

SAFETY MANUAL

HART® TRANSPARENT DRIVER

9107

**This safety manual is valid for the following product versions:
9107-002**

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1. Observed standards

Standard	Description
IEC 61508	Functional Safety of electrical / electronic / programmable electronic safety-related systems
IEC 61508-2:2000	Part 2: Requirements for electrical / electronic / programmable electronic safety-related systems

2. Acronyms and abbreviations

Acronym / Abbreviation	Designation	Description
Element		Term defined by IEC 61508 as “part of a subsystem comprising a single component or any group of components that performs one or more element safety functions”
PFD	Probability of Failure on Demand	This is the likelihood of dangerous safety function failures occurring on demand.
PFH	Probability of dangerous Failure per Hour	The term “Probability” is misleading, as IEC 61508 defines a Rate.
SFF	Safe Failure Fraction	Safe Failure Fraction summarises the fraction of failures which lead to a safe state and the fraction of failures which will be detected by diagnostic measures and lead to a defined safety action.
SIF	Safety Integrity Function	Function that provides fault detection (to ensure the necessary safety integrity for the safety functions)
SIL	Safety Integrity Level	The international standard IEC 61508 specifies four discrete safety integrity levels (SIL 1 to SIL 4). Each level corresponds to a specific probability range regarding the failure of a safety function.

3. Purpose of the product

HART Transparent, galvanic isolation of 4...20 mA current signals between hazardous area and non-classified area.

The module can be mounted in the safe area and in zone 2 / div. 2 and drive a 4...20 mA current signal into zone 0, 1, 2, 20, 21 22 and mines / Class I/II/III, Div. 1, Group. A-G.

Error events, including cable breakage, are monitored and signalled via the individual status relay and/or a collective electronic signal via the power rail.

The display and programming module 4501 can be used to show the actual process value and alter the set point for high and low limit.

The 9107 has been designed, developed and certified for use in SIL 2 applications according to the requirements of IEC 61508.

4. Assumptions and restrictions for use of the product

4.1 Basic safety specifications

Operational temperature range -20...+60°C

Storage temperature range -20...+85°C

Power supply type..... Double or reinforced

Supply voltage 19.2...31.2 VDC

Mounting area..... Class I, Zone 2 / Division 2
or safe area

Mounting environment..... Pollution degree 2,
Overvoltage category II

4.2 Safety accuracy

The analogue output corresponds to the applied input within the safety accuracy.

Safety accuracy..... ±2%

4.3 Analogue output

The connected safety Valve or other, or shall be able to detect and handle the fault indications from the analogue output of the 9107 Driver by having a NAMUR NE43-compliant input circuit.

4.4. Failure rates

The basic failure rates from the Siemens standard SN 29500 are used as the failure rate database.

Failure rates are constant, wear-out mechanisms are not included.

External power supply failure rates are not included.

4.5 Installation in hazardous areas

The IECEx Installation drawing, ATEX Installation drawing and FM Installation drawing shall be followed if the module is installed in or connected to hazardous areas.

5. Functional specification of the safety functions

Galvanic isolation of 4...20 mA current signals, between hazardous area and non-classified area or zone 2 / Div. 2, within the specified accuracy.

6. Functional specification of the non-safety functions

The status relay (terminal 33 and 34), error signal on power rail (terminal 91) and LED outputs are not suitable for use in any Safety Instrumented Function. The display value and any possible parameterisation by the 4501 add on module does not affect the safety function of the 9107.

Also the HART® transparency of the module is not a safety function.

7. Safety parameters

Probability of dangerous Failure per Hour (PFH)	4.80E-08
	Note ¹
Probability of failure on demand (PFD) - 1 year proof test interval	2.29E-04
Proof test interval (10% of loop PFD)	5 years
Safe Failure Fraction	85%
Demand mode	High
Demand rate	Note ²
Mean Time To Repair (MTTR)	24 hours
Hardware Fault Tolerance (HFT)	0
Component Type	A, see note ³
SIL capability	SIL 2
Description of the "Safe State"	Output ≤ 3.6 mA or Output ≥ 21 mA

Note¹: The 9107 contains no lifetime limiting components, therefore the PFH figures are valid for up to 12 years, according to IEC 61508.

Note²: Depends on detection time in external controller. If detection time is xx seconds, the Demand Rate shall be 100 times xx seconds.

Note³: Simple device (type A) where microprocessors and software have no effect on safety output.

8. Hardware and software configuration.

All configurations of software and hardware versions are fixed from factory, and cannot be changed by end-user or reseller.

This manual only covers products labelled with the product version (or range of versions) specified on the front page.

9. Failure category

Failure category	Failure rates (1/h)
Fail Safe Detected	0.000E-0
Fail Safe Undetected	1.64E-07
Fail Dangerous Detected	1.27E-07
Fail Dangerous Undetected	4.80E-08

10. Periodic proof test procedure

Step	Action
1	Bypass the safety Valve or other and take other appropriate action to avoid a false trip
2	Connect a simulator identical to the input setup.
3	Apply input value corresponding to 0/100% output range to each channel
4	Observe whether the output acts as expected
5	Restore the input / output terminals to full operation
6	Remove the bypass from the safety Valve or other and restore normal operation

This test will detect approximately 95% of possible “du” (dangerous undetected) failures in the module.

11. Procedures to repair or replace the product

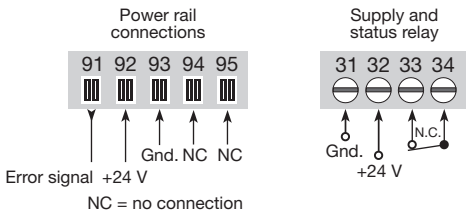
Any failures that are detected and that compromise functional safety should be reported to the sales department at PR electronics A/S.

Repair of the module and replacement of circuit breakers must be done by PR electronics A/S only.

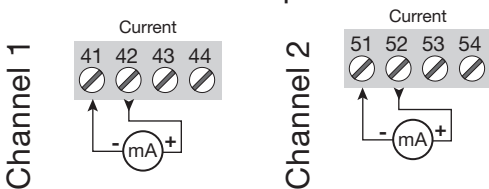
12. Maintenance

No maintenance required.

13. Connections diagram



Ex outputs:



Inputs:

