

***ELECTRONICS &  
COMMUNICATION ENGINEERING***

**TECH**  
**CONNECT**  
September, 2020



**LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING  
MYLAVARAM**

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## ***1. Laser communication***

### **Introduction**

It is very well known for us that we have a lot of communication technologies in our field for different types of communications and they have been developing as well as modernizing/taking new faces each and every day. So, Laser Communication is also a type of communication technique which is very viable and useful in different purposes like Television Broadcasting, Radar Systems, Computer and Mobile Platform Networks and also especially in Satellite Communications.

Lasers have been considered for space communications since their realization in 1960. Specific advancements were needed in component performance and system engineering particularly for space qualified hardware. Advances in system architecture, data formatting and component technology over the past three decades have made laser communications in space not only viable but also an attractive approach into inter satellite link applications.

### **Glance about the laser communication**

Laser communication in space is free-space optical communication in outer space. In outer space, the communication range of free-space optical communication is currently of the order of several thousand kilo meters, suitable for inter-satellite service. It has the potential to bridge interplanetary distances of millions of kilo meters, using optical telescopes as beam expanders.

### **Comparison with RF communication**

We are basically using the RF Technology to communicate with the satellites, which actually means that we are using this technology to extract and get the information. The process included in this is, "Satellites communicate by using radio waves to send signals to the antennas on the Earth and the antennas then capture those signals and process the information coming from those signals". There are certain drawbacks of this RF Technology which are creating some uncertainties in predicting the information. These uncertainties may cost more because there are various purposes, we are using the information delivered for. So, we should be very careful in extracting the data. These uncertainties can be much avoided by using other accurate type of technologies. Laser Communication now comes into play where it gives much accuracy to extract the required information as well as giving the right one.

The smaller antennas with diameter typically less than 30 centimeters create less momentum disturbance to any sensitive satellite sensors. Fewer on-board consumables are required over the long lifetime because there are fewer disturbances to the satellite compared with heavier and larger RF systems.

### **Advantages**

Laser communications systems are wireless connections through the atmosphere, the light speed is the fastest speed than anything can travel, so laser communications and laser sensing are important in mortar defence and other crucial aerospace and defence applications. Lasers are able to see through the dense foliage, and they can allow for space communication from distances measured in millions of miles, we use lasers everywhere such as in the military systems, the avionics and in submarines. Laser communications are better than radio as light wavelengths are packed much more tightly than the sound waves and they transmit more information per second with a stronger signal, Lasers are used in communication with the optical fibres instead of telephone cables. We send and receive the data, video and other information, using lasers to encode and transmit the data at rates 10 to 100 times faster than radio, Laser is a very intense, concentrated, highly parallel and monochromatic beam and coherence is a very important property of laser. Lasers have been used in communications for years, and we can transfer information by lasers every day such as reading CDs and DVDs, and we can scan bar codes at checkout lines or tapping the fibre optic backbone of the phone or internet services.

Laser communications systems can be easily deployed because they are inexpensive and small, they have low power and they do not require any radio interference studies, Data exchange is relatively easy to combine with accurate range metering which is essential in many applications. Most important in space laser communication has been the development of a reliable, high power, single mode laser diode as directly modulable laser source. This technology advance offers the space laser communication system designer the flexibility to design very lightweight, high bandwidth, low cost communication payloads for satellites whose launch costs are a very strong function of launch weigh.

### **Disadvantages**

There are few disadvantages of this communication process to be known. The main disadvantage is to be noticed is that it requires direct line of sight. The second one to be noted is this sort of communication technique is very expensive to bear and also requires

very high standards which are hard to maintain. These can be discussed as the main disadvantages of Laser Communication.

### **Conclusion**

There are many fields where this sort of communication technique can be used to increase their standards as well as their performance like Inter-link satellite communication, Unmanned Aerial Vehicle (UAV), radar communication, TV broadcasting and many more. So, we have a lot of scope for this laser communication which can give us better performances. By considering these scopes, advantages and performance quality, we can suggest that this Laser technology can make far better inventions with greater performance.

