FC SERIES COMPACT CONTROLLER™–Super (CC-S)

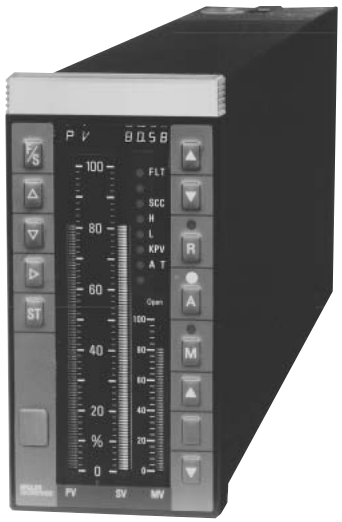
(BASIC PID AND FREELY CONFIGURABLE, STEP OUTPUT TYPE)

DATA SHEET PNC3

The Compact Controller-S (Basic PID and freely configurable type) is a compact single-loop controller using a microprocessor. It receives proportional signals from e.g. thermocouples and RTD's etc., as input, and is equipped with abundant control and computation functions to allow configuring a flexible system with a high cost/performance, above all, as stated below:

— FIELD CONFIGURABLE SLC
— AUTO TUNING FUNCTIONS
— RS-422 DATA LINKAGE

as standard.



FEATURES

1) Versatile functions
- All closed loop control functions, such as cascade, ratio, time scheduling, logic control, etc. are performed in one controller.
- 86 kinds of control functional blocks (Wafers).
- Generic interface RS-422 availability for personal computer (e.g., IBM PC-AT) for supervision, operation, maintenance, configuration, etc.
- Auto tuning capability.
- Pass code security.

2) Simple and flexible
- Basic PID control configuration can be programmed in less than 1 (one) minute from front panel.
- No program loaders and accessories necessary.
- No software programming knowledge necessary.
- Application oriented control function is configurable by connecting the functional blocks.
- Field Configurable through front panel.
- Front panel operation
  Operations such as parameter setting, auto/manual changeover, etc. are all achieved from the front panel.

3) Highly reliable
- Highly reliable with MTBF of 200,000 Hr per MIL Standard 217D.
- LED's are used for bargraph and parameter indication.
- Nonvolatile memory enables to retain parameters in case of power failure.

4) Update hardware technology
- Custom LSI.
- Surface Mounting Technology.

SPECIFICATIONS

1. Control system configuration

There are two methods of control system configuration for CC-S, one is configuration by Basic PID and the other is by wafer connection.

Various types of configuration examples are shown "VARIOUS CONTROL EXAMPLES" stated hereafter.

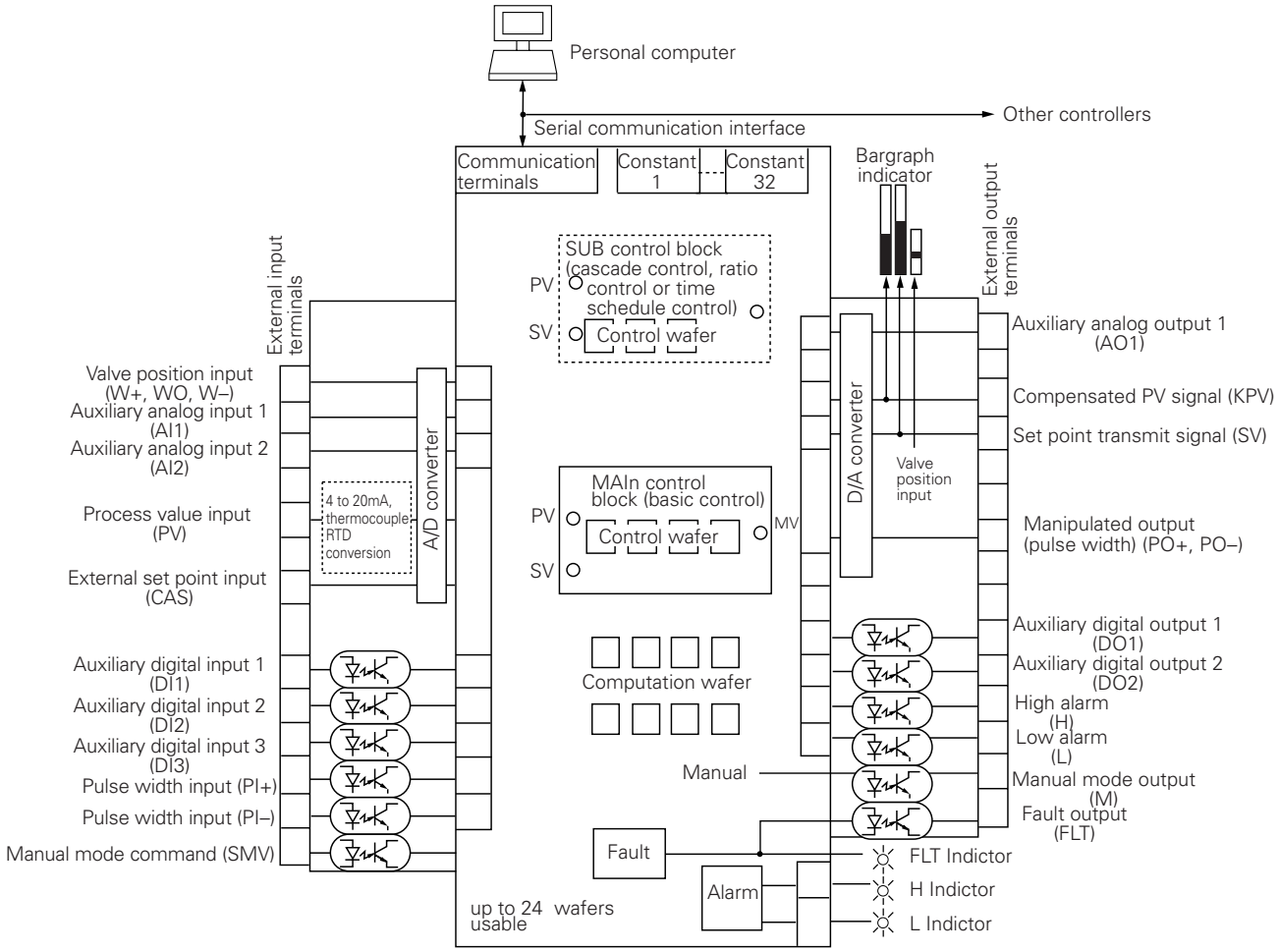
(1) Configuration by basic PID (fixed configuration)

