

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 00 ATEX 2058 X

(4) Equipment: Analog Input Module Typ AI4H-Ex and AI4-Ex

(5) Manufacturer: ABB Automation Products GmbH

(6) Address: D-63754 Alzenau, Borsigstrasse 2 ,Germany

(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 PTB Ex 00-20080.

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

EN 50014:1997

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 and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

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



II 2(1)G EEx [ia]ib IIC T4

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig,

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X**

(15) Description of equipment

The 4-channel Analog Input Modules are parts of the S900 System used in conjunction with the Termination Unit Type TU **R-Ex in accordance with the separate Type Acceptance Certificate PTB 00 ATEX2156 U.

The Analog Input Modules of Type AI4H-Ex, model AI 930 S, are HART compatible and are used to supply *passive* 2-wire transmitters (sensors) and to collect analog measurement signals.

The Analog Input Modules of Type AI4-Ex, model AI 931 S, are used to connect *active* intrinsically safe sensors with HART communication capabilities.

The Analog Input Modules of Type AI4-Ex, model AI 910 S, are used to supply *passive* 2-wire transmitters (sensors) without HART communication capabilities, and to collect analog measurement signals

All modules provide for safe electrical isolation of intrinsically safe measuring current circuits of class "ia" from intrinsically safe bus and supply circuits of class "ib".

Within the Analog Input Module either only passive transmitter supply circuits (models AI 910S and AI 930 S) or only active input current circuits exist (model AI 931 S).

Ambient temperature range: -20°C ... +70°C.

Electrical specifications

I.) Power supply circuit

Multipoint connector X101, pins 15 and 16

Only for connection to approved intrinsically safe current circuits in accordance with PTB 00 ATEX 2156 U (protection type "Intrinsic safety" EEX ib IIC) with the following maximum values:

$V_{\max} = 20 \text{ V AC (amplitude)}$

$f = 307 \text{ kHz} \pm 5 \text{ KHz}$

$P \approx 3.0 \text{ W (power consumption)}$

$P \approx 1.5 \text{ W (power consumption in the device)}$

The intrinsically safe AC power supply circuit has a safe electrical isolation from the intrinsically safe input current circuits, from the transmitter supply circuits, and from the CAN signal current circuits of the module in accordance with EN 50 020 Table 4.

II.) Signal current circuit (CAN-BUS)

(current circuit to be used within the system, exclusively; no external connections provided)

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SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

III.) Address encoding circuit

(current circuit to be used within the system, exclusively; no external connections provided)

IV.) Transmitter supply circuits for (Models AI 910 S and AI 930S for passive sensors)

Multipoint connector X102,

type of protection "Intrinsic safety" EEx ia IIC / II B or
EEX ib IIC / II B

Channel 1: pins +1, -3

Max. values per channel:

Channel 2: pins +7, -9

$$V_o = 22.1 \text{ V}$$

Channel 3: pins +13, -15

$$I_o = 93 \text{ mA}$$

Channel 4: pins +19, -21

$$P_o = 403 \text{ mW}$$

Characteristic curve: trapezoidal, with

$$U_Q = 27.54 \text{ V}$$

$$R = 298 \Omega$$

Effective internal capacitance $C_i \leq 1.1 \text{ nF}$

Effective internal inductance $L_i \leq 0.22 \text{ mH}$

The following max. permissible external values are valid for the external capacitance C_o and external inductance L_o (effective internal values already taken into account)

Type of protection	EEx ia and EEx ib	
Group	IIC	IIB
L_o	1.78 mH	1.78 mH
C_o	100 nF	500 nF

All channels of the transmitter supply circuits are electrically connected to each other via earth. According to Table 4 in EN 50020 the channels of the four intrinsically safe transmitter supply circuits have a safe electrical isolation from each other up to a voltage of 30 V. As a result, the values listed in the table above are valid for all channels.

