TOSHIBA

# TCmini™ TC02V

User's manual

# Safety Precautions

This manual contains important information. They are necessary to prevent the damage to the danger to the user and other people and the properties beforehand, and to use the product safely and correctly.
Understand the meanings of the following marks and their descriptions before reading this manual, and follow descriptions.

● Hazard classifications

| | |
|---|---|
| ⚠ Warning | When handling is mistaken, the death or the serious injury is expected by the dangerous situation. |
| ⚠ Caution | When handling is mistaken, minor moderate Injury or physical loss or damage is expected by the dangerous situation. |

Note)

1. Serious injury means loss of sight, injury, burns (high temperature or 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.

●Explanation of markings

| | |
|---|---|
| ⃠ Prohibition | The prohibition (Do not do) is shown.<br>A concrete content is in the circle and shown by the picture and sentences to be near. |
| ❗ Compulsion | The compulsion (It is necessary to do) is shown.<br>A concrete content is in the circle and shown by the picture and sentences to be near. |
| △ Attention | The Attention is shown.<br>A concrete content is in the circle and shown by the picture and sentences to be near. |

# Precautions in Operation

## ⚠ Warning

Prohibition

Please never reconstruct main body, hardware, substrate, and software (OS etc.). There is danger of a fire, the electric shock, and the injury due to the breakdown and the malfunction.

Compulsion

Please construct the emergency stop circuit and the interlock Circuit, etc. outside of TCmini.
When TCmini breaks down, and the malfunction is caused in TCmini, it becomes an accident resulting in injury or death or there is a possibility of damaging the machine.

Compulsion

Please ground the main body of TCmini. Moreover, please wire after turning off the power supply of the main body.
It causes the accident and the device breakdown because of the electric shock.

Compulsion

The contact relay (it is used for the relay output) has longevity by the wear-out of the point of contact. Please confirm the longevity that has been described to this manual, and use it so as not to exceed it.
When you exceed the longevity of the relay contact, an abnormal output is generated by the loose connection etc. of the contact, and there is danger of causing the machine damage and the accident.

Compulsion

EEPROM (It is used in the data backup register) of main body has the limitation in the rewriting frequency (1 million times). When the limitation frequency is exceeded, it causes the malfunction.
In the program, please avoid frequently rewriting the data of this area. Especially, please note that the limitation is exceeded soon if it processes it like rewriting the content at each scanning.

## ⚠ Caution

**Prohibition**

Please protect from the damage of main body and the substrate, and protect from electroconductive adhesion things, spray of water or solvent, etc.
There is a possibility of a fire, the electric shock, and the injury due to the breakdown and the malfunction.

**Compulsion**

Please make the use of the sample program that has been described to this manual after it is confirmed enough by the user. To prevent the accident due to the malfunction, please confirm program enough before the program is operated.

**Compulsion**

When you scrap the battery, please conform to the ordinance and rule of local government.
When you scrap TCmini, please process as industrial waste, and distinguish from the municipal waste.

**Compulsion**

Please connect an external power supply that suits the ratings specification.
When you connect the power supply that doesn't suit the specification, there is a possibility of the explosion and a fire.

**Compulsion**

Please do not set up or store it under the environment shown below.

- Place with a large amount of dust, metallic particle, etc.
- Place with causticity gas（$SO_2$、$H_2S$）, or combustible gas
- Place with vibration and impact that exceeds permissible value
- Place that might be dewy by rapid temperature change
- Place that becomes low temperature or high temperature by coming off from permissible value
- Place with high humidity that comes off from permissible value
- Place where direct sunshine strikes
- Place near to equipment that generates high-intensity radio waves and magnetic field

# Limitation of Applications

This product is not intended to be used for systems, which can endanger human life (Note 1). Please do not use this product for those usages.

Consult our business window if you intend to use the product for a special application which involves human life and has great influence on the support 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 that can endanger human life are life maintenance systems, equipment installed in the surgery, and other medical equipment.

Note 2 : The systems that involve human life and have great influence on the support of the public function mean the shown follow.

Main control system of nuclear power plant, safety and protection system of a nuclear power facility

Operation and control systems for mass transportation, control systems of aerospace systems, 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 our engineers.

# Immunity

Our company doesn't assume the responsibility at all to the damage that caused due to a fire, earthquake, act by third party, other accidents, misuse by user's intent or negligence, use under abnormal condition.

Our company doesn't assume the responsibility at all for accompanying damage that occurs from use or the unavailability of this product (loss of business profit, interruption of business, and change and disappearance of memory data, etc.).

Our company doesn't assume the responsibility at all for the damage caused without following the content of the manual.

Our company doesn't assume the responsibility at all for the damage caused by the malfunction etc. done by the combination with connected equipment.

Our company doesn't assume the responsibility at all for the damage caused by the malfunction etc. done by the combination with the user’s application program.

# Chapter.1 TCmini main body explanation

## Contents


1. Outline of TCmini ····· 1
2. Basic configuration of TCmini ····· 1
3. Peripheral support ····· 2
4. RS232C port ····· 2
5. RS485 port ····· 2
   - 5.1 PLC link connection mode ····· 3
   - 5.2 Remote I / O connection mode ····· 6
   - 5.3 Inverter connection mode ····· 9
6. Specification ····· 14
   - 6.1 Software specification ····· 14
   - 6.2 General specification ····· 15
   - 6.3 Control input specification ····· 15
   - 6.4 Control input specification ····· 16
   - 6.5 Analogue input specification ····· 17
   - 6.6 Counter input specification ····· 18
   - 6.7 RS232C port ····· 20
   - 6.8 Panel interface ····· 20
   - 6.9 RS485 port ····· 20
   - 6.10 Externals size ····· 21
   - 6.11 Installation size ····· 21
7. Installation environment ····· 22
8. Wiring ····· 23
9. Operation & maintenance ····· 24
10. Operation of TCmini ····· 25
11. Data memory ····· 26
   - 11.1 Contents of address ····· 30
   - 11.2 Indirect address ····· 31
12. Panel support function ····· 32
   - 12.1 Panel support register ····· 32
   - 12.2 7 segments display & setting ····· 33
   - 12.3 Numerical value data register ····· 34
   - 12.4 Character-code register ····· 34
   - 12.5 Example of handling TC01P ····· 36
13. Analogue input function ····· 38

# 1. Outline of TCmini

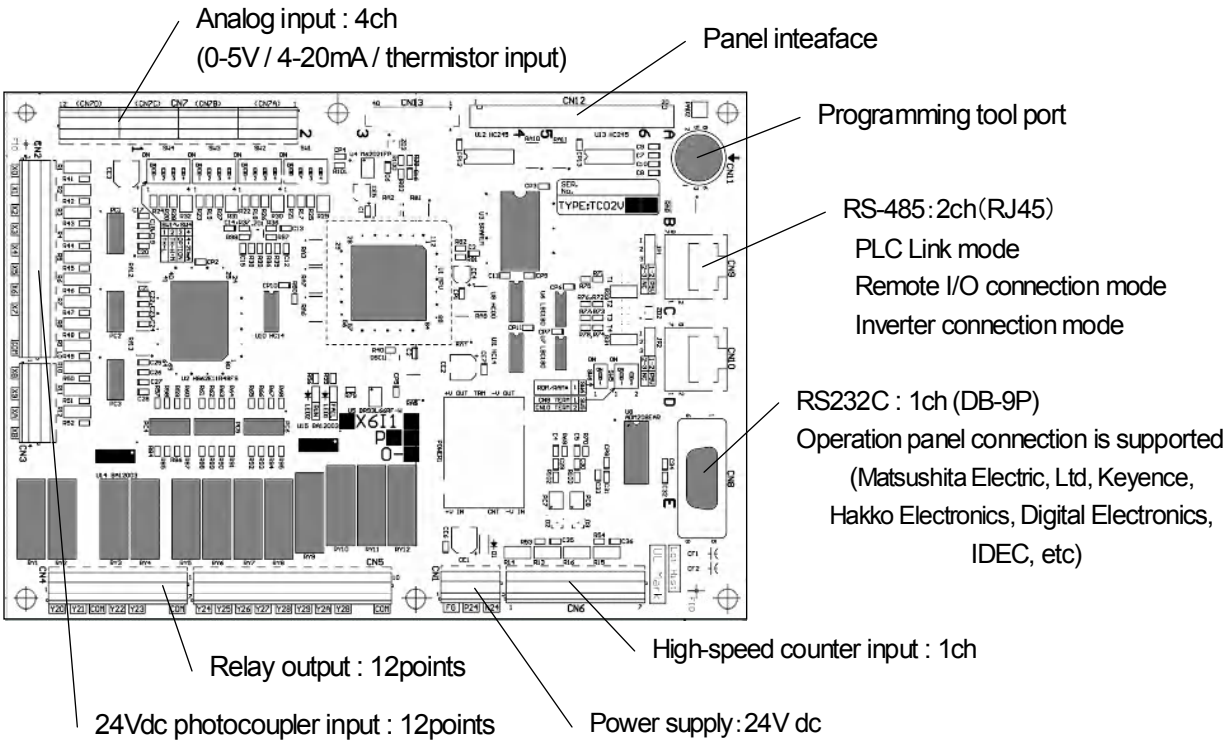
TCmini is compact PLC that has the control facility that equals medium-scale PLC, and RS485 (2ch), RS232C (1ch), and the analog input (4ch) have been equipped normally. TCmini has the performance : the operation capacity : 24kW, I / O areas : 2048 points, data registers : 1kw, and this performance is achieved with the one-chip microcomputer.

Moreover, because the communications function of RS-485 / RS-232C is supported, the system can be easily enhanced only in the connection.

On RS-485, 3 communication modes are supported : PLC link connection mode (this function supports the communication with other TCmini), inverter connection mode (this function supports the communication with a general-purpose inverter made by Toshiba. ) , remote I / O connection mode (this function supports the communication with the operation panel). These achieve various enhancing matched to the system scale and the function. On RS-232C the operation panel that is used for man-machine interface can be connected.

# 2. Basic configuration of TC02V

The TC02V can be operated only in the 24V dc power supply, and 24V dc input (12points), the relay output (12points), the analog input (4ch), the high-speed counter input (1ch), RS-485 : 2ch and RS-232C : 1ch are equipped.

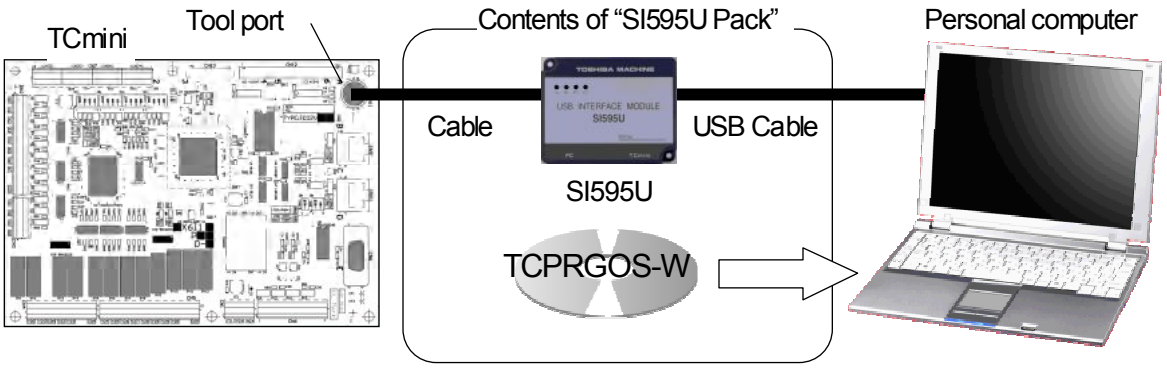



The function of each part is shown.

| Item | Points | Function |
|---|---|---|
| Analog input | 4ch | It is possible to use it by switching each channel to 4-20mA, 0-5V dc, and thermistor input. |
| Panel Interface | 1ch | The display operation panel is connected, and 7segments display and the sheet key are supported. |
| Tool port | 1ch | It connects with the personal computer by way of SI595U, and reading and writing the program are done. |
| RS-485 port | 2ch | The link between TCmini, the remote panel connection, and the inverter connection function are supported. |
| RS-232C port | 1ch | A marketed touch panel and the personal computer can be connected, and it communicates with TCmini. |
| High-speed counter | 1ch | A pulse of the encoder or a high-speed pulse can be input, and it counts. |
| Power supply | 1 | The 24V dc power supply is connected. (24V dc 250mA or less) |
| Relay output | 12 points | They are output of TCmini and are allocated toY020 to Y02B. |
| 24V dc input | 12 points | They are input of TCmini and are allocated toX000 to X00B. |

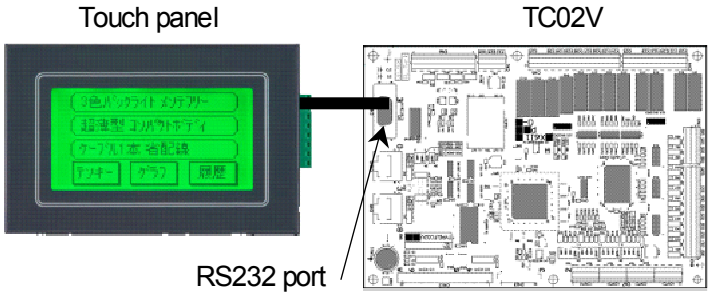
# 3. Peripheral support

The software of TCmini is developed by using programming tool (SI595UPACK) on personal computer. Programming software (TCPRGOS-W) is installed on the personal computer, and it is connected with TCmini by way of USB port through SI595U.




# 4. RS-232C port (Touch panel connection)

RS-232C port of TCmini can be connected to marketed touch panel.



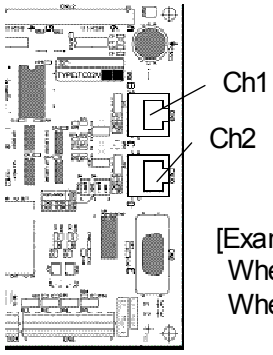

| Model series name | Manufacturer |
|---|---|
| GT01, GT11, GT21C | Matsushita Electric |
| ST401, GP2000 series, GP77Rseries | Digital Electronics |
| VT3series, VT2series | Keyence |
| V6series, V7series, V706series | Hakko Electronics |

There is no especially item set on the TC02V side when the RS-232C port is used.
However, Please set the setting of the communication of the touch panel as follows.

- Baud rate : 9600 / 19.2k / 38.4k
  (TC02V can changes speed automatically.)
- Data length : 8 bits
- Parity : Non
- Stop bit : 2

# 5. RS-485 port

The RS-485 port is equipped in TC02V (2ch). It is possible to use for various operation modes by the setting of parameters. Each operation modes and settings are shown as follows. Ch1 and Ch2 are communicated respectively by setting a set value of the mode that wants to be used for a set register of each Ch in an arbitrary mode.

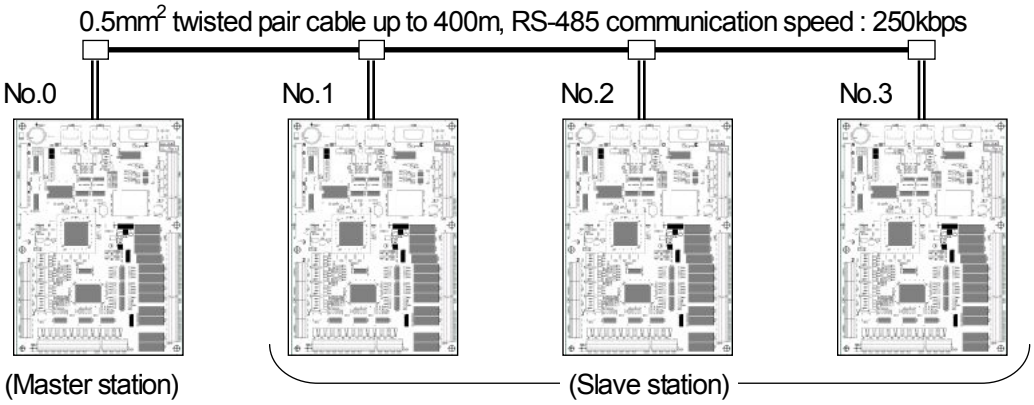



| Operation mode | Setting | Register for Ch1 | Register for Ch2 |
|---|---|---|---|
| Inverter connection mode | 0 | D37D | D37F |
| Remote I / O unit connection mode | 1 | | |
| PLC link connection mode | 2 | | |

[Example]
When you set 0 to register D37D, Ch1 can be used to communicate with the inverter.
When you set 1 to register D37F, Ch2 can be used to communicate with a remote I/O unit.

## 5.1 PLC link mode

TCmini can be linked up to 4 per line once, and mutual information be exchanged. When you want to increase number of I / O points, the I / O points of another station can be used easily by the link. Moreover, the I / O of the distance of 400m or less can be treated.




Communication data area of TC02V

| Ch1 | Ch2 | No.0 | No.1 | No.2 | No.3 |
|---|---|---|---|---|---|
| Z200 to Z27F | Z900 to Z97F | **Talker** | Listener | Listener | Listener |
| Z300 to Z37F | ZA00 to ZA7F | Listener | **Talker** | Listener | Listener |
| Z400 to Z47F | ZB00 to ZB7F | Listener | Listener | **Talker** | Listener |
| Z500 to Z57F | ZC00 to ZC7F | Listener | Listener | Listener | **Talker** |

Talker : Communication origin, Listener : Reception destination

The master station (No.0) can receive information on 128 points (8 words) on each slave station. It becomes 384 points (24 words) in total from No.1 to No.3.

Each slave station can receives same information on 128 points (8 words).