Basic PID control function is fixedly defined as standard control function in the controller beforehand.

Configuration of basic PID can be performed through simple operation on the front panel keys, where wafer connection mentioned below is unnecessary.

Computation wafers such as square root, filter, limiter, non linear, etc. can be made valid or invalid by simple operation of front panel keys.

FUNCTIONAL DIAGRAM



(2) Configuration by wafer connection (Freely configurable)

1) Wafer

The wafer is a functional block (software package) containing control and computation functions needed for measurement and control. Combination of these wafers, each having its own particular function, enables configuring a flexible system applicable to a wide range of control . . . from basic PID control up to sophisticated advanced control.

The PNC3 can accommodate up to 24 wafers. The following kinds of wafers are prepared to allow selection according to the control purpose.

① For control ..... PID control, ratio control, time schedule control, gain schedule control, PID parameter setting

② For computation ..... Various computations performed by connecting wafers given in Table 1

2) Internal input/output terminals

Various internal terminals are provided for external analog input/output, digital input/output and wafer connection.

3) Constants

Various parameters used in computation and control can be freely defined (32 constants).

The following control configuration are achieved.

4) Control functions

By connecting wafers (functional blocks)

Control examples:

Cascade control, ratio control, time schedule control, gain schedule control, etc.

Alarm function:

PV high/low alarm PV change rate alarm DV high/low alarm	Configurable by wafer connection, front panel indicator lights up

2. Control performance

- **PID control:** Proportional band (P); 1.0 to 3276.7%
  Integration time (I): 0.1 to 3276.7 sec.
  Derivative time (D): 0.0 to 900.0 sec.
  PID auto tuning function
- **Execution rate:** Ten (10) times per second/Basic PID control
  Five (5) times per second/others

Table 1 List of computation wafers

Wafer name	Kinds
Logical operation	6
Arithmetic operation	5
Temperature/pressure compensation	1
Linearize	3
Time schedule control	4
Flip-flop	1
Pulse width integration	1
Selector	1
Changeover	1
Timer	1
Absolute value/ sign inversion	1
Square root extraction	1
Lead, lag	1
Limiter	1
Ramp function	2

Wafer name	Kinds
Analog averaging	1
Analog integration	1
Pulse generation	1
Dead band	1
Pulse no. counter	1
Pulse no. output	1
Decoder	1
Moving average	2
Sample hold	1
Dead time	6
ON-OFF	1
Alarm	1
Position type pulse width conversion	1
Bargraph indication	21
Gain schedule control	5

3. Input signals

(1) **Process value input signal:** One input selectable from the following

Voltage input signal	I_+ I_0 I_-	1 to 5V DC	Input resistance 1MΩ or more Allowable error ±0.2%/FS*
Current input signal		4 to 20mA DC	Allowable error ±0.2%/FS* Transmitter power supply 24V ±2V DC approx. 35mA max.
Thermocouple input		Types 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; reference junction compensating function built in Allowable error ±0.5%/FS*
Resistance bulb input		Pt100Ω (0°C) –50 to 500°C	50°C span or more Allowable error ±0.5%/FS*

(2) **Analog input signal:** 3 points

External set point	CAS	three 1 to 5V DC inputs or two 4 to 20mA DC inputs plus two 1 to 5V DC inputs	Input resistance 1MΩ or more, allowable error ±0.2%/FS* Two transmitter power supply 24V ±2V DC approx. 35mA max.
Aux. analog input	AI1		
Aux. analog input	AI2		

CAS is usable as aux. analog input.

