INSTRUCTION MANUAL

FREQUENCY TRANSMITTER
(field-programmable; built-in excitation)

MODEL **JPA2**

BEFORE USE ....

Thank you for choosing M-System. Before use, please check contents of the package you received as outlined below.
If you have any problems or questions with the product, please contact M-System's Sales Office or representatives.

■ PACKAGE INCLUDES:

Signal conditioner (body + base socket)............................(1)

■ MODEL NO.

Confirm Model No. marking on the product to be exactly what you ordered.

■ INSTRUCTION MANUAL

This manual describes necessary points of caution when you use this product, including installation, connection, hardware setting, operation of the Programming Unit (model: PU-2x)* specific to this model and basic maintenance procedures.
This unit is factory adjusted and calibrated according to the Ordering Information included in the product package. If you don't need to change the pre-adjusted setting, you can skip the sections on hardware setting and calibration and Software Setting in this manual.
*When you need to change software settings, please refer to the Operation Manual for Model PU-2x (EM-9255), Section B: (B-1) Introduction, (B-2) General Operation Description, (B-3) Operation Flow chart for general information.

POINTS OF CAUTION

■ POWER INPUT RATING & OPERATIONAL RANGE

- Locate the power input rating marked on the product and confirm its operational range as indicated below:
  85 – 132V AC rating: 85 – 132V, 47 – 66 Hz, approx. 6VA
  12, 24 and 48V DC ratings: Rating ±10%, approx. 3.3W
  110V DC rating: 85 – 150V DC, approx. 3.3W

■ GENERAL PRECAUTIONS

- Before you remove the unit from its base socket or mount it, turn off the power supply and input signal for safety.

■ ENVIRONMENT

- Indoor use.
- When heavy dust or metal particles are present in the air, install the unit inside proper housing with sufficient ventilation.
- Do not install the unit where it is subjected to continuous vibration. Do not subject the unit to physical impact.
- Environmental temperature must be within -5 to +60°C (23 to 140°F) with relative humidity within 30 to 90% RH in order to ensure adequate life span and operation.

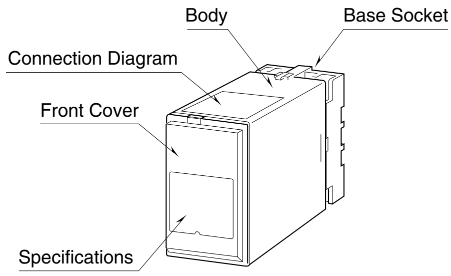
■ WIRING

- Do not install cables close to noise sources (relay drive cable, high frequency line, etc.).
- Do not bind these cables together with those in which noises are present. Do not install them in the same duct.

■ AND ....

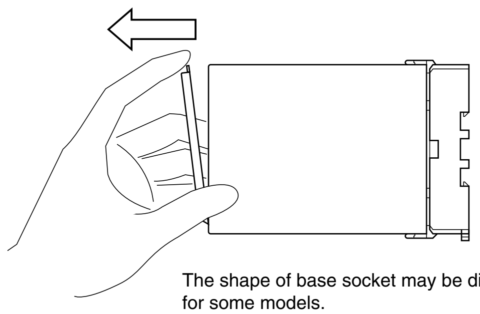
- The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.

COMPONENT IDENTIFICATION



■ HOW TO OPEN THE FRONT COVER:

Hang your finger on the hook at the top of the front cover and pull.



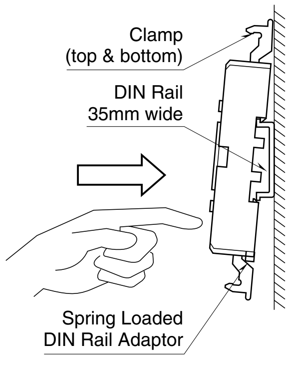
The shape of base socket may be different for some models.

INSTALLATION

Detach the yellow clamps located at the top and bottom of the unit for separate the body from the base socket.

■ DIN RAIL MOUNTING

Set the base socket so that its DIN rail adaptor is at the bottom. Hang the upper hook at the rear side of base socket on the DIN rail and push in the lower. When removing the socket, push down the DIN rail adaptor utilizing a minus screwdriver and pull.



