

GS 05D01D02-01E

General

Model UT350 Digital Indicating Controller is a highly accurate 1/4DIN controller provided with universal input/output. It has a large display for readings and excellent monitoring operability with the Auto/Man switching key. In addition, heating/cooling control, including PID control with auto-tuning, the "SUPER" overshoot suppressing function "SUPER" and the hunting suppressing function "SUPER2" are available as control functions, and a retransmission of variables and a 15 V DC loop power supply are also equipped as standard. A communication function or 24 V DC loop power supply is available optionally. As described above, the UT350 is a controller provided with higher functions and capability than conventional similar-size controllers.

Main Features

- Extra-large digital display allows the indicated values to be read even from a long distance. LEDs of 20mm height are used for the process variable display.
- Universal input and output enable users to set or change freely the type of measured inputs(thermocouple, RTD, or DCV), measurement range, type of control output(4 to 20 mA current, voltage pulse, or relay contact), from the front panel.
- Parameters can be easily set using a personal computer. ("Parameter setting tool (model LL100)" sold separately is required.)
- Various communication functions are provided. Communication is possible with personal computer, programmable logic controller, and other controllers.

Functional Specifications

Control Computation Functions

Control computation:

Can be selected from the following types:
Continuous PID control, Time-proportional PID control, Heating/Cooling control (for heating/cooling type only) or Relay ON/OFF control.

Control cycle time: 250 ms

Number of sets of target setpoints and PID parameters: 4

Target setpoint and PID selection:

PID parameters are provided for every target setpoint and the set of PID parameters are selected at the same time that the setpoint number is selected.

Zone PID selection:

PID parameters are selected depending on the value of the PV. For selection, the reference point (PID parameter selection setpoint) or the reference deviation is used.

Reference point method:

The measuring input range is divided into a maximum of three zones with up to two reference points, and PID parameters are selected (No. 1 PID to No. 3 PID) for every zone.

UT350



UT350E

"E" indicates the model with expanded functions.



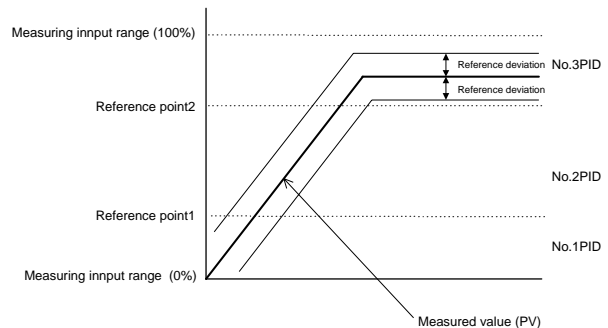
Reference point = Measuring input range (0%) \cong Reference point 1 \cong Reference point 2 \cong Measuring input range (100%)

Reference point hysteresis = Fixed to 0.5% of the measured input range span.

Reference deviation method:

PID parameters (No. 4 PID) are selected when the deviation exceeds the reference deviation. This process takes precedence over the reference point method.

Reference deviation = OFF or 0.1 to 100.0% of measured input range span



Auto-tuning:

Available as standard. If auto-tuning is operated, PID constants are automatically set (limit cycle method).

"SUPER" function:

Overshoots generated by abrupt changes in the target setpoint or by disturbances can be suppressed.

"SUPER2" function:

The function stabilizes the state of control that is unstable due to hunting, etc. without requiring any change in PID constants, when the load and/or gain varies greatly, or when there is a difference between the characteristics of temperature zones.

Control Parameters Setting Range

- Proportional band = 0.1 to 999.9%
 0.0 to 999.9% for heating/cooling control,
 0.0% for ON/OFF control
- Integral time = 1 to 6,000s, or OFF (manual reset)
- Derivative time = 1 to 6,000s, or OFF
- Manual reset value = -5.0 to 105.0% of output range
 (functions when integral time is off.)
- ON/OFF control hysteresis = 0.0 to 100.0% of measured
 input range span (0.1 to 0.5% for heating/
 cooling control)
- Setpoint rate-of-change setting = off, or 0.0 to 100.0%/h or
 min of measured input range span.
 A PV tracking function operates automatically
 when the setpoint is changed, the power is
 turned on, or the mode is changed from
 manual to automatic.
- Direct/reverse action:
 The output increase/decrease direction can be
 defined corresponding to a positive or
 negative deviation.
 For heating/cooling control, it is fixed; for the
 heating side output, reverse, for the cooling
 side output, direct.
- Anti-reset windup:
 When controller output is limited, normal
 integration is superseded by an anti-reset
 windup computation to suppress over-
 integration.
- Control output cycle time = 1 to 1000 s (for Time-
 proportional PID control) (the cooling side
 output cycle time is also the same when
 heating/cooling control is used).
- Preset output value = -5.0 to 105.0% of output range
- Output tracking:
 Whether the output bump is provided or not
 can be selected by changing the PID control
 mode.
- Output limiter
 Upper limit = Lower limit to 105.0% of output
 range
 Lower limit = -5.0% of output range to upper
 limit
- Heating/cooling dead band = -100.0 to 50.0% for output
 range

● Signal Computation Functions

- Measured input computation:
 Bias addition (-100.0 to 100.0% of measured
 input range span), and first-order lag filter
 (time constant off or 1 to 120 s)
- Contact input function:
 Target setpoint selection, Auto/Man operating
 mode switching, key lock parameter display/
 non-display switching
 Target setpoint selection can be done for
 either a 2-setpoint or 4-setpoint selection.
- If the 2-setpoint selection is set, Auto/Man
 mode switching can be used as well.
 - If the 4-setpoint selection is set, Auto/Man
 switching and key lock parameter display/non-
 display switching cannot be used together.
- If key lock parameter display/non-display
 switching is used, target setpoint selection and
 Auto/Man mode switching cannot be used.

● Alarm Functions

Eighteen types of alarm functions are provided. The alarm
 status is indicated by the alarm lamp on the front panel.
 Also, three points among them can be output as relay contact
 outputs.

Alarm types:

PV high limit, PV low limit, Deviation high
 limit, Deviation low limit, Deenergized on
 deviation high limit, Deenergized on deviation
 low limit, Deviation high and low limits, High
 and low limits within deviation, Deenergized
 on PV high limit, Deenergized on PV low
 limit, SP high limit, SP low limit, Output high
 limit, Output low limit, Heater burnout alarm,
 sensor grounding alarm, Fault diagnostic
 alarm, FAIL output.

Alarm output:

3 points. Any three points can be output as
 contact outputs among the above alarms. For
 heating/cooling control, if cooling side output
 is output as a relay contact, up to two alarm
 outputs can be used.

Setting ranges for PV, deviation, setpoint and output alarms:

PV/setpoint alarm:

-100.0 to 100.0% of measured input range

Deviation alarm:

-100.0 to 100.0% of measured input range
 span

Output alarm:

-5.0 to 105.0% of output range

Alarm hysteresis:

0.0 to 100.0% of measured input range span

Delay timer:

0.00 to 99.59 (minute, second)

An alarm is output when the delay timer
 expires after the alarm setpoint is reached.

Setting for each alarm is possible.

Stand-by action:

Stand-by action can be set to make PV/
 deviation alarm OFF during start-up or after
 SP change until SP reaches the normal region.

Heater burnout alarm (optional):

Two circuits incorporated

A heater burnout alarm is output if the heater
 current consumption is the burnout detection
 value or less. This alarm can be used for
 Relay ON/OFF control or time-proportional
 PID control.

Heater current setting range: 0.0 to 50.0 A

Setting accuracy: $\pm 5\%$ of span ± 1 digit

Heater current detecting resolution: 0.5 A

Time required until burnout detection is on:

0.2 s minimum

burnout sensor model: CTL-6-S-H(URD Co. Ltd.)

Sensor grounding alarm:

An alarm is output after detecting a change in
 control output. If the moving average * of
 control output is out of the setting range
 (between the high and low limits of the on/off
 rate) in spite of the deviation being within a
 fixed range (on/off rate detection band) and
 control being in stable condition, the sensor is
 judged to be in a grounding condition.

* Moving average refers to the average value for output
 values sampled (five times) in every cycle time.

High- and low-limit setting range of on/off rate:

-5.0 to 105.0% of output range

Detection band of on/off rate:
0.0 to 100.0% of measured input range span.

Fault diagnostic alarm:
Input burnout, A/D conversion error,
thermocouple reference junction compensa-
tion error

FAIL output:
Software failure and/or hardware failure
When in fail, control output, retransmission
output and alarm output become 0% or OFF.

● **Display and Operation Function**

PV display: In 4-digit digital display for engineering data

Setpoint display:
Various data, such as the setpoint (SP), are
displayed by selection on the 4-digit digital
display.

Status indicating lamps:
3 alarm indicator lamps: AL1, AL2, AL3
3 setpoint number indicator lamps:
SP2, SP3, SP4 (Go out when SP1 is selected.)

