




**WM** vibro-meter

**TRANSDUCER SYSTEMS  
FOR TURBOMACHINERY**

[ *industrial & marine* ]



# TRANSDUCER SYSTEMS

**A**s the heart of any machinery monitoring system, it is vital that the transducer systems deliver accurate and reliable information from the measured parameters. Vibro-Meter's long experience of developing transducers for aerospace, nuclear and industrial applications means that today we can offer an unsurpassed range of quality transducer systems to meet our customer's monitoring requirements.

The following pages give an overview of the complete monitoring systems available and describe the main features of the transducers and accessories. More detail on the various transducers as well as brochures on the complementary protection and condition monitoring systems is naturally available from your local Vibro-Meter sales office or distributor.

## Contents:

- **Systems overview** ..... p 2  
*range of monitoring solutions at a glance*
- **Accelerometers** ..... p 4  
*for the measurement of absolute vibration on all types of rotating machinery on casings, housings, bearings for wide temperature and frequency ranges*
- **Eddy current probes** ..... p 8  
*for displacement measurement, such as relative vibration on journal bearings, axial thrust measurement on thrust bearings and differential expansion on turbine shafts*
- **Ice detection system** .....  
*where ice build up may be a problem on gas turbines, this system will give early warning to the operator, allowing safe and efficient operation*
- **Dynamic pressure sensors** .....  
*for measurement of pressure fluctuation in the combustion chambers on gas turbines, in order to assist in controlling levels of emissions*
- **Velocity sensors** .....  
*or measurement of absolute vibration at low frequencies*
- **Air gap systems** .....  
*on hydro turbines for the measurement of the air gap between rotor and stator*
- **Speed sensors** .....  
*or the rotational speed of turbine shafts, used in conjunction with a toothed wheel*
- **Range of protection monitors, condition and performance monitoring** .....  
*matched with the above sensors*

**Piezoelectric Accelerometers**

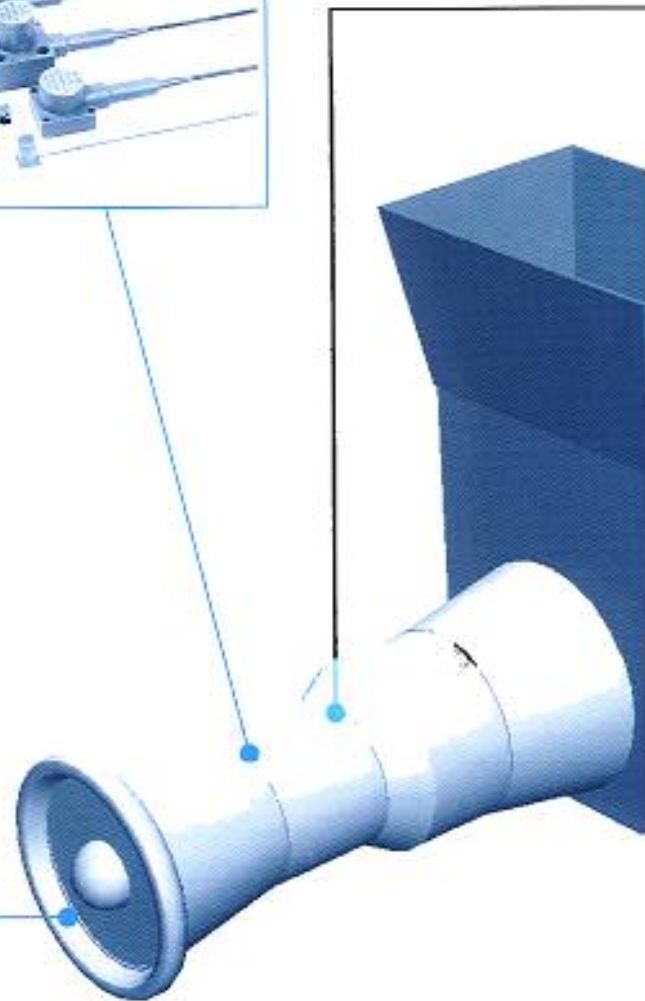
Designed to work continuously in severe industrial conditions. Wide range of models available including types with built-in electronics and current modulation output, others for high temperatures up to 700°C fitted with integral cables or rugged industrial connectors. Intrinsically safe executions conforming to CENELEC safety standards are available.



**Ice Detection**



Ice sensors are used to detect initiation of ice and optimise the use of bleed air in turbine de-icing systems.



