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SIFB set for accessing Beckhoff controllers using ADS protocol

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Introduction

- Introduction
- TwinCAT System
- TwinCAT ADS
- 4DIAC-ADS
- Case Study
- Summary

- ❑ **4DIAC/FORTE** IEC 61499 environment for distributed control systems development
- ❑ **4DIAC need drivers** to access industrial control systems
- ❑ **Beckhoff TwinCAT ADS** (Automation Device Specification) messaging protocol allows a wide and easy IO realtime data access

Introduction

Beckhoff

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The IPC Company



The I/O Company



BECKHOFF

Beckhoff implements open automation systems based on PC Control technology

The Motion Company



The Automation Company



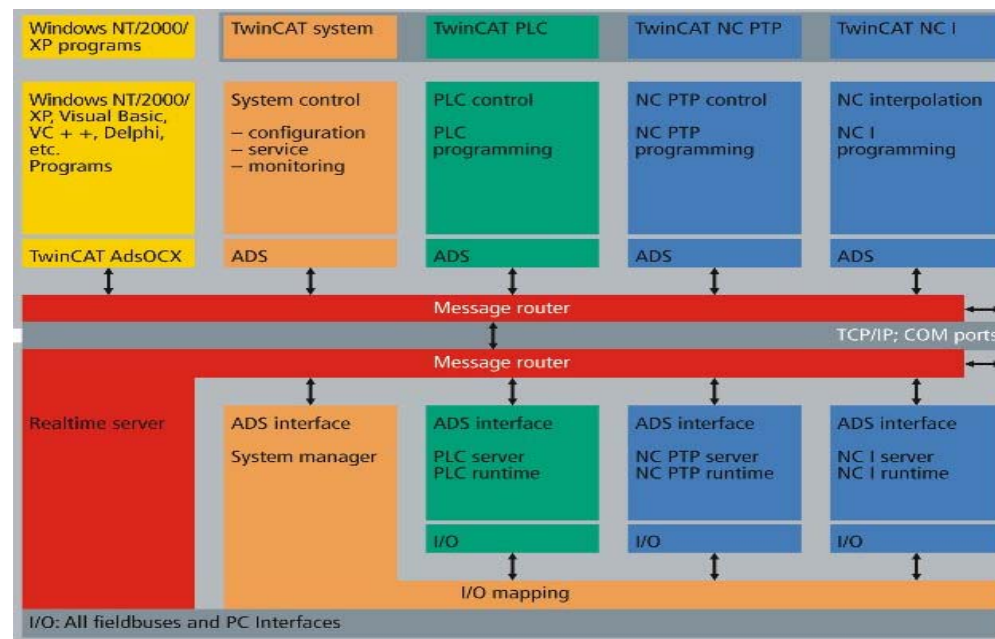
TwinCAT System

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TwinCAT is an automation package comprising engineering and runtime software for:

- motion (Software Motion Control)
- technological function (controllers, communication, OS functions, etc...)

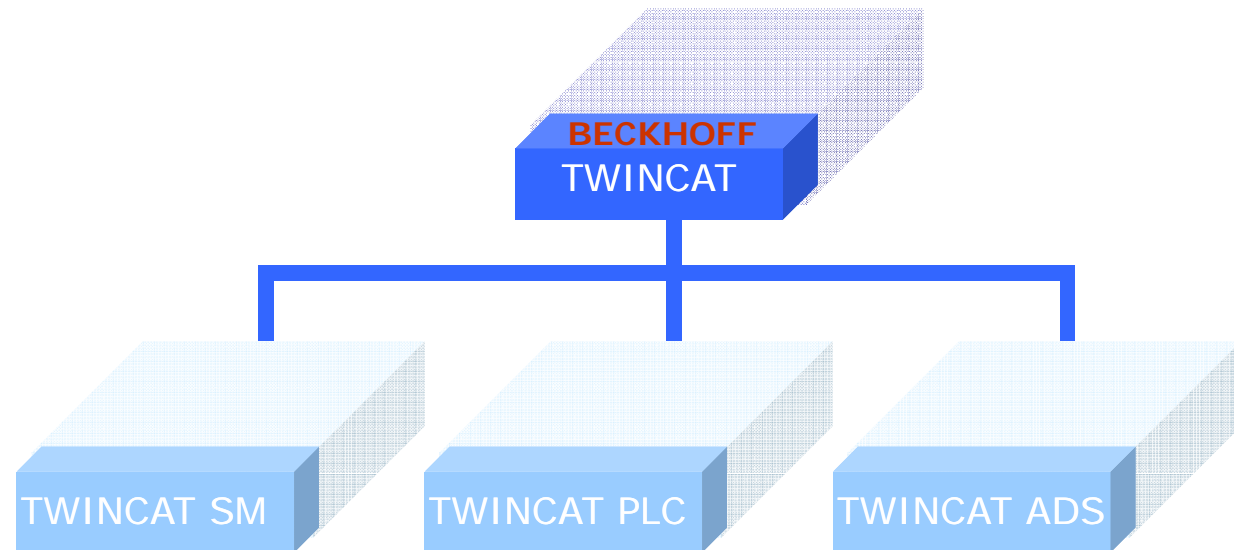
and all this in HARD REALTIME on Windows NT/2000/XP as well as on Windows NT/XP Embedded and CE.NET



