

MT Series PID+Fuzzy Temperature Controller



FUZZY PID CONTROLLER

- ※ **Artificial Intelligence <AI> Control**
Fuzzy+PID Control
- ※ **Enhanced Autotuning Method**
AT BIAS VALUE SETTABLE
- ※ **Multi-Input Type**
K/J/PT SELECTABLE
- ※ **Alarm Function**
15 MODES SELECTABLE
- ※ **RUN/STOP Function**
OPERATED ON THE PANEL EASILY
- ※ **Communication Function**
RS-485 OPTIONED



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Guiding of Model / 型號索引

EX. MT-4896-R-RS-mA

① ② ③ ④ ⑤

① Series / 系列代號

MT Series Temperature Controller

② Outline / 外型尺寸

4896=48<W>x96<H> mmxmm

48=48<W>x48<H> mmxmm

72=72<W>x72<H> mmxmm

96=96<W>x96<H> mmxmm

20=48(W)x 96(H) mmx mm

21=96(W)x 48(H) mmx mm

③ Output Method / 輸出方式

R=Relay Output

V=Voltage Pulse Output

L=Linear 4~20 mA Output

④ Other / 其他

Non=Standard

RS=RS-485

CT=Current Transmitter

S:PV Resender

⑤ Input / 輸入

Non=K/J/PT

mA=mA

V=0~10V

VR=Variable Resisance

Nomenclature / 圖示說明

PV:Display of The Process Value 顯示現在值

SV:Display of The Setting Value 顯示設定值

[SET] :Key of Setting 設定鍵

[F] :Key of Shift & Function 功能鍵及移位鍵

[▲] :Key of Increasing or Autotuning 上加鍵及自動演算鍵

[▼] :Key of Decreasing & ON/OFF 下減鍵及開關鍵



General Specification & Characteristic / 共同規格及特性

| Specification & characteristic | | Data |
|--------------------------------|---------|---|
| Power supply | 工作電壓 | 90 ~ 265 VAC 50/60 Hz |
| Power consumption | 消耗電流 | 5VA max. |
| Sensor input | 測溫體 | K / J / PT-100Ω selectable |
| Control output | Relay | 繼電器 |
| | Voltage | 電壓 |
| | Linear | 線性輸出 |
| Alarm output | 警報輸出 | 3A/ 250 VAC SPDT |
| Control method | 控制方式 | Fuzzy + PID or ON / OFF settable |
| Operating circumstance | 工作環境 | -20°C~+75°C ; 25% ~ 85% RH |
| Display accuracy | 顯示精度 | ±0.1% of FS + 1 digit |
| Cycle time | 動作週期 | 0 ~ 99 sec |
| Proportional band (P) | 比例帶 | 0 ~ 999 |
| integral time (I) | 積分時間 | 0 ~ 3999 |
| Derivative time (D) | 微分時間 | 0 ~ 3999 |
| Alarm range | 警報範圍 | -99 ~ 999 |
| PV sampling time | 取樣時間 | 0.1 sec |
| Input shift | 輸入校正 | -99 ~ +99 |
| AT bias (TU) | 自動演算偏差量 | 0 ~ 999 |
| Memory method | 記憶方式 | EEPROM |
| Insulation resistance | 絕緣阻抗 | Over 50MΩ / 500VDC |
| Dielectric strength | 耐壓強度 | Over 2.5 kV / 1 minute |
| EMC standard | | ESD : 8 kV Air Discharge (Level 3)/EN-61000-4-2 RF Interference: 10V/M/EN/50140 Bursttest:2kV/EN61000-4-4 |

