Measure what you see

smart-robotic



Operating Instructions



A member of **C** ALTANA

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1 Introduction

Dear customer,

thank you for having decided for a BYK-Gardner product. BYK-Gardner is committed to providing you with quality products and services. We offer complete system solutions to solve your problems in areas of color, appearance and physical properties. As the basis of our worldwide business, we strongly believe in total customer satisfaction. Therefore, in addition to our products, we offer VALUE-ADDED services:

- Technical Sales Force
- Technical & Application Support
- Application and Technical Seminars
- Repair & Certification Service

BYK-Gardner is part of the Altana Group and a direct subsidiary of BYK, the worldwide leader of additives for coatings and plastics. Together we offer complete and unique solutions for you, our customer.

Thank you for your trust and confidence. If there is anything we can do better to serve your needs, do not hesitate to let us know.

Your BYK-Gardner Team

www.byk-instruments.com

1.1 Copyright

Specific properties and structural characteristics of the instrument are intellectual property of BYK-Gardner. The copyright of this manual remains with BYK-Gardner.

This document must not be reproduced fully or in party, published or used for any other competitive purposes, no matter whether against payment or not, without prior written authorization from BYK-Gardner.

BYK-Gardner reserves the right to update the instrument, software and written documentation without prior notice.

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1.2 Prerequisites

In order to operate the software basic understanding of following topics is required:

- Products from BYK-Gardner:
 - Instrument BYK-mac i ROBOTIC to measure effect colors
 - Instrument wave-scan ROBOTIC and wave-scan 3 ROBOTIC to measure appearance (orange peel)
 - Software smart-process to monitor the measurement results
- Third-party products:
 - Instruments for measuring the thickness
 - OPC server for the control of the robot
 - Pre-positioning system for robot moves



NOTICE

The software **smart-process** is a variant of the software **smart-chart**. After a trial period of 30 days the software **smart-chart** has to be registered. During registration the variant **smart-process** has to be selected.

1.3 Requirements

1.3.1 Hardware

- Hardware: Intel Core-i3 2.5 GHz; Core-i7 recommended, or equivalent
- Memory: 8 GB RAM, 16 GB recommended
- Hard-disk capacity: 4 GB during installation
- Monitor resolution: 1920 x 1080 pixel or higher
- Interface: LAN port and free USB port

1.3.2 Software

- Operating system: Windows® 10 1607 or later
- Software smart-chart V7.1 or later
- Runtime: .NET core 3.1.0 or later

2 System Description

The software **smart-robotic** is the interface software for the BYK-Gardner robotic color and appearance measurement instruments and for compatible thickness measurement systems.

It provides all necessary modules for system configuration and monitoring for the BYK-Gardner robotic instruments and for storing the measurement results:

- 1. Monitoring [> 26]: Check the logging of events such as errors, warnings, debug events and info.
- 2. OPC [> 28]: Configure and test connection to the server hosting the interface to the robot.
- 3. Devices [▶ 35]: Configure and test the physical robotic measurement instruments.
- 4. Results Management:
 - Without smart-chart: Generate Output Files [> 67] as CSV / XML.
 - With **smart-chart**: Store results via smart-chart link [> 77] in the DB.
- 5. Robot Simulator [▶ 140]: Test the existing configuration and the physical instruments without the need of a robot.

2.1 Overview

The software can control following robotic measuring instruments:

- Color meter for effect colors: BYK-Gardner BYK-mac i ROBOTIC
- Appearance measurement:
 - BYK-Gardner wave-scan ROBOTIC
 - BYK-Gardner wave-scan 3 ROBOTIC
- Thickness measurement: Fisher or PELT



Illustration 1: Car body in robot cell with two robots

The measuring instruments mounted to a robot arm are providing measurement raw data.



Illustration 2: Instrument wave-scan ROBOTIC on robot arm

The raw data are received and evaluated by smart-robotic and stored in CSV / XML files or in the database of the BYK-Gardner software **smart-chart** for further processing.

2.2 Mounting

The measurement instruments and a pre-positioning system are mounted to a robot arm. Via the pre-positioning system the target position is reached. The robot arm rotates to bring the required instrument into measurement position. Afterwards the measurement is started. The measurement data are transferred immediately to **smart-robotic** and evaluated there.

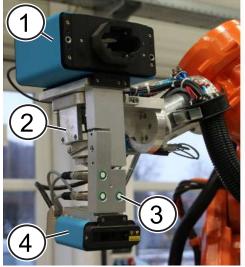
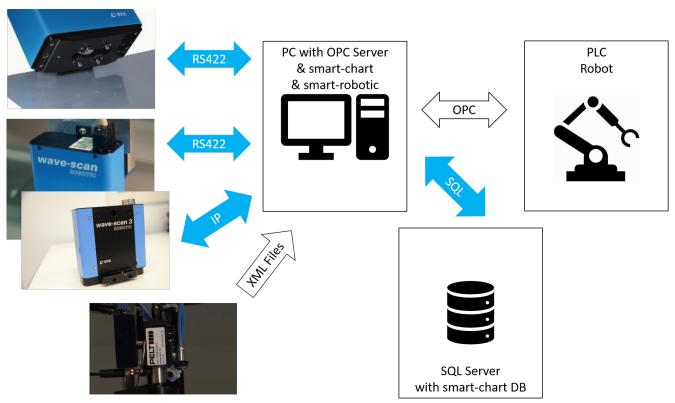


Illustration 3: BYK-Gardner instruments mounted to robot arm

- 1 BYK-mac i ROBOTIC: Color & Effect Measurement
- 2 Rotatable Adapter: 0°, 90°, 180°
- 3 Pre-Positioning System: Ultrasonic or Vision
- 4 Wave-Scan ROBOTIC: Appearance Measurement

After successful measurement the procedure is repeated for the next measurement point / check point.



2.3 Integration

Following figure shows the basic integration principle of smart-robotic.

Illustration 4: Integration of smart-robotic with instruments and robot

The products connected with blue arrows are delivered by BYK-Gardner. The products connected with white arrows are delivered by third parties.

The software **smart-robotic** is designed to fulfill following tasks:

- Provide the interfaces to the measurement instruments mounted on the robot.
- Process and store measurement data in the **smart-chart** database or in CSV / XML files.
- Communicate via Open Platform Communications (OPC) with the Programmable Logic Controller (PLC).



NOTICE

The thickness measuring instruments are not controlled by **smart-robotic**. The supported instruments create XML files (in a predefined format) which can be read by **smart-robotic** and processed in **smart-chart**. Details see Thickness Measurement [▶ 107] and PELT Measurement [▶ 122].

3 System Installation

Install and configure following components:

- 1. OPC Server (3rd Party) [> 12]
- 2. Software smart-chart [> 17]
- 3. Robotic Instruments [> 21]

3.1 OPC Server (3rd Party)

The OPC server is required to communicate with the PLC robot. It is a 3rd party software and thus not in the scope of this documentation. Perform following steps:

- 1. Install the OPC server
- 2. Configure the OPC server

Step 1 depends on the OPC server and is described in the documentation for this product. Step 2 is smart-robotic specific and described below.

OPC Signals / Items

The OPC server communicates with the robot via "OPC signals" – sometimes also called "OPC items". These signals have to be configured in **smart-robotic**. Following signals are mandatory:

- 1. Common Control Signals [▶ 12]
- 2. Control Signals for BYK-mac i ROBOTIC [> 13]
- 3. Control Signals for wave-scan ROBOTIC [> 13]

These signals / items must meet following requirements. For the creation of this documentation the OPC signals have been used as described in Example List of OPC Signals [▶ 14].



NOTICE

The suggested refresh rate for each signal on the server is 10 ms.

3.1.1 Common Control Signals

Following common OPC signals are required in smart-robotic.

Group	Symbol name	Symbol type	Direction
ALL_CTRL	IN_HEARTBEAT	Boolean	PLC to SR
ALL_CTRL	IN_ERR_ACK	Boolean	PLC to SR
ALL_CTRL	IN_JOB_START	Boolean	PLC to SR
ALL_CTRL	IN_JOB_STOP	Boolean	PLC to SR
ALL_CTRL	IN_REQU_CAL	Boolean	PLC to SR
ALL_CTRL	IN_REQU_MAST	Boolean	PLC to SR
ALL_CTRL	IN_REQU_DAILY_CHECK	Boolean	PLC to SR

Group	Symbol name	Symbol type	Direction
ALL_CTRL	OUT_HEARTBEAT	Boolean	SR to PLC
ALL_CTRL	OUT_JOB_RUN	Boolean	SR to PLC
ALL_CTRL	OUT_JOB_SUCCESS	Boolean	SR to PLC
ALL_CTRL	OUT_ERR_NO	Integer (4 byte)	SR to PLC
ALL_CTRL	OUT_ERR_STROBE	Boolean	SR to PLC

These items are to be created once in the OPC server. Details see Common Control Signals [> 31].

3.1.2 Control Signals for BYK-mac i ROBOTIC

In order to address the correct instrument an index is used:

- BYK-mac i ROBOTIC on robot 1: MAC1_CTRL
- BYK-mac i ROBOTIC on robot 2: MAC2_CTRL

For **BYK-mac i ROBOTIC** with index 1 following OPC signals have to be created. Details see OPC Control Signals [> 39].

Group	Symbol name	Symbol type	Direction
MAC1_CTRL	IN_ENABLE	Boolean	PLC to SR
MAC1_CTRL	IN_POINT_POS	Boolean	PLC to SR
MAC1_CTRL	IN_SYS_ERR_ACK	Boolean	PLC to SR
MAC1_CTRL	IN_CURVATURE	Short (2 byte)	PLC to SR
MAC1_CTRL	OUT_SYS_ERR	Boolean	SR to PLC
MAC1_CTRL	OUT_CAL_OK	Boolean	SR to PLC
MAC1_CTRL	OUT_CORR_VAL	Boolean	SR to PLC
MAC1_CTRL	OUT_POINT_READY	Boolean	SR to PLC
MAC1_CTRL	OUT_POINT_RESULT	Boolean	SR to PLC
MAC1_CTRL	OUT_CORR_Z	Short (2 byte)	SR to PLC
MAC1_CTRL	OUT_CORR_K	Short (2 byte)	SR to PLC
MAC1_CTRL	OUT_CORR_Q	Short (2 byte)	SR to PLC
MAC1_CTRL	OUT_ERROR_NR	Integer (4 byte)	SR to PLC
MAC1_CTRL	OUT_ERR_STROBE	Short (2 byte)	SR to PLC

For **BYK-mac i ROBOTIC** with index 2 the same OPC items with prefix MAC2_CTRL have to be created.

3.1.3 Control Signals for wave-scan ROBOTIC

In order to address the correct instrument an index is used:

- wave-scan ROBOTIC on robot 1: WAVE1_CTRL
- wave-scan ROBOTIC on robot 2: WAVE2_CTRL

For **wave-scan ROBOTIC** with index 1 following OPC signals have to be created. Details see OPC Control Signals [▶ 58].

