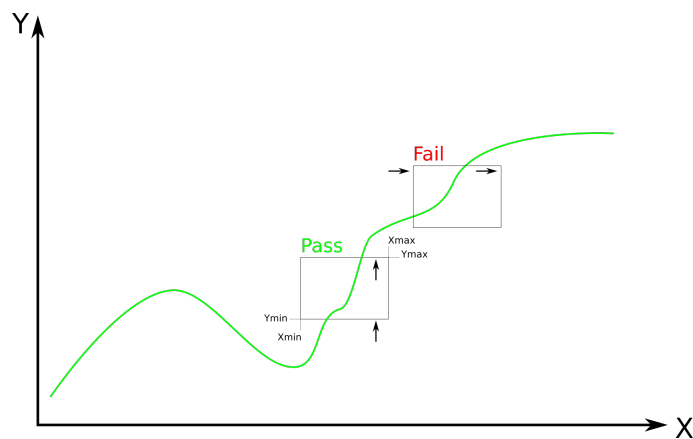# LinMot®

Process Monitoring SG6

Manual

This document applies to the following drives:

- **C12x0-xx-xx-xxx (SG6)**
- **C14x0-xx-xx-xxx (SG6)**
- **E14x0V2-xx-xx-xxx (SG6)**

(with ProcessMonitoring application installed)

Table of Contents

LinMot®

1 Software overview

This software application can be used to monitor the relationship of two measured process variables (e.g. force and position). These variables are measured and stored as a XY-curve.

This curve is evaluated afterwards using different tools and methods to verify that the production process was completed within allowed tolerances.

A global OK / not OK result can be derived and communicated to higher layer systems such as a PLC, I/Os or fieldbus interfaces.

The recorded curve can be read out via PLC and archived for quality control.

The LinMot-Talk software is used to visualize and configure the measurements graphically.

System key parameters:

- Maximum sampling rate for process variables: 8kHz
- Maximum points per measured curve: 8000
- Number of evaluation windows: 16
- Number of online evaluation windows: 1
- Number of online switching points: 2
- Time between completed measurement and availability of   5ms   (1 window, <500 Points)
  evaluation result (depending on configured evaluation and   up to
  number of recorded curve points):   277ms   (16 windows, 8000 Points)

Note: A software license key is required to use the functionality of this application software (ordering Number of article 'TF-ProcessMonitoring': 0150-4224).
To evaluate the application without purchasing a key, a trial period can be activated when logged in to the drive in the menu "Drive -> Set Access Code..."

Note: This Software is not a substitute for safety devices or other protective monitoring devices. Use according safety equipment!

2 Recording and evaluating data

2.1 Recording a measurement

To start recording a measurement the software has to be put out of its idle state in order to evaluate the trigger condition to start recording.

This can be done via I/O or by writing to the Measurement Control word.

The transition from state 0 to state 1 is only executed on a rising edge of bit 0 of the Measurement Control or on a rising edge on one of the inputs configured to arm the measurement.

Bit 0 of the Measurement Control word is cleared by SW when transitioning from state 1 to state 2.

If the arming of a measurement is done with an external digital I/O, the user must make sure that it is reset by the time the measurement is finished.

Otherwise a new measurement is armed as soon as the old one is finished and all data of that measurement is lost.

Trigger conditions for starting or stopping a measurement can be set independently by different means (see Start/Stop mode):
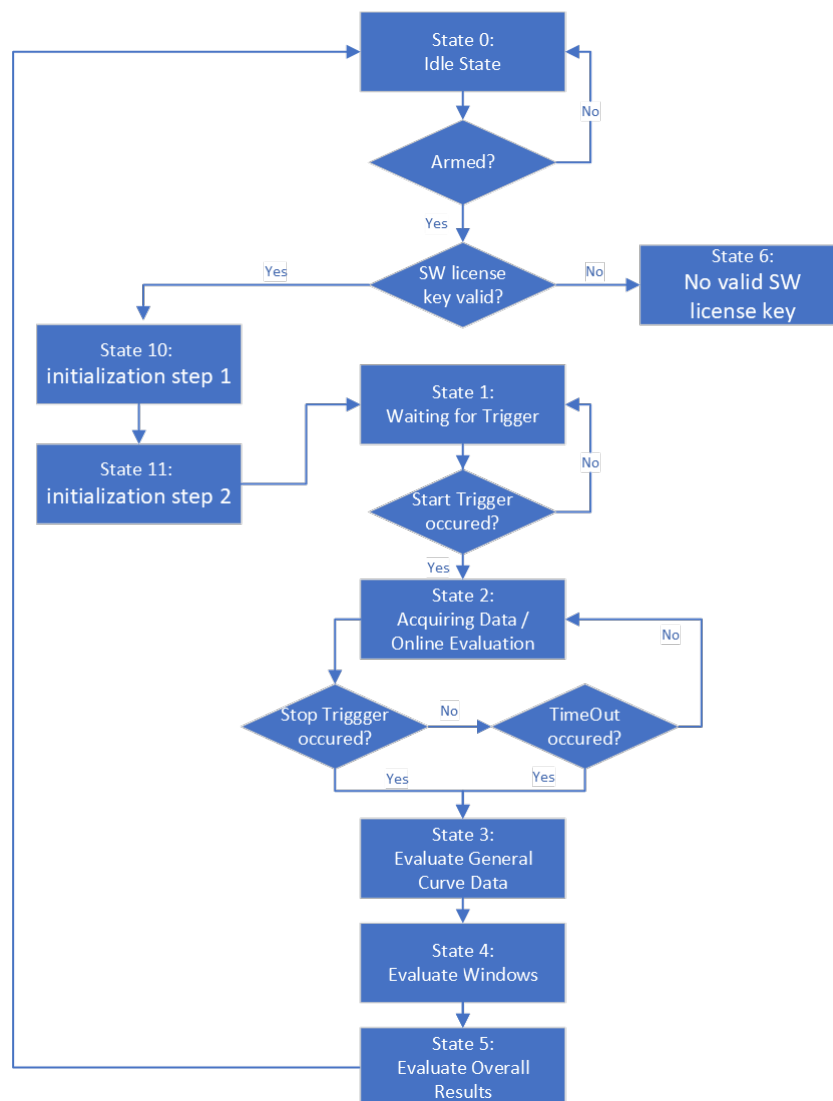
Fig. 1: Statemachine Process Monitoring

Regardless of the configured stop trigger source, the measurement stops when either the timeout has expired or the maximum number of possible samples has been recorded.

After evaluating the measurement, the state machine transitions back to the idle state. All evaluated data and results are still available to be read out at this time.

Measurement data is only reset when the state changes to "waiting for trigger".

2.2 Sampling of the measured data

XY-data is always sampled at a rate of 8kHz. To provide greater flexibility in which points to record, recording of data can be configured using different settings for the X-interval, the Y-interval and the time interval. This allows the use of an optimal number of sample points to accurately record and analyze the desired data. All three intervals can be used together. If one of the three conditions for recording is met, a sample is stored. If none of the conditions are met at any time, the measurement stops after the configured timeout.
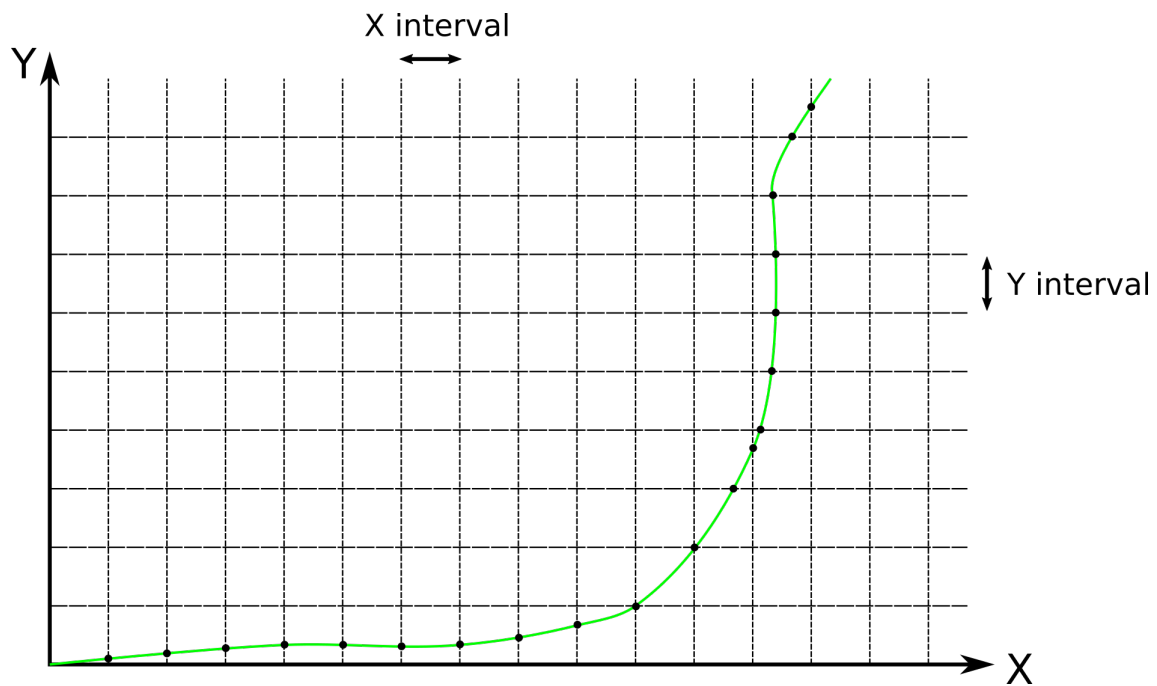
Fig. 2: Sampling of measured data