V.) Input current circuits for Model AI 931 S for active intrinsically safe sensors

Multipoint connector X102,

type of protection "Intrinsic safety" EEx ia IIC / II B or
EEX ib IIC / II B

Channel 1: pins +4, -2

Max. values per channel:

Channel 2: pins +10, -8

$$V_o = 7.2 \text{ V}$$

Channel 3: pins +16, -14

$$I_o = 16 \text{ mA}$$

Channel 4: pins +22, -20

$$P_o = 29 \text{ mW}$$

Characteristic curve: linear

Effective internal capacitance $C_i \leq 1.1 \text{ nF}$

Effective internal inductance $L_i \leq 0.11 \text{ mH}$

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All channels of the transmitter supply circuits are electrically connected to each other via earth. According to Table 4 in EN 50020 the channels of the four intrinsically safe transmitter supply circuits have a safe electrical isolation from each other up to a voltage of 30 V. As a result, the values listed in the table below are valid for all channels.

Va) The following maximum permissible values for the external capacitance C_0 and the external inductance L_0 are valid for the connection of an **active** intrinsically safe sensor with a **linear characteristic curve**. The effective internal values have already been taken into account:

Maximum value for active sensors (linear characteristic curve)		EEx ia IIC and EEx ib IIC		EEx ia IIB and EEx ib IIB	
U_i	I_i	L_0	C_0	L_0	C_0
2 V	100 mA	2.4 mH	4.2 μ F	9.8 mH	33 μ F
5 V	100 mA	2.4 mH	1.3 μ F	9.8 mH	8.3 μ F
10 V	100 mA	2.4 mH	358 nF	9.8 mH	2.1 μ F
15 V	100 mA	2.4 mH	158 nF	9.8 mH	1.1 μ F
16.5 V	100 mA	2.4 mH	126 nF	9.8 mH	950 nF
20 V	100 mA	2.4 mH	87 nF	9.8 mH	688 nF
22 V	100 mA	2.4 mH	71 nF	9.8 mH	594 nF
25 V	100 mA	2.0 mH	54 nF	9.0 mH	465 nF
30 V	100 mA	2.0 mH	37 nF	9.0 mH	345 nF

Vb) The following maximum permissible values for the external capacitance C_0 and the external inductance L_0 are valid for the connection of an **active** intrinsically safe sensor with a **trapezoidal characteristic curve**. The effective internal values have already been taken into account:

Maximum value for active sensor (trapezoidal characteristic curve)		EEx ia IIC and EEx ib IIC		EEx ia IIB and EEx ib IIB	
U_i	I_i	L_0	C_0	L_0	C_0
22.1 V	93 mA	0.5 mH	60 nF	2 mH	250 nF

Vc) The following maximum permissible values for the external capacitance C_0 and the external inductance L_0 are valid for the connection of an **active** intrinsically safe sensor with a **rectangular or trapezoidal characteristic curve**. The effective internal values have already been taken into account:

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Max. value for active sensor (rectangular or trapezoidal characteristic curve)		EEX ia IIC and EEX ib IIC		EEX ia IIB and EEX ib IIB	
U_i	I_i	L_0	C_0	L_0	C_0
2 V	100 mA	1.99 mH	500 nF	4.89 mH	3 μ F
5 V	100 mA	1.99 mH	300 nF	4.89 mH	1.5 μ F
10 V	90 mA	1.99 mH	200 nF	4.89 mH	1 μ F
15 V	56 mA	0.99 mH	100 nF	4.89 mH	500 nF
16.5 V	49 mA	0.99 mH	100 nF	4.89 mH	500 nF
20 V	35 mA	0.99 mH	70 nF	4.89 mH	300 nF
16.5 V	97 mA	-	-	1.99 mH	400 nF
20 V	80 mA	-	-	0.99 mH	300 nF
22 V	65 mA	-	-	0.99 mH	300 nF
25 V	50 mA	-	-	0.99 mH	250nF

(16) Test report PTB Ex 00-20080

(17) Special conditions for safe use

The Analog Input Modules Type AI4H-Ex und Type AI4-Ex may only be used within the S900 System, in conjunction with the Termination Unit Type TU *R-Ex, PTB 00 ATEX 2156 U.

