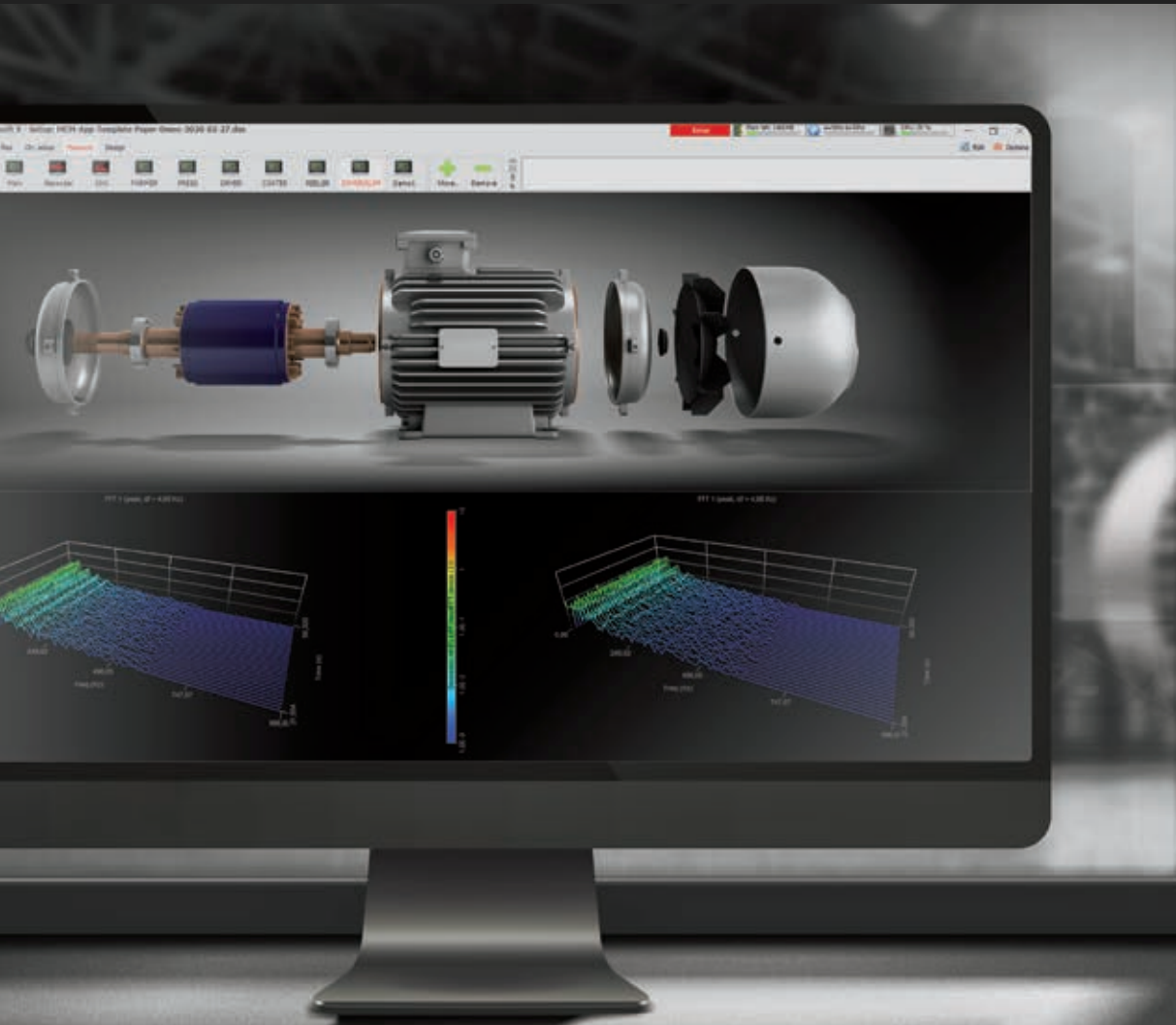# DEWESoft®

MACHINE CONDITION MONITORING

SOLUTION DATASHEET
MCM_V20-1.

Improve machinery efficiency - reduce maintenance and repairs. Simple overview of distributed measurements with a virtually limitless number of synchronized DAQ devices - connected and powered through a single network cable.

