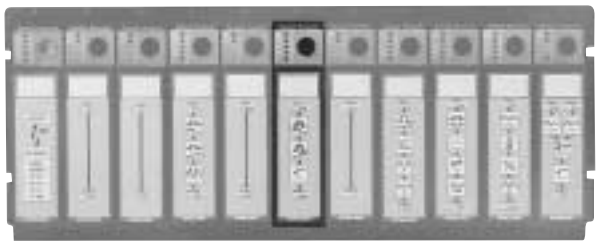
YAMATAKE

Specification

IntellpaK
Calculation Unit
IP313

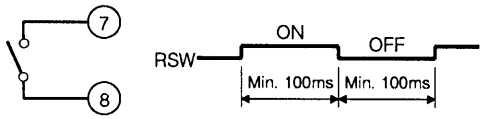
The IntellpaK IP313 is a microprocessor based calculation unit which receives a linear input signal of DC current, or DC voltage, etc., processes it and outputs the converted DC current or DC voltage signal.
Calculation functions are set using the Handy Loader QN715A101.



Features

- Response time of 300ms, and accuracy as high as ±0.15%FS.
- Both input range and output range permit scaling to be executed in the multi-range system.
- Up to three types of calculations can be selectively set.
- The input and output are isolated from each other.
- Remote switch input, monitor switch output and self-diagnosics, etc. are provided as standard.
- A communication function can be added.

Specifications

<table>
<tr><td rowspan="10">Input part</td><td>Input type</td><td colspan="3">DC current, DC voltage See Table 1 (page 3).</td></tr>
<tr><td>Input sampling cycle</td><td colspan="3">100ms (TYP)</td></tr>
<tr><td>Input digital filter</td><td colspan="3">First-order lag filter system: 0.0 to 99.9sec variable (filter off at 0.0)</td></tr>
<tr><td>Input bias current</td><td colspan="3">mV input: –0.15μA to +0.15μA</td></tr>
<tr><td rowspan="2">Input impedance</td><td colspan="3">mA input: Max. 30Ω</td></tr>
<tr><td colspan="3">Voltage input (V): Min 500kΩ</td></tr>
<tr><td>Allowable wiring resistance</td><td colspan="3">mV input: Max. 250Ω</td></tr>
<tr><td>Isolation</td><td colspan="3">The input and output are isolated from each other.</td></tr>
<tr><td rowspan="5">Remote switch input (RSW)</td><td>Function</td><td colspan="2">Signal source for various calculations requiring DI. Operation object is specified using the Handy Loader QN715A101.</td></tr>
<tr><td>Input mode</td><td>With contact provided, or no voltage semi-conductor contact.</td><td rowspan="4"> 
</td></tr>
<tr><td>Input time</td><td>ON or OFF held for a min. of 100ms.</td></tr>
<tr><td>Input contact capacity</td><td>20V DC, 10mA min.</td></tr>
<tr><td>Isolation</td><td>Not isolated between the remote switch input and output.</td></tr>
<tr><td rowspan="14">Calculation part</td><td>Type of setting</td><td colspan="3">Up to three types in total can be selected: one type from the group A or B, and two types from the group M.</td></tr>
<tr><td>Setting range</td><td colspan="3">See Table 3 (page 4 to 6)</td></tr>
<tr><td>Setting sequence</td><td colspan="3">The group M is set first, followed by group A (necessary condition).</td></tr>
<tr><td rowspan="12">Calculation types</td><td>Group A</td><td>Group B</td><td>Group M Note (1)</td></tr>
<tr><td>No operation</td><td>First-order lag filter</td><td>Low monitor</td></tr>
<tr><td>Reverse</td><td>Ratio bias</td><td>High monitor</td></tr>
<tr><td>Analog memory</td><td>Scaling</td><td>Deviation monitor</td></tr>
<tr><td>Preset</td><td>Square root extraction</td><td>Arrival monitor</td></tr>
<tr><td>—</td><td>High-low limiter</td><td>Timer monitor (low)</td></tr>
<tr><td>—</td><td>Change rate limiter</td><td>Timer monitor (high)</td></tr>
<tr><td>—</td><td>Derivative</td><td>Keep monitor (low)</td></tr>
<tr><td>—</td><td>Lead, lag</td><td>Keep monitor (high)</td></tr>
<tr><td>—</td><td>Absolute value</td><td>Keep monitor (deviation)</td></tr>
<tr><td>—</td><td>Linearize table</td><td>Keep monitor (arrival)</td></tr>
<tr><td>—</td><td>Keep maximum value</td><td>Change rate monitor</td></tr>
<tr><td>—</td><td>Keep minimum value</td><td>—</td></tr>
<tr><td>—</td><td>Soft preset</td><td>—</td></tr>
<tr><td colspan="3">Note (1) : The external contact output is connected with the M group monitor by the handy loader QN715A101.</td></tr>
</table>

