THE HUB® CONNECT

OPC UA SERVER GUIDE

RJG®

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The Hub® Connect OPC UA Server

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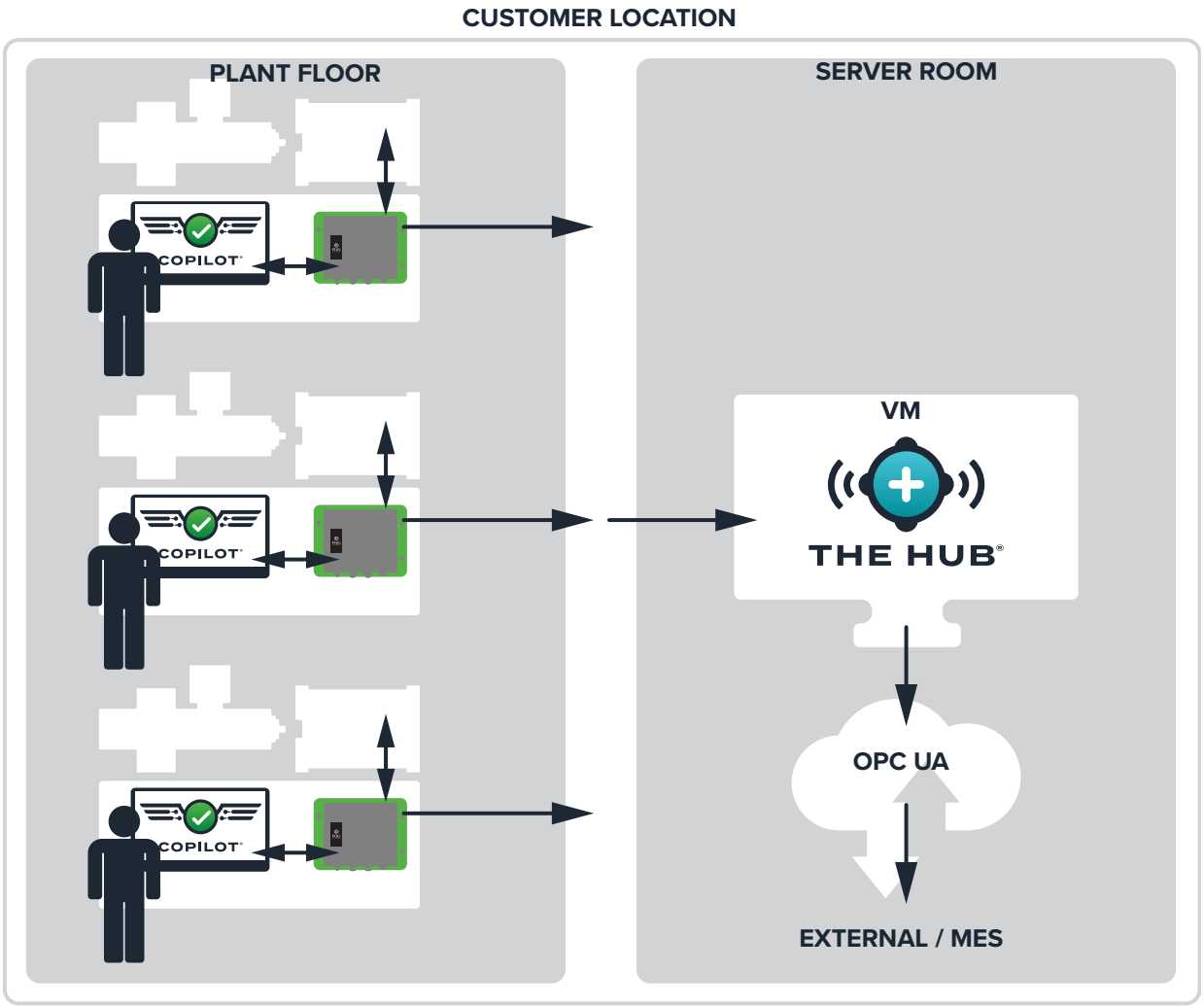
OVERVIEW

The Hub® Connect Open Platform Communications Unified Architecture (OPC UA) server facilitates the transfer of RJG job information, summary variables, and alarm changes from The Hub software to a Manufacturing Execution System (MES) using Transmission Control Protocol (TCP) communication.

The Hub Connect OPC UA server data model adheres to OPC UA and EUROMAP standards. The illustration below maps the path of data travel from the CoPilot system, to The Hub software, to the OPC UA server, and finally, to the external systems/MES.



The Hub® Connect OPC UA Server

REQUIREMENTS

The Hub Connect OPC UA access is a separately-licensed feature available for addition to The Hub software. RJG customer support will provide the The Hub Connect OPC UA license key to the customer, or will work with the customer to update their license key to activate the feature on The Hub software.

Only users with OPC UA permissions in The Hub are able to access the OPC UA server; refer to The Hub® Software User Guide for all The Hub user roles and permissions.

