TC300SK

Hot Runner Temperature Controller

Communications Function Manual

Date：Jan. 2021

Version：Ver.A (English)

Contents

1. Safety Regulations and Attentions

In order to use the TC300SK Hot Runner Temperature Controller safely and effectively, please read through this operation manual before operation, and abide by warning marks in the content and operation instructions.

Precautions prior to operation:

1. Install the machine on a firm floor in a well ventilated location; avoid a damp, dusty or high-temperature environment since installation in such environments is likely to cause failure or malfunction of the machine or even a fire.
2. Before connecting a power supply to the TC300SK, make sure the phase, voltage and capacity of the power supply are correct. Use of any power supply other than that specified will cause severe damage to the system. If there is no response from machine after switching on the power supply, switch off the power mains immediately and check the wiring for correct connection.
3. Before switching on the power mains of the TC300SK, make sure the system grounding (FG) is correctly connected. Incorrect grounding may result in electrical shock or damage to equipment.
4. Before connecting the die cable to the TC300SK, make sure the connection method of the two are consistent. Connecting the die cable with inconsistent connector to the TC300SK will result in electrical shock and equipment damage.
5. Check operation of the TC300SK's heat cooling fan from time to time. In case the heat dissipation fan is clogged, immediately clean the fan to ensure air flow or heat dissipation will be unhindered.
6. The control system shall never be altered or modified by non-professional personnel, or else electrocution, injury, equipment damage, or even a fire may occur.
7. In the event of abnormal smoke, splashing, odor or noise from the TC300SK during operation, switch off the power mains immediately and notify a specialist for check up. Do not switch on the power before the problem is solved.

8. The TC300SK shall be serviced by professionals only. Before service work, make sure the power mains are switched off. Dismantling the TC5A when it the power is on is likely to cause electrical hazards.

2. General Description

Read this manual carefully before operation to prevent damage of the machine or personal injuries.

Temperature controller, being used in hot runner system, is a device which maintains the required temperature value for the hot runner via. PID control. It consists of temperature control card, circuit breaker, cabinet, fan, terminal blocks and cables. The temperature control card in the cabinet controls the temperature of the hot runner and the temperature accuracy of system. Self-protection and fault tolerance depends on the function of the temperature control card. At present, temperature controller is necesscry in the application of hot runner molds.

3. Description of MODBUS Features

3.1 Master-Slave Structure

1. The Modbus is configured in a Master-Slave Structure in which, a point-to-point communication method is implemented. After delivering a message, the Master end will wait for the corresponding message reply from the Slave end; Likewise, the Slave end must respond to the corresponding message that is received from the Master end.
2. Communication Method:
    1) The Query: The “function code” contained in the query message notifies the Slave of the action that will be executed. The information in the “Data” refers to the content that must be filled for the Slave to acknowledge. Take “function code 03” for example, it is the address data that is responded to by the Slave for reading by the Master; the “Data” is the address and the message count that must be filled in the Master Field for reading; and the “error check” is the tool used by the Slave to check the correctness of the message.
    2) The Response: Under normal status, the “function code” in the message responded to by the Slave will be identical with the “function code” in the Query at the Master end. The information in the “Data” comes from the Slave end or the status in the Register. When detecting the error, the “function code” at the Slave end will be modified (max. bit to be set as “1”) in order to identify that the message is incorrect. The information in the “Data” can be used for storing the error code; whereas, the “error check” is provided for the Master to check the correctness of the message.

3.2 Transmission Protocol

In RS-485/RS-422/RS-232 applications, the Modbus is configured with two transmission protocols, namely ASCII and RTU for the user to select according to actual needs. Nonetheless, the serial communication parameters (e.g. baud rate, parity mode...etc.) of all equipment connected to the same line must be the same, and the selected Modbus communication protocol (ASCII/RTU) shall be identical as well.

1. ASCII Mode: After selecting Modbus ASCII (American Standard Code for

Information Interchange), each count of 8-bit data in the communication packet will occupy two ASCII bits. The advantage of this kind of communication mode is to avoid errors occurring when judging the data (bit) if the packet data is delayed (even up to 1 second) during the transmission process.

