

**TOSHIBA**

UM-TS01\*\*\*-E034

PROGRAMMABLE CONTROLLER

PROSEC **T1-16S**

**USER'S MANUAL**  
**– I/O Modules –**

**TOSHIBA CORPORATION**



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Misuse of this equipment can result in property damage or human injury. Because controlled system applications vary widely, you should satisfy yourself as to the acceptability of this equipment for your intended purpose.

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# Safety Precautions


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This manual is prepared for users of Toshiba's Programmable Controller T1-16S. Read this manual thoroughly before using the T1-16S. Also, keep this manual and related manuals so that you can read them anytime while the T1-16S is in operation.

## Hazard Classifications

In the manuals related to the T1-16S, the following two hazard classifications are used to explain the safety precautions.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Even a precaution is classified as CAUTION, it may cause serious results depending on the situation. Observe all the safety precautions described on this manual.

## Safety Precautions

 **CAUTION**

- Turn off power to the T1-16S before removing or mounting the option card or I/O module. Failure to do so can cause electrical shock or damage to the product.
- Read the Safety Precautions described in the "T1-16S User's Manual – Basic Hardware and Function –" before using the option cards and the I/O modules.
- Follow the instructions described in this manual and in the "T1-16S User's Manual – Basic Hardware and Function –" when installing and wiring the option cards or I/O modules.
- The I/O modules have been designed for the T1-16S. Use your I/O modules only with the T1-16S.
- Do not touch electronic components on the printed circuit board. It may cause damage to the product.

## About This Manual

### About This Manual

This manual explains the specifications and operations of the I/O modules which are used with the T1-16S.

The TOSLINE-F10 data link module is also covered in this manual.

For your better understanding of the T1-16S, read the following manual at first to understand the T1-16S system, then read this manual.

**T1-16S User's manual – Basic Hardware and Function–**      UM-TS01\*\*\*-E031

### Terminology

The following is a list of abbreviations and acronyms used in this manual.

<b>μs</b>	microsecond
<b>ASCII</b>	American Standard Code For Information Interchange
<b>AWG</b>	American Wire Gage
<b>CPU</b>	Central Processing Unit
<b>CRC</b>	Cyclic Redundancy Checking
<b>EEPROM</b>	Electrically Erasable Programmable Read Only Memory
<b>H</b>	hexadecimal (when it appears in front of an alphanumeric string)
<b>I/O</b>	Input/Output
<b>LED</b>	Light Emitting Diode
<b>ms</b>	millisecond
<b>RAM</b>	Random Access Memory
<b>ROM</b>	Read Only Memory
<b>Vac</b>	AC voltage
<b>Vdc</b>	DC voltage

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# *Section 1*

## *System Configuration*

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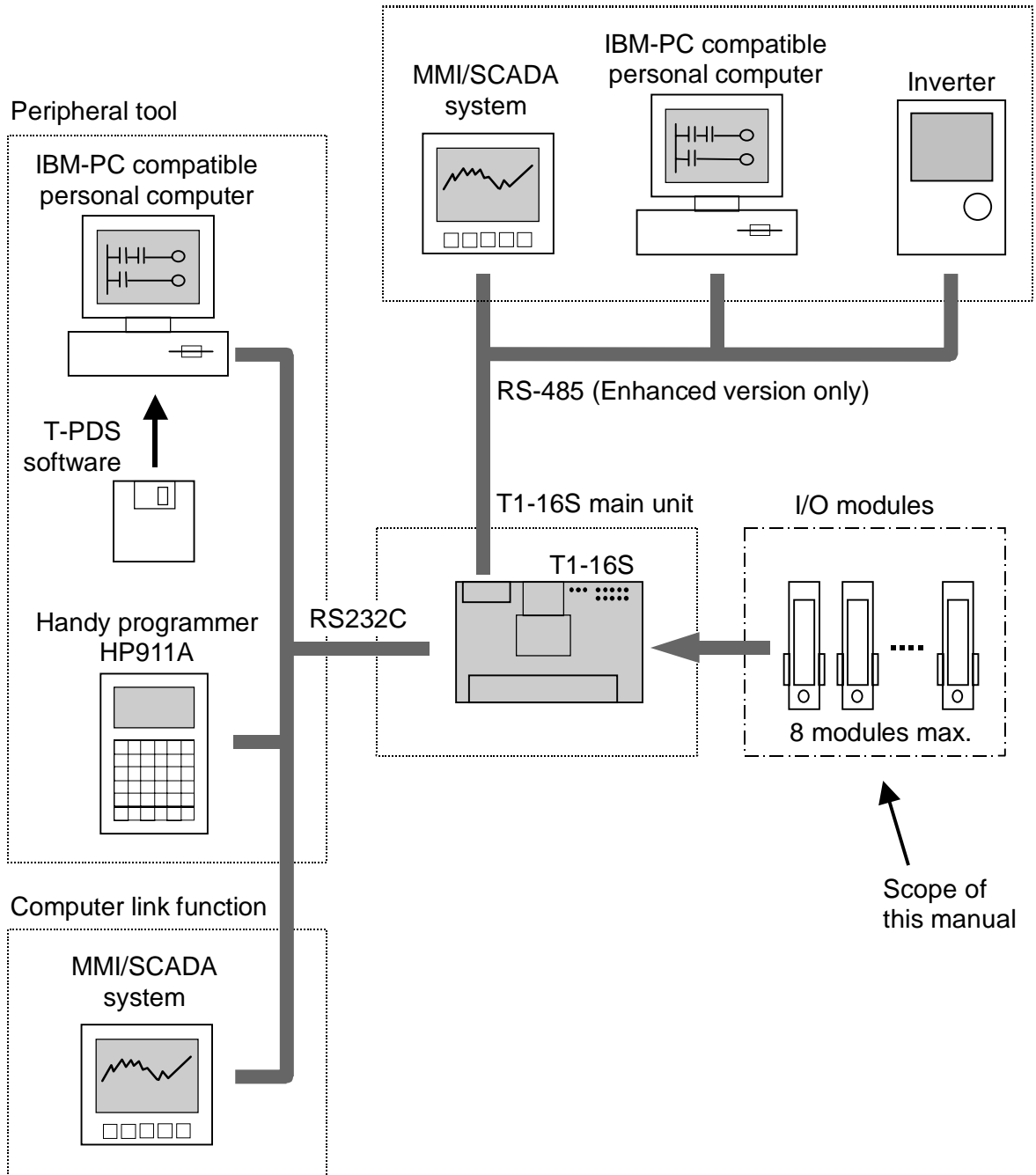
- 1.1 T1-16S system configuration, 6*
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# 1. System Configuration

## 1.1 T1-16S system configuration

The following figure shows the T1-16S system configuration.



# 1. System Configuration

## 1.2 Using the I/O module

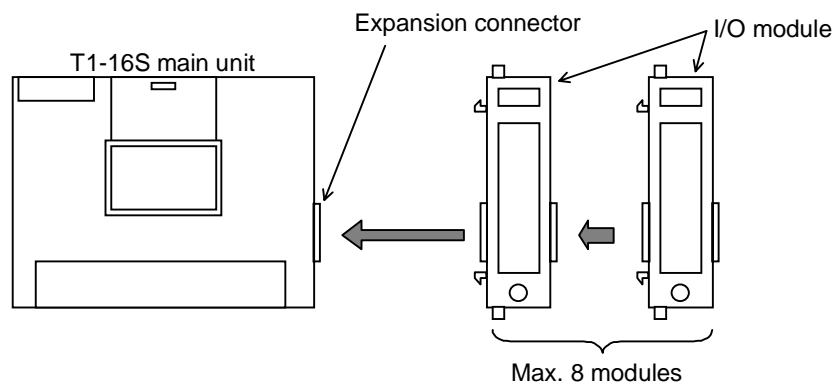
The T1-16S has an expansion connector for connecting the I/O module on the right side of the unit. Maximum eight I/O modules can be connected to the T1-16S main unit.

If eight 16-point modules are connected, the T1-16S can control 144 I/O points.

The following 10 types of the I/O modules are available.

Type	Description	Power supply
DI116M	16 points input, 24 Vdc - 5 mA	Supplied from the basic unit (5 Vdc). See section 1.3.
DO116M	16 points output, 24 Vdc - 100 mA	
DD116M	8 points input, 24 Vdc - 5 mA + 8 points output, 24 Vdc - 100 mA	
RO108M	8 points relay output, 24Vdc/240Vac - 1A	
AD121M	1 channel analog input 0-5V/0-20mA	
AD131M	1 channel analog input $\pm 10V$	
DA121M	1 channel analog output 0-20mA	
DA131M	1 channel analog output $\pm 10V$	
TC111M	1 channel thermocouple input	
FR112M	TOSLINE-F10 remote station, 1 word input + 1 word output	
DN111M	DeviceNet slave module, 4 word input + 4 word output, 8 word input + 8 word output, 12 word input + 12 word output, 16 word input + 16 word output (selectable)	

- Up to eight I/O modules can be connected.
- The TOSLINE-F10 card (FR112M) can be used together with other I/O modules. However only one FR112M is allowed at a time. The FR112M must be connected at the right end.
- When the DeviceNet slave (DN111M) is used, the T1-16S must be version 1.1 or after.
- The DeviceNet slave (DN111M) can be used together with other I/O modules. However only one DN111M is allowed at a time.
- Cable side connector for the discrete I/O card (DI116M, DO116M or DD116M) is not supplied with the I/O module. This connector is separately available. See section 1.4.
- Some I/O modules require jumper plug settings on the board. For this purpose, a screw (puller) for removing the internal board from the module case is attached to the I/O module.



## 1. System Configuration

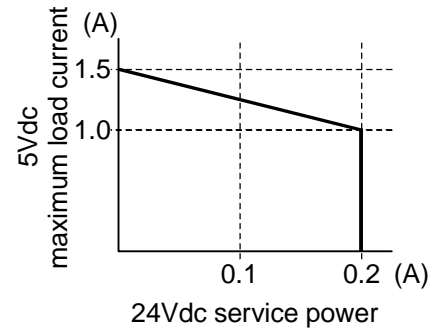
### 1.3 Power capacity consideration

The T1-16S main unit supplies internal 5Vdc for I/O modules.  
The 5Vdc output capacity of the T1-16S main unit is as follows.

The maximum output current of the 5Vdc for I/O modules is decreased if 24Vdc service power is used. See the figure on the right.

Also, the 5Vdc power is consumed by the handy programmer HP911A and the T1-16S's RS-485 communication port, if they are used. See below.

- The HP911A consumes 0.2A.
- The RS-485 port consumes 0.1A.



