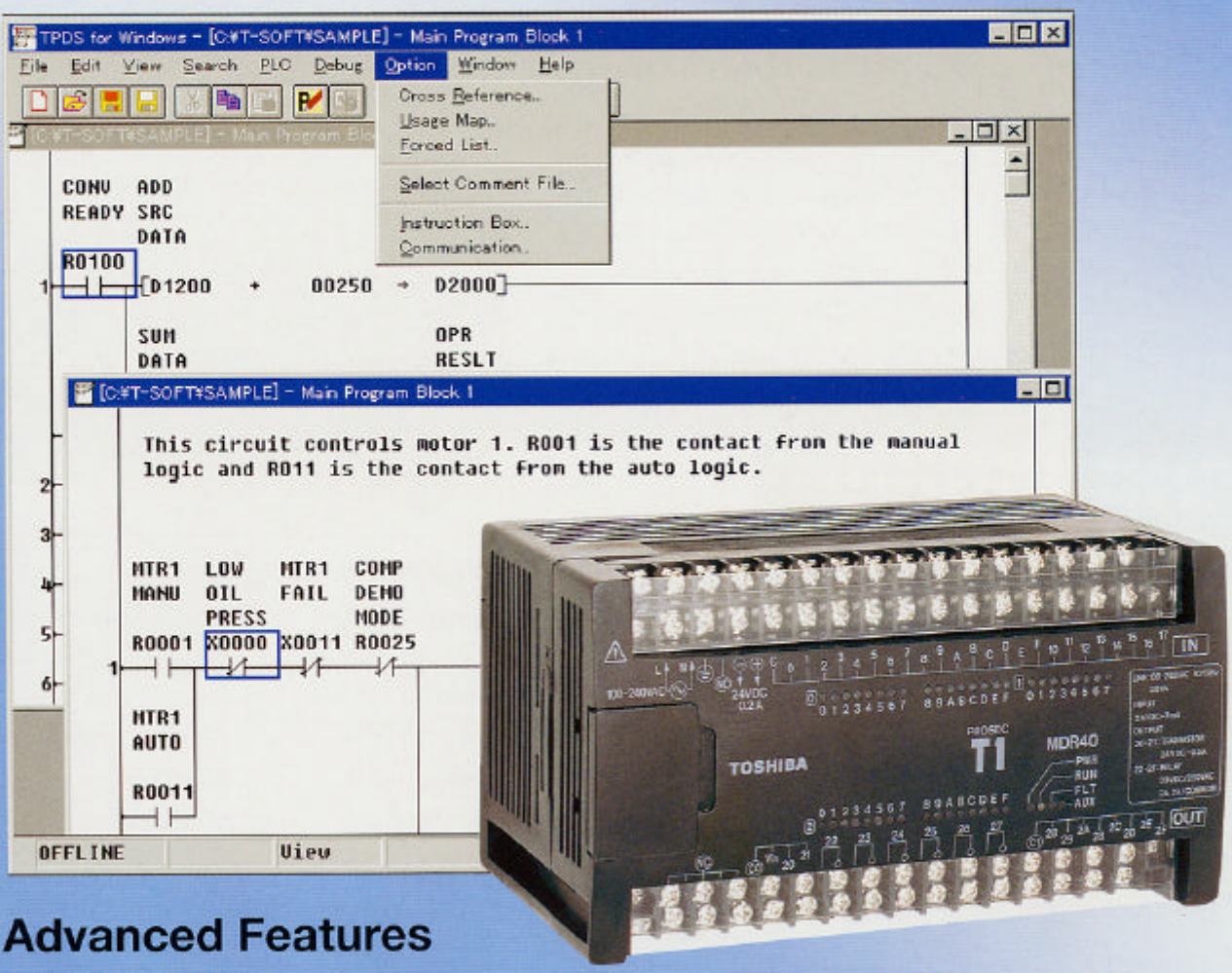
TOSHIBA

Main Menu

# PROGRAMMABLE CONTROLLER

# PROSEC T1/T1S



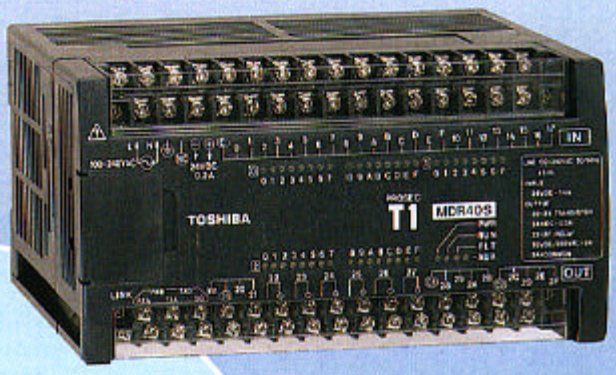

## Advanced Features

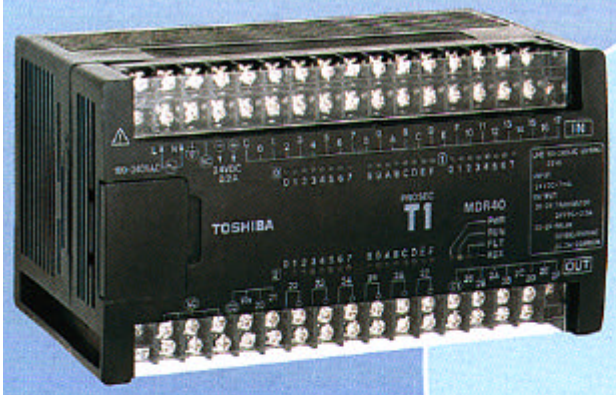
- High-Speed Processing
- High Performance Software
- Unique I/O Option Cards
- Built-in Computer Interface and Active Serial Port
- ASCII Message Storage in Register & Program Memory
- MS Windows Programming Software

# PROSEC T1 Series

## Micro Programmable Controllers

T1s are the micro programmable controllers in Toshiba's popular T-Series family. They are full-fledged members of the T-Series family and all programs written for a T1 will run on other T-Series controllers. The T1s are palm-sized controllers with CPU, I/O and power supply all in one small block. The T1's small size make it ideal for a variety of applications including:



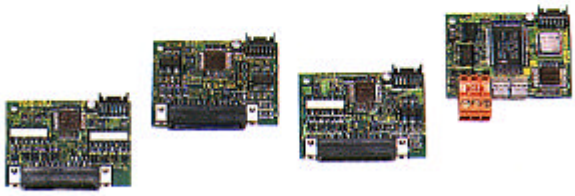




- Packaging Machinery
- Punch Press Control
- Material Handling
- Washing & Drying Control
- Pneumatic Control
- Conveyer Control
- Compliance Monitoring
- Many Others


# Flexible I/O

The T1 Series consist of four models, T1-16, T1-28, T1-40 and T1-40S. All four are block style controllers allowing for I/O to be economically matched to specific requirements.
The T1-16 and T1-28 are fixed I/O non-expandable controllers. The T1-40 and T1-40S I/O, however, can be expanded. The I/O can be expandable three ways:

## Option Cards



Toshiba used its advanced surface mount technology to develop an extremely compact I/O option card. The I/O option cards are approximately 1/2 the size of a credit card. The T1-40/T1-40S can hold two I/O option cards inserted in the end of the controller. The following option cards are currently available.

- 16 points DC input
- 16 points DC output
- 8 DC in/8 DC out combo
- 1 channel Analog output
- 1 channel Analog output
- Field network TOSLINE-F10 remote

## Expansion Rack

The T1-40/T1-40S can be connected to a two/four slot expansion rack allowing it to utilize most T2 Series I/O modules.
The following I/O modules are available for T1-40/T1-40S.

- 16 points DC input
- 32 points DC input
- 64 points DC input
- 16 points AC input
- 8 points relay output
- 4 channels analog input
- 1 channel pulse input
- Communication interface
- 16 points DC output
- 32 points DC output
- 64 points DC output
- 12 points AC output
- 12 points relay output
- 2 channels analog output
- 1 axis position control

## Expansion Unit

A block type expansion unit is also available.
Each expansion unit has 32 I/O points (16 inputs and 16 outputs). The T1-40/T1-40S can be connected to either one expansion rack or one expansion unit.