### 5.1.1 Setting of communication

When you use the RS485 communication as PLC link connection mode, please set register as follows. Because a set register is backup area (EEPROM), it sets and it is unnecessary since the second times.

| Setting item | Register for Ch1 | Register for Ch2 | Details |
|---|---|---|---|
| Station number | D37C | D37E | No.0 (Master) : 0<br>No.1 (Slave) : 1<br>No.2 (Slave) : 2<br>No.3 (Slave) : 3 |
| Mode | D37D | D37F | PLC link connection mode : 2 |

The PLC link connection can be confirmed by the following register.

| Communication channel | Station number | Registers | Details |
|---|---|---|---|
| Ch1 | 0 | A160 | ON : It is connecting now.<br>OFF : It is cutting or is a communication abnormality.<br><br>When the power supply at the master station is turned on, The presence of slave station is confirmed.<br>Master station communicates with the slave station that existed at that time. |
| | 1 | A161 | |
| | 2 | A162 | |
| | 3 | A163 | |
| Ch2 | 0 | A168 | |
| | 1 | A169 | |
| | 2 | A16A | |
| | 3 | A16B | |

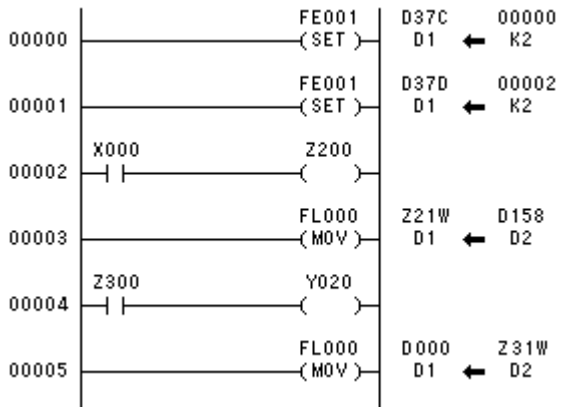
5.1.2 Program example

Program example is shown.

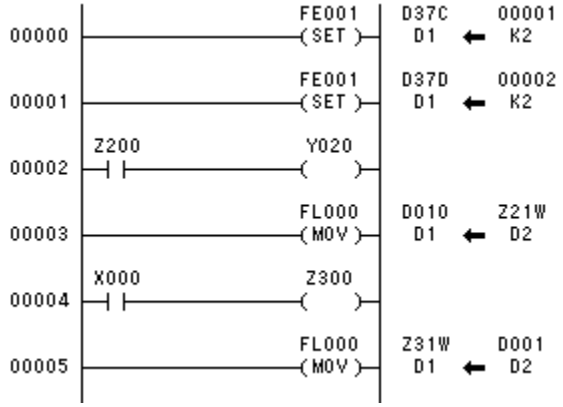
Master station (No.0) and the slave station (No.1) in the PLC link mode

Case with PLC link that uses Ch1

Master station (No.0)




Slave station (No.1)




Explanation of circuit

Cicuit0 : The station number is set.

Cicuit1 : The PLC link connection mode is set.

Cicuit2 : The master station (No.0) puts information on X000 on Z200.
It is output to Y020 of the slave station (No.1).

Cicuit3 : The master station (No.0) puts information on D158 on Z21W.
It is forwarded to D010 of the slave station (No.1).

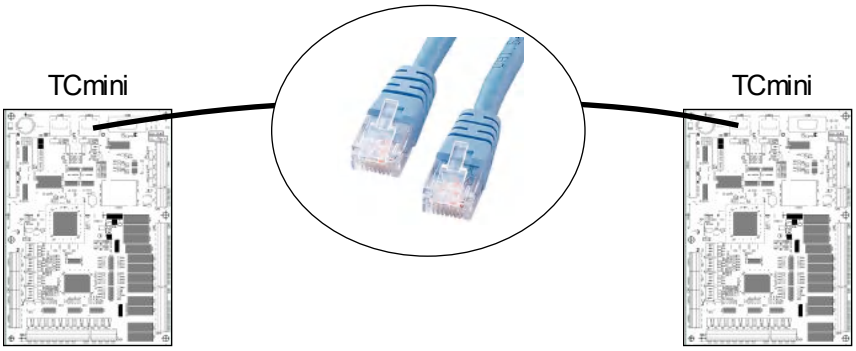
Cicuit4 : Information on X000 of the slave station (No.1) is put on Z300.
It is output to Y020 of the master station (No.0).

Cicuit5 : Information on D001 of the slave station (No.1) is put on Z31W.
It is forwarded to D000 of the master station (No.0).

5.1.3 Connection of couple 1

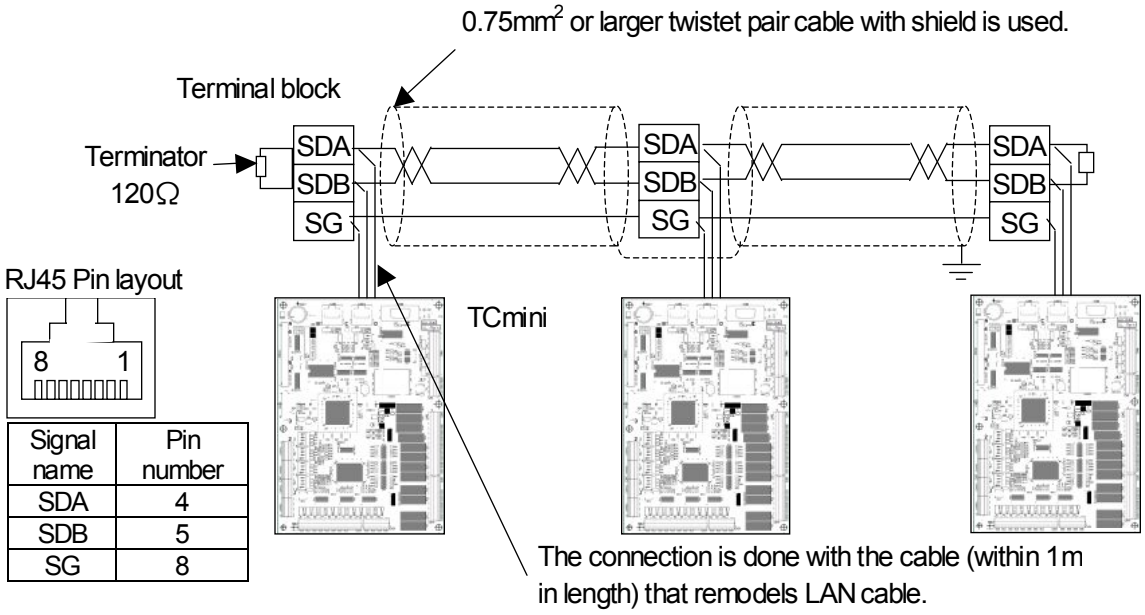
RS-485 connection of TCmini adopts the RJ45 connector.

At one a couple of connection, you can connect easily by marketed LAN cable.



5.1.4 Connection when long distance is transmitted

When you do communication that exceeds 100m, normal communication is impossible only in LAN cable. Please connect it by the following method. Moreover, please do as follows when you connect 3 TCmini or more.




| Signal name | Pin number |
|---|---|
| SDA | 4 |
| SDB | 5 |
| SG | 8 |

Terminator connection SW is prepared in the main body of TC02V. However, when there is a possibility of detaching TC02V from the communication line, please connect the terminator with the communication line as shown in the above figure. There is a possibility that the entire communication stops when the communication line is removed in the RS485 connector when the terminator with built-in TC02V is used.

Please ground the shield of the communication cable to the earth point that the noise doesn't influence easily by single-point earth.

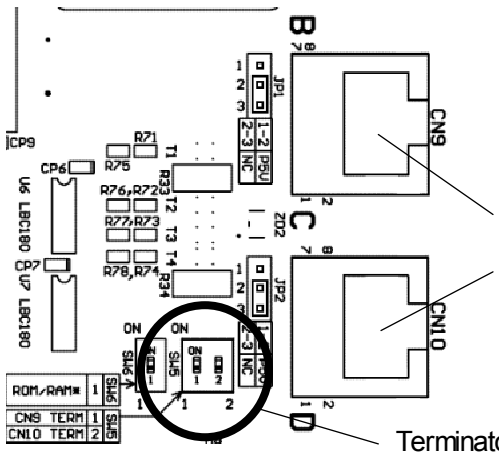
When the communication cutting happens at random, please float and use the earth.

5.1.5 Terminator

In the RS485 transmission, the terminator is connected with the terminal station.

The terminator can be connected with SW mounted on TC02V.

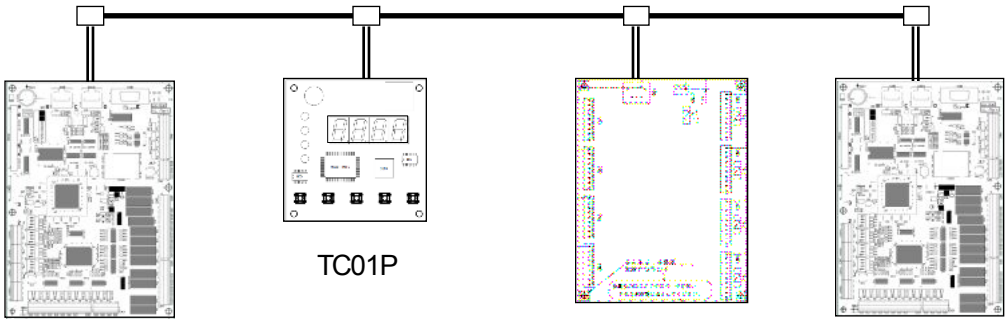
When SW is adjusted to the turning on side, the terminator is connected.



## 5.2 Remote I / O connection mode

In the remote I / O connection mode of RS485, TC02V can connect panel (TC01P) and the enhancing I / O unit. As a result, the operation panel can be remotely set up, and the data transfer between TC02V and slave station be done as well as the PLC link.

RS485 : 250kbps, Up to 400m




Communication data area of TCmini

| Item | Number of points | Address & contents | |
|---|---|---|---|
| Panel support | | Ch1 | Ch2 |
| Panel input | 32 points | X200 to X21F | X900 to X91F |
| LED output | 16 points | Y220 to Y22F | Y920 to Y92F |
| 7segment numeric display | 10 words | D400 to D409 | D420 to D429 |
| 7segment character code display | 14 words | D410 to D41D | D430 to D43D |
| Panel setting | 2 words | D40D & D40E | D42D & D42E |
| Remote I / O : Master station | | Ch1 | Ch2 |
| Station number 1 | 128 points | Z300 to Z37F | ZA00 to ZA7F |
| Station number 2 | 128 points | Z400 to Z47F | ZB00 to ZB7F |
| Station number 3 | 128 points | Z500 to Z57F | ZC00 to ZC7F |
| Station number 4 | 128 points | Z600 to Z67F | ZD00 to ZD7F |
| Station number 5 | 128 points | Z700 to Z77F | ZE00 to ZE7F |
| Station number 6 | 128 points | Z800 to Z87F | ZF00 to ZF7F |
| Remote I / O : Slave station | | Ch1 | Ch2 |
| Data transfer area | 128 points | Z200 to Z27F | Z900 to Z97F |

### 5.2.1 Communication setting

When you use the RS485 communication as a remote I / O connection mode, please execute the following setting. Because a set register is backup area (EEPROM), it sets and it is unnecessary since the second times.

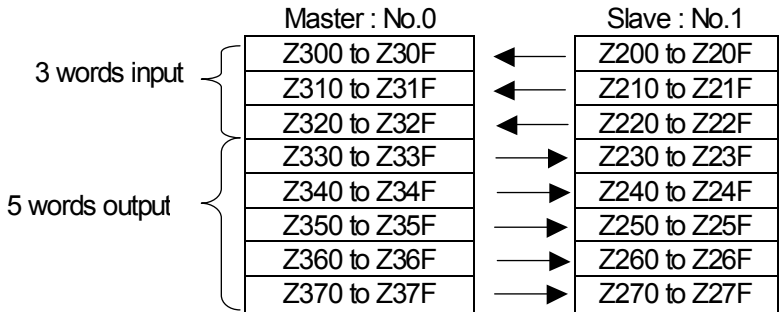
| Setting item | Register for Ch1 | Register for Ch2 | Detail |
|---|---|---|---|
| Station number<br>Number of input<br>Number of output | D37C | D37E | Master station No.0 : 0000H<br>Slave station No.1 to 6<br>3 \| 5 \| 0 \| 4<br>[Example : The setting of remote slave station that has 5 words input, 3 words output, station number is 4] 3504H<br>Number of output / Number of output / Station number 1～6 |
| Mode | D37D | D37F | Remote I / O unit connection mode : 1 |

5.2.2 Method of the remote connection between TCmini

When setting to register D37C of the remote slave station No.1 as "3501H", the communication is done as follows.

The master station reads 3 words (Z300 to Z32F), and writes the data to the slave station in 5 words (Z330 to Z37F). The slave station writes the data to the master station in 3 words (Z200 to Z22F), and reads 5 words (Z230 to Z27F).

Content of transmission when value of DC37C is "3501H"

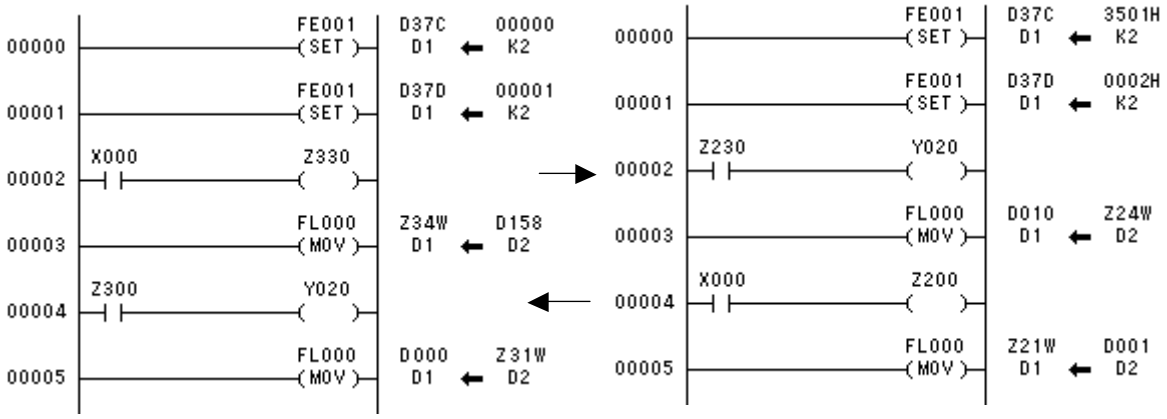



5.2.3 Program example

The program example at the remote I / O connection between TCmini master station (No.0) and the TCmini slave station (No.1) is shown.

Case with remote I / O connection that uses Ch1

Master station (No.0) Slave station (No.1)




Communication status

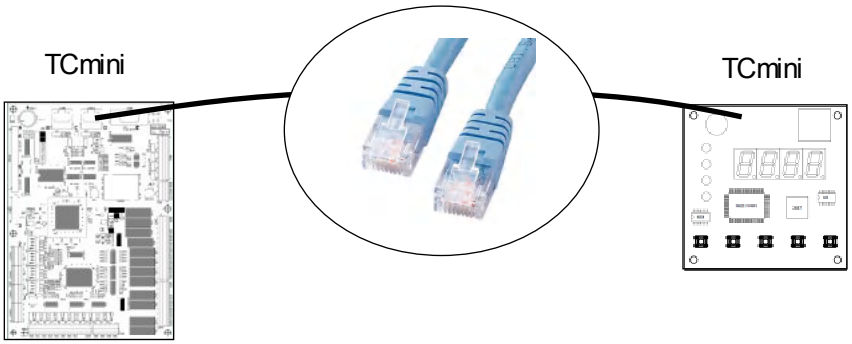
The connection of remote I / O can be confirmed by the following register.

| Mode | Communication channel | Station number | Register | Detail |
|---|---|---|---|---|
| Master Station | Ch1 | 0 | A160 | ON : It is connecting now.<br>OFF : It is cutting or is a communication abnormality.<br><br>When the power supply at the master station is turned on, The presence of slave station is confirmed.<br>Master station communicate with the slave station that existed at that time. |
| | | 1 | A161 | |
| | | : | : | |
| | | 6 | A166 | |
| | Ch2 | 0 | A168 | |
| | | 1 | A169 | |
| | | : | : | |
| | | 6 | A16E | |
| Slave station | Ch1 | - | A160 | |
| | Ch2 | - | A168 | |

5.2.4 Connection of couple 1 with TC01P

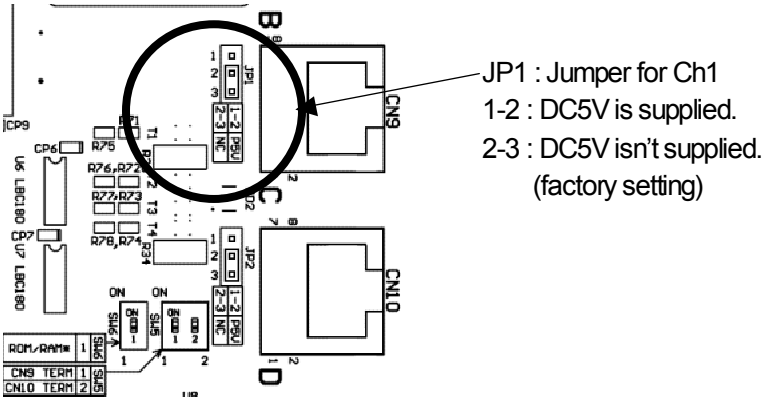
When connecting TC02V with the panel (TC01P), power supply (DC5V) can be supplied with LAN cable (straight cable).

Please make the length of LAN cable within 5m when TC02V supplies DC5V.