Additionally, the customer-selected OPC UA client will require an IP address and two ports available for OPC UA. The default limits for the selected OPC UA Server are as follows:

receive_buffer_size = 131072

send_buffer_size = 131072

The use of Prosys and Matrikon will not require additional configuration; other OPC UA clients may require configuration as follows:

Endpoint URL: opc.tcp://<IP>:4855

Example Configuration Using UAExpert: Settings/Configure UAExpert

Stack.TcpConnection_DefaultChunkSize: 131072

The Hub® Connect OPC UA Server

SECURITY

The Hub Connect OPC UA server supports server and client certificates, and user management for authentication and security (referred to as “Security” from hereforth in this document). Security is enabled by default on The Hub Connect OPC UA server and cannot be disabled. Only users with OPC UA security authentication are able to access The Hub Connect OPC UA server.

REQUIREMENTS

- One Authenticated User, *at minimum*
- Self-Signed Server Certificate, *supplied by customer*
- Trusted Client Certificate

USER MANAGEMENT

At least one user must be created and authenticated for connection to The Hub Connect OPC UA. Users are added via the credentials.csv provided by RJG; the file is only accesible by the root user.

File Path: /opt/rjg/openserv/credentials.csv

Format: user, password

Example:

```
1  # file:  /opt/rjg/opcserv/credentials.csv
2  user1,password1
3  user2,password2
4  user3,password3
```

The Hub® Connect OPC UA Server

SECURITY (CONTINUED)

INITIALIZING CREDENTIALS FILE

CONNECT TO THE HUB

```
# connect to the hub as rjguser
ssh rjguser@<HUB_IP>
```

HOW TO CREATE CREDENTIALS FILE USING ECHO

```
# Login as root user
sudo su

# change to opcserv directory
cd /opt/rjg/opcserv

# create credentials file with sample username/password
echo “user1,password1” > credentials.csv

# to append lines to the file, use >> instead of >
echo “user2,password2” >> credentials.csv

# if > is used instead of >>,
# “user2,password2 will overwrite the current contents of teh file

# once the server is restarted, “user1” will be able to connect

# to the OPCUA server using the password “password1”
```

HOW TO CREATE CREDENTIALS FILE USING NANO

```
# as root, open credentials.csv with nano
sudo nano /opt/rjg/opcserv/credentials.csv

# add username + password to csv file
# example:
username,password

# commit changes with CTRL+X
# confirm changes with Y, Enter
```

REBOOT THE HUB OR RESTART OPC UA SERVER

Reboot The Hub or restart the OPC UA server to ensure the new credentials are loaded.

REBOOT THE HUB

```
sudo reboot
```

RESTART THE OPC UA SERVER

```
sudo systemctl restart esm-opcua-server
```

The Hub® Connect OPC UA Server

SECURITY (CONTINUED)

SELF-SIGNED SERVER CERTIFICATE

Customers must provide self-signed server certificates for The Hub Connect OPC UA server; RJG does not provide self-signed certificates.

GENERATE SELF-SIGNED SERVER CERTIFICATE AND PRIVATE KEY

Generate a self-signed server certificate and private key for The Hub Connect OPC UA server using **openssl** with LINUX/sh or Windows/PowerShell (for Debian instances), or with the **opcua-certificate-creator** utility from l**ocka99/opcua** repository (for NixOS instances).

Copying the certificate and private key to the server can be done using scp or rsync.

Copy the certificate to
`/opt/rjg/opcserv/pki/own`

Copy the private key to

`/opt/rjg/opcserv/pki/private`

REQUIRED INFORMATION

The following details are used in both the OpenSSL and opcua-certificate-creator commands:

- **Country (C):** US
- **State (ST):** Michigan
- **Organization (O):** RJG Inc
- **Common Name (CN):** RJG Hub OPCUA Server
- **Application URI:** urn:RJG Hub OPCUA Server
- **Key Usage**
  - digitalSignature
  - nonRepudiation
  - keyEncipherment
  - dataEncipherment
  - keyCertSign
- **Extended Key Usage**
  - serverAuth
  - clientAuth

Private key output path: pki/private/private.pem
Certificate output path: pki/out/cert.derAdd Certificate and Private Key

The Hub® Connect OPC UA Server

SECURITY (CONTINUED)

CERTIFICATE AND PRIVATE KEY GENERATION USING LINUX/SH (DEBIAN INSTANCES)

```
mkdir -p pki/{own,private}
echo "[req]
distinguished_name = req_distinguished_name
x509_extensions = v3_req
prompt = no

[req_distinguished_name]
CN = RJG Hub OPCUA Server
O = RJG Inc
C = US
ST = Michigan

[v3_req]
subjectAltName = URI:urn:RJG Hub OPCUA Server
extendedKeyUsage = serverAuth, clientAuth
keyUsage = digitalSignature, nonRepudiation, keyEncipherment, dataEncipherment, keyCertSign
" ">extfile.cnf
openssl req -x509 -newkey rsa:4096 -keyout pki/private/private.pem -out pki/own/cert.der -nodes -days 365 -outform DER -config extfile.cnf
rm extfile.cnf
```

