SECTION 4/
TRACTION ELEVATOR CONTROLLERS
PTC, VVMC, VFMC

4.0 GENERAL
Systems described in this section can be used for geared traction elevators with DC or AC motors and speeds up to 350fpm in a simplex, duplex or group system configuration.

PTC Programmable Traction Control provides low cost, easily programmable elevator controls for simplex or duplex applications. Combined digital/analog technology and closed loop (CL) velocity feedback deliver superior performance to 350fpm (1.78 m/s). PTC for AC applications at speeds below 150fpm (0.76m/s) uses an open loop (OL) configuration.

Standard VVMC-1000 or VFMC-1000 controls, dispatched by an M3 Group System, allow group configurations with 64 landings and as many as 12 cars.

Depending on project requirements, a consultant, contractor or building owner can choose which control system is appropriate for the specific application.

4.1 MODEL PTC RECOMMENDED USE
These products can use either SCR drives, VVVF drives, Flux Vector drives or Motor- Generator shunt field control. PTC controllers are identified by application as either DC or AC systems. PTC, using proven solid state devices, provides "STEPLESS" acceleration and deceleration for smooth elevator operation while significantly improving elevator service for most low-rise to mid-rise buildings. Use PTC for simplex or duplex applications with up to 32 landings, where low cost and ease of field programmability are desired.

For DC geared applications to 350 fpm (1.78 m/s), where contract speed can be reached on a two floor run, use closed loop (CL) configured with either SCR drive or MG drive.

For AC geared applications to 150 fpm (0.76 m/s), use open loop (OL) configuration with VVVF drive; for speeds over 150 fpm (0.76 m/s), use closed loop (CL) configuration with Flux Vector drive.

PTC uses discrete and fixed slowdown distances and is not recommended for buildings with short floors or buildings with substantial variation of floor heights. Consult MCE Sales Engineers for limitations on floor heights.

4.2 PTC-SCR RECOMMENDED USE
PTC-SCR, using a six-pulse SCR drive, is an ideal low cost closed loop (CL) control solution for DC geared elevator applications to 350fpm (1.78 m/s). This control system provides high reliability with low maintenance cost.

To create a PTC-SCR system specification use Section 2, plus Section 4.8, plus Section 4.9, plus Section 4.14.

4.3 PTC-AC SERIES M RECOMMENDED USE

PTC-AC Series M is the most versatile control solution for geared elevators with AC hoist motors. This easily installed and adjusted control system can be configured for most applications.

Use open loop (OL) VVVF drive to 150fpm (0.76 m/s); use closed loop (CL) FLUX VECTOR drive to 350fpm (1.78 m/s). PTC-AC Series M non-regenerative control systems use the latest in AC drive technology and, for many applications, the existing motors can be reused. Consult your MCE Sales Representative for specific motor recommendations.

To create a PTC-AC Series M specification use Section 2, plus Section 4.8, plus Section 4.10, plus Section 4.11, plus Section 4.14.

To create a PTC-AC Series M Flux Vector system specification use Section 2, plus Section 4.8, plus Section 4.10, plus Section 4.12, plus Section 4.14.

4.4 PTC-MG RECOMMENDED USE

PTC-MG utilizes a field proven drive unit, manufactured by MCE, which employs an analog pattern generator and integrates control of the generator field, motor field and brake. PTC-MG is an ideal low cost closed loop (CL) control solution for DC geared elevator applications to 350fpm (1.78 m/s).

To create a PTC- MG system specification use Section 2, plus Section 4.8, plus Section 4.13, plus Section 4.14.

4.5 VVMC-1000 SCR RECOMMENDED USE

VVMC-1000 SCR used with an M3 Group System provides coordinated dispatching for up to 12 cars serving up to 64 landings. A six-pulse SCR drive provides an ideal, low cost closed loop (CL) control solution for group operation of DC geared elevators to 350fpm (1.78 m/s). This control system provides high reliability with low maintenance cost.

To create a VVMC-1000 SCR Group system specification use Section 2, plus 4.8, plus 4.9.

4.6 VFMC-1000 AC RECOMMENDED USE

VFMC-1000 AC used with an M3 Group System provides coordinated dispatching for up to 12 cars serving up to 64 landings. These reliable, value-priced controls use VVVF or FLUX VECTOR drives for AC applications. VFMC-1000 AC is the most versatile control solution for group operation of geared elevators with AC hoist motors. This easily installed and adjusted control system can be configured for most applications.

Use open loop (OL) VVVF drive to 150fpm (0.76 m/s); use closed loop (CL) FLUX VECTOR drive to 350fpm (1.78 m/s). PTC-AC Series M non-regenerative control systems use the latest in AC drive technology and for many applications the existing motors can be reused. Consult your MCE Sales Representative for specific motor recommendations.

To create a VFMC-1000 VVVF Group system specification use Section 2, plus Section 4.8 plus Section 4.10, plus Section 4.11.

To create a VFMC-1000 Flux Vector Group system specification use Section 2, plus Section 4.8, plus Section 4.10, plus Section 4.12.

