



PLCD Displacement Sensor

A Flexible Construction Kit for the
Magneto-Inductive Linear Path Measurement

Introduction

The X-Length Concept

The PLCD Sensor (**P**ermanent-magnetic-**L**inear-**C**ontactless-**D**isplacement Sensor) belongs to the group of Magneto-Inductive sensors.

Tyco Electronics has been developing and manufacturing products based on this sensor principle for many years in increasing numbers, thus building long-term field experience in the area of non-contact, wear-free displacement measurement.

Whereas the application focus used to be in the automotive industry with its often highly specific and tailor-made solutions, the new platform concept is clearly targeted toward industrial uses.

It removes one of the main obstacles encountered so far, tooling costs. In large volume projects tooling costs were easily amortized however they posed a barrier for small and medium volume opportunities.

The main challenge was to achieve high flexibility in measuring length and mechanical adaptation with minimum costs.

The Solution:

A modular product.

The heart of the sensor – the sensing element – is constructed to be any desired length (currently up to 200 mm) by a simple cutting process that is

simple, fast and that does not incur additional tooling costs. The sensor casing can be adapted accordingly with a simple tool insert.

The PLCD tool box concept offers seven standard lengths, five fixture types and the option to customize according to customers' requirements, with only a minimal tool investment.

On the following pages you will find a more detailed presentation of the new PLCD sensor system.

PLCD Standard Types



Total Length (L) mm	Measuring Range (LN)* mm	Part Number
80	30	0-1824061-8
100	50	1-1824061-0
120	70	1-1824061-2
140	90	1-1824061-4
160	110	1-1824061-6
180	130	1-1824061-8
200	150	2-1824061-0

*) **Measuring Range (LN):** Measuring range by using the recommended driving magnet.

PLCD Principle of Function

PLCD Principle of Function

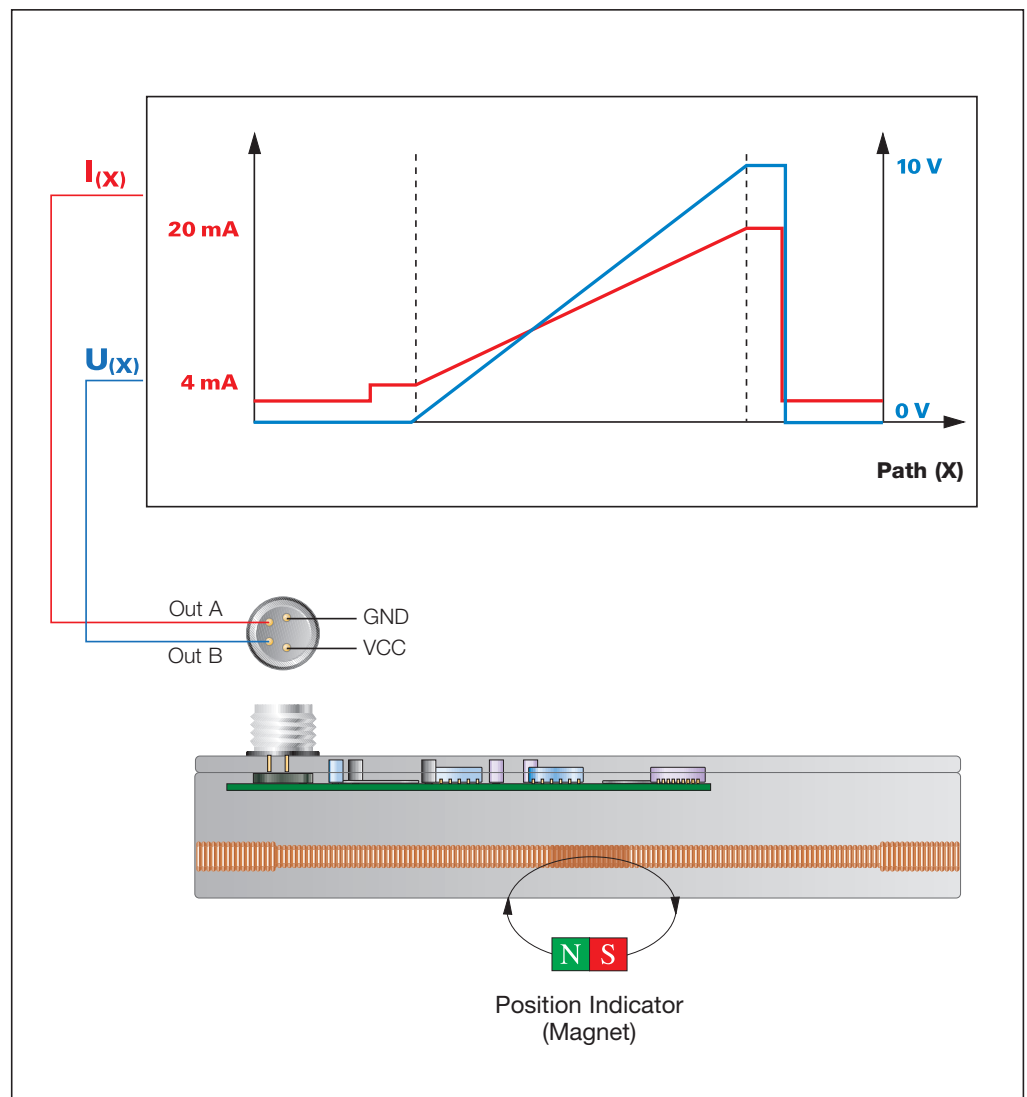
The PLCD displacement sensor consists of a special soft magnetic core that is completely surrounded by a coil (primary coil). Each end of the sensor carries another short coil (secondary coil).

