# Technical Information

Explosion Protection

TI 33Q01J30-01E

YOKOGAWA

Yokogawa Electric Corporation
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Tel.: 81-422-52-5634 Fax.: 81-422-52-9802

TI 33Q01J30-01E

6th Edition Dec. 2010 (YK)

Blank Page

# Introduction

This book describes explosion protection compliance of CENTUM 3000 and CENTUM VP (hereinafter referred to as CENTUM.) Some parts of this book will occupy the general explanation about explosion protections, but it mainly explains what explosion protection complied with CENTUM which is an integrated production control system, and what regulation it has.

The engineering practice of explosion protection is regulated by each country, and in principle, the wiring and the other methods for construction should be done in accordance with safety standards. When you implement the explosion protection system on the job, select the products as to comply with the standards of the country in which it is used, and the methods for construction should be researched.

Furthermore, this document contains the details of the NFM020-A13 and IFM035-A07 certificates that are included in the product documentation.

# Safety Precautions

## Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and to ensure safe operation, observe the safety precautions described in this user's manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Modification of the product is strictly prohibited.
- The following symbols are used in the product and user's manual to indicate there are safety precautions:

Indicates that caution is required for operation. This symbol is placed on the product where the user is advised to refer to this book in order to protect the operator and the equipment. This book describes precautions to avoid physical injury or death to the operator, including electrical shocks.

Identifies a protective grounding terminal. Before using the product, ground the terminal.

Identifies a functional grounding terminal. Before using the product, ground the terminal.



Indicates an AC power supply.



Indicates a DC power supply.



Indicates that the main switch is ON.

Indicates that the main switch is OFF.

## Symbols in this Book

This book has the following symbol.

**CAUTION**

Describes the considerations about the danger that the failure of handling causes the operators' life and body.

**IMPORTANT**

Identifies important information required to understand the operations or functions.

**TIP**

Identifies additional information.

**SEE ALSO**

Identifies a source to be referred to.

# Cautions for Safely Applying the Device

## Power Supply Wiring

**CAUTION**

The connection of power cables and the selection of power cables must be done in accordance with this book and the Installation Guidance, and implement so as to comply with the standards and laws about explosion protection in the country or the area where the cables are laid.

## Ground Wiring

**CAUTION**

You should implement so as to comply with the standards and laws about explosion protection in the country or the area where the cables are laid.

## Input/Output Wiring

**CAUTION**

The connection of input and output should be done in accordance with this book and the Installation Guidance, and implement so as to comply with the standards and laws about explosion protection in the country or the area where the cables are laid.

- Wiring material and equipment which is electrically connected to this equipment should be products that complied with standards and laws about explosion protection in the country or the area where the cables are laid.

## Replacement of fuse

**CAUTION**

- The specified fuse must be used to replacement.
- Before replacing fuse, confirm if there's no dangerous gas, and the power supply is OFF.

### Maintenance

**CAUTION**

- The maintenance work should be done only by operators who received special training.
- Use a vacuum cleaner and soft cloth to clean up the equipment.
- At the time of the maintenance work, put on wrist straps and take the measures for ESD (Electrostatic Discharge).
- If the label that indicates Danger is not legible, or if it has peeled off, order a new label using part number T9029BX.
- Before starting the maintenance work, confirm if there's no dangerous gas.

## Drawing Conventions

Some drawings depicted in the user's manual may be partially emphasized, simplified, or omitted for the convenience of description.

# Trademarks

## Trademarks

- CENTUM, Vnet/IP is a registered trademark of Yokogawa Electric Corporation.
- Ethernet is a registered trademark of XEROX Corporation.
- FOUNDATION of FOUNDATION fieldbus is a registered trademark of Fieldbus Foundation.
- All other company and product names mentioned in the text body are trademarks or registered trademarks of their respective companies.
- We do not use the TM or ® mark to indicate these trademarks or registered trademarks in this book.
- We do not use logos and logo marks in this manual.

# CENTUM
# Explosion Protection

TI 33Q01J30-01E 6th Edition

# CONTENTS

Blank Page

# 1. Overview of Explosion Protection

**This chapter provides the general explanation about explosion protection.**

## 1.1 Primary Explosion Protection and Secondary Explosion Protection

In order to prevent explosions and its danger, plants must have an effective explosion protection. To prevent explosions of plant, as a comprehensive countermeasure, the following steps must be taken.

(1) Step to prevent generating dangerous explosive atmospheres

(2) Step to prevent ignition to explosive atmospheres

(3) Step to limit the influence of explosion within the security area

Steps such as (1) are called Primary explosion protection, Steps such as (2), (3) are called Secondary explosion protection.

### Primary Explosion Protection

Primary explosion protection is a step to avoid the formation of potentially explosive atmospheres. It includes removing explosive gas and chemically changing explosive gas into non-explosive gas.

### Secondary Explosion Protection

Secondary explosion protection is a step to keep the influence of explosion to a minimum. In order to prevent the ignition, it pays attention to the electric circuit area of equipment in plant that may cause it. Moreover, if it happens, it prevents the propagation of the influence to the exterior.

CENTUM-compliant explosion protection products are for Secondary explosion protection. The following chapters in this book mostly describe Secondary explosion protection.

# 1.2 Explosion Protection Standards

## Explosion Protection Standard in Each Country

In regard to engineering practice for explosion protection, standards and rules are defined in each country. Explosion protection standards in each country including Japan are listed in the following table. IEC-compliant countries have the standard that complies with IEC, the international standard defined by International Electro-technical Commission. Although the United States and Canada have a standard that complies with IEC, they usually use IEC-non-compliant standard.

**Table Explosion Protection Standards**

| Explosion protection construction | IEC-compliant countries | | | | IEC-non-compliant countries (*2) | |
|---|---|---|---|---|---|---|
| | IEC international Standard (*5) | Europe CENELEC (*5) | Australia SA (*5) | Japan TIIS | U.S. FM (*3) (*5) | Canada CSA (*3) (*5) |
| Common | 60079-0 | EN 50014 | AS 2380.1 | (*6) | FM 3600 | C22.2 No.0<br>CAN/CSA-E79-0-95 |
| Flame-proof enclosures Type “d” | 60079-1 | EN 50018 | AS 2380.2 | (*6) | FM 3615 | C22.2 No.30<br>CAN/CSA-E79-1-95 |
| Pressurized apparatus Type “p” | 60079-2 | EN 50016 | AS 2380.4 | (*6) | FM 3620<br>- | NFPA496 (*4)<br>CAN/CSA-E79-2-95 |
| Increased safety Type “e” | 60079-7 | EN 50019 | AS 2380.6 | (*6) | - | -<br>CAN/CSA-E79-7-95 |
| Oil immersion Type “o” | 60079-6 | EN 50015 | (AS 1076P.9) | (*6) | -<br>ISA S12.26.01 | -<br>CAN/CSA-E79-6-95 |
| Intrinsic safety Type “i” | 60079-11 | EN 50020 | AS 2380.7 | (*6) | FM 3610<br>- | C22.2 No.157<br>CAN/CSA-E79-11-95 |
| Powder filling Type “q” | 60079-5 | EN 50017 | AS 2380.5 | (*6) | -<br>ISA S12.25.01 | -<br>CAN/CSA-E79-5-95 |
| Encapsulation Type “m” | 60079-18 | EN 50028 | AS 2431<br>AS 2380.3 | (*6) | -<br>ISA S12.23.01 | -<br>CAN/CSA-E79-18-95 |
| Type “n”(*1) | 60079-15 | EN 60079-15 | AS 2380.9<br>AS 2238 | - | IEC 79-15 | CAN/CSA-E79-15-95 |
| Special | - | UK (SFA3009) | AS 2380.8<br>AS 1826 | - | - | - |
| Non-Incendive | - | - | - | - | FM 3611 | C22.2 No.213<br>C22.2 No.157 |

*1: Type “n”.....IEC, Australia, etc.
Non-Incendive ....the United States, Canada
*2: In the classification of equipment, not in the classification of explosion protection structure, it may be the request of explosion protection.
*3: In regards to the United States and Canada, lower numbers in the cell are IEC-compliant standards.
*4: The internal pressure of Canada defined in T.I.L. No E-13A (TECHNICAL INFORMATION LETTER).
*5: IEC : International Electro-technical Commission (50 countries)
CENELEC: European Committee for Electrotechnical Standardization (18 countries, as of January 10, 1994)
SA: Standards Australia
CSA: Canadian Standards Association
FM: Factory Mutual Research Corporation etc.
*6: Electric machine apparatus explosion protection construction standards (1969, Labor Ministry Notice No. 16) or technical standards.

## ATEX Directive

In Europe, European Community (EC) directive 94/9/EG (March 23, 1994) was issued. This is a new directive about explosion protection in Europe. On all the EC countries, it puts an obligation to pay attention and assure the safety and health mainly for persons. This directive goes by the name of ATEX. As one of the CE marking adaptation directive, it has been compulsory since July 2003. ATEX means “Atmospheres Explosibles” in French, and “Potentially Explosive Atmospheres” in English.

The target of this regulation is also the usage of equipments that are used at hazardous area, and the explosion protection electric equipments/accident prevention systems that are used in potentially explosive atmospheres. Since July 1, 2003, in EC area, although the product complies with CENELEC explosion protection standard, in addition to this, it should comply with “ATEX directive” about CE marking, and should have a specific indication. Unless it complies with the directive, the explosion protection products are not allowed to be launched on the market in EU countries. In order to comply with this directive, EN standard is undergoing revisions.

# 1.3 Classification of Explosion Protection Equipment

Explosion protection equipment is classified as follows:

- Classification by to explosion protection constructions: what kind of method is taken for explosion protection?
- Classification by hazardous area and explosive gas: in what kind of environment are they used?

## Classification by Explosion Protection Constructions

Type of explosion protection constructions are listed in the following table.

**Table Type of explosion protection constructions**

| Type of explosion protection constructions | Abbreviation of standard |
|---|---|
| Flame-proof enclosures | Type “d” |
| Pressurized apparatus | Type “p” |
| Increased safety | Type “e” |
| Oil immersion | Type “o” |
| Intrinsic safety | Type “i” |
| Powder filling | Type “q” |
| Encapsulation | Type “m” |
| Type of protection “n” | Type “n” |
| Non-Incendive | - |

Classified roughly, explosion protection constructions include 4 types of the principle as below.

(1) It isolates the potentially explosive atmospheres from the place where sparks and high temperature arise and prevents explosions. The constructions based on this principle include Pressurized apparatus, Oil immersion, and Encapsulation.

(2) It keeps an explosion within the enclosure, if it is induced there. The constructions based on this principle include Flame-proof enclosures.

(3) Even if sparks and heat is caused by an electric accident at the normal operation, it prevents ignitions of potentially explosive atmospheres. The constructions based on this principle include Increased safety, Type of protection “n”, Non-Incendive.

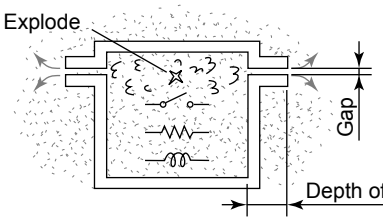
(4) If an electric accident such as short-circuit, ground fault, and burnout occurs, it doesn’t ignite potentially explosive atmospheres, because of the system which the specific intrinsic safety circuit is installed in. The constructions based on this principle include Intrinsic safety. Intrinsic safety construction has the ia equipment and the ib equipment. The ia equipment maintains its performance of explosion protection even if it has two defects, it is able to react Zone 0 (Division 1). The ib equipment maintains its performance of explosion protection even if it has one defect, it is able to react Zone 1 (Division 1).

# Definition and Comparison of Explosion Protection Construction

## Flame-proof Enclosures (Type “d”)

1) Definition: “Flame-proof enclosures” is totally enclosed construction. When gas or vapor get into the enclosure and an explosion take place, the enclosure withstands the pressure of explosion and prevents the ignition of explosion fire to gas and vapor surrounding the enclosure.

2) Construction




* Even if explosion occurs inside the container, the enclosure withstands it.
* No ignition occurs outside even if explosion occurs inside the container.
* It restricts the surface temperature of the enclosure.

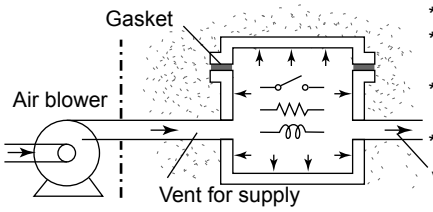
F010301.AI

**Figure Flame-proof Enclosures (Type “d”)**

## Pressurized Apparatus (Type “p”)

1) Definition: “Pressurized apparatus” supplied protective gas such as air, nitrogen, and carbon dioxide into the enclosure, so that gas or vapor doesn’t get into the enclosure.

2) Construction




* It increases the internal pressure of the enclosure.
* Protective gas is filled in the container before turning the power on.
* It shuts off the power, when the internal pressure decreases.
* It restricts the surface temperature of the enclosure.

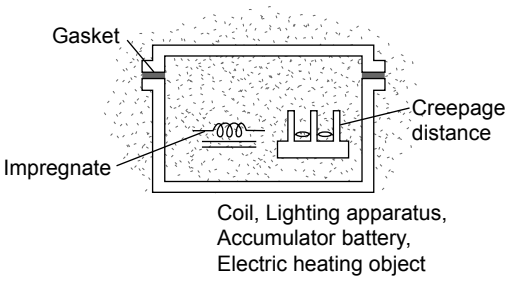
F010302.ai

**Figure Pressurized Apparatus (Type “p”)**

## Increased Safety (Type “e”)

1) Definition: When a part of electric machine and apparatus (except insulating parts), which has no possibility of the creation of sparks or arc, is under normal operation and turned on electricity, “Increased safety” increases the insulation performance and the level of safety for danger of the unacceptable high temperature and the external damage.

2) Construction




* Measures to increase the level of safety so as not to spark.
  • Coil is impregnated.
  • Wires are connected so as not to slip.
  • Creepage distance/insulation distance is kept.
  • Tracking property of insulating material.
* It restricts the surface temperature of the coil, etc.
* An enclosure catching no dust is used (IP54/IP44).

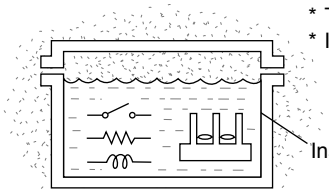
F010303.ai

**Figure Increased Safety (Type “e”)**

## Oil Immersion (Type “o”)

1) Definition: “Oil immersion” is an explosion protection construction that a part of electric machine and apparatus, which may create sparks or arcs and may become an ignition source by unacceptable high temperature, is immersed in insulating oil, so as not to ignite to gas or vapor.

2) Construction




* The electric circuit immersed in insulating oil.
* It restricts the surface temperature of enclosure and oil.

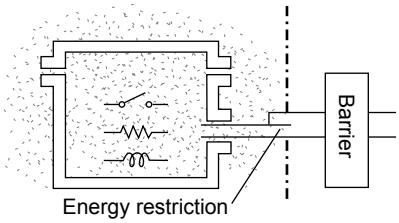
F010304.ai

**Figure Oil Immersion (Type “o”)**

## Intrinsic Safety (Type “i”)

1) Definition: “Intrinsic safety” is the explosion protection construction confirmed that the sparks, arcs or heat, which the component part of the electric machine and apparatus create, have no possibility of ignition to gas or vapor, by the spark ignition test and so on.

2) Construction




* It has no ignition to gas, even if it's under abnormal situation.
  • It restricts the electric energy.
  • Creepage distance/insulation distance is kept.
  • It restricts the surface temperature of electric component and so on.
* A barrier is necessary.
* IP22 enclosure (technical standard)

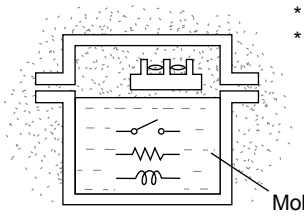
F010305.ai

**Figure Instrinsic Safety (Type “i”)**

## Encapsulation (Type “m”)

1) Definition: “Encapsulation” is the explosion protection construction that parts which may ignite potentially explosive atmospheres by heating are embedded in sealing compound, so that potentially explosive atmospheres cannot be ignited.

2) Construction




* The electric circuit is encapsulated by resin.
* It restricts the surface temperature of enclosure and resin.

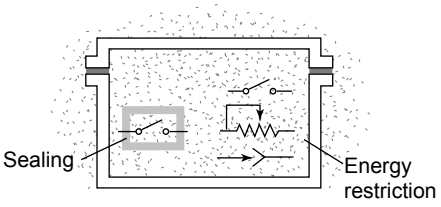
F010306.ai

**Figure Encapsulation (Type “m”)**

### Type of Protection “n” or Non-Incendive

1) Definition: “Type of protection “n” or Non-Incendive” is the special explosion protection construction for Zone 2 or Division 2. It is applicable to electric equipments which is not capable of igniting potentially explosive atmospheres under normal operation.

2) Construction




* Under normal operation, it restricts the electric sparks and so on.
  • It seals the component that creates sparks.
  • It restricts the energy that creates sparks.
  • Creepage distance/insulation distance is kept.
  • It restricts the surface temperature of electric component.
* The enclosure withstands the shock.
* The enclosure is sealed (BS standard).

F010307.ai

**Figure Types of Protection “n” or Non-Incendive**

## Classification by Hazardous Area and Explosive Gas

### Classification of Hazardous Area

In the plant which handle flammable gas or vapor, when they are emitted and mixed with air while at work, “potentially explosive atmospheres” are generated. The area that has a risk of explosion is called “Hazardous area”.

Zone 0: potentially explosive atmospheres exist continuously or for a long time (at all time)

Zone 1: potentially explosive atmospheres may exist under normal operation of the plant and so on (sometime)

Zone 2: no potentially explosive atmospheres exist under normal operation of the plant and so on, or exist briefly if they do (at accidents only)

**Table Classification of Hazardous Area**

| Europe<br>Australia | U.S.<br>Canada | Explosion protection<br>approved equipment |
|---|---|---|
| Zone 0 | Division 1 | Intrinsic safety (ia) |
| Zone 1 | | Intrinsic safety (ia, ib)<br>Flame-proof enclosures, Increased safety<br>Pressurized apparatus, Oil immersion |
| Zone 2 | Division 2 | Intrinsic safety (ia, ib)<br>Flame-proof enclosures, Increased safety<br>Pressurized apparatus, Oil immersion<br>Type of protection “n”<br>Non-Incendive |

## Classification of Explosive Gas

Classification of Explosive gas (vapor) involves a division by explosion intensity and a division by explosion energy. Classifications in the technical standard, IEC, and CENELEC are listed in the following table.

**Table Classification of Explosive Gas**

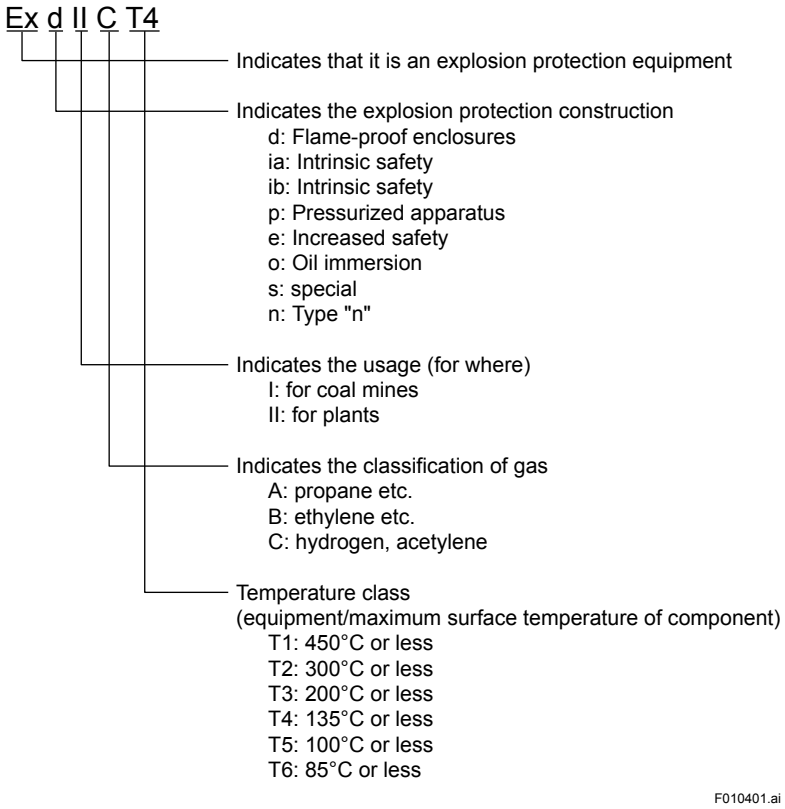
| Classification | Flame-proof enclosures | Intrinsic safety | Major gas |
|---|---|---|---|
| | Maximum gap in mm where the fire runs, when the depth of joint surface is set to 25 mm | Minimum ignition current ratio of the target gas, when the minimum ignition current of methane, which is calculated by spark ignition test equipment, is assigned 1 | |
| **A** | 0.9 or more | More than 0.8 | Propane, Methane |
| **B** | More than 0.5, 0.9 or less | 0.45 or more, 0.8 or less | Ethylene |
| **C** | 0.5 or less | Less than 0.45 | Hydrogen, Acetylene |

The United States and Canada have another classification.

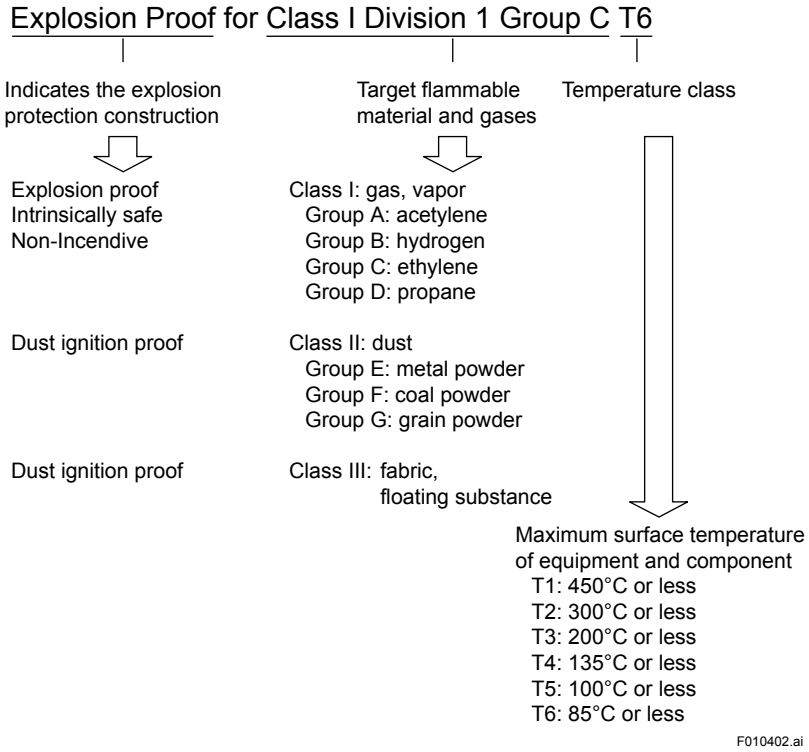
# 1.4 Symbols That Indicate Specifications of Explosion Protection

Each country has its own symbols. The following is an example of symbols.

## Europe, Australia, IEC



# The United States, Canada



# 2. CENTUM and Explosion Protection Instrumentation

## 2.1 Explosion Protection Standards that CENTUM has Acquired

There are various standards for explosion protection in each region. Therefore, when equipment tries to be used in a certain region, the equipment needs to be an approved product with explosion protection standards adopted in the region. CENTUM, a global product, has complied the standards adopted in North America and Europe.

The table below lists the explosion protection standards that CENTUM complies and their approval authorities. As shown in the table, RIO equipment has acquired CSA standard regarding Non-Incendive and can be installed in Zone 2 or Division 2 hazardous areas. This chapter mainly describes the explosion protection compliance of FIO equipment. See Appendix for the explosion protection compliance of RIO equipment.

**Table Explosion Protection Standards that CENTUM Complies**

| Explosion protection construction | Conformed standard number | Testing authorities | Appropriate equipment |
|---|---|---|---|
| CSA Non-Incendive | CSA C22.2 No. 157<br>and No. 213 | CSA | FIO (Field network I/O), RIO (Remote I/O) and associated equipment |
| FM Non-Incendive | FM 3600:1998<br>FM 3611:2004<br>FM 3810:2005 | FM | FCU (Field Control Unit), FIO and associated equipment<br>Module with built-in barrier (FIO) |
| Type “n” | EN 60079-15:2005<br>IEC 60079-0:2004<br>IEC 60079-11:1999<br>(for 24 V DC power supply) | Self-declaration | FIO and associated equipment |
| | EN 50021:1999<br>(for 24 V DC power supply) | | Module with built-in barrier (FIO) |
| Type “i”<br>(intrinsic safety explosion protection) | EN 50014:1997 + A1 + A2<br>EN 50020:1994 | PTB | Module with built-in barrier (FIO) |
| FM intrinsic safe explosion protection | FM 3600:1998<br>FM 3610:1999<br>ANSI/ISA-12.12.02:2003 | FM | Module with built-in barrier (FIO) |

# 2.2 Explosion Protection Construction that I/O Devices of CENTUM Comply

As described in 2.1, countries define their own standards and rules regarding technical methods for explosion protection. With CENTUM, NI, Type “n” and intrinsic safety explosion protection are adopted as explosion protection construction for the installation of remote nodes in hazardous areas. The adoption of NI and Type “n” with FIO devices of CENTUM allows remote nodes to be installed in Class II hazardous area (Division 2, Zone 2) which covers most hazardous areas. This provides more variety of instrumentation. In addition, it makes possible to connect to field devices installed in Class II area without special wiring construction or barriers. (There are some restrictions.)

Module with built-in barrier of FIO are equipment compliant with intrinsic safety explosion protection and are the modules that can be connected to the devices installed in Zone 0, Zone 1 and Zone 2 (Division 1, Division 2).

To install remote nodes in a hazardous area, the node itself and the terminal board as well as the I/O modules should acquire standards. The figure bellow shows one example of Type “n” standard compliant devices. The devices shown in half-tone dot meshing and the cables shown in heavy line are Type “n” acquired products. The same is with NI compliant devices. Remote nodes can be installed in Zone 2 (Division 2). See “5.2 List of Type “n” Compliant Products and Type “n” Parameters” for the list of intrinsic safety explosion protection compliant devices.

See the tables in Appendix for details of each CENTUM equipment and their approved standards.

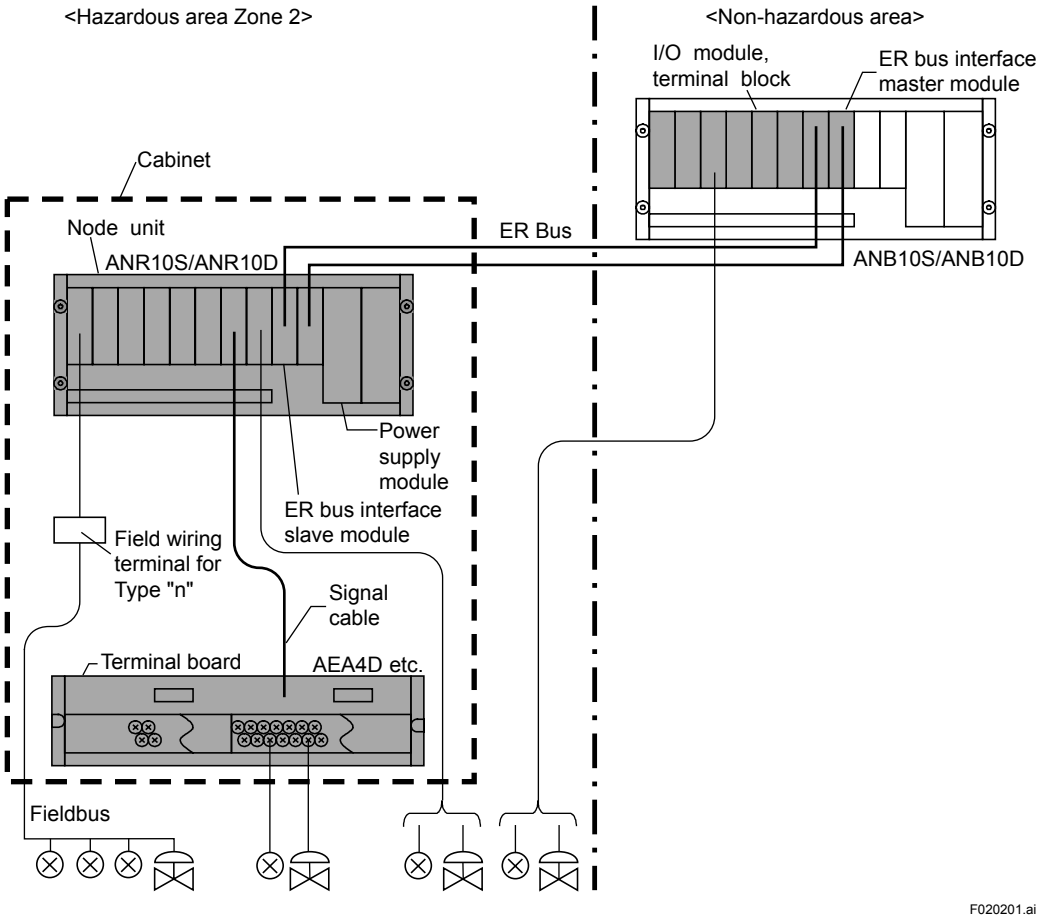



**Figure Example of Type “n” Standard Compliant Devices**

When the Type “n” equipment is connected, energy exchange between them may affect the properties of Type “n”. Therefore, to ensure the properties, it is necessary to compare parameters among connected equipment in advance. With the results, it is necessary to evaluate whether general wiring can do connection in a hazardous area or dedicated wiring will be needed. To compare parameters, it is required to display parameters on Type “n” equipment.

# 2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area

This section describes the overview of connecting CENTUM to the devices installed in a hazardous area by giving some examples.

## Overview of Connecting a Module with Built-in Barrier (Equipment Compliant with Intrinsic Safety Explosion Protection) with Devices

### Overview of Connecting a Module with Built-in Barrier (Compliant with CENELEC Standard)

A module with built-in barrier can be connected to the devices installed in Zone 0, Zone 1 and Zone 2. For connecting to the devices installed in Zone 0, Zone 1 or Zone 2, it is necessary to compare intrinsic safety parameters between the devices installed and the module with built-in barrier to evaluate whether connection is possible or not.

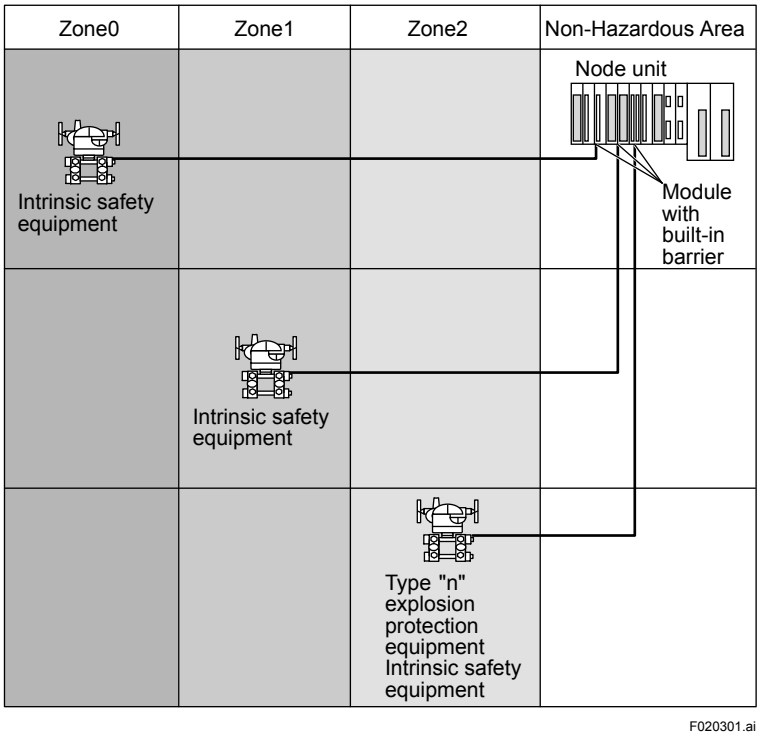



**Figure Connection of a Module with Built-in Barrier (Compliant with CENELEC Standard) (1)**

Module with built-in barrier itself can be installed in Zone 2.

