Universal Input Digital Temperature Controller

TE series

INSTRUCTION MANUAL

Thank you for purchasing TOKY products. Please read the instruction manual carefully before using this product, and use the product correctly. Also, please keep this instruction manual where you can view it any time.

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I. Safety Information

Please read the safety information carefully before the use, and use the product correctly.
The alerts declared in the manual are classified into Warning and Caution according to their importance.

⚠ WARNING

1) When the failure or abnormal of products lead to a system of major accidents, please set the proper protection circuit in the external.
2) Please don`t plug in before completing all the wire.Otherwise it may lead to electric shock, fire, fault.
3) Not allow to use outside the scope of product specification,otherwise it may lead to fire,fault.
4) Not allow to use in the place where is inflammable and explosive gas.
5) Do not touch power terminal and other high voltage part when the power on, otherwise you may get an electric-shock.
6) Do not remove,repair and modify this product,otherwise it may lead to electric shock, fire, fault.

⚠ CAUTION

1) The product should not be used in a nuclear facility and human life associated medical equipment.
2) The product may occur radio interference when it used at home.You should take adequate countermeasures.
3) The product get an electric shock protection through reinforced Insulation. When the product is embedded in the devices and wiring,please subject to the specification of embedded devices.
4) In order to prevent surge occurs,when using this product in the place of over 30m indoor wiring and wiring in outdoor, you need to set the proper surge suppression circuitry.
5) The product is produced based on mounting on the disk.In order to avoid to touch the wire connectors,please take the necessary measures on the product.
6) Be sure to observe the precautions in this manual, otherwise there is a risk of a major injury or accident.
7) When wiring, please observe the local regulation.
8) To prevent to damage the machine and prevent to machine failure, the product is connected with power lines or large capacity input and output lines and other methods please install proper capacity fuse or other methods of protection circuit.
9) Please don't put metal and wire clastic mixed with this product,otherwise it may lead to electric shock, fire, fault.
10) Please tighten screw torque according to the rules.If not,it may lead to electric shock and fire.
11) In order not to interfere with this products to dissipate heat, please don't plug casing around the cooling vent hole and equipment.
12) Please don`t connect any unused terminal.
13) Please do the cleaning after power off, and use the dry cleaning cloth to wipe away the dirt. Please don`t use desiccant, otherwise, it may casue the deformation or discoloration of the product.
14) Please don`t knock or rub the panel with rigid thing.
15) The readers of this manual should have basic knowledge of electrical,control, computer and communications.
16) The illustration, example of data and screen in this manual is convenient to understand,instead of guaranteeing the result of the operation.
17) In order to use this product with safety for long-term,regular maintenance is necessary. The life of some parts of the equipments are by some restrictions, but the performance of some will change for using many years.
18) Without prior notice, the contents of this manual will be change. We hope these is no any loopholes, if you have questions or objections, please contact us.

⚠ CAUTION OF INSTALLATION & CONNECTION

1. Installation
1) This product is used in the following environmental standards. (IEC61010-1) [Overvoltage categoryⅡ、class of pollution 2]
2) This product is used in the following scope:
Temperature:0~50℃;
Humidity: 45~85%RH;
Environment condition: Indoor warranty.
The altitude is less than 2000m.
3) Please avoid using in the following places:
The place will be dew for changing temperature; with corrosive gases and flammable gas; with vibration and impact; with water, oil, chemicals, smoke and steam facilities with Dust, salt, metal powder; and with clutter interference, static electric and magnetic fields, noise; where has air conditioning or heating of air blowing directly to the site; where will be illuminated directly by sunlight; where accumulation of heat will happen caused by radiation.
4) On the occasion of the installation, please consider the following before installation.
In order to protect heat saturated, please ensure adequate ventilation space.
Please consider connections and environment,and ensure that the products below for more than 50mm space. Please avoid to installed over the machine of the calorific value (Such as heaters, transformer, semiconductor operations, the bulk resistance). When the surrounding is more than 50 , please using the force fan or cooling fans.But don't let cold air blowing directly to the product. In order to improve the anti - interference performance and security, please try to stay away from high pressure machines, power machines to install.
Don`t install on the same plate with high pressure machine and the product.
The distance should be more than 200mm between the product and power line.

2. Cable caution
1) Please use specified compensation wire in the place of TC input; Please use insulated TC if the measured device is heated metal.
2) Please use the cable of lesser resistance in the place of RTD input,and the cable(3 wire) must be no resistance difference,but the total length is within 5m.
3) In order to avoid the effect of noise,please put the input dignal away from meter cable,power cable,load cable to wiring.
4) In order to reduce the power cables and the load power cables on the effect of this product,please use noise filter in the place where easy to effect.
You must install it on the grounding of the disk if you use the noise filter,and make the wiring to be shortest between noise filter output side and power connectors.
Don`t install fuse and switch on the wiring of noice filter output side,otherwise it will reduce the effect of noise filter.
5) It takes 5s from input power to output.If there is a place with interlocking actions circuit signal,please use timer relay.
6) Please use twisted pair with a shield for analog output line, can also connect the common-mode coil to the front-end of the signal receiving device to suppress line interference if necessary, to ensure the reliabilty of signal.
7) Please use twisted pair with a shield for remote RS485 communication cable, and deal with the shield on the host side earth, to ensure the reliabilty of signal.
8) This product don`t have the fuse; please set according to rated voltage 250V,rated current 1A if you need; fuse type:relay fuse.
9) Please use suitable slotted screwdriver and wire.
Terminal distance: 5.0mm. Screwdriver size: 0.6X3.5, length of slotted screwdriver >130mm. Recommended tightening torque: 0.5N.m.
Proper cables: 0.25 ~ 1.65mm single cable/multiple core cable
10) Please don`t put the Crimp terminal or bare wire part contact with adjacent connector.