Shape and size of the base socket are slightly different with various socket types.

■ WALL MOUNTING

Refer to "EXTERNAL DIMENSIONS."

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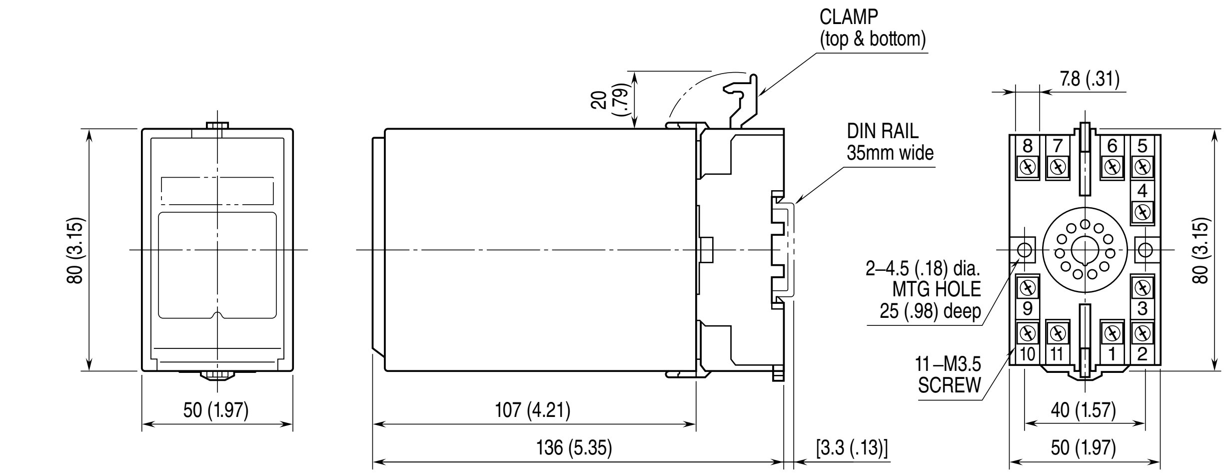
TERMINAL CONNECTIONS

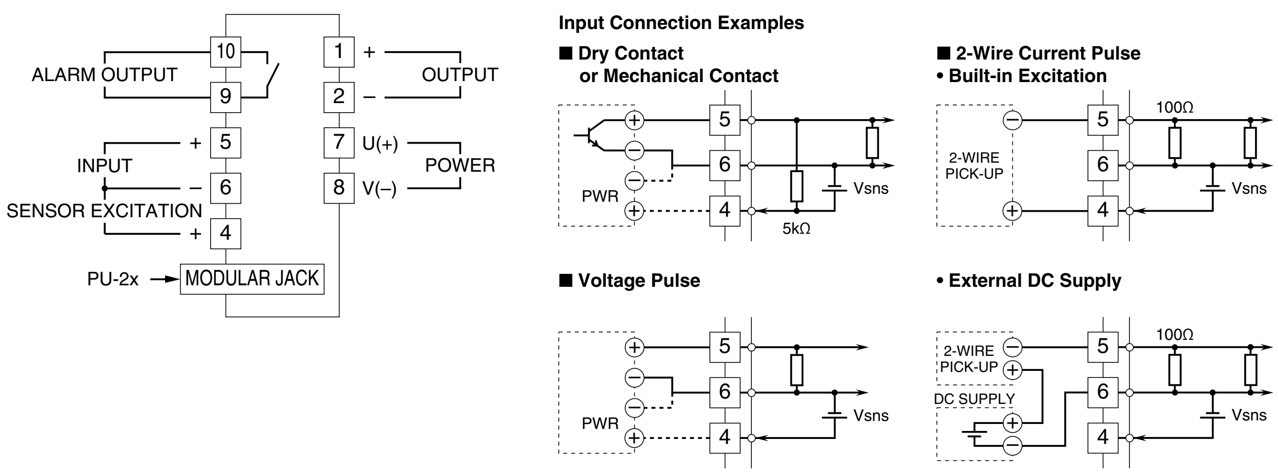
Connect the unit as in the diagram below or refer to the connection diagram on the top of the unit.

