

# Technology Options

Technology software is an option available with the MASTERDRIVE MC. Technology software can be divided into three main categories:

- General Technology Functions

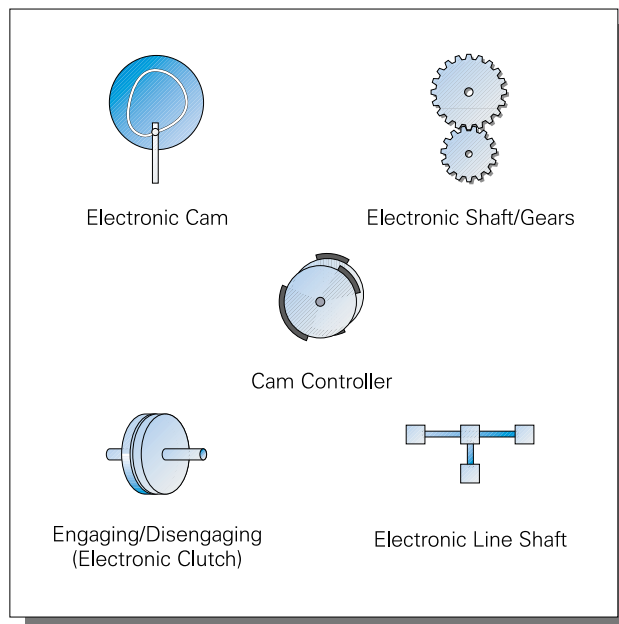
General technology functions include linear axis, rotary axis, and roll feeding.

- Positioning

Positioning includes point-to-point positioning or automatic positioning which combines multiple point-to-point moves.

- Synchronous Operation

Synchronous operation involves the synchronizing of two or more axes via electronics. Synchronous operation includes electronic gears, cams, clutches, and so on.

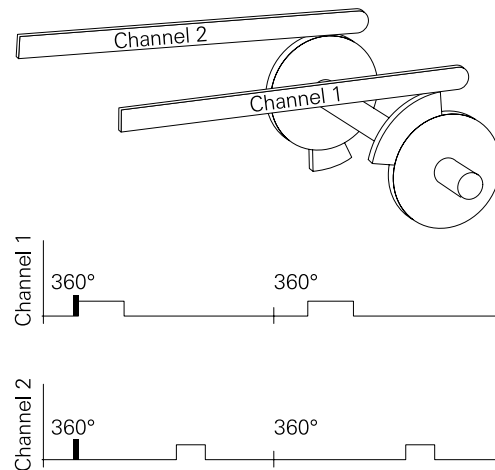


## Basic Function Software

Some technology functions are readily available and can be implemented at any time. These include cam control and brake control.

## Cam Controller

A cam controller switches digital outputs on and off. With this function external switching elements, such as pneumatic valves, may be operated at defined points. Two cam controllers are available with the basic technology software. Each controller has two positioning cams, making a total of four cams whose switch-on and switch-off positions can be set independently of each other. Digital outputs from the MASTERDRIVE MC signal the on/off position to the controlled equipment.



## Brake Control

Applying and releasing a brake can be effected by means of external commands. However, with the brake control function built into the MASTERDRIVE MC braking can be fully automated without intervention by an external machine control unit.

There are three ways to operate a brake:

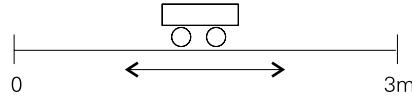
- Relay Output on the EB1 Expansion Board
- Digital Output from the MASTERDRIVE MC to an External Relay
- The Relay for Operating the Main Contactor in the Chassis and Compact Unit, when the Main Contactor is not used

## Technology Software F01

The following position and synchronizing functions are software options that can be purchased with the MASTERDRIVE MC, or ordered and enabled at a later date. They are part of the technology option software (F01) package.

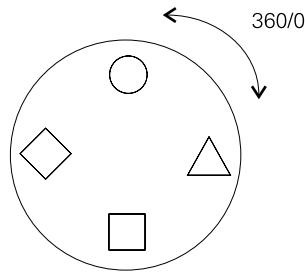
### Linear Axis Function

The linear axis function is designed to traverse an object along a specified range with fixed stops. A traversing car is an example of a linear axis.