INTRODUCTION

Machinery is at the core of almost all industrial processes – and avoiding downtime and repairs, ensuring operational performance and staff safety is crucial. Machine Condition Monitoring (MCM) is the process of monitoring various parameters of the condition of machineries such as vibration or temperature, while in operation.

Permanent monitoring is the only way to understand the condition of the rotating machine in detail and to be able to perform the right maintenance. The overall benefits of MCM are: Reduced repair and maintenance costs, reduced spares inventories, increased revenues, strengthened personnel safety and prolonged plant life.

Complete MCM solution
Dewesoft offers a complete solution with plug-and-play hardware and powerful software for permanent condition-based monitoring applications. EtherCAT hardware architecture enables distributed measurements – the distance up to 100m node to node – with a virtually limitless number of synchronized devices connected through a single cable delivering power and data.

The Dewesoft machine condition monitoring software combines in-depth machine condition analysis features - including FFT analyzer, time-domain analyzer, orbit analyzer, waterfall diagram, trends, bearing fault detection etc. - and high-level software layers with an overview of the machinery state, suited for quick decision making.

APPLICATIONS

Pulp & Paper
Blowers, conveyor belts, chippers, chip classifiers, refiners, pressure screens, screw conveyors, agitators, nip monitoring, felt rollers, etc.

Iron & Steel
Raw material handling machines, conveyor belts, ship unloaders, galvanization plants, stack reclaimers, continuous casters, cranes, rolling mills, annealing machinery and also pumps, fans and gearboxes, etc.

Automotive
Wind Tunnels, Air handling units and pumps in paint shops as well as presses and transfer presses, etc.

Cement
Crushers, gearboxes, conveyor belts, separators, fans, raw mills, ball mills, elevators and blowers.

Industrial plant facilities
Gearboxes, UPS, AC, electric motors, fans, pumps.

FUNCTIONALITY

Machine Condition Monitoring (MCM) is based on continuous measurements of various machine parameters including vibration, temperature, pressure, current, oil levels and more. Vibration is the most commonly used parameter to assess the overall condition, detect failures and understand the root causes. Measurements are compared to historical trends, a baseline or representative data of equivalent machines to assess the severity of the fault.

Vibration measurement
To measure vibration, accelerometers are commonly used to monitor changes in amplitude across a wide frequency range. Vibration monitoring can detect phenomena such as misalignment, imbalance, looseness or bearing wear before failure. Accelerometers are normally installed on bearing casings at locations that ensure the best transmission of acceleration from the shaft and bearing to the sensor.

The vibration data is normally presented in the time (waveform) and frequency (spectrum) domain. This allows the observation of three components: frequency, amplitude, and direction (H, V, A). Frequency and direction reveal the nature of a problem while amplitude provides an understanding of fault severity. Frequencies can be divided in two main categories:

- Low-frequency vibration (DC to 1 kHz) related to the machine speed – measured in velocity (mm/s). Misalignment, mechanical looseness and imbalance fall into this category.

- High-frequency vibration (1 kHz to 10 kHz) related to the natural frequency of the component – measured in acceleration (g). Bearing faults and gear faults fall into this category.

Interpreting the vibration signal obtained requires training and experience. However, the Dewesoft MCM solution offers automatic data analysis and provides simple operational user interfaces as well as all raw data and advanced analysis features.

Dewesoft MCM solution enables detection of:
- Bearing faults
- Overheating
- Shaft imbalance
- Detached mounting
- Gear-tooth failure
- Load misalignment
- Stator eccentricity

USER INTERFACE

Dewesoft machine condition monitoring solution offers an intuitive user interface. From a high-level overview of the status of production facility to in-depth machinery elements condition in just a few clicks!