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~Gannavarapu Harish (18761A04D3)

## ***2. Covid-19 : A Boon to technology??***

As we all face the challenge that this global pandemic has given us, as we think about the role technology is playing a vital character and not only helping all to be productive as the world deal with this pandemic but what impact it means to having people being more in a global economy. So, the three main things that we should mainly recognize are that we have been increasingly digital this has been a transformation for many years but in many ways the root realities of kind of working, studying from home and social distancing but trying to be more productive and connected to people through technology has given us a kind of an incredible leap forward.

When it comes to technology adoption so any laggards that may have been holding on the old ways doing a business now find to need this digital tools necessary to go ahead and stay connected not only with those across the globe but frankly even those that might live in their own neighborhood as they try to stay connected and productive while keeping social distancing.

The other thing we should recognize is that digital technology helps on only in keeping people connected but also in medical field to step out of this drastic situation. Many resources are now made digitalized in order to provide better services

The thought of corona virus pandemic is ultimate drawback to the lives of many people, yet provides a perfect development towards the future digital world through technology. Let us hope this technology provides a game changing solution even to this corona virus.

- K.M. Cherry Blossom

### **3. POLY FUSE**

Poly fuse is a new standard device. It's a re-settable device. Poly fuse are also called as "POLY SWITCH" or "MULTI FUSE". Poly fuse are not just fuses they are "Polymeric Positive Temperature Coefficient Thermistors" (PPTC). Current can be accomplished through fuses, resistors and other alternatives. But resistors are rarely acceptable cases because of the high power resistors are highly expensive. Another solution is "Resettable Ceramic Positive Temperature Coefficient". This is also not in wide use because of high resistance and power dissipation characteristics. Hence the best solution is PPTC device which has low resistance in normal and high resistance in fault conditions. These PPTC'S restrict the flow of dangerously high current during the fault condition. PPTC'S reset after the fault is cleared and the power to the circuit is removed, they are also as it is small enough it can be directly placed in the electronic modules, junction boxes and power distribution centers.

#### **Working of poly fuse**

Poly fuse device operation is based on an overall energy balance. Under normal operating conditions, the heat generated by the device and the heat lost by the device to the environment are in balance at a relatively low temperature. If the current through the circuit is increased while the temperature is constant, so the temperature of the device increases. Further increase in the current, ambient temperature or both will cause the circuit to reach a temperature where the resistance also rapidly increases. Any further increase in the current or the temperature will cause the device to heat up and if this heat generation is greater than the heat dissipation then the device heats up instinctly. At this stage a very large increase in resistance occurs for a very small change in temperature. This causes a corresponding decrease in the current flowing through the circuit. As long as the voltage remains at this level, the device will remain in the Tripped state (Protective State). Once the device voltage is decreased and the power is removed the device will reset.

PPTC'S are designed for today's demanding electronic and electrical engineering. The concept of self-resettable fuse is a useful technology. They also have several advantages. Majority of the PPT'S have the trip times in the range of 1-10 second, but there are PPTC'S fuses with trip time of a few milliseconds. It is compact. It is ideal for low voltage AC and DC. Finally it is affordable.

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#### ***4. Future drones***

Drones are becoming the common place to the commercial and to the non-profit businesses. In our near future their use will be even more widespread. These are used very commonly now days in functions to capture the moments more easily. There are many degree programs running for these drones it. Even huge companies like Amazon and Google are testing ways to deliver packages with drones. In olden days, pigeons are used to deliver the news.

There are many types of drones like agriculture purpose, fulfillment, disaster mitigation and relief, logistics, film making, law enforcement, and many more. By 2025, there will be more than 1,00,000 new jobs in this drone technology. These are also called as Unmanned Aerial Vehicles. These make the things easier. The next generation of drones, Generation 7, is already underway, as 3DRobits announced the world's first all-in-one Smart Drone called Solo. This smart drone with built in safeguards and compliance tech, smart accurate sensors, and self –monitoring are the next big revolution in drone technology that would provide new opportunities in transport, military, and commercial sectors. As this technology continues to evolve and grow, these will become safer and easier in our future.

As this technology is evolving, so future drone tech is currently undergoing groundbreaking progressive improvement. A drone of today is a combination of all advanced technologies like microcontrollers, GPS, WI-FI, and sensor units. They need to work in a synchronized fashion which is giving business to many companies and start-ups. Besides, the profusion of drone kits, easy to learn programming languages, and course material on the internet makes it easy for novices to build and code a drone. As this is becoming our future let us hope this may not make the human lazier.

