

## Digital Panel Meter

## K3TS



A High-speed Intelligent Signal Processor Capable of Inspecting 10,000 Objects a Minute

- Sampling time of 1.04 ms and only 5 ms output delay for high speed, high precision measurement
- Dual analog inputs with choice of 5 arithmetic functions
- Up to 5 comparative relay or transistor outputs available, plus BCD, linear or communications
- A wide range of standard features: sample averaging, output OFF delay, display refresh period, sensor excitation and 8 banks of comparative output valves
- Scaling of signal into relevant engineering units easily accomplished through the front panel
- Four choices of timing signal output operation (hold, minimum, maximum, peek and valley)
- Forced zero function for ease of calibration in deviation applications



## Ordering Information

### ■ DIGITAL PANEL METER BASE UNITS

Base units	Input type	Part number		
		Supply voltage		Applicable output boards
		100 to 240 VAC	12 to 24 VDC	
Set value LED model  Process value and set value LED, front panel membrane switches.	DC voltage/current	K3TS-SD11B	K3TS-SD12B	K31-C2/-C5 K31-T1/-T2 K31-B4 K31-L4/-L5/-L6/-L9/-L10 K31-FLK1/-FLK5/-FLK6
Thumbwheel switches model  Process value and set value thumb-wheel switches, front panel membrane switches.	DC voltage/current	K3TS-SD11D	K3TS-SD12D	K31-C1/-C2/-C5 K31-T1/-T2 K31-B4

Note: "Set Value LED" models must be used with an output board in order for them to operate.

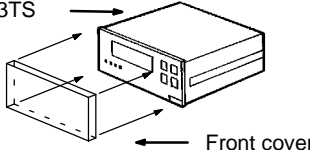
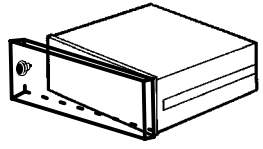
## ■ OUTPUT BOARDS

Output type	Output configuration	Part number
Comparative relay contact output	3 outputs (H, PASS, L (SPDT))	<b>K31-C1</b>
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	<b>K31-C2</b>
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	<b>K31-C5</b>
Comparative transistor output	5 outputs (NPN open collector)	<b>K31-T1</b>
	5 outputs (PNP open collector)	<b>K31-T2</b>
BCD output	BCD output + 5 transistor outputs (NPN open collector)	<b>K31-B4</b>
Linear output	4 to 20 mA + 5 transistor outputs (NPN open collector)	<b>K31-L4</b>
	1 to 5 V + 5 transistor outputs (NPN open collector)	<b>K31-L5</b>
	1 mV/digit + 5 transistor outputs (NPN open collector)	<b>K31-L6</b>
	0 to 5 V	<b>K31-L7</b>
	0 to 10 V	<b>K31-L8</b>
	0 to 5 V + 5 transistor outputs (NPN open collector)	<b>K31-L9</b>
	0 to 10 V + 5 transistor outputs (NPN open collector)	<b>K31-L10</b>
Communication unit*	RS-232C	<b>K31-FLK1</b>
	RS-485 + 5 transistor outputs (NPN open collector)	<b>K31-FLK5</b>
	RS-422 + 5 transistor outputs (NPN open collector)	<b>K31-FLK6</b>

\*For details, refer to "K3TS Communication Output-type Intelligent Signal Processor Operation Manual".

## ■ PROTECTIVE COVERS (ORDER SEPARATELY)

The Panel Meter does not have a water-resistive structure preventing the internal circuitry from drops of water that may penetrate through the space between the keys and operating panel. If operated by wet or oily hand, put a soft cover K32-49S (sold separately) onto the operating panel. Although the soft cover corresponds to IP51, use the watertight cover Y92A-49N where the Panel Meter is directly exposed to water or oil.

Description	Appearance	Part number
Transparent, soft front cover which protects the Set Value LED panel meter from oil and water. All keys on the front panel can be operated with the cover on. It meets IP51 only.		<b>K32-49SC</b>
Watertight cover meets NEMA 4 requirements for hose-down protection. Hinged cover is 94V-2 polycarbonate, packing is chloroprene rubber and base panel is 304 stainless steel.		<b>Y92A-49N</b>