**VibroSmart - VMU100**

VMU 100, a single channel vibration monitor for mV/g ICP accelerometers. A simple and cost effective solution for monitoring smaller machinery like pumps and fans.



# YOUR TURBOMACHINERY MONITORING REQUIREMENTS

## Dynamic Pressure



High temperature dynamic pressure transducers for the combustion chamber are frequently used by gas turbine manufacturers to assist in the optimisation of low NOx emissions.

## Eddy Current Proximity Probes



Eddy current proximity probes and signal conditioners, now with current modulation, used in the contactless measurement of relative vibration or axial displacement on rotating machines such as steam and gas turbines, hydroelectric turbines, generators, turbocompressors etc. Intrinsically safe executions conforming to CENELEC safety standards are available.

## Galvanic Separators



Provide the link between machinery-mounted accelerometers and eddy current probe conditioners in hazardous areas, and the remote vibration monitors, thus ensuring interference-free, current modulated signals up to 10 kHz bandwidth at 1000 meters distance. CENELEC approved safety standard.

## VM 600 On-Line Condition and Performance Monitoring



VM 600 is a complete protection, condition and performance monitoring system to give you useful information about the mechanical and aerothermal condition of your turbomachinery, helping you to optimise production and maintenance costs.

# ACCELEROMETERS

with external charge amplifiers

## Transducer type

Characteristic  
Sensitiv. / Range  
Temperature  
Frequency range

Application

### CA 201

100 pC/g / 200 g  
-54 to 260 °C  
0.5 to 4500 Hz

General purpose, but  
mainly used for Steam Turbine and  
heavy duty Gas Turbine



3, 6 m armoured  
Integral cable

### CA 216

20 pC/g / 1000 g  
-54 to 200 °C  
5 to 7000 Hz

Electric Motor



2, 4 m armoured  
Integral cable

### CA 134

10 pC/g / 500 g  
-196 to 500 °C  
5 to 6000 Hz

Gas Turbine  
Cryogenic pump

### CA 136

100 pC/g / 1000 g  
-54 to 260 °C  
0.5 to 6000 Hz

Gas Turbine, Gear Box,  
Compressor



### CA 902

10 pC/g / 500 g  
-54 to 450 °C  
0.5 to 3000 Hz

Aeroderivative Gas Turbine

### CA 905

20 pC/g / 200 g  
-54 to 620 °C  
0.5 to 2800 Hz

Aeroderivative Gas Turbine

### CA 303

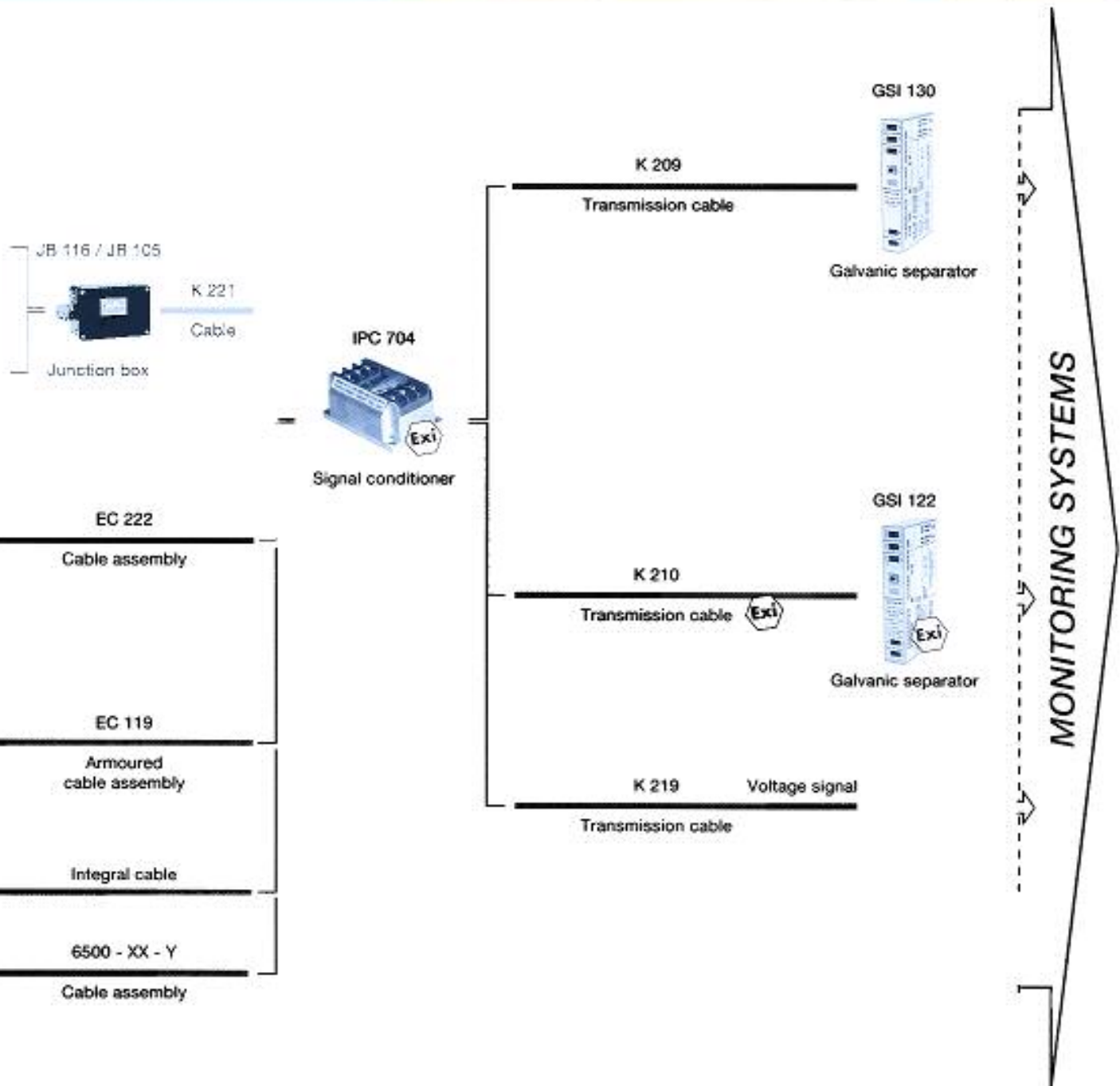
50 pC/g / 100 g  
-54 to 427 °C  
5 to 10000 Hz

