Integrated Controller V series Information and Control Network Module
TC-net 100 Installation and Wiring Manual

Apr. 16, 2002
TOSHIBA CORPORATION
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Safety Precautions

This manual contains important information for the operator to operate this product safely and correctly and avoid bodily injury and property damage. Grasp the meanings of the following marks and their descriptions before reading this manual.

Hazard Classifications

<table>
<thead>
<tr>
<th>Mark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️ WARNING</td>
<td>Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.</td>
</tr>
<tr>
<td>⚠️ CAUTION</td>
<td>Indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury, or property damage. It can also be used to alert against unsafe practices.</td>
</tr>
</tbody>
</table>

Note: 1. Serious injury means loss of sight, injury, burns (high temperature, low temperature), electrical shock, fracture, or intoxication which leaves aftereffects or requires hospitalization or need to go to the hospital for a long time.
2. Injury means hurt, burn, or electrical shock which does not require hospitalization or going to the hospital for a long time.
3. Property damage means extended breakdown of assets and materials.

Notation of Markings

<table>
<thead>
<tr>
<th>Mark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☞ Prohibited</td>
<td>Indicates a “may not” mark. The concrete forbiddance is indicated with a pictograph or wording.</td>
</tr>
<tr>
<td>⚠️ Mandatory</td>
<td>Indicate a mandatory action that you should never fail to do. The concrete content is indicated inside or near the circle with a pictograph or wording.</td>
</tr>
<tr>
<td>⚠️ Caution</td>
<td>Indicates a caution. The concrete content is indicated inside or near the triangle.</td>
</tr>
</tbody>
</table>

Note: The description of forbiddance, mandatory, and caution marks are subject to change, depending on the labels on the main unit.
1. Checking the Warning Labels on the Main Unit

Make sure warning markings are attached on the main unit. If any of them are missing or the wording is illegible, contact Toshiba's Service Department.

2. Precautions on Installation

⚠️ WARNING

Mandatory
Be sure to ground the equipment. Operation without grounding may cause accidental fire or shock.

⚠️ CAUTION

Mandatory
Avoid the following locations when installing or storing the equipment.
- Locations where there is dust, salinity, or ion particles
- Locations where there are corrosive gases (SO₂, H₂S) or flammable gases
- Locations where vibration or shock occurs beyond the allowance
- Locations where there is condensation due to sharp temperature variations
- Locations where the ambient temperature exceeds the allowance range
- Locations where the relative humidity exceeds the allowance range
- Locations where the equipment is exposed to direct sunlight
- Locations where strong electric radiation or magnetic field is generated

Mandatory
Improper the installation or writing of the system can cause not only insufficient performance but also malfunction and failure of the equipment

Mandatory
Install the equipment at a place where maintenance and inspection are easy to do. Otherwise, recovery from failure may take much more time, leading to a serious accidents.

Forbidden
Do not cover the hole of the equipment, and the ventilator/air inlet of the system. Otherwise, overheating, etc. can cause fire or malfunction.
3. Safety Precautions on Maintenance and inspection

**WARNING**

**Mandatory**
Turn off power removing or connecting any modules, boards, or devices. Otherwise, it can cause electrical shock, or machine damage.

**Mandatory**
Turn off power removing any modules after installing. Otherwise, exposed conductive parts of wire or on the rear of terminal blocks can cause electrical shock.

**CAUTION**

**Forbidden**
Be careful not to hit or fall off the equipment by accident. Excess shock can cause failure.

**Mandatory**
Touch a grounded metal part to discharge the static electricity on your body before touching the equipment. Otherwise, charged static electricity on your body can cause malfunction or failure.

**Forbidden**
Do not apply benzene and thinner when cleaning the equipment. Otherwise, it can cause deformity or discoloration the panel or case of the equipment.

**Mandatory**
Use soft cloth to clean the equipment. Use water-dipped and squeezed cloth to clean it if dirty. Leaving the equipment dirty can cause mistaken or malfunction.
4. Precautions During Parts Replacement

⚠️ WARNING

Mandatory
Turn off power of the equipment before replacing the power fuse or warning fuse. Otherwise, it can cause electrical shock or fire.

5. Precautions During Daily Use

⚠️ WARNING

Mandatory
Apply power of the specified ratings (voltage fluctuation range, frequency, output rating, etc.) in User's manual. Otherwise, it can cause malfunction, machine damage or fire due to overheat.

Forbidden
Do not touch any components, terminals, connectors, or printed circuit boards in the module. Otherwise, it can cause the IC or LSI or the like to be broken by static electricity, resulting in failure or malfunction. Also, the edge of components can cause injury.

Forbidden
Do not forcibly bend or pull or distort the power cord and other cables. Otherwise, they can be cut off or cause overheat.
6. Safety Precautions on Disposal

**Forbidden**
Do not disassemble or modify the equipment. Otherwise, it can cause malfunction or failure.

**Forbidden**
Do not enter wire scraps or other foreign debris into the equipment. Also, do not insert metal parts into them. They can cause fire or accidents.

**WARNING**
Do not throw lithium batteries into fire. Otherwise, they can explode.

**CAUTION**
Observe local regulations for disposal of the lithium batteries or the product (Base unit and modules).
Limitation of Applications

The equipment has been designed and manufactured for use in an industrial environment. However, the equipment is not intended to be used for systems which can endanger human life (Note 1). Consult Toshiba if you intend to use the equipment for a special application which involves human life and has great influence on the maintenance of the public function (Note 2). This is why such application requires special care on the operation, maintenance, and control of the system (Note 3).

(Note 1) The systems which can endanger human life are life maintenance systems, equipment installed in the surgery, and other medical equipment.
(Note 2) The systems which involve human life and have great influence on the maintenance of the public function mean the main control system of a nuclear power plant, safety and protection system of a nuclear power facility, transport operation and control systems for mass transportation, control systems of aviation and space systems, and other systems and subsystems where safety is critical.
(Note 3) "Special care" means to build a safety system (foolproof design, fail safe design, redundancy design, etc.) in full consultation with Toshiba's engineers.

Immunity

Toshiba is not liable for any loss caused by fire, earthquake, action by a third party, or other accidents, or the operator's intentional or accidental misuse, incorrect use, or use under abnormal condition.
Toshiba is not liable for any incidental loss caused by the use or non-use of this product, such as loss of business profits, suspension of business, or loss or change of data on memory.
Toshiba is not liable for the loss caused by an operation contradictory to any of the instructions stated in this manual.
Toshiba is not liable for the loss caused by an incorrect operation in combination with other equipment.
Toshiba is not liable for the loss caused by a malfunction in combination with an application program made by the customer.

NOTE:

Use cellular phones and PHSSs at least one meter away from the working equipment, transmission cables, and I/O bus cable. Otherwise, the system can malfunction.
Preface

The TOSHIBA Integrated Controller V Series is a new integrated control system designed for the open rightsizing age. The control technology and computer technology advanced over many years were combined with a standard multivender network and simple engineering package software to achieve an easy-to-use open system.

The information and control network TC-net 100 (called the TC-net 100 in this manual) is a trunk LAN for configuring an Integrated Controller system, and supports a single bus and dual bus.

This manual describes the installation and wiring of the TC-net 100 and its transmission parts.

To use each component of the product correctly and safely, be sure to read the Safety Precautions in advance. Carefully keep the manual after reading it for quick reference whenever necessary.

In case the TC-net 100 is repaired or any of its parts replaced, it will be charged even within the warranty period if it arises from consumption or wear.

Chapter 1 TC-net 100 Network Configuration
Describes the configuration of the TC-net 100 network and the restrictions.

