TD－320A

DIGITAL INDICATOR

OPERATIONAL MANUAL

FEB. 1994
REV. 2. 00-00

TABLE OF CONTENTS

1. MAIN FEATURES

◆ EASY CALIBRATION

Various types of calibration like the Equivalent Input Calibration are extremely easily carried out by simple key-operation.

◆ EASY KEY-OPERATION

Function-Oriented System provides very simple and easy functional setting.

◆ NOV RAM

NOV RAM (non-volatile memory) is built-in so that important data such as entered values and calibration values will not be cancelled in case of power failure.

◆ EXCELLENT STABILITY

Low Noise Pre-amplifier ensures remarkable stability of indicated values.

◆ HIGH SPEED CONVERSION

High speed conversion (1066 cycles per second)
Digital Peak Hold is free from drooping of values.

◆ SERIAL DATA OUTPUT

Dual-Wire Serial Output is equipeped as standard so that the Large-sized Display, Printer, Analogue Comverter (4 20mA, 0 10V) for SI/F Series can be directly connected to TD-320A.

◆ OPTIONAL UNITS

BCD Data Output, RS-232C Communication Interface

◆ HIGH NOISE-RESISTANCE

All the digital in/ outputs including the Serial Output and BCD Data Output are insulated with photocouplers.

◆ SELF-CHECK (SELF-DIAGNOSIS) FUNCTION

Internal circuits are automatically checked and errors are detected.

2.PREPARATION

ANY DAMAGES DURING TRANSPORTATION ?

Right after being delivered to your hand, please unpack the shipping case and make sure if nothing has been damaged during its transportation.

CORRECT ITEMS DELIVERD ?

Packing List it attached to the shipping case. Please make sure if the delivered goods are right items that you ordered.

STADARD ACCESSORIES ACCOMPANIED ?

AC Power Cord		1 Unite
Spare Fuse (0.5A)		1 Piece
Mini-Screwdriver		1 Unit
B.C.D Output Connector (when OP-3 TD-3203 ordered)		1 Unit
Operation Manual for TD-320A		1 Copy

> TD-320A is carefuly manufactured and thoroughly inspected by our qualified engineers before its shipment from our factory. Therefore, its quality and function are fully guaranteed by us. However, in case of any damages or erroneous functions found, please immediately report to us such conditions directly or via our sales agent from whom you purchased.
>
> When you return TD-320A to us for its repare, please pack it just in the same way and in the same box as it was delivered to you. If you no longer have the same box and packing materials, you are requested to pack it as follows.

(1) First, TD-320A shall be wrapped with a strong wrapping paper or plastic sheet.

(2) Please use a carton box of which size shall be about 10 cm larger than each corner of the housing size of TD-320A .

(3) In the space between TD-320A and the carton box, some shock-absolving materials shall be filled.

(4) The carton box shall be sealed firmly with an adhesive tape and reinforced by a tape-band if necessary.

3.SAFTY MEASURE

When you start operating TD-320A Digital Indicator,you are requested to pay your special attention to the following points.

◆ **TD-320A MUST BE GROUNDED**

In order to avoid any hazards of electric shocks and static electricity, the Terminal F.G in the rear panel must be grounded.

The F.G terminal is connected to the ground terminal of the noise filter of the AC power input part and the frame.

The terminal 19 is for connecting the shield of the transducer input cable to the frame.

◆ **DANGEROUS OPERATING AREA**

TD-320A must not be operated in areas where any inflammable gas or steam is existing. If you have any question on this matter,please contact us.

◆ **POWER SUPPLY SOURCE**

The power input terminal of AC 90~ 110 V, 50/ 60 Hz as standard.

◆ **OPERATING AND STORAGE TEMPERATURE**

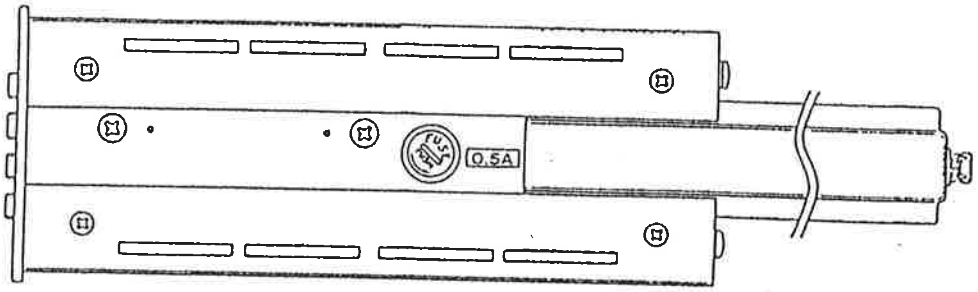
Operating temperature: -10℃ ~ +40℃

Storage temperature : -40℃ ~ +80℃

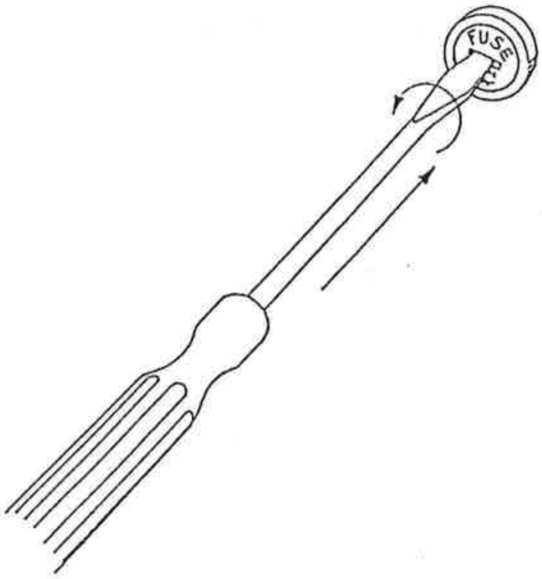
4. FUSE REPLACEMENT

1.) Remove the screws in the rear panel and pull out the rails.

front



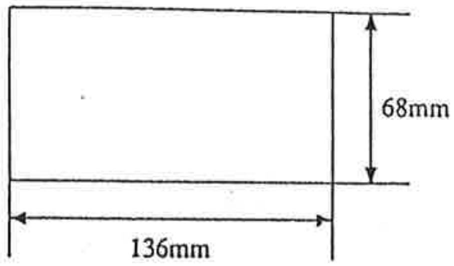
2.) Turn the screwdriver counterclockwise and pull out the fuse holder. The capacity of the fuse is 0.5A.



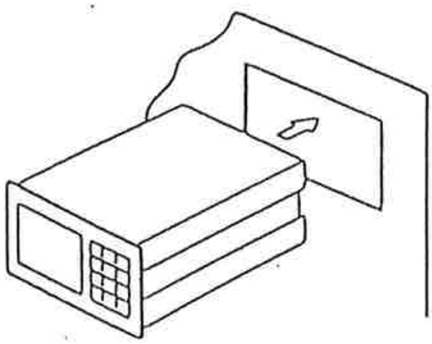
3.) Insert a new fuse into the fuse holder and fit the holder, turning it clockwise.

5 . INSTALLATION

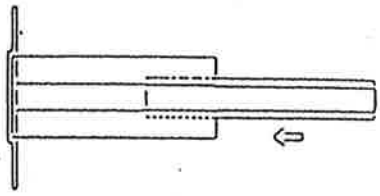
1.) Cut out a panel.
size 136 W × 68 H



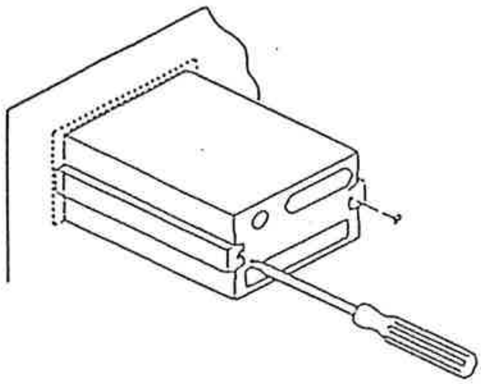
2.) Remove the metal fittings of TD320A and insert it into the panel.



3.) Insert the metal fittings from the rear to the both sides of TD-320A.

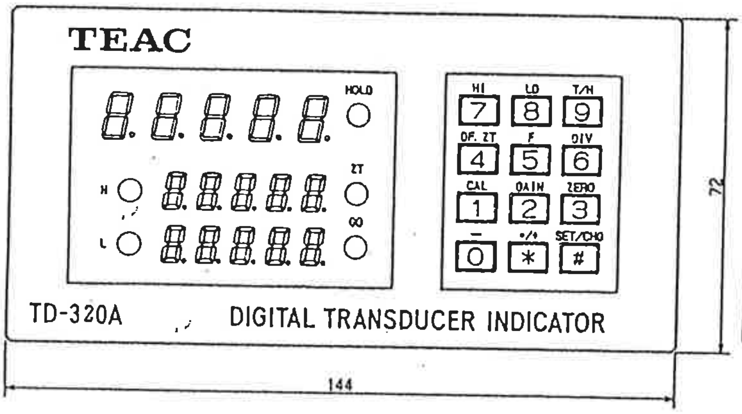


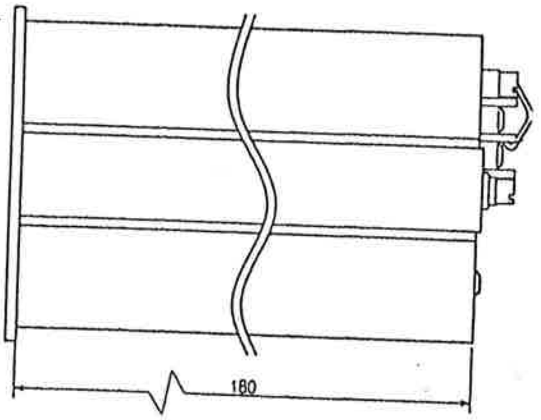
4.) Fix the metal fittings firmly with 4mm vis.



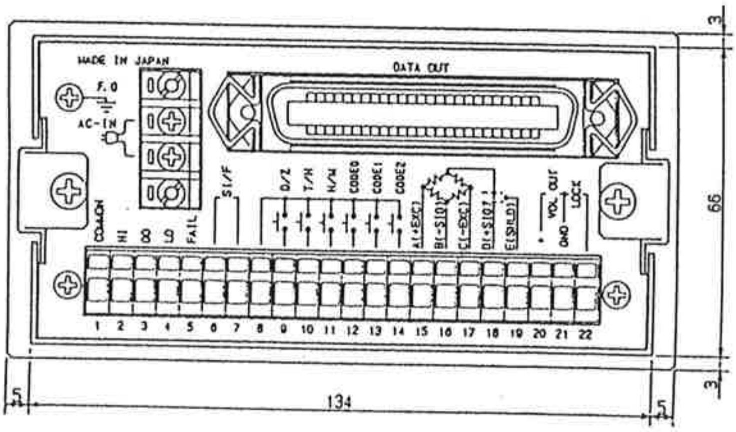
When it is necessary to be moved after installation, be careful any strong shocks or vibrations will not be given to TD-320A.

6. DIMENSIONS





FRONT PANEL **SIDE VIEW**



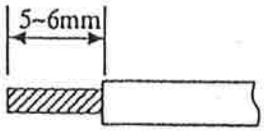
REAR PANEL

UNIT: mm

7. CONNECTION GUIDE (TERMINAL BOARD AT REAR PANEL)

◆ Connection of the Cage Clamping System Terminals

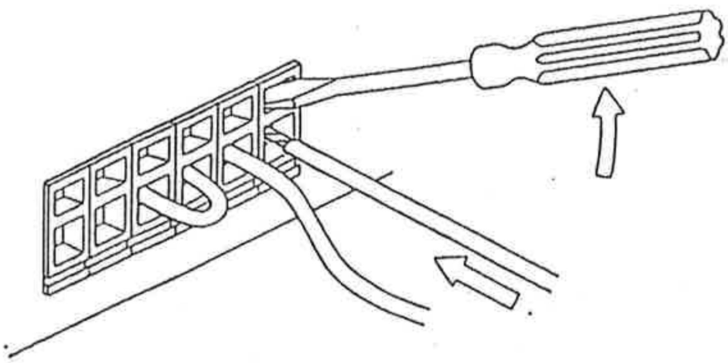
1.) Peal the cover, 5~ 6 mm long, of the cable to be connected.



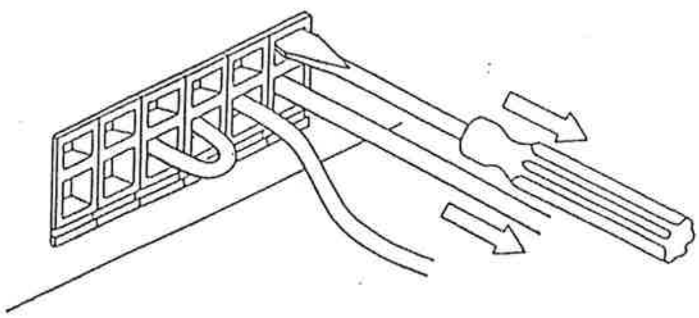
2.) Twist the bare wire so as to be easily inserted into the terminal hole.

3.) **Insert the screwdriver attached to TD-320A into the upper hole and lift it upward.**

4.) Insert the twisted wires into the lower hole.



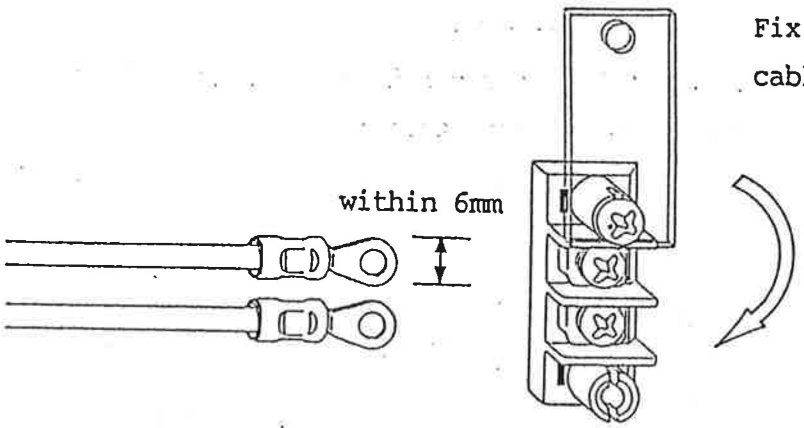
5.) Pull the screwdriver out from the upper hole.



6.) Make sure if the cable is clamped firmly and would not come out even if it is pulled out with a little force.

* The size of the cable is 0.2~ 2.5 mm2.
* It is not necessary to solder the cable wires or to fix a solderless terminal for connection.
* If several cables are to be connected to the same hole, twist those cable wires together and then insert them into the hole.

◆ Connection of the power input terminals



Fix a solderless terminal (M3) to the cable to be connected.

[AC IN]

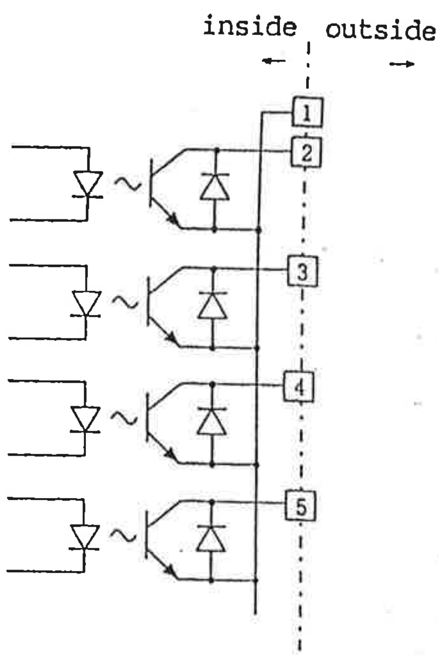
The power input terminal of AC 90~110 V, 50/ 60 Hz as standard.

[F.G]

The ground terminal. In order to protect TD-320A from any hazard of electric shocks and static electricity, the FG termonal must be grounded with a thick cable (about 0.75 mm^2).

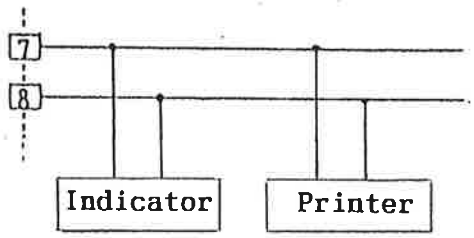
[No 1, 2, 3, 4, 5] COMMON, HIGH, GO, LO, FAIL

The output circuits of the HI, GO, LO and FAIL signals are open-collectors. The number 1 is a common. The capacity of the open-collector output is 30mA and its withstand voltage is 30V.



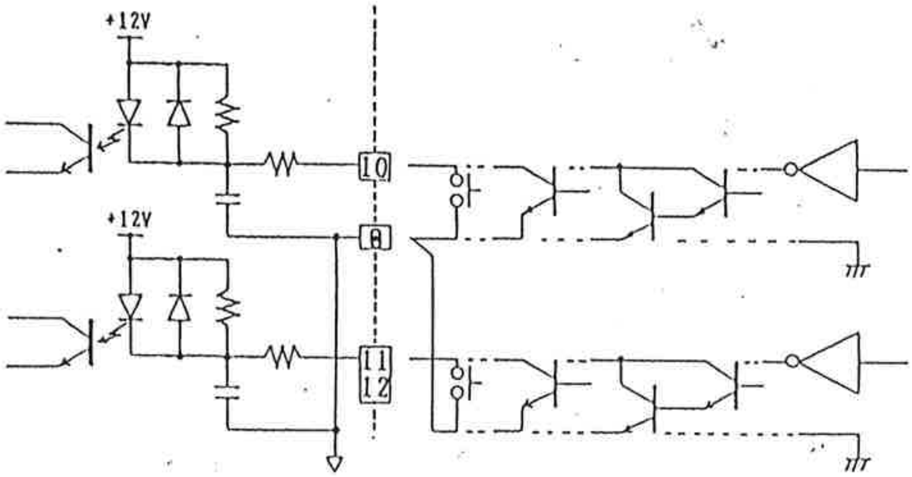
[6,7] SI/F SERIAL OUTPUT

Terminal : and · are of Non-Polarity. External S I/F can be connected in parallel upto 3 units. Shielded Cables are not required, but the cables should be connected separately from AC lines and other lines with noises.