For example, if you do not use the 24Vdc service power, HP911A, and RS-485 port, the T1-16S can supply 1.5A = 1500mA of 5Vdc for I/O modules. And if you use 0.2A of 24Vdc service power and the RS-485 port, the maximum 5Vdc current for I/O modules is 1.0 - 0.1 = 0.9A = 900mA.

The table below shows the maximum current consumption of 5 Vdc power of each I/O module. When using the I/O modules, confirm that the total current consumption is within the T1-16S's output capacity.

I/O module		5Vdc current consumption (max.)
DI116M	16 points DC input	50mA
DO116M	16 points DC output	50mA
DD116M	Combination 8 inputs and 8 outputs	50mA
RO108M	8 points relay outputs	260mA
AD121M	1 channel analog input 0-5V/0-20mA	260mA
AD131M	1 channel analog input $\pm 10V$	260mA
DA121M	1 channel analog output 0-20mA	350mA
DA131M	1 channel analog output $\pm 10V$	240mA
TC111M	1 channel thermo-couple input	400mA
FR112M	TOSLINE-F10 remote station	100 mA
DN111M	DeviceNet slave module	250mA

# 1. System Configuration

## 1.4 Optional items

The following optional items related to the I/O modules are available.

Item	Type	Description	
I/O connector	PT15S	Cable side connector for DI116M, DO116M, or DD116M	Soldering type
	PT15F		Flat cable type

Note) The I/O connector (cable side connector) for the discrete I/O module (DI116M, DO116M or DD116M) is also available on the market. Refer to the followings.

Connector maker: Fujitsu

- (1) Card side (PWB side) connector  
Type: FCN-365P024-AU
- (2) Cable side connector [soldering type]  
Type: FCN-361J024-AU (connector)  
Type: FCN-360C024-E (cover)
- (3) Cable side connector [flat cable type]  
Type: FCN-367J024-AU/F

Use above (2) or (3).



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## Section 2

# Specifications

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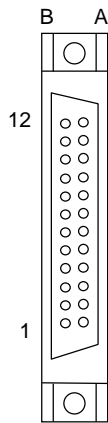
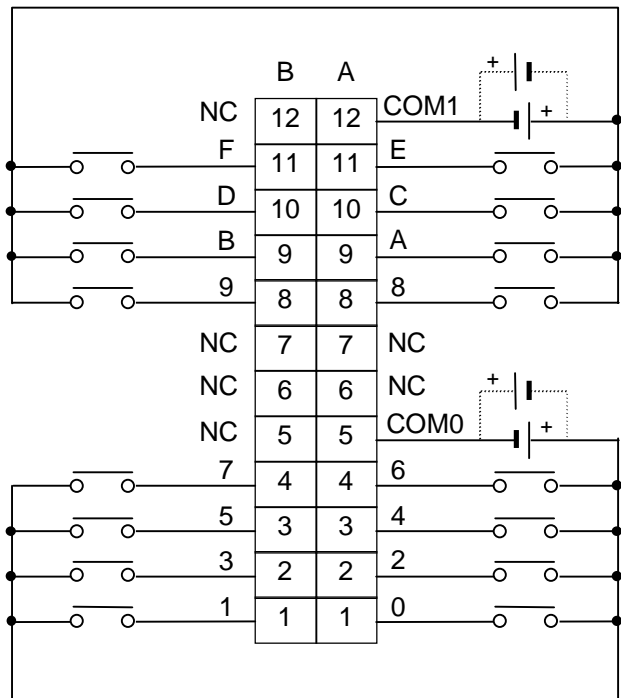
- 2.1 16 points DC input, 12
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## 2. Specifications

### 2.1 16 points DC input

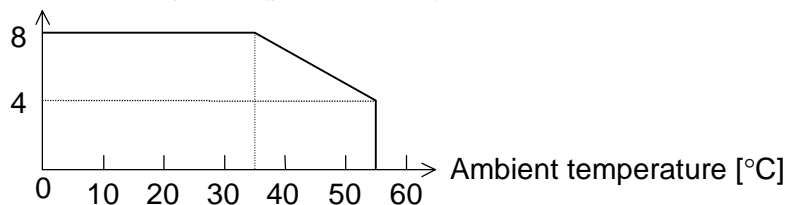
Item	DI116M
Card type	DC input, current sourcing/sinking
I/O allocation type	X 1W (1 input register XW assigned)
Number of input points	16 points (8 points/common)
Rated input voltage	24 Vdc, +10/-15 %
Rated input current	5 mA (at 24 Vdc)
Minimum ON voltage	18.0 Vdc
Maximum OFF voltage	6.0 Vdc
ON delay time	10 ms
OFF delay time	10 ms
De-rating condition	See Note on the next page
Input signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)
External connection	24-pin connector
Withstand voltage	1500 Vac, 1 minute (internal ↔ external circuits)
Current consumption	Max. 50 mA (5 Vdc)
Internal circuit	<p>The diagram illustrates the internal circuit of the DI116M card. It shows a 24-pin connector with 16 input points (0, 1, ..., 7, COM0) and 8 output points (8, F, COM1). The input points are connected to a common bus through resistors. The output points are connected to a common bus through resistors. The internal circuit block is shown as a vertical rectangle with a label 'Internal circuit'.</p>

## 2. Specifications

Item	DI116M
<p>Terminal connection</p> 	 <p>When input register <math>XW_n</math> is assigned;  Input 0 ... <math>X_{n0}</math> (<math>n</math> is register address)  Input 1 ... <math>X_{n1}</math>  ⋮  Input F ... <math>X_{nF}</math></p>

Note) As for the DC input, there is the following de-rating condition for maximum number of simultaneous ON points, depending on the ambient temperature.

Simultaneous ON points (per common)



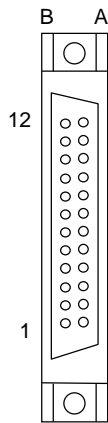
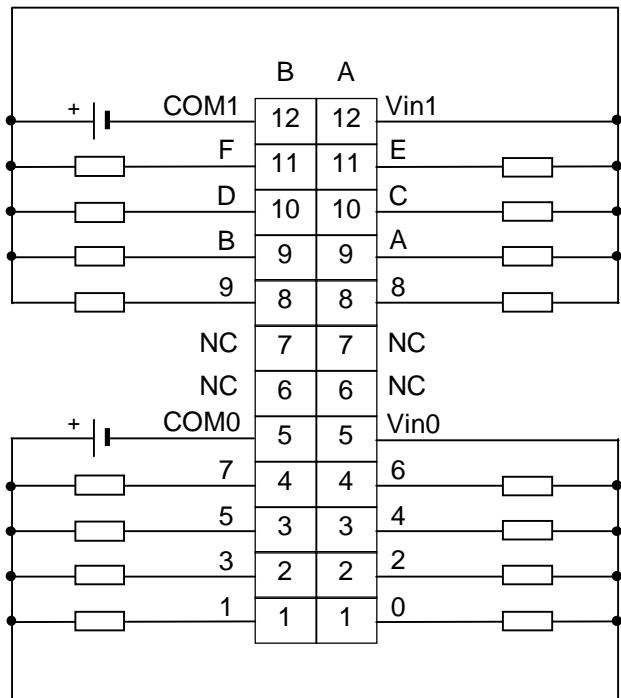


## 2. Specifications

### 2.2 16 points DC output

Item	DO116M
Card type	Transistor output, current sinking
I/O allocation type	Y 1W (1 output register YW assigned)
Number of output points	16 points (8 points/common)
Rated load voltage	5 to 24 Vdc, +10/-5 %
Maximum load current	100 mA/point (at 24 Vdc), 20 mA/point (at 5 Vdc), 800 mA/common
Voltage drop at ON	0.4 V or less
Leakage current at OFF	100 $\mu$ A
ON delay time	1 ms
OFF delay time	2 ms
Output signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)
External connection	24-pin connector
Withstand voltage	1500 Vac, 1 minute (internal $\leftrightarrow$ external circuits)
Current consumption	Max. 50 mA (5 Vdc)
Internal circuit	

## 2. Specifications

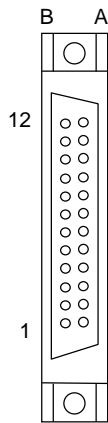
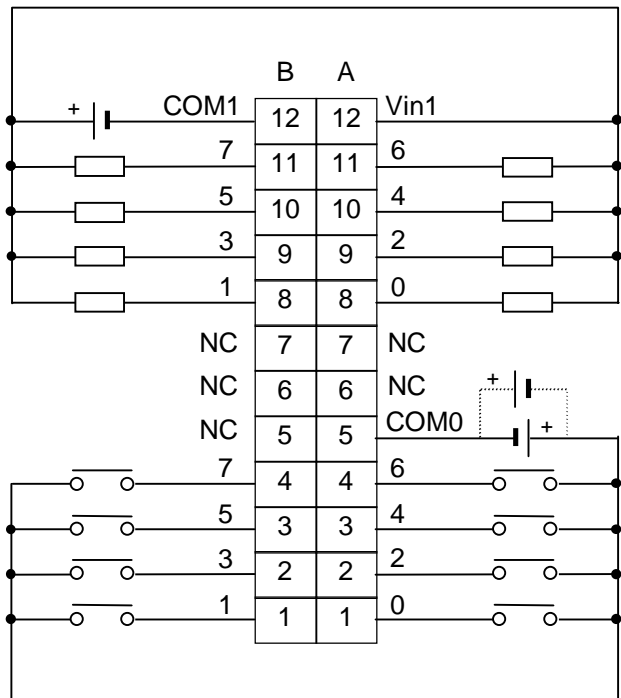
Item	DO116M																																																				
<p>Terminal connection</p> 	 <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>B</th> <th>A</th> <th></th> </tr> </thead> <tbody> <tr> <td>12</td> <td>12</td> <td>12</td> <td>Vin1</td> </tr> <tr> <td>11</td> <td>11</td> <td>11</td> <td>E</td> </tr> <tr> <td>10</td> <td>10</td> <td>10</td> <td>C</td> </tr> <tr> <td>9</td> <td>9</td> <td>9</td> <td>A</td> </tr> <tr> <td>8</td> <td>8</td> <td>8</td> <td>8</td> </tr> <tr> <td>7</td> <td>7</td> <td>7</td> <td>NC</td> </tr> <tr> <td>6</td> <td>6</td> <td>6</td> <td>NC</td> </tr> <tr> <td>5</td> <td>5</td> <td>5</td> <td>Vin0</td> </tr> <tr> <td>4</td> <td>4</td> <td>4</td> <td>6</td> </tr> <tr> <td>3</td> <td>3</td> <td>3</td> <td>4</td> </tr> <tr> <td>2</td> <td>2</td> <td>2</td> <td>2</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table> <p>When output register <math>YW_n</math> is assigned;  Output 0 ... <math>Y_{n0}</math> (<math>n</math> is register address)  Output 1 ... <math>Y_{n1}</math>  ⋮  Output F ... <math>Y_{nF}</math></p>		B	A		12	12	12	Vin1	11	11	11	E	10	10	10	C	9	9	9	A	8	8	8	8	7	7	7	NC	6	6	6	NC	5	5	5	Vin0	4	4	4	6	3	3	3	4	2	2	2	2	1	1	1	0
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3	3	3	4																																																		
2	2	2	2																																																		
1	1	1	0																																																		