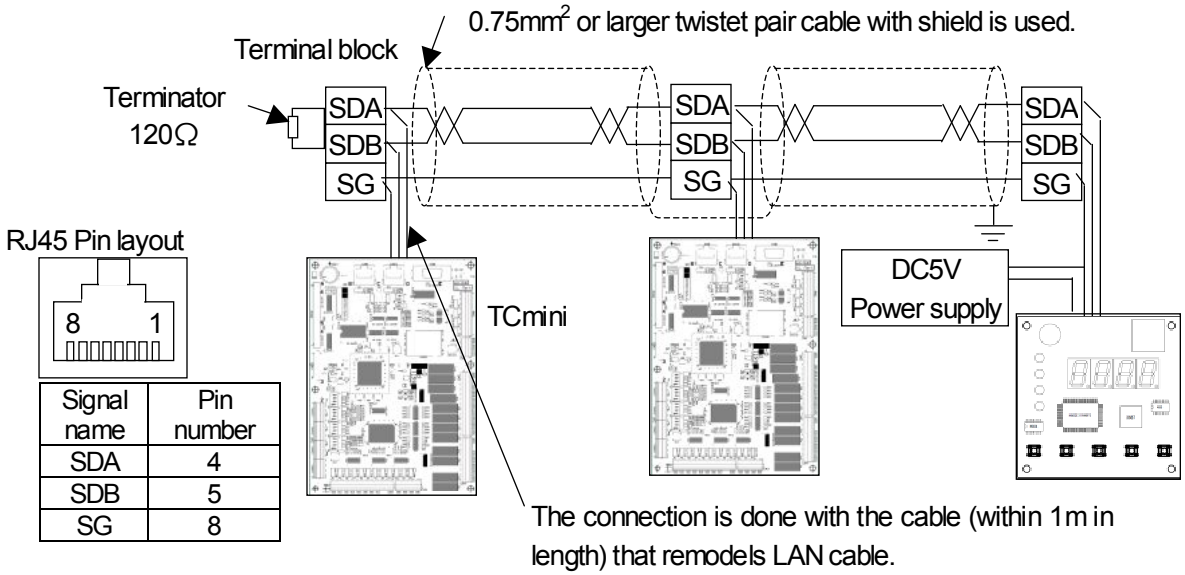

5.2.5 Supply of DC5V

Please set the jumper installed in TCmini when you supply DC5V to TC01P.




5.2.6 When you connect a lot of numbers, or when you transmit the long distance

When communicating by the distance of 100 meters or more, it is not possible to transmit normally only with LAN cable. Moreover, when 3 or more is connected, the following connections are done.



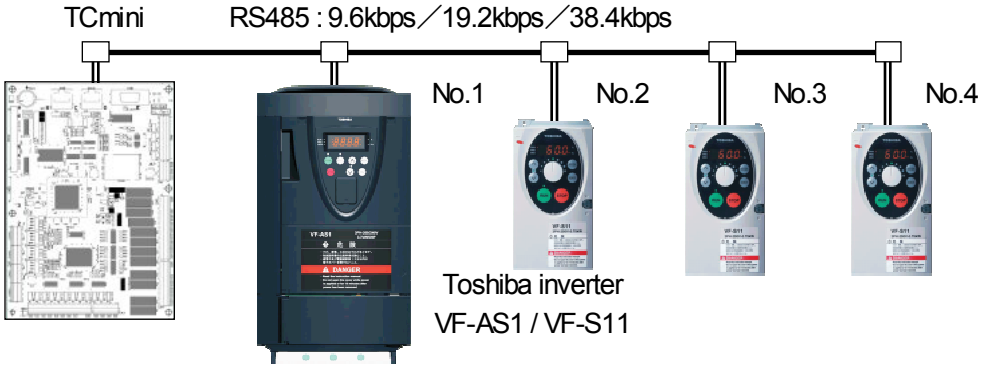

| Signal name | Pin number |
|---|---|
| SDA | 4 |
| SDB | 5 |
| SG | 8 |

When communicating at a lot of stations includingTC01P, TC01P is connected with the terminal (The terminator is built into TC01P. ).

Moreover, please supply the DC5V power supply especially. (current capacity : 350mA)

## 5.3 Inverter connection mode

TC02V can connect with inverter made by Toshiba (VF-AS1 / VF-S11) by using RS485, and can control this. Because the command and the frequency instruction can be communicated, if the driving frequency is written from TC02V to a prescribed register, driving in the specified frequency is possible.




Communication data area of TCmini

| Port | Division | | No1 | No2 | No3 | No4 |
|---|---|---|---|---|---|---|
| Ch1 | Transmission data | Command | Y20W | Y30W | Y40W | Y50W |
| | | Frequency instruction | Y21W | Y31W | Y41W | Y51W |
| | Receive data | Status | X22W | X32W | X42W | X52W |
| | | Driving frequency | X23W | X33W | X43W | X53W |
| | | Output voltage | X24W | X34W | X44W | X54W |
| | | Output current | X25W | X35W | X45W | X55W |
| | | Alarm information | X26W | X36W | X46W | X56W |
| Ch2 | Transmission data | Command | Y90W | YA0W | YB0W | YC0W |
| | | Frequency instruction | Y91W | YA1W | YB1W | YC1W |
| | Receive data | Status | X92W | XA2W | XB2W | XC2W |
| | | Driving frequency | X93W | XA3W | XB3W | XC3W |
| | | Output voltage | X94W | XA4W | XB4W | XC4W |
| | | Output current | X95W | XA5W | XB5W | XC5W |
| | | Alarm information | X96W | XA6W | XB6W | XC6W |

### 5.3.1 Communication setting

When the RS485 communication is used as an inverter connection, the following are set with TCmini. Because a set register is backup area (EEPROM), it sets and it is unnecessary since the second times.

| Setting item | Register for Ch1 | Register for Ch2 | Detail |
|---|---|---|---|
| Retrying frequency | D37C | D37E | Retrying. frequency until judging communication fault : 0 to 10 |
| Mode | D37D | D37F | Inverter connection mode : 0 |
| Baud rate | D378 Low-order 8 bits | D37A Low-order 8 bits | 9600bps : 0, 19200bps : 1, 38400bps : 2 |
| Parity | D378 High-order 8 bits | D37A High-order 8 bits | Non : 0, Odd number : 1, Even number : 2 |
| Connected flag | D379 | D37B | The connection is done by turning on correspondence bit (bit0 to 3) of the connected inverter number (No.1 to 4). |

Connected flag : The communication cycle can be done shortest by the thing that only the correspondence bit is turned on.

5.3.2 Program example

The program example when 1 VF-AS1 is connected with the RS485 line of Ch1 is shown. The area where data is transmitted to No.1 inverter is as follows.

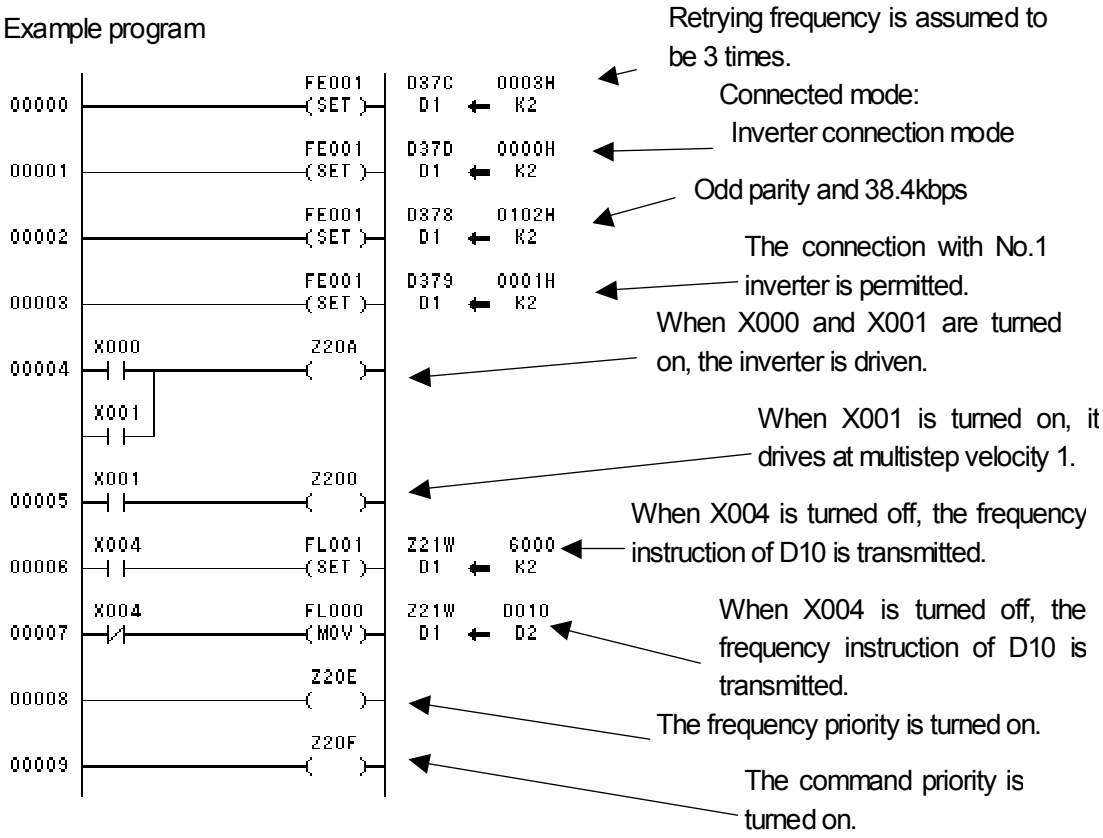
When the command is Z20W

| Device | Function | Contents |
|---|---|---|
| Y200 | Preset-speed 1 | 0 : Disable<br>1 to 15 :<br>Each multistep velocity |
| Y201 | Preset-speed 2 | |
| Y202 | Preset-speed 3 | |
| Y203 | Preset-speed 4 | |
| Y204 | Motor selections | 0 : Moter1, 1 : Moter2 |
| Y205 | PI control | 1 : Disable |
| Y206 | Acceleration & deceleration Pattern | 0 : Pattern.1, 1 : Pattern.2 |
| Y207 | DC brake | 1 : Braking |
| Y208 | JOG driving | 1 : JOG driving |
| Y209 | Rotation direction | 0 : Normal , 1 : Reverse |
| Y20A | Run / Stop | 0 : Stop , 1 : Operation |
| Y20B | Coast Stop | 1 : Coast Stop |
| Y20C | Emergency stop | 1 : Emergency stop |
| Y20D | Reset | 1 : Reset |
| Y20E | Frequency priority | 1 : Frequency priority |
| Y20F | Command priority | 1 : Command priority |

The frequency instruction is stored in Z21W as BIN value by every 0.01Hz. 60Hz is driven if it is specified 6000.

Status

Example program



5.3.3 The state of the communication : The connecting state can be confirmed by the following register.

| Communication channel | Station number | Register | Detail |
|---|---|---|---|
| Ch1 | 0 | A160 | ON : It is connecting now.<br>OFF : It is cutting or is a communication abnormality. |
| | 1 | A161 | |
| | 2 | A162 | |
| | 3 | A163 | |
| Ch2 | 0 | A168 | |
| | 1 | A169 | |
| | 2 | A16A | |
| | 3 | A16B | |

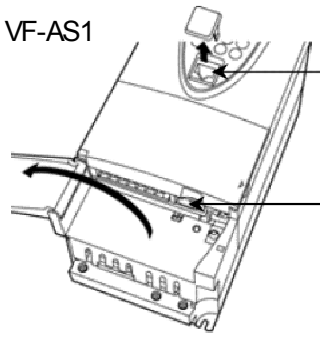
The error state

The error code of the communication of the inverter can be confirmed by the following register.

| Communication channel | Register | Detail |
|---|---|---|
| Ch1 | A12F Low-order 8 bits | Please refer to the manual of the inverter for details of the error code. |
| Ch2 | A12F High-order 8 bits | |

5.3.4 Connection with VF-AS1

When TCmini is connected to VF-AS1, it is connected with the RJ45 connector in front of the main body of the inverter. 4-wire system RS-485 can not be used.



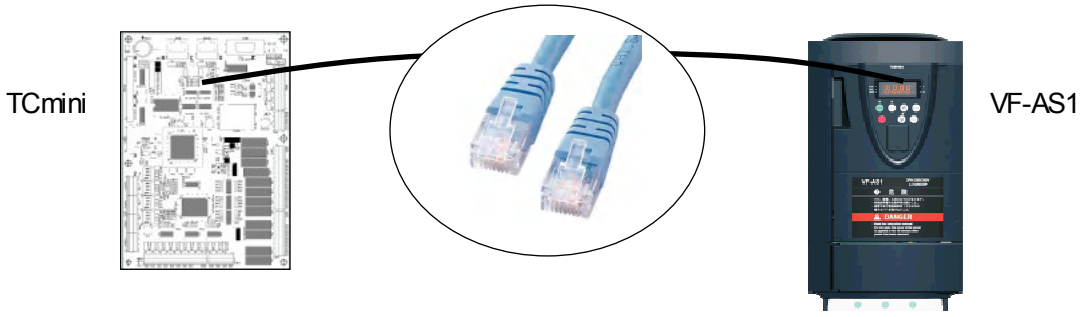

| Signal name | Pin number |
|---|---|
| DA | 4 |
| DB | 5 |
| SG | 8 |

Please set the following parameter when connecting VF-AS1 with TCmini.

| Item | Function | Adjustable range | Factory setting | Setting example |
|---|---|---|---|---|
| F800 | 2-wire system RS485 communication speed | 0 : 9600bps, 1 : 19.2kbps<br>2 : 38.4kbps | 1 | 1 or 2 |
| F801 | Parity | 0 : Non parity<br>1 : Even parity, 2 : Odd parity | 1 | Arbitrariness |
| F802 | Inverter number | 0 to 247 | 0 | 1 to 4 |
| F803 | Communication timeout | 0 : Timeout function OFF<br>1 to 100 seconds : Detection time | 0 | 1<br>(Recommendation) |
| F804 | Communication timeout operation | 0 :<br>1 : t Alarm, 2 : Err5 Trip | 8 | 2<br>(Recommendation) |
| F805 | 2-wire system transmission waiting time | 0.00 : Waiting none<br>0.01 to 2.00 seconds | 0.00 | 0.0 |
| F807 | 2-wire system Protocol selection | 0 : Toshiba inverter protocol<br>1 : MODBUS-RTU protocol | 0 | 0 |
| F870 | Block writing data 1 | 0 : Non selection<br>1 : Command information 1<br>2 : Command information 2<br>3 : Frequency instruction value<br>4 : Tarminal block output data<br>5 : Analogue data output for communication | 0 | 1 |
| F871 | Block writing data 2 | | | 3 |
| F875 | Block read data 1 | 0 : Non selection<br>1 : Status information<br>2 : Output frequency<br>3 : Output current<br>4 : Output voltage<br>5 : Alarm information | 0 | 1 |
| F876 | Block read data 2 | | | 2 |
| F877 | Block read data 3 | | | 3 |
| F878 | Block read data 4 | | | 4 |
| F879 | Block read data 5 | | | 5 |

One a couple of connection between VF-AS1 and TCmini

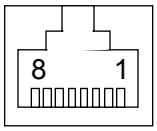
When VF-AS1 is connected to TCmini by One a couple, marleted LAN cable (straight cable) can be used.



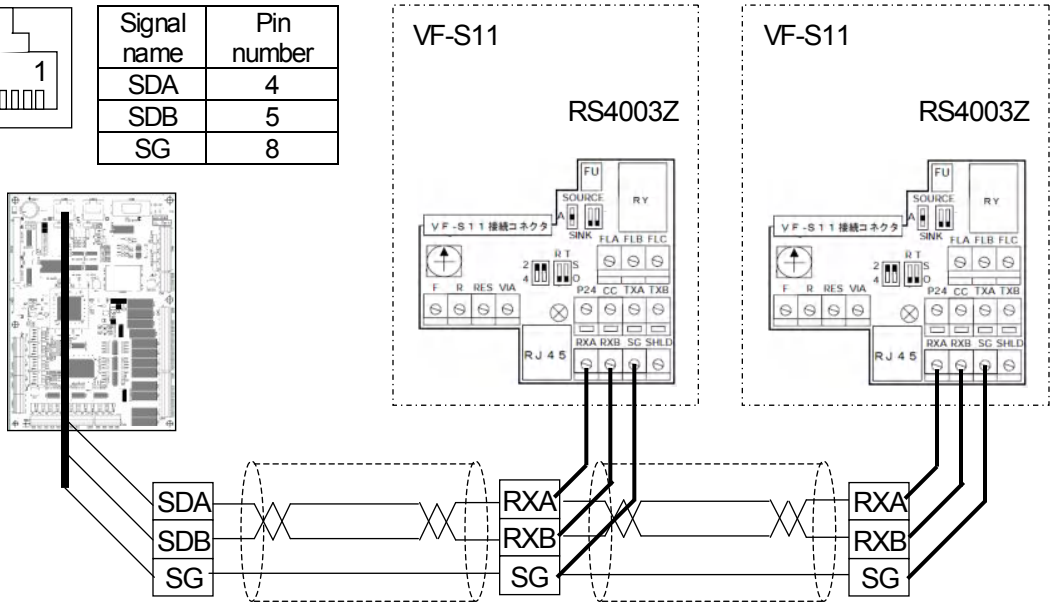
5.3.5 Connection with VF-S11

When TCmini is connected to VF-S11, please do the following wiring and the setting after insatlling RS485 option substrate(RS4003Z).