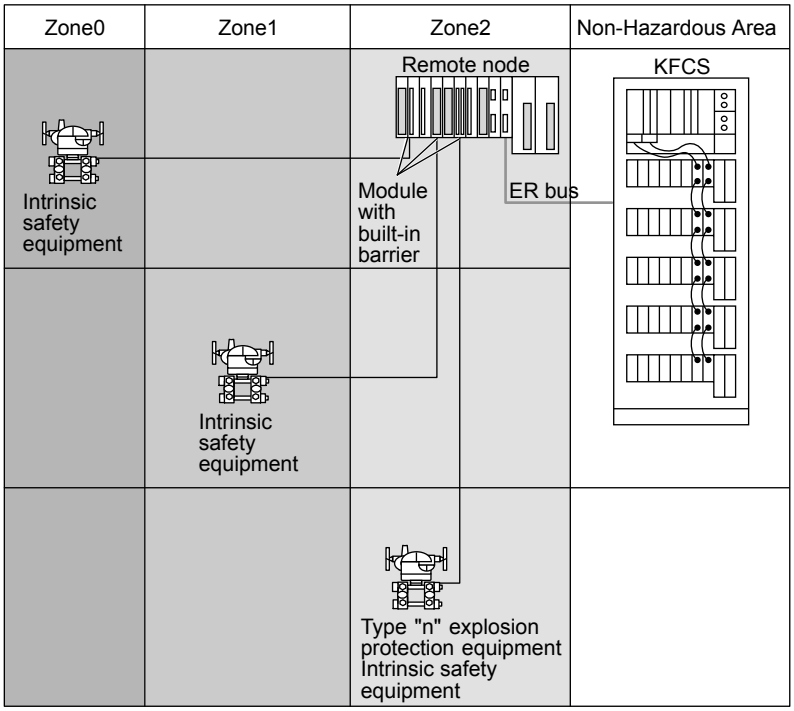



**Figure Connection of a Module with Built-in Barrier (Compliant with CENELEC Standard) (2)**

## Overview of Connecting a Module with Built-in Barrier (Compliant with FM Standard)

A module with built-in barrier can be connected to the devices installed in Division 1 and Division 2. For connecting to the devices installed in Division 1 or Division 2, it is necessary to compare intrinsic safety parameters between the devices installed and the module with built-in barrier to evaluate whether connection is possible or not.

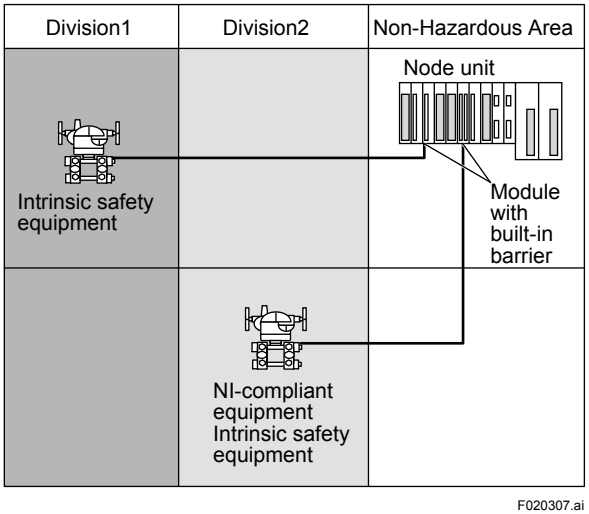



**Figure Connection of a Module with Built-in Barrier (Compliant with FM Standard) (1)**

Module with built-in barrier itself can be installed in Division 2.

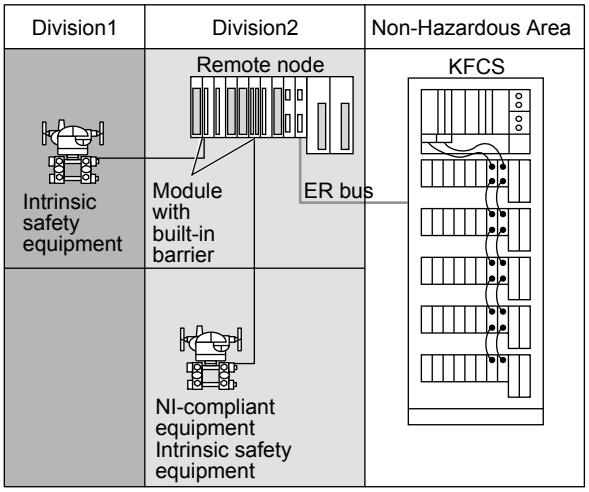


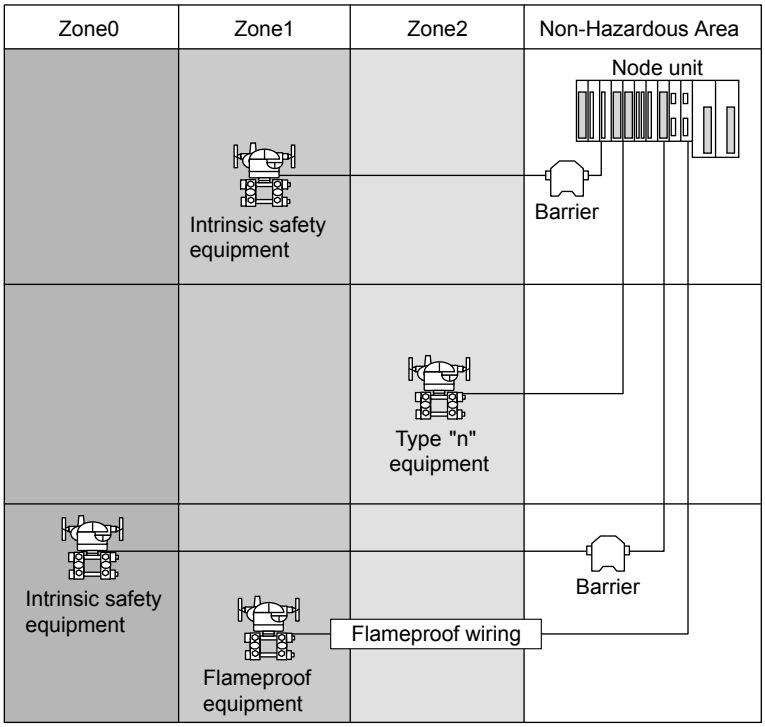

**Figure Connection of a Module with Built-in Barrier (Compliant with FM Standard) (2)**

## Overview of Connecting a Type “n”-compliant FIO Module with Devices

A Type “n”-compliant module can be directly connected with the devices installed in Zone 2 but cannot be connected with the devices installed in Zone 0 and Zone 1. Barrier is necessary to connect them.

For connecting with flameproof equipment, wiring construction is needed in accordance with installation specifications of the flameproof equipment. Flameproof wiring in the figure refers to cabling (with flameproof packing) or metal tube wiring (sealing fitting).

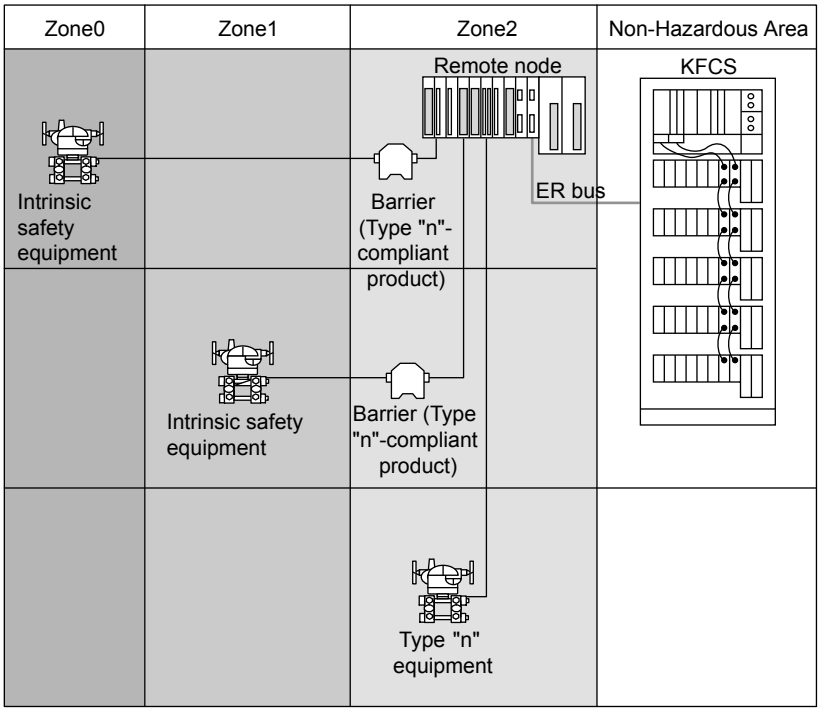
For connecting to a Type “n”-compliant module, it is necessary to compare parameters between the device installed in a hazardous area and the device of CENTUM to evaluate whether connection is possible or not. A Type “n”-compliant module and a remote node (24 V DC feeding type) can be installed in Zone 2 by mounting in a keyed metal cabinet with protection rating of IP54 or higher.




Flameproof wiring refers to cabling (with flameproof packing) or metal tube wiring (sealing fitting).
Wiring construction is needed in accordance with installation specifications of the flameproof equipment.

F020303.ai

**Figure Connection of a Type “n” Compliant Module (1)**



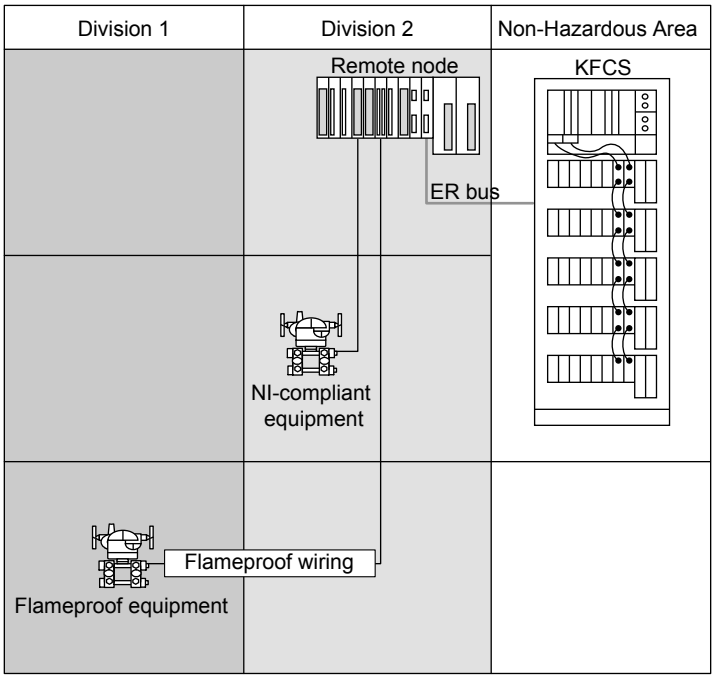

F020305.ai

**Figure Connection of a Type “n” Compliant Module (2)**

# Overview of Connecting Non-Incendive Compliant Module

NI-compliant module can be connected to the devices installed in Division 2. For the connection to an NI-compliant module, it is necessary to compare parameters between the device installed in a hazardous area and the device of CENTUM to evaluate whether connection is possible or not.

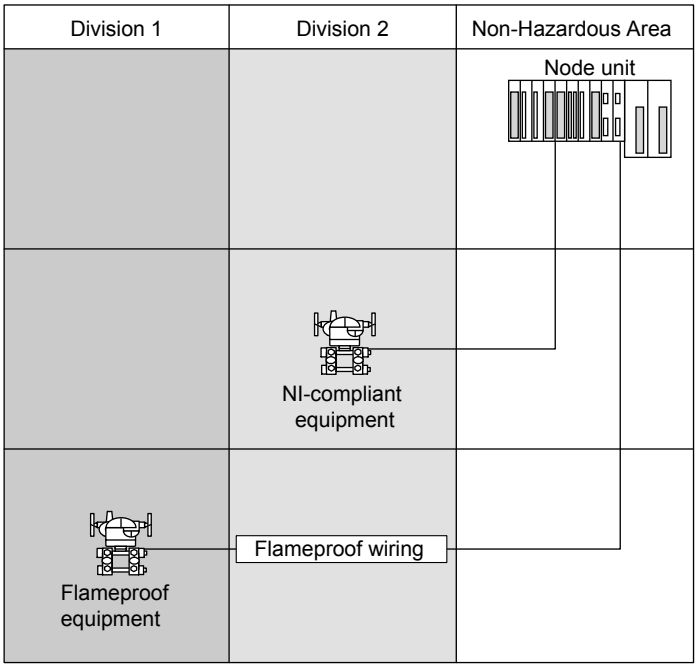
An NI-support module and a remote node can be installed in Division 2 by mounting in a keyed metal cabinet approved by approval authorities.




Flameproof wiring refers to cabling (with flameproof packing) or metal tube wiring (sealing fitting).
Wiring construction is needed in accordance with installation specifications of the flameproof equipment.

F020304.ai

**Figure Connection of an NI Compliant Module (1)**




Flameproof wiring refers to cabling (with flameproof packing) or metal tube wiring (sealing fitting).
Wiring construction is needed in accordance with installation specifications of the flameproof equipment.

F020306.ai

**Figure Connection of an NI Compliant Module (2)**

# 3. Explosion Protection Instrumentation in Zone 2/Division 2

## 3.1 Non-Incendive

Non-Incendive (hereafter described as NI), especially in North America, represents one of the explosion protection constructions for explosion-proof apparatus used in hazardous areas.

NI is a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation.

### 3.1.1 CSA NI (CSA Non-Incendive)

A node unit for FIO, an I/O module (FIO), node interface units for RIO and an I/O module (RIO), and an optic repeater of CENTUM have acquired CSA NI certificates of the following standards from CSA.

This approval proves that the products above can be used in hazardous areas such as Class I and Division 2(*1) and that the I/O module can be directly connected to an CSA NI approved field device installed in hazardous areas such as Class I and Division 2.

In addition, an I/O modules (FIO or RIO) installed in non-hazardous areas can be directly connected to an CSA NI approved field device installed in hazardous areas such as Class I and Division 2.

*1: Class I, Division 2
This places where gases or vapors do not form a potentially explosive atmosphere in a normal state, or even if so, the atmosphere exists for only a short time.

#### Approved Types and Standards

Class I, Division 2, Groups A, B, C and D temperature code T4

CSA Standard C22.2 No. 157-92

CSA Standard C22.2 No. 213-M1987

CSA Standard C22.2 No. 61010

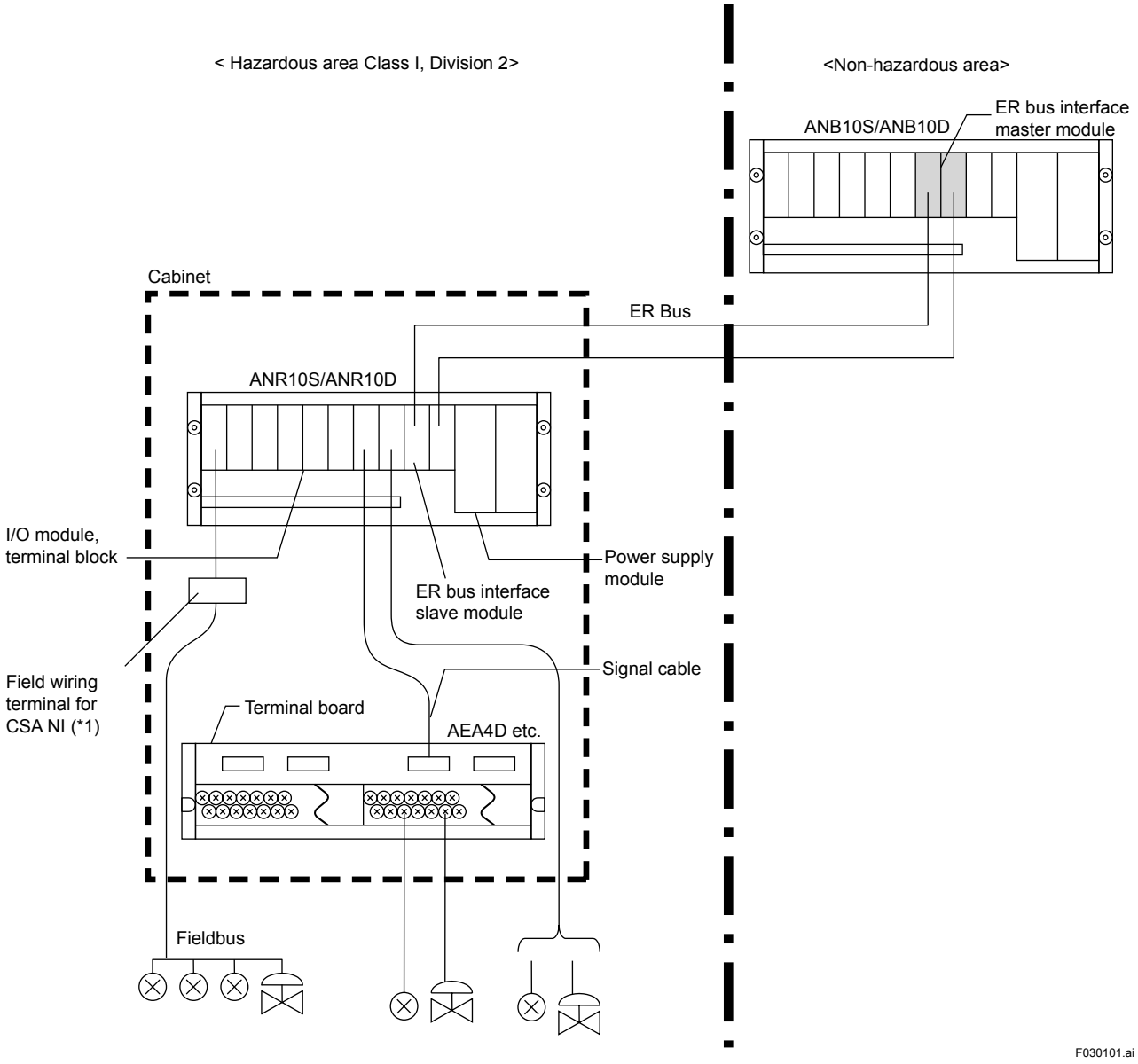
ISA Standard ISA-S12.12 1994

#### Precautions in Use

- To install a device in accordance with the standards above, the device needs to be accommodated in a keyed metal cabinet and installed. It is necessary to use a cabinet approved by CSA or local testing authorities for explosion-proof products.
- Use a cabinet which is larger than the size of W600 X H760 X D350 (mm) to mount a FIO node unit on.
- As a rule, NI explosion protection with a connection of a CSA standard approved device and an FM standard approved device shall not be approved. It is necessary to connect devices approved by the same standard.

# CSA NI Approved Products and Their Configuration Example

The figure below is an example of the configuration of CSA NI approved products which can be installed in hazardous areas. See the table “The List of CSA NI Compliant Products” in Appendix for details.




*1: Use a barrier for a fieldbus as a field wiring terminal for CSA NI. (Ex. barrier KLD2-PR-Ex1.IEC1)

**Figure Example of the configuration of CSA NI approved products**

## Power Supply Wiring

The power cable of a node unit for FIO, a node interface unit for RIO and an optic repeater must be wired from the non-hazardous area by using Division 2 wiring dedicated in potentially explosive atmospheres such as a threaded metal conduit. In addition, it is necessary to be wired not to apply stress at the end of the cable.

When AED5D is combined with ADV151, ADV161, ADV551 and ADV561, install an explosion-proof wiring defined in the relevant country for the wiring outside of the external power supply cable cabinet.

Wiring should be installed to conform to NEC (National Electrical Code: NFPA-70), CEC (Canadian Electrical Code) or the wiring construction standards in countries or regions where wiring will be installed.

## Signal Wiring

Cables other than power cables should be wired to conform to NEC (National Electrical Code: NFPA-70), CEC (Canadian Electrical Code) or the wiring construction standards in the countries or regions where wiring will be installed.

The following is special considerations.

- The cable (AKB332) connected to ADV141 and a field wiring need a Division 2 wiring dedicated in potentially explosive atmospheres such as a conduit wiring.
- When AAP135 is used in a power supply mode, the cable (KS1) connected to AAP135 and a field wiring need a conduit wiring.
- When a combination of ADV551 and AED5D or a combination of ADV561 and AED5D is used in a voltage output mode, a field wiring connected to AED5D need a Division 2 wiring dedicated in potentially explosive atmospheres such as a conduit wiring.
- For ALF111, use a barrier for a fieldbus as a field wiring terminal for NI. (Ex. Barrier KLD2-PR-Ex1.IEC1)
- Use DC power supply compliant with the Standard for Explosion Protection for combination of ADV151 and AED5D, or that of ADV161 and AED5D in contact input mode and voltage input mode. Connection according to the parameters of this power supply makes signal wiring outside of the cabinet compliant with the local standard. Please read the instruction on contact input mode wiring and the instruction on voltage input mode when you actually install wiring.

## Instruction on Contact Input Mode Wiring

When the number of channels is limited because power supply exceeds its capacity, but parallel connection for the purpose of increasing capacity is not allowed.
Mount ADV151, ADV161, AED5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

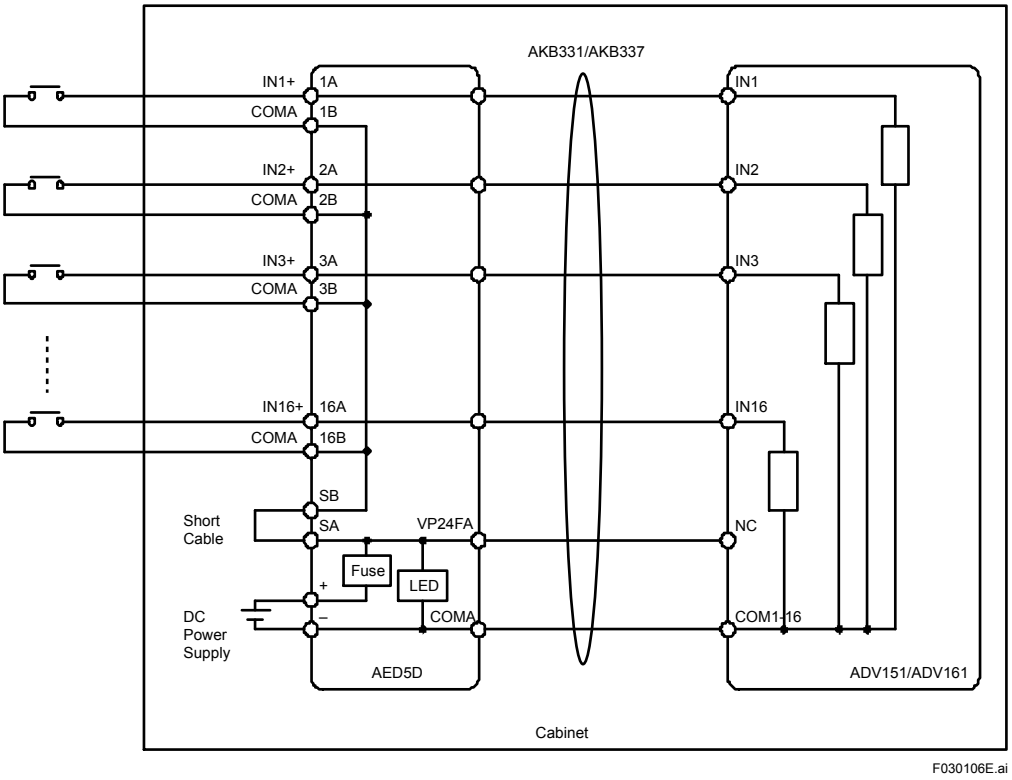



**Figure Connection example of ADV151/ADV161 Contact Input Mode**

## Instruction on Voltage Input Mode Wiring

The total current value of the channels must be within the rated current (limit) for DC power supply.
But if the total current value exceeds the rated current, reduce the number of channels to be supplied at on time, and prepare the same DC power supply for each channel group.
In such a case, the polarity of power sources should be the same.
Mount ADV151, ADV161, AED5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

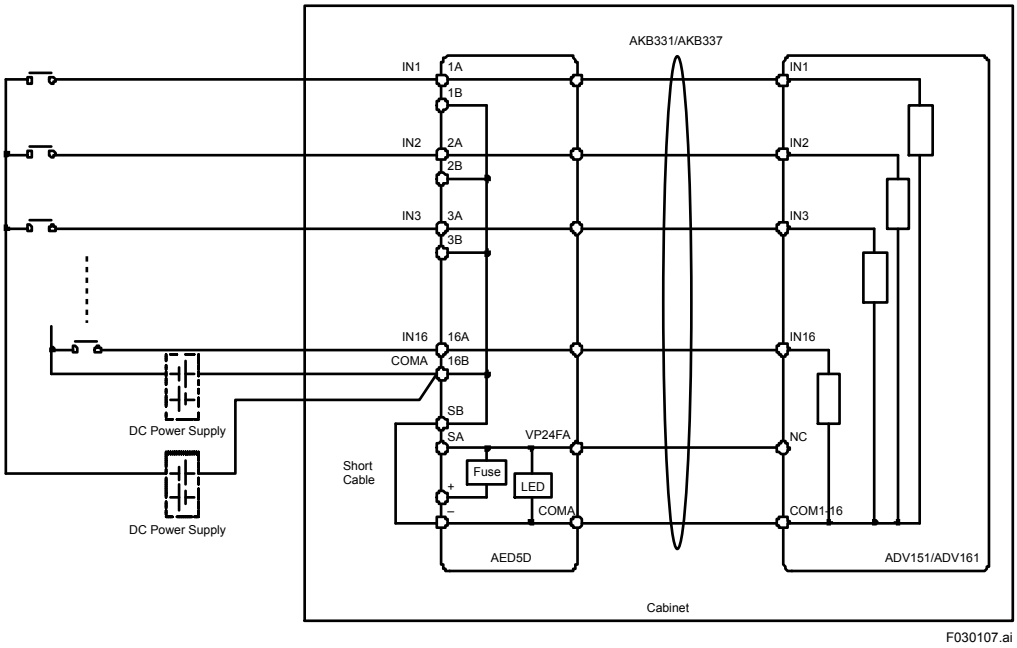



**Figure Connection example of ADV151/ADV161 Voltage Input Mode**

## IMPORTANT

(1) Attaching or removing a cable, a fuse or a card

With the system in operation, never attach or remove a cable, a fuse or a card in a potentially explosive atmosphere.

(2) Maintenance of a product

When maintenance of a product is carried out with the system in operation, never attach or remove the product in a potentially explosive atmosphere.

<English>

WARNING-EXPLOSIVE HAZARD-

DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

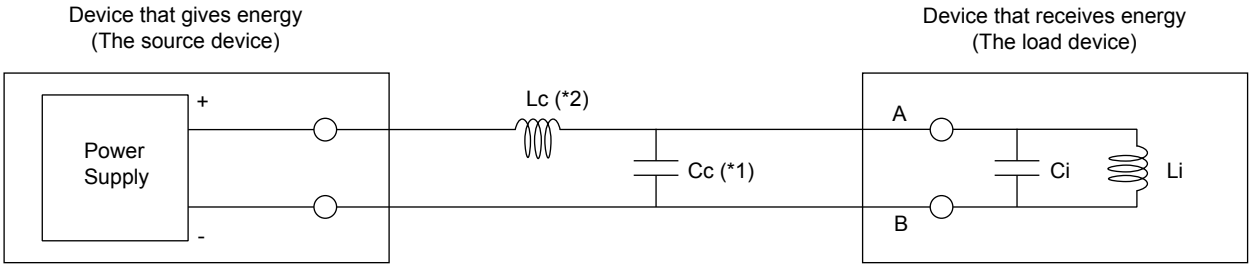
<French>

AVERTISSEMENT-RISQUE D'EXPLOSION. NEPAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, Á MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.

## Parameters in Connecting with CSA NI Devices

Energy transfer influences CSA NI properties. In order to maintain these properties, parameters must be displayed when CSA NI devices are connected.

To display parameters, CSA NI devices are divided into the device that gives energy and the device that receives energy. The parameters displayed in each device are as follows.




Displayed parameters
Voc: maximum open-circuit output voltage
Isc: maximum short-circuit output current
Ca: maximum allowable capacitance
La: maximum allowable inductance
Cn: maximum allowable capacitance (in a normal circuit voltage of Vn)
Vn: normal circuit voltage
Ln: maximum allowable inductance (in a normal circuit current of In)
In: normal circuit current

*1: Cc: capacitance of the external wiring
*2: Lc: inductance of the external wiring

Displayed parameters
Vmax: maximum input voltage
Imax: maximum input current
Ci: maximum internal capacitance
Li: maximum internal inductance

F030102E.ai

**Figure Connection of CSA NI Devices and Associated Parameters**

## Parameters of the Device which Gives Energy

Voc: maximum open-circuit output voltage
Maximum voltage that occurs at the open terminal (part) when the Non-Incendive (NI) circuit is open

Isc: maximum short-circuit output current
Maximum current which currents when the NI circuit is short and earth fault

Ca: maximum allowable capacitance
Maximum capacitance that can be connected to the NI circuit

La: maximum allowable inductance
Maximum inductance that can be connected to the NI circuit

Cn: maximum allowable capacitance (in a normal circuit voltage of Vn)
Maximum capacitance that can be connected in a normal circuit voltage of Vn ( the circuit current in a state where no opening circuit, short circuit, earth fault occur) in the NI circuit

Vn: normal circuit voltage
Circuit voltage in a state where no opening circuit, short circuit, earth fault occur

Ln: maximum allowable inductance (in a normal circuit current of In)
Maximum inductance which can be connected in a normal circuit voltage of In ( the circuit current in a state where no opening circuit, short circuit, earth fault occur) in the NI circuit

In: normal circuit current
Circuit current in a state where no opening circuit, short circuit, earth fault occur

Cc: capacitance of the external wiring

Lc: inductance of the external wiring

## Parameters of the Device which Receives Energy

Vmax: maximum input voltage
Maximum voltage that can maintenance the NI properties of the device

Imax: maximum input current
Maximum current that can maintenance the properties of the device

Ci: maximum internal capacitance
Maximum internal capacitance of the device that can be considered to conduct to the NI circuit (the external wiring) when the device is connected to the NI circuit (the external wiring)

Li: maximum internal inductance
Maximum internal inductance of the device that can be considered to conduct to the NI circuit (the external wiring) when the device is connected to the NI circuit (the external wiring)

## How to Compare Parameters

It is necessary to compare both parameters of the CENTUM I/O module and the CSA NI device when they are connected.

Comparing parameters between the device which gives energy and the device which receives energy are connected are the following two ways.

In either way to compare, wiring construction should be installed to conform to NEC (National Electrical Code) or the wiring construction standards in the local regions where wiring will be installed.

### Installing a Field Wiring in Accordance in a Division 2 Dedicated Wiring Construction

| Device that gives energy | | Device that receives energy |
|---|---|---|
| Vn | ≤ | Vmax |
| In | ≤ | Imax |
| Cn | ≥ | summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring |
| Ln | ≥ | summation of Li in the device which receives energy + summation of inductance Lc in the external wiring |

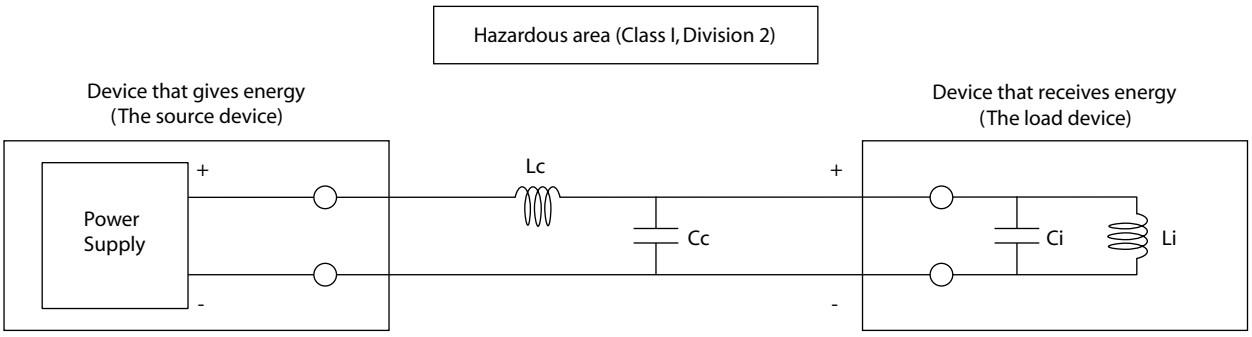
### Installing a Field Wiring in Accordance in a General Wiring Construction

| Device that gives energy | | Device that receives energy |
|---|---|---|
| Voc | ≤ | Vmax |
| Isc | ≤ | Imax |
| Ca | ≥ | summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring |
| La | ≥ | summation of Li in the device which receives energy + summation of inductance Lc in the external wiring |

## Example

We discuss the case where AAI141 of CENTUM I/O module, a power input module and EJA, a differential pressure transmitter of Yokogawa Electric Corporation are connected.

EJA is connected to the circuit of AAI141 via a 100m cable, and installed in a hazardous area of Class I, Division 2.




<CS 3000 AAI141> <Differential pressure transmitter EJA>

The defined parameters have the following values.

(Voc) = 27.6 V
(Isc) = 27 mA
(Ca) = 0.19 mF
(La) = 2.7 mH
(Cn) = 0.19 mF at (Vn) = 27.6 V
(Ln) = 100 mH at (In) = 24.0 mA
and,
(Cc) = 200 pF/m X 100 m = 0.0002 mF X 100 = 0.02 mF
(Lc) = 0.66 mH/m X 100 m = 0.00066 mH X 100 = 0.066 mH

(Vmax) = 30 V
(Imax) = 165 mA
(Ci) = 0.0225 mF
(Li) = 0.73 mH

therefore,

| | | |
|---|---|---|
| Voc = 27.6 V | < | Vmax = 30 V |
| Isc = 27.0 mA | < | Imax = 165 mA |
| Ca = 0.19 mF | > | Ci + Cc = 0.0425 mF |
| La = 2.7 mH | > | Li + Lc =0.796 mH |

The results above meet the combinational conditions. It can be judged that a field wiring can be installed in accordance with a general wiring construction.