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- Sequence control (Software PLC)
- **communication over all components (ADS)**



- Is the configuration center for the system:
- **The TwinCAT ADS Communication Library** organizes data independently of the manufacturer
 - **Configuration of I/O channels** and Windows programs and includes
 - **Connects I/O devices to tasks** in a variable-oriented manner
 - Use to all defined programming languages; IL, FBD, LD, SFC, ST
 - Connects tasks to tasks in a variable-oriented manner
 - Has a powerful development environment for programs
 - Supports units at the bit level
 - **Supports synchronous** or asynchronous relationships
 - Exchange of consistent data areas and process images

TwinCAT ADS Protocol

Introduction

TwinCAT System

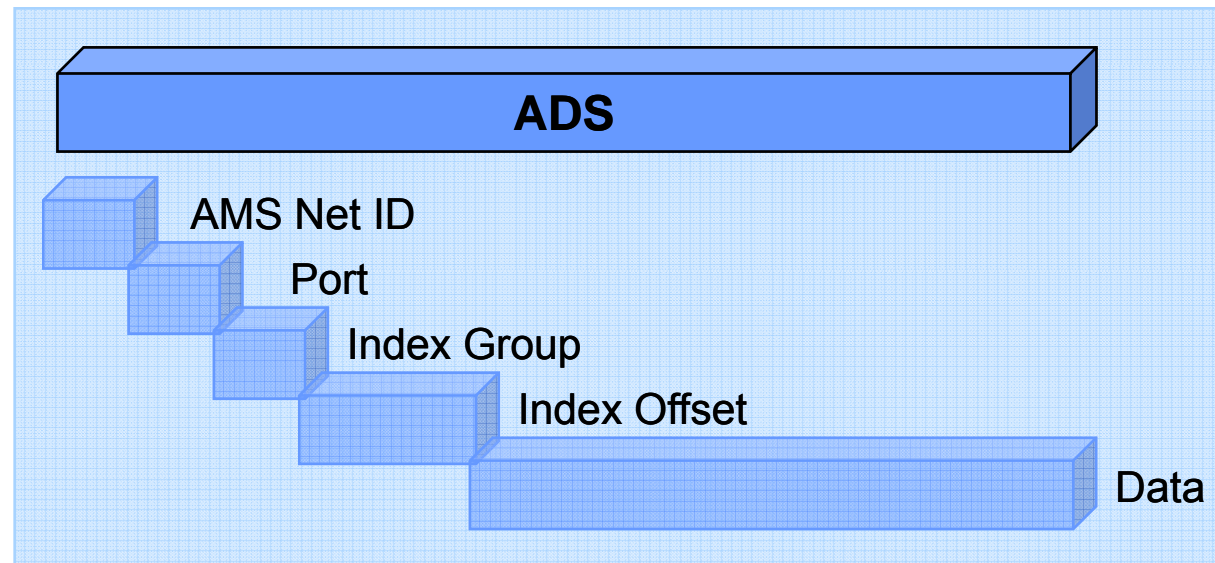
● TwinCAT ADS

4DIAC-ADS

Case Study

Summary

- ❑ ADS protocol, is a transport protocol within the Beckhoff TwinCAT system
- ❑ Developed for data exchange between the different software modules
- ❑ Offers the freedom of using other tools to communicate
- ❑ Is used on top of TCP/IP
- ❑ All the data is accessible from any desired point