## ■ MODEL NUMBER LEGEND

K3TS - 

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1
2
3
4
5

### 1, 2. Input Sensors Codes

SD: DC voltage/current input

### 3. Series No.

1: Standard specifications

2: Forced zero RAM

3: Display shift function

### 4. Supply Voltage

1: 100 to 240 VAC

2: 12 to 24 VDC

### 5. Display

B: Set value LED display

D: Thumbwheel switches

# Specifications

## RATINGS

Supply voltage		100 to 240 VAC (50/60 Hz); 12 to 24 VDC
Operating voltage range		85% to 110% of supply voltage
Power consumption		15 VA max. (at max. AC load); 10 W max. (at max. DC load)
Insulation resistance		10 MΩ min. at 500 VDC between external terminal section and housing
Dielectric strength		2,000 VAC min. for 1 min between external terminal section and housing
Noise immunity		±1,500 V on power supply terminals in normal or common mode ±1 μs, 100 ns for square-wave noise with 1 ns rise
Vibration	Malfunction	10 to 55 Hz, 0.5-mm for 10 min each in X, Y, and Z directions
	Destruction	10 to 55 Hz, 0.75-mm for 2 hrs each in X, Y, and Z directions
Shock	Malfunction	100 m/s <sup>2</sup> (approx. 10G) for 3 times each in X, Y, and Z directions
	Destruction	300 m/s <sup>2</sup> (approx. 30G) for 3 times each in X, Y, and Z directions
Ambient temperature	Operating	-10° to 55°C (14° to 131°F) with no icing
	Storage	-20° to 65°C (-4° to 149°F) with no icing
Humidity	Operating	35% to 85% RH with no condensation
Ambient atmosphere		Must be free of corrosive gas
Enclosure ratings	Front panel	IEC IP50
	Rear case	IEC IP20
	Terminals	IEC IP00
Approvals	UL	File No. E41515
	CSA	File No. LR67027

## CONTROL OUTPUT BOARD RATINGS

Note: Output boards which can have combinations of output settings will be denoted by an \* after the part number

### Relay Contact Outputs

Part number		K31-C1, K31-C2, K31-C5
Rated load	Resistive load	5 A at 250 VAC; 5 A at 30 VDC (p.f. = 1)
	Inductive load	1.5 A at 250 VAC, 1.5 A at 30 VDC (p.f. = 0.4)
Carry current		5 A max. at COM terminal
Max. contact voltage		380 VAC, 125 VDC
Max. contact current		5 A max. at COM terminal
Max. switching capacity	Resistive load	1,250 VA, 150 W
	Inductive load	375 VA, 80 W
Output response	ON time	15 ms
	OFF time	15 ms
Min. permissible load		10 mA at 5 VDC

### Transistor Outputs

Part number		K31-T1, K31-L4*, K31-L5*, K31-L6*, K31-L9*, K31-L10*, K31-B4*, K31-S5*, K31-S6*	K31-T2
Output type		NPN open collector	PNP open collector
Rated load voltage		12 to 24 VDC, +10%/-15%	
Maximum load current		50 mA	
Leakage current		100μA max.	
Output response time		1 ms max.	

**Linear Outputs**

Part number	K31-L4*	K31-L5*	K31-L6*	K31-L9*	K31-L10*
Output capacity	4 to 20 mA	1 to 5 V	mV/digit	0 to 5 V	0 to 10 V
Resolution	4,096				
Permissible load resistance	600Ω max.	500Ω min.	1 KΩ min.	500Ω min.	500Ω min.

**BCD Outputs**

Part number			K31-B4*	
Inputs	REQUEST HOLD MAX REQ. MIN REQ. RESET	Input voltage		No-voltage contact input
		Input current		10 mA
		Operating voltage	ON	1.5 V max.
			OFF	3 V min.
		Input response time	ON	30 ms
			OFF	12 ms
Outputs	DATA (4 digits) POLARITY DATA OVERFLOW DATA VALID RUN	Rated load voltage		12 to 24 VDC, +10%/-15%
		Max. load current		10 mA
		Leakage current		100μA max.

**■ COMMUNICATIONS**

Part number		K31-FLK1	K31-FLK6	K31-FLK5
Output type		RS-232C	RS-422	RS-485
Transmission method		4-wire, half-duplex		2-wire, half-duplex
Synchronization method		Start-stop synchronization		
Baud rate		1,200/2,400/4,800/9,600/19,200/38,400		
Transmission code		ASCII (7-bit)		
Communications	Write to K3TS	Comparative set value, prescaling value, remote/local programming, reset control of maximum/minimum values, and other setting mode items excluding communications conditions.		
	Read from K3TS	Process value, comparative set value, maximum value, minimum value, model data, error code, and others.		

## ■ CHARACTERISTICS

Input		DC voltage/current
Input range		See "Measurement Ranges" table below
A/D conversion method		Sequential conversion method
Sampling speed		1.04 ms
Display refresh speed	Selectable	Sampling period 0.1/1.0/2.0/3.0/4.0 s
Max. displayed digits		4 digits ( $\pm 9999$ )
Display		7-segment LED
Polarity display		"-" is displayed automatically when the input signal is negative.
Zero display		Leading zeros are automatically suppressed.
Scaling function		Programmable with front-panel key inputs (range of display: $\pm 9999$ with a decimal position of $10^{-1}$ to $10^{-3}$ )
Math operations		A, A + B, A - B, k - (A + B), (1 - B/A) x 100, B/A x 100
Operation functions	Normal	Panel meter display will update as fast as the inputs are scanned
	Hold	Process value held until external source sends signal to update display
External controls	TIMING	Timing input
	HOLD	Process value held, maximum/minimum data, peak-to-peak, sampling held
	RESET	Maximum/minimum data reset, measurement reset
	ZERO	Forced zero
	BANK	Selection of one bank out of 8 banks of set values
Comparative output setting		4-stage setting (when a 5-output unit is used); 2-stage setting (when a 3-output unit is used)
Output hysteresis setting		Programmable with front-panel key inputs (1 to 999 digits).
Other functions		Set value protect (for models with comparative outputs only) Variable linear output range (for models with linear outputs only)
Output configuration	Relay contact outputs	5 or 3 outputs
	Transistor outputs	NPN open collector
	Parallel BCD outputs	NPN open collector
	Linear output	4 to 20 mA, 1 to 5 V, mV/digit
	Communication functions	RS-232C, RS-485, RS-422
Delay in comparative outputs	Normal	6.24 ms
	HOLD	5.20 ms
Memory protection		Non-volatile memory (EEPROM)

