MTConnect® Standard
Part 3.0 – Streams Information Model
Version 1.5.0

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MTConnect Specification and Materials

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1 Purpose of This Document

This document, *MTConnect Standard: Part 3.0 - Streams Information Model* of the MTConnect Standard, establishes the rules and terminology that describes the information returned by an MTConnect *Agent* from a piece of equipment. The *Streams Information Model* also defines, in *Section* **??** - **??**, the structure for the XML documents that are returned from an *Agent* in response to a *Sample Request* or *Current Request*.

MTConnect Standard: Part 3.0 - Streams Information Model is not a stand-alone document. This document is used in conjunction with *MTConnect Standard Part 1.0 - Overview and Fundamentals* which defines the fundamentals of the operation of the MTConnect Standard and *MTConnect Standard: Part 2.0 - Devices Information Model* that defines the semantic model representing the information that may be returned from a piece of equipment.

Note: *MTConnect Standard: Part 5.0 - Interfaces* provides details on extensions to the *Streams Information Model* required to describe the interactions between pieces of equipment.

In the MTConnect Standard, equipment represents any tangible property that is used in the operation of a manufacturing facility. Examples of equipment are machine tools, ovens, sensor units, workstations, software applications, and bar feeders.

2 Terminology and Conventions

Refer to *Section 3* of *MTConnect Standard Part 1.0 - Overview and Fundamentals* for a dictionary of terms, reserved language, and document conventions used in the MTConnect Standard.

2.1 Glossary

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.

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.

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*.

Asset Document

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

Current Request

: An HTTP request to the *Agent* for returning latest known values for the `DataItem` as an `MTConnectStreams` XML document

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*.

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*.

Equipment Metadata

See *Metadata*

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 Document

See *Document*.

MTConnect XML Document

See *Document*.

Response Document

See *Document*.

Sample Request

A request from the *Agent* for a stream of time series data.

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*.

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*.

2.2 Acronyms

AMT

The Association for Manufacturing Technology

2.3 MTConnect References

[MTConnect Part 1.0] *MTConnect Standard Part 1.0 - Overview and Fundamentals*. Version 1.5.0.

[MTConnect Part 2.0] *MTConnect Standard: Part 2.0 - Devices Information Model*. Version 1.5.0.

[MTConnect Part 3.0] *MTConnect Standard: Part 3.0 - Streams Information Model*. Version 1.5.0.

[MTConnect Part 5.0] *MTConnect Standard: Part 5.0 - Interfaces*. Version 1.5.0.

3 Observations Model

3.1 Observations

3.1.1 DataSet

Placeholder for documentation!

Table 1: `Properties of DataSet`

Properties	Value	Multiplicity
`count`	`integer`	1
`Entry`	`Entry`	0..*
`observationDataSet`		1

3.1.1.1 `count`

Placeholder for documentation!

3.1.1.2 `Entry`

Placeholder for documentation!

3.1.1.3 `observationDataSet`

Placeholder for documentation!

3.1.2 Discrete

Placeholder for documentation!

Table 2: `Properties of Discrete`

Properties	Value	Multiplicity
observationDiscrete		1

3.1.2.1 observationDiscrete

Placeholder for documentation!

3.1.3 Entry

Placeholder for documentation!

Table 3: `Properties of Entry`

Properties	Value	Multiplicity
key	ID	1
removed	boolean	0..1
Entry	DataSet	1
value	T	0..1

3.1.3.1 key

Placeholder for documentation!

3.1.3.2 removed

Placeholder for documentation!

3.1.3.3 Entry

Placeholder for documentation!

3.1.3.4 value

Placeholder for documentation!

3.1.4 Observation

Placeholder for documentation!

Table 4: Properties of Observation

Properties	Value	Multiplicity
compositionId	ID	0..1
dataItemId	ID	1
name	string	0..1
sequence	integer	1
subType	string	0..1
timestamp	dateTime	1
type	string	1
category	CategoryEnum	1
units	string	0..1
isUnavailable	boolean	1
result	string	0..1

3.1.4.1 compositionId

Placeholder for documentation!

3.1.4.2 dataItemId

Placeholder for documentation!

3.1.4.3 name

Placeholder for documentation!

3.1.4.4 sequence

Placeholder for documentation!

3.1.4.5 subType

Placeholder for documentation!

3.1.4.6 timestamp

Placeholder for documentation!

3.1.4.7 type

Placeholder for documentation!

3.1.4.8 category

Placeholder for documentation!

Placeholder for documentation!

Table 5: `CategoryEnum` Enumeration

Name	Description
SAMPLE	Placeholder for documentation!
EVENT	Placeholder for documentation!
CONDITION	Placeholder for documentation!

3.1.4.9 units

Placeholder for documentation!

3.1.4.10 isUnavailable

Placeholder for documentation!

3.1.4.11 result

Placeholder for documentation!

3.1.5 Condition

Subtype of Observation

Placeholder for documentation!

Table 6: Properties of Condition

Properties	Value	Multiplicity
nativeCode	string	0..1
nativeSeverity	string	0..1
qualifier	QualifierEnum	0..1
statistic	StatisticEnum	0..1
xs:lang	xslang	0..1
Condition	ProtocolStack	1
category	CategoryEnum	1

3.1.5.1 nativeCode

Placeholder for documentation!

3.1.5.2 nativeSeverity

Placeholder for documentation!

3.1.5.3 qualifier

Placeholder for documentation!

Placeholder for documentation!

Table 7: `QualifierEnum` Enumeration

Name	Description
HIGH	Placeholder for documentation!
LOW	Placeholder for documentation!

3.1.5.4 statistic

Placeholder for documentation!

Placeholder for documentation!

Table 8: `StatisticEnum` Enumeration

Name	Description
AVERAGE	Placeholder for documentation!
KURTOSIS	Placeholder for documentation!
MAXIMUM	Placeholder for documentation!
MEDIAN	Placeholder for documentation!
MINIMUM	Placeholder for documentation!
MODE	Placeholder for documentation!
RANGE	Placeholder for documentation!
ROOT_MEAN_SQUARE	Placeholder for documentation!
STANDARD_DEVIATION	Placeholder for documentation!

3.1.5.5 xs:lang

Placeholder for documentation!

3.1.5.6 Condition

Placeholder for documentation!

3.1.5.7 category

Placeholder for documentation!

183 Placeholder for documentation!

Table 9: `CategoryEnum` Enumeration

Name	Description
SAMPLE	Placeholder for documentation!
EVENT	Placeholder for documentation!
CONDITION	Placeholder for documentation!