[8,9,10,11,12,13,14,] D/Z,T/H,H/M (DIGITAL ZERO and TRACK-HOLD COMMAND INPUT) CODE 0 CODE2 (HIGH/LOW LIMIT VALUE

The connections are shown below. Terminal 8 is for Common.
Input can be made both for connecting points like Relay and Switch, and for non-connecting points like TTL Open Collector and Transistor.



Shielded Cables are not required, but the cables should be connected separately from AC lines and other lines with noises.

CAUTION

CAUTION FOR D/Z, T/H, H/M EXTERNAL INPUT

(1) External elements shall withstand 10 mA or more current flowing in circuits.

(2) Current Leakage of external elements shall be within 100 μA.

(3) External elements shall be of 2V or less voltage when Terminal 9-10, 9-11 and 9-12 are in a short-circuit.

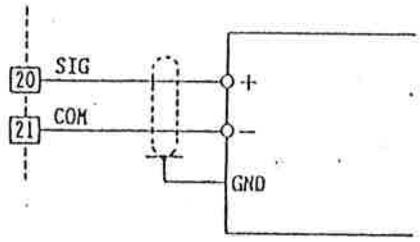
(15, 19) TRANSDUCER INPUT

Upto the unit of 350 Family transducers can be connected in parallel with each other.

For further details, please refer to TRANSDUCER CONNECTION in "11".

(20, 21) VOLT OUTPUT

Voltage Output terminals.
Terminal 20 is for signal and
Terminal 21 is for common.



CAUTION

CAUTION TO VOLTAGE OUTPUT

(1) VOL OUT is not isolated from the internal circuits.
When connecting to an external equipment, the shielded cable should be used and its length should be within 2 or 3 meters.
If a longer cable is used, it might be influenced by noise.

(2) Do not have it short-circuited for a longer time than one hour.
Otherwise, it will cause troulbes.

(3) Do not apply an external voltage to the Voltage Output Terminals.
Otherwise, it will break TD-300A ..

(22) LOCK (CALIBRATION LOCKOUT)

This terminal is not for external interface. (Do not use it for external.)
Please refer to Calibration in " "

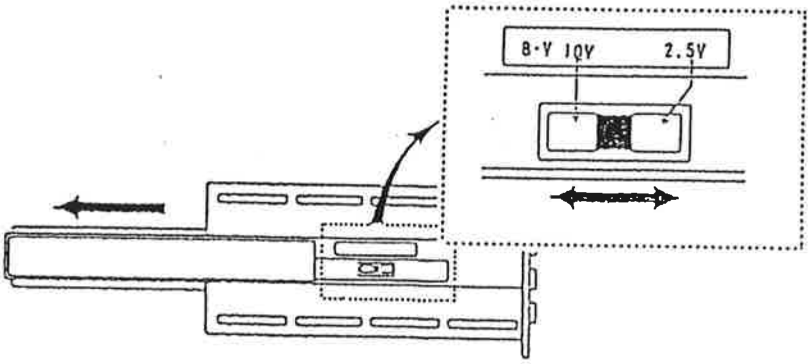
8.CONNECTION OF A TRANSDUCERS

The excitation voltage of TD-320A can be switched to DC10V or DC2.5V.
One four- wire type transducer of 350Ω can be connected.

1) Selection of the excitation voltage

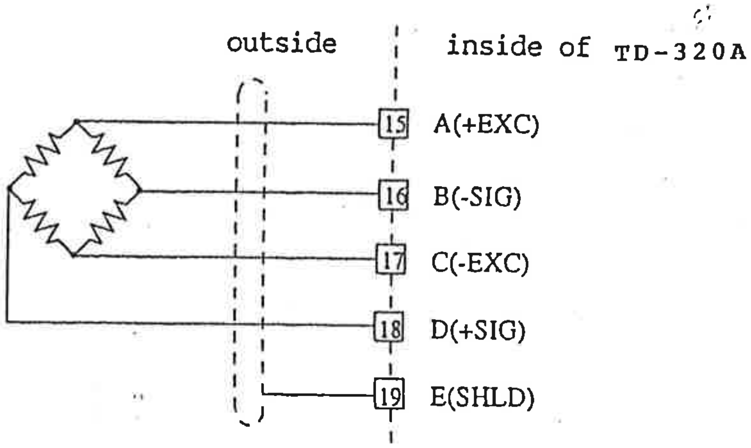
Make sure that the excitation voltage indicated on the upper cover of TD-320A is suited to that of the transducer. The excitation voltage of TD-320A must be within the recommended excitation voltage of the transducer.

In general, select 10V for a transducer whose excitation voltage is more than 10V, and select 2.5V for less than 10V.



If you apply higher voltage than the recommended excitation voltage of the sensor, the sensor will have heat and the drift will be bigger and the sensor will be likely to be broken.

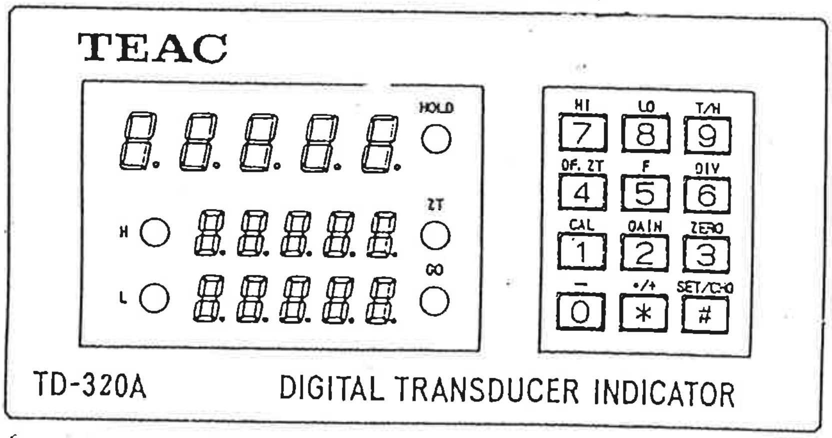
2) Connection of a transducer



Connect a transducer to TD-320A with four-wire shielded cable separately from AC power wiring and other noise generating wiring. Use a thick cable (about 0.75mm²) for the Terminal 19 and ground it.

9. FUNCTIONAL DISCRIPTION

(FRONT PANEL)



STATUS INDICATOR UNIT

These LEDs indicate the present conditions of TD-320A under a normal operation. During presetting, LEDs indicate the functions being preset. However, the following only describe under a normal operating conditions.

[HI]

ON, When an indicated value is higher than the upper limit preset value,and the high limit transister is operated.

[LO]

ON, When an indicated value is lower than the lower limit preset value,and the low limit transister is operated.

〔HOLD〕

ON, when an indicated value equals to the hold preset value.
There are two kinds of Hold Functions (i.e. SAMPLE-HOLD and PEAK-POINT-HOLD. In both cases, an indicated value shows that it is at the same value as that of External T/H Signal or T/H Key Setting.

〔ZT〕

ON, when Zero Tracking is working.

[GO]

ON, When an indicated value is between lower and higher limit,and the go signal trasister is operated.

NUMERICAL INDICATOR

A measured value and each value of the setting items are indicated. Usually a value corresponding to the output of a transducer or an overflowed value is indicated.

oFL1 (overflow 1) : minus overflow of the A/D converter
oFL2 (overflow 2) : plus overflow of the A/D converter
oFL4 (overflow 4) : indicated value overflowed (indicated value > 9999)

* Overflow 1 and 2 are alarm indications caused by mis-connection or a break-down of a transducer,overload, a snapping or bad connection of a wire etc.
* Overflow 4 is an alarm indication caused by mis-inputting of calibration.

SETTING KEY PAD

[0] (—) ··· minus sign and digit '0'

[*] (·/+) ··· decimal point, plus sign and cancellation

[#] (SET/CHG) ··· set value input start command and set value entry command

[1] (CAL) ··· equivalent input calibration and digit '1'

[2] (GAIN) ··· actual load calibration and digit '2'

[3] (ZERO) ··· digital zero and digit '3'

[4] (DF.ZT) ··· selection of digital filter or zero tracking and digit '4'

[5] (F) ··· digital tare subtraction and digit '5'

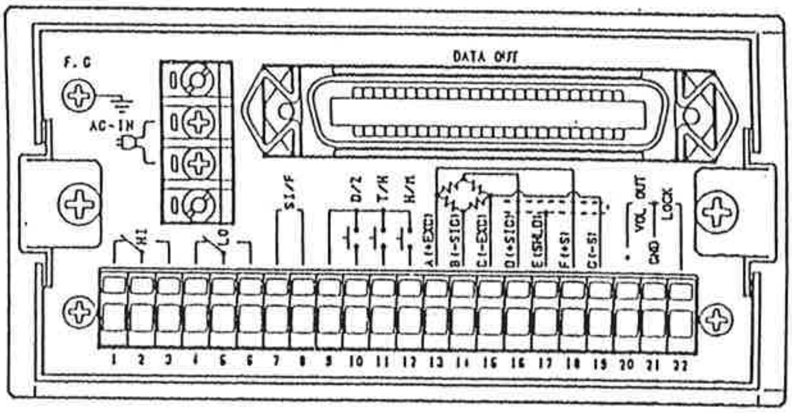
[6] (DIV) ··· minimum scale value and digit '6'

[7] (HI) ··· high limit and digit '7'

[8] (LO) ··· low limit and digit '8'

[9] (T/H) ··· selection of the hold mode, hold command and digit '9'

(REAR PANEL)



[AC-IN]
Input power supply terminal.

[F.G]
Ground terminal.To protect from sny damages of electric or electrostatic shocks, this terminal shoud be grounded.

[No.1,2] HI OUT
The output of the HI signal are open-collectors.The number 1 is a common. ON,When an indicated value is higher than tha upper limit preset value.

[No.1,3] GO OUT
The output of the GO signal are open-collectors.The number 1 is a common. ON,When an indicated value is between lower and higher limit.

[No.1,4] LO OUT
The output of the LO signal are open-collectors.The number 1 is a common. ON,When an indicated value is lower than the lower limit preset value.

[No.1,5] FAIL OUT
The output of the FAIL signal are open-collectors.The number 1 is a common. ON,When it is normal operation.

[No 6 and 7]   SI/ F

The exclusive serial data output for connecting an external display and a printer etc.

[No 8 and 9]   D/Z

The digital zero command input. The digital zero is carried out when these terminals are short-circuited. This input does not work when the terminal 21 and 22 are opened.

[No 8, 10 and 11]   T/H, H/M

The hold command input. There are four kinds of hold mode.

[No 8, 12, 13 and 14]   CODE 0, 1 and 2

Select the high and low limit values among the eight preset limit values. Refer to the section 'Multiple High and Low Limit Comparison'.

[No 15, 16, 17, 18 and 19]   Sensor input

One sensor of 350Ω can be connected.

[No 20 and 21]   VOL OUT

The analogue output terminals. Voltage corresponding to the input of a sensor is outputted. The output level is about 2V per input of 1mV/V.

[No 21 and 22]   LOCK

The calibration inhibiting input terminals. When these terminals are short-circuited, calibration is inhibited and the initial zero cannot be changed. In order to prevent mis-operation, short-circuit these terminals after calibration.

FUSE

A fuse whose capacity is 0.5A is inserted into the power source (AC IN).

OP SPACE

The following are Optional Functions.

(1) B.C.D Data Output   TD-3203
(2) RS-232C Data Output   TD-3204

10.KEY-SWITCH OPERATION

● KEY-SWITCH OPERATION BASED ON OBJECT PRIORITY ORDER

Key-Switch has two different operation functions (i.e. Presetting Subject and Figure Input) and is operted in Automatic Priority Order.

TEN-KEY AS SELECTION SWITCHES

Presetting Subjects can be selected by Ten-Key. Selections can be repeated and revised as many times as necessary. Once # Key is pushed, the selection is finalized and the function is commanded or the presetting is registered.

PRESETTING DATA DISPLAY

If a presetting subject is selected, its preset data are shown in the display panel. At the same time, [H I] LED is flashing to indicate the condition. [L O], [HOLD], [Z T] and [GO] are shown in the page .

PRESETTING TO BE STARTED BY # KEY

Push # Key so that you can input a figure as a selecting subject. [H I] LED is changed from flashing to lighting, and MSD (Most Significant Digit) of a displayed figure is flashing.

TEN-KEY AS FIGURE INPUT SWITCHES

TEN-KEY is turned from Function Keys to Figure Keys. A flashing point is the place where you can input a figure. When a figure is input, a flashing point is shifted to its next digit (i.e. the second largest digit).

If LSD (Least Significant Digit) is input, the largest digit starts flashing again. If wanted, a new figure can be input again for correction.

REGISTRATION BY # KEY

If a displayed figure is correct and corresponds to your aiming subject, its registration can be made by pushing the # Key regardless a flahsing point. Now, a transducer input is to be displayed.

If a new registration is required, start again selecting a presetting of subject.

NOTICE

(1) Presetting Unit is based on First Priority Object System and therefore, + Key, - Key, Decimal Point, etc. become effective only when it is in order.

(2) Only when a registration of Upper/Lower Limit Presettings is input, Minus by 0 Key and Plus by . * Key become effective.

(3) Key becomes Decimal Point Function Key only while registering figure for Simulative Calibration and for Real Loaded Calibration. In the other cases, Decimal Point is automatically determined and displayed.

status display LED					item selection key	setting item
HI	LO	HOLD	ZT	GO		
✳	○	○	○	○	— [0]	self-check
✳	○	○	○	●	CAL [1]	entry of an output value of a sensor for the equivalent input calibration
✳	○	○	●	○	GAIN [2]	entry of a value for the equivalent input calibration and actual load calibration
✳	○	○	●	●	ZERO [3]	entry of a zero point for calibration and the auto zero
✳	○	●	○	○	DEZT [4]	selection of the digital filter or zero tracking
✳	○	●	○	●	F [5]	digital tare subtraction
✳	○	●	●	○	DIV [6]	minimum scale value
✳	○	●	●	●	HI [7]	high limit
✳	●	○	○	○	LO [8]	low limit
✳	●	○	○	●	T/H [9]	selection of the hold mode

○ ----- LED is off.

● ----- LED is on.

✳ ----- LED is on or blinking.

After pressing a key, do not allow more than twelve seconds for pressing the next key; otherwise, the mode will automatically return to a display of a value of a sensor and all the inputted values become ineffective. Return to selection of the setting item if you will continue setting.

11.CALIBRATION

EQUIVALENT INPUT CALIBRATION

What is Equivalent Input Calibration ? Calibration can be done just by registering a rated output of transducer, but not by input of an actual load.

For Example :

Heavy Weight Measurement	:	2.001 mV/V - 100.0 kgf
Pressure Measuremnt	:	2.002 mV/V - 10.00 kgf/ cm^2
Torque Measurement	:	2.502 mV/V - 15.00 kgf・m

By registering the above values, Gain will be automatically adjusted and fixed.

◆ EQUIVALENT INPUT CALIBRATION PROCEDURE

Release LOCK (Terminal 21 and 22) located at the rear panel.
Make Terminal 21 and 22 (LOCK) open.
If LOCK is made by KEY-SWITCH, release it as follows.

[*] → [#] → [1] → [1] → [#] → [0] → [#]

NOTICE

> LOCK by Terminal Board and LOCK by KEY-SWITCH are both for the LOCK Function (Double Function). If LOCK is made by the both, you have to release the both LOCKs.
> For KEY-SWITCH LOCK, please refer to KEY-SWITCH LOCK FUNCTION in the page 33.

Register the minimum figure for digital value changes (i.e. select a figure among 1 to 100). When **TD-320A** is delivered to you, 001 was registed for this purpose. If necessary, this registration can be done as follows.

Registration can be repeated after Input of LSD (Least Significant Digit) is finished.

[6] → [#] → (0 0 0 (Minimum Value Input, 1 to 100) (Input at a flashing point)) → [#]

1) Enter the rated value of the transducer

After the least significant digit is inputted, you can re-input a value from the most significant digit.

CAL [1] → SET/CHG [#] → Input the rated value of the sensor. Input a digit to a blinking place.
For example, to input 2.001mV/V, press GAIN [2] — [0] — [0] CAL [1]
The decimal point is fixed.
→ SET/CHG [#]

After the least significant digit is inputted, you can re-input a value from the most significant digit.

→ Input the rated load equivalent to the entered rated value of the sensor and the decimal point.
For example, to input 100.00kg, press CAL [1] — [0] ·/+ [*] — [0] — [0]
The decimal point is deleted by pressing ·/+ [*] key while the least significant digit place is blinking.
→ SET/CHG [#]

The decimal point is indicated to the right of the blinking place.
Input the decimal point ·/+ [*] in the desired place, then input a digit to a blinking place.

2) Enter the zero point without any load (input is zero).

ZERO [3] → SET/CHG [#]

The zero point entered here is the initial zero point data, not the normal digital zero.

3) Inhibit calibration (LOCK).

Short-circuit the terminal 21 and 22 of the rear terminals in order to prevent mis-operation.

Calibration values and the zero point are stored in the NOV RAM (non-volatile memory) so that they will not cancelled in case of power failure.

◆ACTUAL LOAD CALIBRATION

What is Actual Load Calibration ?

When a transducer is loaded actually, its indicated value is converted to a certine figure, which is called as Actual Load Calibration.

◆ACTUAL LOAD CALIBRATION PROCEDURE

- Release LOCK by disconnecting Terminal 21 and 22 at the rear panel. (Terminal 21 and 22 are open now.)

  If LOCK is made by KEY-SWITCH, release it as follows.

  •/+ [*] → SET/CHG [#] → CAL [1] → CAL [1] → SET/CHG [#] → — [0] → SET/CHG [#]

NOTICE

> LOCK by Terminal Board and LOCK by KEY-SWITCH are both for LOCK Function (Double Function). If LOCK is made by the both, you have to release the both LOCKs.
>
> For KEY-SWITCH LOCK, please refer to KEY-SWITCH LOCK FUNCTION in the page 33.

Register Minimum Stepping Value.

Select a value between 1 to 100 as Minimum Stepping Value.

