

LCD Display PID Temperature Controller

TX Series

USER MANUAL For COMMUNICATION



Preface

Thank you for purchasing an Autonics product.

Please familiarize yourself with the information contained in the Safety Precautions section before using this product.

This user manual contains information about the product and its proper use, and should be kept in a place where it will be easy to access.

User Manual Guide





- Please familiarize yourself with the information in this manual before using the product.
- This manual provides detailed information on the product's features. It does not offer any guarantee concerning matters beyond the scope of this manual.
- This manual may not be edited or reproduced in either part or whole without permission.
- A user manual is not provided as part of the product package.
Visit our web site (www.autonics.com) to download a copy.
- The manual's content may vary depending on changes to the product's software and other unforeseen developments within Autonics, and is subject to change without prior notice.
Upgrade notice is provided through out homepage.
- We contrived to describe this manual more easily and correctly. However, if there are any corrections or questions, please notify us these on our homepage.

Communication Protocol

TX Series is accepted to Modbus RTU Protocol.


Users should be aware that it does not support a broadcast command.


User Manual Symbols

Symbol	Description
 Note	Supplementary information for a particular feature.
 Warning	Failure to follow instructions can result in serious injury or death.
 Caution	Failure to follow instructions can lead to a minor injury or product damage.
 Ex.	An example of the concerned feature's use.
※1	Annotation mark.

Safety Precautions

- Following these safety precautions will ensure the safe and proper use of the product and help prevent accidents, as well as minimizing possible hazards.
- Safety precautions are categorized as Warnings and Cautions, as defined below:

 Warning	Warning	Failure to follow the instructions may lead to a serious injury or accident.
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 Caution	Caution	Failure to follow the instructions may lead to a minor injury or accident.
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Warning

- 1. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)
Failure to follow this instruction may result in fire, personal injury, or economic loss.
- Install on a device panel to use.
Failure to follow this instruction may result in electric shock or fire.
- Do not connect, repair, or inspect the unit while connected to a power source.
Failure to follow this instruction may result in electric shock or fire.
- Check 'Connections' before wiring.
Failure to follow this instruction may result in fire.
- Do not disassemble or modify the unit.
Failure to follow this instruction may result in electric shock or fire.



Caution

- When connecting the power input and relay output, use AWG 20(0.50mm²) cable or over and tighten the terminal screw with a tightening torque of 0.74 to 0.90N·m.
- When connecting the sensor input and communication cable without dedicated cable, use AWG 28 to 16 cable and tighten the terminal screw with a tightening torque of 0.74 to 0.90N·m.
Failure to follow this instruction may result in fire or malfunction due to contact failure.
- Use the unit within the rated specifications.
Failure to follow this instruction may result in fire or product damage.
- Use dry cloth to clean the unit, and do not use water or organic solvent.
Failure to follow this instruction may result in electric shock or fire.
- Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.
Failure to follow this instruction may result in fire or explosion.
- Keep metal chip, dust, and wire residue from flowing into the unit.
Failure to follow this instruction may result in fire or product damage.

※ The above specifications are subject to change and some models may be discontinued without notice.

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1 Modbus RTU Protocol

1.1 Read coil status(Func 01-01H)

Read output(OX reference, Coil) ON/OFF status in the slave device.

(1) Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

(2) Response (Slave)

Slave address	Function	Byte count	Data	Data	Data	Error check(CRC16)	
						Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

If read the 10 output status(ON: 1, OFF: 0) within coil 00001(0000 H) to 00010(0009 H) on Slave(Address 17) from Master.

- Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	01 H	00 H	00 H	00 H	0A H	## H	## H

If the values range from coil 00008(0007 H) to 00001(0000 H) on the Slave are "ON-ON-OFF-OFF-ON-ON-OFF-ON", and the values from 00010(0009 H) to 00009(0008 H) are respectively "OFF-ON".

- Response (Slave)

Slave address	Function	Byte count	Data	Data	Error check(CRC16)	
			(000008 to 000001)	(000010 to 000009)	Low	High
11 H	01 H	02 H	CD H	01 H	## H	## H

1.2 Read input status(Func 02-02H)

Read Input ON/OFF status(1X reference) in Slave device.

