

Delta Temperature Controller

User Manual



Foreword

The user manual details the process of using Delta DT series temperature controllers step by step for beginners to easily set up all kinds of parameters in a short time.

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CHAPTER 1: DEFAULT SETTINGS OF PARAMETERS

1.1 Default Settings in Temperature Controller

DTA		DTB		DTC	
Model: DTA4896R1		Model: DTB4896RR		Model: DTC1000R	
PV	SV	PV	SV	PV	SV
no	Cont	no	Cont	Not connected to sensor	0.0
Press SET for more than 3 seconds to enter initial setting mode		Press SET for more than 3 seconds to enter initial setting mode		Set up control modes	
LnPt	Pt2	LnPt	Pt	Control mode	PID control
				Run/stop	Run
EPUn	C	EPUn	C	Output 1	Heating
				Output 2	Heating
EP-H	5000	EP-H	5000	Status of key	Normal
				Auto-tuning	End
EP-L	-200	EP-L	-999	Set up temperature	
				Input type	PT100
Ctrl	PId	Ctrl	PId	Input unit	°C
				Set value	0.0
S-HC	HEAT	S-HC	HEAT	Maximum input temperature	600.0
				Minimum input temperature	-20.0
ALAI	0	ALAI	0	Position of decimal point	1 digit after decimal point
				Set up PID parameter	
ALAI2	0	ALAI2	0	Proportional band (P)	47.6
				Integral time (I)	260
CoSH	oFF	ALAI3	0	Derivative time (D)	41
				Control cycle 1	20
C-no	1	SALA	oFF	Integral default value	0.0
				Control cycle 2	20

DTA		DTB		DTC	
Model: DTA4896R1		Model: DTB4896RR		Model: DTC1000R	
PV	SV	PV	SV	PV	SV
				Adjust temperature	
				Input compensation	0.0
				Password of DTC	
				Level 1 password	Disabled
				Level 2 password	Disabled
				Level 3 password	Disabled
Back to top					
		Back to top			

1.2 How to Return to Default Settings in DTA



Display		Explanations
PV	SV	Status of the temperature controller
		Temporary display when DTA is switched on: = relay output with RS-485 communication.
		Example displayed values
		Press twice
		Key-locked function
		Select Lock 1
+		Press “up” and “down” keys together for 1 second.
		Default value

Display		Explanations
PV	SV	Status of the temperature controller
ECU0	-136	Default value
		
PA55	4321	
		
PA55	1357	Press “down” key continuously until the value reaches 1357 <u>(please DO NOT modify this value; otherwise system confusion may occur).</u>
SET		
PA55	4321	
SET + 		Press the two keys together once to return to main screen.
25.0	00	Main screen
Switch off DTA and re-power it.		
Err	21	
no	Cont	Return to default value. The default sensor is PT100, which will be displayed when DTA is not connected to a sensor or thermocouple.

The model adopted in this example is: DTA4896R1 with firmware V3.50.



Communication

1. Make sure RS-485 hardware communication cable in DTA has been connected to the computer.
2. Make sure the communication parameters in DTA are consistent with those in the computer.

Display		Explanations
PV	SV	Status of the temperature controller
25.0	00	Example displayed values
Press SET for more than 3 seconds to enter initial setting mode		
Err	Pt2	Example displayed value: PT100 Sensor
Press  continuously for 8 times		
Err	off	ON/OFF of communication write-in
		
Err	on	OFF: communication write-in disabled ON: communication write-in enabled

Display		Explanations
PV	SV	Status of the temperature controller
		
		Communication address
		
		Communication speed
		
		Data length (in bits)
		
		Parity bit
		
		Stop bit
		
 Back to top		Return to the first item in the initial setting mode: 
		Return to PV/SV screen in the operation mode

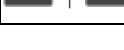
DTCOM Software	Explanations
	Execute DTCOM Software
	Select "SINGLE COMMAND TEST"
SINGLE COMMAND TEST (HEX FORMAT) ADDRESS 01 COMMAND Write One Wr FUNC ADDR 471B WRITE DATA 1234 LRC 51 SEND :0106471B123451 RECEIVED :0106471B123451 Send Repeat Clear Result Close	Function address = 471B; Write data =1234. <u>(Please DO NOT modify this value; otherwise system confusion may occur.)</u>

DTCOM Software	Explanations
SINGLE COMMAND TEST (HEX FORMAT) ADDRESS: 01 COMMAND: Write One Wr FUNC ADDR: 4724 WRITE DATA: 1234 LRC: 48 SEND: :01064724123448 RECEIVED: :01064724123448 Buttons: Send, Repeat, Clear Result, Close 	Clear the user's settings. Function address = 4724; Write data = 1234 <u>(Please DO NOT modify this value; otherwise system confusion may occur.)</u>
	After the above procedures are completed, DTA will display the information on the left hand side, representing that DTA has return to default settings successfully.
Switch off DTA and re-power it.	
	