RJ45 Connector




| Signal name | Pin number |
|---|---|
| SDA | 4 |
| SDB | 5 |
| SG | 8 |




Twisted pair wire with shield

Please set the following parameter when connecting VF-S11 with TCmini.

| Item | Function | Adjustable range | Factory setting | Setting example |
|---|---|---|---|---|
| F800 | 2-wire system RS485 communication speed | 0 : 1200bps, 1 : 2400bps, 2 : 4800bps<br>3 : 9.6kbpa, 4 : 19.2kbps | 3 | 3 or 4 |
| F801 | Parity | 0 : Non parity<br>1 : Even parity, 2 : Odd parity | 1 | Arbitrariness |
| F802 | Inverter number | 0 to 255 | 0 | 1 to 4 |
| F803 | Communication error trip time | 0 : Function OFF<br>1 to 100 seconds : Detection time | 0 | 1<br>(Recommendation) |
| F805 | Transmission waiting time | 0.00 : Waiting none<br>0.01 to 2.00 seconds | 0.00 | 0.0 |
| F829 | Communication Protocol selection | 0 : Toshiba inverter protocol<br>1 : MODBUS-RTU protocol | 0 | 0 |
| F870 | Block writing data 1 | 0 : Non selection<br>1 : Command information 1<br>2 : Command information 2<br>3 : Frequency instruction value<br>4 : Tarminal block output data<br>5 : Analogue data output for communication | 0 | 1 |
| F871 | Block writing data 2 | | | 3 |
| F875 | Block reading data 1 | 0 : Non selection<br>1 : Status information<br>2 : Output frequency<br>3 : Output current<br>4 : Output voltage<br>5 : Alarm information | 0 | 1 |
| F876 | Block reading data 2 | | | 2 |
| F877 | Block reading data 3 | | | 3 |
| F878 | Block reading data 4 | | | 4 |
| F879 | Block reading data 5 | | | 5 |

# 6. Specification

## 6.1 Software specification

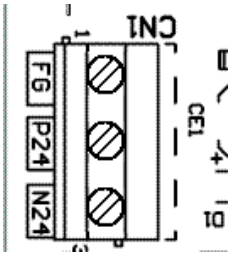
| Item | | Specification | |
|---|---|---|---|
| Program method | | Ludder diagram 11Line×11Row, 11output | |
| Instruction word | Basic Ladder instruction | 12 types | |
| | Function instruction | 74 types | |
| Program memory capacity | | 24 ksteps | |
| EEPROM writing frequency | | 100 times | |
| Processing speed | | 3ms / 1k steps | |
| Relay | | | |
| External input | Photo coupler input | 12 points | X000 to X00B |
| | Panel input | 32 points | X100 to X11F |
| Extarnal output | Relay output | 12 points | Y020 to Y02B |
| | Panel LED | 16 points | Y140 to Y14F |
| Ch1 Communication I / O | Ch1 Link relay 1 | 128 points | Z200 to Z27F |
| | Ch1 Link relay 2 | 128 points | Z300 to Z37F |
| | Ch1 Link relay 3 | 128 points | Z400 to Z47F |
| | Ch1 Link relay 4 | 128 points | Z500 to Z57F |
| | Ch1 Link relay 5 | 128 points | Z600 to Z67F |
| | Ch1 Link relay 6 | 128 points | Z700 to Z77F |
| | Ch1 Link relay 7 | 128 points | Z800 to Z87F |
| Ch2 Communication I / O | Ch2 Link relay 1 | 128 points | Z900 to Z97F |
| | Ch2 Link relay 2 | 128 points | ZA00 to ZA7F |
| | Ch2 Link relay 3 | 128 points | ZB00 to ZB7F |
| | Ch2 Link relay 4 | 128 points | ZC00 to ZC7F |
| | Ch2 Link relay 5 | 128 points | ZD00 to ZD7F |
| | Ch2 Link relay 6 | 128 points | ZE00 to ZE7F |
| | Ch2 Link relay 7 | 128 points | ZF00 to ZF7F |
| Internal relay | | 1024 points | R000 to R77F |
| Edge relay | | 256 points | E000 to E17F |
| Latch relay | | 128 points | L000 to L07F |
| Timer | Units of 100ms | 256 points | T000 to T17F |
| | Units of 10ms | 128 points | T200 to T27F |
| Counter | | 384 points | C000 to C27F |
| Special supplementary relay | | 240 points | A000 to A16F |
| Register | | | |
| Data register | General purpose register | 416 words | D000 to D11F<br>D800 to D97F |
| | EEPROM buckup | 240 words | D200 to D36F |
| | SRAM buckup (Note) | 512 words | D400 to D77F |
| | Calendar (Note) | 6 words | D120 to D126 |
| | High-speed counter | 1 words | D140 |
| | Inverter communication | 5 words | D378 to D37B<br>D12C : Error code |
| | Communication function setting | 4 words | D37C to D37F |
| | Analogue input truth value | 7 words | D150 to D153, D154 to D156 |
| | Analog input temperature | 7 words | D158 to D15B, D15C to D15E |
| | Analog setting | 2 words | D157, D15F |
| | 7segment numerical value | 10 words | D160 to D169 |
| | 7segment panel setting | 2 words | D16D to D16E |
| | 7segment character code | 14 words | D170 to D17D |
| Timer & Counter register | Setting value | 384 words | V000 to V27F |
| | Present value | 384 words | P000 to P27F |

Note : When calendar option board is installed

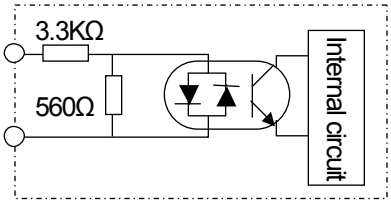
## 6.2 General specification

| Item | Specification |
|---|---|
| Insulation resistance | 20MΩ or more (by 500V dc megger) |
| Withstand voltage | 1500V ac 1min |
| Power supply noise performance | 1500V P-P (0.1 to 1μs) |
| Induction noise performance | 500V P-P (0.05 to 1μs) |
| Vibration resistance | JIS C0911 II B3 kind conforming |
| Ambient temperature of use | 0 to 55 degrees Celsius |
| Ambient temperature of preservation | -10 to 65 degrees Celsius |
| Ambient humidity of use | 30 to 85%RH (There is never be dewy and freezing) |
| Ambient atmosphere of use | Thing without dust and causticity gas |
| Flame resisting | UL94V-0 Corresponding |
| Tracking resistance | CT III Lank1 |
| Externals dimensions | W190×H135×D28 |
| Weight | 230g |

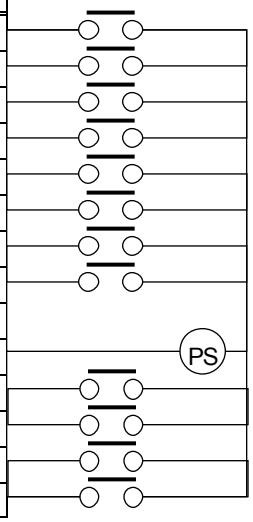
Power supply(DC24V)

| Item | Specification |
|---|---|
| Nominal voltage | 24V dc(-10% to +15%) |
| Current consumption | 250mA or less |
| Withstand voltage | 500V ac 1min |
| Noise performance | 500V P-P (0.1 to 1μs) |
| Connection |  |

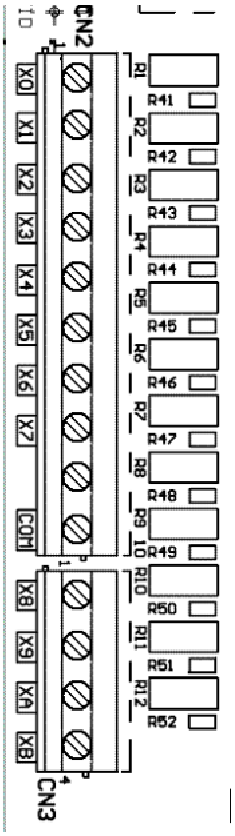
## 6.3 Control input specification

| Item | Specification | Circuit composition |
|---|---|---|
| Input voltage | 12 / 24V dc |   |
| Input current | 7mA (24V dc Typ.) | |
| Minimum ON voltage | ON voltage : 10V dc | |
| Maximum OFF voltage | OFF voltage : 7V dc | |
| ON delay time | OFF→ON : 1ms | |
| OFF delay time | ON→OFF : 1ms | |
| Common connection | 12 points 1common, No polarity | |
| Insulation method | Photo coupler insulation | |
| External connection | Terminal block : ELK508V-10P, 4P | |
| Connection | | |

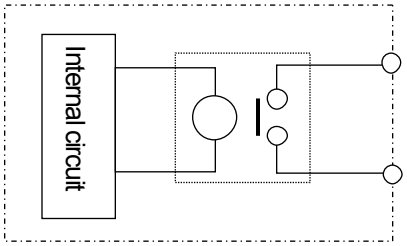
| Sign | Address |
|---|---|
| X0 | X000 |
| X1 | X001 |
| X2 | X002 |
| X3 | X003 |
| X4 | X004 |
| X5 | X005 |
| X6 | X006 |
| X7 | X007 |
| – | – |
| COM | Common |
| X8 | X008 |
| X9 | X009 |
| XA | X00A |
| XB | X00B |



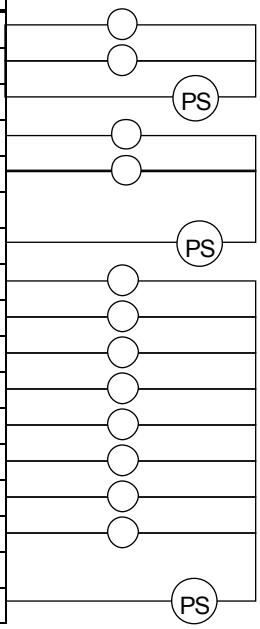

PS : Power supply



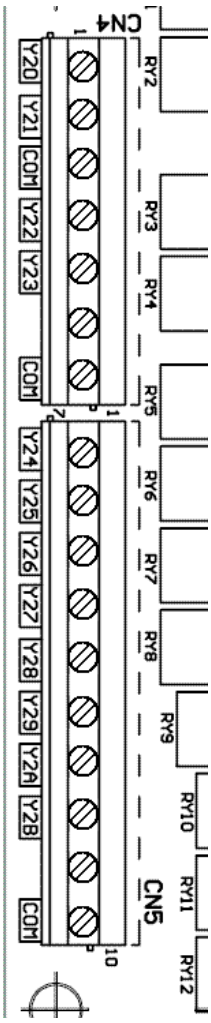
## 6.4 Control output Specification

| Item | Specification | Circuit composition |
|---|---|---|
| Output form | Relay contact point output |   |
| Load voltage | 250V ac / 30V dc | |
| Load current | 3A (Resistance load) | |
| Minimum load | 5V dc 10mA | |
| ON response time | OFF→ON : 10ms | |
| OFF response time | ON→OFF : 10ms | |
| Common conection | 8 points1common, 4 points2common | |
| ON/OFF life of relays | 5million times (Mechanical)<br>2million times (Electricity) | |
| Insulation method | Relay insulation | |
| External connection | Terminal block : ELK508V-10P, 7P | |
| Connection | | |

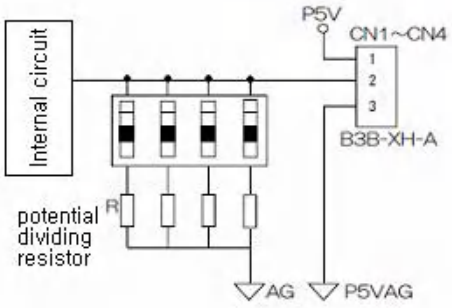
| Sign | Address |
|---|---|
| Y20 | Y020 |
| Y21 | Y021 |
| COM | Common |
| Y22 | Y022 |
| Y23 | Y023 |
| | |
| COM | Common |
| Y24 | Y024 |
| Y25 | Y025 |
| Y26 | Y026 |
| Y27 | Y027 |
| Y28 | Y028 |
| Y29 | Y029 |
| Y2A | Y02A |
| Y2B | Y02B |
| | |
| COM | Common |



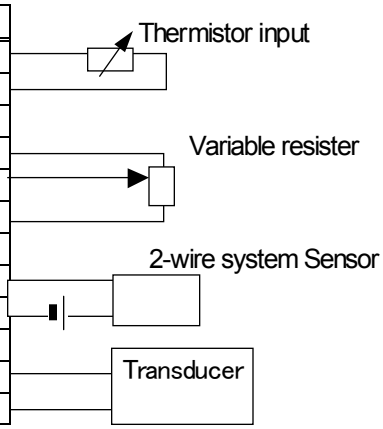

PS : Power supply

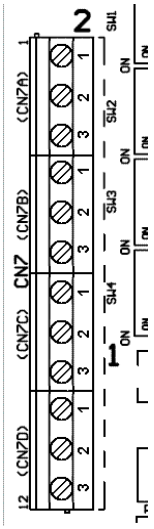


## 6.5 Analogue input Specification

| Item | Specification | Circuit composition |
|---|---|---|
| Channel | 4ch |   |
| Input range | 0-5V dc, 4-20mA, Thermistor | |
| Insulation | Non-insulation | |
| Resolution | 10 bits, 0-1000 | |
| Input accuracy | ±0.5%FS | |
| Data area | D150 to D153 : Read value (Truth value)<br>D158 to D15B : Conversion value | |
| Setting register | D157, D15F | |
| External connection | Terminal block : ELK508V-3P ×4 | |
| Connection | | |

| Terminal | Pin | Contents |
|---|---|---|
| CN7A Ch1 | 1 | P5V |
| | 2 | Analogue input Ch1 |
| | 3 | P5VAG |
| CN7B Ch2 | 1 | P5V |
| | 2 | Analogue input Ch2 |
| | 3 | P5VAG |
| CN7C Ch3 | 1 | P5V |
| | 2 | Analogue input Ch3 |
| | 3 | P5VAG |
| CN7D Ch4 | 1 | P5V |
| | 2 | Analogue input Ch4 |
| | 3 | P5VAG |



Setting

Set function of SW1 to 4 on surface of substrate

| Analogue input Specification | Setting of SW1 to SW4 | | | | D157 D15F | Resistor value | Recommendation thermistor (Made of Shibaura Electronics) |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | | |
| Thermistor Low temperature | ON | OFF | OFF | OFF | 0 | 10 kΩ | PBN-36 |
| Thermistor Medium temperature | OFF | ON | OFF | OFF | 1 | 3.09 kΩ | PBN-36 |
| Thermistor High temperature | OFF | ON | OFF | OFF | 2 | 3.09 kΩ | PTN-51F |
| 4-20mA | OFF | OFF | OFF | ON | 6 | - | - |
| 0-5V dc | OFF | OFF | OFF | OFF | 7 | - | - |

Input Specification & conversion value

| Input Specification | Input range | Conversion value (D158 to D15B) | Temperature accuracy 1 degrees Celsius or less | Temperature accuracy 5 degrees Celsius or less |
|---|---|---|---|---|
| Thermistor Low temperature | -50 to 60 degrees Celsius | -500 to 600 | -50 to 40 degrees Celsius | 40 to 60 |
| Thermistor Miedium temperature | -50 to 60 degrees Celsius | -500 to 600 | -40 to 60 degrees Celsius | -50 to -40 |
| Thermistor High temperature | -20 to 298 degrees Celsius | -200 to 2980 | 42 to 156 degrees Celsius | 156 to 230 |
| 4-20mA | 4-20mA | 0 to 1000 | Accuracy : ±0.5% | - |
| 0-5V dc | 0-5V dc | 0 to 1000 | Accuracy : ±0.5% | - |

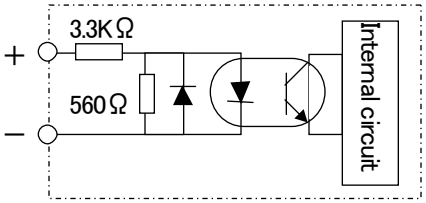
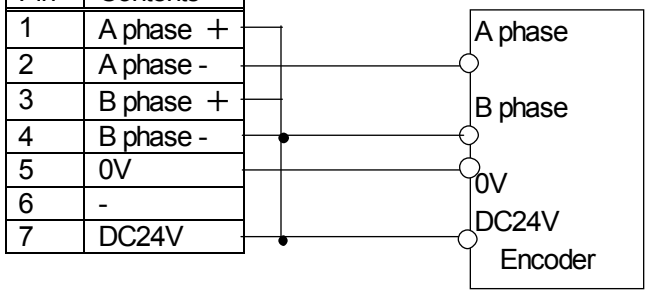
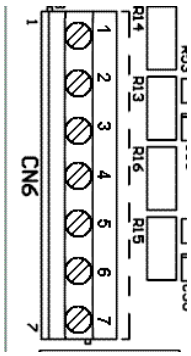
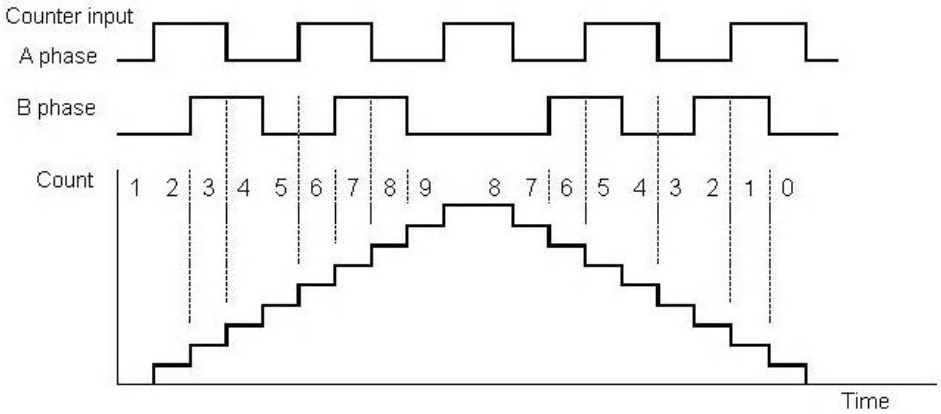
In the thermistor input, the conversion value becomes 20000 when the sensor was short-circuited or it is outside the range of the high temperature. Moreover, the conversion value becomes 10000 when it is outside the sensor opening or the range of the low temperature.