II. Mode Code

Model	Code								Content
TE	□	□-	□	□	□	□	W-□		TE series digital temperature controller
Size		3							36(W) X 72(H) X 64(D) mm
		4							48(W) X 48(H) X 91(D) mm
		6							48(W) X 96(H) X 88.5(D) mm
		7							72(W) X 72(H) X 88.5(D) mm
		8							96(W) X 48(H) X 88.5(D) mm
		9							96(W) X 96(H) X 88.5(D) mm
Power voltage		-							AC/DC 100~240V
		F							AC/DC 24V
Output selection			RC						Relay + 2 Alarms
			SC						SSR + 2 Alarms
			DC						4-20mA + 2 Alarms
			MC						Relay + SSR + 2 Alarms
			IMC						Relay+SSR+4-20mA+2 Alarms
			IRC						Relay + 4-20mA + 2 Alarms
			ISC						SSR + 4-20mA + 2 Alarms
Communication				10					No communication
				18					RS485 communication
Input signal					-				TC / RTD / mV / Rt input signal
					X				4-20mA / 0-10V input signal
Version								W-E	Version E

Only for TE6, TE8, TE9: Relay or SSR or 4-20mA control output is selected by parameter ACT. 4-20mA can be used as control output or analog output, selected by parameter ACT.

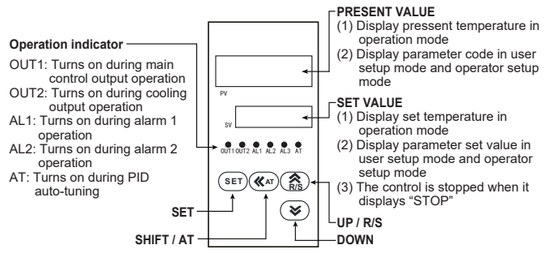
III. Specifications

Classification		TE7 TE8 TE9
Input	Thermocouple	K, J, E, T, B, R, S, N
	RTD	PT100, JPT100, CU50, CU100, 0~50mV, 0~400Ω
	Sample rate	2 times per second
	Display accuracy	0.5% F.S ±3 digit (in case of B,R,S type, ±1.0 % F.S ± 2 ℃)
Output	Relay capacity	AC 250V /3A Life of rated load>100,000 times
	SSR output	DC 24V pulse voltage, load<30mA
	Current output	DC 4 ~ 20mA load<500Ω, temperature drift 250PPM
Control	Control type	PID control (by auto-tuning), P control, ON/OFF control
	Auto-tuning	PID operation by auto-tuning
	ON/OFF control	When PV>SV, 0% output. When PV<SV, 100% output (only when control hysteresis is 0)
	Control output	Relay/voltage pulse (SSR) outputs ※ selection by parameter setting
Communication port		RS485 port Modbus-RTU protocol, max input 30 units
Power	Power supply	AC/DC 100 ~ 240V (85-265V)
	Power consumption	< 6VA
	Environment	Indoor use only, temperature: 0~50℃ no condensation, humidity < 85%RH, altitude<2000m
Insulation impedance		Input, output, power VS meter cover > 20MΩ
Isolation voltage		Signal input, output, power: 1500VAC 1min, <60V low voltage circuit: DC500V，1min
ESD		IEC/EN61000-4-2 Contact ±4KV /Air ±8KV perf.Criteria B
Pulse traip anti-interference		IEC/EN61000-4-4 ±2KV perf.Criteria B
Surge immunity		IEC/EN61000-4-5 ±2KV perf.Criteria B
Voltage drop & short interruption immunity		IEC/EN61000-4-29 0% ~ 70% perf.Criteria B
Safety Standard		IEC61010-1 Overvoltage category Ⅱ, pollution level 2, levelⅡ(Enhanced insulation)
Power failure memory		10 years, times of writing: 1 million times
Storage environment		-10 ~ 60℃, no condensation
Cover material		The shell and panel frame PC/ABS (Flame Class UL94V-0)
Panel material		PET(F150/F200)
Panel Protection level		IP65(IEC60529)
Total weight		About 400g

IV. Ranges and Input Types

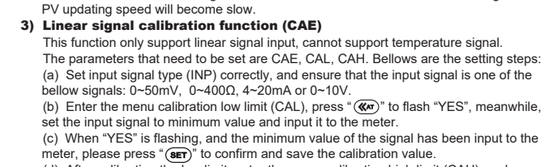
Model	Input type	Symbol	Measure range	Reso-lution	Accuracy	Input impedance /auxiliary current	Comm. parameter code
TE-W (e.g. TE4-M C10W)	K	E	-50~1200	1℃	0.5%F.S±3digits	> 500kΩ	0
	J	J	0~1200	1℃	0.5%F.S±3digits	> 500kΩ	1
	E	E	0~850	1℃	0.5%F.S±3digits	> 500kΩ	2
	T	t	-50~400	1℃	0.5%F.S±3℃	> 500kΩ	3
	B	b	250~1800	2℃	1%F.S±2℃	> 500kΩ	4
	R	r	-10~1700	1℃	1%F.S±2℃	> 500kΩ	5
	S	S	-10~1600	1℃	1%F.S±2℃	> 500kΩ	6
	N	n	-50~1200	1℃	0.5%F.S±1℃	> 500kΩ	7
	PT100	Pt	-200~600	0.2℃	0.5%F.S±0.3℃	0.2mA	8
	JPT100	JPt	-200~500	0.2℃	0.5%F.S±0.3℃	0.2mA	9
	CU50	CUS0	-50~150	0.2℃	0.5%F.S±3℃	0.2mA	10
	CU100	CU00	-50~150	0.2℃	0.5%F.S±1℃	0.2mA	11
	0~50mV	mV	-1999~9999	12bit	0.5%F.S±3digits	> 500kΩ	12
	0~400Ω	rt	-1999~9999	12bit	0.5%F.S±3digits	0.2mA	13
TE-XW (e.g. TE4-MC 10XW)	4~20mA	mA	-1999~9999	12bit	0.5%F.S±3digits	100Ω	14
	0~10V	V	-1999~9999	12bit	0.5%F.S±3digits	>1MΩ	15

V. Panel Illustration



Name		Content
SET	SET key	(1) Menu key: enter or exit user settup mode and operatior setup mode (2) Confirm key: confirm and save the modified set value
AT	Shift/AT key	(1) Activate key: activate the set value modification (2) Shift key: move set value row (3) AT auto-tuning key: press and hold it more than 3 sec to start or exit auto-tuning
R/S	Up key/ R/S	(1) Up key: increase set value, move among parameter menus (2) R/S: in operation mode, press and hold it more than 3 sec to change between RUN and STOP operation mode
	Down key	Decrease set value, move among parameter menus