MAN operation mode lamp: MAN (lit in MAN mode)

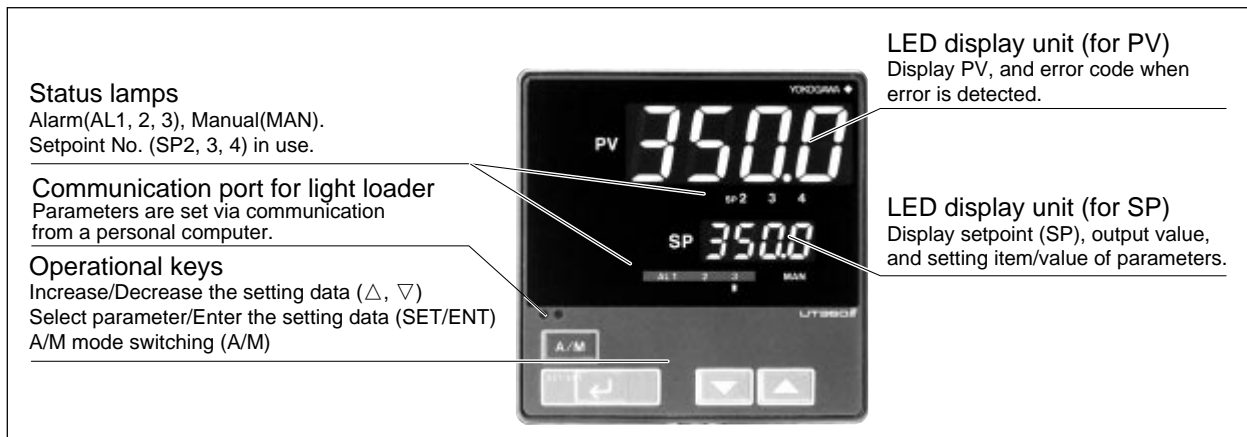
Operation keys:
△ and ▽ keys:
Increase or decrease setpoints and various
parameters.

SET/ENT key:
Used for data setting or call-up/selection of
various parameters

A/M key: Switching of operation mode (Auto/Man)

SELECT display:
A panel where operating parameters that are
frequently changed during operation can be
selected and registered. For example, by
registering the alarm -1 setpoint in the
SELECT display, the setpoint can easily be
displayed during operation.

Security function:
An operation-inhibiting mode using a
password is provided.



● **Communication Functions(optional)**

This controller has a communication function and can be connected to a personal computer, programmable logic controller or other GREEN series controllers.

Communication protocol

Computer link communication:

Communication protocol with a personal computer.

Ladder communication:

Communication protocol with programmable logic controller.

MODBUS communication:

Communication protocol with a personal computer or PLC.

Coordinated operation:

Communication protocol to coordinated operation with two or more GREEN series controllers. The UT350 can be connected as a master station or a slave station.

Communication interface

Communication protocol:

Computer link, ladder communication, MODBUS or coordinated operation.

Standards: EIA RS485

Maximum number of connectable controllers:

31 GREEN series controllers

Maximum communication distance: 1,200 m

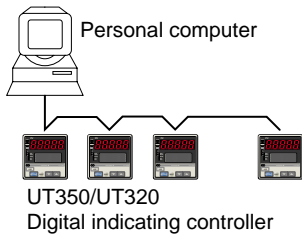
Communication method:

Two-wire half duplex or four-wire half duplex, start-stop synchronization, non-procedural.

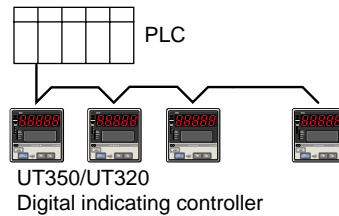
Communication rate: 600, 1200, 2400, 4800, or 9600 bps

Examples of Communication System Configuration Diagram

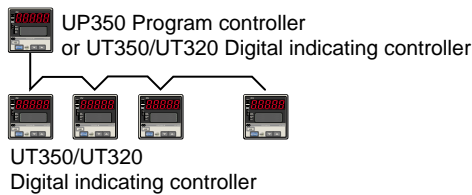
(1) Computer link communication



(2) Ladder communication



(3) Coordinated operation



■ Hardware Specifications

Measured Input Signal

Number of input points: 1

Input system:

The types of input/measurement ranges can be set using key operation or software from a list of inputs.

Input type, measurement ranges and measurement accuracy:

Refer to the table below.

Input Type		Input range code	Instrument range (°C)	Instrument range (°F)	Measurement accuracy*1			
Unspecified(when shipped from the factory)		OFF	Set the data item PV input Type"IN" to the OFF option to leave the PV input type undefined.					
Thermocouple	K	1	-200 to 1370°C	-300 to 2500°F	±0.1% of instrument range ±1 digit for temperatures equal to or higher than 0 °C, ±0.2% of instrument range ±1 digit for temperatures below 0 °C			
		2	-199.9 to 999.9°C	0 to 2300°F				
		3	-199.9 to 500.0°C	-199.9 to 999.9°F				
	J	4	-199.9 to 999.9°C	-300 to 2300°F				
	T	5	-199.9 to 400.0°C	-300 to 750°F				
		6	0.0 to 400.0°C	-199.9 to 750.0°F				
	B	7	0 to 1800°C	32 to 3300°F	±0.15% of instrument range ±1 digit for temperatures equal to or higher than 400 °C ±5% of instrument range ±1 digit for temperatures below 400 °C			
	S	8	0 to 1700°C	32 to 3100°F	±0.15% of instrument range ±1 digit			
	R	9	0 to 1700°C	32 to 3100°F				
	N	10		-200 to 1300°C	-300 to 2400°F	±0.1% of instrument range ±1 digit ±0.25% of instrument range ±1 digit for temperature below 0 °C		
	E	11		-199.9 to 999.9°C	-300 to 1800°F	±0.1% of instrument range ±1 digit for temperatures equal to or higher than 0°C		
	L (DIN)	12		-199.9 to 900.0°C	-300 to 1300°F			
	U (DIN)			-199.9 to 400.0°C	-300 to 750°F	±0.2% of instrument range ±1 digit for temperatures below 0°C		
								0.0 to 400.0°C
	W (DIN)	15		0 to 2300°C	32 to 4200°F	±0.2% of instrument range ±1 digit		
	Platinel 2	16		0 to 1390°C	32 to 2500°F	±0.1% of instrument range ±1 digit		
	PR20-40			0 to 1900°C	32 to 3400°F	±0.5% of instrument range ±1 digit for temperatures equal to or higher than 800°C No guarantee of accuracy for temperatures below 800°C		
W97Re3-W75Re25			0 to 2000°C	32 to 3600°F	±0.2% of instrument range ±1 digit			
RTD	JPt100		-199.9 to 500.0°C	-199.9 to 999.9°F	±0.1% of instrument range ±1 digit (Note 1) (Note 2)			
	Pt100			-150.0 to 150.0°C	-199.9 to 300.0°F	±0.2% of instrument range ±1 digit (Note 1)		
Standard signal	0.4 to 2V	40	0.400 to 2.000	Scaling is enable in the following 4 range.	±0.1% of instrument range ±1 digit The read-out range can be scaled between -1999 and 9999.			
	1 to 5V	41	1.000 to 5.000					
DC voltage	0 to 2V	50	0.000 to 2.000	-1999 to 9999				
	0 to 10V	51	0.00 to 10.00	-199.9 to 999.9				
	-10 to 20mV	55	-10.00 to 20.00	-19.99 to 99.99				
	0 to 100mV	56	0.0 to 100.0	-1.999 to 9.999				

*1: Performance in the standard operating condition (at 23°C ±2°C, 55±10%RH, and 50/60Hz power frequency)

*2: To receive a 4 to 20mA DC signal, select a standard signal of 1 to 5V DC and connect it to a 250 ohm resistor. This resistor is optional.

Model & suffix code : X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

Note 1: The accuracy is ±0.3°C of instrument range ±1 digit for a temperature range from 0 to 100°C.

Note 2: The accuracy is ±0.5°C of instrument range ±1 digit for a temperature range from -100 to 0°C and 100 to 200°C.

Sampling period: 250 ms

Burnout detection:

Functions with a thermocouple (TC), RTD, standard signal 0.4 to 2 V DC, and 1 to 5 V DC. Can be specified as upscale, downscale, and off. For standard signal, judged as burnout at 0.1 V or less.

Input bias current: 0.05 µA (for TC/RTD b-terminal)

Measuring current(RTD): about 0.13mA

Input resistance:

1 MΩ or more for TC/mV input
About 1 MΩ for DC voltage input

Allowable signal source resistance:

250 Ω or less; effect of permissible signal source resistance 0.1 µV/Ω or less for TC/mV input 2 k Ω or less; effect of permissible signal source resistance 0.01%/100 Ω or less for DC voltage input

Allowable leadwire resistance:

Max. of 150 Ω/wire (resistance in each of three wires must be equal) for RTD input However, 10 Ω/wire for a maximum range of -150.0 to 150.0°C. Effect of permissible leadwire resistance ±0.1°C/10 Ω or less

Allowable input voltage:
 ± 10 V DC for TC/mV/RTD input
 ± 20 V DC for DC voltage input

Noise rejection ratio:
 Normal mode 40 dB (50/60 Hz) or more
 Common mode 120 dB (50/60 Hz) or more

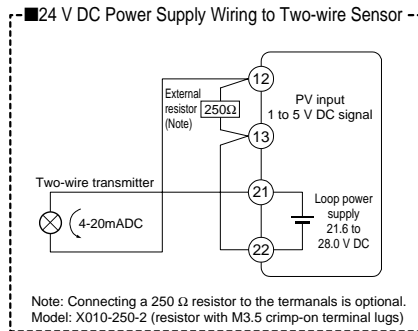
Reference-junction compensation error:
 ± 1.0°C (15 to 35°C),
 ± 1.5°C (0 to 15°C, 35 to 50°C)

Applicable standards: JIS, IEC, or DIN(ITS-90) for TC and RTD

24V DC Loop Power Supply for Sensor

The controller supplies power to a two-wire transmitter. Place a resistor (10 to 250Ω) between the controller and the transmitter, convert a current signal to a voltage signal, and read it from the PV input.