When delivered from our factory, 001 is registered already. If you use this value, you do not have to register it again.

The following is the registration proceudre.

Registration can be repeated after Input of LSD (Least Significant Digit) is finished.

DIV [6] → SET/CHG [#] → { 0 0 0 Input a value selected from 1 to 100 at a flashing digit. } → SET/CHG [#]

Register Zero Point under Non-Loaded (Input Zero) Condition.

ZERO [3] → SET/CHG [#]

NOTICE

> Zero Point Data registered here are Initial Zero Point Data, not Digital Zero under a normal operation.

4) Apply an actual load to the transducer and enter the indicated value.

GAIN [2] → SET/CHG [#] → (Input the indicated value of the actual load and the decimal point.
For example, to input 100.00kg, press
CAL [1] — [0] ·/+ [*] — [0] — [0]) → SET/CHG [#]

The decimal point is indicated to the right of the blinking place.
Input the decimal point ·/+ [*] in the desired place, then input a digit to a blinking place.

The decimal point is deleted by pressing ·/+ [*] key while the least significant digit place is blinking.

5) The output voltage of the transducer can be indicated. Record this value so that the equivalent input calibration can be carried out with this value when TD-320A is broken and replaced with a new one and gain calibration is carried out.

CAL [1] → (The output voltage of the sensor is displayed
□. □□□mV/V)

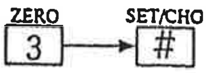
6) Inhibit calibration (LOCK).
Short-circuit the terminal 21 and 22 of the rear terminals in order to prevent mis-operation.

Calibration values and the zero point are stored in the NOV RAM (non-volatile memory) so that they will not cancelled in case of power failure.

12, DIGITAL ZERO

Digital Zero is a function which compulsorily changes a present indicated value to 'zero'.

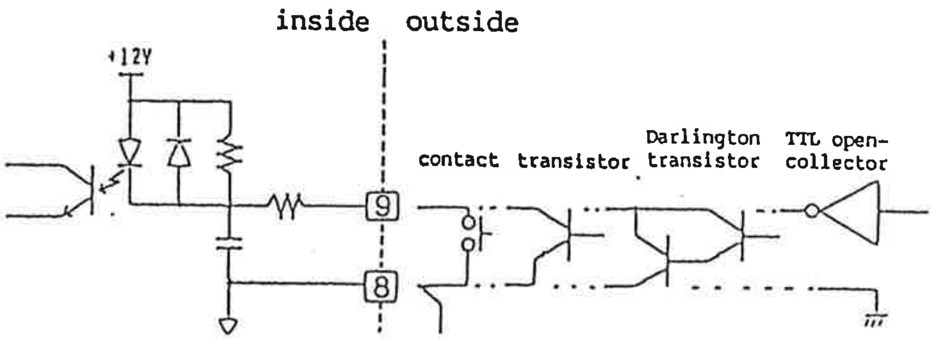
◆ Digital zero by the key-switches



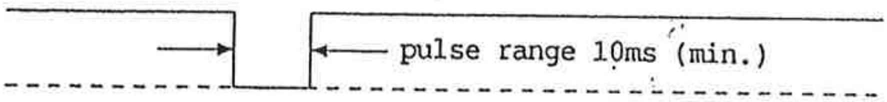
The digtal zero is operated and a present indicated value is changed to zero.

◆ Digital zero by an external signal (D/Z input signal)

The moment the terminal 8 and 9 (the D/Z input signal of the rear terminals) are short-circuited, the digital zero is operated.
This input is carried out either with a contact (a relay or a switch) or with a contactless switch (a TTL, a transistor etc).



D/Z input



The digital zero will not be operated in the calibration mode (when the terminal 21 and 22 [LOCK] are opened). It is impossible to zero the voltage output by the digital zero.

13.DIGITAL ZERO SUBTRACTION

14-1. What is DIGITAL TARE SUBTRACTION FUNCTION ?

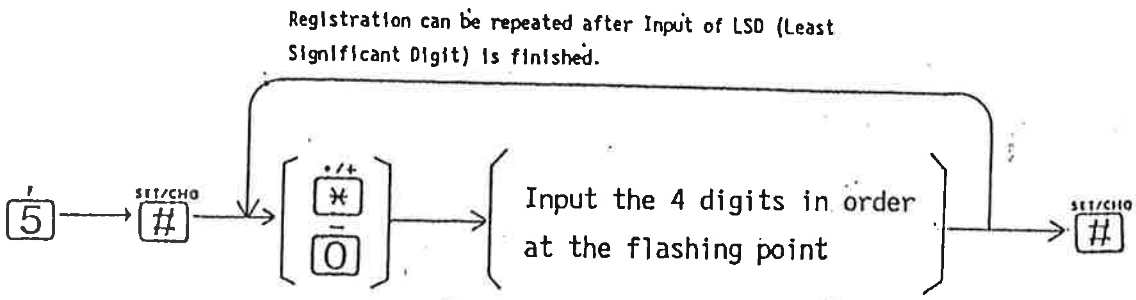
A previously known Tare Weight can be subtracted from the displayed value and make only Net Weight Value displayed by this function.
If a gross weight is loaded, you can subtract the tare weight from the displayed value just by input the known tare value.
Also if Zero Calibration is not possible, you can adjust the zero point by input of an appropriate value.

NOTICE

(1) If a setting value is with "-" (Minus Sign), it will be added to the displayed value.

(2) In case that the displayed value is needed to be changed to an aiming value, but it can not be done by calculated tare subtraction, Zero is input for Digital Tare Subtraction and then, again calculate a tare value and input it so as to get the aimed value.

14-2. DIGITAL TARE SUBTRACTION PROCEDURE



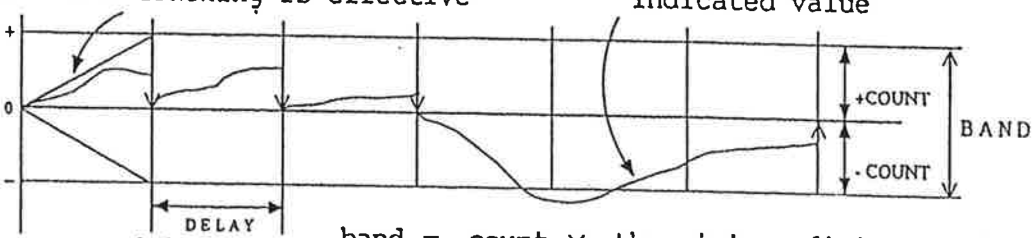
NOTICE

Digital Tare Subtraction Input Value is recorded in NOV RAM (Non-Evaporating RAM) so that the data will not be extinguished even in cases of power-failures.

14.DIGITAL FILTER AND ZERO TRACKING

Digital Filter is a function which averages an input signal of a sensor and stabilizes an indicated value.
Intensity of the built-in moving average method type digital filter can be selected according to status of an input signal.
This function is very effective when vibration of machinery is affecting a signal from a sensor and an indicated value may fluctuate.

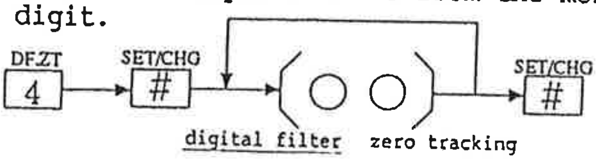
Zero Tracking is a function which automatically compensates a fine shift of the zero point. This function is effective to a shifted zero point of a transducer and TD-320A itself and lessens an error due to a shifted zero point caused by a small quantity of material left in a container.
After a fixed time delay, a shifted zero point less than a fixed range is automatically adjusted. Several combinations of a time to be delayed and a range (band) are available.



band = count × the minimum digital scale × 2

Selection of the digital filter and the zero tracking

After the least significant digit is inputted,
you can re-input a value from the most significant digit.



digital filter selection

0: no digital filter
1: less intense (2; moving average times)
2: (4)
3: (8)
4: (16)
5: (32)
6: intense (64)

Selected values are stored in the NOV RAM (non-volatile memory) and will not be cancelled in case of power failure.

zero tracking selection

0: no zero tracking
1: time delay 5 seconds, within 0± 1 count (range of shifted zero point)
2: 3 seconds, within 0± 1 count
3: 2 seconds, within 0± 1 count
4: 5 seconds, within 0± 2 counts
5: 3 seconds, within 0± 2 counts
6: 2 seconds, within 0± 2 counts
7: 5 seconds, within 0± 5 counts
8: 3 seconds, within 0± 5 counts
9: 2 seconds, within 0± 5 counts

15.LOCK BY KEY-SWITCH

This function is for inhibiting rewriting of calibration values and entered values to prevent mis-operation.

<u>Calibration inhibition (LOCK)</u>

The same function as the terminal 21 and 22 of the rear terminal (LOCK) is carried out by key-operation.

·/+ [*] → SET/CHG [#] → CAL [1] → CAL [1] → SET/CHG [#] → (0: release LOCK / 1: LOCK) → SET/CHG [#]

(2~ 9 are all treated as '1'.)

LOCK by the rear terminals and LOCK by the key-swithes are individual functions. Release both LOCKs in order to operate calibration.

<u>Inhibition of re-entry of values (LOCK)</u>

This function is for inhibiting rewriting of all the entered values and is carried out by key-switches.

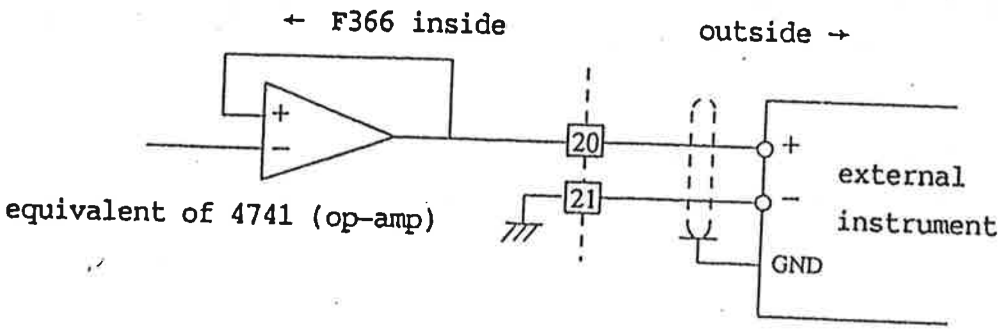
While this function is effective, a selected entered value is displayed after pressing the ten-key pad, but the mode will not be changed to the entry mode after pressing SET/CHG [#] key and the display returns to a measured value (an input value of a sensor). Release the LOCK in order to re-enter values.

·/+ [*] → SET/CHG [#] → CAL [1] → GAIN [2] → SET/CHG [#] → (0: release LOCK / 1: LOCK) → SET/CHG [#]

(2~ 9 are all treated as '1'.)

16. VOLTAGE OUTPUT

This voltage output is an interface to output analogue voltage in proportion to signal input of a sensor to external instruments. This interface is useful in connecting a recorder etc and observing and recording wave form.
Output level is about 2V per 1mV/V input.



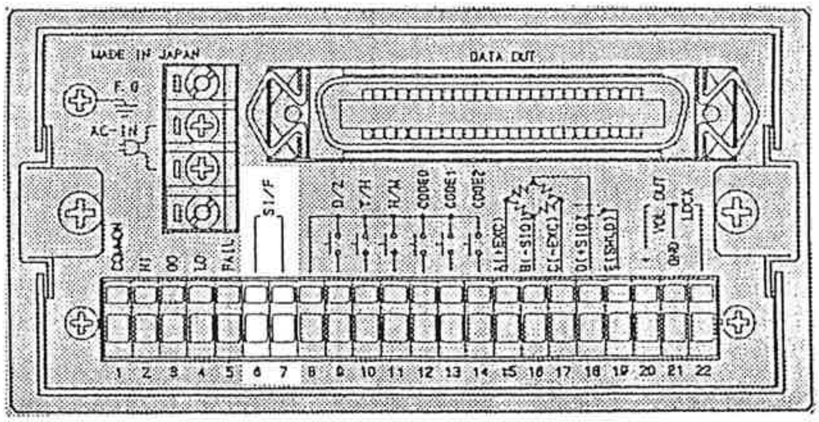
Output signal is derived from the circuit before the A/D conversion of input signal of a sensor. Although this is in proportion to an indicated value, it is not the indicated value itself. Therefore this output signal does not correspond to an indicated value processed by the digital zero. Output level is about 5.2V when the maximum input is 2.6mV/V.

17. CONNECTION OF SI/F

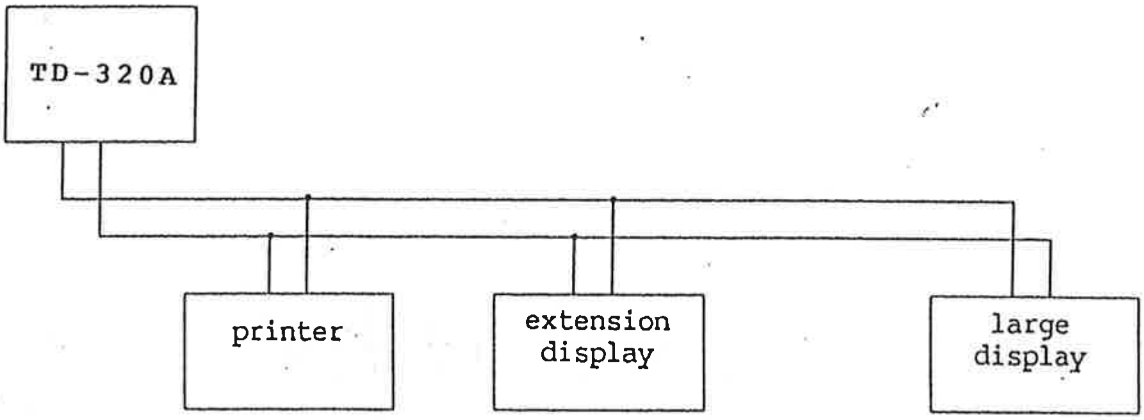
Exclusive Serial Interface (a standard unit) provides easy connection to peripheral instruments for the F Series (a printer, display, entry device etc). Connect the terminal 6 and 7 of the rear terminals (SI/F) to SI/F terminals of an external instrument. These terminals do not have polarity.

SI//F (dual-wire system)

Transmitting system : Asynchronous
distance: Approx. 300m
speed : 600bps



Up to 3 units can be connected in parallel.
Consult us if you need to connect more than 4 units.

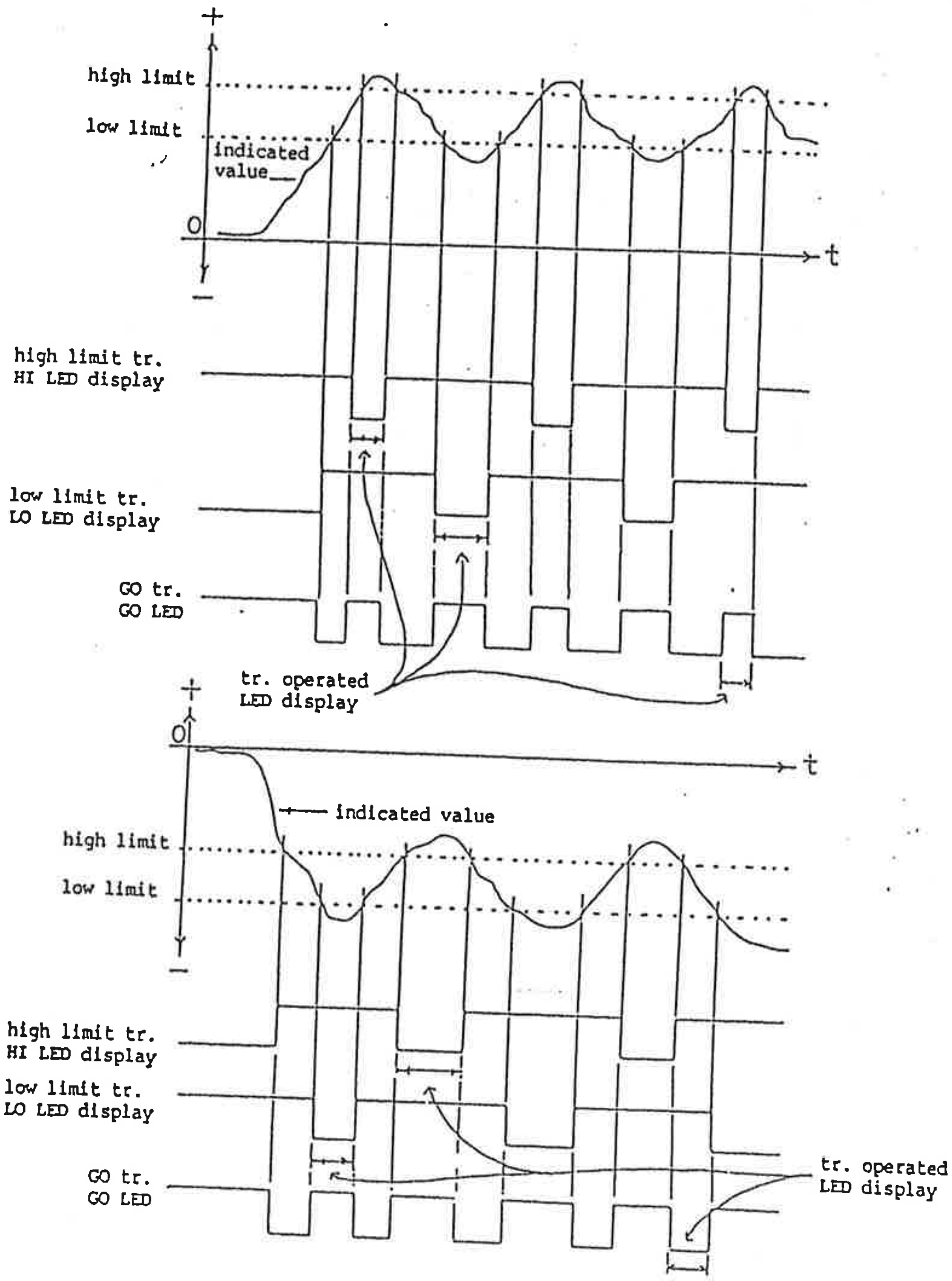


Use a parallel dual-wire cable for connection. Do not connect to a AC line or a high voltage line in parallel.