## 2. Specifications

### 2.3 8 points DC input and 8 points DC output combined

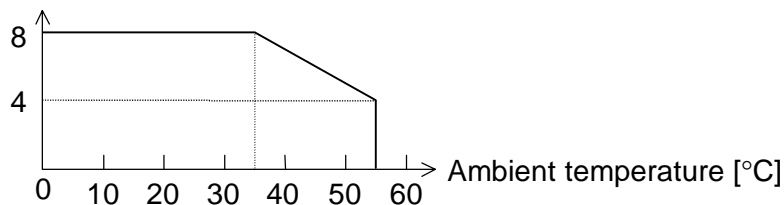
Item		DD116M
Card type		DC input (current sinking/sourcing), Transistor output (current sinking), combined
I/O allocation type		X+Y 2W (1 input XW and 1 output YW registers assigned)
Input	Number of input points	8 points (8 points/common)
	Rated input voltage	24 Vdc, +10/-15 %
	Rated input current	5 mA (at 24 Vdc)
	Minimum ON voltage	18.0 Vdc
	Maximum OFF voltage	6.0 Vdc
	ON delay time	10 ms
	OFF delay time	10 ms
	De-rating condition	See Note on the next page
Output	Number of output points	8 points (8 points/common)
	Rated load voltage	5 to 24 Vdc, +10/-5 %
	Maximum load current	100 mA/point (at 24 Vdc), 20 mA/point (at 5 Vdc), 800 mA/common
	Voltage drop at ON	0.4 V or less
	Leakage current at OFF	100 $\mu$ A
	ON delay time	1 ms
	OFF delay time	2 ms
I/O signal display		None (It can be displayed on the T1-16S main unit. Refer to section 2.11)
External connection		24-pin connector
Withstand voltage		1500 Vac, 1 minute (internal $\leftrightarrow$ external circuits)
Current consumption		Max. 50 mA (5 Vdc)
Internal circuit		

## 2. Specifications

Item	DD116M
<p>Terminal connection</p> 	 <p>When input register <math>XW_n</math> and output register <math>YW_{n+1}</math> is assigned;</p> <p style="margin-left: 20px;">Input 0 ..... <math>X_{n0}</math> (<math>n</math> is register address)</p> <p style="margin-left: 20px;">⋮</p> <p style="margin-left: 20px;">Input 7 ..... <math>X_{n7}</math></p> <p style="margin-left: 20px;">Output 0 ... <math>Y_{n+10}</math> (<math>n+1</math> is next register address of <math>n</math>)</p> <p style="margin-left: 20px;">⋮</p> <p style="margin-left: 20px;">Output 7 ... <math>Y_{n+17}</math></p>

Note) As for the DC input, there is the following de-rating condition for maximum number of simultaneous ON points, depending on the ambient temperature.

Simultaneous ON points (per common)



## 2. Specifications

### 2.4 8 points relay output

Item		RO108M
Card type		Relay output
I/O allocation type		Y 1W (1 output register YW assigned)
Number of output points		8 points (8 points/common)
Rated load voltage		240Vac/24Vdc
Maximum load current		1A/point (resistive load), 4A/common
ON resistance		30mΩ or less (initial value)
Leakage current at off		None
Minimum load		5Vdc, 10mA
ON/OFF delay time		10ms or less
Output signal display		None (It can be displayed on the T1-16S main unit. Refer to section 2.11)
Terminal block (removable)	Screw size	M2
	Screw torque	0.2 - 0.4N·m
	Wire size	0.3 - 1.25mm <sup>2</sup> (AWG 22 - 16)
Mechanical switching life		20 million times or more
Electrical switching life		100 thousand times or more (at max. rated voltage and current)
Insulation resistance		10MΩ or more (between terminal block and internal circuit)
Withstand voltage		1500Vac, 1 minute (between terminal block and internal circuit)
Current consumption		Max. 260mA (5Vdc)
Internal circuit		

## 2. Specifications

### 2.5 1 channel analog input (0-5V/0-20mA)

Item	AD121M																																	
Card type	Analog input																																	
I/O allocation type	X 1W (1 input XW register assigned)																																	
Number of input points	1 channel																																	
Resolution	12 bits (1/4000)																																	
Rated input range	0 - 5 V	0 - 20 mA																																
Absolute max. input	±7 V	±25 mA																																
Rated input impedance	1 MΩ or more	250 Ω																																
Overall accuracy	±0.5 % FS : 25°C ±1 % FS : 0 to 55°C																																	
Conversion cycle	2ms																																	
External power supply	None																																	
Insulation	Photo-coupler																																	
Input signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)																																	
External connection	2-pin removable connector																																	
Withstand voltage	500 Vac, 1 minute (internal ↔ external circuits)																																	
Current consumption	Max. 260 mA (5 Vdc)																																	
Input range setting (jumper plug JP1)	Open	Short (factory setting)																																
Data format	Converts full scale analog input signal (0-20mA/0-5V) into digital data in 0 to 4000. <div style="text-align: center;"> <table style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 0 5px;">F</td><td style="padding: 0 5px;">E</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">C</td><td style="padding: 0 5px;">B</td><td style="padding: 0 5px;">A</td><td style="padding: 0 5px;">9</td><td style="padding: 0 5px;">8</td><td style="padding: 0 5px;">7</td><td style="padding: 0 5px;">6</td><td style="padding: 0 5px;">5</td><td style="padding: 0 5px;">4</td><td style="padding: 0 5px;">3</td><td style="padding: 0 5px;">2</td><td style="padding: 0 5px;">1</td><td style="padding: 0 5px;">0</td> </tr> <tr> <td style="padding: 0 5px;">XW</td><td style="padding: 0 5px;">0</td><td style="padding: 0 5px;">0</td><td style="padding: 0 5px;">0</td><td style="padding: 0 5px;">0</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td> </tr> </table> <p style="text-align: center;">D: Data bit (12bits) 0 - 4000 (H0000 - H0FA0)</p> <div style="display: flex; align-items: center;"> <div style="flex: 1;"> </div> <div style="flex: 1; margin-left: 20px;"> <p>0-20mA: <math>D=200 \times A</math> 0-5V: <math>D = 800 \times A</math></p> <p style="font-size: small;">A: Analog value D: Digital value</p> </div> </div> </div>		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	XW	0	0	0	0	D	D	D	D	D	D	D	D	D	D	D
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																			
XW	0	0	0	0	D	D	D	D	D	D	D	D	D	D	D																			
Internal circuit																																		
Terminal connection																																		

## 2. Specifications

### 2.6 1 channel analog input ( $\pm 10V$ )

Item	AD131M																																
Card type	Analog input																																
I/O allocation type	X 1W (1 input XW register assigned)																																
Number of input points	1 channel																																
Resolution	12 bits (1/4000)																																
Rated input range	$\pm 10 V$																																
Absolute max. input	$\pm 13 V$																																
Rated input impedance	1 M $\Omega$ or more																																
Overall accuracy	$\pm 0.5 \% FS : 25^{\circ}C$ $\pm 1 \% FS : 0 \text{ to } 55^{\circ}C$																																
Conversion cycle	2ms																																
External power supply	None																																
Insulation	Photo-coupler																																
Input signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)																																
External connection	2-pin removable connector																																
Withstand voltage	500 Vac, 1 minute (internal $\leftrightarrow$ external circuits)																																
Current consumption	Max. 260 mA (5 Vdc)																																
Data format	<p>Converts full scale analog input signal (<math>\pm 10V</math>) into digital data in -2000 to +2000.</p> <p>XW <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>S</td><td>S</td><td>S</td><td>S</td><td>S</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td><td>D</td> </tr> </table></p> <p>S: Sign 0 = positive, 1 = negative D: Data bit (11bits) -2000 - 2000 (HF830 - H07D0) Negative value is expressed by 2's complement</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;"> <p>Digital value</p> <p>Analog value (V)</p> </div> <div style="margin-left: 20px;"> <p><math>D = 200 \times A</math></p> <p>{ A: Analog value D: Digital value }</p> </div> </div>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	S	S	S	S	S	D	D	D	D	D	D	D	D	D	D	D
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																		
S	S	S	S	S	D	D	D	D	D	D	D	D	D	D	D																		
Internal circuit																																	
Terminal connection	<p style="text-align: center;">Shielded two-core twisted pair cable</p>																																

## 2. Specifications

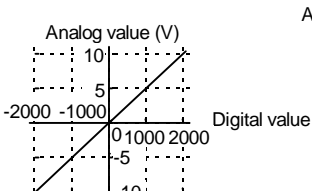
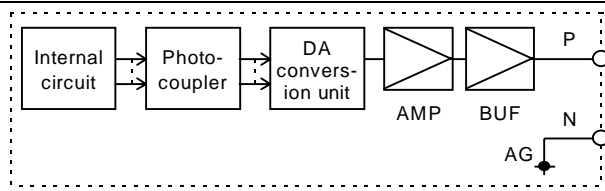
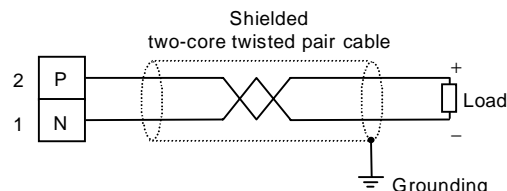
### 2.7 1 channel analog output (0-20mA)

