Hypertherm®

MTConnect® Demo for Powermax65/85/105 SYNC™ Cartridges

Demo documentation

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Environmental stewardship is one of Hypertherm's core values, and it is critical to our success and our customers' success. We are striving to reduce the environmental impact of everything we do. For more information: www.hypertherm.com/environment.

Introduction

By enabling a *Powermax65/85/105 SYNC* cartridge reader to communicate with an MTConnect® client, you get access to data about the cartridge, cartridge reader, and torch on which the cartridge was last used.

Purpose

This document helps you to:

- Learn what cartridge data items are available over MTConnect. Refer to the next section.
- Learn more about each data item that is available over MTConnect. Refer to page 5.
- Review the devices and assets data schemas that are available with MTConnect on page 8.

To learn more about MTConnect, refer to: https://www.mtconnect.org/ and http://mtcup.org.

Available data

This section summarizes the cartridge, cartridge reader, and torch data that is available over MTConnect.

To view the data described in this document, log into Hypertherm's VPN and go to the IP address of the machine that is connected to the cartridge reader.

Cartridge data

The general and operational Powermax SYNC cartridge data that is available with MTConnect is listed in *Table 1* on page 4.

Table 1 – Cartridge data

General

- Type
- TypeRevision
- PartNumber
- PartNumberRevision
- ManufacturerLocation
- RfidManufacturerId
- ManufacturingDate
- RfidTagPartNumber
- RfidTagRevision
- ManufacturingTestStatus

Operations and recent settings

- StartNumber
- TransferNumber
- PilotTime
- TransferTime
- ArcTime
- Faults
- EndOfLifeStrikeNumber
- LastPowerSupplyType
- LastTorchType
- LastCutMode
- LastCurrentSetting
- LastPressureSetting

Cartridge reader data

Cartridge reader data that is available with MTConnect is listed in *Table 2* below.

Table 2 – Cartridge reader data

- BuildDate
- ReleaseType
- Revision
- FirmwarePartNumber
- FirmwareVersion
- FirmwareBuiltOn
- BootloaderVersion
- PcbPartNumber
- PcbVersion
- PartNumber
- Version
- SerialNumber
- ManufacturingDate
- Type

For more details about each data item, refer to *Data item dictionaries* on page 5.

Data item dictionaries

For details about each item that is available over MTConnect from the cartridge, cartridge reader, and most recently used torch refer to the following pages.

Table 3 below describes the basic information about a Powermax SYNC cartridge that is available with MTConnect. The operational data from a cartridge is described in *Table 4* on page 6.

Table 3 – Basic cartridge data

Data item ID	Description	Data type	Possible values and examples
Type	The type of cartridge. Currently hardcoded to '1' (0x01).	string	**Example:** 1
TypeRevision	The revision of the cartridge type.	string	**Example:** 00A
PartNumber	The Hypertherm part number for the cartridge.	integer	**Example:** 428934 Cartridge part numbers are listed in the *Parts Guide for Powermax65/85/105 SYNC™* (810490).
PartNumberRevision	The version number of the cartridge model.	string	**Example:** 00D
ManufacturerLocation	The Hypertherm facility that manufactured the cartridge.	string	This is a 2 character length that has not yet been defined.
RfidManufacturerId	The unique identifier for the company that manufactured the RFID tag.	integer	**Example:** 048266 REVH
ManufacturingDate	The date when the cartridge was manufactured. The time is always set as 12:00 AM.	timestamp	
RfidTagPartNumber	The part number of the RFID tag.	integer	**Example:** 420857
RfidTagRevision	The version number of the RFID tag model.	integer	**Example:** *00
ManufacturingTestStatus	The result of a test performed on the cartridge.	string	Untested, FailedAtOnload, FailedShockTest, FailedRotationTest, FailedPlasmaTest, FailedSpringTest, FailedInspection, Passed

