YAMATAKE **Specification**

DigitroniK
Digital Indicating Controller
SDC40B

FEATURES

The DigitroniK SDC40B is a single loop digital indicating controller for controlling temperatures, pressures, flow rates, levels, PH values, etc.
A compact instrument with PID control and various auxiliary functions, it offers instrumentation with a high level of cost performance.
A PC loader allows the user to design any combination of functions.

A host of I/O functions

- *Three analog inputs*
  - *Input 1: Thermocouple, RTD (resistance temperature detector), DC voltage and DC current*
  - *Input 2: 4 to 20mA DC or 1 to 5V DC*
  - *Input 3: 1 to 5V DC*
- *Capable of accepting and processing the following inputs: Approximation by linearization table, temperature and pressure compensation, and square-root extraction.*
- *12 digital inputs*
  - *No-voltage contact (relay contact) or open collector*
  - *The digital input processor can convert data to 2^n index data.*
  - *In addition to mode switching and selections, the controller can be directly linked to internal processing.*
- *Three (5G) and two (2G) analog outputs*
  - *5G output: 4 to 20mA DC (3 analog outputs)*
  - *2G output: M/M driven relay (1 analog output) 4 to 20mA DC (1 analog output)*
- *8 digital outputs*
  - *SPST relay outputs (2 digital outputs), SPDT relay output (1 digital output), open collector outputs (5 digital outputs)*
  - *Results of internal processing can be assigned to any output.*

FUNCTIONS

- *Inputs..... Analog inputs : 3*
  Digital inputs : 12
- *Outputs..... Analog outputs : 3 (5G), 2 (2G)*
  Digital outputs : 8
- *Number of computational expressions: Approx. 80*
- *Number of computational units: 50*
- *Variable parameters ..... %: 40, Time: 10, Flag: 20, Index: 10*
- *Fixed parameters Unlimited number*
- *Number of PID units: Up to 2 units*
- *Number of PID parameter groups: 8*
- *Engineering unit parameters: 8 per PID, a total of 16*
- *Linearization tables: 3 tables (connectable), 16 points per table*
- *PTB (% → %) tables: 4 tables with 16 points per table that can be used as linearization tables*
- *TTB (% → time) tables: 4 tables with 16 points per table*

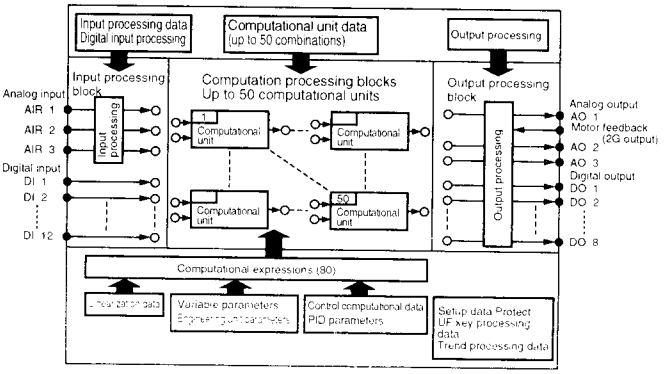
A great number of control functions

- *Four types of controllers combined with numerous computational units allow not only local control and cascade control, but feed forward control, non-linear control, dead time compensation control, override control and more.*
- *In addition to conventional PID auto-tuning, the following three functions can be selected and combined (only normal PID computation mode).*
  - *PID with two degrees of freedom: Independent rising edge characteristics PID and disturbance response characteristics PID functions are provided and are automatically switched through the use of fuzzy rules.*
  - *Smart tuning : Helpful in suppressing overshoots*
  - *Neural network : Supports a wide-range of response characteristics and automatically finetunes PID constants.*
- *Approximately 80 computational expressions (addition, subtraction, multiplication, division, selector, linearization table, etc.) A total of 50 computational units can be assigned.*
- *An autc balance function prevents output shear for smooth mode switching.*
- *Analog input errors and computational errors can be detected and an interlock function is available.*

Easy to configure and operate

- *Configurations (combining computational units) can be simplified with the use of a PC loader.*
- *Two user definable function keys each of which can store up to 8 data items.*
- *Trends can be monitored on a PC loader.*

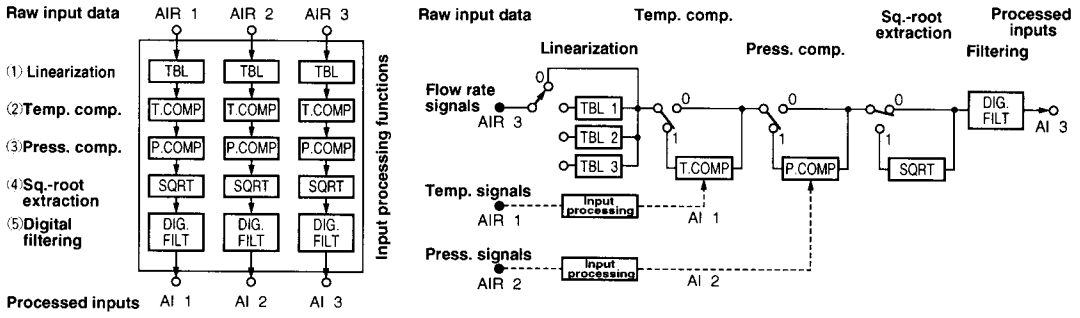
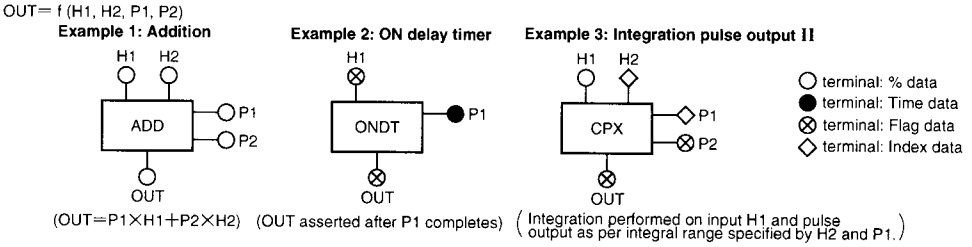
BLOCK DIAGRAM



