

The Application Note is pertinent to the Unidrive Family

Selecting 1 of 2 Values

On occasion, it becomes necessary to be able to select between 2 values based upon an external contact for instance. For example, let's say you wanted to be able to select one of two preset ratios. The Unidrive has 8 contact selectable preset speeds (with corresponding accel/decel rates). But there are no contact selectable Preset Ratios for example. Other applications may include selection between 1 of 2:

- Gains for different situations
- Max Speed Scalings to accommodate a different gear ratio
- Current Limit values – an initial hi starting value then a lower running value

This application note will outline a method to select 1 of 2 values by an external contact and there will be an example for each of the above application situations.

Implementation

Note: The method used employs Menu 14 or the PID block. Therefore, it can only be used for this purpose if the PID is not already being used. The screenshots in this application note were taken directly from UniSoft available free from our website at :

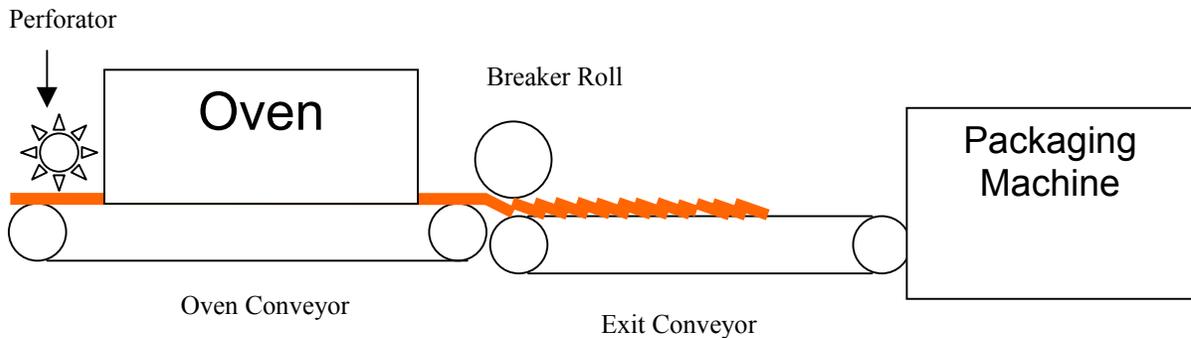
<http://www.emersonct.com/pdProducts/downloads/software.asp>

The PID block within the Unidrive series includes an asymmetric magnitude limiter (a separately adjustable max and min limiter) with a resultant destination pointer which gives us the basic ability to be able to achieve such a function.

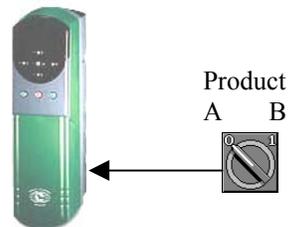
Example 1 Dual Ratio Selection

To understand how to accomplish this function it is best to start with an actual example.

Let's take the example of selecting one of 2 ratios. A practical application for such a thing might be in a bakery where they make 2 types of rectangular crackers on the same line but at different times of course. The cracker types have 2 different widths and get broken from the continuous sheet after the dough is baked at the perforation lines. The customer wants to be able to make the machine change from one product to another using a simple selector switch.



Obviously, the Oven conveyor speed is set as a function of the product baking time based on the material types, Oven temperatures etc. The perforator roll would run at a ratio (preferably digitally locked (a standard built-in function for Unidrive) to the Oven conveyor speed for consistency and ease of packaging -see CTAN118 for Digital Locking). After the product is baked, it is necessary to break the material at the perforation lines to become crackers. For ease of packaging reasons it is sometimes desirable to create an overlap of product. The amount of overlap would again be a ratio to the main Oven Conveyor depending on product type. This is where the dual ratio comes into play for Product A/Product B selection by the Operator.