Item	DA121M																																
Card type	Analog output																																
I/O allocation type	Y 1W (1 output YW register assigned)																																
Number of input points	1 points																																
Resolution	12 bits (1/4000)																																
Rated input range	0 - 20 mA																																
Rated input impedance	600 Ω or less																																
Overall accuracy	±0.5 % FS : 25°C ±1 % FS : 0 to 55°C																																
Conversion cycle	2ms																																
External power supply	None																																
Insulation	Photo-coupler																																
Output signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)																																
External connection	2-pin removable connector																																
Withstand voltage	500 Vac, 1 minute (internal ↔ external circuits)																																
Current consumption	Max. 350 mA (5 Vdc)																																
Data format	Converts digital data in 0 to 4000 into analog signal in full scale (0-20mA)  <div style="text-align: center;"> <table style="border-collapse: collapse; margin: auto;"> <tr> <td style="padding: 0 5px;">F</td><td style="padding: 0 5px;">E</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">C</td><td style="padding: 0 5px;">B</td><td style="padding: 0 5px;">A</td><td style="padding: 0 5px;">9</td><td style="padding: 0 5px;">8</td><td style="padding: 0 5px;">7</td><td style="padding: 0 5px;">6</td><td style="padding: 0 5px;">5</td><td style="padding: 0 5px;">4</td><td style="padding: 0 5px;">3</td><td style="padding: 0 5px;">2</td><td style="padding: 0 5px;">1</td><td style="padding: 0 5px;">0</td> </tr> <tr> <td style="padding: 0 5px;">Y</td><td style="padding: 0 5px;">W</td><td style="padding: 0 5px;">*</td><td style="padding: 0 5px;">*</td><td style="padding: 0 5px;">*</td><td style="padding: 0 5px;">*</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td><td style="padding: 0 5px;">D</td> </tr> </table> <p style="margin-top: 5px;">D: Data bit (12bits) 0 - 4000 (H0000 - H0FA0) *: No effect on D/A conversion</p> <div style="text-align: center;"> <p style="margin-top: 5px;"><math>A = 0.005 \times D</math>  <span style="font-size: small;">( A: Analog value  D: Digital value )</span></p> </div> </div>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	Y	W	*	*	*	*	D	D	D	D	D	D	D	D	D	D
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																		
Y	W	*	*	*	*	D	D	D	D	D	D	D	D	D	D																		
Internal circuit																																	
Terminal connection																																	



## 2. Specifications

### 2.8 1 channel analog output ( $\pm 10V$ )

Item	DA131M
Card type	Analog output
I/O allocation type	Y 1W (1 output YW register assigned)
Number of output points	1 channel
Resolution	12 bits (1/4000)
Rated output range	$\pm 10V$
Rated output impedance	10k $\Omega$ or more
Overall accuracy	$\pm 0.5\%$ FS : 25°C $\pm 1\%$ FS : 0 to 55°C
Conversion cycle	2ms
External power supply	None
Insulation	Photo-couple
Output signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)
External connection	2-pin removable connector
Withstand voltage	500 Vac, 1 minute (internal $\leftrightarrow$ external circuits)
Current consumption	Max. 240 mA (5Vdc)
Data format	<p>Converts digital data in -2000 to +2000 into analog signal in full scale (<math>\pm 10V</math>)</p> <p style="text-align: center;">           F E D C B A 9 8 7 6 5 4 3 2 1 0            YW <span style="border: 1px solid black; padding: 2px;">S</span> <span style="border: 1px solid black; padding: 2px;">S</span> <span style="border: 1px solid black; padding: 2px;">S</span> <span style="border: 1px solid black; padding: 2px;">S</span> <span style="border: 1px solid black; padding: 2px;">S</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> <span style="border: 1px solid black; padding: 2px;">D</span> </p> <p>S: Sign 0 = positive, 1 = negative            D: Data bit (11bits) -2000 - 2000 (HF830 - H07D0)            Negative value is expressed by 2's complement</p> <p style="text-align: center;"><math>A = 0.005 \times D</math></p> <p style="text-align: center;"> <span style="border-left: 1px dashed black; border-right: 1px dashed black; padding: 0 5px;">A: Analog value</span>  <span style="border-left: 1px dashed black; border-right: 1px dashed black; padding: 0 5px;">D: Digital value</span> </p> 
Internal circuit	
Terminal connection	

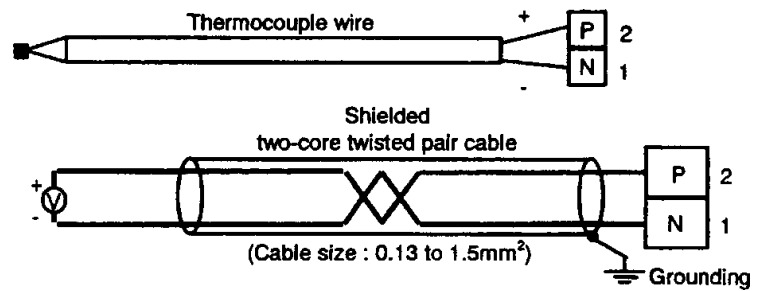
## 2. Specifications

### 2.9 1 channel thermocouple input

Item	TC111M			
Card type	Thermocouple input			
I/O allocation type	X 1W (1 input XW register assigned)			
Input points	1 channel			
Type of input (*1)	Type K	Type J	Type E	mV input
Rated input range	-200 to 1200°C	-200 to 800°C	-200 to 600°C	-50 to +50mV
Load impedance	1MΩ or more			
Resolution	0.63°C	0.4°C	0.3°C	25μV
Input range for T1	-2000 to 12000	-2000 to 8000	-2000 to 6000	-2000 to +2000
Overall accuracy	±1%FS ±1°C			
Conversion cycle	20ms or less			
External power supply	None			
Insulation	Photo-coupler			
Input signal display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)			
External connection	2-pin removable connector			
Withstand voltage	500 Vac, 1 minute (internal ↔ external circuits)			
External connection	2-pin removable terminal block			
Current consumption	Max. 400mA (5Vdc)			
Data format	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>Digital value</p> <p>temperature (°C)</p> <p>thermocouple input</p> </div> <div style="text-align: center;"> <p>Digital value</p> <p>Analog value(mV)</p> <p>mV voltage input</p> </div> </div> <p style="text-align: right;">D=40×A [ A : Analog value D : Digital value ]</p>			
Internal circuit				

## 2. Specifications

Terminal connection



Precautions in wiring cables.

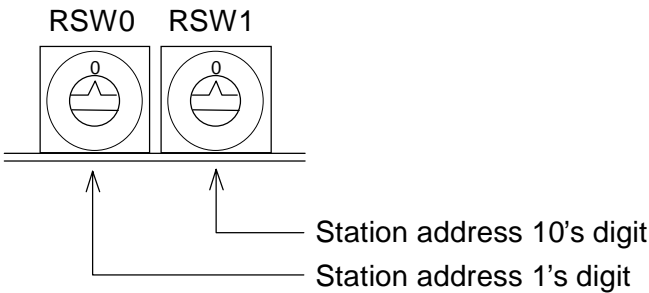
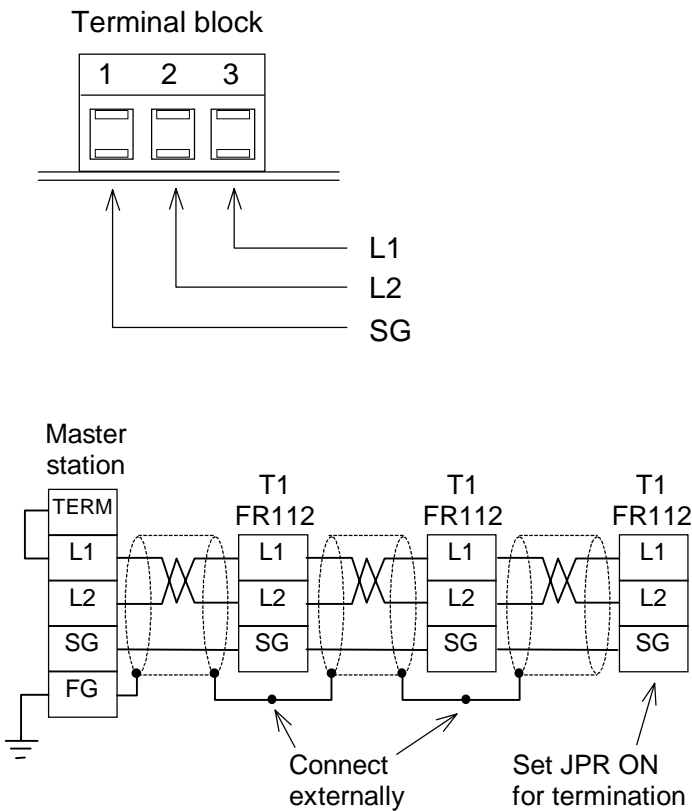
- (1) Thermocouple input  
In wiring, pay attention to the polarity of thermocouple.
- (2) mV voltage input
  - a) Use shielded two-core twisted pair cable in wiring analog cable. Be sure to ground the shield at load side.
  - b) In wiring, be sure to keep analog signal cable off the external cable and power supply cable to avoid noise (200mm or more).

## 2. Specifications

### 2.10 TOSLINE-F10 remote station

Item	FR112M	
Card type	TOSLINE-F10 remote station	
I/O allocation type	TL-F (no I/O register assigned)	
TOSLINE-F10 system	Transmission cable	Shielded twisted-pair cable
	Configuration	Bus (party line)
	Transmission speed	750 kbps or 250 kbps
	Transmission distance	Max. 500 m (750 kbps) Max. 1 km (250 kbps)
	Transmission data capacity (cyclic scan)	Max. 32 words (512 points)
	Scan cycle	7 ms/32 words (750 kbps) 12 ms/32 words (250 kbps)
	Error checking	CRC check
FR112M function	Register assignment	SW34 ... Data send to the master SW35 ... Data receive from the master (2 words of transmission data shared)
	Transmission speed	750 kbps or 250 kbps, Jumper selection (JPS)
	Transmission line termination	Jumper selection (JPR)
	Receive data at transmission error	Previous data is held (TOSLINE-F10 error flag S00D comes ON)
Status display	None (It can be displayed on the T1-16S main unit. Refer to section 2.11)	
External connection	3-pin removable terminal block	
Current consumption	Max. 100 mA (5 Vdc)	
Jumper settings	<div style="text-align: center;"> </div> <p>JPS: Transmission speed    Open ... 750 kbps          Short ... 250 kbps</p> <p>JPR: Termination resistor    Open ... No connect          Short ... Connect</p>	

