SAFETY IN THE FACTORY/ DISTRIBUTION CENTER: THE NEED FOR CABLE-PULL SAFETY SWITCHES.

A Honeywell White Paper

Honeywell

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ABSTRACT

Safety is considered a top priority in manufacturing and distribution facilities around the world.

Safety measures not only provide a safe and healthy environment for the millions of workers in these facilities, but it also safeguards companies from any potential mishaps; thereby, protecting company assets and reputation.

One of the most stressful, regretful and disastrous events a factory floor manager can experience is the injury of a colleague due to an accident. In today's world, companies are trying to optimize the time of a factory worker. Companies are providing workers with high-tech gadgets and machinery to both improve and increase their productivity and efficiency. As a result of these demands, it is quite possible that a factory worker can easily get behind his or her daily schedule. This type of situation has the potential to result in an accident on a factory floor.

Honeywell can be a good asset to the distribution and manufacturing facilities around the globe with the wide variety of safety limit switches offered for various factory-floor applications. One Honeywell safety product that plays a major role in the well-being of a factory worker is the cable-pull safety switch. This switch saves critical time in case of an emergency by providing a means of shutting down the machinery at any point along the cable's length.

INTRODUCTION

There are various safety regulatory organizations around the globe whose only priority is worker safety and health.

Occupational Safety and Health Administration (OSHA), The American National Standards Institute (ANSI), National Safety Council (NSC), European Safety Federation (ESF), Canadian Center for Occupational Health and Safety (CCOHS) and British Safety Council (BSC) are some of the top safety committees.

It is true that companies spend thousands of dollars annually to train workers on how to use the various machinery that one would see in manufacturing and distribution facilities. Some companies have their own internal safety departments who offer high-quality safety programs and seminars for the well-being of personnel. While others hire industry experts to provide a comprehensive and thorough training on how to do daily jobs.

But one thing that must not be overlooked is "human error". Some of the causes that can lead to human error include when an individual did not follow certain operating protocols and procedures to implement a task or perhaps when an individual did not wear the proper protective gear. Simply put, no amount of training can eliminate human error. Otherwise, there would be zero number of accidents in manufacturing and distribution centers around the world, which unfortunately is not the case. As a matter of fact, it does not matter how much precaution has been taken or how much training has been provided, accidents can still happen.

Consider a factory floor environment. A factory floor has various industrial machinery and equipment that is used by workers day in and day out. It is very challenging to determine which group should have access to certain sections or areas of a factory floor. There are workers who operate equipment as part of their daily jobs, and then there is a different group of workers who perform service and maintenance activities on the equipment as part of their job.

For instance, a 100-foot long conveyor belt is transporting cartons of product from the packaging area to the shipping area. There needs to be a way to allow a worker who gets a sleeve caught in a conveyor belt to stop the line, but to put switches every two-to-three feet around the perimeter is not practical from a safety and cost perspective.

A good solution would be to consider Honeywell's cable-pull safety switch. The cable encircles the entire conveyor perimeter, and a worker simply pulls on the cable to activate the switch to stop the machine.

Honeywell's cable-pull safety switches are an affordable, sensible way to provide protection associated with conveyors and work-cell perimeters. It's like having an infinite number of emergency stop switches.

Some of the common factory-floor applications for the cable-pull safety switch are:

- Long conveyor systems found in warehouses and distribution centers
- Conveyor systems with a high amount of vibration
- Conveyor systems that experience wide temperature swings
- Long conveyor systems where easy-through wiring, or highly visible trip status, is required
- Perimeter guarding in hose-down conditions (CPS Series)
- Packaging equipment
- Assembly lines
- Waste recycle facilities

CABLE-PULL SAFETY SWITCH

Honeywell's MICRO SWITCH CPS Series Cable-Pull Safety Switches provide a readily accessible emergency stop signal: a cost-effective means compared to using multiple emergency stop push-buttons.