Table 4 – Cartridge operations and recent settings data

Data item ID	Description	Data type	Possible values and examples
StartNumber	The number of times that the cartridge has ignited an arc.	integer	**Example:** 65
TransferNumber	The number of times that current has flowed between the cartridge's electrode and the workpiece.	integer	**Example:** 89
PilotTime	The total number of seconds over the lifetime of the cartridge in which low current has flowed between the electrode and the nozzle as part of arc initiation.	integer	**Example:** 134 seconds
TransferTime	The number of seconds over the lifetime of the cartridge in which current has flowed between the electrode and the workpiece.	integer	**Example:** 30
ArcTime	The number of seconds that an arc has been ignited over the lifetime of the cartridge.	integer	**Example:** 64
Faults	The Fault ID of the 4 most recent cartridge errors from most recent to oldest.	array of integers	
EndOfLifeStrikeNumber	The number of times the cartridge has been marked as having reached end of life. When this value is greater than 0, the user should discard the cartridge.	integer	**Example:** 1
LastPowerSupplyType	The name of the plasma power supply that was most recently used with the cartridge.	string	Powermax65/85/105 SYNC
LastTorchType	The name of the torch on which the cartridge was most recently installed.	string	FactoryDefault, HAND_025, HAND_050, HAND_075, HAND_100, MECH_025, MECH_050, MECH_075, MECH_100
LastCutMode	The type of cutting that was most recently performed with the cartridge.	string	Factory Default, None, Normal, CPA, or Gouge
LastCurrentSetting	The amount of electricity, as measured in amperes, that last flowed through the cartridge.	integer	**Example:** 105
LastPressureSetting	The most recent measure of the force per unit area exerted on the cartridge by a supply gas in PSI.	integer	**Example:** 85

Table 5 describes the data items from the cartridge reader board and firmware.

Table 5 – Cartridge reader board and firmware data

Data item ID	Description	Data type	Possible values and examples
ReleaseType	The original purpose for creating the firmware on the cartridge reader, such as for a reliability test.	string	Standard = '_', ReliabilityTest = 'R', HaltTest = 'H', StressTest = 'S'
Revision	The number of times that the cartridge reader firmware has officially been modified.	string	**Example:** 1
FirmwarePartNumber	The part number of the firmware on the cartridge reader board.	integer	081288, 081223, 081251, 081335, 081329
FirmwareVersion	The revision of firmware on the cartridge reader board.	string	**Example:** *00
FirmwareBuiltOn	The date and time of day (AM/PM) when the firmware on the cartridge reader board was built. **Format:** TYYMMDD_{AM, PM}	timestamp	**Example:** 200521_AM
BootloaderVersion	The revision of the bootloader on the cartridge reader board.	string	**Example:** A
PcbPartNumber	The part number of the cartridge reader PCB.		**Example:** 141463
PcbVersion	The revision of the cartridge reader PCB.	string	**Example:** C
PartNumber	The part number assigned to the torch model.	integer	**Example:** 059614
Version	The revision of the torch model.	string	00A
SerialNumber	A unique sequence of numbers that identifies a specific torch.	string	**Example:** 123456789
ManufacturingDate	The date when the torch was built.	timestamp	**Example:** 200522_PM
Type	The torch size category.	string	hand, machine, full-length machine, mini-machine

Devices schema

Data from the Powermax SYNC cartridge reader and cartridge devices is available from the /probe endpoint with MTConnect as shown on the following pages.

For information about MTConnect, refer to https://www.mtconnect.org/.

Devices schema overview

Figure 1 below provides a high-level outline of the cartridge reader and cartridge data schemas that are available with MTConnect.

Figure 1 – Devices schema overview (page 1 of 2)

