Application Note

AN2011

D-Series

Moving Target Characteristic

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Abstract
Many position control tasks require fast and precise distance measurement with a constant output rate. Especially for these requirements the Dimetix laser distance sensors provide the Moving Target measurement characteristics.

Dimetix AG • Degersheimerstr. 14 • 9100 Herisau • Switzerland • Phone +41 71 353 00 00 • Fax +41 71 353 00 01 • info@dimetix.com • www.dimetix.com

Table of content

1 Document scope

This document covers an Application Note written for the Dimetix D-Series laser distance sensors. The following topics are discussed:

- Safety instructions
- Moving Target measurement characteristics
- Calming filter for Moving Target

2 Safety instructions

This Application Note is written for qualified system integrators to help doing an application specific sensor configuration.
Before using the D-Series sensor also the safety related information in the D-Series Technical Reference Manual must be consider.

Looking into the laser beam may be hazardous to the eyes.

- Do not look into the laser beam. Make sure the laser is aimed above or below eye level. (particularly with fixed installations, in machines, etc.).

Take precaution against electrostatic discharge (ESD) when the D-Series laser distance sensors exchangeable cover is open.

- Generally the sensor with removed exchangeable cover is a sensitive device and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems**.**

3 Introduction

Many position control tasks require fast and precise distance measurement with a constant output rate. Especially for these requirements the Dimetix laser distance sensors provide the Moving Target measurement characteristics.

Moving Target properties:

- 250 Hz output rate over serial interfaces (RS-232, RS-422/485, USB)
- 500 Hz output rate over Industrial Ethernet
- 1 kHz output rate over analog and SSI interface
- High accuracy for distances changing steplessly with a speed of up to 10 m/s
- Temporarily reduced accuracy after distance jumps
- Optimized for the Dimetix orange reflective target/foil
- Optional calming filter

The features mentioned above refer to the DPE-10-500 and the DPE-30-500 high end sensors. With the other Dimetix sensors, certain Moving Target properties may be limited. Consider the Technical Reference Manual for these limitations.

4 Considerations

4.1 Typical application

Positioning control applications similar to figure 1 are commonly used in various fields such as warehouse logistics, cranes and industrial automation.

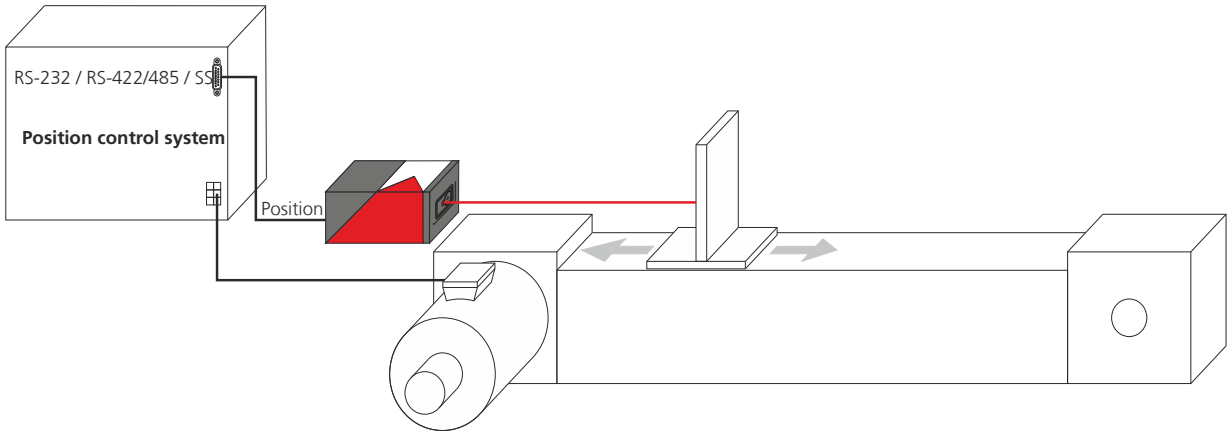


Figure 1: Typical position control application with D-Series sensor

4.2 Continuous movement

Position control systems as shown in the illustration in figure 1 have the following properties:

- The distance is continuously measured
- The target position always changes continuously because physics dose not allow distance jumps

The Moving Target characteristics takes advantage of these facts to achieve high measurement accuracy at a constant high output rate.