Both the 2CCP Series and CPS Series Cable-Pull Safety Switch's internal mechanism latches on both slackened cable (push) and pulled cables. One key feature of the 2CCP Series and CPS Series switches is the positive or direct-opening of normally closed contacts. Positive-opening contacts are designed to be forced open when actuated through direct mechanical linkage. The direct-opening switch contacts are held closed when the actuating cable is under proper tension and the reset knob is set to the RUN position. When the actuating cable is pulled, slackened or broken, a cam positively opens the NC (Normally Closed) switch contacts.

The snap-action operation causes the switch contacts to change state and mechanically latch almost simultaneously when the cable is pulled, slackened or broken. The NC switch contacts remain open until the cable-pull switch is reset by properly tensioning the cable and manually rotating the reset knob. When the positive-opening switch contacts open, the optional auxiliary contacts also actuate (i.e. NO contacts close). The auxiliary contacts are electrically isolated from the direct-opening, normally closed switch contacts. These NO (Normally Open) contacts may be used for monitoring or signaling.

Figure 1. Honeywell MICRO SWITCH Cable-Pull Switches

OPERATING MECHANISM OF A CABLE-PULL SWITCH

CONVEYOR BELT SYSTEM

Let's take a look at how a cable-pull safety switch functions. In this example, a cable-pull safety switch (P/N 2CPSA2A3A) is installed with a conveyor belt system. This is one of the most common applications in a manufacturing and distribution center.

It is to be noted that the 2CPSA2A3A has two contact blocks where each contact block has 1NC/1NO contact. Figure 2 illustrates the application and wiring schematic for contact block 1 with 1NC/1NO contact within the 2CPSA2A3A switch. Contact block 1 is being used to control and monitor the ON/OFF status of one conveyor belt system. Contact block 2 of the 2CPSA2A3A can be used as a redundant set of contacts or to control and monitor the status of an adjacent conveyor belt system.

In this particular application, an ac control circuit (typically 120 Vac or 240 Vac) provides the control for the conveyor system. Let's assume that the perimeter of the conveyor belt is 100 meters and the cable-pull safety switch being used here has a cable span of 200 meters so that the cable can encircle the perimeter of the conveyor system. This way, a person working anywhere within the conveyor perimeter will have the ability to stop the conveyor in case of an emergency.