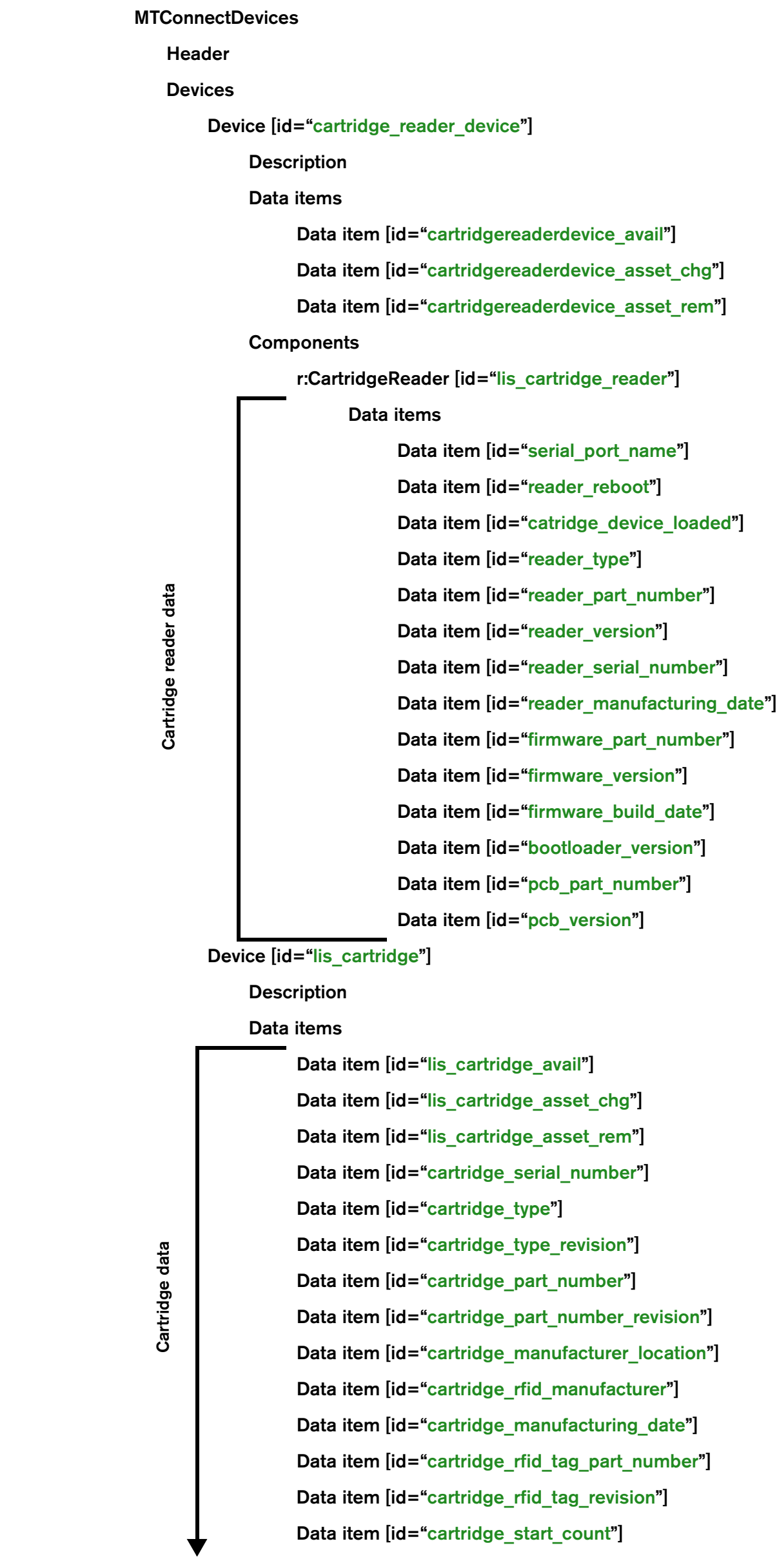
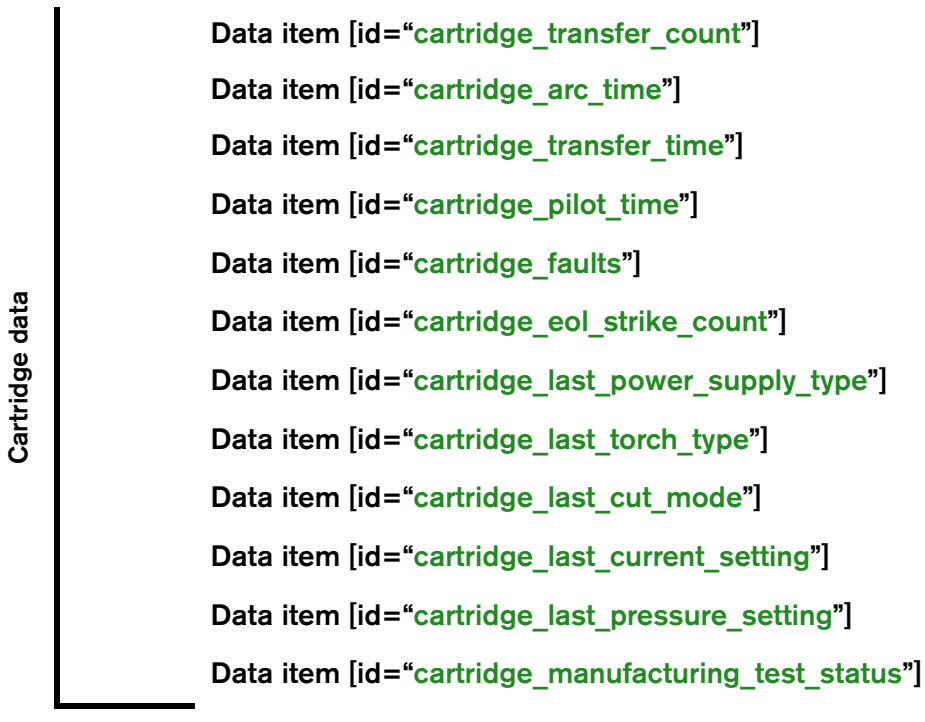


