# NEF210

## *Dual DC Overcurrent Protector 2...10A*

## User Manual

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# 1 Product description

⚠ **Use latest device Documentation, Software and Firmware to ensure reliable operation of the system (downloadable from www.nextys.com).**

NEF210 is a microprocessor controlled unit that can perform 2 functions:

1. DC overcurrent protector with two output channels rated 2…10A usable in any system rated 10…31Vdc
2. Static relay with two output channels rated 10A usable in any system rated 10…31Vdc

NEF210 is used on critical applications to protects DC loads that require selectivity. This unit monitors the load current of a maximum of two output channels and, in case of load failure, isolates the load to protect the components connected to the system.

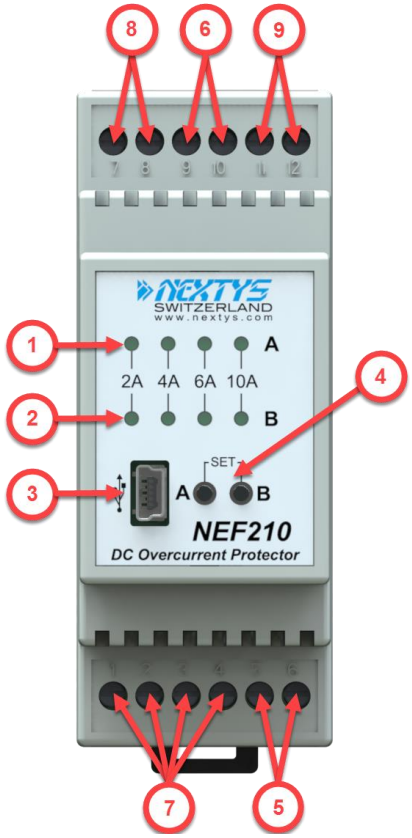


**Figure 1: Front panel view**

1. **LEDs channel A**: if the output channel A is enabled, the LED related to the selected current rating is *ON*. All the four LEDs blink at 1Hz rate in case of trip.
2. **LEDs channel B**: if the output channel B is enabled, the LED related to the selected current rating is *ON*. All the four LEDs blink at 1Hz rate in case of trip.
3. **Modbus over USB**: used to connect a PC running POWERMASTER or custom application for remote monitoring and controlling. Firmware update is also possible through USB connection.
4. **Control keys:** two push buttons are provided to select various functions.
5. **Reset/Inhibit input**: a signal between 5Vdc and 30Vdc applied to this input, depending on the function selected, rearm (in case of tripping) or inhibits the two output channels (see §3.4).
6. **Output OK output**: a diagnostic output is present for remote monitoring. See §3.5 for more details.
7. **Input connection**: two "+" and two "-" poles (rated 10A/pole) are provided for input connection. They must be connected to a power supply rated 10…31Vdc with a maximum rated current of 20A. **If the input current is higher than 10A, use all the four poles of the connector.**
8. **Channel A output connection**: two poles are provided for channel A output connection. It must be connected to the load to be protected with a maximum rated current of 10A.
9. **Channel B output connection**: two poles are provided for channel B output connection. It must be connected to the load to be protected with a maximum rated current of 10A.

# 2 Features and benefits

The main features are:

- Ultra-compact DC overcurrent protector with two independent channels
- Classic circuit breaker shape
- Input: 10…31Vdc / maximum 20A

- Output: maximum 10A per channel (user settable, independently)
- Digital power regulation
- Programmable static switch function
- Advanced CPU control – allows set-up of various tripping curves
- Modbus over USB interface for control and monitoring
- Suitable for **POWERMASTER** software (available for Windows and Android OS)

Embedded user interface:

- Two buttons, four LEDs per channel. Displays the set-up and status, measures and alarms
- Allows online device configuration

Free PC and Android application **POWERMASTER** used for:

- Connection through Modbus
- Remote monitoring and configuration
- Firmware upgrade
- Same functionalities of the embedded used interface with the ease of the PC benefits

# 3 Functional description

NEF210 is a high performance dual channel overcurrent protector that can be used in any DC system with a rated voltage between 10V and 31V and up to 20A. At the core of the device, two MOSFETs driven by a microcontroller acts as a fuse. In case of overload or short circuit the monitoring and control stage disables in a targeted way the concerned output channel.