■ EXTERNAL DIMENSIONS unit: mm (inch)



• When mounting, no extra space is needed between units.

■ CONNECTION DIAGRAM



EXPLANATIONS OF TERMS & FUNCTIONS

■ LOW-END CUTOUT

The transmitter outputs a DC voltage/current signal equivalent to 0 Hz when a frequency lower than the low-end cutout setpoint. It is selectable with the Programming Unit for the range from -15 to +115% of the input range.
For example, suppose the input zero and span frequencies are set respectively to 0 Hz and 10 kHz, the low-end cutout to 10% (= 1 kHz) , and the low-end cutout deadband to 1%. The transmitter outputs the value equivalent to 0 Hz while the input is within 0 and 1 kHz. When the input reaches over 11% (= 1.1 kHz), the low-end cutout is reset and the transmitter outputs proportionally to the input.

■ ALARM OUTPUT

Either Hi or Lo alarm output is supplied by a relay contact. The alarm setpoint and the deadband (hysteresis) are adjustable with the Programming Unit in percentage of the input range. The alarm setpoint is selectable from -15 to +115%, while the deadband is from 0 to 20%.
Once the relay contact trips, it is reset to the normal position when the input signal goes back past the deadband setting.
With Hi alarm, the relay is turned on when the input goes above the setpoint, and returns to off when the input goes below the setpoint and down past the deadband setting.
With Lo alarm, the relay is turned on when the input goes below the setpoint, and returns to off when the input goes above the setpoint and up past the deadband setting.
When the output linearization is used, signals before the output linearization process is used to compare with the setpoints.

■ DETECTING PULSE EDGE

• Open Collector & Mechanical Contact

OFF (input monitor LED ON) to ON
(input monitor LED OFF)

• Voltage Pulse

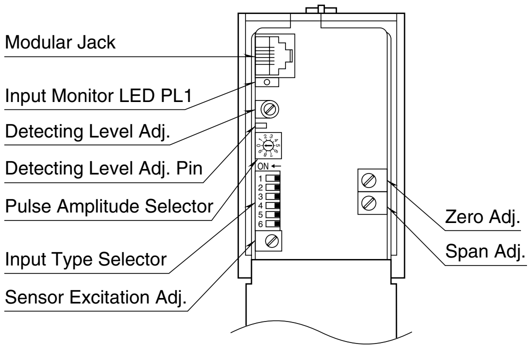
A pulse rise detected when the input voltage goes above the detecting level (input monitor LED ON); a pulse sink detected when it goes below the level (input monitor LED OFF).

• Two-Wire Current Pulse

The input resistor (100Ω) converts the current signal (0 – 25mA) into 0 – 2.5V. A pulse rise detected when the voltage goes above the detecting level (input monitor LED ON); a pulse sink detected when it goes below the level (input monitor LED OFF).

HARDWARE SETTING & CALIBRATION

■ FRONT PANEL CONFIGURATION



■ PULSE AMPLITUDE (rotary switch)

(*) Factory setting

For voltage pulse input, select the pulse amplitude (V p-p) among the switch positions 0 through 6. For open collector, mechanical contact or two-wire current pulse input, set the switch to 7. DO NOT SET to 8 or 9. The power supply to the unit must be turned off when changing the setting.

SW	PULSE AMPLITUDE	MAX. INPUT VOLTAGE
0	50 – 100V p-p	50V
1	25 – 50V p-p	50V
2	10 – 25V p-p	25V
3	5 – 10V p-p	10V
4	1 – 5V p-p	5V
5*1	0.5 – 1V p-p	1V
6*1	0.1 – 0.5V p-p	0.5V
7(*)	Open collector, mechanical contact or two-wire current pulse	

*1. Maximum frequency limited to 50 kHz.

■ DETECTING LEVEL

A specific sensitivity scale is applied according to the pulse amplitude setting. The scaled input voltage is then compared to the preset detecting level.
With DC coupling, the scaled H level voltage must be higher than the detecting level so that the pulse state is accurately detected (Refer to the instruction manual for detailed information about adjusting the detecting level).