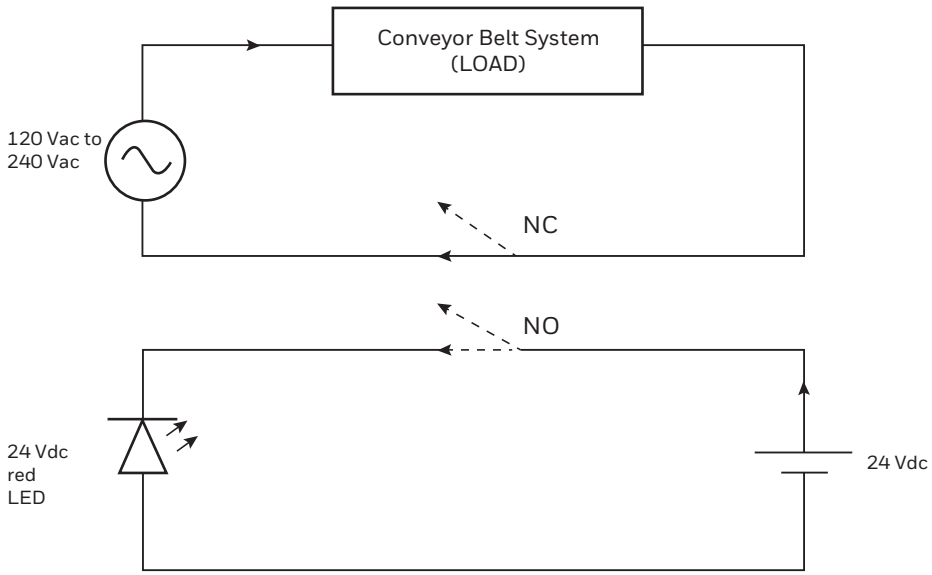


Figure 2. Wiring schematic of 2CPSA2A3A contact block 1

Conveyor belts are typically used for transporting materials, objects, packages, etc. from point A to point B. There are factory workers who handle these materials, objects or packages as these loads are moving along the conveyor belt. If for some reason there is a mechanical issue with the conveyor belt system, then shutdown of the system may be required. A conveyor belt system can be very expensive to replace and can also be costly to repair. Furthermore, it is not very economical from production and efficiency standpoints to shut down a conveyor system during normal operating hours.

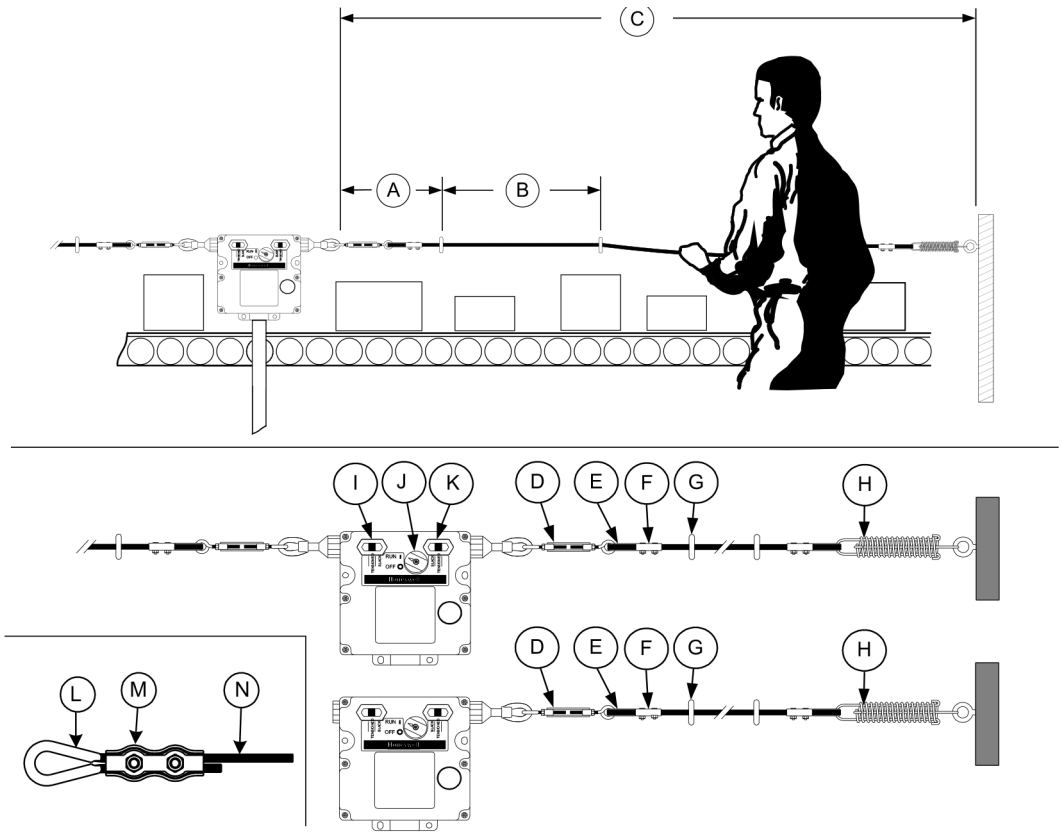
Another scenario could be if a worker's clothing is caught in the conveyor belt machinery, then the worker can pull the cable of a cable-pull safety switch, if the conveyor system is equipped with one. This way, the worker can be protected from any potential harm. In both of the two above scenarios, it is required to shut down the conveyor belt system.

