# TOHO ELECTRONICS INC.

## BOARD TYPE DIGITAL CONTROLLER TTM-10L SERIES INSTRUCTION MANUAL

Thank you for purchasing model TTM-10L series Digital Process Controller.
Please go through this Instruction Manual carefully and use the unit in proper manner.

## 1. NOTICE/WARNING BEFORE USAGE

・When having the controller in hand,please confirm the correct model and optional function for your purchase. Please refer to ”8. ORDERING INFORMATION” for details of model.
・The following symbol marks are used in this Instruction Manual for handling this model safely.

| | |
|---|---|
| ⚠WARNING | In case of mishandling, serious dangers may occur to the operator such as death, electrocution and a skin burn. |
| ⚠CAUTION | In case of mishandling, it may cause some damages to the unit or the operator getting slight injury. |

⚠CAUTION

・Do not push the keys by sharp points for prevention of its malfunction.

⚠WARNING

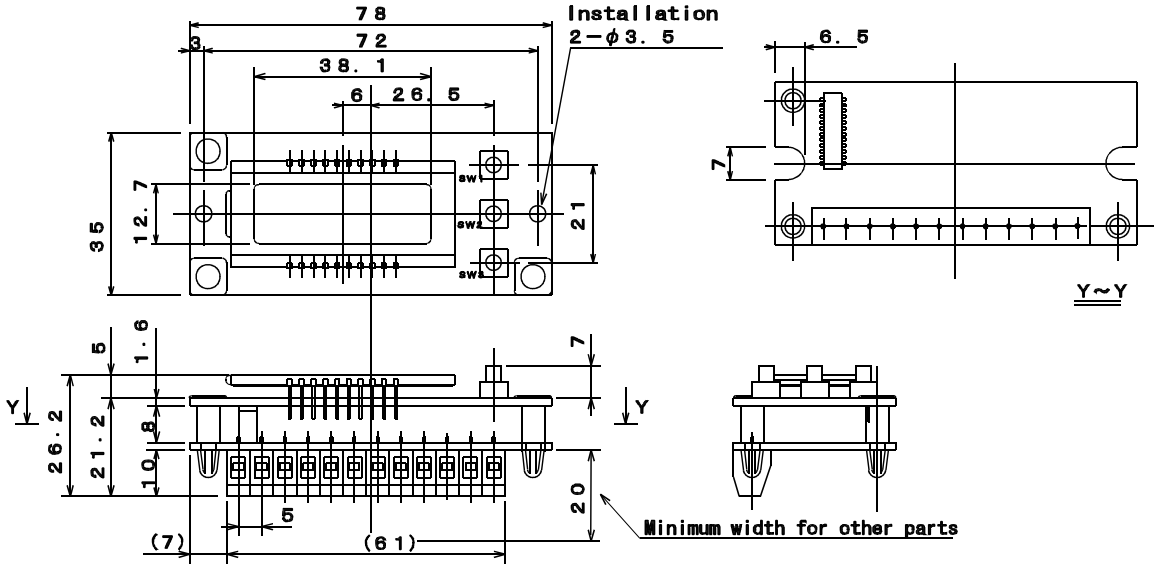
・Make sure the correct wiring connection before turning on electricity. Mis-wiring may cause malfunction of the unit and may cause a fire.
・Never remodel the unit to prevent malfunction of unit and fire.

## 2. PARTS INDICATION

2.1 OPERATION KEYS
a) ＳＷ１ : MODE key. ・・・・・Change Each Mode/Parameter.
b) ＳＷ２ : Up key ・・・・・・Up Setting Value or Change setting.
c) ＳＷ３ : Down key ・・・・・Down Setting Value or Change setting.

