This Application Note is pertinent to the Unidrive SP,
Commander SK, GP20 and Affinity Families

Creating a % Speed Readout Register

Background

All of our AC drives have an Output Frequency and Motor RPM register but sometimes customers
wish to have a readout of the motor speed in percent. % Speed is often more meaningful to an
Operator than an absolute motor rpm number. For example, 1965rpm might be 100% machine
speed. It is harder for one to realize that if the motor is running around 490rpm that this is actually
25% or ¼ machine speed. In another case, 1610rpm may be full machine speed on one machine
while 2100rpm may be full machine speed on another machine- whereas 100% means full speed
on both machines.   For these reasons, a percent is easier to understand and is not dependent on
the actual details of the scaling units from machine to machine.

This application note will outline how to create a % Speed register that would be available for an
HMI or SCADA system readout.

Implementation
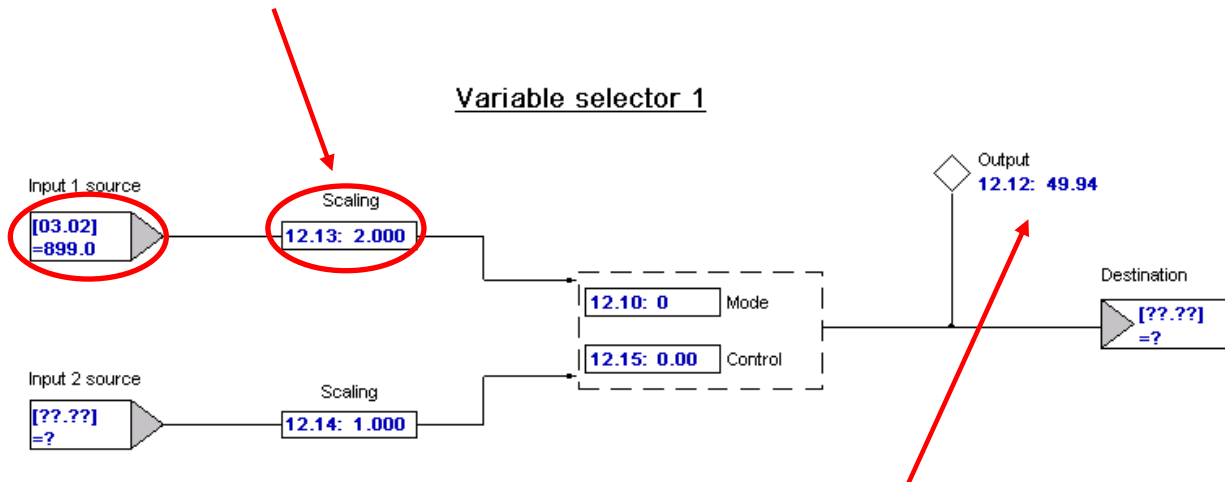
For Open Loop applications

For Open Loop applications where the output frequency basically determines the motor speed,
what we will be doing is referring to the Output Frequency register (which is parameter #5.01) and
using the drives automatic scaling feature to perform the conversion.

To accomplish this we could use a Variable Selector in Menu 12 as shown below: In this
example, the drive Max Frequency is set for 80Hz and the motor is running at 80Hz.   Parameter
#5.01 is set into #12.08.   The % Speed can be read at #12.12.

