

KAS IDE

Getting Started



Valid for Software Revision 2.5

Keep all manuals as a product component during the life span of the product.
Pass all manuals to future users / owners of the product.

Trademarks and Copyrights

Copyrights

Copyright © 2009-12 Kollmorgen™

Information in this document is subject to change without notice. The software package described in this document is furnished under a license agreement or non-disclosure agreement. The software may be used or copied only in accordance with the terms of those agreements.

This document is the intellectual property of Kollmorgen™ and contains proprietary and confidential information. The reproduction, modification, translation or disclosure to third parties of this document (in whole or in part) is strictly prohibited without the prior written permission of Kollmorgen™.

Trademarks

KAS and AKD are registered trademarks of Kollmorgen™.

SERVOSTAR is a registered trademark of Kollmorgen™.

Kollmorgen™ is part of the Danaher Motion company.

Windows® is a registered trademark of Microsoft Corporation

EnDat is a registered trademark of Dr. Johannes Heidenhain GmbH.

EtherCAT® is registered trademark of Ethercat Technology Group.

PLCopen is an independent association providing efficiency in industrial automation.

INtime® is a registered trademark of TenAsys® Corporation.

Codemeter is a registered trademark of WIBU-Systems AG.

SyCon® is a registered trademark of Hilscher GmbH.

Kollmorgen Automation Suite is based on the work of:

- Qwt project (distributed under the terms of the GNU Lesser General Public License - see also GPL terms)
- Zlib software library
- Curl software library
- Mongoose software (distributed under the MIT License - see terms)
- JsonCpp software (distributed under the MIT License – see terms)
- U-Boot, a universal boot loader is used by the AKD-PDMM (distributed under the terms of the GNU General Public License). The U-Boot source files, copyright notice, and readme are available on the distribution disk that is included with the AKD-PDMM.

All other product and brand names listed in this document may be trademarks or registered trademarks of their respective owners.

Disclaimer

The information in this document (Version 2.5 published on 5/7/2012) is believed to be accurate and reliable at the time of its release. Notwithstanding the foregoing, Kollmorgen assumes no responsibility for any damage or loss resulting from the use of this help, and expressly disclaims any liability or damages for loss of data, loss of use, and property damage of any kind, direct, incidental or consequential, in regard to or arising out of the performance or form of the materials presented herein or in any software programs that accompany this document.

All timing diagrams, whether produced by Kollmorgen or included by courtesy of the PLCopen organization, are provided with accuracy on a best-effort basis with no warranty, explicit or implied, by Kollmorgen. The user releases Kollmorgen from any liability arising out of the use of these timing diagrams.

Table of Contents

Trademarks and Copyrights	2
Copyrights.....	2
Trademarks.....	2
Disclaimer.....	2
Table of Contents	3
1 Introduction	5
1.1 Related Documents.....	5
1.2 Alerts and Warnings.....	5
2 System Overview	7
2.1 Software Packages.....	7
2.2 Hardware Components.....	8
3 Installing KAS IDE	9
3.1 System Requirements.....	9
3.2 Download.....	9
3.3 Installation Procedure.....	9
4 Installing KAS Run Time	15
4.1 System Requirements.....	15
4.2 Installation Procedure.....	15
5 Installing Hardware	19
5.1 HMI Part numbers.....	21
5.2 IPC.....	21
5.3 AKT.....	22
5.4 Installing EtherCAT Motion Bus.....	23
5.5 Installing AKD Drive.....	23
5.6 Installing AKM Motor.....	23
5.7 HMI - Graphic Operator Interface.....	23
5.8 Controller - Industrial PC (IPC).....	23
5.8.1 Deploying IPC standard image.....	25
5.8.2 Configuring INtime.....	25
5.9 EtherCAT Motion Bus.....	27
5.10 Remote Input/Output - I/O Terminal.....	28
5.10.1 Installing Bus Terminals on mounting rails.....	29
5.10.2 Connection Details.....	30
5.11 Installing AKD Drive.....	31

5.12	Installing AKM Motor.....	31
6	Updating Firmware.....	33
6.1	Check AKD PDMM Drive Firmware.....	33
6.2	Download AKD PDMM Drive Firmware.....	33
6.3	AKD PDMM Firmware Update.....	33
7	Installing Kollmorgen Visualization Builder.....	35
7.1	Installation.....	35
7.2	Download.....	35
7.3	Installation Procedure.....	35
8	Finalizing Installation.....	41
8.1	Testing Installation.....	41
8.2	Saving Installation.....	41
8.2.1	Backup IPC Image.....	41
8.2.2	Enhanced Write Filter.....	46
8.2.3	Restore IPC backup Image.....	48
9	Troubleshooting KAS.....	49
	Global Support Contacts.....	51
	Danaher Motion Assistance Center.....	51
	Europe Product Support.....	51

1 Introduction

This guide covers the main following procedures to have your KAS system up and running:

- **Hardware Installation** (Connection and Wiring)
Hardware details, connectors, system diagrams
- **Hardware Configuration**
Basic configuration and settings needed to start the HW components
(HMI + Industrial PC + Fieldbus + I/O)
- **KAS IDE Installation**
KAS software setup

1.1 Related Documents

In addition to this Guide, you need the following manuals to install KAS

Title	Description
KAS Release Notes	Contains recommendations, known limitations and workarounds
AKD Quick Start	Contains all information needed to safely install and setup an AKD drive
AKD Installation Manual	Covers the most important points to install the drive hardware and software Provides instructions for basic drive setup and connection to a network
AKD EtherCAT Communication	Describes the installation, setup, and software protocol for the EtherCAT AKD product series

When alert symbols are seen in a manual, be alert to the potential for personal injury. Follow the recommended precautions and safe operating practices included with the alert symbols. Safety notices in the manuals provide important information. Read and be familiar with these instructions before attempting to install, operate, or perform maintenance. The purpose of this section is to alert users to possible safety hazards associated with equipments and the precautions that need to be taken to reduce the risk of personal injury and damage to the equipment. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, or operational difficulty.

1.2 Alerts and Warnings



CAUTION

Directs attention to general precautions, which if not followed, could result in personal injury and/or equipment damage



WARNING

Alerts you to potential physical danger or harm. Not following warning notices could result in personal injury



NOTE

Provides important information to ensure a thorough understanding of product use.

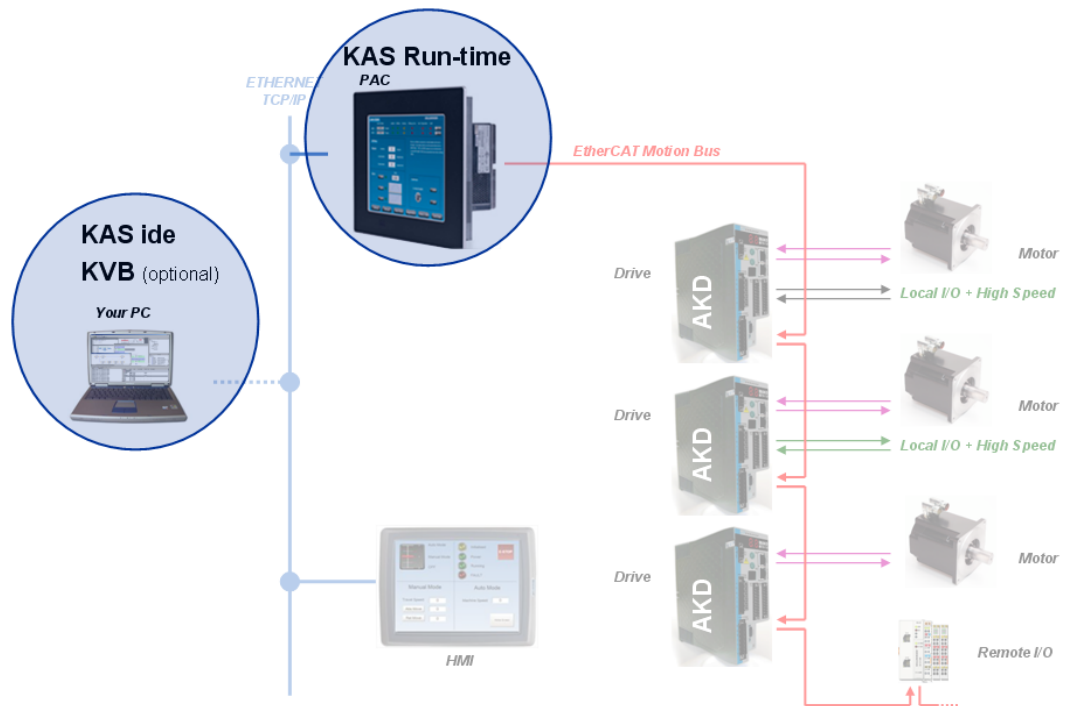
This page intentionally left blank.

2 System Overview

Kollmorgen Automation Suite is a complete system solution. This includes a variety of powerful software packages designed to give you complete control over your hardware.

2.1 Software Packages

Software	Description
KAS IDE	Provides you with all the necessary tools for designing, programming, configuring, debugging and maintaining machine applications
KAS Run Time	The KAS Run Time engine includes a soft PLC and a motion controller
KVB (optional)	This application is optional and assists in designing an HMI panel



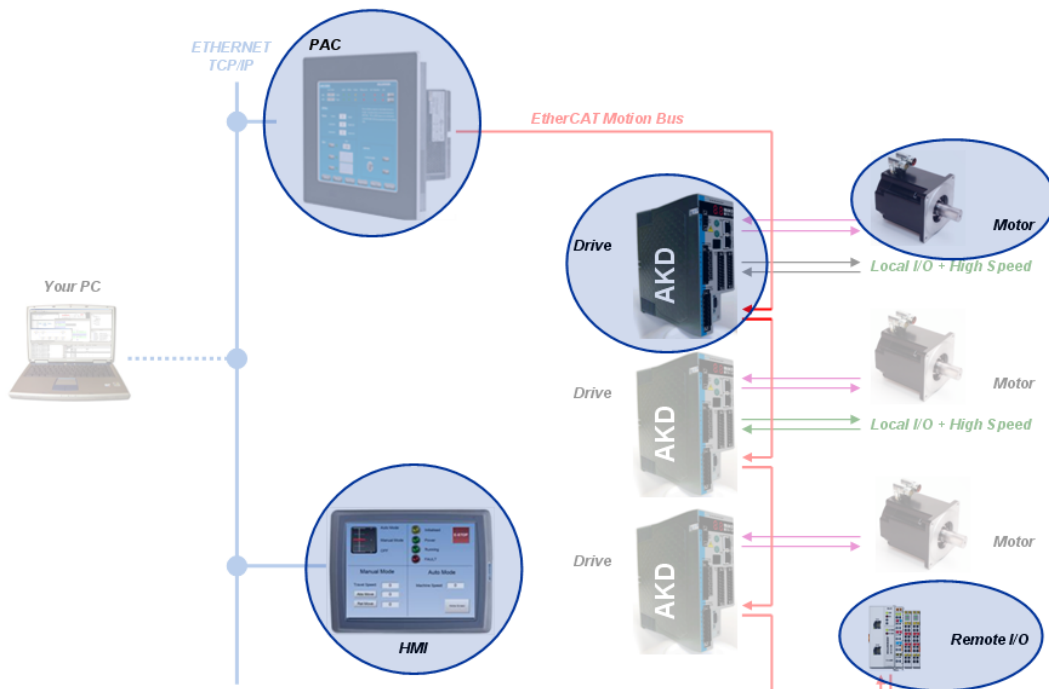
Warning

Do not install KAS IDE on the Kollmorgen PAC controllers. The two are **not** compatible.

2.2 Hardware Components

The KAS system is build using the following hardware components.

Component	Name	Description
Industrial PC	AKC	Controls all the network devices (remote I/O, drives...) by managing the PLC and motion engines
Remote I/O	AKT	Refers to the communication and acquisition of data between your automation system and the outside world
HMI	AKI	This component provides an interface for controlling the KAS Run Time
Drive	AKD	Servo drives specifically designed with versatility, communications, and the power to expand machine performance and increase integration speeds
Motor	AKM	The servo motor is an engine that can drive to different setpoint positions and then maintains these in the sense of a control drive



3 Installing KAS IDE

3.1 System Requirements

KAS IDE minimum system requirements:

Requirement	Description
Operating System	Microsoft Windows XP (32-bit XP pro SP3 or above), Windows 7 (32 and 64-bit)
Processor type	Intel® Pentium® M or equivalent processor 1.5 GHz
Memory	512 MB RAM
Storage	1 GB hard drive or compact flash space
Display	WXGA+ (1440 x 900) or higher-resolution monitor with 24-bit color
Connectivity	1 Ethernet port 100Mbps/s or 1Gbits/s 1 RS-232 serial port is needed for some target devices

Warning

KAS IDE and KAS Simulator should not be installed on a Kollmorgen PAC. The IDE and Simulator are for use on PCs only.

3.2 Download

The latest version of the Kollmorgen Automation Suite is available at www.kollmorgen.com.

3.3 Installation Procedure

How to proceed if you have a CD?

After inserting the installation CD, a web browser automatically displays the installation start page.

Note

If the installation start page does not automatically display, double-click on the file **Index.html** file.

To start the installation of Kollmorgen Automation Suite, click the corresponding link and confirm that you want to execute **KAS-Setup.exe**.

