

LIMIT CONTROLLER
MODEL: TC10-L QUICK GUIDE · IM 05C01E81-11EN
3rd EDITION – FEBRUARY 2020



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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/

The Authorised Representative for this product in the EEA is: **Yokogawa Europe BV** (Address: Euroweg 2, 3825 HD Amersfoort, The Netherlands) is the Authorised Representative of Yokogawa Electric Corporation for this Product in the EEA.

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.

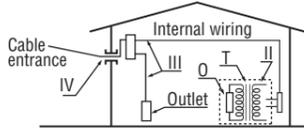
AC
AC/DC
 The equipment wholly protected by double insulation or reinforced insulation.

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	0 (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

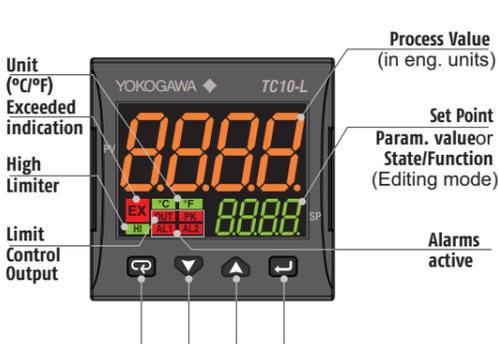
WARNING
 - Wiring work must be carried out by a person with basic electrical knowledge and practical experience.
 - Be sure to turn OFF the power supply to the controller before wiring to avoid an electric shock. Use a tester or similar device to ensure that no power is being supplied to a cable to be 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.
 - Recommended tightening torque: 0.5 Nm.

MODEL AND SUFFIX CODES

MODEL CODE	SUFFIX CODES	DESCRIPTION
TC10	L H C □ R □ D □ F/GK	TEMPERATURE CONTROLLER
Fixed code	L	Always "L"
Power supply	H	100 to 240 VAC
Fixed code	C	Always "C"
Retransmission	N	None
	A	Measured value retransmission out 4 to 20 mA
Limit control output	R	Limit control relay output
Alarm output 1,2	N	None
	R	Alarm output: 2 points (OP3 relay + OP4 SSR)
Fix code	D	Always "D"
Serial communication	N	None
	S	RS485 Modbus
Fixed code	F	Always "F"
Option Code	/GK	Panel gasket for IP65

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 then you can use the instrument.
 This document follows this structure.

DISPLAY AND KEYS

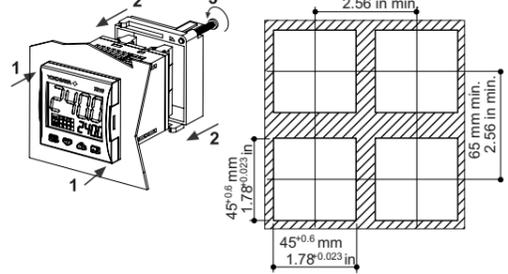


Operator Mode	Editing Mode
Access to: - Operator visualizations (PV, max or min, time) - Editing Parameters - Editing Configuration	Confirm and go to Next parameter
	Increase the displayed value or select the next element of the list
	Decrease the displayed value or select the previous element
Confirming operation (Pressed when OUT LED lit and EX LED is OFF.)	Exit from Operator commands/Parameter setting/Configuration

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.)

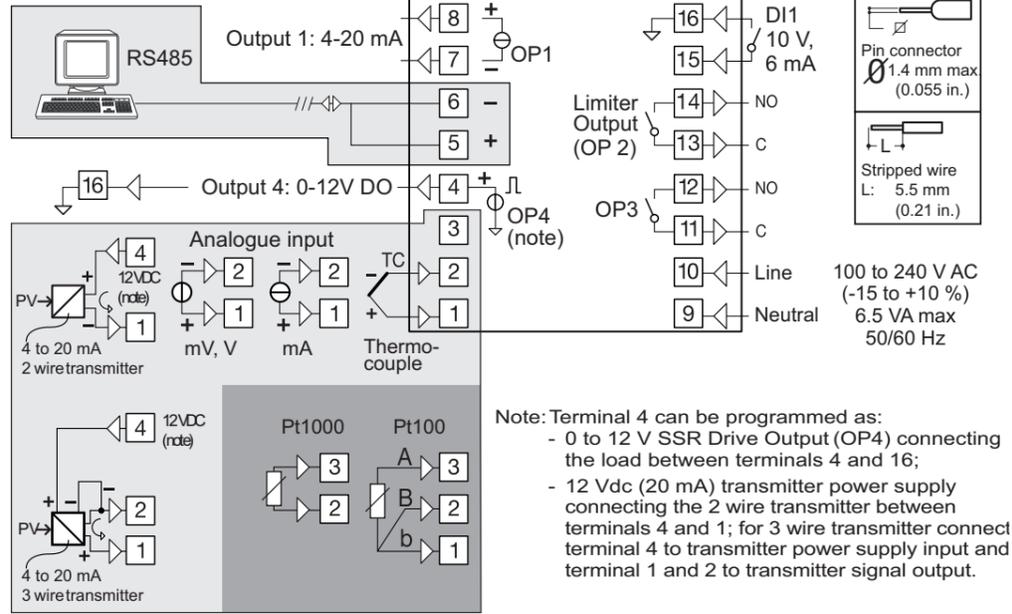
MOUNTING



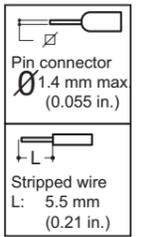
Mounting requirements
 This instrument is intended for permanent installation, for indoor use only, in an electrical panel which encloses the rear housing, exposed terminals and wiring on the back. Select a mounting location having the following characteristics:
 1. It should be easily accessible;
 2. 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 90%);
 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. **WARNING** This is mandatory for FM approval

ELECTRICAL CONNECTIONS

Relay output 2,3: 2A, 250 V AC, resistive load
 Linear output : 0/20 mA, 0/10 V



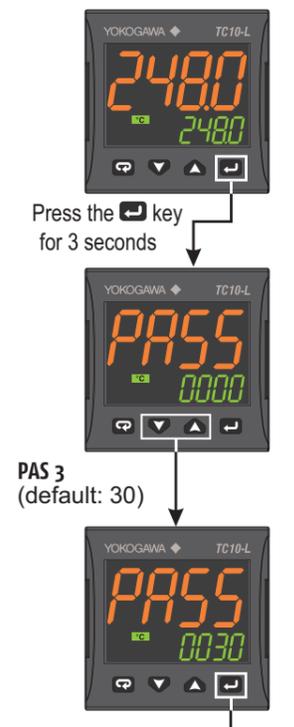
TERMINALS



Line 100 to 240 V AC (-15 to +10 %)
 Neutral 6.5 VA max 50/60 Hz

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



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	
Go to the groups	
Go to the next group	

To exit the config. parameter setting procedure press the key for more than 6 seconds

INP GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DEC. POINT
1	SEnS	Measuring input	J = TC J crAL = TC K, S = TC S, r = TC R t = TC T, n = TC N Pt1 = PT 100, Pt10 = PT 1000, 0.60 = 0 to 60 mV, 12.60 = 12 to 60 mV, 0.20 = 0 to 20 mA, 4.20 = 4 to 20 mA, 0.5 = 0 to 5 V, 1.5 = 1 to 5 V, 0.10 = 0 to 10 V, 2.10 = 2 to 10 V,	dP
2	dP	Decimal point figure Note: For TC and RTD inputs the decimal figure must be 0 or 1 only.	0 to 3	dP
3	Ssc	Initial scale readout NOTE: This parameter will be shown only when a linear input has been selected (mV, V or mA).	-1999 to 9999	dP
4	Fsc	Full scale readout NOTE: This parameter will be shown only when a linear input has been selected (mV, V or mA).	-1999 to 9999 (E.U.)	dP
5	unit	Engineering unit NOTE: This parameter will be shown only when a TC or RTD input has been selected.	°C or °F	
6	Fil	Digital filter on the measured value. Note: This filter will affect the measured value but also the control action the analogue retransmission and the alarms behaviour.	0 (off) to 20.0 (s)	1
7	bS	PV input bias	-100 to 100 % of the input span	dP
8	di.A	Digital Input action	0 = Dh direct 1 = Dh reverse	