TwinCAT ADS Properties

Introduction

TwinCAT System

● TwinCAT ADS

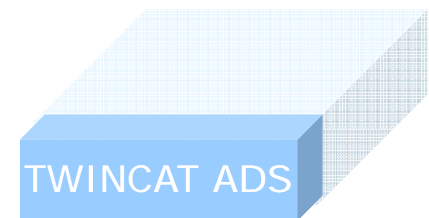
4DIAC-ADS

Case Study

Summary

ADS Properties

- **ADS describes a device independent** and fieldbus independent interface **governing the type of access** to ADS devices
- **ADS enabled devices** - PC running TwinCAT, Beckhoff BC Bus Controllers
- **I/O data** are imported via ADS and are **mapped to the device**
- This greatly **reduces programming time**



TwinCAT ADS Properties

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● TwinCAT ADS

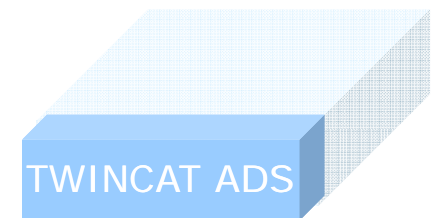
4DIAC-ADS

Case Study

Summary

ADS properties

- ADS enables applications **to communicate** to fieldbus devices in **cyclic and acyclic way**
- This protocol enables a wide range of communication and **enables local and remote access**
- **An ADS address** (AMS Net ID) is **configured** to devices using **acyclic communication**
- ADS allows **horizontal and vertical** application-to-application **communication** throughout several platforms (Windows NT/CE, TCP/IP, fieldbuses)



TwinCAT ADS Device

Introduction

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● TwinCAT ADS

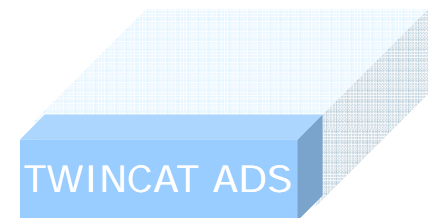
4DIAC-ADS

Case Study

Summary

ADS Device is an object that implements the ADS interface and offers “ADS server services”

- **Real-time communication** to Input/Output devices
- ADS handles streamed **data** through **synchronous and asynchronous** communication support
- ADS **access all devices** through **IP** type addresses
- The TwinCAT message router **distributes messages** based on **TCP/IP** over wide system



TwinCAT ADS Architecture

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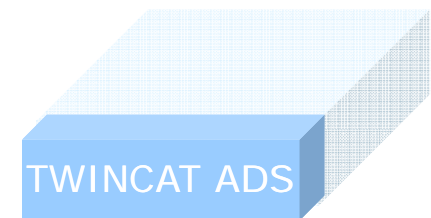
4DIAC-ADS

Case Study

Summary

ADS *Client/Server* Architecture

- Beckhoff system allows individual software modules as **independent devices**
- Any task can perform a software module (Server or Client)
- Servers are implemented like software devices which operate like traditional hardware devices
 - **Server works** like "virtual devices" implemented by software
- Clients are programs which request services from servers



TwinCAT ADS Access

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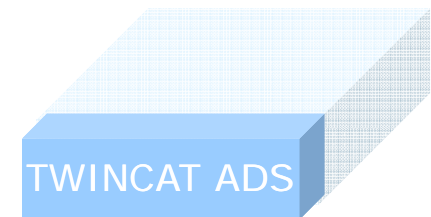
Summary

TwinCAT ADS organizes the exchange of data between TwinCAT and Windows programs and includes:

- Searching for variables
- Access by variable name
- Synchronization of timing with the operating system
- Adaptation of the differing data types
- Creation of data blocks and list generation to improve System effectiveness
- Ensuring that accessed data are consistent

