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cronologic GmbH & Co. KG

Ndigo Crate

User Guide

cronologic

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1 Overview

The Ndigo Crate is a PCI Express (PCIe) expansion enclosure containing up to 8 x16 PCIe2 slots. The Ndigo Crate connects to a host computer via a x16 PCIe cable using an adapter (PCIe expansion card) which is plugged into a PCIe2 or PCIe x16 slot. Depending on the variant of the Ndigo Crate up to 8 PCIe2 slots and two PCI slots are present on the base board (see Table **??**).

The Ndigo Crate was specifically designed to operate multiple synchronized digitizer boards by cronologic GmbH & Co. KG thereby providing a high speed data acquisition (DAQ) system. It can also be used to house other PCIe and PCI devices such as DAQ cards, GPUs for high performance computing, storage adapters or networking equipment. The PCIe expansion card is already installed into the Ndigo Crate.

1.1 Parts List

The following parts are provided with the Ndigo Crate: see table 1.2.

Quantity	**Part**
1	Ndigo Crate with power supply and extension board installed.
1	PCIe x16 host card
1	PCIe x16 host cable (3 meter)
1	Power cord (220Vac)

Table 1.1: Parts shipped with the Ndigo Crate.

1.2 Environmental Conditions

Operating temperature range	5°C to 40°C
Storage temperature range	−10°C to 60°C
Relative humidity (non-condensing)	$< 90\%$

Table 1.2: Parts shipped with the Ndigo Crate.

2 Component Identification

2.1 Front Panel

Figure 2.1 displays the front side of the Ndigo Crate ready to be installed into a 19" rack. Figure 2.1 shows an exemplary configuration of the Ndigo Crate and may not resemble your ordered product.

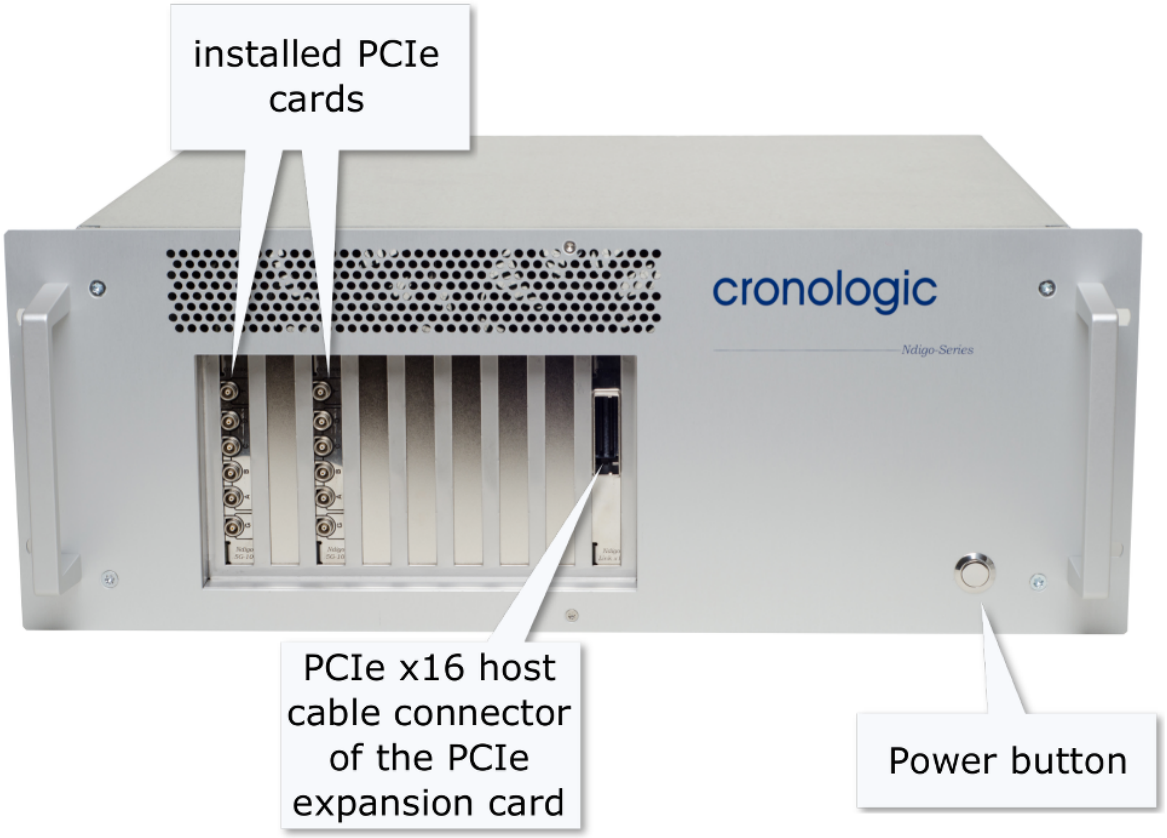

Figure 2.1: Ndigo Crate front panel view.

