AS-interface makes truck production go full speed ahead

Project:
Scania - Zwolle / NL
Scania Nederland B.V. in Zwolle / Netherlands is one of the largest truck plants in the world. Since 6 January 2003 more than 95 trucks have been leaving the Scania plant each day - an absolutely top value. The trucks are exclusively produced according to customers’ requests - Scania’s "modular construction system" thus enables the trouble-free production of custom-made trucks.

As regards automation technology, everything from plant design to installation and maintenance was to be as cost-effective as possible. This also meant that extensions of the plant were to be implemented as quickly and easily as possible. In order to meet these requirements a system had to be chosen which considerably reduces wiring and simplifies projection, commissioning and maintenance. Thus only a decentralised automation system could be chosen, which can do without complex conventional parallel wiring. The (fieldbus) system Actuator Sensor Interface (AS-i) was chosen - a system which has been tried and tested in many fields of industrial automation for years.

The whole assembly was made in a so-called Castor-/ Pollux line. In the 14 track supplies with a length of more than 100 m each carriers are present all the time, transporting engines, axles, chassis, bodies etc. and even the finished truck.

This requires a high process availability which is offered by AS-interface in combination with AS-i Safety at Work in a reliable and robust way.
The connection of the inductive and photoelectric sensors is done using robust AS-interface compact modules. The detection of the EMERGENCY STOP signals was implemented by means of the safe intelligent **AS-i Safety at Work** EMERGENCY STOP pushbutton boxes. These EMERGENCY STOP pushbutton boxes are located every 6 metres on both sides of the production lines and have two functions.

**- EMERGENCY STOP**

**- Process stop**

**EMERGENCY STOP** is only used in the case of endangered personal safety or if a risk of damage to the carrier or other units has occurred. In this case the red pushbutton is pressed. When pressing it, a red signal lamp lights in the pushbutton and above the pushbutton box. The voltage supply for the whole production line is switched off.

The **process stop** is used when a process cannot be carried out in the planned time. In this case the black pushbutton of the same EMERGENCY STOP pushbutton box is pressed. Process start or fault acknowledgement are carried out by pressing the green pushbutton.

There is another external output below the EMERGENCY STOP pushbutton box, triggering the red signal lamp.

Safe EMERGENCY STOP signals and standard AS-interface information are transmitted to the AS-interface master via the same two-wire cable.
The brain of safety technology - the AS-interface safety monitor

The AS-interface safety monitor monitors all connected AS-i Safety at Work EMERGENCY STOP pushbutton boxes (safe slaves) per production line and ensures safe switch-off of the production line in the case of malfunctions. The AS-interface safety monitor replaces the safety relay, so far common in systems with parallel wiring.

In this project an AS-interface safety monitor with a redundant output circuit has been used. 10 - 14 AS-i Safety at Work EMERGENCY STOP pushbutton boxes and one AS-i safety monitor are used per production line.

Each production line has an on-site control cabinet. In this control cabinet there is an AS-i safety monitor, an AS-i master, two AS-i power supplies, an AS-i control cabinet module and an AS-i repeater.

AS-interface Safety at Work is based on the standard AS-i protocol. This enables the AS-i system to transmit safety relevant information. It is based on the transmission of dynamic code sequences (8 x 4-bit data sequence), which are stored in each safe AS-i slave. These code sequences have to be learned by the AS-i safety monitor during set-up. During operation the AS-i safety monitor permanently compares the preset and the actual sequences of the safe AS-i slave. If the safe AS-i slave transmits a wrong code sequence (e.g. 4 x 0 bits) the AS-i safety monitor ensures safe switch-off.

Figure 3: on-site control cabinet
Connecting the AS-interface data to Profibus DP

The AS-interface master assumes important functions in every AS-i system. It is responsible for the control and monitoring of the complete communication. The AS-i master controls the cyclical data exchange with the connected AS-i slaves, monitors the replies and makes the data available to the host. The host consists of a controller which processes the AS-i data.

AS-interface gateways make a connection from the AS-interface to a higher-level bus system. Thus the advantages of both systems can be combined. The advantages of AS-interface as the bus system of the first automation level are easy handling, fast data transmission, low costs and quick mounting technology.

In this project an AS-i DP controller with an AS-i master and an integrated Profibus DP interface has been chosen. The AS-i controller is integrated as participant / slave in the Profibus DP network. It is thus the interface to the second automation level. In the gateway mode the signals from the AS-i slave to the central plc are directly made available. All AS-interface data of all production lines are visualised on an operator panel.

The AS-i DP controller is a compact, industrially compatible AS-i master system. An AS-i master is integrated so that max. 124 inputs and 124 outputs (max. 31 AS-i slaves with 4 inputs / 4 outputs each) can be processed.
Detailed on-site diagnosis can be carried out by means of the integrated LED display in connection with the two operating pushbuttons. This display for example indicates faulty AS-i slaves, configuration errors or AS-i voltage faults. Slave lists, addressing and projection functions are available for set-up. During operation the missing Profibus DP communication or faulty / missing AS-i slaves are displayed with their addresses.

The complete plant is represented on an operator panel. The position of the carrier is determined by means of transponder systems. A track is embedded in the floor. There is a data and energy cable each on the right and left side of the track.

Every 1.5 m a transponder determines the position of the vehicle. As the size of the carrier is known the position can be determined exactly up to +/- 2 mm.

The carrier itself consists of two vehicles. In order to be able to transport a completely assembled truck the front vehicle is driven with a 4 kW electric motor.

Figure 5: Overview Castor- / Pollux line
AS-interface and AS-i Safety at Work components used

- AC 1005 AS-i controller, Profibus-DP and RS232 interface with 1 master
- AC 1212 AS-i dual power supply, 2 x 4 A
- AC 1015 AS-i repeater
- AC 001S AS-i safety monitor
- AC 2410 AS-i compact module, 4 inputs
- AC 2251 AS-i control cabinet module, 4 inputs / 4 outputs
- AC 4000 AS-i flat cable, yellow
- ZB 0207 AS-i EMERGENCY STOP pushbutton boxes
- ZB 01XX optical and acoustic signal transmitters
- inductive and photoelectric sensors

Figure 6: Completely assembled truck on a carrier

Due to the use of the AS-interface and AS-i Safety at Work systems in connection with Profibus DP this industrial plant could be installed with a minimum of wiring and commissioned within a very short time. As in many other projects, AS-interface has technically and economically complemented the higher-level fieldbus Profibus DP in this project. On the basis of AS-interface the plant can be extended easily and at low cost at any point without changes having to be made in the control cabinets.

AS-i Safety at Work has been approved up to control category 4 according to EN 954-1 and certified by TÜV Nord. In the future this concept will serve as a model with regard to safety and profitability.
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