MITSUBISHI ELECTRIC

GROUP CONTROL SYSTEM

Changes for the Better

Quality in Motion

ΣAI-2200C

Artificial Intelligence System

for a greener tomorrow

eco Changes

Elevator Group Control System
ΣAI-2200C System

Performance
- Cooperative Optimization Assignment

Earth Conscious
- Energy-saving Operation

Technology
- Dynamic Rule-set Optimizer

Mitsubishi AI Technology Compilation

Intelligence
- Destination Oriented Prediction System

Flexibility
- Neural Network
- Fuzzy Logic

Reduces waiting time and eases passenger frustration

Average waiting time*1 and long-wait*2 rate have been greatly reduced.

Improvement*3

Morning Up Peak
Long-wait reduction: max. 60%
Average waiting time reduction: max. 30%

Other times
Long-wait reduction: max. 40%
Average waiting time reduction: max. 20%
Running distance reduction: max. 5%

High traffic efficiency realized with new algorithm

The new Cooperative Optimization Assignment Algorithm improves traffic efficiency and reduces the chance of a long wait. In addition, the algorithm provides higher performance when combined with the Dynamic Rule-set Optimizer and the Destination Oriented Prediction System.

Energy saving

By reducing the traveling distance of elevators, the power consumption and CO_2 emissions of elevator operation are reduced.

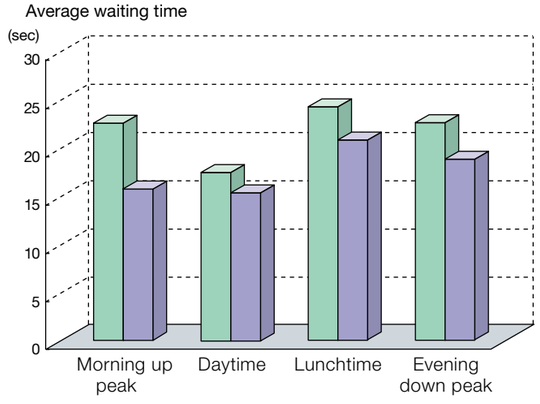
Notes
*1: The average time from when a passenger arrives at the hall until when the passenger boards an assigned car.
*2: A waiting time of 60 seconds or longer.
*3: Compared with the AI-2100N system. Actual reduction percentages may differ from those shown depending on conditions.

ΣAI-2200C Main Features

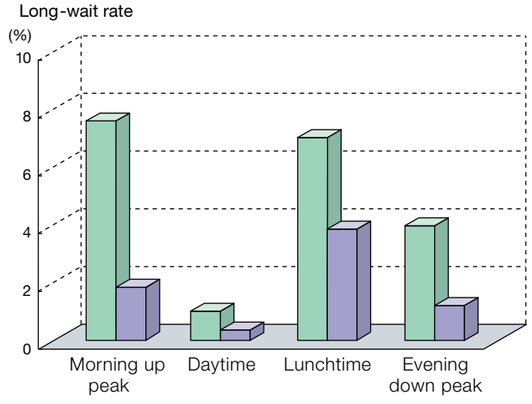
Applicable number of cars: 3 to 8 cars

- Expert System and Fuzzy Logic
- Psychological Waiting Time Evaluation
- Cooperative Optimization Assignment
- Car Travel Time Evaluation
- Determination of Traffic Flow with Neural Networks
- Energy-saving Operation — Allocation Control
- Immediate Prediction Indication (Optional)
- Dynamic Rule-set Optimizer
- Destination Oriented Prediction System (Optional)
- Motor Drive Mix (Optional)
- Mitsubishi Elevators & Escalators Monitoring and Control System MelEye (Optional)

