Multifunction LCD Digital Counter
TC-Pro481 Series

User's Manual

Ver:3.0

Multifunction LCD Digital Counter

TC-Pro481×××

■ Highly visible display with backlit negative transmissive LCD
■ Visual alert when output status changes
■ PNP/NPN switchable DC-voltage input
■ Finger-safe terminals(screw terminal block models)
■ Three-language instruction manual
■ Applied to connect PC/HMI

Contents

Model Number Structure

■ List of Models

Output type	Supply voltage	Model	
		Standard	Communication
Contact output	100~240 VAC	TC-Pro481SRA (-D)	TC-Pro481CRA (-D)
	24 VDC/24 VAC	TC-Pro481SRD (-D)	TC-Pro481CRD (-D)
Transistor output	100~240 VAC	TC-Pro481STA (-D)	TC-Pro481CTA (-D)
	24 VDC/24 VAC	TC-Pro481STD (-D)	TC-Pro481CTD (-D)

Note: The model with communication must be used with cable.

■ Model Number Legend

$$\text{TC-Pro 481} \underset{1}{\square} \underset{2}{\square} \underset{3}{\square} - \underset{4}{\square}$$

1. **Communication**
   S: Standard (no communication)
   C: Communication

2. **Output type**
   R: Contact
   T: Transistor

3. **Supply voltage**
   A: 100V~240VAC
   D: 24VDC、24VAC

4. **Mounting method**
   None: Flush mounting
   D: DIN track mounting

■ Accessories (Order Separately)

Name	Models
9-pin Female D-sub cable for RS-232 connector, 1.5m Cable	CAB-090A232
9-pin Female D-sub cable for RS-485 connector, 1.5m Cable	CAB-090A485
9-pin Female D-sub cable for RS-422 connector, 1.5m Cable	CAB-090A422
9-pin male D-sub adapter for CAB-090A232/CAB-090A485/CAB-090A422	ADP-090401
9-pin Female D-sub cable for RS-232 connector, 1.5m Cable	CAB-090B232
9-pin Female D-sub cable for RS-485 connector, 1.5m Cable	CAB-090B485
9-pin Female D-sub cable for RS-422 connector, 1.5m Cable	CAB-090B422
Mounting Track	0F-A
Panel Protective Cover	SVF-A
Communication Protective Cover	TTL-11

Note：CAB-090A232/485/422 is used for Flush mounting products
　　　CAB-090B232/485/422 is used for DIN track mounting products

Specifications

■ Ratings

Item	TC-Pro481□□□-□
Classification	Digital counter
Supported configurations	1-stage counter, 2-stage counter, total counter, batch counter, dual counter, and tachometer (selectable)
Rated supply voltage	100~240VAC (50/60Hz), 24VAC (50/60Hz),24VDC (permissible ripple:20% (p-p) max.)
Operating voltage range	85% to 110% rated supply voltage (24VDC; 90% to 110%)
Power consumption	Approx. 6.2VA at 264VAC, Approx. 5.1VA at 26.4VAC, Approx. 2.4W at 24VDC
Mounting method	Flush mounting, DIN track mounting
External connections	Screw terminals
Terminal screw tightening torque	0.5 N•m Max.
Display	7-segment, LCD display Present value: 9-mm-high characters, white Set value: 4-mm-high characters, white
Digits	6 digits, PV/SV (-99,999~999,999)
Input signals	CP1, CP2, Reset 1, Reset 2
Max. counter speed	30Hz or 5KHz (10KHz for tachometer) selectable, ON/OFF ratio 1:1, common setting for CP1 and CP2
Input mode	Increment, decrement, command, individual, and quadrature
Input method	※ No-voltage input/voltage input (switchable) ◆ No-voltage input ON impedance: 1kΩ max. (leakage current: 5~20 mA at 0Ω) ON residual voltage: 3V max. OFF impedance: 100kΩ min. ◆ Voltage Input High (logic) level: 4.5 to 30 VDC Low (logic) level: 0 to 2 VDC (Input resistance: approx. 4.7 kΩ)
Reset input	Minimum reset input signal width: 1 or 20ms(selectable), common setting for all inputs
Reset system	External, manual, and automatic reset (internal according to C,R,P, and Q mode operation)
Output modes	N,F,C,R,K-1,P,Q,A,K-2,D,L,H
One-shot output time	0000.01~9999.99s
Output method	Relay/transistor output
Control output	SPDT contact output: 5A at 250 VAC, resistive load (cosΦ=1) Minimum applied load: 10 mA at 5 VDC (failure level: P, reference value) Transistor output: NPN open collector, max. 100mA at 30 VDC Residual voltage: 1.5 VDC max. (approx. 1V) Output category according to EN60947-5-1 for timers with Contact outputs (AC-15; 250V 3A / AC-13; 250V 5A / DC-13; 30V 0.5A) Output category according to EN60947-5-2 for timers with Transistor outputs (DC-13; 30V 100 mA) NEMA B300 Pilot Duty, 1/4 HP 5-A resistive load at 120 VAC, 1/3 HP 5-A resistive load at 240 VAC
External power supply	12VDC (15%), 80mA
Key protection	Yes
Prescaling function	Yes (000.001~999.999)
Decimal point adjustment	Yes (rightmost 3 digitals)
Sensor waiting time	Approx. 250 ms (control output is turned OFF and no input is accepted during sensor waiting time)
Memory backup	EEPROM (overwrites: 100,000 times min.) that can store data for 10 years min.
Ambient temperature	Operating: -10 to 55°C (with no icing or condensation) Storage: -25 to 65°C (with no icing or condensation)
Ambient humidity	25% to 85%
Case color	Flush mode: black, DIN track mode: gray-black
Attachments	Waterproof packing, flush mounting adapter

■ Characteristics

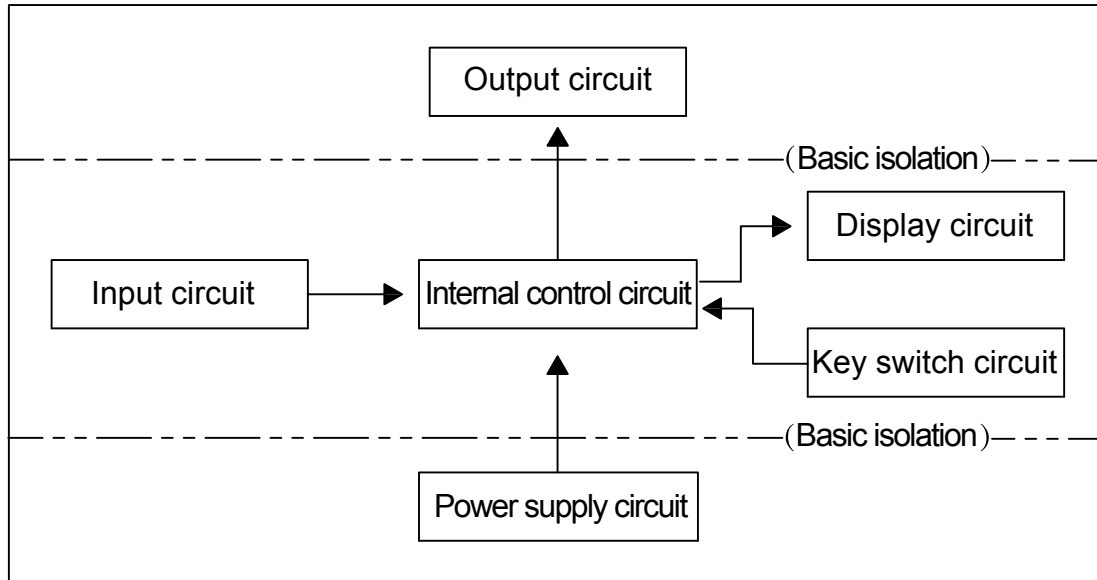| Item	TC-Pro481□□□-□	
Life expectancy	Mechanical: 10,000,000 operations min. Electrical: 100,000 operations min. (5 A at 250 VAC, resistance load)	
EMC	(EMI) Emission Enclosure: Emission AC mains: (EMS) Immunity ESD: Immunity RF-interference: Immunity Conducted Disturbance: Immunity Burst: Immunity Surge: Immunity voltage Dip/interruption:	EN61326 EN55011 EN55011 EN61326 EN61000-4-2 EN61000-4-3 EN61000-4-6 EN61000-4-4 EN61000-4-5 EN61000-4-11
Weight	Approx. 168g	

Nomenclature
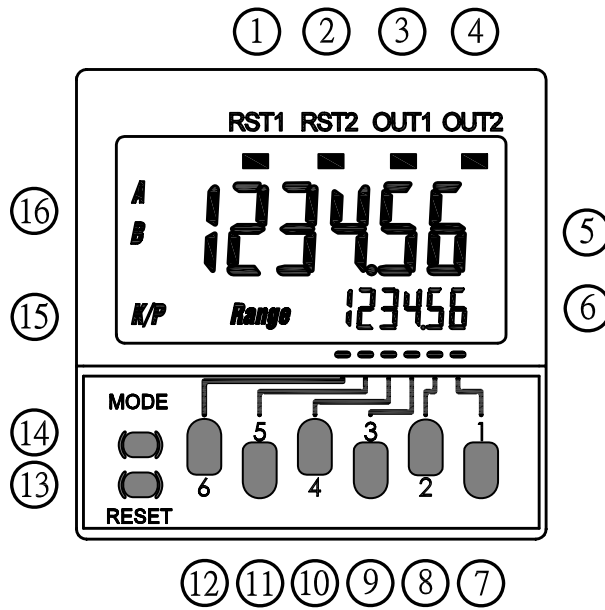
① ② Reset Indicator
③ ④ Control Output Indicator
⑤ Present Value (character height: 9 mm)
⑥ Set Value (character height: 4 mm)
⑦ The First Setting Key
⑧ The Second Setting Key
⑨ The Third Setting Key

⑩ The Fourth Setting Key
⑪ The Fifth Setting Key
⑫ The Sixth Setting Key
⑬ Reset Key (resets present value and output)
⑭ Mode Key (changes modes and setting items)
⑮ Key Protection Indicator (the preset value is OFF)
⑯ Set Value (Range) A, B Display

■ Reset Operation by Reset Key

Configuration	Reset operation
1-stage/2-stage counter	Resets the present value and outputs
Total counter	Resets the present value and outputs When the total count value is displayed, resets the present value, the total count value, and outputs.
Batch counter	Resets the present value and OUT1 When the batch count value is displayed, resets the present value, the batch count value, and outputs.
Dual counter	Resets the CP1 present value, CP2 present value, dual count value and outputs
tachometer	Maintains the measured value and outputs

■ Block Diagram

■ I/O Functions (Counter)

|		
Inputs	CP1, CP2	1. In general (except for dual counter mode) Reads counting signals Increment, decrement, command, individual, and quadrature inputs accepted. 2. When used as a dual counter Reads CP1 count signals with CP1 input and CP2 count signals with CP2 input. Increment signals can be input.
	Reset or Reset 1	1. In general (except for dual counter mode) Resets present value and outputs Counting can not be performed during reset/reset 1 input The reset indicator is lit during reset input. 2. When used as a dual counter Resets CP1 present value Counting for CP1 input can not be performed during reset 1 input. The reset indicator is lit during reset 1 input.
	Total Reset or Reset 2 (see note 2.)	1. When used as 1-stage/2-stage counter Does not operate (Not used). 2. When used as a total and present counter Resets the total count value Hold the total count value at 0 during total reset input 3. When used as a batch counter Reset the batch count value and batch output (OUT1) Holds the batch count value at 0 during total reset 2 input 4. When used as a dual counter Resets the CP2 present value Counting for CP2 input can not be performed during reset 2 input
Output	Control output (OUT)	Outputs take place according to designated output mode when corresponding preset is reached.

Note:
1. In increment mode or increment/decrement mode, the present value returns to 0, in decrement mode, the present value returns to the set value with 1-stage models, and returns to set value 2 with 2-stage models.
2. The reset indicator will not be lit when the total reset or reset 2 input is ON.

