"Visual act specializes in the development of software and technical installations for theatre and the performing arts. Our software is designed to be flexible and user friendly, while maintaining a high level of safety. The intuitive and effective software for our wagon system was important in winning the Plasa award for new technology in 2001."

Visual act Scandinavia AB
Contents

Visual act Stage Control System .......................4
Visual act Wagon System .................................10
Visual act Fly and 3D ......................................18
Visual act Creative Solutions ...............................22
References ....................................................26
"The Visual act Stage Control System is a complete control system for theatrical stage equipment. It consists of a user interface, a server and positioning system. The system is designed to control any type of intelligent machinery, including fly systems, stage lifts and motorized wagons.

The Visual act system is scalable and is suitable for simple shows with only a few drives as well as for large permanent installations with several hundred drives."

Visual act Scandinavia AB
Visual act Stage Control System

The Stage Control System is an integral part of all Visual act installations.

The system can move and position any theatrical equipment, from simple battens to advanced multiple axis machines. Axes can be controlled by a variety of interfaces, including Canopen, Profibus, and Ethercat as well as traditional analogue and digital signals. An independent routine controls the status of all axes both during movement and while at rest. The relative positions of synchronized axes are also controlled continuously.

Positions and speeds are used to create movements, which are organized in ques and productions. All of these elements can be reused, copied and moved. Descriptive text can be provided for all elements. The size of the database is, in practice, infinite such that older productions can be retained or archived for reuse or documentation.

Motion is controlled by one or more joysticks, allowing simple and instinctive control of speed and direction. Movements and ques can be stopped and started during motion. Links can be added to create sequences and special effects. With optional modules, links can also be made to other control systems by the use of DMX, time code or other standard protocols. A single key press switches between programming and motion.

The operator desk has been developed in close cooperation with active users. The simple, intuitive user interface is easy for the beginner to learn and use. The professional user will find tremendous flexibility and a comfortable workplace designed for use over long periods without fatigue.

The operator can skip ques or move easily to an earlier que. An “on the fly” movement puts all axes in appropriate start positions for a que. Similarly, a “start que” automatically controls the use of all the axes in a show, and makes for simple and effective control of start positions and presets.

Several desks can be used simultaneously. The server makes certain that only one user can be in control of an axis, and informs as to who is in control of the axis. The desks are totally independent of each other so that one can be removed from the system without effect on any other.
The display

The display consists of two main areas. One shows a three dimensional view of the stage while the other shows data for the active que, its movements and axes. All common functions are available in the main view. Colors are used to show status. Errors and messages are displayed in clear text and can be linked to a database with system information. It is possible to change system texts and add notes to error events.

The user can adapt and develop the 3D view. Axes can be combined to create objects representing a ceiling or other larger element. 3D drawings can be imported and assigned to any object or axis, or even to the stage itself. The user can pan, zoom and rotate the picture, save views and assign them to ques.

Operator desks

The Visual act operator desk is available in several versions. All versions feature the same award winning user interface and have similar capabilities.

THE ADVANCED DESK has two playbacks and a complete keyboard. Designed with large repertory stages in mind, the professional user will find tremendous flexibility and a comfortable workplace suitable for use over long periods without fatigue. The keyboard is specially designed to fit the user software and can be adapted to the local language. The desk is fitted with either two independent playbacks for theatrical applications or a 3D joystick for Visual act 3D and Advanced Wagons.

THE TOURING DESK is compact and robust and makes use of a built-in touch screen. It is all that is needed for smaller systems as it can include all the control system components – user interface, server and positioning system – as well as an emergency stop relay. It can therefore be connected directly to the system bus. All standard system functions are supported. This desk is usually supplied with a flight case but can also be placed on a stand or table.
The stage machinery

Most Visual act winches and lifts are based on synchronous or asynchronous servomotors of modern compact design. They are matched to intelligent servo amplifiers of high quality, allowing for accuracies and position errors to better than ±1 mm and full torque at all speeds including standstill. As all drives are connected to the control system by a communications bus all drive parameters, errors and status messages are available at the operator desk.

Drive amplifiers are usually mounted in separate, independent cabinets. A fault with one axis will not affect operation of other axes. The same is true for repairs and maintenance – any drive or motor can be serviced while the remainder of the system is operating. Drives are connected to their respective machines by connectors, such that they can be easily exchanged in the event of failure.

Maintenance and service

The system is easy to service. Technicians have read and write access to all system parameters and variables. The most common parameters are readily accessible through a status window. A firewall and software for remote control can be included, allowing a service technician to analyze and update the system from a distance.

