Terms included here are excerpted from "ANSI/MTC1.4-2018," available at https://www.mtconnect.org/documents.

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1 MTConnect Glossary

1.1 MTConnect Important Terms

Abstract Element

An element that defines a set of common characteristics that are shared by a group of elements.

An abstract element cannot appear in a document. In a specific implementation of a schema, an abstract element is replaced by a derived element that is itself not an abstract element. The characteristics for the derived element are inherited from the abstract element.

Appears in the documents in the following form: abstract.

Adapter

An optional piece of hardware or software that transforms information provided by a piece of equipment into a form that can be received by an *Agent*.

Appears in the documents in the following form: adapter.

Agent

Refers to an MTConnect Agent.

Software that collects data published from one or more piece(s) of equipment, organizes that data in a structured manner, and responds to requests for data from client software systems by providing a structured response in the form of a *Response Document* that is constructed using the *semantic data models* defined in the Standard.

Appears in the documents in the following form: *Agent*.

Application Programming Interface

A set of methods to provide communications between software applications.

The API defined in the MTConnect Standard describes the methods for providing the *Request/Response* Information Exchange between an *Agent* and client software applications.

Appears in the documents in the following forms: Application Programming Interface or API.

Archetype

General Description of an *MTConnect Asset*:

Archetype is a class of *MTConnect Assets* that provides the requirements, constraints, and common properties for a type of *MTConnect Asset*.

Appears in the documents in the following form: Archetype.

Used as an XML term describing an *MTConnect Asset*:

In an XML representation of the *Asset Information Models*, `Archetype` is an abstract element that is replaced by a specific type of *Asset* Archetype.

Appears in the documents in the following form: `Archetype`

Asset

General meaning:

Typically referred to as an *MTConnect Asset*.

An *MTConnect Asset* is something that is used in the manufacturing process, but is not permanently associated with a single piece of equipment, can be removed from the piece of equipment without compromising its function, and can be associated with other pieces of equipment during its lifecycle.

Used to identify a storage area in an *Agent*:

See description of *buffer*.

Used as an *Information Model*:

Used to describe an *Information Model* that contains the rules and terminology that describe information that may be included in electronic documents representing *MTConnect Assets*.

The *Asset Information Models* defines the structure for the *Assets Response Document*.

Individual *Information Models* describe the structure of the *Asset Documents* represent each type of *MTConnect Asset*. Appears in the documents in the following form: *Asset Information Models* or (asset type) *Information Model*.

Used when referring to an *MTConnect Asset*:

Refers to the information related to an *MTConnect Asset* or a group of *MTConnect Assets*.

Appears in the documents in the following form: *Asset* or *Assets*.

Used as an XML container or element:

- When used as an XML container that consists of one or more types of `Asset` XML elements.

  Appears in the documents in the following form: `Assets`.

- When used as an abstract XML element. It is replaced in the XML document by types of `Asset` elements representing individual *Asset* entities.

  Appears in the documents in the following form: `Asset`.

Used to describe information stored in an *Agent*:

Identifies an electronic document published by a data source and stored in the *assets buffer* of an *Agent*.

Appears in the documents in the following form: *Asset Document*.

Used as an XML representation of an *MTConnect Response Document*:

Identifies an electronic document encoded in XML and published by an *Agent* in response to a *Request* for information from a client software application relating to *MTConnect Assets*.

Appears in the documents in the following form: `MTConnectAssets`.

Used as an *MTConnect Request*:

Represents a specific type of communications request between a client software application and an *Agent* regarding *MTConnect Assets*.

Appears in the documents in the following form: *Asset Request*.

Used as part of an *HTTP Request*:

Used in the path portion of an *HTTP Request Line*, by a client software application, to initiate an *Asset Request* to an *Agent* to publish an `MTConnectAssets` document.

Appears in the documents in the following form: `asset`.

Attribute

A term that is used to provide additional information or properties for an element.

Appears in the documents in the following form: attribute.

Base Functional Structure

A consistent set of functionalities defined by the MTConnect Standard. This functionality includes the protocol(s) used to communicate data to a client software application, the *semantic data models* defining how that data is organized into *Response Documents*, and the encoding of those *Response Documents*.

Appears in the documents in the following form: *Base Functional Structure*.

---

buffer

General meaning:

A section of an *Agent* that provides storage for information published from pieces of equipment.

Used relative to *Streaming Data*:

A section of an *Agent* that provides storage for information relating to individual pieces of *Streaming Data*.

Appears in the documents in the following form: *buffer*.

Used relative to *MTConnect Assets*:

A section of an *Agent* that provides storage for *Asset Documents*.

Appears in the documents in the following form: *assets buffer*.

CDATA

General meaning:

An abbreviation for Character Data.

CDATA is used to describe a value (text or data) published as part of an XML element.

For example, `"This is some text"` is the CDATA in the XML element:

```
<Message ...>This is some text</Message>
```

Appears in the documents in the following form: CDATA

Child Element

A portion of a data modeling structure that illustrates the relationship between an element and the higher-level *Parent Element* within which it is contained.

Appears in the documents in the following form: *Child Element*.

Client

A process or set of processes that send *Requests* for information to an *Agent*; e.g. software applications or a function that implements the *Request* portion of an *Interface Interaction Model*.

Appears in the documents in the following form: client.

Component

General meaning:

A *Structural Element* that represents a physical or logical part or subpart of a piece of equipment.

Appears in the documents in the following form: *Component*.

Used in *Information Models*:

A data modeling element used to organize the data being retrieved from a piece of equipment.

- When used as an XML container to organize *Lower Level* `Component` elements.

  Appears in the documents in the following form: `Components`.

- When used as an abstract XML element. `Component` is replaced in a data model by a type of *Component* element. `Component` is also an XML container used to organize *Lower Level* `Component` elements, *Data Entities*, or both.

  Appears in the documents in the following form: `Component`.

Composition

General meaning:

Data modeling elements that describe the lowest level basic structural or functional building blocks contained within a `Component` element.

Appears in the documents in the following form: *Composition*

Used in *Information Models*:

A data modeling element used to organize the data being retrieved from a piece of equipment.

- When used as an XML container to organize `Composition` elements.

  Appears in the documents in the following form: `Compositions`

- When used as an abstract XML element. `Composition` is replaced in a data model by a type of *Composition* element.

  Appears in the documents in the following form: `Composition`.

Condition

General meaning:

An indicator of the health of a piece of equipment or a *Component* and its ability to function.

Used as a modeling element:

A data modeling element used to organize and communicate information relative to the health of a piece of equipment or *Component*.

Appears in the documents in the following form: *Condition*.

Used in *Information Models*:

An XML element used to represent *Condition* elements.

- When used as an XML container to organize *Lower Level* `Condition` elements.

  Appears in the documents in the following form: `Condition`.

- When used as a *Lower Level* element, the form `Condition` is an abstract type XML element. This *Lower Level* element is a *Data Entity*. `Condition` is replaced in a data model by type of *Condition* element.

  Appears in the documents in the following form: `Condition`.

Note: The form `Condition` is used to represent both above uses.

Controlled Vocabulary

A restricted set of values that may be published as the *Valid Data Value* for a *Data Entity*.

Appears in the documents in the following form: *Controlled Vocabulary*.

Current

General meaning:

Meaning 1: A term describing the most recent occurrence of something.

Meaning 2: A term used to describe movement; e.g. electric current or air current.

Appears in the documents in the following form: current

Used in reference to an *Agent*:

A reference to the most recent information available to an *Agent*.

Appears in the documents in the following form: current.

Used as an *MTConnect Request*:

A specific type of communications request between a client software application and an *Agent* regarding *Streaming Data*.

Appears in the documents in the following form: *Current Request*.

Used as part of an *HTTP Request*:

Used in the path portion of an *HTTP Request Line*, by a client software application, to initiate a *Current Request* to an *Agent* to publish an `MTConnectStreams` document.

Appears in the documents in the following form: `current`.

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data dictionary

Listing of standardized terms and definitions used in *MTConnect Information Models*.

Appears in the documents in the following form: *data dictionary*.

Data Entity

A primary data modeling element that represents all elements that either describe data items that may be reported by an *Agent* or the data items that contain the actual data published by an *Agent*.

Appears in the documents in the following form: *Data Entity*.

Data Item

General meaning:

Descriptive information or properties and characteristics associated with a *Data Entity*.

Appears in the documents in the following form: data item.

Used in an XML representation of a *Data Entity*:

- When used as an XML container to organize `DataItem` elements.

  Appears in the documents in the following form: `DataItems`.

- When used to represent a specific *Data Entity*, the form `DataItem` is an XML element.

  Appears in the documents in the following form: `DataItem`.

Data Source

Any piece of equipment that can produce data that is published to an *Agent*.

Appears in the documents in the following form: data source.

Data Streaming

A method for an *Agent* to provide a continuous stream of information in response to a single *Request* from a client software application.

Appears in the documents in the following form: *Data Streaming*.

Deprecated

An indication that specific content in an *MTConnect Document* is currently usable but is regarded as being obsolete or superseded. It is recommended that deprecated content should be avoided.

Appears in the documents in the following form: **DEPRECATED** .

Deprecation Warning

An indicator that specific content in an *MTConnect Document* may be changed to **DEPRECATED** in a future release of the standard.

Appears in the documents in the following form: **DEPRECATION WARNING** .

Devices Information Model

A set of rules and terms that describes the physical and logical configuration for a piece of equipment and the data that may be reported by that equipment.

Appears in the documents in the following form: *Devices Information Model*.

Device

A part of an information model representing a piece of equipment.

Used in an XML representation of a *Response Document*:

- When used as an XML container to organize `Device` elements.

  Appears in the documents in the following form: `Devices`.

- When used as an XML container to represent a specific piece of equipment and is composed of a set of *Structural Elements* that organize and provide relevance to data published from that piece of equipment.

  Appears in the documents in the following form: `Device`.

Document

General meaning:

A piece of written, printed, or electronic matter that provides information.

Used to represent an *MTConnect Document*:

Refers to printed or electronic document(s) that represent a *Part*(s) of the MTConnect Standard.

Appears in the documents in the following form: *MTConnect Document*.

Used to represent a specific representation of an *MTConnect Document*:

Refers to electronic document(s) associated with an *Agent* that are encoded using XML; *Response Documents* or *Asset Documents*.

Appears in the documents in the following form: *MTConnect XML Document*.

Used to describe types of information stored in an *Agent*:

In an implementation, the electronic documents that are published from a data source and stored by an *Agent*.

Appears in the documents in the following form: *Asset Document*.

Used to describe information published by an *Agent*:

A document published by an *Agent* based upon one of the *semantic data models* defined in the MTConnect Standard in response to a request from a client.

Appears in the documents in the following form: *Response Document*.

Document Body

The portion of the content of an *MTConnect Response Document* that is defined by the relative *MTConnect Information Model*. The *Document Body* contains the *Structural Elements* and *Data Entities* reported in a *Response Document*.

Appears in the documents in the following form: *Document Body*.

Document Header

The portion of the content of an *MTConnect Response Document* that provides information from an *Agent* defining version information, storage capacity, protocol, and other information associated with the management of the data stored in or retrieved from the *Agent*.

Appears in the documents in the following form: *Document Header*.

Element

Refers to an XML element.

An XML element is a logical portion of an XML document or schema that begins with a `start-tag` and ends with a corresponding `end-tag`.

The information provided between the `start-tag` and `end-tag` may contain attributes, other elements (sub-elements), and/or CDATA.

Note: Also, an XML element may consist of an `empty-element tag`. Refer to *Appendix A* for more information on element tags.

Appears in the documents in the following form: element.

Element Name

A descriptive identifier contained in both the `start-tag` and `end-tag` of an XML element that provides the name of the element.

Appears in the documents in the following form: element name.

Used to describe the name for a specific XML element:

Reference to the name provided in the `start-tag`, `end-tag`, or `empty-element tag` for an XML element.

Appears in the documents in the following form: *Element Name*.

Equipment

Represents anything that can publish information and is used in the operations of a manufacturing facility shop floor. Examples of equipment are machine tools, ovens, sensor units, workstations, software applications, and bar feeders.

Appears in the documents in the following form: equipment or piece of equipment.

Error Information Model

The rules and terminology that describes the *Response Document* returned by an *Agent* when it encounters an error while interpreting a *Request* for information from a client software application or when an *Agent* experiences an error while publishing the *Response* to a *Request* for information.

Appears in the documents in the following form: *Error Information Model*.

Event

General meaning:

The occurrence of something that happens or takes place.

Appears in the documents in the following form: event.

Used as a type of *Data Entity*:

An identification that represents a change in state of information associated with a piece of equipment or an occurrence of an action. Event also provides a means to publish a message from a piece of equipment.

Appears in the documents in the following form: *Event*.

Used as a `category` attribute for a *Data Entity*:

Used as a value for the `category` attribute for an XML `DataItem` element.

Appears in the documents in the following form: `EVENT`.

Used as an XML container or element:

- When used as an XML container that consists of one or more types of `Event` XML elements.

  Appears in the documents in the following form: `Events`.

- When used as an abstract XML element. It is replaced in the XML document by types of `Event` elements.

  Appears in the documents in the following form: `Event`.

Extensible

The ability for an implementer to extend *MTConnect Information Models* by adding content not currently addressed in the MTConnect Standard.

Fault State

In the MTConnect Standard, a term that indicates the reported status of a *Condition* category *Data Entity*.

Appears in the documents in the following form: *Fault State*.

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heartbeat

General meaning:

A function that indicates to a client application that the communications connection to an *Agent* is still viable during times when there is no new data available to report – often referred to as a "keep alive" message.

Appears in the documents in the following form: *heartbeat*.

When used as part of an *HTTP Request*:

The form `heartbeat` is used as a parameter in the query portion of an *HTTP Request Line*.

Appears in the documents in the following form: `heartbeat`.

HTTP

Hyper-Text Transport Protocol. The protocol used by all web browsers and web applications.