OUT GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
9	o1.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	o1F	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	Ao1L	Retransmission – initial scale value	-1999 to Ao1H	dP
12	Ao1H	Retransmission – full scale value	Ao1L to 9999	dP
13	o3F	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	o3AL	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	o3Ac	Out 3 action	dir = Direct action rEU = Reverse action	
16	o4F	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	o4AL	Alarms linked up with Out 4	from 0 to 7 +1 = Alarm 1 +2 = Alarm 2 +4 = Burn-out	0
18	o4Ac	Out 4 action	dir = Direct action rEU = Reverse action	

AL1 GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
19	ALt	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	ALtL	- For High and low alarms, it is the low limit of the AL1 threshold - For band alarm, it is low alarm threshold	-1999 to ALtH (E.U.)	dP
22	ALtH	- For High and low alarms, it is the high limit of the AL1 threshold - For band alarm, it is the high alarm threshold	ALtL to 9999 (E.U.)	dP
23	AL1	Alarm 1 threshold	ALtL to ALtH (E.U.)	dP
24	HAL1	Alarm 1 hysteresis	1 to .9999 (E.U.)	dP
25	ALtd	Alarm 1 delay	0 (OFF) to 9999 (s)	0

AL2 GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
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.	

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
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, it is the low limit of the AL2 threshold - For band alarm, it is low alarm threshold	-1999 to AL2H (E.U.)	dP
29	AL2H	- For High and low alarms, it is the high limit of the AL2 threshold - For band alarm, it is the high alarm 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

REG GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
33	Hi.Lo	Limit control type	Hi = High limit. Lo = Low limit.	
34	r.md	Restart mode	0 = On > limit output is ON in any case (the instrument start in shutdown condition) 1 = OFF > limit output is OFF when, at power on, PV doesn't exceed SP.	
35	HyS	Hysteresis of the control output	From 0 to 100% of the input span	dP
36	oP.SL	Operative display selection	0 = PU.SP > PV and SP / SP only (lower display) 1 = SP > SP only (lower display)	
37	SPLL	Minimum set point value	-1999 to SPHL (E.U.)	dP
38	SPHL	Maximum set point value	SPLL to 9999 (E.U.)	dP
39	SP	Set point	SPLL to SPHL	dP
40	dis	The way to confirming operation	but = by keyboard (button) di = by digital input	
41	tim	Duration time when in exceeded (in shutdown)	00.00 to 99.59 (HH.mm)	0
42	Hi	Maximum measured value	In Engineering Units	dP
43	Lo	Minimum measured value	In Engineering Units	dP

PAN GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
44	PAS2	Password level 2	0 (OFF) to 200	0
45	PAS3	Password level 3	3 to 200	0
46	di.CL	Display color	0 = Bargraph (the display color is used to show the Exceeded condition). 1 = fixed red display 2 = fixed green display 3 = fixed amber display	0
47	dis.t	Display time-out	0 (OFF) to 99.59 (mm.ss)	2

SER GROUP

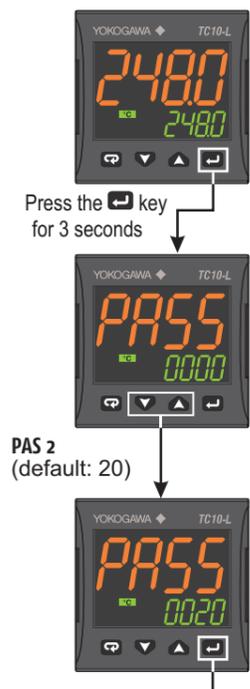
N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
48	Add	Address	0 (OFF) to 254	0
49	bAud	Baud rate	1200 2400 9600 19.2 38.4	

