



User information - EUROMAP 77 ENGEL



WARNING!

Improper use of the machine can lead to severe injury to persons and damage to equipment!

You must read this instruction manual carefully and familiarize yourself with the safety precautions before operating the system or carrying out any maintenance.

You must ensure that the persons carrying out the activities on the machine have read and understood the relevant sections and chapters of the instruction manual.

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Translation of original instruction manual

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ENGEL Data interface

Interface between injection molding machine and MES - Manufacturing Execution System.

Based on

- EUROMAP 77, Release 1.00a, 28. Januar 2019
- EUROMAP 83, Release 1.01, 28. Januar 2019

This document should provide a first overview about the availability of the specified functions in Eu-romap 77. For detailed information, please use the appropriate version of the EURO-MAP specifications.

They are available for download on the following listed pages:

- http://www.euromap.org/en/euromap77
- http://www.euromap.org/en/euromap83

The data interface is available for all machines with control CC300 from Software version V4.50.

(i

Information

In order to use all the functions described in this document, a software update may be required.

1 EUROMAP 77 - OPC UA based communication

How is communication?

OPC UA was defined as the transmission technology for the EUROMAP 77 standard. OPC UA is an industrial M2M communication protocol with a platform independent and service ori-ented architecture, which includes all individual OPC class specifications within one extendable framework. The first release happened 2008.

Further information is available online at <u>www.opcfoundation.org</u>.

What is available?

Within the scope of EUROMAP 77 and EUROMAP 83 information models were developed, which define the data, that is available and the provided functionalities.

EUROMAP 83 is herein the superior standard with general definitions of plastics and rubbery machines.



2 Functional overview

The following functions are available with the EUROMAP 77

- General information about the machine (manufacturer, model, serial number...), current configuration and status of the machine including moulds, injection units and power units, and logbook of relevant changes on the machine.
- Order management: Production cycles and methods to send jobs from the MES to the machine and to release the production.
- Data set management: Storage of the settings in data sets. These also include information about process parameters (times, temperatures, pressures, etc.) of the machine, but also of integrated robot systems. EUROMAP 77 enables data set transfer between injection molding machines and MES for setting up a central memory for data sets.

Source: EUROMAP 77 Specification, Release 1.00a, 28 January 2019.

3 Network connection to the machine

A network connection is located at the rear of the monitor or as an option at the switch cabinet to connect the machine with the site network.

EUROMAP 77 requires a network connection to the machine (client-server communication via network).

Example: Network connection located at the rear of the screen of the injection molding machine.



Network configuration

The network configuration can be implemented from user level 11 in the service application. The following screen pages will take you to the network configuration:

- Production management system
 Screen page is available from software version V4.82.
- System administration

Screen page



The screen page is below the following components and tasks:

Components		Tasks
Peripheral unit	Prc	oduction
Configuration		
Connection information		
	URL Machine	opc.tcp://192.168.110.1:4840





1. Select 'System Administration' - 'Network' - 'Change'.

Configuration file selection

When selecting a configuration file, the selection option appears for network interfaces that were saved in the configuration file. These network interfaces can be edited. If you change the network settings, then the control unit creates a backup of the last settings. This backup can be used to restore data after an incorrect setting.

Network interface

Select 'eth0' as network interface. This is located on the rear of the screen or optionally on the control cabinet.

Automatically start the network interface

If the screen switch is ticked, the network interface is configured when the control unit starts. If the screen switch is not ticked, the network interface is not active.

- 2. Adjust network configuration.
 - Network type

Select either 'static' (static IP address) or 'dhcp' (automatically assigned IP address). Also fill out the other fields in the 'static' setting.

IP address

The IP address assigned to the control unit. Do not use the following internal control unit addresses:

Machine network	System network
192.168.100.1	192.168.101.10
192.168.100.2	192.168.101.11
192.168.100.10	192.168.101.20
192.168.100.20	192.168.101.50 - 59
192.168.100.30	192.168.101.60
192.168.100.40	192.168.101.62
	192.168.101.64
192.168.110.x	192.168.101.70 - 85

- Subnet mask
- Subnet mask
- Network gateway IP-address of the gateway in the network
- Name server The DNS server IP address can also be left blank.
- DNS search Suffix for DNS requests.
- 3. Press **[Accept]** to confirm the change. Press **[Cancel]** to not save the change.
- 4. Restart the control unit so that the changes become effective.



4 EUROMAP 77 Authentication

Using the data interface EUROMAP 77 requires an OPC UA capable client software (the client) connecting to the OPC UA Server on the IMM (the server). To establish the connection, the client must authenticate to the server.

For authentication, the user name and password are required. As of software version V4.82, authentication is also possible with a certificate. An anonymous login is rejected by the server. Together with the EUROMAP 77 data interface you will also receive the license 'Access authorization via password', which allows you to create users with a password locally on the machine. These users with a password can be used for authentication on the server.

	– Licenses			
(i)		OptionsID	Option value	Valid until
		Maximum clamp force	500	01.01.4000
		Autoprotect - Mold protection	0	01.01.4000
		Access authorization via password	0	01.01.4000
		e-factory	1	01.01.4000
		Data interface EUROMAP 77	0	01.01.4000

User creation for the EUROMAP 77 authentication:

Only required if authentication is not done with a certificate.

- 1. Log on to the machine using a user authorization card with the 'Administrator' role (e.g.: 'Service_Customer' user authorization card).
- 2. Tap on the user name in the header.

208476-192.168.110.1 cc300	Service_Customer	19.12.17 15:41

'Log-on' dialog box appears

3. Change to the 'user management' tab in the dialog window.

Log in			
Log in	User settings	User management	
Service_Customer			
Cancel 😣	Delete	Edit	Add

4. Press the **[add]** key.

□ The dialog window 'create new user' appears.

Create new user				
	User name			
	User key			
		Language	DE - Deutsch	-
		Country	AT	-
		Password		
		Repeat password		
			User level lo	ocal 1
			User level rem	note 1
		Unit	ISO	-
		Valid until	30.12.2100	
		Assigned roles		
			Write user	on card
Cancel 😣	Help	? Ro	llers A	Accept 📀

- User name Name of the new user
- User key

The user key must contain only lowercase letters and numbers.

For the authentication to the server, the user key is used as user name not the display user name. The text field User key will be prefilled with a generated unique iden-



tifier.

Change the user key to the desired user name for logging in at the server.

Language

Setting has no effect for the EUROMAP 77. English is always used in the OPC UA interface (at least from the machine).

Country

Setting has no effect for EUROMAP 77.

Password

The password must be at least 5 characters long. This password will be used later to authenticate to the server.

- Repeat password
- User level local

Access level on the machine. User level is also used when writing via EUROMAP 77.

User level remote

Access level for the robot handheld operator panel, additional panel and access via the network to the machine. Setting has no effect for EUROMAP 77.

Unit

Setting has no effect for EUROMAP 77. ISO absolute is always used.

Valid until

Date up to which the user is valid.

- Assigned roles
- Setting has no effect for EUROMAP 77.
- 5. Activate 'Write user on card' (optional).
- 6. Enter the relevant values from 'User name' to 'Valid until'.
- 7. Click on the [Roles] button to select the requested roles.

Selection of user roles		
Available roles		Selected roles
Production personnel		Maintenance technician
Mold set-up personnel		
Allrounder		
Quality manager		
Process technician		
)))	
Consol	Holp	Evenute
Cancel 😣	нер	Execute 🥑

□ By tapping (marking) an Available roles and pressing the arrow key[>], this is

moved to the **Selected roles** and vice-versa. The **[>>>]** and **[<<<]** keys move all roles.

- D Press [Execute], the roles are displayed under 'Assigned Roles'.
- 8. Press [Accept].
 - □ The following dialog appears. Hold the authorization card in front of the sensor until the dialog disappears.

Writing a user authorization card
Hold card in front of sensor

4.1 Authentication with certificates

As of software version V4.82, authentication is possible with a certificate.

Term explanation

- Application certificate Uniquely identifies the application to the EUROMAP 77 server on the control unit.
- User certificate Uniquely identifies the user to the EUROMAP 77 server on the control unit.

Possible authentication methods on EUROMAP 77

Authentication with user name and password All users with the corresponding password, which are also available on the machine control unit, can be used.

Authentication with certificates

An application certificate and/or a user certificate is required for successful authentication with certificates. They are not issued by ENGEL. Self-signed certificates as well as official certificates from certification authorities (CA) are supported. Furthermore, certificates with the file extensions .crt, .cer, .der and .pem are possible.

4.1.1 Authentication with user certificates in UaExpert

1. Create a new connection to an OPC UA server.





2. Double click on the following line.



3. Select the required IP address and confirm with **[OK]**.

Endpoint	Filter: No Filter
0	Local
🗸 😣	Local Network
>	😌 Microsoft Terminal Services
>	🔮 Microsoft Windows Network
>	🔮 Web Client Network
🔻 🐼	Reverse Discovery
~	Souther and the second seco
× 😼	Custom Discovery
_	Souther and the second seco
\odot	Recently Used
	Enter URL ? ×
	Enter URL ? ×

4. In the 'Certificate' field, load the certificate file and, in the 'Private Key' field, enter the corresponding private key.

Username	Store
Password	
Certificate	tmould/netdrive/certificates/uaexpert_user.der
9 Private Key	d/netdrive/certificates/uaexpert_key_user.pem

- 5. Close the dialog window with **[OK]**.
- 6. Establish connection to the OPC UA server.

Unitied Automation Uabipert - The UPC Unitied Architecture Client - NewProject* File View Server Document Settings Help			×
D 🖉 🗗 🙆 🔶 🗕 🍳 🗙 🔧 💄 🖻 🕱 🖵			
Project B × Data Access View		C Attri	ibutes & ×
V ■ Popet V ■ Server Node Id Dig Dist B4GE LEROMAR 77 Server®locathed Dig Data Access View	Value Datatype iource Timestamp Server Timestamp	Statuscode 2	N: 0 O

□ The first connection fails because an unknown certificate is not trusted. To allow a connection to be established, the user certificate must be trusted on the machine control unit.

[See Trust user certificates on the machine control unit on page 13.]

4.1.2 Trust user certificates on the machine control unit

- 1. Log on to the machine control unit with user level 11.
- 2. Select screen page **Production management system**.

Production management system

3. Select the **Configuration** tab.

	Configuration			
2444	Connection information			
33		URL Machine	opc.tcp://192.168.110.1:4840	
			Change IP-address	
	Application certificates			
	loaded application certificates			
	Description			
	– User certificates			
	loaded user certificates			
	Description			
		Edit		



- 4. Select menu key [Edit] -> [Load user certificate].
 - The following dialog box appears.

Read certifica	tes						
Output	Local certificates	•					
	52C6CEE6DE5CC615210D029A3BB7B9EAC2FD7798.der						
certificate							
	CN=UaExpert@engelVirtmould Gültigkeit von=Mon Mar 22 07:20:10 CET 2021 Gültigkeit bis=Sat Mar 21 07:20:10 CET 2026						
Description	Guitigkeit bis-sat Mar 21 07:20:10 CEI 2020						
Cancel	8 Help 🕡 Read 💿						

 In the dialog box, select the certificate from a connected netdrive, USB stick or directly from the transferred certificates.
 The certificate transferred when a connection is established is given an automatically generated name to avoid any naming conflicts.

6. Press [Read].

□ After that, the connection to the OPC UA server is possible via UaExpert.

4.1.3 Trust application certificates on the machine control unit

If encrypted communication with the OPC server is required, the application certificate must also be trusted.

This requires creating a new server connection using one of the three supported encryption algorithms.