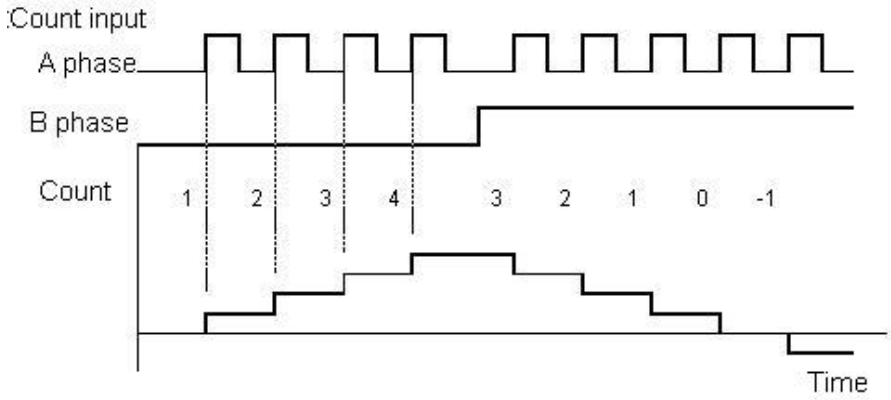
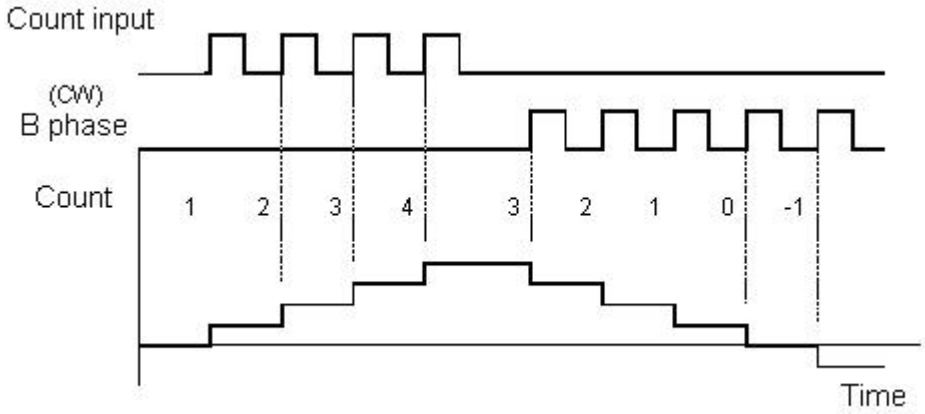
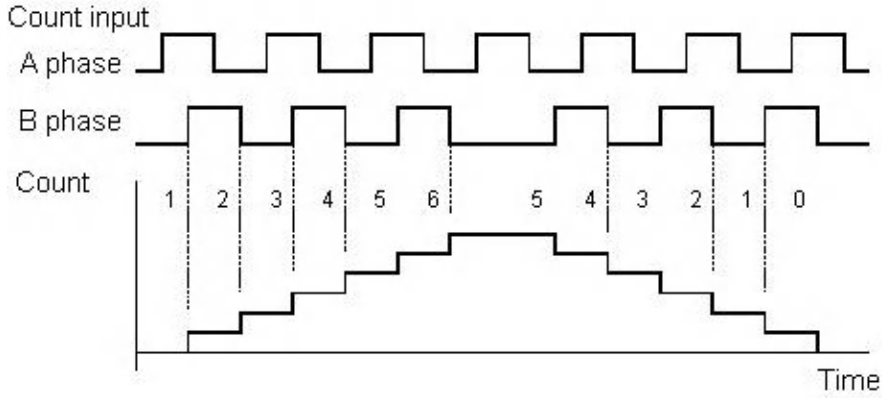
Correspondence of register

| | Terminal | Truth value | Conversion value | Setting SW |
|---|---|---|---|---|
| Ch1 | CN7A | D150 | D158 | SW1 |
| Ch2 | CN7B | D151 | D159 | SW2 |
| Ch3 | CN7C | D152 | D15A | SW3 |
| Ch4 | CN7D | D153 | D15B | SW4 |

When you do the disconnection detection when inputting it 4-20mA, please become an error when the truth value is less than 100.

## 6.6 Counter input Specification

| Item | Specification | Circuit composition |
|---|---|---|
| Input voltage | DC12 / 24V |   |
| Maximum frequency | 25kPPS, A / B Phase count<br>50kpps, pulse count (Sign and pulse) | |
| Minimum ON voltage | DC10V | |
| Maximum OFF voltage | DC7V | |
| Data area | Present value : D140(-32768 to 32767)<br>D140 : It can be set with instruction FL01. | |
| Exteranal connection | Terminal block : ELK508V-8P | |
| Setting | Count mode 1 : D370=0 Count mode 2 : D370=1<br>Count mode 3 : D370=2 Count mode 4 : D370=3 | |
| Connection | Please use the encoder of the open collector type.<br>Pin / Contents<br>1 / A phase ＋<br>2 / A phase -<br>3 / B phase ＋<br>4 / B phase -<br>5 / 0V<br>6 / -<br>7 / DC24V<br>  <br>   | |
| Count mode 1<br><br>Phase pulse (Quad edge evaluation count) | Count operation<br>  <br>2000 pulses / rotation can be counted with the encoder of 500 pulses / rotation. | |

| | |
|---|---|
| Count mode 2<br><br>Pulse+Sign<br>(Normal count) | Count operation<br>  <br><br>Up / Down is counted in the state of B phase at the rising edge of A phase pulse. |
| Count mode 3<br><br>CW＋CCW pulse<br>(Normal count) |  <br> |
| Count mode 4<br><br>Phase pulse<br>(Double edge evaluation count) |  <br><br>1000 pulses / rotation can be counted with the encoder of 500 pulses / rotation. |

Double length count program

The program counted as double length data is shown.

```
                FL022   D001    D140    D000
00000 ---------(BIN)-   D1  <-  D2  -   D3

                FL000   D000    D140
00001 ---------(MOV)-   D1  <-  D2

                FL047   D001    00015   R000
00002 ---------(TST)-   D1BIT   K2  ->  B3

                FL000   D002    D001
00003 ---------(MOV)-   D1  <-  D2

        R000    FL001   D003    00000
00004 --/--     (SET)-  D1  <-  K2

        R000    FL001   D003    -00001
00005 --| |     (SET)-  D1  <-  K2

                FL092   D004    D004    D002
00006 ---------(W.B)-   D1  <-  D2  +   D3
```

The increment and a decrease in a high-speed scanning are calculated at each

D000: Count value of pre -scanning

The top bit of increase and decrease is checked.

The value of D001 is converted into double length BIN data of D003･D002.

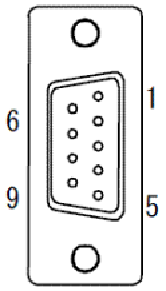
Double length count value is stored in D005 & D004 by the double length addition instruction.

## 6.7 RS232C port

| Item | Specification | Connection |
|---|---|---|
| Communication standard | RS232C | |
| Transmission speed | 9600 / 19.2k / 38.4kbps<br>Automatic change | |
| Transmission code | NRZ | |
| Synchronization | Asynchronous | |
| Bit length | 8 bits | |
| Parity | Non | |
| Stop bit | 2 bits | |
| External connection | DB-9P connector (Male)<br>The personal computer can be connected with a straight cable. | |
| Touch panel | Matsushita Electric, Keyence, Hakko Electronics, Digital Electronics, IDEC | |

| Pin | Contents |
|---|---|
| 1 | CI |
| 2 | TXD |
| 3 | RXD |
| 4 | DSR |
| 5 | GND |
| 6 | DTR |
| 7 | CTS |
| 8 | RTS |
| 9 | CD |

CN8

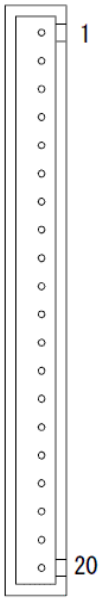



## 6.8 Panel interface

| Item | Specification | Connection |
|---|---|---|
| Input bit | Key switches, up to 32 points | |
| Output bit | LED : up to 16 points, Buzzer : 1 points | |
| 7segment display | Support up to 14 digits | |
| Connection | 8 bits I / O bus port | |
| Connector | XH Connector 20 Pins (Made by JST) | |
| Cable length | Up to 2m | |
| External connection | Connector<br>Cable side : XHP-20<br>Substrate : B20B-XH-A<br><br>Reel contacts<br>SXH-001T-P0.6(AWG#28 to 22)<br>SXH-002T-P0.6(AWG#30 to 26)<br>Bulk contacts<br>BXH-001T-P0.6(AWG#28 to 22)<br><br>Contact crimp tool<br>YC-110R(for BXH-001T-P0.6)<br>Contact extraction tool<br>XJ-06 | |

| Pin | Contents |
|---|---|
| 1 | WR |
| 2 | RD |
| 3 | CS |
| 4 | A0 |
| 5 | A1 |
| 6 | A2 |
| 7 | A3 |
| 8 | P5 |
| 9 | P5 |
| 10 | RESET |
| 11 | GND |
| 12 | GND |
| 13 | D0 |
| 14 | D1 |
| 15 | D2 |
| 16 | D3 |
| 17 | D4 |
| 18 | D5 |
| 19 | D6 |
| 20 | D7 |

CN12

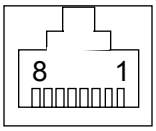



## 6.9 RS485 port

| Item | Specification | Connection |
|---|---|---|
| Communication standard | EIA RS485 Conforming | |
| Transmission speed | 250kbps, 9.6 / 19.2 / 38.4kbps switching | |
| Transmission method | Half duplex | |
| Synchronous | Asynchronous | |
| Trasmission range | Up to 400m | |
| Support function | PLC link mode, Remote I / O connection mode, Inverter connection mode | |
| External connection | RJ45 Connector can use to one couple connection with LAN cable.<br>The terminator is connected with SW5. | |

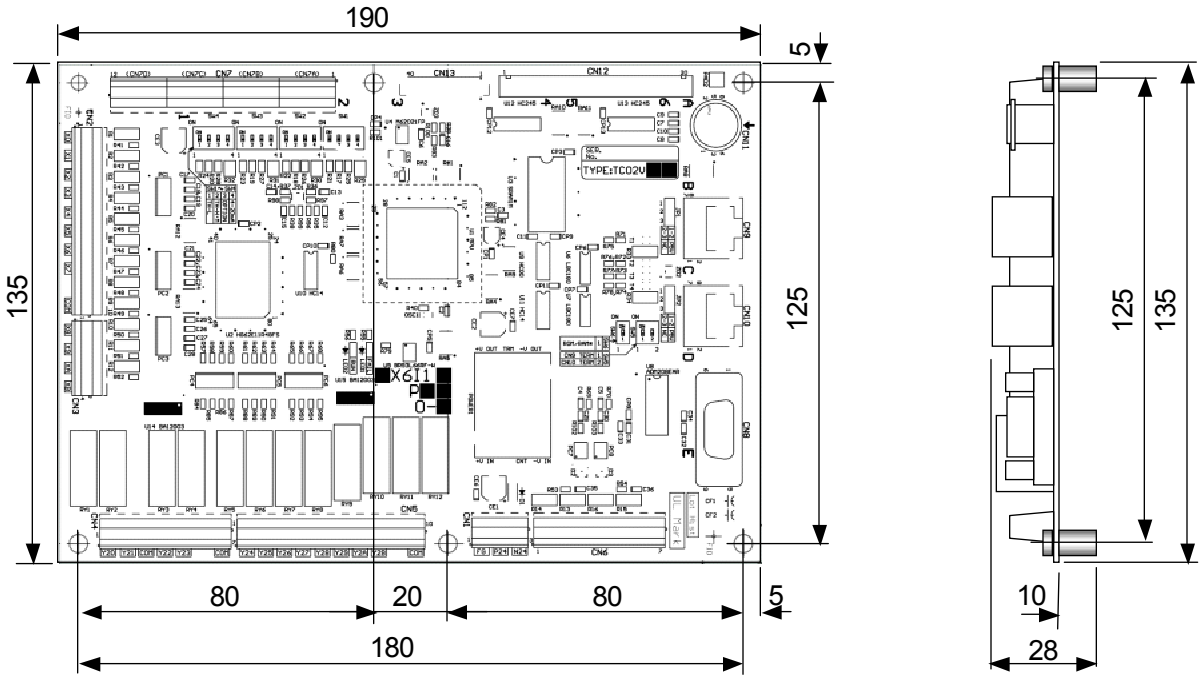
| Pin | Contents |
|---|---|
| 1 | P5V |
| 2 | - |
| 3 | - |
| 4 | SDA |
| 5 | SDB |
| 6 | - |
| 7 | - |
| 8 | GND |

CN9 / 10



## 6.10 External dimensions

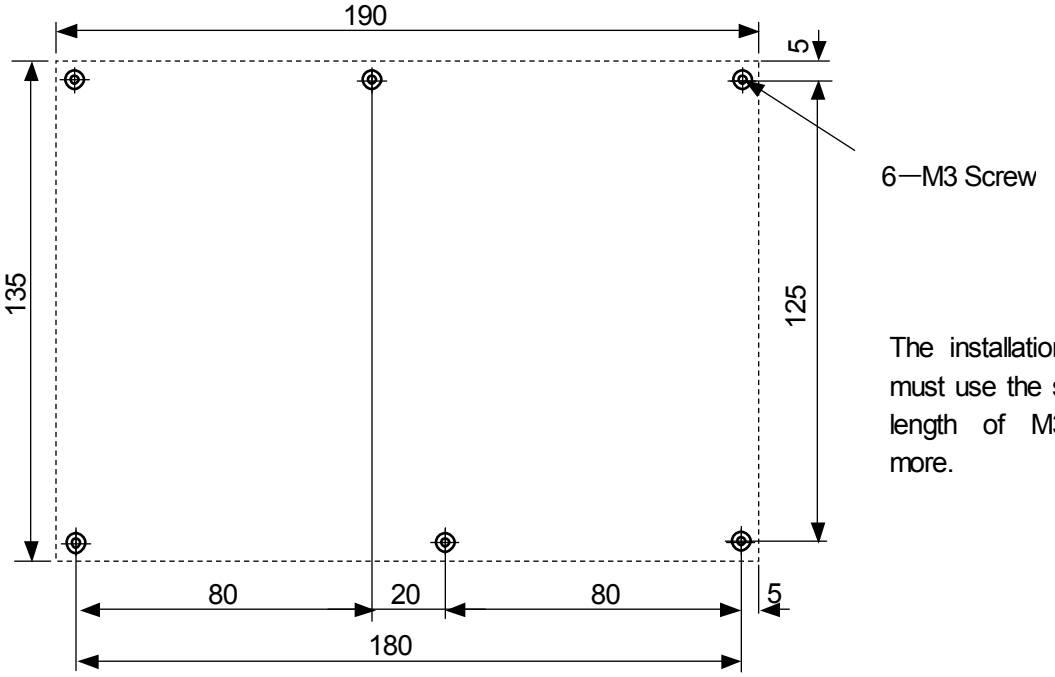
Externals dimensions of TCmini is shown in the following.




(Units : mm)

## 6.11 Installation dimensions

Installation dimensions of TCmini is shown in the following.




The installation of TC02V must use the screw of the length of M3-16mm or more.

(Units : mm)

# 7. Installation environment

TCmini does not have the exterior case. To improve the reliability of the system, and to demonstrate the function enough, please install it in consideration of the following.

## 7.1 Caution in handling

Please exchange main bodies of TCmini after it turns off power.

When you handle TCmini, Please treat the substrate edge side of the main body of TCmini having it so as not to touch parts by bare-handed.

Please do not put TCmini in the place where static electricity is generated easily (Carpet, vinyl cloth, etc.).

When you exchange TCmini due to trouble, please confirm whether exchanged main bodies of TCmini is normal.

When you repairing return defective TCmini, please report on the content of the breakdown as in detail as possible before returning it to our branch or the agency.

In the connector loose connection, please contain the industrial alcohol (ethanol 90% or more) in a clean cotton cloth and wipe the contact of connector. Please never use the organic solvent (thinners).

## 7.2 Installation requirements

Please do not set up TCmini in the place shown as follows.

- Where the ambient temperature drops below 0 degrees Celsius, or exeeds 55 degrees Celsius
- In location exposed to direct sunlight.
- Where the relative humidity drops below 30% or exeeds 85%.
- Where there is condensation due to sudden temperature changes (10Kelbin / hour or more)
- Where there are corrosive or inflammable gasses ($SO_2$, $H_2S$, etc.)
- Where there are shocks or vibration that exeeds the tolerance of the TCmini
- Where there are many dusts, metallic particle or salinity
- Where there are spray of water, oil, and chemical
- Control panel where high-voltage equipments is set up

## 7.3 Installation position in control pane

Please consider operativeness, an environment, and maintenance enough about the installation in the control panel.

### 7.3.1 Consideration to ambient temperature

Please consider the following point to use TCmini at ambient temperature (0 to 55 degrees Celcius) of use.

- Please take space enough for ventilation.
- Do not install above or near from equipments which generates a large amount of heats. (Heater, transformer, large capacity resistor, etc.)
- Please set up cooling fan or cooler when the ambient temperature becomes 55 degrees Celcius or more. In the environment with a lot of dust, we recommend the indirect air cooling method.

7.3.2 Consideration to improve noise resistance performance

- Please avoid the installation in the board where a high-pressure equipment is set up.
- Please do not set TCmini up near the equipment that generates an electromagnetic noise such as the electric welding machine, electromagnetic cookers, and microwave ovens.
- Please confirm the noise performance after setting up a real machine when coming off from the terms and conditions above.
- Please separate this machine and the power line by 200mm or more.
- Please bundle neither cable nor the power line connected with this machine.
- Please separate the inductive loads such as the magnetic contactors, and the solenoid valves by 200mm or more.

# 8. Wiring

This chapter describes everything from an important content concerning safety to installation and the basic wiring method when this machine is introduced. Please follow the description of this chapter matter when you introduce or repair TCmini.

| | |
|---|---|
| ⚠ Danger | The I / O cable must separate with another wirings. Please do not store it in the same duct as other wirings.<br>The high voltage cable and the power cable separate with the wiring for TCmin as much as possible, and parallel wiring is avoided as much as possible. Especially, please even do not pass inverter and servo driver's cables through the same duct and piping even by the distance of several meters.<br>When it doesn't follow the above-mentioned matter, it causes the injury by abnormal operation. |

| | |
|---|---|
| ⚠ Caution | Before you work, please cut off all power supplies supplied to TCmini. When the description is not followed, it causes the electric shock and the equipment damage.<br>Before you work, please remove the static electricity of the worktable and the body. Please wire for I / O and the power supply after installing TCmini. These causes the equipment damage. |

## 8.1 Caution when wiring

The noise causes the malfunction not especially found easily. The cause might not be able to be found to the malfunction by the noise quantitatively so that there are 2 or more factors. Therefore, please do measures to match to the situation of the site.