Sudden changes in the measured distance only occur if the laser beam is interrupted by mistake. With the Moving Target characteristics, the sensor measures reliably even in this situation, although the accuracy will temporally be reduced.

4.3 Output rate

A target speed of e.g. 8 m/s and a sensor output rate of 250 Hz results in a new distance measurement every 32 mm.

$$\Delta\, Distance = \frac{Target\ speed}{Output\ rate} = \frac{8\,m/s}{250\,Hz} = 32\,mm$$

At a first glance, this might seam much too coarse for precise positioning. But knowing the exact position instantly when traveling at full speed is not a requirement for most positioning applications. Only when approaching the end position where due to physical restrictions the speed must be ramped down anyway this becomes a requirement.

Figure 2 shows an example with an intentionally very slow output rate (5 Hz), so that this effect is clearly visible. At maximum speed, the difference between actual position and the last measured distance becomes significant. But near to the start and the end position the two curves are nearly identical.

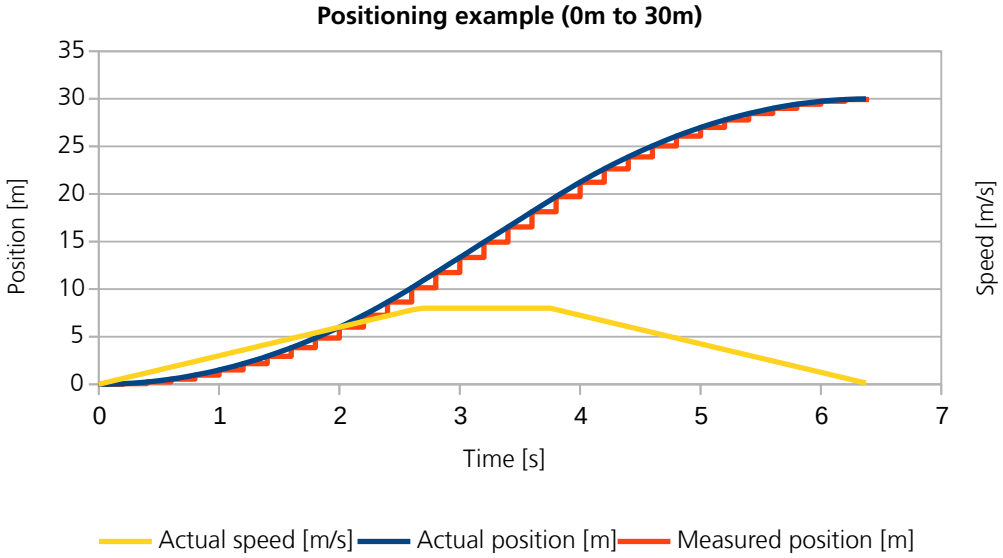


Figure 2: Positioning example with very low sensor output rate

In this example the effect is highly exaggerated. Of course for real world applications much higher output rates are chosen (eg. 250 Hz with the Moving Target characteristics) and the effect is therefor way less notable.

If 250 Hz output rate is still not sufficient for your application, consider using an Industrial Ethernet interface (500 Hz) in conjunction with your sensor or the sensors built in SSI interface (1 kHz).

4.4 Measurement jitter effects and calming filter

The distance measurements usually jitter within the sensors accuracy specification.
Especially during standstill some position control systems encounter extensive power consumption due to this jitter. This is because the position control systems permanently tries to compensate the apparent position deviation caused by this jitter.
The first approach to solve this problem should be to carefully examine the position control systems settings. If this is not sufficient to solve the problem, the internal D-Series calming filter configuration can be used.