Group	Symbol name	Symbol type	Direction
WAVE1_CTRL	IN_ENABLE	Boolean	PLC to SR
WAVE1_CTRL	IN_POINT_POS	Boolean	PLC to SR

Group	Symbol name	Symbol type	Direction
WAVE1_CTRL	IN_SYS_ERR_ACK	Boolean	PLC to SR
WAVE1_CTRL	OUT_SYS_ERR	Short (2 byte)	SR to PLC
WAVE1_CTRL	OUT_POINT_READY	Boolean	SR to PLC
WAVE1_CTRL	OUT_POINT_RESULT	Boolean	SR to PLC
WAVE1_CTRL	OUT_ERROR_NR	Integer (4 byte)	SR to PLC
WAVE1_CTRL	OUT_ERR_STROBE	Short (2 byte)	SR to PLC

For **wave-scan ROBOTIC** with index 2 the same OPC items with prefix WAVE2_CTRL have to be created.

3.1.4 Example List of OPC Signals

For the creation of this documentation following instruments - and corresponding OPC signals - have been created:

- BYK-mac i ROBOTIC [36] for robot #1 (USB)
- BYK-mac i ROBOTIC for robot #2 (USB)
- wave-scan ROBOTIC [> 55] for robot #1 (USB)
- wave-scan 3 ROBOTIC [> 63] for robot #2 (USB)
- wave-scan 3 ROBOTIC for robot #2 (LAN)

This results in the following list of OPC signals required. The different sections are described more detailed below the list in Description of Example List [> 16].

```
ALL_CTRL.IN_ERR_ACK // Section #1
ALL_CTRL.IN_HEARTBEAT
ALL_CTRL.IN_JOB_START
ALL_CTRL.IN_JOB_STOP
ALL CTRL.IN REQU CAL
ALL CTRL.IN REQU DAILY CHECK
ALL CTRL.IN REQU MAST
ALL CTRL.OUT ERR NO
ALL CTRL.OUT_ERR_STROBE
ALL CTRL.OUT_HEARTBEAT
ALL_CTRL.OUT_JOB_RUN
ALL_CTRL.OUT_JOB_SUCCESS
ALL JOB.DATA COLOR // Section #2
ALL JOB.DATA COMMENT
ALL JOB.DATA MODEL
ALL JOB.DATA PAINTLINE
ALL JOB.DATA VID
MAC1 CTRL.IN CURVATURE
MAC1 CTRL.IN ENABLE // Section #3
MAC1 CTRL.IN POINT POS
MAC1 CTRL.IN SYS ERR ACK
MAC1 CTRL.OUT CAL OK
MAC1 CTRL.OUT CORR K
MAC1 CTRL.OUT CORR Q
MAC1 CTRL.OUT CORR VAL
MAC1 CTRL.OUT CORR Z
MAC1 CTRL.OUT ERR NO
MAC1 CTRL.OUT ERR STROBE
MAC1 CTRL.OUT POINT READY
```

MAC1 CTRL.OUT POINT RESULT

MAC1 CTRL.OUT SYS ERR MAC1 POINT.IN CHECKZONE MAC1 POINT.IN POINTNR MAC2 CTRL.IN CURVATURE MAC2 CTRL.IN ENABLE // Section #4 MAC2 CTRL.IN POINT POS MAC2 CTRL.IN SYS ERR ACK MAC2_CTRL.OUT_CAL_OK MAC2 CTRL.OUT CORR K MAC2_CTRL.OUT_CORR_Q MAC2 CTRL.OUT CORR VAL MAC2_CTRL.OUT_CORR_Z MAC2 CTRL.OUT ERR NO MAC2_CTRL.OUT_ERR_STROBE MAC2_CTRL.OUT_POINT_READY MAC2_CTRL.OUT_POINT_RESULT MAC2 CTRL.OUT SYS ERR MAC2 POINT.IN CHECKZONE MAC2 POINT.IN POINTNR WAVE1 CTRL.IN ENABLE // Section #5 WAVE1_CTRL.IN_POINT_POS WAVE1_CTRL.IN_SYS ERR ACK WAVE1_CTRL.OUT_ERR_NO WAVE1_CTRL.OUT_ERR_STROBE WAVE1_CTRL.OUT_POINT_READY

WAVE1_CTRL.OUT_POINT_RESULT WAVE1_CTRL.OUT_SYS_ERR WAVE1_POINT.IN_CHECKZONE WAVE1_POINT.IN_POINTNR

WAVE2_CTRL.IN_ENABLE // Section #6 WAVE2_CTRL.IN_POINT_POS WAVE2_CTRL.IN_SYS_ERR_ACK WAVE2_CTRL.OUT_ERR_NO WAVE2_CTRL.OUT_ERR_STROBE WAVE2_CTRL.OUT_POINT_READY WAVE2_CTRL.OUT_POINT_RESULT WAVE2_CTRL.OUT_SYS_ERR WAVE2_POINT.IN_CHECKZONE WAVE2_POINT.IN_POINTNR

WAVE3_CTRL.IN_ENABLE // Section #7 WAVE3_CTRL.IN_POINT_POS WAVE3_CTRL.IN_SYS_ERR_ACK WAVE3_CTRL.OUT_ERR_NO WAVE3_CTRL.OUT_ERR_STROBE WAVE3_CTRL.OUT_POINT_READY WAVE3_CTRL.OUT_POINT_RESULT WAVE3_CTRL.OUT_SYS_ERR WAVE3_POINT.IN_CHECKZONE WAVE3_POINT.IN_POINTNR

RESULT_CTRL.IN_ACK // Section #8 RESULT_CTRL.OUT_READY RESULT_DATA.OUT_COLOR RESULT_DATA.OUT_COMMENT RESULT_DATA.OUT_DATETIME RESULT_DATA.OUT_INSTRUMENT RESULT_DATA.OUT_MODEL RESULT_DATA.OUT_PAINTLINE RESULT_DATA.OUT_STATUS RESULT_DATA.OUT_VID

For the configuration of these signals in **smart-robotic** see OPC [**>** 28].



NOTICE

1 This example list is required to describe the **corresponding** items in the configuration of **smart-robotic**.

2 The signals listed above are **examples** only – you always HAVE to adapt the signals according to YOUR configuration(!).

3.1.5 Description of Example List

The example list of OPC signals shown above consists of the following sections.

Prefix	Meaning			
ALL_CTRL	Common control items (mandatory); valid for all instruments, see Common Control Signals [> 31].			
ALL_JOB	Common job items (specific), valid for a specific car / body, see Common Job Signals [> 32].			
MAC1_xxx	Items for BYK-mac i R	OBOTIC with index 1 (mandatory)		
	MAC1_CTRL	Items for instrument control		
	MAC1_POINT	Items for measurement point / check zone		
MAC2_xxx	Items for BYK-mac i R	OBOTIC with index 2 (mandatory in case of 2nd instrument)		
	MAC2_CTRL	Items for instrument control		
	MAC2_POINT	Items for measurement point / check zone		
WAVE1_xxx	Items for wave-scan R	OBOTIC with index 1 (mandatory)		
	WAVE1_CTRL	Items for instrument control, see OPC Control Signals [> 58].		
	WAVE1_POINT	Items for measurement point / check zone, see OPC Point Signals [> 58].		
WAVE2_xxx	Items for wave-scan R	OBOTIC with index 2 (mandatory in case of 2nd instrument)		
	WAVE2_CTRL	Items for instrument control		
	WAVE2_POINT	Items for measurement point / check zone		
WAVE3_xxx	Items for wave-scan R	OBOTIC with index 3 (mandatory in case of 3rd instrument)		
	WAVE3_CTRL	Items for instrument control		
	WAVE3_POINT	Items for measurement point / check zone		
RESULT	Measurement result it	ems (specific), see Quality Alarm [> 99].		
	RESULT_CTRL	Items for result control		
	RESULT_DATA	Items for result data		
	ALL_CTRL I ALL_JOB I ALL_J	ALL_CTRLCommon control item nals [> 31].ALL_JOBCommon job items (sp [> 32].MAC1_XXXItems for BYK-mac i R MAC1_CTRL MAC1_POINTMAC2_XXXItems for BYK-mac i R MAC2_CTRL MAC2_POINTWAVE1_XXXItems for BYK-mac i R MAC2_CTRL WAVE1_CTRL WAVE1_CTRL WAVE1_POINTWAVE2_XXXItems for wave-scan R WAVE1_POINTWAVE2_XXXItems for wave-scan R WAVE1_POINTWAVE3_XXXItems for wave-scan R WAVE3_CTRL WAVE3_POINTRESULTMeasurement result it RESULT_CTRL		



NOTICE

Do not forget to adapt the list of OPC signals according to your required configuration.

3.2 Software smart-chart

The software **smart-robotic** is installed along with **smart-chart**. It offers close interworking with **smart-chart**.

If **smart-chart** is used, measurement results can be transferred automatically to **smart-chart** - according to the organizers and standards in the DB.

The software package also includes the necessary drivers for the BYK-Gardner robotic instruments.

3.2.1 Download

The software package for **BYK-mac i ROBOTIC** and **wave-scan ROBOTIC** is the same. To download the package go to following web-site:

- www.byk-instruments.com/byk-maci or
- www.byk-instruments.com/wave-scan

Via these links you can easily open and view the software package with your preferred browser application.

Opening smart-chart_7.1.1.8442.zip	×			
You have chosen to open:				
😰 smart-chart_7.1.1.8442.zip				
which is: ZIP file (561 MB)				
from: https://byk-gardner-manuals.s3.eu-central-1.amazonaws.com	n			
What should Firefox do with this file? O Open with Applications\7zFM.exe (default)				
● <u>S</u> ave File				
Do this <u>a</u> utomatically for files like this from now on.				
OK Cancel				

Illustration 5: Download-Software-Package

It is recommended to save the package on the hard drive of your PC before extraction or installation.



NOTICE

During beta phase an alternatively download link may be provided. In this case use the alternative link. It will take some time until the latest software package has been placed on our website.

3.2.2 Installation



NOTICE

You need administrator privilege on the PC in order to install the software package.

Perform following steps:

- 1. Save the ZIP file on your hard drive into a new folder.
- 2. Extract the complete ZIP archive.
- 3. In the extracted folder, right mouse click on the file "install.exe".
- 4. In the context menu select **Run as administrator**.
- 5. Follow the setup instructions on the screen.

For **smart-chart** following information is relevant:

- Program files: "C:\Program Files (x86)\BykWare\smart-chart3"
- Configuration and DB: "C:\ProgramData\BYK\smart-chart 3.0"

To start the software open the file "App.SmartChart.exe". After program start following sections are available:

- General
- smart-process
- smart-lab

For **smart-robotic** the section smart-process is relevant.