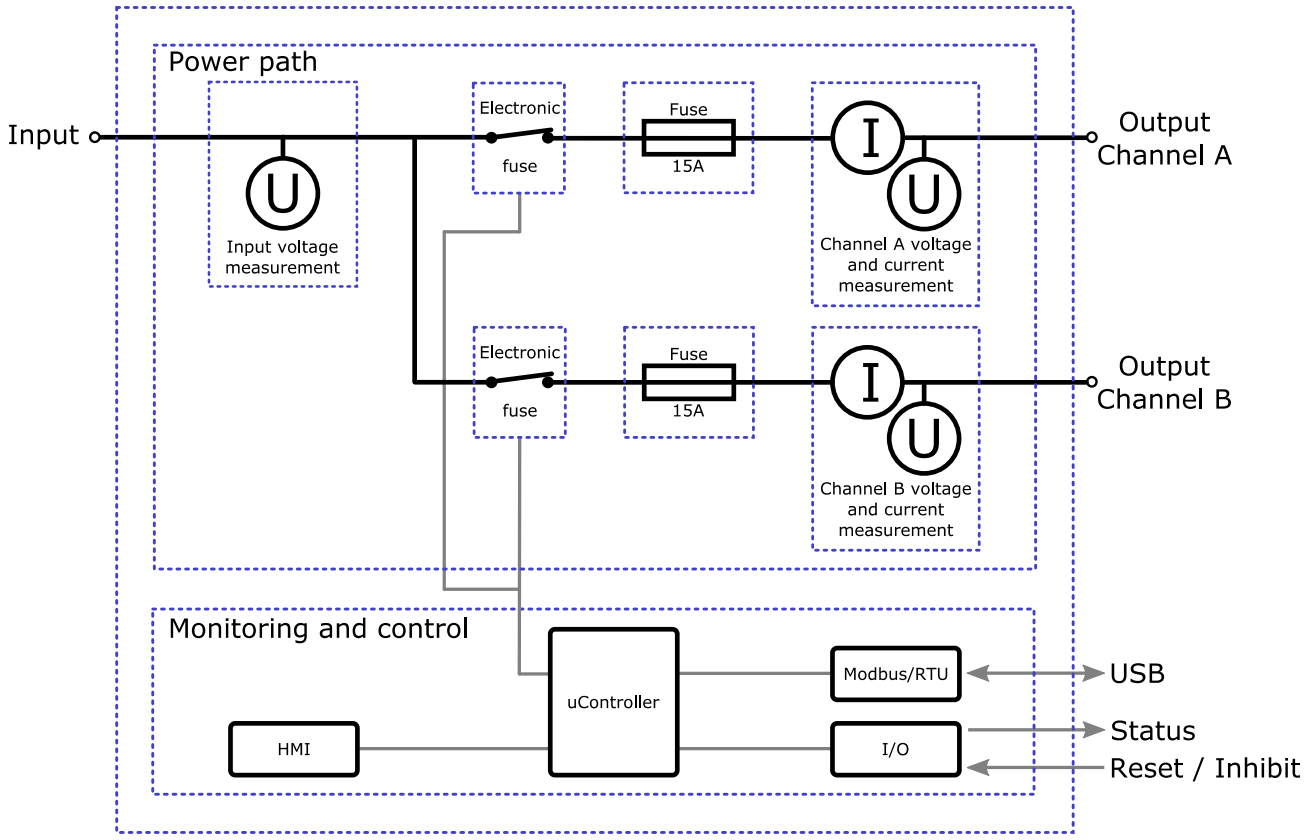


**Figure 2: NEF210 simplified block diagram**

## 3.1 Fuse mode

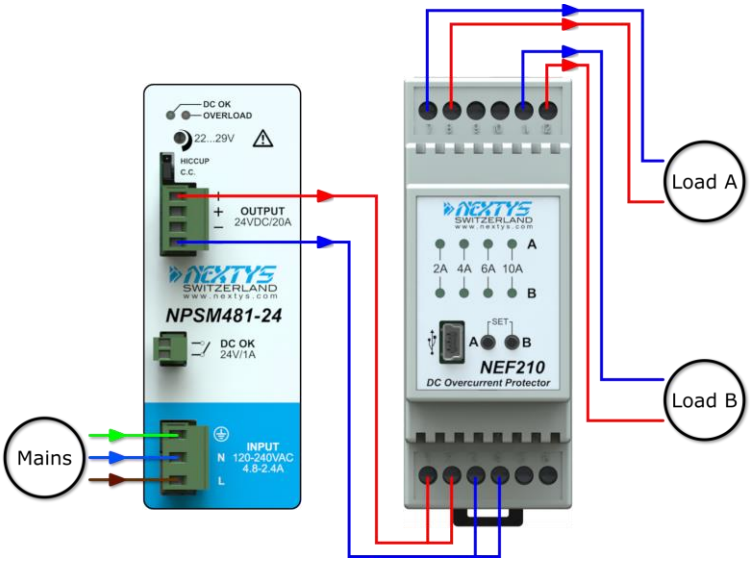


**Figure 3: Fuse connection example**

In fuse mode, the NEF210 protects up to two loads against overload and short circuit. On each output channel an overcurrent protection is implemented. When an overload or a short circuit is detected, the corresponding channel is switched OFF according to the tripping characteristics (see §3.1.1). The trip of an output channel is reported to the user visually by blinking the LEDs of the output channel and through the POWERMASTER application or corresponding Modbus field. The output channels are individually configurable. A LED shows the current rating selected. An example of Fuse connection is given on Figure 3.

### 3.1.1 Tripping characteristics

NEF210 implements an active current limitation. When the device detects an overload or a short circuit, the overcurrent protector limits the load current. If one of the outputs will switch OFF, the other channel will remain enabled.

**Overload:** The NEF210 is in this state when the load current is in the range between 1 and 1.5 times the nominal current (if the current rating selected is 2A, 4A or 6A) or between 1 and 1.2 times the nominal current (if the current rating selected is 10A). When the NEF210 detects an overload, its behavior is the same as a traditional fuse. In this situation, the time that elapses between the overload detection and the channel switch OFF will depend on three factors:

- Rated current selected
- Time-current characteristic selected
- Output current

**Short circuit:** The NEF210 is in this state when the load current is over 1.5 times the nominal current (if the current rating selected is 2A, 4A or 6A) or 1.2 times the nominal current (if the current rating selected is 10A). When the NEF210 detects a short circuit, the load current is limited (constant current) before the channel switch OFF, as described in the following table:

| Current rating | Short circuit current limited to | Channel switch OFF after |
|---|---|---|
| 2A | 3A | 100ms |
| 4A | 6A | 100ms |
| 6A | 9A | 100ms |
| 10A | 12A | 100ms |

**Table 1: Short circuit current limitation**

The short circuit current is also limited depending on the input and output voltages as the protection algorithm limits the power dissipated by NEF210 to 100W per channel.

