

Avoid These Common Misconceptions Regarding OPC UA and Weighing

The OPC UA communication standard allows for the definition of Companion Specifications. Users of these Specifications benefit from even easier OPC UA integration and interoperability. However, there are potential traps in the weighing process that result when combining IT communication and physical operation in an industrial environment. This white paper provides practical information to help you avoid misunderstandings and enable success from the start, when programming automated simple weighing processes.



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1 What is an OPC UA Companion Specification?

OPC UA is a future-oriented machine-to-machine protocol for industrial automation developed by the non-profit OPC Foundation. The communication technology facilitates secure, reliable and vendor-neutral transport of raw data and preprocessed information from machine to machine and from the manufacturing level into the production planning or Enterprise Resource Planning (ERP) system.

The OPC UA communication standard allows definition of Companion Specifications. These Companion Specifications describe how particular technologies can be addressed to make their integration and interoperability even easier.

The OPC UA Companion Specification for Weighing was designed by a Joint Workgroup consisting of 11 leading weighing technology manufacturers which met regularly over a period of two years ending in June 2020. Over this period, the group maintained an open-book policy in accordance with OPC Foundation requirements, and any weighing technology manufacturer was free to join. This allowed interested organizations to participate or simply follow the development of the Companion Specification for Weighing.

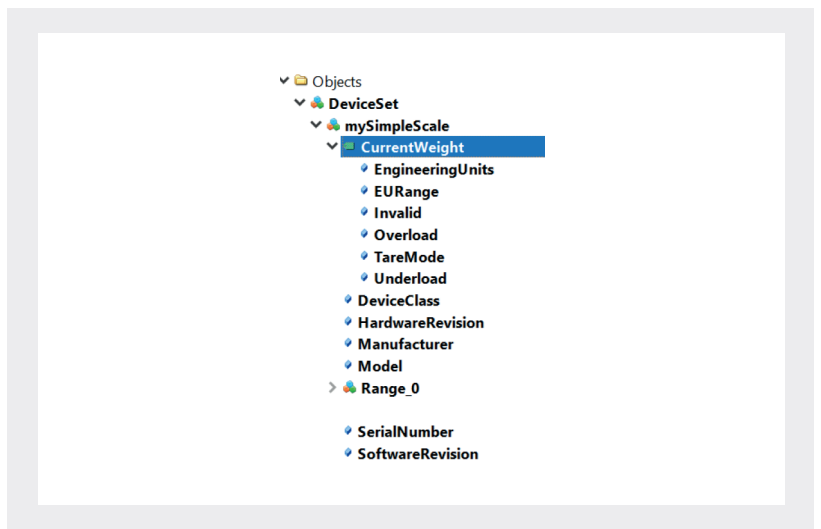
After the release of the first version, the Joint Workgroup decided to continue its cooperation to define online testing tools that would verify if OPC UA Servers for Weighing comply with the Companion Specification for Weighing.

2 The Specification for Simple Weighing

A large variety of very different applications can be realized using weighing as measurement technology. Therefore, the Companion Specification for Weighing is subdivided into 14 different groups to describe weighing applications in industrial automation. One of those subdivisions is dedicated to simple weighing, describing how to obtain the weight measurement and its related parameters.

This document explains a few important aspects of the Specification for Simple Weighing and explains the functionality of generally relevant data nodes.

OPC UA server
for Simple Weighing
with one
Weighing Range



3 What is the Current Weight Node?

"Node" is the OPC UA term for a single consistent data point that may include more than one value. The Current Weight node manages three essential weight values: net, tare and gross. The gross weight is the sum of the net and the tare weights. However, the relationship between these three values bears the risk of errors resulting from time differences in the data capturing procedure in case the three values are not captured simultaneously. In other words, Current Weight provides a consistent data set.

The OPC UA Current Weight node can eliminate this potential error source by transferring all three values as one node, but the user must open the Current Weight node to transfer the correct values. However, an OPC UA Client might not support the transfer of three values in one node. Therefore, it is helpful to choose one that does.

