

# FC SERIES COMPACT CALCULATOR

DATA SHEET

PNM2

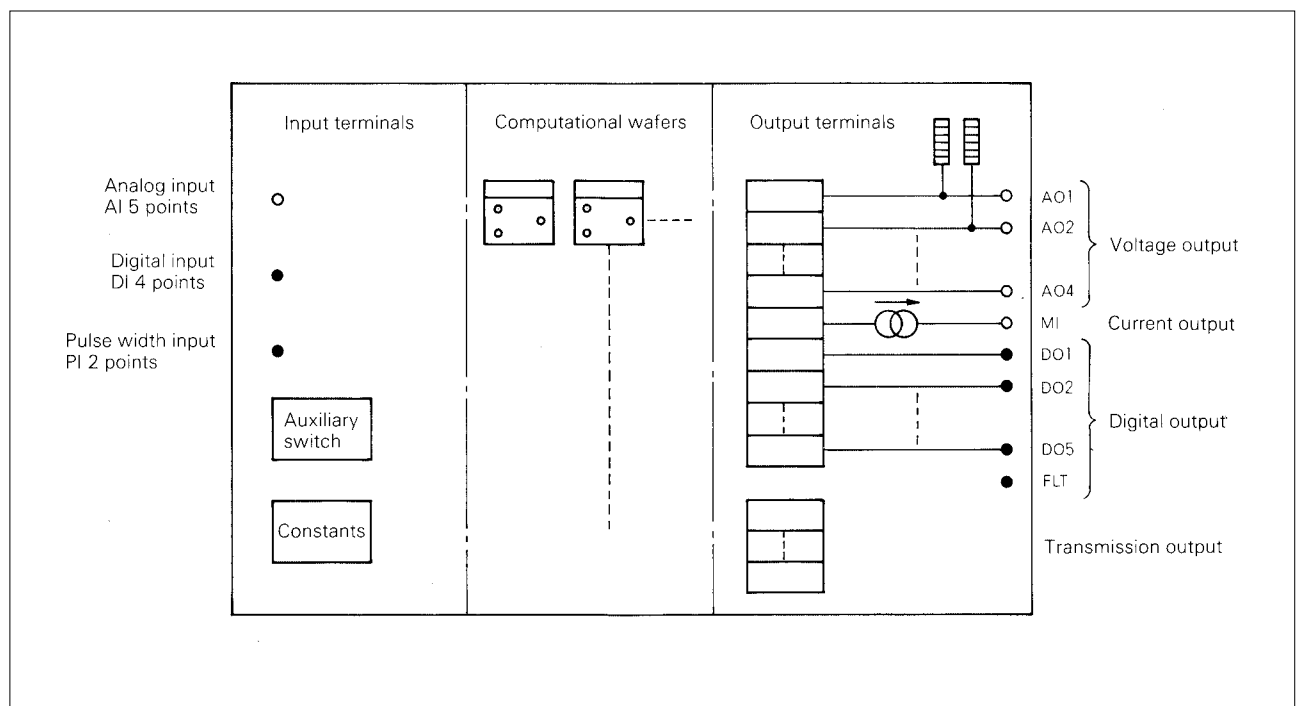
The FC series compact calculator is a high cost-performance, flexible, and highly functional calculator which inputs 5 analog signals and 6 digital signals, digitally performs complex calculations such as arithmetic, square root extraction, time-factor calculations, etc., and then provides 5 analog and 6 digital outputs.

## FEATURES

- Highly functional calculator using a microprocessor**  
A variety of calculating functions are coordinated into functional units called wafers. Complex calculations are thus performed flexibly and accurately through connection of the computational wafers.
- International standards**  
This instrument is compact in size, conforming to international standards IEC. It operates on 24V DC power to deliver 1 to 5V DC signals as recommended by IEC standards.  
100V and 200V AC power are also available for convenience of operation.
- Contents of calculation are changeable on the spot**  
The contents of calculation can be specified on the spot using key operation on the front panel. And the contents are retained even at power failure due to utilization of a non-volatile memory.



## FUNCTIONAL PRINCIPLE



## SPECIFICATIONS

### 1. Computational functions

#### (1) Wafers

The wafer is a functional software package which realizes the computational functions needed for instrumentation control. A calculator which responds flexibly to the application purpose is realized through combination of these wafers having their own individual functions.