# T1 Series Line-up

The T1 Series consists of two CPU versions, T1 and T1S. The T1S is called the Super T1, it is an enhanced version of the standard T1. Each version consists of different models, see following chart. There are a total of 12 different types of T1 Series controllers.

## T1 Series Line-up

| Series | Version | Model | Type (Power supply & I/O) | |
|---|---|---|---|---|
| **T1 Series** | **T1** | **T1-16** | **T1-MDR16** | (AC PS, DC In / Relay Out) |
| | | | **T1-MAR16** | (AC PS, AC In / Relay Out) |
| | | | **T1-MDR16D** | (DC PS, DC In / Relay Out) |
| | | **T1-28** | **T1-MDR28** | (AC PS, DC In / Relay Out) |
| | | | **T1-MAR28** | (AC PS, AC In / Relay Out) |
| | | | **T1-MDR28D** | (DC PS, DC In / Relay Out) |
| | | **T1-40** | **T1-MDR40** | (AC PS, DC In / Relay Out) |
| | | | **T1-MAR40** | (AC PS, AC In / Relay Out) |
| | | | **T1-MDR40D** | (DC PS, DC In / Relay Out) |
| | **T1S** | **T1-40S** | **T1-MDR40S** | (AC PS, DC In / Relay Out) |
| | | | **T1-MAR40S** | (AC PS, AC In / Relay Out) |
| | | | **T1-MAR40SD** | (DC PS, DC In / Relay Out) |

### T1 vs. T1S Comparison

| | |
|---|---|
| **T1** | 2 k steps of program memory,<br>Standard functions |
| **T1S** | 8 k steps of program memory (4 k mode or 8 k mode),<br>All the functions of the T1 plus built-in Clock/calendar, built-in RS-485 communication port, on-line programming function (4 k mode only), on-line EEPROM write function, expanded data memory, and expanded instruction set. |

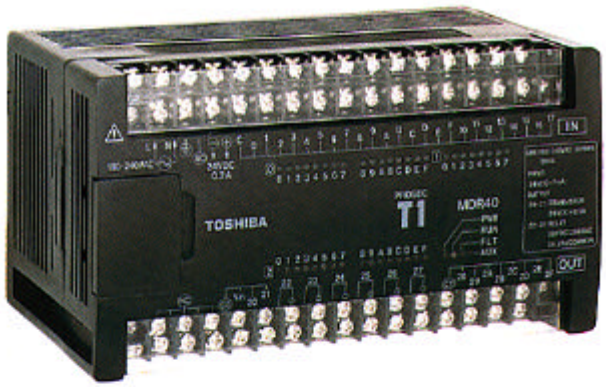
## T1-16 (I/O non-expandable)


| Type | Description | |
|---|---|---|
| **T1-MDR16** | Power supply: | 100— 240 Vac |
| **(TDR116*6S)** | Input: | 8 points, dry contact |
| | Output: | 6 points, relay and<br>2 points, transistor |
| **T1-MAR16** | Power supply: | 100— 240 Vac |
| **(TAR116*6S)** | Input: | 8 points, 100—120 Vac |
| | Output: | 6 points, relay and<br>2 points, triac |
| **T1-MDR16D** | Power supply: | 24 Vdc |
| **(TDR116*3S)** | Input: | 8 points, 24 Vdc |
| | Output: | 6 points, relay and<br>2 points, transistor |

## **T1-28** (I/O non-expandable)

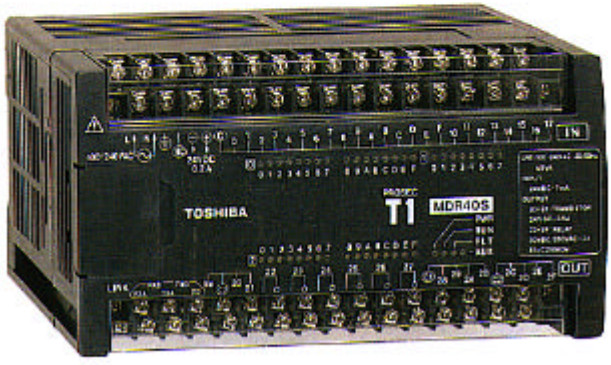

| Type | Description | |
|---|---|---|
| **T1-MDR28** | Power supply: | 100— 240 Vac |
| **(TDR128*6S)** | Input: | 14 points, 24 Vdc |
| | Output: | 12 points, relay and 2 points, transistor |
| **T1-MAR28** | Power supply: | 100— 240 Vac |
| **(TAR128*6S)** | Input: | 14 points, 100—120 Vac |
| | Output: | 12 points, relay and 2 points, triac |
| **T1-MDR28D** | Power supply: | 24 Vdc |
| **(TDR128*3S)** | Input: | 14 points, 24 Vdc |
| | Output: | 12 points, relay and 2 points, transistor |

## **T1-40** (I/O expandable)




| Type | Description | |
|---|---|---|
| **T1-MDR40** | Power supply: | 100— 240 Vac |
| **(TDR140*6S)** | Input: | 24 points, 24 Vdc |
| | Output: | 14 points, relay and 2 points, transistor |
| **T1-MAR40** | Power supply: | 100— 240 Vac |
| **(TAR140*6S)** | Input: | 24 points, 100—120 Vac |
| | Output: | 14 points, relay and 2 points, triac |
| **T1-MDR40D** | Power supply: | 24 Vdc |
| **(TDR140*3S)** | Input: | 24 points, 24 Vdc |
| | Output: | 14 points, relay and 2 points, transistor |

## **T1-40S** (I/O expandable)




| Type | Description | |
|---|---|---|
| **T1-MDR40S** | Power supply: | 100— 240 Vac |
| **(TDR140S6S)** | Input: | 24 points, 24 Vdc |
| | Output: | 14 points, relay and 2 points, transistor |
| **T1-MAR40S** | Power supply: | 100— 240 Vac |
| **(TAR140S6S)** | Input: | 24 points, 100—120 Vac |
| | Output: | 14 points, relay and 2 points, triac |
| **T1-MDR40SD** | Power supply: | 24 Vdc |
| **(TDR140S3S)** | Input: | 24 points, 24 Vdc |
| | Output: | 14 points, relay and 2 points, transistor |

# T1/T1S Common Features

## T-Series Compatible

The HP911A Handy Programmer and the T-PDS (T-Series Program Development System) software program the entire family of T-Series programmable controllers. Programs written for the T1/T1S are upward compatible to other T-Series controllers.

## High-Performance Software

The T1 offers 17 basic ladder instructions and 76 insertable function instructions. The T1S offers 21 basic ladder instructions and 99 insertable function instructions.
Subroutines, Interrupt functions, Indirect addressing, For/Next loops, Increment/Decrement, Pre-derivative real PID, etc. are standard on the T1/T1S. These functions allow the T1/T1S to be applied to the most demanding control applications.

## High-Speed Processing

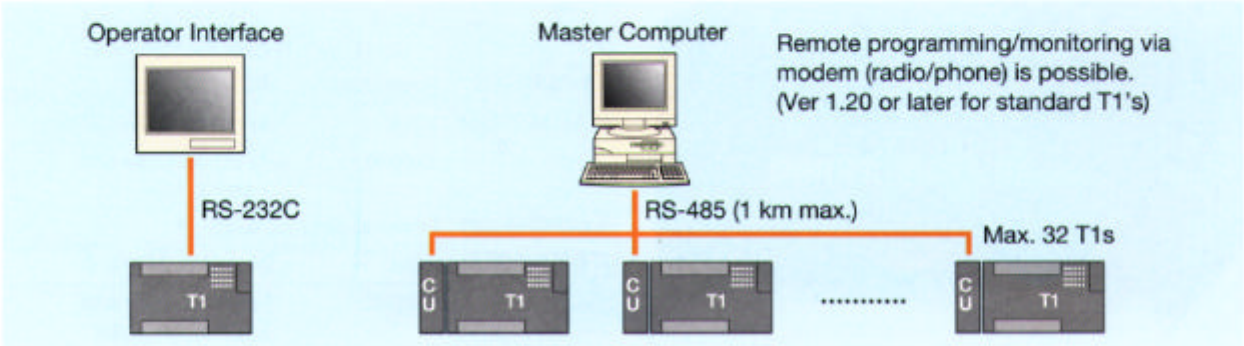
Sophisticated machine control applications require high speed data manipulation. The T1/T1S is designed to meet these requirements. High-speed data processing is the T1/T1S's key feature.