VI. Dimension and Panel Cutout



Classification	Product dimension						Panel cutout			
	A	B	C	D	E	F	G	H(Min)	J	K(Min)
TE3:(72*36)	72	36	70.5	6.5	64	32	68	25	33	25
TE4:(48*48)	48	48	97.5	6.5	91	45	45.5	25	45.5	25
TE6:(96*48)	48	96	97.5	9	88.5	89.5	45	25	92	25
TE7:(72*72)	72	72	97.5	9	88.5	67	67.5	25	67.5	25
TE8:(48*96)	96	48	97.5	9	88.5	44.5	92	25	45	25
TE9:(96*96)	96	96	97.5	9	88.5	91.5	92	25	92	25
80:(160*80)	160	80	96	13	83	75.5	155.5	30	76	30

VII. Main Function Description

1. SV setting

1) In RUN or STOP mode, press “AT” key to activate SV modification mode, the ones place of SV window will flash, and every press of this key will move the row to the left.
2) When the number is fleshing, press UP/DOWN key to increase/decrease the value.
3) After the modification, press “SET” key to confirm and save the setting.

2. Input setting (INP)

1) TC/RTD signal input

(a) Enter user setup mode, set input signal type (INP) according to the signal of the actual using thermocouple or RTD.
For example, if the K type thermocouple is connected to the meter, INP need to be set as “E”; if the Pt100 RTD is connected to the meter, INP need to be set as “Pt”.
(b) Enter operator setup mode, set measure range low limit (FL) or high limit (FH) according to actual situation.
Normally, no need to set FL and FH. But in some application, in order to avoid equipment damage caused by too high or too low temperature, need to set the FL or FH accordingly. This setting value will limit the setting range of SV.
(c) Enter operator setup mode, set decimal point (DP).
TC: Initial setting is no decimal place, maximum 1 decimal place.
RTD: Initial setting is 1 decimal place, maximum 1 decimal place, can be set as 0.
(d) Enter operator setup mode, set PV filter (FT).
When PV value becomes unstable due to effects of noise, the filter helps suppress the unstable status. The value is greater, the effect is better. But if the value is too great, the PV updating speed will become slow.
(e) Enter operator setup mode, set the temperature unit (UT), select ℃ or °F.

2) Linear signal input

(a) Enter user setup mode, set input signal type (INP) according to the actual input linear signal. 0~50mV: mV, 0~400Ω: rt, 4~20mA: mA, 0~10V: V.
(b) Enter operator setup mode, set decimal point (DP). According to the setting of FL and FH to choose the decimal place, can be set as 0~3 decimal place.
(c) Enter operator setup mode, set measure range low limit (FL) or high limit (FH) according to actual situation.
For example, if need to input 4~20mA and display 0~100, please set FL=0 & FH=100.
(d) Enter operator setup mode, set PV filter (FT).
When PV value becomes unstable due to effects of noise, the filter helps suppress the unstable status. The value is greater, the effect is better. But if the value is too great, the PV updating speed will become slow.

3) Linear signal calibration function (CAE)

This function only support linear signal input, cannot support temperature signal.
The parameters that need to be set are CAE, CAL, CAH. Bellows are the setting steps:
(a) Set input signal type (INP) correctly, and ensure that the input signal is one of the bellow signals: 0~50mV, 0~400Ω, 4~20mA or 0~10V.
(b) Enter the menu calibration low limit (CAL), press “AT” to flash “YES”, meanwhile, set the input signal to minimum value and input it to the meter.
(c) When “YES” is flashing, and the minimum value of the signal has been input to the meter, please press “SET” to confirm and save the calibration value.
(d) After calibrating the low limit, enter the menu calibration high limit (CAH), and press “AT” to flash “YES”.
(e) Set the input signal to maximum value and input it into the meter; when “YES” is flashing, press “SET” to confirm and save the calibration value.
(f) After calibration, enter menu CAE, change “N” to “Y” to enable the calibration value; otherwise, it will still use the factory default setting value.
(g) The input linear signal value that is calibrated as high-limit should not exceed the standard input range ±10%.
(h) If not satisfied with the calibration result, can do calibration again.

3. Control output type (ACT)

1) Relay contact output

(a) Enter operator setup mode, set control output type (ACT) as 0.
(b) Make sure the load is connected to OUT1 (Relay) terminals.

2) SSR drive voltage output

(a) Enter operator setup mode, set control output type (ACT) as 1.
(b) Make sure the load is connected to OUT1 (SSR) terminals.

3) Current control output

(a) Enter operator setup mode, set control output type (ACT) as 2.
(b) Make sure the load is connected to OUT1 (4~20mA) terminals.
(c) Output limit function (OLL) & (OLH).
(i) Output low limit (OLL): For example, in the application of frequency converter motor , if the minimum output is 4mA, the frequncy converter will stop, in order to prevent its stop, please set OLL=10% (5.6mA), then the frequency converter is always running.
(ii) Output high limit (OHL):
For example, in the application of SCR controller in heating system, in order to prevent the heating tube from full power output, please set OLH=90%(18.4mA), then the heating tube will not be overheating.

4) Retransmission output for TE3, TE4, TE7

(a) Enter operator setup mode, set control output type (ACT) as 3.
(b) Set the retransmission low limit (BRL) and retransmission high limit (BRL) properly. If display 0-100 and output 4~20mA, please set BRL=0, BRH=100.
(c) Make sure the secondary instrument is connected to OUT1 (4~20mA) terminals.

5) Retransmission output for TE6, TE8, TE9

(a) Enter operator setup mode, set control output type (ACT) as 0 or 1.
When AC=0 or 1, if Relay or SSR output is used as control output, then 4~20mA output is used as retransmission output automatically.
(b) Set the retransmission low limit (BRL) and retransmission high limit (BRL) properly. If display 0-100 and output 4~20mA, please set BRL=0, BRH=100.
(c) Make sure the secondary instrument is connected to OUT1 (4~20mA) terminals, and the load is connected to OUT1 (Relay) or OUT1 (SSR).

4. Operation mode

Supplying the power after wiring, PV window will display the current temperature, SV window will display the set temperature, the meter is in RUN mode.
The meter can be set as STOP mode if needed, belows are the setting steps:
1) In RUN mode, press and hold “R/S” key more than 5 sec to enter the STOP mode, SV window will display “STOP”, main control output will stop or keep the minimum output.
2) In STOP mode, press and hold “R/S” key more than 5 sec to exit STOP mode.
3) In STOP mode, alarm output and retransimition output work normally.