- Basic128
- Basic256
- Basic256Sha256

A certificate file does not need to be read in this case. The certificate is generated by UaExpert itself.

figuration Name	ENGEL EUROMAP 77 Server@engelVirtmould	
iscovery Adv	anced	
ndpoint Filter: N	o Filter	
🔍 Local		
🗸 🧐 Local Ne	etwork	
> 💇 Micr	osoft lerminal Services	
> 🔮 Web	Client Network	
✓ M Reverse	Discovery	
🗣 < Do	ouble click to Add Reverse Discovery >	
🗸 🐼 Custom	Discovery	
🔶 < Do	ouble click to Add Server >	
V Q opc.	tcp://192.168.110.1:4840	
× 🖉 🛛	NGEL EUROMAP 77 Server@engelVirtmould (opc.tcp)	
	None - None (uatcp-uasc-uabinary) Provide the second se	
6		
S Recently	Basic235- Sign & Encrypt (uatcp-uasc-uabinary) Basic2303ha230 - Sign & Encrypt (uatcp-uasc-uabinary) Used	
⊘ Recently	a Basic236- Sign & Encrypt (uatcp-uasc-uabinary) Basic2305ha236 - Sign & Encrypt (uatcp-uasc-uabinary) Used	
Recently	Basic236- Sign & Encrypt (uatcp-uasc-uabinary) Basic2303ha236 - Sign & Encrypt (uatcp-uasc-uabinary) Used	
Recently	Basic2356 - Sign & Encrypt (uatcp-uasc-uabinary) Basic2305ha236 - Sign & Encrypt (uatcp-uasc-uabinary) Used	
Authentication Anonymou Username	Basic2356 - Sign & Encrypt (uatcp-uasc-uabinary) Basic2305ha236 - Sign & Encrypt (uatcp-uasc-uabinary) Used Settings	itore
Authentication Anonymou Username Password	Besic2305-Sign & Encrypt (uatcp-uasc-uabinary) Besic2305ha230 - Sign & Encrypt (uatcp-uasc-uabinary) Used Settings	tore
Authentication Anonymou Username Password Certificate	Basic236 - Sign & Encrypt (uatcp-uasc-uabinary) Basic2305ha236 - Sign & Encrypt (uatcp-uasc-uabinary) Used Settings s tmould/netdrive/certificates/uaexpert_user.der	tore
Recently Recently Authentication Anonymou Username Password Certificate Private Key	Besic235 - Sign & Encrypt (uatcp-uasc-uabinary) Besic2305ha236 - Sign & Encrypt (uatcp-uasc-uabinary) Used Settings s tmould/netdrive/certificates/uaexpert_user.der d/netdrive/certificates/uaexpert_key_user.pem	tore

Procedure

1. Establish connection to the OPC UA server.

Unified Automation UaExpert - The OPC Unified Architecture Client	t - NewProject*						- 0	×
0 🖉 🖯 🖉 🔕 🔶 = 🍳 × 🔩 🕹								
Abject # Poject * Poject # Poject * Reflect EUROMAP 77 Sever@localitiest * Dota Access View	Data Access Vew # Server	Node Id Display Name	Value Datatype	Source Timestamp Server Timestamp	Statuscode	Attributes S R (1) Attribute Value		e × O

□ This transfers application certificate to the machine control unit.

- 2. Log on to the machine control unit with user level 11.
- 3. Select screen page **Production management system**.

Production management system

4. Select the **Configuration** tab.

Configuration

5. Select menu key [Edit] -> [Load application certificate].

□ 'Read certificates' dialog box opens.

6. Select the transferred application certificate in the dialog box and press **[Read]**.



7. Establish connection to the OPC UA server.



□ This transfers user certificate to the machine control unit.

- Trust user certificate on the machine control unit. [See <u>Trust user certificates on the machine control unit</u> on page 13.]
- 9. Establish connection to the OPC UA server.

Unified Automation UaExpert - The OPC Unified Architecture Cli	nt - NewProject*	- 🗆 🗙
File View Server Document Settings Help		
D 🖉 🗗 🖉 🔕 🗢 = 🍳 🛛 🔌 🔔		
Project # >	Data Access View	Attributes & X
Y 🗊 Project	Server Node ld Display Name Value Datatype jource Timestamp Server Timestamp Statuscode	<u>∽</u> 🖌 🖲 🛛 Ο
Servers Servers Servers Servers Servers Secondent Deconnents Data Access View		Attribute Value

4.1.4 Deleting the certificate

To delete a certificate again and thus no longer trust the certificate, the certificate to be deleted is selected on the **Manufacturing Execution System** screen page in the list of loaded certificates and deleted through the menu key **[Edit]** -> **[Delete application certificate]** or **[Delete user certificate]**.

5 ENGEL EUROMAP 77 Server

Establish a connection to the EUROMAP 77 server of the machine:

- 1. Enter the IP addresse of the machine with your client e. g. opc.tcp://<IP-adress>:4840 (Scheme = opc.tcp, Port = 4840). [See <u>Network configuration</u> on page 5.]
- 2. The login requires the user data of a machine user. This requires the creation of a user with user name and password. As of software version V4.82, also possible with certificate.

[See EUROMAP 77 Authentication on page 8.]



Information

The user for logging on to the ENGEL OPC UA EUROMAP 77 server automatically has read and write permissions independent of the user level.

5.1 Representation of the injection moulding machine with its sub components

The moulding machine is grouped in the following sub components, in which the appropriate infor-mation and events are available. The sub components are accessible via BrowseName directly under the main object machine 'IMM_ENGEL_<Seriennummer>'.



Scheme from EUROMAP77-Specification Figure 1 - IMM_MES_Interface Type Overview



LogbookEvent EUROMAP 83 - Table 11 5.1.1

ParameterChangeLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory		
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value	
JobCycleCounter Current value of JobCycleCounter	Optional		
ParameterId Id of the changed parameter	Mandatory		
OldValue Previous value	Mandatory		
OldValueUnit Unit of the old value	Optional	Only when unit can be provided of the control system	
NewValue New value	Mandatory		
NewValueUnit Unit of the new value	Optional	Only when unit can be provided of the control system	

UserLogType (Event)				
User User, who is responsible for the change that leads to the event	Mandatory			
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value		
JobCycleCounter Current value of JobCycleCounter	Optional			
UserChange Information of login (LOG_ON_0) or logoff (LOG_OFF_1)	Mandatory			

RemoteAccessLogType (Event)				
User User, who is responsible for the change that leads to the event	Mandatory	Not implemented		
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Not implemented		
JobCycleCounter Current value of JobCycleCounter	Optional	Not implemented		
RemoteUserName Name of the remote user	Mandatory	Not implemented		
UserChange Information of login (LOG_ON_0) or logoff (LOG_OFF_1)	Mandatory	Not implemented		
Orgin Information about the origin of the remote access	Optional	Not implemented		

SequenceChangeLogType (Event)				
User User, who is responsible for the change that leads to the event	Mandatory			
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value		
JobCycleCounter Current value of JobCycleCounter	Optional			
SequenceChange Classification of the changes Current information on every change 'MODI- FY_2'	Mandatory	Default value		
Supported values: MODIFY_2				
Not available: UPDATE_0 ADD_1 MOVE_3 DELETE_4				



MachineModeChangeLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory		
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value	
JobCycleCounter Value of shot counter	Optional		
OldMachineMode Old operation mode	Mandatory		
NewMachineMode New operation mode	Mandatory		

ProductionStatusChangeLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory		
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value	
JobCycleCounter Value of shot counter	Optional		
OldProductionStatus Old production state	Mandatory		
NewProductionStatus New production state	Mandatory		

ProductionDatasetChangeLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory		
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value	
JobCycleCounter Value of shot counter	Optional		
OldProductionDatasetName Name of previous activated data set	Mandatory		
NewProductionDatasetName Name of the new data set	Mandatory		

ProductionDatasetFrozenLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory	Not implemented	
EventOriginator Represents the originator of the event	Mandatory	Not implemented	
JobCycleCounter Value of shot counter	Optional	Not implemented	
OldValue Previous value	Mandatory	Not implemented	
NewValue New value	Mandatory	Not implemented	

StandstillReasonLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory		
EventOriginator Represents the originator of the event Default value: OPERATOR_2	Mandatory	Default value	
JobCycleCounter Value of shot counter	Optional		
StandstillReasonId Id of the current StandstillReasons	Mandatory		

MessageLogType (Event)			
User User, who is responsible for the change that leads to the event	Mandatory		
EventOriginator Represents the originator of the event Default value: MACHINE_1	Mandatory	Default value	
JobCycleCounter Value of shot counter	Optional		
Id Id of alarm message	Mandatory		
IsStandstillMessage Indication if the message has led to a stand- still	Mandatory	Only based on alarm class (≤4)	



MessageLogType (Event)		
Classification Classification of the alarm message	Mandatory	Not implemented
Active State Indicates whether error was set or reset.	Optional	Active/Inactive

UserFeedbackLogType (Event)		
User User, who is responsible for the change that leads to the event	Mandatory	Not implemented
EventOriginator Represents the originator of the event	Mandatory	Not implemented
JobCycleCounter Value of shot counter	Optional	Not implemented

CycleParametersEventType EUROMAP 83 - Table 90 5.1.2

CycleParametersEventType			
JobName Name of the job	Mandatory		
JobStatus Current status of the job	Mandatory		
CurrentLotName Current production lot	Mandatory		
BoxId Id of the box	Optional	Not implemented	
JobCycleCounter Number of finished cycles in the job	Mandatory		
BoxCycleCounter Number of finished cycles for the current box	Optional	Not implemented	
MachineCycleCounter Number of finished cycles in the machine life time	Optional		
CycleTime Cycle time	Mandatory		
AverageCycleTime Average cycle time	Optional	Not implemented	
JobPartsCounter Total number of produced parts	Mandatory		
JobGoodPartsCounter Number of good parts in the current job	Mandatory		

CycleParametersEventType			
JobBadPartsCounter Number of bad parts in the current job	Mandatory		
JobTestSamplesCounter Number of test sample parts in the current job	Mandatory	Not implemented	
BoxPartsCounter Total number of produced parts in the current box	Optional	Not implemented	
BoxGoodPartsCounter Total number of good parts in the current box	Optional	Not implemented	
BoxBadPartsCounter Total number of bad parts in the current box	Optional	Not implemented	
BoxTestSamplesCounter Total number of test sample parts in the cur- rent box	Optional	Not implemented	
CycleQuality Information on the quality of the whole cycle Supported values: GOOD_CYCLE_0 in case of good part BAD_CYCLE_1 in case of bad part	Mandatory		
Not available: TEST_SAMPLE_CYCLE_2 FAILED_CYCLE_3			
CavityCycleQuality Information on the quality of the cycle for each cavity	Optional	Not implemented	
PartId Ids of the parts which were produced in the cycle	Optional	Not implemented	

5.1.3 EngelCycleParametersEventType

EUROMAP 77 - Extension of the CycleParametersEventType (Table 11)

- MouldCycleParameters_<Nr> (MouldCycleParametersType)
- InjectionUnitCycleParameters_<Nr> (InjectionUnitCycleParametersType)

MouldCycleParametersType			
Index Index of the mould Default value: 1	Mandatory	Default value	
MouldTemperatureZones MouldTemperatureZone_ <nr></nr>	Mandatory		



MouldCycleParametersType			
	Index Number of temperature zone within group	Mandatory	
	Name Name of temperature zone	Mandatory	
	Classification Type of the temperature zone	Optional	
	ActualTemperature Current temperature (real value) of the temperature zone	Mandatory	