## 3. OUTER DIMENSIONS

3.1 OUTER DIMENSIONS




3.2 LOCATION OF THE UNIT SETTING

Install the unit at the following proper locations:-

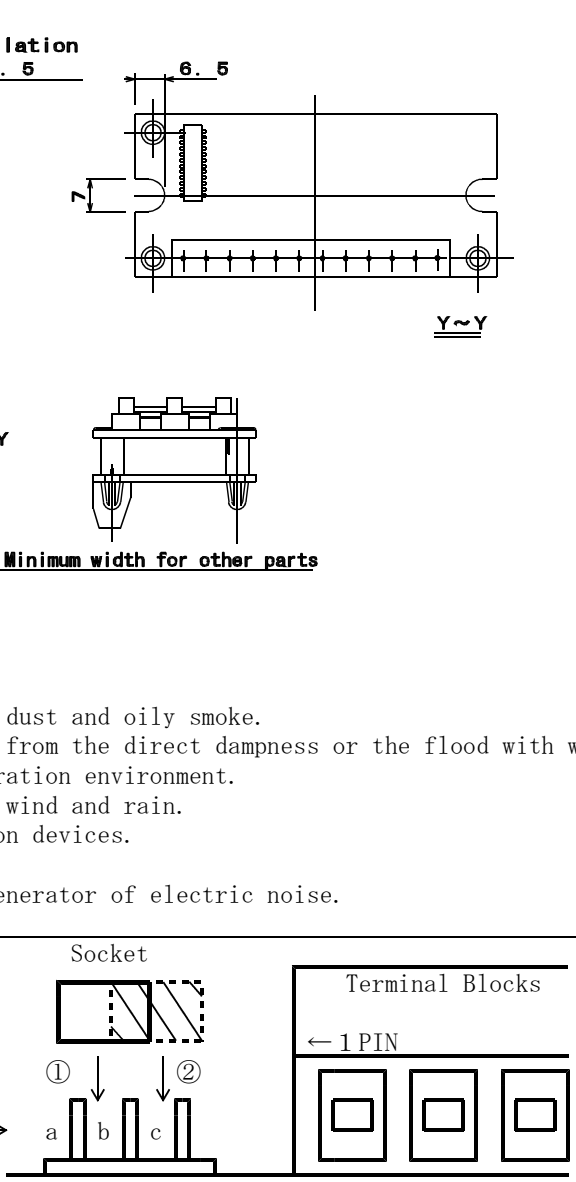
a) Away from the gas of sulfide and corrosion.
b) Less mechanical vibration and shock.
c) Temperature and Humidity being within the limit of operation environment.
d) Away from the direct sunshine and not to be exposed by wind and rain.
e) Far away from the equipments using high-voltage ignition devices.
f) Away from the influence of electromagnetic field.
g) Away from High-Voltage wire, welding machine and the generator of electric noise.
h) Less dust and oily smoke.
i) Away from the direct dampness or the flood with water.

## 4. WIRING METHOD

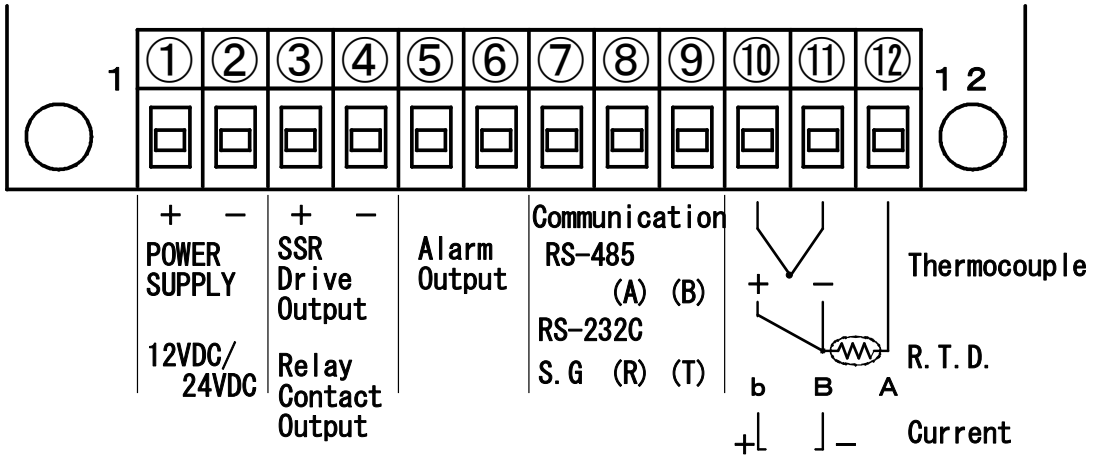
4.1 CHANGE OF POWER SUPPLY.

The change of Power supply is available to select with the following plugs a,b and c.

