

Project:

Palm Beach, Stein/Nuremberg

Thermal Spa



by Arnold Roth

*Water is the essence of all things.
For everything is made of water and
to water everything returns.*

Thales von Milet (624 – 546 B.C.)
Greek philosopher



and ifm sensors in
swimming pool technology

Thermal Spa Kristall Palm Beach in Stein

One of the most beautiful thermal spas of Central Franconia is located in Stein near Nuremberg. The Palm Beach is the first among eleven water parks of Kristall Bäder AG where currently 750 employees work.

Investment in modern technology and automation is essential to operate water parks economically. Thus it was time for reconstruction and extension of the system also at the Palm Beach. Prior to this reconstruction the automation technology in the whole system was designed with conventional installation technology. This led to large line quantities with the disadvantage of a complex fault research.

The automation technology was only focused on few and important things. Thus system processes such as the backflush of the filter systems require much manpower. Due to the low degree of automation the technical staff was rarely able to react quickly to operating messages of the systems.

In order to minimise the required time and manpower and to increase system safety it was decided to renew and extend the automation technology. The intelligent wiring concept AS-interface was chosen to increase the efficiency of the automation technology and to drastically reduce installation input for reconstruction.

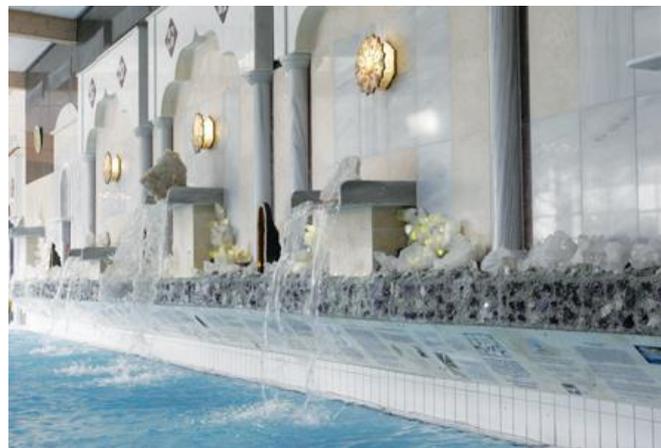


Figure 1: officially recognised as a medicinal spa since 2005

Why automation?

Many processes in swimming pools still require much manpower due to old technology. This is why not only pool attendants but also technical staff is necessary for smooth operation. In order to obtain safe and cost optimised processes it is important that these employees concentrate on the essential tasks.

For this, automated system technologies offer support. By means of sensors, actuators and a higher-level controller (PLC) defined processes can be carried out even outside the regular swimming times.

In this way a smooth operation of the swimming pool is ensured. Processes which normally require staff can be carried out at night due to automation technology. Investment in automation results in higher operational reliability of the system and in increased staff availability.

AS-interface to reduce wiring complexity

The control technology concept in parts of this system is based on the intelligent wiring system AS-interface (AS-i) as an economic technical extension to the Profibus DP fieldbus system.

Using AS-interface, sensors as well as actuators are connected to the so-called AS-i master via a two-wire profiled yellow cable in a simple reverse-polarity protected way by means of field and control cabinet modules (AS-i slaves).

For the use of AS-i controllers from ifm electronic one or two AS-i master, PLC functionality as well as a Profibus DP or Ethernet interface are integrated in one housing. The AS-i controller is, together with an AS-i communication power supply, installed in a decentralised way as a data collector and signal pre-processing PLC in the system.

The connection to the central control technology (central PLC) is carried out via a Profibus DP interface as slave or via Ethernet. For larger installations several AS-i controllers are distributed in the system to bridge the long distances.

