CLAVIS

Fourier Belt Measurement System

www.clavis.co.uk

FOURIER BELT MEASUREMENT SYSTEM



The Clavis FourierBMS measures the tension of the drive belt using an optical sensor to detect high frequency vibrations of a belt under tension. Designed and built for production lines and manufacturing facilities, the FourierBMS is the industry standard for most OEMs.

FourierBMS

CLAVIS

Why is the Correct BELT TENSION Important?

1. Too little tension results in slippage, excess heat, and premature belt & pulley wear.
2. Too much tension results in excessive stress on belts, bearings, and shafts.

NOISE REDUCTION

Machinery is a major cause of workplace noise, causing employees to suffer from temporary deafness to more serious ear conditions (cumulating over a period).

REDUCED MAINTENANCE

Preventive maintenance, like ensuring the correct tension in a belt, will reduce the possibility of unnecessary repairs.

ENERGY EFFICENCY

A more energy efficient machine reduces running costs, lowers carbon emissions and increases the lifespan of a machine.

REDUCED DOWNTIME

Increases the operating time for a running machine and reduces the chance of emergency repair calls.

INCREASED HORSEPOWER

More horsepower leads to better acceleration, increased speed, torque boost, and better fuel economy.

REDUCED VIBRATION

The effects of machine vibration can be severe. Unchecked machine vibration can accelerate rates of wear and damage equipment. Vibrating machinery can create excessive noise.

FOURIER BELT MEASUREMENT SYSTEM

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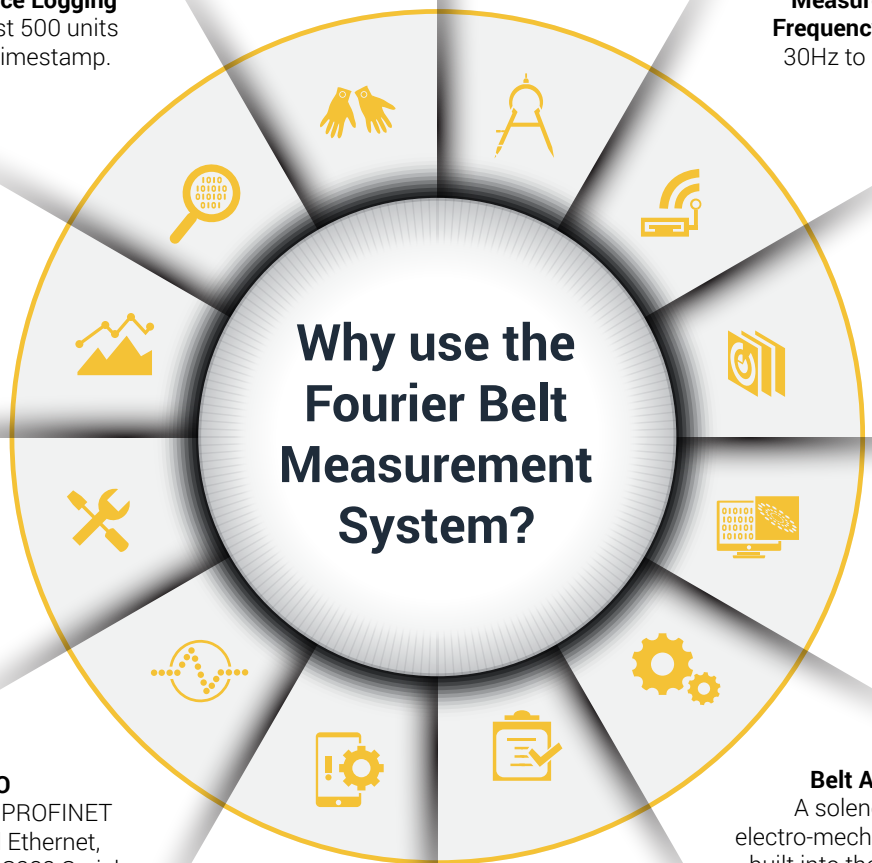
The Clavis FourierBMS measures the natural frequency of a belt under tension using optical technology. Designed and built for production lines and manufacturing facilities the Fourier system is an integrated OEM solution for many different sectors.

