

SINGLE LOOP MCU BASED DIRECT DIGITAL CONTROLLERS

REX-C10 SERIES

INSTRUCTION MANUAL

IM10C05-E1

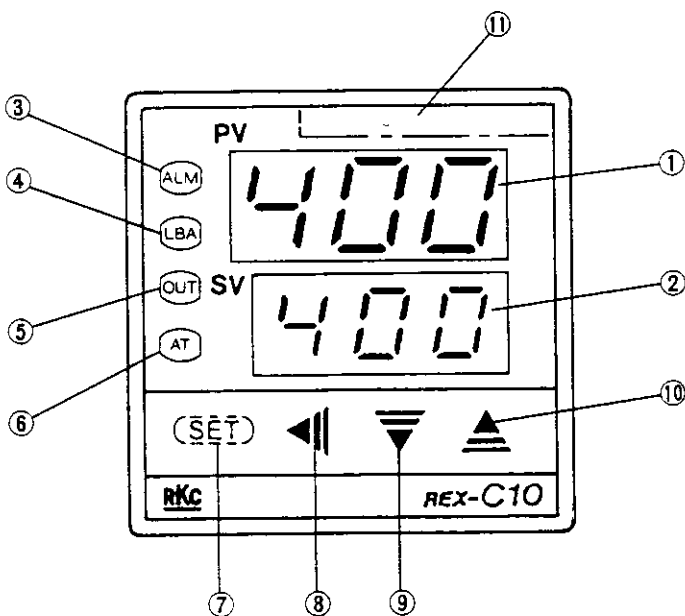
Notes:

Make sure that this Instruction Manual is always readily available to personnel who use the REX-C10 series. The contents of the Instruction Manual are subject to change without notice. If you have any questions regarding the manual, contact one of our sales people, our nearest sales office, or the place where you have purchased this controller.

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1. NAME OF PARTS



- ① Measured-value (PV) display unit (Green)
- ② Set-value (SV) display unit (Orange)
- ③ Alarm (ALM) lamp (Red)
- ④ Control loop break alarm (LBA) action lamp (Red)
- ⑤ Control output (OUT) lamp (Green)
- ⑥ Auto-tuning (AT) lamp (Green)
- ⑦ Set (SET) key
- ⑧ Setting digit shift key
- ⑨ Set-value decrement key
- ⑩ Set-value increment key
- ⑪ Input range display

2. OPERATION

2.1 Description of each parameter

The measured-value (PV) display unit displays a measured-value with the power turned ON, and the set-value(SV) display unit displays the set-value (SV). Every time the (SET) key is pressed, modes and parameters change as shown in the following table. (When the last parameter is displayed, it returns to the first parameter.)

At this time, the measured-value (PV) display unit shows each parameter symbol and the set-value (SV) display unit shows the relevant parameter set-value.

● PV/SV display and SV setting modes

Measured-value (PV) display unit	Set-value (SV) display unit	Description	Initial value prior to shipment
Measured-value	Set-value (SV)	Displays measured-value. Set-value (SV) can be set. *1	0 or 0.0°C(°F)

Pressing the (SET) key continuously for 5 sec.

*1 : Set-value (SV) is a control target. It is settable within the input range.

● Parameter setting mode

(If no key operation is performed for 1 minute, the controller is set to the PV/SV display mode automatically.)

Measured-value (PV) display unit	Symbol	Name	Description	Setting Range	Initial value prior to shipment
*2 AL	AL	Alarm	Sets alarm set-value.	-199 to +999°C(°F) or -19.9 to +99.9°C(°F)	50 or 50.0°C(°F)
*3 LbA	LbA	Control loop break alarm	Sets control loop break alarm set-value.	0.1 to 99.9min (Setting below "0.1" cannot be made.)	8.0 min
*3 Lbd	Lbd	LBA dead band	Sets the area of not outputting LBA.	0 to 999°C(°F) (For input display resolution of 1°C(°F).) 0 to 200°C(°F) (For input display resolution of 0.1°C(°F).)	0°C(°F)
ATU	ATU	Auto-tuning	Turns the auto-tuning function ON/OFF.	0: Auto-tuning end or stop. 1: Auto-tuning start.	0
*4 P	P	Proportional band	Set when proportional control is performed.	1 to span°C(°F) or 0.1 to span°C(°F). Upper within 200°C(°F) or 99.9°C(°F). (ON/OFF action with P set to "0" or "0.0")	30 or 30.0°C(°F)
(SET) I	I	Integral time	Eliminates offset occurring in proportional control.	1 to 999 sec. (I action turns OFF with I set to "0".)	240 sec.
d	d	Derivative time	Prevents ripples by predicting output change thereby improving control stability.	1 to 999 sec. (D action turns OFF with D set to "0".)	60 sec.
Ar	Ar	Anti-reset windup	Prevents overshoot and/or undershoot caused by integral action effect.	1 to 100% of P band (I action turns OFF with this action set to "0".)	100%
f	T	Proportioning cycle	Sets control output cycle.	1 to 100 sec.	Relay contact output : 20 sec. Voltage pulse output : 2 sec.
LCK	LCK	Set data lock	Turns the set data lock ON/OFF.	100: No set data locked. 101: Set data locked. 110: Only the set-value (SV) is changeable with the set data locked.	100