	Return to default value. The default sensor is PT100, which will be displayed when DTA is not connected to a sensor or thermocouple.

The model adopted in this example is: DTA4896R1 with firmware V3.50.

1.3 How to Return to Default Settings in DTB



Display		Explanations
PV	SV	Status of the temperature controller
		Temporary display when DTB is switched on:  = firmware V1.50;  = relay output for OUT1/OUT2
		Example displayed value
		Press  for 3 times
		Key-locked function
		
		Select Lock 1
		
		Press “up” and “down” key together for 1 second.

Display		Explanations
PV	SV	Status of the temperature controller
SHd0	OFF	
		
PA55	4321	
		
PA55	1357	Press “down” key continuously until the value reaches 1357 <u>(please DO NOT modify this value; otherwise system confusion may occur).</u>
SET		
SHd0	OFF	
SET + 		Press the two keys together once to return to main screen.
25.0	00	Main screen
Switch off DTB and re-power it.		
6150	rr	
na	Cont	Return to default value. The default sensor is PT100, which will be displayed when DTB is not connected to a sensor or thermocouple.

The model adopted in this example is: DTB4896RR with firmware V1.50.

Communication

1. Make sure RS-485 hardware communication cable in DTB has been connected to the computer.
2. Make sure the communication parameters in DTB are consistent with those in the computer.

Display		Explanations
PV	SV	Status of the temperature controller
25.0	00	Example displayed value
Press SET for more than 3 seconds to enter initial setting mode		
Cont	PT	Example displayed value: PT100 Sensor
Press  continuously for 10 times		
Cont	OFF	ON/OFF of communication write-in
		

Display		Explanations
PV	SV	Status of the temperature controller
		OFF: communication write-in disabled ON: communication write-in enabled
		
		ASCII or RTU
		
		Communication address
		
		Communication speed
		
		Data length (in bits)
		
		Parity bit
		
		Stop bit
 back to top		Return to the first item in the initial setting mode: 
		Return to PV/SV screen in the operation mode

DTCOM Software	Explanations
	Execute DTCOM Software
	Select "SINGLE COMMAND TEST"
SINGLE COMMAND TEST (HEX FORMAT) ADDRESS 01 COMMAND Write One W FUNC ADDR 472A WRITE DATA 1234 LRC 42 SEND :0106472A123442 RECEIVED :0106472A123442 Send Repeat Clear Result Close 	Function address = 472A; Write data =1234 <u>(Please DO NOT modify this value; otherwise system confusion may occur.)</u>

DTCOM Software	Explanations
SINGLE COMMAND TEST (HEX FORMAT) ADDRESS: 01 COMMAND: Write One Wt FUNC ADDR: 474E WRITE DATA: 1234 LRC: 1E SEND: :0106474E12341E RECEIVED: :0106474E12341E Buttons: Send, Repeat, Clear Result, Close 	Clear the user's settings. Function address = 474E; Write data = 1234 <u>(Please DO NOT modify this value; otherwise system confusion may occur.)</u>
	After the above procedures are completed, DTB will display the information on the left hand side, representing that DTB has return to default settings successfully.
Switch off DTB and re-power it. 	
	Return to default value. The default sensor is PT100, which will be displayed when DTC is not connected to a sensor or thermocouple.

The model adopted in this example is: DTB4896RR with firmware V1.50.

1.4 How to Return to Default Settings in DTC

Communication

1. Make sure RS-485 hardware communication cable in DTC has been connected to the computer.
2. Make sure the communication parameters in DTC are consistent with those in the computer.

DTCOM Software	Explanations
	Execute DTCOM Software
	Select "SINGLE COMMAND TEST"

