

LIMIT CONTROLLER
Model: TC10-L Quick Guide · IM 05C01E81-11EN
5th edition - December 2025



YOKOGAWA
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EU Declaration of conformity and Manual retrieval
TC10-L 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 05C01E81-12EN and the Communication Manual: IM 05C01E81-13EN and General Specification: GS 05C01E81-11EN.
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/

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.

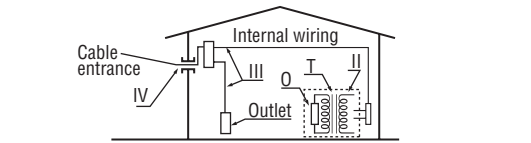


Table with 2 columns: No., Description. Rows include measurement categories II, III, IV and their descriptions.

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.
- Recommended tightening torque: 0.5 Nm.

Table with 3 columns: Model Code, Suffix codes, Description. Rows include TC10, Fixed code, Power supply, Fixed code, Retransmission, Limit control output, Alarm output, Fix Code, Serial communication, Fixed code, Option Code.

Note about the Structure of this Document
The usual installation sequence is the reverse of the operator sequence. During installation, the first step is the wiring procedure followed by the complete configuration. At this point you can set the operator parameter and than you can use the instrument. This document follows this structure.

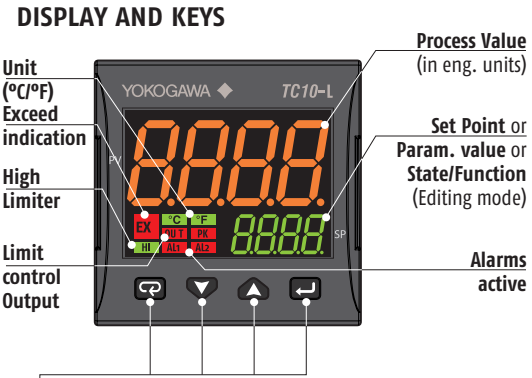
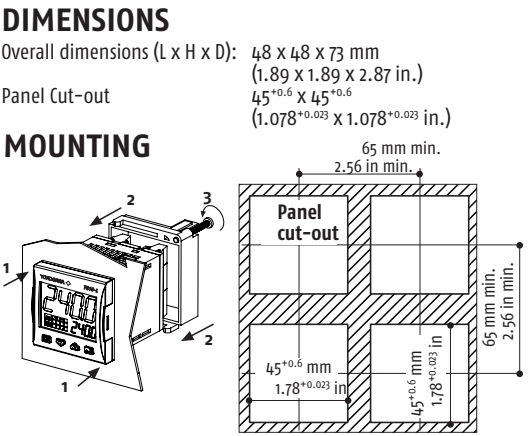
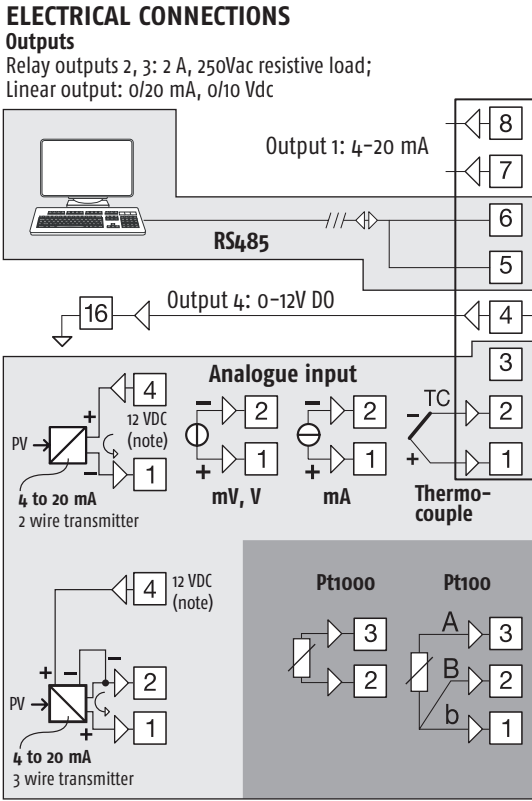
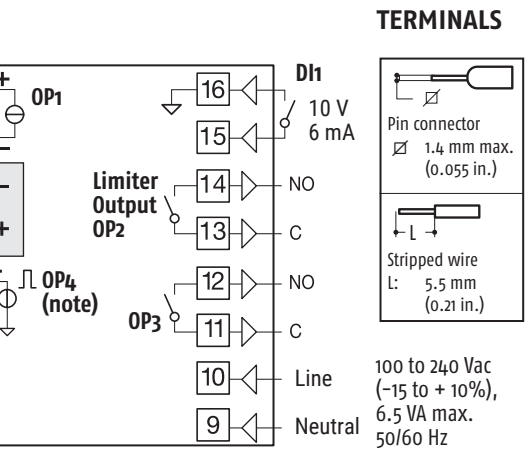


Table with 2 columns: Operator Mode, Editing Mode. Rows include Access to, Confirm and go to Next parameter, Increase the displayed value, Decrease the displayed value, Confirming operation.



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 50°C);
6. The relative humidity is in accordance with the instrument specifications (20 to 85%);
7. Installation altitude: less than 2000 m;
8. Pollution category: 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. This is mandatory for FM approval.