VERIFYING CERTIFIACTE AND PRIVATE KEY USING LINUX/SH (DEBIAN INSTANCES)

```
# Convert DER to PEM for verification
openssl x509 -in pki/own/cert.der -inform DER -out pki/own/cert.pem -outform PEM

# Verify the certificate
openssl x509 -in pki/own/cert.pem -text -noout

# Verify the private key
openssl rsa -in pki/private/private.pem -check

# Extract public keys and compare
openssl x509 -in pki/own/cert.pem -noout -pubkey > pki/own/cert_pubkey.pem
openssl rsa -in pki/private/private.pem -pubout > pki/private/private_pubkey.pem
diff pki/own/cert_pubkey.pem pki/private/private_pubkey.pem
```

SECURITY (CONTINUED)

CERTIFICATE AND PRIVATE KEY GENERATION USING LINUX/SH (NIXOS INSTANCES)

```
#!/usr/bin/env nix-shell
#! nix-shell -i bash -p openssl

mkdir -p pki/{own,private}
echo “[req]
distinguished_name = req_distinguished_name
x509_extensions = v3_req
prompt = no

[req_distinguished_name]
CN = RJG Hub OPCUA Server
O = RJG Inc
C = US
ST = Michigan

[v3_req]
subjectAltName = URI:urn:RJG Hub OPCUA Server
extendedKeyUsage = serverAuth, clientAuth
keyUsage = digitalSignature, nonRepudiation, keyEncipherment, dataEncipherment, keyCertSign
“ > extfile.cnf
openssl req -509 -newkey rsa:4096 -keyout pki/private/private.pem -out pki/own/cert.der -nodes -days  365 -outform DER -config extfile.cnf
rm extfile.cnf
```

SECURITY (CONTINUED)

VERIFYING CERTIFIACTE AND PRIVATE KEY USING LINUX/SH (NIXOS INSTANCES)

```
#!/usr/bin/env nix-shell
#! nix-shell -i bash -p openssl

# Convert DER to PEM for verification
open ssl x509 -in pki/own/cert.der -inform DER -out pki/own/cert.pem -outform PEM

# Verify the certificate
openssl x509 -in pki/own/cert.pem -text -noout

#Verify the private key
openssl rsa -in pki/private/private.pem -check

# Extract public keys and compare
openssl x509 -in pki/own/cert.pem -noout -pubkey > pki/own/cert_pubkey.pem
openssl rsa -in pki/private/private.pem -pubout > pki/private/private_pubkey.pem
diff pki/own/cert_pubkey.pem pki/private/private_pubkey.pem
```

SECURITY (CONTINUED)

CERTIFICATE AND PRIVATE KEY GENERATION USING WINDOWS/POWERSHELL

```
$ext = @"
[req]
distinguished_name = req_distinguished_name
x509_extensions = v3_req
prompt = no

[req_distinguished_name]
CN = RJG Hub OPCUA Server
O = RJG Inc
C = US
ST = Michigan

[v3_req]
subjectAltName = URI:urn:RJG Hub OPCUA Server
extendedKeyUsage = serverAuth, clientAuth
keyUsage = digitalSignature, nonRepudiation, keyEncipherment, dataEncipherment, keyCertSign
@

$ext | Out-File -FilePath extfile.cnf -Encoding ascii

mkdir pki\own
mkdir pki\private

openssl req -x509 -newkey rsa:4096 -keyout pki\private\private.pem -out pki\own\cert.der -nodes -days 365 -outform DER -config extfile.cnf
Remove-Item extfile.cnf
```

SECURITY (CONTINUED)

VERIFYING CERTIFIACTE AND PRIVATE KEY USING WINDOWS/POWERSHELL

```
# Convert DER to PEM for verification
openssl x509 -in pki\own\cert.der -inform DER -out pki\own\cert.pem -outform PEM

# Verify the certificate
openssl x509 -in pki/own/cert.pem -text -noout

# Verify the private key
openssl rsa -in pki/private/private.pem -check

# Extract public keys and compare
openssl x509 -in pki/own/cert.pem -noout -pubkey > pki/own/cert_pubkey.pem
openssl rsa -in pki/private/private.pem -pubout > pki/private/private_pubkey.pem
if (Compare-Object (Get-Content pki\own\cert_pubkey.pem) (Get-Content pki\private\
private_pubkey.pem)) {
    Write-Output “The private key does not match the certificate.”
} else {
    Write-Output “The private key matches the certificate.”
}
```

The Hub® Connect OPC UA Server

SECURITY (CONTINUED)

OPCUA-CERTIFICATE-CREATOR

RUST/CARGO INSTALLATION FOR UNIX

Run the following command:

curl --proto '=https' --tlsv1.2 -sSf https://sh.rustup.rs | sh

RUST/CARGO INSTALLATION FOR WINDOWS

Download and run the following installer:

- x64: https://win.rustup.rs/x86_64
- x32: https://win.rustup.rs/i686
- Install opcua-certificate-creator

To install the the latest version of the certificate creator utility, run the following command after installing Rust/Cargo:

```
cargo install opcua-certificate-creator
```

Then, provide the following arguments to create a certificate/private key pair for the OPCUA server

```
opcua-certificate-creator.exe -o --application-uri 'urn:RJG Hub OPCUA Server' --pki-path . --CN 'RJG Hub OPCUA Server' --O 'RJG Inc' --C 'US' --ST 'Michigan'
```

Refer to Verify the Certificate and Private Key for steps to validate the outputs for the relevant platform.

CLIENT CERTIFICATE

The Hub Connect OPC UA server will not trust any client connections and will reject all client certificates by default. New client connections to the server must first be explicitly trusted on The Hub Connect OPC UA server.

TRUST CLIENT CERTIFICATES

Move rejected client certificates from the "rejected" directory to the "trusted" directory; the client certificates will then be accepted by the server.

The client certificate directories are located within the pki folder under the application directory for opcserv

opcserv directory: /opt/rjg/opcserv

pki directory: /opt/rjg/opcserv/pki

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HOW TO MOVE CLIENT CERTIFICATES FROM REJECTED TO TRUSTED

```
# connect to hub using SSH
# Debian username:  rjg
# NixOS username:  rjguser

# Example:  connect to a Debian Hub
ssh rjg@<HUB_IP>

# Navigate to the pki directory under /opt/rjg/opcserv
cd /opt/rjg/opcserv/pki

# list the files under the "rejected" directory to see which clients have tried to connect
ls rejected

# determine the name of the certificate you'd like to trust

# as the root user, move the desired certificate from the "rejected" directory to the "trusted" directory
sudo mv rejected/<cert_filepath> trusted

# if the filename contains spaces, ensure that <cert_filepath> is wrapped with quotes
# this includes the parent directory, i.e. "rejected/"
# Example filename: Ignition OPC UA Client [hash].der
# Example command:
mv 'rejected/Ignition OPC UA Client [hash].der' trusted/

# list the files under the "trusted" directory to see which clients have been trusted
# if the previous steps have been completed correctly, you should see <cert_filepath> under the "trusted" directory
ls trusted

# The client certificate should be allowed in subsequent connection attempts
```

The Hub® Connect OPC UA Server

JOB INFORMATION

The Hub Connect OPC UA server supplies job information collected from the connected CoPilot systems once per cycle, in realtime. The following data is provided:

JOB INFORMATION

Machine Name	CoPilot Serial Number
Mold Name	CoPilot IP Address
Process Name	CoPilot Software Version

CYCLE INFORMATION AND COUNTS

Alarm State	Reject Cycles
Down Time	Reject Percent
Down Time Percent	Run Time
Good Cycles	Sort State
Last Cycle Time	Standard Cycle Time
Machine Match	Suspect Cycles
Machine State	Total Cycles
Material Match	Unique Cycle ID
Mold Match	

The Hub® Connect OPC UA Server

JOB INFORMATION (CONTINUED)

SUMMARY VARIABLES

Average Cavity Fill Time	Hold Pressure
Average Flow Rate	Hold Time
Average Peak Pressure	Injection Integral
Average Temperature	Melt Temperature
Back Pressure	Minimum Temperature
Balance Cavity Fill Time	Part Out Time
Balance Peak	Peak Mold Deflection
Cavity Fill Time	Peak Pressure
Cooling Rate	Peak Temperature
Cooling Time	Process Fill Time
Cushion	Process Pack Time
Cycle Integral	Recovery Time
Cycle Time	RJG Shot Size
Decompress	RJG Transfer
Delta Average Cavity Fill Time	Shot Size
Effective Shot Size	Temperature Rise
Effective Viscosity	Temperature Out Peak Integral
Fill Only Weight	Temperature Out Peak Time
Fill Pressure	Transfer
Fill Time	Water Temperature A Half
Final Part Weight	Water Temperature B Half

JOB INFORMATION (CONTINUED)

ALARM LIMITS, CHANGES, AND EVENTS

Alarm Above	Alarm Error
Alarm Lower Limits	Alarm Nominal
Alarm Lower Limits Changes	Warning Above
Alarm Upper Limits	Warning Below
Alarm Upper Limits Changes	Warning Error
Alarm Below	Warning Nominal

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DATA IN OPC UA EUROMAP FORMAT

MACHINE

NAMESPACE

Namespace		7
NodeId	Numeric	1005
Name	Machine	
BrowseName	7:MachineType	
DisplayName	Machine	
NodeClass	Object Type	Nodeset definition
Parent	BaseObjectType	Reference documentation