① :Short circuit socket fixed to a and b.:12VDC
② :Short circuit socket fixed to b and c.:24VDC



4.2 TERMINAL CONNECTION DRAWING




4.3 CAUTION FOR WIRING CONNECTION

- Wiring material with resistance less than 5 Ω per wire should be used to connect R.T.D. with this unit.
- The Specified extension lead wire or the wire itself should be used to connect thermocouple with this unit as wiring material.
- In case this unit should be used close to the noise generators, please use shield-wires.
  Please do not wire the Input/Output lines inside of the same duct and the pipes of electric wires.
- The signal wire of Input/Output should be away from power supply and loaded lines at least 50cm.

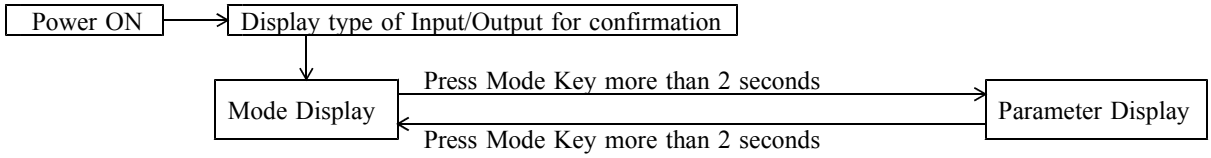
**⚠ WARNING** · For prevention of electric shock, please do wiring connection only after turning off Power.

**⚠ CAUTION** · This unit does not function for approx. 4 seconds after turning on Power. (No function at Output side)

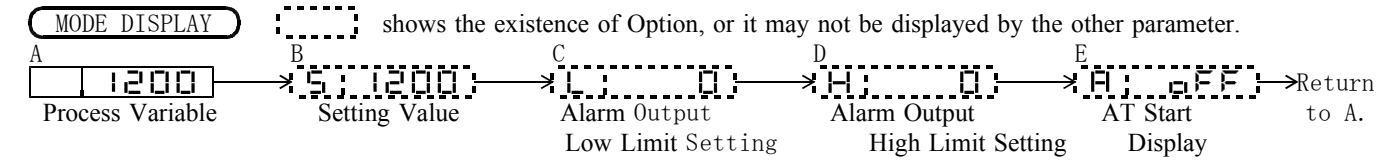
- For prevention of mis wiring, please make sure to confirm the name labels i.e. Input terminal and Power source terminal etc. beside the each wire.

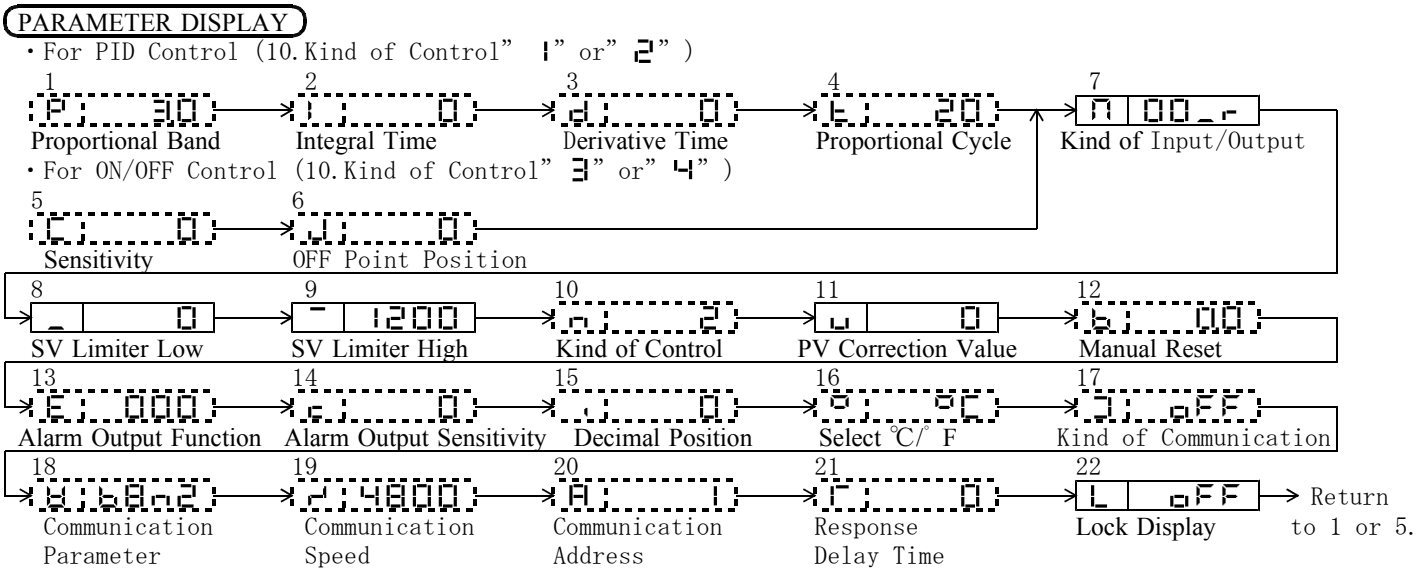
## 5. OPERATE FLOW AND PARAMETER INFORMATION

