

T.A.O. NEWSLETTER

Quarterly Company Newsletter



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Highlight

ENVIRONMENTAL FRIENDLINESS, SIMPLICITY, COMFORT

➔ **Bosch Ceramic Fridge / Ceramic material**



This fridge from Bosch features an innovative ceramic material made from certificated clay, stone and sandy soil. The entire is covered with a thin coating of this ceramic, which gives the appliance a very autonomous appearance. The result is a naturally appealing surface with a pleasant feel and a timeless, clear design.^[2]

➔ **Hitachi Side by Side Grande Series**



In the new Side by Side Grande series Refrigerator, we created a new unique Polygon pattern design for the exterior glass door and complemented it with a new color: glass bronze [GBZ].



The new Refrigerator Side by Side Grande Series has been awarded 'iF Design Award 2020' in Berlin, Germany on February 4th, 2020.^[3]

➔ **Samsung Bespoke**



Designed for you, by you bring your personal style to the kitchen and beyond. Available in eight colors and two finishes, you can customize your dream BESPOKE 4-Door Flex™ using our Design Studio.^[4]

➔ **LG InstaView door-in-door refrigerator (Next8)**



The striking feature of the InstaView refrigerator is its door: with a “KnockOn” gesture its window in the right upper side becomes transparent, revealing the so-called “Magic Space” behind. The user can thus locate the desired food before opening the door and thereby reduce the cooling loss by up to 47 percent. This especially simplifies access to the foods or drinks that are used most frequently. With another “KnockOn” gesture the door will turn opaque again.^[5]



reddot award 2019 winner



TREND & TECHNOLOGY OF TOUCH PANEL DECORATION

The trend of creative design and decoration in the coming 2022 is minimalism and environmental friendliness. Over the past few years, many companies have advocated the use of natural or recycled materials, taking maximum care of our planet. Various environmental activists, such as Greta Thunberg, are also calling for the same.^[1]

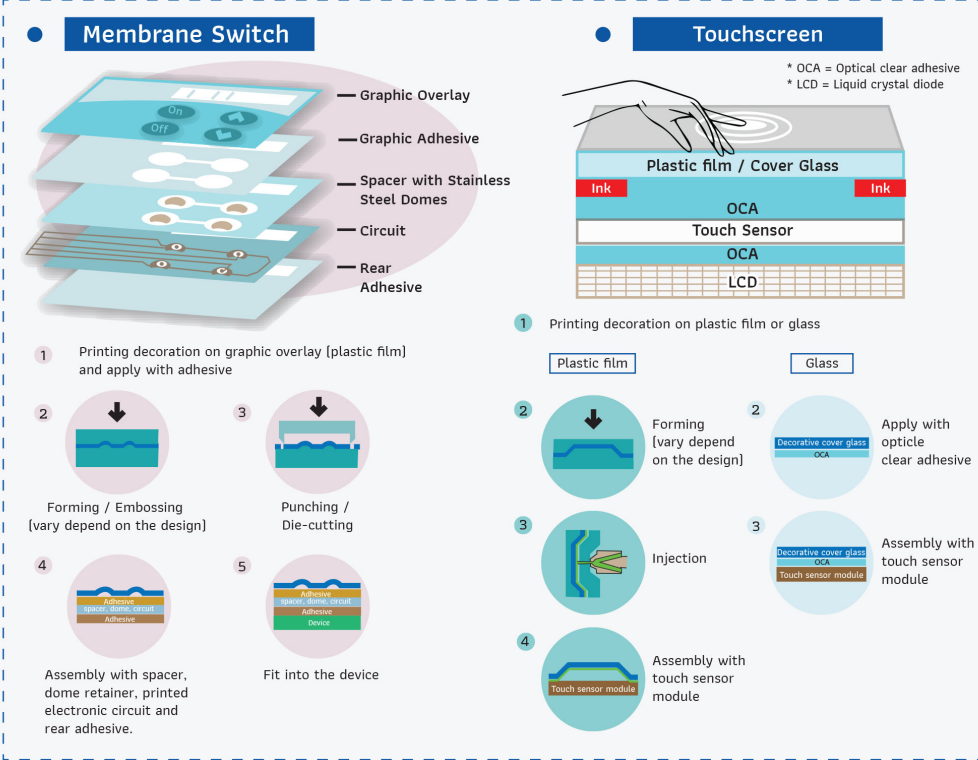
Not only furniture and decoration are subject to the cycle of trends, so are household appliances, as they undergo greater changes, but new ones also appear that make our lives easier, and manufacturers innovate to create more efficient and effective appliances. Functionalities like this have made manufacturers bet heavily on equipping household appliances with multi-functions, thus making them the so-called Smart Appliances of today.



The Thai electronics industry is forecast to return to healthy rates of growth over the three years from 2021 to 2023 including output by Thai electrical appliance manufacturers is forecast to rise by an average of 2.0-4.0% per year. Thanks to several different developments on the technology front. In particular, demand for electronics parts will be boosted by the development and rollout of 5G technology and the need for equipment that supports this, and by the increasing market penetration of smart cars, smart homes which will in turn encourage greater uptake of hyperconnected internet of things [IoT] applications. Domestically, stronger property markets and a recovery in the economy will help to boost demand, while internationally, a rebound in the global economy and within the ASEAN zone, higher rates of urbanization, and in terms of the Covid-19 pandemic, the demand of consumers for home appliances has grown as people have had in working from home.^[6]

Highlight

Overview & Process of Touch panel [Membrane switch, Touchscreen]



The touch panel is normally layered on the top of an electronic visual display of an information processing system. They are user-equipment interface utilities that allow for the communication of commands from users to electronic devices. Membrane switches can be thought of as one category of interface utilities alongside touchscreens. They have become an innate part of everyday life.

Membrane switches are designed to create an open or closed electrical circuit via user controls. It has a circuit printed on polyethylene terephthalate (PET) or polycarbonate (PC). The ink used for screen printing is usually conductive silver/carbon paste. ^[11]

A touchscreen technology is the assembly of a touch panel with a display device. Generally, a touch panel is covered on an electronic visual display within a processing system. It enables the user to interact directly with what is displayed. The display is often an LCD or OLED display whereas the system is normally like a laptop, tablet, smartphone, electrical appliances, or smart household appliances.

Touch Panel Industrial Segment

Both membrane switches and touchscreens have unique design capabilities. Design engineers are very creative with their approach to functionality and can often make either option work if needed.

With a touchscreen you really need visual, haptic, or audio feedback to know that you have engaged a button or command. With a membrane switch, you have more of a tactile experience which allows for higher precision and peace of mind. They provide a nice user experience knowing that you have pushed the right button. ^[17]

Nowadays, become very commonplace in our daily lives: mobile phones, ATM's kiosks, ticket vending machines, medical monitors, kitchen appliances, cars, industrial control panels, and more, divided by industry segment as follow. ^[18]

Membrane Switch



Household appliance



Medical appliance



Industrial control

Touchscreen



Household appliance



Medical appliance



Electronic communication



Automotive industry



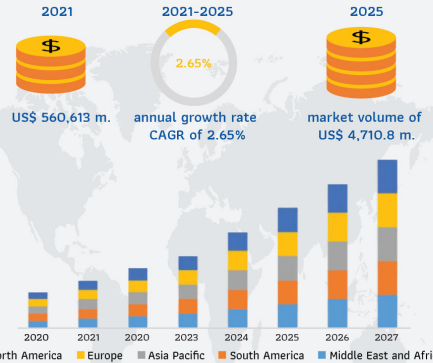
Industrial control



Kiosk



Revenue in the Household Appliances market amounts to US\$ 560,613 m. in 2021. The market is expected to grow annually by 2.65% [CAGR 2021-2025]. In the Household Appliances market, volume is expected to amount to 4,710.8 m. pcs. by 2025. ^[7]



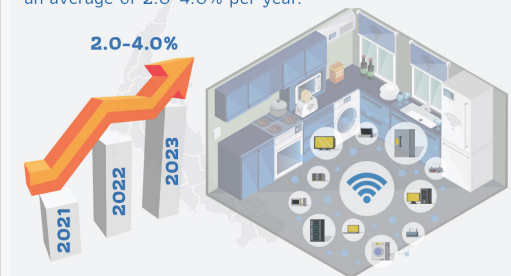
Global Touchscreen Display Market is expected to account for USD 50.85 billion by 2027 witnessing market growth at a rate of 8.50% in the forecast period of 2020 to 2027 ^[8]



Revenue in the Household Appliances market amounts to US\$ 3,678 m. in 2021. The market is expected to grow annually by 1.86% [CAGR 2021-2025]. In the Household Appliances market, volume is expected to amount to 30.1 m. pcs. by 2025. ^[9]



Over the three years from 2021 to 2023, output by Thai electrical appliance manufacturers is forecast to rise by an average of 2.0-4.0% per year. ^[10]



Development of Membrane switch & Touchscreen

1959 Toggle switches, and push buttons dials

The IBM 1620 Computer was announced by IBM on October 21, 1959. Marketed as an inexpensive "scientific computer". They have consisted of toggle switches, dials, and push buttons mounted on a sheet metal faceplate. ^[12]



1965 The first touchscreen

The first finger-driven touchscreen to have been invented by Eric Arthur Johnson in 1965 who worked at the Royal Radar Establishment in Malvern, United Kingdom. ^[13]



1970 Membrane switch

In 1970, when the first Membrane switch was officially launched, the situation continued until the early 1980s were improved. Membrane switch manufacturers quit the tactile membrane switch by using metal dome and the polyester material replaces Polycarbonate to solve the problem of easy damage to the product. ^[14,15]



2010 Touchscreen Anywhere

Now that touchscreens are in the public consciousness, more and more businesses are using them to for connecting with customers. The easy-to-use design of tablets makes them perfect for featuring digital catalogs or self-checkout areas. Companies also bring them to trade shows, showing their portfolio to passersby that can browse at their own pace. ^[16]



References:
 [1] <https://newdecortrends.com/> [2] <https://worlddesignguide.com/entry/285536-bosch-ceramic-fridge> [3] Hitach. lifecentric [4] <https://www.samsung.com/us/bespoke/> [5] <https://www.red-dot.org/project/ly-nostview-door-in-door-refrigerator-nest-8-37348> [6] Hi-tech Industries/Electronics - Krungsri/Th/research/industry [7] <https://www.statista.com/outlook/cmo/household-appliances/worldwide> [8] <https://www.databridgemarketresearch.com/reports/global-touch-screen-display-market> [9] <https://www.statista.com/outlook/cmo/household-appliances/thailand> [10] Krungsri-Electrical-Appliances [11] Membrane Switches vs Touch Screens - JN White.pdf [genersip.com] [12] https://en.wikipedia.org/wiki/IBM_1620 [13] History of touchscreen technology [14] History of Membrane Switches [15] <https://commons.wikimedia.org/w/index.php?curid=6974258> [16] History of touchscreen technology[2] [17] Comparing Membrane Switches and Touchscreens [18] Touch Panel Industrial Segment
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Touch Panel Decoration Solutions



MEMBRANE SWITCH

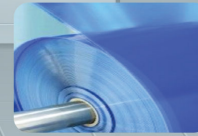


TOUCHSCREEN

The products support touch panel solutions



Printing Ink



Plastic films



Screen printing accessories



Screen printing machine



Drying and curing system

Refer trend of creative design and decoration is minimalism and environmental friendliness, a sample design on touch panel of refrigerator.

The designability of membrane switches have a much thinner profile which is much easier for mechanical designers to work. Touchscreens can be more difficult to integrate into a product assembly because of their overall thickness.^[1]

The graphic overlay layer of membrane switch is produced by printing on the second surface and add decorative texture on first surface of clear polyester or polycarbonate film. The circuitry is created by screen printing conductive ink. While upper layer of touch screen is called front panel needs high electrical resistance value and high opacity to work with LCD display, however, both can provide a positive user experience.

Solution case sample: Automatic Vacuum Cleaner Touch Panel

This solution case is based on T.A.O.'s experience, Nevertheless, the individual conditions must be considered and completed tested, to process production next step.

Decorative process

1. Substrate

Transparent film
- PC film [Makrofol®]
First surface
Second surface

2. Decorative process

2.1
Screen Noriphan®XWR as decoration layers.
Drying at 90°C

2.2
Screen Noriphan®HTR N as final layer to guarantee the adhesion to injection molding material. Drying at 90°C

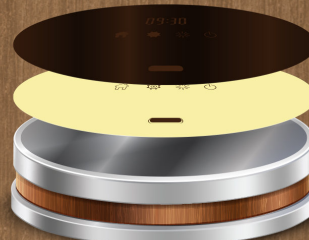
2.3
Screen Norilux®DC-10 as decoration texture.
Curing with UV dose 1,200 mJ/cm²

Touch panel

Touch Sensor

LCD

Electronic Device



[1] membrane-switches-vs-touch-screens-phil-heft

For more details, please feel free to contact at info@taobangkok.co.th

Product & Solutions



T.A.O. Bangkok Corporation Limited provide screen printing ink, plastic film substrate, screen printing machine with screen printing accessories and drying system for touch panel decoration.

There are different manufacturing methods to produce touch panels. Design and making the decorative plastic film (PET, PC or PMMA) or glass surfaces are the core elements for screen printing. Requirements for touch panel product, such as high resistance for chemical, mechanical and weather, resistances must be balanced with printing quality and optical density to achieve a perfect result.

These applications naturally require the seamless integration of different materials, increasingly appreciated for their appearance, technologies, and functions. And they must enable a user-friendly design.

The products support touch panel solutions as the following.

Printing ink

Decorative ink and printed electronic ink are normally used in touch panel application. Usually, the second surface of a plastic

(PET, PC or PMMA) or glass is printed. Not only very good adhesion, good ink flow, high flexibility, high fade-resistance, excellent reproduction and high edge definition of the ink is needed but also the feature of both decorative ink and printed electronic ink are described as follow:

• Decorative ink [color and texture]

Advantage of Decorative ink:

- High electrical resistance values at least 10^{12} ohm to ensure the input system operates correctly
- High optical density for high opacity
- High intercoat adhesion for multi-layered ink structures
- High durability and resistance to adhesives
- Excellent flexibility, suitable for punching
- Good light fastness

Recommend series:

- ink designed for graphic overly of membrane switch



• ink designed for cover of touchscreen

JUJO	8300 SERIES EMA	Mara® Star SR
	9300 SERIES HI-PET	Mara® Switch MSW
	3100 SERIES FM	Mara® Panel MPA
Proell	RC GA 41 SERIES	Ultra® Switch UVSW*
	NORIPHAN® HTR N	Mirror ink
MARABU	NORIPHAN® XWR	Mara® Glass MGL
	NORILUX® DC-10	Ultra® Glass UVGL

MARABU	Mara® Glass MGL
	Ultra® Glass UVGL
	Mara® Glass MGHT
Ultra® Glass UVG3C	

* Model for texture decoration.

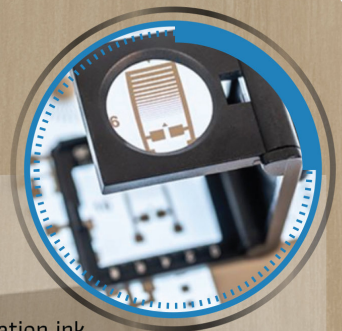
• Printed electronic ink

Advantage of printed electronic ink

- Both Conductive ink and Insulation ink are flexible and thermoformable with High Pressure forming machine or Thermoforming machine.
- Fine line printing
- VOC-free

Recommend series:

ELANTAS	Conductive silver inks
	Conductive carbon inks
	Insulating inks
JUJO	Jelcon CH-8
	Jelcon IN-10 M



Plastic films

Common substrates used in touch panel application for input systems are mainly high-quality transparent plastic materials like PET, PC, PMMA and compounds made of PC and PMMA.

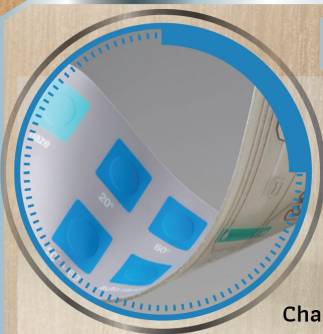
Characteristics of film for touch panel are high resistance for impact, abrasion, chemical and weathering. Especially electrical and insulation property are required.

Advantage of Plastic films:

- Glass-like transparency and toughness
- Excellent light transmission, enable to create novel designs when combined with LEDs or LCDs
- Excellent adhesion to numerous kinds of inks and coatings
- Excellent printability, die-cutting, cold formability and good embossing

Recommend film:

PET film	Toray: Excell® XG	PC film	Covestro: Makrofol® DE
	SKC: Skyrol® SH		Covestro: Makrofol® LM
			Covestro: Bayfol® CR



Screen printing machine

The screen-printing system is necessary for printing the ink on the substrate. In electronic application, printing machine and printing accessories which provide excellent print quality, maximum preciseness for multi-layer printing process with perfect precision fit are the best choice to create high productivity with small set-up times

Advantage of printing machine:

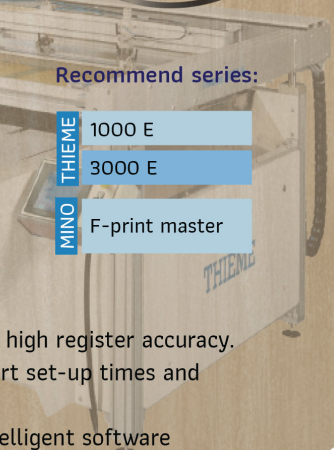
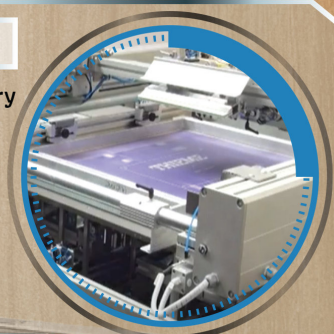
- Multi-layer printing process with perfect precision fit
- High speed and productivity.
- Vision System is characterized by two independent camera systems for automatic screening and automatic alignment of the printed material.

The two systems ensure a consistently high register accuracy.

- The whole machine concept allows short set-up times and economic handling
- Program control with user-friendly, intelligent software

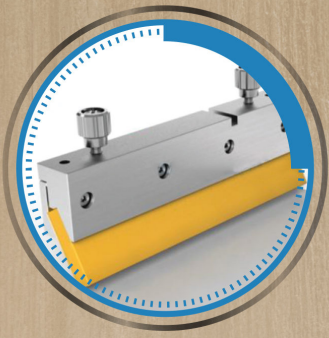
Recommend series:

THIEME	1000 E
	3000 E
MINO	F-print master





Screen printing accessories



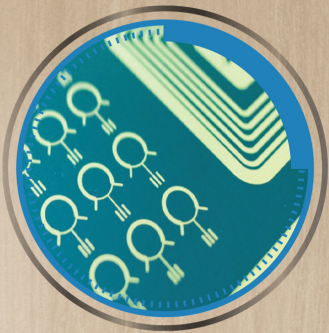
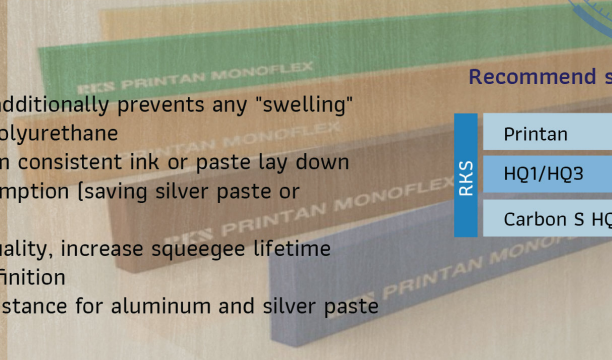
• Squeegee

Advantage of Squeegee:

- High quality of material additionally prevents any "swelling" and "undulation" of the polyurethane
- Process stable result from consistent ink or paste lay down
- Lower ink or paste consumption [saving silver paste or aluminum paste 5-6%]
- Best possible recovery quality, increase squeegee lifetime
- Reproducible fine line definition
- Outstanding abrasion resistance for aluminum and silver paste

Recommend series:

RKS	Printan
	HQ1/HQ3
	Carbon S HQ



• Stencil

Advantage of Stencil:

- Perfect and consistent printing results are achieved with reproducible sieving parameters such as tension, new softer emulsion system and using automatic coating system to control very accurate coating thickness and paste volume of the stencil
- During printing this new emulsion can better adapt on to the printing substrate surface as they are more flexible

Recommend products:

Frintrup: can customize as customer request



Drying and curing system

After printing the solvent-based ink, drying and intermediate drying is carried out with tunnel dryer, IR dryer or drying oven. For UV-based ink, the ink is cured by UV-curing system. The printing of multi-layered ink structure is followed by the final drying or curing that to essential for the stability and resistance of both solvent and UV ink film, respectively. The result is strongly influenced by the type and settings of the drying or curing unit. T.A.O. is able to provide high precision and consistency for hot-air temperature, IR radiation and UV power control system with energy efficient and cost-saving with Intelligent Energy Control (IEC), feature as below.

Advantage of Drying and curing system:

- Energy efficient with heat exchanger design
- Cost saving with the Intelligent Energy Control (IEC) uses a substrate sensor from the print machine to automatically control the dryer's run-condition. When no substrate is detected the dryer is put into stand-by state for power saving.
- High precision and consistency for temperature and UV power control
 - ± 0.5°C temperature variance across the belt width
 - ± 0.1°C temperature between set value and process value
- Constant conveyor belt speed
- Efficient cooling system protects UV lamp from heating, swelling or damaging and also protects workpiece from distortion by heat.



Available systems:

Natgraph	Air force dryer / Air force + IR dryer
	UV dryer
	Combination dryer

Remark : The dryer modules can be customize by select one or mix drying system

We are pleased to provide consultation on Touch Panel decoration solution that you required, or more detail please feel free to contact us at info@taobangkok.co.th or visit our website at www.taobangkok.co.th

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