Calming filter properties:

- For use in conjunction with Moving Target characteristics only
- Low pass filtering of measured distance in standstill or low speed (-10 mm/s < v < +10 mm/s)
- No filtering at higher speeds
- Configuration over serial command sNafi+2+bbbbbbbb or Industrial Ethernet interface
- The filter strength can be selected in range 0...400, where 400 is max. possible calming. 0 disables the calming filter.

Generally it is recommended to set the calming filter strength cautiously. Select the filter strength only as high as required for the application. Tests are recommended. A good starting point for this tests is a filter strength of 50.

Figure 3 shows Moving Target measurement data without (green) and with calming filter (red, filter strength 100). The jitter is reduced from about 1 mm to about 0.2 mm. Also the measured distance changes much less dynamically.

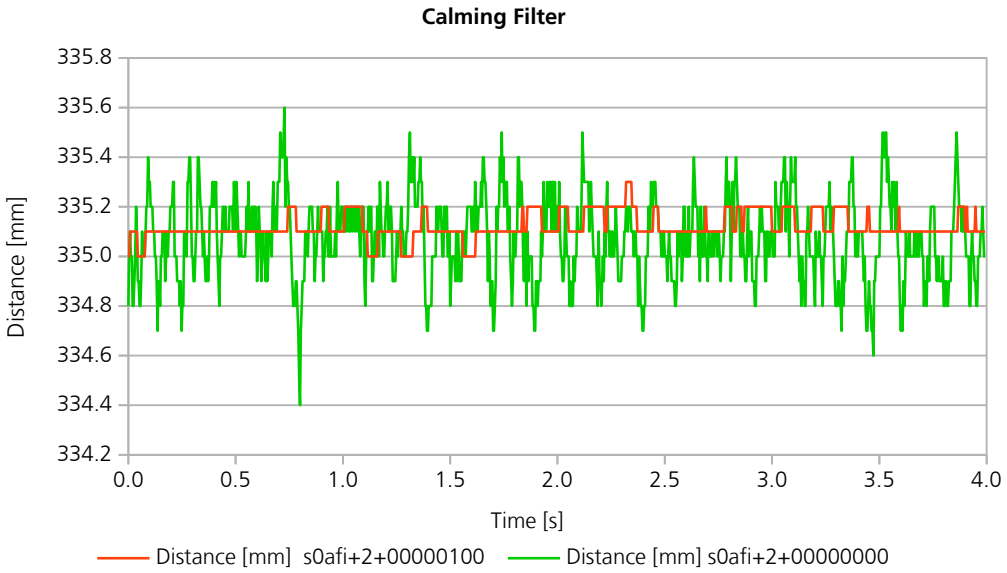


Figure 3: Moving Target measurement data without (green) and with calming filter (red) configuration

4.5 Orange Dimetix target foil

Although the Dimetix sensors are capable for measuring on natural surfaces, for distances above 100 m the Dimetix orange reflective target / foil must generally be used. If maximum measurement speed is required in conjunction with optimum accuracy, even at close range the usage of the Dimetix orange reflective target / foil is highly recommended.
When using the Moving Target characteristics without the Dimetix orange reflective target / foil the sensors constant high output rate is still maintained but measurement accuracy and range will be significantly deteriorated. Moving Target characteristic is designed and optimized for the use of the Dimetix orange reflective foil, therefore it's strongly recommended to use it.
More information about the Dimetix orange reflective target / foil can be found in the Products / Accessory section of the Dimetx homepage.

