TEMPERATURE CONTROLLER
Model: TC10 - Quick Guide · IM 05C01E81-01EN
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YOKOGAWA ◆

Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750 Japan
internet site: www.yokogawa.com

EU Declaration of conformity and Manual retrieval
TC10 is a panel mounting, Class II instrument. It has been designed with compliance to the European Directives. All information about the controller use can be found in the Engineering Manual: IM 05C01E81-02EN and the Communication Manual: IM 05C01E81-03EN and General Specification: GS 05C01E81-01EN.
The EU Declaration of Conformity and the manual of the controller can be downloaded (free of charge) from the web-site:
www.yokogawa.com/ns/tc10/im/
In relation to CE marking, the authorized representative for this product in EEA:
Yokogawa Europe B.V.
Euroweg 2, 3825 HD Amersfoort, The Netherlands
and the importer for this product into the EU/EEA market via the YOKOGAWA sales channel is:
Yokogawa Europe B.V.
Euroweg 2, 3825HD Amersfoort, The Netherlands
In relation to UKCA marking, the importer for this product into the Great Britain market via the YOKOGAWA sales channel is:
Yokogawa United Kingdom Limited
Stuart Road Manor Park Runcorn, WA7 1TR, United Kingdom.

Safety Precautions
The following general safety precautions must be observed during all phases of operation, service and repair of this instrument.
If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired. Also, YOKOGAWA Electric Corporation assumes no liability for the customer's failure to comply with these requirements. The following symbol is used on the instrument.
This manual is an essential part of the product; keep it in a safe place for future reference. This manual is intended for the following personnel:
– Engineers responsible for installation, wiring, and maintenance of the equipment.
– Personnel responsible for normal daily operation of the equipment.

⚠ **WARNING**
Calls attention to actions or conditions that could cause serious or fatal injury to the user or damage to the instrument, and indicates precautions that should be taken to prevent such occurrences. The user must refer to the Engineering manual for special instructions.

∼ **AC**
≈ **AC/DC**
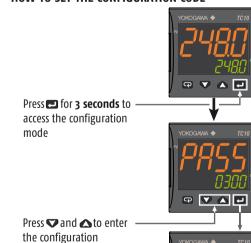▣ The equipment wholly protected by double insulation or reinforced insulation.

⚠ **WARNING**
– Whenever a failure or a malfunction of the device may cause dangerous situations for persons, things or animals, please remember that the plant must be equipped with additional devices which will guarantee safety.
– We warrant that the products will be free from defects in material and workmanship for 18 months from the date of manufacturing. Products and components that are subject to wear due to conditions of use, service life and misuse are not covered by this warranty.

Safety, Protection, and Modification of the Product
– In order to protect the system controlled by this product and the product itself, and to ensure safe operation, observe the safety precautions described in the Engineering manual. Use of the instrument in a manner not prescribed herein may compromise the product's functions and the protection features inherent in the device. We assume no liability for safety, or responsibility for the product's quality, performance or functionality should users fail to observe these instructions when operating the product.
– Installation of protection and/or safety circuits with respect to a lightning protector; protective equipment for the system controlled by the product and the product itself; foolproof or failsafe design of a process or line using the system controlled by the product or

the product itself; and/or the design and installation of other protective and safety circuits are to be appropriately implemented as the customer deems necessary.
– This product is not designed or manufactured to be used in critical applications that directly affect or threaten human lives. Such applications include nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities, and medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.
– Modification of the product is strictly prohibited.
– This product is intended to be handled by skilled/trained personnel for electric devices.
– Overvoltage category: II.

⚠ **WARNING**
– This instrument is for Measurement Category No. 1. Do not use it for measurements in locations falling under Measurement Categories No. 2, No. 3 and No. 4.

No.	EN 61010-2-030	Description
No. 1	O (Other)	For measurements performed on circuits not directly connected to MAINS.
No. 2	Measurement Category II	For measurements performed on circuits directly connected to the low-voltage installation.
No. 3	Measurement Category III	For measurements performed in the building installation.
No. 4	Measurement Category IV	For measurements performed at the source of the low-voltage installation.