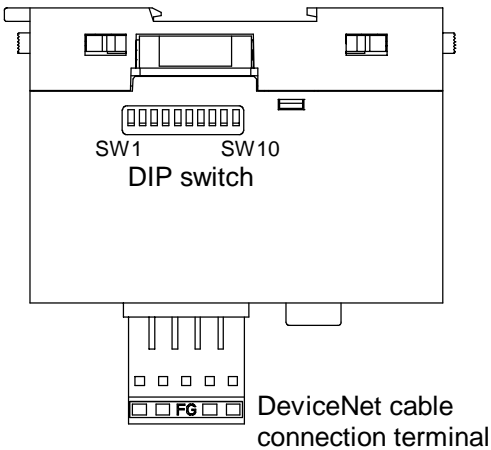
## 2. Specifications

Item	FR112M
Station address setting	<div style="text-align: center;">  <p>Station address 10's digit</p> <p>Station address 1's digit</p> <p>Allowable station address: 0 to 30</p> </div>
Transmission cable connection	<div style="text-align: center;">  <p>Terminal block</p> <p>1 2 3</p> <p>L1</p> <p>L2</p> <p>SG</p> <p>Master station</p> <p>TERM</p> <p>L1</p> <p>L2</p> <p>SG</p> <p>FG</p> <p>T1 FR112</p> <p>L1</p> <p>L2</p> <p>SG</p> <p>T1 FR112</p> <p>L1</p> <p>L2</p> <p>SG</p> <p>T1 FR112</p> <p>L1</p> <p>L2</p> <p>SG</p> <p>Connect externally</p> <p>Set JPR ON for termination</p> </div>

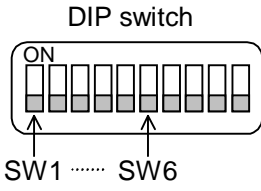
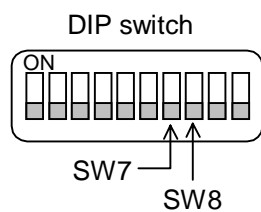
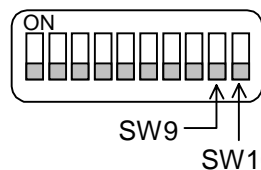
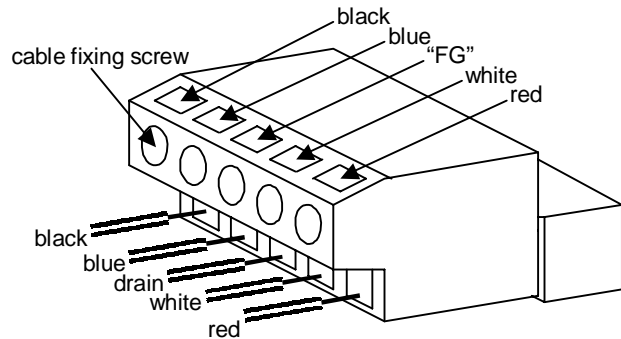
Note) Refer to the TOSLINE-F10 manual for details of the TOSLINE-F10 system.

## 2. Specifications

### 2.11 DeviceNet slave module

Item	DN111M			
Module type	DeviceNet slave module			
I/O allocation type	OPT (no I/O register assigned)			
DeviceNet system	Conformity specification	DeviceNet Rev 2.0		
	Network configuration	Bus structure (trunk line – branch line)		
	Network speed	125/250/500kbps (selectable)		
	Maximum cable length	Network speed	Thick cable	Thin cable
		125kbps	500m	100m
		250kbps	250m	
500kbps	100m			
Connectable cable	Thick cable or thin cable of DeviceNet specification			
Network terminal block	5-pin removable terminal block			
Vendor ID	71 (TOSHIBA)			
Product type	12 (Communication adapter)			
Product code	100			
Node address	0 to 63 (selectable)			
Function on DeviceNet	Polling type slave device			
Input/output data size	(1) 4 words input / 4 words output (2) 8 words input / 8 words output (3) 12 words input / 12 words output (4) 16 words input / 16 words output		} selectable	
Data synchronization	Every 4 words (If the master device has more than 4 words data synchronization function)			
RAS information	DN111M status information (DN111M to T1-16S)			
	DN111M request command (T1-16S to DN111M)			
Status display	Bi-color LED (green and red) for module and network status			
Current consumption	Max. 250mA (5Vdc) / Max. 90mA (Network)			
Switch settings	 <p style="text-align: center;">SW1      SW10 DIP switch</p> <p style="text-align: right;">DeviceNet cable connection terminal</p>			

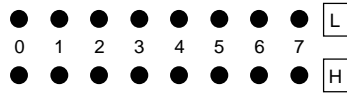
## 2. Specifications

Item	DN111M																																																	
<p>Node address setting</p> 	<p>SW1 to SW6 (6-bit) of the DIP switch is used to set the node address. Possible node address is 0 to 63. (SW1 to SW6 configure binary number with SW1 LSB)</p> <table border="1"> <thead> <tr> <th>Address</th> <th>SW1</th> <th>SW2</th> <th>SW3</th> <th>SW4</th> <th>SW5</th> <th>SW6</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>1</td> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>2</td> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>:</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>62</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>63</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> <p>The factory setting is address 0.</p>	Address	SW1	SW2	SW3	SW4	SW5	SW6	0	OFF	OFF	OFF	OFF	OFF	OFF	1	ON	OFF	OFF	OFF	OFF	OFF	2	OFF	ON	OFF	OFF	OFF	OFF	:							62	OFF	ON	ON	ON	ON	ON	63	ON	ON	ON	ON	ON	ON
Address	SW1	SW2	SW3	SW4	SW5	SW6																																												
0	OFF	OFF	OFF	OFF	OFF	OFF																																												
1	ON	OFF	OFF	OFF	OFF	OFF																																												
2	OFF	ON	OFF	OFF	OFF	OFF																																												
:																																																		
62	OFF	ON	ON	ON	ON	ON																																												
63	ON	ON	ON	ON	ON	ON																																												
<p>Network speed setting</p> 	<p>SW7 and SW8 of the DIP switch is used to set the network speed.</p> <table border="1"> <thead> <tr> <th>Speed</th> <th>SW7</th> <th>SW8</th> </tr> </thead> <tbody> <tr> <td>125kbps</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>250kbps</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>500kbps</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>N/A</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> <p>The factory setting is 125kbps. Note) Network speed of all nodes on DeviceNet must be the same. Otherwise, some nodes may be busoff.</p>	Speed	SW7	SW8	125kbps	OFF	OFF	250kbps	ON	OFF	500kbps	OFF	ON	N/A	ON	ON																																		
Speed	SW7	SW8																																																
125kbps	OFF	OFF																																																
250kbps	ON	OFF																																																
500kbps	OFF	ON																																																
N/A	ON	ON																																																
<p>In/out data size setting</p> 	<p>SW9 and SW10 of the DIP switch is used to set the input and output data size.</p> <table border="1"> <thead> <tr> <th>Input + Output</th> <th>SW9</th> <th>SW10</th> </tr> </thead> <tbody> <tr> <td>4 word + 4 word</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>8 word + 8 word</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>12 word + 12 word</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>16 word + 16 word</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> <p>The factory setting is 4 word input and 4 word output.</p>	Input + Output	SW9	SW10	4 word + 4 word	OFF	OFF	8 word + 8 word	ON	OFF	12 word + 12 word	OFF	ON	16 word + 16 word	ON	ON																																		
Input + Output	SW9	SW10																																																
4 word + 4 word	OFF	OFF																																																
8 word + 8 word	ON	OFF																																																
12 word + 12 word	OFF	ON																																																
16 word + 16 word	ON	ON																																																
<p>DeviceNet cable connection</p>	<p>Connect DeviceNet cable to a terminal block of DN111M. The terminal block has color labels corresponding to the DeviceNet cable.</p>  <p>Strip 5mm the DeviceNet cable sheath and insert according to the color. Be sure to connect properly.</p>																																																	

## 2. Specifications

### 2.12 How to display the I/O status on the LED

On the T1-16S main unit, 16 points of I/O status LEDs are provided.



In the normal condition (default state), these LEDs indicate the main unit I/O status. However, these LEDs can also be used for displaying the I/O status of the connected I/O modules.

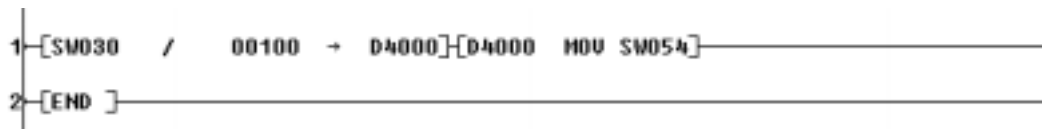
The LED display contents are controlled by the value of the special register SW54. See table below.

I/O status LEDs:

Indicates the ON/OFF status of each I/O signal.

SW54 value	Display contents	Note
0 (default)	Main unit (L: X000-007, H: Y020-027)	
1	I/O module slot 0	It indicates I/O module status. (Effective only in RUN mode)
2	I/O module slot 1	
3	I/O module slot 2	
4	I/O module slot 3	
5	I/O module slot 4	
6	I/O module slot 5	
7	I/O module slot 6	
8	I/O module slot 7	
9	TOSLINE-F10 (FR112M), Low 1 word	
10	TOSLINE-F10 (FR112M), High 1 word	
Others	Main unit (L: X000-007, H: Y020-027)	

By writing the following program in the T1-16S, the analog setting adjuster (V0) on the T1-16S main unit can be used to select the LED display contents. That is, you can display the I/O module ON/OFF status on the LED by adjusting the V0 using screwdriver.



SW30 < 100 ... Main unit

100 ≤ SW30 < 200 ... Slot 0 I/O

200 ≤ SW30 < 300 ... Slot 1 I/O

300 ≤ SW30 < 400 ... Slot 2 I/O

400 ≤ SW30 < 500 ... Slot 3 I/O

500 ≤ SW30 < 600 ... Slot 4 I/O

600 ≤ SW30 < 700 ... Slot 5 I/O

700 ≤ SW30 < 800 ... Slot 6 I/O

800 ≤ SW30 < 900 ... Slot 7 I/O

Note) Do not designate SW54 as the division result register directly. Otherwise the next register SW55 data will be changed unexpectedly.