PAPER MILL PRODUCTION FACILITY
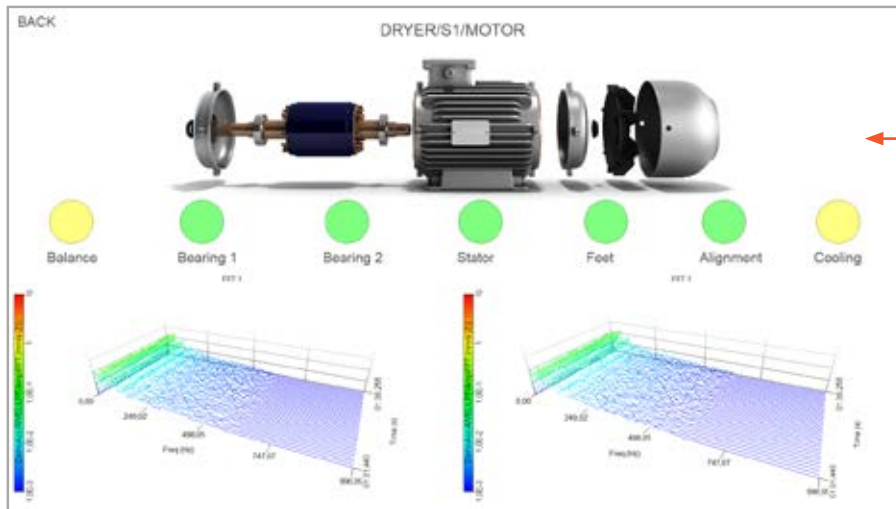
DRYER MOTOR DETAILED ELEMENTS CONDITION OVERVIEW
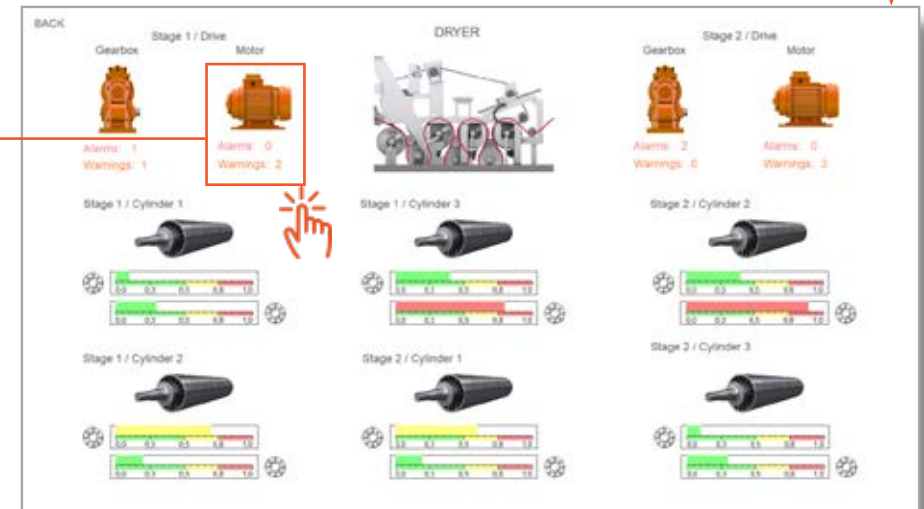
PAPER MILL DRYER-SECTION MACHINERY

SOFTWARE

WEB-BASED SOFTWARE

A web client interface is accessible from any web browser, making it a cross-platform and mobile solution. It provides an overview of the most important machine health data and trends over time from the beginning of monitoring.

Alarm and alert levels can be set on each display and tied to email notifications. For long-term measurement and data storage, Dewesoft provides the Historian package which includes a time-series database based on InfluxDB. The database can be located locally, on the remote server or in the cloud.

Raw and reduced data
Raw data are always saved on the measurement unit for an in-depth analysis, while long-term reduced data are stored in the database.

Data safety and retransmit
If the connection between the hardware and the database is lost, the data is stored on the measurement unit and transmitted to the database when the connection is restored.

Trending and analysis
Historical data can be recalled and loaded from the database for trend as well as for in-depth analysis and root cause identification.

The solution is based on Grafana open source project which was enhanced by Dewesoft to support features like vector display (FFT) and selective loading of historical data which dramatically speeds up the loading of long term data in the displays.

PC CLIENT SOFTWARE

Dewesoft X3 Machine Condition Monitoring software is a powerful yet easy-to-use data acquisition, recording, visualization and analysis software offering preconfigured calculations, display and analysis functions that help to detect machinery issues and their root cause. Some of the useful data analysis features: 3D Graph - Representation of the frequency spectrum over time offers a three-dimensional view to the trend of machine behaviour.

