ROBOTICS

IDFP – PRODUCT MANUAL
Version 2.1 Rev. D

Programming and parameterization

Version – 1.0

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Nr.	Name	Date	Description
1	H.Herzberger	21.01.20	start document
2	H.Herzberger	20.08.20	Changed name docking to fillingstation an renamed signals of fillingstation.

Table 1: List of changes

1 IPS

1.1 General information

IPS (Integrated Process System) is the software that is installed on the PIB and controls the application system of the IDFP. It is part of the complete IDFP system and is integrated into the robot controller main computer via a high performance ethernet connection. The IPS is configured automatically when installing depending on the software options. Manual changes due to parameters or configuration in IPS are in general not required.

Minimal system requirements:

The minimal required IPS software version according to this manual is IPS 4.60.15. In addition, the firmware of the PIB must be at least OleOS version 3.1. Required hardware is PIB-03. For more information about IPS structure see reference manual IPS.

1.2 Communication and logging

Communication between robot controller main computer takes places via ICI protocol (High performance ethernet) connected to the LAN port on PIB-03. Second communication channel (WAN) on PIB-03 is only used to be able to connect to RobotStudio and Robview via a LAN-Address at the same time (Used for debugging and logging with Robview). PIB-03 has its own IP addresses despite to the IP addresses of the robot controller main computer. In case of doing signal logging with Robview it is recommended to use the WAN connection of the PIB-03 (and LAN on robot controller main computer) to be able to log signals on both sides of the systems (main computer and IPS). The service connection between robot controller main computer and PIB-03 is the required main communication channel. All application signals will be exchanged via this main channel.

1.3 Configuration and files

The following software option (checked boxes) are mandatory to run IPS 4.6.x with IDFP on PIB-03:

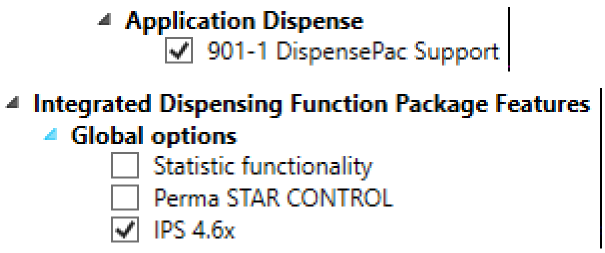


Figure 1: mandatory software option IDFP - part 1

Doser sizes and other software options decides how the IPS configuration will look like. The configuration of IPS is depending on several software option mainly of the IDFP software AddIn.

1.3.1 General IPS configuration (example D1A)

The following IPS tree structure can be found when connecting with Robview to IPS and open IPS explorer.

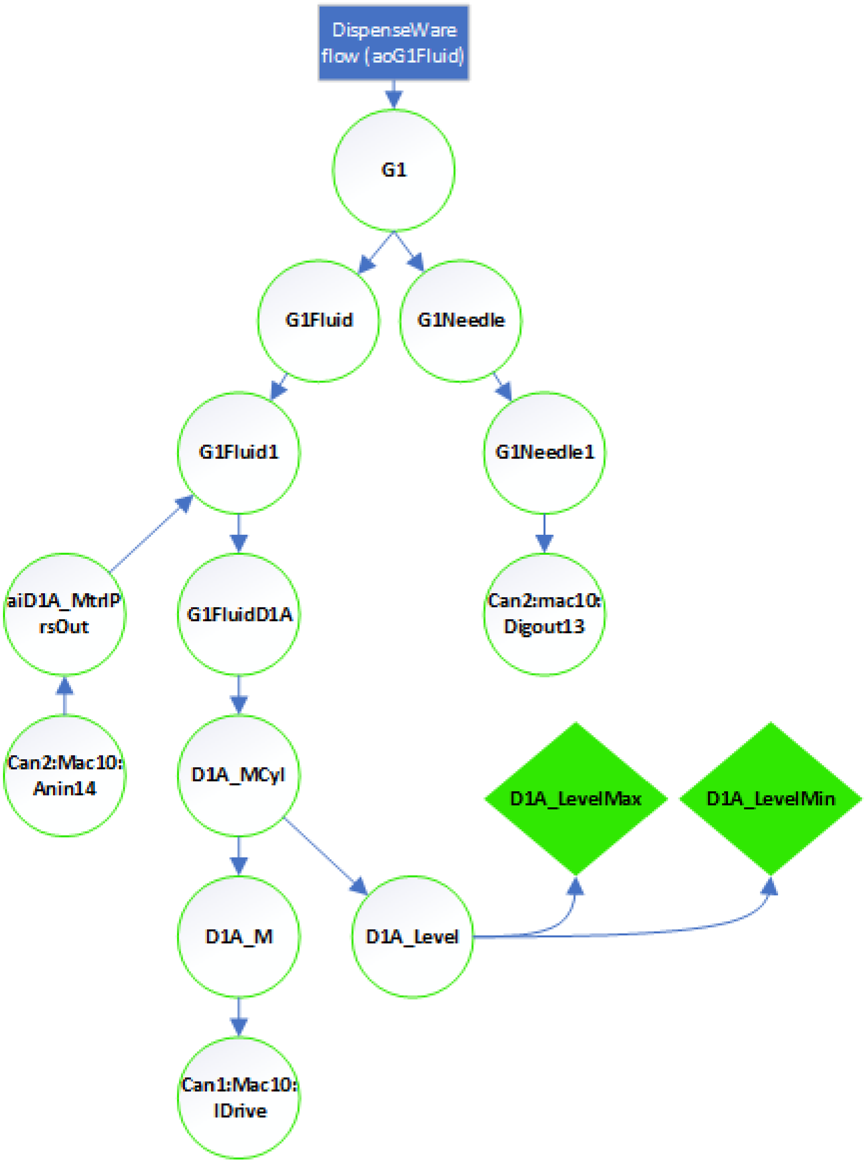


Figure 2: General IPS configuration

DispenseWare flow (aoG1Fluid)	Application flow setpoint. Send from Rapid / DispenseWare. If DispenseWare is used, the signal which routes the flow setpoint to IPS is defined in configuration file PROC.cfg / Dispense signals.
G1	**APPLICATOR** object. Receives flow setpoint from Rapid / DispenseWare. Combines Flow setpoint and opening of the needle including adjusted needle and flow delays.
G1Needle	**SELECTOR** object. Selects which needle to open (Default: needle 1). More than one needle can exist on one applicator
G1Needle1	**ACTUATOR** object. This Actuator will be activated if above selector is set to needle 1.
Can2:mac10: Digout13	**DIGOUT** object. Physical digital output object. Sets digital output signal for needle 1
G1Fluid	**SELECTOR** object. Selects which doser to be use (DeviceNo:1 for doser A; DeviceNo:2 for doser B)
G1Fluid1	**BIASREGULATOR** object doser 1 (doser A). This object has two main functionalities. First one is to route the application flow to the next IPS object (down to IDrive speed setpoint). This is the case if flow regulation when needle is opened, and application or other flow function is running. Second functionality is to regulate pressure in a closed loop regulation. This will be done automatically when there is no flow setpoint (from object G1) is active. The object has two kind of setpoint. *Setpoint* will lead through the flow setpoint to the IDrive. *BiasSetPoint* can regulate a pressure setpoint as long as flow *Setpoint* is 0. As soon as a *Setpoint* appears the pressure regulation will be interrupted. After the flow *Setpoint* is gone again (set to 0), the last *BiasSetPoint* will be reactivated and starts to regulate the pressure in closed loop.
G1FluidD1A	**ACTUATOR** object doser D1A. This object leads through the flow setpoint to the IDrive. The setpoint will be recalculated depending on the doser size (spindle size) to the related speed setpoint for the IDrive object.
D1A_MCyl	**ACTUATOR** object doser D1A. This object leads through the recalculated speed setpoint to IDrive object.
D1A_M	**Filterdevice** object doser D1A. This object amplifies the speed setpoint according to the filter number and related filter curve which is set (shootfilter). Then this new speed setpoint is leads through to IDrive object.
Can1:Mac10: IDrive	**IDrive** object doser D1A. This is the physical output for the IDrive motor. The speed setpoint will be send to the physical drive module and starts the motor turning.

aiD1A_MtrlPrsOut	**Sensor** object doser D1A. This object is a sensor object which recalculates the physical input signal of a pressure sensor (mA) to a pressure sensor signal in bar. This sensor is located inside the doser chamber. The sensor object is directly connected to the BiasRegulator object and is used for the closed loop pressure regulation in case that a *BiasSetPoint* is active (and no flow *SetPoint* is activated)
Can2:Mac10:Anin14	**ANIN** object doser D1A. This object is the physical analog input for the material pressure sensor inside the doser chamber. It reads in the physical sensor value in mA.
D1A_Level	**SENSOR** object doser D1A. This is a virtual sensor object which show the actual fill level of the doser. It will be recalculated from the physical value of the IDrive motor position to a fill level in ml.
D1A_LevelMax	**LIMITALARM** object doser D1A. This is a limitalarm which stops the doser on a certain defined position. In this case if the doser is at full level. If this Limitalarm is triggered it stops the doser action without sending any alarm message, because it is used as normal doser stop at doser full level. IPS stop the doser. At the same time a trigger is send via a signal to continue the next action in Rapid after the doser was stopped e.g. give signal to continue application.
D1A_LevelMin	**LIMITALARM** object doser D1A. This is a limitalarm which stops the doser on a certain defined position. In this case if the doser is at minimum level. If this Limitalarm is triggered it stops the doser action without sending any alarm message, because it is used as normal doser stop at doser empty level. IPS stop the doser. At the same time a trigger is send via a signal to continue the next action in Rapid after the doser was stopped e.g. to fill the doser.
G1Fluid1Filter	**IIRFILTER** object doser D1A. This object is used to set the closed loop regulator parameters for the BiasRegulator object, depending if it used as fill pressure regulator or as pre pressure regulator. In both cases different sets of regulator parameters are used. The Signal G1Fluid1Filter:FilterNo is set to 1 if pre pressure regulation is active. It is set to 2 if fill pressure regulation parameters are activated.

Table 2: Description main IPS objects

There are several more limit alarms connected to the doser fill level. They are not described here. Only the most important are described above.

1.3.2 IPS configuration – flow regulation (example D1A)

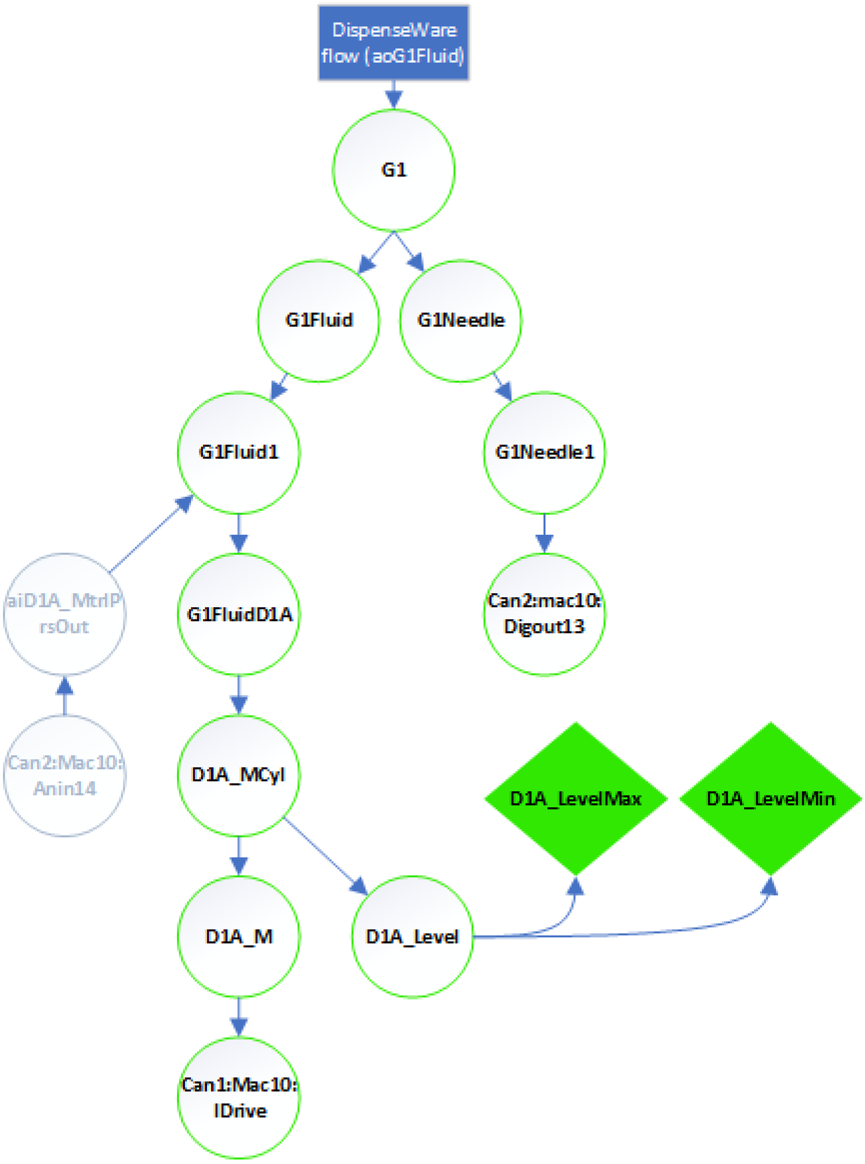


Figure 3: IPS configuration flow regulation

In this case the flow regulation is activated. The flow value will be lead through from G1 down to Can1:Mac10:IDrive. The current motor speed is used to create a closed loop flow (motor speed) regulation. All greyed out objects in this picture will not be used to create the application flow when flow regulation is activated. If a new setpoint is set to object G1Fluid1:BiasSetPoint while the flow regulation is active, this new setpoint will be stored and activated in the closed loop pressure regulation, as soon as the flow set-point in object G1:Fluid was set to 0. The flow regulation is used to have the correct flow value on a seam.

1.3.3 IPS configuration – pressure regulation (example D1A)

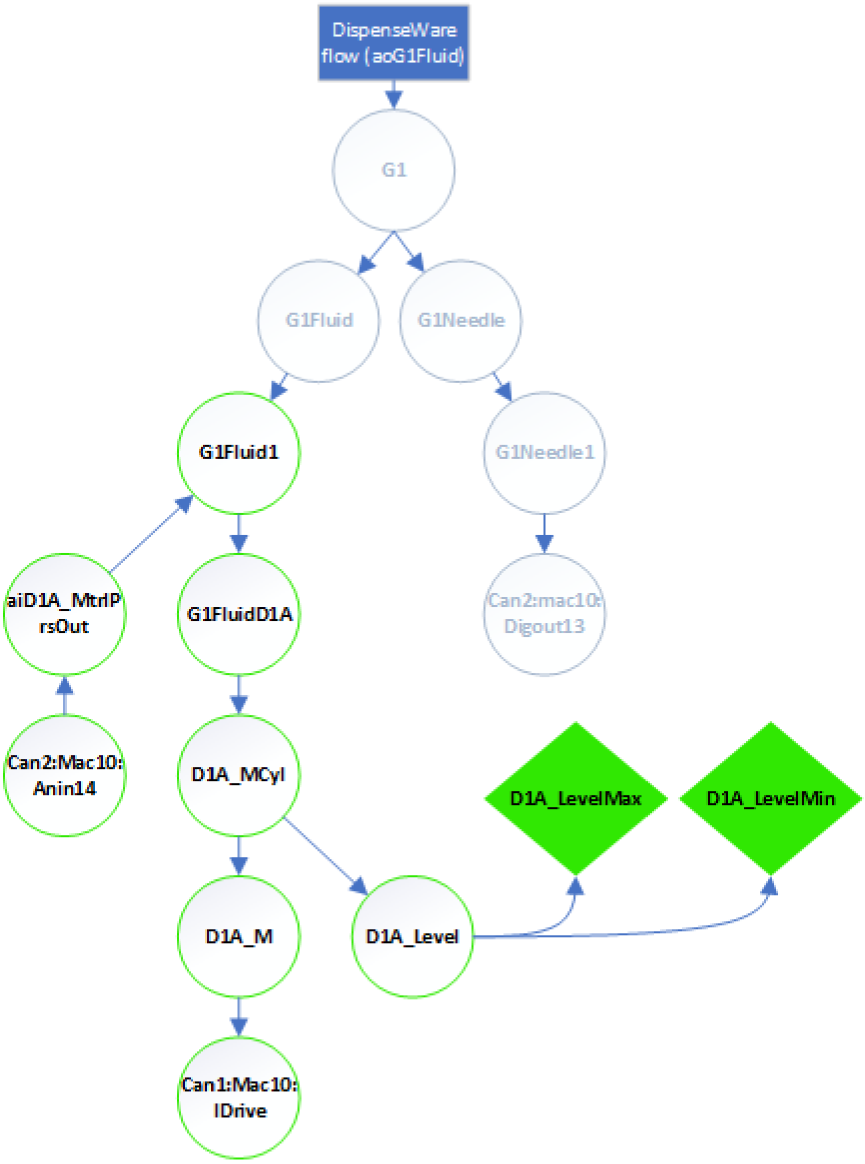


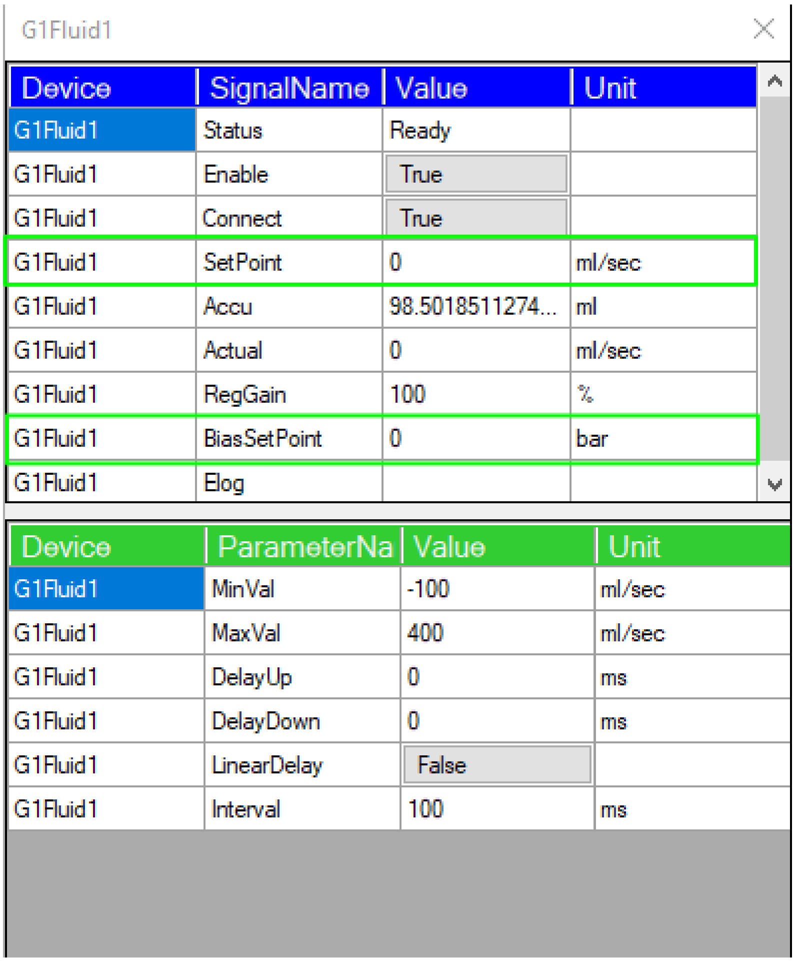
Figure 4: IPS configuration pressure regulation

In this case the pressure regulation is activated. The pressure setpoint for the closed loop regulation will be set to object G1Fluid1:BiasSetPoint. The speed of the motor will be regulated according to the correct pressure value. The value will be lead through from G1Fluid1 down to Can1:Mac10:IDrive. The actual pressure value of object aiD1A_MtrlPrsOut is used to create a closed loop pressure regulation. This will result into motor speed regulation. In this case the motor could turn forward and backward. All greyed out objects in this picture will not be used to create the pressure when pressure regulation is activated. As long as there is no new flow setpoint available on object G1:Fluid, or the value G1Fluid1:BiasSetPoint will be set to 0, the pressure regulation will continue. As soon as a new setpoint for flow is available in G1:Fluid the configuration will switch to flow regulation. The pressure regulation is used for filling the doser with material and for regulating a prepressure before a seam starts. For both usages the

BiasRegulator object uses different regulator parameter. The parameters will be set from Rapid by a signal goG1Fluid1Filter. This signal is set to one if pre pressure regulation is active. It will be set to two if fill pressure regulation is active.

1.3.4 IPS configuration – BiasRegulator

The object BiasRegulator is a special regulator object in IPS which is possible to do flow regulation and pressure regulation (not at the same time). For each regulation type there is a setpoint available. For the application flow regulation the signal G1Fluid1:SetPoint will we used. If this setpoint got a value higher than 0 (from external source or RAPID) the setpoint G1Fluid1:BiasSetPoint is set to 0. As long as a setpoint G1Fluid1:Setpoint is active (higher than 0) there will be no setpoint on G1Fluid1:BiasSetPoint for the closed loop pressure regulation. As soon as the setpoint G1Fluid1:SetPoint equals 0, the setpoint for G1Fluid1:BiasSetPoint will be reactivated and start the closed loop pressure regulation with the last active value. This last active value can be changed (external source or RAPID) while flow regulation loop is active (G1Fluid1:SetPoint is higher 0) and will be activated as soon as the G1Fluid1:SetPoint equals 0.



G1Fluid1

Device	SignalName	Value	Unit
G1Fluid1	Status	Ready	
G1Fluid1	Enable	True	
G1Fluid1	Connect	True	
G1Fluid1	SetPoint	0	ml/sec
G1Fluid1	Accu	98.5018511274...	ml
G1Fluid1	Actual	0	ml/sec
G1Fluid1	RegGain	100	%
G1Fluid1	BiasSetPoint	0	bar
G1Fluid1	Elog		

Device	ParameterNa	Value	Unit
G1Fluid1	MinVal	-100	ml/sec
G1Fluid1	MaxVal	400	ml/sec
G1Fluid1	DelayUp	0	ms
G1Fluid1	DelayDown	0	ms
G1Fluid1	LinearDelay	False	
G1Fluid1	Interval	100	ms

Figure 5: IPS object BiasRegulator

1.3.5 IPS configuration - files and parameters

All configuration and parameter files of the IPS are located on the robot controller folder HOME:\ipsdata\node1. IPS grabs the files directly from this folder. No configuration or parameter files are located on the PIB. On PIB are located only installation and system files. When starting up the system the PIB is loading the configuration from the Home folder of the robot controller main computer. In the robot backup the complete IPS configuration is included so that its possible to restore a backup easily. No files have to be copied or deleted manually on the PIB. The folder Home:\ipsdata\node1\config includes the complete for this system setup relevant configuration files. The folder Home:\ipsdata\node1\param includes all relevant IPS system parameters.

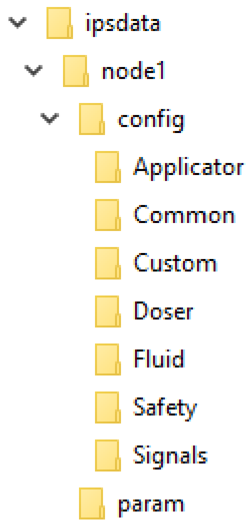


Figure 6: IPS folder structure on robot controller Home:\

1.4 Error messages

Detailed description of the IPS error message can be found in the IPS reference manual and in the alarm code lists for the IDrive.