*2 ● No display when alarm is not attached.

● Alarm hysteresis band : 2°C(°F) or 2.0 °C(°F)

*3 ● No display when control loop break alarm is not attached.

● LBA dead band hysteresis band : 0.8°C(°F)

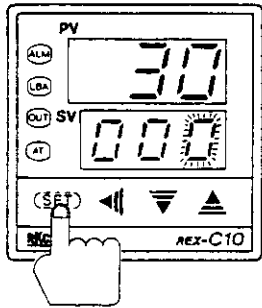
*4 ● Hysteresis band at ON/OFF action : 2°C(°F) or 2.0°C(°F) [±1°C(°F) or ±1.0°C(°F) from the set value (SV)]

2.2 Each parameter setting

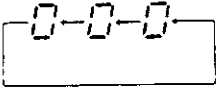
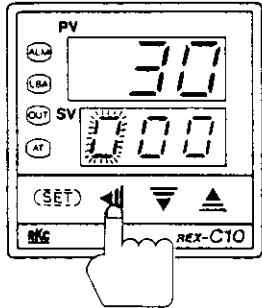
(1) Set-value (SV) setting procedure

Following is an example of setting the set-value (SV) to 200°C. (PV : 30°C)

① Press the (SET) key to enter the SV setting mode. The least significant digit on the set-value (SV) display unit lights brightly. The digit which lights brightly is settable.



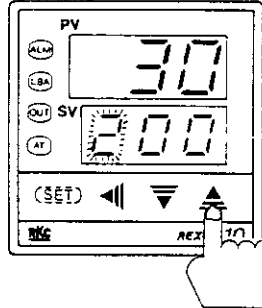
② Press the \leftarrow key to shift the digit which lights brightly up to the hundreds digit. The digit which lights brightly shifts as follows every time the \leftarrow key is pressed.

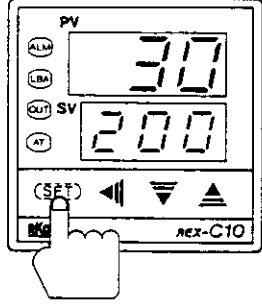
③ Press the \triangle key to set "2". Pressing the \triangle key increments numerals, and pressing the ∇ key decrements numerals.

- Setting range : Within input range
- When minus (-) sign is set.

Example :
When 200 is changed to -100, shift the digit lit brightly to the hundreds digit, then press the ∇ key to decrement figures in order of 1 → 0 → -1.



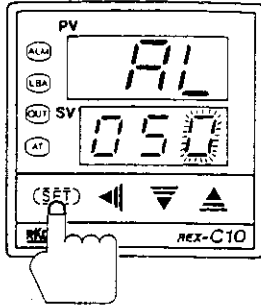
④ After finishing the setting, press the (SET) key. All of the set-value digits light brightly and as a result the controller returns to the PV/SV display mode.



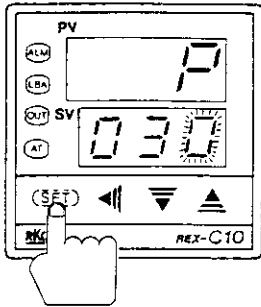
(2) Each parameter (other than SV) setting procedure

This parameter setting example shows that the proportional band (P) is set to 20°C.

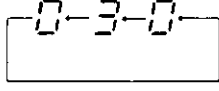
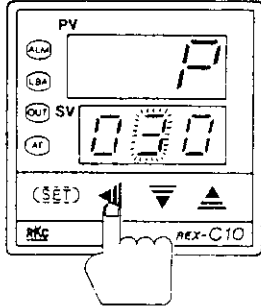
① Pressing the (SET) key continuously for 5 sec. set the controller to the parameter setting mode (other than SV). Thus, the parameter symbol is shown on the measured-value (PV) display unit. The least significant digit also lights brightly. The digit which lights brightly is settable.