F030103.ai

**Figure Connection of AAI141 and EJA**

# Example of a Connection

## Connecting a Directly Connected Node and a Device Installed in Division 2

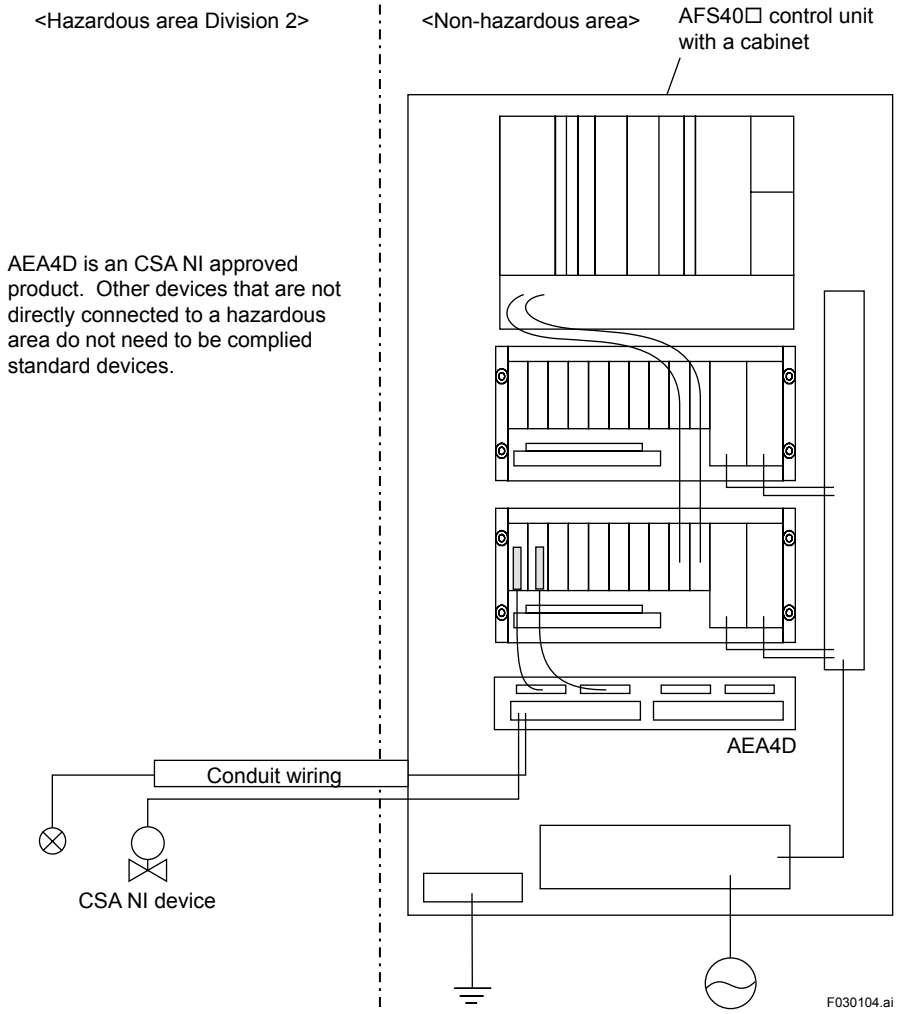



**Figure Connecting a Directly Connected Node and a Device Installed in Division 2**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (threaded conduit wiring) defined in NEC (National Electrical Code: NFPA-70), CEC (Canadian Electrical Code) or in each country.

## Installing a Remote Node in Division 2

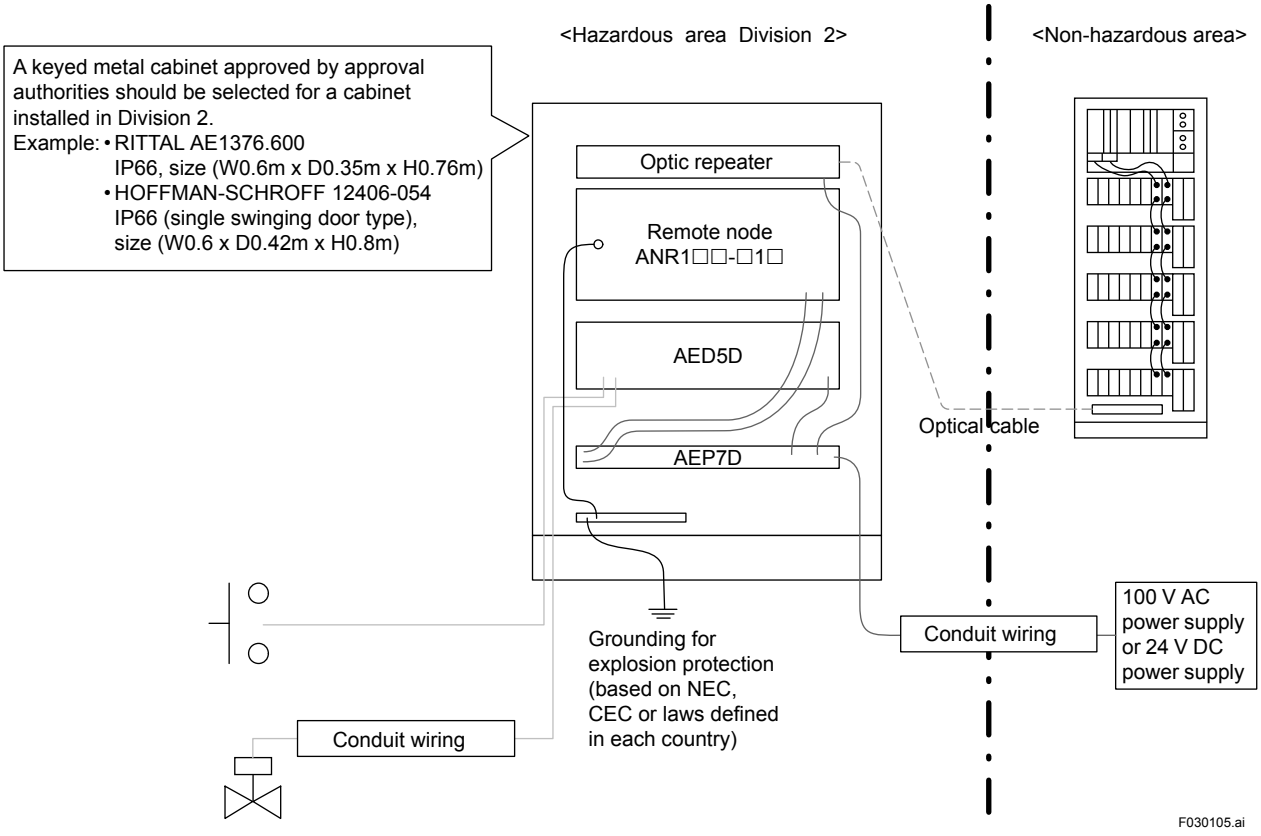



**Figure Installing a Remote Node in Division 2**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (threaded conduit wiring) defined in NEC (National Electrical Code: NFPA-70), CEC (Canadian Electrical Code) or in each country.
- Use optical repeater (Network Devices) which can be installed in a hazardous area in Division 2.

## 3.1.2 FM NI (FM Non-Incendive)

A Field Control Unit (for Vnet/IP), a node unit for FIO and an I/O module of CENTUM have acquired NI of Factory Mutual (FM) safety certification.

This approval permit that the products above can be used in hazardous areas such as Class I and Division 2 and that the I/O module can be directly connected to an FM NI approved field device installed in hazardous areas such as Class I and Division 2.

In addition, an I/O modules installed in non-hazardous areas can be directly connected to an FM NI approved field device installed in hazardous areas such as Class I and Division 2.

### Complied Standards

Class I, Division 2, Groups A, B, C and D, Temperature Code T4

FM Class Number 3600 : 1998

FM Class Number 3611 : 2004

FM Class Number 3810 : 2005

# FM NI Approved Products and Their Configuration Example

The figure below is an example of the configuration of FM NI approved products that can be installed in hazardous areas. See the table “The List of FM NI Compliant Products” in Appendix for details.

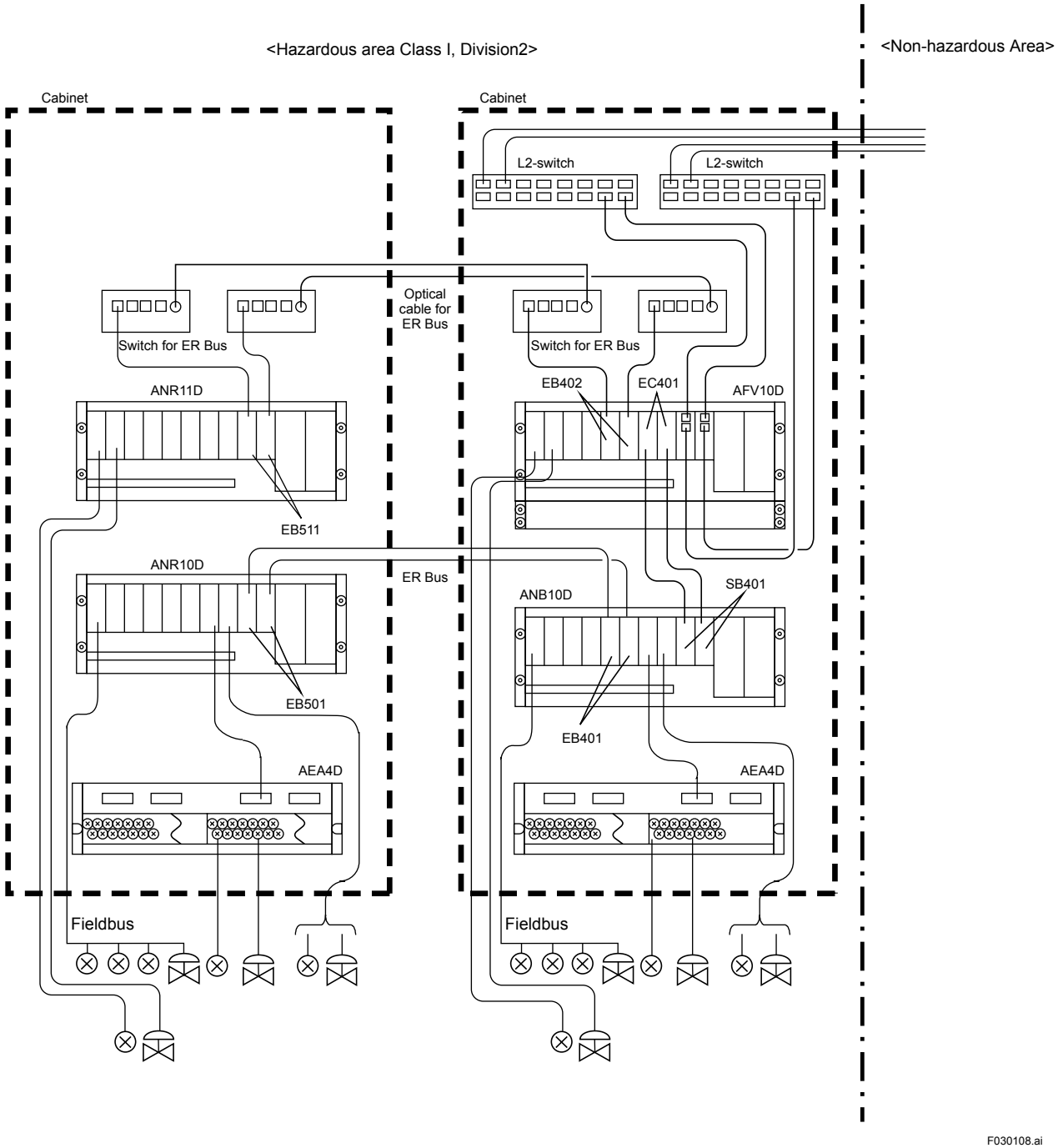



**Figure Example of the configuration of FM NI approved products**

## Device Installation

- Devices must be installed by professionally trained personnel.
- Install devices according to NEC (National Electrical Code: ANSI/NFPA-70).
- When devices are installed in a hazardous area in Class I, Division2, put them in a metal cabinet with a key compliant with FM 3810 and FM 3600, or the one approved by FM or a local testing institution.
  When the devices to be connected to field devices in a hazardous area are installed in non-hazardous area, put them in a metal cabinet conforming to FM 3810.
- Please refer to the related GS (General Specifications), “Installation Guidance” TI33Q01J10-01E and “Installation Guidance (for Vnet/IP)” TI33P01J10-01E.
- Precautions on device use
  - Cabinet door must be closed when devices are used.
  - Empty slots in a cabinet must be covered by a dedicated cover.
  - Each cable in a cabinet must be fixed.
  - A breaker to cut power supply must be installed in non-hazardous area so that power supply to the devices is cut under abnormal circumstances.

## Maintenance

- Devices must be installed by professionally trained personnel or ask Yokogawa’s service office. If devices are installed by person other than those above, FM NI approved products will be invalid.
- Do not perform maintenance on running devices installed in a hazardous area in Class I, Division 2.
  Disconnect modules and terminals installed in a hazardous area in Class I, Division 2 only for installation or maintenance.
- Initial and regular maintenance are also done by professionally trained personnel according to IEC 60079-17.

## Wiring

- Devices must be wired by professionally trained personnel.
- Install explosion-proof wiring defined in NEC (National Electrical Code: ANSI/NFPA-70) or the code in the relevant country to wire devices with no indication of electrical parameters. Wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in the relevant country.

### Power Supply Wiring

When field control unit (for Vnet/IP), node unit for FIO, power distribution unit and power supply module are installed in a hazardous area in Class I, Division 2, wire a power supply cable from a non-hazardous area by explosion-proof wiring (including metal conduit wiring).

When AED5D is combined with ADV151, ADV161, ADV551 and ADV561, install an explosion-proof wiring defined in the relevant country for the wiring outside of the external power supply cable cabinet.

## Signal Wiring

When an optical cable is installed in Class I, Division 2, general wiring defined in the relevant country is available. Optical cable does not emit energy to cause air explosion.

Install explosion-proof wiring defined in the relevant country for the following signal wiring:

- Wiring contact output terminals of field control unit outside of a cabinet
- Wiring Vnet/IP cable and ESB bus cable outside of a cabinet
- Wiring ER bus cable to be connected to EB402 and EB511 outside of a cabinet
- Wiring AAP135 outside of a cabinet when it is used as the source device (*1)
  General wiring defined in the relevant country can be installed according to the indicated electrical parameters for signal wiring of AAP135 outside of a cabinet when it is used as the load device (*1).
- Use DC power supply compliant with the Standard for Explosion Protection for combination of ADV151 and AED5D, or that of ADV161 and AED5D in contact input mode and voltage input mode. Connection according to the parameters of this power supply makes signal wiring outside of the cabinet compliant with the local standard. Please read the instruction on contact input mode wiring and the instruction on voltage input mode when you actually install wiring.
- Wiring outside of a cabinet in voltage output mode by a combination of ADV551 and AED5D, or ADV561 and AED5D.
  Wiring contact output mode outside of a cabinet according to the indicated electrical parameters is compliant with the local standard.
- Wiring outside of a cabinet to ALR111, ALR121 or ALE111.
- Wiring outside of a cabinet to ALF111
  When a barrier for field bus available in Class I, Division 2 is mounted in the same cabinet and connected, wiring to the field devices outside of the cabinet can be a general wiring defined in the relevant country.

*1: AAP135 is “the source device” in case of voltage-free contact input and voltage pulse input (when connected to signal names IN□B and IN□C). In other connections, it is “the load device.”

## Instruction on Contact Input Mode Wiring

When the number of channels is limited because power supply exceeds its capacity, but parallel connection for the purpose of increasing capacity is not allowed.
Mount ADV151, ADV161, AED5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

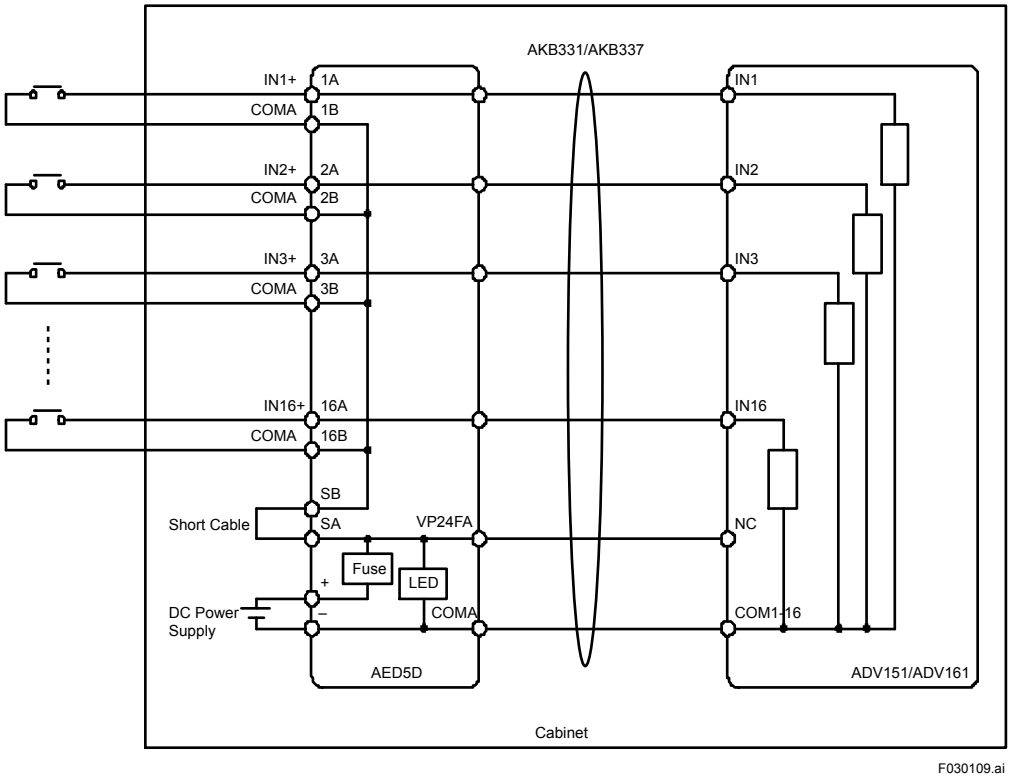



**Figure Connection example of ADV151/ADV161 Contact Input Mode**

## Instruction on Voltage Input Mode Wiring

The total current value of the channels must be within the rated current (limit) for DC power supply.
But if the total current value exceeds the rated current, reduce the number of channels to be supplied at on time, and prepare the same DC power supply for each channel group.
In such a case, the polarity of power sources should be the same.
Mount ADV151, ADV161, AED5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

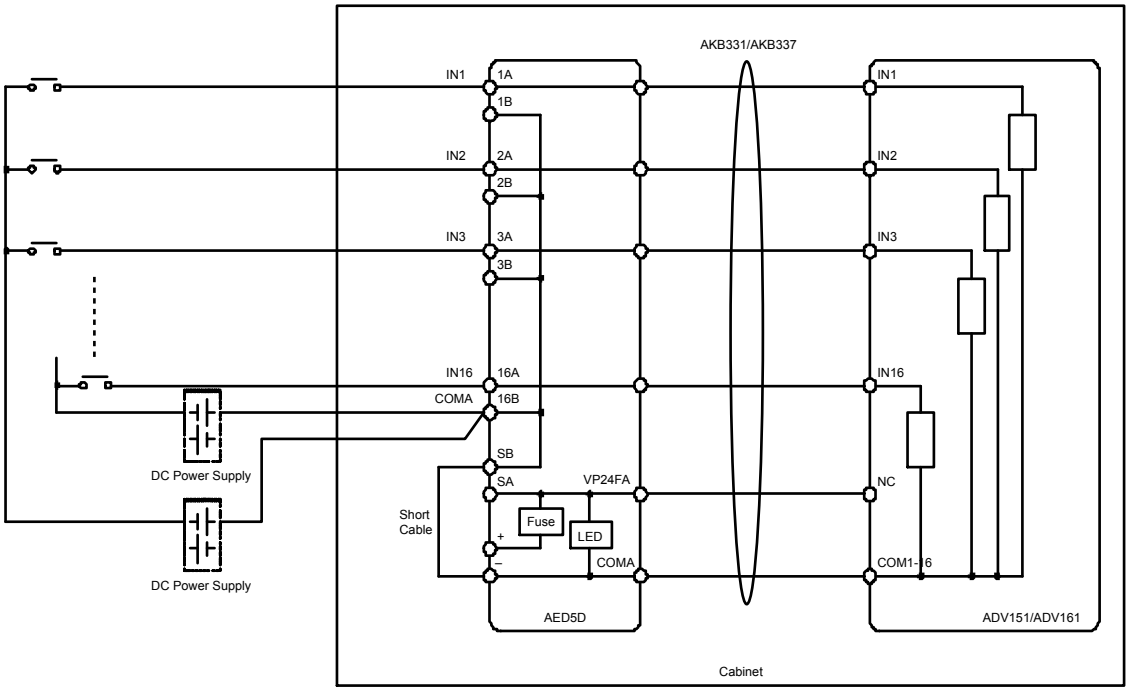
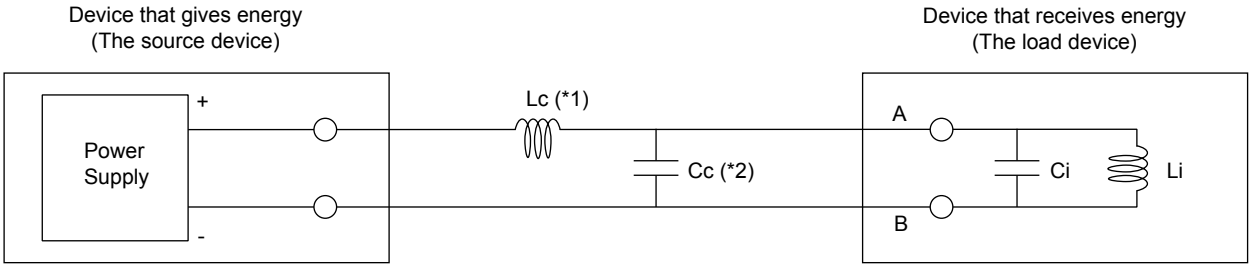



**Figure Connection example of ADV151/ADV161 Voltage Input Mode**

## Parameters in Connection with FM NI Devices

Energy transfer influences FM NI properties. In order to maintain these properties, parameters must be displayed when FM NI devices are connected.

To display parameters, FM NI devices are divided into the device that gives energy and the device that receives energy.




Displayed parameters
Voc: maximum open-circuit output voltage
Isc: maximum short-circuit output current
Ca: maximum allowable capacitance
La: maximum allowable inductance

*1: Lc: inductance of the external wiring
*2: Cc: capacitance of the external wiring

Displayed parameters
Vmax: maximum input voltage
Imax: maximum input current
Ci: maximum internal capacitance
Li: maximum internal inductance

F030115.ai

**Figure Connection of FM NI Devices and Associated Parameters**

## How to Compare Parameters

How to compare parameters when the device that gives energy and the device that receives energy are connected is in the following. If the parameters satisfy the following formulas, a FM NI explosion-proof device can be connected in a general wiring. Otherwise, the wiring should be installed to conform to NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring defined in the relevant country.

| Device that gives energy | | Device that receives energy |
|---|---|---|
| Voc | ≤ | Vmax |
| Isc | ≤ | Imax |
| Ca | ≥ | summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring |
| La | ≥ | summation of Li in the device which receives energy + summation of inductance Lc in the external wiring |

# Example of a Connection

## Connecting a Directly Connected Node and a Device Installed in Class I, Division 2

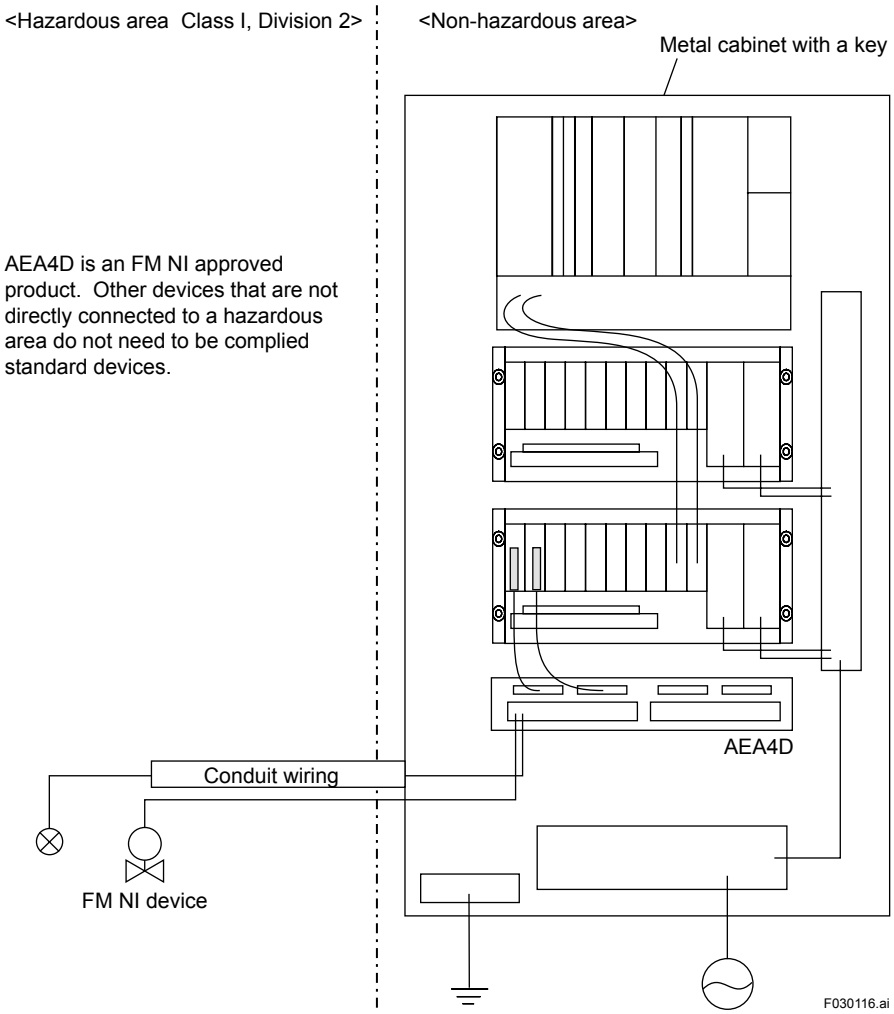



**Figure Connecting a Directly Connected Node and a Device Installed in Class I, Division 2**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.

## Installing a Remote Node in Class I, Division 2 (Wiring by ER Bus)

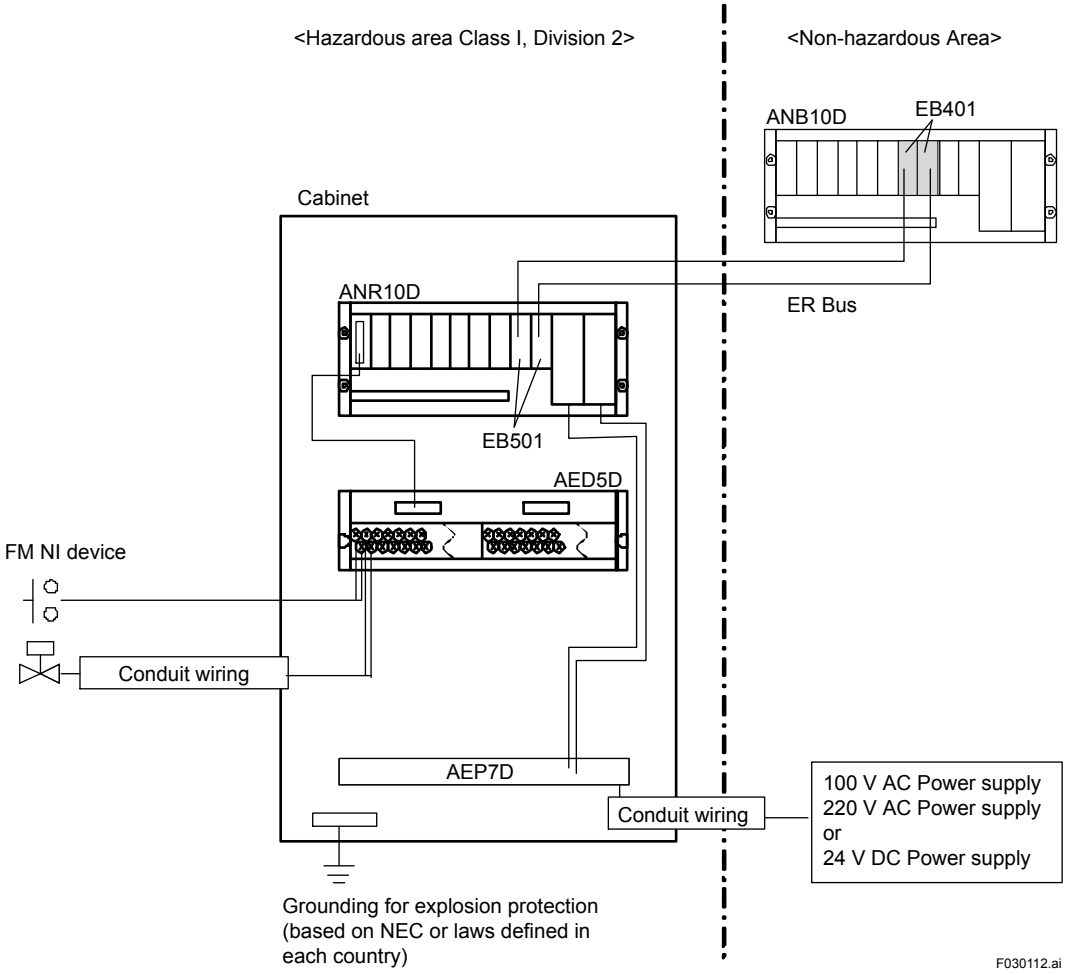



**Figure Installing a Remote Node in Class I, Division 2 (Wiring by ER Bus)**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.

## Installing a Remote Node in Class I, Division 2 (Wiring by Optical cable for ER Bus)

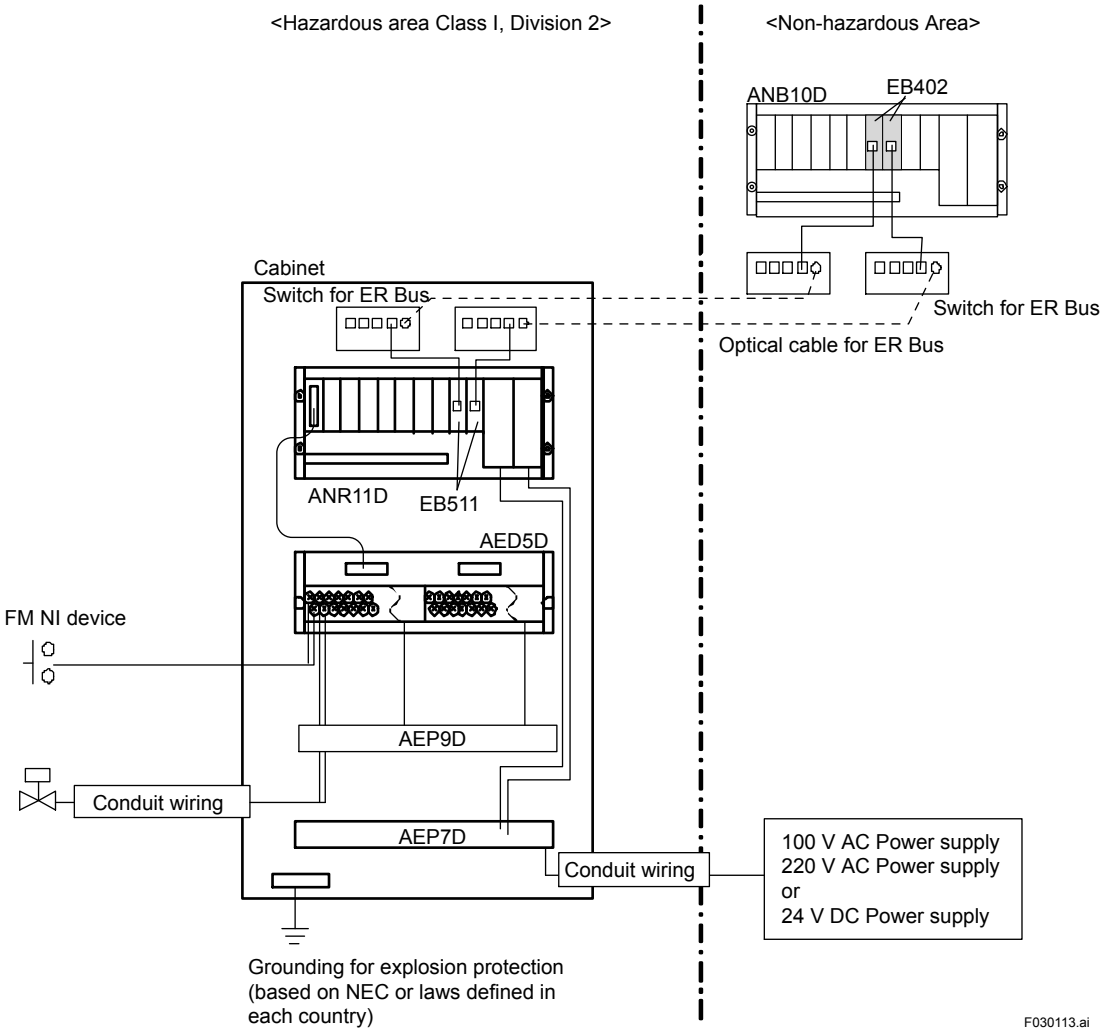



**Figure Installing a Remote Node in Class I, Division 2 (Wiring by Optical cable for ER Bus)**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- Use ER bus switch (Network Devices) which can be installed in a hazardous area in Class I, Division 2.