Continuous and Run-up/Coast-down operation - provides order domain data over time during continuous operation and over RPM during run-up and coast-down. Frequency spectrum identification - Simple identification of machine parts in the frequency spectrum

Bearing and gear analysis - Enveloped acceleration is used to demodulate high frequency acceleration spikes into characteristic bearing and gear mesh frequencies.

Rotor Balancing module - for detection of imbalance and performing balancing. Order Tracking Analysis module - advanced spectrum analysis. Tracking filters allow you to track specific orders of the rotating frequency.

Rotational and Torsional Vibration module - for measurement and analysis of rotational and torsional vibration.

Octave Band Analysis module - machine monitoring based on its sound footprint over a wide frequency range.

Dewesoft X software user interface is translated into all major languages - English, Spanish, Portuguese, Chinese, Japanese, Korean, German, Italian, French, Russian and others.

Data transfer from Dewesoft to SCADA is straightforward using the Dewesoft OPC UA Server or Client extension modules. Dewesoft acts as a SCADA server or client, depending on the requirements. MODBUS, serial communication, TCP/IP and Siemens S7 (reading only) communication protocols are also supported within Dewesoft as optional upgrades.

SYSTEM REQUIREMENTS

Client PC:
Operating system: Windows
Minimum CPU: i3
Minimum RAM: 4 GB
Recommended disk: 500 GB SSD

Server:
Specifications highly depend on the total amount of channels, the sample rate of the channels in the database and the long-term retention of the data in the database. The specs given below are purely informative minimum.

Operating system: Windows (at the moment, Linux build is pending)
Minimum CPU: i5
Minimum RAM: 8 GB
Minimum disk: 500 GB

KEY FEATURES

HIGH-LEVEL WEB-BASED SOFTWARE
Overview of the machinery state via a pre-configured web browser application. Monitoring software built on top of 20 years of experience in high precision test and measurement applications.

CONNECTIVITY
Data can be integrated into any 3rd party control system using OPC UA protocol.

UNLIMITED INPUT CHANNELS
DAQ systems with virtually unlimited input channel configurations.

PRICE/PERFORMANCE RATIO
Price-effective hardware technologies with the powerful, yet easy to use Dewesoft Machine Condition Monitoring software.

ACCESS
Data accessible from the local computer, control system or remotely.

HISTORICAL DATA
Data permanently stored in a database on local or cloud servers for trend tracking as well as in-depth analysis and root cause identification.

IN-DEPTH MACHINE CONDITION ANALYSIS
Multiple software features suited for PDM experts.

ANY SENSOR
Input amplifiers offer support for any type of sensors needed to detect rotating machinery issues.

TOTAL SOLUTION
Sensors, DAQ devices, low level software and high level overview including database storage from the same vendor.

DISTRIBUTED SYSTEM
EtherCAT technology allows devices to be placed far apart and near the sensors - connected through a single cable for power, data and synchronization.

HARDWARE OPTIONS

1. OPTION: IOLITED-2XASI

A measurement device with two analog sensor interface channels and one tachometer designed to work with Dewesoft ASI-1xVIB-50g, a 10 kHz vibration and temperature sensor.

ASI-1xVIB-50g: a 1-axis high bandwidth (DC to 10 kHz) and low noise acceleration sensor probe which also includes a temperature sensor and 3-axial low-speed accelerometer for orientation identification. IOLITEd-2xASI: data acquisition device

with 2 analog input channels (with 40 kS/s sampling speed per channel) for interfacing 2 Dewesoft ASI-1xVIB-50g vibration probes and 1 digital input channel for connecting an RPM sensor (tacho).

A cost-effective solution designed for synchronized, distributed vibration and temperature measurements. Fast and easy mounting is facilitated by RJ45 connectors. The DAQ device is very close to the sensor eliminating the need for long analog cables.

2. OPTION: IOLITEr AND IOLITEs

Multi-channel general measurement devices with a wide range of input types, 24-bit resolution and 20 kS/s sampling speed: voltage, current, strain, vibration (IEPE), temperature, digital I/O and more. EtherCAT communication ensures synchronization between devices.

A solution designed for applications needing a large number of channels at the same location while being part of a wider EtherCAT measurement network. IOLITEr and IOLITEs feature a secondary EtherCAT bus for parallel real-time data output to a 3rd party control & protection system.