SPECIFICATIONS

Performance specifications

Analog input 1 (AIR 1)	**Type of inputs**	Multirange indication of thermocouple, RTD, and DC voltage/currents (**See Table 1.**)
	Input indicating accuracy	±0.1% FS ±1U (This may be affected by indication value conversion and ranges under standard conditions)
	Input sampling cycle	0.1 to 0.5 sec. (depends on computation cycle)
	Input bias current	Thermocouple and DC voltage input : Max. ±1.3μA (peak value under standard conditions) Range above 1V or more, −3μA
	Input impedance	DC current input: 50Ω ±10% (under operating conditions)
	Measuring current	RTD: 1.04mA ±0.02mA, Current input on terminal A. (under operating conditions)
	Effect of wiring resistance	Thermocouple, DC current and DC voltage : Variation in indicated value due to input conversion when the wiring resistance at both ends is 250Ω • 0 to 10mV, −10 to +10mV: 35μV or less • 0 to 100mV : 60μV or less • Others : 750μV or less RTD : ±0.01% FS/Ω max. in a wiring resistance range of 0 to 10Ω. ±0.02% FS/Ω max. in a range with a minimum resolution of 0.01°C. The allowable wiring resistance is 85Ω max. (A zener barrier is available only for the 0.1°C resolution range and requires on-site adjustment.)
	Allowable parallel resistance	Allowable parallel resistance for thermocouple break detection: 1MΩ or more
	Maximum allowable input	Thermocouple and DC voltage input: −5 to +15V DC current input : 28mA
	Burnout	Internal upscale and downscale selection
	Over range detection threshold	110% FS or more: Upscaled −10% FS or less : Downscaled (However, inputs in the −200.0 to +500.0°C range of JIS Pt100 and the −200.0 to +500.0°C range of JIS JPt100 are not downscaled. The indicating values lower limit for B input (0.0 to 1800.0°C) is 20°C.)
	Cold junction compensation accuracy	±0.5°C (under standard conditions)
	Cold junction compensation method	Internal or external compensation (at 0°C) selectable
	Scaling	−19999 to +26000U (These settings are available for linear inputs only. Reverse scaling and decimal point repositioning can be performed with resolutions to 1/20000.)
Analog input 2 (AIR 2)	**Type of inputs**	4 to 20mA DC, 1 to 5V DC (**See Table 1.**)
	Input indicating accuracy	±0.1% FS ±1U (display value conversion under standard conditions)
	Input sampling cycle	0.1 to 0.5s (depends on computation cycle)
	Input bias current	1 to 5V DC input : ±10μA max. (under operating conditions)
	Input impedance	1 to 5V DC input : 1MΩ or more (under operating conditions) 4 to 20mA DC input: 50Ω ±10% (under operating conditions)
	Maximum allowable input	1 to 5 V DC input : 0 to 6V 4 to 20mA DC input: 28mA
	Burnout	Downscale
	Over range detection threshold	110% FS or more: Upscaled −10% FS or less : Downscaled
	Scaling	−19999 to +26000U (Reverse scaling and decimal point repositioning can be performed with resolutions to 1/20000.)
Analog input 3 (AIR 3)	**Type of inputs**	1 to 5V DC (**See Table 1.**)
	Input indicating accuracy	±0.1% FS ±1U (display value conversion under standard conditions)
	Input sampling cycle	0.1 to 0.5 sec. (depends on computation cycle)
	Input bias current	±10μA max. (under operating conditions)
	Input impedance	1MΩ or more (under operating conditions)
	Maximum allowable input	0 to 6V
	Burnout	Downscale
	Over range detection threshold	110% FS or more: Upscaled −10% FS or less : Downscaled
	Scaling	−19999 to +26000U (Reverse scaling and decimal point repositioning can be performed with resolutions to 1/20000.)

<table>
<tr><td rowspan="9">Digital input
(DI 1 to DI 12)</td><td>No. of inputs</td><td>12 points</td></tr>
<tr><td>Types of connectable outputs</td><td>No-voltage contacts (relay contacts) and open collector (current sink to ground)</td></tr>
<tr><td>Terminal voltage (open)</td><td>12V $^{+0.6V}_{-1.6V}$ (under operating conditions) across common terminal (terminal ㉕) and each input terminal.</td></tr>
<tr><td>Terminal current (short-circuited)</td><td>6mA $^{+0.6mA}_{-1.0mA}$ (under operating conditions) across each terminal</td></tr>
<tr><td>Allowable contact resistance (no-voltage contact)</td><td>On: 700Ω or less (under operating conditions)
Off: 10kΩ or more (under operating conditions)</td></tr>
<tr><td>Residual voltage (open collector on)</td><td>3V or less (under operating conditions)</td></tr>
<tr><td>Leakage current when an open collector is off</td><td>0.1mA or less (under operating conditions)</td></tr>
<tr><td>Parallel connection to other instruments</td><td>Can be connected to Yamatake-Honeywell SDC40B series instruments</td></tr>
<tr><td>Input sampling cycle</td><td>0.1 to 0.5 sec. (depends on computation cycle)</td></tr>
<tr><td>ON detection min. hold time</td><td>0.2 to 1.0 sec. (double computation cycle)</td></tr>
<tr><td rowspan="5">Input processing block</td><td colspan="2">As shown below, the controller can accept and process five analog inputs: approximation by ① linearization table, ② temperature compensation, ③ pressure compensation, ④ square-root extraction and ⑤ digital filtering.
 
</td></tr>
<tr><td>Linearization</td><td>Three sets of 16 approximation by linearization tables are provided.
They can be assigned to analog inputs 1, 2 and 3.</td></tr>
<tr><td>Temperature compensation (T.COMP)</td><td>Compensation flow rate signal = $\frac{\text{design (target) temperature + constant}}{\text{current temperature + constant}}$ × flow rate signal
°C or °F can be selected as units.</td></tr>
<tr><td>Pressure compensation (P.COMP)</td><td>Compensation flow rate signal = $\frac{\text{current pressure + constant}}{\text{design (target) pressure + constant}}$ × flow rate signal
MPa, KPa, Pa, kgf/cm² or mmH₂O can be selected as units.</td></tr>
<tr><td>Square-root extraction (SQRT)</td><td>Dropout value: 0.0 to 100.0% variable</td></tr>
<tr><td>Digital filtering (DIG. FILT)</td><td>First order lag computation: Output = $\frac{1}{1+T\times S}$ × input
T: Filter constant 0.0 to 120.0 sec. (no filtering at 0.0)
S: Laplacian</td></tr>
<tr><td>Computation processing block</td><td colspan="2">About 80 computational expressions can be assigned to a total of 50 computational units.
Each computational expression has the following format and can operate on up to 4 inputs. Refer to the list of computational expressions for details.
OUT= f (H1, H2, P1, P2)
 