### 8.1.1 Grounding methods

The earth has aimed at the electric shock prevention of the human body and the malfunction prevention by the noise.

- Please connect by 2mm$^2$ or larger wire in shortest possible distance.
- When the earth wire is 5m or more, the effect cannot be expected. It is assumed a single D kind earth, and moreover, please do not common earth.
- When it is not possible to single-point ground, please connect ground lines from the FG terminal of the power supply with the chassis of control panel shortest.

### 8.1.2 Method of preventing noise from power supply line

The noise resistance performance of the power supply is 500V.

When the noise more than this might be impressed, please set up the insulation transformer, and supply power by a marketed switching power supply.

### 8.1.3 Lightning measure

To suppress the damage of the equipment to the minimum, the following content is done. It is not measures of the direct lightning stroke.

- When you install surge absorber on the receipt boad, please assume C kind earth (below 10Ω), and wire for earths shortest with the stranded wire of 3.5mm$^2$ or larger.
- The I / O signal insulates once via the relay, and prevents damage being expanded.

## 8.2 General Caution for wiring

Wiring by having turned on the power supply causes the injury by abnormal operation and an electric shock . Moreover, when the mistake do short-circuit of the terminal by the cable, the destruction of internal elements is caused.

- Please separate and wire for the I / O line with the power line.

### 8.2.1 Power supply and I / O wiring

Please see chapter 4 (Specification) about a pin array, an external connecting, (connector contact, acceptable wire diameter to use, etc.) of the power supply and each I / O of TCmini, and notes.

- Please use a special tool when you process the wire.
- Please use the wire that suits the crimp terminals and contacts.

# 9. Operation and maintenance

There are few longevity goods because the main parts that compose this machine are semiconductors. However, the deterioration of the element by the environment and the longevity of the output relay etc. are thought.
Please execute the check to use the product best.

## 9.1 Check before operation

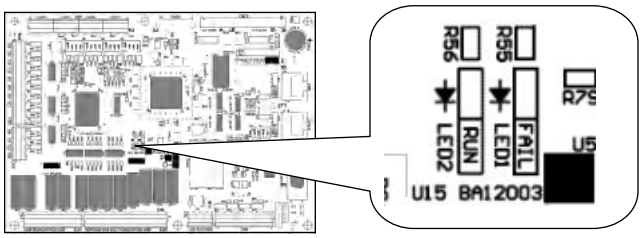
When the installation and the wiring for TCmini are completed, please confirm following Item before it drives .

| | Item of confirmation | Content of confirmation |
|---|---|---|
| 1 | State of installation | Does not controller's installation screw loosen?<br>Is the peripheral equipment correctly connected? |
| 2 | Wiring for power supply and I / O | Is wiring correctly connected?<br>Is the connector correctly connected?<br>Are you connected with the power supply of the rated voltage? |

## 9.2 Troubleshooting procedure

| Abnormality | Cause that can be presumed | Measure |
|---|---|---|
| It doesn't operate. | The power supply has not been turned on. | Turning on of power supply |
| Even if the input equipment is turned on, it doesn't operate. | External wiring mistake or disconnection | Wiring check |
| | Loosening of connector | Confirmation of connector insertion |
| | The turning on time of the external input equipment is too short. | Adjustment of external equipment |
| | Defect in input circuit | The controller's exchange |
| The input is irregularly turned on and off. | Malfunction by noise | Wiring is made the twist line or a shield line. |
| | Difference of turning on time of input equipment | Adjustment of external equipment |
| | Loosening of input equipment or relay terminal | The screw is tightened again. |
| | Loosening of connector | Insertion confirmation |
| | Defective crimping of connector pin | Correction of crimping |
| A part of input is not turned on. | The circuit is defective. | The controller's exchange |
| A specific input as turning on. | The circuit is defective. | The controller's exchange |
| The output equipment is not turned on. | The load power supply is not supplied or the voltage of power supply is low. | The load power supply is supplied.<br>It steps up the voltage. |
| | External wiring mistake or disconnection | Wiring check |
| | Loosening of connector | Confirmation of connector insertion |
| | Defect of output circuit | The controller's exchange |
| | Disconnection of external load | Exchange of load equipment |
| | The turning on time of the output is too short. | Program modification |
| A specific output is not turned on. | The application instruction is turning off according to a double output. | Program modification |
| | Defect of output circuit | The controller's exchange |
| The output is irregularly turned on and off. | The load voltage is low. | It steps up the voltage. |
| | Mistake of program | Program modification |
| | Malfunction by noise | Wiring is made the twist line or a shield line.<br>Serge killer is installed. |
| | Loosening of input equipment or relay terminal | The screw is tightened again. |
| | Loosening of connector | Insertion confirmation |
| | Defective crimping of connector pin | Correction of crimping |
| A part of output is not turned on. | The circuit is defective. | The controller's exchange |
| A specific output is turning on, and it doesn't turn it off. | The circuit is defective. | The controller's exchange |

## 9.3 Content of LED display on substrate and the treatment




The TCmini have status LED (RUN LED & FALT LED) on the substrate. Driving state can be judged by seeing lighting.

| RUN (Green) | FAIL (Red) | Content | | Measure |
|---|---|---|---|---|
| Not Lit | Not Lit | PLC Stop | The power supply has not been turned on. | Turning on of power supply |
| Lit | Not Lit | PLC Run | Nomal operation | ——— |
| | | PLC Stop | Stop command from PC | ——— |
| Lit | Lit | Abnormality of sequence program | Buckup data error | Reload sequence program |
| | | | Illegal use of instruction word | Confirmation of sequence program |
| | | | Undefined of label | |
| | | | Repetition definition of label | |
| | | | Excess of number of function use | |
| | | System software is boot mode | Connection of boot mode of SI595U | Reload of the system software. |
| | | | | Switch confirmation of SI595U |
| Blinking | Lit | System abnormality | ROM abnormality | The controller's exchange |
| | | | RAM abnormality | |
| | | | Watch dog abnormality | |
| | | | CPU abnormality | |

## 9.4 Maintenance

Please check following Item. Please correct to enter in the standard when coming off from the standard.

| NO | Checking Item | Contents of check | Standard |
|---|---|---|---|
| 1 | Power supply | when measuring at Tcmini's power supply terminal,is the voltage fluctuation in the standard ? | DC24V (DC21.6V to DC27.6V) |
| 2 | Surrounding environment | Is the temperature in the control board appropriate? | 0 to +55 degrees Celsius |
| | | Is the humidity in the control board appropriate? | 30 to 85%RH There is never be dewy. |
| | | Are there neither dust nor a metallic paticle? | Do not be there. |
| 3 | State of installation | Is the controller firmly fixed? | There must not be loosening. |
| | | Has each connector been surely inserted? Moreover, isn't there loosening? | The connector must surely be fixed. |
| | | Is the connector of the I / O terminal firmly fixed? | |
| 4 | State of FALT LED | Isn't it an abnormal display? | No abnormal display. |

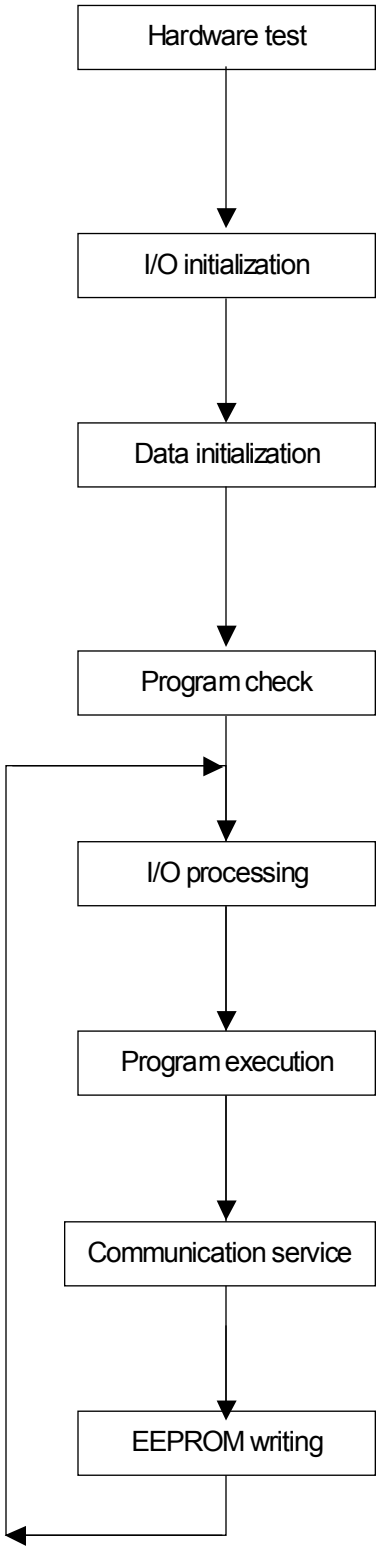
## 9.5 Parts with longevity

Parts related to the longevity of TCmini are shown in the following. Please make longevity a standard, and exchange parts or main bodies.

| | Item | Standard of longevity | |
|---|---|---|---|
| 1 | EEPROM<br>(Backup memory) | Writing frequency : 1 million times | |
| 2 | Relay | Mechanical | 5 million times |
| | | Electrical | 200,000 times<br>(Rated load, witching frequency 1800 times / hour) |

# 10. Operation of TCmini

When the power supply is turned on, TCmini starts in the following order. Operation from the hardware test to the program check is executed only once at doing the power supply On. Operation from the I / O processing is executed cyclic repeatedly. One operation time of this processing is called a scan time, and it stores it in A03L by the unit of ms.




System ROM check : Check SUM on system OS area is confirmed.
System RAM check : Operation of reading and writing of the memory that MPU uses is confirmed.
User program check : CRC code of the user's program is checked.

Panel interface, I/O ports, serial communication port, and the analog input port are initialized.
The use mode of the RS485 port is decided, and the presence of the station connected with the port is checked. In remote I/O connection mode, connected composition is established at this time.

The content of all relays and registers except the power failure hold area and registers is cleared to OFF/0.
Set value (V) of the timer counter is adjusted to the value specified by the user program.

The number of subroutines (32 or less) and the use number of the edge type instruction (4096 or less) is confirmed.

Output data on the memory is transmitted to the output port, and input data on the input port is transmitted to the memory.
The I/O processing is a batch refreshing method. It is not possible to refresh it while operating the program.

The user program is operated from the first circuit to the program end.

The RS485 port, the RS232C port, and the tool port are served synchronizing with the scanning.

When there is a data change in EEPROM area, writing is executed.

# 11. Data memory

## 11.1 Memory area

The following memory area is prepared in TCmini.

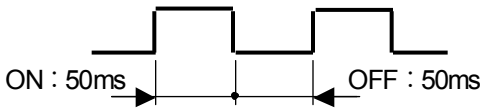
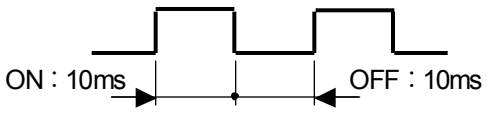
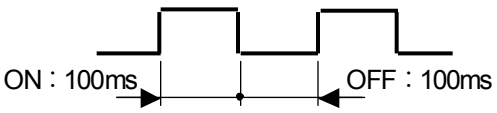
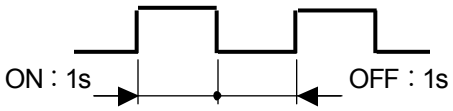
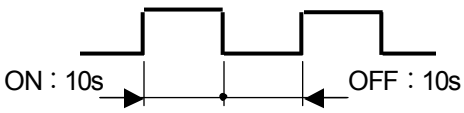
| Type | Number of point | Form of description | | Function | Hold |
|---|---|---|---|---|---|
| I / O Relay | 2048 points | Relay address | X / Y000 to X / YF7F | X : State (ON / OFF) of the input is shown.<br>Y : State (ON / OFF) of the output is shown.<br>Z : It is a relay that not is to be input and output directly. It is used for the data transfer in remote I / O mode and PLC link mode. | Cleared |
| | | Byte register | X / Y00L / H to X / YF7L / H | | |
| | | Word register | X / Y00W to X / YF7W | | |
| Internal Relay | 1024 points | Relay address | R000 to R77F | It is a relay used for temporary memory. It doesn't output it outside.<br>Whenthe power failure is occur, state is not held. | Cleared |
| | | Byte register | R00L / H to R77L / H | | |
| | | Word register | R00W to R77W | | |
| Latch Relay | 128 points | Relay address | L000 to L07F | It is a relay used for the latch type instruction. | Cleared |
| | | Byte register | L00L / H to L07L / H | | |
| | | Word register | L00W to L07W | | |
| Timer & Counter | 384 points | Relay address | T / C000 to T / C27F | The relay address of the timer and the counter is shared. The same address cannot be used.<br>T000 to T17F(256points) : 100ms timer<br>T200 to T27F(128points) : 10ms timer<br>It is a subtraction type timer counter.<br>When present value (P***) becomes 0, it is turned on. | Cleared |
| | | Byte register | T / C00L / H to T / C27F | | |
| | | Word register | T / C00W to T / C27W | | |
| Edge Relay | 256 points | Relay address | E000 to E17F | It is used as a standing up differentiation contact. | Cleared |
| | | Byte register | E00L / H to E17L / H | | |
| | | Word register | E00W to E17W | | |
| Special relay | 240 points | Relay address | A000 to A16F | It is a function relay such as Clocks, operation flags, and the scan time.<br>A03L : Scan time (mS)<br>A10L to A13L<br>: Calender(When option is installed) | Cleared |
| | | Byte register | A00L / H to A16L / H | | |
| | | Word register | A00W to A16W | | |

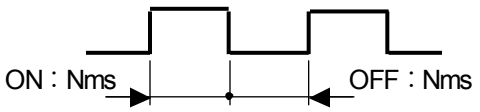
The following register area is prepared in TCmini.

| Type | Number of point | Form of description | | Function | Hold |
|---|---|---|---|---|---|
| Data register 1280 words | 416 words | Word register | D000 to D11F<br>D800 to D97F | It is a data storage area.<br>Whenthe power failure is occur, state is not held. | Cleared |
| | 96 words | Word register | D120 to D17F | It is an area where a special function is achieved.(Setting of panel and communication, analog input etc. | Cleared |
| | 240 words | Word register | D200 to D36F | It is backup area (Data is held by EEPROM).<br>It is used for the memory of the user parameter etc. | Hold |
| | 16 words | Word register | D370 to D37F | It is backup area (Data is held by EEPROM)<br>It is used for the operation control of TCmini. | Hold |
| | 512 words | Word register | D400 to D77F | It is an area held at time equipped with the battery of the option. (It is not held when there is no battery. ) | Hold |
| Timer & Counter set value register | 384 words | Word register | V000 to V27F | Set value of the timers & counters is stored. | Cleared |
| Timer & Counter present value register | 384 words | Word register | P000 to P27F | Present value of the timers & counters is stored. | Cleared |

## 11.2 Special relay

The following functions are provided in the special relay described like“A***”.

| Type | Address | Name | Function |
|---|---|---|---|
| Operation flag | A000 | Carry flag | When carry or borrow is generated by the operation, it is turned on. |
| | A002 | Overflow flag | When overflow is generated by the operation, it turns it on. |
| | A006 | Zero flag | When the operation result is 0, it turns it on. |
| | A007 | Sign flag | When MSB of the operation result is 1, it turns it on. |
| System flag | A009 | Calendar start flag | Present time is reflected in the calendar register. |
| | A00A | Calendar setting flag | When time is set to the calendar register, it is turned on. |
| Alarm flag | A011 | Battry abnormal flag | When the battery voltage decreases, it is turned on when the battery of the option is installed. |
| Scan time | A03L | Scan time | The scanning time is indicated by the BIN data whose m s is unit. |
| 50ms Clock | A038 | 50ms Clock | Standard Clock : A038 (50ms)   |
| | A039 | 100ms Clock | |
| | A03A | 200ms Clock | |
| | A03B | 400ms Clock | |
| | A03C | 800ms Clock | |
| | A03D | 1.6s Clock | |
| | A03E | 3.2s Clock | |
| | A03F | 6.4s Clock | |
| 10ms Clock | A040 | 10ms Clock | Standard Clock : A040 (10ms)   |
| | A041 | 20ms Clock | |
| | A042 | 40ms Clock | |
| | A043 | 80ms Clock | |
| | A044 | 160ms Clock | |
| | A045 | 320ms Clock | |
| | A046 | 640ms Clock | |
| | A047 | 1.2s Clock | |
| 100ms Clock | A048 | 100ms Clock | Standard Clock : A048 (100ms)   |
| | A049 | 200ms Clock | |
| | A04A | 400ms Clock | |
| | A04B | 800ms Clock | |
| | A04C | 1.6s Clock | |
| | A04D | 3.2s Clock | |
| | A04E | 6.4s Clock | |
| | A04F | 12.8s Clock | |
| 1s Clock | A050 | 1s Clock | Standard Clock : A050 (1s)   |
| | A051 | 2s Clock | |
| | A052 | 4s Clock | |
| | A053 | 8s Clock | |
| | A054 | 16s Clock | |
| | A055 | 32s Clock | |
| | A056 | 64s Clock | |
| | A057 | 128s Clock | |
| 10s Clock | A058 | 10s Clock | Standard Clock : A058 (10s)   |
| | A059 | 20s Clock | |
| | A05A | 40s Clock | |
| | A05B | 80s Clock | |
| | A05C | 160s Clock | |
| | A05D | 320s Clock | |
| | A05E | 640s Clock | |
| | A05F | 1280s Clock | |

| Type | Address | Name | Function |
|---|---|---|---|
| User Clock | A06L | Nms Clock setting | The Clock cycle of A068 is set by the unit of 2ms. |
| Nms Clock | A068 | Nms | Clock of user definition set in A06L<br>  <br> |
| | A069 | 2Nms | |
| | A06A | 4Nms | |
| | A06B | 8Nms | |
| | A06C | 16Nms | |
| | A06D | 32Nms | |
| | A06E | 64Nms | |
| | A06F | 128Nms | |
| Calendar (It is effective only to install the option.) | A10L | Second register | Data of present time is shown by the BCD data.<br><br>The day of the week code<br>Sunday : 00H, Monday : 01H, Tuesday : 02H, Wednesday : 03H, Thursday : 04H, Friday : 05H, Saturday : 06H |
| | A10H | Minute register | |
| | A11L | Time register | |
| | A11H | Dayregister | |
| | A12L | Month register | |
| | A12H | Year register | |
| | A13L | Day of the week register | |

