MTConnect Overview and Architecture
Myself & Mazak

• 27 Years at Mazak (Large Turnkeys, Custom Software)
• Microsoft Certified Professional (MCP)
• Responsible for Implementing MTConnect at Mazak i-Smart factory
• Chairperson for the “Machine Tool Working Group”

• Mazak one of the founding participants at Institute
• Mazak one of the leading supporters of the Standard
• Mazak one of the leading implementers (i-Smart factory)
Agenda

• How does it all work?
• What Can I do with it?
• Future capabilities
• Crawl, Walk, Run
How it Works (Adapter / Agent Relationship)

HTTP://machinename:5000/current

Stateless (Request / Response)

Web service on port 5000
Adapters not part of the MTConnect standard
Adapters can be Hardware or Software
Agent Responsibility

Respond to the following commands...

Probe
Return the device file

Current
Return data matching PATH parameter, else all data

Sample
Return specific data in buffer at location and/or interval

Assets
Return Asset documents (Tools, etc)
This method is used for testing. Not recommended for daily use.

But yes...this is cool!

HTTP://mtconnect.mazakcorp.com:5612/probe
Status of Specification


V1.0  V1.1  V1.2  V1.3  V1.4

Monitoring  Mobile Assets and Sensors  Interfaces Additional DataItems (restructuring)  Metrology Parts data Transformations
10,000 ft View

Client Apps/Dashboards

Database

Agent 5000
Adapter 7878

Agent 5000
Adapter 7878
Utilization

- Shop Floor Dashboard
- Self Managing Operators
Sensors

Controller

Vibration Sensor (E-Stop)

Headstock (spindle)

Spindle Temp Sensors
Front and rear Bearings

D I/O
Mazak Factory Spindle Test Stands using Ethernet Network

- Database
- Dashboards/ Analysis / Tracability
- MES / Utilization Apps
- ERP systems Integration

Temperature (F)

- 75
- 70
- 65
- 60

Time

1 3 5 7 9

Temperature

Temperature

Time

Database

ERP systems Integration

Microsoft Dynamics

Mazak Factory Spindle Test Stands using Ethernet Network

MC²

Ethernet Network
Add Sensors to Existing Equipment

AGENT.CFG FILE

```
Devices = mazak.xml
ServiceName = MTConnect_Agent_MC1
Port = 5000
BufferSize = 14
FilterDuplicates = yes
AllowPut = false
IgnoreTimestamps = true

Adapters {
  Mazak {
    Device = Mazak
    Host = 172.26.83.69
    Port = 7878
  }

  MOXA {
    Device = Mazak
    Host = 172.26.83.69
    Port = 5254
  }
}
```
Maintenance

- Real-time Dashboard for Maint dept
- Preemptive Diagnostics
- Email / Text notifications
- Push events into Maintenance ticketing system
Internal Solution (Vendor Supplied)

Customer Supplied....
- Windows Server
- Network
- Database
Cloud Solution (Vendor Supplied)

- Network/Internet connection
- Server
- Database

Customer Supplied..
- Network/Internet connection

Vendor Supplied...
- Server
- Database
Cloud Solution (Remote Facilities)

Factory #1  Factory #2  Factory #3

Internet

3rd party s/w
"PURE" MTConnect

Multiple Apps / Same Protocol
NOT “PURE” MTConnect

Agent 5000
Adapter 7878

Agent 5000
Adapter 7878

Hardware Adapters

Proprietary Protocol
To App / Dashboard

[MTConnect logo]

[Diagram of MTConnect network with hardware adapters and connections]

[MTConnect dashboard interface]

[Logo for Mazak]
Tool Management

Supports a Universal Tool Management System based on ISO13399
Metrology

Quality Measurement Standards Committee
Quality Information Framework (QIF)

- QIF Components
- QIFLibrary
- QMRules
- QMPlans
- QMExecution
- QMResults
- QMStatistics

You will be able to...

Collect on-machine inspection data (process control)
Exchanging data between machine / CMM and Quality systems
Automation (Traditional)

Bar Feeder Interface

Digital Bar feed interface (Multiple wires)

MASTER

SLAVE
Automation (MTConnect)

Bar Feeder Interface

* Power and ESTOP Circuit must still be connected

Allows for additional info to be transferred

Ethernet Cable connection only

MASTER

[Image of bar feeder interface, Ethernet cable, and Mazak machine]
Bar Feeder Interface

Concept

Intelligence through Read/Read solution
Dynamic Scheduling?

Exposed Scheduling data via MTConnect

Machines will decide what parts to machine based on their capabilities.
Implementation Levels of Monitoring

Crawl
- Utilization
- Dashboards
- Low Hanging Fruit

Walk
- Analysis/Reporting
- Operator Feedback
- Preventative Maintenance
- Unseen Issues

RUN
- ERP Integration
- OEE
- Tool Management
- Targeted improvements
“Low Hanging Fruit” (samples)

Availability issues due to...

• No Material at machine /cell
• Missing tooling (Can’t find / other machine using)
• Inadequate manpower (Loading fixtures for cell/multiple machines)
• Workforce issues (Personal issues, sick, late, absent, etc.)
Unseen issues (examples)

Performance issues due to...

- Programmed stops (M00/M01)
- Rapid Overrides not set at 100%
- Feed Overrides not set at 100%
- Spindle Overrides not set at 100%
Targeted Improvements (examples)

- Process flow (Find more efficient flow of materials through the facility)
- Bottlenecks (Manpower or equipment deficiencies)
- Equipment Capacity (Do you need to purchase a new machine?)
- Cycle times not as expected (Review cutting process/tooling)
Overall Equipment Effectiveness (O.E.E.)

OEE measures effectiveness based on scheduled hours. OEE is calculated as the product of its three contributing factors:

\[
\text{OEE} = \text{(Availability)} \times \text{(Performance)} \times \text{(Quality)}
\]

\[
(\text{Availability}= 86.6\%) \times (\text{Performance}=93\%) \times (\text{Quality}=91.3\%) = (\text{OEE}=73.6\%)
\]
Thank you for your Time. Questions?

For more information...

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