21.6 to 28.0 V DC, maximum supply current is about 30mA (only for models with 24V DC loop power supply).



Retransmission Output

Either PV, target setpoint, or control output is output. Either the retransmission output or the 15V DC loop power supply can be used.

Number of output points: 1
 Output signal: 4 to 20 mA DC
 Load resistance: 600 Ω or less
 Output accuracy: ± 0.3% of span
 * Performance in the standard operating conditions (at 23± 2°C, 55± 10% RH, and 50/60 Hz power frequency)

15V DC loop power supply:

Supply voltage is 14.5 to 18.0 V DC. Maximum supply current is about 21 mA (with a protection circuit for a field short-circuit).

Control Outputs

The control output is of a universal scheme and can be selected from the following types of outputs. In the case of heating/cooling control, it is also selectable from these outputs. However, if the cooling side output is a relay contact output, the alarm-3 cannot be used, and similarly if the cooling side output is a voltage pulse or current output, the retransmission output/15 V DC sensor power supply cannot be used.

Current output
 Number of output points: 1 or 2 (2 for heating/cooling type), switched between voltage pulse output and current output.
 Output signal: 4 to 20 mA
 Load resistance: 600 Ω or less
 Output accuracy: ±0.3% of span
 * Performance in the standard operating conditions (at 23± 2°C, 55± 10% RH, and 50/60 Hz power frequency)

Voltage pulse output
 Number of output points: 1 or 2 (2 for heating/cooling type), switched between voltage pulse output and current output.
Output signal:
 On voltage = 12 V DC or more (load resistance of 600 Ω or more; current on short-circuiting about 30 mA)
 Off voltage = 0.1 V DC or less
Resolution: 10 ms
Relay contact output
 Number of output points: 1 or 2 (2 for heating/cooling type)
Output signal:
 Three terminals for NC, NO, and Common transfer-contact
Contact rating:
 250 V AC, 3 A or 30 V DC, 3A (resistive load)
Resolution: 10 ms

Contact Inputs

Usage: Target setpoint selection, Auto/Man mode switching, or Key lock parameter display/non-display switching
Number of input points: 2
Input type: Non-voltage contact input or transistor open collector input
Input contact rating: 12 V DC, 10 mA or more (for non-voltage contact input)
On/off determination:
 For non-voltage contact input,
 ON = contact resistance of 1 kΩ or less,
 OFF = contact resistance of 20 kΩ or more.
 For transistor contact input,
 ON = 2 V or less,
 OFF = leakage current of 100 μA or less.
Minimum retention time for status detection: about 1 second

Contact Outputs

Usage: Alarm output, FAIL output, and others
Number of relay contact output points: 3
Relay contact rating: 240 V AC, 1 A or 30 V DC, 1 A (COM terminal is common for every contact output.)

● Display Specifications

PV display:
 4-digit, 7-segment red LED; character height - 20 mm
Setpoint display:
 4-digit, 7-segment red LED; character height - 9.3 mm
Status indicating lamps: LEDs

● Conformance to Safety and EMC Standards

Safety: Compliant with IEC/EN61010-1: 2001, approved by CSA1010, approved by UL508.
Installation category : CAT. II (IEC/EN61010, CSA1010) **Pollution degree :** 2 (IEC/EN61010, CSA1010)
Measurement category : I (CAT. I : IEC/EN61010)
Rated measurement input voltage : 10V DC max.(across terminals), 300V AC max.(across ground)
Rated transient overvoltage : 1500V (Note)
Note : It is a value on the safety standard which is assumed by IEC/EN61010-1 in measurement category I, and is not the value which guarantees an apparatus performance.

EMC standards:

Complies with EN61326.
The instrument continues to operate at a measuring accuracy of within $\pm 20\%$ of the range during tests.

● Construction, Mounting, and Wiring

Construction: Dust-proof and Drip-proof front panel conforming to IP55.
For side-by-side close installation, the controller loses its dust-proof and drip-proof protection.

Material: ABS resin and polycarbonate

Case color: Black

Weight: Approx. 1 kg or less

External dimensions:

96 (width) \times 96 (height) \times 100 (depth) mm

Mounting : Direct panel mounting; mounting bracket, one each for upper and lower mounting

Panel cutout dimensions: $92_{-0}^{+0.8}$ (width) \times $92_{-0}^{+0.8}$ (height) mm

Mounting attitude:

Up to 30 degrees above the horizontal. No downward tilting allowed.

Wiring:

M3.5 (ISO 3.5 mm) screw terminals (signal wiring and power/ground wiring as well)

● Power Supply Specifications and Isolation

Power supply: Rated at 100 to 240 V AC ($\pm 10\%$), 50/60 Hz

Power consumption: MAX. 20 VA (MAX. 8.0 W)

Internal fuse rating: 250 VAC, 1.6A time-lag fuse

Memory back-up: Non-volatile memory (Service life approx. 100,000 times of writings)

Withstanding voltage:

1500 V AC for 1 minute between primary and secondary terminals. (Note)

1500 V AC for 1 minute between primary and ground terminals. (Note)

1500 V AC for 1 minute between ground and secondary terminals.

500VAC for 1 minute between two secondary terminals.

(Primary terminals = Power and relay output terminals)
(Secondary terminals = Analog I/O signal terminals, voltage pulse output terminals, contact input terminals)

Note. The withstanding voltage is specified as 2300V AC per minute to provide a margin of safety.

Isolation resistance:

20 M Ω or more when 500 V DC voltage is applied between the power terminals and ground terminal.

Grounding:

Class D grounding (grounding resistance of 100 Ω or less)

● Isolation specifications:

Measured input terminal:

Isolated from other I/O terminals. Not isolated from internal circuits.

15 V DC loop power supply terminals:

Not isolated from 4-20mA analog output and voltage pulse control output. Isolated from other I/O terminals and internal circuit.

24 V DC loop power supply terminals:

Isolated from other I/O terminals and internal circuit.

Control output (current or voltage pulse) and retransmission terminals: Not isolated between control output terminals and retransmission output terminals. Isolated from other I/O terminals and internal circuits.

Relay contact control output terminals:

Isolated from other I/O terminals and internal circuits.

Contact input terminals:

Not isolated from other contact input terminals mutually, and communication terminals. Isolated from other I/O terminals and internal circuits.

Relay contact alarm output terminals:

Isolated from other I/O terminals and internal circuits.

RS-485 communication terminals:

Not isolated from contact input terminals. Isolated from other I/O terminals and internal circuits.

Power supply terminals:

Isolated from other I/O terminals, ground terminal, and internal circuits.

Ground terminal:

Isolated from other I/O terminals, power terminals, and internal circuits.

● Environmental Conditions

Normal operating conditions:

Ambient temperature: 0 to 50°C (40°C or less for mounting of instruments side-by-side)

Ambient temperature change limit: 10°C /h or less

Ambient humidity: 20 to 90% RH (no condensing)

Magnetic field: 400 A/m or less

Continuous vibration (5 to 14 Hz):

Peak-to-peak amplitude of 1.2 mm or less

Continuous vibration (14 to 150 Hz):

4.9 m/s² or less

Short-period vibration: 14.7 m/s², 15s or less

Shock: 147 m/s² or less, 11 ms

Installation altitude: 2,000 m or less above sea level

Warm-up time 30 minutes or more

Transportation and storage conditions:

Temperature: -25 to 70°C

Temperature change limit: 20°C /h or less

Humidity: 5 to 95% RH

Effects of operating conditions

Effect of ambient temperature:

For voltage or TC inputs:

Whichever is greater, $\pm 1\mu\text{V}/^\circ\text{C}$ or $\pm 0.01\%$ of F.S./ $^\circ\text{C}$

For RTD inputs:

$\pm 0.05^\circ\text{C}/^\circ\text{C}$ (ambient temperature) or less for RTD input