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# *Section 3*

## *Installation*

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*3.1 Connecting and removing the I/O module, 32*

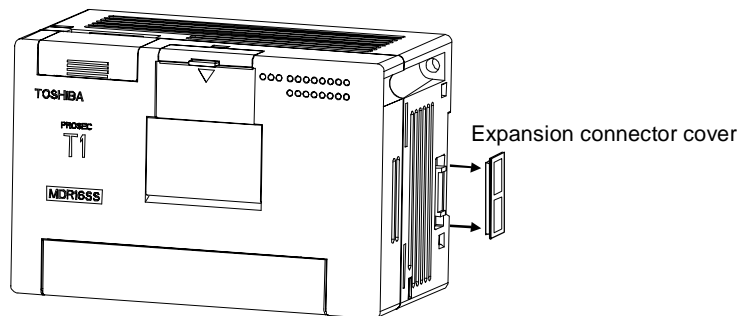
## 3. Installation

### 3.1 Connecting and removing the I/O module

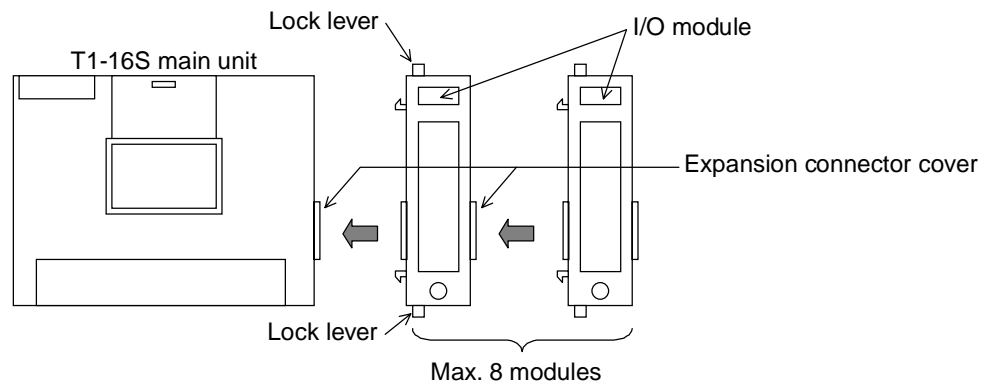
#### ⚠ CAUTION

- Turn off power to the T1-16S before connecting or removing the I/O module. Failure to do so can cause electrical shock or damage to the product.
- Cover the unused expansion connector by attached protective cover to prevent short-circuit of the connector pins.

- (1) Remove an expansion connector cover of a surface on the right of the T1-16S main unit or the last I/O module.



- (2) Installs increasing I/O module from the right side.



- (3) When remove the I/O module, move to the right side while it pushes top and bottom lock lever.

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# *Section 4*

## *I/O Allocation*

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- 4.1 I/O allocation overview, 34*
- 4.2 I/O allocation methods, 36*
- 4.3 Register assignment rule, 37*
- 4.4 Option (OPT) module, 37*
- 4.5 I/O allocation examples, 39*

## 4. I/O Allocation

### 4.1 I/O allocation overview

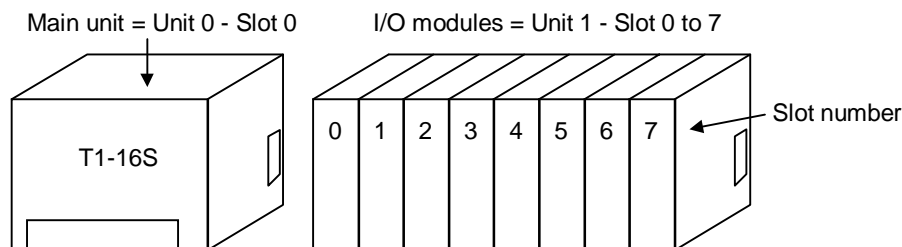
The I/O allocation is the operation to let the T1-16S to recognize the type and location of the I/O modules which are connected to the T1-16S.

The T1-16S has the information called "I/O allocation table" in its memory. This "I/O allocation table" indicates what type of module is connected on which slot. The contents of the I/O allocation table is as follows.

Unit	Slot	I/O type
0	PU	
	0	X+Y 4W
	1	
	2	
	3	
	4	
	5	
	6	
1	0	
	1	
	2	
	3	
	4	
	5	
	6	
	7	

← PU slot must be blank  
 ← Slot 0 is for main unit (XW00, XW01, YW02 and YW03 are assigned internally)  
 ← Slots 1 to 7 of unit 0 are reserved. (They must be blank)  
 ← **Expansion I/O slots. Connected I/O modules are allocated here.**

The figure below shows the correspondence between I/O allocation "Slot" and hardware location.



Note 1) When the TOSLINE-F10 remote station module (FR112M) is used, only one FR112M is allowed with the T1-16S. The FR112M must be connected as the last (right end) module.

As for the I/O allocation of the FR112M, different from the other I/O modules, the FR112M is allocated on the slot 3 or slot 7 regardless of physical connecting location.

Note 2) When the DeviceNet slave module (DN111M) is used, only one DN111M is allowed. There is no restriction of the mounting position.

## 4. I/O Allocation

The “I/O type” indicates the type of module and assigned number of I/O registers (XW/YW registers).

“X” means input, “Y” means output, and “X+Y” means input and output mixture types. And, for example, “4W” means 4 words of XW/YW registers are assigned.

The table below shows the “I/O type” of each module.

Basic unit / I/O module		I/O type
T1-16S main unit		X+Y 4W
16 points DC input	DI116M	X 1W
16 points DC output	DO116M	Y 1W
8 points input + 8 points output	DD116M	X+Y 2W
8 points relay output	RO108M	Y 1W
1 channel analog input (12-bit)	AD121M	X 1W
	AD131M	X 1W
1 channel analog output (12-bit)	DA121M	Y 1W
	DA131M	Y 1W
1 channel thermocouple input	TC111M	X 1W
TOSLINE-F10 remote station <sup>Note 1)</sup>	FR112M	TL-F
DeviceNet slave module <sup>Note 2)</sup>	DN111M	OPT

Note 1) The FR112M has the I/O type “TL-F”. No XW/YW register is assigned to the FR112M. For the FR112M, special registers SW34 and SW35 are assigned, instead of XW/YW registers. See section 5.

Note 2) The DN111M has the I/O type “OPT”. No XW/YW register is assigned to the OPT module. For the OPT module, RW registers (from RW240 to RW255) and D registers (from D4000 to D4095) are assigned, instead of XW/YW registers. See section 6.

## 4. I/O Allocation

### 4.2 I/O allocation method

The operation to create the I/O allocation table is called "I/O allocation".

When the T1-16S is used without connecting I/O module, the I/O allocation is not required. Because the I/O allocation table for main unit is created automatically when the memory clear operation is performed.

However, when I/O modules are used, or T1-16S's user program is developed in off-line, the I/O allocation is necessary.

There are two methods for the I/O allocation.

#### Automatic I/O allocation:

When the automatic I/O allocation command is executed from the programmer, the T1-16S checks the hardware configuration, then creates the I/O allocation table. This method is useful when all the necessary hardware (I/O modules) is prepared.

#### Manual I/O allocation:

I/O type can be set onto the I/O allocation table slot by slot by the programmer. (Editing of the I/O allocation table)

The table below shows the available I/O type by the manual I/O allocation.

Function type	Number of I/O registers assigned	Description
X	01, 02, 04, 08, or 16	For input
Y	01, 02, 04, 08, or 16	For output
X+Y	02, 04, 08, or 16	For input and output mixture
TL-F	-	For TOSLINE-F10 (no I/O register is assigned)
OPT	-	For Option module such as DN111M (no I/O register is assigned)

#### NOTE



- (1) Do not use the I/O type other than the listed above for the T1-16S.
- (2) To run the T1-16S, the I/O allocation table and physical I/O configuration must be matched.

## 4. I/O Allocation

### 4.3 Register assignment rule

Once the I/O allocation table is created, the T1-16S's registers are assigned to the hardware (I/O module) according to the following rules.

- (1) Input register (XW) and output register (YW) have consecutive register addresses. That is, one address is for either XW or YW.
- (2) XW registers are assigned to the I/O type "X".
- (3) YW registers are assigned to the I/O type "Y".
- (4) XW and YW registers are assigned to the I/O type "X+Y". Leading half are XW and following half are YW.
- (5) I/O registers (XW/YW) are assigned sequentially from slot 0.
- (6) T1-16S main unit has the I/O type "X+Y 4W". Therefore, four registers (XW00, XW01, YW02 and YW03) are assigned to the main unit. XW01 and YW03 are assigned internally.
- (7) No register is assigned to a vacant slot.
- (8) For "TL-F", special registers SW34 and SW35 are assigned.
- (9) For "OPT" module, RW registers (RW240 to RW255) and D registers (D4000 to D4095) are assigned, instead of XW/YW registers. See section 4.4.

### 4.4 Option (OPT) module

The I/O module which has the special I/O type "OPT" are allocated to RW and D registers, instead of XW/YW registers.

The module status and the request command are allocated to RW registers (RW240 to RW255), and the I/O data are allocated to D registers (D4000 to D4095).

Note that the OPT setting is supported by the T1-16S version 1.1 or later.

- (1) Allocation of status data and request data

Register	Contents	
RW240	1st OPT module	Status data
RW241		Request command
RW242	2nd OPT module	Status data
RW243		Request command
RW244	3rd OPT module	Status data
RW245		Request command
RW246	4th OPT module	Status data
RW247		Request command
RW248	5th OPT module	Status data
RW249		Request command
RW250	6th OPT module	Status data
RW251		Request command
RW252	7th OPT module	Status data
RW253		Request command
RW254	8th OPT module	Status data
RW255		Request command



## 4. I/O Allocation

Note1) Contents of the status data and request command are due to each OPT module.

Note2) The RW registers which are not assigned to OPT modules can be used for normal RW registers. For example, when one OPT module is connected, RW240 and RW241 are assigned to this OPT module. In this case, RW242 to RW255 can be used for normal RW registers.

### (2) Allocation of input/output data

Input/output data of the OPT module are allocated to D4000 and after (up to D4095). The assigned data size is dependent on the OPT module.

For example, if the 1st OPT module requires 8 words of I/O data, the 2nd OPT module requires 32 words of I/O data, and the 3rd OPT module requires 4 words of I/O data, the allocation is as follows.

Register	Contents	
D4000	1st OPT module	I/O data (8 words)
:		
D4007		
D4008	2nd OPT module	I/O data (32 words)
:		
D4039		
D4040	3rd OPT module	I/O data (4 words)
:		
D4043		
D4044	Can be used for normal D register	
:		
D4095		

Note 1) The contents of the I/O data (in or out) are due to each OPT module.

Note 2) The total I/O data of the connected OPT modules must be 96 words or less. If exceeded, the T1-16S comes error because of allocation error.

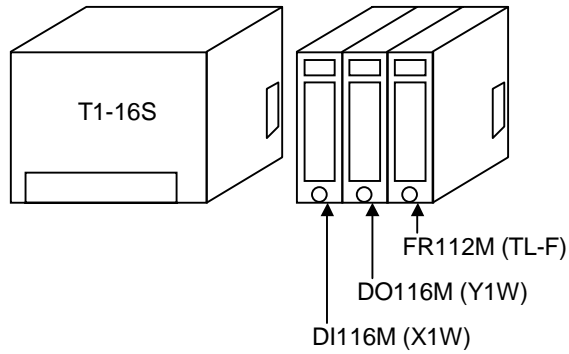
Note 3) D registers which are not assigned to OPT modules can be used for normal D registers.

