



**Notes about operation of the
Bus Terminals System and the EtherCAT Terminal System
in potentially explosive areas (ATEX)**

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1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation technology who are familiar with the applicable national standards. It is essential that the following notes and explanations are followed when installing and commissioning these components.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

1.1.1 Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development. For that reason the documentation is not in every case checked for consistency with performance data, standards or other characteristics.

In the event that it contains technical or editorial errors, we retain the right to make alterations at any time and without warning.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

1.1.2 Trademarks

Beckhoff®, TwinCAT®, EtherCAT®, Safety over EtherCAT®, TwinSAFE® and XFC® are registered trademarks of and licensed by Beckhoff Automation GmbH.

Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

1.1.3 Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, DE102004044764, DE102007017835 with corresponding applications or registrations in various other countries.

The TwinCAT Technology is covered, including but not limited to the following patent applications and patents: EP0851348, US6167425 with corresponding applications or registrations in various other countries.

1.1.4 Copyright

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1.1.5 Delivery conditions

In addition, the general delivery conditions of the company Beckhoff Automation GmbH apply.

1.2 Safety instructions

1.2.1 Delivery state

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH.






1.2.2 Operator's obligation to exercise diligence

The operator must ensure that

- the Beckhoff Fieldbus Components are only used as intended (see chapter Special conditions in potentially explosive areas).
- the Beckhoff Fieldbus Components are only operated in sound condition and in working order.
- the Beckhoff Fieldbus Components are maintained repaired only by suitably qualified and authorized personnel.
- the personnel is instructed regularly about relevant occupational safety and environmental protection aspects, and is familiar with the operating manual and in particular the safety notes contained herein.
- none of the safety and warning notes attached to the Beckhoff Fieldbus Components are removed, and all notes remain legible.

1.2.3 Description of safety symbols

The following safety symbols are used in this operating manual. They are intended to alert the reader to the associated safety instructions.

 DANGER	<p>Serious risk of injury!</p> <p>Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.</p>
 WARNING	<p>Caution – Risk of injury!</p> <p>Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.</p>
 CAUTION	<p>Personal injuries!</p> <p>Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.</p>
 Warning	<p>Damage to the environment or devices</p> <p>Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.</p>
 Note	<p>Tip or pointer</p> <p>This symbol indicates information that contributes to better understanding.</p>

1.3 Validation

This documentation is valid for all Beckhoff fieldbus components, which bear one of the following markings



II 3 G Ex nA II T4

KEMA 10ATEX0075 X Ta: 0 - 55°C

or



II 3 G Ex nA nC IIC T4

KEMA 10ATEX0075 X Ta: 0 - 55°C

and which product code is built as follows:

Bus Coupler

BKxxxx-xxxx, LCxxxx-xxxx

Bus Terminal Controller

BCxxxx-xxxx, BXxxxx-xxxx

Bus Terminals

KLxxxx-xxxx, KSxxxx-xxxx

Terminal-Modules

KMxxxx-xxxx

EtherCAT Coupler

EK1xxx-xxxx, BK1xxx-xxxx

EtherCAT Terminals

ELxxxx-xxxx, ESxxxx-xxxx, EMxxxx-xxxx

At this each small character x stands for a cipher from 0 to 9.

Updated lists of the certified components may be found at the Beckhoff homepage under


<http://www.beckhoff.com/english/certifications/busterm.htm>

and

<http://www.beckhoff.com/english/certifications/ethercat.htm>

2 Notes about operation in potentially explosive areas

2.1 Special conditions

 <p>WARNING</p>	<p>Observe the special conditions for the intended use of Beckhoff fieldbus components in potentially explosive areas (directive 94/9/EU)!</p> <ul style="list-style-type: none">• The certified components are to be installed in a suitable housing that guarantees a protection class of at least IP54 in accordance with EN 60529! The environmental conditions during use are thereby to be taken into account!• If the temperatures during rated operation are higher than 70 °C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!• Observe the permissible ambient temperature range of 0 - 55°C for the use of Beckhoff fieldbus components in potentially explosive areas!• Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!• The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!• The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!• The fuses of the KL92xx power feed terminals may only be exchanged if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!• Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
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The fundamental health and safety requirements are fulfilled by compliance with the following standards:

- **EN 60079-0: 2006**
- **EN 60079-15: 2005**

2.2 Marking

The Beckhoff fieldbus components certified for potentially explosive areas bear one of the following markings:



II 3 G Ex nA II T4

KEMA 10ATEX0075 X Ta: 0 - 55°C

or



II 3 G Ex nA nC IIC T4

KEMA 10ATEX0075 X Ta: 0 - 55°C

The meaning of the marking is described at chapter "Kennzeichnung von Betriebsmitteln".

2.3 Serial number

The Beckhoff fieldbus components bear a serial number that is structured as follows:

CW YY SW HW

Key:

CW: Calendar week of manufacture

YY: Year of manufacture

SW: Software version

HW: Hardware version

Example: Serial number 29 10 02 01

Calendar week: 29

Year: 2010

Software version: 02

Hardware version: 01

2.4 Terminal Specific Documentation

Pay attention to the terminal specific documentation for installation, parameterizing and programming that is available in the download area of the Beckhoff homepage <http://www.beckhoff.com>.

3 Basic principles of explosion protection

3.1 Why explosion protection?

The basis of an explosion is the presence of all three of the following factors:

- flammable material in a finely distributed form
- oxygen
- and an ignition source


An explosion can no longer take place if any one of these factors is absent.

Dealing with gases, dusts, vapors and mists is part of everyday work in many branches of industry, for example in the petrochemical industry or in mills. In other areas these flammable materials are produced directly during processing. Explosions can occur anywhere there due to the surrounding air and an ignition source.

Primary and **secondary** explosion protection measures have been developed in order to prevent explosions and the resulting injuries to people and damage to materials and environment. Primary protective measures are aimed at maintaining the surrounding atmosphere in a state incapable of explosion, while secondary protective measures are intended to prevent the ignition of such an atmosphere. Secondary explosion protection is used whenever a danger of explosion cannot be excluded despite primary protection.

Differentiation of the protective measures

Primary explosion protection	Secondary explosion protection
Measures that prevent or limit the formation of explosive atmospheres Avoidance of flammable materials in an explosive form Rendering inert (displacement of oxygen)	Measures that prevent the ignition of the explosive atmosphere Avoidance or enclosure of the ignition source

 WARNING	<p>Observe the relevant standards and directives!</p> <p>This chapter serves only as an introduction to “secondary explosion protection” and does not claim to be complete. Therefore, knowledge of the contents of this document does NOT relieve you from your duty to study all standards and directives relevant to the use of electrical equipment in potentially explosive atmospheres.</p>
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In the ATEX directive 94/9/EC, the European Community has created the basis for binding uniform property requirements with regard to the protection of systems, equipment and components against explosion, which apply to use in Europe. The application of the directive 94/9/EC for explosion-protected applications has been compulsory in the European Union since 1 July 2003.

Furthermore, this chapter serves as reference for the decoding of device markings.