Visual act can supply installations where all computer systems are doubled. A failure of one component will not stop the system. A redundant Ethernet ring is used for communication between computers. It is possible to repair or replace components while the system is fully operational.

Expansion and upgrades

The system is open and easily expanded. Additional axes can be added at any time. Interfaces to other equipment, such as lighting desks or stage management systems, can be accommodated. Functionality is upgraded through software. An example of this is Visual act’s 3D system, where it is the path of an axis or multi-axis object that is programmed, as opposed to the object’s end position and speed.

Scalability and flexibility

Visual act’s control system is extremely scalable and suits both smaller and larger installations. The smallest system uses a controller no larger than a laptop pc while larger systems installed in 19” racks can control several hundred axes.
Safety

Safety is built into the system at all levels. All drives are monitored by a separate process. Absolute encoders on the output shaft are used together with motor encoders to control each machine’s integrity, as well as to monitor synchronous motion. Important functions are not simply doubled, but are handled by two different methods so that design and system errors will not compromise safety.

In designing the safety systems, the goal is to obtain the highest levels of safety without compromising reliability. All safety functions that can stop or prevent movement are easily traceable and continuously supervised by the main control system.

The following points are central to the Visual act safety philosophy:

• **CONTINUOUS CONTROL OF SYSTEM INTEGRITY**  All important parts of the system are continuously monitored, also when drives are not in use.

• **DOUBLING OF FUNCTION BY SEPERATE ALGORITHMS (DIVERSITY)**  We do not simply mirror or double components in order to achieve the required safety levels. This avoids system failure due to systematic design or production faults. Each drive is monitored by a control routine on a separate and different computer using an independent network and an independent encoder. Software modules are monitored by both parent and child processes.

• **USABILITY AND OPERATOR TRAINING**  No amount of safety features can stop an operator from making dangerous movements. Even if it was possible, doing so would seriously cripple the system, destroying both its dependability and availability. The operator desk must be usable in the sense of providing the operator with the information necessary to evaluate the safety of his actions. The owner must insure that operators are suitable qualified.

In designing, producing and testing hardware and software Visual act actively follows the safety standard EN 61508 for all stages of the product lifecycle. Based on the risk assessment safety functions are identified, described and allocated. The hardware and software is then designed to provide the required safety integrity level (SIL) for each function. High standards of quality control during production and intensive testing confirm that the safety level is attained.

Options

Options currently available include:

- **WIRELESS OPERATOR DESK** This allows the operator to move about the stage without being limited by cables. All standard operator functions are available. Emergency stop integrity is maintained by the use of an active emergency stop radio with a watchdog channel.

- **EXTERNAL TRIGGERS AND LINKS** A number of options are available to link the system to other control systems, such as lighting or stage management consoles. Available options include DMX, Midi and Ethernet as well as galvanically separated digital signals.

- **3D MOTION** The 3D option allows for the definition, programming and operation of objects capable of moving in several dimensions. With the Visual act 3D it is the path of an object that is described, as opposed to its end positions. The operator is able to define various types of objects by selecting an object type and assigning drives and coordinates. Examples of 3D objects include 1D, 2D or 3D vector rigs and tracks in 2 or 3 dimensions.

- **SCENERY BASED PROGRAMMING** Scenic elements such as drops, ceilings and tracked items can be defined by the operator. To program scenic objects the user enters that actual position of the object, including the object’s angle, if applicable; as opposed to entering the position of the individual point hoist or batten.

- **3D OUTPUT** With this option the control system outputs the actual position of a 3D object over a network. This position can then be used by an intelligent lighting console to allow a moving light or projector to follow the motion of a 3D object.

- **3D INPUT** Paths created on other systems, such as animation or simulation programs, can be imported.
"Whether to create powerful visual effects for the audience, or simply move scenery in a blackout or off screen, the purpose of modern stage technology is to make these movements possible.

The Visual act Advanced Wagon System is designed to allow total freedom of movement on and off stage. Movements are limited only by the imagination, giving both designers and technicians more freedom with design."

Visual act Scandinavia AB
Visual act Wagon System

Designing a show with Visual act is simple. The stage designer freely creates the scenery, without concern for how movements take place. The wagons are built to fit the scenic elements. Elements can move by themselves or in combination. Wagons can be built to almost any size and shape.

After the wagons are designed, the physical dimensions along with the relative placements of the drive units are entered into the control system database. A simplified scale drawing of the stage and fixed elements is also added to the on screen graphic. The Visual act operator can now start programming the movements, even before the set arrives on stage. Once the show is in rehearsal the operator can move through the show both forwards and backwards. Changes to movements can be made quickly and new cues can be inserted at will.