Follow the procedure below to proceed with the KAS IDE software installation.

Note

Installation of the KAS IDE can require you to change your firewall setting. If you do not have sufficient privileges to configure your firewall, you must stop the relevant Windows Service.

Once KAS has finished downloading, complete the following installation steps:

1. Double-click the **KAS-Setup.exe** file to run the installation Wizard

Note

A Security Warning dialog displays as a result of security certification. Do not be alarmed.

2. Click **Run** to start the installation Wizard



Figure 3-1: Launch Setup File

3. While the setup is loading, wait for the setup splash screen to vanish after being displayed

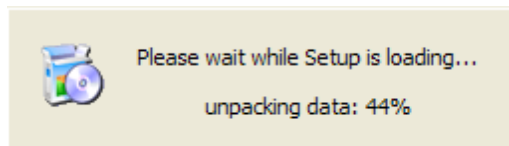


Figure 3-2: Loading Setup Wizard



Figure 3-3: Setup Splash Screen

4. Uninstall the previous version of the KAS IDE

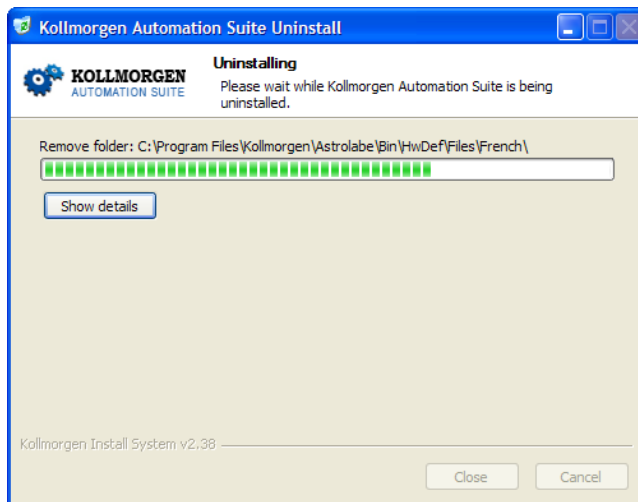


Figure 3-4: Uninstall Old Version

5. If a previous version of the KAS IDE is installed then an uninstall notice is displayed. The previous version must be uninstalled before the installation can continue. All content of the previous repository is deleted during the uninstall
6. The following Welcome Wizard displays with the version and build number of the KAS IDE. Click **Next** to continue

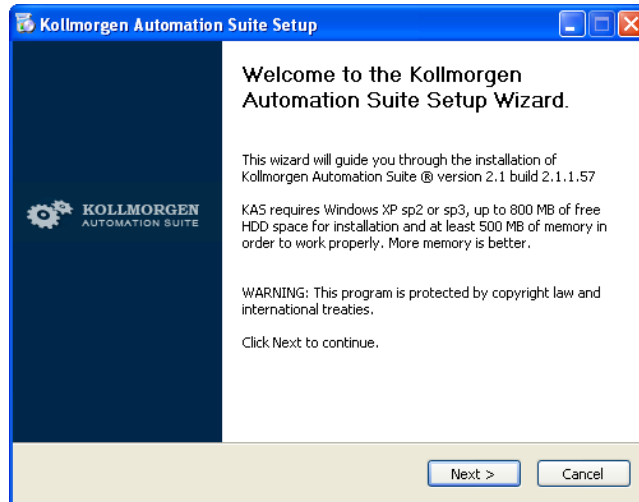


Figure 3-5: Welcome Setup Wizard

7. Select the **Development Environment** installation type from the drop-down menu.

Installation type	Description
Development Environment	This kind of installation is typically used for creating and developing a new application. When you need to install the KAS IDE and the KAS Run Time Simulator, you can select Development Environment as the type of installation.
Run-time Industrial PC	This installation is typically used when you have an industrial PC (IPC). You are able to view and run your application. You need to install Kollmorgen Visualization Builder and the KAS Run Time. Kollmorgen Visualization Builder is specially designed to view and control your application. The KAS Run Time only executes the application.
Custom	You can manually select the specific KAS components to install.

8. Click **Next** to access the destination folder
9. Click **Browse** to specify a custom install directory or accept the recommended default location. When finished, click **Install** to continue

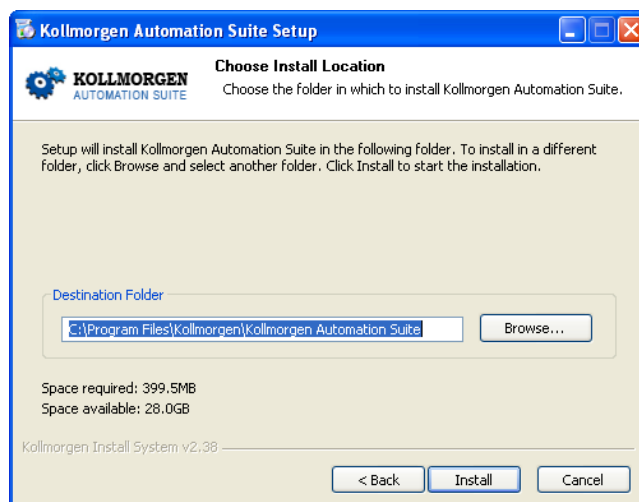


Figure 3-6: Destination Folder

Note

Kollmorgen strongly recommends accepting the default destination folder under C:\Program Files\Kollmorgen\Kollmorgen Automation Suite\Kollmorgen Automation Suite.

- The software installation begins. Wait until the installation process is complete

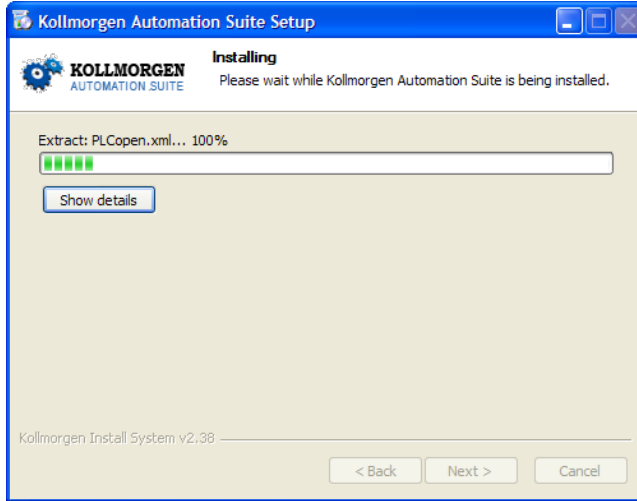


Figure 3-7: Installation in Progress

- Install the Microsoft Visual C++ 2005 Redistributable package if you are prompted to

Note

The Kollmorgen Automation Suite requires the Microsoft Visual C++ 2005 Redistribute package for proper operation

- Wait until the installation is complete

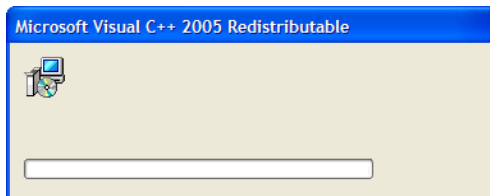


Figure 3-8: Microsoft Visual C++ Redistributable Package Installation

- Select the **Reboot** option and click **Finish**

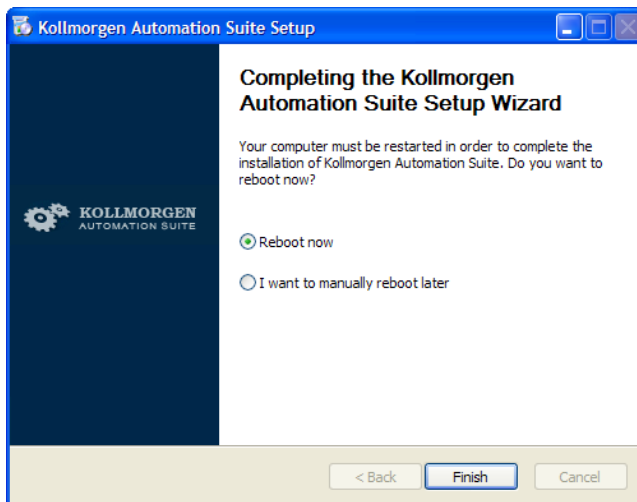


Figure 3-9: Completing Installation

Tip

Adding the **KAS IDE** application as an exception in your firewall settings is recommended to avoid security issues

This page intentionally left blank.

4 Installing KAS Run Time

The PAC controller comes with all the necessary software already installed (including KAS Run Time). The image version is displayed on the background image of the desktop.

Note

KAS Run Time is only supported with Kollmorgen controllers.

4.1 System Requirements

Operating System

The KAS Run Time is supported under XP embedded (XPe) for the industrial PC.

Recommended network Environment

Only a **Local Network** connection can ensure the communicate between the KAS IDE and the KAS Run Time.

Warning

The KAS IDE is not able to communicate to the KAS Run Time through NAT connection.

Supported Kollmorgen Industrial PC

KAS Run Time is compatible with AKC hardware models:

4.2 Installation Procedure

Install the KAS Run Time software.

1. Double-click the **KAS-Setup.exe** file to run the installation Wizard
2. Click **Run** to launch the setup wizard



Figure 4-1: Launch setup file

It is normal to get this window since our application is not yet certified.

3. Wait for the setup splash screen to vanish after being displayed



Figure 4-2: Setup splash screen

4. The welcome wizard appears and show you the version and build number, click **Next** to continue the wizard

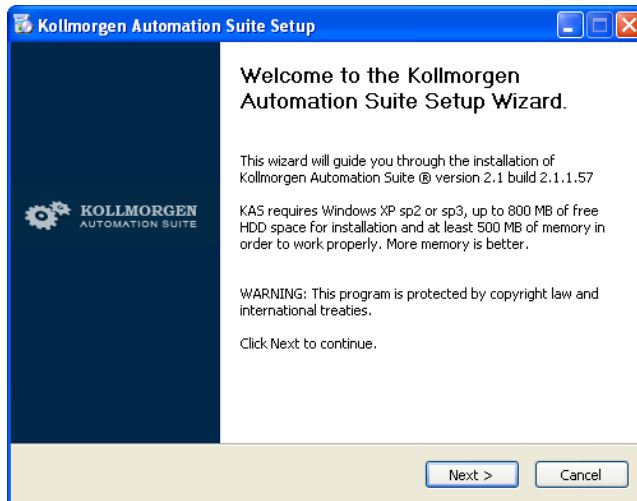


Figure 4-3: Welcome Setup wizard

5. In the drop-down menu, choose the type of installation to deploy: **Run-time Industrial PC**

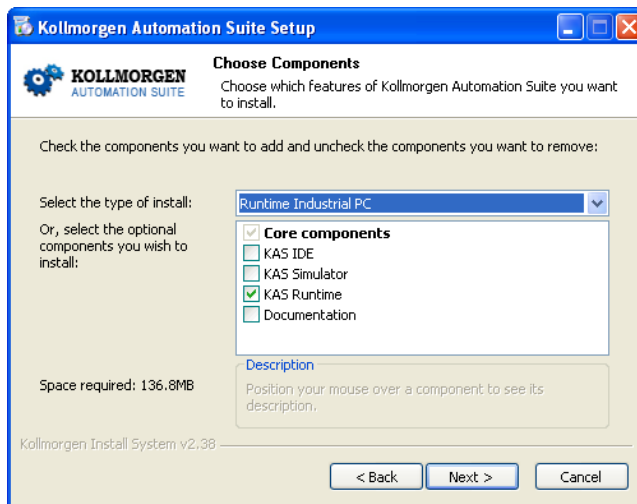


Figure 4-4: Install Run-time for Industrial PC

(See the different Types of Deployment in paragraph "Installing KAS IDE" on page 9)

6. Click **Next** to access the destination folder
7. Select where you want to install KAS

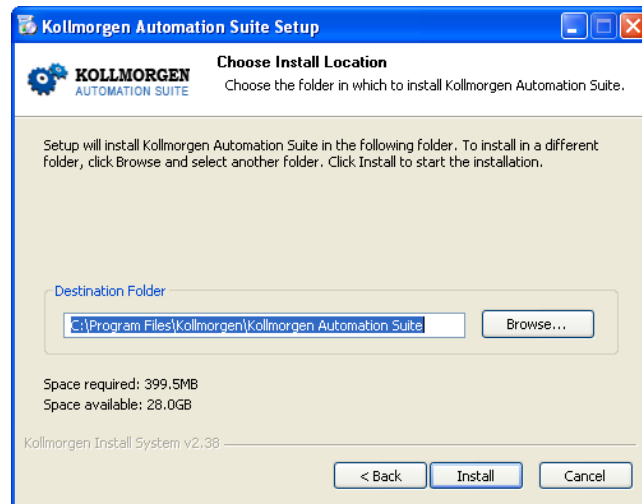


Figure 4-5: Destination Folder

Kollmorgen strongly recommends accepting the default destination folder under C:\Program Files\Kollmorgen\Kollmorgen Automation Suite