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

Manual mode command	SMV	Contact input (Photocoupler isolation)	ON 0V DC, OFF 24V DC (Input current approx. 11mA/24V DC)
Aux. digital input	DI1		
Aux. digital input	DI2		
Aux. digital input	DI3		

(4) **Pulse width input signal:** 1 set

Pulse width input signal	PI_+ PI_-	Contact input (Photocoupler isolation)	ON 0V DC, OFF 24V DC (Input current approx. 11mA/24V DC)

(5) **Valve position input signal**

Voltage input	WO	1 to 5V DC	Input resistance 1MΩ or more Allowable error ±0.5%/FS
Potentiometer input	W+ WO W–	50Ω to 1.5MΩ width	3-wire potentiometer Allowable error ±0.5%/FS

Potentiometer input is 10-100-10Ω standard.

4. Output signals

(1) **Manipulated output signal:** 1 point

Pulse width output	PO+ PO–	Open collector output (Photocoupler isolation)	Output rating 30V DC 0.1A max.

(2) **Analog output signal:** 3 points

Compensated PV signal	KPV	1 to 5V DC	Output resistance 0.5Ω or less, allowable error ±0.2%/FS*
Set point transmit signal	SV		
Aux. analog output	AO1		

KPV and SV are usable as aux. analog output.

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

Fault output	FLT	Open collector output (Photocoupler isolation)	Output rating 30V DC 0.1A max.
Manual mode output	M		
High alarm output	H		
Low alarm output	L		
Aux. digital output	DO1		
Aux. digital output	DO2		

H and L are usable as aux. digital output.

5. Internal data conversion

(1) **Analog data**

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

(2) **Digital data**

Signal status	Data
ON (Contact closed)	0.01%
OFF (Contact open)	0.00%

6. Indication, setting, operation functions

(1) **Bargraph indication**

	PV indicator	SV indicator	MV indicator
Indication method	LED (Red)	LED (Green)	LED (Red)
No. of segments	101 + 2	101 + 2	51 + 2
Range	0 to 100% linear	0 to 100% linear	0 to 100% linear
Resolution	1%/FS*	1%/FS*	2%/FS*
Scale length	100mm	100mm	50mm
Indication mode	0 to 100% bargraph indication, 0 to 100% reverse bargraph indication, dot indication, –50 to +50% deviation indication		

(2) **Operation mode indication**

Indicating method:
LED (Red and green)
Red; M, HM, SCC
Green; A, R

(3) **Numerical indication, setting**

Indication method:
LED (Red), name in 3 digits + data in 5 digits (Negative sign included)

Indication contents:
Process variable (Industrial value), set point (Industrial value), high/low alarm values, PID parameters, etc.
Indication data are selectable by F/S, △, ▽ keys on front panel.

Setting method: By use of F/S, △, ▽, ▷, ST keys on front panel.

*Note: "FS" stands for "Full Scale".

(4) SV setting function

Fixed value setting method:

By ▲, ▼ buttons on front panel.
Setting speed; about 40 sec/FS*

Remote setting method:

By external set point signal
(Voltage or pulse width input)

(5) MV operating function

Manual operating method:

By ▲, ▼ buttons on front panel.

(6) Operation mode changeover

By R/A/M pushbuttons on front panel.

R → A changeover		Balanceless bumpless
A → R changeover	Voltage signal	Balance bumpless
	Pulse width input	Balanceless bumpless
A or R ⇄ M changeover		Balanceless bumpless

7. Power failure and restart function

Power failure detection:

Control function interrupted at power failure detection.

During power failure:

Operating parameters backed up by capacitor when power failure within 5 minutes.
Initial set point and control output values, PID parameters etc. are stored in non-volatile memory (lasts for 10 years or longer at ambient temperature of 50°C or less)

Restart from power failure:

Initial or continuous start is selectable for power failure within 5 minutes.
Restart from power failure lasting longer than 5 minutes is made by initial automatically.

Control mode at initial start is selectable from.

R: Remote mode
M: Manual mode
A: Automatic mode
SCC: SCC mode

8. Self-diagnosis functions

Computation/control function failure:

FLT indicator lights up, FLT contact output closes, and computation and control function interrupted.
Manipulated output can be controlled manually at FLT (Soft manual).

Input signal and control output failure:

FLT indicator lights up, FLT contact output closes, control stops, and manipulated output is held, while other computation and control functions continue to be processed.

Fault indication: Cause of fault is indicated numerically on digital indicator of front panel.