Visual act Advanced Wagons used in “Clouseau” concert, Antwerp, Belgium.
The modular components of a standard Visual act Advanced Wagon:

- **The DRIVE UNIT** is the key to the mechanical operation of the wagon. Each unit includes two servomotors that provide for locomotion and steering in tandem. The drive unit’s patented design allows rotation of the wheels at standstill without any damage to the stage floor. Depending on the maximum speed, drive units can move from 500 to 2000 kg. Up to 10 units can be mounted in a single wagon.

- **The TRIPLE CASTER UNITS** have been especially designed to provide a minimum of rolling friction. This helps to provide for high positioning accuracy, even when the navigation system is out of range.

- **A LASER SCANNER** works together with the navigation computer to control the position of the wagon. The scanner can be mounted anywhere on the wagon, including under the floor or on top of scenery. As long as the laser can see a minimum of three reflectors, a repeatability of +/- 5 mm can be expected.

- **The CONTROL CABINET** contains the control and navigation computers, a power supply and an emergency stop system. Two independent radio systems ensure reliability and safety.

- **The AMPLIFIER CABINET** includes four intelligent servo amplifiers. The servos work together with the control computer to dynamically position the wagon.

- **SEALED BATTERY PACKS** provide power for many hours of continuous operation.

- **The POWER SWITCH** includes an emergency stop button and a socket for connecting a mains cable. It is small and can be placed in any accessible position.

All of the wagon components are designed to fit into the wagon frame while allowing for a platform height of 200 mm. Being modular they can be reused in wagons of different shapes and sizes and quickly replaced for service.

*See separate datasheets for component detailed specifications.*
Visual act Advanced Wagon

Each VISUAL ACT ADVANCED WAGON has a complete navigation system on board allowing the user to create a virtually unlimited range of movement. Using a patented algorithm, wagons can move along curves, maintain one face forward as they move, or rotate and move forward simultaneously.

Wagons are built according to the following specifications:

- Full freedom of movement in two dimensions plus unlimited rotation.
- No cables, wires or other mechanical limitations.
- Operation on most floor surfaces, including dance floor.
- All components in a height of 200 mm.
- User programming and operation from a single point.
- Multiple operators and operating positions.
- Up to 16 wagons in operation at any time.
- Synchronization of any number of wagons.
- Speeds of up to 1 m/s.
- Position repeatability to less than 5 mm.
- Reusable components.

A Visual act Advanced Wagon System consists of one or more control desks, one server and up to 16 wagons.

Programming the wagons involves creating sequences of movements that are organized as ques. After selecting the wagon or wagons to be moved the operator uses the mouse to "drag" the wagon into position, much like adjusting a curve in a PC drawing program. Alternatively, the operator can use the teach-in function to save a manual motion. For accurate positions coordinates, angles and distances can be entered directly. Two or more wagons can be combined into a group such that several wagons appear to function as a single wagon. Movements can also be tested "off-line" by running the cues on the screen.

All the components are modular and easily installed in the wagon framework. They can therefore be reused in wagons of different shapes and sizes and quickly replaced for service.
**Visual act Analog Wagon**

The Visual act Analog System provides dynamic motion under direct operator control. Two drive units are installed in a wagon of any size. The path is determined by the relative speed of the drives. The operator controls motion with 2 joysticks, one for speed and one for direction. The radio system uses a reserved frequency and is certified for the transportation of persons.

Features of Visual act Analog System:

- Motion directly under operator control.
- Move along curves and create rotations.
- Separate function for rotation about central axis.
- Use to create revolves and stage wagons.
- Simulate cars or other vehicles.
- Build wagons of any size. See component dimensions below.
- True servo motors for constant speeds and accelerations at all loads.

The **VISUAL ACT ANALOG PLUS** adds rotation to the drive units by implementing the same patented drive unit used on Visual act’s Advanced Wagons. This allows the second joystick to steer the wagon directly, adding to the range of motion available.

The Analog system can be upgraded to **VISUAL ACT ADVANCED WAGON**, complete with intelligent navigation and multidirectional motion, by the addition or replacement of modular components.
Specifications for **VISUAL ACT ANALOG:**

- Two servo drive units, each 1,5 kW.
- Drive wheel diameter 140 mm.
- Drive wheel hardness Shore 92. Other values available.
- 360 degree adjustable steering angle of drive wheels.
- Standard gear ratios for moving:
  - loads of 2000 kg at speeds up to 1 m/s
  - loads of 4000 kg at speeds up to 0.6 m/s
- Other gear ratios available.
- Vertical load on drive unit up to 600 kg.
- 120 Vdc, sealed battery system.
- Noise level < 40 db at 1 meter.
- Radio system with:
  - 2 joysticks for motion control
  - 5 switches for function selection
  - 1 emergency stop

**VISUAL ACT ANALOG PLUS** adds:

- Two motors for 270 degree automated steering of the drive unit angle.
"Visual act has the solution whether you are moving scenery about the stage, flying performers or camera or automating an original construction.

