QNA 600

API (Application Programming Interface)



APPLICATION NOTES

(M294E0101-03-24A)

CE


22
PAP

DISCLAIMER

CIRCUTOR S.A.U. reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

CIRCUTOR S.A.U. on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

www.circutor.com

CIRCUTOR S.A.U. recommends using the original cables and accessories that are supplied with the device.

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REVISION LOG

Table 1: Revision log.

Date	Revision	Description
10/24	M294E0101-03-24A	Initial Version

1.- API

This annex details the **APIs** (*application programming interface*) that can be used to work with the **QNA 600**.
You can download the API at the link: **https://docs.circutor.com/docs/QNA_REST_API.yaml**

You can use the *special-key* **API** key to test authorization filters.

1.1.-CONFIGURATION

This section shows the **QNA 600** configuration commands.

1.1.1. - GET /config/measure

Returns the measurement parameters of the **QNA 600**

REQUEST
No request parameters

RESPONSE

STATUS CODE - 200: Successful operation
RESPONSE MODEL - application/json
{

PrimaryVoltage	number	between 1 and 2000000
SecondaryVoltage	number	between 1 and 2000000
PrimaryCurrent	number	between 1 and 2000000
SecondaryCurrent	number	between 1 and 5
PrimaryNeutral	number	between 1 and 2000000
SecondaryNeutral	number	between 1 and 5
PrimaryCurrentLeak	number	between 1 and 2000000
SecondaryCurrentLeak	number	between 1 and 5
NominalVoltage	number	between 50 and 2000000
NominalCurrent	number	between 0.05 and 20000
NominalFrequency	enum	ALLOWED: 50, 60
ConnectionMode	enum	ALLOWED: 1PH2W, 2PH3W, 3PH4W, 3PH3W,ARON
Block200msReport	[enum]	ALLOWED: Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
Block3sReport	[enum]	ALLOWED: Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent,

		InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlockUserReport	[enum]	ALLOWED: Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlocksMaxReport	[enum]	ALLOWED: Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlocksMinReport	[enum]	ALLOWED: Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
NumberHarmonicsTHD	integer	between 2 and 64
InterruptDipSwellEnable	boolean	
PolyphaseInterruptDipSwell	boolean	
VoltageInterruptThreshold	number	between 1 and 20
VoltageInterruptHysteresis	number	between 0 and 100
VoltageDipThreshold	number	between 50 and 97
VoltageDipHysteresis	number	between 0 and 100
VoltageSwellThreshold	number	between 100 and 150
VoltageSwellHysteresis	number	between 0 and 100
SlidingReference	boolean	
RapidVoltageChangeEnable	boolean	
RapidVoltageChangeThreshold	number	between 0 and 100
RapidVoltageChangeHysteresis	number	between 0 and 100
SignalVoltageEnable	boolean	
SignalVoltageFreq	number	between 0 and 3000
SignalVoltageThreshold	number	between 0.3 and 100
SignalVoltageDuration	integer	between 1 and 120
TransientVoltageEnable	boolean	
TransientVoltageSensitivity	integer	between 0 and 100

TransientVoltageSamples	integer	between 1 and 10
TransientCurrentEnable	boolean	
TransientCurrentSlowSensitivity	integer	between 1 and 4
TransientCurrentSlowInhibitCycles	integer	between 1 and 10
TransientCurrentSlowThreshold	number	between 1 and 100
TransientCurrentFastSensitivity	integer	between 1 and 4
TransientCurrentFastInhibitCycles	integer	between 1 and 10
TransientCurrentFastThreshold	number	between 1 and 100
AggregationPeriod	enum	ALLOWED: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
MeterPeriod	enum	ALLOWED: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
FullLoadCurrentL1	number	between 0.05 and 20000
FullLoadCurrentL2	number	between 0.05 and 20000
FullLoadCurrentL3	number	between 0.05 and 20000
FullLoadCurrentLN	number	between 0.05 and 20000
CurrentReversed	[boolean]	
VoltagePhasesSquence	enum	ALLOWED: L1L2L3, L1L3L2, L2L1L3, L2L3L1, L3L1L2, L3L2L1
CurrentPhasesSequence	enum	ALLOWED:L1L2L3, L1L3L2, L2L1L3, L2L3L1, L3L1L2, L3L2L1
PhaseColorProfile	string	max:50 chars
OscType	enum	ALLOWED:Disabled, Waveform, RMS
OscPreTriggerTime	integer	between 20 and 1000
OscPostEventTime	integer	between 100 and 4000
OscMaxDuration	integer	between 1000 and 60000