Mode of alarm / 警報模式

| ALT | Alarm description / 警報說明 | ALT | Alarm description / 警報說明 | ALT | Alarm description / 警報說明 |
|-----|--|-----|---|-----|---|
| 0 | AL1 ON SV (SV+AL1) AL2 ON SV (SV+AL2) | 1 | AL1 ON (SV-AL1) SV AL2 ON SV (SV+AL2) | 2 | AL1 ON (SV-AL1) SV AL2 ON (SV-AL2) SV |
| 3 | AL1 ON (SV-AL2) SV (SV+AL1) AL2 ON SV (SV+AL2) | 4 | AL1 ON (SV-AL1) SV (SV+AL1) AL2 ON SV (SV+AL2) | 5 | AL1 ON (SV-AL1) SV (SV+AL1) AL2 ON SV (SV+AL2) |
| 6 | AL1 ON (SV-AL2) SV (SV+AL1) AL2 ON SV (SV+AL2) | 7 | AL1 ON First cycle unable AL1 AL2 ON AL2 | 8 | AL1 ON First cycle unable (SV-AL1) SV AL2 ON SV (SV+AL2) |
| 9 | AL1 ON First cycle unable (SV-AL1) SV (SV+AL1) AL2 ON SV (SV+AL2) | 10 | AL1 ON SV (SV+AL1) AL2 ON SV -t _{nr} 99h59m | 11 | AL1 ON AL1 AL2 ON AL2 |
| 12 | AL1 ON AL1 AL2 ON AL2 | 13 | AL1 ON SV (SV+AL1) AL2 ON (SV-AL2) SV | 14 | AL1 ON SV SV+AL1 AL2 ON (SV-AL2) SV |
| 15 | AL1 ON Flick ON SV (SV+AL1) AL2 ON SV (SV+AL2) | 16 | AL1 ON SV SV+AL1 AL2 ON SV -t _{nr} 99h59m | 17 | AL1 ON SV SV+AL1 AL2 ON SV -t _{nr} 99m59s |
| 18 | AL1 ON SV SV+AL1 AL2 ON SV -t _{nr} 99m59s | 19 | Non-use Note | | |

1 > ALT=15 ; t = AL2 flick ON time settable · OFF time is controlled by PID
2 > 「ALH」 is hysteresis of alarm
Ex : PV ≥ (SV+AL1) → AL1 ON · PV < (SV+AL-ALH) → AL1 OFF
3 > 「t_{nr}」 = Process time of timer ; 「t_{nr} ≥ t_{nr}」 → AL2 is turned ON or OFF

Setting of Parameter / 參數設定

| Function 參數設定 | Symbol 參數符號 | Range 範圍 | Remarks 備註 |
|---|---------------------|-------------|--|
| Control status 控溫狀態 Press [SET] Key ↓ 3 sec | 1999 1999 | 1>-999~9999 | ① CT=0 ON/OFF控制 CT=0 ON/OFF Control |
| Cycle Time 動作週期 Press [SET] Key ↓ | CT 15 | 0~99 | ② 線性輸出型不顯示 Linear Type Disappeared |
| Auto Tunning 自動演算 Press [SET] Key ↓ | AT 0 | 0 or 1 | ① AT=0 控溫狀態 AT=0 Control Status AT=1 自動演算狀態 AT=1 Autotuning Status |
| Autotuning Bias 演算偏差值 Press [SET] Key ↓ | Tu 0 | 0~999 | ① 演算值 = SV-Tu Autotuning Value=SV-Tu |
| Proportional Band 比例帶 Press [SET] Key ↓ | P 25 | 0~999 | ① CT=0 P值不顯示 CT=0 P Disappeared |
| Integral Time 積分時間 Press [SET] Key ↓ | SEC I 150 | 0~3999 | ① CT=0 I值不顯示 CT=0 I Disappeared |
| Derivative Time 微分時間 Press [SET] Key ↓ | SEC D 41 | 0~3999 | ① CT=0 D值不顯示 CT=0 D Disappeared |
| Hysteresis 應差設定 Press [SET] Key ↓ | C/F HYS 2 | -99~999 | ① CT=0 才顯示 CT=0 Appeared only |
| Input Selecting 輸入選擇 Press [SET] Key ↓ | In J E | K/J/Pt | ① K:0~1372°C ② J:0~1200°C ③ PT:-200~850°C |
| Unit Selecting 單位選擇 Press [SET] Key ↓ | Un C F | °C/°F | |
| Decimal Selecting 小數點選擇 Press [SET] Key ↓ | dp 0 | 0 or 1 | ① dp=0 No Decimal Point ② dp=1 One decimal Point |
| Code 通信碼選擇 Press [SET] Key ↓ | rS 0 | 0~2 | ① Communication type appeared only ② RS=0: BCD code (8N1) ③ RS=1: ASCII code (8N1) ④ RS=2: ASCII code (7O1) |
| BPS 傳輸速率 Press [SET] Key ↓ | bPS 192 | 96 or 192 | ① 「96」: 9600bps ② 「192」: 19200bps |
| Input Shift 輸入校正 Press [SET] Key ↓ | C/F Sh E 0 | -99~999 | |
| Alarm Mode 警報模式 Press [SET] Key ↓ | AL E 0 | 0~15 | ① 參考警報模式 Prefer to the mode of Alarm |
| Contoller No. 控制器編號 Press [SET] Key | Id 00 | 0~99 | ① 附RS-485才顯示 Communication Type Appeared Only |