■ I/O Functions (Tachometer)

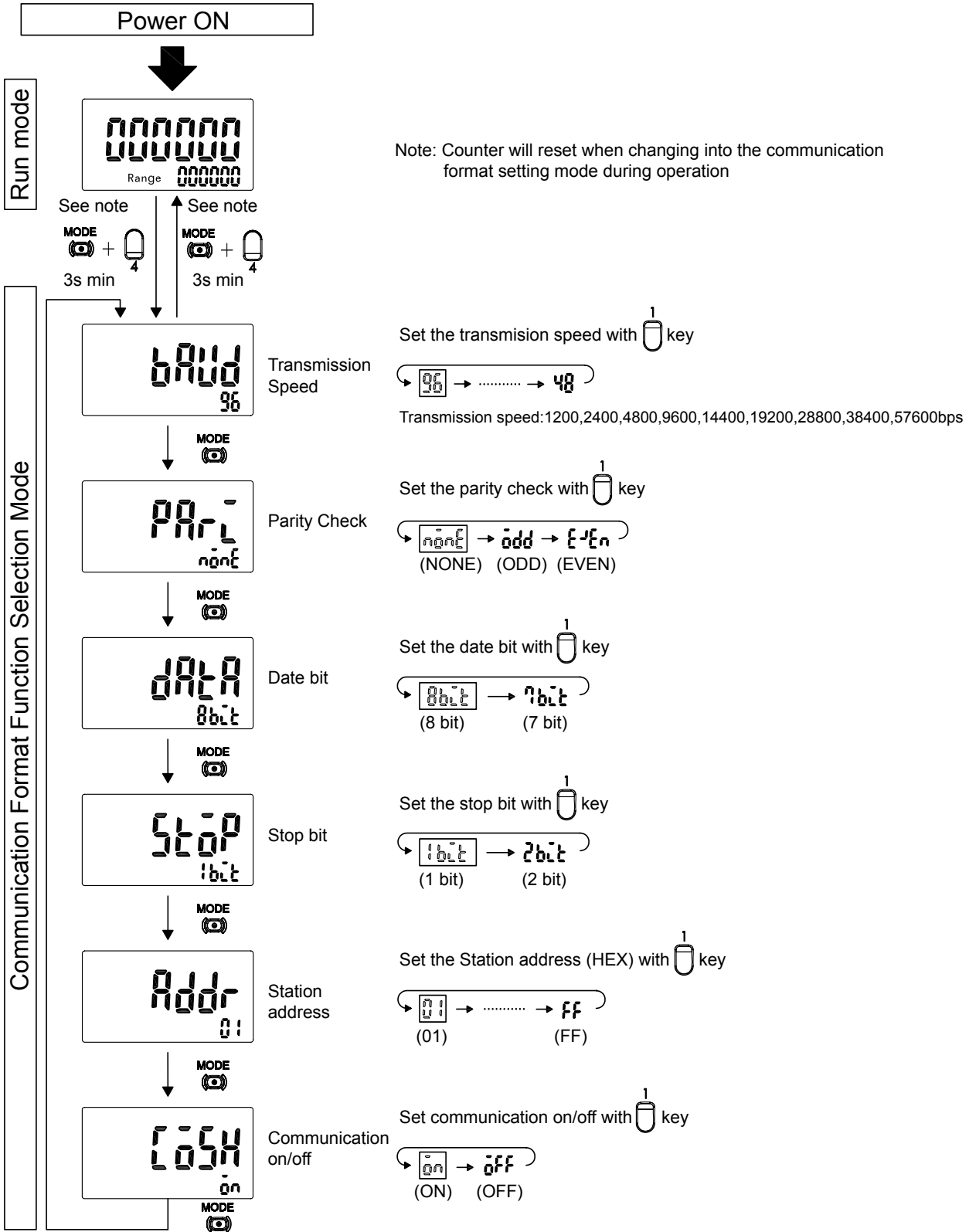| Inputs	CP1, CP2	Reads counting signals. (CP2 input is not used)
	RESET1, RESET2	Holds the measurement value and outputs. (CP2 input is not used) The reset indicator is lit during hold.
Outputs	OUT1, OUT2	Outputs signals according to the specified output mode when a set value is reached.

Operating Procedures

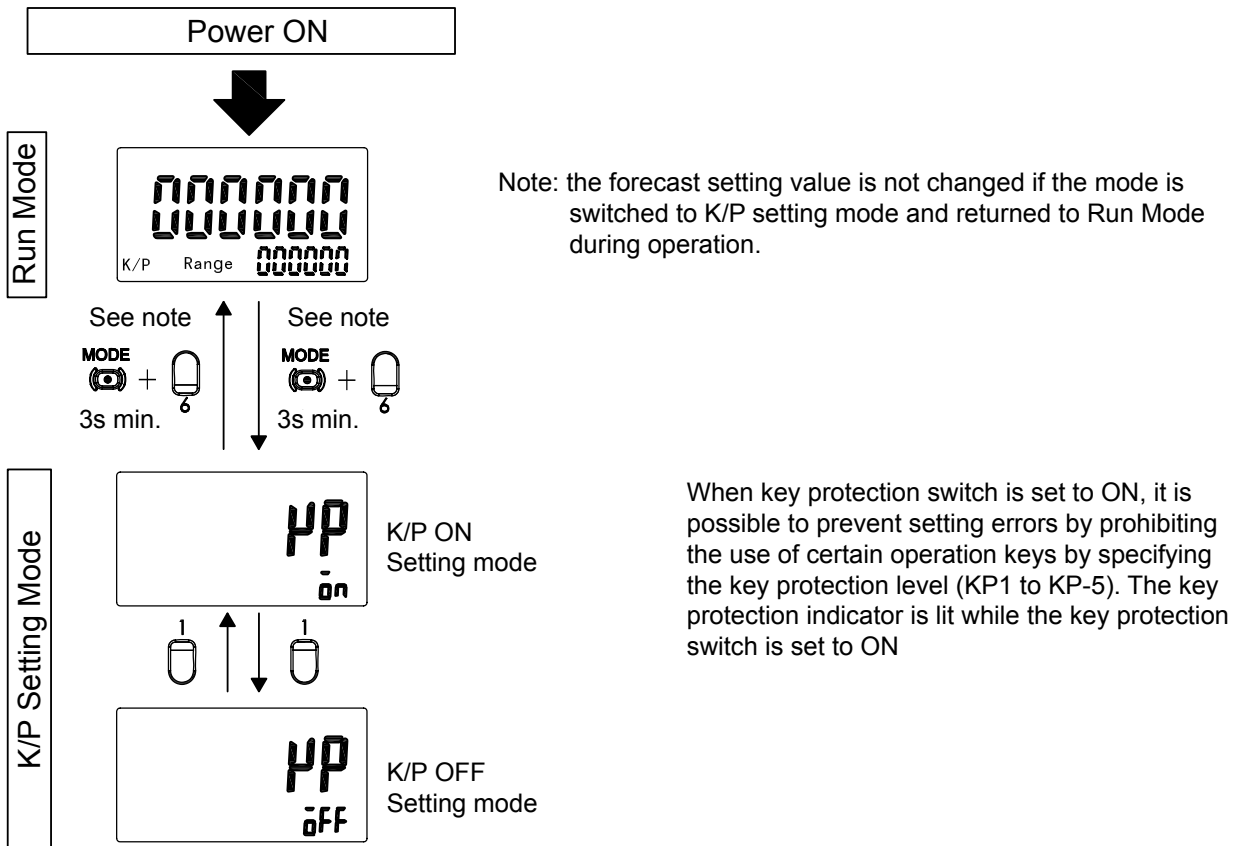## ■ 1-stage/2-stage/Total/Batch/Dual Counter/Tachometer Selection Mode
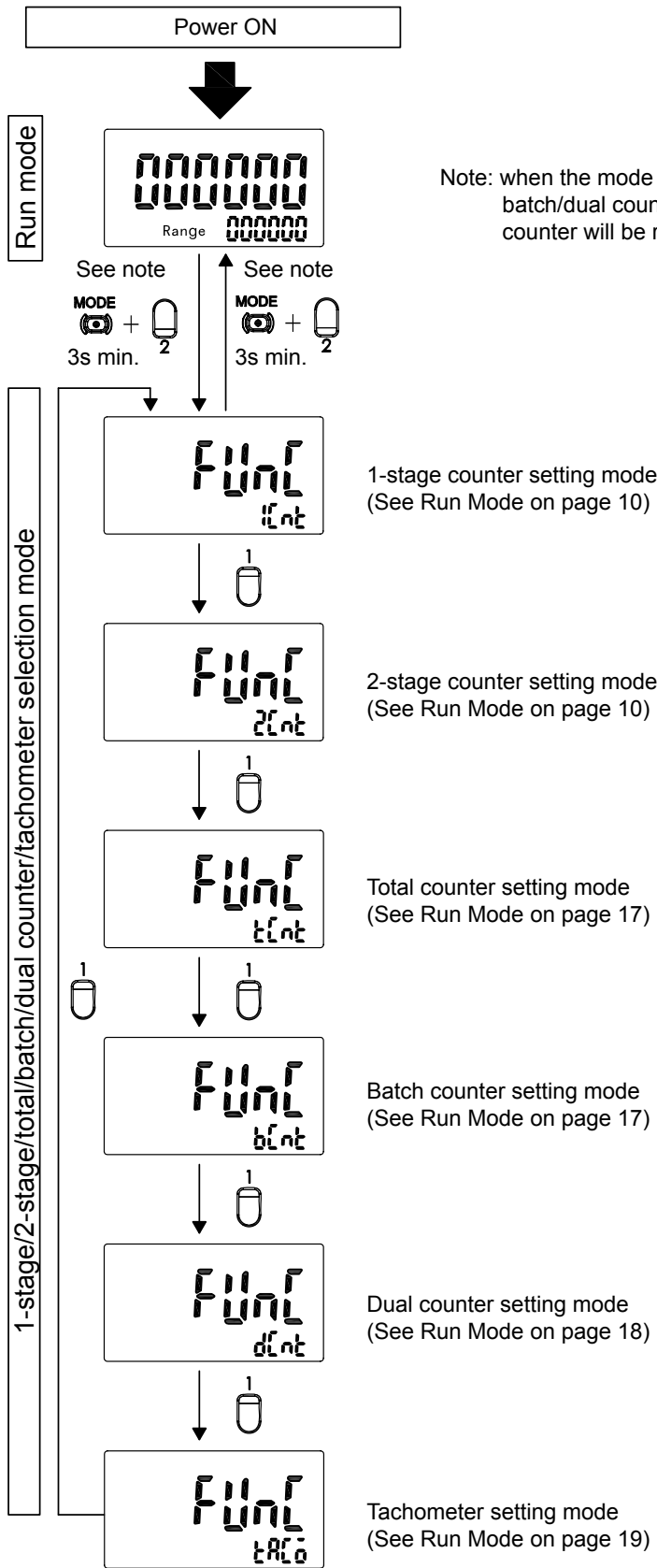
Note: when the mode is changed to 1-stage/2-stage/total/
batch/dual counter/tachometer selection mode,
counter will be reset.

1-stage counter setting mode
(See Run Mode on page 10)

2-stage counter setting mode
(See Run Mode on page 10)

Total counter setting mode
(See Run Mode on page 17)

Batch counter setting mode
(See Run Mode on page 17)

Dual counter setting mode
(See Run Mode on page 18)

Tachometer setting mode
(See Run Mode on page 19)

■ Communication Format Function Selection Mode

Power ON

Run mode

Note: Counter will reset when changing into the communication format setting mode during operation

See note   See note

MODE + 🔘 (4)   MODE + 🔘 (4)
3s min   3s min

Communication Format Function Selection Mode

bAUd 96 — Transmission Speed

Set the transmision speed with 🔘(1) key

96 → .... → 48

Transmission speed:1200,2400,4800,9600,14400,19200,28800,38400,57600bps

MODE

PArі nonE — Parity Check

Set the parity check with 🔘(1) key

nonE → odd → EvEn
(NONE) (ODD) (EVEN)

MODE

dAtA 8bіt — Date bit

Set the date bit with 🔘(1) key

8bіt → 7bіt
(8 bit)   (7 bit)

MODE

StoP 1bіt — Stop bit

Set the stop bit with 🔘(1) key

1bіt → 2bіt
(1 bit)   (2 bit)

MODE

Addr 01 — Station address

Set the Station address (HEX) with 🔘(1) key

01 → .... → FF
(01)   (FF)

MODE

CoSH on — Communication on/off

Set communication on/off with 🔘(1) key

on → oFF
(ON)   (OFF)

MODE

Note: The communication format function is not performed for the model without the communication function.

