

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



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>×96<H> mm×mm

48=48<W>×48<H> mm×mm

72=72<W>×72<H> mm×mm

96=96<W>×96<H> mm×mm

20=48(W)×96(H) mm×mm

21=96(W)×48(H) mm×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 Resistance



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

[OFF] : 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/ENV50140 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 tnr 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 tnr 99h59m	17	AL1 ON SV SV+AL1) AL2 ON SV tnr 99m59s
18	AL1 ON SV SV+AL1) AL2 ON SV tnr 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> 「tnr」 = Process time of timer: 「tnr ≥ tnr」 → AL2 is turned ON or OFF

MT Series PID+Fuzzy Temperature Controller



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 Key ↓ 3 sec		1>-999~9999	① CT=0 ON/OFF 控制 CT=0 ON/OFF Control
Cycle Time 動作週期 Press Key ↓		0~99	② 線性輸出型不顯示 Linear Type Disappeared
Auto Tunning 自動演算 Press Key ↓		0 or 1	① AT=0 控溫狀態 AT=0 Control Status AT=1 自動演算狀態 AT=1 Autotunning Status
Autotunning Bias 演算偏差值 Press Key ↓		0~999	① 演算值 = SV-Tu Autotunning Value=SV-Tu
Proportional Band 比例帶 Press Key ↓		0~999	① CT=0 P值不顯示 CT=0 P Disappeared
Integral Time 積分時間 Press Key ↓		0~3999	① CT=0 I值不顯示 CT=0 I Disappeared
Derivative Time 微分時間 Press Key ↓		0~3999	① CT=0 D值不顯示 CT=0 D Disappeared
Hysteresis 應差設定 Press Key ↓		-99~999	① CT=0 才顯示 CT=0 Appeared only
Input Selecting 輸入選擇 Press Key ↓		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 Key ↓		°C/°F	
Decimal Selecting 小數點選擇 Press Key ↓		0 or 1	① dp=0 No Decimal Point ② dp=1 One decimal Point
Code 通信碼選擇 Press Key ↓		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 Key ↓		96 or 192	① 「96」:9600bps ② 「192」:19200bps
Input Shift 輸入校正 Press Key ↓		-99~999	
Alarm Mode 警報模式 Press Key ↓		0~15	① 參考警報模式 Prefer to the mode of Alarm
Contoller No. 控制器編號 Press Key		0~99	① 附RS-485才顯示 Communication Type Appeared Only

■ Setting of Alarm/警報設定

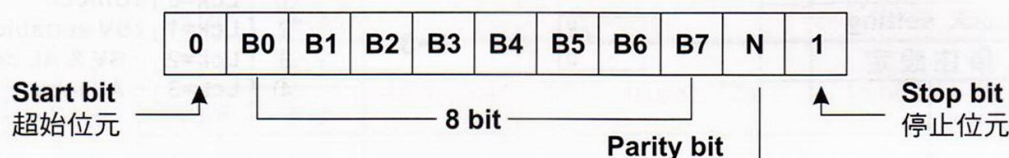
Function 參數設定	Symbol 參數符號	Range 範圍	Remarks 備註
Control status 控溫狀態	1999 1999	-999~9999	
Press SET Key 3 sec			
Lock setting 鎖住設定	Lck 0	0~3	① 「Lck=0」:Unlock ② 「Lck=1」:SV settable only ③ 「Lck=2」:SV & AL settable only ④ 「Lck=3」:All lock
Press SET Key			
AL1 alarm setting AL1 警報值設定	AL1 50	-999~9999	
Press 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)

MT Series PID+Fuzzy Temperature Controller



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
---	----	---	---------	-----	----

Reesponse:

@	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 munber / 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