- 1.4 µs per Contact
- 2.3 µs per Coil
- 4.2 µs per Transfer
- 6.5 µs per Addition
- 8.8 µs per Multiplication
- 5.0 µs per Comparison

The T1/T1S also supports the immediate interrupt function (DC input types only). This allows inputs to be recognized and outputs turned ON/OFF independent of the program scan.

## Built-in Computer Interface

The T1/T1S's RS-232C programmer port can accept computer read/write commands. This results in easy connection to higher level computers, operator interface units, etc. By using the multi-drop adapter (CU111), up to 32 T1/T1Ss can be connected to a master computer. The T1/T1S has the same communications protocol as other members in the T-Series family.

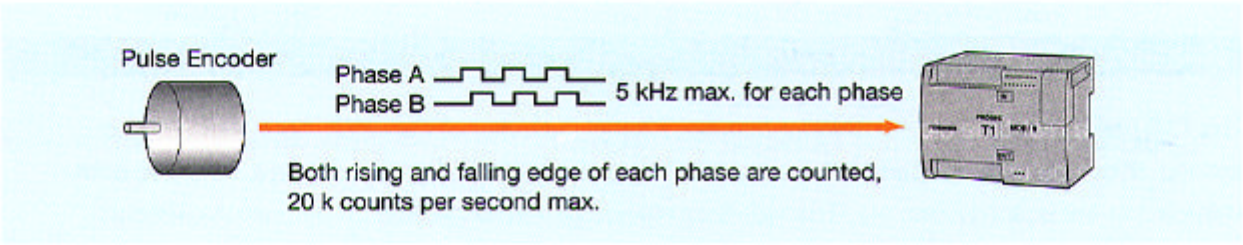


## ASCII Message Storage in Register & Program Memory

T1/T1S can store ASCII messages in either program memory, register memory, or both. There are over 1,000 data registers on the standard T1 and over 4,000 data registers on the T1S that can be used for ASCII message storage. This makes T1s ideal for use with the low-cost operator interface stations that require massages to be stored in the PLC.

## High-Speed Counter Input

The T1/T1S has two high-speed counter inputs (DC input types only). These 5 kHz counters can be used independently (of each other and of CPU scan) for discrete parts count in applications requiring high-speed compare, reset, and strobe. The counters can also be used together as a quadrature counter.

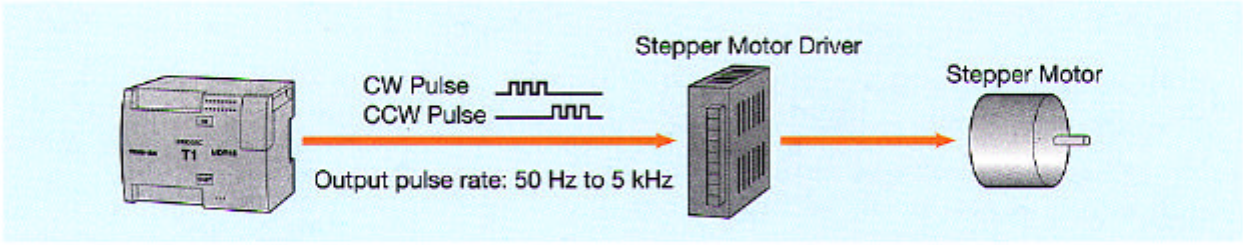



## Analog Register Adjustment

Each T1/T1S has two terminals (which can be adjusted with a screwdriver) that vary the value in two separate registers. These registers can be used as presets for timers and counters, maximum, minimum, or equal values for comparisons, add or subtract adjustments, etc.

## Pulse/PWM Output

An output from the T1/T1S can generate a variable frequency output (5 kHz max.). The output can also be driven so that it switches ON and OFF at varying duty cycles. This output can be used to drive a stepper motor or to simulate an analog output (DC input types only).




## Password Protection

The T1/T1S can be programmed with no password, or with one of three selectable protection levels. This is a serious password utility. There is no way for anyone to recover, modify or view a fully protected program.

# T1S Features

## Large Program Memory

Tired of loading a micro PLC with different programs or different recipes for each different part or different process? The T1S has 8 k steps of program memory & 4 k words of data memory. Several programs and recipes can be easily loaded into a T1S. Then, simply select the program or recipe to be executed.

## On-line Program Changes

In the 4 k memory mode, it is possible to make program changes and write to the internal EEPROM while the T1S is executing the user application program. This feature is very important in process control applications where it is not always possible to stop the process just to add an additional interlock or permissive.

## Real-time Clock/Calendar

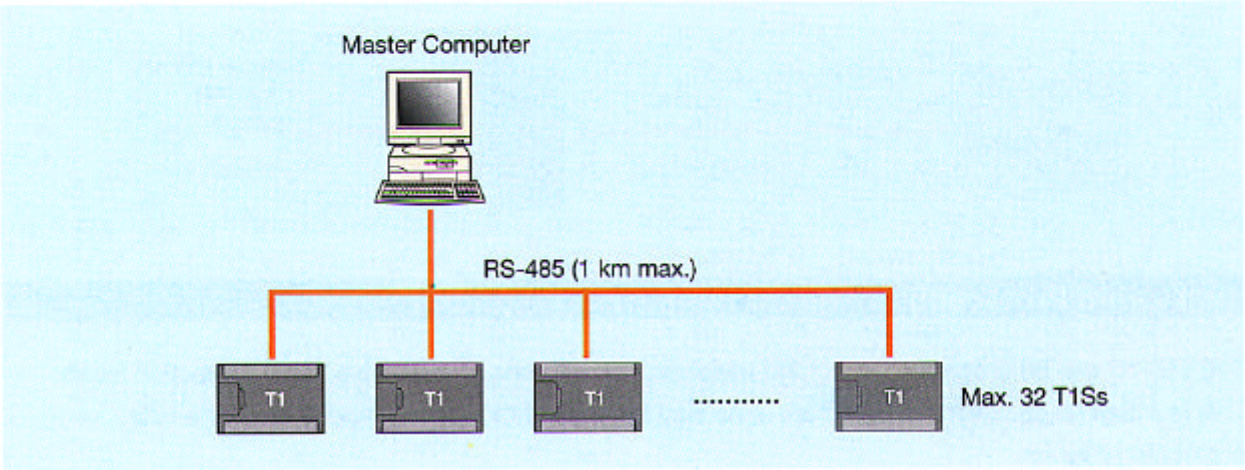
The T1S has a real-time clock/calendar for year, month, day, day of the week, hour, minute, and second. It can be used for performing scheduled operations (each Sunday at 6 pm), time and date stamping event occurrences, etc. The real-time clock/calendar is backed up by built-in capacitor. The back-up period is more than 7 days (25°C).

## Built-in RS-485 Communication Port

The T1S has a built-in RS-485 multi-purpose communication port. This port can operate in one of three (3) different modes.

### Computer link mode

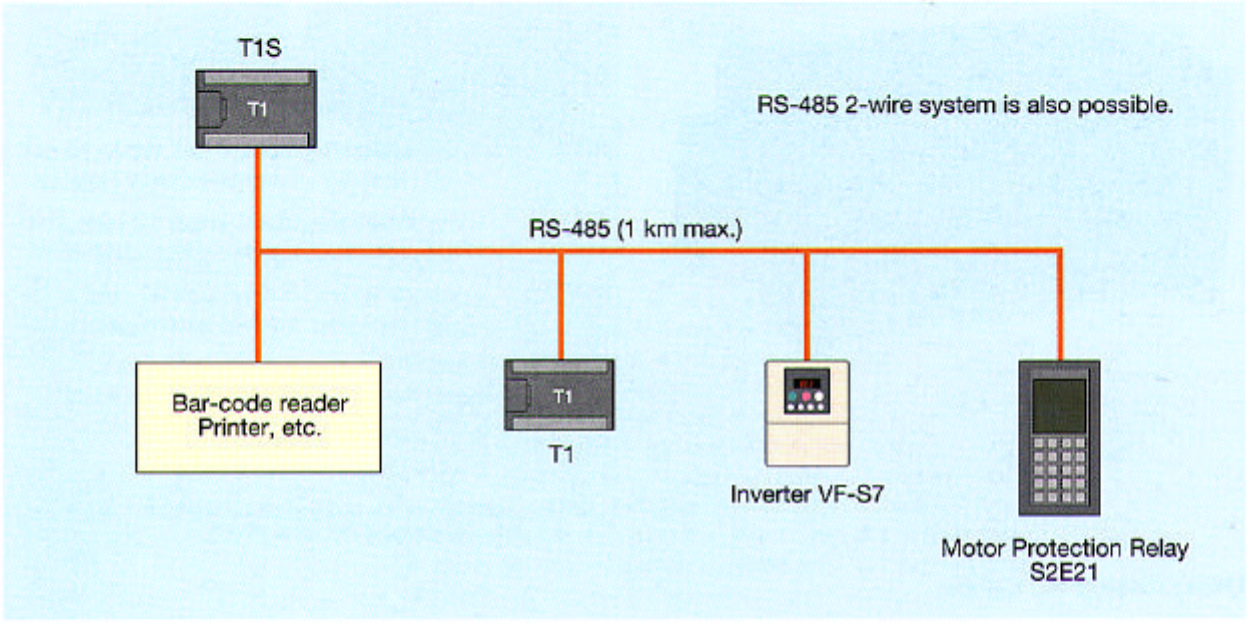
T-series computer link protocol can be used in this mode. A maximum of 32 T1Ss can be connected to a master computer, operator interface station, or other higher level controller. In this mode, the computer can read and write to all the registers in the T1S. The T-series PLC programming software (T-PDS) can also be used in this configuration to program each of the T1S's.