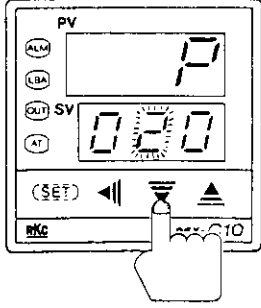
② Press the (SET) key to display the proportional band (P) parameter symbol (P) on the measured-value (PV) display unit.



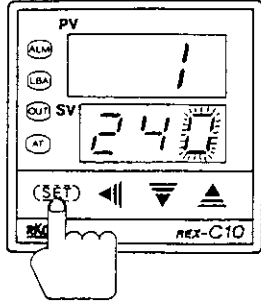
③ Press the \leftarrow key to shift the digit which lights brightly up to the tens digit. The digit which lights brightly shifts as follows every time the \leftarrow key is pressed.

④ Press the ∇ key to set "2". Pressing the \triangle key increments numerals, and pressing the ∇ key decrements numerals.



⑤ Pressing the (SET) key after the setting ends shifts to the next parameter. Repeat the procedures from ② to ⑤ to shifts each parameter in order.



Notes

1. If the setting ends, pressing the (SET) key continuously for 5 sec., again returns the controller to the PV/SV display mode. In addition, if no key operation is performed for 1 minute, the controller is set to the PV/SV display mode automatically.
2. If the SV setting mode is not activated (set-value (SV) is lit brightly even though the (SET) key is pressed) or each value is lit brightly, even though the status enters the parameter setting mode, make sure that the "LCK" (LCK) parameter set-value is "100", because the setting data may be locked. (For the set data locking, see "3. MAIN FUNCTIONS".)
3. This instrument does not allow set-value to be valid in the setting mode. A desired set-value is valid only after the (SET) key has been pressed and the status shifted to the next parameter or returned to the PV/SV display mode.
4. This controller can shift the digit up and down when each parameter is changed.
For example, if "199°C" is necessary to be changed to "200°C", first shift the digit which lights brightly to the least significant digit, then press the ▲ key to change "9" to "0", thereby obtaining 200°C.
This procedure also applies to shift the digit down.

2.3 Cautions for operation

- (1) If any problems arise due to hunting exists in the control system, do not use the auto-tuning function. In this case, set each value to match the controlled object.
- (2) Connect the measuring circuit, and then turn ON the power. If the circuit opens, the controller judges that input is disconnected to cause the upscale of measured-value display (For thermocouple input, downscale is also available as option.)
- (3) No influence is exerted upon the controller for power failure of 20msec. or less. For power failure of 20msec. or more, the controller performs the same operation as that at the time of power-ON after power recovery (This applies only when alarm action is turned OFF).

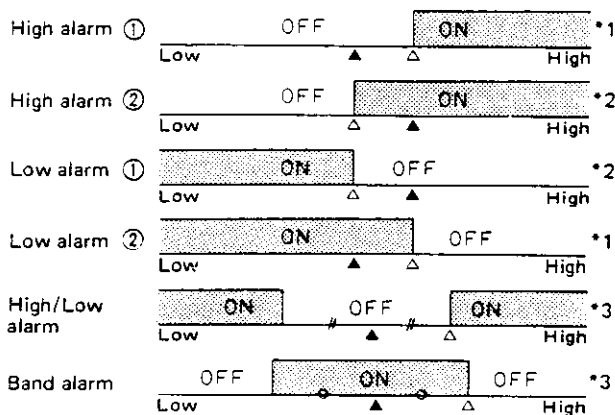
3. MAIN FUNCTIONS

3.1 Alarm (ALM) function

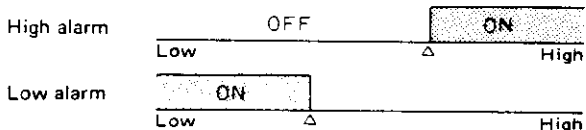
(1) The action for each alarm becomes as follows.

(▲ : Set-value (SV) △ : Alarm set-value)

● Deviation alarm



● Process alarm



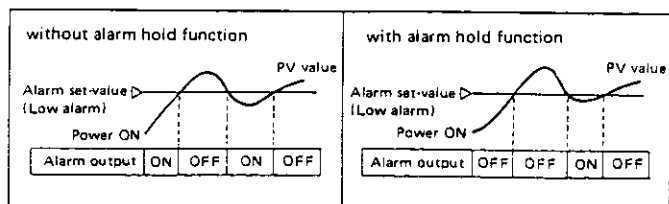
- *1 Alarm status where the alarm set-value is set to plus (+).
- *2 Alarm status where the alarm set-value is set to minus (-).
- *3 Status where alarm is activated at 2 equal deviation points from the set-value (SV) with the alarm set-value (absolute deviation) is set.

