

The lifting device on the pallet can be adjusted to the optimum height for every work step

Sheer Conveying Pleasure

To maintain maximum flexibility in the allocation of work in body assembly for the 3 series, BMW and Siemens developed a tailor-made concept for automation of the conveyor system. With Simatic power rail boosters and safe PLC technology the Bavarian automobile builder has a future-safe conveyor system at its disposal which should survive two model generations.

In the course of modernization and expansion of the factory in the shadow of the emblematic four-cylinder-shaped headquarters, a new skid conveyor system for body assembly for the 3 series was installed. With this new system, BMW feels fit for future vehicle models.

In the body assembly shop, the complete interior of the 3 series BMW is equipped. Assembly takes place mainly in a moving operation. Exceptions are the stations for the automatic installation of sunroof, cockpit and windows in which the body comes to a standstill. Two people are responsible for every assembly step. They ride along on the assembly line during the work step and then return to the starting

point. Up to 500 assembly workers ride the 800-m line at once.

Flexibility required

The conveyor system consists of 146 articulated push-pallets. Because of the particular “historically developed” geographical situation at the Munich factory, only a bend maneuvering solution was viable.

The platforms do not have their own drives but are pushed along by lateral friction drives distributed along the line. Absolute value encoders monitor the exact synchronization of the 102 drives and prevent gap formation between the pallets.

The new assembly line required the height of the body to be adjustable during operation anywhere along the line to guarantee an ergonomically optimum position for assembly. Therefore every pallet carries a lifting station with which the body can be raised a maximum 80 cm.

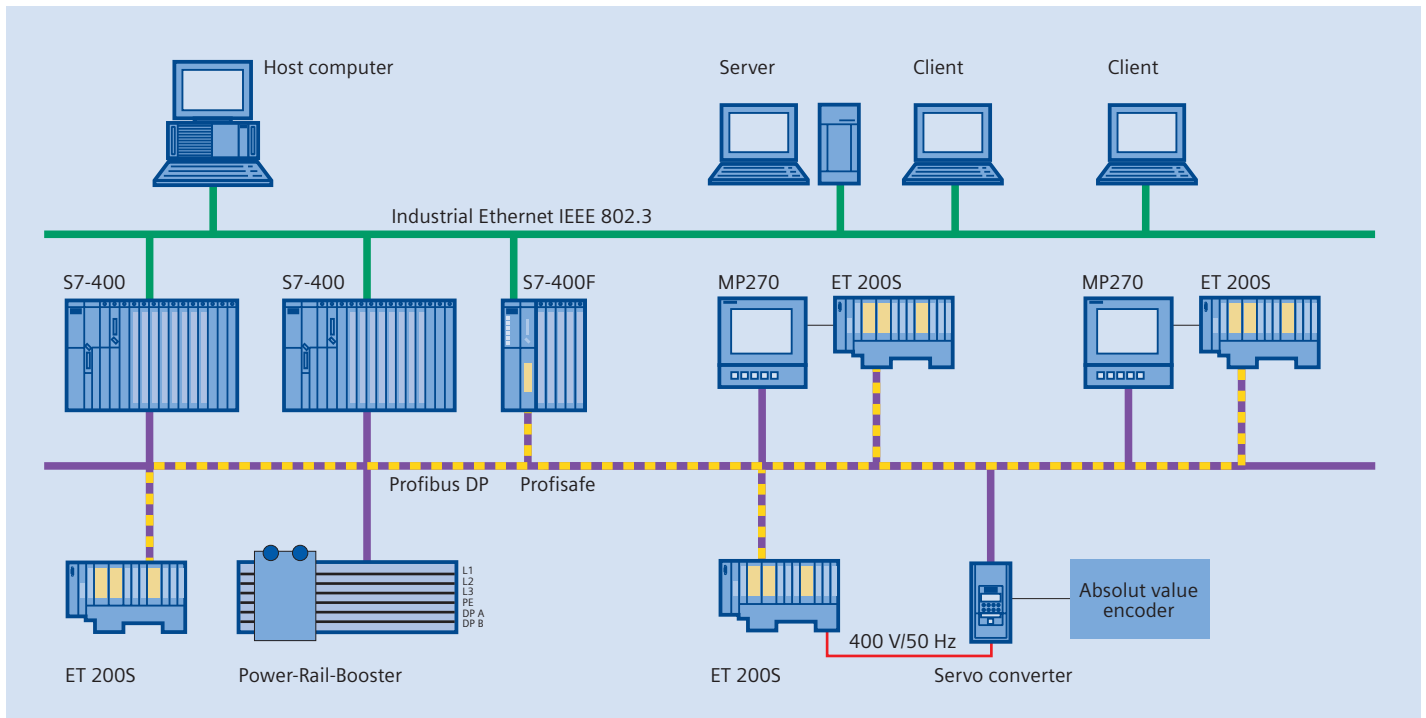
An important requirement of the production planning at BMW was also the possibility of being able to switch the 12 V test voltage supply on and off safely at freely definable points on every platform. The on-board electronics of the cockpit and the loudspeakers are tested during assembly. Since no battery is installed yet, the 12 V supply must be provided externally. The supply must be switched off reliably in sen-

sitive areas of assembly – such as airbag installation – without having to have a permanently wired assignment of the assembly sections.