## Installing a FCS or Directly Connected Node in Class I, Division 2

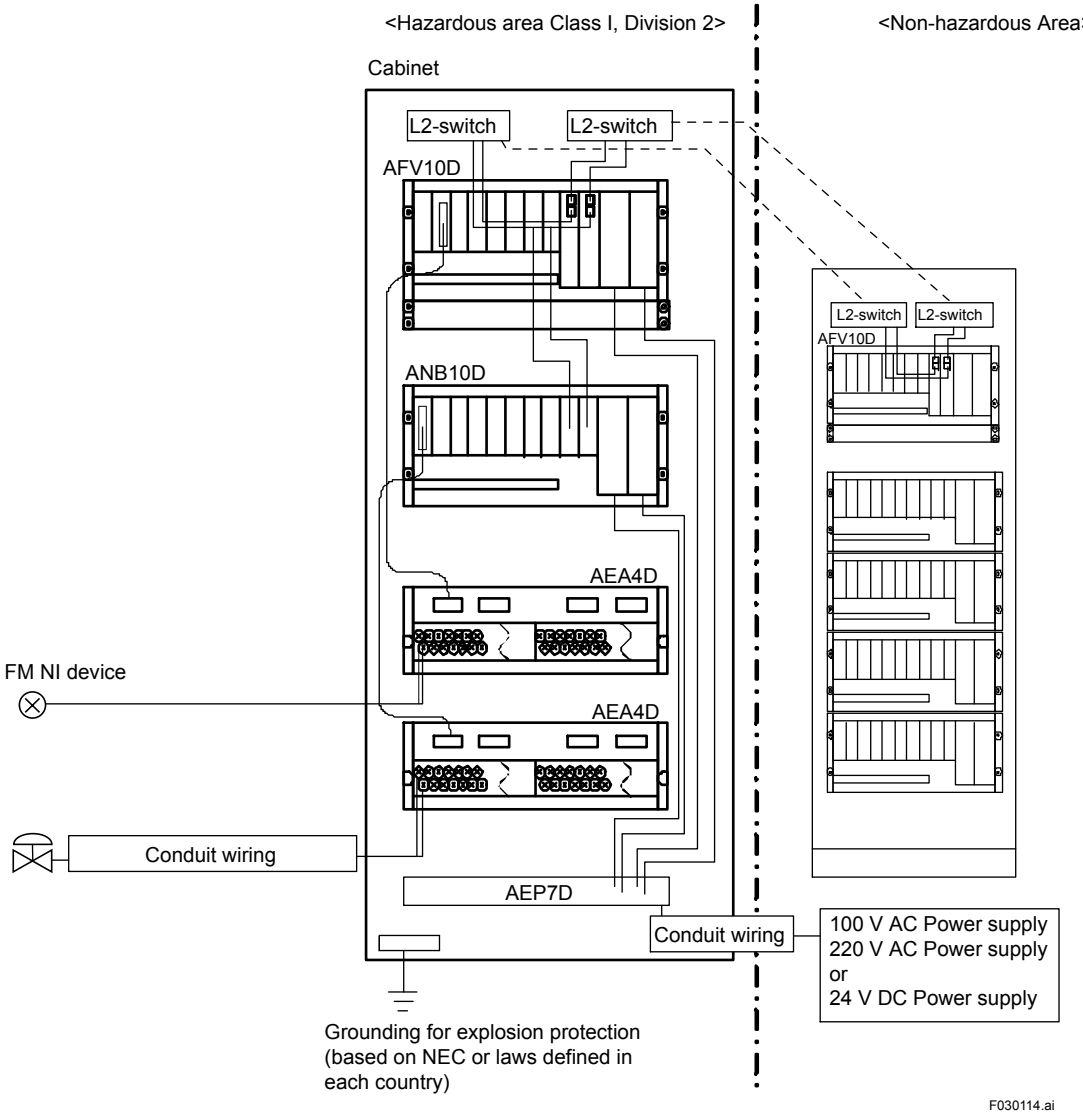



**Figure Installing a FCS or Directly Connected Node in Class I, Division 2**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- Use L2 switch (Network Devices) which can be installed in a hazardous area in Class I, Division 2.

# 3.2 Type “n”

Type “n” is a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation in CENELEC standard and IEC standard and also to avoid causing a spark, an arc or high surface temperatures under defined conditions such as an overload.

A Field Control Unit (for Vnet/IP), a node unit for FIO and an I/O module of CENTUM have acquired Type “n” of CENELEC standard.

This approval permits that the products above can be used in hazardous areas such as Zone 2 and that the I/O module can be directly connected to an Type ”n” approved field device installed in hazardous areas such as Zone 2.

In addition, an I/O modules installed in non-hazardous areas can be directly connected to a Type “n” approved field device installed in hazardous areas such as Zone 2.

## Complied Standards

**[Explosion-proof specifications]**
**II 3G Ex nC [nL] IIC T4**

**[Complied standard]**
**EN 60079-15:2005**
**IEC 60079-0:2004**
**IEC 60079-11:1999**
**(for 24 V DC power supply)**

# Type “n” Approved Products and Their Configuration Example

The figure below is an example of the configuration of Type “n” approved products that can be installed in hazardous areas. See the table “The List of Type “n” Compliant Products” described in Appendix for detail.

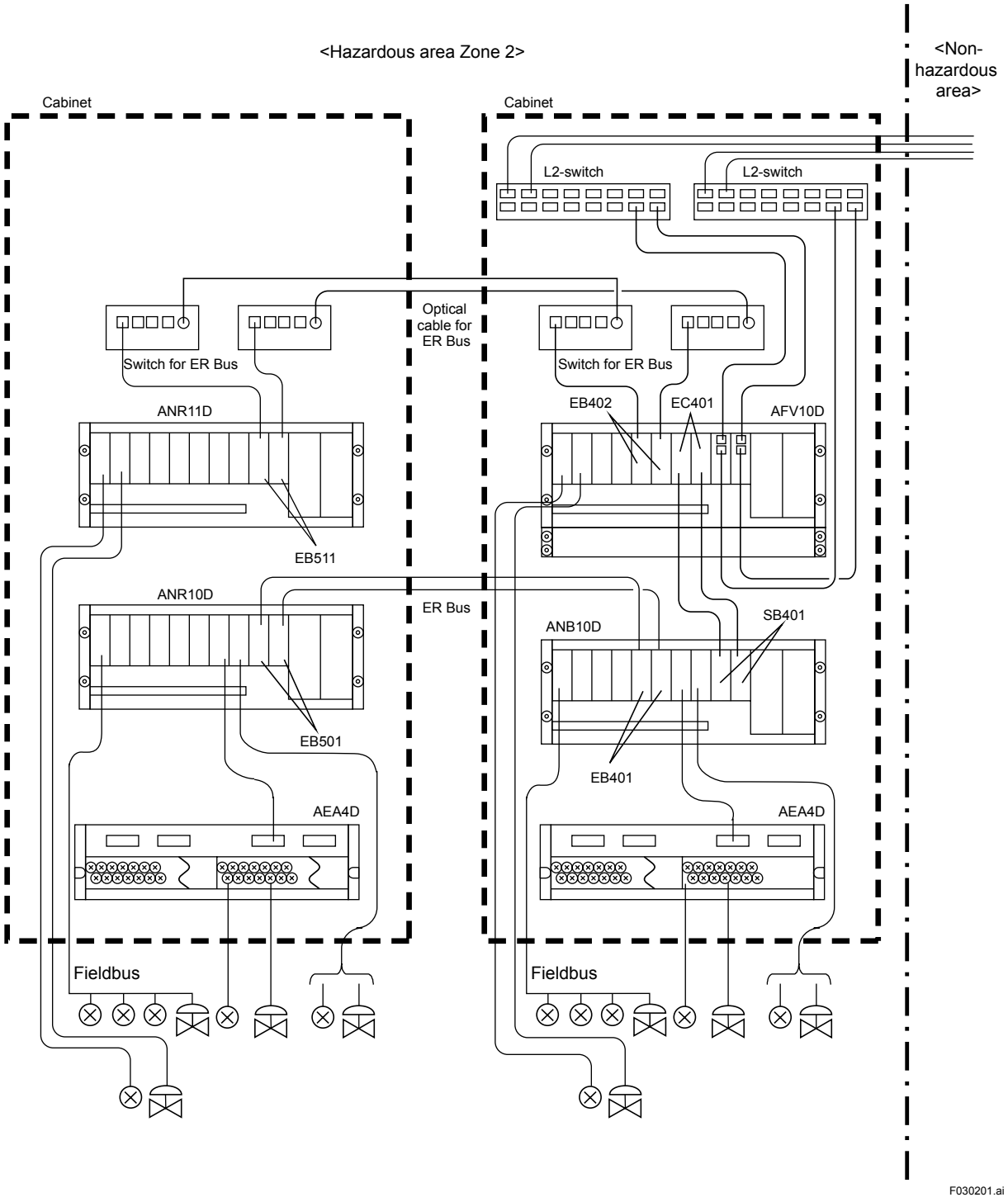



**Figure Example of the configuration of Type “n” approved products**

## Device Installation

- Devices must be installed by professionally trained personnel.
- When a device is installed in Zone 2, put it in a keyed, metal cabinet which satisfies the requirements of EN 61010 and EN 60079-15, and also has protection rating of IP54 or higher.
  When a device to be connected to a field device installed in a hazardous area is installed in a non-hazardous area, put it in a metal cabinet which satisfies the requirements of EN 61010.
- Please refer to the related GS (General Specifications), “Installation Guidance” TI33Q01J10-01E, “Installation Guidance (for Vnet/IP)” TI33P01J10-01E and “Explosion Protection of FIO Products” IM33Y06K01-90E.
- Precautions on device use
  - Cabinet door must be closed when devices are used.
  - Empty slots in a cabinet must be covered by a dedicated cover.
  - Each cable in a cabinet must be fixed.
  - A breaker to cut power supply must be installed in non-hazardous area so that power supply to the devices is cut under abnormal circumstances.

## Maintenance

- Devices must be installed by professionally trained personnel or ask Yokogawa’s service office. If devices are installed by person other than those above, Type “n” approved products will be invalid.
- Do not perform maintenance on running devices installed in a hazardous area in Zone 2. Disconnect modules and terminals installed in a hazardous area in Zone 2 only for installation or maintenance.
- Initial and regular maintenance are also done by professionally trained personnel according to IEC 60079-17.

## Wiring

- Devices must be wired by professionally trained personnel.
- Install explosion-proof wiring defined in EN 60079-14/IEC 60079-14 or the code in the relevant country to wire devices with no indication of electrical parameters. Wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in the relevant country.
- The lead-in of the cabinet wiring installed in Zone 2 should be wired in a way to maintain protection rating IP54 for the cabinet.

### Power Supply Wiring

When field control unit (for Vnet/IP), node unit for FIO, power distribution unit and power supply module are installed in a hazardous area in Zone 2, wire a power supply cable from a non-hazardous area by explosion-proof wiring (including metal conduit wiring).

When AED5D is combined with ADV151, ADV161, ADV551 and ADV561, install an explosion-proof wiring defined in the relevant country for the wiring outside of the external power supply cable cabinet.

## Signal Wiring

When an optical cable is installed in Zone 2, general wiring defined in the relevant country is available. Optical cable does not emit energy to cause air explosion.

Install explosion-proof wiring defined in the relevant country for the following signal wiring:

- Wiring contact output terminals of field control unit outside of a cabinet
- Wiring Vnet/IP cable and ESB bus cable outside of a cabinet
- Wiring ER bus cable to be connected to EB402 and EB511 outside of a cabinet
- Wiring AAP135 outside of a cabinet when it is used as the source device (*1)
  General wiring defined in the relevant country can be installed according to the indicated electrical parameters for signal wiring of AAP135 outside of a cabinet when it is used as the load device (*1).
- Use DC power supply compliant with the Standard for Explosion Protection for combination of ADV151 and AED5D, or that of ADV161 and AED5D in contact input mode and voltage input mode. Connection according to the parameters of this power supply makes signal wiring outside of the cabinet compliant with the local standard. Please read the instruction on contact input mode wiring and the instruction on voltage input mode when you actually install wiring.
- Wiring outside of a cabinet in voltage output mode by a combination of ADV551 and AED5D, or ADV561 and AED5D.
  Wiring contact output mode outside of a cabinet according to the indicated electrical parameters is compliant with the local standard.
- Wiring outside of a cabinet to ALR111, ALR121 or ALE111.
- Wiring outside of a cabinet to ALF111
  When a barrier for field bus available in Zone 2 is mounted in the same cabinet and connected, wiring to the field devices outside of the cabinet can be a general wiring defined in the relevant country.

*1: AAP135 is “the source device” in case of voltage-free contact input and voltage pulse input (when connected to signal names IN□B and IN□C). In other connections, it is “the load device.”

## Instruction on Contact Input Mode Wiring

When the number of channels is limited because power supply exceeds its capacity, but parallel connection for the purpose of increasing capacity is not allowed.

Mount ADV151, ADV161, AED5D, AKB331 and AKB337 in the same cabinet.

When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

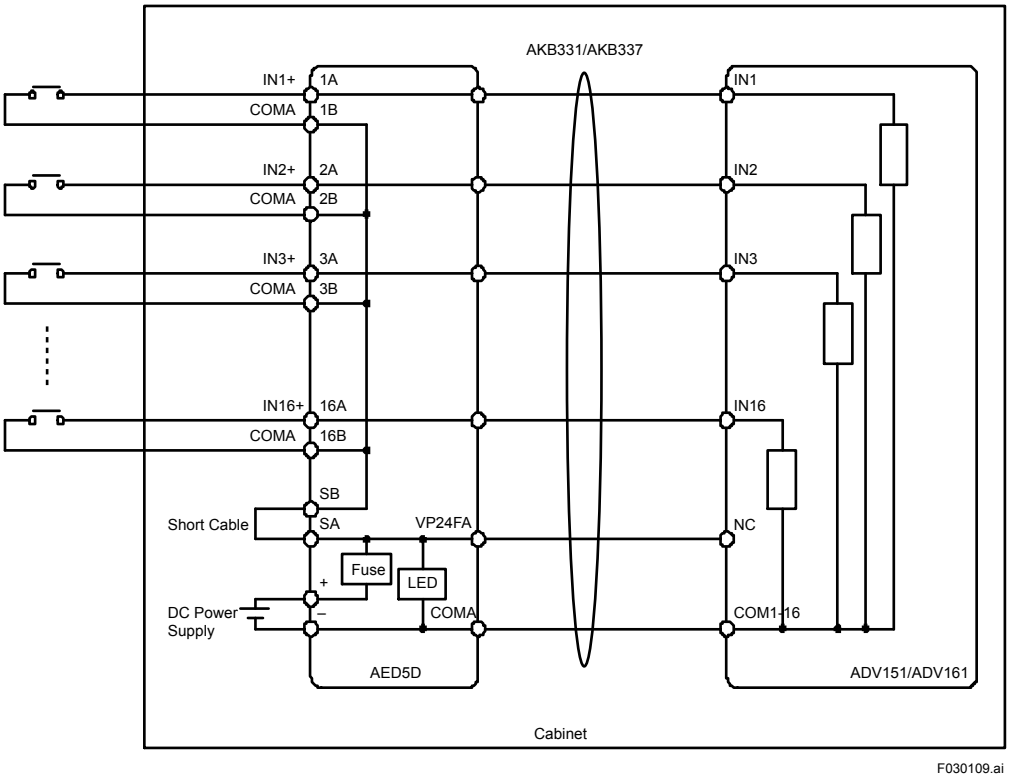



**Figure Connection example of ADV151/ADV161 Contact Input Mode**

## Instruction on Voltage Input Mode Wiring

The total current value of the channels must be within the rated current (limit) for DC power supply.
But if the total current value exceeds the rated current, reduce the number of channels to be supplied at on time, and prepare the same DC power supply for each channel group.
In such a case, the polarity of power sources should be the same.
Mount ADV151, ADV161, AED5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

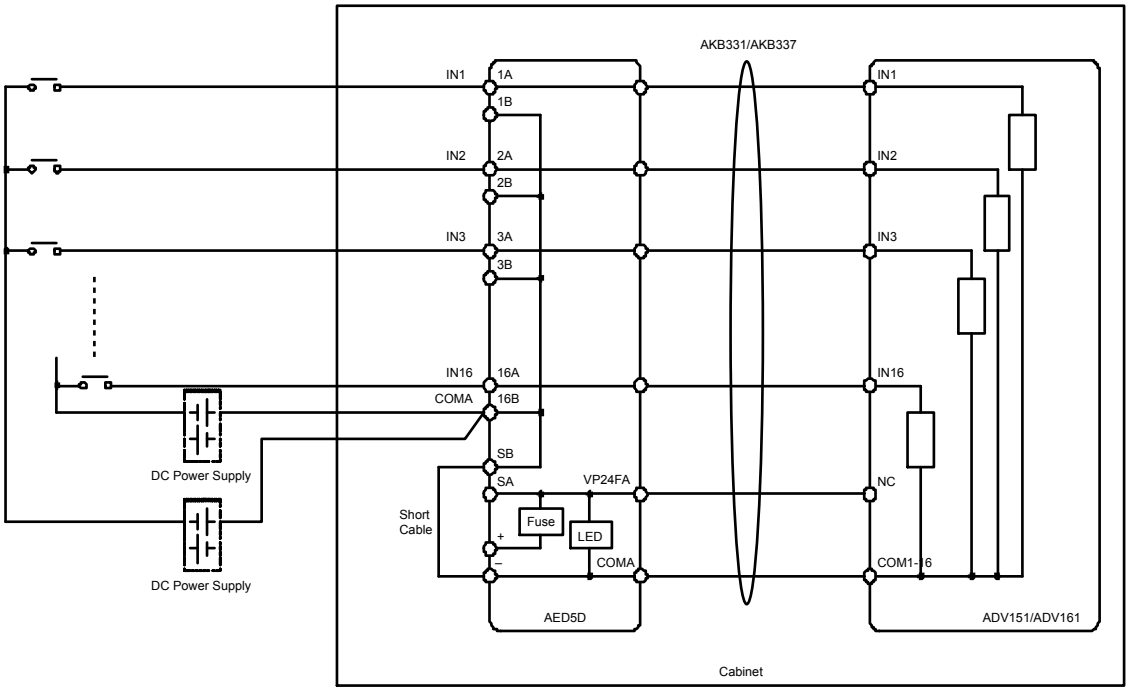
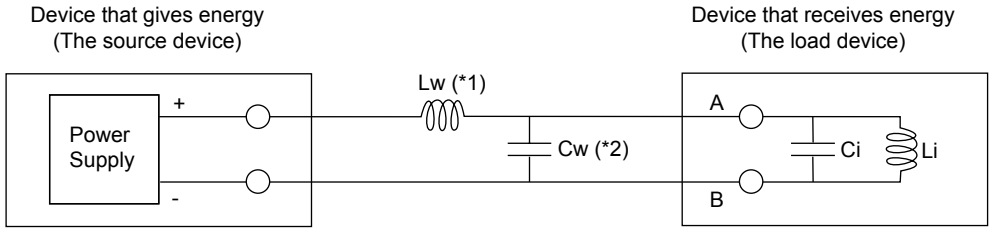



**Figure Connection example of ADV151/ADV161 Voltage Input Mode**

## Display of Parameters of the Type “n” Devices

Energy transfer influences Type “n” properties. In order to maintain these properties, parameters must be displayed when Type “n” devices are connected.

To display parameters, Type “n” devices are divided into the device that gives energy and the device that receives energy. The parameters displayed in each device are as follows.




Displayed parameters
Uo: maximum open-circuit output voltage
Io: maximum short-circuit output current
Co: maximum allowable capacitance
Lo: maximum allowable inductance

Displayed parameters
Ui: maximum input voltage
Ii: maximum input current
Ci: maximum internal capacitance
Li: maximum internal inductance

F030202.ai

*1: Lw
inductance of the external wiring
*2: Cw
capacitance of the external wiring

**Figure Connection of Type “n” Devices and Associated Parameters**

## How to Compare Parameters

Comparing parameters between the device that gives energy and the device that receives energy are connected is the following way. If the parameters satisfy the following conditional formula, a Type “n” explosion proof device can be connected in a general wiring construction. Otherwise, the wiring constructions should be installed in accordance with each country’s explosion protection standards.

| Device that gives energy | | Device that receives energy |
|---|---|---|
| Uo | ≤ | Ui |
| Io | ≤ | Ii |
| Co | ≥ | summation of Ci in the device which receives energy + summation of capacitance Cw in the external wiring |
| Lo | ≥ | summation of Li in the device which receives energy + summation of inductance Lw in the external wiring |

# Example of a Connection

## Connecting a Directly Connected Node and a Device Installed in Zone 2

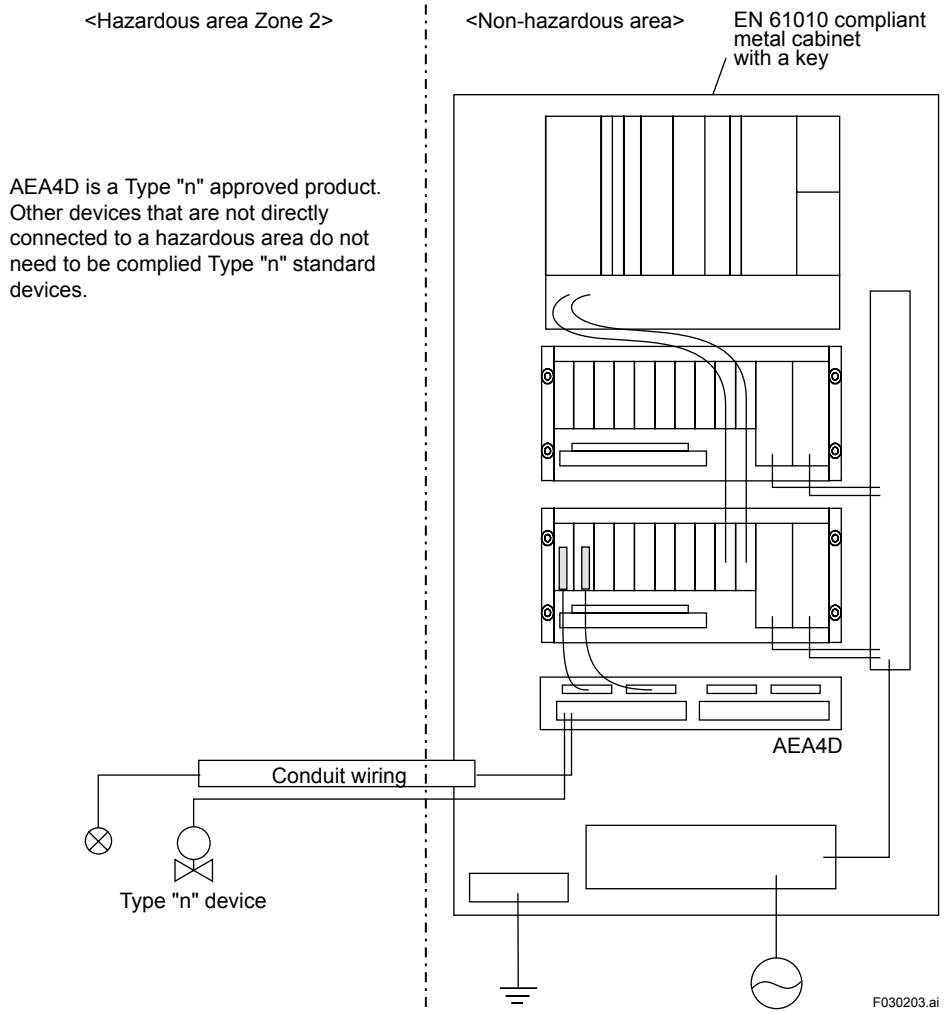



**Figure Connecting a Directly Connected Node and a Device Installed in Zone 2**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (Including threaded conduit wiring) defined in EN 60079-14/IEC 60079-14 or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.

## Installing a Remote Node in Zone 2 (Wiring by ER Bus)

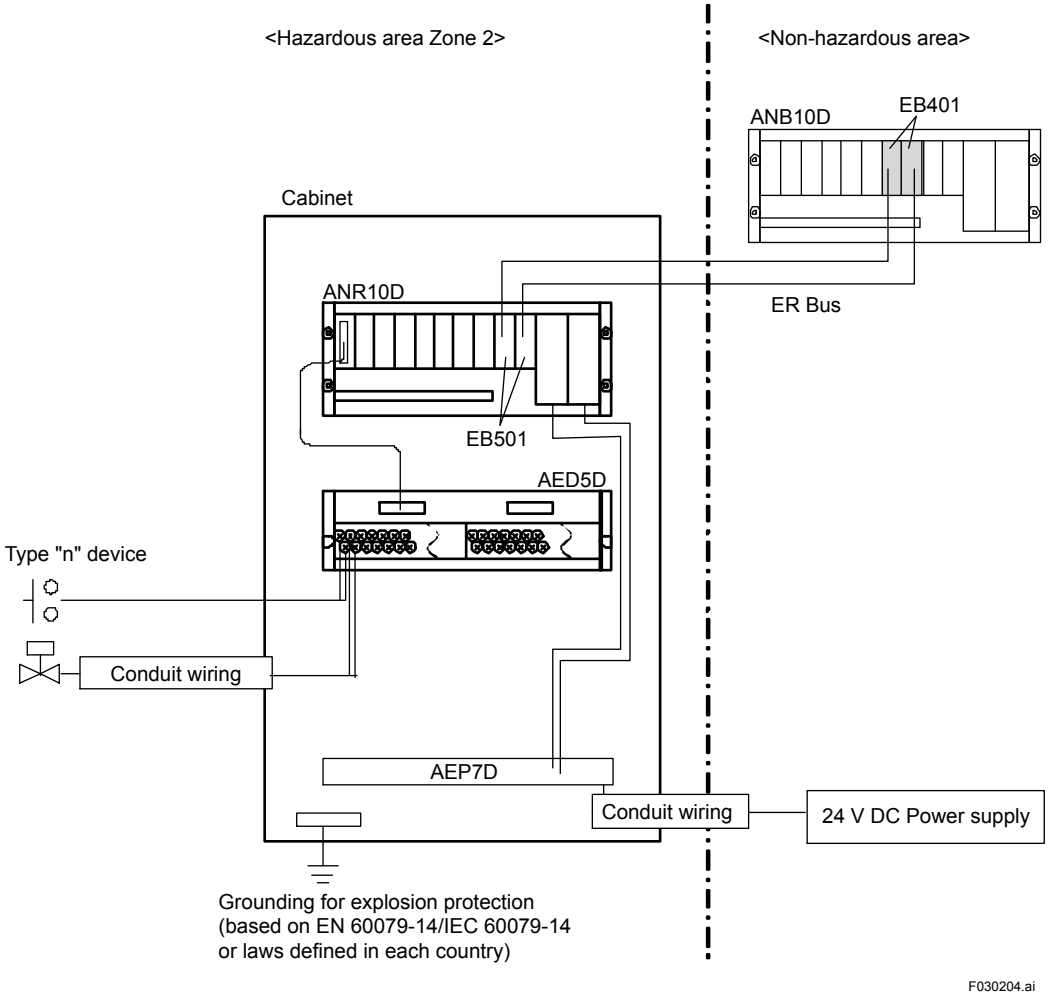



**Figure Installing a Remote Node in Zone 2 (Wiring by ER Bus)**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (Including threaded conduit wiring) defined in EN 60079-14/IEC 60079-14 or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- The lead-in of the cabinet wiring installed in Zone 2 should be handled not to lose a protection rating IP54 of the cabinet.

## Installing a Remote Node in Zone 2 (Wiring by Optical cable for ER Bus)

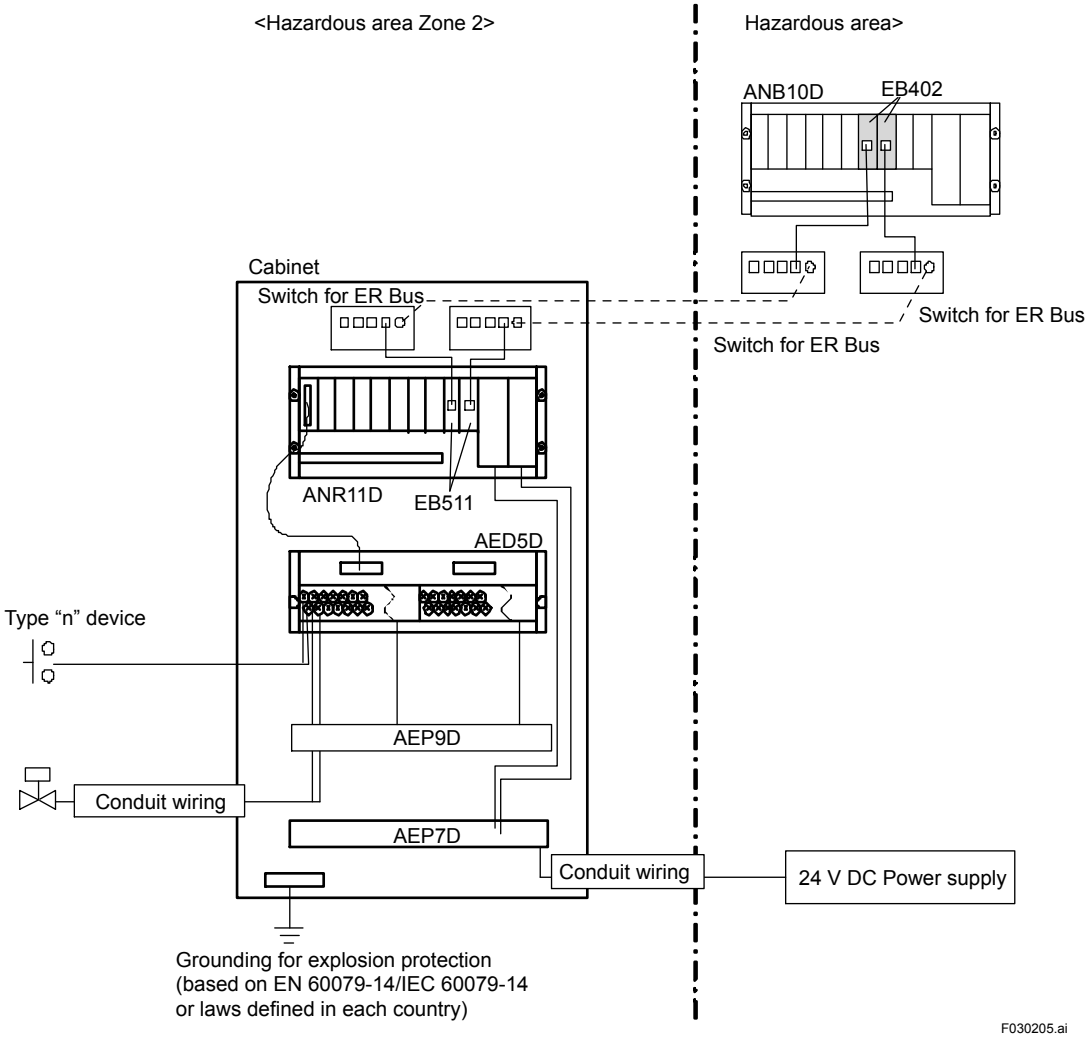



**Figure Installing a Remote Node in Zone 2 (Wiring by Optical cable for ER Bus)**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in EN 60079-14/IEC 60079-14 or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- The lead-in of the cabinet wiring installed in Zone 2 should be handled not to lose a protection rating of IP54 for the cabinet.
- Use L2 switch (Network Devices) which can be installed in a hazardous area in Zone 2.