■ Key Protection Setting Mode

Note: the forecast setting value is not changed if the mode is switched to K/P setting mode and returned to Run Mode during operation.

K/P ON
Setting mode

When key protection switch is set to ON, it is possible to prevent setting errors by prohibiting the use of certain operation keys by specifying the key protection level (KP1 to KP-5). The key protection indicator is lit while the key protection switch is set to ON

K/P OFF
Setting mode

Level	Meaning	Changing mode (see note)	Switching display during operation	Reset key	Up/down key
KP- 1 (default setting)		No	Yes	Yes	Yes
KP- 2		No	Yes	No	Yes
KP- 3		No	Yes	Yes	No
KP- 4		No	Yes	No	No
KP- 5		No	No	No	No

Note: Changing mode to 1-stage Counter, 2-Stage Counter, Total Counter, Batch Counter, Dual Counter and Tachometer selection mode (MODE + 2 3 min.), Communication Format Function Mode

(MODE + 4 3min.), and Basic Function setting (MODE 3s min.)

Counter Function

■ Setting for Counter Function

Power ON

Run mode

Range

1-stage counter function setting mode

See note 1 / See note 2
MODE 3s min. / MODE 3s min.

(See note 3) when using as a dual counter:

[ALn
Add

Dual counter calculating mode

ŘŮŘ → SUb

Note: Displayed for output modes other than K-2, D, L and H only.

See note 3

[ntn
UP

Input mode

See note 4   See note 4

UP → down → Ud-A → Ud-b → Ud-C
(UP)   (DOWN)   (UP/DOWN A) (UP/DOWN B) (UP/DOWN C)

Note: displayed for output modes other than K-2, D, L and H only.

MODE

outn
n

Output mode

See note 5   See note 5

n → F → [→ r → ᵇ-1 → P → q → A → ᵇ-2 → d → L → H
(N) (F) (C) (R) (K-1) (P) (Q) (A) (K-2) (D) (L) (H)

Note 5: displayed only when the input mode is UP/DOWN A, B or C.

MODE

See note 6

otcn
000500

One-shot output mode

000001 → 000500 → 099990 → 999999
(000.001s) (000.005s) (099.990s) (999.999s)

Note : Displayed only when the output mode is C, R, K-1, P, Q, A or K-2.

(See note 6) when using as a 2-stage counter :

otn2
000500

One-shot output 2 time

000001 → 000500 → 999999
(000.001s) (000.500s) (999.999s)

MODE

otn1
Hold

One-shot output 1 time

Hold → 000001 → 999999
(HOLD) (000.001s) (999.999s)

when using as a batch counter:

otn1
000500

One-shot output 2 time

000001 → 000500 → 999999
(000.001s) (000.500s) (999.999s)

Note: Displayed only when the output mode is C, R, K-1, P, Q, A or K-2.

[ntS
30HZ

Counting speed

30HZ → 5PHZ
(30Hz) (5KHz)

MODE

iFLt
20nS

Input signal width

20nS → 1nS
(20ms) (1ms)

MODE

dP

Decimal point position

---- → ---- → ---- → ----
(no decimal point) (one digit after decimal point) (two digit after decimal point) (three digit after decimal point)

MODE

PSCL
001000

Prescale value

000001 → 001000 → 999999
(000.001) (001.000) (999.999)

MODE

inod
nPn

NPN / PNP input mode

nPn → PnP
(NPN input) (PNP input)

MODE

ᵇyPt
ᵇP-1

Key protection level

ᵇP-1 → ᵇP-2 → ᵇP-3 → ᵇP-4 → ᵇP-5
(K-1) (K-2) (K-3) (K-4) (K-5)

MODE

11

■ Explanation of functions

Input mode (cntm)
Set increment mode(UP)、decrement mode (DOWN)、or increment/ decrement mode (UP/DOWN A、UP/DOWN B、UP/DOWN C) as the input mode.

Dual count calculating mode (calm)
When using a dual counter, select ADD (addition) or SUB (subtraction) as the calculation method for the dual count value. SUB mode can be used only when K-2, D, L or H is selected as the output mode with 6-digit models.
ADD: Dual count value=CP1 PV+CP2 PV
SUB: Dual count value =CP1 PV-CP2 PV

Output mode (outm)
Set the way that control output for the present value is output. The possible settings are N,F,C,R,K-1,P,Q,A,K-2,D,L and H.

One-shot output 2 time (otm2)
Set one-shot output time for control output (OUT2) when using as a 2-stage counter or batch counter. (000.001 to 999.999)One-shot output can be used only when C, R, K-1, P, Q, A or K-2 is selected as the output mode.

One-shot output 1 time (otm1)
Set one-shot output time (000.001 to 999.999) for control output (OUT1) when using as 2-stage counter. One-shot output can be used only when D, L or H is selected as the output mode. If the output time is set to 0.00, HOLD is displayed, and outputs are held. HOLD can not be set when the output mode is K-2.

Counting speed (cnts)
Set the maximum counting speed (30Hz/5KHz) for CP1 and CP2 inputs together. If contacts are used for input signal, set the counting speed to 30Hz. Processing to eliminate chattering is performed for this setting.

Input signal width (iflt)
Set Reset input signal width (20ms/1ms) for reset/reset1 and total reset/reset2 inputs together. If contacts are used for input signals, set the counting speed to 20ms. Processing to eliminate chattering is performed for this setting.

Decimal point position (dp)
Decide the decimal point position for the present value, CP1/CP2 present values, set value (SV1, SV2), total count value and dual count set value.

Prescale value (pscl)
Pulses input to the counter are converted according to the specified prescale value. (Setting range: 000.001~99.999)
Example: To display the feed distance for systems that output 25 pulses for a feed length of 0.75m in the form □□□.□□□m:
1. Set the decimal point position to 2 decimal places
2. Set the prescale value to 0.03
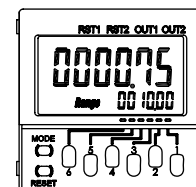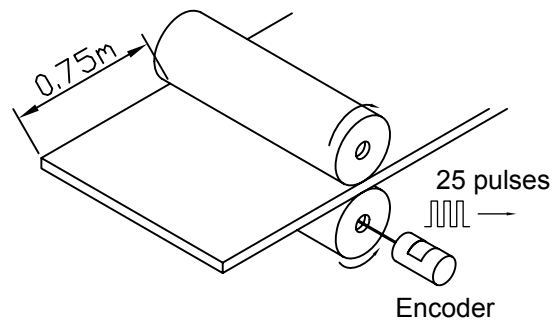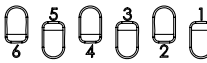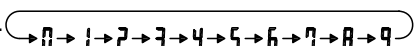
25 pulses

Encoder

NPN/PNP input mode (imod)
Select either NPN input (no-voltage input) or PNP input (voltage input) as the input format. The same setting is used for all external inputs.

■ Operation in Run Mode

Set values for each digit as required with the ⬙5 ⬙4 ⬙3 ⬙2 ⬙1 keys. 0→1→2→3→4→5→6→7→8→9

1-stage Counter

000000 ← Present value
Range 000000 ← Set value
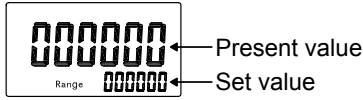
Present value: Shows present count value
Set value(Set value 1,2): Set the set value. When the present value reaches the set value, signals are output according the specified output mode.

2-stage Counter

A 000000 ← Present value
Range 000000 ← Set value 1

↓ MODE

B 000000 ← Present value
Range 000000 ← Set value 2
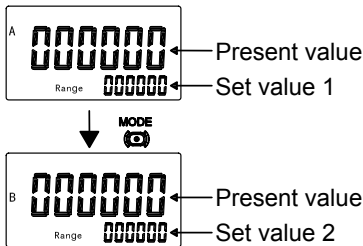
Total and forecast counter

000000 ← Present value
Range 000000 ← Set value

↓ MODE

000000 ← Total count value
T
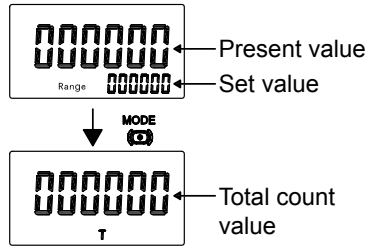
Present value/ Set value:
Same as 1-stage counter

Total count value:
Shows the present total count value

Batch Counter

000000 ← Present value
Range 000000 ← Set value

↓ MODE

000000 ← Batch count value
b 000000 ← Set value for Batch counting
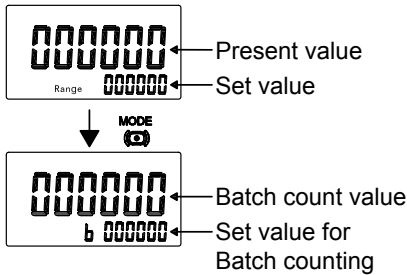
Present value/ Set value:
 Same as 1-stage counter

Batch count value: shows the number of times the count has been completed for the present value.
Batch count set value: set the batch count set value. When batch count value reaches the batch count set value, batch output (OUT2) turns ON.

Dual Counter

000000 ← Dual count value
Range 000000 ← Set value for Dual counting

↓ MODE

A
B 000000 ← CP1 Present value
000000 ← CP2 Present value
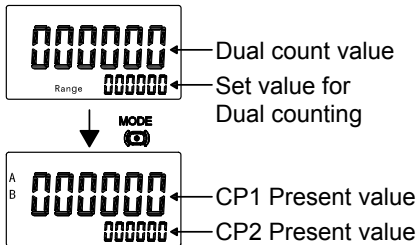
Dual count value:
  Shows the sum of the CP1 present value and the CP2 present value when the dual count calculating mode is ADD and shows the value obtained by subtracting the CP1 present value from the CP2 present value when the dual count calculating mode is SUB.

Dual count value:
  Set dual count value. When the dual count value reaches the dual count set value, signals are output according to the specified output mode.

CP1/ CP2 present value:
  Show the present count values for CP and CP2 present values respectively.

■ Input Modes and Present Value (Counter)

UP (increment) Mode	DOWN (decrement) mode
CP1: Count input ; CP2: Prohibit（gate）input **Note:** Input CP2 while CP1 is "L"	CP1: Count input ; CP2: Prohibit（gate）input **Note:** Input CP2 while CP1 is "L"
CP1: Prohibit（gate）input ; CP2: Count input **Note:** Input CP1 while CP2 is "H"	CP1: Prohibit（gate）input ; CP2: Count input **Note:** Input CP1 while CP2 is "H"

UP / DOWN A command input mode

UP / DOWN B individual input mode

UP / DOWN C Quadrature input mode

Note:
1. If the configuration selection is set to dual count, CP1 and CP2 input will operate in the same way as the count input (CP1) of UP (increment) mode.
2. The meaning of the H and L symbols in the tables is explained below.

