

SWIFT FUTURA[®]

ELEVATOR CONTROL AND MANAGEMENT SYSTEM

SPECIFICATIONS

SWIFT[®]

SHORTER WAITING INTERVALS FASTER TRIPS

COMPUTERIZED ELEVATOR CONTROL, CORP.

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PREFACE

SWIFT® **FUTURA**™ is a micro-processor-based, *REAL TIME* oriented elevator control and management system. It is programmed to always send the most appropriate car to every hall call based on which car has the best potential arrival time, thereby providing the best overall response for the predicted traffic demand. To achieve this order of precise response, a network of computers manages the elevator system. **FUTURA** uses multiple microprocessors per car to control the cab related functions and the motion of the elevator, and to manage the dispatching of the elevators.

The **FUTURA**™ was designed to function well into the 21st century. It is fully Year 2000 Compliant.

This specification manual is divided into four sections:

Section 1, "Group Specifications," describes how **FUTURA** analyzes developing traffic situations based on real-world traffic demands. **FUTURA EXPERT** dispatching technology, based on fuzzy logic algorithms, is used to predict future traffic to better manage the dispatching of the elevators.

Section 2, "Car Control System," describes the distributed processing techniques used to control the operation of the drive system, the cab and hall related functions.

Section 3, "General Hardware Technical Information," describes the equipment, the hardware and the design specifications.

Section 4, "Elevator Monitoring and Control System," is an overview of the **FUTURA Wizard**, the monitoring and the diagnostic system.

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SECTION 1

1. GROUP SPECIFICATIONS

1.1. GENERAL

The **FUTURA** dispatching is based on a high-speed microprocessor system that continuously scans and analyzes in real time every elevator's changing position, condition and workload. It then calculates the potential arrival of every car using both real time data and predicted traffic conditions; it assigns and reassigns hall calls to the car that can provide the best service. The goal of the **FUTURA** fuzzy logic call allocation algorithm is to minimize long wait times and to effectively transport passengers to their destinations in all traffic conditions.

Each elevator in the group is capable of providing the dispatching functions. When a car is out for service, another car in the group takes over the full dispatching functions without service interruption to the building. This feature makes it possible to add additional units to existing groups should the group need to be expanded.

1.2. REAL WORLD MANAGEMENT

REAL WORLD management of the dispatching permits **FUTURA** to accurately predict the requirements for elevator service. The following real-time elevator system information is taken into account to calculate the time required for each of the cars to travel to a hall call:

- Elevator in or out service
- Elevator at lobby in NEXT UP mode
- Motor generator ON or OFF (MG only)
- Direction and position of each elevator
- Condition of the car doors: opened, closed, opening or closing
- Condition and velocity of each elevator: accelerating, full speed, decelerating
- Car load (with **FUTURA** sensor)
- Number of stops required due to car calls and their locations
- Number of stops required due to previously assigned hall call(s)
- Coincident car call(s)

➤ System conditions: up peak, down peak, light, heavy, balanced light and heavy

1.2.1. Heavy Up Incoming Traffic Conditions

FUTURA automatically recognizes heavy incoming traffic in the morning, as well as other times during the day, by monitoring changes in car passenger loads, the number of car calls registered, and the frequency of cars departing the lobby or other designated floors. The incoming traffic intensity determines the number of cars assigned to the lobby. The system recognizes the increasing incoming traffic early and reacts in a controlled manner.

During *heavy up*, the cars at the lobby are loaded one at a time (standard) and only the doors of the *next* car are open. As the car becomes loaded, or the loading time expires, the car leaves and another car becomes next. Special provisions can be implemented to permit multiple car loading.

A car completes its up trip after it has answered its car calls and any up hall calls assigned to it. It then reverses and proceeds to the lobby floor, provided the system is still in *heavy up*. The down hall calls can be answered by any car when assigned.

When the incoming traffic becomes lighter, **FUTURA** de-allocates cars from the lobby accordingly. The other cars park with their doors closed at the landing they last served.

1.2.2. Heavy Down Traffic Conditions

FUTURA automatically recognizes heavy outgoing or down traffic by monitoring the recent and short-term traffic pattern, the number of down hall calls, their ETA's and the actual waiting time. During this mode, the down hall calls are given preferential service to handle the traffic which can occur in the evening or other time during the day. All cars assigned for *Next Up*, or other similar service are released. Cars arriving at the lower dispatching terminal light their lantern and remain at the terminal for the same length of time as for any other floor. The available car(s) are dispatched immediately to floors or to a sector of floors with the highest down waiting time, or alternatively to the floors with the most down calls in the recent history buffer. All down hall calls *of down traveling cars are assigned based on which car has best potential arrival time*. *Down peak* traffic mode has priority over *up peak*.

1.2.3. Two Way Traffic Conditions

All hall calls are given equal priority during this mode. An adjustable number of cars (usually one) is assigned at the lobby terminal. Available cars are left at the last floor served and can be assigned to hall calls above or below their position. A car traveling up or a car traveling down is not required to travel to the terminal floor or to the main floor. All car assignments are made on the basis of the forecast. Since the forecast is continually updated, reassignment of the call is also made based on the best time, always ensuring the quickest possible response.

1.2.4. Intermittent or Light Traffic

FUTURA automatically keeps the required number of cars in service based on the actual and forecasted waiting time. Cars remain parked at the last floor served unless the *parking* feature is activated.

MG only: After a predetermined adjustable time, the MG sets are shut down when there is no demand. The MG sets are restarted only when the forecast waiting time reaches a preset level. This energy saving feature prevents the unnecessary restarting of MG sets during light or intermittent traffic conditions.

