→ Over the last five years nearly all the assembly lines in the engine assembly area at the VW factory at Uitenhage in South Africa have been converted on the basis of PC-based control technology from Beckhoff. There are also TwinCAT controlled lines in final assembly and body shop. So far, more than 20 TwinCAT licenses and about 6000 I/O have been installed at Uitenhage. This ensures correct process reliability and data warehousing of all production processe

High end Industrial PCs control the
Volkswagen South Africa assembly lines in South Africa

PC control for Polo engine production

The latest production line to be added to the Volkswagen plant is that of the PQ24 Polo, a light passenger vehicle. At present the Polo is being produced for the South African market and for export to Japan. Beckhoff's partner, Jendamark Automation, was responsible for the automation and process control of this new production line in which the engines, sub-frames, rear-axles and front struts are all assembled. The general aim for the design of the control system was a scalable, reliable system that could link the entire production set-up into a single control network. As a result, a control architecture emerged in which sub-systems operate independently of one another, but are linked together and guarantee precise process execution through their flexibility.

The controller system is optimized for process reliability in production, and for machine control while incorporating data collection and sub-systems tracking.

Seven Beckhoff Industrial PCs series C3330 and C3350 control the production lines via Lightbus and Interbus components. TwinCAT PLC is the controlling software, and has interfaces to Visual Basic via TwinCAT ADS, and using Microsoft SQL Server as database. The TwinCAT programming environment was used to implement software modules that have been specially customized to meet Volkswagen's requirements.

Data transfer via fibre optic
The I/O data required to control the conveying systems, special purpose machinery, bolting and press fit systems is transferred across the entire assembly area reliably and rapidly on the Beckhoff Lightbus. The Lightbus ring passes through a series of Bus Terminal stations with their associated digital, analog and serial I/O terminals. In order to minimise downtime and to assist the traceability of faults, any fault that occurs within the entire fieldbus network is automatically rectified, logged and reported using the special functions that are integrated into the PLC code. Interbus provides the connection to the user interface (HMI) and to the electronic bolting spindles that are used when assembling the components.

The individual assembly stations are situated on a conveyor system that feeds the assembly line with pallets. The pallets transport the parts for assembly, and are fitted with RFID (Radio Frequency Identification Device) transponders that follow the route of each single part down the entire line. All the information relevant
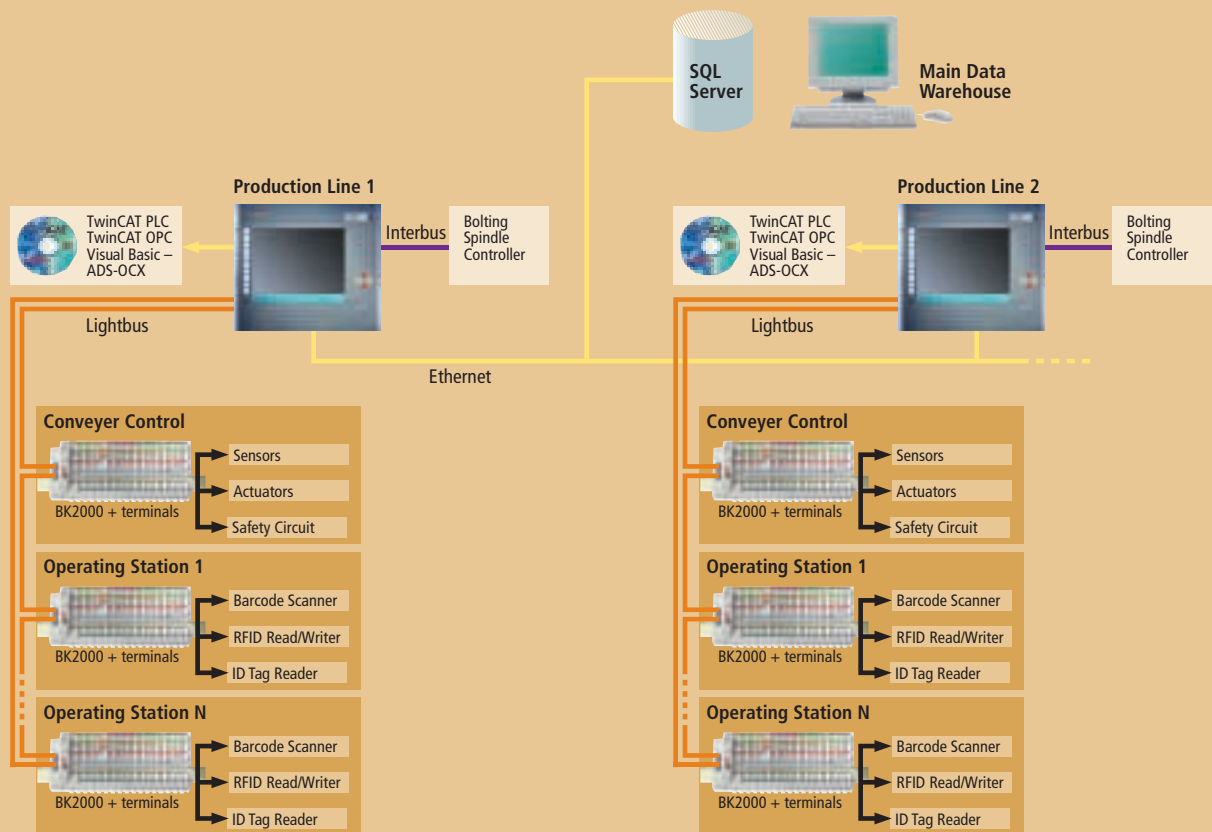
Volkswagen South Africa