## Built-in RS-485 Communication Port (cont'd)

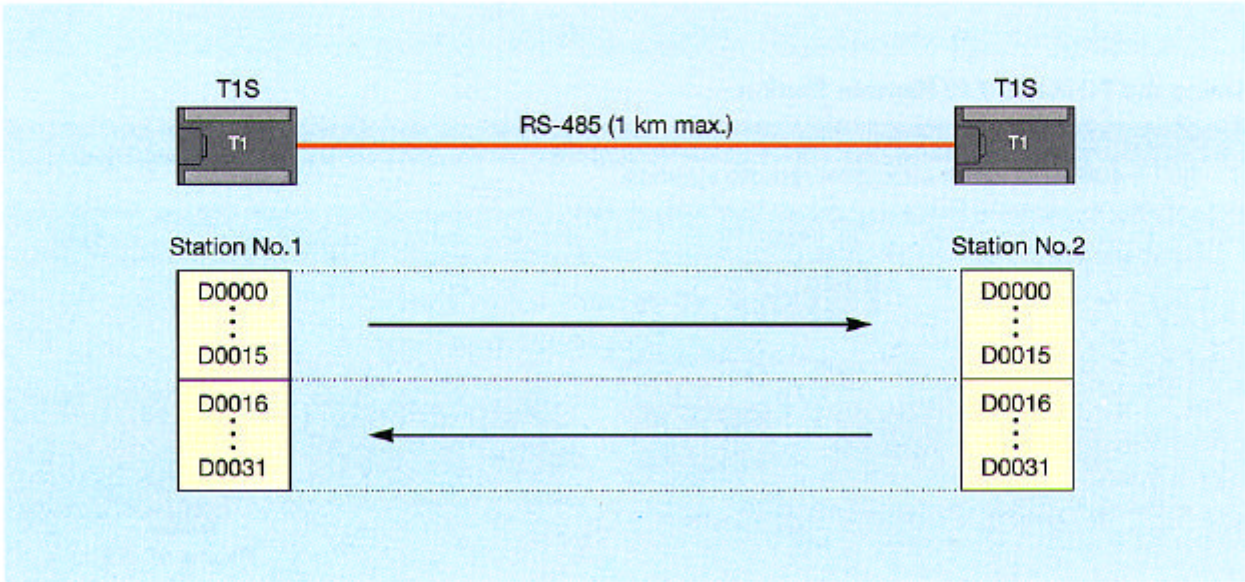
### Free ASCII mode

In this mode, user defined ASCII messages can be transmitted and received. A terminal, printer, bar-code reader, or other serial ASCII device can be directly connected to the T1S. This mode allows the T1S to communicate with other PLCs (T1, T2E, T2N, etc.), Inverters (VF-S7/A5, G3), motor protection relays (S2E21), and other devices with a simple ASCII read/write protocol.




### Data link mode

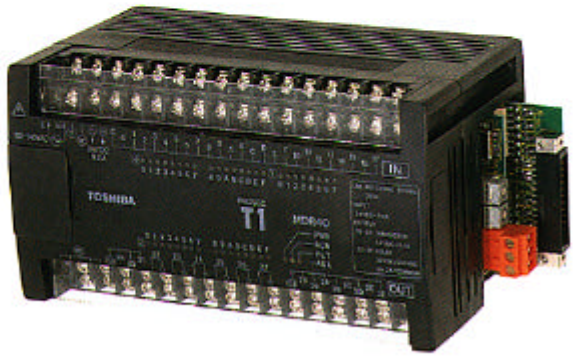
In this mode, two (2) PLCs (any combination of T1S, T2E or T2N) can be directly linked together. This direct link is inexpensive, easily configured and require no special programming. Data registers D0000 to D0031 are used for the data transfer.



# I/O Expansion

## Option Cards

These option cards are extremely compact I/O expansion cards. They are approximately 1/2 the size of a credit card. The T1-40/T1-40S can hold two option cards inserted in the end of the controller. By using the option cards, the T1-40/T1-40S can expand its I/O without increasing panel mounting space. The following eight types of option cards are available.

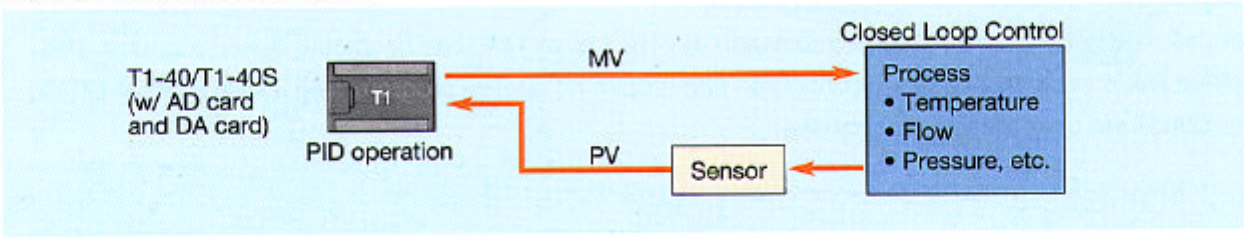


| Type | Description |
|---|---|
| **DI116** | 16 points, 24 Vdc input, 5 mA (Note) |
| **DO116** | 16 points, 24 Vdc output, 100 mA (Note) |
| **DD116** | 8 points, 24 Vdc input, 5 mA<br>8 points, 24 Vdc output, 100 mA (Note) |
| **AD121** | 1 channel analog input, 0 to 5 V/0 to 20 mA,<br>12-bit resolution, internal-external isolation |
| **AD131** | 1 channel analog input, -10 to 10 V,<br>12-bit resolution, internal-external isolation |
| **DA121** | 1 channel analog output, 0 to 20 mA,<br>12-bit resolution, internal-external isolation |
| **DA131** | 1 channel analog output, -10 to 10 V,<br>12-bit resolution, internal-external isolation |
| **FR112** | TOSLINE-F10 remote station,<br>1 word input + 1 word output |

Note: Cable side connector is not included with the DI, DO, or DD card. It is separately available. (PT15S or PT15F)

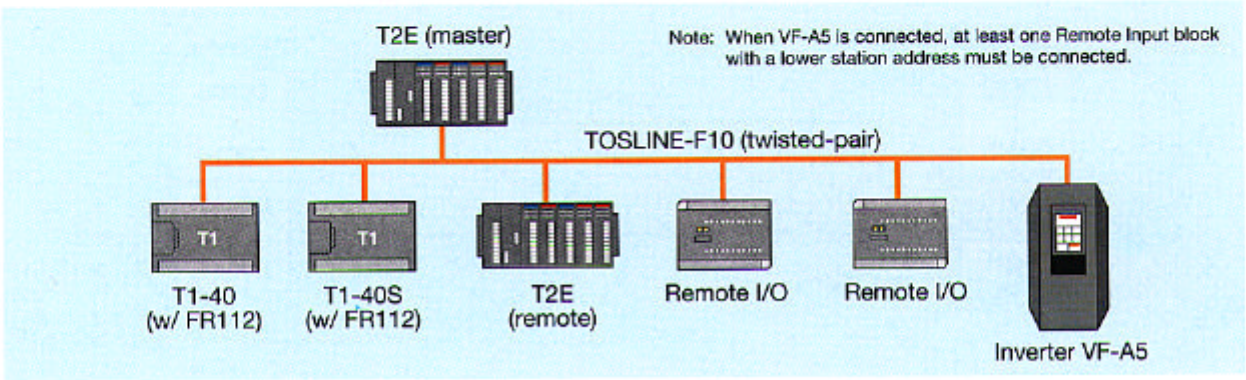
### Using Analog I/O Cards:

The T1-40/T1-40S's PID function and analog I/O option cards enable the T1-40/T1-40S to be applied to process control applications.