InjectionUnitCycleParametersType			
Index Index of the InjectionUnit	Mandatory		
CushionVolume Material volume remained in front of the screw after injec-tion and holding pressure	Mandatory		
CushionStroke Screw position	Optional	Not implemented	
PlastificationVolume Volume dosed by the machine for the next injection shot	Mandatory		
DecompressionVolumeBeforePlastifica- tion Decompression before plastification is the movement of the screw in the opposite direc- tion to injection	Optional		
DecompressionVolumeAfterPlastification Decompression after plastification is the movement of the screw in the opposite direc- tion to injection	Optional		
HydraulicPressureMaximum Maximum pressure in the hydraulic cylinder	Optional	Not implemented	
SpecificPressureMaximum Pressure in the screw antechamber	Mandatory		
PlastificationRotationalSpeedMaximum Maximum plastification speed of the injection unit (RPM)	Optional	Not implemented	
PlastificationRotationalSpeedAverage Average plastification speed of the injection unit (RPM)	Optional	Not implemented	
PlastificationCircumferentialSpeedMaxi- mum Maximum screw speed for plasticizing (mm/ s)	Optional	Not implemented	

InjectionUnitCycleParametersType		
PlastificationCircumferentialSpeedAver-	Optional	Not implemented
Average screw speed for plasticizing (mm/s)		
InjectionSpeedMaximum Maximum injection speed (mm/s)	Optional	
InjectionSpeedAverage Average injection speed (mm/s)	Optional	Not implemented
TransferVolume Switch-over point to the holding pressure via volume	Optional	
TransferStroke Switch-over point to the holding pressure via stroke	Optional	Not implemented
HoldHydraulicPressureMaximum Maximum holding pressure in the hydraulic cylinder	Optional	Not implemented
HoldHydraulicPressureAverage Average holding pressure in the hydraulic cylinder	Optional	Not implemented
HoldSpecificPressureMaximum Maximum holding pressure in front of the screw	Optional	Not implemented
HoldSpecificPressureAverage Average holding pressure in front of the screw	Optional	Not implemented
CavityPressureMaximum Maximum pressure during the injection pro- cess in the cavity or mould	Optional	Not implemented
PlastificationHydraulicPressureMaximum Maximum plastification pressure in cylinder	Optional	Not implemented
PlastificationHydraulicPressureAverage Average plastification pressure in cylinder Average plastification pressure in cylinder	Optional	Not implemented
PlastificationSpecificPressureMaximum Average plastification pressure in front of the screw tip	Optional	Not implemented
PlastificationSpecificPressureAverage Average plastification pressure in front of the screw tip	Optional	Not implemented
TransferHydraulicPressure Hydraulic pressure in the cylinder during switch-over to the holding pressure	Optional	Not implemented
TransferSpecificPressure Pressure in front of the screw tip during switch-over to the holding pressure	Optional	Not implemented



InjectionUnitCycleParametersType			
TransferCavityPressure Cavity pressure in the mould during switch- over to the holding pressure	Optional	Not implemented	
BackPressure Back pressure is the melt-pressure against the screw movement during dosage	Optional	Not always available	
InjectionTime Time required to fill the cavity or mould	Mandatory		
DosingTime Time to melt-up the plastic granulates and feed the melt for the next injection shot to the front of the screw	Mandatory		
FlowIndex Flow number	Optional	Not implemented	
InjectionStartPosition Start position of the injection	Optional	Not implemented	
VPChangeOverPosition Screw position at switching between injection (V) and hold-ing pressure (P)	Optional	Not implemented	



Information

In the PD record, it is possible to provide further process parameters for the ENGEL EURO-MAP 77 Server. For this purpose, it is necessary to define a new protocol on the machine. The name of the protocoll must start with 'EUROMAP' (case sensitive!). The exact description of the PD record see **Operator Manual - Machine**.

5.1.4 MachineInformation

MachineInformation		
Manufacturer Manufacturer of the machine Default value: ENGEL Austria GmbH	Mandatory	Default value
DeviceManual Address of the user manual for the Device or web address of manufacturer. Default value: engelglobal.com	Mandatory	Default value
Model Machine Type Example: DUO 2460/650	Mandatory	
SoftwareRevision Software version Example: 4.30.00 (always 7 characters)	Mandatory	

MachineInformation		
SerialNumber Serial number of the machine Example: 226778	Mandatory	
DeviceRevision Overall revision level of the Device Default value: [CC300 A01]	Mandatory	Default value
HardwareRevision Revision level of the hardware of the Device Default value: [CC300 A01]	Mandatory	Default value
RevisionCounter Amount of modifications of static data within the device Default value: [-1]	Mandatory	Default value
DeviceClass Purpose of the Device Constant: "Injection Moulding Machine"	Optional	Default value
ControllerName Default value: [CC300]	Mandatory	Default value
SupportedLogbookEvents Information which LogbookEvents are supported by the machine Default value: [0;1;2;3;4;5;6;8;9]	Mandatory	Default value
Supported Events: PARAMETER_CHANGE_0 USER_1 REMOTE_ACCESS_2 SEQUENCE_CHANGE_3 MACHINE_MODE_CHANGE_4 PRODUCTION_STATUS_CHANGE_5 PRODUCTION_DATASET_CHANGE_6 STANDSTILL_REASON_8 MESSAGE_9 Not available: PRODUCTION_DATASET_FROZEN_7 USER_FEEDBACK_10		
EuromapSizeIndication	Optional	Not implemented



MachineConfiguration EUROMAP 83 - Table 26 5.1.5

MachineConfiguration		
UserMachineName Individual machine name Default value: serial number of the machine	Mandatory, RW	
LocationName Description of the location of the machine	Mandatory, RW	
TimeZoneOffset Difference of the local time to UTC Default value: [0;false] Due to NTP (Network time protocol) on CC300 this method is not used	Mandatory, RW	Not implemented
SetMachineTime (Method) Setting time and TimeZoneOffset to UTC in minutes The time on control CC300 can be updated through NTP (Network Time Protocol) For description, please see the Service Manual - Machine	Mandatory	Not implemented
PageDirectory List of the screen pages of the machine (Id+Titel) Default value: [;]	Optional	Not implemented
GetPage (Method) Retrieving the image of a page of the control system	Optional	Not implemented
GetCurrentPage (Method) Screenshot of the control system with the currently shown contents	Optional	Not implemented

MachineMESConfiguration EUROMAP 83 - Table 34 5.1.6

MachineMESConfiguration		
StandstillReasons Setting of the text for the standstill reasons on the machine.	Mandatory, RW	
In99 the field Code on the machine, it is pos- sible to set reason id from 1 to 99. But only 12 text explanations are shown on the central computer page. Software version <v4.82, 'central="" com-<br="" see="">puter' screen page. Software version ≥V4.82, see 'Manufacturing Execution System' screen page on 'Data transmission' tab. Default value in the field Code: 0 for no standstill According to the specification, it will be an empty String</v4.82,>		
Id Identifier of standstill reason Default value 0 (= no standstill)		
Text Text of the standstill reason		
LockedByMES Can be set or modified by the MES and may not be changed by the machine.		Not implemented
StandstillReasonsLockedByMES Indicates, if it is possible to change reasons on the machine. Constant: false	Mandatory, RW	Not implemented
MESUrl URL to display a webpage, which is genera- ted by the MES in a web browser integrated in the machine. Default value: [MESUrl]	Optional, RW	Not implemented



5.1.7 MachineStatus

MachineStatus			
IsPresent Informs the client if the machine is p present and connected. The Server available when the machine is switc and connected. Default value: [true]	Mandatory hysically is always hed on	Default value	
Users Currently logged on users	Mandatory		
Id Id of the user	Mandatory		
Name Name of the user	Mandatory		
IsPresent True, when the user is current in. Indicates always the current u refore Default value: true	ly logged Iser, the-	Default value	
CardUid UserId of the user card	Optional		
UserLevel User level	Optional		
UserRole User role of the current user	Optional		
Language Currently used language	Optional		
MachineMode Current operation mode of the mach Supported values: OTHER_0: if no other choice is corre AUTOMATIC_1: full automatic mode not mean, that machine is producing SEMI_AUTOMATIC_2: half automat not mean, that machine is producing MANUAL_3: manual mode or progra ruption key. SETUP_4: setup-, teach- or calibrati Not available: SLEEP_5	ine. ect. e(does g). ic (does g). am inter- on mode.		
ActivateSleepMode Activation of sleep mode of Machine SLEEP_5	Mode =	Not implemented	
DeactivateSleepMode Deactivation of sleep mode of Mach = SLEEP_5	Optional ineMode	Not implemented	

5.1.8 MachineMESStatus

MachineMESStatus		
StandstillReasonId Id of the current standstill reason.	Mandatory	
In99 the field Code on the machine, it is pos- sible to set reason id from 1 to 99. But only 12 text explanations are shown on the central computer page. Software version <v4.82, 'central="" com-<br="" see="">puter' screen page. Software version ≥V4.82, see 'Manufacturing Execution System' screen page on 'Data transmission' tab. Default value in the field Code: 0 for no standstill. According to the specification, it will be an empty String</v4.82,>		
StandstillMessage Represents the fault which causes standstill. - Id - Message - Severity - Classification	Mandatory	
MESMessage Represents a text message sent from the MES to be shown on the machine. - Id - Message - Severity	Mandatory	Not implemented
SetMESMessage (Method) Method for setting the MESMessage. - Id - Message - Severity	Mandatory	Not implemented
ClearMESMessage (Method) Method for clearing the MESMessage.	Mandatory	Not implemented
ProductionControl Allows the MES to control the production of the machine.	Mandatory	



MachineMESStatus			
	ProductionStatus Represents the production status when the machine is in automatic or semi- automatic mode. One of the following information will be set.	Mandatory	
	Supported values: OTHER_0 NO_PRODUCTION_1 READY_FOR_PRODUCTION_3 PRODUCTION_4		
	Not available: DRY_RUN_5 START_UP_2		
	ProductionReleasedByMES Release of production by MES. Default value: True.	Mandatory, RW	Not implemented
	AutomaticRunEnabled Indicates if semiautomatic or automatic run is allowed by MES. Default value: True Available from software version≥V4.80.	Mandatory, R	
	EnableAutomaticRun (Method) AutomaticRunEnabled = True Available from software version≥V4.80.	Mandatory	
	DisableAutomaticRun (Method) AutomaticRunEnabled = False Available from software version≥V4.80.	Mandatory	
	ProductionOnlyWithMES Indicates if production with the machine is only allowed when the MES is active. Default value: false	Optional, RW	Not implemented
	SetWatchDogTime (Method) Setting the duration time for which the production is released (seconds).	Optional	Not implemented
	ResetWatchDog (Method) Set of the timer again to the last value of "SetWatchDogTime".	Optional	Not implemented
	RequestTestSample (Method) Request a test sample for separation.	Optional	Not implemented

5.1.9 MachineMESStatus Events

MachineMESStatus Events			
Mess Alarn	sageConditionType (Event) n message of the machine		
	Id Id of the alarm message.	Mandatory	
	Classification Classification of the message.	Mandatory	Not implemented
	IsStandstillMessage Indication if the message has led to a standstill.	Mandatory	
	Time Time when the alarm occured.	Mandatory	
	Message Text string displayed with the alarm indication that provides additional infor- mation to the operator.	Mandatory	
	Severity Urgency of the event.	Mandatory	

5.1.10 PowerUnits

PowerUnit_ <nr></nr>		
Index Number of the power unit.	Mandatory	Not implemented
IsPresent Informs if the power unit is physically present.	Mandatory	Not implemented
Id Represents the ID of the power unit.	Mandatory	Not implemented
PowerOn Power Unit is switched on or off.	Mandatory	Not implemented
ActualTemperature Current temperature of the power unit.	Optional	Not implemented
ActualPressure Current pressure of the hydraulic unit (only if machine has a hydraulic unit).	Optional	Not implemented