The PNM is capable of executing a total of either 24, 48 or 64 wafers. The wafers given in the table below are standard-equipped which enables selection according to the purpose of application.

- For computation: A variety of computations are feasible by combining the wafers in Table 1.

#### (2) Internal input/output terminals

Various internal terminals for connecting external analog input/outputs and digital input/outputs with wafers are provided.

#### (3) Constants

These can be freely defined as parameters for use in calculation. (32 constants with 24 wafers, 48 constants with 48 wafers, 64 constants with 64 wafers)

#### (4) Computation cycle

0.2 sec (24 wafer type)

0.4 sec (48 wafer type)

0.5 sec (64 wafer type)

Table 1 List of computational wafers

Wafer name	Kinds	Outline of functions
Logical computation	6	Performs logical computation such as AND, OR, NOT, EOR and a combination of these.
Arithmetic computation	5	Performs computation such as addition, subtraction, multiplication and division.
Temperature/pressure compensation	1	Performs temperature/pressure compensation using differential pressure, correcting pressure and/or proper temperature.
Linearize	3/6/8	Performs segmented line approximation using 15 segmented line functions (6 kinds with 48 wafers, 8 kinds with 64 wafers).
Flip-flop	1	RS flip-flop
Pulse width integration	1	Adds the input change amount at each basic cycle to the previous integrated value.
Selector	1	Compares two input values, and outputs the result of high/low judgment as HIGH output (higher one) or LOW output (lower one).
Changeover	1	A switch function which selects either input or output. An analog hold circuit can also be combined.
Timer	1	Outputs an on-delay/off-delay timer signal via input signal start according to the timer setting.
Square root computation	1	Subjects an input value to square root extraction and outputs the result. Also has a low input cutoff function.
Lead, lag	3	Subjects the input to lead or lag computation and outputs the result. Used for analog filter function and various compensations.
Limiter	1	Limits the input within the range of upper/lower limit setting and outputs the result. Also outputs an upper/lower limit alarm signal.
Absolute value sign inversion	1	Subjects the input to absolute value processing and outputs the result. Also judges the input value sign (positive, negative) and outputs the results.
Ramp function	2	Outputs a signal which changes in ramp-like form toward the target value within the set full-scale time. Includes two kinds for minute and hour unit.
Analog average	1	Subjects the input data to sequential integration, calculates the average for each average value calculation time and outputs the result.
Analog integration	1	Integrates the value obtained by multiplying the input data via a proportional constant, and outputs the result.
Pulse generation	1	Outputs a pulse at a set time interval.
Dead band	1	Adds dead band compensation to the input and outputs the result.
Pulse number counter	1	Detects the rise of a pulse and counts the number of pulses.
Pulse number output	1	Integrates the input signal, converts it to number of pulses and outputs the result.
Decoder	1	Decodes binary input of two bits and outputs it at 4 terminals.
Moving average	2	Calculates moving average for the input data and outputs the result.
Sample hold	1	Holds the input value according to sample time (0/1) and outputs it successively.
Dead time	9	Usable for dead time compensation control, etc. Data sampling is available in units of 1 second and 1 minute.
On-off	1	Outputs an on-off signal with hysteresis versus the input.
Alarm	1	Compares the input with the set value, and outputs the judgment result.
Position type pulse width change	1	Performs output processing for time-proportional PID control.

Various applications are feasible by combining encoder, saw-tooth wave generating and sine wave generating wafers.

## 2. Input signal

### (1) Analog input signal AI<sub>1</sub>:

One input selectable from the following

Voltage input signal		1 to 5V DC	Input resistance: 1MΩ or more; accuracy: ±0.2%/FS(*)
Current input signal		4 to 20mA DC	24V ±2V DC can be supplied to transmitter when using AC source (approx. 35mA); accuracy: ±0.2%/FS
Thermocouple input	I <sub>+</sub> I <sub>0</sub> I <sub>-</sub>	Type J: 0 to 600°C K: 0 to 1200°C E: 0 to 800°C R: 0 to 1600°C	10mV DC span or more; cold junction compensation comprised; accuracy: ±0.5%/FS
Resistance bulb input		Jpt100, Pt100 -50 to 500°C	50°C span or more; accuracy: ±0.5%/FS

