

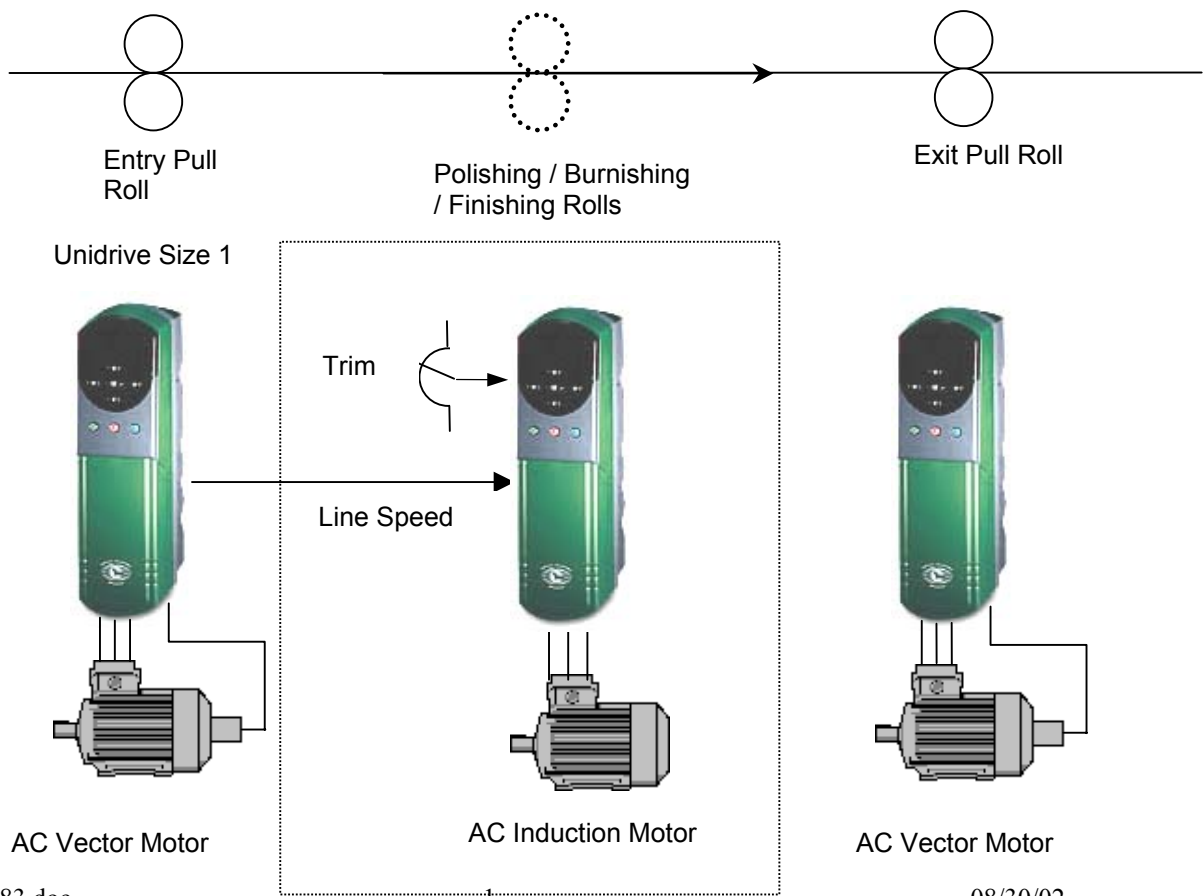
The Application Note is pertinent to the Unidrive Family

### Line Speed plus Trim

A common drive application involves following a Process Line Speed and having a +/- trim. This application note will address such a function and describe how to accomplish it using inherent features within the Unidrive series.

Consider the application below. The application involves a product being pulled perhaps from a roll by a Master drive ( Unidrive which is running a Vector motor). The downstream follower drive ( being a Unidrive running a common induction motor in Open Loop Vector mode), is to run at an adjustable speed proportional to the Master drive. There may be an exit Pull Roll which may be running in Digital Lock with the Entry Pull Roll but that's the topic of another Application Note.