### 3.1.1.1 Trip curve for the Very Quick Acting time-current characteristic

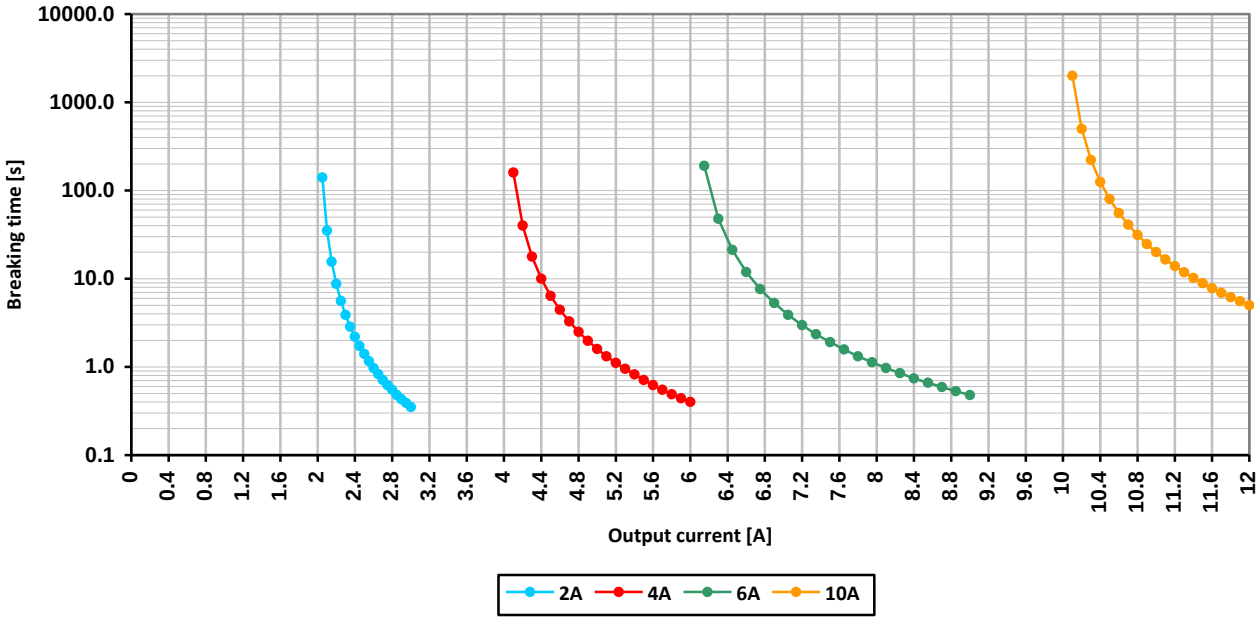


**Figure 4: Very Quick Acting Fuse Breaking Time**

### 3.1.1.2 Trip curve for the Fast Acting time-current characteristic

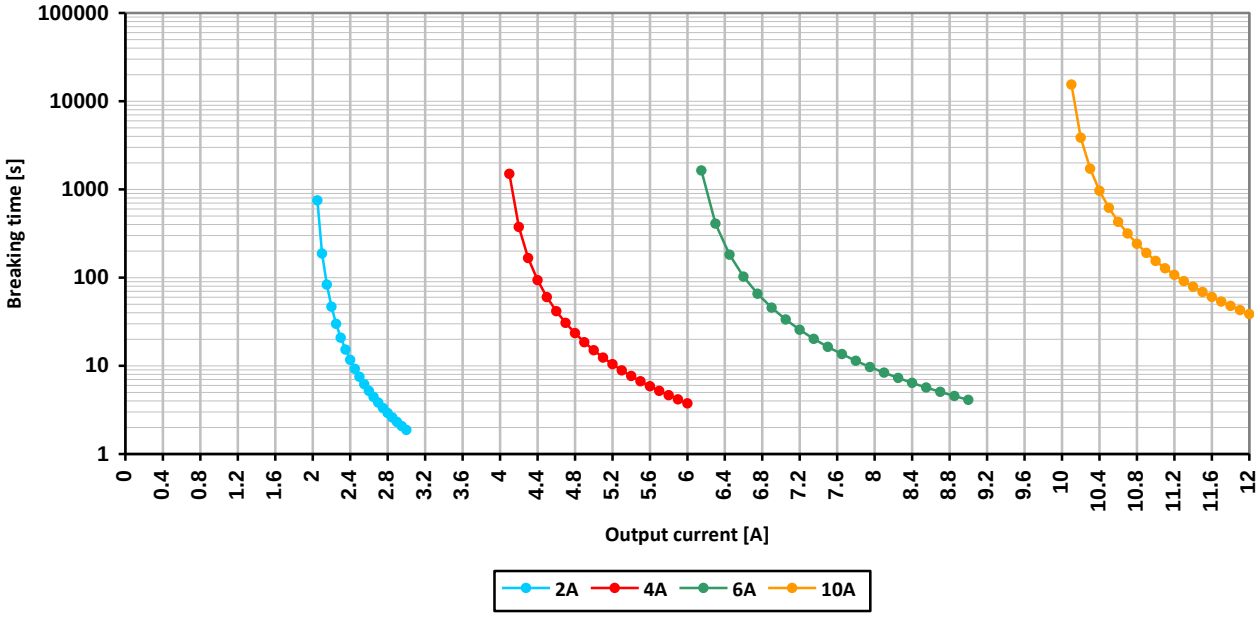


**Figure 5: Fast Acting Fuse Breaking Time**

### 3.1.1.3 Trip curve for the Medium Acting time-current characteristic

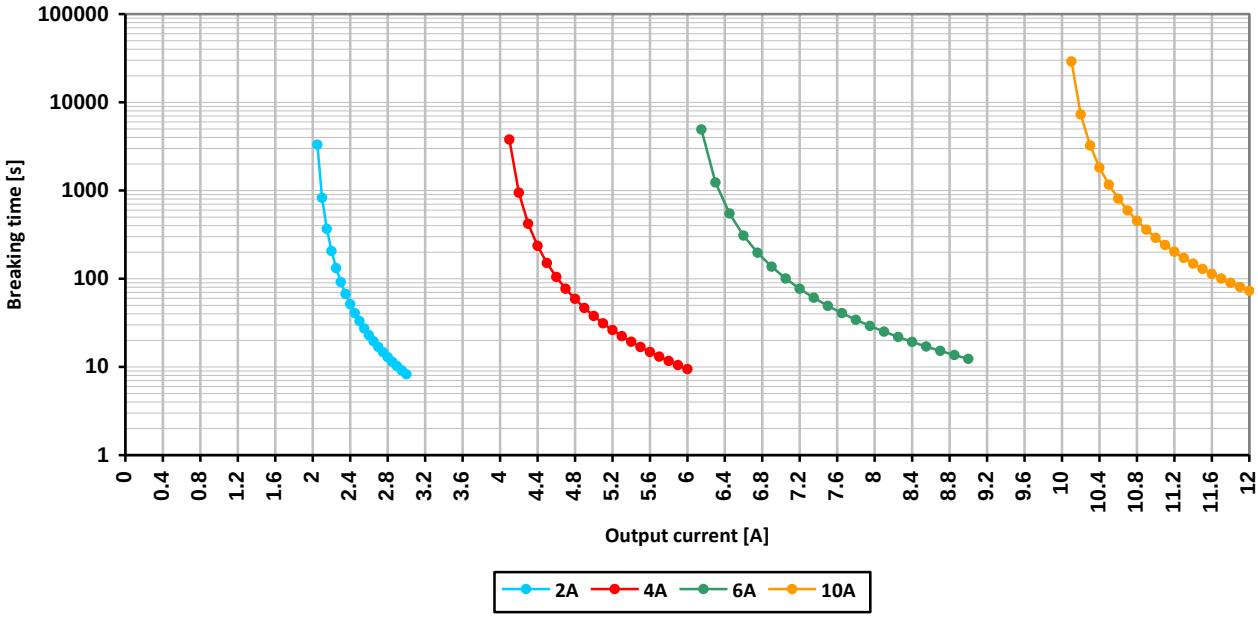


**Figure 6: Medium Acting Fuse Breaking Time**

### 3.1.1.4 Trip curve for the Time Lag Acting time-current characteristic

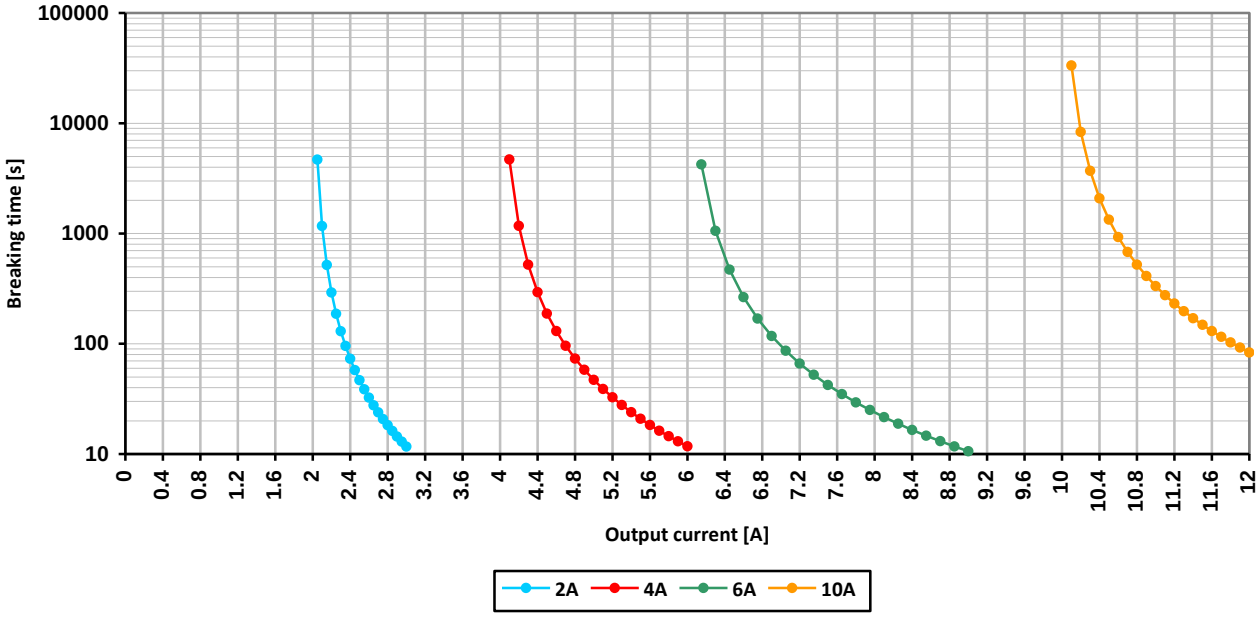


**Figure 7: Time Lag Acting Fuse Breaking Time**

### 3.1.1.5 Trip curve in Short Circuit

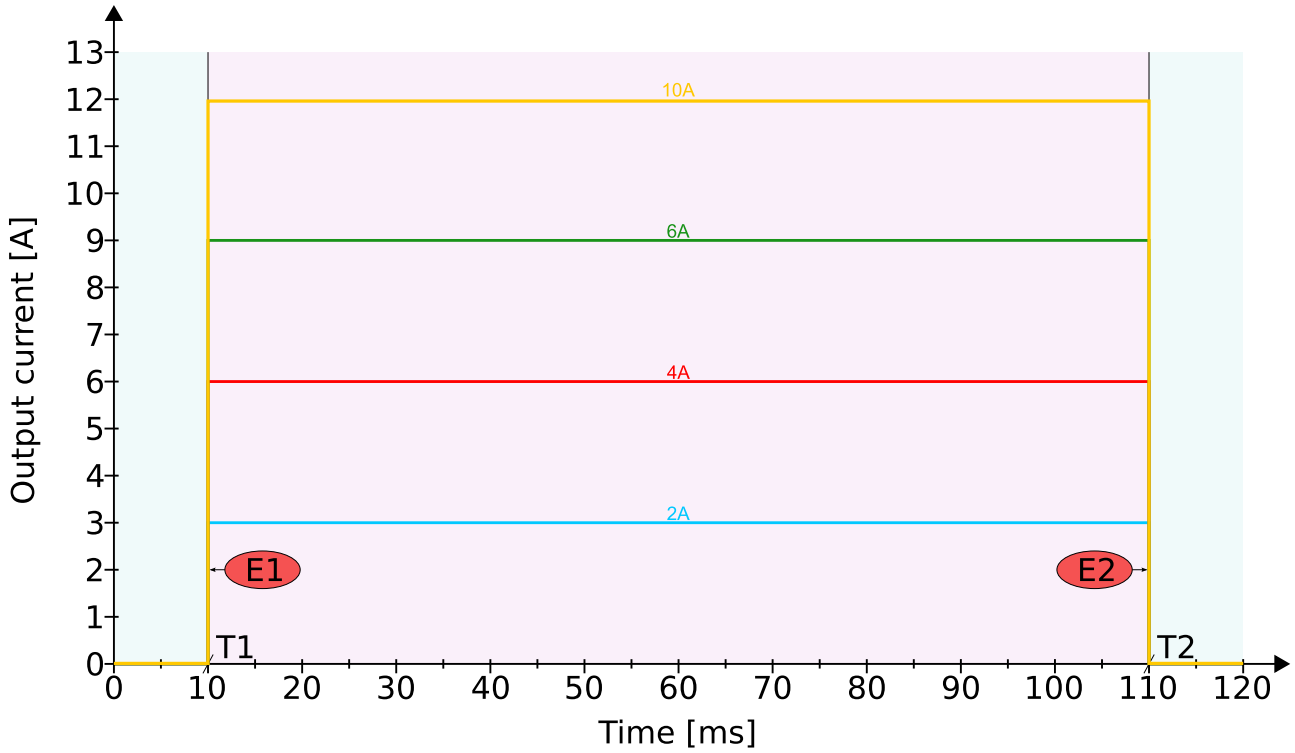


**Figure 8: Short Circuit Breaking Time**

| Parameter | Name | Description |
|---|---|---|
| E1 | *Short circuit detection* | The NEF210 detects a short circuit at the output channel. |
| E2 | *Output channel switch OFF* | After 100ms the output channel is switched OFF. |
| T1 – T2 | *Current limitation time* | Time between the detection of the short circuit and the output channel switch OFF. During this time, the output current is limited to 1.5 times the nominal current (if the current rating selected is 2A, 4A or 6A) or to 1.2 times the nominal current (if the current rating selected is 10A). |

**Table 2: Short circuit behavior description**

The trip curve in short circuit may differ from Figure 8 since the short circuit current is also limited depending on the input and output voltages as the protection algorithm limits the power dissipated by NEF210 to 100W per channel.

For example, if the input voltage is 24V, the output voltage is 0.5V and the current limitation is 12A the NEF210 it would be dissipating (24V – 0.5V) / 12A = 282W on the channel. In this case the short circuit current will be 100W / (24V – 0.5V) = 4.25A.

In the case of capacitive loads, the current limit will progressively increase as the voltage in the capacitors increases.

## 3.2 Static relay mode

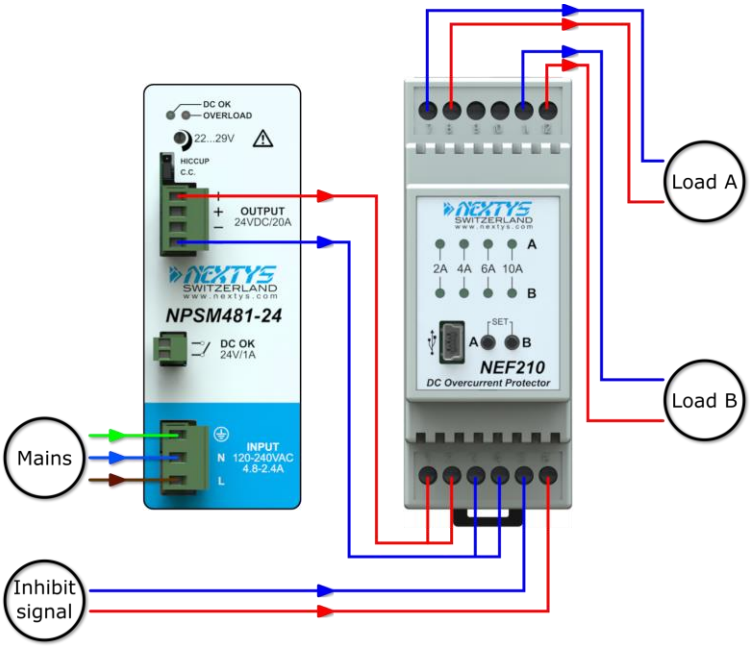