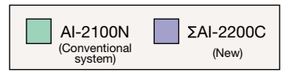
ΣAI-2200C Performance*1



Improved: Max. 30%



Improved: Max. 60%

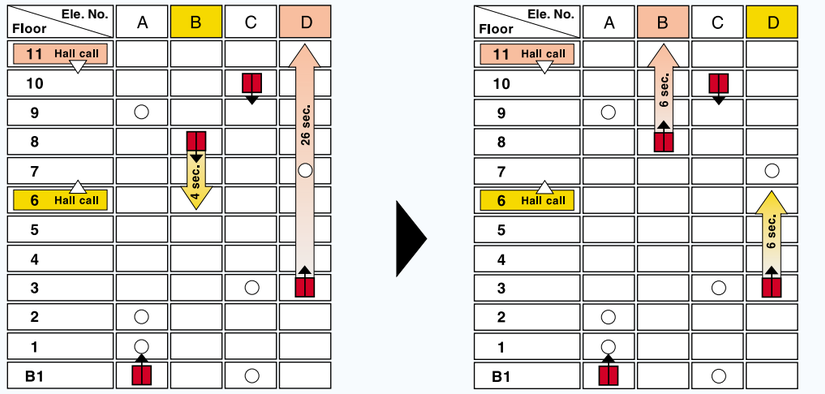


Notes
*1: Simulated with 6 cars, 20 persons each at 2.5m/sec. for 15 stops.

Cooperative Optimization Assignment

Forecasting a near-future hall call to reduce long wait

When a hall call is registered, the algorithm assumes a near-future call that could require long waits. Through evaluation of the registered hall call and the forecasted call, the best car is assigned. All cars work cooperatively for optimum operation.



AI-2100N (Conventional system)
[A hall call is registered at 6th Fl.]
Allocates the closest car B.
[Another hall call is soon registered at 11th Fl.]
Allocates D, resulting in long wait of 26 sec.

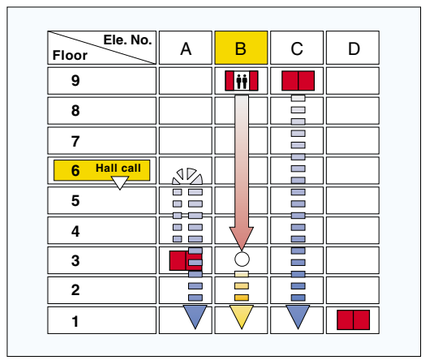
ΣAI-2200C (New)
[A hall call is registered at 6th Fl.]
Allocates D, which is running upward.
[Another hall call is soon registered at 11th Fl.]
Allocates B, which immediately arrives at the floor.

··· Car ··· Car call ··· Hall call ··· Traveling direction

Energy-saving Operation — Allocation Control

Maximizing operational efficiency and minimizing energy consumption

This system selects the elevator in a group that best balances operational efficiency and energy consumption. Priority is given to operational efficiency during peak hours and energy efficiency during non-peak hours. Car allocation that maximizes operational efficiency does not necessarily translate to energy efficiency. A car uses energy efficiently when it travels down with a heavy load, or up with a light load. Accordingly, if multiple cars have the same traveling distance, this system chooses the car that requires the least energy. Through a maximum 10% reduction in energy consumption compared to our conventional system, this system allows building owners to cut energy costs without sacrificing passenger convenience.



Initial conditions: non-peak period
Car A: Parked at the 3rd floor
Car B: About to leave the 9th floor with several passengers
Car C: Parked at the 9th floor
Car D: Parked at the 1st floor
Under the conditions above, when a hall call is registered at the 6th floor to go to the 1st floor, waiting time and traveling distance will be the same regardless of whether car A, B or C responds to the call.
In response to the call, the cars will operate in the following ways:
Car A will travel up with no passengers and then down with only one passenger (requires more energy than car B).
Car B will travel down with more passengers than car A (requires the least energy).
Car C will travel down with no passengers and then down with only one passenger (requires the most energy).
Car selection
During non-peak hours when energy efficiency is prioritized, car B is selected.

Dynamic Rule-set Optimizer

Selecting optimum car allocation through rule-set simulations

Based on real traffic data, passenger traffic is predicted every few minutes. According to the prediction, real-time simulation selects the best rule-set (multiple rules have been set as car allocation patterns), which optimizes transport efficiency.