Depending on the amount of overspeed ( or underspeed ) of the Finishing Rolls, different types of surface textures or finishes can be achieved. Some applications may require a +10% or more overspeed and yet other products may require a -10% relative speed for just the right surface finish.

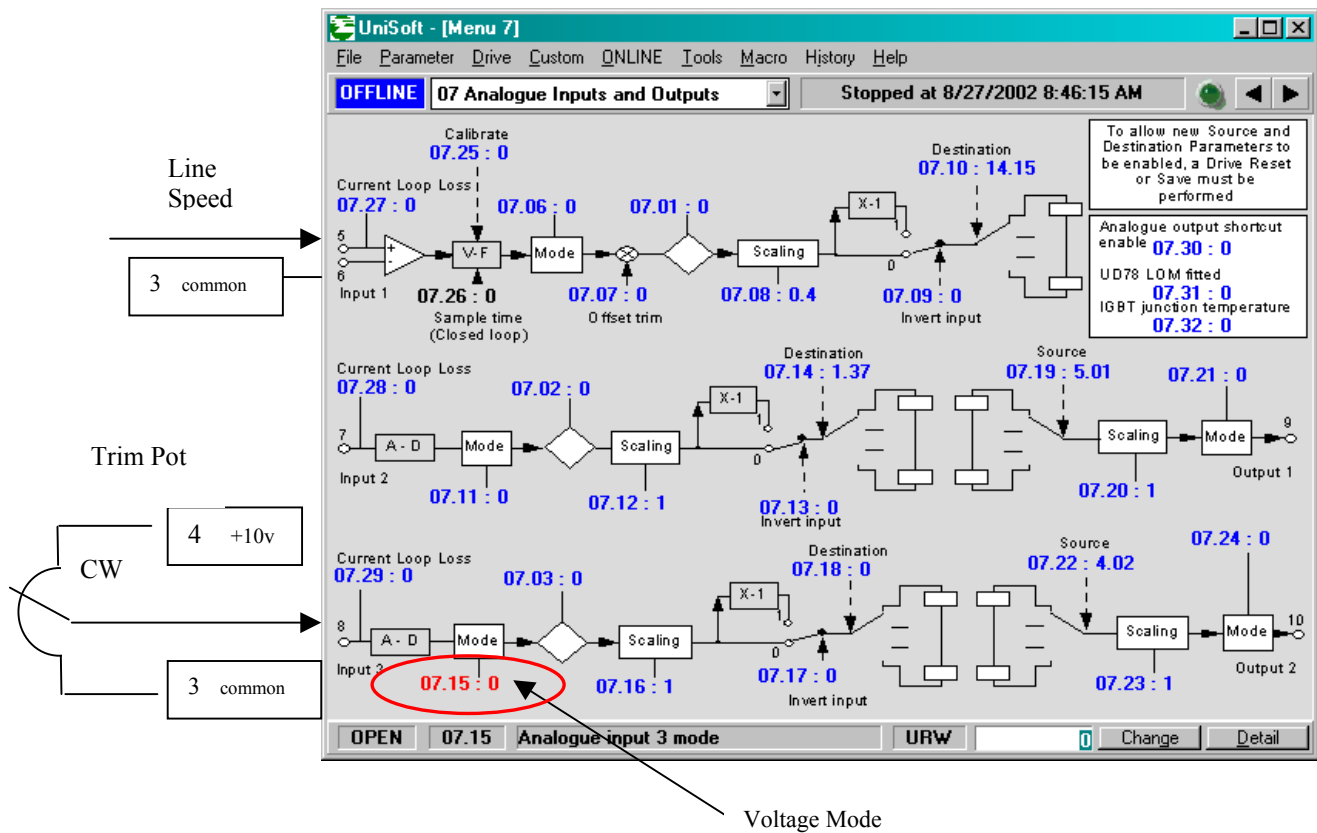


## Can the Unidrive be configured to achieve this kind of application ?

Sure.