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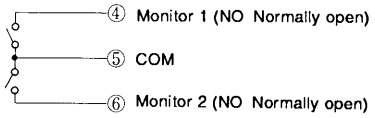
Output part	**Output type**	DC current, DC voltage See Table 2 (page 3).	
	Output range	Range including 0mA: 0 to 110%FS Range not including 0mA : –10 to 100%FS	
	Output update cycle	100ms (TYP)	
	Output impedance	mA output: Min. 500kΩ	
		mV output: Max. 60Ω	
		Voltage output (V): Max. 10Ω	
	Load resistance	Max. 600Ω in 20mA range	
	Manual output	Output value can be set irrespective of input by the Handy Loader QN715A101: –10.0 to 110.0%	
	Monitor switch output	**Output mode**	'a' contact
		No. of output contacts	2 points
		Output contact capacity	250V AC, 30V DC, 0.5A, resistive load
		Output contact life	100,000 times, resistive load
			
Self-diagnosics	**Input underrange check**	If PV input is less than –10% calculation is performed with the PV input set to –10%. Alarm is triggered.	
	Input overrange check	If PV input is more than 110%, calculation is performed with the PV input set to 110%. Alarm is triggered.	
	EEPROM adjustment area sum check	EEPROM adjustment area is sum checked only when power supply is turned ON.	
	EEPROM user area sum check	EEPROM user area is sum checked during normal operation. Minimum time for error detection is 13sec.	
	Error indication	OPR/ALM LED blinks at 0.5sec intervals when an error is detected.	
	Error type	Readable using the Handy Loader QN715A101.	
Optional functions	**Communication**	Connected to the mother board within the communication system 11ch rack (QN716A101) where the communication module (IP390A) is mounted.	
		For details, see Catalog No. CP-SS-1411E.	
General specifications	**Accuracy**	±0.15%FS See Table 1 (page 3).	
	Response time	300ms (TYP). 95% response to step input.	
	Power supply type	AC	DC
	Rated power voltage	100 to 240V, 50/60Hz	24 to 48V DC
	Power voltage	90 to 264V AC, 50/60Hz	20 to 56V DC
	Power consumption	Max. 12VA Max. 12VA	Max. 12V
	Starting current	—	Max. 0.5A
	Peak power current value and width when turning on power supply	20A, 2ms	20A, 0.2ms
	Insulation resistance	Min. 50MΩ between each terminal and case, and between primary and secondary terminals by using a 500V DC megger.	
	Dielectric strength	1500V AC, 1 min or 1800V AC, 1 sec between primary terminal and case, and between primary and secondary terminals.	
		500V AC, 1 min or 600V AC, 1 sec between secondary terminal and case.	
		1000V AC, 1 min or 1200V AC, 1 sec between input and output	
	Temperature characteristics	For standard range : ±0.18%FS, ±57μV or ±3.3μV, whichever is larger (by an input conversion value per 10°C of ambient temperature).	
		For intermediate range : Standard range x 1.2, ±57μV or ±33μA, whichever is larger (by an input conversion value per 10°C ambient temperature).	
	Allowable ambient temperature	0 to 50°C	
	Storage temperature	–20 to +70°C	
	Allowable ambient humidity	Max. 90%RH at 40°C No dewing	
	Vibration resistance	Max. 0.5G, 10 to 60Hz, XYZ directions, 2 hours each	Excluding DIN rail mounted type.
	Impact resistance	Max. 50G, three times in vertical direction	
	Case material	Polycarbonate	
	Case color	Gray, Munsell 2.5PB3.5/1	
	Wiring terminal screw	M3.5	
	Insertion life of Handy Loader jack	Max. 1000 times (with the Handy Loader cord incorporated)	
	Mounting	Rack mount	
		Wall mount: Vibration-absorbing bracket (Part No. 814080-001) is used where there is wall vibration.	
		DIN rail mount: Not possible where there is vibration or shock.	
	Weight	Approx. 0.6kg	

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Attachments	Name of Article	Part No.	Q'ty
	Mounting brackets	81403255-101	1 set
	Vibration-absorbing bracket	81404080-001	1 set
	Various labels	N-3217	1 set
	Test data	—	1 copy
	Instruction manual	—	1 copy
	—	—	—
	—	—	—

Options	Name of Article	Model	Weight (approximately)
	5ch rack (non-communication system)	QN717A101	2.6kg
	11ch rack (communication system)	QN716A101	1.6kg
	Blind cover for rack	81403291-001	10kg
	Handy Loader *	QN715A101	0.4kg
	Handy Loader case	81403304-001	
	Curled cord for Handy Loader	81403280-001	
	* With connecting curled cord, output cable and leather case provided.		

