



## D-Cinema and Automation: Joining Two Worlds

As digitization has swept the industry, more and more movie theatres have installed new equipment and upgraded existing components and systems. However, seamlessly integrating the newly installed digital cinema projectors, servers, and alternative content players with conventional auditorium functions is quite a challenge for conventional automation systems. Modular, decentralized theatre automation systems can come to the rescue. They ensure fast, cost-effective, all-encompassing system integration while providing the greatest possible flexibility for adding hardware and features later.

Conventional cinema automation systems are based on a central matrix programmer machine. Each individual function of every connected component requires a separate signal line to the central machine and yet another line to at least one control panel in the projection booth and/or auditorium. If more control functions are added later, they also have to be wired and connected to the central machine. The resulting dense web of wiring and complex connections incur high costs for materials, and it is time-consuming to install and commission these systems. The work is additionally complicated by the use of nonstandard GPIO interfaces (see the information box on page 4).

Dear Kinoton Customers,  
Business Partners, and Colleagues,

The last issue of "Kinoton Special" explained how a theatre management system (TMS) works. The main purpose of a TMS is managing digital film copies and distributing them among the servers or auditoriums of a cinema center or multiplex.

Although server playlists let you program the basic functions of shows, until recently there were few if any possibilities for (remotely) controlling all of the devices in projection booths and all auditorium systems from different places in the theatre. In particular, it was difficult to integrate existing cinema automation systems.

While designing and developing our new digital cinema automation system, we paid especially great attention to ensuring its flexibility and modularity for use with virtually any combination of equipment, including older models. One outstanding benefit of our automation system is that in most cases, it lets you reuse existing wiring, for example for auditorium control.

If you have any questions, your local Kinoton sales and service partner will be glad to answer them.

Sincerely,

*Christoph Dobler*  
Christoph Dobler  
CEO of Kinoton GmbH

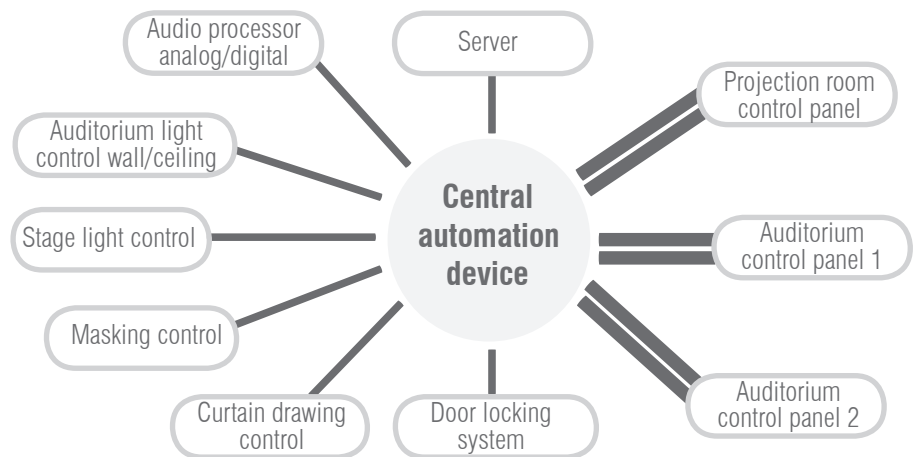


Figure 1: Layout of a centralized automation system

To make matters even worse, cinema automation systems with a centralized structure are usually based on relays, even when they are computer-controlled. But a central automation device can only hold a limited number of these electromagnetic switches, which makes it difficult or impossible to extend its functionality, especially if the aim is to integrate D-Cinema technology.



Figure 2: Examples for centrally organized cinema automation systems that have proven their value in film technology: Kinoton Matrix Programmer (left) and the EMK 1 Electronic Automation System (right)

# Decentralization Opens Up New Vistas

The latest-generation automation systems avoid these problems by dispensing with central control. They are characterized by a distributed system architecture with a single, common data line or bus that links together cinema components such as servers, sound processors, and light control circuits.

The new decentralized Kinoton DCA Digital Cinema Automation system, for example, quickly and securely transfers data via what is called a CAN-bus system (see information box 2). The CAN-bus is the spinal cord of the DCA system. It doesn't require a central junction box or complex wiring. Cinema technology components for automation are simply connected to the CAN-bus in any order using installation modules. Each connection only needs four lines: two signal lines, a ground line, and a power supply line (see Figure 5).