184 3.1.6 Event

185 **Subtype of Observation**

186 Placeholder for documentation!

Table 10: `Properties of Event`

Properties	Value	Multiplicity
resetTriggered	ResetTriggeredEnum	0..1
Events	ProtocolStack	1
category	CategoryEnum	1

187 3.1.6.1 resetTriggered

188 Placeholder for documentation!

189 Placeholder for documentation!

Table 11: `ResetTriggeredEnum` Enumeration

Name	Description
ACTION_COMPLETE	Placeholder for documentation!
ANNUAL	Placeholder for documentation!
DAY	Placeholder for documentation!
MAINTENANCE	Placeholder for documentation!
MANUAL	Placeholder for documentation!
MONTH	Placeholder for documentation!
POWER_ON	Placeholder for documentation!
SHIFT	Placeholder for documentation!
WEEK	Placeholder for documentation!

3.1.6.2 Events

Placeholder for documentation!

3.1.6.3 category

Placeholder for documentation!

Placeholder for documentation!

Table 12: `CategoryEnum` Enumeration

Name	Description
SAMPLE	Placeholder for documentation!
EVENT	Placeholder for documentation!
CONDITION	Placeholder for documentation!

3.1.7 Sample

Subtype of Observation

Placeholder for documentation!

Table 13: `Properties of Sample`

Properties	Value	Multiplicity
duration	second	0..1
resetTriggered	ResetTriggeredEnum	0..1
sampleRate	float	0..1
statistic	StatisticEnum	0..1
Samples	ProtocolStack	1
category	CategoryEnum	1
result	float	0..1
units	string	1

3.1.7.1 duration

Placeholder for documentation!

3.1.7.2 resetTriggered

Placeholder for documentation!

Placeholder for documentation!

Table 14: `ResetTriggeredEnum` Enumeration

Name	Description
ACTION_COMPLETE	Placeholder for documentation!
ANNUAL	Placeholder for documentation!
DAY	Placeholder for documentation!
MAINTENANCE	Placeholder for documentation!
MANUAL	Placeholder for documentation!
MONTH	Placeholder for documentation!
POWER_ON	Placeholder for documentation!
SHIFT	Placeholder for documentation!
WEEK	Placeholder for documentation!

3.1.7.3 sampleRate

Placeholder for documentation!

3.1.7.4 statistic

Placeholder for documentation!

Placeholder for documentation!

Table 15: StatisticEnum Enumeration

Name	Description
AVERAGE	Placeholder for documentation!
KURTOSIS	Placeholder for documentation!
MAXIMUM	Placeholder for documentation!
MEDIAN	Placeholder for documentation!
MINIMUM	Placeholder for documentation!
MODE	Placeholder for documentation!
RANGE	Placeholder for documentation!
ROOT_MEAN_SQUARE	Placeholder for documentation!
STANDARD_DEVIATION	Placeholder for documentation!

3.1.7.5 Samples

Placeholder for documentation!

3.1.7.6 category

Placeholder for documentation!

Placeholder for documentation!

Table 16: CategoryEnum Enumeration

Name	Description
SAMPLE	Placeholder for documentation!
EVENT	Placeholder for documentation!
CONDITION	Placeholder for documentation!

3.1.7.7 units

Placeholder for documentation!

3.1.8 ProtocolStack

Placeholder for documentation!

Table 17: `Properties of ProtocolStack`

Properties	Value	Multiplicity
`Condition`	`Condition`	0..*
`Samples`	`Sample`	0..*
`Events`	`Event`	0..*

3.1.8.1 `Condition`

Placeholder for documentation!

3.1.8.2 `Samples`

Placeholder for documentation!

3.1.8.3 `Events`

Placeholder for documentation!

3.1.9 TimeSeries

Placeholder for documentation!

Table 18: `Properties of TimeSeries`

Properties	Value	Multiplicity
`sampleCount`	`integer`	1
`observationTimeSeries`		1

3.1.9.1 `sampleCount`

Placeholder for documentation!

3.1.9.2 `observationTimeSeries`

Placeholder for documentation!

3.2 ConditionTypes

3.2.1 Fault

Subtype of Condition

Placeholder for documentation!

3.2.2 Normal

Subtype of Condition

Placeholder for documentation!

3.2.3 Warning

Subtype of Condition

Placeholder for documentation!

3.3 EventTypes

3.3.1 ActiveAxes

Subtype of Event

The set of axes currently associated with a model:Path or model:Controller term:Structural Element.

Table 19: `Properties of ActiveAxes`

Properties	Value
type	ACTIVE_AXES

3.3.2 ActuatorState

Subtype of Event

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

Table 20: `Properties of ActuatorState`

Properties	Value
type	ACTUATOR_STATE
result	ActuatorStateEnum

Enumerated `result` values for `ActuatorState` are:

Table 21: `ActuatorStateEnum` Enumeration

Name	Description
ACTIVE	The value of the term:Data Entity that is engaging.
INACTIVE	The value of the term:Data Entity that is not engaging.

3.3.3 Alarm

Subtype of Event

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

Table 22: `Properties of Alarm`

Properties	Value
type	ALARM

3.3.4 AssetChanged

Subtype of Event

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

Table 23: `Properties of AssetChanged`

Properties	Value
type	ASSET_CHANGED

3.3.5 AssetRemoved

Subtype of Event

The value of the term:CDATA for the event *MUST* be the model:assetId of the asset that has been removed. The asset will still be visible if requested with the model: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.

Table 24: `Properties of AssetRemoved`

Properties	Value
type	ASSET_REMOVED

3.3.6 Availability

Subtype of Event

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

Table 25: `Properties of Availability`

Properties	Value
`type`	`AVAILABILITY`
`result`	`AvailabilityEnum`

Enumerated `result` values for `Availability` are:

Table 26: `AvailabilityEnum` Enumeration

Name	Description
`AVAILABLE`	The value or status of an XML element when it is available.
`UNAVAILABLE`	The value of the term:Data Entity either when the data is not received or the entity is incapable of providing data.

3.3.7 AxisCoupling

Subtype of Event

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

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

Table 27: `Properties of AxisCoupling`

Properties	Value
`type`	`AXIS_COUPLING`
`result`	`AxisCouplingEnum`

Enumerated `result` values for `AxisCoupling` are:

Table 28: `AxisCouplingEnum` Enumeration

Name	Description
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 model:DataItem of similar type.
SLAVE	The axis is a slave to the model:COUPLED_AXES

3.3.8 AxisFeedrateOverride

Subtype of Event

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

Table 29: `Properties of AxisFeedrateOverride`

Properties	Value
type	AXIS_FEEDRATE_OVERRIDE

Subtypes of `AxisFeedrateOverride` are :

- `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 model:Axes.
- `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.

3.3.9 AxisInterlock

Subtype of Event

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

Table 30: `Properties of AxisInterlock`

Properties	Value
`type`	`AXIS_INTERLOCK`
`result`	`ActuatorStateEnum`

Enumerated `result` values for `AxisInterlock` are:

Table 31: `ActuatorStateEnum` Enumeration

Name	Description
`ACTIVE`	The value of the term:Data Entity that is engaging.
`INACTIVE`	The value of the term:Data Entity that is not engaging.