NODESET

Name	CoPilotInformationType	CustomFields	RJGActiveCyclicValuesType	RJGJobInformation-Type	RJGInjectionUnitCycleParame-tersType
Browse Name	1:CoPilotInformationType	1:Custom-Fields	1:RJGActiveCyclicValues-Type	1:RJGJobInformation-Type	1:RJGInjectionUnitCycleParam-etersType
RJG Name	CoPilot	Custom Fields	Cycle Values	Job Information	Summary Variables
Display Name	CoPilotInformationType	CustomFields	RJGActiveCyclicValuesType	RJGJobInformation-Type	RJGInjectionUnitCycleParame-tersType
Node Class	Object				
Data Type					
Type Defi-nition	7:CoPilotInformationType	0:BaseObject-Type	7:RJGActiveCyclicValues-Type	7:RJGJobInformation-Type	7:RJGInjectionUnitCycleParam-etersType
Description		Custom Fields defined by the user	Additional information on the running job for cyclic production		

Indicates RJG-Provided Values (NOT EUROMAP)

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

COPILOT SYSTEM

NAMESPACE

Namespace		7
NodeId	Numeric	1008
Name	CoPilotInformation	
BrowseName	7:CoPilotInformation	
DisplayName	CoPilotInformation	
NodeClass	Object Type	
Parent	BaseObjectType	

NODESET

Name	Gateway	IPAddress	Key	MAC Address	Netmask	Serial Number	Version
Browse Name	1:Gateway	1:IPAddress	1:Key	1:MAC Address	1:Netmask	1:SerialNumber	1:Version
Display Name	Gateway	IPAddress	Key	MACAddress	Netmask	SerialNumber	Version
Node Class	Variable						
Data Type	0:String						
Type Definition	0:BaseDataVariable Type						
Description			Unique key identifying a CoPilot system Managed by The Hub software.				

Indicates RJG-Provided Values (NOT EUROMAP)

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DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

CYCLIC JOB INFORMATION

NAMESPACE

Namespace		7
NodeId	Numeric	1007
Name	RJGCyclicJobInformationType	
BrowseName	7:RJGCyclicJobInformationType	
DisplayName	RJGCyclicJobInformationType	
NodeClass	Object Type	Nodeset definition https://reference.opcfoundation.org/nodesets/58/19519
Parent	CyclicJobInformationType	Reference documentation https://reference.opcfoundation.org/PlasticsRubber/GeneralTypes/v103/docs/18.2.11

NODESET

Name	Machine Name	Mold Name	Process Name	Expected Cycle Time
Browse Name	1:MachineName	1:MoldName	1:ProcessName	1:ExpectedCycleTime
Display Name	MachineName	MoldName	ProcessName	ExpectedCycleTime
Node Class	Variable			
Data Type	0:String			0:Duration
Type Definition	0:PropertyType			
Description				Calculated cycle time for the job

Indicates RJG-Provided Values (NOT EUROMAP)

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DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

SUMMARY VARIABLE ALARM TYPES

NAMESPACE

Namespace		7
NodeId	Numeric	3003
Name	SummaryVariableAlarmType	
BrowseName	7:SummaryVariableAlarmType	
DisplayName	SummaryVariableAlarmType	
NodeClass	Data Type	Nodeset definition https://reference.opcfoundation.org/nodesets/2/16283
Parent	Structure	Reference documentation https://reference.opcfoundation.org/v105/Core/docs/Part5/12.2.12

NODESET

Name	Tag	Profile	LowLimit	Nominal	HighLimit	Alarm-Count-Above	Alarm-CountBe-low	Warning-Count-Above	Warning-CountBe-low	ErrorCount
Symbolic Name	Tag	Profile	LowLimit	Nominal	HighLimit	Alarm-Count-Above	Alarm-CountBe-low	Warning-Count-Above	Warning-CountBe-low	ErrorCount
Display Name	Tag	Profile	LowLimit	Nominal	HighLimit	Alarm-Count-Above	Alarm-CountBe-low	Warning-Count-Above	Warning-CountBe-low	ErrorCount
RJGName	Alarm Type		Lower Limit		Upper Limit					
Type	String	String	DataValue	DataValue	DataValue	UInt64	UInt64	UInt64	UInt64	UInt64
Note			Instances may set a more specific type as needed.							