**Figure 9: Static relay connection example**

The NEF210 can be used as a static relay. An advantage compared to a traditional static relay is that the two outputs are protected against overload and short circuit. The output channels can be enabled/disabled separately through the POWERMASTER application, the Modbus field (see §5.4.3 and §5.4.10) or together through the Reset/Inhibit input, see §3.4. The output channels are individually configurable. An example of Static relay connection is given on Figure 9: Static relay connection example.

## 3.3 Modbus

NEF210 communicates through Modbus/RTU over USB as specified on "MODBUS over Serial Line" and "MODBUS APPLICATION PROTOCOL SPECIFICATION" documents available on http://www.modbus.org/.

Table 3 contains the used field types. For types bigger then 16bit, access all registers in one transaction (multiple register read or write) to ensure atomic operation.

<table>
<tr><th rowspan="2">Type</th><th colspan="2">Modbus function codes</th><th rowspan="2">Description</th></tr>
<tr><th>Read</th><th>Write</th></tr>
<tr><td>BIT</td><td>1,2</td><td>5,15</td><td>Single bit with value 0 or 1</td></tr>
<tr><td>SINT16</td><td>3,4</td><td>6,16</td><td>Signed 16 bit value (2's complement)</td></tr>
<tr><td>UINT16</td><td>3,4</td><td>6,16</td><td>Unsigned 16 bit value</td></tr>
<tr><td>SINT32</td><td>3</td><td>16</td><td>Signed 32 bit value (2's complement). Since Modbus maximum variable size is 16bit, it is composed of 2 consecutive registers in big-endian order.</td></tr>
<tr><td>UINT32</td><td>3</td><td>16</td><td>Unsigned 32 bit value. Since Modbus maximum variable size is 16bit, it is composed of 2 consecutive registers in big-endian order.</td></tr>
<tr><td>DATE</td><td>3</td><td>16</td><td>Time and date field. Composed of 4 Modbus registers as follows:
<table>
<tr><th>Address offset</th><th>Byte</th><th>Description</th></tr>
<tr><td rowspan="2">0</td><td>MSB</td><td>Reserved, set to 0</td></tr>
<tr><td>LSB</td><td>Year-2000</td></tr>
<tr><td rowspan="2">1</td><td>MSB</td><td>Month (1=January)</td></tr>
<tr><td>LSB</td><td>Day of the month</td></tr>
<tr><td rowspan="2">2</td><td>MSB</td><td>Hour of the day (24h format)</td></tr>
<tr><td>LSB</td><td>Minutes</td></tr>
<tr><td rowspan="2">3</td><td>MSB</td><td rowspan="2">Milliseconds</td></tr>
<tr><td>LSB</td></tr>
</table>
</td></tr>
</table>