1.2.5. Coincident Calls

FUTURA gives priority (ETA bonus) in its assignment of a hall call to a car with a corresponding car call. If a *coincident* hall call cannot be answered within the adjustable priority time, the car with the best potential arrival time is then assigned.

During peak conditions, the priority time is increased (adjustable) to further benefit from the elimination of a stop due to the *coincident call*.

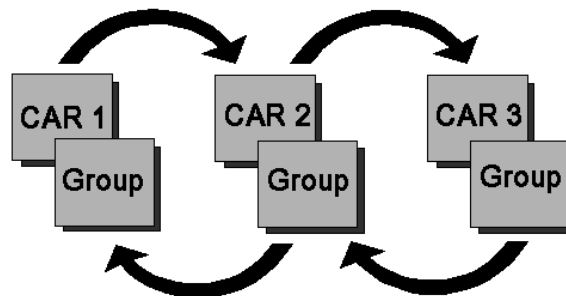
1.3. OPERATION

1.3.1. Alternate Lobby Service

This feature allows the location of the lobby floor to be changed between two designated floors which can be field adjustable. Selection of one of the two lobbies can be activated manually or by means of the *EMIS* real-time-clock service. Dual lobby service overrides this feature.

1.3.2. Continuity of Service

➤Group functions: **FUTURA** has the group functions integral to each individual car controller. In the event that the car managing the dispatching functions goes out of service, the next car in the group automatically continues the dispatching functions without interruption.



➤Hall Call: The hall call interface is integral to each individual car controller. In the event of a hall call interface malfunction, the next car in the group continues the dispatching and hall call service functions without interruption.

➤Hall Call Power: In the event of a complete failure of the group or hall call system, the individual cars will continue hall service in an adjustable and pre-established pattern.

1.3.3. Dual Lobby Service

This feature permits the dispatching of cars from two simultaneous main floors (field adjustable), each of which can have a *next car*. The selection of the secondary lobby floor can be activated manually or by means of the *EMIS* real-time-clock service.

1.3.4. Emergency Power Operation

During emergency power, the cars are automatically returned to a pre-designated floor at full rated speed. The number of cars to run simultaneously is adjustable. If a car is unable to move, it is bypassed after a predetermined time interval. After all cars have been returned, a pre-designated car(s) is put into operation to provide service to the building. Provisions are made to manually override the automatic operation.

As an option, the car speed profile (acceleration, top speed and deceleration) can be decreased to accommodate the generator power output.

1.3.5. High Zone Demand

FUTURA always ensures that there is a specific number (adjustable) of cars in the high zone (usually for high rise banks) during off peak conditions. When this requirement is not met, the ETA's of the up traveling cars are calculated. If no cars can service the upper zone within the adjustable time limit, a high zone demand is automatically placed to an available car.

1.3.6. Lobby Terminal Demand

FUTURA always ensure that there is a specific number (adjustable) of cars at the lobby during *off peak* conditions. When there is no *next car* at the lobby, the ETA's of the down traveling cars are calculated. If no car can reach the lobby in a preset time (adjustable), a *lobby demand* is automatically placed to return an available car.

1.3.7. MG Sequential Start

Variable time delays are provided for each car requesting to start their MG sets. In the event the group functions are off-line, each car has a different built-in delay to start their MG sets. These delays are used to stagger startup preventing more than one MG from starting at the same time.

When a car has its MG off, **FUTURA** assigns a penalty to that car during ETA calculation. This prevents unnecessary startup of the MG's. This penalty time is adjustable.

1.3.8. Parking

When a car is available, the dispatcher can either send the car to pre-designated floors or send the car to a floor that has a high probability of service requirement. When the car arrives to the parking floor, the doors do not open.

1.3.9. Real-Time Clock

A battery operated *real time clock* is provided and is used for certain dispatching, security, and control functions. The time is displayed on the VGA screen. The *real time clock* is fully Year 2000 Compliant.

1.4. OPTIONAL GROUP FEATURES (OPERATION)

1.4.1. Code Blue

Upon registration of a Code Blue (CB) call, the Group system will select a car for service. The selected car will immediately cancel all its calls (Car and Hall) and proceed to the CB floor.

- While traveling to a Code Blue call, the subsequent activation of the hall fire service circuitry will not affect its operation, except that the in-car fire buzzer will sound and the in-car return jewel will light. A car sitting at a fire service landing because of the transfer of a Code Blue call for that floor can be commandeered by a fireman for car fire service operation, assuming that smoke detectors or the fire switch in the hall have activated the fire service logic.
- After arrival at the CB floor, the doors will open for a predetermined time (field adjustable) or until the car is commandeered from inside the elevator by the activation of the independent or hospital emergency service switch. Should the door open time expire without the car being commandeered, the elevator will return to automatic operation.
- When the car is no longer needed for emergency use, turning off the independent or hospital emergency service switch will return the car to the previous operation.
- The registration of another Code Blue call will cause another car in service to be selected.
- Code Blue car selection can be performed from these methods of operation:
 - Pre-selected Sequence: Using the "Pre-selected Sequence" method of selection the system will select car(s) by a predetermined priority, which is normally based on car size or position in the building.
 - Most Available: The "Most Available" method of selection allows the quickest or best available (usually the car that has the lowest ETA based on

nonstop) car to travel to the floor. Although the "Most Available" method will generally bring a car faster, the "Pre-selected Sequence" method allows the selection to favor cars best suited for this service.

1.4.2. Inconspicuous Riser Service

This feature permits the operation of specific car(s) from a separate hall push-button riser. This service can be activated manually or automatically when an IR call is registered. When activated, the assigned car is removed from group service. With automatic activation, the car resumes group service operation, after a preset time interval following the last IR call.

