hebusens

n-Core®

n-Core® Configuration Tool

Sensors Configuration

Rev. 20150205

Table of contents

1. n-Core Sirius Devices

1.1. Ports

The following tables shows the ports and addresses that should be used for the definition of Behaviors and Rules.

Port	Port Type	Port Address (Hex.)
Sirius A		
GPO_1	GPO	0x01
GPO_2	GPO	0x02
GPO_3	GPO	0x03
GPO_4	GPO	0x04
GPI_1	GPI	0x01
GPI_2	GPI	0x02
GPI_3	GPI	0x03
GPI_4	GPI	0x04
ADC_1	ADC	0x01
ADC_2	ADC	0x02
I2C	I2C	-
RELÉ_1	GPO	0x1D
RELÉ_2	GPO	0x08
IRQ 6 – Associated to GPI_3	IRQ	0x06
IRQ 7 – Associated to GPI_4	IRQ	0x07
Green Led	GPO	0x01
Red Led	GPO	0x00
USART_DTR	GPI/GPO	0x18
ADC_3	GPI/GPO	0x1B
BAT	GPI/GPO	0x1C
1WR	GPI/GPO	0x1D
Sirius B/D		
IRQ_6 – Left button (SW3)	IRQ	0x06
GPI – Left button (SW3)	GPI	0x21
IRQ_7 – Right button (SW4)	IRQ	0x07
GPI - Right button (SW4)	GPI	0x22
I2C	I2C	-
ADC_1	ADC	0x01
GPIO_2	GPI/GPO	0x02
GPIO_13	GPI/GPO	0x0D
GPIO_14	GPI/GPO	0x0E
GPIO_15	GPI/GPO	0x0F
GPIO_6	GPI/GPO	0x06
USART_DTR	GPI/GPO	0x18
ADC_3	GPI/GPO	0x1B
BAT	GPI/GPO	0x1C
1WR	GPI/GPO	0x1D
USART0_TXD	GPI/GPO	0x1E
USART0_RXD	GPI/GPO	0x1F
USART0_EXTCLK	GPI/GPO	0x20
Green Led	GPO	0x08

Red Led	GPO	0x01
Disable/enable Green Led normal operation for sending[1]	GPO	0x2F
Disable/enable Red Led normal operation for receiving[2]	GPO	0x30
Sirius Quantum/RadIOn		
IRQ_2 – Left button (SW2)	IRQ	0x02
GPI – Left button	GPI	0x23
IRQ_3 – Right button (SW1)	IRQ	0x03
GPI - Right button	GPI	0x24
IRQ_4 – Accelerometer[3] INT_1	IRQ	0x04
GPI – Accelerometer INT_1	GPI	0x25
IRQ_5 – Accelerometer INT2	IRQ	0x05
GPI - Accelerometer INT_2	GPI	0x26
I2C	I2C	-
SPI_CS	GPI/GPO	0x27
HW_SPI_CS	GPI/GPO	0x28
SPI_SCK	GPI/GPO	0x29
SPI_MOSI	GPI/GPO	0x2A
SPI_MISO	GPI/GPO	0x2B
Green Led (B5)	GPO	0x2C
Red Led (B7)	GPO	0x2E
GPI_1	GPI/GPO	0x19
ADC_1	GPI/GPO	0x01
Common		
I2C_CLK	GPI/GPO	0x11
I2C_DATA	GPI/GPO	0x12
USART1_TXD	GPI/GPO	0x13
USART1_RXD	GPI/GPO	0x14
USART1_EXTCLK	GPI/GPO	0x15
USART_RTS	GPI/GPO	0x16
USART_CTS	GPI/GPO	0x17
USART0_TXD	GPI/GPO	0x1E
USART0_RXD	GPI/GPO	0x1F
USART0_EXTCLK	GPI/GPO	0x20

[1] Green Led Normal operation:

- Green led will turn on when the device is trying to send unicast or broadcast data over the air.
- Green led will turn off when the data has been sent correctly over the air.

