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Rockwell Automation + Schlumberger

NUFLO™

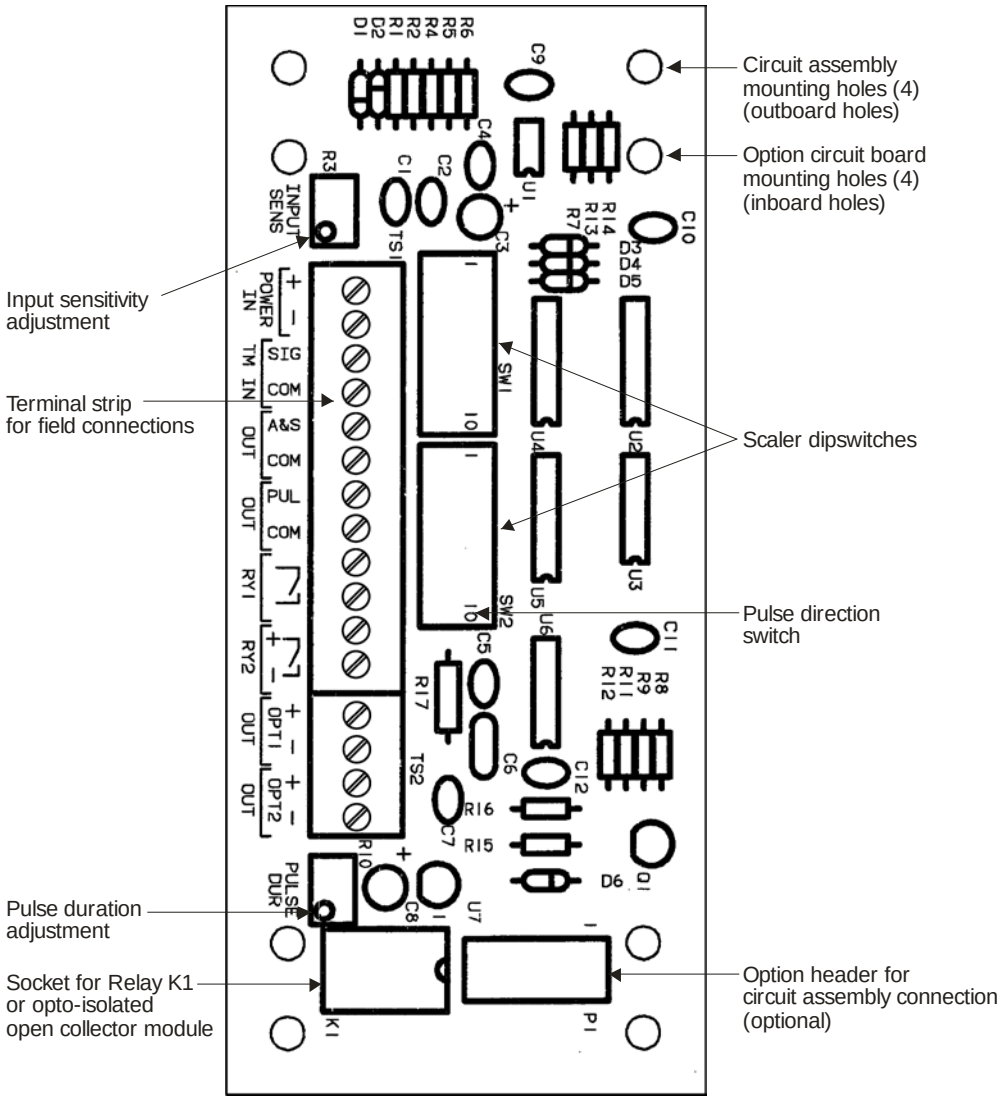
TMP-100 Turbine Meter Pulse Divider Circuit

User Manual

Manual No. 9A-100080245, Rev. 01

Table of Contents

Nomenclature



General Information

The NuFlo TMP-100 Turbine Meter Pulse Divider Circuit is a solid-state electronic instrument designed for use with a NuFlo turbine flowmeter. The TMP-100 provides a pulse output in the form of two dry contacts from a two-pole relay, single-pole relay or an opto-isolated open collector transistor output.