5.1 METHOD TO CHANGE EACH DISPLAY




5.2 OPERATE FLOW



5.3 OTHER DISPLAY INDICATIONS

- ----: Shown whenever Input value exceeds the High limit of Display range, or the snapping of the Input line.
- ----: Shown whenever Input value exceeds the Low limit of Display range, or the snapping of the Input line at 4-20mA.
- Err0: Shown for Memory error. Please contact us for repairing service.
- Err1: Shown for A/D converter error. Please contact us for repairing service.
- Err2: Shown for Auto-tuning error,Push any keys for resetting this display.
- LoC: Shown when Parameter being changed during Key lock.
- AT: Shown during Auto-tuning.

5.4 INFORMATIONS FOR EACH PARAMETER

・MODE Display

| | Character Indications | Descriptions | Initial Value | Display conditions & Remarks |
|---|---|---|---|---|
| A | Process Variable | | | Normal Display after the Input of Power |
| B | S Setting Value | Setting range:SV Limiter Low (_) ～ SV Limiter High (¯)<br>Setting unit :Thermocouple : 1℃ (°F)<br>R.T.D. :1／0.1℃ (°F)<br>Current : 1／0.1／0.01 | 0 | Shown on PID or ON/OFF control. |
| C | L Alarm Output Setting Low Limit | Setting range : Thermocouple : -1999～9999<br>R.T.D. : -199～999／-199.9～999.9<br>Current : -1999～9999／-199.9～999.9／-19.99～99.99<br>Setting unit : Same as that of **B.Setting Value.** | 0 | Shown when Alarm Output is installed and set at Low Limit Alarm Output or High/Low Limit Alarm Output. |
| D | H Alarm Output Setting High Limit | Setting range : Same as that of **C.Alarm Output Setting Low Limit.**<br>Setting unit : Same as that of **B.Setting Value.** | 0 | Shown when Alarm Output is installed and set at High Limit Alarm Output or High/Low Limit Alarm Output. |
| E | AT AT start display | Press UP/DOWN key more than 2 seconds for start/reset of Auto-tuning,(AT)<br>AT : on : Shown during AT.<br>AT : oFF : Shown without AT.<br>NORMAL & AT : Shown alternatively during A T. | oFF | Shown on PID control. |

PARAMETER DISPLAY

| | | | | |
|---|---|---|---|---|
| 1 | P Proportional Band | Setting range : 0.1～200.0 Setting unit : 0.1% | 30 | Shown on PID control. |
| 2 | I Integral Time | Setting range : 0～3600 Setting unit : 1 second | 0 | Shown on PID control. Integral operation OFF at I = 0 |
| 3 | d Derivative Time | Setting range : 0～3600 Setting unit : 1 second | 0 | Shown on PID control. Derivative operation OFF at d = 0 |
| 4 | t Output Proportional Cycle | Setting range : 1～120 Setting unit : 1 second | 20 | Shown on PID control. |
| 5 | C Output Sensitivity | Setting range : Thermocouple : 0～9999<br>R.T.D. : 0～999／0.0～999.9<br>Current : 0～9999／0.0～999.9／0.00～99.99<br>Setting unit : Same as that of above **B.Setting Value.** | 0 | Shown on ON/OFF control. |
| 6 | d OFF point position | Setting range : Same as that of above **C.Alarm Output Setting Low Limit.**<br>Setting unit : Same as that of above **B.Setting Value.** | 0 | Displays at ON/OFF control. |
| 7 | n Kinds of INPUT/ OUTPUT | n ＊＊_※<br>＊＊ Input Type: 00 K thermocouple; 01 J thermocouple; 02 E thermocouple; 03 T thermocouple; 04 R thermocouple; 05 S thermocouple; 06 N thermocouple; 07 W5Re/W26Re<br>＊＊ Input Type: 10 Pt100; 11 JPt100; 20 4-20mA DC<br>※ Output Type: r Relay contact output; P SSR Drive Output | therm-ocouple INPUT 00<br>4-20mDC INPUT 20 | The Kind of Output needs to be selected"r "or"P" before purchase.<br>The following Input types are NOT selective.<br>thermocouple ←→ 4-20mADC<br>R.T.D←→4-20mADC |