**Table 3: Modbus types**

| Address | Type | R/W | Unit | Min. | Max. | Description |
|---|---|---|---|---|---|---|
| *Settings (see §5.4)* | | | | | | |
| 0x1000 | UINT16 | R/W | 1 | 1 | 4 | Current rating CH A<br>1: 2A<br>2: 4A<br>3: 6A<br>3: 10A |
| 0x1001 | UINT16 | R/W | 1 | 1 | 4 | Time-current characteristic CH A<br>1: Very Quick Acting<br>2: Fast Acting<br>3: Medium Acting<br>3: Time Lag |
| 0x1002 | UINT16 | R/W | 1 | 0 | 1 | Output state CH A enable<br>0: Disabled<br>1: Enabled |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0x1003 | UINT16 | R/W | 1 | 0 | 1 | Automatic rearm CH A enable<br>0: Disabled<br>1: Enabled |
| 0x1004 | UINT16 | R/W | 1 | 0 | 1 | Undervoltage lockout CH A enable<br>0: Disabled<br>1: Enabled |
| 0x1005 | UINT16 | R/W | 0.1V | 11 | 29 | Undervoltage lockout threshold CH A |
| 0x1006 | UINT16 | R/W | 0.1s | 1 | 10 | Time before undervoltage lockout trip CH A |
| 0x1010 | UINT16 | R/W | 1 | 1 | 4 | Current rating CH B<br>1: 2A<br>2: 4A<br>3: 6A<br>3: 10A |
| 0x1011 | UINT16 | R/W | 1 | 1 | 4 | Time-current characteristic CH B<br>1: Very Quick Acting<br>2: Fast Acting<br>3: Medium Acting<br>3: Time Lag |
| 0x1012 | UINT16 | R/W | 1 | 0 | 1 | Output state CH B enable<br>0: Disabled<br>1: Enabled |
| 0x1013 | UINT16 | R/W | 1 | 0 | 1 | Automatic rearm CH B enable<br>0: Disabled<br>1: Enabled |
| 0x1014 | UINT16 | R/W | 1 | 0 | 1 | Undervoltage lockout CH B enable<br>0: Disabled<br>1: Enabled |
| 0x1015 | UINT16 | R/W | 0.1V | 11 | 29 | Undervoltage lockout threshold CH B |
| 0x1016 | UINT16 | R/W | 0.1s | 1 | 10 | Time before undervoltage lockout trip CH B |
| 0x1020 | UINT16 | R/W | 1 | 1 | 2 | Input function<br>1: Rearm<br>2: Inhibit |
| 0x1021 | UINT16 | R/W | 1 | 1 | 2 | Inhibit polarity<br>1: Low<br>2: High |
| 0x1022 | UINT16 | R/W | 1 | 0 | 1 | Channel rating modifiable by buttons<br>0: Disabled<br>1: Enabled |
| 0x1023 | UINT16 | R/W | 1 | 0 | 65535 | Output OK configuration (see §5.4.18) |
| *Metering* | | | | | | |
| 0x2000 | UINT16 | R | 0.1V | 0 | 38 | Input voltage |
| 0x2001 | UINT16 | R | 0.1V | 0 | 38 | Output voltage CH A |
| 0x2002 | UINT16 | R | 0.1V | 0 | 38 | Output voltage CH B |
| 0x2003 | UINT16 | R | 0.1A | 0 | 25 | Output current CH A |
| 0x2004 | UINT16 | R | 0.1A | 0 | 25 | Output current CH B |
| 0x2010 | UINT16 | R | 1 | 0 | 65535 | Power ON cycles |
| 0x2011 | UINT16 | R | 1 | 0 | 65535 | Counter trip CH A |
| 0x2012 | UINT16 | R | 1 | 0 | 65535 | Counter trip CH B |
| *Control* | | | | | | |
| 0x3000 | BIT | W | 1 | 0 | 1 | Rearm Channel A |
| 0x3001 | BIT | W | 1 | 0 | 1 | Rearm Channel B |

| *State (see §5.3)* | | | | | | |
|---|---|---|---|---|---|---|
| 0x4000 | BIT | R | 1 | 0 | 1 | Activated CH A |
| 0x4001 | BIT | R | 1 | 0 | 1 | Fuse CH A trip |
| 0x4002 | BIT | R | 1 | 0 | 1 | Overtemperature CH A |
| 0x4003 | BIT | R | 1 | 0 | 1 | Failure CH A |
| 0x4004 | BIT | R | 1 | 0 | 1 | Undervoltage lockout CH A |
| 0x4005 | BIT | R | 1 | 0 | 1 | Overload CH A |
| 0x4006 | BIT | R | 1 | 0 | 1 | Current CH A > 90% |
| 0x4010 | BIT | R | 1 | 0 | 1 | Activated CH B |
| 0x4011 | BIT | R | 1 | 0 | 1 | Fuse CH B trip |
| 0x4012 | BIT | R | 1 | 0 | 1 | Overtemperature CH B |
| 0x4013 | BIT | R | 1 | 0 | 1 | Failure CH B |
| 0x4014 | BIT | R | 1 | 0 | 1 | Undervoltage lockout CH B |
| 0x4015 | BIT | R | 1 | 0 | 1 | Overload CH B |
| 0x4016 | BIT | R | 1 | 0 | 1 | Current CH B > 90% |
| 0x4020 | BIT | R | 1 | 0 | 1 | Rearm CH A |
| 0x4021 | BIT | R | 1 | 0 | 1 | Rearm CH B |
| 0x4022 | BIT | R | 1 | 0 | 1 | Inhibit |
| 0x4023 | BIT | R | 1 | 0 | 1 | USB powered |
| 0x4024 | BIT | R | 1 | 0 | 1 | Input undervoltage |

**Table 4: Modbus fields**

## 3.4 Digital input

An **opto-isolated input** allows, depending on the function selected (Rearm or Inhibit), to rearm the output channels in case of intervention of the digital fuse or to enable/disable the outputs if the function “Inhibit” has been selected.

If the input function selected is “Rearm”, it is possible to rearm remotely a tripped output channel. To rearm a tripped output channel just change the polarity of the input signal. In the case where both output channels are tripped, the signal rearms all the output channels. For safety reasons, the channel can be rearmed only if at least 20 seconds are elapsed from the event.

On the table below the inhibit behavior is shown:

| **Input function selected** | **Inhibit polarity selected** | **Input signal status** | **Output channels status** |
|---|---|---|---|
| Inhibit | Low | Low | Disabled |
| Inhibit | Low | High | Enabled |
| Inhibit | High | Low | Enabled |
| Inhibit | High | High | Disabled |

**Table 5: Output channels status with inhibit function selected**

The polarity of the input can be defined using the Inhibit polarity setting (see §5.4.16).

## 3.5 Status signal output

An **opto-isolated output** is present on the NEF210 for remote monitoring. The output is an open collector. An external voltage source is required for this function. The maximum applied voltage is 30Vdc and the maximum sink current is 50mA. Please refer to Figure 10 for the connection.

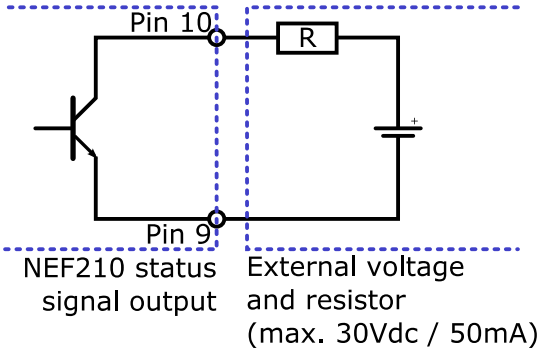


**Figure 10: Output Ok signal connection**

See §5.4.18 for more details on the behavior of the status output OK signal.

## 3.6 Warning at 90% of the configured nominal current

The NEF210 has a function that warns the user if the current has exceeded 90% of the configured nominal current. When 90% of the selected current load is reached the information is provided to the user visually by blinking the LED of the output channel (blinking frequency 2Hz) and through the POWERMASTER application or corresponding Modbus field. The alarm is switched OFF if the current drops below the threshold of 0.2A.

## 3.7 Automatic rearm

The NEF210 has implemented an automatic rearm function (see §5.4.4 and 5.4.11). This function autonomously rearms an output channel following a switch OFF. For safety reasons, the channel will be rearmed only 20 seconds after the event. If the output channel trips for 3 times consecutively after the automatic rearm, the function will be disabled until the load fault is resolved.

## 3.8 Undervoltage lockout

The NEF210 has an undervoltage lockout function that can be enabled. This function switches OFF the output channel in the event of the voltage dropping below the set threshold for a time longer than that of the parameter “Time before undervoltage lockout trip”. To configure the parameters of the undervoltage lockout function, please see:

- §5.4.5 and 5.4.12 to enable the function
- §5.4.6 and 5.4.13 to set the voltage threshold
- §5.4.7 and 5.4.14 to set the time that the channel stays in undervoltage before the trip

## 3.9 Overtemperature

The NEF210 is provided with a thermal protection that disables the output channels in the case where it is detected a high temperature. The channels will be automatically activated when the temperature has returned to the safe values.

## 3.10 Hardware failure

The NEF210 continuously monitors the health of its safety components. In case of detection of a hardware failure, the output channel concerned will be disabled. The information related to the hardware failure is provided to the user visually by blinking the LEDs of the output channel and through the POWERMASTER application or corresponding Modbus field.