Chapter 2 TC-net 100 Cabling (Optical Fiber Cable)
Describes the installation and wiring of the TC-net 100 transmission lines of optical fiber cables inside the cabinet.

Chapter 3 TC-net 100 Cabling (Twisted-Pair Cable)
Describes the installation and wiring of the TC-net 100 transmission lines of twisted-pair cables inside the cabinet.

Chapter 4 Installation and Wiring of TC-net 100 Parts
Describes the installation and wiring of the transmission parts used for the TC-net 100.

Chapter 5 External Wiring (Twisted-Pair Cable)
Describes the wiring of the TC-net 100 outside the cabinet.

Chapter 6 Grounding
Describes the grounding of the TC-net 100 and its transmission parts.

Chapter 7 At the End of Wiring
Describes the items for confirmation after the wiring.
Be Sure To Observe The Following

Observe the following to ensure the safety of the operator in using the equipment and to keep it in normal operating condition.

1. Carefully read the Operation Manual before use.
2. Avoid installing or keeping the equipment at any of the places or in the environment mentioned below.
   (1) Very dusty place
   (2) Place where corrosive gases (SO₂, H₂S, etc.) are generated
   (3) Place where the product may be exposed to vibration or shock
   (4) Environment of low or high temperature deviating from the conditions for installation specified herein.
   (5) Very humid place
3. If the ambient temperature or the internal temperature of the equipment has arisen too high, or if the equipment has developed a fault, stop using it, switch power off, and contact the nearest Toshiba service station.
4. Do not open the case of the equipment while it is in operation except when setting the switches.
5. Do not attempt to modify the equipment.
6. Take care not to drop the EN7 module during transit.
Chapter 1  TC-net 100
Network Configuration

The information and control network TC-net 100 of the Integrated Controller V Series permits selection of a system using optical fiber cables or a system using twisted-pair cables.

An optical fiber cable system employs optical TC-net 100 modules and optical shared hub units connected with optical fiber cables having an MT-RJ connector to form a network.

General Ethernet devices can be connected to the TC-net 100 through a multiport unit (under development).

Figure 1-1 Example of Optical Fiber Cable System Configuration
A twisted-pair cable system employs electrical TC-net 100 modules and electrical shared hub units connected with enhanced category 5 STP (shielded twisted-pair) cables having an RJ connector to form a network.

Figure 1-2 Example of Twisted-Pair Cable System Configuration

The standard TC-net 100 is of a dual transmission line configuration, but a single transmission line configuration of the TC-net 100 is also available.
1.1 TC-net 100 System Configuration

Examples of TC-net 100 transmission line configuration are described in this section.

1.1.1 Restrictions on transmission line extension

- The optical shared hub unit permits connection of 8 channels of MT-RJ optical connector ports and 1 channel of RJ45 modular connector port. The electrical shared hub unit permits connection of 12 channels of RJ45 modular connector ports.

- The optical shared hub unit permits stackable connection for an extension of up to 3 units (24 channels of optical connector ports and 3 channels of modular connector ports). In this case, the UTNH21A (for line A) and UTNH21B (for line B) are employed as master units, to which up to two slave UTNH22s can be connected with the stacking cables (supplied with the UTNH22).

- The optical and electrical shared hub units permit cascade connection for an extension of up to 3 units high. The maximum cable extension length is 2 km in connecting them through the optical connector ports with optical fiber cables, or 100 m in connecting them through the modular connector port with twisted-pair cables. Cross cable must be used for cascade connection through the modular connector port.

- The optical fiber cables connecting the TC-net100 modules to optical shared hub units in an optical fiber cable system can be extended up to 2 km.

- The twisted-pair cables connecting the TC-net100 modules to hubs in a twisted-pair cable system can be extended up to 100 m.

- The maximum length of cables connecting the TC-net 100 modules in an optical fiber cable system or a twisted-pair cable system or in a combined system must not exceed 8 km.

![Figure 1-3 Extension of Transmission Lines](image-url)
1.1.2 Maximum network configuration

Maximum inter-station distance: 8 km

Stackable connection: 3 units maximum

Optical fiber 8 optical ports 1 electrical port

Twisted-pair 8 optical ports

Optical fiber 2 km maximum (full dual)

2 optical ports 8 electrical ports

Twisted-pair 100 m maximum

Optical fiber 2 km maximum (full dual)

2 optical ports 8 electrical ports

Twisted-pair 100 m maximum

TCCN interface with built-in electrical/optical converter

Figure 1-4 Maximum Network Configuration
2.1 Optical Fiber Cabling

Connect optical fiber cables for optical TC-net 100 transmission. Connect one TC-net 100 module to another with an optical fiber cord inside the Integrated Controller cabinet. To connect one Integrated Controller cabinet to another, use optical fiber cables. Optical fiber cables may also be used for cabling from one building to another. Optical fiber cabling is described in this section.

Figure 2-1 Optical Fiber Transmission Line Wiring
Warning

- Before starting your cabling work, make sure that power has been switched off. Otherwise, there is the danger of electric shock.
- Never disassemble any part other than specified in the manual. Disassembly of the product can cause not only product failure but also electric shock.

Caution

- A place with as little moisture and dust as possible and not exposed to direct sunlight is recommended for doing your work.
- Do not expose the product to abrupt temperature changes causing condensation.
- Work gloves are recommended to protect yourself from injuries with angular parts of the product.
- Static might cause the product to fail. Discharge the static from the human body before starting your work.
- Never touch any other parts than those necessary for performing the work.
- Be careful not to lose the screws and parts removed from the product. Do not drop them inside the module.
- In using a screwdriver, make sure that it fits the screw to be tightened or loosened. Use of an unfit screwdriver will not only adversely affect work efficiency but also cause possible damage to the slots in the screw head.

- Before wiring, check the wiring routes and the spaces for passing the connectors through, and determine the required cable length. If extra cable length is expected, study ways of processing it in advance.
- Be sure to observe the allowable bending radius in installing cables. (See Table 2-1 Allowable Cable Bending Radiiuses on page 10.)
- In a system of dual transmission line configuration, correctly wire TN-A and TN-B. After wiring them, check that they have been correctly connected.
- If errors or defects have developed, contact your nearest TOSHIBA service office.
2.1.1 Optical transmission line installation

Install optical fiber cables as follows:

Figure 2-2 Example of TC-net Transmission Line (Optical Fiber Cable) Connection

Form of Connecting the Parts Used
An example of connecting the parts that constitute a TC-net 100 transmission system is shown in figure 2-2.

Criteria for Use of Cables
Use an optical fiber cord with an MT-RJ connector at one end to connect a TC-net 100 node to the splice box.
Use optical fiber cables to connect one Integrated Controller cabinet to another or one operator room to another. For the installation of twisted-pair cables, refer to Chapter 5 External Wiring (Twisted-Pair Cable).
Be sure to use optical fiber cables for connection from one building to another.

Cable Installation
Do not bend cables to less than the minimum bending radius. The allowable bending radiiuses are shown in Table 2-1 Allowable Cable Bending Radiiuses on page 10. After cable installation, support the cables so that the connectors will be free of the cable load.

Trunk Cable Installation
Use optical fiber cables for trunk cabling.

Grounding
Have a grounding pole ready exclusive to the transmission lines, and ground them at single point. Connect the transmission parts to the grounding terminal of the Integrated Controller.
In cases where other grounding is also present, or where the effect of noise, etc. is anticipated, have the class D grounding exclusive to transmission parts ready and use it for one-point grounding. (Refer to Chapter 6 Grounding.)
2.2 Wiring Inside the Cabinet

An example of wiring inside the cabinet using optical fiber cords is described below.