For analog output: $\pm 0.05\%$ of F.S./ $^\circ\text{C}$ or less

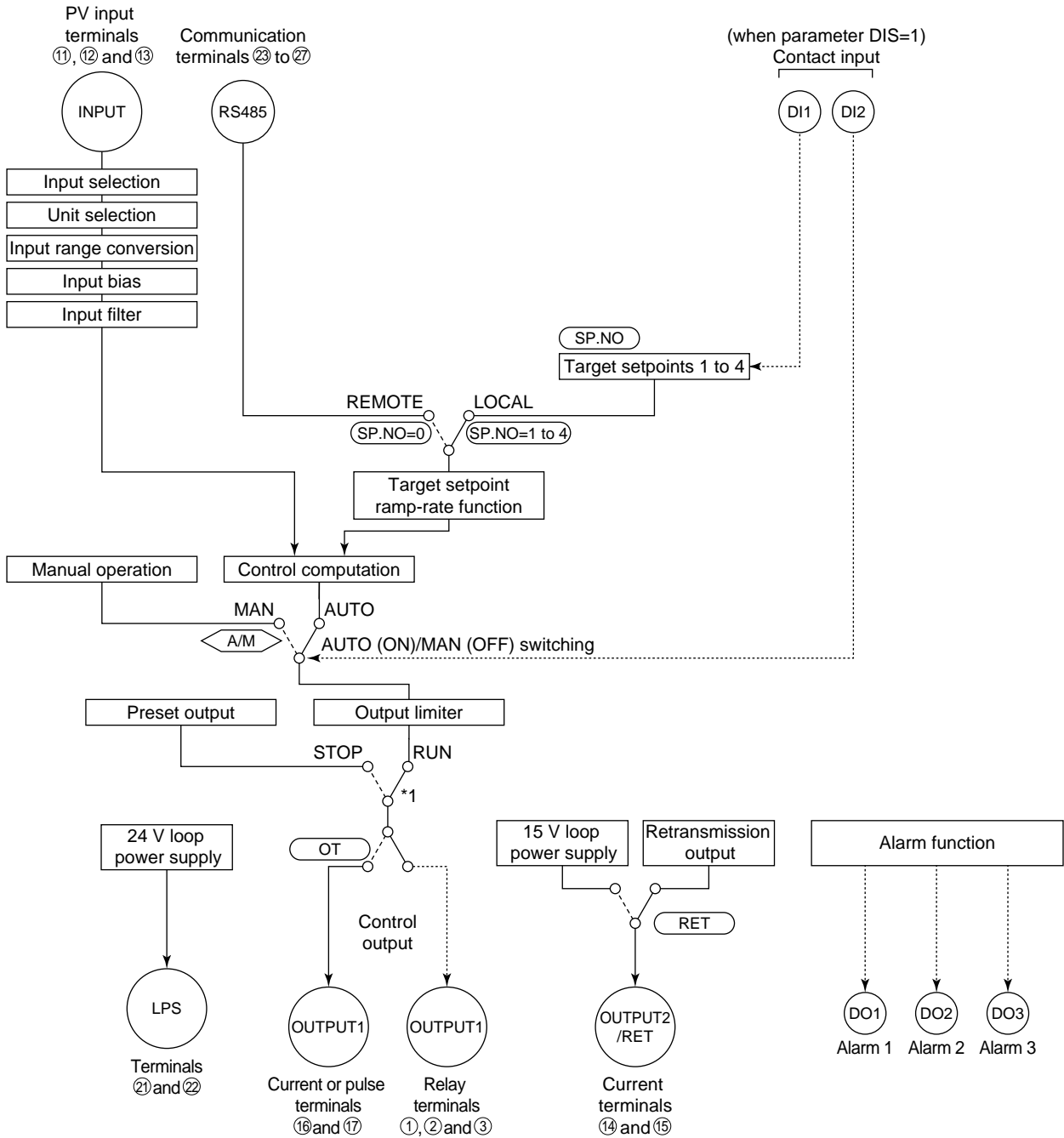
Effect of power supply fluctuation (within rated voltage range):

For analog input:

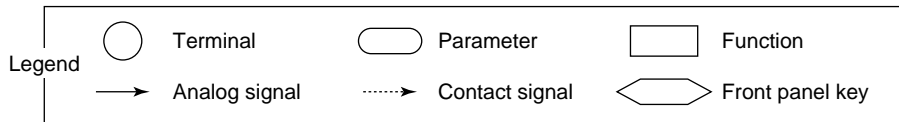
Equal to or less than whichever is greater, $\pm 1\mu\text{V}/10\text{ V}$ or $\pm 0.01\%$ of F.S./10 V

For analog output: $\pm 0.05\%$ of F.S./10 V or less

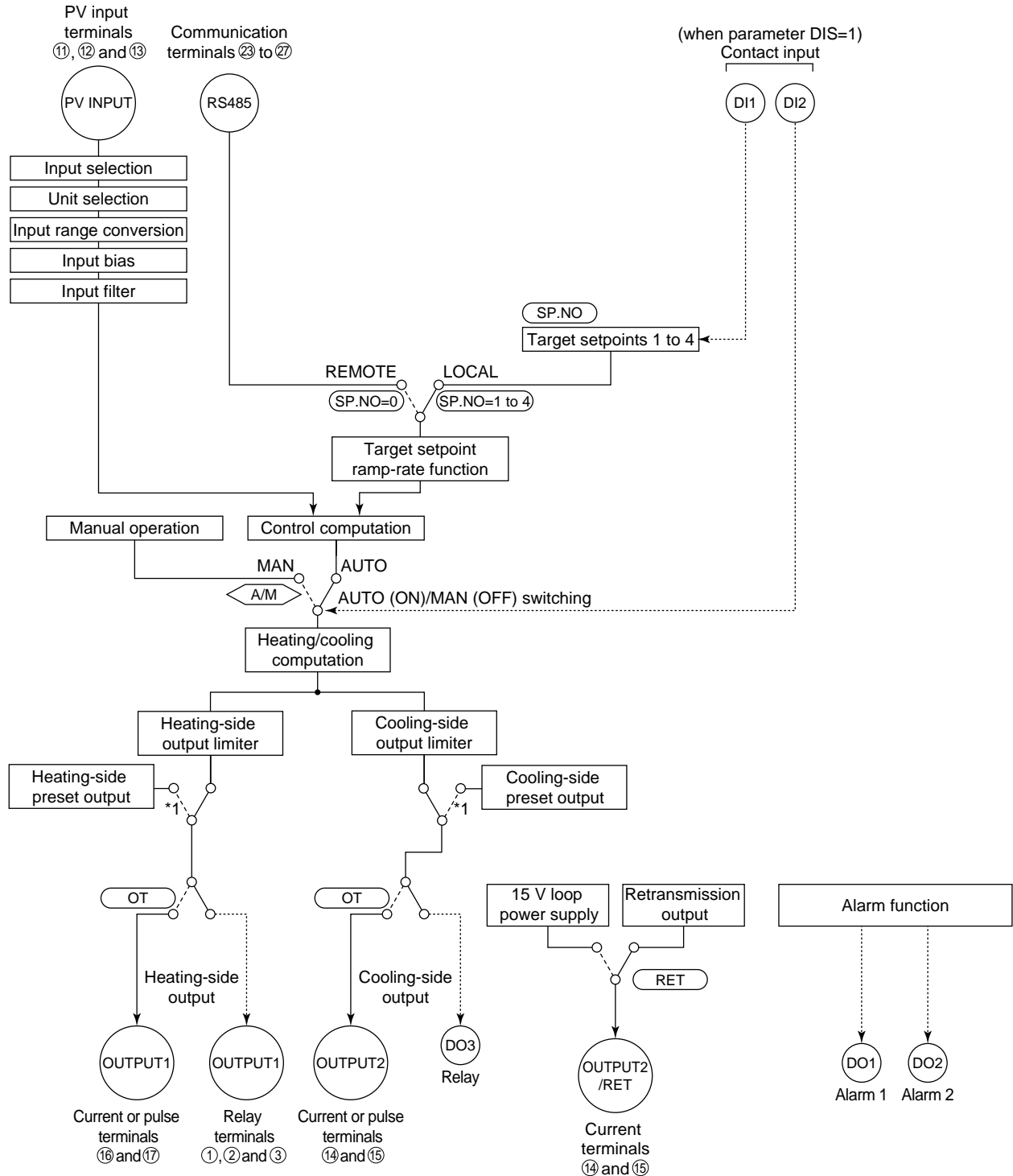
Function Block Diagram for Standard Type



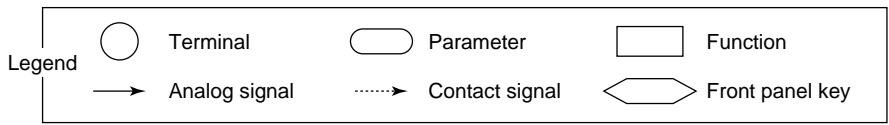
*1: If the setup parameter DIS (DI function selection) is set to "4", when the contact input 2 is ON (stop state), that controller outputs the preset output value.



Function Block Diagram for Heating/Cooling Type



*1: If the setup parameter DIS (DI function selection) is set to "4",
 *1: When the setup parameter DIS (DI function selection) is set to "4",
 when the contact input 2 is ON (stop state), that controller outputs the preset output value.



Standard Type, Terminal Arrangements

Control output
Relay contact output
NC → 1, NO → 2, COM → 3
Contact rating: 250 V AC, 3 A
30 V DC, 3 A (resistance load)

Alarm output
AL1 → 6, AL2 → 5, AL3 → 4, COM → 7
Relay contact rating: 240 V AC, 1 A
30 V DC, 1 A (resistance load)

Power supply
L → 8, N → 9, 10 → Ground
Allowable range: 100 to 240 V AC (±10%)
50/60 Hz shared

RS-485 communication
23 SDB(+), 24 SDA(-), 25 RDB(+), 26 RDA(-), 27 SG

Wiring options:
 * Wiring can only be carried out for controllers with 24 V DC loop power supply.
 * Wiring can only be carried out for controllers with communication functions. Maximum baud rate: 9600 bps.
 * Time proportional PID relay contact output is configured at factory before shipment.
 Note: Select this option from the OT parameter.
 * PV input * Not configured at factory before shipment

PV input
 TC input: 12(+), 13(-)
 RTD input: 11(A), 12(b), 13(B)
 m/V/V input: 12(+), 13(-)

Re transmission output
 14(+), 15(-)
 15 V DC loop power supply
 14(+), 15(-)
 14.5-18.0 V DC (21 mA DC max.)