How to Connect Wires

⚠ **WARNING**
– Wiring work must be carried out by a person with basic electrical knowledge and practical experience.
– Be sure to turn OFF the power supply to the controller before wiring to avoid an electric shock. Use a tester or similar device to ensure that no power is being supplied to a cable to be connected.
– As a safety measure, always install a circuit breaker (an IEC 60947 compatible product, 5 A, 100 V or 220 V AC) in an easily accessible location near the instrument. Moreover, provide indication that the switch is a device for turning off the power to the instrument.
– Install the power cable keeping a distance of more than 1 cm from other signal wires.
– The power cable is required to meet the IEC standards concerned or the requirements of the area in which the instrument is being installed.
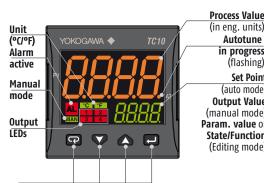– Wiring should be installed to conform to NEC (National Electrical Code: ANSI/NFPA-70) or the wiring construction standards in countries or regions where wiring will be installed.
– For control relay output, alarm relay output, and power terminal connections, use heat-resistant cables.
– Do not short-circuit the terminals of the SSR output.
– Recommended tightening torque: 0.5 Nm.

Model and suffix codes

Model Code	Suffix codes	Description
TC10	-N□□C□□□□D□F	**Temperature Controller**
Fixed code	-N	Always "-N"
Power supply	L	24 VAC/DC (custom order)
	H	100 to 240 VAC
Fixed code	C	Always "C"
OUT1 - 3	R N N	Relay output for ON/OFF control
	R R R	Relay output with 2 alarm relays, for ON/OFF or Heat/Cool control with 1 alarm
	V N N	DC Output for SSR
	V R R	DC Output for SSR with 2 alarm relays or DCV and Relay output for Heat/Cool control with 1 alarm
	V V R	2 DCV output for SSR with 1 Relay (Custom order)
	A R R	Analogue output with 2 alarm Relays, or analog output and Relay output for Heat/Cool control with 1 alarm
IN/OUT4 (Fixed code)	D	Always "D" – Selectable I/O (logic input / 12 V SSR drive output / 12VDC 20 mA transmitter power supply
Serial communication	S	RS485 Modbus
	N	None
Fixed code	F	Always "F"
Option Code	/GK	Panel gasket for IP65

HOW TO SET THE CONFIGURATION CODE

Press ⟳ for **3 seconds** to access the configuration mode

Press ▽ and △ to enter the configuration Password 4 (default 300)

Press ▽ and △ to enter *Cod 1* (Input Type and Control Mode)

Press ▽ and △ to enter *Cod2* (Alarms and Service Functions)

Press ↵ to store the **Configuration code**

Note: To leave the Configuration session **without saving** the settings made, press the ⟳ button

DISPLAY AND KEYS

- **Unit** (°C/°F)
- **Alarm active**
- **Manual mode**
- **Output LEDs**
- **Process Value** (in eng. units)
- **Autotune in progress** (flashing)
- **Set Point** (auto mode)
- **Output Value** (manual mode) **Param. value** or **State/Function** (Editing mode)

	Operator Mode	Editing Mode
↵	Access to: – Operator Commands (Timer, Setpoint selection …) – Parameters – Configuration	Confirm and go to Next parameter
△	Access to: – Operator additional information (Output value, running time …)	Increase the displayed value or select the next element of the parameters list
▽	Access to: – Set Point	Decrease the displayed value or select the previous element
⟳	Programmable key: Start the programmed function (Autotune, Auto/Man, Timer …)	Exit from Operator commands/Parameter setting/Configuration

ELECTRICAL CONNECTIONS

Outputs
Relay Output 1: 4 A, 250Vac resistive load;
Relay outputs 2, 3: 2 A, 250Vac resistive load;
Linear output: 0/20 mA, 0/10 Vdc

Note: Terminal 4 can be programmed as:
– **Digital Input** (DI2) connecting a free of voltage contact between terminals 4 and 16;
– **0 to 12 V SSR Drive Output** (OP4) connecting the load between terminals 4 and 16;
– **12 Vdc (20 mA) transmitter power supply** connecting the 2 wire transmitter between terminals 4 and 1; for 3 wire transmitter connect terminal 4 to transmitter power supply input and terminal 1 and 2 to transmitter signal output.