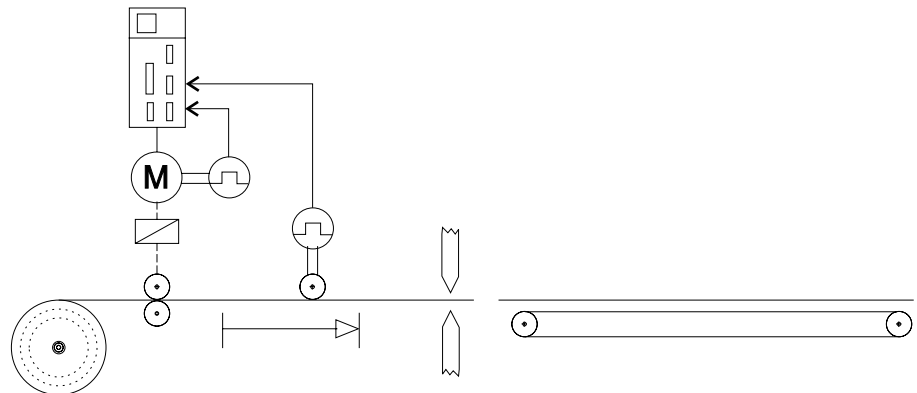
### Rotary Axis Function

A turntable is an example of a rotary axis. The rotary axis function is designed to move an object the shortest distance around a 360° path. Depending on where an object is, and where it must be moved to, the servomotor will turn the table either clockwise or counter clockwise.



### Roll Feed

This function works with a permanently rotating rotary axis and incorporates a cut-to-length function. A roll feeding into a cutting machine is one example.



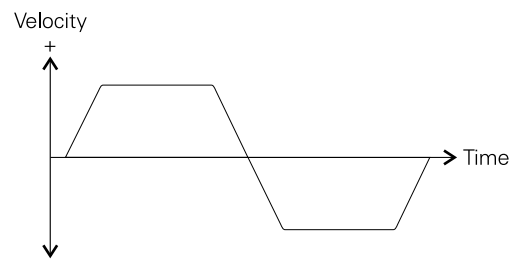
## Positioning

The MASTERDRIVE MC drive has a positioning control system capable of executing a variety of positioning tasks such as:

- Setup - Manually jogging an axis into position with acceleration and speed determined by preset parameters
- Homing - Moving the axis to a predefined zero position with acceleration and speed determined by preset parameters
- Point-to-Point Positioning using Manula Data Input (MDI) - Moving the axis to either an absolute or relative position at a given speed and acceleration
- Roll Feed - Automatic cut-to-length feature useful for presses, punching machines, and cross-cutters
- Automatic Mode - Automatic execution of complete positioning programs

Although the MASTERDRIVE MC may be operated in multiple modes in a given application, understanding a basic application that involves automatic mode and homing would be beneficial at this point. Since velocity versus time profiles are commonly used to describe positioning applications, a simple example is provided along with the explanation.

A velocity versus time profile provides a graphical representation of the velocity of an axis at any point in time. Velocity includes speed and direction. Speed in one direction is considered to be positive velocity and speed in the opposite direction is considered to be negative velocity. Positive velocity is graphed above the time axis and negative velocity is graphed below the time axis.



In the following example the MASTERDRIVE MC controls the vertical movement of a drill. The drill will penetrate a composite material that has been moved into position.

The drilling sequence is:

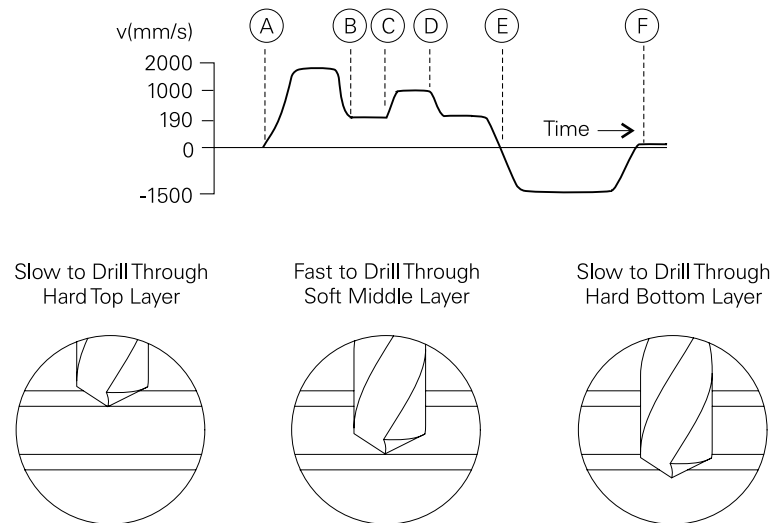
Point A to B - From the home position, the drive is started and accelerated to full speed. As the drill approached the workpiece it decelerates to 190 millimeters per second (mm/s).

Point B to C - The drill penetrates the hard top layer.

Point C to D - The drill is accelerated to 1000 mm/s to drill through the soft middle layer.

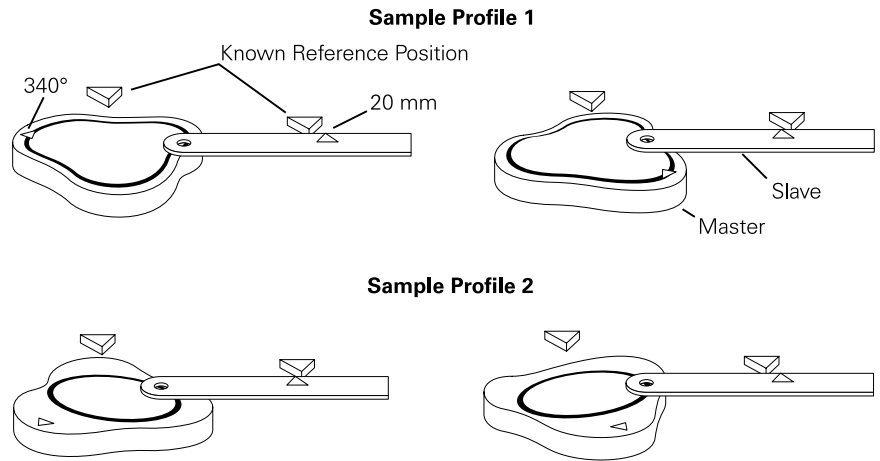
Point D to E - The drill is decelerated to drill through the hard bottom layer, then slows to zero at point E.

Point E to F - The drill is accelerated to -1500 mm/s (negative velocity) while it is raised out of the workpiece and returned to the home position at point F.



## Electronic Cam

The following illustration is representative of two sample electronic cam profiles available in the MASTERDRIVE MC. Electronic cam profiles are used to replace mechanical cams, and follow a specific cam pattern. The examples illustrate a linear axis coordinated with a rotary axis. Both axes are positioned at a known reference position to run the cam profile. In this example the rotary axis is designated the master and the linear axis is the slave. The slave axis (linear slider) will track the master (black line on rotating cam). With the MASTERDRIVE MC, unlike a mechanical cam, the profile can be changed easily, almost "on the fly." For example, sample profile 2 can replace sample profile 1.



