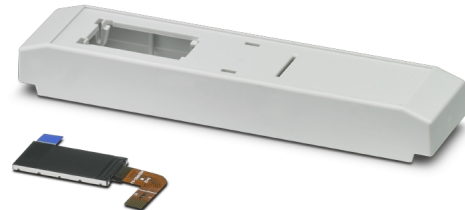


ICS25-C100(122)X12-DKP-7035

Upper housing part with industrial-grade display for control cabinet applications



Data sheet
109941_en_00

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1 Description

The display is suitable for stationary ICS series electronics housing applications.

Use the display and a membrane keypad to implement display and operating solutions with a screen size of 0.96 inches.

- High-contrast TFT color display
- Can be used in temperature ranges from -20°C to +70°C
- Integrated in ICS series electronics housings
- Membrane keypad that is tailored to the upper housing part and display

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This document is valid for the products listed in Section “Ordering data” on page 2.

2 Ordering data

Display

Description	Type	Order No.	Pcs./Pkt.
Upper housing part with 0.96 inch display , for ICS25 series housings, height: 100 mm, depth: 12 mm, color: similar to RAL 7035 (light gray)	ICS25-C100X12-DKP-7035	1215686	10
Upper housing part with 0.96 inch display , for ICS25 series housings, height: 122 mm, depth: 12 mm, color: similar to RAL 7035 (light gray)	ICS25-C122X12-DKP-7035	1215685	10


Accessories


Description	Type	Order No.	Pcs./Pkt.
Membrane keypad for ICS25-C100X12-DKP-7035	KP ICS25X100 K4 C3 P5	1215683	10
Membrane keypad for ICS25-C122X12-DKP-7035	KP ICS25X122 K4 C3 P5	1215684	10

3 Technical data

3.1 General data

Display data	
Display	2.44 cm / 0.96"
Panel technology	IPS-TFT
Screen resolution	80 x 160 pixels
Backlight	LED, white
Dot pitch	0.135 mm x 0.1356 mm
Controller	ST7735S
Interface	4-wire SPI half duplex
Weight	33 g
Dimensions	
Dimensions of the module (W x H x D)	13.5 mm x 27.95 mm x 1.5 mm
Active area (W x H)	10.8 mm x 21.7 mm
Ambient conditions	
Ambient temperature (operation)	-20°C ... +70°C
Ambient temperature (storage)	-30°C ... +80°C

 The background color may vary slightly depending on the ambient temperature. This procedure can be reversed.

 **NOTE: Electrostatic discharge**
Electrostatic discharge can damage or destroy components. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

3.2 Maximum electrical values

- i** In this specification, all voltages are in reference to ground (GND).
Permanent damage will be caused to the device if the maximum values are exceeded. Furthermore, this device may not function properly at the maximum values.

These are only load values:

Description		Min.	Max.
Logic power supply	V_{CC}	-0.3 V	4.6 V
Input voltage	V_I	-0.3 V	$V_{CC} + 0.3 V$

3.3 Electrical properties (operation)

- i** Correct operation of the device is only ensured in accordance with the specifications provided in the table.

At an ambient temperature of +25°C

Condition		Min.	Typ.	Max.
Logic power supply				
V_{CC}		2.5 V	2.8 V	3.3 V
Input voltage				
V_{IH}	High level	$0.8 \times V_{CC}$	-	$1 \times V_{CC}$
V_{IL}	Low level	GND	-	$0.2 \times V_{CC}$
Logic current consumption				
I_{CC}	$V_{CC} = 2.8 V$	-	2 mA	3 mA

