



# AVERTLE® CONDITION BASED MAINTENANCE

## NEED OF THE HOUR

Businesses can no longer afford sudden losses of productivity and capital due to unplanned machine breakdowns. The typical lifetime of any equipment ranges from 10 to 15 years. Traditional techniques and spot solution models used by most organizations for maintenance are unable to leverage the right metrics to monitor machines and in turn, fail to predict equipment health and life correctly. The lack of historical data for future analysis also makes it difficult for existing solutions to identify faults that are most likely to happen for a specific equipment. There is therefore a strong need for a model that can accurately predict the health and performance of an equipment through monitoring the right metrics and utilizing historical fault information for machine-specific analysis.

## LTTS SOLUTION

L&T Technology Services (LTTS) offers Avertle®, a best-in-class equipment maintenance solution that employs machine learning principles in predictive analytics to proactively notify operators about potential machine failure. The solution simulates data using the Digital Twin approach to compensate for missing historical information. Our domain expertise and experience ensures that the credibility of the simulated data remains intact. The constantly evolving fault signature libraries further allow the solution to predict faults that have never occurred in the past. The libraries come with fault data that has been captured, processed, and analyzed on live running systems over several years. This AI-powered model is validated in an accelerated life test under controlled conditions, ensuring high accuracy in fault prediction.

Capture  
real-time  
data

Hybrid approach  
(Digital twin +  
data models)

Reduce data  
latency

Fault signature  
libraries for  
different  
equipment types

Predict and  
prevent possible  
component faults

Access  
actionable  
intelligence

Accurately  
identify  
MTTF & MTTR

AI based models  
for asset life  
prediction

Ensure remote  
monitoring of  
equipment

Integrate with  
existing solution

## DIFFERENTIATORS

LTTS' Avertle® solution is an advanced predictive maintenance offering in the market. This end-to-end solution for condition-based monitoring of critical process equipment comes with an industrial grade edge gateway, analytics component, intuitive dashboards, and AI/ML algorithms for motors. The solution uses:

- A robust hardware with high speed real-time data capture and multiple I/Os that can input data from virtually any source
- AI edge analytics models
- A digital twin approach
- User-friendly dashboards and visualization application with widget-based architecture

### Key features of the solution include:

General	
Dimensions (mm)	200x150x100
Weight(g)	800
Temperature Range	-25°C to 85°C (Industrial grade)
Operating Voltage	24 VDC, 110/230 VAC / 50Hz / 60Hz
Data Collection	Continuous data acquisition as and when required
Hardware	
Processor	Quad Core 1.2 GHz 64 bit CPU
RAM	1 GB
Internal Storage	32 GB
Certification	IP67, IP65 compliant
LED Indications	3 LEDs (Health, Alert, and Power)
Signal Conditioning	12-bit ADC
Memory	1 GB DDR3 RAM
Storage	64 GB Micro SD Card
Mounting Bracket	DIN Rail Mount
Security	128/256 AES
Input/Output	Refer to the Input/Output Table below
Mechanicals	Standard Enclosure - Polycarbonate (IP66), Metal Enclosure (IP67)
Software	
Operating System	Linux
Connectivity	
Ethernet 10/100 Mbit/s (Down link)	✓
Wi-Fi	✓
4G/LTE	✓
CAN	✓
BACnet	✓
J1939	✓
BLE	✓

Sensors	
Vibration (Single and Tri axis)	✓
Acoustics	✓
Temperature	✓
Pressure	✓
Flow rate	✓
Airflow	✓
Oil Quality	✓
Current	✓
Package	Edge Gateway (Industrial grade)
	Server Analytics Component (AI/ML enabled)
	Web Portal/Dashboard
Data Analytics	On board pre-processing and comprehensive analytics with on premise server
Dashboards	Published on enterprise server and cloud
Pricing	License-based pricing

### Input/Output Table

Analog Input (XXX)	
1 : 0-10 VDC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
	16 : 16 Channels
2 : 4-20mA	02 : 2 Channels

Digital Input (XXX)	
1 : 24 VDC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
	16 : 16 Channels
2 : 110VAC	02 : 2 Channels
3 : 230VAC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
	12 : 12 Channels
	16 : 16 Channels

Digital Output (XXX)	
1 : 24 VDC	02 : 2 Channels
	04 : 4 Channels
	08 : 8 Channels
2 : 24 V (open collector)	02 : 2 Channels
	08 : 8 Channels

Faults	
Misalignment	Bent Shaft or Angular Misalignment
	Offset/Parallel Misalignment
	Combination Misalignment
	Belt/Pulley Misalignment
	Gear Problem
Bearing Defect	Adapter Sleeve Looseness
	Axial Play
	Axial Thrust
	Improper fit with Housing
	Cage Inaccuracies
	Increased Clearance
	Oil Whirl
Improper Fit with Shaft	
Mechanical Looseness	General Looseness
	Mechanical Bearing Looseness
	Cracked Foundation or Structure Mechanical Looseness
	Mechanical Looseness - Bearing Looseness
	Mechanical Looseness - Cracked Foundation and Structure

Electrical Problem	Stator Eccentricity
	Rotor Eccentricity
	Cracked Rotor Bar
	Loose Rotor Bar
	Phasing Problem
	Torque Pulses
	Magnetic Center Deviation
Belt Problem	Worn, Loose or Mismatched Belts
	Eccentric Pulley
	Belt Resonance
Gear Problem	Eccentricity
	Tooth Wear
	Cracked/Broken Tooth
	Backlash
Rotor Problem	Rotor Rub
	Unbalance on Overhung rotor
	Unbalance on simply supported rotor
	Eccentric Rotor
Hydraulic Problem	Hydraulic and Aerodynamic Forces
	Hydraulic and Aerodynamic Forces - Flow Turbulence
Others	Worn, Loose or Mismatch Belts
	Wear/Clearance Sleeve Bearing Defect
	Sleeve Bearing Defects - Wear/Clearance Problem
	Resonance

## BENEFITS

LTTS' Avertle® enables plant operators to:

- Gain actionable insights in real time, with AI/ML analytical models operating at dual levels, both edge and server
- Detect potential machine faults early on, before incident occurrence or major equipment damage with round-the-clock monitoring
- Leverage feature-rich fault signature libraries developed with simulation as well as real-time equipment
- Save cost, data transmission bandwidth, and storage space at server due to preliminary analysis on the edge gateway
- Drastically reduce maintenance cost, which includes the price of repair and spare part storage
- Integrate the solution with existing hardware and software, along with SCADA systems
- Ensure safe remote monitoring with a secure and connected network