18.HIGH/LOW LIMIT COMPARATION

When an indicated value is higher than the fixed value of the high limit, the high limit transistor is operated, and when lower than the fixed value of the low limit, the low limit transistor is operated.
Operating status of the high/ low limit transistor is displayed by the LED on the front panel.

Operating time chart of the high/ low transistor

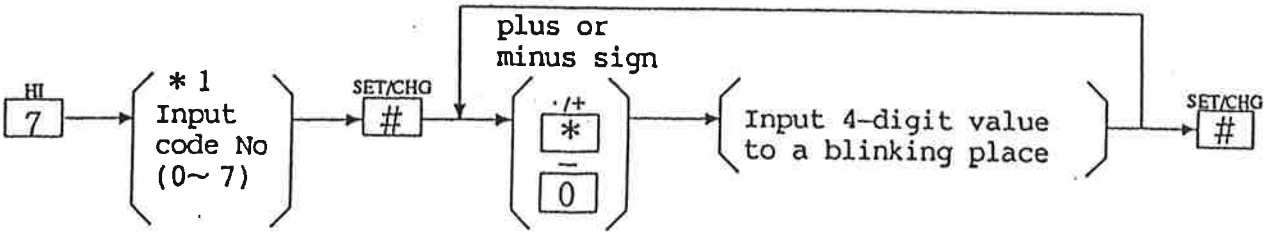


The high transistor is operated when
an indicated value > the high limit value
The low transistor is operated when
an indicated value < the low limit value

19.MULTIPULE HIGH/LOW LIMIT COMPARATION

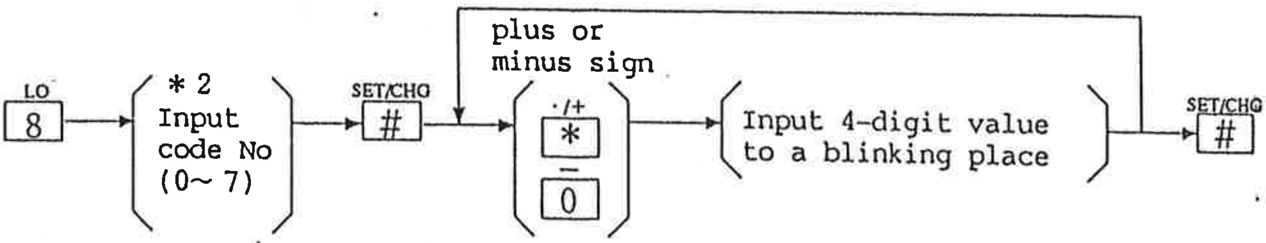
Eight types of high and low limit value can be stored and selected by external input.

Entry of eight high limit values



* 1
After 'H-[code No.]' is displayed for a second, an entered value corresponding to the code No. is displayed.

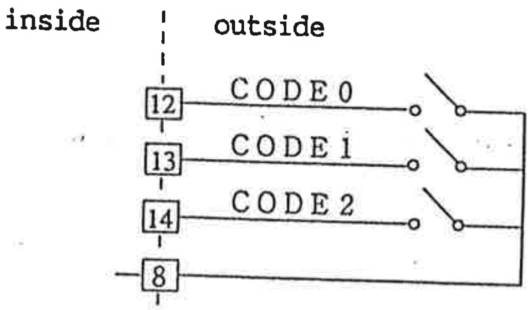
Entry of eight low limit values



* 2
After 'L-[code No.]' is displayed for a second, an entered value corresponding to the code No. is displayed.

> Entered high and low limit values are stored in the NOV RAM (non-volatile memory) so that they will not be cancelled in case of power failure.
> When the high/ low limit value is re-entered by the RS-232C (Option 2), the re-entered value becomes effective.

Entry of high/ low limit values by external selection

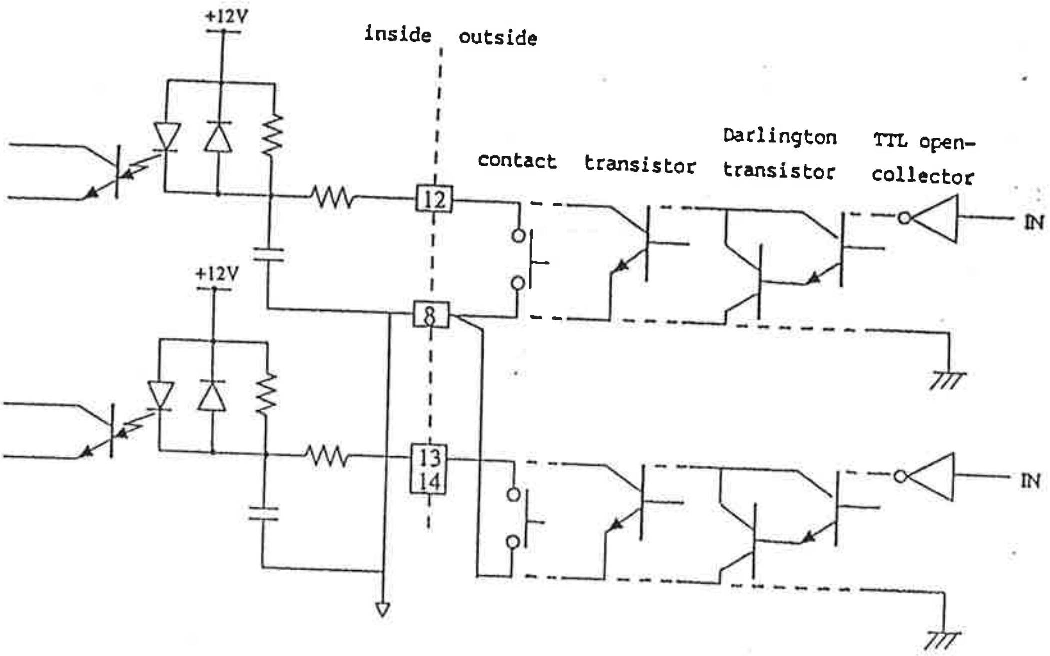


External selection is carried out by combination of three code No. inputs.

code No	CODE 0	CODE 1	CODE 2
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1

0 : OPEN
1 : CLOSE

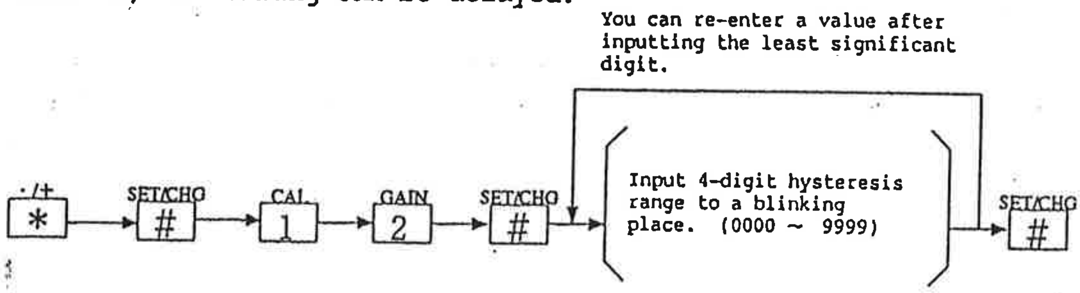
Input interface



20.HYSTERESIS FUNCTION FOR HIGH/LOW LIMIT COMPARATION

Hysteresis Function

Usually the high limit transistor turns on when a measured value is above the high limit value and turns off when below. If you set a hysteresis range, the transistor turns off when a measured value is below the hysteresis range, that is, the timing can be delayed.



Entered hysteresis value is common to high and low limits.

Comparison Conditions (also effective for minus values)

(1) High limit transistor (LED display)

Condition of ON

indicated value > high limit value

Condition of OFF

indicated value < high limit value − hysteresis range

(2) Low limit transistor (LED display)

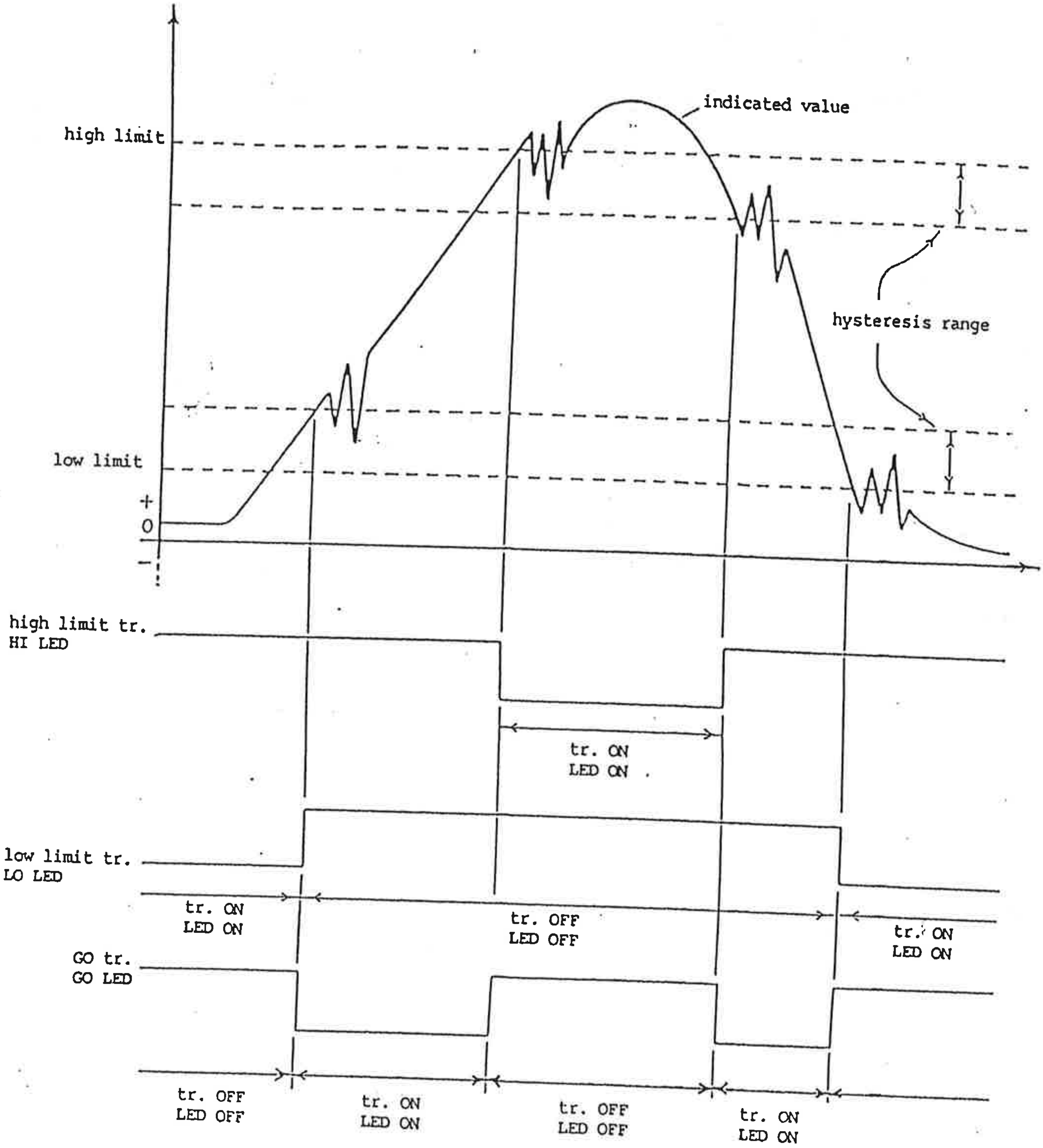
Condition of ON

indicated value < low limit value

Condition of OFF

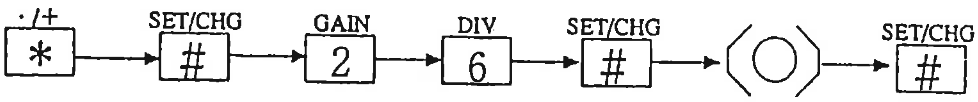
indicated value > low limit value + hysteresis range

Operation time chart of high/ low limit transistor



21.ANALOGUE FILTER

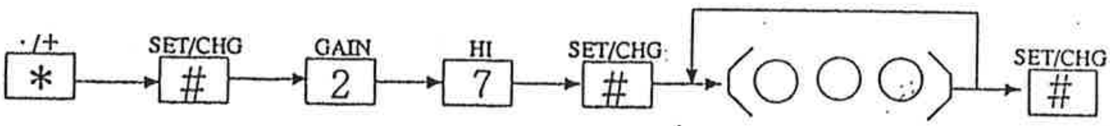
Analogue Filter smoothes an input signal of a sensor and stabilizes an indicated value. You can select one among four types of filter by key input.



0 : 10 Hz
1 : 30 Hz
2 : 100 Hz
3 : 300 Hz

<u>Compensation for time delay of the analogue filter</u>

When a signal of a sensor passes through the analogue filter, a delay is caused to the signal. Since a digital signal (T/H, H/M) is not affected by anything that may cause a delay, it is transmitted faster than an analogue signal. Therefore, if you try to hold the wave form by the T/H signal, a point which is previous to the actual point you would like to hold may be held. To compensate this delay, a delay equivalent to that of the analogue filter is added to a digital signal by calcuration.
Time delay can be 0 to 200 mSEC (the unit 1mSEC).



3–digit
unit: mSEC

22.SELECTION OF HOLD MODE

$\boxed{9} \rightarrow \boxed{\#} \rightarrow$

$\boxed{0}$	no hold
$\boxed{1}$	sample hold
$\boxed{2}$	peak hold
$\boxed{3}$	peak hold with specified section
$\boxed{3}\ \boxed{1}$	bottom hold with specified section
$\boxed{4}$	peak hold with specified duration
$\boxed{4}\ \boxed{1}$	peak hold with specified duration (auto start)
$\boxed{4}\ \boxed{2}$	bottom hold with specified duration
$\boxed{4}\ \boxed{3}$	bottom hold with specified duration (auto start)
$\boxed{5}$	auto hilltop hold
$\boxed{6}$	auto vally hold
$\boxed{7}$	auto inflection hold

$\rightarrow \boxed{\#}$

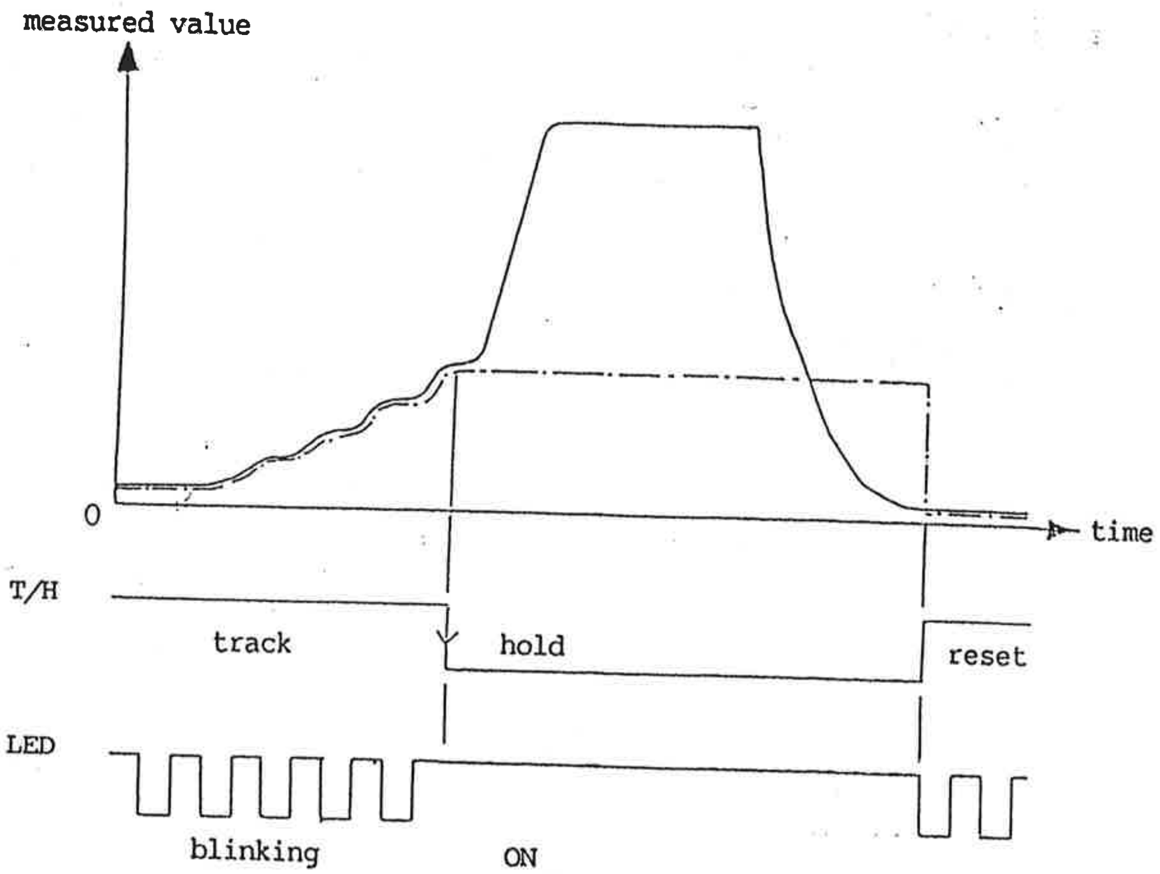
- [*] [#]
  - [0] [1] [#] a a a a # specified duration
  - [2] [1] [#] n n n n # judging value for point of inflection
  - [2] [2] [#] b b b # detecting time of point of inflection A
  - [2] [3] [#] b b b # detecting time of point of inflection B
  - [2] [4] [#] ±n n n n # auto start level
  - [2] [8] [#] c c c # minimum counts of hilltop/ valley detection
  - [2] [9] [#]
    - [1] [#] hilltop/ valley detecting level; 1.5 time
    - [1] [#] hilltop/ valley detecting level; 2 times
    - [2] [#] hilltop/ valley detecting level; 3 times
    - [3] [#] hilltop/ valley detecting level; 4 times

'a a a a' indicates time; the unit is second.

