

0 TO 20mA RECEIVER USING RCV420

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Many industrial current-loop applications call for conversion of a 0 to 20mA input current into 0 to 5V output. The RCV420 is intended primarily as a complete solution for precise 4 to 20mA to 0 to 5V conversion. But, with the addition of one or two external 1% resistors, the RCV420 can also accurately convert a 0 to 20mA input into a 0 to 5V output.

The recommended hook-up for 0-20mA/0-5V conversion is shown in Figure 1. To reduce the gain from 5V/16mA to 5V/20mA, the internal 75Ω sense resistor is paralleled with a 301Ω, 1% external resistor connected between pins 1 and 2. Even though the external paralleling resistor has a 1% tolerance, the worst-case gain error of the current-to-voltage conversion will be only 0.5%. This is because the parallel combination of an external 301Ω resistor and the internal 75Ω resistor is dominated by the internal resistor.

A tighter tolerance on the external paralleling resistor would not significantly improve the gain accuracy. This is because the internal 75Ω sense resistor also has a tolerance of 1%.

The high gain accuracy of the RCV420 transfer function comes from a fine laser trim of the internal amplifier's gain which compensates for any error in the 75Ω internal sense resistor. So even if the sense resistor were replaced by a resistor of exact value, the gain error could be as much as 1%.

For best common-mode rejection performance, a second 301Ω external resistor should be connected between pins 2 and 3 in parallel with the other internal 75Ω sense resistor. Without it, 86dB CMR would be degraded to about 80dB. If high CMR is not needed, the second resistor shown can be omitted.

To eliminate the offset, used for 4-20mA/0-5V conversion, the "Ref In" (pin 12) must be connected to ground instead of to the 10V reference. The "Ref Out" and "Ref Feedback" (pins 10 and 11) should still be connected together to prevent the reference circuitry from locking-up. Even though the 10.0V reference is not used for span offsetting, it is a precision reference which may be useful for other circuitry.

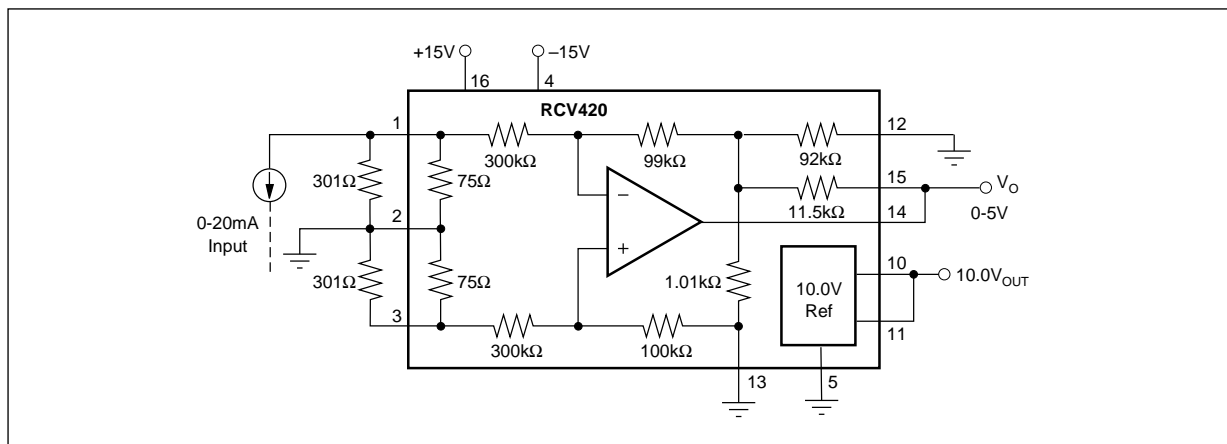


FIGURE 1. 0-20mA/0-5V Receiver Using RCV420.

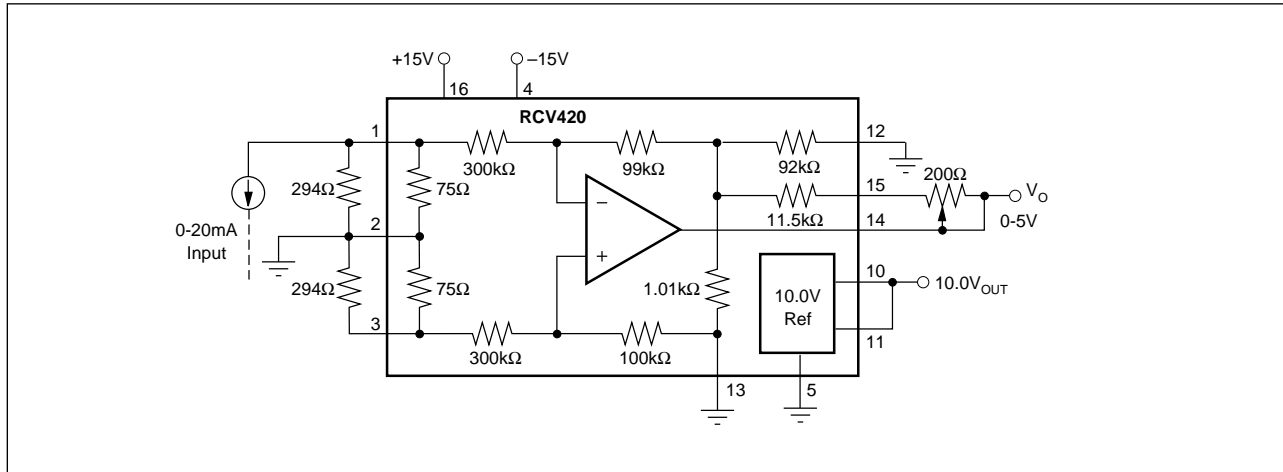


FIGURE 2. Gain Trimmable 0-20mA/0-5V Receiver Using RCV420.

If better gain accuracy is required, use the gain trim circuit shown in Figure 2. This circuit uses a slightly lower value external resistor in parallel with the internal 75Ω sense resistor and a potentiometer in the feedback for fine trim of gain. Because of its small value, and the action of the “T” network feedback arrangement, the effect of the gain adjust pot on CMR is negligible.

Of course, any mix of input/output polarity can be obtained by connecting the current source input to either pin 1 or 3.

| INPUT CURRENT | OUTPUT VOLTAGE | INPUT CONNECTION |
|---------------|----------------|------------------|
| 0 to 20mA | 0 to 5V | Pin 1 |
| 0 to -20mA | 0 to -5V | Pin 1 |
| 0 to 20mA | 0 to -5V | Pin 3 |
| 0 to -20mA | 0 to 5V | Pin 3 |

Gain-reduction paralleling-resistors for selected gains are shown in the table below.

| INPUT RANGE | OUTPUT RANGE | PARALLELING-RESISTOR |
|-------------|--------------|----------------------|
| 0 to 20mA | 0 to 5V | 301Ω |
| 0 to 50mA | 0 to 5V | 35.7Ω |

In general, to determine the value of the external paralleling-resistor:

$$R_{EXT} = \frac{75\Omega}{\frac{I_{IN}}{16mA} - 1}$$

Where:

R_{EXT} = External paralleling resistor (Ω)

I_{IN} = Input current range (mA)

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