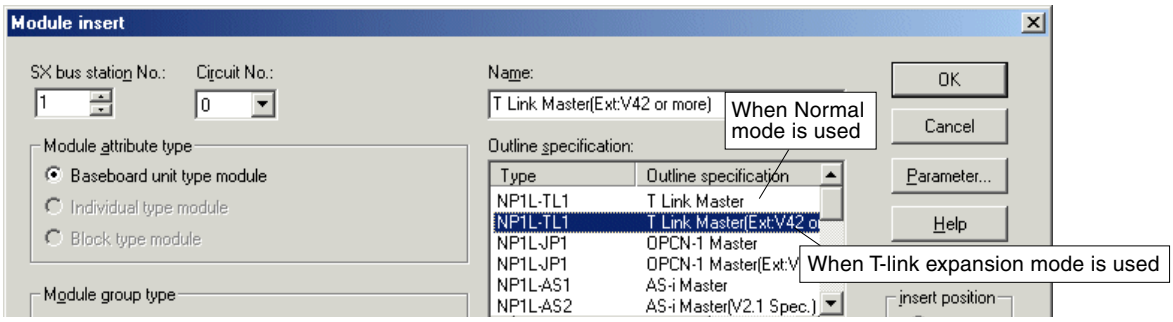
<Outline of T-link expansion>



Note: The T-link expansion function expands the I/O areas that can be assigned to one T-link system. However, maximum number of total I/O words for one CPU is 512 words include SX-bus I/O, T-link I/O, and other I/Os. Maximum number of T-link I/O stations for one T-link master is 32 (It can be expanded to 64 using T-link repeater or optical converter).

<Necessary environment for constructing an expanded T-link system>

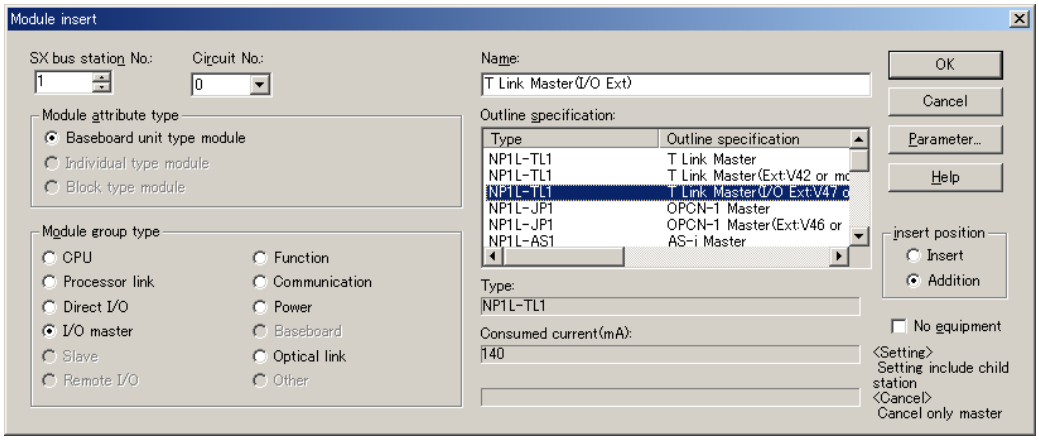
To construct an expanded T-link system, there is version condition mentioned on section 1-5.
To use T-link expansion function, set mode switch of NP1L-TL1 as “1”, select “T-link Master(Ext:V42 or more)” in system definition.
If used as normal mode, select “T-link Master”.



1-4 Overview of the I/O Expansion Function

The I/O expansion function include functionality of “T-link expansion”. In addition, it expands total number of I/O words for one CPU from 512 words (8192 points) to 4096 words (65536 points). Please note total number of I/O words for one T-link master is 512 words. This function is useful if you use more than 1 T-link master module to one CPU, and need more than 512 words I/Os. (Maximum number of I/O is different depends on CPU model. For more detail, please see Instruction manual.)
Please note if you use this function, I/O response time will become longer according to number of master modules (T-link, Device-net, OPCN-1, Profibus modules are included.)
As for input, if external input ON (or OFF) width is less than two to three times of input response time, PLC may fail to catch external input status.
As for output, please maintain ON (or OFF) status for two to three times of output response time. Otherwise, external output may not changed.
As for input/output response time calculation, please see Appendix1.

<Necessary environment for constructing an I/O expansion system>
To construct an I/O expansion system, there is version condition mentioned on section 1-5.
To use I/O expansion function, set mode switch of NP1L-TL1 as “2”, select “T-link Master (I/O Ext: V47 or more)” in system definition.



<Restriction of combination when using I/O expansion system>
When using I/O expansion, combination of modules in the same configuration (the same SX bus) is restricted as follows:

- When there are other I/O master modules, set up I/O expansion for them.
- Cannot be mixed with I/O masters (AS-i, LON WORKS, S-LINK, and remote terminal) that do not provide I/O expansion function
- Cannot be mixed with various slaves (T-link slave, OPCN-1 slave, Device-Net slave, and PROFIBUS-DP slave).

(1) T-link expansion supported version

Name		Adapted version
T-link master module (NP1L-TL1) (Mode setting switch: 1)		V**42 or later
CPU	SPH200	N/A
	SPH300	V**56 or later
	SPH2000	All
Loader	D300winV2	V2.2.2.0 or later
	D300winV3	V3.0.0.0 or later
	Standard loader	V2.0.0.0 or later

(2) I/O expansion supported version

Name		Adapted version
T-link master module (NP1L-TL1) (Mode setting switch: 2)		V**47 or later
CPU	SPH200	N/A
	SPH300	V**64 or later (Note)
	SPH2000	NP1PM-48*: N/A NP1PM-256*: V**08 or later
Loader	D300winV2	Not supported.
	D300winV3	V3.2.1.0 or later
	Standard loader	V2.2.0.0 or later

Note: NP1PS-32/32R, board type PLC are not supported.

(3) 64 stations for one T-link master supported version

Name		Adapted version
T-link master module (NP1L-TL1)		V**47 or later
CPU	SPH200	All
	SPH300	All
	SPH2000	All
Loader	D300winV2	Not supported.
	D300winV3	V3.2.1.0 or later
	Standard loader	V2.2.0.0 or later

Note: As for system configuration, please see clause 3-2-6.

1-5 Supported version

(4) Slave module mounting on NP1L-RT1 base supported version

Name		Adapted version
T-link master module (NP1L-TL1)		All
T-link interface module (NP1L-RT1)		V**33 or later
Slave modules (NP1L-TS1, NP1L-JS1, NP1L-PS1)		All
CPU	SPH200	N/A
	SPH300	All
	SPH2000	All
Loader	D300winV2	Not supported
	D300winV3	V3.2.1.1 or later
	Standard loader	V2.2.0.0 or later

(5) High-speed counter module mounting on NP1L-RT1 base supported version

Name		Adapted version
T-link master module (NP1L-TL1)		All
T-link interface module (NP1L-RT1)		V**34 or later
High-speed counter modules 2ch products (NP1F-HC2, HC2MR, HC2MR1)		All
CPU	SPH200	N/A
	SPH300	All
	SPH2000	All
Loader	D300winV2	Not supported
	D300winV3	V3.4.1.0 or later
	Standard loader	V2.3.2.0 or later

Note: The only mountable high-speed counters are the 2ch products (models: NP1F-HC2 / HC2MR / HC2MR1).

Section 2 Specifications

Page

Section 2 Specifications

2-1 General Specifications

Item		Specification
Physical environmental conditions	Operating ambient temperature	0 to 55° C
	Storage temperature	-25 to +70° C
	Relative humidity	20 to 95%RH no condensation (Transport condition: 5 to 95%RH no condensation)
	Pollution degree	2
	Corrosion immunity	Free from corrosive gases. Not stained with organic solvents.
	Operating altitude	2000 m or less above sea level (Transport condition: 70 kPa or more)
Mechanical service conditions	Vibration	Half amplitude: 0.15 mm, Constant acceleration: 19.6 m/s^2, Two hours for each of three mutually perpendicular axes, total six hours.
	Shock	Acceleration peak: 147 m/s^2 Three times for each of three mutually perpendicular axes.
Electrical service conditions	Noise immunity	1.5 kV, rise time 1 ns, pulse width 1 μs (noise simulator)
	Electrostatic discharge	Contact discharge: ± 6 kV Aerial discharge: ± 8 kV
	Radioelectromagnetic field	10 V/m (80MHz to 1000 MHz)
Construction		Panel-mounted type
Cooling		Air cooling
Isolation method		Photocoupler
Dielectric strength		445 V AC 1 minute (between connector pins and frame ground)
Insulation resistance		10 MΩ or more with 500 V DC megger (between connector pins and frame ground)
Occupied slot		NP1L-TL1: 1 slot NP1L-RT1: 1 slot NP1L-TS1: 1 slot
Internal current consumption		NP1L-TL1: 24 V DC, 140 mA or less NP1L-RT1: 24 V DC, 140mA or less NP1L-TS1: 24 V DC, 140 mA or less
Mass		NP1L-TL1: Approx. 200 g (unit module) NP1L-RT1: Approx. 200 g (unit module) NP1L-TS1: Approx. 200 g (unit module) T-link connector: Approx. 40 g
Dimensions		Refer to "2-5 Dimensions"

2-2-1 Communication specifications

Item	Specification
No. of connectable devices	T-link system slave stations per master module (one T-link system): Max. 32 (Note1)
No. of I/O points	Normal mode: Max. 128 words (2048 points) T-link expansion mode or I/O expansion mode: Max. 512 words (8192 points)
Transmission line format	Bus configuration (multi-drop) Optical loop connection through optical converters on each bus (Loops can be duplicated.)
Transmission line	Bus transmission line: Twisted pair cable (1 pair) Total length: Max. 1 km Optical transmission line: SI/GI quartz fiber cable (length between optical converters: Max. 1 km/3 km)
Transmission method	Half-duplex, serial transmission
Data exchange method	1 : N (polling/selecting) method
Transmission speed	500kbps
Effective transmission speed	7 kbytes/sec. (10 ms/512 digital points)
Modulation method	PDM (Pulse Duration Modulation)
Error check	FCS (frame check sequence)
Duplication of transmission line	Optical converters enable duplication of optical transmission lines.
Number of ports for message transmission instructions	Up to five ports per master (Note2) * This means that message transmission instructions (M_OPEN) for up to five stations are available at the same time.

Note1: Up to 64 modules can be supported according to version and configuration (refer to section 1-5).
Note2: General interface capsule (model: FFK120A-C10) is a typical communication device using message transmission instructions. In the case of FFK120A-C10, the transfer data command or non-procedure communication use port. When multiple modules are used for a single CPU, the number of ports opened at the same time is restricted to up to 56 ports.

2-2-2 Basics of T-link transmission

Data transmission on the T-link uses the polling/selecting method. In the polling/selecting method, the master module first talks to a slave station with the specified station number, then the slave station responds to it. This section describes the basics of the data transmission.

(1) Initial transmission

When the power is turned on, the master module performs initial transmission before starting to operate. That is, the master module checks the I/O configuration, and the address of (the station number) slave stations connected to the T-link when the power is turned on. The master module checks from station 0 to station 99 in sequence. After checking them completely, the master module starts to operate. When the results of the check are different from settings in the system configuration definition, the “SER” (setting error) lamp lights indicating a configuration error (fatal fault).
When fail-soft operation is specified, the system starts operation in non-fatal fault state.

(2) Normal transmission

After initial transmission, the T-link enters normal transmission mode. In this mode, CPU exchanges I/O data with slave stations that have been already checked for their connections with the T-link in initial transmission, in ascending order by their numbers. When CPU exchanges data with the final station, CPU repeats the data exchange with them. This cycle is called a “transmission cycle.”

(3) Transmission errors

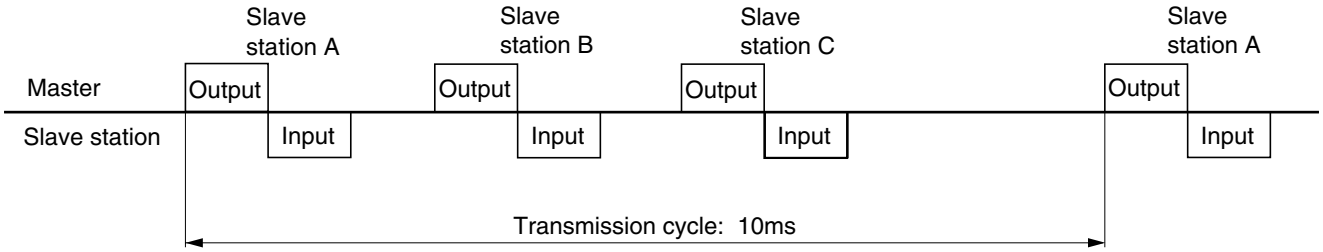
When an error occurs during T-link transmission, data transmission fails. The master module will retry transmission. An error may occur due to power interruption of a slave station, disconnection of a T-link cable, noise, or malfunction of T-link transmission elements in the master module or slave station. If communication returns to a normal state after transmission retry, T-link transmission continues and the master module continues its operation.
If communication still fails after transmission retry has been repeated three times for the same slave station, the master module regards it as a fatal fault and stops operation. In this case, the master module cannot return to operation until the cause of the fault is removed and the master module power supply is reset. However, if fail-soft operation is specified, the CPU module regards it as a nonfatal fault and continues operation.

2-2-3 Transmission types

The T-link handles I/O transmission and message transmission.

(1) I/O transmission

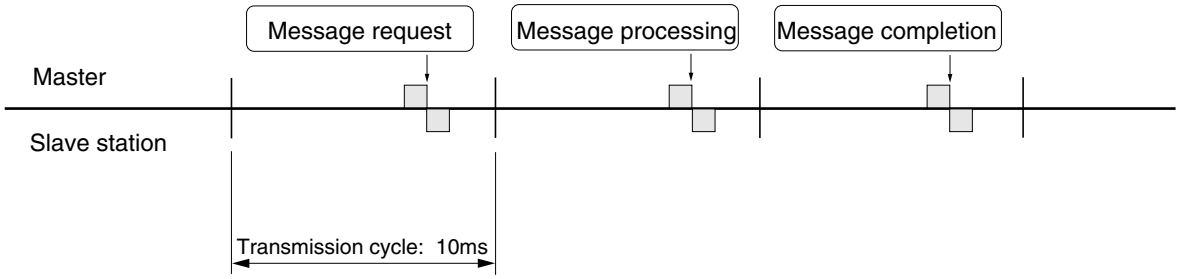
I/O transmission is a high-speed communication method enabling transmission of signals from distributed I/O devices to the PC. On the T-link data refresh is usually performed every 10ms. However, if one T-link system is connected to a large number of I/O devices or there are a large number of occupied words, the refresh cycle may exceed 10ms.



(2) Message transmission

Message transmission is a way to transfer a large amount of data between the CPU and slave stations. The T-link takes several I/O transmission cycles from the beginning of a request for a message to its completion (until data delivery is completed), thus message transmission is slower than I/O transmission. Also, the master module handles message transmission for one station at a time. Therefore, when many devices that use message transmission (such as POD) are connected to one master module, the transmission rate becomes slower in proportion to the number of connected devices.

<Example of message transmission>



2-2-4 Communication specifications for the T-link slave module

The T-link slave module, or NP1L-TS1, is connected to the base board that is directly connected to the MICREX-SX series SX bus to communicate I/O data between MICREX-SX series configurations or with other PC system having the T-link master function.

Item	Specification	
Connectable master models	MICREX-SX, MICREX-F, FLEX-PC	
Communication function	I/O transmission (no message transmission function)	
Number of link I/O points	1 word/1 word, 2 words/2 words, 4 words/4 words, 8 words/8 words, 32 words/32 words (Note 2)	
Number of connectable devices	On SX bus	Max. 8 units per configuration (Note 1)
	On T-link	Max. 32 units (Note 3)

Note: 1) The limit on the number of I/O master modules (T-link, OPCN-1, DeviceNet, etc.) in a same configuration is maximum 8 units in the total number of connected I/O master modules and T-link slave modules.
2) If NP1L-TS1 is mounted on NP1L-RT1 base, number of occupied I/O of NP1L-TS1 is fixed as 4 word input/4 word output.
3) If connected to T-link master module which support 64 I/O station connection, Max. number also 64 units.

2-3 Cable

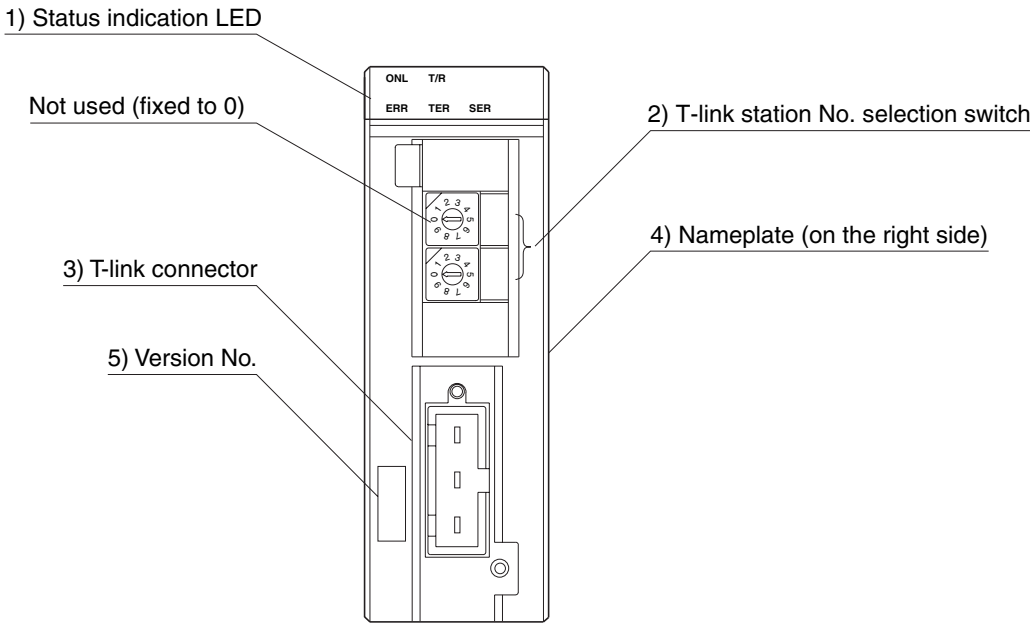
Cables that meet the following specifications should be used for the T-link cables.

Maker	Cable type		Maximum length	Remarks
The Furukawa Electric Co., Ltd., Japan	KPEV-SB	0.75 mm^2 x 1 pair	700 m	Twisted pair cable
	T-KPEV-SB	1.25 mm^2 x 1 pair	1000 m	

Note: The maximum length values in the above table are confirmed by Fuji.

2-4-1 NP1L-TL1 (T-link master module)

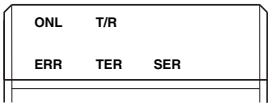
(1) Names



(2) Functions

1) Status indication LED

This LED indicates the NP1L-TL1 operation status.



Symbol	Color	Description:
ONL	Green	Turns on when the master module is operating normally (when the SX bus operates normally).
ERR	Red	Turns on when an error has occurred in the master module or SX bus.
T/R	Green	Blinks quickly while sending and receiving T-link data. (As LED indicates the T-link transfer state directly through hardware, it will only light dimly.)
TER	Red	Turns on when a nonfatal fault has occurred in a unit on the T-link, a registered station has become disconnected, or a transmission error has occurred.
SER	Red	Turns on when there is an error in the system configuration.

<Example of LED status indications>

Common indicators		Individual indicators			Module status
ONL	ERR	T/R	SER	TER	
Blinks	—	—	—	—	The module is waiting for initialization of the SX bus. (common for all stations)
On	—	Blinks	—	—	The module is operating normally.
On	—	Blinks	—	*	(*: The transmission error LED indicator blinks sometimes, but the module can continue operation.)
—	On	—	—	—	The local module has a hardware fault or SX bus error. (module fatal fault)
On	—	Blinks	On	—	Remote I/O configuration has a fault. (remote I/O nonfatal fault)
—	—	—	—	—	24 V DC power is not connected.

Note: "—" indicates that the LED is OFF.

2) T-link station No. selection switch
0: Normal mode
1: T-link expansion mode
2: I/O expansion mode
3 to 9: Not used
Note: As for T-link expansion , I/O expansion mode, see section 1-5.

3) T-link connector
This connector is used to connect the T-link connector. The tightening torque for the connector fixing screw should be between 0.9 to 1.0 N•m. For assembly of the T-link connector, refer to Section 5-2.

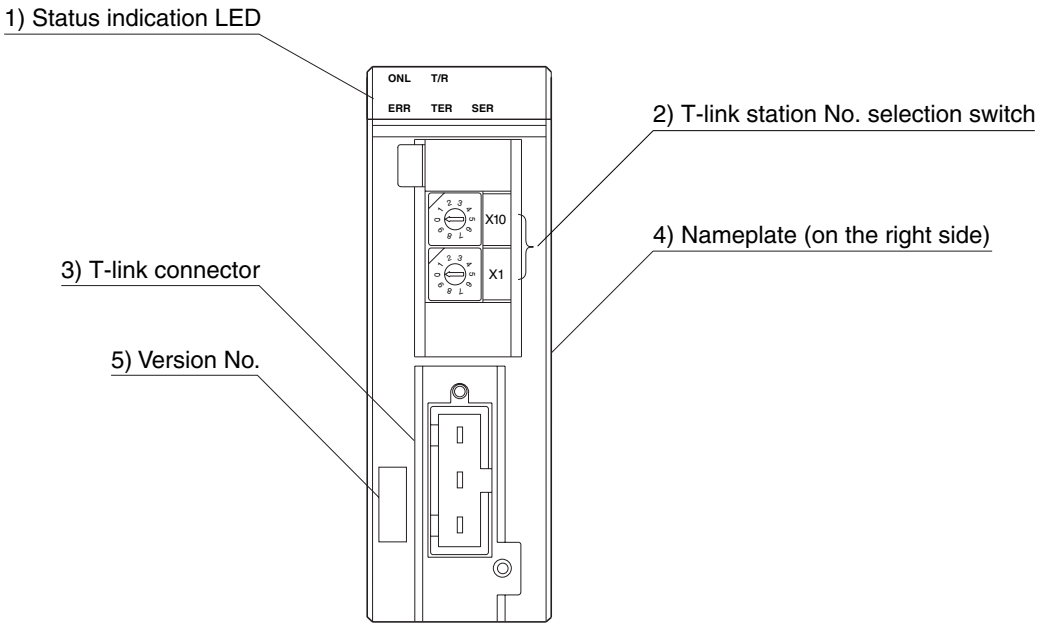
4) Nameplate
The type, production date, and serial number are printed on the right side of the module.

5) Version No.

2 2	←Hardware version
4 2	←Farmware version

2-4-2 NP1L-RT1 (T-link interface module)

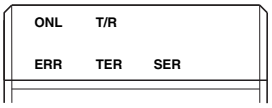
(1) Names



(2) Functions

1) Status indication LED

This LED indicates the NP1L-RT1 operation status.



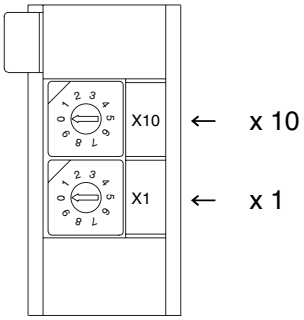
Symbol	Color	Description:
ONL	Green	Turns on when the interface module is operating normally.
ERR	Red	Turns on when an error has occurred in the interface module or a unit on the T-link.
T/R	Green	Blinks quickly while sending and receiving T-link data. (As LED indicates the T-link transfer state directly through hardware, it will only light dimly.)
TER	Red	Turns on when a nonfatal fault has occurred in a unit on the T-link, or a station registered in the configuration cannot be found.
SER	Red	Turns on when there is an error in a system definition.

<Example of LED status indications>

Common indicators		Individual indicators			Module status
ONL	ERR	T/R	SER	TER	
Blinks	—	—	—	—	The interface module has not been initialized.
On	—	Blinks	—	—	The module is operating normally.
On	—	Blinks	On	—	A nonfatal fault has occurred.
—	On	—	—	—	A fatal fault has occurred.
On	—	Blinks	—	On	A transmission error has been detected. This error may not be recognized and indicated on the LED, depending on its frequency of occurrence. Transmission errors with low frequency of occurrence can be checked by RAS information on D300win.
—	On	—	On	—	There is a setting error (such as a station number change during transmission).

Note: 1) "—" indicates that the LED is OFF.
2) When I/O transmission is not started, ONL is not ON.

2) T-link station No. selection switch
This switch is used to specify the T-link station number. Range: 00 to 99



3) T-link connector
This connector is used to connect the T-link connector. The tightening torque for the connector fixing screw must be between 0.9 to 1.0 N•m.
For assembly of the T-link connector, refer to Section 5-2.