TERMINALS

Pin connector ⌀ 1.4 mm max. (0.055 in.)

Stripped wire L: 5.5 mm (0.21 in.)

24 Vac/dc (±10%) 5.5 VA max.
100 to 240 Vac (−15 to + 10%), 6.5 VA max. 50/60 Hz

DIMENSIONS
Overall dimensions (L x H x D): 48 x 48 x 73 mm (1.89 x 1.89 x 2.87 in.)
Panel Cut-out (L x H): 45+0.6 x 45+0.6 mm (1.78+0.023 x 1.78+0.023 in.)

MOUNTING

65 mm min. 2.56 in min.
45+0.6 mm 1.78+0.023 in
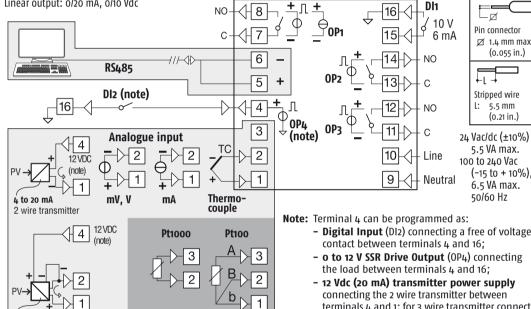69 mm min. 2.56 in min.

Mounting requirements
This instrument is intended for permanent installation, for indoor use only, in an electrical panel which encloses the rear housing, exposed terminals and wiring on the back.
Select a mounting location having the following characteristics:
1. It should be easily accessible;
2. There is minimum vibrations and no impact;
3. There are no corrosive gases;
4. There are no water or other fluids (i.e. condensation);
5. The ambient temperature is in accordance with the operative temperature (0 to 50ºC);
6. The relative humidity is in accordance with the instrument specifications (20 to 90%);
7. Installation altitude: less than 2000 m on sea level;
8. Pollution cathegory 2.
The instrument can be mounted on panel with a maximum thickness of 8 mm.
When the maximum front protection (IP65) is desired, the optional gasket must be mounted.

CONFIGURATION CODE
The TC10-N can be easily configured by the "**Code Configuration**" method for the most common requirements, just entering two 4-digit codes: *Cod 1* [**LMNO**] for the Input Type and Control Mode selection and *Cod2* [**PQRS**] for the Alarms and the Service Functions.
For complete controller configuration see the Engineering Manual.
Note: Before starting the configuration code setting, please define and write down *Cod 1* and *Cod2* as needed:

User *Cod 1* | L | M | N | O |

Cod 1 | L | M | N | O |

Input Type and Range		L	M
TC J	−50 to +1000°C	0	0
TC K	−50 to +1370°C	0	1
TC S	−50 to 1760°C	0	2
TC R	−50 to 1760°C	0	3
TC T	−70 to +400°C	0	4
PT 100	−200 to +850°C	0	7
PT 1000	−200 to +850°C	0	8
Linear 0 to 60 mV		0	9
Linear 12 to 60 mV		1	0
Linear 0 to 20 mA (this selection forces Out 4 = TX)		1	1
Linear 4 to 20 mA (this selection forces Out 4 = TX)		1	2
Linear 0 to 5 V		1	3
Linear 1 to 5 V		1	4
Linear 0 to 10 V		1	5
Linear 2 to 10 V		1	6
TC J	−58 to +1832°F	1	7
TC K	−58 to +2498°F	1	8
TC S	−58 to 3200°F	1	9
TC R	−58 to 3200°F	2	0
TC T	−94 to +752°F	2	1
PT 100	−328 to +1562°F	2	4
PT 1000	−328 to +1562°F	2	5