Figure 1 – Devices schema overview (page 2 of 2)



Detailed devices schema

Figure 2 below provides a high-level outline of the Powermax SYNC cartridge reader and cartridge data schemas that are available with MTConnect.

Figure 2 – Detailed devices schema overview (page 1 of 3)

```
<MTConnectDevices xmlns:m="urn:mtconnect.org:MTConnectDevices:1.5" xmlns="urn:mtconnect.org:MTConnectDe-
vices:1.5" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:r="urn:hypertherm.com:Hypertherm-
CartridgeReaderDevice:1.0" xsi:schemaLocation="urn:hypertherm.com:HyperthermCartridgeReaderDevice:1.0 /
schemas/HyperthermCartridgeReaderDevice_1.0.xsd urn:mtconnect.org:MTConnectDevices:1.5 /schemas/MTConnect-
Devices_1.5.xsd">

   <Header creationTime="2020-06-04T18:19:20Z" sender="SATURLEYHALLP50" instanceId="1591294750" ver-
   sion="1.5.0.14" assetBufferSize="1024" assetCount="0" bufferSize="131072"/>

   <Devices>

       <Device id="cartridge_reader_device" name="CartridgeReaderDevice" sampleInterval="1000" uuid="car-
       tridgeread999">

           <Description manufacturer="Hypertherm" model="Powermax SYNC Cartridge Reader">USB-Connected
           cartridge consumable reader for the Powermax G5.</Description>

           <Data items>

               <DataItem category="EVENT" id="cartridgereaderdevice_avail" type="AVAILABILITY"/>

               <DataItem category="EVENT" id="cartridgereaderdevice_asset_chg" type="ASSET_CHANGED"/>

               <DataItem category="EVENT" id="cartridgereaderdevice_asset_rem" type="ASSET_REMOVED"/>

           </DataItems>

           <Components>

               <r:CartridgeReader id="lis_cartridge_reader" name="LisCartridgeReader" sampleInter-
               val="10000">

                   <Data items>

                       <DataItem category="EVENT" id="serial_port_name" name="Serial Port Name"
                       type="r:SERIAL_PORT"/>

                       <DataItem category="EVENT" id="reader_reboot" name="Reader Reboot"
                       type="DATE_CODE"/>

                       <DataItem category="EVENT" id="catridge_device_loaded" name="Cartridge Device
                       Loaded Reference" type="DEVICE_UUID"/>

                       <DataItem category="EVENT" id="reader_type" name="Reader Type" type="r:READER_-
                       TYPE"/>

                       <DataItem category="EVENT" id="reader_part_number" name="Reader Part Number"
                       type="PART_ID"/>

                       <DataItem category="EVENT" id="reader_version" name="Reader Version"
                       type="r:RELEASE_VERSION"/>

                       <DataItem category="EVENT" id="reader_serial_number" name="Reader Serial Number"
                       type="SERIAL_NUMBER"/>

                       <DataItem category="EVENT" id="reader_manufacturing_date" name="Reader Manufac-
                       turing Date" subType="MANUFACTURE" type="h:DATE"/>

                       <DataItem category="EVENT" id="firmware_part_number" name="Firmware Part Number"
                       type="PART_ID"/>
```

When returned from the /current and /sample endpoints, data values in the EVENT category are reported with a sequence reference and timestamp.