### But how do we do it ?

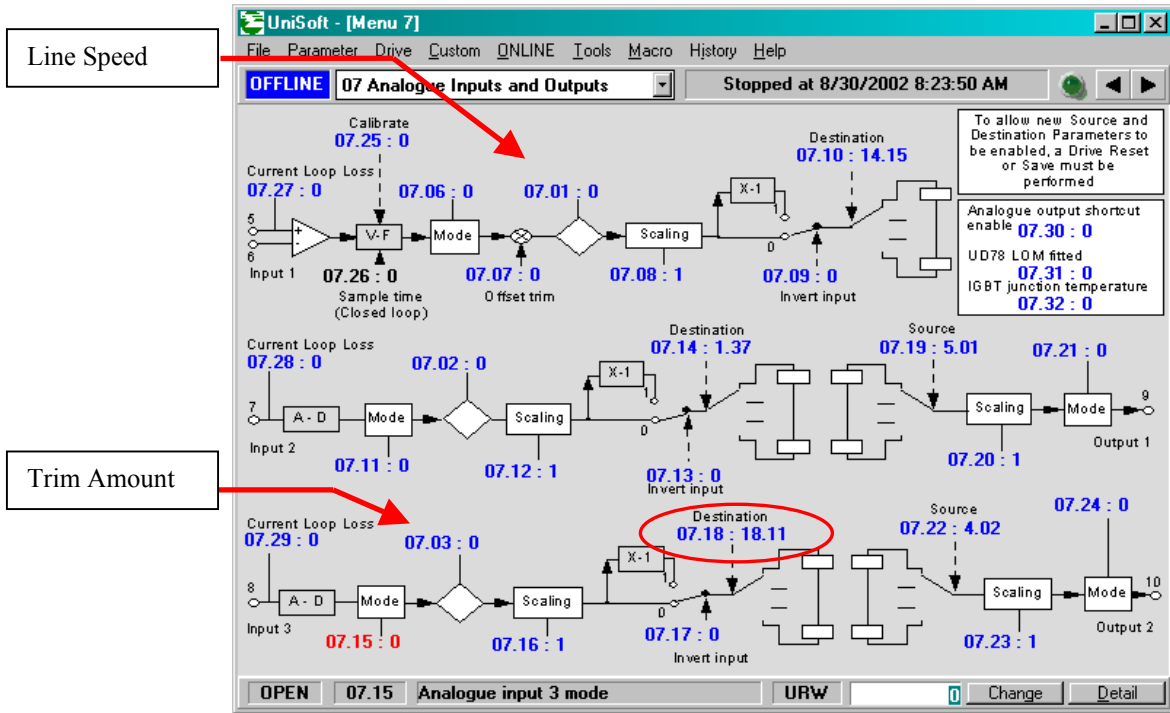
Well, it will involve the application of UniSoft ( Drive configuration software available for free from our website at [www.emersonct.com](http://www.emersonct.com) under Performance Drives/Downloads/Software). The Unidrive has 3 analog inputs available. One of which we will use to bring in an Operator adjustable TRIM pot. The other will be used to bring in the LINE SPEED signal to be followed.



### Details:

The Trim pot shown above can be 5K $\Omega$  or 10K $\Omega$  ( Linear Taper )

# Controlling Signals



Now for the more complicated portion of this application. One must ask, “ **Does the Trim need to be unipolar or bi-polar** ? ( ie +/-xx% or only 0 to +XX% ). To allow maximum application flexibility, I decided to direct the trim signal to a free register. There are 2 banks of free registers in the Unidrive available up in Menu 18 and 19. I selected #18.11 to hold/receive the scaled trim input signal.