288

289 3.3.10 AxisState

290 **Subtype of Event**

291 An indicator of the controlled state of a model:Linear or model:Rotary component repre-
292 senting an axis.

Table 32: `Properties of AxisState`

Properties	Value
`type`	`AXIS_STATE`
`result`	`AxisStateEnum`

293 Enumerated `result` values for `AxisState` are:

Table 33: `AxisStateEnum` Enumeration

Name	Description
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.

3.3.11 Block

Subtype of Event

The line of code or command being executed by a model:Controller term:Structural Element.

Table 34: `Properties of Block`

Properties	Value
type	BLOCK

3.3.12 BlockCount

Subtype of Event

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

Table 35: `Properties of BlockCount`

Properties	Value
type	BLOCK_COUNT

3.3.13 ChuckInterlock

Subtype of Event

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

Table 36: `Properties of ChuckInterlock`

Properties	Value
`type`	`CHUCK_INTERLOCK`
`result`	`ActuatorStateEnum`

Enumerated `result` values for `ChuckInterlock` are:

Table 37: `ActuatorStateEnum` Enumeration

Name	Description
`ACTIVE`	The value of the term:Data Entity that is engaging.
`INACTIVE`	The value of the term:Data Entity that is not engaging.

Subtypes of `ChuckInterlock` are :

- `ManualUnclamp` : 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 term:Valid Data Value *MUST* be model:ACTIVE or model:INACTIVE. When model:MANUAL_UNCLAMP is model:ACTIVE, it is expected that a chuck cannot be unclamped until model:MANUAL_UNCLAMP is set to model:INACTIVE.

3.3.14 ChuckState

Subtype of Event

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.

Table 38: `Properties of ChuckState`

Properties	Value
`type`	`CHUCK_STATE`
`result`	`LatchedStateEnum`

Enumerated `result` values for `ChuckState` are:

Table 39: `LatchedStateEnum` Enumeration

Name	Description
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.

3.3.15 CloseChuck

Subtype of Event

Service to close a chuck.

Table 40: `Properties of CloseChuck`

Properties	Value
type	CLOSE_CHUCK

3.3.16 CloseDoor

Subtype of Event

Service to close a door.

Table 41: `Properties of CloseDoor`

Properties	Value
type	CLOSE_DOOR

3.3.17 Code

Subtype of Event

DEPRECATED in Version 1.1.

Table 42: `Properties of Code`

Properties	Value
type	CODE

3.3.18 CompositionState

Subtype of Event

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

Table 43: `Properties of CompositionState`

Properties	Value
type	COMPOSITION_STATE

Subtypes of `CompositionState` are :

- `Action` : An indication of the operating state of a mechanism represented by a model:Composition type component. The operating state indicates whether the model:Composition element is activated or disabled. The term:Valid Data Value *MUST* be model:ACTIVE or model:INACTIVE.
- `Lateral` : An indication of the position of a mechanism that may move in a lateral direction. The mechanism is represented by a model:Composition type component. The position information indicates whether the model:Composition element is positioned to the right, to the left, or is in transition. The term:Valid Data Value *MUST* be model:RIGHT, model:LEFT, or model:TRANSITIONING.
- `Motion` : An indication of the open or closed state of a mechanism. The mechanism is represented by a model:Composition type component. The operating state indicates whether the state of the model:Composition element is open, closed, or unlatched. The term:Valid Data Value *MUST* be model:OPEN, model:UNLATCHED, or model:CLOSED.
- `Switched` : An indication of the activation state of a mechanism represented by a model:Composition type component. The activation state indicates whether the model:Composition element is activated or not. The term:Valid Data Value *MUST* be model:ON or model:OFF.
- `Vertical` : An indication of the position of a mechanism that may move in a vertical direction. The mechanism is represented by a model:Composition type component. The position information indicates whether the model:Composition element is

positioned to the top, to the bottom, or is in transition. The term:Valid Data Value *MUST* be model:UP, model:DOWN, or model:TRANSITIONING.

3.3.19 ControllerMode

Subtype of Event

The current operating mode of the model:Controller component.

Table 44: `Properties of ControllerMode`

Properties	Value
`type`	`CONTROLLER_MODE`
`result`	`ControllerModeEnum`

Enumerated `result` values for `ControllerMode` are:

Table 45: `ControllerModeEnum` Enumeration

Name	Description
`AUTOMATIC`	The model: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.

3.3.20 ControllerModeOverride

Subtype of Event

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

Table 46: `Properties of ControllerModeOverride`

Properties	Value
`type`	`CONTROLLER_MODE_OVERRIDE`
`result`	`OnOffEnum`

Enumerated `result` values for `ControllerModeOverride` are:

Table 47: `OnOffEnum` Enumeration

Name	Description
`ON`	On state or value.
`OFF`	Off state or value.

Subtypes of `ControllerModeOverride` are :

- `DryRun` : A setting or operator selection used to execute a test mode to confirm the execution of machine functions. The term:Valid Data Value *MUST* be model:ON or model:OFF. When model:DRY_RUN is model: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.

- `MachineAxisLock` : A setting or operator selection that changes the behavior of the controller on a piece of equipment. The term:Valid Data Value *MUST* be model:ON or model:OFF. When model:MACHINE_AXIS_LOCK is model:ON, program execution continues normally, but no equipment motion occurs

- `OptionalStop` : A setting or operator selection that changes the behavior of the controller on a piece of equipment. The term:Valid Data Value *MUST* be model:ON or model:OFF. The program execution is stopped after a specific program block is executed when model:OPTIONAL_STOP is model:ON. In the case of a G-Code program, a program model:BLOCK containing a M01 code designates the command for an model:OPTIONAL_STOP. model:EXECUTION *MUST* change to model:OPTIONAL_STOP after a program block specifying an optional stop is executed and the model:OPTIONAL_STOP selection is model:ON.

- `SingleBlock` : A setting or operator selection that changes the behavior of the controller on a piece of equipment. The term:Valid Data Value *MUST* be model:ON or model:OFF. Program execution is paused after each model:BLOCK of code is executed when model:SINGLE_BLOCK is model:ON. When model:SINGLE_-BLOCK is model:ON, model:EXECUTION *MUST* change to model:INTERRUPTED after completion of each model:BLOCK of code.

- `ToolChangeStop` : A setting or operator selection that changes the behavior of the controller on a piece of equipment. The term:Valid Data Value *MUST* be model:ON or model:OFF. Program execution is paused when a command is executed requesting a cutting tool to be changed. model:EXECUTION *MUST* change to model:INTERRUPTED after completion of the command requesting a cutting tool to be changed and model:TOOL_CHANGE_STOP is model:ON.