| | | | | |
|---|---|---|---|---|
| 8 | SV Limiter Low | For Thermocouple Input<br>Setting range: Full scale range of SV, but the difference with (‾) should be more than 50 ℃(˚ F).<br>For R.T.D. Input<br>Setting range: Full scale range of SV,but the difference with (‾) should be more than 5.0 ℃(˚ F).<br>For Current Input.<br>Setting range: Full scale range of SV, but the difference with (‾) should be more than 50 digit. | 0<br>-1000 | Shown at all cases. |
| 9 | SV Limiter High | For Thermocouple Input<br>Setting range: Full scale range of SV, but the difference with (_) should be more than 50 ℃(˚ F).<br>For R.T.D. Input<br>Setting range: Full scale range of SV, but the difference with (_) should be more than 5.0 ℃(˚ F).<br>For Voltage/Current Input.<br>Setting range: Full scale range of SV, but the difference with (_) should be more than 50 digit. | 1200<br>9000 | Shown at all cases. |
| 10 | Kind of Control | Kind of Control 1 : PID Control (Normal)<br>2 : PID Control (Reverse)<br>3 : ON/OFF Control (Normal)<br>4 : ON/OFF Control (Reverse) | 2 | During each control. |
| 11 | PV Correction Value | Setting range : Same as that of above **C.Alarm Output Setting Low Limit.**<br>Setting unit : Same as that of above **B.Setting Value.** | 0 | Shown at all cases. |
| 12 | Manual Reset | Setting range : 0.0～100.0<br>Setting unit : % | 0.0 | Shown on PID control. |
| 13 | Alarm Output Function | E * * *<br>ADDITIONAL FUNCTIONS<br>0 None<br>1 Alarm output hold<br>2 Stand-by sequence<br>3 Alarm output hold +Stand-by sequence<br>TYPE OF PV Alarm OUTPUT<br>0 None<br>1 Deviation high/low limit<br>2 Deviation high limit<br>3 Deviation low limit<br>4 Deviation high and low limit range<br>5 Absolute value high/low limit<br>6 Absolute value high limit<br>7 Absolute value low limit<br>8 Absolute value high and low limit range<br>TYPE OF ABNORMAL Alarm OUTPUT<br>0 None<br>1 PV Abnormal Alarm output | 000 | Shown at Alarm Output.<br>PV Abnormal Output means : "OVER"display or "UNDER"display |
| 14 | Alarm Output sensitivity | Setting range : Same as that of above **5.Output Sensitivity.**<br>Setting unit : Same as that of above **B.Setting Value.** | 0 | Shown at Alarm Output. |
| 15 | Decimal Position | R.T.D. : 0／0.0<br>Current : 0／0.0／0.00 | 0 | Shown at Current or R.T.D. Input. |
| 16 | ℃／˚F Change | °C ・・・℃<br>°F ・・・˚F | °C | Shown at Thermocouple or R.T.D. Input. |
| 17 | Kind of Communication | RS-232C<br>oFF : OFF 232C : RS-232C<br>RS-485<br>oFF : OFF 485 : RS-485 | oFF | Shown at either of Communications. |

| | | | | |
|---|---|---|---|---|
| 18 | Communication parameter | ●◆■▲<br>●BCC CHECK: n None, b Yes<br>◆DATA LENGTH: 7 7 BITS, 8 8 BITS<br>■PARITY: n None, o odd Number, E Even Number<br>▲STOP BIT: 1, 2 | bBn2 | Displays at Communication. |
| 19 | Communication Speed | Communication Speed : 1200/2400/4800/9600BPS | 4800 | Same as above. |
| 20 | Communication Address | Setting range : 1～99 | 1 | Displays at Communication. |
| 21 | Response Delay Time | Setting range : 0～250<br>Setting unit : mSEC | 0 | Displays at Communication. |
| 22 | Lock Setting | oFF ・・・Lock OFF<br>ALL ・・・ALL Parameters Lock<br>Pr A ・・・Parameter Display Lock<br>ESu ・・・Lock except SV | oFF | Display at all cases. |

## 6. PRECAUTION OF CONTROL

This unit uses a fixed memory device to memorize setting value. Therefore, the setting value remains in memory even after Power Off. At actual selection, please arrange to match the kind and initial setting of the sensor.
For the setting of input kind, please refer to "Kinds of Input/Output in Parameter Display 7 ". This unit is able to control 2 types such as ON/OFF control and PID control(Time Proportional Control).