Note: \*FS: Full scale

### (2) Analog input signal: 4 points

Analog input	AI2	1 to 5V DC	Input resistance: 1MΩ or more Accuracy: ±0.2%/FS
Analog input	AI3		
Analog input	AI4		
Analog input	AI5		

### (3) Digital input signal: 4 points

Digital input	DI1	Contact input (photo-coupler insulation)	ON/0V, OFF/24V (input current approx. 11mA/24V DC)
Digital input	DI2		
Digital input	DI3		
Digital input	DI4		

### (4) Pulse width or pulse number input signal: One set

Pulse width input signal	PI <sub>+</sub> PI <sub>-</sub>	Contact input (photo-coupler insulation)	ON/0V, OFF/24V (input current approx. 11mA/24V DC)
Pulse number input signal			ON/0V, OFF/24V (approx. 11mA/24V DC); input max. frequency: 500Hz

## 3. Output signal

### (1) Current output signal: One point

Current output	MI <sub>+</sub> MI <sub>-</sub>	4 to 20mA DC	Allowable load resistance: 600Ω or less; accuracy: ±0.2%/FS
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### (2) Analog output signal: 4 points

Analog output	AO1	1 to 5V DC	Output resistance: 1Ω or less; accuracy: ±0.2%/FS
Analog output	AO2		
Analog output	AO3		
Analog output	AO4		

### (3) Digital output signal: 6 points

Fault output	FLT	Open collector output (Photo-coupler insulation)	Output rating 30V x 0.1A DC max.
Digital output	DO1		
Digital output	DO2		
Digital output	DO3		
Digital output	DO4		
Digital output	DO5		

## 4. Internal uniform data conversion

### (1) Analog data

Standard	Minimum	Maximum
0.00 to 100.00%	-327.6%	327.67%

### (2) Digital data

Input/output status	Data
ON (contact closed)	0.01%
OFF (contact open)	0.00%

## 5. Indication, setting, operating functions

### (1) Bargraph indication

	RV indicator	GV indicator
Indication type	LED (red)	LED (green)
No. of segments	101+2	101+2
Range	0 to 100% linear	0 to 100% linear
Resolution	1%/FS	1%/FS
Scale length	100mm	100mm
Indication mode	0 to 100% bargraph indication 0 to 100% reverse bargraph indication dot indication -50 to +50% deviation indication	

### (2) Run mode indication

#### Indicating method:

LED (red); red, H/L

### (3) Numerical indication, setting

#### Indication method:

LED (red), name 3 digits+numerals 5 digits (including negative sign)

#### Indication contents:

Indication contents such as constants, segmented line and wafers selectable by  $\boxed{F/S}$ ,  $\boxed{\Delta}$  and  $\boxed{\nabla}$  keys on the front.

**Setting method:** By operation of  $\boxed{F/S}$ ,  $\boxed{\Delta}$ ,  $\boxed{\nabla}$ ,  $\boxed{\boxtimes}$ , and  $\boxed{ST}$  keys on the front.

## 6. Power failure processing function

### Power failure detection:

Calculation stops at power failure detection.

### During power failure:

Operating parameters retained by capacitor backup within 5 minutes. Constants, segmented line, wafers, parameters etc. are stored in non-volatile memory (lasts 10 years expected at ambient temperature below 50°C).

### At power recovery:

Initial or continuous start mode can be set within 5 minutes. Recovery from power failure lasting longer than 5 minutes is done by initial.

## 7. Self-diagnosis functions

### Computing circuit fault:

H, L lamp simultaneously lit FLT contact output ON, computation stops

### Input/output signal fault, run output disconnection:

H, L lamp simultaneously lit; FLT contact output ON, computation and output processing for other than run output continue.

### Fault contents indication:

Cause of fault is numerically indicated on front-panel numerical indicator

**8. Transmission function**

**(1) Transmission items**

**Monitor items:** PNM → host  
 Fault information, constants, analog input/output, digital input/output, etc.

**Setting, operation items:**

Host → PNM  
 Constants, etc.

**(2) Transmission setting inhibit:**

Parameter setting enable/inhibit can be designated by transmission from the host. Designation is done by keys on the front panel.