1.4.3. Inter Group Emergency Power

All SWIFT Cars: During emergency power, all the cars of each group are automatically returned to a pre-designated floor, at full rated speed, until all the cars of the selected groups are returned. The number of cars to run simultaneously is adjustable. If a car is unable to move, it is bypassed after a predetermined time interval. After all cars (all groups) have been returned, pre-designated car(s) are put into operation to provide service to the building. Provisions are made to manually override the automatic operation. As an option, the car speed profile (acceleration, top speed and deceleration) can be decreased to accommodate the generator power source.

SWIFT Group with Non-SWIFT Cars: A special interface, located on a SWIFT car controller, is provided to interconnect all the non-SWIFT cars. The SWIFT cars will be recalled first, then commands will be provided to recall the other cars sequentially. The non-SWIFT car controllers must be wired to control the recall operation. Non-SWIFT car controllers such as GAL freight elevators are easily interconnected with **FUTURA**[™] controllers.

1.4.4. Security

The **FUTURA** security network system provides a much higher level of security than the car-call key switch lockout alone, because it is integrated with the control, dispatching, and management of the elevators. The calls can be secured from an EMIS workstation or from the car push-button. During security operation, the car operating panel can be used to unsecure floors by registering a 4-digit push-button code. Security monitoring and alerting are accomplished from the lobby VGA screen (monitoring only) or from the EMIS workstation.

1.4.5. V.I.P. Service

FUTURA defines a V.I.P. floor as one that is served in the best possible time. **FUTURA** assigns the V.I.P. call to the best available car taking into consideration only car call stops. The car is then removed from group operation and is expressed to that floor when it becomes available. The car parks with its doors open and the

appropriate hall lantern is illuminated. The car remains parked with its doors opened until a car call is registered or a preset time has elapsed. If a car call is registered, normal door operation resumes and the car is returned to group operation as soon as it becomes available.

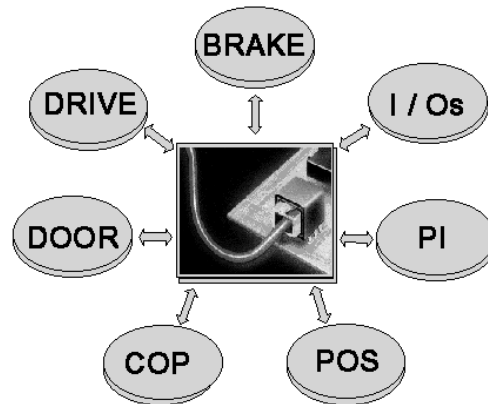
The selection of this features is accomplished by the activation of a special push-button or from the EMIS workstation.

SECTION 2

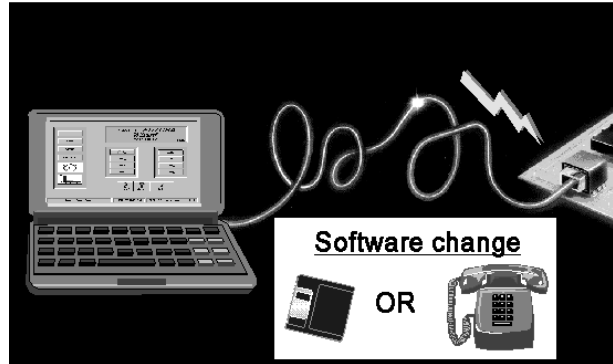
2. CAR CONTROL SYSTEM

2.1. GENERAL

The **FUTURA** controller is based on distributed processing technology. The main system processor (SPU) communicates with "smart" micro-controllers over a high speed communication network (SWIFT LINK) providing an all digital, extremely powerful, multiprocessor system. For example, the brake controller with minimum commands from the SPU, controls the voltage/current profile of the brake providing smooth start and stop transition. The COP processor handles all the Car Operating Panel functions, including the car call latching, the lamp illumination intensity, and the access codes when in security operation. Without additional burden to the SPU, the **FUTURA** PI fixtures provide all the required COP buzzer tones and illumination level to match the cab lighting. Most of these "smart" controllers connect as easily as a telephone extension providing quick servicing.

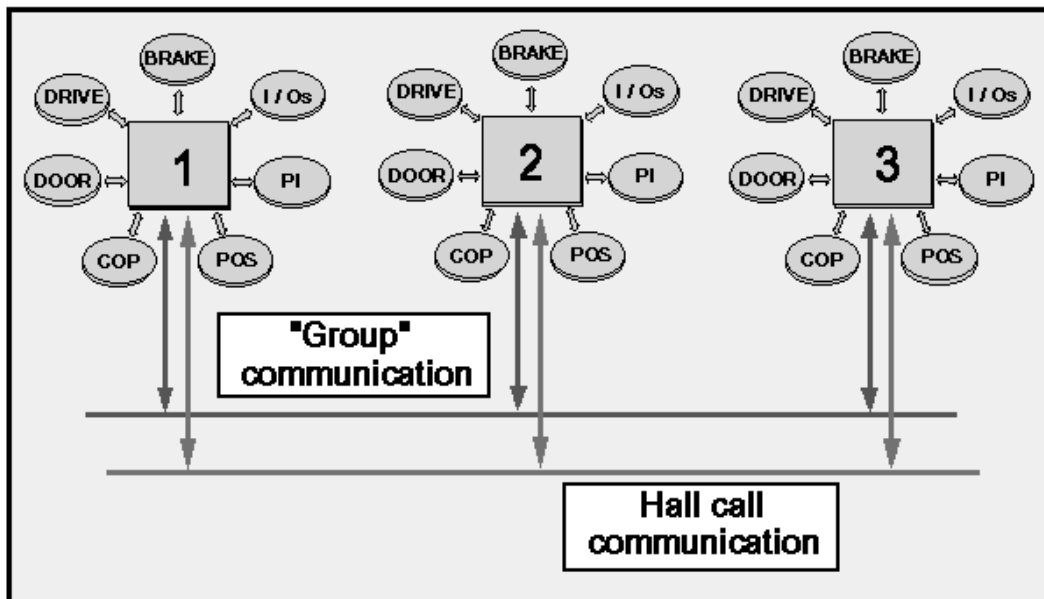


The **FUTURA** Program and Parameter memory is based on FLASH memory technology. This technology permits the downloading of software via a high speed serial communication interface. This process is controlled by Wizard software technology which provides electronic assistance during the download operation. There is no need to shut down the power, remove the printed circuit cards, or remove the "chips", in order to upgrade the software. This is an all digital process.