## 4. I/O Allocation

### 4.5 I/O allocation examples

#### Example 1

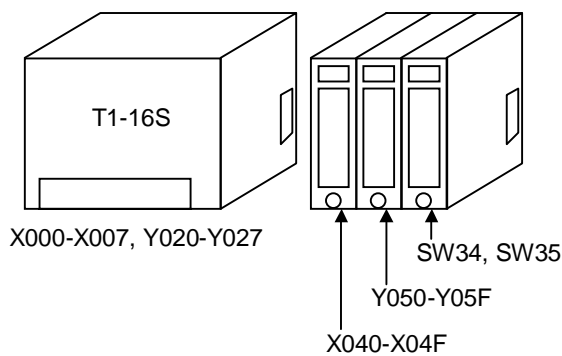
- Hardware configuration



- I/O allocation table and register assignment

Unit	Slot	I/O type	Assigned register	Assigned device
0	PU	-	-	-
	0	X+Y 4W	XW00, YW02	X000 - X007, Y020 - Y027
1	0	X 1W	XW04	X040 - X04F
	1	Y1W	YW05	Y050 - Y05F
	2	-	-	-
	3	TL-F	SW34, SW35	S340 - S34F, S350 - S35F

- Hardware and register/device relation



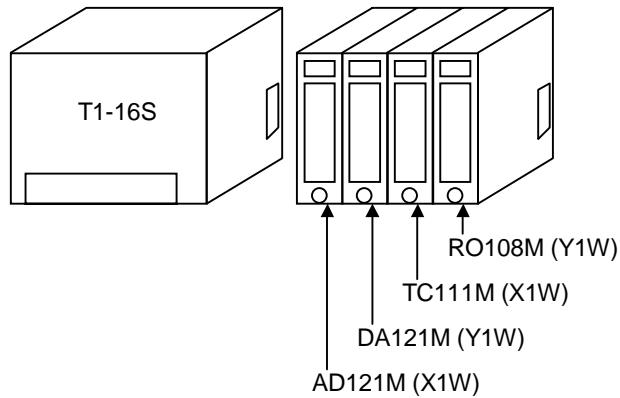
Note 1) X008 to X01F, Y028 to Y03F are assigned internally.

2) As for the I/O allocation of FR112M, refer to the note on page 34.

## 4. I/O Allocation

### Example 2

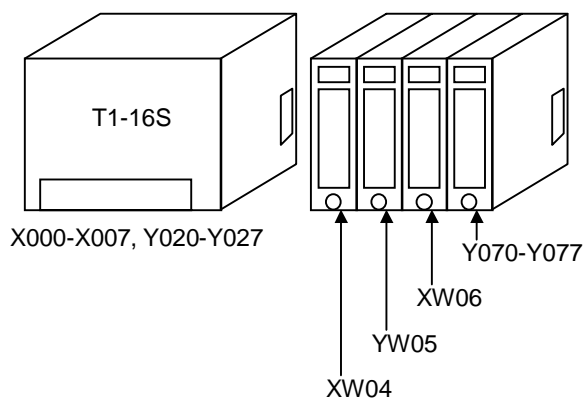
- Hardware configuration



- I/O allocation table and register assignment

Unit	Slot	I/O type	Assigned register	Assigned device
0	PU			
	0	X+Y 4W	XW00, YW02	X000 - X00F, Y020 - Y02F
1	0	X1W	XW04	X040 - X04F
	1	Y1W	YW05	Y050 - Y05F
	2	X1W	XW06	X060 - X06F
	3	Y1W	YW07	Y070 - Y077

- Hardware and register/device relation

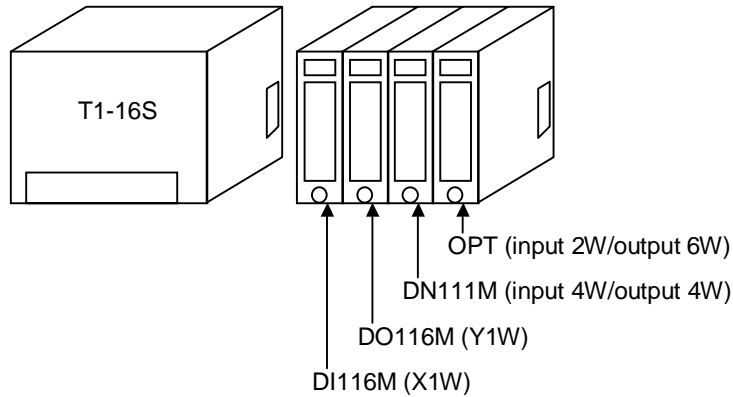


Note) X008 to X01F, Y028 to Y03F, Y078 to Y07F are assigned internally.

## 4. I/O Allocation

### Example 3

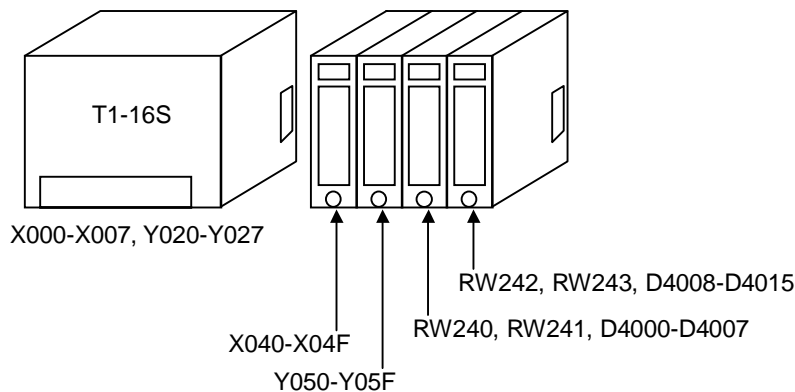
- Hardware configuration



- I/O allocation table and register assignment

Unit	Slot	I/O type	Assigned register	Assigned device
0	PU			
	0	X+Y 4W	XW00, YW02	X000 - X00F, Y020 - Y02F
1	0	X1W	XW04	X040 - X04F
	1	Y1W	YW05	Y050 - Y05F
	2	OPT	RW240: Status data RW241: Request command D4000-D4003: Input data D4004-D4007: Output data	None
	3	OPT	RW242: Status data RW243: Request command D4008-D4009: Input data D4010-D4015: Output data	None

- Hardware and register/device relation



Note 1) X008 to X01F and Y028 to Y03F are assigned internally.

Note 2) RW244 to RW255 can be used for normal RW registers. D4016 to D4095 can be used for normal D registers.



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## *Section 5*

### *About the TOSLINE-F10*

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- 5.1 Network configuration, 44*
- 5.2 Register assignment, 45*
- 5.3 RAS information, 46*

## 5. About the TOSLINE-F10

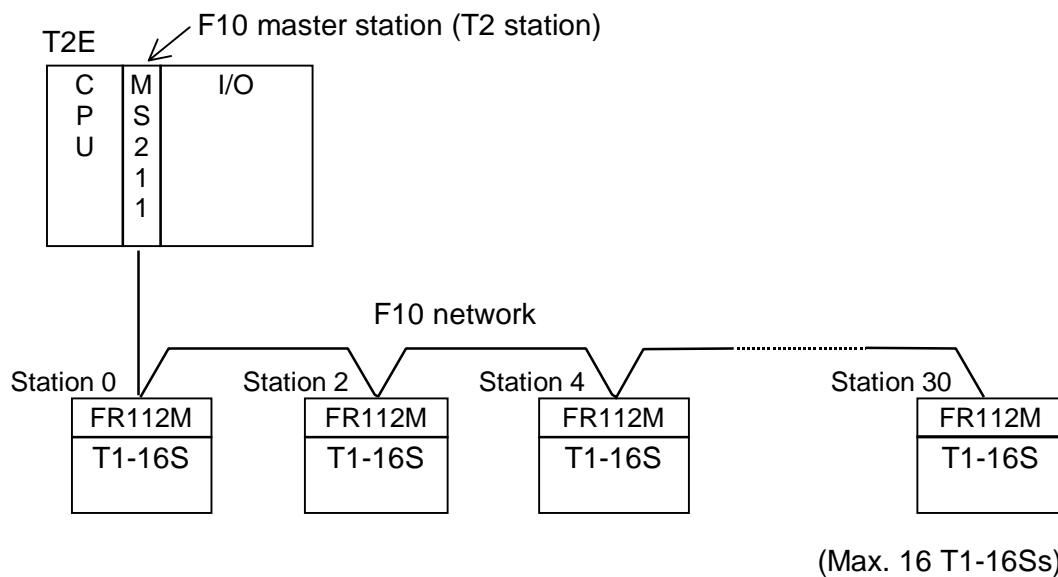
### 5.1 Network configuration

The FR112M is the TOSLINE-F10 remote station module for the T1-16S. By using the FR112M, high-speed data linkage between the T1-16S and the upper T-series PLC (T2/T2E/T2N or T3/T3H) becomes available. For details of the TOSLINE-F10 system, read separate TOSLINE-F10 user's manual.

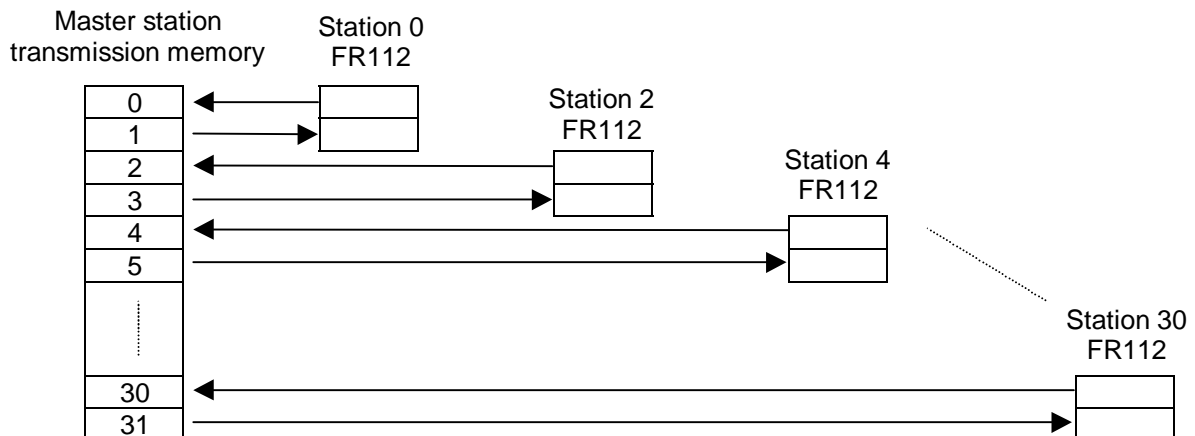
The FR112M works as a remote station. One master station is necessary on a TOSLINE-F10 (hereafter called F10) network.

