

# NRGC-PN



## NRG controller with PROFINET Communication



### Main features

- **Communication interface.** The NRG controller bridges the field level devices to the control level to allow exchange of data in real-time with the NRG solid state relays.
- **Reduced maintenance costs and downtime.** Use of real-time data for prevention of machine stoppages during operation.
- **Good quality products and low scrap rates.** Real-time monitoring allows timely decisions for better machine and process management.
- **Reduced efforts in troubleshooting.** A number of faults can be distinguished to facilitate and reduce troubleshooting time.
- **Fast installation and set-up.** Control, monitoring and diagnostics all possible via the communication system.
- **Compact dimensions.** One controller with a product width of 35 mm can handle up to 32 switched poles of the RG..CM..N.

### Description

The **NRGC-PN** is the NRG controller in the NRG BUS chain.

The **NRGC-PN** interfaces directly with the main controller of the system through PROFINET communication. Each **NRGC-PN** in the system is identified by a unique MAC address which is printed on the façade of the product.

The **NRGC-PN** is mainly a facilitator of the communication between the main controller and each individual RG..N solid state relay in the system. The **NRGC-PN** also performs internal operations to setup and maintain the internal bus.

The **NRGC-PN** needs to be supplied with 24 VDC. LEDs on the front facade give a visual indication of the status of the **NRGC-PN**, of any ongoing communication with the main controller and the RG..Ns on the BUS chain and of any alarm condition related specifically to the **NRGC-PN**.

Specifications are noted at 25°C unless otherwise specified.

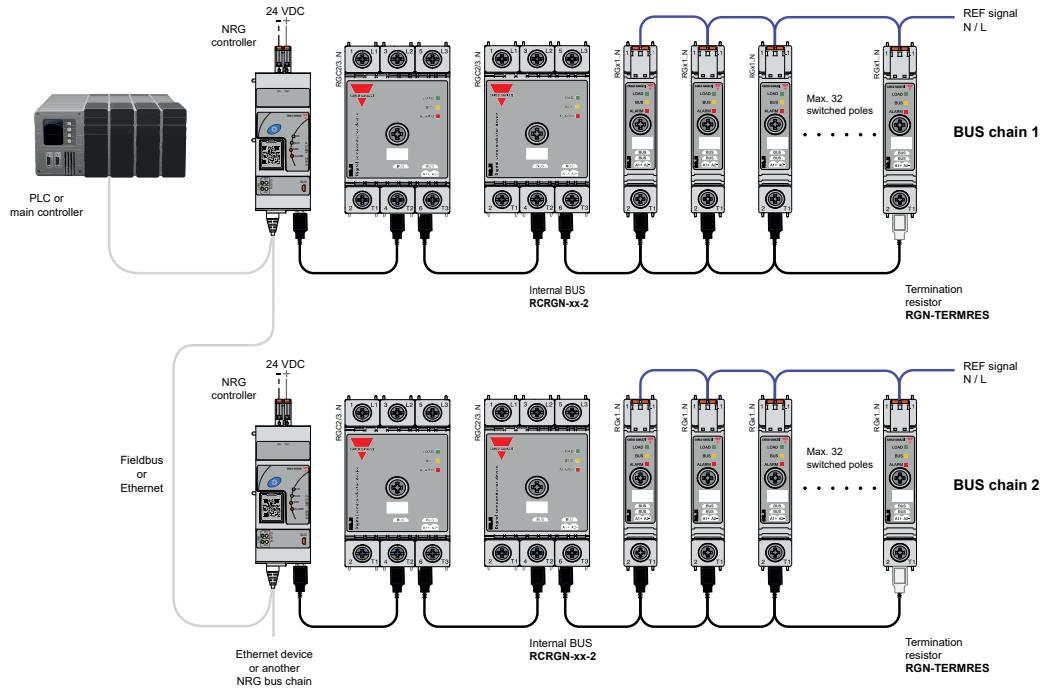
### Applications

Any heating application where reliable and precise maintenance of temperatures is crucial to the quality of the end product. Typical applications include plastic machinery such as injection machines, extrusion machines and PET blow moulding machines, packaging machinery, sterilisation machinery, drying tunnels and semiconductor manufacturing equipment.

### Main function

- Communication interface: PROFINET
- Connects up to 32 switched poles of the RG..CM..N.. solid state relays
- Supply voltage 24 VDC +/-20%

## The NRG system



### System Overview

The NRG is a system consisting of one or more BUS chains that enable communication between the field devices (such as the solid state relays) and the control devices (such as the machine controller or PLC).

Each NRG BUS chain consists of the following 3 components:

1. the NRG controller (NRG..)
2. the NRG solid state relay(s) (RG..N)
3. the NRG internal BUS cables (RCRGN-XXX-2)

The NRG controller is the interface to the machine controller and determines the communication protocol used. It is not possible to operate the NRG system without the NRG controller.