・PID CONTROL Advantage : Better result of control compared with ON/OFF Control.
Disadvantage: The life period of relay contact becomes short as it switches On and OFF so frequently.
・ON/OFF CONTROL Advantage : Generally, the life period of relay contact last longer as it switches ON at temperature increase and OFF at temperature decrease from the level of setting value.
Disadvantage: The result of control is not as good as PID Control.

As for the Setting of the KIND OF CONTROL, please select and set at the display of "KIND OF CONTROL"of "PARAMETER DISPLAY ・10".

### PID CONTROL

The initial value for Parameter of "Proportional Band" set at "P =30.0" .
Though the control can be done by this initial setting, please do Auto-Tuning for getting better result of control. While Auto-tuning is operational the setting of all necessary parameters for each value (P, I , d) can be done automatically.
At the time of Auto-Tuning, set the unit to the condition of actual control by connecting heater and sensors.
It may take a time to finalize Auto-tuning.
For start of Auto-tuning, please press ▲ key for more than 2 seconds at AT Start Display of ″Mode Display E". After start up, Auto-tuning and Parameters Setting will be done automatically, and the control is to be started soon.

### ON/OFF CONTROL

The parameter of sensitivity is set initially at ″C= 0″.
In case the sensitivity flutters at control, use larger parameter of sensitivity to stabilize the fluttering.

Due to the above procedure, the parameter can be set to match the unit to be controlled.

## 7. DEFINITIONS AND FUNCTIONS

### 7.1 ADDITIONAL FUNCTIONS

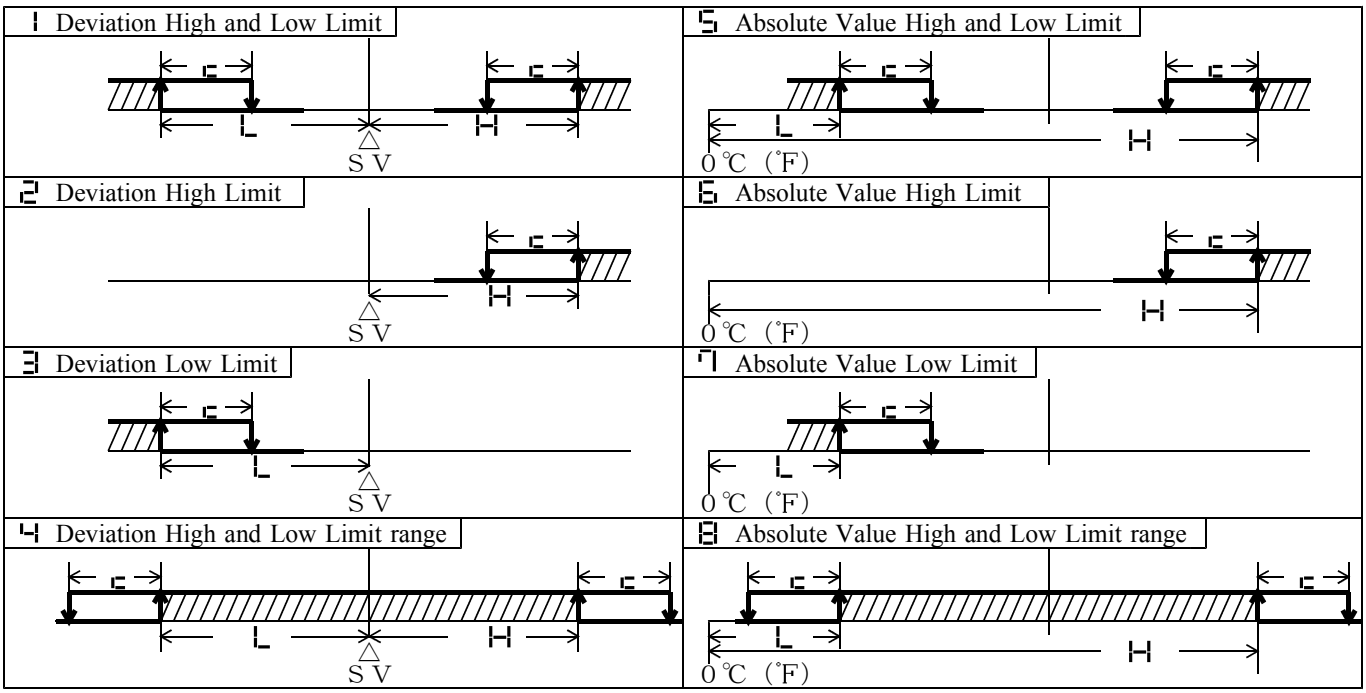
・Stand-by Sequence・・・This is the function not to turn on Alarm Output even if it covers the conditions to activate Alarm Output at Power ON. This function is valid when the Power turns on at the part of a slanting line of the following Alarm Output Function Chart.