Input method symbol	No-voltage (NPN input)	Voltage input (PNP input)
H	Short-circuit	4.5~30VDC
L	OPEN	0~2VDC

■ Input/Output Mode Setting(Counter)

Operation for 1-stage models is the same as that for OUT2.
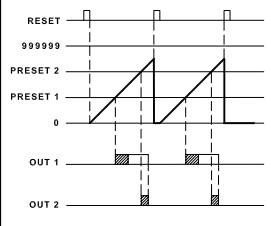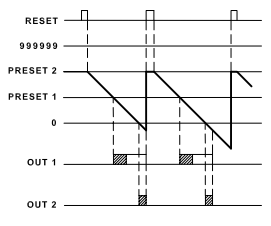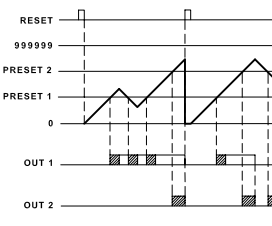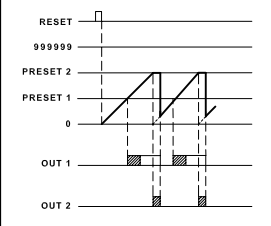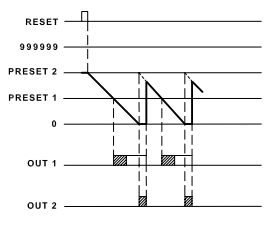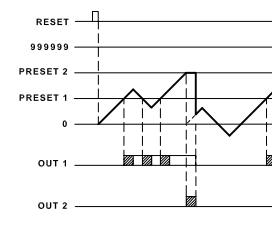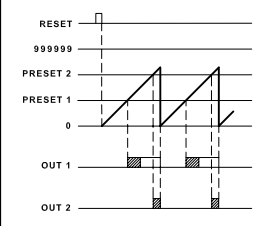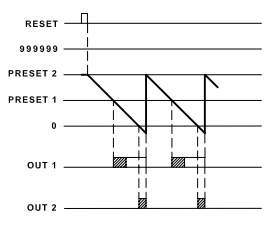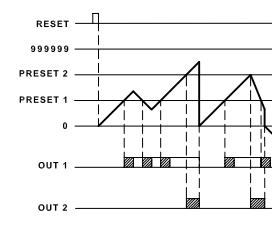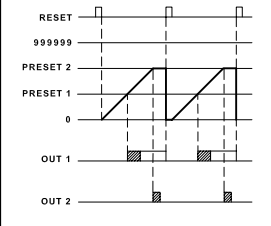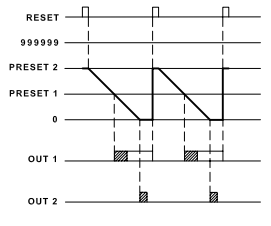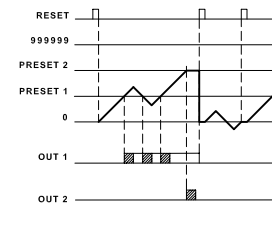
When using a 2-stage model as a 1-stage counter, or dual counter, total and preset counter, OUT1 and OUT2 turn ON and OFF simultaneously.

Self-holding output One-shot One-shot output

(the one-shot output time can be set in the range 0.001to 999.999s)

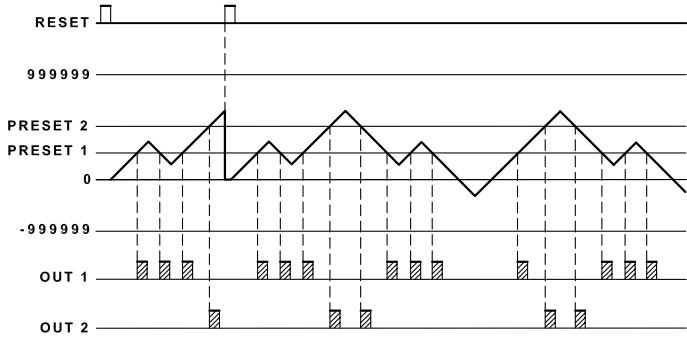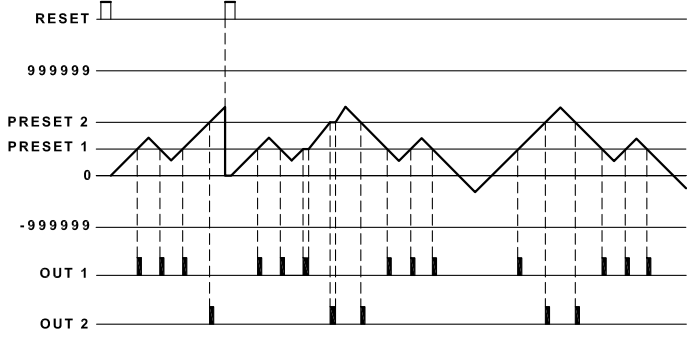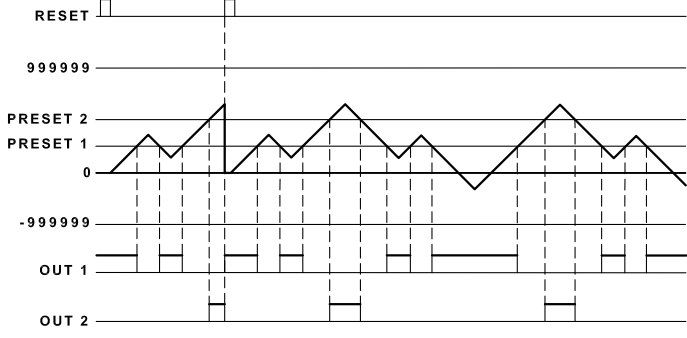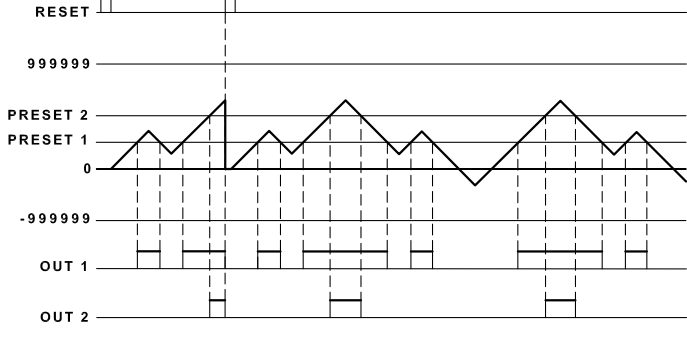|		Output mode			
		UP	DOWN	UP/DOWN A, B, C	Operation after count completion
Output mode setting	N				The outputs and present value display are held until reset/reset1 is input.
	F				The present value display continues to increase/decrease. The outputs are held until reset/reset1 is input.
	C				As soon as the count value reaches SV, the present value display returns to the reset start status. The present value display does not show the present value upon count-up. The outputs repeat one-shot operation. OUT1 self-holding output turns OFF after the OUT2 one-shot output time. The OUT1 one-shot output time is independent of OUT2.
	R				The present value display returns to the reset start status after the one-shot output time. OUT1 self-holding output turns OFF after the OUT2 one-shot output time. The OUT1 one-shot output time is independent of OUT2.

Note:
1. The full scale (FS) for TC-Pro 6-digit models is 999999.
2. When the present value reaches 999999, it returns to 0.
3. Counting can not be performed during reset/reset1 input.
4. If reset/reset1 is input while one-shot output is ON, one-shot output turns OFF.
5. Do not use the counter function in applications where the count may be completed (again) while one-shot output is ON.

		Output mode			Operation after count completion
		UP	DOWN	UP/DOWN A, B, C	
Output mode setting	K-1				The present value display continues to increase/decrease. OUT1 self-holding output turns OFF after the OUT2 one-shot output time. The OUT1 one-shot output time is independent of OUT2.
	P				The present value display does not change during the one-shot output time, but the actual count returns to the reset status. The outputs return to the one-shot start state and repeat one-shot operation. OUT1 self-holding output turns OFF after the OUT2 one-shot output time. The OUT1 one-shot output time is independent of OUT2.
	Q				The present value continues to increase/decrease for the one-shot output time, but returns to the reset start status after the one-shot output time has elapsed. The outputs repeat one-shot operation. OUT1 self-holding output turns OFF after the OUT2 one-shot output time. The OUT1 one-shot output time is independent of OUT2.
	A				The present value display and OUT1 self-holding output is held until reset/reset1 is input. OUT1 and OUT2 are independent.

Note:
1. The full scale (FS) for TC-Pro 6-digit models is 999999.
2. When the present value reaches 999999, it returns to 0.
3. Counting can not be performed during reset/reset1 input.
4. If reset/reset1 is input while one-shot output is ON, one-shot output turns OFF.
5. Do not use the counter function in applications where the count may be completed (again) while one-shot output is ON.

☐ ▮ ▨ (the one-shot output time can be set in the range 0.001to 999.999s)

Self-holding output One-shot One-shot output

		Output mode		Operation after count completion
		UP/DOWN A, B, C		
Output mode setting	K-2			The display continues to increase/decrease until the overflow or underflow value is reached. One-shot output only.
	D			The display continues to increase/decrease until the overflow or underflow value is reached. The outputs are ON while the count is equal.
	L			The display continues to increase/decrease until the overflow or underflow value is reached. OUT1 is held while the present value is less than or equal to set value 1. OUT2 is held while the present value is less than or equal to set value 2.
	A			The display continues to increase/decrease until the overflow or underflow value is reached. OUT1 is held while the present value is less than or equal to set value 1. OUT2 is held while the present value is less than or equal to set value 2. Note: H mode is available for 2-stage models only.

Note:
1. Counting can not be performed during reset/reset 1 input.
2. If reset/reset 1 is input while one-shot output is ON, one-shot output turns OFF.
3. Do not use the counter function in applications where the count may be completed (again) while one-shot output is ON.
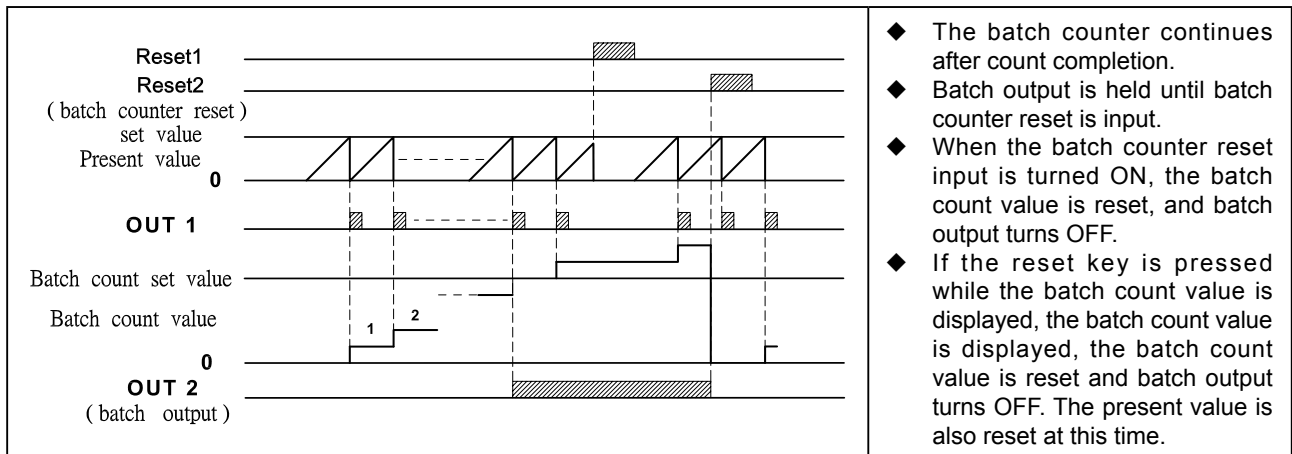
■ Total Operation

TC-Pro481 has a total counter, separate from the 1-stage present counter, for counting the total accumulated value.

◆ the total counter continues to count the total accumulated value when the present value is reset using reset/reset 1 input (reset key).

◆ the total count value is reset when the total reset/reset 2 input is turned ON. If the reset key is pressed while the total count value is reset. The present value is also reset at this time.

◆ the counting range of the total counter is -99,999 to 999,999 (-999 to 9,999). The total count value returns to 0 when it reaches the full scale limit.

■ Batch Counter Operation

TC-Pro481 has a batch counter, separate from the 1-stage present counter, for counting the number of times the count value returns to 0 when it reaches the full scale limit.

◆ The batch counter continues after count completion.

◆ Batch output is held until batch counter reset is input.

◆ When the batch counter reset input is turned ON, the batch count value is reset, and batch output turns OFF.