5. Control type (OT)

0) ON/OFF heating control

Set the control type OT=0, and set the control hystersis DB properly.
When PV<SV-DB, control output OUT1 turns on, when PV>SV, control output OUT1 turns off.

1) PID heating control

Set OT=1, and set the PID value by auto-tuning (AT) or by manual. Related parameters that needs to be set are P, I, D, OVS, CP, ST, SPD, PDC.

2) ON/OFF compressor cooling control

Set OT=2, and set control hystersis DB and compressor start delay time PT properly.
When PV>SV+DB, if PT=0, control output OUT1 turns on immediately; if PT>0, after delay time PT runs out, control output OUT1 turns on.
When PV<SV, control output OUT1 turns off.

3) PID heating and proportional cooling control

This control mode is widely used in twin-screw extruder.
(a) Set OT=3.
(b) There will be two outputs, OUT1 is PID heating control output, OUT2 is proportional cooling control output.
(c) Proportional cooling control OUT2 outputs via AL1 alarm terminals.
(d) Please set the cooling start hystersis DB to a value larger than 5, to ensure the cooling output will not affect the PID heating control.
(e) Please set the cooling control cycle time CP1 and the cooling proportionality coefficient PC to a proper value.
(f) When PV > SV+DB, the cooling control starts to operate; the difference between them is bigger, the output time of OUT2 will be longer.

4) ON/OFF over temperature cooling control

Set OT=4, and set control hystersis DB properly.
When PV>SV, control output OUT1 turns on, when PV<SV-DB, control output OUT1 turns off.

5) PID cooling control

Set OT=5, and set the PID value by auto-tuning (AT) or by manual. Related parameters that needs to be set are P, I, D, OVS, CP, ST, SPD, PDC.

6. PID auto-tuning (AT)

The auto-tuning function automatically measures, computes the control system characteristics, and automatically sets the optimum proportional band (P), integral time (I), and derivative time(D) constants. Bellows are the setting steps:
1) Before auto-tuning procedure, please switch off the control output load power, or set the meter as STOP mode.
2) Before auto-tuning procedure, PV value should meet below condition: when it is PID heating control, PV needs to be much smaller than SV; when it is PID cooling control, PV needs to be much larger than SV.
3) Before auto-tuning procedure, please set a proper alarm value or eliminate the alarm condition, in order to prevent the auto-tuning procedure from being affected by alarm output.
4) Set PID type and SV value properly, the factory default setting is fuzzy PID.
5) Set the menu OT as PID control mode, if there is OLL & OLH output limit for current control output, please set the output to a proper range, factory default setting is OLL=0%, OLH=100%.
6) Exit STOP mode, or supply power to the load, then immediately press and hold “AT” key more than 3 sec to enter auto-tuning mode, after that, the AT indicator turns on.
7) The auto-tuning procedure will take some time, in order to avoid any influence on the auto-tuning result, please don`t modify the parameters settings or cut the power.
8) When AT indicator turns off, it automatically exits auto-tuning mode, PID parameter value will be updated automatically, and the control starts automatically and precisely.
9) During the auto-tuning procedure, below actions will cause the termination of the process, pressing and holding “AT” key, measuring beyond the scope, error display, switching to STOP mode, power-off, etc.
10) Note: In the occasions with output limit operation, sometimes, even if the auto-tuning is carried out, the best PID parameter value still cannot be obtained.
11) Experienced users can properly set the PID parameters according to their experience.

7. Auto-manual control (A-M)

1) Auto control only

The initial setting is auto control, menu A-M is set as “AUTO”.

2) Manual control only

(a) Enter user setup mode, set the menu A-M as “MAN”.

(b) After return back to operation mode, SV window will display the output percentage: M0~M100 (corresponding to 0%~100%), press UP key or DOWN key to modify the value.

(c) After the meter is powered on again, the manual control output percentage before power failure can be restored.

3) Auto-manual control shortcut switch

(a) Enter user setup mode, set the menu A-M as “AM”.

(b) After return back to operation mode, pressing “ (SET) ” key can switch the operation between auto control and manual control easily.

(c) When it is switched to manual control, SV window will display the output percentage: M0~M100 (corresponding to 0%~100%), press UP key or DOWN key to modify the value.

(d) Before the switch from manual control to auto control, in order to ensure the smooth switch, please press “ (<<A/M) ” key to modify the SV value first.

(e) After the meter is powered on again, manual control mode will be restored, and the output percentage will be 0%.

8. Alarm output (AD1, AL1, HY1, AE1, AD2, AL2, HY2, AE2)

TE series supports 2 alarm outputs (AL1 and AL2). These two alarms can work independently or work together as a combination, total 12 different types of alarm functions.

1) No alarm

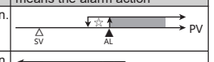
Enter user setup mode, set alarm mode (AD1, AD2) =0, alarm function will be closed.

2) Independent alarm

(a) When AD1=1~6, AD2=1~6, alarm AL1 and AL2 are used as two independent alarm, both AL1 and AL2 will output.

(b) Refere to below alarm output logic and set SV value “△”, alarm value (AL1, AL2) “▲”, alarm hystersis (HY1, HY2) “☆” according to the actual usage.

Note ※ : For deviation alarm, if alarm value (AL) is set as a negative number, it will be used as an absolute value.

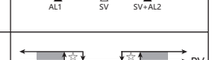
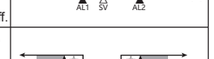
AD1/AD2 value	Alarm mode	Illustration	Alarm logic: the hatched section means the alarm action
1	High limit absolute alarm	When PV>AL, alarm output turns on. When PV<AL-HY, alarm output turns off.	
2	Low limit absolute alarm	When PV<AL, alarm output turns on. When PV>AL+HY, alarm output turns off.	
3	※ High limit deviation alarm	When PV>SV+AL, alarm output turns on. When PV<SV+AL-HY, alarm output turns off.	
4	※ Low limit deviation alarm	When PV<SV-AL, alarm output turns on. When PV>SV-AL+HY, alarm output turns off.	
5	※ High/low limit deviation alarm	When PV>SV+AL or PV<SV-AL, alarm output turns on. When SV-AL+HY<PV<SV+AL-HY, alarm output turns off.	
6	※ High/low limit interval alarm	When SV-AL<PV<SV+AL, alarm output turns on. When PV<SV-AL-HY or PA>SV+AL+HY, alarm output turns off.	