SW	PULSE AMPLITUDE	SENSITIVITY SCALE
0	50 – 100V p-p	1/20
1	25 – 50V p-p	1/10
2	10 – 25V p-p	1/5
3	5 – 10V p-p	1/2
4	1 – 5V p-p	1
5	0.5 – 1V p-p	5
6	0.1 – 0.5V p-p	10
7	Open collector Mechanical contact Two-wire current pulse	1

■ DIP SWITCH SETTING (*) Factory setting

SW6 is not used. The power supply to the unit must be turned off when changing the setting.

• Input Type

INPUT TYPE	SW1	SW2
Open collector (*) Mechanical contact	ON	OFF
Voltage pulse	OFF	OFF
Two-wire current pulse	OFF	ON

• Pulse Sensing

PULSE SENSING	SW3
Capacitor coupled *2	OFF
DC coupled (*) *3	ON

*2. Frequency range must be 0 – 100 Hz or higher. 0 – 1 kHz or higher for sinusoidal waveform input. Frequencies lower than 10 Hz may be out of accuracy conformance.
*3. For sinusoidal waveform input with the pulse amplitude smaller than 1Vp-p, the frequency range must be 0 – 1 kHz or higher.

• Noise Filter

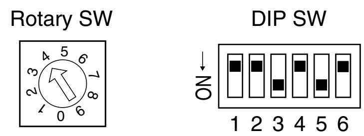
NOISE FILTER	SW4	SW5
High	ON	OFF
Low (*)	OFF	ON
None	OFF	OFF

Be sure to apply the noise filter appropriate for the selected frequency range as shown in the table below. The accuracy may not be assured if no filter is applied.

FREQUENCY RANGE	NOISE FILTER TYPE
0 – 10 mHz 0 – 100 mHz	High High
0 – 1 Hz 0 – 10 Hz 0 – 100 Hz	High Low Low
0 – 1 kHz 0 – 10 kHz 0 – 100 kHz	Low None None

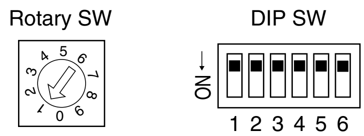
■ EXAMPLE 1: VOLTAGE PULSE with Amplitude 5V p-p, DC Offset 2.5V, Frequency Range 0 – 1 kHz

Input type: Voltage Pulse
Frequency range selected: 0 – 1 kHz
(Select the frequency range and set 0% and 100% range values with the Programming Unit.)
Input amplitude: 1 – 5V p-p
Pulse sensing: DC coupled (Choose Capacitor coupling if necessary.)
Detecting level: 2.5V
(Set to the offset value after it is scaled by the sensitivity scale.)
Noise filter: Low
The rotary switch and DIP switch are configured as shown to the right.



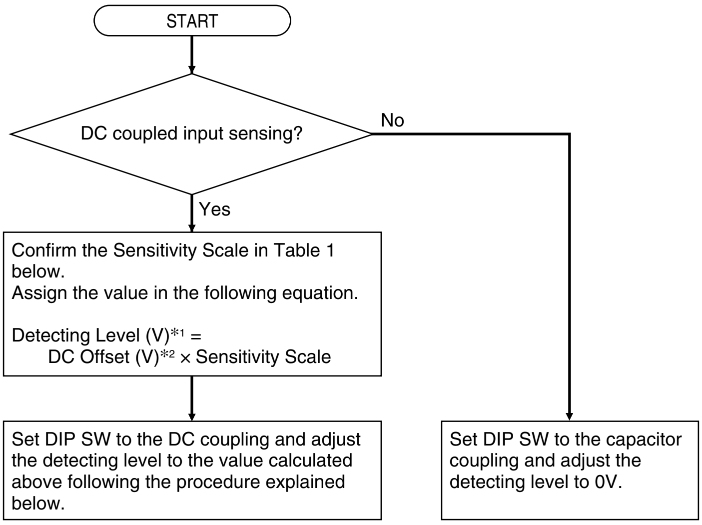
■ EXAMPLE 2: VOLTAGE PULSE with Amplitude 35V p-p, DC Offset 16V, Frequency Range 10 – 50 kHz

Input type: Voltage Pulse
Frequency range selected: 0 – 100 kHz
(Select the frequency range and set 0% and 100% range values with the Programming Unit.)
Input amplitude: 25 – 50V p-p
Pulse sensing: Capacitor coupled
(Choose DC coupling if necessary.)
Detecting level: Turn the adjustment fully counterclockwise. (Set to 0V)
Noise filter: None
The rotary switch and DIP switch are configured as shown to the right.