Used for quality assurance and production line assembly purposes and with over 1000 customers worldwide, the Fourier contributes enormously to the increase of performance, quality and efficiency.

The system accurately measures frequencies between 30Hz and 500Hz on a wide range of belts. The system takes measurements in Hertz (Hz) and can report in Hertz (Hz), Pounds (Lbs), Newtons (N), or Kilogram-force (KgF). The tension of a belt can be calculated based on mass and span length of a belt.

In addition to belt measurement, the FourierBMS calculates a Quality Factor as a scale indication of how good the measurement was taken. Belt measurement with a low quality factor can indicate that the optical sensor is positioned too far away from the belt or there are objects resting on the belt, causing the signal to “dampen” the natural vibration of the belt.

Why use the Fourier Belt Measurement System?



Robust
Designed and built for production lines and manufacturing facilities.

Highly Accuracy
Below 100Hz +/- 1 significant digit & Above 100Hz +/- 1%.

Measurement Frequency Range
30Hz to 500Hz.

Repeatable Measurement Results
Consistent and precise readings obtained from the belt.

Advanced Measurement Method
Fast Fourier Transform (FFT) is used when a belt vibrates at several frequencies simultaneously which can be problematic for interval-based frequency determination.

Belt Agitation
A solenoid driven electro-mechanical hammer, built into the sensor head, agitates the belt causing the belt to vibrate.

Quality Factor
A scale indication to determine the status of the measurement taken.

Scope Output
Used for advanced diagnostics of belt frequency and vibration.

I/O
The Fourier PROFINET Networked Ethernet, PROFIBUS, RS232 Serial, and 24v Isolated Outputs.

Power Tool Interface
Built in closed-loop system can use the measurements to physically adjust and set the unit to the correct frequency or tension range.

Output Measurement
Hertz (Hz), Pounds (Lbs), Newtons (N), or Kilogram-force (KgF) - tension can be calculated based on mass and span length of a belt.

Data Trace Logging
Holds last 500 units with a Timestamp.

OPTICAL SENSOR HEAD

The FourierBMS measures the frequency of a belt using an optical sensor head connected to the control cabinet via a cable. The sensor head contains an infra-red optical sensor and a spectrally matched photodiode which recovers the belt vibration signal.

The sensor contains a solenoid driven electro-mechanical hammer which is used to agitate the belt causing it to vibrate. An infra-red optical sensor is employed to convert the belt vibration into an electrical signal which is processed by the FourierBMS control cabinet.

We have a wide range of sensor heads available designed for a range of different applications.








FOURIER BELT MEASUREMENT SYSTEM

Our dedicated team is made up of a wide range of highly skilled and expert mechanical design, electronic, and software engineers who ensure that every customer receives the highest standard of equipment and support the company is renowned for.

Where is the Fourier Used?

The Clavis FourierBMS is used in numerous industries.
For quality assurance and production line assembly our belt measurement equipment makes a vital contribution to the improvement of products and processes.

From global major corporations to medium-sized companies the Fourier system ensures reliable measurement results with the highest precision all over the world.

From automotive production lines and HVAC assembly, to integrated OEM solutions - nearly all industries benefit from our belt measurement technology.

- EPAS
- Vehicle Assembly
- HVAC Assembly
- Agriculture

FOURIER BMS

The control cabinet contains the system power supplies, interfaces with a PC/PLC to control measurements, operates the gauge unit, recovers the belt vibration signal and displays the resulting measurements on various displays and indicators.

FourierBMS

Belt Status Indicators
'Tight-O.K.-Slack'

USB Port - Used to save an image of the view on LCD display.

LCD Display - Displays either the scope output or the FFT output. Illustrates the vibration signal both in the frequency and time domain.

Quality Factor Bar Graph Display

Frequency LED Display
This displays the frequency measurement on a 7-segment LED display.