4.7 VVMC-1000 MG RECOMMENDED USE

VVMC-1000 MG used with an M3 Group System provides coordinated dispatching for up to 12 cars serving up to 64 landings. VVMC-1000 MG uses a field proven drive unit, manufactured by MCE, which employs an analog pattern generator and integrates control of the generator field, motor field and brake. VVMC-1000 MG is an ideal low cost closed loop (CL) control solution for group operation of DC geared elevators to 350fpm (1.78 m/s).

To create a VVMC-1000 MG Group system specifications use Section 2, plus Section 4.8, plus Section 4.13.

4.8 GENERAL SPECIFICATIONS

All power feed lines to the brake shall be opened by an electro-mechanical switch. A single ground, short circuit or solid-state control failure shall not prevent the application of the brake.

The automatic leveling zone shall not extend more than 6" (152.4 mm) above or below the landing level, nor shall the doors begin to open until the car is within 6" (152.4 mm) of the landing. In addition, the inner leveling zone shall not extend more than 3" (76.2 mm) above or below the landing. The car shall not move if it stops outside the inner leveling zone unless the doors are fully closed and locked.

The system shall use an automatic two-way leveling device to control the leveling of the car to within .25" (6.35 mm) or better above or below the landing sill. Overtravel, undertravel or rope stretch must be compensated for and the car brought level to the landing sill. (Except in the case of AC Series M open loop applications)

The closed loop feedback power control shall be arranged to continuously monitor the actual elevator speed signal from the velocity transducer and compare it with the intended speed signal to verify proper and safe operation of the elevator. (Except in the case of AC Series M open loop applications)

During operation of the elevator with an overhauling load (empty car up or loaded car down), precision speed control shall be obtained by the regulation system used in the power control. The power control shall have the capability to maintain regulation under varying loads. (Except in the case of AC Series M open loop applications)

The controller shall provide stepless acceleration and deceleration and smooth operation at all speeds. The system shall provide the required electrical operation of the elevator control system including automatic application of the brake, which shall bring the car to rest upon power failure.

OPTIONAL - LS- STAN or LS-QUTE landing systems can be used with PTC, VVMC and VFMC controllers, Refer to Section 10 of this specification for details.

OPTIONAL - Failure of the brake to lift as detected by a mechanical switch (if provided) shall cause the control system to take the elevator out of service at the next stop and remain out of service until the condition is corrected.

4.9 SPECIFICS: SCR using 6-PULSE SCR DRIVE

The controller shall use a six pulse regenerative solid-state drive unit using SCRs to control the motor armature current. The solid-state power control shall be a closed loop feedback design. The controller shall be a compact, self-contained unit that shall provide stepless acceleration, deceleration and regulation at all speeds.

Isolation transformers or line inductors, plus proper filtering to eliminate both electrical and audible noise of SCR drives, shall be provided. The controller shall use a solid-state drive unit with solid-state power devices to control the motor field and brake.

A means of sensing motor field current shall be provided which shall cause electric power to be removed from the armature and brake, unless the direct current flowing in the shunt field of the motor is sufficient to prevent over-speeding of the motor.

4.10 SPECIFICS: AC Series M using VVVF or FLUX VECTOR DRIVE

The controller shall use a variable voltage variable frequency drive for the control of three phase AC induction motors.

The drive shall use a three-phase, full-wave bridge rectifier and capacitor bank to provide a DC voltage bus for the solid-state inverter.

The drive shall use power semiconductor devices and pulse width modulation, with a carrier frequency of not less than 2 kHz, to synthesize the three-phase, variable voltage variable frequency output to operate the hoist motor in an essentially synchronous mode.

The drive shall have the capability of being adjusted or programmed to achieve the required motor voltage, current and frequency, in order to properly match the characteristics of the AC elevator hoist motor.

The drive shall not create excessive audible noise in the elevator motor.

The drive shall be a heavy-duty type, capable of delivering sufficient current required to accelerate the elevator to contract speed with rated load. The drive shall provide speed regulation appropriate to the motor type.

A means shall be provided for removing regenerated power from the drive's DC power supply during dynamic braking. This power shall be dissipated in a resistor bank, which is an integral part of the controller. Failure of the system to remove the regenerated power shall cause the drive's output to be removed from the hoist motor.

A contactor shall be used to disconnect the hoist motor from the output of the drive unit each time the elevator stops. This contactor shall be monitored. The elevator shall not start again if the contactor has not returned to the de-energized position when the elevator stops.

All power feed lines to the brake shall be opened by an electro-mechanical switch. A single ground, short circuit or solid-state control failure shall not prevent the application of the brake. The controller shall provide stepless acceleration and deceleration and smooth operation at all speeds.

The controls shall be arranged to continuously monitor the performance of the elevator in such a way that if the car speed exceeds 150 fpm during access, inspection or leveling, the car shall shut down immediately, requiring a reset operation.

4.11 SPECIFICS: VVVF DRIVES

For VVVF applications (open loop), it is recommended that the AC motor have slip specifications between 8% and 12%, or a NEMA rating of "D".