9. Communication functions

(1) Communication items

Supervisory items:

From CC-S to host
Process variable, set point, manipulated out-put, deviation, operation mode, alarm in-formation, fault information, PID parameters, various limiter values, constants, segmented line, analog input/output, digital input/output, configuration program (Wafer connection) etc.

Setting items: From host to CC-S
Set point, manipulated output, operation mode, PID parameters, various limiter values, constants, segmented line, configuration program (Wafer connection) etc.

(2) Communication enable/inhibit:

Data setting from the host can be enabled/inhibited by F/S, △, ▽, ▷, ST keys on the front panel.

(3) Communication interface

RS-422: Universal interface

Transmission speed:

2400, 4800, 9600 or 19200 BPS selectable

No. of units connectable:

31 max.

Code format: One or two stop bits, parity EVEN/ODD/NONE selectable.

Transmission distance:

1 km max.

10. Personal computer software packages

Two software packages, running on IBM PC-AT, are provided for CC-S supervision, operation, maintenance and configuration.
They are Fix software packages and CC-S configurator. Fix is a user-configurable, menu-driven software packages for CC-S supervision, operation and maintenance, while CC-S configurator is another package to configure CC-S control system.

E.g. Real time process display
Process Alarming
Trending
Control Strategy Configuration

Fix is a trade mark of Intellution Inc./U.S.A. Standard software packages for plant supervision, operation and maintenance are available under Fix:

11. Security functions

Data security function by means of pass code.

12. Operating conditions

Supply voltage: 24V DC (20 to 30V DC), 110V AC (85 to 132V AC), 220V AC (187 to 264V AC)

Power consumption:

Approx. 13W (DC), 20VA (AC)
Power factor: approx. 0.6

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

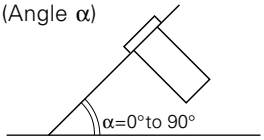
Enclosure class: Front IP65 (IEC 529)

Nameplate: 10(H) x 70(W), white acrylic

Dimensions: 144(H) x 72(W) x 407 (D)mm, IEC 668 (DIN) standards

Mass{weight}: Approx. 2.9kg

Mounting method:
Flush on indoor panel vertical mounting is standard.
Mounting on tilted surface possible (Angle α)



Finish color: Munsell N1.5

Scope of delivery: Controller and mounting bracket.

Item to be ordered separately:
Communication cable (Type PNZ)
Terminal resistor (Type PNY)

CODE SYMBOLS

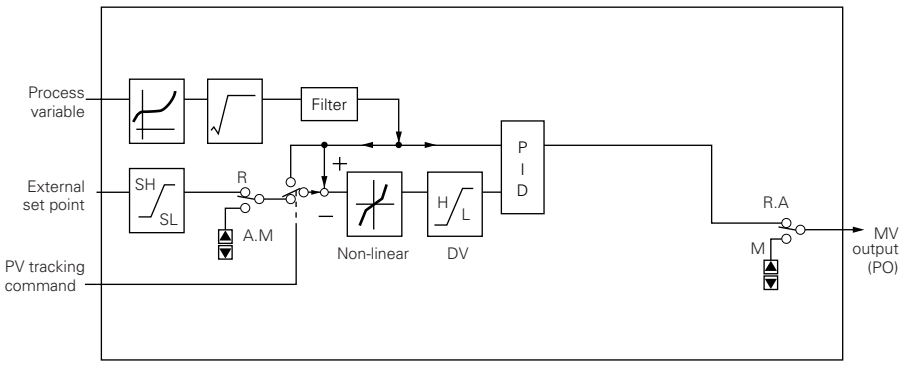
1 2 3 4 5 6 7 8	9 10 11 12	Description
P N C 3	R 0 A	
A		**Process variable input signal** 1 to 5V DC 4 to 20mA DC with 24V DC power supply J thermocouple, K thermocouple, E thermocouple, R thermocouple: 10mV DC span or more, with reference junction compensating function RTD Pt100Ω (0°C) 3-wire type, 50°C span or more
B		**Auxiliary analog input** Four 1 to 5V DC inputs
C		Two 4 to 20mA DC with 24V DC power supply plus two 1 to 5V DC inputs
1		**Supply voltage** 24V DC (20 to 30V DC)
2		110V AC (85 to 132V AC), 50/60Hz
3		220V AC (187 to 264V AC), 50/60Hz
	1	**Valve position input signal** Voltage input (1 to 5V DC)
	2	Potentiometer input (10-100-10Ω)
	R	**Comunication interface** RS-422
	0	**Wafer connection** Without
	A	**PID auto tuning function** With

Note: Front scale and temperature range are to be selected and specified from the "STANDARD FRONT SCALE" and "STANDARD TEMPERATURE RANGE" stated hereafter, when order being placed.