An external permanent magnet – in cube or ring form – is used as the position indicator.

The magnetic field of the position indicator (magnet) guided close to the sensor causes a localized magnetic saturation and thereby a virtual division of the core.

The position of the saturation zone (= position of the permanent magnet) along the sensor axis (X-direction) can be determined by the coil system in combination with the signal processing unit (patent Tyco Electronics).

At the sensor's output, the operator can choose between several analog signals (e.g. current interface, voltage interface). The signal is determined by the magnets location and always follows a linear, continuously rising curve.



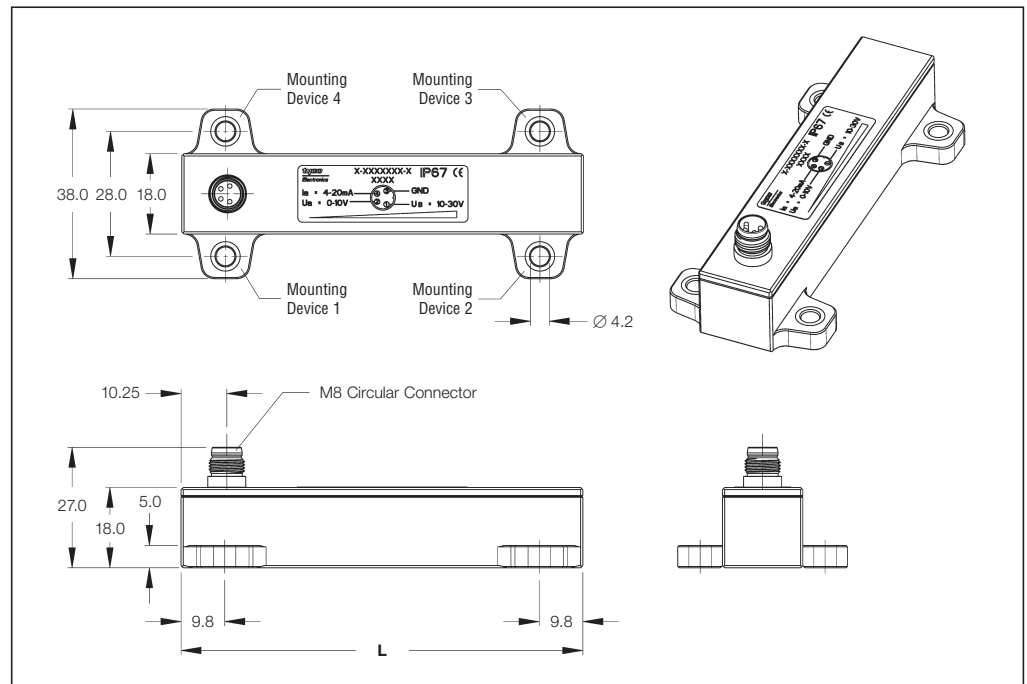
Mechanical Set Up and Casing Variants

Mechanical Set Up

Standard PLCD displacement sensors are available in a rectangular casing in overall lengths of 80 mm to 200 mm (see overview standard program). The signal transmission is conducted by an industry-compatible M8 circular connector.

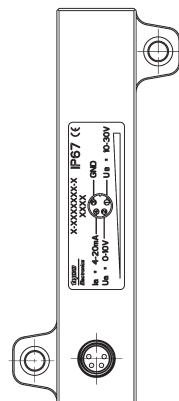
To simplify assembling, mounting devices can be molded into the casing (see further casing variants), thus securing a direct connection between sensor and application. A time consuming alignment of the sensor is no longer necessary and thereby reduces costs.

Customers with a more flexible mounting can get the sensor without these mounting devices. In these cases, the sensor can then be fixed individually with separate fixing elements.

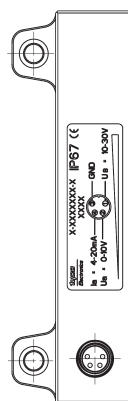


Further Casing Variants

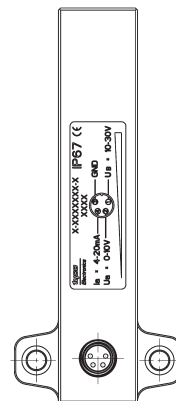
In addition to our standard types with four mounting devices (see page 2) the following casing configurations are available upon request.