METTLER TOLEDO offers these three values as individual nodes in addition to Current Weight nodes. This built-in flexibility also respects the fact that many users do not subscribe to all three values for weight processing in their IT system.

Client View with display of net, tare and gross via Current Weight

Node Id	Display Name	Value	Datatype	Source Timestamp
NS5 Numeric 8	DeviceClass	Weighing Device	String	08:23:17.724
NS5 Numeric 4	Manufacturer	"", "Mettler Toledo"	LocalizedText	08:23:22.740
NS5 Numeric 7	SoftwareRevision		Null	17:24:30.128
NS5 Numeric 92	WeightStable	true	Boolean	08:26:17.757
NS5 Numeric 100	WeightUnit	g	String	08:26:30.898
NS5 Numeric 11	CurrentWeight		ExtensionObject	17:24:30.159

Gross	0
Net	0
Tare	0

Write Cancel

Client View with individual nodes for gross, net and tare

- Scale 1
 - Clear Tare
 - CurrentWeight
 - CenterOfZero
 - Gross
 - InsideZero
 - Invalid
 - Net
 - Overload
 - Tare
 - TareMode
 - Underload
 - WeightStable
 - WeightUnit

4 What is the Registered Weight Node?

Weighing is often performed in an unstable environment with vibrations and draft. This can result in permanently fluctuating net, tare or gross values. This can pose a problem when the user wants to get the correct value for further processing in their IT system.

Fluctuating value issues can be solved by using the Registered Weight node which freezes the next stable value in the server after pressing a particular key on the human-machine interface (HMI) or by using a method call initiated by the client. The Registered Weight node keeps its value until the key is pressed again or the client calls the method RegisterWeight again.

Context
between
Current Weight
and
Registered Weight








5 Tips to Remember About Method Functionality

A method is sub-process initiated by the client and executed by the weighing device. The use of a method relieves the software engineer from having to deal with multiple data nodes, handshakes and states to control a weighing process.

The execution of a method in a Simple Weighing application can last from a fraction of a second to several minutes. However, the execution of method calls for „Tare“, „SetPresetTare“ and „Zero“ can last longer than expected. This can be due to an unstable environment (vibrations or draft) or the sloshing or vaporization of liquids that delays detection of the criteria for a stable weight value.