3.3.21 CoupledAxes

Subtype of Event

Refers to the set of associated axes.

Table 48: `Properties of CoupledAxes`

Properties	Value
type	COUPLED_AXES

3.3.22 DateCode

Subtype of Event

The time and date code associated with a material or other physical item.

model:DATE_CODE *MUST* be reported in ISO 8601 format.

Table 49: `Properties of DateCode`

Properties	Value
type	DATE_CODE

Subtypes of `DateCode` are :

- `Expiration` : The time and date code relating to the expiration or end of useful life for a material or other physical item.
- `FirstUse` : The time and date code relating the first use of a material or other physical item.
- `Manufacture` : The time and date code relating to the production of a material or other physical item.

3.3.23 DeviceUuid

Subtype of Event

The identifier of another piece of equipment that is temporarily associated with a component of this piece of equipment to perform a particular function.

The term:Valid Data Value *MUST* be a NMTOKEN XML type.

Table 50: `Properties of DeviceUuid`

Properties	Value
`type`	`DEVICE_UUID`

3.3.24 Direction

Subtype of Event

The direction of motion.

Table 51: `Properties of Direction`

Properties	Value
`type`	`DIRECTION`

Subtypes of `Direction` are :

- `Linear` : The direction of motion of a linear motion.
- `Rotary` : The rotational direction of a rotary motion using the right hand rule convention. The term:Valid Data Value *MUST* be model:CLOCKWISE or model:COUNTER_-CLOCKWISE.

3.3.25 DoorState

Subtype of Event

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

Table 52: `Properties of DoorState`

Properties	Value
type	DOOR_STATE
result	LatchedStateEnum

Enumerated `result` values for `DoorState` are:

Table 53: `LatchedStateEnum` Enumeration

Name	Description
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.

3.3.26 EmergencyStop

Subtype of Event

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.

Table 54: `Properties of EmergencyStop`

Properties	Value
type	EMERGENCY_STOP
result	EmergencyStopEnum

Enumerated `result` values for `EmergencyStop` are:

Table 55: `EmergencyStopEnum` Enumeration

Name	Description
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.

3.3.27 EndOfBar

Subtype of Event

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

Table 56: `Properties of EndOfBar`

Properties	Value
type	END_OF_BAR
result	YesNoEnum

Enumerated `result` values for `EndOfBar` are:

Table 57: `YesNoEnum` Enumeration

Name	Description
YES	The model:END_OF_BAR has been reached.
NO	The model:END_OF_BAR has not been reached.

Subtypes of `EndOfBar` are :

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

- `Primary` : Specific applications *MAY* reference one or more locations on a piece of bar stock as the indication for the model:END_OF_BAR. The main or most important location *MUST* be designated as the model:PRIMARY indication for the model:END_OF_BAR. If no model:subType is specified, model:PRIMARY *MUST* be the default model:END_OF_BAR indication.

3.3.28 EquipmentMode

Subtype of Event

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

Table 58: `Properties of EquipmentMode`

Properties	Value
`type`	`EQUIPMENT_MODE`
`result`	`OnOffEnum`

Enumerated `result` values for `EquipmentMode` are:

Table 59: `OnOffEnum` Enumeration

Name	Description
`ON`	On state or value.
`OFF`	Off state or value.

Subtypes of `EquipmentMode` are :

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

3.3.29 Execution

Subtype of Event

The execution status of the model:Controller.

Table 60: Properties of Execution

Properties	Value
type	EXECUTION
result	ExecutionEnum

Enumerated result values for Execution are:

Table 61: ExecutionEnum Enumeration

Name	Description
READY	A component is ready to engage.
ACTIVE	The value of the term:Data Entity that is engaging.
INTERRUPTED	The action of a model:Component has been suspended due to an external signal.
FEED_HOLD	Motion of a model:Component has been commanded to stop at its current position.
STOPPED	The component is stopped.
OPTIONAL_STOP	The controllers program has been intentionally stopped
PROGRAM_STOPPED	The execution of the model:Controller's program has been stopped by a command from within the program.
PROGRAM_COMPLETED	The execution of the controllers program has been stopped by a command from within the program.

3.3.30 FunctionalMode

Subtype of Event

The current intended production status of the device or component.

Table 62: Properties of FunctionalMode

Properties	Value
type	FUNCTIONAL_MODE
result	FunctionalModeEnum

Enumerated result values for FunctionalMode are:

Table 63: `FunctionalModeEnum` Enumeration

Name	Description
PRODUCTION	A term:Structural Element is currently producing product.
SETUP	A term:Structural Element is being prepared or modified to begin production of product.
TEARDOWN	Typically, a term: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.
MAINTENANCE	Action related to maintenance on the piece of equipment.
PROCESS_DEVELOPMENT	A term:Structural Element is being used to prove-out a new process.

3.3.31 Hardness

Subtype of Event

The measurement of the hardness of a material.

Table 64: `Properties of Hardness`

Properties	Value
type	HARDNESS

Subtypes of `Hardness` are :

- `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.

3.3.32 InterfaceState

Subtype of Event

An indication of the operational state of an model:Interface component.

Table 65: `Properties of InterfaceState`

Properties	Value
`type`	`INTERFACE_STATE`
`result`	`EnabledStateEnum`

Enumerated `result` values for `InterfaceState` are:

Table 66: `EnabledStateEnum` Enumeration

Name	Description
`ENABLED`	A component is currently operational and performing as expected.
`DISABLED`	A component is currently not operational.

3.3.33 Line

Subtype of Event

DEPRECATED in Version 1.4.0.

Table 67: `Properties of Line`

Properties	Value
`type`	`LINE`

Subtypes of `Line` are :

- `Maximum` : Maximum value of a data entity or attribute.
- `Minimum` : The minimum value of a data entity or attribute.

3.3.34 LineLabel

Subtype of Event

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

Table 68: `Properties of LineLabel`

Properties	Value
`type`	`LINE_LABEL`

3.3.35 LineNumber

Subtype of Event

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

Table 69: `Properties of LineNumber`

Properties	Value
`type`	`LINE_NUMBER`

Subtypes of `LineNumber` are :

- `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 model:LINE_LABEL encountered in the control program.

3.3.36 Material

Subtype of Event

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

Table 70: `Properties of Material`

Properties	Value
`type`	`MATERIAL`

3.3.37 MaterialChange

Subtype of Event

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

Table 71: `Properties of MaterialChange`

Properties	Value
`type`	`MATERIAL_CHANGE`

3.3.38 MaterialFeed

Subtype of Event

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

Table 72: `Properties of MaterialFeed`

Properties	Value
`type`	`MATERIAL_FEED`

3.3.39 MaterialLayer

Subtype of Event

Identifies the layers of material applied to a part or product as part of an additive manufacturing process.