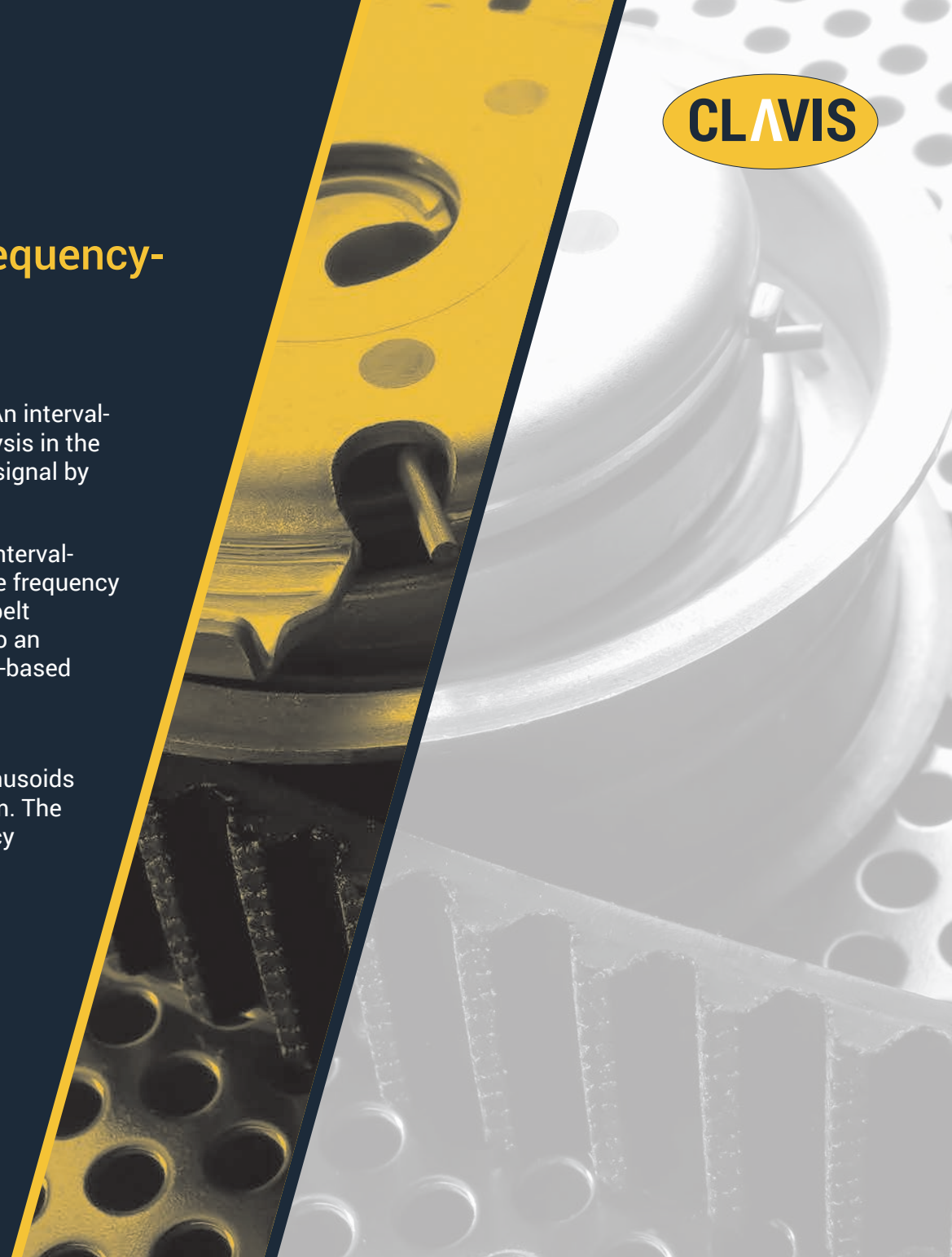
FOURIER BELT MEASUREMENT SYSTEM

Time-Domain Measurement and Frequency-Domain Measurement

The Fourier BMS analyses the belt signal in two different ways; An interval-based measurement in the Time-domain and a FourierBMS analysis in the Frequency-domain. The latter one offers a representation of the signal by utilising the Fast Fourier Transform (FFT) algorithm.

The ideal belt would vibrate in a pure sinusoidal frequency. The interval-based measurement (time domain) is enough for determining the frequency of such a belt. However, not all belts vibrate in this ideal way - a belt may vibrate at several frequencies simultaneously which leads to an uncertainty in determining the frequency when using the interval-based measurement method (time domain).

