

1/2/3-Pen Printing Model Smart Recorder SRF201/202/203

The Smart Recorder SRF 201/202/203-Pen Printing Model accepts DC voltage, thermocouple and resistance temperature detector (RTD), communications and ON/OFF inputs. This 201/202/203-Pen Printing Model accommodates 180 mm wide charts.

Smart Recorder offers the dual features of functions and operator ease as a recorder for various equipment and instrumentation.

It also supports relay output, external switch inputs and communications as optional functions.



■ Features

- One of the following two groups can be specified to each channel as input. Input types can be changed as desired within each group.
 - Thermocouple/DC voltage (mV, V) group
 - Resistance temperature detector (RTD)/DC voltage (mV, V) group
- Three recording formats are provided and can be freely selected:
 - Trend recording, trend + tabulation recording, trend + schedule demand recording
- Three measurement methods are provided and can be selected to each channel:
 - Measurement value (PV value), deviation value between channels, deviation value from fixed value
- Free power supply allows use anywhere:
 - 100 to 240Vac, 50/60 Hz
- Wide range of printing functions:
 - ① Printing at the following start conditions is possible:
 - Date - Time
 - Recording format - Chart feed speed
 - Recorder ID No.
 - ② Schedule printing
 - Marker, date, time, chart feed speed, engineering unit (6 characters per channel), recording scale and measurement value (PV value) are printed.
 - ③ Event occurrence, reset times and states are printed.
 - ④ Manual demand printing
 - Printing is started by DMD (demand) key or external switch input, time and measurement values (PV values) on each channel are printed.
 - ⑤ If the time (max. 4 times) is set when trend + schedule demand recording is selected as the recording format, that preset time and the measurement values (PV values) of each channel are automatically printed.
 - ⑥ Messages and times can be printed according to external switch input. (6 characters max. per message, max. 4 messages)
 - ⑦ Printing OFF function
 - This function turns printing of date, time, scale and events OFF.
- Compensated pen phase synchronization is provided as standard. Two compensation types are available for you to choose from (compensation OFF can also be chosen).
 - Pen internal compensation and printing pen compensation (real time for printing pen)
 - Each pen records with a time delay that takes into account the mechanical gap with the printing pen.
 - Pen interval compensation and printing pen compensation (real time for trend pen and reference pen)
 - Each pen records ahead with the reference pen.
 - “Reference pen” refers to pen 1 type (No.1 pen), pen 2 type (No.2 pen) and pen 3 type (No.3 pen).
- Setup data is protected in EEPROM when the power is OFF.

■ Optional Functions

- Relay output
 - (6 outputs; SPDT relay output)
- External switch inputs
 - (4; Recording ON/OFF, Demand printing, Chart feed, Print messages. etc.)
- Communications (RS-485, RS-232C)