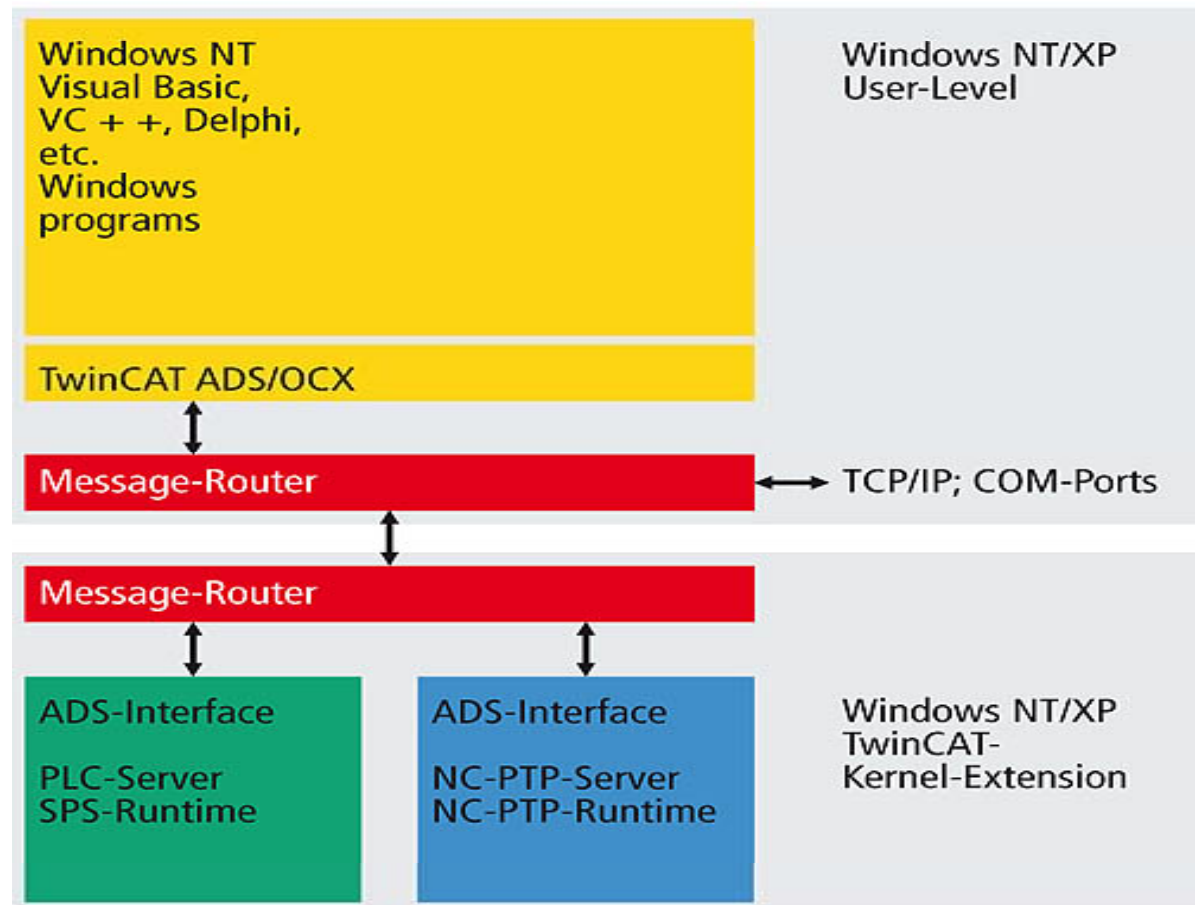
Access methods

- Synchronous: cyclic
- Asynchronous: notify on change



TwinCAT ADS

The data link to TwinCAT servers is performed via the message system



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TwinCAT ADS Communication Library

Introduction

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- ❑ **TwinCAT Communication Library is a collection of ADS components**
 - ❑ The **ADS library is included** in the full TwinCAT software, but it is also available as a free, **separate package from Beckhoff**
 - ❑ Organizes data exchange between TwinCAT and Windows programs and includes the search for variables
 - ❑ The TwinCAT interface for **programming languages** (Visual Basic, Visual **C/C++**, Delphi, Java, ...)
 - ❑ **ADS data exchange** can be managed transparently via different **physical transport** routes: TCP, UDP, **fieldbus**, EtherCAT, serial, SOAP
 - ❑ **ADS components are available** for the following areas of implementation: **DLL**, OCX, VB Script, J Script, .NET assembly, Java, web service
 - ❑ **ADS DLL: It's possible to link the ADS DLL (Dynamic Link Library) into one C/C++ program**