8. Keep the name proposed for the Start Menu Folder and click the **Install** button to install KAS

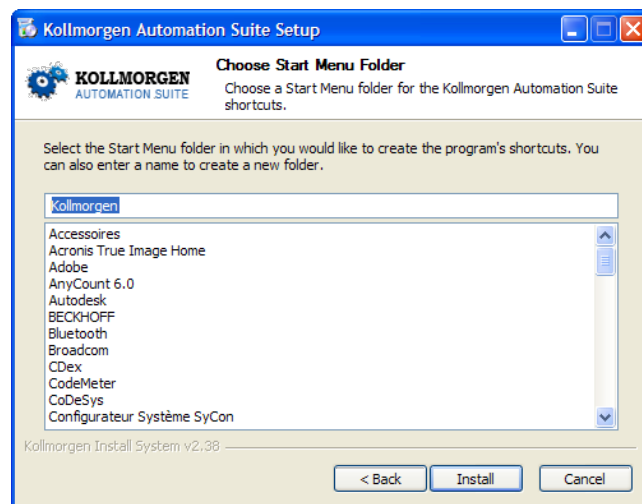


Figure 4-6: Start Menu Folder

9. You have to wait until the end of the process

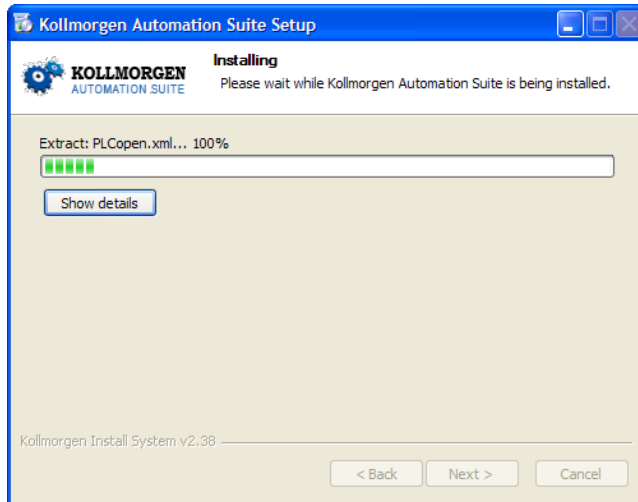


Figure 4-7: Installation in progress

10. Wait until the installation is complete

Note

If your Wibu-Key driver is not already installed, a reminder is displayed saying that the WKRuntime.exe needs to be installed. If so, click **OK**.

11. Click **Finish**

You can now activate your license application (refer to § "Activating License").

Note

The EWF filter must be activated on the IPC when everything is ready and must not change anymore. If a significant change happens (like a new KAS version or downloading a new application), the recommendation is to turn off the EWF filter, make the change, and then reactivate it. For more details about this procedure, see page 46

Note

After the KAS Run Time installation, you have to restart the IPC.

5 Installing Hardware

Connecting, Wiring and Configuring HW Components

Prior to have your motion application up and running, you first need to connect, wire and configure all your hardware components.

For installing each component, refer to the following sections:

- Installing HMI
- Installing Industrial PC
- Installing I/O Terminals
- Installing EtherCAT Motion Bus
- Installing AKD Drive
- Installing AKM Motor

Also

The **Getting Started** guide contains procedures for installing and configuring hardware components (HMI, PAC controllers, I/O Terminals, EtherCAT Motion Bus, AKD Drive, and AKM Motor).

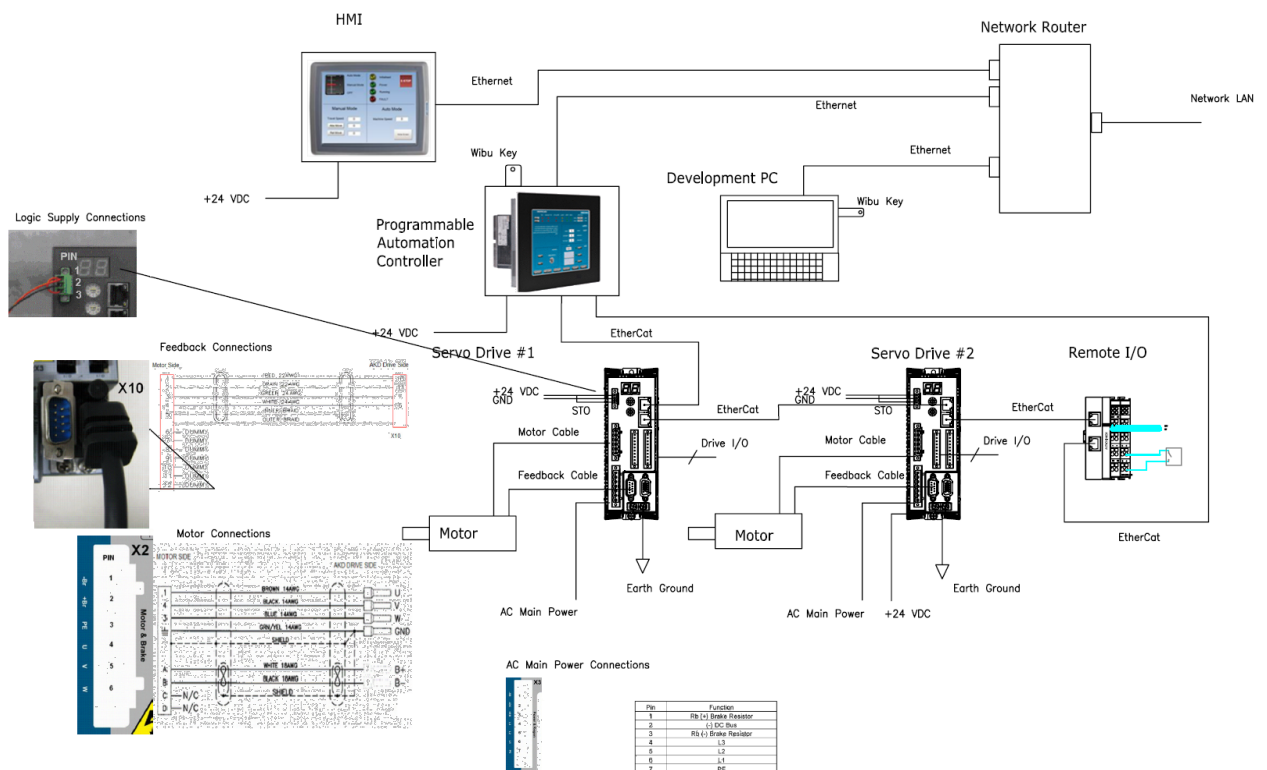


Figure 5-1: Connecting all the Hardware components

Note

For extensive information about installing the different hardware components, see the relevant documentation available on:





- KollmorgenWeb site
- KAS IDE online help (after it has been installed)

Links to installation instructions for hardware components can be found in the following table.

Component		Installation
HMI (Human-Machine Interface)		Install the graphic operator interface Install HMI
Controller		Install the Panel or Box Programmable Automation Control (PAC) Install Industrial PC
EtherCAT Motion Bus		Set up EtherCAT Motion Bus Communication See AKD™ EtherCAT Communication
I/O Terminal		Install the remote Input/Output Terminal Install I/O Terminals
AKD Drive		Install the AKD Drive See AKD Installation Manual (and also AKD Quick Start)
AKM Motor		Install the AKM Motor Mechanical and Electrical installation Available in http://www.kollmorgen.com/website/com/eng/download/document/akm_deis.pdf (pp 31-52)















Table 5-1: Kollmorgen Automation Suite Installation and Configuration










5.1 HMI Part numbers



HMI part number	Description	Tech. Manual
AKI-CDT-MOD-04T-000	Graphical Display 3.5" TFT, LCD, 64k Colors, Touch	
AKI-CDT-MOD-06T-000	Graphical Display 5.7" TFT, LCD, 64k Colors, Touch	
AKI-CDT-MOD-10T-000	Graphical Display 10.4" TFT, LCD, 64k Colors, Touch	
AKI-CDT-MOD-15T-000	Graphical Display 15.1" TFT, LCD, 64k Colors, Touch	

5.2 IPC

Master image version is: **2010-11-22**

PAC part number	Description	Specs.	Tech. Manual
AKC-PLC-C1-224-00N-00-000	Box Controller, Celeron 1.2GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		
AKC-PLC-D2-224-00N-00-000	Box Controller, Dual Core 2.26GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		
AKC-PNC-C1-224-10N-00-000	10" Panel Controller, Celeron 1.2GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		
AKC-PNC-C1-224-15N-00-000	15" Panel Controller, Celeron 1.2GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		
AKC-PNC-D1-224-15N-00-000	15" Panel Controller, C2D 1.86GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		
AKC-PNC-D1-224-17N-00-000	17" Panel Controller, C2D 1.86GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		
AKC-RMC-D2-224-00N-00-000	Rackmount Controller, Dual Core 2.26GHz CPU, 2G RAM, 4G CF, 128KB NVRAM		

Cable part number	Description	Specs.	Tech. Manual
ENCP-0017-000	Ethernet Cable .17 meter		
ENCP-0026-000	Ethernet Cable .26 meter		
ENCP-0050-000	Ethernet Cable .50 meter		
ENCP-0100-000	Ethernet Cable 1 meter		
ENCP-0200-000	Ethernet Cable 2 meter		
ENCP-0300-000	Ethernet Cable 3 meter		
ENCP-0400-000	Ethernet Cable 4 meter		
ENCP-0500-000	Ethernet Cable 5 meter		
ENCP-1000-000	Ethernet Cable 10 meter		

Cable part number	Description	Specs.	Tech. Manual
ENCU-0000-000	Raw Ethernet Cable (per meter)		
ENCC-KIT-000	Connector Kit		

5.3 AKT

Hardware revision greater or equal to **9** (with firmware version **12**)

I/O terminal part number	Description	Tech. Manual
AKT-ECT-000-000	ETHERCAT Coupler	
AKT-DNH-008-000	8 Channel Digital Input Module, 24Vdc 0.2ms	
AKT-DN-008-000	8 Channel Digital Input Module, 24Vdc 3ms	
AKT-DNH-004-000	4 Channel Digital Input Module, 24Vdc 0.2ms	
AKT-DN-004-000	4 Channel Digital Input Module, 24Vdc 3ms	
AKT-DT-008-000	8 Channel Digital Output Module, 24Vdc 0.5A	
AKT-DT-004-000	4 Channel Digital Output Module, 24Vdc 0.5A	
AKT-DT-2RT-000	2 Channel Relay Output Module, 250V AC 2.0A Rel.2NO Pot.-Free	
AKT-AN-420-000	4 Channel Analog Input Module, 0-20mA	
AKT-AN-410-000	4 Channel Analog Input Module, 0-10Vdc	
AKT-AN-820-000	8 Channel Analog Input Module, 0-20mA	
AKT-AN-810-000	8 Channel Analog Input Module, 0-10Vdc	
AKT-AN-200-000	2 Channel Thermocouple Input Module	
AKT-AN-400-000	4 Channel Thermocouple Input Module	
AKT-AT-220-000	2 Channel Analog Output Module, 0-20mA	
AKT-AT-420-000	4 Channel Analog Output Module, 0-20mA	
AKT-AT-410-000	4 Channel Analog Output Module, 0-10Vdc	
AKT-AT-820-000	8 Channel Analog Output Module, 0-20mA	
AKT-AT-810-000	8 Channel Analog Output Module, 0-10Vdc	
AKT-EM-000-000	End Module	
AKT-IM-000-000	Isolation Module	
AKT-PS-024-000	Power Supply, 24Vdc	
AKT-PSF-024-000	Fused Power Supply with diagnostics, 24Vdc	

5.4 Installing EtherCAT Motion Bus

One EtherCAT master (e.g. PAC) has to be connected with all the slaves (drives and I/O terminals) of your system. Please find all the details about the installation procedure for the EtherCAT Motion Bus in the following deliverable **AKD EtherCAT Communication**

5.5 Installing AKD Drive

The official AKD firmware version is: **01-03-00-302**

To install the AKD drive as well as the AKD GUI Views, refer to chapters 7 to 9 in the **AKD Installation Manual**

5.6 Installing AKM Motor

To install rotary AKM Servomotors, refer to chapters 17 to 19 in: **AKM Synchronous Servomotors - Product Manual**

5.7 HMI - Graphic Operator Interface

Please find in the table below the list of each HMI component available with a link to get more details on installation procedures:





HMI part number	Description	Tech. Manual
AKI-CDT-MOD-04T-000	Graphical Display 3.5" TFT, LCD, 64k Colors, Touch	
AKI-CDT-MOD-06T-000	Graphical Display 5.7" TFT, LCD, 64k Colors, Touch	
AKI-CDT-MOD-10T-000	Graphical Display 10.4" TFT, LCD, 64k Colors, Touch	
AKI-CDT-MOD-15T-000	Graphical Display 15.1" TFT, LCD, 64k Colors, Touch	

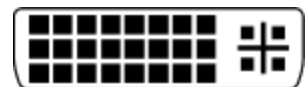
Table 5-2: List of KAS HMI

Please see the Kollmorgen website for specifications and Technical Manuals for more information.

5.8 Controller - Industrial PC (IPC)

First connect the keyboard and the mouse to the IPC (as well as the monitor if it is not built into the IPC) to be sure that the IPC correctly starts when it is powered by a supply voltage of 24v (not necessarily provided).

The box PAC is equipped with a DVI port, as seen to the right. DVI ports are backwards compatible for use with VGA monitors when using a DVI-to-VGA adapter. The first time the PAC is booted, an external monitor will only stay on for a brief time. The system needs to be configured from the keyboard, depending on what is connected to the DVI port. Press the keyboard combination shown below that matches your set-up. This configuration is automatically saved.