VARIOUS CONFIGURATION EXAMPLES

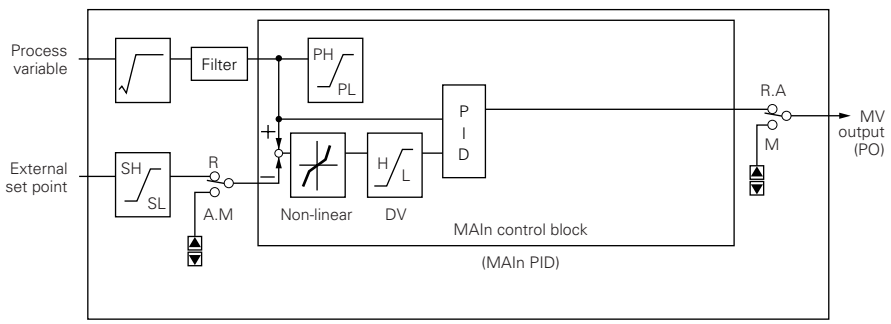
Basic PID control (Fixed configuration)

Basic PID control function is fixedly defined as standard control function in the controller beforehand. Configuration of basic PID can be performed through simple operation on the front panel keys, where wafer connection is unnecessary. Computation functions such as square root, filter, limiter, non linear, etc. can be made valid or invalid by simple operation of front panel keys.



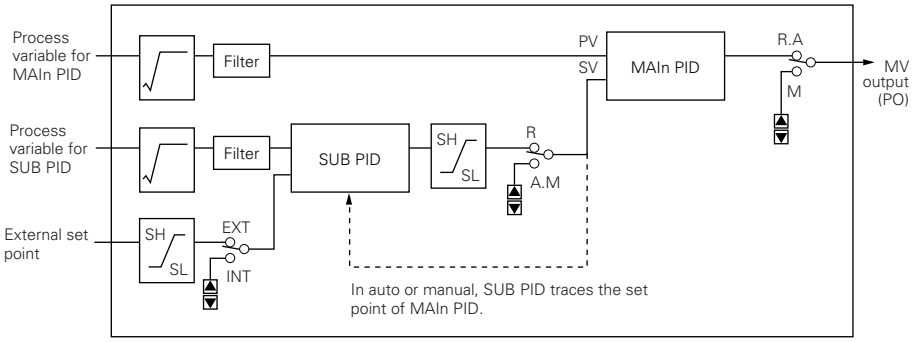
PID control

PID control is carried out by using only the MAIn control block. PID control by means of an external set point is also performed.



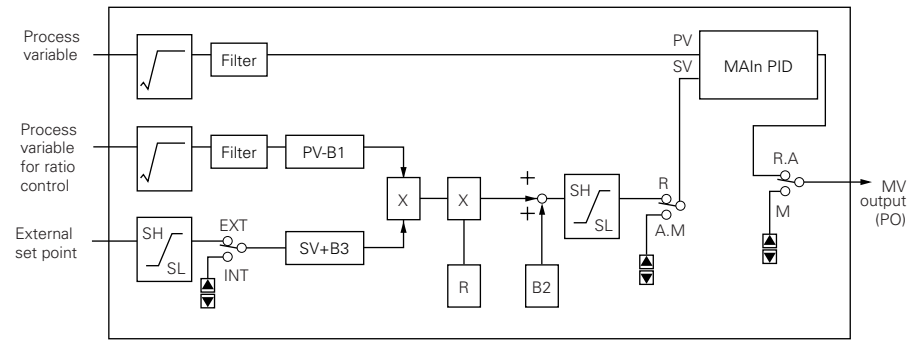
Cascade control

Cascade control is carried out by combining two PID control blocks. Since the output of the SUB PID controller follow up the set point of the MAIn PID controller, A and R can be changed over balancelessly.



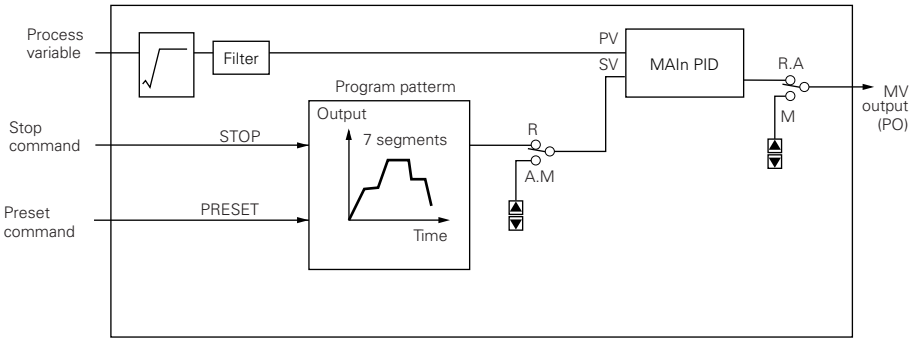
Ratio control

Ratio control is carried out by combining a ratio computation and a PID control block.