Model Configuration Table

I | II | 0 | III | IV | V | VI

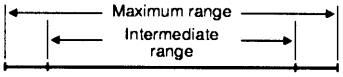
Ex. : IP313C05A0000

I	II	III	IV	V	VI	Contents
Basic model	Input range	Output range	Power voltage	Optional function	Additional processing	
IP313						Calculation unit
Selected from ▶ Table 1.	C					—
	Selected from ▶ Table 2.					—
			A			100 to 240V DC, 50/60Hz
			D			24 to 48V DC
				00		None
				02		Communication
					00	None
					T0	Torrid zone processing

Table 1. Input Range

Range / Input type	Code	Indication, setting unit (on Handy Loader)	Range: Standard range (set at delivery time)	Range: Maximum range (settable after delivery)	Accuracy Note (1): Maximum range	Accuracy Note (1): Intermediate range (maximum error)
Current, voltage (linear)	C	mA	4 to 20mA	0 to 20mA	±0.15%FS	±0.030mA
	1	mA	10 to 50mA	0 to 50mA	±0.15%FS	±0.075mA
	2	mA	2 to 10mA	0 to 10mA	±0.15%FS	±0.015mA
	3	mA	0 to 1mA	0 to 1mA	±0.15%FS	±0.0015mA
	4	V	0 to 10V	0 to 20V	±0.15%FS	±0.03V
	5	mV	1 to 5V	0 to 5V	±0.15%FS	±7.5mV
	6	mV	0 to 1V	0 to 1V	±0.15%FS	±1.5mV
	7	V	−4 to 4V	−10 to 10V	±0.15%FS	±0.03V
	8	mV	0 to 100mV	0 to 100mV	±0.15%FS	±0.15mV
	M	mV	0 to 10mV	−10 to 10mV	±0.15%FS	±0.03mV

Note (1)
- In all cases, input conversion accuracy
- Reference conditions:
  Ambient temperature 23.5 ±1°C
  Power voltage 105 ±2V AC or 24 ±0.5V DC



Maximum error:
The maximum error in an intermediate range (including the standard range) is an error which occurs when the relevant range is included within the maximum range.

Example 1:
When the intermediate range is 4 to 24mA, it is included within the standard range of 0 to 50mA.
Therefore, the maximum error is ±0.75mA.

Example 2:
When the standard range is 4 to 20mA, it is included within the maximum range of 0 to 20mA.
Therefore, the maximum error is ±0.030mA.

Table 2. Output Range

Range / Output type	Code	Indication, setting unit (on Handy Loader)	Range: Standard range (set at delivery time)	Range: Maximum range (settable after delivery)	Accuracy (Reference conditions: Ambient temperature 23.5 ±1°C, Power voltage 105 ±2V AC or 24 ±0.5V DC): Maximum range	Accuracy by scaling
Current, voltage (linear)	C	mA	4 to 20mA	0 to 20mA	±0.15%FS	80% or more : ±0.15%FS Less than 80% : Accuracy shown in Table 1 × Maximum output range width / Intermediate output rnage width However, the input conversion value of ±5%FS, when scaling is within 0 to 1mA. Note: The accuracy is doubled where less than 0.5mA in the current output.
	2	mA	2 to 10mA	0 to 10mA	±0.15%FS	
	5	V	1 to 5V	0 to 5V	±0.15%FS	
	8	mV	0 to 100mV	0 to 100mV	±0.15%FS	
	M	mV	0 to 10mV	0 to 10mV	±0.15%FS	