LM 1600, LM 2500, LM 5000, LM 6000  
and other gas turbines

Designed to work continuously in severe industrial conditions, the range of CA accelerometers operate with an external signal conditioner, allowing models for use in extreme temperature applications, from 200°C below zero up to 700°C, for such applications as cryogenic pumps up to hot gas turbine casings.

As well as general purpose accelerometers for most machine applications, many models are available for Exi application and there are executions with integral cables or rugged industrial connectors.

- Features**
- Extremely reliable, since there are no moving parts
  - Frequency ranges 0.5 Hz to 20 KHz
  - Extreme temperature ranges possible
  - Galvanic separation prevents earth loops
  - Long transmission of signal via current modulation



The signal conditioning electronics are enclosed within an industrial splashproof housing. Using current modulated output, transmission distances of up to 1000 m are achievable without frequency loss and because of the galvanic separation unit the possibility of earth loops is avoided.

# ACCELEROMETERS

with built-in or attached electronics

## Transducer type

**Characteristic**  
Sensitiv. / Range  
Temperature  
Frequency range

**Application**

### CE 310

50  $\mu$ A/g / 40 g  
-30 to 150 °C  
5 to 8000 Hz

General purpose, but mainly used for  
Steam Turbine and heavy duty Gas Turbine



3, 6, 12 m armoured  
Integral cable

### CE 134

5  $\mu$ A/g / 400 g  
-70 to 350 °C  
5 to 10000 Hz

Gas Turbine, Compressor



3m, armoured  
Integral cable  
Attached electronic

### CE 136

10  $\mu$ A/g / 200 g  
-54 to 260 °C  
3 to 7000 Hz

Machines:  
Gear Box, Pump, Compressor



3m, armoured  
Integral cable  
Attached electronic

### CE 680 M 411

100 mV/g / 80 g  
-55 to 120 °C  
0.5 to 10000 Hz

Low cost, for any type of  
auxiliary machine.

MS3106-10SL-4S  
connector



MS3106-10SL-4S

connector

### SE 120

2 mA/g / 4 g  
0 to 75 °C  
0.2 to 750 Hz

High sensitivity accelerometer suitable  
for low frequency measurement  
on hydraulic turbines or fans

