



# Instruction manual




## **Readout and control modules for Ex-proof applications ATEX**

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### **ATTENTION**

**Please read this instruction manual carefully before installing and operating the instrument.  
Not following the guidelines could result in personal injury and/or damage to the equipment.**



Related drawing.  
No modifications permitted without  
approval of the authorised person.



Even though care has been taken in the preparation and publication of the contents of this manual, we do not assume legal or other liability for any inaccuracy, mistake, mis-statement or any other error of whatsoever nature contained herein. The material in this manual is for information purposes only, and is subject to change without notice.

Bronkhorst High-Tech B.V.  
July 2011

## **Warranty**

The products of Bronkhorst High-Tech B.V. are warranted against defects in material and workmanship for a period of three years from the date of shipment, provided they are used in accordance with the ordering specifications and the instructions in this manual and that they are not subjected to abuse, physical damage or contamination. Products that do not operated properly during this period may be repaired or replaced at no charge. Repairs are normally warranted for one year or the balance of the original warranty, whichever is the longer.

See also paragraph 9 of the Conditions of Sales.

The warranty includes all initial and latent defects, random failures, and indeterminable internal causes.

It excludes failures and damage caused by the customer, such as contamination, improper electrical hook-up, dropping etc.

Re-conditioning of products primarily returned for warranty service that is partly or wholly judged non-warranty may be charged for.

Bronkhorst High-Tech B.V. prepays outgoing freight charges when any part of the service is performed under warranty, unless otherwise agreed upon beforehand. However, if the product has been returned collect to Bronkhorst High-Tech B.V., these costs are added to the repair invoice. Import and/or export charges, foreign shipping methods/carriers are paid for by the customer.



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# 1 INTRODUCTION

The Ex-proof modules have been designed for powering and signal conversion of intrinsic safe meters. Furthermore a valve drive circuit may be incorporated in the system. The output stage for the valve can, depending on the limits of the valve also be made intrinsically safe by using an isolating repeater. Without isolating repeater a valve with "II 2 G (ATEX group and category) - Ex e mb II T4" (Cenelec) classification can be powered. With isolating repeater a valve with "II 1 G/D (ATEX group and category) - Ex ia IIC T6" (Cenelec) classification can be powered.


**Note: Readout units with its I.S. isolators should be situated outside zone 2.**





### 2.2.2 Isolating repeater for XB coil

Repeater for isolating the output of the controller circuit and the (XB) valve.  
The unit is capable of handling one channel. 0 - 50 mA input; 0 - 50 mA output.

Manufacturer : R. Stahl Schaltgeräte GmbH  
 Type : ISPac 9167/\*\*-11-00  
 Type of protection :  II 3 (1) G Ex nA [ia] IIC T4

Certificate no. : BVS 04 ATEX E 082 X

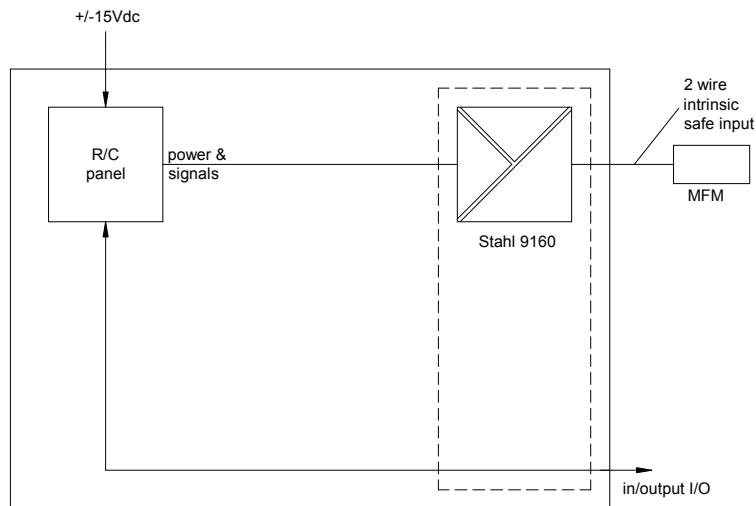
Uo = 25 V  
 Io = 99 mA  
 Po = 613 mW  
 Co ≤ 110 nF (IIC) / ≤ 840 nF (IIB)  
 Lo ≤ 2.5 mH (IIC) / ≤ 11 mH (IIB)  
 Ci negligible  
 Li negligible

