

I. LES LVDT ET ELECTRONIQUE ASSOCIEE

DIAGRAMME FONCTIONNEL

Q1. Le diagramme fonctionnel d'un LVDT est représenté sur la figures ci-contre. Commenter le rôle de chaque étage.

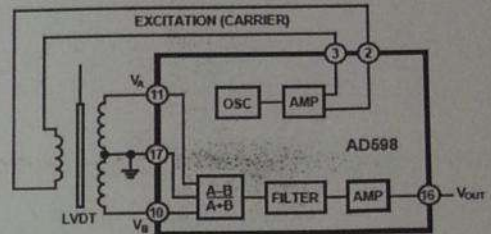
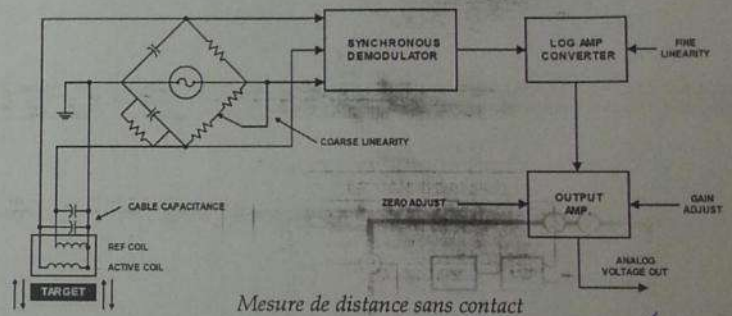


Figure 5. AD598 Functional Block Diagram

II. CAPTEURS INDUCTIFS DE DEPLACEMENT SANS CONTACT

CAPTEURS A COURANT DE FOUCAULT

- Q2. La figure ci-contre illustre la mise en oeuvre d'une mesure de distance sans contact au moyen d'un capteur à courant de Foucault.
- Tracer un schéma électrique équivalent du montage.
 - Quelle est la tension en sortie du pont?

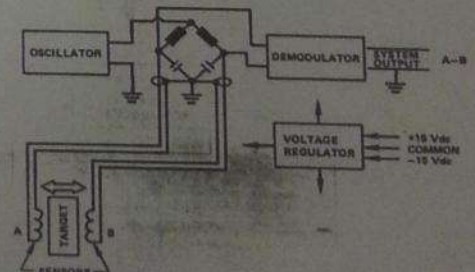
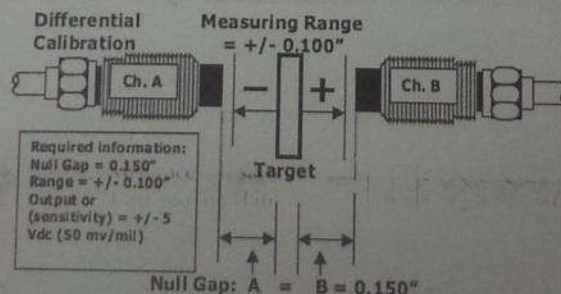


Q3. Discuter la linéarité et la condition d'équilibre du pont. Et justifier le rôle des étages suivants.

Q4. Un jeu de capteurs différentiel à courant de Foucault et son électronique associée sont représentés sur les figures ci-dessous. Il est facile d'admettre que les mouvements de la cible puissent produire des variations ΔL opposées dans l'inductance apparente des canaux A et B. Nous notons alors :

$$L_A = L + \Delta L \text{ et } L_B = L - \Delta L \text{ Et nous admettons en plus que } \Delta L / L < 1.$$

Le démodulateur fourni une tension continue de 10V maximum pour un déplacement de 0,25 cm.



LINEARITE DU CAPTEUR

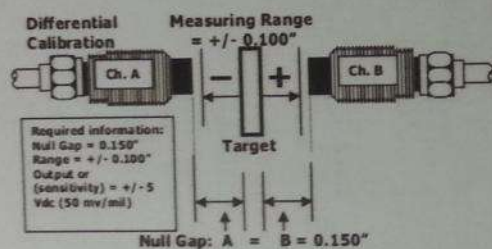
- Vérifier la condition d'équilibre du pont alimenté avec un oscillateur sinusoïdal lorsque la cible se trouve à égale distance de A et de B ($\Delta L = 0$).
- Etablir l'expression de la tension de déséquilibre (ΔL différent de 0) en négligeant les termes du 2ème ordre (en $\Delta L^2 / L^2$). Discuter la linéarité de l'instrumentation. NB : $(1+u)^{-1} = 1-u$ pour $u < 1$.

Q5. Quelle doit être la nature de la démodulation en sortie du dispositif (amplitude ou fréquence) ?

CAPTEURS A COURANT DE FOUCAULT :

KD-5100 - Dual channel differential analog based, extremely high precision eddy current position measuring system

This product incorporates a custom MIL-SPEC hybrid circuit in an efficiently sized and rugged electronics package. The KD-5100 is available with several sensor options suitable for high precision applications. The system provides a DC voltage output. It is intended for low to high volume end user applications and is very well suited to high precision OEM & Military applications. Due to the high precision nature of the intended use, it is suggested that this system be used with non-ferrous targets (non-magnetic). Custom calibrations and sensor designs are available.