Note: Terminal 4 can be programmed as:
- 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.

CONFIGURATION PARAMETERS SETTING

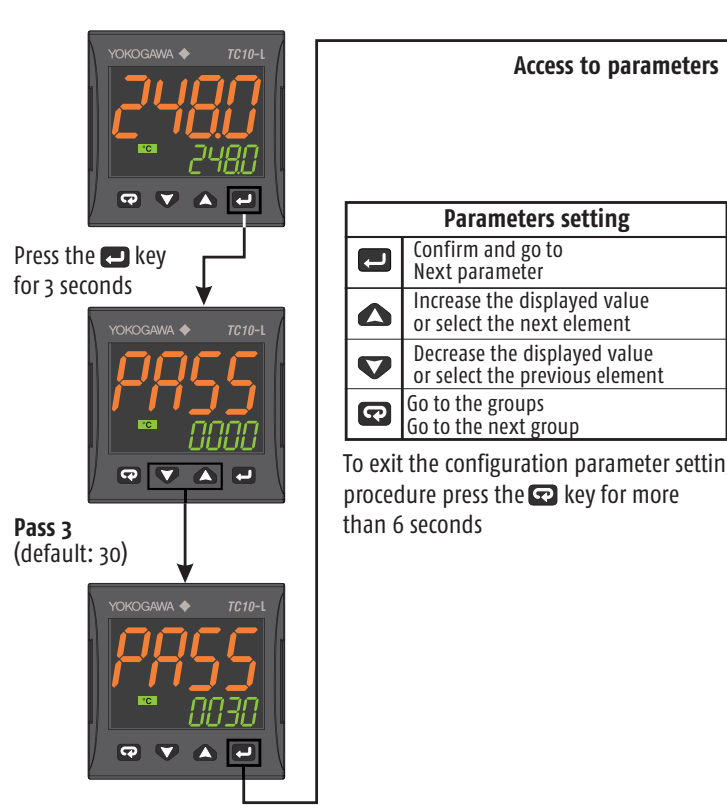


Table with 5 columns: No., Param., Description, Range value or selection list elements, Decimal digits. Rows include InP Group parameters: SEoS, dP, SSs, FSc, unit, FiL, bS, di.A.

OUT group

No.	Param.	Description	Range value or selection list elements	Decimal digits
9	01.t	Out 1 type Note: this parameter will be shown only when Out 1 is present	0.20 = 0~20 mA 4.20 = 4~20 mA 0.10 = 0~10 Volt 2.10 = 2~10 Volt	0
10	01F	Out 1 function	nonE = Out not used r.inP = Measure retransmission r.Err = Error retransmission r.SP = SP retransmission r.SEr = Retransmission of a value coming from serial link	
11	A01L	Retransmission – initial scale value	~1999 to A01H	dP
12	A01H	Retransmission – full scale value	A01L to 9999	dP
13	03F	Out 3 function Available: when Out 3 is present.	nonE = Out not used AL = Alarm output or.bo = Over-range and burn-out P.FAL = Power failure bo.PF = Over-range, burn-out and power Fail	
14	03AL	Alarms linked up with Out 3	from 0 to 15 +1 = Alarm 1 +2 = Alarm 2 +4 = Burn-out +8 = Overload of Out 4	0
15	03Ac	Out 3 action	dir = Direct action rEU = Reverse action	
16	04F	Out 4 function	nonE = Out not used AL = Alarm output or.bo = Over-range and burn-out P.FAL = Power failure bo.PF = Burn-out and power Fail On = Output ever ON (usable as auxiliary PWS for a transmitter)	
17	04AL	Alarms linked up with Out 4	from 0 to 7 +1 = Alarm 1 +2 = Alarm 2 +4 = Burn-out	0
18	04Ac	Out 4 action	dir = Direct action rEU = Reverse action	

AL1 Group

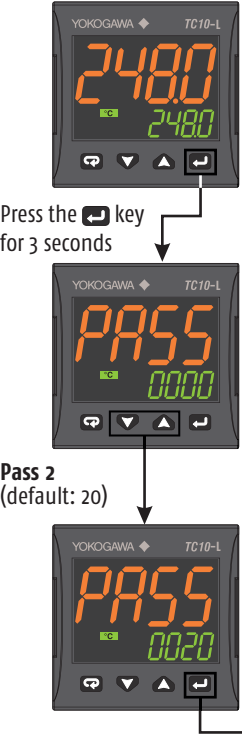
No.	Param.	Description	Range value or selection list elements	Decimal digits
19	AL1t	Alarm 1 type	nonE = Alarm not used; LoAb = Absolute low alarm; HiAb = Absolute high alarm; LHAo = Absolute band alarm with alarm indication out of the band; LHAi = Absolute band alarm with alarm indication inside the band; SE.br = Sensor break; LodE = Deviation low alarm; HidE = Deviation high alarm; LHdo = Relative band alarm with alarm indication out of the band; LHdi = Relative band alarm with alarm indication inside the band.	
20	Ab1	Alarm 1 function	From 0 to 3: 0 = no function; +1 = not active at power up; +2 = Relative alarm not active at Set Point change.	0
21	AL1L	- For High and low alarms AL1L is the Low limit of AL1 threshold; - For band alarm AL1L is the low AL1 threshold	~1999 to AL1H (E.U.)	dP
22	AL1H	- For High and low alarms AL1H is the high limit of AL1 threshold; - For band alarm AL1H is the high AL1 threshold	AL1L to 9999 (E.U.)	dP
23	AL1	Alarm 1 threshold	AL1L to AL1H (E.U.)	dP
24	HAL1	Alarm 1 hysteresis	1 to 9999 (E.U.)	dP
25	AL1d	Alarm 1 delay	0 (oFF) to 9999 (s)	0