#### Mechanical data

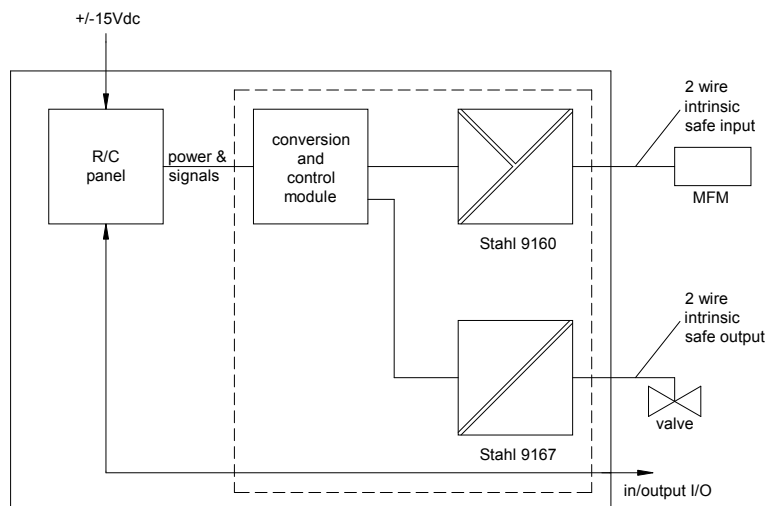
Dimensions : 17.6 x 108 x 114 mm  
 Mounting type : on top hat rail 35

## 2.3 Module setup

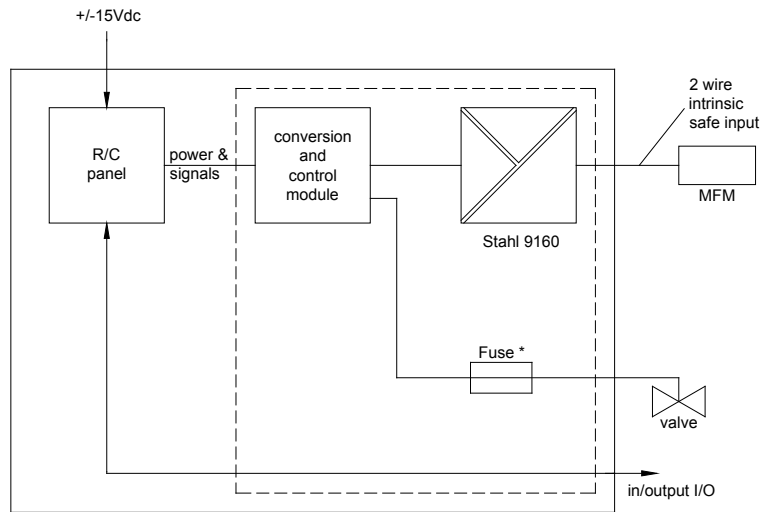
### 2.3.1 Model "20"