The NRG controllers available are:

- **NRGC** - NRG controller with a Modbus RTU interface over RS485.
- **NRGC-PN** - NRG controller with a PROFINET communication interface. The NRGC-PN is identified by a unique MAC address which is printed on the facade of the product. The GSD file can be downloaded from [www.gavazziautomation.com](http://www.gavazziautomation.com).
- **NRGC-EIP** - NRG controller with an EtherNet/IP communication interface. The IP address is provided automatically via a BOOTP server. The EDS file can be downloaded from [www.gavazziautomation.com](http://www.gavazziautomation.com)
- **NRGC-ECAT** - NRG controller with an EtherCAT communication interface. The ESI file can be downloaded from [www.gavazziautomation.com](http://www.gavazziautomation.com)
- **NRGC-MBTCP** - NRG controller with a Modbus TCP communication interface.

The NRG solid state relay is the switching and monitoring component in the NRG system. Each RG..N integrates a communication interface to exchange data with the machine controller (or PLC). The available RG..Ns that can be used in an NRG system are:

- **RG..D..N**

The RG..D..N are solid state relays for use in an NRG system having the communication interface only for real time monitoring. Control of the RG..N is done via a DC control voltage. It is possible to have max. 48 x RG..D..Ns in one NRG BUS chain.

## ► System Overview - continued

### • RG..CM..N

The RG..CM..N are solid state relays for use in an NRG system having a communication interface for control of the RG..N through the BUS and for real-time monitoring. Different variants of the RG..CM..N can be mixed on the buschain with a maximum limit of 32 switched poles. The variants of the RG..CM..N are:

- RGx1A..CM..N – 1-pole solid state relay with zero cross switching.
- RGx1P..CM..N – 1-pole solid state relay with proportional switching.
- RGC2P..CM..N – 2-pole solid state contactors with proportional switching.
- RGC3P..CM..N – 3-pole solid state contactor with proportional switching.

For a review of the features and compatibilities across all variants refer to the table below:

Feature	RGx1A..D..N	RGx1A..CM..N	RGx1P..CM..N	RGC2P..N	RGC3P..N
COMMUNICATION PROTOCOLS	 Modbus RTU	●	●	●	●
	 Modbus TCP	-	●	●	●
	 PROFINET	-	●	●	●
	 EtherNet/IP	-	●	●	●
	 EtherCAT	-	●	●	●
Max. number of switched poles on BUS	48	32	32	32	32
External control	●	●	-	●	●
Control over BUS	-	●	●	●	●
SWITCHING MODES	ON / OFF	●	●	●	●
	Burst	●	●	●	●
	Distributed full cycle	●	●	●	●
	Advanced full cycle	●	●	●	●
	Phase angle	-	-	●	-
	Soft start with time *	-	-	●	-
	Soft start with current limit *	-	-	●	-
	Voltage compensation	-	-	●	●
True power compensation *	-	-	-	●	●
Monitoring of system parameters	●	●	●	●	●
SSR diagnostics	●	●	●	●	●
Load diagnostics	●	●	●	●	●
Over-temperature protection	●	●	●	●	●

\* feature currently unavailable for RGC2/3P..N. To be released soon..

### Notes:

- RG..D..N and RG..CM..N devices cannot be mixed in the same bus chain.
- The **NRG internal BUS cables** are proprietary cables to daisychain the RG..Ns on the NRG bus chain and to connect the NRG controller to the first RG..N.
- The **internal BUS terminator** is provided in the same package with the NRG controller and shall be plugged into the last RG..N in the NRG bus chain.