5.1.11 Moulds

Mould_ <nr></nr>			
Index Number of the mould	Mandatory		
ld Mold number Default value: 'Description'	Mandatory		
IsPresent Mould is currently on the machine Default value: true	Mandatory	Default value	
Description Current (physical) status of the mou Returns value from the 'Mold numb on the machine. 20 characters for software version = 50 characters for software version =	Mandatory er' field <∨4.80 ≥∨4.82		
MouldStatus Current (physical) status of the mou Current (physical) status of the mou always related to current mould on machine, therefore Default value: MOULD_INSTALLED_3	Mandatory Ild Ild. Is the	Default value	
MouldTemperatureZones MouldTemperatureZone_ <nr></nr>	Mandatory		
Index Number of temperature zone group	Mandatory within		
Name Default name of the tempera	Mandatory ture zone		
IsPresent Temperature zone is present nected Default value: true	Mandatory and con-	Default value	
Classification Type of the temperature zone	Optional		
'Supported values:' HEATING_1 COOLING_2			
Not available: OTHER_0 TEMPERATURE_CONTROL HOT_RUNNER_4 MEASURING_5	3		
Mould_ <nr></nr>			
---	-----------	-----------------	--
ControlMode Control mode of the temperature zone	Mandatory		
Supported values: OFF_1 AUTOMATIC_2 OPEN_LOOP_5 ONLY_MEASUREMENT_6			
Not available: OTHER_0 TUNING_3 STANDBY_4			
NominalTemperature Nominal value	Mandatory		
HighDeviationTemperature1 Maximum value that is in the normal tolerance	Optional		
HighDeviationTemperature2 Maximum tolerable value	Optional	Not implemented	
LowDeviationTemperature1 Minimum tolerable value	Optional		
LowDeviationTemperature2 Minimum tolerable value	Optional	Not implemented	
ActualTemperature Current temperature (real value) of the temperature zone	Mandatory		
StandbyTemperature Lowering temperature	Optional		

5.1.12

InjectionUnits EUROMAP 77 - Table 9

InjectionUnit_ <nr></nr>		
Index Number of the injection unit	Mandatory	
Barrelld Id of the barrel	Mandatory	Equals Index
IsPresent Information whether injection unit is currently physically connected.	Mandatory	
InProduction Information, if the InjectionUnit is used in the current running	Mandatory	



InjectionUnit_ <nr></nr>			
Scre Id of Defa	wld the screw ult value: ""	Optional	Default value
Scre Screv	wDiameter w diameter	Optional	
Scre Shot	wVolume volume	Optional	
Maxs Maxi	ScrewStroke mum stroke of the screw	Optional	
Tem Barre	peratureZones elTemperatureZone_ <nr></nr>	Mandatory	
	Index Number of the BarrelTemperatureZone	Mandatory	
	Name Name of the BarrelTemperatureZone	Mandatory	
	IsPresent Default value: true	Mandatory	Default value
	Classification Type of the temperature zone	Mandatory	
	Supported values: HEATING_1 COOLING_2		
	Not available: OTHER_0 TEMPERATURE_CONTROL_3 HOT_RUNNER_4 MEASURING_5		
	ControlMode Control mode of the temperature zone	Optional	
	Supported values: OFF_1 AUTOMATIC_2 OPEN_LOOP_5 ONLY_MEASUREMENT_6		
	Not available: OTHER_0 TUNING_3 STANDBY_4		
	NominalTemperature Nominal value	Mandatory	
	HighDeviationTemperature1 Maximum value that is in the normal tolerance	Optional	
	LowDeviationTemperature1 Minimum tolerable value	Optional	

InjectionUnit_ <nr></nr>			
HighDeviationTemperature2 Maximum tolerable value	Optional	Not implemented	
LowDeviationTemperature2 Minimum tolerable value	Optional	Not implemented	
ActualTemperature Current temperature (real value) of the temperature zone	Mandatory		
StandbyTemperature Lowering temperature	Optional		
Position Position of temperature zone. Starting with '1' from the material supply. The highest position is at the nozzle. CAUTION! In contrast, the sequence in the	Mandatory		
	tionUnit_ <nr> HighDeviationTemperature2 Maximum tolerable value LowDeviationTemperature2 Minimum tolerable value ActualTemperature Current temperature (real value) of the temperature zone StandbyTemperature Lowering temperature Position Position of temperature zone. Starting with '1' from the material supply. The highest position is at the nozzle. CAUTION! In contrast, the sequence in the machine starts at the nozzle with '1'.</nr>	tionUnit_ <nr>HighDeviationTemperature2 Maximum tolerable valueOptionalLowDeviationTemperature2 Minimum tolerable valueOptionalActualTemperature Current temperature (real value) of the temperature zoneMandatoryStandbyTemperature Lowering temperatureOptionalPosition with '1' from the material supply. The highest position is at the nozzle.MandatoryCAUTION! In contrast, the sequence in the machine starts at the nozzle with '1'.Mandatory</nr>	

5.1.13 Jobs

EUROMAP 83 - Table 66

Jobs			
Activ Curre	veJob ent order	Mandatory	The attributes can be described via SetCyc-licJobData .
	JobName Name of the job	Mandatory	
	JobDescription Description of the job	Mandatory	
	CustomerName Name of the customer for the current job	Mandatory	
	ProductionDatasetName Name of the production dataset	Mandatory	
	ProductionDatasetDescription Description of the data set	Mandatory	
	Material Material name used for the job. Limited to one entry per injection unit.	Mandatory	
	ProductName Name of the product(s) (multiple cavity). Limited to one entry.	Mandatory	



Jobs			
	ProductDescription Description of the product	Mandatory	
	ContinueAtJobEnd Indicates if the machine continues the production even if the nominal output has been reached. Default value: [false]	Mandatory	Default value
	NominalParts Total number of parts that shall be pro- duced by the job (Sum of all cavities)	Mandatory	
	NominalBoxParts Number of parts that shall be put into one box	Optional	
	ExpectedCycleTime Calculated cycle time for the job	Optional	
	MouldId Id from the mould	Mandatory (RW)	
	NumCavities Number of cavities	Mandatory	
	SetCyclicJobData (Method) Method for setting the job data for cyc- lic jobs from MES to machine Input-Argumente: [in] String JobName [in] String JobDescription [in] String CustomerName [in] String ProductionDatasetName [in] String ProductionDatasetDescrip- tion [in] String[] Material [in] String[] ProductName [in] String[] ProductDescription [in] Boolean ContinueAtJobEnd [in] UInt64 NominalParts [in] UInt64 NominalBoxParts (NULL) [in] Duration ExpectedCycleTime (NULL) [in] String MouldId [in] UInt32 NumCavities)	Mandatory	Not implemented Not implemented Not implemented Not implemented
	RequestCyclicJobWriteEventType Event is used to initiate a call of the SetCyclicJob-Data method by the cli- ent		Not implemented
Jobli Next ding	n Preparation planned order incl. all properties accor- to 'ActiveJob'.	Optional	Not implemented
Send Send the s	IJobList (Method) a list of jobs available on the client to erver	Optional	Not implemented

Jobs	Jobs			
Send Send (inste	CyclicJobList (Method) a list of jobs for cyclic production ad SendJobList)	Optional	Not implemented	
Activ Value	eJobValues s of the active job	Mandatory		
	JobStatus Current status of the job Default value: [0]	Mandatory		
	Supported values: JOB_FINISHED_8 JOB_IN_PRODUCTION_6 JOB_INTERRUPTED_7 OTHER_0			
	Not available: TRANSFERRED_ASSIGNED_1 SET_UP_ACTIVE_2 SET_UP_INTERRUPTED_3 SET_UP_FINISHED_4 START_UP_ACTIVE_5 TEAR_DOWN_ACTIVE_9 TEAR_DOWN_INTERRUPTED_10 TEAR_DOWN_FINISHED_11			
	StartJob (Method) Change the JobStatus to JOB_IN_PRODUCTION_6	Mandatory	Not implemented	
	InterruptJob (Method) Change the JobStatus to JOB_INTER- RUPTED_7	Mandatory	Not implemented	
	FinishJob (Method) Change the JobStatus to JOB_FINIS- HED_8	Mandatory	Not implemented	
	CurrentLotName Current production lot Default value: ""	Mandatory, RW		
	BoxId Id of the box in which the current pro- duction is put in	Optional		
	JobCycleCounter Number of finished cycles in the job	Mandatory		
	BoxCycleCounter Number of finished cycles for the cur- rent box	Optional	Not implemented	
	MachineCycleCounter Number of finished cycles in the machine life time	Optional	Implemented	



Jobs	;		
	LastCycleTime Cycle time of the recently finished cycle (millisec.)	Mandatory	
	AverageCycleTime Average cycle time	Optional	Not implemented
	JobPartsCounter Total number of produced parts	Mandatory	
	JobGoodPartsCounter Number of good parts in the current job	Mandatory	
	JobBadPartsCounter Number of bad parts in the current job	Mandatory	
	JobTestSamplesCounter Test sample parts are – according to the machine settings - rated as good or bad part. Therefore test sample parts counter is always 0. Default value: [0].	Mandatory, R	Default value and/or. Not implemented
	BoxPartsCounter Total number of produced parts in the current box	Optional	Not implemented
	BoxGoodPartsCounter Total number of good parts in the cur- rent box	Optional	Not implemented
	BoxBadPartsCounter Total number of bad parts in the current box	Optional	Not implemented
	BoxTestSamplesCounter Total number of test sample parts in the current box	Optional	Not implemented
	LastPartId Ids of the parts produced in the recently finished cycle	Optional	Not implemented
	StopAtCycleEnd (Method) MES directs the machine to stop at the end of the current cycle Available from software version≥V4.80.	Mandatory	
	ResetJobCounters (Method) Setting the cycle and parts counters for the job to 0	Mandatory	
	ResetBoxCounters (Method) Setting the cycle and parts counters for the current box to 0	Optional	Not implemented
	ResetAverageCycleTime (Method) Initiates a new calculation of the ave- rage cycle time for the job	Optional	Not implemented

5.1.14 Jobs Events

Jobs Events	
RequestJobListEventType (Event) Initiates a call of SendJobList method by the client.	Not implemented
RequestCyclicJobListEventType (Event) Initiates a call of SendCyclicJobList method by the client.	Not implemented

5.1.15 ProductionDatasetManagementType

EUROMAP 83 - Table 96

Prod	ProductionDatasetManagementType			
Activ	eProductionDatasetStatus	Mandatory		
	Information Status of the production dataset which is active in the control system of the machine	Mandatory		
	Modified Informs if the production dataset has been changed	Optional	Not implemented	
	Frozen If TRUE, no changes on the machine in the produc-tion dataset (change of process parameters) are al-lowed.	Optional	Not implemented	
	Load (Method) Loads a production dataset from the file system of the machine to the con- trol of the machine	Optional		
	Save (Method) stores a production dataset from the control of the machine to the file sys- tem of the machine with the given name	Optional		
Prod Statu prepa	luctionDatasetInPreparationStatus us of the production dataset which is in aration	Optional	Not implemented	
Prod Is us lable ver	luctionDatasetLists ed to exchange information on the avai- pro-duction datasets on client and ser-	Optional		
	GetProductionDatasetList For reading a list from the server which production datasets are available on the machine's file system		Not implemented	



Prod	ProductionDatasetManagementType			
	SendProductionDatasetList For sending a list of production data- sets available on the client to the ser- ver			
Prod For t	uctionDatasetTransfer he transfer of production datasets	Mandatory		
	ClientProcessingTimeout Maximum of accepted duration in milli- seconds for the server between met- hod call and finished file transfer Default value: [120]		Default value	
	GenerateFileForRead (Method) Dataset transfer from the machine to the client			
	Input argument: ProductionDatasetReadOptionsType: Storage / Name			
	Supported values for Storage: PRODUCTION_1: Create part data set from current set- tings FILE_SYSTEM_4: Read part data set with name from input argument			
	Not available: PREPARATION_2			
	GenerateFileForWrite (Method) Dataset transfer from the client to the machine Input argument: ProductionDatasetWriteOptionsType: Storage / Name / Components Supported values for Storage: PRODUCTION_1: Movement of a part data set to the machine control with immediate activa- tion FILE_SYSTEM_4: Movement of a part data set to the local file system of the machine. Name is required. Not available: PREPARATION_2			
	CloseAndCommit (Method) Termination of GenerateFileForWrite			

Further supported OPC UA methods of the temporary FileType-Object according to OPC UA Part 5:

- Read (Method)
- Write (Method)
- Close (Method)

GetProductionDatasetInformation (Method) Allows reading the description of a production da-taset during the file transfer from the ser- ver to the cli-ent with ProductionDataset- Transfer.	Optional	
SendProductionDatasetInformation (Method) Allows sending of the description of a produc- tion da-taset during the file transfer from the client to the server with ProductionDataset- Transfer.	Optional	

5.1.16 ProductionDatasetLists Events

ProductionDatasetLists Events					
RequestProductionDatasetListEventType Request to MES to send possible data sets (info about the data sets) to the machine via SendProductionDatasetList.					