The term:Valid Data Value *MUST* be an integer.

Table 73: `Properties of MaterialLayer`

Properties	Value
`type`	`MATERIAL_LAYER`

Subtypes of `MaterialLayer` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.

- `Target` : The desired measure or count for a data item value.

3.3.40 MaterialLoad

Subtype of Event

Service to load a piece of material or product.

Table 74: `Properties of MaterialLoad`

Properties	Value
`type`	`MATERIAL_LOAD`

3.3.41 MaterialRetract

Subtype of Event

Service to remove or retract material or product.

Table 75: `Properties of MaterialRetract`

Properties	Value
`type`	`MATERIAL_RETRACT`

3.3.42 MaterialUnload

Subtype of Event

Service to unload a piece of material or product.

Table 76: `Properties of MaterialUnload`

Properties	Value
`type`	`MATERIAL_UNLOAD`

3.3.43 Message

Subtype of Event

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

Table 77: `Properties of Message`

Properties	Value
type	MESSAGE

3.3.44 OpenChuck

Subtype of Event

Service to open a chuck.

Table 78: `Properties of OpenChuck`

Properties	Value
type	OPEN_CHUCK

3.3.45 OpenDoor

Subtype of Event

Service to open a door.

Table 79: `Properties of OpenDoor`

Properties	Value
type	OPEN_DOOR

3.3.46 OperatorId

Subtype of Event

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

Table 80: `Properties of OperatorId`

Properties	Value
type	OPERATOR_ID

538 3.3.47 PalletId

539 Subtype of Event

540 The identifier for a pallet.

Table 81: `Properties of PalletId`

Properties	Value
type	PALLET_ID

541 3.3.48 PartChange

542 Subtype of Event

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

Table 82: `Properties of PartChange`

Properties	Value
type	PART_CHANGE

545 3.3.49 PartCount

546 Subtype of Event

547 The count of parts produced.

Table 83: `Properties of PartCount`

Properties	Value
type	PART_COUNT

Subtypes of `PartCount` are :

- `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.
- `Target` : The desired measure or count for a data item value.

3.3.50 PartDetect

Subtype of Event

An indication designating whether a part or work piece has been detected or is present.

The term:Valid Data Value *MUST* be model:PRESENT or model:NOT_PRESENT.

Table 84: `Properties of PartDetect`

Properties	Value
type	PART_DETECT

3.3.51 PartId

Subtype of Event

An identifier of a part in a manufacturing operation.

Table 85: `Properties of PartId`

Properties	Value
type	PART_ID

562 3.3.52 PartNumber

563 Subtype of Event

564 An identifier of a part or product moving through the manufacturing process. The term:Valid
565 Data Value *MUST* be a text string.

Table 86: `Properties of PartNumber`

Properties	Value
type	PART_NUMBER

566 3.3.53 PathFeedrateOverride

567 Subtype of Event

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

Table 87: `Properties of PathFeedrateOverride`

Properties	Value
type	PATH_FEEDRATE_OVERRIDE

571 Subtypes of `PathFeedrateOverride` are :

572 • `Jog` : The feedrate specified by a logic or motion program, by a pre-set value, or set
573 by a switch as the feedrate for the model:Axes.

574 • `Programmed` : The value of a signal or calculation specified by a logic or motion
575 program or set by a switch.

576 • `Rapid` : The value of a signal or calculation issued to adjust the feedrate of a
577 component or composition that is operating in a rapid positioning mode.

3.3.54 PathMode

Subtype of Event

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

Table 88: `Properties of PathMode`

Properties	Value
`type`	`PATH_MODE`
`result`	`PathModeEnum`

Enumerated `result` values for `PathMode` are:

Table 89: `PathModeEnum` Enumeration

Name	Description
`INDEPENDENT`	The path is operating independently and without the influence of another path.
`MASTER`	It provides information or state values that influences the operation of other model:DataItem of similar type.
`SYNCHRONOUS`	Physical or logical parts which are not physically connected to each other but are operating together.
`MIRROR`	The axes associated with the path are mirroring the motion of the model:MASTER path.

3.3.55 PowerState

Subtype of Event

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

Table 90: `Properties of PowerState`

Properties	Value
`type`	`POWER_STATE`
`result`	`OnOffEnum`

Enumerated `result` values for `PowerState` are:

Table 91: `OnOffEnum` Enumeration

Name	Description
`ON`	On state or value.
`OFF`	Off state or value.

Subtypes of `PowerState` are :

- `Control` : The state of the enabling signal or control logic that enables or disables the function or operation of the term:Structural Element.
- `Line` : The state of the power source for the term:Structural Element.

3.3.56 PowerStatus

Subtype of Event

DEPRECATED in Version 1.1.0.

Table 92: `Properties of PowerStatus`

Properties	Value
`type`	`POWER_STATUS`

3.3.57 ProcessTime

Subtype of Event

The time and date associated with an activity or event.

model:PROCESS_TIME *MUST* be reported in ISO 8601 format.

Table 93: `Properties of ProcessTime`

Properties	Value
type	PROCESS_TIME

Subtypes of `ProcessTime` are :

- `Complete` : Completion of an action.
- `Start` : The time and date associated with the beginning of an activity or event.
- `TargetCompletion` : The projected time and date associated with the end or completion of an activity or event.

3.3.58 Program

Subtype of Event

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

Table 94: `Properties of Program`

Properties	Value
type	PROGRAM

3.3.59 ProgramComment

Subtype of Event

A comment or non-executable statement in the control program. The term:Valid Data Value *MUST* be a text string.

Table 95: `Properties of ProgramComment`

Properties	Value
type	PROGRAM_COMMENT

3.3.60 ProgramEdit

Subtype of Event

An indication of the status of the model:Controller components program editing mode. On many controls, a program can be edited while another program is currently being executed.

Table 96: `Properties of ProgramEdit`

Properties	Value
`type`	`PROGRAM_EDIT`
`result`	`ActiveStateEnum`

Enumerated `result` values for `ProgramEdit` are:

Table 97: `ActiveStateEnum` Enumeration

Name	Description
`ACTIVE`	The value of the term:Data Entity that is engaging.
`READY`	A component is ready to engage.
`NOT_READY`	A component is not ready to engage.

3.3.61 ProgramEditName

Subtype of Event

The name of the program being edited. This is used in conjunction with model:PROGRAM_-EDIT when in model:ACTIVE state. The term:Valid Data Value *MUST* be a text string.

Table 98: `Properties of ProgramEditName`

Properties	Value
`type`	`PROGRAM_EDIT_NAME`

3.3.62 ProgramHeader

Subtype of Event

The non-executable header section of the control program.

Table 99: `Properties of ProgramHeader`

Properties	Value
type	PROGRAM_HEADER

3.3.63 ProgramLocation

Subtype of Event

The Uniform Resource Identifier (URI) for the source file associated with model:PROGRAM.