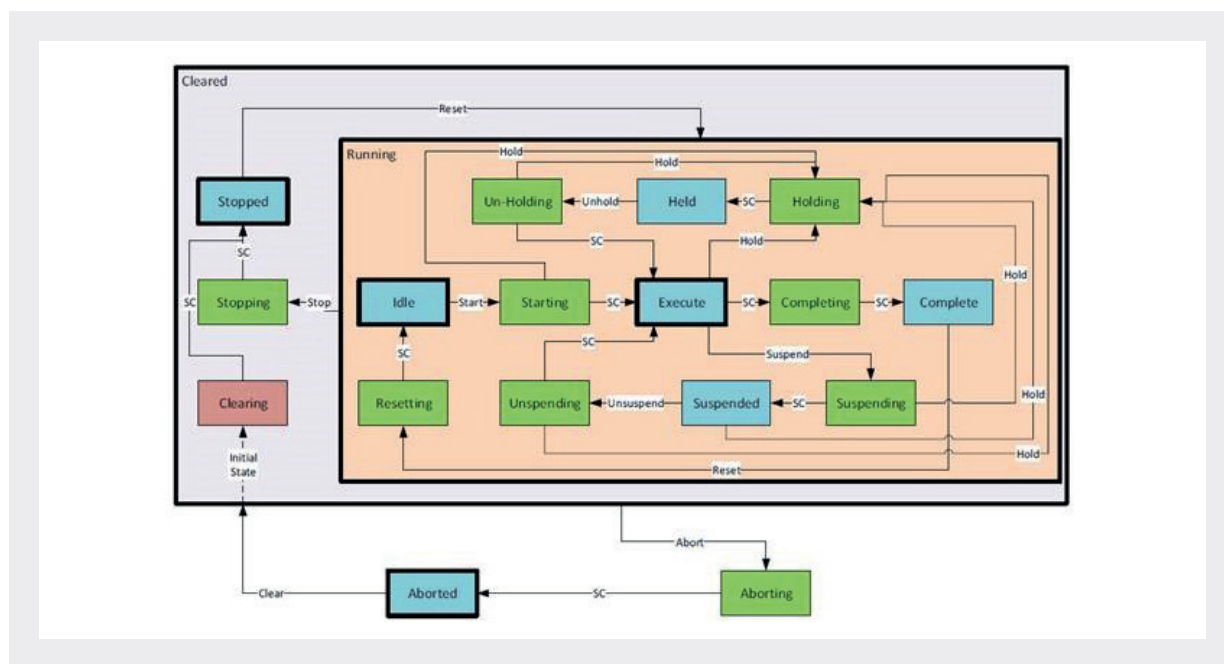
Methods for
Simple Weighing

- >  Set Preset Tare Command
- >  Tare
- >  Zero Scale
- >  Clear Tare
- >  RegisterdWeight

6 "State Machine" for Weighing and Packaging

For customers, weighing and packaging are often part of one process. It is also not uncommon for a weighing device to be integrated deep inside the packaging machine. In such a configuration, the user would have to deal with two different machine states (StateMachine). The Joint Workgroup decided to eliminate the possibility for such situations by adopting the StateMachine model of the OPC UA Companion Specification PackML, which was designed for packaging lines.

The PackML StateMachine model is a comprehensive model. To simplify, it is possible to use a minimum StateMachine node set for basic scales and other non-automated weighing devices. The full set of PackML StateMachine nodes can be applied for automatic weighing devices such as checkweighers.



State Machine for PackML and Weighing

7 Legal-for-Trade Weighing

In the European Union, weighing device certificates for legal-for-trade are standardized and recognized by all member states. Many countries outside of the European Union recognize these certificates as well. Other countries such as the United States have their own legal-for-trade standards for weighing. However, enforcement in the field is always subject to national legislation. Therefore, defining an OPC UA solution that is recognized globally will be quite complex. For this reason, the Joint Workgroup decided not to include legal-for-trade aspects in the first version of the OPC UA Companion Specification.

8 Overlaps with Other Specifications

The Companion Specification for Weighing overlaps with the Companion Specification for Machinery in certain areas. However, the two specifications are harmonized so that all overlapping nodes have the same semantics. This simplifies the programming and selection of nodes.

Display Name	Value	Datatype	Source Timestamp
DeviceClass	Weighing Device	String	9:53:26.592 PM
DeviceManual	www.mt.com	String	9:53:26.592 PM
Manufacturer	"", "Mettler Toledo"	LocalizedText	9:53:26.592 PM
Model	"", "IND780"	LocalizedText	9:53:26.592 PM
RevisionCounter	0	Int32	9:53:26.592 PM
SerialNumber	B916545478	String	9:53:36.576 PM
SoftwareRevision	9.0.03 03/12/2020	String	9:53:36.580 PM

The above nodes are available both in the companion specification for weighing as well as in the companion specification Machinery and have the same semantics.

9 When Selecting a Client

The Companion Specification for Weighing only works with clients that support the following attributes:

- Read Client Facet with optional Conformance Units
- Client Read Complex
- Client Read with proper encoding

As previously noted, if the Current Weight node is to be used, make sure that the client supports this format as well.

10 Outlook

Future-proof weighing devices enable connectivity to both control systems and clouds using the latest industry standards following demands for more data and speed. OPC UA in its current state is the perfect solution for non-time-critical data exchange. It offers many possibilities for joining the Industry 4.0 / Industrial Internet of Things revolution and gaining significant benefits in terms of reducing coding and processing time.

Information about METTLER TOLEDO products that support the OPC UA Companion Specifications are available here:

► www.mt.com/ind-opc-ua-cs