</td></tr>
</table>

<table>
<tr><td rowspan="20">Computation processing block</td><td>Computation cycle setting</td><td colspan="4">0.1 to 0.5 sec. (Settable in 0.1 sec. increments.)</td></tr>
<tr><td rowspan="19">PID control and output unit</td><td colspan="4">Performed by PID computational unit 1 (PID 1) or PID computational unit 2 (PID 2) in the computational expressions. Of the 50 computational units only one each can be assigned as PID computational units 1 and 2.</td></tr>
<tr><td rowspan="5">Control type</td><td></td><td>PID computational unit 1 (PID 1)</td><td>PID computational unit 2 (PID 2)</td><td rowspan="5">Type 0 to 3 are set at setup.
Only one MAN computational unit can be used for two PID computa-tional units.</td></tr>
<tr><td>Type 0</td><td>Local setting</td><td>Not used</td></tr>
<tr><td>Type 1</td><td>Remote/Local setting</td><td>Not used</td></tr>
<tr><td>Type 2</td><td>Remote/Local setting</td><td>Remote setting</td></tr>
<tr><td>Type 3</td><td>Local setting</td><td>Remote/Local setting</td></tr>
<tr><td>Control output model No.</td><td colspan="2">2G</td><td>5G</td></tr>
<tr><td rowspan="3">Analog output signal</td><td>AO1</td><td colspan="2">M/M drive relay contact output</td><td>Current output (4 to 20mA DC)</td></tr>
<tr><td>AO2</td><td colspan="2">None</td><td>Current output (4 to 20mA DC)</td></tr>
<tr><td>AO3</td><td colspan="2">Current output (4 to 20mA DC)</td><td>Current output (4 to 20mA DC)</td></tr>
<tr><td>Control operation</td><td colspan="2">Position proportional PID and current proportional PID</td><td>Current proportional PID</td></tr>
<tr><td>Computation mode</td><td colspan="3">Normal or derivative-based is selectable using PID computational units.</td></tr>
<tr><td>Proportional band (P)</td><td colspan="3">0.1 to 999.9% (ON/OFF disabled)</td></tr>
<tr><td>Integral time (I)</td><td colspan="3">0.0 to 6000.0 sec. (PD activates at I = 0)</td></tr>
<tr><td>Derivative time (D)</td><td colspan="3">0.0 to 6000.0 sec. (PI activates at D = 0)</td></tr>
<tr><td>Integral limit</td><td colspan="3">Lower limit: –200.0 to upper integral limit %, Upper limit: Lower integral limit to 200.0%</td></tr>
<tr><td>Dead band</td><td colspan="3">0.0 to 100.0% (no dead band at 0)</td></tr>
<tr><td>Output deviation rate limit</td><td colspan="3">0.0 to 100.0% / Computation cycle (no limit at 0)</td></tr>
<tr><td>Manual reset</td><td colspan="3">0.0 to 100.0%</td></tr>
<tr><td>No. of PID groups</td><td colspan="3">8 groups (shared by PID computational units 1 and 2)</td></tr>
<tr><td>PID auto-tuning (Only normal PID computation mode)</td><td colspan="3">Neuro, fuzzy (with two degrees of freedom) and smart methods are used in addition to the limit cycle method to set PID auto-tuning.</td></tr>
<tr><td>RSP ratio</td><td colspan="3">–999.9 to +999.9% of RSP of PID computational units 1 and 2</td></tr>
<tr><td>RSP bias</td><td colspan="3">–999.9 to +999.9% of RSP of PID computational units 1 and 2</td></tr>
<tr><td>Deviation alarm</td><td colspan="3">0.0 to 100.0% of |SP-PV|, the absolute value of PID computational units 1 and 2</td></tr>
<tr><td>Upper PV alarm limit</td><td colspan="3">–10.0 to +110.0% of PV of PID computational units 1 and 2</td></tr>
<tr><td>Lower PV alarm limit</td><td colspan="3">–10.0 to +110.0% of PV of PID computational units 1 and 2</td></tr>
<tr><td>Alarm hysteresis</td><td colspan="3">0.0 to 100.0% for deviation alarm, upper PV alarm limit and lower PV alarm limit</td></tr>
<tr><td rowspan="3">Output processor</td><td rowspan="3">Analog output (AO1 to AO3)</td><td>Model No. 2G AO1</td><td>M/M drive relay contact output</td><td colspan="2">Contact system : 2SPST
Contact rating : 2.5A (30V DC L/R = 0.7ms)
4A (120V AC cos ϕ= 0.4)
2A (240V AC cos ϕ= 0.4)
Allowable contact voltage : 250V AC resistive load, 125V DC resistive load, 125V DC L/R = 0.7ms, 250V AC cos ϕ= 0.4
Maximum on-off power : 75W (L/R = 0.7ms), 480VA (cos ϕ= 0.4)
Mechanical life : 10,000,000 repetitions
Electrical life : 100,000 repetitions (cos ϕ= 0.4 at contact rating and 30 repetitions per minute)
Minimum switching voltage: 5V
Minimum switching current : 100mA
MFB (motor feedback) input range : 100 to 2500Ω
MFB (motor feedback) line-break control : Whether action is continued is determined by MFB estimated position setting.</td></tr>
<tr><td>Model No. 2G AO3</td><td rowspan="2">Current output (4 to 20 mA)</td><td colspan="2" rowspan="2">Current output : 4 to 20mA DC
Allowable load resistance : 680Ω or less (under operating conditions)
Output accuracy : ±0.1% FS or less (under operating conditions)
Output resolution : 1/10000
Inrush current : 25mA or less, 50ms or less (with 250Ω load)
Maximum output current : 21.6mA DC
Minimum output current : 2.4mA DC
Opening terminal voltage : 25V or less
Output update cycle : 0.1 to 0.5 sec. (depends on computation cycle)</td></tr>
<tr><td>Model No. 5G AO1, AO2, AO3</td></tr>
</table>

<table>
<tr><td rowspan="4">Output processing block</td><td rowspan="4">Digital output (DO1 to DO8)</td><td>DO1</td><td rowspan="2">SPST relay contact</td><td rowspan="2">Electric rating : 250V AC, 30V DC, 1A resistive load
Mechanical life: 20,000,000 repetitions
Electrical life : 100,000 repetitions (at rated capacity)
Minimum switching voltage: 10V
Minimum switching current: 10mA</td></tr>
<tr><td>DO2</td></tr>
<tr><td>DO3</td><td>SPST relay contact</td><td>Electric rating : 250V AC, 30V DC, 2A resistive load
Mechanical life: 50,000,000 repetitions
Electrical life : 100,000 repetitions (at rated capacity)
Minimum switching voltage: 10V
Minimum switching current: 10mA</td></tr>
<tr><td>DO4 to DO8</td><td>Open collector</td><td>External supply voltage : 10 to 29V DC
Maximum load current : 70mA per point
Leakage current when off : 0.1mA</td></tr>
<tr><td rowspan="8">Indications and settings</td><td>Display panel 1</td><td colspan="3">Green 5-digit, 7-segment LED
This panel normally displays PV values. Item codes are displayed in control data setting mode and alarm codes are displayed when alarms are generated.</td></tr>
<tr><td>Display panel 2</td><td colspan="3">Orange 5-digit, 7-segment LED
This panel normally displays SP values. Set values are displayed in control data setting mode.</td></tr>
<tr><td>Display panel 3</td><td colspan="3">Orange 2-digit, 7-segment LED
This panel displays the difference between LSP and RSP values in normal indicating mode when display panel 2 shows SP values. In control data setting mode, item codes are displayed.</td></tr>
<tr><td>LED bar display</td><td colspan="3">12 green and amber LEDs
Analog monitor (includes control output) which doubles as a digital monitor.</td></tr>
<tr><td>Status display</td><td colspan="3">18 LEDs
SP, LCK, OUT, CH1 (PID computational unit 1), CH2 (PID computational unit 2), FLW (follow mode), AUT (auto mode), MAN (manual mode), CAS (cascade mode), IM (interlock manual mode), AT (auto-tuning), FZY (during fuzzy switching), OUT1, OUT2, OUT (bar graph control output), UF1, UF2, UF3 (user defined)</td></tr>
<tr><td>Operation keys</td><td colspan="3">13 rubber keys (of which two are user definable)</td></tr>
<tr><td>Loader connecting port</td><td colspan="3">1 (dedicated cable with stereo miniplugs)</td></tr>
<tr><td rowspan="5">Modes</td><td rowspan="4">Normal operating mode</td><td>Auto mode</td><td colspan="2">PID computational units control constants (LSP).</td></tr>
<tr><td rowspan="2">Manual mode</td><td colspan="2">MAN computational units output manual settings. (However, only one MAN computational unit can be used.)</td></tr>
<tr><td colspan="2">Only PID computational units perform integral operations.</td></tr>
<tr><td>Cascade mode</td><td colspan="2">PID computational units control cascade settings (RSP).</td></tr>
<tr><td>Follow mode</td><td colspan="2">MAN computational units outputs follow inputs to the SDC40B.</td></tr>
<tr><td>Emergency operating mode</td><td colspan="3">Interlock manual mode: This mode is activated when an analog overflow, computational overflow or computational overload is detected.</td></tr>
<tr><td rowspan="11">Communications</td><td rowspan="4">Communications system</td><td>Communications standard</td><td>RS-485</td><td>RS-232C</td></tr>
<tr><td>Network</td><td>Multidrop (SDC40B provided with only slave node functionality) 1 to 16 units or less (DIM), 1 to 31 units or less (CMA, SCM)</td><td>Point-to-point (SDC40B provided with only slave node functionality)</td></tr>
<tr><td>Data flow</td><td>Half duplex</td><td>Half duplex</td></tr>
<tr><td>Synchronization</td><td>Start-stop synchronization</td><td>Start-stop synchronization</td></tr>
<tr><td rowspan="5">Interface system</td><td>Transmission system</td><td>Balanced (differential)</td><td>Unbalanced</td></tr>
<tr><td>Data line</td><td>Bit serial</td><td>Bit serial</td></tr>
<tr><td>Signal line</td><td>5 transmit/receive lines (3-wire connection is also possible.)</td><td>3 transmit/receive lines</td></tr>
<tr><td>Transmission rate</td><td>4800, 9600bps</td><td>4800, 9600bps</td></tr>
<tr><td>Transmission distance</td><td>500m max. (total) (300m for MA500DIM connection)</td><td>15m max.</td></tr>
<tr><td>Misc.</td><td>Comforms to RS-485 standard</td><td>Comforms to RS-232C standard</td></tr>
<tr><td rowspan="3">Display characters</td><td>Char. bit count</td><td>11 bits per character</td><td>11 bits per character</td></tr>
<tr><td>Format</td><td>1 start bit, even parity, 1 stop bit; or 1 start bit, no parity, and 2 stop bits</td><td>1 start bit, even parity, 1 stop bit; or 1 start bit, no parity, and 2 stop bits</td></tr>
<tr><td>Data length</td><td>8 bits</td><td>8 bits</td></tr>
<tr><td>Isolation</td><td colspan="3">Input and output are completely isolated.</td></tr>
<tr><td colspan="4">Note 1: RS-485 communications can be performed by connecting to a computer equipped with an RS-485 interface or to Yamatake-Honeywell's MX200, MA500 (DK link II DIM) or CMA50 controllers.</td></tr>
</table>

