

# Project:

## Municipal theatre Rüsselsheim

Fire dampers  
with spring return actuators  
and smoke detection

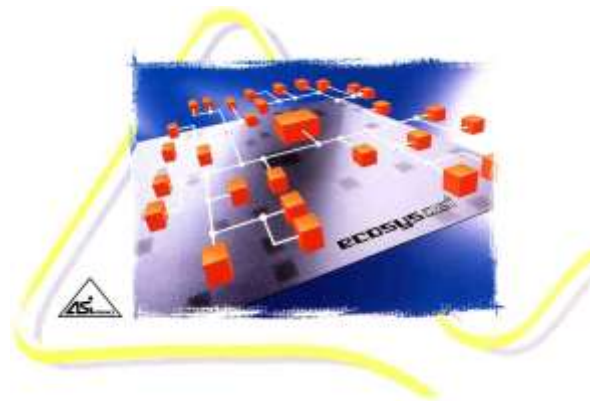


in building services automation

## Why is there a bus in the theatre ?

In the past the technical systems in buildings lagged behind industrial technology by many years. Nowadays the common parallel wiring is very often used for modification and set-up of electrical installations even in huge buildings. But especially for the modernisation of buildings it is important to use a field bus system which enables the use of existing installation systems in the building with minimum wiring efforts. Especially for new building complexes a system which saves cable ducts and reduces environmental damage due to fire by up to 80 % due to reduced cable lengths is more and more often required.

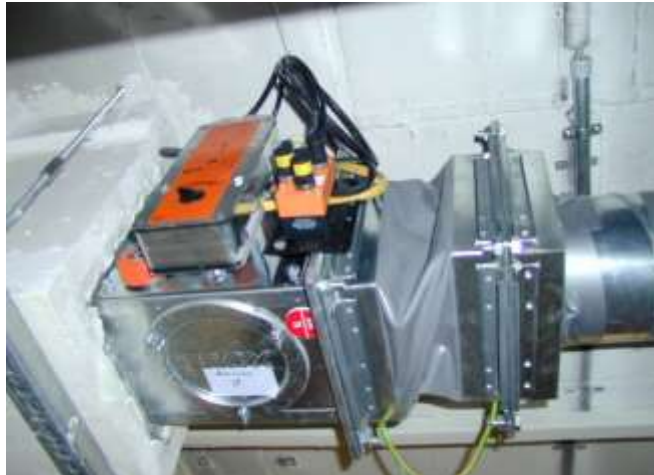
**AS-Interface** (AS-i) - is such a field bus system which reduces environmental damage due to fire considerably and saves costs. AS-Interface is used in automation technology world-wide, which is shown by the number of more than 1 million slaves used. For almost a decade this system has been used in small and in big installations, especially in areas susceptible to interference. Especially for building automation AS-i benefits from its considerable advantages: cost savings, easy to use and considerably reduced environmental damage due to fire.



## System set-up in the project

The control concept is based on the AS-Interface field bus system. All fire dampers are divided into five AS-i lines and are connected with one AS-i master per line via the yellow flat cable. These AS-i masters are in the controller (with 1 or 2 masters) which is the central control unit of the AS-Interface. The smoke sensing devices are also connected to the field bus via the flat cable. The field bus connection of dampers and smoke sensing devices is made by means of AS-i isolation displacement connection. Each controller in the project has a second RS485 interface in addition to its RS232 programming interface. All four controllers are interconnected via this interface. One controller is the master controller and enables the exchange of data with the remote (slave) controllers. In the individual controllers all functions of the dampers are programmed with the plc programming language (to IEC 61131-3) and thus preprocessed. Only defined signals are exchanged with the higher system (building services control system). The programming in the higher building services control system is considerably reduced and less expensive.

## AS-i connection of the fire damper



**Figure 1: fire damper with spring return actuator and AS-i connection via the classic 2I/2O module**

All fire dampers have been equipped with spring return actuators by Belimo in the factory. The dampers are equipped with the AS-i modules and directly delivered to the construction site by the manufacturer TROX. The actuator and the upper part of the AS-i module are connected via plug and socket connection.

For installation on the construction site only the yellow and/or the black flat cable are inserted in the profiled ducts of the lower part. By screwing the upper part onto the lower part the contact between the module and the flat cable and thus the controller is made.

## AS-i connection of the smoke sensing devices in the field

In the factory the TROX smoke sensing devices of type RM-O-VS are also premounted on an air duct with AS-i connection. By means of isolation displacement connection the yellow and the black flat cable are connected with the housing of the AS-RM module which is mounted at the air duct. The smoke sensing device is supplied with voltage via the AS-i module installed in the housing which enables a test function of the smoke sensing device via AS-Interface.