}

1.1.2. - PUT /config/measure

Configure the measurement parameters of the **QNA 600**

REQUEST

REQUEST BODY - application/json

{

PrimaryVoltage	number	between 1 and 2000000
SecondaryVoltage	number	between 1 and 2000000
PrimaryCurrent	number	between 1 and 2000000
SecondaryCurrent	number	between 1 and 5
PrimaryNeutral	number	between 1 and 2000000
SecondaryNeutral	number	between 1 and 5
NominalVoltage	number	between 50 and 2000000
NominalCurrent	number	between 0.05 and 20000
NominalFrequency	enum	ALLOWED:50, 60
ConnectionMode	enum	ALLOWED:1PH2W, 2PH3W, 3PH4W, 3PH3W, ARON
Block200msReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent,

		InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
Block3sReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlockUserReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlocksMaxReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlocksMinReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
NumberHarmonicsTHD	integer	between 2 and 64
InterruptDipSwellEnable	boolean	
PolyphaseInterruptDipSwell	boolean	
VoltageInterruptThreshold	number	between 1 and 20
VoltageInterruptHysteresis	number	between 0 and 100
VoltageDipThreshold	number	between 50 and 97
VoltageDipHysteresis	number	between 0 and 100
VoltageSwellThreshold	number	between 100 and 150
VoltageSwellHysteresis	number	between 0 and 100
SlidingReference	boolean	
RapidVoltageChangeEnable	boolean	
RapidVoltageChangeThreshold	number	between 0 and 100
RapidVoltageChangeHysteresis	number	between 0 and 100
SignalVoltageEnable	boolean	

SignalVoltageFreq	number	between 0 and 3000
SignalVoltageThreshold	number	between 0.3 and 100
SignalVoltageDuration	integer	between 1 and 120
TransientVoltageEnable	boolean	
TransientVoltageSensitivity	integer	between 0 and 100
TransientVoltageSamples	integer	between 1 and 10
TransientCurrentEnable	boolean	
TransientCurrentSlowSensitivity	integer	between 1 and 4
TransientCurrentSlowInhibitCycles	integer	between 1 and 10
TransientCurrentSlowThreshold	number	between 1 and 100
TransientCurrentFastSensitivity	integer	between 1 and 4
TransientCurrentFastInhibitCycles	integer	between 1 and 10
TransientCurrentFastThreshold	number	between 1 and 100
AggregationPeriod	enum	ALLOWED:1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
MeterPeriod	enum	ALLOWED:1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
FullLoadCurrentL1	number	between 0.05 and 20000
FullLoadCurrentL2	number	between 0.05 and 20000
FullLoadCurrentL3	number	between 0.05 and 20000
FullLoadCurrentLN	number	between 0.05 and 20000
CurrentReversed	[boolean]	
VoltagePhasesSquence	enum	ALLOWED:L1L2L3, L1L3L2, L2L1L3, L2L3L1, L3L1L2, L3L2L1
CurrentPhasesSequence	enum	ALLOWED:L1L2L3, L1L3L2, L2L1L3, L2L3L1, L3L1L2, L3L2L1
PhaseColorProfile	string	max: 50 chars
OscType	enum	ALLOWED: Disabled, Waveform, RMS
OscPreTriggerTime	integer	between 20 and 1000
OscPostTriggerTime	integer	between 100 and 4000
OscMaxDuration	integer	between 1000 and 60000

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid measure configuration, please check configuration json file
STATUS CODE - 500: Measure configuration change failed

1.1.3. - POST /config/measure

Configure the measurement parameters of the **QNA 600**

REQUEST

REQUEST BODY - application/json

{

PrimaryVoltage	number	between 1 and 2000000
SecondaryVoltage	number	between 1 and 2000000
PrimaryCurrent	number	between 1 and 2000000
SecondaryCurrent	number	between 1 and 5

PrimaryNeutral	number	between 1 and 2000000
SecondaryNeutral	number	between 1 and 5
NominalVoltage	number	between 50 and 2000000
NominalCurrent	number	between 0.05 and 20000
NominalFrequency	enum	ALLOWED:50, 60
ConnectionMode	enum	ALLOWED:1PH2W, 2PH3W, 3PH4W, 3PH3W, ARON
Block200msReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
Block3sReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlockUserReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlocksMaxReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
BlocksMinReport	[enum]	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
NumberHarmonicsTHD	integer	between 2 and 64
InterruptDipSwellEnable	boolean	
PolyphaseInterruptDipSwell	boolean	
VoltageInterruptThreshold	number	between 1 and 20
VoltageInterruptHysteresis	number	between 0 and 100