For this example, I have selected a bi-polar trim of +/-10%. Normally, to achieve this, one would merely connect one end of the trim pot to a + reference supply and the other to a minus reference supply. The Unidrive has only a + reference supply. This is no problem, we can simply use the pre-PID loop summation to bias the incoming TRIM so that both + and – trim can be achieved. Since the trim input provides us with a 0 to 100% signal on #7.03, we can scale it before sending it to #18.11 and bias it with an appropriate value so that when the pot is at full CCW it will result in –50% and at full CW yield +50% readable at #14.22 ( error ).

To provide bias, I selected #18.12 to hold this value. Since these free registers have a maximum value of 32000 for 100%, we would enter a value of 16000 for 50%.

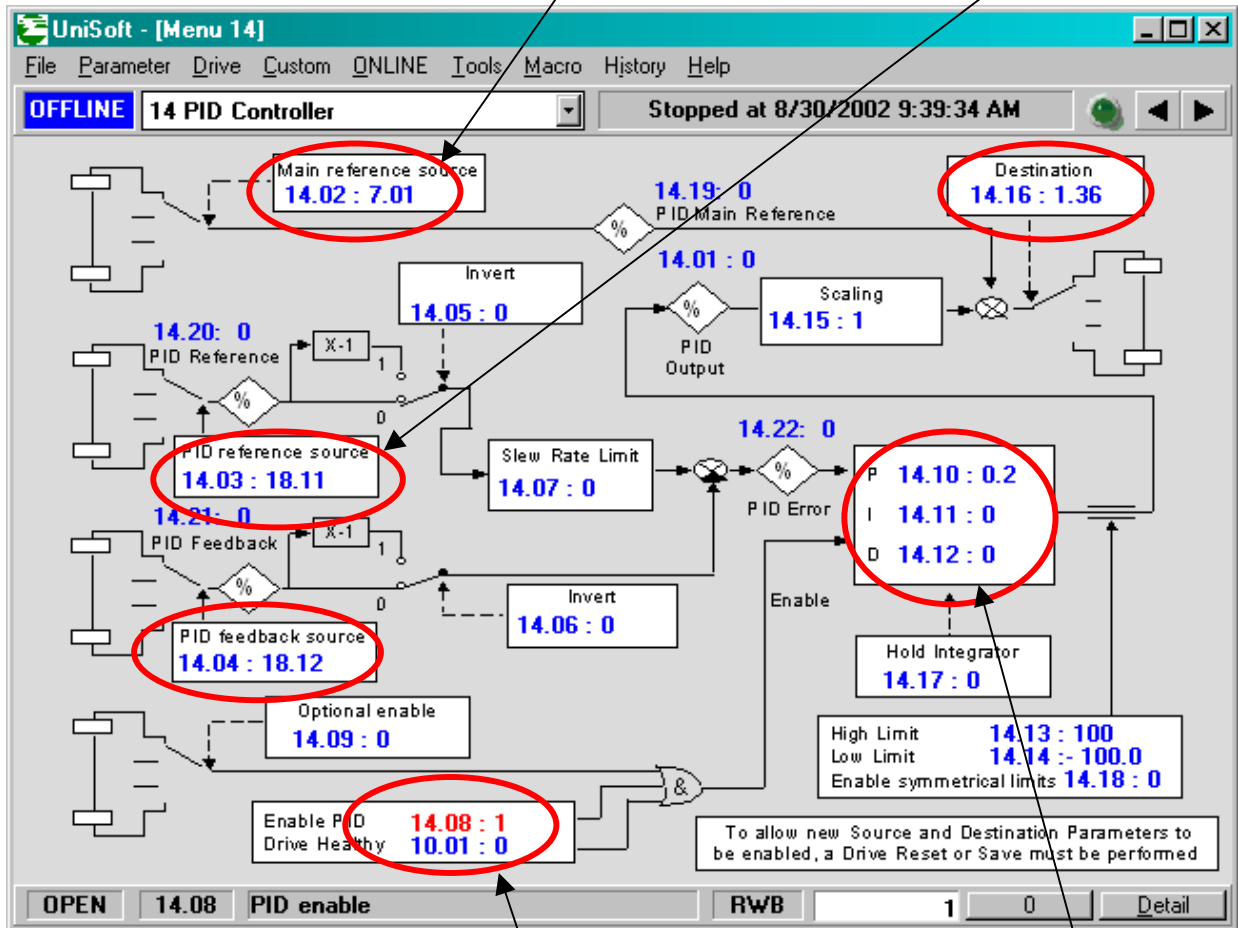
The screenshot shows the 'Compare and Menu Tables' window in UniSoft. It displays a table of application parameters. Parameter 18.12 is highlighted in green, indicating it is selected. The table shows the default and memory values for each parameter.