**Caution**

- In a system of dual transmission line configuration using TC-net 100 dual modules, connect the TN-A of each TC-net 100 module to the line-A transmission line and the TN-B of it to the line-B transmission line. Avoid mixed connection of TN-A and TN-B.
- For module wiring, refer to the User's Manuals for the individual TC-net 100 modules.

1. **Using a splice box**

   To connect a TC-net 100 module to a splice box in the cabinet, use an optical fiber cord which has an MT-RJ connector at one end. Splice the optical fiber cord with the optical fiber cable in the splice box before external wiring.

   ![Diagram of wiring using a splice box](image)

2. **Using a optical fiber cable with MT-RJ connectors (future)**

   Connect an optical fiber cable to a TC-net 100 module in the cabinet with its MT-RJ connector. Pass the optical fiber cable directly outside for external wiring.

   ![Diagram of wiring using a optical fiber cable with MT-RJ connectors](image)
(3) Using an optical fiber cable with SC connectors

Connect an optical fiber cord, which has an MT-RJ connector and SC connector, to a TC-net 100 module in the cabinet with its MT-RJ connector. Connect the SC connector to the aligner. Connect an optical fiber cable having an SC connector to the opposite end of the aligner, and pass it outside for external wiring.

(4) Using a mechanical splice

Connect an optical fiber cord having an MT-RJ connector at both ends to a TC-net 100 module in the cabinet. Connect the other end of the optical fiber cord to an optical fiber cable through a mechanical splice. Pass the optical fiber cable outside for external wiring.

Observe the following in connecting optical fiber cords.

- Observe the allowable bending radius requirements specified in Table 2-1 Allowable Cable Bending Radiiuses on page 10, in connecting the optical fiber cords. Connect them in such a way that other modules and parts can be installed and removed.
- For wiring TC-net 100 modules, refer to the manuals for the TC-net 100 modules.
  - model 3000 Information and Control Network Module TC-net 100 User's Manual (6F8C0939)
  - Information and Control Network TC-net 100 Optical Shared Hub Unit User's Manual (6F8C0940)
  - Information and Control Network TC-net 100 PCI Bus Card User's Manual (6F8C0941)
Clamp the cables so that the connectors will be free of the cable weight and the force of cable bends.

After wiring, check that the cables satisfy the allowable bending radius requirements specified in Table 2-1 Allowable Cable Bending Radiiuses on page 10. If any cable is found not satisfying the requirements, install it again so its bending radius is equal to, or greater than, the figures specified in the table.

<table>
<thead>
<tr>
<th>Cable</th>
<th>Outer Size (mm)</th>
<th>Allowable Bending Radius (mm) Clamped</th>
<th>Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical fiber cable</td>
<td>17.0</td>
<td>170</td>
<td>20 times cable OD or more</td>
</tr>
<tr>
<td>Optical fiber cord</td>
<td>5.0</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
3.1 Twisted-Pair Cabling

Connect twisted-pair cables for TC-net 100 transmission. Connect category 5 twisted-pair cables to the TC-net 100 modules in the cabinet.

If an electrical shared hub unit is installed in the same cabinet, connect the twisted-pair cable from the TC-net 100 module to the port of the hub unit, and connect a trunk cable to another port for external wiring.

Use a trunk cable through a relay connector for wiring outside the cabinet, or pass the twisted-pair cable directly outside.

Use drop cables and trunk cables for wiring in the same building. Do not use them for outdoor wiring. Use optical fiber cables for wiring outside the building. Indoor wiring is described below.

![Figure 3-1 Transmission Line Wiring with Twisted-Pair Cables](image)
### Warning

- Before starting connecting the cables, make sure that power has been switched off. Otherwise, there is the danger of electric shock.
- Never disassemble any part other than specified in the manual. Disassembly of the product can cause not only failure but also electric shock.

### Caution

- A place with as little moisture and dust as possible and not exposed to direct sunlight is recommended for doing your work.
- Do not expose the product to abrupt temperature changes causing condensation.
- Work gloves are recommended to protect yourself from injuries with angular parts of the product.
- Static might cause the product to fail. Discharge the static from the human body before starting your work.
- Never touch any other parts than those necessary for performing the work.
- Be careful not to lose the screws and parts removed from the product. Do not drop them inside the module.
- In using a screwdriver, make sure that it fits the screw to be tightened or loosened. Use of an unfit screwdriver will not only adversely affect work efficiency but also cause possible damage to the slots in the screw head.

- Before wiring, check the wiring routes and the spaces for passing the connectors through, and determine the required cable length. If extra cable length is expected, study ways of processing it in advance.
- If trunk cabling is needed, either attach a ferrite core to a twisted-pair cable or use a shielded twisted-pair cable to comply with the EMC Instructions (89/336/EEC). (See figure 3-1.)
- Recommended part: SFC-6 (made by Kitagawa Industries, Ltd.)
- After connecting twisted-pair cables, clamp them securely.
- Be sure to observe the allowable bending radius in installing cables. (See Table 3-1 Allowable Cable Bending Radiuses on page 15.)
- In a system of dual TC-net 100 transmission line configuration, correctly wire TN-A and TN-B. After wiring them, check that they have been correctly connected.
- Have a special grounding pole ready and ground the parts at a single point. Connect the transmission parts to the grounding terminal of the Integrated Controller. The wrong grounding will cause transmission errors. (Refer to Chapter 4 Installation and Wiring of TC-net 100 Parts and Chapter 6 Grounding.)
- If errors or defects have developed, contact your nearest TOSHIBA service office.
3.1.1 Twisted-pair cable transmission line installation

Install twisted-pair cables as follows:

![Diagram of TC-net 100 Transmission Line (Twisted-Pair Cable)](image)

**Form of Connecting the Parts Used**

An example of connecting the parts that constitute a TC-net 100 transmission system is shown in figure 3-2.

**Criteria for Use of Cables**

Use a category 5 twisted-pair cable with an RJ45 connector at both ends without shield (called UTP cable with modular connector hereafter) to connect a TC-net 100 node to the relay connector unit.

Use a category 5 twisted-pair cable with an RJ45 modular connector at both ends and shield (called STP cable with modular connector hereafter) for wiring outside the cabinet from the relay connector unit. Use cross cables for cascade connection of electrical shared hub units.

---

**Caution**

In using twisted-pair cables for a series of cabinets, secure the routes exclusive to the TC-net 100 transmission cables by separating them from the power and other power-related cables.

Twisted-pair cables used in the same cabinet must also have an exclusive route separated from power (high-amperage and high-voltage) cables.
Handling Cables with Connector

Observe the following in handling the individual cables (UTP and STP cables) to which a connector has been attached.

- Before wiring, check the wiring routes and the spaces for passing the connectors through, and determine the required cable length. If extra cable length is expected, study ways of processing it in advance.
- To reattach a connector to a cable, cut a cable end and fix a new connector to that cable end.
- Till the time of cable installation, keep the connectors covered with a vinyl sheet or a thick sheet of cloth to protect them from damage. Also exercise care to keep the connectors free of dust and dirt.
### Cable Installation

Do not bend cables to less than the minimum bending radius. The allowable cable bending radiiuses are shown in Table 3-1 Allowable Cable Bending Radiiuses on page 15. After cable installation, clamp the cables so that the connectors will be free of the cable load.

### Use of Relay Connector Unit

Use a relay connector unit to connect a drop cable (UTP cable) to a trunk cable (STP cable). Exercise care, when installing the relay connector unit, not to let the connectors contact each other because they are insulated from the mounting parts.

The cable shield requires Class D grounding at one point. (Refer to Chapter 6 Grounding.)