General specifications

General specifications	**Memory backup**	User settings (design data and control data): Non-volatile semiconductor memory (EEPROM) Mode, local SP, control output (AO1) and hold computations: RAM backed up by super-capacitor (stored for 24 hours)					
	Rated power voltage	90 to 264V AC, 50/60Hz					
	Power consumption	25VA max.					
	Power switching inrush current	15A max. for 10ms (under operating conditions) **Note:** When starting up a number of SDC40Bs simultaneously, ensure ample power is supplied or stagger their startup times. Otherwise the controllers may not start normally due inrush current induced-voltage drop. Voltage must stabilize within 2 seconds after power on.					
	Power ON operation	Reset time: 15 sec. max. (time until normal operation possible under normal operating conditions)					
	Allowable transient power loss	20ms min. (under operating conditions)					
	Power failure recovery operations	Hot start or cold start selectable (see below)					
		Selection	**RAM backup**	**Actual outage recovery process**	**Description**		
					Mode	**Local SP**	**Control output (AO1)**
		Hot start	During normal operation	Hot start	Before outage	Before outage	Before outage
			During failure	Cold start	Preset mode	Preset LSP	Preset value
		Cold start	N/A not applicable				
	Insulation resistance	Min. 20MΩ or more between power terminal ① or ② and ground terminal ③ (using a 500V AC megger).					
	Dielectric strength	Across power terminal and ground terminal : 1500V AC 50/60Hz for 1 minute Across relay output and ground terminal : 1500V AC 50/60Hz for 1 minute Across non-power terminal and ground terminal: 500V AC 50/60Hz for 1 minute Across isolated terminals : 500V AC 50/60Hz for 1 minute					
	Standard conditions	**Ambient temperature**	23 ±2°C				
		Ambient humidity	60 ±5% RH				
		Rated power voltage	105V AC ±1%				
		Power frequency	50 ±1Hz or 60 ±1Hz				
		Vibration resistance	0m/s² {0G}				
		Impact resistance	0m/s² {0G}				
		Mounting angle	Reference plane (vertical) ±3°				
	Operating conditions	**Ambient temperature range**	0 to 50°C				
		Ambient humidity range	10 to 90% RH (non-condensing)				
		Rated power voltage	90 to 264V AC				
		Power frequency	50 ±2Hz or 60 ±2Hz				
		Vibration resistance	0 to 1.96m/s² {0 to 0.2G}				
		Impact resistance	0 to 9.81m/s² {0 to 1G}				
		Mounting angle	Reference plane (vertical) ±10°				
	Shipping and storage conditions	**Ambient temperature range**	–20 to +70°C				
		Ambient humidity range	10 to 95% RH (non-condensing)				
		Vibration resistance	0 to 4.90m/s² {0 to 0.5G} (10 to 60Hz for 2 hours each in X, Y and Z directions)				
		Impact resistance	0 to 4.90m/s² {0 to 50G} (3 times vertically)				
		Package drop test	Drop height: 90cm (1 angle, 3 edges and 6 planes; free fall)				
	Materials of mask and case	Mask: Multilon Case: Polycarbonate					
	Colors of mask and case	Mask: dark gray Case: Light gray					
	Installation	Specially designed mounting bracket					
	Weight (Mass)	Approx. 900g					

	Parts name	**Parts number**	**Quantity**		**Parts name**	**Parts number**
Standard accessories	Unit indicating label	N-3132	1	**Options**	Hard dust-proof cover set	81446083-001
	Mounting bracket	81405411-001	2		Soft dust-proof cover set	81446087-001
	User's manual: Basic Operations*	CP-UM-1679*	1		Terminal cover set	81446084-001
					PC loader package	SLPC4B-0000
Related Publications	User's manual: Computational Functions*	CP-UM-1680*				
	User's manual: CPL Communication Functions*	CP-UM-1683*				

*: CP-UM-1679, -1680 and -1683 is are Japanese manual.
An English manuals can be supplied on request.

Table 1. Input types and ranges (selected at setup)

Input 1 Thermocouples, RTDs, DC current and DC Voltage

Symbol	°C range	°F range
K (CA)	0.0 to 1200.0	0 to 2400
K (CA)	0.0 to 800.0	0 to 1600
K (CA)	0.0 to 400.0	0 to 750
K (CA)	−200.0 to +1200.0	−300 to +2400
K (CA)	−200.0 to +300.0	−300 to +700
K (CA)	−200 to +200.0	−300 to +400
E (CRC)	0.0 to 800.0	0 to 1800
J (IC)	0.0 to 800.0	0 to 1600
T (CC)	−200.0 to +300.0	−300 to +700
B (PR30-6)	0.0 to 1800.0	0 to 3300
R (PR13)	0.0 to 1600.0	0 to 3100
S (PR10)	0.0 to 1600.0	0 to 3100
W (WRe5-26)	0.0 to 2300.0	0 to 4200
W (WRe5-26)	0.0 to 1400.0	0 to 2552
PR40-20	0.0 to 1900.0	0 to 3400
Ni-Ni · Mo	0.0 to 1300.0	32 to 2372
N	0.0 to 1300.0	32 to 2372
PL II	0.0 to 1300.0	32 to 2372
DIN U	−200.0 to +400.0	−300 to +750
DIN L	−200.0 to +800.0	−300 to +1600
JIS '89 Pt100 (IEC Pt100Ω)	−200.0 to +500.0	−300.0 to +900.0
	−200.0 to +200.0	−300.0 to +400.0
	−100.0 to +150.0	−150.0 to +300.0
	−50.0 to +200.0	−50.0 to +400.0
	−60.00 to +40.00	−76.00 to +104.00
	−40.00 to +60.00	−40.00 to +140.00
	0.0 to 500.0	0.0 to 900.0
	0.0 to 300.0	0.0 to 500.0
	0.00 to 100.00	0.00 to 200.00