CAL GROUP

N	PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DECIMAL FIGURE
50	A.L.P	Adjust low Point	-1999 to AH.P-10 (E.U.)	dP
51	A.L.o	Adjust low Offset	-300 to 300 (E.U.)	dP
52	A.H.P	Adjust High Point	A.L.P +10 to 9999 (E.U.)	dP
53	A.H.o	Adjust High Offset	-300 to 300 (E.U.)	dP

OPERATOR PARAMETERS

PARAMETERS SETTING

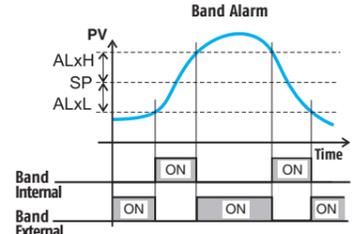
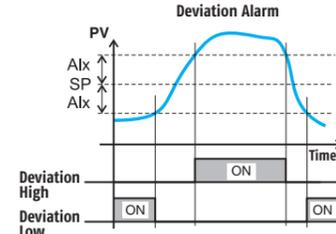
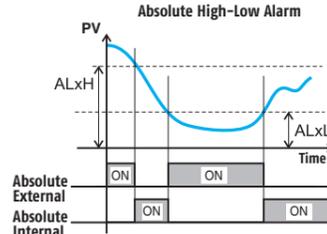
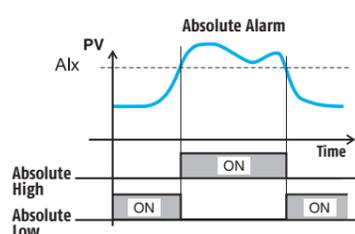


Parameters setting	
	Confirm and go to Next parameter
	Increase the displayed value or select the next element
	Decrease the displayed value or select the previous element

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

PARAM.	DESCRIPTION	RANGE VALUE OR SELECTION LIST ELEMENTS	DEC. POINT
SP	Set point (shutdown set point)	From SPLL to SPHL	dP
ALtL	- For high or low alarm, it is the low limit of AL1 threshold - For band alarm, it is low alarm threshold	From -1999 to ALtH E.U.	dP
ALtH	- For high or low alarm, it is the high limit of AL1 threshold - For band alarm, it is high alarm threshold	From ALtL to 9999	dP
AL1	Alarm 1 threshold	From ALtL to ALtH	dP
AL2L	- For high or low alarm, it is the low limit of AL2 threshold - For band alarm, it is low alarm threshold	From -1999 to AL2H E.U.	dP
AL2H	- For high or low alarm, it is the high limit of AL2 threshold - For band alarm, it is high alarm 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	

ALARM TYPES



Navigation, access levels and keyboard management

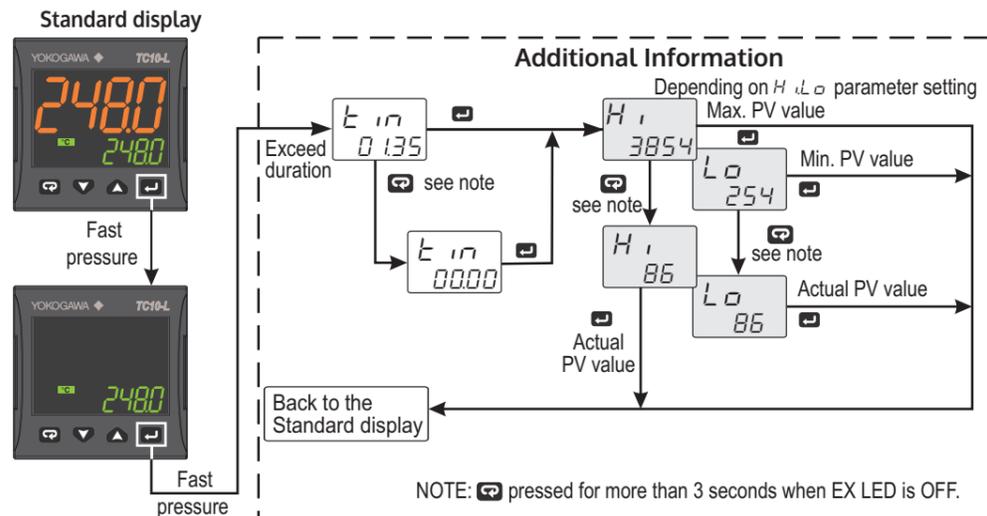
The TC10-L is equipped with 3 different levels:

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

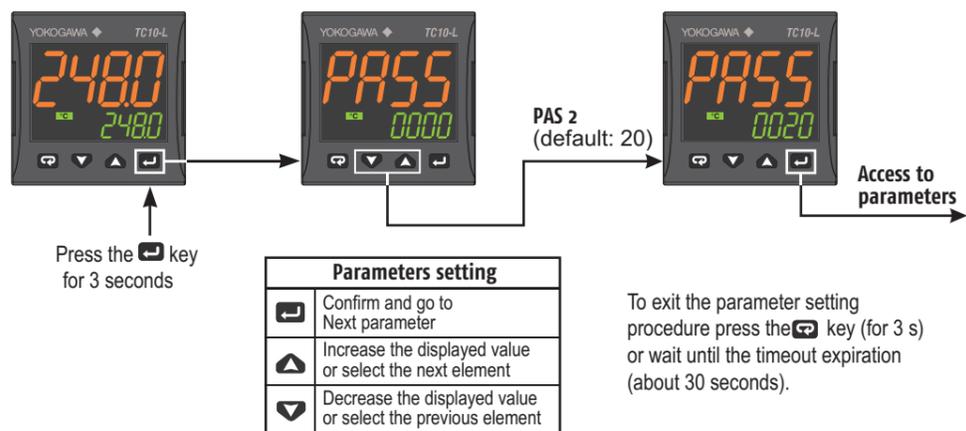


Level 2

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

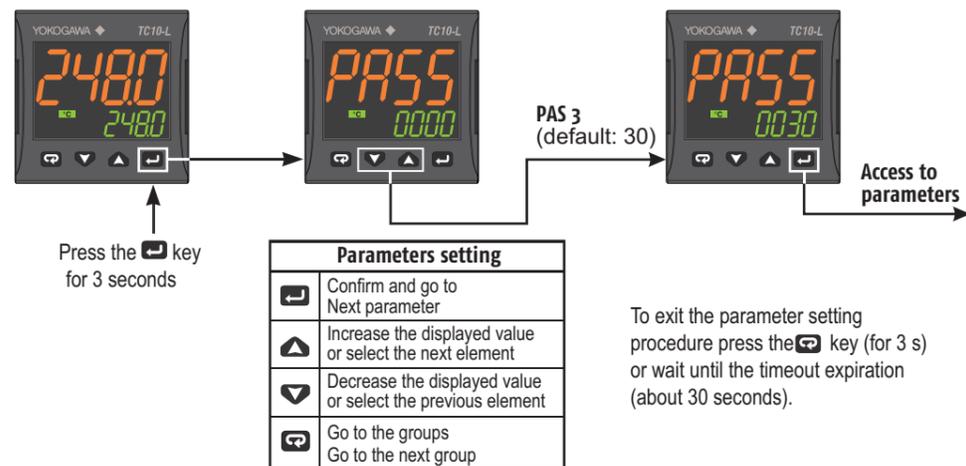


For the full list see "parameter setting".

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 101300 °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 60751A2.
	-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 Ω

Contact rating: 10 V, 6 mA.

Outputs

Out 1

Available: Optionally

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: Ever

Output action: Reverse

Output type: relay

Contact type: SPST (NO contact)

Contact rating: 2 A / 250 V c.a. on resistive load.

1 A / 250 V with cosφ = 0.4

Out 3

Function: Alarm output

Available: optionally

Output type : relay

Contact type: SPST (No contact)

Contact rating: 2 A / 250 V c.a. on resistive load.

1 A / 250 V with cosφ = 0.4

Out 4 (when programmed)

Function: alarm output

Available: ever

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

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: ever

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 optionally

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标准所规定的限量要求。

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，从产品生产之日起至该标志所示年限内，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体产生重大影响。

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。



DISPOSAL

The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.