5.1.17 ProductionDatasetTransfer Events

ProductionDatasetTransfer Events							
RequestProductionDatasetReadEvent- Type Event to trigger a file transfer from the ma- chine/server to the client. The event can be initiated e.g. by the operator.		Implemented					
RequestProductionDatasetWriteEvent- Type Event to trigger a file transfer from the client to the machine/server. The event can be initi- ated e.g. by the operator.		Implemented					



6 ENGEL Extensions

The following functions are an extension of ENGEL and are not defined in EUROMAP 77/83.

🗎 Root Dbjects 🚕 DeviceSet > 뤚 DeviceFeatures IMM_ENGEL_212582 Extension > 🔹 AddParameter > = GetCurrentAlarms > = GetPhrases ListParameter ListPossibleParameter RemoveParameter RemoveParameterByUri Parameters InjectionUnits Jobs MachineConfiguration MachineInformation MachineMESConfiguration

Integration of the Extention in the IMM_MES_InterfaceType

Behavior of the node IDs

For ENGEL machines, it must be taken into account that the node ID can change after the control unit is switched off/on. When a client makes a new connection, it should be expected that the node IDs may have changed in the meantime.

Based on this, a good approach would be to traverse the OPC UA information model at the beginning of a new client session and thus implicitly after switching off/on the machine, and to redetermine the node IDs/browse paths. It is not advisable to use the node ID fixed coded.

AddParameter

Create a new data end point in the extended information model. Data end point is added to the 'Parameters' folder and remains even over a restart. However, this may change the Nodeld. Further information, see **ListParameter**. [See <u>ENGEL Parameters URI</u> on page 46.]

```
AddParameter (
[In] String ParameterURI
[Out] NodeId NodeId);
```

GetCurrentAlarms

Returns all alarms pending at the system.

```
GetCurrentAlarms (
[Out] AlarmDataType[] Alarms);
```

GetPhrases

Phrases for the PhraseKeys are returned in the specified language. For unknown languages, en (English) is used.

Language codes according to ISO 639-1 e.g. en, de.

```
GetPhrases (
[In] String[] PhrasesKeys,
[In] String Language,
[Out] String[] Phrases);
```

A PhraseKey can also be a parameter URI. This makes it possible to get the short and long text of a variable (result: 'short text|long text').

ListParameter

Listing of the currently included data endpoints in the extended information model Function can be helpful after a restart, as this can change the Nodeld's of the data end points added via AddParameter.

```
ListParameter (
[Out] ParameterDataType[] ListOfAddedUris);
```

ListPossibleParameter

Listing of the parameters, which are available for extension of the information model Existing variables can be searched for and then added via their URI using **AddParameter**.

```
ListPossibleParameter (
[In] String MachineryPart;
[In] String[] Components;
[Out] PossibleParameterDataType[] PossiblePa-
rameters);
```

Input arguments: MachineryPart e.g. cc300://imm/ Components: LongText of the desired unit from 'PossibleParameterDataType'

The 'PossibleParameterDataType' is as 'SubType' from 'BaseDataType' defined as follows:

```
PossibleParameterDataType{
String VisUri;
String LangText;
};
```

Step-by-step approach possible

- Call without parameters: The MachineryParts are located in VisUri. Possible arguments of MachineryParts are returned.
- Call with MachineryPart / without components: Possible components are returned.
- Call with MachineryPart + component(s): The LongText arguments contain the components. Example for shot volume: VisUri = cc300://imm/cm#//c.InjectionUnit1/p.sv_rPlastStopVol/v; LongText = sv_rPlastStopVol

RemoveParameter

Deleting a data end point from the extended information model via its Nodeld. Data end point is deleted from the 'Parameters' folder.

RemoveParameter ([In] NodeId NodeId);

RemoveParameterByUri

Deleting a data end point from the extended information model via its URI. Data end point is deleted from the 'Parameters' folder.

```
RemoveParameterByUri (
[In] String Uri);
```



6.1 ENGEL Parameters URI

The ENGEL Extensions are also used to dynamically add parameters that are available in the machine software but are not covered by the standard EUROMAP 77 interface. To fully use this function, you need to know the parameter URI. The parameter URI (Unified Recource Identifier) is a unique designation of parameters that is used internally to identify parameters. Depending on the software version, various options for determining the parameter URI are available as described in the following chapters.

6.1.1 Determining parameter URI via function menu

Software version ≥V4.72

To determine the URI for a specific parameter proceed as follows:

- 1. Log on as a user with Level 11 rights.
- 2. Tap the desired parameter on the screen so that the input keyboard is displayed.

Opening strok	е		
			300,0
5,0			750,0
intermediate depo	osit:		(300)
7	8	9	+
4	5	6	‡
1	2	З	Ŧ
0	+/-	,	++
8	?		9

- 3. The dialog box closes again
- 4. Press [Determine URI] in the function menu.
 - □ The following dialog box is displayed with the data of the previously selected parameter:

Determine URI and add to file							
Variable	Variable APPL.Mold1.sv_rMldOpenPos						
URI	URI cc300://imm/cm#//c.Mold1/p.sv_rMldOpenPos/v						
Long text Opening stroke							
	Target drive master://media/usbstick1/						
	Cancel 🚫	Help 🕐	Save ⊘				

- 5. Change the target drive, if required, and input the file name. The control unit automatically adds the extension '.csv' to the file name while saving it.
- 6. Save

If the file does not yet exist in the target drive, it is created by the control unit. Otherwise the control unit adds the current URI to the file.

If the control unit does not find the 'variable', the following message is displayed:

IPI not found			
	URI not found		

6.1.2 Determining parameter URI with component model browser Software version <V4.72

To determine the URI for a specific parameter proceed as follows:

- 1. Log on as a user with Level 13 rights.
- 2. Tap the desired parameter on the screen so that the input keyboard is displayed.

Opening strol	ke		
			300,0
5,0			750,
intermediate dep	osit:		(300
7	8	9	+
4	5	6	‡
1	2	3	Ŧ
0	+/-	,	++
8	?		9
1			

- 3. Close the dialog box again. Information for the parameter is thereby copied to the clipboard.
- 4. Open the 'Notes' screen page and insert the contents from the clipboard using the following key.

The first line of the text contains the NativeKey (e.g. B. Mold1.sv_rMldOpenPos) which will be needed later.





5. Ac	cept inpu	ıt wil	th the	e foll	owin	ig ke	ey.									
	Note	s														
	Mold	1.sv_	rMidC	⊃pen⊦	'os											
	Varia IEC Value Shor	√ariable Mold1.sv_rMldOpenPos EC Type REAL √alue 350,0 Shorttext swa														
	^	1	2	3	4	5	6	7	8	9	0	ß	ž	#	+	
	-	q	w	e	r	t	z	u	1	0	р	ũ	+	Entf	Alles	
	ত	_	a	s	d	f	g	h	J	k	1	ö	ä		L	
	Ŷ	<	< y	×	c		/ k	o r	n n	n,			+	•	Se	
	Str	9	Alt									C	3	-	•	
			0					?					0		<	_

- 6. In the function menu, press **[Screen page selection]**.
- 7. In the dialog box, select the 'Component model browser' and [Show].

Screens
+ cc300://tcd/
cc300://system/
Notifications
E Component model browser
Jean Set management
Ĩ→ EtherCAT
₫ → EtherCAT
System administration
Infolog
System capacity utilization
IO-Overview
8 Oscilloscope

- □ The 'Component model browser' appears.
- 8. In the menu, select [Edit] and [Find URI].
 - □ The following dialog box appears:

URI search for Native	e Key		
Native Key			
Search in model		cc300://system/	-
URI			
	Close	Copy URI	

- 9. Depending on the NativeKey for determining the URI, make the following setting in the dialog box:
 - Native Key: Mold1.sv_rMldOpenPos
 - Search in model: cc300://imm/

10. The determined URI can now be copied to the clipboard with [Copy URI].

URI search for Native Key						
Native Key	/old1.sv_rMldOpenPos					
Search in model	cc300://imm/					
URI cc300://imm/cm#//c.Mold1/p.sv_rMldOpenPos/v						
	Close	Copy URI				

6.1.3 Determine parameter URI based on its native key

The key can be converted in a generic way. This is possible for almost all parameters except the heaters and e-flomo.



Example:

```
Ejector1.sv_rEjeFPos
is
cc300://imm/cm#//c.Ejector1/p.sv_rEjeFPos/v
```



Example:

```
Ejector1.sv_BackwardAvailableInSequence[1]
is
cc300://imm/cm#//c.Ejector1/p.sv_BackwardA-
vailableInSequence/v/p.[1]/v
```

6.1.3.1 Definition of the parameters of the heating zones

The definition of the heating parameters depends on the individual machine configuration. This configuration also depends on the delivery state of the machine. In addition, the heating configuration can be adapted by the customer.

Therefore, it is not possible for ENGEL to offer a generally valid list of heating parameters. It must be generated individually for each machine, based on its heating configuration. This part of the documentation describes how the parameter URI of the heating parameters is composed.

The parameters for the CC300 machine control unit are structured as follows:

cc300://imm/cm#//c.TemperingComponent/groupnumber/zone-number/v/parameter/v

Group number	p.TemperingGroup	n = group number of the heating group
Zone number	p.TemperingZone	n = zone number within the group start- ing with 1
Parameters	p.ActValue	Actual value
	p.SetValue	Set value
	pActionSignal	Heating power real value [%]





Example:

The parameter for the actual value of the nozzle heating (=first zone of the barrel heating group) is therefore:

cc300://imm/cm#//c.TemperingComponent/p.TemperingGroup1/p.TemperingZone1/v/p.ActValue/v

This is how you can check the zone number on the machine control unit

You can read the group and zone numbers on the 'Heating configuration' screen page on the CC300 machine control unit.

Group number

Select the heating group and read the group number on the Attributes tab. In this example: TemperingGroup1.

	- 4 Barrel heating 1	Attributes	Parameters
O,P	Nozzle 1	Element attributes	
	Barrel zone 2		
	Barrel zone 3	Name	Barrel heating 1
	Barrel Zone 4	System name	
	Peedinioal 5		\mathbf{N}

Zone number

The zone number results from the position of the zone within the heating group. In the following example, 'Barrel zone 2' has the zone number 3 because it is in the second position within the 'Barrel heating 1' group.