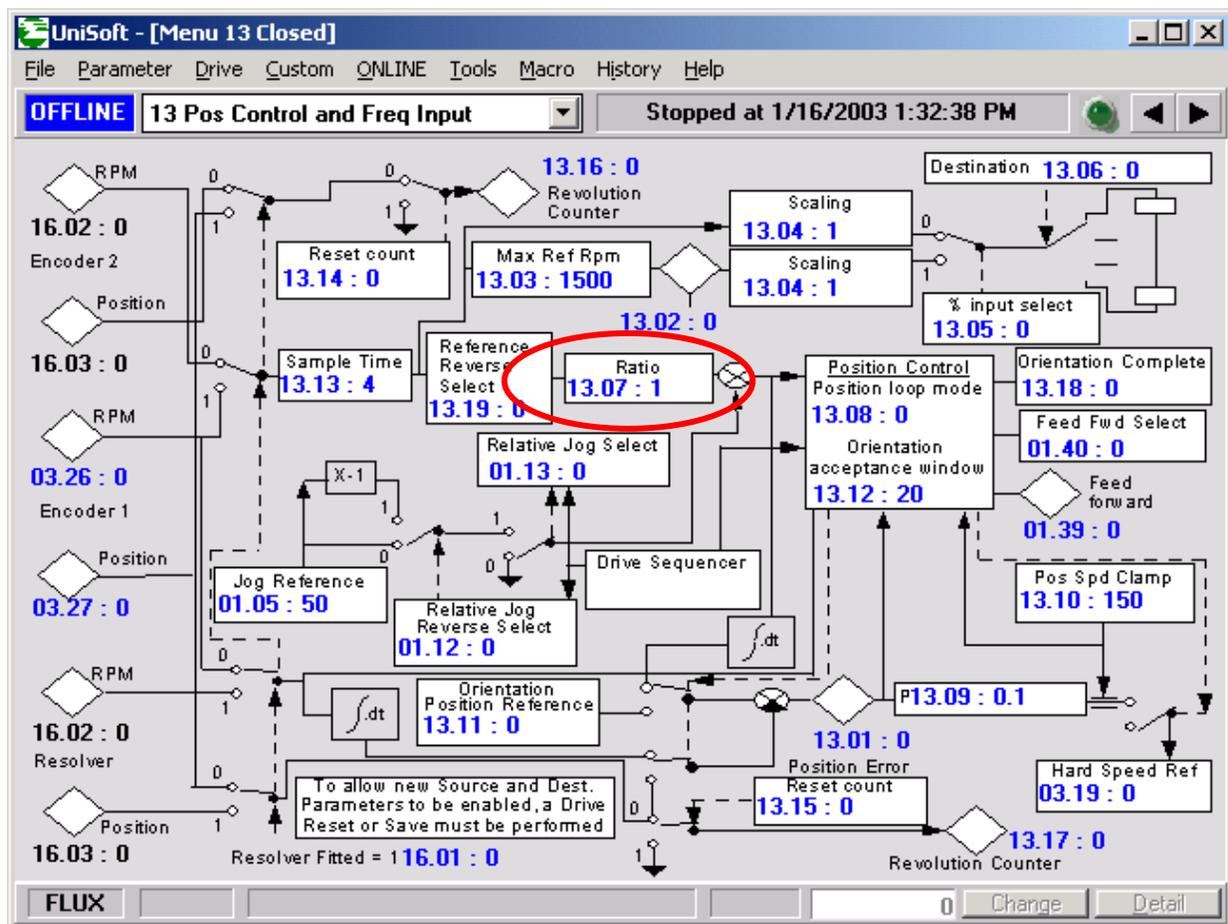


Let's say for this example the two product types require the Exit Conveyor to run at $0.45 * \text{the Oven Conveyors speed}$ for Product A and 0.62 for Product B.

