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Device: Fieldbus barrier /  
field device

Type: coupler  
9411/21

Company: R. Stahl Schaltgeräte GmbH  
74638 Waldenburg

The field device coupler 9411/21-210- connects a main fieldbus line designed according to explosion protection type "Increased Safety" (EEx-e) with four or eight intrinsically safe (EEx-i) fieldbus output lines. The fieldbus device coupler is suitable for Foundation Fieldbus H1 and Profibus PA.

The input and output circuits are safely and galvanically separated. The device is fitted with an integrated terminal resistor which can be connected via jumpers. Two LEDs integrated in the enclosure indicate the power supply and a general error of the field device coupler. The four LEDs of the single channels indicate the operating state of the channel and short circuits occurring at the corresponding channel.



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#### Conclusion:

The field device coupler 9411/21 achieved very good results in the tests. For the planning, the voltage drop must be observed since the maximum cable length may be limited by this voltage drop.

## A) Manufacturer's data

Device designation:	Field device coupler
Type/version:	9411/21-210-31
Serial no. :	006469DE0017
Input voltage in V (in the bus):	16 V...32 V
Ambient temperature:	-40...+70 °C
EMC:	EN 61326 (IEC/EN 61000-4-1...6, 11; EN 55022 class B) Namur NE21 (IEC/EN 61000-4-1...6, 8, 11; EN 55022 class B)
Protection type enclosure:	IP30
Explosion protection: EC type examination certificate no.:	II2 (1) G D Ex mb e ib [ia] IIC/IIB T4 BVS 06 ATEX E 004 X
Weight:	852g
Dimensions (L x W x D):	128 mm x 209 mm x 82 mm

## B) In-house measurements

General setup:	Power supply: Laboratory power supply unit 24 V Power-Conditioner: Relcom IPM 350 mA terminal resistor set at the device Load resistors spurs: 670 $\Omega$ corresponding to ~40 mA Spur
voltage, no-load operation:	13.5 V Spur
voltage, full load operation:	10.4 V
Current consumption at the trunk, no-load operation:	21.6 mA
Current consumption at the trunk, full load operation:	121.8 mA
No-load losses, no-load operation:	0.61 W
No-load losses, full load operation:	1.7 W
Reaction in case of undervoltage, full load:	$U_{Bus} \leq 16 \text{ V}$ / no problems
Reaction in case of overvoltage, full load:	$U_{Bus} \leq 38.4 \text{ V}$ / no problems

Starting current at the trunk:

Measured: trunk current exceeding 10  $\Omega$   
Series resistor (cursor V1)

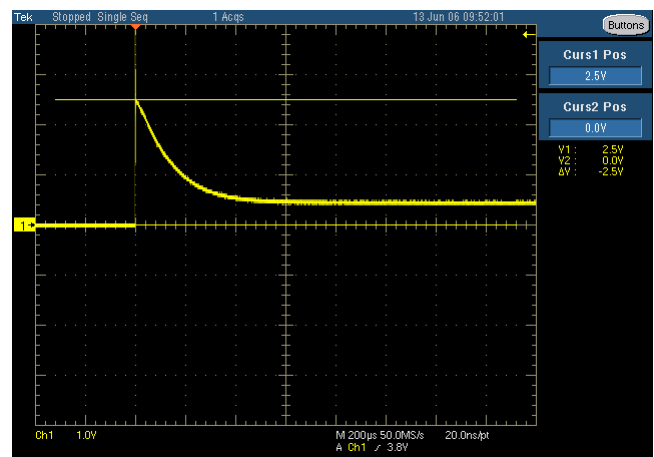
No-load operation

### Result:

**Max. 248 mA**

**Passed**

See remarks



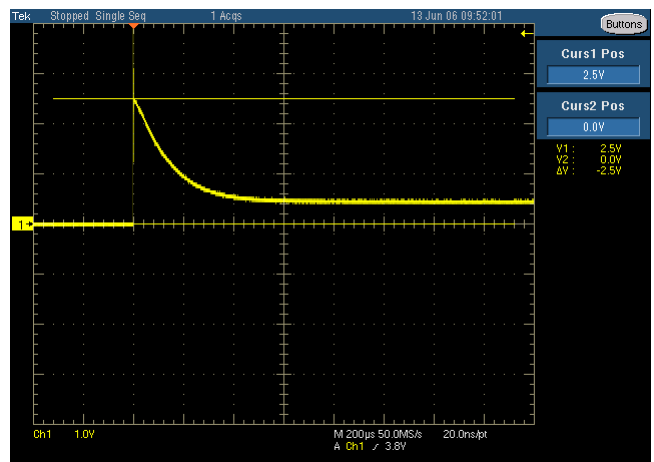
III. 1

Starting current at the trunk:

Measured: trunk current exceeding  $10 \Omega$   
Series resistor (cursor V1)

Full load

**Result:**  
**Max. 250 mA**  
**Passed**  
See remarks

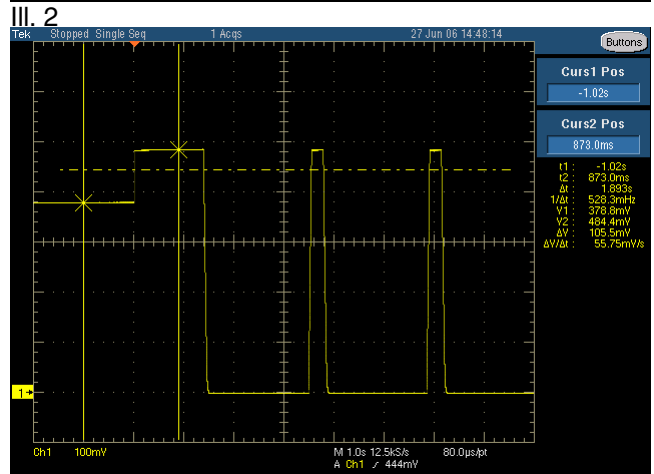


Short circuit current at the spur:

Measured: spur current exceeding  $10 \Omega$   
Series resistor (cursor V1/V2)

Full load  
Spur 2 when  $t = 0$  short-circuited

**Result:**  
**Max. 48.8 mA**  
**Passed**

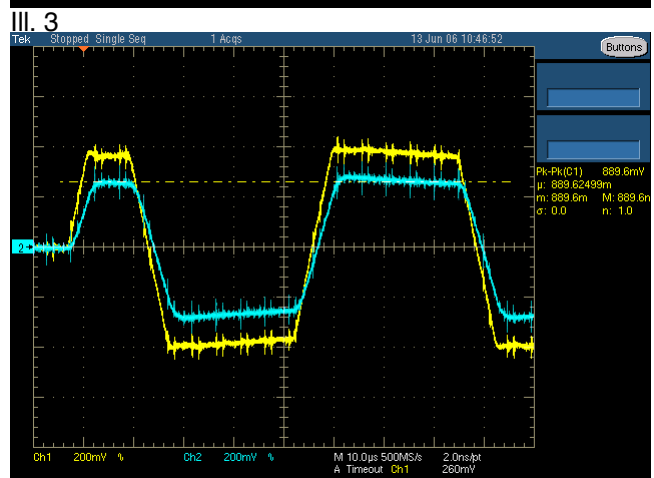


Signal curve in transmission:

Measured:  
Yellow signal: input signal at the trunk  
Blue signal: output signal at spur 1

Full load, resistive load at spur 1

**Result:**  
**Passed**

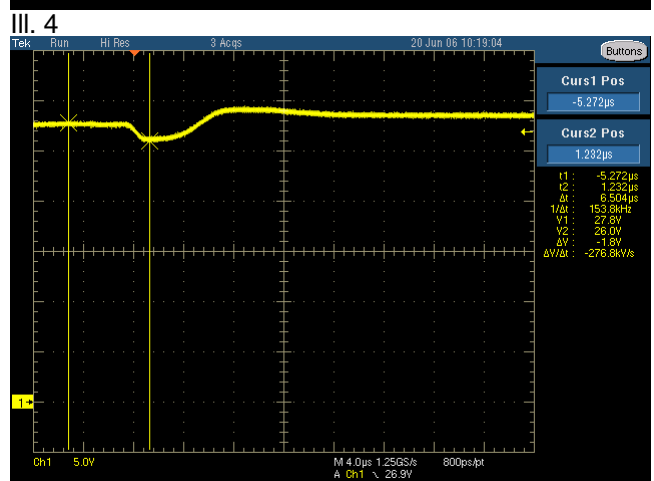


Effects on trunk in case of short-circuit at spur:

Measured: voltage at trunk

Full load  
Spur 2 when  $t = 0$  short-circuited

**Result:**  
**Voltage dip ~1.8 V for ~3 µS**  
**Passed**  
See remarks



III. 5

Effects on neighboring channel in case of short-circuit at spur:

Measured: voltage at field device spur 1

Spur 2 when  $t = 0$  short-circuited  
 Spur 3 & 8 ~40 mA

**Result:**

**Voltage dip ~4.4 V for ~1  $\mu$ S**

**Passed**

See remarks

Change in temperature +25°C, -20°C, +70°C:

admissible -40°C...70°C

tested -20°C...70°C

Measured: voltage at field device spur 1  
 In the case of a short-circuit of a neighboring channel and in addition the general communication parameters of the bus.

Spur 1 ~40 mA, when  $t = 0$  short-circuited  
 Spur 2 FF field device  
 Spur 3 & 8 ~40 mA

**Results**

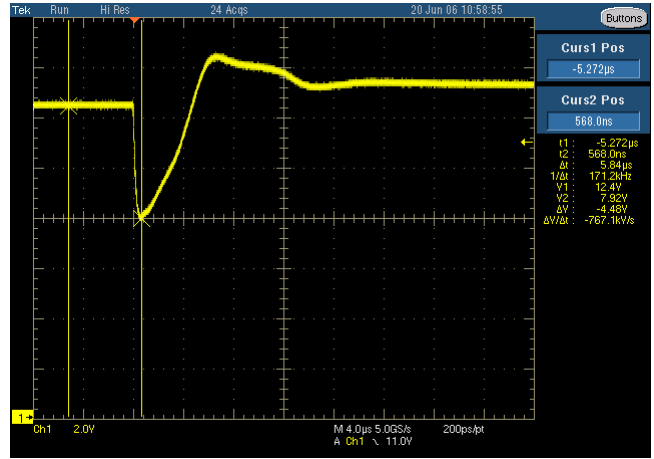
**No changes occurred when testing the effects compared with the room temperature.**

**The communication parameters of the fieldbus on all temperature points did not change.**

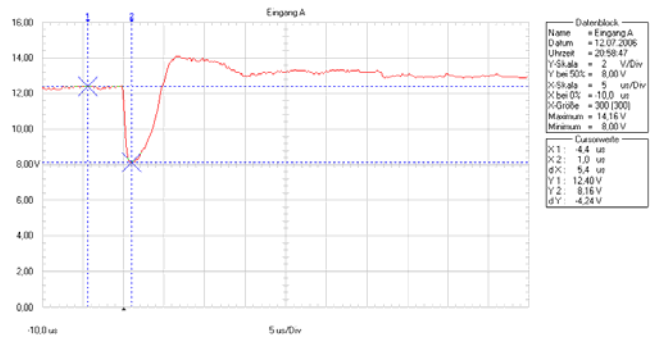
Continuous test

Spurs: 1x Profibus PA field device for each spur, in total 16 units of various manufacturers, 30 m stub line to the field device

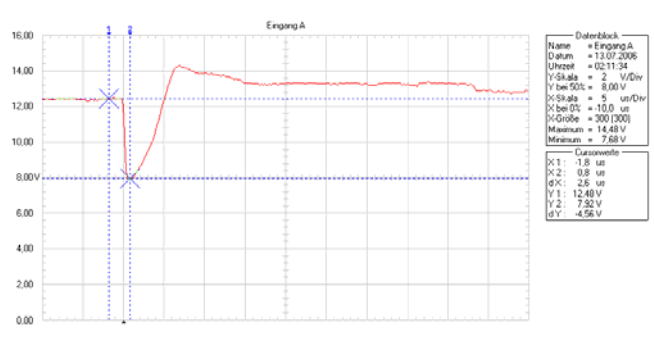
Trunk: in total 800 m trunk line Monitoring of the field devices by means of the diagnostic functions of the host system. Test duration approximately one week.