Example table:

IPS ErrNo.	IDFP ErrNo.	Title	Description
133254	115243	Can1/MacX/Idrive: Over current: DMC Error	A too high current flows to the motor
133254	115243	Can1/MacX/Idrive: Overload: DMC Error	IDrive $arg2 Overload Error - Current over time period exceeded high limit
133254	115124	Can1/MacX/Idrive: Overspeed: DMC Error	IDrive overspeed alarm
133205	115153	Can1/MacX/iDrive/Overheatlim:Sprv. alarm	Temperature in Idrive for Dispenser $arg2 is very high. Actual temperature of Idrive $arg2 is 85°C or more
133254	115119	Can1/MacX/Idrive: sensor error: DMC Error (61)	IDrive Resolver Error - Resolver signal is missing or faulty
133254	115119	Can1/MacX/Idrive: sensor error: DMC Error (62)	IDrive Resolver Error - Resolver signal is missing or faulty
133254	115120	Can1/MacX/Idrive: over voltage: DMC Error	IDrive overvoltage error
133254	115121	Can1/MacX/Idrive: voltage down: DMC Error	IDrive power supply is missing
133254	115123	Can1/MacX/Idrive: internal vo: DMC Error	IDrive regeneration alarm
133200	115238	*Devicename* : Trig error	Application program trigger error while (before) the seam $arg3 with nozzle $arg4 Dispenser $arg2 an error was triggered

Table 3: Most important IPS error messages for IDFP

2 Robotware Dispense (DispenseWare)

2.1 General use

To use IDFP in combination with IPS and Robotware-Dispense the software option Dispense (641-1) is mandatory to use.

Table 4: mandatory software option IDFP - part 2

The RobotWare-Dispense package provides support for different types of dispensing processes such as gluing, sealing and similar. The RobotWare-Dispense application provides fast and accurate positioning combined with a flexible process control. Communication with the dispensing equipment is carried out by digital and analog outputs. RobotWare-Dispense is a package that can be extensively customized. User data and routines can be adapted to suit a specific dispensing equipment and environmental situation. (Excerpt from application manual dispense)

2.2 Connection from DispenseWare to IPS

In order to route the application flow value from the Rapid movement program to the IPS receiving object G1 an analog signal is defined. This signal connects the flow ordered from an application program to the IPS (to get the IDrive running).

This signal is called aoG*X*Fluid. (*X*=1 for dispenser1; *X*=2 for dispenser2; *X*=3 for dispenser3; *X*=4 for dispenser4.

This signal is the connection signal between the Rapid DispenseWare instruction DispL/C and is defined in the system configuration – process – Dispense signals (file PROC.cfg).

2.3 Data type equipdata (DispenseWare)

In general, there are four sets of data equipdata available. Depending on the number of dispensers per system (1-4) the equipments could be used. Table 5 shows the possible use (IDFP default setup) of how equipdata is used depending on the system setup. Equipdata is used to set equipment specific data which will not change on single beads. In comparison Beaddata should include all data that could change for each bead.

Dispenser combination	Equipment 1	Equipment 2	Equipment 3	Equipment 4
D1	D1	D1	D1	D1
D1/D2	D1	D2	D1	D2
D1/D2/D3	D1	D2	D3	D1
D1/D2/D3/D4	D1	D2	D3	D4
D1/D2/D34(2K)	D1	D2	D34 (2K)	D34 (2K)
D12(2K)	D12 (2K)	D12 (2K)	D12 (2K)	D12 (2K)
D12(2K)/D3	D12 (2K)	D12 (2K)	D3	D3
D12(2K)/D3/D4	D12 (2K)	D12 (2K)	D3	D4
D12(2K)/D34(2K)	D12 (2K)	D12 (2K)	D34 (2K)	D34 (2K)

Table 5: Dispenser combination types IDFP

Equipdata and Beaddata consist of the following data and must be assigned in the program (recommended in DPUser.sys). It is user defined how the data will be set. It could be part of the Equipdata (as default) but could also be shifted to datatype Beaddata. Also possible is to remove the data from datatype Equipdata and define it as a global variable. (See reference “Application manual dispense”). For more information about each parameter please see reference “Application manual dispense”. For functionality of IDFP is must be ensured that the mandatory data, see Table 6 (M) is assigned. All optional data (O) can be used for optimization of the seams (according to “Application manual dispense”.

Data value DispenseWare	Possible values when using with IDFP	Mandatory (M) / Optional (O) / Constant (C)	Default Equipdata (E) or Beaddata (B)
int_dp_data.flow1_type	1: speed independent flow 2: speed dependent flow	M	E
int_dp_data.on_time	0 (needle delay used in IPS)	Do not use	E
int_dp_data.off_time	0 (needle delay used in IPS)	Do not use	E
int_dp_data.switch_time	0.3 (fixed, real available time is 0.28)	C	E
int_dp_data.ref_speed	10-20% more than used max. robot application speed	M	E

int_dp_data.acc_max	3 = default for IDFP	M	E
int_dp_data.dec_max	3 = default for IDFP	M	E
int_dp_data.fl1_on_time	0 (flow delay used in IPS)	O	E
int_dp_data.fl1_off_time	0 (flow delay used in IPS)	O	E
int_dp_data.fl1_inc_time	0-0.5	O	E
int_dp_data.fl1_dec_time	0-0.5	O	E
int_dp_data.fl1_delay	0-0.5	O	E
int_dp_data.flow1	0-? (material flow depending on system configuration and unit)	M	B
Int_dp_data.equip_no	0-4	IDFP system dependent	B
Int_dp_data.gun_no	1 (1-3 to be defined…)	M	B

Table 6: to be defined internal DispenseWare data

2.4 Data type beaddata (DispenseWare)

The definition of the beaddata must include mandatory entries and could include additionally optional entries.

Data value DispenseWare	Usage	Mandatory (M) / Optional (O)	Default: Equipdata (E) or Beaddata (B) Not used (N)
string Info	User defined info	O	B
bool ActivateRefRun	Activates to create a new reference for single seam supervision (each seam reference of corresponding evaluation cluster will be updated) TRUE/FALSE	O	B
dnum BeadID	Unique seam number (up to 10 digits) for each seam	O	B
num BeadArea	Flow setpoint of seam (0-96ml/s)	M	B

num MaxRelVolDev	allowed relative volume deviation for seam if deviation is too high (0-100%)	O	B
num MinRelVolDev	allowed relative volume deviation for seam if deviation is too low (0-100%)	O	B
num MaxAbsVolDev	allowed absolute volume deviation for seam if deviation is too high (0.2-1000ml)	O	N
num MinAbsVolDev	allowed absolute volume deviation for seam if deviation is too low (0.2-1000ml)	O	N
dnum DetailID	User defined number for seam	O	B
num PrePressure	-1: pressure regulation deactivated 0: pressure from nozzle calibration curve is used 1-300: absolute pressure is used (no use of dynamic viscosity curve)	M	B
num PrePrsOverride	0 or 100: pre pressure override is 100% (no override) Value range: 50-200%	M	B
num Equip_No	Used to set the number of the dispenser to use (1-4)	O	B
num Nozzle_No	Used nozzle for current seam	O	B
num Shootfilter	Used shootfilter for current seam (to be activated with trigg event T1 (DispenseWare)	O	N

Table 7: to be defined beaddata

2.5 Error messages

A detailed description of the dispense error messages can be found in the *"Application manual dispense"*

3 Structure of the dispenser software

The software structure of the dispenser is designed to have different modes. If the doser is not calibrated no other doser functionality will be possible. The dispenser functions can be divided into three parts. Dispenser is only possible to be in one of three modes at the same time. The manual function mode can be used to order service functions as purging or filling the doser in manual dispenser mode. Also, the service routines like hose accumulation, leakage detection and nozzle calibration are only possible to do in the manual mode.

3.1 Dispenser mode and state

The dispenser (single or dual dispenser) has a mode which describes the overall condition of the dispenser (i.e. a dual dispenser consists of two single dosers A and B). The mode will be changed by the system as soon as a defined dispenser action is requested. The group signal goDXMode (X=1,2,3,4) includes the current mode.

Number	Mode	Description
0	Undefinied	The dispenser is undefined if the doser was not calibrated
1	Ready	The dispenser is ready to receive an order
2	Calibration	The dispenser runs a calibration routine
3	Application	The dispenser is in application mode
4	Circulation	The dispenser is in material circulation mode
5	Purge	The dispenser is doing a purge
6	Busy	A dispenser function is running

Table 8: Dispenser mode

Number	State	Description
0	Undefined	The doser is not calibrated
1	Ready	Doser is calibrated, currently not doing any action. Doser fill level is between minimal and maximum level
2	Full	Doser is calibrated and material level is on maximum level
3	Empty	Doser is calibrated and material level is on minimum (empty) level
4	Fill	The doser piston moves up. Inlet valve is opened. Doser is filling.
5	Empty	The piston moves down. Outlet valve and circulation valve or needle is opened.

6	Set pressure	A material pressure is regulated inside the doser chamber up to the applicator
7	Follow	One doser follows the current pressure od the other doser due too upcoming swap (doser A to B or B to A)
8	Disabled	Doser is disabled (was deactivated manually)

Table 9: Doser state

3.2 Filling function of the dosing unit

Filling is used to fill the doser chamber with material. Therefore, the material inlet valve is opened, and the material will be pushed by the pump into the doser chamber. To ensure that the doser motor does not move to fast in backwards direction a pressure regulation while filling is active. If the doser would move to fast the material could not follow fast enough. This can lead to air bubbles inside the doser chamber.

The functionality filling is used as a manual service function and is also used in the application mode when filling between seam is necessary. If the pressure falls below the specified minimum filling pressure for a certain time, an error message is created, but the filling process is continued.

The filling time is also monitored during the filling process. If the current calculated filling time is exceeded, an error message is displayed, and the filling process is canceled. The filling process is also canceled in the event of an emergency stop, an error with the driver or a forced stop of the function. If the function is stopped by sending a function stop request (**goD1Order** = 31), no message is issued. An error message is generated for other interruptions to the filling process by a fault. The function is **not** automatically restarted following the acknowledgement of the error or emergency stop.

The time required for the filling process is dependent on various factors: material properties, temperatures, material inlet pressure, doser size and regulator parameters. With the operation of a single doser (or a dual doser in single mode), it is possible to force the doser to refill during an application run (between two seams).

3.2.1 Parameter description

3.2.1.1 Filling – TPU Parameter

The following parameters can be changed on the IDFP TPU screens. They will be activated immediately after they have been changed.

Parameter overview

Parameter name / TPU	Parameter Rapid	How to change	Module	Description
Fill regulator parameters	rdDXFillPrs	Call manual function “change regulator parameters” (Order number 5)	ID1A_User.sys	PID-regulator parameters

				for the filling.
Setpoint fill pressure regulator [bar]	DD_DXA.FillRegPrs	TPU – Configuration - Fill	ID1A_Data.sys	Pressure setpoint for fill pressure regulator
Min. dynamic fill pressure [bar]	ILD_DXA.MtrlPrsOutFillLim	TPU – Configuration - Fill	ID1A_User.sys	Minimal limit for dynamic fill pressure
Min. dynamic fill pressure – error time [ms]	ILD_DXA.MtrlPrsDynErrTime	TPU – Configuration - Fill	ID1A_User.sys	Error time for minimal limit of dynamic fill pressure
Allowed fill time [s]	ILD_DXA.FillTimeLim	TPU – Configuration - Fill	ID1A_User.sys	Maximum allowed fill time
Allowed deviations of dynamic fill pressure error	APN_DXA.nFillPrsTimeOut	TPU – Configuration - Fill	ID1A_User.sys	Allowed times of dynamic fill pressure deviations before error appears
Stop filling in case of dynamic fill pressure error	bDXFillTimeOutStop	TPU – Configuration - Fill	ID1A_Param.sys	Stop filling in case of dynamic fill pressure error
Hysteresis for autom. Filling [%]	nDxFillHyst	TPU – Configuration - Fill	ID1A_Param.sys	Hystere for filling. Filling ignored if fill level falls not short of doser level
Automatic filling by cycle start	bDXAutoFillStart	TPU – Configuration - Fill	ID1A_Param.sys	Doser will be automatically filled when application cycle was started (PreApplicationDX)
Automatic filling by cycle end	bDXAutoFillEnd	TPU – Configuration - Fill	ID1A_Param.sys	Doser will be automatically filled when application cycle was ended (PostApplicationDX)

Fill limit	dstDXA.VolLimMax	TPU – Configuration – Dispenser	ID1A_User.sys	Volume maximum fill limit for doser
pressure regulation setpoint after filling	DD_D1A.FillStopPressure	Change rapid variable	ID1A_Data.sys	This material pressure will be adjusted inside doser chamber after each fill cycle

Table 10: Filling TPU parameters

3.2.1.2 Filling – regulator parameters

The regulator parameters for filling (PID parameters) must be changed via user menu which has to be ordered in manual function mode (see chapter 3.5). It is not possible only to change the parameter in Rapid.

Parameter name	Parameter Rapid	How to change	Module	Description
Fill pressure regulator parameter	rdD1FillPrs	User menu (Order number 5)	ID1A_User.sys	PID regulator parameter fill regulator

Table 11: Filling regulator parameters

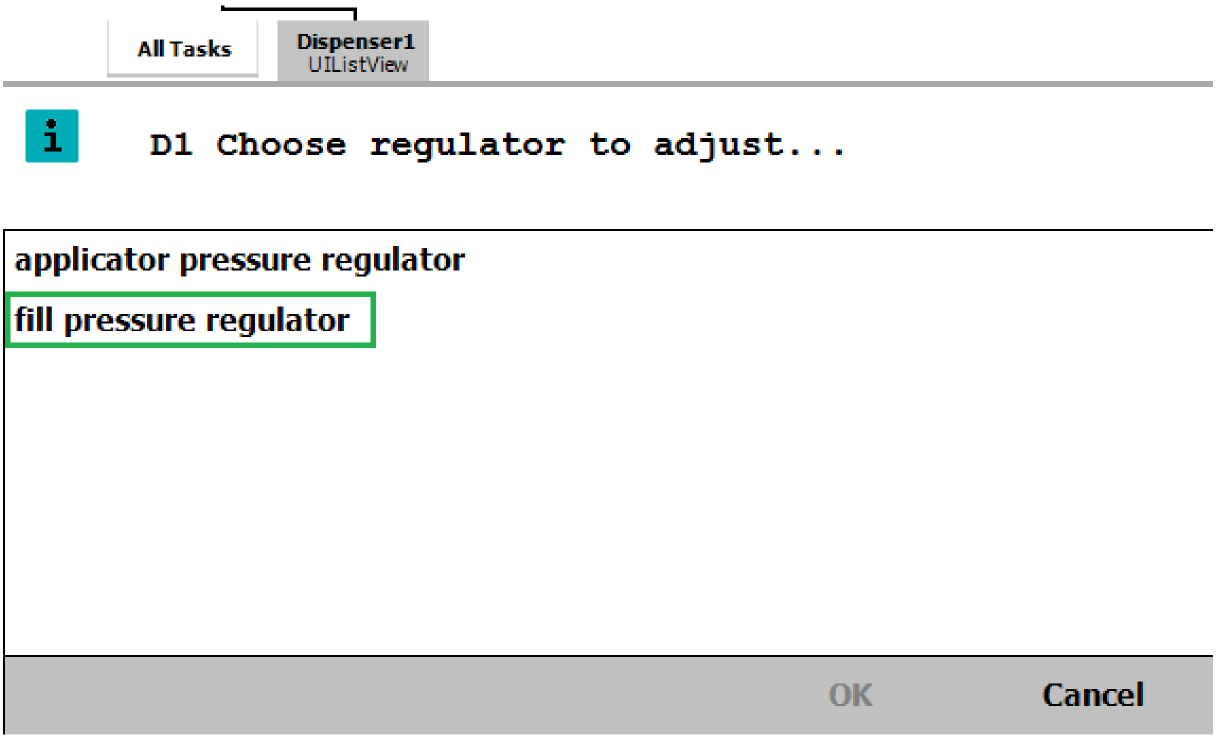


Figure 7: Menu fill regulator adjustment

3.2.1.3 Filling – more parameters

The function filling has some more parameters which cannot be set via the TPU. They are existing as Rapid variables and can be changed if needed.

Parameter name	Parameter Rapid	How to change	Module	Description
Doser volume low level	nDXA_RefillLevel	Change rapid variable	IDXA_Param.sys	In combination with rapid function CheckLowLevelDXA() returns TRUE, if volume low level has fallen short of nDxA_RefillLevel [ml]
Pressure to set after filling	DD_DXA.FillStopPressure	Change rapid variable	ID1A_Data.sys	Pressure setpoint to set after filling (0=not certain pressure will be adjusted)
Fill flow factor	DD_DXA_FillFlowFac	Change rapid variable	ID1A_Data.sys	Limits the motor speed when filling {%]. Influeces the fill regulation behavior.

Table 12: Filling non TPU parameters

3.2.2 Fill request signal description

This signal can be set by the user from the foreground TASK T_ROB1) to order a filling cycle.

Signal name	Signal type	Signal description
doDXA_FillRequest	DI (digital input)	Request a doser filling cycle. Will work in dispenser idle mode and even in application mode (if needle is closed)

Table 13: Fill request signal

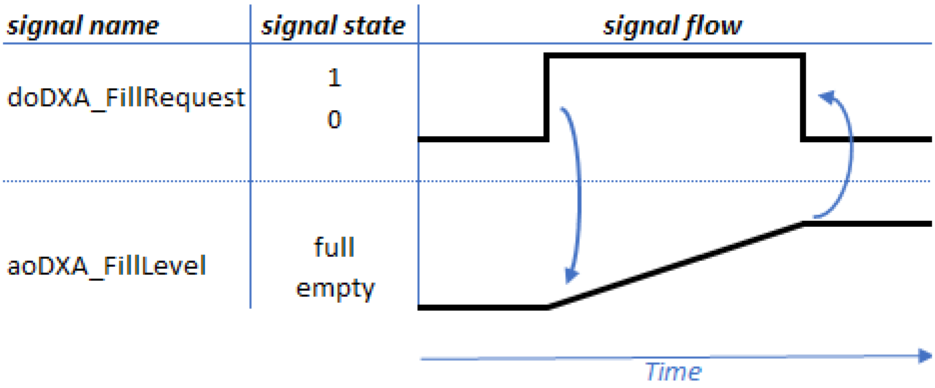


Figure 8: Signal flow diagram doDXA_FillRequest

3.2.3 Filling station

A filling station is used to fill the doser with material on a fixed stationary installed mechanical installation. The filling station is connected to a material hose to the material supply (external or internal pump). If a filling station is installed in the system as an option, the doser does not have a material inlet valve as usual. Instead the doser will be docked directly to the filling station. The inlet valve is in that case mechanically installed inside the filling station. Additionally, a second material supply valve (yellow valve; located in front of the inlet valve inside the filling station) is installed. This valve is used to reduce the static inlet pressure before the inlet valve inside the filling station to prevent a leakage due to high material pressure. A mechanical clamp fixes the doser for the filling cycle on the filling station. For the filling station additional valves and signals are used to ensure the correct handshake with the robot (TASK T_ROB1). The signals and valves used for the filling station are explained in Table 14.

Signal name	Signal type	Signal description
doDXReqRobToFillStation	Digital output	Signal state=1: IDFP system requests the robot to move to filling station position (due to requested filling cycle).
doDXRobInFillStation	Digital output	Signal state=1: Signal indicates that robot has reached the filling station position (and is not moving anymore!).
doDXFS_ClampClose	Digital output	Signal state=1: clamping unit is ordered to close (fix the doser on the filling station for filling cycle).
diDXFS_ClampClosed	Digital input	Signal state=1: Feedback signal clamping unit is closed.

diDXFS_ClampOpen	Digital input	Signal state=1: Feedback signal clamping unit is opened.
doDXFS_ValveInlet	Digital output	Signal state=1: Additional inlet valve (yellow valve)
doDXA_ValveFill	Digital output	Signal state=1: Open inlet valve (inside filling station)
goDXFillStationState	Group output	Indicates error state of the filling station clamp Signal state=0: undefined Signal state=1: ok (no error) Signal state=2: clamp not opened Signal state=3: clamp not closed Signal state=4: clamp not opened and closed
goDXA_FillState	Group output	Signal state=0: undefined Signal state=1: ok Signal state=2: not ok (filling has not ended successfully or fill-ingstation had a problem)

Table 14: Fillingstation related signals

In the picture the signal flow for a successful filling operation with a filling station is shown.

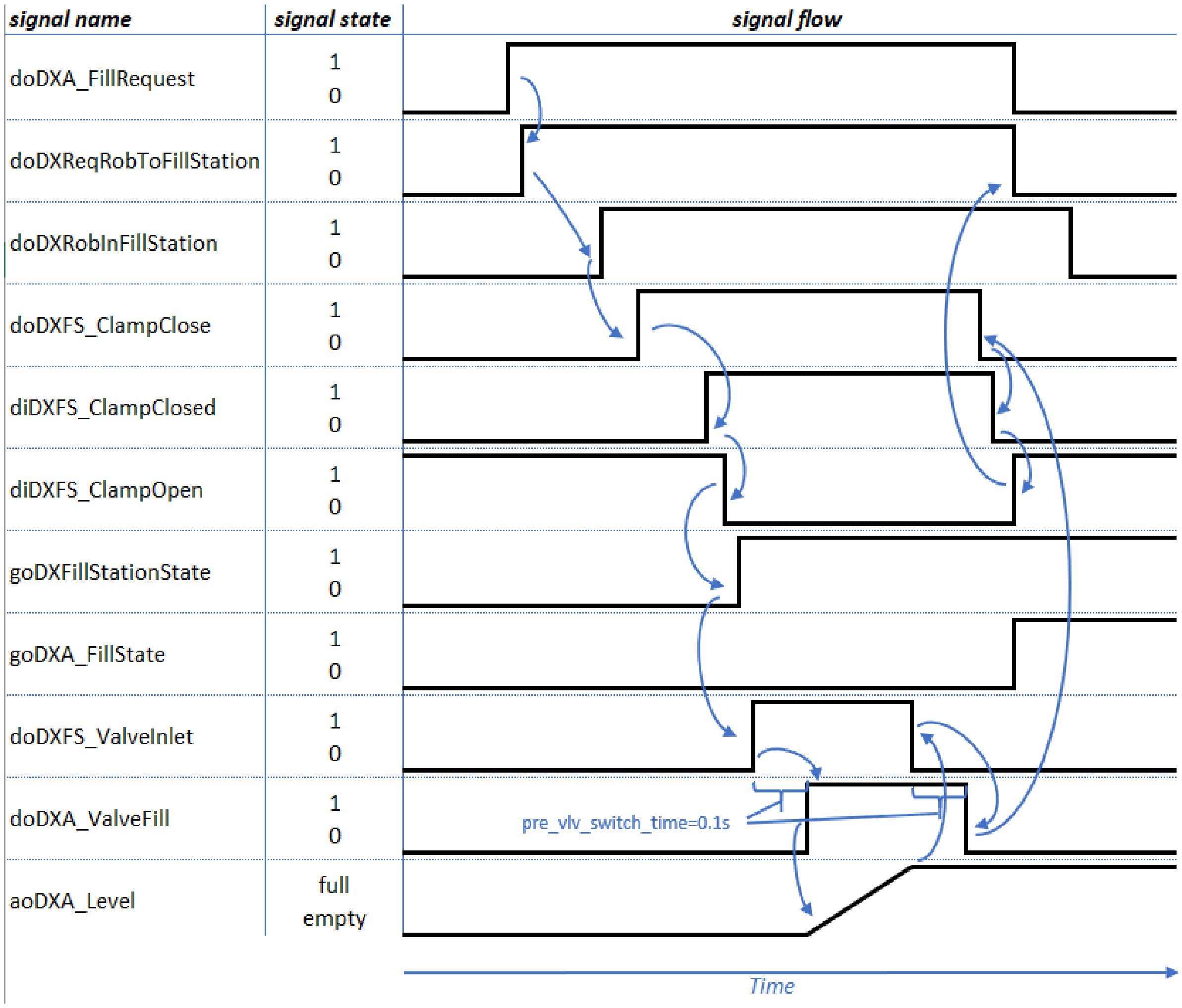


Figure 9: Filling station signal flow diagram

In case of running a filling cycle not in automatic mode of the robot controller a separate safety window will pop up before opening or closing the clamp of the filling station. This is due to safety of the user because of mechanical moving parts when opening or closing the clamp. This warning must be acknowledged by the user to continue the process.