2.2 PCIe Host Card

Figure 2.2 shows the PCIe x16 host card already connected to the Ndigo Crate via the PCIe x16 host cable. The PCIe x16 host card is to be installed into your computer system.

Figure 2.2: PCIe host card with the PCIe x16 host cable connected to the Ndigo Crate.

2.3 Internal View

Figure 2.3 provides insight to the opened enclosure of the Ndigo Crate. In this configuration example two PCIe cards are installed onto the base board and may not resemble your ordered product.

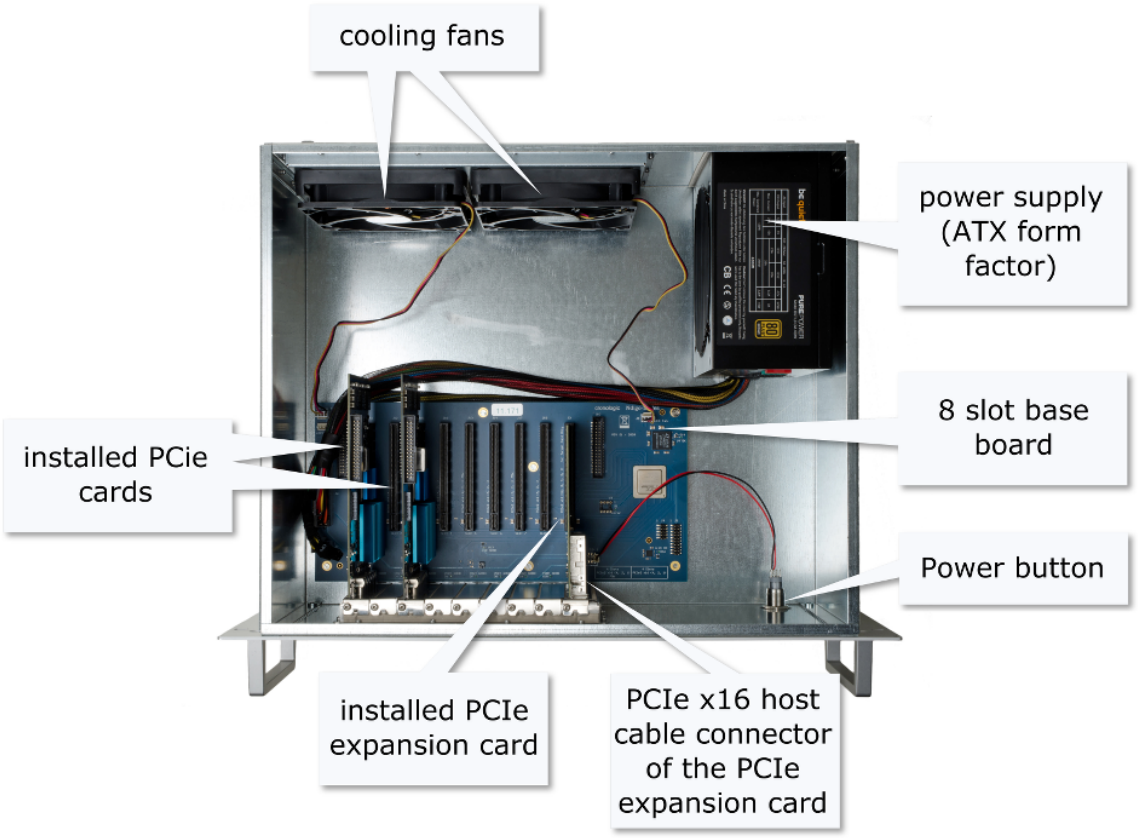

Figure 2.3: Internal view of the Ndigo Crate.

2.4 Electrical Specifications

2.4.1 Power Supply

The table below (Table 2.1) lists AC input and DC output voltage, frequency range, current and peak loads of the power supply shipped with the Ndigo Crate.

AC input	**Part**
	Voltage 100–240Vac
	Frequency 50–60Hz
	Current 8-4A
DC output	+3.3V, max. current 24A
	+5V, max. current 15A
	+3.3V and +5V, max. combined power 120W
	+12V1, max. current 22A
	+12V2, max. current 20A
	+12V3, no current
	+12V4, no current
	+12V1–4, max. current 33A
	+12V1-4, max. combined power 396W
	-12V, max. current 0.3A
	-12V, max. combined power 3.6W
	+5VSB, max. current 3A
	+5V, max. combined power 15W
	Combined peak power 430W

Table 2.1: Power supply specifications of the be quit! Pure Power L8-430W.