◆ If the reset key is pressed while the batch count value is displayed, the batch count value is displayed, the batch count value is reset and batch output turns OFF. The present value is also reset at this time.

Note:
1. The batch count value is held at 0 during batch counter reset input.
2. If the batch count set is 0, batch count will be performed but there will be no batch output.
3. The batch count value returns to 0 when it reaches 999,999.
4. Once batch input has been turned ON, it will return to the ON state after power interruptions.
5. If the batch count set value is changed from a value that is greater than the batch count value to one that is less, batch output will turn ON.

■ Operation (Dual Counter)

1. Using the dual counter allows the count from 2 inputs to be added or subtracted and the result displayed. It is possible to specify a set value for which output turns ON when the set value matches the added or subtracted result.
2. OUT1 and OUT2 turn ON and OFF simultaneously.

Dual Count Calculating Mode = ADD Dual count value = CP1 PV + CP2 PV	Dual Count Calculating Mode = SUB Dual count value = CP1 PV -CP2 PV
Note: the above is for when the output mode is N.	Note: the above is for when the output mode is K-2. SUB mode can be used only when K-2, D,L or H is selected as the output mode with 6-digit models.

◆ the operation after count completion for the dual counter value is determined by the output mode.
◆ the CP1 present value is reset when reset 1 input is turned ON and the CP2 present value is reset when reset 2 input is turned ON.
◆ if the reset key is pressed while the dual count value, CP1 present value or CP2 present value is displayed, all of the present values are reset and outputs turn OFF. At this time, counting is not possible for CP1 or CP2 input.

Note:
1. Counting is not possible for CP1 during reset 1 input. CP2 will not be affected. The dual count value will be calculated based on a CP1 present value of 0.
2. Counting is not possible for CP2 during reset 2 input. CP1 will not be affected. The dual count value will be calculated based on a CP2 present value of 0.
3. The counting range for dual count value is -99,999 to 999,999.

■ Reset Function List

Function	1-stage/2-stage counter	Total counter		Batch counter		Dual counter	
Screen displayed in run mode	Present value/set value(1,2)	Present value/set value	Total count value	Present value/set value	Batch count value/ batch count set value	Dual count value/dual count set value	CP1 present value/ CP2 present value
Reset/reset 1	Present value and output reset	Present value and output reset		Present value and output reset		Only the CP1 present value is reset	
Total reset/ reset 2	No effect	Only the total count value is reset		Batch count value and batch output reset.		Only the CP2 present value is reset	
Reset key	Present value and output reset	Present value and output reset	Present value, total count value, and output reset	Present value and output reset	Present value, batch count value, output and batch output reset.	CP1 present value, CP2 present value, dual count value, and output reset.	

Tachometer Function

Power ON

Run mode

```
000000
```

See note 1   See note 2

MODE
🔘
3s min.
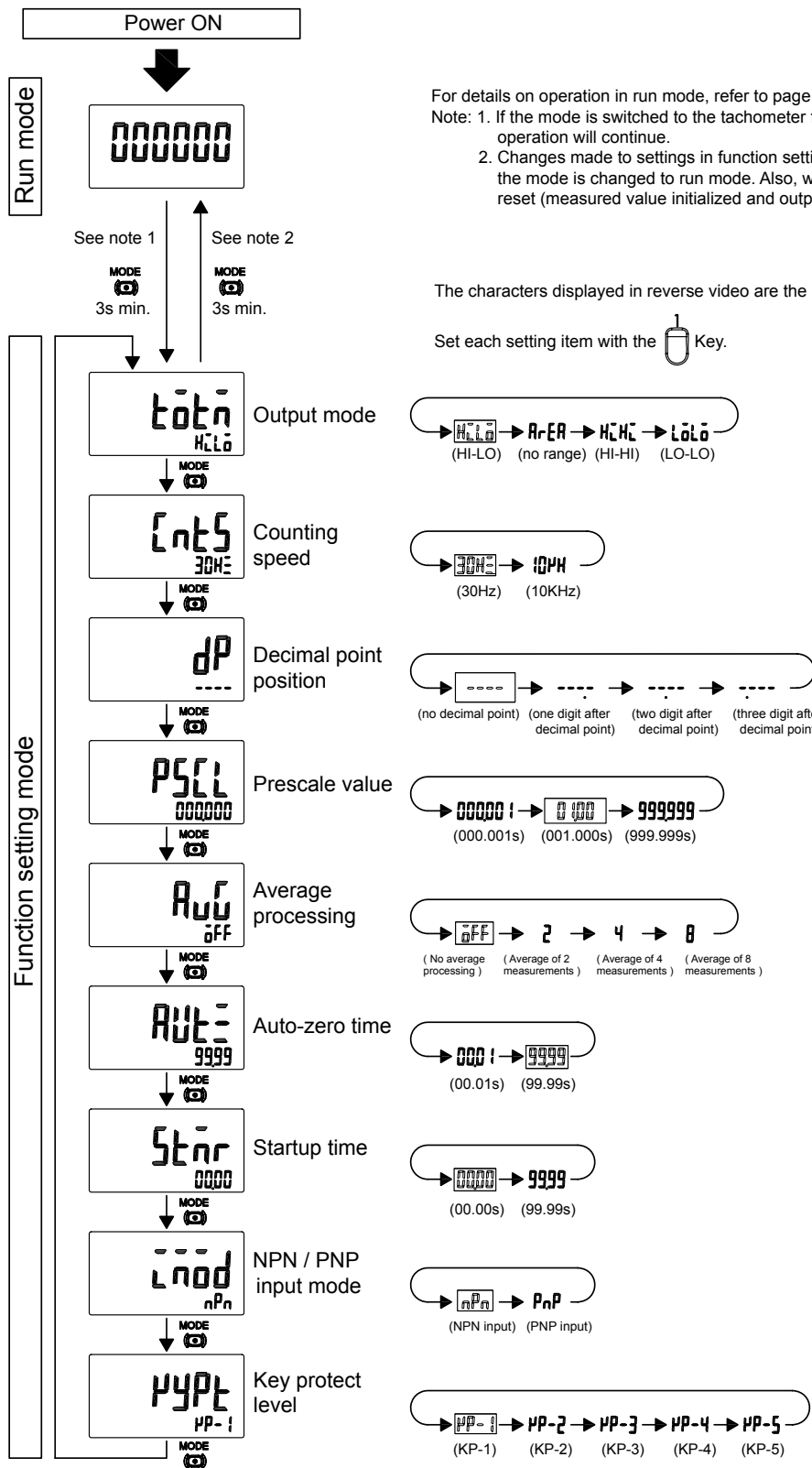
MODE
🔘
3s min.

For details on operation in run mode, refer to page 22.
Note: 1. If the mode is switched to the tachometer function setting mode during operation, operation will continue.
2. Changes made to settings in function setting mode are enabled for the first time when the mode is changed to run mode. Also, when settings are changed, the counter is reset (measured value initialized and output turned OFF) on returning to run mode.

The characters displayed in reverse video are the initial values.

Set each setting item with the 🔘 Key.

Function setting mode

totn
HiLo — Output mode

→ HiLo → ArER → HiHi → LoLo
(HI-LO) (no range) (HI-HI) (LO-LO)

CntS
30Hz — Counting speed

→ 30Hz → 10KH
(30Hz) (10KHz)

dP
---- — Decimal point position

→ ---- → ---- → ---- → ----
(no decimal point) (one digit after decimal point) (two digit after decimal point) (three digit after decimal point)

PSCL
000000 — Prescale value

→ 000001 → 001000 → 999999
(000.001s) (001.000s) (999.999s)

AuG
oFF — Average processing

→ oFF → 2 → 4 → 8
(No average processing) (Average of 2 measurements) (Average of 4 measurements) (Average of 8 measurements)

Aut
9999 — Auto-zero time

→ 0001 → 9999
(00.01s) (99.99s)

Stnr
0000 — Startup time

→ 0000 → 9999
(00.00s) (99.99s)

Lnod
nPn — NPN / PNP input mode

→ nPn → PnP
(NPN input) (PNP input)

KYPt
KP-1 — Key protect level

→ KP-1 → KP-2 → KP-3 → KP-4 → KP-5
(KP-1) (KP-2) (KP-3) (KP-4) (KP-5)

MODE
🔘

■ Explanation of Tachometer Functions

Tachometer output mode (totm)
Set the output method for control output based on the OUT1/OUT2 set value. Upper and lower limit (HI-LO), area (AREA), upper (HI-HI),and lower limit (LO-LO) can be set.

Counting speed (cnts)
Set the maximum counting speed (30Hz/10KHz) for CP1 input. If contacts are used for input signals, set the counting speed to 30Hz. Processing to eliminate chattering is performed for this setting.

Decimal point position (dp)
Decide the decimal point position for the measurement value, OUT1 set value, and OUT2 set value.

Prescale value (pscl)
It is possible to display the rate of rotation or the speed of a device or machine to which the TC-Pro481 is mounted by converting input pulses to a desired unit. If this prescaling function is not used, the input frequency (Hz) will be displayed.
The relationship between display and input is determined by the following equation. Set the prescale value according to the unit to be displayed. Displayed value=input pulse frequency×prescale value

1. Displaying rotation rate

Display unit	Prescale value
rpm	1/N*60
rps	1/N

N: number of pulses per revolution
Example: in order to display the rate of rotation for a machine that outputs 10 pulses per revolution in the form □□□.□□□rpm:
1. Set the decimal point position to 3 decimal place
2. Using the formula, set the prescale value to 6.

2. Displaying speed

Display unit	Prescale value
m/min	πd*1/N*60
m/s	πd*1/N

N: number of pulses per revolution
d: diameter of rotating body
πd: circumference
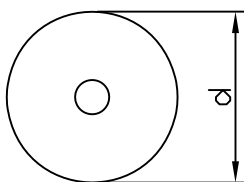
Average processing (aug)
Flickering display and output chattering can be prevented using average processing (simple averaging). Average processing can be set to one of four levels: no average processing, 2 times (i.e., the average of 2 measurement values), 4 times, 8 times. The measurement cycle will be equal to the sampling cycle (100ms) multiplied by the average processing setting (i.e., the number of time). Average processing enables fluctuating input signals to be displayed stably. Set the optimum number of times for the application.

Auto-zero time (autz)
It is possible to set the TC-Pro481 so that if there is no pulse for a certain time the display is force-set to 0. This time is called the auto-zero time. Set the auto-zero time to a time slightly longer than the estimated interval between input pulses and within the setting range (00.01~99.99s).It will not be possible to make accurate measurements if the auto-zero time is set to a time shorter than the input pulse cycle. Setting a time that is too long may also result in problems, such as a time-lag between rotation stopping and the alarm turning ON.