Symbol	°C range	°F range
JIS '89 JPt100	−200.0 to +500.0	−300.0 to +900.0
	−200.0 to +200.0	−300.0 to +400.0
	−100.0 to +150.0	−150.0 to +300.0
	−50.0 to +200.0	−50.0 to +400.0
	−60.00 to +40.00	−76.00 to +104.00
	−40.00 to +60.00	−40.00 to +140.00
	0.0 to 500.0	0.0 to 900.0
	0.0 to 300.0	0.0 to 500.0
	0.00 to 100.00	0.00 to 200.00
4 to 20mA	Scale setting range: −19999 to +26000 (Decimal point repositioning and reverse scaling possible.)	
0 to 20mA		
0 to 10mA		
−10 to +10mV		
0 to 100mV		
0 to 1V		
−1 to +1V		
1 to 5V		
0 to 5V		
0 to 10V		

Input 2 DC current and DC voltage

Input format	Range
4 to 20mA	Scale setting range: −19999 to +26000 (Decimal point repositioning and reverse scaling possible.)
1 to 5V	

Input 3 DC voltage

Input format	Range
1 to 5V	Scale setting range: −19999 to +26000 (Decimal point repositioning and reverse scaling possible.)

● Items that do not meet stated indication accuracy(±1% FS ±1U)

- K and T thermocouples:
  ±1°C ±1U for temperatures below −100°C
- B thermocouples:
  ±4.0% FS ±1U for temperatures below 260°C
  ±0.4% FS ±1U for temperatures ranging from 260 to 800°C
  ±0.2% FS ±1U for temperatures ranging from 800 to 1800°C
- R and S thermocouples:
  ±0.2% FS ±1U for temperatures below 100°C
  ±0.15% FS ±1U for temperatures ranging from 100 to 1600°C
- PR40 – 20 thermocouples:
  ±2.5% FS ±1U for temperatures below 300°C
  ±1.5% FS ±1U for temperatures ranging from 300 to 800°C
  ±0.5% FS ±1U for temperatures ranging from 800 to 1900°C
- RTDs:
  ±0.15% FS ±1U for the range below 2 decimal places
- ±0.15% FS ±1U for the range 0 to 10mV
- DIN U thermocouples:
  ±2°C ±1U for temperatures below −100°C
  ±1°C ±1U for temperatures ranging from −100 to 0°C
- DIN L thermocouples:
  ±1.5°C ±1U for temperatures below −100°C

Data and setting procedures

◎: can be set ○: can sometimes be set △: can be monitored −: cannot be set or monitored

Category	Data	Description	From console	From PC loader
Design data	Computational unit data	Specifies computational expressions, connections, etc.	△	◎
	Output processing data	Specifies output processing connections	△	◎
Control data	Setup data	Specifies control types and computation cycles	○	◎
	Input processing data	Specifies input processing types, etc.	○	◎
	Control Computational data	Specifies PID computation modes, PID groups to be used, etc.	○	◎
	PID parameters	Specifies control parameters for PID groups 0 to 7	◎	◎
	Linearization data	Specifies linearization format	○	◎
	Variable parameters	Specifies computation coefficients, constants, etc.	◎	◎
	Engineering unit parameters	For setting engineering units	◎	◎
	UF key processing data	Specifies functions assigned to user function keys (UF) 1 and 2	○	◎
	Digital input processing data	Used as DI1 to DI12 index data	△	◎
	ID data	Identifiers for hardware type, ROM and others not in EEPROM	△	△
	Protector	Specifies key lock ,etc	◎	◎
	Trend processing data	Specified when using data trend functions on PC loader	−	◎

List of computational expressions

No.	Computational expressions	Symbol	Description
1	**Addition**	ADD	OUT=P1×H1+P2×H2
2	**Subtraction**	SUB	OUT=P1×H1−P2×H2
3	**Multiplication**	MUL	OUT=H1×H2
4	**Division**	DIV	OUT=H1/H2+P1
5	**Absolute Value**	ABS	OUT=|H1|
6	**Square-Root Extraction**	SQR	OUT=$\sqrt{H_1}$
7	**Maximum Value**	MAX	OUT=MAX (H1, H2, P1, P2)
8	**Minimum Value**	MIN	OUT=MIN (H1, H2, P1, P2)
9	**4-point Addition**	SGM	OUT=H1+H2+P1+P2
10	**High Selector/Low Limiter**	HSE	When H1 ≧ H2, OUT is H1. When H1 < H2, OUT is H2. When used as a low limiter, H2 is the lower limit value.
11	**Low Selector/High Limiter**	LSE	When H1 ≧ H2, OUT is H2. When H1 < H2, OUT is H1. When used as a high limiter, H2 is the upper limit value.
12	**High and low limiter**	HLLM	H1 is limited by the high limit value P1 and the low limit value P2.
13	**High Monitor**	HMS	Output is asserted when H1 exceeds high monitor value H2. (Hysteresis width is P2.)
14	**Low Monitor**	LMS	Output is asserted when H1 falls below the low monitor value H2. (Hysteresis width is P2.)
15	**Deviation Monitor**	DMS	Output is asserted when the deviation between H1 and H2 exceeds deviation monitor value P1. (Hysteresis width is P2.)
16	**Deviation Rate Limiter**	DRL	Limits input H1s deviation rate per minute to H2% on positive side and to P1% on the negative side.
17	**Deviation Rate Monitor**	DRM	Output is asserted when input H1 exceeds H2% on positive side and is within P1% on negative side compared to inputs made one minute earlier.
18	**Manual Output**	MAN	Enables manual output from system console.
19	**Controller #1**	P1D1	PID controller 1 (with auto-tuning)
20	**Controller #2**	P1D2	PID controller 2 (with auto-tuning)
21	**Dead Time**	DED	OUT=$e^{-P1 \cdot S}$×H1(Input H1, the dead time, is output after P1 seconds.)
22	**Lead/Lag**	L/L	OUT=(1+P1 · S)/(1+P2 · S)×H1
23	**Derivative**	LED	OUT=P1 · S/(1+P2 · S)×H1
24	**Integral**	INT	OUT=H1/P1 · S (Integration performed on input H1 in integral time of P1 seconds.)
25	**Moving Average**	MAV	OUT=$\frac{1}{30}\sum_{i=1}^{30} H_1\left(\frac{i}{30}\ P_1\right)$
26	**Flip-Flop**	RS	Set input H1 holds flag data; H2 input resets the data.
27	**Logical Product**	AND	OUT=H1∧ H2 ∧ P1∧ P2
28	**Logical OR**	OR	OUT=H1∨ H2 ∨ P1∨ P2
29	**Exclusive OR**	XOR	OUT=H1⊻H2
30	**Invert**	NOT	OUT=$\overline{H1}$
31	**2-Position Transfer Switch**	SW	P1 switches between H1 and H2 percent data.
32	**Softening Transfer Switch**	SFT	Switches between H1 and H2 using a P2 (%) slope for smooth switching.
33	**Timer switch**	TSW	Switches between H1 and H2 using P1 time data.
34	**Flag switch**	FSW	Switches between H1 and H2 using P1 flag data.
35	**Alternate switch**	ALSW	Inverts output when the rising edge of H1 is detected.
36	**Timer**	TIM	Pulse generation per P1 seconds
37	**On delay timer**	ONDT	Asserts output after P1 seconds.
38	**Off delay timer**	OFDT	Inhibits output after P1 seconds.
39	**One-shot timer**	OST	Generates pulse for P1 seconds.
40	**Integration pulse output I**	CPO	Outputs the number of pulses proportional to input H1.
41	**Integration pulse output II**	CPX	Performs integration on input H1 and outputs one pulse when the output pulse value set by P1 is reached.
42	**Pulse width modulation**	PWM	Asserts output in proportion to input H1 within the P1 cycle.
43	**Ramp signal**	RMP	Outputs a waveform with a rising slope.
44	**LOG**	LOG	OUT = LOG_{10} (H_1) or OUT = LOG_e (H_1)
45	**Exponent**	EXP	OUT = 10^{H1} or OUT = e^{H1}
46	**(Not used)**		
47	**(Not used)**		
48	**(Not used)**		
49	**(Not used)**		
50	**(Not used)**		
51	**Control variable change #1**	PMD1	Changes PID 1 control variables. (enables changing of PID group numbers also.)
52	**Control variable change #2**	PMD2	Changes PID 2 control variables. (enables changing of PID group numbers also.)
53	**Mode select (status detection)**	MOD	Cycles through follow, manual, auto and cascade modes.
54	**Mode select (edge detection)**	MODX	Cycles through follow, manual, auto and cascade modes.
55	**Auto-tuning start/stop 1**	AT1	Starts/stops PID 1 unit auto-tuning.
56	**Auto-tuning start/stop 2**	AT2	Starts/stops PID 2 unit auto-tuning.
57	**Data hold**	HOLD	Retains input H1 during outage, and outputs it as is after restore.
58	**Raise lower unit**	RL	Raises output when H1 is ON (raise) and lowers it when H2 is ON (lower).
59	**Reset unit**	RST	Resets the interlock manual mode.
60	**(Not used)**		
61	**Linearization Table #1**	TBL1	Linearization Table #1 (16 points)
62	**Linearization Table #2**	TBL2	Linearization Table #2 (16 points)
63	**Linearization Table #3**	TBL3	Linearization Table #3 (16 points)