Note: HTTP is an IETF standard and is defined in RFC 7230. See https://tools.ietf.org/html/rfc7230 for more information.

HTTP Error Message

In the MTConnect Standard, a response provided by an *Agent* indicating that an *HTTP Request* is incorrectly formatted or identifies that the requested data is not available from the *Agent*.

Appears in the documents in the following form: *HTTP Error Message*.

HTTP Header

In the MTConnect Standard, the content of the *Header* portion of either an *HTTP Request* from a client software application or an *HTTP Response* from an *Agent*.

Appears in the documents in the following form: *HTTP Header*.

HTTP Method

In the MTConnect Standard, a portion of a command in an *HTTP Request* that indicates the desired action to be performed on the identified resource; often referred to as verbs.

HTTP Request

In the MTConnect Standard, a communications command issued by a client software application to an *Agent* requesting information defined in the *HTTP Request Line*.

Appears in the documents in the following form: *HTTP Request*.

HTTP Request Line

In the MTConnect Standard, the first line of an *HTTP Request* describing a specific *Response Document* to be published by an *Agent*.

Appears in the documents in the following form: *HTTP Request Line*.

HTTP Response

In the MTConnect Standard, the information published from an *Agent* in reply to an *HTTP Request*. An *HTTP Response* may be either a *Response Document* or an *HTTP Error Message*.

Appears in the documents in the following form: *HTTP Response*.

HTTP Server

In the MTConnect Standard, a software program that accepts *HTTP Requests* from client software applications and publishes *HTTP Responses* as a reply to those *Requests*.

Appears in the documents in the following form: *HTTP Server*.

HTTP Status Code

In the MTConnect Standard, a numeric code contained in an *HTTP Response* that defines a status category associated with the *Response* – either a success status or a category of an HTTP error.

Appears in the documents in the following form: *HTTP Status Code*.

---

id

General meaning:

An identifier used to distinguish a piece of information.

Appears in the documents in the following form: id.

Used as an XML attribute:

When used as an attribute for an XML element - *Structural Element*, *Data Entity*, or *Asset*. `id` provides a unique identity for the element within an XML document.

Appears in the documents in the following form: `id`.

Implementation

A specific instantiation of the MTConnect Standard.

Information Model

The rules, relationships, and terminology that are used to define how information is structured.

For example, an information model is used to define the structure for each *MTConnect Response Document*; the definition of each piece of information within those documents and the relationship between pieces of information.

Appears in the documents in the following form: *Information Model*.

---

instance

Describes a set of *Streaming Data* in an *Agent*. Each time an *Agent* is restarted with an empty *buffer*, data placed in the *buffer* represents a new *instance* of the *Agent*.

Appears in the documents in the following form: *instance*.

Interaction Model

The definition of information exchanged to support the interactions between pieces of equipment collaborating to complete a task.

Appears in the documents in the following form: *Interaction Model*.

Interface

General meaning:

The exchange of information between pieces of equipment and/or software systems.

Appears in the documents in the following form: interface.

Used as an *Interaction Model*:

An *Interaction Model* that describes a method for inter-operations between pieces of equipment.

Appears in the documents in the following form: *Interface*.

Used as an XML container or element:

- When used as an XML container that consists of one or more types of `Interface` XML elements.

  Appears in the documents in the following form: `Interfaces`.

- When used as an abstract XML element. It is replaced in the XML document by types of `Interface` elements.

  Appears in the documents in the following form: `Interface`.

Message

General meaning:

The content of a communication process.

Appears in the documents in the following form: message.

Used relative to an *Agent*:

Describes the information that is exchanged between an *Agent* and a client software application. A *Message* may contain either a *Request* from a client software application or a *Response* from an *Agent*.

Appears in the documents in the following form: *Message*.

Used as a type of *Data Entity*:

Describes a type of *Data Entity* in the *Devices Information Model* that can contain any text string of information or native code to be transferred from a piece of equipment.

Appears in the documents in the following form: `MESSAGE`.

Used as an Element Name:

An *Element Name* for a *Data Entity* in the *Streams Information Model* that can contain any text string of information or native code to be transferred from a piece of equipment.

Appears in the documents in the following form: `Message`.

Metadata

Data that provides information about other data.

For example, *Equipment Metadata* defines both the *Structural Elements* that represent the physical and logical parts and sub-parts of each piece of equipment, the relationships between those parts and sub-parts, and the definitions of the *Data Entities* associated with that piece of equipment.

Appears in the documents in the following form: *Metadata* or *Equipment Metadata*.

MTConnect Agent

See definition for *Agent*.

MTConnectAssets Response Document

An electronic document published by an *Agent* in response to a *Request* for information from a client software application relating to *MTConnect Assets*.

Appears in the documents in the following form: *MTConnectAssets Response Document*.

MTConnectDevices Response Document

An electronic document published by an *Agent* in response to a *Request* for information from a client software application that includes *Metadata* for one or more pieces of equipment.

Appears in the documents in the following form: *MTConnectDevices Response Document*.

MTConnectErrors Response Document

An electronic document published by an *Agent* whenever it encounters an error while interpreting a *Request* for information from a client software application or when an *Agent* experiences an error while publishing the *Response* to a *Request* for information.

Appears in the documents in the following form: *MTConnectErrors Response Document*.

MTConnect Request

A communication request for information issued from a client software application to an *Agent*.

Appears in the documents in the following form: *MTConnect Request*.

MTConnectStreams Response Document

An electronic document published by an *Agent* in response to a *Request* for information from a client software application that includes *Streaming Data* from the *Agent*.

Appears in the documents in the following form: *MTConnectStreams Response Document*.

NMTOKEN

The data type for XML identifiers.

Note: The identifier must start with a letter, an underscore "_" or a colon. The next character must be a letter, a number, or one of the following ".", "-", "_", ":". The identifier must not have any spaces or special characters.

Appears in the documents in the following form: NMTOKEN.

---

parameter

General Meaning:

A variable that must be given a value during the execution of a program or a communications command.

When used as part of an *HTTP Request*:

Represents the content (keys and associated values) provided in the *Query* portion of an *HTTP Request Line* that identifies specific information to be returned in a *Response Document*.

Appears in the documents in the following form: parameter.

Parent Element

An XML element used to organize *Lower Level* child elements that share a common relationship to the *Parent Element*.

Appears in the documents in the following form: *Parent Element*.

Persistence

A method for retaining or restoring information.

Probe

General meaning of a physical entity:

An instrument commonly used for measuring the physical geometrical characteristics of an object.

- Used to describe a measurement device:

  The form probe is used to define a measurement device that provides position information.

  Appears in the documents in the following form: probe.

- Used within a *Data Entity*:

  The form `PROBE` is used to designate a subtype for the *Data Entity* `PATH_POSITION` indicating a measurement position relating to a probe unit.

  Appears in the documents in the following form: `PROBE`.

General meaning for communications with an *Agent*:

Probe is used to define a type of communication request.

- Used as a type of communication request:

  The form *Probe Request* represents a specific type of communications request between a client software application and an *Agent* regarding *Metadata* for one or more pieces of equipment.

  Appears in the documents in the following form: *Probe Request*.

- Used in an *HTTP Request Line*:

  The form `probe` is used to designate a *Probe Request* in the `<Path>` portion of an *HTTP Request Line*.

  Appears in the documents in the following form: `probe`.

Protocol

A set of rules that allow two or more entities to transmit information from one to the other.

Publish/Subscribe

In the MTConnect Standard, a communications messaging pattern that may be used to publish *Streaming Data* from an *Agent*. When a *Publish/Subscribe* communication method is established between a client software application and an *Agent*, the *Agent* will repeatedly publish a specific `MTConnectStreams` document at a defined period.

Appears in the documents in the following form: *Publish/Subscribe*.

Query

General Meaning:

A portion of a request for information that more precisely defines the specific information to be published in response to the request.

Appears in the documents in the following form: *Query*.

Used in an *HTTP Request Line*:

The form `query` includes a string of parameters that define filters used to refine the content of a *Response Document* published in response to an *HTTP Request*.

Appears in the documents in the following form: `query`.

Request/Response

A communications pattern that supports the transfer of information between an *Agent* and a client software application. In a *Request/Response* information exchange, a client software application requests specific information from an *Agent*. An *Agent* responds to the *Request* by publishing a *Response Document*.

Appears in the documents in the following form: *Request/Response*.

Request

A communications method where a client software application transmits a message to an *Agent*. That message instructs the *Agent* to respond with specific information.

Appears in the documents in the following form: *Request*.

Requester

An entity that initiates a *Request* for information in a communications exchange.

Appears in the documents in the following form: *Requester*.

Responder

An entity that responds to a *Request* for information in a communications exchange.

Appears in the documents in the following form: *Responder*.

Response Document

See *Document*.

REST

Stands for REpresentational State Transfer: A software architecture where a client software application and server move through a series of state transitions based solely on the request from the client and the response from the server.

Appears in the documents in the following form: REST.

Root Element

The first *Structural Element* provided in a *Response Document* encoded using XML. The *Root Element* is an XML container and is the *Parent Element* for all other XML elements in the document. The *Root Element* appears immediately following the XML Declaration.

Appears in the documents in the following form: *Root Element*.

Sample

General meaning:

The collection of one or more pieces of information.

Used when referring to the collection of information:

When referring to the collection of a piece of information from a data source.

Appears in the documents in the following form: sample.

Used as an *MTConnect Request*:

When representing a specific type of communications request between a client software application and an *Agent* regarding *Streaming Data*.

Appears in the documents in the following form: *Sample Request*.

Used as part of an *HTTP Request*:

Used in the `path` portion of an *HTTP Request Line*, by a client software application, to initiate a *Sample Request* to an *Agent* to publish an `MTConnectStreams` document.

Appears in the documents in the following form: `sample`.

Used to describe a *Data Entity*:

Used to define a specific type of *Data Entity*. A *Sample* type *Data Entity* reports the value for a continuously variable or analog piece of information.

Appears in the documents in the following form: *Sample* or *Samples*.

Used as an XML container or element:

- When used as an XML container that consists of one or more types of Sample XML elements.

  Appears in the documents in the following form: `Samples`.

- When used as an abstract XML element. It is replaced in the XML document by types of `Sample` elements representing individual *Sample* type of *Data Entity*.

  Appears in the documents in the following form: `Sample`.

schema

General meaning:

The definition of the structure, rules, and vocabularies used to define the information published in an electronic document.

Appears in the documents in the following form: schema.

Used in association with an *MTConnect Response Document*:

Identifies a specific schema defined for an *MTConnect Response Document*.

Appears in the documents in the following form: *schema*.

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semantic data model

A methodology for defining the structure and meaning for data in a specific logical way.

It provides the rules for encoding electronic information such that it can be interpreted by a software system.

Appears in the documents in the following form: *semantic data model*.

---

sequence number

The primary key identifier used to manage and locate a specific piece of *Streaming Data* in an *Agent*.

sequence number is a monotonically increasing number within an instance of an *Agent*.

Appears in the documents in the following form: *sequence number*.

Standard

General meaning:

A document established by consensus that provides rules, guidelines, or characteristics for activities or their results (as defined in ISO/IEC Guide 2:2004).

Used when referring to the MTConnect Standard:

The MTConnect Standard is a standard that provides the definition and semantic data structure for information published by pieces of equipment.

Appears in the documents in the following form: Standard or MTConnect Standard.

Streaming Data

The values published by a piece of equipment for the *Data Entities* defined by the *Equipment Metadata*.

Appears in the documents in the following form: *Streaming Data*.

Streams Information Model

The rules and terminology (*semantic data model*) that describes the *Streaming Data* returned by an *Agent* from a piece of equipment in response to a *Sample Request* or a *Current Request*.

Appears in the documents in the following form: *Streams Information Model*.

Structural Element

General meaning:

An XML element that organizes information that represents the physical and logical parts and sub-parts of a piece of equipment.

Appears in the documents in the following form: *Structural Element*.

Used to indicate hierarchy of Components:

When used to describe a primary physical or logical construct within a piece of equipment.

Appears in the documents in the following form: *Top Level Structural Element*.

When used to indicate a *Child Element* which provides additional detail describing the physical or logical structure of a *Top Level Structural Element*.

Appears in the documents in the following form: *Lower Level Structural Element*.

---

subtype

General meaning:

A secondary or subordinate type of categorization or classification of information.

In software and data modeling, a subtype is a type of data that is related to another higher-level type of data.

Appears in the documents in the following form: subtype.

Used as an attribute for a *Data Entity*:

Used as an attribute that provides a sub-categorization for the `type` attribute for a piece of information.

Appears in the documents in the following form: `subType`.

---

time stamp

General meaning:

The best available estimate of the time that the value(s) for published or recorded information was measured or determined.

Appears in the documents as "time stamp".

Used as an attribute for recorded or published data:

An attribute that identifies the time associated with a *Data Entity* as stored in an *Agent*.

Appears in the documents in the following form: `timestamp`.

---

type

General meaning:

A classification or categorization of information.

In software and data modeling, a type is a grouping function to identify pieces of information that share common characteristics.

Appears in the documents in the following form: type.

Used as an attribute for a *Data Entity*:

Used as an attribute that provides a categorization for piece of information that share common characteristics.

Appears in the documents in the following form: `type`.

URI

Stands for Universal Resource Identifier.

See http://www.w3.org/TR/uri-clarification/#RFC3986

URL

Stands for Uniform Resource Locator.

See http://www.w3.org/TR/uri-clarification/#RFC3986

URN

Stands for Uniform Resource Name.

See http://www.w3.org/TR/uri-clarification/#RFC3986

UTC/GMT

Stands for Coordinated Universal Time/Greenwich Mean Time.

UTC/GMT is the primary time standard by which the world regulates clocks and time.

The time stamp for all information reported in an *MTConnect Response Document* is provided in UTC/GMT format.

UUID

General meaning:

Stands for Universally Unique Identifier. (Can also be referred to as a GUID in some literature – Globally Unique Identifier).

Note: Defined in RFC 4122 of the IETF. See https://www.ietf.org/rfc/rfc4122.txt for more information.