## ■ MEASUREMENT RANGES

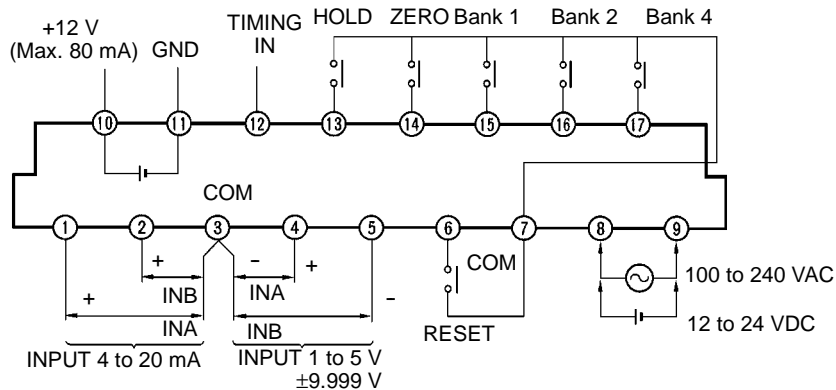
Input type	Measurement range	Input impedance	Accuracy*	Instantaneous overload
Current	2.40 to 26.00 mA	10 $\Omega$	1-ch. input: $\pm 0.1\%$ reading $\pm 1$ digit maximum 2-ch. input: $\pm 0.2\%$ reading $\pm 1$ digit maximum	$\pm 200$ mA
Voltage	0.600 to 6.500 V	1 M $\Omega$		$\pm 200$ V
	$\pm 9.999$ V	1 M $\Omega$		$\pm 200$ V

Note: Accuracy is measured at 25°C (73°F) ambient temperature,  $\pm 5^\circ\text{C}$  ( $\pm 9^\circ\text{F}$ )

# Connections

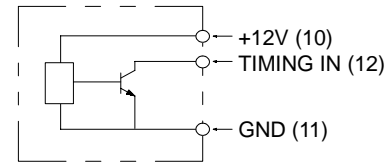
## EXTERNAL CONNECTION

### Base Unit



### Connecting timing sensor:

ON: Residual voltage must be 3 V max.  
 OFF: Leakage current must be 1.5 mA max.  
 Load current: The input device must have a switching capacity of 20 mA min..

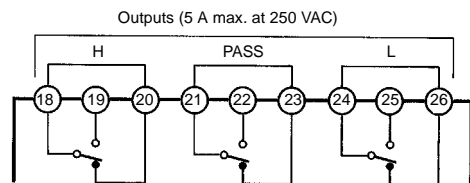


Terminals 11 and 12 should be opened and closed so that a load current of 5 mA or less will be easily switched for a non-voltage contact input.

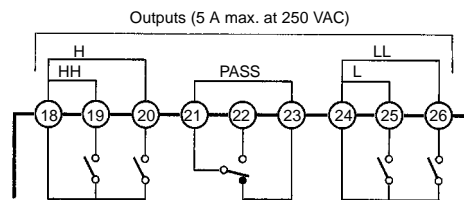
## OUTPUT BOARDS

### Comparative Relay Contact Output Types

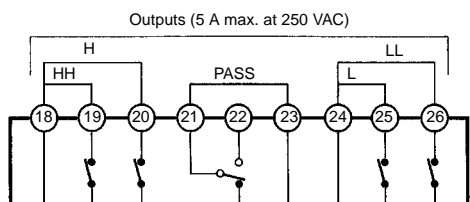
#### K31-C1



#### K31-C2

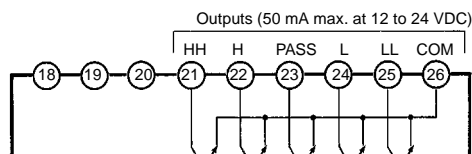


#### K31-C5

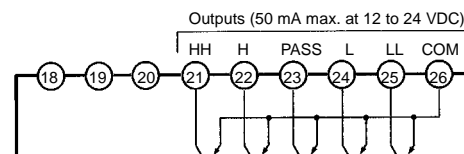


### Comparative Transistor Output Type

#### K31-T1



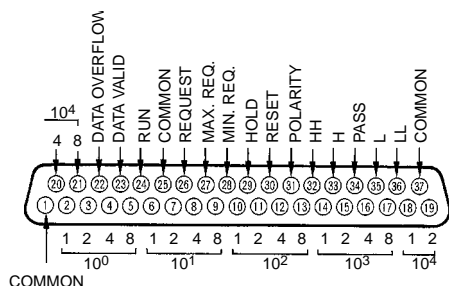
#### K31-T2



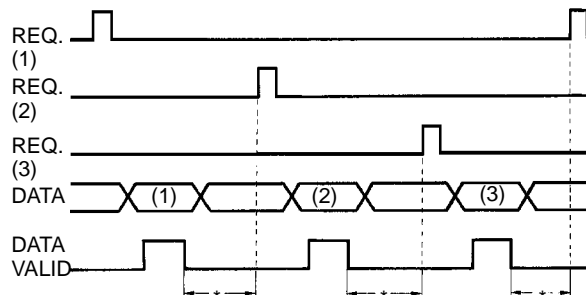
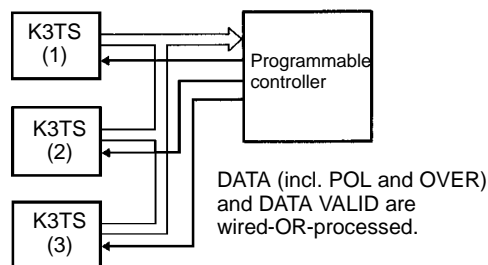
## BCD Output Type

### K31-B4

(Terminals 32 to 36 are provided only on models with special specifications.)