The **FUTURA** service tool is based on a PC notebook. The **NON-PROPRIETARY FUTURA WIZARD** software operates under the Microsoft Windows operating system. All monitoring, diagnostics and servicing are accomplished with an easy-to-use graphics screen. Most adjusting and servicing parameters can be set by using the built-in mouse and clicking the mouse buttons.

The group functions and the hall call interface are integral to each car controller. This provides a fully redundant system in which a single failure does not discontinue normal elevator service.



Each **FUTURA** controller has nonvolatile CMOS data memory and a battery backed real-time-clock controller. The real-time clock is fully Year 2000 Compliant.

2.2. MOTION

2.2.1. Control of Motion

The **FUTURA** controller provides an all digital, closed loop, microprocessor-based motion control system. Quadrature solid-state transducers provide the controller with constant feedback. The speed profile program uses the crystal based real-time clock function and the Car Primary Transducer (CPT), which provides accurate position and velocity feedback, to continuously adjust the profile for optimum performance. The secondary machine-mounted digital velocity transducer provides continuous comparison of machine speed to the digital speed profile. Any deviations are corrected within milliseconds. This accurate position/velocity feedback permits a fast and accurate control of the acceleration and deceleration right to the final stop without discomfort regardless of direction of travel or load in the car.

The all digital motion controllers can interface with SCR drives or with the motor generator for DC hoist motors, and with *Flux* and *Vector* AC VVVF drives for AC geared motors.

2.2.2. Car Primary Position Transducer

The primary position transducer, located on the car top, has it's own micro-controller which interfaces with the digitizer, leveling and preset transducers. The car position in the hoistway is digitized through a stationary steel perforated tape. The position digitizer uses two sensors to determine the direction (quadrature), velocity (within one percent) and the car position. It permits a 0.1875 inch resolution accuracy for the entire length of the hoistway. Other sensors are used to interface with the leveling and absolute preset vanes located on the tape. During setup, the main processor learns the floor position as well as the slowdown limit position and stores this data in *Flash* memory.

2.2.3. Leveling

The automatic two way leveling device provided is designed to govern the leveling of the car to within 1/4" above or below the landing sill. Any over travel, under travel or rope stretch returns the car level to the landing sill.

2.2.4. Brake Controller

For all geared or gearless installations, a "smart" microprocessor based brake controller is utilized. Current feedback is provided to permit a higher level of control and fault detection. It is fully integrated with the **FUTURA** logic and permits infinite control of the brake voltage. This results in smoother starting and stopping of the elevator.

The microprocessor based brake controller communicates with the main processor, via a high speed RS 485 communication link, for its voltage, status, diagnostic and parameter information.

All adjustments are digital and are performed using the **FUTURA WIZARD** tool.

The brake controller has the following features:

- Protection of the power semiconductors (SCR) from failure under short circuit or current surges conditions
- Protection against ground faults
- Electronic protection of the brake coil against sustained overload
- Protection against transients

2.3. DOOR OPERATION

The doors open automatically when the car arrives at the floor to permit transfer of passengers. After an adjustable time interval, the doors automatically close.

2.3.1. Pre Door Opening

If pre-opening is required, the computer calculates the correct point at which to initiate the door opening using the physical leveling target, the velocity and the distance information. Continuous monitoring of the velocity/distance profile, at the physical zone, is performed. Any deviations from a pre-establish "approach" will result in cancellation of the door opening process. This prevents passenger transfer when the car is not level at the floor.

2.3.2. Door Timing

The door open time is field adjustable with a resolution of 0.1 second. The dwell time for a car call stop is adjustable between 1 and 8 seconds, and the dwell time for a hall call stop is adjustable between 1.5 and 8 seconds. The hall call timing predominates. In the event the door detector beam is interrupted, the door open time is reduced to an adjustable 0.5 to 2 seconds and is separately adjustable for combinations of car and/or hall call stop.

2.3.3. Door Close Protection

If the doors are closing but do not fully close after a time delay, then the doors will recycle to try to correct the fault. An adjustable number of cycles will be tried before aborting the recycle operation and removing power from the doors. Activation of the door open push button, door close push button, or detector edge will reinitiate the process. During this mode, the car is immediately removed from group operation.

2.3.4. Door Open Protection

If the doors do not open according to their respective operation, they repeat or recycle the operation to try to correct the fault. An adjustable number of cycles will be tried before finally closing the doors and allowing the car to answer another call. During this mode, the car is immediately removed from group operation.

2.3.5. Nudging

In the event the doors are held open for a predetermined adjustable time interval (10-45 seconds) after automatic door closing has been initiated, a buzzer sounds and a signal is given to close the door at reduced speed. The detector edge and door open button will prevent further door closing by removing power to the doors. The electric eye is deactivated during nudging operation.

