Pilot Devices - 101

A basic guide to ABB's pilot device portfolio

ABB

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Contents

Objectives

The purpose of this guide is to reinforce the basic aspects of ABB's pilot device product offering. This includes the following:
- Understand fundamental pilot device terminology
- Recognize marketing opportunities
- Develop solutions with related components
- Make educated sales recommendations
- Compete in the market and improve ABB's market position in pilot devices
- Learn where to find the pilot device tools and resources available from ABB

Using this guide

This guide has been designed to give a thorough overview of pilot devices, both as a general industrial product, and also as a quality ABB offering.

Readers who are new to the pilot device controls industry should begin with Section 2, which explains several industry-wide terms and products.

For those who are familiar with pilot devices, but are new to the ABB product ranges, you may go straight to Section 3 which gets into the ABB product portfolio.

Product definition

Pilot devices are a family of related products including pushbuttons, selector switches, pilot lights, toggle switches, and signal beacons. In its simplest form, a pilot device is basically a device that communicates information, whether it is from the human operator to the machine, or from the machine back to the operator. Value is added when the operator is able to make better decisions or have better control of the system.

Pilot devices are products that can be found in *any* industrial or commercial application where human-to-machine interface is needed.

Terminology

Contact	The conducting part of a switch that makes or breaks a circuit. Available as "normally open", in which the circuit is open in its neutral state, or "normally closed", in which the circuit will be closed. Activation of the operator will reverse the neutral state of the contact.
Contact block	The part of a pilot device that encapsulates the contact. Blocks are held to the back of a device with a contact block holder.
Operator/Actuator	The part of the device that is touched to operate, i.e., the pushbutton head, selector switch knob, or pilot light lens.
Lamp block	The part of a pilot device that holds and activates the light bulb when it receives the appropriate signal
Maintained	A circuit that remains closed after pressure is released from the button
Momentary	A closed circuit that lasts only as long as pressure is maintained on the button
Rated thermal current	The amperage the pilot device can withstand in AC-1 applications (ABB's is 10A for our Modular range)
Rated operational current	The amperage the pilot device can withstand in AC-3 applications for a given voltage level.

Applicable industries & markets

Some of many industries with pilot device needs:
- Material handling – packaging, moving, warehousing, distribution
- Oil & gas mining/extracting, refining, processing
- Food & beverage packaging, distribution
- HVAC(R)
- Water/waste water
- Manufacturing – automotive/heavy equipment, machining, marine/aviation, glass & plastics
- Metals – mining, refining, processing, forming
- Commercial applications
- Many, many more!

Product descriptions & applications

Pilot devices are available in many shapes and sizes based on their functionality and application. In general, devices are designed for two general markets: the IEC (global) market, and the NEMA (North American) market. The NEMA standard does not dictate function and appearance of pilot devices, but the standard does allow the use of industrial market segments to define such requirements. Some common pilot devices and their applications are further discussed below:

	Flush Pushbutton - Require direct pressure on the operator surface, making it less likely to be accidentally activated
	Extended Pushbutton – Usually used for most prominent commands on a control panel, as it is easily accessible because of its height
	Selector Switch – Used for multiple commands in one control device, or often when maintained control is desired
	Mushroom Pushbutton – (40mm shown) Large push area makes an easy activation; often used for emergency controls
	Emergency Stop – Demands a more active decision on behalf of the worker to reset a control function
	Keyed Selector Switch – Used for safety-related issues, i.e., locking down a machine for maintenance
	Illuminated Pushbutton – Saves space and cost, combining two functions into one operator. Most ABB operators are available in an illuminated style
	Double Pushbutton - Saves space and cost; combines two operators (and an indicator in the illuminated version) into one 22 mm position on a panel.
	Potentiometer – Adjusts the amount of voltage sent to a machine.

Color coding & marking standards

Color Coding:

The IEC standard has adopted strict requirements concerning the application of pilot devices. For example, IEC 60204-1 requires pushbutton actuators be color-coded for universal application according to the format in the table above.

Pushbutton Actuators:

Color	Meaning	Explanation	Examples
Red	Emergency	Actuated in the event of a hazardous condition or emergency	Emergency-Stops
Yellow	Abnormal	Actuated in the event of an abnormal condition	Devices that intervene to suppress an abnormal condition; devices that intervene to restart an interrupted automatic cycle
Green	Normal	Actuated to initiate a normal condition	START/ON
Blue	Mandatory	Actuated for a condition requiring mandatory action	Reset function
White	No specific meaning assigned	For general initiation of functions except for emergency stop	START/ON (preferred) STOP/OFF
Black	No specific meaning assigned	For general initiation of functions except for emergency stops	START/ON STOP/OFF (preferred)

Pilot Lights:

Color	Meaning	Explanation	Action by Operator
Red*	Emergency	Hazardous condition	Immediate action to deal with hazardous condition (e.g., by operating the emergency-stop)
Yellow	Abnormal	Abnormal condition or impending critical condition	Monitoring and/or intervention (e.g., by reestablishing the intended function)
Green	Normal	Normal condition	Optional
Blue	Mandatory	Indication of a condition that requires action by the operator	Mandatory action
White	No specific meaning assigned	Other conditions; may be used whenever doubt exists about the application of other colors	Monitoring

*Note: Some market segments (such as automotive) have adopted a RED "run" pilot light indicator standard in which red indicator lights illuminate when machinery is operating in a potentially unsafe condition.

Marking:
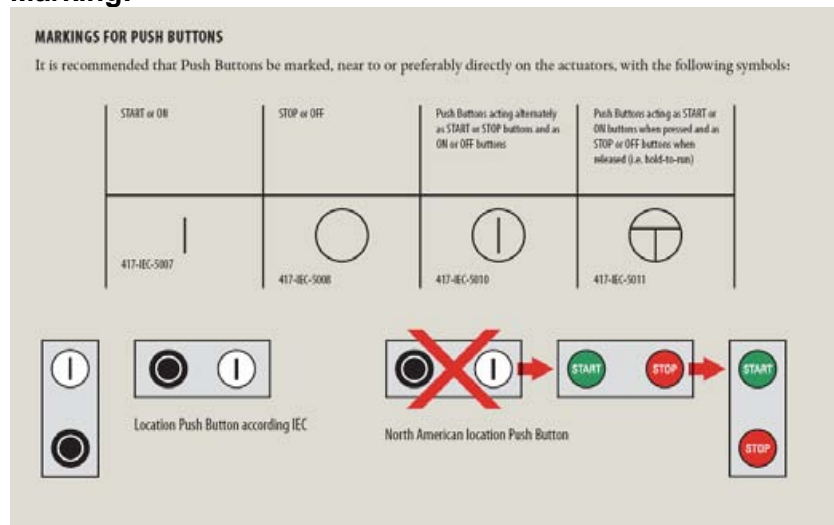
Introduction

In the U.S., the most common pilot device sizes are 30mm (70%) and 22mm (25%). Regardless of the hole size, the operator surfaces are actually about the same size for either a 30mm or 22mm device. The 22mm devices save panel space, are generally less expensive, and are great for OEMs shipping overseas as 22mm is the international standard. In addition to our 22mm product size, ABB has a 30mm adaptor available for using 22mm devices in a 30mm application.

ABB offers two complete ranges of pilot devices designed for most types of industrial environments. The following pages explain the differences and benefits of both ranges.

Modular range

The Modular range of ABB pilot devices is extensive, flexible, and durable. By combining a few basic components, a large number of different devices can be acquired.

The Modular range consists of pushbuttons, E-stop buttons, selector switches, pilot lights, signals, potentiometers, toggle switches, reset buttons, and special definite-purpose buttons.

Some features include:
- Easy to assemble, mount, and wire; reduces installation time for OEMs, and downtime/replacement costs for end-users
- 12 operator styles; 6 color choices; 1000's of combinations are available from mixing just a few components
- Can be used in tough environments, NEMA Types 1, 3R, 4, 4X, 12, 13 & IP 66
- Large text and push area
- Modern and substantial appearance
- Up to six contacts per actuator

What Makes Them "Modular"?
Our devices are designed so that each piece of the device can be selected and coordinated for a device's special purpose.

Shown (right to left):
- operator/actuator (red pushbutton head)
- locking nut which secures operator to panel
- contact block holder, snaps onto back of operator (light grey part). Available in 3- and 5-block widths
- contact blocks, snap onto back of the holder. Shown, 2 normally open (indicated by green)

Three Benefits of the Modular Range:

1. **Pre-wiring is Possible:** With our Modular range, contact blocks can be prewired before being installed onto a panel. With most competitors' designs, the entire pilot device unit must be first installed into a panel, and then they can be wired. This method insists that the second step (wiring) is only completed after the first step (installation) is performed. With ABB, users can do double-duty, having one employee install the operators onto the panel while another is wiring the contacts. This saves time by allowing two functions to be performed at once.

2. **Flexible and Customizable:** Any combination of operator, blocks, and accessories can be easily combined into one device, without the need for any tools. Our design features a unique snap-together feature, so assembly, stocking, and mounting are simplified.

3. **Base-mounted Enclosure Design:** Unique to ABB alone is our simplistic base-mount contact block design. In each ABB enclosure is a molded rail (sized to match 35mm DIN rail). Our base-mounted contact blocks snap into place in the base of our enclosures. This solution lets our users wire their enclosures neatly efficiently. With competitors' enclosures, the blocks (and wiring) are attached to the back of the lid. This flawed

design means that when an enclosure is opened, the wiring is pulled out with the lid of the box. With ABB's design, the blocks and wiring stays neatly in place when the lid is removed, even if the enclosure has been already been mounted. This makes maintenance, rewiring, light bulb changes, and contact rearrangement super-simple.

Assembled Modular Range
ABB also offers our Modular range pilot devices as preassembled units. Customers can select a unique combination of components to form a particular device with just one catalog part number.

Our new Assembled Pilot Devices catalog (LV088) simplifies selecting components, building part numbers, and calculating list prices into one easy process.

Compact range

The Compact range from ABB is establishing new standards of performance. This product line increases space-savings and streamlines cost. The all-in-one design makes everything easier: the entire functionality is condensed into one unit. Items do not need to be matched together, and each item has a single, unique part number. The Compact range consists of pushbuttons, E-stop buttons, selector switches, and pilot lights that include a new integrated LED style. The Compact range devices are compatible with the extensive Modular range products. Both product lines are identical from the front of the panel, so mixing devices from both ranges does not compromise the appearance of the control panel.

The main features include:
- Reliable and durable design
- Quick ordering, mounting, and wiring
- Built-in LED as an option
- Stocking inventory reduction
- Compatible with 30 mm adaptor
- One of the lowest built-in depths on the market (42 mm); this translates to greater clearances for panel components mounted behind the pilot devices
- Front-panel appearance is identical to Modular range, so they can be used side by side on a panel
- Wide selection of marked pushbuttons available
- NEMA Types 1, 3R, 4, 4X, 12, 13 & IEC IP 66, 67
- IP69K – For heavy spray-down applications

What makes them "Compact"?

Let's review: In general, pilot devices are typically built up from selected components, much like our Modular range. While this gives the advantage of being able to choose each component you want included in your pilot device, the disadvantage is that it's harder to manage all of the pieces involved!

There are number operators to choose from, then a contact block holder is needed, and of course all of the blocks must be selected. Each of these components has an individual part number and list price.

To simplify the ordering and inventory processes, ABB's Compact pilot devices features a unique all-in-one design. The mono-bodied device includes the operator *and* the desired combination of contacts integrated into one unit. Each piece has one part number, one list price, and takes up only space in inventory bins. In addition, the Compact range features one of the shallowest behind-panel depths on the market, at only 42 mm.

Three Benefits of the Compact Range:

1. **All-in-one Design:** This benefit means that stocking is easier, only one part number needs to be managed, only one list price, only one single part must be installed into a panel… and many more benefits! For panel builders using several identical parts over and over, this is the perfect product to increase productivity and eliminate massive inventory management.

2. **Highest Ratings Available:** The Compact range from ABB is available with all the industry-standard NEMA protection ratings: Type 1, 12, 13, 3R, 4, 4X.   And now, our range boasts new ratings as well: IP67 and IP69K. **IP67** is an IEC rating approval for the withstand of submersion in water up to 1m deep. **IP69K** is a rating often requested in the food/beverage, pharmaceutical, and waste treatment industries. This rating protects against high-pressure, high-heat sprays downs. The IP69K rating is tested with water sprayed onto the device at 1420psi (equivalent to an average-duty sand blaster!), at 176°F, and from the close-range distances of 4-6 inches. Compare this to the NEMA rating of water sprayed from 10 -12 feet away, without the high pressure or high temperature. Often devices

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rated NEMA 4 or 4X will not protect against ingress of water because the user is spraying the device from much closer distances than 10 feet. IP69K has been around since 1993, but is just catching on in the U.S. ABB is one of the first to offer this rating across a full line of products. Fast Facts sales sheets are available that give further details into this new rating.

3. **E-stop Enclosures:** New enclosures are available from ABB. These compact 1-hole stations are a mere 2 ½" square, versus traditional industry sizes of about 3" by 4" enclosures. The enclosures are designed to enclose our standard Compact range, and are available in both yellow and grey. The smaller size allows for much better usage of space, especially in small spaces where E-stop stations are mandatory (i.e., boom lift buckets, conveyor lines, control towers, airline gateways, etc.) And this doesn't even begin to address the cost-savings involved…

Disadvantages of the Compact Range
The Compact range is an efficient solution for pilot device products. However there are two disadvantages to the range: (1) Only 2 contacts are available per operator, and (2) illuminated pushbuttons are currently not an option. In a situation in which these two options are required, ABB's Modular range can be used to get the job done. Mixing and matching the two ranges on a panel is perfectly acceptable, and the lines have been designed to share a commonality in appearance from the operator side of a panel.

Emergency stops An Emergency-Stop or "E-stop" button is a special type of pilot device. These buttons have to meet specific requirements beyond the simply *stop* function. Some of these requirements are described below:

- **IEC 60947-5-5**, major E-stop certification. Deals specifically with "electrical emergency stopping devices with mechanical latching function"
- **(IEC 60204-1**, gives additional requirements for installation of an emergency stop
- **ISO 13850/4.4.4**, gives specific qualifications of latching "it shall not be possible for the e-stop device to engage without generating the stop command."

Beyond a basic "stop" pushbutton, E-stops are also required to lock the circuit in the open (or off) position, until the E-stop has been manually reset. This ensures that the machine can be inspected without the system accidentally being put back into the "on" mode.

The three most common style of E-stops are:
- Push-pull – the operator is pushed in and locks into stop; released by pulling back
- Twist-release – the operator is pushed in and locks into stop, released by twisting
- Key-release - the operator is pushed in and locks into position to stop; released only with a key.

ABB has a complete range of emergency stop pushbuttons, both in the Modular and Compact ranges.
This includes 30 mm, 40 mm and 60 mm operator heads with twist, pull or key release options. As an industry standard, E-stops are red with yellow background. We also offer the same buttons with various specialty colors. These non-red operators do not qualify as "emergency stops", but can be applied in a similar way to stop applications. (eg, black is often used as standard machine stop; blue is used along water valves; yellow is common for gas lines).

All ABB emergency stops include Positive Opening (or Positive Safety) contacts, which apply force directly to the normally closed (NC) contacts, guaranteeing that they open when the button is mechanically operated. This eliminates a potentially unsafe environment in which the circuit does not open and stop the system. Durability tests ensure a minimum mechanical life of 50,000 operations.

ABB also offers enclosures and shrouds designed specifically for our emergency stops, made of bright yellow polycarbonate. In addition, our Compact range of emergency stop enclosures gives customers maximum performance in the smallest space on the market!

Assembled stations & enclosures

ABB offers a full line of pilot device enclosures and assembled stations, of either plastic or metal material.

Non-metallic enclosures

ABB's PBT enclosures feature a unique design in which the contact blocks snap onto the base. The operators are mounted onto the lid of the enclosure and are held in place to activate the blocks when the lid is installed, though the blocks never touch the operator. This allows for simple maintenance and wiring; if the lid is removed, the blocks and wiring stay in place. With most competitors' designs, the blocks and wires are pulled out with the lid.

Features of our non-metallic enclosures include:
- 1-, 2-, 3-, 4-, and 6-seat available; one of the largest variety among market leaders
- Up to 5 contact blocks can be used per operator for some combinations
- Environmental ratings: NEMA Type 1, 3R, 4, 4X, 12, and 13; IP66 – rated for outdoor usage
- UL/CSA/CCC certifications
- High impact strength polycarbonate
- Shrouds with weep holes to eliminate moisture collection
- Withstands light acid solutions and other chemicals
- Base-mounted contacts allow for easy removal of operator cover; wiring remains with base

Compact enclosures

Our newest additions to the ABB pilot device enclosure line are the Compact range. These operator stations are the smallest on the market—perfect for any application where space savings is a must! Available in both yellow and gray, with a complete assortment of accessories.

Metallic enclosures

Type 12 – Oil-tight enclosures are designed to accommodate 22mm pushbuttons, selector switches, pilot lights, and other devices. NEMA Type 12 & 13. These products are primarily used in *indoor* environments to offer protection against *dust, falling dirt, and splashing of non-corrosive liquids.*

Type 4X Stainless – Stainless steel enclosures for 22mm pilot devices can withstand a wide range of environments—both indoors and outdoors. NEMA Type 4, 4X, 12, & 13. These products offer protection from *corrosion, wind-blown dust, rain, hose-directed liquids, and ice formation on the enclosure.*

Lamps

The bulb or LED in a pilot light is referred to as a "lamp". The most common types of lamps are incandescent (or filament) bulbs and LEDs.

Filament/Incandescent bulbs have good illumination, a lower unit cost, and can work with AC or DC. However, filament bulbs have a shorter lamp life (usually 6,000 to 10,000 hours).

LED (light emitting diode) lamps offer the greatest value by providing the longest service life and the best resistance to shock and vibration. They last over to 50,000 hours—that's about 6 years of 24-hour continuous usage! Before losing 50% of the illumination. LED color is determined by the wavelength of light that is emitted (in nanometers, nm). ABB's LEDs are available in five colors: Red---630 nm; Yellow---592 nm; Green---525 nm; Blue---470 nm; White---x=0.31, y=0.32

Transformer lamp blocks can work with any style of lamp. They drop the supplied voltage to the lamp, which provides for longer lamp life. This also filters voltage spikes. However, one disadvantage is that they only operate with AC current.
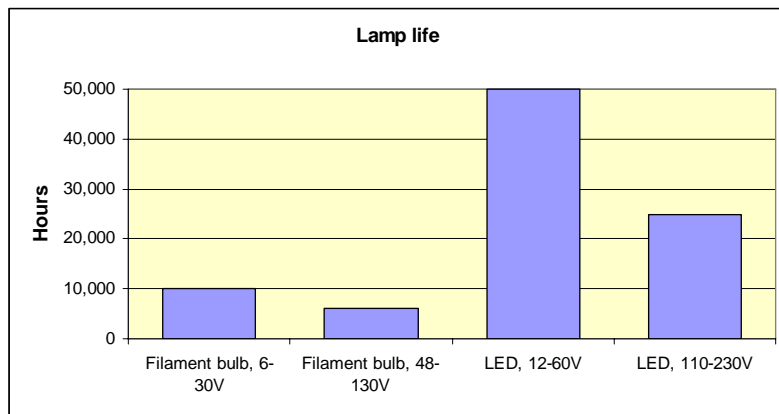
Lamp life

	Filament, 6-30V	Filament, 48-230V	LED, 12-60V	LED, 110-230V
Lamp life (hrs)	10,000	6,000	>50,000	25,000
Luminance	Medium	Low	Medium	High
Shock & vibration resistance	Fair	Fair	Best	Best

Integrated LEDs

Our Compact range of pilot lights are available both as empty bases (which can accept standard filament bulbs or LEDs), or with "Integrated LEDs". In this case, two LED diodes are embedded into a chip that is fused into the body of the pilot light unit. These LEDs have been tested to last over 50,000 hours without needing to be replaced.

Legend plates & text caps

ABB offers both standard and customized aluminum legend plates for all of our pilot devices. Custom-engraved legend plates are easy to order; order forms are included in our catalogs.

Legend plate features include:
- Legend plate holders with brushed aluminum inserts
- For plastic enclosures: legend plate holders or solid-piece legend plates
- Legend plates available for emergency stops

We also offer a wide selection of text caps for pushbuttons (flush, extended, illuminated and non-illuminated) and pilot lights. Marked text caps save panel space by eliminating the need for large legend plates.

In addition to text caps, ABB offers the ability to mark directly onto the button surface. We have some standard products available in our catalog with this direct marking method, but custom markings are another solution.

Special operators & accessories

ABB's line of pilot devices also includes some less common "special purpose" devices.

	The **definite purpose** pushbutton is a robust device for use in hot, cold, damp, oily, and other tough environments.
	Reset buttons are designed with a long shaft which can reset a mechanical trip latch through a door. These are commonly used on the enclosures of our combination starters to reset a tripped overload relay.
	Toggle switches can be used in place of a selector switch. These are available in both maintained and momentary (will return to normal state when released) versions.

We offer a complete line of accessories to make our pilot devices more competitive in the market.
Accessories include:
- Transformer and diode blocks for lamps
- Tools for changing lamps and tightening locking nuts
- Square-shaped bezels
- Hole plugs
- Locks, guards, and protective silicone covers
- Cable glands for enclosures

Material properties

Material	Characteristic
Light-alloy	Good corrosion resistance for inland, sea, and industrial atmospheres.
Polyamide (PA)	Withstands high temps, aliphatic, aromatic and chlorinated hydrocarbons, esters, ketone-aldehydes, alcohols, and bases
Polycarbonate (PC)	High impact strength, good outdoor resistance, can withstand light acid solutions, aliphatic hydrocarbons, paraffin, alcohols, and animal and vegetable greases.
Polysulphone (PSU)	Can withstand high temperatures, acids, basic solutions, alkaline compounds, oils, alcohols
PBT	Can withstand temperature, aliphatic and aromatic hydrocarbons, acids, basic solutions, alcohols, grease and oils
Zinc	Good corrosion resistance for inland, sea, and industrial atmospheres

Signal towers & signal beacons

If your customers are concerned with visibility of indicator lights or want to add audible alarms to a control panel, ABB signal towers and beacons are the solution.

Signal Towers K70:

ABB's signal towers are modular in function: customers can mix and match the light components they want to build up the tower they need. Each colored unit is equipped with a bayonet fixing and an integral contact system. The modules are fastened together without tools by aligning the corresponding white marks, then locking them into place by twisting.

K70 features include:

- Fast, tool-less assembly of signal elements using bayonet fixing
- Easy to change lamps
- Flexibility of signal element combination
- Up to 5 elements possible per stack
- Elements in constant, blinking, and flashing
- Integrated LED elements optional
- Siren and buzzer elements available

Signal Beacons KSB

Signal beacons are single light elements not designed for stacking. ABB offers a large variety of different versions, including permanent, blinking, strobe, and rotating effects. Other features include:

- IP65 for outdoor usage
- Available in 5 colors
- High impact polycarbonate material

Section 4 – Literature Reference List

Catalogs

All of our literature is available in electronic form from our website:

→www.abb-control.com
    →Literature Resources
        →Online Literature Library
           →Catalog Index

Then scroll to the Pilot Devices section (sections are listed alphabetically).

Product Selector – LV023
Section 8 of the ABB Product Selector catalog features our complete range of ABB pilot device products, as well as our other control products in our portfolio.

Assembled Pilot Devices – LV088
This catalog is designed to assist you in building up assembled Modular kits, rather than ordering components as individual pieces. By using the selection grids in this catalog, you can create a single part number and list price that includes ALL of the components you want for each pilot device. For example, a G2MP1-60R10 is a 30mm red pushbutton, momentary, flush, with chrome trim, and 1NO contact block and holder. This eliminates the need to order the 4 separate components individually.

30mm Pilot Devices – LV109
This catalog provides part numbers for our operators *including the 30mm adaptor ring*

Sales Literature

Pilot Devices Panorama – LV103
This full-color, four-page brochure shows the complete portfolio of ABB pilot devices, including both the Modular and Compact ranges.

Compact E-stops – LV012
This full-color brochure features our new line of Compact emergency stop pilot devices.

Compact E-stop Enclosures – LV094
Fast Facts sales sheet announcing the new Compact enclosures.

New Ratings: IP69K – LV117
The Compact range of pilot devices just received higher protection ratings! Find out what they are and how they can provide new solutions.

Definite Purpose Pushbutton, 30mm – LV119
Part numbers and list prices for our silicone-boot definite purpose pushbutton.

Modular range

1. **Flexible choices, assembled product or components** – Customers can order exactly what they need without having to juggle so many component part numbers

2. **Pre-wiring is possible** – Saves time and labor cost by allowing the operators to be installed onto the panel while blocks have already been wired

3. **Base-mounted enclosures** – Provides the simplest and neatest method for wiring pushbutton enclosures by keeping all of the wiring in the base of the box rather than being pulled out with the lid.

4. **Custom-engraving (legend plates, button surfaces, or enclosure surfaces)** – Customer can have product exactly as they want it, simply, and with standard lead times.

5. **22mm can be adapted to 30mm hole** – No need to stock both 30mm and 22mm versions of virtually the same button; just keep 22mm's on hand and add a 30mm adaptor when necessary.

Compact range

1. **All-in-one design** – one single part number, one single price, one single unit! Saves time and inventory space

2. **Cost efficiency** – Compact range saves 30% off list price on average versus traditional modular products.

3. **Highest Protection degree** – In addition to NEMA Type 1, 3R, 4, 4X, 12, & 13, our devices also feature the IP69K High-pressure jet protection rating together with IP 66 and 67.

4. **Highest Ratings –** Our Compact Range has the highest ratings on the market. It meets the demands of IEC 60947-5-1, C-300. This means that it can break a circuit fed by 240V and 1A without any problems.

5. **Compact E-stop enclosures** – Smallest enclosures on the market—2 ½" square—saves space when needed most.

6. **Integrated LEDs** – simplifies ordering for pilot lights, offers long-lasting LED life and bright, pure colors with even intensity.

1. List three industries or applications where pilot devices are used:

    _____

    _____

    _____

2. Match the pushbutton color with it's industrial standardized meaning:

    Color: Meaning:

    Red _____   A. Mandatory, for a condition requiring action

    Yellow _____   B. Normal, to initiate a normal condition

    Blue_____   C. Emergency, to signal or initiate a stop

    Green_____   D. Abnormal, activated to restart an interrupted cycle

    Black _____   E. General, for initiation of functions (non-emergency)

3. When an application calls for an illuminated selector switch with 6 contacts, which product range would you select from?

    A. Modular

    B. Compact

    C. Emergency Stops

    D. Pilot lights

4. Which is not a benefit of the Modular range?

    A. Pre-wiring is possible

    B. Flexible and customizable

    C. AS-I interface capability

    D. Base-mounted enclosure design

5. Which is not a feature of the Compact range?

    A. Integrated LEDs

    B. Up to 4 contacts per operator

    C. Compact E-stop enclosures

    D. IP69K spraydown rating

True or False:

6. Pilot devices are only used by panel builders and large OEMs.

7. ABB offers pilot device products for both 22mm and 30mm applications.

8. To create a Modular pilot device, all of the components must be ordered individually and assembled.

9. ABB offers Emergency stops in push/pull, twist release, and keyed versions.

10. Both plastic and metallic enclosures are available from ABB.

Answers: 1)see page 4 2)C,D,A,B,E. 3)A 4)C 5)B 6)F 7)T 8)F 9)T 10)T

Modular technical sheets

Pilot Devices
Modular Range

Technical data

c(UL)us E 57057   (CCC)s   CE

Approvals

The pushbuttons, selector switches and pilot lights are approved by:
- National approval agencies: UL, CSA and China Compulsory Product Certification

For detail information please contact ABB

Standards

IEC 60947-1	Low-voltage switchgear and controlgear – Part 1: General rules
IEC 60947-5-1	Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices
8 IEC 60947-5-5	Low-voltage switchgear and controlgear – Part 5-5: Control circuit devices and switching elements – Electrical emergency stop device with mechanical latching function
IEC 60073	Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators
IEC 60529	Degrees of protection provided by enclosures (IP Code)
EN 60947-1	Low-voltage switchgear and controlgear – Part 1: General rules
EN 60947-5-1	Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices
EN 60947-5-5	Low-voltage switchgear and controlgear – Part 5-5: Control circuit devices and switching elements – Electrical emergency stop device with mechanical latching function
EN 60073	Basic and safety principles for man-machine interface, marking and identification – Coding principles for indication devices and actuators
EN 60529	Degrees of protection provided by enclosures (IP Code)
EN 50013	Low-voltage switchgear and controlgear for industrial use – Terminal marking and distinctive number for particular control switches
UL 508	Industrial Control Equipment
CSA C22.2 No 14	Industrial Control Equipment

Degrees of protection

Operators	IP	UL/CSA
Pushbutton with flush or extended button, **MP**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Double pushbutton, **MPD**	IP 66	Type1, 3R, 4, 4X, 12, 13
Mushroom pushbutton, momentary, **MPM**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Emergency stop pushbutton, **MPMT/P**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Selector switch, **M2SS/M3SS**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Key operated selector switch, **M2SSK/M3SSK**	IP 66	Type 1, 3R, 4, 4X, 12
Toggle switch, **MTS2/MTS3**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Definite purpose pushbutton, 30 mm, **KP6**	IP 66	–
Reset button, **KPR**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Pilot lights, **ML**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Buzzer, **KB**	IP 65	Type 4X
Potentiometer, **KT**	IP 66	Type 1, 3R, 4, 4X, 12, 13
Contact block & transformer block	IP 20	
Enclosures		
Plastic enclosures	IP 66	
Metallic enclosures	IP 67	

ABB
Declaration of Conformity

CE

Material

No ozone depleting substances in the products.

All front parts are made of polycarbonate

Material		
PC	Polycarbonate	High impact strength, good outdoor resistance. Can withstand light acid solutions, aliphatic hydrocarbons, paraffin, alcohols, animal and vegetable greases.
PSU	Polysulphone	Can withstand high temperatures, acids, basic solutions, alkaline compounds, oils, alcohols.
PA	Polyamide	Can withstand high temperatures, aliphatic, aromatic and chlorinated hydrocarbons, esters, ketone-aldehydes, alcohols and basic solutions.
PBT		Can withstand high temperature, aliphatic and aromatic hydrocarbons, acids, basic solutions, alcohols, grease and oils
Zinc		Good corrosion resistance in inland-, sea and industrial atmosphere.
Light-alloy		Good corrosion resistance in inland-, sea and industrial atmosphere.
Rubber		Chloroprene Nitrile

8.28   **Discount schedule CA**   Low Voltage Products & Systems

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Technical data

Pilot Devices
Modular Range

Mechanical life

Operators

Pushbuttons with flush or extended button, momentary mushroom push-button	2 million operations
Selector switch, maintained mushroom pushbutton, key operated selector switch and double pushbutton	0.5 million operations
Emergency stop pushbutton	0.1 million operations
Toggle switch	1 million operations
Lockable pushbuttons	0.3 million operations

Temperature

Ambient temperature during operation	-25 to +70 °C
Exception: All pilot devices with 2 W continuously lit filament bulb	-25 to +40 °C
Storage temperature	-30 to +85 °C

Terminals

Plus-minus Pozidriv No.2 screw with DIN-washer.

Connectable area	min. 1 x 0.5 mm²/AWG 20
	max. 2 x 2.5 mm²/2 x AWG14
Recommended torque	0.9 Nm

Tightening torque

Locking nut, M22	Min. 2 Nm
	Max. 2.3 Nm

Contact blocks

Mechanical endurance	10 million operations

Self cleaning contacts of silver, NC contact with positive opening. At voltages and currents below 24 V and 5.6 mA two contact blocks in parallel are recommended. As an alternative, gold plated contacts can be used.

Ratings as per UL, CSA, NEMA		A600		Q600
		AC		DC
Rated insulation voltage		600 V		600 V
Rated thermal current		10 A		2.5 A
Rated operational current	at 120 V	6 A	at 125 V	0.55 A
	240 V	3 A	250 V	0.27 A
	480 V	1.5 A	480 V	0.10 A
	600 V	1.2 A	600 V	0.10 A

Ratings as per IEC 60 947-5-1		
Rated insulation voltage, U_i		690 V
Rated thermal current, I_{th}		10 A
Rated operational current, I_e utilisation category AC 15,	at 120 V	8 A
	230 V	6 A
	400 V	4 A
	690 V	2 A
Rated operational current, I_e utilisation category DC 13,	at 24 V	5 A
	125 V	1.1 A
	250 V	0.55 A
Contact resistance		< 25 m
Compulsory function test	at	5V, 16 mA

Max. number of contact blocks per operator ①

Pushbutton, toggle switch and mushroom pushbutton	6
Maintained pushbutton	4
Double pushbutton, selector switch, key operated selector switch and emergency stop pushbutton	4

Short circuit protection

Max. fuse at 1 kA	16 A ordinary
	10 A delayed

Lamp block

Ratings as per IEC 60 947-5-1

Rated insulation voltage	230 V
Base	Ba 9s
Permissible power, up to	2 W

Service life of filament bulb

Relative service life, luminous flux and power consumption at different service voltages.
It is generally true to say that bulbs for lower voltages give more light and have better vibration-withstand capability than bulbs for higher voltages.

a = service life (H)
b = luminous flux (lm)
c = power (W)
U_d = service voltage, V
U_m = bulb voltage (V)
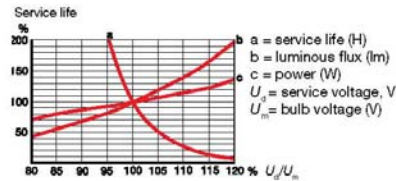
Lamp comparison

Bulb Catalog No.	Approx. life (hours)	Shock and service immunity	High vibration temperature	Low power operating	Brightness consumption
Filament	5000 - 10 000	+	+	+	+++
LED	25 000 - 50 000	+++	++	++	++

Very good +++
Good ++
Less good +

Transformer block

Suitable for filament bulb 6 or 24 V AC and 1.2 W and LED 24 V.

|	
Rated power	1.5 W
Rated voltage	Ratio, see Accessories page 8.25
Rated insulation voltage acc. to IEC 70 °C (DT)	Class E

① The contact blocks can be stacked in max. two levels on the 3- block holder. Only one level is accepted on the 5-block holder.

Low Voltage Products & Systems	Discount schedule CA	8.29

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Modular dimensions

Approximate dimensions
Modular range

Pilot Devices
Dimensions

All dimensions in MM

Pushbutton
Double pushbutton
Mushroom pushbutton
Emergency stop pushbutton
Selector switch
Key-operated selector switch
Toggle switch
Pilot light
Pilot light with transformer
Transformer block
Emergency stop shroud

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Pilot Devices
Dimensions

Approximate dimensions and drilling plans
Miscellaneous

All dimensions in MM
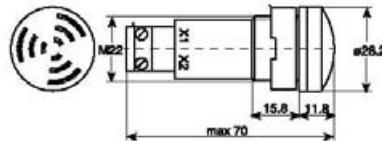
Definite purpose pushbutton
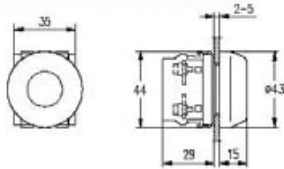
Reset pushbutton
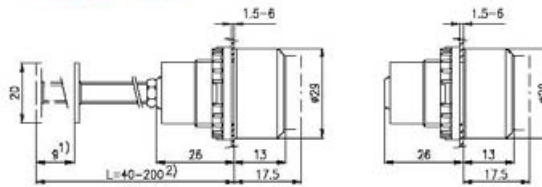
1) Length of stroke.
2) Can be cut to desired length.

Potentiometer
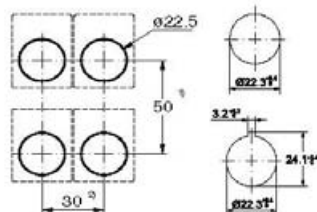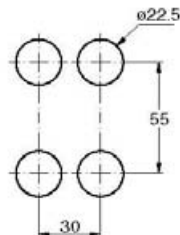
Acc. to potentiometer
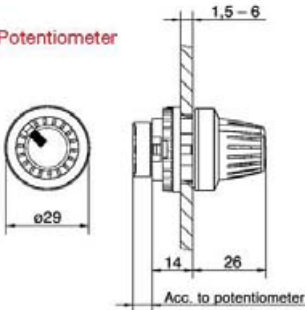
Buzzer

Drilling plans for pushbuttons, switches and pilot lights

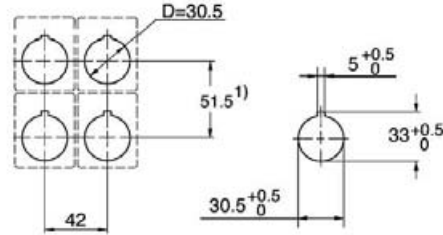1) 55 mm when legend plate H= 44.5 mm is used.
   61 mm for mushroom pushbutton with D=60 mm
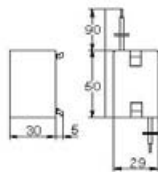
2) 37 mm when legend plate with insert is used,

Drilling plan for double pushbutton

Drilling plan for 30 mm adaptor

Transformer block

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Compact technical sheets

Technical data

*Pilot Devices
Compact range
22mm*

E 57057

Approvals
The pushbuttons, selector switches and pilot lights are approved by:
- National approval agencies: UL and China Compulsory Product Certification

For detail information please contact ABB

Standards

IEC 60947-1	Low-voltage switchgear and controlgear - Part 1: General rules
IEC 60947-5-1	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
IEC 60947-5-5	Low-voltage switchgear and controlgear - Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function
IEC 60073	Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators
IEC 60529	Degrees of protection provided by enclosures (IP Code)
EN 60947-1	Low-voltage switchgear and controlgear - Part 1: General rules
EN 60947-5-1	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
EN 60947-5-5	Low-voltage switchgear and controlgear - Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function
EN 60073	Basic and safety principles for man-machine interface, marking and identification - Coding principles for indication devices and actuators
EN 60529	Degrees of protection provided by enclosures (IP Code)
EN 50013	Low-voltage switchgear and controlgear for industrial use - Terminal marking and distinctive number for particular control switches
UL 508	Industrial Control Equipment
CSA C22.2 No 14	Industrial Control Equipment

Degrees of protection

Pilot device	IP	UL/CSA
Compact pushbutton, CP1, CP2, CP3, CP4	IP66	Type 1, 3R, 4, 4X, 12, 13
Compact selector switch, C2SS, C3SS	IP66	Type 1, 3R, 4, 4X, 12, 13
Compact pilot light, CL	IP66	Type 1, 3R, 4, 4X, 12, 13
Compact emergency stop pushbutton, CE3T, CE3P, CE4T, CE4P, CE3K1, CE4K1	IP66	Type 1, 3R, 4, 4X, 12, 13
Terminals	IP20	

Temperature

Ambient temperature during operation	-25 to +70 °C
Exception: All pilot devices with 2 W continuously lit filament bulb	-25 to +40 °C
Storage temperature	-30 to +85 °C

Tightening torque

Locking nut, M22	Min. 2 Nm
	Max. 2.3 Nm

Contacts
Self-cleaning contacts of silver-coated brass

		AC C300	DC R300
Ratings as per UL, CSA, NEMA			
Rated insulation voltage		250 V	250 V
Rated thermal current		2.5 A	1 A
Rated operational current	at 120 V	1.5 A	
	125 V		0.22 A
	240 V	0.75 A	
	250 V		0.11 A
Ratings as per IEC 60947-5-1			
Rated insulation voltage, U_i		300 V	
Rated thermal current, I_{th}		5 A	
Rated operational current, I_e utilisation category AC-15			
	at 120 V	1.5 A	
	240 V	1 A	
Rated operational current, I_e, utilisation category DC-13,			
	at 24 V	0.3 A	
	125 V	0.2 A	

Short circuit protection

Max. fuse at 1 kA	16 A ordinary
	10 A delayed

Tightening torque

compact pushbutton & selector switch	0.8 Nm (M3)
compact pilot light	0.9 Nm (M3.5)
compact emergency stop pushbutton	0.8 Nm (M3)

Terminals
Plus-minus Pozidriv No. 2
Compact pushbutton
Compact selector switch
Compact emergency stop

Connectable area	min. 1 x 0.5 mm²/1 x AWG22 max. 2 x 1.5 mm²/2 x AWG14
Compact pilot light Connectable area	min. 1 x 0.5 mm²/1 x AWG20 max. 2 x 2.5 mm²/2 x AWG14

Material
No ozone depleting substances in the products.
All front parts are made of polycarbonate

Material		Characteristics
PC	Polycarbonate	High impact strength, good outdoor resistance. Can withstand light acid solutions, aliphatic hydrocarbons, paraffin, alcohols, animal and vegetable greases.
PA	Polyamide	Can withstand high temperatures, aliphatic, aromatic and chlorinated hydrocarbons, esters, ketone-aldehydes, alcohols and basic solutions.
PBT		Can withstand temperature, aliphatic and aromatic hydrocarbons, acids, basic solutions, alcohols, grease and oils
Zinc		Good corrosion resistance in inland-, sea and industrial atmosphere.
Light-alloy		Good corrosion resistance in inland-, sea and industrial atmosphere.
Rubber		Chloroprene, Nitrile

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Compact dimensions

Approximate dimensions
Compact range

All dimensions in MM

Pushbutton

Selector switch

Pilot light

Emergency stop pushbuttons
CE3P/CE4P (Pull release)

CE3T/CE4T (Twist release)

CE3K1/CE4K1

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NEMA rating definitions

NEMA Rating	Enclosure Protection:
1	Indoor Falling dirt
2	Indoor Falling dirt Dripping/light splashing of liquids
3	Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external ice formation
3R	Indoor/Outdoor Falling dirt, rain, sleet, snow, external ice formation
3S	Indoor/Outdoor Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external mechanism remain operable with ice formation
4	Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external ice formation, splashing water, hose-directed water
4X	Indoor/Outdoor Falling dirt, rain, sleet, snow, windblown dust, external ice formation, splashing water, hose-directed water, corrosion
5	Indoor Airborne dust, lint, fibers, flyings, light splashing of liquids
6	Indoor/Outdoor Falling dirt, hose-directed water and occasional, temporary submersion, formation of ice
6P	Indoor/Outdoor Falling dirt, hose-directed water and prolonged submersion, undamaged by external formation of ice
12	Indoor Falling dirt, circulating dust, lint, fiber, flyings, dripping and light splashing of liquids
13	Indoor Falling dirt, circulating dust, lint, fiber, flyings, dripping and light splashing of liquids, spray/splashing/seepage of oil and non-corrosive coolants

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