VoltageDipThreshold	number	between 50 and 97
VoltageDipHysteresis	number	between 0 and 100
VoltageSwellThreshold	number	between 100 and 150
VoltageSwellHysteresis	number	between 0 and 100
SlidingReference	boolean	
RapidVoltageChangeEnable	boolean	
RapidVoltageChangeThreshold	number	between 0 and 100
RapidVoltageChangeHysteresis	number	between 0 and 100
SignalVoltageEnable	boolean	
SignalVoltageFreq	number	between 0 and 3000
SignalVoltageThreshold	number	between 0.3 and 100
SignalVoltageDuration	integer	between 1 and 120
TransientVoltageEnable	boolean	
TransientVoltageSensitivity	integer	between 0 and 100
TransientVoltageSamples	integer	between 1 and 10
TransientCurrentEnable	boolean	
TransientCurrentSlowSensitivity	integer	between 1 and 4
TransientCurrentSlowInhibitCycles	integer	between 1 and 10
TransientCurrentSlowThreshold	number	between 1 and 100
TransientCurrentFastSensitivity	integer	between 1 and 4
TransientCurrentFastInhibitCycles	integer	between 1 and 10
TransientCurrentFastThreshold	number	between 1 and 100
AggregationPeriod	enum	ALLOWED:1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
MeterPeriod	enum	ALLOWED:1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
FullLoadCurrentL1	number	between 0.05 and 20000
FullLoadCurrentL2	number	between 0.05 and 20000
FullLoadCurrentL3	number	between 0.05 and 20000
FullLoadCurrentLN	number	between 0.05 and 20000
CurrentReversed	[boolean]	
VoltagePhasesSquence	enum	ALLOWED:L1L2L3, L1L3L2, L2L1L3, L2L3L1, L3L1L2, L3L2L1
CurrentPhasesSequence	enum	ALLOWED:L1L2L3, L1L3L2, L2L1L3, L2L3L1, L3L1L2, L3L2L1
PhaseColorProfile	string	max:50 chars
OscType	enum	ALLOWED:Disabled, Waveform, RMS
OscPreTriggerTime	integer	between 20 and 1000
OscPostTriggerTime	integer	between 100 and 4000
OscMaxDuration	integer	between 1000 and 60000

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid measure configuration, please check configuration JSON file
STATUS CODE - 500: Measure configuration change failed

1.1.4. - GET /config/scheduled

Returns the programmed parameters of the **QNA 600.**

REQUEST

No request parameters.

RESPONSE

STATUS CODE - 200: Successful operation
RESPONSE MODEL - application/json

```
{
```

Enabled	boolean	
Protocol	enum	ALLOWED: FTP, SFTP
FtpIP	string	max:50 chars
FtpPort	integer	between 1 and 65535
FtpUserName	string	max:50 chars
FtpPassword	string	max:50 chars
FtpPath	string	max:50 chars
TimePush	string	PATTERN:^(0[0-9]|1[0-9]|2[0-3]):([0-5][0-9])$
Report	enum	ALLOWED: PQDIF, EN50160
PrefixName	string	max:20 chars
Periodicity	enum	ALLOWED: daily, weekly, monthly
WeekDay	integer	between 0 and 6
MonthDay	integer	between 1 and 28

```
}
```

1.1.5. - PUT /config/scheduled

Configure the programmed parameters of the **QNA 600**.

REQUEST

REQUEST BODY - application/json

```
{
```

Enabled	boolean	
Protocol	enum	ALLOWED: FTP, SFTP
FtpIP	string	max:50 chars
FtpPort	integer	between 1 and 65535
FtpUserName	string	max:50 chars
FtpPassword	string	max:50 chars
FtpPath	string	max:50 chars
TimePush	string	PATTERN:^(0[0-9]|1[0-9]|2[0-3]):([0-5][0-9])$
Report	enum	ALLOWED: PQDIF, EN50160
PrefixName	string	max:20 chars
Periodicity	enum	ALLOWED: daily, weekly, monthly
WeekDay	integer	between 0 and 6
MonthDay	integer	between 1 and 28

```
}
```

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Scheduled configuration change failed
STATUS CODE - 500: Scheduled configuration change failed

1.2.- DATA

This section shows the **QNA 600** data commands.

1.2.1. - POST /data/periodic

Periodic values recorded in JSON or CSV format

A specific timeframe and a set of periodic variables in JSON format are requested. The output consists of time series vectors in JSON format, or a single table in CSV.