No.	Computational expressions	Symbol	Description
64	Inverse linearization Table #1	TBR1	Inverse function of linearization Table #1 (16 points)
65	Inverse linearization Table #2	TBR2	Inverse function of linearization Table #2 (16 points)
66	Inverse linearization Table #3	TBR3	Inverse function of linearization Table #3 (16 points)
67	Time → % conversion	TTP	Converts time data to percent data.
68	% → Time conversion	PTT	Converts percent data to time data.
69	Engineering unit parameter selection #1	E_P1	Selects engineering unit parameters for PID 1 units.
70	Engineering unit parameter selection #2	E_P2	Selects engineering unit parameters for PID 2 units.
71	(Not used)		
72	(Not used)		
73	(Not used)		
74	(Not used)		
75	(Not used)		
76	(Not used)		
77	(Not used)		
78	(Not used)		
79	(Not used)		
80	(Not used)		
81	% → % table #1	PTB1	Not connectable, but otherwise identical to linearization tables.
82	% → % table #2	PTB2	Not connectable, but otherwise identical to linearization tables.
83	% → % table #3	PTB3	Not connectable, but otherwise identical to linearization tables.
84	% → % table #4	PTB4	Not connectable, but otherwise identical to linearization tables.
85	% → time table #1	TTB1	Uses linearization table to convert % data to time data.
86	% → time table #2	TTB2	Uses linearization table to convert % data to time data.
87	% → time table #3	TTB3	Uses linearization table to convert % data to time data.
88	% → time table #4	TTB4	Uses linearization table to convert % data to time data.
89	(Not used)		
90	(Not used)		
91	User lamp output #1	UF1	User lamp control unit #1
92	User lamp output #2	UF2	User lamp control unit #2
93	User lamp output #3	UF3	User lamp control unit #3
94	Bar graph display switch	BLED	Selects bar graph display.
95	Additional display unit #1	DSP1	Additional display unit #1 of display panels 1 and 2
96	Additional display unit #2	DSP2	Additional display unit #2 of display panels 1 and 2
97	Additional display unit #3	DSP3	Additional display unit #3 of display panels 1 and 2
98	Additional display unit #4	DSP4	Additional display unit #4 of display panels 1 and 2
99	(Not used)		