2.4.2 Electrical Load of each Power Supply Rail

The nominal and maximum electrical load per power supply rail of the Ndigo Crate are show in Table 2.2 below. The given values apply to the exemplary configuration of the Ndigo Crate where no additional PCIe cards, except the PCIe expansion card (i.e. the interface card), are installed.

The DC output currents are sufficient to power any combination of PCIe CEM compliant devices via the slot connectors. PCIe devices with additional power supply connectors might draw more power. If such devices are connected to the power supply it is the users responsibility to ensure that the power supply's capabilities are not exceeded.

Nominal (only PCIe expansion card installed)	+3.3V, current 200mA +5V, current 2.5A +12V1, no current +12V2, current 1.1A (cooling fans)
Maximum (PCIe CEM compliant boards with maximum load installed in all slots)	+3.3V, max. current 24A +5V, max. current 2.7A +12V1, max. current 15.2A +12V2, max. current 16.2A

Table 2.2: Electrical load of each power supply rail of the Ndigo Crate with installed PCIe expansion card but without any installed PCIe cards.

2.4.3 Electrical Load per Slot

The Ndigo Crate PCIe expansion enclosure provides eight slots. The maximum electrical load per slot is shown in Table 2.3.

Slot	Slot Rail	Supply Rail	Max. current per slot
1-8	+3.3V	+3.3V	6A
1-8	+53V	+5V	0
1 and 3	+12V	+12V1	5.5A
2 and 4			2.1A
5 and 7		+12V2	5.5A
6 and 8			2.1A

Table 2.3: Maximum electrical load per slot of the Ndigo Crate.

3 Installation

To connect the Ndigo Crate to your computer, the PCIe x16 host card needs to be installed into this computer. The two interface cards provided look very similar. Make sure to install the *host* card in the PC and the *target* card in the Ndigo Crate. The cards are labeled accordingly. If the label has been removed, the host card can be identified as the parts $U11, U14, U15$ and $U38$ are *not* populated on this board, while they are present on the target card. $U11, U14, U15$ and $U38$ are located above the PCIe-cable connector. After installing the target PCIe expansion card in the Ndigo crate, PC and Crate need to be connected via the PCIe x16 cable supplied.

Important notice:
The Ndigo Crate PCIe expansion enclosure operates in most cases only with the original cronologic GmbH & Co. KG PCIe expansion card (i.e. interface card) which is already installed. 3rd party PCIe expansion cards might not operate correctly in the Ndigo Crate as the expansion connector pinout is not standardized.

Important notice:
When manipulating and open the crate enclosure ESD precautions should be considered.
In order to avoid damaging of the electrical components via high voltage discharging we strongly recommend proper grounding while working inside your computer or the Ndigo Crate.
In operation it is obligatory that the enclosure of the Ndigo Crate is closed and the slot brackets are inserted with the mounting screws fastened.

3.1 Installation of the PCIe x16 host card

Before you start with the installation of the PCIe x16 host card the following ESD precautionary procedures should be considered. Power down your computer and remove the power cord. After power down you should wait until fans and hard drives have stopped rotating and all lights are off. Please open the enclosure carefully. Insert the PCIe x16 host card by gently pushing it into a PCIe x16 slot. Secure the PCIe x16 host card with a mounting screw.

3.2 Installation of 3rd party PCIe cards

The Ndigo Crate is suitable for 3rd party PCIe cards. All slots on the base board are mechanically PCIe x16 slots. Electrically four or eight lanes are connected. See table 3.1.

When installing 3rd party PCIe cards the recommendations of the manufacturer should be followed. Please follow the ESD instructions given in the upper paragraph (Installation of the PCIe x16 host card).

Slot	Crate	Crate3	Crate5
1	PCIe2 x4, 75W	PCI32, 33MHz, 5V	PCI32, 66MHz, 3.3V
2	PCIe2 x4, 25W	PCI32, 33MHz, 5V	PCI32, 66MHz, 3.3V
3	PCIe2 x4, 75W	none	
4	PCIe2 x4, 25W	PCIe2, x4, 25W	
5	PCIe2 x4, 75W	PCIe2, x8, 75W	
6	PCIe2 x4, 25W	PCIe2, x4, 25W	
7	PCIe2 x4, 75W	PCIe2, x8, 75W	
8	PCIe2 x4, 25W	PCIe2, x4, 25W	

Table 3.1: Slot configurations

The Ndigo Crate is capable of any link width up to the number of lanes electrically connected at the slot (x4 or x8, see Table 7). This might not be true for all third party PCIe boards. The negotiated link width will be the maximum width supported by both the third party PCIe board and the Ndigo Crate (Table 3.3).