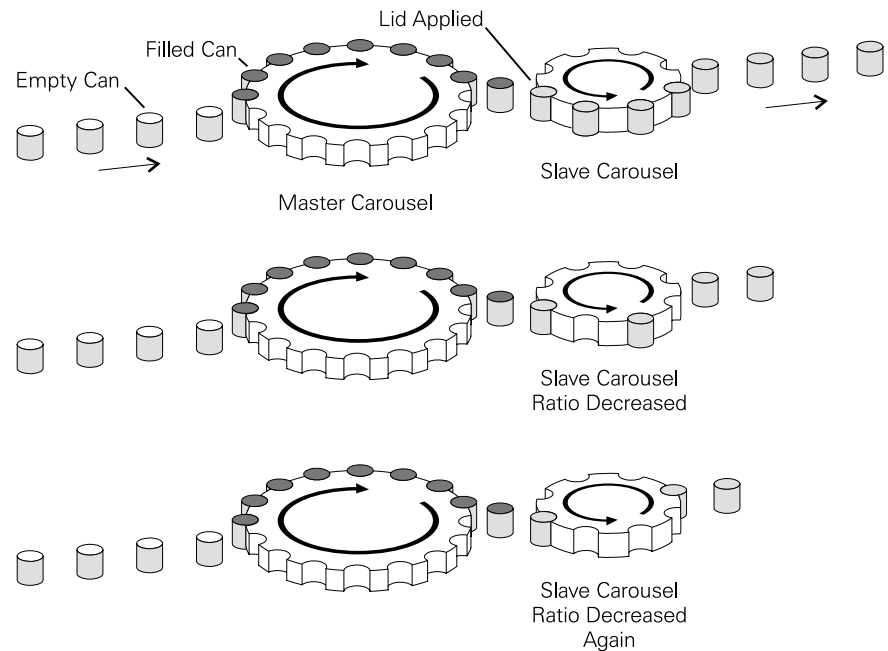
Each angular position on the cam is assigned a position on the slider, creating a cam table like the following example. Mathematical interpolation is used to control the move between the points on the table. In sample profile 1, for example, when the marker on the cam is 340° from the known cam reference position, the slider marker is 20 mm from the known slider reference position.

Master	Slave
360°/0°	0 mm
10°	20 mm
20°	40 mm
30°	50 mm
40°	60 mm
50°	70 mm
60°	80 mm
70°	90 mm
80°	105 mm
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340°	20 mm
350°	10 mm

## Electronic Gear Box

The electronic gear box function can be used to replace a mechanical gear box on a machine. In the following illustration two axes are used to control the speed of two carousels. One carousel is the master and one is the slave. In this example empty paint cans are loaded onto the master carousel where a filling process is carried out. The cans are then transferred to the slave carousel where lids are applied.

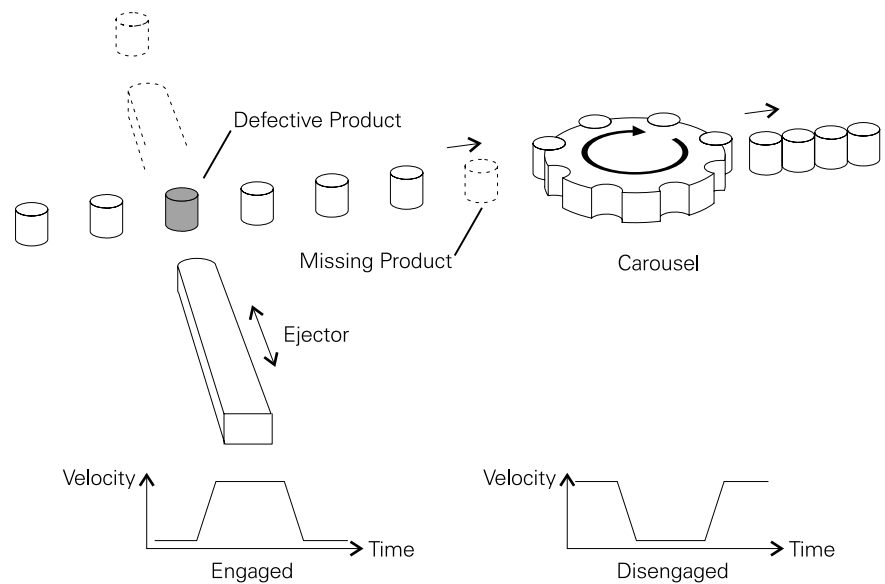
In many applications such as this there must be a difference in speed between the two processes. It may take longer, for example, to fill the can than to apply the lid. With the electronic gear box function an electronic speed ratio exists between the two carousels. Increasing the speed of the slave carousel, for example, will decrease the ratio. The ratio can be set anywhere from  $\pm 32,767:32,767$ , allowing for precise gear ratio adjustments. It should also be noted that the speed of the entire process can be changed while maintaining a desired ratio. For example, once the process is running it may be desirable to increase the process speed which will increase the production.