2.3 Evaluating a measurement

Several evaluation tools are provided which can be used for a pass/fail classification of a wide range of different curve types. The different evaluation methods are described in detail here.

2.3.1 Window evaluation

Up to 16 windows can be set up for graphical evaluation of recorded curves.
Windows are defined by their corner points Xmin, Xmax, Ymin and Ymax.
For each window the sides where the curve is allowed to enter or exit can be individually configured.
These conditions are evaluated after the measurement is over and e.g. a pass/fail criteria can be derived from the results.

If one or more sides are defined as entry sides, at least one of those entry conditions has to be fulfilled.
If that is not the case, the window is evaluated as "fail".

If one or more sides are defined as exit sides, at least one of those exit conditions has to be fulfilled.
If that is not the case, the window is evaluated as "fail".
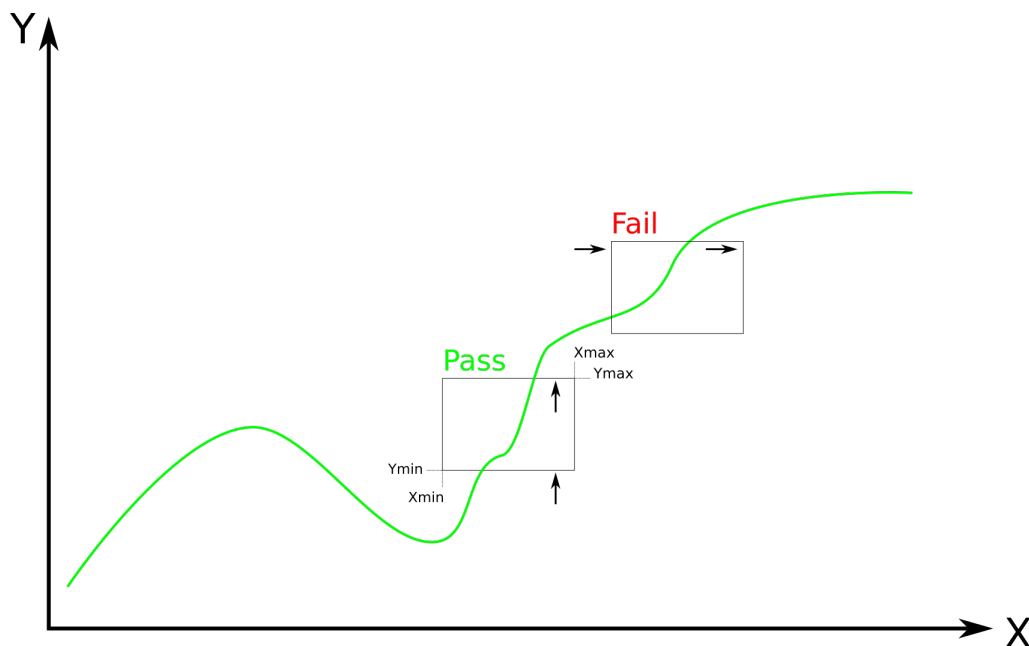
Fig. 3: Window evaluation

Examples of window evaluation:

Pass-through window (Entry: left; Exit: right)

PASS   FAIL
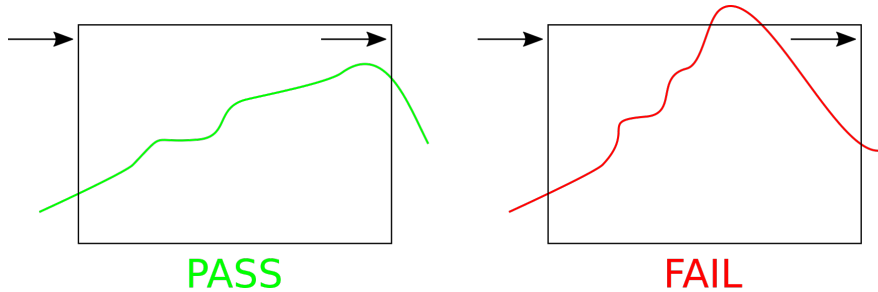
Fig. 4: Window evaluation example 1

Pass-through window (Entry: left, top; Exit: right)

PASS   FAIL
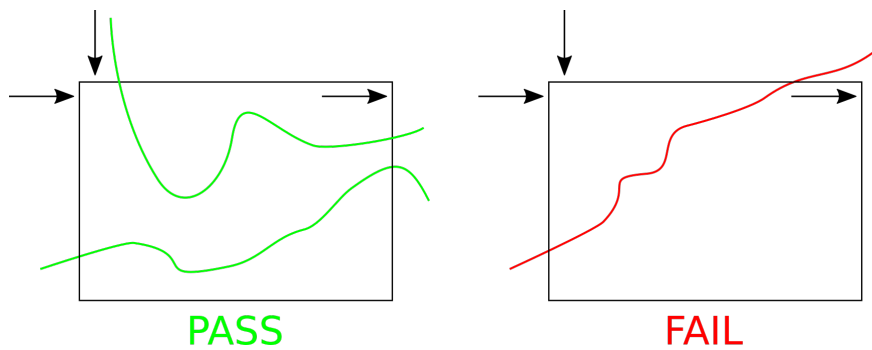
Fig. 5: Window evaluation example 2

Block window (Entry: bottom, Exit: -)

PASS   FAIL
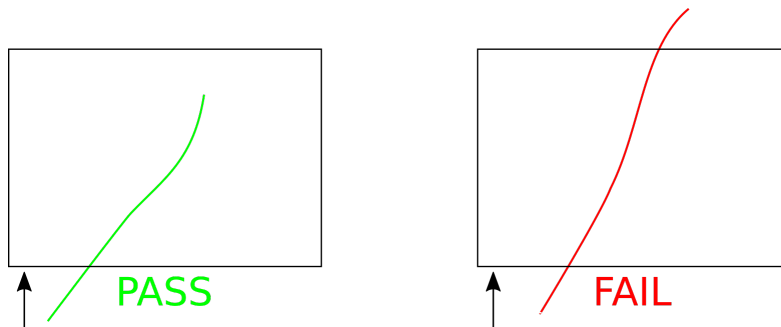
Fig. 6: Window evaluation example 3

Not window (Entry: -, Exit: -)

PASS   FAIL
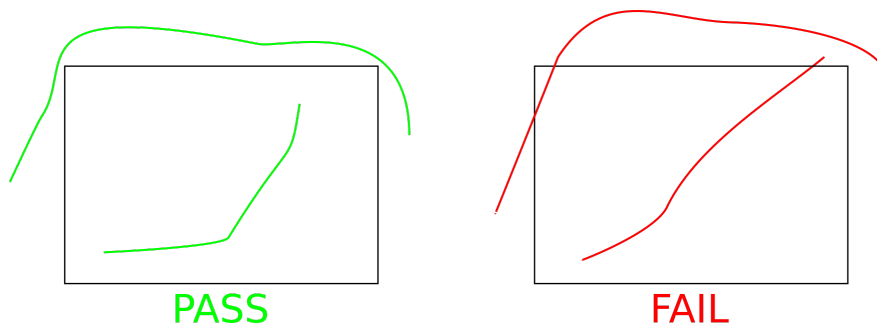
Fig. 7: Window evaluation example 4

2.3.2 Uncertain Exits/Entries

The user has to make sure that the sampling points are recorded in a way that entries and exits can be detected reliably.
This can be achieved by setting appropriate sample intervals for X,Y and time.
As the real course of the measurement curve is not known in between sampling points, this data cannot be evaluated.