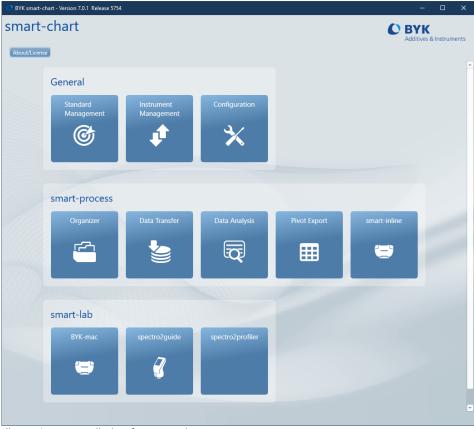


Illustration 6: Installed-Software-Package

After download and installation the software package can be used for **30 days** free trial. Thereafter, you need to register your software package. The standard delivery includes two PC licenses for the selected software package.



NOTICE

During registration you have to decide for **smart-process**. Afterwards the section **smart-lab** will not be available anymore.

In the section **General** of **smart-chart** the measurement database can be linked.

BYK smart-chart - Version 7.2.0 Release 8927			
< Configuration			X
Category	Measurement Database		
Options General Properties, Language, etc. Standard Database Standard Database Standard and Organizer database settings Instruments Instruments Rename and filter instruments and enter the network settings to detect the instruments.	SQL Server Compact database files Add database Link existing database Backup database files SQL Server connections Link existing database		
Measurement Database Measurement database settings Database Backup Database backup settings	Delete Database link Delete Data Auto data extract → DB Password		
Organizer Management Remove unused catalog entries or checkzones Schematics Manage custom schematics Catalogs Manage catalogs.			
User groups Manage user groups and permissions	Connection string: Data Source = 'C\ProgramData\BYK\smart-chart 3.0\Measurement- Data.sdf;Max Database Size = 4050;		

Illustration 7: Link to measurement database in smart-chart

The option shown above was chosen for the creation of this documentation.



NOTICE

For a productive **smart-robotic** system the option **SQL Server Connections** > **Link existing database** is recommended, see Integration [▶ 11].

3.2.3 Robotic

The software **smart-robotic** is installed along with smart-chart. For **smart-robotic** following information is relevant:

- Program files: "C:\Program Files (x86)\BykWare\smart-robotic"
- Configuration files: "C:\ProgramData\BYK\smart-robotic"

To start the software open the file "SmartRobotic.exe".

3.2.4 Runtime

Both **smart-chart** and **smart-robotic** are written in C# (C-Sharp). In order to run the program the runtime .NET core is required.

smartchart_x86_64 - InstallShield Wizard
smartchart_x86_64 requires the following items to be installed on your computer. Click Install to begin installing these requirements.
Status Requirement Pending Microsoft .NET Core Runtime - 3, 1.8(x86) Pending Microsoft ASP.NET Core Runtime - 3, 1.8(x86) Pending Microsoft .NET Core Desktop Runtime - 3, 1.8(x86) Pending Microsoft ASP.NET Core Runtime - 3, 1.8(x86) Pending Microsoft ASP.NET Core Runtime - 3, 1.8(x86)
Install Cancel

Illustration 8: Installation of smart-chart - Runtimes

If this runtime is not yet available in the system, it will be installed during the installation of **smart-chart**.

3.2.5 Upgrade

The installer for **smart-chart** will uninstall an existing installation prior to the installation of a newer software version.

In case of fallback to an older version (downgrade) deinstall the older version manually using the Windows functions.

In both scenarios the information stored in "C:\ProgramData\BYK\smart-chart" and "C:\ProgramData\BYK\smart-robotic" remains unchanged.

3.3 Robotic Instruments

The software package for **smart-chart** also includes the necessary drivers for the BYK-Gardner ROBOTIC instruments. Use these drivers to create following setups:

- 1. FTDI Driver [> 21]
- 2. USB Bulk Driver [> 22]



A WARNING

To avoid instrument damage, only use the cables which are part of the delivery for connecting the instruments!

3.3.1 FTDI Driver

The instruments **BYK-mac i ROBOTIC** and **wave scan ROBOTIC** are using an RS422 interface for data communication. They are connected via a USB to serial interface adapter with a Future Technology Devices International (FTDI) driver. The driver is available in "..\smart-chart-7.2.0.8927\Tools\USBDriver".

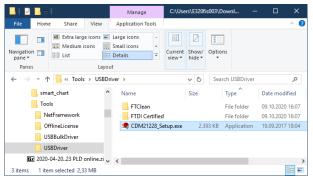


Illustration 9: FTDI driver in smart-chart software package

Perform following steps:

- 1. Extract the folder with the driver.
- 2. Run the file "CDM21228_Setup.exe".
- 3. Connect instrument via appropriate cable to your PC. Wiring details see instrument documentation.
- 4. The driver creates a new USB Serial Port (COMx).
- 5. Check the installation in the Windows device manager.

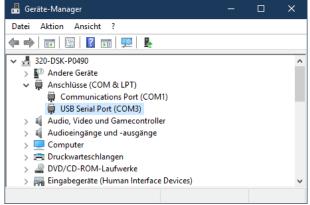


Illustration 10: COM port from FTDI driver in Windows device manager

This COM port will be used later on in **smart-robotic**.



Illustration 11: Sample test setup for wave-scan ROBOTIC

Power supply and data interface are provided to the instrument via the 9-pole RS422 plug. The data interface is provided via USB to serial adapter. This interface can also be provided through a PC interface card with physical serial ports.

3.3.2 USB Bulk Driver

The instrument **wave scan 3 ROBOTIC** is using an Ethernet interface for data communication. For system integration and test an additional USB3 port is provided. The driver is available in "..\smart-chart-7.2.0.8927\Tools\USBBulkDriver \DriverFilesWin10".

File Hom	e Share View	1							^
Navigation 100 pane + Panes	Extra large icons Medium icons List List L		Small icons → Details →	Current view *	Show/ hide •	Optio	_		
← → • •	🕨 📙 « USBBulkDriv	er >	DriverFilesWin10		~ Ū	Sea	arch DriverFiles	Win10	P
Fin	mware	^	Name				Size	Туре	(
sm	art_chart		💐 dpinst_x64.ex	e			1.016 KB	Application	0
To:	ols		💐 dpinst_x86.ex	e			894 KB	Application	(
	letFramework		usbbulk.cat				18 KB	Security C	
	IfflineLicense		USBBulk.inf				13 KB	Setup Info	(
			USBBulk.sys				38 KB	System file	(
	SBBulkDriver		USBBulkx64.s	ys			49 KB	System file	(
	DriverFiles	~	<						

Illustration 12: USB driver in smart-chart software package

Perform following steps:

- 1. Extract the folder with the driver.
- 2. Install the device driver "USBBulkx64.inf" / "USBBulkx64.sys".
- 3. Connect instrument via USB3 cable to your PC.
- 4. The driver will be installed in the Windows system.
- 5. Check the installation in the Windows device manager.

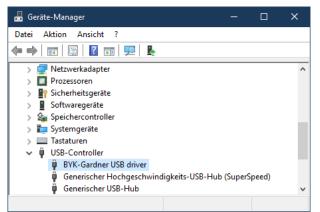


Illustration 13: USB device for wave-scan 3 ROBOTIC in Windows device manager

The new USB device will be detected later on in **smart-robotic**. A possible test setup may look like following example.



Illustration 14: Sample test setup for wave-scan 3 ROBOTIC

Power is provided to the instrument via the black 8-pole plug. The data interface for test is provided via USB. The green 4-pole plug is the Ethernet interface. It will be used in the production system. The cables are part of the instrument delivery.

4 System Basics

It is recommended to perform all steps in a test environment in a first phase and to bring the final configuration to the productive system in a second phase.

4.1 Startup

To startup the system perform following steps:

- 1. Start the OPC server.
- 2. Connect power supply to the instruments.
- 3. Connect the data cable to the instruments.
- 4. Start smart-robotic.

O smart-robotic - Version 3.0.0	-		×
		bot Simu	
Monitoring OPC Devices Output files smart-chart link			
Timestamp Category Module Information			
2020-10-08 17:41:13.458 Debug Monitoring Monitoring started.			
2020-10-08 17:41:13.510 Debug Main Creating processor			
2020-10-08 17:41:13.511 Debug MainProcessor Log service created.			
2020-10-08 17:41:13.530 Debug MainProcessor OPC common service created.			- 1
2020-10-08 17:41:13.664 Info Configuration Loading configuration			- 1
2020-10-08 17:41:15.374 Debug MainProcessor Configuration service created.			- 1
2020-10-08 17:41:15:375 Debug MainProcessor OPC common service initialized.			
2020-10-08 17:41:15.378 Warn DataFileProcessor No PELT data file source directory defined!			
2020-10-08 17:41:15.378 Warn DataFileProcessor No thickness data file source directory defined!			
2020-10-08 17:41:15:378 Info DataFileProcessor Data file processor is initialized.			- 1
2020-10-08 17:41:15:428 Error OPC Invalid Url:			- 1

Illustration 15: Initial monitoring screen in smart-robotic



NOTICE

The complete configuration of the system - including connection testing and instrument testing - takes place in **smart-robotic**; no other software is needed.

4.2 Shutdown

The shutdown procedure is the startup procedure in reverse order. Perform following steps:

- 1. Close **smart-robotic** with **Alt** + **F4** or with the **X** symbol in the upper right corner.
- 2. Disconnect the data cables from the instruments, if required.
- 3. Disconnect the power supply from the instruments, if required.
- 4. Close the OPC server.

The configuration done in **smart-robotic** is stored in an XML file. The file is placed in the folder "C:\ProgramData\BYK\Robotic". The name of the file is "Configura-tion.xml_<Timestamp>.xml".