Figure 2 – Detailed devices schema overview (page 2 of 3)

```
                    <DataItem category="EVENT" id="firmware_version" name="Firmware Version"
                    type="r:RELEASE_VERSION"/>

                    <DataItem category="EVENT" id="firmware_build_date" name="Firmware Build Date"
                    type="h:DATE"/>

                    <DataItem category="EVENT" id="bootloader_version" name="Bootloader Version"
                    type="r:RELEASE_VERSION"/>

                    <DataItem category="EVENT" id="pcb_part_number" name="PCB Part Number"
                    type="PART_ID"/>

                    <DataItem category="EVENT" id="pcb_version" name="PCB Version"
                    type="r:RELEASE_VERSION"/>

                </DataItems>

            </r:CartridgeReader>

        </Components>

    </Device>

    <Device id="lis_cartridge" name="LisCartridge" uuid="UndefinedCartridge">

        <Description manufacturer="Hypertherm" model="Powermax SYNC Cartridge" serialNumber="Undefined-
        Cartridge">RFID-enabled cartridge consumable for the Powermax G5.</Description>

        <DataItems>

            <DataItem category="EVENT" id="lis_cartridge_avail" type="AVAILABILITY"/>

            <DataItem category="EVENT" id="lis_cartridge_asset_chg" type="ASSET_CHANGED"/>

            <DataItem category="EVENT" id="lis_cartridge_asset_rem" type="ASSET_REMOVED"/>

            <DataItem category="EVENT" id="cartridge_serial_number" name="Cartridge Serial Number"
            type="SERIAL_NUMBER"/>

            <DataItem category="EVENT" id="cartridge_type" name="Cartridge Type" type="c:CARTRIDGE_-
            TYPE"/>

            <DataItem category="EVENT" id="cartridge_type_revision" name="Cartridge Type Revision"
            type="h:RELEASE_REVISION"/>

            <DataItem category="EVENT" id="cartridge_part_number" name="Cartridge Part Number"
            type="PART_ID"/>

            <DataItem category="EVENT" id="cartridge_part_number_revision" name="Cartridge Part Number
            Revision" type="h:RELEASE_REVISION"/>

            <DataItem category="EVENT" id="cartridge_manufacturer_location" name="Cartridge Manufac-
            turer Location" type="c:MANUFACTURING_LOCATION"/>

            <DataItem category="EVENT" id="cartridge_rfid_manufacturer" name="Cartridge RFID Manufac-
            turer" type="c:MANUFACTURER"/>

            <DataItem category="EVENT" id="cartridge_manufacturing_date" name="Cartridge Manufacturing
            Date" subType="MANUFACTURE" type="h:DATE"/>

            <DataItem category="EVENT" id="cartridge_rfid_tag_part_number" name="Cartridge RFID Tag
            Part Number" type="PART_ID"/>

            <DataItem category="EVENT" id="cartridge_rfid_tag_revision" name="Cartridge RFID Tag Revi-
            sion" type="h:RELEASE_REVISION"/>

            <DataItem category="EVENT" id="cartridge_start_count" name="Number Cartridge Starts"
            type="c:START_COUNT"/>

            <DataItem category="EVENT" id="cartridge_transfer_count" name="Number Cartridge Transfers"
            type="c:TRANSFER_COUNT"/>

            <DataItem category="EVENT" id="cartridge_arc_time" name="Cartridge Arc Time" sub-
            Type="WORKING" type="EQUIPMENT_TIMER"/>

            <DataItem category="EVENT" id="cartridge_transfer_time" name="Cartridge Transfer Time"
            subType="WORKING" type="EQUIPMENT_TIMER"/>

            <DataItem category="EVENT" id="cartridge_pilot_time" name="Cartridge Pilot Time" sub-
            Type="WORKING" type="EQUIPMENT_TIMER"/>

            <DataItem category="CONDITION" id="cartridge_faults" name="Cartridge Faults" type="SYS-
            TEM"/>

            <DataItem category="EVENT" id="cartridge_eol_strike_count" name="Number Cartridge End of
            Life Events" type="c:END_OF_LIFE_EVENT_COUNT"/>

            <DataItem category="EVENT" id="cartridge_last_power_supply_type" name="Last Connected
            Power Supply Type" type="c:POWER_SUPPLY_TYPE"/>

            <DataItem category="EVENT" id="cartridge_last_torch_type" name="Last Connected Torch Type"
            type="c:TORCH_TYPE"/>

            <DataItem category="EVENT" id="cartridge_last_cut_mode" name="Last Cut Type" type="c:CUT_-
            TYPE"/>

            <DataItem category="EVENT" id="cartridge_last_current_setting" name="Last Current Setting"
            subType="TARGET" type="AMPERAGE"/>
```