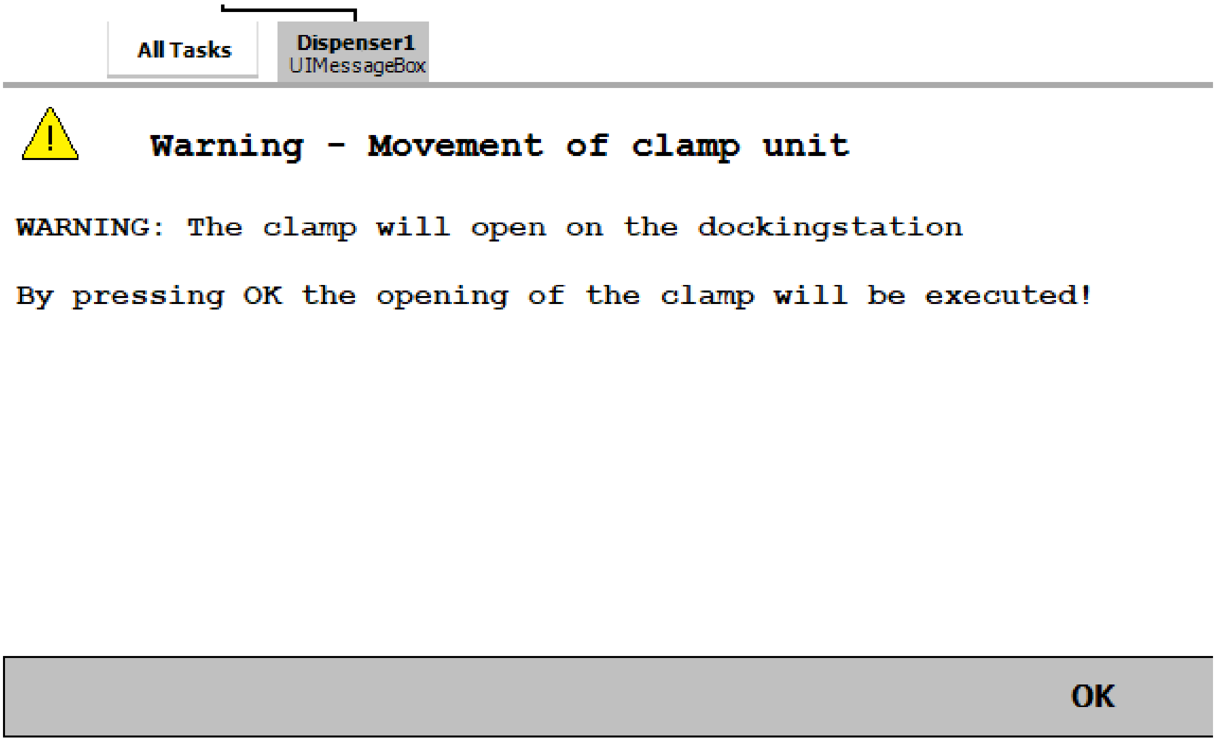


Figure 10: User warning clamp -mechanical parts moving

3.2.4 Error messages

Error No.	Title	Description
5102	Material Supply not ready	Material supply for $arg2 is not ready. Actual pressure: $arg3 bar.
5105	Dispenser inlet pressure (dynamic) to low	Dispenser $arg2 exceeded low pressure. Actual pressure is $arg3 bar.
5144	Fill time exceeded	Filling process of dispenser $arg2 has exceeded allowed fill time of $arg3 s.
5157	Total volume of Dispenser has exceeded	Total volume of dispenser $arg2 exceeded
5163	Dispenser inlet pressure (dynamic) to low - filling stopped	Dispenser $arg2 exceeded low pressure. Actual pressure is $arg3 bar
5164	Number of switching cycles exceeded	the number of switching cycles for valve Filling at dispenser $arg2 is exceeded maximum switching cycles: $arg3 current number of switching cycles: $arg4
5165	Number of switching cycles exceeds warning level	the number of switching cycles for valve $arg1 at dispenser $arg2 will soon exceed the service level. maximum switching cycles till service: $arg3 current number of switching cycles: $arg4
5192	Voltage on Idrive too high	Voltage of IDrive $arg2 is too high. Actual voltage is $arg3 V
5250	Fillingstation robot not in position	A fill request was ordered for dispenser $arg2 but the robot did not moved to fillingstatio position
5251	Fillingstation clamp was not closed	The clamp for fillingstation for dispenser $arg2 did not close within the given wait time of $arg3 s
5252	Fillingstation clamp was not opened	The clamp for fillingstation for dispenser $arg2 did not open within the given wait time of $arg3 s
5264	Fillingstation fill request timeout	A fill request was ordered for dispenser $arg2 but the robot did not moved to fillingstation position after $arg3 s
5274	Total hose volume has exceeded	Total hose volume of dispenser inlet hose $arg2 exceeded

Table 15: error messages filling

3.3 Automatic prepressure adaption

The automatic prepressure adaption is used to react on different material viscosity and on different application speed of the robot. Both results in different material flow in case of using speed dependent application flow. The prepressure will be adjusted dependent on the upcoming robot speed and application flow.

The automatic prepressure adaption will be started a certain time before the needle will open and the application start. This pre-switch time is configured in robotware dispense data value int_dp_data.switch_time. This time must not be changed by the user. It ensures that the prepressure regulation starts correctly 300ms before the needle opens. As soon as the application start (needle opens) the prepressure regulation will be ended and the flow regulation for the application starts.

See also detailed description in chapter 3.4 Main program and seam (robtarget) event guideline.

3.3.1 Material viscosity

The functionality automatic prepressure adaptation adjusts a related prepressure for the material depending on the upcoming material flow. The doser motor will regulate the material pressure inside the doser chamber (up to the needle of the applicator) to prepare for the next application seam. Therefore, a nozzle calibration curve is needed which depict the relation between the material flow and the resulting material pressure. This curve must be created one time manually by using the manual function “nozzle calibration”. In general, the viscosity (and material pressure) of a used application material is not constant quantity in relation to the material flow. The viscosity also changes with different material barrels in use and differences in the used material itself. The suppliers of the material will not warrant on constant material viscosity. Therefore, the viscosity will change. Also, material temperature fluctuation will change the viscosity of the material. Therefore, an adaptation of the viscosity (material pressure) will be done to be independent from material and viscosity changes. Material viscosity (and material pressure changes depending on the application flow. See reference example for material viscosity depending on application flow in Figure 11.

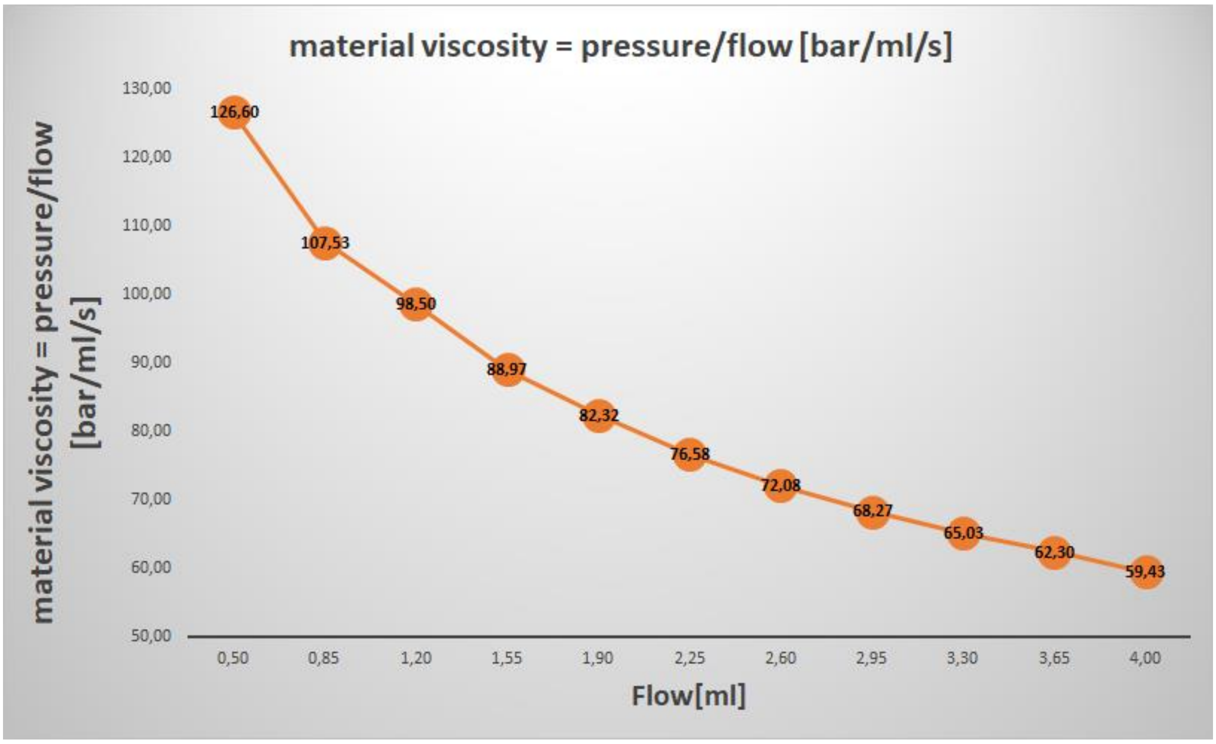


Figure 11: material viscosity graph

This graph will vary from material barrel to material barrel and from material charge to material charge. Because of that it is needed to have an automatic prepressure adaptation (machine learning) to react on the viscosity changes and use the correct prepressure for the upcoming used material flow of the application seam.

3.3.2 Nozzle calibration

The manual function nozzle calibration purges material with a predefined flow through the nozzle. The target is to measure a certain material pressure used for a certain material flow. This results into the viscosity factor curve (viscosity factor=material pressure/material flow).

To create the correct boundary conditions (real application conditions) some things must be noted before using the nozzle calibration function. It must be ensured that the material temperature has the same temperature as application conditions. Also, it must be ensured, that the material is not outdated. The IDFP system must be heated with the correct temperature. Because the viscosity is dependent on the temperature this is important to keep. If it is ensured that the material has the correct temperature the function can be run.

After starting the nozzle calibration, the user must put in some values.

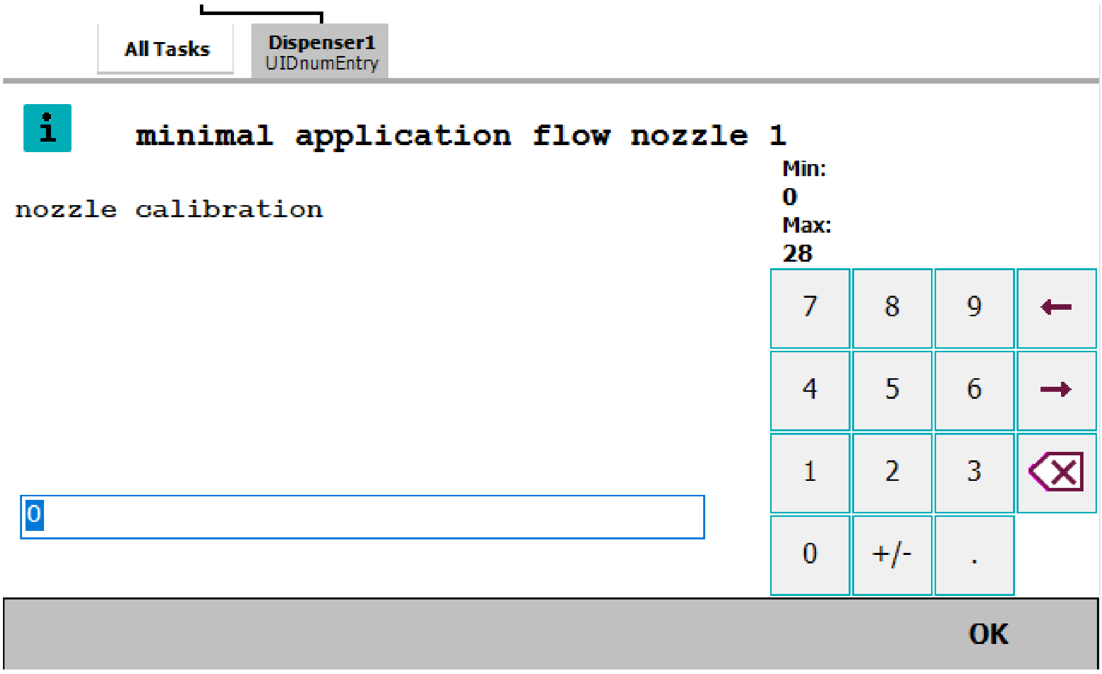


Figure 12: Nozzle calibration menu min flow

The user should put in here the minimal used application flow in ml. After pressing “ok” the user should put in the maximum used application flow in ml. As smaller the range in ml which is used the more accurate the calculation of the prepressure could be depending on the upcoming flow.

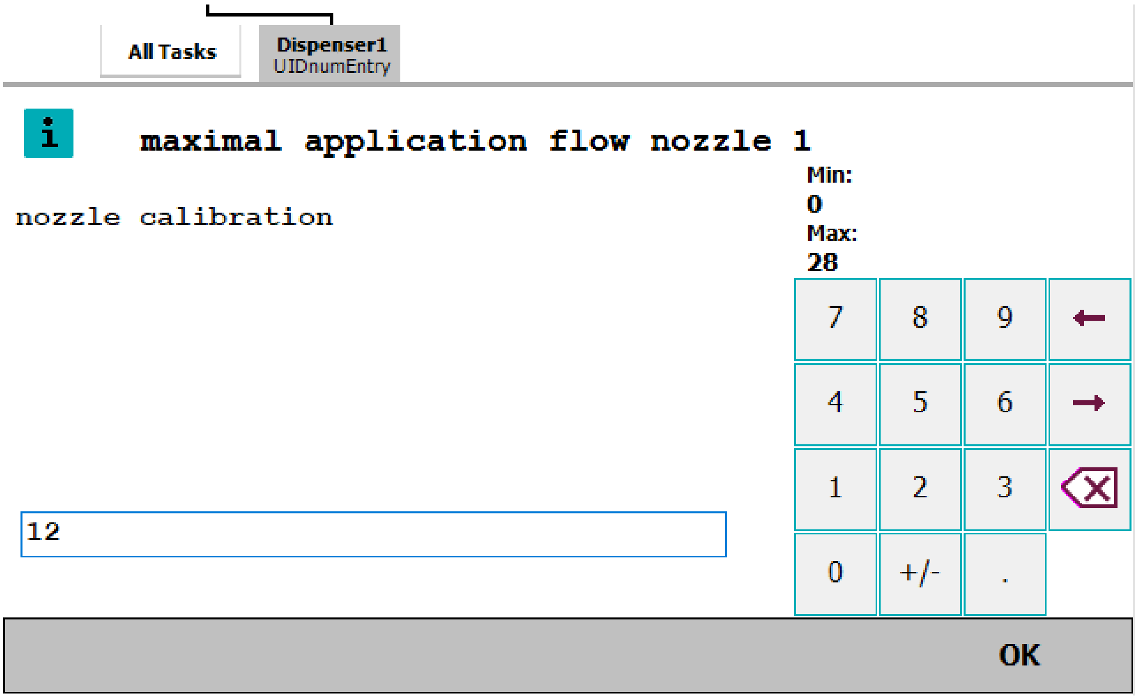


Figure 13: Nozzle calibration menu max flow

The maximal application flow should not create a material pressure higher than 250bar. The flow range which is put in by the user should be in a realistic range of the later used application flow.

When running the nozzle calibration, the flow range which was put in by the user will be divided into 11 grid points (results in 10 linear curves). See reference Figure 14.

Example: The user puts in 0,5ml/s for the minimum flow value and 4ml/s for the maximum flow value.

Internal calculation of the step-wide [ml] for each linear curve: (4ml/s-0,5ml/s)/10=0,35ml/s
In that case the complete nozzle calibration curve will be like this (related to Figure 14)

Linear curve-part	Flow range [ml/s]	Pressure range [bar]
1	**0,5**-0,85	63,3-91,4
2	0,85-1,20	91,4-118,2
3	1,20-1,55	118,2-137,9
4	1,55-1,90	137,9-156,4
5	1,90-2,25	156,4-172,3
6	2,25-2,60	172,3-187,4
7	2,60-2,95	187,4-201,4
8	2,95-3,30	201,4-214,6
9	3,30-3,65	214,6-227,4
10	3,65-**4**	227,4-237,7

Table 16: nozzle calibration curve - table

This leads to 10 linear curves which will be compounded to the complete nozzle calibration curve. (See reference Figure 14).

If the nozzle calibration curve was successfully created the result will be stored in a curve to calculate the prepressure before a seam. See example of a curve below. If nozzle calibration was created successfully, the static curve can be used for application and automatic prepressure adaptation.

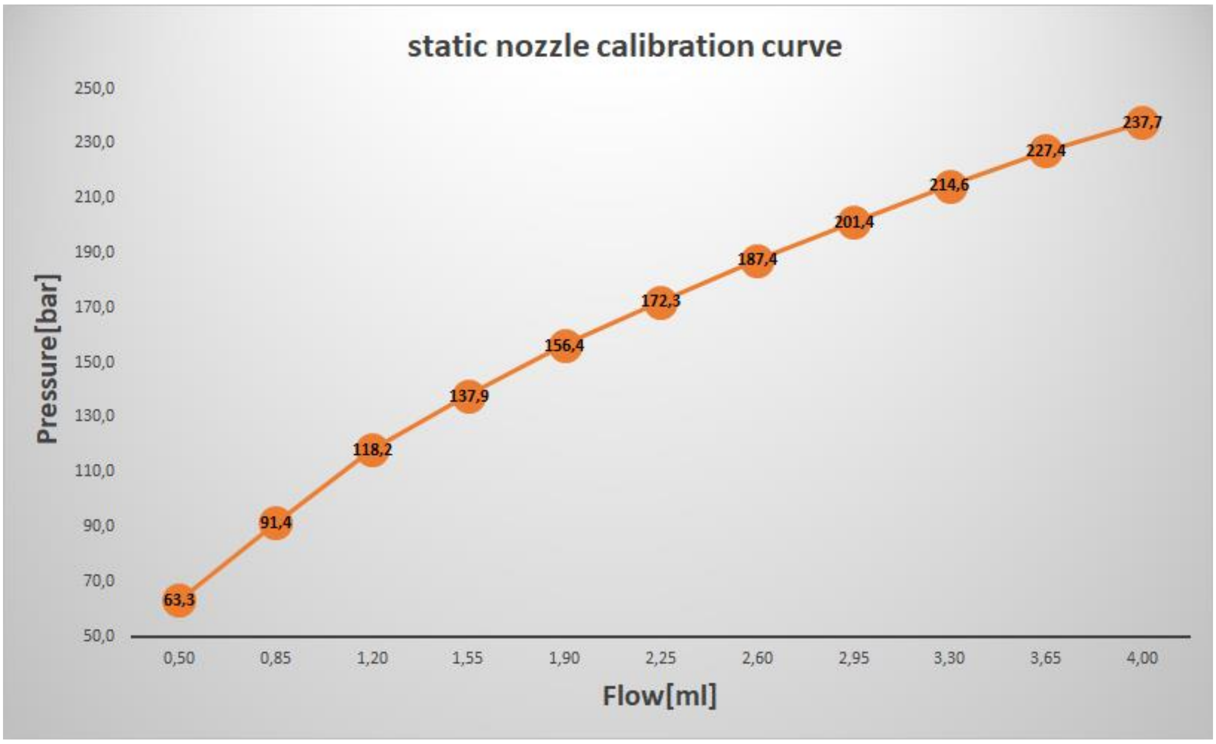


Figure 14: static nozzle calibration curve

The values for the static calibrated curve (including related flow, pressure and viscosity) will be stored in the variable called PERS num NozzleParam NP_D*X*N*Y* (Rapid module IDXA_Param.sys) (*X=number of the dispenser; Y=number of the nozzle).*

3.3.3 Automatic prepressure adaption with static calibrated nozzle curve

As explained in chapter 2.421 the value called num PrePressure is mandatory to use in beaddata definition. With that value the user can choose the possibility to use the nozzle calibration curve (PrePressure value =0). Table 17 and Figure 15 show some examples for value num prepressure in the beaddata and the result which pressure will be adjusted depending on different influencing factors **(example for flow setpoint in beaddata: 2,5ml)**

Flow_ type	PrePressure value (in beaddata)	PrePrsOverride[in beaddata)	Programmed speed	Robot speed	Reference speed	"real" flow value [ml]	Resulting prepressure setpoint
1	0	100	v500	100%	500	2,5	185bar (blue line in Figure 15)
2	0	100	v250	100%	500	1,25	122bar (green line in Figure 15
2	0	100	v500	50%	500	1,25	122bar (green line in Figure 15
2	-1	100	v500	50%	500	1,25	No pressure adaptation
2	0	80	v500	50%	500	1,25	97,6bar (122bar*80%)
2	130	100	v500	50%	500	1,25	130bar
2	130	80	v500	50%	500	1,25	104bar (130bar*80%)

Table 17: PrePressure adjustment possibilities

The resulting prepressure setpoint will be automatically calculated and adjusted by the system, before the related seam will be started. A detailed "how to program" description is explained in chapter 3.4 Main program and seam (robtarget) event guideline.

E.g. when the system calculated an upcoming flow of 2,5ml/s for the next seam, the doser will adjust a prepressure of 185bars about 300ms (see reference Table 6 int_dp_data.switch_time) before the seam starts automatically (Figure 15: blue dotted line) when the prepressure value 0 is used in the beaddata (related to examples in Table 17). When the system calculated an upcoming flow of 1,25ml/s for the next seam will adjust a prepressure of 122bars about 300ms before the seam starts (Figure 15: green dotted line).

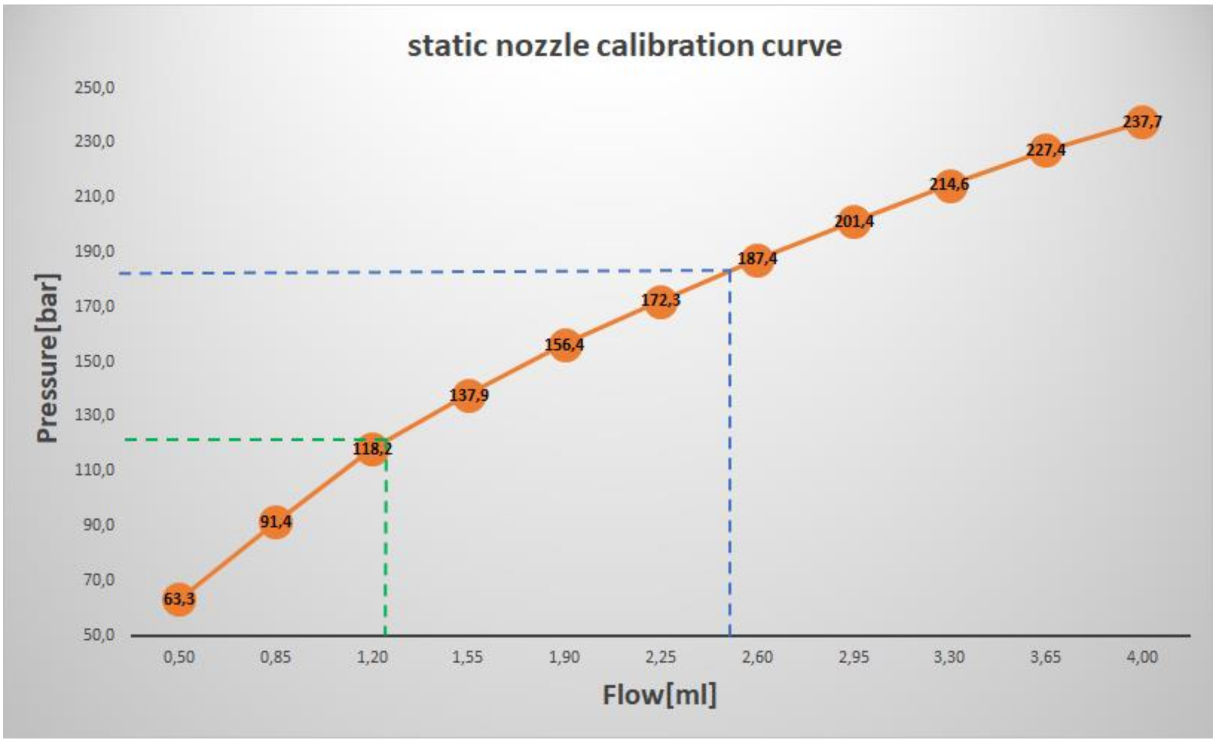


Figure 15: static nozzle calibration curve – 2,5ml/185bar – 1,25ml/122bar

If software option single seam supervision is used in combination with automatic pre-pressure adaptation and nozzle calibration (recommended and default setting of the system) it is possible to use it in a “machine learning mode” explained in chapter 3.3.4.

