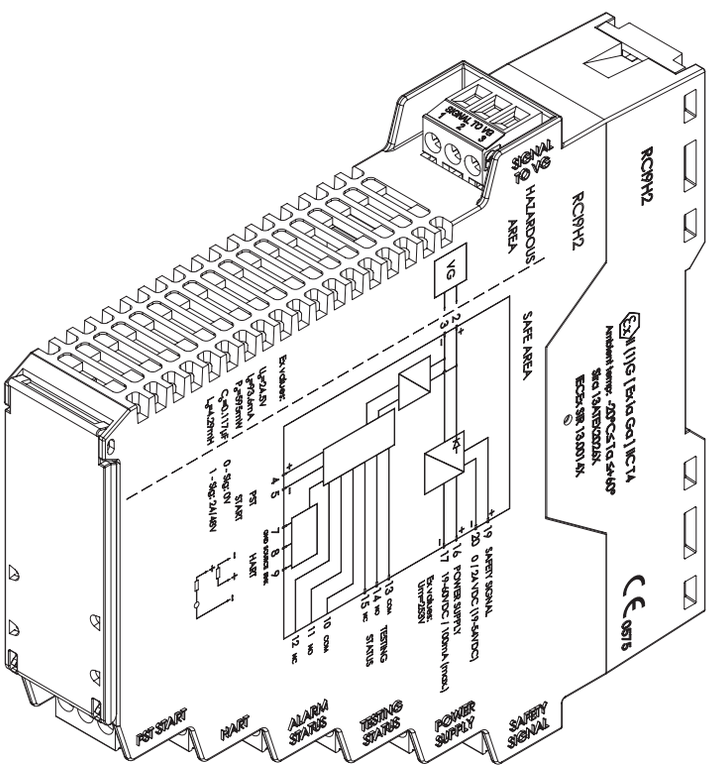
Remote communication interface for Neles™ VG9000H™

Type RCI9H2

Safety manual



Functional Safety Type Approved

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Table of Contents

1. Introduction

This manual contains information for application of RCI9H2 product in functional safety related loops.

1.1 System description

RCI9H2 is meant to be used together with Neles ValvGuard VG9000H safety valve controller. It is needed when 24 VDC output (DO) is used in the safety system. RCI9H2 is connected between the safety system and the field device VG9000H as presented in figure 1.