AL2 Group

No.	Param.	Description	Range value or selection list elements	Decimal digits
26	AL2t	Alarm 2 type	nonE = Alarm not used; LoAb = Absolute low alarm; HiAb = Absolute high alarm; LHAo = Absolute band alarm with alarm indication out of the band; LHAi = Absolute band alarm with alarm indication inside the band; SE.br = Sensor break; LodE = Deviation low alarm; HidE = Deviation high alarm; LHdo = Relative band alarm with alarm indication out of the band; LHdi = Relative band alarm with alarm indication inside the band.	
27	Ab2	Alarm 2 function	0 = no function +1 = not active at power up +2 = Relative alarm not active at Set Point change.	0
28	AL2L	- For High and low alarms AL2L is the low limit of AL2 threshold; - For band alarm AL2L is the low AL2 threshold	~1999 to AL2H (E.U.)	dP
29	AL2H	- For High and low alarms AL2H is the High limit of AL2 threshold; - For band alarm AL2H is the high AL2 threshold	AL2L to 9999 (E.U.)	dP
30	AL2	Alarm 2 threshold	AL2L to AL2H (E.U.)	dP
31	HAL2	Alarm 2 hysteresis	1 to 9999 (E.U.)	dP
32	AL2d	Alarm 2 delay	0 (oFF) to 9999 (s)	0

OPERATOR PARAMETERS

PARAMETERS SETTING




Press the  key for 3 seconds


Pass 2 (default: 20)

Access to parameters


Parameters setting




Confirm and go to Next parameter



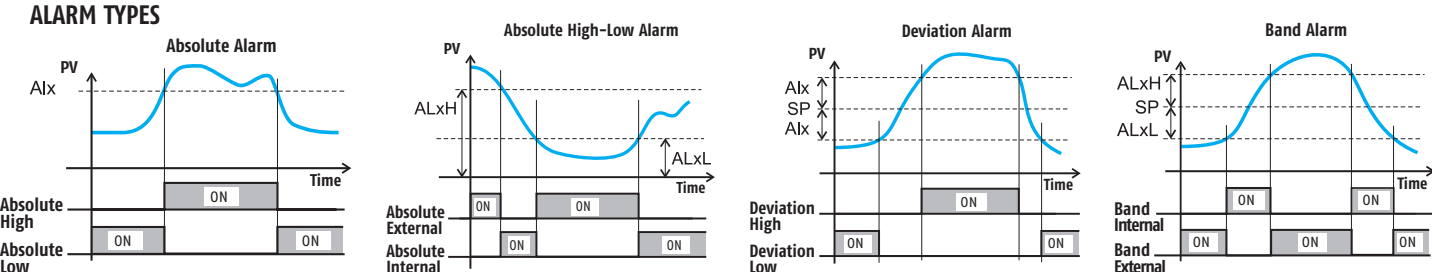
Increase the displayed value or select the next element



Decrease the displayed value or select the previous element

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

Param.	Description	Range value or selection list elements	Decimal digits
SP	Set point (shutdown set point)	From SPLL to SPHL	dP
AL1L	- For High and low alarms AL1L is the low limit of AL1 threshold - For band alarm AL1L is the low AL1 threshold	From ~1999 to AL1H E.U.	dP
AL1H	- For High and low alarms AL1H is the high limit of AL1 threshold - For band alarm AL1L is the high AL1 threshold	From AL1L to 9999	dP
AL1	Alarm 1 threshold	From AL1L to AL1H	dP
AL2L	- For High and low alarms AL2L is the low limit of AL2 threshold - For band alarm AL2L is the low AL2 threshold	From ~1999 to AL2H E.U.	dP
AL2H	- For High and low alarms AL2H is the high limit of AL2 threshold - For band alarm AL2L is the high AL2 threshold	From AL2L to 9999	dP
AL2	Alarm 2 threshold	From AL2L to AL2H	dP
HyS	Hysteresis of the shutdown control (relay hysteresis for control output)	From 0 to high limit of the measured input range selected (MIRS)	dP
Fil	Digital filter on the measured value	From 0 (OFF) to 20.0 s	1
dS	PV input bias	From ~100 to 100 % of the input span	



INSTRUMENT OPERATIVITY

1 Introduction

The TC10-L is an FM (both FM3545 and FM3810) approved limit controller that can be configured either as a high limit or as a low limit controller by a user.

The TC10-L features:

- universal input,
- two alarm outputs,
- retransmission output,
- a timer to count the total time the Set Point has been exceeded,
- a register to retain the maximum (or the minimum) measure reached.
- The RS485 communication interface is available optionally.