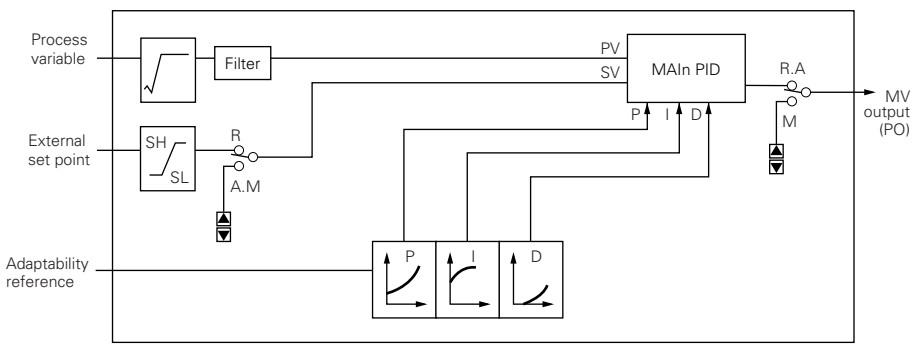
Time schedule control

By combining a time schedule block and a PID control block, the set point is decided according to a time schedule pattern.
A preset function is also provided for starting time schedule control from the present temperature in a furnace for control of heating or the like.



Gain schedule control

Carries out PID control according to three (3) PID parameter patterns, which are stored in the form of 7 segmented lines.



STANDARD TEMPERATURE RANGE

Followings are standard input temperature ranges to be selected and to be specified with the ordering code.

Detector	Measurement range
J type thermocouple	0 to 200, 0 to 300, 0 to 400, 0 to 500, 0 to 600, 200 to 400, 300 to 600 deg C
K type thermocouple	0 to 300, 0 to 400, 0 to 500, 0 to 600, 0 to 800, 0 to 1000, 0 to 1200, 300 to 600, 400 to 800, 500 to 1000, 600 to 1200 deg C
E type thermocouple	0 to 200, 0 to 300, 0 to 400, 0 to 500, 0 to 600, 0 to 800, 200 to 400, 300 to 600 deg C
R type thermocouple	0 to 1000, 0 to 1200, 0 to 1600, 400 to 1400, 600 to 1600, 800 to 1600 deg C
Platinum resistor temperature detector	0 to 50, 0 to 100, 0 to 150, 0 to 200, 0 to 300, 0 to 400, 100 to 300, 200 to 400, –50 to 100, –50 to 500 deg C

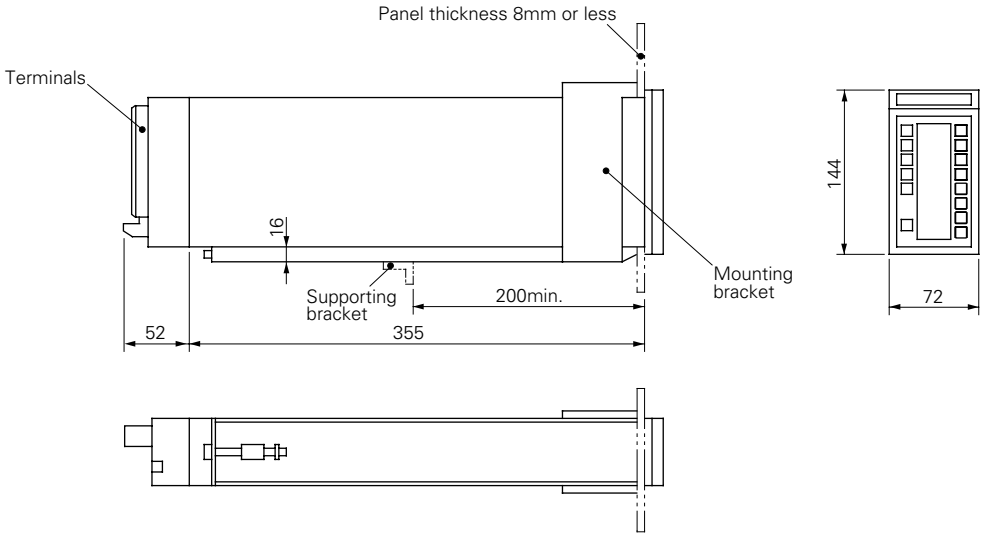
Note: The underlined temperature range will be selected and delivered, when input temperature range is not specified in the ordering code.

STANDARD SCALE

Followings are standard scales to be selected and to be specified with the ordering code.
On condition that PV and SV are of the same scale each other, following standard scale plates are prepared as standard.

