TOSHIBA CORPORATION

USER'S MANUAL – I/O Modules –



UM-TS01***-E034

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TOSHIBA

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Safety Precautions

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.

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



- 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.

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

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Section 1

System Configuration

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1.1 T1-16S system configuration

The following figure shows the T1-16S 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.

Туре	Description	Power supply
DI116M	16 points input, 24 Vdc - 5 mA	Supplied from the basic
DO116M	16 points output, 24 Vdc - 100 mA	unit (5 Vdc). See section
DD116M	8 points input, 24 Vdc - 5 mA	1.3.
	+ 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 ±10V	
DA121M	1 channel analog output 0-20mA	
DA131M	1 channel analog output ±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.



1.3 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 ±10V	260mA
DA121M	1 channel analog output 0-20mA	350mA
DA131M	1 channel analog output ±10V	240mA
TC111M	1 channel thermo-couple input	400mA
FR112M	TOSLINE-F10 remote station	100 mA
DN111M	DeviceNet slave module	250mA

1.4 Optional items

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

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

DI116M
DC input, current sourcing/sinking
X 1W (1 input register XW assigned)
16 points (8 points/common)
24 Vdc, +10/-15 %
5 mA (at 24 Vdc)
18.0 Vdc
6.0 Vdc
10 ms
10 ms
See Note on the next page
None (It can be displayed on the T1-16S main unit. Refer to section 2.11)
24-pin connector
1500 Vac, 1 minute (internal \leftrightarrow external circuits)
Max. 50 mA (5 Vdc)
0 • • • • • • • • • • • • • • • • • • •



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.



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 μΑ
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	Vin0 Internal circuit 0 1 0 7 0 COM0 Vin1 8 F 0 COM1



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)		
	Number of input points	8 points (8 points/common)		
	Rated input voltage	24 Vdc, +10/-15 %		
	Rated input current	5 mA (at 24 Vdc)		
put	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		
	Number of output points	8 points (8 points/common)		
	Rated load voltage	5 to 24 Vdc, +10/-5 %		
t t	Maximum load current	100 mA/point (at 24 Vdc), 20 mA/point (at 5 Vdc),		
tp [800 mA/common		
0 0	Voltage drop at ON	0.4 V or less		
	Leakage current at OFF	100 μΑ		
	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)		
Ext	ternal connection	24-pin connector		
Wi	thstand voltage	1500 Vac, 1 minute (internal \leftrightarrow external circuits)		
Cu	rrent consumption	Max. 50 mA (5 Vdc)		
Internal circuit				
		circuit circuit		
		Vin1 O O DC output O O O O O O O O O O O O O		



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)



2.4 8 points relay output

ltem		RO108M
Card type		Relay output
I/O allocation type		Y 1W (1 output register YW assigned)
Number of ou	Itput points	8 points (8 points/common)
Rated load vo	oltage	240Vac/24Vdc
Maximum loa	d current	1A/point (resistive load), 4A/common
ON resistance	e	$30m\Omega$ or less (initial value)
Leakage curr	ent at off	None
Minimum load	k	5Vdc, 10mA
ON/OFF dela	y time	10ms or less
Output signal	display	None (It can be displayed on the T1-16S main
	-	unit. Refer to section 2.11)
Terminal	Screw size	M2
block	Screw torque	0.2 - 0.4N · m
(removable)	Wire size	0.3 - 1. <u>2</u> 5mm ² (AWG 22 - 16)
Mechanical s	witching life	20 million times or more
Electrical swit	tching life	100 thousand times or more (at max. rated
	-	voltage and current)
Insulation res	istance	$10M\Omega$ or more (between terminal block and
		internal circuit)
Withstand vo	ltage	1500Vac, 1 minute (between terminal block and
		internal circuit)
Current consu	umption	Max. 260mA (5Vdc)
Current consumption Internal circuit		