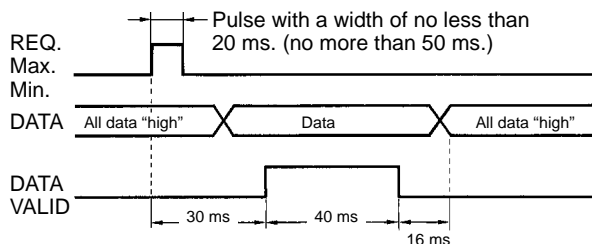
Models with a BCD output have an open collector output configuration so that wired-OR connection is possible.



\*The period between the DATA VALID signal and the REQ signal should be no less than 20 ms max..

## BCD Output Timing Chart

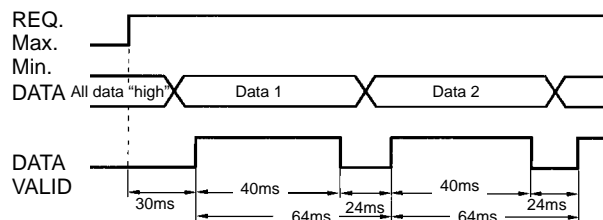
### Single Sampling Data Output



Approximately 30 ms after the REQ signal rises, a sample is taken and the DATA VALID signal is output. Read the data when the DATA VALID signal is ON.

The DATA VALID signal will turn OFF in 40 ms, and then in 16 ms, the data will go OFF.

### Continuous Data Output



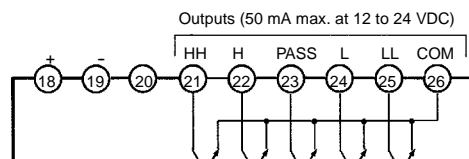
The K3TS outputs each measurement on an interval of 64 ms when a REQ signal is ON continuously.

If the HOLD signal is ON at the moment the DATA output is switched from data 1 to data 2 or vice versa, the output BCD data will be either data 1 or data 2 according to the timing of the HOLD signal. However, output data will be low.

## Linear Output Type

### K31-L4, L5, L6, L9, L10

(Terminals 21 to 26 are provided only on models with special specifications.)

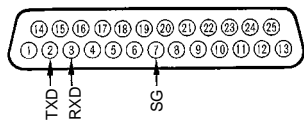


Outputs (50 mA max. at 12 to 24 VDC)  
 L4: 4 to 20 mA  
 L5: 1 to 5 V  
 L6: mV/digit  
 L9: 0 to 5 VDC + 5 transistor outputs (NPN)  
 L10: 0 to 10 VDC + 5 transistor outputs (NPN)



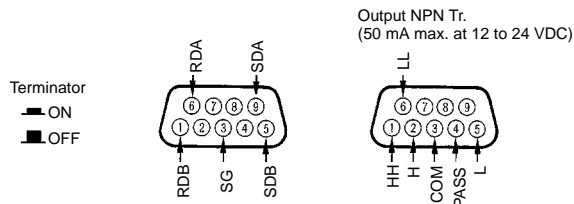
## Communications Output Type

### K31-FLK1



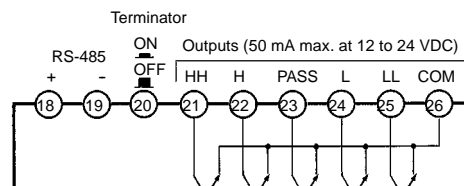
### K31-FLK6

(The right connector is provided only on models with special specifications)



### K31-FLK5

(Terminals 21 to 26 are provided only on models with special specifications.)



D-sub 37P Connectors for BCD output (order separately)