3.3.4 Automatic prepressure adaption with dynamic nozzle curve (machine learning mode)

Different factors can lead to differences in the material viscosity. These are

- Temperature fluctuations
- Inhomogeneous material within one material barrel
- Inhomogeneous material within one material charge
- Age and expiring date of the material
- Material thixotropy
- Mechanical or physical changes inside the dosing system (e.g. hardened material inside the nozzle and so on…)

To use this functionality the software option single seam evaluation must be set up and activated successfully. This will be described in chapter 3.9 Single seam supervision.

To prevent that the look of the seams differs from time to time because of these factors, a learning mode is used to adapt the nozzle calibration curve to the characteristics of the material.

When using the automatic prepressure adaption and learning mode is activated (default) the static calibrated nozzle curve will be adjusted dependent on the result of the single seam evaluation. In the course of measuring the mean pressure value on a seam connected to a certain application material flow the static nozzle calibration curve will be recalculated to the new measured results within different limits and factor.

Each time a single seam evaluation is run from the system (e.g. at the end of one application cycle or cluster) a calculation will adapt the dynamic curve depending on the adjusted parameters for the dynamic prepressure adaption. See parameters Table 17.

Each time a new factor will be calculated and activated the complete curve will be multiplied with that factor. This leads to a shifting of the whole curve like seen in Figure 16 graph “dynamic learning viscosity curve”.

When the dynamic viscosity curve is activated the procedure, as explained in chapter 3.3.3 Automatic prepressure adaption with static calibrated nozzle curve and Table 17: PrePressure adjustment possibilities, is the same related to the dynamic viscosity curve, which will be changed in runtime from time to time, instead of using the static curve.

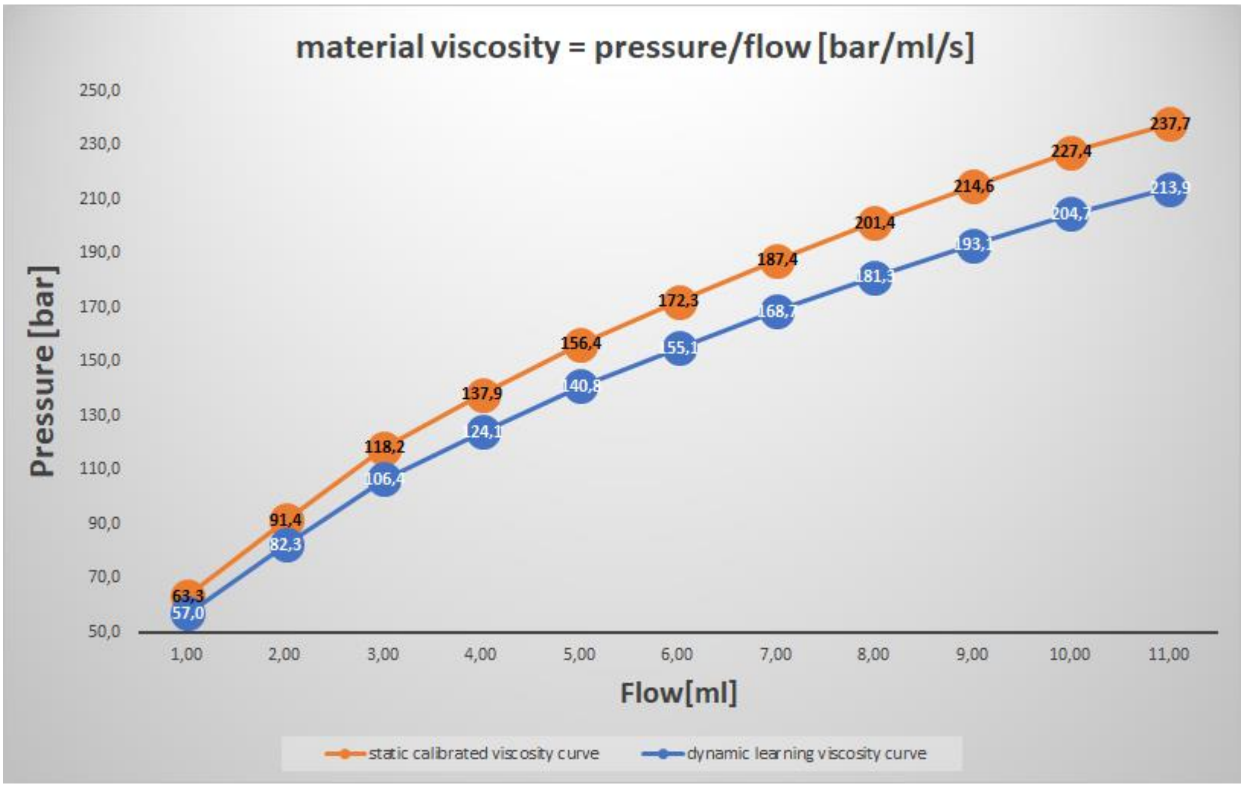


Figure 16: static and dynamic viscosity curve

3.3.4.1 Automatic prepressure adaption – calculating new displacement factor for dynamic curve

The calculation of the new calculation factor for the dynamic curve is described here in detailed.

The calculation of new factors for the dynamic curve is only possible if software option single seam supervision is set up and running. For further information please see chapter Machine learning mode – step by step guide

Only valid seams will be used to calculate a new dynamic factor to adjust the dynamic viscosity curve. A valid seam is a seam which satisfies special conditions. These conditions are:

- Seam length of application time must be inside the limits
- Seam must not be a faulty seam (no pressure or volume deviation on the seam)

Depending how the parameters are adjusted there must be at least two (default value) valid seams in one application cycle (cluster). This can be adjusted with the parameter nValidPrsValueLim. Otherwise this cycle (cluster) will not be included into the recalculation of the new dynamic curve factor.

If the new calculated factor is not within the limit for the factor (depending on the allowed viscosity fluctuations by the customer (by the material supplier) the factor will not be included into the recalculation and not be activated.

Not each cycle (cluster) a new dynamic factor will be activated. Depending on the parameter nDynFacCalcCycles a new factor will be activated (if validation check of the seam was ok, otherwise the cycle (cluster) will not be counted).

Each valid cycle (cluster) a factor will be calculated and will be included in an average factor calculation before the factor will be activated.

For example, if every 3rd cycle a new factor will be activated, also the 1st and 2nd cycle (cluster) calculated factor will be included into the recalculation (if all seams of the cycles (clusters) where valid seam).

Example for recalculation on the dynamic curve factor:

1. **Calculation of dynamic factor for each cycle (cluster):**

   Current pressure for a certain flow (red from dynamic curve) =91,4bar

   1st cycle measured pressure=89,3bar

   factor for that cycle=measured pressure/curve pressure=89,3bar/91,4bar=**0,9770**

   2st cycle measured pressure=84,4bar

   factor for that cycle=measured pressure/curve pressure=84,4bar/91,4bar=**0,9234**

   3st cycle measured pressure=88,0bar

   factor for that cycle=measured pressure/curve pressure=88,0bar/91,4bar=**0,9628**

2. **Calculation of dynamic average factor of last cycles (clusters):**

   calculate the **new dynamic average factor**: (**0,9770**+**0,9234**+**09628**)/3=**0,9544**

   This factor will be damped with a damping factor (parameter nDynPrsAvgDampFac). The default value for this is **10%**.

3. **Calculation of dynamic average damped factor of last cycles (clusters):**

   The new dynamic average and damped factor (parameter nNewDynPrsAvgFacDamped) which will be activated will be calculated like that:

   New dynamic damped factor =1-[(1- **new dynamic average factor**)*(damping factor/100)] →

   New dynamic damped factor =1-[(1- **0,9544**)*(**10%**/100)] =**0,99544**

4. Recalculation of the material viscosity curve

New pressure for certain flow=0,99544*91,4bars=91,0bars

Old pressure value for the material flow of 0,85ml/s is 91,4 bar.

New pressure value for the material flow of 0,85ml/s is 91,0 bar.

This new factor will be multiplied with the whole current dynamic curve (or static calibrated curve).

The two curves (old dynamic or static curve and new dynamic curve) are shown in Figure 17.

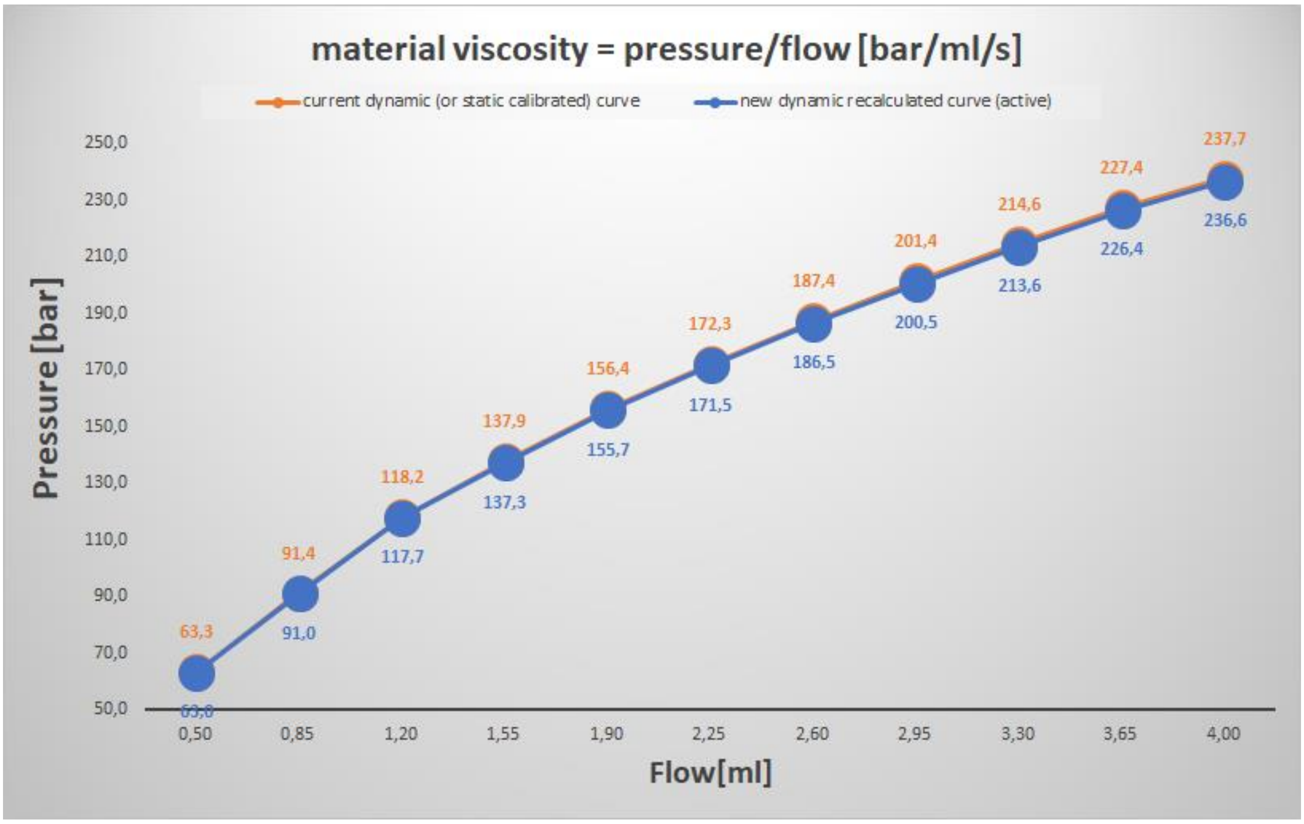


Figure 17: static (current dynamic) curve (orange) and new dynamic curve (blue) after first recalculation

For the next application cycle the new dynamic recalculated curve will be activated. Setting up the new prepressure values for the next seams the same approach as explained in chapter 3.3.3 and in Figure 15 will be used.

The adaption of the dynamic viscosity curve will be approximated step by step onto the viscosity change. Fast changes in the application pressure will not have big influence of the dynamic curve if the system is used with the default values and a damping factor of 10% (parameter nDynPrsAvgDampFac) is used. Faster changes of the material pressure could only be related to material inconsistencies or different temperature inside the system.

If there were any known issues with other influencing factors for the application pressure the dynamic curve can be reset by a parameter (bNozzleCurveDynReset). In case of setting this to TRUE, the application starts again with machine learning with the last learned static viscosity curve.

3.3.5 Parameters

Parameter name	Parameter Rapid	How to change	Module	Description
Dynamic viscosity curve is used	bDXNozzleParamDynCurve	Change rapid variable	IDXA_Param.sys	Default: TRUE (Dynamic curve / learning mode activated). FALSE=static calibrated curve is used
Point of time for determination the application pressure of the seam	bNozzleCurveUseLastPrs	Change rapid variable	ID1A_Data.sys	Default: FALSE. FALSE=application pressure will be determined from the mean pressure of the seam TRUE= application pressure will be determined from the end pressure of the seam (when closing the needle)
Reset dynamic learning viscosity curve	bNozzleCurveDynReset	Change rapid variable	IS_Param.sys	TRUE= dynamic viscosity curve will be reset (one time) to
Minimal amount of valid seam per cycle (cluster)	nValidPrsValueLim	Change rapid variable	IS_Param.sys	The amount of seams must be at least applicated in one cycle (cluster) to calculate a new dynamic curve factor
Cycles (clusters) until new dynamic	nDynFacCalcCycles	Change rapid variable	IS_Param.sys	Amount of cycles (clusters) to be done until new

factor activation				factor will be activated
Damping factor for the dynamic curve factor	nDynPrsAvgDampFac	Change rapid variable	IS_Param.sys	This factor will be assigned to the not damped dynamic curve factor Default: 10% 100%=not damped
Average dynamic curve factor (not damped)	nNewDynPrsAvgFac	No change	IS_Data.sys	Average dynamic curve factor (not damped)
Average dynamic curve factor (damped)	nNewDynPrsAvgFacDamped	No change	IS_Data.sys	Average dynamic curve factor (damped)
Nozzle curve log	bNozzleCurveLogActive	Change rapid variable	IS_Param.sys	Activate log for dynamic nozzle curve. Default=TRUE
Pause dynamic learning	bNozzleParamDynPause	Change rapid variable	IS_Param.sys	Dynamic learning will be paused. Latest dynamic curve will be used.
Minimal application time [s] of bead	nApplTimeLim	Change rapid variable	IS_Param.sys	Minimal temporal duration of bead to include to recalculation of dynamic curve Default: 0.2s

Table 18: automatic prepressure adaption parameters

3.3.6 Machine learning mode – step by step guide

This is a step by step instruction guide how to set up the system for running application with machine learning mode (dynamic viscosity curve).

1. Electrical heating must be set up correctly. All used heating circuit parameters must be adjusted and ready for heating
2. Electrical heating must be switched on and heating must be ready without errors.
3. Air supply must be switched on
4. Dispenser must be calibrated without errors

5. Material supply must be ready and switched on
6. Nozzle calibration must be run (see chapter 3.3.2)
7. Main program must be set up correctly (including single seam evaluation)
8. Single seam evaluation must be set up correctly for all application programs
9. Application program must be set up correctly (including beaddata)
10. Application delay (flow and needle, up and down) must be set up correctly.
11. Application must be run in automatic mode (or manual 100%)

3.3.7 Regulator parameters

3.3.7.1 Applicator pressure regulation (Prepressure regulation)

The regulator parameters for prepressure (PID parameters) must be changed via user menu which has to be ordered in manual function mode (see chapter 3.5). It is not possible only to change the parameter in Rapid.

Parameter name	Parameter Rapid	How to change	Module	Description
pressure regulator parameter	rdD1GunPrs	User menu (Order number 5)	ID1A_User.sys	PID regulator parameter applicator pressure regulator

Table 19: Applicator pressure regulator parameters

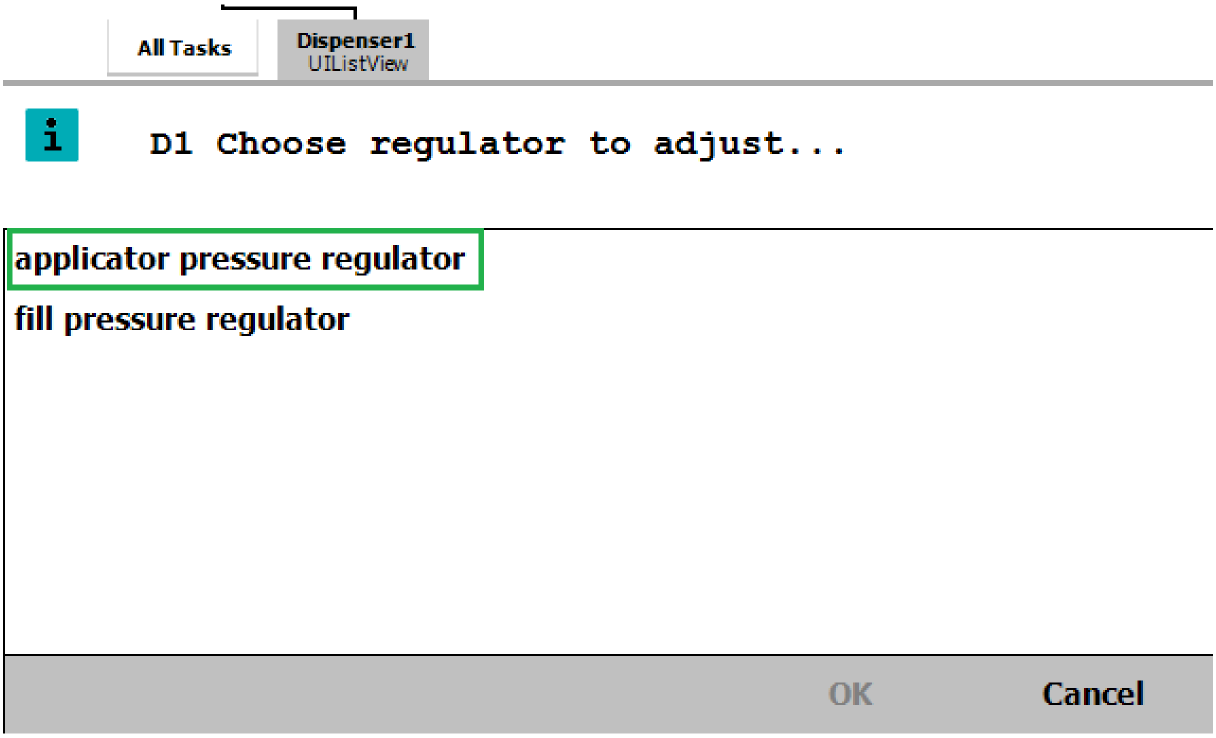


Figure 18: Applicator regulator adjustment menu

3.3.7.2 Fill pressure regulation

The regulator parameters for prepressure (PID parameters) must be changed via user menu which has to be ordered in manual function mode (see chapter 3.5). It is not possible only to change the parameter in Rapid.

Parameter name	Parameter Rapid	How to change	Module	Description
fill regulator parameter	rdD1FillPrs	User menu (Order number 5)	ID1A_User.sys	PID regulator parameter fill pressure regulator

Table 20: Fill pressure regulator parameters

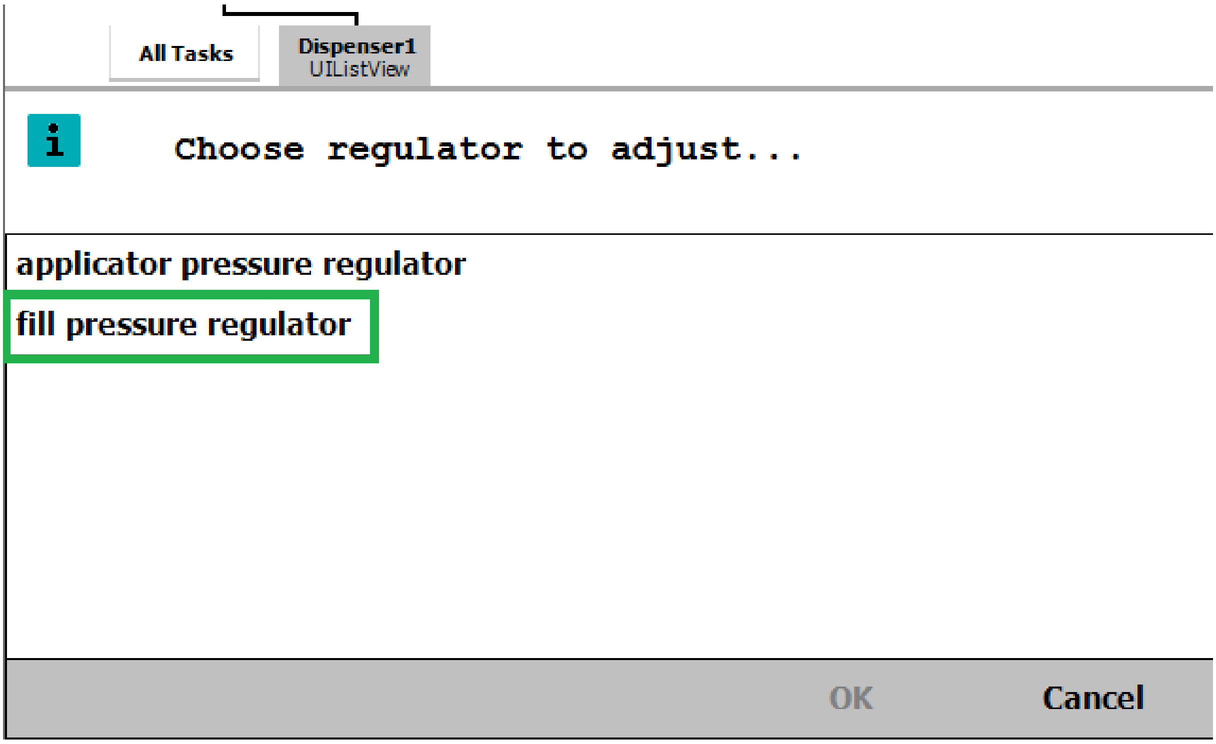


Figure 19: Fill regulator adjustment menu

3.3.8 Applicator pressure regulator adjustment

To adjust the regulator parameters for the applicator pressure regulator

3.3.9 Error messages

Error No.	Title	Description
5265	Dynamic viscosity change was too high	The change of the viscosity factor was too high related to last value

3.4 Main program and seam (robtarget) event guideline

3.4.1 General information

An application program for the ABB Integrated Dispensing Function Package is created largely in the same way as the creation of an application program with ABB DispenseWare e.g. Instruction "DispL" (see *manual "RAPID ProcessWare/Dispense-Ware"*). There are a few special commands, which have been added due to the doser technology and must be considered during the creation of the application program. Detailed information is provided in a training course by ABB Automation GmbH.

For this chapter an example for a predefined beaddata definition (see chapter 2.4) is used like the following definition:

```
RECORD beaddata
    String info;
    Bool ActivateRefRun;
    Dnum BeadID;
    Num BeadArea;
    Num MaxRelVolDev;
    Num MinRelVolDev;
    Dnum DetailID;
    Num PrePressure;
    Num PrePrsOverride;
    Num Equip_No;
    Num Nozzle_No;
ENDRECORD
```

This guideline describes the seam programming rules when using dynamic viscosity nozzle curve. This guideline can also be used when not using dynamic viscosity curve (automatic pressure adaptation). It is also possible to handle the prepressure events by setting a certain prepressure value in each bead manually (see chapter 2.4: Data type beaddata (DispenseWare) and Table 7: to be defined beaddata).

Important for the user is to take the action describes under “User” in this chapter. The user must build in some routines into the main program (application program) Internal events are handled automatically. Important is to keep the order of the events otherwise the full functionality of the automatic dynamic prepressure adaptation is not ensured.

A seam consists of different events. All possible events (pre-event, post-event, trigger-event) are described in Figure 20: possible trigger events on one seam.

