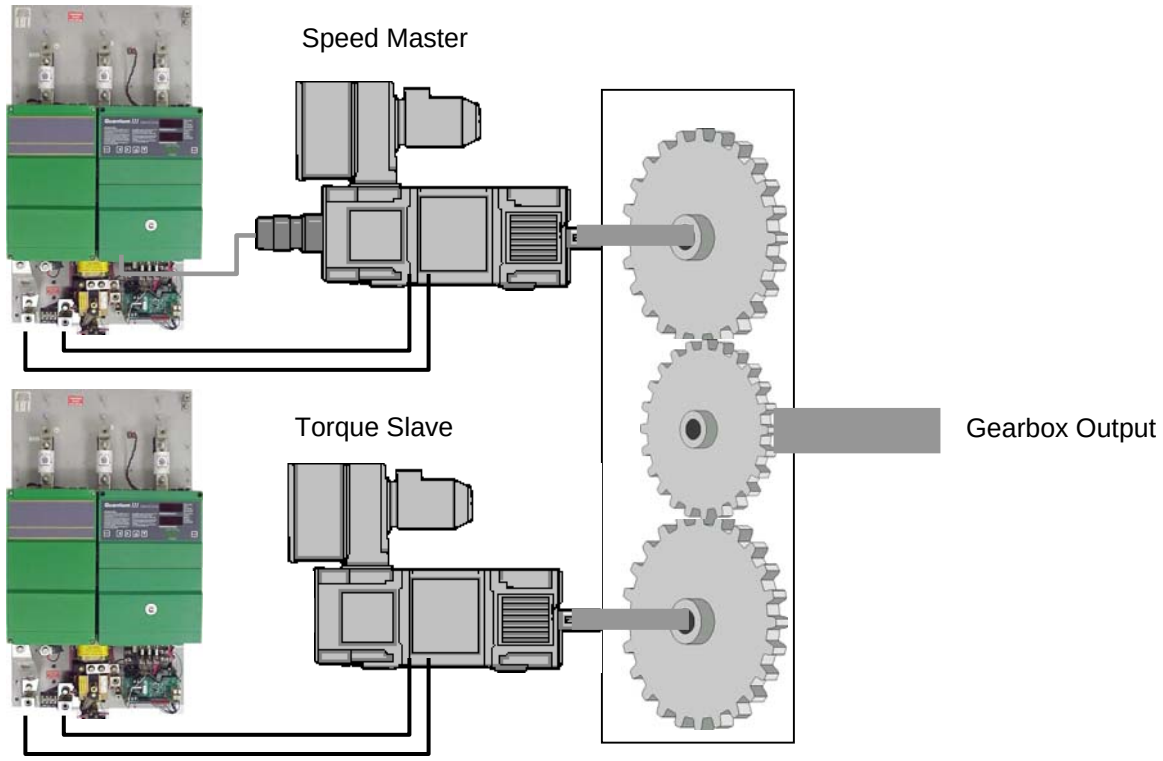
EMERSON
Industrial Automation

Application Note CTAN #158

The Application Note is pertinent to the Quantum III / Mentor II Family

Load Sharing

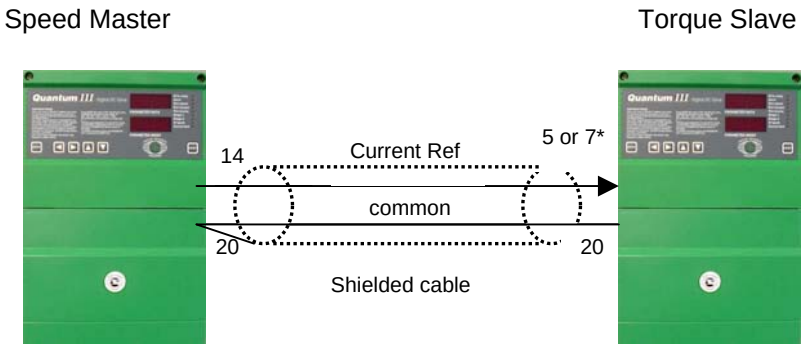
Loading sharing is a common drive application requirement. In load sharing situations it is customary to have one drive configured as a Speed Regulator which is referred to as the master. The slave drive is typically configured as a Torque (*current*) Regulator. On a DC machine, output torque is proportional to armature current. So if we can regulate around a current reference, we can regulate torque. For example, consider the dual input gearbox as shown below:



The upper motor would be our Speed master and the lower drive would be configured as a Torque Regulator to help share the load and assist driving the load. In this illustration, the upper motor is equipped with a speed feedback device (AC or DC tach or possibly an Encoder). It would not have to have such a device, just plain old Armature Voltage feedback would typically suffice depending on the degree of speed regulation and drift that could be tolerated.