DVI cable	DVI-VGA adapter
CTRL-ALT-F4	CTRL-ALT-F1

How to recover when the monitor seems to be unplugged or switched off?

The problem is probably due to the internal graphical card configuration and the currently

known solution is the following:

- Restart the IPC and press the **F8** key to enter the advanced XP start-up mode
- Select the **VGA mode enable start-up** option
- Reboot the IPC and XP starts normally
- Ignore Windows comments on the screen
- Click the **Start** menu and select **Settings** then **Control Panel**
- Click the **System** command to explore the hardware configuration of the computer
- In the System Properties windows, select the **Device Manager** command in the **Hardware** tab
- In the Device Manager windows, expand the **Display Adapters** node
- Check that two Graphic Controllers are displayed
- Right-click on the first item and select the **Uninstall** command in the contextual menu
- Reboot your IPC as requested to validate the modification

After the reboot operation, your IPC should now work normally.

To be sure that the modification has been done properly, explore again the hardware configuration and compare it with the figure below.



One of the controllers must be deactivated (see **red cross** on its icon).

Please find in the table below the list of each IPC component available:

PAC part number	Description	Tech. Manual
AKC-PLC-C1-224-00N-00-000	Box Controller, Celeron 1.2GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	
AKC-PLC-D2-224-00N-00-000	Box Controller, Dual Core 2.26GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	
AKC-PNC-C1-224-10N-00-000	10" Panel Controller, Celeron 1.2GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	
AKC-PNC-C1-224-15N-00-000	15" Panel Controller, Celeron 1.2GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	
AKC-PNC-D1-224-15N-00-000	15" Panel Controller, C2D 1.86GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	
AKC-PNC-D1-224-17N-00-000	17" Panel Controller, C2D 1.86GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	
AKC-RMC-D2-224-00N-00-000	Rackmount Controller, Dual Core 2.26GHz CPU, 2G RAM, 4G CF, 128KB NVRAM	

Table 5-3: List of KAS PAC

5.8.1 Deploying IPC standard image

The next step is to deploy the standard image that contains INtime Software with the correct settings for all the real-time part, as well as the EtherCAT option card settings. This step is done by Kollmorgen.

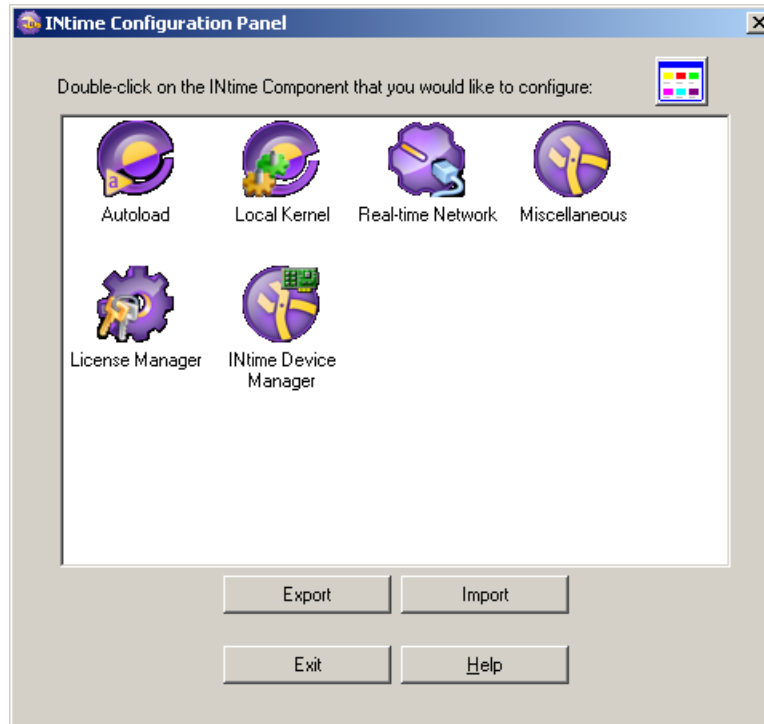
5.8.2 Configuring INtime

To finalize the INtime software installation, some fine tuning still has to be performed as follows:

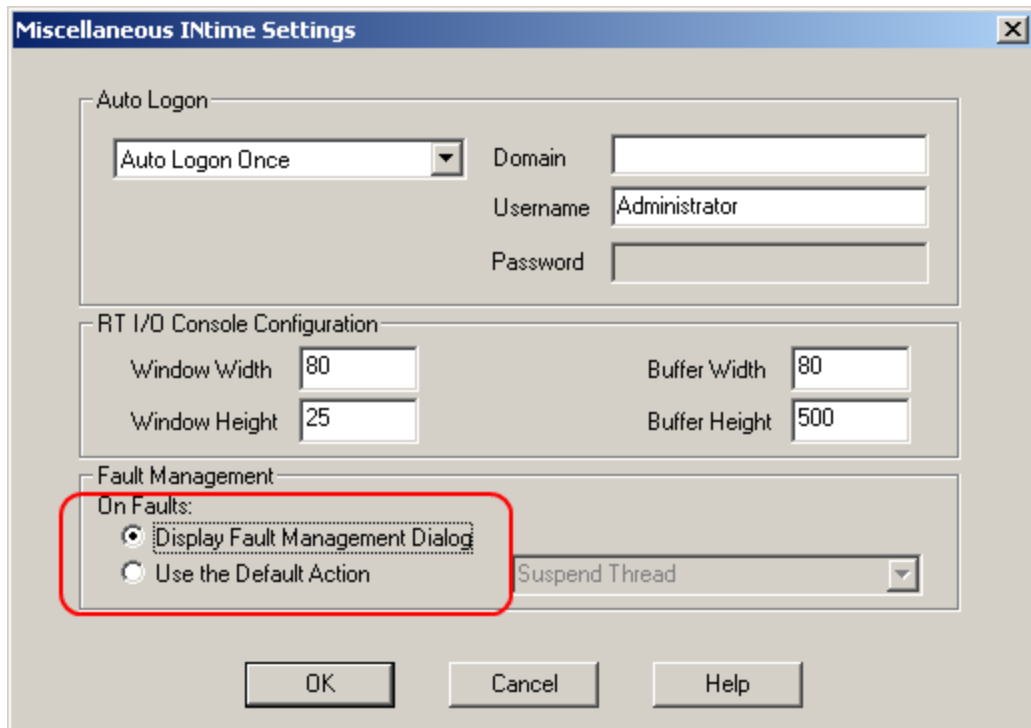
1. Right-click on the INtime icon and select the **INtime Configuration** command in the contextual menu



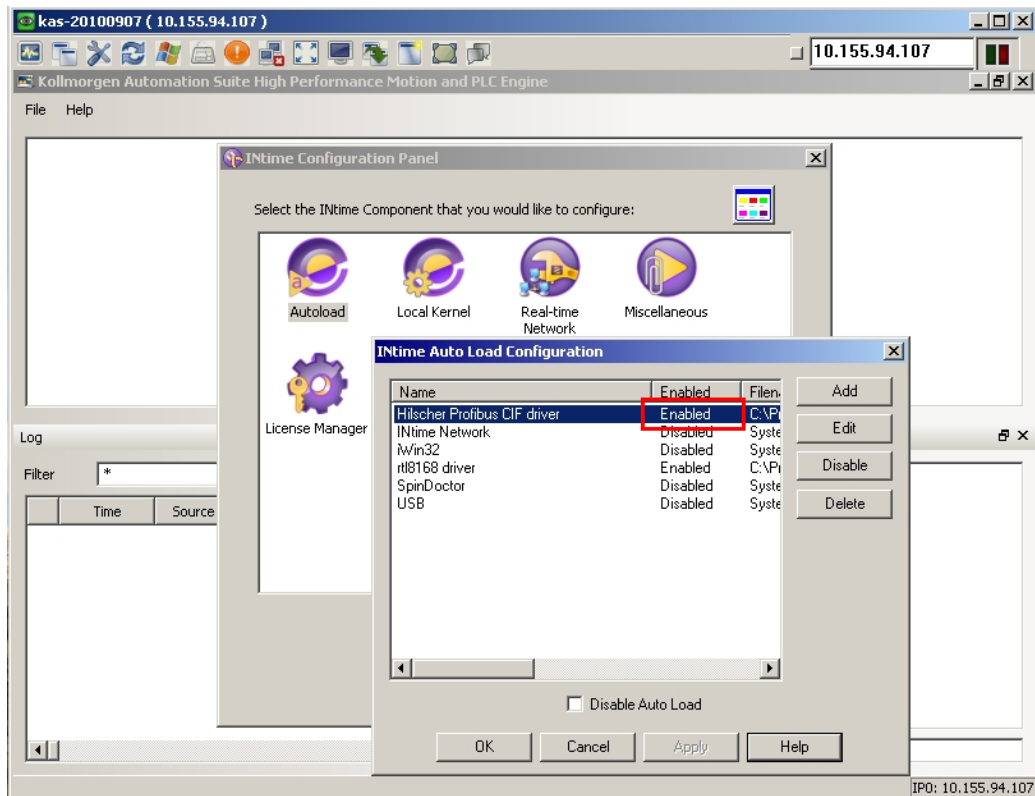
2. Double-click the **Miscellaneous** icon



3. Select the **Display Fault Management Dialog** option



4. Click **OK**
5. In the INtime Configuration Panel, click on the **Autoload** icon
6. Enable the **Hilscher Profibus CIF driver** option, but disable the **SpinDoctor** and **iWin32** options as shown below



7. Click **OK**
8. Restart your IPC for the changes to become effective

After these changes, INtime is now successfully configured to run on your IPC.

5.9 EtherCAT Motion Bus

One EtherCAT master (e.g. PAC) has to be connected with all the slaves (drives and I/O terminals) of your system. Please find all the details about the installation procedure for the EtherCAT Motion Bus in the following deliverable **AKD™ EtherCAT Communication** listed in the list of References.

5.10 Remote Input/Output - I/O Terminal

Please find in the table below the list of each I/O component available.

I/O terminal part number	Description	Tech.Manual
AKT-ECT-000-000	ETHERCAT Coupler	
AKT-DNH-008-000	8 Channel Digital Input Module, 24Vdc 0.2ms	
AKT-DN-008-000	8 Channel Digital Input Module, 24Vdc 3ms	
AKT-DNH-004-000	4 Channel Digital Input Module, 24Vdc 0.2ms	
AKT-DN-004-000	4 Channel Digital Input Module, 24Vdc 3ms	
AKT-DT-008-000	8 Channel Digital Output Module, 24Vdc 0.5A	
AKT-DT-004-000	4 Channel Digital Output Module, 24Vdc 0.5A	
AKT-DT-2RT-000	2 Channel Relay Output Module, 250V AC 2.0A Rel.2NO Pot.-Free	
AKT-AN-420-000	4 Channel Analog Input Module, 0-20mA	
AKT-AN-410-000	4 Channel Analog Input Module, 0-10Vdc	
AKT-AN-820-000	8 Channel Analog Input Module, 0-20mA	
AKT-AN-810-000	8 Channel Analog Input Module, 0-10Vdc	
AKT-AN-200-000	2 Channel Thermocouple Input Module	
AKT-AN-400-000	4 Channel Thermocouple Input Module	
AKT-AT-220-000	2 Channel Analog Output Module, 0-20mA	
AKT-AT-420-000	4 Channel Analog Output Module, 0-20mA	
AKT-AT-410-000	4 Channel Analog Output Module, 0-10Vdc	
AKT-AT-820-000	8 Channel Analog Output Module, 0-20mA	
AKT-AT-810-000	8 Channel Analog Output Module, 0-10Vdc	
AKT-EM-000-000	End Module	
AKT-IM-000-000	Isolation Module	
AKT-PS-024-000	Power Supply, 24Vdc	
AKT-PSF-024-000	Fused Power Supply with diagnostics, 24Vdc	

Table 5-4: List of KAS I/O Terminals

5.10.1 Installing Bus Terminals on mounting rails



Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the Bus Terminals!

5.10.1.1 Assembly

The Bus Coupler and Bus Terminals are attached to commercially available 35 mm mounting rails (DIN rails according to EN 50022) by applying slight pressure:

1. First attach the Fieldbus Coupler to the mounting rail.
2. The Bus Terminals are now attached on the right-hand side of the Fieldbus Coupler. Join the components with tongue and groove and push the terminals against the mounting rail, until the lock clicks onto the mounting rail.
If the Terminals are clipped onto the mounting rail first and then pushed together without tongue and groove, the connection is not operational! When correctly assembled, no significant gap is visible between the housings.

During the installation of the Bus Terminals, the locking mechanism of the terminals must not come into conflict with the fixing bolts of the mounting rail.

5.10.1.2 Disassembly

Each terminal is secured by a lock on the mounting rail, which must be released for disassembly:

1. Carefully pull the orange-colored lug approximately 1 cm out of the disassembled terminal, until it protrudes loosely. The lock with the mounting rail is now released for this terminal, and the terminal can be pulled from the mounting rail without excessive force.
2. Grasp the released terminal with thumb and index finger simultaneous at the upper and lower grooved housing surfaces and pull the terminal away from the mounting rail.