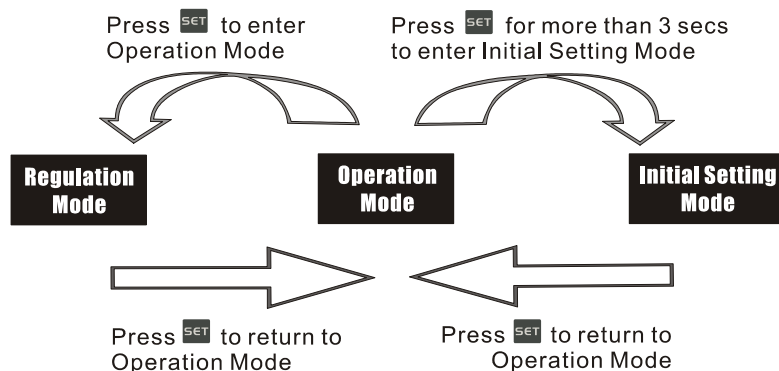
DTCOM Software	Explanations
SINGLE COMMAND TEST (HEX FORMAT) ADDRESS: 01 COMMAND: Write One Wr FUNC ADDR: 472A WRITE DATA: 1234 LRC: 42 SEND: :0106472A123442 RECEIVED: :0106472A123442 Buttons: Send, Repeat, Clear Result, Close 	Function address = 472A; Write data = 1234 (Please DO NOT modify this value; otherwise system confusion may occur.)
SINGLE COMMAND TEST (HEX FORMAT) ADDRESS: 01 COMMAND: Write One Wr FUNC ADDR: 474E WRITE DATA: 1234 LRC: 1E SEND: :0106474E12341E RECEIVED: :0106474E12341E Buttons: Send, Repeat, Clear Result, Close 	Clear the user's settings. Function address = 474E; Write data = 1234 (Please DO NOT modify this value; otherwise system confusion may occur.)
Switch off DTC and re-power it.	Return to default settings

The model adopted in this example is: DTC1000R with firmware V1.40.

CHAPTER 2: CONTROL MODES IN DTA

2.1 ON/OFF

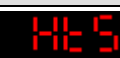
There are three control modes in DTA: ON/OFF, MANUAL and PID. First, press **SET** for 3 seconds to enter the “initial setting” mode. See below for how to switch between each mode:



Display		Explanations
PV	SV	Status of the temperature controller
		Message displayed when DTA has not yet been connected to a sensor.
Press  for more than 3 seconds to enter initial setting mode		
		Select the sensor connected. Default = PT100
		
		Temperature unit. Default = °C
		
		Upper limit of temperature range
		
		Lower limit of temperature range
		
		The control modes include: PID, ON/OFF, MANUAL. Default = PID. Select "ON/OFF" here.
		
		Select heating or cooling mode. Default = heating
		
		Set up Alarm mode 1. Default = alarm output disabled
		
		Set up Alarm mode 2. Default = alarm output disabled
		
		ON/OFF of communication write-in. Default = OFF
		
		Communication address
		
		Communication speed
		
		Data length (in bits)
		
		Parity bit
		
		Stop bit
		
 Back to top		

■ Parameters relevant to ON/OFF control

Press  in the main screen of DTA to enter the “regulation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
 or 		Set up hysteresis. Default = heating hysteresis. Can be set as cooling hysteresis as well. Both default values are “0”.

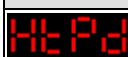
2.2 MANUAL

Press  for 3 seconds in the main screen to enter the “initial setting mode”. Press  several times until the parameter  is displayed.

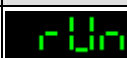
Display		Explanations
PV	SV	Status of the temperature controller
		The control modes include: PID, ON/OFF, MANUAL. Default = PID. Select “MANUAL” here.
 Back to top		Press  to return to the main screen.

■ Parameters relevant to MANUAL control

Press  in the main screen of DTA to enter the “regulation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
 or 		Set up heating or cooling control cycle. Default = heating, 20 seconds per cycle.

Press  in the main screen of DTA to enter the “operation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
		Run/stop
		
		Key-locked function
		
		Manually adjust the output percentage. Assume the percentage value = 50 and the cycle = 20 seconds plus heating control, the system will conduct heating output for 10 seconds and stop for the other 10 seconds.

2.3 PID

Press  for 3 seconds in the main screen to enter the “initial setting mode”. Press  several times until the parameter  is displayed.

Display		Explanations
PV	SV	Status of the temperature controller
		The control modes include: PID, ON/OFF, MANUAL. Default = PID. Select "PID" here.
 Back to top		Press  to return to the main screen.

■ Parameters relevant to PID control

Press  in the main screen of DTA to enter the "regulation mode".