Control output
 16(+), 17(-)
 4-20 mA DC, voltage pulse (12 V)

External contact input
 18, 19, 20
 Transistor contact
 +5V L, +5V, COM

Receiving 4-20 mA DC Current Signals with the Controller
 * When receiving 4-20 mA DC current signals, set the PV input type to 1-5 V DC (setpoint "41").
 Note: Connecting a 250 Ω resistor to the terminals is optional.
 Model: X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

DIS is a setup parameter.
 Changing DIS setpoint allows you to change the function of external contact input.

When DIS=OFF	When DIS=1 (Factory-shipped setting)	When DIS=2	When DIS=3	When DIS=4
No function	2.SP when DI1=ON 1.SP when DI1=OFF	Hides the LOCK parameter when DI=ON. Shows the LOCK parameter when DI=OFF.	1.SP, SP1, SP2, SP3, SP4, SP5 DI1 OFF ON OFF ON DI2 OFF OFF ON ON	2.SP when DI1=ON 1.SP when DI1=OFF STOP when DI2=ON RUN when DI2=OFF
No function	AUTO when DI2=ON MAN when DI2=OFF	No function	Common	Common
Common	Common	Common	Common	Common

Heater current detection input
 29 CT1, 28 CT2, 30 COM

Time proportional control
 OT=0 (factory-shipped setting)
 Time proportional control Relay output (terminals ①, ② and ③)

Current output
 OT=2
 Current output (terminals ④ and ⑤)

On-off control
 OT=3
 On-off control (terminals ⑥ and ⑦)

Note: External Contact Input
 If the power is turned on when the external contact input is OFF, the mode (SP, NO or AM) existing before the power is turned off will be continued. (except for RUN/STOP)

Note: External Contact Input
 If the power is turned on when the external contact input is OFF, the mode (SP, NO or AM) existing before the power is turned off will be continued. (except for RUN/STOP)

Heating/Cooling Type, Terminal Arrangements

■ Receiving 4-20 mA DC Current Signals with the Controller

* When receiving 4-20 mA DC current signals, set the PV input type to 4-5 V DC (setpoint "41").

Note: Connecting a 250Ω resistor to the terminals is optional.
Model: X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

PV input * Not configured at factory before shipment

RTD input

* Wiring can only be carried out for controllers with communication functions.
Maximum baud rate: 9600 bps

Heating-side control output

* Time proportional PID relay contact output is configured at factory before shipment.
* Available if 4, 7 or 10 is set in the OT (Control Output Type) setup parameter.

Contact rating: 250 V AC, 3 A
30 V DC, 3 A (resistance load)

Alarm output/cooling-side control output

Relay contact rating: 240 V AC, 1 A
30 V DC, 1 A (resistance load)

Note: The cooling-side control output is selected if 4, 5 or 6 is set in the OT (Control Output Type) setup parameter.
The alarm-3 output is not available.
The controller is factory-set to the cooling-side control output (time proportional PID relay contact output).

Power supply

CAUTION
Before carrying out wiring, turn off the power to the controller and check that cables to be connected are not alive with a tester or the like because there is a possibility of electric shock.

Allowable range: 100 to 240 V AC (±10%)
(free voltage)
50/60 Hz shared

* This wiring is only possible for a controller with a heater burnout alarm.

Heating-side control output

* Available if 5, 6, 8, 9, 11 or 12 is set in the OT (Control Output Type) setup parameter.

* PV retransmission is configured at factory before shipment.

Retransmission output: 15 V DC loop power supply

Cooling-side control output: * If 15 V DC loop power supply is used, retransmission output cannot be used.

* The retransmission output and 15 V DC loop power supply are not available if the cooling-side control output is set to "continuous output" and "voltage pulse output."

External Contact Input

If the power is turned on when the external contact input is OFF, the mode (SP NO or AM) existing before the power is turned off will be continued.
(except for RUN/STOP)

Contact rating: 12 V DC, 10 mA or more

Heater current detection input

Correspondence between parameter DIS and external contact input functions

When DIS=1 (Factory-shipped setting)	When DIS=2	When DIS=3	When DIS=4	When DIS=5	When DIS=6	When DIS=7	When DIS=8	When DIS=9	When DIS=10	When DIS=11	When DIS=12
2.SP when D1=ON 1.SP when D1=OFF	Hides the LOCK parameter when D1=ON Shows the LOCK parameter when D1=OFF	When switching target SP 1 to 4. 1.SP:SP1,SP2,SP3 D1:OFF ON:OFF ON	2.SP when D1=ON 1.SP when D1=OFF STOP when D12=ON RUN when D12=OFF	Common	Common	Common	Common	Common	Common	Common	Common

* DIS is a setup parameter.
Changing DIS setpoint allows you to change the function of external contact input.

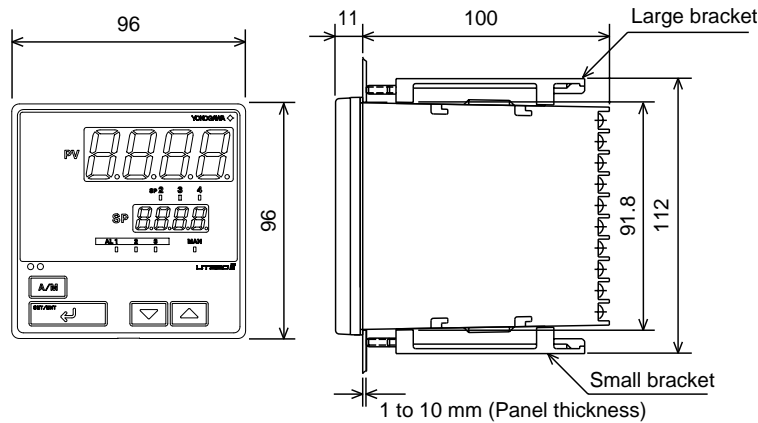
OT is a setup parameter. You can change the settings of the parameter OT to change the control output type.

Correspondence between parameter OT and heating-side/cooling-side output types											
OT=4 (factory-shipped setting)	OT=5	OT=6	OT=7	OT=8	OT=9	OT=10	OT=11	OT=12			
Heating side: Relay output (terminals ①, ② and ③) Cooling side: Relay output (terminals ④ and ⑤)	Heating side: Voltage pulse output (terminals ⑥ and ⑦) Cooling side: Voltage pulse output (terminals ⑧ and ⑨)	Heating side: Current output (terminals ⑩ and ⑪) Cooling side: Voltage pulse output (terminals ⑫ and ⑬)	Heating side: Relay output (terminals ⑭, ⑮ and ⑯) Cooling side: Voltage pulse output (terminals ⑰ and ⑱)	Heating side: Voltage pulse output (terminals ⑲ and ⑳) Cooling side: Voltage pulse output (terminals ㉑ and ㉒)	Heating side: Current output (terminals ㉓ and ㉔) Cooling side: Voltage pulse output (terminals ㉕ and ㉖)	Heating side: Relay output (terminals ㉗ and ㉘) Cooling side: Current output (terminals ㉙ and ㉚)	Heating side: Voltage pulse output (terminals ㉛ and ㉜) Cooling side: Current output (terminals ㉝ and ㉞)	Heating side: Current output (terminals ㉟ and ㊱) Cooling side: Current output (terminals ㊲ and ㊳)			

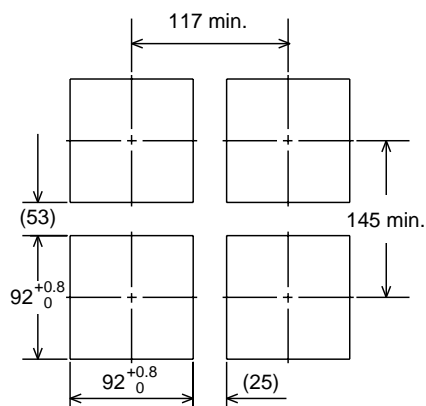
The control output types, "relay output" and "voltage pulse output" shown in the table above refer to those of time proportional control. To change the type to a relay output for on-off control, select "Relay Terminals" and change the setpoint of the proportional band to "0."

External Dimensions and Panel Cutout Dimensions

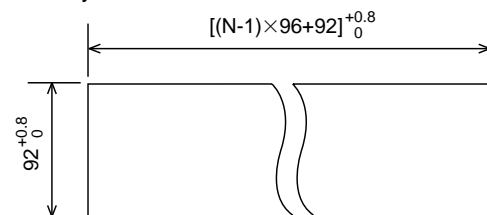
Unit: mm



General installation



Side-by-side close installation



"N" stands for the number of controllers to be installed.
However, the measured value applies if $N \geq 5$.

Model and Suffix codes

Model	Suffix Code	Description
UT350		Digital indicating controller (provided with retransmission output and 15 V DC loop power supply as standard)
Type	-0	Standard type
	-2	Heating/cooling type
	-3	Standard type (with 24 V DC loop power supply)
Optional functions	0	None
	1	With communication, Heater burnout alarm
	2	With heater burnout alarm

Standard Accessories: Brackets (mounting hardware), unit label, User's Manuals, and User's Manual (reference) (CD-ROM version)

Items to be specified when ordering

Model and suffix codes, necessary/unnecessary of User's Manual or QIC.