	 Barrel heating 1 	Attributes		Parameters	
O'lr	1 Nozzle 1		Element attributes		
	Ar Barrel zone 2	_	Element attributes		
	The Barrel zow			Name Barrel zone - ce-	
	📲 Barrel zone 4		User-defined name		
	Cl ⁴ Feedthroat 5			Number 1	
	- I Mold heating 1		Hardware designation	=FB101-B11:TI2+	
	4 ∯ ¹ Mold 9		System name	zone3	
	Mold 10			Use zone 📈	

The set value of 'Barrel zone 2' of the 'Barrel heating_1' heating group (system name TemperingGroup1) is the following parameter:

cc300://imm/cm#//c.TemperingComponent/p.TemperingGroup1/p.TemperingZone3/v/p.SetValue/v

6.2 Application examples with UaExpert

This section of the document shows how you can use the EUROMAP 77 data interface with the UaExpert client software from Unified Automations GmbH. UaExpert is not an ENGEL product and therefore not included in the scope of delivery of the EUROMAP 77 data interface.

6.2.1 Connection build-up with UaExpert

Add an OPC UA server to the UA Client configuration with the following steps:

- 1. Select the 'Servers' folder.
- 2. '+' Select the icon for Add Server.
- 3. Enter a free name for configuration.
- 4. Define end point URL with IP address of machine opc.tcp://<IP-address>:4840
- 5. Enter the user who is available on the control unit. [See <u>EUROMAP 77 Authentication</u> on page 8.]
- 6. Enter password
- 7. Enter a free name for the session.
- 8. Confirm entries with OK.



A certificate is initially exchanged between CC300 and UA Client to establish the connection. However, the one from the CC300 is self-signed, i.e. without an official certification authority. This must be accepted once as trustworthy by UaExpert.



Certificate Validation			?	×
The certificate of serve	r 'Engel Euromap77	Server' was validated succ	essfully.	
Good				
Certificate Chain				
Name		Trust Status		
🛕 EM77 OPCUA-Se	rver@engelVirtmould	Trusted		
Certificate Details				
Subject		- O N/i - t I - I		^
Common Name	EMITT OPCUA-Serve	er@engelvirtmould		
Organization	Engel Austria GmbH			
OrganizationUnit				
Locality				
State				
Country	bars 11			
DomainComponent	engelVirtmould		_	
Common Namo	EM77 OPCIIA-Sonra	r@ongolVirtmould	_	
Organization	Engol Austria GmbH	awengervirtinould		~
		Trust Serve	r Certific	ate <
Accept the server certific	cate temporarily for this	session Continue	Cance	el

The connection to the server is then established by means of "Connect":

Unified Automation UaExpert - The OPC Unified Ar <u>File</u> View <u>Server</u> <u>D</u>ocument <u>Settings</u> <u>H</u>elp



After a successful 'Connect', the address space of the specific machine appears:



6.2.2 Subscribing to events

Part of the data provided by the EUROMAP 77 data interface is represented in the form of OPC UA events, e.g. cycle parameters or alarms. Access to data provided in the form of events is different from other data provided as nodes in the server's address space.

After connecting to the EUROMAP 77/OPC UA server on the injection molding machine, you need to add a new 'Document' called 'Event View' to the UaExpert GUI. In the 'Document' menu, click the 'Add...' menu item. In the dialog box, select 'Event View' as the document type and then click 'Add'.

Unified Automation UaExpert - The OPC Unified Architecture Clien	nt - virtmoule 📃 Add Document ? 🗙
Unified Automation UaExpert - The OPC Unified Architecture Clies File View Server Document Settings Help Project Project Project Withmould Ocuments Data Access View	Image: Second
	There are no functional limitations. Add Cancel

After that, a new tab called 'Event View' will be displayed in the middle of the UaExpert GUI.

Any node that acts as a creator of events can be dragged into the 'Configuration' section. According to the EUROMAP 77 specification, the main object that represents the injection molding machine /Objects/2:DeviceSet/1:IMM_ENGEL_<Serialnumber> is, among other things, an EventNotifier for the CycleParametersEventType events.





For the EUROMAP 77 interface there are two nodes that act as creators of events:

- /Objects/2:DeviceSet/1:IMM_ENGEL_<Serialnumber>
- /Objects/2:DeviceSet/1:IMM_ENGEL_<Serialnumber>/1:MachineMESStatus

Add	ress Space	6	×
9	No Highlight		•
0	Root		
~	Dbjects		
	🗸 👶 DeviceSet		
	IMM_ENGEL_III MC		
	> 🗀 Extension		
	> 🚕 InjectionUnits		
	> 👶 Jobs		
	> 👶 MachineConfiguration		
	> 臱 MachineInformation		
	> MachineMESConfiguration		_
	> 💑 MachineMESStatus		
	> 💑 MachineStatus		
	> 💑 Moulds		
	> 💑 PowerUnits		
	> 👶 ProductionDatasetManagement		
	> 💑 DeviceTopology		
	> 💑 NetworkSet		
	> 🚜 Server		
>	Types 🔁		
>	C Views		

To subscribe to specific events, expand the node you just dragged into the 'Event View' by clicking the arrow on the left side of the entry. You will find a hierarchical structure of events based on the 'Type heritage' (subtypes are included in their supertype). Check the boxes of the event types you want to subscribe to and then click the 'Apply' button.



The 'Events' section shows a list of these event notifications. You can select one of these events and check the data sent with the event in the 'Details' section.



- [1] Events
- [2] Details

6.2.3 Using the ENGEL Extension

This chapter explains how to use the ENGEL specific feature 'ENGEL Extension' in the UaExpert Client. As mentioned above, the 'ENGEL Extension' is located inside the main computer instance /Objects/2:DeviceSet/1:IMM_ENGEL_<Serialnumber> in the 'Extension' folder.

This folder contains two folders, one called 'Functions' with several OPC UA methods and one called 'Parameters'. The 'Parameters' folder is initially empty, but contains OPC UA variable nodes after parameters have been added via interaction with the methods provided in the extension.



ENGEL Extension in UaExpert



6.2.3.1 Adding a parameter with a known parameter URI

Suppose you want to add a parameter to the address space whose parameter URI is already known, for example: cc300://imm/cm#//c.system/p.sv_CoolingTime/v/p.rSetVal/v

To add a parameter, call the OPC UA method 'AddParameter'. Right-click on the method in 'Address Space' to open the context menu and select 'Call...'. This opens a dialog box where possible input arguments for the method are to be inserted.

Address Space 🗶		
😏 No Highlight 🔹 👻		
Root Objects Obje	Call AddParameter on Functions Input Arguments Name Value Parametriki Image: Cooling Time /r/b rSetValvit Output Arguments Name Value Nodeid 0 Q Numeric N Result	2 X NataType Description tring ParamterUri NataType Description lodeId NodeId
	Ca	all Close

Calling AddParameter method

The AddParameter method requires an input argument called ParameterUri. After entering the URI of the above parameter, the method is called by clicking the 'Call...' button of the dialog box.

If the method is executed successfully, it returns the 'Succeeded' status as well as values for its output arguments. Otherwise, the status contains an error code indicating the reason why the method failed. The output argument of the AddParameter method is the node ID of the OPC UA variable node that was added to the address space. This node ID can be used to access the variable node directly.

Result of the AddParameter method

🔚 Call Add	Parameter on Functions		?	\times
Input Arg	iments			
Name	Value	DataType	Descript	ion
ParamterUri	cc300://imm/cm#//c.system/p.sv_CoolingTime/v/p.rSetVal/v Load file	String	Paramterl	Jri
Output Ar	guments			
Name	Value	DataType	Descript	ion
NodeId	5 🔄 Numeric 🔻 29	NodeId	NodeId	
Result				
Succeeded				-
		Call	Close	

The newly added OPC UA variable node representing the parameter is located in the 'Parameters' folder inside the 'Extension' folder. Normally, you need to update the 'Parameters' folder to view the updated contents. Right-click the 'Parameters' folder to open its context menu and select the 'Rebrowse' item. After that, you should see the new variable node as shown below.



Updating parameters folder





Information

Please note that the number of parameters that can be added is limited for performance reasons. Currently, this limit is 100 parameters. Therefore, you cannot add more than 100 parameters at a time.

6.2.3.2 Removing a parameter

Removing a parameter added to the address space can be called either with 'RemoveParameter' or 'RemoveParameterByUri'. The former requires the node ID of the variable node that represents the parameter as an input argument. The latter requires the parameter URI as an input argument instead.

These methods have no output arguments other than the mandatory status code that indicates whether the method succeeded or failed.

RemoveParameter

Call RemoveParameter on Functions		?	×
Input Arguments			
Name Value	DataType	Descript	ion
NodeId 5 🗘 Numeric 🔻 29	NodeId	NodeId	
Result			
	Call	Close	

RemoveParameterByUri

Call RemoveParameterByUri on Functions		?	×
Input Arguments			
Name Value	DataType	Descrip	tion
Uri cc300;//imm/cm#//c.system/p.sv_CoolingTime/v/p.rSetVal/v Load file	String	Uri	
Result			
	Call	Close	

6.2.3.3 Listing the added parameters

The 'ListParameter' method returns a list of parameter URIs of all added parameters. The result is the same as when browsing the 'Parameters' folder.

6.2.3.4 Listing possible parameters and determining the parameter URI

Using the 'ListPossibleParameter' method you can determine all available parameters and specify their parameter URI so that you can add them by calling the 'AddParameter' method. [See <u>ENGEL Extensions</u> on page 44.]

ListPossibleParameter

Input Arguments	;			
Name	Value		DataType	Description
MachineryPart	cc300://imm/	Load file	String	MachineryPart
Components			String	Components
Output Argumen	ts			
Name	Value		DataType	Description
PossibleParameters	Click '' to display value		PossibleParameterDataType	PossibleParameters
Result				
				_
			Call	Close

Call the 'ListPossibleParameter' function without input values to retrieve the available 'MachineryParts'.

📕 Call ListPossible	eParameter on Functions		7 ×	C 📕 Value	×
Enput Argument Name MachineryPart Components	Value	DataType String String	Description MachineryPart Components	Name Value > PossibleParameterDataType Array(4) > [0] PossibleParameterDataType VisUn cc300//erc/ LangText [1] Y VisUn cc300//erc/ VisUn cc300//erc/ VisUn cc300//erc/	
Name PossbleParameters Result Succeeded	Cide"" to display value	DataType PossbleParameterDataType	Description PossbleParameters	VisUri cc300//tcd/ LangText VisUri cc300//tcd/ LangText VisUri cc300//tcd/ VisUri cc300//tystem/ LangText LangText	
		Cal	Close		Close

Call the function with the correct 'MachineryPart' to retrieve the underlying components.

Call ListPossib	leParameter on Functions		7 X	Value Value	×
Input Argumen Name MachineryPart	15 Value [cc300://mm/ Load fit	DataType String	Description MachineryPart	Name Value 	^
Components Output Arounne Name PossibleParameter	0	DataType PossbleParameterDataType	Description PossibleParameters	VisUri cc300://mm/cm#/cAccessDemand1 LangText AccessDemand1 V [2] PossibleParameterDataType VisUri cc300://mm/cm#/cAccessDemand2 LangText AccessDemand2	
Result Succeeded		Call	Close	[3] PossibleParameterDataType VisUri cc3000//mm/cm#/cAccousticAlarm1 LangText AcousticAlarm1 [4] PossibleParameterDataType VisUri cc3000//mm/cm#/cActivityCheck LangText ActivityCheck	

Search the long text of the selected component in the output.



Val	ue		\times
Name		Value	^
×	[62]	PossibleParameterDataType	
	VisUri	cc300://imm/cm#//c.MachineDiagnostics	
	LangText	MachineDiagnostics	
	[63]	PossibleParameterDataType	
	VisUri	cc300://imm/cm#//c.Maintenance	
	LangText	Maintenance	
v	[64]	PossibleParameterDataType	
	VisUri	cc300://imm/cm#//c.MatConveyor1	
	LangText	MatConveyor1	
×	[65]	PossibleParameterDataType	
	VisUri	cc300://imm/cm#//c.MatCylinderCoding1	
	LangText	MatCylinderCoding1	
~	[66]	PossibleParameterDataType	

Access the Edit value function of the Components field.