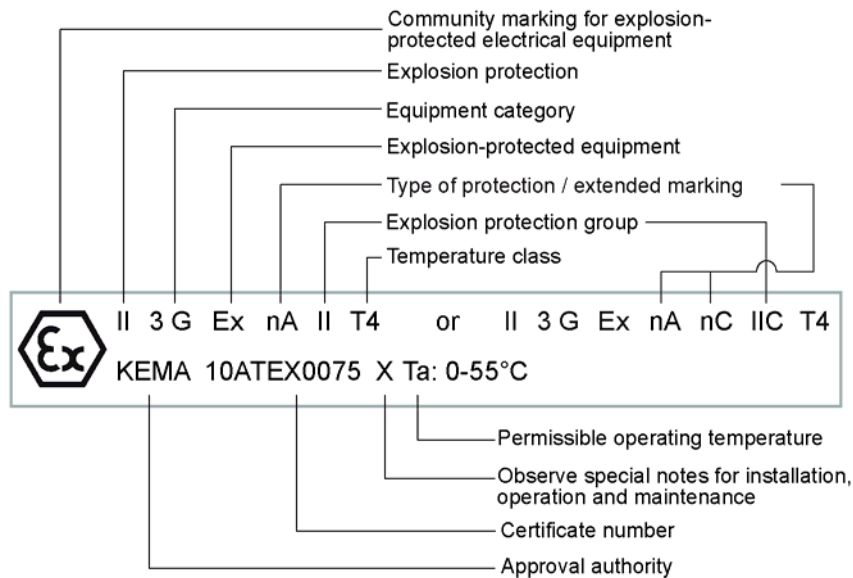
3.2 Components from Beckhoff

The marked components from Beckhoff Automation GmbH fulfill the requirements of the ATEX directive 94/9/EC for the use of equipment as intended in Zone 2 areas at risk of gas explosions. The fundamental health and safety requirements are fulfilled by compliance with the following standards:

- EN 60079-0 Explosive atmosphere – Part 0: Equipment – general requirements
- EN 60079-15 Explosive atmosphere – Part 15: Equipment protection by type of protection “n”

3.3 Marking of equipment

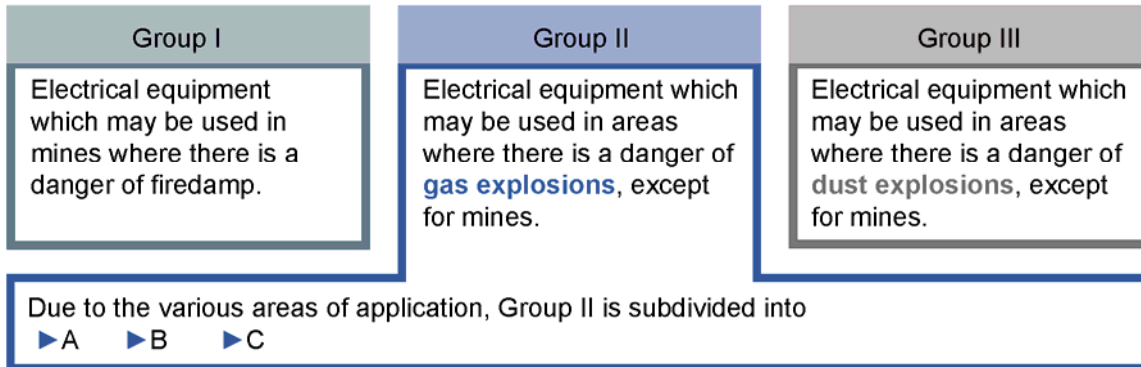
The areas where the equipment may be used, the constructive safety level to which the equipment is certified and the material group in which the equipment may be used must be recognizable on the basis of adequate marking of the equipment. The following illustration shows the marking of equipment for zone 2. The individual elements of the marking are explained in the remainder of this document.



3.4 Classification of electrical equipment into protection groups

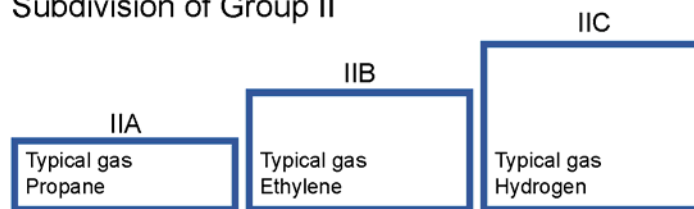
The usability of electrical equipment in potentially explosive atmospheres is classified into three groups:

Explosion protection groups



This subdivision is graded in accordance with the properties of the explosive atmosphere in which the equipment is used and is based on the minimum ignition current ratio of representative gases.

