Super-mini Signal Conditioners Mini-M Series

PULSE SCALER
(field-configurable)

Functions & Features
• Converts pulse rate into convenient engineering unit for display on a totalizing counter or meter
• Excitation
• Scaling factor adjustable of 1.0000 × 10^0 to 0.0001 × 10^-6
• Various outputs (open collector, voltage pulse and AC/DC switch)
• Three-way isolation
• CE marking
• UL approval

Typical Applications
• Positive displacement flowmeters and turbine flowmeters
• Magnetic tachometers

ORDERING INFORMATION
• Code number: M2PRU-[1][2][3]-[4][5]
  Specify a code from below for each [1] through [5].
  (e.g. M2PRU-A24A-M2/CE/Q)
  • Scaling factor (e.g. 0.7000 × 10^-2)
  • Specify the specification for option code /Q
    (e.g. /C01/S01)

[1] INPUT
A1: Open collector
A2: Mechanical contact
C: Voltage pulse (sensitivity 2 V)
H: Two-wire current pulse

[2] EXCITATION
4: 12 V DC / 30 mA
7: 24 V DC / 30 mA

[3] OUTPUT
A: Open collector (max. 100 kHz)
M: 5 V pulse (max. 100 kHz)
N: 12 V pulse (max. 100 kHz)
P: 24 V pulse (max. 100 kHz)
R: AC/DC switch (max. 1 kHz)

[4] POWER INPUT
AC Power
M: 100 – 240 V AC (Operational voltage range 85 – 264 V, 47 – 66 Hz)
   (90 – 264 V for UL)
R: 24 V DC
   (Operational voltage range 24 V ±10 %, ripple 10 %p-p max.)
R2: 11 – 27 V DC
   (Operational voltage range 11 – 27 V, ripple 10 %p-p max.)
   (Select ‘/N’ for ‘Standards & Approvals’ code.)
P: 110 V DC
   (Operational voltage range 85 – 150 V, ripple 10 %p-p max.)
   (110 V ±10 % for UL)

[5] OPTIONS (multiple selections)
STANDARDS & APPROVALS (must be specified)
/N: Without CE or UL
/CE: CE marking
/UL: UL approval (CE marking)
OTHER OPTIONS
blank: none
/Q: Option other than the above (specify the specification)
   (UL not available)

SPECIFICATIONS OF OPTION: Q (multiple selections)
COATING (For the detail, refer to M-System’s web site.)
/C01: Silicone coating
/C02: Polyurethane coating
/C03: Rubber coating

TERMINAL SCREW MATERIAL
/S01: Stainless steel

CAUTION
1) The M2PRU’s output waveform is not uniform due to its scaling method. The user must be aware that it may be inconvenient for certain types of application.
2) The M2PRU is designed to accept at the maximum of 100 kHz, which may cause errors due to chattering in the input pulses. A filter circuitry (time constant: approx. 1 msec.) is incorporated to eliminate unwanted chattering when the mechanical contact input is specified. It is effective for
most relay types, however, an external CR filter as indicated below, could be added if the user need improvement. Limit the input frequency to 10 Hz at maximum.

### GENERAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Construction: Plug-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection: M3 screw terminals (torque 0.8 N·m)</td>
</tr>
<tr>
<td>Housing material: Flame-resistant resin (black)</td>
</tr>
<tr>
<td>Isolation: Input to output to power</td>
</tr>
<tr>
<td>Chattering protection: Filter provided for mechanical contact input (time constant: approx. 1 msec.)</td>
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</table>

**Input pulse sensing**: DC coupled; capacitor coupling (automatic trigger*) is field selectable with the side DIP switch for the voltage pulse input.

*Capacitor coupling, with which the detecting levels are automatically set within two peaks of the waveforms, is effective way to detect those with DC offset. However, it may be ineffective if the duty ratio is extremely high or low. The automatic trigger method can compensate such irregular pulses.

**Scaling factor adjustment**: 10-position rotary switch (front); 1.0000 x 10^-0 – 0.0001 x 10^-6; factory set to 1.0000 x 10^0 if not specified when ordering

**Output pulse width adjustment**: Single-turn screwdriver adjustment (front); 5 μsec. – 400 msec. (one-shot type); Factory set to 5 μsec. except for the mechanical contact input set to 15 msec. or AC/DC switch output set to 500 μsec.

(Min. 400 μsec. recommended for AC/DC switch output of which the internal voltage drop value may increase with a shorter pulse width.)