4DIAC-ADS Functional System

Introduction

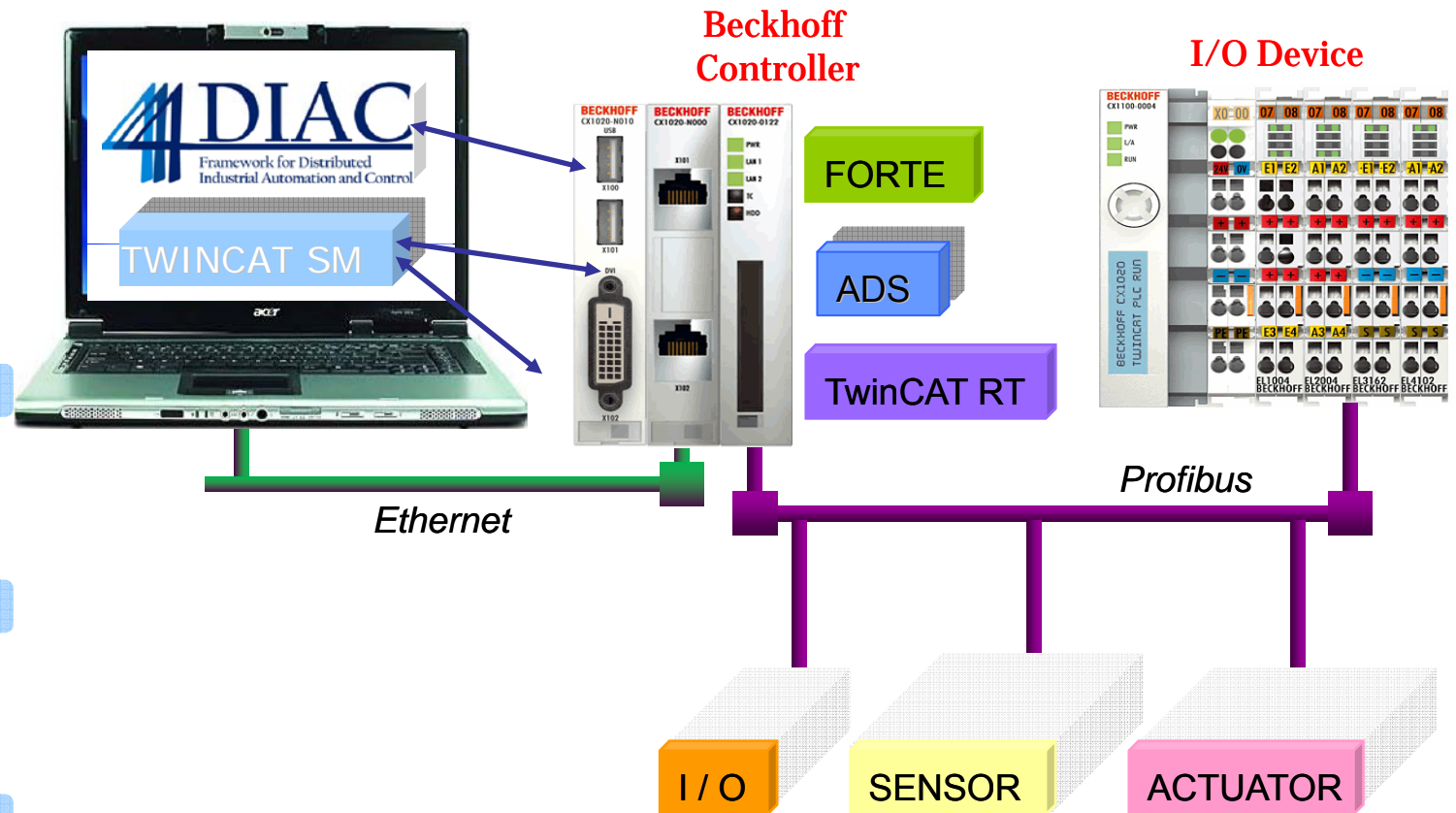
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TwinCAT ADS