This is illustrated by the following examples:

The real curve between the sampled point can take different routes.
Since no sampled point is inside the window, no entry or exit will be detected.
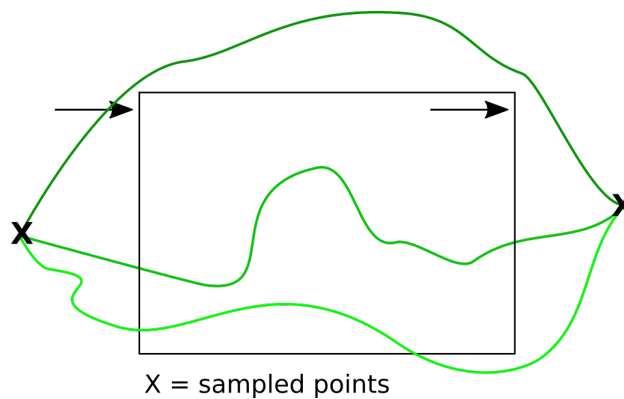
X = sampled points
Fig. 8: No Enty or Exit

With the sampled information it is not possible to reliably evaluate if the window was entered from the top or from the left side.
If such a case is detected, the entry is marked as an entry from the left side and the warning bit "uncertain entry detected" is set in the window status
and the overall measurement result.
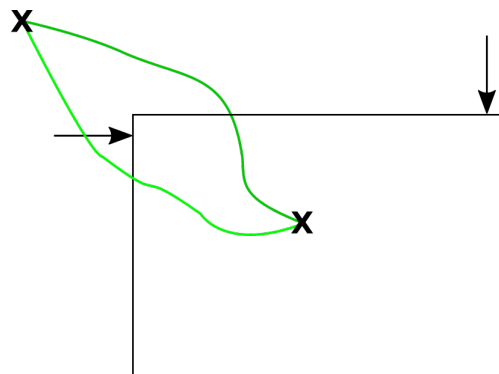
X = sampled points
Fig. 9: Uncertain Entry

With the sampled information it is not possible to reliably evaluate if the window was exited through the bottom or through the right side.
If such a case is detected, the exit is marked as an exit through the right side and the warning bit "uncertain exit detected" is set in the window status
and the overall measurement result.

X = sampled points
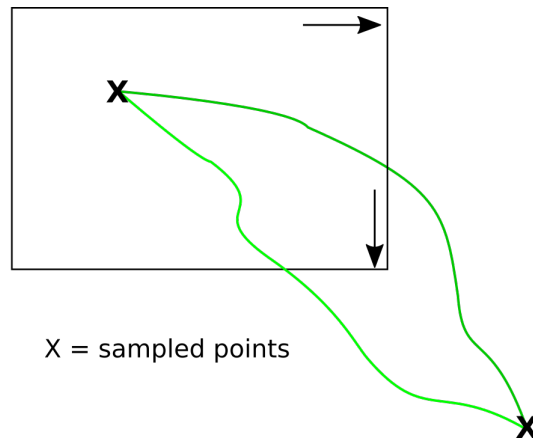
Fig. 10: Uncertain Exit

2.3.3 Setting the return point

Evaluation elements like windows can be applied only to the forward or return segment of a curve or the complete curve.
To determine which point of the curve is regarded as its return point, the user must choose between Xmin, Xmax, Ymin and Ymax.

Example with Ymax set as the return point:
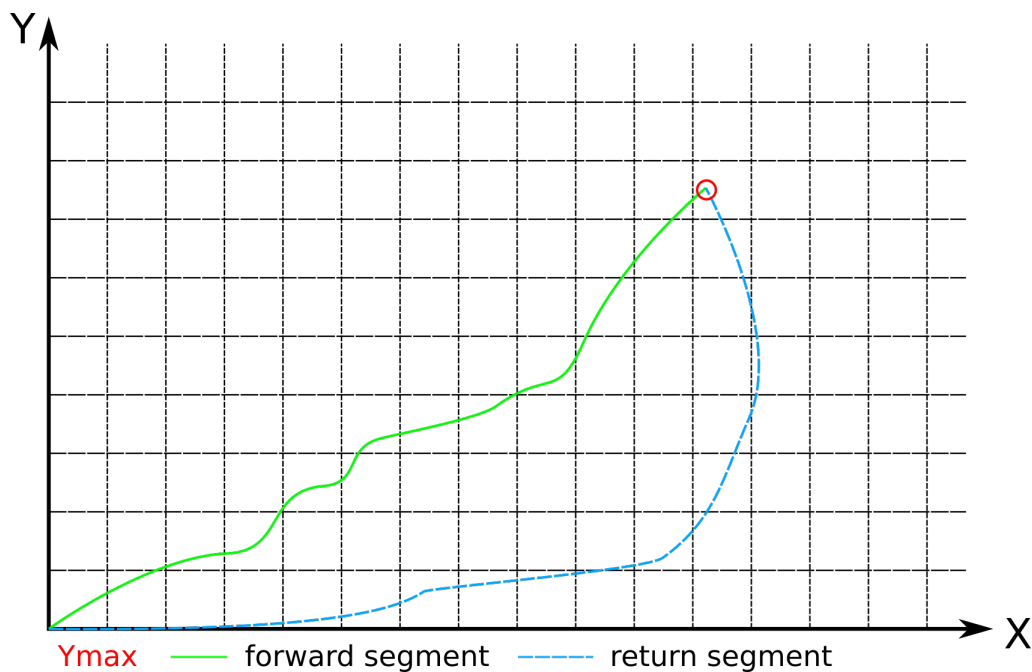
Ymax ——— forward segment ––––– return segment
Fig. 11: Return point

2.3.4 Online switching points evaluation

If a configurable threshold is reached during measurement, an indication is set. If the curve goes above/below this threshold again, the indication is not reset until the start of a new measurement.

3 ProcessMonitoring Parameters

All Parameters which can be configured via LinMot-Talk or a PLC are described here.

3.1 Dis-/Enable

UPID 0x3000

With the Dis-/Enable parameter the LinMot drive can be run without the ProcessMonitoring application starting up.

ProcessMonitoring\Dis-/Enable		Default Value
Disable	The application is disabled	-
Enable	The application is enabled	X

3.2 Measurement Config

General parameters that affect the measurement globally are configured here.
If all sample intervals (X, Y and time) are set to 0, no samples are taken at all.
The measurement is finished if either the timeout triggers the end of the measurement or it is stopped via the measurement control word.

3.2.1 X axis UPID

UPID 0x3001

UPID of the parameter used for X axis data. The most common parameter used for the x axis is the actual position of the motor.
All configurable X values (e.g. X-coordinates of a window) are referenced to the unit and scale of this parameter.

3.2.2 Y axis UPID

UPID 0x3002

UPID of the parameter used for Y axis data. The most common parameter used for the y axis is the actual force of the motor.
All configurable Y values (e.g. Y-coordinates of a window) are referenced to the unit and scale of this parameter.

3.2.3 X sample interval

UPID 0x3003

Minimum difference between two X-values for them to be recorded.
Deactivated if set to 0.

3.2.4 Y sample interval

UPID 0x3004

Minimum difference between two Y-values for them to be recorded.
Deactivated if set to 0.

3.2.5 Time sample interval

UPID 0x3005

Minimum time difference between samples for them to be recorded.
The interval can be defined in multiples of 125 us.
Deactivated if set to 0.

3.2.6 Return point

UPID 0x3006

This defines which point in the curve is regarded as the return point during evaluation of the windows. The return point divides the curve in a forward and a return segment (see Setting the return point).

ProcessMonitoring\Measurement Config\Return point		Default Value
X min	X min is set as the return point	-
X max	X max is set as the return point	X
Y min	Y min is set as the return point	-
Y max	Y max is set as the return point	-

3.2.7 Online Window

UPID 0x3009

Only one of the configured windows can be set for online evaluation. This window is constantly evaluated during the recording of the measurement. The pass/fail status of this window can be read out in realtime via I/O or PLC.
Only pass-through windows can be evaluated suitably this way.
This is especially useful to monitor for example the area of initial contact in a press-fit application. If something is amiss, the online evaluation can be used to prevent further damage to equipment.