Startup time (stmr)
In order to prevent undesired output resulting from unstable input immediately after the power supply is turned ON, it is possible to prohibit measurement for a set time (00.00~99.99s), the startup time. It can also be used to stop measurement and disable output until the rotating body reaches the normal rate of rotation, after the power supply to the TC-Pro481 and rotating body are turned ON at the same time.
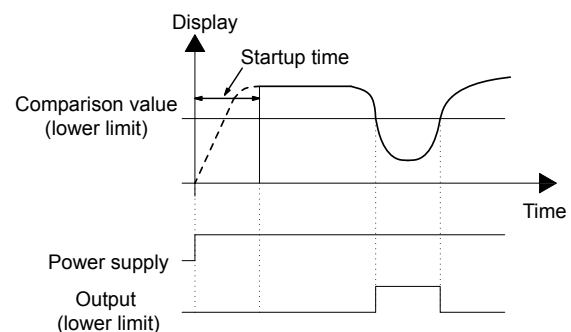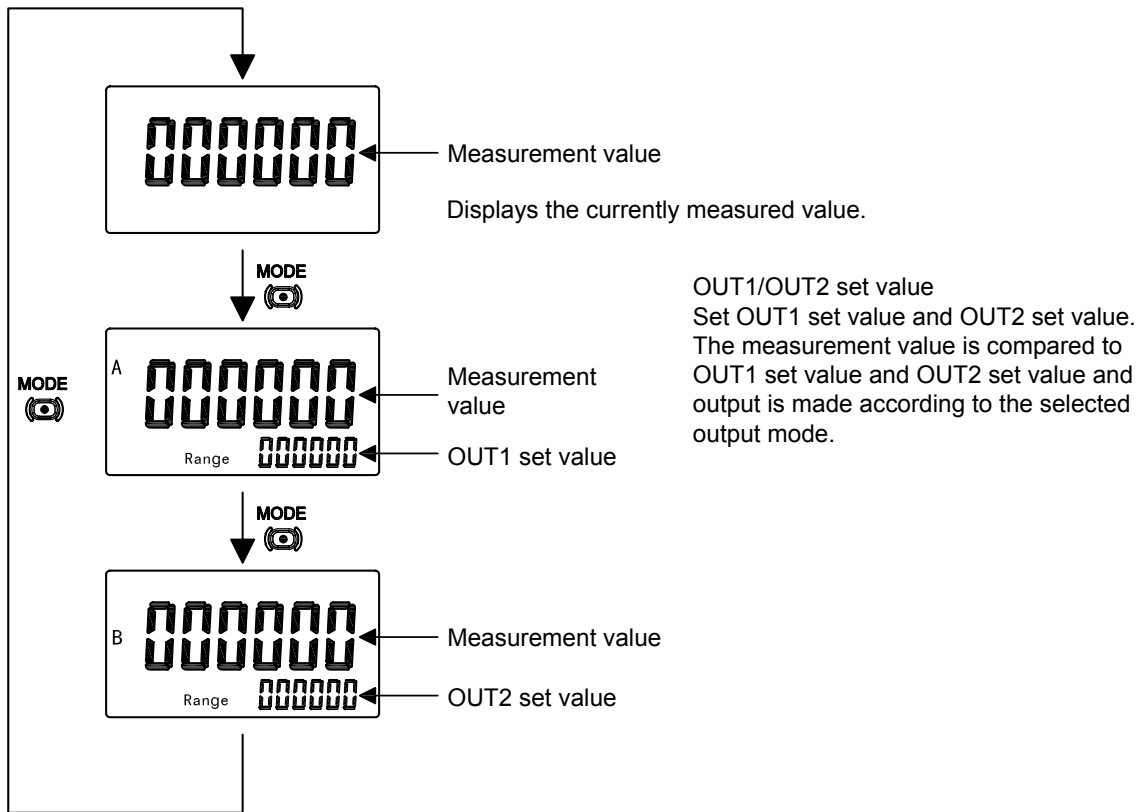
NPN/PNP input mode (imod)
Select either NPN input (no-voltage input) or PNP input (voltage input) as the input format. The same setting is used for all external inputs.

■ Operation in Run Mode

Set values for each digit as required with the ⬭ ⬭ ⬭ ⬭ ⬭ keys. →0→1→2→3→4→5→6→7→8→9

MODE

MODE

Measurement value

Displays the currently measured value.

MODE

A Measurement value

Range OUT1 set value

OUT1/OUT2 set value
Set OUT1 set value and OUT2 set value.
The measurement value is compared to
OUT1 set value and OUT2 set value and
output is made according to the selected
output mode.

MODE

B Measurement value

Range OUT2 set value

■ Output Mode Settings (Tachometer)

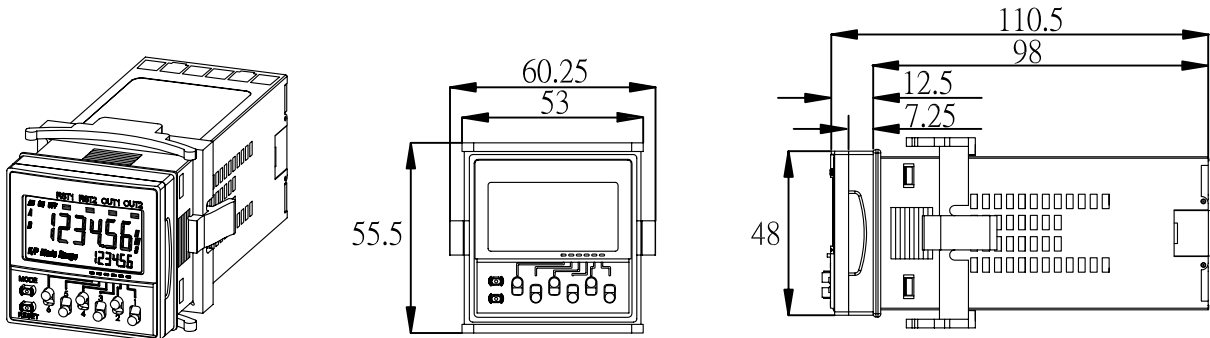| Output mode setting	Upper and lower limit (HI-LO)	(upper-limit) OUT2 set value / Measurement value / (Lower-limit) OUT1 set value / OUT 1 / OUT 2 ON condition for OUT1: measurement value≤OUT1 set value ON condition for OUT2: measurement value≥OUT2 set value
	Area (AREA)	OUT2 set value / Measurement value / OUT1 set value / OUT 1 / OUT 2
	(Upper-limit) (HI-HI)	(Upper-limit) OUT2 set value / Measurement value / (Lower-limit) OUT1 set value / OUT 1 / OUT 2 ON condition for OUT1: measurement value≥OUT1 set value ON condition for OUT2: measurement value≥OUT2 set value
	(Lower-limit) (LO-LO)	(Upper-limit) OUT2 set value / Measurement value / (Lower-limit) OUT1 set value / OUT 1 / OUT 2 ON condition for OUT1: Measurement value≤OUT1 set value ON condition for OUT2: Measurement value≤OUT2 set value

Area (AREA) table:

Condition	OUT1 set value≤OUT2 set value	OUT1 set value >OUT2 set value
ON condition for OUT1	OUT set value≤Measurement value ≤OUT2 set value	OUT2 set value≤Measurement value ≤OUT1 set value
ON condition for OUT2	Measurement value<OUT1 set value Measurement value >OUT2 set value	Measurement value <OUT2 set value Measurement value >OUT1 set value

Dimensions

Note: all units are in millimeters unless otherwise indicated.
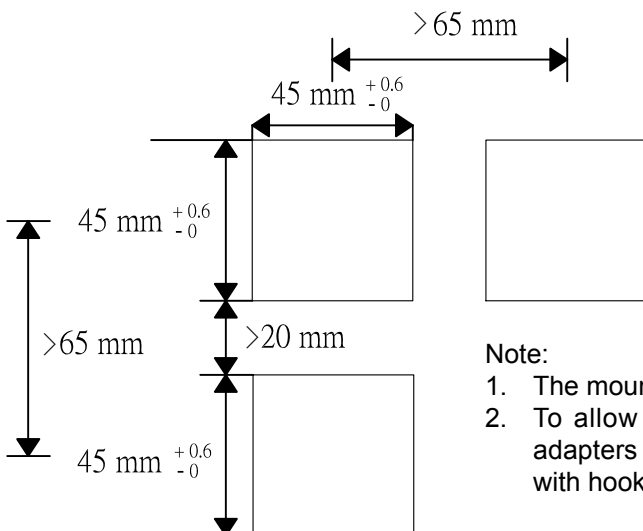
Dimensions without Flush Mounting Adapter

48

48

48

110.5
98
12.5
7.25
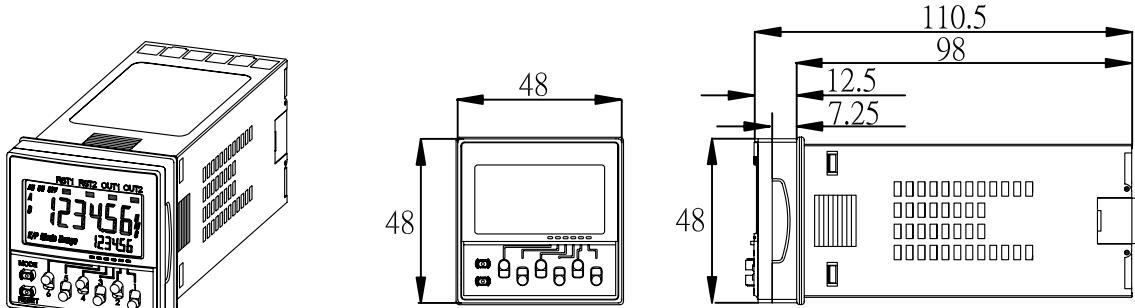
Note: M3 terminal screw (effective length: 8mm)

Dimensions with Flush Mounting Adapter

60.25
53

55.5

110.5
98
12.5
7.25

48

Panel Cutouts

$>$65 mm

45 mm $^{+0.6}_{-0}$

45 mm $^{+0.6}_{-0}$

$>$65 mm

$>$20 mm

45 mm $^{+0.6}_{-0}$

Note:
1. The mounting panel thickness should be 1.5 mm.
2. To allow easier operability, it is recommended that adapters are mounted so that the gap between sides with hooks is at least 20mm.

Dimensions

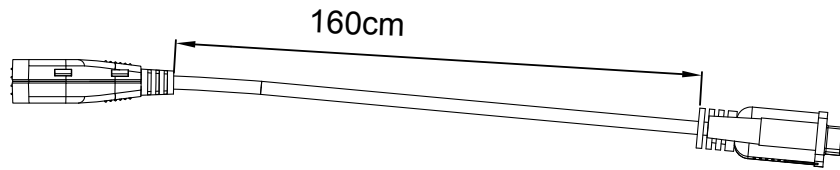Note: all units are in millimeters unless otherwise indicated.

Dimensions without DIN Track Mounting Adapter

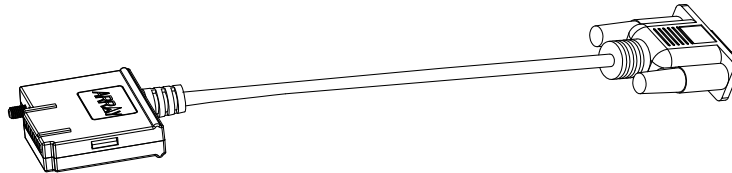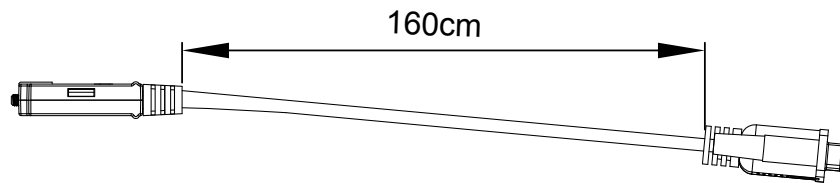Note: M3 terminal screw
(effective length: 8mm)
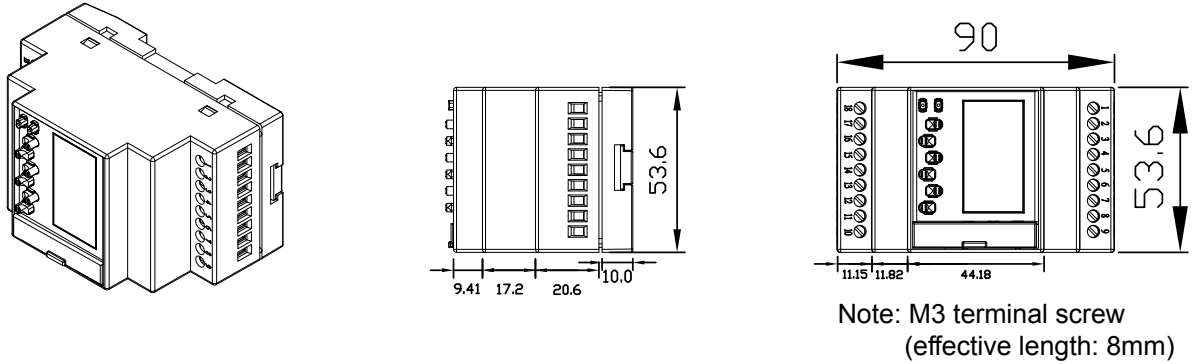
Dimensions without DIN Track Mounting Adapter (with communication)
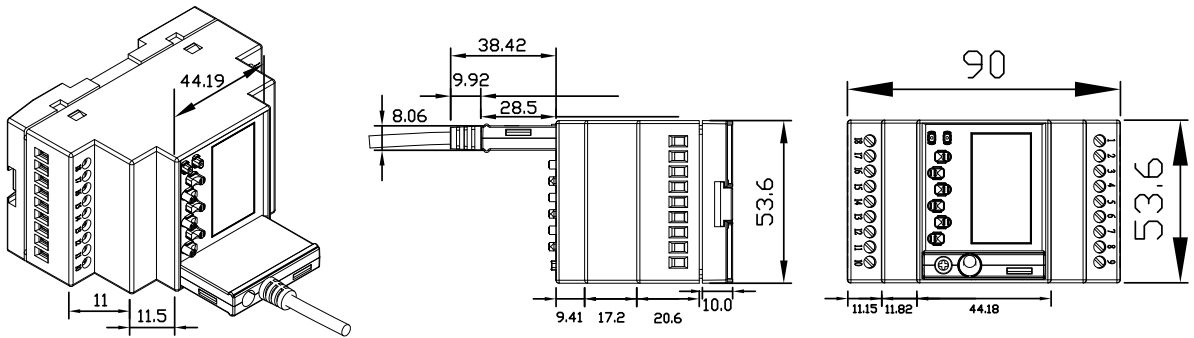
Installation & Accessories