Table 100: `Properties of ProgramLocation`

Properties	Value
type	PROGRAM_LOCATION

Subtypes of `ProgramLocation` are :

- `Active` : The value of the term:Data Entity that is engaging.
- `Main` : The identity of the primary logic or motion program currently being executed. It is the starting nest level in a call structure and may contain calls to sub programs.
- `Schedule` : The identity of a control program that is used to specify the order of execution of other programs.

3.3.64 ProgramLocationType

Subtype of Event

Defines whether the logic or motion program defined by model:PROGRAM is being executed from the local memory of the controller or from an outside source.

The term:Valid Data Value *MUST* be model:LOCAL or model:EXTERNAL.

Table 101: `Properties of ProgramLocationType`

Properties	Value
type	PROGRAM_LOCATION_TYPE

Subtypes of `ProgramLocationType` are :

- `Active` : The value of the term:Data Entity that is engaging.
- `Main` : The identity of the primary logic or motion program currently being executed. It is the starting nest level in a call structure and may contain calls to sub programs.
- `Schedule` : The identity of a control program that is used to specify the order of execution of other programs.

3.3.65 ProgramNestLevel

Subtype of Event

An indication of the nesting level within a control program that is associated with the code or instructions that is currently being executed.

If an Initial Value is not defined, the nesting level associated with the highest or initial nesting level of the program *MUST* default to zero (0).

The value reported for model:PROGRAM_NEST_LEVEL *MUST* be an integer.

Table 102: `Properties of ProgramNestLevel`

Properties	Value
`type`	`PROGRAM_NEST_LEVEL`

3.3.66 RotaryMode

Subtype of Event

The current operating mode for a model:Rotary type axis.

Table 103: `Properties of RotaryMode`

Properties	Value
`type`	`ROTARY_MODE`
`result`	`RotaryModeEnum`

Enumerated `result` values for `RotaryMode` are:

Table 104: `RotaryModeEnum` Enumeration

Name	Description
SPINDLE	The axis is functioning as a spindle.
INDEX	The axis is configured to index.
CONTOUR	The position of the axis is being interpolated.

3.3.67 RotaryVelocityOverride

Subtype of Event

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

Table 105: `Properties of RotaryVelocityOverride`

Properties	Value
type	ROTARY_VELOCITY_OVERRIDE

3.3.68 SerialNumber

Subtype of Event

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

Table 106: `Properties of SerialNumber`

Properties	Value
type	SERIAL_NUMBER

3.3.69 SpindleInterlock

Subtype of Event

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

Table 107: `Properties of SpindleInterlock`

Properties	Value
type	SPINDLE_INTERLOCK
result	ActuatorStateEnum

Enumerated `result` values for `SpindleInterlock` are:

Table 108: `ActuatorStateEnum` Enumeration

Name	Description
ACTIVE	The value of the term:Data Entity that is engaging.
INACTIVE	The value of the term:Data Entity that is not engaging.

672

673 3.3.70 ToolAssetId

674 Subtype of Event

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

Table 109: `Properties of ToolAssetId`

Properties	Value
type	TOOL_ASSET_ID

677 3.3.71 ToolGroup

678 Subtype of Event

679 An identifier for the tool group associated with a specific tool. Commonly used to desig-
680 nate spare tools.

Table 110: `Properties of ToolGroup`

Properties	Value
type	TOOL_GROUP

3.3.72 ToolId

Subtype of Event

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

Table 111: `Properties of ToolId`

Properties	Value
type	TOOL_ID

3.3.73 ToolNumber

Subtype of Event

The identifier assigned by the model:Controller component to a cutting tool when in use by a piece of equipment. The term:Valid Data Value *MUST* be a text string.

Table 112: `Properties of ToolNumber`

Properties	Value
type	TOOL_NUMBER

3.3.74 ToolOffset

Subtype of Event

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

Table 113: `Properties of ToolOffset`

Properties	Value
`type`	`TOOL_OFFSET`

Subtypes of `ToolOffset` are :

- `Length` : A reference to a length type tool offset variable.
- `Radial` : A reference to a radial type tool offset variable.

3.3.75 User

Subtype of Event

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

Table 114: `Properties of User`

Properties	Value
`type`	`USER`

Subtypes of `User` are :

- `Maintenance` : Action related to maintenance on the piece of equipment.
- `Operator` : The identifier of the person currently responsible for operating the piece of equipment.
- `SetUp` : 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.

3.3.76 Variable

Subtype of Event

A data value whose meaning may change over time due to changes in the opertion of a piece of equipment or the process being executed on that piece of equipment.

Table 115: Properties of Variable

Properties	Value
type	VARIABLE

3.3.77 WaitState

Subtype of Event

An indication of the reason that model:EXECUTION is reporting a value of model:WAIT.

The term:Valid Data Value *MUST* be model:POWERING_UP, model:POWERING_-DOWN, model:PART_LOAD, model:PART_UNLOAD, model:TOOL_LOAD, model:TOOL_-UNLOAD, model:MATERIAL_LOAD, model:MATERIAL_UNLOAD, model:SECONDARY_-PROCESS, model:PAUSING, or model:RESUMING.

Table 116: Properties of WaitState

Properties	Value
type	WAIT_STATE

3.3.78 Wire

Subtype of Event

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

Table 117: Properties of Wire

Properties	Value
type	WIRE

3.3.79 WorkOffset

Subtype of Event

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

Table 118: Properties of WorkOffset

Properties	Value
type	WORK_OFFSET

3.3.80 WorkholdingId

Subtype of Event

The identifier for the current workholding or part clamp in use by a piece of equipment.
The term:Valid Data Value *MUST* be a text string.

Table 119: Properties of WorkholdingId

Properties	Value
type	WORKHOLDING_ID

3.4 SampleTypes

3.4.1 Acceleration

Subtype of Sample

The measurement of the rate of change of velocity.

Table 120: Properties of Acceleration

Properties	Value
units	MILLIMETER/SECOND^2
type	ACCELERATION

3.4.2 AccumulatedTime

Subtype of Sample

The measurement of accumulated time for an activity or event.

Table 121: Properties of AccumulatedTime

Properties	Value
units	SECOND
type	ACCUMULATED_TIME

3.4.3 Amperage

Subtype of Sample

The measurement of electrical current.

Table 122: Properties of Amperage

Properties	Value
units	AMPERE
type	AMPERAGE

Subtypes of Amperage are :

- Actual : The measured value of the data item type given by a sensor or encoder.
- Alternating : The measurement of alternating voltage or current. If not specified further in statistic, defaults to RMS voltage.
- Direct : The measurement of DC current or voltage.
- Target : The desired measure or count for a data item value.

