



USEC312SBLUSN

31.2" E-paper Display with
Unisystem`s Controller



SPECIFICATIONS

Revision Record

Rev No.	Rev Date		Author	Remarks
1.0	02.09.2020	Documentation Release	B. Soczyński	-
1.1	24.11.2020	Change in PN and adding power consumption	P.Dominik, B.Soczyński	-
1.2	11.02.2021	Mode description, drawing update	P.Dominik	-

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1. General Description

USEC312SBLUSN is a comprehensive solution consisting of assembled Electronic Paper Display (EPD) and Unisystem's EPD Controller. It ensures easy implementation of the module in the final product and facilitates EPD image handling. The display has 31.2" active area with 2560x1440 pixels and can show content with 2, 4, 8, and 16 gray levels (1 to 4 bits). The Unisystem's EPD Controller supports both partial changes of the displayed image and flashless mode. The controller enables communication via USB and SPI interfaces.

Size (inch)	31.2
Resolution (Pixel)	2560 (H) x 1440 (V)
Controller Interface	USB, SPI
Active Area (mm)	691.2 (H) x 388.8 (V)
Grayscale Levels	2 to 16
EPD Outline Dimensions (mm)	697.2 (H) x 402.8 (V) x 0.805 (D)
Pixel Pitch (mm)	0.27
Driving Board Outline Dimensions (mm)	400 (H) x 75 (V)
Operating temp. (°C)	-15 to +65
Storage temp. (°C)	-25 to +70

3. Driving Board Block Diagram

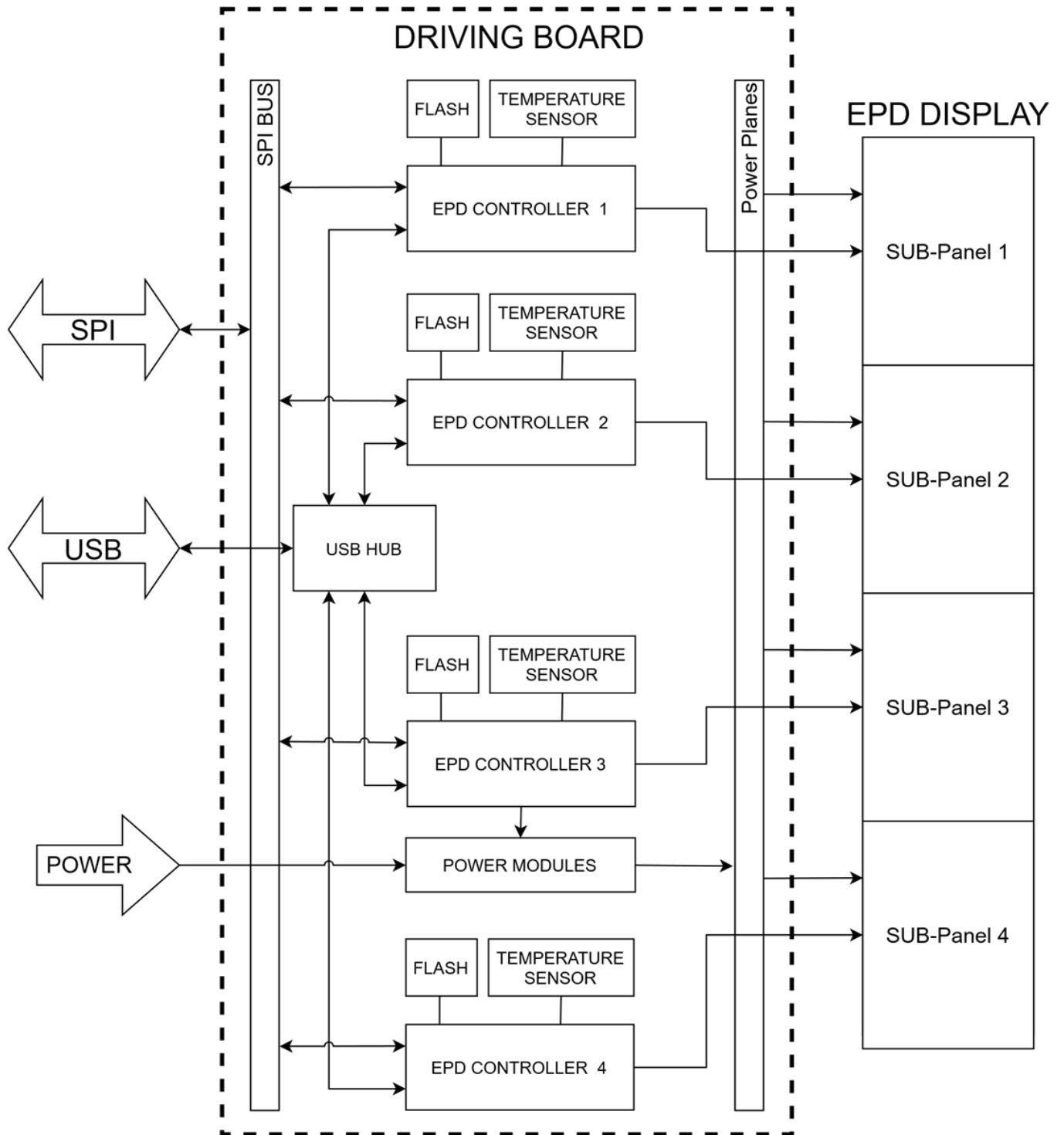


Figure 3.1 - Driving Board Block Diagram

4. Pinout

Table 4.1 presents the pinout of the power connector (CN4):

Pin Number	Pin name	Description
1	V _{IN}	USEC power supply pin
2	V _{IN}	USEC power supply pin
3	GND	Ground
4	GND	Ground

Table 4.1 - Power supply connector pinout

Tables 4.2 and 4.3 present the pinouts of interfaces connectors. Unisystem's EPD Controller supports the following interfaces:

- USB 2.0,
- SPI (up to 14MHz SCK frequency)¹.

There are two USB connectors on the controller board. One of them is USB C (CN11) connector, and another is a crimp USB connector (CN10). USB C pinout is compliant with USB2.0 standard, and Table 4.2 presents the pinout of the crimp connector:

Pin Number	Pin Name	Description
1	V _{BUS}	USB Power Supply
2	D-	USB D- data line
3	D+	USB D+ data line
4	GND	Ground
5	Shield	Shield pin (if used, please connect to shield of the cable)

Table 4.2 - USB crimp connector pinout

¹ Maximum frequency for working SPI communication, is dependent on the length and electrical characteristic of the cable

Table 4.3 presents the pinout of the SPI connector (CN1):

Pin Number	Pin name	Description
1	CS1	SPI Chip Select input pin for selecting 1st internal controller (active low)
2	CS2	SPI Chip Select input pin for selecting 2nd internal controller (active low)
3	CS3	SPI Chip Select input pin for selecting 3rd internal controller (active low)
4	CS4	SPI Chip Select input pin for selecting 4th internal controller (active low)
5	SCK	SPI Clock signal input pin
6	MOSI	SPI MOSI input pin
7	MISO	SPI MISO output pin
8	HRDY	Ready signal output. Do not send a command to the selected controller until the state of HRDY line is high
9	RST	Reset signal input (active low)
10	GND	Ground

Table 4.3 - SPI Interface Pinout

5. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
USEC Power Supply	V _{IN}	-0.3	15	V
Logic Signals Voltage (RST, HRDY, MOSI, MISO, SCK, CS1-CS4)	V _{LOG}	-0.3	3.5	V
Operating temperature	T _{op}	-15	65	°C
Storage temperature	T _{st}	-25	70	°C

Table 5.1 - Absolute Maximum Ratings

Note 5.1 Exceeding one or more limiting values from Table 5.1 may cause permanent damage to the module.

Note 5.2 For USB maximum ratings, please refer to USB 2.0 specification.

6. Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
USEC Power Supply	V _{IN}	5	12.0	13.5	V
Logic Signals High State Voltage (RST, HRDY, MOSI, MISO, SCK, CS1-CS4)	V _{LOG_H}	2.9	3.3	-	V
Logic Signals Low State Voltage (RST, HRDY, MOSI, MISO, SCK, CS1-CS4)	V _{LOG_L}	-	0	0.4	V
Operating temperature (with 1-bit WF)	T _{op_1bit}	-15	-	65	°C
Operating temperature (with 4-bit WF)	T _{op_4bit}	0	-	50	°C
Supply Current (when V _{IN} = 12V, during screen change)	I _{IN}	-	0.23	0.8	A
Power Consumption (when V _{IN} = 12V, during screen change)	P _{IN}	-	2.76	9.6	W

Table 6.1 - Electrical Characteristics

Note 6.1 For USB electrical characteristics, please refer to the USB 2.0 specification.

7. Optical characteristics

Table 7.1 presents the optical parameters of the display for temperature 25 °C and 45 degrees of angle of illumination. Contrast ratio is the ratio between the reflectance in the full white area and the reflectance in the dark area.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Reflectance	R	White	30	40	-	%
Contrast Ratio	CR	-	10	12	-	-

Table 7.1 - Optical parameters

8. Reliability Tests of Display

Item	TEST	CONDITION	METHOD
1	High Temperature Operation	T = +65°C, RH = 30% for 240 hrs	IEC 60 068-2-2Bp
2	Low Temperature Operation	T = -15°C for 240 hrs	IEC 60 068-2-2Ab
3	High Temperature Storage	T = +70°C, RH = 23% for 240 hrs	IEC 60 068-2-2Bp
4	Low Temperature Storage	T = -25°C for 240 hrs	IEC 60 068-2-1Ab
5	High Temperature, High Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC 60 068-2-3CA
6	High-Temperature, High-Humidity Storage	T = +60°C, RH = 80% for 240 hrs	IEC 60 068-2-3CA
7	Temperature Cycle	-25°C (30min) -> +70°C (30min), 100 Cycles	IEC 60 068-2-14

Table 8.1 - Reliability Test of Display

9. Subpanels

EPD panel includes four subpanels marked in figure 9.1 as SUB1-SUB4.

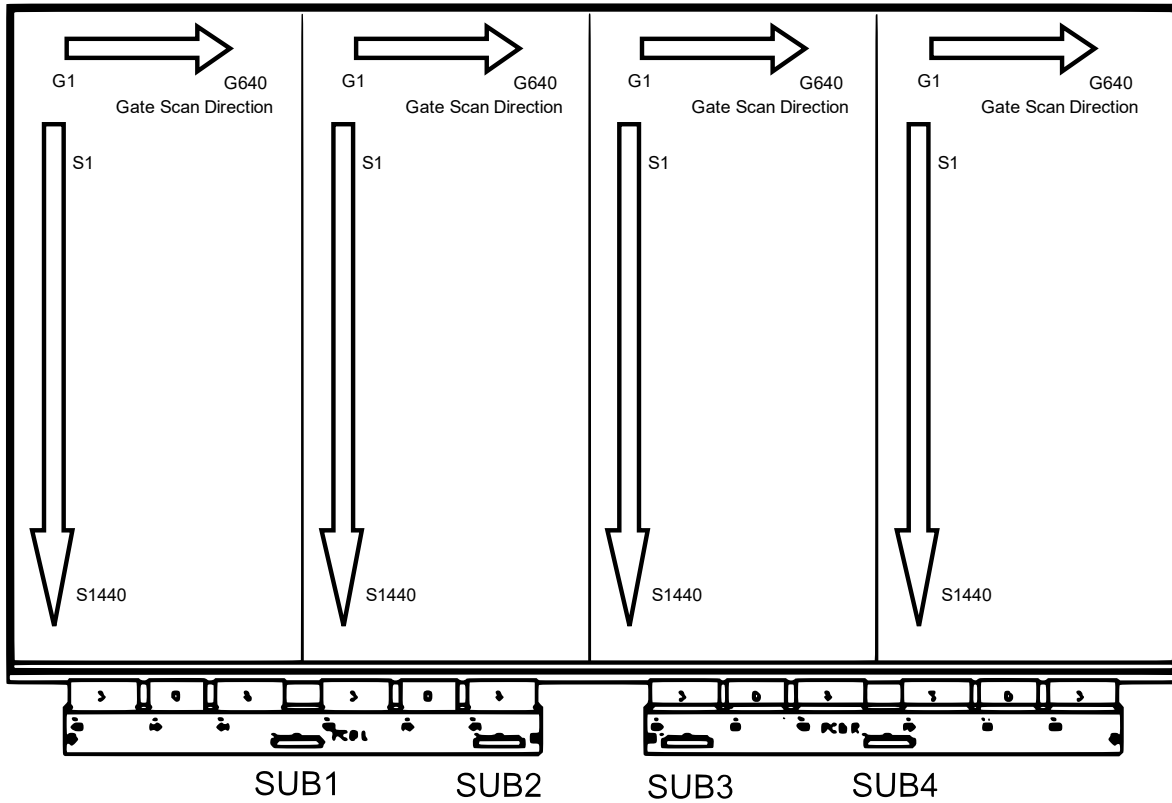


Figure 9.1 - Subpanels of display

The subpanel is selected by setting the corresponding CS line to a low state using SPI communication. When using USB interface, the subpanel can be selected by communication with USB device with the corresponding name. Table 9.1 presents the collation of USB device names and SPI CS lines corresponding to subpanels:

Subpanel	SPI CS line	USB device name
SUB1	CS1	UNISYS UniEPDC312BWN0-1 USB Device
SUB2	CS2	UNISYS UniEPDC312BWN0-2 USB Device
SUB3	CS3	UNISYS UniEPDC312BWN0-3 USB Device
SUB4	CS4	UNISYS UniEDPC312BWN0-4 USB Device

Table 9.1 - Collation of subpanels, SPI CS lines, and USB device names

10. Display modes

USEC312SBLUSN has six modes of displaying the content – table 10.1 presents their names:

Mode	Name	Description	Type
0	INIT	Initialize	Global
1	DU	Direct update	Local
2	GC16	Grayscale Clear 16 Levels	Global
3	GCC16	Grayscale Clear 16 levels, slower and more precise than Mode 2	Global
4	A2	Animation	Local
5	GL16	Grayscale 16	Local

Table 10.1 - Display modes

11. SPI Timing

Figure 11.1 presents SPI Timing diagram:

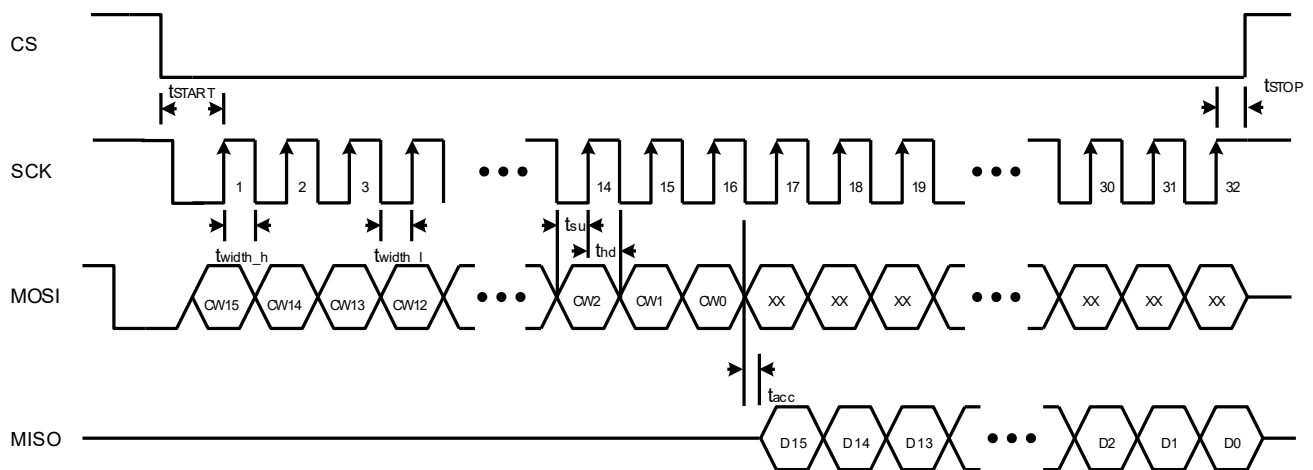


Figure 11.1 - SPI Timing diagram

Table 11.1 presents the values of timing parameters:

Symbol	Parameter	Min	Max	Unit
tSTART	CS falling to SCK rising edge	10	-	ns
tSTOP	SCK rising to CS rising edge	10	-	ns
twidth_h	SCK high pulse width	20	-	ns
twidth_l	SCK low pulse width	20	-	ns
tsu	MOSI to SCK setup time	10	-	ns
thd	MOSI to SCK hold time	10	-	ns
tacc	MISO access time after SCK falling edge	-	20	ns

Table 11.1 - SPI Timing values

12. Example Application

Exemplary application code is available on request. Please contact your supplier.

13. Precautions

Please pay attention to the following precautions while using the USEC312SBLUSN.

Handling

Handle with care. The display glass may break when it is dropped or bumped on a hard surface. Please avoid bending the module.

Storage and Operation

1. The module should be stored and operated in suggested ranges of temperature.
2. The module should be stored and operated in an environment without the abrupt changes in the conditions. They can cause the malfunction of the module.
3. Do not pull the interface connector in or out while the module is operating.
4. Do not hit the module with sharp-edged or hard objects.

Others

1. The product meets the specification requirement of the RoHS standard criteria.
2. Avoid applying high voltage and static charges to the module.
3. Keep the module's surface clean for the proper optical characteristics.
4. If the display breaks, do not touch the electrophoretic material. In case of contact with electrophoretic material, use water and soap to remove particles from the skin.

14. Legal information

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