3) Combination alarm

(a) When AD1=7~12, AD2 can be set as 0 only, alarm AL1 and AL2 are used as a combination alarm, AL1 outputs, AL2 does not output.

(b) Refere to below alarm output logic and set SV value “△”, alarm value (AL1, AL2) “▲”, alarm hystersis (HY1, HY2) “☆” according to the actual usage.

Note ※ : For deviation alarm, if alarm value (AL) is set as a negative number, it will be used as an absolute value.

AD1 value	Alarm mode	Illustration	Alarm logic: the hatched section means the alarm action
7	High and low limit absolute value interval alarm	When AL1<PV<AL2, alarm output turns on. When PV<AL1-HY1 or PV>AL2+HY2, alarm output turns off.	
8	※ High and low limit deviation value interval alarm	When SV-AL1<PV<SV+AL2, alarm output turns on. When PV<SV-AL1-HY1 or PV>SV+AL2+HY2, alarm output turns off.	
9	※ High limit absolute value and low limit deviation value interval alarm	When SV-AL1<PV<AL2, alarm output turns on. When PV<SV-AL1-HY1 or PV>AL2+HY2, alarm output turns off.	
10	※ High limit deviation value and low limit absolute value interval alarm	When AL1<PV<SV+AL2, alarm output turns on. When PV<AL1-HY1 or PV>SV+AL2+HY2, alarm output turns off.	
11	High/low limit absolute value alarm	When PV<AL1 or PV>AL2, alarm output turns on. When PV>AL1+HY1 or PV<AL2-HY2, alarm output turns off.	
12	※ High/low limit deviation value alarm	When PV<SV-AL1 or PV>SV+AL2, alarm output turns on. When PV>SV-AL1+HY1 or PV<SV+AL2-HY2, alarm output turns off.	

4) Alarm hold operation

Set AE1 & AE2 to choose the alarm operation method when the meter displays error (HHHH/LLLL), and the low alarm hold operation when the power is supplied.

AE1/AE2 set value	Alarm operation when the meter displays error code(HHHH/LLLL)	Low alarm hold operation after power on
0	Alarm operation keeps the same state before the error is displayed.	**No alarm hold operation.** After power on and temperature increases, low alarm output turns on immediately when the alarm condiction is reached.
1	Alarm output turns on even during alarm cancel condition.	
2	Alarm output turns off even during alarm condition.	
3	Alarm operation keeps the same state before the error is displayed.	**Alarm hold operation.** After power on and temperature increases, low alarm output is prevented from turning on until PV value reaches SV value for the first time. After that alarm works normally, it will not be held.
4	Alarm output turns on even during alarm cancel condition.	
5	Alarm output turns off even during alarm condition.	

9. User setup mode

User setup mode is the mode that sets the set values changed by users frequently. The parameters of the operator setup mode are also displayed in the user setup mode, so that they can be easily set.In the operation mode, press and hold “(SET)” key for 3 sec to enter the user setup mode.Press and hold “(SET)” key for 3 sec again to return to the operation mode.

Symbol (PV)		Name	Content		Initial value (SV)	Display condition
AL1	AL1	Alarm 1 value	FL (measure range low limit) ~ FH (measure range high limit) Note: For deviation alarm, if AL1 is set as a negative number, it will be used as an absolute value.		10	Always displayed
HY1	HY1	Alarm 1 hystersis	0~1000		1	
AD1	AD1	Alarm 1 mode (Refer to alarm logic diagram)	0: Not using, if AL1 is used as OUT2 (cooling output).		3	
			AL1 & AL2 are independent from each	1: High limit absolute alarm 2: Low limit absolute alarm 3: High limit deviation alarm 4: Low limit deviation alarm 5: High / low limit deviation alarm 6: High / low limit interval alarm		
			AL1 & AL2 are used in combination, AL1 output, AL2 not output, AD2 = 0	7: High and low limit absolute value interval alarm 8: High and low limit deviation value interval alarm 9: High limit absolute value and low limit deviation value interval alarm 10: High limit deviation value and low limit absolute value interval alarm 11: High / low limit absolute value alarm 12: High / low limit deviation value alarm		
AL2	AL2	Alarm 2 value	FL (measure range low limit) ~ FH (measure range high limit) Note: For deviation alarm, if AL2 is set as a negative number, it will be used as an absolute value.		5	When there are 2 alarm outputs.
HY2	HY2	Alarm 2 hystersis	0~1000		1	
AD2	AD2	Alarm 2 mode	0: Not using, if AD1=7~12, AD2 can be set as 0 only.		4	
			AL1 & AL2 are independent from each	1: High limit absolute alarm 2: Low limit absolute alarm 3: High limit deviation alarm 4: Low limit deviation alarm 5: High / low limit deviation alarm 6: High / low limit interval alarm		
PS	PS	PV bias value	Use this function to adjust PV value in cases where it is necessary for PV value to agree with another indicator, or when the sensor cannot be mounted in correct location. Setting range: FL (measure range low limit) ~ FH (measure range high limit) PV = actual measured value + bias value		0	
INP	INP	Input type	TE-W	K : K thermocouple J : J thermocouple E : E thermocouple T : T thermocouple B : B thermocouple R : R thermocouple S : S thermocouple N : N thermocouple Pt : PT100 RTD JPt : JPT100 RTD CU50 : CU50 RTD CU00 : CU100 RTD 0.5V : 0~50mV 0.4 : 0~400Ω	Note: after selecting the signal, pls properly set below related parameters: SV, AL1, HY1, AL2, HY2, P, OVS, DB.	K	Always displayed
			TE-XW	4A : 4~20mA 1V : 0~10V		
OT	OT	Control type	0: ON/OFF heating control 1: PID heating control 2: ON/OFF cooling control 3:PID heating & cooling control (cooling control OUT2 will output via AL1 relay) 4: ON/OFF over temperature cooling control 5. PID cooling control		1	
A-M	A-M	Auto-manual control switch	AUTO(0): auto control only MAN(1): manual control only AM(2): auto-manual shortcut switch		AUTO	
P	P	Proportional band	0~9999, unit: same as PV The smaller the value is, the faster the system responds, otherwise, it is slower. When P=0, no PID control.		30	With PID control type
I	I	Integral time	0~9999 sec The smaller the value is, the stronger the integral action is, otherwise, it is weeker. When I=0, no integral action.		120	
D	D	Derivative time	0~9999 sec The greater the value is, the stronger the differential actiontion is, otherwise, it is weeker. When D=0, no differential action. Set D=0 when controlling fast systems, e.g., pressure, speed.		30	
OVS	OVS	Overshoot limit	0~9999 During PID control process, if PV>SV+OVS, force to close output. The smaller this value is, the smaller the PID adjustment range is, the worse the control stability is. Please set the appropriate value according to the actual situation.		5	
CP	CP	OUT1 control output cycle	1 sec: SSR control output 4~200 sec: Relay control output		20	
CP1	CP1	OUT2 relay output cycle	4~200 sec		20	With PID heating & cooling control type
PC	PC	OUT2 cooling proportional coefficient	1~100 The higher of value, the stronger of cooling effect.		10	