Display		Explanations
PV	SV	Status of the temperature controller
		ON/OFF of auto-tuning
		
		Default value for proportional control
		
		Default value for integral control
		
		Default value for derivative control
		
		Default integral value
		
		Heating/cooling control cycle
		
		Temperature inaccuracy adjustment value
		

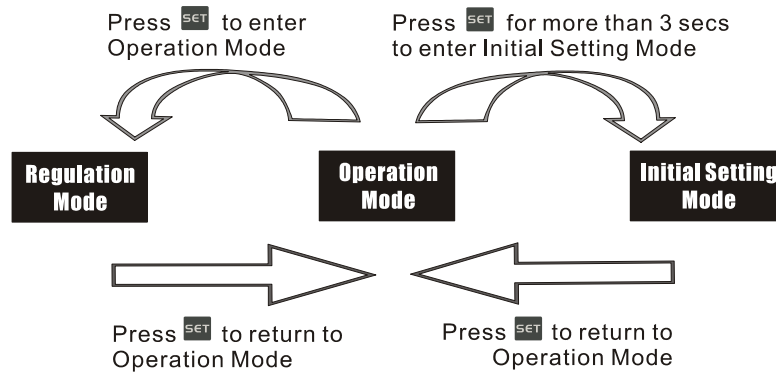
Press  in the main screen of DTA to enter the "operation mode".

Display		Explanations
PV	SV	Status of the temperature controller
		Run/stop
		
		Key-locked function
		
		Output volume. In PID control mode, this is a read-only parameter and cannot be modified.

CHAPTER 3: CONTROL MODES IN DTB

3.1 ON/OFF

There are four control modes in DTB: ON/OFF, MANUAL, PID and PID PROG. To switch to ON/OFF mode, first press **SET** for 3 seconds to enter the “initial setting” mode. See below for how to switch between each mode:



Display		Explanations
PV	SV	Status of the temperature controller
no	Cont	Message displayed when DTB has not yet been connected to a sensor.
Press SET for more than 3 seconds to enter initial setting mode		
TYPE	PT	Select the sensor connected. Default = PT100
UNIT	C	Temperature unit. Default = °C
TEMP-H	6000	Upper limit of temperature range
TEMP-L	-999	Lower limit of temperature range
CTRL	onof	The control modes include: ON/OFF, MANUAL, PID and PID PROG. Default = PID. Select “ON/OFF” here.
5-HC	HEAT	Select heating/cooling/heating 1 cooling 2/heating 2 cooling 1. Default = heating
ALARM	0	Set up Alarm mode 1. Default = alarm output disabled.

Display		Explanations
PV	SV	Status of the temperature controller
ALR2	0	Set up Alarm mode 2. Default = alarm output disabled.
ALR3	0	Set up Alarm mode 3. Default = alarm output disabled.
SALA	OFF	Set up system alarm
CoSH	OFF	ON/OFF of communication write-in. Default = OFF
C-SL	ASCII	Select communication format
C-no	1	Communication address
bPS	9600	Communication speed
LEN	7	Data length (in bits)
Prty	EVEN	Parity bit
Stop	1	Stop bit
Back to top		

■ Parameters relevant to ON/OFF control

Press in the main screen of DTB to enter the “regulation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
HE5 or CE5	00	Set up hysteresis. Default = heating hysteresis. Can be set as cooling hysteresis as well. Both default values are “0”.

3.2 MANUAL

Press for 3 seconds in the main screen to enter the “initial setting mode”. Press several times until the parameter **Ctrl** is displayed.

Display		Explanations
PV	SV	Status of the temperature controller
Ctrl	MANU	The control modes include: ON/OFF, MANUAL, PID and PID PROG. Default = PID. Select "MANUAL" here.
 Back to top		Press  to return to the main screen.

■ Parameters relevant to MANUAL control

Press  in the main screen of DTB to enter the "regulation mode".

Display		Explanations
PV	SV	Status of the temperature controller
HEPd or CLPd	20	Set up heating or cooling control cycle. Default = heating, 20 seconds per cycle.

Press  in the main screen of DTB to enter the "operation mode".

Display		Explanations
PV	SV	Status of the temperature controller
r-s	run	Run/stop
		
SP	1	Set up the position of decimal point. 1 = value with decimal point; 2 = value without decimal point
		
LoC	off	Key-locked function
		
OUT 1	00	Manually adjust the output percentage. Assume the percentage value = 50 and the cycle = 20 seconds plus heating control, the system will conduct heating output for 10 seconds and stop for the other 10 seconds.

3.3 PID

Press  for 3 seconds in the main screen to enter the "initial setting mode". Press  several times until the parameter **Ctrl** is displayed.

Display		Explanations
PV	SV	Status of the temperature controller
Ctrl	PID	The control modes include: ON/OFF, MANUAL, PID and PID PROG. Default = PID.
 Back to top		Press  to return to the main screen.

■ Parameters relevant to PID control

Press  in the main screen of DTB to enter the "regulation mode".