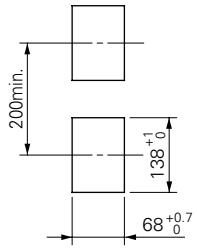
Detector	PV and SV scale
J type thermocouple	0 to200, 0 to 300, 0 to 400, 0 to 500, 0 to 600, 200 to 400, 300 to 600 deg C, 0 to 100%
K type thermocouple	0 to 300, 0 to 400, 0 to 500, 0 to 600, 0 to 800, 0 to 1000, 0 to 1200, 300 to 600, 400 to 800, 500 to 1000, 600 to 1200 deg C, 0 to 100%
E type thermocouple	0 to 200, 0 to 300, 0 to 400, 0 to 500, 0 to 600, 0 to 800, 200 to 400, 300 to 600 deg C 0 to 100%
R type thermocouple	O to l000, 0 to 1200, 0 to 1600, 400 to 1400, 600 to 1600, 800 to 1600 deg C, 0 to 100%
Platinum resistor temperature detector	0 to 50, 0 to 100, 0 to 150, 0 to 200, 0 to 300, 0 to 400, 100 to 300, 200 to 400, –50 to 100, –50 to 500 deg C, 0 to 100%
1 to 5 VDC input	0 to 10, 0 to 20, 0 to 30, 0 to 40, 0 to 50, 0 to 60, 0 to 80, 0 to 100, 0 to 200, 0 to 300, 0 to 400, 0 to 500, 0 to 600, 0 to 800, 0 to 1000 unit. 0 to 100%
MV	0 to 100%

OUTLINE DIAGRAM (Unit:mm)