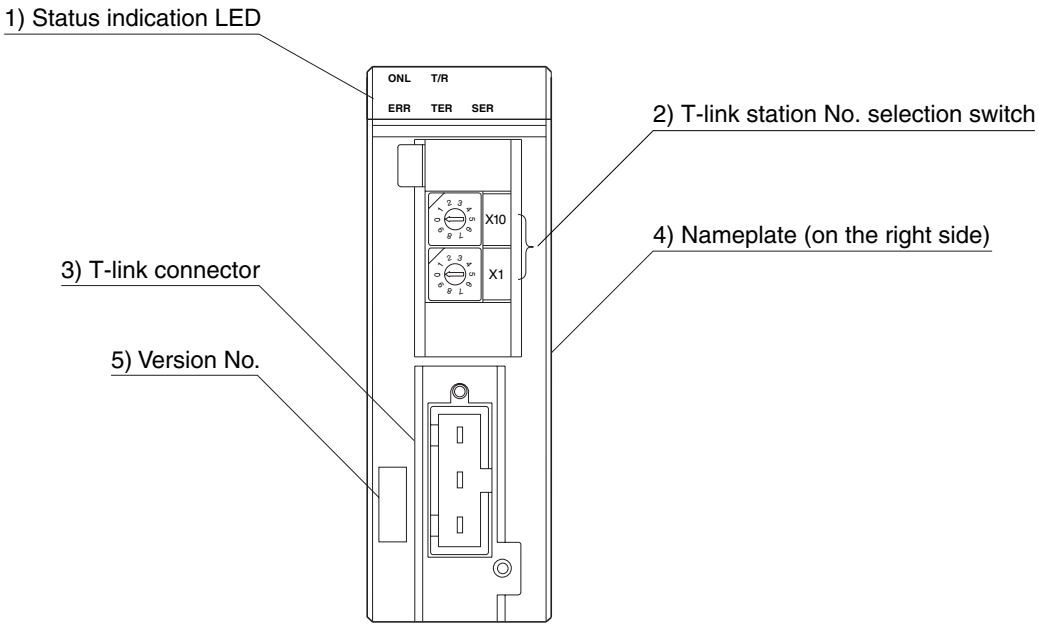
4) Nameplate
The type, production date, and serial number are printed on the right side of the module.

5) Version No.

2 0	←Hardware version
3 0	←Farmware version

2-4-3 NP1L-TS1 (T-link slave module)

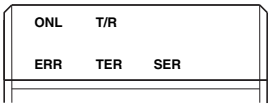
(1) Names



(2) Functions

1) Status indication LED

This LED indicates the NP1L-TS1 operation status.



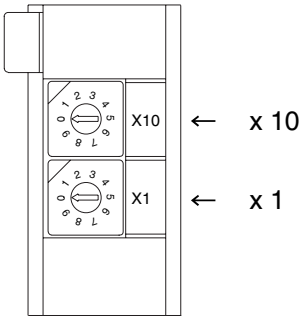
Symbol	Color	Description:
ONL	Green	Turns on when the interface module is operating normally.
ERR	Red	Turns on when an error has occurred in the interface module or a unit on the T-link.
T/R	Green	Blinks quickly while sending and receiving T-link data. (As LED indicates the T-link transfer state directly through hardware, it will only light dimly.)
TER	Red	Turns on when a nonfatal fault has occurred in a unit on the T-link, or a station registered in the configuration cannot be found.
SER	Red	Turns on when there is an error in a system definition.

<Example of LED status indications>

Common indicators		Individual indicators			Module status
ONL	ERR	T/R	SER	TER	
Blinks	—	—	—	—	During for the SX bus initialization, and waiting for the T-link has been communication ready.
On	—	Blinks	—	—	The module is operating normally.
On	—	—	On	—	The own module is setting error.
—	On	—	—	—	The module is hardware error or the SX bus error.
On	—	Blinks	—	On	A transmission error has been detected. This error may not be recognized and indicated on the LED, depending on its frequency of occurrence. Transmission errors with low frequency of occurrence can be checked by RAS information on D300win.
—	On	—	On	—	There is a setting error (such as a station number change during transmission).

Note: 1) "—" indicates that the LED is OFF.
2) When I/O transmission is not started, ONL is not ON.

2) T-link station No. selection switch
This switch is used to specify the T-link station number. Range: 00 to 99



3) T-link connector
This connector is used to connect the T-link connector. The tightening torque for the connector fixing screw must be between 0.9 to 1.0 N•m.
For assembly of the T-link connector, refer to Section 5-2.

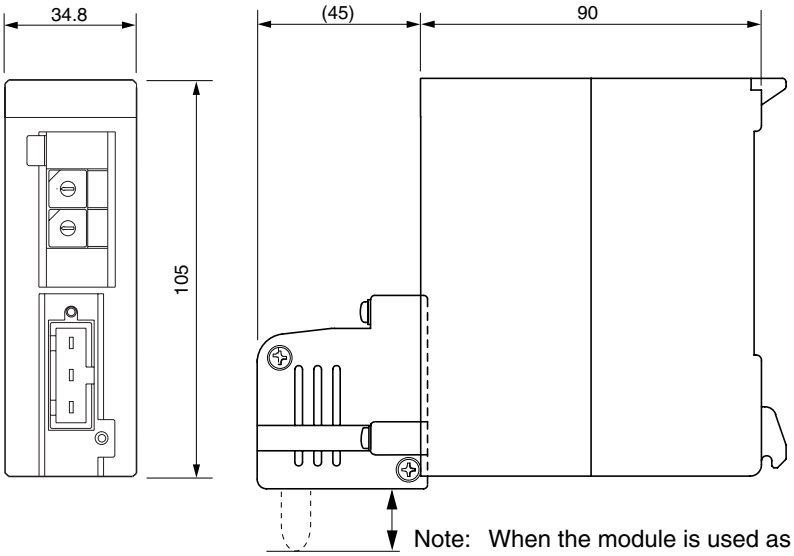
4) Nameplate
The type, production date, and serial number are printed on the right side of the module.

5) Version No.

2 0	←Hardware version
3 0	←Farmware version

2-5 Dimensions

The dimensions of NP1L-TL1, NP1L-RT1 and NP1L-TS1 are identical. [in mm]



Note: When the module is used as the end terminal of the T-link, a T-link terminating resistor must be attached.
When the resistor is attached, an approximately 22 mm to 24 mm protrusion is added.

Note: The bending radius of the cable to use must also be taken into consideration.

Section 3 System Configuration

Page

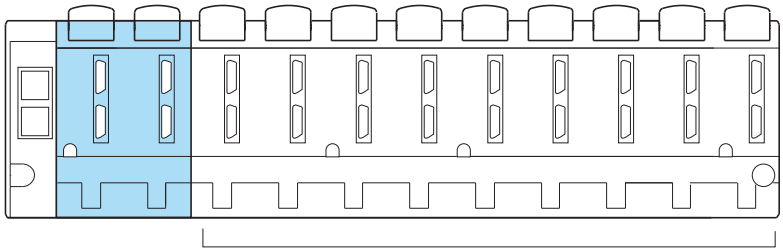
Section 3 System Configuration
3-1 Mounting Restrictions

3-1-1 Mounting position

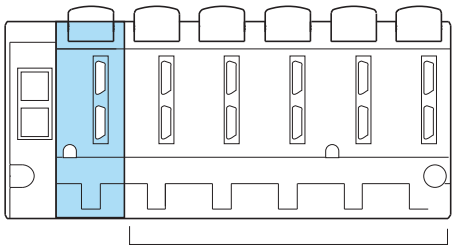
(1) T-link master module/T-link slave module

T-link master module and T-link slave module can be mounted on the following slots: any slot except the power module mounting slot (two slots from the left on the base board).

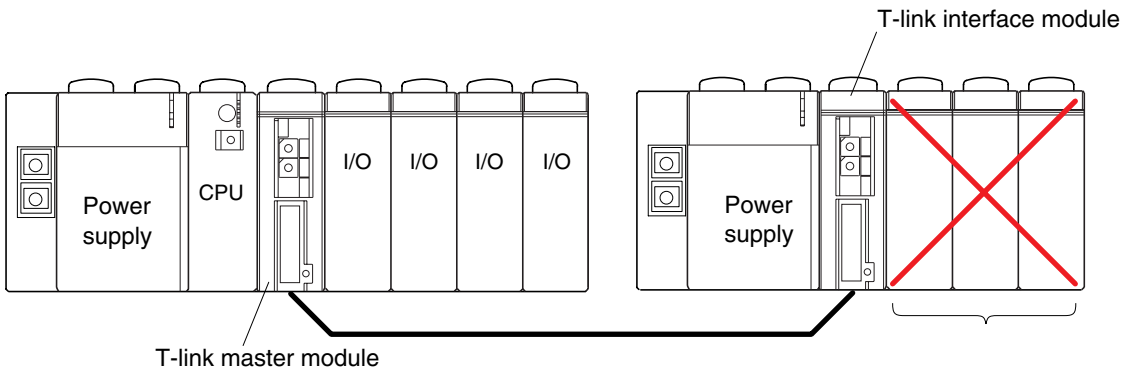
<8/11/13-slot base board>



<3/6-slot base board>



Note: T-link master module (NP1L-TL1) can not be mounted on T-link interface module (NP1L-RT1) base.
In case of NP1L-RT1 version V**33 or later, it is possible to mount various slave module (such as NP1L-TS1, etc...).

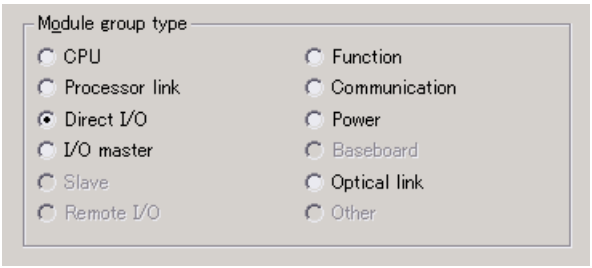


(2) T-link interface module

Only one unit of NP1L-RT1 can be mounted on one base board. NP1L-RT1 must be mounted on the right side of the power supply module.

In general, modules mountable on NP1L-RT1 base are of “Direct I/O” module type only. (However, the following I/O modules cannot be mounted.)

NP1X3206-A, NP1Y32T09P1-A, NP1AX08-MR, NP1AX08V-MR, NP1AX08I-MR



<Notes on mounting slave module on NP1L-RT1 base board>

It is possible to mount slave module (NP1L-TS1, NP1L-JS1, NP1L-PS1) on NP1L-RT1 base board if NP1L-RT1 version is V**33 or later. As for CPU or loader version, please see section1-5. Number of occupied words of slave modules is fixed as 4/4 words if slave module is mounted on NP1L-RT1 base board.

Maximum number of slave modules for one NP1L-RT1 base board are 8 (Also Maximum 8 slaves for one configuration).

Note :

If you mount slave module on NP1L-RT1 base board, it is necessary to set “Fail-soft setting” in system definition. As for “Fail-soft setting”, please see section 4-2.

With “Fail-soft setting”, if actual system configuration of NP1L-RT1 base board is different from defined system configuration, and turned ON PLC power, system behaves as shown below.

1) If NP1L-RT1 RUN earlier than CPU : CPU stops with fatal error because of discrepancy detection of system definition.
2) If NP1L-RT1 RUN later than CPU : At first, CPU goes RUN. Then, when NP1L-RT1 goes RUN, CPU show “Non-fatal error”, and continues RUN. However, NP1L-RT1 is considered as drop out from system (remote I/O configuration = OFF, remote I/O error information = ON), and CPU cannot detect NP1L-RT1.

If slave module mounted on NP1L-RT1 base board is not making communication (for example, master station power is OFF), both NP1L-RT1 and CPU show non-fatal error. (remote I/O configuration = ON, remote I/O error information = ON). Remote I/O configuration and error information are assigned to %MW10.128... (In case of Standard loader, WSM128...).

<Mounting high-speed counter module on NP1L-RT1 base>

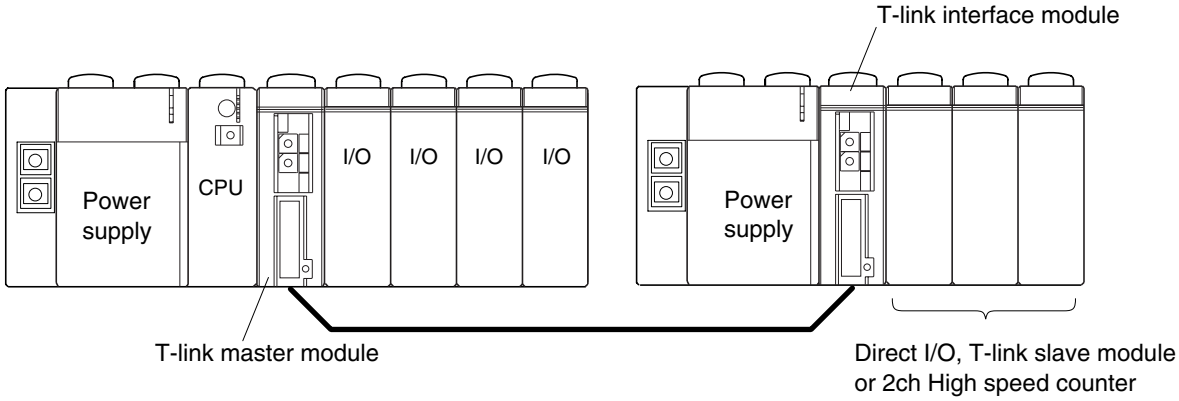
When NP1L-RT1 version is V**34 or more, a 2ch high-speed counter module (model: NP1F-HC2/HC2MR/HC2MR1) can be mounted on the base. For information about the supported versions of CPU and loader, refer to Section 1-5.

When a high-speed counter is combined with the standard expansion FB (_MHCNTH, _MHCNTR), some variable connected to FB may have double word access. Therefore, when using these FBs, the system should be configured so that the start address of the high-speed counter module is an even address.

For information about the concept of even addresses, see Section 3-2-2.

<Restriction of number of I/O words mounting on NP1L-RT1 base>

The maximum total number of I/O words mounted on the NP1L-RT1 base is 128 words.



3-1-2 Number of mountable modules

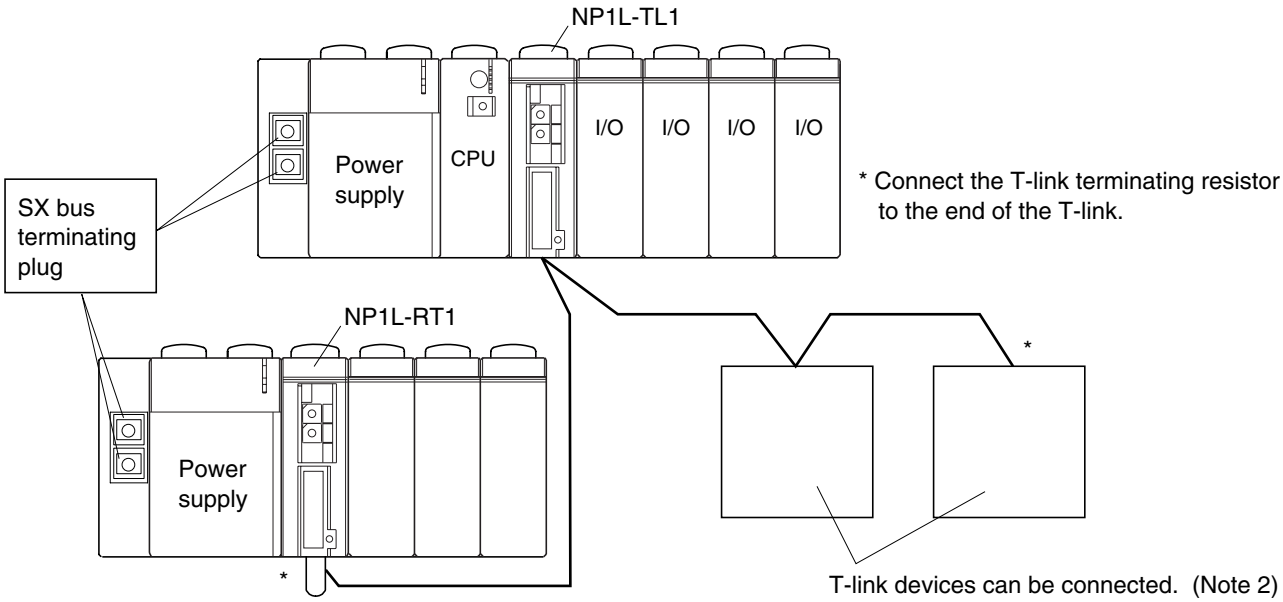
Maximum 8 units of T-link master module and T-link slave module can be mounted in one configuration. However, when other I/O master or slave modules, such as OPCN-1 and DeviceNet master or slave modules, are installed, this limit of 8 units applies to the total including them.

(Number of mountable T-link master modules) + (Number of mountable other I/O master modules) + (Number of mountable T-link slave modules) + (Number of mountable other slave modules) ≤ 8

3-2-1 Basic system configuration

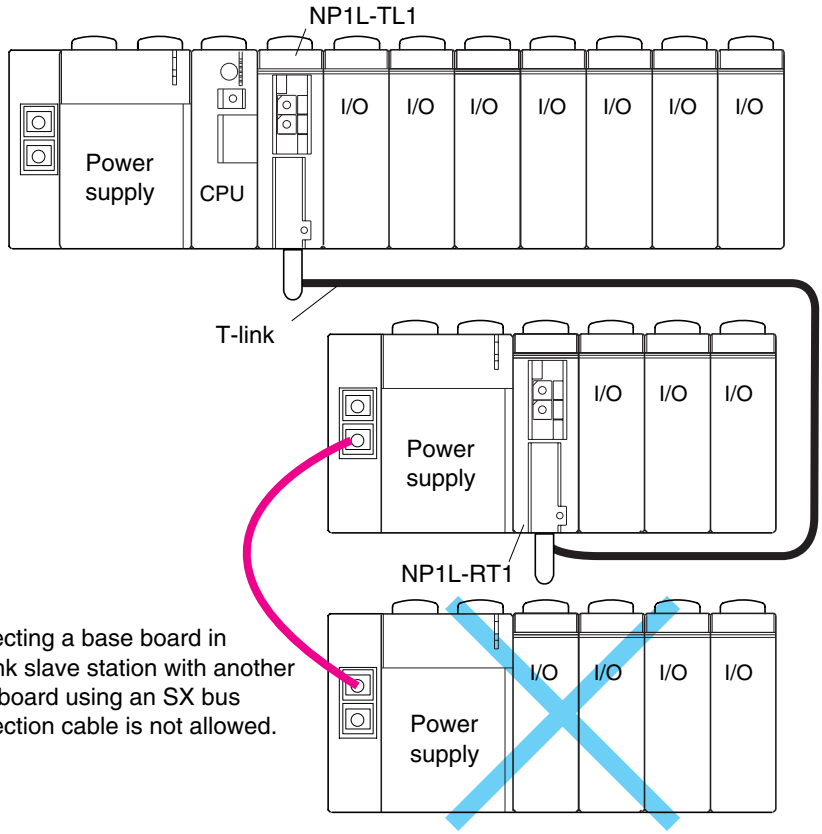
Connecting one NP1L-TL1 master module with the MICREX-SX series SX bus (on the base board) enables one T-link system configuration to be constructed.

<Example of system configuration>



The T-link interface module (NP1L-RT1) enables MICREX-SX series SPH I/O modules to be used as T-link devices.

Note: 1) The allowable distance depends on the type of the cable used. For the details, refer to “2-3 Cable Specifications.”
2) Devices that use different loader commands such as MICREX-F series loaders, FLEX-PC series loaders, and POD cannot be connected.
3) The configuration shown below is not possible.

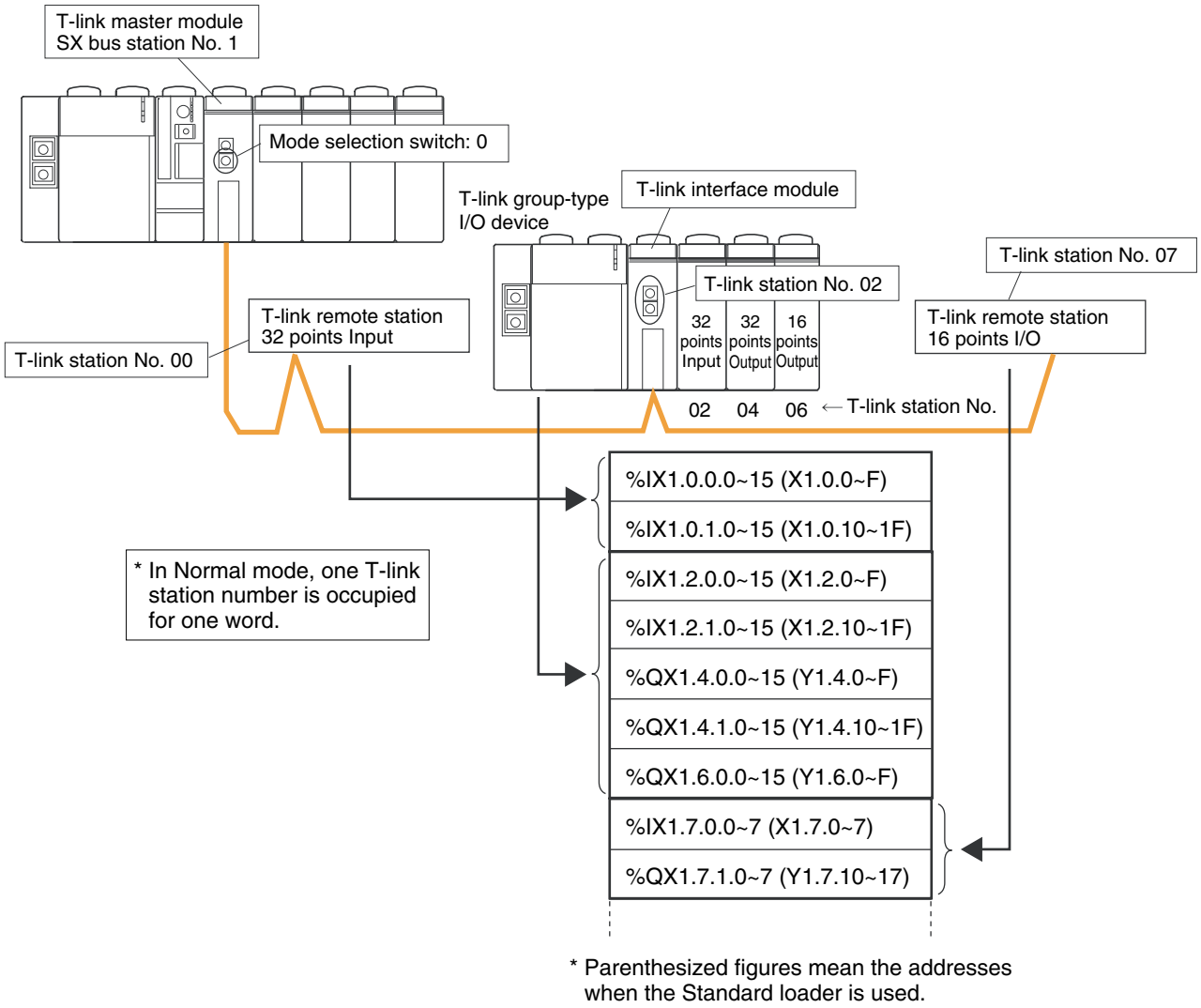


* Connecting a base board in a T-link slave station with another base board using an SX bus connection cable is not allowed.

3-2-2 I/O address assignment

T-link device is assigned to the I/O area of the CPU. Assigned address differs between Normal mode and T-link expansion mode.

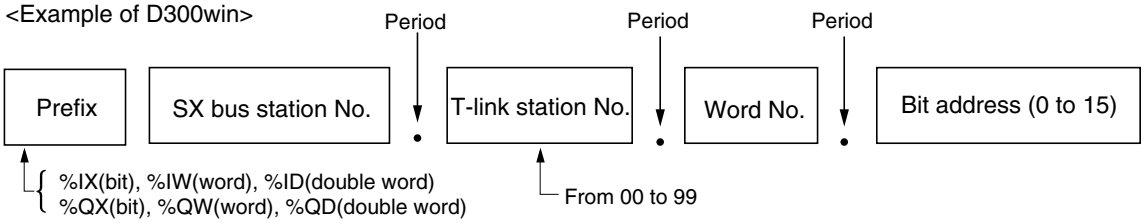
(1) Normal mode



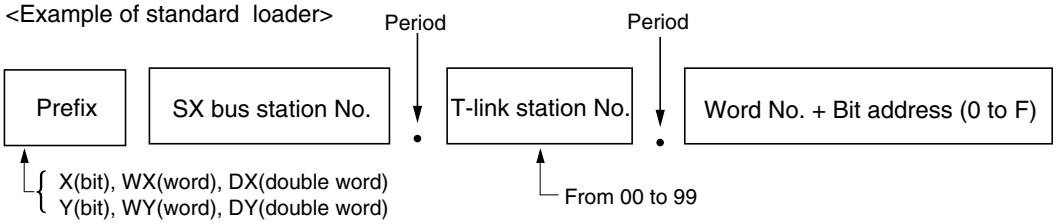
<Addressing modes>

In MICREX-SX series, the I/O addresses on the SX bus are assigned to the same I/O area as the I/O addresses on the T-link.

<Example of D300win>



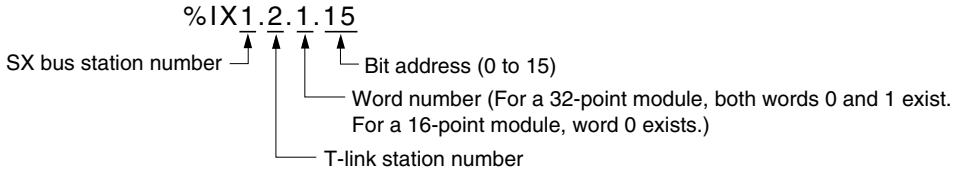
<Example of standard loader>



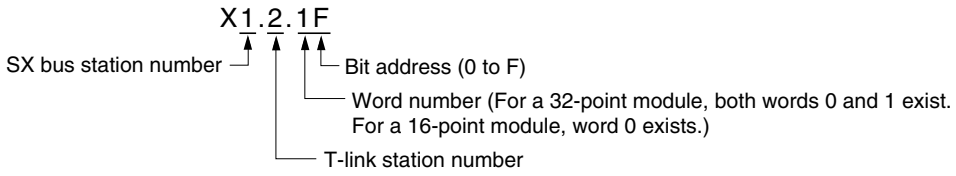
<Address number assignments>
The address of each I/O module mounted on the T-link group type I/O device needs the T-link station number and the word number which indicates the order in the device.