ProcessMonitoring\Measurement Config\Online window		Default Value
None	No window selected for online evaluation	X
Window 1	Window 1 is selected for online evaluation	-
…	…	…
Window 16	Window 16 is selected for online evaluation	-

> **i** **Note**: The online window is always evaluated over the complete curve. A distinction into forward and return segments is not possible as the return point is not known during measurement recording.

3.3 I/O Config

This section describes the configurable functionality of the I/Os.
All I/Os are "active high" by default.
I/O polarity can be inverted by setting the according parameters in the Motion Control SW: Parameters -> Motion Control SW -> Drive Configuration -> I/O Definitions -> I/O Logic Definitions.

3.3.1 Dig Out X4.3

UPID 0x3200

This parameter defines for which function the output X4.3 is used.

Function of Dig Out X4.3		Default Value
None	No function	X
Result OK	Indicates positive evaluation result after measurement (1: pass, 0: fail), resets to 1 at the start of the next measurement	-
Result nOK	Indicates negative evaluation result after measurement (0: pass, 1: fail), resets to 0 at the start of the next measurement	-
Result nOK (online)	Indicates negative evaluation result of the online window (0: pass, 1: fail), resets to 0 at the start of the next measurement	-
Measurement active	Output is set on start trigger and reset when measurement and evaluation are completed	-
Online switching point 1	Output is set when the configured condition for the online switching point 1 is met	-
Online switching point 2	Output is set when the configured condition for the online switching point 2 is met	-

> **i** **Note:** To use the output for this application, The "Dig Out X4.3 Function" Parameter of the Motion control software (UPID 1070h) has to be set to "Application Output".

3.3.2 Dig Out X4.4

UPID 0x3201

This parameter defines for which function the output X4.4 is used.

Function of Dig Out X4.4		Default Value
None	No function	X
Result OK	Indicates positive evaluation result after measurement (1: pass, 0: fail), resets to 1 at the start of the next measurement	-
Result nOK	Indicates negative evaluation result after measurement (0: pass, 1: fail), resets to 0 at the start of the next measurement	-
Result nOK (online)	Indicates negative evaluation result of the online window (0: pass, 1: fail), resets to 0 at the start of the next measurement	-
Measurement active	Output is set on start trigger and reset when measurement and evaluation are completed	-
Online switching point 1	Output is set when the configured condition for the online switching point 1 is met	-

Function of Dig Out X4.4		Default Value
Online switching point 2	Output is set when the configured condition for the online switching point 2 is met	-

> **Note:** To use the output for this application, The "Dig Out X4.4 Function" Parameter of the Motion control software (UPID 1071h) has to be set to "Application Output".

3.3.3 Dig In X4.5

UPID 0x3202

This parameter defines for which function the input X4.5 is used.

Function of Dig In X4.5		Default Value
None	No function	X
Arm measurement	Set the system to a state where it waits for and reacts to a start trigger condition	-
Start trigger	Triggers the start of the measurement (data acquisition is started)	-
Stop trigger	Triggers the stop of the measurement (data acquisition is stopped)	-

> **Note:** To use the input exclusively for this application, The "Dig In X4.5 Function" Parameter of the Motion control software (UPID 1060h) has to be set to "None".
> If anything other than "None" is configured, the input will trigger both configured functions.

3.3.4 Dig In X4.6

UPID 0x3203

This parameter defines for which function the input X4.6 is used.

Function of Dig In X4.6		Default Value
None	No function	X
Arm measurement	Set the system to a state where it waits for and reacts to a start trigger condition	-
Start trigger	Triggers the start of the measurement (data acquisition is started)	-
Stop trigger	Triggers the stop of the measurement (data acquisition is stopped)	-

> **Note:** To use the input exclusively for this application, The "Dig In X4.6 Function" Parameter of the Motion control software (UPID 1061h) has to be set to "None".
> If anything other than "None" is configured, the input will trigger both configured functions.

3.3.5 Dig In X4.7

UPID 0x3204

This parameter defines for which function the input X4.7 is used.

Function of Dig In X4.7		Default Value
None	No function	X
Arm measurement	Set the system to a state where it waits for and reacts to a start trigger condition	-
Start trigger	Triggers the start of the measurement (data acquisition is started)	-
Stop trigger	Triggers the stop of the measurement (data acquisition is stopped)	-

i **Note:** To use the input exclusively for this application, The "Dig In X4.7 Function" Parameter of the Motion control software (UPID 1062h) has to be set to "None".
If anything other than "None" is configured, the input will trigger both configured functions.

3.3.6 Dig In X4.8

UPID 0x3205

This parameter defines for which function the input X4.8 is used.

Function of Dig In X4.8		Default Value
None	No function	X
Arm measurement	Set the system to a state where it waits for and reacts to a start trigger condition	-
Start trigger	Triggers the start of the measurement (data acquisition is started)	-
Stop trigger	Triggers the stop of the measurement (data acquisition is stopped)	-

i **Note:** To use the input exclusively for this application, The "Dig In X4.8 Function" Parameter of the Motion control software (UPID 1063h) has to be set to "None".
If anything other than "None" is configured, the input will trigger both configured functions.

3.4 Start/Stop mode

The trigger conditions to start and stop a measurement can be configured here.

3.4.1 Start trigger

3.4.1.1 Start trigger source

UPID 0x3010

Configures the source for the start trigger of a measurement.
If a rising or falling edge trigger is selected, the X and Y tolerance bands (X tolerance band and Y tolerance band) are activated when the start trigger occurs, to prevent the immediate triggering of a stopping edge transition if this is configured as the stop trigger source.

ProcessMonitoring\Start/Stop mode\Start trigger source		Default Value
External	A digital input or the Measurement Control word is used to start the measurement	-
X above threshold	The measurement is triggered when X rises above the configured threshold	X
X below threshold	The measurement is triggered when X falls below the configured threshold	-
Y above threshold	The measurement is triggered when Y rises above the configured threshold	-
Y below threshold	The measurement is triggered when Y falls below the configured threshold	-
X rising edge	The measurement is triggered when a rising edge of the configured X value occurs ((actual X-value > triggervalue) and (last X-value <= triggervalue))	-
X falling edge	The measurement is triggered when a rising edge of the configured X value occurs ((actual X-value < triggervalue) and (last X-value >= triggervalue))	-
Y rising edge	The measurement is triggered when a rising edge of the configured Y value occurs ((actual Y-value > triggervalue) and (last Y-value <= triggervalue))	-
Y falling edge	The measurement is triggered when a rising edge of the configured Y value occurs ((actual Y-value < triggervalue) and (last Y-value >= triggervalue))	-

3.4.1.2 X triggervalue

UPID 0x3011

Threshold value for X data if either "X above threshold" or "X below threshold" is configured as the start trigger source.

Trigger value for X data if either "X rising edge" or "X falling edge" is configured as the start trigger source.

3.4.1.3 Y triggervalue

UPID 0x3012

Threshold value for Y data if either "Y above threshold" or "Y below threshold" is configured as the start trigger source.
Trigger value for Y data if either "Y rising edge" or "Y falling edge" is configured as the start trigger source.

3.4.2 Stop trigger

3.4.2.1 Stop trigger source

UPID 0x3020

Configures the source for the stop trigger of a measurement.

ProcessMonitoring\Start/Stop mode\Stop trigger source		Default Value
External	A digital input or the [Measurement Control](#) word is used to stop the measurement	-
X above threshold	The measurement is stopped when X rises above the configured threshold	-
X below threshold	The measurement is stopped when X falls below the configured threshold	-
Y above threshold	The measurement is stopped when Y rises above the configured threshold	-
Y below threshold	The measurement is stopped when Y falls below the configured threshold	-
X rising edge	The measurement is triggered when a rising edge of the configured X value occurs ((actual X-value > triggervalue) and (last X-value <= triggervalue))	-
X falling edge	The measurement is triggered when a rising edge of the configured X value occurs ((actual X-value < triggervalue) and (last X-value >= triggervalue))	-
Y rising edge	The measurement is triggered when a rising edge of the configured Y value occurs ((actual Y-value > triggervalue) and (last Y-value <= triggervalue))	-
Y falling edge	The measurement is triggered when a rising edge of the configured Y value occurs ((actual Y-value < triggervalue) and (last Y-value >= triggervalue))	-
Timeout	The measurement stops after a set time has elapsed.	X
Number of readings	The measurement stops after a set number of recorded samples.	-

> **Note**: The timeout to stop the measurement is always active in addition to any other configured stop source. If the maximum number of recorded points (8000) is reached, the measurement also stops.