Display		Explanations
PV	SV	Status of the temperature controller
		ON/OFF of auto-tuning
		
		The 0 th PID parameter. There are 4 groups of PID parameters built in DTB. When the parameter is set as PID4, the system will automatically adopt the PID value of the current temperature closest to PID0 ~ 3.
		
		The 0 th SV
		
		The 0 th default value for proportional control
		
		The 0 th default value for integral control
		
		The 0 th default value for derivative control
		
		The 0 th default integral value
		
		Heating/cooling control cycle
		
		Temperature inaccuracy adjustment value
		

Press  in the main screen of DTB to enter the “operation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
		Run/stop
		
		Set up the position of decimal point
		
		Key-locked function
		
		Output volume. In PID control mode, this is a read-only parameter and cannot be modified.

3.4 PID PROG

Press **SET** for 3 seconds in the main screen to enter the “initial setting mode”. Press  several times until the parameter **Ctrl** is displayed.

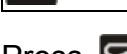
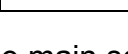
Display		Explanations
PV	SV	Status of the temperature controller
Ctrl	Prog	The control modes include: ON/OFF, MANUAL, PID and PID PROG. Default = PID. Select “PID PROG” here.
		
Pattern	0	DTB offers 8 patterns and 8 steps for each pattern, totaling 64 steps. Range of a pattern: OFF ~ 7. OFF = the function disabled.
		
SP00	00	Temperature SV for pattern 0 and step 0
		
Time	0000	Time SV for pattern 0 and step 0
		
SP01	00	Temperature SV for pattern 0 and step 1
		
Time	0000	Time SV for pattern 0 and step 1
...	...	...
...	...	...
SP07	00	Temperature SV for pattern 0 and step 7
		
Time	0000	Time SV for pattern 0 and step 7
		
PS00	7	Actual number of steps executed in pattern 0
		
LY00	0	Actual number of loops executed in pattern 0
		
Link	0	Pattern linked after the execution of pattern 0 is completed. OFF = end of linking patterns
		
		Return to Pattern
SET Back to top		Press SET to return to the main screen.

Return to the main screen to switch to the functions below.

Display		Explanations
PV	SV	Status of the temperature controller
	 	Remaining time in the current step
	 	Target temperature for the current execution
	 	The pattern currently executed

■ Parameters relevant to PID PROG control

Press  in the main screen of DTB to enter the “regulation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
		The 0 th PID parameter. There are 4 groups of PID parameters built in DTB. When the parameter is set as PID4, the system will automatically adopt the PID value of the current temperature closest to PID0 ~ 3.
		
		The 0 th SV
		
		The 0 th default value for proportional control
		
		The 0 th default value for integral control
		
		The 0 th default value for derivative control
		
		The 0 th default integral value
		
		Heating/cooling control cycle
		
		Temperature inaccuracy adjustment value
		

Press  in the main screen of DTB to enter the “operation mode”.

Display		Explanations
PV	SV	Status of the temperature controller
		Stop/run/program stop/program hold °
		Program stop: Run the system again, and DTB will start from the initial step.
		Program hold: Run the system again, and DTB will follow and start from the previous step.

Display		Explanations
PV	SV	Status of the temperature controller
		
		Set up the position of decimal point
		
		Key-locked function
		
		Output volume. In PID PROG control mode, this is a read-only parameter and cannot be modified.