Example:
In the sample system configuration shown at the bottom of the previous page, the address of the bit 32 position of the 32-point input module (the module at far right) on the T-link group type I/O device would be expressed as follows:

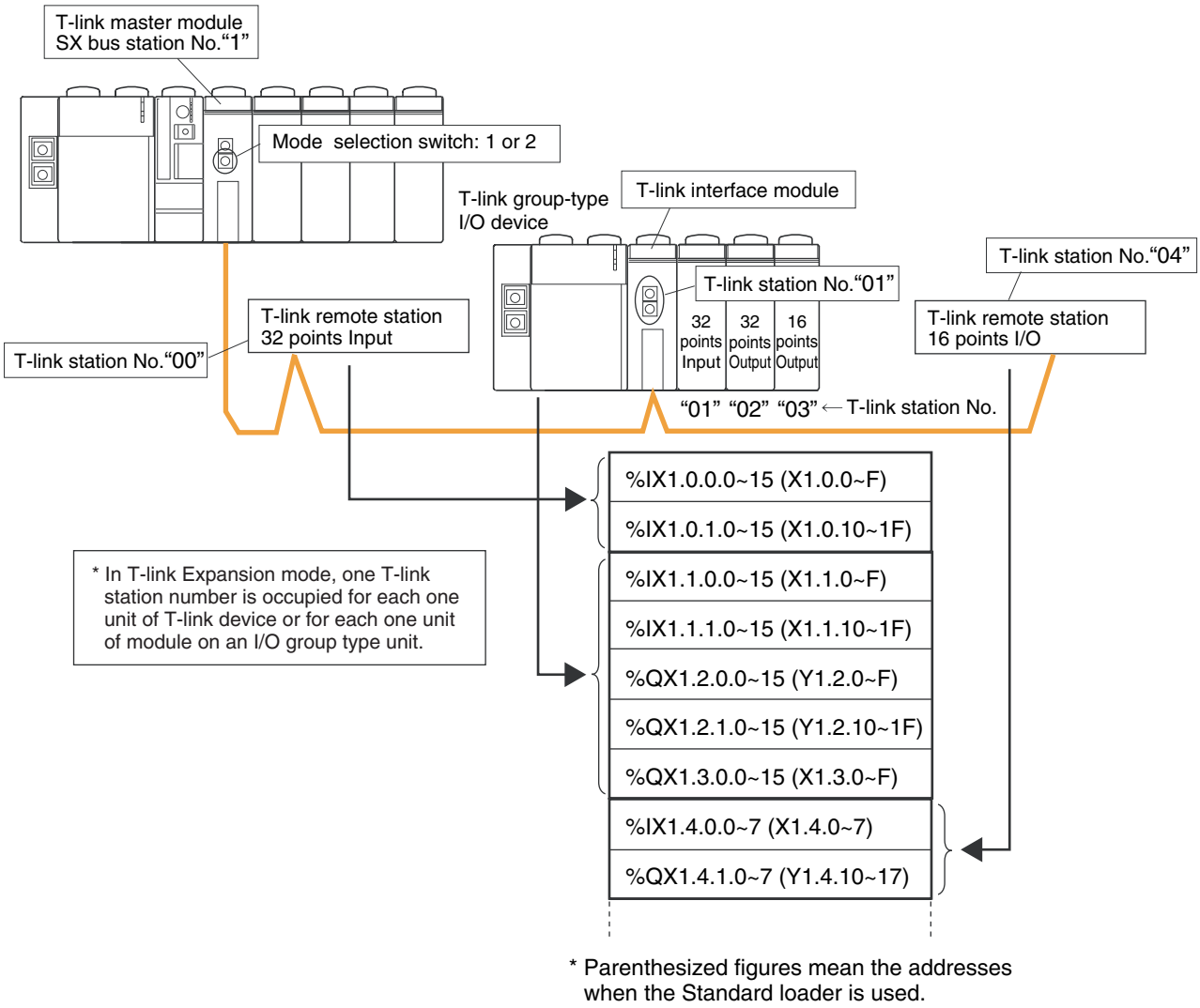
<Example of D300win>



<Example of standard loader>



(2) T-link expansion mode, I/O expansion mode

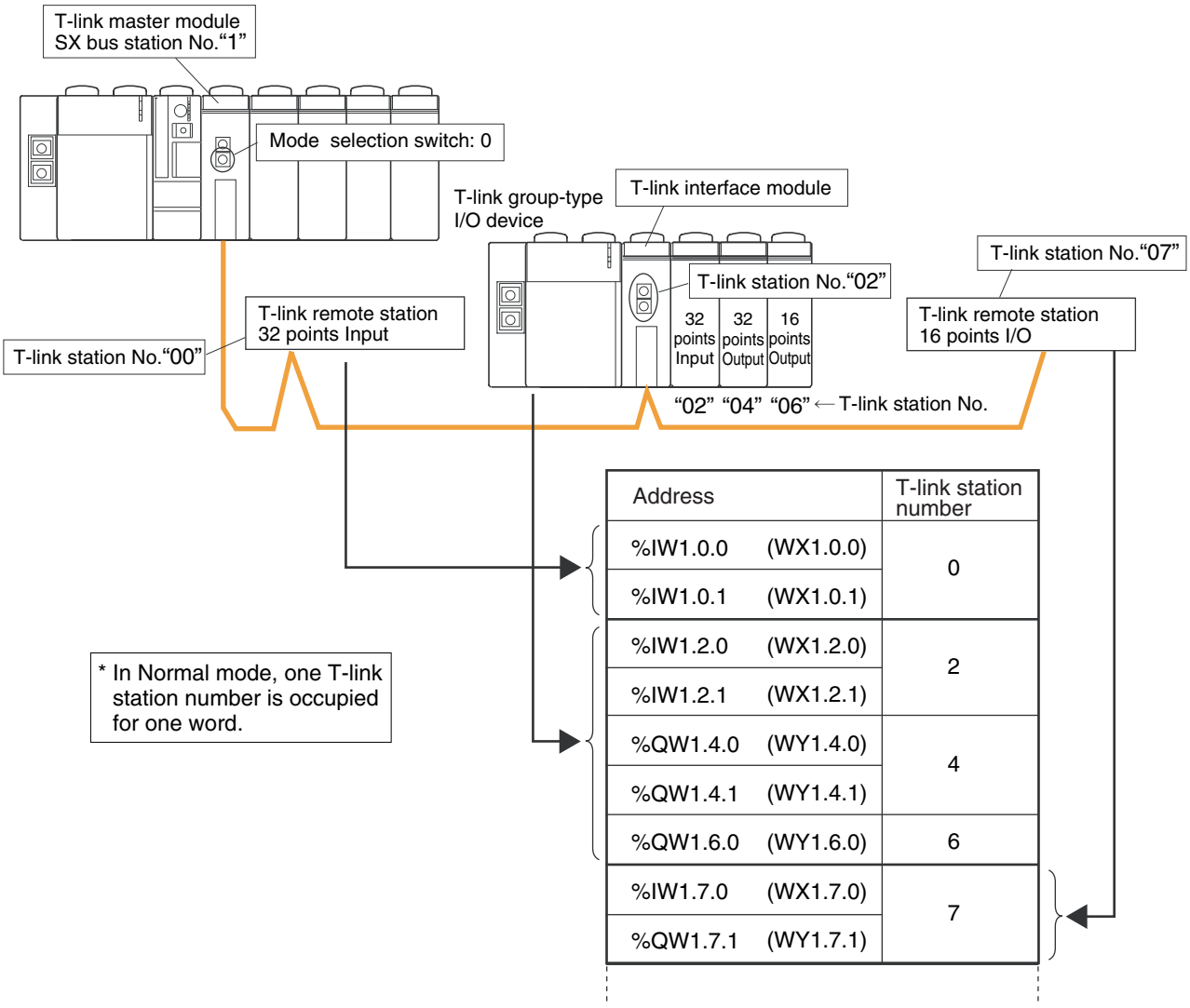


* In T-link Expansion mode, one T-link station number is occupied for each one unit of T-link device or for each one unit of module on an I/O group type unit.

* Parenthesized figures mean the addresses when the Standard loader is used.

<Cautionary note on the concept of even addresses>
To use I/O address on T-link by allocating it to a double word (array and structure including 32bit length data) such as DINT and DWORD, observe the following precautions according to the modes (normal mode, T-link expansion mode, and I/O expansion mode) of the T-link master. (The precautions are for MICREX-SX series T-link master. When your T-link master is MICREX-F series, you do not need to take it into account.)

1) Normal mode
You need to configure the unit which carries out double word access so that the T-link station number is even.
T-link station number is next to a SX station number in address representation.
The figure below shows addresses and T-link station numbers in the “normal mode” system configuration.



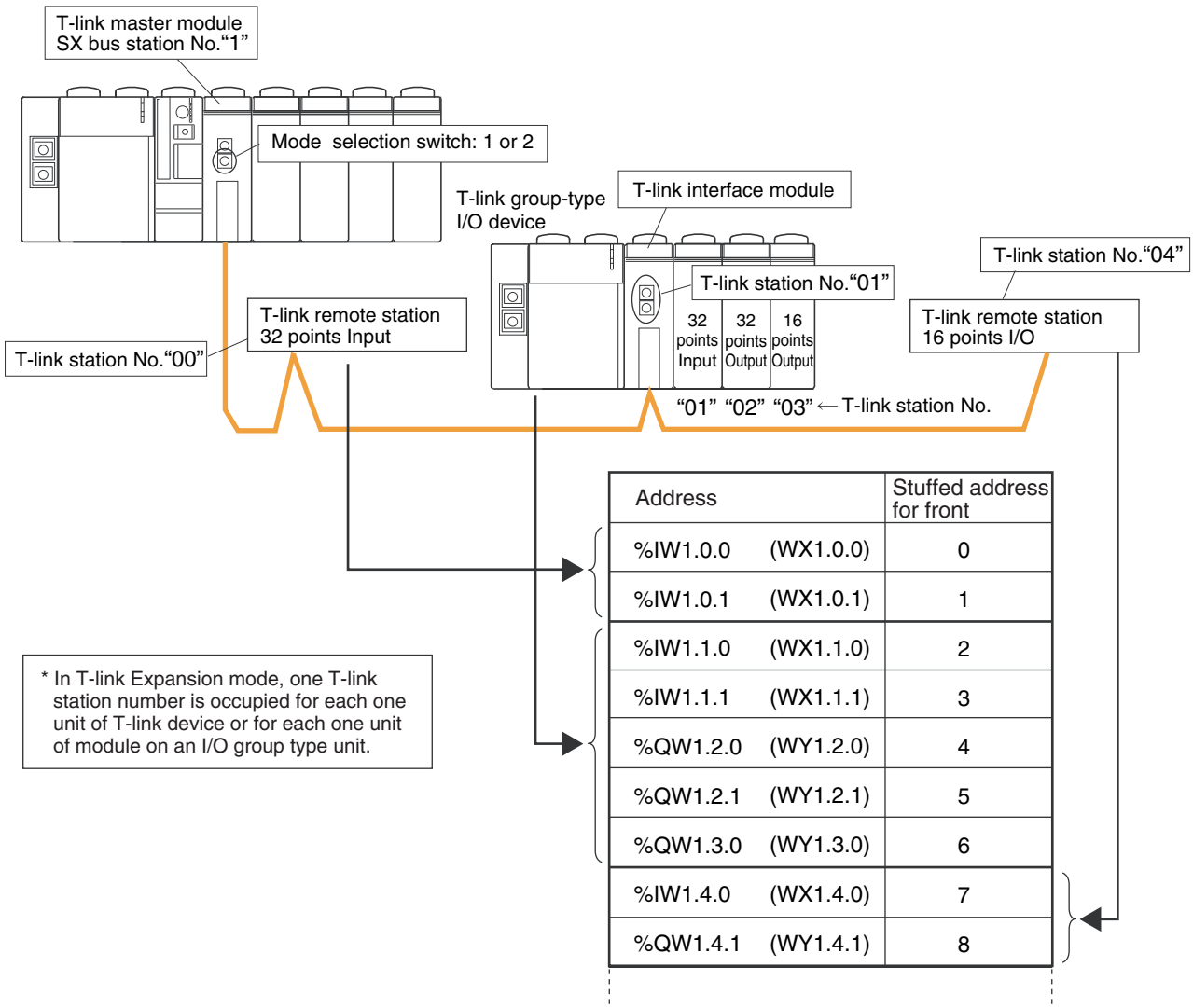
Address		T-link station number
%IW1.0.0	(WX1.0.0)	0
%IW1.0.1	(WX1.0.1)	
%IW1.2.0	(WX1.2.0)	2
%IW1.2.1	(WX1.2.1)	
%QW1.4.0	(WY1.4.0)	4
%QW1.4.1	(WY1.4.1)	
%QW1.6.0	(WY1.6.0)	6
%IW1.7.0	(WX1.7.0)	7
%QW1.7.1	(WY1.7.1)	

* Parenthesized figures mean the addresses when the Standard loader is used.

2) T-link expansion and I/O expansion modes

You need to configure the unit which carries out double word access so that the unit has an even number from the beginning by arranging all units connected to the T-link system in youngest to oldest order of addresses ("Address arranged from the front" in the table below is even).

The figure below shows addresses in the "T-link expansion or I/O expansion mode" system configuration.



Address		Stuffed address for front
%IW1.0.0	(WX1.0.0)	0
%IW1.0.1	(WX1.0.1)	1
%IW1.1.0	(WX1.1.0)	2
%IW1.1.1	(WX1.1.1)	3
%QW1.2.0	(WY1.2.0)	4
%QW1.2.1	(WY1.2.1)	5
%QW1.3.0	(WY1.3.0)	6
%IW1.4.0	(WX1.4.0)	7
%QW1.4.1	(WY1.4.1)	8

* In T-link Expansion mode, one T-link station number is occupied for each one unit of T-link device or for each one unit of module on an I/O group type unit.

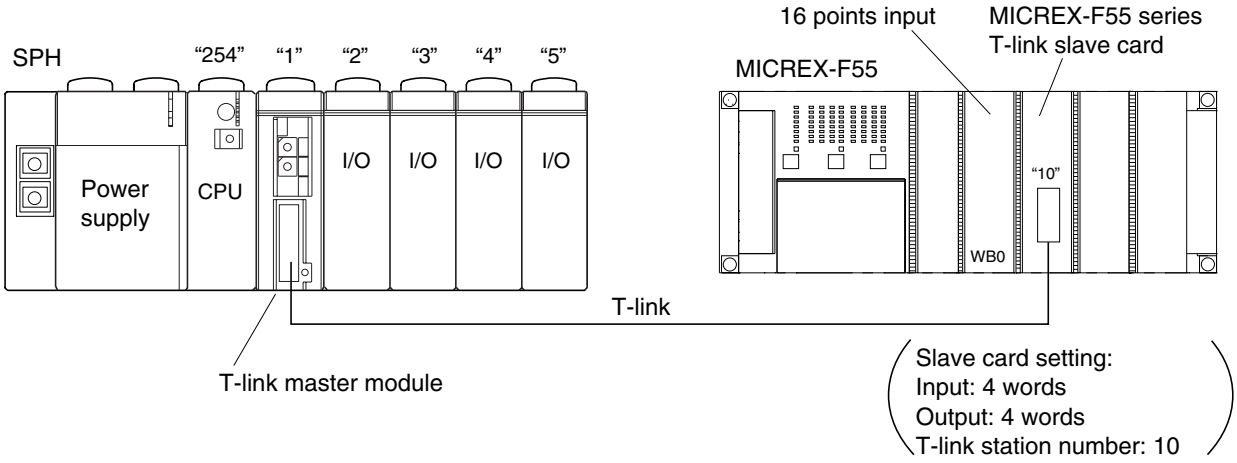
* Parenthesized figures mean the addresses when the Standard loader is used.

3-2-3 Communication system with other series using T-link slaves

Data can be transferred through T-link between MICREX-SX series SPH CPUs and MICREX-F series or FLEX-PC series CPUs.

(1) Example of connection to MICREX-F55 series when MICREX-SX series CPU becomes a master

The MICREX-SX series CPU is the master, and the MICREX-F55 series CPU is a slave.



<Assignment of I/O addresses>

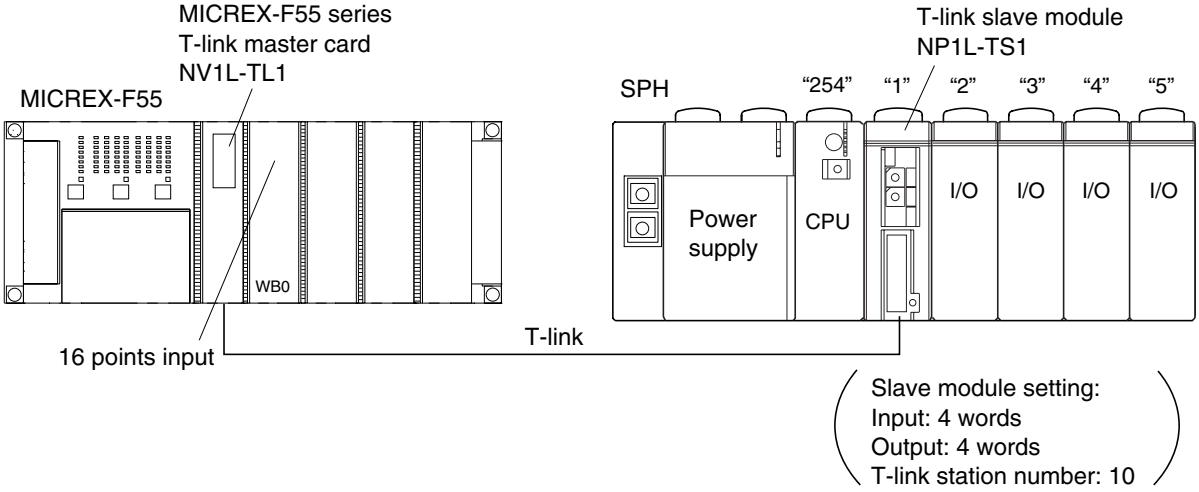
<Example of D300win>

	Master CPU side		Slave CPU side
Input	%IW1.10.0 (%IX1.10.0.0~15)	T-link	WB1
	%IW1.10.1 (%IX1.10.1.0~15)		WB2
	%IW1.10.2 (%IX1.10.2.0~15)		WB3
	%IW1.10.3 (%IX1.10.3.0~15)		WB4
Output	%QW1.10.4 (%QX1.10.4.0~15)		WB5
	%QW1.10.5 (%QX1.10.5.0~15)		WB6
	%QW1.10.6 (%QX1.10.6.0~15)		WB7
	%QW1.10.7 (%QX1.10.7.0~15)		WB8

<Example of standard loader>

	Master CPU side		Slave CPU side
Input	WX1.10.0 (X1.10.0~F)	T-link	WB1
	WX1.10.1 (X1.10.10~1F)		WB2
	WX1.10.2 (X1.10.20~2F)		WB3
	WX1.10.3 (X1.10.30~3F)		WB4
Output	WY1.10.4 (Y1.10.40~4F)		WB5
	WY1.10.5 (Y1.10.50~5F)		WB6
	WY1.10.6 (Y1.10.60~6F)		WB7
	WY1.10.7 (Y1.10.70~7F)		WB8

(2) Example of connection to MICREX-F55 series when MICREX-SX series CPU becomes a slave
The MICREX-F55 series CPU is the master, and the MICREX-SX series CPU is a slave.



<Assignment of I/O addresses>

<Example of D300win>

	Master CPU side		Slave CPU side
Input	WB10	T-link	%IW1.0 (%IX1.0.0~15)
	WB11		%IW1.1 (%IX1.1.0~15)
	WB12		%IW1.2 (%IX1.2.0~15)
	WB13		%IW1.3 (%IX1.3.0~15)
Output	WB14		%QW1.4 (%QX1.4.0~15)
	WB15		%QW1.5 (%QX1.5.0~15)
	WB16		%QW1.6 (%QX1.6.0~15)
	WB17		%QW1.7 (%QX1.7.0~15)

<Example of standard loader>

	Master CPU side		Slave CPU side
Input	WB10	T-link	WX1.0 (%IX1.0~F)
	WB11		WX1.1 (%IX1.10~1F)
	WB12		WX1.2 (%IX1.20~2F)
	WB13		WX1.3 (%IX1.30~3F)
Output	WB14		WY1.4 (%QX1.40~4F)
	WB15		WY1.5 (%QX1.50~5F)
	WB16		WY1.6 (%QX1.60~6F)
	WB17		WY1.7 (%QX1.70~7F)

3-2-4 T-link system using the T-link electric repeater/converter

(1) Overview of the T-link Electric Repeater (FRC200A-C10)

The FRC200A, with the functions listed below, allows flexible T-link network configurations.

- Extension of the T-link transmission distance
  Two repeaters can be used for one T-link system. The transmission distance can be extended up to 3 km.
- Branching of transmission line
  T-branches can be used.
- Connection with mini T-link
  The repeater supports mini T-link. The repeater has four pairs of terminals for connecting cables. (Terminal names: T-link 1, T-link 2, T-link 3, mini T-link)
  Either the T-link 3 connectors or mini T-link connectors can be used by setting a switch.

Note: 1) When the FRC200A repeaters are located at each end of the T-link, or for unused link connectors, connect the supplied terminating resistor (100 Ω/1 W). For the T-link 3 connectors and mini T-link connectors, it is not necessary to connect the terminating resistor to the connectors that are not selected by the switch.
2) For the T-link 3 connectors and mini T-link connectors, signals are transmitted to the connectors selected by the switch.

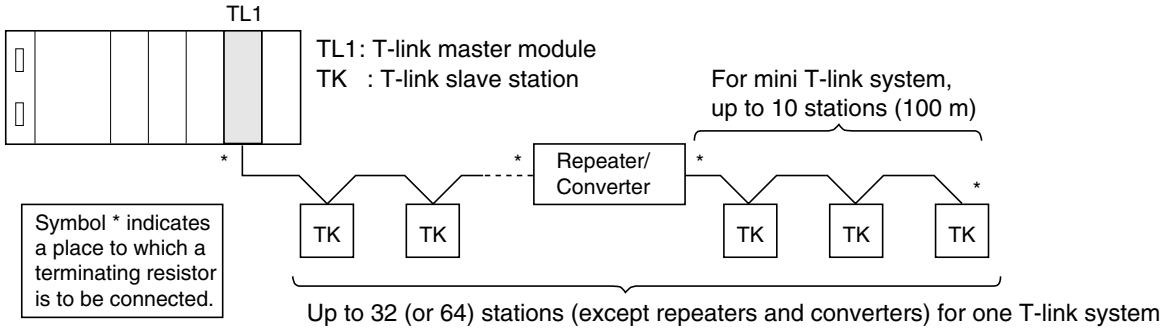
(2) Overview of the T-link converter (FRC100A-G02)

The FRC100A converts T-link signals to mini T-link signals (and vice versa) to support connections with various T-link I/O devices or mini T-link I/O devices.

Note: For terminating of the T-link or mini T-link transmission lines, connect the supplied terminating resistor (100 Ω/1 W).

(3) Notes on connecting T-link electric repeaters and T-link converters

Note the restrictions described below for T-link (mini T-link) system construction.