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4DIAC SIFBs set for ADS

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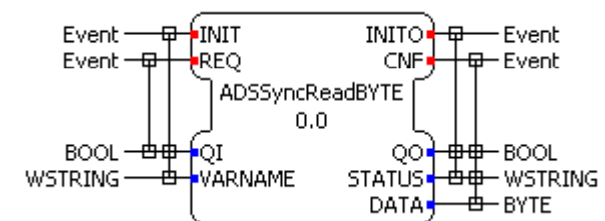
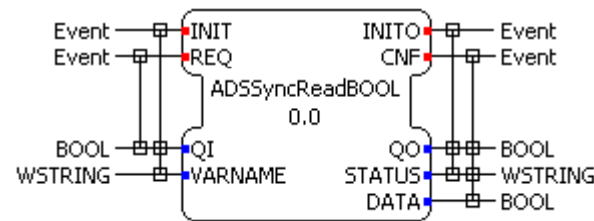
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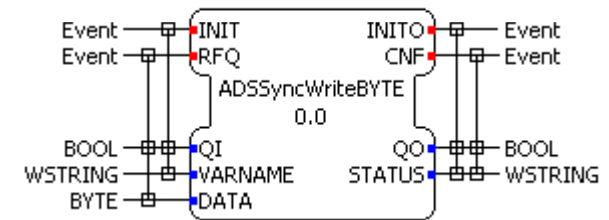
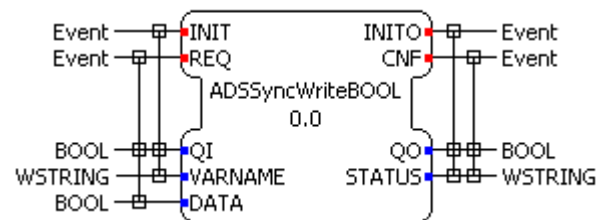
SIFBs set elements

- Synchronous Read/Write for real time control data

✓ SIFBs ADSSyncReadBOOL and ADSSyncReadByte



✓ SIFBs ADSSyncWriteBOOL and ADSSyncWriteByte



4DIAC SIFBs set for ADS

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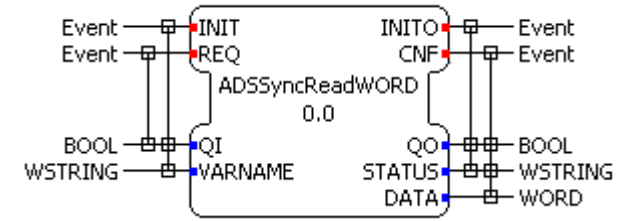
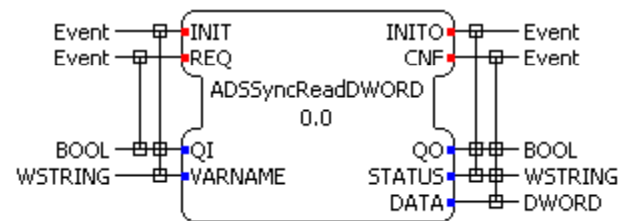
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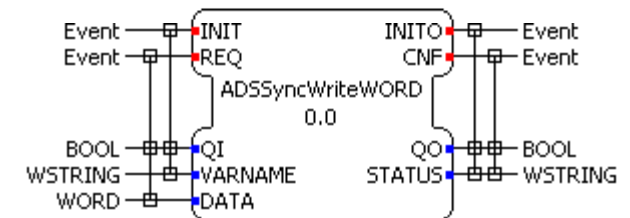
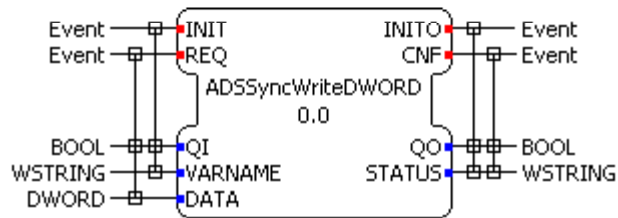
SIFBs set elements