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

ltem	AD1	21M
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 Refer to section 2.11)	on the T1-16S main unit.
External connection	2-pin removable connecto	r
Withstand voltage	500 Vac, 1 minute (interna	al \leftrightarrow external circuits)
Current consumption	Max. 260 mA (5 Vdc)	
Input range setting	Open	Short (factory setting)
(jumper plug JP1)		
Data format	Converts full scale analog 0-5V) into digital data in 0 $F = D C B A 9$ $XW 0 0 0 0 D D D D$ $D: Data bit (12bits) (0)$ $\frac{4000}{\text{Digital}}$ 2000 $0 = 10 20 (m)$ $2.5 5 (V)$	input signal (0-20mA/ to 4000. $\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$
	P AD convers ion unit 250Ω Jumper plug	Photo- coupler + Internal circuit
Terminal connection	shield two-core twiste -	ded ad pair cable P 2 N 1 E Grounding

2.6 1 channel analog input (±10V)

ltem	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	±10 V	
Absolute max. input	±13 V	
Rated input impedance	1 MΩ or more	
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 \leftrightarrow external circuits)	
Current consumption	Max. 260 mA (5 Vdc)	
Data format	Converts full scale analog input signal (±10V) into	
	digital data in -2000 to +2000.	
	F E D C B A 9 8 7 6 5 4 3 2 1 0	
	עז א א א א א א א א א א א א א א א א א א א	
	S: Sign 0 = positive, 1 = negative	
	D: Data bit (11bits) -2000 - 2000 (HF830 - H07D0)	
	Negative value is expressed by 2's complement	
	Digital value $D = 200 \times A$	
	A: Analog value	
	1000 [D: Digital value]	
	0 5 10 Analog value (V)	
Internal circuit		
	AD convers-	
	✦ AG	
Terminal connection	Shielded	
	two-core twisted pair cable	
	는 Grounding	

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 \leftrightarrow 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)	
	F E D C B A 9 8 7 6 5 4 3 2 1 0 YW * * * D	
	D: Data hit (12hits), 0 - 4000 (H0000 - H0E40)	
	*: No effect on D/A conversion	
	Analog 15 $A= 0.005 \times D$ Analog 15 $A= 0.005 \times D$ A: Analog value D: Digital value 0 2000 4000 Digital value	
Internal circuit	Internal circuit Photo- coupler Coupler Coupler AMP BUF AG	
Terminal connection	Shielded two-core twisted pair cable $2 \xrightarrow{P}$ $1 \xrightarrow{N}$ $\xrightarrow{-}$ = Grounding	

2.8 1 channel analog output (±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	± 10V			
Rated output impedance	10k Ω or more			
Overall accuracy	±0.5 % FS : 25°C			
	±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	Converts digital data in -2000 to +2000 into analog			
	signal in full scale (±10V)			
	F E D C B A 9 8 7 6 5 4 3 2 1 0			
	YW SSSSSSDDDDDDDDDDDDDD			
	S: Sign 0 = positive, 1 = negative			
	D: Data bit (11bits) -2000 - 2000 (HF830 - H07D0)			
	Negative value is expressed by 2's complement			
	$A = 0.005 \times D$ $(A + Apple x value)$			
	Analog value (V) (A: Analog value)			
	5			
	-2000 -1000 Digital value			
	∠			
Internal circuit				
	Internal Photo-			
	circuit coupler ion unit			
	AG			
Terminal connection				
	Shielded two-core twisted pair cable			
	· · · · · · · · · · · · · · · · · · ·			
	⊥ – Grounding			

2.9 1 channel thermocouple input

ltem	TC111M			
Card type	Thermocouple input			
I/O allocation type	X 1W (1 input XW register assigned)			
Input points	1 channel			
Type of input (*1)	Туре К	Type J	Туре Е	mV input
Rated input range	-200 to 1200°C	-200 to 800°C	-200 to 600°C	-50 to +50mV
Load impedance	$1M\Omega$ or more			
Resolution	0.63°C	0.4°C	0.3ºC	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	None			
supply				
Insulation	Photo-coupler			
Input signal display	None (It can be	e displayed on t	he T1-16S mai	n unit. Refer
	to section 2.11)		
External connection	2-pin removab	le connector		
Withstand voltage	500 Vac, 1 mir	nute (internal \leftrightarrow	external circuit	s)
External connection	2-pin removab	le terminal block	k	
Current	Max. 400mA (5Vdc)			
consumption				
Data format	Digital value 12000 8000 6000 -200 -2000 (Type E) thermocoup	temperature (°C) 8001200 Type J) (Type K) le input	Digital value 2000 1000 -25 0 25 -1000 mV voltage input	Analog value(mV) 50 D=40×A [A : Analog value [D : Digital value]
Internal circuit		A/D Converte	Photo Coupler	Internal Circuit