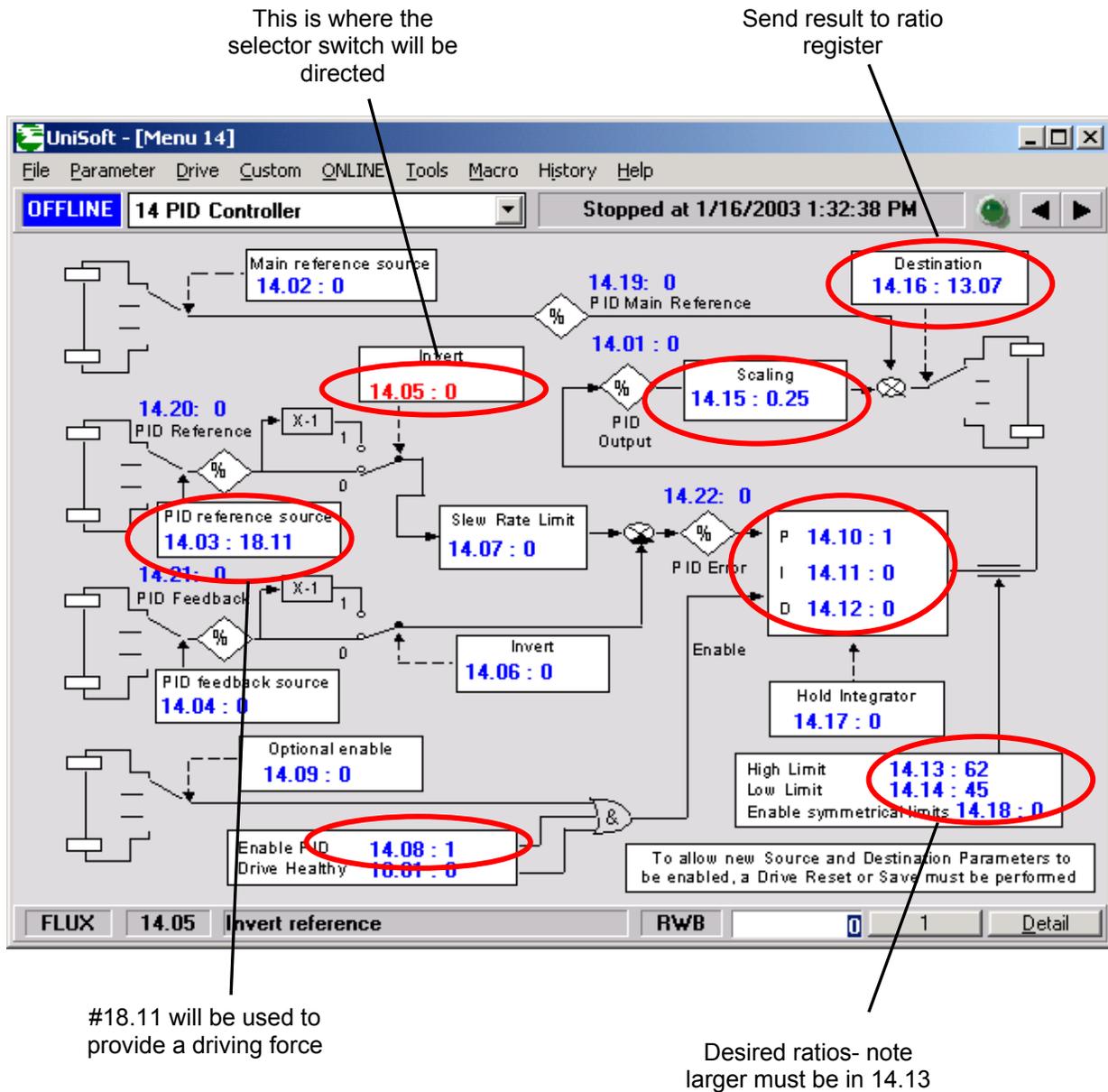
First off all, let's take a quick look at Menu 13 , the Digital Locking Menu and specifically the Ratio register parameter #13.07.

Menu 13 Digital Lock Menu

The parameter we wish to change with the Product selection switch is #13.07.



Menu 13 PID Block



You would set the following parameters on Menu 14.

- #14.03 = 18.11 (just a free location where a driving force can be entered)
- #14.08 = 1 to enable this menu
- #14.11 = 0
- #14.13 = upper ratio
- #14.14 = lower ratio
- #14.15 = 0.25 if desired ratios are less that 1.000
- #14.16 = 13.07 destination of this selection method
- #18.11 = 32000 (Driving force)

For this scheme to work, the **larger** of the 2 selections must always be in #14.13.

Below is a table to assist with the scaling associated with the desired ratios.

| Desired Ratios | Scaler #14.15 | #14.13 & #14.14 |
|----------------|---------------|--------------------------------------|
| 0.00 to 0.999 | 0.25 | Enter ratio x100 |
| 1.000 to 1.999 | 0.50 | Enter ratio x50 (round to 1 decimal) |
| 2.000 to 4.000 | 1 | Enter ratio x25 (round to 1 decimal) |

Testing

After entering in the necessary parameters and making the alterations listed on the previous page, you are ready to test things. Fortunately, all of this can be tested statically, that is, without running the motor.

All you need to do is flip #14.05 from 0 to 1 and observe #13.07. When #14.05 is 0, the larger of the 2 ratios you desire should appear in #13.07.

If this works, you can now assign a free input to change the state of #14.05 externally from a selector switch for instance.