REQUEST

REQUEST BODY - application/json

```
{
  start(1)      string
  end(1)        string
  vars(1)       [string]
  format(1)     enum        ALLOWED: json, csv
}
```

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
STATUS CODE - 404: Item not found in database
STATUS CODE - 500: Internal server error
(1) Required parameters.

1.2.2. - POST /data/events/list

List of events with associated data in JSON format

Provides a list of events for a given time period. If any of these events has an associated waveform, its id is also returned.
Any event and waveform has a unique id, whether numeric or alphanumeric.

REQUEST

REQUEST BODY - application/json

```
{
  start(2)      string
  end(2)        string
}
```

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
STATUS CODE - 404: Item not found in database
STATUS CODE - 500: Internal server error
(2) Required parameters.

1.2.3. - POST /data/delete

Delete periodic event or waveform data.

The data recorded between two time stamps may be deleted. This function will be used to keep the internal database within certain size limits.

REQUEST

REQUEST BODY - application/json
{

start(3)	string	
end(3)	string	
format(3)	enum	ALLOWED: any, periodic, event, waveform

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
STATUS CODE - 500: Internal server error
(3) Required parameters.

1.2.4. - POST /data/online

Online values in JSON or CSV format

Online request for readings. The time stamp is included in the result.

REQUEST

REQUEST BODY - application/json
{

vars(4)	[string]	
format(4)	enum	ALLOWED:json, csv

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
STATUS CODE - 404: Item not found in database
STATUS CODE - 500: Internal server error
(4) Required parameters.

1.2.5. - POST /data/waveform

Waveform data points in JSON, CSV or ZIP + COMTRADE format

Returns the data of the full time series in any waveform given by a unique id.

REQUEST

REQUEST BODY - application/json

{

waveform_id[5]	string	
format[5]	enum	ALLOWED:json, csv, zipcomtrade

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
STATUS CODE - 500: Internal server error
[5] Required parameters.

1.2.6. - POST /data/report

Data values recorded in PQDIF or EN50160 format

A specific timeframe and format in JSON format are requested

REQUEST

REQUEST BODY - application/json

{

start[6]	string	
end[6]	string	
format[6]	enum	ALLOWED:pqdif, en50160

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
STATUS CODE - 500: Internal server error
[6] Required parameters.

1.2.7. - POST /data/tags

Returns the list of request labels.

REQUEST

REQUEST BODY - application/json

{

block[7]	enum	ALLOWED:Voltage, Current, Power, Unbalance, Phasors, Frequency, Flicker, HarmonicTHD, HarmonicVoltage, HarmonicCurrent, InterharmonicVoltage, InterharmonicCurrent, CrestFactor, KFactor, VDeviation, VSignalling, PInst, BlockNumber, DetachedPower, Temperature, Energy
tagType[7]	enum	ALLOWED:max, min, avg
harmInit	integer	between 0 and 50
harmEnd	integer	between 0 and 50

}

RESPONSE

STATUS CODE - 200: Successful operation
STATUS CODE - 400: Invalid parameters configuration
[7] Required parameters.

1.2.8. - GET /data/info

Returns measurement information data

REQUEST

No request parameters.

RESPONSE

STATUS CODE - 200: Successful operation

RESPONSE MODEL - application/json

{

MeasureVersion	string

}

1.3.- PING

Simple ping function.

REQUEST

No request parameters.

RESPONSE

STATUS CODE - 200: Successful operation

RESPONSE MODEL - text/plain
string

1.4.- UPDATE

This section shows the **QNA 600** update commands.

1.4.1. - GET /update/measure

Returns the **QNA 600** update status.

REQUEST
No request parameters.

RESPONSE

STATUS CODE - 200: Successful operation
RESPONSE MODEL - application/json

```
{
  IsUpdating          boolean
  Percentage          integer          between 1 and 100
}
```

2.- MAINTENANCE AND TECHNICAL SERVICE

In the case of any query in relation to device operation or malfunction, please contact the **CIRCUTOI S.A.U.** Technical Support Service.

Technical Assistance Service
Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)
Tel: 902 449 459 (Spain) / +34 937 452 919 (outside of Spain)
email: sat@circutor.com

3.- GUARANTEE

CIRCUTOR guarantees its products against any manufacturing defect for two years after the delivery of the units.

CIRCUTOR will repair or replace any defective factory product returned during the guarantee period.



• No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
• The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. "Improper usage" is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual.
• **CIRCUTOR** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or "improper usage" of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:
- Overvoltages and/or electrical disturbances in the supply;
- Water, if the product does not have the appropriate IP classification;
- Poor ventilation and/or excessive temperatures;
- Improper installation and/or lack of maintenance;
- Buyer repairs or modifications without the manufacturer's authorisation.

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