2.10 TOSLINE-F10 remote station

	Item	FR112M
Ca	rd type	TOSLINE-F10 remote station
I/O	allocation type	TL-F (no I/O register assigned)
_	Transmission cable	Shielded twisted-pair cable
en	Configuration	Bus (party line)
yst	Transmission speed	750 kbps or 250 kbps
s O	Transmission distance	Max. 500 m (750 kbps)
Ε		Max. 1 km (250 kbps)
Щ	Transmission data	Max. 32 words (512 points)
	capacity (cyclic scan)	
SC	Scan cycle	7 ms/32 words (750 kbps)
Ĕ	Fores also also a	12 ms/32 words (250 kbps)
	Error checking	
Ę	Register assignment	SW34 Data send to the master
ctic		2 words of transmission data shared
ŭn	Transmission speed	(2 words of italishinssion data shared) 750 kbps or 250 kbps Jumper selection (JPS)
Σ	Transmission line	lumper selection (IPR)
12	termination	
Ř	Receive data at	Previous data is held
	transmission error	(TOSLINE-F10 error flag S00D comes ON)
Sta	itus displav	None (It can be displayed on the T1-16S main
		unit. Refer to section 2.11)
Ext	ernal connection	3-pin removable terminal block
Cu	rrent consumption	Max. 100 mA (5 Vdc)
Jur	nper settings	
		JPR JPR JPR JPR JPR JPR JPR JPR JPR JPR
		JPS: Transmission speed Open 750 kbps Short 250 kbps JPR: Termination resistor Open No connect Short Connect





2.11 DeviceNet slave module

	Item	DN111M			
Мо	dule type	DeviceNet slave module			
I/O	allocation type	OPT (no I/O register a	assigned)		
	Conformity specification	DeviceNet Rev 2.0			
ε	Network configuration	Bus structure (trunk line – branch line)			
ste	Network speed	125/250/500kbps (se	lectable)		
s		Network speed	Thick cable	Thin cable	
let		125kbps	500m		
e∧ N	Maximum cable length	250kbps	250m	100m	
šči		500kbps	100m		
ď	Connectable cable	Thick cable or thin ca	ble of DeviceN	et specification	
	Network terminal block	5-pin removable term	inal block	•	
Ve	ndor ID	71 (TOSHIBA)			
Pro	oduct type	12 (Communication a	dapter)		
Pro	oduct code	100	• •		
No	de address	0 to 63 (selectable)			
Fui	nction on DeviceNet	Polling type slave dev	/ice		
		(1) 4 words input / 4 v	vords output	J	
Inn	ut/output data aiza	(2) 8 words input / 8 v	vords output	coloctoblo	
mp	urouipui dala size	(3) 12 words input / 1	2 words output	Selectable	
		(4) 16 words input / 1	6 words output	J	
		Every 4 words			
Data synchronization		(If the master device has more than 4 words data			
		DN1111M status information (DN1111M to T1-16S)			
RAS information		DN111M status inform	nation (DINTTTIN	/1 to 11-165)	
		DINTITIM request corr	inana (11-165	dulo ond	
Sta	itus display	network status			
Сп	rrent consumption	Max 250mA (5)/dc) /	Max 90mA (N	etwork)	
Sw	itch settings				
0	tion oottingo		5		
		SW1	SW10 Switch		
			Switch		
]	
				at a a b l a	
				et cable	
			CONTECUT	on terrininal	
		SW1 DIP	SW 10 SW 10 Switch DeviceNe connection	et cable on terminal	