Lanes connected on PCIe card	PCIe lanes active	
	x4 slot	x8 slot
x16, x12	or x1 (required by standard) x2 or x4 (optional)	x1 (required by standard) x2, x4 or x8 (optional)
x8	x1 (required by standard) x2 or x4 (optional)	x8
x4	x4	x4
x2	x2	x2
x1	x1	x1

Table 3.2: Negotiated lane width in the PCIe x16 slots of the Ndigo Crate

Important notice:
The PCIe standard requires all boards to support x1 and maximum width, all other link widths are optional. So an x16 board is required to run at x1 speed and might also run at x2 and x4 speed in an x4 slot.
However, in violation to the PCIe standard older x16 graphics boards sometimes do only support x16 links. These boards will not work properly in the Ndigo Crate.

3.3 Connecting the Ndigo Crate to the PCIe x16 host card

After the installation of the PCIe host card in your computer, the PCIe expansion card of the Ndigo Crate must be connected with the PCIe host card via the PCIe x16 host cable.

For this purpose connect the PCIe x16 host cable to the PCIe x16 host cable connector of the PCIe expansion card which is installed in the Ndigo Crate (please refer to figure 2.1).

PCIe x16 host connection iPass™ cables by Molex with the following part numbers can be used, as well: 74546-1601 (1m), 74546-1602 (2m), 74546-1603 (3m), 74546-1605 (5m), 74546-1607 (7m).

There is no driver or software installation required.

3.4 Checking the status of the PCIe connection

Proper functioning and the interconnect bandwidth of each board installed inside the Ndigo Crate is indicated by a flashing pattern of an LED beside each slot on the crate base board. The flashing pattern indicates the PCIe speed as shown in Table 9.

LED flashing pattern	**Link status of the slot**	**Used Lanes**	**PCIe x16 bandwidth**
●●●●●●●●	Link down	0	0Gb/s
○○○○○○○○	Link up	All	5Gb/s
○●○●○●○●	Link up	Some	5Gb/s
○○○●○○○●	Link up	all	2.5Gb/s
●●●○●●●○	Link up	some	2.5Gb/s
Legend: ●: 0.5s LED off; ●●●: 1.5s LED off; ○:0.5s LED on; ○○○ : 1.5s LED on			

Table 3.3: Negotiated lane width in the PCIe x16 slots of the Ndigo Crate

3.5 Maintenance

The cooling fans have to be checked and cleaned from time to time, especially if the noise level increases. The same applies for the power supply unit.

4 Regularity Compliance and Recycling

The following Table 4.1 lists the regularity and recycling compliances fulfilled by cronologic GmbH & Co. KG.

European Conformity Mark (CE)	The ndigo crate is manufactured by **cronologic GmbH & Co. KG.** **Jahnstrasse 49,** **60318 Frankfurt (2012)** and fully CE compliant. Only CE compliant power supplies are allowed to be used with the Ndigo Crate.
Electromagnetic Compatibility(EMC)	The Ndigo Crate is designed and tested to comply with DIN EN-61326-1 when operated with compliant PCIe devices and host computers. For full compliance it is obligatory that both the enclosure and the host PC are not damaged, completely closed and all slot brackets installed.
Product Safety	The Ndigo Crate does not pose any hazard as defined by DIN EN-61010-1.
Restriction of Hazardous Substances (RoHS)	The Ndigo Crate complies with EU directive 2002/95/EG (RoHS).
Stiftung Elektro-Altgeräte Register(Foundation EAR)	cronologic GmbH & Co. KG is registered with the „Stiftung Elektro-Altgeräte Register“ as a manufacturer of electronic systems with registration ID DE 77895909.
German Electrical and Electronic Equipment Act (ElektroG)	The Ndigo Crate belongs to category 9, “Überwachungs und Kontrollinstrumente für ausschließlich gewerbliche Nutzung” (Controlling and monitoring instruments in industry).
Recycling information	The last owner of a Ndigo Crate must recycle or dispose the board in compliance with §11 and §12 of the German ElektroG or return it to cronologic GmbH & Co. KG, Jahnstrasse 49, D-60318 Frankfurt.

Table 4.1: Regularity Compliance Directives and Recycling Information