Figure 2 – Detailed devices schema overview (page 3 of 3)

```
                <DataItem category="EVENT" id="cartridge_last_pressure_setting" name="Last Pressure Set-
                ting" nativeUnits="POUND/INCH^2" type="Pressure"/>

                <DataItem category="EVENT" id="cartridge_manufacturing_test_status" name="Cartridge Manu-
                facturing Test Status" type="c:MANUFACTURING_TEST_STATUS"/>

            </DataItems>

        </Device>

    </Devices>

</MTConnectDevices>
```

Assets schema

The Powermax SYNC cartridge data assets schema that is available with MTConnect is described in *Figure 3* below.

Figure 3 – Detailed Powermax SYNC cartridge assets schema (page 1 of 2)

```
<MTConnectAssets

    xmlns:m="urn:mtconnect.org:MTConnectAssets:1.5"
    xmlns="urn:mtconnect.org:MTConnectAssets:1.5"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="urn:mtconnect.org:MTConnec-
    tAssets:1.5 /schemas/MTConnectAssets_1.5.xsd">
    <Header creationTime="2020-06-04T17:33:09Z" sender="SATURLEYHALLP50" instanceId="1591288823" ver-
    sion="1.5.0.14" assetBufferSize="1024" assetCount="3"/>

    <assets>

        <LisCartridge manufacturer="Hypertherm" serialNumber="E0-04-01-D0-03-71-42-5D" timestamp="2020-
        06-04T17:25:49.0944372Z" deviceUuid="cartridgeread999" assetId="cc4eda92-016b-400c-9753-
        2f106a8889f9">

            <Description>This is a Hypertherm cartridge consumable.</Description>

            <ManufacturingData>

                <Description>This is static data on the cartridge which is established by Hypertherm.</
                Description>

                <UUID>E0-04-01-D0-03-71-42-5D</UUID>

                <PartNumber>428934</PartNumber>

                <PartNumberRevision>A</PartNumberRevision>

                <CartridgeType>01</CartridgeType>

                <CartridgeDesignRevision>01</CartridgeDesignRevision>

                <ManufacturingDate>2020-02-21</ManufacturingDate>

                <ManufacturingTestStatus>235</ManufacturingTestStatus>

                <CartridgeType>01</CartridgeType>

                <CartridgeType>01</CartridgeType>

                <CartridgeType>01</CartridgeType>

            </ManufacturingData>

            <OperationalData available="true">

                <Description>This is time varying data which will change with use of the cartridge.
                </Description>

                <ArcTime>19552</ArcTime>

                <PilotTime>64</PilotTime>

                <TransferTime>19488</TransferTime>

                <NumberOfStarts>1033</NumberOfStarts>

                <NumberOfTransfers>1033</NumberOfTransfers>

                <Faults faultCount="4" description="The most recent faults experienced by the cartridge
                during its use. A maximum of 4 will be available ordered from most recent to oldest.">

                    <Fault faultId="0">320</Fault>

                    <Fault faultId="1">0</Fault>

                    <Fault faultId="2">0</Fault>

                    <Fault faultId="3">0</Fault>

                </Faults>
```

Figure 3 – Detailed Powermax SYNC cartridge assets schema (page 2 of 2)

```
                    <EndOfLifeEventCount description="Count of the number of events determined to have dam-
                    aged the cartridge beyond is useful life. If this number is greater than 0 it should be
                    replaced.">1</EndOfLifeEventCount>

                </OperationalData>

            </LisCartridge>

        </Assets>

</MTConnectAssets>
```