Every day a new file is created. It is read when **smart-robotic** is started and written when **smart-robotic** is closed. Backup these files in regular intervals.

ave configuration								
Monitoring	ОРС	De	vices	Output files	smart-chart link	Robot simulato	۶r	
Timestamp	Category	Module	Information					
2020-10-08 17:50:26.17	2 Info	ImportProcessor	Importing data. W	/avescan				
2020-10-08 17:50:26.34	1 Info	WaveFileOutput	C:\ProgramData\B	3YK\Robotic\Outpu	tFiles\2020-10-08-17	-50-26-Convertible-Ro	botic.xml is successfully w	ritten
2020-10-08 17:50:26.40	16 Info	WaveFileOutput	C:\ProgramData\B	3YK\Robotic\Outpu	tFiles\2020-10-08-17	-50-26-Convertible-By	klink.xml is successfully w	ritten
2020-10-08 17:50:26.42	6 Info	WaveFileOutput	C:\ProgramData\B	3YK\Robotic\Outpu	tFiles\2020-10-08T1	7_50_12-Convertible-W	/hite-Green.xml is successf	ully written
2020-10-08 17:50:31.32	0 Info	WavescanThree 3	Instrument is disa	bled.				
2020-10-08 17:50:31.32	0 Info	WavescanThree 2	Instrument is disa	bled.				
2020-10-08 17:50:31.32	0 Info	Wavescan	Job Normal starte	d with: Information	: Car-Model = Static	n Car-Color = Black	Paint-Line = PL1 Free-Cor	nment = Cre
2020-10-08 17:50:31.32	0 Info	Bykmac 1	Instrument is disa	bled.				
2020-10-08 17:50:31.32	0 Info	Bykmac 2	Instrument is disa	bled.	changes		×	
2020-10-08 17:50:31.33	3 Info	Wavescan	Initialize	Jave	changes		^	
2020-10-08 17:50:31.34	4 Info	Wavescan 1	Prepare measuring	g				
2020-10-08 17:50:35.73	1 Info	Wavescan 1	Start measuring		🔊 The configurati	on has not saved chang	es! Would you like to	
2020-10-08 17:50:35.82	3 Info	Wavescan 1	Command sent.		save them?			
2020-10-08 17:50:39.23	2 Info	Wavescan 1	Measuring ended.	.				
2020-10-08 17:50:39.78	7 Info	Wavescan 1	Read data.		Г			
2020-10-08 17:50:40.96		Wavescan 1	Prepare measuring	g		Ja N	ein Abbrechen	
2020-10-08 17:50:42.24		Wavescan 1	Device idle.					
2020-10-08 17:50:42.58		Opc ALL_JOB	Job stop					
2020-10-08 17:50:42.84		ImportProcessor	Importing data. W					
2020-10-08 17:50:43.14		WaveFileOutput					ic.xml is successfully writte	
2020-10-08 17:50:43.16		WaveFileOutput				· · · · · · · · · · · · · · · · · · ·	k.xml is successfully writte	
2020-10-08 17:50:43.18		WaveFileOutput		3YK\Robotic\Outpu	tFiles\2020-10-08T1	7_50_31-Station -Black-	Green.xml is successfully v	written
2020-10-08 17:51:44.36	i0 Info	Main	Stop services					

Illustration 16: Shutdown smart-robotic - confirmation message

In the upper left corner the button **Save Configuration** is available. It is recommended to click this button after important changes. This writes all configuration data immediately into the XML file – without the need of closing the application. The button is inactive if no changes took place after last save.



NOTICE

If you have unsaved changes in the configuration, a confirmation message is displayed. You can close and save, close without saving or abort the program shutdown.

4.3 Monitoring

On the **Monitoring** tab all important system messages are displayed. This tab is used to check the logging of events such as errors, warnings, debug events and info.

The log files are placed in the folder "C:\ProgramData\BYK\smart-robotic\Logs". Every day a separate file is written. Backup these files in regular intervals.

smart-robo	tic - Version 3	.0.0						-		;
									bot Sim	
Monitorin	9	OPC	De	vices	Output files	smart-chart link				
Timestamp		Category	Module	Information						
2020-10-08	17:58:30.416	Debug	Monitoring	Monitoring s	tarted.					
2020-10-08	17:58:30.470	Debug	Main	Creating pro	cessor					
2020-10-08	17:58:30.471	Debug	MainProcessor	Log service o	reated.					
2020-10-08	17:58:30.491	Debug	MainProcessor	OPC commo	n service created.					
2020-10-08	17:58:30.623	Info	Configuration	Loading cont	figuration					
2020-10-08	17:58:35.771	Exception	Bykmac 1	WaitForData	Timeout waiting data					
2020-10-08	17:58:36.563	Info	Wavescan 1	Device found	on COM3 with Cat.Nr	4822 and Serial Nr: 1213	324			
2020-10-08	17:58:38.229	Debug	MainProcessor	Configuratio	n service created.					
2020-10-08	17:58:38.261	Debug	MainProcessor	OPC commo	n service initialized.					
2020-10-08	17:58:40.794	Warn	DataFileProcessor	No PELT data	a file source directory d	efined!				
	17:58:40.795		DataFileProcessor	No thickness	data file source direct	ory defined!				
	17:58:40.795				cessor is initialized.					
	17:58:40.791		COM1	Port is alread						
	17:58:46.873				Timeout waiting data					
	17:58:48.020			Check device						
	17:58:48.037		WavescanThree							
	17:58:48.047				ed with IP address:					
	17:58:48.171		WavescanThree							
	17:58:48.181		WavescanThree							
2020-10-08	17:58:48.192	Info	WavescanThree	Device skipp	ed with IP address:					

Illustration 17: Monitoring screen in smart-robotic

Following colors are used:

- White: Debug / Information
- Red: Error / Exception
- Yellow: Warning

The entries can be sorted by clicking into the corresponding tab. A 2^{nd} click inverts the sorting.



NOTICE

For more details on the error messages see Error Handling [> 46].

4.4 Operation

When all configuration and testing has finished in the test system the final configuration can be delivered to the productive system. Perform following steps:

- 1. Setup the productive system.
- 2. Copy the XML configuration file for **smart-robotic**.
- 3. Place it in the program folder for the productive system.
- 4. Start **smart-robotic** it in the productive system.
- 5. Make all necessary adaptations and save.
- 6. Restart **smart-robotic**.

The application is now listening to OPC signals coming from the OPC server. When the signals arrive, the measurements are started according to the operation modes described in Run Procedure [▶ 146].

5 OPC

On the tab **OPC** the connection to the OPC server and the communication between OPC server and **smart-robotic** is configured.

This communication is based on "OPC signals". In general an OPC signal is defined by its type and by its content / data. Different types of signals are supported.

Following information is provided:

- 1. OPC Signal Basics [> 28]
- 2. OPC Server Settings [> 29]
- 3. Common Control Signals [> 31]
- 4. Common Job Signals [> 32]

5.1 OPC Signal Basics

The communication between **smart-robotic** and OPC server is based on OPC signals. The OPC signals carry data e.g. to initialize the measurement instruments and hand over information about the measurement object from the PLC to **smart-robotic**.

Signal Types

In **smart-robotic** different types of OPC signals are used for communication:

- Control Signals
- Job Data
- Point Data

Control Signals

Control data is needed for the operation of the measuring head. They represent a so called handshake to the PLC. Here information is handed over such as start measurement, measurement finished or errors. Control data is handed over for a complete measuring instrument group and separately for each **BYK-mac i RO-BOTIC** or **wave-scan ROBOTIC**.

Example: IN_JOB_START = Start a new measurement series on a car body.

Job Data

General data for a job. A job is e.g. a vehicle or a component and can consist of many measuring points. These data are valid for all measuring instruments used in a group.

Example: TYPE = Denotes the model of the measured car body, e.g. "SUV".

Point Data

General data for a measuring point, for example measuring point coordinates or point numbers. These data are handed over separately for each measuring instrument.

Example: PART = Denotes the measured part on the car body, e.g. "Roof".

OPC Naming Conventions

All signals must have one of the following group names be placed in front - according to their function:

- ALL_CTRL: Contains general control data, job start, error handshake etc. for a group.
- ALL_JOB: Contains all job data for a group.
- MAC1_CTRL: Addresses a **BYK-mac i ROBOTIC** with index 1.
- MAC1_POINT: Contains check point data for a **BYK-mac i ROBOTIC** with index 1.
- WAVE1_CTRL: Addresses a **wave-scan ROBOTIC** with index 1.
- WAVE1_POINT: Contains check point data for a **wave-scan ROBOTIC** with index 1.

For all signals a prefix must be defined and preset in the OPC server configuration as well as in the OPC settings of **smart-robotic**, see also OPC Signals.

5.2 OPC Server Settings

Click on the tab **OPC Server Settings**.

🔕 smart-robotic - Version 3.0.0		×
Save configuration	Robot Sim	
Monitoring OPC Devices Output files smart-chart link		
OPC Server settings Common control signals Common Job signals		
OPC Settings		
Host localhost		
Server INAT TcplpH1 OPC Server Browse Server found		
Prefix / Group BYKLINK Browse Prefix found		
 Flat signal definition Legacy BYKlink error handling (Restart needed) 		

Illustration 18: OPC server settings

Perform following steps:

1. **Host**: Enter hostname or IP address of the machine where the OPC server is installed. In the example shown above the OPC server is installed on the same machine as **smart-robotic**. 2. **Server**: Enter the name / ID of the OPC server. This ID is manufacturer dependent and must be taken from the documentation of the OPC server. Alternatively click the **Browse** button to select the OPC server. All servers available on the target machine are displayed. In the sample shown below one server was found - supporting the protocols Data Access V1 and V2.

Local Data Access V1	
INAT TcplpH1 OPC Server (3DA28330-68CB-11D2-9C65-0021A0020009) INAT TcplpH1 OPC Server INAT TcplpH1 OPC Server Data Access V2 INAT TcplpH1 OPC Server	
(3DA28330-68CB-11D2-9C65-0021A0020009) INAT TcplpH1 OPC Server INAT TcplpH1 OPC Server Data Access V3 Network	

Illustration 19: OPC server list on target machine

Prefix / Group: Enter a unique name under which all smart-robotic signals are summarized in the OPC signal definition, see Example List of OPC Signals [▶ 14]. This comprises control signals, job signals and a group item for each individual instrument. This unique group item ensures that the correct instrument is addressed always (and this one only).

 opcda://localhost/INAT TcplpH1 OPC Server 	
- BYKLINK	
ALL_CTRL	
MAC1_CTRL	
MAC2_CTRL	
WAVE1_CTRL	
WAVE2_CTRL	
RESULT CTRL	
RESULT_DATA	
ALL JOB	
MAC1_POINT	
WAVE1_POINT	
MAC2_POINT	
WAVE2_POINT	
WAVE3_CTRL	
 WAVE3_POINT 	
WAVE3_POINT.IN_POINTNR	
WAVE3_POINT.IN_CHECKZONE	
YKLINK	
	OK Cancel

Illustration 20: OPC items with hierarchical structure / grouping

4. Flat Signal Definition: Activate this option if the Prefix / Group does not have a hierarchy (not recommended). In the OPC signal definition hierarchies / subgroups are formed by e.g. points as with MAC1_CTRL.IN_ENABLE. If the OPC server does not offer any hierarchies the checkbox must be activated, then MAC1_CTRL_IN_ENABLE is a single signal and not a signal of the group MAC1_CTRL.

 op 	cda://localhost/INAT TcplpH1 OPC Server	^
-	BYKLINK	
	ALL_CTRL_IN_HEARTBEAT	
	ALL_CTRL_IN_ERR_ACK	
	ALL_CTRL_IN_JOB_START	
	ALL_CTRL_IN_JOB_STOP	
	ALL_CTRL_IN_REQU_CAL	
	ALL_CTRL_IN_REQU_MAST	
	ALL_CTRL_IN_REQU_DAILY_CHECK	
	ALL_CTRL_IN_REQU_MODE5	
	ALL_CTRL_IN_REQU_MODE6	
	ALL_CTRL_IN_REQU_MODE7	
	ALL_CTRL_IN_REQU_MODE8	
	ALL_CTRL_IN_REQU_MODE9	
	ALL_CTRL_OUT_HEARTBEAT	
	ALL_CTRL_OUT_ERR_STROBE	
	ALL_CTRL_OUT_JOB_RUN	
	ALL_CTRL_OUT_JOB_SUCCESS	
	ALL_CTRL_OUT_ERR_NO	
	ALL_JOB_DATA_BYTE	
		~

Illustration 21: OPC items with flat structure / no grouping

Legacy BYKlink Error Handling: Check this option to activate the global error handling. Uncheck this option to activate instrument-specific error handling. For more details see Error Handling [> 158] in the appendix.