### 2.3.2 Model "21"

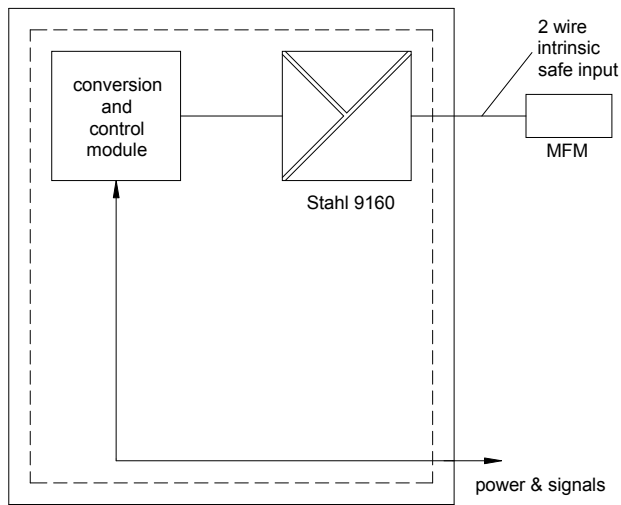


**2.3.3 Model "22"**

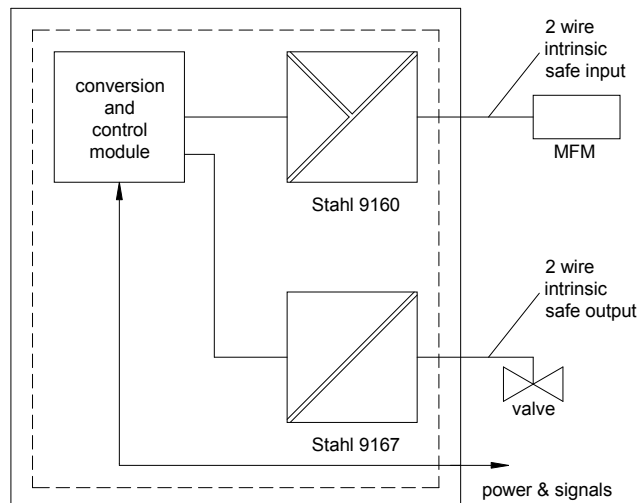


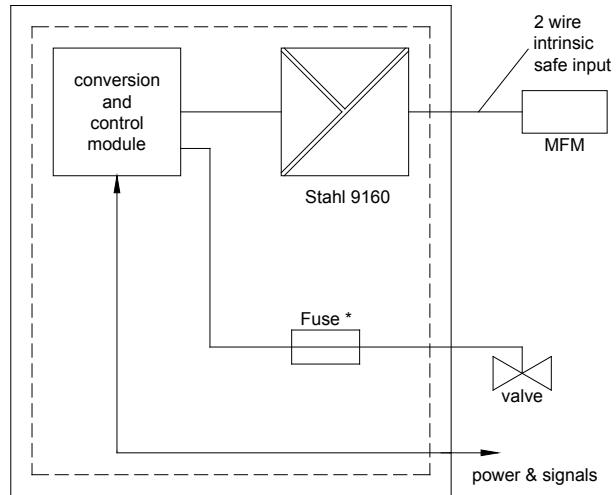
\* Module is provided with a 400 mA fuse according to IEC 60127-3 to meet the special conditions for safe use of the applied valve coil.

**2.3.4 Model "23"**



**2.3.5 Model "24"**



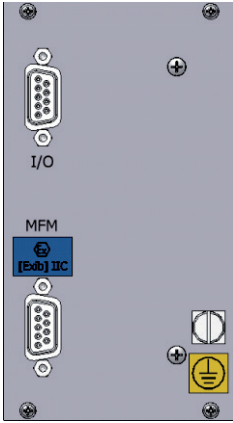
**2.3.6 Model "25"**

\* Module is provided with a 400 mA fuse according to IEC 60127-3 to meet the special conditions for safe use of the applied valve coil.

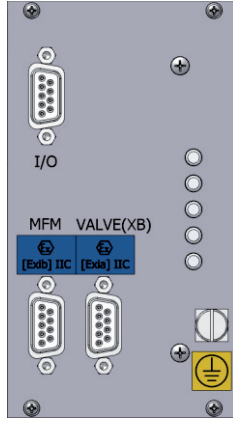
### 3 IN/OUTPUT SIGNALS

If applicable, connection of cables carrying in- and/or output signals is further explained in the customer system description.

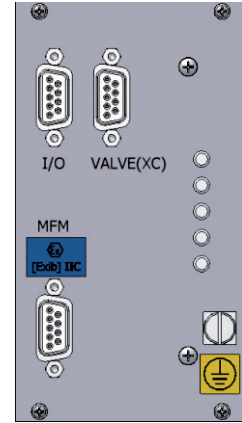
#### 3.1 Rear panel connectors and controls



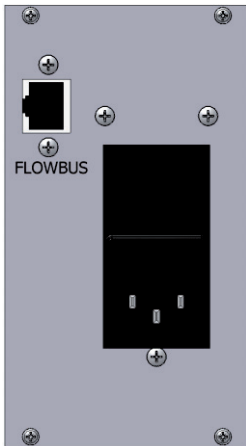
Rear (code 20 / 23)



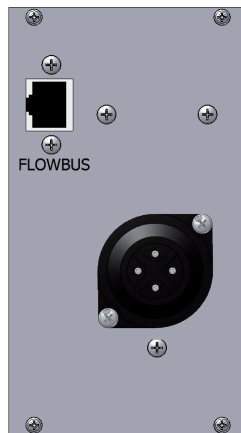
Rear (code 21 / 24)



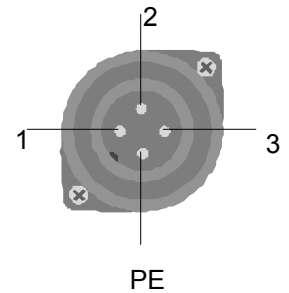
Rear (code 22 / 25)