■ DETECTING LEVEL (voltage pulse and two-wire current pulse)

Determine the appropriate detecting level referring to the flow chart below.



*1. Divide a two-wire current pulse input (mA) by 10 and convert it into voltage (V).
*2. Rounded off to one decimal place.

Table 1

SW	PULSE AMPLITUDE	SENSITIVITY SCALE
0	50 – 100V p-p	1/20
1	25 – 50V p-p	1/10
2	10 – 25V p-p	1/5
3	5 – 10V p-p	1/2
4	1 – 5V p-p	1
5	0.5 – 1V p-p	5
6	0.1 – 0.5V p-p	10
7	Open collector Mechanical contact Two-wire current pulse	1

A specific sensitivity scale is applied according to the pulse amplitude setting. The scaled input voltage is then compared to the preset detecting level.
With DC coupling, the scaled H level voltage must be higher than the detecting level so that the pulse state is accurately detected.

• Setting Examples

Voltage Pulse (DC Offset = Pulse Amplitude / 2)

PULSE AMPLITUDE (Vp-p)	AMPLITUDE RANGE (Vp-p)	DETECTING LEVEL (V)
50	50 – 100	1.3
50	25 – 50	2.5
30	25 – 50	1.5
25	10 – 25	2.5
15	10 – 25	1.5
10	5 – 10	2.5
7.5	5 – 10	1.9
5	1 – 5	2.5
3.5	1 – 5	1.8
2	1 – 5	1
1	0.5 – 1	2.5
0.5	0.1 – 0.5	2.5

Two-wire Current Pulse (DC Offset = Pulse Amplitude / 2)

PULSE AMPLITUDE (mAp-p)	AMPLITUDE RANGE	DETECTING LEVEL (V)
15 (1.5Vp-p) 25 (2.5Vp-p)	Set to open collector, mechanical contact or two-wire current pulse	0.8 1.3

Set DC offset to 0V for 100Vp-p pulse input.

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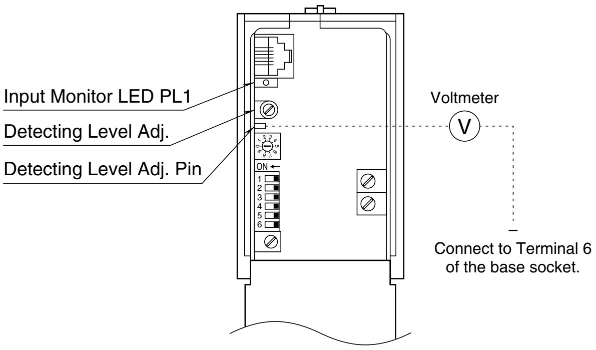
• How to Change the Detecting Level



For the capacitor coupling, turn the detecting level adjustment fully counter-clockwise so that the detecting level is set to 0V.

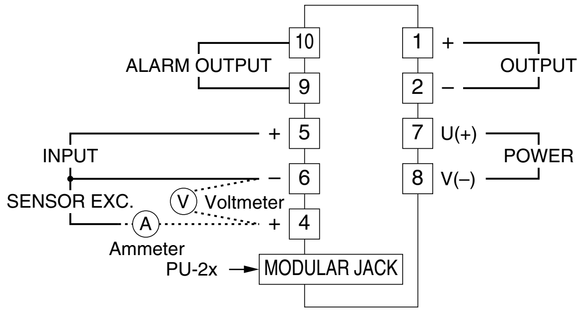
For the DC coupling, refer to the procedure below. A voltmeter of class 0.5 or better accuracy with pointed probes is required.

1) Connect the negative probe of voltmeter to the terminal 6 of base socket.
2) If you need a noise filter, set the SW4 and SW5 in advance.
3) Connect the positive probe to the test pin and turn the Detecting Level Adjustment until the meter shows desired value.
4) Apply input signals and check that input monitor LED (PL1) blinks according to the input signal.