Control mode	OP1	OP2	OP3	OP4	N	O
ON/OFF heating = H	H	AL1	AL2	AL3	0	0
	NU	AL1	AL2	H	0	1
ON/OFF cooling = C	C	AL1	AL2	AL3	0	2
	NU	AL1	AL2	C	0	3
ON/OFF with neutral zone (H/C)	H	C	AL2	AL3	0	4
	H	AL1	AL2	C	0	5
	C	H	AL2	AL3	0	6
	NU	H	AL2	C	0	7
	C	AL1	AL2	H	0	8
	NU	C	AL2	H	0	9
PID heating = H	H	AL1	AL2	AL3	1	0
	NU	AL1	AL2	H	1	1
PID cooling = C	C	AL1	AL2	AL3	1	2
	NU	AL1	AL2	C	1	3
PID double action (H/C)	H	C	AL2	AL3	1	4
	H	AL1	AL2	C	1	5
	C	H	AL2	AL3	1	6
	NU	H	AL2	C	1	7
	C	AL1	AL2	H	1	8
	NU	C	AL2	H	1	9

Note: As default, when the alarms are active, only AL1 threshold is available at "**Operator Command**" level to perform non critical tasks. To protect the AL2 and AL3 thresholds against undesired changes, they are available only at "**Parameters list**" level (password: 20). For different configurations, see the Engineering Manual.

User *Cod2* | P | Q | R | S |

Cod2 | P | Q | R | S |

		P	Q	R
Alarm 3				R
Alarm 2			Q	
Alarm 1		P		
Not used		0	0	0
Sensor break		1	1	1
Absolute	High	2	2	2
	Low	3	3	3
Absolute High/Low	External High/Low	4	4	4
	Internal High/Low	5	5	5
Deviation	Deviation high	6	6	6
	Deviation low	7	7	7
Band	External band	8	8	8
	Internal band	9	9	9

Service functions activation	S
None	0
Wattmeter (instantaneous power expressed in kW) (note 1)	1
Wattmeter (Power consumption expressed in kWh/h) (note 2)	2
Absolute worked time (expressed in days) (note 3)	3
Absolute worked time (expressed in hours) (note 3)	4

Notes: 1. **Wattmeter Instantaneous power** is continuously computed as multiplication of the Load Voltage, Load Current parameter values and the controller output instantaneous value.
2. **Wattmeter power consumption** is the estimated hourly energy consumption (using Load Voltage and Load Current parameter values), computed on the previous 15 minutes period. The readout is updated every 15 minutes.
3. **Worked Time counter** is continuously increased when the controller is turned ON.

ALARM TYPES (*Cod2* digits: **P, Q, R**)

Absolute Alarm

Absolute High-Low Alarm

Deviation Alarm

Band Alarm

PARAMETERS SETTING

Press the ⏎ key for 3 seconds

Password 2 (default: 20)

Password 4 (default: 300)

Access to parameters

To Code configuration mode (cod1, cod2 tables on the front page)

Parameters setting

⏎	Confirm and go to Next parameter
▲	Increase the displayed value or select the next element
▼	Decrease the displayed value or select the previous element

To exit the parameter setting procedure press the ⏎ key (for 3 s) or wait until the timeout expiration (about 30 seconds).

CONTROLLER OPERATION

Additional Information

Heating — H035

Cooling — C045

Output Value % (e.g. heating = 35%, cooling = 45%)

Power (kW) or Energy (Wh) — U854

Worked time (days) — d854

Worked time (hours) — h854

Depending on Cod2 digit **S** setting

If active

To return to the Normal Mode, press the ⏎ key for 3 seconds or wait for the 10s timeout

Set Point Change

SP 248.0 → SP 250.0

▲ Increase value
▼ Decrease value

Operative Set Point

Changed operative Set Point

Press the ⏎ key (3 s) or wait for the 10s time out to **store the new Set Point** and return to Normal Mode

EVOTUNE Start

248.0 tunE → 248.0 248.0

Auto-tune started

Auto-tune in progress

Dot flashes while the Auto-tune is in progress

Press the ⏎ key for 3 s

Note: The ⏎ key could be assigned by the user to other functions using the USrb parameter setting

EVOTUNE is a fast and fully automatic procedure that can be started in any condition, regardless the deviation from SP. The controller selects automatically the best tune method and computes the optimum PID parameters.