NOTICE

1 In earlier versions of **smart-robotic** the "OPC signals" were referenced as "OPC items".

- 2 The list of signals must match on OPC server and in **smart-robotic**.
- 3 "BYKlink" was the predecessor of the software **smart-robotic**.

5.3 Common Control Signals

The **Common OPC Control Signals** (ALL_CTRL) define high level commands which can be executed by the PLC.

🔘 smart-robotic - Versio	on 3.0.0				-		×
Save configuration						oot Simul	
Monitoring	OPC	Devices	Output files	smart-chart link			
OPC Server settings	Common control items	Common Job items					
Common OPC con	ntrol items (ALL_CTRL)						
Name	Туре	Connection					
IN HEARTBEAT IN ERR, ACK IN, JOB, START IN, JOB, STOP IN, REQU, CAL IN, REQU, CAL IN, REQU, CAL IN, REQU, CAL IN, REQU, CAL IN, REQU, CAL OUT, ERR, STROBE OUT, JOB, SUCCESS OUT_ERR, NO	boolean boolean boolean	Connected Connected Connected Connected Connected Connected Connected Connected Connected Connected					

Illustration 22: Common OPC control signal in status Connected

Perform following steps:

- 1. Click the tab Common OPC Control Signals.
- 2. Check if the connection status is **Connected**.

3. If status is **Not found**, check / edit the signals in the OPC server and restart **smart-robotic**.

The common OPC control signals are well known in **smart-robotic**. Thus they have a fix implementation here – there is no need to manage these items (add / modify / delete).

5.4 Common Job Signals

By using these types of parameters the data can be accordingly filtered and analyzed. This is not mandatory and may be skipped (not recommended).

The **Common Job Signals** (ALL_JOB) define the necessary information to store the measurement results for the corresponding object in the **smart-chart** database:

- Model
- Color
- Paintline
- Comment
- Vehicle ID

Perform following steps:

- 1. Click the tab **Common Job Signals**.
- 2. Add a new entry by clicking on the button **Add**.
- 3. Modify an existing entry by clicking on the button Edit.
- 4. Delete an existing entry (without confirmation) by clicking on the button **Remove**.
- 5. Check if the connection status for all signals is **Connected**.
- 6. If status is **Not found**, check / edit the signals in the OPC server and restart **smart-robotic**.

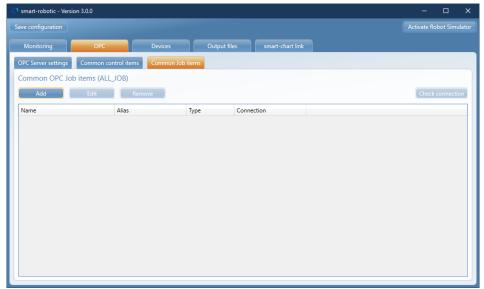


Illustration 23: Common job signals – initial state

When adding or editing a signal, a dialogue box opens.

🜔 smart-robotic - Versi	on 3.0.0				-		×
Save configuration						oot Simu	
Monitoring	OPC De	vices Output file	smart-chart link				
OPC Server settings	Common control items	mmon Job items					
Common OPC Jol	b items (ALL_JOB)						
Add	Edit Remove				Check c	onnectio	on
Name	Alias	Туре	Connection				
		Edit Opc Item Add new ALL_JOB item Name IDATA_MODEL Alias Car-Model Tyre String	• OK Cancel	× •			

Illustration 24: Common job signals – adding a new entry

A job item has following parameters:

- 1. **Name**: Corresponds to the OPC item on that occasion, it must be defined precisely as in the OPC server configuration, e.g. DATA_MODEL.
- 2. Alias: A free value. Under this name the parameter can be used for outputting the measurement result files and for naming the files.
- 3. Type: Defines the parameter type used.
 - Boolean
 - Double
 - Float
 - Integer
 - String



NOTICE

For **Name** and **Alias** the value can be entered manually or via copy / paste function.

The results can look like the following.

Monitoring IPC Server settings Cor	OPC Device					
C Server settings		s Outpu	t files smart-chart link	Robot simulator		
re server settings	mmon control signals	mon Job signals				
ommon OPC Job sigr	nals (ALL_JOB)					
Add	dit Remove				Check	onnectio
Name	Alias	Type	Connection			
DATA_MODEL DATA_COLOR	Car-Model Car-Color	String	Connected Connected			
DATA_COLOR DATA_PAINTLINE	Paint-Line	String	Connected			
DATA_COMMENT	Comment	String	Connected			
DATA_VID	Vehicle-ID		Connected			

Illustration 25: Common job signals – all entries created and connected With this step the OPC configuration in smart-robotic is finished.

6 Devices

On the tab **Devices** the measurement instruments can be configured and tested. There are two groups of instruments:

- 1. Color measurement: BYK-mac instruments
- 2. Appearance measurement: wave-scan instruments

Each group provides two buttons:

- 1. Add: Create an entry for each measurement instrument attached in the robotic system or test environment. When adding a wave-scan, select the type – wave-scan 2 or wave-scan 3.
- 2. **Remove**: Remove the selected entry from the instrument group.

Up to 9 **BYK-mac i ROBOTIC** and 9 **wave-scan ROBOTIC** can be operated within each device group (with index 1 ... 9).

🜔 smart-robotic - Version 3.0.0								×
							oot Simula	ator
Monitoring	ОРС	Devices	Output files	smart-chart link				
BYKmac instruments								
Add Partners Add Wavescan 2 Wavescan 3 Wavescan 3								

Illustration 26: Device-Management-Main

The number is the index for the measuring head. This index is used to identify the instrument in all signals and error messages – for example:

- MAC1_CTRL = OPC control items for the 1st **BYK-mac i ROBOTIC**
- MAC2_CTRL = OPC control items for the 2nd BYK-mac i ROBOTIC

Following BYK-Gardner robotic instrument types can be created:

- 7036 BYK-mac i ROBOTIC [> 36]
- 4822 wave-scan ROBOTIC [> 55]
- 7410 wave-scan 3 ROBOTIC [> 63]

The sequence of configuration steps required is nearly the same, but the configuration details are different for each type.



The BYK-mac i ROBOTIC (catalog number 7036) is the BYK-Gardner colorimeter for effect colors.



Illustration 27: BYK-mac-i ROBOTIC

For product details see: <u>https://www.byk-instruments.com/p/7036</u>. The product operation is described in:

• Operating Instructions: 300 000 877 - 1309

The configuration comprises following steps:

- 1. Connection Settings [> 37]
- 2. Device Configuration [38]
- 3. OPC Control Signals [> 39]
- 4. OPC Point Signals [▶ 40]
- 5. Device Calibration [> 42]
- 6. Error Handling [> 46]
- 7. Device Test [47]

These steps are described below.



NOTICE

If necessary, restart smart-robotic in order to take changes made to the configuration into effect.

6.1.1 Connection Settings

The BYK-mac i ROBOTIC communicates via RS422 with smart-robotic, see FTDI Driver [> 21]. It requires a COM port.

Smart-robotic - Version 3.0	b.0			- 🗆 X
Save configuration				Activate Robot Simulator
Monitoring	OPC Devices	Output files	smart-chart link	
BYKmac instruments	OPC point items	Calibration	Error handling	Device Test
Index Type 1 bykmac	Connection Settings		Configuration	OPC control items
2 bykmac	bykmac 1 Settings			
	Port COM3 Baudrate			
		57600		
	Check connection Connected	7026 51 00 56		
	BYK-mac Ser.Nr: 1056565 Cat.N	Ir: 7036 Firmware: 09.56		
Add Remove				
wave-scan instruments				
Index Type				
1 Wavescan 2 WavescanThree				
3 WavescanThree				

Illustration 28: BYK-mac i ROBOTIC – Connection details

Perform following steps:

- 1. Choose the correct COM port to establish a connection to the device.
- 2. Use the button Check connection to verify the connection.

You can select only free COM ports here. If you try a COM port which is already in use, you get a system message.

Smart-robotic - Version 3.0.0						-		×
							oot Simu	
Monitoring	ОРС	Devices	Output files	smart-chart link				
BYKmac instruments	OPC p	oint items	Calibration		Error handling	Device Test		
Index Type 1 bykmac	с	onnection Settings		Configuration		OPC control items		
2 bykmac	bykmac 1 S	Settings						
	Port COM3	Baudrate	57600					
	Check conne		51000					
		er.Nr: 1056565 Cat.Nr:	7036 Firmware: 09 56					
	or a made of							
Add Remove			rror		×			
		E	rror		^			
wave-scan instruments			COM1 is used f	or other instrument!				
Index Type 1 Wavescan								
2 WavescanThree 3 WavescanThree				ОК				
3 WavescanThree								

Illustration 29: BYK-mac i ROBOTIC – COM port selection

In this case you have following options:

- Choose another COM port.
- Unassign the COM port from the other device.

You can unassign a COM port by selecting a different COM port or by deleting the device.

6.1.2 Device Configuration

This Configuration tab manages the measurement data captured by the respective instrument.

smart-robotic - Version 3.0.0)			- 🗆 X
				Activate Robot Simulator
Monitoring	OPC Devices	Output files smart-	chart link	
BYKmac instruments	OPC point signals Connection Settings	Calibration	Error handling	Device Test OPC control signals
1 bykmac 2 bykmac	bykmac 1 Configuration	Color data		OPC control signals
	Temp. Alarm Min 10 °C / 50 °F Temp. Alarm Max 45 °C / 113 °F	Color Spectrum		
Add Remove	Illumination / Observer D65/10			
wave-scan instruments Index Type 1 Wavescan 2 WavescanThree 3 WavescanThree	5			

Illustration 30: BYK-mac i ROBOTIC – Configuration details

You have following options:

- Temperature control: Sends an alarm if the measurement surface temperature is out of the given limits.
 - Temperature Alarm Minimum: Send alarm, if temperature is below this value.
 - Temperature Alarm Maximum: Send alarm, if temperature is above this value.
- Illumination/Observer: Defines the measurement conditions. Default is D65 (Daylight) and 10° for the observer.
- Maximum number of position adjustments: Sets a limit to the number of position corrections the BYK-mac i ROBOTIC can reach before skipping a check zone. Range is 5..15. Recommended is a maximum of 10.
- Color Data / Effect Data / Color Spectrum: If activated, the BYK-mac i ROBOTIC performs all these measurements sequentially.