2 Limiter function

The relay of the output 2 operates in fail-safe mode (relay de-energized during shutdown condition) and latching mode.

OUT 2 turns OFF (in this document this condition will be named shutdown) when:


The instrument is configured as a high limiter (Hi.Lo = Hi) and the measured value is greater than limiter threshold [“SP” parameter].

The instrument is configured as a low limiter (Hi.Lo = Lo) and the measured value is lower than limiter threshold.

Out 2 remains OFF until the condition which generated the shutdown, no longer exists and the Confirming action (rearm) has been performed.

During a shutdown (Out 2 is OFF) the upper display will be red.

Confirming action (rearm) can be performed in two different way:

- by pressing the  key [when “diS” parameter is set to “but”] but it will be accepted only when the condition which generated the shutdown, no longer exists (EX lamp is OFF) and the set point is shown on the lower display (see “normal display” in “Navigation access”)
- by momentarily closing the digital input (by an external dry contact) [when diS parameter is set to “di”] but it will be accepted only when the condition which generated the shutdown, no longer exists.

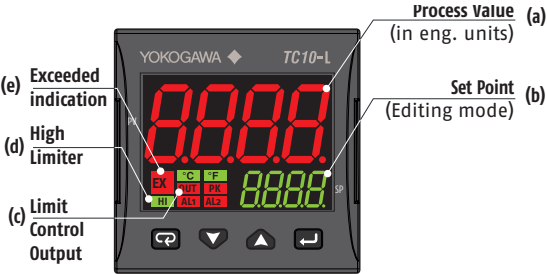
We define also that the time duration of the shutdown condition, stored by the instrument, will be the time from Out 2 goes OFF (shutdown start) and the condition that generate the shutdown no longer exists.

The confirmation action is not part of this time count.

The time duration of the shutdown condition and max/min measured values are stored in memory and available for viewing (see “navigation access”) until the next shutdown condition occurs.

These informations are lost at power down.

2.1 High limit control




The HI lamp (d) is ON

When a measured value (a) is higher than the set point (b), “EX” lamp (e) lights, “OUT” lamp (b) turns ON and the limit output relay (Out 2) is de-energized.

EX lamp (e) turns off when PV goes into normal condition, while the “OUT” lamp (c) stays on as it is.

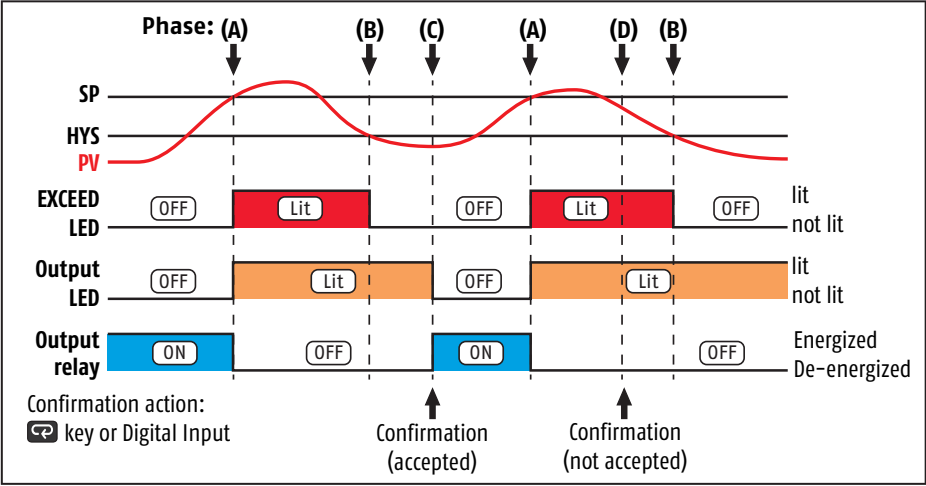
The out (c) lamp turns off only when the EX lamp (e) is off and a confirming operation (rearm) has been done by an operator.

The way to confirm are (according to the “diS” parameter):

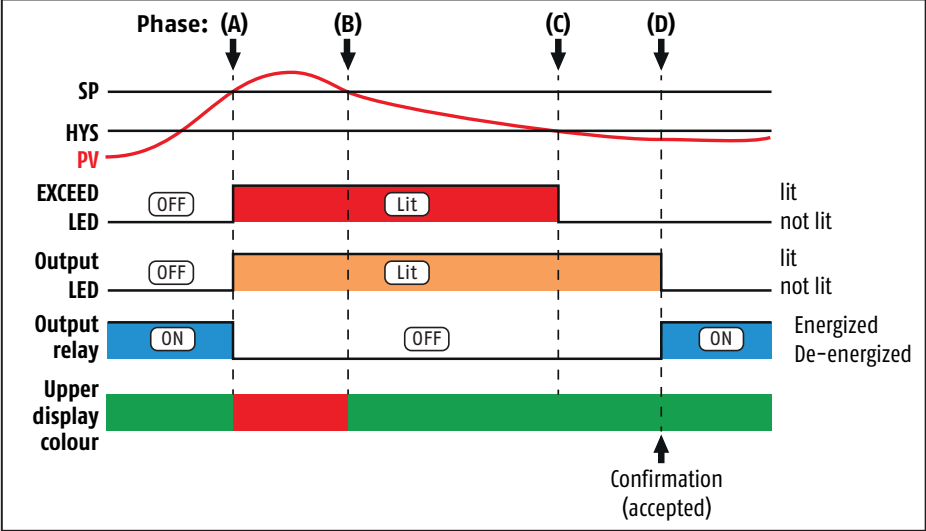
- pressing  key for more than 3 seconds or
- by Dh.