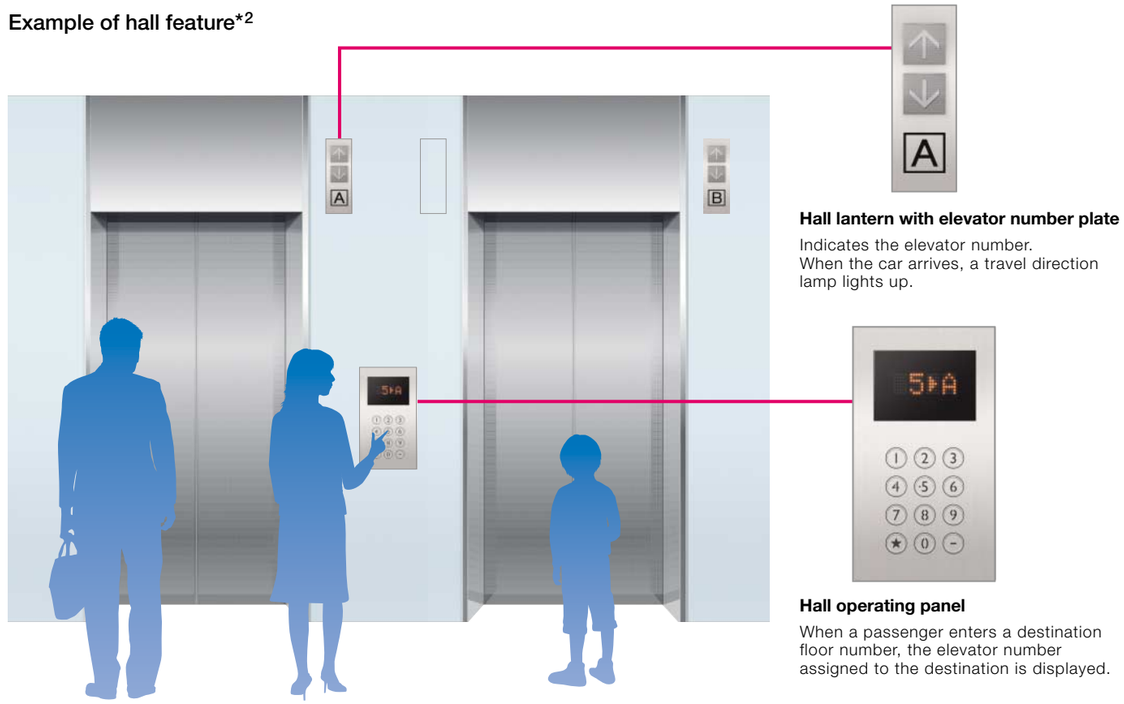
Destination Oriented Prediction System (DOAS-S) (Optional)

Allocating passengers to cars depending on destination floors

When a passenger enters a destination floor number at a hall, the hall operating panel immediately indicates which car will serve the floor. Because the destination floor is already registered, the passenger does not need to press a button in the car. Furthermore, dispersing passengers by destination prevents congestion in cars and minimizes their waiting and traveling time.
(Car destination floor indicator can be installed on the car operating panel to display floors to stop.*1)

More detail on pages 5 to 8

Example of hall feature*2



Hall lantern with elevator number plate
Indicates the elevator number.
When the car arrives, a travel direction lamp lights up.

Hall operating panel
When a passenger enters a destination floor number, the elevator number assigned to the destination is displayed.

Notes
*1: Car Destination Floor Indicator can be installed as an option. See page 8 for details.
*2: See page 8 for available hall fixtures.

Advantages of the Destination Oriented Prediction System

1. Reducing traveling time

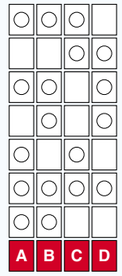
The system uses timely and specific destination information to direct each passenger to the right car. Passengers spend less time in a car, as the number of stops per trip is minimized. Working with other features of the ΣAI-2200C, DOAS-S can significantly reduce the total time required for passengers to get to their destinations, as well as long waits.

Without DOAS-S

Cars make stops at every selected floor. You cannot tell how many stops the car will make to complete your trip.

Example

Car A makes 5 stops.
Car B makes 5 stops.
Car C makes 4 stops.
Car D makes 4 stops.

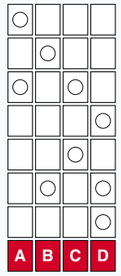


With DOAS-S

The number of stops per car is minimized since the number of passengers is evenly distributed to cars according to their destinations.

Example

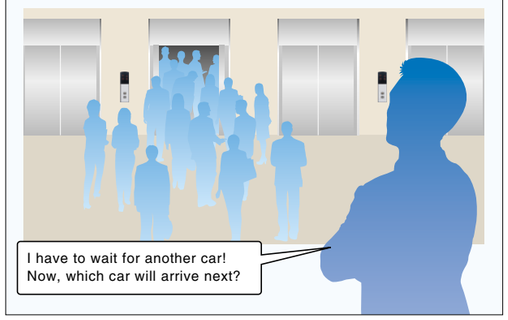
Car A makes 2 stops.
Car B makes 2 stops.
Car C makes 2 stops.
Car D makes 3 stops.



2. Enhancing usability for passengers at halls

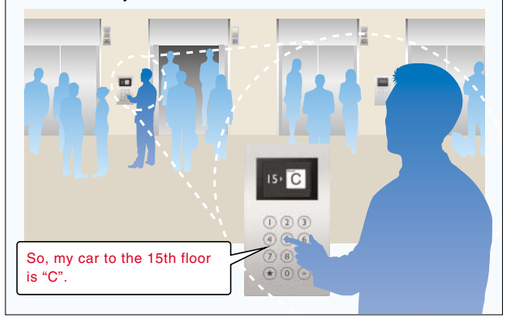
Without DOAS-S

You wait for cars wondering which car will arrive first. Once a car arrives, regardless of the destination, passengers rush to get into the car.



With DOAS-S

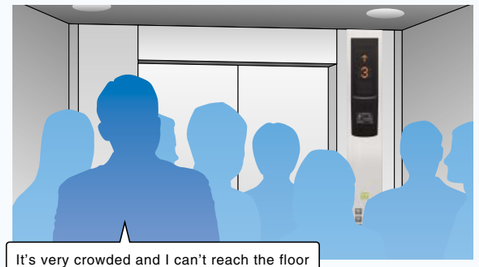
When you enter your destination floor number on a hall operating panel, it shows you which elevator to take. As you proceed to the assigned elevator, the car is on its way. When the car arrives, you step in the car without hurry.



3. Enhancing passengers usability in car

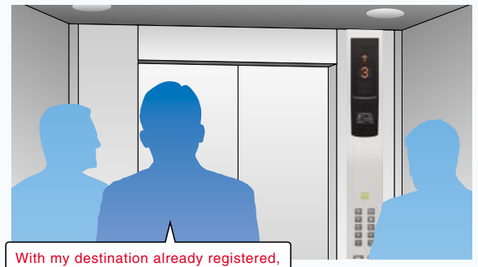
Without DOAS-S

You need to press the destination floor button on a car operating panel. In a busy car, you have to fight through a crowd of bodies to reach the button.



With DOAS-S

Your destination floor is registered when you enter it on the hall operating panel. Relax and enjoy the ride in the car. The car skips unnecessary stops and quickly takes you to the destination floor.



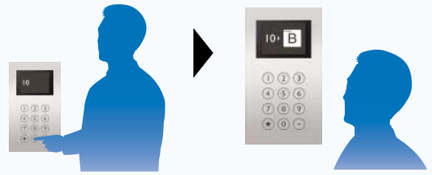
With DOAS-S, all you have to do is enter your destination floor using the hall operating panel. The journey from then on is completely automatic.

When you are going to the 10th floor

Hall operating panel (keypad type)

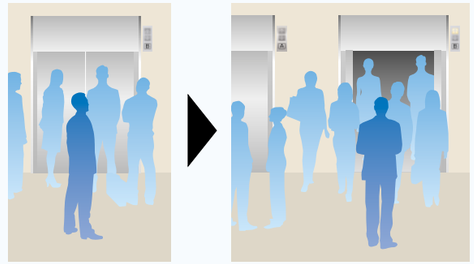
Enter "1", then "0" on a hall operating panel.

Your elevator number is displayed on the hall operating panel.



Confirm the elevator identification below the hall lantern, and proceed to the assigned car.

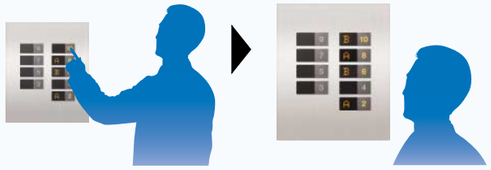
Board the car when it arrives.



Destination floor buttons with car number indicators

Press the button "10" on a hall operating panel.

Your elevator number is displayed beside the button "10".