In this system, the NC contact of contact block 1 is wired in the ac control circuit for the conveyor belt. And the NO contact of contact block 1 is wired in series with the 24 Vdc power supply. When the factory worker pulls the cable, the NC contact opens thereby breaking the ac circuit so that power is removed from the conveyor belt system resulting in the shutdown of the conveyor.

At the same time, the NO contact closes, thereby completing the dc circuit and allowing dc power to flow through the 24 Vdc red LED. The 24 Vdc LED is a pilot light and when lighted indicates the cable-pull switch has been actuated to shut the conveyor system down. To turn off the LED, the blue reset knob on the cover of the cable-pull switch must be manually rotated to RUN position.

TYPICAL INSTALLATION OF A 2CPS SWITCH ON A CONVEYOR BELT SYSTEM

For more detailed product specification of the cable-pull series, please refer to the datasheets on the Honeywell website.



Definition of the items for a typical installation of a 2CPS Series switch –

A – defines the total length of J-hook turnbuckle, thimble, cable clamp and eyebolt which is around 18 inches maximum

B – defines the distance between cable supports which is around 8 feet

C – defines the total cable length which is around 250 feet

D – J-hook turnbuckle

E – Thimble

F – Cable clamp

G – Cable support

H – Endspring

I – Tension indicator

J – Resent knob

K – Tension indicator

L – Thimble

M – Cable clamp

N – Cable

PART NUMBER SELECTION FROM THE PRODUCT NOMENCLATURE TREE

In the previous application example, the part number of the cable-pull safety switch being used is "2CPSA2A3A". The product nomenclature tree can be used to select the part number of a cable-pull safety switch for a specific application.

2CPS	A	1	A	1	A	A
Switch Type	Conduit	Contact Mounting Code	Basic Switch Code	Actuation Code	Indicator-Pilot Light Code	Accessory Switch Code
2CPS Series Dual-Head Cable-Pull Safety Switch	**A** 1/2 NPT	**1** Standard: contact block mounted to housing	**A** 2NO/2NC, direct acting Switch 1: 1NO/1NC Switch 2: 1NO/1NC	**1** Maintained, both sides	(None) No indicator	(None) No acc. switch
	B PG 13.5	**2** Removeable: contact blocks with receptacles	**B** 1NO/3NC, direct acting Switch 1: 1NO/1NC Switch 2: 2NC	**2** Maintained, left side No actuation, right side	**A** 24 Vdc LED cluster	**1** 1NO, momentary
	C 20 mm		**D** 4NC, direct acting Switch 1: 2NC Switch 2: 2NC	**3** Maintained, right side No actuation, left side	**B** 120 Vac LED cluster	**2** 1NC, momentary
	D PF 1/2			**4** Maintained, both sides w/o broken cable detection	**C** 24 Vdc LED cluster, low profile	**3** 1NO, maintained
				5 Maintained, left side No actuation, right side w/o broken cable detection	**D** 120 Vac LED cluster, low profile	**4** 1NC, maintained
				6[1] Maintained, right side No actuation, left side w/o broken cable detection		

NOTE: Not all combinations of model code are available.
Please contact your Honeywell provider/representative for assistance.

[1] Not valid on 4NC switches

2CPS – defines the switch series type, 2CPS in this case

A – defines that the switch has 0.5 inch NPT conduit thread

2 – defines that the switching contact block is removable with receptacles

A – defines that the switching contact block has two switches, Switch 1 and Switch 2, and both have 1NO/1NC contacts with direct/positive opening feature

3 – defines that the switch has maintained contact operating mechanism on the left side of the 2CPS switch and no actuation on the right side