**(3) Transmission interface**

**(a) T-link: Private interface**

**Transmission speed:** 500Kbps  
**No. of units connectable:** 32 max.  
**Transmission distance:** 1km max.  
**Transmission form:** Multi-drop  
**Control method:** I/O transmission and message

**(b) RS-422A/485: Universal interface**

**Transmission speed:** 2400, 4800, 9600 or 19200 bps configurable  
**No. of units connectable:** 31 max.  
**Transmission distance:** 1km max.  
**Transmission form:** Multi-drop  
**Control method:** Polling/selecting

**(c) CC data line: Private interface**

**Transmission speed:** 19.2 Kbps (fixed)  
**No. of units connectable:** 15 max.  
**Transmission distance:** 500m max.  
**Transmission form:** Multi-drop  
**Control method:** Polling/selecting

**9. Other functions**

Data protective function by pass code

**10. Usage conditions**

**Power supply:** Selectable from three types  
 24V DC (20 to 30V DC), 100V AC (85 to 132V AC/47 to 63Hz), 200V AC (187 to 264V AC/47 to 63Hz)

**Power consumption:**  
 Approx. 12W (DC), approx. 20VA (AC)

**Dielectric strength:**  
 1500V AC for 1 minute

**Insulation resistance:**  
 100MΩ or more at 500V DC

**Ambient temperature:**  
 0 to 50 °C

**Ambient humidity:**  
 90% RH or less

**Enclosure:** Steel case

**Casing protective structure:**  
 Front section: IP65 (IEC 529)

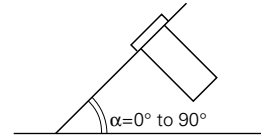
**Rating plate (Name plate):**  
 100 (H) x 70 (W), white acrylic resin

**Dimensions:** 144 (H) x 72 (W) x 391 (D) mm, IEC (DIN) standard

**Mass {weight):** Approx. 2.9kg

**Mounting method:**

Indoor panel mounting, vertical mounting standard, can be tilted within following angle



**Finish color:** Front panel; Munsell N1.5  
 Casing; Munsell N1.5

**Scope of delivery:** Calculator and mounting bracket

**Item to be ordered separately:**

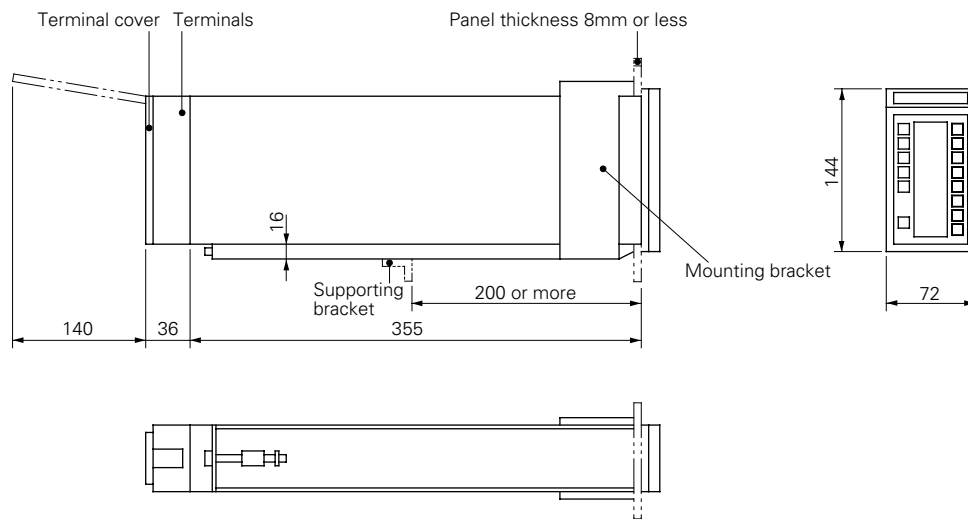
Communication cable (type PNZ)