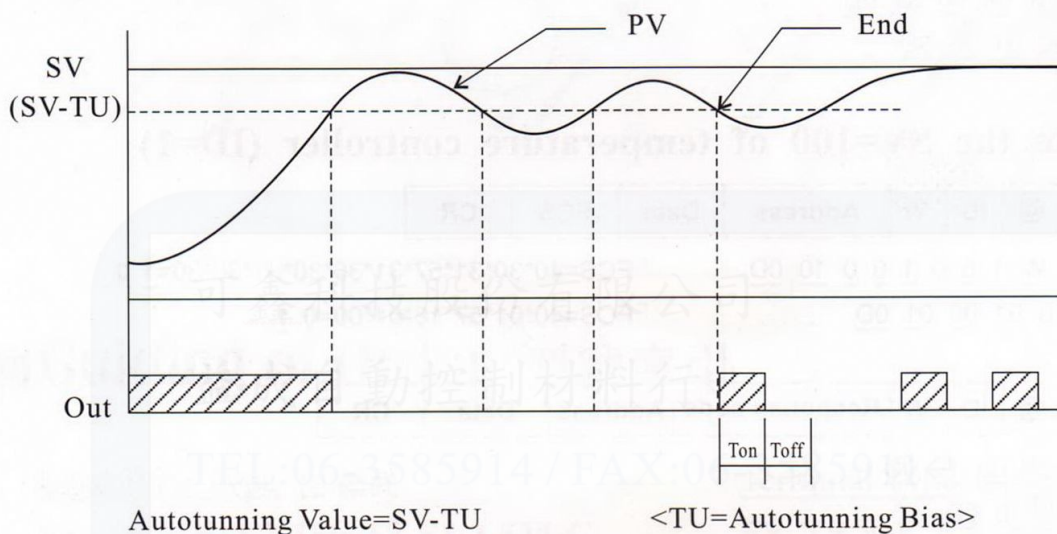
Cycle Time<CT>動作週期

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

T_{on} = Time of Heater ON 加熱時間

T_{off} = Time of Heater OFF 不加熱時間

Auto Tunning<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 Tunning Key 自動演算鍵

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

按  鍵3秒，可以進入自動演算狀態。

Notice

■ Notice of Use / 使用注意事項

1. Please Install The Temperature Controller In The Circumstance

Temperature: $-20^{\circ}\text{C} \sim +75^{\circ}\text{C}$ (Without Icing or Condensation)

Humidity: $35\% \sim 85\%\text{RH}$

The high Ambient Temperature May Shorten The Service Life of Temperature Controller, Please Don't Let It Exceed 75°C

溫度控制器安裝環境

溫度: $-20^{\circ}\text{C} \sim +75^{\circ}\text{C}$ (無結冰或結露)

濕度: $35\% \sim 85\%\text{RH}$

高溫環境可能縮短溫度控制器壽命，請不要讓工作的環境溫度超過 75°C

2. The Service Life of Relays Are Affected By The Switching Load.

Please Assure The Switching Load Are Under The Rated Current.

繼電器壽命受工作負載影響很大，請勿超載使用。

3. Thermcouple Type, If Need To Extend The Thermcouple Lead Wire Please Be Sure To Use The Compensation Wires That Must To Match The Thermcouple Type.

PT Resistance Type, If Need To Extend The PT Sensor Lead Wire Please Be Sure To Use The Low Resistance Wire.

熱電偶感溫線，如果須延長時務必使用同規格的補償導線。

白金電阻型感溫線，如果須延長時務必使用低阻抗電線。

4. The Lead Wire of Temperature Sensor, Please Separate It Away From

The Power Lines or High Tension Lines To Avoid Noise Interruption.

感溫線請勿與和高壓線或動力線結紮在一起。

5. It is Suggested To Settle The Separated Alarm System, In Case of The Alarm of Temperature Controller May Not Be Operated Properly When The Device is Abnormal.

建議設置獨立的警報系統，以免溫控器異常時警報器功能失效。

6. The Temperature Controller May Be Interrupted By Movable Phone or Wireless Device.

溫控器可能會受行動電話或無線發射器干擾。

7. Outline of Crimp Terminal 端子夾外型



■ Notice Of Safety/安全注意事項

Definition of Symbol Marks



WARNING

Potentially Hazardous Situation
In Case Of Mishandling, May Result In Death
Or Serious Injury
潛在危險
如果操作失誤，有可能導致死亡或嚴重傷害。



CAUTION

Potentially Hazardous Situation
In Case of Mishandling, May Result In Slight Dangerous.
潛在危險
如果操作失誤，有可能導致輕微傷害。



WARNING

1. Please Do Not Touch The Terminals While The Power Is Supplied, If Do, It May Result In Electronic Shock.
送電中，請勿碰觸接線端以免觸電。
2. Please Do Not Let The Metal or Wire Cuttings Drop Into The Inside of Temperature Controller, If Do, It May Result In Malfunction, Burning Out or Fire.
請勿讓鐵屑或鋼絲掉入溫控器內，以免造成溫控器失效，燒毀甚至起火。
3. Please Make Sure To Wire The Temperature Controller Correctly Before Power ON, If Not, It May Result In Malfunction or Burning out.
送電前請確認配線是否正確，否則可能導致異常或燒毀。
4. Please Do Not Modify or Repair The Temperature Controller, To Avoid Resulting In Malfunction or Burning out.
請勿修改或修理溫控器，以免造成異常燒毀。



CAUTION

1. Please Rate The Power Supply Voltage Within The Specified Range, If Not, It May Result In Malfunction or Burning.
工作電壓請限制在規格內，否則可能造成溫控器異常或燒毀。
2. Please Rate The Load Within The Specified Value, If Not, It May Result In Malfunction or Burning.
工作負載請勿超過額定電流，否則可能造成溫控器異常或燒毀。
3. Please Settle a Separated Alarm System To Ensure Safety Protection In The Event of Malfunction, If Not, It May Result In A Serious Accident.
請設置獨立警報系統，確保溫控器異常時安全保護，否則可能造成嚴重意外事故。