## Electronic Clutch Engage/Disengage

The electronic clutch function allows an axis to be engaged or disengaged without losing position synchronization. This is particularly important when several parts of a complex machine are dependent on each other. In the following illustration, for example, one axis controls an ejector. If a defective product is detected the ejector is engaged for one cycle while the ejector removes the defective product. A second axis disengages (stops) the carousel for one cycle. At the end of the cycle the ejector is disengaged and the carousel engaged.

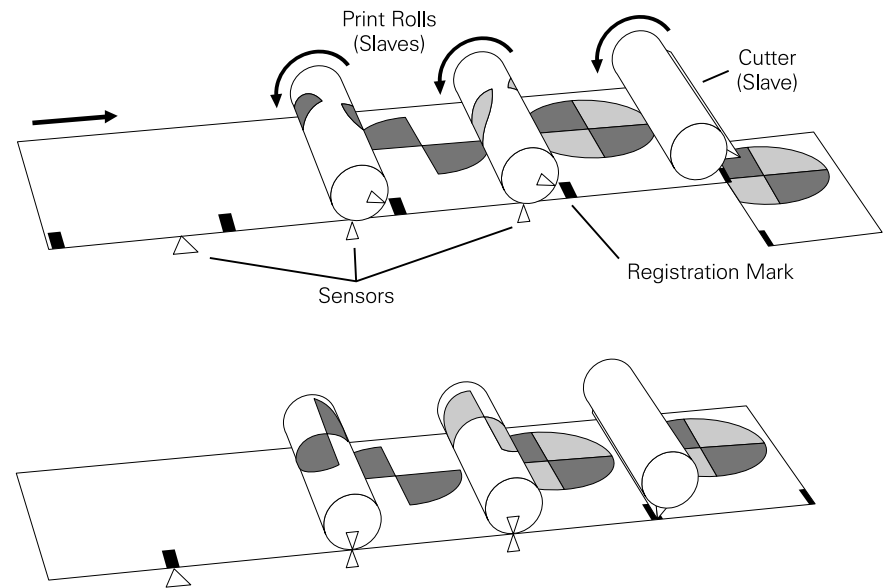
If a missing object is detected on the infeed the electronic clutch disengages the slave axis for one cycle to allow the next object in line to be loaded into the slave axis. The clutch is then engaged and the process is switched back to synchronous mode operation.





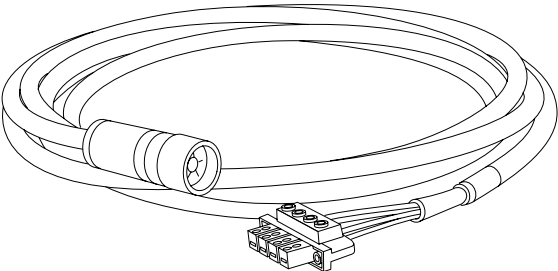
## Print Mark Registration

Print mark registration is used to compensate for creep, stretch, and thermal expansion of a printing operation. Registration marks are sensed within  $1\ \mu\text{s}$ , allowing for appropriate compensation at each print roll and at the cutter. The slave's position is evaluated relative to the registration mark. The motion control drives correct for any deviation. Without this correction creep, accumulates with every revolution. This creep would cause printing and cutting to be unsynchronized.



# Cables

Power and encoder/resolver cables can be ordered by the meter or are available prefabricated with appropriate plugs and connectors.



Power and encoder (feedback) cables have a maximum allowable length. Typically feedback cable length can be greater than power cable length (approximately 492 ft or 150 m). The following tables show the maximum power cable lengths.

## Compact PLUS

Output	Unscreened	Screened
0.55 kW Converters 0.75 kW Inverters	328 ft (100 m)	229 ft (70 m)
1.1 kW - 18.5 kW	426 ft (130 m)	328 ft (100 m)

## Compact and Chassis

Output	Unscreened	Screened
up to 4 kW	164 ft (50 m)	114 ft (35 m)
5.5 kW	229 ft (70 m)	164 ft (50 m)
7.5 kW	328 ft (100 m)	219 ft (67 m)
11 kW	360 ft (110 m)	246 ft (75 m)
15 kW	410 ft (125 m)	278 ft (85 m)
18.5 kW	442 ft (135 m)	295 ft (90 m)
22 kW - 200 kW	492 ft (150 m)	328 ft (100 m)