



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

HMT070MEE-D

LCD Module User Manual

Prepared by: Chenzhonghua Date: 2025-03-14	Checked by: Date:	Approved by: Date:
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Rev.	Descriptions	Edit	Release Date
0.1	Preliminary release	Chenzhonghua	2025-03-14

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1 Basic Specification

TOPWAY HMT070MEE-D is a Smart TFT Module with 32bit MCU on board. Its graphics engine provides numbers of outstanding features. It supports TOPWAY SGTools for preload and pre-design display interface that simplify the host operation and development time. Suitable for industry control, instrumentation, medical electronics, power electric equipment applications.

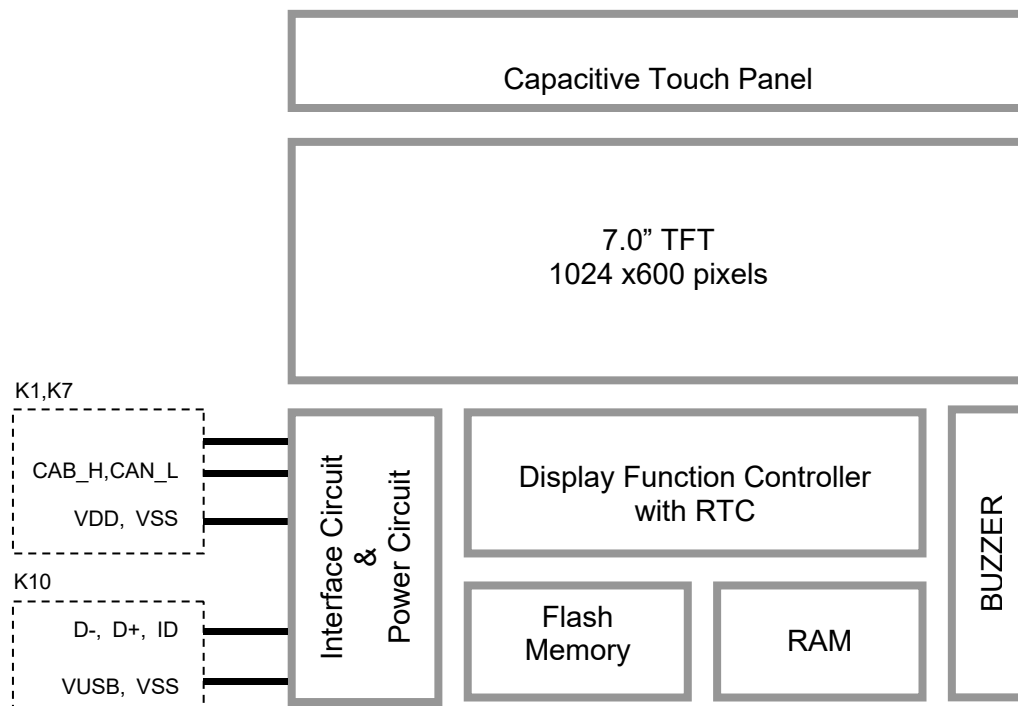
1.1 General Specification

Screen Size(Diagonal) :	7.0"
Resolution :	1024(RGB) x600
Color Depth :	65k color (16bit)
Pixel Configuration :	RGB Stripe
Display Mode :	Transmissive / Normal Black
Viewing Direction :	Full
Outline Dimension :	185.9 x 109.5 x 30.1 (max)(mm) (see attached drawing for details)
Active Area :	154.21 x 85.92 (mm)
Backlight :	LED
Surface Treatment :	Anti-Glare Treatment
Touch Panel:	Capacitive Touch
Command I/F:	CAN
Project Download:	by PC(USB), U-Drive (with OTG cable)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C
Highlight :	RTC without battery, Support 90 degrees rotation, Lua script engine,Buzzer,256MB flash

Note:

*1. Color tone may slightly change by Temperature and Driving Condition.

1.2 Block Diagram



1.3 Terminal Function

CAN Interface Terminal (K1)

Pin No.	Pin Name	I/O	Descriptions
1	VDD	P	Power supply (11.0~26.0 V)
2	NC	--	Not connected
3	NC	--	Not connected
4	CAN_H	I/O	CAN Differential signal H
5	CAN_L	I/O	CAN Differential signal L
6	VSS	P	Ground, (0V)

CAN Interface Terminal (K7)

Pin No.	Pin Name	I/O	Descriptions
1,2,3	VDD	P	Power supply (11.0~26.0 V)
4,7	NC	--	Not connected
5	CAN_L	I/O	CAN Differential signal L
6	CAN_H	I/O	CAN Differential signal H
8,9,10	VSS	P	Ground, (0V)

Note.

*1. User data and commands transfer through this terminal.

USB Interface Terminal (K10)

Pin No.	Pin Name	I/O	Descriptions
A1,A12,B1,B12	VSS	P	Ground, (0V)
A4,A9,B4,B9	VUSB	P	Power supply(5.0 V)
A5,B5	ID	I	USB_ID,1:Client,0:HOST
A6,B6	D+	I/O	USB DATA positive signal
A7,B7	D-	I/O	USB DATA negative signal
A8,B8	NC	--	Not connected

Note.

*1. TML files and image files preload through this terminal.

*2. Standard "USB-drive" functions provided.

*3. During the files transfer, all others display functions will be suspended.

2 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Power Supply voltage	V _{DD}	-0.3	28.0	V	
Operating Temperature	T _{OP}	-20	70	°C	No Condensation
Storage Temperature	T _{ST}	-30	80	°C	No Condensation

Note:

*1. This rating applies to all parts of the module and should not be exceeded.

*2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, T_{OP}=25°C

*3. Ambient temperature when the backlight is lit (reference value)

*4. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

3 Electrical Characteristics

3.1 DC Characteristics

VSS=0V, VDD=12.0V, T_{OP} =25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin/FUNC
Operating Voltage	V _{DD}	11.0	12.0	26.0	V	VDD
Operating Current	I _{DD}	-	315	-	mA	VDD (*2)
Operating Current (USB)	I _{VUSB}	-	150	-	mA	VUSB(*3)

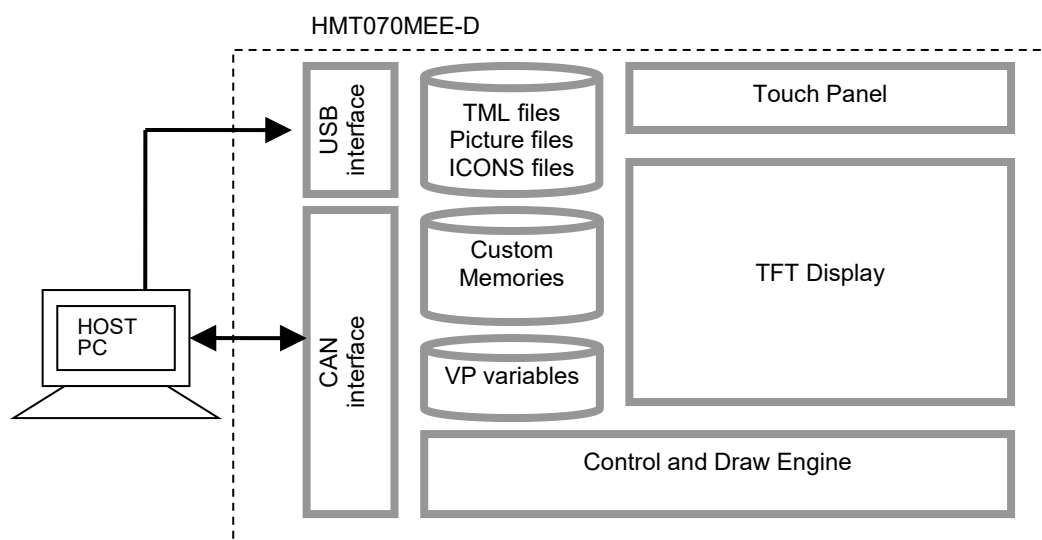
Note.

*1. Normal display condition

*2.USB-drive(high-speed)

4 Function Specifications

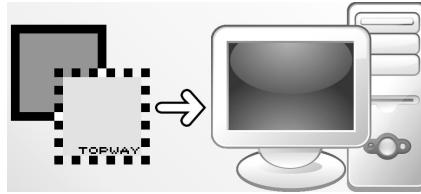
4.1 Basic Operation Function Descriptions



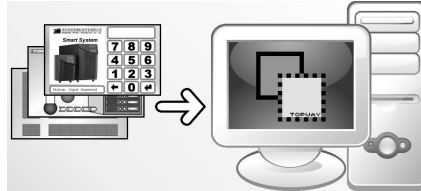
- TML files, Picture files, ICON files are stored inside FLASH memory area. They are preloaded to HMT070MEE-D for stand alone interface use.
- Those files are preloaded via USB interface as an USB drive.
- All the interface flow and the touch response are based on the preloaded TML files
- VP variables memory is inside RAM area, it provides real time access via CAN by the HOST or display onto the TFT by TML file.
- Custom Memories are inside FLASH memory area. It can be accessed via CAN interface by the HOST.
- Control and Draw Engine executes HOST commands and response respectively
- It also reports the real time Touch Key number to the HOST.

4.2 Quick Start Guide

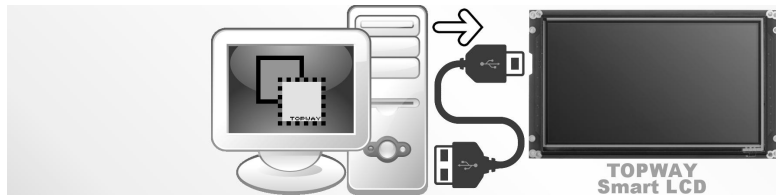
1. Install TOPWAY Graphics Editor



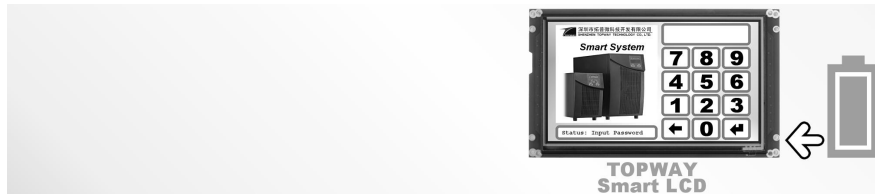
2. Import pictures design UI flow



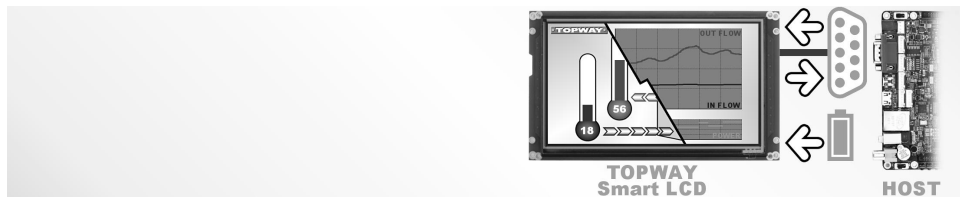
3. Download to Smart LCD



4. power on & display



5. Connect to host Show real time data



4.3 Command Descriptions

Please refer to “SMART LCD CAN Interface Reference Note”.

5 Optical Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT	Note.
Viewing angle (CR $\geq$ 10)	θ_L	9 o'clock	70	85	-	degree	*2
	θ_R	3 o'clock	70	85	-		
	θ_T	12 o'clock	70	85	-		
	θ_B	6 o'clock	70	85	-		
Response Time	T_f	Normal $\theta=0^\circ$	-	25	35	ms	*3
	T_r						
Contrast ratio	CR		600	800	-	-	*1
Color chromaticlty	W_X		0.27	-	0.33	-	
	W_Y		0.27	-	0.33	-	
Luminance	L		-	350	-	cd/m ²	*4
Luminance uniformity	Y_U		70	75	-	%	*4

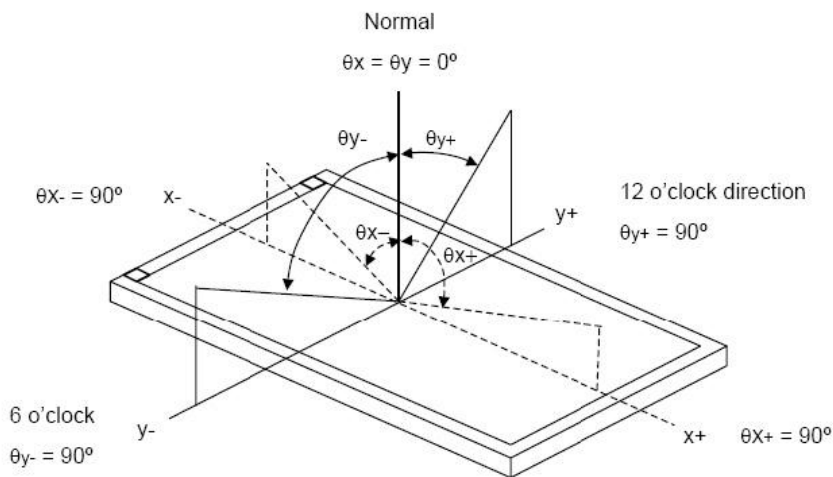
Note:

*1. Definition of Contrast Ratio

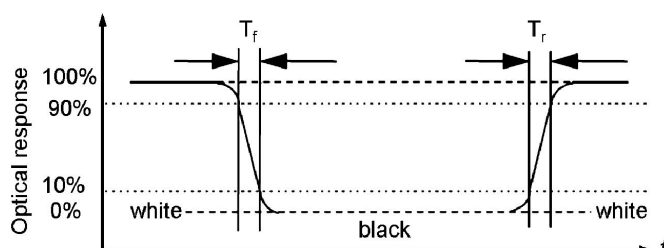
The contrast ratio could be calculate by the following expression:

Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black

*2 Definition of Viewing Angle



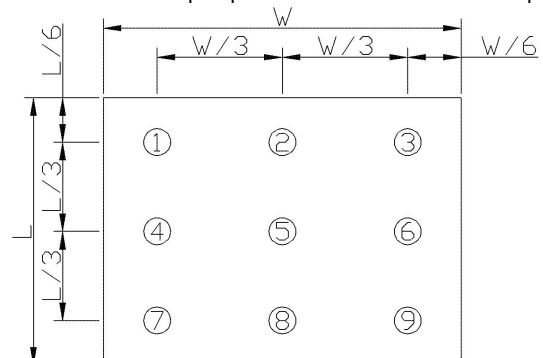
*3 Definition of response time



*4 Definition of Luminance Uniformity

Luminance uniformity (Lu)=

Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



6 LCD Module Design and Handling Precautions

- Please ensure V0, VCOM is adjustable, to enable LCD module get the best contrast ratio under different temperatures, view angles and positions.
- Normally display quality should be judged under the best contrast ratio within viewable area. Unexpected display pattern may come out under abnormal contrast ratio.
- Never operate the LCD module exceed the absolute maximum ratings.
- Never apply signal to the LCD module without power supply.(No Hot-plugging)
- WARNING! Be aware of (if any) frame grounding of the LCD Module connection with the system which may cause safety Issue(e.g. electric shock,etc).
- Keep signal line as short as possible to reduce external noise interference.
- IC chip (e.g. TAB or COG) is sensitive to light. Strong light might cause malfunction. Light sealing structure casing is recommended.
- Make sure there is enough space (with cushion) between case and LCD panel, to prevent external force passed on to the panel; otherwise that may cause damage to the LCD and degrade its display result.
- Avoid showing a display pattern on screen for a long time (continuous ON segment).
- LCD module reliability may be reduced by temperature shock.
- When storing and operating LCD module, avoids exposure to direct sunlight, high humidity, high or low temperature. They may damage or degrade the LCD module.
- Never leave LCD module in extreme condition (max./min storage/operate temperature) for more than 48hr.
- Recommend LCD module storage conditions is 0 C~40 C <80%RH.
- LCD module should be stored in the room without acid, alkali and harmful gas.
- Avoid dropping & violent shocking during transportation, and no excessive pressure press, moisture and sunlight.
- LCD module can be easily damaged by static electricity. Please maintain an optimum anti-static working environment to protect the LCD module. (eg. ground the soldering irons properly)
- Be sure to ground the body when handling LCD module.
- Only hold LCD module by its sides. Never hold LCD module by applying force on the heat seal or TAB.
- When soldering, control the temperature and duration avoid damaging the backlight guide or diffuser which might degrade the display result such as uneven display.

6 液晶显示模块设计和使用须知

- 请注意 V0, VCOM 的设定, 以确保液晶显示模块在不同的使用温度下以及在不同的视角和位置观察模块显示, 均能达到最佳对比度, 请务必将应用电路上设置为对比度可调。
- 请注意液晶显示模块的显示品质判定是指在正常对比度下以及视窗(V.A)范围内进行的, 非正常对比度下液晶可能会出现非预期的显示不良, 应注意区分。
- 请勿在最大额定值以外使用液晶显示模块。
- 请勿在没有接通电源的条件下, 给液晶显示模块输送信号。(禁止热插拔)
- 警告! 使用前需评估液晶显示模块的金属框架/壳体地(如有)与整机关系和安全性(如: 漏电安全性, 等)。
- 请尽可能缩短信号线的连接, 以避免对液晶显示模块的信号干扰。
- 集成电路因 IC 芯片(如 TAB 或 COG)对紫外线极为敏感, 强光环境下可能会引起液晶显示模块功能失效, 故应采用不透光的外壳。
- 请在液晶显示模块与外壳之间保留足够的空间(可使用衬垫), 以缓冲外力对液晶显示模块的损坏或因受力不均而产生的显示不均匀等异常现象。
- 避免液晶显示屏在某一画面下长时间点亮, 否则有出现残影的风险; 请通过软件每隔一段时间改变一次画面。
- 液晶显示模块的可靠性可能因温度冲击而降低。
- 请勿在阳光直射、高湿、高温或低温下储存和使用液晶显示模块, 这将造成液晶显示模块的损坏或失效。
- 请勿在极限环境(最大/最小存储/工作温度)下使用或放置液晶显示模块超过 48 小时以上。
- 液晶显示模块建议存储条件为: 0 C~40 C <80%RH。
- 请勿让液晶显示模块存储于带有 酸性, 碱性, 有害气体环境之中。
- 在运输过程中, 请勿让液晶显示模块跌落与猛烈震动, 同时避免 异常挤压, 高湿度, 与阳光照射。
- 液晶显示模块极易受静电损坏, 请务必保证液晶显示模块在防静电的工作环境中使用或保存。(如: 烙铁正确接地, 等)
- 拿取液晶显示模块时需注意操作人员的接地情况。
- 请手持液晶显示模块的边沿取放模块, 防止热压纸或 TAB 部位受力。
- 焊接液晶模块时, 请注意控制烙铁的温度、焊接时间, 以免烫坏导光板或偏光片, 导致显示不均匀等不良现象发生。

- Never let LCD module contact with corrosive liquids, which might cause damage to the backlight guide or the electric circuit of LCD module.
 - Only clean LCD with a soft dry cloth, Isopropyl Alcohol or Ethyl Alcohol. Other solvents (e.g. water) may damage the LCD.
 - Never add force to components of LCD module. It may cause invisible damage or degrade the module's reliability.
 - When mounting LCD module, please make sure it is free from twisting, warping and bending.
 - Do not add excessive force on surface of LCD, which may cause the display color change abnormally.
 - LCD panel is made with glass. Any mechanical shock (e.g. dropping from high place) will damage the LCD module.
 - Protective film is attached on LCD screen. Be careful when peeling off this protective film, since static electricity may be generated.
 - Polarizer on LCD gets scratched easily. If possible, do not remove LCD protective film until the last step of installation.
 - When peeling off protective film from LCD, static charge may cause abnormal display pattern. The symptom is normal, and it will turn back to normal in a short while.
 - LCD panel has sharp edges, please handle with care.
 - Never attempt to disassemble or rework LCD module.
 - If display panel is damaged and liquid crystal substance leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes promptly wash it off using soap and water.
- 请勿使用洗板水等腐蚀性液体接触液晶模块，以免腐蚀导光板或模块电路。
 - 仅可使用柔软的干布，异丙醇或乙醇清洁液晶屏表面，其他任何溶剂(如:水)都有可能损坏液晶模块。
 - 请勿挤压液晶显示模块上的元器件，以避免产生潜在的损坏或失效而影响产品可靠性。
 - 装配液晶显示模块时，请务必注意避免液晶显示模块的扭曲或变形。
 - 请勿挤压液晶显示屏表面，这将导致显示颜色的异常。
 - 液晶屏由玻璃制作而成，任何机械碰撞(如从高处跌落)均有可能损坏液晶显示模块。
 - 液晶屏表面带有保护膜，揭除保护膜时需要注意可能产生的静电。
 - 因液晶显示屏表面的偏光片极易划伤，安装完成之前请尽量不要揭下保护膜。
 - 请缓慢揭除保护膜，在此过程中液晶显示屏上可能会产生静电，此为正常情况，可在短时间内消失。
 - 请注意避免被液晶显示屏的边缘割伤。
 - 请不要试图拆卸或改造液晶显示模块。
 - 当液晶显示屏出现破裂，内部液晶液体可能流出；相关液体不可吞吃，绝对不可接触嘴巴，如接触到皮肤或衣服，请使用肥皂与清水彻底清洗。

7 CTP Mounting Instructions

7.1 Bezel Mounting (Figure 1)

- The bezel window should be bigger than the CTP active area. It should be $\geq 0.5\text{mm}$ each side.
- Gasket should be installed between the bezel and the CTP surface.
The final gap should be about $0.5\sim 1.0\text{mm}$.
- It is recommended to provide an additional support bracket for backside support when necessary (e.g. slim type TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module.

7 电容触摸屏安装指导

7.1 面框安装（附图 1）

- 客户面框窗口应大于 CTP 动作区域，各边离动作区应 $\geq 0.5\text{mm}$.
- 面框与 CTP 面板间应垫有胶垫，其最终间隙约为 $0.5\sim 1.0\text{mm}$.
- 建议必要时在背面提供附加支架(例如无安装结构的薄型 TFT 模块)，应仅利用适当支撑以保持模块位置。
- 安装结构应具有足够的强度，以防止外部不均匀力或扭曲力作用到模块上。

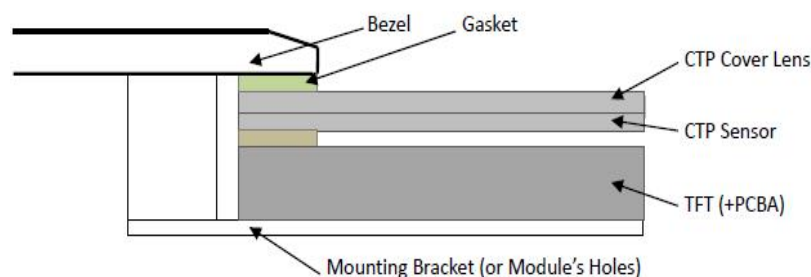


Figure
1

7.2 Surface Mounting (Figure 2)

- As the CTP assembling on the countersink area with double side adhesive.
The countersink area should be flat and clean to ensure the double side adhesive installation result.
- The Bezel is recommend to keep a gap ($\geq 0.3\text{mm}$ each side) around the cover lens for tolerance.
- It is recommended to provide an additional support bracket with gasket for backside support when necessary (e.g. TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module

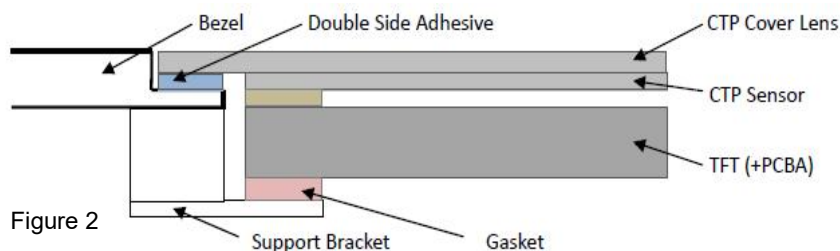


Figure 2

7.2 嵌入安装（附图 2）

- 客户面框应具有使用双面胶粘贴 CTP 的结构沉台面，其粘贴面要求平整且洁净无污染以保证粘贴牢靠。
- 考虑到制作误差，建议面框与 CTP 盖板之间四周留有 $\geq 0.3\text{mm}$ 间隙。
- 建议必要时在背面提供垫有胶垫附加支架（例如无安装结构的 TFT 模块），应仅利用适当支撑以保持模块位置。
- 安装结构应具有足够的强度，以防止外部不均匀力或扭曲力作用到模块上。

7.3 Additional Cover Lens Mounting (Figure 3)

- For the case of additional cover Lens mounting, it is necessary to recheck with the CTP specification about the material and thickness to ensure the functionality.
- It should keep a $0.2\sim 0.3\text{mm}$ gap between the cover lens and the CTP surface..
- The cover lens window should be bigger than the active area of the CTP. It should be $\geq 0.5\text{mm}$ each side.
- It is recommended to provide an additional support bracket for backside support when necessary (e.g. slim type TFT module without mounding structure). They should only provide appropriate support and keep the module in place.
- The mounting structure should be strong enough to prevent external uneven force or twist act onto the module.

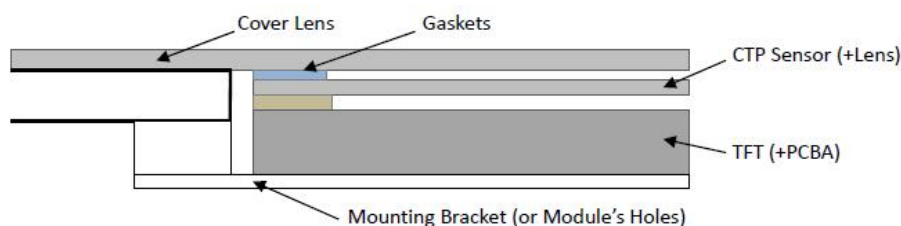


Figure 3

7.3 覆加盖板（附图 3）

- 需要覆加玻璃盖板的安装，为确保其功能，有必要查看产品规格书中有关盖板材料和厚度的说明。
- 玻璃盖板与 CTP 表面之间应留有 $0.2\sim 0.3\text{mm}$ 间隙。
- 玻璃盖板视窗应大于 CTP 动作区域，各边离动作区应 $\geq 0.5\text{mm}$ 。
- 建议必要时在背面提供附加支架（例如无安装结构的薄型 TFT 模块），应仅利用适当支撑以保持模块位置。
- 安装结构应具有足够的强度，以防止外部不均匀力或扭曲力作用到模块上。

Warranty

This product has been manufactured to our company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed our company's acceptance inspection procedures.
- When the product is in CCFL models, CCFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.
- We cannot accept responsibility for intellectual property of a third part, which may arise through the application of our product to our assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

Smart LCD

CAN Interface Protocol Reference

Prepared by:	Checked by:	Approved by:
Date: 2025-03-07	Date:	Date:

Rev.	Descriptions	Edit	Release Date
0.1	- Preliminary Draft release	liwenming	2025-03-07

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1 Basic

CANopen is a CAN-based communication protocol. Over the CANopen master is able to communicate with up to 127 slaves. CANopen provides SDO objects and PDO objects for transferring data and data is stored in object dictionary. The object dictionary is like a table that holds all network accessible data and it may be read and written to by the master.

The Smart LCD is operated as such a slave device and it uses a standard CANopen protocol (CiA DS301 v4.02). Appendix 1 provides a description of object dictionary. It allows the adjustment of bit rates from 10 kbit/s to 1000 kbit/s.

2 Message Transmission Format

CANopen message transmission adopts CAN base frame format (11-bit CAN-ID/COB-ID), which consist of:

- A 11 bit COB-ID, as the unique identifier for message transmission
- Data field, data to be transmitted (0~8 bytes)

11bit	0~8 Byte
COB-ID	Data

Note.

*1. Numerical data type are transferred using little-endian format.

3 Communication Type

3.1 Communication type table

Communication type	Descriptions
NMT	NMT is used to switch network state and control nodes, these include NMT node control, heartbeat, and boot up.
SYNC	SYNC message can be used to synchronize the PDO transmissions.
PDO	PDO is used to transmit real-time data, which does not require a response from the receiving node.
SDO	SDO is used to transmit data and generates a response for each transmission.
LSS	LSS message is used to configure node-ID and Bit rate.

3.2 NMT

3.2.1 Node Control

Node control is used to switch NMT state. The Node control message has the CAN message identifier and contains 2 bytes. All CANopen slave nodes must be able to receive this message and act upon its content.

Message issued by the master:

COB-ID	Data	
	0	1
0x000	CS	Node-ID

Note.

*1. zero if addressed at all nodes, or the specific node-ID of the single node addressed with this message.

*2. The switch NMT state descriptions:

CS	Switch NMT state Descriptions
0x01	Switch to Operational
0x02	Switch to stopped
0x80	Switch to Pre-Operational
0x81	Reset application
0x82	Reset communication

NMT State Dependent Communication table

	Pre-Operational	Operational	Stopped
PDO	NO	YES	NO
SDO	YES	YES	NO
SYNC	YES	YES	NO
EMCY	YES	YES	NO
NMT	YES	YES	YES
LSS	YES	NO	YES

Note.

*1. Yes = executable

3.2.2 Heartbeat

Smart LCD device transmits a heartbeat message cyclically within 1017h Heartbeat Producer Time. When 1017h is set to a non-zero value, the device sending the packet with one byte of data indicating the NMT status.

Message issued by Smart LCD:

COB-ID	Data
0x700 + Node-ID	CS

Note.

*1. The default value for heartbeat producer time is 0, it can be configurable via SDO.

*2. The NMT state descriptions:

CS	NMT state Descriptions
0x04	Stopped
0x05	Operational
0x7F	Pre-Operational

3.2.3 NMT Boot-up

The CANopen Bootup Message is sent by a CANopen device when it starts. This is done to indicate to host device in the network that it is ready to communicate by other CANopen services.

Message issued by Smart LCD:

COB-ID	Data
0x700 + Node-ID	0x00

3.3 SYNC

Message issued by the master:

COB-ID	Data Length
0x80	0

Note.

*1. SYNC message can be used to synchronize the PDO transmissions.

3.4 PDO

PDOs (Process data objects) are used to transmit real-time data, typically no larger than 8 bytes. The transfer of PDO is performed with no protocol overhead. PDO communication is based on a producer/consumer model, and each PDO has a unique identifier. There are two kinds of use for PDO: data transmission "TPDO" and the data reception "RPDO".

Smart LCD provides 4 TPDOs and 4 RPDOs, for each PDO the pair of communication and mapping parameter is mandatory.

3.4.1 PDO communication parameter

The communication parameters indicate the CAN identifier that is used by this PDO, and the triggering event that prompts the transmission of the related PDO.

The communication parameters for receive PDOs are arranged in the index range from 1400h to 1403h and for transmit PDOs in the range from 1800h to 1803h.

PDO communication parameter table:

Index	Sub_index	Description	Data type
RPDO: 1400h to 1403h TPDO: 1800h to 1803h	00h	Number of entries	UINT8
	01h	COB-ID: TPDO/RPDO	UINT32
	02h	Transmission	UINT8
		00h: acyclic Synchronous	
		01h~F0h: cyclic Synchronous	
		FEh/FFh: Asynchronous	
	03h	Inhibit time(unit: 0.1ms)	UINT16
	05h	Event time(unit: ms)	UINT16
	06h	SYNC start value	UINT8

If TPDO's transmission=0, PDO is transmitted during the next "SYNC" after a value change.

If TPDO's transmission=1~240, PDO is transmitted for each first to 240th "SYNC" regardless of value changes

If TPDO's transmission=254/255 and event time > 5ms, PDO is transmitted when every event time milliseconds

If RPDO's transmission=254/255, update the received data directly to the application

3.4.2 PDO mapping parameter

The mapping parameters indicate which information of the local object dictionary is supposed to be transmitted and where the received information is to be stored. The related mapping entries are managed in the index ranges 1600h to 1603h and 1A00h to 1A03h.

PDO mapping parameter table:

Index	Sub_index	Description	Data type
RPDO: 1600h to 1603h TPDO: 1A00h to 1A03h	0x00	Number of PDO mapping parameter	UINT8
	0x01	PDO Mapping for an application object1	UINT32
	...	...	...
	0x08	PDO Mapping for an application object8	UINT32

The following table describes the mapping parameters:

bit	31	...	16	15	...	8	7	...	0
Description	Index			Sub_index			Object length		

Indexes and sub_index determine the location of the mapped object in object dictionary, and the object length indicates the specific bit length of the object.

Note.

*1. One PDO can map up to 8 objects, and the total bit length of mapping objects is up to 64 bit.

*2. The communication parameter and mapping parameter of TPDO 0 have been defined, it cannot be changed. It will transmit message containing TPK ID and page ID when touch TPK.

*3. PDO communication can be used only in operational state.

*4. PDO mapping parameters and communication parameters can be configurable via SDO.

3.4.3 TPDO communication format

Message issued by Smart LCD:

COB-ID	Data
TPDO 0 : 0x180 + Node-ID	1~8 Byte
TPDO 1 : 0x280 + Node-ID	1~8 Byte
TPDO 2 : 0x380 + Node-ID	1~8 Byte
TPDO 3 : 0x480 + Node-ID	1~8 Byte

3.4.4 RPDO communication format

Smart LCD receives message issued by the master and update data to object dictionary:

COB-ID	Data
RPDO 0 : 0x200 + Node-ID	1~8 Byte
RPDO 1 : 0x300 + Node-ID	1~8 Byte
RPDO 2 : 0x400 + Node-ID	1~8 Byte
RPDO 3 : 0x500 + Node-ID	1~8 Byte

3.5 SDO

SDO (Service data objects) enable access to all entries of a CANopen device's object dictionary. The SDO transmission is initiated by the client and the server replies. As a server of the SDO, if Smart LCD receives an SDO message, it will reply an SDO response message. The response message will indicate if the read/write was successful or not, and will provide an abort code if unsuccessful.

SDO message format:

COB-ID	Data							
0x580+Node-ID/ 0x600+Node-ID	0	1	2	3	4	5	6	7
	CS	Index		Sub_index (Sub)	Data			

Smart LCD support different transmission of the SDO :

- Expedited transfer (data length within 4 bytes)
- Normal (segmented) transfer (data length > 4 bytes)
- Block transfer (data length > 4 bytes)

3.5.1 Expedited transfer

Expedited transfer is used to transfer 4 bytes of data or less.

3.5.1.1 Expedited upload

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x40	Index		Sub	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x4F	Index		Sub	data			
			0x4B				data		-	-
			0x47				data		-	-
			0x43				data	-	-	-
	abnormal		0x80				Abort code			

Note.

*1. The meaning of the abort code returned is shown in Appendix 2.

*2. "-" = 0x00, the same below

3.5.1.2 Expedited download

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x23	Index		Sub	data			
			0x27				data			-
			0x2B				data		-	-
			0x2F				data	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x60	Index		Sub	-	-	-	-
	abnormal		0x80				Abort code			

3.5.2 Normal (segmented) transfer

The normal (segmented) transfer allows for transmission of data bigger than 4-bytes.

SDO transfer can be split up into:

- Initiate SDO upload / download
- Upload / Download SDO segment

3.5.2.1 Normal (segmented) upload

Initiate SDO upload

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x40	Index		Sub	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x41	Index		Sub	Data length			
	abnormal		0x80				Abort code			

Note.

*1. Data length is number of bytes to be upload.

Upload segments

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x60	-	-	-	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x00	Data						
	abnormal		0x80	Index		Sub	Abort code			
Master →		0x600+Node-ID	0x70	-	-	-	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x10	Data						
	abnormal		0x80	Index		Sub	Abort code			

Note.

*1. the 4th bit of CS is a flip bit, transmit once for segments and flip once for bits.

Upload the last segment

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x60/0x70	-	-	-	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x01/0x11	Data						
			0x03/0x13	Data						-
			0x05/0x15	Data					-	-
			0x07/0x17	Data				-	-	-
			0x09/0x19	Data			-	-	-	-
			0x0B/0x1B	Data		-	-	-	-	-
			0x0D/0x1D	Data	-	-	-	-	-	-
	abnormal		0x80	Index		Sub	Abort code			

Note.

*1. the 4th bit of byte 0 is a flip bit, transmit once for segments and flip once for bits.

E.g. If 15 bytes of data are uploaded, cs of 1st segment is 0x00, cs of 2nd segment is 0x10 and cs of 3rd segment is 0x0D.

3.5.2.2 Normal (segmented) download

Initiate SDO download

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x21	Index		Sub	Data length			
← Smart LCD	normal	0x580+Node-ID	0x60	Index		Sub	-	-	-	-
	abnormal		0x80				Abort code			

Note.

*1. data length is number of bytes to be download.

Download segments

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x00	Data						
← Smart LCD	normal	0x580+Node-ID	0x20	-	-	-	-	-	-	-
	abnormal		0x80	Index		Sub	Abort code			
Master →		0x600+Node-ID	0x10	Data						
← Smart LCD	normal	0x580+Node-ID	0x30	-	-	-	-	-	-	-
	abnormal		0x80	Index		Sub	Abort code			

Note.

*1. the 4th bit of CS is a flip bit, transmit once for segments and flip once for bits.

Download the last segment

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x01/0x11	Data						
			0x03/0x13	Data						-
			0x05/0x15	Data					-	-
			0x07/0x17	Data				-	-	-
			0x09/0x19	Data			-	-	-	-
			0x0B/0x1B	Data		-	-	-	-	-
			0x0D/0x1D	Data	-	-	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0x20/0x30	-	-	-	-	-	-	-
	abnormal		0x80	Index		Sub	Abort code			

Note.

*1. the 4th bit of byte 0 is a flip bit, transmit once for segments and flip once for bits.

3.5.3 Block transfer

The block transfer allows for transmission of data bigger than 4-bytes. Block transfer is faster than the segmented transfer for a large set of data.

SDO Block Transfer, which can be split up into

- Initiate block upload / Download
- Upload / Download block
- End block upload / download

3.5.3.1 Block upload

Initiate block upload:

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0xA0	Index		Sub	N	-	-	-
← Smart LCD	normal	0x580+Node-ID	0xC0	Index		Sub	Length	-	-	-
	abnormal		0x80				Abort code			
Master →		0x600+Node-ID	0xA3	-	-	-	-	-	-	-

Note.

*1. N: number of segments per block (1~127)

*2. Length: number of transmission bytes

Upload blocks(segment 1 ~ segment N):

		COB-ID	0	1	2	3	4	5	6	7
← Smart LCD		0x580+Node-ID	0x01	Data(segment 1)						
← Smart LCD		0x580+Node-ID	0x02	Data(segment 2)						
:		:	:	:						
← Smart LCD		0x580+Node-ID	N-1	Data(segment N-1)						
← Smart LCD		0x580+Node-ID	N	Data(segment N)						
Master →		0x600+Node-ID	0xA2	-	-	-	-	-	-	-

Note.

*1. The master send a response at the end of each block.

Upload the last block:

		COB-ID	0	1	2	3	4	5	6	7
← Smart LCD		0x580+Node-ID	0x01	Data(segment 1)						
← Smart LCD		0x580+Node-ID	0x02	Data(segment 2)						
:		:	:	:						
← Smart LCD		0x580+Node-ID	m-1	Data(segment m-1)						
← Smart LCD		0x580+Node-ID	0x80+m	Data(segment m)						
Master →		0x600+Node-ID	0xA2	-	-	-	-	-	-	-

Note.

*1. The number of segments is m.

*2. The master send a response at the end of each block.

End block upload:

		COB-ID	0	1	2	3	4	5	6	7
← Smart LCD	normal	0x580+Node-ID	CS	-	-	-	-	-	-	-
	abnormal		0x80	Index		Sub	Abort code			
Master →		0x600+Node-ID	0xA1	-	-	-	-	-	-	-

Note.

*1. CS Descriptions:

CS	Descriptions
0xC1	The Number of bytes in last segment that do not contain data is 0
0xC5	The Number of bytes in last segment that do not contain data is 1
0xC9	The Number of bytes in last segment that do not contain data is 2
0xCD	The Number of bytes in last segment that do not contain data is 3
0xD1	The Number of bytes in last segment that do not contain data is 4
0xD5	The Number of bytes in last segment that do not contain data is 5
0xD9	The Number of bytes in last segment that do not contain data is 6

3.5.3.2 Block download**Initiate SDO download:**

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0xC2	Index		Sub	Length	-	-	-
← Smart LCD	normal	0x580+Node-ID	0xA0	Index		Sub	0x10	-	-	-
	abnormal		0x80				Abort code			

Note.

*1. Length: number of transmission bytes

Download blocks(segment 1 ~ segment 16):

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x01	Data(segment 1)						
Master →		0x600+Node-ID	0x02	Data(segment 2)						
:		:	:	:						
Master →		0x600+Node-ID	0x0F	Data(segment 15)						
Master →		0x600+Node-ID	0x10	Data(segment 16)						
← Smart LCD		0x580+Node-ID	0xA2	0x10	0x10	-	-	-	-	-

Note.

*1. Smart LCD send a response at the end of each block.

Download the last block:

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	0x01	Data(segment 1)						
Master →		0x600+Node-ID	0x02	Data(segment 2)						
:		:	:	:						
Master →		0x600+Node-ID	m-1	Data(segment m-1)						
Master →		0x600+Node-ID	0x80+m	Data(segment m)						
← Smart LCD		0x580+Node-ID	0xA2	m	0x10	-	-	-	-	-

Note.

*1. The number of segments is m.

*2. Smart LCD send a response at the end of each block.

End block download:

		COB-ID	0	1	2	3	4	5	6	7
Master →		0x600+Node-ID	CS	-	-	-	-	-	-	-
← Smart LCD	normal	0x580+Node-ID	0xA1	-	-	-	-	-	-	-
	abnormal		0x80	Index		Sub	Abort code			

Note.

*1. CS descriptions:

CS	Descriptions
0xC1	The Number of bytes in last segment that do not contain data is 0
0xC5	The Number of bytes in last segment that do not contain data is 1
0xC9	The Number of bytes in last segment that do not contain data is 2
0xCD	The Number of bytes in last segment that do not contain data is 3
0xD1	The Number of bytes in last segment that do not contain data is 4
0xD5	The Number of bytes in last segment that do not contain data is 5
0xD9	The Number of bytes in last segment that do not contain data is 6

3.6 LSS

Smart LCD may be configured node-ID or bit timing parameters via LSS (layer setting services) communication.

3.6.1 Switch state global service

3.6.1.1 Switch Mode Global

By switch state global service, the LSS master device shall switch all LSS slave devices in the network into LSS waiting state or LSS configuration state.

Message issued by the master:

COB-ID	0	1
0x7E5	0x04	Mode

Mode = 0: switch to waiting state

Mode = 1: switch to configuration state

3.6.1.2 Switch state selective service

By identify the LSS address(1018H), the LSS master device shall switch the Smart LCD into configuration state.

The master sends messages in turn:

COB-ID	0	1	2	3	4	5	6	7
0x7E5	0x40	vendor-ID				0x00		

COB-ID	0	1	2	3	4	5	6	7
0x7E5	0x41	product-code				0x00		

COB-ID	0	1	2	3	4	5	6	7
0x7E5	0x42	Revision-number				0x00		

COB-ID	0	1	2	3	4	5	6	7
0x7E5	0x43	serial-number				0x00		

If the sending LSS address attribute equals the Smart LCD LSS address, the Smart LCD replies the packet and switch to configuration state.

Message issued by Smart LCD:

COB-ID	0	1	2	3	4	5	6	7
0x7E4	0x44	00	CiA reserved					

3.6.2 Configuration services

The configuration services are used to configure the node_ID or the bit timing parameters. The configuration services are supported only in configuration state and the Smart LCD does not support store the configuration.

3.6.2.1 Configure node_ID service

Message issued by the master:

COB-ID	0	1
0x7E5	0x11	node-ID

Message issued by Smart LCD:

COB-ID	0	1	2	3	4	5	6	7
0x7E4	0x11	Error code	0x00			0x00		

Error code = 0, success

Error code = 1, failure

Note.

*1. Only one LSS slave device into LSS configuration state before requesting this service.

3.6.2.2 Configure bit timing parameters service

Message issued by the master:

COB-ID	0	1	2
0x7E5	0x13	0x00	index

The following table shows the relationship between bit timing parameter(bit rate) and index

Bit rate	index
1000K Bit	0
800K Bit	1
500K Bit	2
250K Bit	3
125K Bit	4
100K Bit	5
50K Bit	6
20K Bit	7
10K Bit	8

Message issued by Smart LCD:

COB-ID	0	1	2	3	4	5	6	7
0x7E4	0x13	error code	0x00			0x00		

3.6.2.3 Activate bit timing parameters service

The LSS master shall activate the bit timing as defined by the configure bit timing parameters service.

Message issued by the master:

COB-ID	0	1	2
0x7E5	0x15		switch delay(ms)

The switch delay parameter shall specify the length of two delay periods of equal length, which are necessary to avoid operating the bus with differing bit timing parameters.

Appendix 1: Object dictionary

(1000h~1018h) - General communication objects

Index	Sub_index	Description	Data Type	Access	PDO Mapping	Default value
1000h	-	Device Type	UINT32	RO	NO	0x00000000
1001h	-	Error Register	UINT8	RO	NO	0x00
1005h	-	SYNC COB ID	UINT32	RW	NO	0x00000080
1006h	-	Communication Cycle Period	UINT32	RW	NO	0x00000000
1008h	-	Manufacturer Device Name	STR	RO	NO	--
1009h	-	Manufacturer Hardware Version	STR	RO	NO	--
100Ah	-	Manufacturer Software Version	STR	RO	NO	--
1014h	-	Emergency COB ID	UINT32	RW	NO	Node ID + 0x80
1017h	-	Producer Heartbeat Time	UINT16	RW	NO	0x0000
1018h	0	Identity	UINT8	RO	NO	0x04
	01h	Vendor ID	UINT32	RO	NO	0x00000000
	02h	Product Code	UINT32	RO	NO	0x00000001
	03h	Revision Number	UINT32	RO	NO	0x00000001
	04h	Serial Number	UINT32	RO	NO	0x00000000

1200h - SDO parameter object

Index	Sub_index	Description	Data Type	Access	PDO Mapping	Default value
1200h	0	SDO server parameter	UINT8	RO	NO	0x02
	1	Client to server COB-ID	UINT32	RO	NO	Node ID + 0x600
	2	Server to client COB-ID	UINT32	RO	NO	Node ID + 0x580

(1400h~16FFh) - RPDO Parameter objects

Index	Sub_index	Description	Data Type	Access	PDO Mapping	Default value
1400h	0	RPDO 0 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x200
	2	Transmission Type	UINT8	RW	NO	0xFE
1401h	0	RPDO 1 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x300
	2	Transmission Type	UINT8	RW	NO	0xFE
1402h	0	RPDO 2 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x400
	2	Transmission Type	UINT8	RW	NO	0xFE
1403h	0	RPDO 3 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x500
	2	Transmission Type	UINT8	RW	NO	0xFE
1600h	0	RPDO 0 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	RPDO 0 Mapping for an application object 1~8	UINT32	RW	NO	--
1601h	0	RPDO 1 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	RPDO 1 Mapping for an application object 1~8	UINT32	RW	NO	--
1602h	0	RPDO 1 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	RPDO 1 Mapping for an application object 1~8	UINT32	RW	NO	--
1603h	0	RPDO 1 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	RPDO 1 Mapping for an application object 1~8	UINT32	RW	NO	--

(1800h~1AFF) - TPDO parameter objects

Index	Sub_index	Description	Data Type	Access	PDO Mapping	Default value
1800h	0	TPDO 0 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x180
	2	Transmission Type	UINT8	RW	NO	0xFE
	3	Inhibit Time	UINT16	RW	NO	0x00C8
	5	Event Timer	UINT16	RW	NO	0x0000
	6	SYNC start Value	UINT8	RW	NO	0x00
1801h	0	TPDO 1 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x280
	2	Transmission Type	UINT8	RW	NO	0xFE
	3	Inhibit Time	UINT16	RW	NO	0x00C8
	5	Event Timer	UINT16	RW	NO	0x0000
	6	SYNC start Value	UINT8	RW	NO	0x00
1802h	0	TPDO 2 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x380
	2	Transmission Type	UINT8	RW	NO	0xFE
	3	Inhibit Time	UINT16	RW	NO	0x00C8
	5	Event Timer	UINT16	RW	NO	0x0000
	6	SYNC start Value	UINT8	RW	NO	0x00
1803h	0	TPDO 3 Communication Parameter	UINT8	RO	NO	0x06
	1	COB ID	UINT32	RW	NO	Node ID + 0x480
	2	Transmission Type	UINT8	RW	NO	0xFE
	3	Inhibit Time	UINT16	RW	NO	0x00C8
	5	Event Timer	UINT16	RW	NO	0x0000
	6	SYNC start Value	UINT8	RW	NO	0x00
1A00h	0	TPDO 0 Mapping Parameter	UINT8	RW	NO	0x08
	1	TPDO 0 Mapping for an application object 1	UINT32	RW	NO	0x25002740
	2~8	TPDO 0 Mapping for an application object 2~8	UINT32	RW	NO	--
1A01h	0	TPDO 1 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	TPDO 1 Mapping for an application object 1~8	UINT32	RW	NO	--
1A02h	0	TPDO 2 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	TPDO 2 Mapping for an application object 1~8	UINT32	RW	NO	--
1A03h	0	TPDO 3 Mapping Parameter	UINT8	RW	NO	0x08
	1~8	TPDO 3 Mapping for an application object 1~8	UINT32	RW	NO	--

(2000h~24FFh) - Integer Variable

Index	Sub_index	Description	Data Type	Access	PDO Mapping	Default value
2000~21FFh	0	Number of string variable	UINT8	RO	NO	0x02
	1~2	string variable	STR	RW	YES	-
2200~22FFh	0	Number of 16bit Integer variable	UINT8	RO	NO	0x80
	1~128	16bit Integer variable	UINT16	RW	YES	0
2300~23FFh	0	Number of 32bit Integer variable	UINT8	RO	NO	0x40
	1~64	32bit Integer variable	UINT32	RW	YES	0
2400~24FFh	0	Number of 64bit Integer variable	UINT8	RO	NO	0x20
	1~32	64bit Integer variable	UINT64	RW	YES	0

The following table gives an overview over the relationship between Index-Sub Index and the Smart LCD Address space

Index	Index - Sub_index	Smart LCD Address space	Variable Type
2000~21FFh	2000-01h	0x000000	VP_STR (string variable)
	2000-02h	0x000080	
	2001-01h	0x000100	
	2001-02h	0x000180	
	⋮	⋮	
	21FF-01h	0x01FF00	
2200~22FFh	21FF-02h	0x01FF80	VP_N16 (16bit Integer variable)
	2200-01h	0x080000	
	2200-02h	0x080002	
	2200-80h	0x0800FE	
	⋮	⋮	
	22FF-01h	0x08FF00	
2300~23FFh	22FF-02h	0x08FF02	VP_N32 (32bit Integer variable)
	22FF-80h	0x08FFFE	
	2300-01h	0x020000	
	2300-02h	0x020004	
	2300-40h	0x0200FC	
	⋮	⋮	
2400~24FFh	23FF-01h	0x02FF00	VP_N64 (64bit Integer variable)
	23FF-02h	0x02FF04	
	23FF-40h	0x02FFFC	
	2400-01h	0x030000	
	2400-02h	0x030008	
	2400-20h	0x0300F8	
	⋮	⋮	
	24FF-01h	0x03FF00	
	24FF-02h	0x03FF08	
	24FF-20h	0x03FFF8	

2500h - System Register Variable

Index	Description	Data type	Access	PDO Mapping	Default value
2500h	Register Variable	--	--	--	--

System register variable

Sub_Index	Description	Data type	Access	PDO Mapping	Default value
01h	Page ID	UINT16	WO	YES	--

Display a pre-stored TML file(page), value = 0~999

Sub_index	Description	Data type	Access	PDO Mapping	Default value
02h	Current Page ID	UINT16	RO	YES	--

The current page ID

Sub_index	Description	Data type	Access	PDO Mapping	Default value
03~0Ah	Timer Ctrl 0~7	UINT8	RW	YES	0

0 = stop the timer
1 = count down , time down to 0x00000000
3 = count up, time up to 0x7FFFFFFF

Sub_index	Description	Data type	Access	PDO Mapping	Default value
0Bh	RTC	INT56	WO	YES	0

E.g.

Byte	Descriptions
0	RTC - Year, Value = 0~99(2000~2099)
1	RTC - Month, Value = 1~12
2	RTC - Day, Value = 1~31
3	RTC - Hour, Value = 0~23
4	RTC - Minute, Value = 0~59
5	RTC - Second, Value = 0~59
6	RTC - Set, Value = 1, SYNC the time

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6
0x18	0x01	0x01	0x08	0x20	0x0A	0x01

the time is 2024-01-01 08:32:10

Sub_index	Description	Data type	Access	PDO Mapping	Default value
0Ch	USB Access Lock	STR	WO	YES	--

Value = password, Unlock the USB drive with pre-stored password

Sub_index	Description	Data type	Access	PDO Mapping	Default value
0Dh	Select project folder	UINT8	RW	YES	--

Project ID = 0~9
0: System execute the default project "THMT"
1~9: System execute the project "THMT01"~"THMT09"

Sub_index	Description	Data type	Access	PDO Mapping	Default value
0Eh	Read project folder ID	UINT8	RO	YES	--

Read the current project
Value = the current project ID

Sub_index	Description	Data type	Access	PDO Mapping	Default value
0Fh	Format the U drv	UINT32	WO	YES	--

0xA55AAA55 = format the USB drive.
All the files (include the security lock file) will be erased

Sub_index	Description	Data type	Access	PDO Mapping	Default value
10h	Reset	UINT32	WO	YES	--

0xA55AAA55 = restart the Smart LCD

Sub_index	Description	Data type	Access	PDO Mapping	Default value
12h	Buzzer	UINT16	RW	YES	--

Buzzer touch sound control, sounding time length (in 10ms), value = 0~63, 0x00=disable

Sub_index	Description	Data type	Access	PDO Mapping	Default value
13h	Backlight	UINT8	WO	YES	--

Backlight brightness setting, value = 0~64

Sub_index	Description	Data type	Access	PDO Mapping	Default value
14h	ScreenSaver Backlight	UINT8	RW	YES	--

Screen Saver backlight brightness setting, value = 0~64

Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
15h	Screen Saver Page	UINT16	RW	YES	--																																																				
Screen Saver display Page, value = 0~999																																																									
Sub_Index	Description	Data type	Access	PDO Mapping	Default value																																																				
16h	Screen Saver Timer1	UINT16	RW	YES	--																																																				
17h	Screen Saver Timer2	UINT16	RW	YES	--																																																				
Screen saver delay time, value = 0~65535																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
18h	Real time backlight	UINT8	RO	YES	--																																																				
Real time backlight brightness, value = 0~64																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
19h	Multi Language	UINT8	RW	YES	0x00																																																				
Multi_Language ID, the value is the language ID of the display																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
1Ah	Udisk_Update_Mode	UINT8	RW	YES	0x00																																																				
0=Default(display update UI) 1=No files, not display update UI 2=Only starting within 4s, always displaying updated UI 3=Only starting within 4s, no files, not display update UI 4=Disable update																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
1Bh	TTF space set	UINT8	RW	YES	0x00																																																				
Reserved																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
1Ch	Country Code	UINT8	RW	YES	0x00																																																				
Country Code table																																																									
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Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
1Dh	Code Page	UINT8	RW	YES	0x00																																																				
Code Page table																																																									
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Code Page	Descriptions	Code Page	Descriptions																																																						
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11	1251 (ANSI - Cyrillic)	--	--																																																						
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
1Eh	IS CN or EN	UINT8	RW	YES	0x00																																																				
PIP Chinese keyboard input is Chinese Input or English Input 0 = Chinese 1 = English																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
1Fh	PIP Key Board state	UINT8	RO	YES	0x00																																																				
0 = PIP Key Board is not used 1 =PIP Key Board is using																																																									
Sub_index	Description	Data type	Access	PDO Mapping	Default value																																																				
20h	Screen touch state	UINT8	RO	YES	0x00																																																				

0 = screen is not touched
1 = touching the screen

Sub_index	Description	Data type	Access	PDO Mapping	Default value
21h	Touch coordinate X	UINT16	RO	YES	0x0000
The value is the last touch coordinate X					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
22h	Touch coordinate Y	UINT16	RO	YES	0x0000
The value is the last touch coordinate Y					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
23h	Touch_TPK ID	UINT16	RO	YES	0x0000
The value is TPK ID of the last touch, if value = 0xFFFF, TPK has never been touched					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
24h	page ID of TPK	UINT16	RO	YES	0x0000
The value is page ID of TPK that recently touch					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
25h	TPK touch state	UINT8	RO	YES	0x00
If value = 0, no touch If value > 0, touch down					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
26h	VP address	UINT32	RO	YES	--
The value is VP address of TPK that recently touch					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
27h	Return parameter	INT64	RO	YES	--

The value is the return parameter of TPK that recently touch

Byte0 = response code (0x77/0x78/0x79)

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5~7
0x77	Addr0(LSB)	Addr1	Addr2	Addr3(MSB)	0x00
0x78/0x79	page ID_L	page ID_H	TPK ID_L	TPK ID_H	0x00

0x77: Select the "True" options for TPK Properties - "Input VP Return".

0x78: Touched release Key_ID defined, select the "Up" option for TPK properties - "Return Value".

0x79: Touched down Key_ID defined, select the "Down" option for TPK properties - "Return Value".

2501h - VP_G16 Variable

Index	Description	Data type	Access	PDO Mapping	Default value
2501h	VP_G16 Variable	--	--	YES	0x04
16 bit graph Variable					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
01h	VP_G16 address	UINT32	RW	YES	0x060000
The graph variable address, value = 0x060000~0x07FFF8					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
02h	Graph range length	UINT16	RW	YES	0x0000
The value is graph length and the range is start with VP_G16 address					

Sub_index	Description	Data type	Access	PDO Mapping	Default value
03h	Offset	UINT16	RW	YES	0x0000
If the value < graph range length, write graph value to VP_G16 address (address + Offset) and the value is self-incrementing					
If the value = graph range length, write graph value to the last position(address + graph range length) of VP_G16 array with rotation effect					

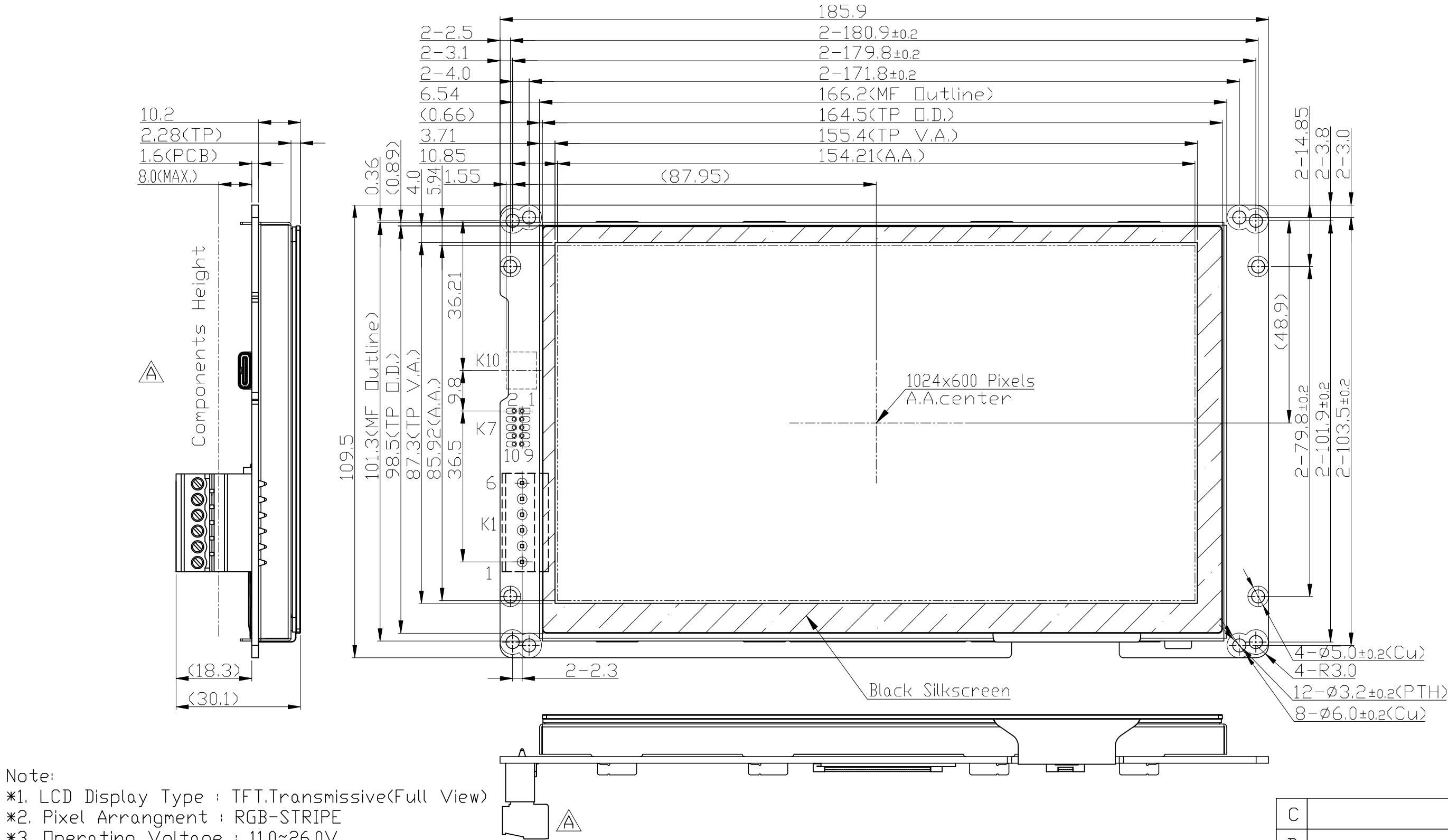
Sub_index	Description	Data type	Access	PDO Mapping	Default value
04h	Graph value	UINT16	RW	YES	0
If the value is update, it will write graph value to VP_G16 address, value = 0~65535					

Appendix 2: SDO abort code

Abort code	name
0503 0000h	Toggle bit not alternated
0504 0000h	SDO protocol timed out
0504 0001h	Client/Server command specifier not valid or unknown
0504 0002h	Invalid block size(block mode only)
0504 0003h	Invalid sequence number(block mode only)
0504 0004h	CRC error(block mode only)
0504 0005h	Out of memory
0601 0000h	Unsupported access to an object
0601 0001h	Attempt to read a write only object
0601 0002h	Attempt to write a read only object
0602 0000h	Object does not exist in the object dictionary
0604 0041h	Object cannot be mapped to the PDO
0604 0042h	The number and length of the objects to be mapped would exceed PDO length
0604 0043h	General parameter incompatibility reason
0604 0047h	General internal incompatibility in the device
0606 0000h	Access failed due to an hardware error
0607 0010h	Data type does not match, length of service parameter does not match
0607 0012h	Data type does not match, length of service parameter too high
0607 0013h	Data type does not match, length of service parameter too low
0609 0011h	Sub-index does not exist
0609 0030h	Invalid value for parameter (download only)
0609 0031h	Value of parameter written too high (download only)
0609 0032h	Value of parameter written too low (download only)
0609 0036h	Maximum value is less than minimum value
060A 0023h	Resource not available: SDO connection
0800 0000h	General error
0800 0020h	Data cannot be transferred or stored to the application
0800 0021h	Data cannot be transferred or stored to the application because of local control
0800 0022h	Data cannot be transferred or stored to the application because of the present device state
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of a file error)
0800 0024h	No data available

K1 Terminal	
No	Pin Name
1	VDD
2	NC
3	NC
4	CAN_H
5	CAN_L
6	VSS

K7 Terminal	
No	Pin Name
1	VDD
2	VDD
3	VDD
4	NC
5	CAN_L
6	CAN_H
7	NC
8	VSS
9	VSS
10	VSS



Note:

- *1. LCD Display Type : TFT,Transmissive(Full View)
- *2. Pixel Arrangement : RGB-STRIPE
- *3. Operating Voltage : 11.0~26.0V
- *4. Backlight : White LED
- *5. Color Depth : 65k colors
- *6. User Interface : CAN
- *7. Terminal :
 - K1 : P3.81(6*1)
 - K7 : P2.0(5*2)
 - K10 : USB Type-C
- *8. Touch Panel Type : Capacitive Touch Panel
- *9. Operating Temperature : -20°C~70°C
- *10. Storage Temperature : -30°C~80°C
- *11. Unmarked Tolerance : ≤150,±0.3; >150,±0.5

C		
B		
A	Revise Outline and Terminal	Liyongzheng 2025-03-14
Rev	Note	Date
Dwg	Title	HMT070MEE-D Outline Dwg
Dwg No.	MK-008575a-1-1	Date 2024-07-26
Scale 1/1	Tol.	Unit mm
Approved	Checked	Drawn Li Yongzheng
TOPWAY		