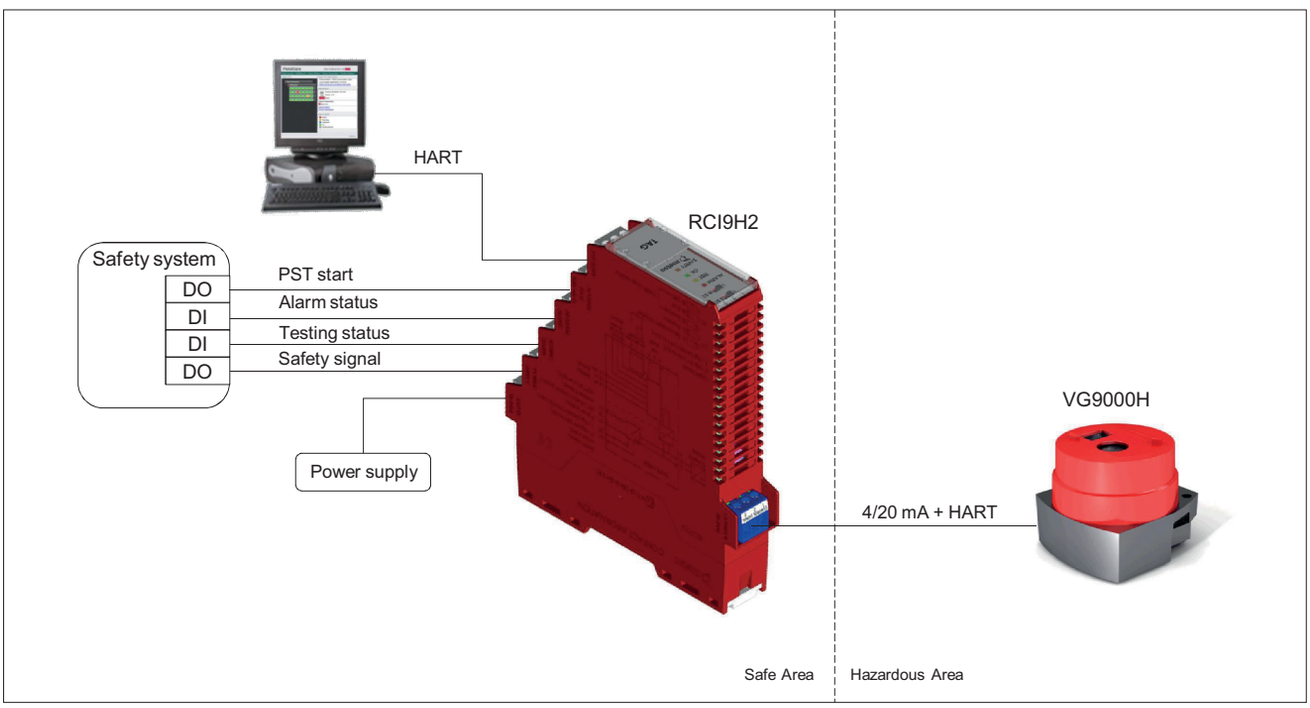

Fig. 1. RCI9H2 System Level Diagram

The primary function of RCI9H2 is to convert safety binary input from a safety DO (Digital Output) system into a SIL 3 compatible 4-20mA current signal. RCI9H2 also provides relay outputs for monitoring the test and alarm status of the VG9000H and a discrete input for commanding VG9000H to start a Partial Stroke Test. Additionally, RCI9H2 includes an isolated barrier and can be used in intrinsically safe application.

RCI9H2 has local interface with status relays and LED's, which can be used to indicate the status information of the VG9000H (Alarm and Test status).

RCI9H2 has two configuration switches. One switch is for configuring Mode A (Secondary master) / Mode B (Monitor) selection and other switch is to connect RCI9H2 internal HART loop resistor (250 Ohm) to HART loop.

1.2 Supplementary documentation

Table 1. List of references

Document ID	Name of document
7RCI9H270EN	RCI9H2 Installation, Maintenance and Operation instructions
7VG9H70EN	VG9000H Installation, Maintenance and Operation instructions
VG9000H_Safety_Manual	VG9000H Safety Manual

2. Safety function

2.1 Safety function

Safe conversion of 0V/24V or 48V safe digital output signal into a 4...20mA current signal with safe state: output <5mA. This means that the current output (terminal SIGNAL TO VG) is in low condition when the controlling input (terminal SAFETY SIGNAL) is in the de-energized condition.

2.2 Safe State

The safe state of the RCI9H is defined as the current output is less than 5 mA.

2.3 Reaction Time

The reaction time (switch off delay) of the safety function is less than 50 ms.

3. Functional safety and product reliability indicators

Functional safety and product reliability indicators are presented in table 2.

Table 2. Functional safety data

Characteristics as per IEC 61508	Value
SIL	SIL 3
HFT	1
Device Type	A
Mode of operation	Low demand mode
SFF	>90%
Recommended time interval for proof-testing T1	10 years
PFD_{avg} for T1 = 10 years	$4{,}72 \times 10^{-5}$
Dangerous undetected failure rate λ_{du}	1.9×10^{-9} 1/h
Dangerous detected failure rate λ_{dd}	0 1/h
Safe undetected failure rate λ_{su}	$1{,}1 \times 10^{-9}$ 1/h
Safe detected failure rate λ_{sd}	0 1/h
Diagnostic Coverage DC	0 %
Safe Failure Fraction	98,9%
MTBF	216 years

1 FIT = 1 E-09 1/h
Remark: Failure rates of the electronic components as per Siemens SN 29500, calculated based upon an ambient temperature of 40 °C.

4. Behavior of device

In this section the behavior of voltage to current conversion is explained in different situations.

Safety signal thresholds are presented in figure 3.

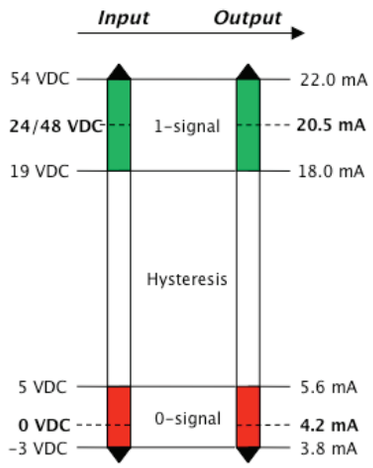

Fig. 3. RCI9H2 safety signal thresholds in normal use case.

4.1 Normal vs. loop powered mode

RCI9H2 normal use case is to connect power supply to POWER SUPPLY terminal. RCI9H2 can additionally be used without power supply, i.e., in loop powered mode. See details in RCI9H2 IMO.