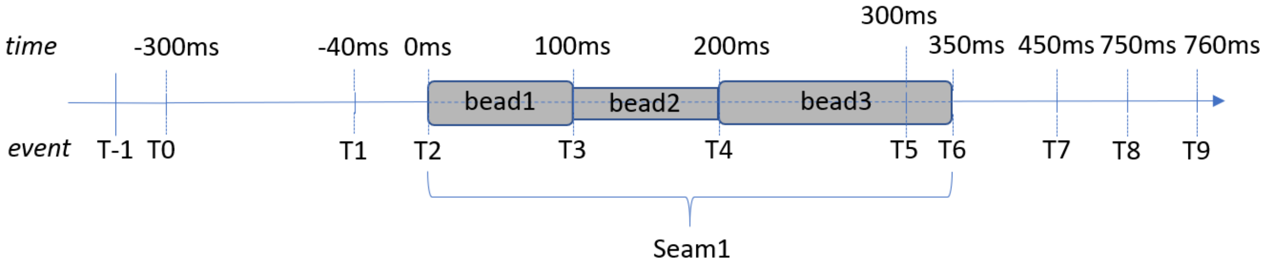


Figure 20: possible trigger events on one seam

All bead information will be read in to a beaddata register (called shiftregister) in advance of the robot motion and trigger events. This shiftregister is limited to have 128 entries (per cycle or cluster).

3.4.2 Preapplication action (Event T-1)

Description related to Figure 20: possible trigger events on one seam.

Event T-1 is a not constant timed event. It must be triggered somewhen before event T0. The time for system internal action is dependent on the general system behavior and cannot be influenced. The user action must be triggered at least 300ms (or more) before the first DispOn-instruction (event T2) is triggered.

System internal action:

1. This pre-event reads in the beaddata bead1 (also possible already beaddata bead2 and bead3, depending on robot speed, programming speed and number of trigger-events in a certain time) into an internal register beaddata array. (Bead4 which would be used in event T5 will not be read into the internal register, because there is no use of this).

   Depending on the application program and the defined datatype beaddata (see chapter 2.4) the array will e.g. look like this:

   ShiftRegister{128}:=[["bead1",FALSE,1234567890,5,20,20,36820,0,0,1,1],…]

User action:

1. Run rapid routine *PreApplicationDX*

   The routine *PreApplicationDX* prepares the dosing system to run an application. In case of the dosing system was in idle mode (See chapter 3.5

Error No.	Title	Description

5111	Dispenser not in application mode	A flow for applicator $arg2 was orderd with a Disp-instruction. Dispenser is not in application mode
5160	Wrong nozzle is activated	While using Disp-instruction $arg3 of dispenser $arg2 a wrong nozzle number was used. Only nozzle 1-3 are valid nozzles.
5176	Requested material flow above high limit	In bead $arg2 a material flow has been requested which is above the allowed flow of $arg3 ml/s.
5185	Dispenser is waiting for enable of temperature conditioning system	Routine: $arg1 Dispenser $arg2 is waiting for temperature conditioning system enabling.
5188	Dispenser is not ready for production	Dispenser $arg2 is not ready after filling and/ or applicator pressure regulation
5190	Start of the application programm not possible	Application or circulation mode of $arg2 was not stopped or application error is active
5196	Requested needle override exceeds limits	$arg1 : The override request of $arg3 for needle $arg2 exceeds the system limits ($arg4 - $arg5)
5199	Error class 2 - stop end of cycle- active	An error of class 2 (11$arg2) - stop end of cycle - was generated while last application cycle.
5248	Single seam aquisition - no evaluated data available	No single seam data was evaluated for dispenser $arg2. Signal go$arg2SingleSeamEval has value 0.

Manual function mode (Idle mode)) the doser will be set application mode (See chapter 3.6 Application mode). Depending on used parameters the doser will be filled with material to be ready for application cycle. Now the doser is ready to apply beads on a part and is not possible to receive the orders for the manual function mode (despite filling (see chapter 3.2 Filling function of the dosing unit).

Example:

PreApplicationD1;

2. Run rapid routine *PrepareSingleSeamDX* with the optional switch parameter *strSeg* or *nProg* (PrepareSingleSeamDX\strSegment*:="actual cluster string"* or PrepareSingleSeamDX\nProg*:="actual program num"*).

   When using a datatype *string* for the program string or cluster string then the optional switch parameter \strSegment must be assigned. When using a datatype *num* for the program number or cluster number then the optional switch parameter \nProg must be assigned here.

The routine is used to delete the old temporary data for the single seam evaluation (which is mandatory to use for dynamic prepressure and viscosity adaptation) of the last cycle and reads in (in the rapid background task *Statistic*) the reference data for the assigned cluster string or program number. For more information about the single seam evaluation see chapter 3.9.

Example:

strSegment:="C1234";

PrepareSingleSeamD1;

<u>System limits:</u>

3.4.3 Dispense switch action (Event T0)

Description related to Figure 20: possible trigger events on one seam.

from datatype equipdata (see chapter 2.3). This parameter must not be changed. This event is triggered 280ms before the DispOn robtarget event T2 is triggered.

<u>System internal action:</u>

1. Internally a routine will be triggered. This routine reads out several information from the internal register array to catch the beaddata information which is used for trigger-event T2. Depending on robot speed and distance to the next bead (bead2) it is possible that meanwhile the next set of beaddata was red into the beaddata register array.

   (hint: this is not shown in this example…)

   ShiftRegister{128}:=[["bead1",FALSE,1234567890,1.25,20,20,36820,0,0,1,1],…]
2. The related dispenser number (num Equip_No) will be red out of the register array.
3. In case of using the system in speed dependent mode (see chapter 2.3) the actual robot tcp speed will be measured. Depending on this speed the next upcoming flow (depending on the programmed speed in Disp-instruction and the reference speed (see chapter 2.3)) will be calculated.
4. Setpoint for prepressure regulation will be activated. Prepressure regulation starts. Depending on the calculated flow setpoint (2.) the setpoint for the prepressure regulation will be calculated like that:
   i) If value *num prepressure* in beaddata register = -1 prepressure regulation will not be activated.
   ii) If value *num prepressure* in beaddata register = 0 the the setpoint for the prepressure regulation will be red out of the viscosity curve, depending on

the calculated flow setpoint. Also, the datatype beaddata value num pre-prsoverride will be included into this calculation. If the value = 0 or =100 the pressure value from the viscosity curve will be used and activated. If the value for preprsoverride in beaddata register is e.g 80 (80%) then the red out prepressure value from the viscosity curve will be multiplied with 80/100=0,8 and activated.

iii) If value num prepressure in beaddata register > 1 and <300 the given pre-pressure setpoint (bar) will be activated.

5. Activated prepressure setpoint will be written to beaddata register array num prepressure. If original value for num prepressure from the beaddata was “0” then this value will be overwritten by the real activated prepressure setpoint (see example Figure 15 , for 1,25ml/s flow setpoint the prepressure setpoint will be 122bar).

   Note: the prepressure could also be different if the robot speed was reduced to i.e. 50%. In this case the flow setpoint will be reduced to 0,625ml/s and the pre-pressure will be lower, related to the viscosity curve. The prepressure value which will be written to the beaddata register includes the calculation of the robot speed and of the prepressure override value and is the pressure which will be activated and adjusted in the system.

   *ShiftRegister{128}:=[[“bead1”,FALSE,1234567890,**1.25**,20,20,36820,122,0,1,1],…]*

6. Nozzle device number will be set. Depending of the value num Nozzle_No in the datatype beaddata register the device number for the nozzle will be set. (Default value =1 for nozzle 1).

User action:

1. Datatype beaddata must include the correct needle number and correct values for the prepressure and for the prepressure override if used. Equipment which dispenser is used must be set correctly in num Equip_No.
2. If using speed dependent mode, the user must ensure, that the robot has the same tcp speed which will also be nearly the same speed than at event T1(T2).
3. If using speed independent tcp speed,the tcp speed at trigger event T0 is not important because a fixed flow (and related fixed prepressure) will be activated.

3.4.4 Application delay on actions (Event T1)

Description related to Figure 20: possible trigger events on one seam.

System internal action:

1. Application delays will be activated (i.e. like in figure flow delay on and needle delay on both=40ms).
2. Needle opens.
3. Application flow starts. Dispenser motor starts turning.

4. Prepressure regulation will be deactivated (due to activated flow setpoint). Dispensing system changes from pressure regulation mode to flow regulation mode. This will be automatically done by IPS when recognizing that a new flow setpoint was sent from DispenseWare to IPS.
5. Single seam evaluation data will be reset.

User action:

1. Application on-delays must be set up correctly.

3.4.5 Robtarget DispOn (Event T2)

Description related to Figure 20: possible trigger events on one seam.

System internal action:

1. This is the original robtarget event for the DispOn instruction. This is the point of time when triggering the needle and flow if application delays are set to “0”.

User action:

1. This is the point to teach for the user with correct tool and workobject to connect the robtarget position with the DispOn instruction.

3.4.6 Bead switch action (Event T3)

Description related to Figure 20: possible trigger events on one seam.

System internal action:

1. This is the point where the bead change starts. If no delays (DispenseWare, see chapter 2.3) are activated the change of the bead starts here. If e.g. int_dp_data.fl1_delay is set to 0,05s the bead change starts 50ms before this trigger event.
2. Single seam evaluation data for bead1 will be saved.
3. Single seam evaluation data for bead1 will be reset (for next bead2).

User action:

1. This is the point to teach for the user with correct tool and workobject to connect the robtarget position with the Disp instruction.
2. Optional shootfilter can be activated (see chapter 3.4.15.2

3.4.7 Bead switch action (Event T4)

Description related to Figure 20: possible trigger events on one seam.

System internal action:

1. This is the point where the bead change starts. If no delays (DispenseWare, see chapter 2.3) are activated the change of the bead starts here. If e.g. int_dp_data.fl1_delay is set to 0,05s the bead change starts 50ms before this trigger event.
3. Single seam evaluation data for bead2 will be saved.
4. Single seam evaluation data for bead2 will be reset (for next bead3).

User action:

5. This is the point to teach for the user with correct tool and workobject to connect the robtarget position with the Disp instruction.

3.4.8 Application delay off actions (Event T5)

Description related to Figure 20: possible trigger events on one seam.

System internal action:

1. Application delays will be activated (e.g. like in figure flow delay off and needle delay off both=50ms).
2. Needle closes.
3. Application flow stops. Dispenser motor stops turning.
4. Prepressure regulation will be activated (due to deactivated flow setpoint). Dispensing system changes from flow regulation mode to pressure regulation mode. This will be automatically done by IPS when recognizing that the flow setpoint was set to 0 from DispenseWare and sent to IPS.
5. Single seam evaluation data will be saved (for bead3).

User action:

1. Application off-delays must be set up correctly.

3.4.9 Robtarget DispOff (Event T6)

Description related to Figure 20: possible trigger events on one seam.

System internal action:

1. This is the original robtarget event for the DispOff instruction. This is the point of time when triggering the needle and flow if application delays are set to “0”.

User action:

1. This is the point to teach for the user with correct tool and workobject to connect the robtarget position with the DispOff instruction.

2. Optional shootfilter can be deactivated (see chapter 3.4.15.2

3.4.10 Starting single seam evaluation (Event T7)

Description related to Figure 20: possible trigger events on one seam.

<u>System internal action:</u>

1. As soon as the user action was started by running the rapid routine *EvalDataDX* the rapid task statistic gets the order to evaluate all existing data for the last run cycle (cluster). The temporary current application data will be compared with the reference data (csv file for each program / cluster). The data will be written to a production log (see chapter 3.9.3.8) and the general result of the evaluation will be mirrored into the signal goDxSingleSeamEval (see chapter 3.4.11).

<u>User action:</u>

1. The user has different opportunities to continue depending on:
    a. If a next seam in the same cycle (or cluster) follows.

       In this case the next event **T0** will follow like explained in chapter 3.4.3
    b. If a single seam evaluation should be triggered (end of cluster) but a new cluster will begin before the cycle will be ended.

       In this case the user must run the rapid routine *EvalDataD1* and it is important to synchronize the robot with the program here. Otherwise the program pointer will run in advance compared to the robot movement and will start the single seam evaluation maybe too early. In worst case the evaluation will be started but the robot does not have ended the last seam completely.

       This can be ensured by using synchronized rapid instructions like *MoveLSync* or *MoveJSync or WaitRob\InPos.*

       <u>Example:</u>

       MoveLSync Offs(p1,x,y,z),v200,z10,tDoser\WObj:=wtrig,"EvalDataDX";

       or

       WaitRob\InPos;

       EvalDataDX;
    c. If a single seam evaluation should be triggered and the cycle should end.

       In this case same steps as described in (b.) to evaluate the single seam data must be done. Then the single seam evaluation result can be checked as described in chapter 3.4.11 before the rapid routine

PostApplicationDX must be run to end the cycle (see chapter 3.4.12). The dispenser will be set to manual function mode (idle mode).

3.4.11 Getting single seam evaluation result (Event T8)

Description related to Figure 20: possible trigger events on one seam.

User action:

1. To get the result of the single seam evaluation (evaluation time up to 300ms including writing production log) the user must call the rapid function *SingleSeamState(\DX).* This Boolean function return the value =TRUE if the result for the single seam evaluation was ok. If the result has any faults it will return the value =FALSE.
2. To have a more detailed result about the fault the user could check the result of the group output signal *goDXSingleSeamEval*. For more detailed information about the result the production log must be check. (See chapter 3.9.3.8)

Signal state goDxSingleSeamEval	State description
0	No evaluation result is available
1	Evaluation result ok (no errors)
2	Evaluation result ok (with errors). Check production log for more information.
3	Evaluation result not ok (no .csv reference file found)

Table 21: Evaluation result single seam

Depending on the result the robot can be moved to a “part showing position”.

3.4.12 Postapplication action (Event T9)

Description related to Figure 20: possible trigger events on one seam.

User action:

1. Run rapid routine *PostApplicationDX*

   The routine *PostApplicationDX* resets the dosing system to manual function mode (idle mode). Depending on used parameters the doser will be filled with material to be ready for next application cycle. Now the doser is ready to receive orders to do manual functions.

   Example:

   PostApplicationD1;

3.4.13 Overlapping triggers

If time between trigger events is too small, it happens that the trigger events will overlap.

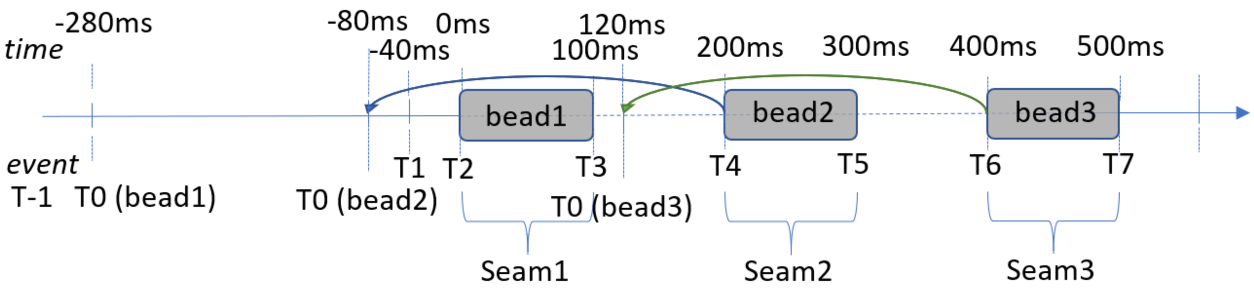


Figure 21: Seam trigger events overlapping

In case of the distance from one DispOn instruction to the next DispOn instruction will be less then int_dp_data.switch_time (=280ms ; see chapter 2.3), the trigger event Dispense switch action (**Event T0**) will be activated before the previous seam starts. In that case the prepressure activation will take place to early and will have the wrong value. This can only be used if the beads have the same flow setpoint and will be applicated with the same nozzle. If a nozzle must be changed the two DispOn instructions must have a least the distance of 280ms in between. In case that all short seams in the application will have the same flow setpoint and the used nozzle will not change, it will not be a problem.

3.4.14 Trigger events on a seam

If the time between two seams is equal to the int_dp_data.switch_time (=280ms ; see chapter 2.3) the triggerevent T0 for the next seam will activated on the current seam.

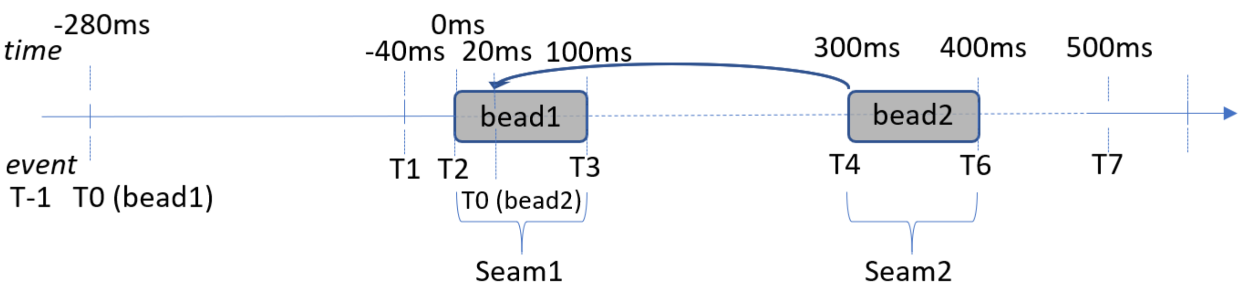


Figure 22: Seam trigger events on a seam

In this case the new prepressure setpoint for the next seam (Figure 22: Seam trigger events on a seam bead2) will be activated while seam 1 is running. This is possible because the new pressure setpoint can be sent to IPS BiasRegulator, even if a flow setpoint is active. The prepressure value will be stored (inside BiasRegulator object) and automatically activated, as soon as the flow setpoint was reset. Then the pressure setpoint will be automatically activated from BiasRegulator.

This can only be used if Figure 22: Seam trigger events on a seam bead1 and bead2 are using the same nozzle. If the nozzle must be changed between two seams the time between the two seams must be at least int_dp_data.switch_time (=280ms ; see chapter 2.3).

3.4.15 Shootfilter trigger events

Shootfilter is a software functionality which overshoots the change of a flow setpoint for a certain time.

3.4.15.1 General information about shootfilter

A shootfilter is a software function that increases a requested change of a flow setpoint to a certain value in percent (depending on the physical conditions between theoretically 100% and 700%) for a defined period (specified in Hz as cut-off frequency).
The related short-term increase (or reduction) of the setpoint flow causes a brief increase (or reduction) of the motor speed of the doser. This influences the material volume at the start, end or during a requested flow change on a seam.
The shootfilter acts as a boost function to compensate the length of the hose between dispenser and applicator. It is also used as a compensation for hose breathing and for compressible materials. Shootfilters can be activated during the application cycle. If shootfilters are activated, they only influence the process if a requested flow volume changes. A flow change can occur on the following application scenarios:

- At the start of a seam (flow changes from 0ml/s to i.e. 10ml/s)
- At the end of a seam (flow changes from 10ml/s to i.e. 0ml/s)
- When a flow change on the seam is ordered (flow changes from 5ml/s to 10ml/s, and in negative direction from 10ml/s to 5ml/s)
- Flow change in case of a speed change of the robot an using speed dependent flow

The shootfilter functionality and predefined shootfilter parameters are defined in the IPS (see Table 22: Predefined shootfilter definition in IPS). Resulting flow values could be higher than the related flow setpoint. If a calculated shootfilter flow value will be higher than highest possible flow value (nominal flow) for that system variant, the flow setpoint will be cut at the nominal flow value. The potential flow with shootfilters is restricted by the physical limits of the motor and the driver stages. Ten filter coefficients are predefined in the IPS configuration (see Table 22: Predefined shootfilter definition in IPS). Additional filter coefficients can be added or the existing can be changed.

Filter number	Overshoot	Cut-off frequency
1	200%	2Hz
2	200%	6Hz
3	350%	2Hz

4	350%	6Hz
5	500%	2Hz
6	500%	6Hz
7	750%	1Hz
8	750%	4Hz
9	750%	8Hz
10	750%	12Hz

Table 22: Predefined shootfilter definition in IPS

Figure 23: Shootfilter behavior shows the shootfilter behavior as an example. The same behavior can also be seen if the flow setpoint is decreasing (i.e. from 5ml/s to 0ml/s). This leads to an under shoot of the motor rotational speed. The motor will turn backwards for a short time. This could lead to a material pressure reduction inside the doser chamber. This could also take influence of the next upcoming seam. How long the shootfilter is effective depends on the cut-off-frequency. It defines the length of the effect.

In case that the shootfilter will be activated before a DispOn instruction the shootfilter will be active before opening the needle. The shootfilter will overlay the automatic pre-pressure adaptation. This can lead to unforeseen behavior at the start of the seam.

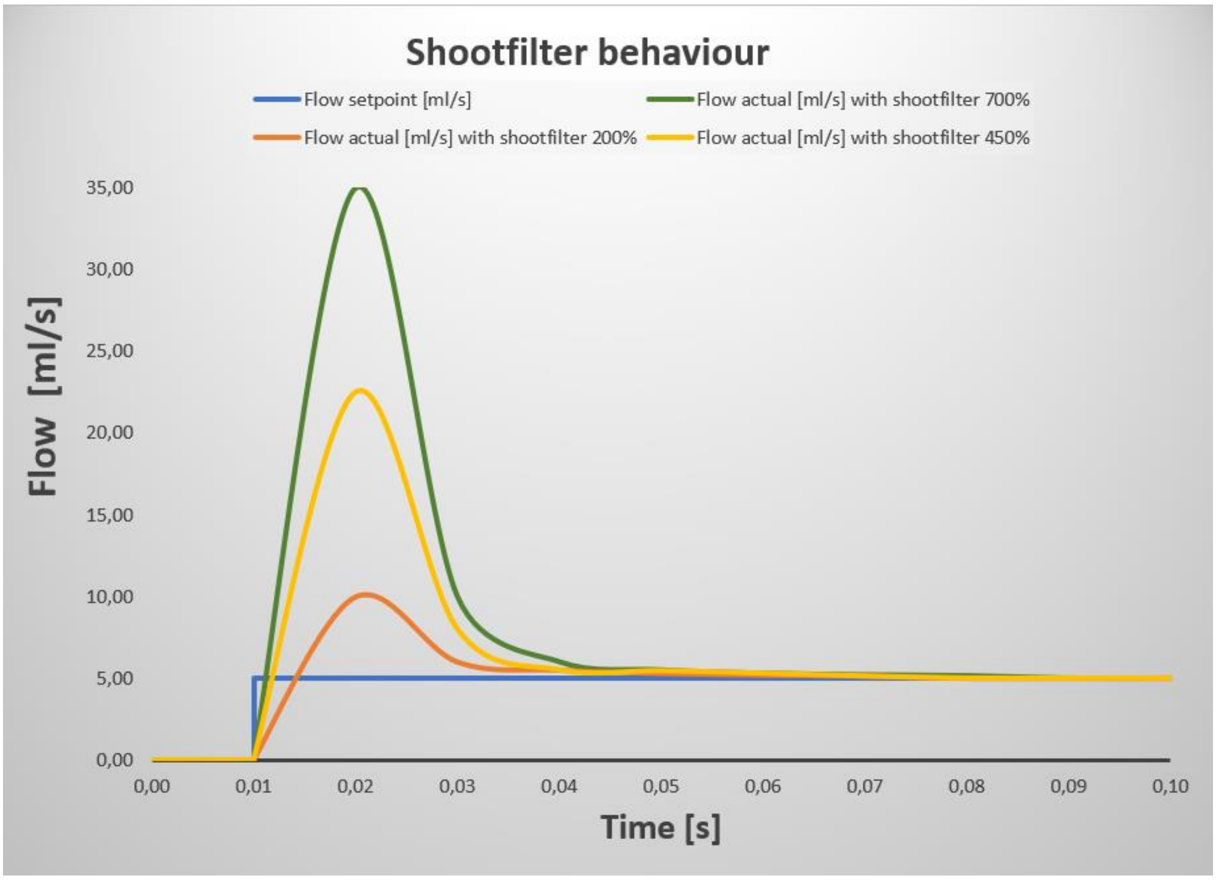


Figure 23: Shootfilter behavior

3.4.15.2 Creating shootfilter triggerevent

A shootfilter trigger event may be useful when having a flow change on a seam.

System internal action:

1. By activating the filter (user action) the predefined shootfilter will be activated with a group output signal in IPS.

User action:

1. Add the following lines (the lines starting with "!" are optional and only comments) to the application program (before the seam where to use the shootfilter)

   !This line defines a AliasIO signal to use with rapid instruction TriggIO.

