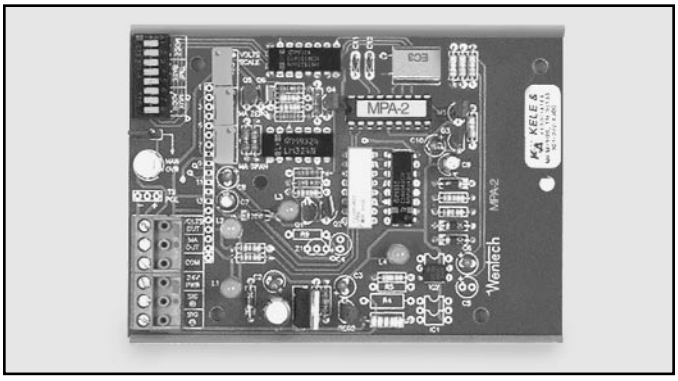
METER PULSE TO ANALOG TRANSDUCER

MPA-2

DESCRIPTION

The **MPA-2** Meter Pulse to Analog transducer accepts kWh totalizer pulses from a utility meter and calculates the demand using a 5 minute, 15 minute or 30 minute "sliding window" averaging scheme. The average kW demand value is output as a milliamp or voltage signal which can be read by a building automation system. The average kW demand can also be displayed using a panel meter indicator such as the **LPI-1B** or **LPI-2**.



FEATURES

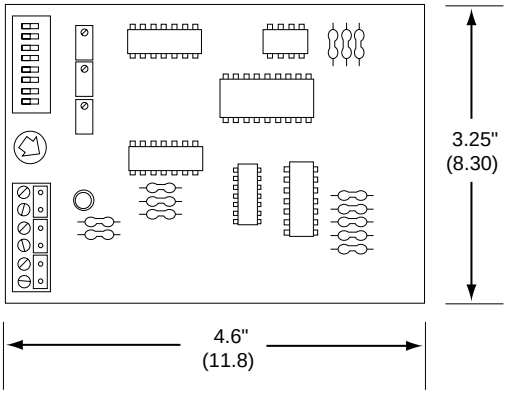
- ***Converts kWh pulses to an analog kW signal***
- ***Both milliamp and volts DC signals available***
- ***5, 15, 30 minute sliding window selection***
- ***24 VAC or 24 VDC power***
- ***Adjustable zero and span***
- ***Snap track mounted***

OPERATION

The **MPA-2** accumulates all the input pulses for the previous sliding window time period. (ex. 15 min.) It calculates an average kW value over this time period and outputs an analog signal representing this kW. The sliding window pulse count is updated on one second intervals with the input from the oldest interval constantly being replaced by the input pulses from the most recent interval.

DIMENSIONS

in
(cm)



SPECIFICATIONS

Power supply	24 VAC ±10% @ 120 mA max 24 VDC ±10% @ 50 mA max
Input signal	24 VAC or 24 VDC switched through electronic or mechanical contact closure. Input current 15 mA non-inductive at 24V. Maximum pulse rate is 10 pulses/second.
Output signal	4-20 mA factory set, adjustable 0-20 mA zero & span. 2-10 VDC factory set, adjustable 0-18 VDC, (See calibration instructions for details) **NOTE: Both outputs can be used simultaneously.**
Output Impedance	Max output resistance 650 ohms for mA output. Maximum current available from voltage and current outputs combined is 25 mA.
User options	Sliding window size is DIP switch selectable for 5, 15, or 30 minute periods. kWh pulses to produce full-scale output are DIP switch selectable from 10 pulses per period to 18000 pulses per period.
Indicators	Green "status" LED Steady green = normal Slow flashing green = "cal" mode Fast flashing green = kW demand overflow Red "signal" LED is on to indicate contact closure on the utility meter kWh contacts. LED is off when contacts open.
Mounting	3.25" snap-track (supplied with unit)

SET-UP PROCEDURE

To set-up the **MPA-2** for the proper settings, the pulse rate (kWh per pulse) from the meter, maximum kW and the sliding window size must be determined. The pulse rate information can be obtained from the meter face-plate, meter manufacturer or the local utility. The maximum kW is calculated using one of the procedures in step one below. **NOTE: The sliding window size should be selected to match either the utility's window or the window size recommended by the controls manufacturer.**

1. Calculate the maximum kW using the formulas in Formula A or by adding up all the individual kW ratings of the loads to be monitored, or reviewing utility bills.
2. Verify the kWh per pulse being generated by the pulse meter.
3. Select one of the three sliding window sizes:5,15, or 30 minute period from Table 1.
4. Determine the maximum pulses for the window period selected using Formula B. Check Table 1 again to make sure max pulses will fit in selected window size.
5. Using information in Table 2, round up calculated max pulses (from step 4) to a programmable value. Programmable value is set on switches as (significant digits x multiplier).
6. Set the maximum pulse count and window period for the **MPA-2** using the 8 position DIP switch on the top left hand side of the board. Switches 4 through 8 set the significant digits for the maximum pulse count. Switches 1 through 3 set the window period and the multiplier for the significant digits value selected on switches 4 through 8.
7. Calculate the maximum kW demand that the maximum signal output represents on the **MPA-2** using formula "C". This value should be entered into the controller as the maximum kW value the **MPA-2** will produce.