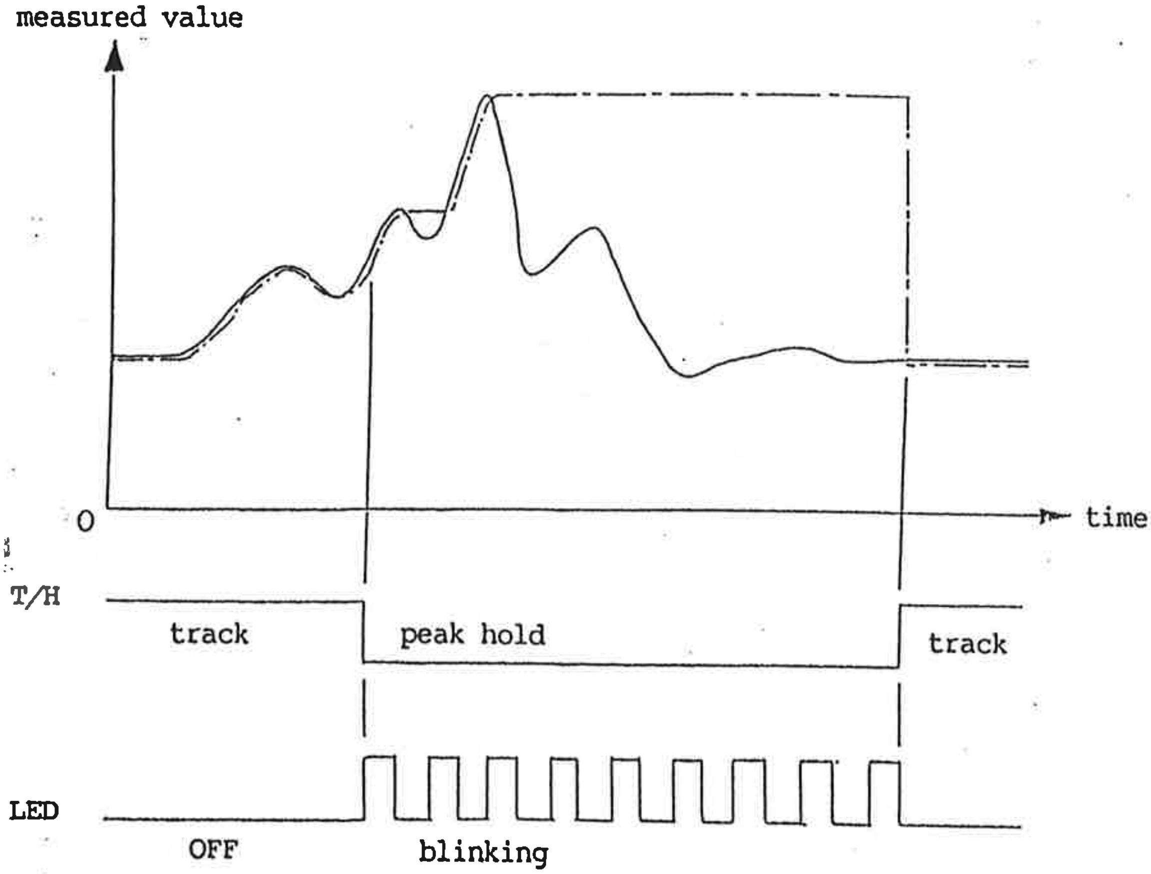
'b b b' indicatess time; the unit is millisecond.

'n n n n' indicates a value.

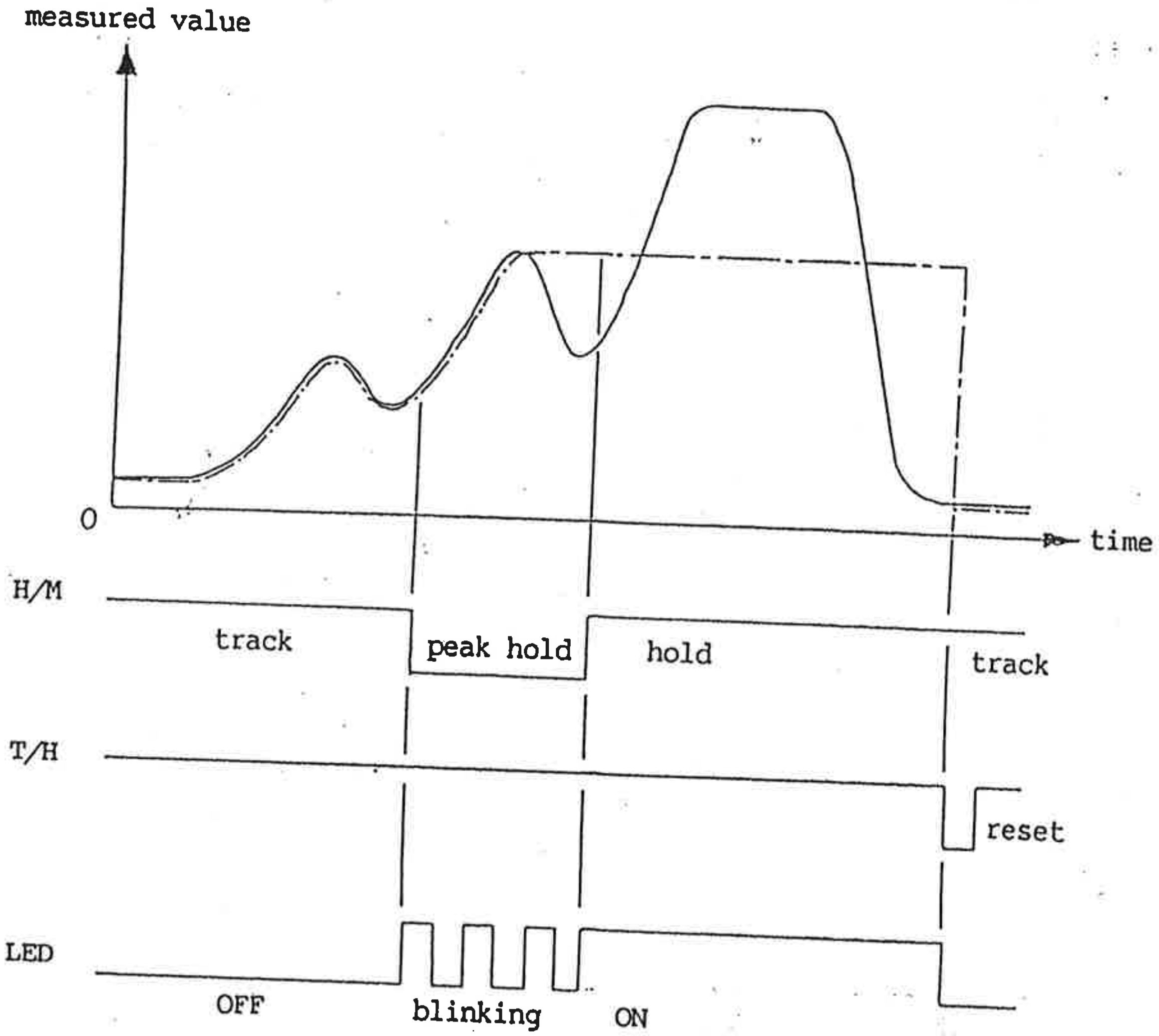
MODE 1: Sample hold time chart



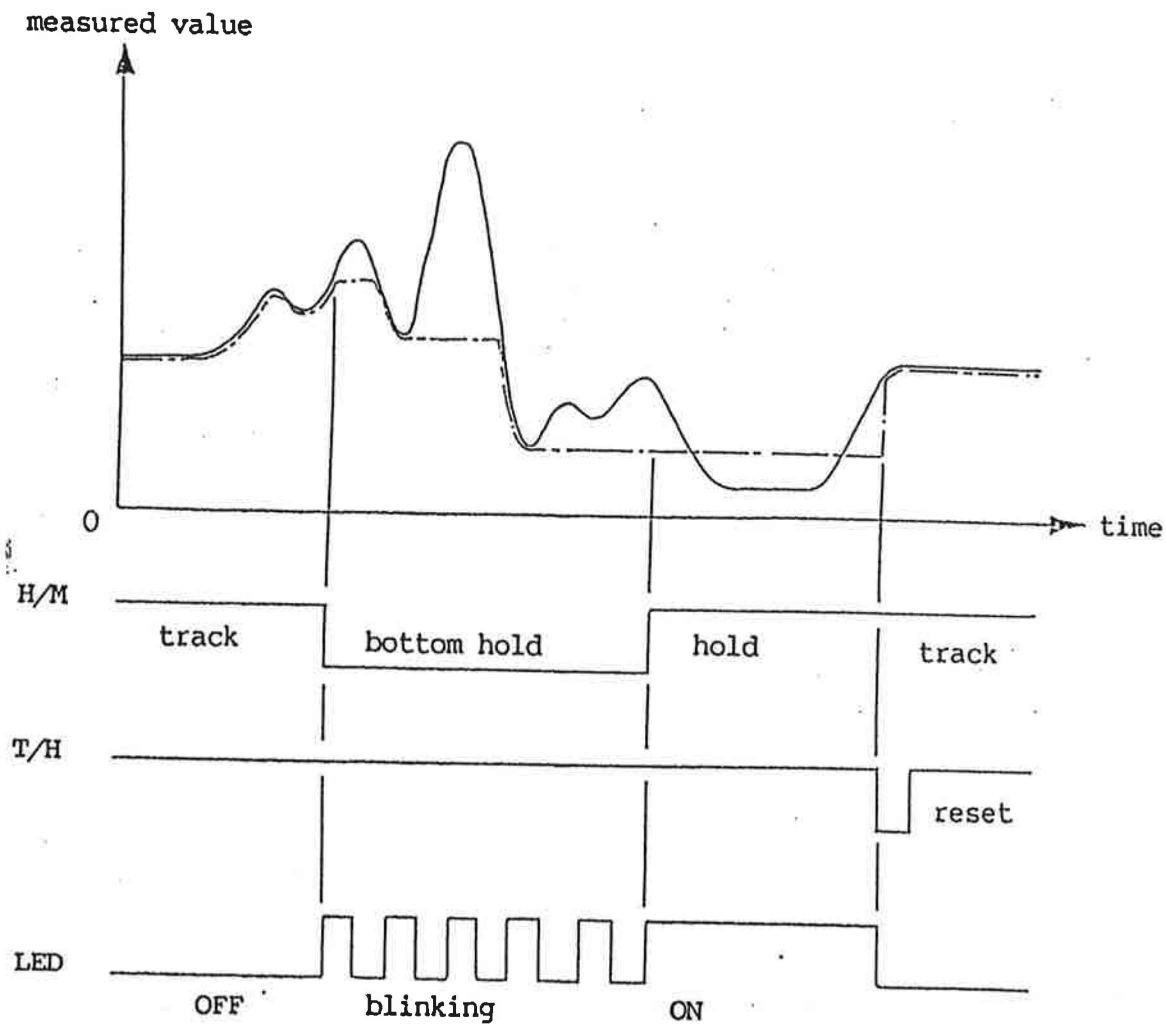
MODE 2: Peak hold time chart



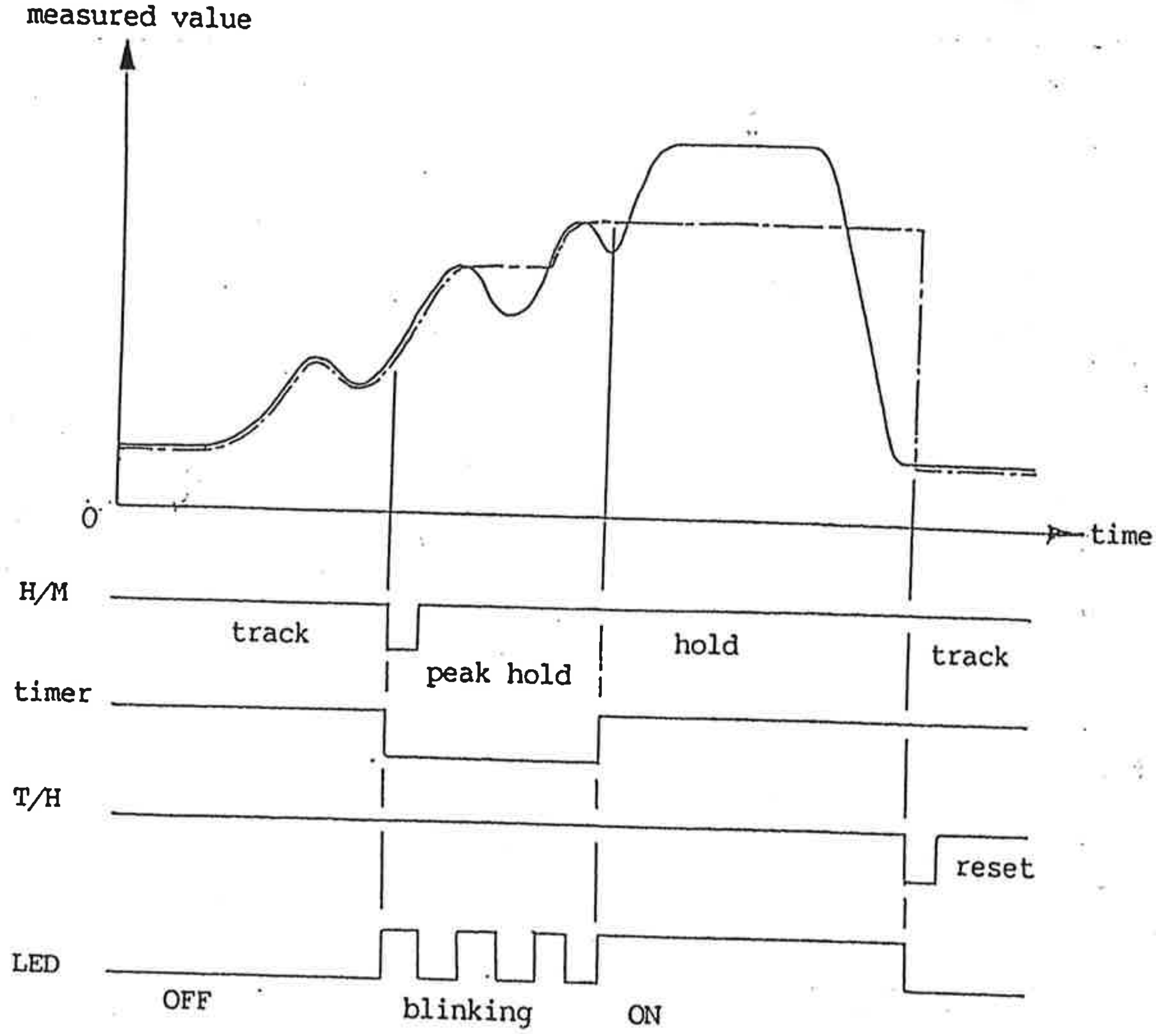
MODE 3: Peak hold with specified section time chart



MODE 3-1: Bottom hold with specified section time chart



MODE 4: Peak hold with specified duration time chart

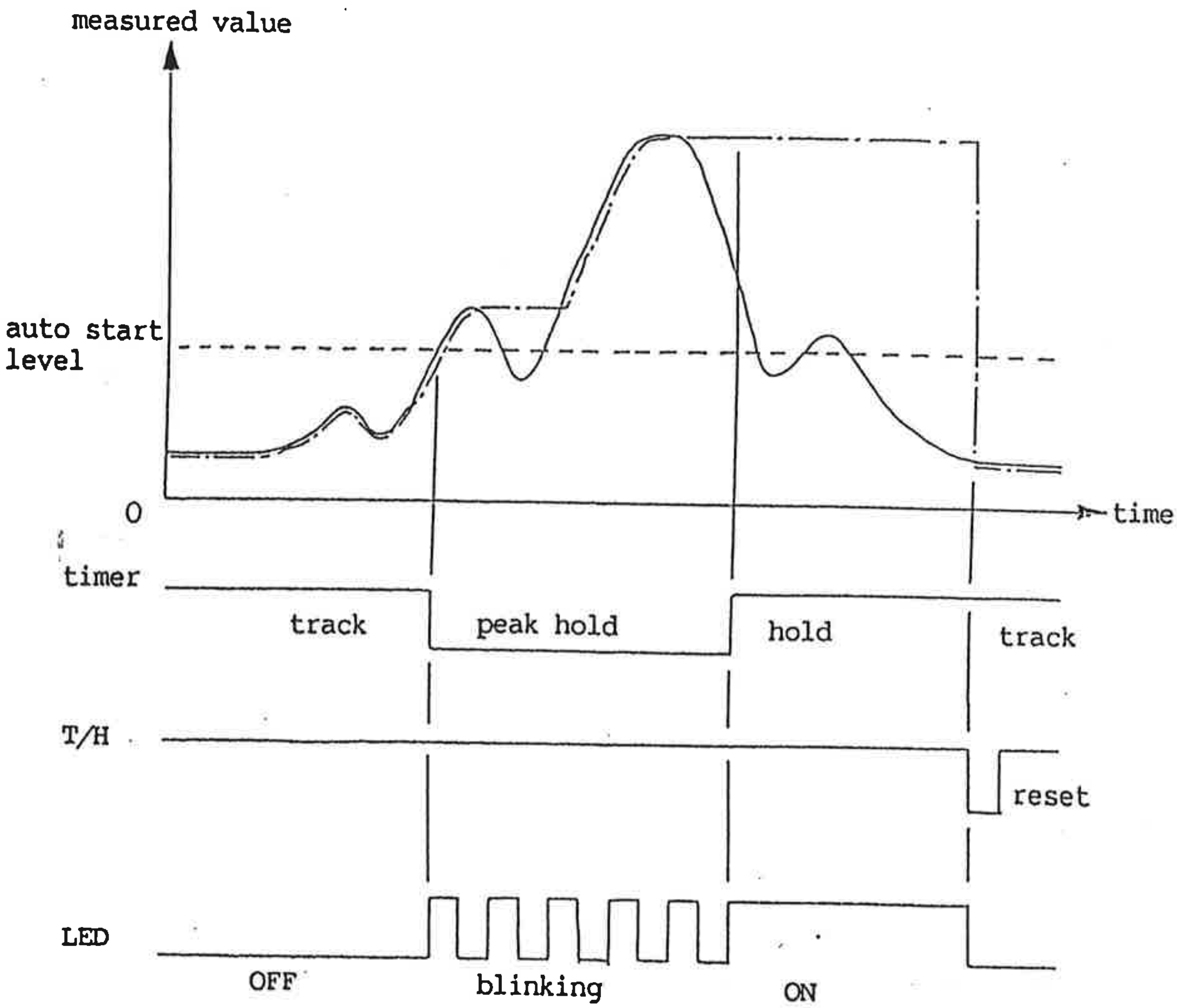


〈Entry of specified time (timer)〉

$$* \ \# \ 0 \ 1 \ \# \ \underbrace{\times \ \times \ \times \ \times}_{\text{unit: millisec.}} \ \#$$

(0 ~ 9.999 sec.)