## Installing a FCS or Directly Connected Node in Zone 2

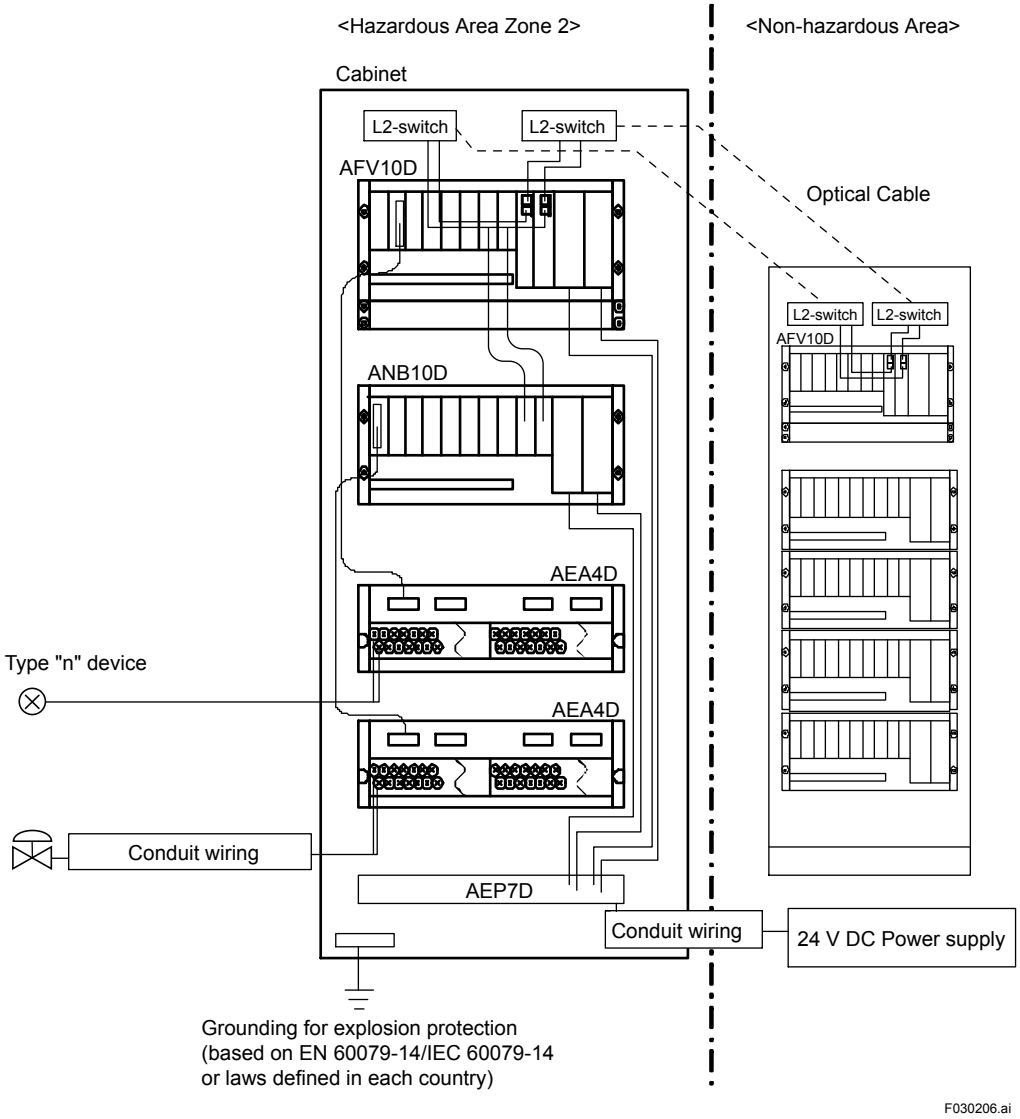



**Figure Installing a FCS or Directly Connected Node in Zone 2**

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in EN 60079-14/IEC 60079-14 or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- The lead-in of the cabinet wiring installed in Zone 2 should be handled not to lose a protection rating of IP54 for the cabinet.
- Use L2 switch (Network Devices) which can be installed in a hazardous area in Zone 2.

# 4. Intrinsic Safety Explosion Protection Instrumentation

**Intrinsic safety explosion protection is an electric circuit and a construction, which made so as not to ignite to gas by controlling the energy of electric circuit, if sparks, arc, and heat occur at the time of normal operating and an accident (short-circuit, earth fault, burnout). Intrinsic safety explosion protection equipments include intrinsic safety equipments and equipments related with intrinsic safety. Intrinsic safety equipments are able to be used in hazardous area. Equipments related with intrinsic safety are set up in non-hazardous area, and is connected with intrinsic safety equipment.**

**In CENTUM, module with built-in barrier is available as equipments related with intrinsic safety. Also, intrinsic safety explosion protection instrumentation can be done by building Zener barrier or insulating barrier into it.**

# 4.1 Intrinsic Safety Explosion Protection Instrumentation Using Module with Built-in Barrier

## 4.1.1 Intrinsic Safety Explosion Protection of CENELEC Standard

### Modules with Built-in Barrier

The module with built-in barrier in CENTUM is equipment related with intrinsic safety, and a construction of explosion protection is implemented, by combination with intrinsic safety equipment placed in hazardous area. The module with built-in barrier eliminates the need for another barrier to connect with the equipment placed in Zone 0, Zone 1 and Zone 2. Moreover, modules with built-in barrier have Type “n”, and it can be placed in Zone 2. Modules with built-in barrier are listed below.

- ASI133 Analog Input Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- ASI533 Analog Output Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- AST143 TC/mV Input Module with Built-in Barrier (16-channel, Isolated)
- ASR133 RTD/POT Input Module with Built-in Barrier (8-channel, Isolated)
- ASD143 Digital Input Module with Built-in Barrier (16-channel, Isolated)
- ASD533 Digital Output Module with Built-in Barrier (8-channel, Isolated)

### Explosion-proof Specifications and Complied Standard

[Explosion-proof specifications]

II (1) G D [EEx ia] II C

[Complied standard]

EN 50014: 1997 +A1 +A2

EN 50020: 1994

### Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit. Wiring should be prepared in accordance with IEC 60079-14, or the standard of the country and the area in which it is set. In regards to the further wiring than the module with built-in barrier, take notice that it should be an intrinsic safety circuit. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

After setting, check the wiring according to the checklist described in IEC 60079-17.

See the Explosion Protection of FIO Products (IM 33Y06K01-90E), for considerations for modules with built-in barrier.

## Parameter of Intrinsic Safety

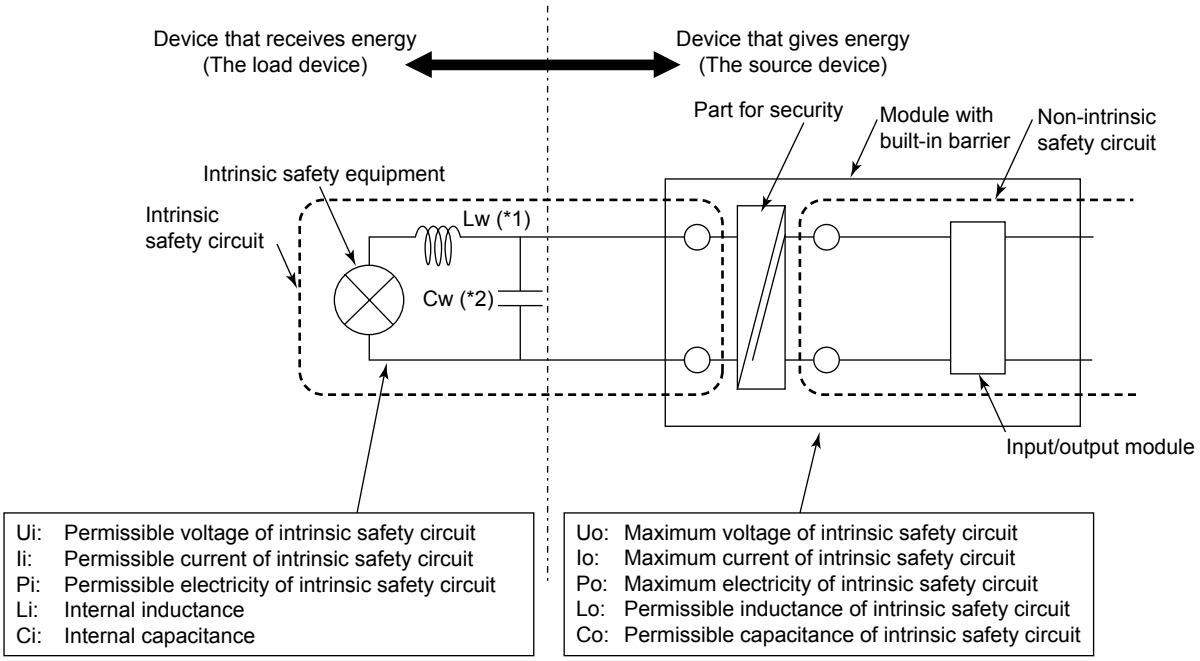
An intrinsic safety circuit of module with built-in barrier has the following ratings.

| | |
|---|---|
| Maximum voltage of intrinsic safety circuit | Uo |
| Maximum current of intrinsic safety circuit | Io |
| Maximum electricity of intrinsic safety circuit | Po |
| Permissible inductance of intrinsic safety circuit | Lo |
| Permissible capacitance of intrinsic safety circuit | Co |

As a combination of intrinsic safety circuits connected with module with built-in barrier and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

| | | | |
|---|---|---|---|
| Uo | ≤ | Ui | |
| Io | ≤ | Ii | |
| Po | ≤ | Pi | |
| Lo | ≥ | Li+Lw | summation of Li in the device which receives energy + summation of inductance Lw in the external wiring |
| Co | ≥ | Ci+Cw | summation of Ci in the device which receives energy + summation of capacitance Cw in the external wiring |

Intrinsic safety circuit should consist of circuitry to meet these condition of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.




*1: Lw: inductance of the external wiring
*2: Cw: capacitance of the external wiring

F040101.ai

**Figure Composition Used for a Module with Built-in Barrier**

# Example of a Connection

## Connect Local Node to Equipment of Zone 0/1/2 Setting

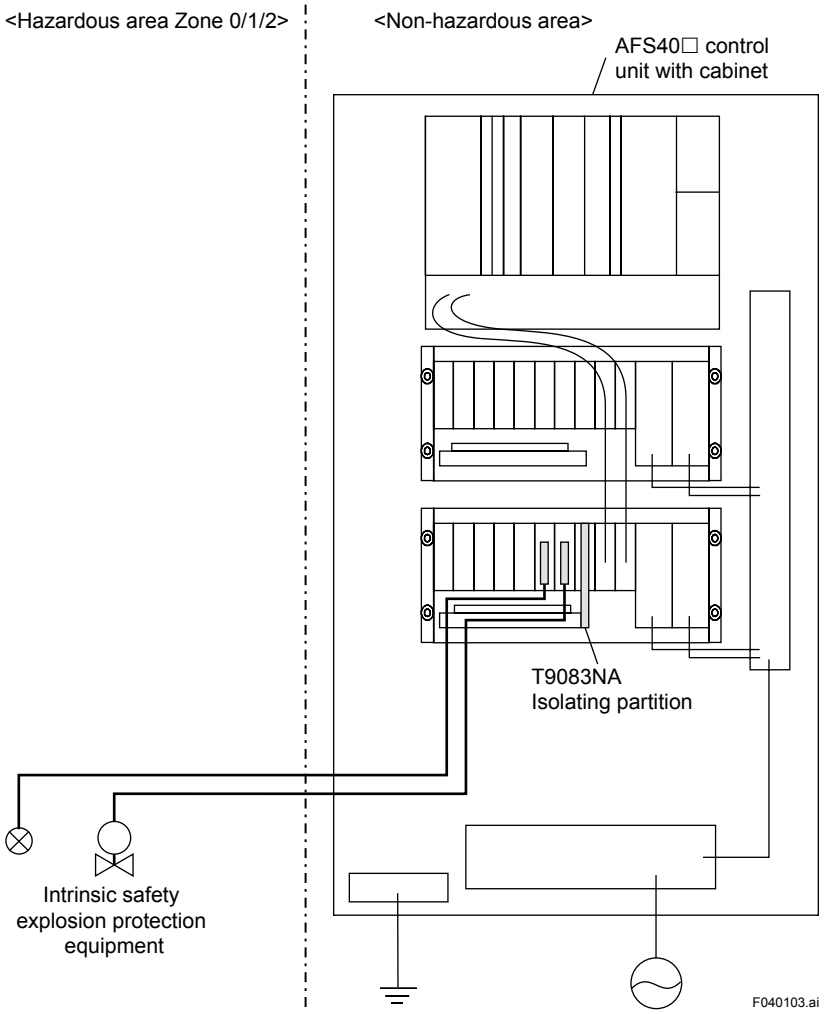



**Figure Connect Local Node to Equipment of Zone 0/1/2 Setting**

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to IEC 60079-14 or the wiring for explosion protection which each country regulates.
- See Input & Output Modules (IM 33M50G10-40E and IM 33Y06K01-01E) for details on how to provide an isolating partition (Part No.: T9083NA).

## Set Remote Node and Module with Built-in Barrier in Zone 2

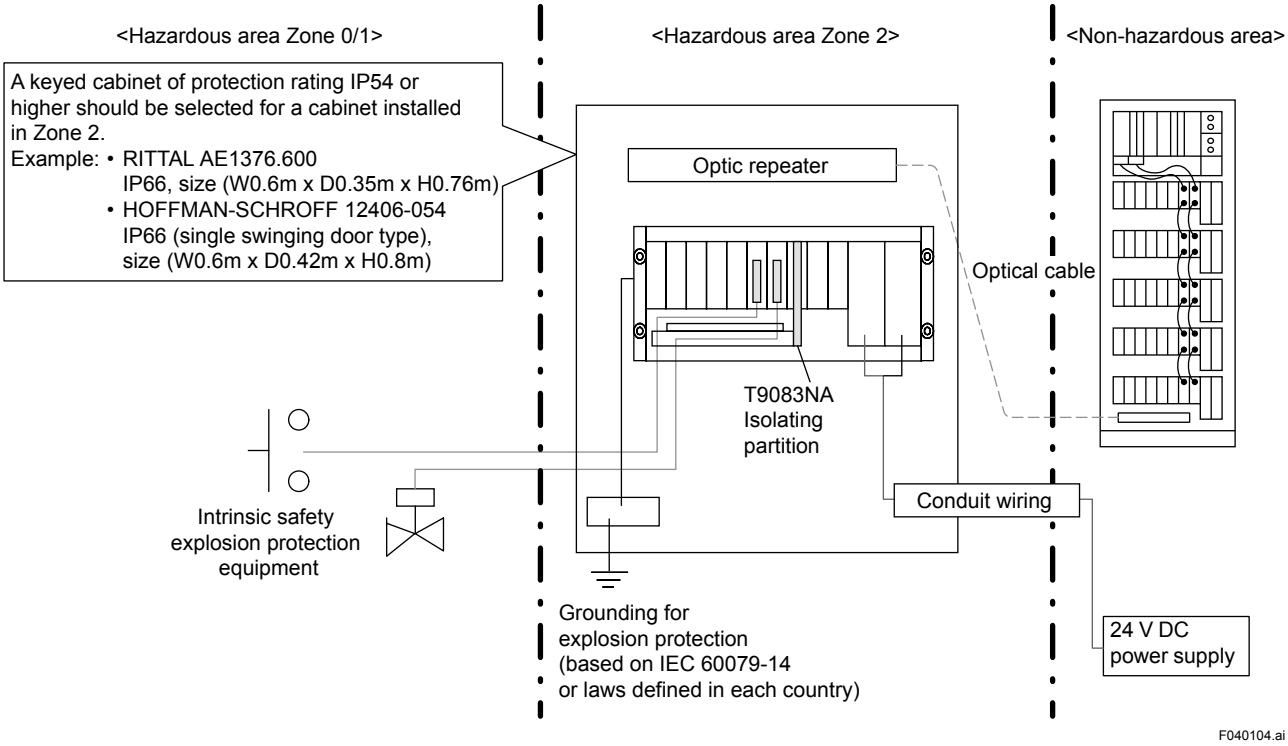



**Figure Set Remote Node and Module with Built-in Barrier in Zone 2**

- To connect with a field device, electrical parameters of each device should be met.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to IEC 60079-14 or the wiring for explosion protection which each country regulates.
- The lead-in of the cabinet wiring installed in Zone 2 should be handled not to diminish a protection rating IP54 of the cabinet.
- Use optical repeater (Network Devices) which can be installed in a hazardous area in Zone 2.
- See Input & Output Modules (IM 33M50G10-40E and IM 33Y06K01-01E) for details on how to provide an isolating partition (Part No.: T9083NA).

# 4.1.2 Intrinsic Safety Explosion Protection of FM Standard

## Modules with Built-in Barrier

The module with built-in barrier in CENTUM is equipment related with intrinsic safety, and a construction of explosion protection is implemented, by combination with intrinsic safety equipment placed in hazardous area. The module with built-in barrier eliminates the need for another barrier to connect with the equipment placed in Division 1 and Division 2. Modules with built-in barrier are listed below.

- ASI133 Analog Input Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- ASI533 Analog Output Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- AST143 TC/mV Input Module with Built-in Barrier (16-channel, Isolated)
- ASR133 RTD/POT Input Module with Built-in Barrier (8-channel, Isolated)
- ASD143 Digital Input Module with Built-in Barrier (16-channel, Isolated)
- ASD533 Digital Output Module with Built-in Barrier (8-channel, Isolated)

## Explosion-proof Specifications and Complied Standard

[Explosion-proof specifications]

Associated intrinsically safe apparatus for connection to

Class I, II, and III, Division 1, Groups A, B, C, D, E, F and G, or

Class I, Zone 0, Group IIC

[Complied standard]

FM Class Number 3600: 1998

FM Class Number 3610: 1999

ANSI/ISA – 12.12.02: 2003

See also Appendix 4, Installation of I/O Modules with Built-in Barrier in accordance with FM Approval.

## Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit. Wiring should be prepared in accordance with NEC (National Electric Code: ANSI/NFPA-70), or the standard of the country and the area in which it is set. In regards to the further wiring than the module with built-in barrier, take notice that it should be an intrinsic safety circuit. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

## Parameter of Intrinsic Safety

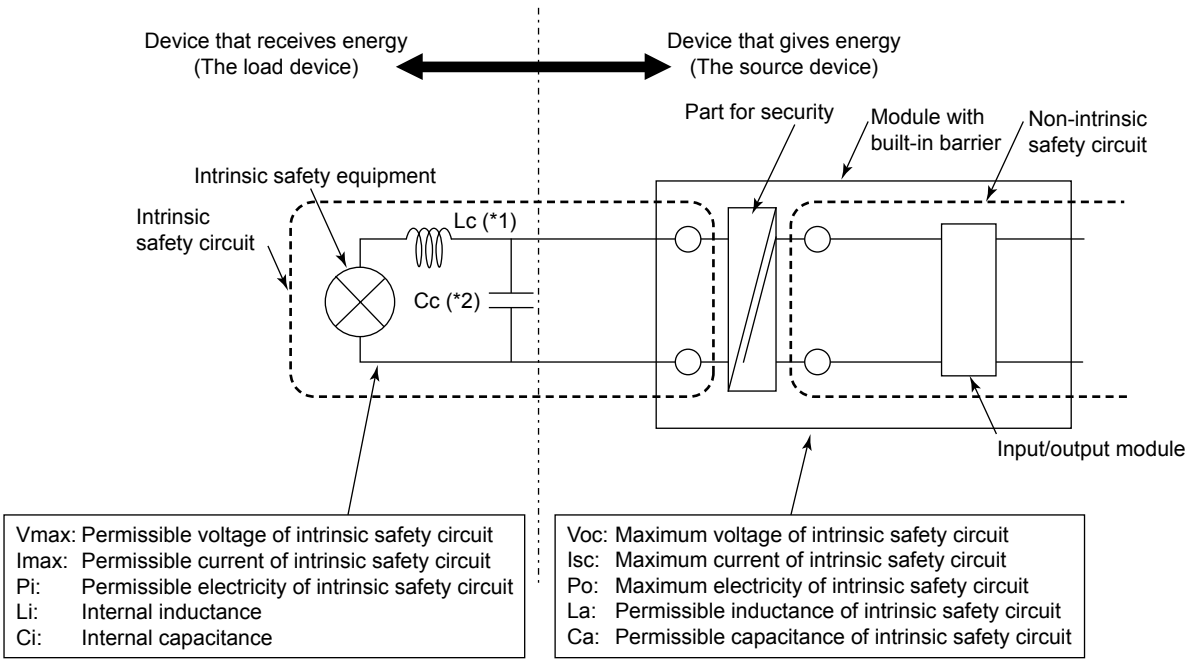
An intrinsic safety circuit of module with built-in barrier has the following ratings.

| | |
|---|---|
| Maximum voltage of intrinsic safety circuit | Voc |
| Maximum current of intrinsic safety circuit | Isc |
| Maximum electricity of intrinsic safety circuit | Po |
| Permissible inductance of intrinsic safety circuit | La |
| Permissible capacitance of intrinsic safety circuit | Ca |

As a combination of intrinsic safety circuits connected with module with built-in barrier and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

| | | | |
|---|---|---|---|
| Voc | ≤ | Vmax | |
| Isc | ≤ | Imax | |
| Po | ≤ | Pi | |
| La | ≥ | Li+Lc | summation of Li in the device which receives energy + summation of inductance Lc in the external wiring |
| Ca | ≥ | Ci+Cc | summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring |

Intrinsic safety circuit should consist of circuitry to meet these condition of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.




*1: Lc: inductance of the external wiring
*2: Cc: capacitance of the external wiring

F040106.ai

**Figure Composition Used for a Module with Built-in Barrier**

# Example of a Connection

## Connect Local Node to Equipment of Division 1/2 Setting

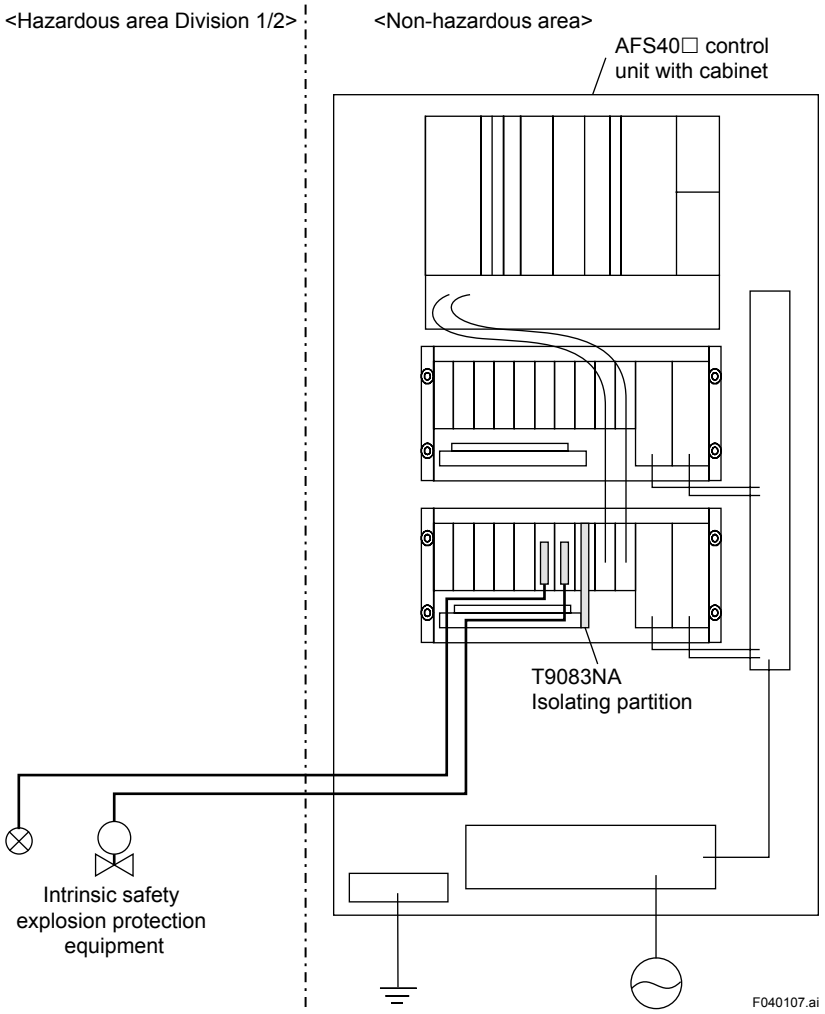



**Figure Connect Local Node to Equipment of Division 1/2 Setting**

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to NEC (National Electric Code: ANSI/NFPA-70) or the wiring for explosion protection which each country regulates.
- When use for associated intrinsically apparatus complying FM approval (FM 3610), following Node unit using PW481-11, PW482-11, or PW484-11 should be combinated.

  AFV10D-S41□1
  AFV10S-S31□1 or -S41□1
  ANB10D-4□1
  ANB10S-3□1 or -4□1
  ANR10D-4□3
  ANR10S-3□3 or -4□3
- In the case of 200 V AC, make sure the N side is grounded.
- See Input & Output Modules (IM 33M50G10-40E and IM 33Y06K01-01E) for details on how to provide an isolating partition (Part No.: T9083NA).

## Set Remote Node and Module with Built-in Barrier in Division 2

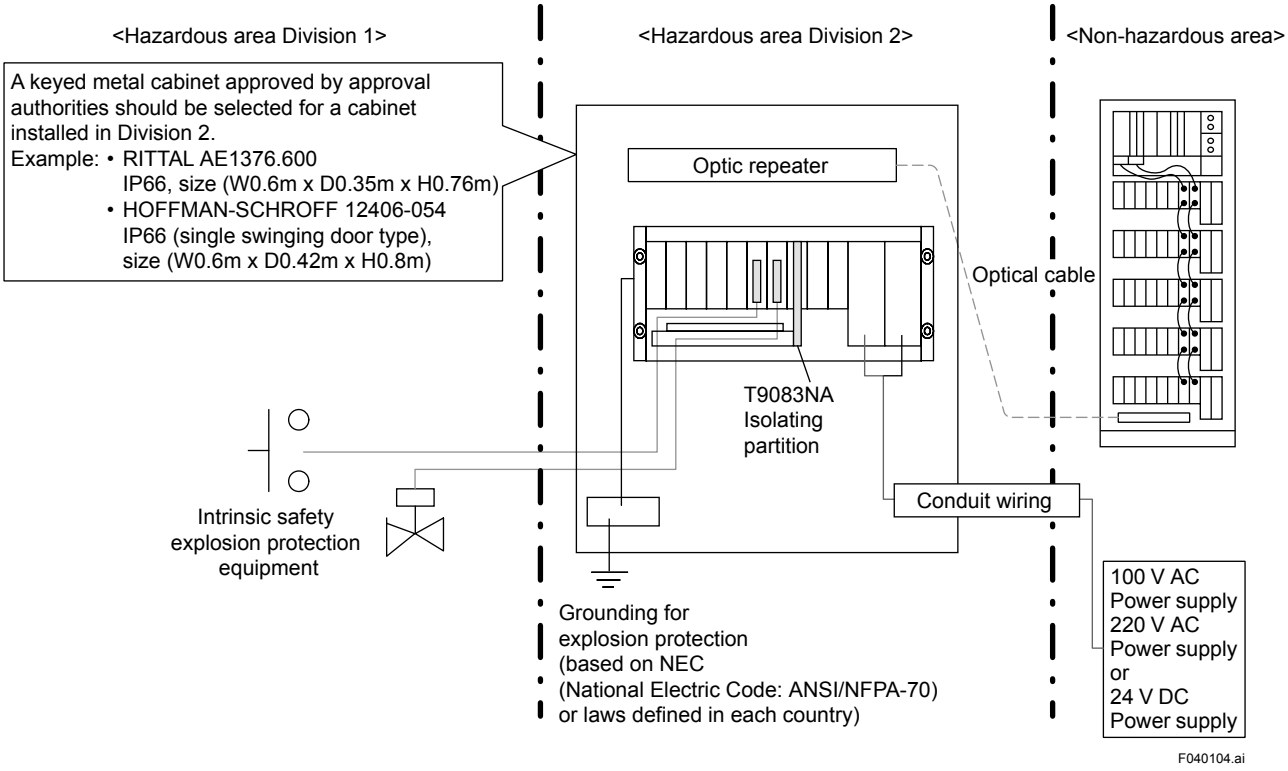



**Figure Set Remote Node and Module with Built-in Barrier in Division 2**

- To connect with a field device, electrical parameters of each device should be met.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to NEC (National Electric Code: ANSI/NFPA-70) or the wiring for explosion protection which each country regulates.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country.
- Use optical repeater (Network Devices) which can be installed in a hazardous area in Division 2.
- When use for associated intrinsically apparatus complying FM approval (FM 3610), following Node unit using PW481-11, PW482-11, or PW484-11 should be combinated.

  AFV10D-S41□1
  AFV10S-S31□1 or -S41□1
  ANB10D-4□1
  ANB10S-3□1 or -4□1
  ANR10D-4□3
  ANR10S-3□3 or -4□3
- In the case of 200 V AC, make sure the N side is grounded.
- See Input & Output Modules (IM 33M50G10-40E and IM 33Y06K01-01E) for details on how to provide an isolating partition (Part No.: T9083NA).

# 4.2 Intrinsic Safety Explosion Protection Instrumentation Using Barriers

## Category of Barriers

Classified roughly, barriers includes Zener barriers and insulating barriers (intrinsic safety barriers). Select the best one as your system, with the knowledge of their future.

(1) Feature of Zener barriers

Zener barrier has a simple construction which consists of just Zener Diode and resistance.

As the circuit of hazardous area and non-hazardous area are not insulated, they request the single point ground by the bus bar of Zener barriers, so as not to be created the functionally unfavorable ground loop by double point ground. Moreover, in most countries, it is impossible to ground circuits in hazardous area.

A power supply for barrier is not required, because Zener barriers carry out the function for security just with Zener Diode and resistance.

(2) Feature of insulating barriers

On the other hand, insulating barriers does not request intrinsic safety ground because the place between input and output of them is insulated. It is possible to ground circuits in hazardous area and use them (single point ground). However, a power supply for barrier is additionally required.

### Considerations for Selection of Barrier

Here is a general explanation about the selection of barrier. On the occasion of implementing intrinsic safety Explosion Protection instrumentation, select a barrier according to the manufacture's specifications and estimates with the equipment.

(1) Approved standard

Make sure the barrier has the approved standard which is required for the installation site.

(2) Cost

Compared Zener barriers to insulating barriers about the general cost of the main unit only per a channel, the approximate proportion are 1 to 2. Also, insulating barriers request a power supply.

(3) Volume (dimensions)

Dimensions may influence the number of cabinet in which the barrier is set. Compared Zener barriers to insulating barriers about the size per a general channel, the approximate proportion are 1 to 2.

(4) Difficulty of wiring, necessity of insulating hazardous area circuit

Zener barriers always need intrinsic safety ground, and most model of them have the construction grounded through the bus bar. All the circuit on the same bus bar in hazardous area and non-hazardous area are grounded to the same electric potential. Moreover, in most countries, circuits in hazardous area need withstand voltage of 500 Vrms. Therefore, it is impossible to ground circuits in hazardous area and use them. Insulating barriers impose no restrictions like this, so it is possible to ground circuits in hazardous area and use them (single point ground). However, a power supply for barrier is additionally required.

(5) Failure rate

The construction of Zener barriers is simple, because they carry out the function for security just with Zener Diode and resistance. On the other hand, insulating barriers consist of various parts, because they have the function of insulation and energy restriction. Therefore, the failure rate of insulating barriers is generally higher than that of Zener barriers. In Zener barriers, problems are usually solved by replacement and, in insulating barriers by modification.

(6) Accuracy, response

In general, Zener barriers have advantages about accuracy and response, because insulating barriers usually have more complex signal path than Zener barriers.

(7) Withstand voltage

Withstand voltage is a rating which only insulating barriers have. Most of the models have 250 V or more AC/DC, so there's almost no problem at the time of instrumentation.

(8) Security rating

Security rating indicates the scale of energy that can be occurred in hazardous area of barrier in the case of the accident. It is usually described by the signage, such as Uo=n V, Io=n mA, Po=n W, Co=n μF, Lo=n mH (Um=n Vrms or DC: only insulating barriers).

(In FM standard, it is called entity parameter, including the parameter of (10), and is described such as Voc=n V, Isc=n mA, Ca=n μF, La=n mH).

(9) Permissible cable parameter

Permissible cable parameter indicates the scale (capacity, inductance) of hazardous area circuit (including cables) which can be connected to barriers. It is regulated by a barrier and a kind of gases. It is usually described by group (ex. IIC etc.=a kind of gases), n μF (capacity), n mH or n μH/Ω (inductance or L/R ratio).

(10) Voltage in non-hazardous area

In regards to Zener barriers, Vwkg (maximum working voltage) and Vmax (maximum permissible voltage) are regulated. In regards to insulating barriers, regulation of voltage is for power supply rating only, but the use conditions of circuit in non-hazardous area are different by models.

(11) Influence by resistance value between input and output

This is a matter of only Zener barriers. As resistance and fuse exist between terminals of input and output in a barrier, in regards to an application that pass an electric current, it is necessary to take account of voltage drop inside the barrier. Moreover, in some application, it is necessary to take account of Diode current leakage (usually several μA).

## Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit.

Wiring should be prepared in accordance with IEC 60079-14, NEC (National Electrical Code : NFPA-70), or the standard of the country and the area in which it is set. In regards to the further wiring than the module with built-in barrier, take notice that it should be an intrinsic safety circuit. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

After setting, check the wiring according to the checklist described in IEC 60079-17.

See the IM 33Y06K01-90E, for considerations for modules with built-in barrier.

An intrinsic safety circuit of barrier is indicated by the following ratings.

| | |
|---|---|
| Maximum voltage of intrinsic safety circuit | Uo |
| Maximum current of intrinsic safety circuit | Io |
| Maximum electricity of intrinsic safety circuit | Po |
| Permissible inductance of intrinsic safety circuit | Lo |
| Permissible capacitance of intrinsic safety circuit | Co |

As a combination of intrinsic safety circuits connected with barriers and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

| | | |
|---|---|---|
| Uo | ≤ | Ui |
| Io | ≤ | Ii |
| Po | ≤ | Pi |
| Lo | ≥ | Li+Lw |
| Co | ≥ | Ci+Cw |

Intrinsic safety circuit should consist of barriers to meet these conditions of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.