### TC-net 100 Trunk Cable Installation

Use trunk (STP) cables for wiring outside the cabinet. For details, refer to Chapter 5 External Wiring (Twisted-Pair Cable).

### Grounding

Have a special grounding pole exclusive to the transmission line ready and ground them at a single point. Connect the transmission parts to the grounding terminal of the Integrated Controller.

In cases where other grounding is also present, or where the effect of noise, etc. is anticipated, have the class D grounding exclusive to transmission parts ready and use it for one-point grounding. (Refer to Chapter 6 Grounding.)

<table>
<thead>
<tr>
<th>Cable</th>
<th>Cable Specifications</th>
<th>Allowable Bending Radius (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clamped</td>
</tr>
<tr>
<td>UTP cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STP cable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- If trunk cables are used, attach a ferrite core to the drop cables to comply with the EMC Instructions (89/336/EEC). (figure 3-1).
  Recommended part: SFC-6 (made by Kitagawa Industries, Ltd.)
Chapter 4  Installation and Wiring
of TC-net 100 Parts

⚠️ Warning

- Before starting connecting the cables, make sure that power has been switched off. Otherwise, there is the danger of electric shock.
- Carefully read the User's Manual supplied with the product before starting your work.
- Never disassemble any parts other than specified in the manual. Disassembly of the product can cause not only failure but also electric shock.

⚠️ Caution

- A place with as little moisture and dust as possible and not exposed to direct sunlight is recommended for doing your work.
- Do not expose the product to abrupt temperature changes causing condensation.
- Work gloves are recommended to protect yourself from injuries with angular parts of the product.
- Static might cause the product to fail. Discharge the static from the human body before starting your work.
- Never touch any other parts than those necessary for performing the work.
- Be careful not to lose the screws and parts removed from the product. Do not drop them inside the product.
- In using a screwdriver, make sure that it fits the screw to be tightened or loosened. Use of an unfit screwdriver will not only adversely affect work efficiency but also cause possible damage to the slots in the screw head.
Caution

- Before wiring, check the wiring routes and the spaces for passing the connectors through, and determine the required cable length. If extra cable length is expected, study ways of processing it in advance.
- For drop cable installation, refer to Chapter 2 TC-net 100 Cabling (Optical Fiber Cable) and Chapter 3 TC-net 100 Cabling (Twisted-Pair Cable).
- After wiring, clamp each transmission cable securely parallel to the cabinet mounting plates of the individual items.
- Be sure to install the transmission parts (hubs) horizontally and fasten them to the cabinet.
- Be sure to observe the allowable bending radius requirements for optical fiber cables.
- In connecting optical fiber cables, connect the optical connector at the transmitting end to the receiving optical connector of the opposite optical repeater, and the optical connector at the receiving end to the transmitting optical connector of the opposite optical repeater, pushing them till you hear a click. After wiring, check that they have been correctly connected.
- Be sure to observe the maximum optical fiber cable length of 2000 m.
- In case of using splice boxes, model VSBXX2 (maximum number of cords: 6) is recommended. In cases where there will be a greater number of splices, model SB-FS6X8-F (maximum number of cords: 6 x 8 high) or SB-FS6X5-F (maximum number of cords: 6 x 5 high) is recommended.
- If the cabinet is not of the grounding exclusive to the Integrated Controller, insulate the individual TC-net 100 transmission parts from the cabinet where they are installed, and ground them by exclusive Class D grounding. Ready grounding poles exclusive to transmission lines, and ground coaxial segments at one point. (Refer to Chapter 6 Grounding.)
- If power noise is likely to be generated, use a noise filter in the power line of the transmission parts.
- If errors or defects have developed, contact your nearest TOSHIBA service office.
4.1 Installation and Wiring of Optical Shared Hub Unit

The TC-net 100 optical transmission line uses optical shared hub units to connect TC-net 100 nodes. Fasten the optical shared hub units to the cabinet. Observe the allowable cable bending radius requirements and clamp the cables after wiring.

There are three ways of fastening the optical shared hub unit as shown in figure 4-1. M4 screws are used for it.

(1) Back mounting
Fasten two panel mounting L-brackets to the rear of the optical shared hub unit with eight M3x6 screws on both sides, and fasten the unit to a rear support panel with four M4x6 screws.

(2) Front mounting
Fasten two panel mounting L-brackets to the front of the optical shared hub unit with eight M3x6 screws on both sides, and fasten the unit to a front support panel with four M4x6 screws.

(3) Bottom mounting
Fasten four panel mounting L-brackets to the front and back of the optical shared hub unit with 16 M3x6 screws on both sides, and fasten the unit to a bottom support panel with eight M4x6 screws. Remove the four rubber feet.

If the cabinet is not exclusively grounded to the Integrated Controller, insulate the hub from the cabinet.

Figure 4-1 Fastening Optical Shared Hub Unit
Example of Connection

**Caution**

- Place a dust cover on the unused connectors (MT-RJ connectors), and connect nothing to them.
- In stacking optical shared hub units, do not place them in close contact with one another, but leave a clearance of about 5 cm between them.
4.1.1 Optical fiber cable connection

Connect optical fiber cables with MT-RJ connector to optical connectors (FX1 to FX8).

1. Remove the dust cover from the optical port to connect. Hold the dust cover with fingers, and press it till the latch on top clicks.

2. Insert an optical fiber cable with MT-RJ connector into the optical connector till it clicks.

3. Clamp the optical fiber cable.

![Figure 4-2 Removing Dust Cover from Optical Connector](image)
![Figure 4-3 Connecting Optical Fiber Cable](image)
4.1.2  **Twisted-pair cable connection**

Connect twisted-pair cables to the RJ modular connectors (TX-0, DUAL MENT).

1. Remove the dust cover from the modular connector to connect. Hook the top edge of the dust cover with a fingernail, and pull it out.

![Figure 4-4 Removing Dust Cover from Modular Connector](image)

2. Insert a twisted-pair cable into the RJ45 connector till it clicks.

![Figure 4-5 Connecting Twisted-Pair Cable](image)

3. Clamp the twisted-pair cable.
4.1.3 **Stacking cable connection**

If the master shared hub units (UTNH21A, UTNH21B) alone are short of ports, slave optical shared hub units (UTNH22) may be stacked using the 50-pin stacking cable (23 cm) supplied with the UTNH22.

(1) Remove the dust cover from the stacking connector to connect.

(2) Insert the stacking cable into the stacking connector till it clicks.
(3) To disconnect the stacking cable, hold the connector by the latches on both sides, and pull out the cable.

Figure 4-8 Disconnecting Stacking Cable
4.1.4 AC Power cable connection

AC power (95 VAC to 250 VAC, 50/60 Hz) is received from an external source through the 3P inlet.

(1) Insert the supplied AC power cable into the 3P inlet of the optical shared hub unit. Do not supply power in this process.

(2) Insert the AC power cable all the way and fit the cable clamp over the power cable.
4.2 Installation and Wiring of Electrical Shared Hub Unit

To install a hub, fasten it to the cabinet. Observe the allowable cable bending radius requirements, and clamp the cables after connection.

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Place a dust cover on the unused connectors (modular connectors), and connect nothing to them.</td>
</tr>
</tbody>
</table>

Install a hub as follows:

1. Place the hub on the cabinet mounting plate, and fasten it with the brackets (supplied) on both sides.
2. Fasten the cabinet mounting plate to the cabinet.
3. Connect the power cable to the hub.
4. Insert the twisted-pair cables having an RJ45 connector at both ends into the hub's modular connectors and push them in to lock.

*C1) If the cabinet is not of the grounding exclusive to the Integrated Controller, insulate the hub from the cabinet.