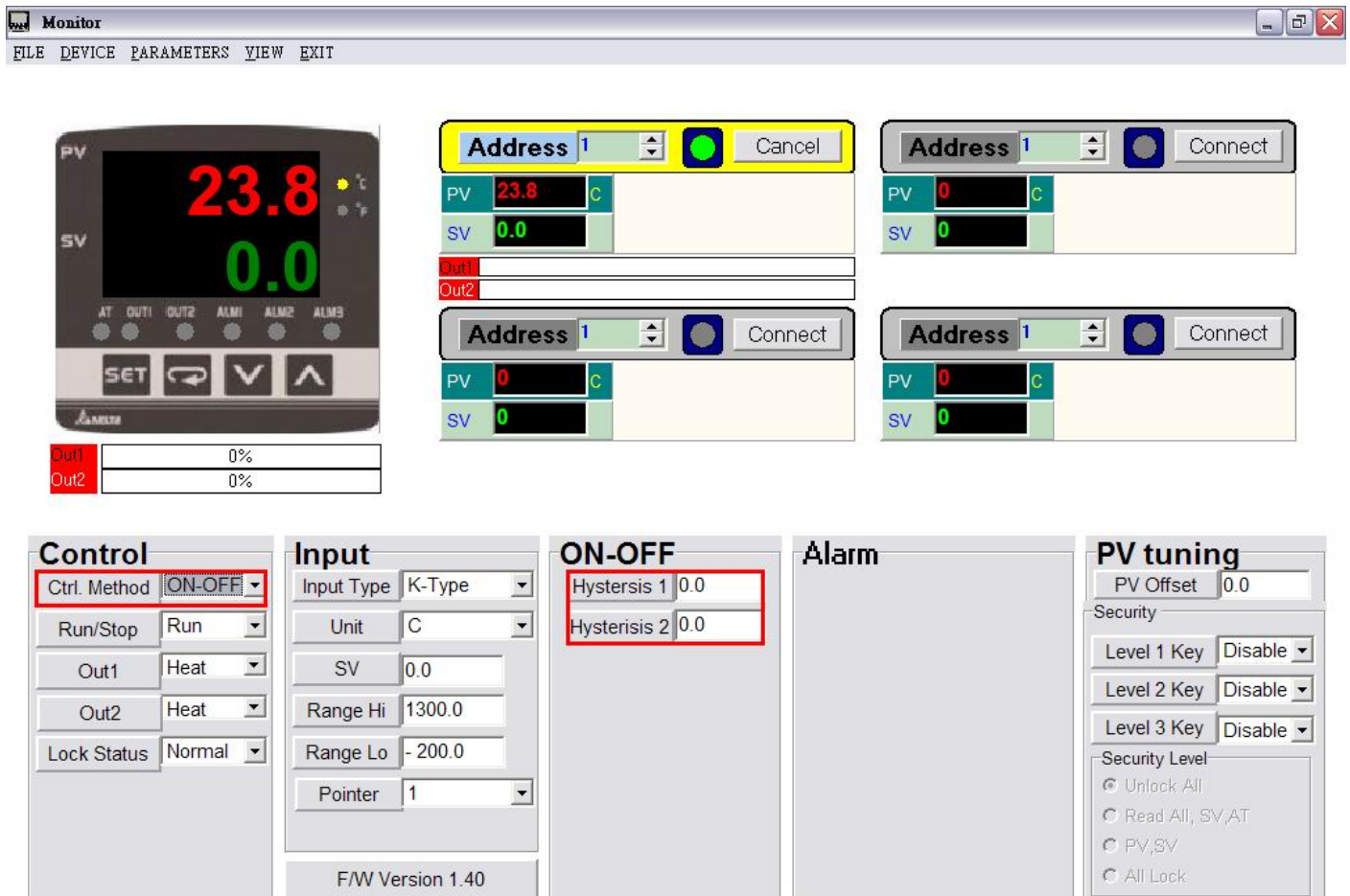
CHAPTER 4: CONTROL MODES IN DTC

4.1 ON/OFF

There are four control modes in DTC: ON/OFF, MANUAL, PID and PID PROG. Due to that DTC has no display panel, the settings and monitoring of parameters have to rely on communication. Therefore, you have to check the following 2 items to ensure normal communication.

1. Make sure RS-485 hardware communication cable in DTC has been connected to the computer.
2. Make sure the communication parameters in DTC are consistent with those in the computer.