MODE 4-1: Peak hold with specified duration (auto start) time chart



〈Entry of specified time (timer)〉

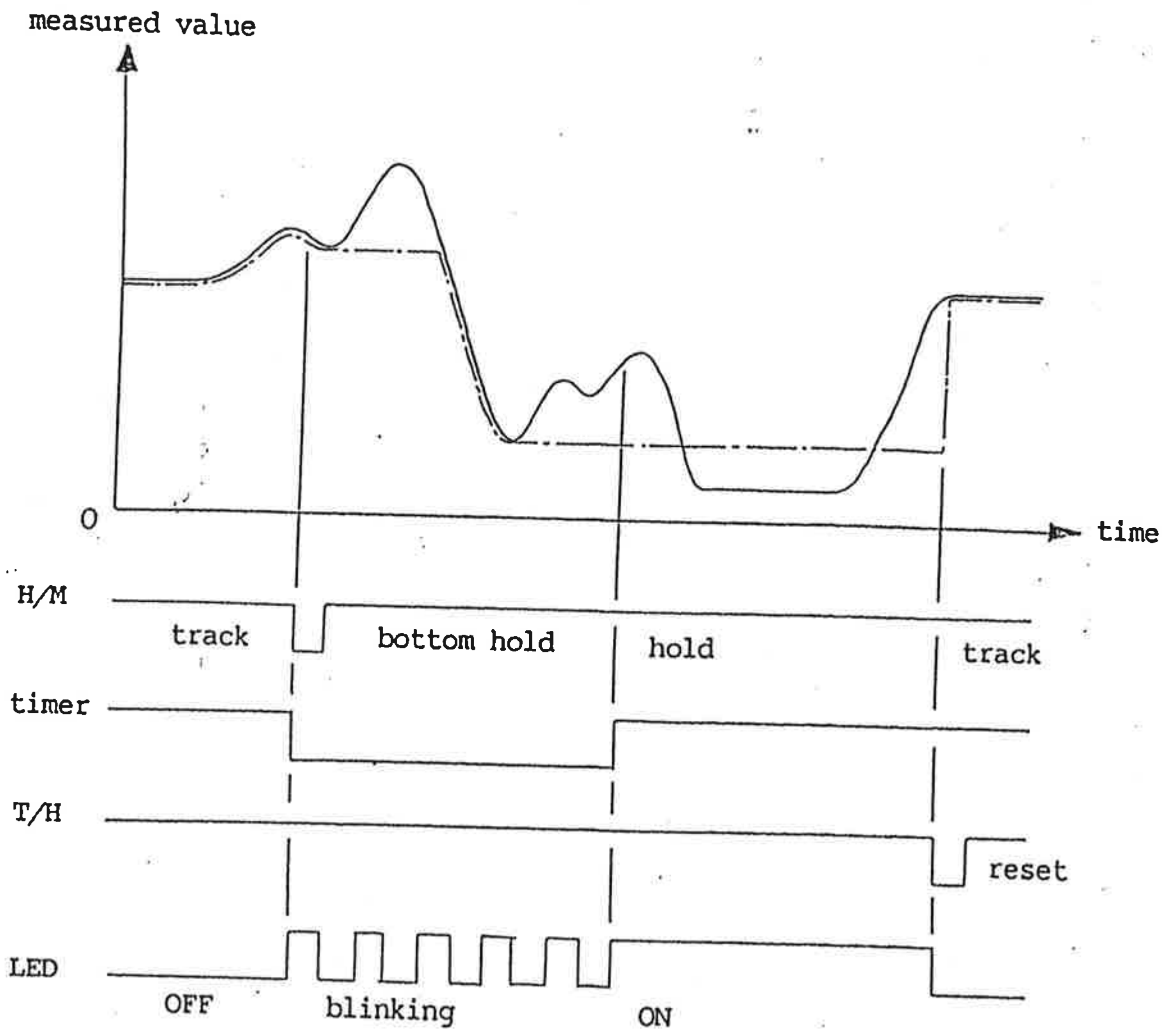
$* \ \# \ 0 \ 1 \ \# \ \underbrace{\times \ \times \ \times \ \times}_{\text{unit: millisec.}} \ \#$

(0 ~ 9.999 sec.)

〈Entry of auto start level〉

$* \ \# \ 2 \ 4 \ \underbrace{\pm \ \times \ \times \ \times \ \times}_{\text{indicated value}} \ \#$

MODE 4-2: Bottom hold with specified duration time chart

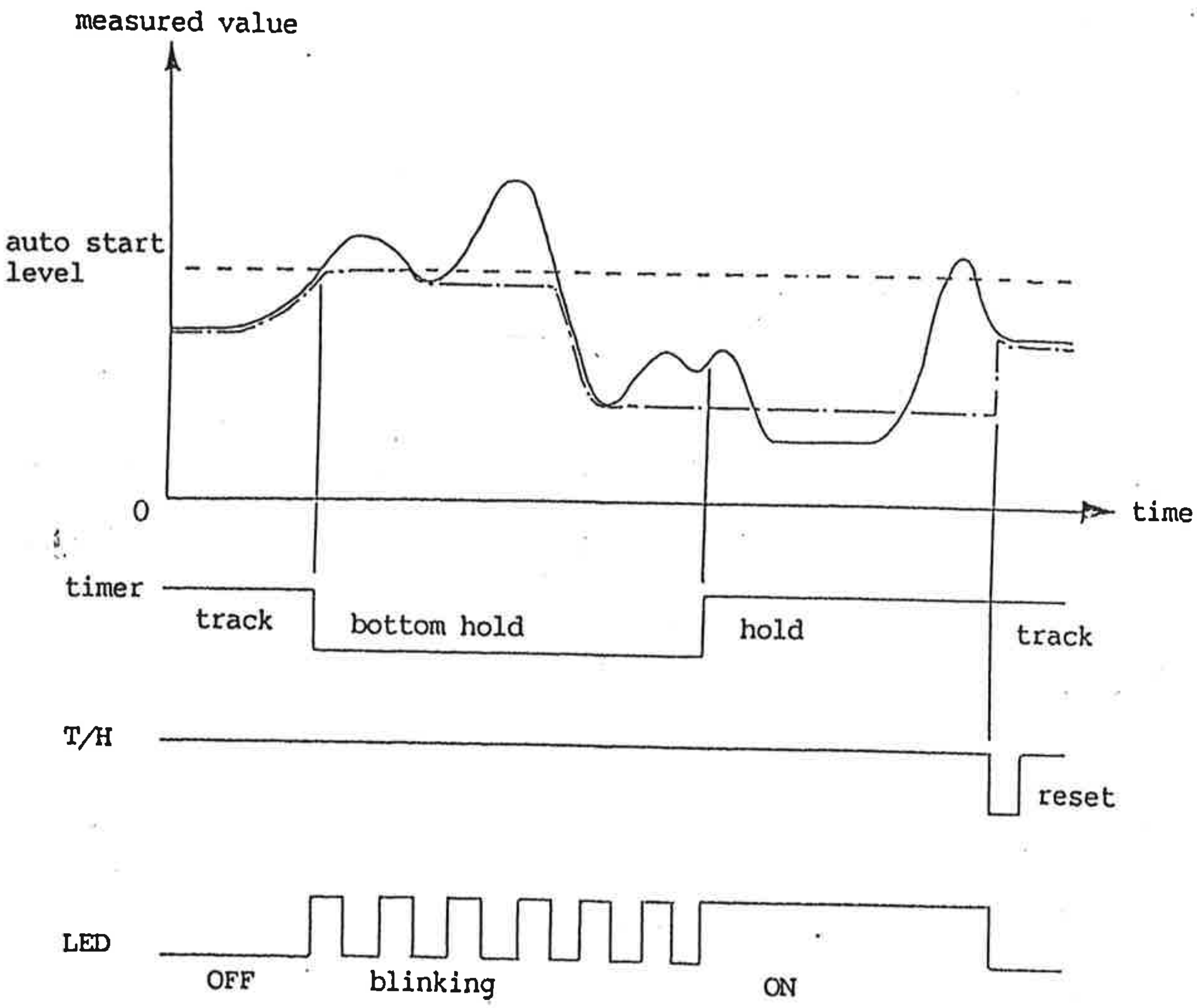


⟨Entry of specified time (timer)⟩

$$* \;\; \# \;\; 0 \;\; 1 \;\; \# \;\; \underbrace{\times \;\; \times \;\; \times \;\; \times}_{\text{unit: millisec.}} \;\; \#$$

(0 ~ 9.999 sec.)

MODE 4-3: Bottom hold with specified duration time chart



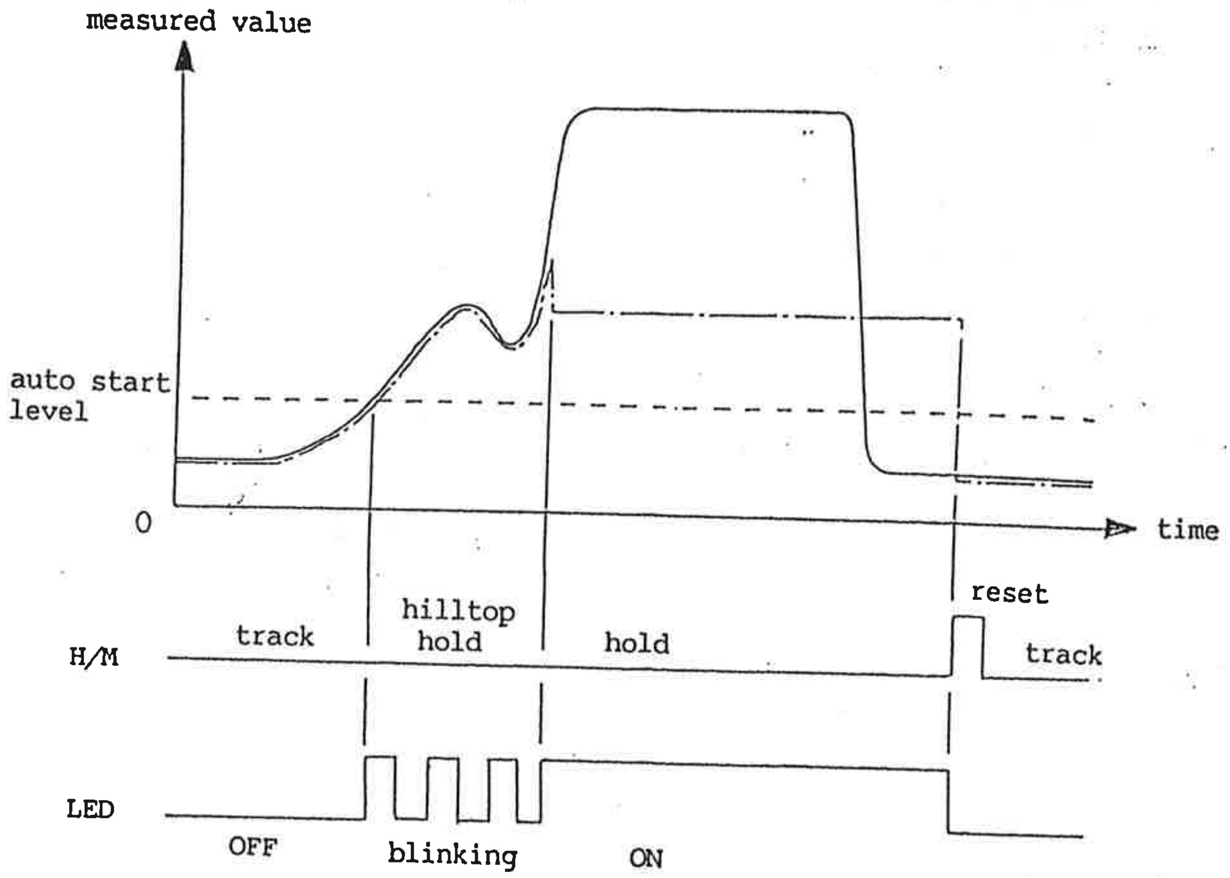
⟨Entry of specified duration (timer)⟩

$* \ \# \ 0 \ 1 \ \# \ \underbrace{\times \times \times \times}_{\substack{\text{unit: millisec.} \\ (0 \sim 9.999 \text{ sec.})}} \ \#$

⟨Entry of auto start level⟩

$* \ \# \ 2 \ 4 \ \# \ \underbrace{\pm \times \times \times \times}_{\text{indicated value}} \ \#$

MODE 5: Auto hilltop hold time chart



⟨Entry of auto start level⟩

$$\ast \ \# \ 2 \ 4 \ \# \ \underbrace{\pm \times \times \times \times}_{\text{indicated value}} \ \#$$

⟨Entry of other values for hilltop detection⟩

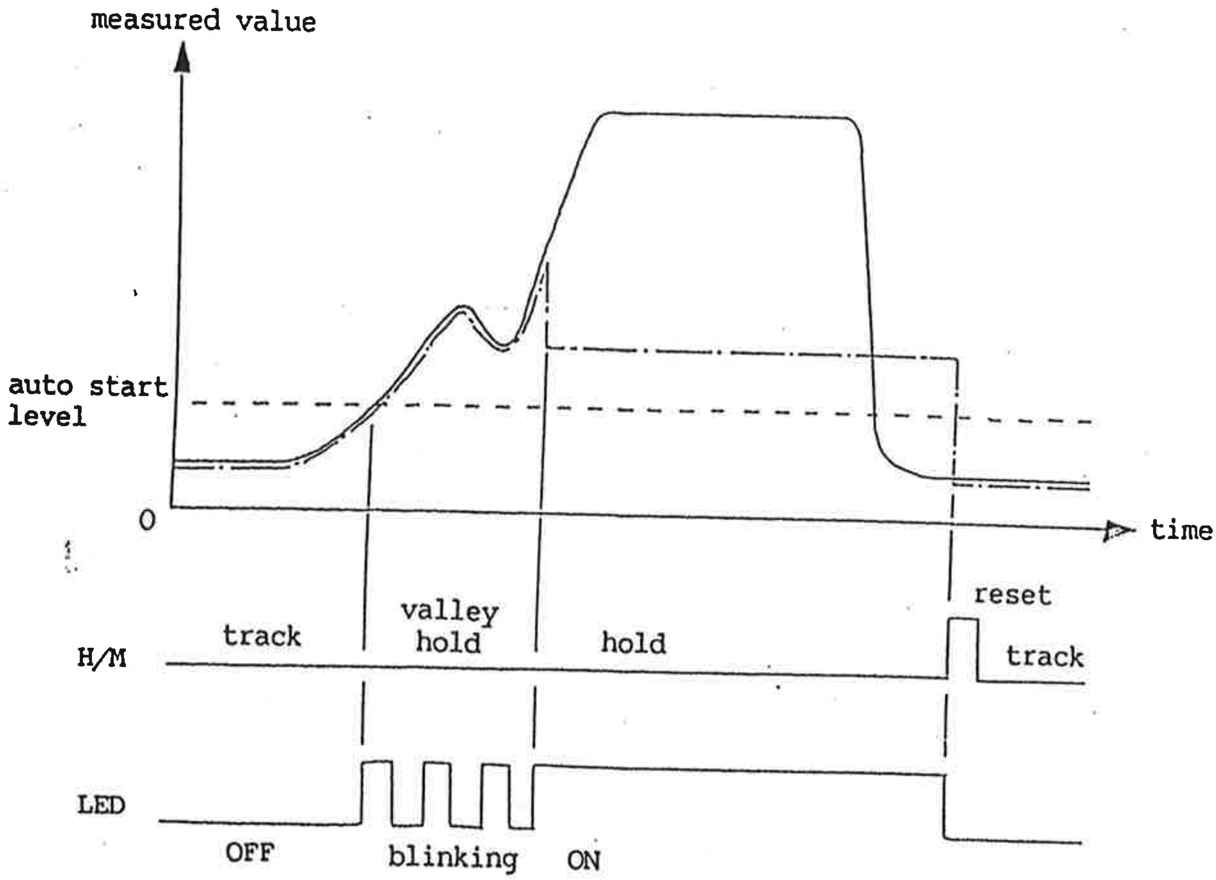
Values entered at the time of shipping are effective for normal detection.
Values corresponding to particular wave form can be entered.

$$\ast \ \# \ 2 \ 8 \ \# \ \underbrace{c \ c \ c}_{} \ \#$$

minimum counts of hilltop/ valley detection

* # 2 9 # 0 # ···	h.top/ valley detecting level;	1.5 time
1 # ···		2 times
2 # ···		3 times
3 # ···		4 times

MODE 6: Auto valley hold time chart



〈Entry of auto start level〉

$* \ \# \ 2 \ 4 \ \# \ \underbrace{\pm \times \times \times \times}_{\text{indicated value}} \ \#$