K4 Series 100 mm Strip Chart Recorders

K4 Series 4" (100 mm) Continuous Trace and Multipoint Trace Strip Chart Recorders

- *Up to Four Pens for Continuous Traces*
- *Up to Six Inputs for Dot Traces*
- *Compact Size*
- *High Reliability*
- *Memory Card / PC Configuration Option*
- *Math, Counters, Timers Option*
- *Communications Option*



optional optional

K4 Series strip chart recorders offer a full family of products from a single pen model K4CA to the full featured K4MB.

Introduction

Barber-Colman K4 Series Strip Chart Recorders are available with continuous trace writing pens (up to four) or a multipoint printhead that will provide dot printed traces for up to six inputs. Both the continuous and multipoint trace models are available with either an analog display or a digital display. In addition, the K4 is available with *both* digital display and segment bar display. This model also offers several advanced features such as memory card reader, math capabilities, totalizers, timers and counters, and serial communications.

The K4 is housed in a compact case that extends less than 9-1/2" behind the mounting panel. It uses 100 mm x 16 m long (4" x 52-1/2 feet long) fanfold paper that is easily accessible from the front door.

Contactless Feedback

All K4 models use a state-of-the-art optical feedback system with brushless motors. This ensures that the combined motor and feedback system have high reliability and an excellent immunity to electromagnetic interference common to many switching cabinets.

Input Card Technology

Custom chips form the basis of a configurable, high accuracy, isolated input system. Auto calibration provides improved accuracy and stability with long-term calibration free service.

By using second order Delta-Sigma modulators, each input is continuously sampled to provide integrated values for the measured variable. Data acquisition is updated regularly by digitally interrogating the variables through optical isolators. Each channel has its own measuring circuit to ensure high sample accuracy and fast input response.

Wide Range of Models

The line-up of K4 recorders includes:

Model K4CA –	Continuous Trace Recorder with Analog Display
Model K4MA –	Multipoint Trace Recorder with Analog Display
Model K4CD –	Continuous Trace Recorder with Digital Display
Model K4MD –	Multipoint Trace Recorder with Digital Display
Model K4CB –	Continuous Trace Recorder with Digital Display and Segment Bar
Model K4MB –	Multipoint Trace Recorder with Digital Display and Segment Bar

Models K4XA and K4XD are configured at the factory to the specifications on your order and are ready for immediate use. Model K4XB is configurable from the front panel which makes it the ideal instrument for applications where configuration needs to be regularly modified.

K4 Series 100 mm Strip Chart Recorders

Ordering Information (continued)

Model K4XB Recorder

MODEL K 4 **B** - - - -

Field No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fields 1, 2, 3, 4. BASE MODEL

K4CB - 4", continuous, bargraph/digital display

K4MB - 4", multipoint, bargraph/digital display

Field 5. NUMBER OF PENS

Model K4MB

0 - None. Multipoint model

Model K4CB

1 - One trace pen

2 - Two trace pens

3 - Three trace pens

4 - Four trace pens

5 - One trace pen with annotating pen

6 - Two trace pens with annotating pen

7 - Three trace pens with annotating pen

8 - Four trace pens with annotating pen

Note: Annotating pen required if you want to print the time, date and channel information on the chart.

Field 6. INPUTS

Model K4CB

0 - Four fixed Inputs

Model K4MB

2 - Two

3 - Three

6 - Six

Fields 7, 8, 9, 10. OPTION CARDS

Four cards maximum.

0 - None

1 - Normally open (four relay outputs)

2 - Normally closed (four relay outputs)

3 - SPDT, Form C (four relay outputs)

4 - Analog retransmission
(two outputs; two cards maximum)

5 - Contact inputs (six inputs; one card maximum)

Field 11. MATH

0 - None

1 - Level 1

2 - Level 2

3 - Totalizers, timers, counters

4 - Level 1, plus totalizers, timers, counters

5 - Level 2, plus totalizers, timers, counters

Field 12. TRANSDUCER POWER SUPPLY

0 - None

3 - Three channel

6 - Six channel

Field 13. MEMORY CARD / COMMUNICATIONS

0 - None

R - Reader only (configuration storage)

1 - Reader and 128K card (configuration storage)

2 - Reader and 512K card (configuration storage)

3 - Reader and 2M card (configuration storage)

4 - Serial communications only

5 - Serial communications, reader and 2M card

6 - Reader only (ASCII storage w/configuration)

7 - Reader and 512K card (ASCII storage
with configuration)

8 - Reader and 2M card (ASCII storage
with configuration)

9 - Reader, 2M card (ASCII w/config) and
serial communications

Field 14. CHART ILLUMINATION/ PEN OFFSET COMPENSATION

0 - No

1 - Chart illumination

Model K4CB only

4 - Pen offset compensation

5 - Chart illumination and pen offset

Field 15. SPECIALS

0 - None

1 - Certified calibration

2 - CE (European Community) approval

3 - Custom messages (20 messages)

4 - CSA testing/labeling

5 - Option codes 1, 2 (Cert. cal. and CE approval)

6 - Option codes 1, 3

7 - Option codes 1, 4

8 - Option codes 2, 3

9 - Option codes 2, 4

A - Option codes 3, 4

B - Option codes 1, 2, 3

C - Option codes 1, 2, 4

D - Option codes 1, 3, 4

E - Option codes 2, 3, 4

F - Option codes 1, 2, 3, 4

Shunts and attenuators to be ordered separately.

AL3000 SERIES 100MM CHART MULTI-POINT TYPE HYBRID RECORDER



MODEL AL3 7 □ 5 - □ □ □

AL3000 series conforming to CE, UL and CSA are 100mm multi-point type hybrid recorders with a simultaneous display of multi-channel data, bargraph display, alarm display/printing and other unique features. Software packages of "KIDS" for data processing of measured values and "PASS" for programming parameters are available.



■ FEATURES

• Simultaneous digital displays of multipoint data

Simultaneous digital display of 6 points allows measured data to be viewed at a glance.

• Universal input

The recorders accept total 56 ranges of 10 DC voltage ranges, 35 thermocouple ranges and 11 resistance thermometer ranges, and these ranges can be programmed for each channel.

• Data acquisition software package "KIDS"

The data acquisition software package "KIDS" is available for data processing by a personal computer.

• Engineering software package "PASS"

Parameters (including inputs and printings) and message printings can be executed through a personal computer by the engineering software package "PASS".

• Communications interface (option)

RS-232C, RS-422A or RS-485 with MODBUS protocol for easy configuration with your personal computer

• Clear trend and digital printings

Cassette type wire-dotting system 6-color ink ribbon for clear trend and digital printings

• Universal power voltage

100VAC to 240VAC, 50/60Hz

• Chart illumination

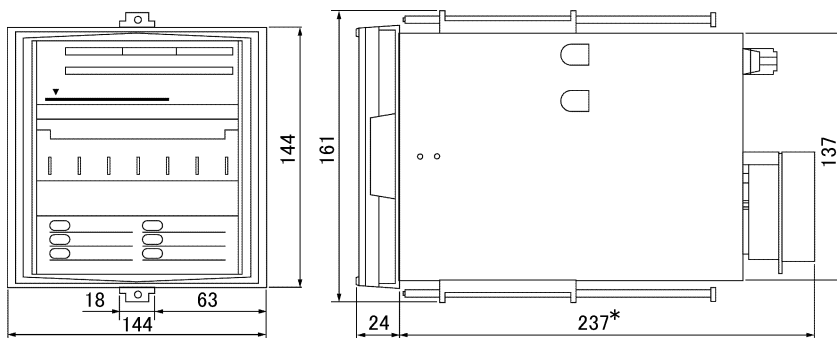
Convenient to confirm printed data in night or dark places

• CE, UL and CSA

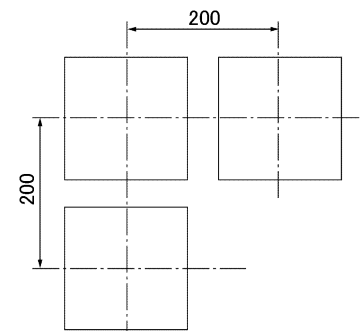
The recorder conforms to the rules of safety standards of CE, UL and CSA (C-UL).

The front panel is the structure with water-proof and dust-proof (IP54).

■ DIMENSIONS



Panel cutout and minimum clearance for installation



* 243mm for adding Form A mechanical relay

Unit: mm

■ MODELS

AL3 7 □ 5 - □ □ □

Input point

- 6: 6 points/5 seconds
- A: 6 points/1 second (option)

Communications interface (option)

- N: None
- A: RS-422A
- R: RS-232C
- S: RS-485

Alarm output/remote contacts (option)

- 0: None
- 1: 6 (MOS relay) alarm outputs + remote contacts
- 2: 6 (Form C mechanical relay) outputs + remote contact (Note 1)
- A: 6 (Form A mechanical relay) outputs + remote contacts

Others (option)

- 0: None
- 1: Printing format + high-speed trace printing

Note 1: Not conforming to CE, UL and CSA

■ INPUT SPECIFICATIONS

Number of measuring points: 6 points

Input signals:

- Universal input
- DC voltage, thermocouple, resistance thermometer
- DC current (by adding shunt resistors)

Range setup:

Programming of input types and ranges by keys

Scale setup:

Programming of maximum values, minimum values and engineering units by keys

Accuracy rating: Refer to the table of inputs.