Appears in the documents in the following form: UUID.

Used as an attribute for an XML element:

Used as an attribute that provides a unique identity for a piece of information reported by an *Agent*.

Appears in the documents in the following form: `uuid`.

Valid Data Value

One or more acceptable values or constrained values that can be reported for a *Data Entity*.

Appears in the documents in the following form: *Valid Data Value*(s).

W3C

Stands for World Wide Web Consortium.

W3C is an international community of organizations and the public work together to develop internet standards.

W3C Standards are used as a guide within the MTConnect Standard.

WARNING

General Meaning:

A statement or action that indicates a possible danger, problem, or other unexpected situation.

Used relative to changes in an *MTConnect Document*:

Used to indicate that specific content in an *MTConnect Document* may be changed in a future release of the standard.

Appears in the documents in the following form: **WARNING** .

Used as a *Valid Data Value* for a *Condition*:

Used as a *Valid Data Value* for a *Condition* type *Data Entity*.

Appears in the documents in the following form: `WARNING`.

Used as an *Element Name* for a *Data Entity*:

Used as the *Element Name* for a *Condition* type *Data Entity* in an *MTConnectStreams Response Document*.

Appears in the documents in the following form: `Warning`.

XML

Stands for EXtensible Markup Language.

XML defines a set of rules for encoding documents that both a human-readable and machine-readable.

XML is the language used for all code examples in the MTConnect Standard.

Refer to http://www.w3.org/XML for more information about XML.

XML Container

In the MTConnect Standard, a type of XML element.

An XML container is used to organize other XML elements that are logically related to each other. A container may have either *Data Entities* or other *Structural Elements* as *Child Elements*.

XML Document

An XML document is a structured text file encoded using XML.

An XML document is an instantiation of an XML schema. It has a single root XML element, conforms to the XML specification, and is structured based upon a specific schema.

MTConnect Response Documents may be encoded as an XML document.

XML Schema

In the MTConnect Standard, an instantiation of a schema defining a specific document encoded in XML.

XPath

General meaning:

XPath is a command structure that describes a way for a software system to locate information in an XML document.

XPath uses an addressing syntax based on a path through the document's logical structure.

See http://www.w3.org/TR/xpath for more information on XPath.

Appears in the documents in the following form: XPath.

1.2 MTConnect Semantic Data Model Terms

`AbsTimeSeries`

It is an abstract type element and will be replaced in the `MTConnectStreams` document by the element name derived from the `type` attribute defined for the associated `DataItem` element defined in the `MTConnectDevices` document

---

`AbstractConfiguration`

It is an abstract type XML element. It will never appear in the XML document representing a piece of equipment.

`Actuator`

Redefined as a piece of equipment with the ability to be represented as a *Lower Level* component of a parent `Component` element or as a `Composition` element. See `ACTUATOR`

`ACTUAL`

The measured value of the data item type given by a sensor or encoder.

`Errors`

An XML container element in an *MTConnectErrors Response Document* provided by an *Agent* when an error is encountered associated with a *Request* for information from a client software application.

`Error`

An `Error`, XML element, occurs while interpreting a *Request* for information from a client software application or when an *Agent* experiences an error while publishing the *Response* to a *Request* for information.

`errorCode`

Provides a descriptive code that indicates the type of error that was encountered by an *Agent*.

`Auxiliaries`

An XML container used to organize information for *Lower Level* elements representing functional sub-systems that provide supplementary or extended capabilities for a piece of equipment, but they are not required for the basic operation of the equipment.

`Axes`

An XML container used to organize the *Structural Elements* of a piece of equipment that perform linear or rotational motion.

`Electric`

`Electric` is an XML container that represents the information for the main power supply for device piece of equipment and the distribution of that power throughout the equipment.

`Loader`

`Loader` is an XML container that represents the information for a unit comprised of all the parts involved in moving and distributing materials, parts, tooling, and other items to or from a piece of equipment.

`WasteDisposal`

`WasteDisposal` is an XML container that represents the information for a unit comprised of all the parts involved in removing manufacturing byproducts from a piece of equipment.

`ToolingDelivery`

`ToolingDelivery` is an XML container that represents the information for a unit involved in managing, positioning, storing, and delivering tooling within a piece of equipment.

`Environmental`

`Environmental` is an XML container that represents the information for a unit or function involved in monitoring, managing, or conditioning the environment around or within a piece of equipment.

`BarFeeder`

`BarFeeder` is an XML container that represents the information for a unit involved in delivering bar stock to a piece of equipment.

`units`

The unit of measurement for the reported value of the data item.

`bufferSize`

A value representing the maximum number of *Data Entities* that **MAY** be retained in the *Agent* that published the *Response Document* at any point in time.

`nextSequence`

A number representing the sequence number of the piece of *Streaming Data* that is the next piece of data to be retrieved from the buffer of the *Agent* that was not included in the *Response Document* published by the *Agent*.

`lastSequence`

A number representing the sequence number assigned to the last piece of *Streaming Data* that was added to the buffer of the *Agent* immediately prior to the time that the *Agent* published the *Response Document*.

`firstSequence`

A number representing the sequence number assigned to the oldest piece of *Streaming Data* stored in the buffer of the *Agent* immediately prior to the time that the *Agent* published the *Response Document*.

`CalibrationDate`

Date upon which the *sensor unit* was last calibrated.

`NextCalibrationDate`

Date upon which the sensor unit is next scheduled to be calibrated.

`CalibrationInitials`

The initials of the person verifying the validity of the calibration data.

`category`

Specifies the kind of information provided by a data item.

`Channel`

`Channel` represents each *sensing element* connected to a *sensor unit*.

`Channels`

When `Sensor` represents multiple *sensing elements*, each *sensing element* is represented by a `Channel` for the `Sensor`.

`Channels` is an XML container used to organize information for the *sensing elements*.

`CharacterData`

See CDATA

`Components`

An XML container that consists of one or more types of `Component` XML elements.

`Component`

An abstract XML element. Replaced in the XML document by types of `Component` elements representing physical parts and logical functions of a piece of equipment.

`component`

`component` identifies the *Structural Element* (`Device`, *Top Level* `Component`, or *Lower Level* `Component`) associated with the `ComponentStream` element.

`componentId`

The identifier attribute of the `Component` element that represents the physical part of a piece of equipment where the data represented by the `DataItem` element originated.

`ComponentRef`

`ComponentRef` XML element is a pointer to all of the information associated with another *Structural Element* defined elsewhere in the XML document for a piece of equipment.

`ComponentStream`

An XML container type element that organizes data returned from an *Agent* in response to a `current` or `sample` HTTP request.

`Composition`

An XML element used to describe the lowest level structural building blocks contained within a `Component` element.

`Compositions`

An XML container consisting of one or more types of `Composition` XML elements.

`Condition`

An XML container type element that organizes the data reported in the `MTConnect-Streams` document for `DataItem` elements defined in the `MTConnectDevices` document with a `category` attribute of `CONDITION`.

`Condition`

An XML element which provides the information and data reported from a piece of equipment for those `DataItem` elements defined with a `category` attribute of `CONDITION` in the `MTConnectDevices` document.

`Constraint`

A `Constraint` is used by a software application to evaluate the validity of the reported data.

`Constraints`

`Constraints` is an optional container that provides a set of expected values that can be reported for this `DataItem`.

`Configuration`

An XML element that contains technical information about a piece of equipment describing its physical layout or functional characteristics.

`current`

Used in the path portion of an *HTTP Request Line*, by a client software application, to initiate a *Current Request* to an *Agent* to publish an `MTConnectStreams` document.

`asset`

Used in the path portion of an *HTTP Request Line*, by a client software application, to initiate an *Asset Request* to an *Agent* to publish an `MTConnectAssets` document.

`DataItem`

Data Entity describing a piece of information reported about a piece of equipment.

`DataItems`

An XML container consisting of one or more types of `DataItem` XML elements.

`dataItemId`

The identifier attribute of the `DataItem` that represents the originally measured value of the data referenced by this data item.

`DataItemRef`

`DataItemRef` XML element is a pointer to a *Data Entity* associated with another *Structural Element* defined elsewhere in the XML document for a piece of equipment.

`Description`

An XML element that can contain any descriptive content.

`Device`

The primary container element for each piece of equipment. `Device` is organized within the `Devices` container.

`Devices`

The first, or highest level, *Structural Element* in a `MTConnectDevices` document.

`DeviceStream`

An XML container element provided in the `Streams` container in the `MTConnect-Streams` document.

`DISCRETE`

A *Data Entity* where each discrete occurrence of the data may have the same value as the previous occurrence of the data.

`duration`

The time-period over which the data was collected.

`Event`

An XML element which provides the information and data reported from a piece of equipment for those `DataItem` elements defined with a `category` attribute of `EVENT` in the `MTConnectDevices` document.

`Events`

An XML container type element that organizes the data reported in the `MTConnect-Streams` document for `DataItem` elements defined in the `MTConnectDevices` document with a `category` attribute of `EVENT`.

`Filter`

`Filter` provides a means to control when an *Agent* records updated information for a data item.

`Filters`

An XML container consisting of one or more types of `Filter` XML elements.

`FirmwareVersion`

Version number for the sensor unit as specified by the manufacturer.

`Header`

An XML container in an *MTConnect Response Document* that provides information from an *Agent* defining version information, storage capacity, and parameters associated with the data management within the *Agent*.

`id`

The unique identifier for this element.

`idRef`

A pointer to the `id` attribute of an element that contains the information to be associated with this XML element.

`InitialValue`

`InitialValue` is an optional XML element that defines the starting value for a data item as well as the value to be set for the data item after a reset event.

`Interface`

Each `Interface` contains *Data Entities* available from the piece of equipment that may be needed to coordinate activities with associated pieces of equipment.

`Interfaces`

An XML container that organizes information used to coordinate actions and activities between pieces of equipment that communicate information between each other.

`Linear`

A `Linear` axis represents the movement of a physical piece of equipment, or a portion of the equipment, in a straight line.

`MACHINE`

An unchangeable coordinate system that has machine zero as its origin.

`manufacturer`

The name of the manufacturer of the physical or logical part of a piece of equipment represented by an XML element.

`Maximum`

The upper limit of data reported for a data item.

`Minimum`

The lower limit of data reported for a data item.

`MINIMUM_DELTA`

For `Filter MINIMUM_DELTA`, a new value **MUST NOT** be reported for a data item unless the measured value has changed from the last reported value by at least the delta given as the CDATA of this element.

`model`

The model description of the physical part or logical function of a piece of equipment represented by this XML element.

`MTConnectDevices`

It is the root XML element of an *MTConnectDevices Response Document*.

`MTConnectStreams`

It is the root XML element of an *MTConnectStreams Response Document*.

`MTConnectError`

It is the root XML element of an *MTConnectErrors Response Document*.

`name`

The name of an element or a piece of equipment.

`nativeName`

The common name normally associated with a piece of equipment or an element.

`nativeScale`

`nativeScale` **MAY** be used to convert the reported value to represent the original measured value.

`nativeCode`

The native code (usually an alpha-numeric value) generated by the controller of a piece of equipment or the element.

`nativeSeverity`

If the piece of equipment designates a severity level to a fault, `nativeSeverity` reports that severity information to a client software application.

`nativeUnits`

The native units of measurement for the reported value of the data item.

`Nominal`

The target or expected value for this data item.

`number`

A unique identifier that will only refer to a specific *sensing element*.

`Path`

`Path` is an XML container that represents the information for an independent operation or function within a `Controller`.

`PERIOD`

The data reported for a data item with this `Filter` is provided on a periodic basis.

`probe`

The form `probe` is used to designate a *Probe Request* in the path portion of an *HTTP Request Line*.

`QName`

A `QName`, or qualified name, is the fully qualified name of an element, attribute, or identifier in an XML document. A `QName` concisely associates the URI of an XML namespace with the local name of an element, attribute, or identifier in that namespace.

`qualifier`

`qualifier` provides additional information regarding a *Fault State* associated with the measured value of a process variable.

`Reference`

`Reference` is a pointer to information that is associated with another *Structural Element* defined elsewhere in the XML document for a piece of equipment.

`References`

An XML container consisting of one or more types of `Reference` XML elements.

---

representation

Description of a means to interpret data consisting of multiple data points or samples reported as a single value.

representation is an optional attribute.

representation will define a unique format for each set of data.

representation for TIME_SERIES, DISCRETE, and VALUE are defined in *MTConnect Standard: Part 2.0 - Devices Information Model Section 7.2.2.12*.

If representation is not specified, it **MUST** be determined to be VALUE.

ResetTrigger

ResetTrigger is an optional XML element that identifies the type of event that may cause a reset to occur. It is additional information regarding the meaning of the data that establishes an understanding of the time frame that the data represents so that the data may be correctly understood by a client software application.

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resetTriggered

For those DataItem elements that report data that may be periodically reset to an initial value, resetTriggered identifies when a reported value has been reset and what has caused that reset to occur.

resetTriggered is an optional attribute.

resetTriggered **MUST** only be provided for the specific occurrence of a *Data Entity* reported in the MTConnectStreams document when the reset occurred and **MUST NOT** be provided for any other occurrence of the *Data Entity* reported in a MTConnectStreams document.

Resources

An XML container used to organize information for *Lower Level* elements representing types of items, materials, and personnel that support the operation of a piece of equipment or work to be performed at a location. Resources also represents materials or other items consumed or transformed by a piece of equipment for production of parts or other types of goods.

Power

Power was **DEPRECATED** in MTConnect Version 1.1 and was replaced by the *Data Entity* called AVAILABILITY.

Materials

Materials is an XML container that provides information about materials or other items consumed or used by the piece of equipment for production of parts, materials, or other types of goods.

Stock

Stock is an XML container that represents the information for the material that is used in a manufacturing process and to which work is applied in a machine or piece of equipment to produce parts.

Personnel

Personnel is an XML container that provides information about an individual or individuals who either control, support, or otherwise interface with a piece of equipment.