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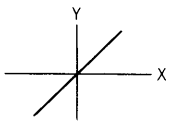
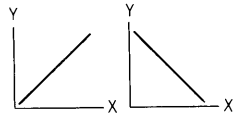
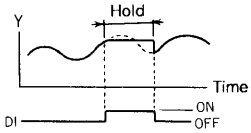
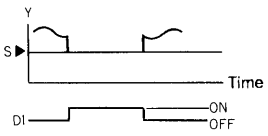
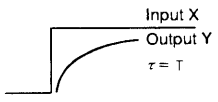
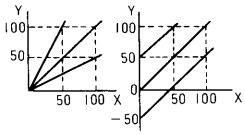
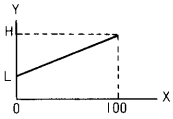
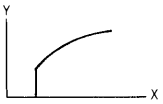
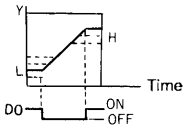
Table 4. Calculation

Group	Name and Function Symbol / Abbreviation	Calculation contents (Remarks: X = Input signal, Y = Output signal, DI = Digital input, DO = Digital output)	Parameter setting range
A	**No operation** • Input signal is used as an output signal as is. • No calculation NOP / **NOP**	 Y = X DI, DO : None	—
	Reverse • Input signal is reversed and used as an output signal. REV. / **RVS**	 Y = 100 – X DI : Reversed when DI is OFF. DI : Not reversed when DI is ON. DO : None	—
	Analog memory • Output signal is held temporarily. ANALOG MEMORY / **ANM**	 DI : Output is not held when DI is OFF. DI : Output is held when DI is ON. DO : None	—
	Preset value • Preset value is output irrespective of the input signal. PRESET / **PRS**	 Y = S DI : Preset value is not output when DI is OFF. DI : Preset value is output when DI is ON. DO : None	Preset value S = –999.9 to 999.9 (0.0)
B	**First order lag filter** • An output signal is delayed against an abrupt change in an input signal. FILTELR / **FLT**	 $Y = X \frac{1}{1 + TS}$ S : Laplace operator DI, DO : None	Filter constant T = 0.0 to 999.9s (0.0)
	Bias factor • An input signal is multiplied by a factor, and a bias is added to it to obtain an output signal. R/B / **R/B**	 Y = RX + B DI, DO : None	Ratio T = –9.999 to 9.999 (1.000) Bias B = –99.99 to 200.0% (0.00)
	Scaling • An input (output) signal is scaled by parameters. SCALING / **SCL**	 $Y = \frac{(H - L)X}{100} + L$ DI, DO : None	Low-limit value L = –999.9 to 999.9 (0.0) High-limit value H = –999.9 to 999.9% (100.0)
	Square root extraction • A square root input signal is extracted into an output signal (with a dropout function provided). ROOT / **SQR**	 $Y = \sqrt{X}$. However, Y = 0 when X < D. DO : Dropout is not activated when DO is OFF. DO : Dropout is activated when DO is ON. DI : None	Dropout D = 0.0 to 10.0%FS (0.0)
	High-low limiter • High-limit and low-limit values are set to the output signal and only the necessary range of an input signal is used. LIMIT / **HILL**	 Y = X. However, Y = L when X ≦ L, and Y = H when X ≧ H. DO : The high-low limiter is not operated when DO is OFF. DO : The high-low limiter is operated when DO is ON. DI : None	Low-limit value L = –999.9 to 999.9% (0.0) High-limit value H = -999.9 to 999.9% (100.0)