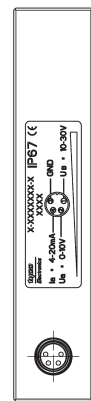
Diagonal Alignment of Mounting Devices



One-Side Alignment of Mounting Devices



Front-Side Alignment of Mounting Devices



Without Mounting Devices
(fixed via separate holding fixtures)

Magnetic Drive and Typical Parameters

Magnetic Drive

The most significant property of our PLCD Displacement Sensors is their operation without any mechanical connection between the driving magnet (position indicator) and the sensor element. This enables the sensor to be driven through partitions of non-ferromagnetic materials like stainless steel, aluminum, plastic, glass and others.

For applications through non-ferromagnetic materials the driving distance is important.

The optimum driving distance and the extension of the range of operation depends on the dimensions, strength and configuration of the permanent magnet used. Close air gaps with large magnets result in non linear curves. If the air gap is too large, the usable measurement range will be markedly reduced.

Tyco Electronics offers suitable magnets whose performance is well defined in standard conditions. With regards to the recommended operation distance, the sensors performance is clearly defined.

But real work environments tend to deviate from given standards. In any situation, Tyco Electronics provides support and helps with the selection and dimensioning of the magnet system that is just right for your condition. For example, driving distances up to 15 mm are then realizable.

Electrical Interfaces

For the sensor's input, only the regular industry power supply of 10/15 V ... 30 V is required.

At the definition of the output signals, the modular construction system was followed without compromise. The result: A number of analog output interfaces for the user to choose from.

In the standard version the current output (4 mA ... 20 mA) and the voltage output (0 V ... 10 V) is linked to the M8 circular connector.

Optional we are able to offer a potentiometer voltage output (0.5 V ... 4.5 V).

Typical Parameters

Total Length	(mm)	Size 80	Size 100	Size 120	Size 140	Size 160	Size 180	Size 200
Measurement Range nominal (LN)	(mm)	30	50	70	90	110	130	150
Air Gap Magnet Sensor	(mm)	5* in reference to a NdFeB magnet (12 x 5 x 4) mm						
Operating Temperature	(°C)	-20 ... +80						
Protection Degree		IP67						
Linearity	(%) v.LN	±2.5						
Resolution	(%) v.LN	≤0.2						
Repeat Accuracy	(mm)	≤0.2						
Temperature Drift	(%/K)	≤0.008						
Supply Voltage	(V)	DC 15 ... 30 (current and voltage output) DC 10 ... 30 (only current output and optionally potentiometer interface 0.5 ... 4.5 V)						
Operational Current	(mA)	<80						
Output Signals	(mA) (V) (V)	outA	outB	optional (outB)	Current	Voltage	Voltage	4 ... 20 0 ... 10 0.5 ... 4.5

*) With an adequate magnet dimensioning driving distances (air gaps) up to 15 mm are achievable.

General Remarks

General Terms and Definitions

Failure of Linearity

The maximum deviation of a nonlinear issued characteristic curve from a linear nominal characteristic curve (regression straight line). The failure notice is related to the span and marked by final value.

Resolution

Resolution is the smallest measurable measuring step/unit. The details are given in % of the measurement range.

Failure of Hysteresis

This denotes the maximum deviation of measurements resulting from positioning the same value of the measurement both from the smaller and the larger measurements.

Application Notes

The PLCD Displacement Sensor functions according to the magneto-inductive principle and needs a permanent magnet to drive the field reliably. Magnetic conductive material in the close vicinity of the position provider (permanent magnet) may influence the direction of the magnetic flux (Φ), thus weakening the field around the sensor element.

Therefore, magnetic conductive material directly between the position provider and the sensor element must be avoided.

For the mounting of the sensors and the position provider, we recommend using a material that cannot be magnetized such as non-ferrous metal, austenitic steel, plastic or similar.

External magnetic fields in the environment of the PLCD Displacement sensor might influence the output signal, depending on their direction and strength. In such cases appropriate shielding precautions must be taken. Naturally, Tyco Electronics provides you with technical support and the benefit of our know-how.

Following these principles, there is a wide range of applications for the PLCD Displacement Sensor:

- Linear actuators (electric, hydraulic, pneumatic)
- Actuating drive, positioning of valves
- Machines, plant engineering (limit of travel monitoring)
- Robotic
- Clamp & gripper equipment
- Level and flow metering
- Conveyor and storage equipment
- Special vehicles (forklifts, digger, cranes)
- Building and safety engineering

Summary

Overview of the most important characteristics

- Non-contact and therefore wear-free measuring principle
- X-length-ability
- Air gap/driving distances up to 15 mm
- Variety of fixture options
- Sensing through any material that cannot be magnetized
- Integrated evaluation electronics with current and voltage output (optional potentiometer interface)

Services

Apart from the standard program described above, many products are developed in close cooperation with our customers.

Our range of services includes the construction of complex sensor housings, the development of signal processing, dimensioning of the magnet

systems, simulation, qualification and fast prototyping up to serial production of customer-specific solutions.

Tyco Electronics can also supply the complete sensor system as a single source.

Connectors and cable assemblies are available from the wide Tyco Electronics portfolio.

The high quality standard of our products is documented by the number of certifications such as ISO 9001, ISO 14001, QS 9000 and TS16949.

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