3.4.2.2 X triggervalue

UPID 0x3021

Threshold value for X data if either "X above threshold" or "X below threshold" is configured as the stop trigger source.

Trigger value for X data if either "X rising edge" or "X falling edge" is configured as the stop trigger source.

3.4.2.3 Y triggervalue

UPID 0x3022

Threshold value for Y data if either "Y above threshold" or "Y below threshold" is configured as the stop trigger source.
Trigger value for X data if either "X rising edge" or "X falling edge" is configured as the stop trigger source.

3.4.2.4 Timeout

UPID 0x3023

The measurement stops after a set time has elapsed.

3.4.2.5 Number of readings

UPID 0x3024

The measurement stops after a set number of recorded samples.

3.5 Evaluation

3.5.1 X tolerance band

UPID 0x3007

The X tolerance band configures an additional hysteresis region at the left and right entry and exit sides of a window.
The curve can cross the window boundary any number of times while inside the tolerance band without resulting in a nOK evaluation.
The tolerance band is applied to all windows (including the configured window for online evaluation) and can not be configured for a single one.
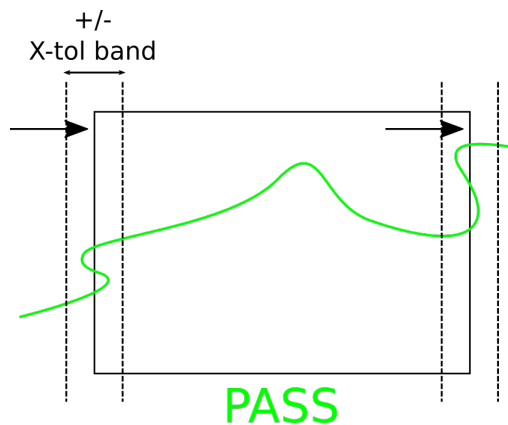
Fig. 12: X tolerance band
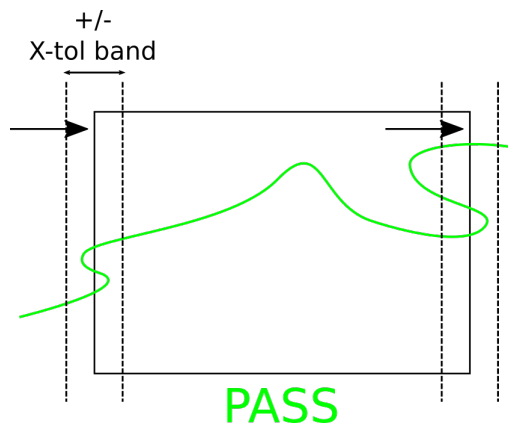
Fig. 13: X tolerance band

+/-
X-tol band

FAIL
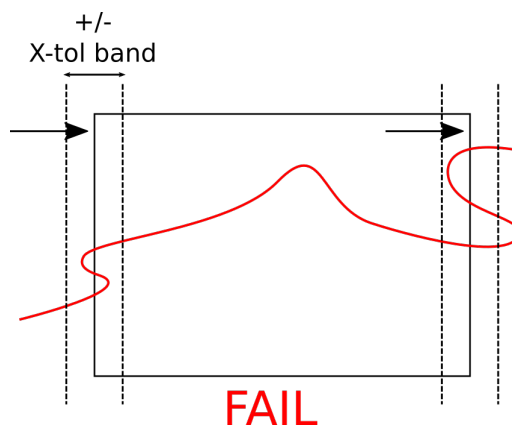
Fig. 14: X tolerance band

Note:

The tolerance bands for X and Y are activated seperately from each other. The X-tolerance band is activaed on entry/exit left/right and the Y-tolerance band is activated on entry/exit top/bottom.

The tolerance bands are activated around the coordinates of the first point which is inside the window after an entry or the first point which is outside of the window after an exit and NOT around the exact window borders.

3.5.2 Y tolerance band

UPID 0x3008

The Y tolerance band configures an additional hysteresis region at the top and bottom entry and exit sides of a window.

The curve can cross the window boundary any number of times while inside the tolerance band without resulting in a nOK evaluation.

The tolerance band is applied to all windows (including the configured window for online evaluation) and can not be configured for a single one.

+/-
Y-tol band

PASS
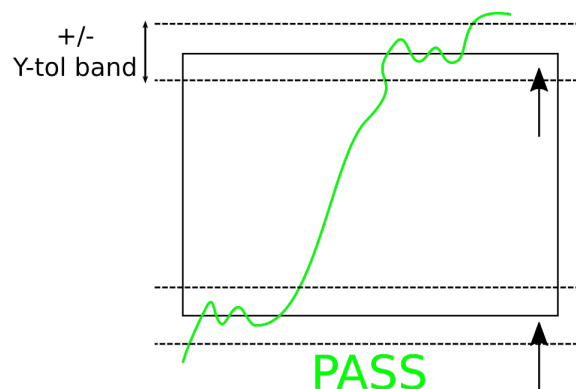
Fig. 15: Y tolerance band
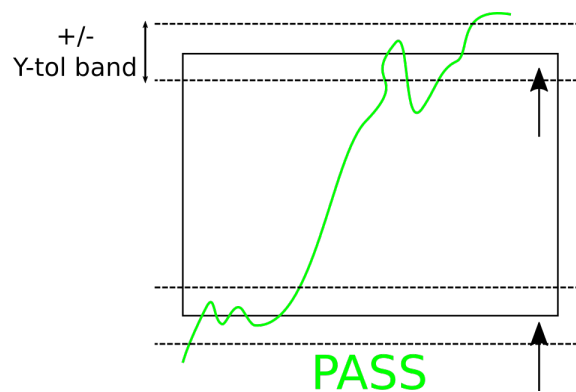
Fig. 16: Y tolerance band
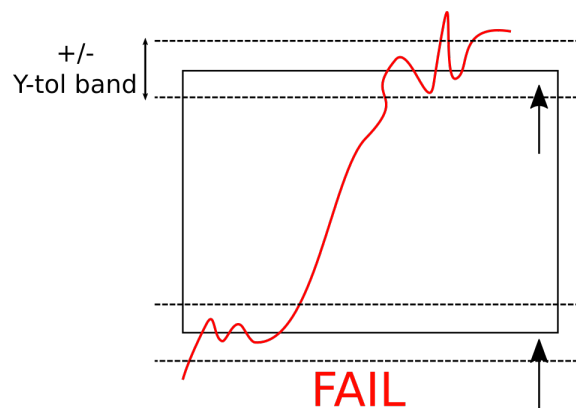
Fig. 17: Y tolerance band

Note:
The tolerance bands for X and Y are activated seperately from each other. The X-tolerance band is activaed on entry/exit left/right and the Y-tolerance band is activated on entry/exit top/bottom.
The tolerance bands are activated around the coordinates of the first point which is inside the window after an entry or the first point which is outside of the window after an exit and NOT around the exact window borders.

3.5.3 Treat uncertain transitions as errors

UPID 0x300A

Disable or Enable if the detection of underline uncertain transitions in measurements should be treated as a measurement error in the overall result.

ProcessMonitoring\Evaluation\Treat uncertain transitions as errors\Dis-/Enable		Default Value
Disable	If uncertain transitions occur, the overall measurement result will not be marked as nOK	X
Enable	If uncertain transitions occur, the overall measurement result will be marked as nOK	-

3.5.4 Windows

Up to 16 windows can be configured simultaneously to evaluate measurements (see Window evaluation for details).

3.5.4.1 Windows 1..16

3.5.4.1.1 Dis-/Enable

UPID 0x3030 + (0x10(Windownumber-1))*

Disables or Enables a window for evaluation

ProcessMonitoring\Evaluation\Windows\Window 1..16\Dis-/Enable		Default Value
Disable	The window is disabled	X
Enable	The window is enabled	-

3.5.4.1.2 Curve segment

UPID 0x3031 + (0x10(Windownumber-1))*

Sets the segment of the curve in which the window is evaluated (see Setting the return point).

ProcessMonitoring\Evaluation\Windows\Window 1..16\Curve segment		Default Value
Forward	window is evaluated only over the forward segment of the curve	-
Return	window is evaluated only over the return segment of the curve	-
Complete	window is evaluated over the complete curve	X

> **Note**: The online window is always evaluated over the complete curve. This setting is ignored when the window is configured as the online window.