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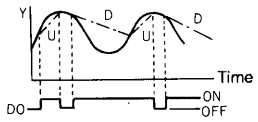
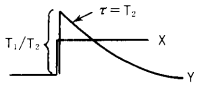
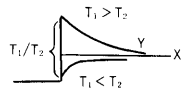
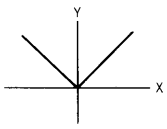
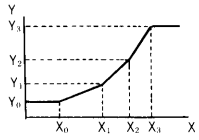
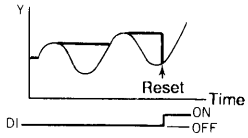
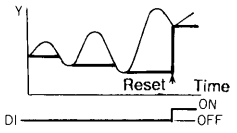
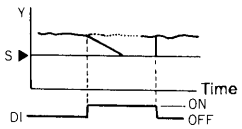
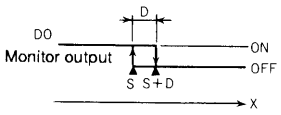
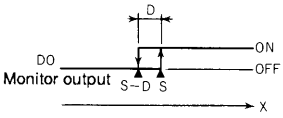
B	**Change rate limiter** • The change rate of an input signal is limited within a preset ramp in such a way that the process value changes rapidly. D.RATE LIMIT **DRL**		The rise rate of Y is limited to ≦ U, and the fall rate of Y to ≦ D. DO : The change rate limiter is operated when DO is ON. DI : The change rate limiter is not operated when DI is ON.	Rise rate U = 0 to 999.9%/s (100.0) Fall rate D = 0 to 999.9%/s (100.0)
	Derivative • An input signal change is predicted and output. $\frac{d}{dt}$ **LED**		$Y = \frac{T_1 S}{1 + T_2 S} X$ S : Laplace operator DI, DO : None	Lead time T_1 = 0.0 to 999.9s Lag time T_2 = 0.0 to 999.9s
	Lead, lag • The dead time in a system is compensated for. LEAD LAG **L/L**		$Y = \frac{1 + T_1 S}{1 + T_2 S} X$ S : Laplace operator DI, DO : None	Lead time T_1 = 0.0 to 999.9s (0.0) Lag time T_2 = 0.0 to 999.9s (0.0)
	Absolute value • The absolute value of an input signal is output. |SIG.| ABS **ABS**		Y = |X| DO turns ON when X < 0. DI : None	—
	Linearization table • An optional function can be prepared and output as up to 20 broken lines, when an input (output) signal is nonlinear. LINEARIZE **TBL**		Y = f (X) 20 broken lines conversion X : No. of broken lines + 1 Y : No. of broken lines + 1 DO, DI : None	X broken line X_1 to X_{20} = −999.9 to 999.9% Y broken line Y_1 to Y_{20} = −999.9 to 999.9%
	Maximum value keeping • The current maximum value is output. MAX. HOLD **MAX**		Y = X (max) DI : The maximum value is kept when DI is OFF. DI : Reset when DI is ON. DO : None	—
	Minimum value keeping • The current mimimum value is output. MIN. HOLD **MIN**		Y = X (min) DI : The minimum value is held when DI is OFF. DI : Reset when DI is ON. DO : None	—
	Soft preset • A preset value is bumplessly output. SOFT PRESET **SPR**		Y = S DI : Y = X when DI is OFF. DI : A preset value is bumplessly output with Y = S when DI is ON. DO : None	Preset value S = −999.9 to 999.9% (0.0) Ramp R = 0.1 to 999.9%/s (10.0)
M	**Low monitor** • ON when the input signal level is less than a monitor set value. • Fail safe high-limit alarm. LOW **LMS**		DO : Monitor output ON when X < S. DO : Monitor output OFF when X < S + D. DI : None	Monitor S = −999.9 to 999.9% (0.0) Differential D = 0.1 to 200.0% (1.0)
	High monitor • On when the input signal level is higher than a monitor set vaule. • Fail-safe low-limit alarm. HIGH **HMS**		DO : Monitor output ON when S < X. DO : Monitor output OFF when S − D < X. DI : None	Monitor S = −999.9 to 999.9% (100.0) Differential D = 0.1 to 200.0% (1.0)

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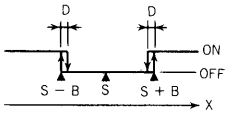
M

Deviation monitor

- Monitor output ON when the input signal level is out of the bandwidth.

DMS



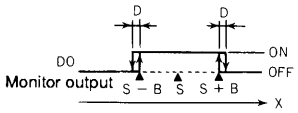
DO: Monitor output ON when X < S – B, S + B < X.
DO: Monitor output OFF when S – B + 0.1% < X, X < S + B – 0.1%.
DI : None

Monitor
S = –999.9 to 999.9% (0.0)
Differential
D = 0.1 (%) fixed
Bandwidth
B = 0.1 to 200.0% (1.0)

Arrival monitor

- Monitor output ON when the input signal level is within bandwidth.

AMS



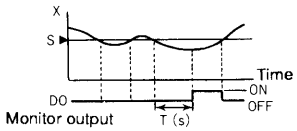
DO: Monitor output ON when S – B < X, X < S + B.
DO: Monitor output OFF when X < S – B + 0.1%, S + B + 0.1% < X
DI : None

Monitor
S = –999.9 to 999.9% (0.0)
Differential
D = 0.1 (%) fixed
Bandwidth
B = 0.1 to 200.0% (1.0)

Timer monitor (low)

- The timer function is activated when the input signal level is lower than a monitor set value.

TLM



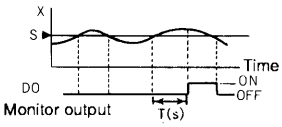
DO: Monitor output ON when X < S is continued for T sec.
DO: Monitor output OFF when X > S (time count is cleared).
DI : None

Monitor
S = –999.9 to 999.9% (0.0)
Time
T = 0 to 5000s (0)

Timer monitor (high)

- The timer function is activated when the input signal level is higher than a monitor set value.