Formed in 1946, Volkswagen of South Africa can be found on the outskirts of the industrial town of Uitenhage, 35 kms from the Indian Ocean of Port Elizabeth in the Eastern Cape province. Volkswagen South Africa has come a long way since the first Beetle rolled off the line on August 31, 1951. As one of seven passenger car manufacturers in South Africa, the market share has more than doubled since the mid-80's. As the largest foreign employer in South Africa, Volkswagen employs 5,500 workers and more than 2,500 suppliers, plus a national network of 152 Dealerships.

→ www.vw.co.za

SQL Server

Main Data Warehouse

Production Line 1

TwinCAT PLC
TwinCAT OPC
Visual Basic –
ADS-OCX

Interbus · Bolting Spindle Controller

Lightbus

Ethernet

Conveyer Control

BK2000 + terminals
→ Sensors
→ Actuators
→ Safety Circuit

Operating Station 1

BK2000 + terminals
→ Barcode Scanner
→ RFID Read/Writer
→ ID Tag Reader

Operating Station N

BK2000 + terminals
→ Barcode Scanner
→ RFID Read/Writer
→ ID Tag Reader

Production Line 2

TwinCAT PLC
TwinCAT OPC
Visual Basic –
ADS-OCX

Interbus · Bolting Spindle Controller

Lightbus

Conveyer Control

BK2000 + terminals
→ Sensors
→ Actuators
→ Safety Circuit

Operating Station 1

BK2000 + terminals
→ Barcode Scanner
→ RFID Read/Writer
→ ID Tag Reader

Operating Station N

BK2000 + terminals
→ Barcode Scanner
→ RFID Read/Writer
→ ID Tag Reader

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to a particular part can be obtained through the transponder from the SQL database, so that any necessary assembly information can be read at the pallet. The transponder readers are connected directly to the Bus Terminals, and achieve a very high data transfer rate since the data is transferred over Lightbus. Any station can thus obtain production-specific information such as set points, identification and variant information for the part that is about to be processed. If a new variant or a new specification comes into use for a line, it is not necessary for every station to be supplied with the program changes. In this kind of production field, which is subject to continuous change, scalability is an important factor.