3. OPTION: KRYPTON

An EtherCAT DAQ device featuring 3-8 measurement inputs in a rugged, waterproof and high-temperature range package for harsh environments. Devices can be daisy-chained between each other using a single rugged cable with LEMO connectors for power, data and synchronization.

A solution designed to be used in the harshest environment while fitting into the same EtherCAT chain as IOLITE devices.

SOLUTION ARCHITECTURE

Dewesoft Data Acquisition devices, with its wide range of analog and digital inputs, offer support for almost any kind of 3rd party sensor. Digital and analog output devices provide the ability to drive actuators or switches.

All EtherCAT devices (IOLITE, KRYPTON) can be connected into the same network to build a virtually unlimited channel chain by using a single cable delivering power, synchronization and data. The whole EtherCAT chain is synchronized to 1 us no matter the distance. Node-node distances can be up to 100 m.

All the raw data from data acquisition devices is collected and processed by Measurement Units running the Dewesoft X3 Machine Condition Monitoring Software. Processed data is sent over the TCP/IP network to the factory server. Data can be accessed and viewed on the client PC or stored in the time series database (Historian) and served to SCADA systems or Cloud Software using standard interfaces such as OPC/UA or XCP to truly support Industry 4.0 applications.

Client PC running **Dewesoft X3 Machine Condition Monitoring SW**

SCADA or any other 3rd pary system - integration over OPC/UA

Database on an internal server or in a cloud

Remote Clients

System access possibilities

TCP/IP Factory Network

Measurement units running **Dewesoft X3 Machine Condition Monitoring Software**

Data Acquisition Devices

Accelerometer   Microphones   Strain Gauge   Temperature sensors   Current transformers   Pressure sensors   Flow meters

Sensors

Robot   Motor   Bearing   Fan

Industrial machinery

SPECS

HARDWARE

Power voltage Supply	Cable device length	Device to Cable-size	Max. number of devices from a single power supply
24 V	1 m	AWG 24	8
4 V	50 m	AWG 24	4
48 V	1 m	AWG 24	12
48 V	50 m	AWG 24	10

SENSOR MODULE

1-AXIS VIBRATION ACCELEROMETER SENSOR SPECIFICATIONS

	Min.	Typ.	Max.	Unit
Measurement range		50		g
Bandwidth (+-10%)		0-10		kHz
Noise density		25		g
0g Offset error (-40 - 125 deg C)		+-5		% deg C
Linearity error		0.1		% FS
Cross axis sensitivity	-1		+1	%
Sensor module weight		20		gram

TEMPERATURE SENSOR SPECIFICATIONS

	Min.	Typ.	Max.	Unit
Measurement range	-40		125	deg C
Accuracy (-40 - 85 deg C)		+-3		deg C
Resolution		10		bits

3-AXIS MEMS ACCELEROMETER SPECIFICATIONS

	Min.	Typ.	Max.	Unit
Measurement range*	2		16*	g
Sample rate		1**		Hz
Resolution		10		bits
0g Offset error	-250		250	mg
0g Offset temp. drift		+-1.2		mg/ °C
Sensitivity variation (sensor to sensor)		+-10		%
Linearity error		+-0.5		% FS
Cross axis sensitivity	-1		+1	%

* default range is 2 g. contact support@dewesoft.com if different range is desired
** higher sample rates are possible, contact support@dewesoft.com if higher sample rate is desired

SOFTWARE: DEWESoft X3

Recommended

Processor:	Intel Core i7 with 4 Cores (3rd generation or higher)
RAM:	8 gigabyte (GB)
Hard drive:	Solid-state drive (SSD)
Graphic card:	Compatible with DirectX 11
Display	1280x720 (HD Ready)
Operating system:	Windows 10 64-bit

*Actual requirements may be different due to specific setup configuration.

IOLITEd DATA ACQUISITION MODULE

Sampling rate	40 kS/s
ADC resolution	24 bit
Digital interface	EtherCAT
Interface connectors	RJ45
Power consumption	1300 mW
Supply voltage	12-48 V
Operating temperature	-20 ... 60 degC
IP rating	IP20

DEWESoft®

LEARN MORE:
https://dewesoft.com/applications/ monitoring/condition-monitoring

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