4.2 During power-up

During power-up it may take up to 40 ms for RCI9H2 to power up and to be fully operational. This is valid when the RCI9H2 receives logic level high (1-Signal) from safety system DO to energize the VG9000H with output current level 18...22 mA / ≥ 16 mA when loop powered.

4.3 During operation

When the input signal to RCI9H2 from the system DO is in logic state 1, the RCI9H2 output current level is 18…22 mA. When loop powered, RCI9H2 output current level will be ≥ 16 mA, which is sufficient to keep the VG9000H in normal state.

When the input signal to RCI9H2 from the system DO is in logic state 0, the RCI9H2 output current level will be 3.8...5.6 mA. When loop powered, RCI9H2 output current level will be 0 mA, which de-energizes VG9000H completely. It may take up to 90 ms for RCI9H to trip the VG9000H.

5. Restrictions for use in safety-related applications

Assembly, installation, commissioning, maintenance and operation of this product may only be carried out by trained, qualified personnel who have read and understood the instruction manuals.

Please ensure that the RCI9H2 is used correctly for the application described in RCI9H2 IMO and that the ambient conditions are taken into account. The instructions for installation conditions, as detailed in the IMO shall be observed. The specifications in the IMO shall not be exceeded.

De-activating or bypassing safety functions or failure to follow the advice given in this manual may cause damage to property, environment or persons for which Valmet will not be liable.

This product is developed, manufactured and tested according to the relevant safety standards. This product must be used for the applications described in the instructions and with specified environmental conditions and only in connection with approved external devices.

6. Installation and commissioning

The installation of the device needs to be done according to the RCI9H2 IMO.

Installation has to consider all aspects regarding the SIL level of the loop. During installation or replacement of the device the loop has to shut down. Devices have to be replaced by the same type of devices.

6.1 Operation

See RCI9H2 IMO for the operation instructions of the device.

6.2 Maintenance

During maintenance work on the device, alternative safety function methods shall be taken to ensure process safety.
See the RCI9H2 IMO for maintenance instructions.

7. Proof-testing

Assuming proof test interval of 10 years, RCI9H2 has average PFD value less than 1 % of the SIL3 budget value. This means that RCI9H2 practically does not need to be proof tested. It is more likely that other components of the system need proof testing prior to RCI9H2.

Nevertheless, the proof test procedure of the RCI9H2 is as follows. This procedure can only be done during service shutdown.

1. Energize RCI9H2 safety system input and the power supply.
2. Now output current shall be within range 18...20 mA. Current measurement can be done using multimeter or VG9000H Local User Interface. See more information on LUI usage from VG9000H manual (7VG9H70EN), chapter “Measurement monitoring”.
3. De-energize RCI9H2 safety system input.
4. Now output current shall be within range 3.8...5.6 mA

8. Repair

Any repair to the device shall be carried out by the manufacturer only. Device failures must be reported to the manufacturer. The user shall provide a detailed report to the manufacturer describing the failure and any possible effects.

9. Certificate

See the next page.

Certificate

Functional Safety

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No.: 968/EZ 585.03/23

Product tested	Remote Control Interface for VG9000H	**Certificate holder**	Valmet Flow Control Oy Vanha Porvoontie 229 FI-01380 Vantaa Finland
Type designation	RCI9H2		
Codes and standards	IEC 61508 Parts 1-7:2010		
Intended application	The device complies with the requirements of the relevant standards (SIL 3 acc. to IEC 61508) and can be used in applications up to SIL 3 for the safety function “Safe conversion of a 0 V/24 V or 48 V safe digital output signal into a 4...20 mA current signal with the safe state: output < 5 mA". The product was also reviewed for the use in the application area of IEC 61511-1:2016 + Corr.1:2016 + AMD1:2017 up to SIL 3.		
Specific requirements	The instructions of the associated Safety Manual and Installation, Maintenance and Operation Manual shall be considered.		

Summary of test results see back side of this certificate.

The issue of this certificate is based upon an evaluation in accordance with the Certification Program CERT FSP1 V3.0:2020 in its actual version, whose results are documented in Report No. 968/EZ 585.03/23 dated 2023-06-22. This certificate is valid only for products, which are identical with the product tested. Issued by the certification body accredited by DAkkS according to DIN EN ISO/IEC 17065. The accreditation is only valid for the scope listed in the annex to the accreditation certificate D-ZE-11052-02-01.

Köln, 2023-08-03

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Certification Body Safety & Security for Automation & Grid

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