Output relay is de-energized whenever “OUT” lamp is on.

Check the “HYS” parameter value if the EX lamp (e) is not turn off when PV (a) is lower than SP (b).



When the EX lamp (e) is ON but PV (a) is lower than SP (b), the upper display will be in green colour and it shows that the PV is in the hysteresis area.



2.2 Low limit control


The HI lamp (d) is OFF

When a measured value (a) is lower than the setpoint (b), “EX” lamp (e) lights, “OUT” lamp (c) turns ON and the limit output relay is de-energized then.

“EX” (e) lamp turns off when PV goes into normal condition, while the “OUT” lamp (c) lamp stays on as it is.

The out (c) lamp turns off only when the EX lamp (e) is off and a confirming operation (rearm) has been done by an operator.

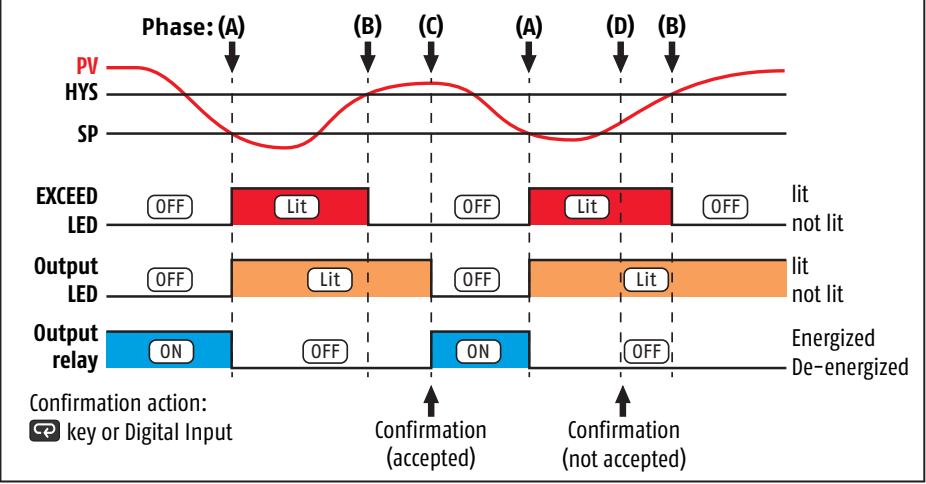
The way to confirm are (according to the “diS” parameter):

- pressing  key for more than 3 seconds or
- by Dh.

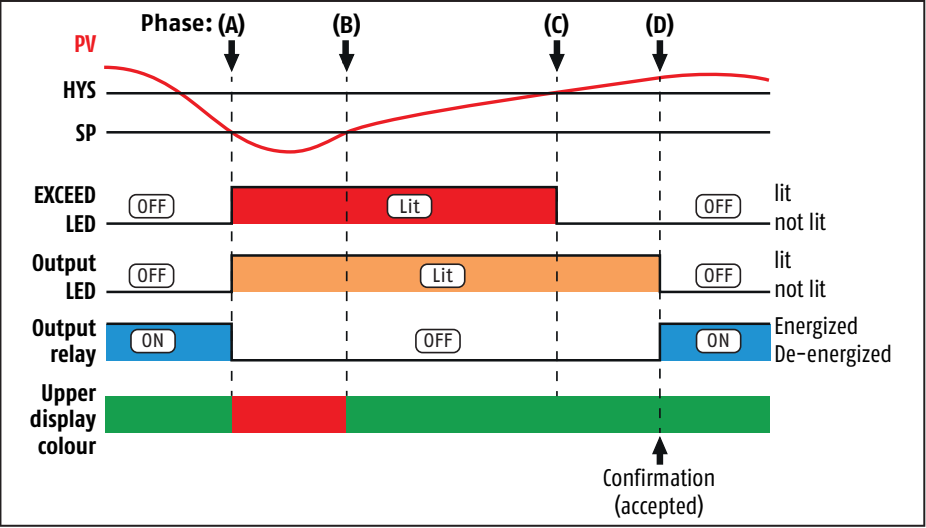
The confirming operation is not accepted during PV exceeds SP (D) (during EXCEEDED lamp lights*). State of output relay is de-energized whenever “OUT” lamp is on.

Output relay is de-energized whenever “OUT” lamp is on.

Check the “HYS” parameter value if the EX lamp (e) is not turn off when PV (a) is lower than SP (b).