Note

When both the alarm (ALM) and control loop break alarm (LBA) are selected, the alarm output terminals (Nos. 2 and 3) are used in common with these alarms.

(2) Alarm hold function

With alarm hold function, the instrument ignores alarm conditions after power-ON, generating no alarm output when the input is in the alarm zone until the input has exited once from the alarm zone.



The alarm hold action is activated when not only the power is turned ON, but also the set-value (SV) is changed.

3.2 Control loop break alarm (LBA) function

(1) Setting procedure

Usually set the set-value of the LBA to a value twice the integral time (I).

The LBA can also be set by the auto-tuning (AT) function. In this case, the set-value is automatically set to a value twice the integral time (I).

(2) Description of operation

The LBA function starts time measurement from the time the controller PID computed value (output ON time/cycle) becomes 0% or 100%, and detects the amount of measured-value (PV) change at each LBA setting time to determine the amount of change, whether the LBA is to be ON or OFF.

- ① When the status at a 100% PID computed value continues beyond the LBA setting time, the LBA turns ON if the measured-value (PV) does not rise by 2°C(°F) or more.
(In direct action, the above alarm turns ON if the measured-value does not fall by 2°C(°F) or more.)
- ② When the status at 0% PID computed value continues beyond the LBA setting time, the LBA turns ON if the measured-value (PV) does not fall by 2°C(°F) or more.
(In direct action, the above alarm turns ON if the measured-value does not rise by 2°C(°F) or more.)

(3) Causes of activation

The LBA is activated under the following conditions.

- ① Controlled object trouble . . . Heater break, no power supply, incorrect wiring, etc.
- ② Sensor trouble . . . Sensor disconnected, shorted, etc.
- ③ Actuator trouble . . . Burnt relay contact, incorrect wiring, relay contact not closed, etc.
- ④ Output circuit trouble . . . Burnt internal relay contact, relay contact not open or closed, etc.
- ⑤ Input circuit trouble . . . The measured-value does not change even if input changes, etc.

* If causes of the above trouble cannot be identified, check the control system.

(4) Cautions for control loop break alarm (LBA) function

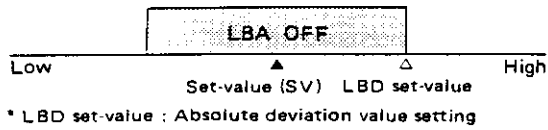
- ① The LBA function is activated only at the 0% or 100% PID computed value.
Therefore, the time from trouble occurrence till the activation of the LBA function equals the time until the PID computed value becomes 0% or 100% plus the LBA setting time.
- ② No LBA function is activated while the auto-tuning (AT) function is activated.
- ③ The LBA function is influenced by disturbances (heat sources, etc.) and as a result may be activated even if there is no trouble in the control system.

- ④ If LBA setting time is too short or does not match the controlled object, the above alarm may not be turned ON and OFF or not be turned ON. In such a case, set the setting time of LBA to be slightly longer.

(5) LBA dead band (LBD)

Even if the control system is not abnormal, LBA may be turned ON by the influence of disturbances (other heat sources, etc.), but an area where LBA is not turned ON can be made by setting LBD.

Therefore, if the input value is in the LBD area, LBA is not turned ON even if the requirements for LBA occurrence have been satisfied. From this, pay much attention to LBD setting.



3.3 Auto-tuning (AT) function

The auto-tuning function automatically measures, computes and sets the optimum PID and control loop break alarm (LBA) constants.

This function is activated after power-ON, during temperature rise and/or when control is stabilized from any process state.