Figure 4-11 Installing and Wiring Hub
4.3 Installation and Wiring of Relay Connector Unit

Fasten the relay connector unit to the cabinet. Observe the allowable cable bending radius requirements, and clamp the cables after connection.

Connect the inside cubicle cable (UTP cable) from a TC-net 100 module or hub unit to one side of the relay connector unit, and the outside cubicle cable (STP cable) from other station to the other side of the unit.

Figure 4-12 Connecting Cables to Relay Connector Unit
Chapter 5  External Wiring  
(Twisted-Pair Cable)

⚠️ **Warning**

- Before starting connecting the cables, make sure that power has been switched off. Otherwise, there is the danger of electric shock.
- Carefully read the User’s Manual supplied with the product before starting your work.
- Never disassemble any parts other than specified in the manual. Disassembly of the product can cause not only failure but also electric shock.

⚠️ **Caution**

- A place with as little moisture and dust as possible and not exposed to direct sunlight is recommended for doing your work.
- Do not expose the product to abrupt temperature changes causing condensation.
- Work gloves are recommended to protect yourself from injuries with angular parts of the product.
- Static might cause the product to fail. Discharge the static from the human body before starting your work.
- Never touch any other parts than those necessary for performing the work.
- Be careful not to lose the screws and parts removed from the product. Do not drop them inside the product.
- In using a screwdriver, make sure that it fits the screw to be tightened or loosened. Use of an unfit screwdriver will not only adversely affect work efficiency but also cause possible damage to the slots in the screw head.

![Screwdriver Images]
Before wiring, check the wiring routes and the spaces for passing the connectors through, and determine the required cable length. If extra cable length is expected, study ways of processing it in advance.

For drop cable installation, refer to Chapter 2 TC-net 100 Cabling (Optical Fiber Cable) and Chapter 3 TC-net 100 Cabling (Twisted-Pair Cable).

After wiring, clamp each transmission cable securely.

Be sure to observe the allowable bending radius requirements for optical fiber cables.

Connecting the optical fiber cables securely. After wiring, check that they have been correctly connected.

The maximum optical fiber cable length is 2000 m.

In case of using splice boxes, model VSBXX2 is recommended.

Ready grounding poles exclusive to the transmission lines of twisted-pair cables and ground them at one point. Ground the transmission parts to the grounding terminal of the Integrated Controller.

If a metal pipe, for example, is used to separate the TC-net 100 trunk cables from other cables, be sure to ground the metal pipe by Class D grounding.

This grounding must be independent of the grounding of transmission lines (twisted-pair cables and transmission parts).

If errors or defects have developed, contact your nearest TOSHIBA service office.
5.1 Trunk Cabling (Twisted-Pair Cable)

Outside the cubicle means in principle the space from a trunk cable to a relay unit. The method of installing trunk cables is described here.

5.1.1 Installation environment and applicable work

Installation of trunk cables should be done as appropriate to the environment. General work details are shown in Table 5-1.

<table>
<thead>
<tr>
<th>Place (environment) of trunk cabling</th>
<th>Major classification</th>
<th>Minor classification</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place free of damage to cables</td>
<td></td>
<td>−</td>
<td>Work without piping, Piping</td>
</tr>
<tr>
<td>Place harmful to cables</td>
<td></td>
<td>Place where people and objects generally move</td>
<td>Piping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Place where cables may be adversely affected by moisture, chemicals, oil, heat, etc.</td>
<td>Metal piping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Place where cables may be damaged by rats or other animals</td>
<td>Piping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Place where cables may be subject to serious mechanical shock or pressure of heavy objects</td>
<td>Metal piping</td>
</tr>
<tr>
<td>Place where there is the danger of trouble by electromagnetic induction</td>
<td>−</td>
<td></td>
<td>Separation of cables and their protection work and metal piping</td>
</tr>
</tbody>
</table>

Note: For piping, both metal pipes and hard vinyl pipes may be used.
For work without piping and work with piping, observe the following instructions.
5.1.2 Installation without piping

- For cable protection, either pass the cables through a floor duct or use a wire protector cable cover. In this case, do not lay them together with wires or cables carrying high current or high voltage.
- To keep the cables free from damage, lay them in the space between walls, or under the floor where devices free of trouble by electromagnetic induction are located.
- In case of laying cables parallel with, close to, or across low-voltage indoor wires, observe the cable separation standards specified in Table 5-2, and Table 5-3.
- In vertically laying cables on walls apart from the floor, be careful not to damage the cables.
- When bending cables, make sure not to bend them in excess of the minimum allowable bending radius specified for each cable.

5.1.3 Installation with piping

Use a pull box in connecting a duct to a cable connecting point different in diameter. Duct length between adjacent pull boxes should be within 20 meters or, in cases where the pipe duct is on the same horizontal level and straight throughout, within 25 meters.
- Do not lay cables along with other cables of high current in the same duct.
- When bending pipes, measure their bending angles as shown in figure 5-1 and make sure that they are less than 90 degrees.
- When bending pipes, make sure that their bending radius is 6 times or more the pipe's inside diameter and that each of the cables in the pipe does not exceed the minimum allowable bending radius. (figure 5-1.)
- The number of bends per section should be 3 or less, and the total of their angles be 180 degrees or less.
- Ground metal pipes (Class D grounding). Make their grounding independent of the grounding of the transmission lines (cables and transmission parts).

![Figure 5-1 Pipe Bends](image-url)
5.2 Separation from Other Cables

Normally, separate the trunk cables 2 meters away from the power lines and other devices which produce a magnetic field or an electric field. If it is difficult to separate them by a space of 2 meters, observe the figures given relative to the actual voltages and amperages of the sources of induction in Table 5-2.

Table 5-2  Recommended Minimum Separation Distances

<table>
<thead>
<tr>
<th>Amperage/voltage of induction source</th>
<th>Minimum distance between parallel lines (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 100 A</td>
</tr>
<tr>
<td>440 V or less</td>
<td>2000</td>
</tr>
<tr>
<td>220 V or less</td>
<td>2000</td>
</tr>
<tr>
<td>110 V or less</td>
<td>2000</td>
</tr>
<tr>
<td>60 V or less</td>
<td>2000</td>
</tr>
</tbody>
</table>

Considering protection from noise, a covered metal cable duct or steel-made protection tube is recommended. The recommended minimum separation distances between parallel signal lines and power cables in using the above means of protection are shown in Table 5-3.

Table 5-3  Recommended Minimum Separation Distances
(Installation in Covered Metal Ducts or Steel Protection Tubes)

<table>
<thead>
<tr>
<th>Cabling method</th>
<th>Covered metal duct or steel protection tube (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total parallel distance</td>
<td>10m or less</td>
</tr>
<tr>
<td>125V or less 10A or less</td>
<td>Over 10</td>
</tr>
<tr>
<td>250V or less 50A or less</td>
<td>10</td>
</tr>
<tr>
<td>400V or less 100A or less</td>
<td>50</td>
</tr>
<tr>
<td>500V or less 200A or less</td>
<td>100</td>
</tr>
<tr>
<td>In excess of the above</td>
<td>Over 500</td>
</tr>
</tbody>
</table>

Note: Excerpt from the Guideline for the Environment of Installing Microcomputer-applied Instrumentation and Control Devices (by the Japan Electric Measuring Instruments Manufacturers’ Association)
Place a steel-made separator in a cable duct and separate the power cables from the trunk cables as shown in figure 5-2.

Figure 5-2 Example of Cabling through a Duct

In installing cables in a pit, use a separator as used in cabling through a duct as shown in figure 5-3.
For the recommended minimum separation distances, conform to the values specified in Table 5-3.