   !X=number of the dispenser (1-4) / Y=A for doser A, B for doser B.

   AliasIO goDXY_filter,goFilter;

   !shootfilter= num value 1-10, depending which shootfilter to use. (Could be red !out of certain beaddata if beaddata definition includes shootfilter, see Table 7)

   !trigg event for setting the shootfilter

   TriggIO FilterOn,0\GOp:=goFilter,shootfilter;

   ! trigg event for resetting the shootfilter

   TriggIO FilterOff,0\GOp:=goFilter,0;

   !activate a shootfilter in front of a bead change. The shootfilter will be activated !from robtarget p10 on…until it will be reset!

   *DispL Offs(p10,x,y,z),v400,bead2,z5,tDoser\WObj:=wtrig**\T1:=FilterOn**;*

   DispL Offs(p10,x,y,z),v400,bead3,z5,tDoser\WObj:=wtrig;

   !deactivate the shootfilter in front of the seam end

   *DispL\OFF,Offs(p10,x,y,z),v400,bead4,z5,tDoser\WObj:=wtrig**\T1:=FilterOff**;*

3.4.16 Error messages

Error No.	Title	Description
5111	Dispenser not in application mode	A flow for applicator $arg2 was orderd with a Disp-instruction. Dispenser is not in application mode
5160	Wrong nozzle is activated	While using Disp-instruction $arg3 of dispenser $arg2 a wrong nozzle number was used. Only nozzle 1-3 are valid nozzles.

5176	Requested material flow above high limit	In bead $arg2 a material flow has been requested which is above the allowed flow of $arg3 ml/s.
5185	Dispenser is waiting for enable of temperature conditioning system	Routine: $arg1 Dispenser $arg2 is waiting for temperature conditioning system enabling.
5188	Dispenser is not ready for production	Dispenser $arg2 is not ready after filling and/ or applicator pressure regulation
5190	Start of the application programm not possible	Application or circulation mode of $arg2 was not stopped or application error is active
5196	Requested needle override exceeds limits	$arg1 : The override request of $arg3 for needle $arg2 exceeds the system limits ($arg4 - $arg5)
5199	Error class 2 - stop end of cycle- active	An error of class 2 (11$arg2) - stop end of cycle - was generated while last application cycle.
5248	Single seam aquisition - no evaluated data available	No single seam data was evaluated for dispenser $arg2. Signal go$arg2SingleSeamEval has value 0.

3.5 Manual function mode (Idle mode)

In manual function mode can be used if the doser is already calibrated. Otherwise no doser action is possible. The Table 23 shows the manual functions and a short description. Some of these functions are available depending on installed options. All these functions can only be run when doser is in idle mode.

Manual function	Order number doser A (doser B)	Short description
Filling	11(21)	Doser will be filled with material
Emptying	12(22)	Doser will be emptied (0ml not mechanically)
Jogging backward	13(23)	Doser will be jogged backward slowly (fill slowly)
Jogging forward	14(24)	Doser will be jogged forward slowly (empty slowly)
Calibration	15(25)	Doser level will be calibrated
Purging	16(26)	Doser will be purged (through nozzle)
Flowcheck	17(27)	Doser applicated volume will be verified

Prepare (2K)	18(28)	2K applicator will be purged with correct mix ratio (ready to applicate) through mixer
Manual application (2K)	19(29)	2K material will be applicated (purged) with correct mix ratio through mixer
Super purge	2	Doser moves to mechanical low limit and will be purged by pump through nozzle. (system will be vented)
Front plate purge	3	Doser front plate will be purge by pulsing inlet valve
Set IPS delays	4	Sending new application delays to IPS. (Only possible if doser is idle)
Change regulator parameters	5	Change the regulator parameters via a user menu on the TPU. Applicator pressure and fill pressure regulator parameters to be changed.
Nozzle calibration	6	Create a curve (application flow/application pressure) for a range of flow values. This curve is used to calculate and set the correct application prepressure depending on the upcoming application flow before a seam. (Mandatory service function for automated prepressure adaptation)
Pressure relief	7	The material pressure of the doser (inlet hose and integrated pump) will be released.
Hose accumulation	8	Hose accumulation and compressibility of material will be tested and saved in a curve. Mandatory service function.
Leakage detection	9	System (between doser, applicator and inlet hose
Needle feedback calibration	30	Calibration of needle feedback sensor (mandatory hardware to be installed)

Table 23: IDFP manual functions

3.5.1 Set application delays (IPS delays needle and flow)

Due to a physical, mechanical delay of the application equipment (needle, doser motor a.s.o.) application delays are needed. The delays must be adjusted individually adapted to the equipment and circumstances. The material has an influence on how to set up the application delays.

Four different application delays are existing to take influence on the beginning of a seam and the end of the seam.

- Needle delay up: the expected time in milliseconds defines, how long the needle takes to be open before reaching the programed DispOn robtarget position (switching time of the needle). The material will take some time before leaving the nozzle depending on material behavior.
  Min value=0ms / Max value =80ms
- Needle delay down: the expected time in milliseconds defines, how long the needle takes to be closed before reaching the programed DispOff robtarget position.
  Min value=0ms / Max value =80ms
- Flow delay up: the expected time in milliseconds defines, how long the doser motor will need to start turning until material will be pushed out of the nozzle. If the motor will turn earlier than the needle opens, it will build up a certain pressure inside doser chamber and applicator.
  Min value=0ms / max value=80ms
- Flow delay down: the expected time in milliseconds defines, how long the doser motor will need to stop turning until material pressure will be build up to a certain value.
  Min value=0ms / max value=80ms

  Note: Flow up and Flow down delay must have the same value! Otherwise this could lead to trigger errors.

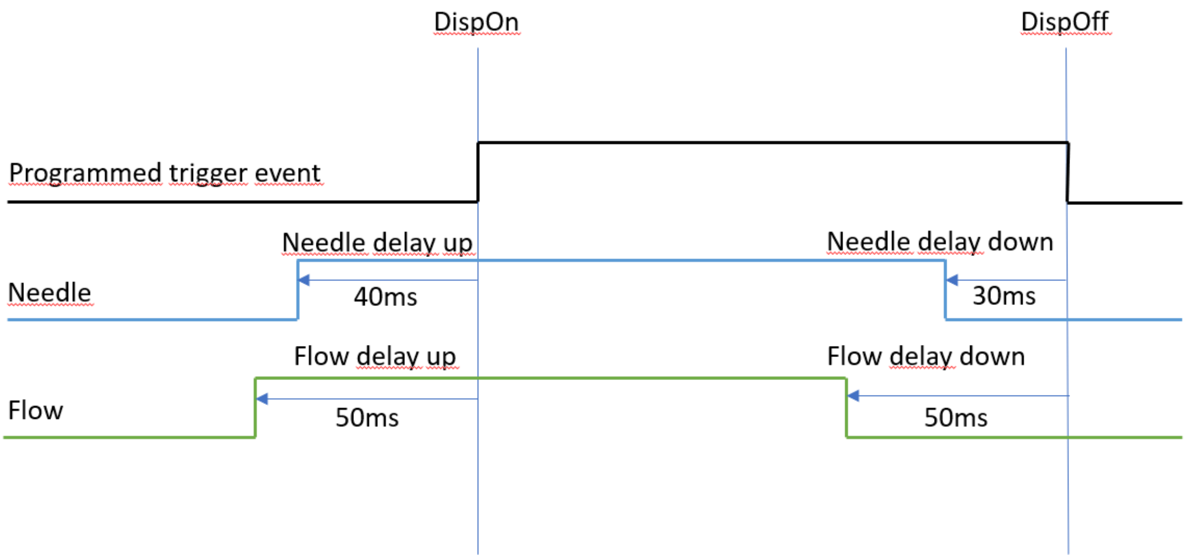


Figure 24: IPS application delays

To determine the needle delays (switching delays of the needle valves) and flow delays (delay time between start of doser motor and the escape of material at the nozzle), a spray test program must be created (see chapter *10 Bead optimization*).

The delays can be set in the window FlexPendant - Configuration - Application.

3.6 Application mode

If running an application program, the doser must be set to an application mode. This ensures that all relevant doser limits will be supervised and useful application functionalities are available.

In application mode it is not possible to start any manual function (idle mode).

3.6.1 Setting initial prepressure

If the system is in application mode (rapid routine *PreApplicationDX* was run) a pressure regulation will start inside doser chamber to prepare the application for the first seam. This will only be done if a pressure setpoint was set before running routine *PreApplicationDX*. This setpoint will be set by a numerical variable called *nDxGunPrs*. This value can be set from task T_ROB1. (This is not necessary if dynmamic viscosity adaption is used)

3.6.2 Fill doser at application cycle start

Depending on parameters for filling at application cycle start the doser will be filled with material (see Table 10: Filling TPU parameters).

3.6.3 Fill doser at application cycle end

Depending on parameters for filling at application cycle end the doser will be filled with material (see Table 10: Filling TPU parameters).

3.6.4 Refill doser between seams

Refill the doser in application mode (between two seams, if needle is closed) can be done by setting the signal *doDXY_FillRequest*=1. The signal will be reset when the filling cycle has ended. This signal can be used as a handshake signal for application program.

3.6.5 Doser limit supervision

In application mode a limit supervision is activated which supervises different limits while the application is running.

1. The doser material fill level minimal limit will be supervised. If the limit will be exceeded an error message will appear and stop the doser. Depending on the error class the robot movement will be stopped.
2. For the filling cycle minimal fill pressure and fill time will be supervised.
3. For the filling cycle the drive voltage (doser motor) will be supervised.
4. The time for applicator pressure regulation will be supervised.

(For more information regarding error messages, see IDFP product manual – Appendix B)

3.7 Circulation mode

3.8 Statistical data (optional)

This functionality is currently not in use. Instead single seam supervision can be used.

3.9 Single seam supervision

The single seam supervision is used to supervise the following measured variable

- volume for a seam (bead) compared to reference volume.
- Nozzle used for a seam compared to reference nozzle
- Mean pressure used for a seam

Therefore, a reference file for each part (program / option or cluster) will be created and used as comparison to the upcoming applicated parts.

Hint: single seam supervision is not a volume consumption supervision.

The "Single Seam Supervision" option requires the corresponding hardware option "Single Seam Supervision" (USB-stick) and software option "Single Seam Supervision". The following functions are included in the option:

- Number of references: max. 64 (product of number of different types of "programs" and "options" or amount of clusters
- Simultaneous creation of references of several programs / options or clusters
- Enable / disable global monitoring
- activate / deactivate monitoring per program / option
- starting reference per program / option or cluster
- no monitoring of the program when referencing is running (monitoring for already existing references remain activated)
- status and error messages
- production log (see chapter 3.9.3.8)
- error log data array for beads with at least one fault
- supervising beads (seam could be divided into different beads when using different bead numbers (see Table 7). When changing a bead needle will not close.
- supervising volume mean pressure when robot speed is reduced
- allows to use dynamic viscosity adaptation for prepressure regulation

3.9.1 Parameters

Parameter name	Parameter Rapid	How to change	Module	Description

BeadID (unique number in beaddata is used)	bUsingBeadID	Change rapid variable	IS_Param.sys	TRUE= BeadID is used FALSE= BeadID is not used
Activate production log	bSingleSeamProd-Log	Change rapid variable	IS_Param.sys	TRUE= Production log is activated FALSE= Production log is deactivated

3.9.2 Configuration

The following steps must be done before using single seam supervision

3.9.2.1 General configuration single seam

All used program number / option or clusters must be configured on the IDFP TPU screen.

Step 1:

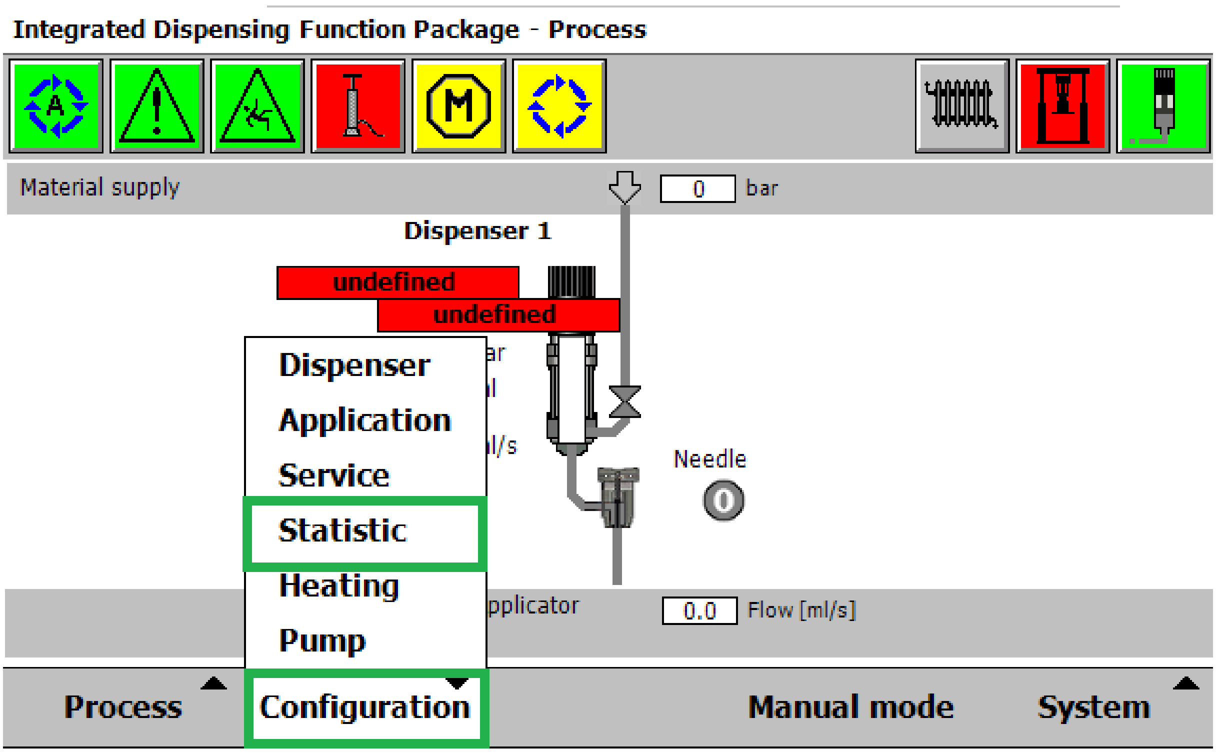


Figure 25: Process windows configuration statistic menu

Step 2:

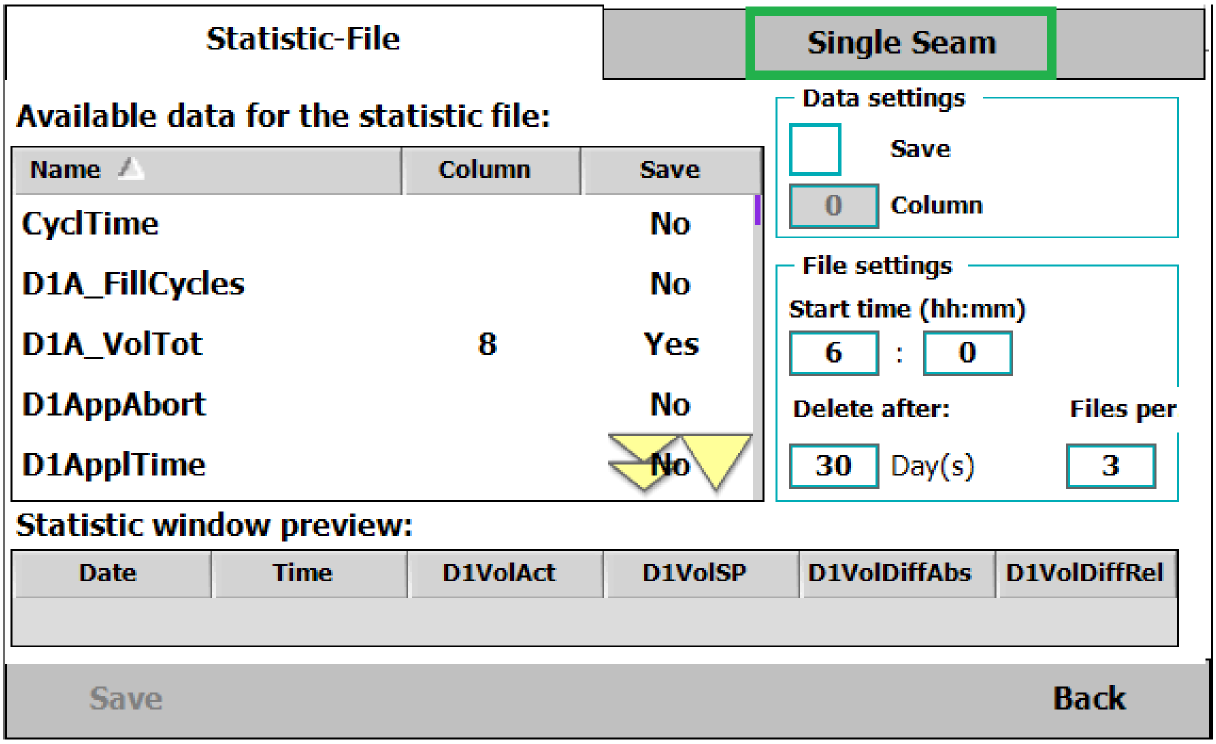


Figure 26: Statistic window single seam tab

Step 3:

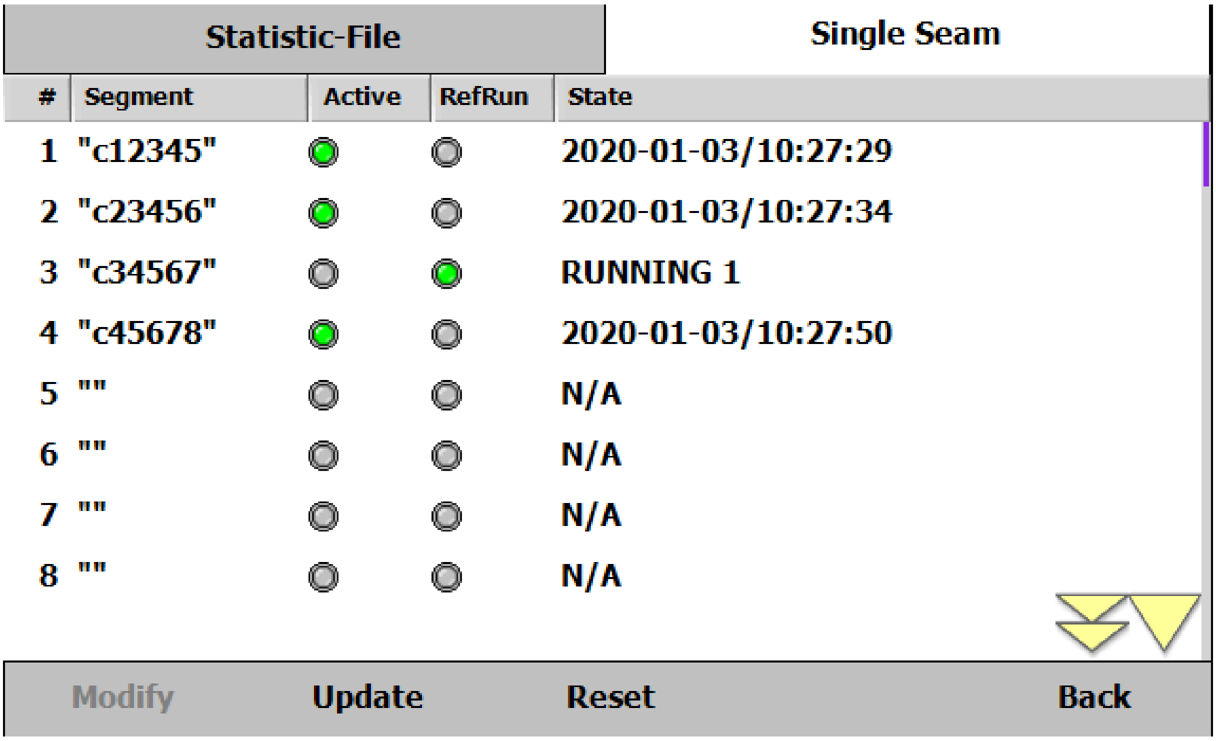


Figure 27: Statistic windows single seam configuration

In this view all used programs (segment=cluster) must be registered. To modify and configure each program (cluster) press on button “Modify” to modify each individually program (cluster).

Step 4:

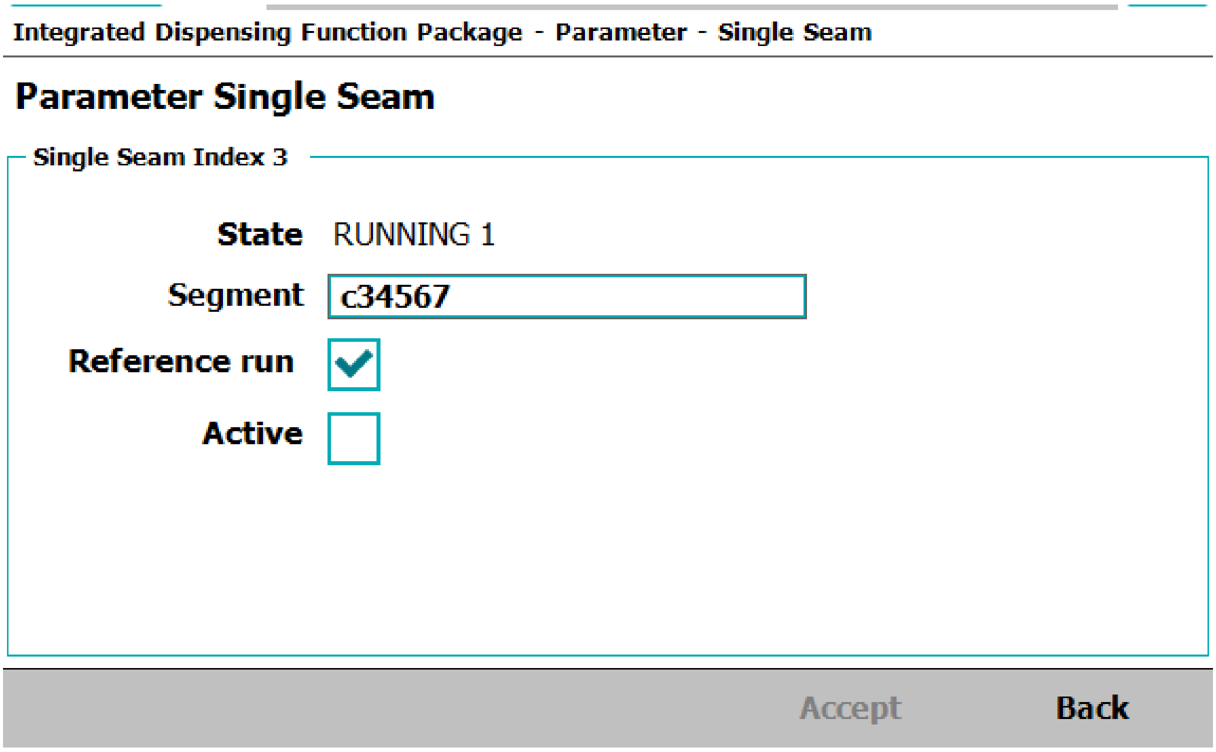


Figure 28: Statistic windows single seam modify individual program

In Figure 28: Statistic windows single seam modify individual program the status for a certain cluster (program and option) is shown.