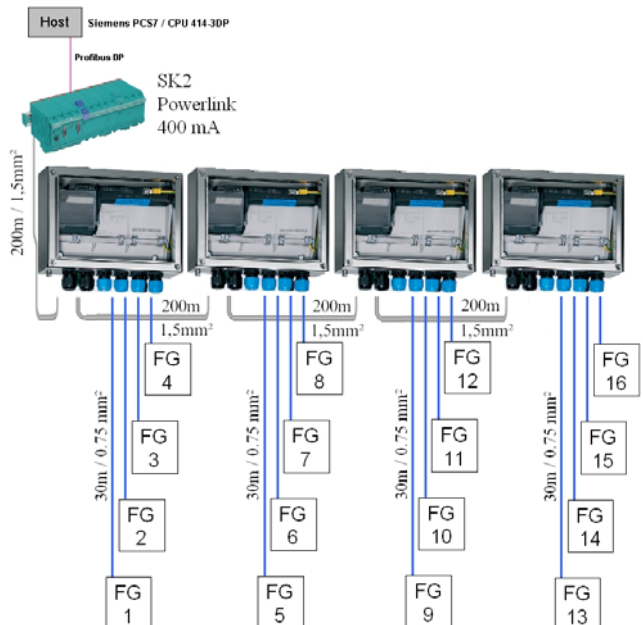
III. 6



III. 7 Effect at -20 °C



III. 8 Effect at +70 °C



III. 9 Setup of continuous test

## **Results**

***No problems occurred during the continuous test. The transmission performance of the field device coupler was good. All values were within the specification:***

<b><i>Voltage min. 24.9 V</i></b>	<b><i>Voltage max. 24.9 V</i></b>
<b><i>Unbalance min. 0 %</i></b>	<b><i>Unbalance max. 0 %</i></b>
<b><i>Noise min. 15 mV</i></b>	<b><i>Noise max. 63 mV</i></b>
<b><i>Jitter min. 0.8 <math>\mu</math>s</i></b>	<b><i>Jitter max. 2.1 <math>\mu</math>s Level</i></b>
<b><i>min. 433 mV</i></b>	<b><i>Level max. 872 mV</i></b>

Repair evaluation

Construction:

Enclosed housing, impossible for the user to open it.

Mounting evaluation

Installation effort:

Mounting on DIN mounting rail in the switch cabinet or mounting with built-in housing on a frame system.

Compatibility with standardized mounting concepts:

Electrical connections:

No objections

The field device coupler is available with spring-type and screw-type terminals. The screen of the fieldbus cable can be connected directly to ground via an integrated metallic bus bar depending on the screening concept. It is also possible to capacitively ground the bus screen via the screen terminals. \*See remarks

Explosion evaluation:

No objections

Check of the device documentation:

The present documentation was complete and easy to understand. The possible connection types are very well illustrated. The documentation was available in German language.

## C) Remarks

### EMC:

NAMUR NE21 complied with.

### Communication / electrical reaction:

- The field device coupler achieved very good results in all communication-specific tests. A self-influence on the fieldbus signal could not be measured.
- The results of the tests of the starting current and the effects between spur and trunk are only of short duration so that an influence on the remaining segment can be excluded.

### Installation:

- The field device coupler does not restart under full load with a trunk line length of 1200 m.  
This is caused by a voltage dip of the Relcom Power-Conditioner when switching on the spurs via the Power-Management of the field device coupler. The trunk voltage falls below the minimum voltage of 16 V for a short time, the Power-Management reacts and switches the field device coupler off. This reaction did not occur with other Power-Conditioners with higher output power.
- Only one field device is allowed for each spur. This corresponds to the standard requirement.  
The maximum number of field device couplers connected to one trunk is limited to 4 devices.


### Mounting:

- The setting of the terminal resistor jumper for the models with spring-type terminals is very complicated since two spring-type terminals must be opened at the same time.  
Remark of the manufacturer: A suitable mounting tool is available as an option.

### Operation/maintenance:

- All terminals are easily accessible, the ground rail makes it possible to connect the screen of the fieldbus cable over a large area.
- The operating and error state LEDs of the device are clearly visible and easy to understand.
- The Power-Management integrated in the device functions perfectly. Typical faults, such as undervoltage at the trunk, short circuit at the spur or excessive starting current of the barrier are thus regulated completely.
- For the calculation of the maximum admissible cable lengths, the software tool "Fieldbus-Wizard" is available as an option from the manufacturer.

gez. Dietz



Prüflabor

gez. Seintsch



Fachreferent