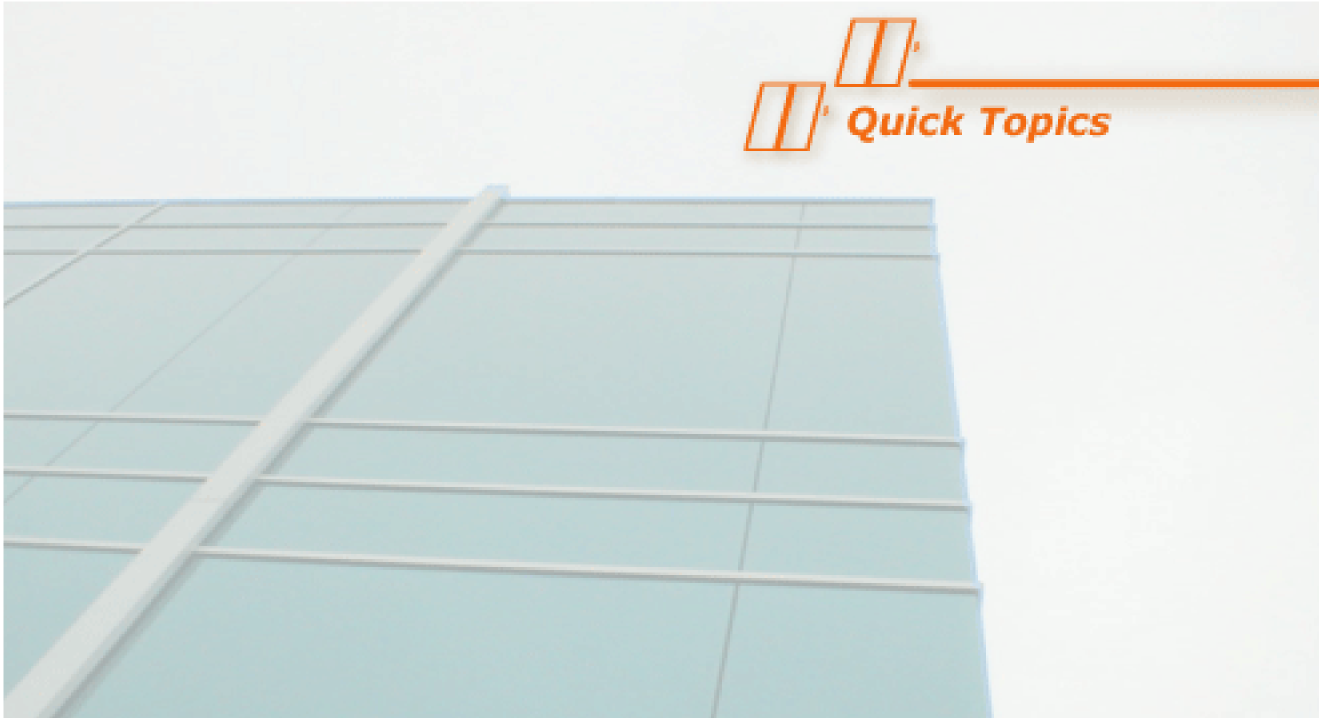

Traction Elevator Controllers, IMC

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The systems described in this section provide premium performance for gearless or geared elevator installations. IMC Intelligent Motion Control is a fully digital system incorporating both distance and velocity feedback. Powerful processing algorithms eliminate the need for adjusting trimpots. All parameters are set and adjusted digitally and stored numerically using the system computer keyboard.

In most cases, replacing components does not require readjustment, simplifying system maintenance.

IMC controllers can be used with the System 12 SCR drive, AC Flux Vector drives, or Motor-Generators. IMC controls will operate as a Simplex or as part of an M3 Group of up to 12 cars serving up to 64 landings. Depending on project requirements, a consultant, contractor or building owner can choose which control system is appropriate for a specific application.

In This Section

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IMC Recommended Use

IMC Intelligent Motion Control incorporates advanced digital elevator control technology. Highly integrated digital logic and motor control enable IMC to deliver premium performance for speeds to 1800 fpm (9.15 mps).