- (1) After finishing settings other than PID and control loop break alarm (LBA), perform the auto-tuning operation.
- (2) Display the parameter symbol " *ATU* " (ATU) by pressing the (SET) key, then set the value to "1" in accordance with Item "2.2 Setting procedure". Thus, the auto-tuning (AT) lamp starts flashing to start the auto-tuning function.
- (3) If the auto-tuning function ends, the auto-tuning (AT) lamp stops flashing and the set-value of " *ATU* " (ATU) automatically returns to "0". When checking the auto-tuned values, press the (SET) key to check for the above values in order on the set-value (SV) display unit.
- (4) When changing the constants automatically set by the auto-tuning, change each constant in accordance with each parameter setting (See Item 2.2).
- (5) When the auto-tuning function is suspended, press the (SET) key to display the parameter symbol " *ATU* " (ATU) then set the value to "0" in accordance with Item "2.2 Setting procedure". The auto-tuning (AT) lamp then stops flashing to release the auto-tuning function. In this case, the values are not changed to those of P.I.D. and control loop break alarm (LBA). (The values just before auto-tuning start are maintained.)
- (6) When the set-value (SV) is changed during progress in the auto-tuning function, suspend the auto-tuning to perform PID control using the values before auto-tuning start.

3.4 Set data locking function

The set data locking function is used to prevent the changing of each set-value by the front key and the activation of the auto-tuning function, i.e., prevent misoperation after setting has ended.

For set data locking, display " *LCK* " (LCK) by pressing the (SET) key, then set the following value in accordance with Item "2.2 Setting procedure", thereby enabling data lock ON or OFF.

- 100 : No set data locked.
- 101 : All set data locked.
- 110 : Only set-value (SV) can be changed with the set data locked.

Cautions

1. Do not change the most significant digit "1" of the set-value, as it may cause a malfunction.
2. Checking each setting is possible during data lock.

3.5 Overscale and underscale

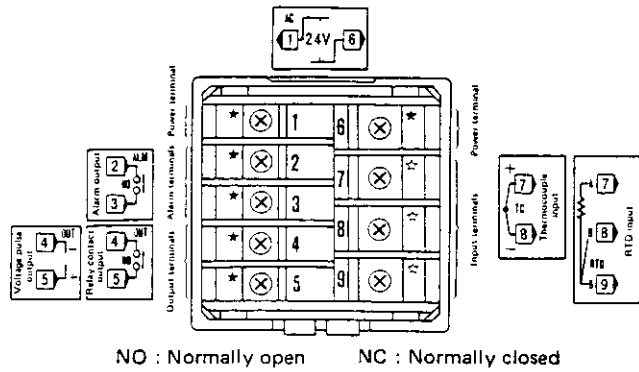
- ① If a measured-value exceeds the high setting range limit due to upscale, etc., measured-value display starts flashing. Further, if it exceeds the high input display range limit, the measured-value (PV) display unit flashes overscale display " *ooo* ".
- ② If a measured-value falls below the low setting range limit due to downscale, etc., measured-value display starts flashing. Further, if it falls below the low input display range limit, the measured-value (PV) display unit flashes underscale display " *ooo* ".

INPUT	TYPE	INPUT DISPLAY RANGE
TC	K	-30 to +999°C, -30 to +999°F
	J	
	E	
	N	
	L	-30 to +900°C, -30 to +999°F
	T	-199 to +400°C, -199 to +752°F -19.9 to +99.9°C, -19.9 to +99.9°F
RTD	U	-199 to +600°C, -199 to +999°F -19.9 to +99.9°C, -19.9 to +99.9°F
	Pt100(JIS/IEC)	-199 to +649°C, -19.9 to +99.9°C
	JPt100(JIS)	
	Pt100 *1	
JPt100 *2		
		-199 to +999°F, -19.9 to +99.9°F

*1 . . . Conforming to JIS/IEC
 *2 . . . Conforming to JIS
 IEC (International Electrotechnical Commission) is equivalent to JIS, DIN and ANSI.

4. WIRING

4.1 Rear Terminals



Notes

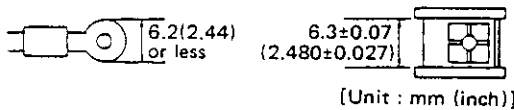
1. The blind patches are inserted to unused terminals.
2. For thermocouple input, no metal piece is attached to terminal No. 9. Instead, the temperature compensation element in the internal assembly is projected through a hole at terminal No. 9. Do not damage the above temperature compensation element when the internal assembly is removed from the case.

Solderless terminal

Therefore, use the lug suitable for a screw of M3.