(18) Essential health and safety requirements

Covered by the relevant standards and regulations .

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig,

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor


1st SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

(Translation)

Equipment: Analog input, types AI4-Ex and AI4H-Ex

Marking:  II 2(1)G EEx [ia]ib IIC T4

Manufacturer: ABB Automation Products GmbH

Address: D-63754 Alzenau, Borsigstrasse 2, Germany

Description of supplements and modifications

The 4-channel analog input modules, types AI4-Ex and AI4H-Ex, of the S 900 system may in future be manufactured in compliance with the test documents listed in the test report.

The modifications concern the revised documentation as well as the output power of the measuring transducer supply circuits.

All other details as well as the "Special Conditions" remain unaffected by the modifications.

Electrical data

IV) Supply circuits for the variants AI910S and AI930S for passive sensors

Plug connector
(X102)

Channel 1: terminal posts +1, -3

Channel 2: terminal posts +7, -9

Channel 3: terminal posts +13, -15

Channel 4: terminal posts +19, -21

type of protection Intrinsic Safety

EEx ia IIC / IIB or EEx ib IIC / IIB

Maximum values per channel:

$U_o = 22.1 \text{ V}$

$I_o = 93 \text{ mA}$

$P_o = 640 \text{ mW}$

Output characteristic: trapezoidal, with

$U_Q = 27.54 \text{ V}$

$R = 298 \ \Omega$

Effective internal capacitance: $C_i \leq 1.1 \text{ nF}$

Effective internal inductance: $L_i \leq 0.22 \text{ mH}$

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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.

The maximum values of the external capacitance C_o and the external inductance L_o are shown in the table below. They already consider the effective internal values.

Type of protection	EEx ia and EEx ib	
Group	IIC	IIB
L_o	1.78 mH	1.78 mH
C_o	100 nF	500 nF

All channels of the supply circuits are electrically interconnected via ground. The channels of the four intrinsically safe supply circuits are safely electrically isolated from each other up to a voltage of 30 V as shown in EN 50020, table 4. The values specified in the table above thus apply to each channel.

Test report: PTB Ex 03-23306

Zertifizierungsstelle Explosionschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



Braunschweig, November 12, 2003

2. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

(Translation)

Equipment: Analog input, type AI4H-Ex, AI4-Ex

Marking:  II 2 (1G/D) G EEx [ia] ib IIC T4

Manufacturer: ABB Automation GmbH

Address: Schillerstraße 72, 32425 Minden, Germany

Description of supplements and modifications

Safety-relevant components have been modified in the analog input, type AI4H-Ex and AI4-Ex.

Furthermore the marking is extended for application in hazardous areas due to combustible dust as follows:

 II 2 (1G/D) G EEx [ia] ib IIC T4

The name and the address of the applicant have changed.

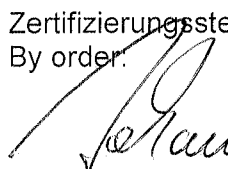
All other specifications and the "Special conditions" apply without changes also for this 2nd supplement.

Applied standards

EN 50014:1997 + A1 + A2 EN 50020:2002

Test report: PTB Ex 07-27066

Zertifizierungsstelle Explosionsschutz
By order:


Dr.-Ing. U. Johannsmeyer
Direktor und Professor



Braunschweig, February 14, 2007

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3. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

(Translation)

Equipment: Analog input, type AI4H-Ex, AI4-Ex

Marking:  II 2 (1G/D) G EEx [ia] ib IIC T4

Manufacturer: ABB Automation GmbH

Address: Schillerstraße 72, 32425 Minden, Germany

Description of supplements and modifications

In the future the analog input, type AI4H-Ex, AI4-Ex may also be manufactured according to the test documents listed in the test report.

The modifications concern the internal and external construction.