   If the LED does not blink, the detecting level may be out of pulse amplitude range. Check the pulse amplitude and the DC offset again and readjust the detecting level.

■ SENSOR EXCITATION ADJUSTMENT

You can change the sensor excitation voltage with the sensor excitation adj. located behind the front cover. If you need to change it, check that the required current is within the specification.

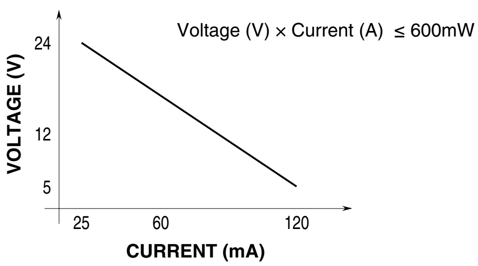


• How to Change the Excitation

A voltmeter and ammeter of class 0.5 or better accuracy are required.

1) Connect the voltmeter across the terminals 4 – 6.
2) Connect the ammeter to terminal 4.
3) Turn the potentiometer until the meter shows the desired value.

   Check that the current value indicated on the ammeter is within the allowable limit. If the value is greater than the limit, lower the voltage value or connect a separate power source. Otherwise, the transmitter may fail.



■ ANALOG OUTPUT ADJUSTMENT

This unit is calibrated at the factory to meet the ordered specifications, therefore you usually do not need any calibration.

For matching the signal to a receiving instrument or in case of regular calibration, adjust the output as explained in the following.

• How to Calibrate The Output Signal

Use a signal source and measuring instruments of sufficient accuracy level. Turn the power supply on and warm up for more than 10 minutes.

1) ZERO: Apply 0% input and adjust output to 0%.
2) SPAN: Apply 100% input and adjust output to 100%.
3) Check ZERO adjustment again with 0% input.
4) When ZERO value is changed, repeat the above procedure 1) – 3).

SOFTWARE SETTING

Please refer to the Operation Manual for Model PU-2x (EM-9255), Section B: (B-1) Introduction, (B-2) General Operation Description, (B-3) Operation Flowchart for general information.

[GROUP 01]

ITEM	MDFY.	DATA INPUT	DISPLAY	DEFAULT	CONTENTS
01	S			N/A	MAINTENANCE SWITCH
		0	MTSW : MON.MODE		0: Data indication only.
		1	MTSW : PRG.MODE		1: All 'P' marked parameters are modifiable.
02	P	Alphabets & No	TG : XXXXXXXXXX	N/A	Tag name entry (10 characters max.)
03	P	Percentage	OUTPER XXX.XX	N/A	Output monitor (%) & simulation output
05	D	No input	INPPER XXX.XX	N/A	Input monitor (%)
06	D	No input	INPFRQ XXX.XX	N/A	Input frequency (Unit as set in ITEM 11)
07	D	No input		N/A	Input specification selected with the front rotary switch
			SW : IN_V 1/20		SW = 0, Voltage pulse input, Sensitivity scale = 1/20
			SW : IN_V 1/10		SW = 1, Voltage pulse input, Sensitivity scale = 1/10
			SW : IN_V 1/5		SW = 2, Voltage pulse input, Sensitivity scale = 1/5
			SW : IN_V 1/2		SW = 3, Voltage pulse input, Sensitivity scale = 1/2
			SW : IN_V 1/1		SW = 4, Voltage pulse input, Sensitivity scale = 1/1
			SW : IN_V 5/1		SW = 5, Voltage pulse input, Sensitivity scale = 5/1
			SW : IN_V 10/1		SW = 6, Voltage pulse input, Sensitivity scale = 10/1
			SW : IN_OC, mA		SW = 7, Open collector, mechanical contact or two-wire current pulse input
			SW : no use		SW = 8, (not used)
			SW : no use		SW = 9, (not used)
10	P			0	Linearization
		0	STRAIGHT		Without
		1	CURVED		With (ITEM 60 to 91 for segment data input)
11	P			5	Frequency Range
		0	FRQRNG : 10mHz		0 – 10 mHz
		1	FRQRNG : 100mHz		0 – 100 mHz
		2	FRQRNG : 1.0Hz		0 – 1 Hz
		3	FRQRNG : 10Hz		0 – 10 Hz
		4	FRQRNG : 100Hz		0 – 100 Hz
		5	FRQRNG : 1.0kHz		0 – 1 kHz
		6	FRQRNG : 10kHz		0 – 10 kHz
		7	FRQRNG : 100kHz		0 – 100 kHz
13	P	Percentage	DRPOUT XXX.XX	-15.00	Low-end cutout (% of the range selected by ITEM 14/15) Specify the low-end cutout deadband using ordering information sheet
14 15	P P	Numeric Numeric	SCLLOW XXXXXX SCLHIG XXXXXX	0.000 1.0000	Input zero frequency (0% input) (Unit as set in ITEM 11) Input span frequency (100% input) (Unit as set in ITEM 11)
18	P	Numeric	SMPL RATE XXX	1	Pulse Divider/Multiplier (averaging non-uniform pulses) The input pulses are divided by 1/X and then multiplied by X in order to suppress unnecessary pulsation of output signal. Frequency Range: Selectable X Value ≤ 0 – 100 Hz: 1 – 255 0 – 1 kHz: 1 – 25 0 – 10 kHz: 1 – 2 0 – 100 kHz: Not selectable (fixed value)
19	P	Percentage	FINZER XXX.XX OUTPER XXX.XX	0.00	Fine zero adjustment When data is entered, output (%) is shown.
20	P	Percentage	FINSPN XXX.XX OUTPER XXX.XX	100.00	Fine span adjustment When data is entered, output (%) is shown.
21	P			1	Alarm mode
		0	NO ALARM		No alarm trip
		1	UPPER ALARM		High alarm trip
		2	LOWER ALARM		Low alarm trip
22	P	Percentage	ALARM XXX.XX	100.00	Alarm setpoint (-15.00 to +115.00%)
23	P	Percentage	ALMHYS XX.XX	1.00	Alarm deadband (hysteresis) (0.00 to 20.00%)
24	P	Seconds	ALTIME XXXX.X	3.0	Alarm delay at the startup (2.0 to 1000.0 seconds)