Plug: XM2A-3701

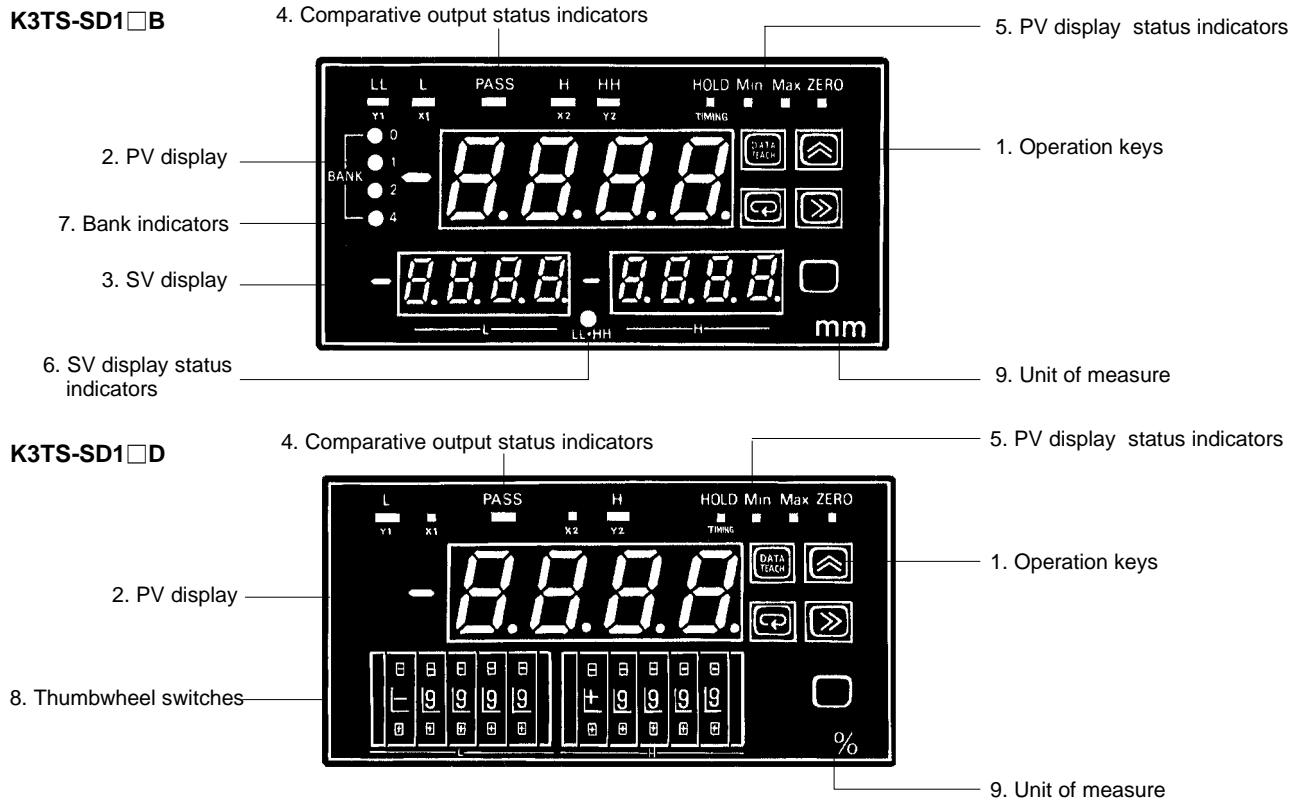
Hood: XM2S-3711

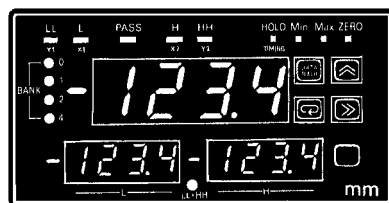
D-sub 9P connectors for RS-422 output (order separately)

Plug: XM2A-0901 or XM4A-0921

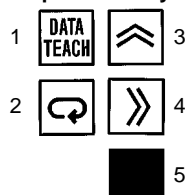
Hood: XM2S-0911

# Nomenclature





## Operation Keys

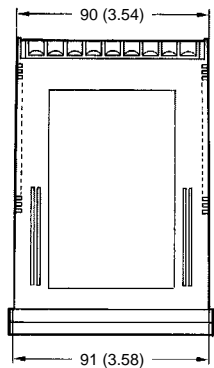
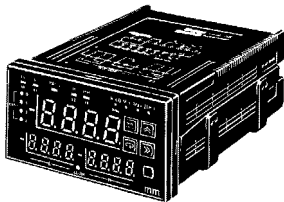


No.	Name	Functions
1	DATA TEACH 	<p>The process value, maximum value, or minimum value is selected.</p> <p>In the setting mode, effects the teaching function. With this function, the set values, prescale values and output range are set by means of actual input.</p>
2	Display Key 	<p>The value shown on the SV display changes for models with LED displays. In the setting mode, this key is used to enable setting or to write set values into memory after selecting the parameter with the Shift Key.</p>
3	Up Key 	<p>Used to increment the current digit in the set value by one.</p>
4	Shift Key 	<p>Used to shift the digit being set.</p> <p>Used to select parameters within each setting level.</p>
5	Level Key 	<p>Used to enter the setting mode. Used within the setting mode to change setting levels.</p>

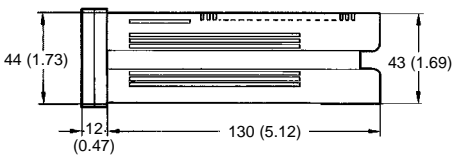
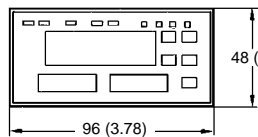
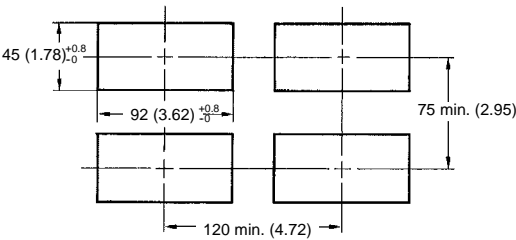
Note: Refer to "K3TS Operation Manual" for details.