5.10.1.3 Connections within a bus terminal block

The electric connections between the Bus Coupler and the Bus Terminals are automatically realized by joining the components:

- The six spring contacts of the Standard/Performance Coupler deal with the transfer of the data and the supply of the Bus Terminal electronics.
- The power contacts deal with the supply for the field electronics and thus represent a supply rail within the bus terminal block. The power contacts are supplied via terminals on the Bus Coupler.



NOTE

During the design of a bus terminal block, the pin assignment of the individual Bus Terminals must be taken account of, since some types (e.g. analog Bus Terminals or digital 4-channel Bus Terminals) do not or not fully loop through the power contacts. Power Feed Terminals (AKT-PS-024-000 or AKT-PSF-024-000) interrupt the power contacts and thus represent the start of a new supply rail.

5.10.1.4 PE power contact

The power contact labeled PE can be used as a protective earth. For safety reasons this contact mates first when plugging together, and can ground short-circuit currents of up to 125 A.



WARNING

Note that, for reasons of electromagnetic compatibility, the PE contacts are capacitatively coupled to the mounting rail. It can lead to incorrect results during insulation testing or to damage on the terminal (e.g. disruptive discharge to the PE line during insulation testing of a consumer with a nominal voltage of 230 V).

For insulation testing, disconnect the PE supply line at the Bus Coupler or the Power Feed Terminal! In order to decouple further feed points for testing, these Power Feed Terminals can be released and pulled at least 10 mm from the group of terminals.

The PE power contact must not be used for other potentials!

5.10.1.5 Wiring

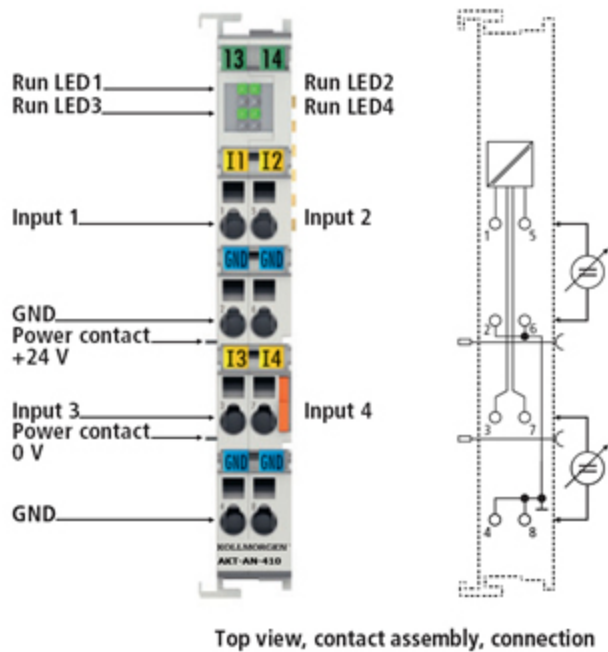
Up to eight connections enable the connection of solid or finely stranded cables to the Bus Terminals. The terminals are implemented in spring force technology. Connect the cables as follows:

1. Open a spring-loaded terminal by slightly pushing with a screwdriver or a rod into the square opening above the terminal.
2. The wire can now be inserted into the round terminal opening without any force.
3. The terminal closes automatically when the pressure is released, holding the wire securely and permanently.



Analog sensors and actors must always be connected with shielded, twisted paired wires.

5.10.2 Connection Details



5.11 Installing AKD Drive

To install the AKD drive as well as the AKD GUI Views, refer to chapters 7 to 9 in the **AKD™- Installation Manual**



Drives Guide		Description
AKD Quick Start		Contains all information needed to safely install and setup an AKD drive
AKD and AKD PDMM Installation Manual		Covers the most important points to install the drive hardware and software Provides instructions for basic drive setup and connection to a network
AKD User Manual		Describes how to use your drive in common applications. It also provides tips for maximizing your system performance with the AKD
AKD Accessories Manual		Includes technical data and dimensional drawings of accessories such as cables, brake resistors, and mains supplies
AKD EtherCAT Manual		Describes the installation, setup, range of functions, and software protocol for the EtherCAT AKD product series
AKD CANopen Communication		This manual includes setup information for the CAN interface and describes the CANopen profile
AKD EtherNet/IP Communications Manual		This manual contains information for using an AKD EtherNet/IP drive.
AKD EtherNet/IP with RSLogix Manual		This manual contains information for using an AKD EtherNet/IP drive with RSLogix.
AKD Profinet Communication Manual		This manual contains information for using an AKD Profinet drive.
AKD SynqNet Communication Manual		This manual contains information for using an AKD SynqNet drive.
AKD HMI Modbus Communication Manual		This manual contains information on communication between an AKD and HMI through Modbus.
S300 Reference Documentation		Kollmorgen website that gives access to all S300 manuals

Table 5-5: List of AKD Guides

5.12 Installing AKM Motor

To install rotary AKM Servomotors, refer to the following AKM deliverable:

- Chapters 17 to 19 in: **AKM™ Synchronous Servomotors - Product Manual**

Note

This manual can be downloaded at http://www.kollmorgen.com/uploadedfiles/Files/Document/Motors_and_Drives_Overview_Brochure.pdf

This page intentionally left blank.

6 Updating Firmware

Check the KAS software release notes to find the AKD PDMM firmware version that matches with your KAS software version. The latest version of the firmware can be downloaded from the Kollmorgen web site.

To ensure your installation is correct, you have to:

- Check the current AKD drive firmware
- Download the official version, if necessary
- Update the firmware

6.1 Check AKD PDMM Drive Firmware

To check AKD PDMM Firmware with KAS IDE:

1. Create a new project
2. Set the controller IP address
3. In the Project Explorer, double-click the **EtherCAT** node to open the EtherCAT Devices summary window
4. In the Devices tab, click the **Scan Devices** button
5. Choose the **Create...** option to map the physical device to a new device
6. Compile the project
7. Connect to the controller
8. Download the project to the controller
9. Click the **Online Configuration Mode** to see the HW Information in the EtherCAT window
10. If the version is not correct, download the new firmware (see link below) and follow with the next procedure

Tip

This procedure is also available in the Animated Lessons in the embedded online help (see section: **About the EtherCAT Scan**)

6.2 Download AKD PDMM Drive Firmware

Component	Down-load
AKD Drive FW - Version M_01_03_00_302	4 MB

To upgrade AKD PDMM Firmware with KAS IDE, continue from the previous procedure as follows:

1. In the EtherCAT Devices summary window, deactivate the **Online Configuration Mode**
2. Select the drives to be updated with the same firmware
(Note that the FW download is limited to 16 drives at a time)
3. Click **Upgrade Firmware** button

Warning

Give careful attention to any warning dialog that appears at this point. These warnings usually include important information about preventing damage to the drives.

4. Browse to select the new AKD firmware file
5. Click **Open** to start the updating procedure

6.3 AKD PDMM Firmware Update

Based on the FoE protocol, the AKD PDMM Firmware can be downloaded as follows:

1. Scan the devices and make sure all devices are created
2. Compile the project
3. Connect to the controller
4. Download the project to the controller
5. Open the EtherCAT Devices summary form
6. Select the drives to be updated with the same firmware
7. Click the Upgrade Firmware button

Warning

Give careful attention to any warning dialog that appears at this point. These warnings usually include important information about preventing damage to the drives.

8. Browse to select the new AKD firmware file
9. Click **Open** to start the updating procedure

Note

This procedure is not possible when applications are running and when the drive is in Online Configuration Mode.

During the firmware download, the AKD Firmware Update window displays a progress bar and the following messages are displayed:

- Uploading firmware to the drive
During the download process, the drive LED displays [dL]. Additional codes may appear during the download; see 3.2 Display Codes for a description of codes related to the firmware download.
- Resetting the drive
- Firmware update is complete

Warning

While the firmware is downloading to your drive, do not remove the 24V logic power. If you remove the 24V logic power during a firmware download, a severe drive crash can occur. If a crash occurs, the drive will restart in a special mode and prompt you to reload the firmware.

7 Installing Kollmorgen Visualization Builder

KVB is an optional feature that is only included in some licenses.

Kollmorgen Visualization Builder allows you to design HMI panels running either on AKI or panel PAC.

7.1 Installation

When purchased as a part of Kollmorgen Automation Suite, KVB is installed automatically during setup.

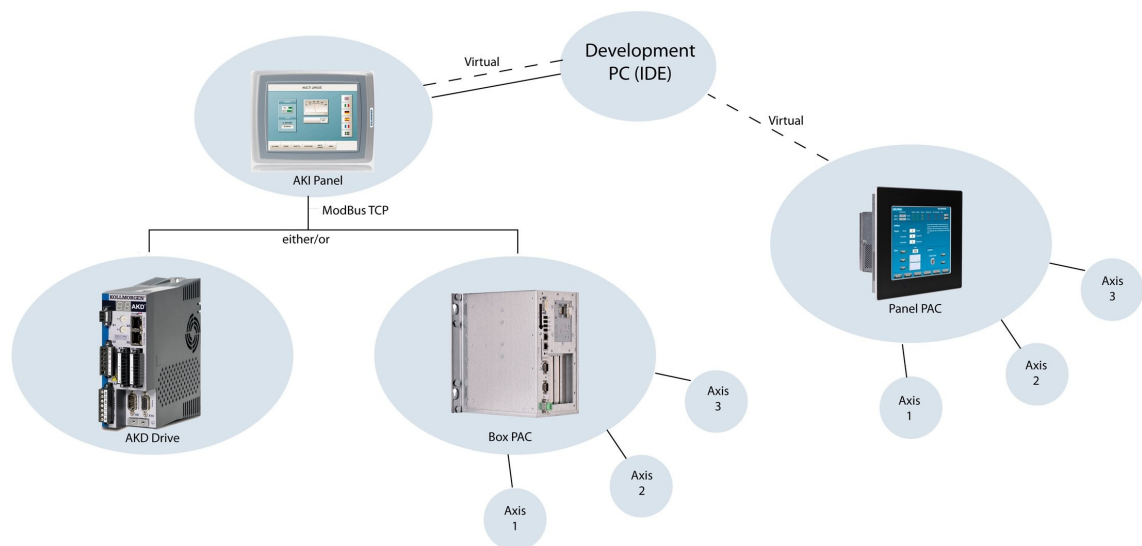
When KVB is purchased as a standalone application, it can be downloaded from <http://www.kollmorgen.com>. After a 30 day evaluation period, the software must be registered.

For more information about product registration, please refer to section Product Registration.

Note

Kollmorgen Visualization Builder contains the two following installation packages:

- Kollmorgen Visualization Builder (KVB IDE) for development PC
- Visualizer RT (KVB RT) for AKI panel runtime



7.2 Download

Component	Down-load
Kollmorgen Visualization Builder (KVB) - Version 1.20 (build 1.20.542)	360 MB
Visualizer RT (KVB RT) - Version 1.20	78 MB

7.3 Installation Procedure

The following programs must be installed before KVB can be installed:

- **Microsoft .NET Compact Framework 3.5**
- **SQL Server Compact Edition**
- **Microsoft Visual C++ 2008 - Redistributable Setup** (vcredist_x86)

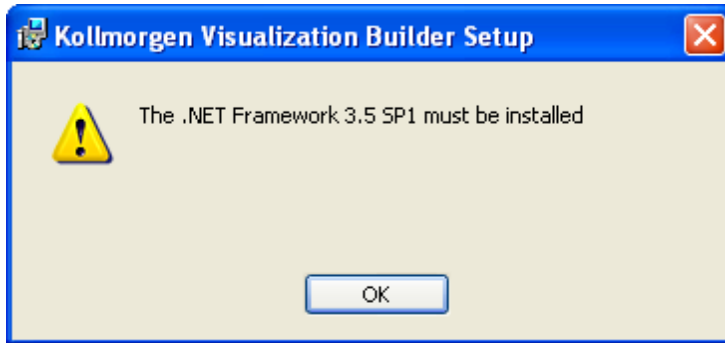
Once Kollmorgen Visualization Builder has finished downloading, complete the following installation steps:

1. Double-click the **Setup.exe** file to run the installation Wizard

Note

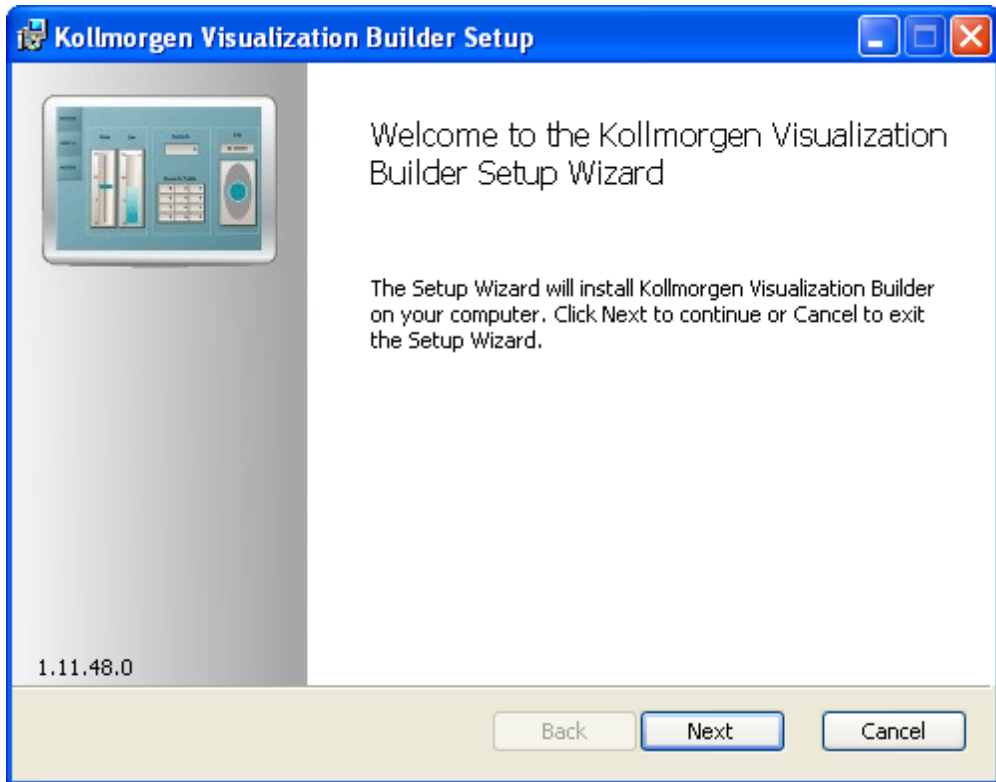
If KVB was already installed and you want to update to a new version, then running **NeoSetup.msi** is enough.