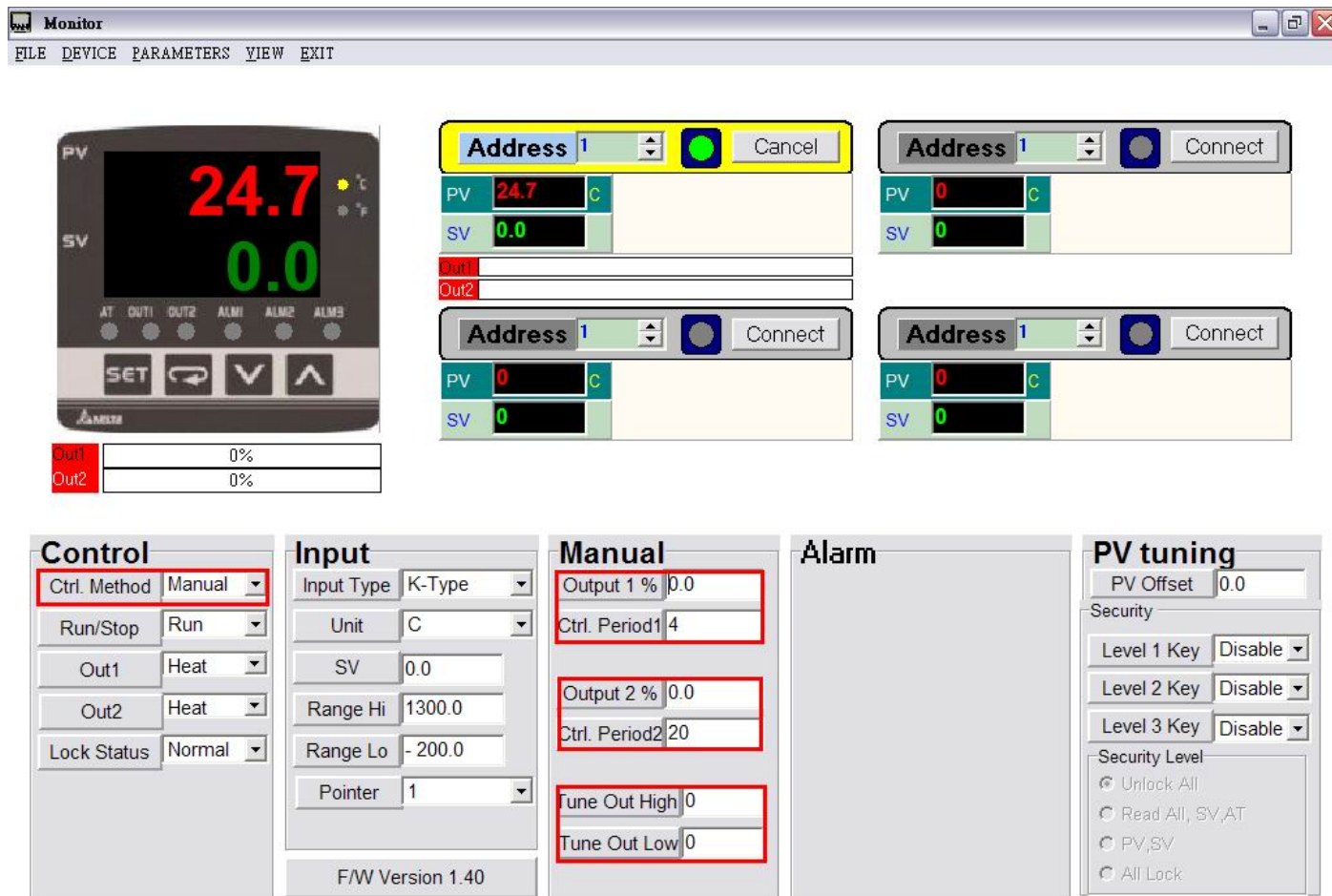
Next, open DTCOM Software and switch to ON/OFF control mode.



- Set up hysteresis. Default = heating hysteresis. Can be set as cooling hysteresis as well. Both default values are "0".

