

# ControlMaster Crane Inverter Control Systems

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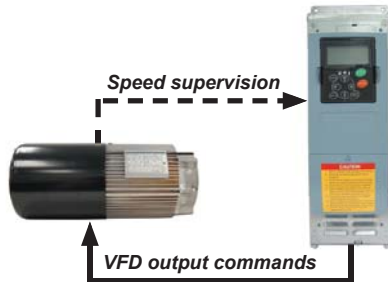
# ControlMaster Plus VFD

## ControlMaster Plus VFD

ControlMaster Plus is an economical, variable frequency drive (VFD) solution for controlling the hoist motor via an "open loop system". In an open loop system, the minimum allowable low frequency setting for the hoist speed is 10 Hertz, which means the speed ratio is about 12:1. The acceleration and deceleration times are usually set at the minimum 2.5 seconds.

### Open Loop System

ControlMaster Plus and ControlMaster Elite VFD's, used in open loop systems, have a built-in motor model which calculates the values of the real motor one thousand times a second. The input data needed for the algorithm is the instantaneous value of the motor voltage and the measured motor current. Motor magnetic flux and shaft torques are calculated in the motor model based on the nameplate data of the motor. The VFD uses the calculated information to change its output in order to control the motor.



### ControlMaster Plus and Elite Standard Features:

- Power classes - (kW & HP) - Inverter sizing is based upon motor current
- Supply voltage 380 - 500 Vac  $\pm$  10% \*
- 42 / 48 / 115 / 230 Vac control voltages
- Removable key pad
- Push button control modes available - EP2 / EP3 (Infinitely variable with accel / decel) or MS2 / MS3 / MS4 (Multi-step with accel / decel)
- Two parameter sets for digital to analog switching
- Drive can be run from any parameter page
- Monitors present operating conditions - currents, voltages & temperatures
- Records key information - faults, operating conditions (currents / voltages / temperatures)
- "Plus" control method - Open loop vector control
- RS communication port for computer hook-up
- Built-in line reactor
- Built-in DB chopper
- Control and Power sections are separated for easy maintenance and protection
- Control cards are mounted vertically for easy access
- SSU Card (Speed Supervision Unit)

\* A transformer is used to supply the correct voltage when the power supply is outside of the inverter's range.

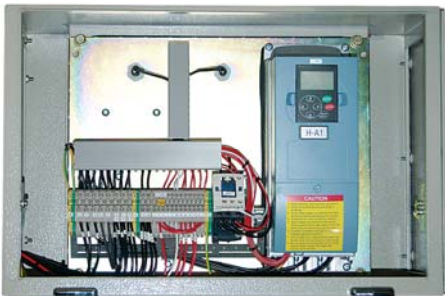
# ControlMaster Elite VFD

## ControlMaster Elite VFD

ControlMaster Elite comes with additional software parameters, and is well suited for sophisticated hoisting operations.

ControlMaster Elite is an open loop system as standard. In an open loop system the minimum allowable low frequency setting for the hoist speed is 10 Hertz, which means the speed ratio is about 12:1. The acceleration and deceleration times are usually set at the minimum 1.5 seconds.

ControlMaster Elite can also be used in a closed loop system for enhanced safety and better load handling precision. In a closed loop system, the lower frequency setting for the hoist speed can be less than 10 Hertz, which means the maximum speed ratio could be about 120:1. The acceleration and deceleration times are usually set at the minimum 1.5 seconds.

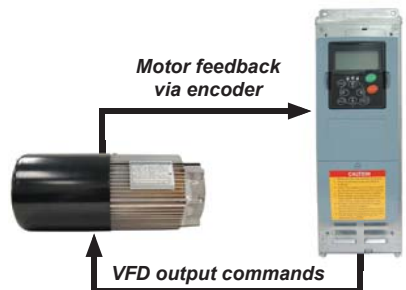


## Closed Loop System

ControlMaster Elite VFD's, used in closed loop systems, have a built-in motor model which calculates the values of the real motor one thousand times a second. The input data needed for the algorithm is the instantaneous value of the motor voltage and the measured motor current. (Unlike an open loop system, torque regulation comes directly from speed feedback from the motor through an encoder.) This closed loop system allows the VFD to know what the motor is really doing and can immediately change its output to compensate for any motor operation.

## Speed Supervision Unit

ControlMaster Plus and ControlMaster Elite VFD controls include a Speed Supervision Unit, (SSU) which is separate from the inverter and not dependent on the software. The Speed Supervision Unit monitors the speed of the motor for additional safety. If a speed difference, over-speed, or stall condition is detected, the Speed Supervision Unit stops the motion immediately. In an open loop system, a sensor bearing in the hoist motor supplies the speed feedback to the Speed Supervision Unit. In a closed loop system, an encoder on the hoist motor supplies the speed feedback.



## ControlMaster Elite Standard Features:

- "Elite" control method - Open loop or closed loop vector control
- 5th slot card available for automation
- Accepts analog controls - joystick, etc.