# 4 User interface

An integrated user interface composed of an 8 LEDs and 2 keys is present on the front face, from where is possible perform the following operations:

- Enable an output channel (see §4.2)
- Disable an output channel (see §4.3)
- Modify the current rating of an output channel (see §4.4)
- Rearm an output channel after a trip (see §4.5)

## 4.1 Description user interface keys

| Name | Function |
|---|---|
| SET A KEY | ◗ Enable/Disable output channel A<br>◗ Select current rating channel A<br>◗ Rearm channel A |
| SET B KEY | ◗ Enable/Disable output channel B<br>◗ Select current rating channel B<br>◗ Rearm channel B |

**Table 6: User interface keys**

## 4.2 Enable output channel

The output channel is enabled when one of the LEDs related to the selected current rating is ON. To switch ON an output channel just press and hold for 5 seconds the button of the channel concerned. At this point, you will see that the channel is active and the selected current rating.

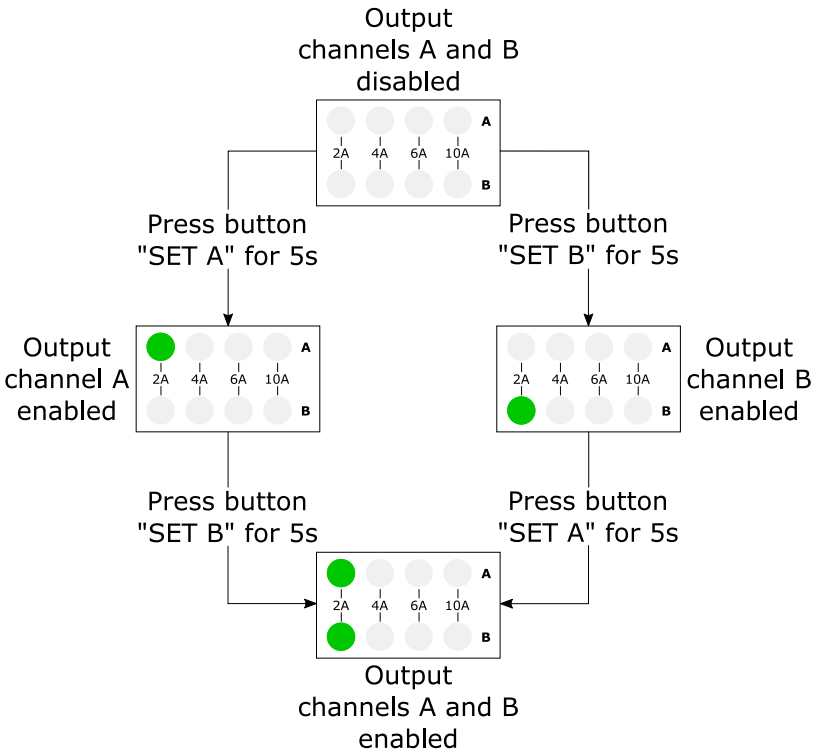


**Figure 11: Example activation of the output channels via HMI**

## 4.3 Disable output channel

The output channel is disabled when all the LEDs related to the selected current rating are OFF. To switch OFF an output channel just press and hold for 5 seconds the button of the channel concerned. At this point, you will see that the channel is inactive.

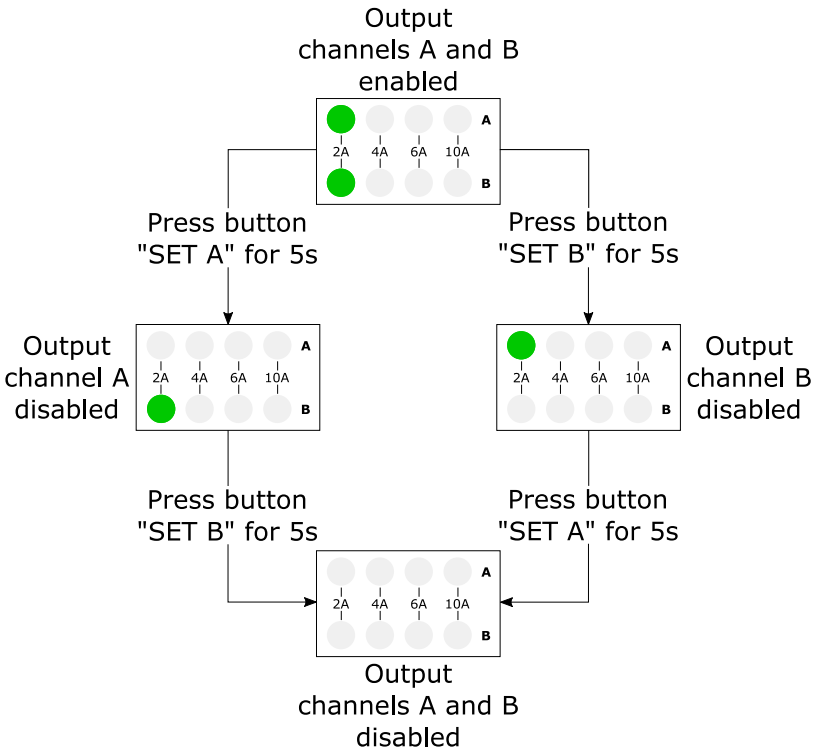


**Figure 12: Example deactivation of the output channels via HMI**

## 4.4 Modify current rating output channel

To change the current rating of the two output channels use the following procedure:

- Press and hold the two buttons until the LEDs start blinking (3 seconds)
- Press the buttons “SET A” and “SET B” and select the desired current ratings
- Press and hold the two buttons until the LEDs switch OFF (3 seconds)
- Release the buttons. If the output channels are enabled the LEDs of the current rating selected are ON.

In the following figure is represented the sequence to modify the current rating of the output channel A from 2A to 4A and of the output channel B from 2A to 10A.

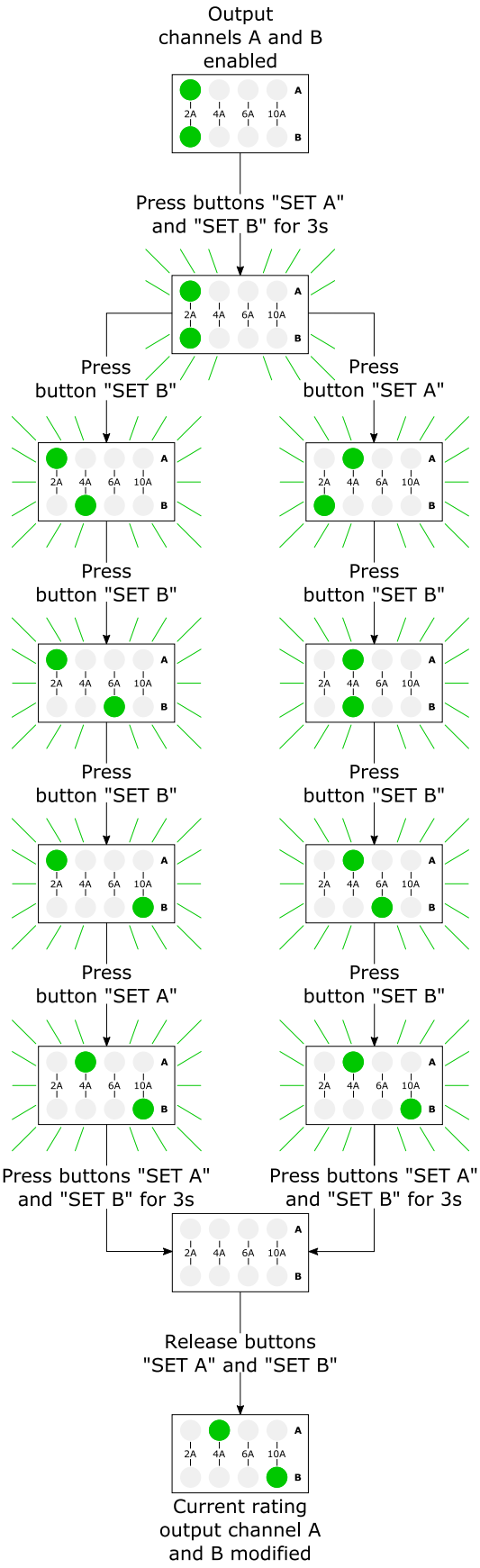


**Figure 13: Example current rating editing of the output channels via HDMI**

## 4.5 Rearm output channel after trip

All the channel LEDs blink when the output channel trips. To rearm a tripped output channel just press the button of the channel concerned. For safety reasons, the channel can be rearmed only if at least 20 seconds are elapsed from the event. If the channel is operational again, the LED related to the selected current rating turns ON.