The TMP-100 has a divisor capability of 1 to 524,287 to enable the pulse outputs to be scaled to most standard units of measurement.

The TMP-100 can drive an LCD counter, user-selectable negative- or positive-going logic level (0-5 VDC) pulse output, and logic level turbine meter frequency output.

An option header enables optional circuits such as the TMR-100, opto-isolated, and loop-powered 4-20mA rate output circuit board to be mounted above the TMP-100.

Specifications

Input

- Power supply: 10 – 28 VDC, 2 mA current draw quiescent (12 mA during relay contact closure or when opto-isolator open collector module is on)
- Input signal: 20 mV peak to peak – 10 V peak to peak
- Divisor: 1 to 524,287 (set by 19 miniature dip switches)
- Operating temperature: -20º to 140ºF (-28º to 60ºC)

Output

- Square wave output at 0 to 5 V logic level at turbine meter frequency. Load = 250K ohm or larger. Maximum turbine meter frequency = 3,000 Hz
- Pulse output from divisor at 0 to 5 V logic level. Pulse direction is user-selectable for positive- or negative-going pulse. Pulse duration is adjustable from 60 ms to 800 ms. Load = 250K ohm or larger.
- Dry contact output two-pole relay, relay closure duration is adjustable from 60 ms to 800 ms (Relay Contact Rating: .5 A, 30 VDC, 10 W max.)
- Opto-isolated open collector output is adjustable from 60 ms to 800 ms “on” time. (Opto-Isolated Module: .1 A max., 30 VDC max.)

Note: The maximum pulse output rate for the pulse output section, whether dry contact relay or opto-coupled output, is 15 Hz (8 Hz @ 50 percent duty cycle). This is based on a 60-ms pulse duration setting. The maximum pulse output rate will be lower for longer pulse duration settings.

- Optional feature: rate option circuit board with 4-20mA output representing rate

Installation

Mounting

The TMP-100 circuit board is designed to be mounted with screw-mounted standoffs or push-on style circuit board supports.

Mount the TMP-100 in a clean, dry location suitable for electronic circuit assemblies where it will not be subjected to extreme operating temperatures (below -20ºF or above +140ºF). The mounting location should ensure easy access to the terminal strip, divisor switches, and pulse duration adjustment. Figure 1 shows dimensions for mounting the TMP-100.