ltem			D	N111M			
Node address setting	SW1 to SW6 (6-bit) of the DIP switch is used to set the						
-	node address. Possible node address is 0 to 63.						
DIP switch	(SVV1 to SVV	6 CONTIQ	gure bir	hary nur	nber wit		LSB)
ON	Address	SW1	SW2	SW3	SW4	SW5	SW6
	0		OFF	OFF	OFF	OFF	OFF
	2	OFF	ON	OFF	OFF	OFF	OFF
SW1 SW6	:						
	62	OFF	ON	ON	ON	ON	ON
	63	ON	ON	ON	ON	ON	ON
	The factory s	etting i	s addre	ess 0.			
Network speed setting	SW7 and SV speed.	V8 of th	e DIP s	switch is	s used to	o set the	e network
DIP switch	Speed	S	SW7	SW8			
(ON)	125kbp	s (DFF	OFF			
	250kbp	S		OFF			
		s (ON			
SW7							
SW8	The factory s	setting is	s 125kt d of oll	ops.	n Dovi		unt ho
	the same. Ot	herwise	a or an e. some	nodes c	may be	busoff.	
In/out data size setting	SW9 and SV	V10 of 1	the DIP	switch	is used	to set th	ne input
DID owitch	and output da	ata size	•				-
	Input + Output SW9 SW10						
ΙΤΙΠΠΠΠΠΠΠΠ	4 word + 4 word		d C	DFF	OFF		
	8 word + 8 word 0						
SW9	12 word +	- 12 WO	rd (ON		
SW10						بمتعا منبذ	a t
Device Net eable	Connect DeviceNet cable to a terminal block of DN111M.						
connection	Connect DeviceNet cable to a terminal block of DN111M. The terminal block has color labels corresponding to the DeviceNet cable.						
				bla	ick		
	cable fixin	ng screw		\leq	Silue F	G"	
		$\mathbf{\mathbf{x}}$	\leq		\sim	_white red	
				\sim		\times	
		$\mathbb{Q}($)~`	(×)	\leq	$ \rightarrow $	
	black blue drain				\rightarrow		
	red					-	
	Strip 5mm the DeviceNet cable sheath and insert according						
		De Suie			peny.		

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:

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
2	I/O module slot 1	module status.
3	I/O module slot 2	(Effective only in
4	I/O module slot 3	RUN mode)
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)	

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

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

 $\begin{array}{l} 100 \leq SW30 < 200 \ ... \ Slot \ 0 \ I/O \\ 200 \leq SW30 < 300 \ ... \ Slot \ 1 \ I/O \\ 300 \leq SW30 < 400 \ ... \ Slot \ 2 \ I/O \\ 400 \leq SW30 < 500 \ ... \ Slot \ 3 \ I/O \end{array}$

 $\begin{array}{l} 500 \leq SW30 < 600 \ ... \ Slot \ 4 \ I/O \\ 600 \leq SW30 < 700 \ ... \ Slot \ 5 \ I/O \\ 700 \leq SW30 < 800 \ ... \ Slot \ 6 \ I/O \\ 800 \leq SW30 < 900 \ ... \ Slot \ 7 \ I/O \end{array}$

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

3.1 Connecting and removing the I/O module, 32

3. Installation

3.1 Connecting and removing the I/O module

- 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 shortcircuit 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.

Section 4

I/O Allocation

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- 4.3 Register assignment rule, 37
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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.

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.

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.

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 Note 1)	FR112M	TL-F
DeviceNet slave module Note 2)	DN111M	OPT

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

- 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.

4.2 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 offline, 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:

 $\ensuremath{\text{I/O}}$ type can be set onto the $\ensuremath{\text{I/O}}$ allocation table slot by slot by the programmer. (Editing of the $\ensuremath{\text{I/O}}$ allocation table)

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

Function	Number of I/O	Description	
type	registers assigned		
Х	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)	

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

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.