Parameter #12.12 will then
become 0-100%
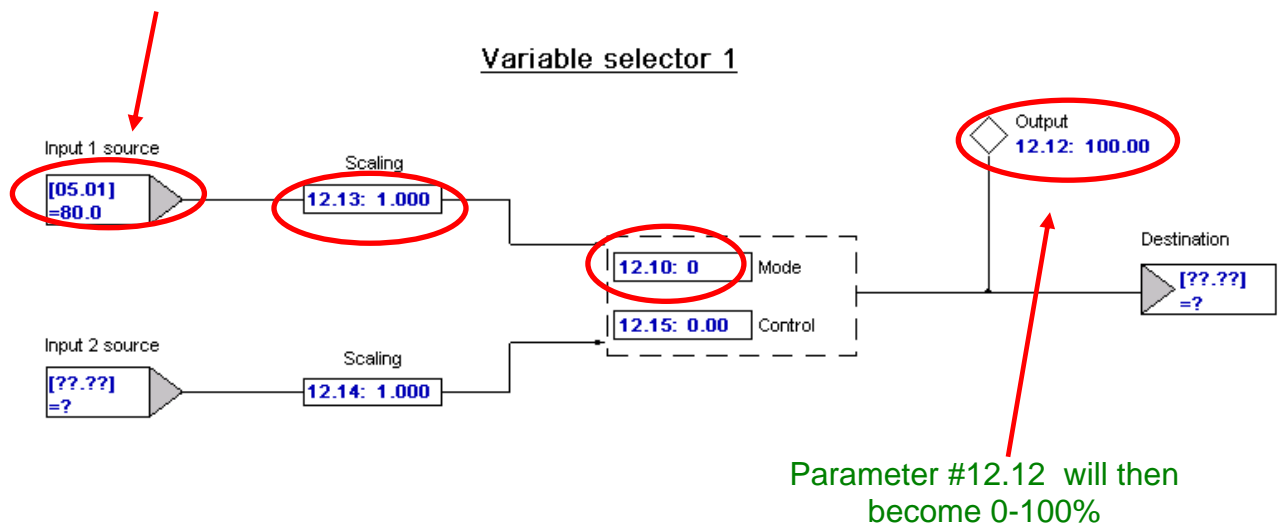
For Closed Loop applications- for Unidrive SP

For Closed Loop applications where the output speed is in rpm, what we will be doing is referring to the motor speed register (which is parameter #3.02) and using the drives automatic scaling feature to perform the conversion. The only thing is that in closed loop the automatic scaling requires a scale factor of 2.

Variable selector 1

Input 1 source
[03.02]
=899.0

Scaling
12.13: 2.000

12.10: 0   Mode

12.15: 0.00   Control

Output
12.12: 49.94

Destination
[??.??]
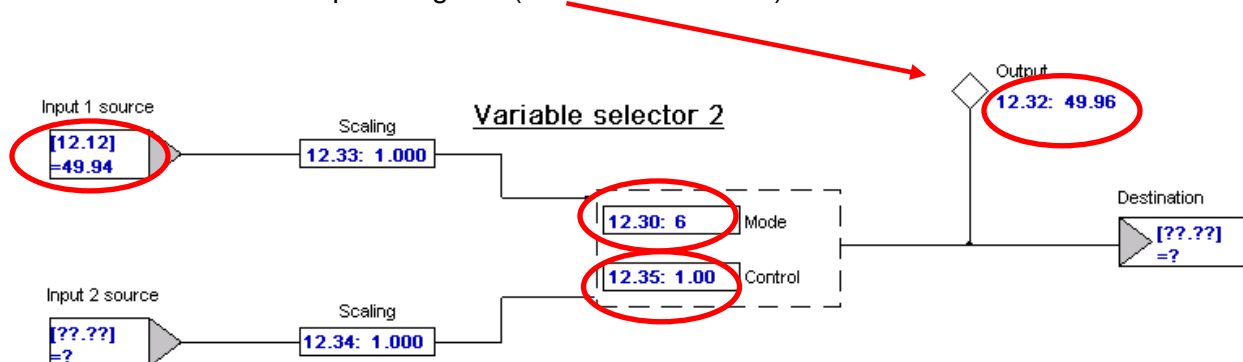=?

Input 2 source
[??.??]
=?

Scaling
12.14: 1.000

Shown above is a screenshot of an 1800rpm motor running at ½ rated speed or 900rpm. We can see 49.94% appear in the output of the Variable selector. The only problem is that this display could be a bit annoying as it will be flickering at a very high rate as #3.02 is updated. This could make the %Speed display readout un- usable. However, we could run this thru a Low Pass Filter to take the jitter out the signal and make it much more readable.