■ Specifications

Input	Input type	Thermocouple/DC Voltage Groups Thermocouple: R, S, B, K, E, J, T, Ni-Ni•Mo, WRe0-26, WRe5-26, PLII, N DC voltage: -14 to +14 mV, -25 to +25 mV, -70 to +70 mV, -5 to +5 V RTD/DC Voltage Groups RTD input: Pt 100 Ω, JPt 100 Ω DC voltage: -14 to +14 mV, -25 to +25 mV, -70 to +70 mV, -5 to +5 V (Note 2) See Table 1 (input type, range, indication accuracy) Note 1) In the case of DC current (4 to 20 mA), attach a converter resistor (sold separately, model No. 81446642-001 or 81401325), and convert to 1 to 5 V to input. Note 2) Externally attach one 1/1000 DC voltage divider input (sold separately, model No. 81446627-001) to each input that exceeds ±5 V for input. (max. input voltage: ±60 V)		
	Number of input channels	1, 2, 3 (according to model No.)		
	Input measurement cycle	Approx. 125 ms		
	Input impedance	DC voltage, thermocouple input: 8 MΩ min.		
	Allowable wiring resistance	DC voltage, thermocouple input (input signal source resistor): 1 kΩ max. RTD input (input wiring resistor): 10 Ω max. per line (However, resistance of three lines must be the same.)		
	Burnout	None		
	Input bias current	DC voltage, thermocouple input: ±100 mA max.		
	Measuring current	RTD input: Approx. 2 mA		
	PV bias	Can be set to each channel in range -19999 to +29999 (engineering unit including decimal point).		
	Linear scaling	Display and recording is possible at actual unit (engineering unit) at DC voltage input		
	Measurement/calculation method	• PV value • inter-channel deviation • deviation from fixed value		
	Measurement range	DC voltage input: Any measurement (upper/lower limit values) can be set for each of the measurement ranges.		
	Engineering range	DC voltage input: The engineering range (upper/lower limit value, decimal point position and unit) can be set within the range -19999 to +29999.		
	Recording scale	Any recording scale (including reverse scaling) can be set for each channel within the range -19999 to 29999.		
Reference contact compensation	Provided			
Intrinsically safe system	When an intrinsically safe system is required, connect a Zener barrier externally. If uneven resistance from the Zener barrier causes a temperature display error to occur, compensate for this by the PV bias. As the input wiring resistance exceeds 10 Ω, the accuracy compensation in Table 1 cannot be applied.			
Display	Digital display	Display method	Red and green 7-digit, 7-segment LED (5 digits are green LEDs for displaying measurement values.)	
		Display cycle	4s (channel refresh rate): 0.5s (data refresh rate)	
		Display information	• Measurement values (PV) • Channel No. • Alarm display • Date • Time • Chart feed speed • Other configuration data	
	Lamp display	Display information	• Lights during recording and occurrence of an event. • Lights and displays information in the configuration and operation modes.	
Recorder	Recording method	Trend recording	Continuous printing by cartridge (disposable type) pen	
		Digital printing	Dot printing by printing (disposable type) pen	
		Pen balancing time	2s (recording paper movement from 0 to 100%)	
		Pen positions	In order pen 1, pen 2, pen 3, printing pen from front (door side)	
		Recording color	Trend recording	Pen 1/red, pen 2/green, pen 3/blue
			Digital printing	Printing pen/purple
		Character structure	7 (V) x 5 (H) dot matrix	
		Recording format	• Trend recording • Trend+tabulation recording • Trend+schedule demand recording	
		Character recording	Recording at chart feed speed of 150 mm/h or less	
	Chart	Shape	Folding type	
		Effective recording width	-0.5 to +180.5 mm of calibration position (0%)	
		Total length	20 m	
		Replacement warning mark	Warning marks are output at 10 cm intervals from 60 cm from the end of the chart.	
Chart feed method		Stepping sprocket system		

Recorder	Chart	Chart feed speed	1 to 599 mm/h, 10 to 200 mm/min.
		Trend recording resolution	0.05 mm
		Recording accuracy	PV axis: Accuracy indicated in Table 1 + ($\pm 0.5\%$ of recording full scale) Time axis: ± 0.5 mm/1 m
		[Reference] Chart shrinkage/elongation:	When the ambient humidity has changed from 60% to 85%RH: → Chart stretches by approx. 0.7%FS. When the ambient humidity has changed from 60% to 45%RH: → Chart shrinks by approx. 0.2%FS.
	Display/recording mode	One of the following three modes can be selected and set for each channel: • Display/recording OFF • Display only • Display/recording ON	
Recording format	Trend recording	Trend	• PV value (analog)
		Scale printing	• Marker/time/date/tag/scale unit, or • Marker/time/chart feed speed/tag/scale unit
		Event	• Channel No./time/event No./state (occurrence or reset) When a state occurs (is reset) before printing has finished, the next 48 items are memorized and printed.
	Trend+tabulation recording	Trend	• PV value (analog)
		Scale printing	• Marker/time/date/tag/scale unit, or • Marker/time/chart feed speed/tag/scale unit • Scale upper- and lower-limit values
		Tabulation	• PV value (CH1, CH2, CH3 from left) Tabulation is carried out after printing of the scale. • Tabulation Cycle Once every 40 to 80 mm
		Event	• Channel No./time/event No./state (occurrence or reset) When a state occurs (is reset) before printing has finished, the next 48 items are memorized and printed.
	Trend+schedule demand recording	Trend	• PV value (analog)
		Scale printing	• Marker/time/date/tag/scale unit, or • Marker/time/chart feed speed/tag/scale unit • Scale upper- and lower-limit values
		Schedule demand	• Time/PV value (CH1, CH2, CH3 from left)
		Event	• Channel No./time/date/event No./state (occurrence or reset) When a state occurs (is reset) before printing has finished, the next 48 items are memorized and printed.
	Event	Setting	Number of set events
Setting range			-19999 to +29999
Differential			0 to 29999
Action		Event action is carried out even while recording has stopped (RCD OFF) except when the following event settings are OFF. • PV upper limit • PV lower limit • Absolute value deviation upper limit • Absolute value deviation lower limit • Rate-of-change upper limit • Rate-of-change lower limit	
Action result		Recording	• Channel No. • Event occurrence/reset time and state • Event level • Output relay No. (when event relay output is supported)
		Display	• Event state and measurement value when an event occurs • Event occurrence/reset state on other channels
		Buffer	• Up to 48 recording actions are memorized. (These are cleared when the power is turned OFF.)
		Relay output	Optionally supportable as event output
Optional functions	External switch inputs (RSW)	Number of inputs	4
		Functions	• RSW1: Recording start (OPEN→CLOSE)/stop (CLOSE→OPEN) • RSW2: Print on demand (DMD) (OPEN→CLOSE) • RSW3: Chart feed (chart feed 40 mm every OPEN→CLOSE) • RSW4: Print message 1 (printing at OPEN→CLOSE) Above function assignments are fixed on body. However, the following functions can be freely assigned to each RSW (1 function per RSW) by the Smart Handy Loader in addition to the above functions. • Message 2 printed • Message 3 printed • Message 4 printed
		Contact hold time	500 ms min.
		Switch type	Dry contacts or open collector
		Open voltage	Approx. 5 V
		Short-circuit current	Approx. 1.6 mA