Figure 5-3 Example of Cable Installation in a Pit
Grounding is absolutely necessary to protect the operators and maintenance personnel from electric shock and prevent equipment malfunction.

⚠️ **Warning**

- Before starting grounding, make sure that power has been switched off. Otherwise, there is the danger of electric shock.

⚠️ **Caution**

- Work gloves are recommended to protect yourself from injuries with angular parts of the product.
- Static might cause the product to fail. Discharge the static from the human body before starting your work.
- Never touch any other parts than those necessary for performing the work.
- Be careful not to lose the screws and parts removed from the product. Do not drop them inside the product.
- In using a screwdriver, make sure that it fits the screw to be tightened or loosened. Use of an unfit screwdriver will not only adversely affect work efficiency but also cause possible damage to the slots in the screw head.
Chapter 6 Grounding

**Caution**

- Check the wiring routes and make the grounding wires as short as possible.
- Use grounding wires 2 mm² or larger and 1 m long or less.
- Do not join grounding wires nor use a chain of wires between grounding busbars (lead-in terminals).
- If a metal pipe, for example, is used to separate the Ethernet trunk cables from other cables, be sure to ground the metal pipe by Class D grounding. This grounding must be independent of the grounding of transmission lines (coaxial segments and transmission parts).
- Ground the transmission parts as follows:
  - Cabinet of Class D grounding or higher exclusive to the Integrated Controller: Cabinet can be grounded.
  - Mixed presence of cabinet grounding and other grounding: Use exclusive Class D grounding.
  - To ground twisted-pair cables, provide the cabinet, where a hub is installed, a means of grounding and ground the hub at one point. To ground the cable connecting one hub to another, ground either of the hubs at one point.
  - If power noise is likely to be generated, use a noise filter in the power line of the transmission parts, and ground it to the grounding terminal exclusive to the Integrated Controller.
  - If errors or defects have developed, contact your nearest TOSHIBA service office.
6.1 Grounding Twisted-Pair Cable Transmission Lines

Ground twisted-pair cable transmission lines using a relay connector unit.

Pull out the grounding wire (2 mm² or more) from the relay connector unit and connect it to the ground.

Note: Shield of a twisted-pair cable performs class D grounding by one point.
Grounding of a twisted-pair cable transmission way is performed as follows.

1. A hub is attached in a case and it connects with grounding of a case. Or a grounding line 2mm or more is connected to a hub (refer to the following clause).

2. A relay connector unit is connected to the connector of one of the two of an STP cable within a board.
   - When connecting a hub unit and TC-net 100 module, connect the STP cable connector by the side of TC-net100 module to a relay connector unit, and change into a UTP cable.
   - When the cascade connection of a hub and the hub unit is being carried out, connect a relay connector unit to one of the STP cables, and change into a UTP cable.
   - When connecting TC-net 100 modules, without using a hub unit, connect a relay connector unit to one of the STP cables, and change into a UTP cable.

3. A transmission article is insulated so that other metal may not be contacted.

4. A grounding line is connected to a grounding pole.

When having doubled the transmission way, one-point grounding is performed separately B system A system, respectively. Please connect the grounding line of a transmission article at the next place.

- When grounding of a case is grounding of exclusive use, such as an integrated controller, it connects with the grounding terminal or bus bar for grounding in a case, and a grounding line is grounded. (It recommends preparing class D grounding only for transmission articles.)
- When grounding of a case is intermingled with groundings, such as other apparatus, class D grounding only for transmission articles is prepared and grounded.
6.2 Grounding Transmission Parts

Ground the transmission parts (optical shared hub units, electrical shared hub units) by class D grounding as follows: The Class D grounding exclusive to transmission parts is recommended.

6.2.1 Grounding hubs

In grounding the hubs, either share the grounding pole exclusive to the Integrated Controller, or prepare a grounding pole exclusive to the transmission parts.

- Grounding exclusive to the Integrated Controller
  Ground the hubs by fastening the cabinet mounting plate for the hubs directly to the cabinet.

- Mixed presence of the grounding of the Integrated Controller and that of other devices
  Either insulate the cabinet mounting plate for the hubs from the cabinet, or insulate the hubs from the cabinet mounting plate.
  Connect the grounding pole of the power cable to the grounding pole of the transmission line, not to that of other devices.

6.2.2 Grounding connectors, etc.

Insulate the connectors, etc. to keep them free of contact with other metal parts.
6.3 Preparing Grounding Exclusive to Transmission Lines

For each twisted-pair cable transmission line, use a grounding bus bar having a unique grounding terminal (Class D grounding), and ground the twisted-pair cables, hubs, and other transmission parts to this grounding bus bar.

In a TC-net 100 system of dual transmission line configuration, ground line A and line B, respectively, by Class D grounding at one point each. If there are two or more cascaded hubs in the same building, the same grounding bus bar can be shared.

Common use of grounding bus bars having different grounding terminals and multiple-point grounding must be avoided.
Note 1: If line noise filters are used, connect the grounding wire to the class D grounding pole exclusive to the Integrated Controller.

Note 2: Insulate the Integrated Controller, transmission parts, and lead-in terminals from the cabinets.

Note 3: Insulate the connectors from other metal parts, and do not ground them.

Figure 6-2 Example of Grounding Exclusive to Transmission Lines
After cabling is finished, check the following and take the necessary steps for protection from dust.

- Check the cable numbers and connector numbers that they agree with those shown in the drawings.
- Check the connectors and terminals that their screws are not loose.
- Check the shielded cables that they have been properly processed.
- Check the cables that they are securely clamped to stay steady.
- Check the terminal units and cables that they are free of dust, lint, screws, etc.
- Check the cable holes in the ducts and pits that they are closed with putty or the like to prevent dust from entering.

In cases where power will not be switched on for a few days after the completion of cabling, maintain the ambient conditions specified of the place where the devices are stored, and cover them with vinyl or cloth sheets, while keeping the place ventilated to protect them from dust.
## A.1 TC-net 100 Transmission Specifications

### Table A-1 Ethernet Transmission Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media access</td>
<td>DOMA (Deterministic Ordered Multiple Access)</td>
</tr>
<tr>
<td>Transmission rate</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>Topology</td>
<td>Star type</td>
</tr>
<tr>
<td>Transmission line</td>
<td>Single bus (future)</td>
</tr>
<tr>
<td></td>
<td>Dual bus</td>
</tr>
</tbody>
</table>
| Transmission cable, cable length | • Optical fiber cable: 2 km  
(extendable up to 8 km using laser light emitting diodes and optical fiber single mode)  
• Twisted-pair cable: 100 m |
| No. of nodes                | 254 nodes maximum per system  
(Optical shared hubs UTNH21As included in the number of nodes) |
| No. of hub levels           | 2 hubs high, cascaded                                                         |
| Transmission mode           | Scan transmission  
- High-speed cycle: 1 ms to 160 ms  
- Medium-speed cycle: 10 ms to 1,000 ms  
- Low-speed cycle: 100 ms to 10,000 ms  
Message transmission  
TCP/IP message transmission/reception |
| Scan transmission capacity  | 128 kW per system (16 bits per word)  
2048 blocks per system (64 words per block)  
Transmission capacity: 576 blocks per node (36 kW per node)  
Status change detection  
- No. of change detection words: 128 W per node  
- Change detection cycle: No. of change detection words x 30 μs  
Detection signal intervals: 50 ms or more |
| Interface                   | Optical: MT-RJ optical connector  
Electrical: RJ45 modular connector |
| Cable                       | Optical: Quartz GI cable (62.5/125 long wavelength) or 50/125, long wavelength)  
Electrical: Enhanced category 5 twisted-pair cable |
## Appendix A Specifications