2. Click **Run** to launch the setup wizard
3. If not already done, you are requested to install the **Microsoft .NET Framework 3.5 Service Pack 1**

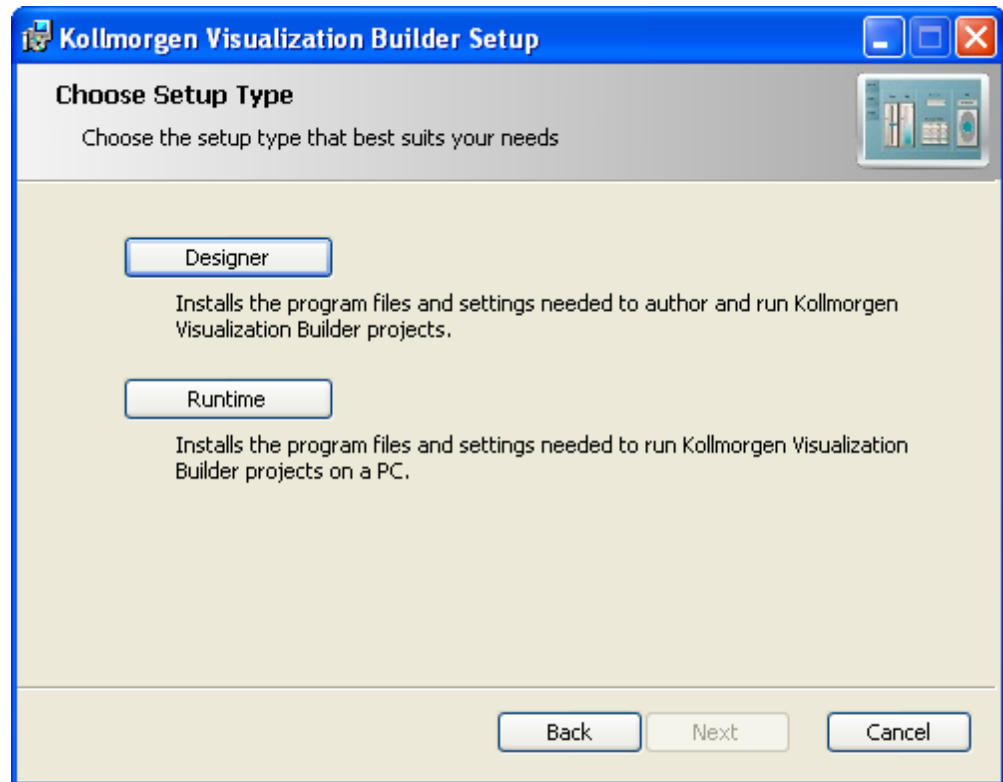


Note: A reboot is required after installing this service pack

4. Click **Next** and accept License Agreement to start **Kollmorgen Visualization Builder** installation

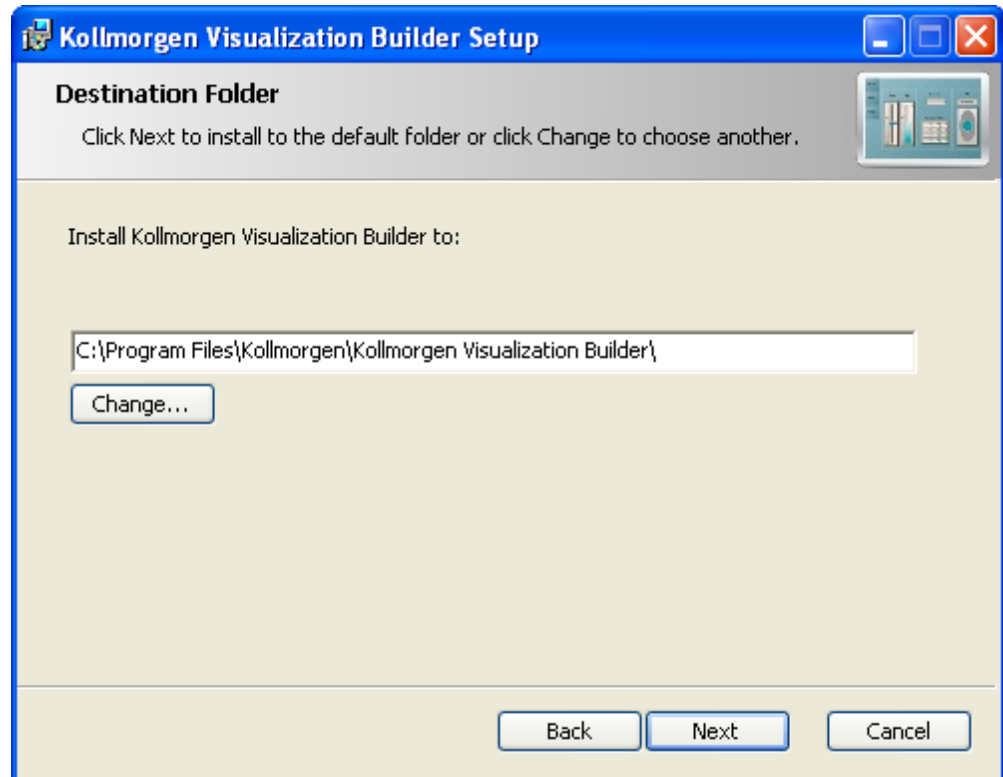


5. Click **Designer** (corresponds to the **Kollmorgen Visualization Builder** application)

**Note**

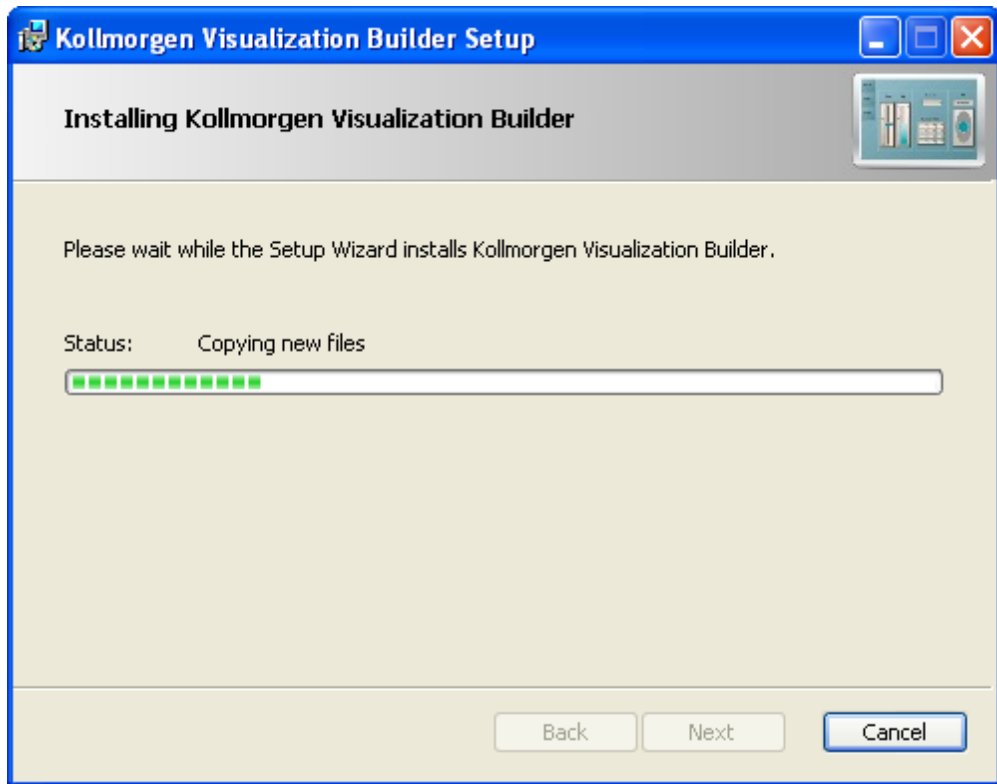
The Runtime (also named Visualizer RT) is dedicated to the PAC only

6. Choose your language and click **Next**
7. Select where you want to install **Kollmorgen Visualization Builder** and click **Next**

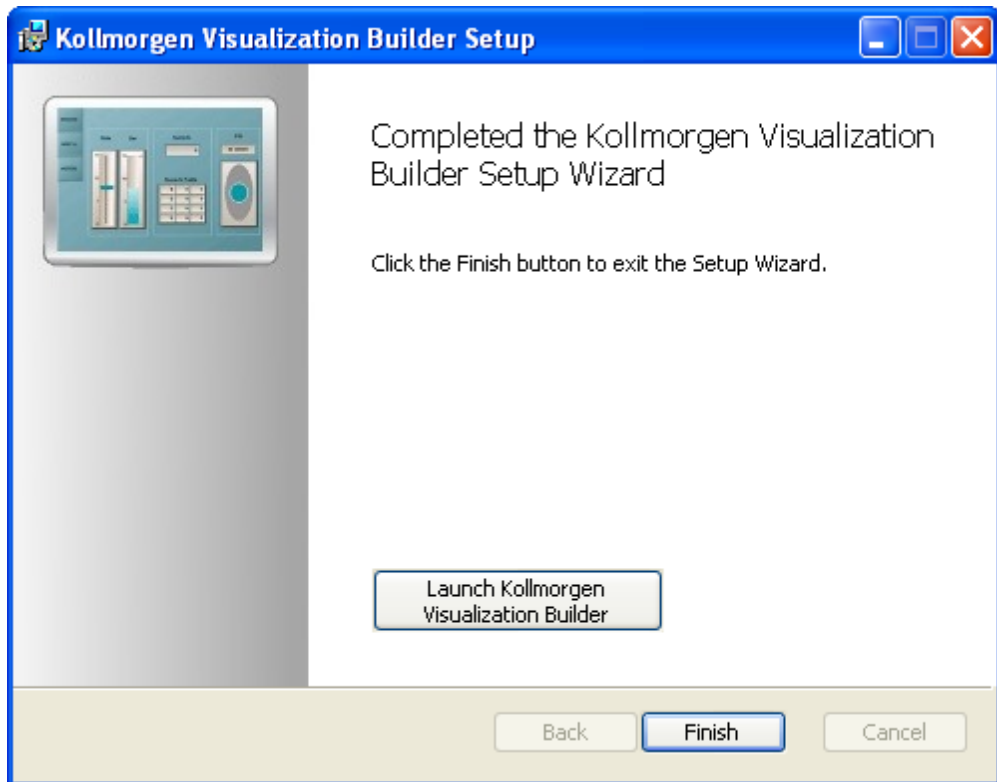


Kollmorgen strongly recommends accepting the default destination folder under C:\Program Files\Kollmorgen\Kollmorgen Visualization Builder\

8. Click **Install** to start **Kollmorgen Visualization Builder** installation



9. Click **Finish**



Note

When **Kollmorgen Visualization Builder** starts for the first time, a dialog box requests a registration key. Entering this key provides unlimited access to all program functionality and software updates.

Also, to allow the runtime (Visualizer RT) to run on the PAC, ensure the USB hardware key is plugged in.

This page intentionally left blank.

8 Finalizing Installation

To complete the KAS installation, you can optionally:

- Test the system
- Create a backup image

8.1 Testing Installation

To conclude your installation, the whole system has to be tested.

A test could be done with the standard Two-Axis Template that corresponds to a simple application (refer to **KAS 30 Minutes to Motion**).

8.2 Saving Installation

This chapter defines how to:

- Save the IPC image on a CompactFlash card (aka USB memory stick)
- Prevents from files corruptions in the PC's CompactFlash memory

To prevent corruption and be able to quickly restore your IPC image, Acronis SW and Microsoft Enhanced Write Filter (EWF) can be used. The procedure described below explains how to use these proposed tools.

Note

Acronis True Image software is **not** part of Kollmorgen Automation Suite. For more details, refer to: www.acronis.com.

EWF software is included in Windows® XP Embedded. For more details, refer to: msdn.microsoft.com/en-us/library/ms912915.aspx

8.2.1 Backup IPC Image

As soon as all the hardware has been tested and validated, you can proceed to a complete backup on a CompactFlash card (aka USB memory stick) with the **Acronis True Image** software.