Optional functions	External switch inputs (RSW)	Allowable open collector	ON residual voltage	3 V max. (under recommended operating conditions)			
			OFF leakage current	100 μ A max. (under recommended operating conditions)			
	Event output	Number of relay outputs	6				
		Output action	2 event actions (max. 6 actions) preset to each channel can be freely combined to select OR output.				
		Output type	Transfer contact (NC, NO contact). Event relay excitation is normal operation.				
		Contact rating	100V ac, 0.2 A, 30V dc, 0.3 A (max. allowable contact voltage 125V ac, 110V dc)				
	Communications	Communications standard	Standard		RS-232C		RS-485
			Number of signal lines	3 (including SG)		5 (including SG)	
			Transmission distance	15 m max.		300 m max.	
		Protocol	Standard	Conforming to Yamatake Corporation CP communications protocol		Conforming to Yamatake Corporation CP communications protocol	
			Network	1-1		Multi-drop (max. 31 nodes)	
			Function	Slave instrument function		Slave instrument function	
			Master instrument	Not specified		Not specified	
		Communications system	Synchronization	Start-stop synchronization		Start-stop synchronization	
			Communications flow	Half duplex		Half duplex	
Transmission speed			4800, 9600 bps		4800, 9600 bps		
Data length			8 bits		8 bits		
Parity			Even parity, no parity		Even parity, no parity		
Stop bit			1 stop bit, 2 stop bits		1 stop bit, 2 stop bits		
General specifications		Memory protection	Setup data	EEPROM			
	Clock backup		Lithium cell (Battery life is about 10 years when unit is operated for 8 hours per day within temperature range of 0 to 40°C.)				
	Vibration resistance	0.1 m/s ² max. (0 to 100 Hz)					
	Insulation resistance	Min. 20 M Ω across each terminal and GND terminal (by 500V dc megger)					
	Dielectric strength	Power supply and event output (leak current 5 mA max.):					
		Across power terminal and GND terminal:		1500V ac 50/60 Hz for 1 minute			
		Across event output and GND terminal:		1500V ac 50/60 Hz for 1 minute			
		Input (leak current 2 mA max.)					
	Across measurement input terminal and GND terminal:		1000V ac 50/60 Hz for 1 minute				
	Across measurement input terminals:		500V ac 50/60 Hz for 1 minute (excluding RTD input)				
	Across external contact input terminal and GND terminal:		500V ac 50/60 Hz for 1 minute				
	Across communications terminal and GND terminal:		500V ac 50/60 Hz for 1 minute				
	Induction resistance	Common mode rejection ratio: 130 dB (50/60 Hz \pm 0.1 Hz, input impedance 500 Ω , across terminals and ground)					
		Normal mode rejection ratio: 50 dB (50/60 Hz \pm 0.1 Hz)					
	Operating conditions	Ambient temperature	0 to 50°C				
		Ambient humidity	30 to 90%RH (condensation not allowed)				
	Transportation/storage conditions	Ambient temperature	-20 to +60°C				
Ambient humidity		5 to 95%RH (condensation not allowed)					
Shock resistance		294 m/s ² max. (continuously for 11 ms max.)					
Vibration resistance		4.9 m/s ² max.					
Rated power voltage	100 to 240V ac (50/60 Hz)						
Allowable voltage fluctuation	90 to 250V ac (50/60 Hz)						
Power consumption	Approx. 40 VA						
Material	Case	Steel plate					
	Door frame	Glass-fiber filled polycarbonate					
	Door window	Acryl					