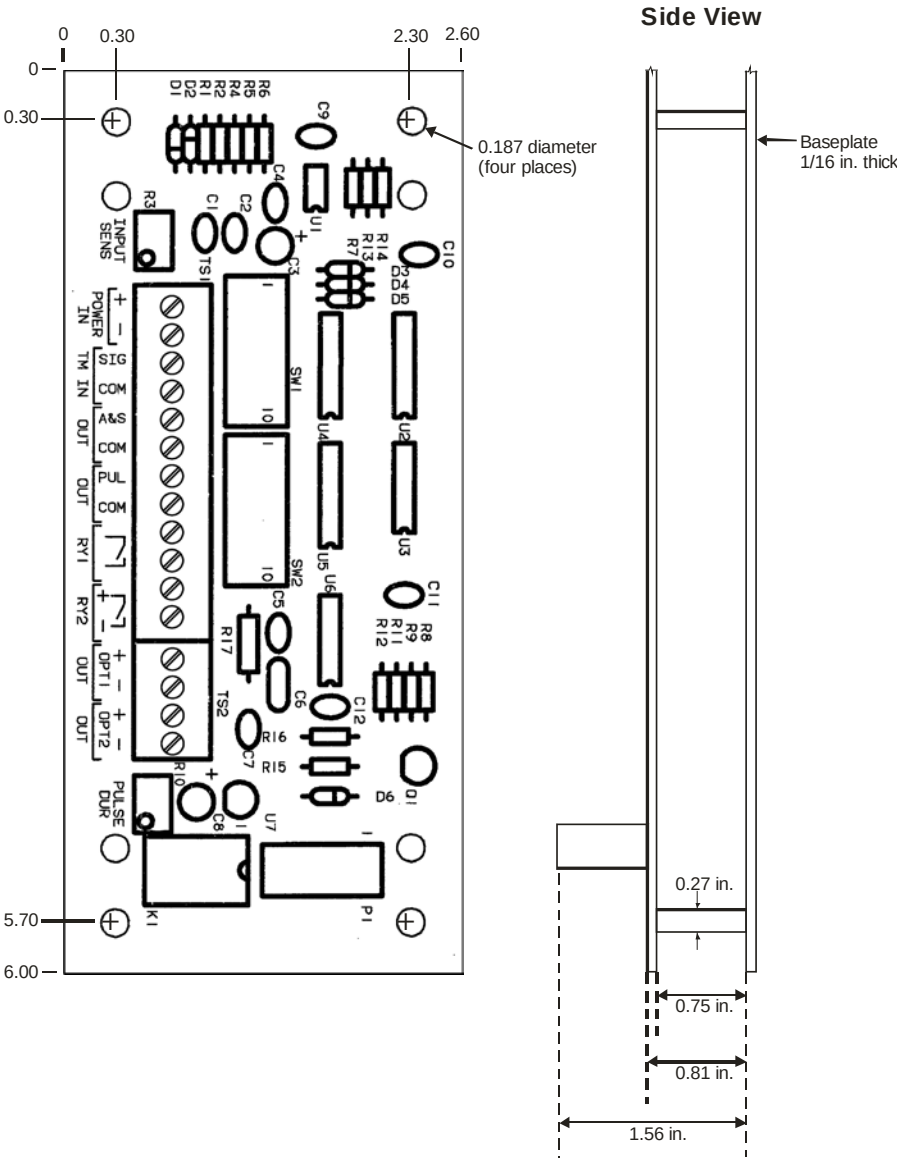


Figure 1—Mounting Dimensions

Wiring

All field wiring is attached to the instrument on the 16-position terminal strip near the edge of the circuit board (Figure 2).

The power requirement for the unit is 10 to 28 VDC.

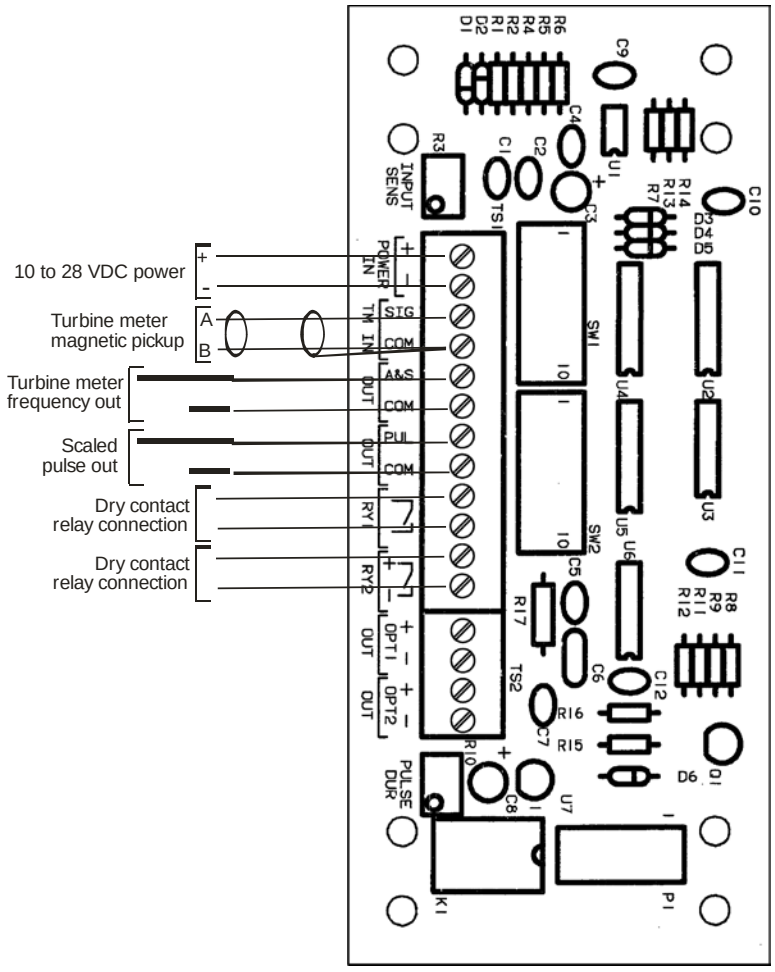


Figure 2— Field Wiring

To wire the instrument, perform the following steps:

1. Connect the DC power leads to the terminals labeled **POWER IN,** with the positive (+) lead connected to the plus terminal and the negative (-) lead connected to the minus terminal.