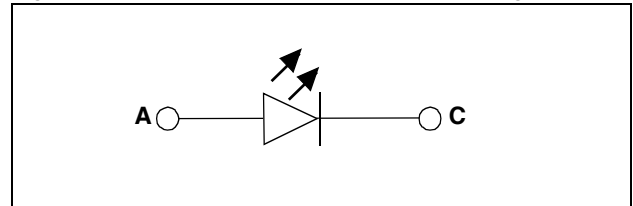
3.4 LED backlight

Electrical data

At an ambient temperature of +25°C

Description	
Conducting-state voltage V_{AC}	2.7 V ... 3.3 V, typical 3.0 V
Conducting-state current I_{AC}	15 mA ... 30 mA, typical 20 mA

Figure 1 Connection scheme for LED backlight



4 Optical characteristics

At an ambient temperature of +25°C

Description	Condition	Typical
Viewing angle Θ ($Cr \geq 10$)	$\varphi = 0^\circ$	80°
	$\varphi = 180^\circ$	80°
	$\varphi = 90^\circ$	80°
	$\varphi = 270^\circ$	80°
Contrast ratio Cr	-	800
Response time T_f, T_r	Maximum 40 ms Typical 30 ms	
Surface luminance L_l , at $I_{AC} = 20$ mA	Minimum 350 cd/m ² Typical 400 cd/m ²	

Figure 2 Definition of the viewing angle $\Theta(\varphi)$

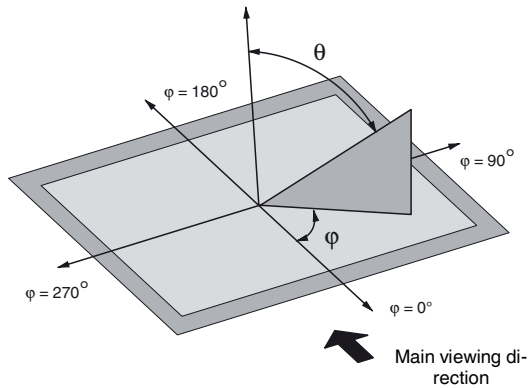


Figure 3 Definition of the contrast ratio Cr (positive type)

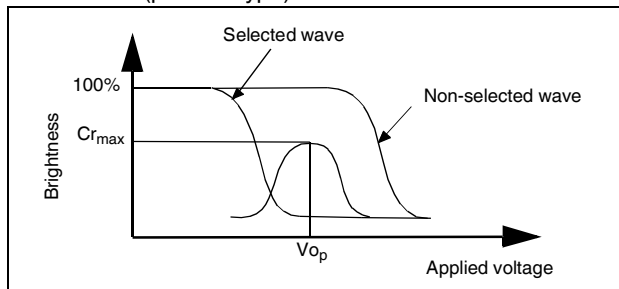


Figure 4 Definition of the contrast ratio Cr (negative type)

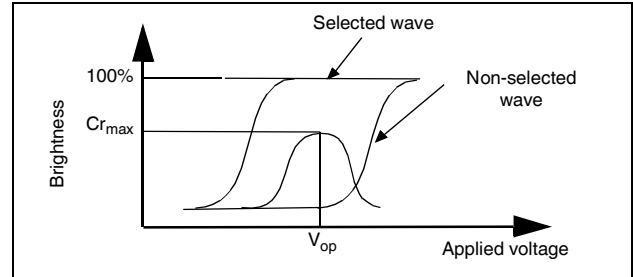


Figure 5 Definition of the response time T_r, T_f (positive type)