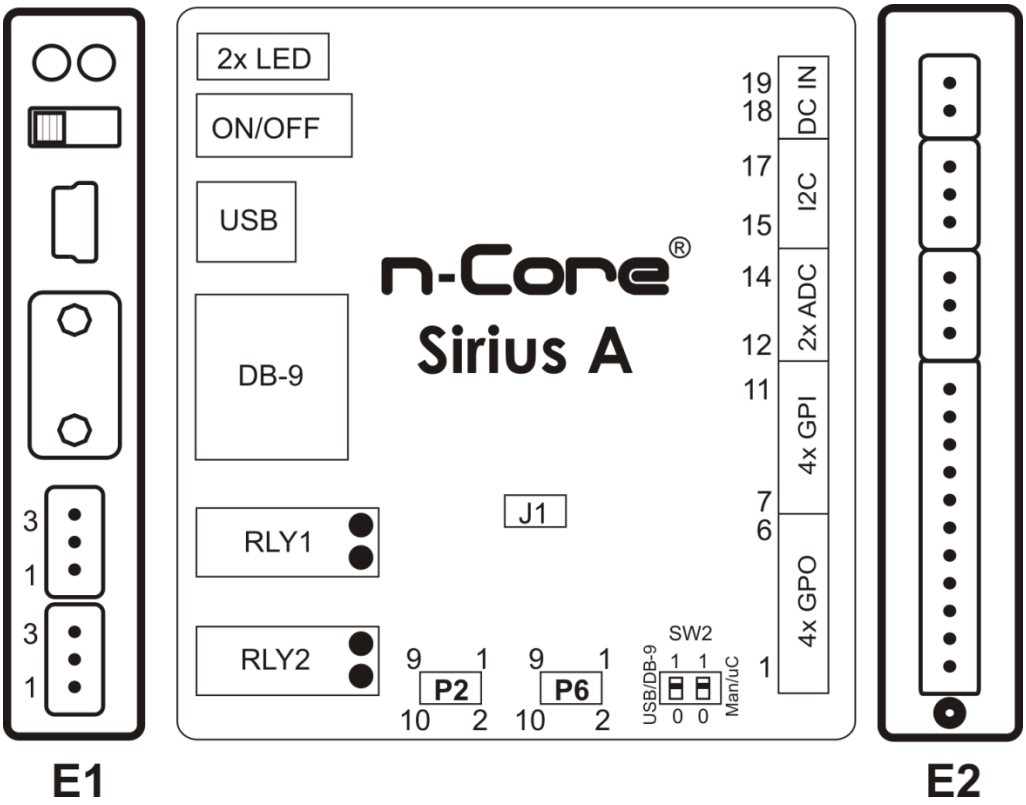
[2] Red Led Normal operation:

- Red led will turn on when the device has received some data over the air.
- Red led will turn off when the received data has been processed by the device.

[3] MMA8452Q Accelerometer.

1.2. Pinout

1.2.1. Sirius A



Block E2	
1	GPO_1
2	GPO_2
3	GPO_3
4	GPO_4
5	GPO_VCC_IN
6	GND
7	GND
8	GPI_1
9	GPI_2
10	GPI_3
11	GPI_4
12	ADC_2
13	ADC_1
14	GND
15	GND
16	I2C SDA
17	I2C SCL
18	5V IN
19	GND

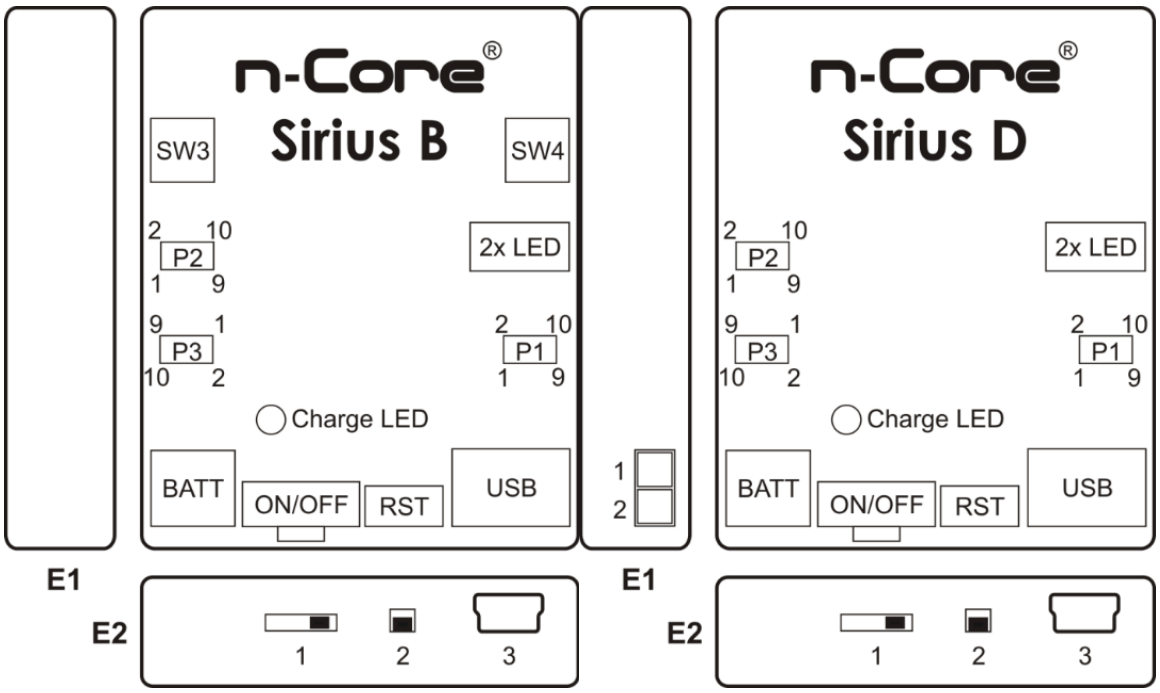
Block P2	
1	3.3 V output (*controlled*)
2	I2C SDA
3	SPI_CLK
4	I2C SCL
5	SPI_MOSI
6	ADC_3
7	SPI_MISO
8	3.3 V output (*permanent*)
9	3.3 V (*USB-dependent*)
10	GND

Block P6	
1	TCK
2	GND
3	TDO
4	3.3 V output (*permanent*)
5	TMS
6	RESET
7	N/C
8	N/C
9	TDI
10	GND

Block E1 (RLY1)	
1	COM
2	N.C.
3	N.O.

Block E1 (RLY2)	
1	COM.
2	N.C.
3	N.O.

1.2.2. Sirius B/D



Block P1 (JTAG)	
1	TCK
2	GND
3	TDO
4	VCC_OUT
5	TMS
6	RESET
7	N/C
8	N/C
9	TDI
10	GND

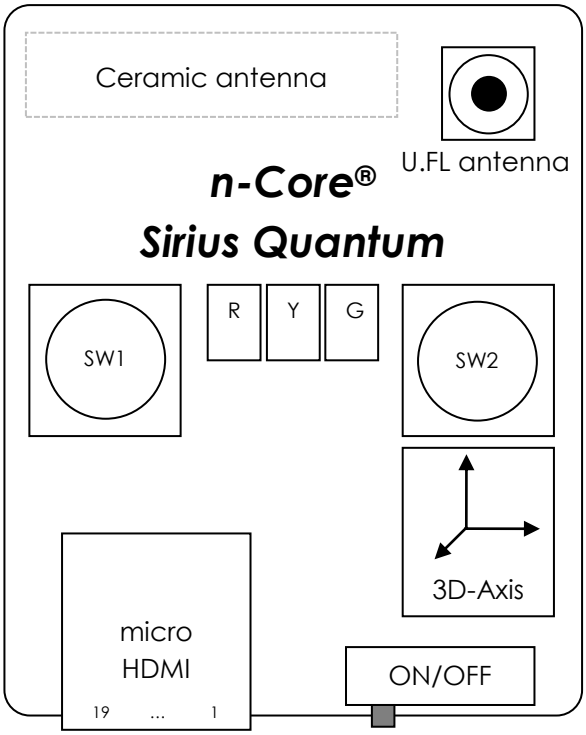
Block P2	
1	I2C_SCL
2	SPI_SCLK
3	I2C_SDA
4	SPI_MOSI
5	USART0_EXTCLK
6	SPI_MISO
7	USART0_TXD
8	USART0_RXD
9	N/C
10	GND

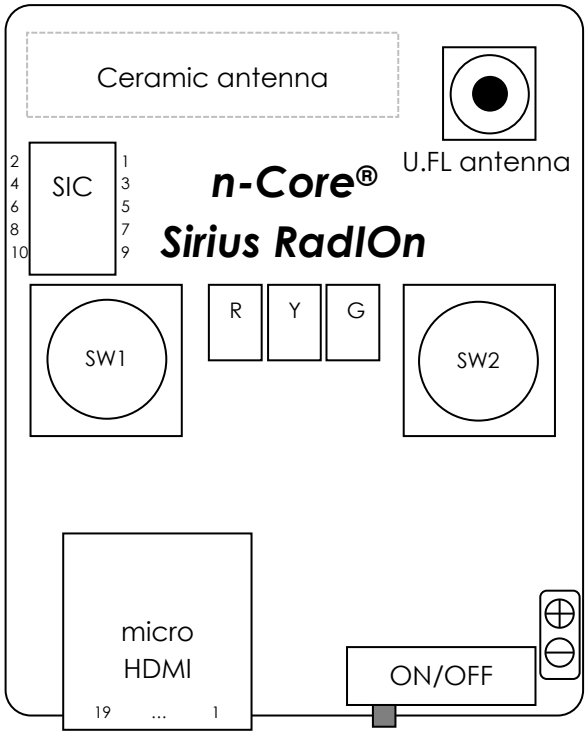
Block P3	
1	GPIO_6
2	GPIO_2
3	GPIO_7
4	GPIO_13
5	IRQ_6 (SW3)
6	GPIO_14
7	IRQ_7 (SW4)
8	GPIO_15
9	GND
10	GND

Block E1 (*Sirius D*)	
1	GND
2	VCC_IN

Block E2	
1	ON/OFF
2	RESET
3	USB

1.2.3. Sirius Quantum/RadIOn





	micro HDMI
1	RESET
2	UART TXD
3	JTAG TDI
4	UART RXD
5	JTAG TDO
6	SPI MISO
7	JTAG TMS
8	SPI MOSI
9	JTAG TCK
10	SPI CLK
11	ADC 1
12	UART CTS
13	VCC IN
14	UART RTS
15	GND
16	GPIO2
17	I2C SCL
18	GPIO1
19	I2C SDA

	SIC
1	I2C SCL
2	SPI SCLK
3	I2C SDA
4	SPI MOSI
5	VCC IN
6	SPI MISO
7	USART0 TXD
8	USART0 RXD
9	ADC 1
10	GND

2. Binary sensors (0/1)

2.1. GPI

Behavior for simple binary sensors, such as presence, open/close, buttons, bed sensors, etc.

Parameter	Value
Port Type	GPI_PORT
Address (Hex)	Digital input to which the sensor is connected. (e.g., 19)
Begin	0

2.2. IRQ

Parameter	Value
Port Type	IRQ_PORT
Address (Hex)	Digital input to which the sensor is connected. • 6 = left button in Sirius B • 7 = right button in Sirius B • 2= left button in Sirius Quantum/RadIOn • 3 = right button in Sirius Quantum/RadIOn
IRQ Guard Time	User defined (e.g., 1500)
IRQ Condition Type	LOW_LEVEL

Note: Addresses 0x19 (Sirius RadIOn), 0x21 and 0x22 (Sirius B/D) may be also used as GPI. In this cases, it is necessary to configure a polling behavior.

3. SHT25 (Temperature and Humidity)

SHT25 datasheet.

3.1. Temperature

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	40
Data Write (Hex)	e3
Data Read Length	3
Type	INT_16
Begin	0
Bitrate	125000
Polling Time	User defined (e.g., 1000)

The temperature (T) is calculated by inserting the temperature signal output (S_T) into the following formula (the result is in °C): $T = -46.85 + 175.72 \frac{S_T}{2^{16}}$

3.2. Humidity

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	40
Data Write (Hex)	e5
Data Read Length	3
Type	UINT_16
Begin	0
Bitrate	125000
Polling Time	User defined (e.g., 1000)

The relative humidity (R_H) is calculated by inserting the relative humidity signal output S_{RH} into the following formula (the result in %RH): $RH = -6 + 125\frac{S_{RH}}{2^{16}}$

4. TSL2561 (Light)

TSL2561 datasheet.

4.1. Step 1: initialization

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	29 or 39 (depending where the sensor is connected).
Data Write (Hex)	8003
Data Read Length	0
Type	DUMMY
Bitrate	62000
Polling Time	0

4.2. Step 2: read value

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	29
Data Write (Hex)	9c
Data Read Length	4
Type	BUFFER
Size	4
Begin	0
Bitrate	62000
Polling Time	User defined (e.g., 1000)

Note: To calculate the lux levels use the following function:

```
extern unsigned int CalculateLux(unsigned int iGain, unsigned int tInt, unsigned int
    ch0, unsigned int ch1, int iType)
```

where:

- iGain = 0
- tInt = 400
- iType = 1

In channel0 (ch0) and channel1 (ch1) you should enter bytes 0 and 1 as uint16 and bytes 2 and 3 as uint16 respectively.

5. TSL257LF (Light)

TSL257LF datasheet.

Parameter	Value
Port Type	ADC_PORT
Address (Hex)	2 (ADC port to which the sensor is connected)
Data Read Length	2
Type	BUFFER
Size	2
Begin	0
Sample Rate	9600
Bits per Sample	10
Polling Time	User defined (e.g., 1000)

6. MMA8452Q (Accelerometer)

MMA8452Q datasheet.

6.1. Step 1: change the resolution to 8g

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	1c
I2C Int. Address (Hex)	0E
Data Write (Hex)	0->2G 1->4G 2->8G
Data Read Length	1
Type	Buffer
Bit Rate	125000
Polling Time	0

6.2. Step 2: change from standby to active mode

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	1c
I2C Int. Address (Hex)	2A
Data Write (Hex)	01
Data Read Length	0

Type	DUMMY
Bit Rate	125000
Polling Time	0

Note: This behavior puts the sensor in active mode.

6.3. Step 2: read value

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	1c
I2C Int. Address (Hex)	01
Data Read Length	6
Type	BUFFER
Size	6
Begin	0
Bit Rate	125000
Polling Time	User defined (e.g., 1000)

Note: X, Y, Z. 12 bits per axis (2 bytes).

7. HMC6352 Compass

HMC6352 datasheet.

7.1. Step 1: initialization

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	21
Data Write (Hex)	474e00
Data Read Length	0
Type	DUMMY
Bit Rate	125000
Polling Time	0

7.2. Step 2: read Value

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	21
Data Write (Hex)	41
Data Read Length	2
Type	BUFFER
Size	2
Bit Rate	125000
Polling Time	User defined (e.g., 1000)

8. Nunchuk

Nunchuk datasheet.

8.1. Step 1: first initialization

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	52
Data Write (Hex)	f055fb004000
Data Read Length	0
Type	DUMMY
Bit Rate	62000
Polling Time	0

8.2. Step 2: second initialization

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	52
Data Write (Hex)	00
Data Read Length	0
Type	DUMMY
Bit Rate	62000
Polling Time	User defined (e.g., 1000)

8.3. Step 3: read value

Parameter	Value
Port Type	I2C_PORT
Address (Hex)	52
Data Read Length	6
Type	BUFFER
Size	6
Begin	0
Bit Rate	62000
Polling Time	User defined (e.g., 1000)

9. Potentiomenter 10k

Parameter	Value
Port Type	ADC_PORT
Address (Hex)	2
Data Read Length	2
Type	BUFFER
Size	2

Begin	0
Bit Rate	9600
Bits per Sample	10
Polling Time	User defined (e.g., 1000)

10. Battery

Parameter	Value
Port Type	BATT_PORT
Begin	0
Polling Time	User defined (e.g., 1000)

11. Sirius A Relays

Note: Relay 1 = 0x1D; Relay 2 = 0x08.

Note: "Data Write" = 1 (ON); "Data Write" = 0 (OFF), "Data Write" = 2 (toggle).

11.1. Relay 1

Parameter	Value
Port Type	GPO_PORT
Address (Hex)	1d
Data Write (Hex)	1 (ON); 0 (OFF); 2 (toggle)
Polling Time	0

11.2. Relay 2

Parameter	Value
Port Type	GPO_PORT
Address (Hex)	08
Data Write (Hex)	1 (ON); 0 (OFF); 2 (toggle)
Polling Time	0

12. Binary actuators (0/1)

Parameter	Value
Port Type	GPO_PORT
Address (Hex)	GPO where the actuator is connected
Data Write (Hex)	1 (ON); 0 (OFF); 2 (toggle)
Polling Time	0

13. Rules (Examples)

13.1. Example 1: Pushing left button on Sirius B → ON/OFF Relay 2 on Sirius A

The rule is composed of two behaviors:

- Firs Behavior: pressing the button launches an interruption.
- Second Behavior: the interruption sends a toggle to the relay.

There are three nodes in the network:

- Coordinator (Sirius D): NodeId 0
- Tag (Sirius B): NodeId 50075
- Router (Sirius A): NodeId 50

Step 1: define the first behavior.

Parameter	Value
Device	50075
Port Type	IRQ_PORT
Address	6
IRQ Guard Time	1500
IRQ Condition Type	LOW_LEVEL

Step 2: define the second behavior.

Parameter	Value
Device	50
Port Type	GPO_PORT
Address	8
Data Write	2

13.2. Example 2: Temperature over XX°C → ON/OFF Relay 1 on Sirius A

The rule is composed of two behaviors:

- First Behavior: the temperature exceeds the threshold.
- Second Behavior: sends a toggle to relay.

Use the temperature signal output (S_T) into the formula (See Section 3.1). S_T is a decimal number, therefore the value must be translated to a hexadecimal value:

$$S_T = \frac{T + 46.85}{175.72} \times 2^{16}$$

For example:

- Value Comp. = 30°C
- $S_T = \frac{30+46.85}{175.72} \times 2^{16} = 28661{,}74 \sim 28662$
- ST(Hex) = 6FF6

There are three nodes in the network:

- Coordinator (Sirius D): NodeId 0
- Router (Sirius D): NodeId 50020
- Router (Sirius A): NodeId 50

Step 1: define the first behavior.

Parameter	Value
Device	50020
Port Type	I2C_PORT
Address	40
Data Write	e3
Type	INT_16
Begin	0
Condition	>=
Type Comp.	INT_16
Value Comp.	6FF6
Bit Rate	125000
Polling Time	1000

Step 2: define the second behavior.

Parameter	Value
Device	50
Port Type	GPO_PORT
Address	1d
Data Write	2

13.3. Example 3: Acceleration exceeding the Z axis threshold → ON/OFF Relay 1 on Sirius A

The rule is composed of two behaviors:

- Firs Behavior: the acceleration in the Z axis exceeds the threshold.
- Second Behavior: sends a toggle to relay.

This example uses only one byte per axis (the resolution is 8 bits). By default, the MMA8452Q range is 2g.

Multiply the read value (1 byte) by 15.6mg to obtain a "real" value (mg). This example uses 1500mg as threshold. Then, 1500mg/15.6mg = 96 (60 hex).