~A.Himaja

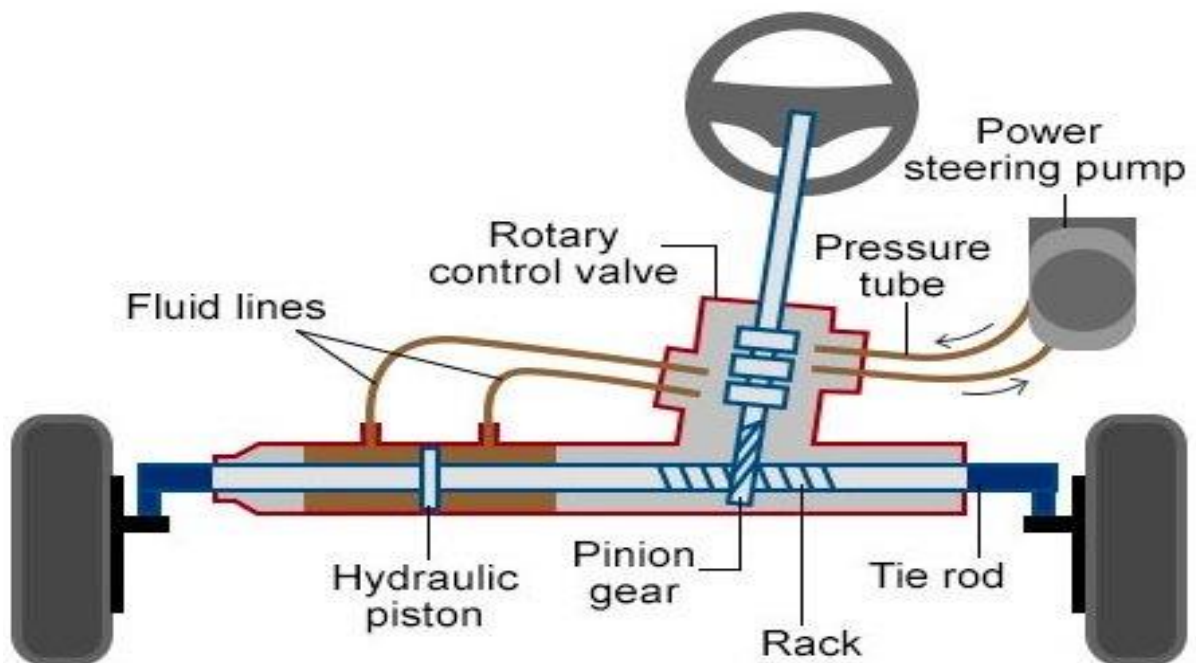


## 5. Electric Power-Assisted Steering

The MLX91377 is a recently-released linear hall-effect sensor IC from Melexis. This article mainly focuses on one of the main use cases of the MLX91377—steering torque measurement. We'll see that by using a reliable hall-effect sensor, you can take accurate and robust torque measurement of paramount importance in electric power-assisted steering (EPAS) systems.

### A Brief History on Hydraulic Power-Assisted Steering

When you drive a fully manual steering system, you might struggle to turn the steering wheel at times, especially when you're driving a large vehicle at a low speed. To address this issue, car manufacturers introduced the first hydraulic power-assisted steering (HPAS) system in the 1950s. The basic idea of this system is shown below.



