Industrial-Automation

System *HIMatrix*

Application Notes
for
Redundant Use of *HIMatrix*

Important Notes

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For more information see the documentation on CD-ROM and on our web site www.hima.com.

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F30/F31
F35
F60

Contents

1   Introduction

With the redundant wiring of HIMatrix F30/F31, F35 und F60 it is possible to increase the availability of the application. All shown wirings within this document fulfill the needs of SIL 3 applications. All shown wirings lead to an availability of higher than 99,999%. Other wirings were not analyzed and are therefore not released.
Furthermore just the hardware is analyzed. As HIMatrix has been designed for mono applications the operating system does not support redundancy of the user program. The interaction of the programs have to be handled by the user. A support for redundant programs can't be offered.
All the shown wiring diagrams allow independent power supplies for the PES.
The existing manuals have to be considered.
A system might be replaced while it is running. Please ensure that this system free of power before the plugs are swapped.

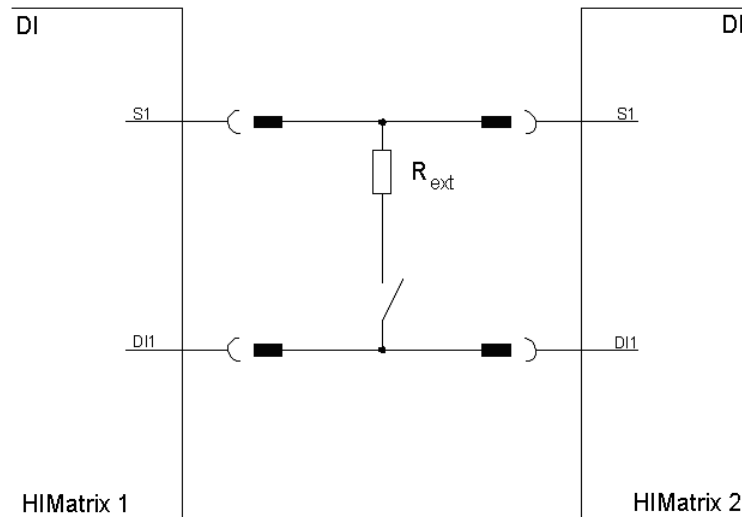⚠️   Caution: The swap has to be done carefully otherwise an electrostatic interference is possible.

When analog values are used shielded wires have to be used.

2 Contact (F30/31 DI, F35 DI, F60 DIO 24/16 01, DI32 01)

Redundant digital inputs for contacts or 24V sensor could be used with F30/F31, F35 and F60 in the described way.

2.1 Basic parameters

- The external resistance must not exceed Rext=1,5KΩ.
- Standard hysteresis of the digital Inputs of F35 have to be used.

2.2 Evaluation

- Standard, read in the digital input and use the value in the program.

3 Digital Output (F30/31 DO, F35 DO, F60 DIO 24/16 01)

Redundant digital outputs for actuators could be used with F30/F31, F35 and F60 in the described way.

3.1 Basic parameters

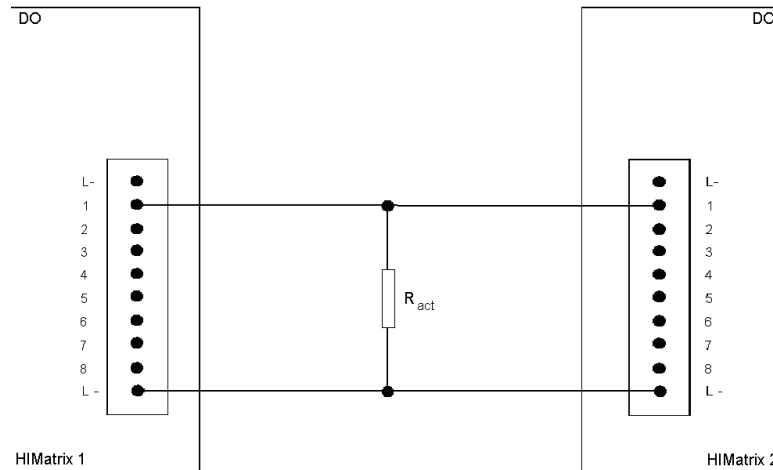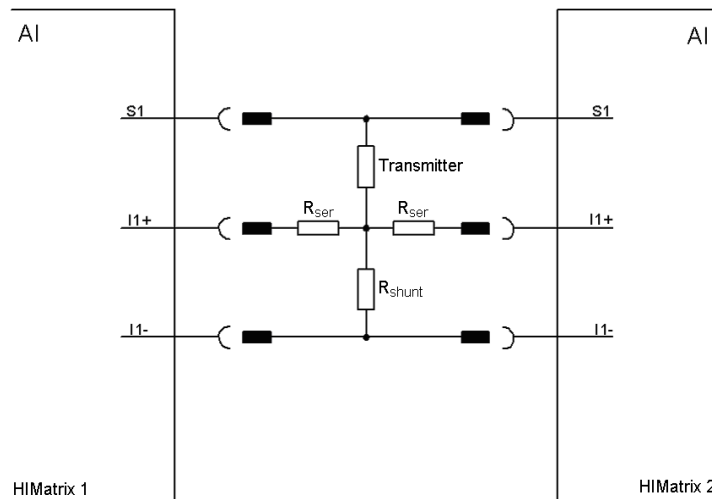- Equivalent to data sheet.