THM



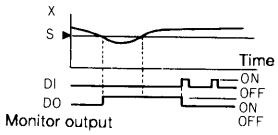
DO: Monitor output ON when X > S is continued for T sec.
DO: Monitor output OFF when X < S (time count is cleared).
DI : None

Monitor
S = –999.9 to 999.9% (100.0)
Time
T = 0 to 5000s

Keeping monitor (low)

- Monitor output ON when the input signal level is lower than a monitor set value. Once the monitor output is ON, output continues until DI turns on.

KLM



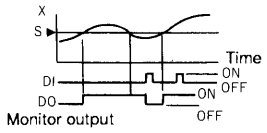
DO: Monitor output ON when X < S. Once the monitor output is ON, output continues even when S < X, unless DI turns on.
DI : Monitor output OFF when DI on.

Monitor
S = –999.9 to 999.9% (100.0)

Keeping monitor (high)

- Monitor output ON when the input signal level is higher than a monitor set value. Once the monitor output is ON, output continues until DI turns on.

KHM



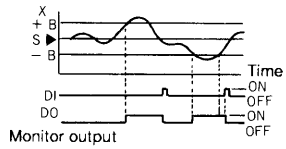
DO: Monitor output ON when X > S. Once DO is ON, output continues even when X < S, unless DI turns ON.
DI : Monitor output OFF when DI is ON.

Monitor
S = –999.9 to 999.9% (0.0)

Keeping monitor (deviation)

- Monitor output ON when the input signal level is out of the bandwidth. Once the monitor output is ON, output continues until DI turns on.

KDM



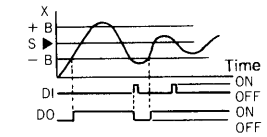
DO: Monitor output ON when X < S – B or S + B = X. Once DO is ON, output continues even when S – B < X < S + B, unless DI turns on.
DI : Monitor output OFF when DI is ON.

Monitor
S = –999.9 to 999.9% (0.0)
Bandwidth
B = 0.1 to 200.0% (1.0)

Keeping monitor (arrival)

- Monitor output ON when the input signal level is within the bandwidth. Once the monitor output is ON, output continues until DI turns on.

KAM



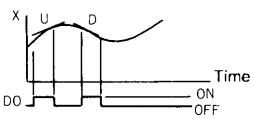
DO: Monitor output ON when S – B < X < S + B. Once DI is ON, output continues even when X < S – B or S + B < X, unless DI turns on.
DI : Monitor output OFF when DI is ON.

Monitor
S = –999.9 to 999.9% (0.0)
Bandwidth
B = 0.1 to 200.0% (1.0)

Change rate monitor

- The input signal change rate is monitored.
- An error in the input signal source is detected.

DRM



DO: Monitor output ON when S – B < X < S + B. Once DI is ON, output continues even when X < S – B or S + B < X, unless DI turns ON.
DI : Monitor output OFF when DI is ON.

High-limit value
U = 0 to 999.9%/s (100.0)
Low-limit value
D = 999.9%/s (100.0)

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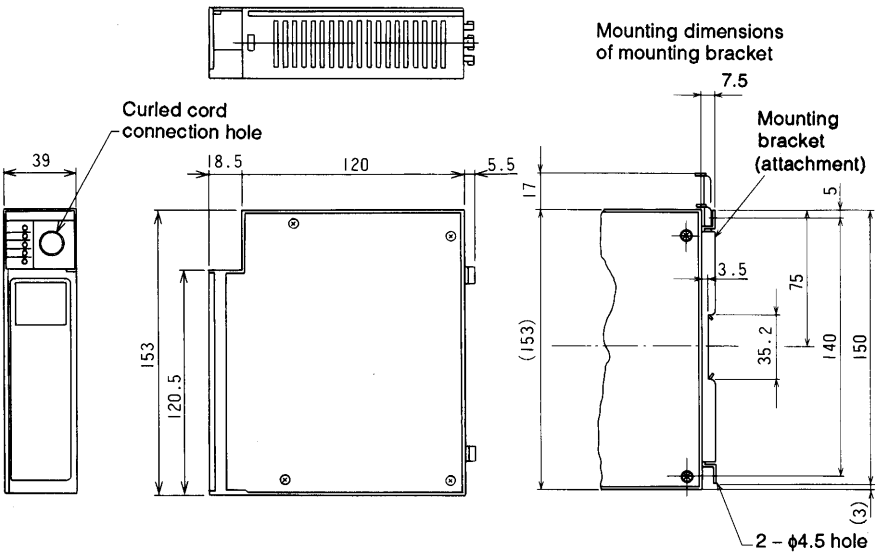
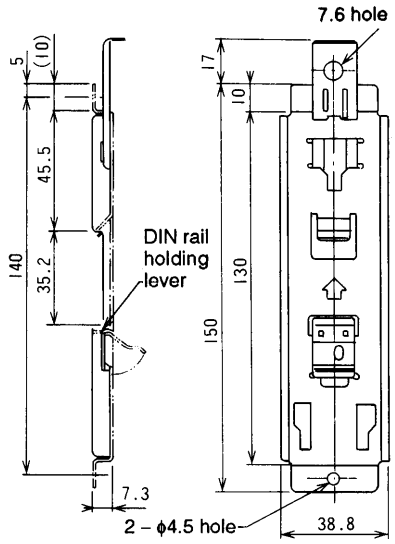
External Dimensions