Via the shared data bus, all of the connected components send and receive protocols that trigger the desired control functions. This system has major advantages. You can exactly calculate in advance the amount and cost of required hardware, such as interfaces and cables. Usually far fewer materials are also needed, since you don't need to perform any of the complicated individual adaptations that are often necessary with conventional central automation. The system is quick and easy to install, thus saving you a lot of time and money. It is also a cinch to extend the CAN-bus at any time to integrate upgraded equipment versions and enhancements. This makes the DCA system a forward-looking investment that delivers enormous value for money.

Because the DCA Digital Cinema Automation can seamlessly integrate digital cinema technology with existing auditorium functions, the system is perfectly transparent to the user and very easy to operate. For example, before now projectionists preparing a show playlist (SPL) at a D-Cinema server always had to keep in mind how each function had been implemented in the system. Commands affecting the D-Cinema system had to be different from those for peripheral functions such as room lighting or the masking system – a constant source of error. With the DCA system, operators simply choose from clearly named automation commands, thus eliminating confusion and preventing problems.

## Modules for Easy System Integration

The DCA Digital Cinema Automation has flexible interface modules that permit quick and easy connection of various cinema components. The modules convert signals from the components into CAN-bus signals and ensure flawless data transfer. All automation modules can be quickly and easily connected to the CAN-bus using identical Phoenix connectors. Diagnostic LEDs on each module provide constant information about its operating status. In addition, each module has a standard CAN-CiA-compliant diagnostic connector (9-pin D-Sub) that qualified service engineers can use to control the CAN-bus signals.

The server module forms a bridge between the D-Cinema server and the Kinoton CAN-bus, thus making sure that all peripheral functions (curtain motors, room lighting, stage lighting, etc.) can be conveniently controlled from the server. The server module is compatible with all common server models. Doremi servers, for example, communicate with the server module over the D-Cinema network (Ethernet), and Dolby models are connected via a serial interface (RS232). The commands of the D-Cinema server are transmitted as short digital codes called control strings. They are the same for all server types and specifically programmed by Kinoton for this. If necessary, more control strings can be defined to add more unusual control tasks to the system.

Various audio modules are available for integrating CP750, CP650, and CP500 Dolby sound processors into the DCA system. The connector pin assignments