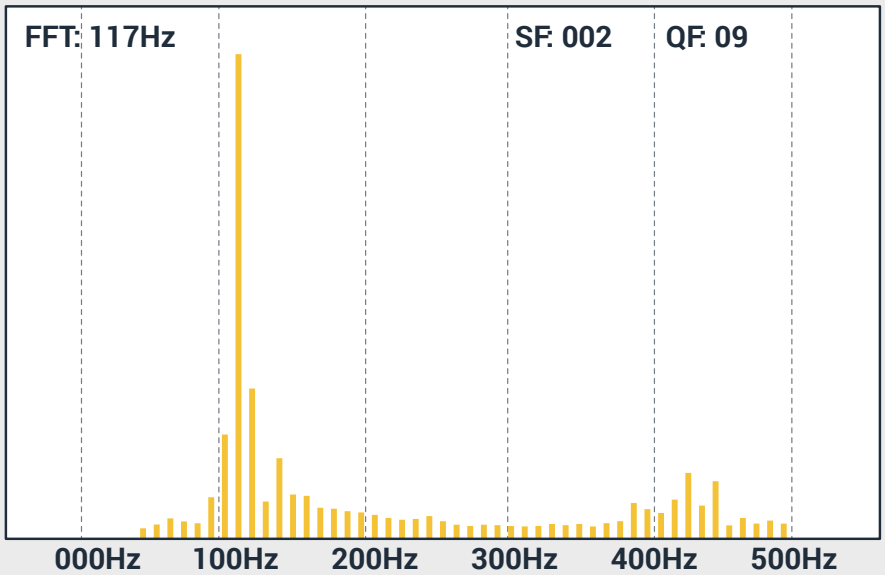
FourierBMS analysis can solve this problem, as it allows a single waveform to be broken down into a series of single frequency sinusoids that can be re-combined together to reform the original waveform. The Clavis FourierBMS performs a live representation of the frequency components and their relative amplitudes for determining the dominant frequency of the belt.

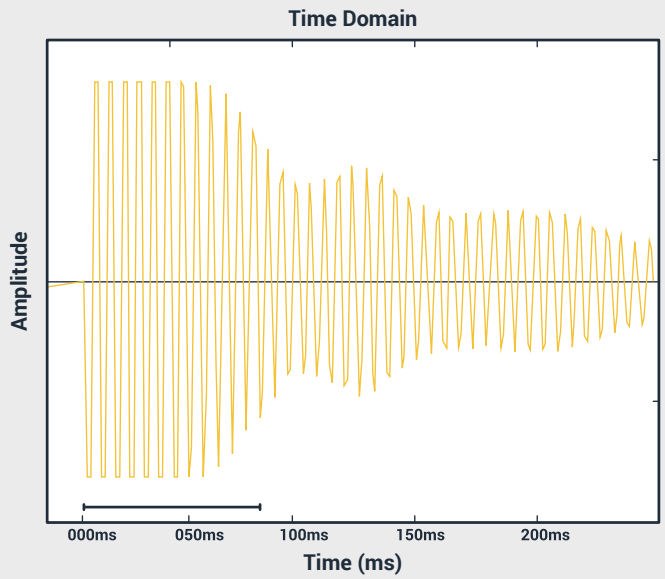


FOURIER BELT MEASUREMENT SYSTEM

Belts vibrating at multiple frequencies have been noted as a particular problem for EPAS units. This combination of multiple sinusoids can result in a complex waveform. Interval-based analysis cannot determine the belt frequency accurately, potentially leading to a false set of tension on the EPAS unit. In a situation when a pure frequency cannot be achieved through good positioning of the gauge, the Fast Fourier Transform (FFT) can be used to determine alternative belt tension setting criteria.

In a situation when a pure frequency cannot be achieved through good positioning of the gauge the FFT can be used to determine alternative belt tension setting criteria.





Communication

The demand for companies to reach the best decisions based on real-time data insights have never been greater. The Fourier is designed to interact not only with operators and engineers, but also other systems and subsystems. PLCs play an important data gathering and reporting role in system transparency by serving and receiving data from plant quality systems. Advanced process control and monitoring functions make it easy to view and collect data.

