

# 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>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 Resisfance

## 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 (SV-AL1) SV First cycle unable 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 -tr- 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 -tr- 99h59m	17	AL1 ON SV SV+AL1 AL2 ON SV -tr- 99m59s
18	AL1 ON SV SV+AL1 AL2 ON SV -tr- 99m59s	19	Non-use	Note	<p>1 &gt; ALT=15 : t = AL2 flick ON time settable , OFF time is controlled by PID</p> <p>2 &gt; 「ALH」 is hysteresis of alarm</p> <p>Ex : PV ≥ (SV+AL1) → AL1 ON · PV &lt; (SV+AL-ALH) → AL1 OFF</p> <p>3 &gt; 「tnu」 = Process time of timer : 「tnu ≥ tr」 → AL2 is turned ON or OFF</p>

## 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	1999 1999	1>-999~9999	① CT=0 ON/OFF控制 CT=0 ON/OFF Control
Cycle Time 動作週期 Press [ ] Key ↓	CT 15	0~99	② 線性輸出型不顯示 Linear Type Disappeared
Auto Tunning 自動演算 Press [ ] 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 [ ] Key ↓	Tu 0	0~999	① 演算值 = SV-Tu Autotuning Value=SV-Tu
Proportional Band 比例帶 Press [ ] Key ↓	P 25	0~999	① CT=0 P值不顯示 CT=0 P Disappeared
Integral Time 積分時間 Press [ ] 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 [ ] Key ↓	SEC D 41	0~3999	① CT=0 D值不顯示 CT=0 D Disappeared
Hysteresis 應差設定 Press [ ] Key ↓	C/F HYS 2	-99~999	① CT=0 才顯示 CT=0 Appeared only
Input Selecting 輸入選擇 Press [ ] Key ↓	In K J Pt	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 ↓	Unit °C °F	°C/°F	
Decimal Selecting 小數點選擇 Press [ ] 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 [ ] 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 [ ] Key ↓	bPS 192	96 or 192	① 「96」: 9600bps ② 「192」: 19200bps
Input Shift 輸入校正 Press [ ] Key ↓	C/F Sh 0	-99~999	
Alarm Mode 警報模式 Press [ ] Key ↓	AL 0	0~15	① 參考警報模式 Prefer to the mode of Alarm
Contoller No. 控制器編號 Press [ ] Key	Id 00	0~99	① 附RS-485才顯示 Communication Type Appeared Only

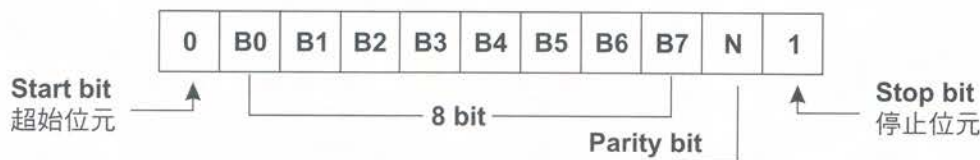
## ■ Setting of Alarm / 警報設定

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 <b>SET</b> 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 <b>SET</b> Key			
AL1 alarm setting AL1 警報值設定	AL1 50	-999~9999	
Press <b>SET</b> Key			
AL2 alarm setting AL2 警報值設定	AL2 50	-999~9999	① Refer to mode of alarm
Press <b>SET</b> 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 <b>SET</b> 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 <b>SET</b> Key			
Heating current 加熱器實際電流值	ctu 20.0		① 「CT」Type appeared only
Press <b>SET</b> Key			
Max. CT value 最大電流值設定	ctH 30.0	0.0~999.9	① 「CT」Type appeared only
Press <b>SET</b> Key			
Limit of setting 設定值上限設定	SLH 400	-999~9999	① SV≤「Limit of setting」
Press <b>SET</b> 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