(1) Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

(2) Response (Slave)

Slave address	Function	Byte count	Data	Data	Data	Error check(CRC16)	
						Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

If read the 10 input status(ON: 1, OFF: 0) within range 100001(0000 H) to 100010(0009 H) in the Slave from the Master.

- Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	02 H	00 H	00 H	00 H	0A H	## H	## H

If the values range 100008(0007 H) to 100001(0000 H) on Slave are "ON-ON-OFF-OFF-ON-ON-OFF-ON", and the values of 100010(0009 H) and 100009(0008 H) are respectively "OFF-ON".

- Response (Slave)

Slave address	Function	Byte count	Data	Data	Error check(CRC16)	
			(100008 to 00001)	(100010 to 100009)	Low	High
11 H	02 H	02 H	CD H	01 H	## H	## H

1.3 Read holding registers(Func 03–03H)

Read the Binary data of Holding Registers(4X reference) in Slave device.

(1) Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

(2) Response (Slave)

Slave address	Function	Byte count	Data		Data	Data	Error check(CRC16)		
			High	Low	High	Low	High	Low	Low
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

If read the 2 values from Holding Register 400001(0000 H) to 400002(0001 H), in Slave(Address 17) from the Master.

- Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	03 H	00 H	00 H	00 H	02 H	## H	## H

If the value of 400001(0000 H) on Slave is "555(22B H)" and the value of 400002(0001 H) is "100(64 H)".

- Response (Slave)

Slave address	Function	Byte count	Data		Data	Data	Error check(CRC16)	
			High	Low	High	Low	Low	High
11 H	03 H	04 H	02 H	2B H	00 H	64 H	## H	## H

1.4 Read input registers(Func 04–04H)

Read the Binary data of Input Registers(3X reference) in Slave device.

(1) Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

←————— CRC16 —————→

(2) Response (Slave)

Slave address	Function	Byte count	Data	Data	Data	Error check(CRC16)	
						Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

←————— CRC16 —————→

If read the 2 values within the range from Input Register 300001(0000 H) to 300002(0001 H) on Slave(Address 17) from Master.

- Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	04 H	00 H	00 H	00 H	02 H	## H	## H

If the values of 300001(0000 H) and 300002(0001 H) on Slave are respectively “10(A H)” and “20(14 H)”.

- Response (Slave)

Slave address	Function	Byte count	Data		Data		Error check(CRC16)	
			High	Low	High	Low	Low	High
11 H	04 H	04 H	00 H	0A H	00 H	14 H	## H	## H

1.5 Force single coil (Func 05–05H)

Turns ON (FF00 H) or OFF (0000 H) of single coil (0X reference) status within slave device.

(1) Query (Master)

Slave address	Function	Starting address		Preset data		Error check (CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte
← CRC16 →							

(2) Response (Slave)

Slave address	Function	Starting address		Preset data		Error check (CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte
← CRC16 →							

If Coil 000001 (0000 H) turns ON of Slave (Address 17) from Master.

▪ Query (Master)

Slave address	Function	Starting address		Preset data		Error check (CRC16)	
		High	Low	High	Low	Low	High
11 H	05 H	00 H	00 H	FF H	00 H	## H	## H

▪ Response (Slave)

Slave address	Function	Starting address		Preset data		Error check (CRC16)	
		High	Low	High	Low	Low	High
11 H	05 H	00 H	00 H	FF H	00 H	## H	## H

1.6 Preset single registers(Func 06–06H)

Read the Binary data of single Holding Registers (4X reference) in Slave device.

(1) Query (Master)

Slave address	Function	Register address		Preset data		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

←———— CRC16 —————→

(2) Response (Slave)

Slave address	Function	Register address		Preset data		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

←———— CRC16 —————→

If write “10(A H)” to Holding Register 400001(0000 H) on Slave(Address 17) from Master.