Drive Configuration

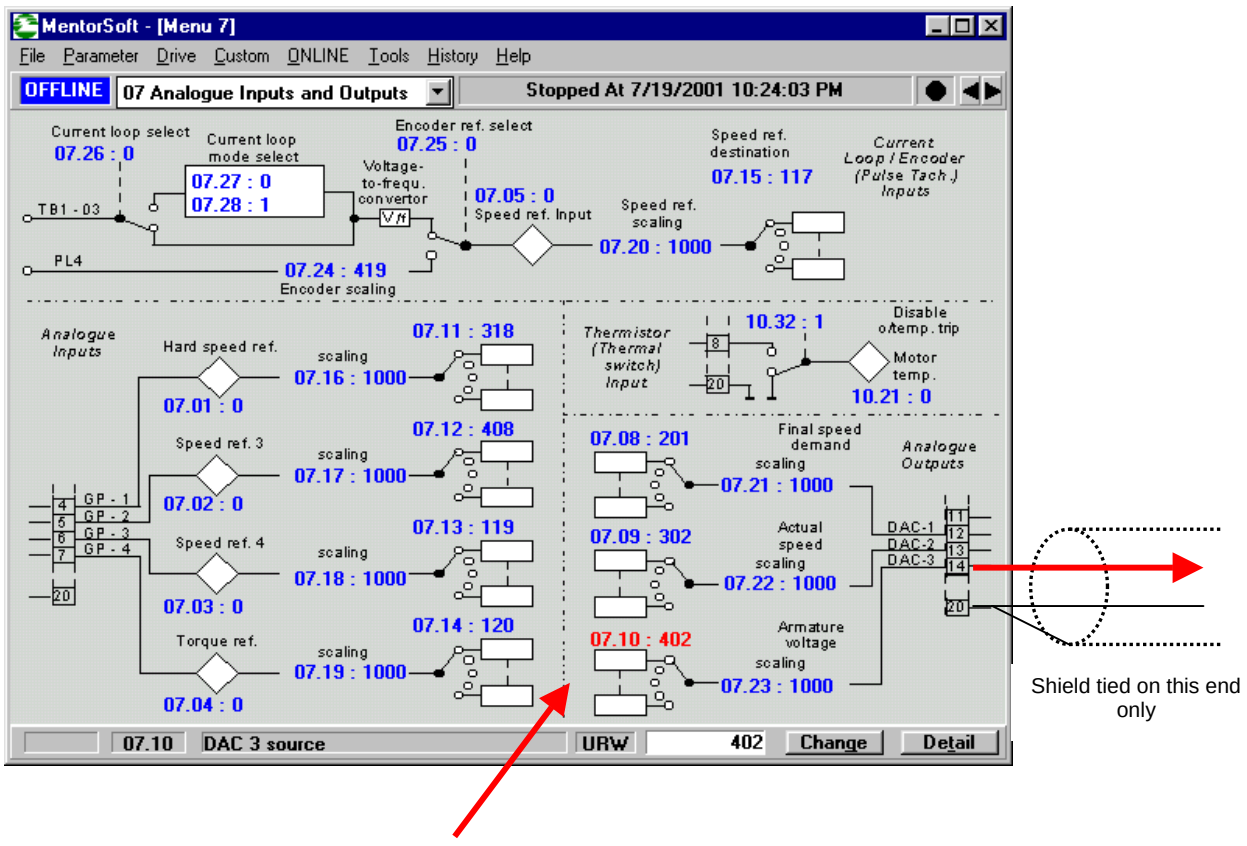
To accomplish the "*torque sharing*" all we would need to do is provide the Torque Slave with a reference signal that represents the amount of load that the Master is experiencing so that the Slave can use it to assist.