Moreover the operating state of the smoke sensing device, the airflow monitoring, soiling warning (> 70%) and smoke alarm of the ventilation system can be indicated to the AS-i controller and thus to the higher control systems via the AS-i module. When smoke is detected, all dampers or damper groups are brought into the safe state (position CLOSED) via the AS-i controller.



**Figures 2a a. 2b: smoke sensing device with AS-i connection**



## Connection to building services control system



**Figure 3: Data transfer via relay contact (4I/4O modules)**

To guarantee a fast and inexpensive connection to the building services control system, relay contacts were selected for signal transfer. Relay contacts of the building services control system transfer commands to the master controller and relay contacts of the AS-i control cabinet modules (4I/4O) transfer group fault messages and individual status messages to the building services control system. The complete ventilation system is divided into eight subinstallations which have their own group fault messages and building services control system commands.

The second interface of the controller enables easy serial connection to higher systems. For these defined interfaces, such as Profibus-DP, Interbus, DeviceNet, Modbus, (LON is being developed at present) ifm electronic gmbh already offers an AS-i controller or AS-i gateway which has already been used in many projects.

## Visualisation options

Illuminated push-buttons have been selected to indicate the individual states of the fire dampers. The state "damper open" is indicated by a green permanent light. The state "damper closed" is indicated by a red permanent light. If a damper moves, a green light flashes. A failure of a damper results in red flashing light. All fault messages remain stored until they have been acknowledged. By pressing a button, one damper is moved in the manual mode or a group of dampers is moved in the automatic mode. There is also a test LED and a test/fault indication for each smoke sensing device.

The state of fire dampers can also be visualised by PC or touch screen (via RS232C), indication and operating panel (via RS232C), LED/push-button module TROX type AS-MO (via RS485) or via the higher building services control system.



**Figure 4: panel with illuminated push-buttons for each damper**

## Considerably shorter cable lengths

Each cable laid in the installation results in a number of subsequent costs. Cables have to be fixed, require cable ducts, must be stripped and connection errors are made easily. AS-i offers a two-wire tree structure and can be branched at any position. It is thus possible to save considerable cable lengths. In this project approx. 30 km NYM cables would have been necessary for parallel wiring. The use of AS-i reduces this to only approx. 800 m AS-i flat cable. Not only the cables but also the described subsequent costs could be reduced.



**Figure 5: Comparison of conventional wiring and AS-Interface with the example of a flat cable branching**

## Problem of heat resistance (E30 / E90)



**Figure 2: channel with fire protection housing**

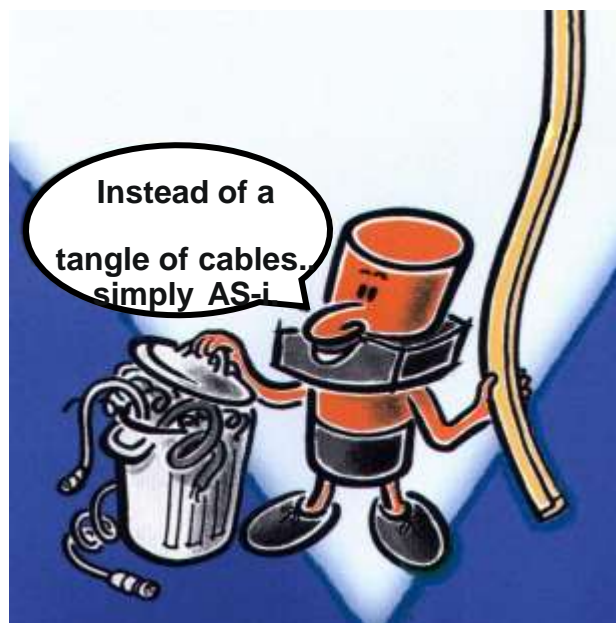
Even under difficult conditions because of rigid fire protection specifications AS-Interface (AS-i) can be used without problems. AS-i module lower parts with SC connection enable use of standard round cables (> with increased functional endurance in case of fire (E30/E90)). The cable types can be mixed since the module lower parts are suited for flat cables by means of the SC connection as well as round cables. For desmoking flaps test showed that the modules plus cable have a better heat resistance than the actuators.

The yellow flat cable can also be laid in the Procan channels at any time. Especially in the applications with increased fire protection requirements, the bus system pays off thanks to the considerable reduction in cables.