IMC controls continually create an idealized velocity profile. Exact car position and speed are tracked using a sophisticated distance and velocity feedback. By maintaining knowledge of exact car position, IMC controls are able to provide a high quality ride and the fastest possible floor-to-floor time. Continuous recalculation of idealized velocity makes IMC ideal for buildings with non-uniform or short floor heights. IMC groups use the M3 Group System.

Specification Text, IMC General

The microprocessor system shall be designed specifically for elevator applications and shall use multiple processors, at least one of which shall be a 32-bit high-performance RISC processor. Each elevator controller shall use at least four microprocessors in a multi-tasking/multi-processing environment and have a capacity of 2 megabytes RAM, 2 megabytes EPROM, and 32 kilobytes of EEPROM.

The drive, microprocessor and controller shall be an integrated system designed for ease of use with diagnostics and parameter adjustments accessible through the same user interface.

The individual car controller shall have an independent safety processor that learns and monitors the velocity of the car near the terminal landings. Whenever the car encounters slowdown limit switches, actual car velocity shall be compared with the learned velocity. If an overspeed condition is detected, the car shall be forced to slow down and approach the terminal landing at reduced speed. The safety processor shall perform its velocity monitoring function independently of any other logic or motion control processors in the system.

A second independent safety processor shall be provided to monitor car velocity near the terminal landings and shall act as the emergency terminal speed (ETS) limiting device. The ETS monitor shall have an adjustable range that can be modified via software parameters. When an ETS overspeed is detected, the car shall come to an immediate stop, then resume movement at reduced speed to the terminal landing.

The brake supply shall be capable of providing at least four independently adjustable output voltage levels to provide smooth lifting, holding and releveling. These values shall be adjusted via computer parameters which control a solid-state brake supply. Adjustment of resistor values is not acceptable.

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 application of the brake.

The control system shall include circuitry to detect insufficient brake current. This failure shall cause the elevator to be removed from service at the next stop and remain out of service until the condition is corrected.

The individual car controller shall have a software program that uses mathematical methods to create an idealized velocity profile to minimize car travel time. All system motion parameters including jerk, acceleration and deceleration rates, and so forth, shall be field programmable with parametric limitations for system dynamics and shall be stored on an EEPROM in non-volatile memory.

The drive control system shall use an optimized velocity profile in a dual-loop feedback system based on car position and speed. A velocity feedback device (tachometer or encoder) shall permit continuous comparison of car speed with the calculated velocity profile to provide accurate control of acceleration and deceleration up to and including the final stop, regardless of direction of travel or load in the car. Drive subsystem control parameters shall be digitally adjustable through software and shall be stored on an EEPROM in non-volatile memory.

The system shall provide continuous monitoring of actual car speed and compare it with the intended speed signal to verify proper and safe operation of the elevator. Should actual speed vary from intended speed by more than a preset amount, the drive shall shut down the elevator and drop the brake.

A system shall be included for precise closed loop motor field control for DC applications. This system shall regulate motor field current throughout the range of operation via current feedback from the motor field. The system shall provide motor field current sensing which shall shut down the elevator if insufficient motor field current is detected.

The system shall provide adaptive gains for optimum control of the elevator throughout its travel.

The system shall use a device to establish incremental car position to an accuracy of 0.1875" (4.76 mm) or better, using a quadrature signal for the entire length of the hoistway.

Absolute floor number encoding with parity shall be provided at each floor in order for exact floor position to be read by the computer. The system shall not require movement to a terminal landing for the purpose of finding correct car position.

The automatic leveling zone shall not extend more than 12" (304.8 mm) above or below the landing level nor shall the doors begin to open until the car is within 12" (304.8 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 leveling of the car to within 0.25" (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.

The car controller shall include a minimum of one serial port for display terminal communication. The display terminal shall be used to view and alter individual car operating parameters such as jerk, acceleration, contract speed, deceleration and leveling. Remote configuration of individual car operating parameters shall be permitted when the car controller is attached to a CRT or PC via modem and an established protocol is followed.