4.2 MANUAL

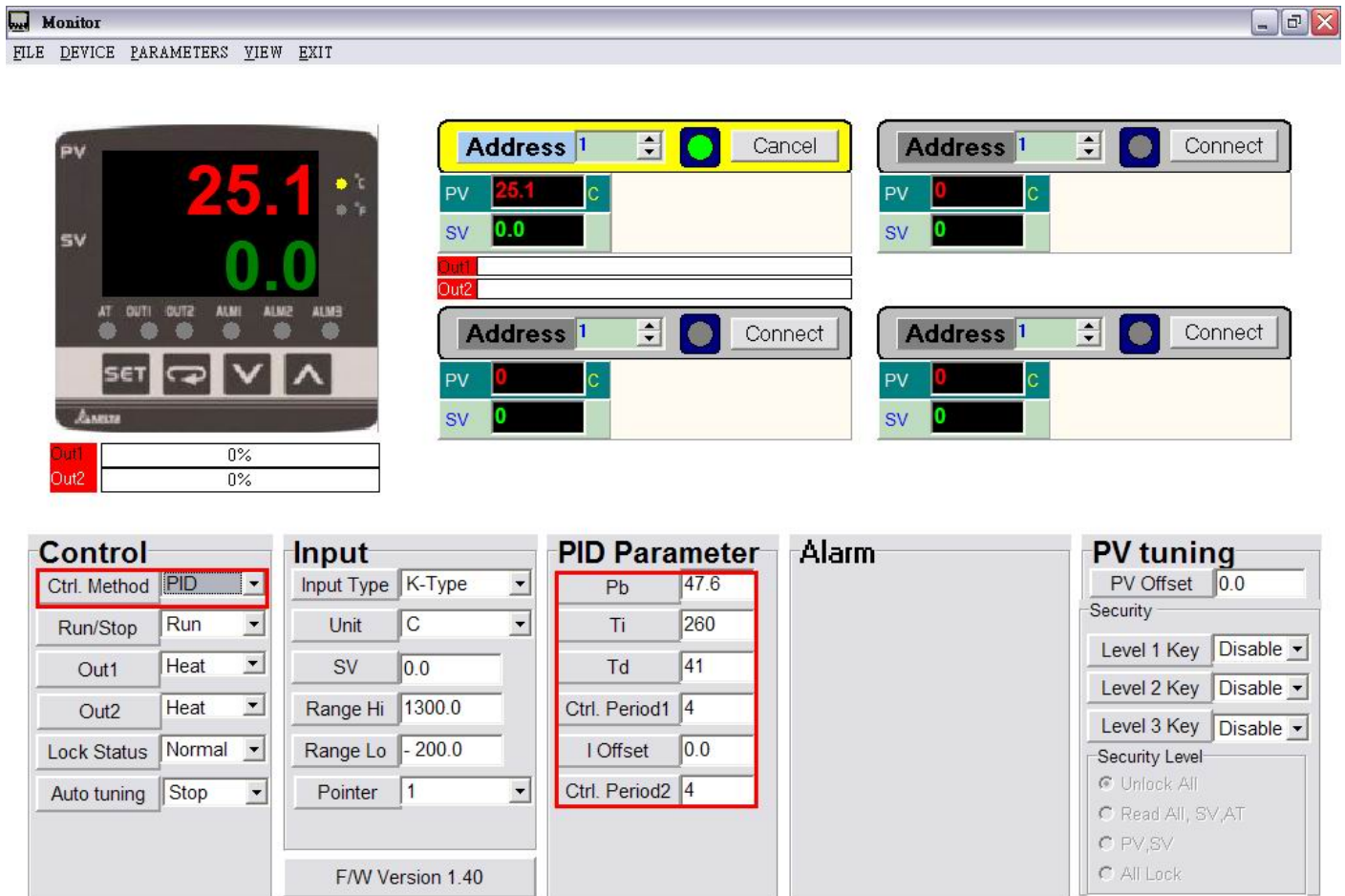
Switch the control mode to MANUAL mode.



- Set up heating or cooling control cycle. Default = heating, 20 seconds per cycle.
- Manually adjust the output percentage. Assume the percentage value = 50 and the cycle = 20 seconds plus heating control, the system will conduct heating output for 10 seconds and stop for the other 10 seconds.

4.3 PID

Switch the control mode to PID mode



- You can conduct auto-tuning on the default PID parameters according to the environment where your equipment is in or its temperature control capability, allowing the temperature controller to generate relevant PID parameters by itself in order to achieve an accurate temperature control.

4.4 PID PROG

Switch the control mode to PID PROG mode

The screenshot displays the Delta Temperature Controller software interface. At the top, a menu bar includes FILE, DEVICE, PARAMETERS, VIEW, and EXIT. Below the menu bar, there are two address input fields: 'Address 1' with a green 'Cancel' button and 'Address 1' with a blue 'Connect' button. The main display area is divided into several sections:

- Monitor:** A digital display showing 'PV 25.4' and 'SV 00:00:00'. Below the display are buttons for 'AT', 'OUT1', 'OUT2', 'ALM1', 'ALM2', and 'ALM3'. A blue arrow points from the 'SV 00:00:00' display to the 'SV' field in the 'Input' section.
- Control:** A section with various control parameters:
 - Ctrl. Method: Ramp Soak
 - Run/Stop: Run
 - Out1: Heat
 - Out2: Heat
 - Lock Status: Normal
 - Auto tuning: Stop
- Input:** A section with input parameters:
 - Input Type: K-Type
 - Unit: C
 - SV: Time Left
 - Range Hi: 1300.0
 - Range Lo: -200.0
 - Pointer: 1
- PID Parameter:** A section with PID parameters:
 - Pb: 47.6
 - Ti: 260
 - Td: 41
 - Ctrl. Period1: 4
 - I Offset: 0.0
 - Ctrl. Period2: 4
- Ramp Soak programmer:** A section with a table for programming steps. The table has columns for Pattern 0, Pattern 1, Pattern 2, Pattern 3, and Pattern 4. The rows include Step Max., Set Value 0 through Set Value 7, Execute Time 0 through Execute Time 7, Loop Count, and Link Pattern. The 'Step Max.' row shows values of 7 for all patterns. The 'Link Pattern' row shows 'Pattern 0' for all patterns.

- The 64 steps come from the combination of 8 patterns and 8 steps for each pattern. You can establish maximum 64 steps according to different systems in use.
- There are 8 steps in each pattern. You can define the step, loop and link pattern in each pattern.