Technical Information

TI 12A01A02-42EN

FLXA202 2-Wire Analyzer Selection Guide for Intrinsic Safety-type Associated Apparatus

FLEXA™

Contents

YOKOGAWA
Yokogawa Electric Corporation

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Introduction

This document describes how to select intrinsically safe associated apparatus, how to implement their configuration or the replacement with an upgraded model, when FLXA™202 is used in combination with intrinsically safe associated apparatus.

The use of an instrument in hazardous area requires you to understand the configuration method and the related regulations. Read this document and follow the regulations on intrinsically safe system for FLXA202.

FLXA202 which was once used without safety barriers shall no longer be used in hazardous area. If there is any chance of using FLXA202 in hazardous area in future, use FLXA202 with a safety barrier even if the FLXA202 is to be installed in nonhazardous area.

Please see “3. How to select safety barriers” for configuration of intrinsically safe system.

Choose an instrument to use in combination with FLXA202 according to the respective general specification. Even if the instrument meets the requirements as an Intrinsic Safety apparatus, you cannot use in combination with FLXA202 Intrinsic Safety-type unless it meets the specification for general purposes.

This document is neither intended to explicate Intrinsically Safe approvals, nor specifications of individual instrument for general purposes. To know the specifications for general purposes, refer to each corresponding user’s manuals or general specifications of each instrument.

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1. Intrinsic safe system

Intrinsic Safety system configuration using FLXA202

Figure 1 illustrates an example of intrinsic safety system configuration with FLXA202. To establish the configuration, FLXA202 must be installed in a hazardous area. The configuration allows a safety barrier installed in nonhazrdous area to control the energy being supplied to the hazrdous area.

The safety barrier must be Intrinsic Safety certified and meet all requirements for the safety use of FLXA202.

Distributor is connected to FLXA202 via the safety barrier at nonhazardous area.

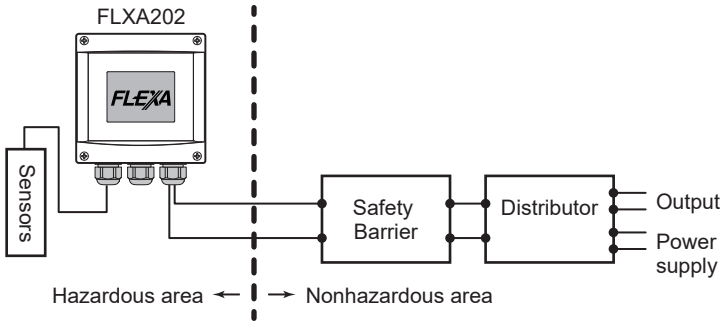

Figure 1 Intrinsic safety system sample configuration

Specification of Intrinsic Safety system with FLXA202

FLXA202 2-Wire Analyzer

Being located in a hazardous area, the analyzer transmits the value signal, which sensors measured, to a nonhazardous area.

Each code is assigned to the specification of a designated country for intrinsic safety use. Specify a designated country code with the suffix code.

Refer to GS 12A01A03-01EN for FLXA202.

Sensors

Select those sensors which are compatible with intrinsic safety FLXA202. Be aware that some sensors are not compatible. Read “2. How to select sensors.”

Safety barrier

Safety barrier limits the amount of energy provided in an electrical circuit passes through the hazardous area to prevent explosions in explosive atmosphere. Two types of intrinsically safe barrier are available: Isolator Barriers and Zener Barriers.

Using Zener Barrier requires instructions to be followed. Read "3. How to select Safety Barrier", to have a proper use of Zener Barriers. Zener Barrier works with the specific intrinsically safe earthing to maintain the intrinsic safety rating of the barrier.

Distributor

The distributor is designed to connect with FLXA202. The distributor supplies drive power to the analyzer and receives simultaneously 4-20 mA DC signal from the analyzer.

Some types of safety barriers do not require distributors but DC power supply. Check the specification of the safety barrier you use.

HART communication device

HART compatible safety barrier enables a maintenance via HART communication.

For a safety use, use the device in nonhazardous area when you perform maintenance via temporary HART communication by hand-held terminal.

Contact output device

Prepare the safety barrier to use a contact output device in a nonhazardous area.

The contact output signals from PH201G are available in nonhazardous area. PH201G (style B) is a dedicated distributor for FLXA202. PH201G controls contact outputs for Maintenance status, Fail status and Wash (Cleaning) by the dedicated communication with FLXA202.