Visual act 3D offers an interactive workspace for creating, commissioning, programming and operating 3D flying objects. Objects are created quickly and easily by selecting an object type and entering appropriate coordinates.

Paths are created by dragging points on the screen. The operator can also choose to move an object with the 3D joysticks and create a path from the saved movement, either online or through simulation."

Visual act Scandinavia AB
Visual act Fly and 3D

A system moving anything on stage - from a single lifted or tracked object - to complicated 3-constructions.

Permanent installations

Flexibly in design and implementation makes Visual act the system of choice for theaters and studios of all sizes. Visual act software and hardware can be easily adapted to fit local practices and requirements. Movements above and below the stage can be controlled and synchronized. Equipment can be added, modified or upgraded at any time.

Visual act features for larger installations include:

- Up to 16 control desks can be used simultaneously. Desks are totally independent of each other; and shutting down one desk will not affect the system.
- Ergonomically designed control desks, with space for printers, communication and other accessories.
- Redundant networks and servers.
- Distributed control. Drive electronics can be placed close to motors to simplify maintenance and reduce cable lengths.
- Advanced error logging with user comments. All axes, even those not in active use, are continuously monitored.
- Radio based control desks and remote units.
- Support for an unlimited number of axes.
- Simultaneous operation of an unlimited number of axes.
- Load monitoring by an intelligent analysis of current or by dedicated load cells.

Installation of the Visual act Fly System at Sohyang Art Center, Busan, South Korea
VISUAL ACT ELECTRONICS can work with motors of any type, including traditional DC and induction motors as well as modern servo systems. In retrofitting older theatres the reuse of motors and mechanics allows safety and functionality to be brought up to modern standards at surprisingly low costs.

VISUAL ACT WINCHES have all modern safety features, such as a second brake working directly on the cable drum, two sets of limit switches and slack rope detection. An absolute encoder attached to the output shaft controls the integrity of the entire drive chain. True servomotors provide high performance and reduce the total weight substantially.

Touring Installations

Visual act can supply winches designed specifically for touring and 3D flying.

The winches are equipped with load cells for load measuring and on slack rope monitoring on each individual line. As the winches are zero fleet they can be mounted in any position. There is no need for a long distance from the winch to the first pulley. Any number of winches can be combined together with the Visual act Stage Control System to create 2d or 3d rigs of any type.

The WINCH P2014 is a flexible zero fleet point hoist for 125 or 250 kg loads. Matched with an appropriate drive cabinet it can be used at speeds of up to 5 m/s. The winch can easily be converted to a two point winch or to roll-on roll-off. Standard stroke for a single rope is 60 meters.
The **WINCH P2073** is designed for high performance applications such as stunt and camera flying. A direct drive motor and moving-pulley zero fleet system allow for a compact design. Speeds up to 10m/s with a load of 250 kg are within this winch's range. The standard stroke is 200 meters which easily covers a football field. The use of 50 mm tubes in the corners allows for many mounting options. With extra equipment the winches can be fitted with 2 ropes, allowing for increased stability for camera dollies. See separate datasheets for detailed technical specifications.

**Visual act 3D**

Visual act 3D is an add-on software module for Visual act’s Stage Control System.

Visual act 3D is at the forefront of an entirely new, groundbreaking concept in motion control. The designer’s only concern is the movement of the object, not the axes that move it. The system handles the specifics of individual axes completely in the background.

Visual act 3D brings the maneuvering of theatrical stage equipment a step forward, supporting applications such as stunt rigging and camera movement. The shape, acceleration, velocity, and deceleration of the flight path can be changed in seconds. The system can operate winches capable of speeds of over 10 m/s.

Visual act 3D is the interface between creative thought and technical solutions. Two joysticks (one with a dead man’s switch) are mounted on the operator desk; one is assigned the X- and Y-axes and the other is assigned the Z-axis. Using both joysticks the operator can freely move an object or play back a preprogrammed path. Paths can be played back at low speeds and stopped at any point for camera or lighting adjustments. Several objects can be operated simultaneously, their motions synchronized or started at will.