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# References

## ▶ Order code

 NRGC-PN

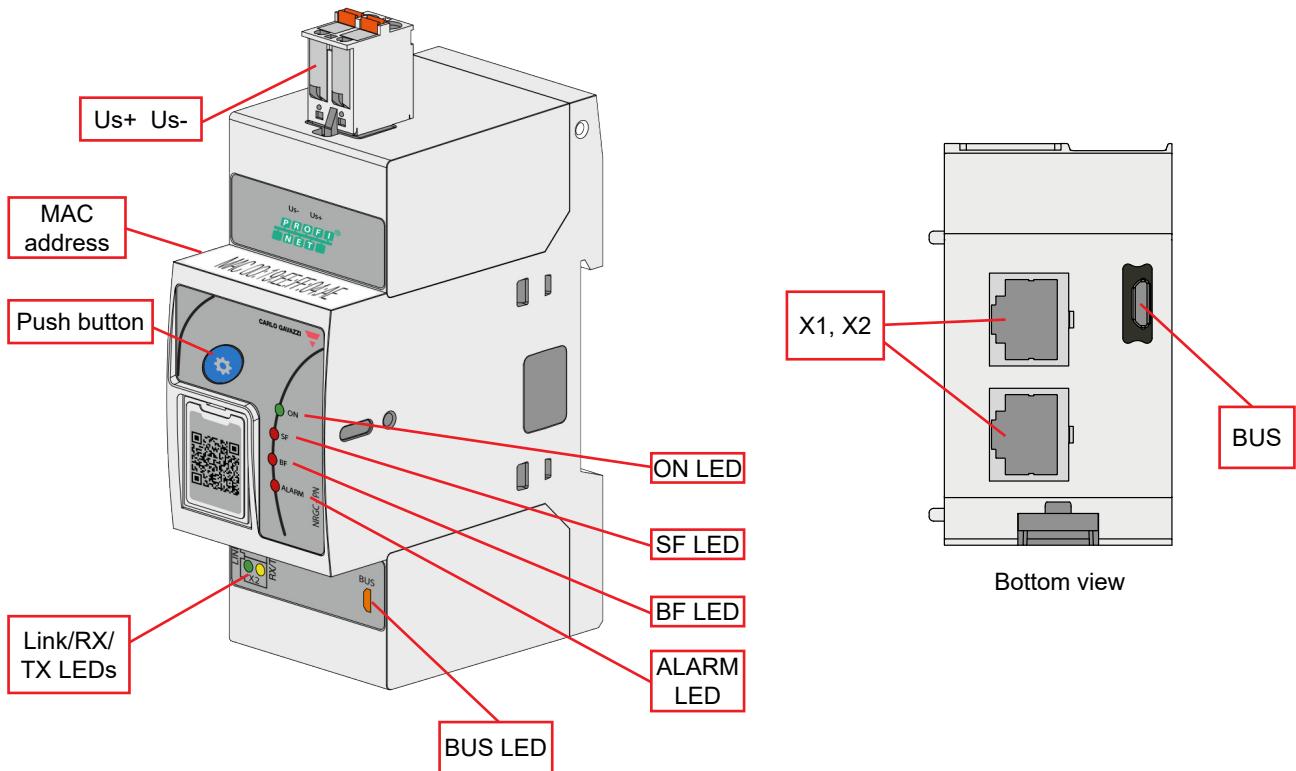
## ▶ Carlo Gavazzi compatible components

Description	Component code	Notes
<b>Solid state relays</b>	RG..CM..N	NRG solid state relays <ul style="list-style-type: none"> <li><b>RGx1..CM..N</b> - 1-pole SSR with control and real-time monitoring via BUS</li> <li><b>RGC2/3P..N</b> - 2/3 pole SSR with control and real-time monitoring via BUS (NRGC-PN requires FW V2.0.0 or later for compatibility with RGC2/3P..N)</li> </ul>
<b>NRG Internal BUS cables</b>	RCRGN-010-2	10cm cable terminated at both ends with a microUSB connector. Packed x4 pcs.
	RCRGN-025-2	25cm cable terminated at both ends with a microUSB connector. Packed x1 pc.
	RCRGN-075-2	75cm cable terminated at both ends with a microUSB connector. Packed x1 pc.
	RCRGN-150-2	150cm cable terminated at both ends with a microUSB connector. Packed x1 pc.
	RCRGN-350-2	350cm cable terminated at both ends with a microUSB connector. Packed x1 pc.
	RCRGN-500-2	500cm cable terminated at both ends with a microUSB connector. Packed x1 pc.

## ▶ Further reading

Information	Where to find it	
User manual NRGC PROFINET	<a href="https://www.gavazziautomation.com/fileadmin/images/PIM/MANUALS/ENG/SSR_UM_NRG_PN.pdf">https://www.gavazziautomation.com/fileadmin/images/PIM/MANUALS/ENG/SSR_UM_NRG_PN.pdf</a>	
Datasheet RGx1..CM..N (1-pole SSR with control and real-time monitoring via BUS)	<a href="https://gavazziautomation.com/images/PIM/DATASHEET/ENG/SSR_RG_CM_N.pdf">https://gavazziautomation.com/images/PIM/DATASHEET/ENG/SSR_RG_CM_N.pdf</a>	
Datasheet RGC2/3P..N (2/3-pole SSR with control and real-time monitoring via BUS)	<a href="https://gavazziautomation.com/images/PIM/DATASHEET/ENG/SSR_RGC_2_3_N.pdf">https://gavazziautomation.com/images/PIM/DATASHEET/ENG/SSR_RGC_2_3_N.pdf</a>	
GSDML file	<a href="https://www.gavazziautomation.com/images/PIM/OTHERSTUFF/GSDML/GSDML_NRG_PN.zip">https://www.gavazziautomation.com/images/PIM/OTHERSTUFF/GSDML/GSDML_NRG_PN.zip</a>	