Example 2 Dual Speed Range Accommodation

Sometimes it becomes necessary to accommodate a machine that has 2 gear ranges. In these situations, if a speed pot is being used to control machine speed, it is customary and usually desirable for full clockwise motion of the pot to cause the motor to go from zero to full speed. Unfortunately, when there are 2 gear ranges, there may be 2 maximum motor speeds to deal with. For example, suppose you had a spindle motor that runs a 4500rpm on 1 gear range and 500rpm. What we can do is change #1.06 for your 2 max speed values so that in the first case full CW travel of the pot means 4500rpm and in the other case 500rpm.

You would set the following parameters on Menu 14.

#14.03 = 18.11 (just a free location where a driving force can be entered)
#14.08 = 1 to enable this menu
#14.11 = 0
#14.13 = scaled upper speed (see Speed Scaling below)
#14.14 = scaled lower speed (see Speed Scaling below)
#14.15 = 1
#14.16 = 1.06 destination of this selection method → Max Speed setting
#18.11 = 32000 (Driving force)

Speed Scaling

If your are running in Closed Loop (Vector or Servo mode), the maximum frequency of the encoder feedback is 250KHz. Therefore, the following table would prevail:

| Encoder PPR | Maximum Motor RPM |
|--------------------|--------------------------|
| 512 | 29296 |
| 1024 | 14648 |
| 2048 | 7324 |

The scaling for #14.13 and #14.14 is based on these maximum speeds in closed loop modes. In Closed Loop modes, Max Speed is in RPM. (In Open Loop it is based on 1000Hz as max)

Assuming our example motor has the default 1024 PPR encoder,

then, the scaling for 4500rpm becomes : $\frac{4500}{14648} = 0.30729$ or **30.7%**

and, the scaling for 500rpm becomes : $\frac{500}{14648} = 0.0341$ or **3.4%**

Testing

After entering in the necessary parameters and making the alterations listed above, you are ready to test things. Fortunately, all of this can be tested statically , that is, without running the motor.

All you need to do is flip #14.05 from 0 to 1 and observe #1.06. When #14.05 is 0, the larger of the 2 max speeds you desire should appear in #1.06.

If this works, you can now assign a free input to change the state of #14.05 externally from a selector switch for instance.

Example 3 Hi Starting Torque with Reduction thenceafter

Some applications require a high starting torque for breakaway purposes (breaking loose) but such a torque value during normal running operation could permit damage. For this reason, these application may need a starting current limit value for a few seconds then a reduced current limit thenceafter. For instance, let's say that a Unidrive model UNI1405 is being used to drive a 9A motor. Since the UNI1405 is capable of 9.5A continuously, the maximum current limit can be set for 199% which would provide a high starting torque (*as long as the motor, shaft and gear train can handle it- you must check with motor and overall machine manufacturer*) but may be considered too high for normal running conditions once rolling. Once rolling, you may want to limit the available torque to 125% of the motors rating.

You would set the following parameters on Menu 14.

- #14.03 = 18.11 (just a free location where a driving force can be entered)
- #14.08 = 1 to enable this menu
- #14.11 = 0
- #14.13 = scaled upper current limit (see Current Scaling below)
- #14.14 = scaled lower current limit (see Current Scaling below)
- #14.15 = 1
- #14.16 = 4.05 destination of this selection method → Motoring Current Limit
(4.07 could be used and would limit regenerative torque also)
- #18.11 = 32000 (Driving force)

Current Limit Scaling

In the Closed Loop modes (Vector & Servo) the maximum current limit that can be set is approximately :

$$\frac{\text{Drive FLA}}{\text{Motor FLA} * \text{PF}} \times 1.75 = \frac{9.5}{9.0 * 0.92} \times 1.75 = 200\%$$

Therefore, if we wanted a starting current of say 180% and a running current limit of 125% we would set :

$$\#14.13 = \frac{180}{200} = 0.9 \text{ or } \mathbf{90.0\%} \quad \text{and} \quad \#14.14 = \frac{125}{200} = .625 \text{ or } \mathbf{62.5\%}$$

These values may need tweaked slightly to obtain the exact value you desire.