General specifications	Color	Case		Gray (Munsell N7 or equivalent)			
		Door frame		Gray (DIC555 or equivalent)			
	Weight	W/out optional functions		Pen 1: 7.8 kg, Pen 2: 8.3 kg, Pen 3: 8.8 kg			
		W/ optional functions		Pen 1: 8.1 kg, Pen 2: 8.6 kg, Pen 3: 9.1 kg			
	Mounting	Panel mount					
Mounting angle	Bottom rear angle to 30° and top rear angle to 3° from horizontal position						
Standard accessories	Item Name	Part No.	Q'ty	Consumable parts (ordered separately)	Item Name	Part No.	Q'ty
	Folding chart	—	1		Folding chart	81407861-001	10
	Cartridge pen	—	Pens 1, 2, 3 according to model No.		Replacement pen 1	81446632-001	3
					Replacement pen 2	81446633-001	3
					Replacement pen 3	81446634-001	3
	Printing pen	—	1	Printing pen	81446296-001	3	
	Mounting bracket	81446641-001	1 set	Auxiliary parts (ordered separately)	250 Ω conversion resistor (accuracy ±0.02%)	81401325	1
	Tag No. plate	—	1		250 Ω conversion resistor (accuracy ±0.05%)	81446642-001	2
	Terminal screw (spare)	—	5		RS-232C cross cable (8 m)	CBL-RS232Z08	1
	Lubricating oil	—	1		—	—	—
User's Manual	CP-UM-5057E	1	—		—	—	

● Table 1 Input Types, Ranges and Display Accuracy

Input			Range		Display accuracy	Resolution	
Type	Symbol	Code	mV/V input	mV/V indication range			
DC voltage	mV	101	-25.00 to +25.00 mV	-19999 to +29999	± (0.2% of FS+1 digit)	10 μV	
		100	-14.00 to +14.00 mV	-19999 to +29999	± (0.2% of FS+1 digit)	10 μV	
		102	-70.00 to +70.00 mV	-19999 to +29999	± (0.2% of FS+1 digit)	10 μV	
	V	105	-5.00 to +5.00 V	-19999 to +29999	± (0.2% of FS+1 digit)	1 mV	
Type	Symbol	Code	°C Range		Display accuracy	Resolution	
Thermocouple (Indication accuracy does not include reference contact compensation accuracy.)	R	200	0.0 to 1760.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C	
	S	210					
	B	220	0.0 to 1820.0°C		Less than 400°C ±50°C ± (0.3% of FS+1 digit) or 0.1°C whichever is larger	Not specified 0.1°C	
			K	230			-200.0 to +1370.0°C
				231			-200.0 to +600.0°C
	K	232	-200.0 to +300.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C	
			E	240			-200.0 to +900.0°C
	E	241		-200.0 to +350.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C
			J	250	-200.0 to +1100.0°C		
	J	251		-200.0 to +450.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C
			T	260	-200.0 to +400.0°C		
	T	261		-200.0 to +250.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C
			N	270	0.0 to 1300.0°C		
	N	271		0.0 to 700.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C
				272	0.0 to 350.0°C		
	WRe0-26	280	0.0 to 2320.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C	
	WRe5-26	290	0.0 to 2320.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C	
PLII	310	-100.0 to +1390.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C		
		311	-100.0 to +600.0°C				
			312			-100.0 to +300.0°C	
Ni-Ni•Mo	320	0.0 to 1310.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C		
Resistance temperature detector (RTD)	Pt100Ω	401	-200.0 to +300.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C	
		402	-140.0 to +150.0°C				
		403	-100.0 to +100.0°C				
	JPt100Ω	411	-200.0 to +300.0°C		± (0.3% of FS+1 digit) or 0.1°C whichever is larger	0.1°C	
		412	-140.0 to +150.0°C				
		413	-100.0 to +100.0°C				