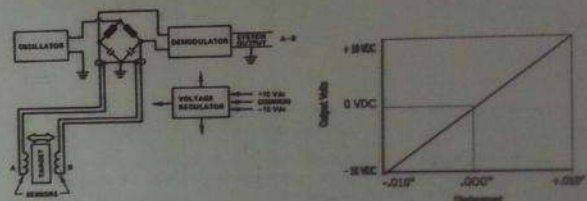


The KD-5100 was developed to satisfy the demands of high precision military measurement applications, and has a history of use in a variety of high precision/high reliability industrial applications as well. Applications include: mirror position, pointing and tracking in night vision and laser systems; control systems for active vibration monitoring and control systems; photolithography and atomic force microscopy stage positioning and control systems; and satellite based communications and laser pointing systems.

Cas particulier d'un capteur différentiel

Theory of Operation

In the KD-5100, the coils of a pair of sensors form the opposite legs of a balanced bridge circuit. This differential configuration achieves its high resolution by eliminating the noise and drift any intervening summation and Log amplifiers normally add to the system. Additionally, by using electrically matched sensors on opposing legs of the same bridge, temperature effects common to the sensors and cabling of a differential sensor pair tend to be cancelled. This is true for the mechanical aspects of the sensor/target system also.



When the target is electrically centered between the two sensors at the nominal null gap for each, the system output is zero. As the target moves away from one sensor and toward another, the coupling between each sensor and target is no longer equal causing an impedance imbalance and its output is amplified, demodulated, and presented as a linear analog signal directly proportional to the target's position. This is a bipolar signal that provides both magnitude and direction of misalignment. Only A-B, or differential output is available.

Application Handbook

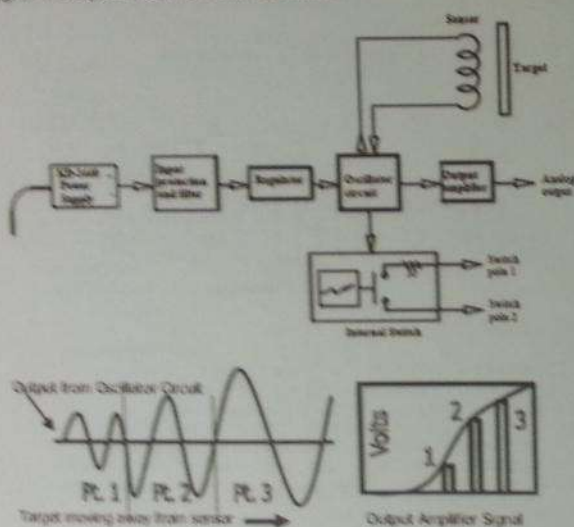
Kaman Instrumentation Corporation, Measuring Systems Group
Colorado Springs, Colorado USA

Annexe TD4 : CAPTEURS A COURANT DE FOUCAULT :

AM ou FM ?

Theory of operation

Unlike the inductive bridge circuit used exclusively in Kaman's measuring systems, the KD-2440 system operates on a traditional Colpitts oscillator circuit where the sensor acts as the resonating coil for the oscillator. The proximity of the targets to the sensor face pulls the oscillator which in turn changes its frequency (small change not used) and amplitude (large change) of modulation. The signal is half-wave rectified (AC to DC) and filtered to obtain an analog voltage proportional to the target position. The analog voltage output can be varied by adjustment of the gain. The input power is diode protected and regulated to provide a clean low noise signal. The output is short-circuit current protected.



KD-2440 Colpitts Circuit Diagram & System Output Characteristics

Application Handbook
Kaman Instrumentation Corporation, Measuring Systems Group
Colorado Springs, Colorado USA

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Mesure de distances

Mesure à partir d'une référence

KD-2300 - single channel high precision analog eddy current position measuring system

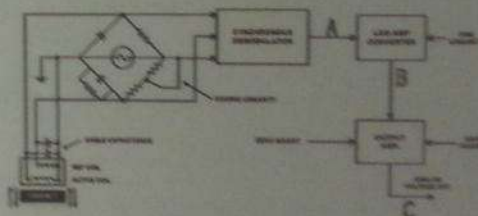
The KD-2300 includes an industrial electronics and a wide variety of sensor options - high precision as well as rugged industrial for moderate temperature applications. The system provides an analog voltage output and a synchronization option is available for multiple channel measurement applications. It is intended for low to high volume end user applications, as well as OEM applications. Operates on non-ferrous and ferrous target materials (non-magnetic and magnetic, respectively). Custom configurations are available.

Theory of Operation

The KD-2300 and KDM-8200 systems use the inductive bridge network shown below. A crystal controlled oscillator drives a wheatstone bridge. The bridge is tuned to be near resonance so that slight changes in inductance in the sensor coil (caused by changes in the electromagnetic coupling between the sensor and the target) provide big shifts in the output of the bridge.

Target movement relative to the sensor causes impedance change in the sensor coil. The impedance of the coil is detected (measured) by the RF control circuitry (synchronous demodulator circuit), then linearized by a logarithmic amplifier and amplified in the DC control stage (providing gain and offset amplification). This voltage is the system output voltage, provided to the user as an analog voltage directly proportional to target position relative to the sensor.

The KD-2300 uses both dual and single coil sensor designs. The dual coil has an active and an inactive reference coil for improved temperature stability when axial space constraints do not apply.



KD-2300/KDM-8200 Circuit Diagram

The KD-2300 is a high precision position measuring system developed to satisfy an extremely wide variety of measurement applications, including R&D, metrology, factory process control, and machine monitoring and control.