Fourier interfaces include:

- PROFINET Networked Ethernet
- PROFIBUS
- RS232 Serial connection
- 24v Isolated Outputs

We have developed a range of FourierBMS controllers integrating PLCs produced by Siemens, Allen-Bradley, and Mitsubishi.

SIEMENS

Allen-Bradley

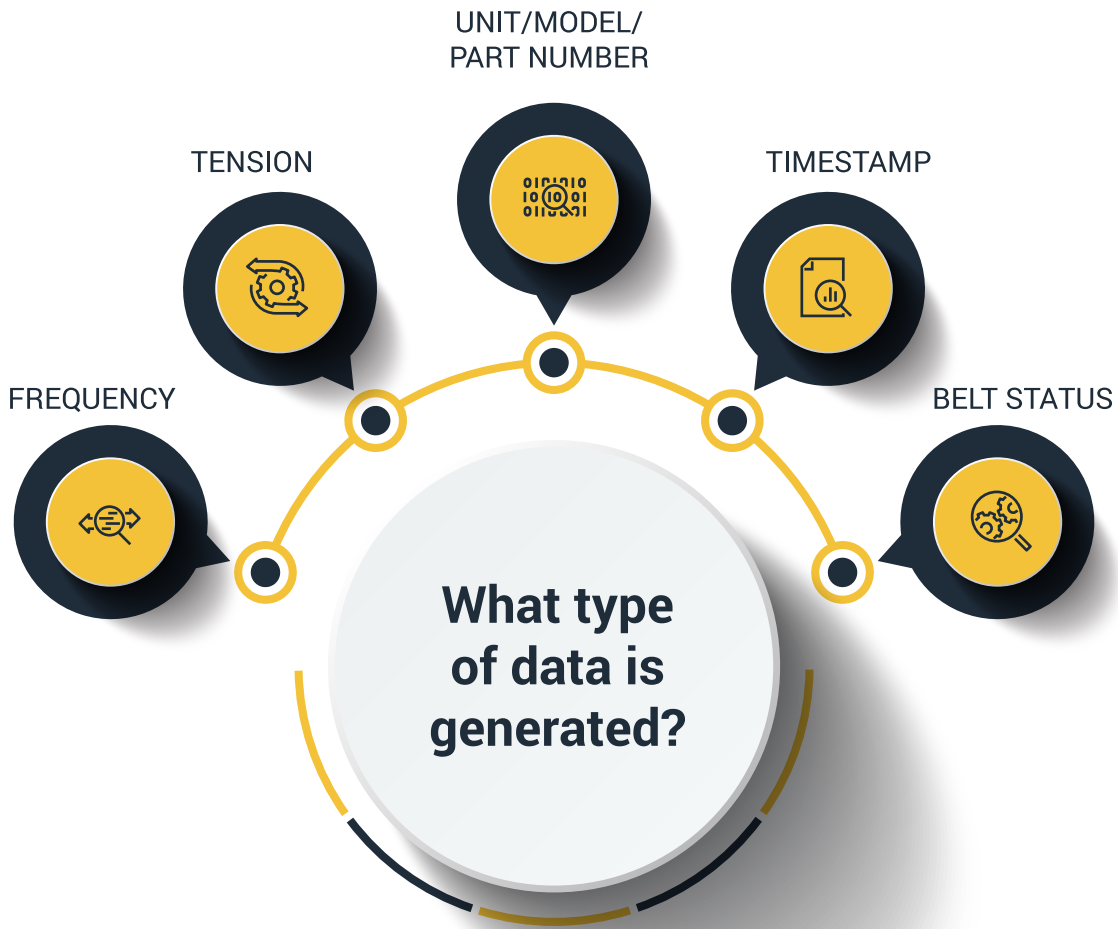
MITSUBISHI

Data

FourierBMS controllers are recognised worldwide for their outstanding belt measurement capabilities. The controller meets the need to enhance error-proofing, connectivity and flexibility. It is important to have data that enables the end user to make decisions now, as well as for the long term.