・Alarm Output Hold・・・This function holds the condition of Alarm Output after the Alarm Output has started to activate. For release of this function, make Power turn on again or setting the position of UNHOLD at Additional Function Setting.

### 7.2 ALARM OUTPUT PV

Alarm Output makes Alarm Output Relay ON/OFF as PV corresponds to Alarm Output PV.

・Alarm Output Function Chart




▨ : Range of Alarm Output　L : Alarm Output Setting Low Limit　H : Alarm Output Setting High Limit

⊏ : Alarm Output sensitivity

### 7.3 INPUT DISPLAY RANGE AND SETTING RANGE

CHART 1 DISPLAY RANGE & SETTING RANGE OF THERMOCOUPLE INPUT (ＪＩＳ Ｃ １６０２－１９９５)

| K | | Setting Range | Display Range | | | Setting Range | Display Range |
|---|---|---|---|---|---|---|---|
| | ℃ | ０～１２００ | －４０～１３２６ | N | ℃ | ０～１３００ | ０～１３３５ |
| | ℉ | ０～２２００ | －４０～２４２０ | | ℉ | ３２～２３５０ | ３２～２４３５ |
| J | ℃ | ０～８００ | －３１～８５０ | W5Re/ | ℃ | ０～２３００ | ０～２３３６ |
| | ℉ | ０～１４５０ | －２４～１５６３ | W26Re | ℉ | ３２～４２００ | ３２～４２３６ |
| E | ℃ | ０～８００ | －２４～８３３ | R | ℃ | ０～１７００ | ０～１７５５ |
| | ℉ | ０～１４５０ | －１６～１５３１ | | ℉ | ３２～３１００ | ３２～３１９２ |
| T | ℃ | －２００～４００ | －２３１～４０７ | S | ℃ | ０～１７００ | ０～１７３０ |
| | ℉ | －３３０～７５０ | －３８５～７６５ | | ℉ | ３２～３１００ | ３２～３１４６ |

CHART 2 DISPLAY RANGE & SETTING RANGE OF R.T.D. INPUT (ＪＩＳ Ｃ １６０４－１９９７)

| | | Setting Range | Display Range | Setting Range (With Decimal) | Display Range (With Decimal) |
|---|---|---|---|---|---|
| Pt100 | ℃ | －１９９～５００ | －１９９～５３９ | －１９９．９～５００．０ | －１９９．９～５３９．１ |
| | ℉ | －１９９～９５０ | －１９９～９９９ | －１９９．９～９５０．０ | －１９９．９～９９９．９ |
| JPt100 | ℃ | －１９９～５００ | －１９９～５２９ | －１９９．９～５００．０ | －１９９．９～５２９．１ |
| | ℉ | －１９９～９５０ | －１９９～９８４ | －１９９．９～９５０．０ | －１９９．９～９８４．４ |

CHART 3 DISPLAY RANGE & SETTING RANGE OF CURRENT

| | Setting Range | Display Range |
|---|---|---|
| 4～20mADC | －１９９９～９９９９／<br>－１９９．９～９９９．９／<br>－１９．９９～９９．９９ | Displays approx.±12% wider then setting range. |