`Rotary`

A `Rotary` axis represents any non-linear or rotary movement of a physical piece of equipment or a portion of the equipment.

`Sample`

An XML element that provides the information and data reported from a piece of equipment for those `DataItem` elements defined with a `category` attribute of `SAMPLE` in the `MTConnectDevices` document.

`Samples`

An XML container type element that organizes the data reported in the `MTConnectStreams` document for `DataItem` elements defined in the `MTConnectDevices` document with a `category` attribute of `SAMPLE`.

`SAMPLE`

A `SAMPLE` is the reading of the value of a continuously variable or analog data value.

`sample`

Used in the path portion of an *HTTP Request Line*, by a client software application, to initiate a *Sample Request* to an *Agent* to publish an `MTConnectStreams` document.

`sampleCount`

The number of readings reported in the data returned for the `DataItem` element defined in the `MTConnectDevices` document that this `Sample` element represents.

`sampleInterval`

An optional attribute that is an indication provided by a piece of equipment describing the interval in milliseconds between the completion of the reading of the data associated with the `Device` element until the beginning of the next sampling of that data.

`sampleRate`

The rate at which successive samples of a data item are recorded by a piece of equipment.

`iso841Class`

DEPRECATED in MTConnect Version 1.1.

`Sensor`

The *sensor unit* is modeled as a *Lower Level* `Component` called `Sensor`.

`SensorConfiguration`

An element that can contain descriptive content defining the configuration information for `Sensor`.

`serialNumber`

The serial number associated with a piece of equipment.

`sequence`

A number representing the sequential position of an occurrence of a `category` type in the data buffer of an *Agent*.

`significantDigits`

The number of significant digits in the reported value.

`station`

The station where the physical part or logical function of a piece of equipment is located when it is part of a manufacturing unit or cell with multiple stations.

`Source`

`Source` identifies the *Structural Element* from which a measured value originates.

`statistic`

Describes the type of statistical calculation performed on a series of data samples to provide the reported data value.

`Streams`

The first, or highest, level XML container element in an `MTConnectStreams` *Response* Document provided by an *Agent* in response to a `sample` or `current` HTTP *Request*.

`subType`

A sub-categorization of the data item `type`.

`Systems`

An XML container used to organize information for *Lower Level* elements representing the major sub-systems that are permanently integrated into a piece of equipment.

`TIME_SERIES`

A series of sampled data.

`timestamp`

The most accurate time available to a piece of equipment that represents the point in time that the data was reported.

`type`

The type of either a *Structural Element* or a `DataItem` being measured.

UNAVAILABLE

The value of the *Data Entity* either when the data is not received or the entity is incapable of providing data.

---

uuid

The unique identifier for an XML element.

Value

Value represents a single data value that is expected to be reported for a DataItem element.

VALUE

The measured value of the sample data.

WORK

The coordinate system that represents the working area for a particular workpiece whose origin is shifted within the MACHINE coordinate system. If the WORK coordinates are not currently defined in the piece of equipment, the MACHINE coordinates will be used.

---

xs:lang

An optional attribute that specifies the language of the CDATA returned for the Condition.

`Controller`

An XML container used to organize information about an intelligent or computational function within a piece of equipment.

`coordinateSystem`

For measured values relative to a coordinate system like `POSITION`, the coordinate system being used may be reported.

`ACTUATOR`

A mechanism for moving or controlling a mechanical part of a piece of equipment.

It takes energy usually provided by air, electric current, or liquid and converts the energy into some kind of motion.

`AMPLIFIER`

An electronic component or circuit for amplifying power, electric current, or voltage.

`BALLSCREW`

A mechanical structure for transforming rotary motion into linear motion.

BELT

An endless flexible band used to transmit motion for a piece of equipment or to convey materials and objects.

BRAKE

A mechanism for slowing or stopping a moving object by the absorption or transfer of the energy of momentum, usually by means of friction, electrical force, or magnetic force.

CHAIN

An interconnected series of objects that band together and are used to transmit motion for a piece of equipment or to convey materials and objects.

CHOPPER

A mechanism used to break material into smaller pieces.

CHUCK

A mechanism that holds a part, stock material, or any other item in place.

Chuck

Chuck is an XML container that provides the information about a mechanism that holds a part or stock material in place.

CHUTE

An inclined channel for conveying material.

CIRCUIT_BREAKER

A mechanism for interrupting an electric circuit.

CLAMP

A mechanism used to strengthen, support, or fasten objects in place.

COMPRESSOR

A pump or other mechanism for reducing volume and increasing pressure of gases in order to condense the gases to drive pneumatically powered pieces of equipment.

DOOR

A mechanical mechanism or closure that can cover a physical access portal into a piece of equipment allowing or restricting access to other parts of the equipment.

Door

Door is an XML container that represents the information for a mechanical mechanism or closure that can cover.

DRAIN

A mechanism that allows material to flow for the purpose of drainage from, for example, a vessel or tank.

ENCODER

A mechanism used to measure rotary position.

FAN

Any mechanism for producing a current of air.

FILTER

Any substance or structure through which liquids or gases are passed to remove suspended impurities or to recover solids.

GRIPPER

A mechanism that holds a part, stock material, or any other item in place.

HOPPER

A chamber or bin in which materials are stored temporarily, typically being filled through the top and dispensed through the bottom.

`Hydraulic`

`Hydraulic` is an XML container that represents the information for a system comprised of all the parts involved in moving and distributing pressurized liquid throughout the piece of equipment.

`Pneumatic`

`Pneumatic` is an XML container that represents the information for a system comprised of all the parts involved in moving and distributing pressurized gas throughout the piece of equipment.

`Coolant`

`Coolant` is an XML container that represents the information for a system comprised of all the parts involved in distribution and management of fluids that remove heat from a piece of equipment.

`Lubrication`

`Lubrication` is an XML container that represents the information for a system comprised of all the parts involved in distribution and management of fluids used to lubricate portions of the piece of equipment.

`Enclosure`

`Enclosure` is an XML container that represents the information for a structure used to contain or isolate a piece of equipment or area.

`Protective`

Protective is an XML container that represents the information for those functions that detect or prevent harm or damage to equipment or personnel.

`ProcessPower`

`ProcessPower` is an XML container that represents the information for a power source associated with a piece of equipment that supplies energy to the manufacturing process separate from the `Electric` system.

`Feeder`

`Feeder` is an XML container that represents the information for a system that manages the delivery of materials within a piece of equipment.

`Dielectric`

`Dielectric` is an XML container that represents the information for a system that manages a chemical mixture used in a manufacturing process being performed at that piece of equipment.

`LINEAR_POSITION_FEEDBACK`

A mechanism that measures linear motion or position.

MOTOR

A mechanism that converts electrical, pneumatic, or hydraulic energy into mechanical energy.

OIL

A viscous liquid.

POWER_SUPPLY

A unit that provides power to electric mechanisms.

PULLEY

A mechanism or wheel that turns in a frame or block and serves to change the direction of or to transmit force.

PUMP

An apparatus raising, driving, exhausting, or compressing fluids or gases by means of a piston, plunger, or set of rotating vanes.

SENSING_ELEMENT

A mechanism that provides a signal or measured value.

STORAGE_BATTERY

A component consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power.

SWITCH

A mechanism for turning on or off an electric current or for making or breaking a circuit.

TANK

A receptacle or container for holding material.

TENSIONER

A mechanism that provides or applies a stretch or strain to another mechanism.

TRANSFORMER

A mechanism that transforms electric energy from a source to a secondary circuit.

VALVE

Any mechanism for halting or controlling the flow of a liquid, gas, or other material through a passage, pipe, inlet, or outlet.

WATER

A fluid.

AVERAGE

Mathematical Average value calculated for the data item during the calculation period.

KURTOSIS

A measure of the "peakedness" of a probability distribution; i.e., the shape of the distribution curve.

MAXIMUM

Maximum value of a data entity or attribute.

MEDIAN

The middle number of a series of numbers.

MINIMUM

The minimum value of a data entity or attribute.

MODE

The number in a series of numbers that occurs most often.

RANGE

Difference between the Maximum and Minimum value of a data item during the calculation period. Also represents Peak-to-Peak measurement in a waveform.

ROOT_MEAN_SQUARE

Mathematical Root Mean Square (RMS) value calculated for the data item during the calculation period.

STANDARD_DEVIATION

Statistical Standard Deviation value calculated for the data item during the calculation period.

ACCELERATION

The measurement of the rate of change of velocity.

ACCUMULATED_TIME

The measurement of accumulated time for an activity or event.

`AMPERAGE`

The measurement of electrical current.

`DIRECT`

The measurement of DC current or voltage.

`TARGET`

The desired measure or count for a data item value.

`ANGLE`

The measurement of angular position.

`COMMANDED`

A value specified by the `Controller` type component.

`ANGULAR_ACCELERATION`

The measurement rate of change of angular velocity.

ANGULAR_VELOCITY

The measurement of the rate of change of angular position.

AXIS_FEEDRATE

The measurement of the feedrate of a linear axis.

OVERRIDE

The operators overridden value.

PROGRAMMED

The value of a signal or calculation specified by a logic or motion program or set by a switch.

RAPID

The value of a signal or calculation issued to adjust the feedrate of a component or composition that is operating in a rapid positioning mode.

CLOCK_TIME

The value provided by a timing device at a specific point in time.

CONCENTRATION

The measurement of the percentage of one component within a mixture of components

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CONDUCTIVITY

The measurement of the ability of a material to conduct electricity.

DISPLACEMENT

The measurement of the change in position of an object.

ELECTRICAL_ENERGY

The measurement of electrical energy consumption by a component.

EQUIPMENT_TIMER

The measurement of the amount of time a piece of equipment or a sub-part of a piece of equipment has performed specific activities.

WORKING

A piece of equipment performing any activity, the equipment is active and performing a function under load or not.

FILL_LEVEL

The measurement of the amount of a substance remaining compared to the planned maximum amount of that substance.

FLOW

The measurement of the rate of flow of a fluid.

FREQUENCY

The measurement of the number of occurrences of a repeating event per unit time.

~~GLOBAL_POSITION~~

DEPRECATED in Version 1.1

LENGTH

The measurement of the length of an object.

STANDARD

The standard or original length of an object.

USEABLE

The remaining useable length of an object.

~~LEVEL~~

DEPRECATED in Version 1.2. See FILL_LEVEL

LINEAR_FORCE

The measurement of the push or pull introduced by an actuator or exerted on an object.

LOAD

The measurement of the actual versus the standard rating of a piece of equipment.

MASS

The measurement of the mass of an object(s) or an amount of material.

PATH_FEEDRATE

The measurement of the feedrate for the axes, or a single axis, associated with a Path component-a vector.

`PATH_POSITION`

A measured or calculated position of a control point associated with a `Controller` element, or `Path` element if provided, of a piece of equipment.

`PROBE`

The position provided by a measurement probe.

`PH`

A measure of the acidity or alkalinity of a solution.

`POSITION`

A measured or calculated position of a `Component` element as reported by a piece of equipment.

`POWER_FACTOR`

The measurement of the ratio of real power flowing to a load to the apparent power in that AC circuit.

`PRESSURE`

The measurement of force per unit area exerted by a gas or liquid.

PROCESS_TIMER

The measurement of the amount of time a piece of equipment has performed different types of activities associated with the process being performed at that piece of equipment.

PROCESS

The measurement of the time from the beginning of production of a part or product on a piece of equipment until the time that production is complete for that part or product on that piece of equipment. This includes the time that the piece of equipment is running, producing parts or products, or in the process of producing parts.

RESISTANCE

The measurement of the degree to which a substance opposes the passage of an electric current.

ROTARY_VELOCITY

The measurement of the rotational speed of a rotary axis.

SOUND_LEVEL

The measurement of a sound level or sound pressure level relative to atmospheric pressure.

A_SCALE

A Scale weighting factor. This is the default weighting factor if no factor is specified

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B_SCALE

B Scale weighting factor

C_SCALE

C Scale weighting factor

D_SCALE

D Scale weighting factor

NO_SCALE

No weighting factor on the frequency scale

~~SPINDLE_SPEED~~

DEPRECATED in Version 1.2. Replaced by ROTARY_VELOCITY

STRAIN

The measurement of the amount of deformation per unit length of an object when a load is applied.

`TEMPERATURE`

The measurement of temperature.

`TENSION`

The measurement of a force that stretches or elongates an object.

`TILT`

The measurement of angular displacement.

`TORQUE`

The measurement of the turning force exerted on an object or by an object.

`VELOCITY`

The measurement of the rate of change of position of a `Component`.

`VISCOSITY`

The measurement of a fluids resistance to flow.

`VOLT_AMPERE`

The measurement of the apparent power in an electrical circuit, equal to the product of root-mean-square (RMS) voltage and RMS current (commonly referred to as VA).

`VOLT_AMPERE_REACTIVE`

The measurement of reactive power in an AC electrical circuit (commonly referred to as VAR).

`VOLTAGE`

The measurement of electrical potential between two points.

`ALTERNATING`

The measurement of alternating voltage or current. If not specified further in statistic, defaults to RMS voltage.

`WATTAGE`

The measurement of power flowing through or dissipated by an electrical circuit or piece of equipment.

`ACTIVE_AXES`

The set of axes currently associated with a `Path` or `Controller` *Structural Element*.

ACTUATOR_STATE

Represents the operational state of an apparatus for moving or controlling a mechanism or system.

~~ALARM~~

DEPRECATED : Replaced with CONDITION category data items in Version 1.1.0.

AVAILABILITY

Represents the *Agent*'s ability to communicate with the data source.

AXIS_COUPLING

Describes the way the axes will be associated to each other.

This is used in conjunction with COUPLED_AXES to indicate the way they are interacting.

AXIS_FEEDRATE_OVERRIDE

The value of a signal or calculation issued to adjust the feedrate of an individual linear type axis.

AXIS_INTERLOCK

An indicator of the state of the axis lockout function when power has been removed and the axis is allowed to move freely.