3.4.4 Angle

Subtype of Sample

The measurement of angular position.

Table 123: Properties of Angle

Properties	Value
units	DEGREE
type	ANGLE

Subtypes of Angle are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.

3.4.5 AngularAcceleration

Subtype of Sample

The measurement rate of change of angular velocity.

Table 124: `Properties of AngularAcceleration`

Properties	Value
`units`	`DEGREE/SECOND^2`
`type`	`ANGULAR_ACCELERATION`

3.4.6 AngularVelocity

Subtype of Sample

The measurement of the rate of change of angular position.

Table 125: `Properties of AngularVelocity`

Properties	Value
`units`	`DEGREE/SECOND`
`type`	`ANGULAR_VELOCITY`

3.4.7 AxisFeedrate

Subtype of Sample

The measurement of the feedrate of a linear axis.

Table 126: `Properties of AxisFeedrate`

Properties	Value
`units`	`MILLIMETER/SECOND`
`type`	`AXIS_FEEDRATE`

Subtypes of `AxisFeedrate` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `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 model:Axes.
- `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.

3.4.8 CapacityFluid

Subtype of Sample

The fluid capacity of an object or container.

Table 127: `Properties of CapacityFluid`

Properties	Value
units	MILLILITER
type	CAPACITY_FLUID

3.4.9 CapacitySpatial

Subtype of Sample

The geometric capacity of an object or container.

Table 128: `Properties of CapacitySpatial`

Properties	Value
units	CUBIC_MILLIMETER
type	CAPACITY_SPATIAL

3.4.10 ClockTime

Subtype of Sample

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

Table 129: Properties of ClockTime

Properties	Value
units	yyyy-mm-ddthh:mm:ss.ffff
type	CLOCK_TIME

3.4.11 Concentration

Subtype of Sample

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

Table 130: Properties of Concentration

Properties	Value
units	PERCENT
type	CONCENTRATION

3.4.12 Conductivity

Subtype of Sample

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

Table 131: Properties of Conductivity

Properties	Value
units	SIEMENS/METER
type	CONDUCTIVITY

3.4.13 CuttingSpeed

Subtype of Sample

The speed difference (relative velocity) between the cutting mechanism and the surface of the workpiece it is operating on.

Table 132: `Properties of CuttingSpeed`

Properties	Value
`units`	`MILLIMETER/SECOND`
`type`	`CUTTING_SPEED`

Subtypes of `CuttingSpeed` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `Programmed` : The value of a signal or calculation specified by a logic or motion program or set by a switch.

3.4.14 Density

Subtype of Sample

The volumetric mass of a material per unit volume of that material.

Table 133: `Properties of Density`

Properties	Value
`units`	`MILLIGRAM/CUBIC_MILLIMETER`
`type`	`DENSITY`

3.4.15 DepositionAccelerationVolumetric

Subtype of Sample

The rate of change in spatial volume of material deposited in an additive manufacturing process.

Table 134: `Properties of DepositionAccelerationVolumetric`

Properties	Value
units	CUBIC_MILLIMETER/SECONDˆ2
type	DEPOSITION_ACCELERATION_VOLUMETRIC

Subtypes of `DepositionAccelerationVolumetric` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.

3.4.16 DepositionDensity

Subtype of Sample

The density of the material deposited in an additive manufacturing process per unit of volume.

Table 135: `Properties of DepositionDensity`

Properties	Value
units	MILLIGRAM/CUBIC_MILLIMETER
type	DEPOSITION_DENSITY

Subtypes of `DepositionDensity` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.

3.4.17 DepositionMass

Subtype of Sample

The mass of the material deposited in an additive manufacturing process.

Table 136: `Properties of DepositionMass`

Properties	Value
units	MILLIGRAM
type	DEPOSITION_MASS

Subtypes of `DepositionMass` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.

3.4.18 DepositionRateVolumetric

Subtype of Sample

The rate at which a spatial volume of material is deposited in an additive manufacturing process.

Table 137: `Properties of DepositionRateVolumetric`

Properties	Value
units	CUBIC_MILLIMETER/SECOND
type	DEPOSITION_RATE_VOLUMETRIC

Subtypes of `DepositionRateVolumetric` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.

3.4.19 DepositionVolume

Subtype of Sample

The spatial volume of material to be deposited in an additive manufacturing process.

Table 138: Properties of DepositionVolume

Properties	Value
units	CUBIC_MILLIMETER
type	DEPOSITION_VOLUME

827 Subtypes of DepositionVolume are :

828 • Actual : The measured value of the data item type given by a sensor or encoder.

829 • Commanded : A value specified by the model:Controller type component.

830 3.4.20 Displacement

831 Subtype of Sample

832 The measurement of the change in position of an object.

Table 139: Properties of Displacement

Properties	Value
units	MILLIMETER
type	DISPLACEMENT

833 3.4.21 ElectricalEnergy

834 Subtype of Sample

835 The measurement of electrical energy consumption by a component.

Table 140: Properties of ElectricalEnergy

Properties	Value
units	WATT_SECOND
type	ELECTRICAL_ENERGY

3.4.22 EquipmentTimer

Subtype of Sample

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

Table 141: `Properties of EquipmentTimer`

Properties	Value
`units`	`SECOND`
`type`	`EQUIPMENT_TIMER`

Subtypes of `EquipmentTimer` are :

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

3.4.23 FillLevel

Subtype of Sample

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

Table 142: `Properties of FillLevel`

Properties	Value
`units`	`PERCENT`
`type`	`FILL_LEVEL`

3.4.24 Flow

Subtype of Sample

The measurement of the rate of flow of a fluid.

Table 143: Properties of Flow

Properties	Value
units	LITER/SECOND
type	FLOW

3.4.25 Frequency

Subtype of Sample

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

Table 144: Properties of Frequency

Properties	Value
units	HERTZ
type	FREQUENCY

3.4.26 GlobalPosition

Subtype of Sample

DEPRECATED in Version 1.1

Table 145: Properties of GlobalPosition

Properties	Value
type	GLOBAL_POSITION

3.4.27 Length

Subtype of Sample

The measurement of the length of an object.

Table 146: Properties of Length

Properties	Value
units	MILLIMETER
type	LENGTH

Subtypes of Length are :

- Remaining : Remaining measure of an object or an action.
- Standard : The standard or original length of an object.
- Useable : The remaining useable length of an object.

3.4.28 Level

Subtype of Sample

DEPRECATED in Version 1.2. See model:FILL_LEVEL

Table 147: Properties of Level

Properties	Value
type	LEVEL

3.4.29 LinearForce

Subtype of Sample

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

Table 148: Properties of LinearForce

Properties	Value
units	NEWTON
type	LINEAR_FORCE

3.4.30 Load

Subtype of Sample

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

Table 149: Properties of Load

Properties	Value
units	PERCENT
type	LOAD

3.4.31 Mass

Subtype of Sample

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

Table 150: Properties of Mass

Properties	Value
units	KILOGRAM
type	MASS

3.4.32 PH

Subtype of Sample

A measure of the acidity or alkalinity of a solution.