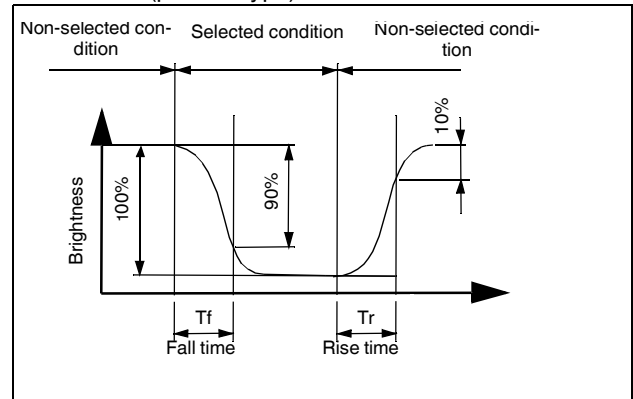
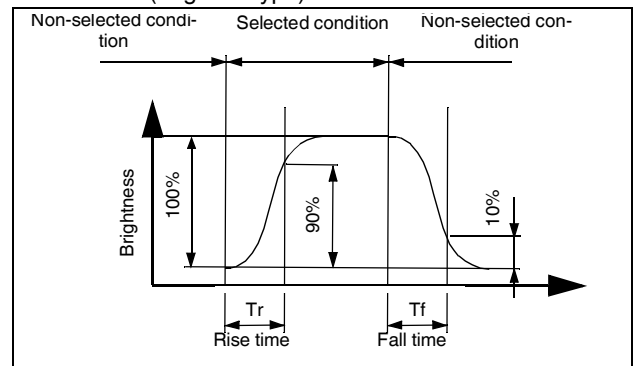
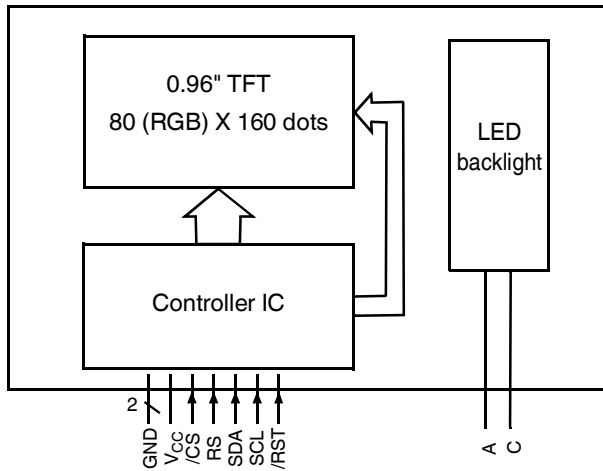


Figure 6 Definition of the response time T_r, T_f (negative type)



5 Display

Figure 7 Block diagram with connecting contacts



Description of the LCD interface

Connection method: FPC connector, 10-pos., pitch: 0.5 mm (FPC UL number: E497910)

Symbol	Pin	I/O	Function
GND	1	PWR	Ground
SCL	2	I	Serial clock
/RST	3	I	Reset input
/CS	4	I	Chip selection
SDA	5	I	Serial data
RS	6	I	Register selection: "L" $\hat{=}$ command data "H" $\hat{=}$ parameter data
V _{CC}	7	PWR	Logic power supply
GND	8	PWR	Ground
C	9	PWR	LED backlight, cathode
A	10	PWR	LED backlight, anode

6 Timing properties

i Observe the specifications for the HX8347I controller block.

7 Reliability test

Test conditions

No.	Task	Condition	
1.	Ambient temperature (storage), maximum	+80°C	96 h
2.	Ambient temperature (storage), minimum	-30°C	96 h
3.	Humidity (storage)	90% RH (+60°C)	96 h
4.	Ambient temperature (operation), maximum	+70°C	96 h
5.	Ambient temperature (operation), minimum	-20°C	96 h
6.	Vibration	Duration: 2 h; 10 Hz ... 150 Hz; Acceleration 100 m/s ²	
7.	Thermal shock	5 cycles (1 cycle = 30 min at -30°C, 30 min at +80°C)	

i After the reliability test, only the function is confirmed. The image properties will only be achieved again after a sufficiently long rest period of at least two hours at room temperature.

8 Software

The TFT/LCM must be initialized prior to use. For detailed information on the register and timing features, refer to specification IC ST7789V.