The VVVF drive shall be capable of providing a braking pulse to use in the stopping sequence of the elevator. The braking pulse shall take the form of an adjustable DC current pulse applied to the AC motor for an adjustable period of time (0 to .75 second).

The VVVF drive shall be able to be programmed with different volts per hertz patterns which shall be used to adjust the drive control characteristics.

4.12 SPECIFICS: FLUX VECTOR DRIVE

For Flux Vector applications (closed loop), it is recommended that the AC motor have a slip specification of 5% or less, or a NEMA rating of "A" or "B". The flux vector drive shall be capable of producing full torque at zero speed. The flux vector drive shall not require DC injection braking in order to control the stopping of the car. The flux vector drive shall use encoder feedback to regulate hoist motor speed. The encoder shall be mounted to the motor shaft.

4.13 SPECIFICS: MG using GENERATOR FIELD CONTROL

The controller shall use a static drive unit using SCRs to control the generator shunt field, hoist motor field and brake. The solid-state power control shall be of a closed loop feedback design. The controller shall be a compact, self-contained unit that shall provide stepless acceleration, deceleration and regulation at all speeds.

The power control shall have the capability to drive the generator field, positive or negative, to a degree required to maintain regulation under varying loads.

The solid-state power control regulation system shall incorporate linear and/or proportional amplifiers, precise reference circuit boards, and speed feedback provided by the tachometer, with output voltage and current proportional to the actual speed of the traction motor. Regulator action shall be by electronic comparison of a reference signal to the feedback signal currents and, when any difference is present, the amplifier shall adjust to reduce the difference.

The controller shall use a solid-state drive unit with solid-state power devices to control the motor field, machine brake and generator shunt field. A means of sensing motor field current shall be provided which shall cause electric power to be removed from the armature and brake, unless the direct current flowing in the shunt field of the motor is sufficient to prevent over-speeding of the motor.

4.14 SPECIFICS: PTC PROGRAMMABLE LOGIC

All available options (consult your MCE Sales Representative) or parameters shall be field programmable without need for any external device or knowledge of any programming languages. Programmable options and parameters shall be stored in nonvolatile memory.

As a minimum, there shall be a 32-character alphanumeric display to be used for programming and diagnostics. The programmable parameters and options shall include, but not be limited to, the following:

Number of Stops/Openings Served (Each Car)
Simplex/Duplex
Single Automatic Pushbutton
Selective Collective/Single Button Collective
Programmable Fire Code Options
Fire Floors (Main, Alternates)
Floor Encoding (Absolute PI)
Digital PIs/Single Wire PIs
Programmable Door Times
Programmable Motor Limit Timer
Nudging
Emergency Power
Parking Floors
Door Pre-Opening
Hall or Car Gong Selection
Retiring Cam Option for Freight Doors.
Independent Rear Doors
MCE Standard Security
Emergency Hospital Service
Attendant Service
Anti-nuisance - Light Load Weighing and Photo Eye

Field selectable pre-programmed Fire Service operations compliant with the following Fire Codes:

ASME A17.1
California
Hawaii
Massachusetts
City of Chicago
City of Detroit
City of Houston
New York City
Veterans Administration
Washington DC
Australia
British
Canadian B44-94

For duplex configurations, each elevator shall have its own computer and dispatching algorithm. Should one computer lose power or become inoperative in any way, the other computer shall be capable of accepting and answering all hall calls. When both computers are in operation, only one shall assume the role of dispatching the hall calls to both elevators.

The dispatching algorithm for assigning hall calls shall be real time, based on estimated time of arrival (ETA). In calculating the estimated time of arrival for each elevator, the dispatcher shall consider, but is not limited to, location of each elevator, direction of travel, existing hall call and car call demands, MG start up time, door time, flight time, lobby removal time penalty and coincidence calls.

The controller shall have field programmable outputs to activate different functions based on customer needs. These functions can be outputs such as those listed below.

Fire Phase I Return Complete Signal
Fire Phase II Output Signal
Hall Call Reject Signal
Emergency Power Return

The controller shall have field programmable inputs to initiate special operations based on customer needs. These functions can be inputs such as those listed below.

Fire Phase I Bypass Input
Fire Phase II Call Cancel Input
Fire Phase II Hold Input
MG Shut Down Input
Attendant Service Input
Building Security Input
Hospital Emergency Operation Input

OPTIONAL - The controller shall include absolute floor encoding which, upon power up, shall move the car to the closest floor to identify the position of the elevator. With absolute floor encoding it is not necessary to travel to a terminal to establish floor position.

OPTIONAL - The controller shall have a serial port for communication with any data or computer terminal such as a CRT terminal, modem, etc.

OPTIONAL - The controller shall have an RFI Filter to help reduce EMI and RFI noise.

OPTIONAL - The controller shall have a 3 Phase Line Inductor to match minimum 3% line impedance recommended by various drive manufacturers.

OPTIONAL - The controller shall have a Drive Isolation Transformer, typically used to match line voltage to motor and drive voltage.