The FourierBMS stores: -

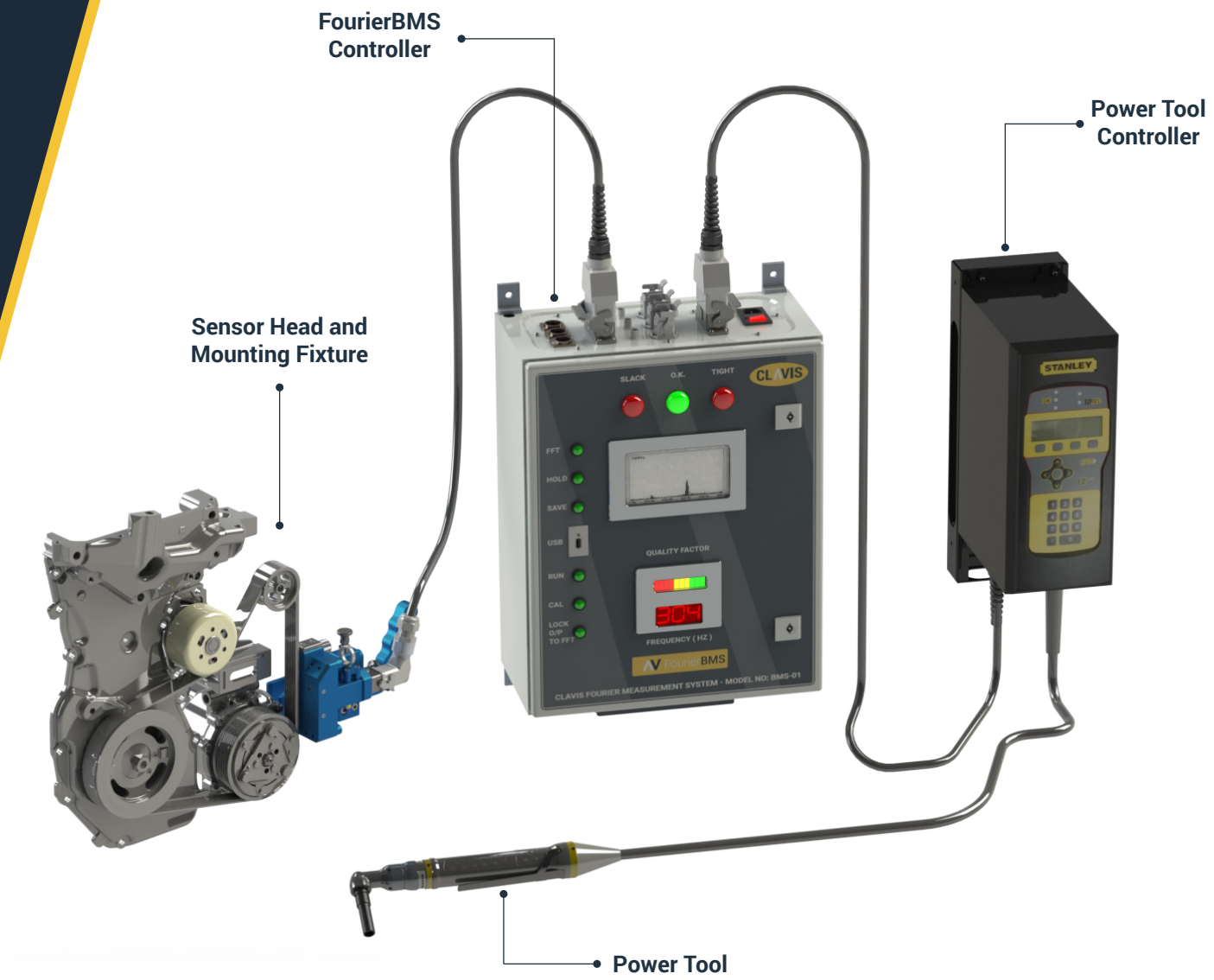
- Measurement Results (including; Frequency (Hz), Tension (N), Belt Status, Belt Quality Factor)
- Events
- Configuration
- Logs



FOURIER BELT MEASUREMENT SYSTEM

Closed-Loop System

Clavis have developed a closed-loop system which measures, monitors, and accurately controls the belt tension process from start to finish. The FourierBMS closed-loop system is designed to automatically achieve and maintain the optimum target tension of a belt under tension.