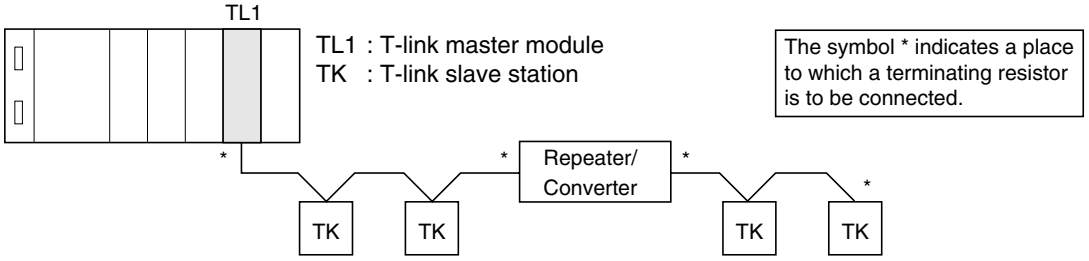


<Number of repeaters and converters usable for one T-link system>

	Serial connection	Parallel connection
T-link converter (FRC100A-G02)	1	2
T-link electric repeater (FRC200A-C10)	2	2

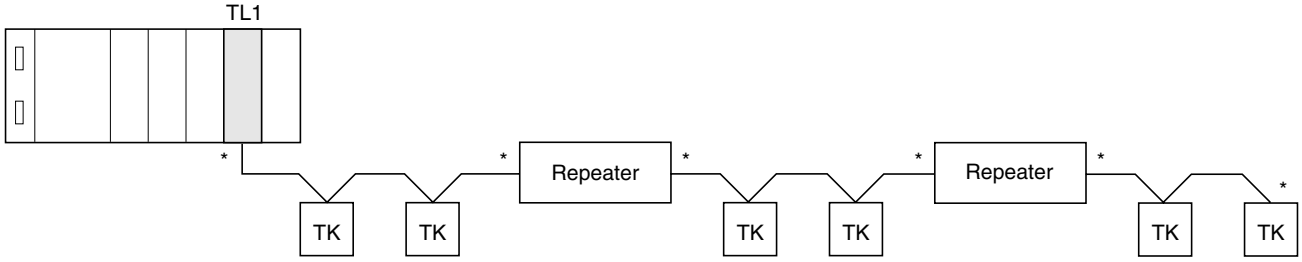
(4) Examples of system configurations

1) One repeater/converter in series

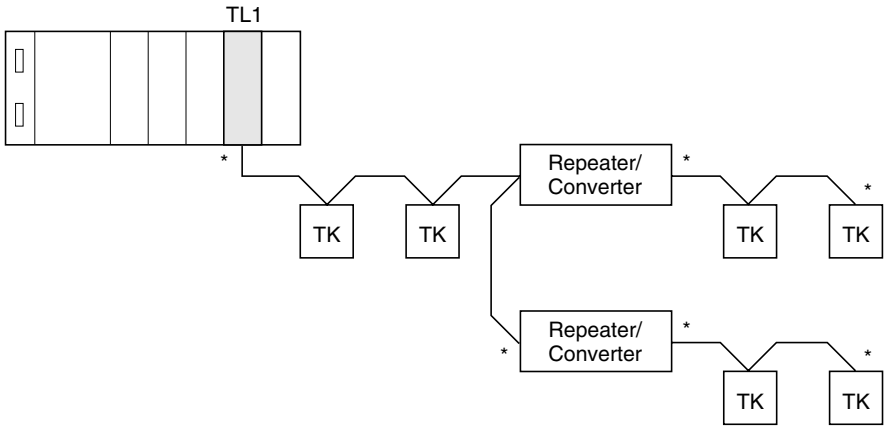


2) Two repeaters in series

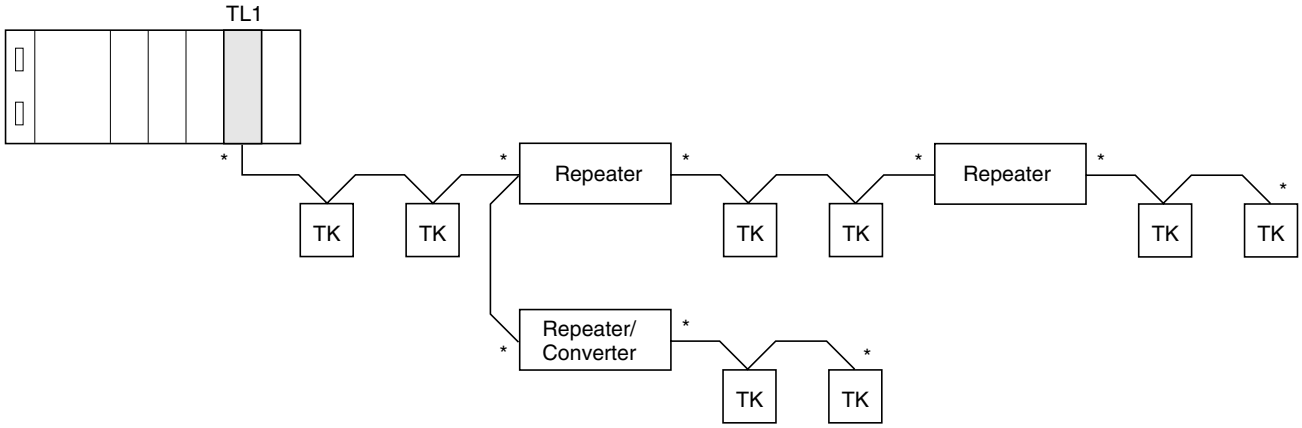
This configuration is allowed only for the T-link electric repeater (FRC200A-C10).



3) Repeaters/converters in parallel



4) Repeaters/converters in series and parallel

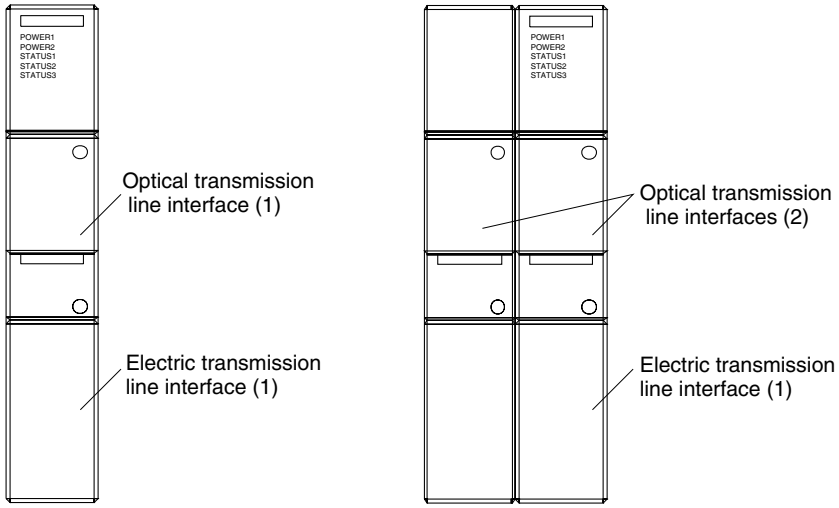


3-2-5 System configuration using the T-link optical converter

The allowable length of the T-link can be extended using optical transmission lines. Optical transmission lines are minimally affected by noise, thus optical transmission lines provide transmission lines suitable for use with noise-generating devices.

(1) Overview of the T-link optical converter

There are two types of T-link optical converter available: simple type FNC120A and high performance type FNC130A.



FNC120A FNC130A

<Communication specifications>

Item		Specification	
Transmission speed		500 kbps	
Electric	Cable	Twisted pair cable (shielded)	
	Total length	Max. 1 km	
Optical	Cable	SI multi-component glass fiber Core/clad diameter: 200 μm/250 μm	GI quartz fiber Core/clad diameter: 50 μm/125 μm
	Total length	Max. 1 km	Max. 1 km

<Optical adapter specifications>

Type	Applicable converter	Applicable fiber	Optical connector
FTC130T	FNC120A FNC130A	SI multi-component glass fiber, 200/250 μm	F 06/08 (JIS C 5975, 8)
FTC132S		GI quartz fiber, 50/125 μm	

Note: For T-link optical converter specification details (FNC120A- □ □, FNC-130A- □ □) and operation of the converters, refer to the operating instructions (INA-F7465).

(2) System configuration

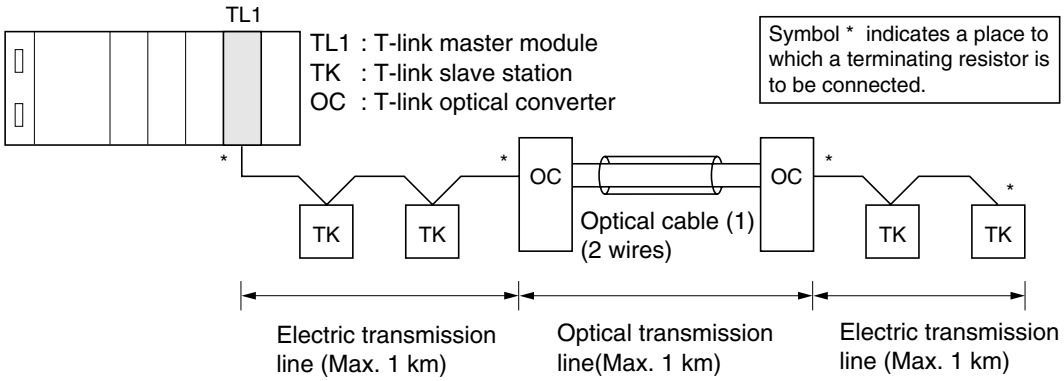
System configurations with optical converters are as follows:

1) 1: 1 connection.....Basic system using two optical converters.
2) Cascade connection....System with optical converters connected in series.
3) Star connection..... System with optical converters connected in parallel.
4) Loop connection.....System with optical converters connected to a loop line.

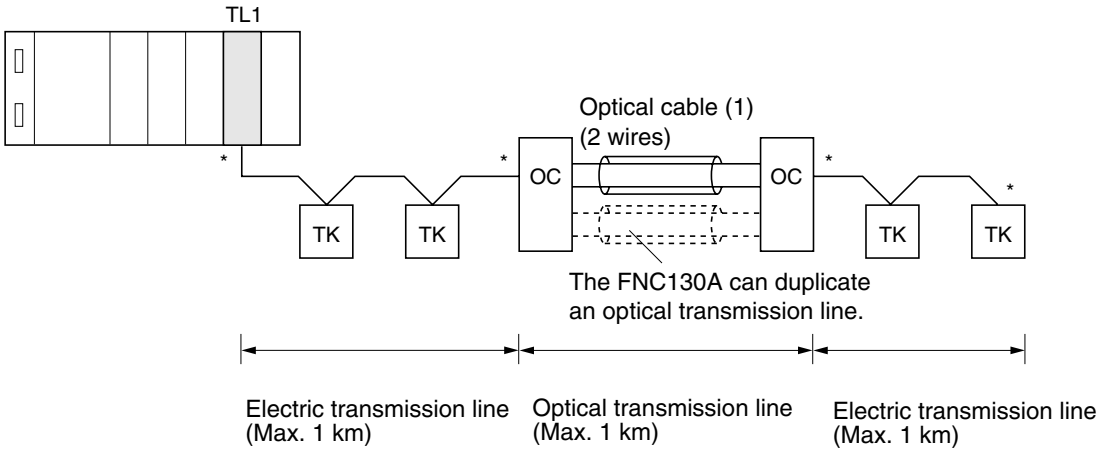
Note: In any system configuration the number of slave stations that can be connected to a master module is up to 32.

1) 1 : 1 connection

<When FNC120A is used>



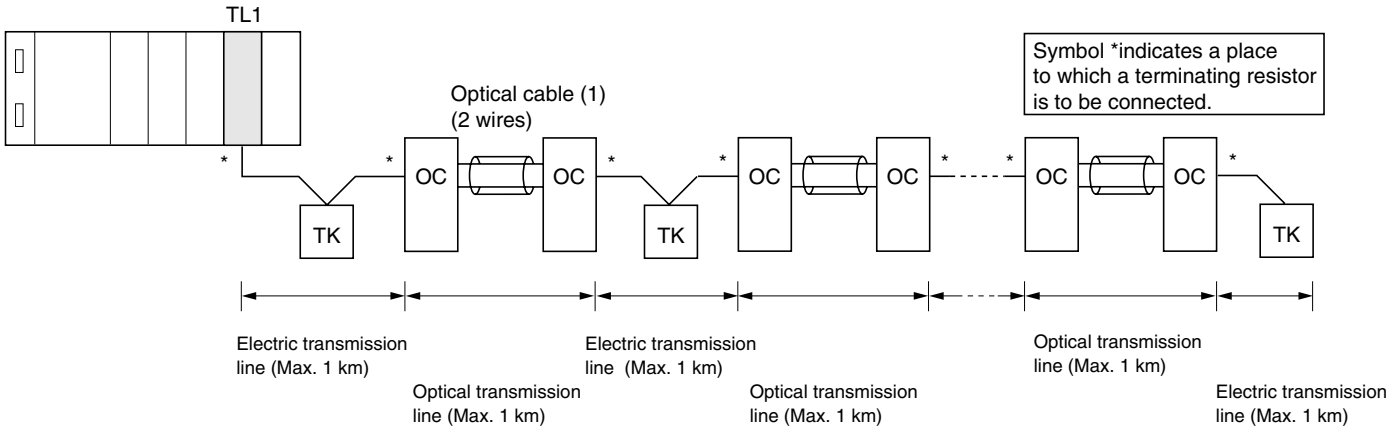
<When FNC130A is used>



2) Cascade connection

<When FNC120A is used>

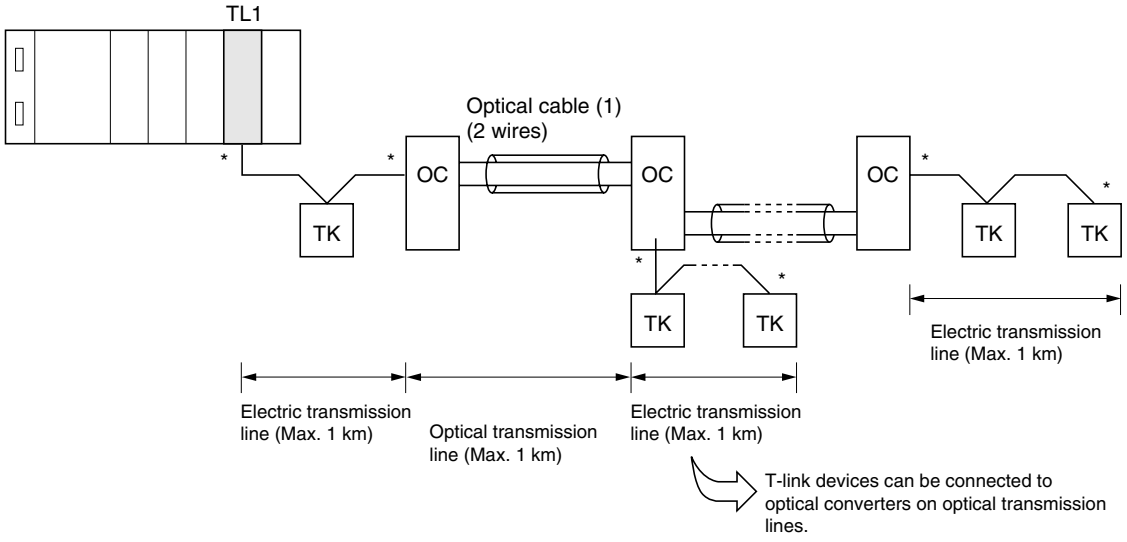
This system connects electrical transmission lines and optical transmission lines alternately in series. This system can contain up to 16 optical converters.



As illustrated above, the optical transmission line can be extended up to 8km and the electric transmission line can be extended up to 9 km with 16 optical converters by alternately connecting electric transmission lines and optical transmission lines together. The total extendable line length is 17km.

<When FNC130A is used>

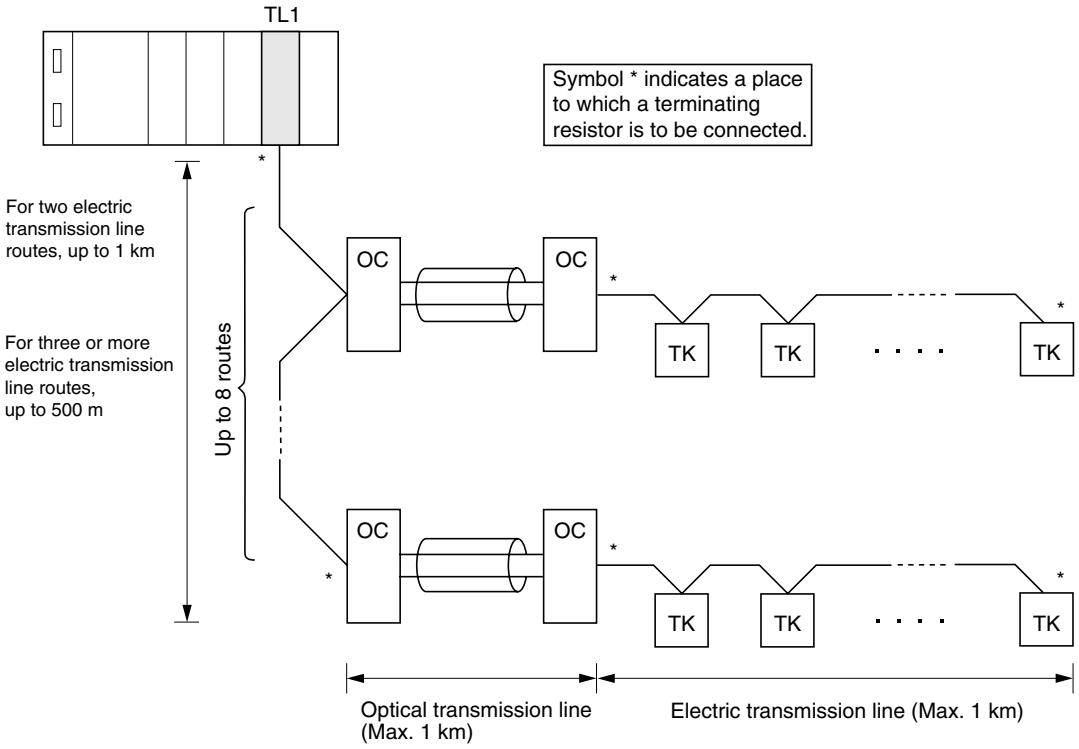
This system connects electric transmission lines and optical transmission lines in series. However, this system can be established by connecting only optical transmission lines. This system can contain up to 16 optical converters.



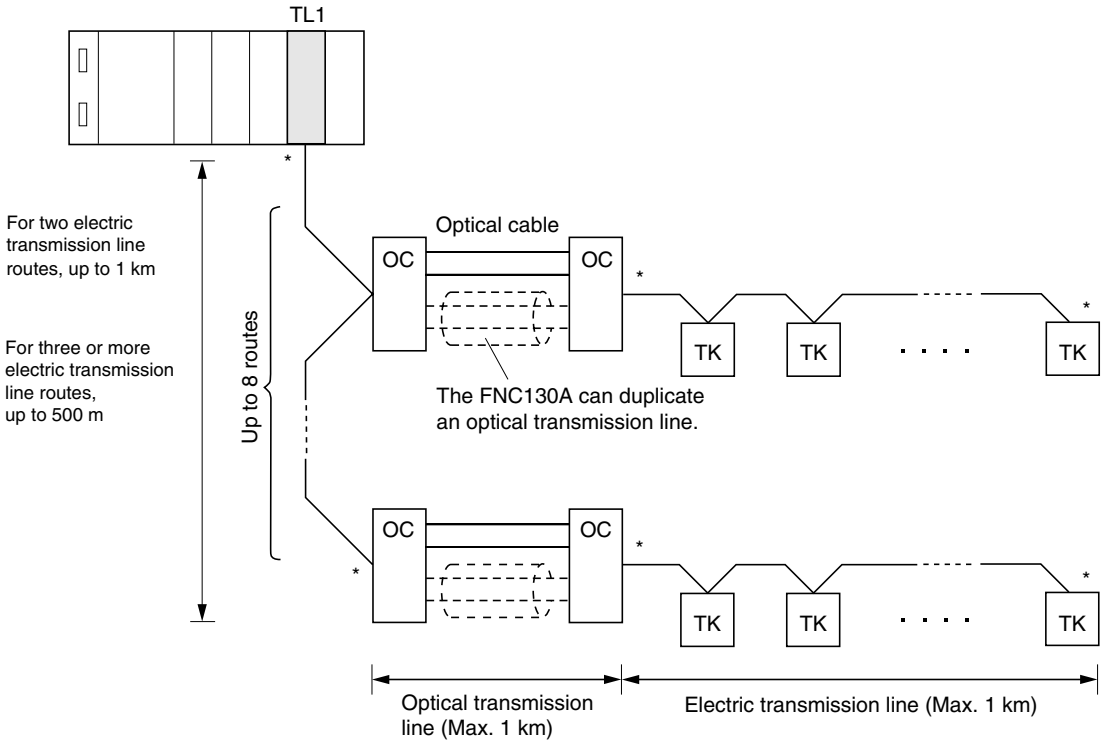
3) Star connection

A star T-link system can be constructed by connecting optical converters to electric transmission lines (up to 8 routes).

<When FNC120A is used>

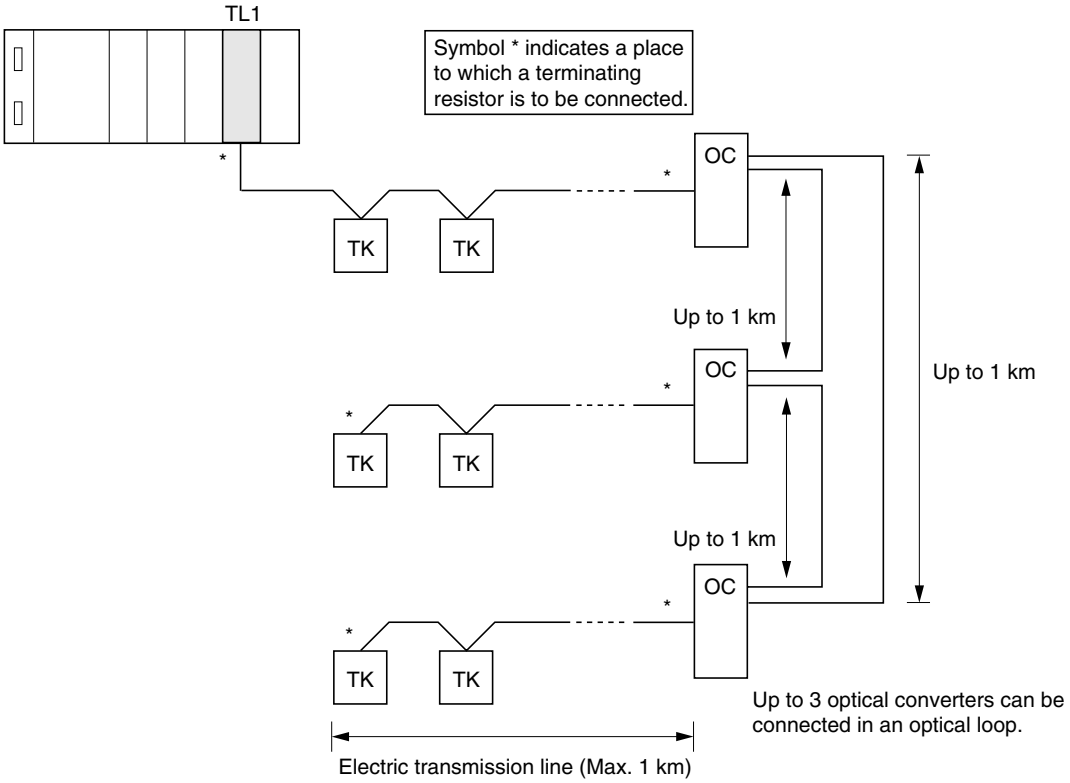


<When FNC130A is used>



4) Loop connection (FNC120A or FNC130A)

The loop connection efficiently implements redundant optical transmission lines. By looping the optical transmission lines, transmission continues even if a part of the optical cable line is disconnected.



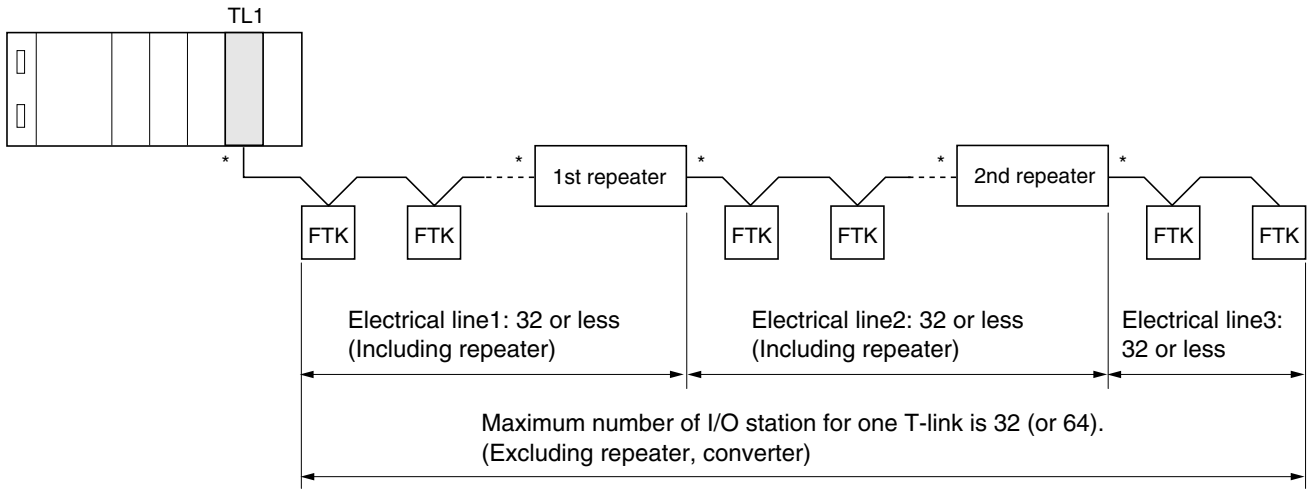
3-2-6 Maximum number of T-link connected I/O stations

Generally speaking, maximum number of T-link connected I/O stations for one T-link master is 32. However, depends on version combination of T-link master and loader, it can be expanded to 64. Here explains calculation of number of T-link connected I/O stations and system configuration for this application. (See section 1-5 for version)

(1) Calculation of number of T-link connected I/O stations

Only I/O station which has T-link station address setting dial should be counted. Therefore ;

* Capsule type I/O : FTK, FTT, NR1T, NR2T, POD, etc... : each station considered as one I/O station.
* Building block type I/O : NP1L-RT1, FTL010A, FTL010H : each base board is considered as one I/O station.
* T-link slave on other configuration (such as NP1L-TS1, MICREX-F series T-link slave) : each slave is considered as one station.
* Converter, repeater : FRC100A, FRC200A, FNC120A, FNC130A : Those are not considered as I/O station. However, need to consider for electrical connection number.



(2) Calculation of number of T-link connected stations on electrical line

Maximum station number for T-link electrical line is 32. If you need to connect more than this limit or need to expand distance, use T-link electrical repeater or T-link optical converter. In this way, it is possible to expand maximum number of T-link I/O station up to 64 (see above picture).

In this case, you need to count repeater or converter as electrically connected station.

For example, in above case;

Electrical line1: Electrical line start from NP1L-TL1. Count total number of “FTK” and 1st repeater. NP1L-TL1 should not be counted.

Electrical line2: Electrical line start from 1st repeater. Count total number of “FTK” and 2nd repeater. 1st repeater should not be counted.