3.2 Evaluation

- Standard, write the digital output.

4   Transmitter (F35 AI, F60 AI 8 01)

Redundant analog inputs for the evaluation of transmitters could be used with F35 and F60 in the described way.


4.1   Basic parameters

- If a F60 is used an additional power supply is required for the transmitter feeding.

- The safety accuracy depends on the wiring.
  series resistor: can be used as shown above to increase the safety accuracy.
  safe communication: if a channel error is detected (AI[xx].ErrorCode != 0) both PES have to go to the safe state. Then the safety accuracy is according to the equivalent to the data sheet. The times including the communication have to be calculated as described in the system manual.
  isolator: If an external isolator is used (e.g. H6200) the safety accuracy is equivalent to the data sheet.
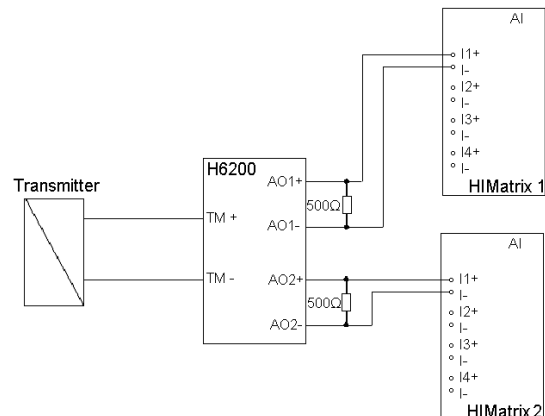
Series resistor	communication	isolator	safety accuracy
-	-	-	+-17%
1,5KΩ	-	-	+11%, -7,5%
-	Yes	-	equivalent to data sheet
-	-	Yes	equivalent to data sheet

- In case of no errors the metrological accuracy is equivalent to the data sheet.

4.2 Evaluation

- Standard, read in the analog input and use the value in the program.
- If the communication is used the error code of the analog inputs has to be checked and the application has to react in a safe manner depending on the application.

5 Line monitoring of contact (F35 DI)

Redundant digital inputs for the evaluation of contacts could be used with F35 in the described way.
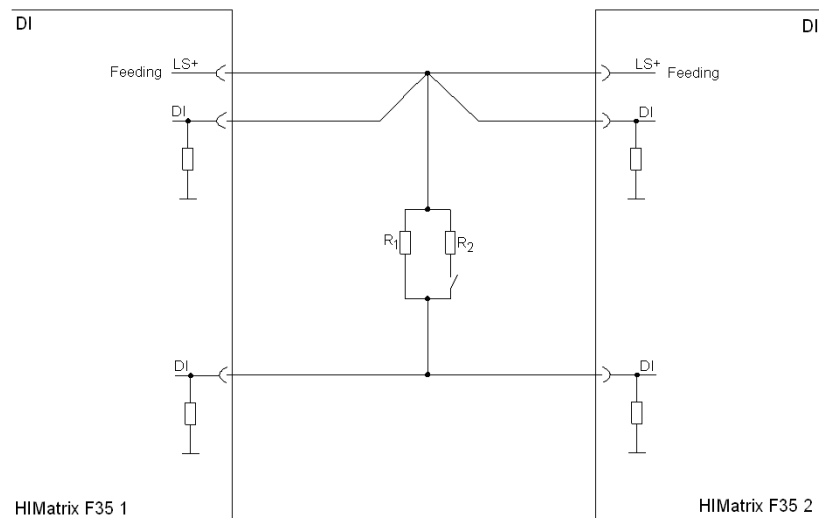
$R_1 = 22K$; $R_2 = 2K$

5.1 Basic parameters

- Each group of 8 digital inputs has one feeding that has to be observed for higher 23V, DI[Observation]Value Analog > 2300.
- The feeding (LS+) depends on the power supply of the F35 and the number of used contacts. (LS+ ~ power supply – 3V) The measured value – 1,1V is the limit for the short circuit detection.
- The hysteresis have to be adopted.
- The analog value of the digital input is used to detect the shot circuit and line break.