## Advantages of AS-i in this project

- faster installation
- reduced material requirements for cables
- fewer cable ducts
- fewer terminal chambers
- reduced cabling, easier installation
- faster set-up
- diagnostic functions
- failure detection of dampers
- shorter maintenance thanks to display panel
- set-up and installation without higher system
- signal preprocessing relieves the building services control system
- all functions even without higher system
- extension of installation possible without changes in the control cabinet

**We would like to thank  
*all companies and persons involved*  
for the good cooperation.**



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# Project scheme Municipal theatre, Rüsselsheim

## Central control cabinet:

Master controller, AC1012  
 AS-i dual power supply, AC1212  
 24VDC power supply, DN2013  
 Repeater, AC1015  
 AS-i power supply, AC1206

## Control cabinet SS-2:

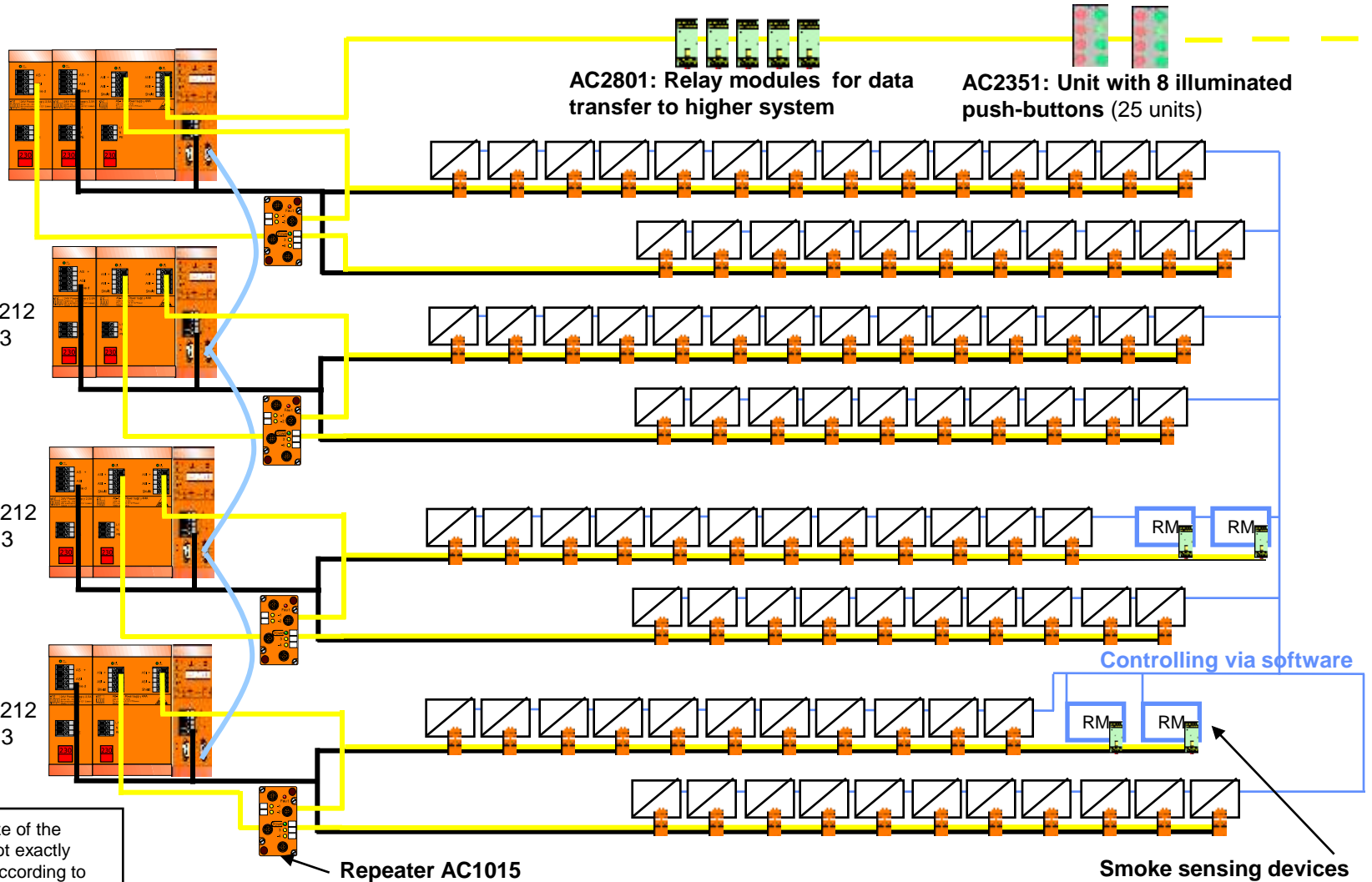
Remote controller, AC1011  
 AS-i dual power supply, AC1212  
 24VDC power supply, DN2013  
 Repeater, AC1015

## Control cabinet SS-3:

Remote controller, AC1011  
 AS-i dual power supply, AC1212  
 24VDC power supply, DN2013  
 Repeater, AC1015

## Control cabinet SS-4:

Remote controller, AC1011  
 AS-i dual power supply, AC1212  
 24VDC power supply, DN2013  
 Repeater, AC1015



This is only a scheme. Since the size of the plant and the local conditions are not exactly known the system must be set up according to the requirements on site.