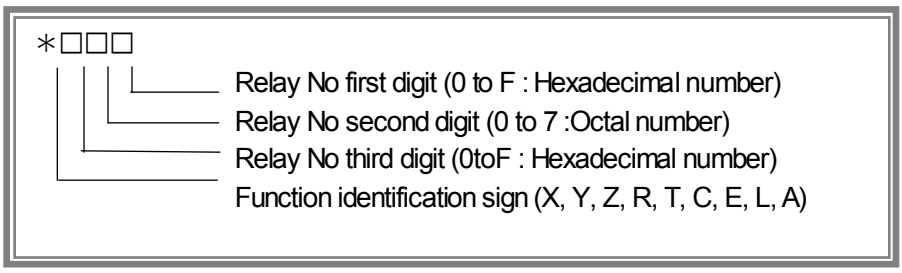
| Type | Address | Name | Function | |
|---|---|---|---|---|
| Communication status | Address | Inverter connection | Remote I / O connection | PLC Link connection |
| | A160 | Turning On when Ch1 : No.1 is connecting | Turning On when Ch1 : panel is connecting | Turning On when Ch1 : station No.0 is connecting |
| | A161 | Turning On when Ch1 : No.2 is connecting | Turning On when Ch1 : station No.1 is connecting | Turning On when Ch1 : station No.1 is connecting |
| | A162 | Turning On when Ch1 : No.3 is connecting | Turning On when Ch1 : station No.2 is connecting | Turning On when Ch1 : station No.2 is connecting |
| | A163 | Turning On when Ch1 : No.4 is connecting | Turning On when Ch1 : station No.3 is connecting | Turning On when Ch1 : station No.3 is connecting |
| | A164 | - | Turning On when Ch1 : station No.4 is connecting | - |
| | A165 | - | Turning On when Ch1 : station No.5 is connecting | - |
| | A166 | - | Turning On when Ch1 : station No.6 is connecting | - |
| | A168 | Turning On when Ch2 : No.1 is connecting | Turning On when Ch2 : station No.1 is connecting | Turning On when Ch2 : station No.0 is connecting |
| | A169 | Turning On when Ch2 : No.2 is connecting | Turning On when Ch2 : station No.1 is connecting | Turning On when Ch2 : station No.1 is connecting |
| | A16A | Turning On when Ch2 : No.3 is connecting | Turning On when Ch2 : station No.2 is connecting | Turning On when Ch2 : station No.2 is connecting |
| | A16B | Turning On when Ch2 : No.4 is connecting | Turning On when Ch2 : station No.3 is connecting | Turning On when Ch2 : station No.3 is connecting |
| | A16C | - | Turning On when Ch2 : station No.4 is connecting | - |
| | A16D | - | Turning On when Ch2 : station No.5 is connecting | - |
| | A16E | - | Turning On when Ch2 : station No.6 is connecting | - |

## 11.1 Content of addressing

In TCmini, memory address and relay address are disclimbed in following format.

### 11.1.1 Relay address

Relay address is written by the following format.

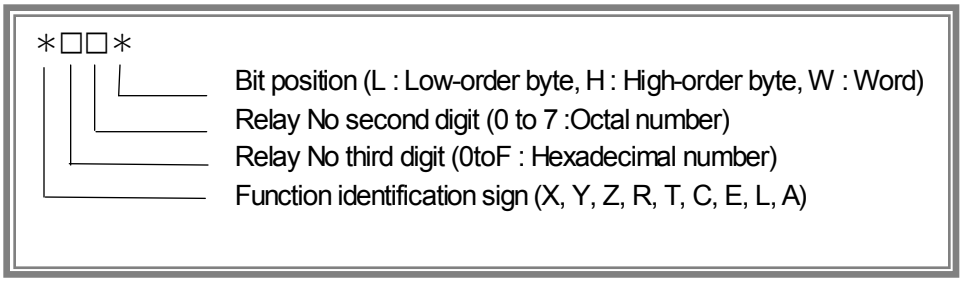



Note

Second digit of relay No is octal number.The following of R07F become R100.
I / O relays X / Y are allocated to actual hardware.The area without hardware is displayed by Z.
It is inputted by Y.

### 11.1.2 Register address

The area that the relay uses can be described the unit of the byte or word. In that case, register address is described by the following form.




Example

Word display and Byte display of 16 bits (X010 to X01F) is shown as follows.

MSB LSB

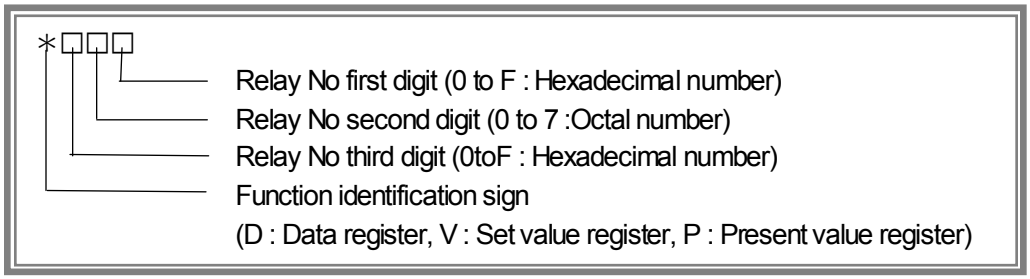
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X01W | X01F | X01E | X01D | X01C | X01B | X01A | X019 | X018 | X017 | X016 | X105 | X014 | X103 | X012 | X011 | X010 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X01H | X017 | X016 | X105 | X014 | X103 | X012 | X011 | X010 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X01L | X01F | X01E | X01D | X01C | X01B | X01A | X019 | X018 |

11.1.3 Data register address

Address of Data register, and register of presen tvalue or set value of Timer and Counter is written by the following format.

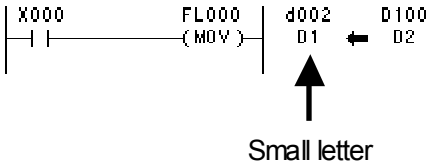



Example : Set value register of T050 is V050, and present value register is P050.

## 11.2 Indirect addressing

A consecutive address like the table below is allocated to the memory of TCmini. When the head of the register is input by the small letter at the operation instruction, the indirect addressing specification that refers to this address can be done. In this case, the referred address becomes a value in each byte. It is necessary to specify the even number twice when using it as a unit of the word.

Example : When D002 is used by indirect addressing

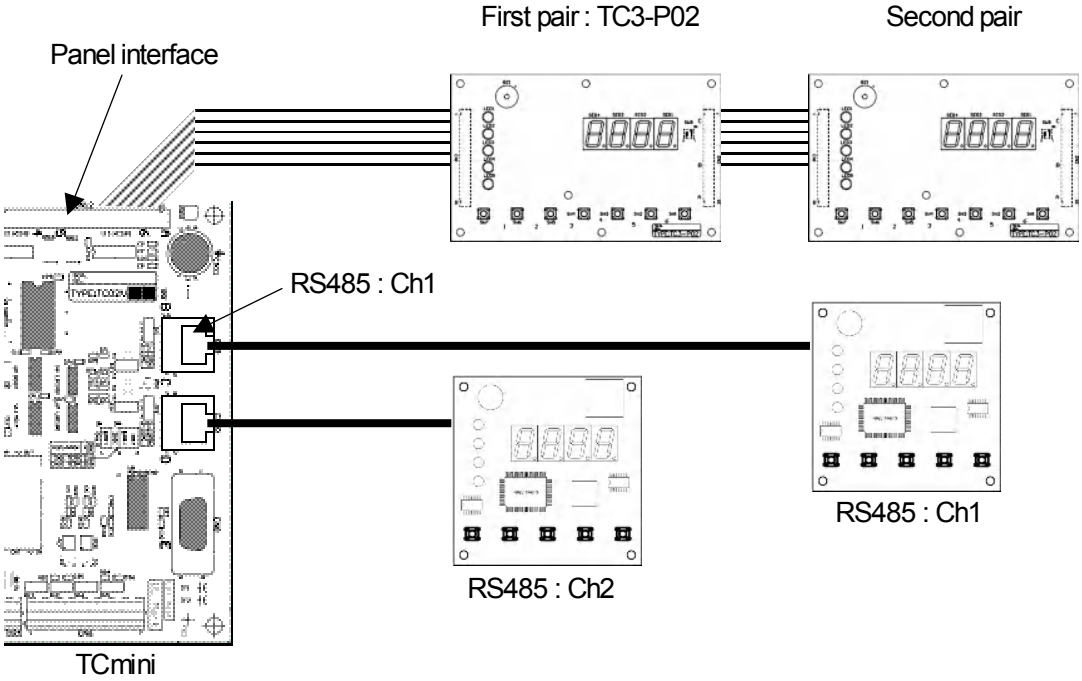



When the value of D002 is 32, the content of D100 is transmitted to D010.

| Address | Correspondence register | Division | Address | Correspondence register | Division |
|---|---|---|---|---|---|
| 0<br>2<br>4<br>to<br>30<br><br>32<br>to<br>2558 | D000<br>D001<br>D002<br>to<br>D00F<br><br>D010<br>to<br>D97F | D register<br><br>1280 words<br>2560 byte | 12544<br>12546<br>12548<br>to<br>12558<br><br>12560<br>to<br>12670 | R00W<br>R01W<br>R02W<br>to<br>R07W<br><br>R10W<br>to<br>R77W | R register<br><br>64 words<br>128 byte |
| 4096<br>4098<br>4100<br>to<br>4126<br><br>4128<br>to<br>4862 | P000<br>P001<br>P002<br>to<br>P00F<br><br>P010<br>to<br>P27F | P register<br><br>384 words<br>768 byte | 12672<br>12674<br>12676<br>to<br>12688<br><br>12690<br>to<br>12718 | T / C00W<br>T / C01W<br>T / C02W<br>to<br>T / C07W<br><br>T / C10W<br>to<br>T / C27W | T / C register<br><br>24 words<br>48 byte |
| 6144<br>6146<br>6148<br>to<br>6174<br><br>6176<br>to<br>6908 | V000<br>V001<br>V002<br>to<br>V00F<br><br>V010<br>to<br>V27F | V register<br><br>384 words<br>768 byte | 12736<br>12738<br>12740<br>12742<br>12744<br>12746<br>12748<br>12750 | L00W<br>L01W<br>L02W<br>L03W<br>L04W<br>L05W<br>L06W<br>L07W | L register<br><br>8 words<br>16byte |
| 12288<br>12290<br>12292<br>to<br>12302<br><br>12304<br>to<br>12542 | X / Y00W<br>X / Y01W<br>X / Y02W<br>to<br>X / Y07W<br><br>X / Y10W<br>to<br>X / YF7W | X / Y register<br><br>128 words<br>256 byte | 12768<br>12770<br>12772<br>12774<br>12776<br>12778<br><br>12796 | A00W<br>A01W<br>A02W<br>A03W<br>A04W<br>A05W<br><br>A16W | A register<br><br>15 words<br>30 byte |

# 12. Panel support function

The TC mini-can support the display of 8 panels in total. (6 pairs by way of RS485, 2 pairs by direct connection. 7segment of each panel is possible up to 7 digits.)




## 12.1 Panel support register

The display setting of each pair is done with D16D & D16E, D40D & D40E, and D42D & D42E.
The table below shows the register that relates to 7 segment display of the panel.

| Item | Panel interface | | RS485 Ch1 | | RS485 Ch2 | |
|---|---|---|---|---|---|---|
| | First pair | Second pair | First pair | Second pair | First pair | Second pair |
| Panel setting register | D16D | D16E | D40D | D40E | D42D | D42E |
| Numeric value data register 1 | D161 & D160 | D166 & D165 | D400 & D401 | D406 & D405 | D420 & D421 | D426 & D425 |
| Numeric value data register 2 | D162 | D167 | D402 | D407 | D422 | D427 |
| Numeric value data register 3 | D163 | D168 | D403 | D408 | D423 | D428 |
| Numeric value data register 4 | D164 | D169 | D404 | D409 | D424 | D429 |
| Character code register | D170 to D176 | D177 to D17D | D410 to D416 | D417 to D41D | D430 to D436 | D437 to D43D |

12.1.1 Panel setting register

The register corresponding to the display is allocated.

12.1.2 Numeric value data register

The BIN numerical value input to the specified register is displayed in 7segments.

12.1.3 Character code register

When character code is input to a prescribed register, the alphabet and numeric character is displayed in 7segments. The display of the decimal point and the flicker of the numerical value can be done by this register.

## 12.2 Setting of 7segment display

The number of display digits and the correspondence register of the panel are set according to the value of a set register. The number of display digits depends on the specification of the panel.

| Display digit | | Numeric data register 4 | Numeric dataregister 3 | Numeric dataregister 2 | Numeric dataregister 1 | Setting register | |
|---|---|---|---|---|---|---|---|
| Panel interface | First pair | D164 | D163 | D162 | D161 & D160 | D16D | |
| | Second pair | D169 | D168 | D167 | D166 & D165 | D16E | |
| RS485 Ch1 | First pair | D404 | D403 | D402 | D401 & D400 | D40D | |
| | Second pair | D409 | D408 | D407 | D406 & D405 | D40E | |
| RS485 Ch2 | First pair | D424 | D423 | D422 | D421 & D420 | D42D | |
| | Second pair | D429 | D428 | D427 | D426 & D425 | D42E | |
| 7 digit | | | | | -999999 to 999999 | -32544 | 80E0H |
| 7 digits 1digit after decimal point | | | | | -99999.9 to 99999.9 | -32536 | 80E8H |
| 7 digits 2digits after decimal point | | | | | -9999.99 to 9999.99 | -32528 | 80F0H |
| 2+5 digits | | | | 0 to 99 | 0 to 99999 | -30560 | 88A0H |
| 1+2+4 digits | | | 0 to 9 | 0 to 99 | 0 to 9999 | -30592 | 8880H |
| 1+3+3 digits | | | 0 to 9 | 0 to 999 | 0 to 999 | -29600 | 8C60H |
| 1+3+3 digits | | | 0 to 9 | 0 to 99.9 | 0 to 99.9 | -29336 | 8D68H |
| 1+3+3 digits | | | 0 to 9 | 0 to 9.99 | 0 to 9.99 | -29072 | 8E70H |
| 2+2+3 digits | | | 0 to 99 | 0 to 99 | 0 to 999 | -26528 | 9860H |
| 1+1+1+4 digits | | 0 to 9 | 0 to 9 | 0 to 9 | 0 to 9999 | -31616 | 8480H |
| 1+1+2+3 digits | | 0 to 9 | 0 to 9 | 0 to 99 | 0 to 999 | -30496 | 8860H |
| 1+2+2+2 digits | | 0 to 9 | 0 to 99 | 0 to 99 | 0 to 99 | -26560 | 9840H |

## 12.3 Numeric value data register

The register that displays the BIN data in 7segment is prepared in TCmini (numeric value data). It is displayed only by forwarding the value that wants to be displayed to the register. Moreover, the following functions are provided in a numeric display.

| Numeric value data register | | Numeric value data 4 | Numeric value data 3 | Numeric value data 2 | Numeric value data 1 |
|---|---|---|---|---|---|
| Panel interface | First pair | D164 | D163 | D162 | D161 & D160 |
| | Second pair | D169 | D168 | D167 | D166 & D165 |
| RS485 Ch1 | First pair | D404 | D403 | D402 | D401 & D400 |
| | Second pair | D409 | D408 | D407 | D406 & D405 |
| RS485 Ch2 | First pair | D424 | D423 | D422 | D421 & D420 |
| | Second pair | D429 | D428 | D427 | D426 & D425 |

12.3.1 Zero suppression

When "50" is forwarded to the numeric data register at 4 digits in the number of display digits, the display becomes not "0050" but "  50".

12.3.2 Decimal point display

When "9" is forwarded to the numeric data register when "80F0H" (7 digits, 2digits after decimal point) is set to a set register, it is displayed as "0.09".

## 12.4 Caracter code register

14 words from D170 to D17D can display the character-code in each digit of 7segment. Moreover, it can be exclusively displayed as the value of a numeric data register, and can display the decimal point at an arbitrary position.