Indicates RJG-Provided Values (NOT EUROMAP)

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

CYCLE VALUES

NAMESPACE

Namespace		7
NodeId	Numeric	1003
Name	RJGActiveCyclicJobValuesType	
BrowseName	7:RJGActiveCyclicJobValuesType	
DisplayName	RJGActiveCyclicJobValuesType	
NodeClass	Object Type	Nodeset definition
		https://reference.opcfoundation.org/nodesets/58/19479
Parent	ActiveCyclicJobValuesType	Reference documentation
		https://reference.opcfoundation.org/PlasticsRubber/GeneralTypes/v103/docs/18.4.7

Indicates RJG-Provided Values (NOT EUROMAP)

The Hub® Connect OPC UA Server

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

NODESET

Name	BrowseName	DisplayName	NodeClass	DataType	TypeDefinition	Description
AlarmState	1:AlarmState	AlarmState	Variable	0:String	0:BaseDataVariableType	
CurrentLotName	1:CurrentLotName	CurrentLotName	Variable	0:String	0:PropertyType	Name of the current production lot
DownTime	1:DownTime	DownTime	Variable	0:Duration		
JobAlarmCycleCounter	1:JobAlarmCycleCounter	JobAlarmCycleCounter	Variable	0:UInt64	0:BaseDataVariableType	
JobBadCycleCounter	1:JobBadCycleCounter	JobBadCycleCounter	Variable	0:UInt64	0:BaseDataVariableType	
JobBadPartsCycleCounter	1:JobBadPartsCycleCounter	JobBadPartsCycleCounter	Variable	0:UInt64	0:BaseDataVariableType	Number of bad parts produced in the current job
JobCycleCounter	1:JobCycleCounter	JobCycleCounter	Variable	0:UInt64	0:BaseDataVariableType	Number of finished cycles in the job
JobGoodCyclesCounter	1:JobGoodCyclesCounter	JobGoodCyclesCounter	Variable	0:UInt64	0:BaseDataVariableType	
JobGoodPartsCounter	1:JobGoodPartsCounter	JobGoodPartsCounter	Variable	0:UInt64	0:BaseDataVariableType	Number of good parts produced in the current job
JobMaterialCycleCounter	1:JobMaterialCycleCounter	JobMaterialCycleCounter	Variable	0:UInt64	0:BaseDataVariableType	
JobOverCycleTimeCounter	1:JobOverCycleTimeCounter	JobOverCycleTimeCounter	Variable	0:UInt64	0:BaseDataVariableType	
JobPartsCounter	1:JobPartsCounter	JobPartsCounter	Variable	0:UInt64	0:BaseDataVariableType	Total number of parts produced in the current job
JobStartTime	1:JobStartTime	JobStartTime	Variable	0:DateTime	0:BaseDataVariableType	
JobStatus	1:JobStatus	JobStatus	Variable	1:JobStatusEnumeration	0:BaseDataVariableType	Current status of the job
JobTestSamplesCounter	1:JobTestSamplesCounter	JobTestSamplesCounter	Variable	0:UInt64	0:BaseDataVariableType	Number of test sample parts produced in the current job
JobWarningCycleCounter	1:JobWarningCycleCounter	JobWarningCycleCounter	Variable	0:UInt64	0:BaseDataVariableType	
LastCycleTime	1:LastCycleTime	LastCycleTime	Variable	0:Duration	0:BaseDataVariableType	Time of the recently finished cycle
MachineMatch	1:MachineMatch	MachineMatch	Variable	0:String	0:BaseDataVariableType	
MachineState	1:MachineState	MachineState	Variable	0:String	0:BaseDataVariableType	
MachineStatus	1:MachineStatus	MachineStatus	Variable	0:String	0:BaseDataVariableType	
Manual	1:Manual	Manual	Variable	0:Boolean	0:BaseDataVariableType	
MaterialMatch	1:MaterialMatch	MaterialMatch	Variable	0:String	0:BaseDataVariableType	
MoldMatch	1:MoldMatch	MoldMatch	Variable	0:String	0:BaseDataVariableType	
SortState	1:SortState	SortState	Variable	0:String	0:BaseDataVariableType	
Timestamp	1:Timestamp	Timestamp	Variable	0:DateTime	0:BaseDataVariableType	

Indicates RJG-Provided Values (NOT EUROMAP)

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

SUMMARY VARIABLES

NAMESPACE

Namespace		7
NodeId	Numeric	1004
Name	RJGInjectionUnitCycleParametersType	
BrowseName	7:RJGInjectionUnitCycleParametersType	
DisplayName	RJGInjectionUnitCycleParametersType	
NodeClass	Object Type	Nodeset definition
		https://reference.opcfoundation.org/nodesets/62/19650
Parent	InjectionUnitCycleParametersType	Reference documentation
		https://reference.opcfoundation.org/PlasticsRubber/IMM2MES/v101/docs/17.3

Indicates RJG-Provided Values (NOT EUROMAP)