# ControlMaster Select VFD

**ControlMaster Select VFD** is used for controlling trolley or bridge drives.

- Power classes - kW & HP - Inverter sizing is based upon motor current
- Supply voltage 380 - 500 Vac  $\pm$  10% \*
- 24 / 48 / 115 / 230 Vac control voltages
- Removable Key Pad display used for displaying the drive identification, electrical values, operating or default parameters and for altering the parameter settings.
- Push button control modes available - EP2 / EP3 (Infinitely variable with accel / decel) or MS2 / MS3 / MS4 / MS5 (Multi-step with accel / decel)
- Control can be automated by using any device with a 0 - 10 Vdc output (computer, radio, PLC)
- Open loop vector control system



## Display Benefits and NC Drives Software

R&M's removable key pad and NC Drive software provide many benefits for the ControlMaster Plus, Elite and Select. The drive's parameters can be downloaded to the key pad. The key pad can then be stored in a secure location away from the crane so a new drive can be quickly programmed in case of an emergency and/or only qualified personnel have access to the key pad and the ability to change the drive parameters.

### NC Drive Software Features:

- Save drive parameters to an external file
- Download fault history from drive
- Graphic monitoring of drive inputs and outputs such as voltage
- Quick re-programming of parameters
- Download service information such as bus voltage at time of fault



# ControlMaster Versatile & Durable

R&M's ControlMaster Variable Frequency Drive Series offers more versatility, better performance and prolonged equipment life than industry-standard contactor motor controls.

That's why R&M, the industry leader in innovation, uses variable frequency drives as standard for trolley and bridge controls and offers as an option the most comprehensive offering of variable frequency drives for hoisting controls.

## More Versatility

Flexibility in speed selection and slower speeds offer precise load positioning and reduced load swing.

- Infinitely variable (stepless - EP) or multi-step (defined speeds - MS) speed control
- Wider range of selectable speed range - very slow speeds can be achieved

## Better Performance and Prolonged Equipment Life

Dynamic braking, controlled acceleration and deceleration, and motor over-current and over-temperature protection are some of the VFD features that provide better performance and prolong the equipment life.

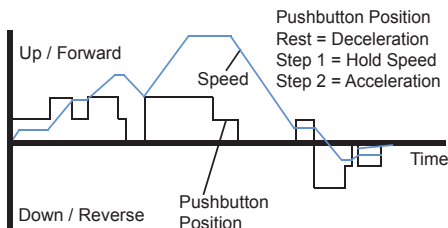
- Dynamic braking is a technique of electric braking in which the retarding force is supplied by the inverter. As the operator releases the control device (pushbutton), the output frequency of the inverter decreases to nearly zero which brings the motor to almost a complete stop before the brake is engaged.
- Controlled acceleration / deceleration provides smooth starts and stops and lowers starting currents, reducing gear and motor wear and structural stress on mechanical components - leading to longer equipment life.
- Motor over-current and over-temperature protection ensures that the motor is operating at its top performance levels.

## Variable Frequency Control Versus Two-speed Contactor Control

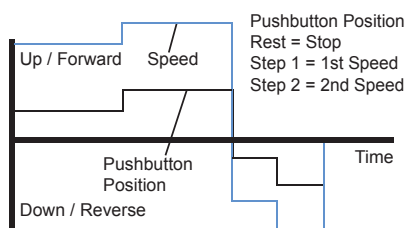
**Infinitely variable (EP)** speed control gives the operator the ability to smoothly accelerate, decelerate and hold any speed between the defined minimum and maximum speed.

**Two-speed contactor** control does not offer the operator the ability to smoothly accelerate or decelerate between the defined speeds.

### EP - for 2-Step Pushbutton



### Two-Speed Contactor Control



# ControlMaster CMXC

**ControlMaster CMXC** adjustable frequency drive is used for controlling trolley or bridge drives.

## CMXC 007:

- Two-step multi-speed (MS-2) or
- Two-step infinitely variable (EP-2)
- Dynamic braking
- Maximum current rating/power rating 2.4 A / 0.75 kW [1 hp]
- Supply voltage 380 - 480 Vac  $\pm 10\%$ \*
- Nominal supply frequency 48 - 62 Hz
- Auto transformer and line reactor are standard

## CMXC 022:

- Two-step multi-speed (MS-2) or
- Two-step infinitely variable (EP-2)
- Dynamic braking
- Capability to reduce the deceleration time to 30% of acceleration time
- Slowdown limit switch capability
- Maximum current rating/power rating 5.1 A / 2.2 kW
- Supply voltage 380 - 500 Vac  $\pm 10\%$ \*
- Nominal supply frequency 48 - 62 Hz



## Factory Settings of Inverters

Unless the crane builder and/or user specifies otherwise, the inverters are factory set for two-step infinitely variable (EP-2) and dynamic braking, and the output speed ratio is 4:1 for traveling (trolley or bridge) and 6:1 for hoisting.

**Note:** Two-step infinitely variable (EP-2) and two-step multi-speed (MS-2) allow the use of a two-step buttons, which is the standard pushbutton supplied by R&M.

\* A transformer is used to supply the correct voltage when the power supply is outside of the inverter's range.

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