### Using the TOSLINE-F10 Remote Station:

The TOSLINE-F10 is a high-speed field level network. In a TOSLINE-F10 network, the T1-40/T1-40S work as an intelligent remote stations.



## Expansion Racks (for mounting T2 I/O modules)

A 2 or 4 slot expansion rack can be connected to the T1-40/T1-40S. By connecting the expansion rack, T2 series I/O modules can be used with the T1-40/T1-40S. Internal 5 Vdc power is supplied from the T1-40/T1-40S.

| Type | Description |
|---|---|
| **BU152** | 2 modules, with 0.15 m cable |
| **BU154** | 4 modules, with 0.15 m cable |

**Available T2 series I/O modules:**

| Type | Name | Specifications |
|---|---|---|
| **DI31** | DC input | 16 points, 12—24 Vdc/ac input, 8 mA |
| **DI32** | | 32 points, 24 Vdc input, 5 mA (connector type) |
| **DI235** | | 64 points, 24 Vdc input, 4 mA (connector type) |
| **IN51** | AC input | 16 points, 100—120 Vac input, 7 mA |
| **IN61** | | 16 points, 200—240 Vac input, 6 mA |
| **RO61** | Relay output | 12 points, 240 Vac/24 Vdc output, 2 A/point (max.) |
| **RO62** | | 8 points (isolated), 240 Vac/24 Vdc output, 2 A/point (max.) |
| **DO31** | Transistor output | 16 points, 5—24 Vdc output (current sink), 1 A/point (max.) |
| **DO32** | | 32 points, 5—24 Vdc output (current sink), 0.1 A/point (max.) |
| **DO235** | | 64 points, 5—24 Vdc output (current sink), 0.1 A/point (max.) |
| **DO233P** | | 16 points, 24 Vdc output (current source), 1 A/point (max.) |
| **AC61** | Triac output | 12 points, 100—240 Vac output, 0.5 A/point (max.) |
| **AI21** | Analog input | 4 channels, 4 to 20 mA/1 to 5 V input, 8-bit resolution |
| **AI31** | | 4 channels, 0 to 10 V input, 8-bit resolution |
| **AI22** | | 4 channels, 4 to 20 mA/1 to 5 V input, 12-bit resolution |
| **AI32** | | 4 channels, -10 to 10 V input, 12-bit resolution |
| **AO31** | Analog output | 2 channels, 4 to 20 mA/1 to 5 V/0 to 10 V output, 8-bit resolution |
| **AO22** | | 2 channels, 4 to 20 mA/1 to 5 V output, 12-bit resolution |
| **AO32** | | 2 channels, -10 to 10 V output, 12-bit resolution |
| **PI21** | Pulse input | 1 channel plus input, 5/12 V, 100 kpps (max.) |
| **MC11** | Position control | 1 axis position control (pulse output), 5—24 Vdc, 200 kpps (max.) |
| **CF211** | Communication I/F | 1 port of RS-232C, free ASCII format, 300 to 19200 bps, 320 bytes (max.) |

## Expansion Units

A 32 point expansion unit can be connected to the T1-40/T1-40S. A 0.5 m cable is included with the expansion unit. Internal 5 Vdc power is supplied from the T1-40/T1-40S, 24 Vdc power for the output relay coils is required from an external source (such as the controller).

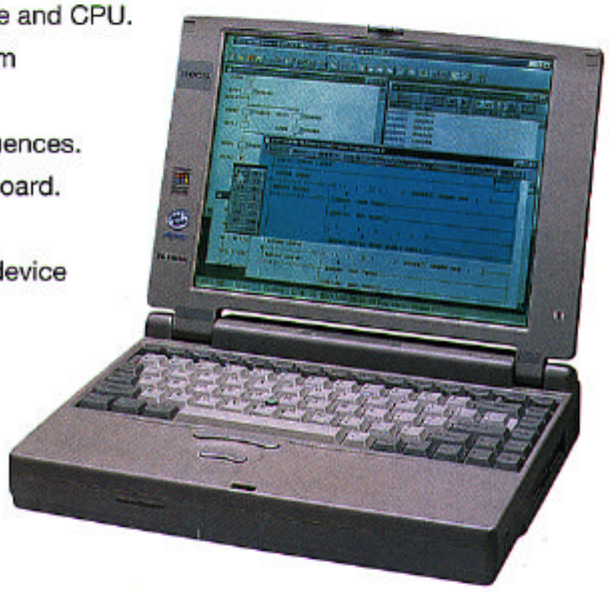
| Type | Description |
|---|---|
| **T1-EDR32** | 16 points, 24 Vdc input, 7 mA<br>16 points, relay output, 2 A/point (max.) |
| **T1-EAR32** | 16 points, 100—120 Vac input, 7 mA<br>16 points, relay output, 2 A/point (max.) |

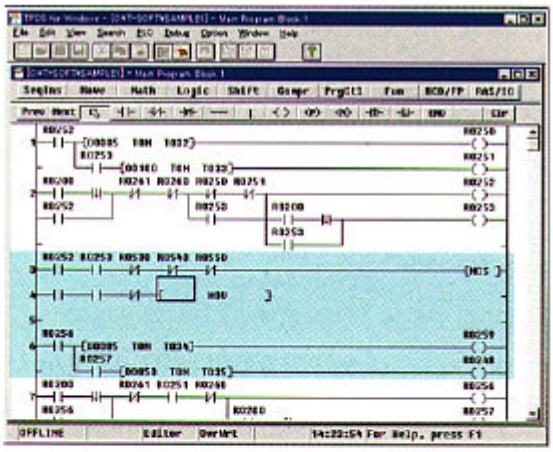
# Programming Tools

## T-Series Program Development System (T-PDS)

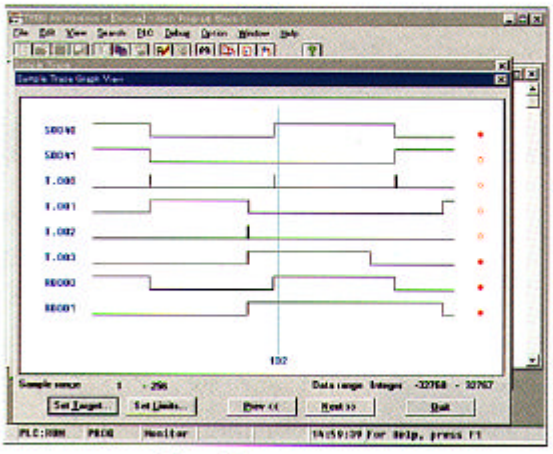
The T-Series Program Development System (T-PDS) is a software program that runs on any Toshiba's Notebook computer or other IBM-PC compatible personal computer. The T-PDS software supports on-line/off-line programming, debugging and program documentation for all T-Series programmable controllers; T1/T1S, T2/T2E/T2N and T3/T3H.
The T-PDS software has:

- A full-feature program edit that includes cut & paste, search & replace, insert, delete, etc.
- Group programming and block merge.
- On-line programming & EEPROM write. (T1S)
- Load, save and compare programs between disk file and CPU.
- Monitor power-flow status of on-line ladder program and display of register values.
- Sampling trace screen for checking event time sequences.
- Disable inputs and force coils ON or OFF from keyboard.
- Document programs with commentary.
- Print map options such as register values, register/device usage, full cross-reference, etc.
- Built-in Modem initialize and Dial-up.