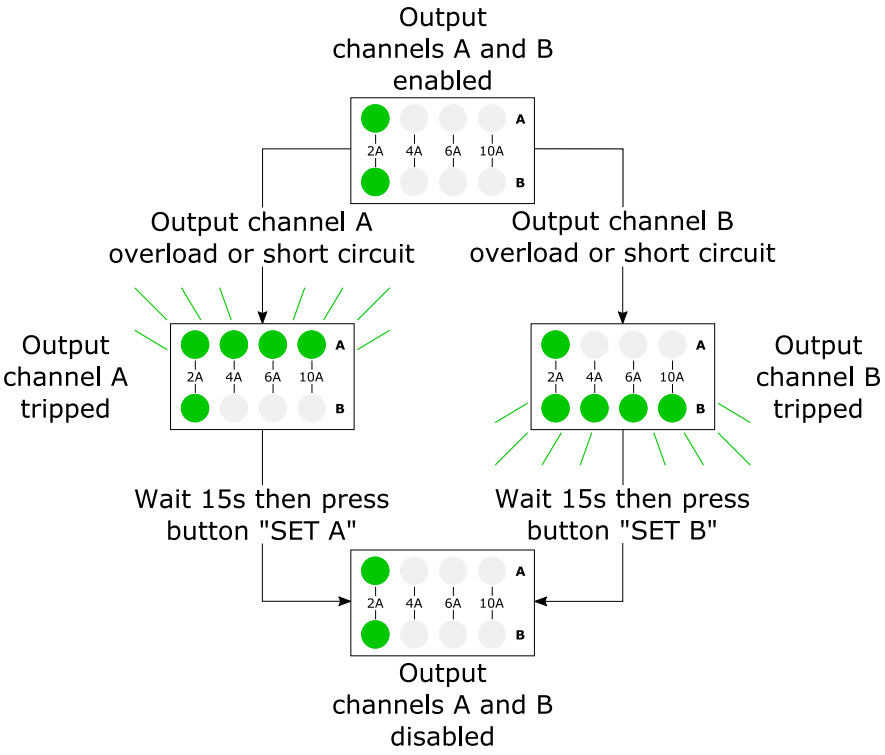


**Figure 14: Example rearming of the output channels via HMI**

# 5 Configuration

To proceed with the configuration, it is necessary to use the POWERMASTER application or the Modbus address field described in the following paragraphs.

## 5.1 First turn ON

At the startup all the LEDs turn ON one by one for a short while. If is the first turn ON, the LEDs will turn OFF after the LEDs check since the two output channels are disabled by default. The factory settings are the following:

| Setting | Default value |
|---|---|
| Current rating CH x | 2A |
| Time-current characteristic CH x | Very Quick Acting |
| Output state CH x enable | OFF |
| Automatic rearm CH x enable | OFF |
| Undervoltage lockout CH x enable | OFF |
| Undervoltage lockout threshold CH A | 11V |
| Time before undervoltage lockout trip CH A | 1s |
| Input function | Rearm |
| Inhibit polarity | High |
| Output OK configuration | Inhibit, CH A open, CH B open, CH A trip, CH B trip, Overtemperature CH A, Overtemperature CH B, Failure CH A, Failure CH B, Undervoltage lockout CH A, Undervoltage lockout CH B, Current CH B > 90%, Current CH A > 90% |
| Channel rating modifiable by buttons | ON |

**Table 7: Default settings**

## 5.2 Information

The information concerning the NEF210 are visible on the panel “Device and Connection” on the POWERMASTER application. The fields are also accessible via Modbus at the specified address. Modbus device identification fields are read using function 43/13 (0x2B/0x0E) at the specified object id.

### 5.2.1 Firmware version

*Modbus*
***Device Identification Object Id 0x02***

3.3 digit indicating the firmware major minor version

### 5.2.2 Firmware subversion

*Modbus*
***Device Identification Object Id 0x80***

3 digit indicating the firmware subversion.

### 5.2.3 Serial number

*Modbus*
***Device Identification Object Id 0x81***

Device serial number.

| 5.2.4 Build date |
|---|
| *Modbus*<br>***Device Identification Object Id 0x82*** |
| Firmware build date. |

| 5.2.5 Build time |
|---|
| *Modbus*<br>***Device Identification Object Id 0x83*** |
| Firmware build time. |

## 5.3 Status

The “Status” panel of the POWERMASTER application shows the measurement and statuses to ease the system diagnostic. Furthermore, in case of alarm a message appears on the screen. The screen is divided in 3 sections, Common, Channel A and Channel B. The fields are also accessible via Modbus at the specified address (see §3.3).

## 5.4 Settings

The “Variable → Settings” panel of the POWERMASTER application contains all the configurable parameters available to the user. All settings are also accessible via Modbus at the specified address.

| 5.4.1 Current rating CH A | |
|---|---|
| *Default value*<br>***2A*** | *Values (Modbus value)*<br>***2A (1), 4A (2), 6A (3), 10A (4)*** |
| *Unit*<br>***NA*** | *Modbus address*<br>***0x1000*** |
| Used to set the nominal current of the channel A. The system provides four nominal current. | |

| 5.4.2 Time-current characteristic CH A | |
|---|---|
| *Default value*<br>***Very Quick Acting*** | *Values (Modbus value)*<br>***Very Quick Acting (1), Fast Acting (2), Medium Acting (3), Time Lag (4)*** |
| *Unit*<br>***NA*** | *Modbus address*<br>***0x1001*** |
| Used to set the time-current characteristic of the channel A. The system provides four time-current characteristics. | |

| 5.4.3 Output state CH A enable | |
|---|---|
| *Default value*<br>***OFF*** | *Values (Modbus value)*<br>***OFF (0), ON (1)*** |
| *Unit*<br>***NA*** | *Modbus address*<br>***0x1002*** |
| Used to enable or disable the channel A. | |

| 5.4.4 Automatic rearm CH A enable | |
|---|---|
| *Default value*<br>***OFF*** | *Values (Modbus value)*<br>***OFF (0), ON (1)*** |
| *Unit*<br>***NA*** | *Modbus address*<br>***0x1003*** |
| Enable this function for automatically rearming the channel A after a tripping (max. 3 times, see §3.7 for details). | |

### 5.4.5 Undervoltage lockout CH A enable

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***OFF*** | ***OFF (0), ON (1)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1004*** |

Enable this function for switch OFF the channel A in the event of the voltage dropping below the threshold value (see §5.4.6 to set the threshold).

### 5.4.6 Undervoltage lockout threshold CH A

| *Default value* | *Range* | *Resolution* |
|---|---|---|
| ***11V*** | ***11…29V*** | ***0.1V*** |
| *Unit* | *Modbus address* | |
| ***Volts*** | ***0x1005*** | |

Used to set the minimum voltage threshold of the channel A for switch OFF the channel in the event of an undervoltage, see §3.8 for details. When the undervoltage lockout function is set to OFF, this setting is disabled.

### 5.4.7 Time before undervoltage lockout trip CH A

| *Default value* | *Range* | *Resolution* |
|---|---|---|
| ***1s*** | ***1…10s*** | ***0.1s*** |
| *Unit* | *Modbus address* | |
| ***Seconds*** | ***0x1006*** | |

Minimum time that the channel A stays in undervoltage before the trip of the channel, see §3.8 for details. When the undervoltage lockout function is set to OFF, this setting is disabled.

### 5.4.8 Current rating CH B

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***2A*** | ***2A (1), 4A (2), 6A (3), 10A (4)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1010*** |

Used to set the nominal current of the channel B. The system provides four nominal current.