## Structure



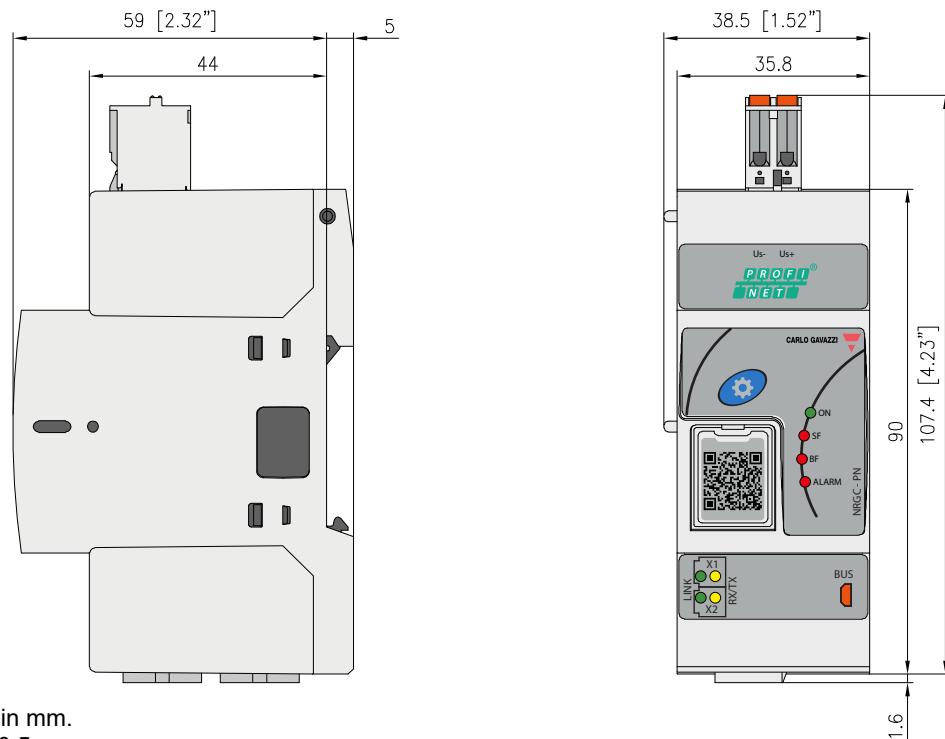
Element	Component	Function
<b>Us+ Us-</b>	Supply connection	2 position spring plug – Us-, Us+ connection for powering the NRGC-PN
<b>Push button</b>	Communications check & Autoaddressing button	Enables and disables a Communications Check function of the BUS chain (link between NRGC-PN and RG..Ns) by pressing front button between 2 to 5 seconds  Enables auto addressing of RG..Ns when pressed for 3 seconds during power up. Check 'Autoaddressing' section for more info.
<b>MAC address</b>	Device MAC address	Increment by 1 and 2 for MAC addresses of X1 and X2
<b>ON LED</b>	ON indicator	Indicates presence of Supply voltage on NRGC-PN
<b>BUS LED</b>	BUS indicator	Indicates ongoing communication with RG..Ns
<b>SF LED</b>	System Fault indicator	Indicates the presence of an alarm on the system
<b>BF LED</b>	Bus Fault indicator	Indicates issues with data exchange and PROFINET configuration
<b>ALARM LED</b>	ALARM indicator	Indicates presence of an alarm condition
<b>Link / RX / TX LEDs</b>	Link/Activity indicators	Indicates the status of the physical ethernet connection
<b>X1, X2</b>	PROFINET ports	2x RJ45 plugs for PROFINET communication
<b>BUS</b>	Micro-USB port – internal BUS	RCRGN cable connection for the internal BUS communications line

## Features

### General data

<b>Material</b>	Noryl (UL94 V0), RAL7035
<b>Mounting</b>	DIN rail
<b>Dimensions</b>	2-DIN
<b>Touch protection</b>	IP20, IP00 with door flap on front facade open
<b>Weight</b>	135 g
<b>Compatibility</b>	RGC..CM..N solid state contactors (RG end-devices) RGS..CM..N solid state relays (RG end-devices)

### Dimensions



All dimensions in mm.  
Tolerances +/- 0.5 mm.

## Performance

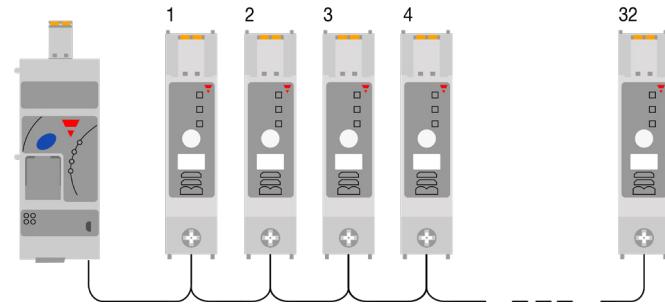
### Power supply specifications

<b>Supply port rating, Us</b>	24 VDC
<b>Supply voltage range, Us</b>	19.2 – 32 VDC*
<b>Reverse polarity protection</b>	Yes
<b>Consumption</b>	< 12 W
<b>LED Indication, Supply ON</b>	Green LED
<b>Power on</b>	2 s

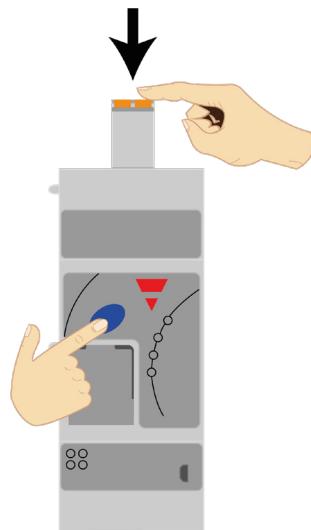
\* to be supplied by class 2 power source according to UL1310

## ► Auto-addressing

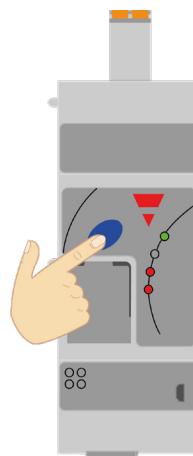
The RG..Ns on the bus chain are automatically addressed upon the first start-up of the system. The RG..Ns are addressed based on their position on the bus chain.