Symbol (PV)		Name	Content	Initial value (SV)	Display condition
DB	DB	ON/OFF control hystersis	-1000~1000 (positive and negative numbers work the same). When OT=3, it is the dead zone for cooling control (positive and negative numbers work differently). After change the INP setting, please change this parameter according to the decimal point position.	5	With ON/OFF control and PID heating & cooling control type
LCK	LCK	Lock function	0~9999 0001: SV value cannot be modified. 0010: menu can be checked only, cannot be modified. 0011: both SV value and menu can be checked only, cannot be modified. 0033: can enter to operator setup mode. 0123: menus are reset to initial value.	0	Always displayed

10. Operator setup mode

Operator setup mode is the setting mode that sets the specifications of the temperature controller when the engineer installs it for the first time.

In the user setup mode, set the menu LCK = 0033 to enter the operator setup mode.

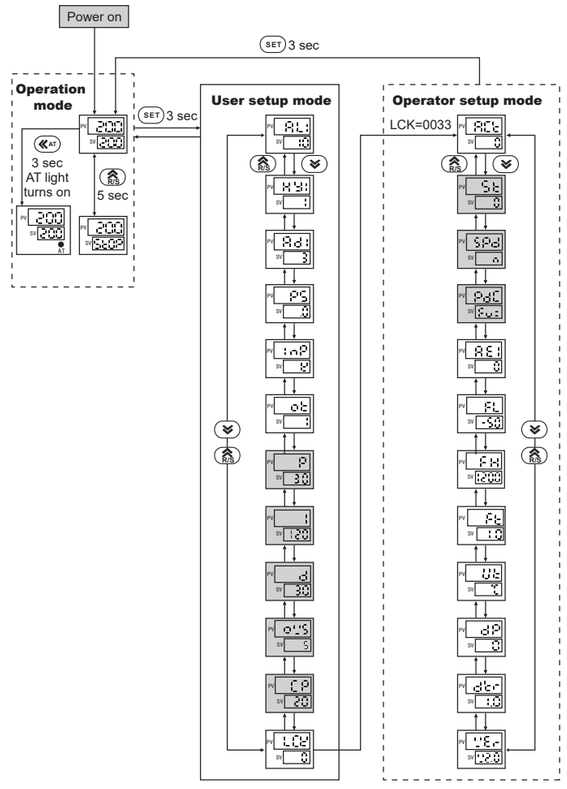
Symbol (PV)		Name	Content	Initial value (SV)	Display condition
ACT	ACT	Control output type	0: Relay contact output. 1: SSR drive voltage output. 2: 4~20mA current control output 3: 4~20mA retransimition output for size 3/4/7 products. Note: For size 6/8/9 products, when this menu is set as 0 or 1, 4-20mA output is used as retransimition output.	0	Always displayed
AE1	AE1	AL1 hold operation	0~5 AL1 operation when power on and meter displays error.	0	
AE2	AE2	AL 2 hold operation	0~5 AL2 operation when power on and meter displays error.	0	When there are 2 alarm outputs.
dP	DP	Decimal point setting	TC & RTD signal: 0~1 decimal place. Linear signal: 0~3 decimal place.	0	Always displayed
dtr	DTR	PV value fuzzy dislay	0.0~2.0 (0%~20%) Properly set this value on some occasions, it can get a more stable display value, this value is not the actual measured value. Note: after setting this value, when alarm setting value is equal to SV set value, alarm output operation is subject to actual measured value. Set as 0 to close this function.	1.0 (10%)	
Ft	FT	PV filter	0~255 When PV value becomes unstable due to effects of noise, the filter helps suppress the unstable status. The higher of the value, the stronger of the filter function.	10	
Ut	UT	Temperature unit	(25)℃: Celsius degrees. (26)℉: Fahrenheit degrees. Note: No unit for linear signal	(25) ℃	
FL	FL	Measure range low limit	Setting range: refer to “IV. Ranges and Input Types” on page 2. Set value must be less than FH.	-50	
FH	FH	Measure range high limit	Setting range: refer to “IV. Ranges and Input Types” on page 2. Set value must be greater than FL.	1200	
brL	BRL	Retransmission low limit	FL (measure range low limit) ~ FH (measure range high limit) Note: when this value is greater than BRH, it is used as reverse retransmission.	-50	With retrans-mission output.
brH	BRH	Retransmission high limit	FL (measure range low limit) ~ FH (measure range high limit) Note: when this value is less than BRL, it is used as reverse retransmission.	1200	
oLL	OLL	Current control output low limit	-5.0~100.0 Set value must be less than OLH.	0	With current control output.
oLH	OLH	Current control output high limit	0.0~105.0 Set value must be greater than OLL.	100.0	
St	ST	Auto-tuning activation right after power-on	0: work normally after power-on, 1: automatically enter PID auto-tuning mode right after the power is supplied, press and hold (<<A/M) key to exit auto-tuning mode.	0	With PID control type
SPd	SPD	PID control speed	0 (N): not using 1 (s): slow 2 (ss): medium slow 3 (SSS): very slow 4 (F): fast 5 (FF): medium fast 6 (FFF): very fast	0 (N)	
Pdt	PDC	PID algorithm control type	0(FUZ): Advanced fuzzy PID algorithm control 1(STD): normal PID algorithm control	0 (FUZ)	
Pt	PT	Compressor start delay time	0~9999 sec	0	With compressor cooling control type
bAd	BAD	Communication baud rate	0 (4.8): 4800 1 (9.6): 9600 2 (19.2): 19200	1 (9.6)	With RS485 Comm.
Add	ADD	Communication address	0~255	1	
Prty	PRTY	Parity check	0: NO 1: ODD 2: EVEN	0 (N0)	
dtC	DTC	Communication data transfer sequence (000)	Set value □□□ 1st bit 0: Function reserved 2nd bit Byte transfer sequency 0: Transfer sequency is 1, 2. 2nd bit Byte transfer sequency 1: Transfer sequency is 2, 1. 3rd bit 0: Function reserved	0	