NOTICE

These configurations options are known from smart-chart. For the hand-held instruments, these configurations are covered by the smart-chart items Standard and Organizer Management.

6.1.3 OPC Control Signals

Control data are compellingly necessary for the operation of the measuring head, the symbolic names are fix defined in smart-robotic.

The control data are to be found in the OPC group of MACx_CTRL, the x stands for the index of the current BYK-mac i ROBOTIC.

Monit	oring	ОРС	Devices	Output file	es smart-ch	nart link		
/Kmac	instruments	OPC poi	nt signals	Calibr	ation	Error handling	Device Test	
Index	Туре	Cor	nnection Settings		Configur	ation	OPC control signals	
1 2	bykmac bykmac	MAC1_CTRL	signals					
		Name		Туре	Connection			
		IN_ENABLE		boolean	Connected			
		IN_POINT_PO		boolean	Connected			
		IN_SYS_ERR_4		boolean	Connected			
		OUT_SYS_ERF		boolean	Connected			
		OUT_CAL_OK		boolean	Connected			
Add	Remove	OUT_CORR_V		boolean	Connected			
Add	Keniove	OUT_POINT_F		boolean	Connected			
		OUT_POINT_F		boolean	Connected			
		IN_CURVATUR		short	Connected			
ave-sc	an instruments			short	Connected			
Index	Туре	OUT_CORR_K		short	Connected			
	Wavescan	OUT_CORR_C		short	Connected			
2	WavescanThree	OUT_ERR_NO		boolean	Connected			
3	WavescanThree	OUT_ERR_STR	OBE	boolean	Connected			

Illustration 31: BYK-mac i ROBOTIC – OPC control signals

Perform following steps:

- 1. Click the OPC control signals tab.
- 2. Check if the connection status is Connected, see also Control Signals for BYKmac i ROBOTIC [▶ 13].
- 3. If status is Not found, check / edit the signals in the OPC server and restart smart-robotic.

The OPC control signals have following meaning.

Symbol / Signal	Description
IN_ENABLE	The BYK-mac i ROBOTIC is chosen.
IN_POINT_POS	The measuring point hit.
IN_CURVATURE	Surface curvature at the measuring point.
IN_SYS_ERR_ACK	System error acknowledged.
OUT_SYS_ERR	System error, measurement series aborted.
OUT_CAL_OK	At present not used, must be existing, however.
OUT_CORR_VAL	Correction values valid.
OUT_POINT_READY	Point finished, off to the next one.
OUT_POINT_RESULT	Measurement at the point was successful
OUT_CORR_Z	Correction value distance (1/1000mm).
OUT_CORR_K	Correction value tilt angle K (1/1000°).
OUT_CORR_Q	Correction value tilt angle Q (1/1000°).
OUT_ERROR_NO	The number / ID of a system error.
OUT_ERROR_STROBE	The details for the system error.

These OPC control signals are predefined by smart-robotic.

6.1.4 OPC Point Signals

Point data give information to a measuring point. If they are defined, this information is stored internally with the results of measurement of this point and are available by the symbolic names for outpassing with the measuring data. The list of symbols can be defined at will.

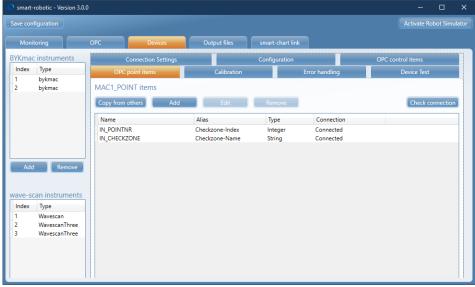


Illustration 32: BYK-mac i ROBOTIC – Add OPC point items

In the OPC server configuration these signals must be compellingly contained then. The point data are to be found in the OPC group of MACx_POINT. The x stands for the current number of the BYK-mac i ROBOTIC in the plant.

Perform following steps:

- 1. Click the OPC control items tab.
- Check if the connection status is Connected, see also Example List of OPC Signals [▶ 14].
- 3. If status is Not found, check / edit the items in the OPC server and restart smart-robotic.

In the example shown above following OPC signals have been created:

- MAC1_POINT.IN_POINTNR: The PLC / robot programmer can send (increasing) **number** > smart-robotic can map it to the correct check zone in smart-chart.
- MAC1_POINT.IN_CHECKZONE: The PLC / robot programmer can also send the correct check zone **name** > in this case no additional mapping is necessary.

An example list of defined signals may look like the following.

OPC item	Alias	Туре	Description	
PART	Part	String	Part number	
POINT	Point	String	Measuring point number	
ROBOTX	robot_x	Integer	X-coordinate of measuring point	
ROBOTY	robot_y	Integer	Y-coordinate of measuring point	

It is also possible to copy existing OPC point items from another device (if already created in that device). Click the Copy from others button.

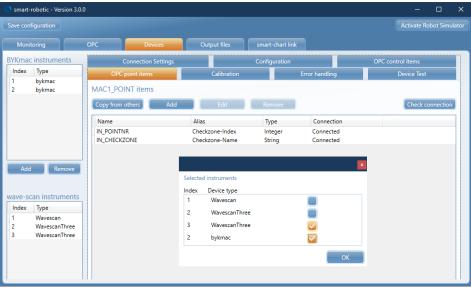


Illustration 33: BYK-mac i ROBOTIC – Copy OPC point signals

The dialog box Selected instruments opens. It lists all devices created in the system. The copy from function works as a pure adding – if the selected instrument has no items created, no item will be added (and no item will be deleted).

6.1.5 Device Calibration

On this screen the calibration and check details can be configured.

Smart-robotic - Version 3.0.0									□ ×
Monitoring	орс	Devices	Outpu	t files	smart-chart	link			
BYKmac instruments	С	Connection Settings			Configuration		OP	C control signals	
Index Type	OPC p	oint signals		Calibration	n Error handling Dev			Device Test	
1 bykmac 2 bykmac	bykmac 1 In	strument calibrati	ion and sta	indards					
	Color standard		Permissible						
	Angle L*	a* b*		dL* +/-da	* +/-db*				
	-15° 80.27	-12.78 11.70	-15° 0.5	1 0.51	0.51				
	15° 81.22	-13.07 12.28	15° 0.5		0.51				
	25° 80.77	-13.11 12.38	25° 0.4		0.41				
	45° 80.89 75° 81.36	-13.17 12.57	45° 0.3 75° 0.3		0.31				
Add Remove	75° 81.36 110° 78.74	12.96 12.24 12.49 11.81	75° 0.3 110° 0.3		0.31				
			110 0.5						
	Effect standard		-	Graininess					
wave-scan instruments	Angle S_i mir 15° 14.6		-		G max				
Index Type 1 Wavescan	45° 14.9	17.9 28.0 18.2 24.6	34.2 30.1	7.7	8.0				
2 WavescanThree	75° 16.2	19.8 19.1	23.4						
3 WavescanThree		1 1	1						
	Calibratic	on sequence				Daily check see	quence		
	1. On wi	hite tile			Calibration	On white tile			
		Pin calibration				🔽 P	in calibration		
		White calibratio	n				leasurement		
		Effect calibration	-						
Add Remove									
		Measurement							
	2. On Co	olor Checking Standar	ď		Color check	On Color Ch	ecking Standard		
		Check measurer	ment			🔽 c	heck measurement		1
	3. On Eff	fect Checking Standar	rd		Effect check	On Effect Ch	ecking Standard		64
		Check measurer	ment			💟 c	heck measurement		

Illustration 34: BYK-mac i ROBOTIC – Calibration

The check and calibration details comprises following items:

- 1. Data in Certificate [> 42]
- 2. Calibration Sequence [▶ 44]
- 3. Daily Check Sequence [> 45]

Make sure that the configured sequence is also programmed in the robot sequence.

6.1.5.1 Data in Certificate

The BYK-mac i ROBOTIC comes with three different standard tiles:

- 1. White: Calibration tile
- 2. Green: Color check tile
- 3. Silver: Effect check tile

These tiles and their measurement values are instrument specific and can vary from instrument to instrument. Therefore, the values and tolerances of color check tile and effect tile must be filled in. The color and effect standard values and tolerances are documented in the certification letter which is delivered with the instrument. The serial number of the device is important here.

O BYK		olicate rtifica 180709	ate 970366	565	lac		ALERATION LABORATORY tifficate No. AC-1
Instrument Standard White Calibration Standard Cat.No. 6331	Ser.No	.: 1056565					
white Galibration Staffdard Cat.No. 6331		L*	a*	b*			
	-15°	97.64	-0.24	0.17			
	15°	99.08	-0.15	0.18			
	25°	99.01	-0.12	0.09			
	45°	99.07	-0.05	0.30			
	75°	98.63	-0.07	0.30			
	110°	94.95	-0.09	0.36			
Spectral Data:	nm	-15° (%)	15° (%)	25° (%)	45° (%)	75° (%)	110° (%)
	400	92.47	96.51	96.49	96.58	95.35	86.30
	410	92.94	96.86	96.71	96.75	95.63	86.41
	420	93.23	96.98	96.89	96.80	95.69	86.51
	430	93.41	96.98	97.08	96.86	95.66	86.71
	440	93.69	97.17	97.29	97.03	95.80	86.91
	450	93.78	97.41	97.40	97.18	96.08	87.00
	460	93.99	97.65	97.52	97.33	96.33	87.12
	470	94.11	97.73	97.56	97.42	96.44	87.24
	480	93.98	97.59	97.42	97.37	96.38	87.31
					07.00		
	490 500	93.96 94.11	97.51 97.65	97.34 97.47	97.36 97.47	96.28	87.40

Illustration 35: BYK-mac i ROBOTIC – Certificate / header

The standard values to be entered in smart-robotic can be found in the lower part of the certificate.

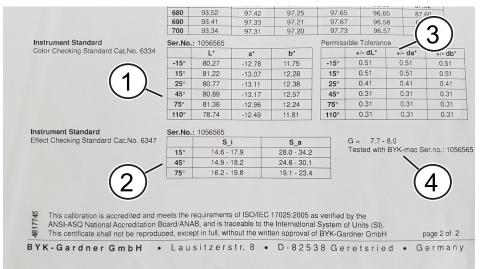


Illustration 36: BYK-mac i ROBOTIC - Certificate / standards

- 1 Color standard values 3 Permissible tolerances
- 2 Effect standard limits 4 Graininess

Click the button Save configuration to write the new configuration data immediately into the XML file.



