

FTC200 Embedded Temperature Controller

Communication Protocol Reference Manual

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Controller Baud Rate Protocol Table:

The following table shows the parameters that must be configured in the software, hardware or both. Use DIP-switches on the PCB for hardware setup.

Parameter	Item	Default	Selection	Remarks
BAUD	Transmission speed	38400	9600 / 19200 / 38400 / 57600	S/W, H/W setup
----	Data length	8 bits	H/W Fixed (cannot be changed)	S/W setup
----	Stop bit	1 bit	H/W Fixed (cannot be changed)	S/W setup
----	Parity setting	None	H/W Fixed (cannot be changed)	S/W setup
ID	Address	1	1 to 16	S/W, H/W setup

Read [Function Code: x03] (*Read parameter/variable from the controller*)

(a) Protocol composition (hex value)

Command message composition

ID	Function	Address	----
x00 ~ x0F	x03	x0000 ~ x002B	xxxx
1 byte	1 byte	2 byte	2 bytes

Response message composition

ID	Function	Byte umber	WordData
x00 ~ x0F	x03	x0002	xxxx
1 byte	1 byte	2 bytes	2 bytes

* [xxxx]: any number stored in the corresponding register

(b) **Example:** *To read the SV (Set Temperature Value) from the controller*

Command message composition

ID	Function	Address	----
x01	x03	x0000	xxxx

Response message composition

ID	Function	Byte umber	Word Data
x01	x03	x0002	xxxx

(c) **Example:** *To read the SV (Set Temperature Value) from the controller*

Command message composition

ID	Function	Address	----
x01	x02	x0000	xxxx

Response message composition

xID	Function + x80	Error code	----
x01	x82	x0001	x0000

* [Error Code: x01] Function error, function with x03H

(d) **Example:**

Command message composition

ID	Function	Address	----
x01	x03	x002F	xxxx

Response message composition

ID	Function + x80	Error code	----
x01	x83	x0002	x0000

* [Error Code: x02] Address error, the parameter address x00H ~ x2BH

Write [Function Code: x05] (write parameter/variable to the controller **RAM** registers)

(a) Protocol composition (hex value)

Command message composition

ID	Function	Address	Word Data
x00 ~ x0F	x05	x0000 ~ x002B	xxxx
1 byte	1 byte	2 bytes	2 bytes

Response message composition

ID	Function	Address	Word Data
x00 ~ x0F	x05	x00XX	xxxx
1 byte	1 byte	2 bytes	2 bytes

(b) **Example:** To write a *SV* value (Set Temperature Value) to the controller

Command message composition

ID	Function	Address	Word Data
x01	x05	x0000	x03E8

Response message composition

ID	Function	Address	Word Data
x01	x05	x0000	x03E8

(c) **Example:** To write a *SV* value (Set Temperature Value) to the controller

Command message composition

ID	Function	Address	Word Data
x01	x07	x0000	x03E8

Response message composition

ID	Function + x80	Error code	----
x01	x87	x0001	x0000

* [Error Code: x01] Function error, function with x05H

(d) **Example:**

Command message composition

ID	Function	Address	Word Data
x01	x05	x002F	x03E8

Response message composition

ID	Function + x80	Error code	----
x01	x85	x0002	x0000

* [Error Code: x02] Address error, the parameter address x00H ~ x2BH

(e) **Example:**

Command message composition

ID	Function	Address	Word Data
x01	X05	x0000	x6FFF

Response message composition

ID	Function + x80	Error code	----
x01	X85	x0003	x0000

* [Error Code: x03] Data error

(f) Example: To write a SV value (Set Temperature Value) to the controller

Command message composition

ID	Function	Address	Word Data
x01	X05	x0000	x03E8

Response message composition

ID	Function + x80	Error code	----
x01	X85	x0004	x0000

- [Error Code: x04] Write EEPROM error

Write [Function Code: x06]

Write parameter/variable to the controller **RAM & EEPROM** registers

Command examples are same as write function code x05

Error Code:

	ID	Function + x80	00	Error code	x00	x00
Function error	xx	X8x	x00	x01	x00	x00
	Function error (write or read) only with x03H or x05H					
Addr error	xx	X8x	x00	x02	x00	x00
	Addr error (write or read parameter addr) parameter address of x00H ~ x2BH					
Data error	xx	X8x	x00	x03	x00	x00
	Data error (only write)					
Write eeprom error	xx	X8x	x00	x04	x00	x00
	Write EEPROM error (only write)					

Data Address Map:

Read & Write Word data map: Function code [x03 , x05, x06]

Note: EC# = English Code

Addr	Parameter	Range	Default	Unit
x0000	SV Set Value	LoLt ~ HiLt	20.0 °C	°C
x0001	A1SP High-Alarm Set Point	LoLt ~ HiLt	100.0 °C	°C
x0002	A2SP Low-Alarm Set Point	LoLt ~ HiLt	0.0 °C	°C
x0003	OUTL Power Output Duty Cycle	-100.00% ~ 100.00%	0.00 %	%
x0004	ENAB Enable function, 'A+nnnn' means when alarm triggered, bridge amp will be disabled	OFF / AT / MPWR / EnON / PROG (EC# x0 / x1 / x2 / x3 / x4) A+AT / A+MPWR / A+EnON / A+PROG (EC# x5 / x6 / x7 / x8)	OFF	
x0005	PB Proportional Band	0.00% ~ 100.00%	5.00 %	%
x0006	TI Integral Time	0 ~ 3600	240	50m Sec
x0007	TD Derivative Time	0 ~ 900	60	50m Sec
x0008	MR Integral entry value when PV enter Integral band	0.00% ~ 51.00%	50.00 %	%
x0009	AR Integral Band Value	0.00% ~ 100.00%	50.00 %	%
x000A	SPOF Set Point Offset	Table 1	0.0 °C	°C
x000B	PVOF Process Value Offset	Table 1	0.0 °C	°C
x000C	ACT Hot/Cold direction	REV / DIR (EC# x9/ xA)	REV	
x000D	TYPE Sensor Type	J / K / T / DPT / TR2252 / TR10K (EC# xB / xC / xD / xE / xF / x10)	TR2252	
x000E	UNIT	°C (EC# x13)	°C	
x000F	DP Decimal Point	000.0 / 00.00 (EC# x16/ x17)	000.0	
x0010	LOLT Low Limit	Table2	0.0 °C	°C
x0011	HILT High Limit	Table2	100.0 °C	°C
x0012	FILT Signal filter	0.0 ~ 99.9	0.0	
X002c	ARES Auto Resume	After Power Cycle, ENAB=x0000 /ENAB=x003 or x004 or x007 or x008 (EC# x0019/x001A)	X001A	

Below this line parameters are for Script Programming

Addr	Parameter	Range	Default	Unit
x0013	BAND Tolerance Band	0.00~100.00	100.0 °C	°C
x0014	RT1 Ramp Time	0 ~ 32767	3 Sec	Sec
x0015	SP1 Set Point	LOLT ~ HILT	20.0 °C	°C
x0016	ST1 Set Time	0 ~ 32767	3 Sec	Sec
x0017	SF1 Step Function	Table3	END	
x0018	RT2	0 ~ 32767	3 Sec	Sec
x0019	SP2	LOLT ~ HILT	20.0 °C	°C
x001A	ST2	0 ~ 32767	3 Sec	Sec
x001B	SF2	Table3	END	
x001C	RT3	0 ~ 32767	3 Sec	Sec
x001D	SP3	LOLT ~ HILT	20.0 °C	°C
x001E	ST3	0 ~ 32767	3 Sec	Sec
x001F	SF3	Table3	END	
x0020	RT4	0 ~ 32767	3 Sec	Sec
x0021	SP4	LOLT ~ HILT	20.0 °C	°C
x0022	ST4	0 ~ 32767	3 Sec	Sec
x0023	SF4	Table3	END	
x0024	RT5	0 ~ 32767	3 Sec	Sec
x0025	SP5	LOLT ~ HILT	20.0 °C	°C
x0026	ST5	0 ~ 32767	3 Sec	Sec
x0027	SF5	Table3	END	
x0028	RT6	0 ~ 32767	3 Sec	Sec
x0029	SP6	LOLT ~ HILT	20.0 °C	°C
x002A	ST6	0 ~ 32767	3 Sec	Sec
x002B	SF6	Table3	END	