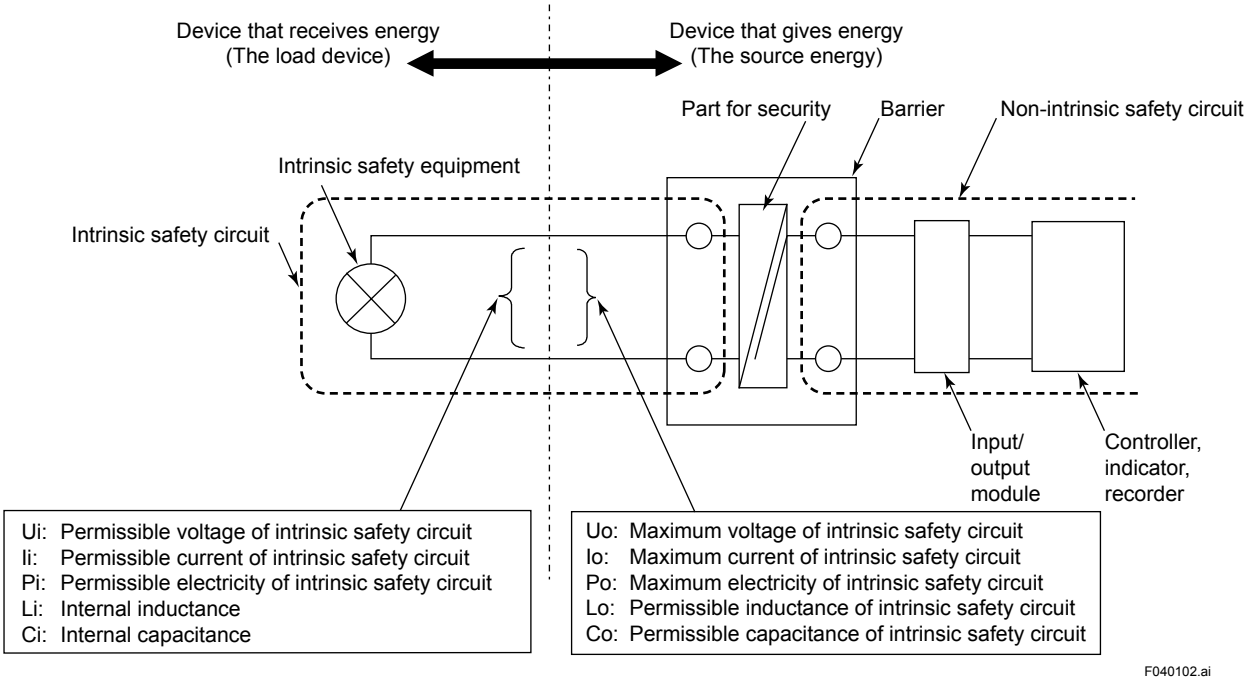



**Figure Composition Used in a Barrier**

# Considerations for Zener Barriers in Use

Check the specifications of barrier, before you use it.

## Considerations for Input Channel of Current

Note that the current value may have errors in a combination of FIO and Zener barrier.

In the system illustrated in the following figure, when the input module applies electric power to the transmitter, the input current value may have errors.

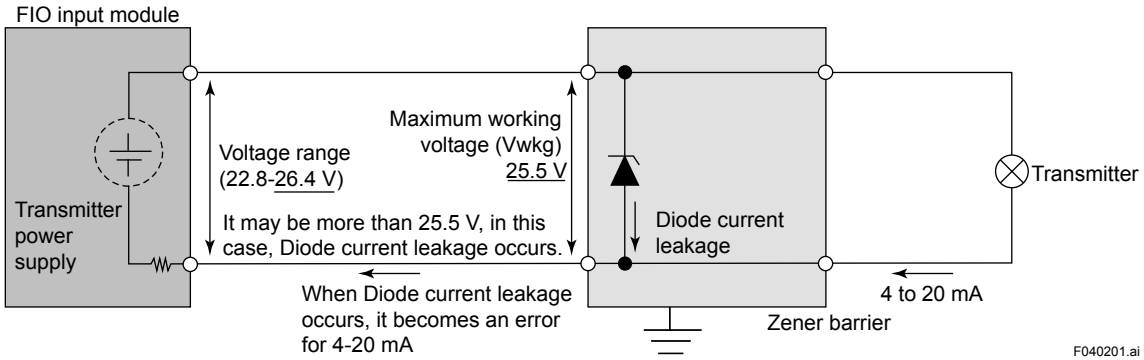



**Figure Considerations for Current Input Channel**

In FIO of CENTUM, when the input module applies electric power to the transmitter, applying voltage of 24 V may produce more than voltage of 25.5 V. In Zener barrier, if the voltage of more than 25.5 V is applied, the current runs on Diode, so that the excess of current doesn't apply. In this case, the quantity of current that passes on Diode for 4-20 mA signal from transmitter is added to the current applied to FIO input module, an error in a measurement are produced.

In RIO, as supply voltage does not exceed 25.5 V, no Diode current leakage generated and no error in a measurement are produced.

Note: In AAI143, although supply voltage is limited 25.5 V, Zener barrier cannot be connected because of the problem about wiring channel.

## Considerations for Current Output Module

The current output module adjusts voltage so that it generates an appropriate value of current, and outputs it. The output module checks if the value of output current and that of actual current are the same. The current of 0 is considered as OOP. If the value of actual current is lower than that of output current, Readback error occurs, which is considered as a hardware mdule failure.

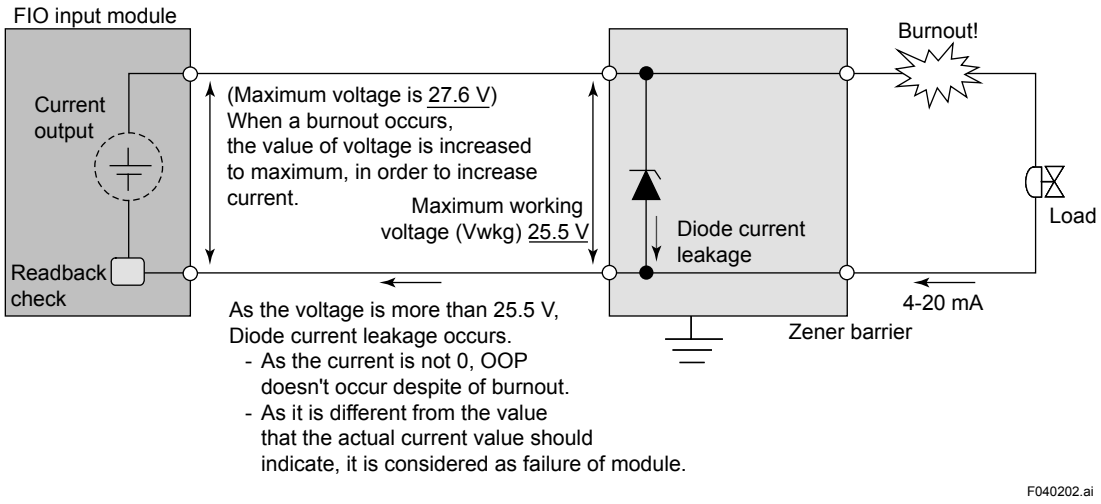



**Figure Considerations for Output Module of Current**

The voltage of more than 25.5 V produces Diode current leakage, so that the value of current never becomes 0 in Readback check, despite of burnout. Therefore, the check of OOP is not available. The value of current is considered as failure of module, because it is different from the value of output current. In RIO module, as the voltage is constant and 25.5 V or less, there is no disadvantage like this.

# Example of Connection at the Barrier in Use (Connection Using Marshaling Panel)

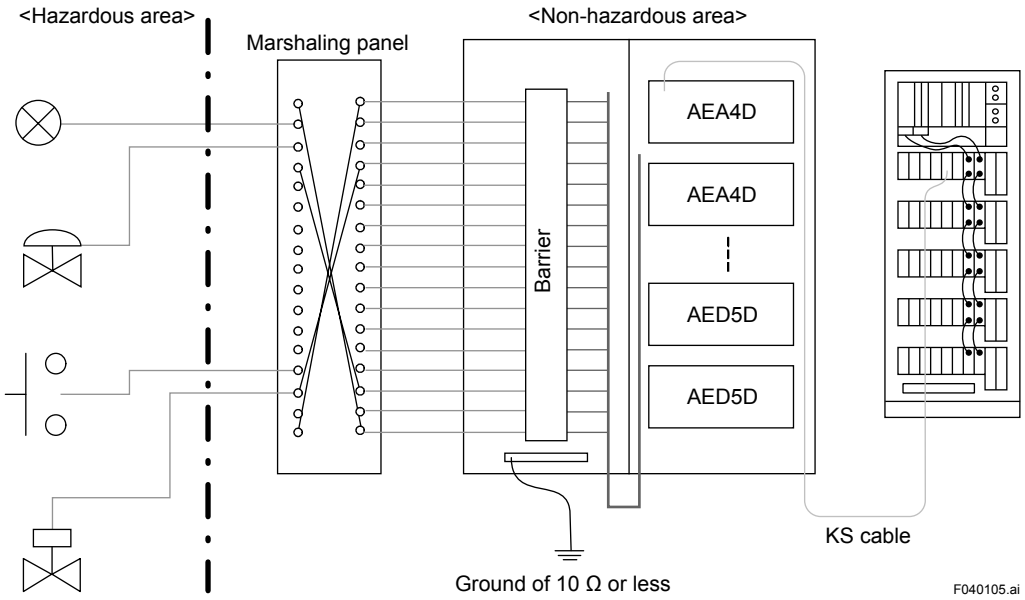



**Figure Example of Connection at the Barrier in Use (Connection Using Marshaling Panel)**

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Creepage distance between intrinsic safety circuit and non-intrinsic safety circuit should be kept 50 mm or more.
- Wiring should be prepared in accordance with IEC 60079-14, NEC (National Electrical Code : ANSI/NFPA-70), CEC (Canadian Electrical Code), or the wiring for explosion protection that each country regulates.

# Appendix 1. Lists of NI Compliant Products and NI Parameters

## Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters

### The List of CSA NI Compliant Products

**Table The List of CSA NI Compliant Products <for FIO> (1/2)**

| Classifications | Type names | Products |
|---|---|---|
| Node unit | ANR10S-□1□ | Node unit for ER bus single (100 V AC power supply) |
| | ANR10S-□4□ | Node unit for ER bus single (24 V DC power supply) |
| | ANR10D-41□ | Node unit for ER bus duplication (100 V AC power supply duplication) |
| | ANR10D-44□ | Node unit for ER bus duplication (24 V DC power supply duplication) |
| | ANR11S-□1□ | Node Unit for Single ER Bus (100 V AC power supply) |
| | ANR11S-□4□ | Node Unit for Single ER Bus (24 V AC power supply) |
| | ANR11D-41□ | Node Unit for Dual-Redundant ER Bus (100 V AC power supply duplication) |
| | ANR11D-44□ | Node Unit for Dual-Redundant ER Bus (24 V AC power supply duplication) |
| Power supply module | PW481-1□ | 100 V AC power supply module |
| | PW484-1□ | 24 V DC power supply module |
| Bus interface module | EB501 | ER bus interface slave module |
| | EB511 | ER bus interface slave module |
| I/O module | AAI141 | Analog input module (4 to 20 mA, 16 points, non-insulation) |
| | AAV141 | Analog input module (1 to 5 V, 16 points, non-insulation) |
| | AAV142 | Analog input module (-10 to +10 V, 16 points, non-insulation) |
| | AAB141 | Analog input module (1 to 5 V / 4 to 20 mA, 16-channel, non-isolated) |
| | AAI841 | Analog I/O module (4 to 20 mA, 8 input points/8 output points, non-insulation) |
| | AAB841 | Analog I/O module (1 to 5 V output 4 to 20 mA, 8 input points/8 output points, non-insulation) |
| | AAB842 | Analog I/O module (1 to 5 V / 4 to 20 mA input, 4 to 20 mA output, 8-channel input / 8-channel output, non-isolated) |
| | AAV542 | Analog output module (-10 to +10 V, 16 points, non-insulation) |
| | AAI143 | Analog input module (4 to 20 mA, 16 points, whole insulation) |
| | AAI543 | Analog output module (4 to 20 mA, 16 points, whole insulation) |
| | AAV144 | Analog input module (-10 to +10 V, 16 points, whole insulation) |
| | AAV544 | Analog output module (-10 to +10 V, 16 points, whole insulation) |
| | AAT141 | Thermocouple/mV input module (16 points, whole insulation) |
| | AAR181 | RTD input module (12 points, whole insulation) |
| | AAI135 | Analog input module (4 to 20 mA, 8 points, individual insulation) |
| | AAI835 | Analog I/O module (4 to 20 mA, 4 points input /4 points output, individual insulation) |
| | AAP135 | Pulse input module (0 to 10 kHz, 8 points, individual insulation) |
| | AAT145 | Thermocouple/mV input module (16 points, individual insulation) |
| | AAR145 | RTD/slide rheostat input module (16 points, individual insulation) |
| | ADV151 | Digital input module (32 points, pulse-count function) |
| | ADV551 (*1) | Digital output module (32 points, pulse with output function) |
| | ADV141 | Digital input module (16 points, 100 V AC, pulse-count function) |
| | ADV157 | Digital input module (32 points, for press-tightening terminal only) |

*1: For the combination of ADV551 and AED5D, or ADV561 and AED5D in voltage output mode ( means powering a external load from AED5D), the CSA NI field wiring cannot be made.

Note: For type names without the basic specification code, any products with basic specification codes are CSA NI approved products. Also any accessories for maintenance are CSA NI approved products.

**Table The List of CSA NI Compliant Products <for FIO> (2/2)**

| Classifications | Type names | Products |
|---|---|---|
| I/O module | ADV557 | Digital output module (32 points, for press-tightening terminal only) |
| | ADV161 | Digital input module (64 points, pulse-count function) |
| | ADV561 (*1) | Digital output module (64 points, pulse-count function) |
| | ADR541 | Relay output module (16 points, pulse with output function) |
| | ALF111 | Fieldbus (FF-H1) communication module |
| Terminal block | ATA4D | Duplicated press-tightening terminal block for analog |
| | ATT4D | Duplicated press-tightening terminal block for thermocouple/mV |
| | ATR8D | Duplicated press-tightening terminal block for RTD |
| | ATB5D | Duplicated press-tightening terminal block for digital input |
| | ATD5D | Duplicated press-tightening terminal block for digital output |
| | ATI3D | Duplicated press-tightening terminal block for analog individual insulation |
| | ATA4S | Single press-tightening terminal block for analog |
| | ATT4S | Single press-tightening terminal block for thermocouple/mV |
| | ATR8S | Single press-tightening terminal block for digital RTD |
| | ATB5S | Single press-tightening terminal block for digital input |
| | ATD5S | Single press-tightening terminal block for digital output |
| | ATI3S | Single press-tightening terminal block for analog individual insulation |
| | ATC4S-5□ | Press-tightening terminal block for digital (for 100 V AC input) |
| | ATC4S-7□ | Press-tightening terminal block for digital (for relay output) |
| | ATC5S | Press-tightening terminal block for digital (for ADV157, ADV557) |
| | ATF9S | Press-tightening terminal block for fieldbus |
| | ATK4A | KS cable interface adapter (for analog) |
| | ATM4A | KS cable interface adapter (for MAC2 compatible) |
| | ATV4A | KS cable interface adapter (for VM2 compatible) |
| | ATI3A | KS cable interface adapter (for AAI135, AAP135) |
| | ATB3A | KS cable interface adapter (for AAI835) |
| | ATD5A | KS cable interface adapter (for digital) |
| Terminal board | AEA3D | Analog/single, Duplicated terminal board (8 points x 4) |
| | AEA4D | Analog/single, Duplicated terminal board (16 points x 2 or 8 points x 2) |
| | AET4D | Thermocouple/single, Duplicated terminal board (16 points x 2) |
| | AER4D | RTD/ slide rheostat single, duplicated terminal board (16 points) |
| | AED5D (*1) | Digital/single, duplicated terminal board (32 points x 2) |
| | AEC4D-5□ | Digital/single, duplicated terminal board (for 100 V AC input) |
| | AEC4D-7□ | Digital/single, duplicated terminal board (for relay output) |
| | AEF9D | Fieldbus/single, duplicated terminal board |
| | MRT | Terminal board for RTD |
| | TERT | Terminal block for RTD (16 points) |
| Bus cable | YCB141 | ER bus cable |
| | YCB311 | ER bus extension cable |
| | YCB147 | ER bus cable conversion adapter |
| Signal cable | AKB331 | Signal cable (ADV151, between ADV551 and terminal board) |
| | AKB332 | Signal cable (between ADV141 and terminal board) |
| | AKB334 | Signal cable (between ADR541 and terminal board) |
| | AKB335 | Signal cable (between AAR145 and AER4D) |
| | AKB336 | Signal cable (between ALF111 and terminal board) |
| | AKB337 | Signal cable (ADV161, between ADV561 and terminal board) |
| | KS1 | Signal cable (40 - 40 pin) |
| | KS8 | Signal cable (50 - 50 pin) |
| I/O module | EB401 | ER bus interface master module |

*1: For the combination of ADV551 and AED5D, or ADV561 and AED5D in voltage output mode ( means powering a external load from AED5D), the CSA NI field wiring cannot be made.

Note: For type names without the basic specification code, any products with basic specification codes are CSA NI approved products. Also any accessories for maintenance are CSA NI approved products.

| Classifications | Type names | Products |
|---|---|---|
| Distribution unit | AEP7D-1□ | Primary distribution unit (for 100 V AC input) |
| | AEP7D-4□ | Primary distribution unit (for 24 V DC input) |
| | AEP9D | Secondary distribution unit |

Note: For type names without the basic specification code, any products with basic specification codes are CSA NI approved products. Also any accessories for maintenance are CSA NI approved products.

**Table The List of CSA NI Compliant Products <for RIO> (1/2)**

| Classifications | Type names | Products |
|---|---|---|
| Node interface unit | ANS50-5□1 | Node interface unit for RIO bus single (100 V AC power supply) |
| | ANS50-5□4 | Node interface unit for RIO bus single (24 V DC power supply) |
| | AND50-5□1 | Node interface unit for RIO bus duplication (100 V AC power supply) |
| | AND50-5□4 | Node interface unit for RIO bus duplication (24 V DC power supply) |
| Optical bus repeater | YNT511□-R41 | Optical bus repeater (for RIO bus, 100 V AC power supply, for 4 km or less) |
| | YNT511□-R44 | Optical bus repeater (for RIO bus, 24 V DC power supply, for 4 km or less) |
| | YNT521□-R11 | Optical bus repeater (for RIO bus, 100 V AC power supply, for 15 km or less) |
| | YNT521□-R14 | Optical bus repeater (for RIO bus, 24 V DC power supply, for 15 km or less) |
| I/O module nest | AMN11 | Nest for analog I/O module |
| | AMN12 | High speed type nest for analog I/O module |
| | AMN21 | Nest for relay I/O module |
| | AMN31 | Terminal type I/O module nest |
| | AMN32 | Connector type I/O module nest |
| | AMN33 | Nest for communication module |
| | AMN34 | Multiple control analog I/O module nest |
| I/O module | AAM10 | Current/Voltage input module |
| | AAM11 | Current/Voltage input module |
| | AAM11B | Current/Voltage input module |
| | AAM21 | mV, thermocouple, RTD input module |
| | AAM21J | mV, thermocouple, RTD input module (JIS C1602-1995, C1604-1997 compliant) |
| | APM11 | Pulse input module |
| | AAM50 | Current output module |
| | AAM51 | Current/Voltage output module |
| | AMM12T | Voltage input multiplexer module (terminal type) |
| | AMM12C | Voltage input multiplexer module (connector type) |
| | AMM22M | mV input multiplexer module |
| | AMM22T | Thermocouple input multiplexer module |
| | AMM22TJ | Thermocouple input multiplexer module (16 points terminal type, JIS C1602-1995 compliant) |
| | AMM22C | mV input multiplexer module (16 points connector type) |
| | AMM32T | RTD input multiplexer module (16 points terminal type) |
| | AMM32TJ | RTD input multiplexer module (16 points terminal type, JIS C1604-1997 compliant) |
| | AMM32C | RTD input multiplexer module (16 points connector type) |
| | AMM32CJ | RTD input multiplexer module (16 points connector type, JIS C1604-1997 compliant) |
| | AMM42T | Two wired transmitter input multiplexer module |
| | AMM52T | Current output multiplexer module |

Note: Accessories for maintenance are CSA NI approved products.

**Table The List of CSA NI Compliant Products <for RIO> (2/2)**

| Classifications | Type names | Products |
|---|---|---|
| I/O module | ADM11T | Contact input module (16 points, terminal type) |
| | ADM11C | Contact input module (16 points, connector type) |
| | ADM12T | Contact input module (32 points, terminal type) |
| | ADM12C | Contact input module (32 points, connector type) |
| | ADM51T-1, ADM51T-2 | Contact output module (16 points, terminal type) |
| | ADM51C-1, ADM51C-2 | Contact output module (16 points, connector type) |
| | ADM52T-1, ADM52T-2 | Contact output module (32 points, terminal type) |
| | ADM52C-1, ADM52C-2 | Contact output module (32 points, connector type) |
| | ADM15R | Relay input module |
| | ADM55R-1, ADM55R-2 | Relay output module |
| | ACM11 | RS-232C communication module |
| | ACM12 | RS-422/RS-485 communication module |
| | ACF11 | Fieldbus communication module |
| | AMC80 | Analog I/O module for multiple control |
| Terminal block | TE16 | Terminal block for 16 points |
| | TE32 | Terminal block for 32 points |
| Terminal board | MCM | Terminal board |
| | MUB | General-purpose terminal board (16 points board) |
| | MUD | General-purpose terminal board (32 points board) |
| | MRT | Terminal board for RTD |
| Bus cable | YCB121 | RIO bus cable |
| Signal cable | KS1 | Signal cable (40-40 pins) |
| | KS2 | Signal cable (40-40 pins) |
| | KS8 | Signal cable (50-50 pins) |
| | KS9 | Signal cable (50-50 pins) |

Note: Accessories for maintenance are CSA NI approved products.

# Parameters of CSA NI Compliant Equipments

## FIO

The appropriate I/O modules and parameters are as follows.
The appropriate equipments are source devices.

**Table FIO Parameters (The Source Devices) (1/2)**

| Module name | | Voc (V) | Isc (mA) | Ca (μF) | La (mH) | Vn (V) | In (mA) | Cn (μF) | Ln (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|---|---|---|---|
| EB501 | | 9.4 | 45.0 | 0.39 | 0.46 | 1.2 | 45.0 | 0.39 | 10.0 | With terminating resistance 50 Ω (*2) |
| EB511 | | 4.0 | 50.0 | 0.019 | 0.27 | 2.1 | 42.0 | 0.019 | 10.0 | |
| AAI141 | Dual | 27.6 | 54.0 | 0.12 | 2.7 | 27.6 | 24.0 | 0.12 | 100.0 | If two-wired type is set |
| | Single | 27.6 | 27.0 | 0.19 | 2.7 | 27.6 | 24.0 | 0.19 | 100.0 | If two-wired type is set |
| AAI143 | Dual | 25.5 | 26.3 | 0.22 | 21.9 | 25.5 | 23.0 | 0.22 | 100.0 | If two-wired type is set |
| | Single | 25.5 | 26.3 | 0.22 | 21.9 | 25.5 | 23.0 | 0.22 | 100.0 | If two-wired type is set |
| AAI841 Input | Dual | 27.6 | 54.0 | 0.12 | 2.7 | 27.6 | 24.0 | 0.12 | 100.0 | If two-wired type is set |
| | Single | 27.6 | 27.0 | 0.19 | 2.7 | 27.6 | 24.0 | 0.19 | 100.0 | If two-wired type is set |
| AAI841 Output | Dual | 27.6 | 23.0 | 0.12 | 19.0 | 27.6 | 23.0 | 0.12 | 100.0 | |
| | Single | 27.6 | 23.0 | 0.19 | 19.0 | 27.6 | 23.0 | 0.19 | 100.0 | |
| AAB841 Output | Dual | 27.6 | 23.0 | 0.12 | 19.0 | 27.6 | 23.0 | 0.12 | 100.0 | |
| | Single | 27.6 | 23.0 | 0.19 | 19.0 | 27.6 | 23.0 | 0.19 | 100.0 | |
| AAI543 | Dual | 24.3 | 23.0 | 0.33 | 21.9 | 24.3 | 23.0 | 0.33 | 100.0 | |
| | Single | 24.3 | 23.0 | 0.33 | 21.9 | 24.3 | 23.0 | 0.33 | 100.0 | |
| AAI835 Input | Dual | 31.0 | 31.0 | 0.25 | 15.4 | 31.0 | 24.0 | 0.25 | 100.0 | If two-wired transmitter is set |
| | Single | 31.0 | 31.0 | 0.12 | 15.4 | 31.0 | 24.0 | 0.12 | 100.0 | If two-wired transmitter is set |
| AAI835 Output | Dual | 31.0 | 23.0 | 0.15 | 40.0 | 31.0 | 23.0 | 0.15 | 100.0 | |
| | Single | 31.0 | 23.0 | 0.12 | 40.0 | 31.0 | 23.0 | 0.12 | 100.0 | |
| AAI135 | Dual | 31.0 | 31.0 | 0.25 | 15.4 | 31.0 | 24.0 | 0.25 | 100.0 | If two-wired transmitter is set |
| | Single | 31.0 | 31.0 | 0.12 | 15.4 | 31.0 | 24.0 | 0.12 | 100.0 | If two-wired transmitter is set |
| AAP135 | | - | - | - | - | - | - | - | - | Non-compliant (*3) |
| AAV542 | Dual | 11.0 | 11.7 | 0.27 | 20.0 | 11.0 | 11.7 | 0.27 | 100.0 | |
| | Single | 11.0 | 11.7 | 0.4 | 20.0 | 11.0 | 11.7 | 0.4 | 100.0 | |
| AAV544 | Dual | 11.8 | 12.5 | 0.27 | 20.0 | 11.8 | 12.5 | 0.27 | 100.0 | |
| | Single | 11.8 | 12.5 | 0.4 | 20.0 | 11.8 | 12.5 | 0.4 | 100.0 | |
| AAR181 | Dual | 5.25 | 1.0 | 1.0 | 20.0 | 5.25 | 1.0 | 5.0 | 100.0 | |
| | Single | 5.25 | 1.0 | 1.0 | 20.0 | 5.25 | 1.0 | 5.0 | 100.0 | |
| AAT145 | Dual | 5.0 | 0.5 | 1.0 | 20.0 | 1.25 | 0.125 | 1.0 | 100.0 | RJC input |
| | Single | 5.0 | 0.5 | 1.0 | 20.0 | 1.25 | 0.125 | 1.0 | 100.0 | RJC input |
| AAT145 | Dual | 16.5 | 33.4 | 0.3 | 0.8 | 16.5 | 5.0 | 0.3 | 0.8 | Power supply for RJC |
| | Single | 16.5 | 16.7 | 0.3 | 0.8 | 16.5 | 5.0 | 0.3 | 0.8 | Power supply for RJC |
| AAT145 | Dual | 16.5 | 33.0 | 0.3 | 0.8 | 16.5 | 4.4 | 0.3 | 0.8 | Detection of unplugged cable |
| | Single | 16.5 | 16.5 | 0.3 | 0.8 | 16.5 | 2.2 | 0.3 | 0.8 | Detection of unplugged cable |
| AAR145 | Dual | 5.0 | 1.1 | 1.0 | 20.0 | 5.0 | 1.1 | 1.0 | 100.0 | RTD/POT input |
| | Single | 5.0 | 1.1 | 1.0 | 20.0 | 5.0 | 1.1 | 1.0 | 100.0 | RTD/POT input |
| AAR145 | Dual | 26.4 | 52.8 | 0.3 | 0.8 | 26.4 | 4.0 | 0.3 | 0.8 | Detection of unplugged cable |
| | Single | 26.4 | 26.4 | 0.3 | 0.8 | 26.4 | 2.0 | 0.3 | 0.8 | Detection of unplugged cable |
| AAB842 Output | Dual | 27.6 | 23.0 | 0.12 | 19.0 | 27.6 | 23.0 | 0.12 | 100.0 | |
| | Single | 27.6 | 23.0 | 0.19 | 19.0 | 27.6 | 23.0 | 0.19 | 100.0 | |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: EB401 and EB501 can be connected in parallel each other without any regard for the order.
*3: Install a conduit wiring or observe the locally regulated explosion protection wiring procedures.

**Table FIO Parameters (The Source Devices) (2/2)**

| Module name | | Voc (V) | Isc (mA) | Ca (µF) | La (mH) | Vn (V) | In (mA) | Cn (µF) | Ln (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|---|---|---|---|
| ADV151 | Dual | - | - | - | - | - | - | - | - | Contact input mode (*3) |
| | Single | - | - | - | - | - | - | - | - | |
| ADV161 | Dual | - | - | - | - | - | - | - | - | Contact input mode (*3) |
| | Single | - | - | - | - | - | - | - | - | |
| ADV551 | Dual | NI field wiring cannot be made (because the combination of this module and terminal boards cannot create current limit during supplying energy for NI equipment external wiring). | | | | | | | | Voltage output mode (*3) |
| | Single | | | | | | | | | |
| ADV561 | Dual | NI field wiring cannot be made (because the combination of this module and terminal boards cannot create current limit during supplying energy for NI equipment external wiring). | | | | | | | | Voltage output mode (*3) |
| | Single | | | | | | | | | |
| EB401 | | 9.4 | 45.0 | 0.39 | 0.46 | 1.2 | 45.0 | 0.39 | 10.0 | With terminating resistance 50 Ω (*2) |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: EB401 and EB501 can be connected in parallel each other without any regard for the order.
*3: Install a conduit wiring or observe the locally regulated explosion protection wiring procedures.

The appropriate products are load devices which received energy from CSA NI equipments.

**Table FIO Parameters (The Load Devices) (1/2)**

| Module name | | Vmax (V) | Imax (mA) | Ci (µF) | Li (µH) | Remarks (*1) (mode, terminals) |
|---|---|---|---|---|---|---|
| EB501 | | 10.0 | 0.9 µA | 8.0 pF | 0.1 | With terminating resistance 50 Ω |
| EB511 | | 4.0 | 50.0 | 40.0 pF | 0.3 | |
| AAI141 | Dual | 20.0 | 60.0 | 4200 pF | 3.6 | If four-wired type is set |
| | Single | 12.0 | 30.0 | 3100 pF | 4.8 | If four-wired type is set |
| AAI143 | Dual | 25.5 | 26.3 | 7000 pF | 10.0 | If four-wired type is set |
| | Single | 25.5 | 26.3 | 3500 pF | 10.0 | If four-wired type is set |
| AAI841 Input | Dual | 20.0 | 60.0 | 4200 pF | 3.6 | If four-wired type is set |
| | Single | 12.0 | 30.0 | 3100 pF | 4.8 | If four-wired type is set |
| AAI835 Input | Dual | 8.2 | 31.0 | 8600 pF | 2.0 | If four-wired transmitter is connected |
| | Single | 8.2 | 31.0 | 5300 pF | 4.0 | If four-wired transmitter is connected |
| AAI135 | Dual | 8.2 | 31.0 | 8600 pF | 2.0 | If four-wired transmitter is connected |
| | Single | 8.2 | 31.0 | 5300 pF | 4.0 | If four-wired transmitter is connected |
| AAP135 | Dual | 25.0 | 72.0 | 2.21 | 0 | If power 24 V DC is supplied |
| | Single | 25.0 | 36.0 | 1.11 | 0 | If power 24 V DC is supplied |
| AAP135 | Dual | 25.0 | 96.0 | 2.21 | 0 | If power 12 V DC is supplied |
| | Single | 25.0 | 48.0 | 1.11 | 0 | If power 12 V DC is supplied |
| AAV142 | Dual | 13.0 | 26.0 µA | 0.057 | 0.438 | |
| | Single | 13.0 | 13.0 µA | 0.03 | 0.880 | |
| AAV141 | Dual | 7.5 | 15.0 µA | 0.146 | 2.4 | |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | |
| AAV144 | Dual | 30.0 | 0.28 | 0.001 | 10.0 | |
| | Single | 30.0 | 0.14 | 0.001 | 10.0 | |
| AAB841 Input | Dual | 7.5 | 15.0 µA | 0.146 | 2.4 | |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | |
| AAT141 | Dual | 0.18 | 0.5 | 2.43 | 2.1 | |
| | Single | 0.18 | 0.25 | 2.43 | 2.1 | |
| AAB141 | Dual | 24.0 | 26.3 | 0.146 | 2.4 | Current input |
| | Single | 24.0 | 26.3 | 0.074 | 4.8 | Current input |
| AAB141 | Dual | 7.5 | 15.0 µA | 0.146 | 2.4 | Voltage input |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | Voltage input |
| AAB842 Input | Dual | 24.0 | 26.3 | 0.146 | 2.4 | Current input |
| | Single | 24.0 | 26.3 | 0.074 | 4.8 | Current input |
| AAB842 Input | Dual | 7.5 | 15.0 µA | 0.146 | 2.4 | Voltage input |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | Voltage input |
| ADV157 | Single | 30.0 | 5.5 | 0.11 | 0 | |
| ADV151 | Dual | 30.0 | 11.0 | 0.001 | 10.0 | |
| | Single | 30.0 | 5.5 | 0.001 | 10.0 | |
| ADV161 | Dual | 30.0 | 6.7 | 0.001 | 10.0 | |
| | Single | 30.0 | 3.4 | 0.001 | 10.0 | |
| ADV141 | - | - | - | - | - | Non-compliant (*2) |
| ADV557 | Single | 26.4 | 100.0 | 0.138 | 0 | |
| ADV551 | Dual | 26.4 | 100.0 | 0.28 | 10.0 | Without surge absorber Contact output mode |
| | Single | 26.4 | 100.0 | 0.14 | 10.0 | Contact output mode |
| ADV561 | Dual | 26.4 | 100.0 | 0.275 | 0 | Contact output mode |
| | Single | 26.4 | 100.0 | 0.138 | 0 | Contact output mode |

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).
*2: Install a conduit wiring or observe the locally regulated explosion protection wiring procedures.
*3: Use a barrier for fieldbus as field wiring terminal for CSA NI (example: KLD2-PR-Ex1.IEC1).