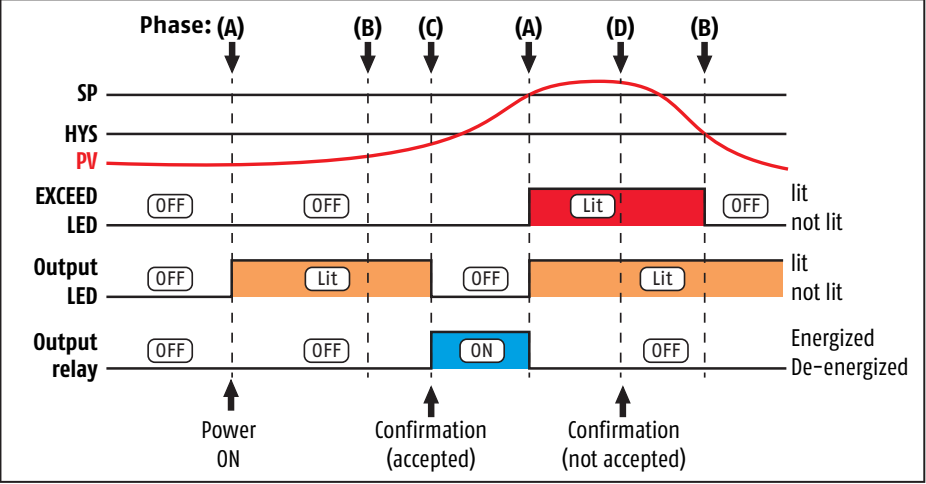
When the EX lamp (e) is ON but PV (a) is lower than SP (b), the upper display will be in green colour and it shows that the PV is in the hysteresis area.



2.3 Working at power on when r.nd is set to 0

(Limit output is de-energized at power on in any cases.)

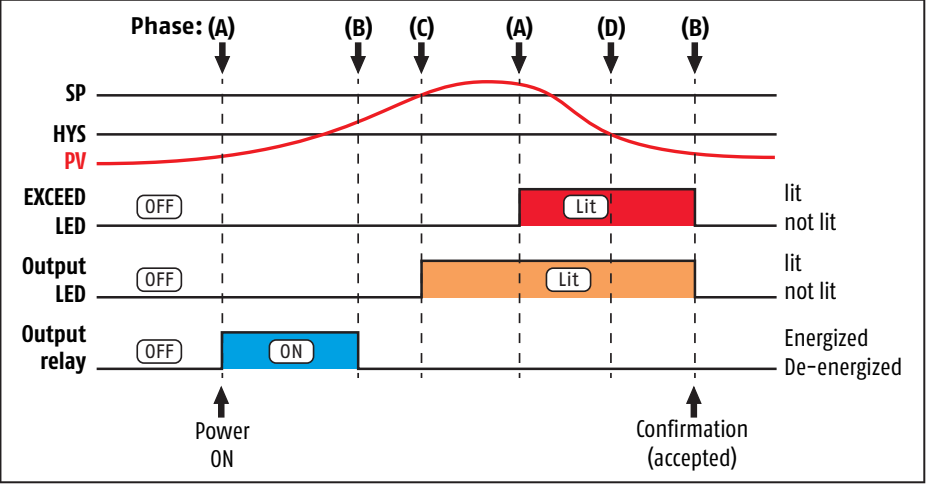
The output relay is always de-energized (opened) at power-on,even if PV does not exceed SP(A). The output (OUT) display lamp is lit. If the PV does not exceed SP, after the confirming operation, output relay will be energized (closed) and the output (OUT) display lamp turns off.



2.4 Working at power on when r.nd is set to 1

(Limit output is energized at power on when PV doesn't exceed SP)

The state of output relay is energized (closed) and the output (OUT) display lamp turns off if the PV does not exceed SP at power-on.



2.5 Note about sensor failure (burnout)

Sensor failure shall result in process shutdown for a limit switch; an alarm or process shutdown for a supervisory switch.
Upscale burnout is required for a high limit switch.
Down scale burnout for a low limit switch.

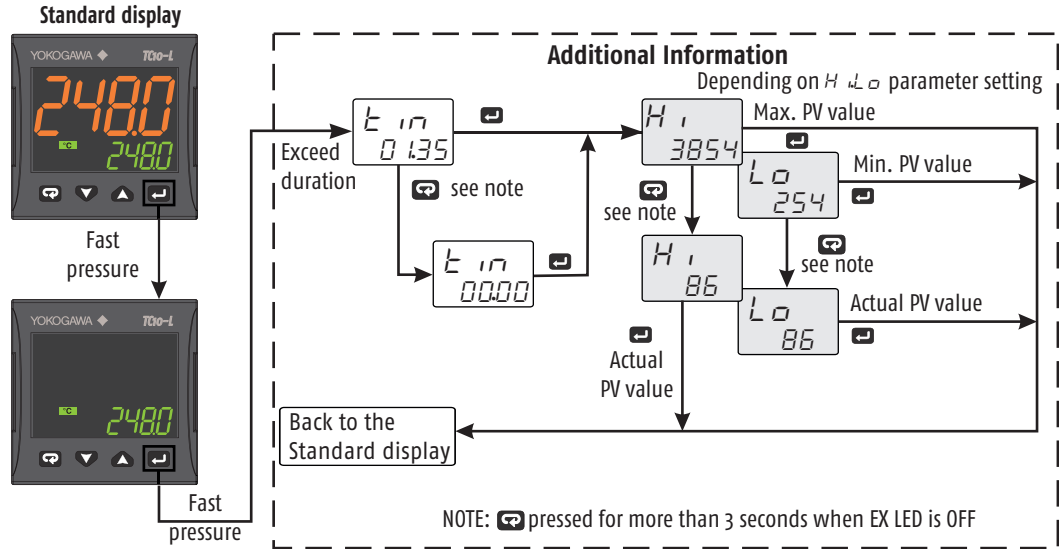
Navigation, access levels and keyboard management