Testing

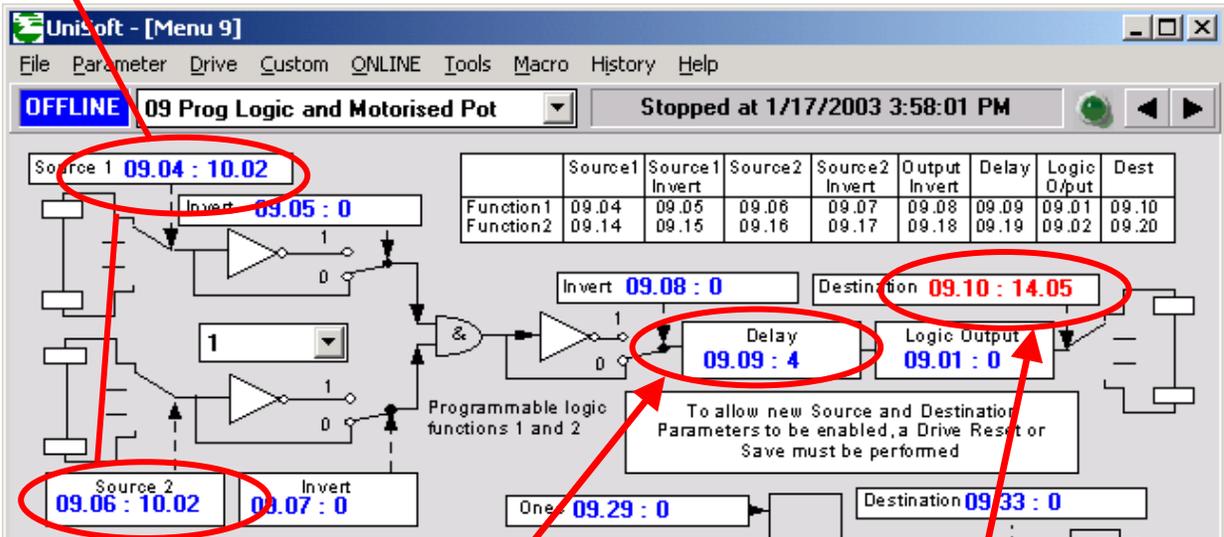
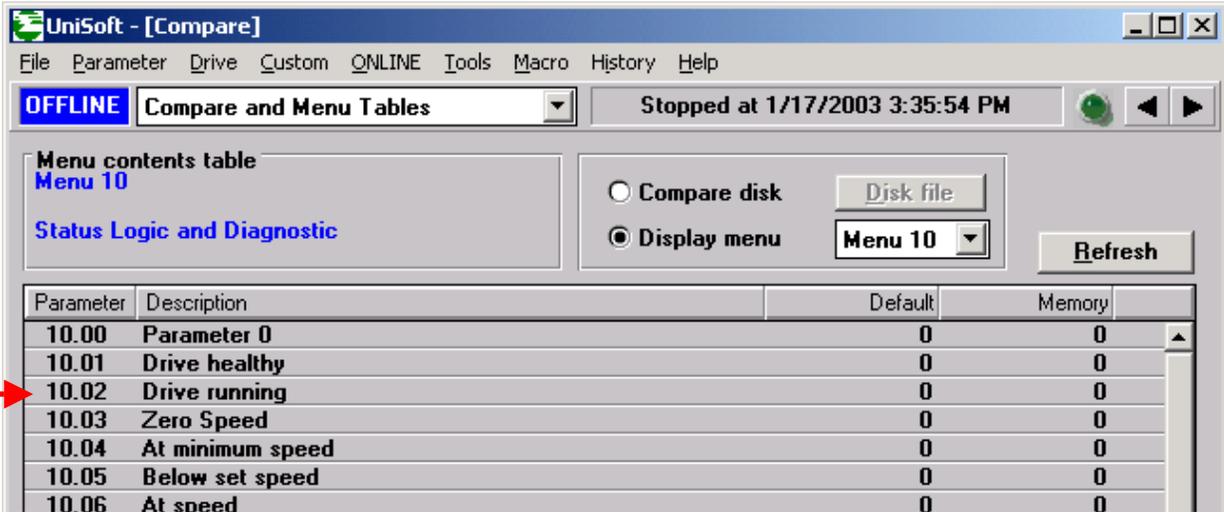
After entering in the necessary parameters and making the alterations listed above, you are ready to test things. Fortunately, all of this can be tested statically , that is, without running the motor.

All you need to do is flip #14.05 from 0 to 1 and observe #4.05 (or #4.07). When #14.05 is 0, the larger of the current limits you desire should appear in that location.

If this works, you are now ready to cause this change to occur automatically upon initial start of the drive and reduce after a delay of your choice. To accomplish this we will use one of the free logic gates of Menu 9 with a programmable output timer.

Starting Torque Timer

When the drive is commanded to start, status bit parameter #10.02 becomes a 1.



4 seconds allowed at high torque level

Send to #14.05 for automatic timed control selection

Perform a reset and store and you should have it.

Questions ?? Ask the Author:

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