5 Sensor configuration and wiring

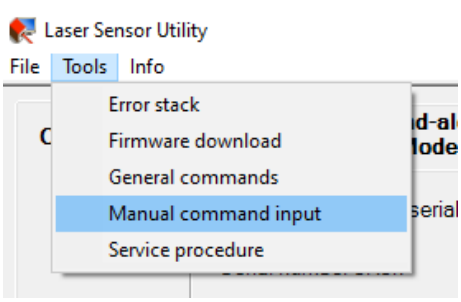
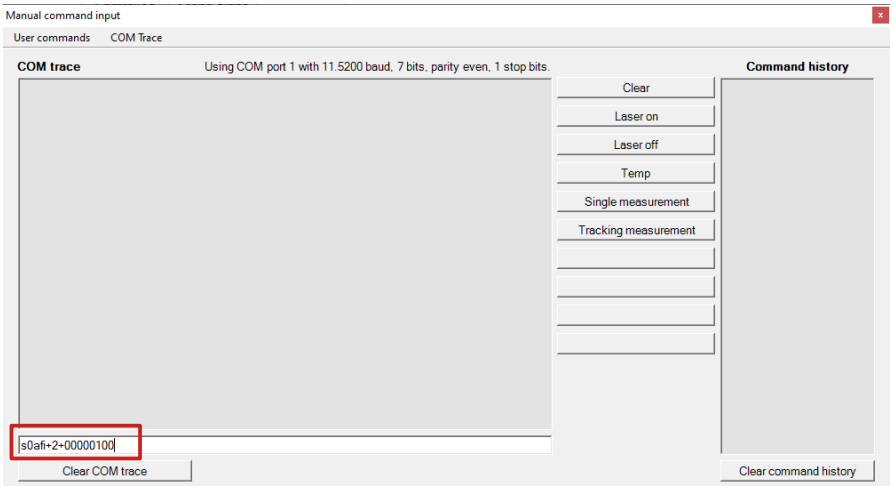
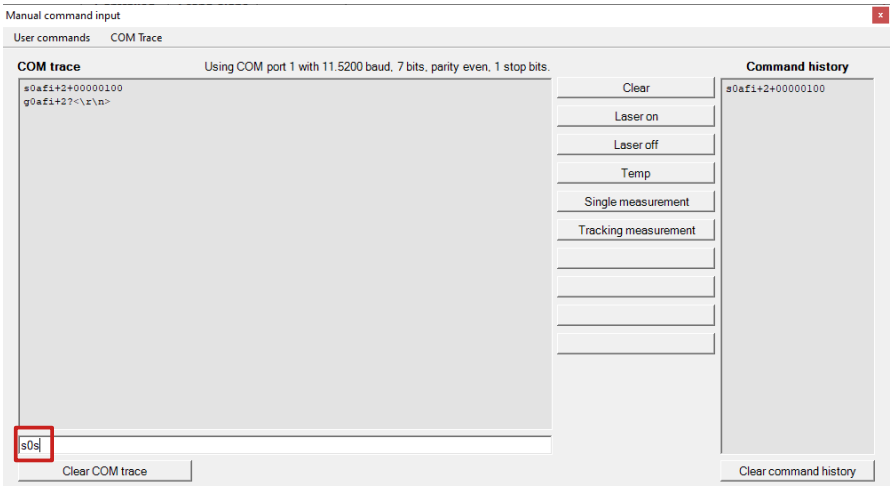
5.1 Moving Target

Sensor configuration for Moving Target measurement characteristics and appropriate wiring is described in the following Application Notes:

- AN2018 Moving Target characteristic with RS-422
- AN2019 Moving Target characteristic with SSI

5.2 Enable calming filter

	Start Laser Sensor Utility software and click the check connection button. The Laser Sensor Utility software can be downloaded from https://dimetix.com/en/products/software/.

	In the main menu chose Tools/Manual command input.
	Set filter strength (in this example 100) by typing the following command: • s0afi+2+100 Note: Pressing the enter key will send the command.
	Save the configuration in the laser sensor permanently by typing the following command: • s0s Note: Pressing the enter key will send the command.