Parameter	Description	Default	Memory
18.09	Volatile Application parameter	0	0
18.10	Volatile Application parameter	0	0
18.11	Application parameter	0	0
18.12	Application parameter	0	16000
18.13	Application parameter	0	0

## Line Speed + Trim

To achieve this function we can use the features available on the built-in PID controller of Menu 14.

Since Line Speed can be found at #7.01 and the Trim Amount from #7.03 ( see previous page ), we can make those assignments to the PID loop source addresses.



We will also need to enable the PID loop. Since we won't be needing the Integral & Derivative portion of the PID loop we will set them to 0.

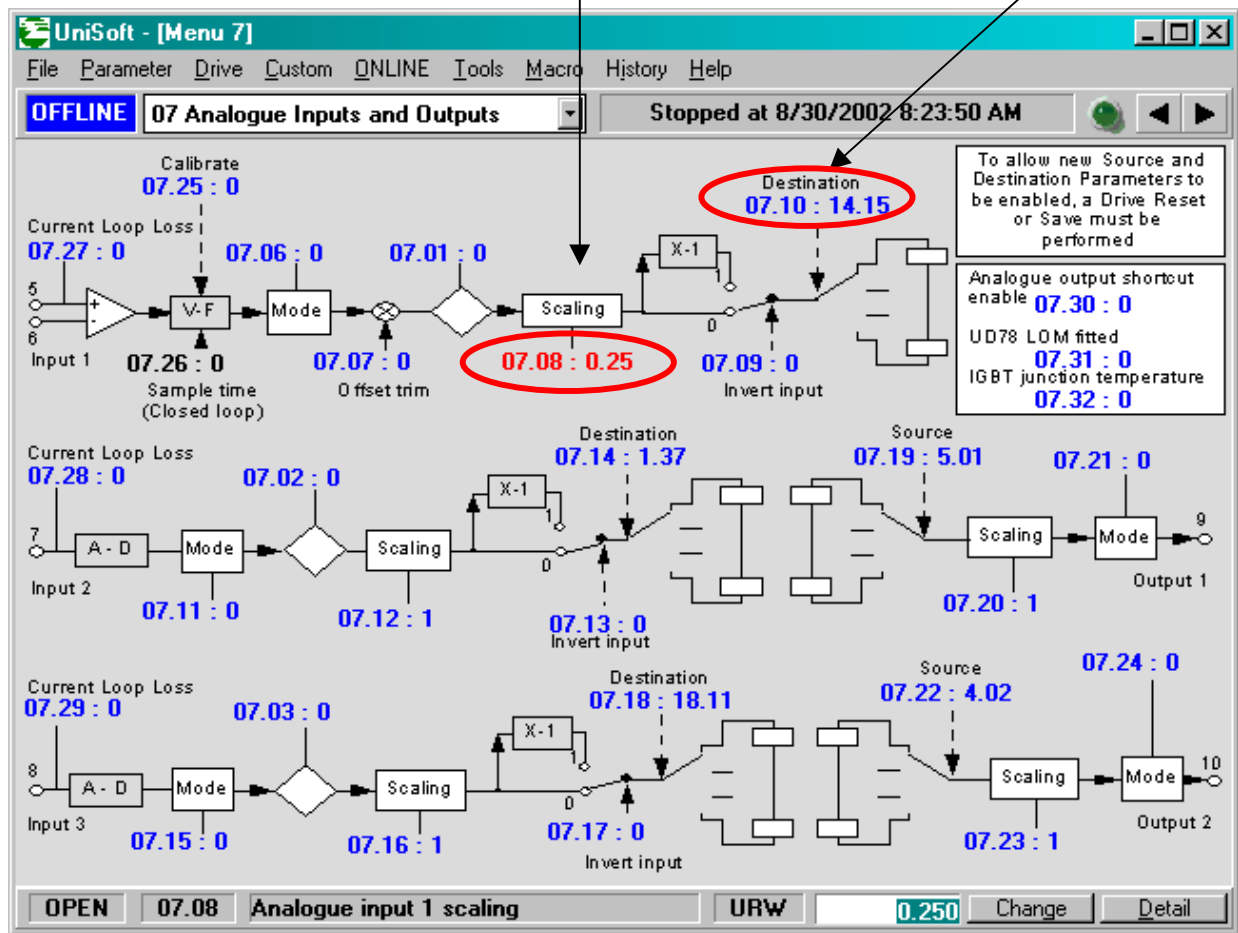
Now as far as the scaling for +/-10%, the P term or Proportional Gain (#14.10) is set to 0.2 so that the +/-50% showing up in #14.22 (error) becomes +/-10% at maximum when it leaves the PID gain block into #14.01.