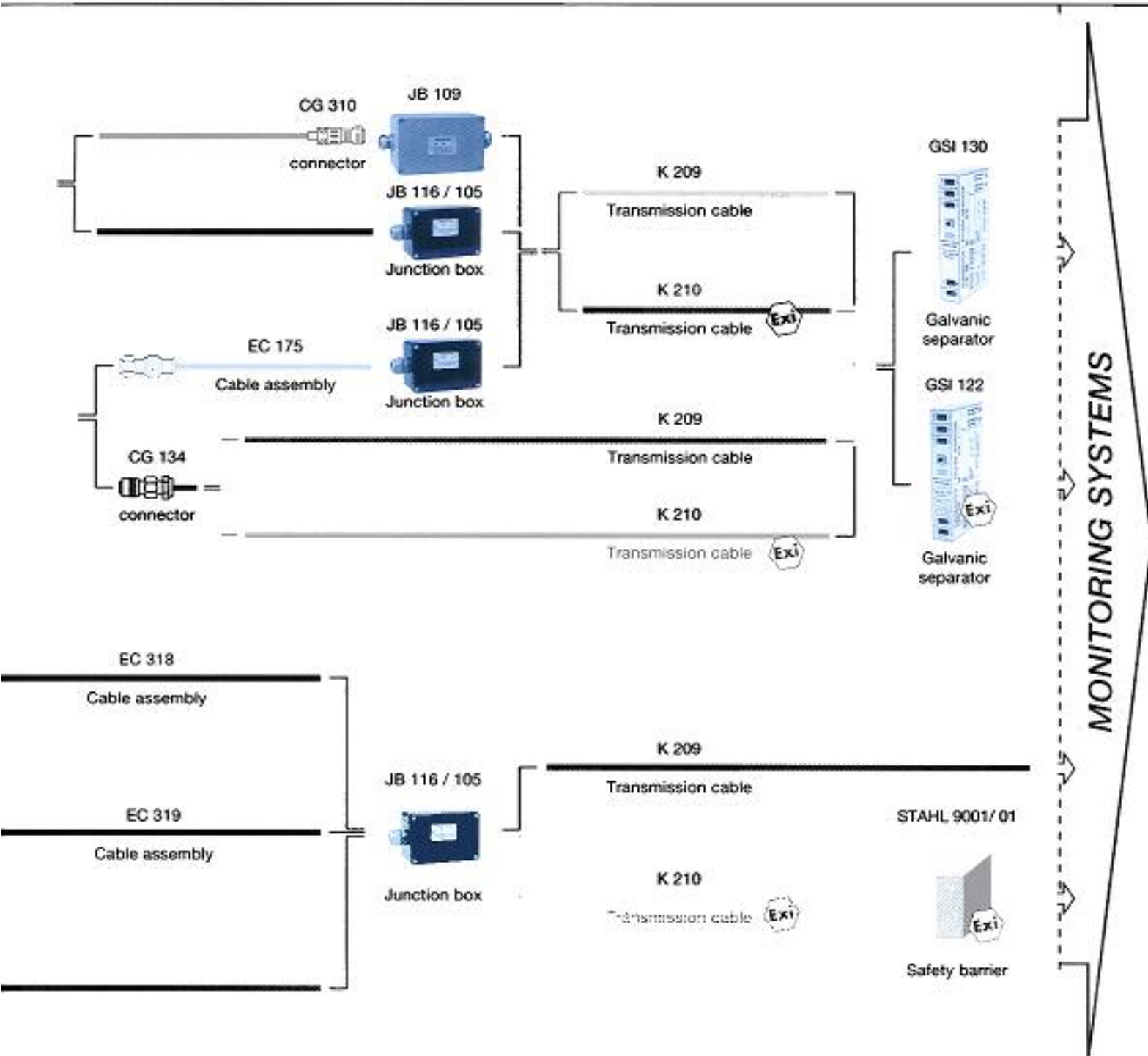


The CE range of piezoelectric accelerometers have built-in or integrally attached electronics. In general, the temperature range is lower than the CA series, but the versions with integrally attached electronics permit operating temperatures up to 350°C.

Models are available with integral cable or rugged industrial connectors. Similar to the CA series, the current modulation technique allows the signal to be transmitted over long distances, exceeding 1000 m.

## Features

- *Reliable, since there are no moving parts*
- *Built-in or integrally attached electronics*
- *Medium temperature ranges up to 350°C*
- *Frequency range from 0.5 Hz up to 20 KHz*
- *Most models hermetically sealed*
- *Exi versions*



The SE 120 is a piezoresistive accelerometer designed for low frequency applications.

The GSI galvanic separation unit prevents the possibility of earth loops and converts the current modulation signal into a voltage output. Intrinsically safe versions are available as shown.