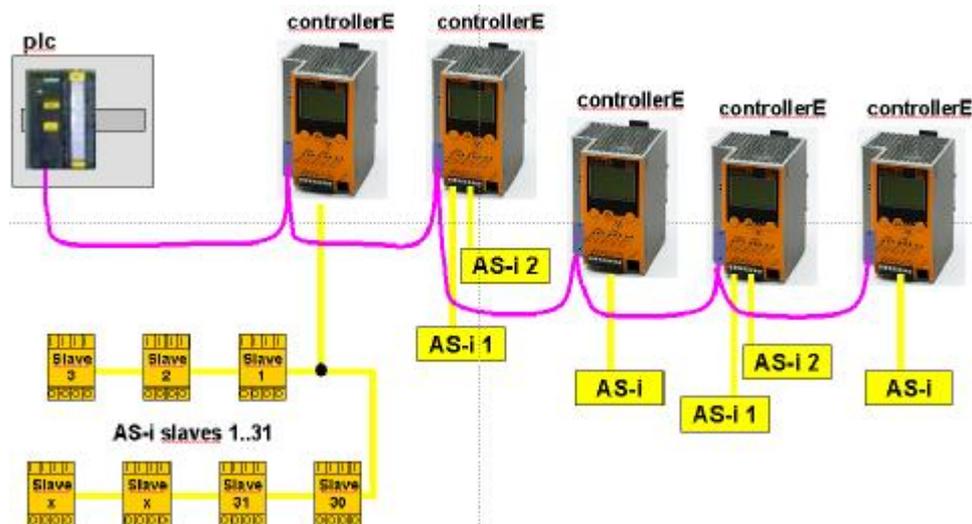


Photo 2: structure of a complete system with central PLC, ControllerE and AS-i slaves in the field

The transmission of all system signals as well as the sensor supply is ensured via the two-wire AS-i cable.

By using AS-interface the wiring complexity of process systems can be reduced by up to 30 %. This allows not only to reduce installation material but, and foremost, also to considerably minimise the workload.

Commissioning times are considerably minimised due to the high diagnostic capability of the system. For these reasons it is often used in process, industrial and building system automation. With the wide range of products of many manufacturers and its comprehensive compatibility, AS-interface provides integration solutions for various sensors and actuators in almost all automation systems.

Control concept with AS-interface and Profibus DP

Common PLCs with Profibus DP master (S7) and Ethernet interface are used as the central control system.

In the first project stages the AS-i controllers were connected to the central control systems as Profibus DP slaves. For visualisation the central control system communicates, via Ethernet, with an external industrial pc using the visualisation software VISU from the company Citect.

In the last project stage an AS-i ControllerE was, depending on the application, directly connected to the industrial pc via Ethernet interface.

Due to the decentralised arrangement of the Profibus DP slaves (AS-i controllers) and the AS-i slaves, the intelligence of the system has been relocated into the field.

This allows savings which become obvious especially by the use of smaller control cabinets.

System extensions can be carried out easily without modifications of the control cabinet.

Control of processes used e.g. for special attractions take place on site in the AS-i controllers. The process for the filter backflush, which normally involves many staff, is completely and fully automatically controlled in cyclical intervals by an AS-i controller. The individual steps and stages are displayed in the visualisation.

Thus the free capacities become available for other processes.

Due to the signal pre-processing in the AS-i controllers the software of the central control system is considerably supported.

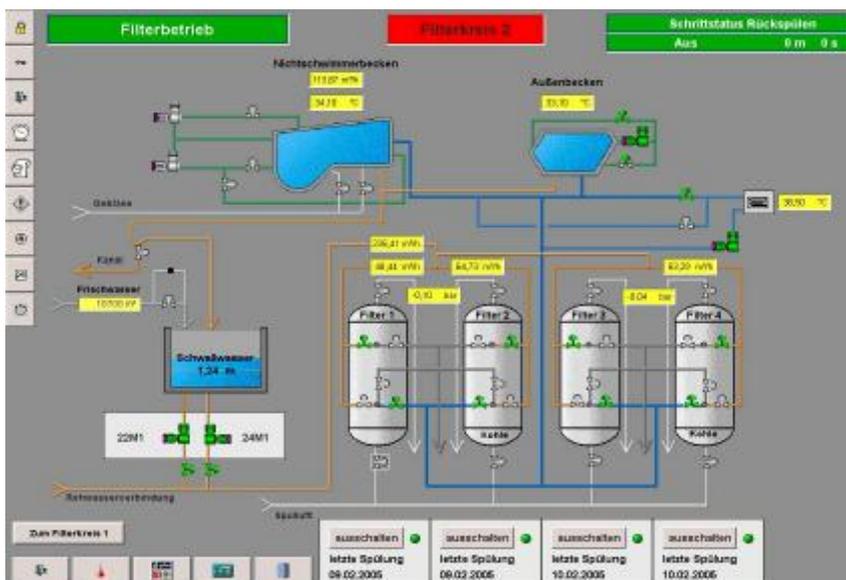


Figure 3: VISU system set-up, backflush of the filter circuits 1 and 2 on AS-i level.



