EMERSON.
Industrial Automation

Driving Analog Meters

### This document pertains to all current Control Techniques Drives

The analog outputs on our drives provide a nominal 10Vdc and can drive loads of approximately 5-10mA. Most commonly, panel meters require 50mV or 100mV to cause FS (full scale)deflection. Some meters will indicate FS = 1mA or 100uA . In any case, one must know at least one of these meter properties in order to interface properly.

The analog outputs on our drives have output scaling multipliers that can attenuate the output signal from 10v. However, a reduction to 50 or 100mV would render the output resolution virtually useless. The better solution would be to put a dropping resistor in series with the meter. In this manner, you could use the full 10Vdc range of the analog output and maintain good resolution.

The basic circuit is shown on the following page.

Drive Analog
Output +/- 10 VDC

Series resistor

**+**

Panel Meter

-

Drive Common 0V
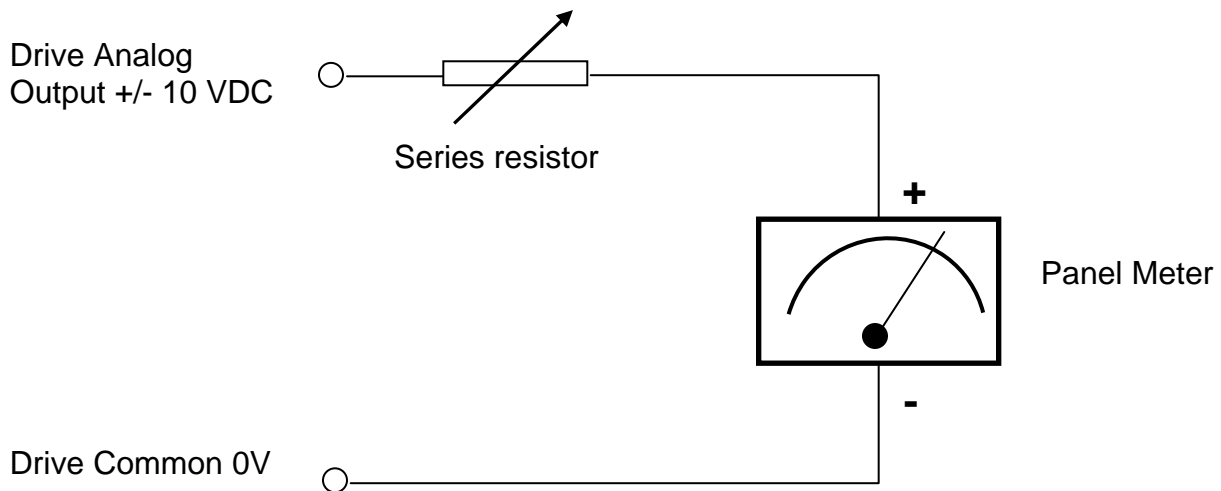
A series resistor must be inserted between the drive and either terminal on the meter.   Ideally this resistor would be a miniature potentiometer that would allow you to trim the meter full scale deflection.   Typically, this FS calibration is accomplished with a PC board that is mounted to the rear of the meter.   However, with our drives, it would be possible to simply insert a fixed resistor with a value that would cause slightly greater than FS deflection, then use the analog output scaling parameter to trim to FS on the meter.