**CODE SYMBOLS**

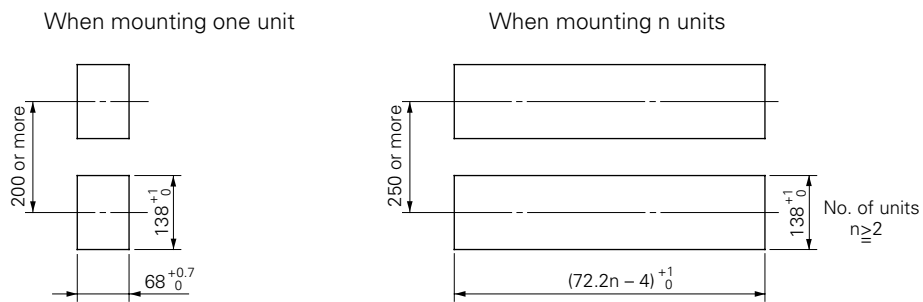
1	2	3	4	5	6	7	8	9	10	11	Description	
P	N	M	2	Y	5	-	0				<b>Measured input signal</b> 1 to 5V DC 4 to 20mA DC J thermocouple K thermocouple E thermocouple R thermocouple Resistance bulb, JPt 100 3 wire type, 50 °C span or more Resistance bulb, Pt100, 3 wire type, 50 °C span or more	
A												10mV DC span or more, with cold junction compensation
B												
C												
D												
E												
F												
G												<b>Power supply</b> 24V DC (20 to 30V DC) 100V AC (85 to 132V AC/47 to 63Hz) 200V AC (187 to 264V AC/47 to 63Hz)
W												
												<b>Transmission function</b> None T-link RS-422A RS-485 CC data line
1												
2												
3												
											<b>Wafer connection/no. of wafers executable</b> 0... None/24 wafers 1... Provided/24 wafers 2... None/48 wafers 3... Provided/48 wafers 4... None/64 wafers 5... Provided/64 wafers	

Note: Resistance bulb symbol is as follows;  
 JPt100.....JIS C 1604-1981  
 Pt100.....IEC Pub 751-1983

# OUTLINE DIAGRAM (Unit:mm)

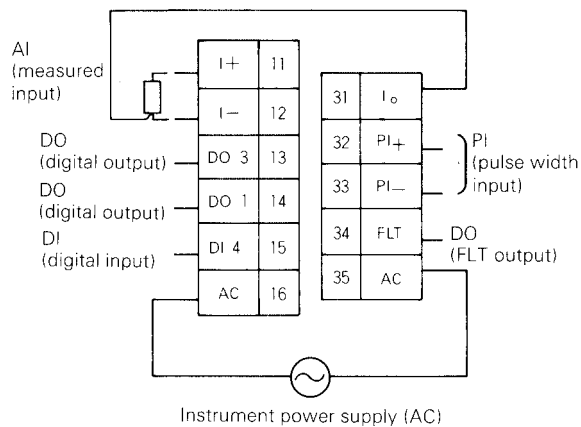


## Panel cutout



# CONNECTION DIAGRAM

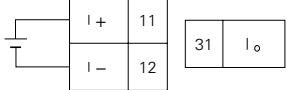
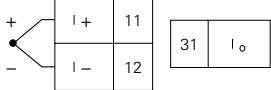
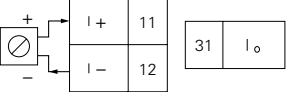
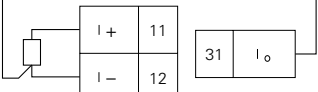
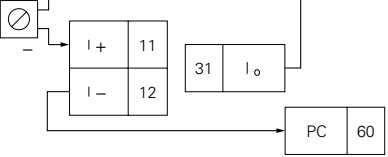
## Block terminals (M4 screw)