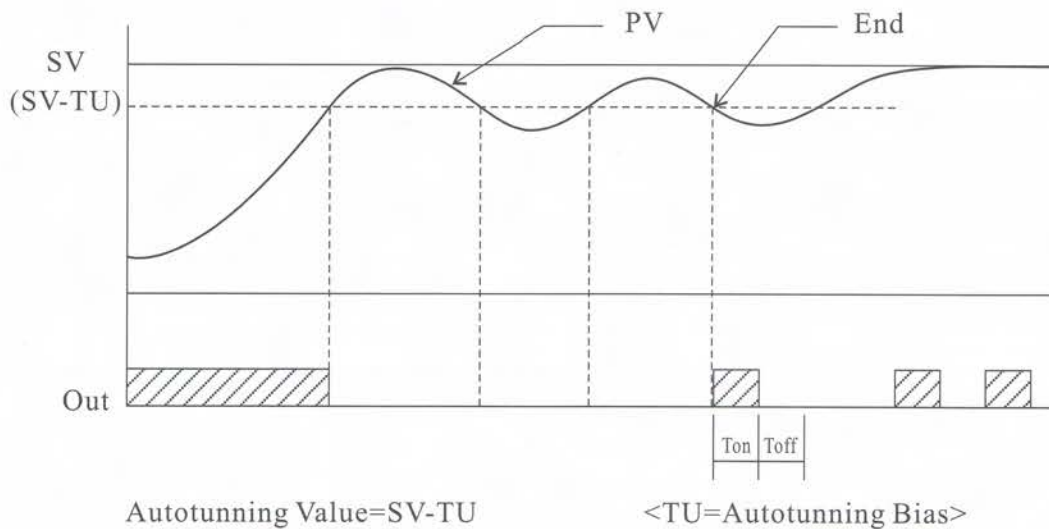
### Cycle Time<CT>動作週期

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

$T_{on}$  = 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.

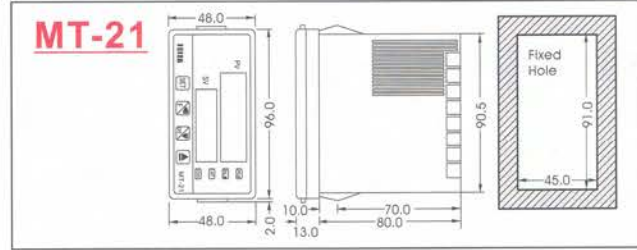
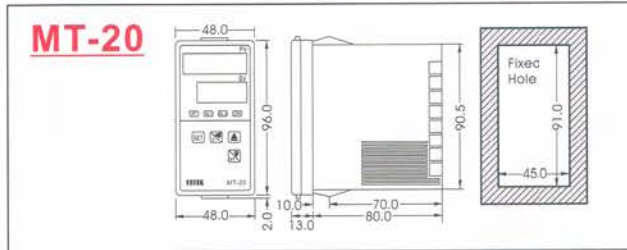
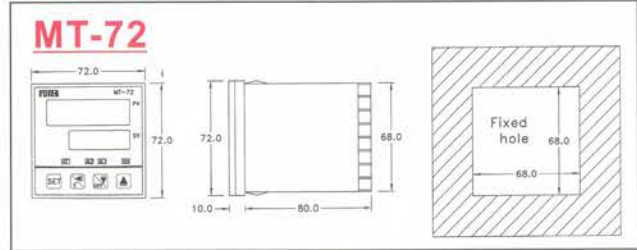
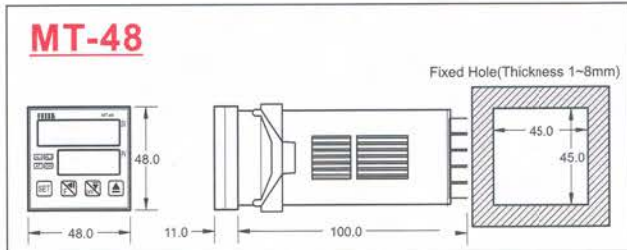
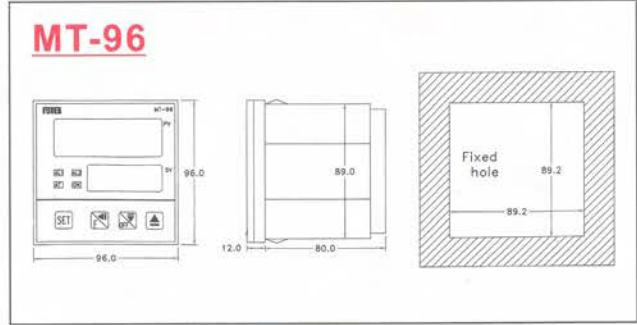
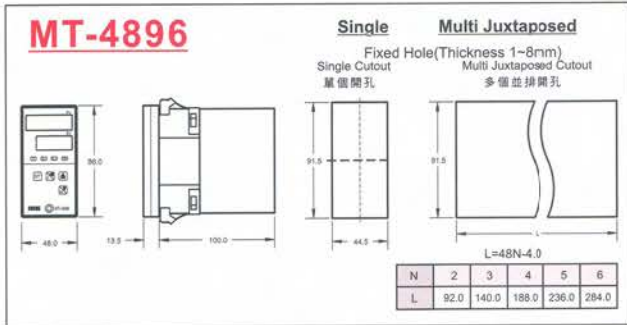
可關閉溫控器所有輸出，只顯示實際溫度值。

### 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