Name	Value		DataType	Description
MachineryPart	cc300://mm/	Load file	String	MachineryPart
Components	0	1	String	Components
Output Argumer	lts	-		
Name	Value		DataType	Description
PossibleParameters	Click '' to display value		PossibleParameterDataType	PossibleParameter
Result				

Enter the array size (1 - n) depending on how many components are to be requested.

🔚 Edi	t Value	×
Name	Value String Array[0]	2
	Array Size ? × Enter the new Array Size: 0 OK Cancel	

Enter the long text and press Write.

Edit \	/alue			\times
Name Y	Value String Array[1] 0] Maintenance			
		5	Vrite	Cancel

Call the function and it will output all possible parameters under the selected component.

Call ListPossibl	eParameter on Functions			7 ×	Watue Value	×
Enter Manual Annual Rome Name MachineryPart	Value (cc300://mm/	Load file	DataType String	Description MachineryPart	Name Value PossibleParameterDataType Array[22] [0] PossibleParameterDataType VisUn cc300//imm/cm#/rcMaintenance/p.sv_fMaxStrokeEjector/v LangText ty_MaxStrokeEjector	^
Components	(Maintenance')		String	Components	 PossibleParameterDataType VisUri cc300,/mm/cm#/ccMaintenance/p.sv_tMaxStrokeMold/v LandTest are understanded 	
Name PossbleParameters	Value Click '' to display value		DataType PossbleParameterDataType	Description PossibleParameters	VisUni cc300//imm/cm#//cMaintenance/p.sv_iOperationHourTotal/v LangTert sv:/operationHourTotal	ř,
Result Succeeded			Cal	Cose	Y [3] PossibleParameterDataType VisUm cs2002/mm/cmP/(cMaintenance/p.sv_ServiceDataStored/v LangText or_ServiceDataStored Y[4] PossibleParameterDataType VisUm cs2002/mm/cmP/(cMaintenance/p.sv_iOperationHour1/v LanoText on OperationHour1	

6.3 Current alarm display.

The current alarms are mapped in the 'ENGEL Extensions'. They can be retrieved again and again by the client at a freely definable interval.

Right-click on the 'GetCurrentAlarms' function to make a 'Call' without parameters. The currently pending alarms are then displayed in the output arguments (see the following figures).



Call GetCurrentAlarma on Functions	7 X
Output Arguments	
Name Value Alema Clob'to daplay value	DataType Description
Erset .	
	Call Close



		ent			
me	Value				
rms	W Val	ue			×
	Name			Value	^
	~			AlarmDataTuna Arra-(20)	11
	· ·	141		AlarmData Type Anaylou	- 15
		100	ы	E Sano as BallScree/TempNotConf	
			Alacentifeccane	Spindle cooling Mold pat correctly cooling and	
	-		Alarmivessage	3	
			TimeStamo	2021-09-21707-30-59 5397	
	-		Severity	810	
			IcStandstillMessage	true	
	~	[1]	a standard and a start	AlamDataTune	
			м	E SonieFiertorit er FiertorMonitorPosPlaus	- 1
	-		AlarmMessage	Plausibility Sprue elector check position	_
			AlarmClass	4	- 1
	-		TimeStamp	2021-09-21707-31-03-9932	_
			Severity	700	
-	-		IsStandstillMessage	false	
	~	[2]		AlarmDataType	_
	-		M	E SprueEjector1.er EjectorStartPosPlaus	
			AlamMessage	Plausibility Sprue elector start position	- 1
	-		AlarmClass	4	
			TimeStamp	2021-09-21707:31:03.9932	_
			Severity	700	
			IsStandstillMessage	false	_
	~	(3)	-	AlarmDataType	
			ld	E_Sprueljector1.er_ljectorFPlaus	_
			AlarmMessage	Plausibility Sprue ejector front	
	-		AlarmClass	4	
			TimeStamp	2021-09-21T07:31:03.993Z	
			Severity	700	
			IsStandstillMessage	false	
	×	[4]		AlarmDataType	
			Id	E_Ejector1.er_EjectorMonitorPosPlaus	- 1
			AlarmMessage	Plausibility ejector control position	
			AlarmClass	4	
			TimeStamp	2021-09-21707:31:04.007Z	

7 Use case - production data log

A very common use case for the EUROMAP 77 data interface is the continuous acquisition of production data for each production cycle of the injection molding machine.

7.1 Specification

The EUROMAP 77 specification stipulates that this should be done via OPC UA events. The specification defines the CycleParametersEventType, which contains basic information about the production cycle, such as cycle time, cycle quality, etc. For more details, see Chapter 16 of the <u>EUROMAP 83</u>, <u>Release 1.01</u>, <u>January 28</u>, 2019 document.

The specification requires the actual EUROMAP 77 implementation to create a subtype of CycleParametersEventType, which should be extended by an InjectionUnitCycleParameters-Type instance for each injection unit of the injection molding machine and a MouldCycleParametersType instance for each mold of the injection molding machine (see Chapter 16.14 of the <u>EUROMAP 83, Release 1.01, January 28, 2019</u>document). In the ENGEL implementation the BrowseName of this subtype is EngelCycleParametersEventType.

7.2 Subscribing to the events

This chapter shows how to access CycleParametersEventType event data, but this can be done for other events in a similar way. This showcase is done with the UaExpert client software from Unified Automations GmbH. This software is not a product of ENGEL and therefore not in the scope of delivery of our EUROMAP 77 implementation. The following screenshots only serve to show the general process of subscribing to events in a very commonly used OPC UA client. Experiences with other OPC UA clients may vary.

7.2.1 Step 1 - Opening event view

After connecting to the EUROMAP 77/OPC UA server on the injection molding machine, you need to add a new 'Document' called 'Event View' to the UaExpert GUI. In the 'Document' menu, click the 'Add...' menu item. In the dialog box, select 'Event View' as the document type and then click 'Add'.



After that, you should see a new tab called 'Event View' in the middle of the UaExpert GUI.



7.2.2 Step 2 - Dragging event notifier to Event View

Any node that acts as a creator of events can be dragged into the 'Configuration' section.

Unified Automation UaExpert - The OPC Unified Arch	ecture Client - virtmould_em77_connection*		– 🗆 X
Project & X	Data Access View Event View-2	Attributes	8 ×
 ✓ Ø Project ✓ Ø Servers 	Configuration	🗲 🧹 💺 🛞 Attribute Valu	O
Virtmould Virtmould Documents	Server/Object		
Data Access View Event View			
Event View-1			
D Event View-2			
	Apply		
	Events		
	Events Alarms Event History		
Address Space 5 ×	X 9 🔒		
😏 No Highlight 🗸 👻	A C Time Severity Server/Object SourceName Message EventType Active		
Cont Cont			
V 🖸 Objects			
		References	₽×
> 🛅 Extension		9 v ± *	Forward 🔻 🕒
> 뤚 InjectionUnits		Reference	Target DisplayName
> 💑 Jobs			
> 🍋 MachineConfiguration			
MachineMESConfiguration			
> A MachineMESStatus			
> A MachineStatus	< > >		
> 💑 Moulds	Datala		
> 👶 PowerUnits			
> 👶 ProductionDatasetManagement	Name Value		
> 뤚 DeviceTopology			
> 💑 NetworkSet			
> 🚜 Server	1		

7.2.3 Step 3 - Subscribing to the CycleParametersEventType event

To subscribe to specific events, expand the node you just dragged into the 'Event View' by clicking the arrow on the left side of the entry. You will find a hierarchical structure of events based on the 'Type heritage' (subtypes are included in their supertype). Check the boxes of the event types you want to subscribe to and then click the 'Apply' button.



7.2.4 Receiving the events

After subscribing to the CycleParametersEventType events, the OPC UA client receives a notification when the computer completes a production cycle. The 'Events' section shows a list of these event notifications. You can select one of these events and check the data sent with the event in the 'Details' section. The events occur as EngelCycleParametersEventType (a subtype of CycleParametersEventType) and contain the production parameters.



- [1] Events
- [2] Details

7.3 Event extension

The data provided with the CycleParametersEventType events is limited to commonly available parameters for different manufacturers. The ENGEL control unit software could possibly provide many more parameters than specified in the EUROMAP 77 specification. Therefore, the ENGEL implementation of EUROMAP 77 provides a mechanism to extend the CycleParametersEventType events with ENGEL specific parameters. Below there is a description of how to extend the CycleParametersEventType events with ENGEL specific parameters.

7.3.1 Create protocol

- 1. Log on to the machine control panel with user level 5.
- 2. Open the Process data screen.





5. Choose whether to create a new parameter list or if you want to use an existing one.

Execute

6. Choose [Execute].

Cancel

8

7. Select an available parameter or an entire parameter group. Filters for 'Available parameters' are available in the **Units** selection field.

Help

?

Select process para	ameters			
Protocol name Eur	omap			
Units No t	filter	•		
				Selection
Available	e parameters		Selected par	ameters
+ Ejector 1			Cycle time ejector [ZAusw]	
+ Nozzle 1			Cycle time nozzle advance [ZDv	o]
+ 📴 Part removal m	nonitoring		Rejects cause [ASU]	
+ 🔚 Mold1			Frame extension [FSPNew]	
+ 🔚 Machine coolir	ng 1			
+ 📴 Process data p	protocol			
+ 🔓 Screw 1		111		
+ 🔄 Shot counter a	and rejects selection	<		•
+ Cycle time				· · · · · · · · · · · · ·
+ 📴 Barrel heating	1			
Description Dur	ation of ejector mov	ement in the cu	rrent cycle	
– Settinas				
System of units				
Cystem of units		•		
Color		·		
	interruption 😵	Help 💿	Execute 🥑	

- 8. By tapping an **Available parameter** and pressing the arrow key[>], it is shifted to the **Selected parameters** and vice-versa. The [>>>] and [<<<] keys shift all parameters.
- 9. If desired, select a system of units under **Settings** and color for the respective **Selected parameter**.
- 10. Adjust the order of the parameters using the arrow keys next to the **Selected parame**ters window.
- 11. Press [execute] to accept a set parameter.

7.3.2 Identifying parameters

The added parameters should now be included in your OPC UA client software. They are added with their English long text and the German abbreviation names.

On the 'Process data' screen page, you can look up the parameter name with the help of the abbreviation name. The abbreviation name is displayed in square brackets after the parameter name.

	 Select protocol 				
8 XX	Protocol name EUROMAP Action at protocol error Production stop				
	 Set process param 	eters			
	Para	ameters	Graphics	Color	Unit
	Cycle time ejector [ZAusv	K			ISO
	Cycle time nozzle advance	e (Vo]			ISO
	Rejects cause [ASU]	\sim			ISO
	Frame extension [FSPNe	w]			ISO



8 Use case - transfer of production data sets

The EUROMAP 77 data interface has the 'Transfer of production data sets' function so that the client software can transfer production data sets of the injection molding machine from and to the Manufacturing Execution System (MES).

The transfer of the production data set is based on the File Transfer API of the OPC UA specification. This document describes a common method for performing a file transfer via the EUROMAP 77 data interface. For further information, please refer to <u>EUROMAP 83 recom-</u> <u>mendation Release 1.01</u> in Chapter 17.5 as well as to <u>OPC UA Specification Part 5: Informa-</u> <u>tion Model Release 1.04 in Appendix C</u>.