- Query (Master)

Slave address	Function	Starting address		Preset data		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	06 H	00 H	00 H	00 H	0A H	## H	## H

- Response (Slave)

Slave address	Function	Starting address		Preset data		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	06 H	00 H	00 H	00 H	0A H	## H	## H

1.7 Preset multiple registers(Func 16–10H)

Write the Binary data of Holding Registers (4X reference) consecutively in Slave device.

(1) Query (Master)

Slave Address	Function	Starting Address		No. of register		Byte count	Data		Data		Error check (CRC16)	
		High	Low	High	Low		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

(2) Response (Slave)

Slave address	Function	Starting address		No. of register		Error check(CRC16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

← CRC16 →

If write "10(A H)" in common to the range of Holding Register 400001(0000 H) to 400002(0001 H) on Slave from Master.

- Query (Master)

Slave address	Function	Starting Address		No. of register		Byte count	Data		Data		Error check (CRC16)	
		High	Low	High	Low		High	Low	High	Low	Low	High
11 H	10 H	00 H	00 H	00 H	02 H	04 H	00 H	0A H	00 H	0A H	## H	## H

- Response (Slave)

Slave address	Function	Starting address		No. of register		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	10 H	00 H	00 H	00 H	02 H	## H	## H

Please use the Single Register Write function rather than Multi Register Write function if you use the slave(device) connecting with external devices such as PLC, Graphic Panel, except in the case of download that presets the minimum/maximum or basic value of parameter by Input specifications in PC Loader Program

1.8 Exception response-error code

If occurs an error, send a response command and transmit each Exception Code after set(1) the highest-level bit of received command(Function).

Slave address	Function +80 H	Exception code	Error check(CRC16)	
			Low	High
1Byte	1Byte	1Byte	1Byte	1Byte
← CRC16 →				

- ILLEGAL FUNCTION (Exception Code: 01 H): A command that is not supported
- ILLEGAL DATA ADDRESS (Exception Code: 02 H): Starting address of queried data is inconsistent with transmittable address from the device.
- ILLRGAL DATA VALUE (Exception Code: 03 H): Numbers of queried data are inconsistent with the numbers of transmittable (transferable) data from the device.
- SLAVE DEVICE FAILURE (Exception Code: 04 H): Not properly completed the queried command (order).

Read the output status of non-existing coil 001001(03E8 H) [ON: 1, OFF: 0] on Slave(Address 17) from Master.

- Query (Master)

Slave address	Function	Starting address		No. of points		Error check(CRC16)	
		High	Low	High	Low	Low	High
11 H	01 H	03 H	E8 H	00 H	01 H	## H	## H

- Response (Slave)

Slave address	Function +80 H	Exception Code	Error check(CRC16)	
			Low	High
11 H	81 H	02 H	## H	## H

2 Modbus Mapping Table

2.1 Read Coil Status(Func 01) / Force Single Coil(Func 05) [Func: 01/05, R/W: R/W]

No. (Address)	Type	Description	Setting/Display range	Unit	Factory Default
000001(0000)	RUN/STOP	Control output run/stop	0: RUN 1: STOP	-	STOP
000002(0001)	AT	Related coil, variable Auto-tuning run/stop	0: OFF 1: ON	-	OFF
000003(0002)	Alarm Reset	Alarm output clear	0: OFF 1: ON	-	OFF
000004 to 000050	Reserved				

2.2 Read Discrete Inputs(Func 02) [Func: 02, R/W: R]

No. (Address)	Type	Description	Setting/Display range	Unit	Factory Default
100001(0000)	°C indicator	Unit indicator	0: OFF 1: ON	-	-
100002(0001)	°F indicator	Unit indicator	0: OFF 1: ON	-	-
100003(0002)	OUT indicator	Control output indicator	0: OFF 1: ON	-	-
100004(0003)	AT indicator	Auto-tuning indicator	0: OFF 1: ON	-	-
100005(0004)	AL1 indicator	Alarm output 1 indicator	0: OFF 1: ON	-	-
100006(0005)	AL2 indicator	Alarm output 2 indicator	0: OFF 1: ON	-	-
100006 to 100050	Reserved				