For passengers with special needs

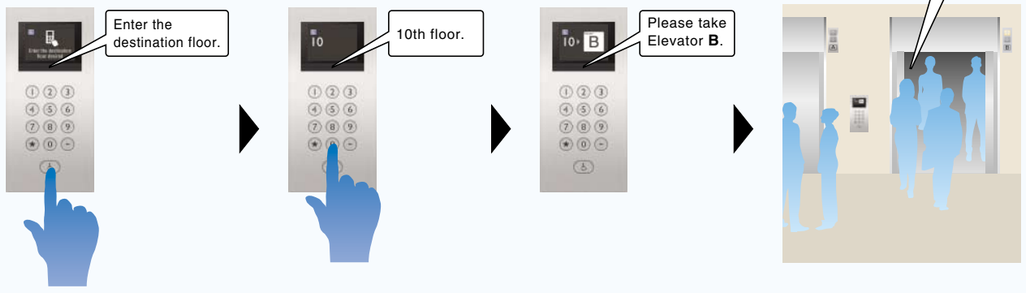
DOAS-S offers dedicated service for passengers with special needs. When the accessibility button on a hall operating panel is pressed, the doors remain open longer and close more slowly to allow passengers extra time to board or exit the car. Also, visual and audio guidance is available throughout the journey.

Press ♿ (accessibility button) on a hall operating panel. ♿ lights up, and then visual and audio guidance starts.

Enter "1", then "0" on the hall operating panel. The audio guidance confirms the floor name entered.

Your elevator number is announced.

Upon arrival, the elevator number and travel direction is announced.



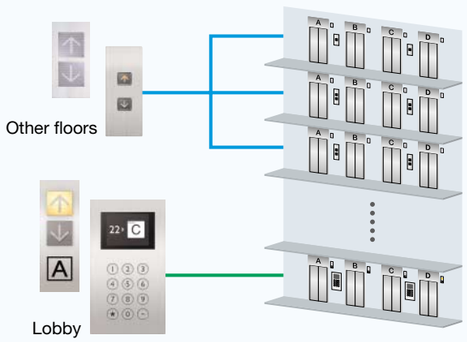
Hall Arrangement

DOAS-S is designed to complement today's complex building environments. It can accommodate the needs of building owners, architects, consultants and elevator passengers. To meet their particular requests, we offer flexible configuration options. Please consult with our local subcontractors for further information.

DOAS-S (Lobby floor(s))

DOAS-S hall operating panels are installed only on busy floor(s) such as the lobby while other floors have conventional hall fixtures. This is particularly beneficial for improving the traffic flow leaving from the busy floor. It is especially useful in buildings with heavy up-peak traffic.

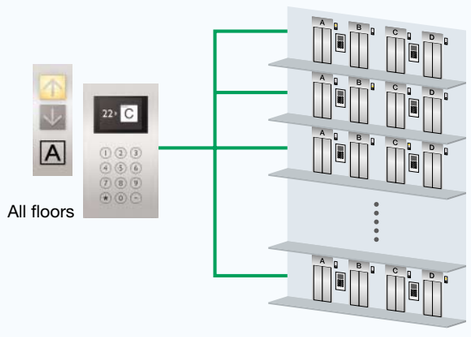
Example of hall arrangement



DOAS-S (All floors)

DOAS-S hall operating panels are installed on all floors. Cars receive destination information from all floors to provide the best service for more complex traffic conditions throughout the day.

Example of hall arrangement



Please consult our local agents for DOAS-S (all floors).

Applicable Equipment and Features

● : Applicable — : Not applicable

Location	Equipment / Features			DOAS-S (Lobby floor(s))		DOAS-S (All floors)	
				Standard DOAS-S	DOAS-S with functions for passengers with special needs	Standard DOAS-S	DOAS-S with functions for passengers with special needs
Hall	Hall operating panel	Keypad	HSVF-C212, HSVF-C262	●	—	●	—
			HSVF-C222, HSVF-C232, HSVF-C272, HSVF-C282	—	●	—	●
		Touch panel		●	—	●	—
		HSM-E210		●	—	—	—
	Hall lanterns with elevator number plate	HLV-E115		●	●	●	●
	Hall destination floor indicator	HDH-A110		●	—	—*1	—
	Immediate Prediction Indication*3			●	●	—*1	—*1
Car	Announcement of elevator number and traveling direction			—	●	—	●
	Operating by floor buttons on car operating panel			●*2	●*2	—	—
	Car Destination Floor Indicator			—	—	●*4	●*4

*1: Applicable to some specified floors.
*2: The floor buttons become available after the car makes the first stop.
*3: When a passenger has registered a hall call, the hall lantern of the assigned elevator lights up and a chime sounds to indicate which elevator to take.
*4: Provided when floor buttons are not installed in the car. Please consult our local agents for application.