NOTICE

- 1 Checks are recommended daily.
- 2 Calibration is recommended monthly.
- 3 New certificate is recommended yearly.

6.1.5.2 Calibration Sequence

The calibration performs following steps – details see Device Test [> 47]:

- 1. On white calibration tile:
 - Pin calibration
 - White calibration
 - Effect calibration
 - Measurement
- 2. On green color check tile:
 - Color check
- 3. On silver effect check tile:
 - Effect check

The sequence of the process for calibration can be set:

- 1. Calibration always takes place first and can not be swapped.
- 2. The test of color and effect can be swapped. Click on the green double arrow to the right of the tests.

The standards are mounted to the wall in the robot cell. For calibration and test, the robot first runs over the white standard, then over the green and finally over the silver standard.

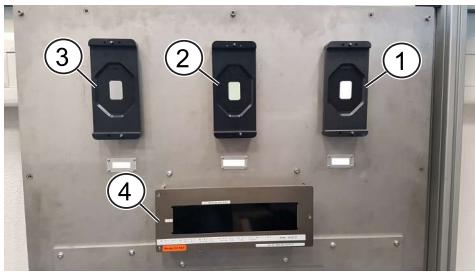


Illustration 37: BYK-mac i ROBOTIC - Calibration sequence

- 1 White: BYK-mac i ROBOTIC calibration tile
- 2 Green: BYK-mac i ROBOTIC color check tile
- 3 Silver: BYK-mac i ROBOTIC effect check tile
- 4 Black: wave-scan ROBOTIC check tile (see Daily Check [> 61])

All standards provide an orientation:

- 1. One pin is located in the middle.
- 2. One pin is located outside the middle.

These pins can be used to fit the instrument precisely to the standard. Make sure to mount the standards with correct orientation to the wall.

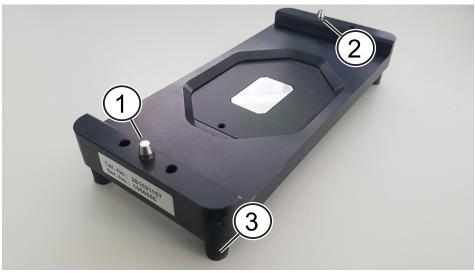


Illustration 38: BYK-mac i ROBOTIC – Effect check standard

- 1 Pin is located in the middle.
- 2 Pin is located outside the middle.
- 3 Rubber buffers are damping movements.

During calibration, the measured values are compared with the standards belonging to that specific instrument.



NOTICE

1 It is recommended to mount the tiles vertically. This avoids collection of dust on the tiles, which could falsify the calibration and test process.

2 Make sure the four rubber buffers on the feet of each standard are in place and in good condition. Order spare parts if necessary.

6.1.5.3 Daily Check Sequence

This sequence is linked to the calibration sequence. The daily check performs following steps:

- 1. On white calibration tile:
 - Pin calibration
 - Measurement
- 2. On green color check tile:
 - Color check
- 3. On silver effect check tile:
 - Effect check

The color and effect check only checks the values of the measurment. There is no change in the device. It is up to the PCL programmer how often the "daily check" should take place.



NOTICE

For more details on calibration and check see Device Test [47].

6.1.6 Error Handling

On the Error Handling tab possible error messages for the BYK-mac i ROBOTIC are listed.

ve configuration											
Monitoring	ОРС	De	vices	Output fi	les sr	nart-chart link					
Kmac instruments		Connection	Settings		Co	nfiguration			OPC contro	ol signals	
ndex Type	OPC	C point signal	s	Calib	ration		Error handlin	9	۵	Device Test	
bykmac bykmac	Dec	Hex	Error descri	ption				System error			
	32771	0x8003	Wrong con	nmand paramet	er				^		
	32772	0x8004	Error CRC								
	32773	0x8005	Error black	calibration							
	32774	0x8006	Memory fu	I							
	32775	0x8007	Maximum r	number reached	ł						
Add Remove	32776	0x8008	Data could	not be deleted							
	32777	0x8009	Organizer r	not found							
ve-scan instrument	32778	0x800A	Wrong ider	ntification							
ndex Type	99100	0x1831C	Maximum I	Number of Adju	istments excee	ded					
Wavescan	99200	0x18380	Distance to	surface too sm	all						
WavescanThree WavescanThree	99201	0x18381	Distance to	surface too big)						
wavescaninree	99202	0x18382	Pin check e	rror							
	99300	0x183E4	Calibration	error							
	99301	0x183E5	A check me	asuring is out o	of the valid ran	ge					
	98001	0x17ED1	Adjustment	t read error							
	98002	0x17ED2	Measureme	ent error							
Add Remove	98003	0x17ED3	Measureme	ent read error					~		
	<							>			

Illustration 39: BYK-mac i ROBOTIC – Error handling

Two types of error are possible:

- Red: System error
- Grey: No system error

In case of a system error the measurement will be aborted. Click the option System Error to the right of an entry to mark this entry accordingly. For more details see Error Handling [▶ 158] in the appendix.



NOTICE

- 1 Some entries are always system errors and can not be deactivated.
- 2 Some entries are never system errors and can not be activated.

6.1.7 Device Test

The Device Test offers functions for measurement, check and calibration of the instrument. Additionally, the position adjustment using the instrument pins can be checked.

Smart-robotic - Version 3.0	.0						-	⊐ ×
								t Simulator
Monitoring	ОРС	Devices Out	put files	smart-chart li	nk			
BYKmac instruments	Co	nnection Settings	-	Configuration		O	PC control items	
Index Type	OPC pc	int items	Calibration		Error handlin	9	Device Test	
1 bykmac	bykmac 1 D	wine check						
2 bykmac	1							
	Instrument: Cor	nnected						
	Initialize							
	Measure							
	Read data							
Add Remove	Calibrate on v	vhite						
	Check cold	or						
wave-scan instruments	Check effe	ct						
Index Type	Curvature	Z [mm] K [deg	ree] Q[degree]	Status			
1 Wavescan 2 WavescanThree	Medium					Check adjus	stment	
3 WavescanThree							\sim 1	_
	Curvature	Positioning +/- Distance / K – / Q -Angle	Positioning Pins	Swinging min / max	Control Delta Pins			
		Distance / K - / Q -Angle	min / max	Distance	Della Pilis	BYK-mac ROBOTIC		
	flat	0,05 / 0,025° / 0,05°	+/- 0,15	+/- 0,10	+/- 0,2		q	
	low	0,05 / 0,025° / 0,05°	+/- 0,3	+/- 0,15	+/- 0,45	к		
	medium	0,10 / 0,050° / 0,10°	+/- 0,6	+/- 0,2	+/- 0,8 +/- 1,5)
	high OFF	0,20 / 0,10° / 0,20°	+/- 1,2	+/- 0,3	+/- 1,5	. t-	Z = Distance	1.1
Add Remove			1	1		· ++	L - Distance	++

Illustration 40: BYK-mac i ROBOTIC - Device-test initial state

To test the device perform following steps:

- 1. Initialize
- 2. Measure
- 3. Read data
- 4. Calibrate on white
- 5. Check color
- 6. Check effect

These steps are described below.



NOTICE

Make sure the standard values given in the certificate for your instrument have been stored in smart-robotic, see Data in Certificate [▶ 42]. Otherwise the device test will not finish successfully.

6.1.7.1 Initialize

To initialize the device test perform following steps:

- 1. Make sure the instrument is connected see Connection Settings [> 37].
- 2. Remove the dust protection from one of the standards.
- 3. Remove protective cap from the instrument.
- 4. Place the instrument on the standard.
- 5. Click the button Initialize.

This function prepares the instrument for measuring and calibration / testing.

Smart-robotic - Version 3.0.	0						-		×		
								ot Simula			
Monitoring	ОРС	Devices	Output files	smart-chart li							
BYKmac instruments Index Type		onnection Settings oint items	Calibration	Configuration	Error handling	OPC co	ntrol items Device Test	-			
1 bykmac 2 bykmac Add Remove	Instrument: Co Initializa Measure Read dat Calibrate on	OPC point items Calibration Error handling Device lest bykmac 1 Device check Instrument: Connected Initialize Initialize<									
Wave-scan instruments Index Type 1 Wavescan 2 WavescanThree 3 WavescanThree	Check co Check eff Curvature Medium Curvature flat		-Angle Positionir Pins min / may 0,05° +/- 0,15	min / max Distance	Status Control Delta Pins +/- 0,2 +/- 0,45	Check adjustmen					
Add Remove	nedium high OFF	0,0570,02570 0,1070,050°/0 0,2070,10°/0	0,10° +/- 0,6	+/- 0,15 +/- 0,2 +/- 0,3	+/- 0,45 +/- 0,8 +/- 1,5	*	Distance —				



The systems responses with Preparing OK.

6.1.7.2 Measure

Click the button Measure to take a measurement.

Smart-robotic - Version 3.0.0								-		×
									obot Simu	
Monitoring O	IPC	Devices	Outp	put files	smart-chart	link				
BYKmac instruments Index Type 1 bykmac 2 bykmac		onnection Settings oint items evice check		Calibration	Configuratio	n Error handlir		C control items Device Test		
Add Remove	Instrument: Connected Initialize									
1 Wavescan 2 WavescanThree 3 WavescanThree	Curvature Medium Curvature	Z [mm] Positioning +/- Distance / K - / Q	K [degr	Positioning Pins	[degree] Swinging min / max	Status Control Delta Pins	Check adjust	ment		
Add Remove	flat low medium high OFF	0,05 / 0,025° / (0,05 / 0,025° / (0,10 / 0,050° / (0,20 / 0,10° / 0	0,05° 0,10°	min / max +/- 0,15 +/- 0,3 +/- 0,6 +/- 1,2	Distance +/- 0,10 +/- 0,15 +/- 0,2 +/- 0,3	+/- 0,2 +/- 0,45 +/- 0,8 +/- 1,5	к	Z = Distance —		-

Illustration 42: BYK-mac-Device-Test-Measure

The measured data is stored in the instrument memory.