AXIS_STATE

An indicator of the controlled state of a Linear or Rotary component representing an axis.

BLOCK

The line of code or command being executed by a Controller *Structural Element*.

BLOCK_COUNT

The total count of the number of blocks of program code that have been executed since execution started.

CHUCK_INTERLOCK

An indication of the state of an interlock function or control logic state intended to prevent the associated CHUCK component from being operated.

MANUAL_UNCLAMP

An indication of the state of an operator controlled interlock that can inhibit the ability to initiate an unclamp action of an electronically controlled chuck.

The *Valid Data Value* **MUST** be ACTIVE or INACTIVE.

When MANUAL_UNCLAMP is ACTIVE, it is expected that a chuck cannot be unclamped until MANUAL_UNCLAMP is set to INACTIVE.

CHUCK_STATE

An indication of the operating state of a mechanism that holds a part or stock material during a manufacturing process. It may also represent a mechanism that holds any other mechanism in place within a piece of equipment.

~~CODE~~

DEPRECATED in Version 1.1.

COMPOSITION_STATE

An indication of the operating condition of a mechanism represented by a Composition type element.

ACTION

An indication of the operating state of a mechanism represented by a Composition type component.

The operating state indicates whether the Composition element is activated or disabled.

The *Valid Data Value* **MUST** be ACTIVE or INACTIVE.

LATERAL

An indication of the position of a mechanism that may move in a lateral direction. The mechanism is represented by a Composition type component.

The position information indicates whether the Composition element is positioned to the right, to the left, or is in transition.

The *Valid Data Value* **MUST** be RIGHT, LEFT, or TRANSITIONING.

MOTION

An indication of the open or closed state of a mechanism. The mechanism is represented by a Composition type component.

The operating state indicates whether the state of the Composition element is open, closed, or unlatched.

The *Valid Data Value* **MUST** be OPEN, UNLATCHED, or CLOSED.

SWITCHED

An indication of the activation state of a mechanism represented by a Composition type component.

The activation state indicates whether the Composition element is activated or not.

The *Valid Data Value* **MUST** be ON or OFF.

VERTICAL

An indication of the position of a mechanism that may move in a vertical direction. The mechanism is represented by a Composition type component.

The position information indicates whether the Composition element is positioned to the top, to the bottom, or is in transition.

The *Valid Data Value* **MUST** be UP, DOWN, or TRANSITIONING.

CONTROLLER_MODE

The current operating mode of the Controller component.

CONTROLLER_MODE_OVERRIDE

A setting or operator selection that changes the behavior of a piece of equipment.

DRY_RUN

A setting or operator selection used to execute a test mode to confirm the execution of machine functions.

The *Valid Data Value* **MUST** be ON or OFF.

When DRY_RUN is ON, the equipment performs all of its normal functions, except no part or product is produced. If the equipment has a spindle, spindle operation is suspended.

MACHINE_AXIS_LOCK

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

When MACHINE_AXIS_LOCK is ON, program execution continues normally, but no equipment motion occurs

---

OPTIONAL_STOP

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

The program execution is stopped after a specific program block is executed when OPTIONAL_STOP is ON.

In the case of a G-Code program, a program BLOCK containing a M01 code designates the command for an OPTIONAL_STOP.

EXECUTION **MUST** change to OPTIONAL_STOP after a program block specifying an optional stop is executed and the OPTIONAL_STOP selection is ON.

SINGLE_BLOCK

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

Program execution is paused after each BLOCK of code is executed when SINGLE_BLOCK is ON.

When SINGLE_BLOCK is ON, EXECUTION **MUST** change to INTERRUPTED after completion of each BLOCK of code.

TOOL_CHANGE_STOP

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

Program execution is paused when a command is executed requesting a cutting tool to be changed.

EXECUTION **MUST** change to INTERRUPTED after completion of the command requesting a cutting tool to be changed and TOOL_CHANGE_STOP is ON.

COUPLED_AXES

Refers to the set of associated axes.

DIRECTION

The direction of motion.

LINEAR

The direction of motion of a linear motion.

ROTARY

The rotational direction of a rotary motion using the right hand rule convention.

The *Valid Data Value* **MUST** be CLOCKWISE or COUNTER_CLOCKWISE.

DOOR_STATE

The operational state of a DOOR type component or composition element.

EMERGENCY_STOP

The current state of the emergency stop signal for a piece of equipment, controller path, or any other component or subsystem of a piece of equipment.

END_OF_BAR

An indication of whether the end of a piece of bar stock being feed by a bar feeder has been reached.

AUXILIARY

When multiple locations on a piece of bar stock are referenced as the indication for the END_OF_BAR, the additional location(s) **MUST** be designated as AUXILIARY indication(s) for the END_OF_BAR.

PRIMARY

Specific applications **MAY** reference one or more locations on a piece of bar stock as the indication for the END_OF_BAR. The main or most important location **MUST** be designated as the PRIMARY indication for the END_OF_BAR.

If no subType is specified, PRIMARY **MUST** be the default END_OF_BAR indication.

EQUIPMENT_MODE

An indication that a piece of equipment, or a sub-part of a piece of equipment, is performing specific types of activities.

DELAY

A piece of equipment waiting for an event or an action to occur.

LOADED

Subparts of a piece of equipment are under load.

`OPERATING`

A piece of equipment are powered or performing any activity.

`POWERED`

Primary power is applied to the piece of equipment and, as a minimum, the controller or logic portion of the piece of equipment is powered and functioning or components that are required to remain on are powered.

`EXECUTION`

The execution status of the `Controller`.

`FUNCTIONAL_MODE`

The current intended production status of the device or component.

`HARDNESS`

The measurement of the hardness of a material.

`BRINELL`

A scale to measure the resistance to deformation of a surface.

`LEEB`

A scale to measure the elasticity of a surface.

`MOHS`

A scale to measure the resistance to scratching of a surface.

`ROCKWELL`

A scale to measure the resistance to deformation of a surface.

`SHORE`

A scale to measure the resistance to deformation of a surface.

`VICKERS`

A scale to measure the resistance to deformation of a surface.

`path`

An XPath that defines specific information or a set of information to be included in an *MTConnectStreams Response Document*.

`heartbeat`

Sets the time period for the heartbeat function in an *Agent*.

`at`

Requests that the *MTConnect Response Document* **MUST** include the current value for all *Data Entities* relative to the time that a specific sequence number was recorded.

`from`

The from parameter designates the sequence number of the first *Data Entity* in the buffer of the *Agent* that **MUST** be included in the *Response Document*.

`interval`

When a *Request* includes a Query with the interval parameter, an *Agent* **MUST** respond to this *Request* by repeatedly publishing the required *Response Document* at the time interval (period) defined by the value provided for the interval parameter.

`asset_id`

Identifies the id attribute of an *MTConnect Asset* to be provided by an *Agent*.

`INTERFACE_STATE`

An indication of the operational state of an `Interface` component.

~~LINE~~

DEPRECATED in Version 1.4.0.

LINE_LABEL

An optional identifier for a BLOCK of code in a PROGRAM.

LINE_NUMBER

A reference to the position of a block of program code within a control program.

ABSOLUTE

The position of a block of program code relative to the beginning of the control program.

INCREMENTAL

The position of a block of program code relative to the occurrence of the last LINE_LABEL encountered in the control program.

MATERIAL

The identifier of a material used or consumed in the manufacturing process.

MESSAGE

Any text string of information to be transferred from a piece of equipment to a client software application.

OPERATOR_ID

The identifier of the person currently responsible for operating the piece of equipment.

PALLET_ID

The identifier for a pallet.

PART_COUNT

The count of parts produced.

ALL

The count of all the parts produced. If the subtype is not given, this is the default.

BAD

Indicates the count of incorrect parts produced.

`GOOD`

Indicates the count of correct parts made.

`REMAINING`

Remaining measure of an object or an action.

`PART_ID`

An identifier of a part in a manufacturing operation.

`PART_NUMBER`

An identifier of a part or product moving through the manufacturing process.

The *Valid Data Value* **MUST** be a text string.

`PATH_FEEDRATE_OVERRIDE`

The value of a signal or calculation issued to adjust the feedrate for the axes associated with a `Path` component that may represent a single axis or the coordinated movement of multiple axes.

`JOG`

The feedrate specified by a logic or motion program, by a pre-set value, or set by a switch as the feedrate for the `Axes`.

PATH_MODE

Describes the operational relationship between a `Path` *Structural Element* and another `Path` *Structural Element* for pieces of equipment comprised of multiple logical groupings of controlled axes or other logical operations.

POWER_STATE

The indication of the status of the source of energy for a *Structural Element* to allow it to perform its intended function or the state of an enabling signal providing permission for the *Structural Element* to perform its functions.

CONTROL

The state of the enabling signal or control logic that enables or disables the function or operation of the *Structural Element*.

LINE

The state of the power source for the *Structural Element*.

~~POWER_STATUS~~

DEPRECATED in Version 1.1.0.

PROGRAM

The name of the logic or motion program being executed by the Controller component.

PROGRAM_COMMENT

A comment or non-executable statement in the control program.

The *Valid Data Value* **MUST** be a text string.

PROGRAM_EDIT

An indication of the status of the Controller components program editing mode.

On many controls, a program can be edited while another program is currently being executed.

PROGRAM_EDIT_NAME

The name of the program being edited.

This is used in conjunction with PROGRAM_EDIT when in ACTIVE state.

The *Valid Data Value* **MUST** be a text string.

PROGRAM_HEADER

The non-executable header section of the control program.

ROTARY_MODE

The current operating mode for a Rotary type axis.

ROTARY_VELOCITY_OVERRIDE

The value of a command issued to adjust the programmed velocity for a Rotary type axis.

This command represents a percentage change to the velocity calculated by a logic or motion program or set by a switch for a Rotary type axis.

SERIAL_NUMBER

The serial number associated with a Component, Asset, or Device. The *Valid Data Value* **MUST** be a text string.

SPINDLE_INTERLOCK

An indication of the status of the spindle for a piece of equipment when power has been removed and it is free to rotate.

TOOL_ASSET_ID

The identifier of an individual tool asset.The *Valid Data Value* **MUST** be a text string.

TOOL_ID

DEPRECATED in Version 1.2.0. See TOOL_ASSET_ID. ~~The identifier of the tool currently in use for a given Path.~~

TOOL_NUMBER

The identifier assigned by the Controller component to a cutting tool when in use by a piece of equipment.

The *Valid Data Value* **MUST** be a text string.

TOOL_OFFSET

A reference to the tool offset variables applied to the active cutting tool associated with a Path in a Controller type component.

RADIAL

A reference to a radial type tool offset variable.

LENGTH

A reference to a length type tool offset variable.

USER

The identifier of the person currently responsible for operating the piece of equipment.

`MAINTENANCE`

Action related to maintenance on the piece of equipment.

`OPERATOR`

The identifier of the person currently responsible for operating the piece of equipment.

`SET_UP`

The identifier of the person currently responsible for preparing a piece of equipment for production or restoring the piece of equipment to a neutral state after production.

`WIRE`

A string like piece or filament of relatively rigid or flexible material provided in a variety of diameters.

`WORK_OFFSET`

A reference to the offset variables for a work piece or part associated with a `Path` in a `Controller` type component.

`WORKHOLDING_ID`

The identifier for the current workholding or part clamp in use by a piece of equipment.

The *Valid Data Value* **MUST** be a text string.

COMMUNICATIONS

An indication that the piece of equipment has experienced a communications failure.

DATA_RANGE

An indication that the value of the data associated with a measured value or a calculation is outside of an expected range.

HARDWARE

An indication of a fault associated with the hardware subsystem of the *Structural Element*.

LOGIC_PROGRAM

An indication that an error occurred in the logic program or programmable logic controller (PLC) associated with a piece of equipment.

MOTION_PROGRAM

An indication that an error occurred in the motion program associated with a piece of equipment.

SYSTEM

A general purpose indication associated with an electronic component of a piece of equipment or a controller that represents a fault that is not associated with the operator, program, or hardware.

EVENT

An EVENT is a data item representing a discrete piece of information from the piece of equipment.

CONDITION

A CONDITION is a data item that communicates information about the health of a piece of equipment and its ability to function.

---

compositionId

The identifier attribute of the Composition element that the reported data is most closely associated.

ACTION_COMPLETE

The value of the *Data Entity* that is measuring an action or operation is to be reset upon completion of that action or operation.

ANNUAL

The value of the *Data Entity* is to be reset at the end of a 12-month period.

DAY

The value of the *Data Entity* is to be reset at the end of a 24-hour period.

`LIFE`

The value of the data item is not reset and accumulates for the entire life of the piece of equipment.

`MONTH`

The value of the *Data Entity* is to be reset at the end of a monthly period.

`POWER_ON`

The value of the *Data Entity* is to be reset when power was applied to the piece of equipment after a planned or unplanned interruption of power has occurred.

`SHIFT`

The value of the *Data Entity* is to be reset at the end of a work shift.

`WEEK`

The value of the *Data Entity* is to be reset at the end of a 7-day period.

`Warning`

Warning value for a `Condition` element.

`Normal`

Normal value for a `Condition` element.

`Fault`

Fault value for a `Condition` element.

`LOW`

Low `qualifier` value for a `Condition` element.

`HIGH`

High `qualifier` value for a `Condition` element.

`AMPERE`

Amps

`CELSIUS`

Degrees Celsius

COUNT

A count of something.

DECIBEL

Sound Level

DEGREE

Angle in degrees

DEGREE/SECOND

Angular degrees per second

DEGREE/SECOND^2

Angular acceleration in degrees per second squared

HERTZ

Frequency measured in cycles per second

JOULE

A measurement of energy.

KILOGRAM

Kilograms

LITER/SECOND

Liters per second

MICRO_RADIAN

Measurement of Tilt

MILLIMETER

Millimeters

MILLIMETER/SECOND

Millimeters per second

MILLIMETER/SECOND^2

Acceleration in millimeters per second squared

MILLIMETER_3D

A point in space identified by X, Y, and Z positions and represented by a space-delimited set of numbers each expressed in millimeters.