160cm
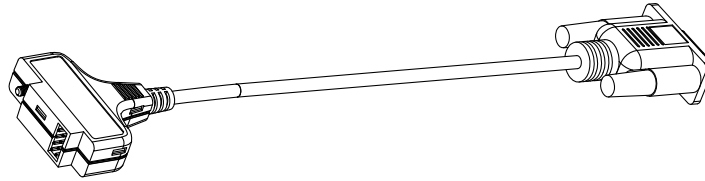
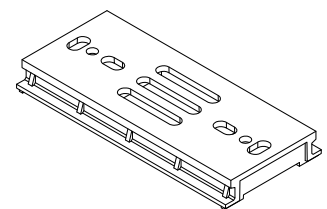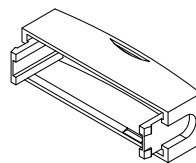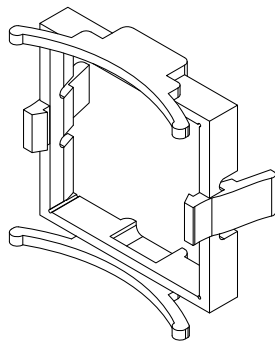Cable: CAB - 090A□□□(order separately)
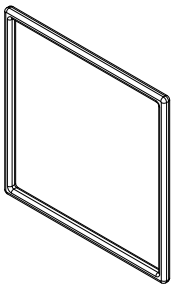
160cm

Cable: CAB - 090B□□□(order separately)

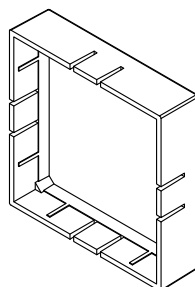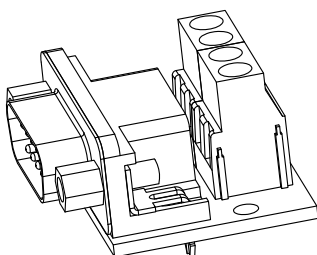| Waterproof Packing PR-43	Flush Mounting Adapter BK-6	End Plate CABC-44	Mounting Track 0F-A (order separately)

ADP-090401 apdater changing 4 into 9 PIN (special between 232, 485 and 422, order separately)

Panel Protective Cover SVF-A (order separately)

Communication Protective Cover TTL-11 (order separately)
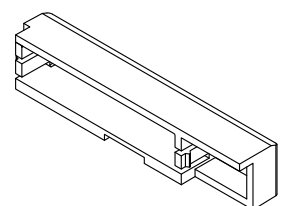
Input Connections

Signal, Reset, and Gate Input
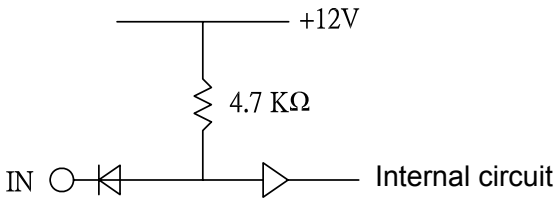
No-voltage Input Signal Levels

No-contact input	Short-circuit level Transistor ON Residual voltage: 3V max. Impedance when ON: 1KΩ min. (the leakage current is 5 to 20 mA when the impedance is 0 Ω)
	Open level Transistor OFF Impedance when OFF: 100KΩ min.
Contact input	Use contact which can adequately switch 5 mA at 10V. The DC voltage must be 30VDC.

No-voltage Inputs (NPN Input)

Open Collector (connection to NPN open collector output sensor)
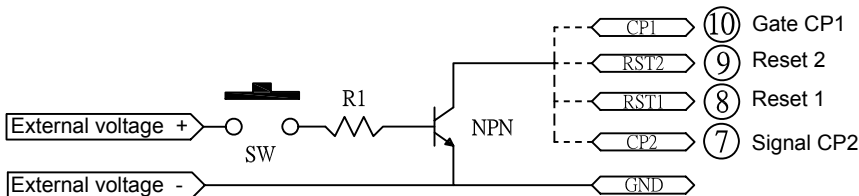
When SW is pressed, the transistor is ON that shows the input has response.

Voltage Inputs (connection to a voltage output sensor)

When SW is pressed, the transistor is ON that shows the input has response.
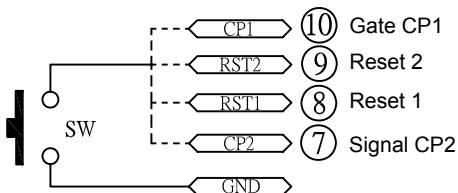
Contact Input

SW is pressed, that shows input the input has response.

Two-wire Sensor

Leakage current: 1.5 mA max.
Switching capacity: 5 mA min.
Residual voltage: 3 VDC max.
Operating voltage: 10 VDC

Voltage inputs (PNP inputs)

No-contact Input (NPN Transistor) (Connection to NPN open collector output sensor)

When SW is pressed, the transistor is ON that shows the input has no response.

No-contact Inputs (PNP Transistor) (connection to a voltage output sensor)
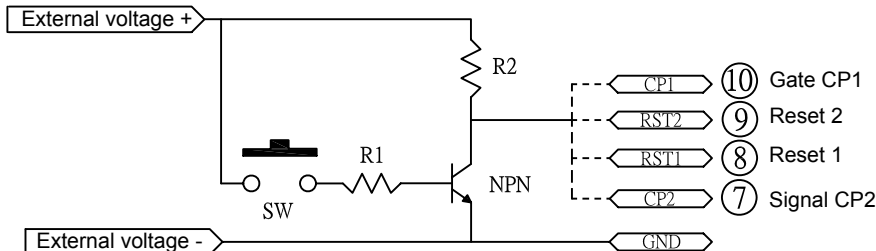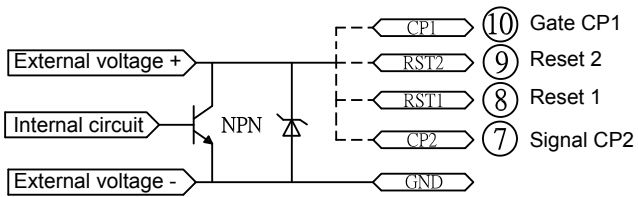

When SW is pressed, the transistor is ON that shows the input has response.

Contact Input
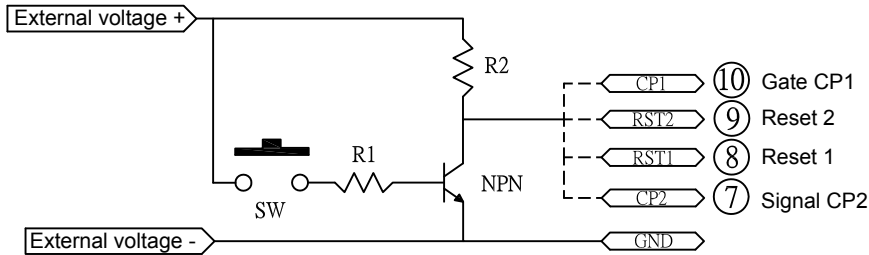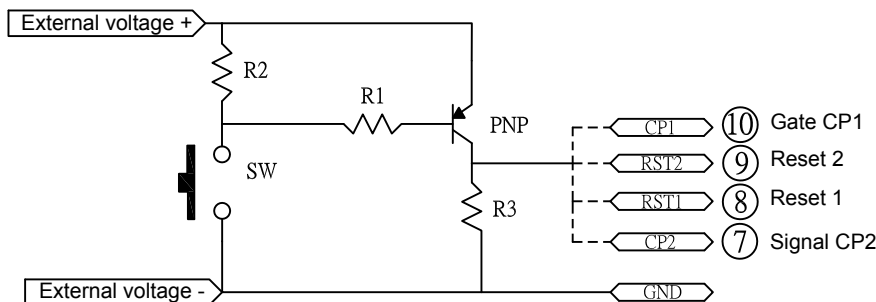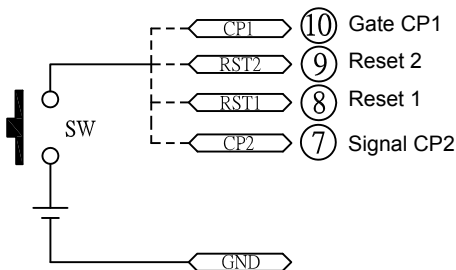

SW is pressed, that shows the input has response.

Safety Precautions

⚠ Caution

√ Do not use the product where corrosive or volatile gases are present, or there may occasionally be a risk of explosion.

√ Usable life of output relay is determined by switch condition. According the actual usage, use product within its rated load and electrical life expectancy. If using product beyond its life expectancy, its contacts may become fused or there may be a risk of fire.

√ Do not disassemble, repair, or modify the product. Doing so may result in electric shock, fire, or malfunction.

√ Do not allow metal objects or conductive wires to enter the product, which may result in electric shock, fire, or malfunction.

Power Supplies

For the power supply of an input device, use an isolating transformer with the primary and the secondary winding not grounded.
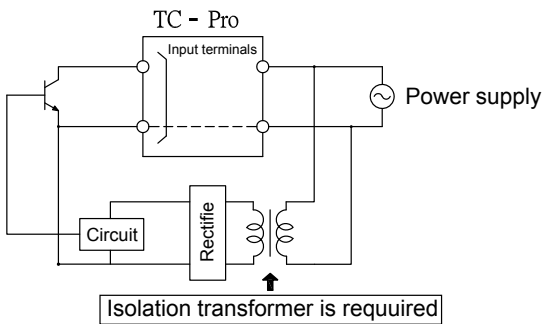
Make sure that the voltage applied is within the specified range, otherwise the internal elements of Timer may be damaged.

Do not touch the input terminals while power is supplied, and so touching the input terminals with power supplied may result in electric shock.

When turning the power ON and OFF, input signal reception is possible, unstable, or impossible.

Turn the power ON and OFF using a relay with a rated capacity

of 10A minimum to prevent contact deterioration due to inrush

current caused by turning the power ON and OFF.

Be sure that the power voltage can be immediately reached to the supply voltage value by relays or switches, otherwise it can not be reset or timing error.

Power Failure Backup

All data is stored in the EEPROM when there is a power failure. The EEPROM can be overwritten more than 100,000 times.

Input and Output

When connecting relay and transformer as an external signal input device, it is necessary to pay attention to the following points to prevent the short circuit because of the hidden current flowing to the power supply. If a relay or transistor connected to two or more timers, those input terminals must be connected correctly, otherwise it can cause short circuit.