The F10 master station has 32 words of scan transmission memory. The FR112M shares 2 words of them. (1 word transmit and 1 word receive)

Therefore maximum 16 T1-16S's can be connected to the master station.



The FR112M shares 2 words of transmission memory. The shared addresses are determined by the station address of the FR112M.



## 5. About the TOSLINE-F10

### 5.2 Register assignment

In case of the T2 and T3 stations, the link registers LW are assigned to the TOSLINE-F10 transmission memory.

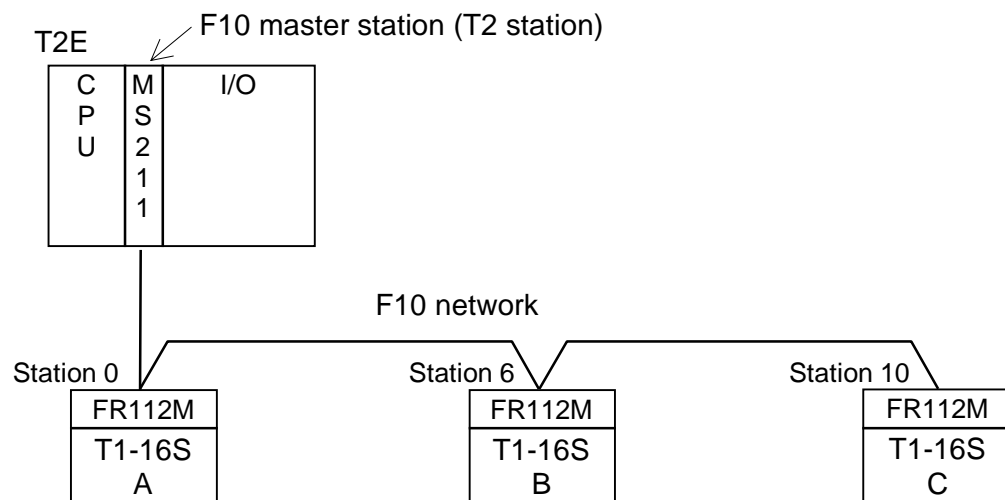
On the other hand, in case of the T1-16S, the special registers SW34 and SW35 are assigned fixedly.

SW34 ... Transmit data to the master

SW35 ... Receive data from the master

The figure below shows an example of the data link map.

< System configuration >



< Data link map >

F10 transmission address	PLC reference				Data source and destination
	T2E Master	T1-16S A (#0)	T1-16S B (#6)	T1-16S C (#10)	
0	LW000	SW34			T2E ← T1-16S A
1	LW001	SW35			T2E → T1-16S A
⋮	⋮				
6	LW006		SW34		T2E ← T1-16S B
7	LW007		SW35		T2E → T1-16S B
⋮	⋮				
10	LW010			SW34	T2E ← T1-16S C
11	LW011			SW35	T2E → T1-16S C
⋮	⋮				



## 5. About the TOSLINE-F10

### 5.3 RAS information

On the F10 network, its data linkage system is controlled by the master station. If the master station is failed, entire data linkage is stopped.

In a normal data linkage situation, the transmission data validity is checked by receiver station using CRC.

The table below shows the behavior of the T1-16S side in case of F10 related trouble.

Trouble situation	F10 operation	T1-16S behavior
Master station down PLC CPU of master station down	Entire data linkage is stopped.	Special device S00D comes ON. Data in SW35 is not changed. T1-16S continues running.
Transmission cable broken		
Interference by noise, etc.	Transmission error occurs frequently.	When an error is detected by the FR112M, special device S00D comes ON.  S00D returns to OFF when data link is recovered. Data in SW35 is not changed during S00D is ON. T1-16S continues running.
FR112M hardware error	Momentary transmission error occurs.	When an error is detected by the FR112M, special device S00D comes ON.  S00D returns to OFF when data link is recovered. Data in SW35 is not changed during S00D is ON. T1-16S continues running.
FR112M hardware error	Data link between the FR112M and master station is stopped.	If the FR112M does not respond to the T1-16S, the T1-16S enters into Error mode. In the Error mode, all outputs of the T1-16S are switched OFF, and program execution is stopped. (PLC CPU of master station can know the error)

#### NOTE



The FR112M does not support the F10's read-back check mode. Do not use the read-back check mode when T1-16S is linked.

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## *Section 6*

### *About the DeviceNet slave*

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- 6.1 DeviceNet conformity, 48*
- 6.2 LED indication, 48*
- 6.3 Data allocation for DN111M, 49*
- 6.4 Conformity for CE marking of DN111M, 50*
- 6.5 DeviceNet Wizard for TOSHIBA, 50*

## 6. About the DeviceNet slave

### 6.1 DeviceNet conformity

The DN111M is a one of T1-16S option module, and acts as DeviceNet slave module. Via DN111M, the T1-16S can communicate with a master device (such as DN211A, DN311A, or DN611A) on DeviceNet.

The DN111M has been tested by ODVA's authorized Independent Test Lab and confirmed to comply with ODVA Conformance Test Software Version A-15.



DeviceNet is a registered trademark of ODVA(Open DeviceNet Vendor Association).

**Note: The T1-16S version 1.1 or later is required for use of the DN111M.**

### 6.2 LED indication

The DN111M has a bi-color LED (green and red) that is called "MS/NS". LED lighting represents DN111M status.

LED	Module status
Not lit	1) No power is supplied to the T1-16S. 2) T1-16S power is normal, but network power is not supplied. 3) T1-16S and network power are normal, but DN111M is alone on the DeviceNet network.
Green blinking	DN111M is normal, but DN111M is not communicating with a master.
Green lighting	DN111M is normal, and DN111M is communicating with a master.
Red blinking	DN111M is encountering a recoverable trouble. (The master stops polling)
Red lighting	1) DN111M is down mode. 2) DN111M detects a duplicated node address. 3) DN111M detects busoff.
Orange lighting	Self check when the power is on.

## 6. About the DeviceNet slave

### 6.3 Data allocation of DN111M

(1) Bit allocation of status data (Bit 3, 4, 5, 6, 7, 8, A and B are not used)

Bit	Contents
F	1: DN111M is down. 0: DN111M is not down.
E	1: DN111M is initializing. 0: DN111M is not initializing.
D	1: DN111M is normal but cannot communicate, because of T1-16S is halt. 0: The other case.
C	1: DN111M is normal and can communicate (T1-16S is run). 0: The other case.
9	1: DN111M communicates with a master and DN111M receives valid data. 0: The other case.
2	1: DN111M detects busoff. Bit F is also "1" 0: DN111M does not detect busoff.
1	1: DN111M detects a duplicated node address. Bit F is also "1" 0: DN111M does not detect a duplicated node address.
0	1: DN111M has no network power. 0: DN111M has network power.

(2) Bit allocation of request command (Bit 1 to bit F are not used)

Bit	Contents
0	1: Reset request for DN111M. 0: Cancel the reset request.

(3) Register allocation example

DN111M (4 words input / 4 words output) is connected with the T1-16S.

Status data	RW240
Request command	RW241
Input data area (received data from master)	D4000 to D4003
Output data area (send data to master)	D4004 to D4007

DN111M (16 words input / 16 words output) is connected with the T1-16S.

Status data	RW240
Request command	RW241
Input data area (received data from master)	D4000 to D4015
Output data area (send data to master)	D4016 to D4031

## 6. About the DeviceNet slave

### 6.4 Conformity for CE marking of DN111M

DN111M can be conformed to the EMC directive and LVD directive (IEC61131-2) under the following condition.

(1) EMC directive

The transmission cable should be fitted with ferrite core. The ferrite cores must be clamped within 10cm from the DN111M.

- Example of ferrite core impedance ... 25MHz: 137Ω / 100MHz: 204Ω

A shield line of the transmission cable must be connected to the ground that resistance must be 100 ohm or less.

The transmission cable must be installed in protect pipes or steel ducts for whole cable. The pipes and ducts must have ground connection to the ground as short as possible, that resistance must be 100 ohm or less.

(2) LVD directive

Use reinforced insulation / double insulation DC power supply that provide to inputs/outputs, internal circuit and communication circuit.

(3) Supplementary information

It is necessary for you to confirm if your system is conform to the EC directive when applying our products, because system configuration (physical arrangement, wiring, other devices, connections to other equipment, etc.) may cause the EMC/LVD conditions to be changed.

Please ask the qualified expert for installation of DeviceNet network because it requires sufficient safety and noise-suppression measures.

### 6.5 DeviceNet Wizard for TOSHIBA

The EDS file of the DN111M is installed in the DeviceNet Wizard for TOSHIBA. The default setting of the input/output data size in the EDS file is "4 words input + 4 words output", ie. 8 bytes input and 8 bytes output.

If you want to use DN111M with other input/output setting, please change the setting as follows.

- 1) Using a network configuration screen on the DeviceNet Wizard, register DN111M onto a master.
- 2) Using a Scan List Editor on the DeviceNet Wizard, change the input/output setting of the DN111M.



If you use a configuration tool from other vendors, you can download the EDS file for the DN111M from ODVA Web site (<http://www.odva.org>).

## 6. About the DeviceNet slave

For your information, the contents of the DN111M EDS file is shown below.

```
[File]
  DescText = "DN111 EDS File";
  CreateDate = 01-28-2002;      $ 2002/01/28
  CreateTime = 10:00:00;
  Revision = 1.0;                $ Revision of EDS

[Device]
  VendCode = 71;
  VendName = "TOSHIBA CORPORATION";
  ProdType = 12;
  ProdTypeStr = "Communication Adapter";
  ProdCode = 100;
  ProdName = "DN111 Slave Module";
  MajRev = 1;
  MinRev = 1;
  Catalog = "";

[IO_Info]
  Default      = 0x0001;      $ Poll

  PollInfo     =
    0X0001,          $ Poll
    1,              $ Default input = 1
    1;              $ Default output = 1

  Input1       =
    8,              $ 8byte
    0,              $ All bits are significant
    0x0001,         $ Poll Connection
    "Pararel Input", $ Name of this I/O
    6,              $ Path Length
    "20 07 24 02 30 04", $ Class7,Instance2,Attribute4
    "";

  Output1      =
    8,              $ 8byte
    0,              $ All bits are significant
    0x0001,         $ Poll Connection only
    "Pararel Output", $ Name of this I/O
    6,              $ Path Length
    "20 07 24 01 30 04", $ Class7,Instance1,Attribute4
    "";
```

# **TOSHIBA**

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