Operator Command

A.SP 1

▲ Active Set Point selection
▼

If more than 1 Set Point active (nSP > 1)

⏎ Confirm/Next

SP 248.0

▲ Increase
▼ Decrease

1st SP value change

⏎ Confirm/Next

nSP > 1

SP2 120.0

nSP > 2

SP3 225.0

nSP > 3

SP4 340.0

⏎ Confirm/Next

AL1 25.0

If AL1 is active

⏎ Confirm/Next

Back to the first parameter

To return to the Normal Mode, press the ⏎ key for 3 seconds or wait for the 10s timeout

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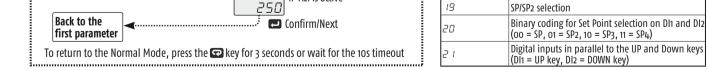| Group	Param.	Description	Range value or selection list elements	Default	User value	Note
Commands	oPEr	Operative Mode Selection	auto = Auto; oplo = Manual; stdy = Standby			
	RSP	Set Point Selection	0 = SP, 1 = SP2, 2 = SP3, 3 = SP4	0 = SP		
	tunE	Start Auto Tune	0 = oFF, 1 = start	0 = OFF		evoTUNE
Control	Pb	Proportional Band	1 to 9999 (Engineering Units = E.U.)	50		
	ti	Integral Time	0 to 10000 s	200		Cod1 Digit **N = 1**
	td	Derivative Time	0 to 9999 s	50		Cod1 Digit **N = 1**
	HSEt	Hysteresis ON/OFF Control	0 to 9999 (E.U.)	1		Cod1 Digit **N = 0**
	tcH	Heating output cycle time	0.1 to 130 s	20.0		Cod1 Digit **N = 1**
	rcG	Relative Cooling Gain	0.01 to 99.99	1.00		Cod1 Digit **N = 1** Cod1 Digit **O > 4**
	tcc	Cooling output cycle time	0.1 to 130 s	20.0		Cod1 Digit **N = 1** Cod1 Digit **O > 1**
Set Point	SP	Set Point 1	−1999 to +9999 (E.U.)			
	SP2	Set Point 2	−1999 to +9999 (E.U.)			If nSP > 1
	SP3	Set Point 3				If nSP > 2
	SP4	Set Point 4				If nSP > 3
	SPLL	Set Point min. Value	−1999 to SPHL (E.U.)			
	SPHL	Set Point max. Value	SPLL to 9999 (E.U.)			
	nSP	No. of Set Points	1 to 4	1		
Alarms	AL1	Alarm 1 threshold	AL1L to AL1H			
	AL1L	Alarm 1 low threshold/Low limit	−1999 to +9999 (E.U.)	−1999		If digit **P** of Cod2 is > 1
	AL1H	Alarm 1 high threshold/High limit		9999		
	HAL1	AL1 hysteresis	1 to 9999 (E.U.)	1		
	AL2	Alarm 2 threshold	AL2L to AL2H			
	AL2L	Alarm 2 low threshold/Low limit	−1999 to +9999 (E.U.)	−1999		If digit **Q** of Cod2 is > 1
	AL2H	Alarm 2 high threshold/High limit		9999		
	HAL2	AL2 hysteresis	1 to 9999 (E.U.)	1		
	AL3	Alarm 3 threshold	AL3L to AL3H			
	AL3L	Alarm 3 low threshold/Low limit	−1999 to +9999 (E.U.)	−1999		If digit **R** of Cod2 is > 1
	AL3H	Alarm 3 high threshold/High limit		9999		
	HAL3	AL3 hysteresis	1 to 9999 (E.U.)	1		
Soft Start	StP	Soft Start Output value	−100 to 100%	0		
	SSt	Soft Start Time	0.00 to 8.00 (hh.mm)	0		
Input	SSc	Low Scale readout	−1999 to 9999	−1999		For linear Input types only
	FSc	High Scale readout	−1999 to 9999	9999		
	dP	Number of decimals	0 to 3 (linear inputs); 0 to 1 (other inputs)	0		
	FiL	Measured value Digital filter	OFF; 0.1 to 20.0 s	1.0		
I/O	io4F	I/O 4 Function	ON = Transmitter Power Supply; OUT4 = SSR out; Di2C = Dig. In. from contact; Di2U = 24 VDC Digital Input;	OUT4		
Digital Inputs	diF.1	Digital Input 1 Function	0 to 21	0		See the DI1, DI2 functions table
	diF.2	Digital Input 2 Function	0 to 21	0		
	diA	Digital Inputs Action	0 = DI1 direct action, DI2 direct action; 1 = DI1 reverse action, DI2 direct action; 2 = DI1 direct action, DI2 reverse action; 3 = DI1 reverse action, DI2 reverse action.	0		DI2 only if configured
	uSrb	Key ⏎ Function	nonE, tunE, oplo, aac, asi, chsp, st.by, str.t	tunE		See the ⏎ Key function table
Display	dicL	Color of the Process Value display	0 = Change 1 = Red 2 = Green 3 = Orange	2		If Change, the color is **green** if PV differs from SP less than AdE, **red** if higher than AdE and **orange** if is lower than AdE
	AdE	Display change color threshold (when dicL = 0)	0 (OFF) to 9999 (e.u.)			
	diSt	Display Power OFF time (mm.ss)	oFF (display ON) 0.1 to 99.59	oFF		
Serial communications	Add	Instrument Address	1 to 254	1		Modbus RTU slave protocol
	bAud	Baud rate	1200, 2400, 9600 baud, 19.2, 38.4 kbaud	9600		
Wattmeter	UoLt	Load Voltage	1 to 999 (V)	230		If digit **S** of Cod2 is > 1
	cur	Load Current	1 to 9999 (A)			
Password	PAS4	Configuration access Password	201 to 400	300		
	PAS2	Parameters access Password	0 to 200	20		