2.3 Read Input Registers (Func 04) [Func:02, R/W : R]

No. (Address)	Type	Description	Setting/ Display range	Unit	Factory Default	Note
300001 to 300100	Reserved					
300101(0064)	-	Product number H	-	-	Dedicated model number	
300102(0065)	-	Product number L	-	-		
300103(0066)	-	Hardware version	-	-	<input type="checkbox"/>	
300104(0067)	-	Software version	-	-	<input type="checkbox"/>	
300105(0068)	-	Model 1	-	-	"TX"	"Product Name"
300106(0069)	-	Model 2	-	-	" 4"	"Digit"
300107(006A)	-	Model 3	-	-	" "	"Size"
300108(006B)	-	Model 4	-	-	" "	"Option output Power supply"
300109(006C)	-	Model 5	-	-	" "	"Control output"
300110(006D)	-	Model 6	-	-	" "	
300111(006E)	-	Model 7	-	-	" "	
300112(006F)	-	Model 8	-	-	" "	
300113(0070)	-	Model 9	-	-	" "	
300114(0071)	-	Model 10	-	-	" "	
300115(0072)	-	Reserved	-	-	-	
300116(0073)	-	Reserved	-	-	-	
300117(0074)	-	Reserved	-	-	-	
300118(0075)	-	Coil status start address	-	-	0000	
300119(0076)	-	Coil status quantity	-	-	0	
300120(0077)	-	Input status start address	-	-	0000	
300121(0078)	-	Input status quantity	-	-	0	
300122(0079)	-	Holding register start address	-	-	0000	
300123(007A)	-	Holding register quantity	-	-	0	
300124(007B)	-	Input register start address	-	-	0000	
300125(007C)	-	Input register quantity	-	-	0	
300127 to 300200	Reserved					

No. (Address)	Type	Description	Setting/ Display range	Unit	Factory Default	Note
301001(03E8)	PV	Present value	-1999 to 9999	°C/°F	-	
301002(03E9)	DOT	Decimal point position	0:0, 1:00, 2:000, 3:0000	-	-	
301003(03EA)	UNIT	Display unit	0: °C, 1: °F	-	-	
301004(03EB)	SV	Setting value	Within L - 5V to H - 5V	°C/°F	0	
301005(03EC)	°C indicator	Front indicator	Unit indicator	0: OFF 1: ON		
	°F indicator		Unit indicator	0: OFF 1: ON		
	OUT indicator		Control output indicator	0: OFF 1: ON		
	AT indicator		Auto-tuning indicator	0: OFF 1: ON		
	AL1 indicator		Alarm output 1 indicator	0: OFF 1: ON		
	AL2 indicator		Alarm output 2 indicator	0: OFF 1: ON		
310006 to 310050	Reserved					

2.4 Read Holding Register(Func 03)/Preset Single Register(Func 06)/Preset Multiple Registers(Func 16) [Func:03/06/16, R/W : R/W]

2.4.1 SV setting

No. (Address)	Parameter	Description	Setting/Display range	Unit	Factory Default
400001(0000)	Set value	SV setting value	Within L - 5% to H - 5%	°C/°F	0
400002 to 400050	Reserved				

2.4.2 Parameter 1 group [PAr 1]

No. (Address)	Parameter	Description	Setting/Display range	Unit	Factory Default
400051(0032)	AL1	AL1 temperature	Deviation temperature: -F.S. to F.S.	°C/°F	1250
400052(0033)	AL2	AL2 temperature	Absolute value alarm: Within temperature range		
400053(0034)	AE	Auto-tuning	0: OFF 1: ON	-	OFF
400054(0035)	P	Proportional band	1 to 9999: 0.1 to 999.9	°C/°F	100
400055(0036)	I	Integral time	0 to 9999: 0 to 999.9	Sec	0
400056(0037)	D	Derivative time	0 to 9999: 0 to 999.9	Sec	0
400057(0038)	RESET	Manual reset	0 to 1000: 0.0 to 100.0	%	500
400058(0039)	HYS	Hysteresis	1 to 100(1 to 500): 1 to 100(0.1 to 50.0)	-	2
400059 to 400100	Reserved				