Symbol (PV)		Name	Content	Initial value (SV)	Display condition
CAE	CAE	Linear signal calibration	0(N): not using 1(Y): enable the calibration value	0 (N)	With linear signal input
CAL	CAL	Calibration low limit	YES/OK	YES	
CAH	CAH	Calibration high limit	YES/OK	YES	
VER	VER	Version	Software version code	—	

11. Fault diagnosis

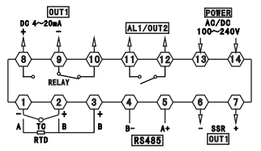
1) After power on, the meter is not working, there is no display, the possible causes are:
   (a) The wiring of the power supply is incorrect, or the contact of the power supply terminals is poor.
   (b) The auxiliary power is short circuited.
2) Inaccurate PV value.
   (a) PV bias value (PS) is not set correctly.
   (b) The wiring of the temperature sensor is incorrect.
   (c) The input signal type (INP) is not set correctly.
3) When PV window displays HHHH/LLLL, the possible causes are:
   (a) The temperature sensor is not connected to the meter, or the wiring is incorrect.
   (b) The input signal type (INP) is not set correctly.
   (c) The temperature sensor is broken.
   (d) Poor contact of the input terminals.
   (e) The meter is broken.

VIII. Parameter configuration

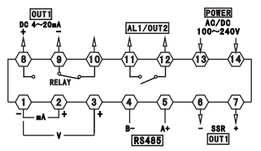


IX. Connection diagrams

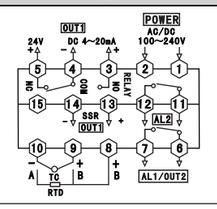
TE3



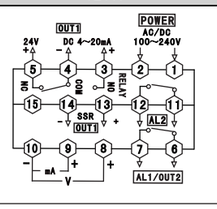
TE3-X



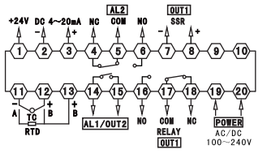
TE4



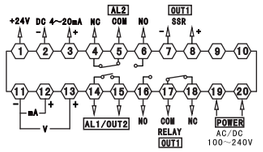
TE4-X



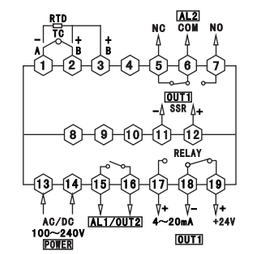
TE6/8/9



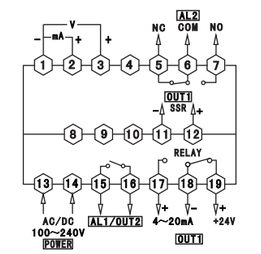
TE6/8/9-X



TE7

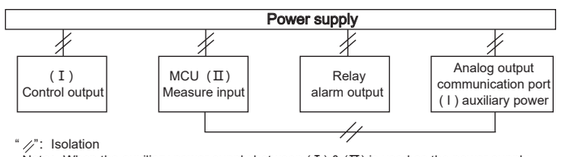


TE7-X



Note: If there is any change, please subject to the drawing on the meter.

X. Isolation diagram



"⫽": Isolation

Note: When the auxiliary power supply between (Ⅰ) & (Ⅱ) is used as the power supply for external sensor, if the sensor is non-isolated, it does not isolate.

XII. Communication procotol

Meter adoptS RS485 Modbus RTU communication protocol, RS485 half duplex communication. Read function code 0x03, write function code 0x10/0x06. Adopt 16 digit CRC check, the meter does not return for error check.

Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	Set in Menu PRTY

Handling of abnormal communication:
When abnormal response，put 1 on the highest bit of function code. For example: Host request function code 0x03,and slave response function code should be 0x83.
Error code:
0x01--- Illegal function: the function code sent from host is not supported by meter.
0x02--- Illegal address: the register address designated by host beyond the address range of meter.
0x03--- Illegal data: Date value sent from host exceeds the corresponding data range of meter.
Communication cycle：
Communication cycle is the time from host request to slave response data, i.e.: communication cycle= time of request data sending +slave preparation time + response delay time + response return time, e.g.:9600 Baud rate:communication cycle of single measured data ≥250ms.

1. Read register

For example:Host reads integer SV(set value 200）
The address code of SV is 0x2000, because SV is integer(2 dyte), seizes 1 data register. The memory code of decimal integer 200 is 0x00C8. Note: when reading data, should read DP value or confirm DP menu value first to ensure the decimal point postion，after that transform the read data to get the actual value. Conversely, it should transform the data to corresponding ratio before writing the data in meter.

Host request (Read multi-register)							
1	2	3	4	5	6	7	8
Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte Length high bit	Data byte Length low bit	※CRC code low bit	※CRC code high bit
0x01	0x03	0x20	0x00	0x00	0x01	0x8F	0xCA

Slave normal answer(Read multi-register)						
1	2	3	4	5	6	7
Meter ADD	Function code	Data byte Length	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x03	0x02	0x00	0xC8	0xB9	0xD2

Function code abnormal answer: (For example: host request ADD is 0x2011)

Slave abnormal answer(Read multi-register)				
1	2	3	8	9
Meter ADD	Function code	Error code	※CRC code low bit	※CRC code high bit
0x01	0x83	0x02	0xC0	0xF1

2. Write multi-register

For example:Host use 0x10 function code write SV （setting value 150）
ADD code of SV is 0x2000,because SV is integer(2 dyte),seizes 1 data register.
The hexadecimal code of decimal integer 150 is 0x0096.