8.2.1.1 Prepare the bootable USB Stick

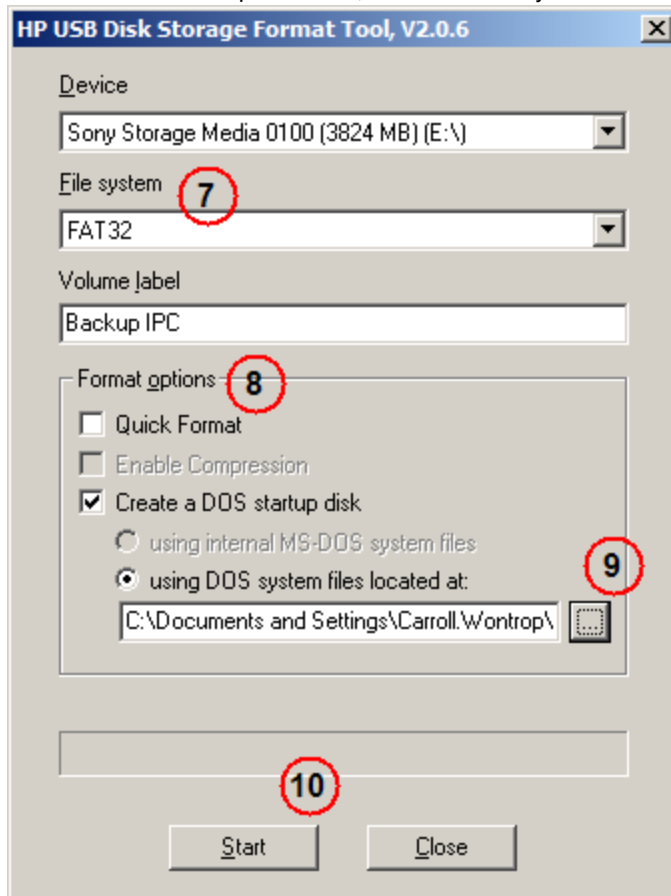
You first need a USB Stick (with a minimum of 2GB capacity) to be prepared as follows:

- Install HP USB Disk Format Storage Tool (HP_USB_Boot_Utility.exe)
- Create a folder for the system files
C:\Documents and Settings\Myname\My Documents\IPC Backup Files\HP_USB\DOS

- Copy the following system files in this folder

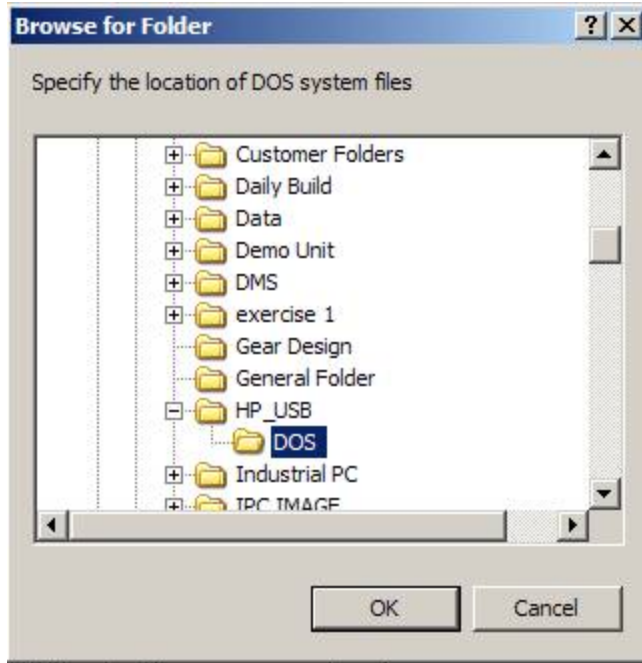
Name	Size	Type	Date Modified
COMMAND.COM	91 KB	MS-DOS Application	6/8/2000 5:00 PM
CONFIG.SYS	1 KB	System file	1/18/2008 9:30 AM
DISPLAY.SYS	17 KB	System file	6/8/2000 5:00 PM
EGA2.CPI	58 KB	CPI File	6/8/2000 5:00 PM
EGA3.CPI	58 KB	CPI File	6/8/2000 5:00 PM
EGA.CPI	58 KB	CPI File	6/8/2000 5:00 PM
KEYB.COM	22 KB	MS-DOS Application	6/8/2000 5:00 PM
KEYBOARD.SYS	34 KB	System file	6/8/2000 5:00 PM
KEYBRD2.SYS	32 KB	System file	6/8/2000 5:00 PM
KEYBRD3.SYS	31 KB	System file	6/8/2000 5:00 PM
KEYBRD4.SYS	13 KB	System file	6/8/2000 5:00 PM
MODE.COM	29 KB	MS-DOS Application	6/8/2000 5:00 PM

- Insert the USB stick into the USB port of your computer
- Launch the HP format tool program (HPUSBFW.EXE) from the installed directory
- Under the **device** drop-down list, make sure that your USB stick is selected

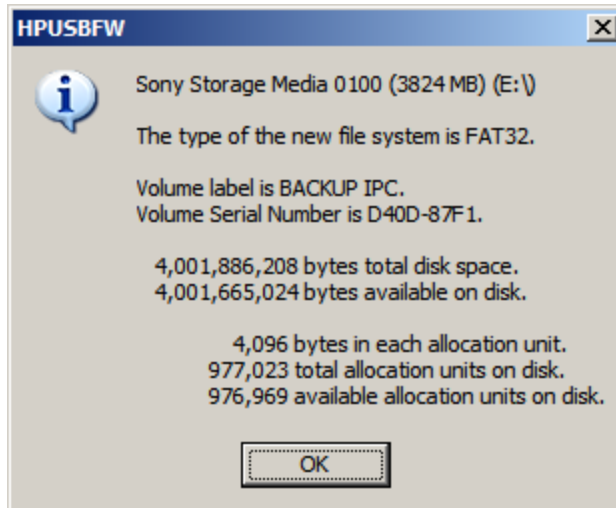


- Under the **File system** drop down list, select **FAT32**
- In the **Format options**, choose to **Create a DOS startup disk** and select **using DOS system files located at:**

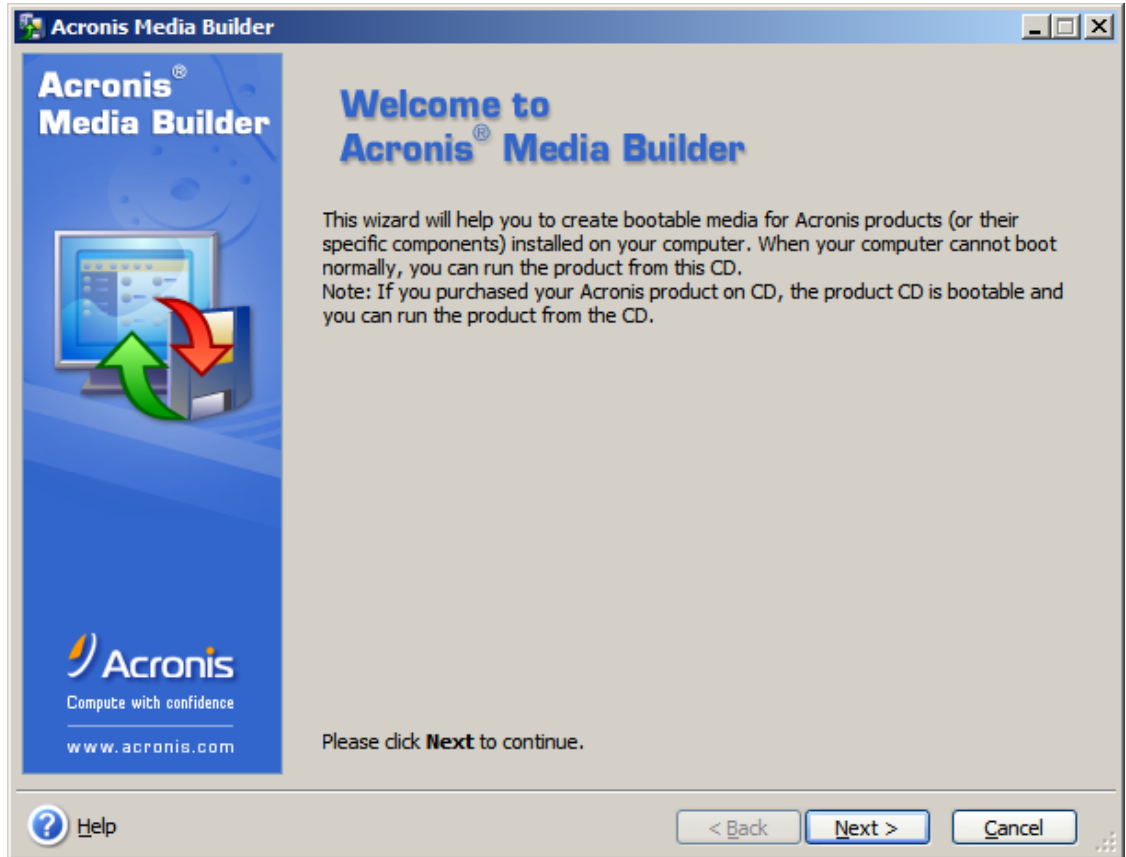
- Specify the folder location created in step 2



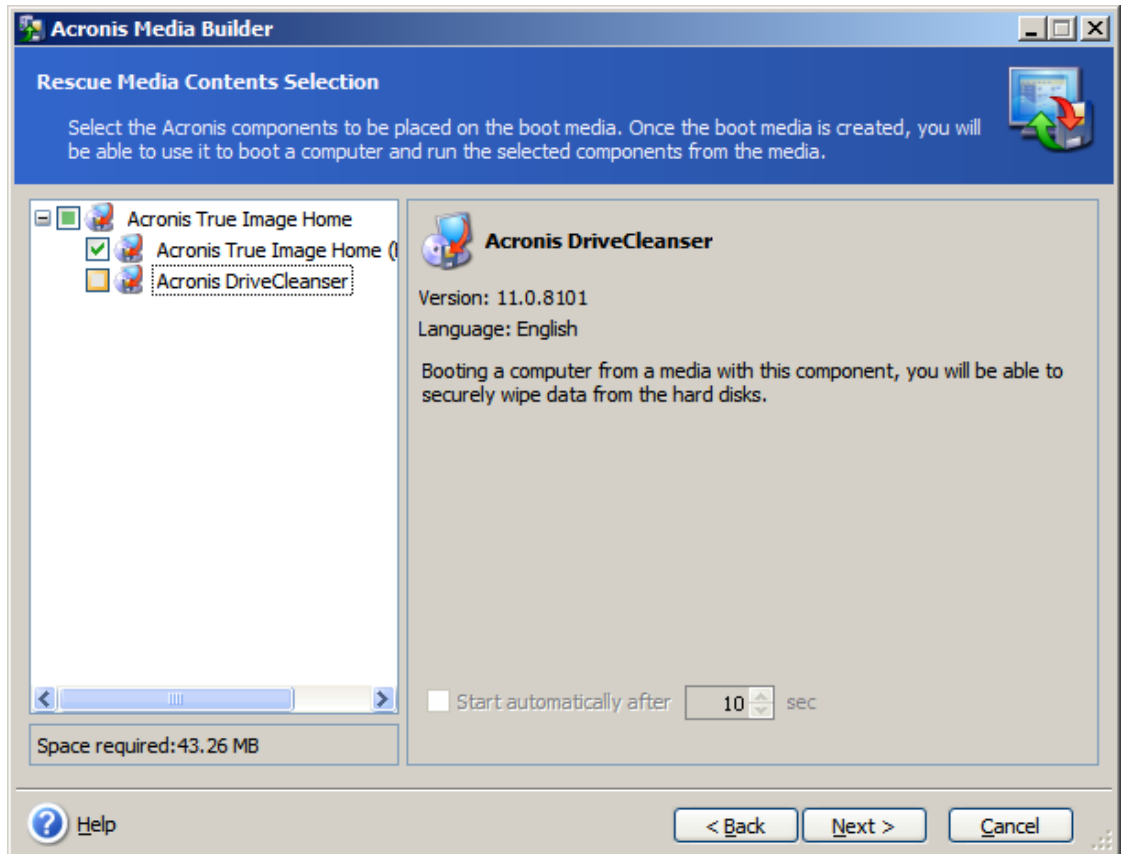
- Click the **Start** button to format as a Bootable device using DOS directory