Recommended initialization:

```
Init_TFT( void ) {
    RESET=1; // set reset pin to high
    Delay(10); // delay 10ms
    RESET=0; // set reset pin to low
    Delay(10); // delay 10ms
    RESET=0; // set reset pin to high
    Delay(120); // delay 120ms

    SPI_Tx_Command(0x11); // Sleep out
    Delay(120); // delay 120ms
    SPI_Tx_Command(0xB1); // set frame rate in normal mode
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);

    SPI_Tx_Command(0xB2); // set frame rate in idle mode
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);

    SPI_Tx_Command(0xB3); // set frame rate in partial mode
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);

    SPI_Tx_Command(0xB4); // set display inversion options
    SPI_Tx_Parameter(0x03);
    SPI_Tx_Parameter(0x02);

    SPI_Tx_Command(0xC0); // set power control 1
    SPI_Tx_Parameter(0xA4);
    SPI_Tx_Parameter(0x04);
    SPI_Tx_Parameter(0x84);

    SPI_Tx_Command(0xC1); // set power control 2
    SPI_Tx_Parameter(0x05);

    SPI_Tx_Command(0xC2); // set power control 3
    SPI_Tx_Parameter(0x0D);
    SPI_Tx_Parameter(0x00);

    SPI_Tx_Command(0xC3); // set power control 4
    SPI_Tx_Parameter(0x8D);
    SPI_Tx_Parameter(0x6A);

    SPI_Tx_Command(0xC4); // set power control 5
    SPI_Tx_Parameter(0x8D);
    SPI_Tx_Parameter(0xEE);
}
```

```
SPI_Tx_Command(0xC5); // set power VCOM
SPI_Tx_Parameter(0x1D);

SPI_Tx_Command(0xE0); // set positive gamma
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x0E);
SPI_Tx_Parameter(0x08);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x10);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x02);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x09);
SPI_Tx_Parameter(0x0F);
SPI_Tx_Parameter(0x25);
SPI_Tx_Parameter(0x36);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x08);
SPI_Tx_Parameter(0x04);
SPI_Tx_Parameter(0x10);

SPI_Tx_Command(0xE1); // set negative gamma
SPI_Tx_Parameter(0x0A);
SPI_Tx_Parameter(0x0D);
SPI_Tx_Parameter(0x08);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x0F);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x02);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x09);
SPI_Tx_Parameter(0x0F);
SPI_Tx_Parameter(0x25);
SPI_Tx_Parameter(0x35);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x09);
SPI_Tx_Parameter(0x04);
SPI_Tx_Parameter(0x10);

SPI_Tx_Command(0xFC); // set frequency for gate pump
SPI_Tx_Parameter(0x80);

SPI_Tx_Command(0x2A); // set column address (full colums)
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x1A);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x69);

SPI_Tx_Command(0x2B); // set page address (full pages)
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x01);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0xA0);

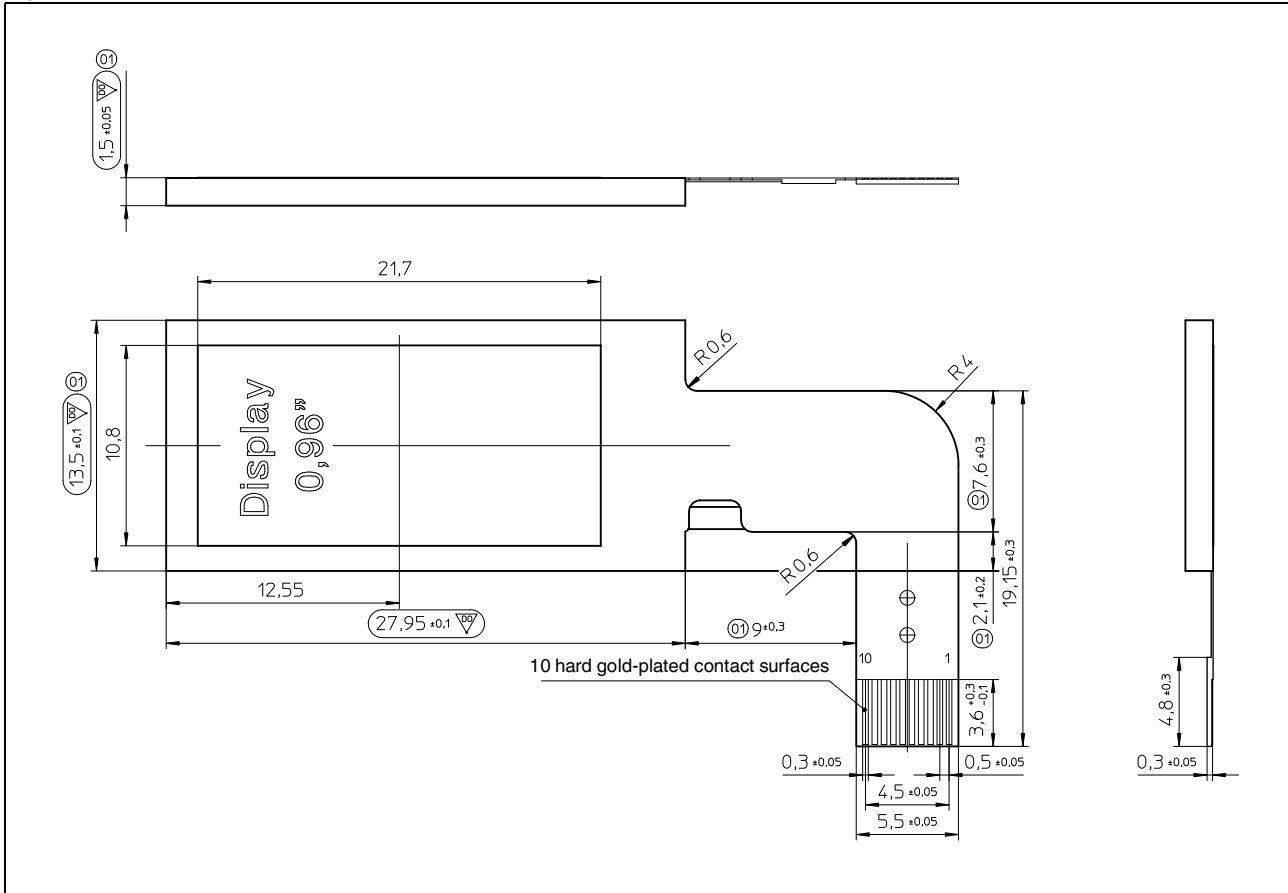
SPI_Tx_Command(0xF0);
SPI_Tx_Parameter(0x11);

SPI_Tx_Command(0xD6);
SPI_Tx_Parameter(0xCB);
```

```
SPI_Tx_Command(0x3A);  
SPI_Tx_Parameter(0x05);  
  
SPI_Tx_Command(0x36); // set interface pixel format  
SPI_Tx_Parameter(0x08);  
  
SPI_Tx_Command(0x21); // set display inversion on  
  
SPI_Tx_Command(0x29); // turn display on  
}
```


9 Dimensional drawings

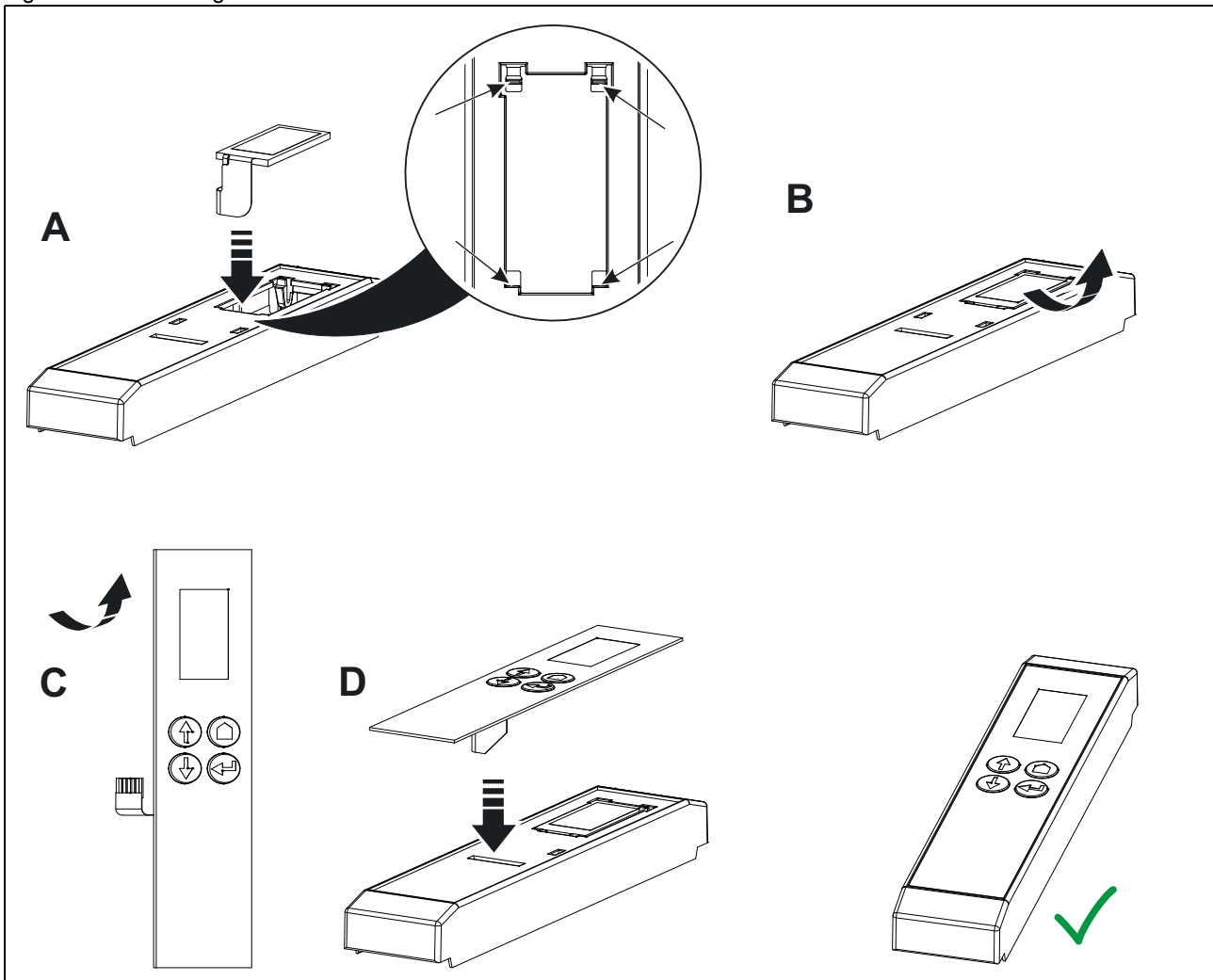
Figure 8 Dimensions



Pin	Symbol
1	GND
2	SCL
3	/RST
4	/CS
5	SDA
6	RS
7	V _{CC}
8	GND
9	C
10	A

10 Mounting the display and membrane keypad

Figure 9 Mounting



Mounting

- Feed the flat-ribbon cable from the display through the cutout on the upper housing part (A). Pay attention to the seating and contact surfaces of the display.
 - Insert the display from above.
 - Remove the foil from the display (B).
 - Remove the foil from the back of the membrane keypad (C). The foil is designed for easy removal. The foil is interrupted on the left side at the height of the opening for the display.
 - Feed the flat-ribbon cable of the membrane keypad through the slot on the upper housing part (D).
- ⚠ **NOTE:** The flat-ribbon cable must not become deformed. Make sure that it is not bent.
- Adhere the membrane keypad so that it is centered in the recessed area of the upper housing part. ⓘ Attach the long side of the membrane keypad. Make sure that the display remains in position.