# Dimensions

Unit: mm (inch)



Panel Cutouts

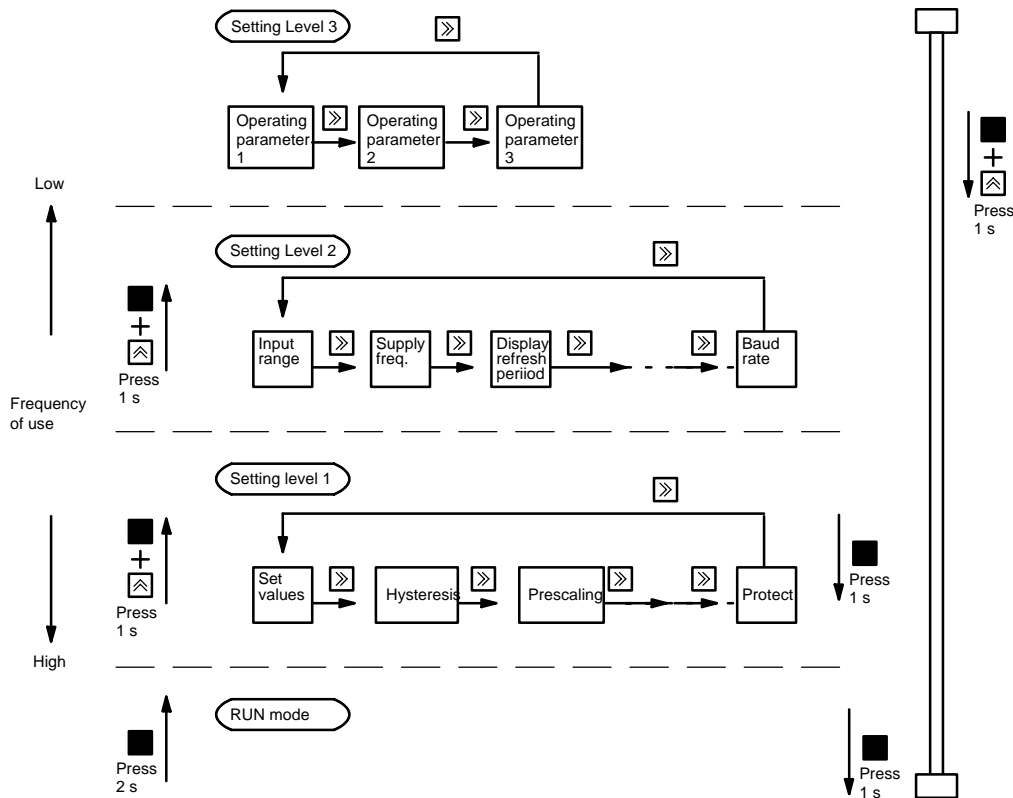


# Operation

## ■ SETTING MODE LEVELS AND PARAMETERS

The Digital Panel Meter has two main modes: RUN mode for normal operations and setting mode for initial parameter input. The setting mode is divided into three levels based on frequency of use. Within both of these levels are various parameters that can be set. Initial setting of parameters thus entails entering the setting mode, shifting to the levels that contain parameters that must be set, selecting the parameters and writing in the desired set values.

### Setting Level Diagram

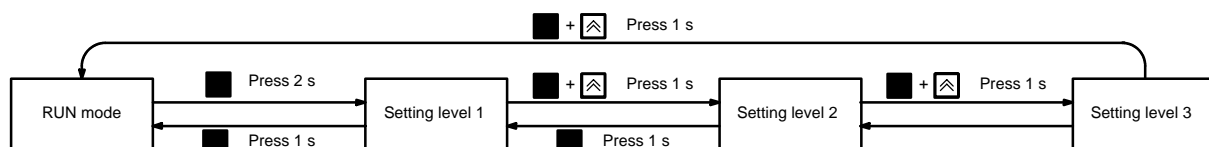


1. Press the Level **■** Key to proceed to setting level 1. Press the Level **■** Key and Up **⏶** Key once simultaneously to proceed to setting level 2 or twice simultaneously to proceed to setting level 3.
2. Use the Shift **⏏** Key to find the desired parameter.
3. Press the Display **⏻** Key to access the parameter.
4. Use the Up **⏶** Key or Shift **⏏** Key to input the desired value.
5. Exit the present parameter with the Display **⏻** Key.
6. Return to the RUN mode with the Level **■** Key or with the Level and Up **■ + ⏶** Keys pressed simultaneously.