Setting of Alarm / 警報設定

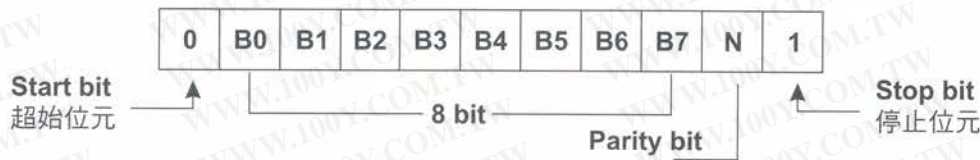
| Function 參數設定 | Symbol 參數符號 | Range 範圍 | Remarks 備註 |
|----------------------------------|----------------|-------------|---|
| Control status 控溫狀態 | 1999 1999 | -999~9999 | |
| Press SET Key 3 sec | | | |
| Lock setting 鎖住設定 | LcL 0 | 0~3 | ① 「Lck=0」:Unlock ② 「Lck=1」:SV settable only ③ 「Lck=2」:SV & AL settable only ④ 「Lck=3」:All lock |
| Press SET Key | | | |
| AL1 alarm setting AL1 警報值設定 | AL1 50 | -999~9999 | |
| Press SET Key | | | |
| AL2 alarm setting AL2 警報值設定 | AL2 50 | -999~9999 | ① Refer to mode of alarm |
| Press SET Key | | | |
| Hysteresis of alarm 警報值應差設定 | ALH 1 | 0~9999 | Ex. Alarm mode=「0」 「PV>(SV+AL1)」→AL1 ON 「PV≤(SV+AL1-ALH)」→AL1 OFF |
| Press SET Key | | | |
| Heater break setting 加熱器斷線值設定 | Hb 10.0 | 0.0~「CTH」 | ① 「CT」 Type appeared only ② 「ctu」 < 「HB」→AL2 ON At heating status |
| Press SET Key | | | |
| Heating current 加熱器實際電流值 | ctu 20.0 | | ① 「CT」 Type appeared only |
| Press SET Key | | | |
| Max. CT value 最大電流值設定 | ctH 30.0 | 0.0~999.9 | ① 「CT」 Type appeared only |
| Press SET Key | | | |
| Limit of setting 設定值上限設定 | SLH 400 | -999~9999 | ① SV ≤ 「Limit of setting」 |
| Press SET Key | | | |
| Limit of output 最大輸出量設定 | Out 100 | 0~100% | ① Ton ≤ 「Limit of output」 (Ton=Heating time) |

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Setting of Communication / 通信協定

| | | | |
|-----------------------------|-------------------------------|-----------------------|---------------------------------|
| Communication Standard | EIA RS-485 | Communication Speed | 「9600」 or 「19200」 bps |
| Bits | 16 bits | Communication Station | 0~99 |
| Communication configuration | 8N1 (RS=0 or 1) 7O1 (RS=2) | Communication Code | BCD (RS=0) ASCII (RS=1 or 2) |



Process of Protocol

Read command:

| | | | | | |
|---|----|---|---------|-----|----|
| @ | ID | R | Address | FCS | CR |
|---|----|---|---------|-----|----|