Read Only Word data map: Function code [x03]

Addr	Parameter	Contents	Unit
x1000	PV	Process value (PV)	°C / °F
x1001~ 101A		System reserved value	
x101B	VER	Firmware Version from A1 ~ F9	

English code:

Some parameter values are set by “English code”. For example, to change the unit to °C via communication; the address value would be 000E(hex) and word data should be 0013(hex).

English	Code	English	Code	English	Code
OFF	x0000	K sensor type	X000C	N/A	x0018
AT auto tune	x0001	T sensor type	x000D	ARES Off	x0019
MPWR manual power	x0002	DPT sensor type	x000E	ARES On	x001A
EnON Enable On	x0003	TR2252 sensor type	x000F	N/A	x001B
PROG Script On	x0004	TR10K sensor type	x0010	N/A	x001C
A+AT w/ alarm trigger	x0005	N/A	x0011	N/A	x001D
A+MPWR w/ alarm	x0006	N/A	x0012	N/A	x001E
A+EnON w/ alarm	x0007	°C	x0013	N/A	x001F
A+PROG w/ arlarm	x0008	N/A	x0014	N/A	x0020
REV Hot/Cold dir	X0009	N/A	x0015	N/A	x0021
DIR Hot/Cold dir	X000A	000.0	x0016	N/A	x0022
J sensor type	X000B	00.00	x0017	N/A	x0023

* [A+nnnn]: The Enable function with “alarm trigger option”; when PV triggers the alarm, bridge amp is disabled.

Tables:

Table 1: SPOF & PVOF Range

DP	Unit	Range
000.0	°C	-100.0°C ~ 100.0°C
0.00	°C	-100.00°C ~ 100.00°C

Table 2: Temperature Sensor Range

Type	DP	Unit	Range
T/C	000.0	°C	-70.0 °C ~ 200.0 °C
J,K,T	00.00	°C	-70.00 °C ~ 200.00 °C
DPT	000.0	°C	-70.0 °C ~ 200.0 °C
PT100	00.00	°C	-70.00 °C ~ 200.00 °C
TR2252	000.0	°C	- 45.0 °C ~ 150.0 °C
	00.00	°C	- 45.00 °C ~ 150.00 °C
TR10K	000.0	°C	-20.0 °C ~150.0 °C
	00.00	°C	-20.00 °C ~150.00 °C

Table3: Script Program Byte Format

Parameter	HIGH(Byte)	LOW(Byte)	Function	
SF1 ~ SF5	--	xFE	NEXT	
	--	xFF	HOLD	
	--	x00	END	
	SF6	xFF = ∞ , xFE ~ x00 (times)	x01	LOOP to RT1
		xFF = ∞ , xFE ~ x00 (times)	x02	LOOP to RT2
		xFF = ∞ , xFE ~ x00 (times)	x03	LOOP to RT3
		xFF = ∞ , xFE ~ x00 (times)	x04	LOOP to RT4
		xFF = ∞ , xFE ~ x00 (times)	x05	LOOP to RT5
		xFF = ∞ , xFE ~ x00 (times)	x06	LOOP to RT6