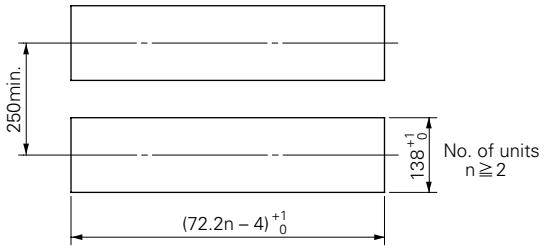


Panel cutout

When mounting one unit

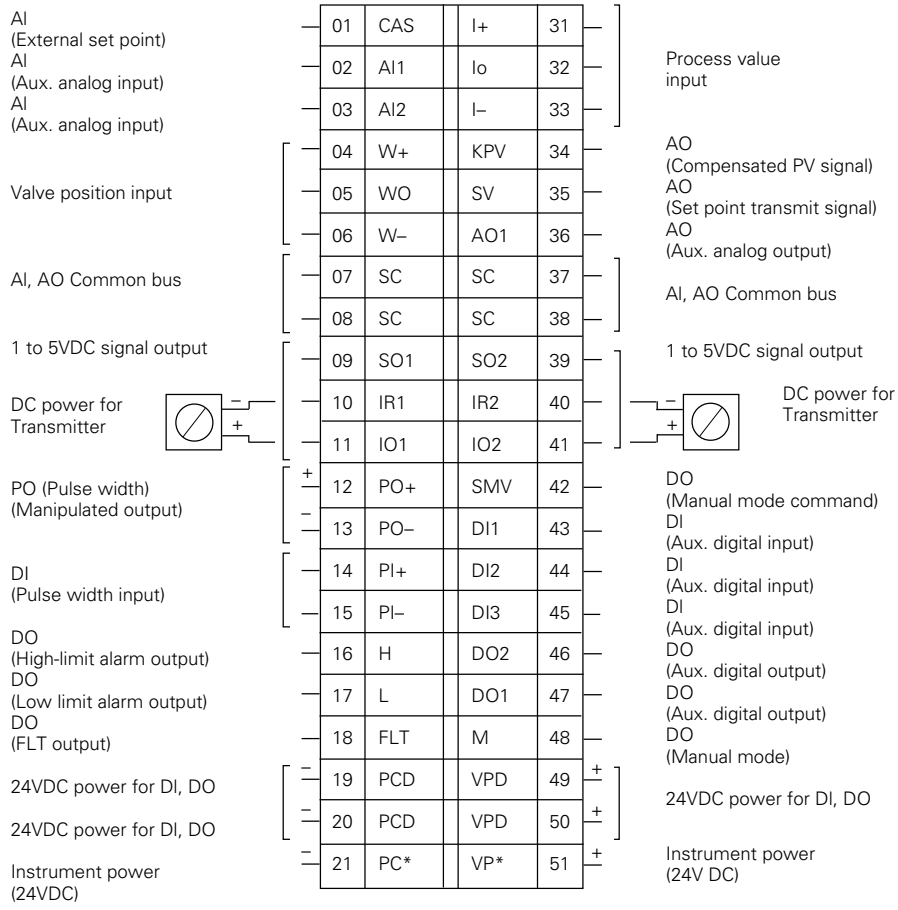


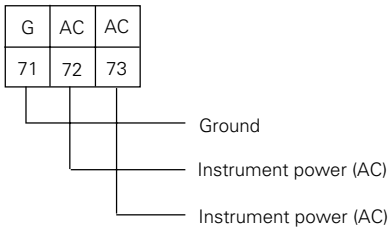
When mounting "n" units



CONNECTION DIAGRAM

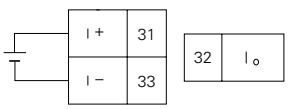
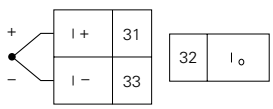
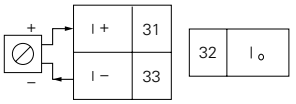
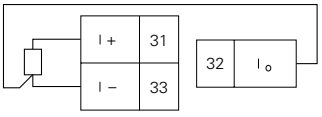
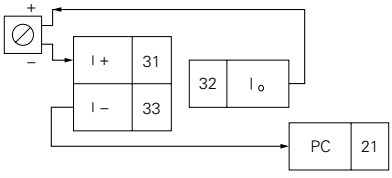
Compression terminal



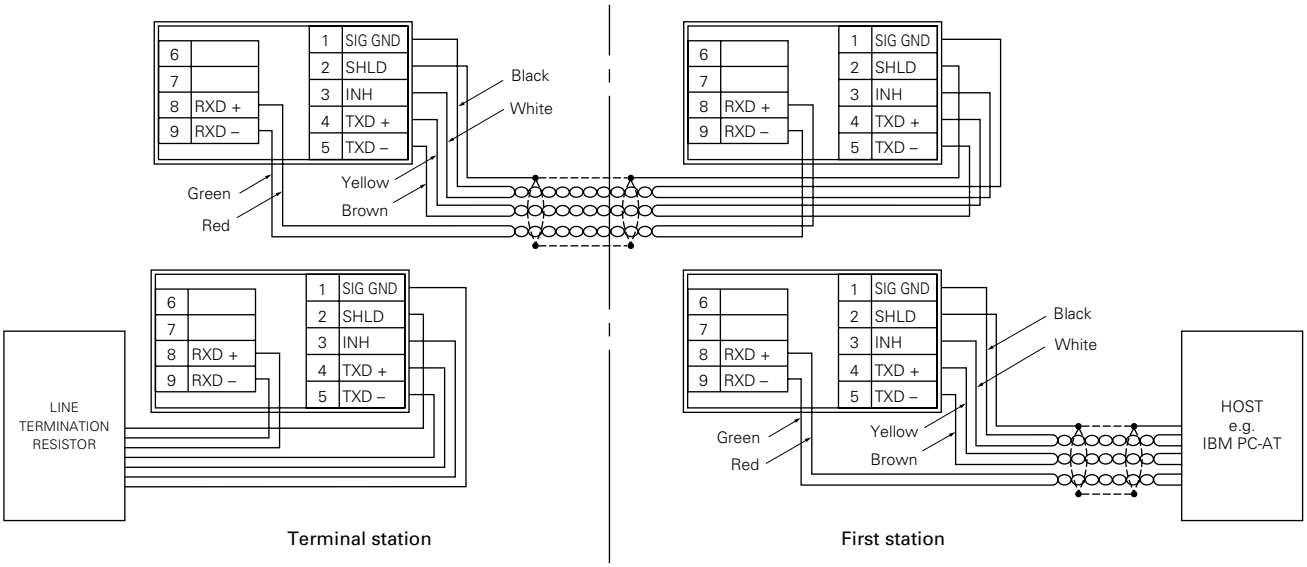


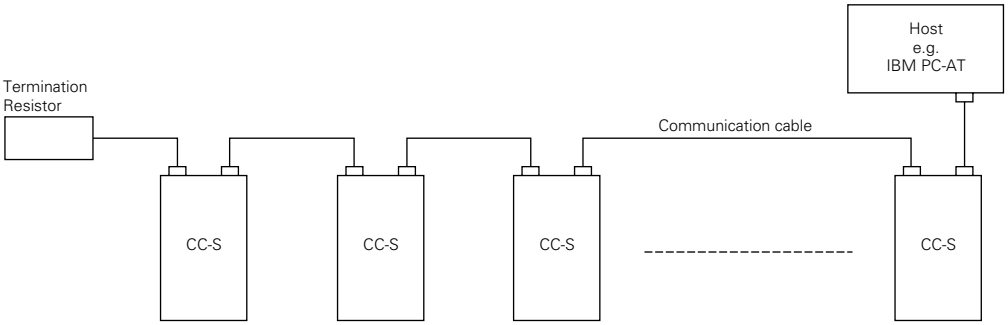
Note: * Symbols for AC instrument power are VPO, PCO.
Output: approx. 24V DC (0.1A, max.)

Process value input terminals connections

1 to 5V DC The 5th digit of code symbols: A		Thermocouple The 5th digit of code symbols: C,D,E,F	
4 to 20mA DC The 5th digit of code symbols: B		Resistance bulb The 5th digit of code symbols: G	
4 to 20mA DC with inner DC power supply of CC-S The 5th digit of code symbols: B			

COMMUNICATION CONNECTOR





⚠ Caution on Safety

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

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