A short run of 2 conductor shielded cable would be used to take the Masters current signal to the Slave. * see Slave Configuration

Master Configuration

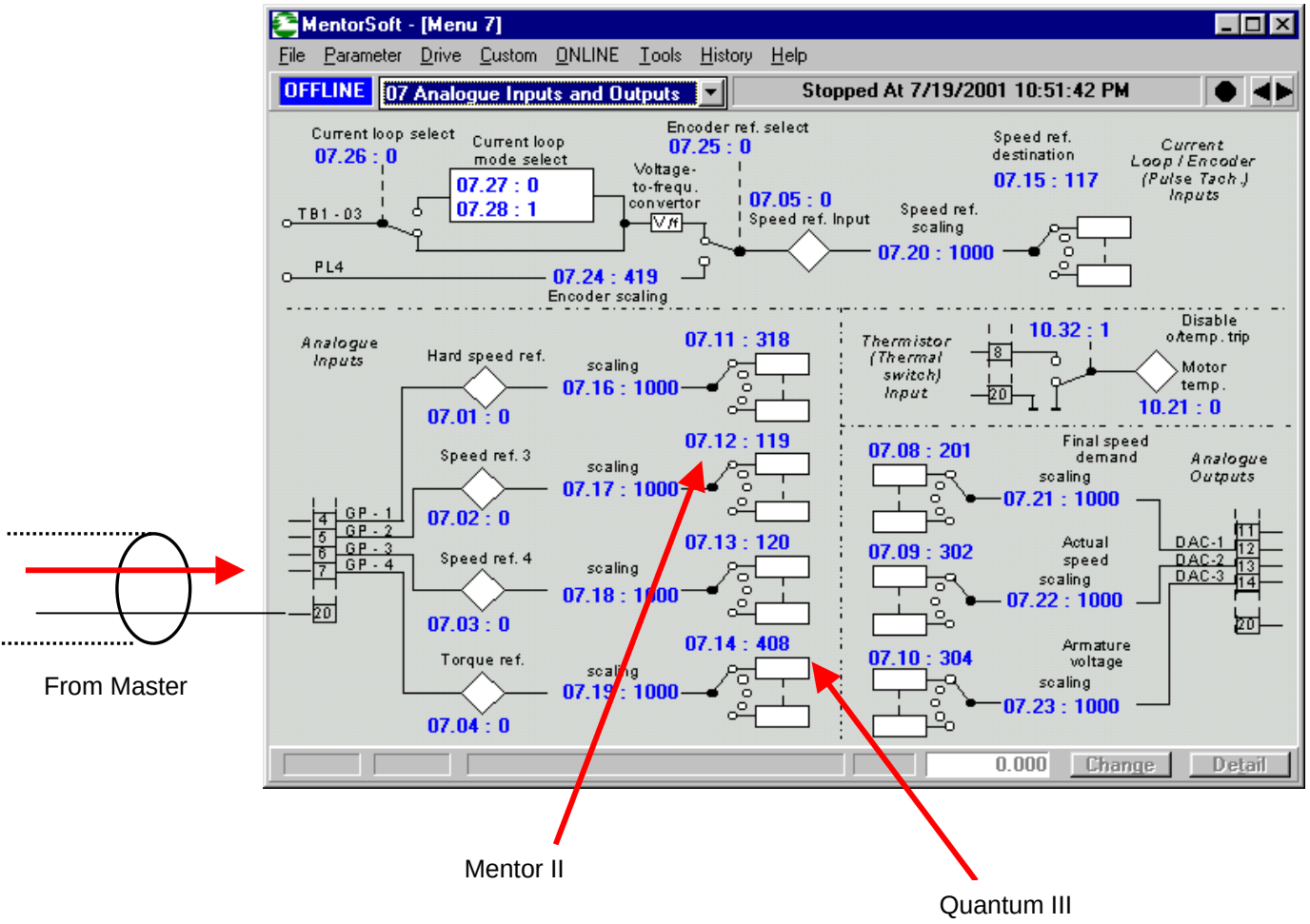
We would set one of the Masters configurable analog outputs to bring out the Masters current reference, parameter #4.02, as a voltage signal (0 to +10v if non-regen drive or +/- 10v for a regen drive).



Slave Configuration

We would set one of the Slaves configurable analog inputs to bring in the Masters current reference, parameter #4.02, as a voltage signal and direct it to the Slave current reference, parameter #4.08.

It turns out that the factory defaults have already set one of the analog input destination to parameter #4.08. For a Quantum this input would go to pin 7 and for a Mentor it would go to pin 5.

