DIRECT DRIVE

MAIN ADVANTAGES
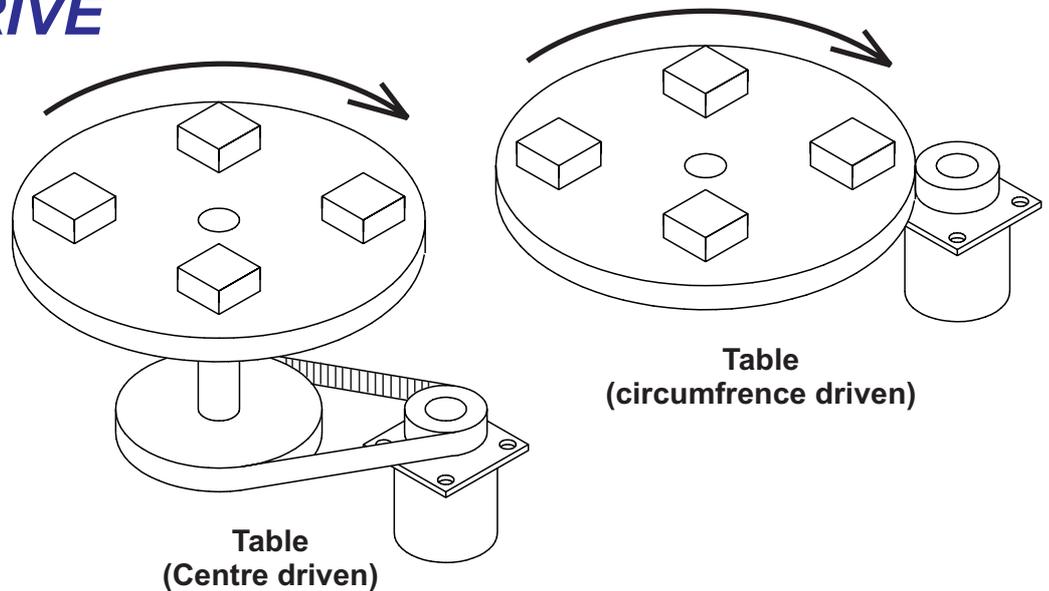Good for rotary tables

MAIN DISADVANTAGES
High inertia
May need high gear reduction
High gearing backlash errors

**Table
(circumfrence driven)**

**Table
(Centre driven)**

Fill in the boxes and return to us. We will size a suitable stepper motor and drive for you!

Table inertia
The inertia of the table must be calculated. For this we need to know table diameter, thickness and material. Large tables can have very high inertias and it is common to use aluminium instead of steel. Also, inertia may be reduced by cutting holes in the table. Table inertia is proportional to 4th power of pulley diameter.($J \propto d^4$).

Pulley inertia
Pulleys, pinions or rollers have inertia which must be driven by the motor. What is inertia of these? If inertia is not known, advise dimensions and material of pulleys or pinions and we can calculate it. On roller systems, inertia can be very high and may be reduced by using hollow rollers rather than solid or making rollers in aluminium instead of steel.

Load & position
This is the mass or inertia that the table must rotate. If you only know the mass of the load it is also necessary to know the position of this mass from table centre. Angular inertia of a load increases to the square of its position from centre.

Drive Method
Usually, small tables are driven through its centre via gearing and large tables are driven by a pinion and ring gear, increasing stability and reducing backlash.

Gear Reduction
Sometimes it is necessary to use gearing to reduce inertia and amplify torque. This may be done using low cost timing belts and pulleys or a precision gearhead that mounts onto the motor. High ratio reduction will help torque but will limit speed. Gearing reduces load inertia by the square of the ratio of the reducer ($J \propto 1/n^2$). Planetary gearheads and pulleys are highly efficient but worm drive gearboxes have very poor efficiency.

External Load
External forces on the load must be taken into consideration. These may be friction or cutting forces on a cutting machine. Sometimes these can be measured on an existing machine. On a new machine, you will just have to estimate these forces or try to calculate them.

Resolution
Resolution is the smallest amount of linear movement that corresponds to one motor step. It will depend on radial position of the load and gearing. What is the minimum accuracy increment of motion your machine needs to do? This is not necessarily the same as accuracy which is also affected by backlash and quality of your gearing.

Top Speed
What is the maximum angular top speed required? Be careful as specifying a very high top speed will result in a costly system. On many machines, the top speed occurs during rapid traverse when there are no cutting forces involved.

Ramp Time
This is stepper motor terminology for acceleration and deceleration time. These are usually linear although some controllers can provide "S" profile ramping to reduce shock on components. Very fast acceleration times will require large and expensive motors and drives. Motor torque is directly proportional to acceleration rate.

Duty Cycle
Duty cycle (expressed as %) is the proportion of time the motor is running compared to total time. In most machines, the motor will run for a short period and rest for a while before starting the next cycle. The duty cycle is (run time)/(run time + rest time).

directdrivedata.cdr