1) Definition of Coding: Each count of 8-bit data consists of two ASCII bits. For example, one count of 1 byte data 64H (16-decimal method) is expressed as ASCII “64”, including ASCII code (36H) of “6” and ASCII code (34H) of “4”.

Listed below are the ASCII codes from 0 to 9 and from A to F.

Bit Symbol	0	1	2	3	4	5	6	7
ASCII Code	30H	31H	32H	33H	34H	35H	36H	37H
Bit Symbol	8	9	A	B	C	D	E	F
ASCII Code	38H	39H	41H	42H	43H	44H	45H	46H

2) Communication Data Structure: In ASCII Communication Mode, each packet includes the initial bit, communication address, command code, data content, error code and end code, etc.

STX	Initial Bit: „:"(3AH) One ASCII code.
ADR	Communication Address: Each byte includes two ASCII codes
CMD	Command Code: Each byte includes two ASCII codes
DATA(n-1)	Data Content: N word = 2N byte includes 4N count of ASCII codes
…….	
DATA(0)	
LRC	Debug Code: Each byte includes two ASCII codes
End 1	End Code: CR (0DH) One ASCII code
End 2	End Code: LF (0AH) One ASCII code

3) Description of Communication Data Format：

STX	Communication Start: ASCII mode is„："(3AH)
ADR	Communication Address: The scope of a legal communication address is between 1~255. Example: Communication with the ID (communication address) expressed by 16" (16-decimal 10H): ASCII Mode: ADR = „1”0”=> 31H,30H.
CMD	Command Code (03H is data reading; 06H is single data writing; 10H is multiple data
DATA	Data Content and length will depend on the respective data.
LRC	Debug code: ASCII Mode uses LRC (Longitudinal Redundancy Check)
End 1 End 2	Communication ending bit

4) Parameter Write-In: Write in data command code – 06H (write in one WORD).

Example: Write 100 (0064 H) to the register 40001 of the instrument address ID=01H, the first register (instrument register address 0) in zone 4, that is, the instrument setting value is 100.

Command Message		Response Message	
STX	：(3AH)	STX	：(3AH)
ADR	30	ADR	30
	31		31
CMD	30	CMD	30
	36		36
Data Address	30	Data Address	30
	30		30
	30		30
	30		30
Data Content	30	Data Content	30
	30		30
	36		36
	34		34
LRC Check	39	LRC Check	39
	35		35
End 1	CR(0DH)	End 1	CR(0DH)
End 2	LF(0AH)	End 2	LF(0AH)

5) Parameter Read-Out: Read out the data command code – 03H (read out one WORD).

Example: Read out the register 40001 of instrument address ID=01H, and the first register (instrument register address 0) in Zone 4. Assume that the register address 40001 is 100 (64H), that is, read out current set temperature of the instrument.

Command Message		Response Message	
STX	: (3AH)	STX	: (3AH)
ADR	30	ADR	30
	31		31
CMD	30	CMD	30
	33		33
Parameter Address	30	DATE SIZE	30
	30		32
	30	Parameter Value	30
	30		30
Parameter Quantity	30		36
	30		34
	30	LRC Check	39
	31		36
LRC Check	46	End 1	CR(0DH)
	42	End 2	LF(0AH)
End 1	CR(0DH)		
End 2	LF(0AH)		

＊If the received command message is wrong, then only the data transmission error code will be responded to.

STX	: (3AH)
ADR	30
	31
CMD	38
	33
Data Transmission Error Code	30
	31
LRC Check	37
	42
End 1	CR(0DH)
End 2	LF(0AH)

2. RTU Mode: After selecting the Modbus RTU (Remote Terminal Unit) Mode, each count of 8-bit data will include two 4-bit 16-decimal system codes. The advantage of selecting this mode is to accommodate higher data quantities than ASCII, but the data transmission in each packet must be continuous without interruption.

   1) Communication Data Structure: In the RTU Communication Mode, each packet will include communication address, command code, data content and debug code.

T1-T2-T3-T4	Before sending the packet must be retained for over 3.5-bit of transmission time with the previous packet.
ADR	Communication Address：1 byte
CMD	Command Code：1 byte
DATA(n-1)	Data Content: N word = 2N byte includes 4N count of ASCII.
…….	
DATA(0)	
CRC	Debug Code: 2 byte
T1-T2-T3-T4	Before sending the next packet, it must be retained for over 3.5-bit of transmission time with the previous packet.