Note: To access all the instrument features, please see the "**Complete configuration procedure**" in the "**Engineering Manual**".

diF_ Digital Inputs DI1 and DI2 Functions

Code displayed	Description
0	Disabled (OFF) (default)
1	Alarm Reset
2	Alarm Acknowledge (ACK)
3	Hold of the measured value
4	Stand by mode
5	Manual Mode
6	Heat with "SP" and Cool with "SP2"
7 to 17	Reserved
18	Sequential Set Point selection [on transition]
19	SP/SP2 selection
20	Binary coding for Set Point selection on DI1 and DI2 (00 = SP, 01 = SP2, 10 = SP3, 11 = SP4)
21	Digital inputs in parallel to the UP and Down keys (DI1 = UP key, DI2 = DOWN key)

uSrb Key ⏎ Function

Code displayed	Description
nonE	Not used
tunE	Starts auto tuning functions (default)
oPLo	Manual mode
AAc	Alarm Reset
ASi	Alarm Acknowledge
chSP	Circular Set Point Selection (shows SP, SP2, SP3)
StbY	Stand-by mode

关于产品污染防止管理
Control of Pollution Caused by the Product

根据中华人民共和国电子信息产品的防污染管理办法，对本仪表进行说明。

This is an explanation for the product based on "Control of pollution caused by Electronic Information Products" in the People's Republic of China.

产品中有毒有害物质或元素的名称及含量

部件名称	有毒有害物质或元素					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(Cr6+)	多溴联苯(PBB)	多溴二苯醚(PBDB)
框架（塑料）	×	×	×	○	○	○
框架（金属）	×	×	×	○	○	○
内部接线材料	×	×	×	○	○	○
电源	×	×	×	○	○	○

○：表示该部件所有基材中所含的有毒有害物质含量均未超过GB/T26572标准中规定的限量要求。

×：表示该部件中至少有一种基材中所含的有毒有害物质含量超过GB/T26572标准中规定的限量要求。

⑩ 该标志为环境保护使用期限，根据SJ/T11364，适用于在中国(台湾、香港、澳门除外)销售的电子电气产品。

只要遵守该产品的安全及使用注意事项，从产品生产之日起到该标志所示年限内，不会因为产品中的有害物质外泄或突变而导致环境污染或对人身财产生严重影响。

注释) 该标志所示年限为 "环境保护使用期限"，并非产品的保质期。另外，关于更换部件的推荐更换周期，请参阅使用说明书。

Waste Electrical and Electronic Equipment (WEEE)

(Only valid in the EEA for EU WEEE Directive and in the UK for UK WEEE Regulation)

This product complies with the WEEE marking requirement.

This marking indicates that you must not discard this electrical/electronic product in domestic household waste.

When disposing of products in the EEA or UK, contact your local Yokogawa office in the EEA or UK respectively.

Note: Some parts of this product include the restricted substances of RoHS Directive, but their applications are under the exemption of the directive.