### A.2 Environment Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working temperature range (Product ambient temperature)</td>
<td>0 to 55°C</td>
</tr>
<tr>
<td>Working humidity range</td>
<td>10 to 95% RH (without condensation)</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-25 to 70°C</td>
</tr>
<tr>
<td>Storage humidity range</td>
<td>5 to 95% RH (without condensation)</td>
</tr>
<tr>
<td>Source voltage range</td>
<td>95 to 250 VAC (50/60 Hz)</td>
</tr>
<tr>
<td>Dust</td>
<td>0.3 mg/m³ or less</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>4.9 m/s² 1.5mm_p_p</td>
</tr>
<tr>
<td>Impact resistance</td>
<td>19.6 m/s² (power off, 3 times)</td>
</tr>
<tr>
<td>Grounding</td>
<td>Class D grounding (Grounding resistance 100Ω or less)</td>
</tr>
<tr>
<td>Cooling</td>
<td>Natural air cooling or forced air cooling</td>
</tr>
<tr>
<td>Communication interface</td>
<td>MT-RJ optical connector/RJ45 modular connector</td>
</tr>
</tbody>
</table>
Appendix B  Checking Optical Fiber Cables for Transmission Loss

Measure the optical power to check the spliced joints and aligned joints and to detect transmission loss errors due to dirty optical connector end faces, etc., following the steps below.

Have the following ready for this purpose.

- Optical power meter: 2 (one of them with a reference light emitting function)
- Reference single-core cord: 2 (about 1 meter long)

(1) Optical power meter check

Using one of the two optical power meters as a light source, connect them as shown in figure B-1, and check the light emitting power.

![Figure B-1 Measuring Light Emitting Power](image)

Measure the light emitting power using two reference single-core cords.

The reason for using two reference cords is to confirm that the cords are normal. Normally, the results will be about the same.

(2) Measuring an actual optical transmission line for transmission loss

Connect the power meters to both ends of the optical transmission line and measure transmission loss.

The difference between the value measured at the light receiving end and the value measured with the reference cords is the actual transmission loss of the line.

Actual transmission loss of transmission line = Value measured with reference cords - Value measured of transmission line

The transmission loss thus measured includes the transmission loss of the optical fiber and the connection loss of splicing and aligner.

(3) Comparing with level diagrams

If a transmission line has an abnormally large transmission loss in comparison with the level diagrams prepared in the design stage, check the parts constituting the transmission line, assuming that there must be something wrong with them.

If spliced joints exist, the cable manufacturer will measure the transmission loss of the transmission lines.

Be sure to measure the transmission loss of your transmission lines.
Appendix C  Cleaning Procedure for Optical Connectors

Optical connectors are extremely susceptible to dirt. If a dirty optical connector is kept in use, it will be damaged on the end face, and be unable to continue normal operation. The method of cleaning optical connectors is described here.

Have the following ready for cleaning optical connectors.
Appendix C Cleaning Procedure for Optical Connectors

C.1 Items to Be Ready

- Lens cleaning paper and cotton swab (Note 1)
- Acetone (Note 2)
- Container for acetone or other solvent (Note 3)

Note 1: Use it to clean optical connector plugs. A special kind of cotton swab is used to clean optical connector adaptors.

Note 2: Acetone is one of organic solvents, used as a cleaning fluid. Ventilation is necessary in using acetone.

Note 3: Use it to dispense the content little by little, so it is safe and makes cleaning easy.

![Diagram of cleaning items]

Figure C-1 Items for Cleaning Optical Connectors
C.2 Cleaning Optical Connector Plugs

Clean optical connector plugs, particularly, the end face shown in figure C-2.

Steps of Cleaning

(1) Fold lens cleaning paper into three parts.

(2) Apply the solvent (acetone) to the lens cleaning paper.
Appendix C Cleaning Procedure for Optical Connectors

(3) Hold the acetone-wet lens cleaning paper on the end face of the optical connector plug, and rub it clean as if by scratching with the thumbnail. Rub it hard so a rubbing sound may be heard.

Figure C-5
C.3 Cleaning Optical Connector Adaptors

Clean the optical connector adaptor, particularly, the inner walls of the joint shown in figure C-6 and the opposite plug end face.

![Figure C-6 Optical Connector Adaptor](image)

**Steps of Cleaning**

1. Apply the solvent (acetone) to a special cotton swab.

![Figure C-7 Adaptor Cleaning Step (1)](image)

2. Insert the acetone-wet special cotton swab into the adaptor, and clean it by turning the swab.
   
   When the special cotton swab is found dirty, use a new one, and repeat cleaning till the adaptor is no longer dirty.

![Figure C-8 Adaptor Cleaning Step (2)](image)
Appendix C Cleaning Procedure for Optical Connectors

C.4 Notes

- Precautions for safety and sanitation
- Observe the following precautions in cleaning the optical connectors.

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keep the eyes and mouth free of the solvent.</td>
</tr>
<tr>
<td>• Ventilate the place when using acetone.</td>
</tr>
<tr>
<td>• If your hands are exposed to the solvent, clean them with water.</td>
</tr>
<tr>
<td>• Put the cap back on the container after use.</td>
</tr>
</tbody>
</table>
Carefully read the User's Manual supplied with the product for the instructions for handling the individual parts.
# D.1 List of Transmission Parts

A list of the TC-net 100 transmission parts are shown in Table D-1 List of Transmission Parts on page 56.

<table>
<thead>
<tr>
<th>Item</th>
<th>Model (Drawing No.)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop cable (UTP cable)</td>
<td>ZCA101A***1</td>
<td>Inside cubicle cable Category 5 twisted-pair cable with RJ45 connector at both ends</td>
</tr>
<tr>
<td>Trunk cable (STP cable)</td>
<td>ZCA109A***1</td>
<td>Outside cubicle cable Category 5 twisted-pair shielded cable with RJ45 connector at both ends</td>
</tr>
<tr>
<td>Optical fiber cord</td>
<td>ZCA403A***1</td>
<td>Optical fiber cord with MT-RJ connector at one end to connect TC-net 100 module to splice box</td>
</tr>
<tr>
<td></td>
<td>ZCA404A***1</td>
<td>Optical fiber cord with MT-RJ connector at both ends to connect one TC-net 100 module to another inside cubicle.</td>
</tr>
<tr>
<td>Optical fiber cable</td>
<td>CT-62.5/125-03-NME</td>
<td>Cable to connect one splice box to another; 5-core optical fiber cable, non-metallic type (One of the 5 cores is a spare.)</td>
</tr>
<tr>
<td></td>
<td>CT-62.5/125-05-NME</td>
<td></td>
</tr>
<tr>
<td>Relay connector unit</td>
<td>UCNT1</td>
<td>Used for cable conversion between a room and control room or between drop cable and trunk cable</td>
</tr>
<tr>
<td>SC-SC connector unit</td>
<td>UCNS1</td>
<td>It is used in order to connect an optical cable with SC connector with a MT-RJ/SC fiber code.</td>
</tr>
<tr>
<td>Optical shared hub unit</td>
<td>UTNH21A</td>
<td>A hub unit constituting an optical transmission line. Master hub with built-in SNMP for line A</td>
</tr>
<tr>
<td></td>
<td>UTNH21B</td>
<td>Master hub for line B</td>
</tr>
<tr>
<td></td>
<td>UTNH22</td>
<td>Slave hub for stackable connection</td>
</tr>
<tr>
<td>Electrical shared hub unit</td>
<td>UHHB1</td>
<td>A hub unit constituting a twisted-pair transmission line</td>
</tr>
</tbody>
</table>

Note: For further information on the cables, see Appendix E.
List of Parts
TC-net 100 transmission parts are shown below.