**Figure1 :Simplified architecture of an HPAS system**

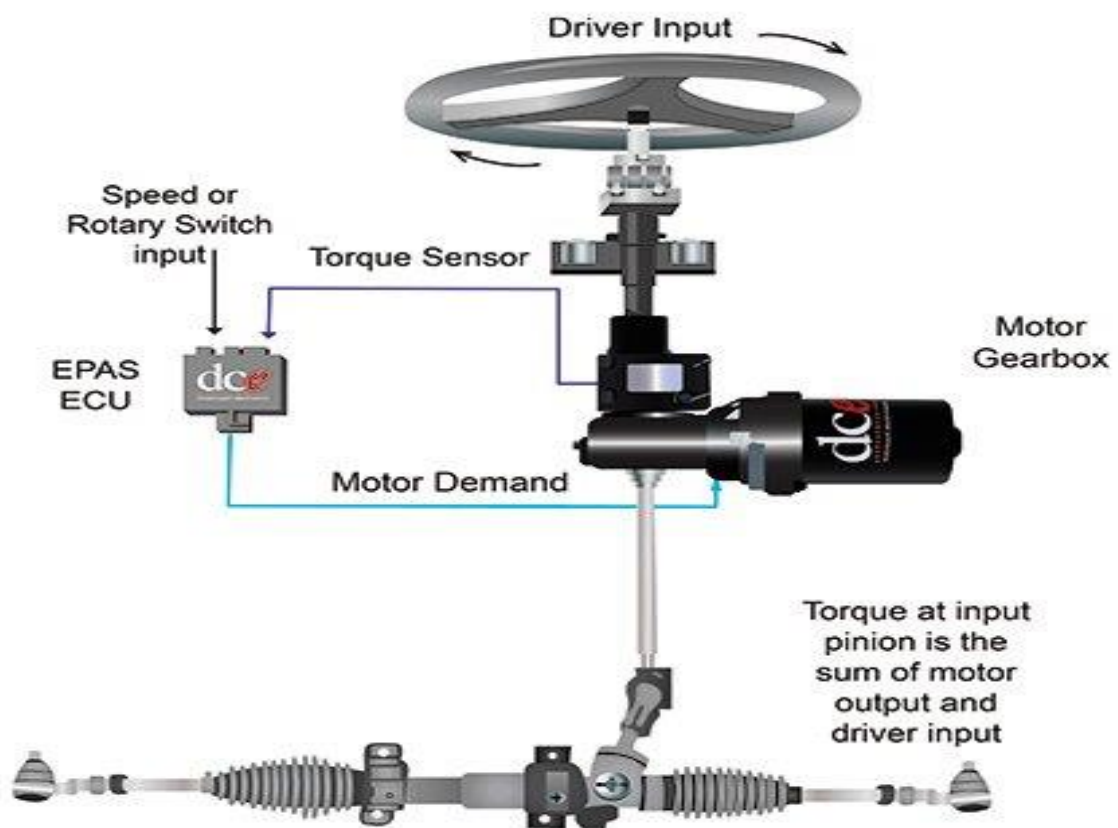
This system uses high-pressure fluid, provided by the power steering pump, to assist the driver with steering. The fluid can be conducted to either the right side or the left side of the hydraulic piston through the fluid lines.

When the driver rotates the steering wheel clockwise or counterclockwise, the pressurized fluid gets applied to the appropriate side of the hydraulic piston. In this way, the piston (and consequently) the rack is moved in the desired direction without excessive physical effort from the driver.

Although the hydraulic power-assisted steering allows the driver to easily steer the vehicle, it has several shortcomings. A major problem with this system is its low power efficiency since the engine has to continuously drive the power steering pump even when the steering system is not used. To overcome the limitations of the HPAS, automotive engineers decided to redesign the system to use the power from an electric motor.

### The Rise of Electric Power-Assisted Steering

Electric power-assisted steering (EPAS) uses an electric motor rather than a hydraulic system to assist the driver with rotating the steering wheel. The basic idea is illustrated here.