Subdivision of Group II



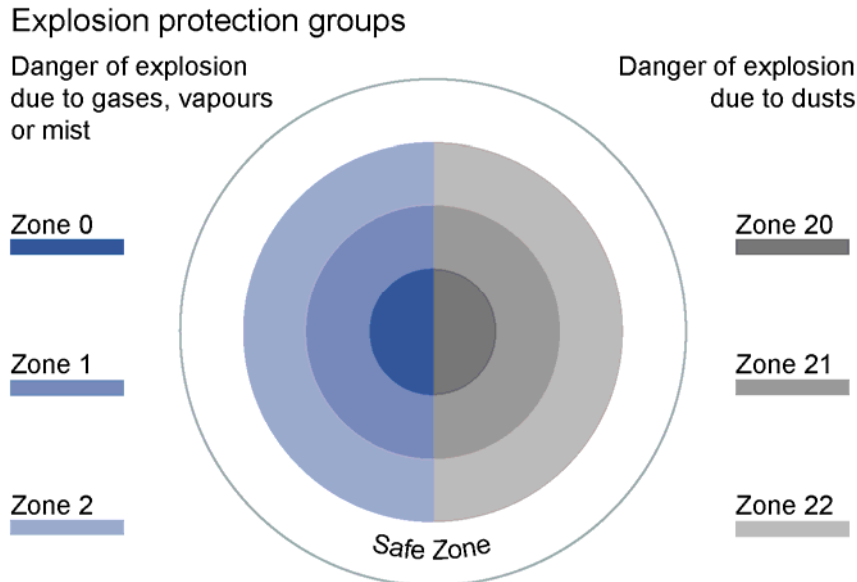
Equipment from higher groups is suitable for use in lower groups.

Group IIC is based on the maximum explosiveness of an inflammable atmosphere.

The lowest classification is group IIA (typical gas: propane) with a high minimum ignition current ratio, while elements of the group IIB possess a moderate minimum ignition current ratio. The highest category IIC covers highly explosive atmospheres with a low minimum ignition current ratio and offers the maximum protection against ignition.

3.5 Classification of surrounding atmosphere into zones

Potentially explosive areas must be classified into zones in which the atmosphere (in the case of potential danger) can become explosive.



This classification takes into account the various dangers due to explosive atmospheres according to the probabilities and enables the implementation of explosion protection with regard to the boundary conditions for safety and economy.

Potentially explosive areas

Zone 0	An atmosphere where a mixture of air and flammable substances in the form of gas, vapor or mist is present frequently, continuously or for long periods.
Zone 1	An atmosphere where a mixture of air and flammable substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally.
Zone 2	An atmosphere where a mixture of air and flammable substances in the form of gas, vapor or mist is not likely to occur in normal operation but, if it does occur, will persist for only a short period.
Zone 20	An atmosphere where a cloud of combustible dust in the air is present frequently, continuously or for long periods.
Zone 21	An atmosphere where a cloud of combustible dust in the air is likely to occur in normal operation occasionally.
Zone 22	An atmosphere where a cloud of combustible dust in the air is not likely to occur in normal operation but, if it does occur, will persist for only a short period.

3.6 Usability of electrical equipment

3.6.1 Equipment category

The use of electrical equipment depends on the protection group and the surrounding atmosphere in which the equipment is used. The corresponding equipment categories are listed in the table below.

Protection group	Area	Equipment category
I	–	I M1 Operation in case of explosion risk
	–	I M2 or I M1 Shutdown in case of explosion risk
II	Zone 0	II 1G
	Zone 1	II 2G or II 1G
	Zone 2	II 3G or II 2G or II 1G
III	Zone 20	III 1D
	Zone 21	III 2D or III 1D
	Zone 22	III 3D or III 2D or III 1D

3.6.2 Types of protection for electrical equipment

Types of protection are equipment measures that fall under the category of secondary explosion protection, since they are intended to prevent the ignition of the explosive atmosphere. Apart from the equipment category, the type of protection is also relevant for the determination of the usability.