Running thru a Filter

It turns out that the built-in Variable Selectors can also be used to Filter a signal. This is accomplish by setting the mode to 6. When set as such, the Variable selector control is used to set the Time Constant of the filter. A reasonable value for general filtering of a display might be 0.5 sec to 2 sec.

Variable selector modes		12.30: 0
	Action	Result
0	Select Input1	Input1
1	Select Input2	Input2
2	Add	Input1 + Input2
3	Subtract	Input1 – Input2
4	Multiply	(Input1 x Input2) / 100
5	Divide	(Input1 x 100) / Input2
6	Time constant	Input1 / (12.35s + 1)
7	Linear ramp	Input1 via Ramp
8	Modulus		Input1	
9	Raise to power	Input1 ^ 12.35

Variable selector control
12.35: 0.00

To finalize this setup we would pick up the rapidly changing % Speed register #12.12, setup for filtering (Mode =6) and set the Time Constant. The filtered %Speed register (#12.32 in this case) should be much more readable.

Variable selector 2

Input 1 source
[12.12]
=49.94

Scaling
12.33: 1.000

12.30: 6   Mode

12.35: 1.00   Control

Output
12.32: 49.96

Destination
[??.??]
=?

Input 2 source
[??.??]
=?

Scaling
12.34: 1.000

Summary

If one gives this a little more thought, we would realize that we could perform the same action but use only 1 of the Variable Selectors. Since the Variable Selectors automatically perform the conversion to percent, we can merely Filter the target quantity. Therefore :

For Open Loop applications

For Open Loop applications where the output frequency basically determines the motor speed, what we will be doing is referring to the Output Frequency register (which is parameter #5.01) and using the drives automatic scaling feature to perform the conversion to percent. But in addition, we can set the mode of the Variable Selector to 6 to allow us to Filter the result to remove jitter.

To accomplish this we could use a Variable Selector #1 in Menu 12 as shown below: In this example, the drive Max Frequency is set for 80Hz and the motor is running at 80Hz.   Parameter #5.01 is set into #12.08.   The Filtered % Speed can be read at #12.12. The Filtering amount is set into #12.15.
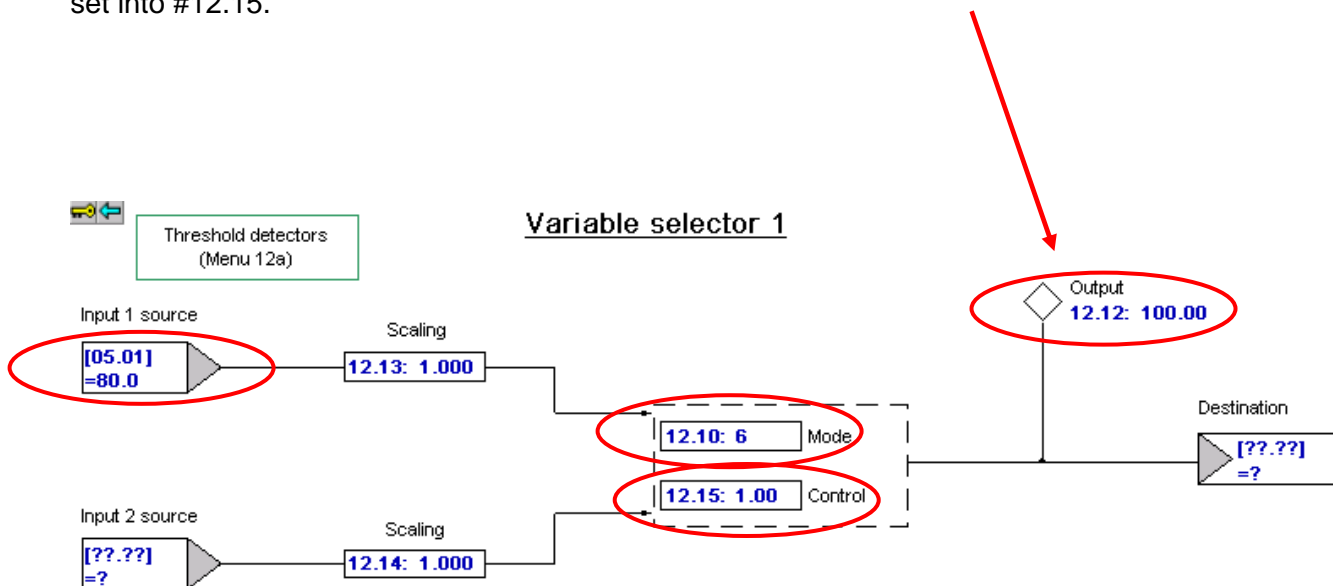
For Closed Loop applications- for Unidrive SP