A – means that the switch comes with a 24 Vdc LED cluster

BENEFITS OF HONEYWELL'S CABLE-PULL SAFETY SWITCH

- Positive-opening action of NC (Normally Closed) contacts
- 2CPS: 2NO/2NC, 1NO/3NC or 4NC contact configurations
- 1CPS: 1NO/1NC, 2NO/2NC, 1NO/3NC or 4NC contact configurations
- 2CCP: 2NO/2NC, 1NO/3NC or 4NC contact configurations
- Typical cable span of 76 m [250 ft] in an environment with a temperature change of ±17°C [±30°F]. Longer spans are possible depending upon temperature change and installation
- Choice of three actuator configurations (2CCP, 2CPS)
- Removable contact block version available (2CPS)
- J-hook turnbuckle included (2CPS)
- Large wiring cavity with straight-through wiring
- Models available without broken cable, slack-cable detection (1CPS, 2CPS)
- 2CCP: optional 24 volt, 120 volt or 240 volt high-intensity LED pilot light
- 2CCP optional E-stop 50 mm diameter pushbutton on cover, optional maintained or momentary pushbutton on cover
- 24 Vdc or 120 Vac bright, multi-cluster high-intensity LED status pilot light available on 2CPS. Single LED on 1CPS
- Gold-plated contacts are standard on 2CPS, available on 1CPS
- Electrostatic, epoxy-coated, die-cast zinc housing (1CPS, 2CPS)
- Electrostatic epoxy-coated die-cast aluminum housing with a hight-strength plastic cover (2CCP)
- Optional hardware packets available

CONCLUSION

Honeywell's cable-pull safety switches play a major role in keeping workers safe in manufacturing and distribution centers by providing consistent, predictable, fail-safe control response.

The cable-pull safety switch is intended to be used in conveyor belt applications. The 2CCP Series and CPS Series have a variety of contact block options to meet the demanding requirements of the industry.

The 2CCP Series switch housing is die-cast aluminum with a high-strength plastic cover and is environmentally sealed to IP54 and NEMA 1. The CPS switches have an enclosure fabricated of die-cast zinc alloy and cover made of cold-rolled steel. The switches are extremely rugged and easy to install. The CPS Series has been designed to withstand harsh environmental conditions and is UL approved and CSA certified for IP67, NEMA 1, 4, 12, 13 ratings.

The switch cable is made of red vinyl coated stainless steel, aircraft-grade cable that enables the switch to perform reliably and effectively in a broad spectrum of operating temperatures. Furthermore, this feature also enhances productivity by reducing nuisance stops which can be due to variations in temperature, stretch of cable over time or other application variables.

The positive or direct-opening characteristic of the normally closed (NC) contact blocks significantly increases the reliability and safety of the cable-pull safety switches. When the cable-pull switch is actuated, the NC contacts will be forced open through direct mechanical linkage and opening the control circuit to the conveyor system.

The 2CCP Series cable-pull safety switch are designed with silver contacts. The 1CPS Series cable-pull switch is designed with silver contacts as the standard with an optional gold-plated contact. The 2CPS Series cable-pull switch has gold-plated silver contacts. Silver is the most common choice due to its chemical, electrical, thermal, mechanical properties and low cost. When silver contacts are contaminant-free and clean, there is no lower limit to what voltage or current can be used and that can be controlled reliably. Silver contacts also have a very low contact resistance, thus allowing the switching to be more reliable in industrial-pollutant-free environments. Gold-plated contacts should be used in low level or dry circuit applications. Gold will not tarnish as easily when exposed to moisture and airborne acids thereby making it a good solution for low current and voltage applications. One example where a gold-plated contact over silver is useful is in a double-pole switch where one pole is switching the power circuit and the other pole is switching the logic level (the gold-plating will be vaporized and the silver base of the contact will provide the switching of the power circuit).

Honeywell's cable-pull safety switches are red making them easier to notice on a factory-floor environment. The 2CCP Series has an optional high-intensity multi-chip red LED that can indicate the cable-pull switch has been activated. Both the 2CPS and 1CPS Series have red LEDs that indicate whether the cable-pull safety switch has been activated or not. 24 Vdc or 120 Vac bright, multi-cluster high-intensity LED status indicator pilot lights are optional on the 2CPS. The 1CPS also has LED options to indicate the cable-pull switch has been actuated.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items that Honeywell, in its sole discretion, finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

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