NEWTON

Force in Newtons

NEWTON_METER

Torque, a unit for force times distance.

OHM

Measure of Electrical Resistance

PASCAL

Pressure in Newtons per square meter

PASCAL_SECOND

Measurement of Viscosity

PERCENT

Percentage

REVOLUTION/MINUTE

Revolutions per minute

SECOND

A measurement of time.

SIEMENS/METER

A measurement of Electrical Conductivity

VOLT

Volts

WATT

Watts

WATT_SECOND

Measurement of electrical energy, equal to one Joule

CENTIPOISE

A measure of Viscosity

DEGREE/MINUTE

Rotational velocity in degrees per minute

FAHRENHEIT

Temperature in Fahrenheit

FOOT

Feet

FOOT/MINUTE

Feet per minute

FOOT/SECOND

Feet per second

FOOT/SECOND^2

Acceleration in feet per second squared

FOOT_3D

A point in space identified by X, Y, and Z positions and represented by a space-delimited set of numbers each expressed in feet.

GALLON/MINUTE

Gallons per minute.

INCH

Inches

INCH/MINUTE

Inches per minute

INCH/SECOND

Inches per second

INCH/SECOND^2

Acceleration in inches per second squared

INCH_3D

A point in space identified by X, Y, and Z positions and represented by a space-delimited set of numbers each expressed in inches.

INCH_POUND

A measure of torque in inch pounds.

KELVIN

A measurement of temperature

KILOWATT

A measurement in kilowatt.

KILOWATT_HOUR

Kilowatt hours which is 3.6 mega joules.

LITER

Measurement of volume of a fluid

LITER/MINUTE

Measurement of rate of flow of a fluid

MILLIMETER/MINUTE

Velocity in millimeters per minute

OTHER

Unsupported units

POUND

US pounds

POUND/INCH^2

Pressure in pounds per square inch (PSI).

RADIAN

Angle in radians

RADIAN/MINUTE

Velocity in radians per minute.

RADIAN/SECOND

Velocity in radians per second

RADIAN/SECOND^2

Rotational acceleration in radian per second squared

REVOLUTION/SECOND

Rotational velocity in revolution per second

ACTIVE

The value of the *Data Entity* that is engaging.

INACTIVE

The value of the *Data Entity* that is not engaging.

AVAILABLE

The value or status of an XML element when it is available.

TANDEM

Elements are physically connected to each other and operate as a single unit.

SYNCHRONOUS

Physical or logical parts which are not physically connected to each other but are operating together.

`MASTER`

It provides information or state values that influences the operation of other `DataItem` of similar type.

`SLAVE`

The axis is a slave to the `COUPLED_AXES`

`HOME`

The component at its home position.

`TRAVEL`

The component is in motion.

`PARKED`

The component has been moved to a fixed position.

`STOPPED`

The component is stopped.

`OPEN`

A component is open to the point of a positive confirmation.

`CLOSED`

A component is closed to the point of a positive confirmation.

`UNLATCHED`

An intermediate position.

`RIGHT`

The position of the `Composition` element is oriented to the right to the point of a positive confirmation.

`LEFT`

The position of the `Composition` element is oriented to the left to the point of a positive confirmation.

`TRANSITIONING`

It is in an intermediate position of the `Composition` element.

`ON`

On state or value.

`OFF`

Off state or value.

`UP`

Increase in the behavior of a *Structural Element*.

`DOWN`

Reduction in the behavior of a *Structural Element*.

`AUTOMATIC`

The `Controller` is configured to automatically execute a program.

`MANUAL`

Operations based on the instructions received from an external source.

MANUAL_DATA_INPUT

The operator can enter a series of operations for the controller to perform.

SEMI_AUTOMATIC

The controller executes a single set of instructions from an active program and then stops until given a command to execute the next set of instructions.

EDIT

The controller is currently functioning as a programming device and is not capable of executing an active program.

CLOCKWISE

A Rotary component type rotating in a clockwise fashion using the right-hand rule.

COUNTER_CLOCKWISE

A Rotary component type rotating in a counter clockwise fashion using the right-hand rule.

POSITIVE

A Linear type component is moving in the direction of increasing position value.

NEGATIVE

A Linear type component is moving in the direction of decreasing position value.

ARMED

The emergency stop circuit is complete and the piece of equipment, component, or composition element is allowed to operate.

TRIGGERED

The operation of the piece of equipment, component, or composition element is inhibited.

READY

A component is ready to engage.

INTERRUPTED

The action of a Component has been suspended due to an external signal.

FEED_HOLD

Motion of a Component has been commanded to stop at its current position.

OPTIONAL_STOP

The controller's program has been intentionally stopped

PROGRAM_STOPPED

The execution of the Controller's program has been stopped by a command from within the program.

PROGRAM_COMPLETED

The execution of the controller's program has been stopped by a command from within the program.

PRODUCTION

A *Structural Element* is currently producing product.

SETUP

A *Structural Element* is being prepared or modified to begin production of product.

TEARDOWN

Typically, a *Structural Element* has completed the production of a product and is being modified or returned to a neutral state such that it may then be prepared to begin production of a different product.

PROCESS_DEVELOPMENT

A *Structural Element* is being used to prove-out a new process.

DISABLED

A component is currently not operational.

ENABLED

A component is currently operational and performing as expected.

INDEPENDENT

The path is operating independently and without the influence of another path.

MIRROR

The axes associated with the path are mirroring the motion of the MASTER path.

YES

The END_OF_BAR has been reached.

NO

The END_OF_BAR has not been reached.

NOT_READY

A component is not ready to engage.

SPINDLE

The axis is functioning as a spindle.

INDEX

The axis is configured to index.

CONTOUR

The position of the axis is being interpolated.

ASSET_NOT_FOUND

The *Request* for information specifies an *MTConnect Asset* that is not recognized by the *Agent*.

INTERNAL_ERROR

The *Agent* experienced an error while attempting to published the requested information.

INVALID_REQUEST

The *Request* contains information that was not recognized by the *Agent*.

INVALID_URI

The URI provided was incorrect.

INVALID_XPATH

The XPath identified in the *Request* for information could not be parsed correctly by the *Agent*.

NO_DEVICE

The identity of the piece of equipment specified in the *Request* for information is not associated with the *Agent*.

OUT_OF_RANGE

The *Request* for information specifies Steaming Data that includes sequence number(s) for pieces of data that are beyond the end of the buffer.

`QUERY_ERROR`

The *Agent* was unable to interpret the Query. The Query parameters do not contain valid values or include an invalid parameter.

`TOO_MANY`

Steaming Data or Assets that includes more pieces of data than the *Agent* is capable of organizing.

`UNAUTHORIZED`

The *Requester* does not have sufficient permissions to access the requested information.

`UNSUPPORTED`

A valid *Request* was provided, but the *Agent* does not support the feature or type of *Request*.

`MTConnectAssets`

It is the root XML element of an *MTConnectAssets Response Document*.

`assetId`

The unique identifier for the *MTConnect Asset*. The identifier **MUST** be unique with respect to all other *Assets* in an MTConnect installation. The identifier **SHOULD** be globally unique with respect to all other *Assets*.

`version`

The protocol version number.

`creationTime`

The time the response was created.

`testIndicator`

Optional flag that indicates the system is operating in test mode.

`instanceId`

A number indicating which invocation of the *Agent*.

`sender`

The *Agent* identification information.

`assetBufferSize`

The maximum number of *MTConnect Assets* that will be retained by the *Agent*.

`assetCount`

The total number of *MTConnect Assets* in an*Agent*.

`Asset`

An abstract XML element. Replaced in the XML document by types of `Asset` elements representing entities that are not pieces of equipment.

`Assets`

An XML container that consists of one or more types of `Asset` XML elements.

`deviceUuid`

The piece of equipments UUID that supplied this data. This is an optional element references to the UUID attribute given in the `Device` element. This can be any series of numbers and letters as defined by the XML type NMTOKEN.

`removed`

An indicator that the *MTConnect Asset* has been removed from the piece of equipment.

`CuttingTool`

A `CuttingTool` physically removes the material from the workpiece by shear deformation.

ASSET_CHANGED

The value of the CDATA for the event **MUST** be the assetId of the asset that has been added or changed. There will not be a separate message for new assets.

ASSET_REMOVED

The value of the CDATA for the event **MUST** be the assetId of the asset that has been removed. The asset will still be visible if requested with the includeRemoved parameter as described in the protocol section. When assets are removed they are not moved to the beginning of the most recently modified list.

---

includeRemoved

A flag to include removed Assets while requesting an *Agent* for an MTConnect-Streams *Response Document*.

---

assetType

The type of asset that was updated.

CuttingToolArchetype

The CuttingToolArchetype represent the static Cutting Tool geometries and nominal values as one would expect from a tool catalog.

`toolId`

The identifier for a class of Cutting Tools. This is defined as an XML string type and is implementation dependent.

`CuttingItem`

A `CuttingItem` is the portion of the tool that physically removes the material from the workpiece by shear deformation.

`CuttingItems`

An optional set of individual Cutting Items.

`CuttingToolDefinition`

Reference to an ISO 13399.

`CutterStatus`

The status of this assembly.

`Status`

The status of the Cutting Tool.

`ToolLife`

The Cutting Tool life as related to this assembly.

`Location`

The Pot or Spindle this tool currently resides in.

`ReconditionCount`

The number of times this cutter has been reconditioned.

`CuttingToolLifeCycle`

Data regarding the use of this tool.

`format`

Identifies the expected representation of the enclosed data.

`XML`

The default value for the definition. The content will be an XML document.

`EXPRESS`

The document will confirm to the ISO 10303 Part 21 standard.

`TEXT`

The document will be a text representation of the tool data.

`UNDEFINED`

The document will be provided in an undefined format.

~~`CuttingToolDefinition`~~

DEPRECATED for `CuttingTool` in Version 1.3.0.

~~Reference to an ISO 13399.~~

`CuttingToolArchetypeReference`

The content of this XML element is the `assetId` of the `CuttingToolArchetype` document. It **MAY** also contain a source attribute that gives the URL of the archetype data as well.

`NEW`

A new tool that has not been used or first use. Marks the start of the tool history.

ALLOCATED

Indicates if this tool is has been committed to a piece of equipment for use and is not available for use in any other piece of equipment. If this is not present, this tool has not been allocated for this piece of equipment and can be used by another piece of equipment.

UNALLOCATED

Indicates this Cutting Tool has not been committed to a process and can be allocated.

MEASURED

The tool has been measured.

RECONDITIONED

The Cutting Tool has been reconditioned. See ReconditionCount for the number of times this cutter has been reconditioned.

USED

The Cutting Tool is in process and has remaining tool life.

EXPIRED

The Cutting Tool has reached the end of its useful life.

`BROKEN`

Premature tool failure.

`NOT_REGISTERED`

This Cutting Tool cannot be used until it is entered into the system.

`UNKNOWN`

The Cutting Tool is an indeterminate state. This is the default value.

`countDirection`

Indicates if the tool life counts from zero to maximum or maximum to zero.

`warning`

The point at which a tool life warning will be raised.

`limit`

The end of life limit for this tool.

`initial`

The initial life of the tool when it is new.

`MINUTES`

The tool life measured in minutes. All units for minimum, maximum, and nominal **MUST** be provided in minutes.

`WEAR`

The tool life measured in tool wear. Wear **MUST** be provided in millimeters as an offset to nominal. All units for minimum, maximum, and nominal **MUST** be given as millimeter offsets as well.

`positiveOverlap`

The number of locations at higher index value from this location.

`negativeOverlap`

The number of location at lower index values from this location.

`POT`

The number of the pot in the tool handling system.

`STATION`

The tool location in a horizontal turning machine.

`CRIB`

The location with regard to a tool crib.

`maximumCount`

The maximum number of times this tool may be reconditioned.

`ProgramToolGroup`

The tool group this tool is assigned in the part program.

`ProgramToolNumber`

The number of the tool as referenced in the part program.

`ProcessSpindleSpeed`

The constrained process spindle speed for this tool.

`ProcessFeedRate`

The constrained process feed rate for this tool in mm/s.

`ConnectionCodeMachineSide`

Identifier for the capability to connect any component of the Cutting Tool together, except Assembly Items, on the machine side. Code: `CCMS`

`Measurement`

A measure of a *Structural Element*.

`Measurements`

The `Measurements` element is a collection of one or more constrained scalar values associated with this Cutting Tool.

`xs:any`

Any additional properties not in the current document model. **MUST** be in separate XML namespace.

`maximum`

The upper bound for the value of a *Structural Element*.

`minimum`

The lower bound for value of a *Structural Element*.

`nominal`

The nominal value for a *Structural Element*.

`CommonMeasurement`

A subtype of `Measurement`.

`AssemblyMeasurement`

A subtype of `Measurement`.

`CuttingItemMeasurement`

A subtype of `Measurement`.

`code`

A shop specific code for this measurement. ISO 13399 codes **MAY** be used for these codes as well.

`BodyDiameterMax`

The largest diameter of the body of a Tool Item.

`BodyLengthMax`

The distance measured along the X axis from that point of the item closest to the workpiece, including the Cutting Item for a Tool Item but excluding a protruding locking mechanism for an Adaptive Item, to either the front of the flange on a flanged body or the beginning of the connection interface feature on the machine side for cylindrical or prismatic shanks.

`DepthOfCutMax`

The maximum engagement of the cutting edge or edges with the workpiece measured perpendicular to the feed motion.

`CuttingDiameterMax`

The maximum diameter of a circle on which the defined point Pk of each of the master inserts is located on a Tool Item. The normal of the machined peripheral surface points towards the axis of the Cutting Tool.

`FlangeDiameterMax`

The dimension between two parallel tangents on the outside edge of a flange.

`OverallToolLength`

The largest length dimension of the Cutting Tool including the master insert where applicable.

`ShankDiameter`

The dimension of the diameter of a cylindrical portion of a Tool Item or an Adaptive Item that can participate in a connection.