Electrical line3: Electrical line start from 2nd repeater. Count total number of “FTK”. 2nd repeater should not be counted.

Please note maximum number of T-link I/O stations for one T-link master is 32 (or 64). Therefore, it is not possible to have 32 I/O stations for each electrical line1, 2, 3 (total 96).

Section 4 System Definitions

Page

Section 4 System Definitions

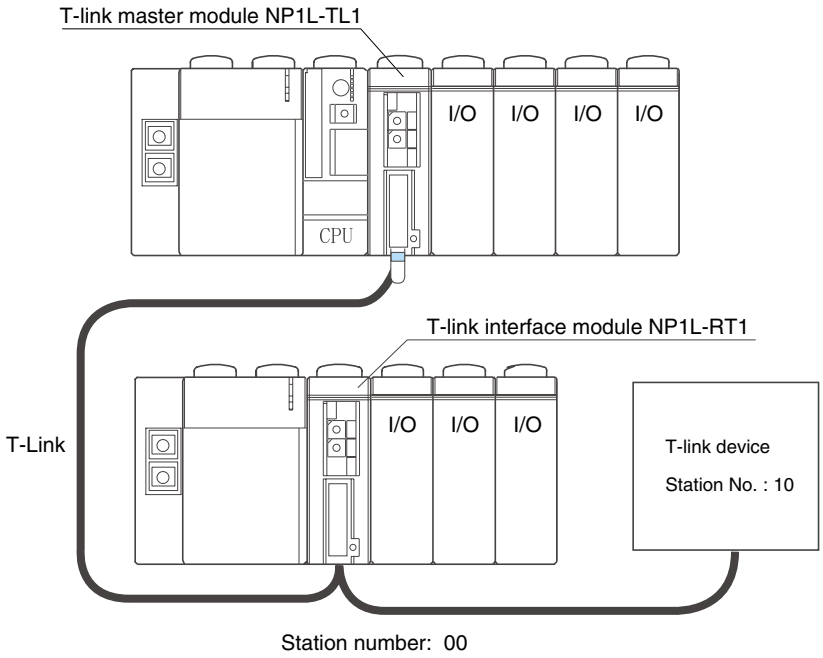
To construct a T-link system in the MICREX-SX series SPH, the system definitions listed below are required.

- System configuration definition (always needed)
- Fail-soft setting
- Output hold definition

Register modules to be used such as CPU modules, T-link master modules, and T-link interface modules, or T-link device with “System_Definition” in the project tree.

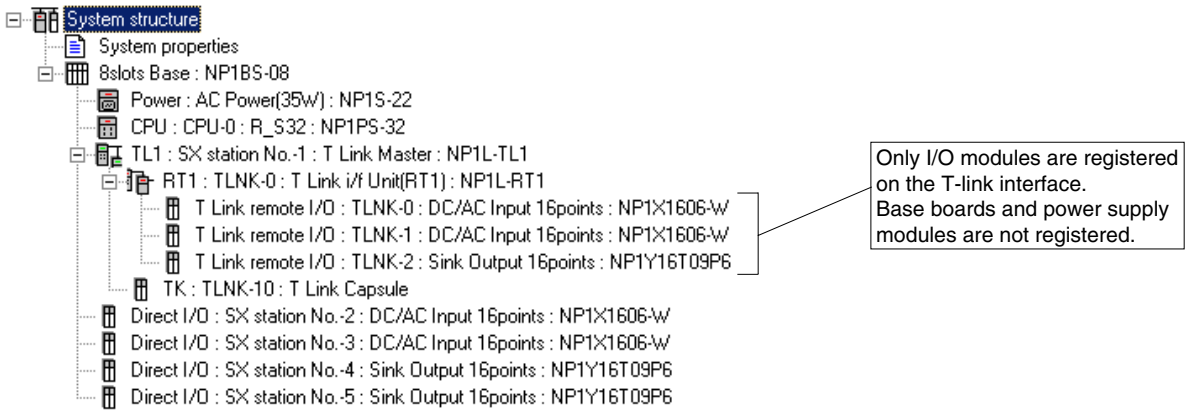
4-1 System Configuration Definition

<Example of system configuration>



<System configuration definition tree screen>

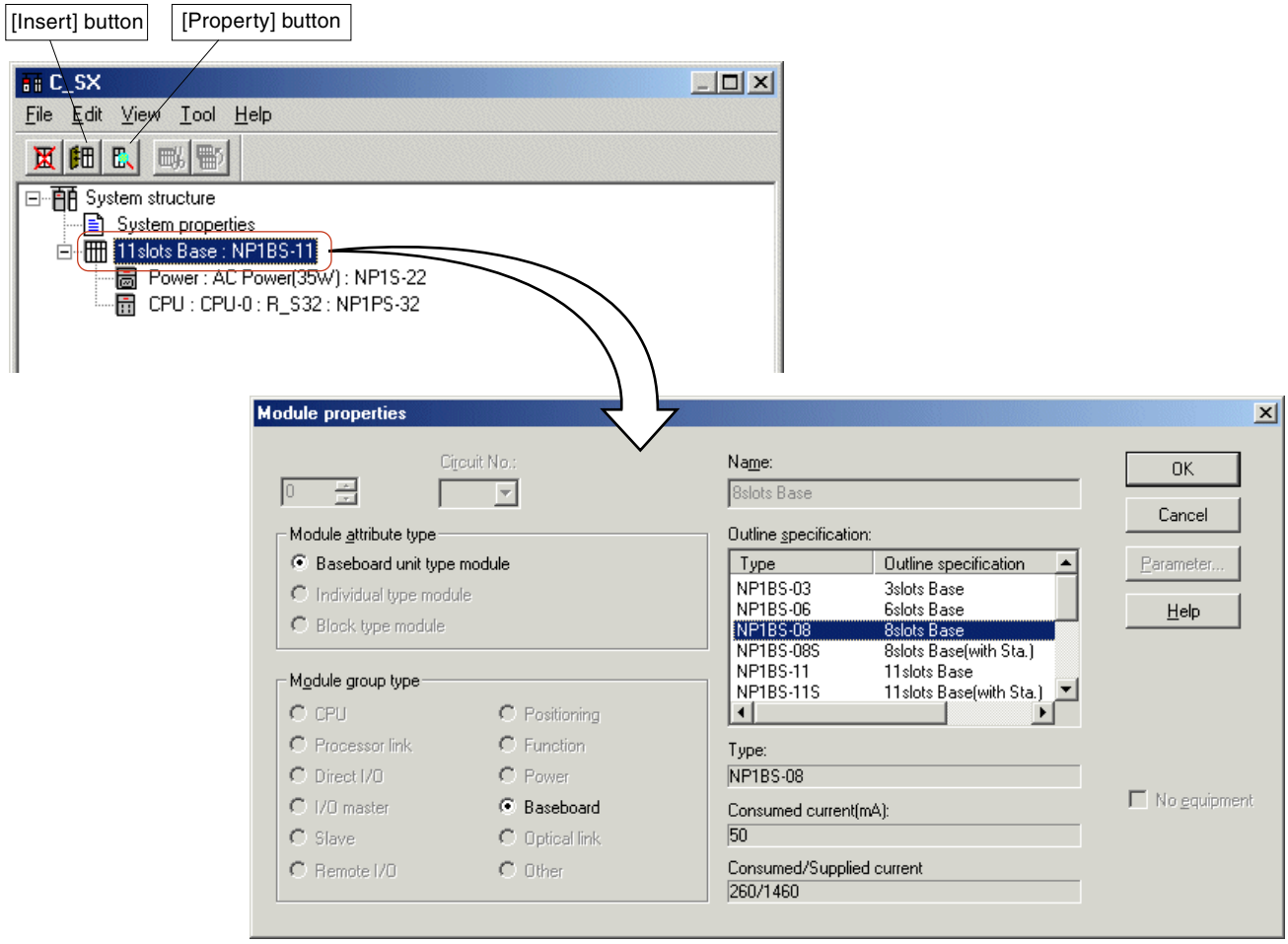
The configuration registered for above system becomes as follows:



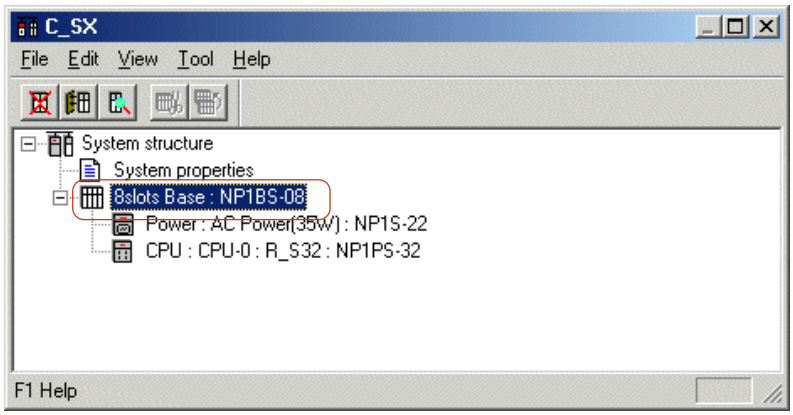
4-1-1 Registration of module

How to register modules is described below, taking the sample system configuration described on the preceding page for example.

◊ In the initial condition of the system definition dialog box, a power module (AC power supply of 2-slot specification) and a CPU module selected with the template are registered for a 11-slot base board, as shown below.
With the base board highlighted, click the [Property] button. The [Module property] dialog box is displayed.

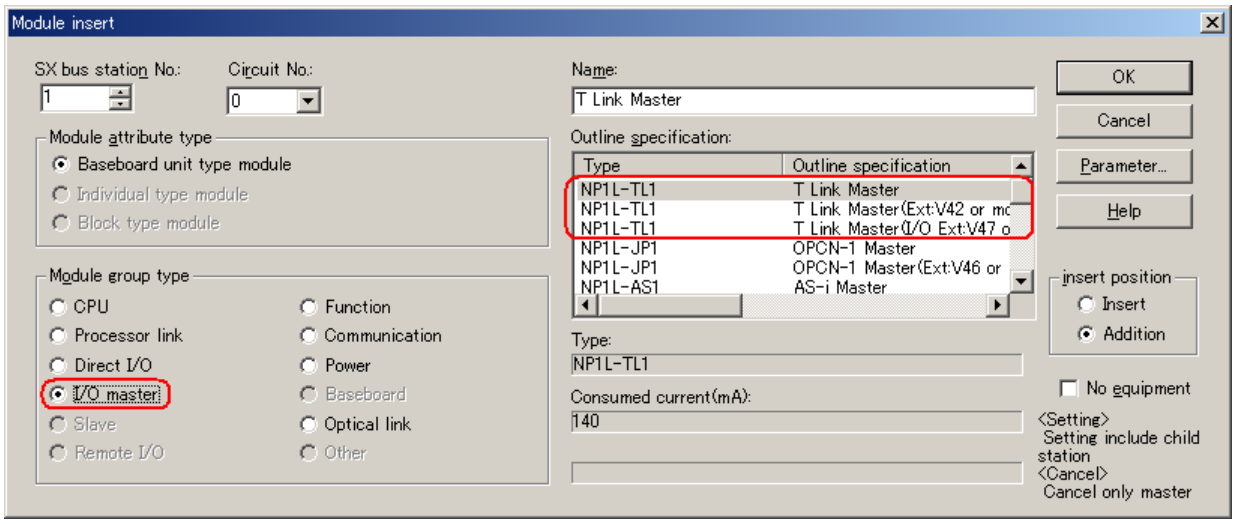


◊ Select a base board you want to use, and click the [OK] button to finish the modification of the base board setting.



4-1 System Configuration Definition

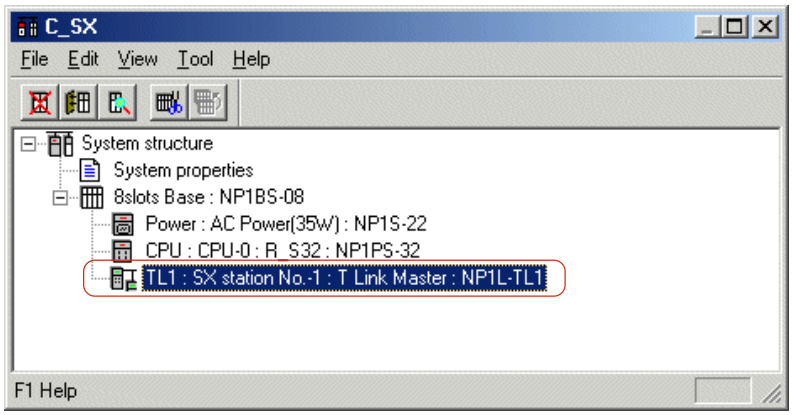
◊ Then, the T-link master module that is mounted next to the CPU module is registered. With the CPU module highlighted, click the [Insert] button on the system configuration registration window. The [Module insert] dialog box is displayed. On this dialog box, select “I/O master” for “Module group type”. "T Link Master” module is displayed in the [Outline specification] box.



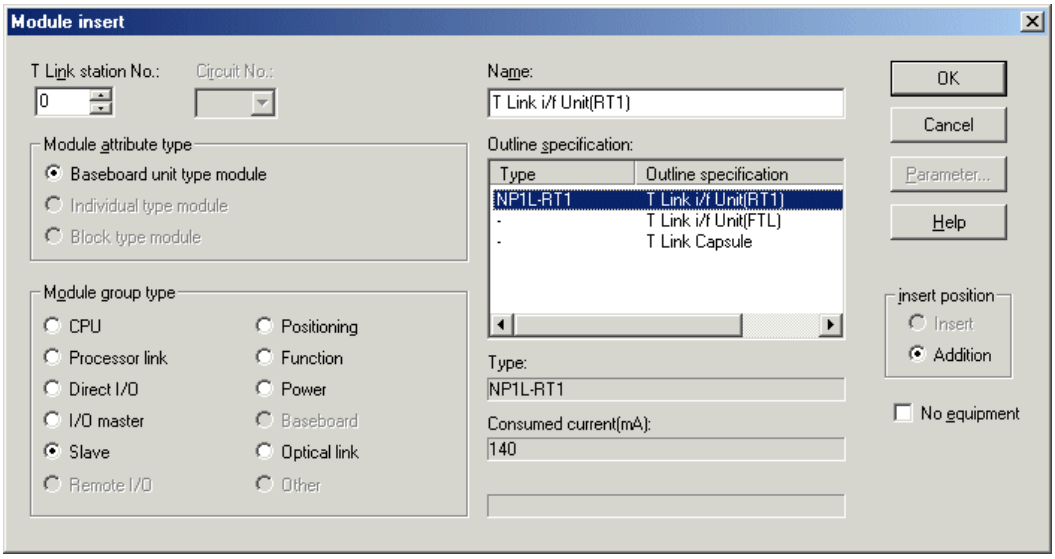
<Items to set when T-link master module is registered>

- Circuit No.
  With MICREX-SX SPH, maximum 8 units of I/O master module can be contained in one configuration. According to the circuit number (0 to 7) that is set on this step, the addresses for remote I/O monitoring flags that are prepared in the system memory of the CPU module are determined.
- Outline specification
  In case of T-link expansion, select “T-link Master(Ext:V42 or more)”.
  In case of I/O expansion, select “T-link Master(I/O Ext:V47 or more)”.

◊ After setting all necessary items, click the [OK] button. The T-link master module is registered.

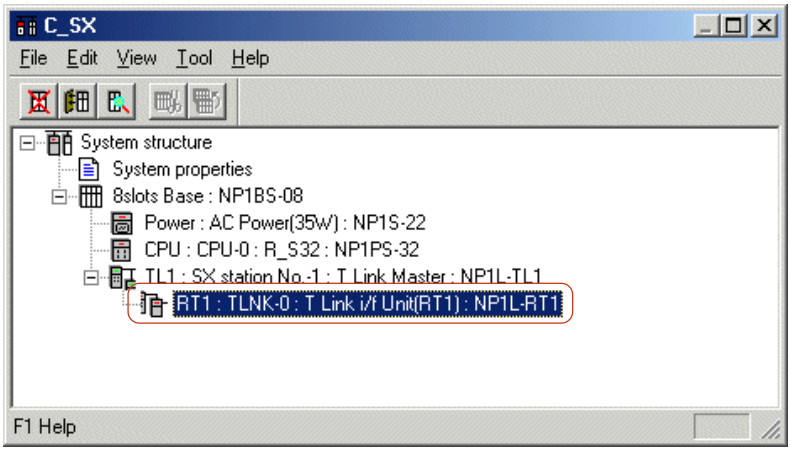


◊ Then, the T-link device, which is to be connected to the T-link master module, is registered.
With the T-link master module highlighted, click the [Insert] button. The [Module insert] dialog box is displayed.
Select “Slave” for “Module group type”. The T-link device is displayed in the [Outline specification] box.



When the T-link interface module for MICREX-SX SPH is connected, select “NP1L-RT1: T Link i/f Unit (RT1)”. When the T-link interface module for conventional MICREX-F series is connected, select “T Link i/f Unit (FTL)”; when other T-link device (I/O terminal, FTK, T-link slave on other configuration etc.) is connected, select “T Link Capsule”.

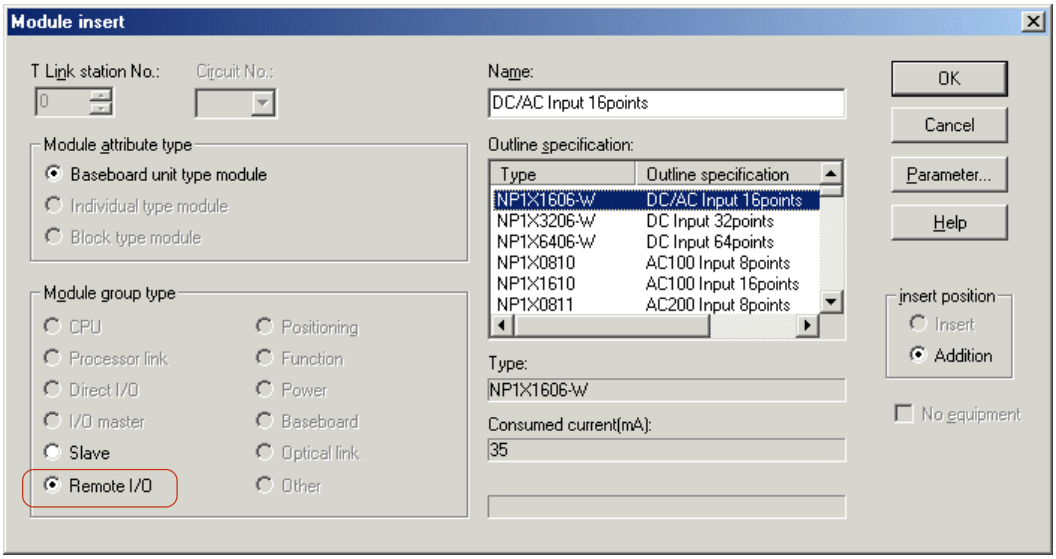
◊ Select “NP1L-RT1: T Link i/f Unit (RT1)” and click the [OK] button. The T-link interface module is registered.



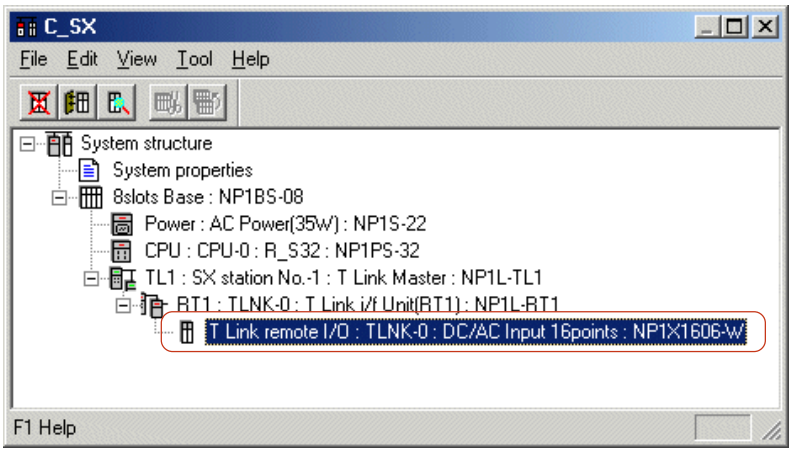
4-1 System Configuration Definition

◊ Then, the I/O module on the T-link group-type unit is registered.

With the T-link interface module highlighted, click the [Insert] button to display the [Module insert] dialog box. To register the I/O module on the T-link interface I/O group-type unit, select “Remote I/O" for “Module group type”.

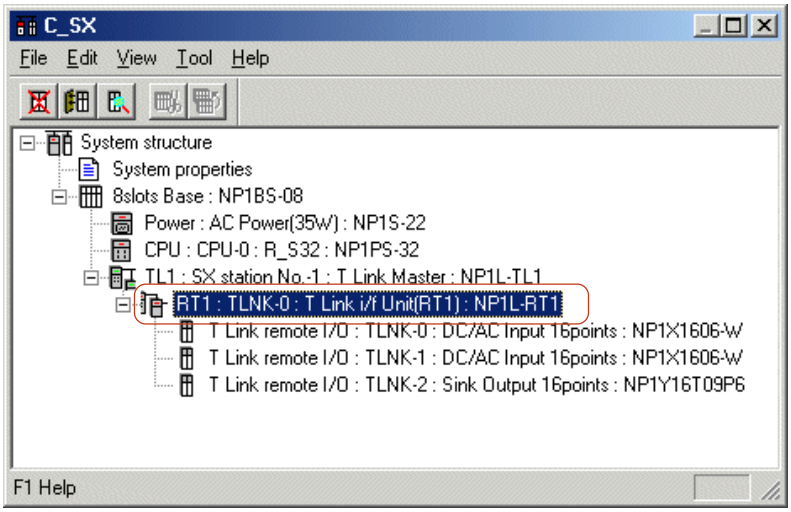


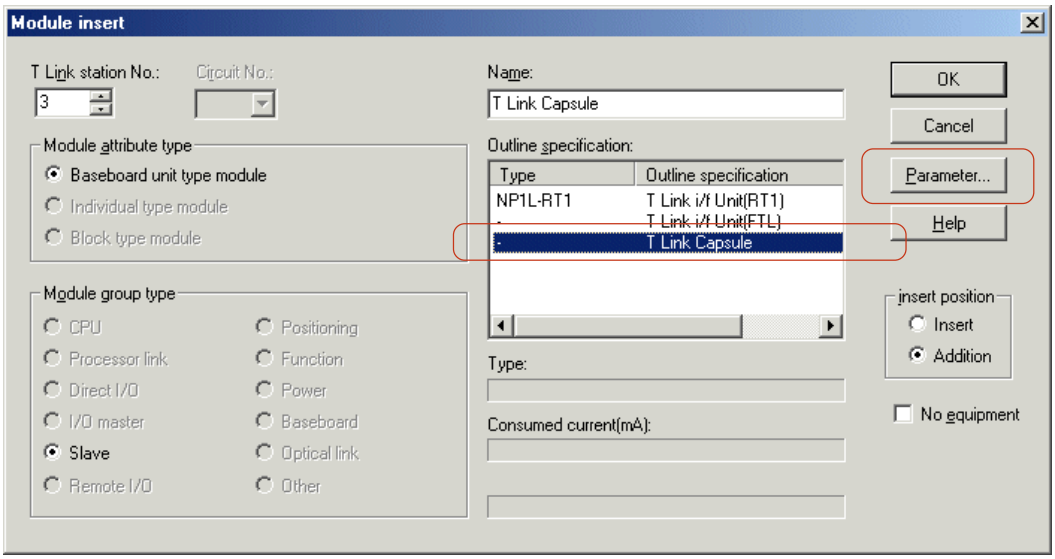
◊ With the I/O module highlighted, which you want to register, click the [OK] button. The module is registered.



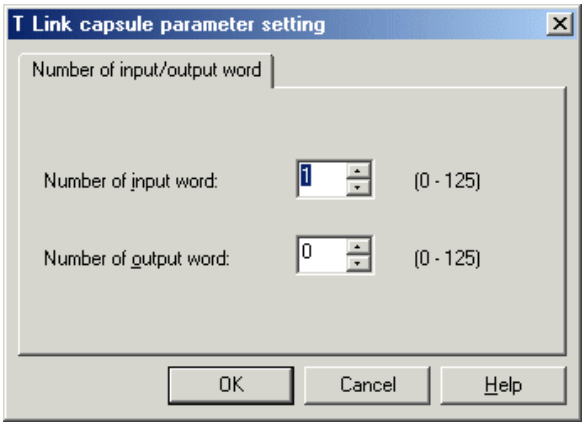
◊ After the remaining I/O modules on the T-link interface group-type unit are registered in the same way, T-link capsule type unit is registered.

With the T-link interface module highlighted, click the [OK] button. The [Module insert] dialog box is displayed.



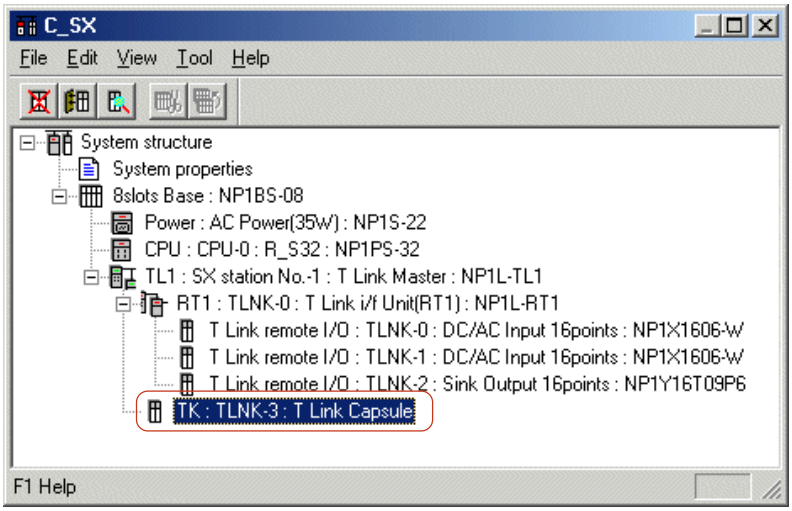


◊ When "T Link Capsule" is selected, the [Parameter…] button is enabled. When this button is clicked, the [T Link capsule parameter setting] dialog box is displayed. On this dialog box, the number of words occupied by T-link capsule is set.