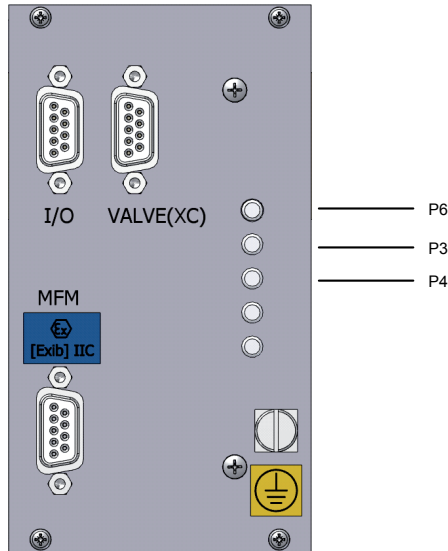
Mains operated power supply



24Vac/dc power supply



- 1: +24 Vdc/24 Vac
- 2: 0 Vdc/24 Vac
- 3: not connected
- PE: ground



Potmeters for controller parameter setting are accessible via holes in the rear panel.

Potmeter:

- P6: controls the valve quick start-up voltage. Set for optimum fast response behaviour from zero setpoint. (optional)
- P3: (flow control only) Controls the output differentiating network. This determines the dynamic response characteristic of the system.
- P4: (flow control only) Controls the D-action of the control circuit.

### 3.2 Connection to measuring devices

The instrument connector is a female sub-miniature 9-pin D-connector. The pin designation is according to the Bronkhorst High-Tech B.V. standard for intrinsic safe instruments

pinnumber	description
1	not connected
2	+ 15 - 20 mA/4 - 20 mA
3	not connected
4	not connected
5	not connected
6	not connected
7	-15 - 20 mA/4 - 20 mA
8	not connected
9	ground

The + and - current signal input is intended for loop powered transducers.

### 3.3 Connection to valves

The valve connector is a female sub-miniature 9-pin D-connector. The pin designation is according to the Bronkhorst High-Tech B.V. standard for control valves.

pinnumber	description
1	not connected
2	not connected
3	not connected
4	0 V valve
5	+ V valve
6	not connected
7	not connected
8	not connected
9	ground

Only XB or XC type valves may be connected. Consult the label on the module for the correct valve model.

### 3.4 Connection to remote equipment

For modules 20, 21 and 22:

The female in/out (1) (sub-miniature 9-pin) D-connector has the following pin configuration:

pinnumber	description
1	output signal
2	input signal
3	0 V (common)
4	not connected
5	relay contact MC
6	relay contact NO
7	relay contact NC
8	reset input
9	ground (shield)

For modules 23, 24 and 25:

The I/O connector is a male sub-miniature 9-pin D-connector. The pin designation is according to the Bronkhorst High-Tech B.V. standard for analog instruments.

pinnumber	description
1	not connected
2	output signal
3	setpoint signal
4	not connected
5	not connected
6	default: not connected / optional : -15Vdc supply
7	default: +24Vdc supply / optional : +15Vdc supply
8	0Vdc / common
9	ground

Power supply (default +24Vdc) must be connected to pin 7 (+) and pin 8 (0Vdc / common)

Analog input signals should be connected to pin 3 (+) and 0 Vdc/common.

Analog output signals are available at pin 2 (+) and 0 Vdc/common.

Signals are according to one of the Bronkhorst High-Tech B.V. standards. The model configuration contains a code, describing the input/output signals.

#### Notes:

- a. Max. load current output (0 – 20 mA / 4 – 20 mA sourcing) : 375 Ohm
- b. Min. load voltage output (0 – 5 Vdc / 0-10 Vdc) : 2 kOhm
- c. Input load resistance (voltage 0 – 5 Vdc / 0-10 Vdc) : 1M
- d. Input load resistance (current 0 – 20 mA / 4 – 20 mA) : 250 Ohm

The power supply of the modules 23, 24 and 25 is factory set to default +24Vdc.

## 4 Cables

### 4.1 Introduction

An average two-wire cable has a capacity of 120 pF per meter and an inductivity of 0.67  $\mu\text{H}/\text{m}$ .