Parameter	Description	Value
State	"RUNNING 1" means run the first of x reference cycle (only if more than 1 cycle is activated) "*DATE/TIME*" Last reference has been created - timestamp	2020-04-01/11:32:34 or RUNNING 1…4
Segment (Program and option number)	Name of the segment (program and option)	String (num) value
Reference run	Reference run is ordered / running	TRUE/FALSE
Active	Supervision for that cluster (program / option) is active	TRUE/FALSE

Table 24: Parameters single seam – single index

3.9.2.2 Limit configuration single seam

For editing the global limit values for the single seam supervision use the following IDFP TPU window (for editing the local single seam limits the values inside beaddata could be changed)

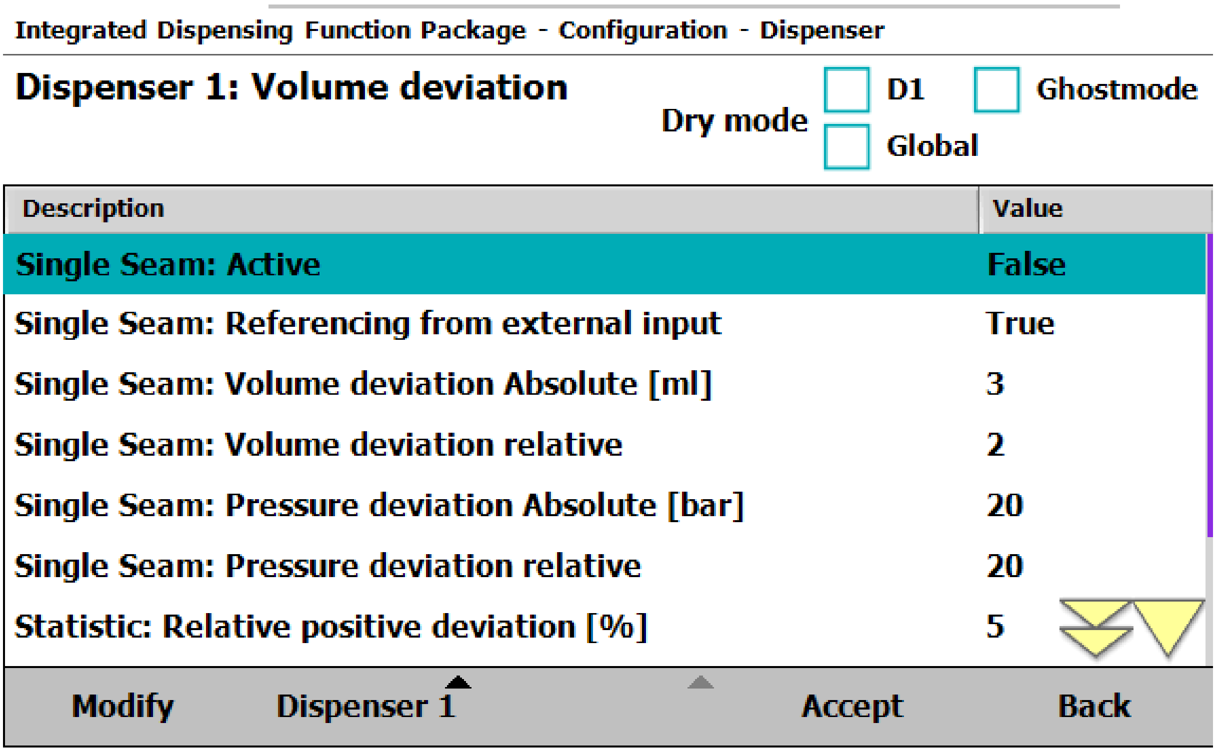


Figure 29: Limit parameters single seam (global values)

The limit values for the single seam supervision can be changed in TPU window configuration – Dispenser – Volume deviation.

Parameter	Function	Value
Active	Switch single seam on / off globaly	TRUE / FALSE
External referencing	Not used	TRUE / FALSE
Volume deviation absolute [ml]	Limit value absolute +/-	0…20 (0 only if local values in beaddata definition are used >=0,2ml / or relative volume devation>=20%)
Volume deviation relative [%]	Limit value relative +/-	0…50 (0 only if local values in beaddata definition are used >=1%)
Pressure deviation absolute [bar]	Limit value absolute +/-	0…50 (0 only if local values in beaddata definition are used

		>=2bar / or relative pressure deviation>=20%
Pressure deviation relative [%]	Limit value relative +/-	0…25 (0 only if local values in beaddata definition are used >=1%)

Table 25: Limit parameters single seam

3.9.3 Functionality

3.9.3.1 Preferences for referencing

- number of reference programs to run: 1 (can be changed)
- recording BeadID / mean pressure / nozzle / number of beads
- max. number of beads per cluster (program and option): 128

The following supervision operations are active during referencing with more than one run (Averaging of references):

- number of beads
- assignment beads / nozzle
- deviation of the measured volumes per seam (>1ml and 15%) from the mean value
- deviation of the measured volumes per seam (>5bar and 15%) from the mean value

When using averaging of references during formation (only if more than one references to be done): Output of an error message with cluster (program and option) and detailed messages in a separate log file. The already created intermediate values are deleted and referencing is restarted.

3.9.3.2 Referencing

To setup the relevant user action in the main program see chapter 3.4 Main program and seam (robtarget) event guideline.

Referencing must always be done in robot speed 100%. After the referencing was done and the supervision is running the robot speed can be reduced de to do a slow production.

Referencing will be started as soon as relevant user action is implemented and the corresponding program and option (or cluster) is configured in the general configuration single seam. Also, the reference must be activated for that program and option (or cluster) by setting the relevant checkbox (see Figure 28: Statistic windows single seam modify individual program. (This can also be done by setting the parameter bool ActivateRefRun in beaddata definition if it is used here (see chapter 2.4). After successful creation of a reference file the monitoring will automatically start with the next part of the same program and option (cluster).

It is possible to activate an averaging of the reference run. Then more than one reference runs are mandatory to create a reference file. By default, this is not activated and only necessary if the fluctuations of the volume data are too high (due to system utilization). The intermediate result and the output of the detailed messages with active monitoring are stored on a USB-stick (plugged into the main computer inside the robot controller).

The reference files will be stored on the robot SD card home folder (Home:\Statistic\VolChk\)

The filename of a reference file will look like that (when using program number and option number):

REF_*Dispenser_Programnumber_Optionnumber*.csv

- Filename example: REF_D1_2_0.csv

The filename of a reference file will look like that (when using cluster):

REF_*Dispenser_Clustername*.csv

- Filename example: REF_D1_C12345.csv

The reference file has the following content:

Name	Description	Mandatory (M) / Optional (O)
SeamNo	Index of seam	M
BeadID	Unique bead number	O
Pressure	Mean pressure / end pressure of a bead	M
Nozzle	Number of nozzle used	M
Volume	Bead material consumption	M
Flow	Mean flow of bead	M
Date	Creation date of reference file	M
Time	Creation time of reference file	M

Table 26: Content of reference file

Example for a reference file:

```
SeamNo,BeadID,Pressure,Nozzle,Volume,Flow,2020-01-10/08:40:03
1,9999489952,63.2,1,0.41,4.8
2,9999489954,80.5,1,0.17,2.4
3,9999489956,61.1,1,0.25,4.8
4,9219489956,80.9,1,0.15,2.4
5,9249489956,59.8,1,0.39,4.8
6,1259281956,83.4,1,0.13,2.4
7,7659281956,60.2,1,0.42,4.8
8,6659581956,58.7,1,0.18,2.4
```

Figure 30: Example reference file

After a reference file was created successfully the supervision will be automatically started (see Figure 29: Limit parameters single seam (global values)) for that cluster (program number / option number). The parameter “reference run” will be automatically deactivated and the parameter “active” will be activated.

A new reference for this cluster (program / option) must be created / ordered if:

- a parameter inside the beaddata of the cluster (program and option) was changed
- a robtarget was changed
- application delays have been changed
- workobject or tool has been changed
- a new cluster (program / option) has been created
- shootfilter has been added for this cluster (program / option)
- dispenseware parameters has been changed (i.e. int_dp_data.fl1_delay)
- a bead has been added or removed from the cluster (program / option)

3.9.3.3 Supervision

The preferences for the supervision are:

- Reference (file) is available
- Supervision is activated

The following supervision operations are active during referencing:

- Number of beads
- Assignment bead / nozzle
- Deviation of the measured volume per bead (>x ml and y%). Mean value of volume is used if average referencing is used.
- Deviation of the measured mean pressure per bead (>x bar and y%).

To load the related reference data from the reference file when starting an application cycle the Rapid routine *PrepareSingleSeamDX ()* must be setup and run correctly like explained in chapter Preapplication action (Event T-1) (user action, bullet point 2.). By running this routine, the reference data will be loaded by the background task statistic. When the cluster has ended the evaluation must be started like explained in chapter Starting single seam evaluation (Event T7).

3.9.3.4 Evaluation (Volume)

The evaluation of the single seam data will be started at the end of a program and option (or cluster). See 3.4.10 Starting single seam evaluation (Event T7). The evaluation and writing logs (production log, error log…) could take up to 300ms depending of the size of the program and option (cluster) and size of the already existing log files.

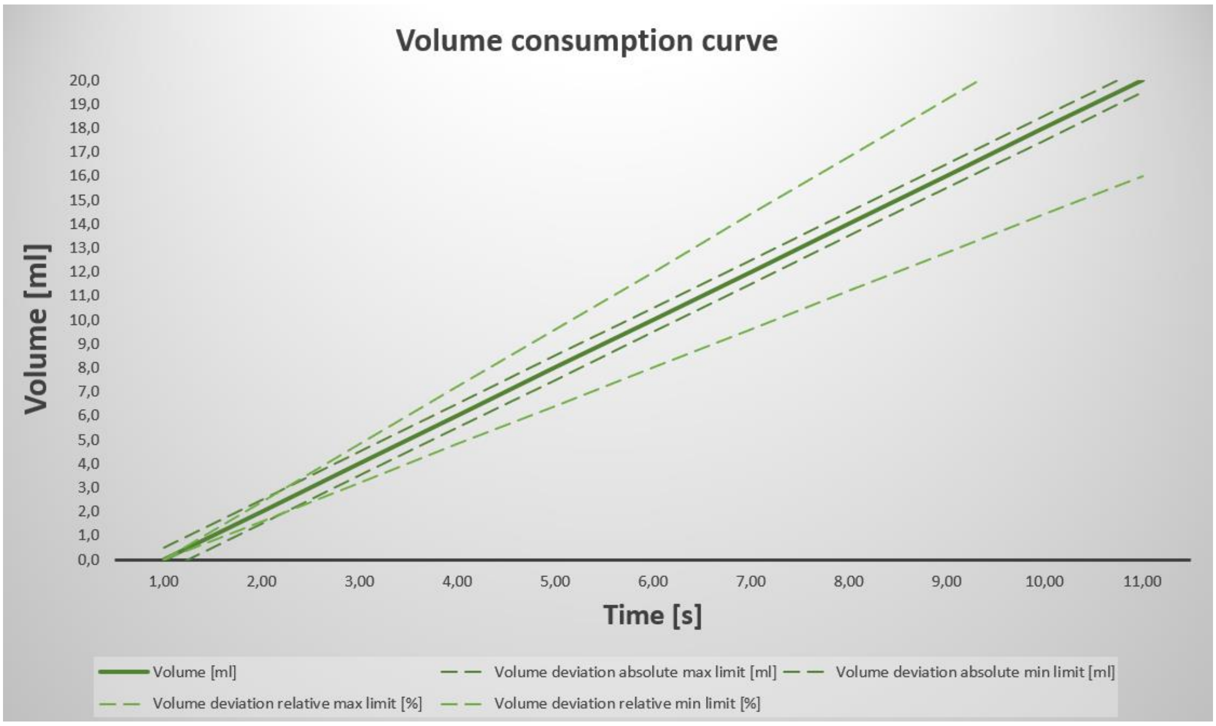


Figure 31: abs. and rel. limits (positive and negative) for volume consumption

Due to resolution limit of the doser motor when using very low speed or using very short movement of the doser motor (very short bead <0,2ml), two limits per measured variable volume are foreseen. One limit is the absolute limit in [ml], the other limit is the relative limit in [%]. These two limits behave like seen in Figure 31: abs. and rel. limits (positive and negative) for volume consumption. Only if both limits are exceeded the bead will be marked as faulty for the volume. The relative and the absolute limits are divided into positive and negative deviation for the volume consumption. This results in four limits per measured variable.

In Figure 31: abs. and rel. limits (positive and negative) for volume consumption the bold line is the measured variable for the volume. The bold line has in its area four dotted lines. These are the four limits for the volume:

- absolute volume limit minimal
- absolute volume limit maximum
- relative volume limit minimal
- relative volume limit maximum.

Volume evaluation examples:

(Result: OK=no error / V=Volume fault)

Application result (measured)					Application limits (parameters)			
Setpoint value	Current value	Relative deviation	Absolute deviation	**Result**	Min limit deviation relative	Max limit deviation relative	Min limit deviation absolute	Min limit deviation absolute

23.7ml	21.4ml	-9.7%	-2.3ml	OK	-20%	+20%	-0.2ml	0.2ml
0.21ml	0.15ml	-28.6%	-0.06ml	OK	-20%	+20%	-0.2ml	0.2ml
0.21ml	0.15ml	-28.6%	-0.06ml	V	-20%	+20%	0ml	0ml
0.11ml	0.17ml	+54.5%	+0.06ml	V	-20%	+20%	0ml	0ml
0.21ml	0.15ml	-28.6%	-0.06ml	OK	-30%	+30%	0ml	0ml
5.3ml	6.4ml	20.8%	+1.1ml	V	-20%	+20%	-0.2ml	0.2ml
5.3ml	6.4ml	20.8%	+1.1ml	OK	-20%	+30%	-0.2ml	0.2ml

Table 27: single seam evaluation volume result example

If the relative or absolute deviation is inside the limits the result for the volume will be marked as ok (except the result of the pressure evaluation).

3.9.3.5 Evaluation (Pressure)

The evaluation of the single seam data will be started at the end of a program and option (or cluster). See 3.4.10 Starting single seam evaluation (Event T7). The evaluation and writing logs (production log, error log…) could take up to 300ms depending of the size of the program and option (cluster) and size of the already existing log files.

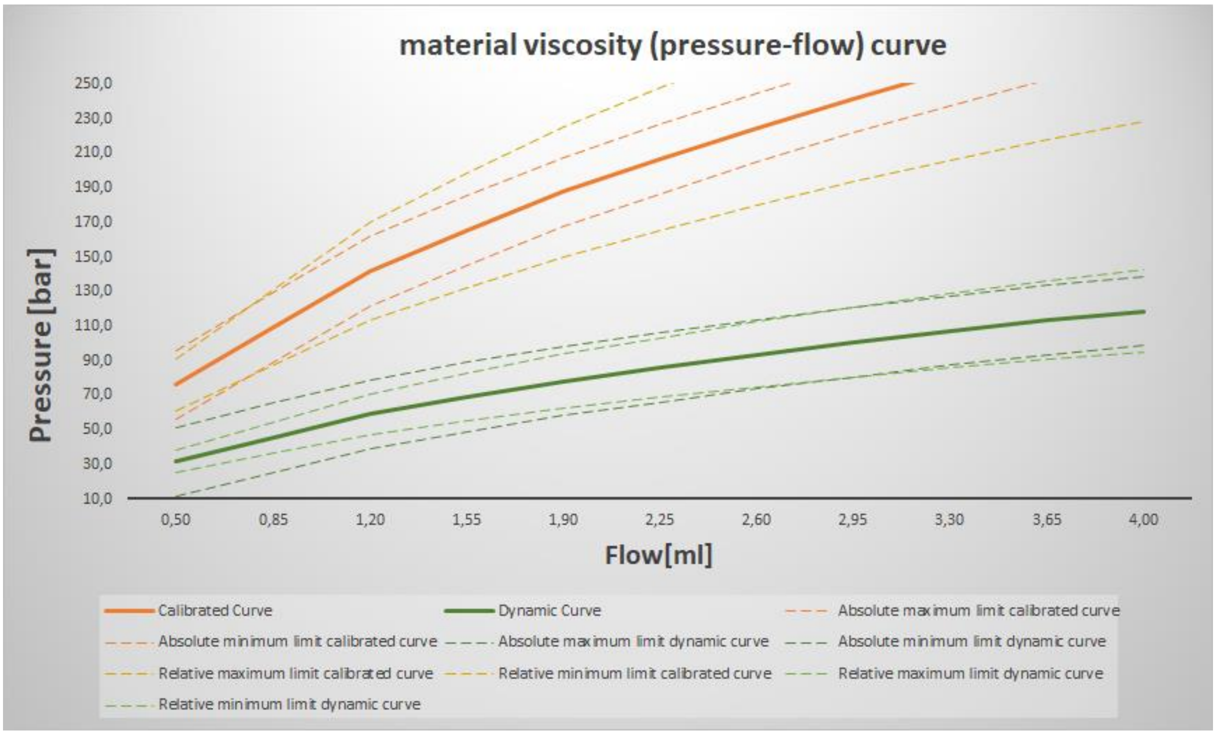


Figure 32: absolute and relative limits (positive and negative) for pressure

Due to resolution limit of the pressure sensor when using very low pressure, two limits per measured variable pressure are foreseen. One limit is the absolute limit in [bar], the other limit is the relative limit in [%]. These two limits behave like seen in Figure 32: absolute and relative limits (positive and negative) for pressure. Only if both limits are exceeded the bead will be marked as faulty for the pressure. The relative and the absolute limits are not divided into positive and negative deviation for the pressure. This results in four limits per measured variable. Positive and negative deviations have every time the same value.

In Figure 32: absolute and relative limits (positive and negative) for pressure, the bold lines are the measured variables for the pressure dependent on the material flow (orange bold line is the calibrated viscosity curve, green bold line the dynamic viscosity curve). The bold lines have in its area each four dotted lines. These are the four limits for the pressure:

- absolute pressure limit minimal
- absolute pressure limit maximum
- relative pressure limit minimal
- relative pressure limit maximum.

Figure 32: absolute and relative limits (positive and negative) for pressure shows that, all limits move dynamically with the dynamic curve.

Pressure evaluation examples:

(Result: OK=no error / P=Pressure fault)

Application result (measured)					Application limits (parameters)	
Setpoint value	Current value	Relative deviation	Absolute deviation	**Result**	Min/Max limit deviation relative	Min/Max limit deviation absolute
53.5	58.4	9.2%	4.9bar	OK	+-20%	+-20bar
3	4.1	36.6%	1.1bar	P	+-20%	+-20bar
113.3	93	-17.9%	20.3bar	P	+-20%	+-20bar

Table 28: single seam evaluation pressure result example

The setpoint value will be read out of the dynamic viscosity curve if this is used.

If the relative or absolute deviation is inside the limits the result for the volume will be marked as ok (except the result of the pressure evaluation).

For the pressure evaluation the mean pressure of the bead will be used (default) it is possible also to use the end pressure (when next bead starts or when needle closes).

If the robot will be moved with robot speed 50% the pressure related to the reference file will be not correct (reference file must be created in robot speed 100%). In this case the current pressure will not compared to the reference file but to the pressure value for the related flow inside the viscosity curve.

3.9.3.6 Evaluation nozzle

If the installed system is always using only one nozzle this will not be an important set of data. The used nozzle will be checked on each seam and compared to the used nozzle for that bead in the reference file.

Setpoint value	**Current value**	Result
1	1	OK
1	2	N

1	0	N

Table 29: single seam evaluation nozzle result example

If a current nozzle number is not the same as in the reference file for the same bead the nozzle number will be marked as faulty (N).

3.9.3.7 Evaluation overall result

The overall result of the single seam evaluation will be created of the volume evaluation result, the pressure evaluation result and the nozzle evaluation result. If one of these three result was marked as faulty, the overall evaluation result for the single seam evaluation will be marked as faulty.

Volume rsult	**Pressure result**	Nozzle result	Overall result
OK	OK	OK	OK
V	OK	OK	V
OK	P	OK	P
OK	OK	N	N
V	P	N	NPV

Table 30: single seam evaluation overall result example

3.9.3.8 Production log

To activate production log please see chapter 3.9.3.8 . To activate the parameter bUsingBeadID must be set to =TRUE.

The production log is a collection of data for each applicated seam (bead). Several application parameters for each seam (bead) will be supervised, stored and written to a production log file (.csv).

The production log file will be stored on a USB-stick (plugged into the main computer of the robot controller). If the USB-stick will be removed or is damaged the production log files will be stored on the robot SD card home folder (Home:\Statistic\VolChk\).

The filename of the production log is coded with the actual date. Each day a new production log file will be created automatically:

Production log filename looks like that: *YearMonthDay.csv* (i.e. 20200110.csv)

Table 31 shows the available parameters for each seam(bead) (default setup).

Parameter name	Parameter description	Values
Date	date of evaluation of bead (seam)	*Day/Month*

Time	Time of evaluation of bead (seam)	HH:MM:SS
ID	BeadID – unique bead number (see Table 7: to be defined beaddata)	0-9999999999
State	State of the bead (evaluation result)	OK=bead has no fault REF=bead was a reference run V=volume fault P=pressure fault N= needle fault (combination of N,P and V possible)
VolSP	Volume setpoint for this bead [ml]	0.1-1000ml (displayed resolution 0.01ml)
VolAct	Current value for this bead [ml] (will be used for volume evaluation)	0.1-1000ml (displayed resolution 0.01ml)
Dev%	Volume deviation in [%]	0-100%
PrsSP	Prepressure setpoint	0-300(displayed resolution 1bar)
PrsAct	Prepressure current value	0-300 (displayed resolution 1bar)
PrsDevAbs[bar]	Prepressure absolute deviation	0-300 (displayed resolution 0.1bar)
VolDevRelMax[%]	Volume deviation relative max limit in [%]	0-100% (displayed resolution 1%)
VolDevRelMin[%]	Volume deviation relative min limit in [%]	0-100% (displayed resolution 1%)
AvgApplPrs[bar]	Average application pressure (will be used for pressure evaluation)	0-300bar (displayed resolution 0.1bar)
ApplTime[s]	Application time	0-300s (displayed resolution 0.1s)
Segment	Cluster name	string
DetailID	User defined number for bead	0-9999999999
RSpeed[%]	Robot speed	0-100%

Table 31: Production log default parameters

To show the production log on the TPU the following steps must be done:

Step1:

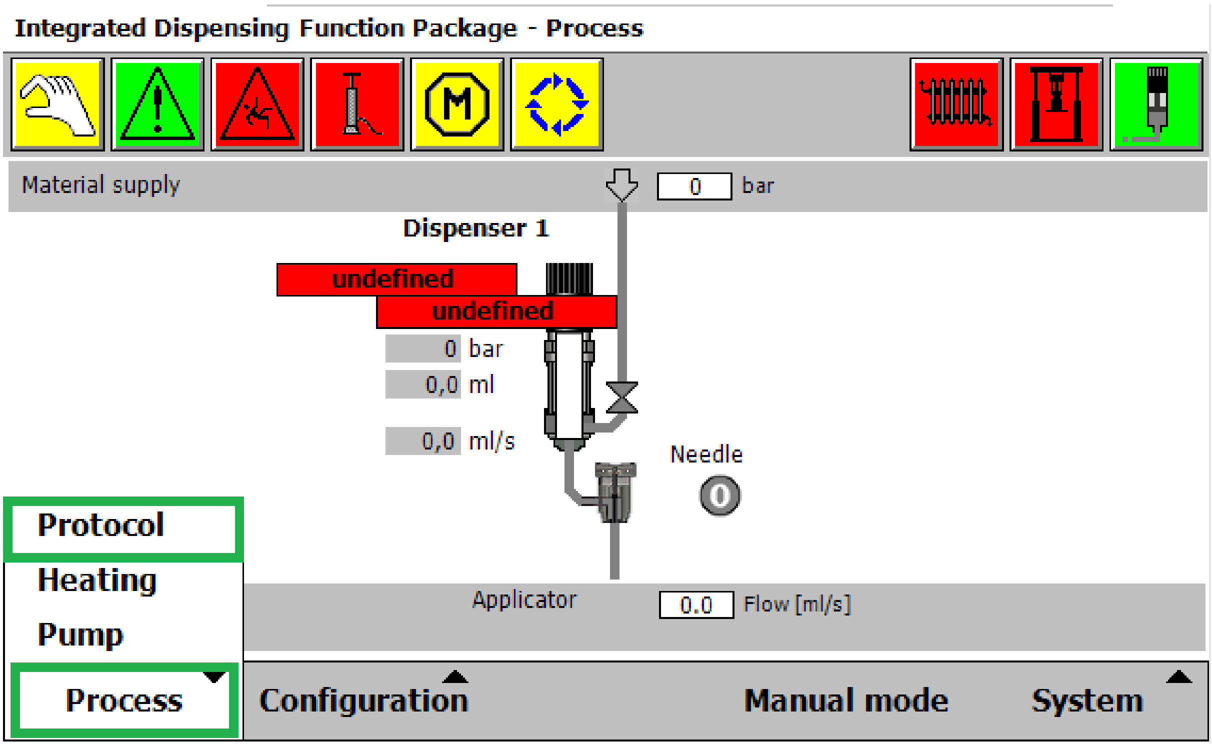


Figure 33: Process windows protocol menu

Step 2:

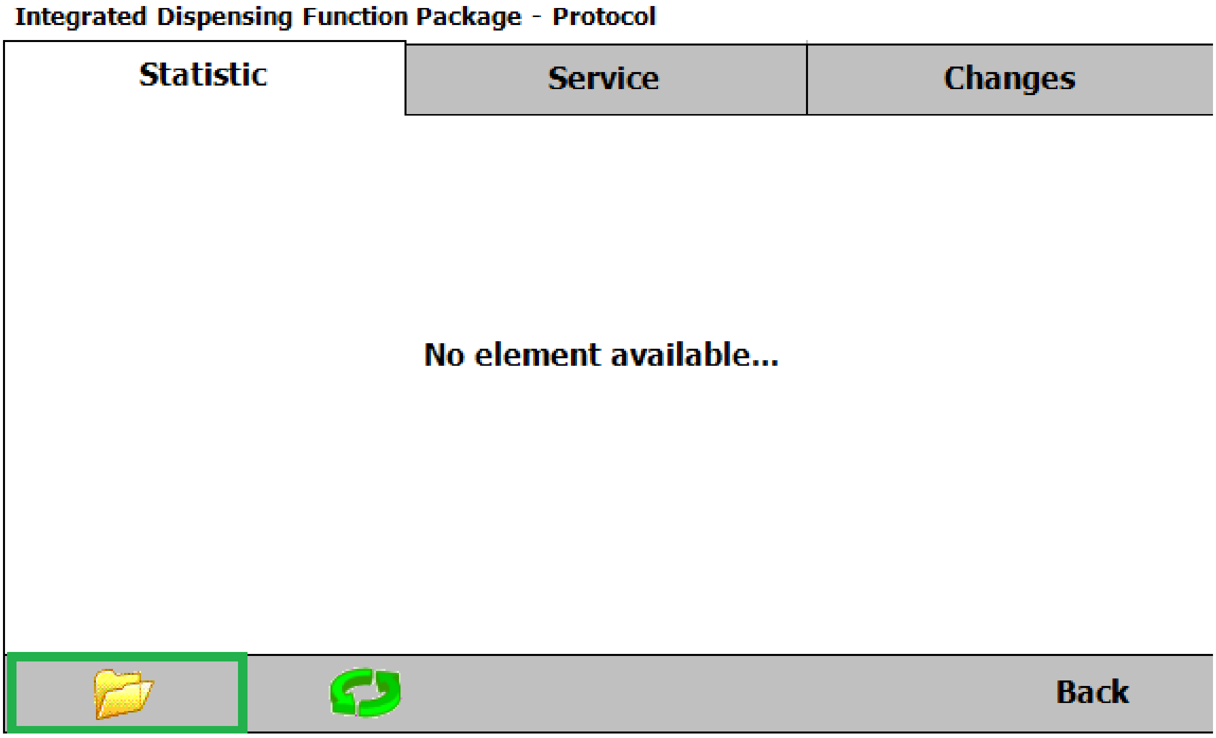


Figure 34: Open file in statistic tab

Step 3:

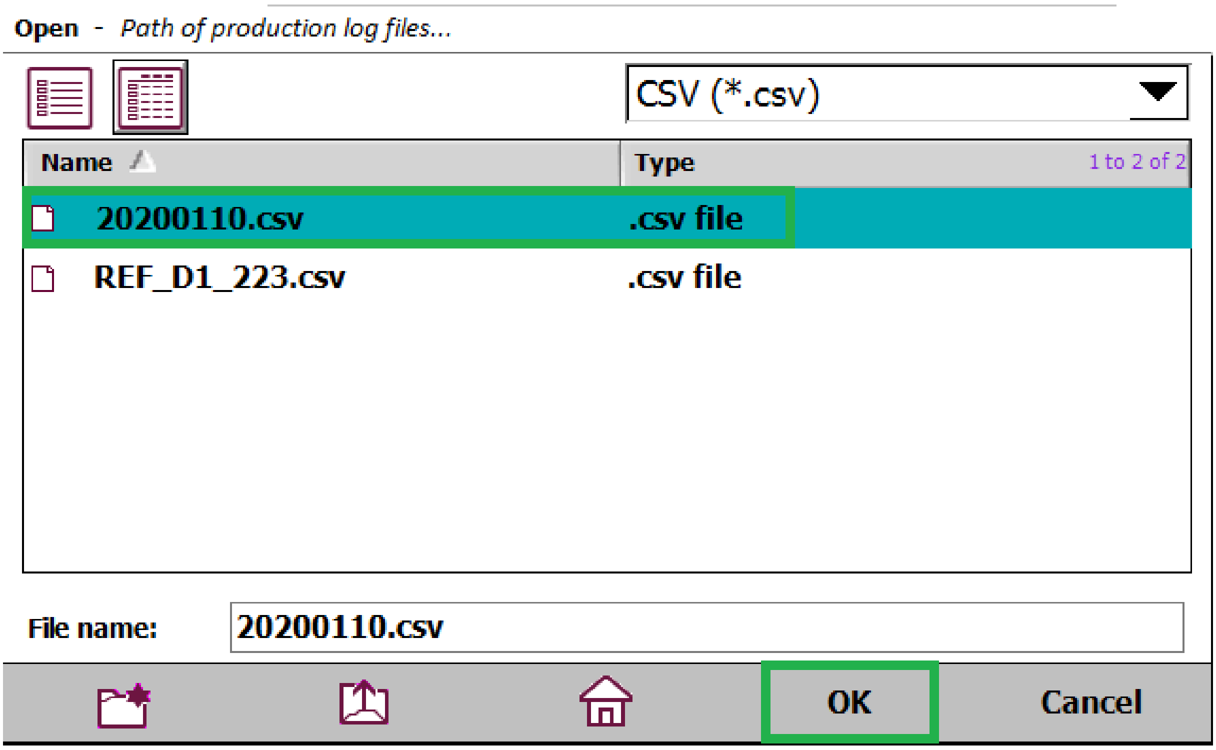
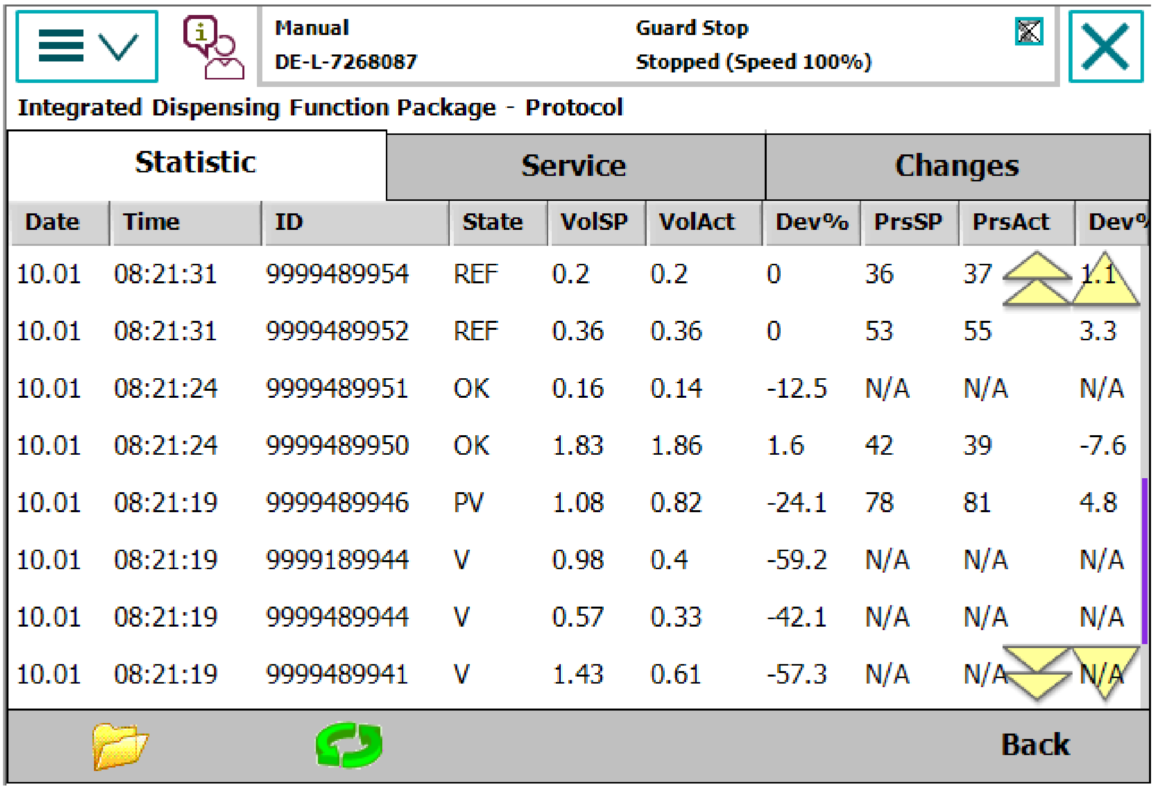


Figure 35: Choose production log file and ok

Step 4:

The production log view will like that:



Date	Time	ID	State	VolSP	VolAct	Dev%	PrsSP	PrsAct	Dev%
10.01	08:21:31	9999489954	REF	0.2	0.2	0	36	37	1.1
10.01	08:21:31	9999489952	REF	0.36	0.36	0	53	55	3.3
10.01	08:21:24	9999489951	OK	0.16	0.14	-12.5	N/A	N/A	N/A
10.01	08:21:24	9999489950	OK	1.83	1.86	1.6	42	39	-7.6
10.01	08:21:19	9999489946	PV	1.08	0.82	-24.1	78	81	4.8
10.01	08:21:19	9999189944	V	0.98	0.4	-59.2	N/A	N/A	N/A
10.01	08:21:19	9999489944	V	0.57	0.33	-42.1	N/A	N/A	N/A
10.01	08:21:19	9999489941	V	1.43	0.61	-57.3	N/A	N/A	N/A

Figure 36: TPU view production log

For beads which do not have a pressure regulation before (if bead follows another bead without a gap) the entry N/A (not available) will appear in the production log.

The Rapid routine *InitProdLog()* in module IS_User.sys (task statistic) defines the order which data will be displayed in which column of the production log. The order can be changed by the user if needed. Also, some additional spare entries of other application data the user needs could be done here.

3.9.3.9 Error log

In case of a bead fault a separate error log file will be created. Each faulty bead will have an entry in the error log file. The error log files are located on the USB-stick (plugged into the main computer inside the robot controller). If the USB-Stick is removed the files will be created be stored on the robot SD card home folder (Home:\Statistic\VolChk\).

All error log files will last two weeks. After the first week (when weekday starts which was already there) the files will be copied to a new filename (*_Old). After the second week the data will be gone.

The filename of an error log file will look like that (when using program number and option number):

Err_*Dispenser*_Prog_*Programnumber*_Opt_*Optionnumber*_*Weekday*.log

- Filename example: Err_D1_2_0_3Wed.log

The filename of an error log file will look like that (when using cluster):

Err_*Dispenser*_Seg_Segment_*Weekday*.log

- Filename example: Err_D1_Seg_C12345_3Wed.log

The error log file has the following content:

Name	Description
Timestamp	Timestamp when single seam evaluation was done
SeamNo	Indexed seam number
BeadID (If BeadID is used)	Unique bead number
Fault	Could be "*Pressure*", "*Volume*" or "*Nozzle*" (If more then one fault, only one will be shown)
SP	Setpoint value of the faulty measured variable
Act	Actual value of the faulty measured variable
DevAbs	Absolute deviation of the faulty measured variable
DevRel	Relative deviation of the faulty measured variable

Table 32: Single seam error log file content

```
09:49:04 SeamNo,BeadID,Fault,SP,Act,DevAbs,DevRel
         2,9999489951,Pressure,100.154,65.5,-34.654,-34.6
09:52:10 SeamNo,BeadID,Fault,SP,Act,DevAbs,DevRel
         1,9999489950,Pressure,82.1616,53.7,-28.4616,-34.6
         2,9999489951,Pressure,100.154,52.8,-47.354,-47.3
10:24:28 SeamNo,BeadID,Fault,SP,Act,DevAbs,DevRel
         1,9999489950,Pressure,82.1616,49.6,-32.5616,-39.6
         2,9999489951,Pressure,100.154,48.4,-51.754,-51.7
10:29:32 SeamNo,BeadID,Fault,SP,Act,DevAbs,DevRel
         1,9999489950,Pressure,87.6079,46.6,-41.0079,-46.8
         2,9999489951,Pressure,106.793,44.5,-62.2929,-58.3
```

Figure 37: Example single seam error log file

3.9.3.10 Error array

The error array is a record array which includes information about all seam fault (shift register with max 100 entries.) It includes the last 100 bead faults line i.e. pressure or volume faults. The following data is included in this array:

- Date (date of creating the entry)
- Time (time of creating the entry)
- SeamNo (bead index)
- Segment (cluster name)
- BeadID (unique Bead number)
- Fault (Volume / Pressure / Needle)
- SP (setpoint)
- Act (actual value)
- DevAbs (deviation absolute – volume / pressure)
- DevRel (deviation relative– volume / pressure)

Each time when single seam evaluation is done the bead marked as faulty will be written into the array. From here it is possible to send information to an external system.

Example:

PERS ErrLogData ELD{100}:=[["2019-11-13","23:51:34",8,"c12345",9400539,"Volume","0.38","0.3","-0.08","-21"]…

3.9.4 Error messages

Error No.	Title	Description
5147	Single seam **aquisition – Error during reference run**	Dispenser $arg1: Number of beads in program $arg3 option $arg4 differs from first application: $arg2
5148	Single seam aquistion - Error during reference run	Dispenser $arg1: Needle in bead $arg2 in program $arg4 option $arg5 differs from first application: $arg3
5149	Single seam aquisition - Reference created	Dispenser $arg1: Reference for program $arg2 option $arg3 was successfully created
5150	Single seam aquistion - Evaluation failed	Dispenser $arg1: Reference for program $arg2 option $arg3 could not be created because the data evaluation has failed (see log)
5246	Single seam aquisition - reference does not exist	Application cycle program $arg3, option $arg4 has ended. Temporary data for dispenser $arg2 could not be evaluated.
5247	Single seam aquisition - deviation in temporary data	Temporary data $arg2 of program $arg3 option $arg1, seam $arg4, $arg5, deviates from reference data
5248	Single seam aquisition - no evaluated data available	No single seam data was evaluated for dispenser $arg2. Signal go$arg2SingleSeamEval has value 0.
5254	Single seam aquisition - deviation pressure at least one seam	Temporary data $arg2 of segment $arg3, BeadID $arg4, pressure, deviates from reference data
5255	Single seam aquisition - deviation volume at least one seam	Temporary data $arg2 of segment $arg3, BeadID $arg4, volume, deviates from reference data

Table 33: Error messages single seam supervision

3.10 IDFP software tasks short description

3.10.1 Task T_ROB1

The task T_ROB1 handles any necessary application routines and movement instruction. The application program must be provided by the user related to the specifications of this document (see 3.4 Main program and seam (robtarget) event guideline). By using the DispenseWare instructions and the related beaddata the application flow will be handled by the DispenseWare and send via an analog output to the IPS where the setpoint is taken over and starts to turn the doser motor.

3.10.2 Task Dispenser*X*

The task DispenserX exists dependent of the number of dispensers of the system up to four times. Task DispenserX has different assignments:

- Run doser functions by receiving orders via the IDFP TPU
- Supervising application functionality
- Supervising circulation functionality

3.10.3 Task MaterialSupply

The task MaterialSupply controls the internal pump and supervision functionalities in case of an integrated pump is installed. Also, one section of the pump interface module (PIM) is controlled by this task. Other internal functionalities are handled by the firmware of the PIM.

In case of having installed an external material supply (pump) this task controls the status signal of the material supply (doP1MtrlSupReady). How and in which cases this signal is set can be defined by the user in case of external material supply is installed. See 3.11.3.1 IM_P1Ext_Main.

3.10.4 Task Statistic

Task Statistic monitors the data for the single seam supervision and collects all the relevent data for single seam evaluation and production log.

3.10.5 Task TemperatureCond

Task TemperatureCond is used to control the electrical heating or the peltier elements.

3.10.6 Task Watchdog

Task Watchdog supervises the execution of all other semistatic running IDFP task.

3.10.7 Task Error

Task Error has the following assignments:

- supervises several doser and application limits.
- Collect, activate and output all error messages of IDFP

3.11 User-specific (project specific) adjustments

The IDFP system is designed to perform user- or project-specific adjustments. Various RAPID user routines are available for this purpose.
In addition, user-specific (project-specific) adjustments and routines can be added in all user modules (for e.g. nozzle change, etc.).

3.11.1 Routines in task T_ROB1

All user-specific routines for dispenser 1 are stored in the module IDFP D1User.sys and exist similarly
for every available dispenser (D1, D2, etc.).

3.11.1.1 User_PreApplicationD1

The RAPID routine **User_PreApplicationD1** is selected in the routine **PreApplicationD1**, which sets dispenser D1 to application mode. The routine can be adapted specific to the user. Here processes can be integrated which are to be performed directly before starting the application.

3.11.1.2 User_PostApplicationD1

The RAPID routine **User_PostApplicationD1** is selected in the routine **PostApplicationD1**, which changes dispenser D1 from application mode to idle mode. The routine can be adapted specific to the user. Here processes can be integrated which are to be performed directly after ending the application.

3.11.1.3 StopMainEOC

This Rapid routine will be run if an IDFP error class two is active at the end of the application cycle (when running PostApplicationD1). If the error class two is still active the program should not execute anymore. This must be done by the user.

3.11.2 Routines in task Dispenser*X*

All user-specific routines are stored in the respective module (IDXA/B_User.sys) of the doser and exist similarly for every available doser (D1A, D1B, D2A, D2B, etc.)

Routine name	Function
User_D1A_PreForward	Running before starting the doser function "Move forward"
User_D1A_PostForward	Running after ending the doser function "Move forward"
User_D1A_PreBackward	Running before starting the doser function "Move backward"
User_D1A_PostBackward	Running after ending the doser function "Move backward"
User_D1A_PreCalib	Running before starting the doser function

	"Calibration"
User_D1A_PostCalib	Running after ending the doser function "Calibration"
User_D1A_PreFill	Running before starting the doser function "Fill"
User_D1A_PostFill	Running after ending the doser function "Fill"
User_D1A_PreEmpty	Running before starting the doser function "Empty"
User_D1A_PostEmpty	Running after ending the doser function "Empty"
User_D1A_PreFlow-Check	Running before starting the doser function "Flowcheck"
User_D1A_PostFlow-Check	Running after ending the doser function "Flowcheck"
User_D1A_PrePres-sureRelief	Running before starting the doser function "PrsRelief"
User_D1A_PostPres-sureRelief	Running after ending the doser function "PrsRelief"
User_D1A_PrePurge	Running before starting the doser function "Purge"
User_D1A_PostPurge	Running after ending the doser function "Purge"
User_D1A_PreHoseAccu	Running before starting the doser function "HoseAccu"
User_D1A_PostHose-Accu	Running after ending the doser function "HoseAccu"

Table 34: User specific routines task Dispenser*X*

3.11.3 Routines in task MaterialSupply

3.11.3.1 IM_P1Ext_Main

The user routine IM_P1Ext_User.sys is used to provide the status “material supply ready” depending on the material inlet pressure. The user can adapt this routine to its own needs. The result must be to set the signal doP1MtrlSupReay in case that the material supply is ready for any doser action.

3.11.4 Routines in task Error

Task Error is used to receive and collect error messages from the IDFP system (from other IDFP tasks) and activates the error by creating an error message which will be send to robot controller event log.

In IDFP system different error classes are available (see Table 35: User routines in IDFP task Error). If an IDFP error will be activated, one of these routines will be run, depending on which error class was activated.

For example, if the error with the error number 115101 will be activated, one of the routines in Table 35: User routines in IDFP task Error will be run, depending how the error class for this error number is defined.

The routines can be used to send the information of the error number which appeared to an external system, i.e. with the help of a group output.

Routine name	Error class	Description
MTStopUser	1	Stops the task T_ROB1 (immediately) and creates an error message in robot event log
EOCStopUser	2	Stops the task T_ROB1 after end of cycle and creates an error message in robot event log
NoStopUser	3	Task T_ROB1 will not be stopped. An error message will be created in robot event log
WarnUser	4	Task T_ROB1 will not be stopped. A warning message will be created in robot event log
InfoUser	5	Task T_ROB1 will not be stopped. An info message will be created in robot event log

Table 35: User routines in IDFP task Error

3.11.5 Routines in task Statistic

3.11.5.1 InitProdLog

The user routine InitProdLog() is used to define the entries in Production log (see 3.9.3.8).

The user can change the titles for each column and the order which parameter should appear in which column of the production log.

Hint: The appearance in the TPU window can change, if the title or the order of the columns are changed.

Example:

To change the title "Date" the user can put in user defined name. In this example "Date" will appear in the 1st column. To change this the number can be changed. The number in the brackets show the number of the column. This column must only appear once in the definition of this routine.

```
!DATE DD.MM.YYYY - COULUMN 1
strDataCol{1}:=strDate;
strDataHeader{1}:="Date";
```

3.11.6 User-specific tasks

The basic functions of the dispenser such as fill, empty, purge, flow check, pressure relief, move forward, move backwards, etc., can also be requested in user-specific routines (for e.g. service runs).

Example: Request for purging in application program

```
PROC PurgeMain ()
!Move to purge position
MoveJ pPurgePos,v500,z20,tool0\wobj:=wobj0;
!Purge position reached
WaitTime \InPos,0;
!Set needle number for purging to needle 2
nG1NeedleSel:=2
!Set request for purging D1A
SetGO goD1Order,16;
!Wait on feedback that purging function completed
WaitUntil GOutput(goD1Order)=0 \MaxTime :=60;
!Move to home position
MoveJ pHomePos,v500,z20,tool0\wobj:=wobj0;
ENDPROC
```

The group signal **goDXOrder** remains set until the function has been completed. Then the group signal is reset to 0.

Function (X=1,2,3,4)	Order number goDXOrder (X=1,2,3,4)
Fill DXA	11
Empty DXA	12
Move backwards DXA	13
Move forward DXA	14
Calibrate DXA	15
Purge DXA	16
Flow check DXA	17

Prepare DXA and DYA (only with 2K option)	18
Manual application DXA/DYA (only with 2K option)	19
Fill DXB	21
Empty DXB	22
Move backwards DXB	23
Move forward DXB	24
Calibrate DXB	25
Purge DXB	26
Flow check DXB	27
Prepare DXB and DYB (only with 2K option)	28
Manual application DXB/DYB (only with 2K option)	29
Stop current requested function	31

Table 36: doser function by order request

3.12 Doser spindle lubrication (Perma Star Control)

The circulating lubrication automatically lubricates the doser spindles in the system. Special hardware (Perma Star Control) is required for this purpose.
The configuration of the parameters for spindle lubrication requires the volume per lubrication cycle to be configured in the IDFP software and in the lubrication unit. The same value must set in both locations. The parameter in IDFP is nDXY_LubrVolPulse in IDXY_LubrUser.sys of the corresponding dispenser task.
The required volume of lubricating material within 20,000 spindle movement can also be configured (nDXY_LubrVolSP).
The number of lubrication cycles (nDXY_LubrActCycles) and the time of last lubrication (stDXY_LastLubricated) can be read out.

3.12.1 Parameters

Parameter name / TPU	Parameter Rapid	How to change	Module	Description
Volume per pulse	nDXY_LubrVol-Pulse	TPU – Configuration – Dispenser - Parameter	ID1A_LubrParam.sys	Volume per lubrication cycle. (Must be also configured on the device)
Volume setpoint per 20K lubrication cycles	nDXY_LubrVolSP	TPU – Configuration - Fill	ID1A_LubrParam.sys	Volume setpoint per 20k lubrication cycles

Actual cycles since last pulse	nDXY_LubrActCycles	No change	ID1A_LubrParam.sys	Actual cycles since last pulse
Date of last lubrication pulse	stDXY_LastLubricated	No change	ID1A_LubrParam.sys	Date of last lubrication pulse

Table 37: Spindle lubrication parameters