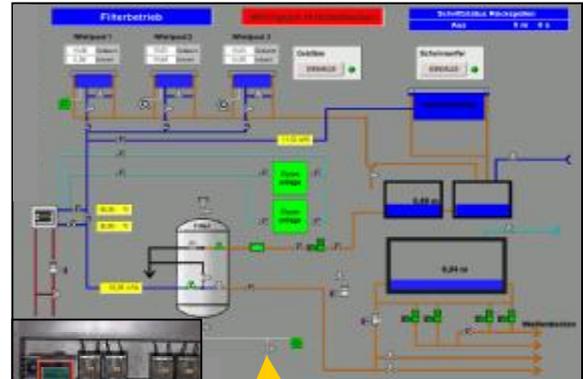
Figure 4: AS-i ControllerE with Profibus DP interface

System set-up

PC visualisation and operation of the complete swimming pool technology



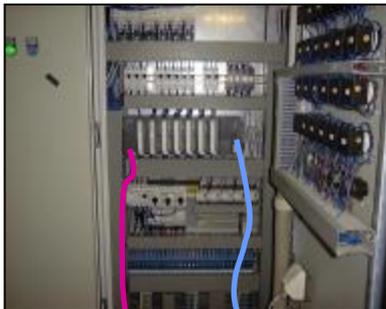
Whirlpool and children's pool
AS-i for filter circuit and heat exchanger



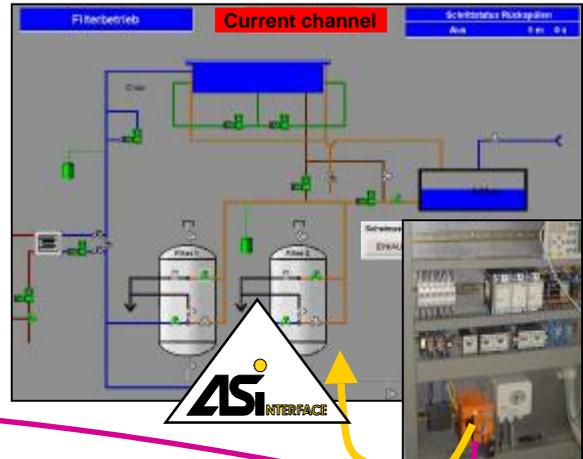
Quarter-turn actuator



Central PLC as Profibus DP master



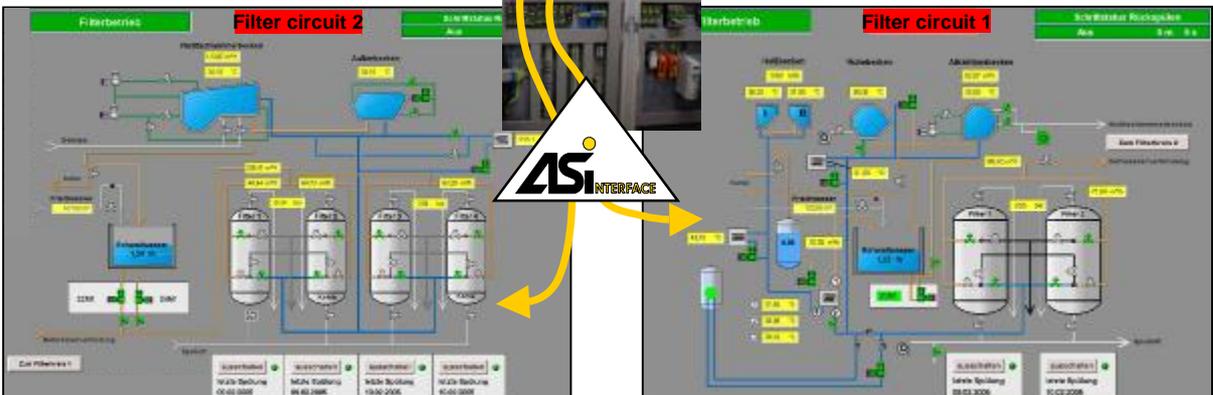
Current channel in the outdoor area
AS-i for filter circuit and heat exchanger



Ethernet

Profibus DP

Backflush and filter monitoring via AS-i



Systematic plant construction

Intelligent systems feature an especially high degree of automation and are very easy to install. Due to the optional preinstallation, system parts can be premounted at the factory and delivered to the system as a complete unit.