   2) Description of communication data format：

ADR	Correspondence address: the legal correspondence address ranges from 1 to 99. For example, the thermometer ID (correspondence address) is "16" (16 carry 10H): ASCII Mode: ADR ='1''0'=> 31H，30H
CMD	Command Code, (03H is data reading; 06H is single data writing)
DATA	Data Content and length will depend on the respective data.
CRC	Debug code: RTU Mode uses CRC (Cyclical Redundancy Check)

3) Parameter Write-In: Data write-in command code-06H (write in 1 count of WORD).

Example: Write 100 (0064H) to the register 40001 of the instrument address ID=01H, the first register (instrument register address 0) in zone 4, that is, the instrument setting value is 100.

Command Message		Response Message	
ADR	01	ADR	01
CMD	06	CMD	06
Data Address	00	Data Address	00
	00		00
Data Content	00	Data Content	00
	64		64
CRC Check	88	CRC Check	88
	21		21

4) Parameter Read-Out: Read out data command code – 03H (read out one WORD).

Example: Read out the register 40001 of the instrument communication ID=01H, and the first register value (instrument register address 0) in zone 4. Assume that the parameter address 40001 value is 100 (64H), that is, read the current set value of the instrument is 100.

Command Message		Response Message	
ADR	01	ADR	01
CMD	03	CMD	03
Parameter Address	00	DATE SIZE	02
	00	Parameter	00
Parameter Quantity	00		64
	01	CRC Check	B9
CRC Check	84		AF
	0A		

* If the command message received by the temperature gauge is wrong, then only the data transmission error code will be responded to.

ADR	01
CMD	83
Data Transmission Error Code	01
CRC Check	80
	F0

3.3 Description of Communication Format and Data Command

1. Communication Protocol: ASCII Mode/RTU Mode
2. Speed: 9600 bps/19200 bps/38400 bps/57600 bps/115200 bps
3. Initial bit: 1 bit
4. Data Length: 8 bit
5. End bit: 1 bit
6. Parity check: None (without parity check)

4. TC300SK Communication Table

	Name	Bit	Address	save	Name Notation	Preset	Scope	Unit	Notation	Note
Write in (load the preset value) in the storage area)	SV		0	Y	Set Value	150	LOS~HIS	℃/℉	Set Value	
	MOP		1	Y	Manual Output Percent	0	0~100 %	%	Manual Output Percent	
	Stby-p		2	Y	Standby Temperature	100	0~300 ℃/℉	℃/℉	Standby Temp.	
	Stby-t		3	Y	Standby Timer	0	0~300 min	m	Standby Time	
	ALR		4	Y	Alarm Range	30	3~99℃/℉	℃/℉	Alarm Range	
	LOS		5	Y	Set Value Low Limit Range	50	0~HIS	℃/℉	Set Value Low Limit Range	
	HIS		6	Y	Set Value High Limit Range	500	LOS~500 ℃ LOS~999 ℉	℃/℉	Set Value Upper Limit Range	
	PLIT		7	Y	Output Limit	100	10~100%	%	Output Limit	
	OPV		8	Y	PV Offset	0	±99 ℃/℉	℃/℉	PV Offset	
	SOFT		9	Y	Soft Start Time	1	0~10 min	m	Soft Start Time	
			10		Reserve				Reserve	
			11		Reserve				Reserve	
			12		Reserve				Reserve	
			13		Reserve				Reserve	
	STB	Bit0 0=OFF 1=ON	14	Y	Standby Switch	1	0=OFF 1=ON		Insulated function switch	

	SENS	Bit2 0=J 1=K		Y	Thermocouple Type	0	0=J 1=K		Thermocouple	
	C-F	Bit3 0=C 1=F		Y	Temperature Unit	0	0=℃ 1=℉		Temp. unit	