In case of an RG..N replacement, or any changes to the NRG bus chain, the RG..Ns have to be re-addressed. Follow the procedure below to re-address the RG..Ns on the NRG bus chain manually. Alternatively, auto-addressing can be done via an acyclic command (check NRG PROFINET User Manual for further information)



**Fig. 1** Hold the blue button while powering up the NRGC-PN



**Fig. 2** Release when Alarm LED turns ON indicating that autoaddressing is complete

## ▶ Communication

<b>Communication protocol to Main Controller</b>	PROFINET
<b>GSD file</b>	The PROFINET GSDML file for NRGC-PN is available electronically by going to <a href="http://www.gavazziautomation.com">www.gavazziautomation.com</a>
<b>Addressing</b>	The MAC address of the device is listed on the façade of the NRGC-PN. Each physical Ethernet Port (X1, X2) has its own MAC address. X1 uses the device MAC address incremented by one and for X2 increment the device MAC address by two.
<b>Connection to main controller</b>	The PROFINET ports (X1, X2) are 100 Mbit, full duplex operation ports and should be connected to another PROFINET device with Cat5e (straight through) cable via the standard RJ45 connector (maximum length 100 m). The interconnecting cables should be fitted with plugs provided with an outer metallic shell with the shell connected to the wire screen of the cable.
<b>LED indication - TX, RX</b>	Yellow, Flashing - NRGC-PN is sending/receiving Ethernet frames
<b>LED indication - Link</b>	Green, ON - Device is linked to Ethernet

## ▶ Internal Bus

<b>Max. number of RG..Ns connected to NRGC</b>	32x switched poles of the RG..CM..N solid state relays
<b>Connection to RG..Ns</b>	RCRGN-xx 5-way cable terminated with micro-USB connection
<b>BUS termination</b>	RGN-TERMRES (1x pc. provided with 1x NRGC-PN) to be plugged on the last RG..N on the BUS chain to terminate the internal BUS
<b>LED indication - BUS</b>	Yellow, ON indicating ongoing communication with the RG end-devices


**Compatibility and Conformance**

<b>Approvals</b>	  
<b>Standards compliance</b>	LVD: EN 60947-5-1 EMCD: EN 60947-5-1 UL: UL508 (E172877), NMFT cUL: C22.2 No. 14 (E172877), NMFT7

<b>Electromagnetic compatibility (EMC) - Immunity</b>	
<b>Electrostatic discharge (ESD)</b>	EN/IEC 61000-4-2 8 kV air discharge, 4 kV contact (PC1)
<b>Radiated radio frequency</b>	EN/IEC 61000-4-3 10 V/m, from 80 MHz to 1 GHz (PC1) 10 V/m, from 1.4 to 2 GHz (PC1) 3 V/m, from 2 to 2.7 GHz (PC1)
<b>Electrical fast transient (burst)</b>	EN/IEC 61000-4-4 Input: 1 kV, 5kHz & 100kHz (PC1) Internal bus: 1 kV, 5kHz & 100kHz (PC1) PROFINET ports: 1 kV, 5kHz & 100 kHz (PC1) 2 kV, 5kHz & 100 kHz (PC2)
<b>Conducted radio frequency</b>	EN/IEC 61000-4-6 10 V/m, from 0.15 to 80 MHz (PC1)
<b>Electrical surge</b>	EN/IEC 61000-4-5 DC Output / Input, line to line: 500 V (PC2) DC Output / Input, line to earth: 500 V (PC2) Signal, line to earth 1 kV (PC2) <sup>1</sup>
<b>Voltage dips and interruptions</b>	EN/IEC 61000-4-11 0% @ 5000 ms (PC2) 40% @ 200 ms (PC2) 60% @ 10, 30, 100, 300, 1000 ms (PC2)
<b>Voltage dips and interruptions on input lines</b>	EN/IEC 61000-4-29 0% @ 1, 3, 10, 30, 100, 300, 1000 ms (PC2) 30% @ 10, 30, 100, 300, 1000 ms (PC2) 70% @ 10, 30, 100, 300, 1000 ms (PC2) 80% @ 10, 30, 100, 300, 1000 ms, 3 s, 10 s (PC2) 120% @ 10, 30, 100, 300, 1000 ms, 3 s, 10 s (PC2)

1. Not applicable to shielded cables <10m. Additional suppression on data lines may be required if shielded cables are not used.