5.2 Evaluation:

- The feeding has to be observed with the anlog value of the dgital input. A value of < 23 V [2300 Digits] is an error.
- Parameters for the digital input
    DI[xx].Hysterese LOW = 1000
    DI[xx].Hysterese HIGH = 1200
- Error detection during runtime :
    Short circuit   DI[xx]Value Analog > DI[Observation]Value Analog – 110
    Line break   DI[xx]Value Analog < 100
- If an error is detected the application has to react in a safe manner depending on the application.

6 Line monitoring of contact (F35 AI, F60 AI 8 01)

Redundant analog inputs for the evaluation of contacts could be used with F35 and F60 in the described way.

$$R_1 = 22K \; ; \; R_2 = 2K$$

6.1 Basic parameters

- The additional electronic components have to be placed near the PES.
- $V_D \rightarrow 11V \leq \pm 5\%$; 0,2W
- $R_P = 1K\Omega$
- $R_{SV} = 1K\Omega$

F60:
- An additional power supply (26,7V…27,3V) is requires for the feeding
- A voltage divider with z-diode protection has to be used to observe the feeding.

F35:
- Z7308 could be used instead of the additional electronic components (V_D, R_P, R_{SV})
- Each group of 8 inputs has one common feeding that has to be observed.

6.2   Evaluation

- Feeding observation F35 (26,7V … 27,3V):
    2670 < DI[Observation]Value Analog < 2730
- Values for the analog inputs at a max. value of 1000:
    LOW   AI[xx].Value < 3V [300 Digit]
    HIGH   AI[xx].Value > 4V [400 Digit]
- Error detection
    short circuit   AI[xx].Value > 10V [1000 Digit]
    Leitungsbruch   AI[xx].Value < 0,2V [20 Digit]
- line break < 0,2V < LOW < 3V < error < 6V < HIGH < 10V < short circuit
- the "error" might be a defect z-diode if 2 are used in serial manner.
- If an error is detected the application has to react in a safe manner depending on the application.

7 Line monitoring of DO (F35 AI, F60 AI 8 01)

Redundant analog inputs could be used to observe redundant digital outputs with F35 and F60 in the described way.
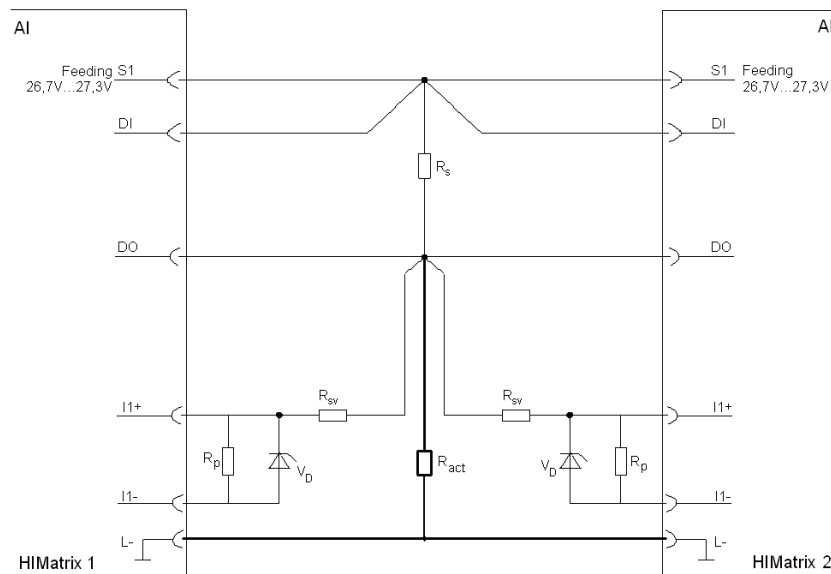
7.1 Basic parameters