	Name	Bit	Address	save	Name Notation	Preset	Scope	Unit	Notation	Note
Write in (load the preset value) in the storage area)	OUT	Bit4 0=ZRC 1=PHA		Y	Trigger Mode	0	0=Zero Cross 1=Phase Angle		Output trigger mode	
	CTM	Bit5 0=AUTO 1=MAN		Y	Control Mode	0	0=Auto 1=Manual		Control mode	
	CDS	Bit6 0=OFF 1=ON		Y	Current Detect Switch	1	0=OFF 1=ON		Current detecting switch	
			15		Reserve					
			16		Reserve					
			17		Reserve					
			18		Reserve					
			19		Reserve					
			20		Reserve					
			21		Reserve					
			22		Reserve					
			23		Reserve					
			24		Reserve					
			25		Reserve					
			26		Reserve					
Write in storage area No need to load the default value	Sys. Para.		27	Y	System parameter				System parameter	
	Sys. Para		28	Y	System parameter				System parameter	
	Sys. Para		29	Y	System parameter				System parameter	

(HMI comm. read only)	Sys. Para		30	Y	System parameter				System parameter	
	Sys. Para		31	Y	System parameter				System parameter	
	Sys. Para		32	Y	System parameter				System parameter	
	Sys. Para		33	Y	System parameter				System parameter	

	Name	Bit	Address	save	Name Notation	Preset	Scope	Unit	Notation	Note
			34	Y	Commuication ID	1	1~255		Comm. ID	
	BUAD		35	Y	Commuication buad rate	2	0=9600 1=19200 2=38400 3=57600 4=115200		Comm. speed	
	NODE	Bit0 0=ASC 1=RTU	36	Y	Commuication Mode	0	0=Modbus ASCII 1=Modbus RTU		Comm. mode	
			37	Y	Reserve					
	COLD		38	Y			0:Real-time ambient temp. 1：Initial power on ambient temp.		Cold end mode	
	COUA		39	Y			0-50 ℃/℉		Cold end temp.	
	TCST		40	Y			3-20 min		Short circuit alarm time	
	TCBF		41	Y			1-4 threshold Increased accordingly		The judgement of temp. sensor line resistance	
			42	Y					Reserve	
			43	Y			30-99 ℃/℉		Temp. alarm lower limit	
			44	Y					Reserve	
			45 45	Y					Reserve	

			46	Y					Reserve	
			47	Y			0:shut down 1：start up		on/off	
Write to not stored area	ATS	Bit0 0=OFF 1=ON	48	N	AT Switch	0	0=OFF 1=ON		AT start switch	
	STS	Bit1 0=OFF 1=ON			Standby Start	0	0=OFF 1=ON		Insulated start switch	
	BELL	Bit2 0=OFF 1=ON			Buzzer Switch	1	0=OFF 1=ON		Buzzer switch	
	rSET	Bit3 0=OFF 1=ON			Initialize	0	0=OFF 1=ON		Module load reset value	
	SSA	Bit4 0=inactive 1=active			Soft start active	1	0=inactive 1=active		Slow start switch	
	BTS	Bit5 0=OFF 1=ON			Boost Start	0	0=OFF 1=ON		Rise start switch	
			49	N					Reserve	
			50	N					Reserve	
			51	N					Reserve	

	Name	Bit	Address	Save	Name Notation	Preset	Scope	Unit	Notation	Note
	PV		52		Present Value			℃/℉	Temp. display value	
	HTC		53		Heater Current			A	Current display value	

Read only area	OPP		54		Heater Out put Percentage			%	Output proportion (SV switch display)	
	ATP		55		Ambient Temperature			℃/℉	Room Temp.	
	EDT		56		Edition				Program Version	
	FRQ		57		AC Power Frequency			H	Power Frequency	
	ERC	Bit0= TCO Bit1=TCR Bit2=TCS Bit3=HTS Bit4=LPB Bit5=TRS Bit6=F1brk Bit7=F2brk	58		Error Code		Bit0: temp. sensor line breaks Bit1:temp. sensor line reversed Bit2:temp. sensor line short circuit Bit3:heater short circuit Bit4:open circuit loop open circuit Bit5:Triac short circuit Bit6:Fuse1 slight open Bit7:Fuse2 slight open		Exception Code	Abnormal display
	ALC	Bit0=HI Bit1=LO	59		Alarm Code		Bit0: upper limit alarm Bit1:lower limit alarm		Alarm Message	Alarm display
	Reserve		60							
			61						Reserve	
			62						Reserve	
			63						Reserve	

PS: The read area is for the system developer only and it is not provided for parties other than the system developer.