2.4. LOAD WEIGHING

Another function of the Car Position Transducer "CPT" is to interface with compatible load cells to measure the car load. Two distinct interfaces are available; the first interfaces with a top-of-car strain gauge transducer and the second interfaces with an under-the-platform linear measuring transducer. After initial calibration, the controller will compensate for load cell variation and for the car position in the hoistway. This data is used by the dispatching system for car load information required in measuring traffic intensity and also for the main terminal dispatching. The car uses this data for anti-nuisance, by-passing and for an overload condition.

With **FUTURA** Load Weighing (as described above): Four separate adjustable load settings are provided to interface with the following features: Anti-nuisance, Terminal Dispatch, Bypass, and Overload. If under-the-platform sensing is used, the pre-torquing motion feature can be activated. This feature provides smoother starting from the floor. After initial calibration, these settings (trip point) can be changed without interruption of service due to car load recalibration.

Without **FUTURA** Load Weighing: I/O's are provided to interface with the following features: Anti-nuisance, Terminal Dispatch, Bypass, and Overload. The calibration settings, or trip point adjustment, must be accomplished with the micro-switches or load-weighing devices.

2.4.1. Anti-Nuisance

With Load Weighing: In the event the car load is less than the anti-nuisance load setting and there are a greater number of car calls than the number allowed under that setting, all the car calls are canceled.

Without Load Weighing: In the event that there are a number of car call stops (adjustable 1 to 10) and the door detector beam is not interrupted, all the car calls are canceled.

2.4.2. Bypass

The elevators bypass hall calls when the load exceeds the bypass setting.

2.4.3. Overload

When the overload device is activated, a buzzer will sound and the elevator will not accept any additional car calls. An indicator light output will be energized. The doors will not close.

2.5. EMERGENCY OPERATION

The elevators are recalled in the event of a fire or other emergency conditions. The operation is according to ANSI/ASME A17.1 as amended. Other fire emergency operations are available to comply with local or state codes.

2.6. INDEPENDENT SERVICE

Activation of the independent key switch in the car or in the hall will place the car on independent service operation. The car will be taken out of group operation. Door operation will be as follows: If the car is at a landing with a single automatic opening, the doors will open. If constant pressure is applied to the door close button, the doors will close. If a car call is registered, the car will proceed to answer the call as soon as the doors are fully closed. With no car calls registered, the doors will reopen as soon as the door close button is released. Optionally, the door can be made to close as soon as a car call is registered (no door close button required).

When initiated from the lobby, the car will return to the lobby after answering the registered car calls. After opening its doors at the lobby, the car will operate under independent service operation.

2.7. CONTINUITY OF SERVICE

In case of malfunction of the hall call circuitry or complete loss of hall call power, the individual car computer provides continuity of service. The floors and the direction of the stops under this operation are field adjustable on a per car basis.

2.8. OUT OF GROUP OPERATION

In the event the car does not start for a hall call dispatch signal, the car removes itself from group operation after an adjustable period of time (10-45 seconds).

2.9. HOISTWAY ACCESS OPERATION

If enabled by in-car inspection, hoistway access allows access to the car top and the pit from the hallway. A three position spring return key switch at each terminal allows running the car up or down at inspection speed.

2.10. OPTIONAL SPECIAL FEATURES

2.10.1. Attendant Service

When the attendant key switch is energized, the doors will open and be held open. If a car call is registered or a hall call assignment is made by the group, the attendant direction arrows will display the proper preference. The attendant can answer the call by closing the doors with constant pressure on the appropriate attendant direction button. If the button is released before the doors are closed, they will reopen. The door close button is inactive on attendant service.

The attendant can override the established preference by registering a car call for the opposite direction and pressing the corresponding attendant direction button. Upon answering a call, only that landing's car or hall call will be canceled. All car calls can be canceled by pressing the cancel button. Hall calls can be bypassed by pressing the appropriate direction button (or the bypass button) when the car is in motion. The optional attendant direction arrow will light when a call must be serviced. A buzzer will sound if the doors are not closed within an adjustable time interval when a call must be serviced. After further delay (adjustable) to answer an assigned hall call, the car will be removed from group service and will remain out of service until it starts again.

2.10.2. Automatic Announcements

A speech synthesizer interface (interface only) for the generation of preprogrammed voice announcements is available.

2.10.3. Limited Door Reversal (Requires Limit Switch)

When the doors are closing and are more than 1/3 closed and the detector edge is activated, the doors will reverse and open to the 1/3 close position. The doors will begin to re-close when the detector edge is deactivated. If the detector edge is activated during the closing cycle before reaching the 1/3 closed position, the doors will stop and resume closing when the detector edge is de-activated. If it is activated longer than 3 seconds, then the doors will reopen completely.

2.10.4. Hospital Emergency Operation

Activation of the independent or hospital service key switch in the car will place the car on hospital emergency operation. The car will be immediately taken out of group operation and open its doors. Door closing requires constant pressure on the door close button. Calls can be canceled at any time with the cancel button. If no calls are registered when the doors get fully closed, the doors will reopen. Optionally, car calls can be accepted only when the doors are fully closed. Optionally, all calls can be canceled automatically when the car stops at a landing. Electric eye, door open and door close buttons will operate normally.

2.10.5.FUTURA Position Indicator

A microprocessor based digital Position Indicator (PI), which is fully integrated with the **FUTURA** logic, can be provided. It operates from the standard 24VDC supply provided on every SWIFT installations. The PI has the following characteristics:

- Two 16-segments digits
- Digit size: two (2) inches
- Arrow size: two (2) inches
- Fire Hat symbol
- Integral speaker control for floor passing tone, fire service buzzer, attendant buzzer, nudging buzzer, and other cab related sounding devices
- Digital illumination level control
- Quick connect on **FUTURA** LINK

SECTION 3

3. GENERAL HARDWARE TECHNICAL INFORMATION

3.1. HARDWARE

3.1.1. General Purpose I/O's (SMI)

The Serial Module Interface (SMI) controller is a "smart" micro-controller which operates on the **FUTURA** LINK. All input and output signals are isolated and have LED indicators. All outputs are fused and are latched via a fail-safe design (watchdog timer) which turns the outputs off in the event of a malfunction of the micro-controller or the communication link.