The TC10-L is equipped with 3 different levels:

Level 1

At power up the instrument starts in “Operator Mode” (in this document O.M.)
When in O.M., the keyboard will operate as follows:

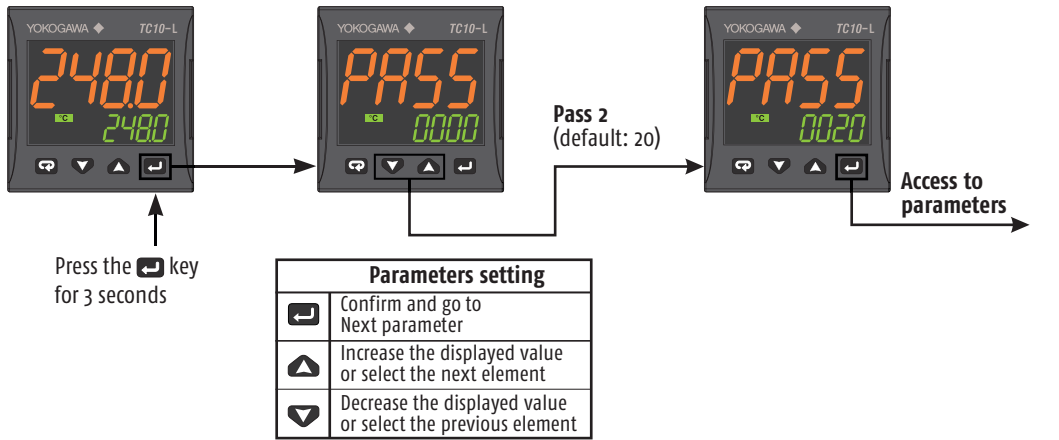
CONTROLLER OPERATION



Level 2

From O.M., pressing “Enter” for more than 3 second and setting Pass 20 the instrument starts the Operator Parameter Procedure
When in OPP, the keyboard will operate as follows:

OPERATOR PARAMETERS SETTING

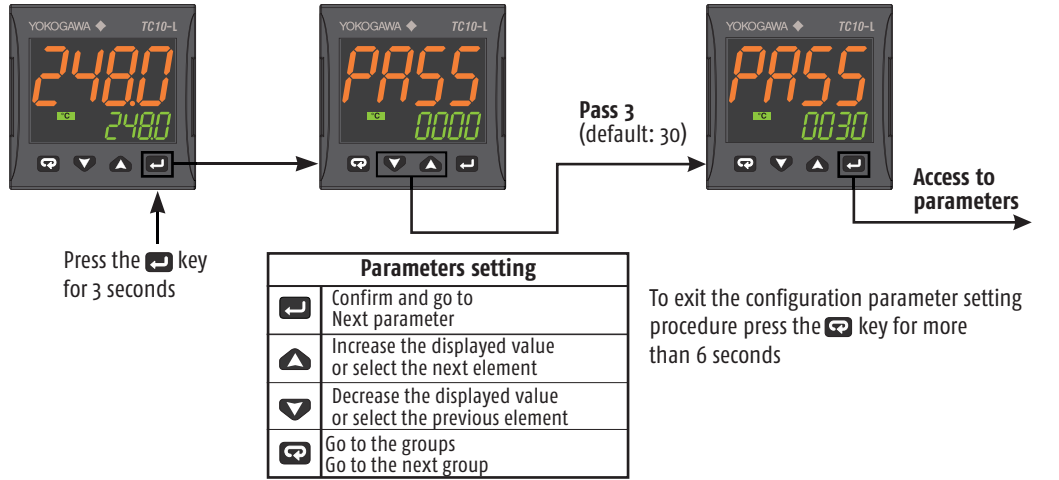


For the full list see “Parameter setting”.

Level 3

From O.M., pressing “Enter” for more than 3 second and setting Pass 30 the instrument starts the Configuration Parameter Procedure.

CONFIGURATION PARAMETERS SETTING



For the full list see “Parameter setting”.

HARDWARE SPECIFICATIONS

Measuring input

Thermocouples

Type: J, K, S, R, T, N programmable.

Continuity detection current: 250 nA.

Engineering Unit: °C or °F programmable.

Cold Junction: Automatic compensation from 0 to +55 °C.

Cold Junction temperature drift: 0.05 °C/°C @ 25 °C after a warm-up (instrument ON) equal to 20 minutes.

Burn-out: Full scale.