3.5.4.1.3 Entry

Entry Left: UPID 0x3032 + (0x10*(Windownumber-1))
Entry Right: UPID 0x3033 + (0x10*(Windownumber-1))
Entry Bottom: UPID 0x3034 + (0x10*(Windownumber-1))
Entry Top: UPID 0x3035 + (0x10*(Windownumber-1))

Set the window sides where an entry of the curve is permitted. Left, Right, Bottom and Top can be selected. More than one side can be selected (see [Window evaluation)](#).

3.5.4.1.4 Exit

Exit Left: UPID 0x3036 + (0x10*(Windownumber-1))
Exit Right: UPID 0x3037 + (0x10*(Windownumber-1))
Exit Bottom: UPID 0x3038 + (0x10*(Windownumber-1))
Exit Top: UPID 0x3039 + (0x10*(Windownumber-1))

Set the window sides where an exit of the curve is permitted. Left, Right, Bottom and Top can be selected. More than one side can be selected (see [Window evaluation)](#).

3.5.4.1.5 X min

UPID 0x303A + (0x10*(Windownumber-1))

Set the Xmin coordinate used to define the window boundaries.

3.5.4.1.6 X max

UPID 0x303B + (0x10*(Windownumber-1))

Set the Xmax coordinate used to define the window boundaries.

3.5.4.1.7 Y min

UPID 0x303C + (0x10*(Windownumber-1))

Set the Ymin coordinate used to define the window boundaries.

3.5.4.1.8 Y max

UPID 0x303D + (0x10*(Windownumber-1))

Set the Ymax coordinate used to define the window boundaries.

3.5.5 Online switching points

3.5.5.1 Dis-/Enable

UPID 0x3130 + (0x10(OnlineSwitchingPointnumber-1))*

Disables or Enables the online switching point for evaluation

ProcessMonitoring\Evaluation\Online switching points\switching point 1..2\Dis-/Enable		Default Value
Disable	The online switching point is disabled	X
Enable	The online switching point is enabled	-

3.5.5.2 X threshold

UPID 0x3131 + (0x10(OnlineSwitchingPointnumber-1))*

Threshold value for X data if either "X above threshold" or "X below threshold" is configured as the switching condition.

3.5.5.3 Y threshold

UPID 0x3132 + (0x10(OnlineSwitchingPointnumber-1))*

Threshold value for Y data if either "Y above threshold" or "Y below threshold" is configured as the switching condition.

3.5.5.4 Switching condition

UPID 0x3133 + (0x10(OnlineSwitchingPointnumber-1))*

Set the switching condition of the online switching point.

ProcessMonitoring\Evaluation\Online switching points\switching point 1..2\Switching condition		Default Value
X above threshold	The online switching point is triggered when X rises above the configured threshold	X
X below threshold	The online switching point is triggered when X falls below the configured threshold	-
Y above threshold	The online switching point is triggered when Y rises above the configured threshold	-
Y below threshold	The online switching point is triggered when Y falls below the configured threshold	-

4 ProcessMonitoring Variables

4.1 ProcessMonitoring

4.1.1 Measurement Control

UPID 0x3620

Measurement Control	
Bit 0	set to 1 to arm measurement (transition from "idle state" to "waiting for trigger" (see Recording a measurement)). This bit is automatically reset after the transition.
Bit 1	set to 1 to activate start trigger (transition from "waiting for trigger" to "acquiring data" state (see Recording a measurement)). This bit is automatically reset after the transition.
Bit 2	set to 1 to activate stop trigger (transition from "acquiring data" to "evaluate data" state (see Recording a measurement)). This bit is automatically reset after the transition.
Bit 3-15	unused

4.1.2 Measurement Status

UPID 0x3621

Measurement Status	
Bit 0-7	measurement state: 0 = Measurement not armed / idle 1 = Waiting for start trigger 2 = Acquire readings (online evaluation) 3 = Evaluate general curve data 4 = Evaluate windows 5 = Evaluate overall results 6 = Required software license key is missing[1] (ordering Number of article 'TF-ProcessMonitoring': 0150-4224) 10 = measurement initialization step 1 11 = measurement initialization step 2
Bit 8-13	unused
Bit 14	0 = Evaluation completed without errors (OK) 1 = Errors occured in evaluation (nOK) (check Measurement Result Errors for details) (same as bit 0 of Measurement Result Overall)
Bit 15	Measurement finished[2]

[1] It is not possible to record data until a valid license key is activated and the drive is restarted again. If a trial license key is used to evaluate the application, the drive has to be restarted and the trial period has to be

activated before a measurement is recorded. If a measurement is started before a valid key or a trial period is activated, the application is locked until the drive is restarted again.

[2] It is set after the measurement is completely evaluated. The measurement finished bit is automatically reset if the state changes from 0 (idle) to 1 (measurement armed).

4.1.3 Measurement Result Overall

UPID 0x3622

Measurement Result Overall	

Bit 0-7	measurement result overall:
	  255 = No readings acquired
	  0 = Evaluation completed without errors (OK)
	  1 = Errors occured in evaluation (nOK) (check Measurement Result Errors for details)

Bit 8-15	unused

4.1.4 Measurement Result Errors

UPID 0x3630

Measurement Result Errors	
Bit 0	llegal transition occured (nOK)
Bit 1	Internal measurement error (nOK)
Bit 2	1 = uncertain entry detected (nOK)[1] 0 = No uncertain entry was detected
Bit 3	1 = uncertain exit detected (nOK)[1] 0 = No uncertain exit was detected
Bit 4-15	unused

[1] see chapter Uncertain Exits/Entries for details. These bits are only set if "Treat uncertain transitions as errors" is enabled.

4.1.5 Measurement Result Windows

UPID 0x3623

Measurement Result Windows	
Bit 0	0 = Window 1 OK 1 = illegal transition in window 1 detected
...	...
Bit 15	0 = Window 16 OK 1 = illegal transition in window 16 detected

If one or more sides are defined as entry and/or exit sides, at least one of those entry and/or exit conditions has to be fulfilled.
If that is not the case, this window will be evaluated as "fail" and the corresponding bit in this variable will reflect this.

4.1.6 Measurement maxima and minima coordinates

Measurement X Maximum (X):   UPID 0x3624
Measurement X Maximum (Y):   UPID 0x3625
Measurement X Minimum (X):   UPID 0x3626
Measurement X Minimum (Y):   UPID 0x3627
Measurement Y Maximum (X):   UPID 0x3628
Measurement Y Maximum (Y):   UPID 0x3629
Measurement Y Minimum (X):   UPID 0x362A
Measurement Y Minimum (Y):   UPID 0x362B

Shows the X and Y values of all minima and maxima of the last recorded measurement.

4.1.7 Return point coordinates

Return Point (X):   UPID 0x362C
Return Point (Y):   UPID 0x362D

Shows the X and Y values of the return point of the last recorded measurement.

4.2 Window 1-16

4.2.1 Window Configuration

UPID 0x370D + (0x10*(Windownumber-1))

Indicates which sides of the window are configured to allow entry and/or exit of the measurement curve through this side.

Window Status	
Bit 0	1 = entry on left side allowed 0 = No entry on left side allowed
Bit 1	1 = entry on right side allowed 0 = No entry on right side allowed
Bit 2	1 = entry on bottom side allowed 0 = No entry on bottom side allowed
Bit 3	1 = entry on top side allowed 0 = No entry on top side allowed
Bit 4	1 = exit on left side allowed 0 = No exit on left side allowed
Bit 5	1 = exit on right side allowed 0 = No exit on right side allowed
Bit 6	1 = exit on bottom side allowed 0 = No exit on bottom side allowed
Bit 7	1 = exit on top side allowed 0 = No exit on top side allowed
Bit 8-32	unused

4.2.2 Window Status

UPID 0x3700 + (0x10*(Windownumber-1))

Indicates where the window was entered and exited.