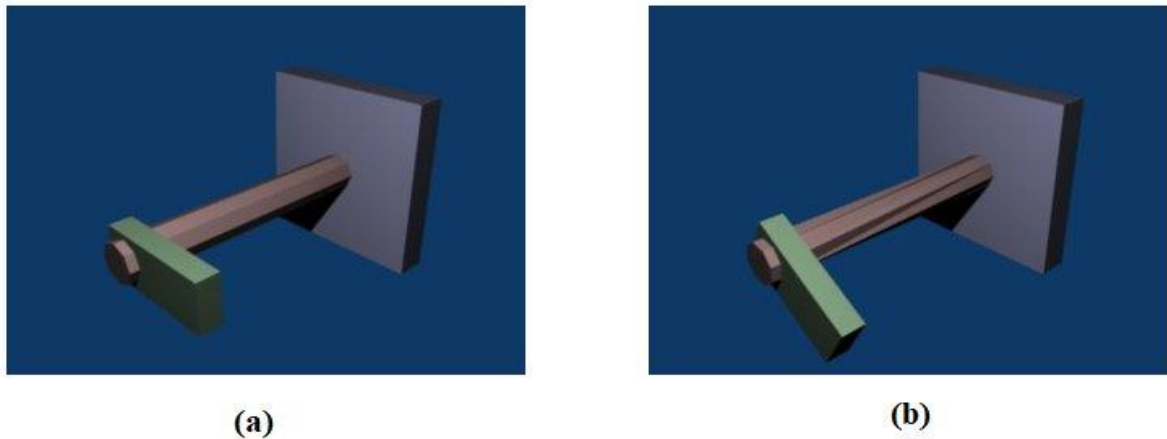


**Figure 2:** *Simplified architecture of an EPAS system*

Since the electric motor will be turned on only when the steering system is used, an EPAS system can be more power-efficient than an HPAS system. To control the motor, we should be able to calculate the required assisting power. An important parameter that determines the required assisting power is the driver input—that is, the torque that the driver applies to the steering wheel.

### The operation of a torsion bar

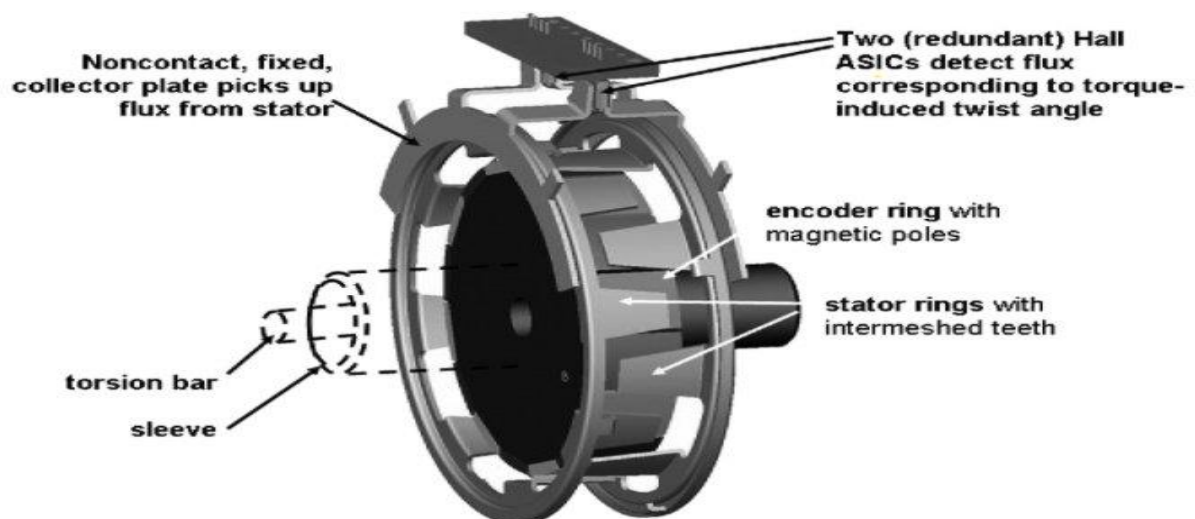
A torsion bar is basically a metal bar with spring-like behavior. If we fix one end of the torsion bar and apply a torque to the other end, it will twist by an angle  $\theta$ , which is a function of the bar's length and stiffness. The torsion bar wants to resist the twisting effect and will return to its normal state when the torque is removed. The following figure shows how a torsion bar twists in response to the applied torque.



**Figure 3: How a torsion bar twists in response to the applied torque**

### Non-Contact Torque Sensor

Here, you'll see a contactless torque-sensing mechanism based on a hall-effect sensor.



**Figure 4: A contactless torque-sensing mechanism based on a hall-effect sensor**

It consists of:

- Two co-rotating stator rings made of ferromagnetic material. The stator rings are fixed to the input end of a torsion bar that is connected to the steering wheel column. We'll explain in a minute what a torsion bar is.
- An encoder ring with alternating magnetic north and south poles. This encoder ring is connected to the output end of the torsion bar.
- One or two (for redundancy) hall-effect sensors fixed to the stator rings.

### **Working of Torque Sensor**

The key point is that the stator rings are connected to one end of the torsion bar and the encoder ring is connected to the other end. As the driver rotates the steering wheel, the torsion bar twists slightly and the encoder ring angularly moves with respect to the stator rings.