**Output pulse width range selector**: Double-throw SW (front)

### INPUT SPECIFICATIONS

**Excitation**: Shortcircuit protection; limited to approx. 40 mA at shortcircuit

- **Open Collector**
  - Frequency range: 0 – 100 kHz
  - Pulse width time requirement: Min. 5 μsec. for ON and OFF
  - Sensing: Approx. 24 V DC @2 mA
  - Detecting levels: ≤ 400 Ω / 0.8 V for ON,
  - ≥ 1200 Ω / 2.4 V for OFF
  - **Mechanical Contact**
  - Frequency range: 0 – 30 Hz
  - Pulse width time requirement: Min. 10 msec. for ON and OFF
  - Sensing: Approx. 24 V DC @2 mA
  - Detecting levels: ≤ 400 Ω / 0.8 V for ON,

- **Voltage Pulse**
  - Waveform: Square or sine
  - Frequency range: 0 – 100 kHz
  - (min. 10 Hz for sine waves)
  - Pulse width time requirement: ≥ 5 μsec. for high and low levels
  - Input impedance: ≥ 10 kΩ

- **Capacitor coupled**: ≥ 2 Vp-p
  - **Two-wire Current Pulse**
  - Frequency range: 0 – 100 kHz
  - Pulse width time requirement: Min. 5 μsec. for high and low levels
  - Detecting levels:
  - ≥ 10 mA for high level
  - ≤ 5 mA for low level

**Maximum current**: ±30 mA

**Input resistance**: Receiving resistor 200 Ω

### OUTPUT SPECIFICATIONS

- **Open Collector**: 50 V DC @200 mA (resistive load)
- **Maximum frequency**: 100 kHz
- **Saturation voltage**: 0.6 V DC
- **Voltage Pulse**
- **Maximum frequency**: 100 kHz
  - High level: Rating (5, 12 or 24 V) ±10 %
  - Low level: ≤ 0.5 V
- **Load resistance**:
  - ≥ 500 Ω for 5 V
  - ≥ 1200 Ω for 12 V
  - ≥ 4800 Ω for 24 V
- **AC/DC Switch**
  - 132 V AC @200 mA (cos ø = 1)
  - 30 V DC @200 mA (resistive load)
- **Maximum frequency**: 1 kHz
- **Internal voltage drop**: ≤ 3 V

### INSTALLATION

**Power Consumption**

- **AC Power Input**:
  - Approx. 4 VA at 100 V
  - Approx. 5 VA at 200 V
  - Approx. 6 VA at 264 V
- **DC Power input**: Approx. 3 W

**Operating temperature**: -5 to +55°C (23 to 131°F)

**Operating humidity**: 30 to 90 %RH (non-condensing)

**Mounting**: Surface or DIN rail

**Weight**: 150 g (0.33 lbs)
**PERFORMANCE**

**Response time:** 25 μsec. + input cycle + output cycle  
(time required for the first pulse to be output from a train of pulse input)

**Insulation resistance:** ≥ 100 MΩ with 500 V DC

**Dielectric strength:** 2000 V AC @1 minute  (input to output to power to ground)

**STANDARDS & APPROVALS**

**CE conformity:**
- EN 61000-6-4 (EMI)
- EN 61000-6-2 (EMS)
- Low Voltage Directive (2006/95/EC)
- EN 61010-1
- Installation Category II
- Pollution Degree 2
- Max. operating voltage 300V
- Input or output to power: Reinforced insulation
- Input to output
- Open collector/voltage pulse output: Basic insulation
- AC/DC switch output: Reinforced insulation

**Approval:**
- UL/C-UL nonincendive Class I, Division 2,
- Groups A, B, C, and D hazardous locations 
  (ANSI/ISA-12.12.01, CAN/CSA-C22.2 No.213)
- UL/C-UL general safety requirements 
  (UL 61010B-1, CAN/CSA-C22.2 No.1010-1)

**EXTERNAL VIEW**

- **FRONT VIEW (with cover open)**
- **RIGHT SIDE VIEW**

Refer to the instruction manual for detailed procedures.
**DIMENSIONS unit: mm (inch)**

- 59.5 (2.32)
- 21.5 (0.85)
- 70.5 (2.78)
- 86.7 (3.41)
- 7.3 (0.29)
- 15 (0.59)
- 6 (0.23)

DIN RAIL 35mm wide

8-M3 SCREW 6 (.24) deep

116.7 (4.59)

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

**SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM**

- Input Connection Examples
  - Mechanical Contact
    - Open Collector
  - Voltage Pulse
    - DC Coupled
  - Voltage Pulse
    - Built-in Excitation
    - External DC Supply
    - Capacitor Coupled

- Output Connection Examples
  - Open Collector
  - Voltage Pulse
  - AC/DC SWITCH

*Provided only for voltage pulse input.

Specifications are subject to change without notice.
INSTRUCTION MANUAL

PULSE SCALER
(selectable range)

MODEL M2PRU

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 and basic maintenance procedures.

POINTS OF CAUTION

■ NONINCENDIVE APPROVAL OPTION
• This equipment is suitable for use in Class I, Div. 2, Groups A, B, C and D or Non-Hazardous Locations only.
• WARNING! Before You Remove the Unit from Its Base Socket or Mount It, Turn Off the Power Supply and Input Signal for Safety.
• WARNING! – Explosion Hazard – Substitution of Components May Impair Suitability for Class I, Div. 2.
• WARNING! – Explosion Hazard – Do Not Disconnect Equipment Unless Power Has Been Switched Off or The Area is Known To Be Non-Hazardous.
• The equipment was evaluated for use in the ambient temperature and relative humidity as mentioned in ‘ENVIRONMENT’ section.
• The input and output wiring must be in accordance with Class I, Div. 2 wiring methods and in accordance with the authority having jurisdiction for use in these hazardous locations.