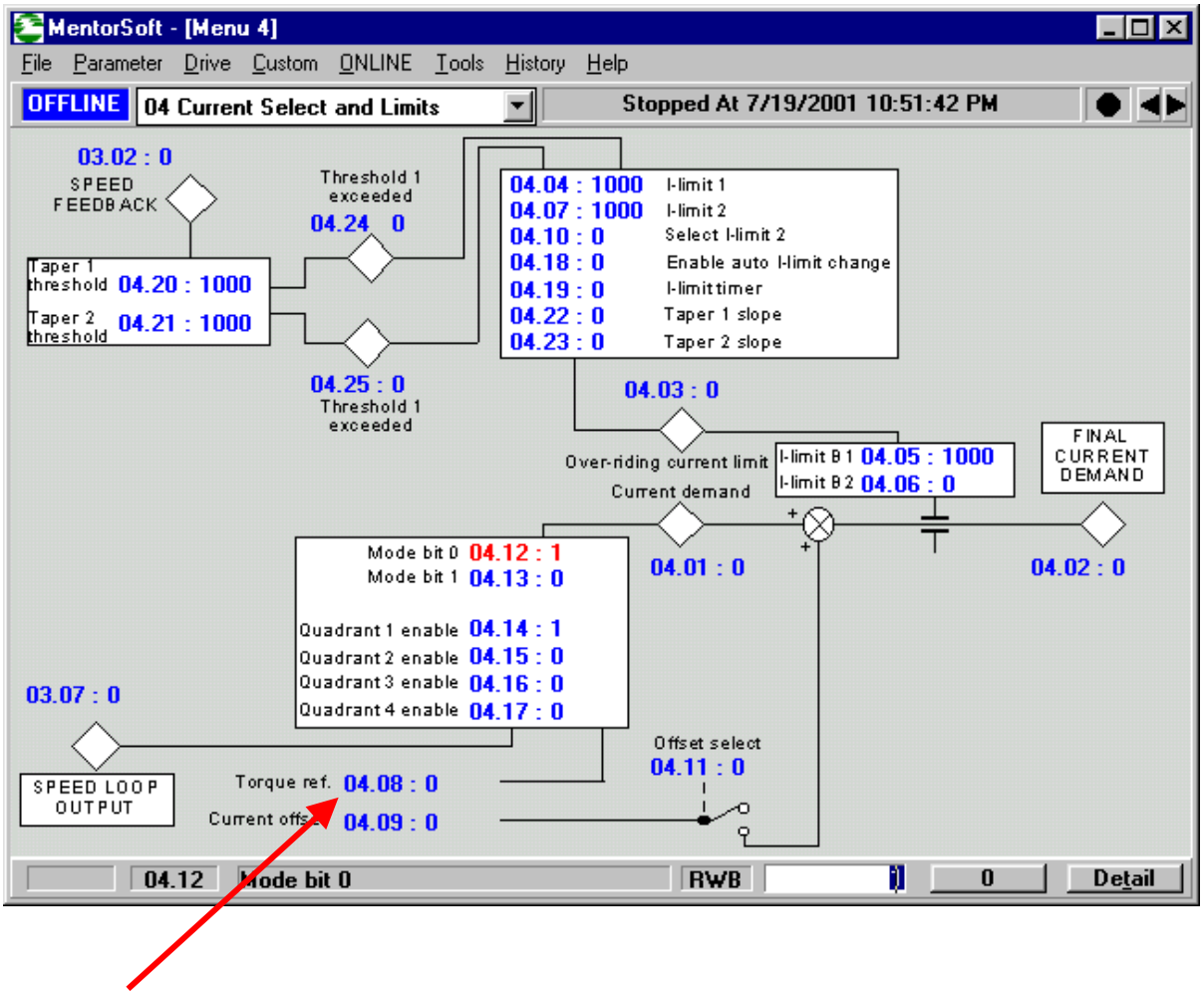


So now all we have to do is configure the Slave as a Torque Regulator which is quite easy.

Slave Configuration-Torque Mode

To configure the Slave as a Torque Regulator, you would set parameter #4.12=1 and #4.13=0.