The Formulas:

Formula A: Maximum kW calculations: Single phase: $\frac{E \times I}{1000}$ Three phase: $\frac{E \times I \times 1.73}{1000}$

Formula B: Maximum pulses per window period = $\frac{\text{max kW x window period in minutes / 60}}{\text{kWh per pulse}}$

Formula C: Maximum kW demand = (kWh per pulse x programmed max pulses) x $\frac{60}{\text{window period}}$

NOTE: If the actual kWh count ever exceeds the full-scale count programmed on the DIP switches, the green status LED will flash rapidly to indicate kW demand overflow. The flashing light can be cleared by moving any switch on the DIP switches from one position to another.

Once the maximum kW demand output by the **MPA-2** has been calculated, the actual average kW demand can be calculated using the following formulas:

Formula D: Actual average demand for 4-20 mA output = $\frac{(\text{mA output} - 4)}{16}$ x max kW demand*

Formula E: Actual average demand for 2-10 VDC output = $\frac{(\text{VDC output} - 2)}{8}$ x max kW demand*

* max kW from formula C

Example: MPA-2 Set-up

The distribution system to be monitored is a 480 volt, 3 phase system with 1200 amps maximum load. The meter is generating a pulse output of 0.48 kWh per pulse.

Step 1 – Select a five minute window

Step 2 – Max kW is = $\frac{(480 \times 1200 \times 1.73)}{1000}$ = 996.48 kW

Step 3 – Maximum pulses per five minute period are: $\frac{(996.48 \times 5 / 60)}{0.48} = \frac{83.04}{0.48}$ = 173 pulses

Step 4 – The maximum pulse rate selected for the **MPA-2**: 180 (Significant digit is 18 with a 10 multiplier)

Step 5 – The maximum kW demand for the **MPA-2**: (0.48 x 180) x $\frac{60}{5}$ = 1036.80 kW

Calculating actual demand assuming 12 mA or 6 VDC output on **MPA-2**:

For milliamp conversion:

$kW_{AVG} = \frac{(12 - 4)}{16}$ x 1036.80 = 518.40 kW

For VDC conversion:

$kW_{AVG} = \frac{(6 - 2)}{8}$ x 1036.80 = 518.40 kW

TABLE 1 WINDOW PERIOD SELECTION FOR MPA-2

The following are the maximum pulse rates for each window period:

5 minute window period …3000 pulses max
15 minute window period …9000 pulses max
30 minute window period ..18000 pulses max

TABLE 2 kW DEMAND CALCULATOR

The period size and digit multiplier to use are specified using DIP switches 1, 2, and 3 as follows:

PERIOD	DIGIT MULTIPLIER	SW1	SW2	SW3
5 MIN	x 10	OFF	OFF	OFF
5 MIN	x 100	OFF	OFF	ON
15 MIN	x 10	OFF	ON	OFF
15 MIN	x 100	OFF	ON	ON
15 MIN	x 1000	ON	OFF	OFF
30 MIN	x 10	ON	OFF	ON
30 MIN	x 100	ON	ON	OFF
30 MIN	x 1000	ON	ON	ON

Rounding up max calculated pulses to get a programmable value:

1) If max pulses are 0 to 310, round to the nearest 10's.

2) If max pulses are 311 to 3100, round up to the nearest 100's.

3) If max pulses are >3100, round up to the nearest 1000's

The significant digits for the maximum counts are selected using DIP switches 4, 5, 6, 7, and 8 as follows:

SIGNIFICANT DIGITS	SW4	SW5	SW6	SW7	SW8
1	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	ON	ON
4	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	ON	OFF	ON
6	OFF	OFF	ON	ON	OFF
7	OFF	OFF	ON	ON	ON
8	OFF	ON	OFF	OFF	OFF
9	OFF	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON	OFF
11	OFF	ON	OFF	ON	ON
12	OFF	ON	ON	OFF	OFF
13	OFF	ON	ON	OFF	ON
14	OFF	ON	ON	ON	OFF
15	OFF	ON	ON	ON	ON
16	ON	OFF	OFF	OFF	OFF
17	ON	OFF	OFF	OFF	ON
18	ON	OFF	OFF	ON	OFF
19	ON	OFF	OFF	ON	ON
20	ON	OFF	ON	OFF	OFF
21	ON	OFF	ON	OFF	ON
22	ON	OFF	ON	ON	OFF
23	ON	OFF	ON	ON	ON
24	ON	ON	OFF	OFF	OFF
25	ON	ON	OFF	OFF	ON
26	ON	ON	OFF	ON	OFF
27	ON	ON	OFF	ON	ON
28	ON	ON	ON	OFF	OFF
29	ON	ON	ON	OFF	ON
30	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON

ZERO AND SPAN CALIBRATION INSTRUCTIONS

- **ADJUSTING THE MILLIAMP OUTPUT**
  (Factory set at 4-20 mA)
  Set the DIP switch to 11111101 – this sets the mA output to the minimum setting – factory set to 4 mA. The minimum can then be adjusted using the ZERO pot.