2. Connect the flowmeter signal cable to the terminals marked **TM IN**, with one lead connected to the **SIG** terminal and the common and shield lead connected to the **COM** terminal.

Installations requiring a turbine meter frequency output are labeled **A&S** and **COM**. These terminals provide a 0- to 5-V square-wave output, representing the turbine meter frequency. A load with a resistance 250K ohm or larger may be connected to these terminals. The shield wire must be connected to the **COM** terminal.

Installations requiring a scaled pulse output are connected to the **OUT** terminal labeled **PUL** and **COM**. A load with a resistance of 250K ohm or larger may be connected to these terminals. The shield wire must be connected to the **COM** terminal.

Relay Modules

Output connections labeled **RY1** and **RY2** are provided for two dry-contact pulse outputs from a two-pole relay. On TMP-100 circuits supplied with the single-pole relay, the output leads may be attached to either the RY1 or RY2 output connections. See the Specifications section for relay module ratings.

Opto-Isolated Module

The relay may be omitted and an opto-isolated module may be substituted for an open collector output at the **RY2** position. When the open collector module is used, **RY1** output is not connected. See the Specifications section for opto-isolated module ratings.

Option-Board Connections

OPT1 and **OPT2** connections are used only when an option board is connected to the option header. **OPT1** terminals are used for 4-20mA output representing rate when the TMR-100 option is installed. Further details on the use of **OPT1** and **OPT2** terminal strips are provided in the TMR-100 4-20mA optional circuit assembly manual.

Calibration

The calibration section of the TMP-100 functions as a scaler (turbine meter pulse divider) with a range of 1 to 524,287, which is set by 19 miniature switches. The input flowmeter signal is amplified and shaped, and then fed into a section where these switches divide it by a number set, or divisor. This 19 binary scaler gives one output pulse for each group of turbine meter pulses equal to the divisor. For example, if a divisor of 1,000 is set on the scaler switches, the output will be one pulse for every 1,000 turbine meter pulses.

Determining the Divisor

The divisor is determined by the flowmeter calibration factor and the conversion factor for the desired units of calibration.

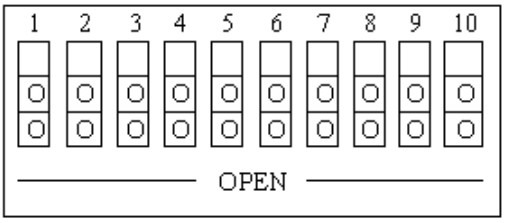
Example:
A customer has a 2-in. turbine meter with a calibration factor of 55.2 pulses per gallon. The desired unit of registration is barrels. The divisor is:

55.2 P/GAL × 42 GAL/BBL = 2,318.4 P/BBL = 2,318 P/BBL

The divisor was rounded to the nearest whole number because a fraction cannot be entered into the binary switches. The above calculated divisor will yield one pulse per barrel of flow through the 2-in. meter.

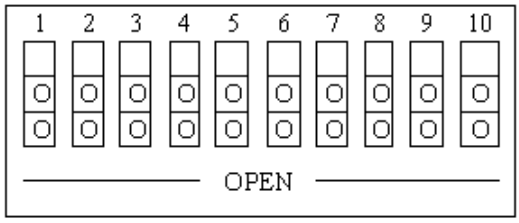
Figure 3 shows the locations and values associated with the 19 miniature switches used to set the divisor.

SW1



SWITCHES 1 - 10 (SW1)	
SW1 POSITION	DIVISOR VALUE
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128
9	256
10	512

SW2



SWITCHES 1 - 10 (SW2)	
SW2 POSITION	DIVISOR VALUE
1	1,024
2	2,048
3	4,096
4	8,192
5	16,384
6	32,768
7	65,536
8	131,072
9	262,144
10	PULSE DIR

Pulse Direction:
ON = Positive-Going Pulse
OFF = Negative-Going Pulse

Figure 3— Switch Locations for Divisor Setting and Pulse Direction

Switch SW1 positions 1 through 10 and switch SW2 positions 1 through 9 are used to select a divisor. Switch SW2, position 10, is used for pulse direction. This function is described in the Pulse Direction and Duration section.