<b>Electromagnetic compatibility (EMC) - Emissions</b>	
<b>Radio interference field emissions (radiated)</b>	EN/IEC 55011 Class A: from 30 to 1000 MHz
<b>Radio interference voltage emissions (conducted)</b>	EN/IEC 55011 Class B: from 0.15 to 30 MHz

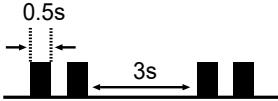
## ► Environmental specifications

<b>Operating temperature</b>	-20 to +65 °C (-4 to +149 °F)
<b>Storage temperature</b>	-20 to +65 °C (-4 to +149 °F)
<b>Relative humidity</b>	95% non-condensing @ 40°C
<b>Pollution degree</b>	2
<b>Installation altitude</b>	0 - 2000m
<b>EU RoHS compliant</b>	Yes
<b>China RoHS</b>	

## ► LED indicators

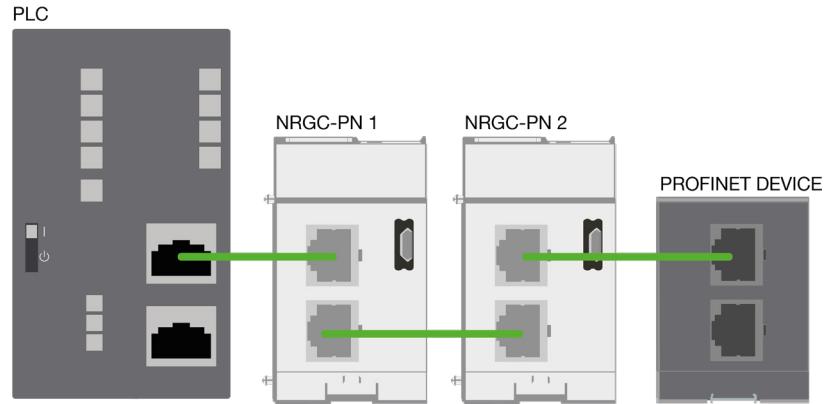
<b>ON</b>	Green 	ON:	Us is present at terminals Us+, Us-
		OFF:	Us is not present at terminals Us+, Us-
<b>Link (X1 &amp; X2)</b>	Green 	ON:	Device is linked to Ethernet
		OFF:	Device has no link to Ethernet
<b>BUS</b>	Yellow 	ON:	During transmission of messages from NRGC-PN to RG..Ns
		OFF:	Idle bus between the NRGC-PN and RG..Ns and when NRGC-PN is receiving data from RG..Ns
<b>TX/RX (X1 &amp; X2)</b>	Yellow 	OFF:	No frames are being sent/received
		Flashing:	NRGC-PN is sending/receiving Ethernet frames
<b>ALARM</b>	Red 	ON:	Flashing when alarm condition on NRGC-PN is present. Refer to Alarm management section
		OFF:	No alarm condition
<b>SF</b>	Red 	ON:	Alarm is present in the system
		OFF:	No error
		Flashing:	DCP signal service is initiated
<b>BF</b>	Red 	ON:	No configuration
		OFF:	No error
		Flashing:	No data exchange

## ▶ Alarm management

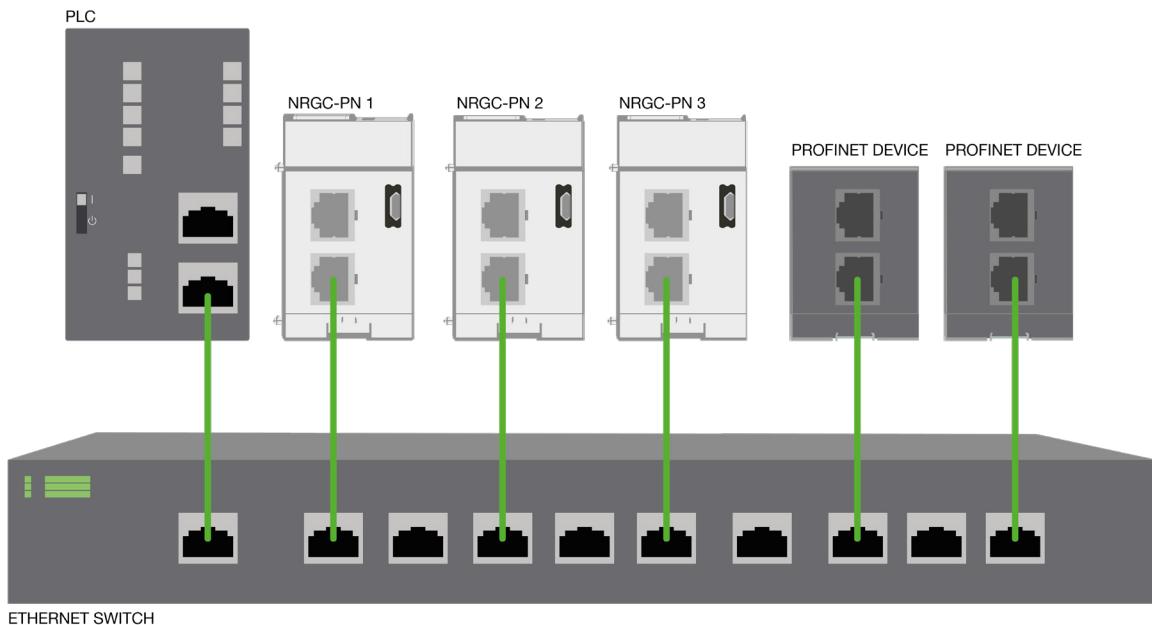
<b>Alarm condition present</b>	<ul style="list-style-type: none"> <li>ALARM LED ON with a specific flashing rate</li> <li>Alarms are available as diagnostics messages via the PROFINET Diagnostic System. Refer to NRG PROFINET User Manual for further information</li> </ul>	
<b>Alarm types</b>	<b>No. of flashes</b>	<b>Description of fault</b>
	2	<p>Errors in the configurations of the internal NRG bus chain including:</p> <ul style="list-style-type: none"> <li>Number of RG..Ns on bus chain is &gt; 32 (Device Limit Error)</li> <li>More than one RG..N on the bus chain have the same address (Device conflict error)</li> <li>One of the RG..Ns does not have an address this may occur when a new RG..N is introduced to the bus chain (Device Unconfigured Error)</li> <li>The internal Device ID of one of the RG..Ns on the bus chain does not correspond to its position on the bus (Device Position Error)</li> </ul>
	4	Supply Error: Supply to NRGC-PN is outside of the specified range
	8	Communication Error (BUS): An error in the communication link (internal BUS) between the NRGC-PN and RG..Ns
	9	Internal Error: Detection of internal issues with the NRGC-PN
	10	Termination (BUS) Error: Internal BUS chain not terminated
<b>Flashing rate</b>		