# PROXIMITY PROBES

for all displacement measurements

Sensitiv. / Range  
Tip  $\phi$  / Thread  
Temperature range  
Pressure

Application

## TQ 401

8 mV/ $\mu$ m / 2 mm ( 200 mV/mil / 79 mils )  
Tip  $\phi$  5 mm / M6 x 0.75 mm or 1/4" x 28 UNF  
-40 to 180 °C  
1 bar ( Tip 10 bar )

relative vibration  
thrust position  
key phaser

TQ 401



## TQ 402

## TQ 412

*Reverse mount*

4 mV/ $\mu$ m / 4 mm ( 100 mV/mil / 158 mils )  
or 8 mV/ $\mu$ m / 2 mm ( 200 mV/mil / 79 mils )  
Tip  $\phi$  8.2 mm / M10 x 1 mm or 3/8" x 24 UNF  
-40 to 180 °C  
1 bar ( Tip 10 bar )

relative vibration  
thrust position  
key phaser

TQ 402



TQ 412



## TQ 403

1.33 mV/ $\mu$ m / 12 mm ( 34 mV/mil / 472 mils )  
Tip  $\phi$  18 mm / M20 x 1.5 mm  
-40 to 180 °C  
1 bar ( Tip 10 bar )

differential expansion  
thrust position

TQ 403



## TQ 422

## TQ 432

*Reverse mount*

4 mV/ $\mu$ m / 4 mm ( 100 mV/mil / 158 mils )  
Tip  $\phi$  12.7 mm / M20  
-25 to 140 °C  
TQ 422 10 bar ( Tip 100 bar )  
TQ 432 1 bar ( Tip 100 bar )

Pressure proof execution for  
immersed environment  
relative vibration  
thrust position  
key phaser