8.1 Transfer of production data sets

The ProductionDatasetTransfer object, located in the ProductionDatasetManagement object, is the core for the data set transfer. It provides several methods for data set transfer, most importantly GenerateFileForRead, GenerateFileForWrite and CloseAndCommit.

Storage location of the ProductionDatasetManagement object



8.2 Transferring parts data from the injection molding machine to the MES

For transferring a data set file of the injection molding machine to the MES, the client software starts by calling the GenerateFileForRead method. GenerateFileForRead uses an input argument of type ProductionDatasetReadOptionsType, which contains two variables that determine the source of the injection molding machine: storage and name.

ProductionDatasetReadOptionsType
Storage: Integral/enumeration Name: String

Storage is an integral representing an enumeration and can have the following values: PRO-DUCTION (integral value 1) or FILE_SYSTEM (integral value 4). If you set storage to PRO-DUCTION, the currently loaded production data set is transferred to the MES. If storage is set to PRODUCTION, the 'Name' variable is ignored and possibly omitted. If you set storage to FILE_SYSTEM, a data set file stored in the local file system of the injection molding machine is transferred to the MES. If storage is set to FILE_SYSTEM, the 'Name' variable determines the file name of the data set file in the local file system (without the file extension '.partdata'). Please note that the file system on the injection molding machine is case sensitive with respect to the file name.



Example:

By calling GenerateFileForRead with the parameters Storage=4 (FILE_SYSTEM) and Name=xyz you can initiate the transfer of the data set file 'xyz.partdata' from the local file system of the injection molding machine.

If there is no data set file with the specified name in the local file system of the injection molding machine, the method fails with the error code BadInvalidArgument.

By calling the GenerateFileForRead method, a temporary object of the FileType is created in the server display area. This temporary object represents the file specified by the input arguments. The output arguments of the GenerateFileForRead method are:

- 1. fileNodeld: the node ID of the temporary object
- 2. fileHandle: a file handle of the temporary file object that will be needed later for subsequent method calls
- 3. completionStateMachine: the node ID to an object of the FileTransferStateMachineType

The third output argument completionStateMachine is optional and can be zero. If it is zero, you can continue reading the file contents.

Check status

If the third output argument completionStateMachine is not zero, the node ID refers to a temporary object of FileTransferStateMachineType that indicates whether the source is ready for reading. This is necessary if the source of the file transfer is PRODUCTION, because the injection molding machine usually has to prepare the data before it can transfer it.

Therefore, before reading the file contents, the client should wait until the value of the Current-State variable of the CompletionStateMachine object has the value 'ReadTransfer'. This status indicates that the file is ready to be read. At this point, no data transfer has taken place.

Read

To retrieve the contents of the file, call the Read method of the temporary file object. The input arguments of the Read method are the file handle (output argument of GenerateFileForRead) and the number of bytes to read.

The output argument is a byte array representing the contents of the file. You can process this byte array (e.g. write it to a database or a file in the file system of the MES). If the file is larger than the specified number of bytes, you must call the Read method again to receive the next byte block. Repeat this process until the byte array from the output arguments contains no more bytes (an empty byte array indicates that the end of the file has been reached).

Close

When you are done reading, call the close method of the temporary file object with fileHandle as the input argument. This causes the server to clean up the temporary object.





Fig. 3 - Transfer parts data from MES to injection molding machine

8.3 Transferring parts data from the MES to the injection molding machine

GenerateFileForWrite

To transfer a data set file from the MES to the injection molding machine, the client software first calls the GenerateFileForWrite method. GenerateFileForWrite uses a GenerateOptions input argument of type ProductionDatasetWriteOptionsType, which contains three variables that determine the destination on the injection molding machine: Storage, Name and Components.

ProductionDatasetWriteOptionsType
Storage: Integral/enumeration Name: String Components: ProductionDatasetComponentEnumeration[]

Storage and Name work the same way as in the GenerateFileForRead method, except that they point to the injection molding machine's file transfer destination (rather than the source). So if you set storage to PRODUCTION, the transferred file will be activated as the current production setting of the injection molding machine (without saving it in the local file system of the injection molding machine). If storage is set to PRODUCTION, the transferred parts data file is stored and possibly omitted. If you set storage to FILE_SYSTEM, the transferred parts data file is stored in the local file system of the injection molding machine.

If storage is set to FILE_SYSTEM, the Name variable determines the file name of the parts data file in the local file system (again, without the file extension '.partdata'). Please note that the file system on the injection molding machine is case sensitive with respect to the file name. The Components input argument is an array of ProductionDatasetComponentEnumeration that can have one of two values: IMM_0 or ROBOT_1. It specifies which parts of the production data set are to be activated in the machine control unit after the data set file has been transferred, so it is only relevant if storage is set to PRODUCTION. On machines with integrated robots, production data sets can contain settings for the robot in addition to the settings for the injection molding machine. With the 'Components' argument, you can select which part of the data set should be activated. You can activate only the injection molding machine part, only the robot part, or both. If Components is set to an empty array (array length is 0), the complete production data set is activated.


Example:

By calling GenerateFileForWrite with the parameters Storage=4 (FILE_SYSTEM) and Name=abc you can, for example, initiate the transfer to the parts data file 'abc.partdata' on the local file system of the injection molding machine.

If a data set with the same name already exists, the method fails with the BadUserAccessDenied error code.

By calling the GenerateFileForWrite method, a temporary file object is created in the server's address space. This temporary file object represents the file specified by the input arguments. The output arguments of the GenerateFileForWrite method are:

- 1. fileNodeId: the node ID of the temporary object
- 2. fileHandle: a file handle of the temporary file object that will be needed later for subsequent method calls

At this point, no data transfer has taken place.

Write

To send the file contents, call the Write method of the temporary file object. The input arguments of the Write method are fileHandle (output argument of GenerateFileForWrite) and the data as ByteString. You can split the file content into several byte blocks and transfer them one after the other. Repeat this process until the complete file content has been transferred.

CloseAndCommit or Close

When you are done writing the file contents, call the CloseAndCommit method of the ProductionDatasetTransfer object with fileHandle as the input argument. This causes the server to save or activate the transferred data set and clean up the temporary file object.

Note that calling the Close method of the temporary file object cancels the file transfer and the data transferred up to that point is discarded.

Transferring parts data from MES to injection molding machine





9 Use case - display of set value changes

This chapter uses UaExpert to demonstrate how set value changes can be retrieved from the control unit.

1. Open Event-View.



2. From the 'DeviceSet', drag the machine object into the 'Event View'.

👑 Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*



3. Select the appropriate 'EventType' and activate it.



4. The value changes that follow from now on are now displayed.

Event	ts							
Eve	nts /	Alarms E	event Histor	y				
× 4	9							
Α	С	Time	Severity	Server/Obi	SourceName	Message	EventType	Artive
		13:06:29	<mark>50</mark> 0	VirtMoul	IMM_Engel_CC300	Parameter changed	ParameterChangeLogType	
		13:06:34	5 <mark>0</mark> 0	VirtMoul	IMM_Engel_CC300	Parameter changed	ParameterChangeLogType	-
Detai	ils							
Nam	e	١	alue 👝					
3:N	VewValu	e 4	51.0					
✓ 3:N	VewValu	eUnit E	UInformati	on				
	Namesp	aceUri						
	UnitId	0						
	UnitId Display№	0 Name "'	', "mm"					
	UnitId DisplayN Descript	0 Name "' ion "'	', "mm" ' <u>, "mm" 3</u>					
3:0	UnitId DisplayN Descript OldValue	0 Name "" ion ""	', "mm" ', "mm" 3 50.0)				
3:C ▼ 3:C	UnitId DisplayN Descript OldValue OldValue	0 Name "" ion " Unit E	', "mm" ', "mm" 50.0 UInformati	on				
	UnitId DisplayN Descript	0 Name "' ion "'	', "mm" ', "mm"					



10 Use case - display of historical alarms

Historical occurring and cleared alarms are supplied by 'LogbookEventType'.

1. Open Event-View.



2. From the DeviceSet, drag the machine object into the Event View

👑 Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject* <u>File View Server Document Settings Help</u> 8) 💋 🖯 🖸 🚺 4 **a** b. × 111 X Project ð× Data Access View Event View 🗸 📁 Project Configuration 🗞 VirtMould Server/Object 📁 Data Access View 📁 Event View Events Events Alarms Event History 🗙 😏 📑 А С Time Severity Server/Obj SourceNai Address Space ð × 😏 No Highlight 🗅 Root 🗸 🗀 Objects 🗸 🜲 DeviceSet 🔉 骉 DeviceFeatures IMM_ENGEL_228881
> Over the second Details > 👶 NetworkSet > 🜲 Server Name Value > 🗀 Types > 🗀 Views

3. Select all sources in the event view. Only the data that is also sent by sources is displayed.

Data Access Vie	ew Event View								0
Configuration									×
Server/Object > \vee > \vee * \ve	t Acknowledge: Comment Comment Comment Comment Condition CalobedState ConditionClas ClientUserld AuditEventType	ableCondi onType isName	tionType					 Apply 	
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Events A	larms Event Hist	ory							
🗙 😏 📄									
A C	Time	Severity	Server/Object	SourceName	Message	EventType	Active	^	
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	14:06:54.953	300	VirtMould / IM	IMM_Engel_CC	Mold closing p	MessageLogType	Active		
	14:06:54.953	300	VirtMould / IM	IMM_Engel_CC	Servo motor int	MessageLogType	Active		
	14:06:54.953	700	VirtMould / IM	IMM_Engel_CC	No barrel codin	MessageLogType	Active		
	14:06:54.953	300	VirtMould / IM	IMM_Engel_CC	Check mold hei	MessageLogType	Active		
	14:06:54.961	300	VirtMould / IM	IMM_Engel_CC	Screw Definitio	MessageLogType	Inactive		
	14:06:59.758	1	VirtMould / IM	IMM_Engel_CC	SIM_FrontPanel	ParameterChan			
	14:07:01.526	1	VirtMould / IM	IMM_Engel_CC	SIM_FrontPanel	ParameterChan			
	14:07:01.821	1	VirtMould / IM	IMM_Engel_CC	SIM_FrontPanel	ParameterChan		~	
Details								A	•



11 Behavior with Browse-Path

Example:

[ObjectsFolder]/2:DeviceSet/1:IMM_ENGEL_218828/4:Jobs/3:ActiveJobValues/3:JobPartsCounter

Syntax:

<root>/<NamespaceIndex>:<BrowseName>/...

In each intermediate level, the NamespaceIndex and the BrowseName can be determined. These together (according to the syntax) result in the BrowsePath.



There is also the theoretical possibility that the BrowsePath can change as well. The cause is the NamespaceArray (figure below), which has the potential to change over time (e.g. when the machine is restarted). However, this is more of a theoretical option, which should probably not play a role in practice.

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✓ ✓ Project ✓ Servers ✓ VirtMould ✓ Documents Data Access View ✓ Event View	≇ Server 1 VirtMould NS0∥	Node Id Display Name <u>Value</u> Datatype Numericj2 NamespaceArray [[http://opcfou] String	Source Timestam; Server Timestamp 09:55:10.153 14:14:20.846 Ge
		Edit Value	×
		Name Value String Array[7] [0] http://opfoundation.org/UA/ [1] urn:engelVithrould:engelseuromap77 [2] http://opfoundation.org/UA/D[3] [1] http://www.euromap.org/euromap83/ [4] http://www.euromap.org/euromap77/ [5] http://engelglobal.com/euromap77/ex [6] urn:engelVithrould:engelseuromap77/ [6]	m tension/ stension:parameters
Address Space			
ProductionDatasetManagement DeviceTopology NetworKSet Server Auditing EstimatedReturnTime GetMonitoredItems GetMonitoredItems OutorTopology ServerConfiguration ServerConfiguration ServerConfiguration ServerStatus ServerStatus			
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