ITEM	MDFY.	DATA INPUT	DISPLAY	DEFAULT	CONTENTS
60	P	Percentage	X (01) : XXX.XX	0.00	Linearization table (16 points)
61	P	Percentage	Y (01) : XXX.XX	0.00	Set at the maximum of 16 pairs of input (X) and output (Y)
:	:	:	:		calibration points in %. Fill data from the lowest ITEM
:	:	:	:		No. from the lowest calibration point and add as many as
:	:	:	:		required. The output in the undefined range is maintained
90	P	Percentage	X (16) : XXX.XX	0.00	at the value of the first and the last calibration points.
91	P	Percentage	Y (16) : XXX.XX	0.00	

Modification Code

D: No modification (writing) possible. Used only for monitoring (reading).
S: Modifiable at any time.
P: Modifiable only when the MAINTENANCE SWITCH is in the “PRG” mode.

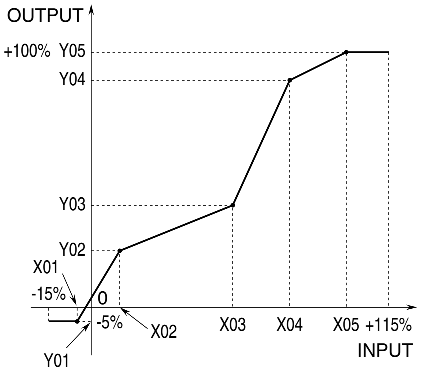
ROM Version Indication

[GROUP 00] [ITEM 99]

■ LINEARIZATION TABLE

The I/O curve is approximated at 16-point segments. Set only the required pairs of I/O points. Refer to the figure below.