Response:

| | | | | | | |
|---|----|---|---------------|------|-----|----|
| @ | ID | R | Response code | Data | FCS | CR |
|---|----|---|---------------|------|-----|----|

Write command:

| | | | | | |
|---|----|---|---------|-----|----|
| @ | ID | W | Address | FCS | CR |
|---|----|---|---------|-----|----|

Response:

| | | | | | |
|---|----|---|---------------|-----|----|
| @ | ID | W | Response code | FCS | CR |
|---|----|---|---------------|-----|----|

Address:Parameter Address

位 址：參數位址

| NO 號碼 | Description 說明 |
|----------|--|
| 00 | AL1:Alarm # 1(Range:-99~999) |
| 01 | AL2:Alarm#2 (Range:-99~999) |
| 02 | Non-use |
| 03 | SLH:Limit of set (Range:0000~9999) |
| 04 | HYS:Hysteresis (Range:0000~9999) |
| 05 | Non-use |
| 06 | Non-use |
| 07 | CT Cycle Time (Range:00~99) |
| 08 | P:Proportion band (Range:0000~0999) |
| 09 | I:Integral time (Range:0000~3999) |
| 10 | D:Dervative time (Range:0000~3999) |
| 11 | INT:Input type(K:0000、J:0001、PT:0002) |
| 12 | UNT:Unit('C:0000、'F:0001) |
| 13 | SHT:Input shift(Range:-99~0099) |
| 14 | ALT:Alarm mode (Range:0000~0015) |
| 15 | Non-use |
| 16 | Setting value (Range:-99~9999) |
| 17 | TU:Autotunning (Range:-99~0999) |
| 18 | ID:Station No (Range:0000~0099) |
| 19 | RV:Process Value (Range:-99~9999) |
| 20 | LCK:Setting lock (0000、0001、0002、0003) |
| 21 | AT:Setting of autotunning (AT OFF:0000、AT ON:0001) |
| 22 | Value of SV & PV |
| 23 | Status of OUT/AL1/AL2 |
| 24 | Decimal point setting (Non:0000、One:0001) |
| 25 | ON/OFF setting (ON:0000、OFF:0001) |

Remarks:

@:Start code / 起始碼

CR: Stop code / 停止碼

ID:Station number / 控制器編號

R:Read command / 讀取指令

W:Write command / 寫入指令

Address: Parameter address / 參數位址

Data: Data for reading or writing / 讀寫資料

FCS: Checking Sum / 查核碼

Response code: 回應碼

00:Command completed / 指令完成

01:Address error / 位址錯誤

02:Data error / 資料錯誤

03:FCS error / 查核碼錯誤

04:Command error / 指令錯誤

05:Lock / 未開放

PID+Fuzzy Temperature Controller MT Series

EX: To read the PV=31 of temperature controller (ID=0)

Read command:

| | | | | | |
|---|----|---|---------|-----|----|
| @ | ID | R | Address | FCS | CR |
|---|----|---|---------|-----|----|

RS=1 or 2: @ 0 0 R 1 9 1A 0D 「FCS=40*30*30*52*31*39=1 A」

RS=0 :40 00 52 19 0B 0D 「FCS=40*00*52*19=0 B」

Read response:

| | | | | | | |
|---|----|---|---------------|------|-----|----|
| @ | ID | R | Response code | Data | FCS | CR |
|---|----|---|---------------|------|-----|----|

RS=1 or 2: @ 0 0 R 00 00 31 0D

RS=0 :40 00 00 00 31 23 0D

EX: To write the SV=100 of temperature controller (ID=1)

Write command:

| | | | | | | |
|---|----|---|---------|------|-----|----|
| @ | ID | W | Address | Data | FCS | CR |
|---|----|---|---------|------|-----|----|

RS=1 or 2: @ 0 1 W 1 6 0 1 0 0 10 0D 「FCS=40*30*31*57*31*36*30*31*30*30=1 0」

RS=0 :40 01 57 16 01 00 01 0D 「FCS=40*01*57*16*01*00=0 1」

Write response:

| | | | | | | |
|---|----|---|---------------|---------|------|----|
| @ | ID | W | Response code | Address | Data | CR |
|---|----|---|---------------|---------|------|----|