Hall Operating Panels

Keypad

HSVF-C212 | HSVF-C222*1 | HSVF-C232*1 | HSVF-C262 | HSVF-C272*1 | HSVF-C282*1

Faceplate	Stainless-steel hairline
Display	Digital LED dot display, orange when illuminated (HSVF-C212, HSVF-C222 and HSVF-C232), 5.7″ TFT color LCD (HSVF-C262, HSVF-C272 and HSVF-C282)
Button (Stainless-steel matte)	Number: Flat button (The number "5" has a small raised dot as tactile orientation of the keypad for visually-impaired passengers.) Star: Tactile button
Speaker for announcement	Hall operating panel HSVF-C222, -C232, -C272, -C282 has a speaker for announcement. (Located under position indicator)

Touch panel*2
(For installation of touch panel, please consult local agents for details.)

Faceplate	Stainless-steel hairline
Touch panel	10.4″ TFT color LCD

Destination Floor Buttons with Elevator Number Indicators

HSM-E210

Faceplate	Stainless-steel hairline
Destination floor buttons (Gray plastic)	Flat button (Light: LED lamp, yellow-orange when illuminated)
Elevator number indicator	Digital LED dot display, orange when illuminated

Hall Lanterns with Elevator Number

HLV-E115

Faceplate	Stainless-steel hairline
Arrival prediction lanterns	Lens: Clear acrylic Light: Incandescent lamp (Yellow-orange when illuminated)
Elevator number plate	Stainless-steel hairline Elevator No. and the border: Etched and black filled

Hall Destination Floor Indicator*3

HDH-A110

Faceplate	Stainless-steel hairline
Display panel	Smoky gray plastic, matte surface
Destination floor indicator	Incandescent lamp (Yellow-orange when illuminated)

Car Destination Floor Indicator*3

Car Destination Floor Indicator (Located under position indicator)	5.7″ TFT color LCD

*1: Complies with EN81-70. The key arrangement can be changed if compliance with EN81-70 is not required.
*2: Please note that the touch panel hall indicator cannot be installed in elevators used by visually impaired passengers, elevators used for firefighter services, or elevators sold in countries and regions where regulations, such as EN81-70, mandate specific measures for physically impaired passengers. Also, the touch panel is designed to react to human touch only. It cannot be operated with gloved hands or inanimate objects.
*3: Please consult our local agents for application.