Default source
2.01 Motor speed

0.00

21.51

Scaling

07.20 : 1.000

B1
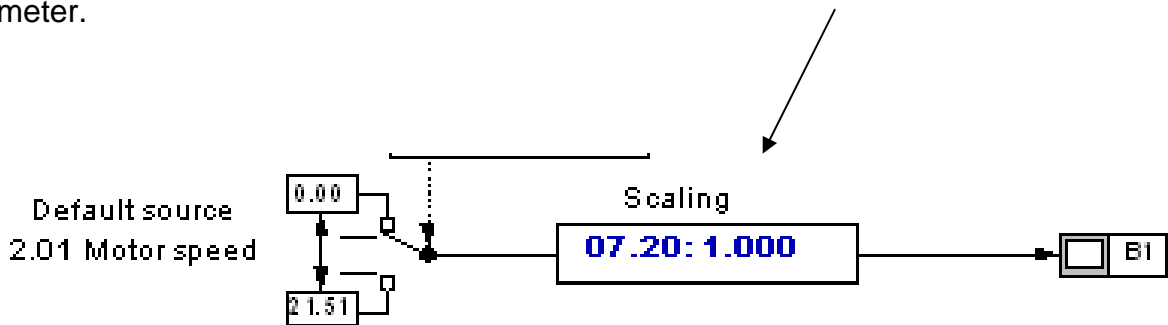
Example 1

In this example, we want to interface to a meter with a FS deflection of 50mV indicated on the meter nameplate. To determine the value of the series resistor you could measure the input resistance of the meter you are going to install. In the example below the meter resistance was 11 Ohms.

11 Ohms internal
resistance

97025
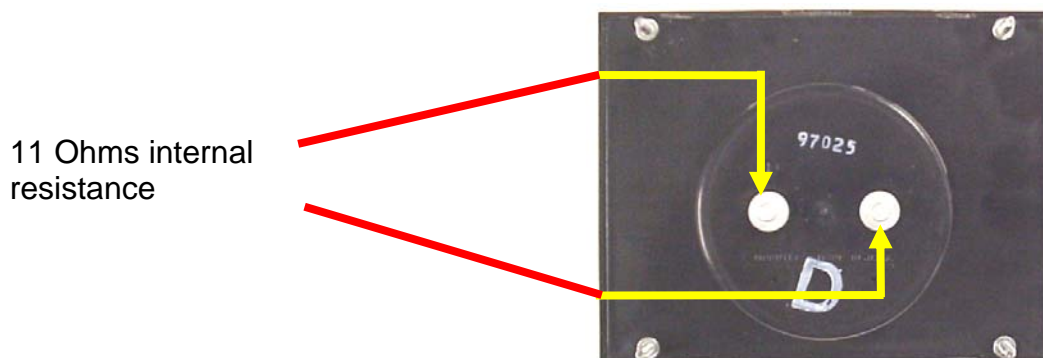
The value for a series resistor can be found using Kirchoff's voltage divider laws.

Perform this calculation to determine the series resistor value:

$$R_{series} = \frac{(R_{meter} \times V_{outmax} \times 1000) - (R_{meter} * Meter_{mV})}{Meter_{mV}}$$

$$= \frac{(11 \times 10v \times 1000) - (11 * 50)}{50}$$

$$R_{series} = 2189 \text{ ohms}$$

A close enough approximation would be:

$$R_{series} = \frac{(R_{meter} \times V_{outmax} \times 1000)}{Meter_{mV}} = \frac{11 \times 10 \times 1000}{50} = 2200 \text{ ohms}$$

In order for us to be able to use the Analog Output scaler, we would select a resistor value of 2K ohms (about 5-10% less than the calculated value).

To test and perform the full scale calibration we could set up our analog output to create a full output.   Below illustrates the setup for a Commander SK.