MODEL SELECTION GUIDE

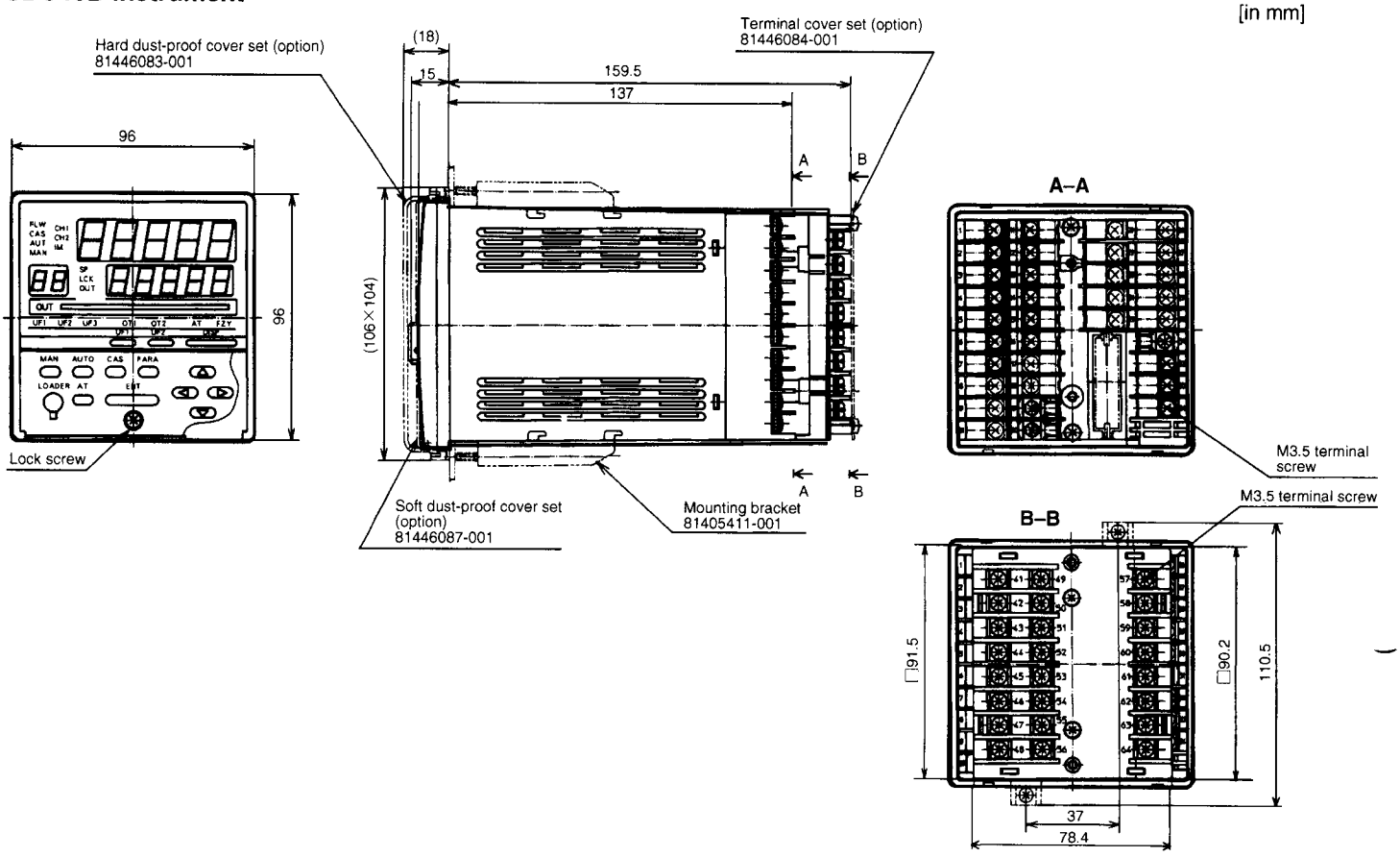
Example: C40B5G4AS09100

Basic Model No.	Control output and other outputs	Options	Additions	Description
C40B				Digital indicating controller
	2G4AS06			• Position proportional output • Inputs 1: Multirange indication of thermocouples, RTD, DC current/voltage 2: 4 to 20mA DC, 1 to 5V DC 3: 1 to 5V DC • UPS (90 to 264V AC) • 1 aux. output, 12 digital inputs, 8 digital outputs (3 relays and 5 open collectors)
	5G4AS09			• Current output (4 to 20mA) • Inputs 1: Multirange indication of thermocouples, RTD, DC current/voltage 2: 4 to 20mA DC, 1 to 5V DC 3: 1 to 5V DC • UPS (90 to 264V AC) • 2 aux. outputs, 12 digital inputs, 8 digital outputs (3 relays and 5 open collectors)
		1		No communications
		2		RS-485 communications interface
		3		RS-232C communications interface
			00	No additional treatment
			T0	Tropical treatment
			K0	Antisulphide treatment
			D0	Inspection certificate provided
			B0	Tropical treatment and inspection certificate provided
			L0	Antisulphide treatment and inspection certificate provided
			Y0	Traceability certificate

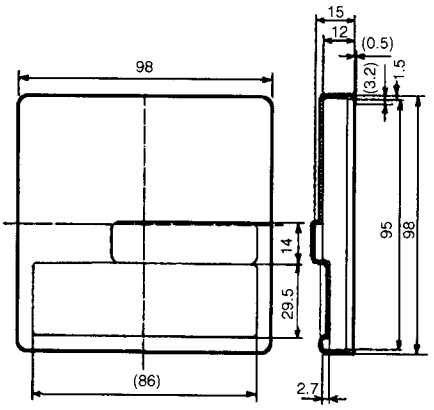
DIMENSIONS

SDC40B instrument

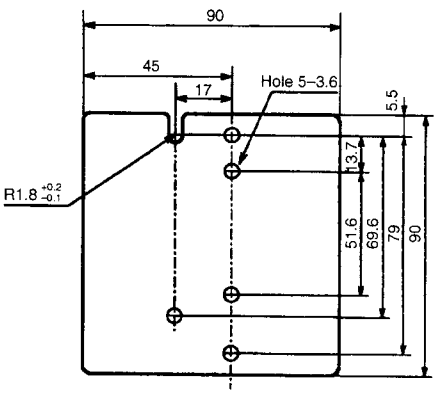
[in mm]



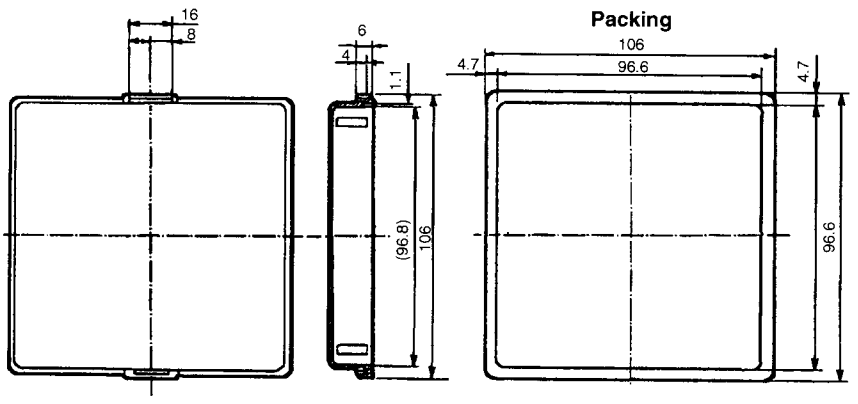
Soft dust-proof cover set:
Parts No. 81446087-001
(Transparent silicon rubber)



Terminal cover set: Parts No. 81446084-001
[Installable on standard and expanded terminal bases]
(Fire-/heat resistant polyvinyl chloride, gray)



Hard dust-proof cover set: Parts No. 81446083-001
(Transparent polycarbonate)

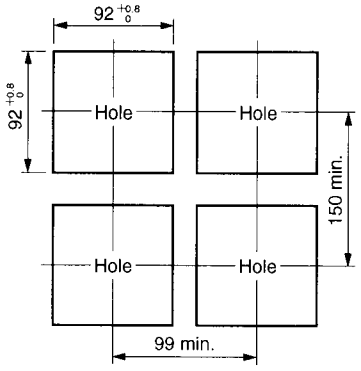


Packing

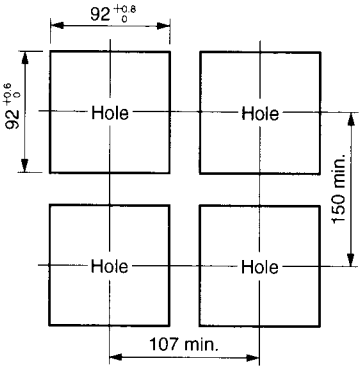
Panel cutout

[in mm]

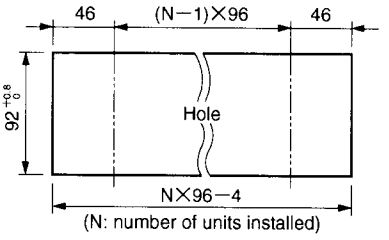
For standard application or with soft dust-proof cover set