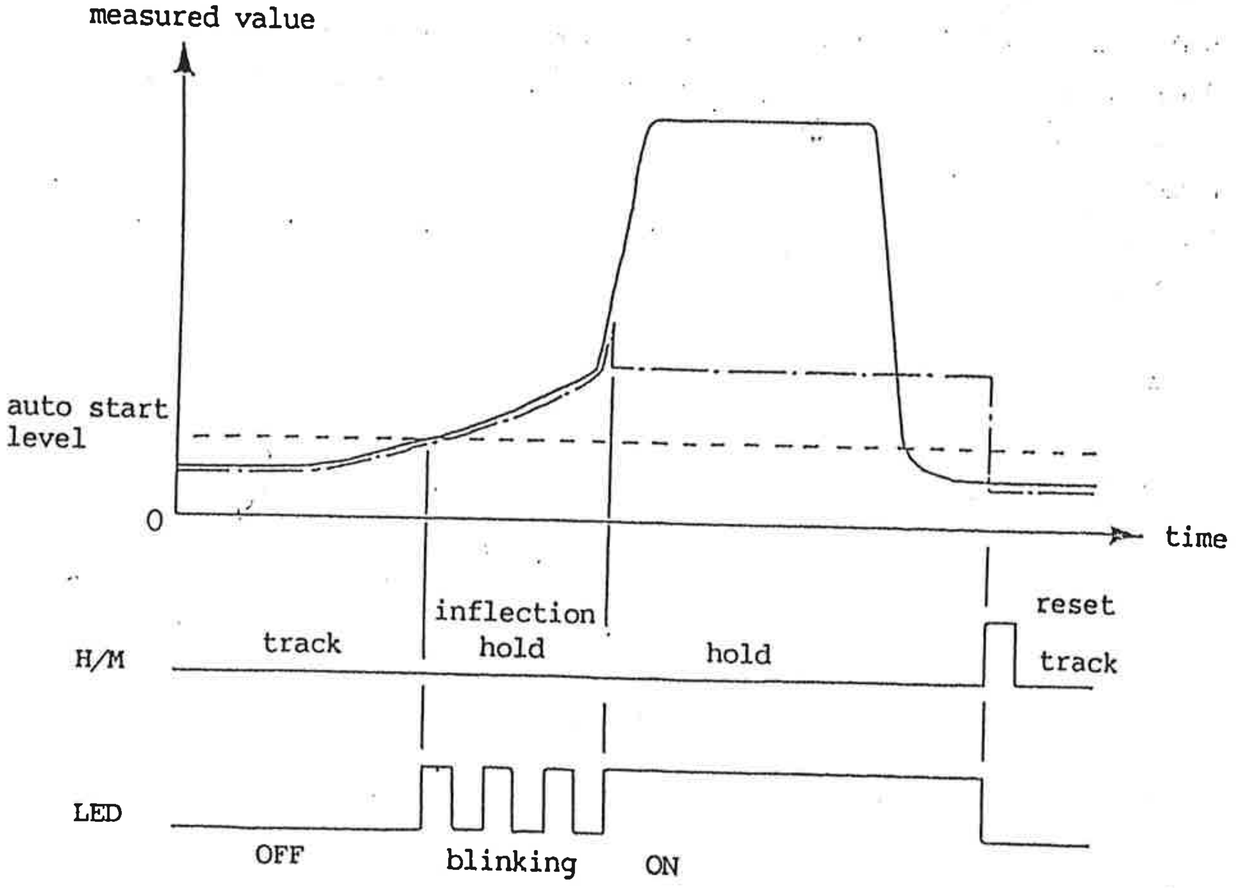
〈Entry of other values for valley detection〉

Values entered at the time of shipping are effective for normal detection. Values corresponding to particular wave form can be entered.

$* \ \# \ 2 \ 8 \ \# \ \underbrace{c \ c \ c}_{\text{minimum counts of hilltop/ valley detection}} \ \#$

* # 2 9 # 0 # ···	h.top/ valley detecting level;	1.5 time
1 # ···		2 times
2 # ···		3 times
3 # ···		4 times

MODE 7: Auto inflection hold time chart



〈Entry of auto start level〉

* # 2 4 # ± × × × × #

indicated value

〈Entry of other values for inflection detection〉

Values entered at the time of shipping are effective for normal detection. Values corresponding to particular wave form can be entered.

* # 2 1 # n n n n #

point of inflection judging value

* # 2 2 # a a a #

inflection detecting time A (millisec.)

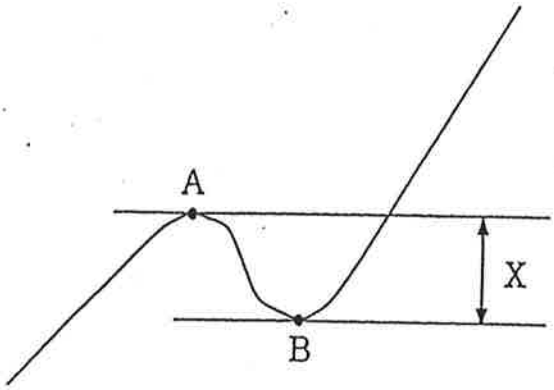
* # 2 3 # b b b #

inflection detecting time B (millisec.)

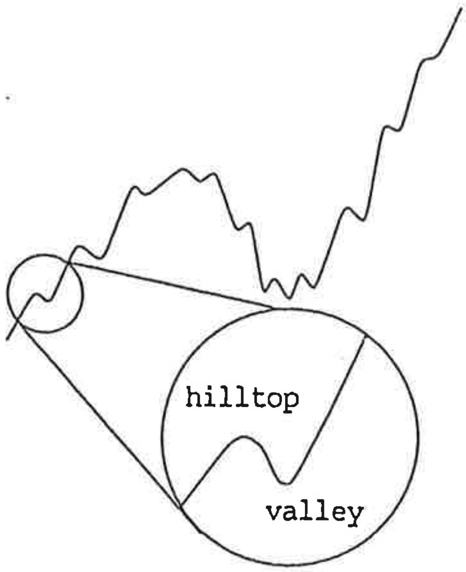
NB: A+ B≦ 255

23. DETECTION OF HILLTOP AND VALLEY

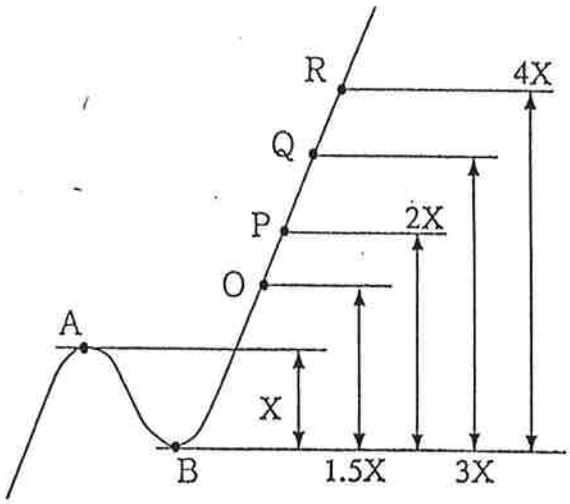
When χ is larger than the entered value (* # 28 #), the point A is judged as the mountain, the point B as the valley.



When there is noise in wave form, the noise may be detected as a hilltop and a valley if χ is too small.

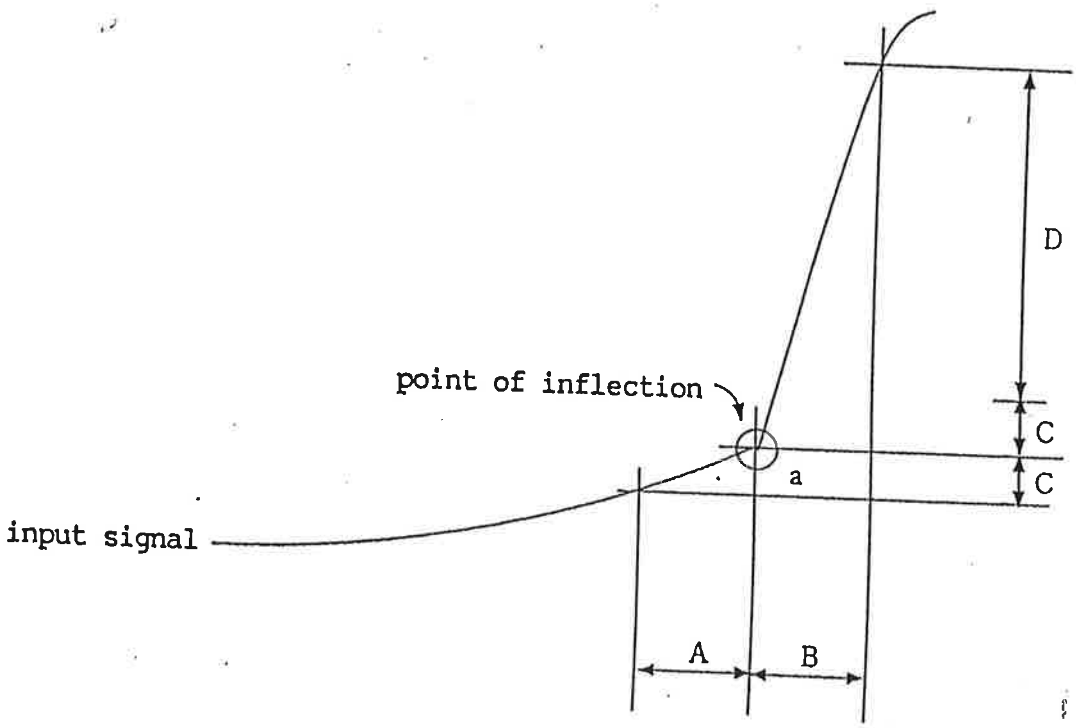


After the hilltop and valley (A and B) are detected, when the input reaches the entered multiple values (1.5, 2, 3 or 4 times) of χ, that is, when the input reaches the point O, P, Q, or R, the value of the point A is held in the hilltop mode, and the value of B is held in the valley hold.



24. DETECTION OF A POINT OF INFLECTION

Detection of a point of inflection is controlled by the three values (A, B and X3) as shown in the figure below.
Subtract the value of inflection C during the time A from the value of inflection during the time B, then name the remainder 'D'. When the value of inflection D reaches the inflection judging value χ 3 (* # 21 #), the point 'a' is held as the point of inflection.
Usually A= B. When inflection is gentle, set A< B so that detection may be easier.
NB: A+ B≦ 255



25.B.C.D OUTPUT (OP. TD-3203)

BCD Data Output is an interface for taking indicated values of TD-320A as data in the BCD code. This interface is useful in connecting a computer, a process-controller, a sequencer etc to TD-320A and carrying out control, totalling, recording etc.
The in/ output circuit and the internal circuit are insulated with photo-couplers.

Output Connector-pin Assignment

1	C O M			26	
2	data	1	output	27	
3	〃	2	〃	28	
4	〃	4	〃	29	
5	〃	8	〃	30	
6	〃	10	〃	31	
7	〃	20	〃	32	
8	〃	40	〃	33	
9	〃	80	〃	34	
10	〃	100	〃	35	
11	〃	200	〃	36	
12	〃	400	〃	37	
13	〃	800	〃	38	
14	〃	1000	〃	39	
15	〃	2000	〃	40	
16	〃	4000	〃	41	
17	〃	8000	〃	42	minus
18				43	
19				44	
20				45	
21				46	over output
22				47	
23				48	
24				49	EOC (end of conversion)
25				50	BCD hold input

Signal Logic

BCD data output ··· negative/ positive (specified at the time of ordering)

Polarity output ··· negative

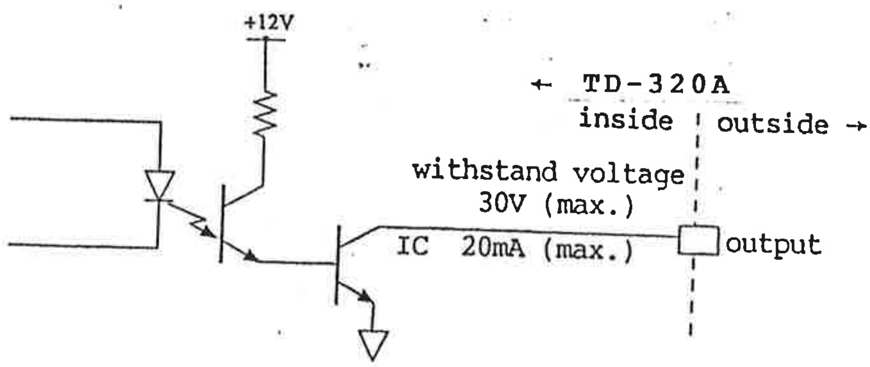
Over output ··· negative

EOC (end of conversion) ··· negative

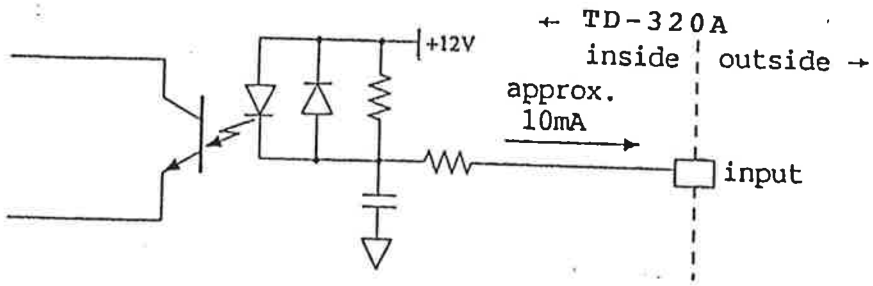
BCD hold input ··· negative

Equivalent Circuit

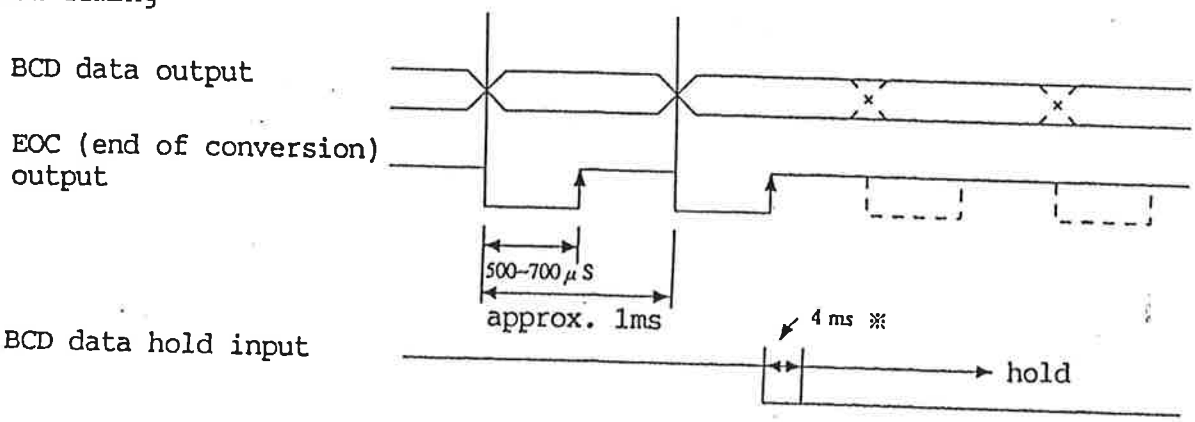
BCD data output and other output



BCD data hold input



Signal Timing



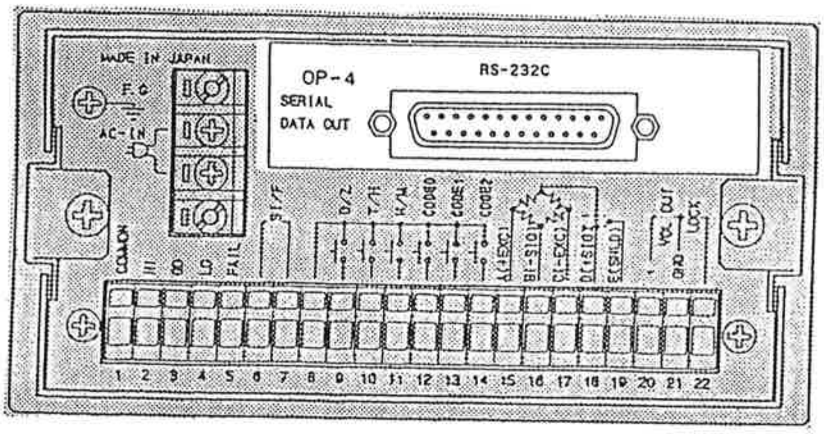
When reading data by the EOC, read the BCD data, polarity and overflow data within 200μ S after the rise edge (when the output changes from 'LO' to 'HI').

When reading data by the BCD data hold, turn the BCD data hold input 'LO' and after 4mS has passed, read the BCD data. The BCD data is not changed while the output is 'LO'.

- BCD Data Output is an option.
- A displayed value is not held while the BCD data hold input is working.

26.RS-232C COMMUNICATION INTERFACE (OP. TD-3204)

RS-232C Communication Interface is an interface for reading out indicated values and status of TD-320A and writing set values of the high and low limit. It is useful in connecting a computer, a process-controller, a sequencer to the TD-320A and carrying out control, totalling, recording etc.



Signal system : RS-232C full-duplex system

Transmitting system : Asynchronous

Transmitting speed : 9600 bps

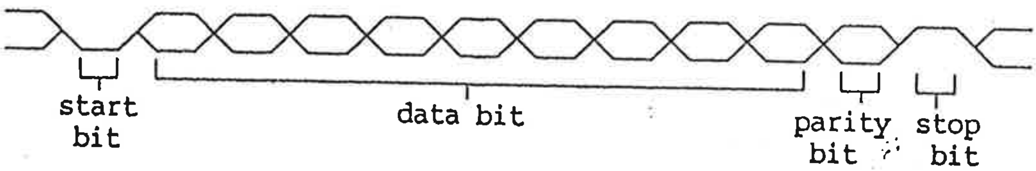
Bit configuration : start ··· 1 bit

data ··· 7 bits

parity ··· 1 bit (odd)

stop ··· 1 bit

Output code : ASCII

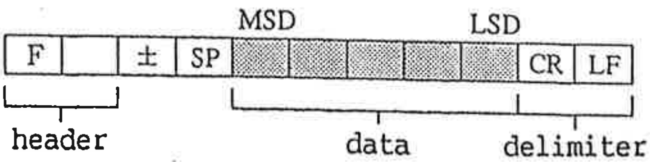


Output Connector-pin Assignment

PIN NO.	signal	
2	TXD	output data
3	RXD	input data
7	SG	signal ground
4	RTS	regularly HI
20	DTR	regularly HI

Output Format

Data configuration



SP ··· space

MSD ··· most significant digit

LSD ··· least significant digit

Mode selection

Mode 0: An indicated value and status are repeatedly transmitted.
Mode 1: Data requested by the request command is transmitted only once. Writing and reading out of the high and low limit values can be carried out.

| M | 0 | CR | Select Mode 0. (Mode 0 is automatically selected when the power source is turned on.)

| M | 1 | CR | Select Mode 1.