Relay Connector Unit UCNE1 (Drop-Trunk cable conversion unit)
This unit is used to connect a drop cable (UTP cable) to a trunk cable (STP cable).

![Figure D-1 Relay Connector Unit](image)

SC-SC connector connection unit UCNS1
This unit is used to connect a optical fiber cord (MT-RJ/SC fiber cord) to a optical fiber cable (with one side at SC connector).

![Figure D-2 SC-SC connector connection unit](image)

Ferrite Core Clamp
Attach it to the TC-net 100 module end of the drop cable to reduce radiation from the cable.

![Figure D-3 Ferrite Core Clamp](image)
Appendix D Transmission Parts

Optical Shared Hub Units (UTNH21A, UTNH21B, UTNH22)

These hub units are necessary for constituting a TC-net 100 optical transmission line. Connect TC-net 100 nodes (optical) with optical fiber cables.

![Optical Shared Hub Units](image)

Electrical Shared Hub Unit (UHHB1)

This hub unit is necessary for constituting a TC-net 100 twisted-pair cable transmission line. Connect TC-net 100 nodes (electrical) with twisted-pair cables.

![Electrical Shared Hub Unit](image)
Appendix E  Transmission Cables

The transmission cables used for transmission lines are described below.

**Category 5 Twisted-Pair Straight Cable without Shield (UTP Cable) ZCA101A***1**

This cable is used for wiring in a room (operator room, for example) or in a cabinet. In particular, it is used for wiring between a TC-net 100 module and a hub.

- Connector used: RJ-45 connector
- Cable shape

![Figure E-1 External View of 10BASE-T Twisted-Pair Cable](image)

- Specifying cable length

Specify a cable as follows: The maximum cable length is 30 m.
Category 5 Twisted-Pair Straight Cable with Shield (STP Cable) ZCA109A***1

This cable is used for trunk cabling. In particular, it is used for wiring one cabinet to another.

- Connector used: RJ-45 connector
- Cable shape

![Diagram of 10BASE-T Twisted Pair Cable](image)

- Specifying cable length
  Specify a cable as follows: The maximum cable length is 100 m.
Category 5 Twisted-Pair Cross Cable (UTP Cable) ZCA********

This cable is used for wiring in a room (operator room, for example) or in a cabinet. In particular, it is used for connecting one hub to another.

- Connector used: RJ-45 connector
- Cable shape

![Cable shape diagram](image)

Figure E-3 10BASE-T Twisted-Pair Cable

- Specifying cable length

Specify a cable as follows: The maximum cable length is 30 m.
Optical Fiber Cable

Use Toshiba-recommended optical fiber cables or equivalents for the TC-net 100. The cables to be used are a non-metallic type, normally with 5 cores, including 1 spare core. For your reference, the structure and characteristics of a Toshiba-recommended optical fiber cable manufactured by Showa Electric Wire & Cable Co., Ltd. are shown.

Figure E-4 optical fiber Cable
Optical Fiber Cord with MT-RJ Connector
(with one side connector) ZCA403A***1
(with both sides connector) ZCA404A***1

It is used for the connection in the board of an optical module.

- use connector
  - MT-RJ connector
- cable form

Figure E-5 optical fiber cord

- Specifying cable length
  Specify a cable as follows: The maximum cable length is 30 m.
The TOSHIBA Integrated Controller V Series conforms to the EMC instructions (89/333/EEC), provided that it is properly installed.

Install it as appropriate according to the following instructions.
F.1 Precautions for Installation

Grounding
The grounding wire for a connector unit must be as short as possible (less than 5 cm) and be connected to the metal part of the chassis.

I/O Cable Shielding
The digital I/O cables must be bundled and shielded with the mesh shielding jacket (made by Kitagawa Industries, Ltd., of part No. CB-ME-40, for example) as a whole. The analog I/O cables must also be shielded in a similar way. These shielded cable bundles must be connected to the metal part of the cabinet with a short grounding strap (less than 10 cm).

Shielded Cabinet
Shielded cabinets must be used for the Integrated Controllers and I/O subsystems. One shielded cabinet model is available from VERO Electronics. The Integrated Controllers and I/O subsystems installed in the shielded cabinet (made by VERO Electronics, of part No. IMRAK3400, for example) have already been tested for conformity with the EMC Specifications.
### F.2 Summary of EMC Instructions

(1) Standards: EN50081-2, EN50082-2

(2) EMC evaluation items and standards

#### Table F-1 EMC Evaluation Items and Standards

<table>
<thead>
<tr>
<th>Evaluation Item</th>
<th>Unit</th>
<th>Specified Test Value</th>
<th>Basic Standard</th>
<th>Judging Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiated interference field strength</td>
<td>MHz dBuV/m at30m</td>
<td>30 to 230 30</td>
<td>EN55011 Class A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MHz dBuV/m at30m</td>
<td>230 to 1000 37</td>
<td>EN55011 Class A</td>
<td></td>
</tr>
<tr>
<td>Terminal interference voltage</td>
<td>MHz dBuV (Semi-peak value) dBuV (Mean value)</td>
<td>0.15 to 0.5 79 66</td>
<td>EN55011 Class A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MHz dBuV (Semi-peak value) dBuV (Mean value)</td>
<td>0.5 to 30 73 60</td>
<td>EN55011 Class A</td>
<td></td>
</tr>
<tr>
<td>Radiation field</td>
<td>MHz V/m %AM at 1kHz</td>
<td>80 to 1000 10 80</td>
<td>ENV50140, ENV50204</td>
<td>A</td>
</tr>
<tr>
<td>High-frequency conduction</td>
<td>MHz V (rms, no modulation) %AM at 1kHz</td>
<td>0.15 to 80 10 80</td>
<td>ENV50141</td>
<td>A</td>
</tr>
<tr>
<td>Static discharge</td>
<td>kV</td>
<td>8 (aerial discharge) 4 (contact discharge) 4 (indirect discharge)</td>
<td>EN61000-4-2</td>
<td>B</td>
</tr>
<tr>
<td>Fast transient</td>
<td>kV</td>
<td>±2kV/5/50</td>
<td>EN61000-4-4</td>
<td>B</td>
</tr>
</tbody>
</table>
F.3 Judging Criteria

The judging criteria A and B in Table F-1 EMC Evaluation Items and Standards are defined as follows:

1. Criteria A
   - During the test
     Analog accuracy deviations: Less than 1%
   - After the test
     Operation and performance shall be normal without user intervention.

2. Criteria B
   - During the test
     Analog accuracy: Alarm by transient effects is permissible.
     Digital input/output: No adverse effects on input/output condition
   - After the test
     Operation and performance shall be normal without user intervention.
Appendix G  Parts Life versus Installation Environment

Some parts vary in service life depending on the ambient temperature and other environmental conditions.

The service life of the parts used in TC-net 100 systems applies in cases where they are used at the recommended operating temperature of 25±10°C.

If the annual average temperature of the place where the product is installed is above the recommended operating temperature, the service life will become shorter.

It is recommended, therefore, that the product be installed at an ambient temperature of 25±10°C.

If the product is used in an environment always at high temperature, air conditioning or forced cooling is recommended. Refer to the following manuals for the parts life of the TC-net 100 modules.

model 3000 Information and Control Network Module TC-net 100 User's Manual (6F8C0939)
Information and Control Network TC-net 100 Optical Shared Hub Unit User's Manual (6F8C0940)
Information and Control Network TC-net 100 PCI Bus Card User's Manual (6F8C0941)