Thus installation times can be reduced and error sources can be minimised. The standards obtained in this way such as for the EBRO quarter-turn actuators ensure a high degree of reliability and help to keep costs low.

In the individual system parts less staff was required due to premounting and the easy installation technology of AS-interface.



Figure 5: quarter-turn actuators with AS-i: Address, connect, ready!

The system solution quarter-turn actuator with IND/T5

Pneumatic quarter-turn actuators from the company EBRO-Armaturen are provided with the intelligent AS-i sensor of the IND/T5 series at the factory. The T5 range contains two inductive sensors for non contact and wear free "open / close" detection of a rotational movement by means of target pucks. An integrated digital output controls the solenoid valve of the pneumatic quarter-turn actuator.

On site this unit has just to be provided with compressed air and the yellow AS-i line. The electro-pneumatic valve is supplied with voltage via the sensor.

A single AS-i line for each AS-i master ensures communication and voltage supply for up to 62 quarter-turn actuators. As no further line is necessary for the voltage supply, set-up and servicing times are considerably reduced due to the easy wiring.



Figure 6: premounted quarter-turn actuator of the IND/T5 series.

AS-i AirBox system solution

The AS-i AirBoxes incorporate industrially compatible solenoid valves with high pneumatic flow within a very small space.

On an area of 45x80 mm two single-acting cylinders or one double-acting cylinder can be triggered.

All tube connections are already integrated so that time-consuming installations as required for conventional solenoid valves are reduced.

AS-i AirBoxes help to reduce wiring and tubing efforts wherever compressed air is used to operate the actuators.

Tube connections are short if an AS-i AirBox is mounted close to the pneumatic actuator. This minimises pneumatic delay times and reduces air quantities thus leading to faster processes and lower cost for the compressed air generation.

Due to the integrated AS-i slave and the binary feedback inputs considerable savings for electrical wiring are also possible.



Photo 7: filter circuit of the current channel

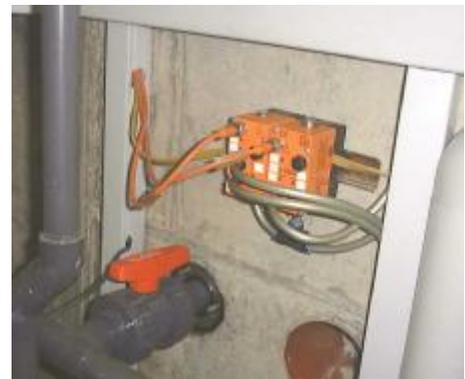


Photo 8: AS-i AirBox with integrated 4/2-way valve

Analogue input/output modules

Standardised analogue signals such as system pressures, temperatures, continuous level measurements, etc. are detected via AS-i ClassicLine field modules on site and are passed on to the AS-i ControllerE for further processing. A/D conversion takes place directly in the AS-i module and considerably facilitates system programming. The same applies to analogue output signals which trigger the actuators.

Standard M12 sockets allow reduced wiring complexity for sensors and actuators.



Photo 9: AS-i ClassicLine analogue module

Prewired connection cables not only ensure a high protection rating (up to IP 67) but almost exclude wiring faults. The AS-i line is connected by means of the flat cable lower part. Of course, analogue control cabinet modules of the SmartLine series are also available.

AS-i in the control cabinet

As AS-i allows a decentralised intelligence structure, control cabinet sizes are reduced. The smaller control cabinets not only offer place for the AS-i controller, power supplies for the AS-i voltage and additional 24V DC supply but also for various other AS-i modules. The AS-i control cabinet modules are available in different designs: either as a digital input/output module with transistor outputs or relay outputs for potential-free switching of motors, or as an analogue input or output module. They can be mounted via simple rail mounting. The electrical connection is made via plug-in Combicon or screw terminals.

Lower costs are not the only advantage of smaller control cabinets. They also allow to implement simplified and more flexible system concepts. Planning and prefabrication of the control cabinets have been facilitated considerably.



**Photo 10: AS-i ControllerE for valve controlling filter circuits 1+2
Control cabinet modules for controlling motors**

Binary field modules

Most of the sensors and actuators used in swimming pool technology are binary. These signals can be picked up by means of field modules of the AS-i ClassicLine family and passed on to the AS-i controller.

Due to standardised M12 sockets the inputs and outputs of the AS-i new ClassicLine modules can be connected to the sensors and actuators via prewired connection cables.