Program edit screen



Sampling trace screen

Note:
For the T1S, the following T-PDS versions are required.
- T-PDS (Windows) ... Ver 1.2 or later
- T-PDS (MS-DOS) ... Ver 2.1 or later

## Handy Programmer (HP911A)


Note:
Some T1S functions are limited with using the HP911A.

The HP911A is a hand-held graphic programmer. Its portability makes it ideal for maintenance use at remote locations. The HP911A has all the features of a full size programming terminal. (2 m cable for T1 is included)

- Ladder logic programming of T-Series programmable controllers T1/T1S, T2/T2E/T2N and T3.
- Built-in EEPROM allows program copy between T-Series controllers.
- Two display modes,
  - Normal: 5 lines and 12 columns
  - Zoom: Full device description
- Data monitor for I/O and internal registers.
- On-line programming & EEPROM write. (T1S)
- On-line data set & I/O force.
- Backlit LCD display for better operation in dim light.

## Program Storage Module (RM102)


The RM102 is an external memory device, which can store a T1/T1S program. By using the RM102, program transfer from a master T1/T1S can be easily done without the need for a computer or hand held programmer. Two-button operation makes program loading/saving accessible to anyone. However, if a password is used in the T1/T1S, the password in the RM102 must match before a program load is executed.

## Multi-drop Adapter (CU111)


The CU111 is an RS-232C/RS-485 converter dedicated to the T1 Series. By using the CU111, up to 32 T1/T1Ss can be connected to a master computer or higher level controller via an RS-485 link. The master computer can run a SCADA, MMI or DDE Server program. The T-PDS programming software can also be used through the RS-485 link to program or monitor each individual T1/T1S. (T1 version 1.20 or later is required for connecting the T-PDS programming software)

# Instruction Set

## Basic Instructions

| FUN No. | Symbol | Name | Available | |
|---|---|---|---|---|
| | | | T1 | T1S |
| | ┤ ├ | NO contact | √ | √ |
| | ┤/├ | NC contact | √ | √ |
| | ┤↑├ | Transitional contact (rising edge) | √ | √ |
| | ┤↓├ | Transitional contact (falling edge) | √ | √ |
| | -( )- | Coil | √ | √ |
| | *( )- | Forced coil (debugging purpose only) | √ | √ |
| | ┤I├ | Inverter | √ | √ |
| | -(I)- | Invert coil | √ | √ |
| | ┤P├ | Positive pulse contact | | √ |
| | ┤N├ | Negative pulse contact | | √ |
| | -(P)- | Positive pulse coil | | √ |
| | -(N)- | Negative pulse coil | | √ |
| | MCS | Master control set | √ | √ |
| | MCR | Master control reset | √ | √ |
| | JCS | Jump control set | √ | √ |
| | JCR | Jump control reset | √ | √ |
| | TON | ON delay timer | √ | √ |
| | TOF | OFF delay timer | √ | √ |
| | SS | Single-shot timer | √ | √ |
| | CNT | Counter | √ | √ |
| | END | End | √ | √ |

## Function Instructions

| FUN No. | Symbol | Name | Available | |
|---|---|---|---|---|
| | | | T1 | T1S |
| 18 | MOV | Data transfer | √ | √ |
| 19 | DMOV | Double-word data transfer | √ | √ |
| 20 | NOT | Invert transfer | √ | √ |
| 22 | XCHG | Exchange | √ | √ |
| 24 | TINZ | Table initialize | | √ |
| 25 | TMOV | Table block transfer | | √ |
| 26 | TNOT | Table invert transfer | | √ |
| 27 | + | Addition | √ | √ |
| 28 | - | Subtraction | √ | √ |
| 29 | * | Multiplication | √ | √ |
| 30 | / | Division | √ | √ |
| 31 | D+ | Double-word addition | √ | √ |
| 32 | D- | Double-word subtraction | √ | √ |
| 35 | +C | Addition with carry | √ | √ |
| 36 | -C | Subtraction with carry | √ | √ |
| 39 | U* | Unsigned multiplication | | √ |
| 40 | U/ | Unsigned division | | √ |
| 41 | DIV | Unsigned double/single division | √ | √ |
| 43 | +1 | Increment | √ | √ |
| 45 | -1 | Decrement | √ | √ |
| 48 | AND | AND | √ | √ |
| 50 | OR | OR | √ | √ |
| 52 | EOR | Exclusive OR | √ | √ |
| 56 | MAVE | Moving average | | √ |
| 61 | DFL | Digital filter | | √ |
| 62 | HTOA | HEX to ASCII conversion | | √ |
| 63 | ATOH | ASCII to HEX conversion | | √ |
| 64 | TEST | Bit test | √ | √ |
| 68 | SHR1 | 1 bit shift right | √ | √ |
| 69 | SHL1 | 1 bit shift left | √ | √ |
| 70 | SHRn | n bits shift right | √ | √ |
| 71 | SHLn | n bits shift left | √ | √ |
| 74 | SR | Shift register | √ | √ |
| 75 | DSR | Bi-directional shift register | √ | √ |
| 78 | RTR1 | 1 bit rotate right | √ | √ |
| 79 | RTL1 | 1 bit rotate left | √ | √ |
| 80 | RTRn | n bits rotate right | √ | √ |
| 81 | RTLn | n bits rotate left | √ | √ |
| 90 | MPX | Multiplexer | √ | √ |
| 91 | DPX | Demultiplexer | √ | √ |

| FUN No. | Symbol | Name | Available | |
|---|---|---|---|---|
| | | | T1 | T1S |
| 96 | > | Greater than | √ | √ |
| 97 | >= | Greater than or equal | √ | √ |
| 98 | = | Equal | √ | √ |
| 99 | <> | Not equal | √ | √ |
| 100 | < | Less than | √ | √ |
| 101 | <= | Less than or equal | √ | √ |
| 102 | D> | Double-word greater than | √ | √ |
| 103 | D>= | Double-word greater than or equal | √ | √ |
| 104 | D= | Double-word equal | √ | √ |
| 105 | D<> | Double-word not equal | √ | √ |
| 106 | D< | Double-word less than | √ | √ |
| 107 | D<= | Double-word less than or equal | √ | √ |
| 108 | U> | Unsigned greater than | | √ |
| 109 | U>= | Unsigned greater than or equal | | √ |
| 110 | U= | Unsigned equal | | √ |
| 111 | U<> | Unsigned not equal | | √ |
| 112 | U< | Unsigned less than | | √ |
| 113 | U<= | Unsigned less than or equal | | √ |
| 114 | SET | Device/register set | √ | √ |
| 115 | RST | Device/register reset | √ | √ |
| 118 | SETC | Set carry | √ | √ |
| 119 | RSTC | Reset carry | √ | √ |
| 120 | ENC | Encode | √ | √ |
| 121 | DEC | Decode | √ | √ |
| 122 | BC | Bit count | | √ |
| 128 | CALL | Subroutine call | √ | √ |
| 129 | RET | Subroutine return | √ | √ |
| 132 | FOR | FOR-NEXT loop (FOR) | √ | √ |
| 133 | NEXT | FOR-NEXT loop (NEXT) | √ | √ |
| 137 | SUBR | Subroutine entry | √ | √ |
| 140 | EI | Enable interrupt | √ | √ |
| 141 | DI | Disable interrupt | √ | √ |
| 142 | IRET | Interrupt return | √ | √ |
| 143 | WDT | Watchdog timer reset | √ | √ |
| 144 | STIZ | Step sequence initialization | √ | √ |
| 145 | STIN | Step sequence input | √ | √ |

| FUN No. | Symbol | Name | Available | |
|---|---|---|---|---|
| | | | T1 | T1S |
| 146 | STOT | Step sequence output | √ | √ |
| 147 | F/F | Flip flop | √ | √ |
| 149 | U/D | Up / down counter | √ | √ |
| 154 | CLND | Calendar set | | √ |
| 155 | CLDS | Calendar operation | | √ |
| 156 | PID3 | Pre-derivative real PID | √ | √ |
| 160 | UL | Upper limit | | √ |
| 161 | LL | Lower limit | | √ |
| 162 | MAX | Maximum value | | √ |
| 163 | MIN | Minimum value | | √ |
| 164 | AVE | Average value | | √ |
| 165 | FG | Function generator | √ | √ |
| 180 | ABS | Absolute value | √ | √ |
| 182 | NEG | Two's complement | √ | √ |
| 183 | DNEG | Double-word two's complement | √ | √ |
| 185 | 7SEG | 7-segment decode | √ | √ |
| 186 | ASC | ASCII conversion | √ | √ |
| 188 | BIN | Binary conversion | √ | √ |
| 190 | BCD | BCD conversion | √ | √ |
| 235 | I/O | Direct input/output | √ | √ |
| 236 | XFER | Expanded data transfer | √ | √ |
| 237 | READ | Special module data read | √ | √ |
| 238 | WRITE | Special module data write | √ | √ |