**Table FIO Parameters (The Load Devices) (2/2)**

| Module name | | Vmax (V) | Imax (mA) | Ci (µF) | Li (µH) | Remarks (*1) (mode, terminals) |
|---|---|---|---|---|---|---|
| ADR541 | Dual | 26.4 | 100.0 | 160.0 pF | 0 | When DC is impressed. |
| | | 110 .0 | 14.0 | 160.0 pF | 0 | When DC is impressed. |
| | Single | 26.4 | 100.0 | 80.0 pF | 0 | When DC is impressed. |
| | | 110 .0 | 14.0 | 80.0 pF | 0 | When DC is impressed. |
| AAT145 | Dual | 5.0 | 1.0 | 0.0015 | 12.6 | TC/mV input |
| | Single | 5.0 | 1.0 | 0.0010 | 12.6 | TC/mV input |
| ALF111 | Dual | - | - | - | - | (*3) |
| | Single | - | - | - | - | (*3) |
| EB401 | | 10.0 | 0.9 µA | 8.0 pF | 0.1 | With terminating resistance 50 Ω |

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).
*2: Install a conduit wiring or observe the locally regulated explosion protection wiring procedures.
*3: Use a barrier for fieldbus as field wiring terminal for CSA NI (example: KLD2-PR-Ex1.IEC1).

**Table Cable Parameter**

| Model | Lc (µH/m) | Cc (pF/m) |
|---|---|---|
| YCB141 | 0.25 | 100 |
| YCB311 | 0.22 | 85 |
| KS1 | 1.50 | 110 |
| KS2 | 1.50 | 110 |
| KS8 | 1.50 | 110 |
| KS9 | 1.50 | 110 |
| AKB331 | 1.50 | 110 |
| AKB332 | 2.20 | 100 |
| AKB334 | 2.20 | 100 |
| AKB335 | 1.50 | 110 |
| AKB336 | 0.67 | 55 |
| AKB337 | 1.50 | 110 |

## RIO

The list of the appropriate I/O modules, electrical transceiver, optical transceiver, and the parameters are as follows.
The appropriate products are source devices.

**Table RIO Parameters (The Source Devices)**

| Module name | Voc (V) | Isc (mA) | Ca (μF) | La (mH) | Vn (V) | In (mA) | Cn (μF) | Ln (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|---|---|---|
| AAM10 | 25.5 | 35.0 | 0.20 | 4.0 | 25.5 | 22.0 | 0.20 | 100.0 | |
| AAM11 | 25.5 | 60.0 | 0.27 | 5.0 | 25.5 | 22.0 | 0.27 | 100.0 | |
| AAM11B | 25.5 | 60.0 | 0.27 | 5.0 | 25.5 | 22.0 | 0.27 | 100.0 | |
| AAM21<br>AAM21J | 3.0 | 1.5 | 1.00 | 20.0 | 1.5 | 1.0 | 1.00 | 100.0 | RTD input |
| APM11 | 26.4 | 40.0 | 0.15 | 2.0 | 26.4 | 35.0 | 0.15 | 50.0 | |
| AAM50 | 25.5 | 21.5 | 0.20 | 2.0 | 25.5 | 21.5 | 0.20 | 100.0 | |
| AAM51 | 25.5 | 21.5 | 0.20 | 4.0 | 25.5 | 21.5 | 0.20 | 100.0 | Current input mode |
| AAM51 | 10.3 | 60.0 | 0.20 | 4.0 | 10.3 | 10.0 | 0.20 | 100.0 | Voltage mode |
| AMC80 | 25.5 | 21.5 | 0.20 | 1.6 | 25.5 | 21.5 | 0.20 | 100.0 | Current output |
| AMC80 | 14.0 | 0.1 | 1.00 | 20.0 | 14.0 | 0.1 | 1.00 | 100.0 | Voltage input |
| AMM12 | 14.0 | 0.1 | 1.00 | 20.0 | 14.0 | 0.1 | 1.00 | 100.0 | |
| AMM22<br>AMM22J | 14.0 | 0.1 | 1.00 | 20.0 | 14.0 | 0.1 | 1.00 | 100.0 | TC/mV input |
| AMM32<br>AMM32J | 6.0 | 1.5 | 1.00 | 20.0 | 1.5 | 1.5 | 1.00 | 100.0 | RTD input |
| AMM42 | 24.5 | 60.0 | 0.27 | 0.8 | 24.5 | 22.0 | 0.27 | 100.0 | |
| AMM52 | 25.5 | 21.5 | 0.27 | 1.6 | 25.5 | 21.5 | 0.27 | 100.0 | |
| ADM11<br>ADM12 | 6.0 | 20.0 | 1.00 | 10.0 | 6.0 | 20.0 | 1.00 | 100.0 | |
| ADM51<br>ADM52 | Non-compliant (because energy is not supplied to NI equipment external wiring). | | | | | | | | |
| ADM15R | 25.5 | 8.5 | 0.20 | 2.0 | 25.5 | 8.5 | 0.20 | 100.0 | |
| ADM55R | Non-compliant (because energy is not supplied to NI equipment external wiring). | | | | | | | | |
| ACM11 | 22.0 | 40.0 | 0.05 | 0.5 | 19.5 | 15.0 | 0.10 | 10.0 | V input |
| ACM12 | 4.7 | 67.0 | 1.00 | 0.8 | 4.7 | 40.0 | 1.00 | 10.0 | |
| ACF11 | 20.0 | 150.0 | 0.18 | 0.1 | 20.0 | 80.0 | 0.18 | 5.0 | |
| RB401 | 13.0 | 140.0 | 0.27 | 10.0 | 5.0 | 90.0 | 1.00 | 1.0 | With terminating resistance 107 Ω (*2) |
| AIP511 | 13.0 | 140.0 | 0.27 | 10.0 | 5.0 | 90.0 | 1.00 | 1.0 | |
| AIP512 | 13.0 | 140.0 | 0.27 | 10.0 | 5.0 | 90.0 | 1.00 | 1.0 | |
| AIP581 | 13.0 | 140.0 | 0.27 | 10.0 | 5.0 | 90.0 | 1.00 | 1.0 | |

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).
*2: RB401, AIP511, AIP512, and AIP581 can be connected in parallel each other without any regard for the order.
Those can be connected, up to a maximum of 9 products, and their cables can be extended, up to a maximum of 750 m.

The appropriate products are load devices which received energy from CSA NI equipments.

**Table RIO Parameters (The Load Devices)**

| Module name | Vmax (V) | Imax (mA) | Ci (µF) | Li (µH) | Remarks (*1) |
|---|---|---|---|---|---|
| AAM10 | 11.0 | 40.0 | 0.015 | 10.0 | Current input mode, B-C |
| AAM10 | 30.0 | 1.0 | 0.015 | 10.0 | Voltage input mode, B-C |
| AAM11 | 11.0 | 40.0 | 0.015 | 10.0 | Current input mode, B-C |
| AAM11 | 30.0 | 1.0 | 0.015 | 10.0 | Voltage input mode, B-C |
| AAM11B | 11.0 | 40.0 | 0.015 | 10.0 | Current input mode, B-C |
| AAM11B | 30.0 | 1.0 | 0.015 | 10.0 | Voltage input mode, B-C |
| AAM21<br>AAM21J | 4.0 | 1.0 | 0.150 | 10.0 | TC/mV input mode, B-C |
| APM11 | 26.4 | 24.0 | 0.010 | 10.0 | Contact input mode, B-C |
| AMC80 | 30.0 | 1.0 | 0.001 | 10.0 | Voltage input |
| AMM12 | 30.0 | 1.0 | 0.010 | 10.0 | Voltage input mode |
| AMM22<br>AMM22J | 4.0 | 1.0 | 0.010 | 10.0 | TC/mV input mode |
| AMM32<br>AMM32J | 5.2 | 1.1 | 0.010 | 10.0 | RTD input mode |
| ADM11<br>ADM12 | 25.0 | 1.0 | 0.001 | 100.0 | Contact input mode, A-B |
| ADM51<br>ADM52 | 30.0 | 100.0 | 0.001 | 10.0 | Transistor contact mode |
| ADM55R | 25.0 | 100.0 | 0.001 | 10.0 | Relay output mode |
| | 130.0 | 12.0 | 0.001 | 10.0 | |
| ACM11 | 15.0 | 5.0 | 0.010 | 100.0 | |
| ACM12 | 14.0 | 5.0 | 0.010 | 100.0 | |
| RB401 | 20.0 | 80.0 | 0.001 | 8.0 mH | Terminating resistance (107 Ω) (*2) |
| AIP511 | 20.0 | 70.0 | 0.001 | 8.0 mH | |
| AIP512 | 20.0 | 80.0 | 0.001 | 8.0 mH | |
| AIP581 | 20.0 | 80.0 | 0.001 | 8.0 mH | |

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).

*2: RB401, AIP511, AIP512, and AIP581 can be connected in parallel each other without any regard for the order.
Those can be connected, up to a maximum of 9 products, and their cables can be extended, up to a maximum of 750 m.

**Table Cable Parameters**

| Model | Lc (µH/m) | Cc (pF/m) |
|---|---|---|
| YCB121 | 0.92 | 85 |
| KS1 | 1.50 | 110 |
| KS2 | 1.50 | 110 |
| KS8 | 1.50 | 110 |
| KS9 | 1.50 | 110 |

# Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters

## The List of FM NI Compliant Products

**Table The List of FM NI Compliant Products (1/2)**

| Classifications | Type names | Products |
|---|---|---|
| Field control unit | AFV10S (*1) | Field Control Unit(for Vnet/IP) |
| | AFV10D (*1) | Duplexed Field Control Unit(for Vnet/IP) |
| Node unit | ANB10S | Node Unit for Single ESB Bus |
| | ANB10D | Node Unit for Dual-Redundant ESB Bus |
| | ANR10S | Node Unit for Single ER Bus |
| | ANR10D | Node Unit for Dual-Redundant ER Bus |
| | ANR11S | Node Unit for Single ER Bus |
| | ANR11D | Node Unit for Dual-Redundant ER Bus |
| Processor module | CP451 | Processor module |
| Power supply module | PW481 | 100 V AC power supply module |
| | PW482 | 220 V AC power supply module |
| | PW484 | 24 V DC power supply module |
| Bus interface module | SB401 | ESB bus interface slave module |
| | EB501 | ER bus interface slave module |
| | EB511 | ER bus interface slave module |
| I/O module | AAI143 | Analog input module (4 to 20 mA, 16 points, whole insulation) |
| | AAI543 | Analog output module (4 to 20 mA, 16 points, whole insulation) |
| | AAV144 | Analog input module (-10 to +10 V, 16 points, whole insulation) |
| | AAV544 | Analog output module (-10 to +10 V, 16 points, whole insulation) |
| | AAI135 | Analog input module (4 to 20 mA, 8 points, individual insulation) |
| | AAI835 | Analog I/O module (4 to 20 mA, 4 points input /4 points output, individual insulation) |
| | AAP135 | Pulse input module (0 to 10 kHz, 8 points, individual insulation) |
| | AAT145 | Thermocouple/mV input module (16 points, individual insulation) |
| | AAR145 | RTD/slide rheostat input module (16 points, individual insulation) |
| | ADV151 | Digital input module (32 points, pulse-count function) |
| | ADV551 | Digital output module (32 points, pulse with output function) |
| | ADV161 | Digital input module (64 points, pulse-count function) |
| | ADV561 | Digital output module (64 points, pulse-count function) |
| | ALR111 | RS-232C communication module (2-port, 1200 bps to 115.2 kbps) |
| | ALR121 | RS-422/RS-485 serial communication module (2-port, 1200 bps to 115.2 kbps) |
| | ALE111 | Ethernet communication module |
| | ALF111 | Foundation Fieldbus (FF-H1) communication module |
| | ADCV01 | Dummy cover |

*1: AFV10S/AFV10D (FCU for Vnet/IP) requires L2 switch to connect to a network.
For L2 switch, select and use one that can be installed at Class I, Division 2 area and conforms to FM NI or UL1604.

Note: For type names without the basic specification code, any products with basic specification codes are FM NI approved products.
Also any accessories for maintenance are FM NI approved products.

**Table The List of FM NI Compliant Products (2/2)**

| Classifications | Type names | Products |
|---|---|---|
| Terminal block | ATA4S | Single press-tightening terminal block for analog |
| | ATB5S | Single press-tightening terminal block for digital input |
| | ATD5S | Single press-tightening terminal block for digital output |
| | ATI3S | Single press-tightening terminal block for analog individual insulation |
| | ATF9S | Press-tightening terminal block for Foundation Fieldbus |
| | ATA4D | Duplicated press-tightening terminal block for analog |
| | ATB5D | Duplicated press-tightening terminal block for digital input |
| | ATD5D | Duplicated press-tightening terminal block for digital output |
| | ATI3D | Duplicated press-tightening terminal block for analog individual insulation |
| | ATK4A | KS cable interface adapter (for analog) |
| | ATI3A | KS cable interface adapter (for AAI135, AAP135) |
| | ATB3A | KS cable interface adapter (for AAI835) |
| | ATD5A | KS cable interface adapter (for digital) |
| Terminal board | AEA3D | Analog/single, Duplicated terminal board (8 points x 4) |
| | AEA4D | Analog/single, Duplicated terminal board (16 points x 2 or 8 points x 2) |
| | AET4D | Thermocouple/single, Duplicated terminal board (16 points x 2) |
| | AER4D | RTD/ slide rheostat single, duplicated terminal board (16 points) |
| | AED5D | Digital/single, duplicated terminal board (32 points x 2) |
| | AEF9D | Fieldbus/single, duplicated terminal board |
| Bus cable | YCB301 | ESB bus cable |
| | YCB141 | ER bus cable |
| | YCB311 | ER bus extension cable |
| | YCB147 | ER bus cable conversion adaptor |
| | YCB138 | Fieldbus terminator |
| Signal cable | AKB331 | Signal cable (between ADV151, ADV551 and terminal board) |
| | AKB335 | Signal cable (for connection between AAR145 and AER4D) |
| | AKB336 | Signal cable (between ALF111 and terminal board) |
| | AKB337 | Signal cable (between ADV161, ADV561 and terminal board) |
| | KS1 | Signal cable |
| | AKB131 | RS-232C cable(for connection between ALR111and Modem) |
| | AKB132 | RS-232C cable(for connection between ALR111and RS-232C Device) |
| | AKB133 | RS-232C cable(for connection between ALR111and FA-M3) |
| | AKB134 | RS-232C cable(for connection between ALR111and RS-232C Device) |
| | AKB135 | RS-232C cable(for connection between ALR111 and Modem) |
| | AKB136 | RS-232C cable(for connection between ALR111 and RS-232C Device) |
| | AKB161 | RS-422/RS-485 cable (for connection between ACM12 and FA500) |
| | AKB162 | RS-422/RS-485 cable (for connection between ACM12 and YS) |
| I/O module | EB401 | ER bus interface master module |
| | EB402 | ER bus interface master module |
| | EC401 | ESB bus coupler module |
| Distribution unit | AEP7D | Primary distribution unit |
| | AEP9D | Secondary distribution unit |

Note: For type names without the basic specification code, any products with basic specification codes are FM NI approved products.
Also any accessories for maintenance are FM NI approved products.

# Parameters of FM NI Compliant Equipments

The table below shows the list of source devices for FM NI equipments.

**Table FIO Parameters (The Source Devices) (1/2)**

| Module name | | Voc (V) | Isc (mA) | Ca (μF) | La (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| AFV10S | TM1 | – | – | – | – | (*2) |
| AFV10D | TM1 | – | – | – | – | (*2) |
| CP451 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| SB401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB501 | Redundant | 9.4 | 45.0 | 0.39 | 0.46 | With terminator resister 50Ω |
| | Single | 9.4 | 45.0 | 0.39 | 0.46 | |
| EB511 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AAI143 | Redundant | 25.5 | 24.4 | 0.19 | 10.0 | 2-wire transmitter input |
| | Single | 25.5 | 24.4 | 0.19 | 10.0 | |
| AAI543 | Redundant | 24.3 | 23.0 | 0.19 | 10.0 | |
| | Single | 24.3 | 23.0 | 0.19 | 10.0 | |
| AAV544 | Redundant | 11.8 | 12.5 | 0.27 | 20.0 | |
| | Single | 11.8 | 12.5 | 0.4 | 20.0 | |
| AAI135 | Redundant | 29.3 | 31.0 | 0.12 | 10.0 | 2-wire transmitter input |
| | Single | 29.3 | 31.0 | 0.12 | 10.0 | |
| AAI835 Input | Redundant | 29.3 | 31.0 | 0.12 | 10.0 | 2-wire transmitter input |
| | Single | 29.3 | 31.0 | 0.12 | 10.0 | |
| AAI835 Output | Redundant | 29.3 | 23.0 | 0.12 | 10.0 | |
| | Single | 29.3 | 23.0 | 0.12 | 10.0 | |
| AAP135 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AAT145 | Redundant | 5.0 | 0.5 | 1.0 | 20.0 | RJC input |
| | Single | 5.0 | 0.5 | 1.0 | 20.0 | |
| | Redundant | 16.5 | 33.4 | 0.3 | 0.8 | Power supply for RJC |
| | Single | 16.5 | 16.7 | 0.3 | 0.8 | |
| | Redundant | 16.5 | 33.0 | 0.3 | 0.8 | Cable coming out detection |
| | Single | 16.5 | 16.5 | 0.3 | 0.8 | |
| AAR145 | Redundant | 5.0 | 1.1 | 1.0 | 20.0 | RTD/POT input |
| | Single | 5.0 | 1.1 | 1.0 | 20.0 | |
| | Redundant | 26.4 | 52.8 | 0.3 | 0.8 | Cable coming out detection |
| | Single | 26.4 | 26.4 | 0.3 | 0.8 | |
| ADV151 | Redundant | – | – | – | – | Contact input mode(*2) |
| | Single | – | – | – | – | |
| ADV551 | Redundant | – | – | – | – | Voltage output mode(*2) |
| | Single | – | – | – | – | |
| ADV161 | Redundant | – | – | – | – | Contact input mode(*2) |
| | Single | – | – | – | – | |
| ADV561 | Redundant | – | – | – | – | Voltage output mode(*2) |
| | Single | – | – | – | – | |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).

*2: For wiring the cables outside of the cabinets, NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

**Table FIO Parameters (The Source Devices) (2/2)**

| Module name | | Voc (V) | Isc (mA) | Ca (μF) | La (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| ALR111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALR121 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALE111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALF111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB401 | Redundant | 9.4 | 45.0 | 0.39 | 0.46 | With terminator resister 50Ω |
| | Single | 9.4 | 45.0 | 0.39 | 0.46 | |
| EB402 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EC401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AEP7D | CN1 to CN14 | – | – | – | – | (*2) |
| AEP9D | CN1 to CN18 | – | – | – | – | (*2) |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).

*2: For wiring the cables outside of the cabinets, NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

The table below shows the list of load devices receive energy from FM NI equipments.

**Table FIO Parameters (The Load Devices) (1/2)**

| Module name | | Vmax (V) | Imax (mA) | Ci (µF) | Li (µH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| AFV10S | TM2 | – | – | – | – | (*2) |
| AFV10D | TM2 | – | – | – | – | (*2) |
| CP451 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| PW481 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| PW482 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| PW484 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| SB401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB501 | Redundant | 10.0 | 0.9 µA | 8.0 pF | 0.1 | With terminator resister 50Ω |
| | Single | 10.0 | 0.9 µA | 8.0 pF | 0.1 | |
| EB511 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AAI143 | Redundant | 25.5 | 26.3 | 7000 pF | 10.0 | 4-wire transmitter input |
| | Single | 25.5 | 26.3 | 3500 pF | 10.0 | |
| AAV144 | Redundant | 30.0 | 0.28 | 0.001 | 10.0 | When power is turned on, Rin = 1 MΩ or more (*3) |
| | Single | 30.0 | 0.14 | 0.001 | 10.0 | |
| AAI135 | Redundant | 24.0 | 31.0 | 5000 pF | 10.0 | 4-wire transmitter input |
| | Single | 24.0 | 31.0 | 5000 pF | 10.0 | |
| AAI835 Input | Redundant | 24.0 | 31.0 | 5000 pF | 10.0 | 4-wire transmitter input |
| | Single | 24.0 | 31.0 | 5000 pF | 10.0 | |
| AAP135 | Redundant | 26.4 | 30.0 | 5000 pF | 10.0 | |
| | Single | 26.4 | 30.0 | 5000 pF | 10.0 | |
| AAT145 | Redundant | 5.0 | 1.0 | 0.0015 | 12.6 | TC/mV input |
| | Single | 5.0 | 1.0 | 0.001 | 12.6 | |
| ADV151 | Redundant | 30.0 | 11.0 | 0.001 | 10.0 | Voltage input mode, Rin = 5.6 kΩ (*3) |
| | Single | 30.0 | 5.5 | 0.001 | 10.0 | |
| ADV551 | Redundant | 26.4 | 100.0 | 0.28 | 10.0 | ON/OFF status output mode, Without surge absorber |
| | Single | 26.4 | 100.0 | 0.14 | 10.0 | ON/OFF status output mode |
| ADV161 | Redundant | 30.0 | 6.7 | 0.001 | 10.0 | Voltage input mode, Rin = 9.1 kΩ (*3) |
| | Single | 30.0 | 3.4 | 0.001 | 10.0 | |
| ADV561 | Redundant | 26.4 | 100.0 | 0.275 | 0 | ON/OFF status output mode |
| | Single | 26.4 | 100.0 | 0.138 | 0 | |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: For wiring the cables outside of the cabinets, NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.
*3: Since the parameters such as Imax are calculated according to the internal impedance (Imax=Vmax/Rin), the case of Isc ≤ Imax in "How to compare parameters" in "3.1.2 FM Non-Incendiv " is omissible.
Make sure that the target equipment can be connected with this module has Rin : internal impedance described in remarks column.

**Table FIO Parameters (The Load Devices) (2/2)**

| Module name | | Vmax (V) | Imax (mA) | Ci (µF) | Li (µH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| ALR111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALR121 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALE111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALF111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB401 | Redundant | 10.0 | 0.9 µA | 8.0 pF | 0.1 | With terminator resister 50 Ω |
| | Single | 10.0 | 0.9 µA | 8.0 pF | 0.1 | |
| EB402 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EC401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AEP7D | TM1,TM2 | – | – | – | – | (*2) |
| AEP9D | TM1,TM2 | – | – | – | – | (*2) |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: For wiring the cables outside of the cabinets, NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

**Table Cable Parawmeters**

| Module | Lc (µH/m) | Cc (pF/m) | Remark (*1) |
|---|---|---|---|
| YCB301 | – | – | (*2) |
| YCB141 | 0.25 | 100.0 | |
| YCB311 | 0.22 | 85.0 | |
| KS1 | 1.5 | 110.0 | |
| AKB331 | 1.5 | 110.0 | |
| AKB335 | 1.5 | 110.0 | |
| AKB336 | 0.67 | 55.0 | |
| AKB337 | 1.5 | 110.0 | |
| AKB131 | – | – | (*2) |
| AKB132 | – | – | (*2) |
| AKB133 | – | – | (*2) |
| AKB134 | – | – | (*2) |
| AKB135 | – | – | (*2) |
| AKB136 | – | – | (*2) |
| AKB161 | – | – | (*2) |
| AKB162 | – | – | (*2) |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: For wiring the cables outside of the cabinets, NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

# Appendix 2. Lists of Type “n” Compliant Product and the Parameters of Type “n”

## The List of Type “n” Compliant Products

**Table The List of Type “n” Compliant Products (1/3)**

| Classifications | Type names | Products |
|---|---|---|
| Field control unit | AFV10S-S□14□1 (*1) | Field Control Unit(for Vnet/IP)(24 V DC power supply) |
| | AFV10D-S414□1 (*1) | Duplexed Field Control Unit(for Vnet/IP)(24 V DC power supply duplication) |
| Node unit | ANB10S-□4□ | Node Unit for Single ESB Bus(24 V DC power supply) |
| | ANB10D-44□ | Node Unit for Dual-Redundant ESB Bus(24 V DC power supply duplication) |
| | ANR10S-□4□ | Node unit for ER bus single (24 V DC power supply) |
| | ANR10D-44□ | Node unit for ER bus duplication (24 V DC power supply duplication) |
| | ANR11S-□4□ | Node Unit for Single ER Bus(24 V DC power supply) |
| | ANR11D-44□ | Node Unit for Dual-Redundant ER Bus(24 V DC power supply duplication) |
| Processor module | CP451 | Processor module |
| Power supply module | PW484 | 24 V DC power supply module |
| Bus Interface module | SB401 | ESB bus interface slave module |
| | EB501 | ER bus interface slave module |
| | EB511 | ER bus interface slave module |
| I/O module | AAI141 | Analog input module (4 to 20 mA, 16 points, non-insulation) |
| | AAI135 | Analog input module (4 to 20 mA, 8 points, individual insulation) |
| | AAV141 | Analog input module (1 to 5 V, 16 points, non-insulation) |
| | AAV142 | Analog input module (-10 to +10 V, 16 points, non-insulation) |
| | AAB141 | Analog input module (1 to 5 V / 4 to 20 mA, 16-channel, non-isolated) |
| | AAI841 | Analog I/O module (4 to 20 mA, 8 points input/4 points output, non-insulation) |
| | AAB841 | Analog I/O module (1 to 5 V input, 4 to 20 mA output, 8 points input/ 8 points output, non-insulation) |
| | AAB842 | Analog I/O module (1 to 5 V / 4 to 20 mA input, 4 to 20 mA output, 8-channel input / 8-channel output, non-isolated) |
| | AAI835 | Analog I/O module (4 to 20mA, 4 points input/4 points output, individual insulation) |
| | AAV542 | Analog output module (-10 to +10V, 16 points, non-insulation) |
| | AAT141 | Thermocouple/mV input module (16 points, whole insulation) |
| | AAR181 | RTD input module (12 points, whole insulation) |
| | AAT145 | Thermocouple/mV input module (16 points, individual insulation) |
| | AAR145 | RTD/slide rheostat input module (16 points, individual insulation) |
| | AAP135 | Pulse input module (0 to 10 kHz, 8 points, individual insulation) |
| | AAI143 | Analog input module (4 to 20 mA, 16 points, whole insulation) |
| | AAI543 | Analog output module (4 to 20 mA, 16 points, whole insulation) |
| | AAV144 | Analog input module (-10 to +10V, 16 points, whole insulation) |
| | AAV544 | Analog output module (-10 to +10V, 16 points, whole insulation) |
| | ADV157 | Digital input module (32 points, for press-tightening terminal only) |
| | ADV151 | Digital input module (32 points, with pulse-count function) |
| | ADV161 | Digital input module (64 points, with pulse-count function) |

*1: AFV10S/AFV10D (FCU for Vnet/IP) requires L2 switch to connect to a network. For L2 switch, select and use one that can be installed at Zone 2 area and conforms to type “n”.

Note: For type names without the basic specification code in the table above, any products with basic specification codes are Type “n” compliant products. Also any accessories for maintenance are Type “n” compliant products.

**Table The List of Type “n” Compliant Products (2/3)**

| Classifications | Type names | Products |
|---|---|---|
| I/O module | ADV557 | Digital output module (32 points, for press-tightening terminal only) |
| | ADV551 | Digital output module (32 points, with pulse width output function) |
| | ADV561 | Digital output module (64 points, with pulse-count function) |
| | ADR541 | Relay output module (16 points, with pulse width output function) |
| | ALR111 | RS-232C communication module (2-port, 1200 bps to 115.2 kbps) |
| | ALR121 | RS-422/RS-485 serial communication module (2-port, 1200 bps to 115.2 kbps) |
| | ALE111 | Ethernet communication module |
| | ALF111 | Foundation Fieldbus (FF-H1) communication module |
| | ADCV01 | Dummy cover |
| Terminal block | ATA4D | Duplicated press-tightening terminal block for analog |
| | ATT4D | Duplicated press-tightening terminal block for thermocouple/mV |
| | ATR8D | Duplicated press-tightening terminal block for RTD |
| | ATB5D | Duplicated press-tightening terminal block for digital input |
| | ATD5D | Duplicated press-tightening terminal block for digital output |
| | ATI3D | Duplicated press-tightening terminal block for analog individual insulation |
| | ATA4S | Single press-tightening terminal block for analog |
| | ATT4S | Single press-tightening terminal block for thermocouple/mV |
| | ATR8S | Single press-tightening terminal block for RTD |
| | ATB5S | Single press-tightening terminal block for digital input |
| | ATD5S | Single press-tightening terminal block for digital output |
| | ATI3S | Single press-tightening terminal block for analog individual insulation |
| | ATC4S-7□ | Press-tightening terminal block for digital (for relay output) |
| | ATC5S | Press-tightening terminal block for digital (for ADV157, ADV557) |
| | ATF9S | Press-tightening terminal block for Foundation Fieldbus |
| | ATK4A | KS cable interface adaptor (for analog) |
| | ATI3A | KS cable interface adaptor (for AAI135, AAP135) |
| | ATB3A | KS cable interface adaptor (for AAI835) |
| | ATD5A | KS cable interface adaptor (for digital) |
| | ATM4A | KS cable interface adaptor (for MAC2 compatible) |
| | ATV4A | KS cable interface adaptor (for VM2 compatible) |
| Terminal board | AEA3D | Analog/single, duplicated terminal board (8 points x 4) |
| | AEA4D | Analog/single, duplicated terminal board (16 points x 2, or 8 points x 2) |
| | AET4D | Thermocouple/single, duplicated terminal board (16 points x 2) |
| | AED5D | Digital/single, duplicated terminal board (32 points x 2) |
| | AEC4D-7□ | Digital/single, duplicated terminal board (for relay output) |
| | AEF9D | Fieldbus single, duplicated terminal board |
| | AER4D | RTD/single, duplicated terminal board |
| Bus cable | YCB301 | ESB bus cable |
| | YCB141 | ER bus cable |
| | YCB311 | ER bus extension cable |
| | YCB147 | ER bus cable conversion adaptor |
| | YCB138 | Fieldbus terminator |

Note: For type names without the basic specification code in the table above, any products with basic specification codes are Type “n” compliant products. Also any accessories for maintenance are Type “n” compliant products.

**Table The List of Type “n” Compliant Products (3/3)**

| Classifications | Type names | Products |
|---|---|---|
| Signal cable | AKB331 | Signal cable (between ADV151, ADV551 and terminal board) |
| | AKB334 | Signal cable (between ADR541 and terminal board) |
| | AKB335 | Signal cable (for connection between AAR145 and AER4D) |
| | AKB336 | Signal cable (between ALF111 and terminal board) |
| | AKB337 | Signal cable (between ADV161, ADV561 and terminal board) |
| | KS1 | Signal cable |
| | AKB131 | RS-232C cable (for connection between ALR111and Modem) |
| | AKB132 | RS-232C cable (for connection between ALR111and RS-232C Device) |
| | AKB133 | RS-232C cable (for connection between ALR111and FA-M3) |
| | AKB134 | RS-232C cable (for connection between ALR111and RS-232C Device) |
| | AKB135 | RS-232C cable (for connection between ALR111 and Modem) |
| | AKB136 | RS-232C cable (for connection between ALR111 and RS-232C Device) |
| | AKB161 | RS-422/RS-485 cable (for connection between ACM12 and FA500) |
| | AKB162 | RS-422/RS-485 cable (for connection between ACM12 and YS) |
| I/O module | EB401 | ER bus interface master module |
| | EB402 | ER bus interface master module |
| | EC401 | ESB bus coupler module |
| Distribution unit | AEP7D-4□ | Primary distribution unit (for 24 V DC input) |
| | AEP9D | Secondary distribution unit |

Note: For type names without the basic specification code in the table above, any products with basic specification codes are Type “n” compliant products. Also any accessories for maintenance are Type “n” compliant products.

# Parameters of Type “n” Compliant Equipments

Type “n” standard compliant I/O modules and parameters are as follows.
The table below shows the list of source devices for Type “n” equipments.