HART compatible safety barrier is necessary to use this dedicated communication, because the physical layer of the dedicated communication is identical to that of HART communication.

FLXA202 transmits either the dedicated communication or HART communication.

2. How to select sensors

Sensors used in the intrinsic safety system must be intrinsic safety approved by those countries where the sensors are used. Besides, the sensors as “Simple Apparatus” are available in the USA, Canada, Korea, and China.

Rating of Intrinsic safety

FLXA202 must be connected to sensors with the intrinsic safety rating as below.

Input	Uo (V)	Io (mA)	Po (mW)	Lo (mH)	Co (µF)
pH/ORP/SC/DO	11.76	116.5	342.4	1.7	0.1
ISC	11.76	60.6	178	8	0.1
SENCOM™	5.36	106.16	142.3	0.45	31

The sensor should be approved as intrinsically safe apparatus and comply with the intrinsic safety parameters of FLXA202.

Ui(V)	Ii(mA)	Pi(mW)	Li(mH)	Ci(µF)
Ui ≧ Uo	Ii ≧ Io	Pi ≧Po	Li ≦ Lo	Ci ≦ Co

Li and Ci include parameters for the wiring.

Read a specific user’s manual to use sensors with Simple Apparatus declaration.

The following table shows Yokogawa sensors which are compatible to FLXA202.

Sensors with “Simple Apparatus” declaration

Item to measure	Model	Code	Description
pH	PH8EFP	—	KCl filling type pH Sensor
pH	PH8EHP	—	pH Sensor for High Purity Water
pH	PH8ECP	—	KCl filling type pH sensor for electrolysis plant
pH	PH8ERP	—	KCl Refillable type pH Sensor
pH	PH4P	—	Polymer Electrolyte pH sensor
pH	PH4PT	—	Polymer Electrolyte pH sensor
pH	PH4F	—	Hydrofluoric Acid-resistant pH sensor
pH	PH4FT	—	Hydrofluoric Acid-resistant pH sensor
pH	PH4C	—	ORP sensor for Chemical Process
pH	PH4CT	—	ORP sensor for Chemical Process
pH	PH4FE	—	pH sensor for fermentation
ORP	OR4P	—	Polymer Electrolyte ORP sensor
ORP	OR4C	—	ORP sensor for Chemical Process
Conductivity	SC4AJ	—	Conductivity detector
Conductivity	SC210G	—	Conductivity detector

Sensors conforming to directives IECEx, ATEX, FM, CSA

Item to measure	Model	Code	Approved (limited to the followings)
pH/ORP	FU20	—	pH/ORP Combination sensor IECEx, ATEX approved.
pH/ORP	FU20F	—	pH/ORP SENCOM sensor
pH	SC25F	—	pH SENCOM sensor
pH	SC25V	—	Combined 12 mm sensor IECEx, ATEX approved.
Inductive conductivity	ISC40S	—	Inductive Conductivity Sensor

3. How to select safety barriers

There are two types of intrinsic safety barriers, Isolator barrier and Zener barrier. Select a suitable safety barrier based on the following conditions.

Isolator barrier

- Isolators used in intrinsically safe circuits must be designed and certified as Associated Apparatus in the country where the apparatus is used. They also must be suitable to connect to FLXA202 in hazardous area.
- Isolators used in intrinsically safe circuits should connect to FLXA202 with the following parameters.

Parameters of FLXA202		Parameters of Isolator barrier
Ui: 30 V	≧	Uo
Ii: 100 mA	≧	Io
Pi: 0.75 W	≧	Po
Ci: 13 nF +Cc	≦	Co
Li: 0 mH +Lc	≦	Lo

Lc: Inductance of external wiring, Cc: Capacitance of external wiring

- The safety barrier must meet the operating conditions of FLXA202.

When pH, SC, DO is specified as 1st input (as 2nd input: Model & Suffix codes -NN), the isolator barrier must supply power larger than 16 V DC at a power supply terminal.

For ISC input, the isolator barrier must supply power larger than 17 V DC at a power terminal of FLXA202.

When FLXA202 is connected to a pH/ORP SENCOM sensor, the isolator barrier must supply power larger than 21 V DC at a power supply terminal of the analyzer.

Selection example of an isolator barrier

The following as an example shows valid parameters and specification when PEPPERL+FUCHS KFD2-STC4-Ex1 is used.

