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曜凌光電股份有限公司



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## RL0F00101000JGAAASA00

### SPECIFICATION

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

TFT Display Inspection Specification: <https://www.raystar-optronics.com/download/products.htm>

Precaution in use of TFT module: <https://www.raystar-optronics.com/download/declaration.htm>

# Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2022/1/17		First issue
A	2022/02/23	7	Modify Product information
		13	Modify Static electricity test
B	2022/04/07	7	Modify product information
		15	Modify Display Usage content
		9	Add PCBA Part number
C	2022/04/15	15	Add description of default selection

# Contents

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# 1. Smart Display Classification Information

R	L	0F	001010	00J	G	A	AA	S	A	00
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪

①	R: RAYSTAR products			
②	Type: L:Standard    K:Customization			
③	Display Type:	Standard:	0H: Character STN 0X: Graphic STN (TAB/COF) 0F: TFT EH: Character OLED EX: OLED (TAB/COF)	0G: Graphic STN 0P: Graphic STN (COG)  EG: Graphic OLED EP: OLED (COG)
		Customization:	DH: Character DN: Graphic ED: OLED	DG: Graphic STN 0J: TFT
④	Display size: (diagonal) / Display format: (resolution)	Character STN:	e.g., 8x1: 000801    16x2: 001602    24x4: 002404	
		Graphic STN:	e.g., 128x64: 012864    320x240: 320240	
		TFT Size (inch):	000096-0.96" / 000350-3.5" / 000430-4.3" / 000570-5.7" 000700-7.0" / 000800-8.0" / 001020-10.2" / 001210-12.1" (The last two digits are two digits after the decimal point)	
⑤	Serial No:	OLED:	e.g., 128x64: 012864 Customization: 0001XX	
		0A1 ~ 0ZZ	Customization STN: 000	

⑥	Touch Panel Type:	N: Without TP T: RTP G: CTP		
⑦	Model Interface:	A: CAN B: Bluetooth C:Controller Specified D: RS485 E: RS232 F: USART G: Logic I/O	H: HDMI R: Memory Specified N: Ethernet J: Analog I/O K: USB L: WIFI M: Zigbee	X: Combined Y: Proprietary interface
⑧	Interface Serial No.:	AA ~ ZZ		
⑨	Control Category:	S: Smart Display E: Entry N: Non-specified		
⑩	Special Code:	A → Generic B → Industrial C →Automotive D →Medical		
⑪	Model code:	00 ~ ZZ		

## **2. Summary**

### **10.1 Inch Smart Display (CAN series) Features**

1. +12V power supply input, the power consumption is around 6W.
2. Self testing after booting function.
3. CAN bus communication interface.
4. Support CANopen negotiation. Default baud rate is 250KB.
5. Built in flash memory, store the font and Object Dictionary Data.
6. Support capacitive touch panel (CTP).
7. Smart Display scenario is slave device display and action from Master Device instruction.
8. Embedded buzzer controlled by Master Device.
9. Demo set HOST can be used on multiple platforms, such as Computer (with USB to CAN Dongle), MCU, Raspberry Pi (with PiCAN2).

## 3. Product information

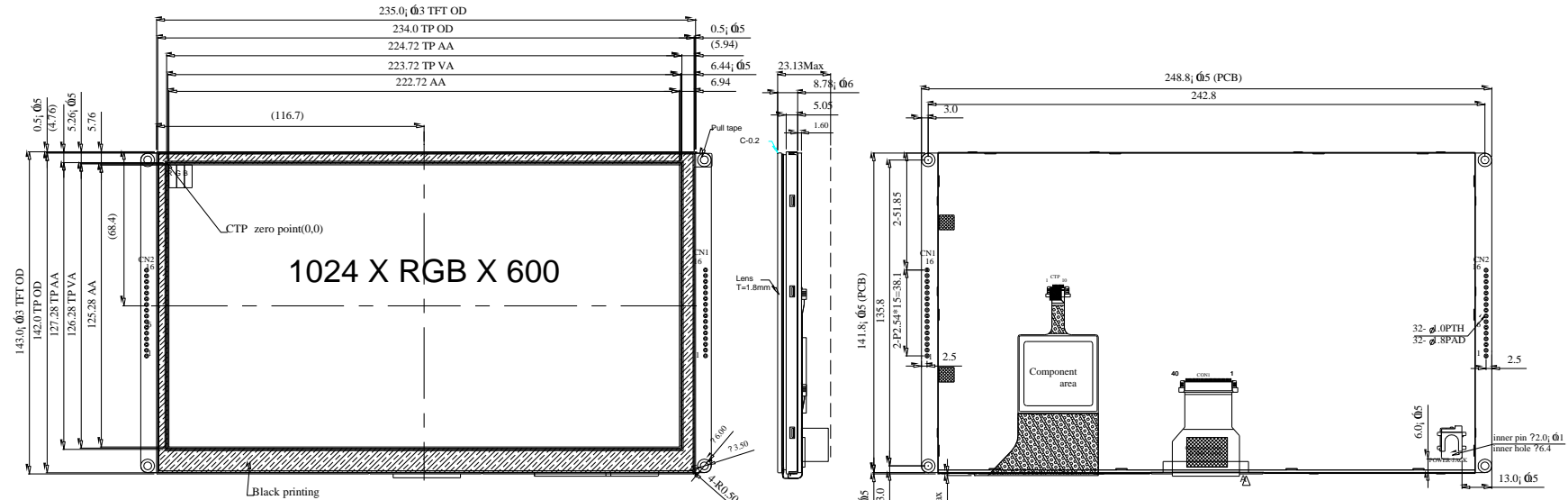
### 3.1 Mechanical Data

Item	Standard Value	Unit
LCD panel	235(W) x 143(H) x 8.78(D)	mm
PCB	248.8(W) x 143(H) x 1.6(D)	mm
Housing outline	NA	mm

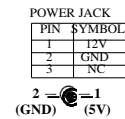
### 3.2 General information

Item	Standard Value	Unit
Operating voltage	12	Vdc
Communication Interface	CAN bus differential $\pm 3.3$	Vpp
MCU	STM32F746	N/A
Flash Memory	16	MB
SDRAM Frequency	166	MHz
LCD display size	10.1	inch
Dot Matrix	1024 x RGBx600(TFT)	dot
Module dimension	235(W) x 143(H) x 8.78(D)	mm
Active area	222.72 (H) x 125.28(V)	mm
Dot pitch	0.2175(W) x 0.2088(H)	mm
LCD type	LED, Normally White	
View Direction	85/85/85/85	
Aspect Ratio	16:9	
With /Without TP	With CTP	
Surface	Glare	

## 4. Contour Drawing



1	Lcd Type	TFT
2	Viewing Angle	85/85/85/85
3	Surface	Glare
4	Screen size	10.1"(diagonal)
5	Display format	1024 x RGB x 600
6	Operating Temperature	-20℃ ~70℃
7	Storage Temperature	-30℃ ~80℃
8	Active area	222.72(H) x 125.28(V) mm
9	Pixel pitch	0.2175(H) x 0.2088(V) mm
10	Color arrangement	RGB-STRIBE
11	Brightness	300min. 400typ. cd/m2
12	CTP Driver IC	ILI2511 or equivalent



CN2		CN1	
PIN	SYMBOL	PIN	SYMBOL
1	VDD3V	1	I2V
2	JTAG_SWCLK	2	GND
3	GND	3	CAN_High
4	JTAG_SWDIO	4	CAN_Low
5	NRST	5	GND
6	GND	6	GND
7	BOOT	7	NC
8	BOOT0	8	NC
9	PA5	9	NC
10	PA6	10	RX
11	PA7	11	TX
12	PA8	12	GND
13	NC	13	5V
14	NC	14	RS485_B
15	PA11	15	RS485_A
16	PA12	16	GND

The non-specified tolerance of dimension is ;  $\pm 0.3$  mm .



## 5. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	°C
Storage Temperature	TST	-30	—	+80	°C

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp.  $\leq 60^{\circ}\text{C}$ , 90% RH MAX. Temp.  $> 60^{\circ}\text{C}$ , Absolute humidity shall be less than 90% RH at  $60^{\circ}\text{C}$

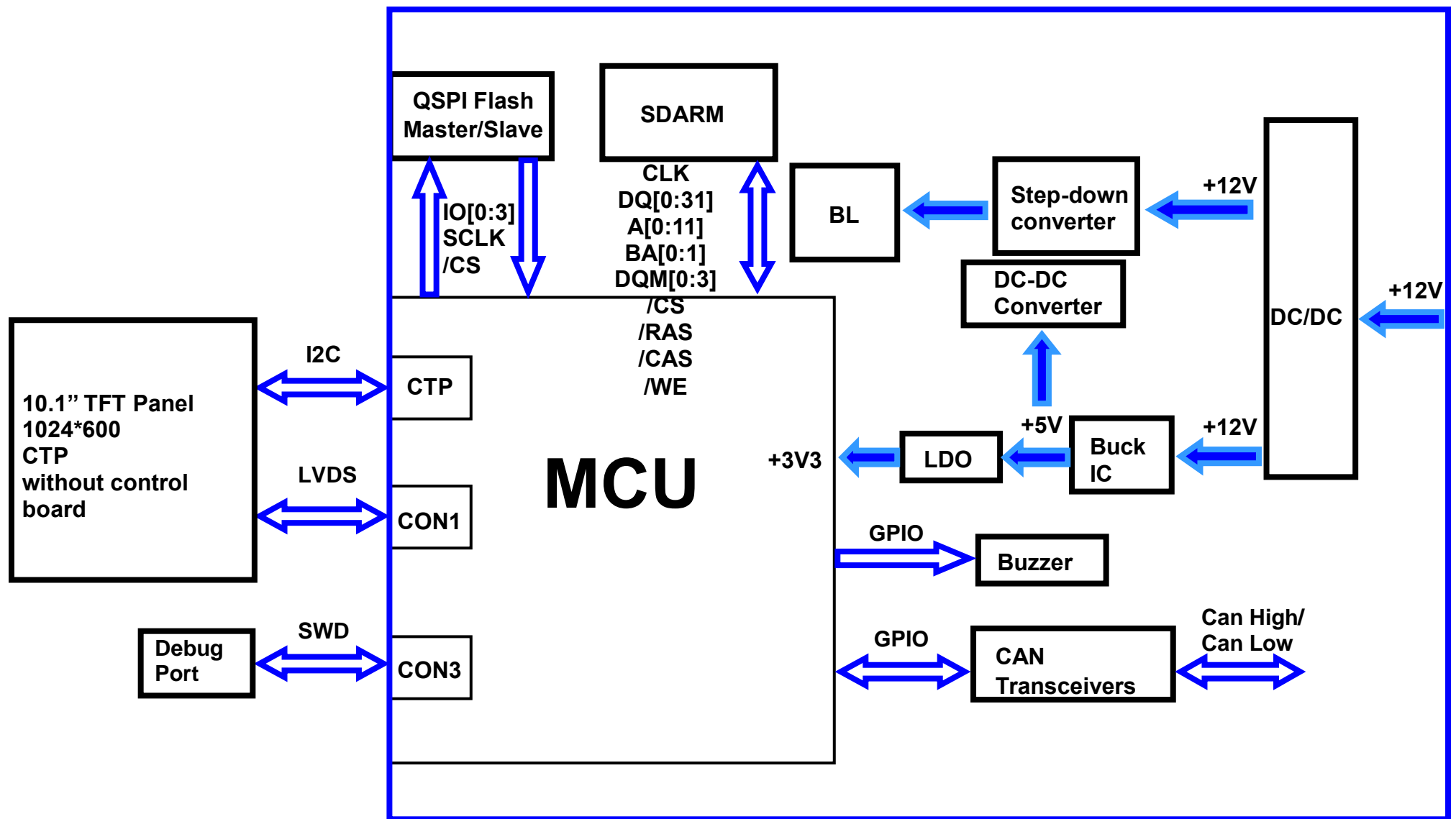
## 6. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage	VCC	—	11.4	12	12.6	V
Supply LCM current	I(mA)	-	-	435	-	mA

## 7. BOM

Item	Description	Remark
LCM	RFH1010J-AYW-LNB	
PCBA	SV100101000JA00N0100	

# Block diagram



## 9. Interface

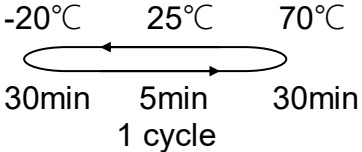
CON1 definition:

Pin	Symbol	Function	Remark
1	+12V	Power supply 12V input	Power
2	GND	Power supply GND input	Power
3	CAN_High	CAN bus D+	I/O
4	CAN_Low	CAN bus D-	I/O
5	GND	Power supply GND input	Power
6	GND	Power supply GND input	Power
7	—	—	—
8	—	—	—
9	—	—	—
10	—	—	—
11	—	—	—
12	—	—	—
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—

**CON2 definition:**

Pin	Symbol	Function	Remark
1	VDD3V	3.3V power for JTAG interface	–
2	JTAG_SWCLK	CLK pin for JTAG interface	–
3	GND	GND for JTAG interface	–
4	JTAG_SWDIO	Data pin for JTAG interface	–
5	NRST	Reset pin for JTAG interface	–
6	GND	GND	–
7	–	–	–
8	–	–	–
9	–	–	–
10	–	–	–
11	–	–	–
12	–	–	–
13	–	–	–
14	–	–	–
15	–	–	–
16	–	–	–

# 10. Reliability

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 96hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 96hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 40°C,90%RH max	40°C,90%RH 96hrs	1,2
Thermal shock resistance	<p>The sample should be allowed stand the following 10 cycles of operation</p>  <p style="text-align: center;">-20°C      25°C      70°C 30min    5min    30min 1 cycle</p>	-20°C/70°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±2KV~±6KV(contact),±2KV~±8KV (air), RS=330Ω CS=150pF 10 times	—

Content of Reliability Test (Wide temperature, -20°C~70°C)

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

# 11. Product inspection check list

Check samples by meter  $V_{IN}$ ,  $I_{system}$

Item	No 1	No 2	No 3	Note
$V_{IN}$ (V)	12.1	12.1	12.1	
$I_{system}$ (mA)	0.445	0.449	0.447	

Check sample Reliability Test

Item	Result	Note
Thermal shock	—	-20°C/70°C 20 cycles
High Temperature Operation	—	70°C 96hrs
Low Temperature Operation	—	-20°C  96hrs
Static electricity test	—	VS=±2KV~±6KV(contact),±2KV~±8KV (air), RS=330Ω CS=150pF 10 times
Vibration test	—	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes

- Prepare sets for testing

## 12. Display Usage

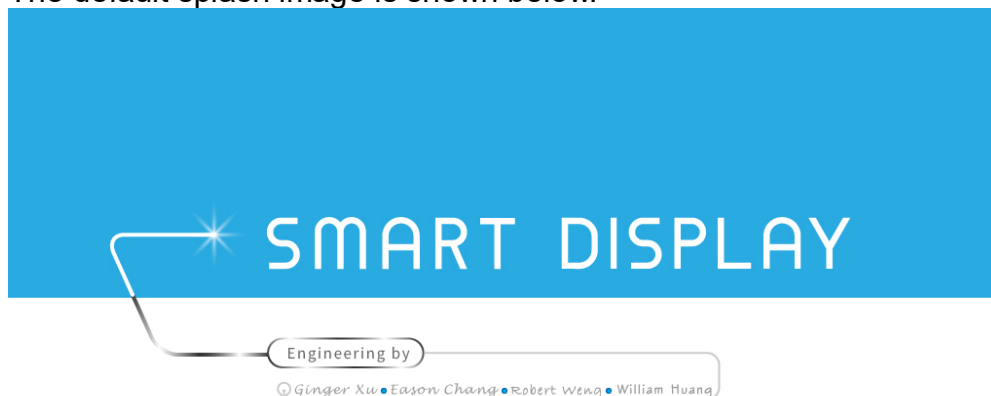
### Functional description

Smart Display can be used to display the coordinate, status and data information provided by the connected HOST device. Customers can configure the position coordinates they want to display in normal operation mode (Node ID = 0x7B).

The Display is designed to be easily connected to a controller network, and to operate with minimum setup or knowledge of the SDO configuration on the controllers.

### Splash Screen

The default splash image is shown below.



- ✓ This product is produced as a generic product. If you require a custom splash image for your application, contact us to discuss.

### Default Selection

Press the preferred application and hold for 3 seconds for the first time power on.

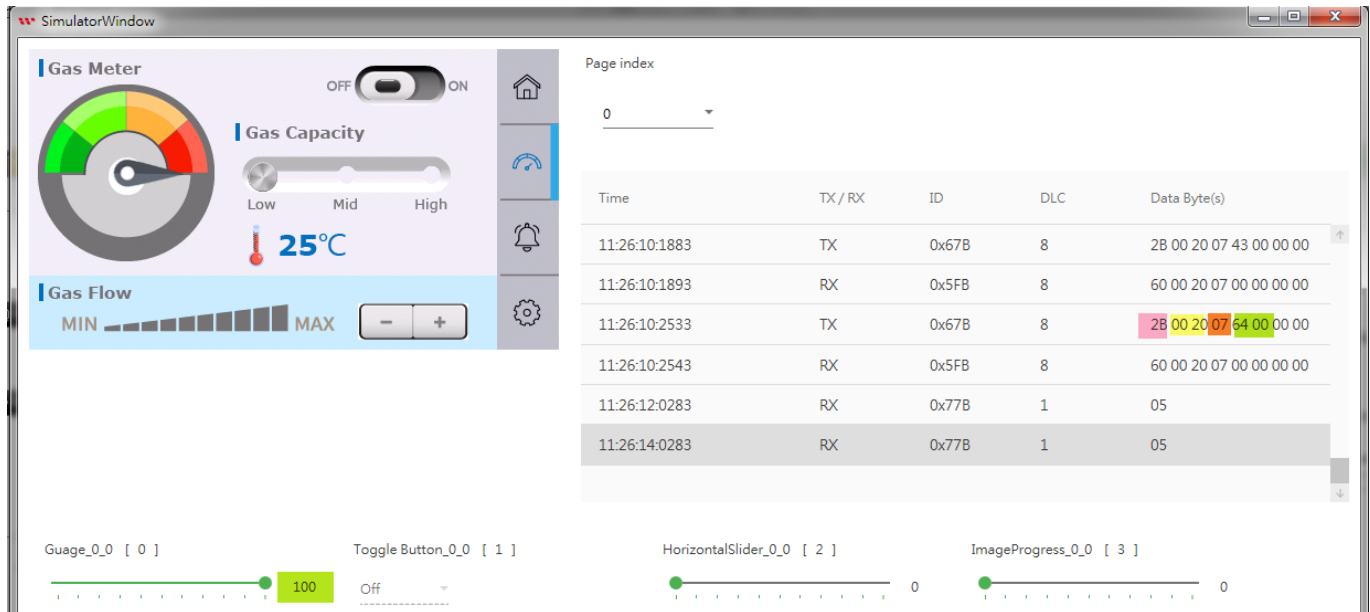


### Acquisition of Displayed Data

The Smart Display can acquire the data that it displays by using the CANopen SDO protocol.

On Pre-operational mode, customers can set the coordinates of objects through SDO; On operational mode, customers can send data of objects through SDO, please see below.

Example:



The client request :

Data length = 2 bytes

600 + Serv NodeId	0	2B	Index	Sub index	d1	d0	x	x
----------------------	---	----	-------	--------------	----	----	---	---

X : undefined. Put 0

To write the 2 byte data : 0x0064 in the object dictionary of node 7B at index 0x2000, sub-index 7, sends :

67B 2B 00 20 07 64 00 00 00

If success, the node 7B responds :

5FB 60 00 20 07 00 00 00 00

### Configuring the Display

Raystar Smart Display CAN series offers an out-of-the-box CANopen development experience that will lower customers' development costs and speed time-to-market expectations.

The Smart Display can use wide-temperature are designed to support control applications in harsh operating conditions, which designed to be connected to a variety of different situation combinations, such as automotive, marine, power generation and oil-and-gas.

The Smart Display comes with standard UI objects to get customers project off the ground quickly. If customers need custom UI objects support, our engineers are here to help. Send over your contents in PNG/JPG format, we will send over a new set of UI objects within 3~5 working days.

The Smart Display is defined as a slave device, which is controlled by master device via CAN bus command to render display content on the display screen and return touch event data with protocol objects.



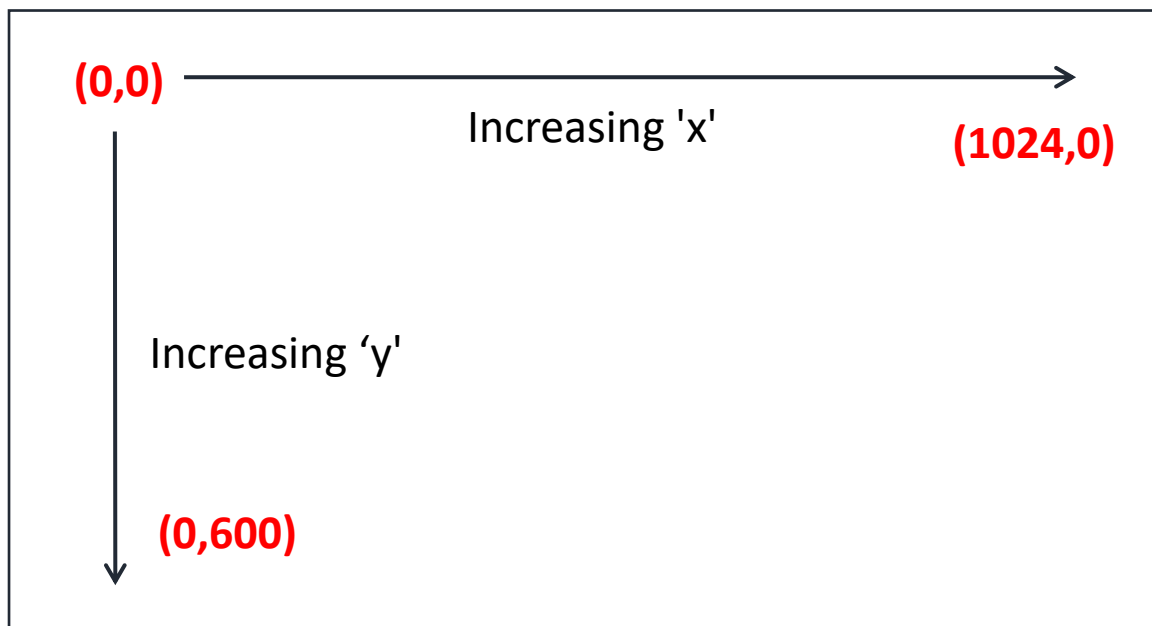
### Node ID when Standalone

If the display is powered up standalone, the node id will default to 0x7B.

### Configuring the Main Screen

The screen on the display is 1024 x 600 pixels.

The co-ordinate system used to specify the location of an item on the screen is shown in the diagram below. The coordinates are (x,y) where 'x' is the horizontal offset from the left, and 'y' is the vertical offset from the top.



### Item Object Dictionary

There are 64 objects entries which are for configuration of the items that can be displayed on the screen in the latest F/W version. These are at location 0x2000 to 0x203F. Each object fully defines one screen item.




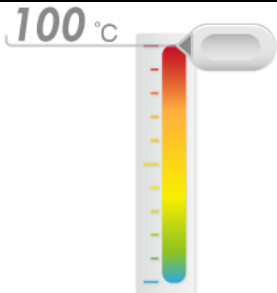


Each item has a set of sub-index items which are used to control the coordinate of the item. The exact functionality varies depending on the type of item selected. The template object is shown below:









## Object List(0x2000 to 0x2009)

Object Index 0x2000 to 0x2009	Name	type	Description
Sub 0	Number of Entries	UNSIGNED8	9
Sub 1	Type	UNSIGNED8	style of Object
Sub 2	Reserve		
Sub 3	X position	INTEGER16	The object's X position
Sub 4	Y position	INTEGER16	The object's Y position
Sub 5	Number of Style	INTEGER16	The photo of style
Sub 6	Reserve		
Sub 7	Value 1	UNSIGNED16	Data to smart display from HOST
Sub 8	Value 2	UNSIGNED16	Data from smart display to HOST
Sub 9	Text	VISIBLE_STRING	Show strings (Unicode)max to 50 Character

### Sub 1 – Type

The item type is selected according to the table below:

Data	Description	Example Image
0	No Item This entry is not used	
1	Reserve	
2	Gauge	
3	Reserve	
4	Button	
5	Toggle Button	
6	Vertical Slider	
7	Horizontal Slider	
8	Reserve	
9	Temperature	







10	Battery	
11	Graph	
12	Indicator	
13	CircleProgress	
14	ImageProgress	
15	Reserve	
16	Animated Image	
17	Number String	65535
18	Text String	ABCDE
19	CustomWidget	
20	Digital Clock	AM 00:00 2021/06/01
21	Reserve	
22	MultiState	

**Sub 3&4 – x and y position**

Each item is drawn on screen by setting a draw rectangle. This rectangle is a bounding rectangle sized to fully enclose the item that is being drawn. The co-ordinates specify the position of the top left of this bounding rectangle.

**Sub 5 –Number of Style**

Various types of icons

Gauge	icon
0	
1	
2	
3	
4	
5	

Graph	icon
<div> <div>Paw cmH2O</div> <div>0</div> <div> </div> </div>	
<div> <div>1</div> <div> <div>40 20 10 0 -5</div> <div>PAW cmH2O</div> <div> </div> </div> </div>	
<div> <div>2</div> <div> <div>100 50 0 -50 -100</div> <div>FLOW l/min</div> <div> </div> </div> </div>	

Button	icon
0	
1	
2	
3	

Toggle Button	icon
0	
1	
2	
3	

Vertical Slider

icon

0

100 °C

1

Horizontal Slider

icon

0

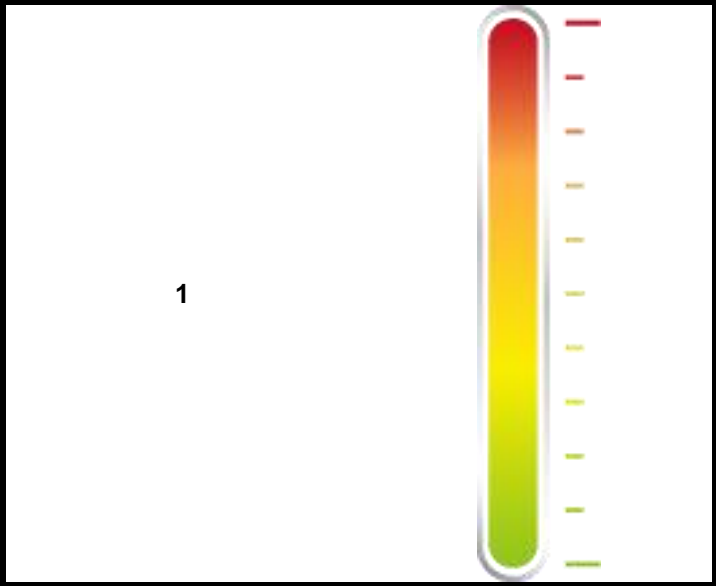
1




2



Temperature

icon


0







Battery	icon
0	
1	
2	

Indicator	icon
0	
1	

CircleProgress	icon
0	

1	
2	

ImageProgress	icon
0	
1	

Animated Image	icon
0	
1	



Number String	icon
0	<b>65535</b>
1	<b>65535</b>
2	<b>65535</b>
3	<b>65535</b>
4	<b>65535</b>
5	<b>65535</b>

Text String	icon
0	<b>ABCDE</b>
1	<b>ABCDE</b>
2	<b>ABCDE</b>
3	<b>ABCDE</b>
4	<b>ABCDE</b>
5	<b>ABCDE</b>

Clock	icon
0	<b>00:00</b>

1	<div>AM 00:00</div> <div>2021/06/01</div>	
2	00:00:00	
3	00:20	

CustomWidget	icon	
0	<div> <div>↕↕↕</div> <div>➡</div> <div>↕↕↕</div> <div>↕↕↕</div> </div>	
1	<div> <div>Line Overview</div> </div>	

MultiState	icon	
0	<div> </div>	

Sub 7&8 –Data send and receive

HOST sends numeric data to Sub 7 to control Smart Display objects another HOST receives numerical data from Sub8.

HOST can be used on multiple platforms, such as **Computer, MCU, Raspberry Pi(with PiCAN2).**

**Background(0x2100)**

Object Index 0x2100	Name	type	Description
Sub 0	Data	UNSIGNED8	Background of number

**Backlight(0x2101)**

Object Index 0x2101	Name	type	Description
Sub 0	Data	UNSIGNED8	Value(0~100)

**Buzzer(0x2102)**

Object Index 0x2102	Name	type	Description
Sub 0	Number of Entries	UNSIGNED8	
Sub 1	Cycle	UNSIGNED8	Number of repetitions
Sub 2	High	UNSIGNED8	High level
Sub 3	Low	UNSIGNED8	Low level
Sub 4	Active	BOOLEAN	Send reverse status to turn on the buzzer.  Ex: If the current active bit is true, send false bit and the buzzer is turned on.

**Page(0x2103)**

Object Index 0x2103	Name	type	Description
Sub 0	Number of Entries	UNSIGNED8	
Sub 1	Count	UNSIGNED8	Return to page number
Sub 2	Index	UNSIGNED8	Jump to number page

**Mode(0x2104)**

Object Index 0x2104	Name	type	Description
Sub 0	Number of Entries	UNSIGNED8	
Sub 1	Mode	UNSIGNED8	'0x00' enter pre-operation '0x01' enter operation

# 13. Example Screen Layout (Industry application)

## Example Layout

The screen layout described in this section is intended to demonstrate the settings of screen items that can be used in an industry application situation.



## 14. Example Screen Layout (Vehicle automotive)

### Example Layout

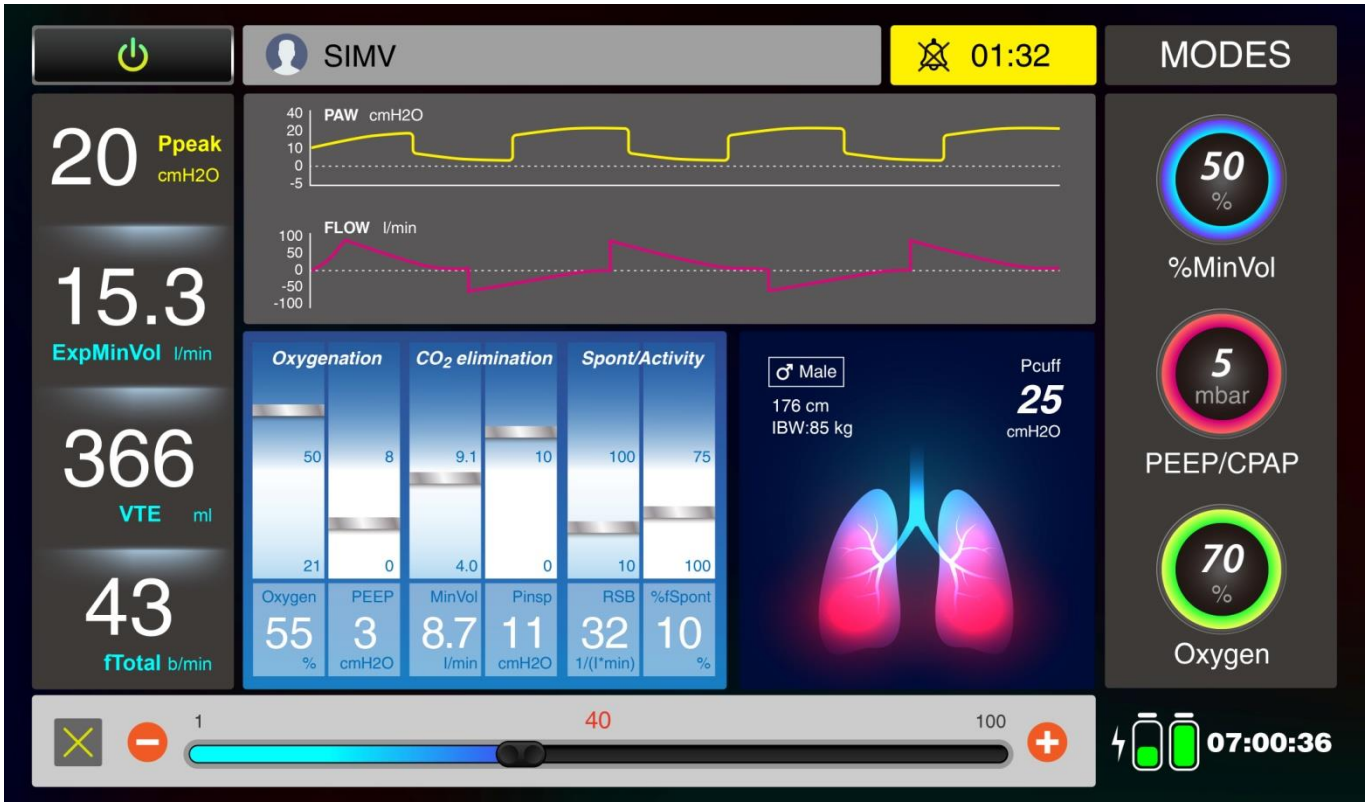
The screen layout described in this section is intended to demonstrate the settings of screen items that can be used in a vehicle automotive situation.



# 15. Example Screen Layout (Medical application)

## Example Layout

The screen layout described in this section is intended to demonstrate the settings of screen items that can be used in a Medical application situation.



# 16. References

[Sample code for Arduino Mega 2560](#)

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