There are various types of protection with different protection concepts. This document deals exclusively with the type of protection “n” according to EN 60079-15. It defines the operation of electrical equipment in potentially explosive atmospheres with the type of protection “n” as follows:

During normal operation and under defined abnormal conditions, electrical equipment with this type of protection is not capable of igniting the surrounding explosive atmosphere.







Type of protection “n”

nA	Non-sparking equipment
nC	Installations and components
nR	Vapour-proof housing

3.6.3 Temperature class

The temperature class is also relevant to the determination of usability. The temperature of a heated surface is decisive for classification into the appropriate temperature class. The rule is that the next higher temperature class includes all lower classes.

Surface temperatures | gas explosion protection

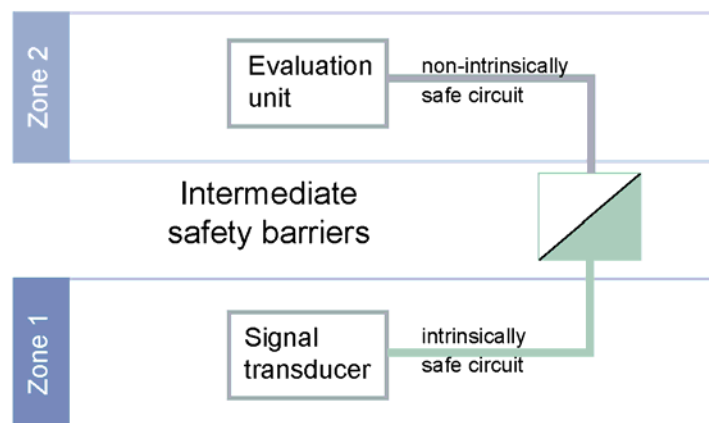
Temperature class	Ignition temperature [°C]	Max. surface temperature [°C]
T1 	> 450	450
T2 	> 300 to ≤ 450	300
T3 	> 200 to ≤ 300	200
T4 	> 135 to ≤ 200	135
T5 	> 100 to ≤ 135	100
T6 	> 85 to ≤ 100	85

3.7 Safety barriers – cross-zone circuits

The connection of signal transducers (sensors) from zone 0 and 1 to evaluation units (fieldbus devices) from zone 2 is subject to special conditions, which are coarsely outlined here. Only intrinsically safe circuits may be used in zones 0 and 1.

A circuit is considered to be intrinsically safe if neither a spark nor a thermal effect can cause the ignition of a certain explosive atmosphere. One of the most important measures when constructing intrinsically safe circuits is the safe isolation of all intrinsically safe circuits from non-intrinsically safe circuits.

If an intrinsically safe circuit from zone 0 or 1 is to be connected to a non-intrinsically safe device in zone 2, the circuit must be routed through a safety barrier. This ensures the adequate isolation of intrinsically safe and non-intrinsically safe circuits. The following illustration shows an exemplary arrangement.



4 Appendix

4.1 Beckhoff Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

4.1.1 Beckhoff branches and partner companies Beckhoff Support

Please contact your Beckhoff branch office or partner company for [local support and service](#) on Beckhoff products!

The contact addresses for your country can be found in the list of Beckhoff branches and partner companies: <http://www.beckhoff.com>. You will also find further [documentation](#) for Beckhoff components there.

4.1.2 Beckhoff company headquarters

Beckhoff Automation GmbH
Eiserstr. 5
33415 Verl
Germany

Phone: + 49 (0) 5246/963-0
Fax: + 49 (0) 5246/963-198
E-mail: info@beckhoff.com
Web: <http://www.beckhoff.com>

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Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

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- design, programming and commissioning of complex automation systems
- and extensive training program for Beckhoff system components

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E-mail: support@beckhoff.com

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- spare parts service
- hotline service

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