<Parameters>

Uo=25.4 V, Io=86.8 mA, Po=0.551 W, Lo=4.6 mH, Co=0.093 µF

<Specification>

The isolator supplies the power 16 V with 20 mA.
pH, SC and DO are specified as 1st input (as 2nd input, the suffix code is -NN.)

Zener barrier

- Zener barrier used in intrinsically safe circuits must be designed intrinsically safe certified, being suitable device to connect to FLXA202 in hazardous area.
- Zener barrier used in intrinsically safe circuits should connect to FLXA202 with the following parameters.

Parameters of FLXA202		Parameters of Isolator
Ui: 30 V	≧	Uo
Ii: 100 mA	≧	Io
Pi: 0.75 W	≧	Po
Ci: 13 nF +Cc	≧	Co
Li: 0 mH +Lc	≧	Lo

Lc: Inductance of external wiring, Cc: Capacitance of external wiring

- As operation conditions, verify internal current limit resistance, voltage of power supply to transmitter of distributor, input resistance of distributor, and wiring resistance.

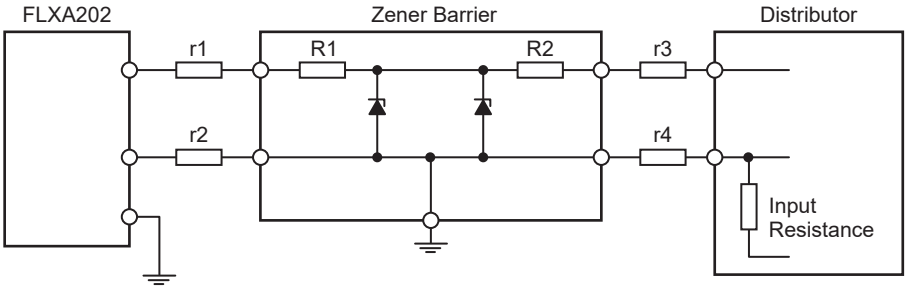

Figure 2 Zener Barrier sample configuration

FLXA202 needs at least 11.5 V at its power terminal when FLXA202 transmits a burnout signal.

When the analyzer becomes burnout, it outputs 22 mA. With this 22 mA current, across the resistors r1 through r4 and through R1 and R2 in the Zener barrier and input resistance, the total voltage drop across all the resistors must satisfy the value for FLXA202 to maintain the 11.5 V at its power terminal.

Yokogawa general distributors are designed to have the input resistance of 250 Ω, the transmitter power supply of 25.25 ± 0.25V while receiving 4-20 mA DC.

Model PH201G dedicated to pH measurement is specifically designed to have the input resistance of 100 Ω and 24 to 28 V of the transmitter power supply.

$$Vtm=Vs - (Rc+Rz+r) \times IB \ (V)$$

Where:

Vtm:	voltage between terminals of FLXA202 (V)
Vs:	minimum value of distributor's power supply voltage (V)
Rc:	input resistance (Ω)
Rz:	Zener barrier internal resistance total (Ω)
r:	total value of wiring resistance (Ω)
IB:	current of burnout status (A)

When you use a YOKOGAWA distributor with a Zener barrier whose internal resistance is totally 340 Ω and the total wiring resistance is 20 Ω, you will obtain the result as follows based on the equation shown above;

$$Vtm=25-(250+340+20) \times 0.022=11.58 \ (V)$$

The result proves the combination of those equipment meets the required voltage between terminals of FLXA202.

If the total wiring resistance is 25 Ω, the result of the equation is 11.47 V, which does not meet the requirements thus disables functions including burnout. In this case, we recommend distributors whose input resistance is small such as PH201G when the total wiring resistance is larger than 25 Ω.

NOTE

As Figure 2 illustrates, for protection of Zener barrier and its circuit, the circuit shall be connected to earth at one point. Input terminals of distributors shall be isolated from earth. 4-20 mA transmitter signal does not go through the input resister, which indicates an error.

Selecting Zener barrier

The following as an example shows valid parameters and specification when EATON MTL7728+ is used.

<Parameters>

Uo=28 V, Io=93 mA, Po=0.65 W, Lo=4.2 mH, Co=0.083 µF

<Specification>

Zener barrier internal resistance is totally 333 Ω at maximum, which allows the wiring to have 25 Ω in combination with a YOKOGAWA distributor.

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Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN
http://www.yokogawa.com/an/