As a side note (and nice feature of the built-in PID loop), one can set in a rate for the TRIM into #14.07 to prevent abrupt Trim adjustments.

The next tricky part is to make the Trim be proportional to the LINE SPEED. That is to say, when the LINE SPEED is 10% of max, the amount of trim will be 10% of this line speed and not 10% of Full Line Speed. To accomplish this, we can make the scaler after #14.01 ( before summing with the Line Speed from #14.19 ) be a function of the Line Speed. ( Refer to page 4 for these register points )

To do this we can re-direct the Line Speed signal after scaling to our scaling parameter #14.15. Since, #14.15 can be 4 at maximum, then the 100% at #7.01 re-directed to #14.15 would become 4. We don't want 4 but rather, 1. Therefore the scaling at #7.12 becomes :

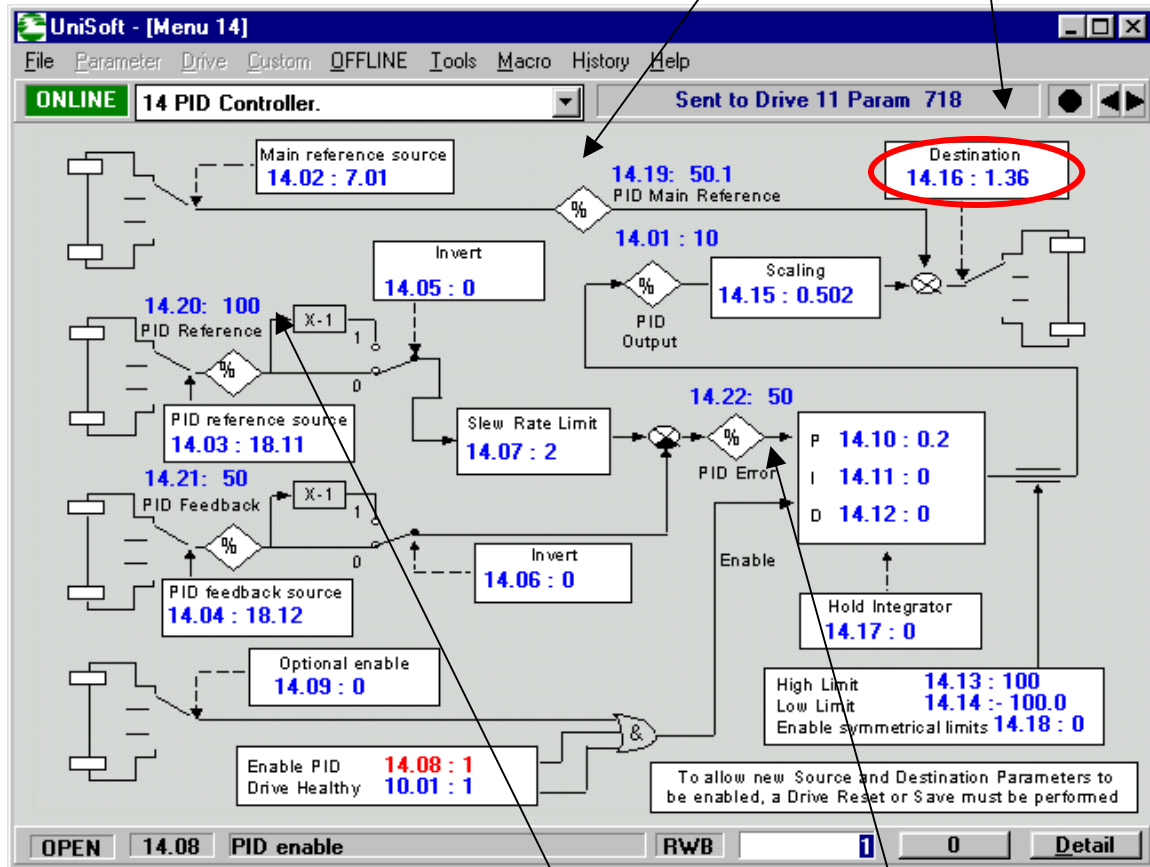
What times 4 = 1 or 0.25 = #7.08



It may be necessary to trim out this input so that when the full Line Speed input is being delivered into the pin 5 input that #14.15 yields 1.000. This can be accomplished by trimming #7.07 while watching #14.15.

This summation is then sent to #1.36 to become the Unidrive's speed reference.

The screen shot below was taken for a Line Speed of 50% . By disabling the PID section (#14.08=0) temporarily, this would result in 1500RPM on my 3000RPM motor setup.



With full 10% trim requested ( resulting in 100 @ #14.20 ) which shows up in #14.22 as 50 but after multiplied by 0.2 ( #14.10 ) becomes 10% @ #14.01. Also with the incoming line speed of 50%, results in 0.5 in #14.15.