## ８． ORDERING INFORMATION

ＴＴＭ－１０Ｌ－□－□－Ａ□

| Input | 記号 |
|---|---|
| Thermocouple / R.T.D. | 0 |
| 4 ～ 20mA DC | 1 |

| Output | 記号 |
|---|---|
| None | N |
| Relay contact | R |
| SSR drive volt. | P |

| Option | 記号 |
|---|---|
| Communication ＲＳ－４８５ | Ｍ１ |
| Communication ＲＳ－２３２Ｃ | Ｍ２ |

## ９． SPECIFICATIONS

9.1 GENERAL SPECIFICATION(COMMON)

| | | | | | | |
|---|---|---|---|---|---|---|
| Power Supply Voltage | | １２ＶＤＣ±１０％ ｏｒ ２４ＶＤＣ±１０％ | | | | |
| Power Consumption | | １２ＶＤＣ：below １．４Ｗ ２４ＶＤＣ：below ２．７Ｗ | | | | |
| Operation environment | Temperature & Humidity range | ０～５０℃ ／ ３５～８５％ＲＨ (Avoid making dew) | | | | |
| | Supply Voltage | １２ＶＤＣ±１０％ ｏｒ ２４ＶＤＣ±１０％ | | | | |
| Transportation storage environment | Temperature & Humidity range | －２０～６０℃ ／ ３５～８５％ＲＨ (Avoid making dew) | | | | |
| | Vibration Condition | ０．５Ｇ | Impact Condition | ０～５０Ｇ | Package Drop test | Drop from the height 60cm |
| Mechanical Specifications | Weight | TTM-10L less then 80ｇ | | | | |

9.2 GENERAL SPECIFICATION(DETAILS)

| | | | |
|---|---|---|---|
| PV INPUT | Kind of INPUT | Thermocouple | K、J、E、T、N、R、S、W5Re/W26Re Switchable.<br>Input resistance: more than １ＭΩ<br>Bias Current:Approx ０．２μＶ／Ω<br>Burn out:"OVER"(－－－－) |
| | | R．T．D. | Pt100／JPt100 Switchable.<br>External resistance:less than ５Ω (Per wire)<br>Burn out:Shown"OVER"(－－－－)<br>same display shown at snapping of either A,B or b. |
| | | CURRENT (4-20mA DC) | Input resistance:２５０Ω<br>Burn out:Shown"UNDER"(＿＿＿＿) |
| | Sampling cycle | ０．５sec (same as Output alteration cycle) | |
| PV/Character Display | PV Display | ４figures ７segmentＬＣＤ Letter height ７ｍｍ | |
| | Character Display | １figure ７segmentＬＣＤ Letter height ５ｍｍ | |
| | Control Output | OUT Lamp | Light ON at Control Output |
| | Alarm Output | AL Lamp | Light ON at Alarm Output |
| | Communication | COM Lamp | Light ON at operating Communication |
| Indication Accuracy | Thermocouple | ±0.5%＋1digit of indicated value,or±4℃ (8℉) ,<br>(Stipulated by the standard environment and the conversion of indicated value) | |
| | R．T．D. | ±0.5%＋1digit of indicated value, or±1.2℃ (2.4℉) ,<br>(Stipulated by the standard environment and the conversion of indicated value) | |
| | CURRENT (4-20mA DC) | ±0.5%＋1digit of Setting Value Limiter Span.<br>(Stipulated by the standard environment and the conversion of indicated value) | |
| Control & Output Section | Output at Special cases | All Output functions being OFF for approximately 4 seconds after Power ON.<br>Control Output being OFF at abnormal Process Value. | |
| | Kind of Output and Rating | Relay Contact Output | Contact specification :1a Contact point.<br>Contact capacity :250VAC 3A(Load resistance)<br>Endurance :more than 100,000 times. |
| | | SSR Drive Voltage Output | Output Voltage :OFF time;0V ON time ;12V+10% -20%<br>Loaded resistance :Over 600 Ω |
| Alarm Functions | Alarm Output | Contact specification :1a Contact point.<br>Contact capacity :250VAC 0.5A(Load resistance)or 125VAC 1A(Load resistance)<br>Endurance :more than 100,000 times. | |

TOHO TOHO ELECTRONICS INC.

Head office : 2-4-3 Nishihashimoto, Midori-Ku, Sagamihara-Shi, Kanagawa 252-0131 Japan

Phone +81-42-700-2100
FAX +81-42-700-2112

(C) 1998 TOHO ELECTRONICS INC. All rights reserved.

43-0872-B