- (1) Terminals Nos. 1 to 6

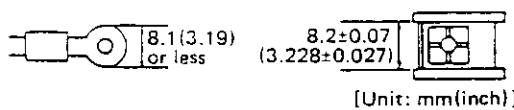
(Power terminals, Alarm terminals and Output terminals) - * -



Note

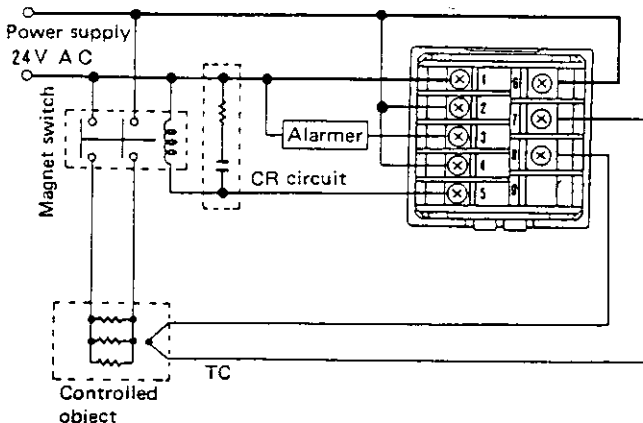
Power terminal (No. 1 and No. 6) dimensions differ, but use the same solderless terminals of 6.2mm or less for these terminals.

- (2) Terminals Nos. 7 to 9 (Input terminals) - * -



4.2 Wiring example

REX-C10FSC-M*□□□



4.3 Cautions for wiring

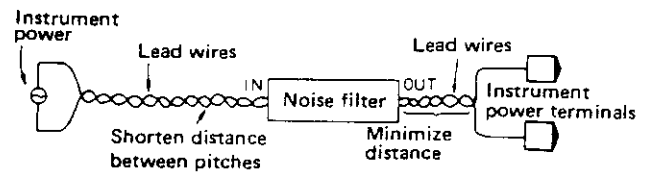
- (1) Conduct input signal wiring away from instrument, electric equipment power and load lines as such as possible to avoid noise induction.

- (2) Conduct instrument power wiring so as not to be influenced by noise from the electric equipment power.

If it is assumed that a noise generation source is located near the controller and the controller is influenced by noise, use a noise filter (select the filter by checking instrument power supply voltage.)

- Sufficient effect may not be obtained depending on the filter. Therefore, select the filter by referring to its frequency characteristic, etc.

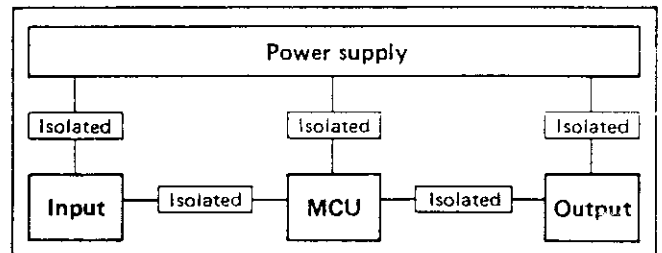
- ① For instrument power wiring, if it is assumed that noise exerts a bad influence upon the controller, shorten the distance between twisted power supply wire pitches. (The shorter the distance between the pitches, the more effective for noise reduction.)
- ② Install the noise filter on the panel which is always grounded and minimize the wiring distance between the noise filter output side and the controller power terminals. Otherwise, the longer the distance between output side and instrument power terminals, the less effective for noise.
- ③ Do not install fuses and/or switches on the filter output signal since this may lessen filter effect.



- (3) For wiring, use wires conforming to the domestic standard of each country.

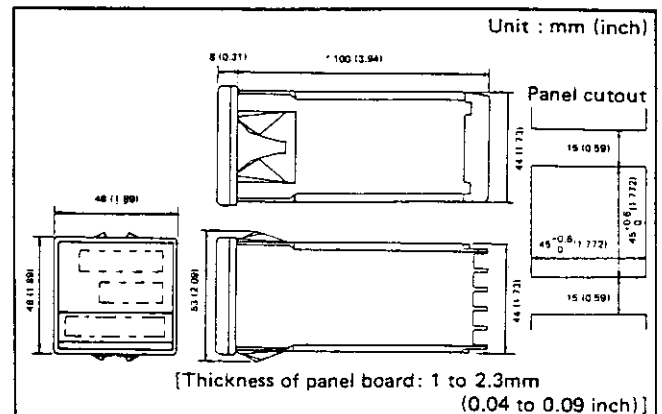
- (4) About 1 to 2 sec. are required as the preparation time of contact output during power-ON. Use a delay relay when the output line, is used for an external interlock circuit.

- (5) The figures below show the REX-C10 circuit configuration. When connecting wires, note that the power, input, MCU and output circuits are isolated independently, while the inside of the input and output circuits are not isolated.



REX-C10 circuit configuration

5. DIMENSIONS



* Dimensions in inches are shown for reference.