Mode 0

Selected by | M | 0 | CR |

Indicated value	F	A	±	SP	①	②	③	④	⑤	CR	LF

'①' (the most significant digit) is '0' when a value does not include a decimal point.

When +1000 is transmitted	F	A	±	SP	0	1	0	0	0	CR	LF
When −0.001 is transmitted	F	A	−	SP	0	.	0	0	1	CR	LF
Status	F	B	SP	I	II	III	IV	V	VI	CR	LF

I HI : When an indicated value is larger than the high limit value, '1' is transmitted.

II LO : When an indicated value is smaller than the low limit value, '1' is transmitted.

III HOLD: When an indicated value is a held value, '1' is transmitted. In either case of the sample hold or the peak hold, it is indicated that an indicated value is held by an external signal or the T/H key.

IV ZT : When a value for the Zero Tracking is entered, '1' is transmitted and that indicates that the Zero Tracking is operated.

V ALM : When any error (including an overflow) is caused, '1' is transmitted.

VI MD : This is a function which detects stability of an indicated value. When an indicated value is shifted more than a certain range, '1' is indicated.

☆ While key-switches are operated, a measured value is transmitted for the 'indicated value'. For the 'status', the status of lighted LEDs of the 'Item Selection Display' of the front panel of TD-320A is transmitted as '1'

Mode 1

Selected by $\boxed{M}\boxed{1}\boxed{CR}$

Request Command

Request command for an indicated value

Selected by $\boxed{R}\boxed{A}\boxed{CR}$

'①' (the most significant digit) is '0' when a value does not include a decimal point.

	R	A	±	SP	①	②	③	④	⑤	CR	LF
When +1000 is transmitted.	R	A	±	SP	0	1	0	0	0	CR	LF
When −0.001 is transmitted.	R	A	−	SP	0	.	0	0	1	CR	LF

Request command for status

Selected by $\boxed{R}\boxed{B}\boxed{CR}$

R	B	SP	I	II	III	IV	V	VI	CR	LF

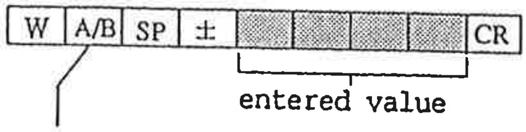
$\underbrace{\text{I II III IV V VI}}_{\text{status}}$

'I ~ VI' are the same formats as the Mode 0.

Writing and reading out of the high/ low limit values

Writing 1 (host → TD-320A)

To write a value in the code number selected by an external instrument



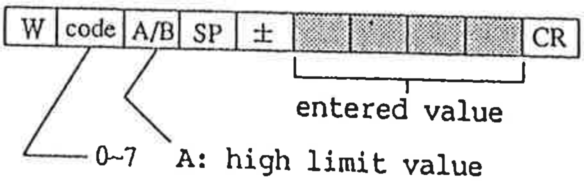
A: high limit value

B: low limit value

High and low limit values entered by key-switches are changed to these written values.

Writing 2 (host → TD-320A)

To write a value in the specified code number



A: high limit value

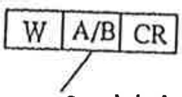
B: low limit value

High and low limit values entered by the key-switches are changed to these written values.

Reading out 1 (TD-320A host)

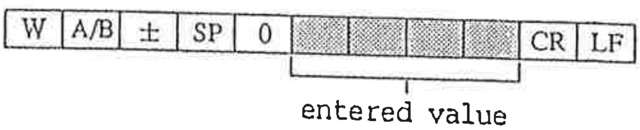
To read out the value of the code number selected by an external instrument

Selected by



A: high limit value

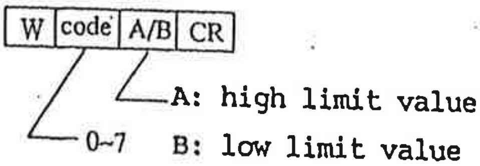
B: low limit value

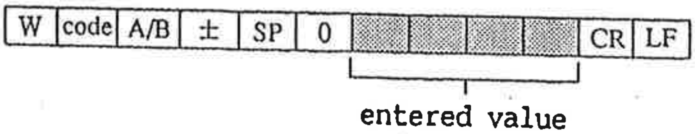


Values entered by the key-switches and those entered by the RS-232C are common and values entered by the key-switches can be read out.

Reading out 2 (TD-320A host)

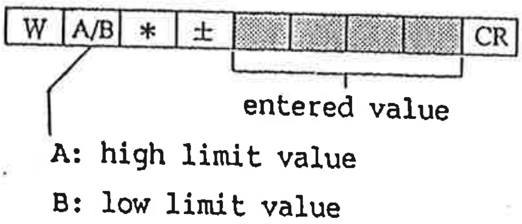
To read out the value of the specified code number

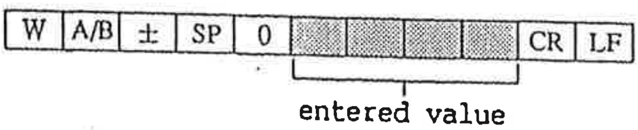




Values entered by the key-switches and those entered by the RS-232C are common and values entered by the key-switches can be read out.

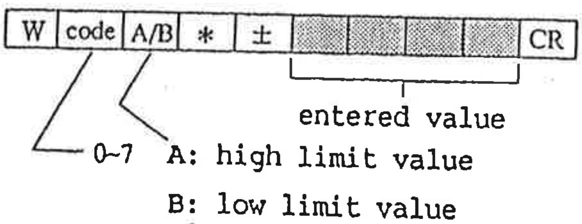
Return after writing 1



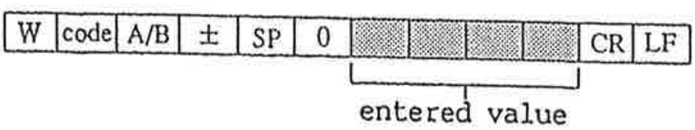


Writing and reading out of the high and low limit values are carried out at once.
Values are returned by the format below.

Return after writing 2



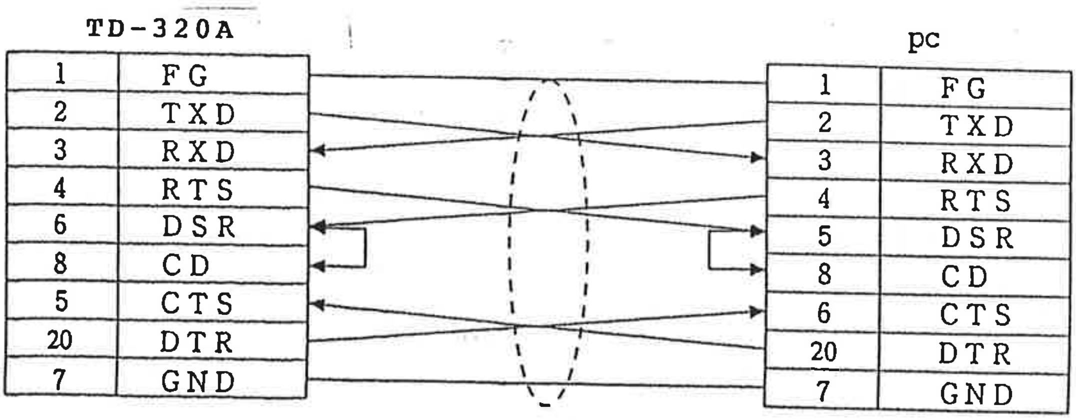
Writing and reading out of the high and low limit values of the specified code number are carried out at once.
Values are returned by the format below.



When a command which cannot be recognized is transmitted, the characters will be returned as follows.

W			....			?	CR	LF

Connection to a personal computer



This connection is for a personal computer of the DTE. Use a straight cable for a personal computer of the DCE.

Initial setting of the RS-232C of a personal computer

Transmitting speed: 9600 bps
Data bit : 7 bits
Parity bit : 1 bit (odd)
Stop bit : 1 bit
Code : ASCII

A personal computer needs to be programmed in order to read data.

- RS-232C Communication Interface is an option.
- Do not connect an instrument except the RS-232C standard.

27.SELF-CHECK FUNCTION)

TD-320A has the Self-Check Function which detects errors in the internal circuit and the programme and the Visual-Check Function.

Self-Check is started by operating the key-switches of the front panel.

[0] → SET/CHO [#] → SET/CHO [#]

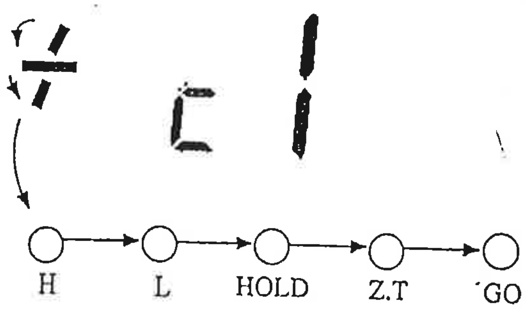
check sequence	item display	item to be checked	time required
1	F F F F	start	1 sec.
2	c 1	status indicator LED	2.4 sec.
3	digits	numerical indicator LED	4 sec.
4	c 2	interrupt circuit	0.1 sec.
5	c 3	A/D converting circuit	0.1 sec.
6	c 4	RAM	0.3 sec.
7	c 5	ROM	6 sec.
8	1.00	software version	1 sec.
9	PASS	end	2 sec.

Check Sequence 1

'F F F F 'is displayed in the numerical indicator for about 1 second and indicates that the Self-Check is started.

Check Sequence 2

The LEDs of the status indicator are to be visually checked. The LEDs are turned on in turn.



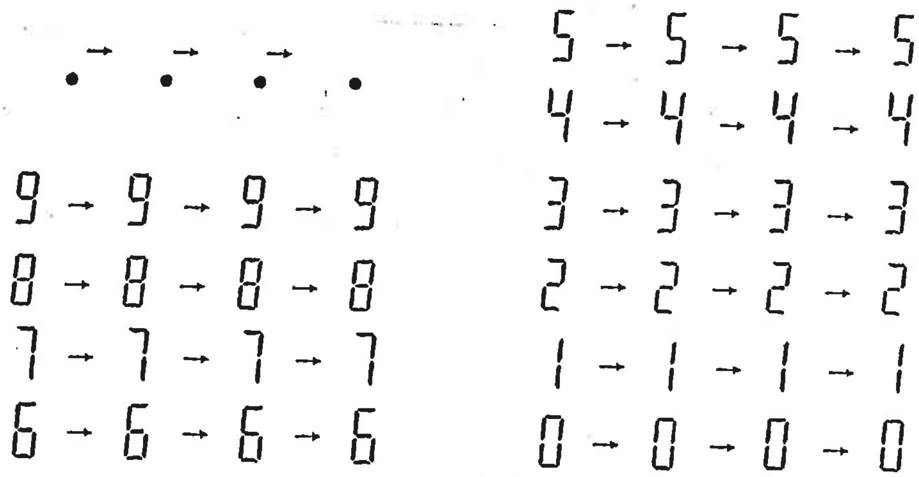
The LEDs are turned on in the order of → .
Each LED is lighted for about 0.3 second.

Check Sequence 3

The LEDs of the numerical indicator are to be visually checked. The LEDs are turned on in turn.

Order of Display

decimal point → 9 → 8 → 7 → 6 → 5 → 4 → 3 → 2 → 1 → 0



Check Sequence 4 ~ 7

After 1 second has passed, the check sequence 4 ~ 7 are started. Each item is automatically checked while the item being checked is displayed in the numerical indicator.

Check Sequence 8

The version of the software is displayed in the numerical indicator for about 1 second. For example, when 1.00 is displayed, the version of the software is V1.08. The version of the software can be different according to the equipped option etc.

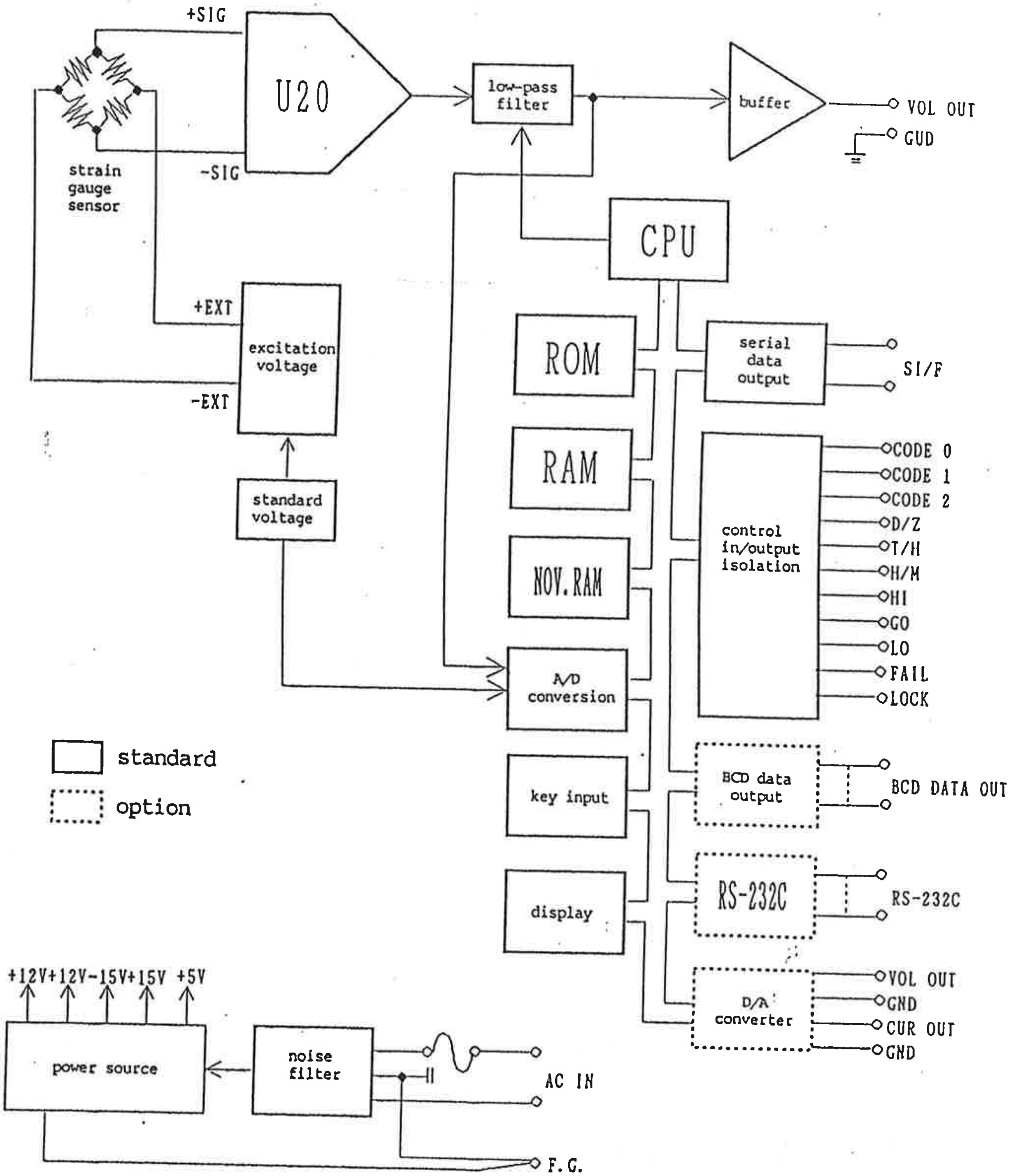
Check Sequence 9

PASS (PASS) is displayed in the numerical indicator and indicates that no error has been found.

TD-320A is out of order if the LEDs of the status indicator are not turned on or correct digits are not displayed in the numerical indicator during the Check Sequence 2～3, or if each checking of the Check Sequence 4～7 is not completed within the required time.

Self-Check can be carried out any time. While checking, any process like the high and low limit comparison, the peak hold etc is interrupted.

28.BLOCK DIAGRAM



29. SPECIFICATIONS

Excitation voltage applied: to a sensor	DC 10V/ 2.5V switching, current 30mA (max.)
Signal input range	: 0.5~ 2.2 mV/V
Zero/ gain adjustment	: Automatic adjustment by a digital operation
Equivalent input calibration	
Setting range	: 0.500~ 2.200 mV/V
Error	: 0.1% FS (max.)
Indicator	: 0000~ ± 9999 Character hight 10mm, red LED
Display frequency	: 10 times/ sec.
Setting display	: Character hight 8mm, red LED 4 digits (both the high limit display and the low limit display)
Decimal point	: Decimal point can be set to any digit place.
Display by lamps	: HI, LO, GO, HOLD
Analogue filter	: Optional for 10, 30, 100 or 300 (Hz)
A/D converter	: 16 bits
Speed	: 1000 cycles/ sec.
Accuracy	
Zero drift	: 0.25μ V/ ℃ RTI (max.)
Gain drift	: 0.01%/ ℃ (max.)
Noise	: 0.2μ Vp-p RTI (max.)
Non-linearity	: 0.03% FS ± 1 digit (0.5mV/V [input])
High and low limit comparison	
Setting range	: 0000~ ± 9999
Code	: Up to 8 codes
Code selection	: External input (3 digits)
Judging output	: HI, LO, GO, FAIL Insulated open-collector output
Hold mode	: 1. sample hold 2. peak hold 3. bottom hold 4. auto hilltop hold mode 5. auto valley hold 6. auto inflection hold

Serial data output	
Transmitting system	: Asynchronous
Transmitting speed	: 600bps
Analogue voltage output	
Output level	: Approx. 2V per 1mV/V input
Load resistance	: 5kΩ (min.)
Other functions	: Digital zero, zero tracking, digital filter, digital tare subtraction, hysteresis
Power source	: AC 100V ± 10%, 50/ 60 Hz, approx. 18VA
Operating temperature	: − 10℃ ～ + 40℃
Humidity	: 80% RH (max. non-condensation.)
External dimensions	: W 144 × H 72 × D 180 (mm)
Weight	: 2.2kg
Options	: B.C.D (OP TD-3203) RS-232C (OP TD-3204)