As the position of the encoder ring changes with respect to the stator rings, the magnetic flux sensed by the hall-effect sensor changes accordingly. This allows us to generate an electrical signal that is related to the torque that the driver applies.

### **Melexis' New Linear Hall-Effect Sensor IC**

The MLX91377 is a monolithic magnetic position processor IC. It consists of a Hall effect magnetic front end, an analog to digital signal conditioner, a DSP for advanced signal processing and an output stage driver.

The MLX91377 is sensitive to the magnetic flux density applied perpendicular to the IC (i.e.  $B_z$ ). This allows the MLX91377 with the correct magnetic circuit to decode the absolute position of any moving magnet or linear displacement, see Figure 2). It enables the design of non-contacting position sensors that are frequently required for both automotive and industrial applications. The MLX91377 provides two output modes. Firstly, the IC supports SPC frames encoded according to a Secure Sensor format. Through programming, the MLX91377 can also be configured to output an analog signal

The built-in signal processing resources allow the device to provide high linearity and thermal stability. The new device supports a wide operating temperature up to 160°C. It employs a dual-die, fully-redundant design that makes it suitable for safety-critical

automotive applications. The MLX91377 can be used to measure the magnetic flux variations in the above torque sensing mechanism. Now that we are familiar with the basics of using a hall-effect sensor to build a non-contact torque sensor, let's take a look at some of the important characteristics of the MLX91377.

**Functional Diagram:**

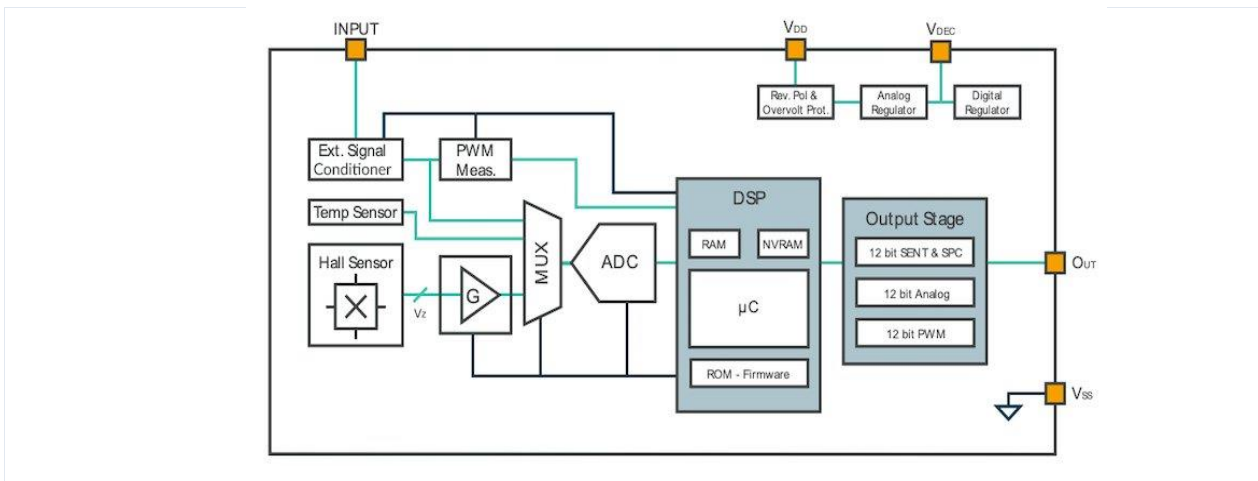


Figure 5. Block diagram of MLX91377

**DSP Chain of the MLX91377**

The figure below depicts the DSP chain of the new sensor.