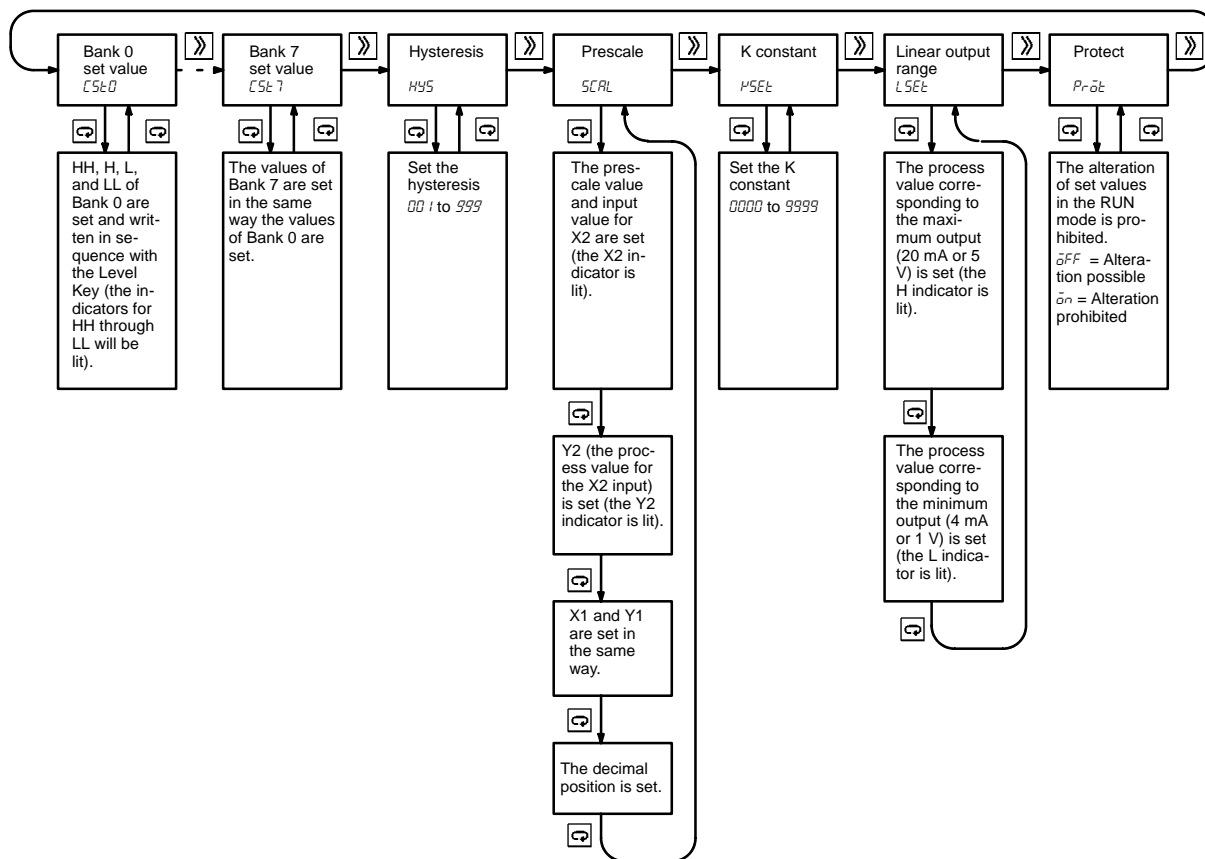
## ■ SETTING PROCEDURES

The K3TS stops operating in the setting mode. There are setting parameters that cannot be set or displayed by some K3TS models due to the differences in the Display Models or Output Models. Refer to the K3TS Operation Manual for further information.

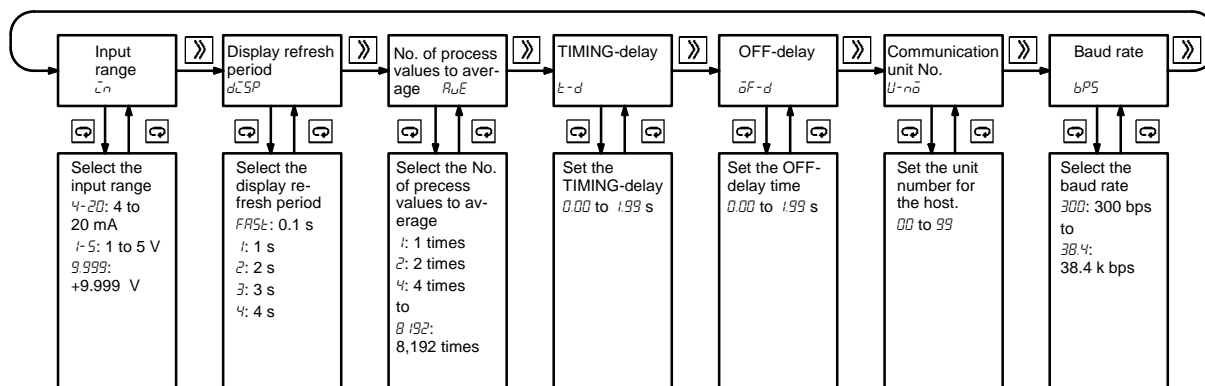
### Shifting Levels



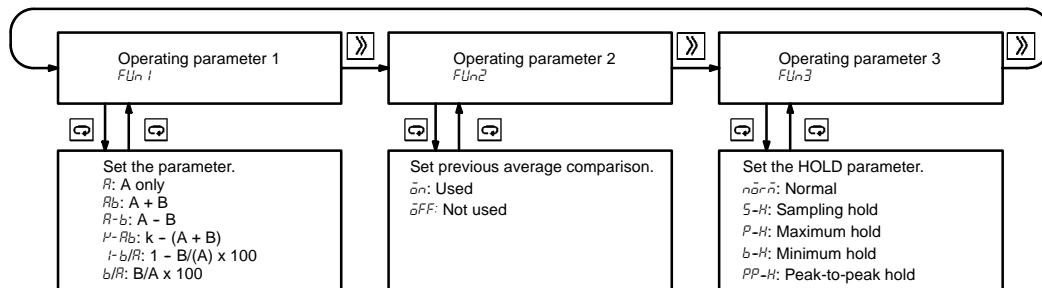
## Setting Level 1



## Setting Level 2



## Setting Level 3



## PARAMETERS

$\overline{CSL0}$  to 7 (not provided on Thumbwheel Switches Models)

Set values on each bank can be set with Up Key and Shift Key. The HH, H, L, or LL comparative output status turns ON when the measured value exceeds the HH or H set value or falls below the L or LL set value. The available setting range is between -9999 to 9999.