Determining Switch Position

To determine which switches should be closed, perform the following steps:

1. Locate the largest binary number that is equal to or less than the required divisor.
2. Subtract that number from the divisor.
3. Locate the next largest binary number that is equal to or less than the remainder.
4. Subtract that number from the remainder.
5. Repeat the process until the remainder is zero. The sum of all binary numbers should equal the divisor.
6. Close the switches that correspond to the binary numbers selected.

Example: Determining Switch Position

For a divisor of 2,318

2318	desired divisor
- 2048	largest binary number equal to or less than divisor
270	remainder (1)
- 256	largest binary number equal to or less than remainder (1)
14	remainder (2)
- 8	largest binary number equal to or less than remainder (2)
6	remainder (3)
- 4	largest binary number equal to or less than remainder (3)
2	remainder (4)
- 2	binary number equal to remainder (4)
0	

The sum of the binary numbers is equal to the divisor:

2048 + 256 + 8 + 4 + 2 = 2318

Switch 2 on SW2 and switches 2, 3, 4, and 9 on SW1 should be closed. All other switches should be open.

Pulse Direction and Duration Adjustment

The pulse output direction is set by the **SW2** POS 10 switch. A positive-going pulse is selected by setting this switch to the up (ON) position. A negative-going pulse is selected by setting the switch in the down (OFF) position.

The pulse duration setting affects the “on” time of the pulse and is variable from 60 ms to 800 ms, depending on the setting of the pulse duration potentiometer **R10**. The unit is factory-set with the potentiometer turned counterclockwise for a pulse of approximately 60 ms.

Adjusting the pulse duration requires an oscilloscope, a power supply, and a signal generator.

To adjust the pulse duration, perform the following steps:

1. Connect the power supply to the **POWER IN** terminals as shown in Figure 2.
2. Connect the signal generator in place of the turbine meter on the **TM IN** terminals.
3. Set the amplitude of the generator at 100 mV and 1 KHz.
4. Set **SW2** POS 3 to the "on" position. All other dip switches should be set at "off." This setting will select 1 pulse out approximately every 4 seconds.
5. Connect the oscilloscope to the **PULSE OUT** terminals with a vertical setting of 1 volt per division.
6. Set the horizontal sweep setting for 3 or 4 divisions equal to the desired pulse duration.
7. Adjust the pulse duration control **R10** for the desired pulse width on the scope.

   The pulse duration adjustment affects both pulse-out and relay-on durations.

Important—The TMP-100 may be factory-modified for pulse durations of 500 microseconds to 60 milliseconds. Pulse duration should be specified at the time of order. Modification fees may apply.

Input Signal Sensitivity Adjustment

The TMP-100's sensitivity is factory-set at 20mV.

To change the input sensitivity, perform the following steps:

1. Connect the test equipment as described in steps 1 through 4 of the pulse duration adjustment procedure.
2. Connect the oscilloscope to the **A&S** output terminals.
3. Set the amplitude of the signal generator to the desired trigger level.
4. Turn input sensitivity control **R3** counterclockwise until the signal disappears from the oscilloscope screen.
5. Slowly turn **R3** clockwise just until the square wave signal appears on the screen.

Ordering Information

Circuit Assemblies

Part No.	Description
9A-100005170	TMP-100 with two-pole relay and circuit board supports
9A-100079944	TMP-100 with single-pole relay and circuit board supports
9A-100079897	TMP-100 with opto-isolated module and circuit board supports

Circuit Board Option

Part No.	Description
9A-100005167	Rate option - 4-20 mA analog output representing flow rate (specify flowmeter size or full scale frequency when ordering)

Recommended Spare Parts

(Select one, depending on output application in use)

Part No.	Description
9A-100036003	Relay – two-pole - 5 VDC
9A-100034876	Relay – single-pole - 5 VDC
9A-100005154	Module - opto-isolated

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