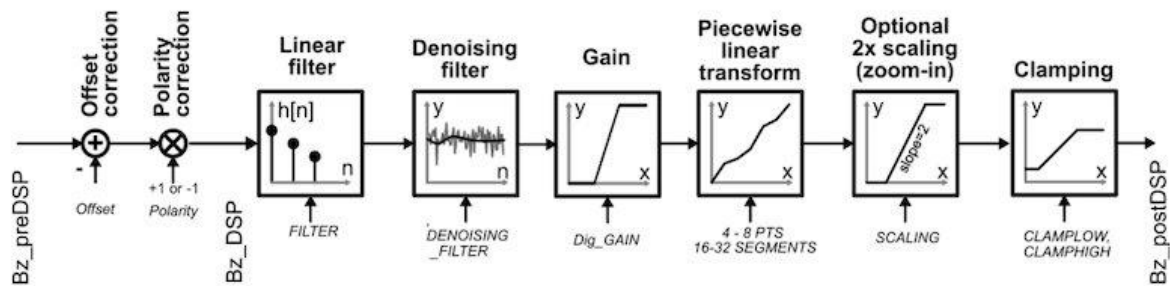
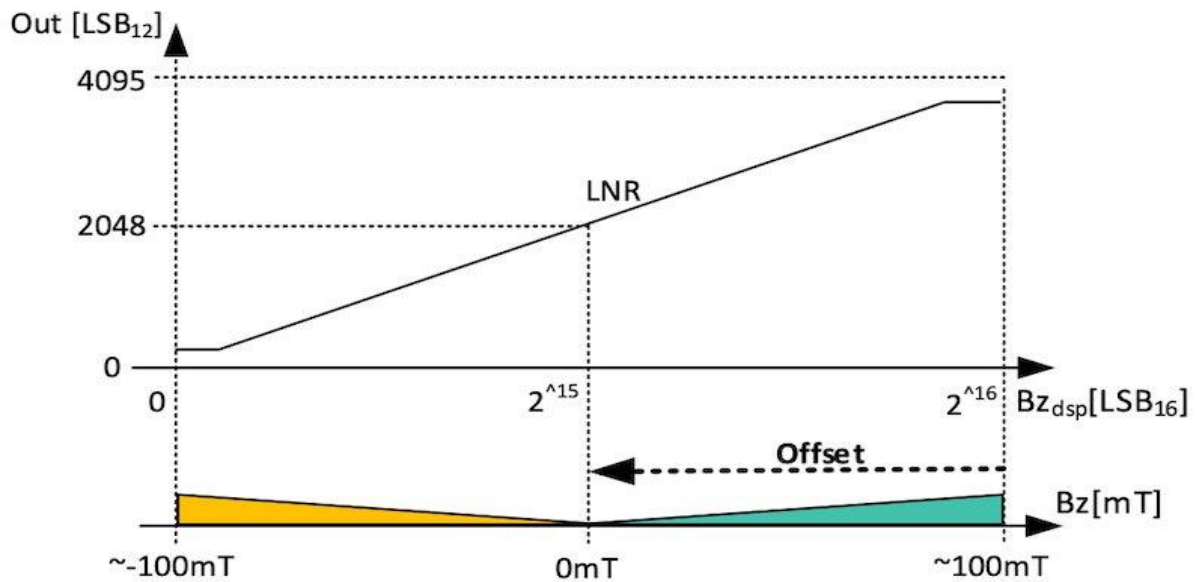


Figure 6: DSP process chain from ADC to MLX91377's output.

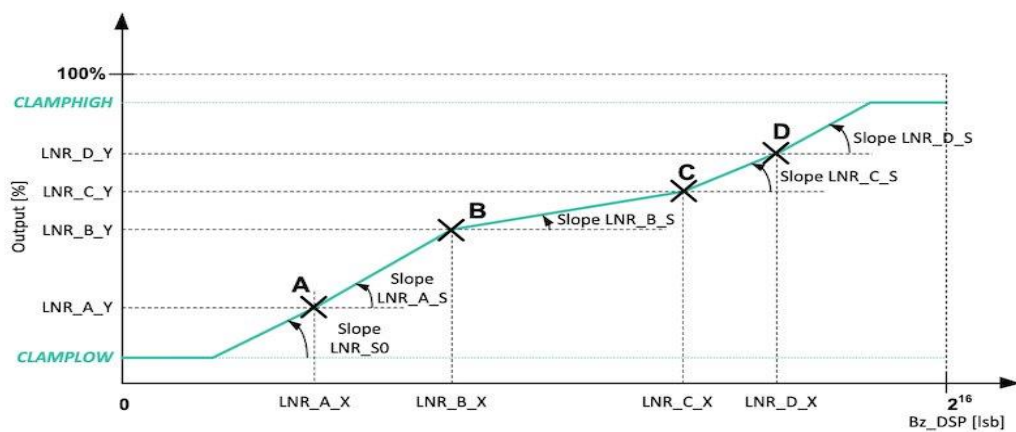
Several parameters of these blocks are programmable. This allows the user to adjust the transfer function of the sensor and compensate for the errors caused by the magnetic and mechanical construction of the design.