2.4.3 Parameter 2 group [PAR2]

No. (Address)	Parameter	Description	Setting/Display range	Unit	Factory Default
400101(0064)	IN-t	Input sensor	Refer to 'Input Type And Range'	-	KCRH
400102(0065)	UNI t	Temperature unit	0: °C, 1: °F	-	°C
400103(0066)	IN-b	Input correction	-999 to 999(-1999 to 9999): -999 to 999(-1999 to 9999)	-	0
400104(0067)	MAV.F	Input digital filter	1 to 1200: 0.1 to 1200	Sec	0.1
400105(0068)	L-SV	SV low-limit value	Refer to 'Input Type And Range'	°C/°F	-50
400106(0069)	H-SV	SV high-limit value			1200
400107(006A)	o-Ft	Control output mode	0: HEARt, 1: CoOL	-	HEARt
400108(006B)	C-Md	control method	0: PId, 1: oNoF	-	PId
400109(006C)	oUt	Control output selection	0: SSR, 1: CURR	-	CURR
400110(006D)	SSRM	SSR drive output method	0: StNd, 1: CYCL, 2: PHAS	-	StNd
400111(006E)	oMR	Current output range	0: 4-20, 1: 0-20	-	4-20
400112(006F)	t	Control cycle	5 to 1200: 0.5 to 1200	Sec	200 20
400113(0070)	AL-1	AL1 operation	00: AMO., 10 to 15: AMIA to AMIF, ...	-	AMIA
400114(0071)	AL-2	AL2 operation	60 to 65: AM6A to AM6F, 70: 5bAA, 71: 5bAb, 80: LbAA, 81: LbAb		AM2A
400115(0072)	AHYS	Alarm output hysteresis	1 to 100(1 to 500): 1 to 100(0.1 to 500)	-	1
400116(0073)	LbARt	LBA detection time	0 to 9999: 0 to 9999	Sec	0
400117(0074)	LbARb	LBA detection band	0 to 999(0 to 9999): 0 to 999(0.0 to 9999)	°C/°F	2
400118(0075)	FS-L	Trans. output low-limit value	Refer to 'Input Type And Range'	-	-50
400119(0076)	FS-H	Trans. output high-limit value		-	1200
400120(0077)	AdRS	Com. address	1 to 127: 1 to 127	-	1
400121(0078)	bPS	Com. speed	0: 24, 1: 48, 2: 96, 3: 192, 4: 384	-	96
400122(0079)	PRtY	Com. parity bit	0: NoNE, 1: EVEN, 2: odd	-	NoNE

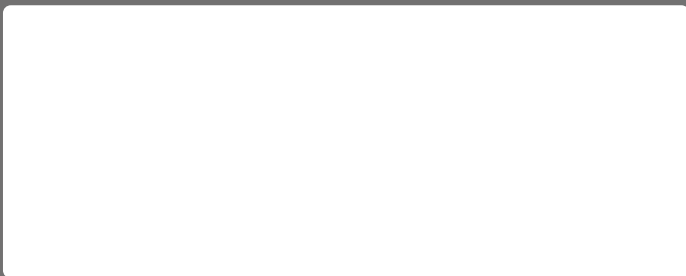
No. (Address)	Parameter	Description	Setting/Display range	Unit	Factory Default
400123(007A)	StP	Com. stop bit	0: 1, 1: 2	-	2
400124(007B)	RStWt	Com. response waiting time	5 to 99: 5 to 99	ms	20
400125(007C)	ENR	Com. write	0: ENR, 1: dI 5A	-	ENR
400126(007D)	dI -K	Digital input key	0: OFF, 1: StOP, 2: ALRE, 3: RE	-	StOP
400127(007E)	ERMV	Control output MV for input break	0 to 1000: 0.0(OFF) to 100.0(ON)	%	0.0
400128(007F)	LoC	Lock	0: OFF, 1: LoC 1, 2: LoC 2, 3: LoC 3	-	OFF
400129 to 400150	Reserved				

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