Temperature drift:

$\pm 0.01\%$ of full scale/ $^{\circ}\text{C}$

[Input signals except resistance thermometer inputs: Converted into reference ranges (reference: the table of inputs)]

Measuring cycle:

About 5 seconds/6 points

Reference junction compensation accuracy:

- K, E, J, T, N, Platinel II $\pm 0.5^{\circ}\text{C}$ or less
 - R, S, NiMo-Ni, CR-AuFe, W-WRe26, WRe5-WRe26
 - U, L $\pm 1.0^{\circ}\text{C}$ or less
- (The above errors are added to the accuracy ratings for internal reference junction compensation.)

Input resolution:

About 1/56000 (converted into reference ranges)

Burnout:

- For thermocouple inputs and resistance thermometer inputs
- Up-scale burnout, down-scale burnout or burnout disable is selectable for each input.

Allowable signal source resistance:

- Thermocouple inputs, DC voltage inputs ... $1\text{k}\Omega$ (burnout disabled) or lower
- Resistance thermometer inputs ... 10Ω or lower (per wire)
- (same resistance for 3 wires)

Input resistance:

- Thermocouple inputs, DC voltage inputs ... about $8\text{M}\Omega$
- DC voltage $\pm 5\text{V}$ or higher ... about $1\text{M}\Omega$

Maximum input voltage:

- Thermocouple inputs, DC voltage inputs (for $\pm 2\text{VDC}$ or lower range) ... $\pm 10\text{VDC}$ or lower
- DC voltage inputs (for $\pm 5\text{VDC}$ or higher range) ... $\pm 60\text{VDC}$ or lower
- Resistance thermometer inputs ... $\pm 6\text{VDC}$ or lower

Input correction:

Zero/span correction and shift correction for each channel

Maximum common mode voltage: 30VAC

Common mode rejection ratio:

130dB or more (50/60Hz)

Series mode rejection ratio:

50dB or more (50/60Hz)

Terminal board:

Detachable type, removable for wirings

■ PRINTING SPECIFICATIONS

Printing interval: About 5 seconds/point

Printing deadband: 0.2%

Printing system: Wire-dot type 6-color ribbon

Printing color:

Trace printing

Channel No.	1	2	3	4	5	6
Colors	Red	Black	Blue	Green	Brown	Purple

Digital printing

Periodic data printing, digital data printing:

Repetition of red, black, blue, green, brown and purple

Channel number printing:

Same color as trace printing

Periodic printing:

Range (scale), tag, engineering unit ... Same color as trace printing

Month/day or year/month/day, time, time line, chart speed ... black

List printing:

Programmed parameters ... Same color as trace printing

Others ... black

Programming change mark: Black

Alarm printing: Red

Chart: Fan-fold type, total width 114mm, total length 10m

Effective chart width: 100mm

Chart speed: 1 to 1500 mm/hr (Default ... 20mm/hr)

Periodic data printing:

Digital printing of time, channel numbers and measured values on trace printing

Interval time (hour, minute) ... optional programming (limited by chart speeds)

Digital data printing:

Digital printing of time and measured values by interrupting trace printing on demand.

Alarm printing:

Alarm activated ... Time, channel number, alarm type and level (alarm setpoint No.) in right side of a chart

Alarm reset... Time, channel number and level (alarm setpoint No.) in right side of a chart

Memory capacity ... Maximum 48 data

Programming change mark:

Marking a black in right side of chart when a parameter is changed

Subtract printing:

Printing of difference between two channels or between a channel and a referenced value (programmed value)

List printing:

Printing of year/month/day, chart speed, parameters of each channel and others.

Fixed-time printing:

Printing of month/day, time, time line, ranges (scales), tags and engineering units every fixed-time (interlocking to chart speed)

Skip function:

No display or printing of channels of which ranges are not programmed.

■ DISPLAY SPECIFICATIONS

Display items:

LCD display

"Simultaneous display of 6-channel measured values", or "time (year/month/day/hour/minute), alarm activated channels and chart speed"

Status display:

Printing status, key lock and alarm activation

■ ALARM SPECIFICATIONS

Alarm judgment cycle: Same as measuring cycle

Alarm display:

Status display "ALARM" and flashing of measured value at an alarm activated channel

Alarm types:

Absolute value alarm, differential alarm, rate-of-change alarm

Alarm programming:

Individual programming for each channel
Maximum 4 levels/channel

Alarm deadband:

0.1 to 9.9% of scale programming range (Default: 0.1%)

Alarm output:

Option (Refer to the list of options.)

■ PROGRAMMING/OPERATION

Programming parameters:

Time, chart speed, periodic data printing, ranges, scales, engineering units, tags, alarms, burnout, subtract printing, °C/ °F, passcode (key lock)
(Options: Communications, printing format)

Printing operation:

RECORD ON/OFF..	Printing on/off
FEED	Fast-feeding of chart
LIST	List printing
DATA PRINT	Digital data printing

Data display selection: (Key selection):

- Measured values display and multi-point sequential bargraph display
- Measured values display and 1-point continuous bargraph display
- Time/other displays and 1-point continuous bargraph display

■ GENERAL SPECIFICATIONS

Rated power voltage:

100 to 240VAC, 50/60Hz

Maximum power consumption: 45VA

Environmental conditions:

- Reference operating condition ...
 - Ambient temperature/humidity range:
21 to 25°C, 20 to 80%RH
 - Power voltage: 100VAC ± 1%
 - Power frequency: 50/60Hz ± 0.5%
 - Attitude: Left/right 0°, Forward tilting 0°,
Backward tilting 0°
 - Warm-up time: 30 minutes or longer
- Normal operating condition ...
 - Ambient temperature/humidity range:
0 to 40°C, 20 to 80%RH
 - Power voltage: 90 to 264VAC
 - Power frequency: 50/60Hz ± 2%
 - Attitude: Left/right 0 to 10°, Forward tilting 0°,
Backward tilting 0 to 30°
- Transportation condition (at the packed condition on shipment from our factory) ...
 - Ambient temperature/humidity range:
-20 to 60°C, 5 to 90%RH
(No dew condensation)
 - Vibration: 10 to 60Hz, 4.9m/s² or less
 - Impact: 392m/s² or less
- Storage condition ...
 - Ambient temperature/humidity range:
-20 to 60°C, 5 to 90%RH
(No dew condensation)

Insulation resistance:

Between secondary terminals and protective conductor terminal ...

20MΩ or more at 500VDC

Between primary terminals and protective conductor terminal ...

20MΩ or more at 500VDC

Between primary terminals and secondary terminals ...

20MΩ or more at 500VDC

Between alarm terminals (Form C mechanical relay) and other secondary terminals ...

20MΩ or more at 500VDC

Note: Primary terminals:

Power (L, N), Alarm (MOS relay, Form A mechanical relay)

Secondary terminals:

Input, Alarm (Form C mechanical relay), Remote contacts, Communications

Dielectric strength:

Between secondary terminals and protective conductor terminal 1 minute at 500VAC

Between primary terminals and protective conductor terminal 1 minute at 1500VAC

Between primary terminals and secondary terminals 1 minute at 2300VAC

Between alarm terminals (Form C mechanical relay) and other secondary terminals ... 1 minute at 1000VAC

Note: Primary terminals:

Power (L, N), Alarm (MOS relay, Form A mechanical relay)

Secondary terminals:

Input, Alarm (Form C mechanical relay), Remote contacts, Communications

Power failure protection:

Programmed parameters stored into EEPROM memory

Clock circuit sustained for 10 years or longer by a lithium battery (at the operation of 8 hours or longer per day)

Case assembly material:

Door ... ABS resin (frame) with glass

Enclosure ... Steel

Color: Door (frame) ... Black (frame - equivalent to Munsell N3.0)

Enclosure Gray (equivalent to Munsell N7.0)

Mounting: Panel mounting

Weight: About 3.0kg (full options)

Clock accuracy:

±2 minutes or shorter per 30-day (under reference operating conditions, except errors by turning power supply on or off)

Terminal screws:

Power terminals M4.0

Protective conductor terminals.. M4.0

Measuring input terminals M3.5

Alarm terminals M3.5

Remote contact terminals M3.5

Communications terminals M3.5

Chart illumination: CFL (Cold cathode fluorescent lamp)

■ STANDARDS

CE: EN61326 + A1 Class A

EN61000-3-2 + A14

EN61000-3-3

EN61010-1 + A2

UL: UL3111-1

CSA (C-UL): C22.2, No.1010

Front protection: Conforming to IEC529 IP54

MEASURING RANGES/ACCURACY RATING/DISPLAY RESOLUTION

The accuracy ratings are based on the measuring ranges (under the reference operating condition).
 For thermocouple inputs, the accuracy of reference junction compensation is not included with the accuracy ratings.
 The indication equivalent to maximum 200µV or 5°C may vary under the test environment by EMC directives.