For example, the user can adjust the “offset” value to place the quiescent output value of the sensor at any point on the transfer function.



**Figure 7:Default OFFSET positioning.**

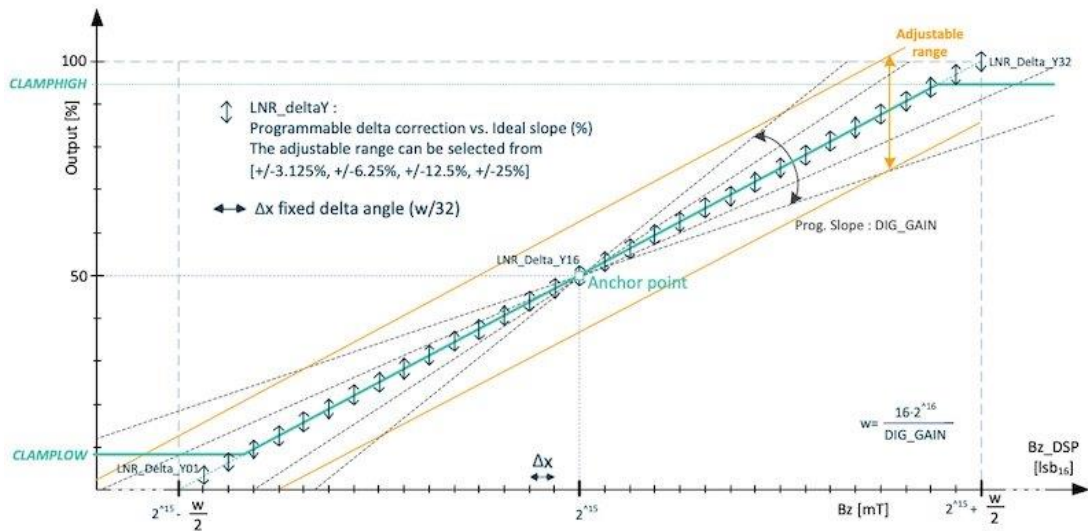
To compensate for the non-idealities you may encounter in practice, the MLX91377 allows the user to adjust the transfer function from the node Bz\_DSP in Figure 6 to the sensor output. This can significantly increase the linearity of the sensor for a given application. The programmable parameters for the four-point linearization of the MLX91377 are shown below.



**Figure**

**Figure.8:Description of the 4-point linearization parameters.**

As you can see, seven segments of the above transfer curve can be programmed by the user. The first and the last segments are necessarily flat. For a more demanding application, we can use an 8-point, 17-point, or a 33-point transfer function. The 33-point transfer function is shown below.



**Figure 9: Description of the 33-point linearization parameters.**

The features discussed above are only some of the programmable parameters of the MLX91377. The user can adjust several other aspects of the design. For example, the user can trim the sensitivity drift of the system to achieve higher thermal stability.

## Summary

MLX91377 can be used for the torque measurement for an EPAS system. We also briefly looked at some of the important features of this sensor.

The MLX91377 can implement a programmable transfer function to increase the linearity of the system. This allows the designer to compensate for the non-idealities that can arise from the magnetic and mechanical construction of the design. Moreover, the device can be programmed to correct the thermal drift of the sensor gain.

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### ***Editorial***

*We always feel suffocated or irritated after sitting in a closed room over a long time. When situation became unbearable we open either the windows or the doors to get fresh air into the room or simply walkout of the room. Many or mostly of it have not thought this situations a problem or a threat. But in life whenever some unexpected thing comes in the way, we curse ourselves and we even blame go . Rarely few take this as an opportunity and derive solutions from the hurdles either individually or make the society to came out of the problem.*

*As everything is not yet normal, one need to get accustomed to the new environment due to covid and try something new that makes them remembered forever. Inventions always are due to the outcomes of the difficulties faced sometime back. Somewhere it was told that brain will be sharper at earlier stages and as time passes becomes lazy if enough work is not given. So what to do is nothing but feed the brain with good , creative thoughts finally yielding good outcome.*

*gln*