X (nn) : Input %
Y (nn) : Output %
Range : -15.00 to +115.00%



[GROUP 01]

ITEM	MDFY.	DATA EXAMPLE
60	P	X (01) : XXX.XX
61	P	Y (01) : XXX.XX
62	P	X (02) : XXX.XX
63	P	Y (02) : XXX.XX
64	P	X (03) : XXX.XX
65	P	Y (03) : XXX.XX
66	P	X (04) : XXX.XX
67	P	Y (04) : XXX.XX
68	P	X (05) : XXX.XX
69	P	Y (05) : XXX.XX
70	P	X (06) : XXX.XX
71	P	Y (06) : XXX.XX
72	P	X (07) : XXX.XX
73	P	Y (07) : XXX.XX
74	P	X (08) : XXX.XX
75	P	Y (08) : XXX.XX
76	P	X (09) : XXX.XX
77	P	Y (09) : XXX.XX
78	P	X (10) : XXX.XX
79	P	Y (10) : XXX.XX
80	P	X (11) : XXX.XX
81	P	Y (11) : XXX.XX
82	P	X (12) : XXX.XX
83	P	Y (12) : XXX.XX
84	P	X (13) : XXX.XX
85	P	Y (13) : XXX.XX
86	P	X (14) : XXX.XX
87	P	Y (14) : XXX.XX
88	P	X (15) : XXX.XX
89	P	Y (15) : XXX.XX
90	P	X (16) : XXX.XX
91	P	Y (16) : XXX.XX

Modification Code

S: Modifiable at any time.
P: Modifiable only when the MAINTENANCE SWITCH is in the “PRG” mode.

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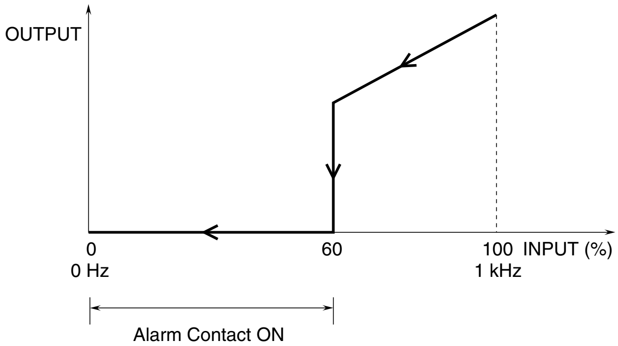
■ LOW-END CUTOUT & ALARM TRIP

[Example]
Input zero frequency: 0 Hz
Input span frequency: 1 kHz
Low-end cutout: 60%
Low-end cutout deadband: 1%
Low alarm setpoint: 50%
Alarm deadband: 20%

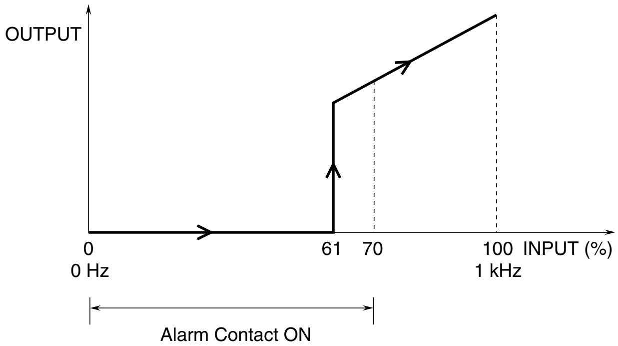
• When the input is decreasing:

The output goes down to 0% when the input goes below 60%. With the low alarm setpoint set to 50%, the alarm is turned on (0% output).



• When the input is increasing:

The low-end cutout is reset when the input goes above 61% (low-end output at 60% plus 1% deadband). With the low alarm setpoint set to 50%, the alarm is turned off when the input goes above 70% (alarm setpoint at 50% plus 20% deadband).



CHECKING

1) Terminal wiring: Check that all cables are correctly connected according to the connection diagram.
2) Power input voltage: Check voltage across the terminal 7 – 8 with a multimeter.
3) Input: Check that the input signal is within 0 – 100% of the full-scale.
4) Output: Check that the load resistance meets the described specifications.

MAINTENANCE

Regular calibration procedure is explained below:

■ CALIBRATION

Warm up the unit for at least 10 minutes. Apply 0%, 25%, 50%, 75% and 100% input signal. Check that the output signal for the respective input signal remains within accuracy described in the data sheet. When the output is out of tolerance, recalibrate the unit according to the “ANALOG OUTPUT ADJUSTMENT” procedure.

LIGHTNING SURGE PROTECTION

M-System offers a series of lightning surge protector for protection against induced lightning surges. Please contact M-System to choose appropriate models.

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