Database-supported part tracing

The work proceeds as follows: The new engine is introduced on a pallet at the start of the assembly line. The serial number is detected using barcode and barcode scanning technology. This number is stored in the database and associated with the transponder number on the pallet. As soon as the pallet arrives at a new assembly station, the transponder is read, and all the necessary information is requested. The ID of the operator is checked against the database for security reasons, and approved for the operation if authorized. The working stage can involve any number of fitting and assembly techniques. The TwinCAT PLC reports all the

resulting data to the SQL Server for permanent storage, and is checked for integrity and validity. Only when the planned stage of manufacture has been completed does the system allow the part to be transported on to the next station. At some stations the pallet is supplied with additional sub-components; barcode-scanning technology is used again here. The serial numbers of these parts are then associated with the engine, which is the master part, and the transponder number. This co-ordinates all the information, and permits traceability of the data from the individual sub components up to the completed assembly.

User interfaces (HMI) are provided at every station in order to assist processing. They provide the user with instructions for each working step, and ensure that the correct procedure is followed for each variant being built. The HMI also displays process results and statistics. If a station detects the ID of a supervisor, the HMI will provide a supervisory interface to the production line, so that, if necessary, the system can be halted, or a parts shortage can be recorded in the database. This may be in order to trigger further action, or may be for report purposes. The data available on the server permits performance assessments in respect of downtimes – including their reasons, and the persons responsible – assembly statistics and complete assembly reports regarding every item built on the line. This data is made available through the powerful TwinCAT PLC Software, and is prepared and displayed for the relevant station by means of Visual Basic applications. These applications have interfaces to the database, and permit authorized staff to manage line operations, performing tasks such as assigning rights to the operating personnel, specifying shift and cycle times, and setting the control parameters for production.

Wonderware Intouch, linked with TwinCAT via the OPC Server, is used as the SCADA System. The SCADA package provides maintenance staff with an overview of the active processes on the production line, and also provides access for the execution of defined maintenance functions to control the line with the aid of the easily operated 19 inch built-in IPCs.

Uniform coding standard

The PLC coding is based on the IEC 61131-3 coding languages, as used throughout the entire Volkswagen concern. Volkswagen's maintenance staff have now received training in the individual programs, so that all the functions relevant for this system are properly understood. By combining the structured coding, careful fieldbus layout, safety mechanisms, data collection and distribution, database connectivity and process reliability in a single system, you start to realize the capabilities that are presented to you by PC control.

The new PQ24 product line represents a leap in technological quality for Volkswagen South Africa, and illustrates the capacity and flexibility of Beckhoff's distributed fieldbus systems and PC controller technology.

Jendamark Automation, South Africa

Based in Port Elizabeth, Jendamark Automation is a leading turnkey solution provider to the Automotive, Tanning, Pharmaceutical, Food and Beverage and Packaging Industries. With thirteen years of Turnkey Projects and Special Purpose Machinery experience, Jendamark is able to provide production lines to export orientated customers. They have become one of the leading suppliers of PC-based automation solutions. Their major automotive customers include Volkswagen, BMW, ZF Lemforder, Daimler Chrysler and Ford, Fresenius Kabi. Lately their involvement has extended into the fast growing and competitive exhaust manufacturing and catalytic converter market.

Jendamark's projecting capability encompasses conceptual and final design, manufacture, assembly, software engineering, commissioning, training and after sales service. As Southern African agents for a number of international companies, Jendamark has a successful component sales and marketing team with representatives countrywide. Their Technical Training facility completes the circle of service provided by Jendamark Automation by providing training courses on all the products that they resell including Beckhoff TwinCAT training.

Jendamark Automation was formed in 1989 by the current managing director, Gary Klare and is co-owned by the operations director, Quinton Uren and the technical director, Duane Orton. Since its inception, Jendamark has grown from 2 people in the beginning days, to over 80 employees today.

→ www.jendamark.co.za