Every pallet under control

Every push-pallet has a peripheral interface Simatic ET 200S with CPU IM 151 which acts as a slave to the Simatic S7-400 controller and at the same time as a master on the platform for driving the lifting mechanics for the body and the absolute value encoder. The pallets are connected to the Simatic central control by power rail boosters, which transfer the Profibus signals reliably by collector wires. The lifting device can also be set individually at any point during operation in this way.

The complete plant was configured under Step 7 and is controlled centrally by two Simatic S7-400. The plant visualization has been programmed with WinCC. It enables the plant to be represented in varying degrees of detail – from the general overview to the status of the binary encoder on every single pallet. The whereabouts of every single pallet can be determined exactly by scanning identification marks. Profibus DP as a central fieldbus provides reliable communication between control and peripheral devices. Simatic Multi Panel MP 270Bs configured with ProTool/Pro are used as ►



Schematic diagram of the automation configuration of the skid conveyor

► local manual operating devices. They allow comfortable distributed access to the conveyor system.

As a result of the individual intelligence on every pallet and the communication via power rail boosters, the plant has maximum flexibility in the assignment of working cycles. This means that several models can be produced simultaneously on the same line and new models fed in successively.

The body carrier contains an RFID tag so that the body can be identified at all times. This is important for the production control, documentation and quality assurance at BMW.

Drifting prohibited

The safety of the assembly workers on the platform is the top priority for BMW. The individual elements are not connected to each other so that it must be ensured that the individual pallets do not drift apart and endanger persons. If the pallets drift just a

few millimeters apart as they move along, the belt is stopped automatically well before persons are in danger. For this purpose, absolute value encoders scan the position of the individual pallets continuously. A safety-oriented Simatic controller S7-416F monitors the light grids, protective doors, pallet sensors and emergency stop switches continuously and shuts down the plant within a few hundred milliseconds if necessary.

Uniform standard from the market leader

Automation of the conveyor system is merely a part of the total package in which Siemens has taken over the responsibility for the automation of the entire production process of the 3 series from the body assembly to delivery through six units. Totally Integrated Automation was able to give a demonstration of its strengths here. System interfaces were minimized and an integrated control architecture was

The Moby U RFID system saves all the data relevant for production of the vehicle



achieved. "Automation of a unit is already a complex task in itself but getting six production units to cooperate without great losses would hardly have been possible with a heterogeneous automation environment," Jakob Wersching, the man responsible for structure planning at BMW explains.

Totally Integrated Automation

Links on the topic:
www.siemens.com/tia
www.siemens.com/automotive

Contact:
josef.schweinberger@siemens.com



All pictures: W. Geyer

The locally mounted manual HMI device with Simatic MP 270B for distributed HMI and emergency stop function

Guaranteed productivity for the next two generations

BMW quotes the availability as being 99%. The commissioning of the plant during a 6-week break in production went by without any major hitches. One of the reasons for this being the valuable experience which had been gained from a test installation with 30 skid pallets at the BMW factory in Lohhof and transferred to the large plant in Munich.

BMW is convinced that the new ergonomic possibilities on the line create ideal conditions for employee motivation, which will be reflected in increased productivity.

The maximum flexibility in the assignment of assembly cycles which are transferred by power rail boosters enables a fast reaction to changes in the production requirements and ensures that BMW is also well equipped for future model offensives. The skid conveyor system in Munich should provide “sheer conveying pleasure” for the next two vehicle generations. ■

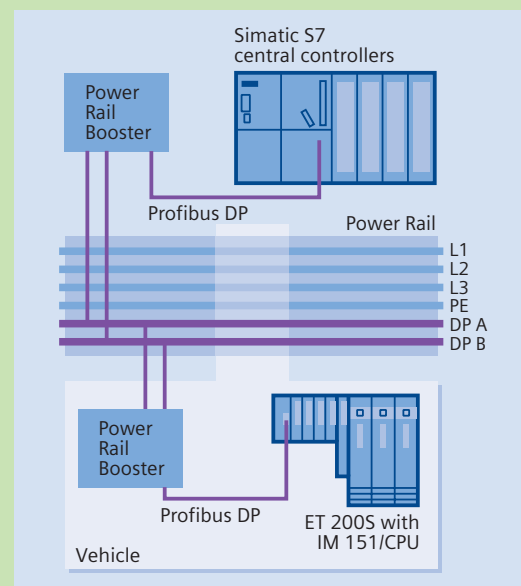
Benefits with Totally Integrated Automation

High availability and safety with TIA

Six production lines at BMW in Munich are automated consistently with TIA. Consistently means, for example, that with Profibus, one field bus is responsible for the standard and safety-oriented communication.

Safety plays a major role in assembly, where people and machines work close together. Assembly workers ride on moving platforms with the automobile bodies. The individual platforms may not be allowed to drift apart for safety reasons. Therefore, it has to be guaranteed that the drives shut down as soon as one of the 146 moving platforms drifts out of the line – long before an assembly worker is in danger. This emergency stop signal is transmitted via the Profibus. Profibus signals – whether standard or safety-oriented signals – can be transmitted easily via power rails thanks to the Power Rail Booster. At BMW, the Power Rail Booster version for electric monorail overhead conveyors is used to control the assembly speed for the whole line. An availability of 99% in the plant is the proof that the speed is consistently kept: an excellent argument in favor of the Power Rail Booster – and for the excellent integration with TIA.

Simatic Power Rail Booster via power rails to Profibus DP



More about the Power Rail Booster:

www.siemens.com/simatic-dp/prb