Hard dust-proof cover

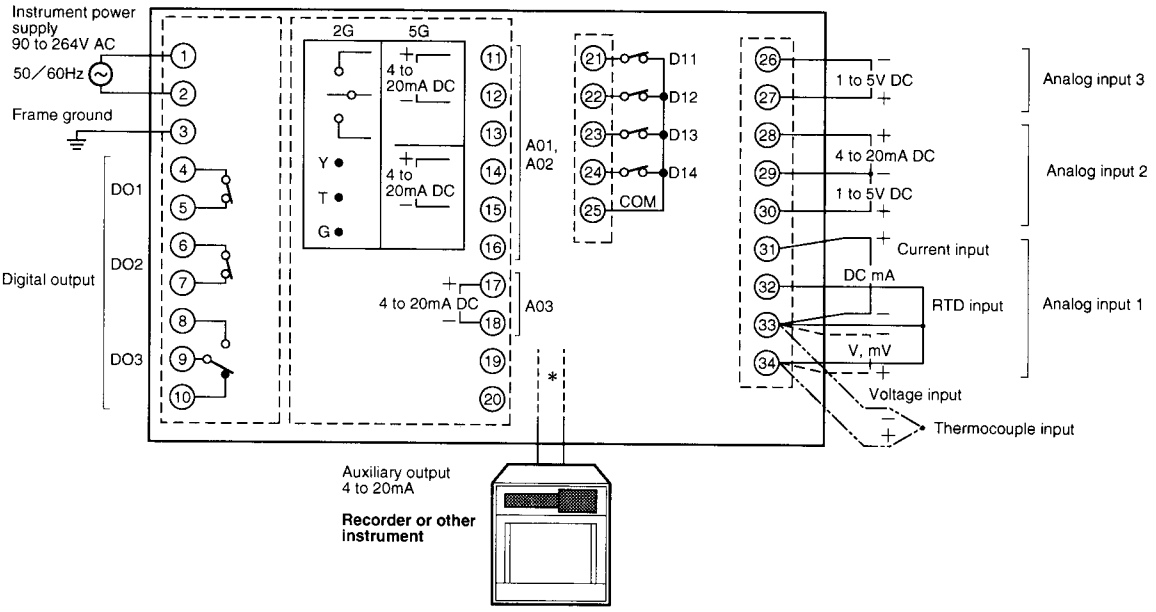


Side-by-side mounting



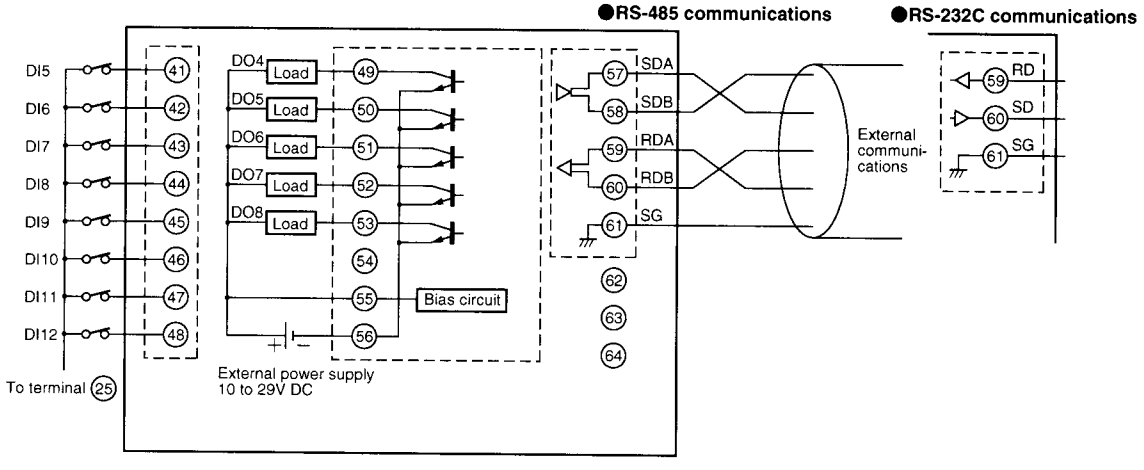
WIRING

Standard terminal layout



* Terminals ⑰ and ⑱ are the auxiliary outputs for the 2G model.
Terminals ⑭ and ⑮ or ⑰ and ⑱ are the auxiliary outputs for the 5G model.

Layout of expanded terminals



PRECAUTIONS ON WIRING

1. Internal instrument isolation

Solid line (——) indicates isolated area.
Dashed line (·····) indicates areas that are not isolated.

Input 1 (AIR1) (full multi)	Digital circuits	Analog output 1 (AO1) (control output 4 to 20mA)
		Analog output 2 (AO2) (auxiliary output 4 to 20mA)
Input 2 (AIR2) (4 to 20mA/1 to 5V)		Analog output 3 (AO3) (auxiliary output 4 to 20mA)
Input 3 (AIR3) (1 to 5V)		
Loader communications I/O		Digital output 1 (relay output 1a)
12 digital inputs		Digital output 2 (relay output 1a)
		Digital output 3 (relay output 1a1b)
Communications I/O (RS-485/RS-232C)		Digital output 4 to 8 (open collector output)

<Control output 5G (current output)>

Input 1 (AIR1) (full multi)	Digital circuits	Analog output 1 (AO1) (Two control output 1C relays)
		Motor feedback input
Input 2 (AIR2) (4 to 20mA/1 to 5V)		Analog output 3 (AO3) (auxiliary output 4 to 20mA)
Input 3 (AIR3) (1 to 5V)		
Loader communications I/O		Digital output 1 (relay output 1a)
12 digital inputs		Digital output 2 (relay output 1a)
		Digital output 3 (relay output 1a1b)
Communications I/O (RS-485/RS-232C)		Digital output 4 to 8 (open collector output)

<Control output 2G (position proportional)>

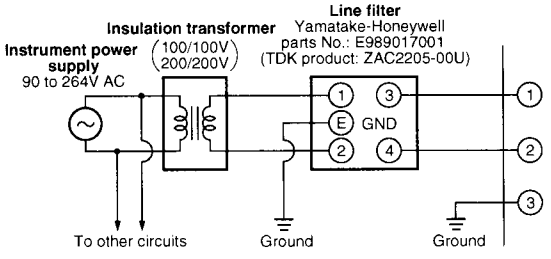
2. Power supply noise countermeasures

(1) Noise reduction

Even if the noise is negligible, use a line filter to minimize line noise.

(2) When noise is excessive

Use an insulation transformer and a line filter to reduce the noise.



3. Noise sources in installation environment and countermeasures

The following are possible noise sources in the installation environment: relays, contacts, magnetic coils, solenoid valves, power lines (especially 90V AC or above), inductive loads, inverters, motor rectifiers, phase control SCR, radio equipment, welding equipment, high-voltage ignition devices, etc.

(1) Counteracting quick rising noise

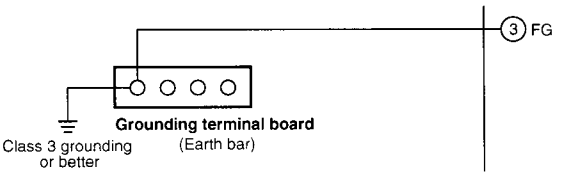
Use a CR filter to counteract quick rising noise.
Recommended filter:
Yamatake-Honeywell parts No.: E989010001
(equivalent to Matsuo Electric product 953M500333311)

(2) Counteracting noise with high peaks

Use a varistor to counteract noise with high peaks, but note that a defective varistor is short-circuited and has to be handled with care.
Recommended varistor:
Yamatake-Honeywell parts No.: E968010471 (100V AC)
E968011821 (200V AC)

4. Grounding

Connect the FG terminal áB to a ground terminal and do not connect any jumper wires. Use a grounding terminal board (earth bar) when shielded wire is not available.
Grounding standard: Class 3 or better (100Ω or less)
Ground wire: Soft steel wire (AWG14) with a cross section of 2mm² or more
Length of ground wire: 20m max.



5. Wiring precautions

(1) When noise countermeasures have been taken, do not bundle primary and secondary cables together or route them through the same distribution box or ducts.

(2) Inputs and communication lines should be at least 50cm away from power lines carrying voltages of 90V AC or more and do not route them through the same distribution box or ducts.

6. Inspections after wiring

When all wiring procedures have been performed, inspect the wiring carefully since incorrect wiring could damage the instruments.

Specifications are subject to change without notice.

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Savemation

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Printed in Japan. (H)
1st Edition: Issued in Jan., 1995
4th Edition: Issued in June, 2000