■ CONFORMITY WITH EC DIRECTIVES OR UL
• This equipment is suitable for use in a Pollution Degree 2 environment and in Installation Category II, with the maximum operating voltage of 300V.
• Insulation between signal input and output for the open collector or voltage pulse output is appropriate for basic insulation class. Prior to installation, check that the insulation class of this unit satisfies the system requirements.
• Altitude up to 2000 meters
• The equipment must be mounted inside a panel.
• The equipment must be installed such that appropriate clearance and creepage distances are maintained to conform to CE/UL requirements. Failure to observe these requirements may invalidate the CE/UL conformance.

■ POWER INPUT RATING & OPERATIONAL RANGE
Locate the power input rating marked on the product and confirm its operational range as indicated below:
100 – 240V AC rating: 85 – 264V (90 – 264V for UL), 47 – 66 Hz, approx. 4 – 6VA
24V DC rating: 24V ±10%, approx. 3W
11 – 27V DC rating: 11 – 27V, approx. 3W
110V DC rating: 85 – 150V (110V ±10% for UL), approx. 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 +55°C (23 to 131°F) with relative humidity within 30 to 90% RH in order to ensure adequate life span and operation.
• Be sure that the ventilation slits are not covered with cables, etc.

■ WIRING
• Do not install cables (power supply, input and output) 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.
• With voltage output, do not leave the output terminals shortcircuited for a long time. The unit is designed to endure it without breakdown, however, it may shorten appropriate life duration.

■ FILTER
The M2PRU is designed to accept at the maximum of 100 kHz, which may cause errors due to chattering in the input pulses.
A filter circuitry (time constant: approx. 1 msec.) is incorporated to eliminate unwanted chattering when the mechanical contact input is specified. It is effective for most relay types, however, an external CR filter as indicated below, could be added if the user need improvement. Limit the input frequency to 10 Hz at maximum.
**INSTALLATION**

Loosen the fixing screw at the front of the unit in order to separate the body from the base socket.

- **DIN RAIL MOUNTING**
  Set the base socket so that its DIN rail adaptor is at the bottom. Position 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.

- **WALL MOUNTING**
  Refer to “EXTERNAL DIMENSIONS.”

**TERMINAL CONNECTIONS**

Connect the unit as in the diagram below or refer to the connection diagram on the side of the unit.
**ADJUSTMENT PROCEDURE**

**FRONT VIEW (with cover open)**

- Scaling Factor
  - (A) $10^{-1}$
  - (B) $10^{-2}$
  - (C) $10^{-3}$
  - (D) $10^{-4}$
  - (E) $10^{-n}$
- Pulse Width Adj.
- Pulse Width Range Selector

*Settings 7 through 9 are invalid.
No pulse output with these settings.
The front cover cannot be opened to 180 deg.
when flush with neighboring units.

**RIGHT SIDE VIEW**

- Pulse Sensing Type Selector
  - DC: DC coupling
  - AC: Capacitor coupling

**SCALING FACTOR**
Positions for the rotary switches $10^{-1}$ through $10^{-n}$ apply respectively to each digit of the decimals and exponential as shown below.

Output Rate = Input Rate \( \times \) \((A)(B)(C)(D) \times 10^{-E}\) where the scaling factor is adjustable from \(1.0000 \times 10^{-6}\) thr. \(0.0001 \times 10^{-6}\)

[Examples]
Scaling factor 0.1440:
- (A) = 1, (B) = 4, (C) = 4, (D) = 0, (E) = 0
Scaling factor 1.0000 is special:
- (A) = 0, (B) = 0, (C) = 0, (D) = 0

**PULSE WIDTH**
Factory adjusted to a suitable value. Use only when the output device (counter) is not able to read the output pulses.
Min. 400 µsec. recommended for AC/DC switch output of which the internal voltage drop value may increase with a shorter pulse width.

<table>
<thead>
<tr>
<th>OUTPUT TYPE</th>
<th>VOLTAGE PULSE</th>
<th>OPEN COLLECTOR AC/DC SWITCH</th>
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</thead>
<tbody>
<tr>
<td>Bold section of the waveform is adjustable.</td>
<td>H</td>
<td>OFF</td>
</tr>
<tr>
<td>L</td>
<td>ON</td>
<td></td>
</tr>
</tbody>
</table>

**PULSE WIDTH RANGE**
Selects adjustable range of the output pulse width.
- L (Left) : Approx. 0.2 – 10 msec.
- CTR (Center) : Approx. 5 – 200 µsec.
- R (Right) : Approx. 10 – 400 msec.

**PULSE SENSING TYPE**
Provided only when the voltage pulse input is selected. Factory set to ‘DC coupling.’
When the DC offset is too large to detect by DC coupling, switch to ‘Capacitor coupling.’

**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 13 – 14 with a multimeter.
3) Input: Check input terminal 1(+) – 4(–) with an oscilloscope.
   With voltage pulse input, the signal should be below 1V at L level, while it should exceed 2V at H level.
4) Output: Check that the load resistance meets the described specifications.

**EXTERNAL DIMENSIONS** unit: mm (inch)

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