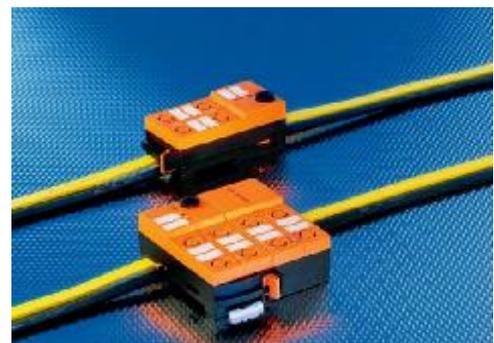


Photo 11: new ClassicLine field modules

This connection technology allows the high protecting rate IP 67.

The sensors connected on the input side are supplied with voltage via AS-i. The supply for the actuators comes from a separate black cable. As an innovation the AS-i new ClassicLine offers quick, tool-free installation ensuring safe mounting at the same time, as well as the possibility to insert the flat cable from three different directions. Thus installation times can be optimised and costs can be reduced.

Temperature sensors:

Different designs and versions of temperature sensors are necessary in order to meet the various requirements of the swimming pool technology. Whether sensors of the TS series with external control monitors or the TN series with integrated control monitors on site: the application-specific demands are met by ifm temperature sensors.

Here, not only the high accuracy of the Pt 1000 sensors but also the protection rating IP 67 offer considerable advantages. The sensors with integrated control monitor provide temperature pick-ups, local display as well as switching and analogue signals with a single process connection. All settings such as switch point, hysteresis, analogue signal values etc. are set directly on site by means of the menu navigation via pushbutton.

These sensors are connected by means of M12 connection cables. Due to the 24V DC version the switching and analogue signals can simply be integrated in higher-level controllers.



Photo 12: temperature sensor Pt 100 of the TS series



Figure 13: Pt 1000 temperature sensor of the TN series with integrated control monitor

Capacitive level monitoring:

The capacitive sensor of the KNQ series monitors the level of tanks or pump sumps without contact. A transistor switching signal indicates when the set switch point is reached.

The adjustment to the level is done via a teach element. Deposits in the pipe are suppressed by means of the adjustment to the medium.

As the sensor is mounted outside the bypass pipe the medium cannot have negative effects on it.

The adjustment of the switch point is done by moving the sensor and allows a simple set-up and quick operational changes.

The connection to the AS-i field modules can be carried out very easily by means of prewired connection cables.

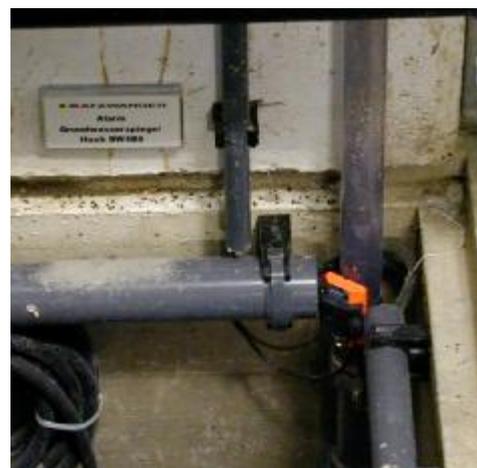


Figure 14: capacitive level sensor, KN

Conclusion

Advantages for the system builder:

- Reduction of the wiring complexity
- Short installation time
- Quick set-up
- Possible wiring faults are minimised.
- Reduced installation and wiring materials

Advantages for the system operator

- Less staff required for operation and maintenance
- Minimised downtimes thus higher system uptime.
- Clear system design
- Easy maintenance
- Excellent diagnostic capability

Profile of ifm electronic gmbh

ifm electronic stands for the optimisation and solution of technical processes by means of sensors, networking and control systems. Close customer contact, quality and innovations have made us the market leader in many areas. Planning and project support make ifm electronic a system supplier on the lower automation level.

Products and systems from ifm electronic

Position sensors and object recognition

inductive sensors, capacitive sensors, magnetic sensors, cylinder sensors, safety technology, valve sensors, photoelectric sensors, object recognition, encoders

Fluid sensors and diagnostic systems

level sensors, flow sensors, pressure sensors, temperature sensors, diagnostic systems

Evaluation systems and power supplies

Bus systems

(communication and control systems for process and industrial applications)

Identification systems

Control systems (controllers for mobile and robust applications)

Connection technology

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