- The additional electronic components have to be placed near the PES (V_D, R_{SV}, R_s, R_p)
- To observe channel errors (system variable AI[xx].error code = 0) a safety related communication has to be established between the two PES. If an error of the channel is detected the application has to react in a safe manner depending on the application. The times including the communication have to be calculated as described in the system manual. If no communication is allowed the analog inputs is required an external isolator has to be used (e.g. H6200).
- Selection of electronic components according to the used actuator

components	example
R_{sv} = 2KΩ	$P_{SV} = (30V)^2 / R_{sv} \rightarrow 0,45$ W
R_P = 100KΩ	
$V_D \rightarrow 11V \leq \pm5\%$	$P_{VD} = U_z * (U - U_z) / R_{sv}$ $= 11V*(27V-11V)/ 2K\Omega$ $= 0,09W$
$13\Omega \leq R_{Act} \leq 550\Omega$	
The error assumption results in 0,4V…1V at power off at R_A.	
$R_s \geq 750\Omega$	Assumption $R_{act} = 400\Omega$ $R_{smin} = (U_{SPmax} - 1V) * R_{act} / 1V$ $= (27,3V - 1V) * 400\Omega / 1V$ $= 10,52K\Omega$ $R_{smax} = (U_{SPmin} - 0,4V) * R_{Act} / 0,4V$ $= (26,71V - 0,4V) * 400\Omega / 0,4V$ $= 26,9K\Omega$

To get the best reserve it makes sense to use a $R_P = 18,7K\Omega$ (average).

All calculation are based on ohmic load. Before actuators with RCL-combinations are used these actuators should be tested.

F60:
- A voltage divider with z-diode protection has to be used to observe the additional external feeding (26,7V…27,3V).
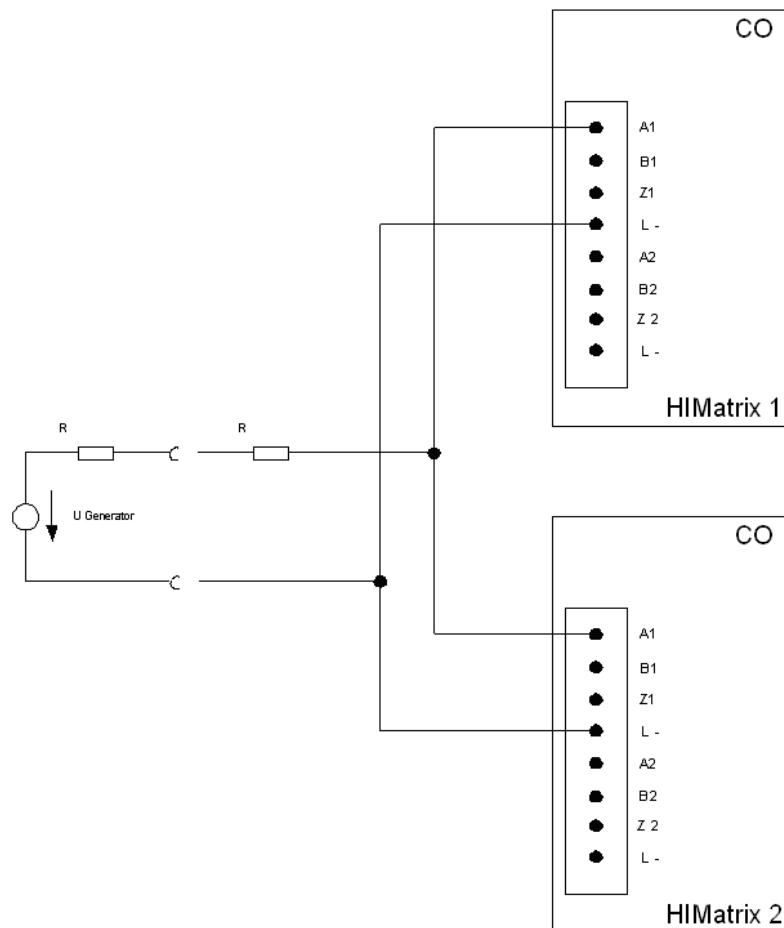
7.2   Evaluation

- The dedicated Input has to observe the feeding voltage for > 26,7V
  F35: 2670 < DI[observation]Value Analog < 2730
  F60: analog value according to a voltage divider instead of the digital input.

values	off	on
Standard	40…100 Digit	> 900 Digit
Line break	> 500 Digit	n.a.
Short circuit	< 30 Digit	
Defect Z-Diode	n.a.	$500 < V_D < 600$

- If a defect Z-Diode should be detected it is possible to use two of them with half of the voltage (VD = 5,6V) in serial manner. Just than the last row is applicable.

8   Counter input (F35 CNT, F60 CIO 2/4 01)

Redundant counter inputs could be used with F35 and F60 in the described way.

8.1   Basic parameters

- Equivalent to data sheet.
- The sum of the resistors has to be < 400Ω.
- The edge steepnes has to be > 1V/µs .

8.2   Evaluation

- Standard, read in the digital input and use the value in the program.

HIMA
...the safe decision.