Host request (write multi-register)										
1	2	3	4	5	6	7	8	9	10	11
Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte Length high bit	Data byte Length low bit	Data byte Length	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x20	0x00	0x00	0x01	0x02	0x00	0x96	0x07	0xFC

Slave normal answer (write multi-register)							
1	2	3	4	5	6	7	8
Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte length high bit	Data byte length low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x20	0x00	0x00	0x01	0x0A	0x09

Host write SV with 0x06 function （set value 150）

Host request （write single-register）							
1	2	3	4	5	6	7	8
Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64
Slave normal answer （write single-register）							
1	2	3	4	5	6	7	8
Meter ADD	Function code	ADD High bit	ADD Low bit	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64

Slave abnormal answer (write single-register)				
1	2	3	4	5
Meter ADD	Function code	Error code	※CRC code low bit	※CRC code high bit
0x01	0x86	0x02	0xC3	0xA1

Meter parameters address mapping table

No.	Add (Register No①)	Variable name	Register	R/W	Remark
1	0x2000 （48193）	Set value SV	1	R/W	
2	0x2001 （48194）	1st alarm value AL1	1	R/W	
3	0x2002 （48195）	1st alarm hysteresis HY1	1	R/W	
4	0x2003 （48196）	2nd alarm valueAL2	1	R/W	
5	0x2004 （48197）	2nd alarm hysteresis HY2	1	R/W	
6	0x2005 （48198）	Display low limit FL	1	R/W	
7	0x2006 （48199）	Display high limit FH	1	R/W	
8	0x2007 （48200）	Analog output low limit BRL	1	R/W	
9	0x2008 （48201）	Analog output high limit BRH	1	R/W	

No.	Add (Register No①)	Variable name	Register	R/W	Remark
10	0x2009 （48202）	Control output low limit OLL	1	R/W	Default 1 decimal place
11	0x200A （48203）	Control output high limit OLH	1	R/W	Default 1 decimal place
12	0x200B （48204）	Overshoot limit OVS	1	R/W	
13	0x200C （48205）	Heat & Cool control dead zone DB	1	R/W	
14	0x200D （48206）	Proportional coefficient of cooling PC	1	R/W	Default 1 decimal place
15	0x200E （48207）	Amend value PS	1	R/W	
16	0x200F （48208）	PV fuzzy tracking value DTR	1	R	Engineering work without decimal point
17	0x2010 （48209）	Measured value PV	1	R	
18	0x2011 （48210）	Output percentage MV	1	R/W	0~100
19	0x2012 （48211）	Auto-Manual switch A-M	1	R/W	0: Auto 1: Manual
Reserve					
20	0x2100 （48449）	1st alarm mode AD1	1	R/W	
21	0x2101 （48450）	2nd alarm mode AD2	1	R/W	
22	0x2102 （48451）	1st alarm extended function AE1	1	R/W	
23	0x2103 （48452）	2nd alarm extended function AE2	1	R/W	
24	0x2104 （48453）	Control mode OT	1	R/W	
25	0x2105 （48454）	Output mode ACT	1	R/W	
26	0x2106 （48455）	RUN/STOP operation	1	R/W	1:RUN 2:STP 3:Run auto-tune 4:Stop auto-tune
27	0x2107 （48456）	Decimal pointDP	1	R/W	
28	0x2108 （48457）	Unit display UT	1	R/W	25（℃）26（℉）
29	0x2109 （48458）	Filter constants FT	1	R/W	
30	0x210A （48459）	Proportional coefficient P	1	R/W	No decimal point
31	0x210B （48460）	Integral time I	1	R/W	No decimal point
32	0x210C （48461）	Differential time D	1	R/W	No decimal point
33	0x210D （48462）	Control speed fine-tune SPD	1	R/W	
34	0x210E （48463）	Heating control cycle CP	1	R/W	No decimal point
35	0x210F （48464）	Cooling control cycle CP1	1	R/W	No decimal point
36	0x2110 （48465）	Cooling delay time PT	1	R/W	No decimal point
37	0x2111 （48466）	Optional input signal INP	1	R/W	Refer to signal table
38	0x2112 （48467）	Meter address ADD	1	R/W	
39	0x2113 （48468）	Communication baud rate BAD	1	R	
40	0x2114 （48469）	Comm. data transfer sequence DTC	1	R	Note ③
41	0x2115 （48470）	PID arithmetic type PDC	1	R	
42	0x2116 （48471）	Lock LCK	1	R	
43	0x2117 （48472）	Meter name	1	R	
44	0x2118 （48473）	Output state	1	R	Note ②
48	0x2119 （48474）	Parity Check PRTY	1	R	

R：Read only；R/W：Read & write

Note①: The register number is the address converted to decimal plus 1 and then the register identification code 4 is added in front; for example: the register number of the data address 0x2000 is 8192 + 1 = 8193 and then 4 is added in front, that is, the register number 48193; Related applications can be seen, such as Siemens S7-200 PLC.

Note ②: Measurement status indication. When the data bit is 1, it means execution, and when it is 0, it means no execution.

D7	D6	D5	D4	D3	D2	D1	D0
STOP	HHHH	LLLL	AT	AL2	AL1	OUT2	OUT1

Note③: DTC communication data transfer sequence description

Set value	□	□	□	Content
1st bit	0			Function reserved
2nd bit Byte transfer sequency		0		Transfer sequency is 1, 2.
		1		Transfer sequency is 2, 1.
3rd bit			0	Function reserved

※16-bit CRC check code to get C program

```
unsigned int Get_CRC(uchar *pBuf, uchar num)
{
  unsigned i,j;
      unsigned int wCrc = 0xFFFF;
      for(i=0; i<num; i++)
      {
            wCrc ^= (unsigned int)(pBuf[i]);
            for(j=0; j<8; j++)
            {
                  if(wCrc & 1){wCrc >>= 1; wCrc ^= 0xA001; }
                  else
                        wCrc >>= 1;
            }
      }
   return wCrc;
}
```