### 5.4.9 Time-current characteristic CH B

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***Very Quick Acting*** | ***Very Quick Acting (1), Fast Acting (2), Medium Acting (3), Time Lag (4)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1011*** |

Used to set the time-current characteristic of the channel B. The system provides four time-current characteristics.

### 5.4.10 Output state CH B enable

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***OFF*** | ***OFF (0), ON (1)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1012*** |

Used to enable or disable the channel B.

### 5.4.11 Automatic rearm CH B enable

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***OFF*** | ***OFF (0), ON (1)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1013*** |

Enable this function for automatically rearming the channel B after a tripping (max. 3 times, see §3.7 for details).

### 5.4.12 Undervoltage lockout CH B enable

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***OFF*** | ***OFF (0), ON (1)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1014*** |

Enable this function for switch OFF the channel B in the event of the voltage dropping below the threshold value (see §5.4.13 to set the threshold).

### 5.4.13 Undervoltage lockout threshold CH B

| *Default value* | *Range* | *Resolution* |
|---|---|---|
| ***11V*** | ***11…29V*** | ***0.1V*** |
| *Unit* | *Modbus address* | |
| ***Volts*** | ***0x1015*** | |

Used to set the minimum voltage threshold of the channel B for switch OFF the channel in the event of an undervoltage, see §3.8 for details. When the undervoltage lockout function is set to OFF, this setting is disabled.

### 5.4.14 Time before undervoltage lockout trip CH B

| *Default value* | *Range* | *Resolution* |
|---|---|---|
| ***1s*** | ***1…10s*** | ***0.1s*** |
| *Unit* | *Modbus address* | |
| ***Seconds*** | ***0x1016*** | |

Minimum time that the channel B stays in undervoltage before the trip of the channel, see §3.8 for details. When the undervoltage lockout function is set to OFF, this setting is disabled.

### 5.4.15 Input function

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***Rearm*** | ***Rearm (1), Inhibit (2)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1020*** |

Used to select the function of the input signal. The two choices are Rearm or Inhibit, see §3.4 for details.

### 5.4.16 Inhibit polarity

| *Default value* | *Values (Modbus value)* |
|---|---|
| ***High*** | ***Low (1), High (2)*** |
| *Unit* | *Modbus address* |
| ***NA*** | ***0x1021*** |

Used to select the polarity of the Inhibit input. The inhibit function allows to switch OFF/ON the two channels remotely, see §3.4 for details. When the input function is set to Rearm, this setting is disabled.

| 5.4.17 Channel rating modifiable by buttons | |
|---|---|
| *Default value*<br>***ON*** | *Values (Modbus value)*<br>***OFF (0), ON (1)*** |
| *Unit*<br>***NA*** | *Modbus address*<br>***0x1022*** |
| Enable this function to allow modification of the current rating of the channels using the buttons. | |

| 5.4.18 Output OK configuration | |
|---|---|
| *Default value*<br>***Inhibit, CH A open, CH B open, CH A trip, CH B trip, Overtemperature CH A, Overtemperature CH B, Failure CH A, Failure CH B, Undervoltage lockout CH A, Undervoltage lockout CH B, Current CH B > 90%, Current CH A > 90%*** | *Values (Modbus value)*<br>***Normally open (1), Inhibit (2), CH A open (3), CH B open (4), CH A trip (5), CH B trip (6), Overtemperature CH A (7), Overtemperature CH B (8), Failure CH A (9), Failure CH B (10), Undervoltage lockout CH A (11), Undervoltage lockout CH B (12), Current CH B > 90% (13), Current CH A > 90% (14)*** |
| *Unit*<br>***NA*** | *Modbus address*<br>***0x1023*** |

This field defines the behavior of output OK as follows:

| Normally open | 1 or more enabled state active? | Output OK status |
|---|---|---|
| True | No | Open |
| True | Yes | Closed |
| False | No | Closed |
| False | Yes | Open |

## 5.5 Logs

Every event is logged in the device FLASH memory. From the “Logs” panel of the POWERMASTER application the user can view their history. The fields are also accessible via Modbus at the specified address. Logs are of 3 different kinds: info, alarms and events. All info and alarms have an associated Modbus field representing the current status (0 if inactive or 1 if active). For info and alarms a log is generated at each status transaction.

### 5.5.1 Info

| 5.5.1.1 Activated CH A | |
|---|---|
| *Modbus address*<br>***0x4000*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when is enabled the channel A. | |

| 5.5.1.2 Activated CH B | |
|---|---|
| *Modbus address*<br>***0x4010*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when is enabled the channel B. | |

| 5.5.1.3 Rearm CH A | |
|---|---|
| *Modbus address*<br>***0x4020*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when is detected a rearm request of the channel A. | |

| 5.5.1.4 Rearm CH B | |
|---|---|
| *Modbus address*<br>***0x4021*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when is detected a rearm request of the channel B. | |

| 5.5.1.5 Inhibit | |
|---|---|
| *Modbus address*<br>***0x4022*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active if the inhibit input signal is asserted (§3.4). | |

| 5.5.1.6 USB powered | |
|---|---|
| *Modbus address*<br>***0x4023*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| NEF210 is powered by USB only. | |

| 5.5.1.7 Input undervoltage | |
|---|---|
| *Modbus address*<br>***0x4024*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when an input undervoltage on the NEF210 is detected. | |

### 5.5.2 Alarms

| 5.5.2.1 Fuse CH A trip | |
|---|---|
| *Modbus address*<br>***0x4001*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Tripping count*** |
| Active when is tripped the channel A. The counter is incremented at every time is tripped the channel A. | |

| 5.5.2.2 Overtemperature CH A | |
|---|---|
| *Modbus address*<br>***0x4002*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when an overtemperature is detected on the channel A. | |

| 5.5.2.3 Failure CH A | |
|---|---|
| *Modbus address*<br>***0x4003*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when a hardware failure is detected on the channel A. | |

| 5.5.2.4 Undervoltage lockout CH A | |
|---|---|
| *Modbus address*<br>***0x4004*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when the measured output voltage of the channel A is under the “Undervoltage lockout threshold CH A” field (§5.4.6). | |

| 5.5.2.5 Overload CH A | |
|---|---|
| *Modbus address*<br>***0x4005*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when an overload is detected on the channel A. | |

| 5.5.2.6 Current CH A > 90% | |
|---|---|
| *Modbus address*<br>***0x4006*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when the measured output current of the channel A has exceeded 90% of the configured nominal current. | |

| 5.5.2.7 Fuse CH B trip | |
|---|---|
| *Modbus address*<br>***0x4011*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Tripping count*** |
| Active when is tripped the channel B. The counter is incremented at every time is tripped the channel B. | |

| 5.5.2.8 Overtemperature CH B | |
|---|---|
| *Modbus address*<br>***0x4012*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when an overtemperature is detected on the channel B. | |

| 5.5.2.9 Failure CH B | |
|---|---|
| *Modbus address*<br>***0x4013*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when a hardware failure is detected on the channel B. | |

| 5.5.2.10 Undervoltage lockout CH B | |
|---|---|
| *Modbus address*<br>***0x4014*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when the measured output voltage of the channel B is under the “Undervoltage lockout threshold CH B” field (§5.4.13). | |

| 5.5.2.11 Overload CH B | |
|---|---|
| *Modbus address*<br>***0x4015*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when an overload is detected on the channel B. | |

| 5.5.2.12 Current CH B > 90% | |
|---|---|
| *Modbus address*<br>***0x4016*** | |
| *Value1*<br>***Inactive (0), Active (1)*** | *Value2*<br>***Not used*** |
| Active when the measured output current of the channel B has exceeded 90% of the configured nominal current. | |

### 5.5.3 Events

| 5.5.3.1 Power ON event | |
|---|---|
| *Modbus address*<br>***0xE000*** | |
| *Value1*<br>***Power ON count*** | *Value2*<br>***Not used*** |
| Generated at every time the NEF210 is turned ON. | |

# 6 Technical Specifications

See NEF210 datasheet for detailed specifications.