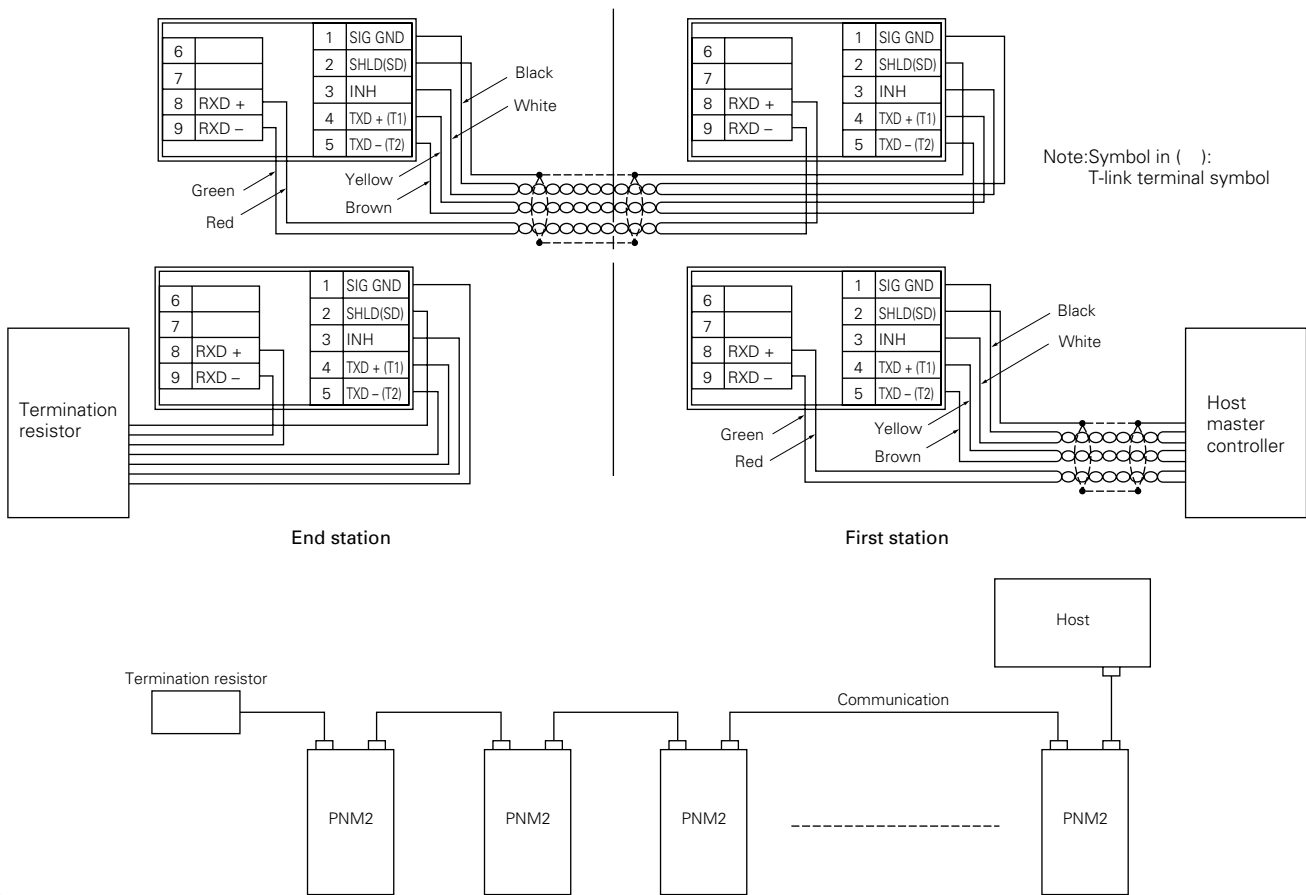
AO (analog output)	AO 1	51	71	AI 2	AI (analog input)
AO (analog output)	AO 2	52	72	AI 3	AI (analog input)
AO (analog output)	AO 3	53	73	AI 4	AI (analog input)
AO (analog output)	AO 4	54	74	AI 5	AI (analog input)
AI, AO (common bus)	SC	55	75		
Power supply output	MI+	56	76	SC	AI, AO common bus
	MI-	57	77	DO 2	DO (digital output)
DO (digital output)	DO 4	58	78	DI 3	DI (digital input)
DO (digital output)	DO 5	59	79	DI 2	DI (digital input)
Instrument power supply (24V DC)	PC*	60	80	DI 1	DI (digital input)
24V power for DI, DO	PCD	61	81	VP*	+ Instrument power supply (24V DC)
Ground	G	62	82	VPD	+ 24V power for DI, DO

Note: The symbol in case of AC instrument power is VPO, PCO. The output is approx. 24V DC (0.1A max.)

Analog output 1 terminal connection specifications

<p>1 to 5V DC A in 5th digit of code</p>		<p>Termocouple C,D,E,F in 5th digit of code</p>	
<p>4 to 20mA DC B in 5th digit of code</p>		<p>Resistance bulb G,W in 5th digit of code</p>	
<p>4 to 20mA DC with inner DC power supply of CC-S B in 5th digit of code</p>			

Transmission connector



⚠ Caution on Safety

\*Before using this product, be sure to read its instruction manual in advance.

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