The Hub® Connect OPC UA Server

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

NODESET

Name	BrowseName	DisplayName	RJG Name	NodeClass	DataType	TypeDefinition	Description
BackPressure	3:BackPressure	BackPressure	Back Pressure	Variable	0:Double	0:RJGAnalogItemType	Back pressure is the melt-pressure against the screw movement during dosage
CavityFillTimeAverage	7:CavityFillTimeAverage	CavityFillTimeAverage	Average Cavity Fill Time	Variable	0:Double	0:RJGAnalogItemType	Average cavity fill time
CavityFillTimeBalance	7:CavityFillTimeBalance	CavityFillTimeBalance	Balance Cavity Fill Time	Variable	0:Double	0:RJGAnalogItemType	
CavityFillTimeDeltaAverage	7:CavityFillTimeDeltaAverage	CavityFillTimeDeltaAverage	Delta Average Cavity Fill Time	Variable	0:Double	0:RJGAnalogItemType	
CoolingTime	7:CoolingTime	CoolingTime	Cooling Time	Variable	0:Duration	0:RJGAnalogItemType	
CushionStroke	3:CushionStroke	CushionStroke	Cushion Stroke	Variable	0:Double	0:RJGAnalogItemType	Stroke position at cushion
CushionVolume	3:CushionVolume	CushionVolume	Cushion Volume	Variable	0:Double	0:RJGAnalogItemType	Material volume remained in front of the screw after injection and holding pressure
DecompressionVolumeBefore-Plastification	7:DecompressionVolumeBefore-Plastification	DecompressionVolumeBefore-Plastification	Decompress, Stroke Length	Variable	0:Double	0:RJGAnalogItemType	Decompression before plastification is the movement of the screw in the opposite direction to injection
DecompressionVolumeAfterPlas-tification	7:DecompressionVolumeAfterPlas-tification	DecompressionVolumeAfter-Plastification	Decompress, Stroke Volume	Variable	0:Double	0:RJGAnalogItemType	Decompression after plastification is the movement of the screw in the opposite direction to injection
DosingTime	3:DosingTime	Dosing Time	Recovery Time	Variable	0:Duration	0:RJGAnalogItemType	Time to melt the plastic granulates and feed the melt for the next injection shot to the front of the scew
FlowIndex	3:FlowIndex	FlowIndex	EffectiveViscosity	Variable	0:Double	0:RJGAnalogItemType	Flow index
HoldHydraulicPressureMaximum	3:HoldHydraulicPressureMaximum	HoldHydraulicPressureMaxi-mum	Hold Pressure, Hydraulic Pres-sure	Varible	0:Double	0:RJGAnalogItemType	Maximum holding pressure in front of the hydraulic cylinder
HoldSpecificPressureMaximum	3:HoldSpecificPressureMaximum	HoldSpecificPressureMaximum	Hold Pressure, Plastic Pressure	Variable	0:Double	0:RJGAnalogItemType	Maximum holding pressure in front of the screw
HoldTime	7:HoldTime	HoldTime	Hold Time	Variable	0:Duration	0:RJGAnalogItemType	
InjectionTime	7:InjectionTime	InjectionTime	FillTime	Variable	0:Duraiton	0:RJGAnalogItemType	Time required to fill the cavity or mould
PartOutTime	7:PartOutTime	PartOutTime	Part Out Time	Variable	0:Duration	0:RJGAnalogItemType	
ProcessFillTime	7:ProcessFillTime	ProcessFillTime	Process Fill Time	Variable	0:Duration	0:RJGAnalogItemType	
ShotSizeEffectiveStroke	7:ShotSizeEffectiveStroke	ShotSizeEffectiveStroke	Effective Shot Size, Stroke Length	Variable	0:Double	0:RJGAnalogItemType	
ShotSizeEffectiveVolume	7:ShotSizeEffectiveVolume	ShotSizeEffectiveVolume	Effective Shot Size, Stroke Vol-ume	Variable	0:Double	0:RJGAnalogItemType	
ShotSizeStroke	7:ShotSizeStroke	ShotSizeStroke	Shot Size, Stroke Length	Variable	0:Double	0:RJGAnalogItemType	
ShotSizeVolume	7:ShotSizeVolume	ShotSizeVolume	Shot Size, Stroke Volume	Variable	0:Double	0:RJGAnalogItemType	Volume dosed by the machine for the next injection shot excluding decompress volume
ShotSizeRJGStroke	7:ShotSizeRJGStroke	ShotSizeRJG	RJG Shot Size, RJG Stroke Length	Variable	0:Double	0:RJGAnalogItemType	
ShotSizeRJGVolume	7:ShotSizeRJGVolume	ShotSizeRJGVolume	RJG Shot Size, RJG Stroke Vol-ume	Variable	0:Double	0:RJGAnalogItemType	
HydraulicPressureMaximum	7: HydraulicPressureMaximum	HydraulicPressureMaximum	Fill Pressure, Hydraulic Pressure	Variable	0:Double	0:RJGAnalogItemType	Maximum pressure in the hydraulic cylinder
SpecificPressureMaximum	3:SpecificPressureMaximum	SpecificPressureMaximum	Fill Pressure Plastic Pressure	Variable	0:Double	0:RJGAnalogItemType	Pressure in front of the screw tip
TransferRJGStroke	7:TransferRJGStroke	TransferRJGStroke	RJG Transfer, RJG Stroke Length	Variable	0:Double	0:RJGAnalogItemType	
TransferRJGVolume	7:TransferRJGVolume	TransferRJGVolume	RJG Transfer, RJG Stroke Volume	Variable	0:Double	0:RJGAnalogItemType	
TransferStroke	3:TransferStroke	TransferStroke	Transfer, Stroke Length	Variable	0:Double	0:RJGAnalogItemType	Switch-over point to the holding pressure via stroke
TransferVolume	3:TransferVolume	TransferVolume	Transfer, Stroke Volume	Variable	0:Double	0:RJGAnalogItemType	Switch-over point to the holding pressure via volume