[Reference operating condition] Ambient temperature/humidity range: 21 to 25°C, 45 to 65%RH
 Power voltage: 100VAC ± 1%
 Power frequency: 50/60Hz ± 0.5%
 Attitude: Left/right 0°, Forward tilting 0°, Backward tilting 0°
 Warm up time: 30 minutes or longer

Input kinds	Measuring ranges	Reference ranges	Accuracy ratings	Display resolution	
Thermocouple	K	-200 to 300°C	±13.8mV	0.1°C	
		-200 to 600°C	±27.6mV	0.1°C	
		-200 to 1370°C	±69.0mV	1°C	
	E	-200 to 200°C	±13.8mV	0.1°C	
		-200 to 350°C	±27.6mV	0.1°C	
		-200 to 900°C	±69.0mV	1°C	
	J	-200 to 250°C	±13.8mV	0.1°C	
		-200 to 500°C	±27.6mV	0.1°C	
		-200 to 1200°C	±69.0mV	1°C	
	T	-200 to 250°C	±13.8mV	0.1°C	
		-200 to 400°C	±27.6mV	0.1°C	
	R	0 to 1200°C	±13.8mV	1°C	
		0 to 1760°C	±27.6mV	1°C	
	S	0 to 1300°C	±13.8mV	1°C	
		0 to 1760°C	±27.6mV	1°C	
	B	0 to 1820°C	±13.8mV	1°C	
	N	-200 to 400°C	±13.8mV	±0.15% ± 1 digit	0.1°C
		-200 to 750°C	±27.6mV	±0.15% ± 1 digit	0.1°C
		-200 to 1300°C	±69.0mV	±0.15% ± 1 digit	1°C
	W-WRe26	0 to 2315°C	±69.0mV	±0.15% ± 1 digit	1°C
WRe5-WRe26	0 to 2315°C	±69.0mV	±0.2% ± 1 digit	1°C	
PtRh40-PtRh20	0 to 1880°C	±13.8mV	±0.2% ± 1 digit	1°C	
NiMo-Ni	-50 to 290°C	±13.8mV	±0.2% ± 1 digit	0.1°C	
	-50 to 600°C	±27.6mV	±0.2% ± 1 digit	0.1°C	
	-50 to 1310°C	±69.0mV	±0.2% ± 1 digit	1°C	
CR-AuFe	0 to 280 K	±13.8mV	±0.1% ± 1 digit	0.1 K	
Platinel II	0 to 350°C	±13.8mV	±0.15% ± 1 digit	0.1°C	
	0 to 650°C	±27.6mV	±0.15% ± 1 digit	0.1°C	
	0 to 1395°C	±69.0mV	±0.15% ± 1 digit	1°C	
U	-200 to 250°C	±13.8mV	±0.1% ± 1 digit	0.1°C	
	-200 to 500°C	±27.6mV	±0.1% ± 1 digit	0.1°C	
	-200 to 600°C	±69.0mV	±0.1% ± 1 digit	1°C	
L	-200 to 250°C	±13.8mV	±0.1% ± 1 digit	0.1°C	
	-200 to 500°C	±27.6mV	±0.1% ± 1 digit	0.1°C	
	-200 to 900°C	±69.0mV	±0.1% ± 1 digit	1°C	

K, E, J, T, R, S, B, N: IEC584, JIS C1602-1995
 U (Cu-CuNi), L (Fe-CuNi): DIN43710
 W-WRe26, WRe5-WRe26, PtRh20-PtRh5, PtRh40-PtRh20, NiMo-Ni, CR-AuFe, Platinel II: ASTM Vol. 14.03

Input kinds	Measuring ranges	Reference ranges	Accuracy ratings	Display resolution	
DC voltage	-13.8 to 13.8mV	±13.8mV	±0.1% ± 1 digit	10µV	
	-27.6 to 27.6mV	±27.6mV		10µV	
	-69.0 to 69.0mV	±69.0mV		10µV	
	-200 to 200mV	±200.0mV		100µV	
	-500 to 500mV	±500.0mV		100µV	
	-2 to 2V	±2V		1mV	
	-5 to 5V	±5V		1mV	
	-10 to 10V	±10V		10mV	
	-20 to 20V	±20V		10mV	
	-50 to 50V	±50V		10mV	
Resistance thermometer	Pt100(1)	-140 to 150°C	160Ω	±0.15% ± 1 digit	0.1°C
		-200 to 300°C	220Ω	±0.1% ± 1 digit	0.1°C
		-200 to 850°C	400Ω	±0.1% ± 1 digit	0.1°C
	Pt100(2)	-140 to 150°C	160Ω	±0.15% ± 1 digit	0.1°C
		-200 to 300°C	220Ω	±0.1% ± 1 digit	0.1°C
		-200 to 649°C	400Ω	±0.1% ± 1 digit	0.1°C
	JPt100	-140 to 150°C	160Ω	±0.15% ± 1 digit	0.1°C
		-200 to 300°C	220Ω	±0.1% ± 1 digit	0.1°C
		-200 to 649°C	400Ω	±0.1% ± 1 digit	0.1°C
	Pt50	-200 to 649°C	220Ω	±0.1% ± 1 digit	0.1°C
Pt-Co	4 to 374K	220Ω	±0.15% ± 1 digit	0.1 K	

Pt100 (1): IEC751 (1995), JIS C1604-1997
 Pt100 (2): IEC751 (1983), JIS C1604-1989, JIS C1606-1989
 JPt100: JIS C1604-1981, JIS C1606-1986

EXCEPTION OF ACCURACY RATINGS

Input kinds	Measuring range	Accuracy rating
K, E, J, T, L	-200 to 0°C	±0.2% ± 1 digit
R, S	0 to 400°C	±0.2% ± 1 digit
B	0 to 400°C	Not specified
	400 to 800°C	±0.15% ± 1 digit
N, U	-200 to 0°C	±0.3% ± 1 digit
W-WRe26	0 to 100°C	±4% ± 1 digit
	100 to 400°C	±0.5% ± 1 digit
PtRh20-PtRh5	0 to 100°C	±4% ± 1 digit
	100 to 400°C	±0.5% ± 1 digit
PtRh40-PtRh20	0 to 300°C	±1.5% ± 1 digit
	300 to 800°C	±0.8% ± 1 digit
CR-AuFe	0 to 20 K	±0.5% ± 1 digit
	20 to 50 K	±0.3% ± 1 digit
Pt100 (1)	700 to 850°C	±0.15% ± 1 digit
Pt-Co	4 to 50 K	±0.3% ± 1 digit

Note) The accuracy ratings of thermocouple input are converted accuracy into reference ranges.

■ OPTIONS

Options	Explanations
Measuring interval	About 1 second/6 points, CE conformance, (UL approval pending), Common mode rejection ratio: 120db or more (50/60Hz), Series mode rejection ratio: 50db or more (50/60Hz) Condition: Peak value of noise including signal is limited to 1.5 times or more of reference range. The indication equivalent to maximum 2mV or 25°C may vary under the test environment by EMC directives.
Remote contacts	By 4-point contact input (2-point common) signal, the following operations are selectable. Chart speed 3-speed/record off, digital data print, list print
Alarm output	Alarm output: 6 points independent output, OR output enabled Maximum contact rating: MOS relay output 240V (AC, DC), 50mA (AC, DC), resistive load Mechanical relay output..... 100VAC 0.5A, 240VAC 0.2A, (common to Form A and Form C) 100VDC 0.3A, resistive load (Form C: not conforming to CE, UL and CSA.)
Printing format (Note)	Zone printing ... Printing area is divided into maximum 2 zones. Compressed/ expanded printing: A part of printing area of each channel is printing compressed or expanded. Automatic range-shift printing: Printing range is automatically changed into a new printing area in the event of over-range or under-range
Communications interface	3 kinds of RS-232C, RS-422A, RS-485 (to be specified) Parameter programming, operation, data acquisition (MODBUS protocol)
High-speed trace printing	Printing interval about 2.5 seconds (standard: 5 seconds)
Shunt resistor for current	Measurement of current by adding a resistor of 250Ω (for 20mA) or 100Ω (for 50mA)
16m chart	Total length of 15.6m
Basic mathematics	The following math-function can be executed in time order or between channels. Arithmetic, Square root, Logarithm, Natural Logarithm, Exponential, Maximum, Minimum, Average, Temperature/humidity
Totalizing	Totalizing of measured data and calculated results Interval: 00:01 to 24:00, or none
Aluminum die-cast door	Case for horizontal high-density panel installation and aluminum die-cast door

Note: One from 4 printing formats is to be specified.

■ Data acquisition software package "KIDS"

The "KIDS" is a software package for storing data being measured by AL3000 and AH3000 series recorders and for replaying of the stored data.

Main function and features:

- Data processing: Up to 5 sets (max. 100 channels)
Real-time data, real-time trend, historical data, historical trend and daily report
- Communications interfaces: RS-232C, RS-422A or RS-485
- Stored data: Enable to export to Microsoft Excel, Lotus 1-2-3 and other application software.
- OS: Windows 95/98, Windows NT4.0

■ Engineering software package "PASS"

The "PASS" is a software package, through a communications interface (optional) or a configuration port, for programming parameters of AL3000 and AH3000 series recorders by a personal computer.

Main functions and features

- Input parameters:
Ranges, scales, tags, engineering units, alarms, burnout
- Printing parameters:
Chart speed, data interval, subtract printing, zone printing, compressed/expanded printing, automatic range-shift printing
- Operation: Message printing
- Others:
Clock setting, temperature units (°C, °F), alarm deadband, communications specification (for programming through a configuration port only)
- OS: Windows95/98, WindowsNT4.0

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