Incorrect

The contact or transistor as an external input signal
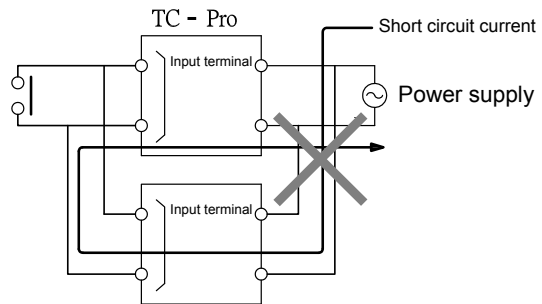
Correct
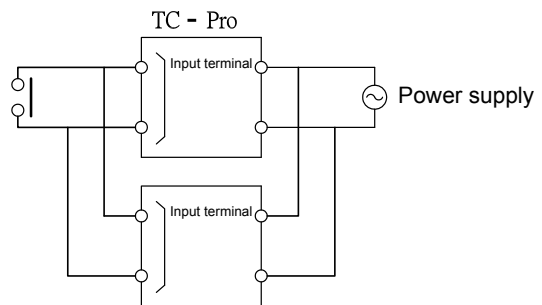
Don't connect the unattached power switch as below, and without considering whether the timer is different or not.
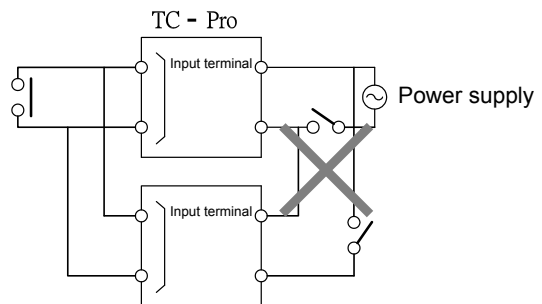
Response time when resetting

The following table shows the delay from when the reset signal is input until the output is turned OFF.

Min. reset signal width	Output delay time
1ms	0.8~1.2ms
20ms	15~25ms

Transistor Output

The transistor output of TC-Pro is insulated from the internal circuitry by a photocoupler, so the transistor output can be used as both NPN and PNP output.

The diode connected to the collector of the output transistor is used to absorb inverted voltage that is generated when an inductive load is connected to TC- Pro.

The transistor output of TC-Pro is insulated from the internal circuitry by a photocoupler, so the transistor output can be used as both NPN and PNP output.

The diode connected to the collector of the output transistor is used to absorb inverted voltage that is generated when an inductive load is connected to TC- Pro.
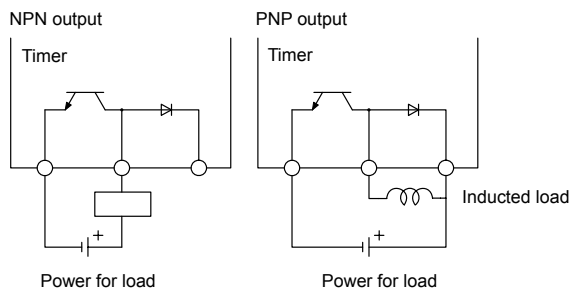
Changing the set values

When changing the set value during a timing operation, the output will turn ON if the set value is changed as follows because of the use of a constant read-in system:

Elapsed time(up) mode: present value≥set value

Remaining time(DOWN) mode: elapsing time≥ set value(the present value is set to 0)

Note: when in the remaining time mode, the amount the set value is changed is added to or subtracted from the present value.

Connection

Make sure that wiring is correct.

Mounting

Tighten two mounting screws on the adapter. Tighten them alternately, a little at a time, so as to keep them at an equal tightness.

TC-Pro panel surface is water-resistant. In order to prevent the internal circuit from water penetration through the space between the TC-Pro and operating panel, attach a waterproof packing between TC-Pro and installation panel and secure the waterproof packing with the BK-62 flush-mounting adapter.

Operation environment

√   Use the product within the rating specified for submerging in water and exposure to oil.

√   Do not use in location affected by excessive vibration or shock

√   Do not use the product in locations subject to dust, corrosive gases, or direct sunlight.

√   Separate the input signal devices, input signal cables, and the product from the source of noise or high-tension cables producing noise.

√   Separate the product from the source of static electricity when using the product in an environment where a large amount of static electricity is produced (e.g. forming compounds, powders, or fluid materials being transported by pipe).

√   Organic solvents (such as paint thinner), as well as very acidic or basic solutions might damage the outer casing of the TC-Pro.

√   Use the product within the rating specified for temperature and humidity.

√   Do not use the product in locations where condensation may occur due to high humidity or where temperature changes are severe.

√   Store at the specified temperature. If TC-Pro has been stored at a temperature of less than -10℃, allow TC-Pro to stand at room temperature for at least 3 hours before use.
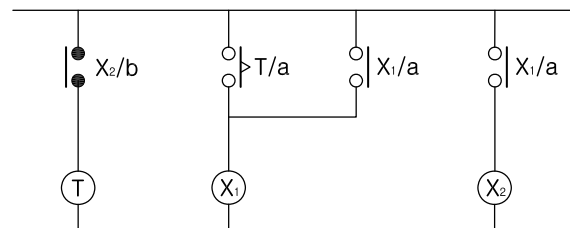
Note: ⊗ auxiliary relay (e.g. MY relay)

Insulation

There is basic insulation between power supply and output terminals.

Input and output terminals are connected to devices without exposed charged parts.

Input and output terminals are connected to devices with basic insulation that is suitable for the maximum operating voltage.

Additional Information (Using the operation keys)

■ Counter Operation

■ Tachometer Operation

```
                              Power ON
                                 │
                                 ▼
Function setting mode  ◄───   Run mode   ───►  Communication setting mode

    Tachometer output mode                         Transmission speed
              │ MODE                                      │ MODE
       Counting speed                                Parity check
              │ MODE                                      │ MODE
    Decimal point position                            Date bit
              │ MODE                                      │ MODE
       Prescale value                                 Stop bit
              │ MODE                                      │ MODE
     Average processing                          Station address (HEX)
              │ MODE                                      │ MODE
      Auto-zero time                              Communication OFF
              │ MODE
       Startup time
              │ MODE
    NPN/PNP input mode
              │ MODE
    Key protection level


        Measurement value
              │ MODE
        Measurement value
        OUT1 set value
              │ MODE
        Measurement value
        OUT2 set value


                                              Key protection switch


                                              Function configuration
                                              selection
```

MODE (3s min.)

MODE + (3s min.)

MODE + (3s min.)

MODE + (3s min.)

List of Settings

Fill in your set values in the set value column of the following tables and utilize the tables for quick reference.

Key protection switch mode

Parameter name	parameter	Setting range	Default value	Unit	Set value
Key protection selection	kp	off/on	off	---	

Communication setting mode

Parameter name	parameter	Setting range	Default value	Unit	Set value
Transmission speed	baud	12/24/48/96/144/192/288/384/576	96	Bps	
Parity Check	pari	none/odd/even	none	---	
Date bit	data	8bit/7bit	8bit	bits	
Stop bit	stop	1bit/2bit	1bit	bit	
Station address (Hex)	addr	01 to ff	01	---	
Communication OFF	cosh	on/off	on	---	

Parameter configuration selection mode

Parameter name	parameter	Setting range	Default value	Unit	Set value
Configuration selection	func	1cnt/2cnt/tcnt/bcnt/dcnt/taco	1cnt	---	

■ Setting for Counter Operation

Run Mode

1-stage counter

Parameter name	parameter	Setting range	Default value	Unit	Set value
Present value	---	-99999~999999	000000	---	
Set value		000000~999999 (For conditions other than those described in note 1.) -99999~999999 (See note 1.)	000000	---	

2-stage counter

Parameter name		parameter	Setting range	Default value	Unit	Set value
Screen 1	Present value	---	-99999~999999	000000	---	
	Set value 1	---	000000~999999 (For conditions other than those described in note 1.)			
			-99999~999999 (See note 1.)			
Screen 2	Present value	---	-99999~999999	000000	---	
	Set value 2	---	000000~999999 (For conditions other than those described in note 1.)			
			-99999~999999 (See note 1.)			

Total and preset counter

Parameter name		parameter	Setting range	Default value	Unit	Set value
Screen 1	Present value	---	-99999~999999	000000	---	
	Set value 1	---	000000~999999 (For conditions other than those described in note 1.)			
			-99999~999999 (See note 1.)			
Screen 2	Total count value	---	-99999~999999	000000	---	

Batch counter

Parameter name		parameter	Setting range	Default value	Unit	Set value
Screen 1	Present value	---	-99999~999999	000000	---	
	Set value	---	000000~999999 (For conditions other than those described in note 1.)			
			-99999~999999 (See note 1.)			
Screen 2	Batch count value	---	000000~999999	000000	---	
	Batch count set value	---	000000~999999			

Dual counter

Parameter name		parameter	Setting range	Default value	Unit	Set value
Screen 1	Dual count value	---	-99999~999999	000000	---	
	Dual count set value	---	000000~999999 (For conditions other than those described in note 2.)			
			-99999~999999 (See note 2.)			
Screen 2	CP1 Present value	---	-99999~999999	000000	---	
	CP2 Present value	---	000000~999999 (For conditions other than those described in note 1.)			
			-99999~999999 (See note 1.)			

Note:
1. The input mode is increment/decrement mode and the output mode is K-2, D, L or H.
2. The dual count calculating mode is subtraction mode and the output mode is K-2, D, L, or H.

Function setting mode

Parameter name	parameter	Setting range	Default value	Unit	Set value
Input mode	cntm	up/down/ud-a/ud-b/ud-c (See note 1.)	up	---	
Dual count calculating mode	caln	add/sub (See note 1.)	add	---	
Output mode	outm	n/f/c/r/k-1/p/q/a/k-2/d/l/h (See note 2.)	n	---	
One-shot output time	otim	000.001~999.999	000.500	s	
One-shot output 2 time	otm2	000.001~999.999	000.500	s	
One-shot output 1 time	otm1	hold/000.001~999.999 (See note 3)	hold	s	
Counting speed	cnts	30Hz/5KHz	30Hz	---	
Input signal width	iflt	20ms/1ms	20ms	---	
Decimal point position	dp	----/---.-/--.--/-.---	----	---	
Prescale value	pscl	000.001~999.999	001.000	---	
NPN/PNP Input mode	imod	NPN/PNP	NPN	---	
Key protection level	kypt	kp-1/kp-2/kp-3/kp-4/kp-5	kp-1	---	

Note:
1. The setting range varies with the output mode.
2. The setting range varies with the model and the input mode.
3. HOLD can not be set when the output mode is K-2.

■ Setting for tachometer operation

Run mode

Parameter name	parameter	Setting range	Default value	Unit	Set value
Measurement value	---	000000~999999	000000	---	---
Measurement value	---	000000~999999	000000	---	---
OUT1 set value	---	000000~999999	000000	---	
Measurement value	---	000000~999999	000000	---	---
OUT2 set value	---	000000~999999	000000	---	

Function setting mode

Parameter name	parameter	Setting range	Default value	Unit	Set value
Tachometer output mode	totm	hilo/area/hihi/lolo	hilo	---	
Counting speed	cnts	30Hz/10KHz	30Hz	---	
Decimal point position	dp	----/---.-/--.--/-.---	----	---	
Prescale value	pscl	000.001~999.999	001.000	---	
Average processing	aug	off/2/4/8	off	---	
Auto-zero time	autz	00.01~99.99	99.99	s	
Startup time	stmr	00.01~99.99	00.00	s	
NPN/PNP Input time	imod	NPN/PNP	NPN	---	
Key protect level	kypt	kp-1/kp-2/kp-3/kp-4/kp-5	kp-1	---	

Comparison Table :

TC-Pro481CRA

TC-Pro481CRD

TC-Pro481CTA

TC-Pro481CTD

TC-Pro481SRA

TC-Pro481SRD

TC-Pro481STA

TC-Pro481STD

TC-Pro481CRA-D

TC-Pro481CRD-D

TC-Pro481CTA-D

TC-Pro481CTD-D

TC-Pro481SRA-D

TC-Pro481SRD-D

TC-Pro481STA-D

TC-Pro481STD-D