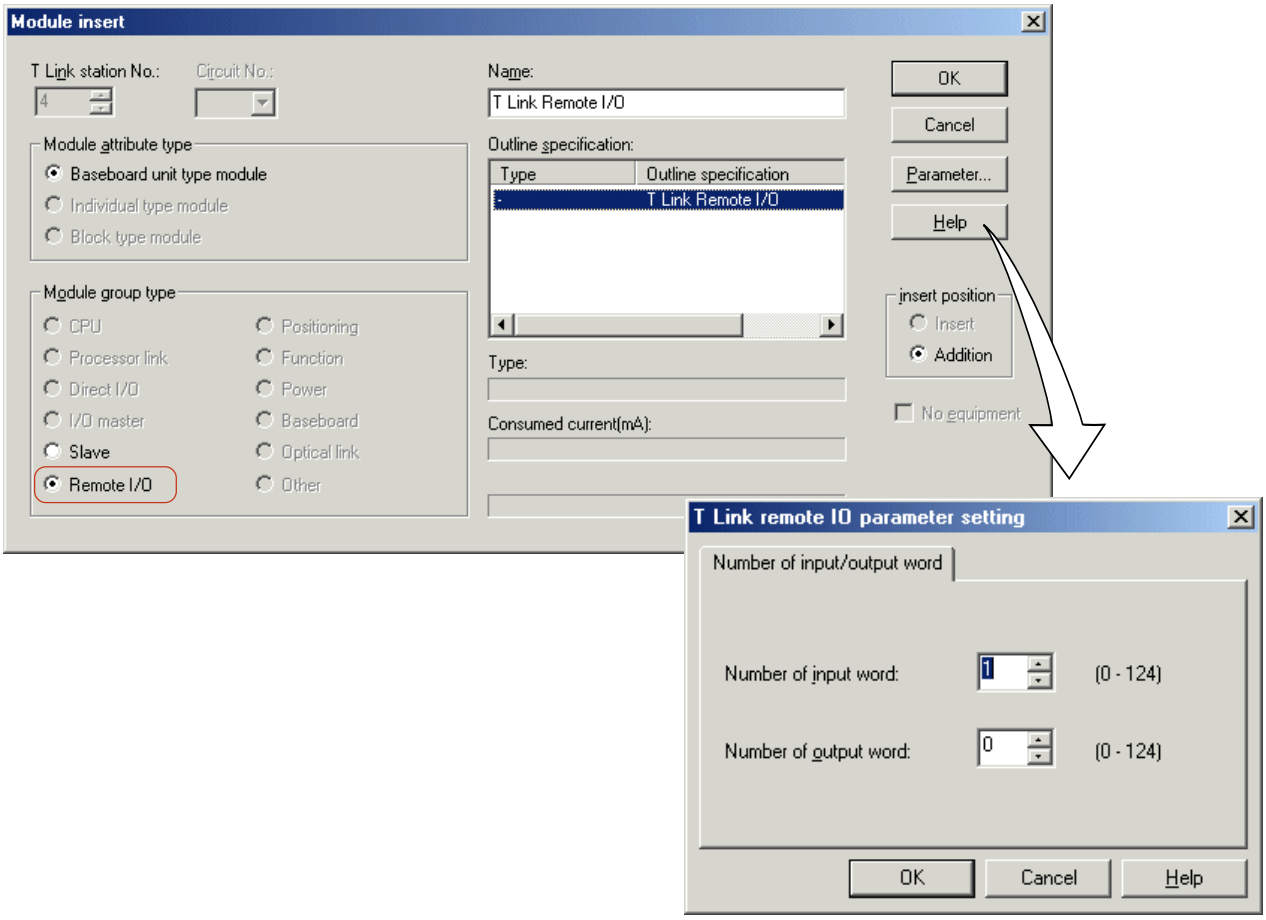
4-1 System Configuration Definition

◊ After registering the number of I/O words occupied by T-link capsule, click the [OK] button. You return to the [Module insert] dialog box. When the [OK] button is clicked on this dialog box, the T-link capsule is registered.



<Registering T-link I/O group-type unit FTL for MICREX-F series>

On the registration window, I/O modules on FTL are all classified to “T Link remote I/O”. The number of words occupied by individual module is set for individual T-link remote I/O by parameter.

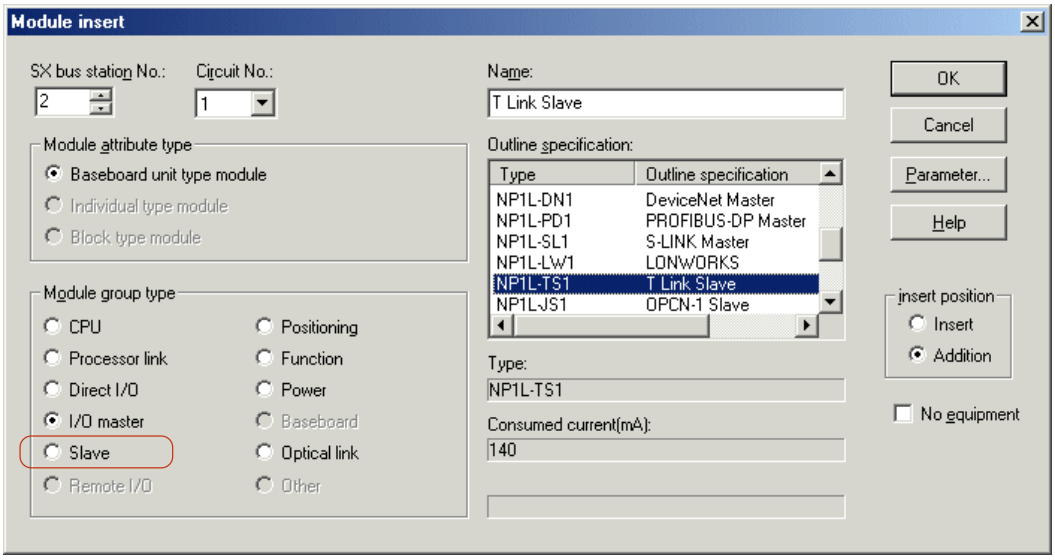


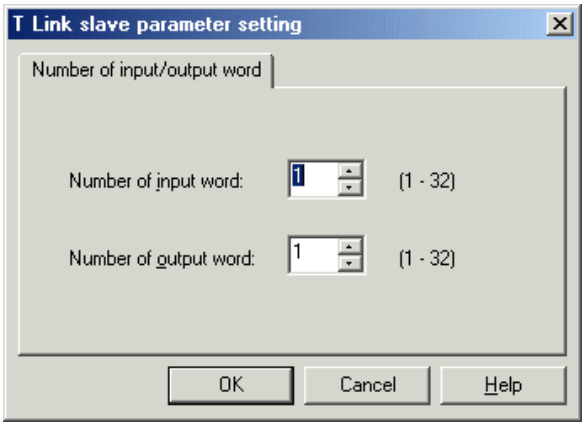
<Registration of T-link slave module>

The T-link slave module, or NP1L-TS1, sends/receives data to/from the PLC system working as a T-link master station by means of I/O communication. The number of occupied I/O words that are used for this communication is set by parameter when the module is registered. (This registration should be done by CPU which has mounted NP1L-TS1 module.)

<Setting procedure>

1) On the [Module property] dialog box for the T-link slave module or on the [Module insert] dialog box displayed when the module is inserted, click the [Parameter…] button. The [T-Link slave parameter setting] dialog box is displayed.





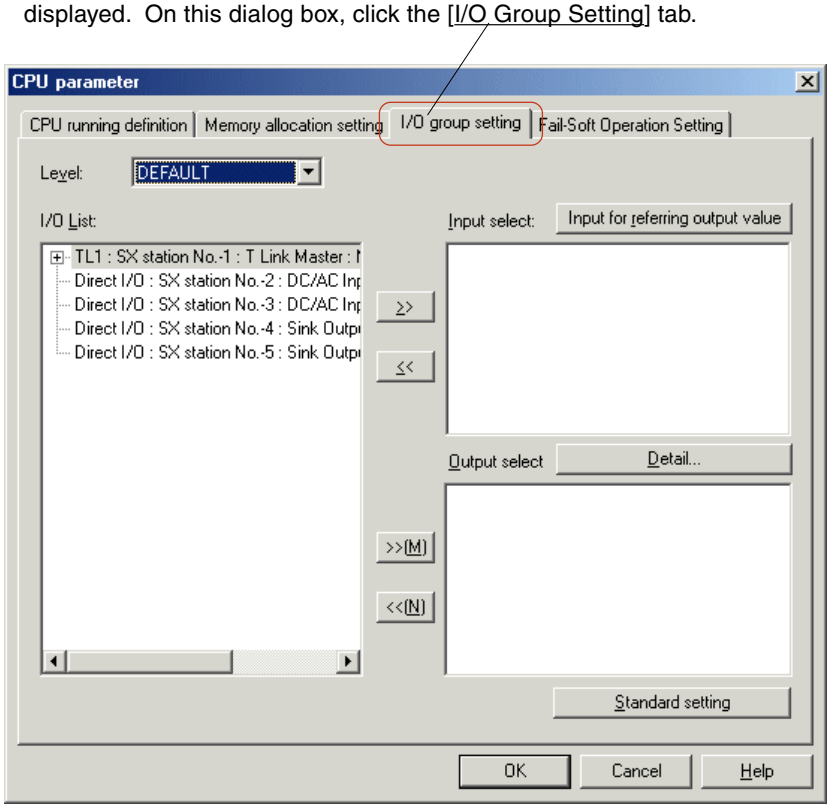
◊ Set 1 word/1 word, 2 words/2 words, 4 words/4 words, 8 words/8 words, or 32 words/32 words for the number of input words/ number of output words, and click the [OK] button. If NP1L-TS1 is mounted on NP1L-RT1 base board, input/output words are fixed as 4/4.

Note: When you want to use the T-link slave module, or NP1L-TS1, it is necessary to set fail-soft operation for that module. If communication with the PLC system working as a master station is disrupted, the T-link slave module falls in a module fatal fault condition. If no fail-soft operation is set, the PLC system (configuration) that connects the T-link slave module falls in a system fatal fault condition and cannot operate at all.

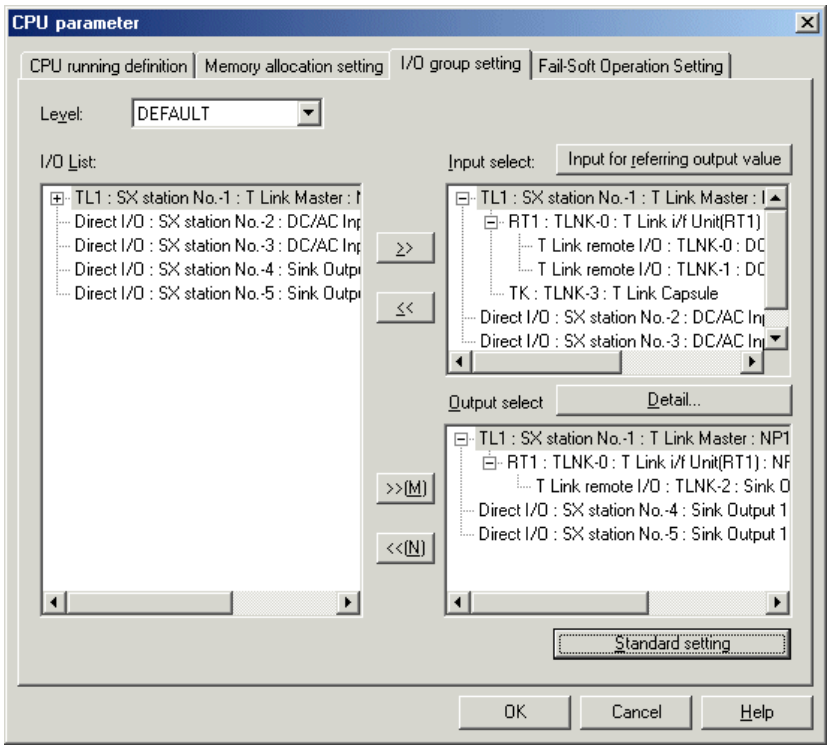
4-1-2 I/O group setting

I/O group is set for the module that is already registered to the system configuration.

◊ On the [Module property] dialog box for the CPU module, click the [Parameter…] button. The [CPU parameter] dialog box is displayed. On this dialog box, click the [I/O Group Setting] tab.



◊ On the [I/O Group Setting] tab window, it is set which task of which CPU controls which I/O. When the default task of a single CPU system controls all I/O's, clicking the [Standard setting] button registers all modules and units.

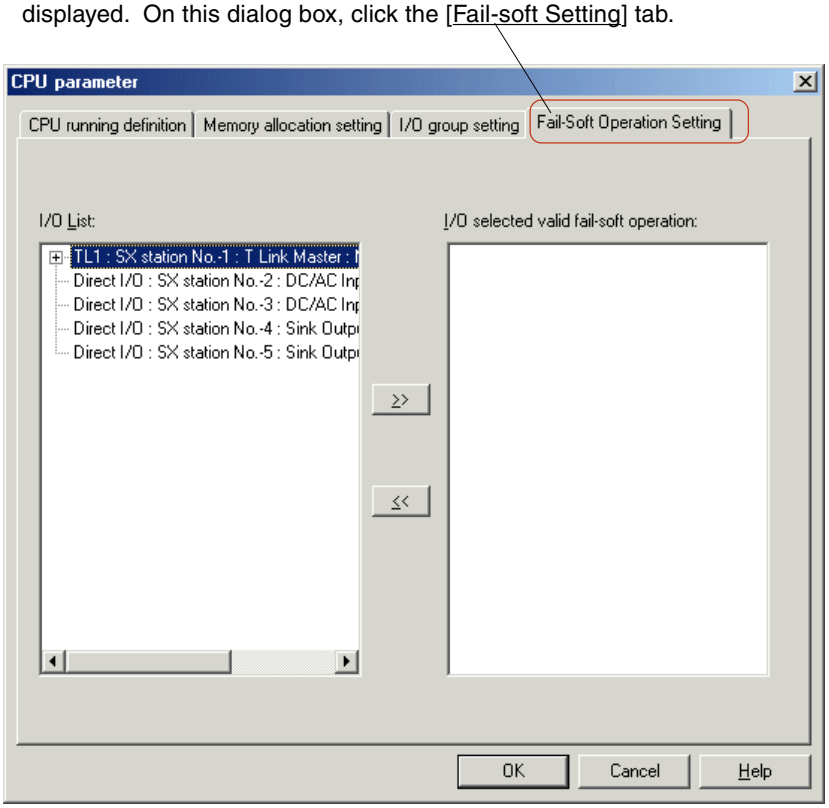


4-2 Fail-soft Setting

"Fail-soft operation" means to have normal modules/capsules continue their operation even if an error occurs in an I/O module/ capsule on the SX bus or T-link.
Set "Fail-soft operation" using the "Fail-soft setting" in the CPU module parameter.

<Setting procedure>

◊ On the [Module property] dialog box for the CPU module, click the [Parameter…] button. The [CPU parameter] dialog box is displayed. On this dialog box, click the [Fail-soft Setting] tab.



◊ With the module or capsule highlighted, for which you want to set fail-soft operation, click the [>>] button to register it. After this, click the [OK] button to finish the registration.

4-2 Fail-soft Setting

<Key-point>

- As for the modules on SX bus, the CPU does not start operation if the modules registered to the system configuration definition are not started up when the system is powered up. However, when fail-soft operation is set for the modules or units on T-link remote I/O, the CPU starts operation in "nonfatal fault" condition even if no remote I/O module is started up. After the remote I/O modules start up, the “nonfatal fault” condition will change to “normal”.

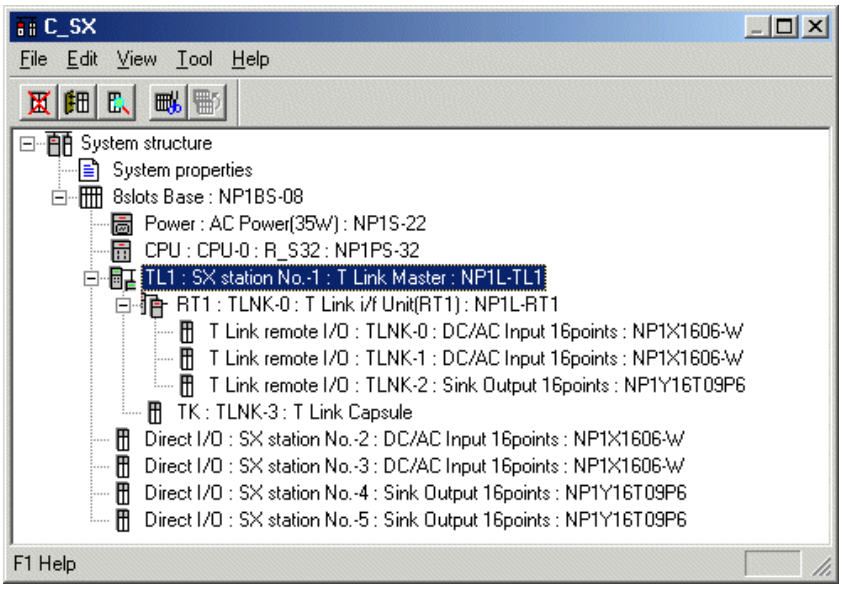
- When use the T-link slave module for MICREX-SX series, or NP1L-TS1, fail-soft operation needs to be set for the T-link slave module. If communication with the PLC system working as a master station is disrupted, the T-link slave module falls in a module fatal fault condition. If no fail-soft operation is set, the PLC system (configuration) that connects the T-link slave module falls in a system fatal fault condition and cannot operate at all.

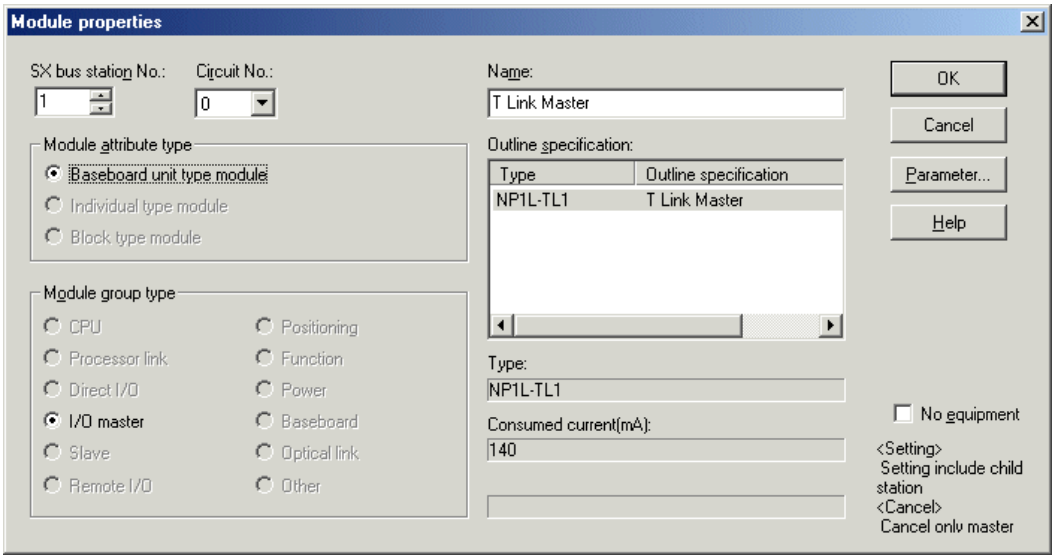
4-3 Output Hold Definition

To hold the state which existed immediately before a system fault that stops CPU module operation, or to hold the output immediately before the CPU module stops, use the output hold facility.
Set the “Output hold” setting using the “Individual output hold station definition” parameter on the T-link master module.

<Operating procedure>

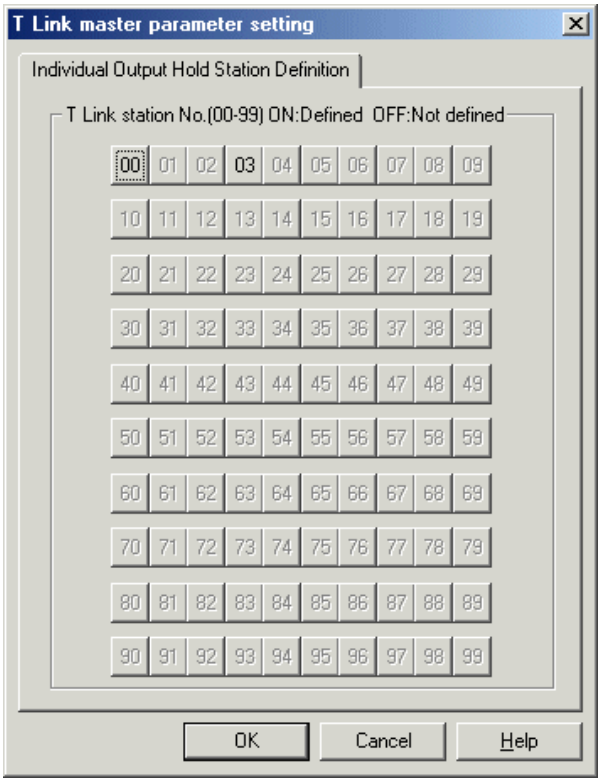
◊ With the T-link master module highlighted, click the [Property] button. The [Module property] dialog box for the T-link master module is displayed.





4-3 Output Hold Definition

◊ When the [Parameter…] button is clicked, the [T Link master parameter setting] dialog box is displayed. On this dialog box, “output hold” is registered for individual T-link station.
For the stations, for which you want to set “output hold”, click the buttons that correspond to their T-link station numbers to set them ON.

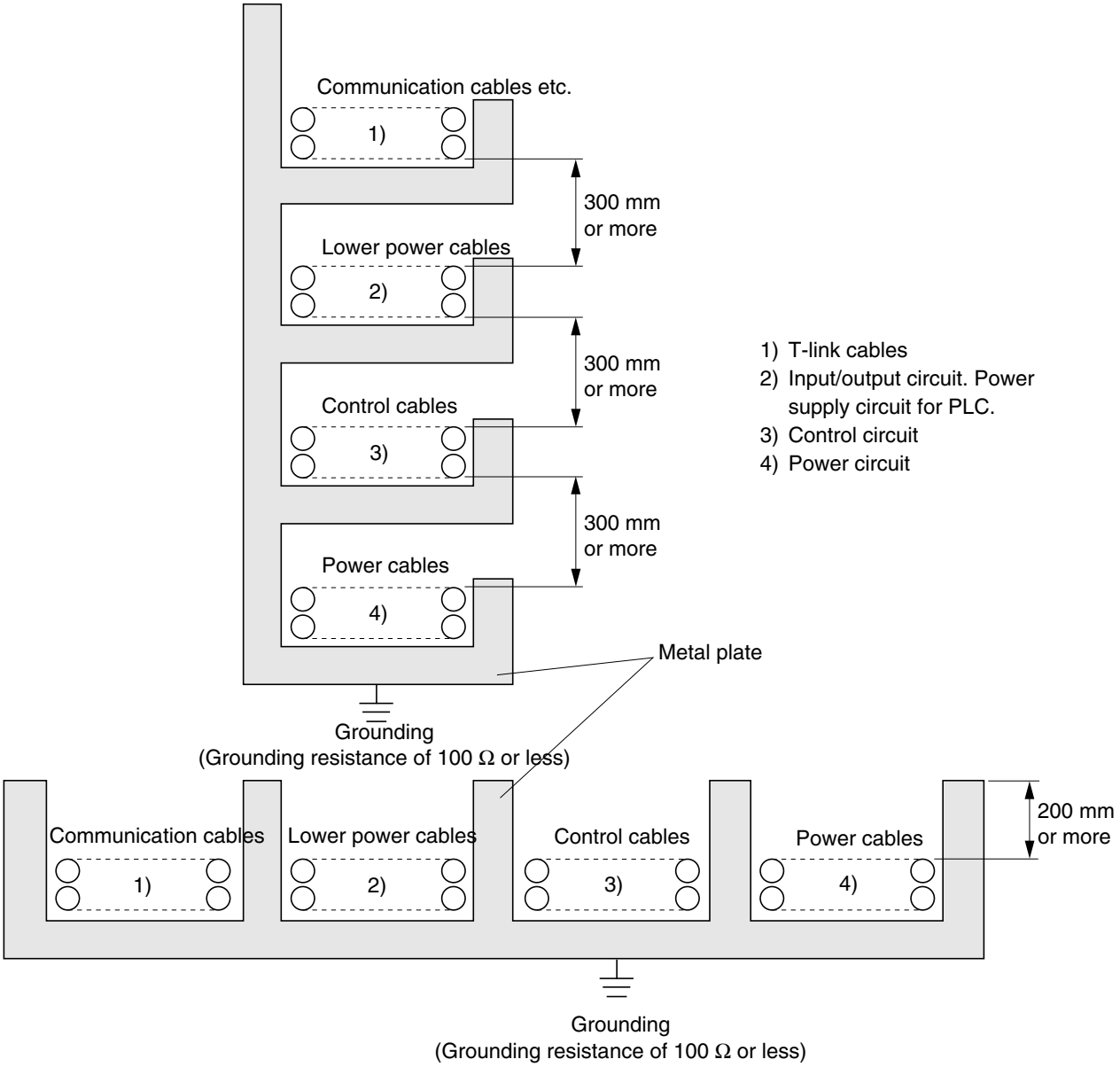


◊ After the setting is finished, click the [OK] button.