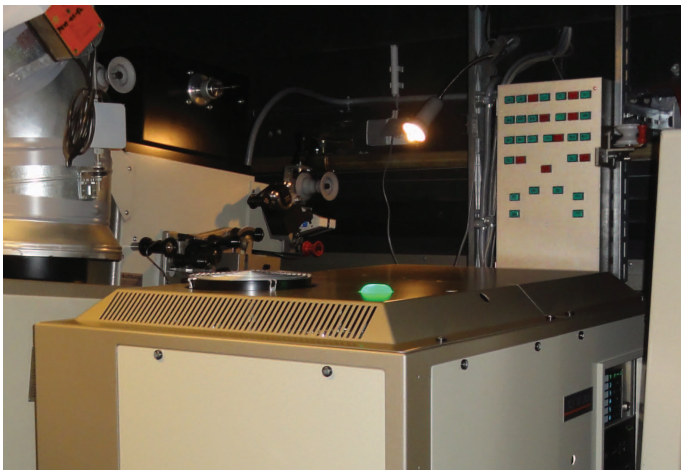


Figure 3: Control panel in the projection booth



Figure 4: Control panel in the auditorium

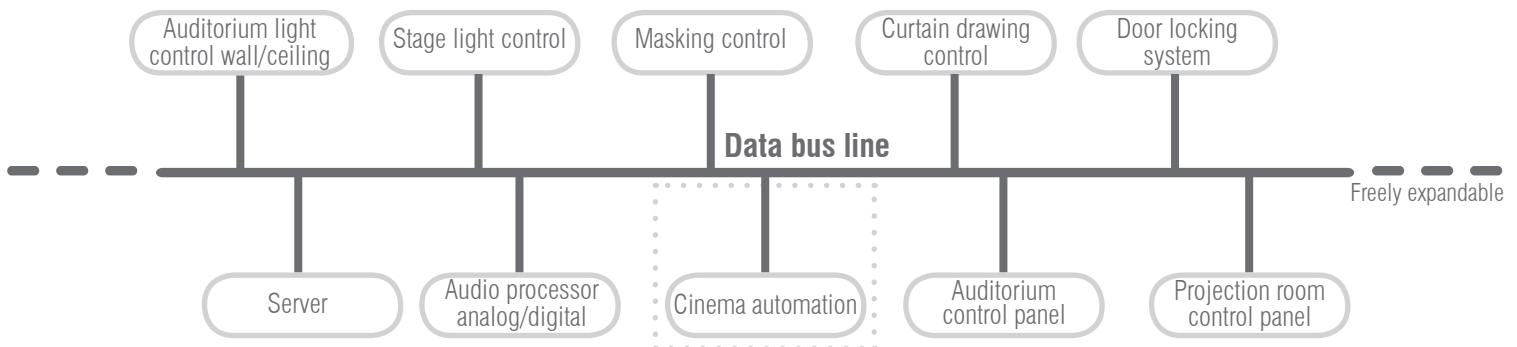
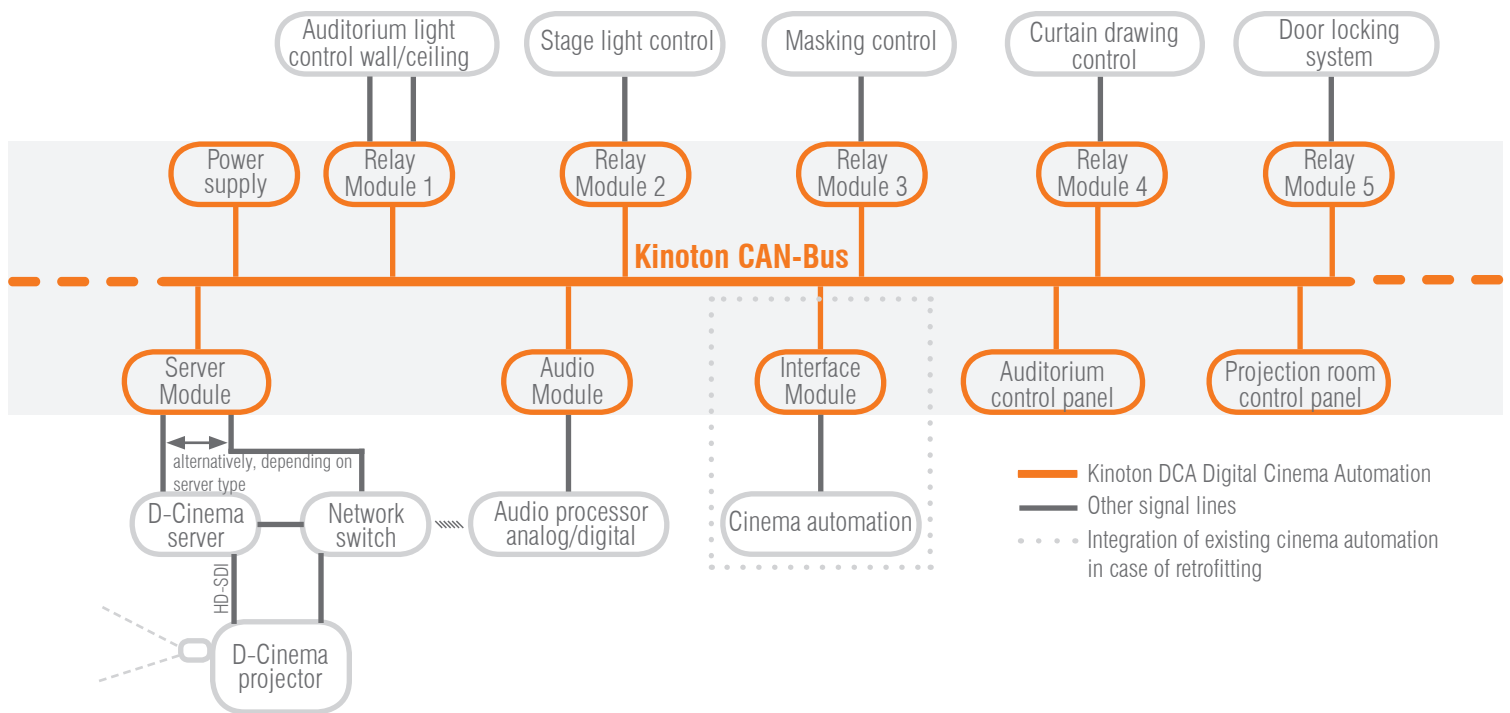


Figure 5: Layout of a decentrally organized automation system

... Integration of existing cinema automation in case of retrofitting



**Figure 6:** Seamless integration of D-Cinema technology and auditorium functions in the Kinoton DCA Digital Cinema Automation system

of the module interfaces correspond to the Dolby conventions, so in most cases no additional adapters are required. The connection module is mounted in the sound rack and controls the cinema processor and auxiliary audio devices such as the Kinoton DMI Digital Media Interface and the Dolby DMA8-Plus. This ensures system-wide signal consistency and lets you uniformly control the volume levels and sound formats of all audio processors via the auditorium panel or the control panel in the projection booth. This even applies to analog cinema processors such as the Dolby CP65, which can be easily connected to the DCA Digital Cinema Automation system using a special analog audio module.

The Kinoton CAN-bus supports up to six D-Cinema control panels and six D-Cinema auditorium panels that let you manually control the connected cinema equipment from the projection booth or auditorium. Each panel has 20 illuminated and labeled pushbuttons, each of which can be assigned to two different functions. A shift key lets you conveniently switch between the two functions. The color of each button's light can be individually configured. You can conveniently and accurately control the volume using a dial with a digital display. It isn't even necessary to carry a physical key to enable control panels; instead, you can activate them simply by pressing a special key combination.

Room functions such as lighting, opening and closing of curtains, masking, and door locking systems are connected to the Kinoton CAN-bus via relay modules. This lets you integrate not only the latest auditorium technology, but also any older system requiring 230-volt control. Each relay module has eight relays for directly connecting devices. The Kinoton CAN bus supports up to 10 relay modules, so when it is equipped with the maximum number you have a total of 80 relays at your disposal. All relays can be configured as "normally closed" (NC) or "normally open" (NO) contacts as required. In addition, each relay module comes with three switch inputs on which you can mount control buttons for the basic server functions Start, Stop, and Pause. This lets you remotely control any D-Cinema server in the theatre from any relay module simply by pressing a button.

If you retrofit the DCA system, it seamlessly integrates with existing automation functions. Kinoton automation systems are especially easy to connect to the Kinoton CAN-bus, thanks to the interface module. Over 20 configurable relay contacts are available for this purpose. Just like the relay modules, the inter-

face module provides three switch inputs for remotely controlling the D-Cinema server (Start, Stop, Pause).

The range of additional modules for the DCA Digital Cinema Automation is growing. The following modules are currently available:

DCA Modules	Code Number
DCA Module „DOREMI Server“	0070 363 01001
DCA Module „DOLBY Server“	0070 363 01002
DCA Module „CP 750 / DMA 8 (plus) / DMI“	0070 363 02001
DCA Module „CP 650 / DMA 8 (plus) / DMI“	0070 363 02002
DCA Module „CP 500 / DMA 8 (plus) / DMI“	0070 363 02003
DCA Module „CP 65 / CP 55 / DMA 8 (plus) / DMI“	0070 363 02004
DCA Module „DMS Scaler / Alternative Content“	0070 363 03001
DCA Module „Control Panel Interface FP 30“	0070 363 04001
DCA Module „Interface Connection FP 40 / 50“	0070 363 04002
DCA Module „External Devices – Relay 8 (230 V)“	0070 363 05001
DCA Module „Auditorium Control Panel“	0070 363 06001
DCA Module „Projection Room Control Panel“	0070 363 06002
DCA Module „Fire Alarm / Emergency-Off“	0070 363 07001
DCA Module „Projector Exhaust Control“	0070 363 08001
DCA Module „Media Control“	on request
DCA Module „Power Supply 24 V“	0070 363 10001
DCA Module Installation Kit	0070 363 10005



### Info Box 1: GPIO

The term GPIO (General Purpose Input/Output) originated in the field of microelectronics, but these days it is also used in control engineering. GPIO interfaces are not assigned to any specific function and are not standardized in any way. Every manufacturer of digital cinema technology therefore uses connectors with varying, arbitrary pin assignments for different connection values.