3.1.2. Specific Purpose I/O's

FUTURA is designed around multiple micro-controller based "smart" controllers. Each has a fail-safe output circuitry and "watchdog" circuitry to monitor the micro-controller and communication operation.

3.1.3. Power Supplies

All power supplies utilized are both UL and CSA recognized. They all have short-circuit protection with foldback current limit. For high efficiency and brownout protection, a switching type power supply powers the computer.

3.1.4. Frame

All assemblies, power supplies, chassis, switches, relays, and other items are securely mounted on a substantial, self supporting steel frame (RETMA). Controller doors and side panels can be easily removed. The equipment is completely enclosed with covers. No equipment is mounted on the covers. Optionally, the controller can be assembled in a wall mount NEMA enclosure.

3.1.5. Machine Room Space

FUTURA controllers do not require mechanical floor selectors. They are of a compact design and can be installed in smaller motor-rooms.

3.1.6. Wiring

All factory wiring utilizes UL & CSA approved copper wires. All wiring interconnections are neatly routed.

3.1.7. Marking

All components are clearly and permanently identified adjacent to each device and are identical to the wiring schematic.

3.2. INDIVIDUAL CAR CONTROLLER

The microprocessor based individual car controller is designed and constructed with the following requirements:

3.2.1. Main System Processor

The car controller is based on a highly integrated Intel 20 MHz 16-bit embedded micro-controller using 256K bytes of nonvolatile CMOS memory, 512K bytes of *FLASH* memory for the program, and 128K bytes of EEPROM memory for the SWIFT Basic Operating System. Six (6) high-speed communication channels are provided to communicate with the other cars and the "smart" controllers. An expansion bus is provided permitting the addition of 768K bytes of memory or another high performance CPU with high memory capacity.

3.2.2. Selector

A stationary steel reference tape located in the hoistway with a top-of-car position transducer (CPT) and appropriate mounting hardware is provided.

3.2.3. Switch and Relay Designs

All switches and relays have contacts designed for maximum conductivity and wiping action. All switches carrying highly inductive currents are provided with suppressers.

3.3. SCR MOTOR DRIVE

For geared or gearless installations specifying SCR motor drive, a MagneTek DSD 412 power converter manufactured specifically for elevator operation is utilized. All circuitry is of the digital microprocessor based type. The velocity feedback is encoded digitally to permit a higher level of control.

3.3.1. Interface

The microprocessor based motor control regulator communicates with the main processor, via an isolated high speed RS 485 communication link, for its speed, status, diagnostic and parameter information.

All adjustments are digital and are performed using the **FUTURA WIZARD** tool.

3.3.2. Protection

The car controller/solid state motor control unit has the following features:

- Protection of the power semiconductors (SCR) from failure under short circuit or current surges conditions
- Protection against ground faults
- Electronic protection of the hoist motor against sustained overload
- Electronic protection against overspeed
- Protection against transients
- Fans are provided to dissipate the heat generated by the SCR's. A heat sink mounted thermostat will alert the controller to stop the car at the nearest floor during excessive temperature.
- Resistances are connected in parallel with the motor armature to absorb regenerated power when normal drive power is removed from the motor.

3.3.3. Transformer and Filter

The solid-state drive unit is provided with appropriate isolation transformer to completely isolate the unit and the hoist motor from the elevator power supply.

An appropriate filter/chokes is provided to remove approximately 90% of the armature AC component. The machine room audible noise level (360 Hz acoustic noise) is practically eliminated.

3.3.4. Encoder

A high precision optical quadrature encoder with mounting hardware is provided.

3.4. MOTOR GENERATOR SHUNT FIELD FOUR QUADRANT DRIVE

For geared or gearless installations specifying motor generator drive, a **FUTURA** REG-4 solid-state MG-field regulator is utilized.

3.4.1. Interface

The solid state generator field control regulator is of the hybrid (analog/digital) design and communicates via an isolated high speed RS 485 communication link with the car controller for all speed related information.

3.4.2. Protection

The car controller/solid state generator field regulator control unit has the following features:

- Protection of the power semiconductors (SCR) from failure under short circuit or current surges conditions
- Protection against ground faults
- Electronic protection against overspeed
- Protection against transients
- The car controller signals are isolated from the solid state regulator.
- Resistances are connected in parallel with the generator shunt field to absorb field regenerated power when normal drive power is removed from the motor.

3.4.3. Tach Feedback

A high precision tacho-generator with mounting hardware is provided.

3.5. AC MOTOR DRIVE

For geared installations specifying AC motor drive, a MagneTek Variable Voltage Variable Frequency (VVVF) drive, interfaced for elevator operation, is utilized. All circuitry is of the digital microprocessor based type. The velocity feedback is encoded digitally to permit a higher level of control.

The VVVF design consists of a sophisticated converter/inverter which first rectifies the incoming building AC supply to DC power. Pulse Width Modulation (PWM) technique is then used to "chop" the rectified DC to AC. The rotating speed of the motor is electronically regulated by controlling the AC voltage and frequency.

☑ The GPD 503 drive is based on flux technology and is available for geared elevators with speeds up to 300 FPM.

☑ The VCD 703 drive is based on flux vector technology and is available for higher performance geared elevators with speeds up to 500 FPM.

3.5.1. Interface

The microprocessor based motor control regulator communicates with the main processor, via an isolated high speed RS 485 communication link, for its speed, status, diagnostic and parameter information.

The advanced speed profile guarantees smooth and efficient transportation capacity by optimizing the acceleration, deceleration and floor level accuracy.

All adjustments are digital and are performed using the non-proprietary **FUTURA WIZARD** tool.

3.5.2. Protection

The controller motor control unit has the following features:

- Protection of the power semiconductors (SCR) from failure under short circuit or current surges conditions
- Protection against ground faults
- Electronic protection of the hoist motor against sustained overload
- Electronic protection against overspeed
- Protection against transients
- Fans are provided to dissipate the heat generated by the SCR's. An appropriate resistive braking unit (braking module) absorbs the regenerative power during overhaul.

3.5.3. Filter

A 3-phase capacitive filter is used to reduce Electro Magnetic Interference (EMI).

The drive IGBT (Insulated Gate Bipolar Transistors) technology permits raising the carrier frequency for quiet (acoustical noise) operation. It also provides greater torque per amp.

3.5.4. Encoder

A high precision optical quadrature encoder with mounting hardware is provided.

3.6. DISPATCH COMPUTER

FUTURA does not require an additional microprocessor for the dispatching functions. The group dispatching functions and the hall call interface are integrated on each individual car controller.

- The group functions communications network (car to car communication) is based on a full-duplex RS-485 multidrop protocol.
- The hall call communications network (serial hall call module) is based on a half-duplex RS-485 multidrop protocol.
- A separate power source is used for the hall call interface and the lamping.

3.7. COMPUTING ENVIRONMENT

3.7.1. Design Specifications

Where computing devices are used, such as the microprocessors along with associated devices, the following design specifications are provided:

- All controller *inputs* and *outputs* are isolated with *opto-isolation* modules.
- All controller *output* modules are fused.
- All controller *opto-isolation* modules and associated fuses are plug-ins.
- Crystal frequency regulation is used for the main processor clock.

- A separate regulated power supply is used for each computer chassis.

3.7.2. Printed Circuits and Solid State Hardware

- All printed circuit boards are fabricated with G10 glass epoxy material with a minimum equivalent two ounce copper.
- All printed circuitry is coated with tin-lead.
- A solder mask screen is provided.
- All multi-layer boards have plated through holes.
- A silk screen with outline and component identification is used on all printed circuit boards.
- All printed circuit board edge connections are plated.
- All solid state hardware have build in noise suppression devices which provide a high level noise immunity.

3.7.3. Electromagnetic Compatibility

- All controllers will meet the electromagnetic compatibility requirements required to bear the FCC Part 15 label and the European CE mark.

3.8. ENVIRONMENTAL

- Ambient service temperature: 0C to 50C (32F to 122F)
- Humidity: non-condensing to 95%
- Altitude: to 3,000 feet. Higher with derating of the controller

3.9. REQUIREMENTS BY OTHERS

3.9.1. Power

- Car controller input voltage: 200/208/220/230/380/415/440/460/480/500/575/600 VAC
- Input frequency: 50/60 HZ +/- 5%
- Car controller: 3-phase, 3 or 4-wire line supply
- Group operation: 120-1-60 VAC having a 20 amp capacity is required in the machine room for the group operation, the monitoring CRT's/PC's and the PC based tool.

➤Lobby (optional): 120-1-60 VAC having a 10 amp capacity is required for the lobby CRT or PC based monitoring equipment. If the lobby CRT is not adjacent to or near the elevator shaft, a conduit must be provided from the fixture to the hoistway.

SECTION 4

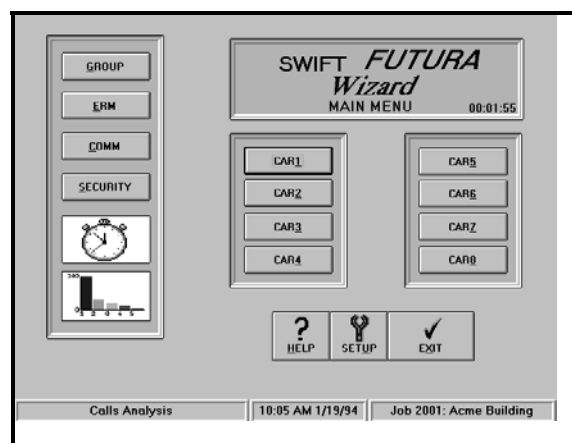
4. ELEVATOR MONITORING AND CONTROL SYSTEM

4.1. GENERAL

The **FUTURA** elevator monitoring and control system (EMCS) is a standard feature which helps to minimize elevator downtime. Its powerful monitoring and diagnostic capabilities enable it to analyze the most difficult-to-find faults, and to perform live or historical traffic and service analysis using a comprehensive PC based visual interface, the **FUTURA WIZARD**. It constantly monitors the condition of all car computers via the communication link. Every changing condition of each elevator is analyzed against its normal mode of operation. When a fault is detected, the location of the elevator, the time of day, the number of times it has occurred, along with the fault message are stored in non-volatile memory.