## ► Connection diagram

The NRG bus chain can be configured in a PROFINET network via a line, ring (support of Media Redundancy Protocol), star or tree topologies via the ethernet ports on the NRGC-PN.



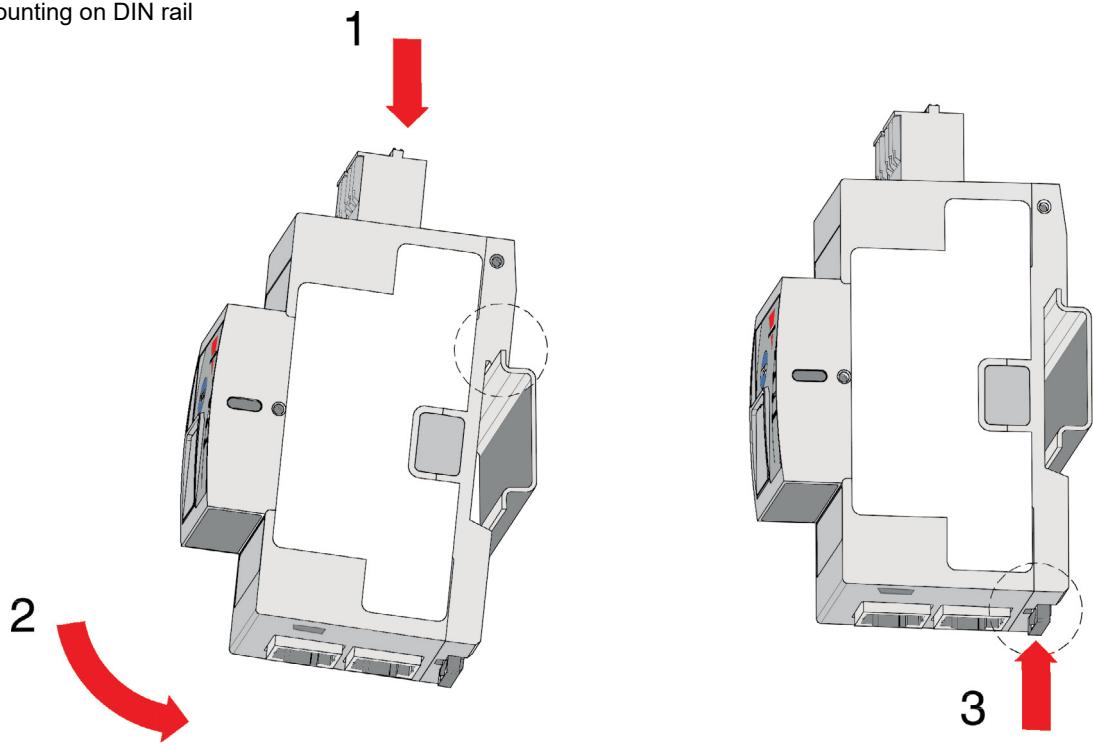
**Fig. 3 Example of a line configuration of the NRGC-PN with other PROFINET devices and controller**