First you would set terminal B1 source temporarily to be #7.31. If we set #7.31= 100% the analog output would at its' max – nominally 10v. (Reset required !) The drive should not be running during this calibration.
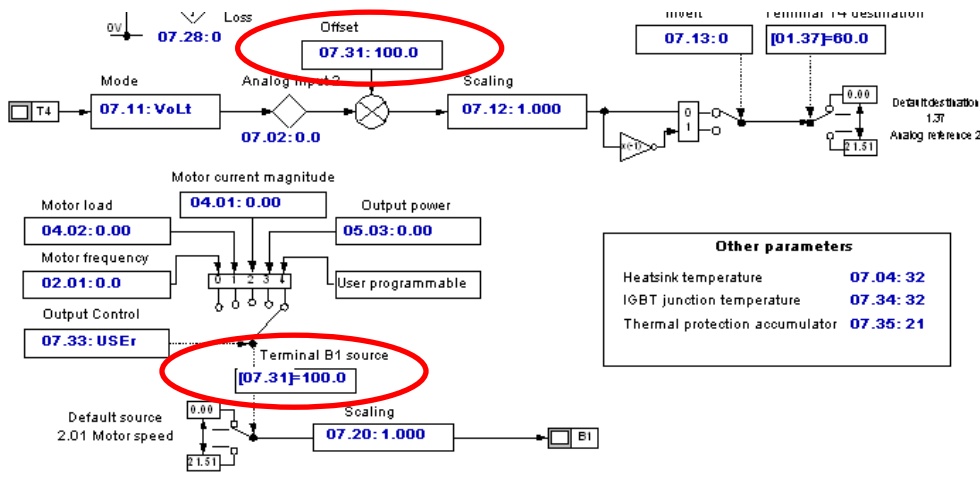
This resulted in the meter being slightly greater than full scale. This was corrected by utilizing the output scaling parameter. When the scaling parameter was decreased from 1.000 to 0.960, the voltage on the panel meter was reading full scale.
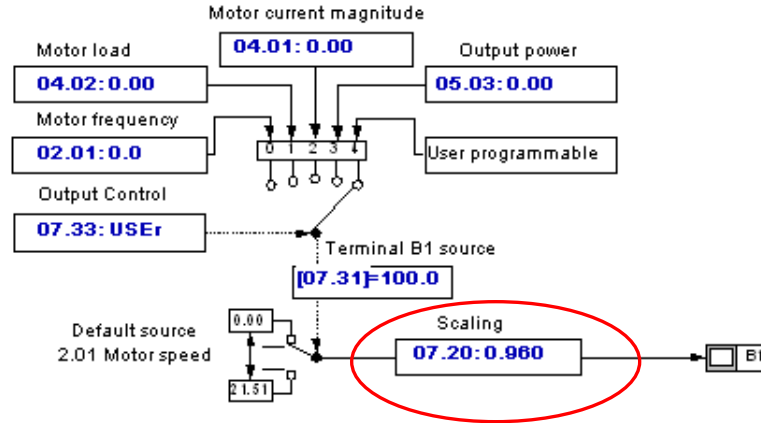
Example 2

In this example, we want to interface to a meter that is specified as FS= 1mA. In this case, the series dropping resistor is simply:

$$R_{series} = \frac{V_{outmax}}{Meter_{ma}} = \text{in K ohms}$$

$$= \frac{10v}{1mA} = 10K$$

Example 3

In this example, we want to interface to a meter that is specified as FS= 100uA. In this case, the series dropping resistor is simply:

$$R_{series} = \frac{V_{outmax}}{Meter_{ua}} = \text{in Meg ohms}$$

$$= \frac{10v}{100uA} = 0.1 \text{ Meg ohms or 100K}$$

When using the analog outputs one must be cognizant of the loading on these analog channels.

Some specifications for the analog outputs are listed below:

Drive Family	Analog Output	Output Drive	# of Outputs
Commander SE	0 to 10Vdc	5mA	1
Unidrive Classic	+/- 10Vdc	5mA	2
UnidriveSP	+/- 10Vdc	20mA	2
Mentor II	+/- 10Vdc	5mA	3
Quantum III	+/- 10Vdc	5mA	3
Affinity	+/- 10Vdc	20mA	2
Commander SK	0 to 10Vdc	5mA	1
Mentor /Quantum MP	+/- 10Vdc	20mA	2

Other applicable Application Notes

Application Note #	Drive Family	Topic
CTAN 188	Quantum III/ Mentor II	%Load Meter Outputs
CTAN 212	Quantum III/ Mentor II	Creating UniPolar %Speed Meter Output
CTAN 326	UndriveSP, GP20, Affinity	Analog Output Scaling of Common Values
CTAN 331	Unidrive SP, Unidrive Classic, Mentor/Quantum MP	Creating a UniPolar Analog Speed Output

The screenshots in this App Note are taken from CTSoft
which is free from our website.

**CTSoft is a complimentary software tool free for your use
with Control Techniques Drives.**

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Free

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