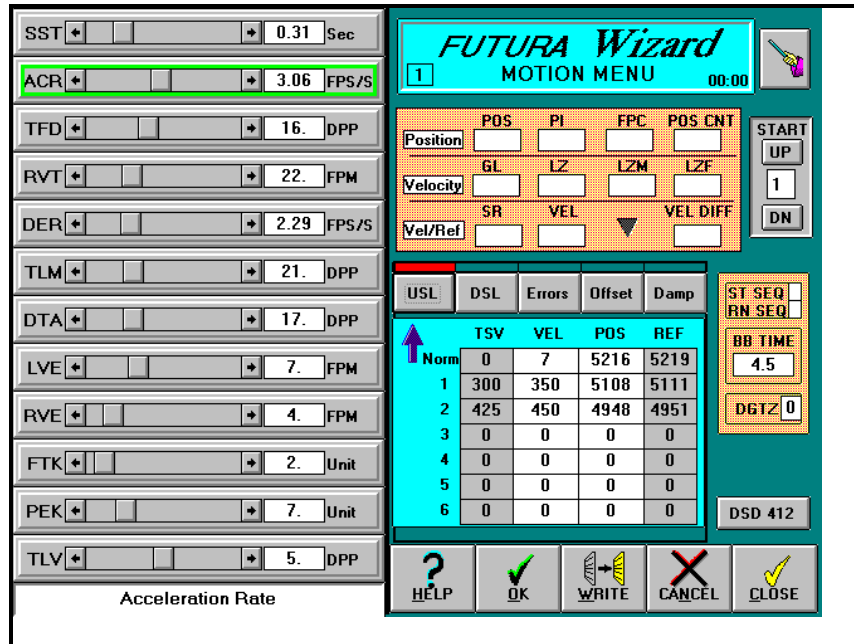
4.2. FUTURA WIZARD

The **FUTURA WIZARD** is a PC based visual interface which operates under the Microsoft Windows operating system. The information is grouped logically permitting easy navigation through the menus with the tool's built-in mouse. The **WIZARD** permits interfacing with all controller functions, including the drive system parameters. Traffic analysis, door timing setup, diagnostics, or downloading new software are accomplished by selecting, with the mouse, the appropriate *push-button*.



The **WIZARD** software is provided for **FUTURA** installations. The **FUTURA** interactive tool is based on a regular PC or a notebook PC with integral mouse control (preferred). The tool is an optional item, available in color or monochrome.

All parameters are adjustable via easy to use *sliders*, which provide both an analog and digital representation of their values. The analog is represented by the slider *thumb* position within the adjustment range. To the right of the slider an accurate digital value is shown. The **FUTURA WIZARD** presents the adjuster with an associative lookup window (right window) of the requested parameter screen (left window). This associative technique permits faster and more accurate setup and direct user interaction.



The on-line help function is fully integrated with the *WIZARD* software. The complete installation and adjustment manual is included and can be accessed via context sensitive screens.

4.3. EMIS (OPTIONAL)

Through an optional PC based workstation, building personnel can interact in *REAL TIME* with **FUTURA** or SWIFT 5000 installations. The EMIS nonvolatile memory permits on-line storage of car status and traffic information on a 7-day basis. The traffic data can be stored on a disk for later reference. An area network utilizing advanced communication technology (see ERM) permits interconnection of multiple workstations. The EMIS performance reports permit building personnel to analyze the elevator traffic information. These reports provide them with an accurate picture of the elevator capacity at each floor, at different times of the day. The following performance reports are included:

- Hall call summary: This daily report provides the total number of calls, the number and percentage of long-wait calls and the percentage of car utilization.

- Hall call data: This report provides a complete printout of all the calls for a selected time period.
- Hall call time distribution: This report provides the number of calls and their average wait times, sorted by time interval, for the selected period.
- Hall call floor distribution: This report provides the number of calls and their average wait times, sorted by floor, for the selected period.
- Elevator availability summary: This report provides the daily number of car calls, time out of service, number of faults, and other status such as the mileage and number of door operations.
- Elevator service: This report provides the daily service type of operation which indicates elevator availability to serve landing calls.

Another function of EMIS is to permit the building personnel to designate, activate, and deactivate certain functions such as:

- Special hall services: V.I.P., second lobby for dual or alternate lobby operation
- Traffic demand: *up peak, down peak*, number of *Next Up* cars
- Security: Each car and hall call station push-button can be locked out individually or in specified groups. Up to 200 codes per floor can be assigned to the individual car call push-button permitting access to the floor during security mode.
- Elevator control: Independent Service, Attendant Service, Parking, Out of Service
- Additional optional features as requested (must be pre-approved)

4.4. VGA MONITOR (OPTIONAL)

A VGA monitor is available for the motor room, or other building location, to graphically illustrate system operation and I/O status. It provides live or historical visual feedback (motor room only) of the condition of the elevators. The monitor displays the following information.

4.4.1. Group (Dispatch) Screen

- Group status
- Hall calls with their assignments to the individual cars
- Hall call waiting time with their respective E.T.A.'s (Estimated Time of Arrival)
- Car position and direction

- Car calls
- Car door status
- Car service status
- Car load weighing
- Car and group security status.

4.4.2. Car Monitoring

- Inputs/Outputs status
- Service status
- Motion status
- Diagnostic.
- Brake and Motor Field power
- Drive status
- Load status

The lobby VGA monitor is normally used to display the dispatching information (group screen) without the hall-call ETA's.

4.5. EXTENDED REMOTE MONITORING (ERM)

ERM is a user-friendly, building management tool for monitoring single and multiple elevator groups. ERM provides live and detailed elevator system information via a network of PC based workstations. The ERM live display permits viewing the same information as that available on the motor room VGA monitor. ERM has multilevel password protection. EMIS (Elevator Management and Information System) operates on the transport layer (communication link protocol) of ERM.

For a building having multiple groups of elevators, ERM requires a PC based network communication controller (master) located in the building. An area network interconnects the elevator groups and the satellite workstations. A modem can be connected to the network for remote access.

Each workstation operates independently while sharing data from the elevator systems. This permits a control workstation to focus on security while other workstations can monitor live data and analyze traffic performance.

An ERM system can be expanded to include future elevators.

Non-SWIFT elevators can be incorporated into an ERM system.