This means that there is no universal solution for integrating digital cinema technology with a conventional cinema automation system. In fact, service engineers have to work out an individual solution for every installation, depending on its unique technical characteristics. In addition, it is generally not possible for a proposed function to be directly triggered via a GPIO input or output. To accomplish this, additional circuits and other adjustments are needed, and in many cases even a separate power supply. As a consequence, integrating digital cinema technology or adding new features to a cinema automation system is always a costly, time-consuming, and unpredictable project.

### Info Box 2: CAN-Bus

A bus (from the Latin word omnibus = for all) is a system for transferring data among multiple parties via a shared communication path. CAN is short for Controller Area Network and describes a network or bus system that is optimized for control tasks. In contrast to the nonstandard GPIO interfaces, CAN-bus technology conforms to clear stipulations defined in the ISO 11898 standard. The DCA Digital Cinema Automation system naturally also complies with this standard.

The CAN-bus system was originally developed in the 1980s by Bosch, Intel, and Daimler-Benz to simplify automotive wiring harnesses and cut down on weight. CAN-bus technology lets you send much larger amounts of data over significantly fewer lines. Moreover, this type of signaling is capable of real-time transmission, highly immune to electromagnetic interference, extremely robust, and easy to handle. Multiple security mechanisms ensure stable, reliable data transfer, which has made CAN-bus systems popular not only in the automotive industry but also in many other, often security-related, applications including medical and aerospace technology.

CAN-bus is a multimaster system in which all connected components have the same potential. Any faulty component immediately disconnects from the bus ("bus off") to avoid blocking the system. The wiring goes in a straight line between successive components, following a pattern called a line topology.

In principle, any bus component can use the bus to transmit signals at any time while all other components just "listen". However, simultaneously transmitting multiple signals can cause data loss, so components have to take turns sending their data. Access conflicts are prevented by the subtle CSMA/CR principle (Carrier Sense Multiple Access/Collision Resolution): Each message is marked with a short code (identifier) that indicates its importance. In an "arbitration" phase, the identifiers of all "transmission inquiries" are compared to define which message is the most important. The relevant

component can then transmit its message instantly and without any loss of data. The principle is therefore also called "loss-free bus arbitration".

This is also one of the main differences from Ethernet transmission. If several participants simultaneously try to access the common data line, their messages are destroyed and they all stop transmitting at once. The next transmission attempt cannot be made until after a brief pause. Obviously, it is not possible to transmit data in real-time on this basis.

To increase the susceptibility to interference of the CAN-bus system, data are differentially transmitted via two lines with complementary signal levels. The receiver determines the signal value from the difference between these two balanced voltages. Electromagnetic interference, e.g. caused by alternating current lines, power transformers, or lamp ignition, influences the complementary signal levels to the same degree and is therefore cancelled out when the difference between the two signals is calculated. The bus cable of the Kinoton DCA Digital Cinema Automation also supplies all bus components with power, so the installation modules do not need their own power supply units.

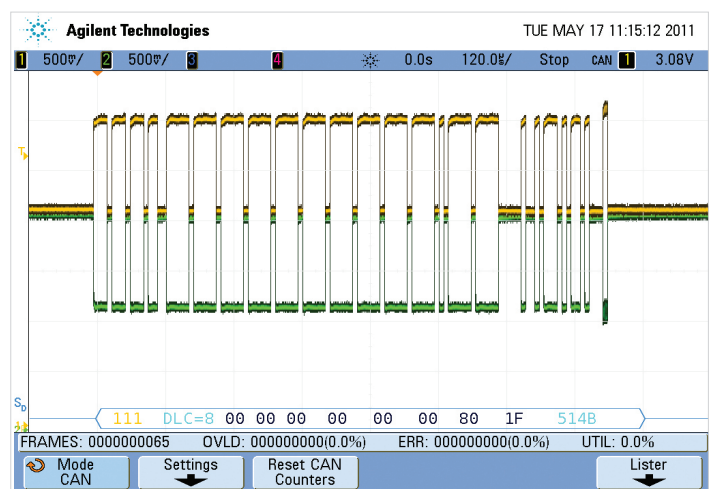


Figure 7: Differential CAN-bus signals displayed by a digital oscilloscope: the desired signal results from the difference between the complementary signals CAN-High (yellow) and CAN-Low (green).