Window Status	
Bit 0	1 = entry on left side detected 0 = No entry on left side
Bit 1	1 = entry on right side detected 0 = No entry on right side
Bit 2	1 = entry on bottom side detected 0 = No entry on bottom side
Bit 3	1 = entry on top side detected 0 = No entry on top side
Bit 4	1 = exit on left side detected 0 = No exit on left side
Bit 5	1 = exit on right side detected 0 = No exit on right side
Bit 6	1 = exit on bottom side detected 0 = No exit on bottom side
Bit 7	1 = exit on top side detected 0 = No exit on top side
Bit 8	1 = uncertain entry detected[1] 0 = No uncertain entry was detected
Bit 9	1 = uncertain exit detected[1] 0 = No uncertain exit was detected
Bit 10-32	unused

[1] see chapter Uncertain Exits/Entries for details

4.2.3 Entry / Exit indicators

Entry Left: *UPID 0x3701 + (0x10*(Windownumber-1))*
Entry Right: *UPID 0x3702 + (0x10*(Windownumber-1))*
Entry Bottom: *UPID 0x3703 + (0x10*(Windownumber-1))*
Entry Top: *UPID 0x3704 + (0x10*(Windownumber-1))*
Exit Left: *UPID 0x3705 + (0x10*(Windownumber-1))*
Exit Right: *UPID 0x3706 + (0x10*(Windownumber-1))*
Exit Bottom: *UPID 0x3707 + (0x10*(Windownumber-1))*
Exit Top: *UPID 0x3708 + (0x10*(Windownumber-1))*

Indicates at which sides the windows were entered and exited. Contains the same information as the window status broken down into single entry and exit sides.

4.2.4 Entry / Exit Values

Entry Value (X): *UPID 0x3709 + (0x10*(Windownumber-1))*
Entry Value (Y): *UPID 0x370A + (0x10*(Windownumber-1))*
Exit Value (X): *UPID 0x370B + (0x10*(Windownumber-1))*
Exit Value (Y): *UPID 0x370C + (0x10*(Windownumber-1))*

Shows the X and Y values of the last entry and exit points of the recorded measurement.
If a window has more then one entry and/or exit, the coordinates represent the last detected transition.

4.3 Online Switching Points

4.3.1 Online Switching Points Status

UPID 0x3800

Online Switching Points Status	
Bit 0	0 = Online Switching point 1 was not triggered 1 = Online Switching point 1 was triggered
Bit 1	0 = Online Switching point 2 was not triggered 1 = Online Switching point 2 was triggered
Bit 3-15	unused

4.4 Curve readout

All (X,Y) values of the last recorded curve can be read out, as long as a new measurement is not started.
This mechanism can be used to access and archive the raw data via a PLC.
The Readout X,Y-Values and the readout status and control can be configured in the real-time process data of fieldbus interfaces which support dynamic configuration mechanisms (e.g. through parameter- and monitoring channels).

By setting the toggle byte of readout control to anything different than the toggle byte of the readout status, the X/Y-values 1-16 are loaded with curve data starting from the index set in readout control.
As soon as the toggle byte of readout status is the same as the one in readout control, the new data is ready and valid.

4.4.1 Number of acquired readings

UPID 0x3810

Shows the number of recorded points (X,Y) of the last completed measurement. 8000 (X,Y)-points is the maximum number of recordable points.

4.4.2 StartTime Hours / Sub Hours

UPID 0x3811 / UPID 0x3812

Time stamp of the drives internal operating time (Operating Hours (UPID 0x0083) / Sub Hours (UPID 0x0082)) when the measurement was started (transition from state "Waiting for trigger" to "Acquiring data").

4.4.3 StopTime Hours / Sub Hours

UPID 0x3813 / UPID 0x3814

Time stamp of the drives internal operating time (Operating Hours (UPID 0x0083) / Sub Hours (UPID 0x0082)) when the measurement was finished (transition from state "Acquire data" to "Evaluate general curve data").

4.4.4 Readout control

UPID 0x3815

Readout control	
Bit 0-23	Array index of readout values
Bit 24-32	Toggle Byte

4.4.5 Readout status

UPID 0x3816

Readout Status	
Bit 0-23	Array index of readout values
Bit 24-32	Toggle Byte

4.4.6 Readout X-Value 1-16

UPIDs 0x3817-0x3826

Sixteen recorded consecutive X-Values starting at the array index set in [Readout control](#).

4.4.7 Readout Y-Value 1-16

UPIDs 0x3827-0x3836

Sixteen recorded consecutive Y-Values starting at the array index set in [Readout control](#).

4.4.8 Readout X-Value String

UPID 0x3840

All sixteen recorded consecutive X-Values as a string of 64 bytes.

4.4.9 Readout Y-Value String

UPID 0x3860

All sixteen recorded consecutive Y-Values as a string of 64 bytes.

5 ProcessMonitoring with LinMot-Talk

The main objective of this graphical evaluation is to have a visualization of the the recorded XY-curve including the configured windows.
With this graphical aid, it is possible to finely tune the monitoring windows exactly to the users needs.

To configure the parameters for the Process Monitoring application in LinMot-Talk there are two possibilities:
One is via the parameters in the tree and the other one is via the Process Monitoring window.
The Process Monitoring window can be opened in the menu "Tools" with "Process Monitoring". It is recommended that a process curve is already recorded beforehand by the drive. Without a curve it is difficult to define some windows for evaluation.
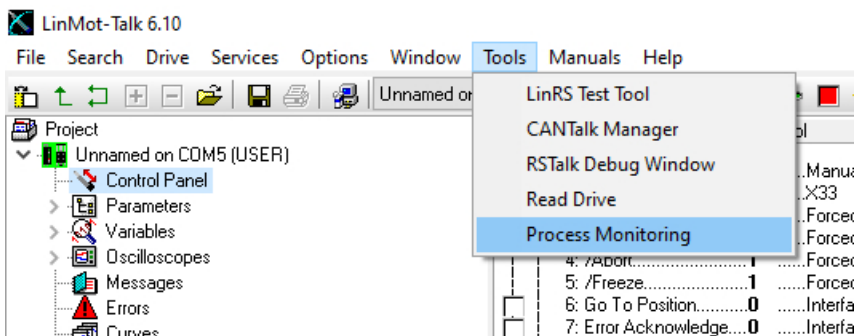

After clicking on the Process Monitoring menu, the Process Monitoring window opens and it reads all the data. As this can take some time, it is recommended to wait until the progress-bar is full and the cursor has its normal form before interacting with the window any further.

5.1 ProcessMonitoring window

The Process Monitoring window has four sections.

- The centre section shows the graph with curve and the evaluation windows.
- In the top section it is possible to hide or show individual evaluation windows and hide or show the window identification numbers.
- The right section is for selecting the mouse function (Cursor, Zoom Box, Window Data)
- In the bottom section, the coordinate values are shown and the three buttons, Fit View, Repaint Windows and Close exists.
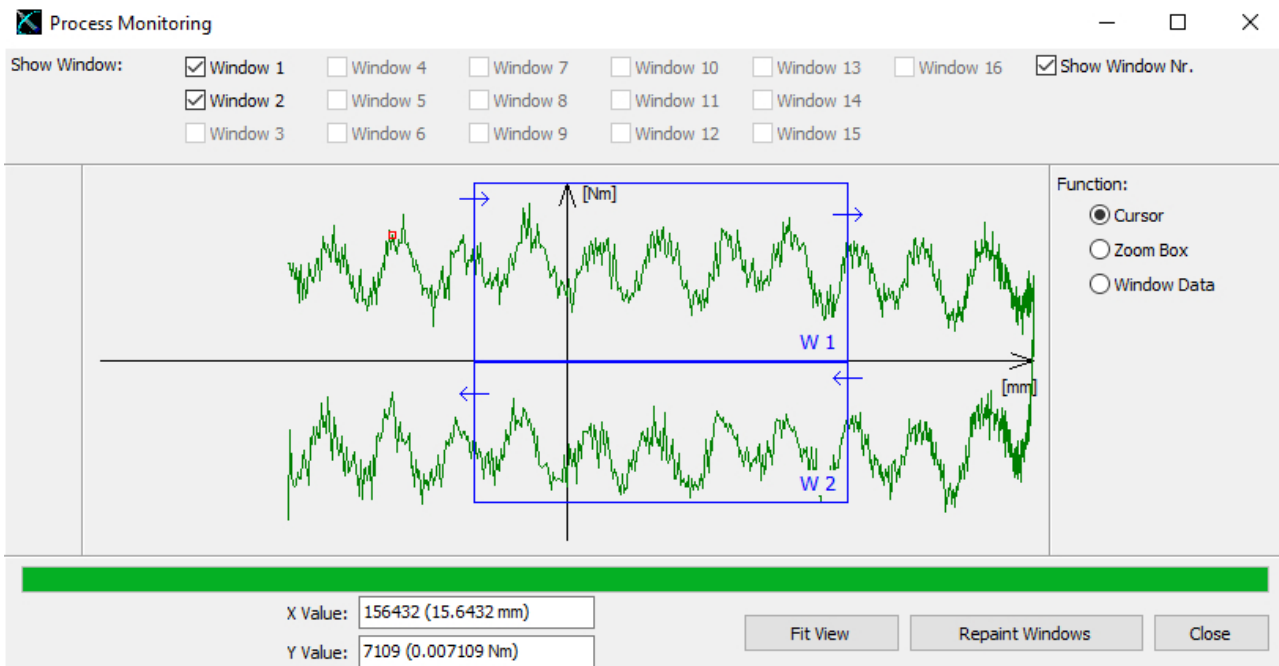
5.1.1 Function Cursor

When the cursor function is selected the red square marks the point on the curve that is the nearest to the mouse cursor. In the bottom section the X value and Y value of the point in the square are displayed.