Similarly, for Closed Loop applications where the output speed is in rpm, what we will be doing is referring to the motor speed register (which is parameter #3.02) and using the drives automatic scaling feature to perform the conversion. The only thing is that in closed loop the automatic scaling requires a scale factor of 2. The Filtered % Speed can be read at #12.12. The Filtering amount is set into #12.15.
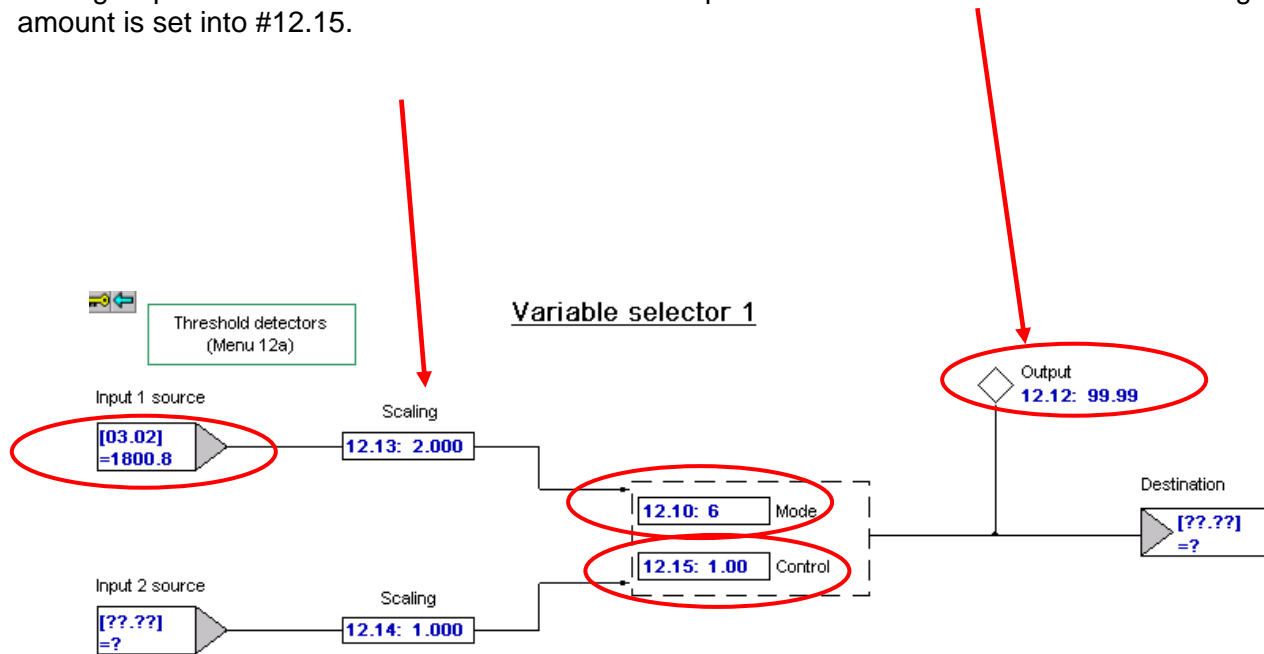
If %Speed is desired as a readout on a drive display, this is possible with the SM-Keypad Plus (LCD keypad display version) - see **CTAN289** and **CTAN250** for more details on how to do this.

By the way, the terminology in CTAN289 speaks of a Filter in there also- but this should not be confused with the Low Pass signal filter used in this application note for the purposes of "averaging" a display value.

There is an alternate method described in **CTAN159** for creating % Speed but also for other quantities as well.

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