`ShankHeight`

The dimension of the height of the shank.

`ShankLength`

The dimension of the length of the shank.

`UsableLengthMax`

Maximum length of a Cutting Tool that can be used in a particular cutting operation including the non-cutting portions of the tool.

`ProtrudingLength`

The dimension from the yz-plane to the furthest point of the Tool Item or Adaptive Item measured in the -X direction.

`Weight`

The total weight of the Cutting Tool in grams. The force exerted by the mass of the Cutting Tool.

`FunctionalLength`

The distance from the gauge plane or from the end of the shank to the furthest point on the tool, if a gauge plane does not exist, to the cutting reference point determined by the main function of the tool. The `CuttingTool` functional length will be the length of the entire tool, not a single Cutting Item. Each `CuttingItem` can have an independent `FunctionalLength` represented in its measurements.

`count`

The total count of something.

`indices`

The number or numbers representing the individual Cutting Item or items on the tool.

`itemId`

The manufacturer identifier of this Cutting Item.

`manufacturers`

The manufacturers of the Cutting Item or Tool.

`grade`

The material composition for this Cutting Item.

`Locus`

A free form description of the location on the Cutting Tool.

`ItemLife`

The life of this Cutting Item.

`CuttingReferencePoint`

The theoretical sharp point of the Cutting Tool from which the major functional dimensions are taken.

`CuttingEdgeLength`

The theoretical length of the cutting edge of a Cutting Item over sharp corners.

`DriveAngle`

Angle between the driving mechanism locator on a Tool Item and the main cutting edge.

`FlangeDiameter`

The dimension between two parallel tangents on the outside edge of a flange.

`FunctionalWidth`

The distance between the cutting reference point and the rear backing surface of a turning tool or the axis of a boring bar.

`IncribedCircleDiameter`

The diameter of a circle to which all edges of a equilateral and round regular insert are tangential.

`PointAngle`

The angle between the major cutting edge and the same cutting edge rotated by 180 degrees about the tool axis.

`ToolCuttingEdgeAngle`

The angle between the tool cutting edge plane and the tool feed plane measured in a plane parallel the xy-plane.

`ToolLeadAngle`

The angle between the tool cutting edge plane and a plane perpendicular to the tool feed plane measured in a plane parallel the xy-plane.

`ToolOrientation`

The angle of the tool with respect to the workpiece for a given process. The value is application specific.

`WiperEdgeLength`

The measure of the length of a wiper edge of a Cutting Item.

`StepDiameterLength`

The length of a portion of a stepped tool that is related to a corresponding cutting diameter measured from the cutting reference point of that cutting diameter to the point on the next cutting edge at which the diameter starts to change.

`StepIncludedAngle`

The angle between a major edge on a step of a stepped tool and the same cutting edge rotated 180 degrees about its tool axis.

`CuttingDiameter`

The diameter of a circle on which the defined point Pk located on this Cutting Tool. The normal of the machined peripheral surface points towards the axis of the Cutting Tool.

`CuttingHeight`

The distance from the basal plane of the Tool Item to the cutting point.

`CornerRadius`

The nominal radius of a rounded corner measured in the X Y-plane.

`FunctionalLength`

The distance from the gauge plane or from the end of the shank of the Cutting Tool, if a gauge plane does not exist, to the cutting reference point determined by the main function of the tool. This measurement will be with reference to the Cutting Tool and **MUST NOT** exist without a Cutting Tool.

`ChamferFlatLength`

The flat length of a chamfer.

`ChamferWidth`

The width of the chamfer.

`InsertWidth`

W1 is used for the insert width when an inscribed circle diameter is not practical.

`FAIL`

Failure before completion of an action.

`COMPLETE`

Completion of an action.

`TRUE`

The *Agent* is functioning in a test mode.

`FALSE`

The *Agent* is not functioning in a test mode.

`true`

Referring to the `Asset`/s removed from the *asset buffer*.

`false`

Referring to the `Asset`/s in the *asset buffer*.

`DoorInterface`

`DoorInterface` provides the set of information used to coordinate the operations between two pieces of equipment, one of which controls the operation of a door.

`ChuckInterface`

`ChuckInterface` provides the set of information used to coordinate the operations between two pieces of equipment, one of which controls the operation of a chuck.

`BarFeederInterface`

`BarFeederInterface` provides the set of information used to coordinate the operations between a Bar Feeder and another piece of equipment.

`MaterialHandlerInterface`

`MaterialHandlerInterface` provides the set of information used to coordinate the operations between a piece of equipment and another associated piece of equipment used to automatically handle various types of materials or services associated with the original piece of equipment.

`REQUEST`

A subtype of an *Interface* `DataItem` type to communicate a request.

`RESPONSE`

A subtype of an *Interface* `DataItem` type to communicate a response.

`OPEN_DOOR`

Service to open a door.

CLOSE_DOOR

Service to close a door.

OPEN_CHUCK

Service to open a chuck.

CLOSE_CHUCK

Service to close a chuck.

MATERIAL_FEED

Service to advance material or feed product to a piece of equipment from a continuous or bulk source.

MATERIAL_CHANGE

Service to change the type of material or product being loaded or fed to a piece of equipment.

MATERIAL_RETRACT

Service to remove or retract material or product.

`PART_CHANGE`

Service to change the part or product associated with a piece of equipment to a different part or product.

`MATERIAL_LOAD`

Service to load a piece of material or product.

`MATERIAL_UNLOAD`

Service to unload a piece of material or product.

`ElementName`

Element Name of a `DataItem`.

`Archetype`

Model of a domain concept.

`query`

See *Query*

`authority`

The `authority` portion consists of the DNS name or IP address associated with an *Agent*.

`port`

The `port` of the *HTTP Request Line*.

`WARNING`

See *WARNING*.

1.3 Sample Data Items

ACCELERATION

The measurement of the rate of change of velocity.

units: MILLIMETER/SECOND^2

float

ACCUMULATED_TIME

The measurement of accumulated time for an activity or event.

units: SECOND

float

AMPERAGE

The measurement of electrical current.

subtypes: ALTERNATING, DIRECT, ACTUAL, TARGET

units: AMPERE

float

ANGLE

The measurement of angular position.

subtypes: COMMANDED, ACTUAL

units: DEGREE

float

ANGULAR_ACCELERATION

The measurement rate of change of angular velocity.

units: $DEGREE/SECOND^2$

float

ANGULAR_VELOCITY

The measurement of the rate of change of angular position.

units: DEGREE/SECOND

float

AXIS_FEEDRATE

The measurement of the feedrate of a linear axis.

subtypes: ACTUAL, COMMANDED, JOG, PROGRAMMED, RAPID, OVERRIDE

units: MILLIMETER/SECOND

float

CLOCK_TIME

The value provided by a timing device at a specific point in time.

units: yyyy-mm-ddthh:mm:ss.ffff

datetime

CONCENTRATION

The measurement of the percentage of one component within a mixture of components

units: PERCENT

float

CONDUCTIVITY

The measurement of the ability of a material to conduct electricity.

units: SIEMENS/METER

float

DISPLACEMENT

The measurement of the change in position of an object.

units: MILLIMETER

float

ELECTRICAL_ENERGY

The measurement of electrical energy consumption by a component.

units: WATT_SECOND

float

EQUIPMENT_TIMER

The measurement of the amount of time a piece of equipment or a sub-part of a piece of equipment has performed specific activities.

subtypes: LOADED, WORKING, OPERATING, POWERED, DELAY

units: SECOND

float

FILL_LEVEL

The measurement of the amount of a substance remaining compared to the planned maximum amount of that substance.

units: PERCENT

float

FLOW

The measurement of the rate of flow of a fluid.

units: LITER/SECOND

float

FREQUENCY

The measurement of the number of occurrences of a repeating event per unit time.

units: HERTZ

float

~~GLOBAL_POSITION~~

DEPRECATED in Version 1.1

units: None

float

LENGTH

The measurement of the length of an object.

subtypes: STANDARD, REMAINING, USEABLE

units: MILLIMETER

float

STANDARD

The standard or original length of an object.

units: MILLIMETER

float

USEABLE

The remaining useable length of an object.

units: MILLIMETER

float

~~LEVEL~~

DEPRECATED in Version 1.2. See FILL_LEVEL

units: None

LINEAR_FORCE

The measurement of the push or pull introduced by an actuator or exerted on an object.

units: NEWTON

float

LOAD

The measurement of the actual versus the standard rating of a piece of equipment.

units: PERCENT

float

MASS

The measurement of the mass of an object(s) or an amount of material.

units: KILOGRAM

float

PATH_FEEDRATE

The measurement of the feedrate for the axes, or a single axis, associated with a Path component-a vector.

subtypes: ACTUAL, COMMANDED, JOG, PROGRAMMED, RAPID, OVERRIDE

units: MILLIMETER/SECOND

float

PATH_POSITION

A measured or calculated position of a control point associated with a Controller element, or Path element if provided, of a piece of equipment.

subtypes: ACTUAL, COMMANDED, TARGET, PROBE

units: MILLIMETER_3D

array3d

PROBE

The position provided by a measurement probe.

units: MILLIMETER_3D

array3d

PH

A measure of the acidity or alkalinity of a solution.

units: PH

float

POSITION

A measured or calculated position of a Component element as reported by a piece of equipment.

subtypes: ACTUAL, COMMANDED, PROGRAMMED, TARGET

units: MILLIMETER

float

POWER_FACTOR

The measurement of the ratio of real power flowing to a load to the apparent power in that AC circuit.

units: PERCENT

float

PRESSURE

The measurement of force per unit area exerted by a gas or liquid.

units: PASCAL

float

PROCESS_TIMER

The measurement of the amount of time a piece of equipment has performed different types of activities associated with the process being performed at that piece of equipment.

subtypes: PROCESS, DELAY

units: SECOND

float

PROCESS

The measurement of the time from the beginning of production of a part or product on a piece of equipment until the time that production is complete for that part or product on that piece of equipment. This includes the time that the piece of equipment is running, producing parts or products, or in the process of producing parts.

units: SECOND

float

RESISTANCE

The measurement of the degree to which a substance opposes the passage of an electric current.

units: OHM

float

ROTARY_VELOCITY

The measurement of the rotational speed of a rotary axis.

subtypes: ACTUAL, COMMANDED, PROGRAMMED, OVERRIDE

units: REVOLUTION/MINUTE

float

SOUND_LEVEL

The measurement of a sound level or sound pressure level relative to atmospheric pressure.

subtypes: NO_SCALE, A_SCALE, B_SCALE, C_SCALE, D_SCALE

units: DECIBEL

float

~~SPINDLE_SPEED~~

DEPRECATED in Version 1.2. Replaced by ROTARY_VELOCITY

subtypes: ACTUAL, COMMANDED, OVERRIDE

units: REVOLUTION/MINUTE

STRAIN

The measurement of the amount of deformation per unit length of an object when a load is applied.

units: PERCENT

float

TEMPERATURE

The measurement of temperature.

units: CELSIUS

float

TENSION

The measurement of a force that stretches or elongates an object.

units: NEWTON

float

TILT

The measurement of angular displacement.

units: MICRO_RADIAN

float

TORQUE

The measurement of the turning force exerted on an object or by an object.

units: NEWTON_METER

float

VELOCITY

The measurement of the rate of change of position of a Component.

units: MILLIMETER/SECOND

float

VISCOSITY

The measurement of a fluids resistance to flow.

units: PASCAL_SECOND

float

VOLT_AMPERE

The measurement of the apparent power in an electrical circuit, equal to the product of root-mean-square (RMS) voltage and RMS current (commonly referred to as VA).

units: VOLT_AMPERE

float

VOLT_AMPERE_REACTIVE

The measurement of reactive power in an AC electrical circuit (commonly referred to as VAR).

units: VOLT_AMPERE_REACTIVE

float

VOLTAGE

The measurement of electrical potential between two points.

subtypes: ALTERNATING, DIRECT, ACTUAL, TARGET

units: VOLT

float

WATTAGE

The measurement of power flowing through or dissipated by an electrical circuit or piece of equipment.

subtypes: ACTUAL, TARGET

units: WATT

float

1.4 Event Data Items

ACTIVE_AXES

The set of axes currently associated with a Path or Controller *Structural Element*.

arraystring

ACTUATOR_STATE

Represents the operational state of an apparatus for moving or controlling a mechanism or system.

Valid Data Values: ACTIVE,INACTIVE

string

~~ALARM~~

DEPRECATED : Replaced with CONDITION category data items in Version 1.1.0.

AVAILABILITY

Represents the *Agent*'s ability to communicate with the data source.

Valid Data Values: AVAILABLE,UNAVAILABLE

string

AXIS_COUPLING

Describes the way the axes will be associated to each other.

This is used in conjunction with COUPLED_AXES to indicate the way they are interacting.

Valid Data Values: TANDEM,SYNCHRONOUS,MASTER,SLAVE

string

AXIS_FEEDRATE_OVERRIDE

The value of a signal or calculation issued to adjust the feedrate of an individual linear type axis.

subtypes: JOG, PROGRAMMED, RAPID

float

AXIS_INTERLOCK

An indicator of the state of the axis lockout function when power has been removed and the axis is allowed to move freely.

Valid Data Values: ACTIVE,INACTIVE

string

AXIS_STATE

An indicator of the controlled state of a Linear or Rotary component representing an axis.

Valid Data Values: HOME,TRAVEL,PARKED,STOPPED

string

BLOCK

The line of code or command being executed by a Controller *Structural Element*.

string

BLOCK_COUNT

The total count of the number of blocks of program code that have been executed since execution started.

integer

CHUCK_INTERLOCK

An indication of the state of an interlock function or control logic state intended to prevent the associated CHUCK component from being operated.

Valid Data Values: ACTIVE,INACTIVE

string

MANUAL_UNCLAMP

An indication of the state of an operator controlled interlock that can inhibit the ability to initiate an unclamp action of an electronically controlled chuck.

