CCS Technical Documentation
NHL-2NA Series Transceivers

User Interface

Issue 1 07/02

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User Interface

NHL-2NA user interface appearance is described below in fig.1. It comprises LG4 module and assembly parts.

UI Module features

- 16-gray scale by PWM, 4096-color is available.
- Backlight unit is provided, so the display can be used in both reflective mode and transmissive mode.
- Direct data display by display data RAM (normally-white LCD)
  RAM bit data "1111" . . . OFF (minimum voltage) Red, green, blue
  "0000" . . . ON (maximum voltage) Black (in the normal display mode)
- Partial display function
  power saving by pausing display process on part of the screen.
- Built-in RAM capacity 4 x 648 x 240 = 622,080 bits.
- MPU interface.
  Directly connectable to an 8-bit parallel MPU, both 80 and 68 series
- A host of command functions (area scrolling, automatic page & column incrementing, and power controlling functions).
- Embedded oscillating circuit.
- User interface keys are provided.

Table 1: Basic specifications

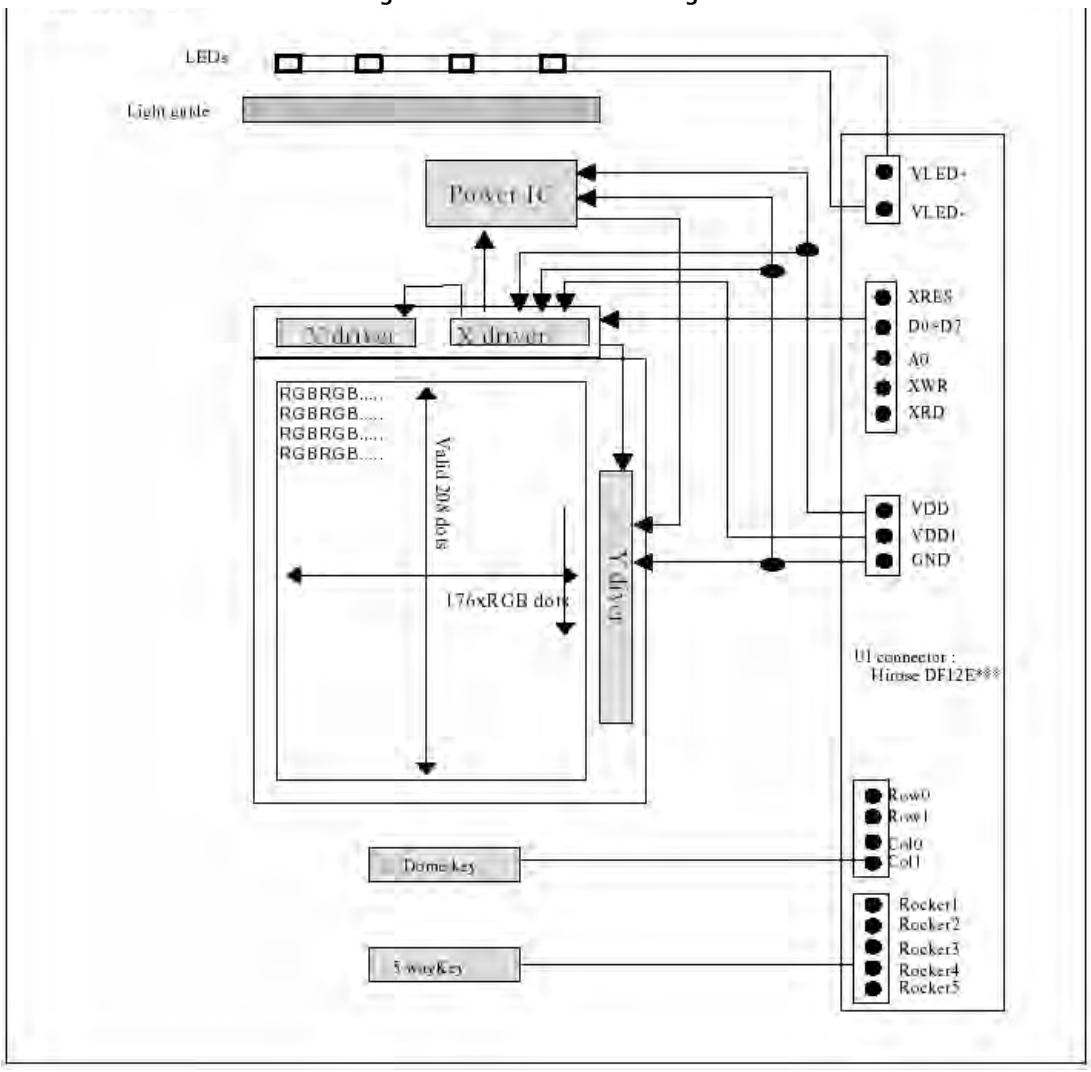
No.	Item	Specifications
1	Outline dimensions (UI module)	48.55 (W) x 79.44 (H) x 6.03 (D) mm (Excluding projections and FPC)
2	Weight	17.5 g (UI module)
3	Screen dimensions	34.86mm(W) x 41.18mm(H)
4	Display format	176 x RGB (W) x 208 (H)
5	Dot pitch size	66µm (W) x 198µm (H)
6	Color dot layout	Stripe
7	Contrast max direction	7 o'clock (Transmissive) 2 o'clock (Reflective)
8	Polarizer direction	1.5 o'clock
9	Image reversal direction	4 o'clock
10	LCD mode	R-TN, Normally white (Transflective type)
11	Polarizers	Hard coated anti-reflective type
12	Polarizer hardness	2H

Figure 1: NHL-2NA user interface

User Interface Module

UI Module comprises LCD, LCD drivers, LCD powering, LED backlightning, 5 way joystick, transceiver keyboard and voice key.

Figure 2: UI module block diagram



I/O Terminals

Table 2: UI connector

Terminal No.	Terminal Name	Function	I/O	Remarks
1	VDD	Power voltage	I	
2	GND	Ground	I	
3	D4	Command/data I/O terminal	I/O	
4	D0	Command/data I/O terminal	I/O	
5	A0	Command/data identification signal input	I	"L" command/"H" data
6	GND	Ground	I	
7	VDDI	Power voltage	I	
8	D1	Command/data I/O terminal	I/O	
9	D2	Command/data I/O terminal	I/O	
10	D3	Command/data I/O terminal	I/O	
11	Rocker3	5 way key	I	
12	Rocker2	5 way key	I	
13	GND-K	5 way key Ground	I	
14	Rocker5	5 way key	I	
15	Rocker4	5 way key	I	
16	Rocker1	5 way key	I	
17	VLED+	LED positive	I	
18	VLED-	LED negative	I	
19	Row1	Dome key	I	
20	Row0	Dome key	I	
21	Col1	Dome key	I	
22	Col0	Dome key	I	
23	GND	Ground	I	
24	XRES	Initial reset signal	I	"L" active
25	D5	Command/data I/O terminal	I/O	
26	D6	Command/data I/O terminal	I/O	
27	D7	Command/data I/O terminal	I/O	
28	GND	Ground	I	
29	XRD	Read signal	I	"L" active
30	XWR	Write signal	I	"L" active

Sub-modules of User Interface

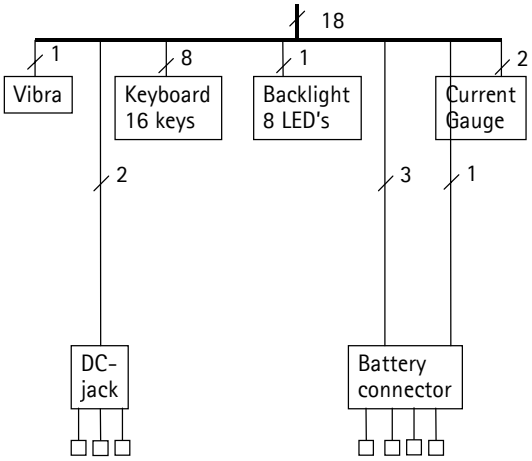
User Interface electronics comprises the following:

Grip module

Grip module includes the keyboard with its PWB and backlight, the vibrator.

Battery is also included in this module

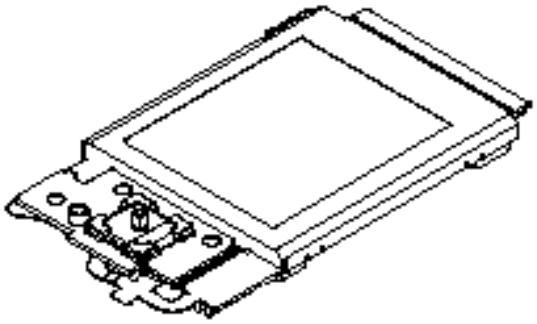
Figure 3: Grip module



LCD module

UI Module is an entity containing the display module, backlighting, 5 way navigation key and transceiver keys.

Figure 4: LCD Module



Absolute Maximum Ratings

Table 3: Absolute maximum ratings

Item	Symbol	Rating	Unit	Terminal
Power supply voltage	V_{DD}	0 ~ +3.3	V	VDD
	V_{DDI}	0 ~ +3.3	V	VDDI
Signal input voltage	V_{IN}	0 ~ V_{DDI}+0.3	V	D0~D7
Signal output voltage	V_{OUT}	0 ~ V_{DDI}+0.5	V	D0~D7, A0, XRES, XRD, XWR
LED input voltage	V_{LED}	6	V	Between VLED+ and VLED-
Operating temperature range	T_{OP}	-20 ~ 70	C	No dew condensation
		-30~-20	C	No dew condensation Reduced optical performance
Storage temperature range	T_{ST}	-40 ~ 85	C	No dew condensation

Note: values respect to UI module GND

DC Characteristics

UI connector is the connector between the UI module and NMP PWB.

Table 4: UI-connector DC characteristics

Pin no.	Signal name	Type	Min	Typical	Max	Unit	Description
1	VDD	IN	2.6	2.78	2.9	V	Voltage supply
2	GND			0		V	System ground
3	D4	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
		OUT	H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
4	D0	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
		OUT	H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
5	A0	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	H: data L: command
6	GND			0		V	System ground
7	VDDI	IN	1.65	1.8	1.95	V	Logic voltage supply

8	D1	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
		OUT	H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
9	D2	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
		OUT	H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
10	D3	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
		OUT	H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
11	Rocker3			200		mOhm	
12	Rocker2			200		mOhm	
13	GND			0		V	System ground
14	Rocker5			200		mOhm	
15	Rocker4			200		mOhm	
16	Rocker1			200		mOhm	
17	V_{LED}+	IN/ OUT		4.5		V	LED, positive terminal
18	V_{LED}-	IN/ OUT	0	0	Vbat	V	LED, negative terminal
19	Row1	IN/ OUT			1	Ohm	Tracking resistance
					1	mA	Drive current
20	Row0	IN/ OUT			1	Ohm	Tracking resistance
					1	mA	Drive current
					1	mA	Drive current
21	Col1	IN/ OUT			1	Ohm	Tracking resistance
					1	mA	Drive current
22	Col0	IN/ OUT			1	Ohm	Tracking resistance
					1	mA	Drive current
23	GND			0		V	System ground
24	RESX	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Reset (active low)

25	D5	IN OUT	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
			H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
26	D6	IN OUT	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
			H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
27	D7	IN OUT	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI	V	Data to write
			H: 0.8xVDDI L: 0		H: VDDI L: 0.2 x VDDI	V	Data to read
28	GND			0			System ground
29	RDX	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI		L: read (active low)
30	WRX	IN	H: 0.7xVDDI L: 0		H: VDDI L: 0.3xVDDI		L: Write (active low)

AC Characteristics of the Display

Signal timings are shown in Figure 7. Read/write characteristics and Table 10. AC characteristics. All the characteristics in this chapter are specified for the whole UI module, including the UI-FPC.

Notes: Rise and fall time must be within 20 ns. Timings of T_{ACC8} and T_{OH8} are according to 20% and 80% VDDI-GND. Other timings are according to 30% and 70% of VDDI-GND. t_{CCLW} and t_{CCLR} are specified according to overlapping of low level periods of CSX and WRX (RDX).

Definitions to rise and fall times as described in Figure 8. Rise and fall time in input and output and Rise and fall times in input and output of display driver.

Figure 5: Rise and fall time in input and output

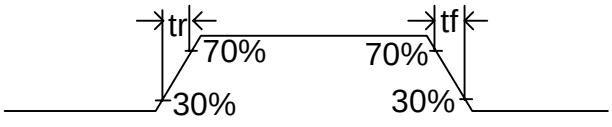


Table 5: Rise and fall times in input and output of display driver

Parameter	Symbol	Min	Max	Unit
Input	tr, tf		20	ns
Output	tr, tf		20	ns

Display Functional Specification

Displayed Data

Pixel and dot ordering in parallel transfer from engine to display is shown in Figure 9. Pixel and dot order in transfer. Three bytes (RG, BR and BG) are needed to send data of two pixels, as data of one pixel is 12 bits. Corresponding order in panel is shown in Figure 10. Pixel data order in display panel.

Reset Timing

Reset timing characteristics are shown in Figure 11. Reset timing and Reset timing. All the characteristics in this chapter are specified for the whole UI module, including the UI-FPC.

Table 6: Reset timing

Signal	Symbol	Parameter	Min	Max	Unit
RESX	TRW	Reset pulse duration	200		ns
	TRT	Reset cancel	1200		ns

Transceiver keyboard

The transceiver keyboard Interface requires 4 programmable I/O pins. The transceiver keyboard interface can be connected to Nokia Engine with these 2 + 2 I/O-pins. T

Key	Description
Key1	Left_Soft_Key
Key2	Right_Soft_Key
Key3	Apps Key
Key4	Side Key

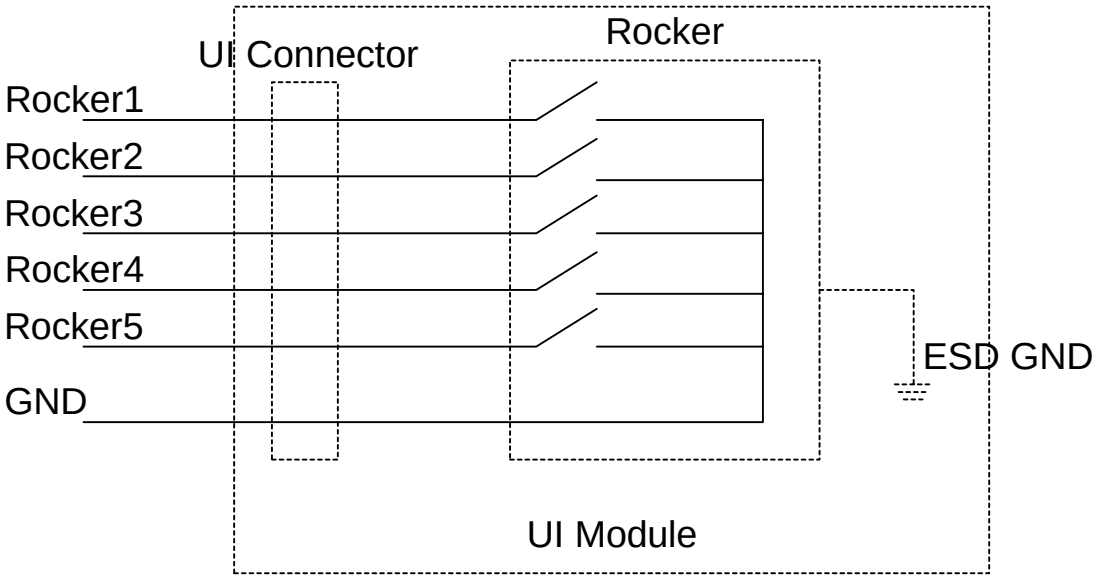
Rocker key

The rocker key is a replaceable part.

Rocker interface

Rocker is connected to general purpose IOs that have internal pull ups. Pull up voltage is 1.8V.

Figure 6: Electrical interface of the rocker



Rocker is operated as a switch in an ideal case. In reality more than two pins can be connected to ground with one move.

Figure 7: Rocker switch 2

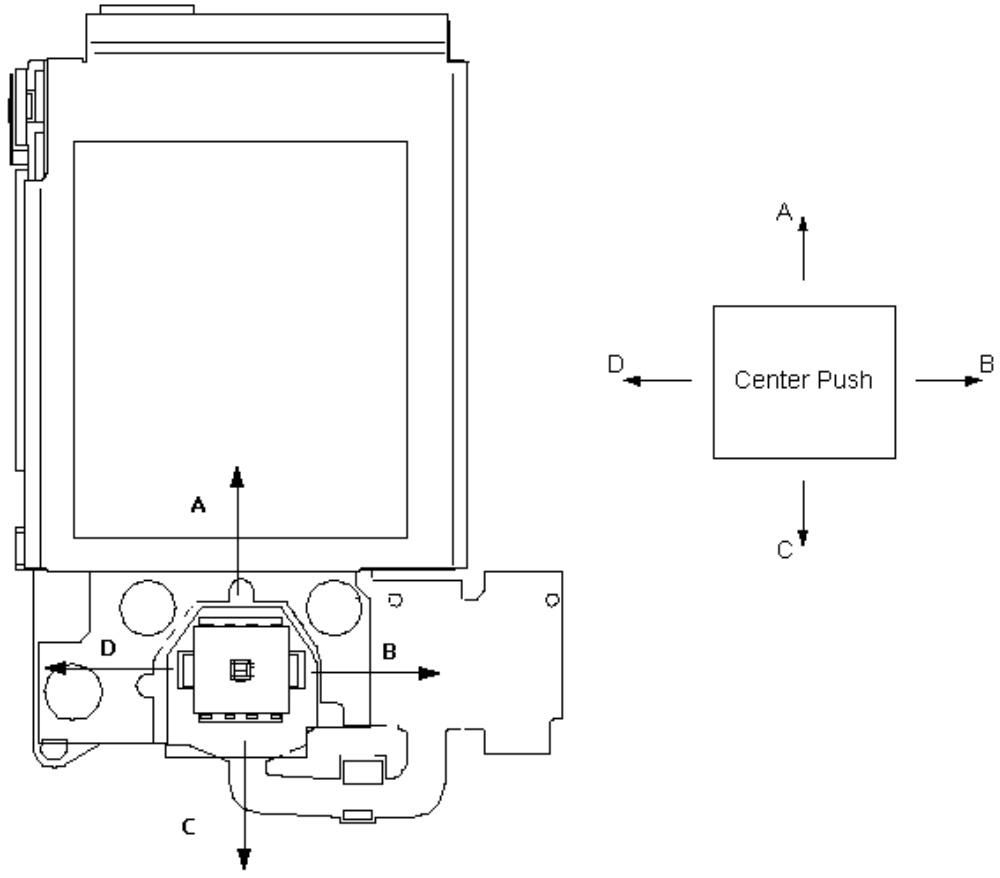


Table 7: Switching order of the terminals

Leaning direction	Terminal number					
	1	2	3	4	5	Com
A				*		*
B	*					*
C		*				*
D			*			*
Center push					*	*