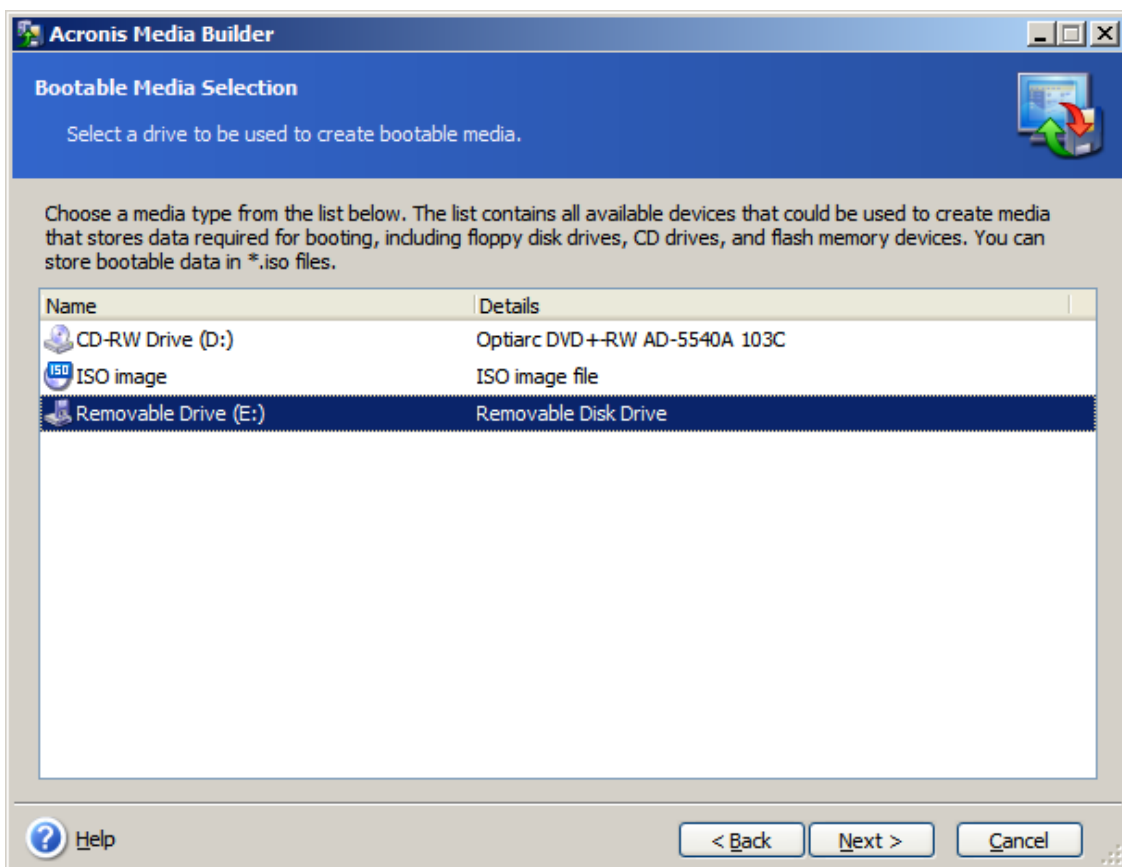
- Click the **Close** button once the operation is completed
- Install **Acronis True Image 11** on your IPC
- Start **Acronis True Image** application



- Go to **Management tool**



- Create Bootable Rescue Media




8.2.1.2 Create the Backup

To the complete backup, proceed as follows:

- Connect the keyboard and the mouse to the IPC (as well as the monitor if it is not built into the IPC)
For more details, refer to paragraph "Controller - Industrial PC (IPC)" on page 23
- Start your IPC
- During startup press the **F2** key to enter the setup
- Set the priority by selecting the first boot device to look for the USB stick (you only need to do it once)
- Insert the USB stick into a free USB port
- Reboot your IPC
- Start **Acronis True Image** application
- Select True Image Home
- Select **Backup**
- Select **My Computer**
- Select what is to be backed up (i.e. **Disk1: Volume C**)
- Exclude nothing (do not select any exclusions)
- Select the store location: A: Removable drive/Image/*FILENAME* (modify with a meaningful *FILENAME*)
- Select **Create a new full backup archive**
- Choose **Compression level** and set to the maximum
- Add notes if desired
- Store in file name *xxxxx_Original* (create a full backup)
- Do not have to enter password

- Compression level: Max
- Finally click **Proceed**

8.2.2 Enhanced Write Filter

The Enhanced Write Filter (EWF) provides write-protection to the runtime image. All write requests are redirected to RAM and the runtime image maintains the appearance of being able to be written to. When the EWF is active its icon is shown in the system tray, as seen to the right. When the EWF is disabled its system tray icon is a red slashed-circle .



The EWF should be activated on the PAC once the system is running and is in a stable condition. If a significant change is going to happen (such as a new KAS version or downloading a new application) turn off the EWF filter, make the change, and then reactivate the filter.

There are two ways to manage the EWF:

- With the **EwfWinDllcaller.exe** application, located in `C:\WINDOWS\system32`. This is the preferred method. See "Enhanced Write Filter Operational Procedures Using the Application" (see page 46) for more information.
- From the command line interface. The command line offers more functions than the application *but is recommended only for advanced users*. See "Enhanced Write Filter Operational Procedures using the command line" (see page 47) for more information.

8.2.2.1 Practical Applications

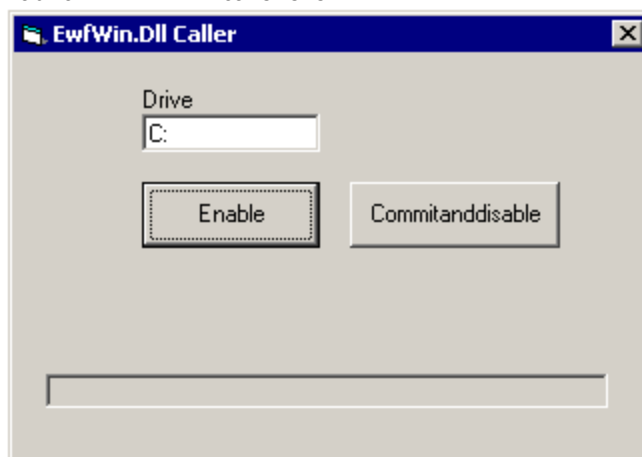
- For the **KAS Runtime installation**, using the "commitanddisable" method (via either command line or the application) is strongly recommended. If some operations have been performed previously, the remaining memory will not be sufficient using another method.
- For a **New PLC application download**, the "Perform Small Changes on a Protected Volume" (see page 48) method is convenient because the usual PLC application does not exceed 10 MB.

8.2.2.2 Enhanced Write Filter Operational Procedures Using the Application


Protect the PAC Image with EWF

The EWF must be activated to protect a stable version of the PAC image from data corruption.

1. Close all applications
2. Launch EwfWinDLLcaller.exe




3. Click the Enable button
You will receive a message about the Enable being successful.

- Restart the computer
The icon in the system tray is green. 

Perform Changes on a Protected Volume

The EWF has to be disabled to perform changes on a PAC.

- Close all applications.
- Launch EwfWinDLLcaller.exe
- Click on the **Commitanddisable** button
You will receive a message about the Disable being successful.
- Restart the computer.
The icon in the system tray is a red slashed-circle. 

Warning

After pressing the **Commitanddisable** button you *must restart the computer*. The EWF is not fully disabled until the computer is restarted and making any changes to the system in this state can be troublesome.

After changes are made to the system, the EWF should be re-enabled to protect the PAC image. See "Protect the PAC Image with EWF" (see page 46).

8.2.2.3 Enhanced Write Filter Operational Procedures using the command line

WARNING

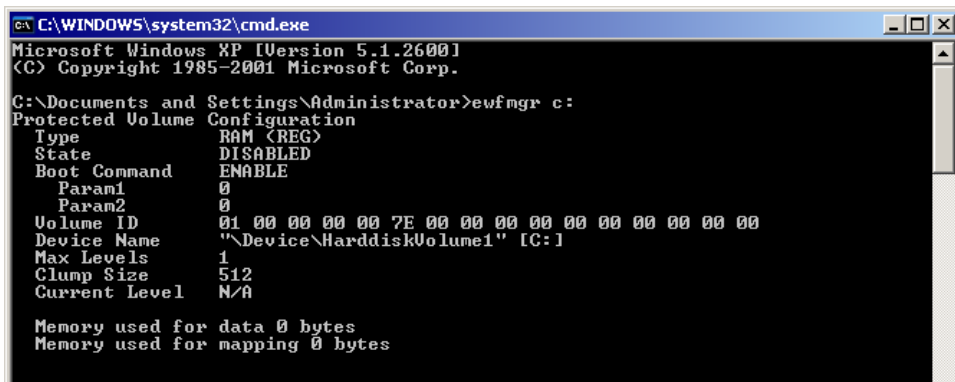
Using the EWF from the command line should only be performed by advanced users. Using the application is easier and more reliable.

Protect the PAC Image with EWF

The EWF must be activated to protect a stable version of the PAC image from data corruption.

- Execute: **ewfmgr c: -enable**
- Reboot the PAC

To ensure that the command has been entered correctly, execute the DOS command shell `ewfmgr c:` prior to rebooting the PAC. Check the field `Boot Command`, which should be set to "ENABLE", as seen in the image below.



```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Administrator>ewfmgr c:
Protected Volume Configuration
Type          RAM <REG>
State         DISABLED
Boot Command  ENABLE
Param1       0
Param2       0
Volume ID    01 00 00 00 00 7E 00 00 00 00 00 00 00 00 00
Device Name  "\Device\HarddiskVolume1" [C:]
Max Levels   1
Clump Size   512
Current Level N/A

Memory used for data 0 bytes
Memory used for mapping 0 bytes
  
```

Warning

If several commands are executed, only the latest will take effect after the reboot. To be sure about the latest command, execute the process described above.

Perform Changes on a Protected Volume

The EWF has to be disabled to perform changes on a PAC. After the changes are made the EWF is re-enabled.

- Execute: **ewfmgr c: -commitanddisable**
- Restart the PAC
- Perform the desired changes (program installation, files record, etc...)
- Execute: **ewfmgr c: -enable**
- Restart the PAC

Note

It is important to note that the maximum overlay size is a little more than 300 MB. Windows runs out of memory and crashes if this available space is exceeded, resulting in the error "**Delayed Write Failed. Windows was unable to save all data for the file**". As a consequence, when making important changes or file copy actions, do not forget to disable EWF first, and re-enable it when the operations are complete.

Perform Small Changes on a Protected Volume

To commit small changes without disabling and enabling EWF, a single command can be executed with the DOS command:

- Execute: **ewfmgr c: -commit**
- Restart the PAC

8.2.3 Restore IPC backup Image

To restore the complete backup, proceed as follows:

- Connect the keyboard and the mouse to the IPC (as well as the monitor if it is not built into the IPC)
For more details, refer to paragraph "Controller - Industrial PC (IPC)" on page 23
- Insert the bootable USB stick into a free USB port
- Reboot your IPC
- Start **Acronis True Image** application
- Select **Restore**
- Select the restored backup file on the USB stick (.tib file)
- Choose Restoration Method
- Restore whole Disks and partitions
- Select both Volume C and Master Boot record (MBR)
- Select the Destination of Disk 1
- Select option **yes, I want to delete all the partitions on the destination hard drive before restoring**
- Then start the restore operation

9 Troubleshooting KAS

Faults occur for a variety of reasons, depending on the conditions in your installation. The causes of faults in multi-axis systems can be especially complex.

Note

You can find more details in:

- the **Troubleshooting** chapter in the online help
- the **FAQ** section in MyKAS.kollmorgen.com Web site

This page intentionally left blank.

Global Support Contacts

Danaher Motion Assistance Center

Phone: 1-540-633-3400
Fax: 1-540-639-4162
Email: contactus@danahermotion.com

Danaher Motion
203A West Rock Road
Radford, VA 24141 USA

Europe Product Support

France

- Linear Units
- Ball- & Leadscrews
- Actuators
- Gearheads
- Rails & Components
- Servo Motors & Direct Drives
- Servo Drives & High Frequency Inverters
- Machine & Motion Controls

Tel.: +33 (0)243 5003-30
Fax: +33 (0)243 5003-39
Email: sales.france@tollo.com

Germany

- Gearheads
- Servo Motors & Direct Drives
- Servo Drives & High Frequency Inverters
- Machine & Motion Controls

Tel.: +49 (0)2102 9394-0
Fax: +49 (0)2102 - 9394-3155
Email: technik@kollmorgen.com

- Ball- & Leadscrews
- Linear Units
- Actuators
- Rails & Components

Tel.: +49 (0)70 22 504-0
Fax: +49 (0)70 22 54-168
Email: sales.wolfschlugen@danahermotion.com

Italy

- Ball- & Leadscrews
- Linear Units
- Actuators

KOLLMORGEN®

Because Motion Matters™

- Rails & Components
- Servo Motors & Direct Drives
- Servo Drives & High Frequency Inverters
- Machine & Motion Controls

Tel.: +39 0362 5942-60

Fax: +39 0362 5942-63

Email: info@danahermotion.it

Sweden

- Ball- & Leadscrews
- Linear Units
- Actuators
- Gearheads
- Rails & Components
- Servo Motors & Direct Drives
- Servo Drives & High Frequency Inverters
- Machine & Motion Controls

Tel.: +46 (0)44 24 67-00

Fax: +46 (0)44 24 40-85

Email: helpdesk.kid@danahermotion.com

Switzerland

- Servo Motors & Direct Drives
- Servo Drives & High Frequency Inverters
- Machine & Motion Controls

Tel. : +41 (0)21 6313333

Fax: +41 (0)21 6360509

Email: info@danaher-motion.ch

- Miniature Motors

Tel.: +41 (0)32 9256-111

Fax: +41 (0)32 9256-596

Email: info@portescap.com

United Kingdom / Ireland

- Ball- & Leadscrews
- Linear Units
- Actuators
- Gearheads
- Rails & Components
- Servo Motors & Direct Drives
- Servo Drives & High Frequency Inverters
- Machine & Motion Controls

Tel.: +44 (0)1525 243-243

Fax: +44 (0)1525 243-244

Email: sales.uk@danahermotion.com