Reference contact compensation accuracy (at 0°C input);

- Type: K, E, J, T, PL-II, N: ±0.5°C/±1°F
- Type: R, S, B, WRe0-26, WRe5-26, Ni-Ni•Mo: ±1°C/±2°F

Table 1 (continued)

Type	Symbol	Code	°F Range	Display accuracy	Resolution
Thermocouple (Indication accuracy does not include reference contact compensation accuracy.)	R	500	32 to 3200°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
	S	510			
	B	520	32 to 3308°F	Less than 752°F ±90°C ± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F 1°F
	K	530	-328 to +2498°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
		531	-328 to +1112°F		
		532	-328 to +572°F		
	E	540	-328 to +1652°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
		541	-328 to +662°F		
	J	550	-328 to +2012°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
		551	-328 to +842°F		
	T	560	-328 to +752°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
		561	-328 to +482°F		
	N	570	32 to 2372°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
		571	32 to 1292°F		
		572	32 to 662°F		
	WRe0-26	580	32 to 4208°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F
WRe5-26	590	32 to 4208°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F	
PLII	610	-148 to +2534°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F	
	611	-148 to +1112°F			
	612	-148 to +572°F			
Ni-Ni•Mo	620	32 to 2390°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	1°F	
Resistance temperature detector (RTD)	Pt100Ω	701	-328 to +572°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	0.1°F
		702	-220 to +302°F		
		703	-148 to +212°F		
	JPt100Ω	711	-328 to +572°F	± (0.3% of FS+1 digit) or 1°F whichever is larger	0.1°F
		712	-220 to +302°F		
		713	-148 to +212°F		

Reference contact compensation accuracy (at 0°C input);

- Type: K, E, J, T, PL-II, N: ±0.5°C/±1°F
- Type: R, S, B, WRe0-26, WRe5-26, Ni-Ni•Mo: ±1°C/±2°F

