Using AM400 with single ended input signal

The current application shows how the AM400 can be used for single ended input signals (20 pin version is used).

Short description of the application:

> The entire input signal is 0...1V and shall be converted into an output signal of 0 to 10V and 4 to 20mA. The instrumentation amplifier and the additional current source are not used in the application, although these functional blocks are available. For that reason the connection to these two blocks are only done to put the amplifiers in a defined operating point. The nature of a voltage output results in a 3(4)-wire application.

In 3-wire operation (current loop) pin 13 (*VCC*) has to be connected with pin 14 (*RS+*), and IC ground pin 18 (*GND*) has to be connected with *Ground*.

For the output voltage is valid ($G_{GAIN} = 1 + R_1/R_2$)

$$V_{OUT} = V_{IN} G_{OP} G_{GAIN} = 1\text{V} \cdot 2.2 \cdot G_{GAIN} = 10\text{V} \quad \Rightarrow \quad G_{GAIN} \approx 4.55$$

For the output current in a 4–20mA application is valid

$$I_{OUT} = V_{IN} \frac{G_{GAIN}}{8R_0} + I_{SET} = 1\text{V} \frac{4.55}{8R_0} + 4\text{mA} = 20\text{mA} \quad \Rightarrow \quad R_0 \approx 35\Omega$$

with the output offset current

$$I_{SET}(V_{IN} = 0) = \frac{V_{REF}}{2R_0} \cdot \frac{R_4}{R_3 + R_4} = \frac{5\text{V}}{35\Omega} \cdot \frac{R_4}{R_3 + R_4} = 4\text{mA} \quad \Rightarrow \quad \frac{R_3}{R_4} \approx 34.7$$

Example: Output current range 4...20mA, output voltage range 0...10V
With $V_{IN} = 0...1\text{V}$ the following values for the external components are valid:

> $C_1 = 2.2\mu\text{F}$
> $R_L = 0...600\Omega$
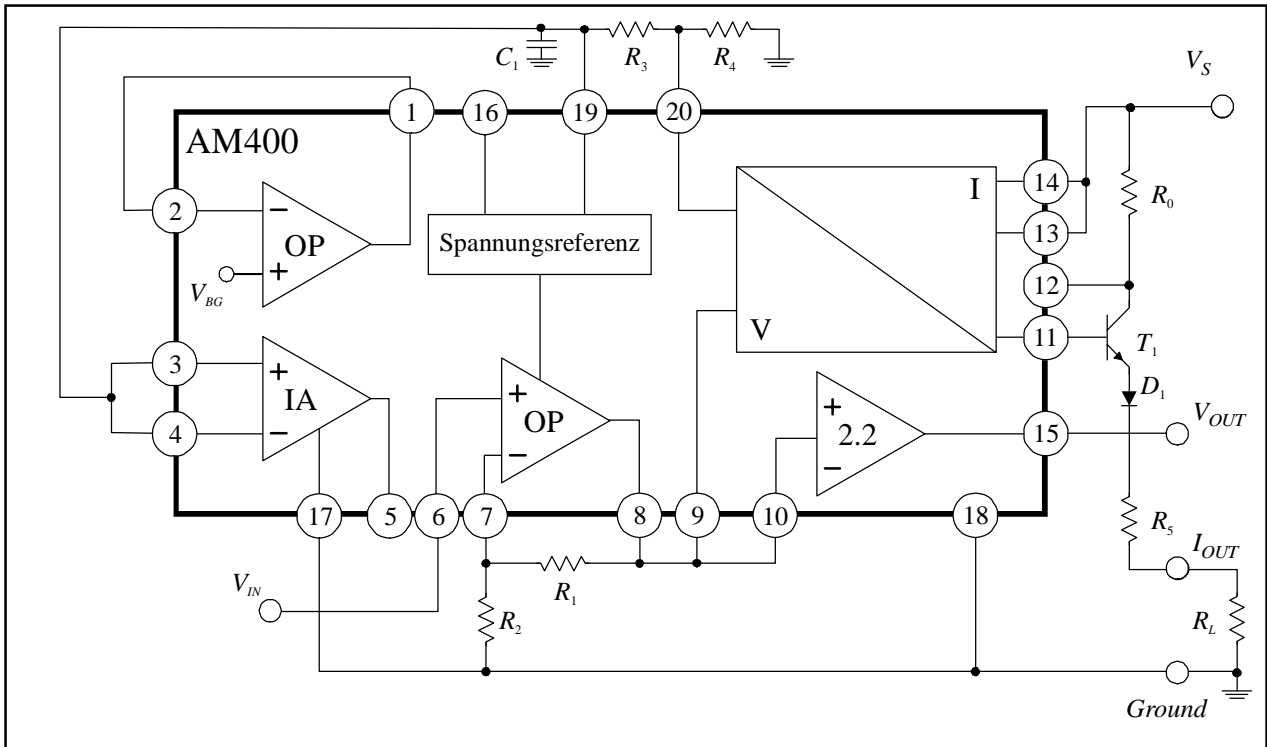> $R_5 = 39\Omega$
> $R_0 \approx 35\Omega$
> $R_1/R_2 = 3.55$
> $R_3/R_4 = 34.7$

Application Note AM400

Figure: Application circuit