# Specifications

## Functional Specifications

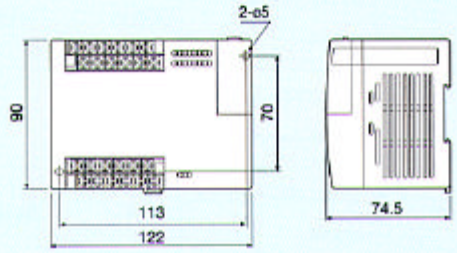
| Model | | T1-16 | T1-28 | T1-40 | T1-40S |
|---|---|---|---|---|---|
| Control method | | Stored program, cyclic scan system | | | |
| Scan system | | Floating scan or constant scan (10—200 ms, 10 ms units) | | | |
| I/O update | | Batch I/O refresh (direct I/O instruction available) | | | |
| Program memory | | RAM (capacitor back-up) and EEPROM (no back-up battery required) | | | |
| RAM memory back-up | | 6 hours (25°C) | | | 168 hours (25°C) |
| Program capacity | | 2 k steps | | | 8 k steps (4 k or 8 k mode) |
| Programming language | | Ladder diagram with function block | | | |
| Instructions | | Basic ladder instructions: 17<br>Function block instructions: 76 | | | Basic: 21<br>Function : 99 |
| Execution speed | | 1.4 µs/contact, 2.3 µs/coil, 4.2 µs/16-bit transfer, 6.5 µs/16-bit addition | | | |
| Program types | | 1 main program | | | |
| | | 1 sub-program (initial program) | | | |
| | | 1 timer interrupt (interval: 5 to 1000 ms, 5 ms units) | | | |
| | | 4 I/O interrupt (high-speed counter and interrupt input) | | | |
| | | 16 subroutines (nesting not available) | | | 256 subroutines (up to 3 nesting) |
| I/O capacity | | 16 points (8 in/8 out) | 28 points (14 in/14 out) | 40 points (24 in/16 out), expandable up to 328 points | |
| Input specification | DC input type | Dry contact (AC PS)<br>24 Vdc, 7mA (DC PS)<br>(current sink or source) | 24 Vdc, 7 mA (current sink or source)<br>Dry contact input is also available by using 24 Vdc service power | | |
| | AC input type | 100—120 Vac, 7 mA | | | |
| Output specification | DC input type | Relay: 240 Vac/24 Vdc, max. 2 A/point<br>Transistor (2 points): 24 Vdc, max. 0.5 A/point | | | |
| | AC input type | Relay: 240 Vac/24 Vdc, max. 2 A/point<br>Triac (2 points): 100—240 Vac, max. 1 A/point | | | |
| I/O terminal block | | Fixed | Removable | | |
| User data | Auxiliary relay | 1024 points/64 words (R/RW) | | | 4096 points / 256 words (R/RW) |
| | Special relay | 1024 points/64 words (S/SW) | | | |
| | Timer | 64 points (T./T), 32 @ 0.01 s, 32 @ 0.1 s | | | 256 points (T./T)<br>64 @ 0.01 s,<br>192 @ 0.1 s |
| | Counter | 64 points (C./C) | | | 256 points (C./C) |
| | Data register | 1024 words (D) | | | 4096 words (D) |
| | Index register | 3 words (I, J, K) | | | |
| Real-time clock/calendar | | No | | | Yes, (±30 s/month) |
| Special I/O functions | | High speed counter (2 single or 1 quadrature) or Interrupt input (2 points),<br>Adjustable analog register (2 points),<br>Pulse output (CW+CCW or pulse+direction) or PWM output | | | |
| Communications interface | | 1 port of RS-232C(programmer port)...Programmer or Computer link | | | |
| | | — | | | 1 port of RS-485<br>-Programmer,<br>-Computer link,<br>-Data link,<br>-Free ASCII |
| | | — | | TOSLINE-F10 remote (by option card) | |
| Debug support function | | Sampling trace (8 devices - 256 times or 1 register - 128 times) | | | Sampling trace (8 device and 3 register - 256 times) |
| | | — | | | On-line programming |
| | | — | | | On-line EEPROM write |

## General Specifications

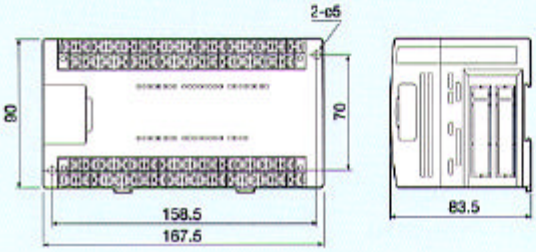
| Model | T1-16 | T1-28 | T1-40 | T1-40S |
|---|---|---|---|---|
| Power supply voltage | 100 to 240 Vac (+10%, −15%), 50/60Hz / 24 Vdc (+20%, -15%) | | | |
| Power consumption | 30 VA or less (AC) / 12 W or less (DC) | | 38 VA or less (AC) / 18 W or less (DC) | 45 VA or less (AC) / 18 W or less (DC) |
| Retentive power interruption | 10 ms or less | | | |
| Withstand voltage | 1500 Vac—1 minute (between power terminals and ground terminal) | | | |
| Ambient temperature | 0 to 55 °C (operation), −20 to 75 °C (storage) | | | |
| Ambient humidity | 20 to 90% RH, no condensation | | | |
| Noise immunity | 1000 V p-p/1 μs, 89/336/EEC (EMC directive) | | | |
| Vibration immunity | 16.7 Hz—3 mm p-p (3 mutually perpendicular axis) | | | |
| Shock immunity | 98 m/s² (10 g), (3 shocks per axis, on 3 mutually perpendicular axis) | | | |
| Standard | UL/c-UL, CE | | | |

## External Dimensions

### T1-16

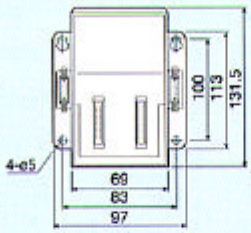



### T1-28/T1-40/T1-40S, Expansion Unit

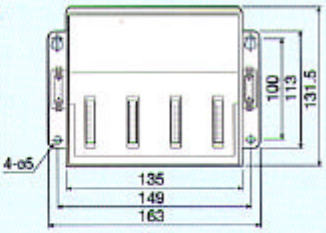



### Expansion Rack

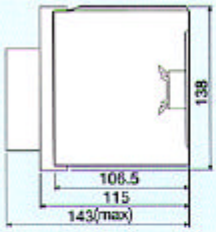
**BU152**



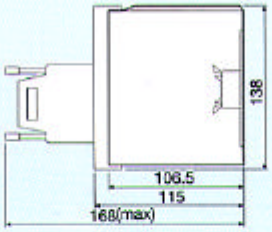

**BU154**




Terminal block type I/O used



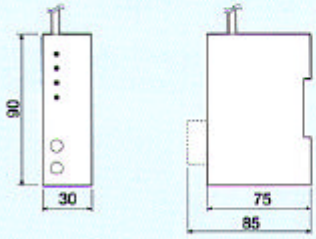

Connector type I/O used




### Connector for Option Card


| Option card | A |
|---|---|
| DI116/DO116/DD116 | 55 |
| AD121/AD131/DA121/DA131 | 16 |
| FR112 | 11 |