The electrical data, the special conditions, the notes for manufacture and operation and all other specifications of the EC-type examination certificate and its supplements apply without changes.

Test report: PTB Ex 09-28124

Zertifizierungssektor Explosionsschutz

By order:

Dr.-Ing. U. Johannsmeyer
Direktor und Professor



Braunschweig, January 19, 2009

4. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

(Translation)

Equipment: Analog Input, type AI4H-Ex and AI4-Ex

Marking:  II 2(1G/D) G Ex [ia] ib IIC T4

Manufacturer: ABB Automation GmbH
formerly ABB Automation Products GmbH

Address: Schillerstraße 72, 32425 Minden, Germany
formerly Borsigstraße 2, 63754 Alzenau, Germany

Description of supplements and modifications

In the future the analog input, type AI4H-Ex and type AI4-Ex may also be manufactured according to the test documents listed in the test report.

The modifications concern the internal and external construction.

The permissible ambient temperature range is -20 °C ... +60 °C

The electrical data are summarized as follows:

Electrical data

- I) **Supply circuit**..... only for connection to the certified intrinsically safe circuit
Plug connector X101 according to PTB 00 ATEX 2156 U in type of protection
Terminal posts 15,16 Intrinsic Safety Ex ib IIC

Maximum values:

$$U_{\max} = 20 \text{ V AC (amplitude)}$$

$$f = 307 \text{ kHz } \pm 5 \text{ KHz}$$

$$P \approx 3.0 \text{ W (power consumption)}$$

$$P \approx 1.5 \text{ W (power dissipation in the module)}$$

The intrinsically safe supply circuit is safely electrically isolated from the intrinsically safe input circuits and the CAN-signal circuits of the module up to a peak value of the maximum voltage of 30 V.

- II) **Signal circuit (CAN-Bus)** (system-internal circuit without external connection
Plug connector X101 facilities)
Terminal posts 9,10 (bus-line 1)
Terminal posts 11,12 (bus-line 2)

4. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

The signal circuit (CAN-Bus) is safely electrically isolated from all other intrinsically safe circuits up to a peak value of the maximum voltage of 30 V.

The signal circuits bus-line 1 and bus-line 2 are safely isolated from each other up to a peak value of the maximum voltage of 30 V. They are, however, electrically interconnected.

- III) **Address coding circuit**..... (system-internal circuit without external connection facilities)
 Plug connector X101
 Terminal posts 1...6

IV) Variants AI 910S and AI 930S for passive sensors

Measuring transducer

supply circuits type of protection Intrinsic Safety
 Plug connector X102 Ex ia IIC/IIB or Ex ib IIC/IIB
 channel 1: Terminal posts +1,-3
 channel 2: Terminal posts +7,-9
 channel 3: Terminal posts +13,-15
 channel 4: Terminal posts +19,-21

Maximum values per channel:

$$U_o = 22.1 \text{ V}$$

$$I_o = 93 \text{ mA}$$

$$P_o = 640 \text{ mW}$$

trapezoidal characteristic with

$$U_Q = 27.54 \text{ V}$$

$$R = 298 \text{ } \Omega$$

$$C_i \leq 1.1 \text{ nF}$$

$$L_i \leq 220 \text{ } \mu\text{H}$$

For relationship between type of protection, explosion group and permissible external reactances, reference is made to the following table:

Type of protection	Ex ia and Ex ib	
Group	IIC	IIB
C_o	65 nF	270 nF
L_o	0.5 mH	2 mH

The four channels of the measuring transducer supply circuits are electrically interconnected via ground. They are safely isolated from each other up to a peak value of the maximum voltage of 30 V. Therefore, the values tabulated above apply to each channel.