Programming in Visual act 3D is easy. By using Bézier curves and click-and-drag drawing techniques, complex 3D-paths can be created in minutes. Teach-in allows the operator to move an object freely with the joysticks, using the resulting path as the basis of a new movement.

Most Visual act systems use industry standard intelligent drives to do the actual work of positioning. The central positioning system is left to calculate paths, to interpolate positions for groups of drives and handle communication and safety. A high-speed independent control loop continuously supervises the status and relative positions of interpolated drives. For 3D objects the actual position is calculated from the data of the individual axes. This is then compared to the theoretical position in real time. Any fault with an axis will be quickly discovered and that axis and any axes synchronized with it will be brought to a controlled stop.

Visual act 3D system used for flying camera at ‘Eurovision Song Contest 2014’, Copenhagen, Denmark.
“Whether you are broadcasting a live international event like the Eurovision Song Contest or producing the world’s maybe largest tassel, you can count on Visual act AB to make your event a success.”

Visual act Scandinavia AB
Visual act Creative Solutions

> Theatre, Exhibition & Museum
> Stage, Show & Event

With over thirty years of experience, the Visual act division for scenery and stage production has built up a reputation for providing creative and technically solid solutions for the performing arts.

At well equipped workshops in Stockholm, Visual act has produced customized scenic solutions for hundreds of stage plays and musicals, films, television shows, exhibitions and events of all kinds.

Visual act has a fulltime staff of 20 with expertise in all areas of stage production. With additional resources from a large network of partners, Visual act can take on projects of any scale.

We work closely with designers and producers to understand the customer’s needs and budgets. From individual props to complete projects including design and production management, we can offer everything from simple and cost effective to the most stunning and innovativ.
The bicycle frame of the Troika -
The Sochi 2014 Olympic Winter Games Opening Ceremony, Russia.

Drawing of the bicycle frame -
The Sochi 2014 Olympic Winter Games Opening Ceremony, Russia.

Drawing of the troika movements -
The Sochi 2014 Olympic Winter Games Opening Ceremony, Russia.
Selected References

Installations

Mall of Scandinavia, Stockholm, Sweden
Eric Ericssonhallen, Stockholm, Sweden
Karolinska Institutet, Stockholm, Sweden
Wuxi Grand Theater, Wuxi, China
Yanka Kupala Theater, Minsk, Belarus
Sohyang Art Center, Busan, South Korea
Poeun Art Hall, Yongin, South Korea
Smland Musik och Teater, Jönköping, Sweden
The Music Theatre ROMA, Warsaw, Poland
Lörenskog Hus, Lörenskog, Norway
Oslo Nye Teater, Oslo, Norway
The Kremlin Palace, Moscow, Russia
Finnish National Opera, Helsinki, Finland
Norwegian National Opera, Oslo, Norway
The Royal Danish Playhouse, The Royal Danish Theatre, Copenhagen, Denmark
Old Stage, The Royal Danish Theatre, Copenhagen, Denmark
Het Muziektheater, Amsterdam, The Netherlands
Dramatiska Institutet, Stockholm, Sweden
Det Norske Teatret, Oslo, Norway
TV4 Studios, Stockholm, Sweden
and more

Shows/Stage/Exhibition

'NU' with Danny Saucedo, Hamburger Börs, Stockholm, Sweden
Scania Event for Occasion, Södertälje, Sweden
'The Sochi 2014 Olympic Winter Games Opening Ceremony', Russia
'14-18 Spektakel Musical', the Nekkerhal, Belgium
'Evita', Göta Lejon, Stockholm, Sweden
'Priscilla Queen of the Desert the Musical', Göta Lejon, Stockholm, Sweden
'SPÖK', Cirkus, Stockholm, Sweden
'Ice Age Live', World Tour
'Germany’s Next Topmodel 2012', Germany
'Jesus Christ Superstar', Göta Lejon, Stockholm, Sweden
'Asian Winter Games 2011', Kazakhstan
'Handover Ceremony at Olympic Winter Games 2010', Vancouver, Canada
'Clouseau', Antwerp, Belgium
'Miss Saigon', Göta Lejon, Stockholm, Sweden
and more
Visual act Advanced Wagon System - Horizontal stage transport system, Norwegian National Opera, Oslo, Norway.

'eurovision Song Contest 2005', Kiev, Ukraine

'eurovision Song Contest 2016', Stockholm, Sweden

The entrance to Klarna, Stockholm, Sweden

'Mechanics of the Miracle', VDNKh, Moscow, Russia

The Royal Danish Playhouse, The Royal Danish Theatre, Copenhagen, Denmark.