Section 5 Wiring

Section 5 Wiring
5-1 Precautions

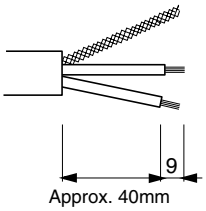
(1) Before removing the connector, remove the fixing screws.
(2) T-link cables must be isolated from high-voltage cables and power cables as far as possible. T-link cables must not be run parallel with those cables.
(3) These cables should be installed as shown in the following figure. Shielding cables should be used.



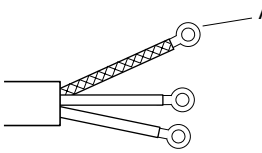
5-2 T-link Wire Assembling

Process the end of a twisted pair cable as shown below.

1) Remove a part of the sheath and internal insulation.

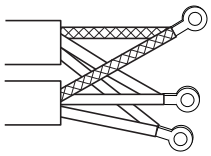


2) Attach crimp terminals.



Note: If wires are connected directly to the terminal block without using crimp terminals, connection failure may result and T-link transmission errors may occur. Therefore, crimp terminals must be used.

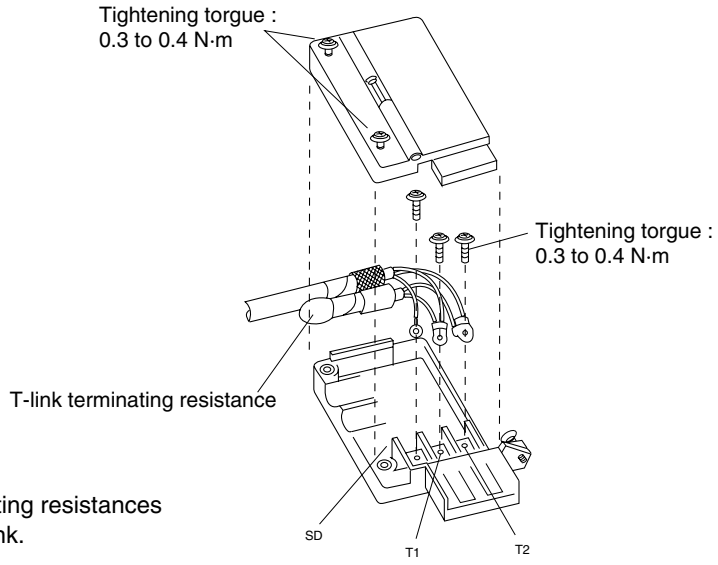
When two T-link cables are to be connected to one terminal block, each pair of wires can be connected to one crimp terminal for convenience.



The followings are recommended.

Maker	Type
JST(Nichiatsu)	2-M3 (2 pieces)
	1.25-3.7 (4 pieces)

3) Assembling



Note: Connect T-link terminating resistances to both ends of the T-link.

Section 6 Troubleshooting

Page

Section 6 Troubleshooting

The T-link master module, or NP1L-TL1, continuously monitors the T-link system that is controlled by the local module and the master module. In case of error, the content of occurred error is indicated by means of the LEDs provided on the module as well as notified to the SX series CPU module.

6-1 LED Indication in Various System Conditions

You can make judgment about the status of T-link system according to the lighting condition of the LEDs provided on the CPU module, the T-link master module and the T-link interface module. The following table shows the status of the LEDs provided on individual module in various conditions of T-link system.

* "–" means "OFF".

CPU			T-link master					T-link interface					System status
ONL	RUN	ALM	ONL	ERR	T/R	TER	SER	ONL	ERR	T/R	TER	SER	
ON	ON	–	ON	–	Blinks	–	–	ON	–	Blinks	–	–	Normal operation
–	–	–	–	–	–	–	–	–	ON	–	–	–	T-link master side is powered off or powering up.
ON	ON	ON	–	–	Blinks	–	ON	–	ON	–	–	–	T-link cable is broken or disconnected (with fail-soft operation setting).
ON	–	ON	–	–	Blinks	–	ON	–	ON	–	–	–	T-link cable is broken or disconnected (without fail-soft operation setting).
ON	ON	ON	–	–	Blinks	–	ON	–	–	–	–	–	Slave station is powered off (with fail-soft operation setting).
ON	–	ON	–	–	Blinks	–	ON	–	–	–	–	–	Slave station is powered off (without fail-soft operation setting).
ON	ON	ON	ON	–	Blinks	–	ON	–	ON	Blinks	–	–	Failed module exists on RT1 (with fail-soft operation setting) (see note).

Note: In addition to failed module on RT1, disconnected module, disconnected SX bus loop-back cable and failed base board can be thought.

6-2 System Memory

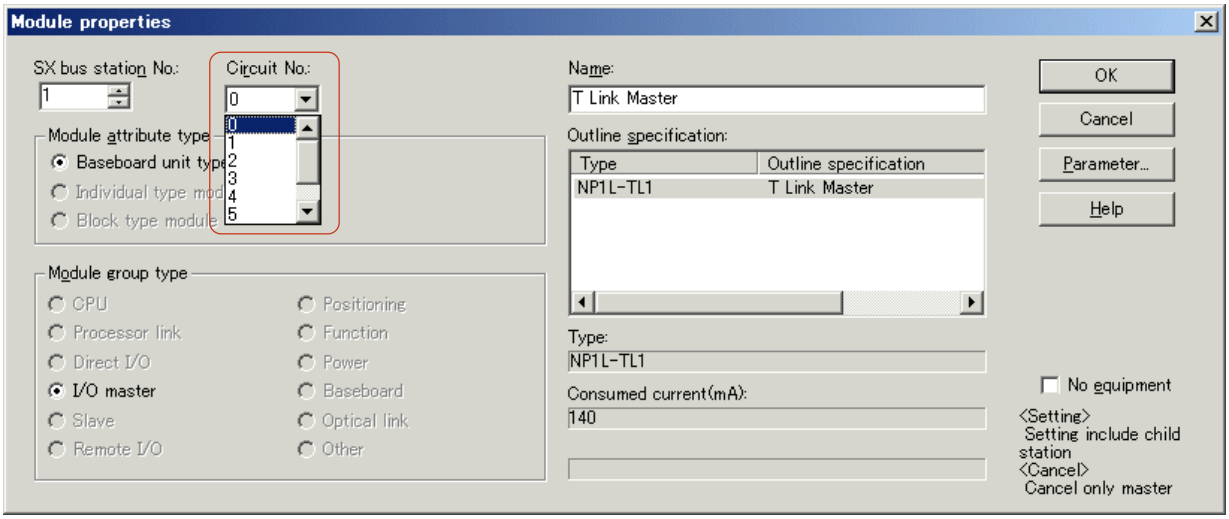
The system memory area in the CPU module contains flags for remote I/O masters.
By checking these flags, you can monitor the status of T-link.

(1) I/O module fault (%MX10.2.5 (D300win), SM25 (Standard loader))
When an I/O module or remote I/O module on the SX bus that has been registered with an “I/O group” in the CPU module, but not registered for the fail-soft setting, has a fault, the CPU module stops its operation.

(2) Remote I/O master initialization error (%MX10.25.0~7 (D300win), SM250~7 (Standard loader))
When an error occurs during initialization of a T-link master module, a corresponding bit is turned on.

Expression for the D300win	Expression for the Standard loader	Flag name
%MX10.25.0	SM250	Initialization error of remote I/O master 0
%MX10.25.1	SM251	Initialization error of remote I/O master 1
%MX10.25.2	SM252	Initialization error of remote I/O master 2
%MX10.25.3	SM253	Initialization error of remote I/O master 3
%MX10.25.4	SM254	Initialization error of remote I/O master 4
%MX10.25.5	SM255	Initialization error of remote I/O master 5
%MX10.25.6	SM256	Initialization error of remote I/O master 6
%MX10.25.7	SM257	Initialization error of remote I/O master 7

Note: Specify remote I/O master numbers using the “Insert module” dialog box or “Line number (R)” in the “Module property” dialog box.



For example, specifying “0” for a line number sets the T-link master module “Remote I/O master 0.”

(3) Remote I/O master - I/O module configuration/fault

%MW10.128 (SM128)	Remote I/O master 0 I/O module configuration
|	
%MW10.135 (SM135)	
%MW10.136 (SM136)	Remote I/O master 0 I/O module fault
|	
%MW10.143 (SM143)	
%MW10.144 (SM144)	Remote I/O master 1 I/O module configuration
|	
%MW10.151 (SM151)	
%MW10.152 (SM152)	Remote I/O master 1 I/O module fault
|	
%MW10.159 (SM159)	
%MW10.160 (SM160)	Remote I/O master 2 I/O module configuration
|	
%MW10.167 (SM167)	
%MW10.168 (SM168)	Remote I/O master 2 I/O module fault
|	
%MW10.175 (SM175)	
%MW10.176 (SM176)	Remote I/O master 3 I/O module configuration
|	
%MW10.183 (SM183)	
%MW10.184 (SM184)	Remote I/O master 3 I/O module fault
|	
%MW10.191 (SM191)	
%MW10.192 (SM192)	Remote I/O master 4 I/O module configuration
|	
%MW10.199 (SM199)	
%MW10.200 (SM200)	Remote I/O master 4 I/O module fault
|	
%MW10.207 (SM207)	
%MW10.208 (SM208)	Remote I/O master 5 I/O module configuration
|	
%MW10.215 (SM215	
%MW10.216 (SM216)	Remote I/O master 5 I/O module fault
|	
%MW10.223 (SM223)	
%MW10.224 (SM224)	Remote I/O master 6 I/O module configuration
|	
%MW10.231 (SM231)	
%MW10.232 (SM232)	Remote I/O master 6 I/O module fault
|	
%MW10.239 (SM239)	
%MW10.240 (SM240)	Remote I/O master 7 I/O module configuration
|	
%MW10.247 (SM247)	
%MW10.248 (SM248)	Remote I/O master 7 I/O module fault
|	
%MW10.255 (SM255)	

Remote I/O master-I/O module configuration
When T-link devices connected with a T-link master are normal or in a fault state, flags for corresponding T-link station numbers are turned on.

Remote I/O master-I/O module fault
When T-link devices connected with a T-link master are in a fatal or nonfatal fault state, flags for corresponding T-link station numbers are turned on.

* Parenthesized figures mean the addresses when the Standard loader is used.

6-2 System Memory

<Flag assignment>
The following tables show an example of flag assignment using the remote I/O master - I/O module configuration fault.
Assignment for remote I/O masters 1 to 7 are handled in the same manner.

<Configuration information>

Word address ↓	(F) 15	(E) 14	(D) 13	(C) 12	(B) 11	(A) 10	9	8	7	6	5	4	3	2	1	0	← Bit address
%MW10.128 (SM128)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
%MW10.129 (SM129)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	
%MW10.130 (SM130)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	
%MW10.131 (SM131)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	
%MW10.132 (SM132)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	
%MW10.133 (SM133)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	
%MW10.134 (SM134)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	
%MW10.135 (SM135)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	

<Fault information>

%MW10.136 (SM136)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%MW10.137 (SM137)	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
%MW10.138 (SM138)	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
%MW10.139 (SM139)	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
%MW10.140 (SM140)	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
%MW10.141 (SM141)	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
%MW10.142 (SM142)	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
%MW10.143 (SM143)	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

* Parenthesized figures mean the addresses when the Standard loader is used.

<T-link slave station (remote I/O) state diagnosis>
States of T-link slave stations can be diagnosed using the configuration information and fault information.

	Configuration information	**Fault information**
Normal	ON	OFF
Nonfatal fault	ON	ON
Fatal fault	OFF	ON

With the fault diagnostic function of the program loader, you can read the following information:

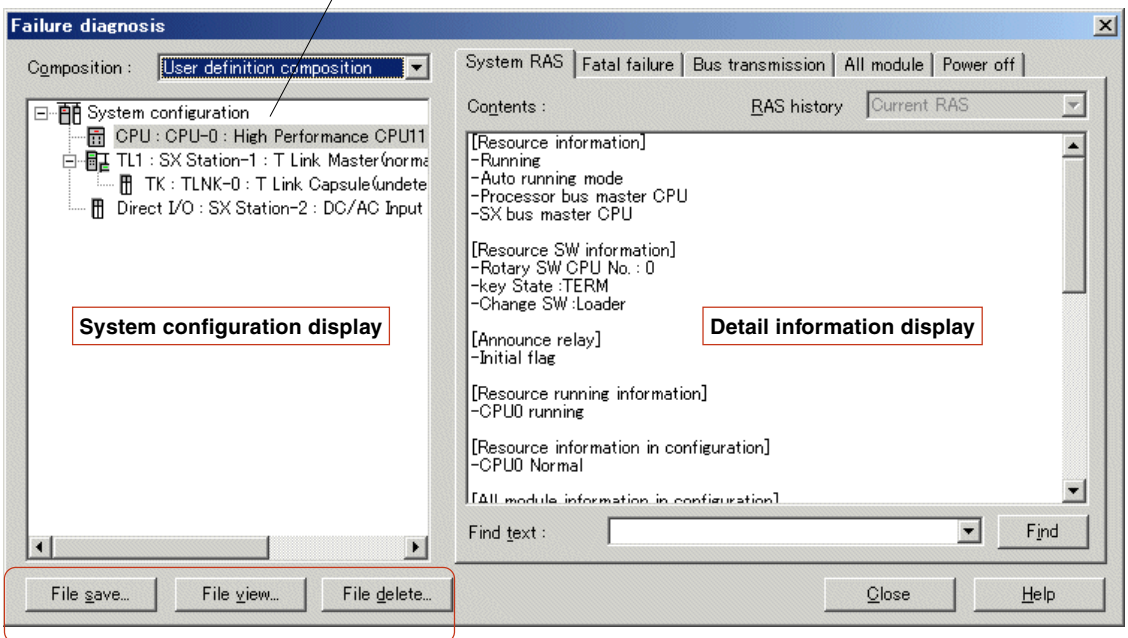
Information	Information display section
Module configuration of system	System configuration display window of the [Fault diagnosis] dialog box
T-link master module type information	Detail information display window of the [Fault diagnosis] dialog box → The [System RAS] tab window
T-link mater module intensive status information	Detail information display window of the [Fault diagnosis] dialog box → The [System RAS] tab window
SX bus transmission status	Detail information display window of the [Fault diagnosis] dialog box → The [Bus transmission information] tab window
T-link master module internal RAS information	Detail information display window of the [Fault diagnosis] dialog box → The [Dump list] tab window

<Diagnosing procedure>

◊ Make the system, which is to be diagnosed, online, and display the [Fault diagnosis] dialog box.

The CPU internal system memory data is read out to display module configuration and status. When a module is selected from those displayed in the system configuration display window, detail information of the module is displayed on the detail information display window at right. Detail information of remote I/O of T-link, etc. is analyzed using the detail information window at right.

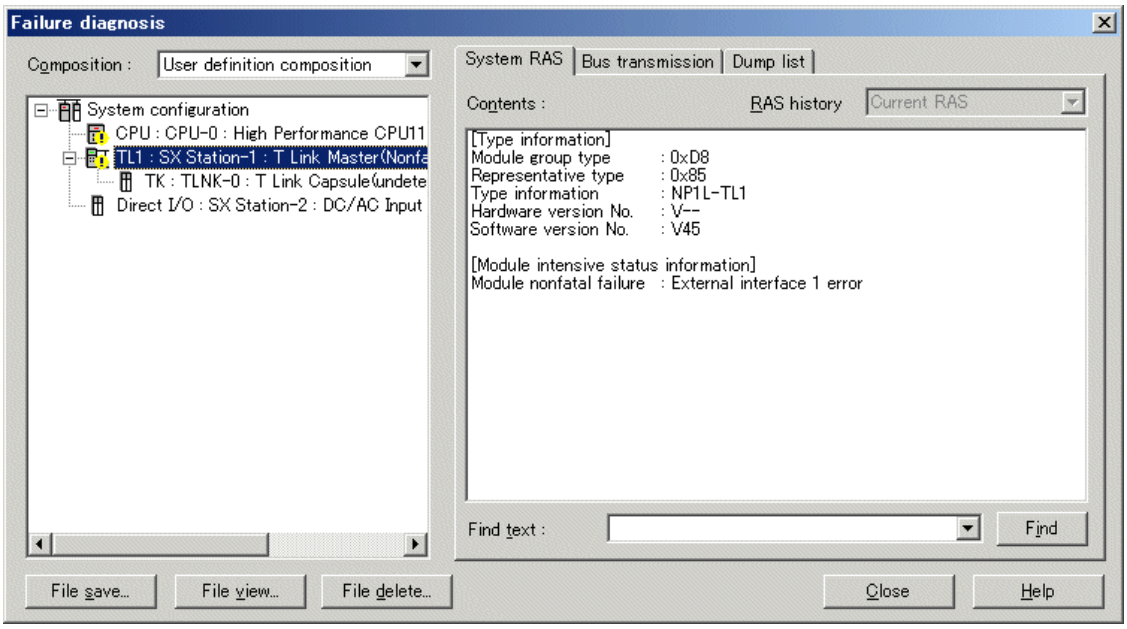
Detail information window can be changed over by clicking the corresponding tab.



Used to save the content of fault diagnosis in a text file. Because of text format, the data can be checked with commercially available text editor.

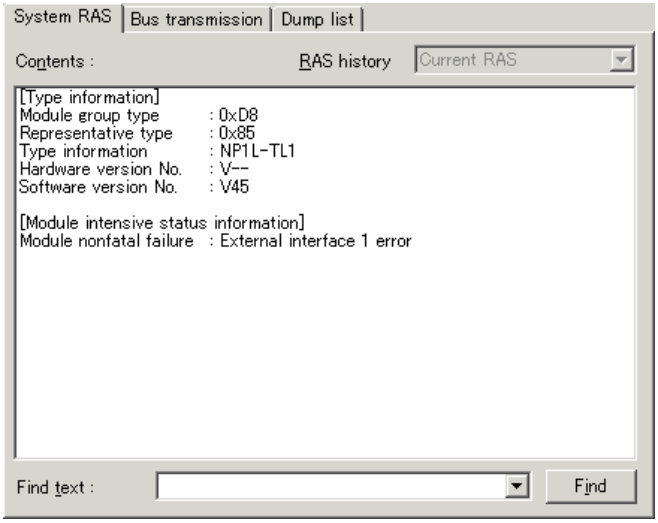
6-3 Diagnosing the Status by Loader

◊ When a T-link master module is selected on the system configuration display window, the detail information of the T-link master module is displayed on the detail information display window.

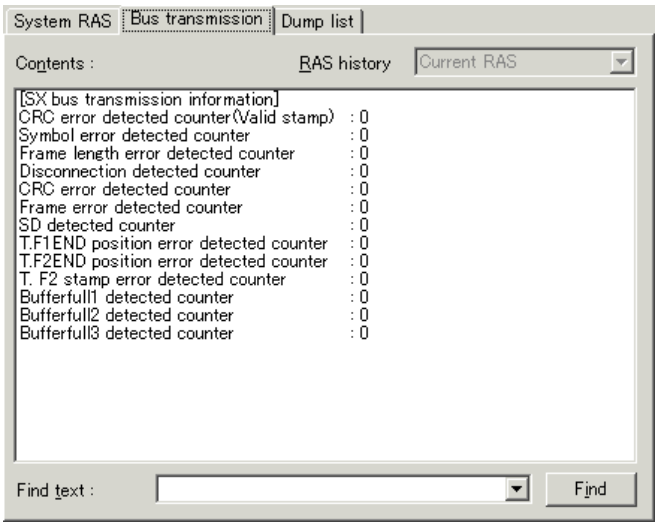


◊ Displayed information can be changed over by clicking the corresponding tab on the detail information display window.

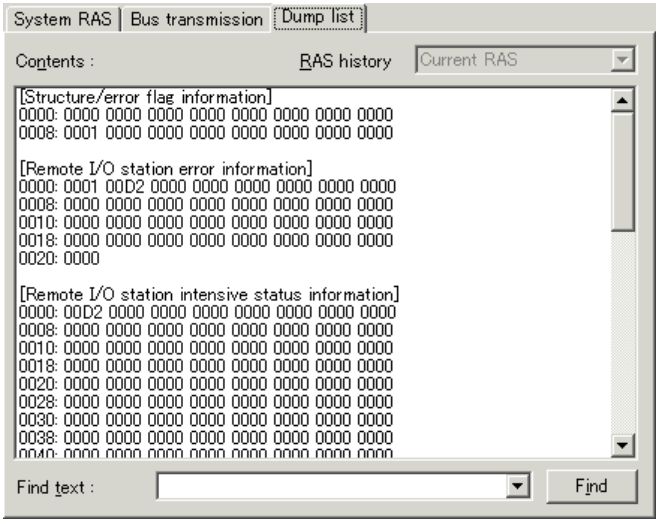
1) [System RAS] tab window



2) [Bus transmission information] tab window



3) [Dump list] tab window

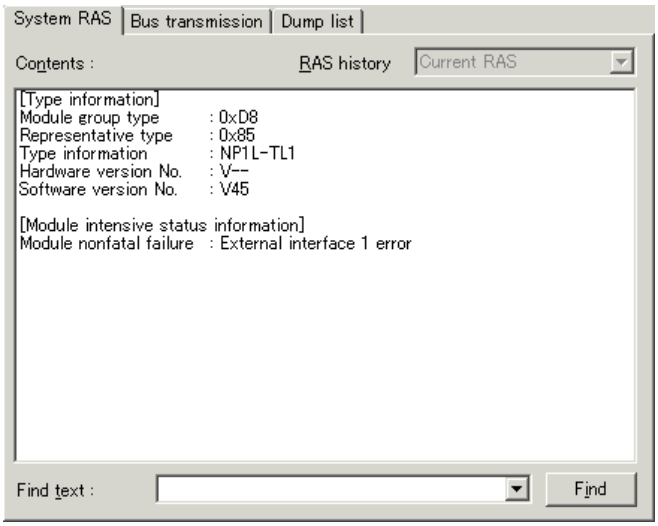


6-3 Diagnosing the Status by Loader

6-3-1 System RAS information

On the [System RAS] tab window, the following information is displayed:

- Type information of the T-link master module that is selected on the system configuration display window
- Module intensive status of the T-link master module that is selected on the system configuration display window



(1) Type information

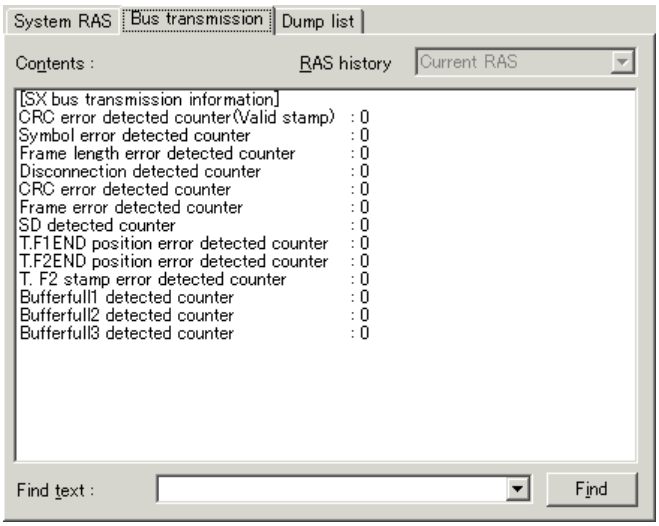
Module type and software version (module firmware version) are displayed.

(2) Module intensive status information

Classification	Displayed message	Description
Normal	Module normally running	Initialization is completed, and the module is running normally.
Fatal fault	Module fatal fault: Failed input detected	Hardware fault. The module requires being replaced.
	Module fatal fault: Sub-processor error	Hardware fault. The module requires being replaced.
	Module fatal fault: ROM error	Hardware fault. The module requires being replaced.
	Module fatal fault: RAM error	Hardware fault. The module requires being replaced.
	Module fatal fault: SX bus error	Check the SX bus condition. Wire breakage of cable, failed base board, external disturbance due to noise, etc. can be thought.
	Module fatal fault: Setting error	Check the setting of switches.
Nonfatal fault	Module nonfatal fault: External interface error	Check for remote I/O device disconnected from the T-link, wire breakage of cable, disconnected connector, etc.

6-3-2 SX bus transmission information

If SX bus transmission path is affected by noise or if the wiring of SX bus is imperfect, various errors related to SX bus transmission are counted. If one of these error counters shows certain count value, it seems that the environment of the SX system installed place is poor with respect to noise and requires your taking proper measures.



<SX bus transmission status list>

SX bus transmission status	Description
CRC error detection counter (stamp normal)	Counts up if a CRC error is detected but stamp is normal.
Symbol error detection counter	Counts up if a symbol error is detected.
Frame length error detection counter	Counts up if a frame length error is detected.
Wire breakage detection counter	Counts up if wire breakage is detected (when transmission is stopped for 130 ms or longer time).
CRC error detection counter	Counts up if a CRC error is detected.
Frame error detection counter	Counts up if the receiving of a frame is stopped in the middle.
SD detection counter	Counts up if an SD (a code for the top of frame) is detected while receiving a frame.
TF1 END position error detection counter	Counts up if END cannot be found at specified position during first cycle of total frame receiving
TF2 END position error detection counter	Counts up if END cannot be found at specified position during second cycle of total frame receiving
TF2 stamp error detection counter	Counts up if an error is detected in received frame during second cycle of total frame receiving.
Buffer full 1 detection counter	Counts up if buffer full is detected during total frame or multi-cast frame receiving.
Buffer full 2 detection counter	Counts up if buffer full is detected when receiving message/ACK/NAK.
Buffer full 3 detection counter	Counts up if buffer full is detected when receiving a token frame.