For 100 m cable this results into:

$$C_{\text{cable}} = 12 \text{ nF}$$

$$L_{\text{cable}} = 67 \text{ } \mu\text{H}$$

### 4.2 The transmitter supply unit for flow sensors

If we take 100 m two-wire shielded 0,25  $\text{mm}^2$  than:

$$C_k = 12 \text{ nF}$$

$$L_k = 67 \text{ } \mu\text{H}$$

$$R_k = 15.8 \text{ } \Omega \text{ (loopresistance)}$$

$$L / R_{\text{ratio}} = 67/16 = 4,2 \text{ } \mu\text{H}/\Omega$$

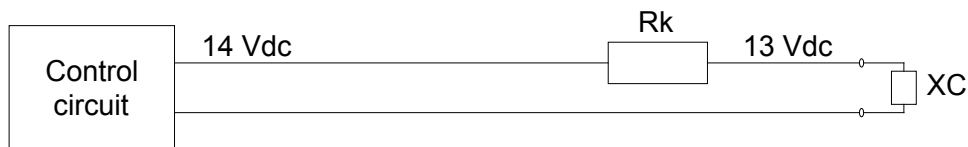
For safety this is no problem.

At 20 mA the voltage loss over the cable is:

$$V = I \times R = 0,02 \times 15.8 = 0,3 \text{ V}$$

### 4.3 The control board with XC coil

For the XC coil the capacity and inductivity is not important, but the voltage loss is the limiting factor. The maximum voltage output of the controller is 14 Vdc.



For a two-wire shielded cable we don't want to allow more than 1 Volt loss. So, on the coil  $V_{\text{max}}$  will be 13 Volt.

for XC 
$$I = \frac{V}{R} = \frac{13}{65} = 200 \text{ mA}$$

The cable resistance may be 
$$R = \frac{V}{I} = \frac{1}{0,2} = 5 \text{ } \Omega$$

A 0,25  $\text{mm}^2$  cable has a loop resistance of 1,6  $\Omega$  per 10 meter.

In other words: the maximum length is:  $\frac{5}{1,6} \times 10 \approx 30 \text{ m}$

Cable diameter	max. length
0,25 $\text{mm}^2$	30 m
0,50 $\text{mm}^2$	60 m
0,75 $\text{mm}^2$	90 m

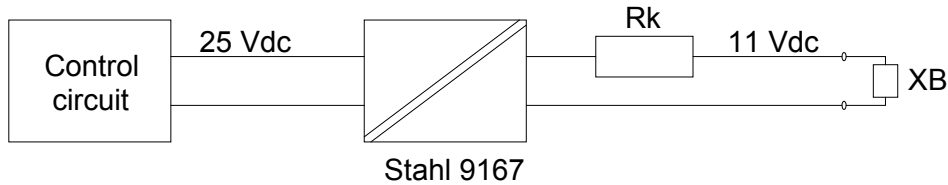
#### 4.4 Control system with XB-coil

For the XB-coil the calculation is as follows:

Because the capacity and inductivity are negligible, these can be left out of the calculation.

Resistance of the XB-coil = 300 Ω

Max. control voltage from the control circuit: 25 Vdc



It has to be possible that the coil gets at least 11 Vdc, so:

$$I = \frac{11}{300} = 37 \text{ mA}$$

The maximum output of the isolating repeater is 11,5 Vdc (at 25 Vdc input).

For cable losses is left : 11,5 - 11 = 0,5 Vdc

$$R_{\text{cable}} = \frac{V}{I} = \frac{0,5}{0,037} = 13,5 \text{ } \Omega$$

0,25 mm<sup>2</sup> gives 1,6 Ω per 10 m, so the max. cable length is  $13,5 \times \frac{10}{1,6} = 84 \text{ m}$ .

#### 4.5 Standard cables for Bronkhorst HI-TEC equipment

Cable length	≤ 10 m	≤ 20 m	≤ 60 m	≤ 100 m
Flow sensor	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>
XB coil	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>	
XC coil	0,25 mm <sup>2</sup>	0,25 mm <sup>2</sup>		

NB: Cable capacity and inductivity are negligible.

#### 4.6 EMC and Intrinsic safe circuits

Screens in cables used for intrinsic safe circuits should be earthed at one point only. For good EMC behaviour however, it is essential that the point of earthing is chosen according to the setup at which the system was tested.

Follow the guidelines for electrical hook-up of sensors (flow) and valves (XC, XB).

## 5 Operation

Consult manual 9.17.004 "Digital readout and control system E-7000 for analog and digital instruments"