A menu-driven CRT display shall provide motor field (where applicable), armature and brake voltages, armature current, intended and actual car velocities and hoist machine rpm.

A special events calendar shall record (depending on controller type) 250 or 500 noteworthy events or faults for a particular car. They shall be displayed in chronological order for examination or review. Data displayed shall include the type of event or fault, the date and time it occurred, and the position of the car and status of various flags at the time of the occurrence.

Optional - A system for pre-torquing the hoist motor (DC) shall be provided in order to ensure consistently smooth starts. An electronic load cell is required to implement the pre-torquing feature.

Optional - Two different landing systems are available, LS-QUAD or LS-QUIK. Refer to Section 11 for details.

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

IMC Performa/System 12 SCR Drive Recommended Use

IMC PERFORMA offers top performance with faster, simplified adjustment for prestige projects with DC hoist motors. This control features the System 12 DC SCR drive using 12-pulse technology which inherently minimizes electrical and audible noise.

PERFORMA takes MCE 12-pulse technology to a new level. Sophisticated software simplifies system setup and operation. Interactive automation reduces motor field and brake calibration from hours to minutes. Imbedded coaching and context-based help make parameter adjustment intuitive.

Precise velocity control is achieved using advanced Digital Signal Processing (DSP) and MCE's sophisticated velocity control software algorithm.

New, more powerful PERFORMA microprocessors work in tandem with high-resolution digital components, using software optimization to provide tighter tracking and greater positioning and leveling accuracy.

IMC PERFORMA offers 12-pulse technology to the independent market; technology exclusively designed for elevator applications. This product is competitively priced despite its superiority to more common, conventional 6-pulse SCR drives.

IMC PERFORMA should be used when the reliability and maintenance-free characteristics of a DC SCR drive are desired; and where the lowest possible AC power line noise and disturbance is required. System 12 is the clear choice when limits are specified for AC power line harmonic distortion. System 12 also provides a superior power factor in comparison to conventional 6-pulse SCR drives.

Specification Text, IMC Performa with System 12 Drive

The control system shall use a 12-pulse SCR drive. The 12-pulse SCR drive shall be designed as an integral part of the control system providing access to and adjustment of all diagnostics and parameters for the entire elevator control system on a single monitor.

The controller shall provide precise velocity control using advanced Digital Signal Processing (DSP) technology. A high speed FPGA device shall be dedicated to encoder velocity processing.

The control system display diagnostics shall include on-line, context sensitive parameter descriptions and help information for fault troubleshooting.

The control system shall be capable of capturing six seconds of event-triggered, real time data for over 350 controller parameters. Data shall be recorded at 30ms intervals, and the system shall be capable of displaying both analog and digital values.

The control system shall provide auto-tuning of Motor Field and Brake control values.

The control system shall include dynamic braking to assist in bringing the car to a smooth, controlled emergency stop and to help limit car speed in the unlikely event of brake failure.

The control system motor field supply shall be current regulated and functionally integrated with the 12-pulse SCR drive in order to accomplish motor field forcing and armature voltage limiting.

A drive isolation transformer shall be provided as part of the control system to further reduce power line distortion and line notching. The transformer shall be matched to the characteristics of the 12-pulse SCR drive and elevator hoist motor.

Overcurrent protection shall be provided by a current limiting circuit with a threshold controlled by a computer system parameter.

Semiconductor fuses shall be provided for catastrophic overcurrent protection and to protect the SCRs from damage.

Heatsink over-temperature shall be monitored and, if an over-temperature condition occurs, the elevator shall be removed from service at the next available stop until the condition is corrected.

Speed regulation shall be +/- 1% or better, whether a tachometer or an encoder is used.

The system shall provide a commutation fault protection system to shut off current flow in the event of unexpected high current, which may occur during power regeneration back into the AC line combined with a sudden loss of AC power.