The HH and H comparative output status values are set to 9999 and the L and LL comparative output status values are set to -9999 before shipment.

$HYS$

The hysteresis of comparative outputs can be set with Up Key and Shift Key. The available setting range is between 001 and 999. The hysteresis is set to 001 before shipment.

$SCALE$

Prescale values X2, Y2, X1, and Y1 can be set with Up Key and Shift Key.

X2: Any input value

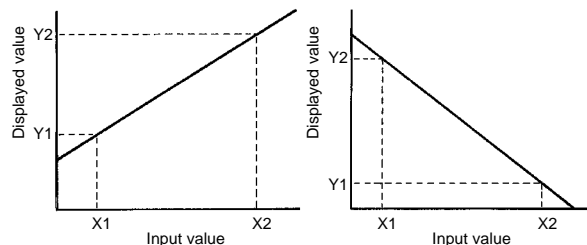
Y2: The displayed value corresponding to X2

X1: Any input value

Y1: The displayed value corresponding to X1

Set so that X2 is larger than X1. Y1 can be either smaller or larger than Y2.

X2 and Y2 are set to 2000 (20.00 mA) and X1 and Y1 are set to 400 (4.00 mA) before shipment.

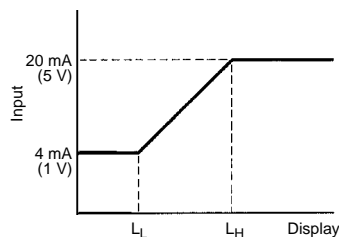


$PSEL$

Set K constant in the parameter,  $K = (A + B)$ , with Up Key and Shift Key. The available setting range is between 0000 and 9999. K constant is set to 0000 before shipment.

$LSEL$  (Special linear output model only)

A linear output range can be set as required. A value corresponding to the  $L_H$  maximum output value (20 mA or 5 V) and that corresponding to the  $L_L$  minimum output value (4 mA or 1 V) can be set with the Up Key and Shift Key. The available setting range is between -9999 and 9999. The  $L_H$  value is set to 9999 and the  $L_L$  value is set to -9999 before shipment.



$Pr\overline{OL}$  (excluding the Thumbwheel Switches Models)

The set value protect can be ON and OFF using the Up Key in the RUN mode.  $\overline{ON}$  = Protected,  $\overline{OFF}$  = Not protected.  $\overline{OFF}$  is set before shipment.

$\overline{IN}$

The input range (4 to 20 (4 to 20 mA), 1 to 5 (1 to 5 V), and 9.999 = +9.999) can be selected with the Up Key. The 4 to 20 mA range is set before shipment.

$d\overline{LSP}$

A display refresh period among five levels,  $FRSE$  (every 0.1 s), 1 (every 1 s), 2 (every 2 s), 3 (every 3 s), and 4 (every 4 s), can be selected with the Up Key. The  $FRSE$  level is selected before shipment.

$RuE$

The number of process values to be averaged (1 to 8192, on 14 different levels) can be selected with the Up Key. A value of 8 level is set before shipment.

$t-d$

TIMING-delay time (the period required for the K3TS to accept the TIMING signal after it is ON) can be set with the Up Key and Shift Key. The available setting range is between 0.00 and 1.99. A time of 0.00 is set before shipment.

$\overline{OF-d}$

Output OFF-delay time can be set with the Up Key and Shift Key. The available setting range is 0.00 to 1.99. The time is set to 0.00 before shipment.

$U-n\overline{O}$  (Communications Output Models)

A unit number, an identification number by which the host computer identifies each K3TS Intelligent Signal Processor, can be selected with Up Key and Shift Key. The available setting range is 00 to 99. A value of 00 is set before shipment.

$bPS$  (Communications Output Models)

A baud rate up to 38,400 bps can be selected with the Up Key. The available setting range is 300 to 38.4K. A value of 9600 is set before shipment.

$FUn1$

Operating parameter 1 can be set to one of the following:

$R$ : A only;  $Rb$ :  $A + B$ ;  $R-b$ :  $A - B$ ;  $P-Rb$ :  $k - (A + B)$ ;

$1-b\overline{OR}$ :  $1 - B/(A) \times 100$ ; or  $b\overline{OR}$ :  $B/A \times 100$ .

a is set before shipment.

$FUn2$

Previous average value comparison (operating parameter 2) can be turned ON and OFF with the Up Key ( $\overline{ON}$  = Possible,  $\overline{OFF}$  = Not possible).  $\overline{OFF}$  is set before shipment.

$FUn3$

The holding data parameter can be set to one of the following:

$n\overline{OR-n}$  (Normal),  $S-H$  (Sampling hold),  $P-H$  (Peak hold),  $b-H$  (Bottom hold), or  $PP-H$  (Peak-to-peak hold) with the Up Key.  $n\overline{OR-n}$  is set before shipment.

- Verify that panel thickness is 1 to 3.2 mm (0.04 to 0.13 in).

NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.

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