Code Example (in pseudo C):

```
// Read SV value
unsigned char  Combuf[6]={0x01,0x03,0x00,0x00,0x00,0x00};
unsigned char  Inbyte[6];
short int     RdVal;
float         fSV;

ComWrt(ComPort,Combuf,6);
Delay (0.02); // delay 20msec
ComRd (ComPort, Inbyte, 6);
If( Inbyte[1]<0x80 ){
    RdVal=(short int)Inbyte[4]*256+(short int)Inbyte[5];
    fSV= (float)RdVal / 100.;    // adjust to two decimal points
} else {    //process your error code here  }

// Write in SV with 75.50°C, hex is x02F3 (7550=75.5x100.)
unsigned char  Combuf[6]={0x01,0x06,0x00,0x00,0x1D,0x7E};
unsigned char  Inbyte[6];

ComWrt(ComPort,Combuf,6);
Delay (0.02); // delay 20msec
ComRd (ComPort, Inbyte, 6);
If( Inbyte[1]<0x80 ) { // the 6 hex values in Inbyte[] should be the same as the Combuf[] }
else {    // process your error code here  }
```

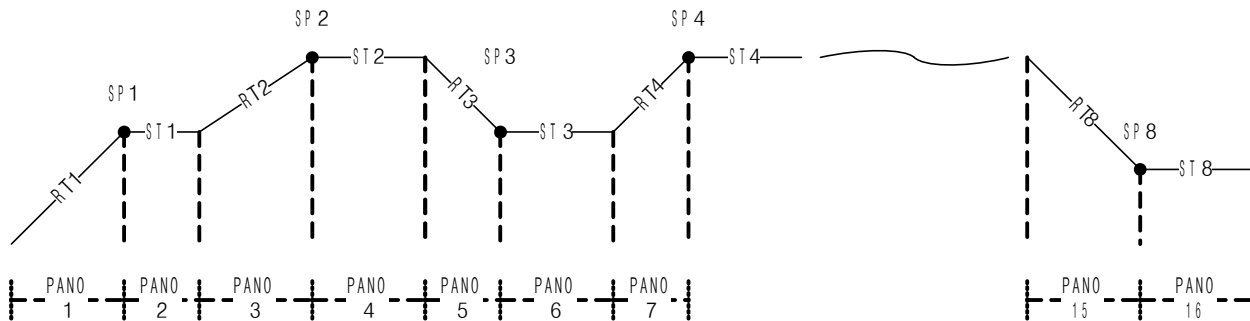
Description of Script Program Coding:

ENAB: “OFF”: Amplifier Enable is OFF

_____ “EnOn, A+EnON”: Enable Amplifier for single point SV control (not for script command)

_____ “PROG, A+PROG”: Running Script Program

PANO: Return the current script step (number from 1 – 12)



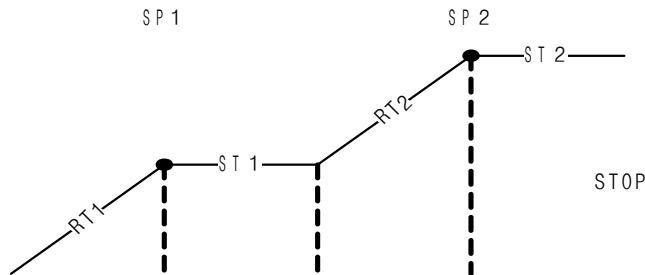
BAND: Tolerance band; When $SV-BAND \leq PV \leq SV+BAND$ is satisfied, the program will go to next step when set time is reached.

RTx: Ramping time from last temperature to new SPx; 0 ~ 32767

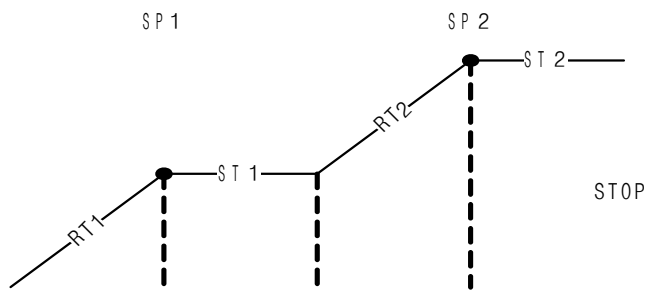
SPx: Set Temperature; Hilt ~ Lolt (within Hi/Lo limit)

STx: Holding Time at SPx temperature

SFx: Script Step Functional setting for END/HOLD/LOOP/NEXT



if SF3 = “END” then out1 = 0.0%



if SF3 = “HOLD” then out1 hold

Notes: