Pilot Devices - 101
A basic guide to ABB’s pilot device portfolio
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Section 1 - Introduction

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.
Section 2 – Basic Training

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>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.</td>
</tr>
<tr>
<td>Contact block</td>
<td>The part of a pilot device that encapsulates the contact. Blocks are held to the back of a device with a contact block holder.</td>
</tr>
<tr>
<td>Operator/Actuator</td>
<td>The part of the device that is touched to operate, i.e., the pushbutton head, selector switch knob, or pilot light lens.</td>
</tr>
<tr>
<td>Lamp block</td>
<td>The part of a pilot device that holds and activates the light bulb when it receives the appropriate signal.</td>
</tr>
<tr>
<td>Maintained</td>
<td>A circuit that remains closed after pressure is released from the button.</td>
</tr>
<tr>
<td>Momentary</td>
<td>A closed circuit that lasts only as long as pressure is maintained on the button.</td>
</tr>
<tr>
<td>Rated thermal current</td>
<td>The amperage the pilot device can withstand in AC-1 applications (ABB’s is 10A for our Modular range)</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>The amperage the pilot device can withstand in AC-3 applications for a given voltage level.</td>
</tr>
</tbody>
</table>

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!
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:

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

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

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

*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:

**Markings for push buttons**

It is recommended that push buttons be marked, near to or preferably directly on the actuators, with the following symbols:

- [Diagram of push button markings]
Section 3 – ABB’s Product Scope

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 176ºF, 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
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!
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

<table>
<thead>
<tr>
<th>Lamp life (hrs)</th>
<th>Filament, 6-30V</th>
<th>Filament, 48-230V</th>
<th>LED, 12-60V</th>
<th>LED, 110-230V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>10,000</td>
<td>6,000</td>
<td>&gt;50,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Shock &amp; vibration resistance</td>
<td>Fair</td>
<td>Fair</td>
<td>Best</td>
<td>Best</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Material</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-alloy</td>
<td>Good corrosion resistance for inland, sea, and industrial atmospheres.</td>
</tr>
<tr>
<td>Polyamide (PA)</td>
<td>Withstands high temps, aliphatic, aromatic and chlorinated hydrocarbons, esters, ketone-aldehydes, alcohols, and bases</td>
</tr>
<tr>
<td>Polycarbonate (PC)</td>
<td>High impact strength, good outdoor resistance, can withstand light acid solutions, aliphatic hydrocarbons, paraffin, alcohols, and animal and vegetable greases.</td>
</tr>
<tr>
<td>Polysulphone (PSU)</td>
<td>Can withstand high temperatures, acids, basic solutions, alkaline compounds, oils, alcohols</td>
</tr>
<tr>
<td>PBT</td>
<td>Can withstand temperature, aliphatic and aromatic hydrocarbons, acids, basic solutions, alcohols, grease and oils</td>
</tr>
<tr>
<td>Zinc</td>
<td>Good corrosion resistance for inland, sea, and industrial atmospheres</td>
</tr>
</tbody>
</table>
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](http://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.
Section 5 – QuickView: Product Benefits

**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)**
   - Customers can have products 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.
Section 6 – Quiz

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.
Appendix

Modular technical sheets

### Technical data

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

**Standards**

<table>
<thead>
<tr>
<th>Standard Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60947-1</td>
<td>Low-voltage switchgear and controlgear - Part 1: General rules</td>
</tr>
<tr>
<td>IEC 60947-1-64</td>
<td>Low-voltage switchgear and controlgear - Part 5: Control circuit devices and switching elements - Electromechanical control circuit devices</td>
</tr>
<tr>
<td>IEC 60947-6-6</td>
<td>Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function</td>
</tr>
<tr>
<td>IEC 60079</td>
<td>Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators</td>
</tr>
<tr>
<td>EN 60079-1</td>
<td>Low-voltage switchgear and controlgear - Part 1: General rules</td>
</tr>
<tr>
<td>EN 60947-5-1</td>
<td>Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices</td>
</tr>
<tr>
<td>EN 60947-5-5</td>
<td>Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function</td>
</tr>
<tr>
<td>EN 60079-1</td>
<td>Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators</td>
</tr>
<tr>
<td>EN 60495-1</td>
<td>Degrees of protection provided for end-users (IP Code)</td>
</tr>
<tr>
<td>EN 60013</td>
<td>Low-voltage switchgear and controlgear for industrial use - Terminal marking and distinctive number for particular control switches</td>
</tr>
<tr>
<td>UL 508</td>
<td>Industrial Control Equipment</td>
</tr>
<tr>
<td>CQC 022.2 NO 14</td>
<td>Industrial Control Equipment</td>
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#### Degrees of protection

<table>
<thead>
<tr>
<th>Operators</th>
<th>IP</th>
<th>UL/CSA</th>
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</thead>
<tbody>
<tr>
<td>Pushbutton with flush</td>
<td>IP 66</td>
<td>Type 1: 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Double pushbutton</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Momentary pushbutton</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Selector switch, M25/330S</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Key operated selector switches, M25/K25K</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Toptip switch, MTO2/MT03</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Contactor purpose pushbutton, M25, KPS</td>
<td>IP 66</td>
<td>-</td>
</tr>
<tr>
<td>Reset button, KPR</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Pilot lights, ML</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Buzzers, KB</td>
<td>IP 66</td>
<td>Type 4X</td>
</tr>
<tr>
<td>Potentiometer KT</td>
<td>IP 66</td>
<td>Type 1, 3R, 4, 4X, 12, 13</td>
</tr>
<tr>
<td>Contact block &amp; transformer block</td>
<td>IP 20</td>
<td></td>
</tr>
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#### Discount schedule CA

<table>
<thead>
<tr>
<th>Caution</th>
<th>Low Voltage Products &amp; Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABB Inc.</td>
<td>+1-888-365-0217</td>
</tr>
</tbody>
</table>
Technical data

Mechanical life

Operators

- Pushbuttons with flush or extended button, mushroom pushbutton
- Selector switch, maintained mushroom pushbutton, key-operated selector switch, and double pushbutton
- Emergency stop pushbutton
- Toggle switch
- Lockable pushbuttons

2 million operations
0.5 million operations
0.1 million operations
1 million operations
0.5 million operations

Temperature

Ambient temperature during operation: -25°C to +70°C

Storage temperature: -30°C to +45°C

Terminals

- Flat-nose, pressed-in No.2 screws with DIN-rail
- Connectable area: min. 1 x 0.5 mm² / 4 AWG 26
- Max. 2 x 2.5 mm² / 10 AWG 14

Recommended torque:
- Locking nut, M5: Min. 2 Nm
- Max. 2.5 Nm

Tightening torque:
- 0.9 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 mA two contact blocks in parallel are recommended. As an alternative, gold-plated contacts can be used.

ratings as per UL, CSA, NEMA

- AC: 600 V
- DC: 300 V

- Rated insulation voltage: 10 A
- Rated thermal current: 6 A
- Rated operational current: 3 A
- Rated operational current: 1.8 A

- Rated thermal current, Iₜₕ: 10 A
- Rated operational current, Iₜₕ: 6 A
- Rated operational current, Iₜₕ: 4 A

- Contact resistance: < 25 mΩ
- Complementary function test: at 99, 16 mA

- Max. number of contact blocks per operator: 6

- Pushbutton, toggle switch, and mushroom pushbutton: 6
- Double pushbutton, selector switch, and emergency stop pushbutton: 4
- Short-circuit protection: Max. fuse at 1 kA

Lamp block

- Ratings as per IEC 60 047-6-1
- Rated insulation voltage: 250 V
- Base: 89 x 89
- 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-tilt-handicap capability than bulbs for higher voltages.

- Filament: 5000 hours
- LED: 50 000 hours

Transformer block

- Suitable for filament bulb 8 or 24 V AC and 12 V DC and LED 24 V.

- Rated power: 1.5 W
- Rated voltage: 120 V

- Rated insulation voltage acc. to IEC 70 °C (IT)

- Accessories page 8.25

- Class E

Low Voltage Products & Systems

Discount schedule CA

ABB Training Manual No. 1: Pilot Devices – 101
# Modular dimensions

## Appendix

### Approximate dimensions

**Modular range**

All dimensions in mm:

<table>
<thead>
<tr>
<th>Module</th>
<th>Dimension Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pushbutton</td>
<td></td>
</tr>
<tr>
<td>Double pushbutton</td>
<td></td>
</tr>
<tr>
<td>Mushroom pushbutton</td>
<td></td>
</tr>
<tr>
<td>Extended</td>
<td></td>
</tr>
<tr>
<td>Emergency stop pushbutton</td>
<td></td>
</tr>
<tr>
<td>Selector switch</td>
<td></td>
</tr>
<tr>
<td>Key-operated selector switch</td>
<td></td>
</tr>
<tr>
<td>Toggle switch</td>
<td></td>
</tr>
<tr>
<td>Pilot light</td>
<td></td>
</tr>
<tr>
<td>Pilot light with transformer</td>
<td></td>
</tr>
<tr>
<td>Transformer block</td>
<td></td>
</tr>
<tr>
<td>Emergency stop shroud</td>
<td></td>
</tr>
</tbody>
</table>
Appendix

Approximate dimensions and drilling plans
Miscellaneous

Definite purpose pushbutton

Reset pushbutton

Potentiometer

Buzzer

Drilling plans for pushbuttons, switches and pilot lights

Drilling plan for double pushbutton

Drilling plan for 30 mm adaptor

Transformer block

Notes:
1. 56 mm when legend plate H = 44.5 mm is used
2. 41 mm for mushroom pushbutton with (H=63) mm
3. 37 mm when legend plate with insert is used.
Appendix

Compact technical sheets

Technical data

Temperature
- Ambient temperature during operation: -25 to +70°C
- Exception: All pilot devices with 2 W contiguously 16 filament bulb
- Storage temperature: -30 to +85°C

Tightening torque
- Locking nut, M22: Min. 2 Nm
- Max. 2.5 Nm

Contacts
- Self-cleaning contacts of silver-coated brass

<table>
<thead>
<tr>
<th>Ratings as per UL, CSA, NEMA</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated thermal current</td>
<td>2 A</td>
<td>1 A</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>at 125 V</td>
<td>1.5 A</td>
</tr>
<tr>
<td></td>
<td>250 V</td>
<td>0.75 A</td>
</tr>
<tr>
<td></td>
<td>250 V</td>
<td>0.11 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ratings as per IEC 947-5-1</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>280 V</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated thermal current</td>
<td>1.5 A</td>
<td>1 A</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>at 125 V</td>
<td>1.5 A</td>
</tr>
<tr>
<td></td>
<td>250 V</td>
<td>0.75 A</td>
</tr>
<tr>
<td></td>
<td>250 V</td>
<td>0.11 A</td>
</tr>
</tbody>
</table>

| Short circuit protection | Max. fault at 1 kA | 16 A ordinary |
|                         |                  | 10 A delayed |

<table>
<thead>
<tr>
<th>Post-operations</th>
<th>Compact pushbutton</th>
<th>Compact selector switch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.8 Nm (A6)</td>
<td>0.8 Nm (M6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Plus minus Fused No. 2 Compact pushbutton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectable area</td>
<td>min. 1 x 0.5 mm²/1 x AWG22</td>
</tr>
<tr>
<td></td>
<td>max. 2 x 1.5 mm²/2 x AWG3</td>
</tr>
<tr>
<td>Connectable area</td>
<td>min. 1 x 0.5 mm²/1 x AWG22</td>
</tr>
<tr>
<td></td>
<td>max. 2 x 3.5 mm²/2 x AWG1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Material</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>High impact strength, good outdoor resistance, can withstand light acid solutions, alkaline hydrocarbons, paraffin, alcohol, animal and vegetable greases.</td>
</tr>
<tr>
<td>PA</td>
<td>Can withstand high temperature, alkaline, aromatic and chlorinated hydrocarbons, solvents, hydrocarbon, oils, and alcohol and basic solutions.</td>
</tr>
<tr>
<td>PBT</td>
<td>Can withstand temperature, alkaline and aromatic hydrocarbons, acids, basic solutions, alcohol, grease and oils.</td>
</tr>
<tr>
<td>Zinc</td>
<td>Good corrosion resistance in inanimate and industrial atmosphere.</td>
</tr>
<tr>
<td>Light alloy</td>
<td>Good corrosion resistance in inanimate and industrial atmosphere.</td>
</tr>
<tr>
<td>Rubber</td>
<td>Chloroprene, Nitrile</td>
</tr>
</tbody>
</table>

Low Voltage Products & Systems
ABB Inc. - 800-523-2520 - www.abb.com/industries

ABB Training Manual No. 1: Pilot Devices – 101
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Appendix

Compact dimensions

Approximate dimensions
Compact range

All dimensions in MM

Pushbutton
Selector switch

Extended button

Pilot light

Emergency stop pushbuttons
CE3P/CE4P (Pull released)

CE3T/CE4T (Twist release)

CE3K1/CE4K1
### NEMA rating definitions

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