The *Valid Data Value* **MUST** be ACTIVE or INACTIVE.

When MANUAL_UNCLAMP is ACTIVE, it is expected that a chuck cannot be unclamped until MANUAL_UNCLAMP is set to INACTIVE.

Valid Data Values: ACTIVE,INACTIVE

string

CHUCK_STATE

An indication of the operating state of a mechanism that holds a part or stock material during a manufacturing process. It may also represent a mechanism that holds any other mechanism in place within a piece of equipment.

Valid Data Values: OPEN,CLOSED,UNLATCHED

string

~~CODE~~

DEPRECATED in Version 1.1.

COMPOSITION_STATE

An indication of the operating condition of a mechanism represented by a Composition type element.

subtypes: ACTION, LATERAL, MOTION, SWITCHED, VERTICAL

string

LATERAL

An indication of the position of a mechanism that may move in a lateral direction. The mechanism is represented by a Composition type component.

The position information indicates whether the Composition element is positioned to the right, to the left, or is in transition.

The *Valid Data Value* **MUST** be RIGHT, LEFT, or TRANSITIONING.

Valid Data Values: RIGHT,LEFT,TRANSITIONING

string

MOTION

An indication of the open or closed state of a mechanism. The mechanism is represented by a Composition type component.

The operating state indicates whether the state of the Composition element is open, closed, or unlatched.

The *Valid Data Value* **MUST** be OPEN, UNLATCHED, or CLOSED.

Valid Data Values: OPEN,CLOSED,UNLATCHED

string

SWITCHED

An indication of the activation state of a mechanism represented by a Composition type component.

The activation state indicates whether the Composition element is activated or not.

The *Valid Data Value* **MUST** be ON or OFF.

Valid Data Values: ON,OFF

string

VERTICAL

An indication of the position of a mechanism that may move in a vertical direction. The mechanism is represented by a Composition type component.

The position information indicates whether the Composition element is positioned to the top, to the bottom, or is in transition.

The *Valid Data Value* **MUST** be UP, DOWN, or TRANSITIONING.

Valid Data Values: UP,DOWN,TRANSITIONING

string

CONTROLLER_MODE

The current operating mode of the Controller component.

Valid Data Values: AUTOMATIC,MANUAL,MANUAL_DATA_INPUT,SEMI_AUTOMATIC,EDIT

string

CONTROLLER_MODE_OVERRIDE

A setting or operator selection that changes the behavior of a piece of equipment.

subtypes: DRY_RUN, SINGLE_BLOCK, MACHINE_AXIS_LOCK, OPTIONAL_STOP, TOOL_CHANGE_STOP

Valid Data Values: ON,OFF

string

DRY_RUN

A setting or operator selection used to execute a test mode to confirm the execution of machine functions.

The *Valid Data Value* **MUST** be ON or OFF.

When DRY_RUN is ON, the equipment performs all of its normal functions, except no part or product is produced. If the equipment has a spindle, spindle operation is suspended.

Valid Data Values: ON,OFF

string

MACHINE_AXIS_LOCK

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

When MACHINE_AXIS_LOCK is ON, program execution continues normally, but no equipment motion occurs

Valid Data Values: ON,OFF

string

OPTIONAL_STOP

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

The program execution is stopped after a specific program block is executed when OPTIONAL_STOP is ON.

In the case of a G-Code program, a program BLOCK containing a M01 code designates the command for an OPTIONAL_STOP.

EXECUTION **MUST** change to OPTIONAL_STOP after a program block specifying an optional stop is executed and the OPTIONAL_STOP selection is ON.

Valid Data Values: ON,OFF

string

SINGLE_BLOCK

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

Program execution is paused after each BLOCK of code is executed when SINGLE_BLOCK is ON.

When SINGLE_BLOCK is ON, EXECUTION **MUST** change to INTERRUPTED after completion of each BLOCK of code.

Valid Data Values: ON,OFF

string

TOOL_CHANGE_STOP

A setting or operator selection that changes the behavior of the controller on a piece of equipment.

The *Valid Data Value* **MUST** be ON or OFF.

Program execution is paused when a command is executed requesting a cutting tool to be changed.

EXECUTION **MUST** change to INTERRUPTED after completion of the command requesting a cutting tool to be changed and TOOL_CHANGE_STOP is ON.

Valid Data Values: ON,OFF

string

`COUPLED_AXES`

Refers to the set of associated axes.

arraystring

`DIRECTION`

The direction of motion.

subtypes: `ROTARY`, `LINEAR`

string

`ROTARY`

The rotational direction of a rotary motion using the right hand rule convention.

The *Valid Data Value* **MUST** be `CLOCKWISE` or `COUNTER_CLOCKWISE`.

Valid Data Values: `CLOCKWISE`,`COUNTER_CLOCKWISE`

string

DOOR_STATE

The operational state of a DOOR type component or composition element.

Valid Data Values: CLOSED,CLOSED,UNLATCHED

string

EMERGENCY_STOP

The current state of the emergency stop signal for a piece of equipment, controller path, or any other component or subsystem of a piece of equipment.

Valid Data Values: ARMED,TRIGGERED

string

END_OF_BAR

An indication of whether the end of a piece of bar stock being feed by a bar feeder has been reached.

subtypes: PRIMARY, AUXILIARY

Valid Data Values: YES,NO

string

PRIMARY

Specific applications **MAY** reference one or more locations on a piece of bar stock as the indication for the END_OF_BAR. The main or most important location **MUST** be designated as the PRIMARY indication for the END_OF_BAR.

If no subType is specified, PRIMARY **MUST** be the default END_OF_BAR indication.

Valid Data Values: YES,NO

string

EQUIPMENT_MODE

An indication that a piece of equipment, or a sub-part of a piece of equipment, is performing specific types of activities.

subtypes: LOADED, WORKING, OPERATING, POWERED, DELAY

Valid Data Values: ON,OFF

string

EXECUTION

The execution status of the Controller.

Valid Data Values: READY,ACTIVE,INTERRUPTED,FEED_HOLD,STOPPED,OPTIONAL_-
STOP,PROGRAM_STOPPED,PROGRAM_COMPLETED

string

FUNCTIONAL_MODE

The current intended production status of the device or component.

Valid Data Values: PRODUCTION,SETUP,TEARDOWN,MAINTENANCE,PROCESS_DEVELOPMENT

string

HARDNESS

The measurement of the hardness of a material.

subtypes: ROCKWELL, VICKERS, SHORE, BRINELL, LEEB, MOHS

float

INTERFACE_STATE

An indication of the operational state of an Interface component.

Valid Data Values: ENABLED,DISABLED

string

~~LINE~~

DEPRECATED in Version 1.4.0.

subtypes: MAXIMUM, MINIMUM

LINE_LABEL

An optional identifier for a BLOCK of code in a PROGRAM.

string

LINE_NUMBER

A reference to the position of a block of program code within a control program.

subtypes: ABSOLUTE, INCREMENTAL

integer

ABSOLUTE

The position of a block of program code relative to the beginning of the control program.

INCREMENTAL

The position of a block of program code relative to the occurrence of the last LINE_-LABEL encountered in the control program.

integer

MATERIAL

The identifier of a material used or consumed in the manufacturing process.

string

MESSAGE

Any text string of information to be transferred from a piece of equipment to a client software application.

string

OPERATOR_ID

The identifier of the person currently responsible for operating the piece of equipment.

string

PALLET_ID

The identifier for a pallet.

string

`PART_COUNT`

The count of parts produced.

subtypes: `ALL`, `GOOD`, `BAD`, `TARGET`, `REMAINING`

float

`PART_ID`

An identifier of a part in a manufacturing operation.

string

`PART_NUMBER`

An identifier of a part or product moving through the manufacturing process.

The *Valid Data Value* **MUST** be a text string.

string

PATH_FEEDRATE_OVERRIDE

The value of a signal or calculation issued to adjust the feedrate for the axes associated with a Path component that may represent a single axis or the coordinated movement of multiple axes.

subtypes: JOG, PROGRAMMED, RAPID

float

PATH_MODE

Describes the operational relationship between a Path *Structural Element* and another Path *Structural Element* for pieces of equipment comprised of multiple logical groupings of controlled axes or other logical operations.

Valid Data Values: INDEPENDENT,MASTER,SYNCHRONOUS,MIRROR

string

POWER_STATE

The indication of the status of the source of energy for a *Structural Element* to allow it to perform its intended function or the state of an enabling signal providing permission for the *Structural Element* to perform its functions.

subtypes: LINE, CONTROL

Valid Data Values: ON,OFF

string

`CONTROL`

The state of the enabling signal or control logic that enables or disables the function or operation of the *Structural Element*.

Valid Data Values: `ON`,`OFF`

string

`LINE`

The state of the power source for the *Structural Element*.

Valid Data Values: `ON`,`OFF`

string

~~`POWER_STATUS`~~

DEPRECATED in Version 1.1.0.

`PROGRAM`

The name of the logic or motion program being executed by the `Controller` component.

string

PROGRAM_COMMENT

A comment or non-executable statement in the control program.

The *Valid Data Value* **MUST** be a text string.

string

PROGRAM_EDIT

An indication of the status of the Controller components program editing mode.

On many controls, a program can be edited while another program is currently being executed.

Valid Data Values: ACTIVE,READY,NOT_READY

string

PROGRAM_EDIT_NAME

The name of the program being edited.

This is used in conjunction with PROGRAM_EDIT when in ACTIVE state.

The *Valid Data Value* **MUST** be a text string.

string

PROGRAM_HEADER

The non-executable header section of the control program.

string

ROTARY_MODE

The current operating mode for a Rotary type axis.

Valid Data Values: SPINDLE,INDEX,CONTOUR

string

ROTARY_VELOCITY_OVERRIDE

The value of a command issued to adjust the programmed velocity for a Rotary type axis.

This command represents a percentage change to the velocity calculated by a logic or motion program or set by a switch for a Rotary type axis.

float

SERIAL_NUMBER

The serial number associated with a Component, Asset, or Device. The *Valid Data Value* **MUST** be a text string.

string

SPINDLE_INTERLOCK

An indication of the status of the spindle for a piece of equipment when power has been removed and it is free to rotate.

Valid Data Values: ACTIVE,INACTIVE

string

TOOL_ASSET_ID

The identifier of an individual tool asset.The *Valid Data Value* **MUST** be a text string.

string

TOOL_ID

DEPRECATED in Version 1.2.0. See TOOL_ASSET_ID. ~~The identifier of the tool currently in use for a given~~ Path.~~.~~

TOOL_NUMBER

The identifier assigned by the Controller component to a cutting tool when in use by a piece of equipment.

The *Valid Data Value* **MUST** be a text string.

string

`TOOL_OFFSET`

A reference to the tool offset variables applied to the active cutting tool associated with a `Path` in a `Controller` type component.

subtypes: `RADIAL`, `LENGTH`

float

`RADIAL`

A reference to a radial type tool offset variable.

float

`LENGTH`

A reference to a length type tool offset variable.

float

`USER`

The identifier of the person currently responsible for operating the piece of equipment.

subtypes: `OPERATOR`, `MAINTENANCE`, `SET_UP`

string

`OPERATOR`

The identifier of the person currently responsible for operating the piece of equipment.

string

`SET_UP`

The identifier of the person currently responsible for preparing a piece of equipment for production or restoring the piece of equipment to a neutral state after production.

string

`WIRE`

A string like piece or filament of relatively rigid or flexible material provided in a variety of diameters.

string

`WORK_OFFSET`

A reference to the offset variables for a work piece or part associated with a `Path` in a `Controller` type component.

float

`WORKHOLDING_ID`

The identifier for the current workholding or part clamp in use by a piece of equipment.

The *Valid Data Value* **MUST** be a text string.

string

`ASSET_CHANGED`

The value of the CDATA for the event **MUST** be the `assetId` of the asset that has been added or changed. There will not be a separate message for new assets.

string

`ASSET_REMOVED`

The value of the CDATA for the event **MUST** be the `assetId` of the asset that has been removed. The asset will still be visible if requested with the `includeRemoved` parameter as described in the protocol section. When assets are removed they are not moved to the beginning of the most recently modified list.

string

`OPEN_DOOR`

Service to open a door.

string

CLOSE_DOOR

Service to close a door.

string

OPEN_CHUCK

Service to open a chuck.

string

CLOSE_CHUCK

Service to close a chuck.

string

MATERIAL_FEED

Service to advance material or feed product to a piece of equipment from a continuous or bulk source.

string

MATERIAL_CHANGE

Service to change the type of material or product being loaded or fed to a piece of equipment.

string

MATERIAL_RETRACT

Service to remove or retract material or product.

string

PART_CHANGE

Service to change the part or product associated with a piece of equipment to a different part or product.

string

MATERIAL_LOAD

Service to load a piece of material or product.

string

`MATERIAL_UNLOAD`

Service to unload a piece of material or product.

string

1.5 Condition Data Items

ACTUATOR

A mechanism for moving or controlling a mechanical part of a piece of equipment.

It takes energy usually provided by air, electric current, or liquid and converts the energy into some kind of motion.

CHUCK_INTERLOCK

An indication of the state of an interlock function or control logic state intended to prevent the associated CHUCK component from being operated.

DIRECTION

The direction of motion.

END_OF_BAR

An indication of whether the end of a piece of bar stock being feed by a bar feeder has been reached.

INTERFACE_STATE

An indication of the operational state of an Interface component.

COMMUNICATIONS

An indication that the piece of equipment has experienced a communications failure.

DATA_RANGE

An indication that the value of the data associated with a measured value or a calculation is outside of an expected range.

HARDWARE

An indication of a fault associated with the hardware subsystem of the *Structural Element*.

LOGIC_PROGRAM

An indication that an error occurred in the logic program or programmable logic controller (PLC) associated with a piece of equipment.

MOTION_PROGRAM

An indication that an error occurred in the motion program associated with a piece of equipment.

SYSTEM

A general purpose indication associated with an electronic component of a piece of equipment or a controller that represents a fault that is not associated with the operator, program, or hardware.