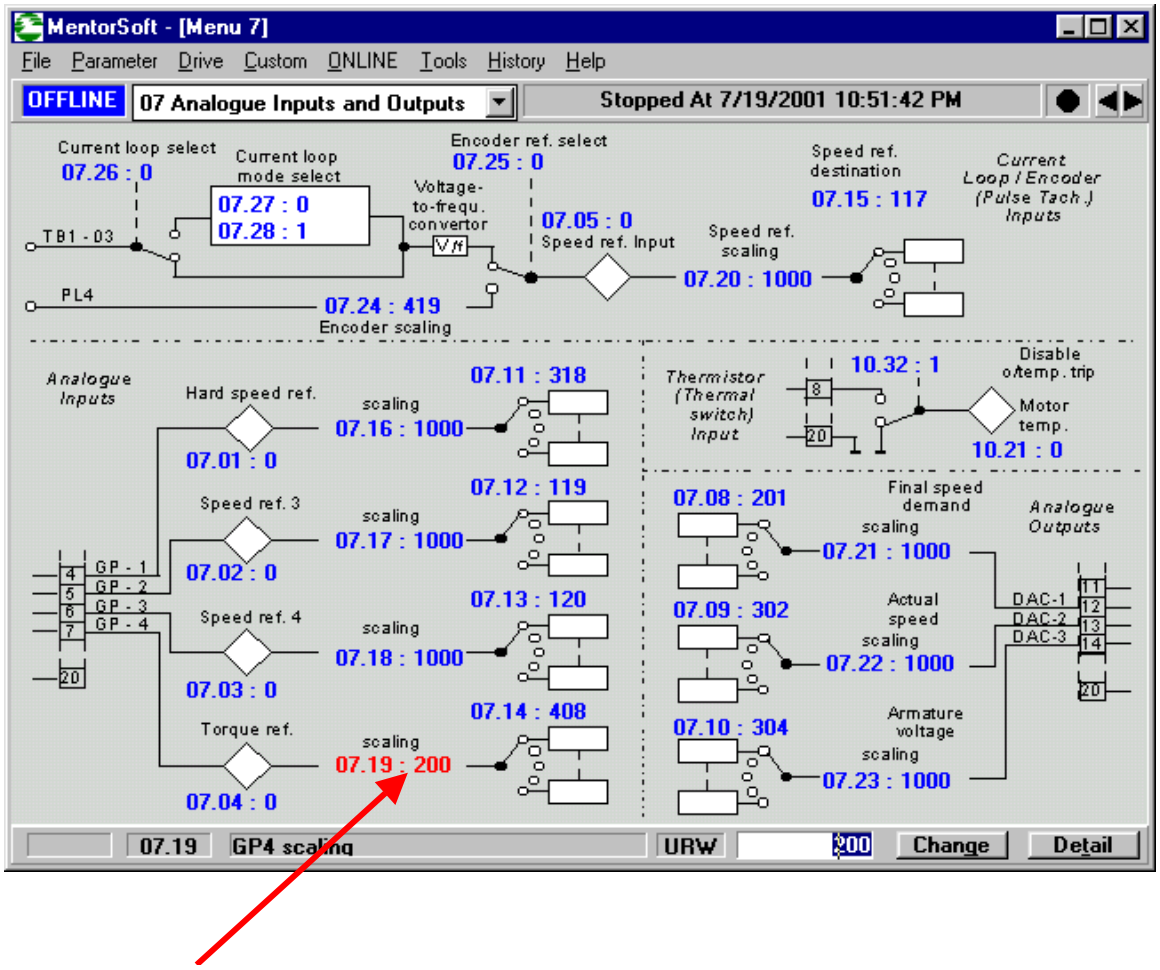
04.12 = 1 and 04.13 = 0. Basic current- or torque-control mode. In this mode, the torque reference 04.08 is the input to the current loop and is subject to the limitations of the over-riding current limit 04.03, the Bridge 1 and Bridge 2 limits 04.05 and 04.06,and to the current slew rate 05.04.



From Analog Input

Details

If the drives are Regenerative models, one should be aware that if the slave is too helpful it will try to overspeed the Master. But being a good Regen, the Master will resist being overhauled and reverse it's current which will cause the slaves current to reverse and so on. This will set up an unstable oscillatory situation. To avoid such a condition, upon initial start-up, one could reduce the Slaves current reference by a substantial amount and watch parameter #4.02 on each drive. For a given steady state load situation, one could then increase the Slaves reference until it approaches but does not exceed the Masters current reference value in #4.02. This will tend to ensure that the slave does not become too aggressive in providing contribution. The contribution amount can be adjusted by setting the A/D Converter multiplier. The default value is 1000 or 1.000. Initially a value of 0200 or 0.200 could be set in and gradually adjusted up as described above.



Contribution amount

Other Details

This particular scenario is one where the Slave motor is rigidly coupled to the load. In such a situation, using the pure Torque mode is reasonable. In other Torque assist applications, the load could suddenly disappear from the Torque Regulating Slave (material could break for instance) . Should this occur, the Slave motor would accelerate to perhaps an unsafe speed which must be avoided. In such cases, one may need to monitor the Slaves speed and provide a shutdown scheme should this condition occur.

The Mentor II and Quantum III have yet another mode of operation that can reduce the possibility of such a runaway condition. There is a mode call ***Torque with Speed Override*** that could be employed. That is a topic for another application note however- from Google type in **CTAN190** or click the link below:

http://www.emersonct.com/download_usa/appNotes/ctan190.pdf

Questions ?? Ask the Author:

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