Ultimately this results in 1655RPM on our Polishing Drive at 10% trim and 1350PRM at -10%.

## Variations

Should other values of trim be desired, one would only need to change the multipliers and bias values. For example, if you wanted the trim to be un-symmetrical ( ie +15% to -5% ) you would want the value in 14.20 to be:

$$\text{Max Pos Trim} + \text{Max Neg Trim} \text{ or } +15 + 5 = 20\%$$

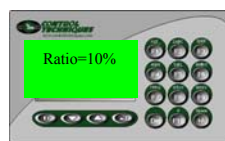
To accomplish this you would set the Trim analog input scaler, #7.16= 0.2 so that when the Trim pot is set fully CW ( yielding 100% at #7.03 ) would provide 20% to #18.11 ( or 6400 ). To obtain the -5% bias, we would set #18.12= 1600 for 5% of 32000. But in this case we would set #14.10 =1.

## Other Considerations:

Since this is a follower section, the accel and decel rates ( #2.11 and #2.21 ) should be set lower than the Line Master rates so that they don't interfere with the Line rates of change. In addition, I would turn on S- Ramp accel/decel on the Master Drive ( #2.06 ) for better overall line speed performance.

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**Could this trim amount be set digitally and adjusted using Up/Down Arrows?** *You bet!*  
*One could use one of our economical CTIU Operator Interface units as shown below and ( in keeping with this example ) even have list of preset Ratio recipe call-ups for different product finishes not to mention permitting other benefits such as plain english diagnostic displays etc.*



CTIU Remote  
Operator Interface  
Unit

RS-485  
Communications



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