RS=1 or 2: @ 0 1 W 00 16 0D

RS=0 :40 01 57 00 16 0D

Note: 【FCS=□□*□□*□□ ; 「*」 = 「XOR」】

| Symbol | Description | ASCII Code | Symbol | Description | ASCII Code | Symbol | Description | ASCII Code |
|--------|-------------|------------|--------|-------------|------------|--------|-------------|------------|
| @ | Start code | 40 | C | HEX | 43 | 4 | HEX/BCD | 34 |
| R | Read | 52 | D | HEX | 44 | 5 | HEX/BCD | 35 |
| W | Write | 57 | E | HEX | 45 | 6 | HEX/BCD | 36 |
| CR | Stop Code | 0D | F | HEX | 46 | 7 | HEX/BCD | 37 |
| - | Minus | 2D | 1 | HEX/BCD | 31 | 8 | HEX/BCD | 38 |
| A | Hex | 41 | 2 | HEX/BCD | 32 | 9 | HEX/BCD | 39 |
| B | Hex | 42 | 3 | HEX/BCD | 33 | | | |

Status of OUT/ AL1/AL2 (Address=23)

| Data | Out | AL1 | AL2 |
|-------|-----|-----|-----|
| 00 00 | OFF | OFF | OFF |
| 00 01 | ON | OFF | OFF |
| 00 02 | OFF | ON | OFF |
| 00 03 | ON | ON | OFF |

| Data | Out | AL1 | AL2 |
|-------|-----|-----|-----|
| 00 04 | OFF | OFF | ON |
| 00 05 | ON | OFF | ON |
| 00 06 | OFF | ON | ON |
| 00 07 | ON | ON | ON |

MT Series PID+Fuzzy Temperature Controller

■ Illustration/功能說明

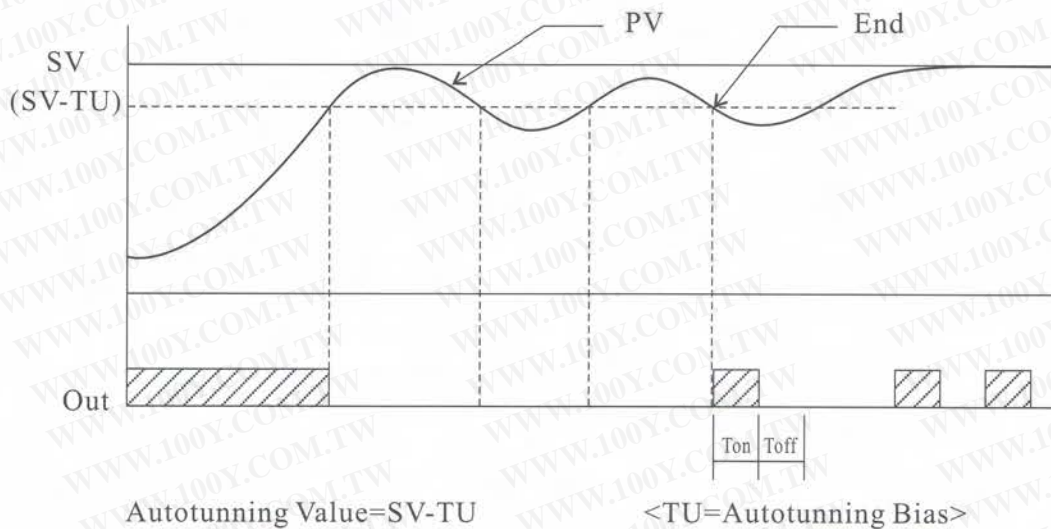
Cycle Time<CT>動作週期

$$CT = T_{on} + T_{off}$$

T_{on} = Time of Heater ON 加熱時間

T_{off} = Time of Heater OFF 不加熱時間

Auto Tuning<AT> 自動演算



Input Shift<SHT>輸出校正

To Correct The Difference Between The Actual Value And The PV Value
可修正實際值和顯示值的誤差

PV Resender 顯示值再傳送

The Range of Transmitter Is Set By The SLH.