TQ 422

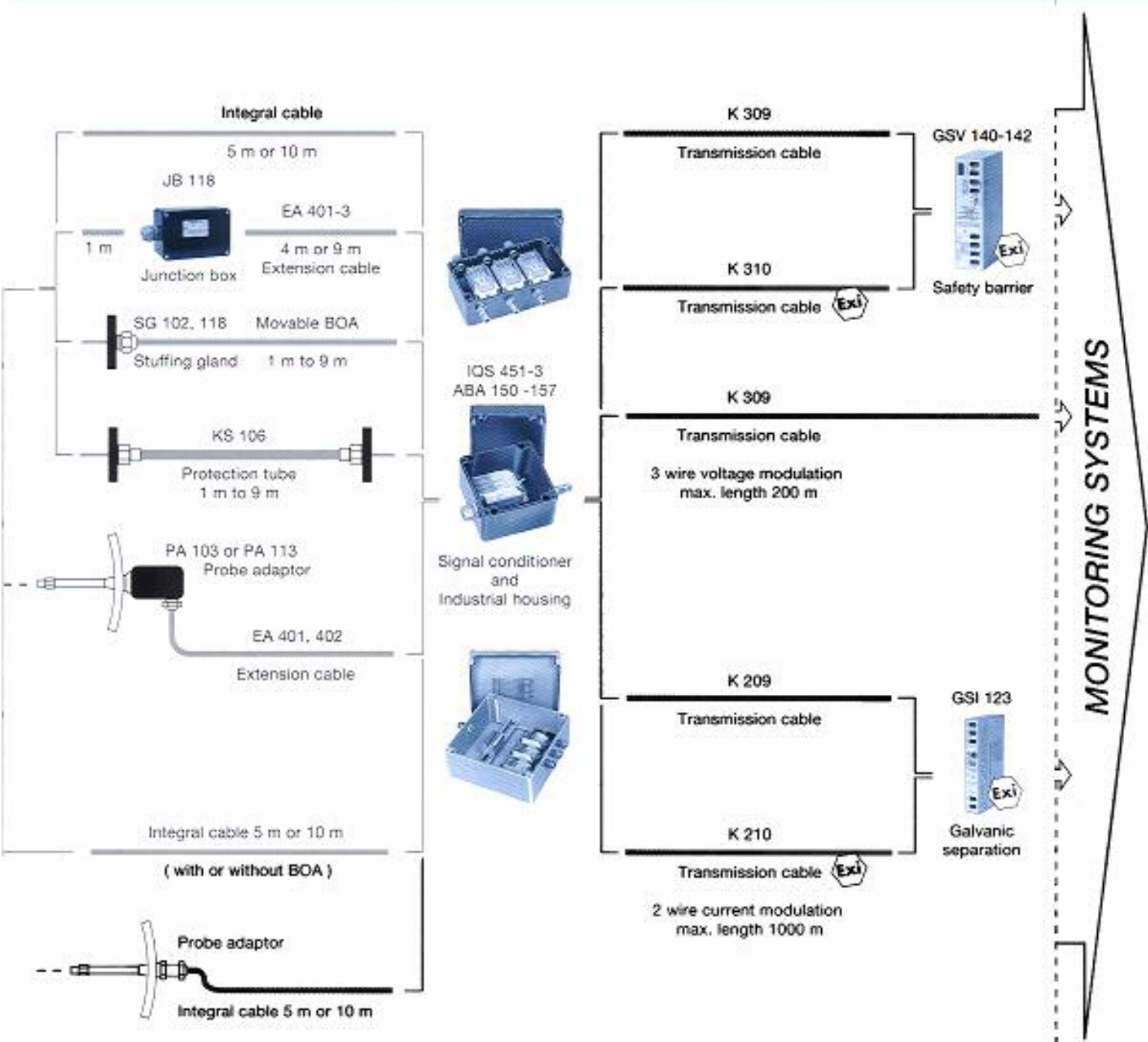


TQ 432



Designed for measuring displacements from 0.2 up to 12 mm, the TQ 400 series of eddy current transducers are typically used for measuring relative vibration, axial thrust, differential expansion and phase reference on turbomachinery. There are 5, 8 and 18 mm tip diameters available and various body lengths, plus a number of options including BOA protection, reversible mounting, probe adapters etc.

- Features**
- Contactless measurement of displacement up to 12 mm ( 472 mils ) using eddy current principle
  - Versions for aggressive environments, high pressure ( up to 100 bar ) and watertight applications
  - Current or voltage outputs available
  - Exi versions available



With its signal conditioner, either voltage or current transmission can be used. Using current modulation, transmission distances over 1000 m may be achieved.

These proximity probes are offered in 5m or 10 m configurations, and versions are available for high pressure and watertight applications, as well as for intrinsically safe or aggressive environments.

# MORE TRANSDUCERS

for other machine parameters

## TRANSDUCER TYPE

## Transducer type

Application

• Features

Characteristic

Measuring range

Temperature

Frequency range

### ICE DETECTION SYSTEM

EW 140

To detect initiation of ice and hence optimise the use of de-icing air in turbine anti-icing systems.

- protects gas turbine from possible ice damage
- optimises use of de-icing air, hence minimises loss of engine power
- no maintenance required

0.2 to 2 mm ICE  
-55 to 120 °C



### DYNAMIC PRESSURE SENSORS

CP 103

High pressure dynamic pressure transducers for the combustion chamber are frequently used by gas turbine manufacturers to assist in the control of NOx emissions. These sensors measure the small pressure fluctuations encountered in the high temperatures of combustion process, or may be used to detect the onset of compressor surge. Higher temperature sensors on request.

- High temperature capability
- High dynamic range and frequency response

20 bar / 232 pC/bar  
-196 to 650 °C  
2 to 10000 Hz



CP 216

250 bar / 200 pC/bar  
-70 to 520 °C  
2 to 15000 Hz



### VELOCITY SENSOR

CV 210

The monitoring of low frequencies is necessary for the special vibration monitoring requirements of hydraulic turbomachinery, which operate at speeds between 60 and 1000 rpm. The excellent low frequency response of the CV210 makes it ideal for all types of low speed machinery.

- stainless steel body ideal for damp and corrosive environments
- can be mounted vertically or horizontally

50 mm/s (50 mV/mm /s)  
-25 to 100 °C  
1 to 1000 Hz



### AIR GAP MONITORING SYSTEM

LS 120

On large hydroelectric generators, the air gap between rotor and stator is an important indicator of machine condition. There are two versions of capacitive sensor according to the air gap which is to be measured.

- pole profile output for condition monitoring
- minimum gap output for protection monitoring
- voltage and current outputs available

5 to 30 mm  
-15 to 125 °C



LS 121

20 to 60 mm  
-15 to 125 °C



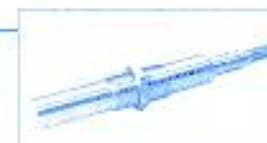
### SPEED PROBES

SP 111

Vibro-Meter has developed special speed probes for gas turbines and nuclear applications.

- non contacting sensor
- magnetic principle
- high temperature probes on request

0 to 100 kHz  
-54 to 180 °C



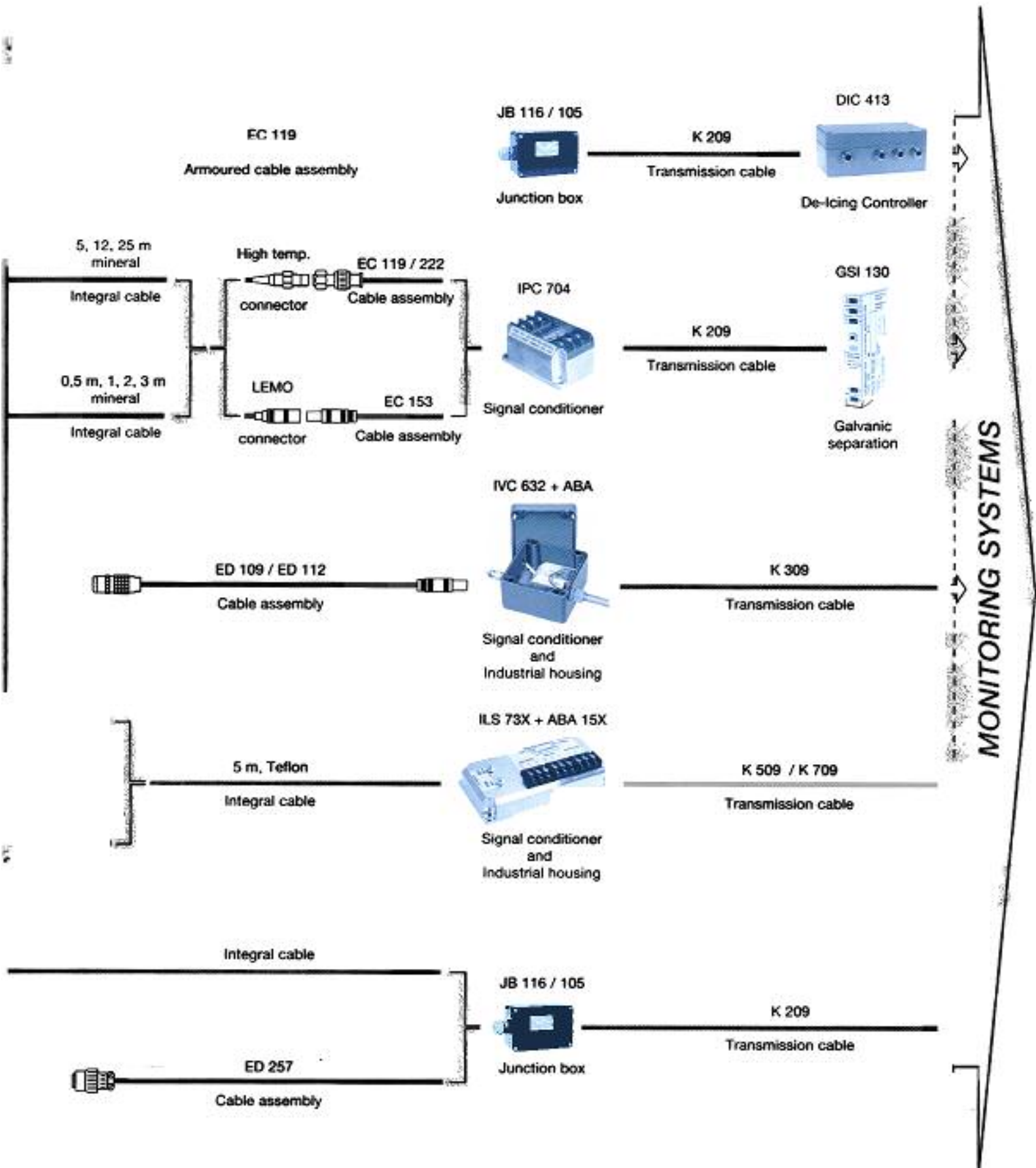
SP 120

0 to 100 kHz  
-54 to 160 °C



As well as providing accelerometers and proximity probes, Vibro-Meter supplies transducers for other important machine parameters, which -

- protect against ice build-up on gas turbines
- monitor dynamic pressure in gas turbines
- measure vibration velocity
- measure air gap on hydro-electric generators
- measure shaft speed on gas turbines



# PROTECTION AND CONDITION MONITORING

A full range of modular and scaleable solutions

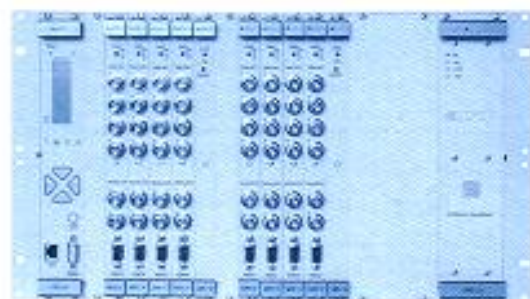
## VMU 100 "VibroSmart"

The single channel monitor is designed for protection monitoring of individual machines, where a multi-channel installation is not required. Housed in a rugged IP 65 industrial enclosure, it can be mounted close to the machine to be monitored.