Indicates RJG-Provided Values (NOT EUROMAP)

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

SUMMARY VARIABLES (CONTINUED)

NODESET—MULTI-PROFILE VARIABLES

NOTES *<Profile> refers to any of the listed profiles from OPC UA; for example, CushionStroke, HoldSpecificPressureMaximum*

Name	Profiles (RJG)	Profiles (OPC UA)	OPC UA Name	Note
Cushion	Stroke Length, Stroke Volume	Stroke, Volume	Cushion<Profile>	
Transfer	Stroke Length, Stroke Volume	Stroke, Volume	Transfer<Profile>	
Shot Size	Stroke Length, Stroke Volume	Stroke, Volume	ShotSize<Profile>	InjectionUnitCycleParametersType does not have any variables for ShotSize
Decompress	Stroke Length, Stroke Volume	Volume	Decompression<Profile>AfterPlastification	RJG Decompress value represents DecompressionAfterPlastification. The OPC UA standard only includes DecompressionVolumeAfterPlastification
Back Pressure	Hydraulic Pressure, Plastic Pressure	Hydraulic, Specific	BackPressure	
Fill Pressure	Hydraulic Pressure, Plastic Pressure	Hydraulic, Specific	<Profile>PressureMaximum	
Hold Pressure	Hydraulic Pressure, Plastic Pressure	Hydraulic, Specific	Hold<Profile>PressureMaximum	
TransferRJG	RJG Stroke Length, RJG Stroke Volume	Stroke, Volume	TransferRJG<Profile>	These are specific representations of these variables from RJG
ShotSizeRJG	RJG Stroke Length, RJG Stroke Volume	Stroke, Volume	ShotSizeRJG<Profile>	These are specific representations of these variables from RJG

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

SUMMARY VARIABLE ALARM VARIABLE TYPES

NAMESPACE

Namespace		7
NodeId	Numeric	2001
Name	SummaryVariableAlarmVariableType	
BrowseName	7:SummaryVariableAlarmVariableType	
DisplayName	SummaryVariableAlarmVariableType	
NodeClass	Data Type	Nodeset definition
		https://reference.opcfoundation.org/nodesets/2/16317
Parent	Structure	Reference documentation
		https://reference.opcfoundation.org/v105/Core/docs/Part5/7.4

NODESET

Name	Tag	Profile	LowLimit	Nominal	HighLimit	Alarm-Count-Above	Alarm-CountBe-low	Warning-Count-Above	Warning-CountBe-low	ErrorCount
NodeID	7:6303	7:6304	7:6305	7:6380	7:6381	7:6091	7:6081	7:6082	7:6083	7:6090
Browse Name	7:Tag	7:Profile	7:LowLimit	7:Nominal	7:HighLimit	7:Alarm-Count-Above	7:Alarm-CountBe-low	7:Warn-ingCount-Above	7:Warning-CountBe-low	7:Er-rorCount
Display Name	Tag	Profile	LowLimit	Nominal	HighLimit	Alarm-Count-Above	Alarm-CountBe-low	Warning-Count-Above	Warning-CountBe-low	ErrorCount
RJGName	Alarm Type		Lower Limit		Upper Limit					
Node Class	Variable									
Data Type	0:String	0:String	0:Number	0:Number	0:Number	0:UInt64	0:UInt64	0:UInt64	0:UInt64	0:UInt64
TypeDefinition	0:BaseDataVariable-Type		0:BaseAnalogType			0:BaseDataVariableType				
Notes										

Indicates RJG-Provided Values (NOT EUROMAP)

DATA IN OPC UA EUROMAP FORMAT (CONTINUED)

RJG ANALOG ITEM TYPE

NAMESPACE

Namespace		7
NodeId	Numeric	2003
Name	RJGAnalogItemType	
BrowseName	7:RJGAnalogItemType	
DisplayName	RJGAnalogItemType	
NodeClass	Variable	Nodeset definition https://reference.opcfoundation.org/nodesets/121/37435
Parent	AnalogItemType	Reference documentation https://reference.opcfoundation.org/v105/Core/docs/Part8/5.3.2/

NODESET

Name	EngineeringUnits	SummaryVariableAlarm
Symbolic Name	1:EngineeringUnits	1:SummaryVariableAlarm
Display Name	EngineeringUnits	SummaryVariableAlarm
RJGName	Alarm Type	Lower Limit
Node Class	Variable	
Data Type	0:Double	
TypeDefinition	0:AnalogItemType	

†currently unused

THE HUB®
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