Ex. SLH=200,0~200 Will be Transmitted To 4~20mA


"OFF" Key 關閉鍵

To Turn OFF All Output Of Temperature Controller, Only Display
The Value of PV.

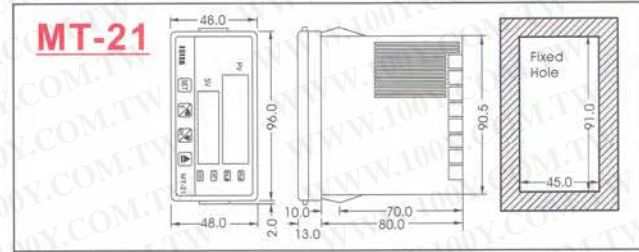
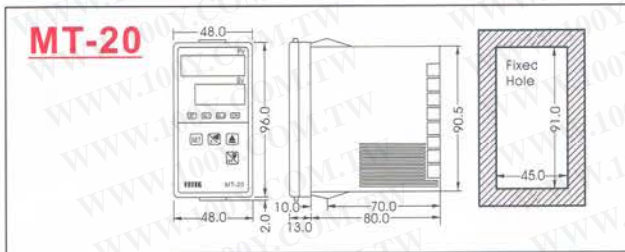
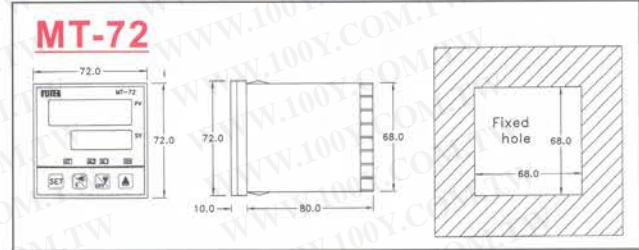
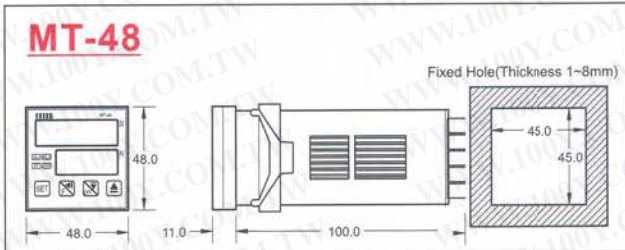
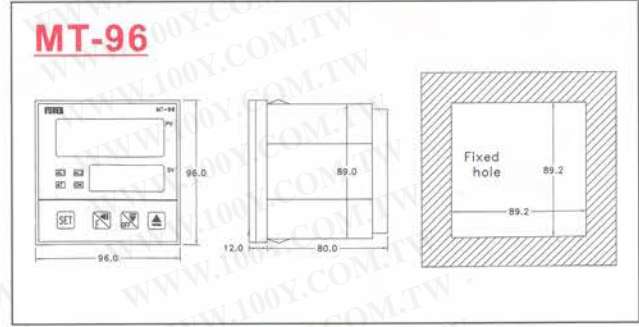
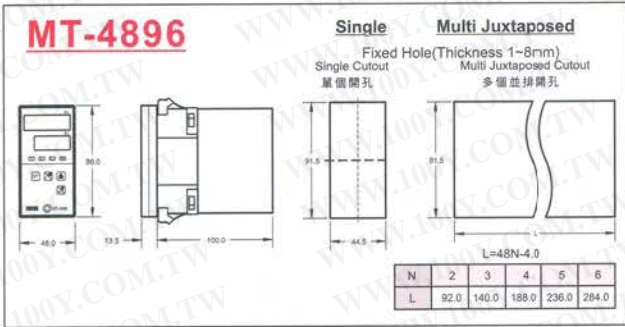
可關閉溫控器所有輸出，只顯示實際溫度值。

Atuo Tuning Key 自動演算鍵

If Press The  Key 3 Seconds, It May Enter To The Status of Auto Tuning.

按  鍵3秒，可以進入自動演算狀態。

Outline & Fixed Hole / 外型及固定孔尺寸圖



Connection Diagram / 接線圖