Closed-Loop System

A closed-loop system uses the concept of an open-loop system as its forward path but has one or more feedback loops between its output and its input. For example, the “feedback” is simply the measurement taken from the sensor head against the belt and compared to an optimum tension tolerance (low/high), this is returned “back” to the input as a signal to rotate the power tool clockwise or counter-clockwise. When the power tool socket is placed on the adjustment nut of the belt tensioner the rotation moves the idler and will either increase or decrease the tension in the belt.

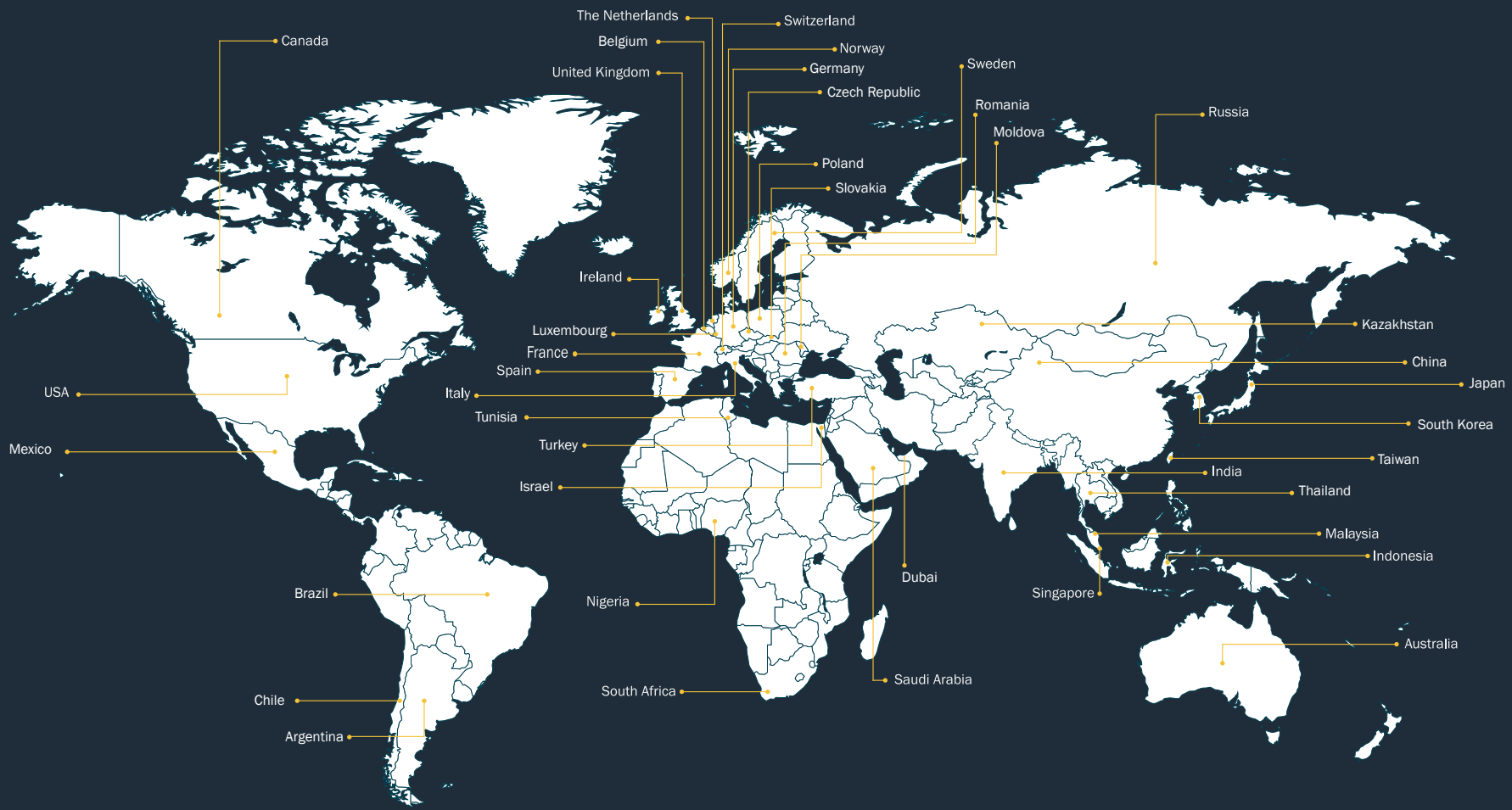
The main benefits of using a FourierBMS Closed-Loop System:

- To reduce errors by automatically adjusting the systems input
- To improve stability of an unstable system
- To increase or reduce the systems sensitivity
- To enhance robustness against external disturbances to the process
- To produce a reliable and repeatable performance

Interface with the following power tool manufacturers products

Atlas Copco BOSCH STANLEY

Supporting Excellence Worldwide



CLAVIS

Winners of The Queen's Award for Enterprise

INNOVATION - 1997, 2004, 2010, 2016
INTERNATIONAL TRADE - 2012, 2014

ABOUT US

Integrated Display Systems (IDS) is internationally recognised as the industry leader in both the design and manufacture of belt tension measurement equipment and automotive handbrake setting equipment.

Established in 1982, over the last 37 years IDS has helped over 1000 customers worldwide to achieve consistent, quantifiable quality control by providing accurate, reliable, and durable equipment.

Our dedicated team is made up of a wide range of highly skilled and expert mechanical design, electronic, and software engineers who ensure that every customer receives the high standard of equipment and support the company is renowned for.

Our fully equipped, high tech CNC machine shop and manufacturing facilities can cope with the most demanding of jobs and all our machining services and manufacturing processes are backed by a proven and recognised quality system.

We have the flexibility to offer a customised and tailored solution to every customer, building close relationships and a sound understanding of requirements to ensure we provide the best possible products and service to meet their needs. We pride ourselves on ensuring efficient lead times, quality and accuracy in everything we do and in every piece of equipment we design, manufacture and supply.

CLAVIS

IDS

IDS INTEGRATED
DISPLAY SYSTEMS LTD

Queen’s Award for Enterprise

In the last 12 years Integrated Display Systems has received numerous independent accolades for innovation and technological achievement, most notably by receipt on six separate occasions of the annual Queen’s Awards for Enterprise.

The Queen’s Award for Enterprise is the most prestigious business award in the United Kingdom and honours outstanding achievement in the areas of innovation, development and international trade.

IDS has received a Queen’s Award for every one of its flagship products. We are proud to be one of only a few companies in history to have achieved this.

In 2016 the founding partners of IDS were personally presented with the Queen’s Award for Enterprise by Her Majesty the Queen. This award acknowledged the technology IDS had developed for the Gusto (POPP Clamp Release) Tool. A presentation at Buckingham Place was followed by a more informal celebration for the IDS team with the Lord Lieutenant of Northumberland.

Previous Queen’s Awards were won for developing the technology of the handheld belt tension meters, Electric Power Assisted Steering (EPAS) belt tension setting equipment, and the unique patented automotive handbrake setting equipment.

ELIZABETH THE SECOND,

by the Grace of God of the United Kingdom of Great Britain and Northern Ireland and of Our other Realms and Territories Queen, Defender of the Faith, to

Integrated Display Systems Limited

Greeting!

We being cognisant of the outstanding achievement of the said body as manifested in the application of Technology in Our United Kingdom of Great Britain and Northern Ireland, Our Channel Islands and Our Island of Man and being desirous of showing Our Royal Favour do hereby confer upon it

THE QUEEN’S AWARD FOR TECHNOLOGICAL ACHIEVEMENT

for a period of five years from the twenty-first day of April 1997 until the twentieth day of April 2002 and do hereby give permission for the authorised flag of the said Award to be flown during that time by the said body and for the device thereof to be displayed in the manner authorised by Our Warrant of the fifth day of May 1992.

And we do further authorise the said body during the five years of the currency of this Our Award further to use and display in like manner the flags and devices of any current former Awards by it received as prescribed in the sixth Clause of Our said Warrant.

Given at Our Court of St. James’s under Our Royal Sign Manual this twenty-first day of April in the year of Our Lord 1997 in the forty-sixth year of Our Reign.

By the Sovereign’s Command.

CLAVIS

IDS

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