Special Functions

Group Control Features

● = Standard ○ = Optional

Feature	Description	Appl.*
Main Functions		
Expert System and Fuzzy Logic	Artificial expert knowledge, which has been programmed using “expert system” and “fuzzy logic”, is applied to select the ideal operational rule which maximizes the efficiency of group control operations.	●
Psychological Waiting Time Evaluation	Cars are allocated according to the predicted psychological waiting time for each hall call. The rules evaluating psychological waiting time are automatically changed in a timely manner in response to actual service conditions.	●
Cooperative Optimization Assignment	The system predicts a potential hall call, which could cause longer waiting time. Car assignment is performed considering not only current and new calls but also near-future calls.	●
Car Travel Time Evaluation	Cars are allocated to hall calls by considering the number of car calls that will reduce passenger waiting time in each hall and the travel time of each car.	●
Distinction of Traffic Flow with Neural Networks (NN)	Traffic flows in a building are constantly monitored using neural network technology, and the optimum operational pattern, such as Lunchtime Service or Up Peak Service, is selected or cancelled accordingly at the appropriate time.	●
Car Allocation Tuning (CAT)	The number of cars allocated or parked on crowded floors is controlled not just according to the conditions on those crowded floors but also the operational status of each car and the traffic on each floor.	●
Dynamic Rule-set Optimizer (DRO)	Traffic flows in a building are constantly predicted using neural network technology, and an optimum rule-set for group control operations is selected through real-time simulations based on prediction results.	●
Destination Oriented Prediction System (DOAS-S)	When a passenger enters a destination floor at a hall, the hall operating panel indicates which car will serve the floor. The passenger does not need to press a button in the car. Dispersing passengers by destination prevents congestion in the cars and minimizes their waiting and traveling time. (Cannot be combined with the IUP feature.)	○
Motor Drive Mix (MDX)	The rate of car acceleration and deceleration is automatically increased, according to the car load, to reduce passenger waiting and traveling time.	○
System Control		
Group Control Self-diagnosis (GCS)	Passenger waiting times, frequency of prediction errors, etc., are automatically detected and recorded as elevator operational data for service personnel.	●
Traffic Functions		
Peak Traffic Control (PTC)	A floor which temporarily has the heaviest traffic is served with higher priority over other floors, but not to the extent that it interferes with the service to other floors.	●
Strategic Overall Spotting (SOHS)	To reduce passenger waiting time, cars which have finished service are automatically directed to positions where they can respond to predicted hall calls as quickly as possible.	●
Closest-car Priority Service (CNPS)	A function to give priority allocation to the car closest to the floor where a hall call button has been pressed, or to reverse the closing doors of the car closest to the pressed hall call button on that floor. (Cannot be combined with hall position indicators.)	○
Light-load Car Priority Service (UCPS)	When traffic is light, empty or lightly-loaded cars are given higher priority to respond to hall calls in order to minimize passenger traveling time. (Cannot be combined with hall position indicators.)	○
Special Car Priority Service (SCPS)	Special cars, such as observation elevators and elevators with basement service, are given higher priority to respond to hall calls. (Cannot be combined with hall position indicators.)	○
Special Floor Priority Service (SFPS)	Special floors, such as floors with VIP rooms or executive rooms, are given higher priority for car allocation when a call is made on those floors. (Cannot be combined with hall position indicators.)	○
Up Peak Service (UPS)	Controls the number of cars to be allocated to the lobby floor, as well as the car allocation timing, in order to meet increased demands for upward travel from the lobby floor during office starting time, hotel check-in time etc., and minimize passenger waiting time.	○
Down Peak Service (DPS)	Controls the number of cars to be allocated and the timing of car allocation in order to meet increased demands for downward travel during office leaving time, hotel check-out time, etc., to minimize passenger waiting time.	○
Congested-floor Service (CFS)	The timing of car allocation and the number of cars to be allocated to floors where meeting rooms or ballrooms exist and the traffic intensifies for short periods of time are controlled according to the detected traffic density data for those floors.	○
Energy Saving Operation — Number of Cars (ESO-N)	To save energy, the number of service cars is automatically reduced to some extent, but not so much that it adversely affects passenger waiting time.	○
Energy Saving Operation — Speed Control (ESO-V)	To save energy, the car speed is automatically reduced to some extent, but not so much that it adversely affects passenger waiting time.	○
Energy Saving Operation — Allocation Control (ESO-W)	The system selects the elevator that best balances operational efficiency and energy consumption according to each elevator's current location and passenger load as well as predicted congestion levels throughout the day.	●
Bank-separation Operation (BSO)	Hall buttons and the cars called by each button can be divided into several groups for independent group control operation to serve special needs or different floors.	○
VIP Operation (VIP-S)	A specified car is withdrawn from group control operation for VIP service operation. When activated, the car responds only to existing car calls, moves to a specified floor and parks there with the doors open. The car will then respond only to car calls. (Cannot be combine with DOAS-S.)	○
Intense Up Peak (IUP)	To maximize transport efficiency, an elevator bank will be divided into two groups of cars to serve upper and lower floors separately during up peak. In addition, the number of cars to be allocated, the timing of car allocation to the lobby floor, the timing of door closing, etc. are controlled based on predicted traffic data. (Cannot be combine with DOAS-S.)	○
Lunchtime Service (LTS)	During the first half of lunchtime, calls for a restaurant floor are served with higher priority, and during the latter half, the number of cars allocated to the restaurant floor, the allocation timing for each car and the door opening and closing timing are all controlled based on predicted data.	○
Indication Functions		
Car Arrival Chime — Car or Hall (AECC/AECH)	Electronic chimes sound to indicate that a car will soon arrive. (The chimes are mounted either on the top and bottom of the car, or in each hall.)	●
Flashing Hall Lantern (FHL)	A hall lantern, which corresponds to a car’s service direction, flashes to indicate that the car will soon arrive.	●
Immediate Prediction Indication (AIL)	When a passenger has registered a hall call, the best car to respond to that call is immediately selected, the corresponding hall lantern lights up and a chime sounds once to indicate which doors will open.	○
Second Car Prediction (TCP)	When a hall is crowded to the extent that one car cannot accommodate all waiting passengers, a hall lantern will light up to indicate the next car to serve the hall.	○