**Table FIO Parameters (The Source Devices) (1/2)**

| Module | | Uo (V) | Io (mA) | Co (μF) | Lo (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| AFV10S | TM1 | – | – | – | – | (*2) |
| AFV10D | TM1 | – | – | – | – | (*2) |
| CP451 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| SB401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB501 | Redundant | 9.4 | 45.0 | 0.39 | 0.46 | 10BASE-2<br>Terminating resistance 50 Ω (both sides) |
| | Single | 9.4 | 45.0 | 0.39 | 0.46 | |
| EB511 | Redundant | - | - | - | - | (*2) |
| | Single | - | - | - | - | |
| AAI141 | Redundant | 27.6 | 54.0 | 0.12 | 2.7 | If two-wired transmitter is connected |
| | Single | 27.6 | 27.0 | 0.19 | 2.7 | |
| AAI135 | Redundant | 29.3 | 31.0 | 0.12 | 10.0 | If two-wired transmitter is connected |
| | Single | 29.3 | 31.0 | 0.12 | 10.0 | |
| AAI841 Input | Redundant | 27.6 | 54.0 | 0.12 | 2.7 | If two-wired transmitter is connected |
| | Single | 27.6 | 27.0 | 0.19 | 2.7 | |
| AAI841 Output | Redundant | 27.6 | 23.0 | 0.12 | 19.0 | |
| | Single | 27.6 | 23.0 | 0.19 | 19.0 | |
| AAB841 Output | Redundant | 27.6 | 23.0 | 0.12 | 19.0 | |
| | Single | 27.6 | 23.0 | 0.19 | 19.0 | |
| AAI835 Input | Redundant | 29.3 | 31.0 | 0.12 | 10.0 | If two-wired transmitter is connected |
| | Single | 29.3 | 31.0 | 0.12 | 10.0 | |
| AAI835 Output | Redundant | 29.3 | 23.0 | 0.12 | 10.0 | |
| | Single | 29.3 | 23.0 | 0.12 | 10.0 | |
| AAV542 | Redundant | 11.0 | 11.7 | 0.27 | 20.0 | |
| | Single | 11.0 | 11.7 | 0.4 | 20.0 | |
| AAV544 | Redundant | 11.8 | 12.5 | 0.27 | 20.0 | |
| | Single | 11.8 | 12.5 | 0.4 | 20.0 | |
| AAR181 | Redundant | 5.25 | 1.0 | 1.0 | 20.0 | |
| | Single | 5.25 | 1.0 | 1.0 | 20.0 | |
| AAT145 | Redundant | 5.0 | 0.5 | 1.0 | 20.0 | RJC input |
| | Single | 5.0 | 0.5 | 1.0 | 20.0 | |
| | Redundant | 16.5 | 33.4 | 0.3 | 0.8 | Power supply for RJC |
| | Single | 16.5 | 16.7 | 0.3 | 0.8 | |
| | Redundant | 16.5 | 33.0 | 0.3 | 0.8 | Detection of unplugged cable |
| | Single | 16.5 | 16.5 | 0.3 | 0.8 | |
| AAR145 | Redundant | 5.0 | 1.1 | 1.0 | 20.0 | RTD/POT input |
| | Single | 5.0 | 1.1 | 1.0 | 20.0 | |
| | Redundant | 26.4 | 52.8 | 0.3 | 0.8 | Detection of unplugged cable |
| | Single | 26.4 | 26.4 | 0.3 | 0.8 | |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: For wiring the cable outside of the cabinets, EN 60079-14/IEC 60079-14 or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

**Table FIO Parameters (The Source Devices) (2/2)**

| Module | | Uo (V) | Io (mA) | Co (µF) | Lo (mH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| AAP135 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AAI143 | Redundant | 25.5 | 24.4 | 0.19 | 10.0 | If two-wired transmitter is connected |
| | Single | 25.5 | 24.4 | 0.19 | 10.0 | |
| AAI543 | Redundant | 24.3 | 23.0 | 0.19 | 10.0 | |
| | Single | 24.3 | 23.0 | 0.19 | 10.0 | |
| AAB842 Output | Redundant | 27.6 | 23.0 | 0.12 | 19.0 | |
| | Single | 27.6 | 23.0 | 0.19 | 19.0 | |
| ADV151 | Redundant | – | – | – | – | Contact input mode (*2) |
| | Single | – | – | – | – | |
| ADV161 | Redundant | – | – | – | – | Contact input mode (*2) |
| | Single | – | – | – | – | |
| ADV551 | Redundant | – | – | – | – | Voltage output mode (*2) |
| | Single | – | – | – | – | |
| ADV561 | Redundant | – | – | – | – | Voltage output mode (*2) |
| | Single | – | – | – | – | |
| ALR111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALR121 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALE111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALF111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB401 | Redundant | 9.4 | 45.0 | 0.39 | 0.46 | 10BASE-2<br>Terminating resistance 50 Ω (both sides) |
| | Single | 9.4 | 45.0 | 0.39 | 0.46 | |
| EB402 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EC401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AEP7D-4□ | CN1 to CN14 | – | – | – | – | (*2) |
| AEP9D | CN1 to CN18 | – | – | – | – | (*2) |

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).

*2: For wiring the cable outside of the cabinets, EN 60079-14/IEC 60079-14 or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

The table below shows the list of load devices receive energy from Type “n” equipments.

**Table FIO Parameters (The Load Devices) (1/2)**

| Module | | Ui (V) | Ii (mA) | Ci (µF) | Li (µH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| AFV10S | TM2 | – | – | – | – | (*2) |
| AFV10D | TM2 | – | – | – | – | |
| CP451 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| PW484 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| SB401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EB501 | Redundant | 10.0 | 0.9 µA | 8.0 pF | 0.1 | 10BASE-2<br>Terminating resistance 50 Ω (both sides) |
| | Single | 10.0 | 0.9 µA | 8.0 pF | 0.1 | |
| EB511 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AAI141 | Redundant | 20.0 | 60.0 | 4200 pF | 3.6 | If four-wired type is set |
| | Single | 12.0 | 30.0 | 3100 pF | 4.8 | |
| AAI135 | Redundant | 24.0 | 31.0 | 5000 pF | 10.0 | If four wired transmitter is set |
| | Single | 24.0 | 31.0 | 5000 pF | 10.0 | |
| AAV141 | Redundant | 7.5 | 15.0 µA | 0.146 | 2.4 | |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | |
| AAV142 | Redundant | 13.0 | 26 µA | 0.057 | 0.438 | |
| | Single | 13.0 | 13 µA | 0.03 | 0.880 | |
| AAV144 | Redundant | 30.0 | 0.28 | 0.001 | 10.0 | When the power is turned ON,<br>Rin = 1 MΩ or more (*3) |
| | Single | 30.0 | 0.14 | 0.001 | 10.0 | |
| AAI841 Input | Redundant | 20.0 | 60.0 | 4200 pF | 3.6 | If four-wired type is set |
| | Single | 12.0 | 30.0 | 3100 pF | 4.8 | |
| AAB841 Input | Redundant | 7.5 | 15.0 µA | 0.146 | 2.4 | |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | |
| AAI835 Input | Redundant | 24.0 | 31.0 | 5000 pF | 10.0 | If four wired transmitter is set |
| | Single | 24.0 | 31.0 | 5000 pF | 10.0 | |
| AAT141 | Redundant | 0.18 | 0.5 | 2.43 | 2.1 | |
| | Single | 0.18 | 0.25 | 2.43 | 2.1 | |
| AAT145 | Redundant | 5.0 | 1.0 | 0.0015 | 12.6 | TC/mV input |
| | Single | 5.0 | 1.0 | 0.0010 | 12.6 | |
| AAP135 | Redundant | 26.4 | 30.0 | 5000 pF | 10.0 | |
| | Single | 26.4 | 30.0 | 5000 pF | 10.0 | |
| AAI143 | Redundant | 25.5 | 26.3 | 7000 pF | 10.0 | If four-wired type is set |
| | Single | 25.5 | 26.3 | 3500 pF | 10.0 | |
| AAB141 | Redundant | 24.0 | 26.3 | 0.146 | 2.4 | Curent input |
| | Single | 24.0 | 26.3 | 0.074 | 4.8 | |
| AAB141 | Redundant | 7.5 | 15.0 µA | 0.146 | 2.4 | Voltage input |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | |
| AAB842 Input | Redundant | 24.0 | 26.3 | 0.146 | 2.4 | Curent input |
| | Single | 24.0 | 26.3 | 0.074 | 4.8 | |
| AAB842 Input | Redundant | 7.5 | 15.0 µA | 0.146 | 2.4 | Voltage input |
| | Single | 7.5 | 7.5 µA | 0.074 | 4.8 | |
| ADV157 | Single | 30.0 | 5.5 | 0.11 | 0 | |
| ADV151 | Redundant | 30.0 | 11.0 | 0.001 | 10.0 | Voltage input mode<br>Rin = 5.6 kΩ (*3) |
| | Single | 30.0 | 5.5 | 0.001 | 10.0 | |

*1: Without any mode name in the appropriate remarks , All parameters are valid for any operation mode of the module (type name).
*2: For wiring the cables outside of the cabinets, EN 60079-14/IEC 60079-14 or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.
*3: Since the parameters such as Ii are calculated according to the internal impedance (Ii = Ui/Ri), the case of Io ≤ Ii in “How to compare parameters” in “3.2 Type “n”” is omissible. Make sure that the target equipment can be connected with this module has Rin: internal impedance described in remarks column.

**Table FIO Parameters (The Load Devices) (2/2)**

| Module | | Ui (V) | Ii (mA) | Ci (μF) | Li (μH) | Remarks (*1) |
|---|---|---|---|---|---|---|
| ADV161 | Redundant | 30.0 | 6.7 | 0.001 | 10.0 | Voltage input mode<br>Rin = 9.1 kΩ (*3) |
| | Single | 30.0 | 3.4 | 0.001 | 10.0 | |
| ADV557 | Single | 26.4 | 100.0 | 0.138 | 0 | |
| ADV551 | Redundant | 26.4 | 100.0 | 0.28 | 10.0 | Without surge absorber<br>Contact output mode |
| | Single | 26.4 | 100.0 | 0.14 | 10.0 | Contact output mode |
| ADV561 | Redundant | 26.4 | 100.0 | 0.275 | 0 | Contact output mode |
| | Single | 26.4 | 100.0 | 0.138 | 0 | |
| ADR541 | Redundant | 26.4 | 100.0 | 160.0 pF | 0 | When DC is impressed. |
| | | 75.0 | 20.0 | 160.0 pF | 0 | |
| | Single | 26.4 | 100.0 | 80.0 pF | 0 | When DC is impressed. |
| | | 75.0 | 20.0 | 80.0 pF | 0 | |
| ALR111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALR121 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALE111 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| ALF111 | Redundant | - | - | - | - | (*2) |
| | Single | - | - | - | - | |
| EB401 | Redundant | 10.0 | 0.9 μA | 8.0 pF | 0.1 | 10BASE-2<br>Terminating resistance 50 Ω (both sides) |
| | Single | 10.0 | 0.9 μA | 8.0 pF | 0.1 | |
| EB402 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| EC401 | Redundant | – | – | – | – | (*2) |
| | Single | – | – | – | – | |
| AEP7D-4□ | TM1,TM2 | – | – | – | – | (*2) |
| AEP9D | TM1,TM2 | – | – | – | – | |

*1: Without any mode name in the appropriate remarks , All parameters are valid for any operation mode of the module (type name).
*2: For wiring the cables outside of the cabinets, EN 60079-14/IEC 60079-14 or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.
*3: Since the parameters such as Ii are calculated according to the internal impedance (Ii = Ui/Ri), the case of Io ≤ Ii in "How to compare parameters" in "3.2 Type "n"" is omissible. Make sure that the target equipment can be connected with this module has Rin: internal impedance described in remarks column.

**Table Cable Parameters**

| Model | Lw (μH/m) | Cw (pF/m) | Remarks (*1) |
|---|---|---|---|
| YCB301 | – | – | (*2) |
| YCB141 | 0.25 | 100.0 | |
| YCB311 | 0.22 | 85.0 | |
| KS1 | 1.5 | 110.0 | |
| AKB331 | 1.5 | 110.0 | |
| AKB334 | 2.2 | 100.0 | |
| AKB335 | 1.5 | 110.0 | |
| AKB336 | 0.67 | 55.0 | |
| AKB337 | 1.5 | 110.0 | |
| AKB131 | – | – | (*2) |
| AKB132 | – | – | (*2) |
| AKB133 | – | – | (*2) |
| AKB134 | – | – | (*2) |
| AKB135 | – | – | (*2) |
| AKB136 | – | – | (*2) |
| AKB161 | – | – | (*2) |
| AKB162 | – | – | (*2) |

*1: Without any mode name in the appropriate remarks , All parameters are valid for any operation mode of the module (type name).

*2: For wiring the cables outside of the cabinets, EN 60079-14/IEC 60079-14 or an explosion-proof wiring (including threaded conduit wiring) defined in each country should be installed.

# Appendix 3. Lists of Parameters of Modules with Built-in Barrier

**Table List of Parameters (CENELEC) of Modules with Built-in Barrier**

| Modules | | Uo (V) | Io (mA) | Po (mW) | Ui (V) | Co (nF) | | | Lo (mH) | | | Remarks (*1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | IIC | IIB | IIA | IIC | IIB | IIA | |
| ASI133-S00 ASI133-H00 | Single | 27.8 | 84 | 584 | – | 84 | 659 | 659 | 2 | 18 | 18 | 2Wire |
| | | 27.8 | 4 | 28 | 28 | 84 | 659 | 695 | 100 | 100 | 100 | 4Wire |
| | Redundant | 27.8 | 93 | 647 | – | 84 | 659 | 659 | 1.2 | 14 | 14 | 2Wire |
| | | 27.8 | 7 | 49 | 28 | 84 | 659 | 659 | 100 | 100 | 100 | 4Wire |
| ASI533-S00 | Single | 27.8 | 86 | 598 | – | 84 | 659 | 659 | 1.8 | 17 | 17 | |
| ASI533-H00 | Redundant | 27.8 | 93 | 647 | – | 84 | 659 | 659 | 1.2 | 14 | 14 | |
| AST143-S00 | Single | 16.8 | 7 | 30 | – | 220 | 1760 | 8000 | 240 | 725 | 1930 | No channel or one channel is connected to equipotential bonding. |
| | | 16.8 | 46 | 194 | – | 65 | 380 | 1550 | 5.6 | 22 | 44 | Two channels up to all channels connected to equipotential bonding. |
| | Redundant | 16.8 | 13 | 55 | – | 220 | 1730 | 8000 | 70 | 280 | 560 | No channel or one channel is connected to equipotential bonding. |
| | | 16.8 | 92 | 387 | – | 65 | 280 | 1550 | 1.4 | 5.6 | 11 | Two channels up to all channels connected to equipotential bonding. |
| ASR133-S00 | Single | 13.7 | 30 | 103 | – | 122 | 867 | 837 | 2.5 | 5 | 5 | |
| | Redundant | 13.7 | 60 | 206 | – | 94 | 714 | 714 | 1 | 5 | 5 | |
| ASD143-P00 | Single | 9.8 | 21 | 52 | – | 1100 | 7600 | 11600 | 26 | 107 | 214 | |
| | Redundant | 9.8 | 41 | 101 | – | 1100 | 7600 | 11600 | 7 | 28 | 56 | |
| ASD533-S00 | Single | 27.16 | 108.6 | 738 | – | 89 | 690 | 690 | 0.42 | 9.9 | 9.9 | |
| | Redundant | 27.16 | 108.6 | 738 | – | 89 | 690 | 690 | 0.42 | 9.9 | 9.9 | |

*1: These parameters are valid for the operation nodes of the corresponding modules if the model.

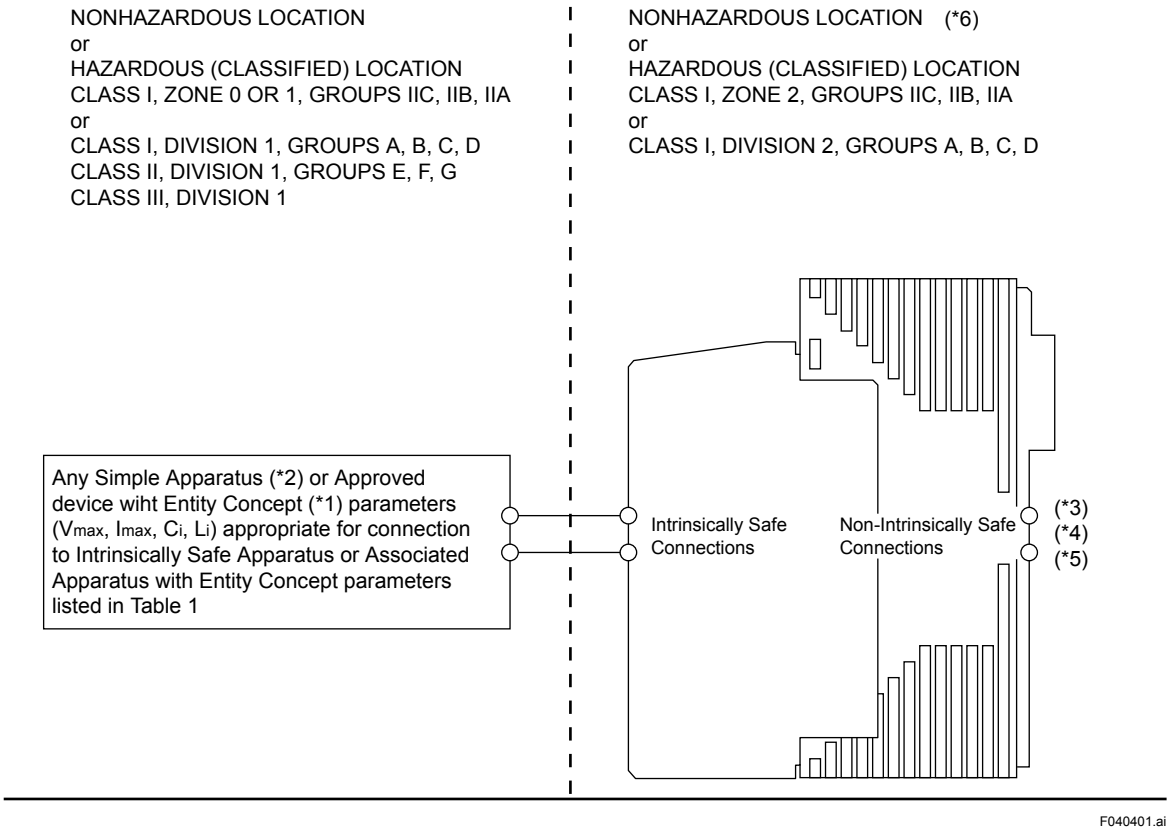
**Table List of Parameters (FM) of Modules with Built-in Barrier**

| Modules | | Voc (V) | Isc (mA) | Po (mW) | Vmax (V) | Ca (nF) | | | La (mH) | | | Remarks (*1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A,B | C,E | D,F,G | A,B | C,E | D,F,G | |
| ASI133-S00 ASI133-H00 | Single | 27.8 | 84 | 584 | – | 84 | 659 | 659 | 2 | 18 | 18 | 2Wire |
| | | 27.8 | 4 | 28 | 28 | 84 | 659 | 695 | 100 | 100 | 100 | 4Wire |
| | Redundant | 27.8 | 93 | 647 | – | 84 | 659 | 659 | 1.2 | 14 | 14 | 2Wire |
| | | 27.8 | 7 | 49 | 28 | 84 | 659 | 659 | 100 | 100 | 100 | 4Wire |
| ASI533-S00 | Single | 27.8 | 86 | 598 | – | 84 | 659 | 659 | 1.8 | 17 | 17 | |
| ASI533-H00 | Redundant | 27.8 | 93 | 647 | – | 84 | 659 | 659 | 1.2 | 14 | 14 | |
| AST143-S00 | Single | 16.8 | 7 | 30 | – | 220 | 1760 | 8000 | 240 | 725 | 1930 | No channel or one channel is connected to equipotential bonding. |
| | | 16.8 | 46 | 194 | – | 65 | 380 | 1550 | 5.6 | 22 | 44 | Two channels up to all channels connected to equipotential bonding. |
| | Redundant | 16.8 | 13 | 55 | – | 220 | 1730 | 8000 | 70 | 280 | 560 | No channel or one channel is connected to equipotential bonding. |
| | | 16.8 | 92 | 387 | – | 65 | 280 | 1550 | 1.4 | 5.6 | 11 | Two channels up to all channels connected to equipotential bonding. |
| ASR133-S00 | Single | 13.7 | 30 | 103 | – | 122 | 867 | 837 | 2.5 | 5 | 5 | |
| | Redundant | 13.7 | 60 | 206 | – | 94 | 714 | 714 | 1 | 5 | 5 | |
| ASD143-P00 | Single | 9.8 | 21 | 52 | – | 1100 | 7600 | 11600 | 26 | 107 | 214 | |
| | Redundant | 9.8 | 41 | 101 | – | 1100 | 7600 | 11600 | 7 | 28 | 56 | |
| ASD533-S00 | Single | 27.16 | 108.6 | 738 | – | 89 | 690 | 690 | 0.42 | 9.9 | 9.9 | |
| | Redundant | 27.16 | 108.6 | 738 | – | 89 | 690 | 690 | 0.42 | 9.9 | 9.9 | |

*1: These parameters are valid for the operation nodes of the corresponding modules if the model.

# Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval

Doc. No.: IFM035-A09




F040401.ai

*1: The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specially examined in combination as a system when the approved values $V_{OC}$ (or $V_t$) and $I_{SC}$ (or $I_t$) for the associated apparatus are less than or equal to $V_{max}$ and $I_{max}$ for the intrinsically safe apparatus and the approved values of $C_a$ and $L_a$ for the associated apparatus are greater than $C_i + C_{cable}$ and $L_i + L_{cable}$, respectively, for the intrinsically safe apparatus.

*2: Simple Apparatus: An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

*3: Wiring methods must be in accordance with the National Electrical Code, ANSI/NFPA 70, Article 504 or 505. Additional installation information can be found in ANSI/ISA-RP 12.6

*4: Modules shall not be connected to any device which uses or generates internally any voltage in excess of 250 V unless the device has been determined to adequately isolate the voltage from the module.

*5: Connection of modules to ground is not required

*6: These modules are rated “Nonincendive”. If the modules are intended to be mounted in a Division 2 location, they must be installed in an enclosure meeting the requirements of ANSI/ISA S82. The enclosure may be installed in a Class I, Division 2, Group A, ,B, C or D or a Class I, Zone 2, Group IIC hazardous (classified) location. A temperature rating of T4 applies to all Nonincendive rated modules.

**Table 1-Entity Parameters (1/2)**

| Module type | Terminals | $V_{oc}$ (V) | $I_{sc}$ (mA) | $V_t$ (V) | $I_t$ (mA) | Groups Ca (µF) | | | Groups La (mH) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A, B | C, E | D, F, G | A, B | C, E | D, F, G |
| ASD143-P00 ATSB4D-0 | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 | 9.8 | 41 | -- | -- | 1.1 | 7.6 | 11.6 | 7 | 28 | 56 |
| ASD143-P00 ATSB4S-0 | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 | 9.8 | 21 | -- | -- | 1.1 | 7.6 | 11.6 | 26 | 107 | 214 |
| ASD533-S00 ATSD3D-0 | A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16 | 27.16 | 108.6 | -- | -- | 0.089 | 0.69 | 0.69 | 0.42 | 9.9 | 9.9 |
| ASD533-S00 ATSD3S-0 | A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16 | 27.16 | 108.6 | -- | -- | 0.089 | 0.69 | 0.69 | 0.42 | 9.9 | 9.9 |
| ASI533-S00 ATSS3D-0 | A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16 | 27.8 | 93 | -- | -- | 0.084 | 0.659 | 0.659 | 1.2 | 14 | 14 |
| ASI533-S00 ATSS3S-0 | A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16 | 27.8 | 86 | -- | -- | 0.084 | 0.659 | 0.659 | 1.8 | 17 | 17 |
| ASI133-S00 ASI133-H00 ATSA3D-0 | A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16 | 27.8 | 93 | -- | -- | 0.084 | 0.659 | 0.659 | 1.2 | 14 | 14 |
| | B1_B2; B3_B4; B5_B6; B7_B8; B10_B11; B12_B 13; B14_B15; B16_B17 | 27.8 | 7 | -- | -- | 0.084 | 0.659 | 0.659 | 100 | 100 | 100 |
| ASI133-S00 ASI133-H00 ATSA3S-0 | A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16 | 27.8 | 84 | -- | -- | 0.084 | 0.659 | 0.659 | 2 | 18 | 18 |
| | B1_B2; B3_B4; B5_B6; B7_B8; B10_B11; B12_B 13; B14_B15; B16_B17 | 27.8 | 4 | -- | -- | 0.084 | 0.659 | 0.659 | 100 | 100 | 100 |
| AST143-S00 ATST4D-0 | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*1) | 16.8 | 13 | -- | -- | 0.22 | 1.73 | 8 | 70 | 280 | 560 |
| | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*2) | 16.8 | 92 | -- | -- | 0.065 | 0.38 | 1.55 | 1.4 | 5.6 | 11 |

**Table 1-Entity Parameters (2/2)**

| Module type | Terminals | $V_{oc}$ (V) | $I_{sc}$ (mA) | $V_t$ (V) | $I_t$ (mA) | Groups Ca (µF) | | | Groups La (mH) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A, B | C, E | D, F, G | A, B | C, E | D, F, G |
| AST143-S00<br>ATST4S-0 | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*1) | 16.8 | 7 | -- | -- | 0.22 | 1.73 | 8 | 240 | 725 | 1930 |
| | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*2) | 16.8 | 46 | -- | -- | 0.065 | 0.38 | 1.55 | 5.6 | 22 | 44 |
| ASR133-S00<br>ATSR3D-0 | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 | 13.7 | 60 | -- | -- | 0.094 | 0.714 | 0.714 | 1 | 5 | 5 |
| ASR133-S00<br>ATSR3S-0 | A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 | 13.7 | 30 | -- | -- | 0.122 | 0.867 | 0.867 | 2.5 | 5 | 5 |

*1: These values are valid if no one of the channels or only one of the channels is connected to earth.
*2: These values are valid if more than one channel is connected to earth.

Note: The ambient operating temperature (Tamb) for the modules is –20 °C to 70 °C.

# Appendix 5. Example of Certificate

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

(1) **EC-TYPE-EXAMINATION CERTIFICATE**

**(Translation)**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

**PTB 03 ATEX 2074**

(4) Equipment: Digital-Output-Module ASD533-*** and Terminal ATSD3*-*

(5) Manufacturer: Yokogawa Electric Corporation

(6) Address: 9-32, Nakacho 2-chome, Musashino-shi, Tokyo 180, Japan

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-23151.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

**EN 50014:1997 + A1 + A2 EN 50020:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

**II (1) GD [EEx ia] IIC**

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Gerlach

Braunschweig, July 21, 2003

sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

nische Bundesanstalt

**SCHEDULE**

**INATION CERTIFICATE PTB 03 ATEX 2074**

D533-*** in combination with the Terminal ATSD3S-* or ATSD3D-
n of control commands from the hazardous area into the non-
for the safe electrical isolation of intrinsically safe and non-

mbient temperature is -20 °C up to +70 °C.

..... nominal voltage: $U_n$ = 24 V±10%, ($P_n$ ≈ 2.5 W ... 12 W)
38 maximum voltage: $U_m$ = 60 V

..... nominal voltage: $U_n$ = 5V±10 %, ($P_n$ ≈ 1.2 W)
(a2, b2, a4, b4, a5, b5, a7 to a37, b7 to b37, a39, b39, a40, b40 at the backplane) maximum voltage: $U_m$ = 60 V

Output circuits..... type of protection Intrinsic Safety EEx ia IIA/IIB/IIC
maximum values per circuit
(A1, B1; A3, B3; A5, B5; A7, B7; A10, B10; A12, B12; A14, B14; A16, B16)
**Terminal ATSD3S-***
**(mode of operation: non-redundant) or**
**Terminal ATSD3D-***
**(mode of operation: redundant)**
$U_0$ = 27.16 V
$I_0$ = 108.6 mA
$P_0$ = 738 mW
$R_i$ = 250 Ω
linear characteristic
$C_i$ ≈ 0
$L_i$ ≈ 0

| type of protection | EEx ia resp. ib | | |
|---|---|---|---|
| | IIA | IIB | IIC |
| max. permissible ext. inductance $L_o$ | 9.9 mH | 9.9 mH | 0.42mH |
| max. permissible ext. capacitance $C_o$ | 690 nF | 690 nF | 89 nF |

sheet 2/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

F050401.ai

## Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2074**

In the presence of concentrated capacitances and/or inductances in the intrinsically safe output circuit, the maximum permissible external capacitances and inductances for circuits are to be taken from the following table.

| type of protection | EEx ia resp. ib | |
|---|---|---|
| | IIB | IIC |
| max. permissible ext. inductance $L_o$ | 2 mH | 0.42mH |
| max. permissible ext. capacitance $C_o$ | 300 nF | 72 nF |

The intrinsically safe output circuits are safely electrically isolated from all other circuits up to a peak value of the nominal voltage of 375 V.

(16) Test report PTB Ex 03-23151

(17) Special conditions for safe use
none

(18) Essential health and safety requirements
Met by compliance with the standards mentioned above.

Zertifizierungsstelle Explosionsschutz
By order:
Dr.-Ing. U. Gerlach

Braunschweig, July 21, 2003

sheet 3/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

F050402.ai

Blank Page

# CENTUM
# Explosion Protection

TI 33Q01J30-01-01E 6th Edition

# INDEX

## A



## C



## D



## E



## F



## H

## I



## L



## M



## N



## O



## P



## R

## S



## T



## W

Blank Page

# Revision Information

- Title: Explosion Protection
- Manual No.: TI 33Q01J30-01E

**March 2004/1st Edition**
Newly published

**Apr. 2007/2nd Edition**
1.2 Explosion Protection Standards
Revised description of Type “n” standard number in “Table Explosion Protection Standards”
2.1 Explosion Protection Standards that CENTUM has Acquired
Non-Icendive of “Table Explosion Protection Standards that CENTUM Complies” is changed to CSA Non-Icendive.
Added FM Non-Icendive of “Table Explosion Protection Standards that CENTUM Complies”
Revised description of Type “n” standard number in “Table Explosion Protection Standards that CENTUM Complies”
3.1.1 CSA NI (CSA Non-Incendive)
NI is changed to CSA NI.
Revised description of “Signal Wiring”
3.1.2 FN NI (FM Non-Incendive)
Added “FM Non-Incendive”
3.2 Type “n”
Revised description of Type “n”
4.2 Intrinsic Safety Instrumentation Using Barriers
Deleted “Concrete Examples of Connections between CS 3000 System and Barriers”
5.1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
NI is changed to CSA NI.
Revised description of “Lists of CSA NI Compliant Products and CSA NI Parameters”
5.1.2 Lists of FM NI Compliant Products and FM NI Parameters
Added “Lists of FM NI Compliant Products and FM NI Parameters”
5.2 List of Type “n” Compliant Product and the Parameters of Type “n”
Revised description of “List of Type “n” Compliant Product and the Parameters of Type “n””

**June 2008/3rd Edition**
CENTUM CS 3000 and CS 3000 changed to CENTUM

1.4 Symbols That Indicate Specifications of Explosion Protection
Deleted “CENELEC acceptable product EEx”
2.1 Explosion Protection Standards that CENTUM has Acquired
“Table Explosion Protection Standards that CENTUM Complies”
Revised Conformed standard number
3.1.1 CSA NI (CSA Non-Incendive)
Approved Types and Standards
Revised The CSA Standard No.
3.2 Type “n”
Revised Collected Standards
Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
Table FIO Parameters (The Load Devices)
Revised to *3 and Remarks
Appendix 2 List of Type “n” Compliant Product and the Parameters of Type “n”
Table FIO Parameters (the Load Devices)
Revised to *3 and Remarks

**Apr. 2010/4th Edition**

2. CENTUM and Explosion Protection Instrumentation
2.1 Explosion Protection Standards that CENTUM has Acquired
Revised description of “Table Explosion Protection Standards that CENTUM Complies”
2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area
Added “Overview of Connecting a Module with Built-in Barrier (Compliant with CENELEC Standard)”
Added “Overview of Connecting a Module with Built-in Barrier (Compliant with FM Standard)”
4. Intrinsic Safety Explosion Protection Instrumentation
4.1 Intrinsic Safety Explosion Protection Instrumentation Using Module with Built-in Barrier
Added “4.1.1 Intrinsic Safety Explosion Protection of CENELEC Standard”
Added “4.1.2 Intrinsic Safety Explosion Protection of FM Standard”
Appendix 3. List of Parameters of Modules with Built-in Barrier
Added “Table List of Parameters (FM) of Modules with Built-in Barrier”
Added “Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval.”

**Oct. 2010/5th Edition**

Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
The List of CSA NI Compliant Products
Table The List of CSA NI Compliant Products <for FIO> [AAB141 and AAB842 are added.]
Parameters of CSA NI Compliant Equipments
Table FIO Parameters (The Source Devices) [AAB842 is added.]
Table FIO Parameters (The Load Devices) [AAB141 and AAB842 are added.]
Appendix 2. Lists of Type “n” Compliant Product and the Parameters of Type “n”
The List of Type “n” Compliant Products [AAB141 and AAB842 are added.]
Parameters of Type “n” Compliant Equipments
Table FIO Parameters (The Source Devices) [AAB842 is added.]
Table FIO Parameters (The Load Devices) [AAB141 and AAB842 are added.]

**Dec. 2010/6th Edition**

Appendix 1.1 Parameters of CSA NI Compliant Equipments
Revised Li for AAT141 (Single) in Table FIO Parameters (The Load Devices)
Appendix 2. Parameters of Type "n" Compliant Equipments
Revised Li for AAT141 (Single) in Table FIO Parameters (The Load Devices)

Blank Page

Written by Yokogawa Electric Corporation

Published by Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN

Printed by KOHOKU PUBLISHING & PRINTING INC.