12.4.1 Relation between character code register and display position

Panel connected directly

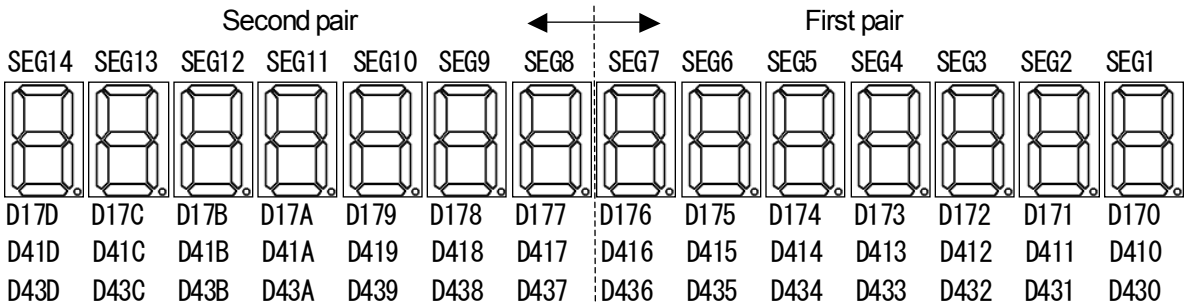
First pair D170 to D176, Secondpair D177 to D17D

Panel connected RS485 Ch1

First pair D410 to D416 , Second pair D417 to D41D

Panel connected RS485 Ch2

First pair D430 to D436, Second pair D437 to D43D

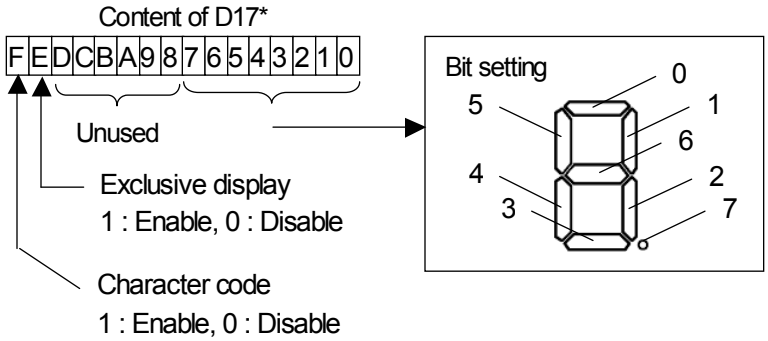



Note

Segment number is different depending on the composition of the panel. Please refer to specifications of the panel.

12.4.2 Content of character code register

When you display the character-code, please set Fbit of the register of the corresponding digit to "1", and store the code displayed from 0 to 7bit. The character code register is given priority more than the display of a numeric data register and displayed.




Bit F : Enable and Disable of the character code display are specified.
(1 : Enable, 0 : Disable)

Bit E : Effective and the invalidity of the exclusive display function of the character code and the numerical value are specified.
(1 : Enable, 0 : Disable)

Bit D to 8 : Unused (It assumes it to 0. )

Bit 7 to 0 : LED of each segment is operated. (1 : Lighting, 0 : turned off.)

12.4.3 Table for character-code

When the following value is forwarded to the character-code register, the corresponding character is displayed.

| Display | Character | Value | Display | Character | Value | Display | Character | Value | Display | Character | Value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 803FH | | A | 8077H | | k | 8074H | | U | 803EH |
| | 1 | 8006H | | b | 807CH | | L | 8038H | | v | 801CH |
| | 2 | 805BH | | C | 8039H | | M | 8037H | | y | 806EH |
| | 3 | 804FH | | d | 805EH | | n | 8054H | | - | 8040H |
| | 4 | 8066H | | E | 8079H | | O | 805DH | | Γ | 8021H |
| | 5 | 806DH | | F | 8071H | | P | 8073H | | ⌋ | 800CH |
| | 6 | 807DH | | G | 803DH | | q | 8067H | | = | 8048H |
| | 7 | 8007H | | H | 8076H | | r | 8050H | | | |
| | 8 | 807FH | | I | 8030H | | S | 806DH | | . | 8080H |
| | 9 | 806FH | | J | 801FH | | T | 8078H | | | 8000H |

12.4.4 Dicimalpoint display

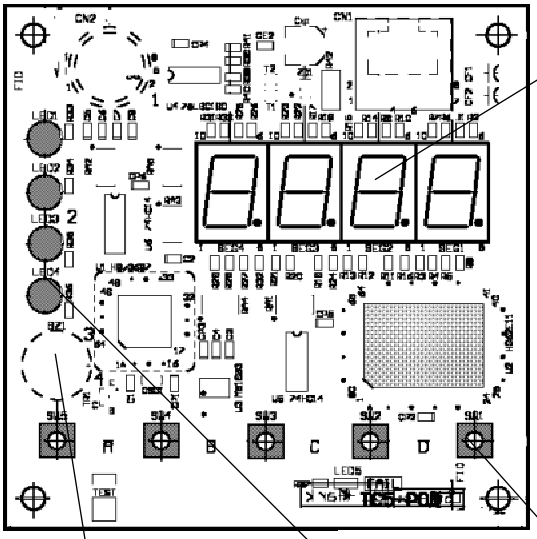
When the decimal point and the numeric character data of the character-code are exclusively displayed, "C080H" is forwarded to the character-code register of the corresponding digit.

12.4.5 Fricker(brinking) display of Numeric value

When you want to blink the numeric data display, "0000H" and "8000H" are alternately forwarded to the character-code register of the corresponding digit at the cycle that wants to blink.

## 12.5 Handling example of TC01P

The allocation content of the register of each I / O of TC01P is shown




| Item | RS485 Ch1 | RS485 Ch2 |
|---|---|---|
| | First pair | First pair |
| Panel setting register | D40D | D42D |
| LED output | Z220 to Z223 | Z920 to Z923 |
| Key SW input | Z200 to Z224 | Z900 to Z904 |
| Buzzer output | Z224 | Z924 |
| Numeric data register 1 | D400 & D401 | D420 & D421 |
| Character code register | D410 to D413 | D430 to D433 |

### 12.5.1 Address of panel

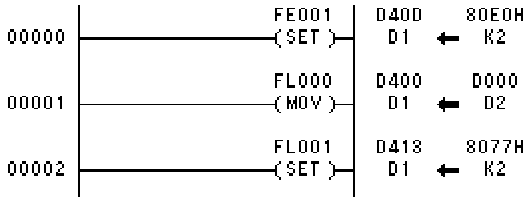
When "80E0H" is set to set register D40D, 7segment display can display the numeric value of D410 or character code of D413 of D400.

Character code register → D413 D412 D411 D410

Setting register : D40D
Numeric data : D400

### 12.5.2 Program example.1

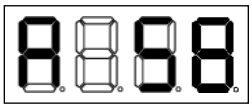
Program that displays "A" in the first digit, and displays numerical value in the remainder digit




"80E0H" is set to set register D40D.

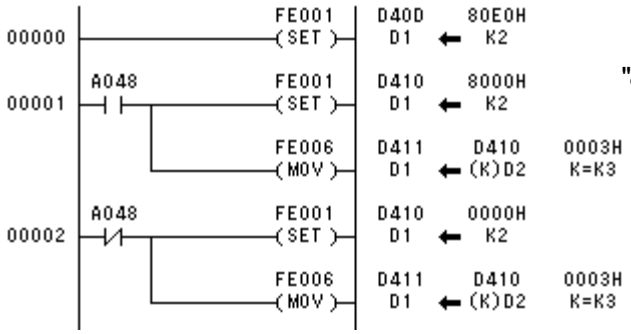
The value of D000 is forwarded to numeric register D400.

"8077H" is set to character code register D413.

Display  When you set “58” to D000 by the BIN data

### 12.5.3 Program example.2

Program that blinks display numerical value

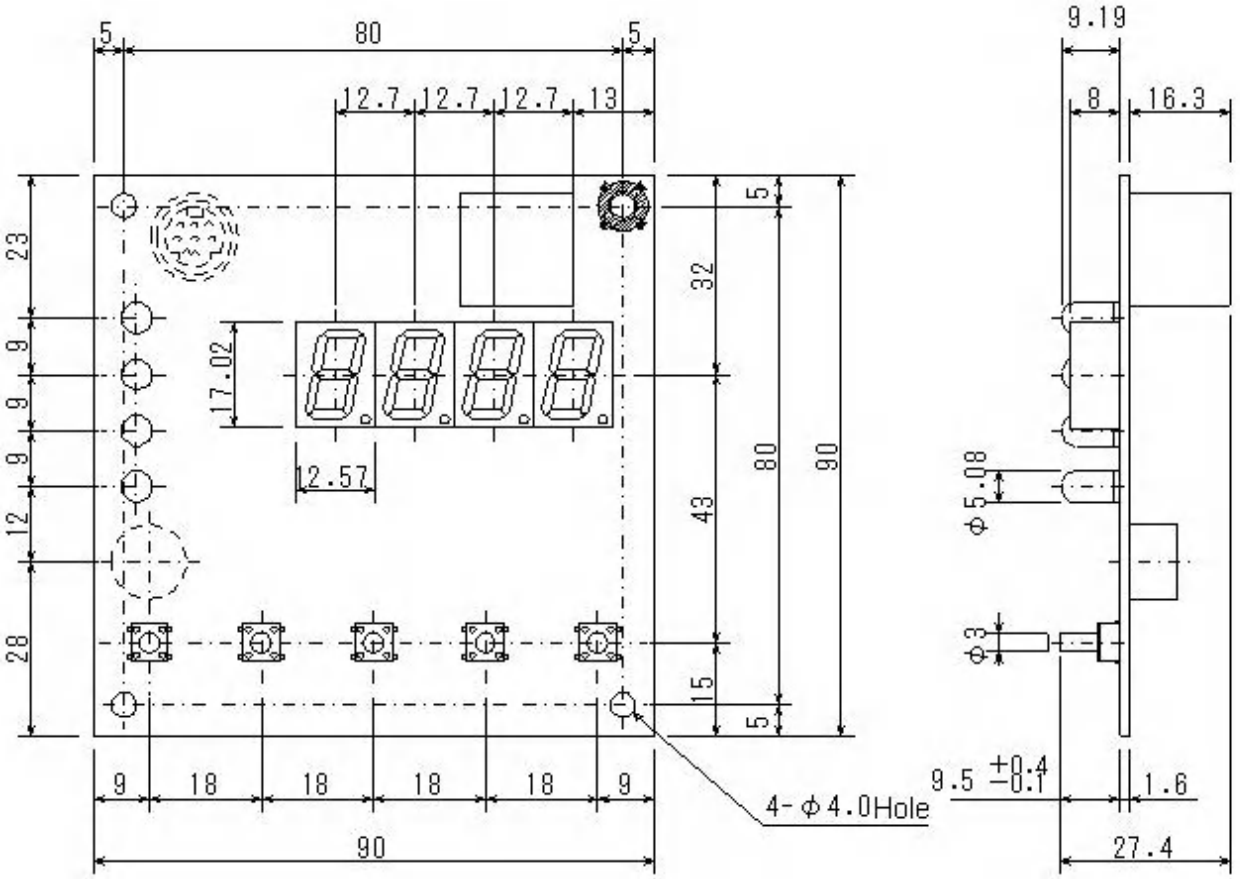



"80E0H" is set to set register D40D.

When A038 is turned on, "8000H" is set from D410 to D413.

When A038 is turned off, "0000H" is set to D410 to D413.

## 12.6 Extarnal ddimensions of TC01P



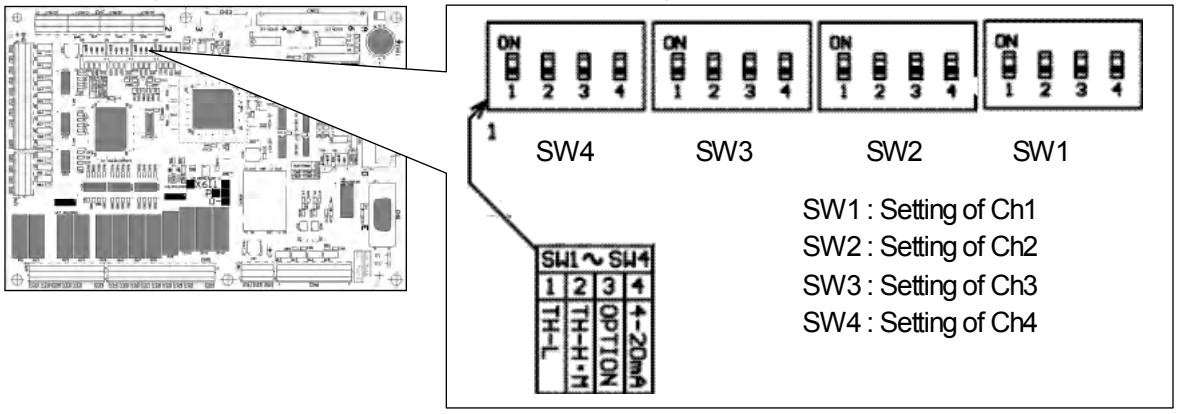

The installation screw must use M3. ( Length is arbitrary.)

# 13. Analogue input function

When you use the analog input, please set a set switches on the surface of the substrate and the value of analog input setting register (D157&D15F).

## 13.1 Switches on substrate

When the analog input is used, SW of each Ch is set according to the kind of the input.




| Analogue input | Input range | Setting of SW1 to SW4 | | | | D157 D15F | Resistance value | Recommended thermistor (Made by Sibaura Electronics) |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | | | |
| Thermistor Low temperature | -50 to 60 degrees Celsius | ON | OFF | OFF | OFF | 2 | 10 kΩ | PBN-36 |
| Thermistor Medium temperature | -50 to 60 degrees Celsius | OFF | ON | OFF | OFF | 1 | 3.09 kΩ | PBN-36 |
| Thermistor High temperature | -20 to 298 degrees Celsius | OFF | ON | OFF | OFF | 0 | 3.09 kΩ | PTN-51F |
| 4-20mA | 4-20mA | OFF | OFF | OFF | ON | 6 | - | - |
| 0-5V | 0-5V | OFF | OFF | OFF | OFF | 7 | - | - |

## 13.2 Setting register

When analog input setting register D157･D15F is set, the value suitable for the input kind from D158 to D15B is obtained.

D157 : All channels are changed to the same setting.

D15F : Each channel is individually set.

### 13.2.1 Content of D157

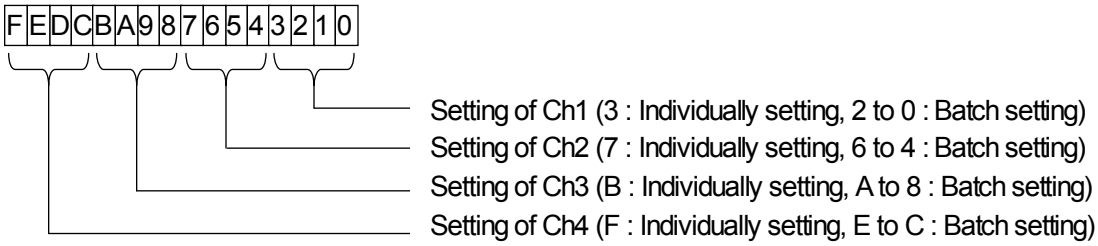
The reading value of D153 to D150 is converted by the value of D157, and the conversion value of D15B to D158 is obtained. The setting of D157 is reflected in all channels.

| Analogue input | Content of D157 | Input range | D158 to D15B Converted value | Setting of SW1 to SW4 | | | |
|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 |
| Thermistor Low temperature | 2 | -50 to 60 degrees Celsius | -500 to 600 | ON | OFF | OFF | OFF |
| Thermistor Medium temperature | 1 | -50 to 60 degrees Celsius | -500 to 600 | OFF | ON | OFF | OFF |
| Thermistor High temperature | 0 | -20 to 298 degrees Celsius | -200 to 2980 | OFF | ON | OFF | OFF |
| 4-20mA | 6 | 4-20mA | 0 to 1000 | OFF | OFF | OFF | ON |
| 0-5V | 7 | 0-5V | 0 to 1000 | OFF | OFF | OFF | OFF |

13.2.2 Content of D15F

D15F can individually set the content of the conversion of each channel.

Analogue input setting register (D15F)




If top bit of each setting (Ch1 : 3) is turned on, the setting by this register becomes effective.
If top bit is turned off, the setting of the Ch becomes a content of D157 set.

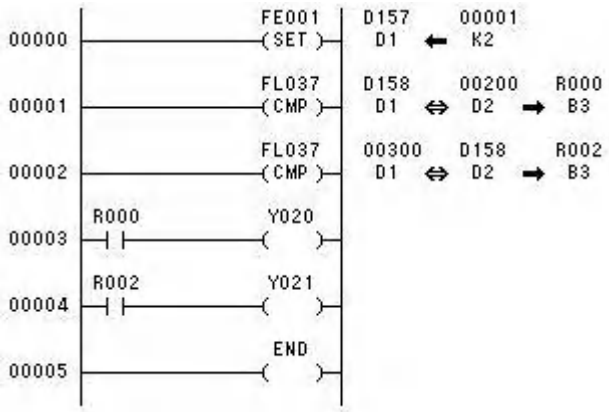
| Analogue input | Bit position of D15F | | | | | Input range | D158 Converted value |
|---|---|---|---|---|---|---|---|
| Setting of Ch1 | 3 | 2 | 1 | 0 | | | |
| Setting of Ch2 | 7 | 6 | 5 | 4 | | | |
| Setting of Ch3 | B | A | 9 | 8 | | | |
| Setting of Ch4 | F | E | D | C | Value | | |
| Setting of D157 | 0 | 0 | 0 | 0 | 0H | - | - |
| Thermistor Low temperature | 1 | 0 | 1 | 0 | AH | -50 to 60 degrees Celsius | -500 to 600 |
| Thermistor Medium temperature | 1 | 0 | 0 | 1 | 9H | -50 to 60 degrees Celsius | -500 to 600 |
| Thermistor High temperature | 1 | 0 | 0 | 0 | 8H | -20 to 298 degrees Celsius | -200 to 2980 |
| 4-20mA | 1 | 1 | 1 | 0 | EH | 4-20mA | 0 to 1000 |
| 0-5V | 1 | 1 | 1 | 1 | FH | 0-5V | 0 to 1000 |

13.2.3 Setting example of D15F

The program example when Ch1 is set in the high temperature of the thermistor, Ch2 is set in the low temperature of the thermistor, Ch3 is set to 4-20mA, and Ch4 is set to the content of D157 is shown.

13.2.4 Sample program using analoge input

All channels are set to the thermistor middle temperature, and the temperature of the thermistor connected with Ch1 is examined, and if it is 20 degrees or less, Y020 (heater) is turned on, and if it is 30 degrees or more, the program that turns on Y021 (air conditioner) is shown.




All Channel : Thermistor middle temperature

Is D158 20 degrees Celsius or less?
Is D158 30 degrees Celsius or more?

If it is 20 degrees Celsius or less, Y020 is turned on.

If it is 30 degrees Celsius or more, Y021 is turned on.