Comfort and Convenience Features

● = Standard ○ = Optional

Feature	Description	Appl.*
Door Sensors		
Electronic Doorman (EDM)	Door open time is minimized using safety ray(s) or multi-beam door sensors that detect passengers boarding or exiting.	○
Multi-beam Door Sensor	Multiple infrared-light beams cover a door height of approximately 1800mm to detect passengers or objects as the doors close. (Cannot be combined with the SR feature.)	○
Multi-beam Door Sensor — Signal Type (MBSS)	Multiple infrared-light beams cover a door height of approximately 1800mm to detect passengers or objects as the doors close. Additionally, LED lights on the door edge indicate the door opening/closing and the presence of an obstacle between the doors. (Cannot be combined with multi-beam door sensor.)	○
Hall Motion Sensor (HMS)	Infrared-light is used to scan a 3D area near open doors to detect passengers or objects.	○
Operating Considerations		
Car Call Erase (FCC-P)	If the wrong car button is pressed, it can be canceled by quickly pressing the same button again twice.	●
Car Fan Shut Off — Automatic (CFO-A)	If there are no calls for a specified period, the car ventilation fan will automatically turn off to conserve energy.	●
Car Light Shut Off — Automatic (CLO-A)	If there are no calls for a specified period, the car lighting will automatically turn off to conserve energy.	●
Reopen with Hall Button (ROHB)	Closing doors can be reopened by pressing the hall button corresponding to the traveling direction of the car.	●
User Considerations		
Automatic Hall Call Registration (FSAT)	If one car cannot carry all waiting passengers because it is full, another car will automatically be assigned for the remaining passengers.	●
Automatic Bypass (ABP)	A fully-loaded car bypasses hall calls in order to maintain maximum operational efficiency.	●
Door Nudging Feature (NDG) — With Buzzer	A buzzer sounds and the doors slowly close when they have remained open for longer than the preset period. With AAN-B or AAN-G, a beep and voice guidance sound instead of the buzzer.	●
Next Landing (NXL)	If the elevator doors do not open fully at a destination floor, the doors close, the car automatically moves to the next or nearest floor where the doors will open.	●
Independent Service (IND)	Exclusive operation where a car is withdrawn from group control operation for independent use, such as maintenance or repair, and responds only to car calls.	●
Service Floor Selection Functions		
Non-Service to Specific Floors — Car Button Type (NS-CB)	To enhance security, service to specific floors can be disabled using the car operating panel. This function is automatically deactivated during emergency operation.	○
Non-Service to Specific Floors — Switch/Timer Type (NS/NS-T)	To enhance security, service to specific floors can be disabled using a manual or timer switch. This function is automatically deactivated during emergency operation.	○
Secret Call Service (SCS-B)	To enhance security, car calls for desired floors can be registered only by entering secret codes using the car buttons on the car operating panel. This function is automatically deactivated during emergency operation.	○
Characteristic Functions		
Basic Announcement (AAN-B)	A synthetic voice (and/or buzzer) alerts passengers inside a car that elevator operation has been temporarily interrupted due to overloading or a similar cause. (Voice available only in English.)	●
Voice Guidance System (AAN-G)	Information on elevator service such as the current floor or service direction is given to the passengers inside a car. (Voice guidance available only in English.)	○
Main Floor Parking (MFP)	An available car always parks on the main (lobby) floor with the doors open to reduce passenger waiting time.	○
Forced Floor Stop (FFS)	All cars in a bank automatically make a stop at a predetermined floor on every trip without being called.	○
Main Floor Changeover Operation (TFS)	This feature is effective for buildings with two main (lobby) floors. The floor designated as the “main floor” in a group control operation can be changed as necessary using a manual switch.	○
In-car LCD Position Indicator (CID-S)	This 5.7-inch LCD for car operating panels shows the date and time, car position, travel direction and elevator status messages.	○
Hall LCD Position Indicator (HID-S)	This 5.7-inch LCD for elevator halls shows the date and time, car position, travel direction and elevator status messages.	○
Car Destination Floor Indicator (CDFI)	LCD indicator mounted on the car operating panel that indicates the registered destination floor(s).	○

*Application of feature in this table shows operation system ΣAI-2200C. Applicability of feature differs depending on the elevator models or operation system. Please consult our local agents for details.

Emergency Operation

- Operation by Emergency Power Source — Automatic/Manual (OEPS)
- Fire Emergency Return (FER)
- Firefighters’ Emergency Operation (FE)
- Earthquake Emergency Return (EER-P/EER-S)
- Mitsubishi Emergency Landing Device (MELD)
- Supervisory Panel (WP)
- Mitsubishi Elevators & Escalators Monitoring and Control System MelEye (WP-W)