5.1.2 Function Zoom Box

When the Zoom Box function is selected it is possible to draw a box with the mouse by clicking and holding the left mouse button. When releasing the button the view will zoom into the box. This function only works when the window is draw from the top left corner to the bottom right one.. This can be used to abort a Zoom Box, move on the left side or to the top until the grey square becomes invisible. In this function the displayed coordinates have the values of the mouse. To reset the zoom the button "Fit View" is used.
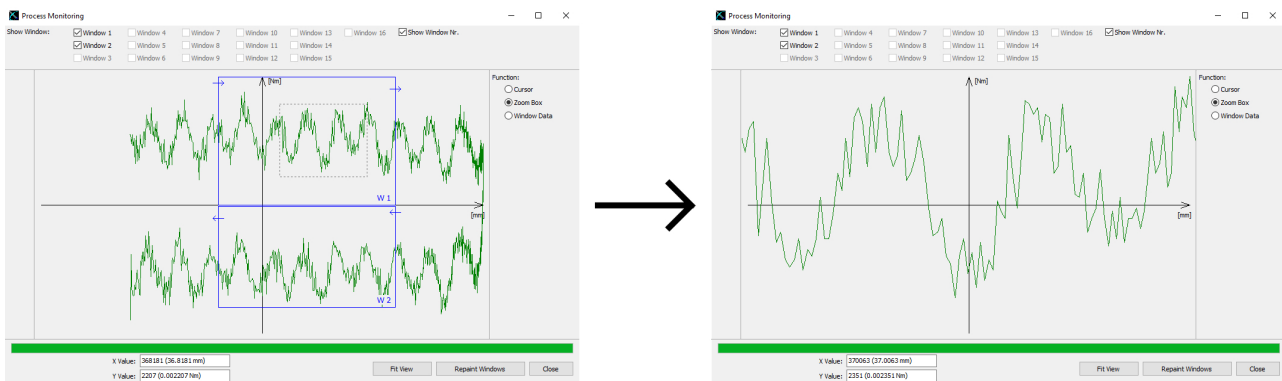
5.1.3 Function Window Data

The function Window Data can be used to define or change an evaluation Window.

- Window Nr: Choose the number of the window to change or (re-)define.
- Min X defines the minimal value in X direction of the window (UPID 30XA)
- Max Y defines the maximal value in Y direction of the window (UPID 30XD)
- Max X defines the maximal value in X direction of the window (UPID 30XB)
- Min Y defines the minimal value in Y direction of the window (UPID 30XC)
- The Entry Check-boxes defines the possible entry into the window (UPID 30X2, 30X3, 30X4, 30X5)
- The Exit Check-boxes defines the possible exit from the window (UPID 30X6, 30X7, 30X8, 30X9)
- The "Write Window Data" button writes the data from the Process Monitoring window to the corresponding parameters for the selected evaluation window. When defining a new window this way, it is automatically set to "enabled".

After changing window data on the drive with the button "Repaint Windows" it is possible to reread the parameters and (re-)draw the newly defined windows.
The coordinates represent the values of the mouse cursor like in the function "Zoom Box".

The recorded curve is not evaluated again after editing windows and repainting them. Recorded data is only evaluated at the end of a measurement.
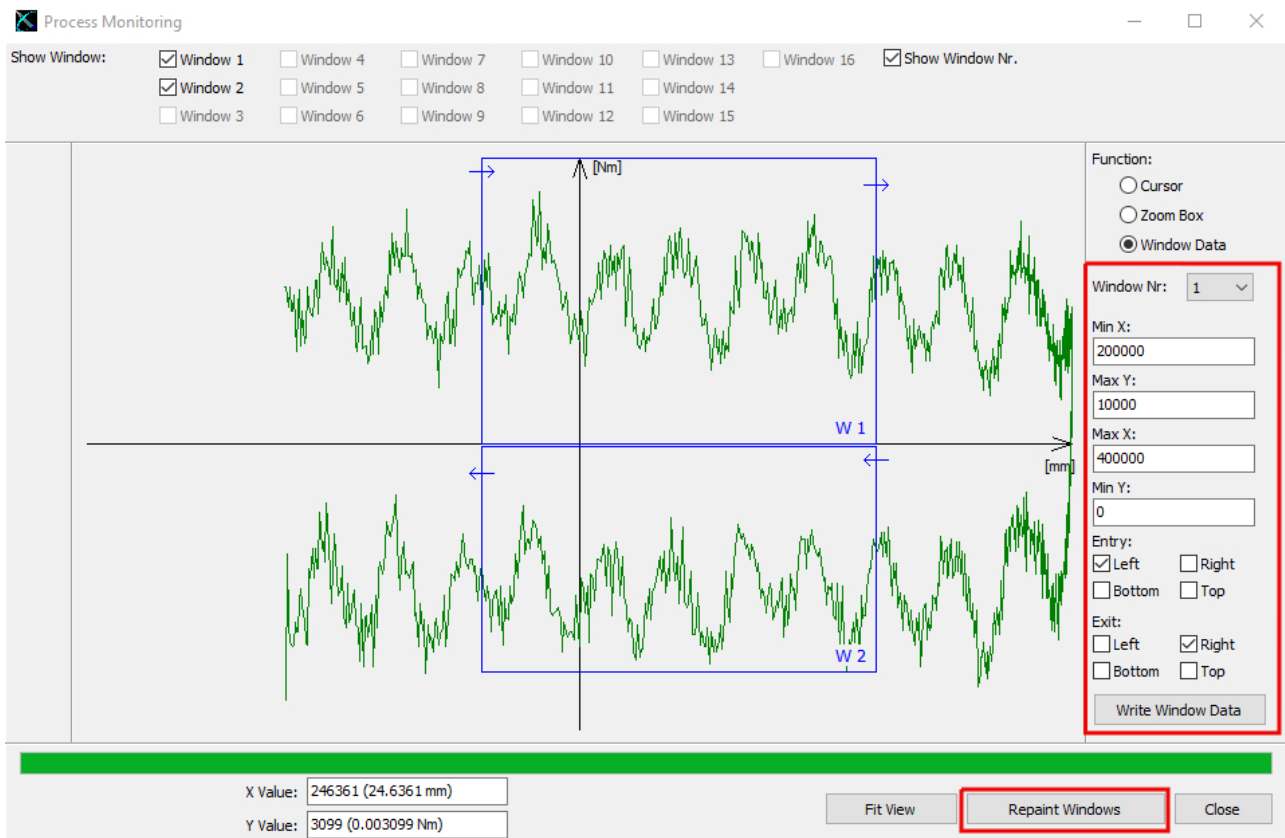
6 Errors and warnings

The ProcessMonitoring application has the following error codes:

Error Code	Error Description	Recommended Actions
E0h	Err: ProcMon SW key missing	Check if a valid SW license key is installed in the drive (when logged in: Drive -> Set Access Code...)
F0h	Cfg Err: Window cfg erroneous	Check the window configurations for errors (e.g. the value of X min is bigger than X max etc.)

![LinMot®]

Contact & Support

SWITZERLAND

NTI AG
Bodenaeckerstrasse 2
CH-8957 Spreitenbach

Sales and Administration:	+41 56 419 91 91
	office@linmot.com
Tech. Support:	+41 56 544 71 00
	support@linmot.com
	http://www.linmot.com/support
Tech. Support (Skype):	support.linmot
Fax:	+41 56 419 91 92
Web:	http://www.linmot.com

USA

LinMot USA Inc.
N1922 State Road 120, Unit 1
Lake Geneva, WI 53147
USA

Phone:	262-743-2555
E-Mail:	usasales@linmot.com
Web:	http://www.linmot-usa.com/

Please visit http://www.linmot.com/contact to find the distribution close to you.

Smart solutions are…

![driven by LinMot® www.LinMot.com]