TC Type	Ranges				Calibration
J	-50 to 1000°C	-50.0 to 999.9°C	-58 to 1832°F	-58.0 to 999.9°F	EC 584-1 DIN 43710 - 1977
K	-50 to 1370°C	-50.0 to 999.9°C	-58 to 2498°F	-58.0 to 999.9°F	
S	-50 to 1760°C	-50.0 to 999.9°C	-58 to 3200°F	-58 to 999.9°F	
R	-50 to 1760°C	-50.0 to 999.9°C	-58 to 3200°F	-58.0 to 999.9°F	
T	-70 to 400°C	-70.0 to 400.0°C	-94 to 752°F	-94.0 to 752.0°F	
N	-50 to 1300°C	-50.0 to 999.9°C	-58 to 2372°F	-58.0 to 999.9°F	

RTD (Resistive Temperature Detector)

Type: Pt 100 3 wires;
Pt 1000 2 wires.

Current injection: 135 µA.

Line resistance: Automatic compensation (PT100 only) up to 20 Ohm/wire with maximum error < +0.1% input span.

Engineering unit: °C or °F programmable.

Burn-out: Full scale.

RTD type	Ranges		Calibration
Pt 100	-200 to 850°C	-328 to 1562°F	DIN 43760 EN 60751/A2.
	- 200.0 to 850.0°C	-328.0 to 999.9°F	
PT 1000	-200 to 850°C	-328 to 1562°F	
	-200.0 to 850.0°C	-328.0 to 999.9°F	

Linear inputs

Type: 0/12-60 mV, 0/4-20 mA, 0/1-5V, 0/2-10V.

Readout: Programmable from -1999 to 9999.

Decimal point: Programmable.

Input type	Input impedance
0/12 to 60 mV	> 1 MΩ
0/4 to 20 mA	53 Ω
0/1 to 5 V or 0/2 to 10 V	> 500 kΩ

Digital input

Type: Contact free of voltage.

Max. contact resistance: 100 Ohm.

Contact rating: 10 V, 6 mA.

Outputs

Out 1

Available: Optional.

Output action: Direct/reverse programmable.

Function: Retransmission.

Output type: 0-20 mA, 4-20 mA, 0-10 V or 2-10V programmable.

Isolation: Isolated output.

Out 2

Function: Limiter output.

Available: Always.

Output action: Reverse.

Output type: Relay.

Contact type: SPST (NO contact).

Contact rating: 2A / 250 V c.a. on resistive load.
1 A / 250 V with cosφ = 0.4.

Out 3

Function: Alarm output.

Available: Optional.

Output type: Relay.

Contact type: SPST (NO contact).

Contact rating: 2A / 250 V c.a. on resistive load.
1 A / 250 V with cosφ = 0.4.

Out 4, (when programmed)

Function: Auxiliary power supply for TX.

Available: Always.

Output type: SSR drive.

Isolation: Not isolated.

Protection: Output protected from short circuit.

Logic level 1: 12 V, 20 mA max..

Logic level 0: <0.5 V.

Function: Auxiliary power supply for TX.

Note: This output is obtained by forcing the out 4 to ON.

Isolation: Not isolated.

Protection: Output protected from short circuit.

Voltage: 12 VDC.

Current: 23 mA max..

Serial interfaces

Type: TTL.

Available: Always.

Isolation: Not isolated.

Protocol: Modbus RTU.

Baud rate: From 1200 to 38400 baud.

Multiple reading: Max. 16 word.

Multiple writing: Max. 16 word.

Parity: None.

Data format: 8 bit.

Start Bit: 1.

Stop Bit: 1.

Type: RS 485 optional.

Available: On request.

Isolation: Isolated (50 V).

Protocol: Modbus RTU.

Baud rate: From 1200 to 38400 baud.

Multiple reading: Max. 16 word.

Multiple writing: Max. 16 word.

Parity: None.

Data format: 8 bit.

Start Bit: 1.

Stop Bit: 1.

关于产品有害物质限制使用管理

Control of Concentration Limits for Certain Restricted Substances by the Product


根据中华人民共和国电器电子产品有害物质限制使用管理办法对本产品进行了说明。

This is an explanation for the product based on “Requirements of concentration limits for certain restricted substances in electrical and electronic products” in the People’s Republic of China.

产品中有害物质的名称及含有信息表

部件名称	有害物质									
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(Cr6+)	多溴联苯(PBB)	多溴二苯醚(PBDB)	邻苯二甲酸二正丁酯(DBP)	邻苯二甲酸二异丁酯(DIBP)	邻苯二甲酸丁基苄酯(BBP)	邻苯二甲酸二(2-乙基)己酯(DEHP)
框架（塑料）	×	×	×	○	○	○	○	○	○	○
框架（金属）	×	×	×	○	○	○	○	○	○	○
内部接线材料	×	×	×	○	○	○	○	○	○	○
电源	×	×	×	○	○	○	○	○	○	○
注1：○：表示该有害物质在该部件所有均质材料中的含量均不超出电器电子产品有害物质限制使用国家标准要求。 ×：表示该有害物质至少在该部件的某一均质材料中含量超出电器电子产品有害物质限制使用国家标准要求。 注2：以上未列出的部件，表明其有害物质含量均不超出电器电子产品有害物质限制使用国家标准要求。										

环保使用期限

 该标识适用于SJ /T11364 中所述，在中华人民共和国销售的电器电子产品的环保使用期限。
注释) 该年数为“环保使用期限”，并非产品的质量保证期。零件更换的推荐周期，请参照使用说明书。

本产品的部分部件包含RoHS 指令中的限用物质，但是其使用方法不受该指令限制。

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



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.