There are three nodes in the network:

- Coordinator (Sirius D): NodeId 0
- Router (Sirius D): NodeId 50020
- Router (Sirius A): NodeId 50

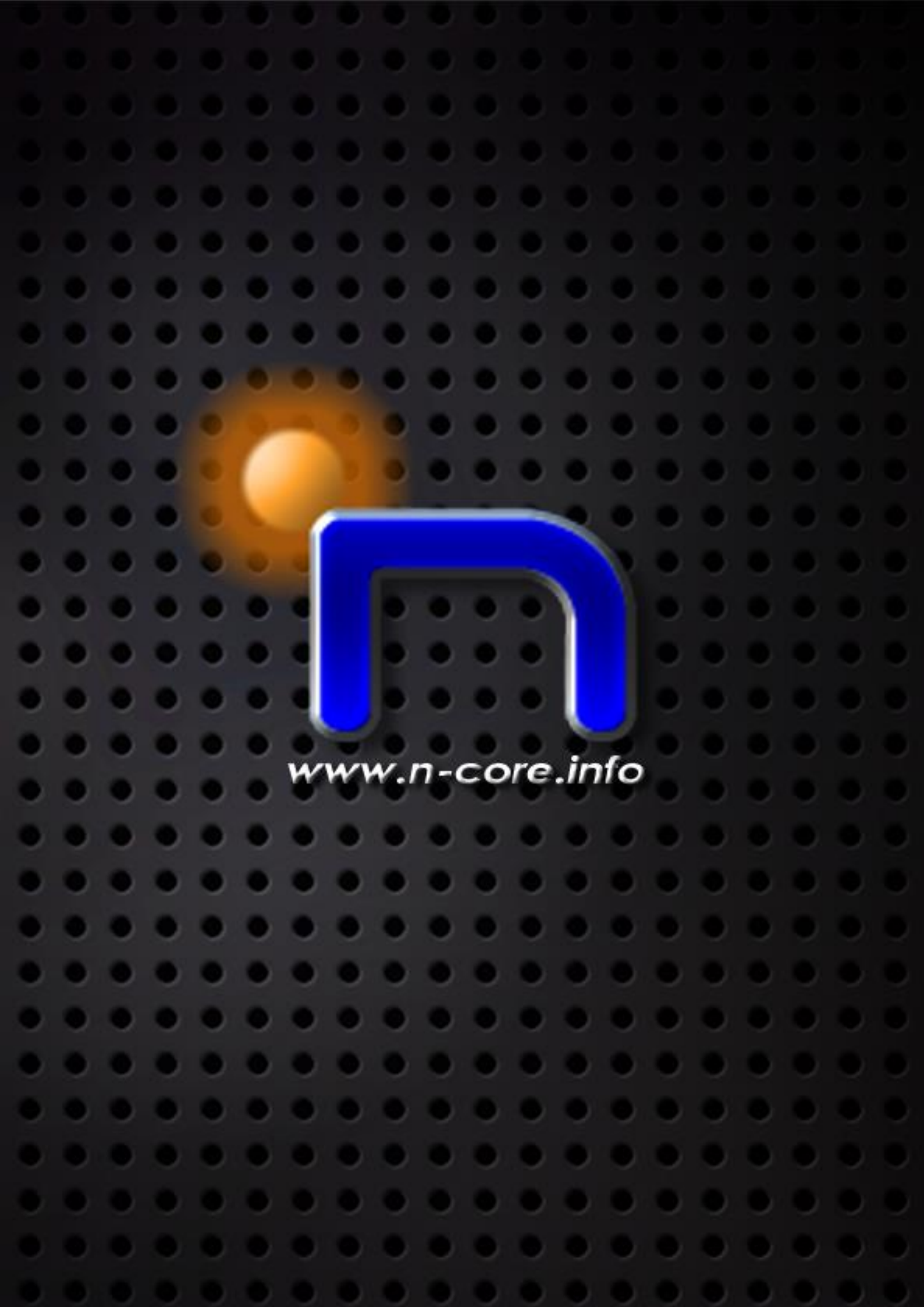
Step 1: define the first behavior.

Parameter	Value
Device	50075
Port Type	I2C_PORT
Address	1c

I2C Int. Address	01
Data Read Length	6
Type	BUFFER
Size	1
Begin	4
Condition	>=
Type Comp.	BUFFER
Value Comp.	60
Bit Rate	125000
Polling Time	0

Step 2: define the second behavior.

Parameter	Value
Device	50
Port Type	GPO_PORT
Address	1d
Data Write	2


www.n-core.info