- Large bright 4 1/2 digit display
- ICP powered accelerometer input
- Imperial or metric versions
- Peak or True RMS vibration velocity
- Programmable low and high pass filters
- Alert and danger relays
- Optional serial communications



## VM600 System



The VM 600 range of products is a complete suite of modular hardware and software, allowing easy configuration for all applications and budgets.

Flexible, powerful and versatile, a VM 600 installation can start small and grow in size and capability as needs evolve. One system from one supplier for all machinery protection, condition and performance monitoring requirements.

### VM 600 Scaleability

- Stand alone machinery protection monitor
- Optional communications through network or modem
- Remote support and maintenance
- Condition monitoring data acquisition
- Performance monitoring data acquisition
- Simple storage and trending software
- Fully featured condition monitoring software
- Simple and advanced performance monitoring
- Multi-site, multi-user access

With the VM 600 Vibo-Meter has taken into consideration the needs of the modern turbomachinery operator. All the tools required to protect valuable machinery, and to enhance its efficiency and reliability, are now available from the same supplier.

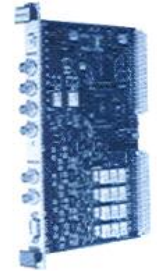
# Total System Capability

Sensors, Protection, Condition and performance Monitoring

## VM 600 Hardware Modules

### MPC 4 Machinery Protection Card

- 4 signal channels, 2 speed channels
- Accepts all vibration, dynamic and static inputs from all the unusual types of sensors
- All machinery monitoring parameters built in including tracking filters
- Latest DSP technology
- Buffered "one to one" analogue outputs on front panel
- **"One card does all"**



### CMC 16 Condition Monitoring Card

- 16 channels, up to four configurable for speed or phase reference
- Accepts all vibration, dynamic and static inputs from all the usual types of sensors
- Latest DSP technology
- Intelligent data acquisition, automatically adapts to changes
- **"One card does all"**



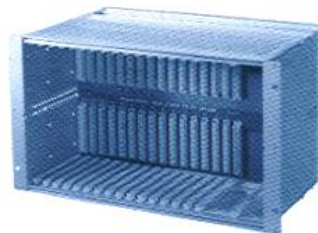
### CPU Central Processing Unit Card

- Optional CPU module for control of external communications
- Local display
- Modem, serial or network links using standard protocols



### ABE 040 Rack and RPS Power Supply

- 6U high, standard VME configuration
- Screw terminal connections at rear
- Optional dual redundant power supplies



## VM 600 Softwares Modules

- MPS 1 Basic protection system configuration, for individual modules
- MPS 2 Adds data storage and trending
- MPS 3 Networked/remote configuration and data exchange
- VM 600 Condition Monitoring, powerful and fully featured
- VM 600 Basic Performance Monitoring
- VM 600 Advanced Performance Monitoring
- VM 600 Plant Usage Optimisation (cost control)

The VM 600 can be integrated with portable data collectors, lube oil analysis results, and other plant and machinery management systems, forming a seamless, easily accessible source of knowledge and advice on plant condition. Commissioning, training and first class international support are all part of the package.

Sensors → Cabling and Conditioning → Systems → Software → Support

**Everything you need from a single source**

Since its foundation in 1952 in Fribourg, Switzerland, Vibro-Meter has been supplying reliable, high quality instrumentation systems for Aviation, Marine and Industrial customers worldwide. As a major company in the Meggitt group we are in a strong position to pursue our aims, offering **Total Condition Monitoring on Land, Sea and Air.**

Our quality policy is one of the basic keys to the success of our company. The priority given to the needs and expectations of our customers, as well as the importance of technical innovation and the quality of our personnel, all contribute to our company's reputation.

The Aerospace division is the leading supplier of vibration, speed, pressure and ice detection systems for civil and military applications.

**The Industrial & Marine division** supplies complete monitoring solutions for turbomachinery applications. Products include a comprehensive range of transducers and associated hardware as well as total condition and performance monitoring systems. The principal parameters monitored are:

- **Vibration**
- **Displacement**
- **Ice**
- **Dynamic pressure**
- **Speed**

Our international network of subsidiaries and distributors is never far away to provide assistance and technical support.

**Switzerland and International**

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Due to the continual development of our products we reserve the right to modify the specifications without forewarning.