6-3 Diagnosing the Status by Loader

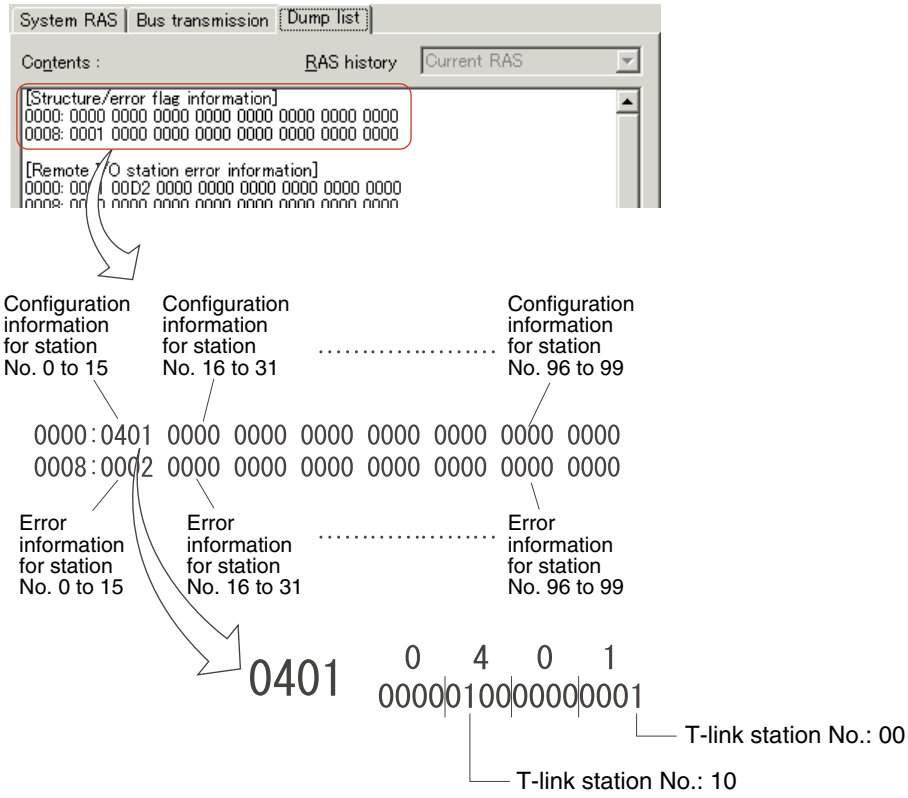
6-3-3 Dump list

The dump list for this module contains the following information:

- Configuration/error flag information
- Remote I/O station error information
- Remote I/O station intensive status information
- T-link transmission information
- On-board hardware error causes
- Setting error causes

(1) Configuration/error flag

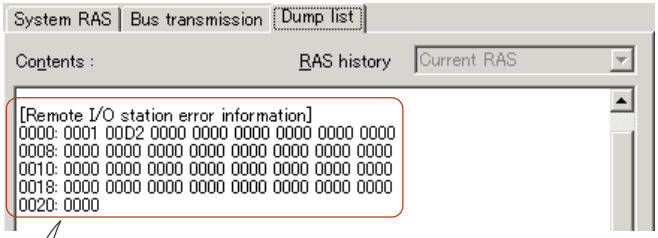
This flag indicates the configuration of normal and abnormal stations for the T-link devices connected to a T-link master module.



From this information, you can understand that T-link station numbers 00 and 10 are configured.

(2) Remote I/O station error information

T-link remote station (slave station) error information is displayed.



Number of error occurred stations

Indicates error occurred station and the content of occurred error (for 32 stations).

```
0000:0001 04D2 0000 0000 0000 0000 0000 0000
0008:0000 0000 0000 0000 0000 0000 0000 0000
0010:0000 0000 0000 0000 0000 0000 0000 0000
0018:0000 0000 0000 0000 0000 0000 0000 0000
0020:0000
```

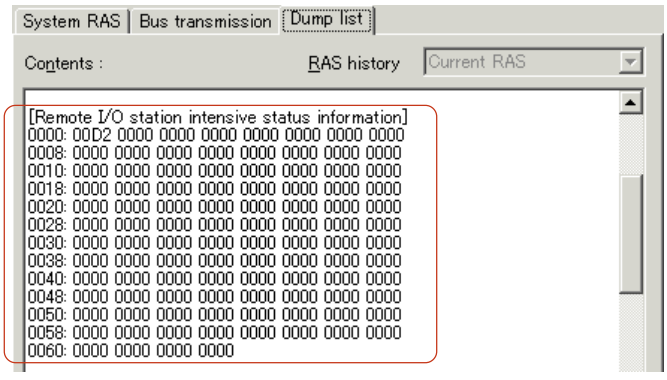
04D2

Error code D1: Remote I/O station configuration mismatch,
D2: Remote I/O station disconnected
D3 to D7: Communication error (noise, etc.,)
D8: Remote I/O station non-fatal error
(Error on remote I/O station)

Error occurred T-link station No.

(3) Remote I/O station intensive status information

The status of all remote I/O stations (00 to 99) is displayed. “0000” is displayed for inexistent station.



Station No. 00 Station No. 01 ..... Station No. 07

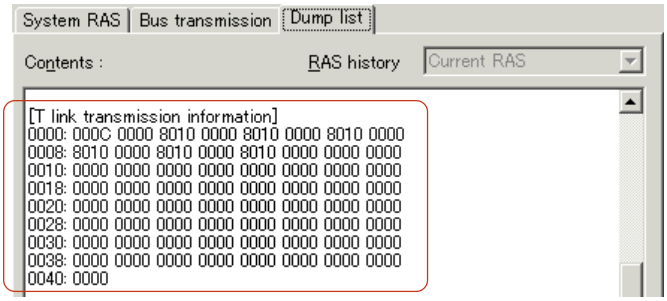
```
0000:0000 0000 0000 0000 00D2 0000 0000 0000
0008:0000 0000 0080 0000 0000 0000 0000 0000
0010:0000 0000 0000 0000 0000 0000 0000 0000
0018:0000 0000 0000 0000 0000 0000 0000 0000
```

00D2

Error code D1: Remote I/O station configuration mismatch,
D2: Remote I/O station disconnected
D3 to D7: Communication error (noise, etc.,)
D8: Remote I/O station non-fatal error
(Error on remote I/O station)
80: Normal operation

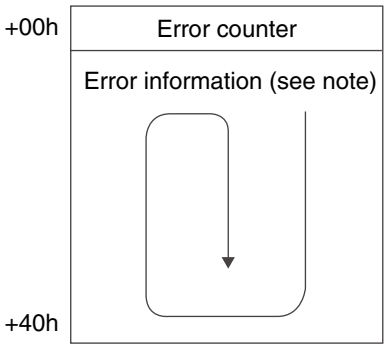
(4) T-link transmission information

Stores the error information that has been detected during T-link communication. Using ring file format, maximum 32 generations of error log can be stored.



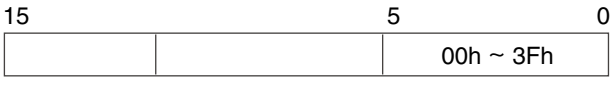
Error counter Error information (see note)

0000:	0063	F182	F18A	F190	3004	100E	3004	100E
0008:	3004	100E	9004	2002	0004	8010	3004	100E
0010:	3004	100E	3004	100E	0004	8010	9004	2002
0018:	0004	8010	3004	100E	3004	100E	3004	100E
0020:	0004	8010	9004	2002	2002	0004	8010	3004
0028:	100E	3004	100E	3004	100E	0004	8010	9004
0030:	2002	0004	8010	3004	100E	3004	100E	3004
0038:	100E	0004	8010	9004	2002	0004	4061	F002
0040:	F18A							



Note: The error information is internal codes that are used basically by Fuji Electric personnel in charge of adjustment.

• Error counter

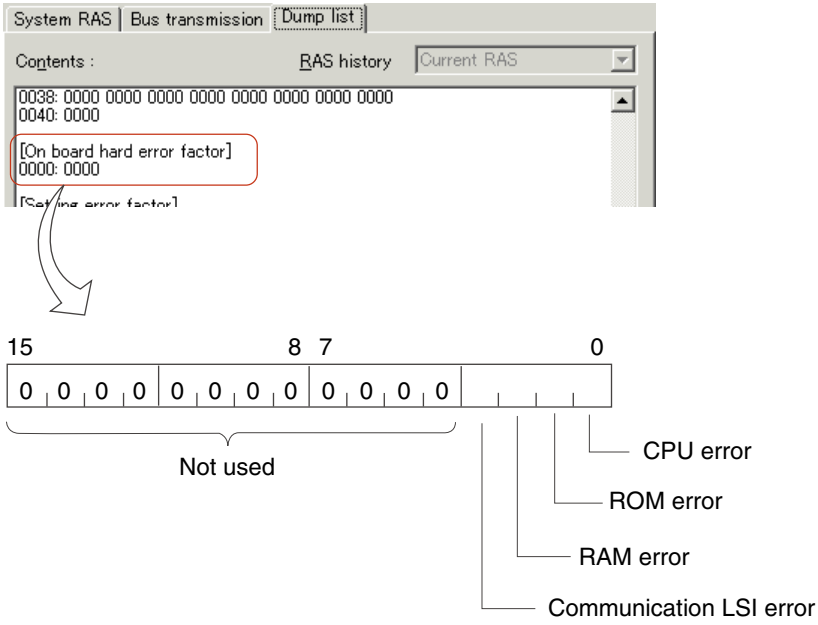


To which extent error information has been stored is indicated by address. If additional errors are detected the next time, an address starting from the next one is stored.

Total error counter: 0000h to FFFFh
The number of words for stored error information is indicated by total value.
When the power supply to the system is reset, this data is also reset.

(5) On-board hardware error RAS

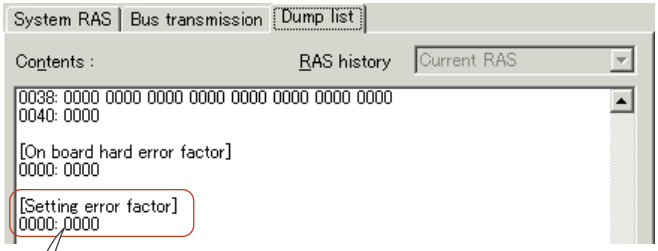
Indicates the error status of the processor, peripheral ROM or RAM used in the module. Error occurrence in this area means that the module's hardware has failed, requiring the replacement or repair of the module.

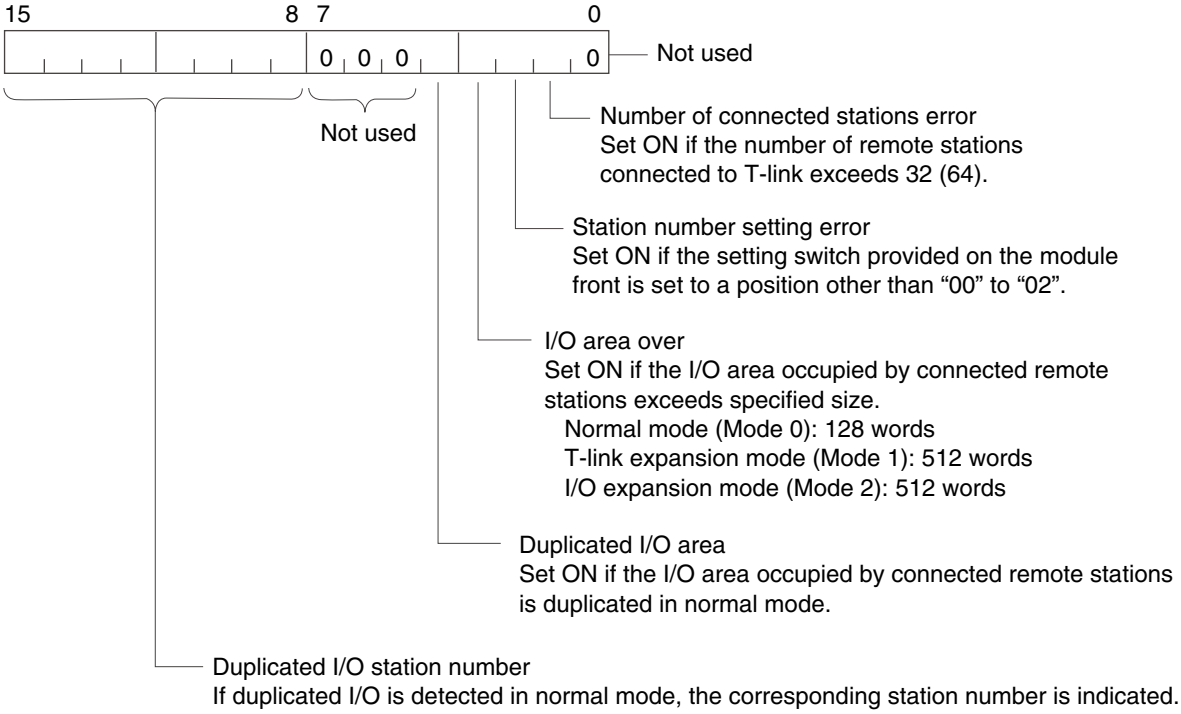


6-3 Diagnosing the Status by Loader

(6) Setting error causes

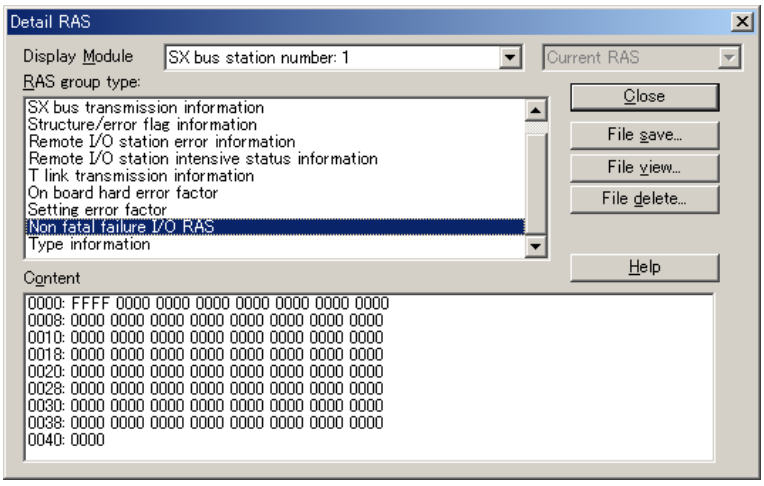
Indicates the content of setting error related to system definition.

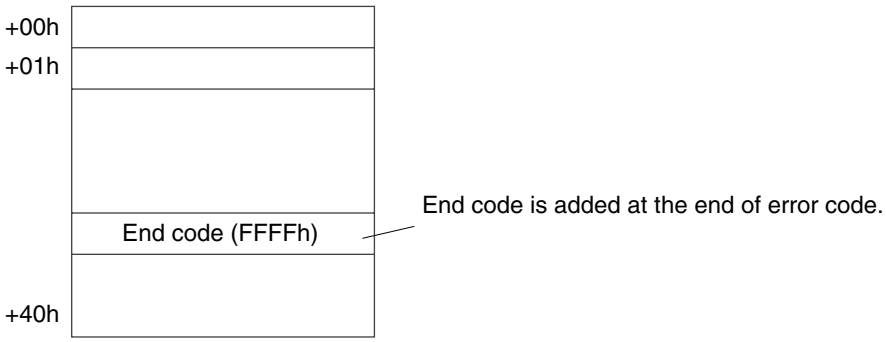




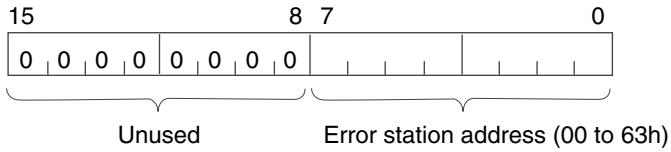
(7) Non-fatal failure I/O RAS

Stores remote I/O station address which has non-fatal failure. If there is no non-fatal failure, "FFFF" is stored on top address of this area.

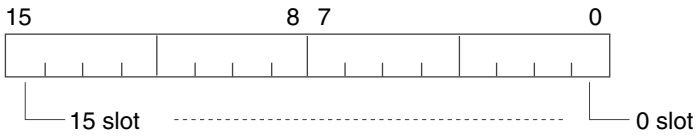




- 1st word (Error station address)

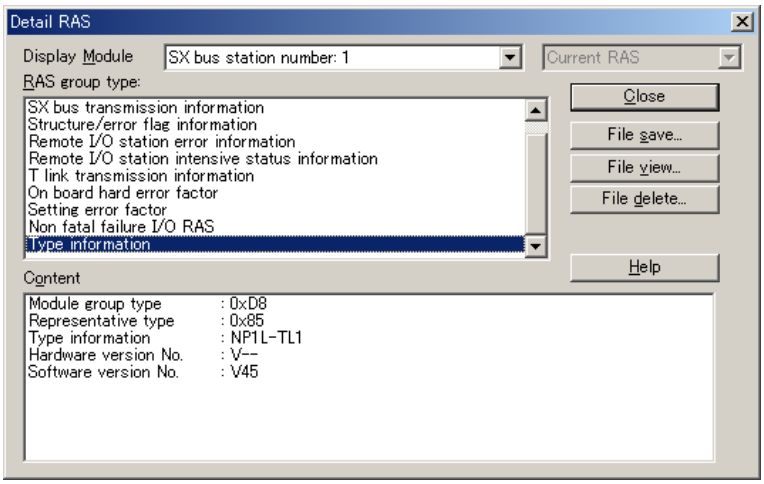


- 2nd word (Error slot position)
  Error slot position bit becomes ON.



(8) Type information

Shows Module group type, Type information, Software version No.,etc.



Appendix 1 I/O Response Time

Page

Appendix 1 I/O Response Time

Appendix 1-1 Outline

I/O response time may changed depends on number of T-link I/O stations, occupied I/O words, SX-bus tact cycle, program execution time (task time). Also, if message communication is used, or SX-bus communication have error because of noise, response time may have fluctuation.
Here explains theoretical I/O response calculation using below mentioned condition.

- No error on communication line by noise
- Message communication is not used
- Single CPU system
- Only default task is used for task

Theoretical I/O response time are calculated by formula as shown below.

Appendix 1-2 Input Response Time

Definition of “Input response time” is time interval from Input signal change at external device to recognition of this data change by PLC application (for example, contact instruction).

(1) In case T-link master is set as Normal or T-link expansion mode (Mode 0 or 1)
Input response (Max) = Input delay + T-link cycle x 2 + SX-bus tact cycle x 2 + task time
Input response (Min) = Input delay + T-link master internal process time + SX-bus tact cycle + task time

(2) In case T-link master is set as I/O expansion mode (Mode 2)
Input response (Max) = Input delay + T-link cycle x 2 + SX-bus tact cycle x (N+1) + task time
Input response (Min) = Input delay + T-link master internal process time + SX-bus tact cycle + task time
N: Total number of I/O master module (including non I/O expansion mode master).

Appendix 1-3 Output Response Time

Definition of “Output response time” is time interval from Output set to ON by PLC application (for example, coil instruction) to Output signal change to external device.

(1) In case T-link master is set as Normal or T-link expansion mode (Mode 0 or 1)
Output response (Max) = Task time + SX-bus tact cycle x 2 + T-link cycle x 2 + Output delay
Output response (Min) = Task time + SX-bus tact cycle + T-link master internal process time + Output delay

(2) In case T-link master is set as I/O expansion mode (Mode 2)
Output response (Max) = Task time + SX-bus tact cycle x (N+1) + T-link cycle x 2 + Output delay
Output response (Min) = Task time + SX-bus tact cycle + T-link master internal process time + Output delay
N: Total number of I/O master module (including non I/O expansion mode master).

Appendix 1-4 Detail of Response Time Parameters

Input delay: Hardware delay time of Input module / capsule. For more detail, see Hardware manual.
Output delay: Hardware delay time of Output module / capsule. For more detail, see Hardware manual.
T-link cycle: Communication cycle time between T-link master and T-link I/O. It depends number of I/O stations and occupied I/O words. See explanation below.
SX-bus tact cycle: Defined value by user in system definition. This value is determined by SX-bus system configuration. For more detail, see Instruction manual.
Task time: Program execution time.
T-link master internal process time: It is T-link master internal process time. It varies depends on system configuration and message communication used/unused. Usually, it is 2 to 6ms.

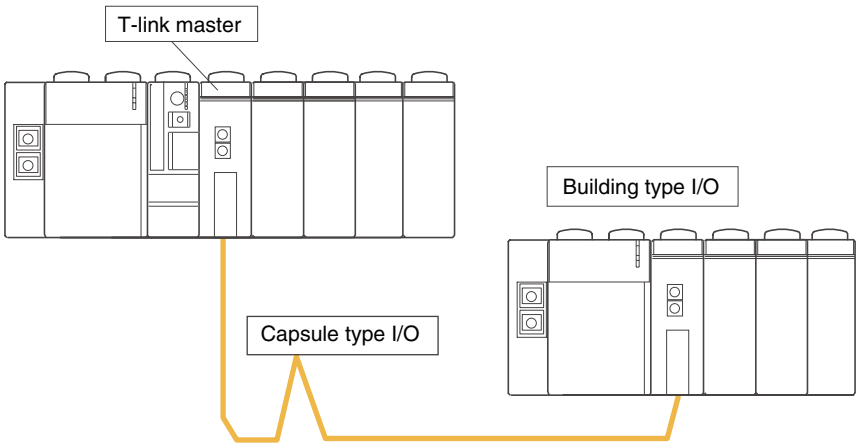
<Calculation of T-link cycle>
T-link cycle: Tcyc is calculated by formula as shown below.

Tcyc (μs) = Nftk x 216 + Nrt x (216 + Tffk) + Nffk x (200 + Tffk) + Nftu x 16
+ (Nffu + Nio) x 32 + T-link master internal process time

Nftk: Number of I/O capsule (FTK, FTT, NR1T, NR2T, etc..)
Nrt: Number of building block type T-link expansion base board (NP1L-RT1, FTL010)
Nffk: Number of special T-link capsule (for example, FFK)
Nftu: Number of I/O modules mounted on building block type T-link expansion base board
Nffu: Number of function modules (RS-232C, Ethernet,..) mounted on building block type T-link expansion base board
Nio: Total I/O words on T-link system
Tffk: Response time of special capsule (for example, FFK) (It depends on special unit. Here defines as 200μs as general)

Appendix 1-5 Example of Response Calculation

Here shows maximum response time calculation example (suppose, input delay time = 0.7ms, one SPH300 CPU and multiple I/Os configuration).
On below picture;
"Capsule type I/O" means FTK, FTT, NR1T or NR2T type I/O.
"Building type I/O" means NP1L-RT1, FTL010.



(1) Case 1: Total 100 words I/O for 1 T-link master.

- 30 Capsule type I/O (Assume one station occupy 2 words.)
- 2 Building type I/O (Assume 10 I/O modules for one base board. One I/O module occupy 2 words.)
- T-link master is set to Normal mode (or T-link expansion mode).
- I/O expansion mode is not used including other master module.
- SX-bus tact cycle: 2ms, Task time: 1ms

T-link cycle Tcyc (μs)
= 30 units x 216 + 2 units x (216 + 200) + 0 unit x (200 + 200) + 20 modules x 16 + 100 words x 32 + 6000 (6ms)
= 16,832 μs (16.832ms)
Input response (Max) = 0.7ms + 16.832ms x 2 + 2ms x 2 + 1ms = 39.364ms

(2) Case 2: 32 Capsule type I/O (total 32 words)

- Capsule type I/O 32 units (Assume one station occupy 1 word.)
- No Building type I/O
- T-link master is set to Normal mode (or T-link expansion mode).
- I/O expansion mode is not used including other master module.
- SX-bus tact cycle: 1ms, Task time: 1ms

T-link cycle Tcyc (μs)
= 32 units x 216 + 0 units x (216 + 200) + 0 unit x (200 + 200) + 0 module x 16 + 32 words x 32 + 6000 (6ms)
= 13,936 μs (13.936ms)
Input response (Max) = 0.7ms + 13.936ms x 2 + 1ms x 2 + 1ms = 31.572ms

Appendix 1-5 Example of Response Calculation

(3) Case 3: Total approx. 500 words I/O for 1 T-link master

- Capsule type I/O 0 unit
- 7 Building type I/O. (Assume 6 analog modules for one base board. One analog module occupy 12 words.) Total I/O = 504 words.
- T-link master is set to I/O expansion mode.
  8 I/O master modules are used in one configuration.
- SX-bus tact cycle: 3ms, Task time: 1ms

T-link cycle Tcyc (μs)

= 0 unit x 216 + 7 units x (216 + 200) + 0 unit x (200 + 200) + 42 modules x 16 + 504 words x 32 + 6000 (6ms)

= 25,712 μs (25.712ms)

Input response (Max) = 0.7ms + 25.712ms x 2 + 3ms x (8+1) + 1ms = 80.124ms

Fuji Electric Systems Co., Ltd.

Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome, Shinagawa-ku, Tokyo, 141-0032,Japan
Phone: +81-3-5435-7280
Fax: +81-3-5435-7425
URL http://www.fesys.co.jp/eng/