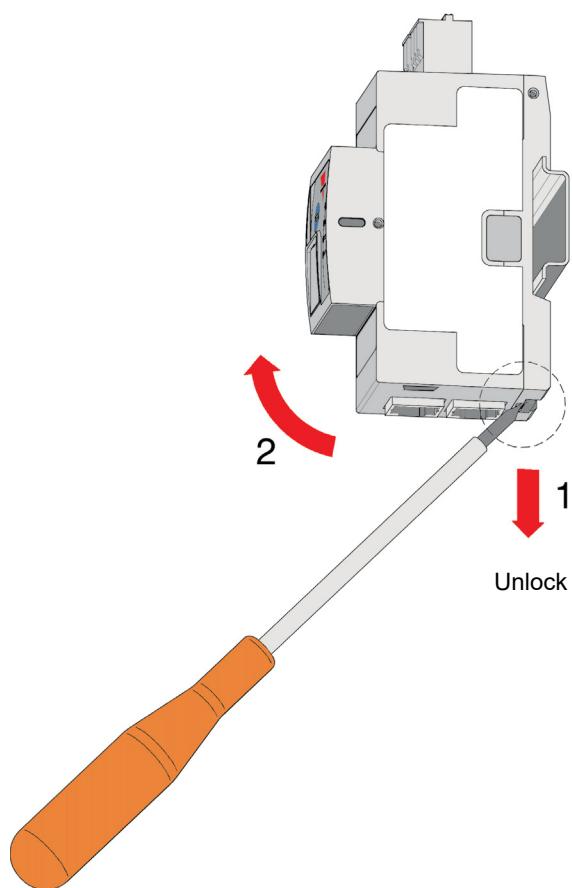
**Fig. 4 Example of a star configuration of the NRGC-PN with other PROFINET devices and controller**

 **Mounting**

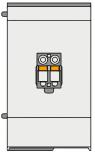
Mounting on DIN rail



Dismounting from DIN rail



## ► Connection specifications

Power connection	
<b>Terminal</b>	Supply: Us+, Us-
	 Top view
<b>Conductors</b>	Use 60/75°C copper (Cu) conductors
<b>Stripping length</b>	12 - 13 mm
<b>Connection type</b>	2-pole spring plug, pitch 5.08 mm
<b>Rigid (solid &amp; stranded) UL/CSA rated data</b>	0.2 – 2.5 mm <sup>2</sup> , 26 – 12 AWG
<b>Flexible with end sleeve</b>	0.25 – 2.5 mm <sup>2</sup>
<b>Flexible without end sleeve</b>	0.25 – 2.5 mm <sup>2</sup>
<b>Flexible with end sleeve using TWIN ferrules</b>	0.5 – 1.0 mm <sup>2</sup>

Communication - connection	
<b>Terminal</b>	X1, X2: RJ45 (x2) BUS: RCRGN-xxx-2
	 Bottom view
<b>PROFINET connection</b>	RJ45 shielded plugs
<b>Cable for PROFINET</b>	Not provided. Shielded CAT-5e straight cables.
<b>Max. length of ethernet cable</b>	100 mtrs (between PROFINET devices)
<b>Cable for Internal Bus</b>	RCRGN-xxx-2: 5-way USB micro connection - +24 supply line for RG..Ns - GND - RS485A - RS485B - Autoconfig / Auto addressing line

# RCRGN..

## NRG internal BUS cable



### Main features

- Cables available at various lengths to provide the internal BUS of the NRG system
- Cables terminated at both ends with a microUSB plug
- Connects the NRG controller to the RG..N solid state relay and respective RG..N solid state relays

### Description

The **RCRGN** cables are proprietary cables that must be used with the NRG system for the internal BUS. These cables connect the NRG controller to the RG..N solid state relays and respective RG..N solid state relays.

The RCRGN... are 5-way cables carrying the communication, supply and autoconfiguration lines. By means of autoconfiguration, the RG..Ns are assigned a unique ID based on the physical location and hence internal BUS wiring sequence when an autoconfiguration command is sent to the RG..Ns.

### Carlo Gavazzi compatible components

Description	Component code	Notes
<b>NRG Controller</b>	NRGC..	NRG controllers: Modbus, Modbus TCP, PROFINET, EtherNet/IP, EtherCAT 1x <b>RGN-TERMRES</b> is included in the NRGC.. packaging. The RGN-TERMRES is to be mounted on the last RG..N on the bus chain.
<b>Solid state relays</b>	RG..N	NRG solid state relays

### Order code

 **RCRGN -  - 2**

Enter the code entering the corresponding option instead of

Code	Option	Description	Notes
RCRGN	-	Cables suitable for the NRG system	
<input type="text"/>	<b>010</b>	10 cm cable length	packed x 4 pcs.
	<b>025</b>	25 cm cable length	packed x 1 pc.
	<b>075</b>	75 cm cable length	packed x 1 pc.
	<b>150</b>	150 cm cable length	packed x 1 pc.
	<b>350</b>	350 cm cable length	packed x 1 pc.
	<b>500</b>	500 cm cable length	packed x 1 pc.
<b>2</b>	-	Terminated at the both ends with a microUSB connector	



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