Unit : mm

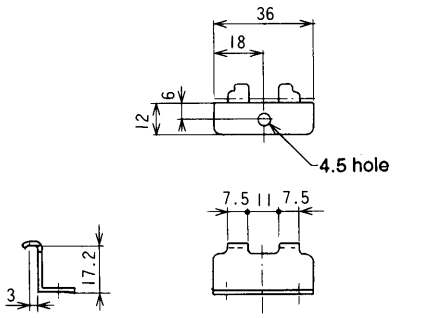
External Dimensions of Instrument



Mounting bracket Part No. 81403255–101

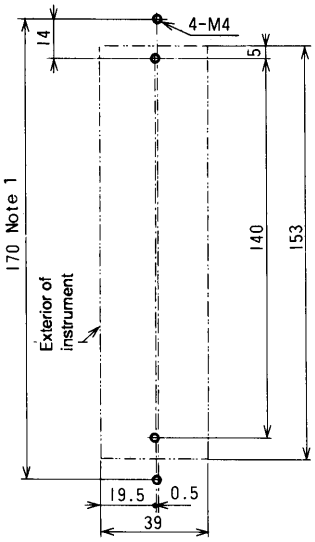


Vibration-absorbing bracket Part No. 81404080-001



Material: Steel plate SPCC t1.6
Galvanized black
chromate processing

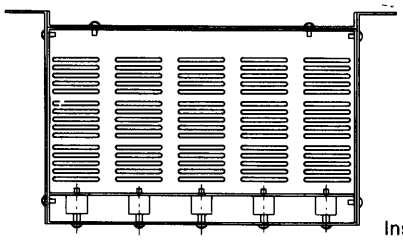
Mounting dimensions of vibration-absorbing bracket



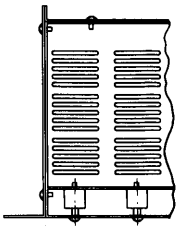
Note 1: The two outer holes (170 pitch) need not be used when the instrument is mounted where there is no vibration.

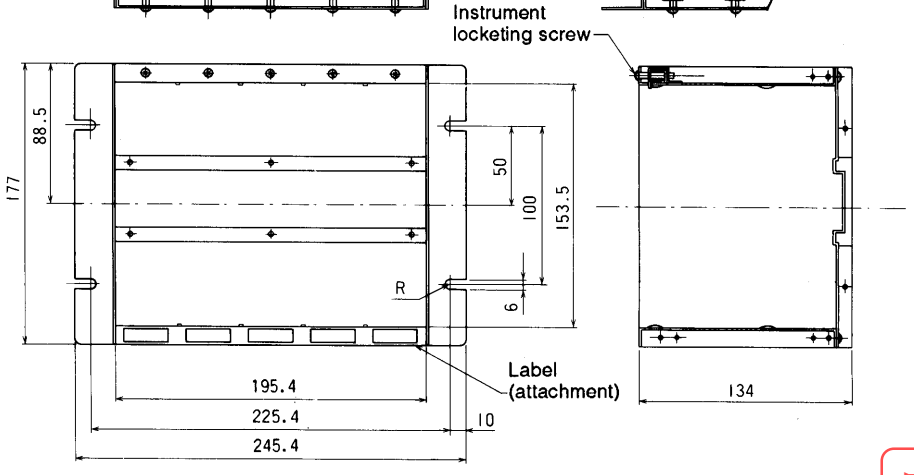
5ch rack (non-communication system) Model QN717A101