Register	Contents		
RW240	1 of ODT modulo	Status data	
RW241	TSLOPT module	Request command	
RW242	and ODT module	Status data	
RW243		Request command	
RW244	and ODT modulo	Status data	
RW245	3rd OPT module	Request command	
RW246		Status data	
RW247	4th OPT module	Request command	
RW248		Status data	
RW249	Stri OPT module	Request command	
RW250		Status data	
RW251	bin OPT module	Request command	
RW252		Status data	
RW253	7th OPT module	Request command	
RW254		Status data	
RW255		Request command	

(1) Allocation of status data and request data

- 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.
- (3) Scan time

When the OPT modules are used, the T1-16S's scan time becomes longer to read/write data for the OPT modules. The scan time extension owing to supporting the OPT modules is calculated as follows.

 $\Delta T = 0.25 \text{ x} (\text{N} + \text{M}) + 3 \text{ [ms]}$

- ΔT : Scan time extension owing to the OPT modules
- N: Total number of words of OPT module's I/O data (D register)
- M: Total number of words of OPT module's status/request data (RW register)

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.

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.

Example 3

• Hardware configuration

• I/O allocation table and register assignment

ſ	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	None
				RW241: Request command	
				D4000-D4003: Input data	
				D4004-D4007: Output data	
		3	OPT	RW242: Status data	None
				RW243: Request command	
				D4008-D4009: Input data	
				D4010-D4015: Output data	

• Hardware and register/device relation

- Note 1) X008 to X01Fand 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. 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	PLC reference				Data source
transmission	T2E	T1-16S	T1-16S	T1-16S	and
address	Master	A (#0)	B (#6)	C (#10)	destination
0	LW000	SW34			T2E \leftarrow T1-16S A
1	LW001	SW35			T2E \rightarrow T1-16S A
6	LW006		SW34		T2E \leftarrow T1-16S B
7	LW007		SW35		T2E \rightarrow T1-16S B
10	LW010			SW34	T2E \leftarrow T1-16S C
11	LW011			SW35	T2E \rightarrow 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	Entire data linkage	Special device S00D comes ON.
PLC CPU of master	is stopped.	Data in SW35 is not changed.
station down		T1-16S continues running.
Transmission cable		
broken	Transmission error	When an error is detected by the
	occurs frequently.	FR112M, special device S00D comes ON.
Interference by	Momentary	S00D returns to OFF when data link is
noise, etc.	transmission error	recovered.
	occurs.	Data in SW35 is not changed during
		S00D is ON.
		T1-16S continues running.
FR112M hardware	Data link between	If the FR112M does not respond to the
error	the FR112M and	T1-16S, the T1-16S enters into Error
	master station is	mode.
	stopped.	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)

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.

Section 6

About the DeviceNet slave

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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	ED Module status	
Not lit	 No power is supplied to the T1-16S. T1-16S power is normal, but network power is not supplied. 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	 DN111M is down mode. DN111M detects a duplicated node address. DN111M detects busoff. 	
Orange lighting	Self check when the power is on.	

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.		
Е	1: DN111M is initializing.		
	0: DN111M is not initializing.		
D 1: DN111M is normal but cannot communicate, because of T1-16			
	0: The other case.		
С	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

6.4 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: 137 Ω / 100MHz: 204 Ω

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).

[File] DescText = "DN111 EDS File"; CreateDate = 01-28-2002; \$ 2002/01/28 CreateTime = 10:00:00; \$ Revision of EDS Revision = 1.0;[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 = \$ Poll 0X0001, *\$ Default input = 1* 1, *\$ Default output = 1* 1; Input1 = 8, \$ 8byte *\$* All bits are significant Ο, \$ Poll Connection 0x0001, *\$ Name of this I/O* "Pararel Input", \$ Path Length 6, "20 07 24 02 30 04",\$ Class7, Instance2, Attribute4 ""; Output1 = \$ 8byte 8, Ο, *\$* All bits are significant 0x0001, \$ Poll Connection only "Pararel Output", \$ Name of this I/O \$ Path Length б, "20 07 24 01 30 04",\$ Class7,Instance1,Attribute4 "";

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

TOSHIBA

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