V) Variant AI 931S for active intrinsically safe sensors

Input circuits type of protection Intrinsic Safety
 Plug connector X102 Ex ia IIC/IIB or Ex ib IIC/IIB
 channel 1: Terminal posts +4,-2

4. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

channel 2: Terminal posts +10,-8
 channel 3: Terminal posts +16,-14
 channel 4: Terminal posts +22,-20

Maximum values per channel:

$$\begin{aligned} U_o &= 7.2 \text{ V} \\ I_o &= 16 \text{ mA} \\ P_o &= 29 \text{ mW} \end{aligned}$$

linear characteristic

$$\begin{aligned} C_i &\leq 1.1 \text{ nF} \\ L_i &\leq 0.11 \text{ mH} \end{aligned}$$

The four channels of the input circuits are electrically interconnected via ground. They are safely isolated from each other up to a peak value of the maximum voltage of 30 V. Therefore, the values tabulated below apply to each channel.

Va) Active intrinsically safe sensors with linear output characteristic

For relationship between the maximum electrical values for active sensors and the permissible maximum values for the external reactances referred to the type of protection, reference is made to the table:

Active sensors (linear characteristic)		Ex ia / ib IIC		Ex ia / ib IIB	
U_i	I_i	L_o	C_o	L_o	C_o
2 V	100 mA	1.89 mH	958 nF	9.8 mH	3.79 μ F
5 V	100 mA	1.89 mH	548 nF	9.8 mH	2.09 μ F
10 V	100 mA	1.89 mH	288 nF	9.8 mH	1.09 μ F
15 V	100 mA	0.89 mH	108 nF	9.8 mH	630 nF
16.5 V	100 mA	0.89 mH	87.9 nF	9.8 mH	508 nF
20 V	100 mA	0.89 mH	61.9 nF	9.8 mH	318 nF
22 V	100 mA	0.89 mH	52.9 nF	9.8 mH	248 nF
25 V	100 mA	0.89 mH	43.9 nF	9 mH	178 nF
28 V	100 mA	0.44 mH	42.9 nF		
30 V	100 mA			4.89 mH	138 nF

Vb) Active intrinsically safe sensors with trapezoidal output characteristic

For relationship between the maximum electrical values for active sensors and the permissible maximum values for the external reactances referred to the type of protection, reference is made to the table:

Active sensors (trapezoidal characteristic)		Ex ia / ib IIC		Ex ia / ib IIB	
U_i	I_i	L_o	C_o	L_o	C_o
22 V	93 mA	0.39 mH	63.9 nF	1.89 mH	268 nF

4. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2058 X

Vc) Active intrinsically safe sensors with rectangular or trapezoidal output characteristic

For relationship between the maximum electrical values for active sensors and the permissible maximum values for the external reactances referred to the type of protection, reference is made to the table:

Active sensors (rectangular or trapezoidal characteristic)		Ex ia / ib IIC		Ex ia / ib IIB	
U_i	I_i	L_o	C_o	L_o	C_o
2 V	100 mA	1.89 mH	958 nF	4.89 mH	4.3 μ F
5 V	100 mA	1.89 mH	518 nF	4.89 mH	2.4 μ F
10 V	90 mA	0.89 mH	288 nF	4.89 mH	1.2 μ F
15 V	56 mA	0.89 mH	86 nF	4.89 mH	608 nF
16.5 V	49 mA	0.89 mH	64 nF	4.89 mH	468 nF
20 V	35 mA	0.89 mH	57 nF	4.89 mH	288 nF
16.5 V	97 mA	-	-	1.89 mH	398 nF
20 V	80 mA	-	-	0.89 mH	318 nF
22 V	65 mA	-	-	0.89 mH	298 nF
25 V	50 mA	-	-	0.89 mH	278 nF

The special conditions, the notes for manufacture and operation and all other specifications of the EC-type examination certificate and its supplements apply without changes.

Applied standards

EN 60079-0:2006

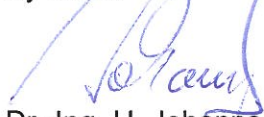
EN 60079-11:2007

Assessment and test report:

PTB Ex 10-29110

Zertifizierungssektor Explosionsschutz

By order:



Dr.-Ing. U. Johannsmeyer
Direktor und Professor



Braunschweig, June 11, 2010