  Set the DIP switch to 11111110 – this sets the mA output to the maximum setting – factory set for 20 mA. The maximum can then be adjusted using the SPAN pot.

- **ADJUSTING THE VOLTAGE OUTPUT**
  (Factory set at 2-10 VDC)

1. Determine minimum and maximum voltage output required (0-18 total range).
2. Using the following formula, determine the minimum mA output:
   minimum mA output = 20 mA x $\frac{\text{desired minimum volts}}{\text{desired maximum volts}}$
3. Set the DIP switch to 11111101 – this sets the mA output to the minimum setting - factory set to 4 mA. The minimum can then be adjusted using the ZERO potentiometer
4. With multimeter connected to mA output, set MA ZERO potentiometer at calculated minimum mA output (from formula in step 2).
5. Set the DIP switch to 11111110 – this sets the mA output to the maximum setting – factory set for 20 mA. The maximum can then be adjusted using the SPAN potentiometer.
6. Set mA span potentiometer at 20 mA.
7. With multimeter connected to voltage output, set the VOLT ADJ potentiometer to your desired maximum voltage. The minimum voltage is automatically set according to the ratio of maximum-to-minimum mA output.

NOTE: Whenever either of the two “cal” codes are set on the DIP switch the green status LED blinks slowly to show the unit is in the “cal” mode.

NOTE: When any DIP switch is changed, the MPA-2 will do a complete restart of the kW calculations (the kW is set to zero and the analog output goes to its minimum value).

WIRING

The power for the kWh pulse can be from the power source used to power the **MPA-2** or from a separate power source. Make connections according to one of the three wiring diagrams below.

Fig. 1 Pulse input powered from the same supply as **MPA-2**, positive leg switched.

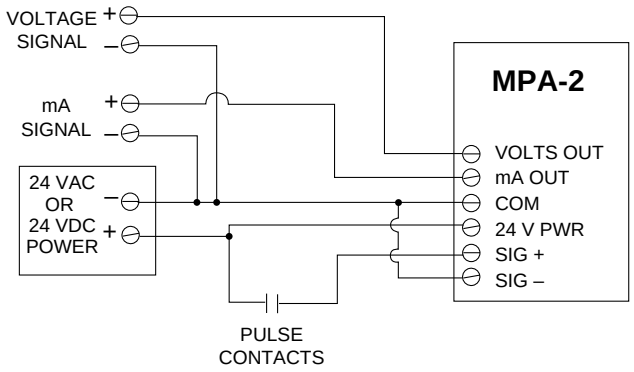


Fig. 2 Pulse input powered from same supply as **MPA-2**, negative leg switched

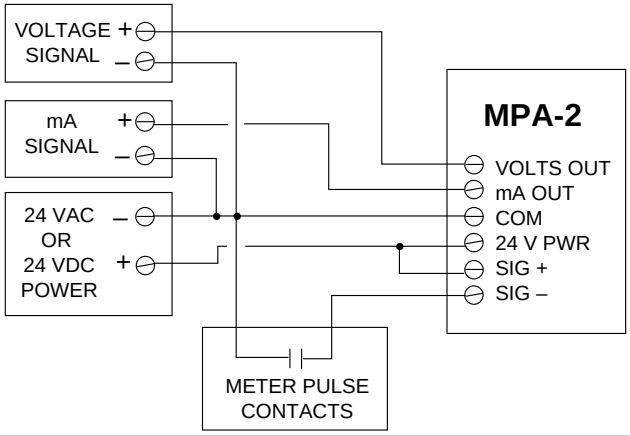
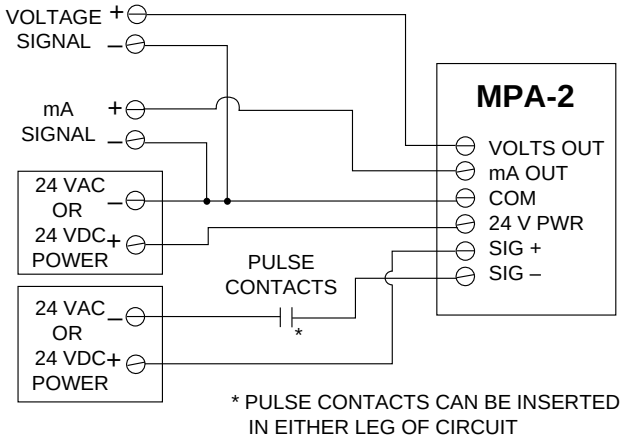


Fig. 3 Pulse Input powered from separate supply



ORDERING INFORMATION

MPA-2	**METER PULSE TO ANALOG TRANSDUCER**