Wall mount



Panel mount





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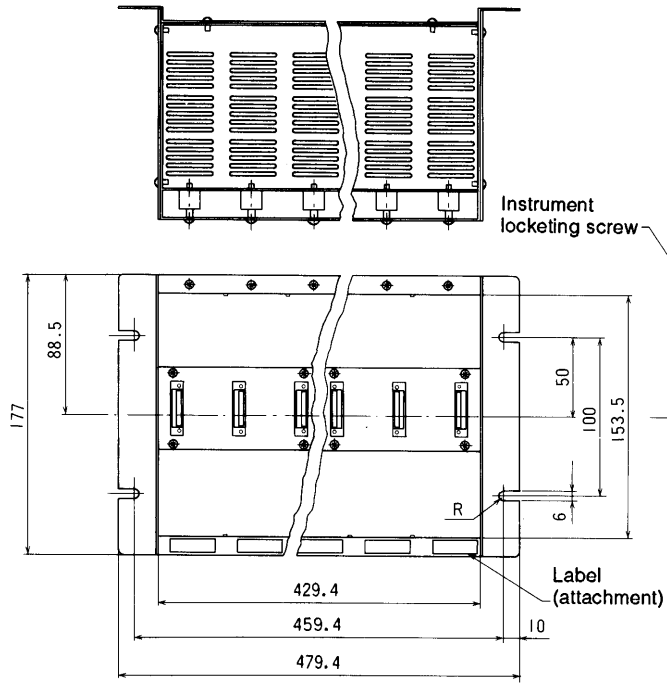
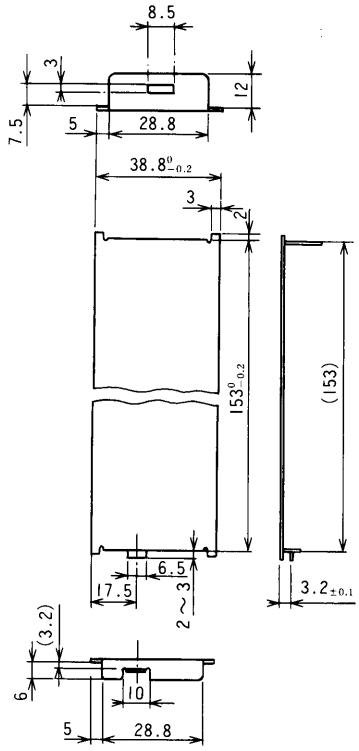
11ch rack (communication system) Model QN716A101

Wall mount



Blind cover for rack Part No. 81403291-001

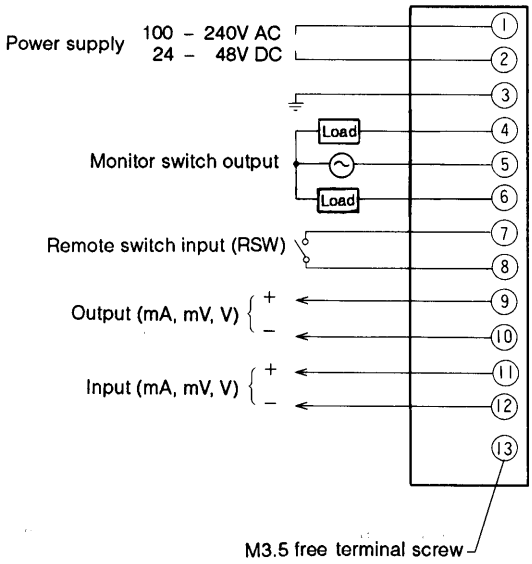
Panel mount



Caution: Rack mount

When two or more racks are stacked, keep a minimum space of 100mm between the upper and lower racks, and install a fan for forced ventilation.

External Terminal Connection Diagram



Cautions :

1. **Power supply**

   Take the starting current of the instrument power supply into account (with DC power supply).

2. **Combination with data input device, etc.**

   When the output of this instrument is applied to an A/D converter or analog scanner, etc.m a dispersion error may occur in the read data.
   To prevent this error, take any of the following measures.

   (1) For A/D conversion of the output of this instrument, use a low speed integral A/D converter.
   If a sequential comparison high-speed A/D converter is used, check the functions by combination tests in advance.

   (2) Insert an isolator with no switching power supply between this instrument and the A/D converter.

   (3) Perform mean processing via personal computer, etc. during data reading.

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⚠ 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.

YAMATAKE

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