- Synchronous Read/Write for real time control data

✓ SIFBs ADSSyncReadDWORD and ADSSyncReadWORD



✓ SIFBs ADSSyncWriteBOOL and ADSSyncWriteByte



ADS Application

An Easy Application

Introduction

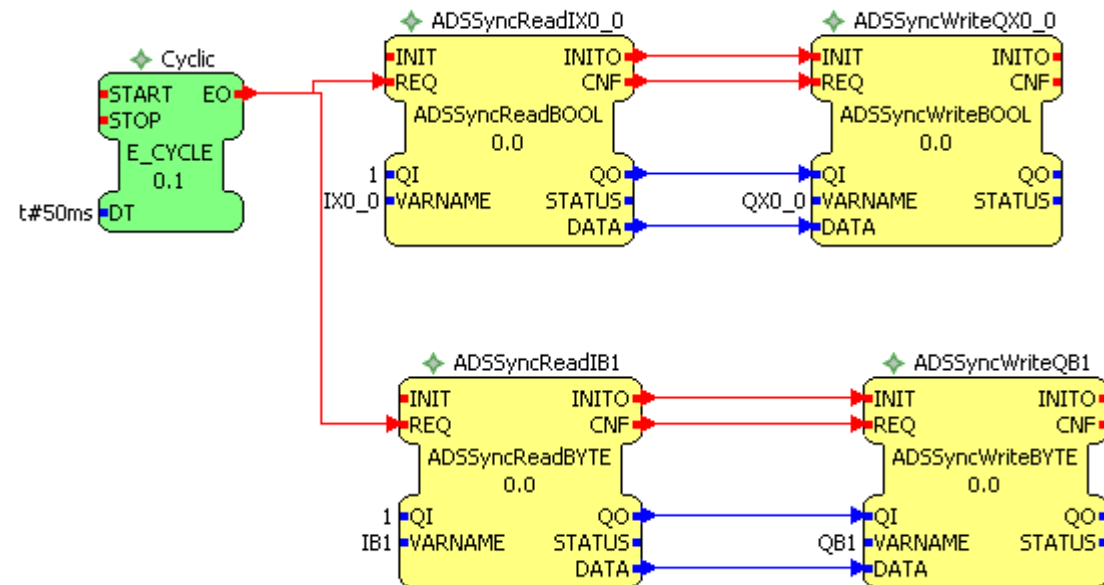
TwinCAT System

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● 4DIAC-ADS

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TwinCAT SM Configuration

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Activate Configuration

The screenshot displays the TwinCAT System Manager interface for 'ADSTestTask.tsm'. The left sidebar shows a tree view of the system configuration, with 'Task1' and 'I/O - Configuration' highlighted. The main window shows the 'Task' configuration for 'Task1', including settings for 'Auto start', 'Priority', 'Cycle ticks', and 'Options'. A status bar at the bottom shows the connection status for 'TCIO (300)' and 'BK6915 (192.168.0.160, 1, 1)' with 'RTime 1%'.

Server (Port)	Timestamp	Message
TCIO (300)	29/08/2011 13:18:38 82 ms	Device 1 (FC31xx): Slave 13 is in data exchange mode

Ready

BK6915 (192.168.0.160, 1, 1) RTime 1%

Case Study

Test platform

Introduction

TwinCAT System

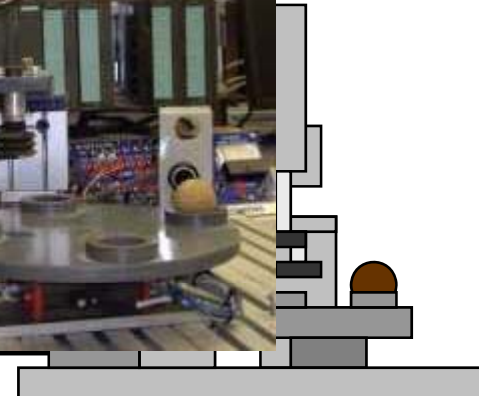
TwinCAT ADS

4DIAC-ADS

● Case Study

Summary

Programming,
Configuration
and Commis



Summary

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Case Study

● Summary

- ❑ **ADS** enables a common protocol for **accessing IO data** in Beckhoff controllers
 - Direct IO interfaces: K-bus, E-bus
 - Fieldbus interfaces: **Profibus**, Interbus, CANopen, DeviceNet, Ethernet, EtherCAT, Sercos, ...
- ❑ Beckhoff TwinCAT SM **enables hardware/IO data configuration**
- ❑ 4DIAC SIFBs set for **local variables access** using ADS
- ❑ **IEC 61499 4DIAC applications close to Industrial Control**

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**Thank you for your
attention!**