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 to accelerate the elevator to contract speed with rated load. The drive shall provide speed regulation.

A contactor shall be used to disconnect the hoist motor from the output of the drive each time the elevator stops. This contactor shall be monitored and the elevator shall not be allowed to 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 application of the brake.

The controller shall provide stepless acceleration and deceleration and provide smooth operation at all speeds.

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

IMC-SCR/System 12 SCR Drive Recommended Use

IMC-SCR brings premium performance to elevators with DC hoist motors. This control features the System 12 DC SCR drive using 12-pulse technology, which inherently minimizes electrical and audible noise.

IMC-SCR offers 12-pulse technology to the independent market; technology exclusively designed for elevator applications. This product is competitively priced despite its superiority to more common, conventional 6-pulse SCR drives.

IMC-SCR should be used when the reliability and maintenance-free characteristics of a DC SCR drive are desired; and where the lowest possible AC power line noise and disturbance is required. System 12 is the clear choice when limits are specified for AC power line harmonic distortion. System 12 also provides a superior power factor when compared to conventional 6-pulse SCR drives.

Specification Text, IMC-SCR with System 12 Drive

The control system shall use a 12-pulse SCR drive. The 12-pulse SCR drive shall be an integral part of the control system providing access and adjustment of all diagnostics and parameters for the entire elevator control system on a single monitor.

The control system shall include dynamic braking to assist in bringing the car to a smooth, controlled stop during emergency stops and to help limit the car speed in the unlikely event of brake failure.

The control system motor field supply shall be current regulated and functionally integrated with the 12-pulse SCR drive in order to accomplish armature voltage limiting.

A drive isolation transformer shall be provided as part of the control system to further reduce power line distortion and line notching. This transformer shall be matched to the characteristics of the 12-pulse SCR drive and the elevator hoist motor.

Overcurrent protection shall be provided by a current limiting circuit with the threshold controlled by a computer system parameter.

Semiconductor fuses shall be provided for catastrophic overcurrent protection and to protect the SCRs from damage.

Heatsink over-temperature shall be monitored, and if an over-temperature condition occurs, the elevator shall be removed from service at the next stop until the condition is corrected.

Speed regulation shall be +/- 1% or better whether a tachometer or an encoder is used.

The system shall provide a commutation fault protection system to shut off current flow in the event of unexpected high current, which may occur during power regeneration back into the AC line combined with a sudden loss of AC power.

IMC-AC/Flux Vector Drive Recommended Use

IMC-AC with Flux Vector, field oriented technology brings premium performance to elevators using AC hoist motors. The AC drive is integrated with the IMC controller, providing 32-bit processing for smooth pattern generation for any application, including short floors.

The regenerative IMC-AC model is ideal for higher speeds and gearless applications. Use the non-regenerative model for geared applications to 450 fpm. The flux vector drive is capable of producing full torque at zero speed. IMC-AC provides the highest ride quality and the best performance time when used in conjunction with an AC motor with a slip specification of 5% or less or a NEMA rating of “A” or “B.”

Specification Text, IMC-AC with Flux Vector Drive

The flux vector drive shall be capable of producing full torque at zero speed and shall not require DC injection braking in order to control the stopping of the car.

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 to accelerate the elevator to contract speed with rated load. The drive shall provide speed regulation appropriate to the motor type.

For non-regenerative drives, a means shall be provided for removing regenerated power from the drive 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 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 and 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 application of the brake.

The controller shall provide stepless acceleration and deceleration and smooth operation at all speeds.

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

IMC-MG/Generator Field Control Recommended Use

IMC-MG is recommended for premium performance when a motor generator is used to operate a DC hoist motor. The drive, microprocessor and controller are combined into one fully integrated system. Sophisticated solid state IGBT devices are used to control the generator shunt field supply for maximum responsiveness and exceptional performance.

Specification Text, IMC-MG with Generator Field Control

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

The main monitor screen shall display the generator shunt field voltage.

The generator shunt field supply shall use IGBTs in a current controlled loop for maximum response.