Table 151: Properties of PH

Properties	Value
units	PH
type	PH

3.4.33 PathFeedrate

Subtype of Sample

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

Table 152: `Properties of PathFeedrate`

Properties	Value
`units`	`MILLIMETER/SECOND`
`type`	`PATH_FEEDRATE`

Subtypes of `PathFeedrate` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `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 model:Axes.
- `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.

3.4.34 PathFeedratePerRevolution

Subtype of Sample

The feedrate for the axes, or a single axis.

Table 153: `Properties of PathFeedratePerRevolution`

Properties	Value
`units`	`MILLIMETER/REVOLUTION`
`type`	`PATH_FEEDRATE_PER_REVOLUTION`

Subtypes of `PathFeedratePerRevolution` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `Programmed` : The value of a signal or calculation specified by a logic or motion program or set by a switch.

3.4.35 PathPosition

Subtype of Sample

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

Table 154: `Properties of PathPosition`

Properties	Value
`units`	`MILLIMETER_3D`
`type`	`PATH_POSITION`

Subtypes of `PathPosition` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `Probe` : The position provided by a measurement probe.
- `Target` : The desired measure or count for a data item value.

3.4.36 Position

Subtype of Sample

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

Table 155: `Properties of Position`

Properties	Value
units	MILLIMETER
type	POSITION

Subtypes of `Position` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `Programmed` : The value of a signal or calculation specified by a logic or motion program or set by a switch.
- `Target` : The desired measure or count for a data item value.

3.4.37 PowerFactor

Subtype of Sample

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

Table 156: `Properties of PowerFactor`

Properties	Value
units	PERCENT
type	POWER_FACTOR

3.4.38 Pressure

Subtype of Sample

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

Table 157: `Properties of Pressure`

Properties	Value
units	PASCAL
type	PRESSURE

3.4.39 ProcessTimer

Subtype of Sample

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.

Table 158: `Properties of ProcessTimer`

Properties	Value
units	SECOND
type	PROCESS_TIMER

Subtypes of `ProcessTimer` are :

- `Delay` : A piece of equipment waiting for an event or an action to occur.
- `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.

3.4.40 Resistance

Subtype of Sample

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

Table 159: `Properties of Resistance`

Properties	Value
units	OHM
type	RESISTANCE

3.4.41 RotaryVelocity

Subtype of Sample

The measurement of the rotational speed of a rotary axis.

Table 160: `Properties of RotaryVelocity`

Properties	Value
units	REVOLUTION/MINUTE
type	ROTARY_VELOCITY

Subtypes of `RotaryVelocity` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `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.

3.4.42 SoundLevel

Subtype of Sample

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

Table 161: `Properties of SoundLevel`

Properties	Value
units	DECIBEL
type	SOUND_LEVEL

Subtypes of `SoundLevel` are :

- `AScale` : A Scale weighting factor. This is the default weighting factor if no factor is specified
- `BScale` : B Scale weighting factor
- `CScale` : C Scale weighting factor
- `DScale` : D Scale weighting factor
- `NoScale` : No weighting factor on the frequency scale

3.4.43 SpindleSpeed

Subtype of Sample

DEPRECATED in Version 1.2. Replaced by model:ROTARY_VELOCITY

Table 162: `Properties of SpindleSpeed`

Properties	Value
`units`	`REVOLUTION/MINUTE`
`type`	`SPINDLE_SPEED`

Subtypes of `SpindleSpeed` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Commanded` : A value specified by the model:Controller type component.
- `Override` : The operators overridden value.

3.4.44 Strain

Subtype of Sample

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

Table 163: Properties of Strain

Properties	Value
units	PERCENT
type	STRAIN

3.4.45 Temperature

Subtype of Sample

The measurement of temperature.

Table 164: Properties of Temperature

Properties	Value
units	CELSIUS
type	TEMPERATURE

3.4.46 Tension

Subtype of Sample

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

Table 165: Properties of Tension

Properties	Value
units	NEWTON
type	TENSION

3.4.47 Tilt

Subtype of Sample

The measurement of angular displacement.

Table 166: Properties of Tilt

Properties	Value
units	MICRO_RADIAN
type	TILT

3.4.48 Torque

Subtype of Sample

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

Table 167: Properties of Torque

Properties	Value
units	NEWTON_METER
type	TORQUE

3.4.49 Velocity

Subtype of Sample

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

Table 168: Properties of Velocity

Properties	Value
units	MILLIMETER/SECOND
type	VELOCITY

3.4.50 Viscosity

Subtype of Sample

The measurement of a fluids resistance to flow.

Table 169: `Properties of Viscosity`

Properties	Value
units	PASCAL_SECOND
type	VISCOSITY

3.4.51 VoltAmpere

Subtype of Sample

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).

Table 170: `Properties of VoltAmpere`

Properties	Value
units	VOLT_AMPERE
type	VOLT_AMPERE

3.4.52 VoltAmpereReactive

Subtype of Sample

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

Table 171: `Properties of VoltAmpereReactive`

Properties	Value
units	VOLT_AMPERE_REACTIVE
type	VOLT_AMPERE_REACTIVE

3.4.53 Voltage

Subtype of Sample

The measurement of electrical potential between two points.

Table 172: `Properties of Voltage`

Properties	Value
units	VOLT
type	VOLTAGE

Subtypes of `Voltage` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Alternating` : The measurement of alternating voltage or current. If not specified further in statistic, defaults to RMS voltage.
- `Direct` : The measurement of DC current or voltage.
- `Target` : The desired measure or count for a data item value.

3.4.54 VolumeFluid

Subtype of Sample

The fluid volume of an object or container.

Table 173: `Properties of VolumeFluid`

Properties	Value
units	MILLILITER
type	VOLUME_FLUID

Subtypes of `VolumeFluid` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Consumed` : The amount of bulk material consumed from an object or container during a manufacturing process.

3.4.55 VolumeSpatial

Subtype of Sample

The geometric volume of an object or container.

Table 174: `Properties of VolumeSpatial`

Properties	Value
units	CUBIC_MILLIMETER
type	VOLUME_SPATIAL

Subtypes of `VolumeSpatial` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Consumed` : The amount of bulk material consumed from an object or container during a manufacturing process.

3.4.56 Wattage

Subtype of Sample

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

Table 175: `Properties of Wattage`

Properties	Value
units	WATT
type	WATTAGE

Subtypes of `Wattage` are :

- `Actual` : The measured value of the data item type given by a sensor or encoder.
- `Target` : The desired measure or count for a data item value.

Appendices

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