### Program Storage Module / Multi-drop Adapter




Unit: mm

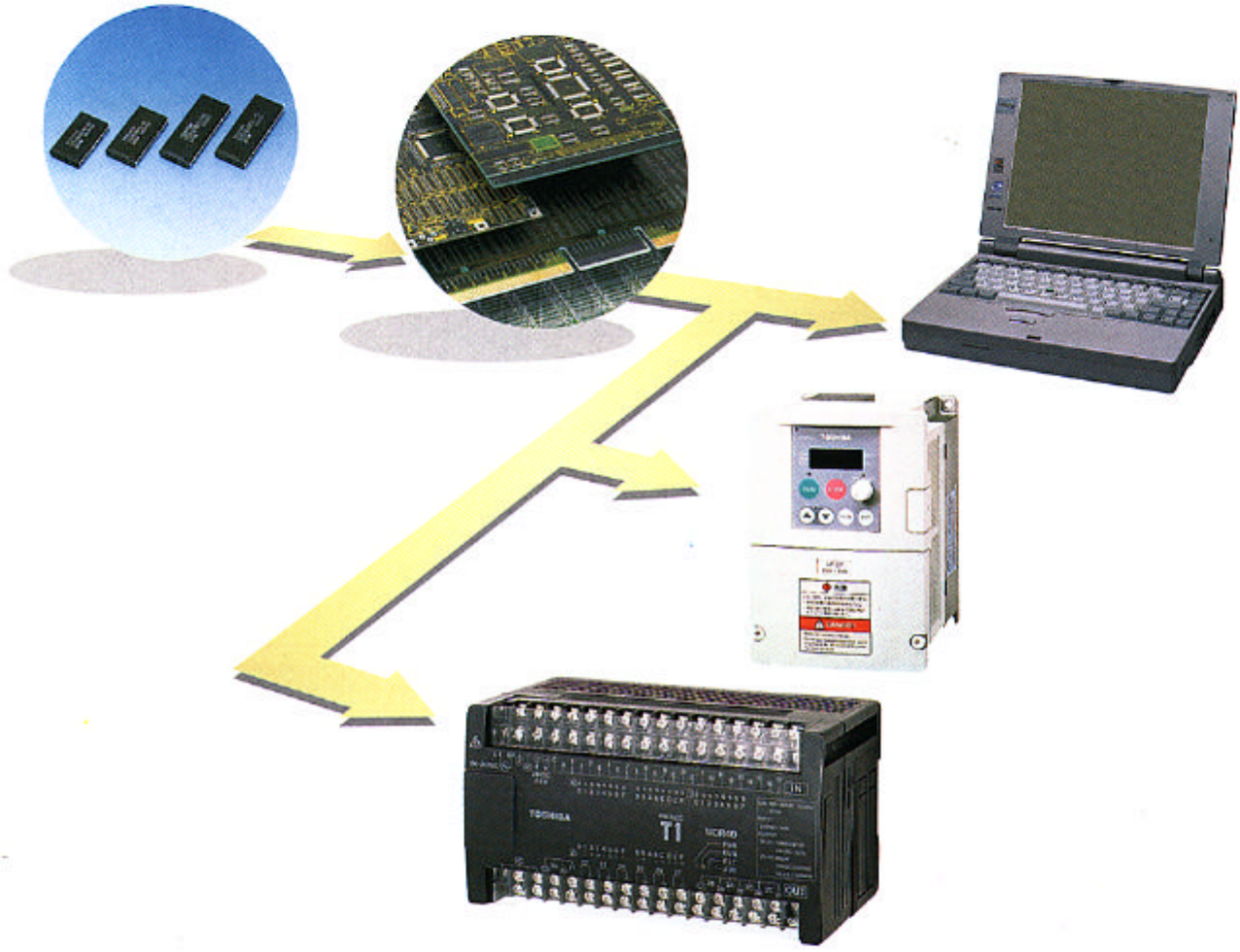
# Ordering Information

| Item | Description | | Type code | Part number |
|---|---|---|---|---|
| T1-16 | AC PS | DC input | T1-MDR16 | TDR116*6S |
| | | AC input | T1-MAR16 | TAR116*6S |
| | DC PS | DC input | T1-MDR16D | TDR116*3S |
| T1-28 | AC PS | DC input | T1-MDR28 | TDR128*6S |
| | | AC input | T1-MAR28 | TAR128*6S |
| | DC PS | DC input | T1-MDR28D | TDR128*3S |
| T1-40 | AC PS | DC input | T1-MDR40 | TDR140*6S |
| | | AC input | T1-MAR40 | TAR140*6S |
| | DC PS | DC input | T1-MDR40D | TDR140*3S |
| T1-40S | AC PS | DC input | T1-MDR40S | TDR140S6S |
| | | AC input | T1-MAR40S | TAR140S6S |
| | DC PS | DC input | T1-MDR40SD | TDR140S3S |
| Option card | 16 pts DC input | | DI116 | TDI116*BS |
| | 16 pts DC output | | DO116 | TDO116*BS |
| | 8 in / 8 out combo | | DD116 | TDD116*BS |
| | 1 ch analog input, 0—5 V/0—20 mA | | AD121 | TAD121*BS |
| | 1 ch analog input, ±10 V | | AD131 | TAD131*BS |
| | 1 ch analog output, 0—20 mA | | DA121 | TDA121*BS |
| | 1 ch analog output, ±10 V | | DA131 | TDA131*BS |
| | TOSLINE-F10 remote | | FR112 | TFR112*BS |
| Expansion rack | 2 slots (w/ 0.15 m cable) | | BU152 | TBU152**S |
| | 4 slots (w/ 0.15 m cable) | | BU154 | TBU154**S |
| Expansion unit | DC input type | | T1-EDR32 | TDR132E*S |
| | AC input type | | T1-EAR32 | TAR132E*S |
| Peripheral | T-PDS (MS-DOS) | | T-PDS | TMM33I1SS |
| | T-PDS (Windows) | | T-PDS Win | TMW33E1SS |
| | Handy programmer (w/ 2 m cable for T1) | | HP911A | THP911A*S |
| | Program storage module | | RM102 | TRM102**S |
| | Multi-drop adapter | | CU111 | TCU111**S |

| Item | Description | | Type code | Part number |
|---|---|---|---|---|
| T2 I/O module | 16 pts 24 Vdc input | | DI31 | EX10*MDI31 |
| | 32 pts 24 Vdc input | | DI32 | EX10*MDI32 |
| | 64 pts 24 Vdc input | | DI235 | TDI235**S |
| | 16 pts 120 Vac input | | IN51 | EX10*MIN51 |
| | 16 pts 240 Vac input | | IN61 | EX10*MIN61 |
| | 12 pts relay output | | RO61 | EX10*MRO61 |
| | 8 pts relay output | | RO62 | EX10*MRO62 |
| | 16 pts 24 Vdc output | | DO31 | EX10*MDO31 |
| | 32 pts 24 Vdc output | | DO32 | EX10*MDO32 |
| | 64 pts 24 Vdc output | | DO235 | TDO235**S |
| | 16 pts 24 Vdc output (current source) | | DO233P | TDO233P*S |
| | 12 pts 100—240 Vac output | | AC61 | EX10*MAC61 |
| | 4 ch Analog input | 8-bit | AI21 | EX10*MAI21 |
| | | | AI31 | EX10*MAI31 |
| | | 12-bit | AI22 | EX10*MAI22 |
| | | | AI32 | EX10*MAI32 |
| | 2 ch Analog output | 8-bit | AO31 | EX10*MAO31 |
| | | 12-bit | AO22 | EX10*MAO22 |
| | | | AO32 | EX10*MAO32 |
| | 1 ch pulse input | | PI21 | EX10*MPI21 |
| | Position control | | MC11 | EX10*MMC11 |
| | Communication I/F | | CF211 | TCF211**S |
| Cable and others | T-PDS cable (5 m) | | CJ105 | TCJ105*CS |
| | RS-232C connector (w/ 2 m cable) | | PT16S | TPT16S*AS |
| | Option card connector (soldering type) | | PT15S | TPT15S*AS |
| | Option card connector (flat cable type) | | PT15F | TPT15F*AS |
| | Empty slot cover (for expansion rack) | | — | EX10*ABP1 |

# Quality

Quality is a religion at Toshiba. Quality starts at the very basic level, the IC (integrated circuit), and proceeds though design development, assembly, and testing of many different consumer and industrial products.




Toshiba corporation's quality management system in design, development and manufacturing of programmable controllers is approved to satisfy the quality management standard ISO9001.

**Safety Precaution**

**This product is intended to be used for the control of industrial machines and processes.**
**Misuse of this product can result in property damage or human injury.**
**Read related manuals carefully before using this product.**



For further information, please contact your nearest Toshiba Representative or International Operations-Producer Goods.

**The data given in this brochure are subject to change without notice.**

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Printed in Japan