● Model Selection Guide

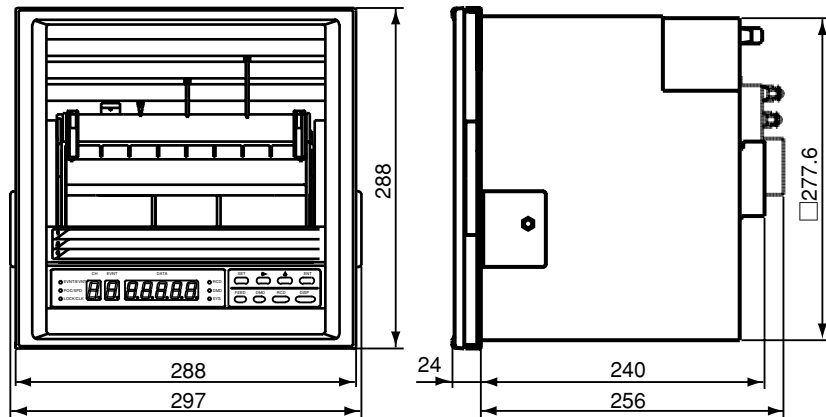
- I II III IV V VI VII VIII

Example: SRF202AA11000

I	II	III	IV	V	VI	VII	VIII	Description					
Basic Model No.	Power	Input	Option 1	Option 2	Option 3	Addition 1	Addition 2	Model No.	Pen 1	Pen 2	Pen 3		
SRF201												180 mm Pen 1 recorder	
SRF202												180 mm Pen 2 recorder	
SRF203												180 mm Pen 3 recorder	
	A											100 to 240V ac	
		A						SRF201	T/C•voltage	—	—		
								SRF202	T/C•voltage	T/C•voltage	—		
								SRF203	T/C•voltage	T/C•voltage	T/C•voltage		
		B						SRF201	RTD•voltage	—	—		
								SRF202	RTD•voltage	RTD•voltage	—		
								SRF203	RTD•voltage	RTD•voltage	RTD•voltage		
		C						SRF202	T/C•voltage	RTD•voltage	—		
								SRF203	T/C•voltage	RTD•voltage	RTD•voltage		
		D						SRF202	RTD•voltage	T/C•voltage	—		
								SRF203	RTD•voltage	T/C•voltage	T/C•voltage		
		E						SRF203	T/C•voltage	T/C•voltage	RTD•voltage		
		F						SRF203	RTD•voltage	RTD•voltage	T/C•voltage		
			0									None	
			1									Relay outputs (6)	
			2									Relay outputs (6) + external switch (4)	
				0								None	
				1								RS-485	
				2								RS-232C	
					0							None	
						0						None	
							0					None	
								D				Inspection certificate provided	
								T				Tropical treatment	
								B				Tropical treatment + Inspection certificate provided	
								0				None	

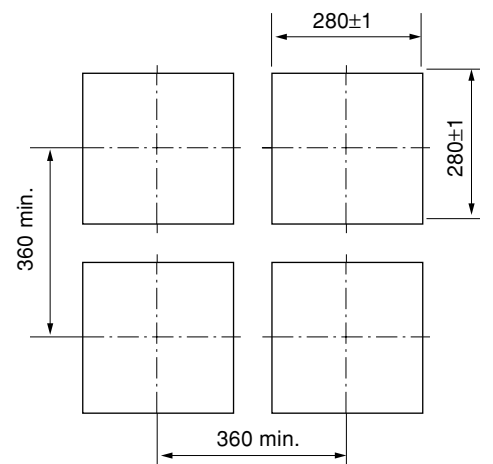
* Conventions Used for Indicating Input Type
 T/C•voltage Thermocouple/DC voltage group
 RTD•voltage Resistance temperature detector/
 DC voltage group

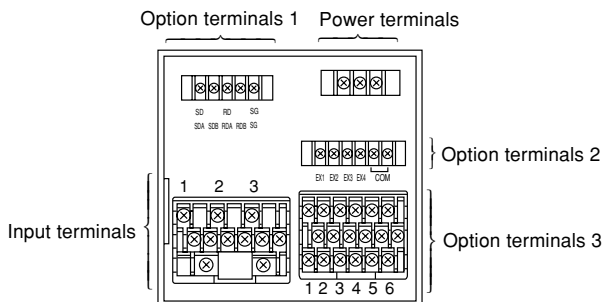
■ External Dimensions



■ Panel Cutout

(Unit: mm)





<p>Power terminals</p> <p>Power supply for instrument 100 to 240V ac 50/60 Hz</p> <p>(compatible crimped terminal: M4)</p>	<p>Input terminals</p> <p>1 2 3</p> <p>T/C • mV (+) or RTD (A) T/C • mV (-) or RTD (B) RTD (B)</p> <table border="1"> <tr> <td>DC voltage</td> <td>Thermocouple</td> <td>Resistance temperature detector</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td>mV, V</td> <td></td> <td>A W B C RTD</td> </tr> </table> <p>(compatible crimped terminal: M3.5)</p>	DC voltage	Thermocouple	Resistance temperature detector				mV, V		A W B C RTD	<p>Option terminals 1 (communications)</p> <p>SD RD SG SDA SDB SDC</p> <p>RS-485</p> <p>SD RD SG SDA SDB SDC</p> <p>RS-232C</p> <p>SD RD SG</p> <p>(compatible crimped terminal: M3)</p>
DC voltage	Thermocouple	Resistance temperature detector									
mV, V		A W B C RTD									
<p>Option terminals 2 (External switch inputs)</p> <p>External switch input No.1 External switch input No.2 Common Common External switch input No.4 External switch input No.3</p> <p>(compatible crimped terminal: M3)</p>	<p>Option terminals 3 (relay output)</p> <p>NO C NC</p> <p>1 2 3 4 5 6</p> <p>NO C NC Lamp Lights when event occurs</p> <p>NO C NC Power supply for event Lamp Normally lit</p> <p>(compatible crimped terminal: M3.5)</p>										

⚠ RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment. Accordingly, when used in the applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

Specifications are subject to change without notice.

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