6.1.7.3 Read Data

Click the button Read data. This reads the measured data in the instrument memory and displays it.

smart-robotic - Version 3.0	0.0							-		×
									obot Sirr	
Monitoring	ОРС	Devices	Outpu	t files	smart-o	chart link				
BYKmac instruments		onnection Settings			Configu	iration		OPC control items		
Index Type	OPC p	point items	С	alibration		Error hand	ling	Device Test		
1 bykmac 2 bykmac	Instrument: C									
Add Remove	Initializ Measur Calibrate or Check co	e 114940.694 114940.700 114940.700 114940.703 114940.703 114940.703 114940.703 114940.703 114940.715 114940.715 114940.715 114940.715 114940.715 114940.712 114940.721 114940.722 114940.722 114940.722 114940.722 114940.723 114940.725 114940.728 1149	id: 1124 id: 1125 id: 1125 id: 1127 id: 1128 id: 1129 id: 1155 id: 1156 id: 1157 id: 1159 id: 1180 id: 1180 id: 1180 id: 1193 id: 1224 id: 1210 id: 1219 id: 1219 id: 1218 id: 1219 id: 1212 id: 1221 id: 1224 id: 1218 id: 1214 id: 1201 id: 1201	Name: Spec Name: 1* 75 Name: b* 77 Name: b* 77 Name: b* 77 Name: b* 77 Name: b* 71 Name: b* 71 Name: b* 11 Name: b* 11 Name: b* 11 Name: b* 11 Name: Spar Name: Spar	trum 45 \\ 5 Value: 95 5 Value: 0, 5 Value: 0, 5 Value: 0, Value: 10 trum 75 \\ 10 Value: 10 Value: 10 Value: 10 Value: 10 Value: 0, kle_araet kle_araet kle_araet kle_araet kle_araet kle_araet kle_araet kle_araet kle_araet	(alue: 1 3,63036 0,0550748 32496452 33144218 1,34629 (alue: 1 94,956535 0,09083748 0,37522316 0,37562316 0,366086 Value: 1 44682708 5 Value: 0 Value: 0 Value: 0 Value: 0 Value: 0 5 Value: 0 Value: 0 Value: 0	2			

Illustration 43: BYK-mac-Device-Test-Reading

Scroll up and down to see all data.

6.1.7.4 Calibrate on White

To calibrate in a test environment without robot, place the white calibration standard on a table.

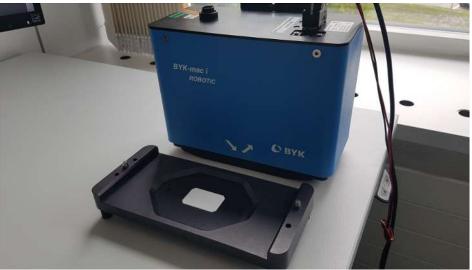


Illustration 44: BYK-mac - Device and calibration tile

The instrument has four positioning pins on the bottom. It measures only, if all for pins are pressed. This way the correct position of the instrument can be detected.

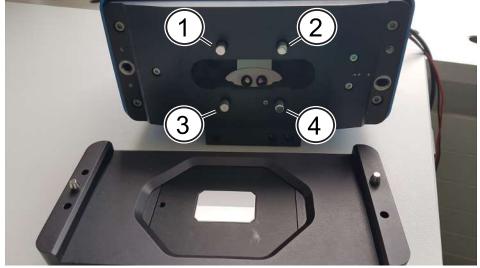


Illustration 45: BYK-mac-Calibration-Pins Place the instrument on the white calibration standard.



Illustration 46: BYK-mac-Device on calibration tile

To calibrate the instrument perform following steps:

- 1. Press the instrument with both hands down ca. 4 mm until you hear the 1st "Click" from the four positioning pins.
- Press the instrument with both hands further down until you hear the 2nd "Click" from the four positioning pins.
- 3. Hold the instrument in this position and click the button calibrate on white.
- 4. A message is displayed stating this procedure.
- 5. Click on OK to start the process.
- 6. Wait ca. 25 seconds for the end.

The procedure needs some exercise. Help from a 2^{nd} person is recommended in order to click the button in the correct state.

						Activate Robot Simul
Monitoring	ОРС	Devices	Output files	smart-chart link		
Kmac instruments	_	Connection Settings		Configuration		OPC control items
ndex Type	OPC	point items	Calibration	E	rror handling	Device Test
bykmac bykmac	bulkman 1	Device check		-		-
буктас	-					
	Instrument:	Connected				
	Initiali		I Id: 1098 Name: h 45			^
			4 Id: 1124 Name: Spe			
	Measu		7 Id: 1125 Name: L* 7) Id: 1126 Name: a* 7			
	Read d	11,40,40 703	3 Id: 1127 Name: b* 7			
	Read d	ata 11:49:40.705	5 Id: 1128 Name: C* 7	5 Value: 0,33144218		
Add Remove	Calibrate o	n white Start calibra	ation		×	
	Check c	olor	Maaaaa	the Collinstice The Article	the base of	
ave-scan instrument		A n	lease place the device on press it down around 4 mr	n. The calibration takes f		
	S Check e	ifect 2	0 seconds. Click OK to sta	rt!		
ndex Type						
Wavescan WavescanThree				ОК	Abbrechen	
WavescanThree			3 Id: 1210 Name: Spar			
		11:49:40.724		kle_area 15 Value: 0		
			4 Id: 1236 Name: Spar 5 Id: 1212 Name: Spar)	
			5 Id: 1212 Name: Spar 5 Id: 1198 Name: Spar			
			7 Id: 1238 Name: Spar)	
		11:49:40.728	3 Id: 1214 Name: Spar	kle_int 75 Value: 0		
			Id: 1201 Name: Spar			
Add Remove) Id: 1207 Name: Grai I Id: 1766 Name: Int E			

Illustration 47: BYK-mac-Device-Test-Calibrate-Message

If the positioning was not performed correctly, the message "Robotic calibration switch not pressed" will be displayed. Repeat the procedure.

	obotic - Version 3. guration	J.0					- 🗆 Activate Robot Sir	mula
Monito	oring	ОРС	Devices	Output files	smart-chart link			
/Kmac	instruments	Co	nnection Settings		Configuration		OPC control items	
Index	Туре	OPC po	oint items	Calibration	1	Error handling	Device Test	
2	bykmac bykmac	bykmac 1 D						
		Instrument: Co Initialize	11:49:40.708	ld: 1129 Name: h 75				^
		Measure	11:49:40.712 11:49:40.713	ld: 1155 Name: Spect ld: 1156 Name: L* 110 ld: 1157 Name: a* 110	Value: 94,956535 Value: -0,0908374			
		Read dat	11:49:40.717 11:49:40.719	ld: 1158 Name: b* 110 ld: 1159 Name: C* 110 ld: 1160 Name: h 110	0 Value: 0,38606197 Value: 103,60886			
Add	Remove	Check col	or 11:49:40.720 11:49:40.721 11:49:40.722	ld: 1186 Name: Spect ld: 1193 Name: Flop ld: 1234 Name: Spark	Value: 0,24682708 le_Grade 15 Value:	0		
ave-sca Index	an instruments Type	Check effe	ct 11:49:40.724	ld: 1210 Name: Spark ld: 1195 Name: Spark ld: 1236 Name: Spark	le_area 15 Value: 0	0		
2	Wavescan WavescanThree		11:49:40.726	Id: 1212 Name: Spark Id: 1198 Name: Spark Id: 1238 Name: Spark	le_area 45 Value: 0	0		
5	WavescanThree		11:49:40.728 11:49:40.729	ld: 1214 Name: Spark ld: 1201 Name: Spark	le_int 75 Value: 0 le_area 75 Value: 0			
			11:49:40.731	Id: 1207 Name: Graini Id: 1766 Name: Int En Id: 1764 Name: Flourd	nission Value: 0,008			
			11:49:40.733	ld: 1765 Name: corr S Start pin calibration.	pec Value: 1			
Add	Remove		11:51:38.829		alibration Error occur	red: 0x800000 robotic	calibration switch not pressed	

Illustration 48: BYK-mac-Device-Test-Calibrate-Failed

If the positioning was performed correctly the instrument performs following steps – see Data in Certificate [**\ 42**]:

- 1. Pin calibration
- 2. White calibration
- 3. Camera / effect calibration
- 4. Measurement

The progress is displayed in the screen.

smart-robotic - Version 3.0.	.0			- c	; c
Monitoring	OPC Devices	Output files	smart-chart link		
YKmac instruments	Connection Setting	5	Configuration	OPC control items	
Index Type	OPC point items	Calibration	Error hand	lling Device Test	
1 bykmac 2 bykmac	bykmac 1 Device check	-	_		
e byknic	Instrument: Connected				
		1.719 Id:1160 Name:h 11 1.720 Id:1186 Name:Spe			^
		.720 Id: 1180 Name: Spe .721 Id: 1193 Name: Flop			
		.722 Id: 1234 Name: Spa			
	Read data 11:49:4	.723 Id: 1210 Name: Spa	kle_int 15 Value: 0		
	11:49:4	.724 Id: 1195 Name: Spa			
Add Remove		.724 Id: 1236 Name: Spa			
Add Remove	11:49:4	1.725 Id: 1212 Name: Spa 1.726 Id: 1198 Name: Spa			
		1.727 Id: 1238 Name: Spa			
		.728 Id: 1214 Name: Spa			
ave-scan instruments		.729 Id: 1201 Name: Spa			
Index Type			niness diffuse Value: 0,478406	52	
1 Wavescan			mission Value: 0,008570358		
2 WavescanThree		.732 Id: 1764 Name: Flou			
3 WavescanThree		1.733 Id: 1765 Name: corr	Spec Value: 1		
5 Haveseanniee	11:49:4	.733 .722 Start pin calibration.			
			Calibration Error occurred: 0v900	0000 robotic calibration switch not pressed	
		.832 Start White calibration		solo robotic calibration switch hot pressed	
				800000 robotic calibration switch not pressed	d i
		.985 Start Camera calibrati			
	11:51:5	.96 Camera calibration fail	ed. Calibration Error occurred: 0x	800000 robotic calibration switch not presse	d
		.296 Start pin calibration.			
Add Remove		.399 Pin calibration finishe			
Add Remove	11:53:3	.401 Start White calibration	h.		

Illustration 49: BYK-mac-Device-Test-Calibrate-OK

For the calibration process following rules apply:

- Calibration is required, if the measurement results are not in the range of the standards.
- If calibration fails, try cleaning the standards, details see instrument documentation.
- If cleaning does not help, send instrument to BYK-Gardener service team.
- The service team will re-calibrate the instrument and provide new certificate.



NOTICE

The re-calibration and the issue of a new certificate is recommended once a year.

6.1.7.5 Color check

This function checks if the instruments color readings are within the specified tolerances. The target values and tolerances can be set in the Device Calibration [▶ 42] tab.

Perform following steps:

- 1. Please place the instrument on the green color check tile.
- 2. Click the button Color check to perform the color check.

smart-robotic - Version 3.0	.0					- 0	×
						Activate Robot Si	
Monitoring	ОРС	Devices	Output files	smart-chart link			
BYKmac instruments	Con	nection Settings		Configuration		OPC control items	
Index Type	OPC poir	nt items	Calibration	E	rror handling	Device Test	
1 bykmac 2 bykmac	bykmac 1 Dev	vice check					
	Instrument: Conr	nected					
Add Remove vave-scan instruments Index Type 1 Wavescan 2 WavescanThree 3 WavescanThree	Initialize Measure Read data Calibrate on wi Check color Check effect	11:564:104 12:84:15743 12:84:15743 12:84:15929 12:82:3678 12:82:5579 12:82:5579 12:82:5540 12:82:5540 12:82:5540 12:82:5541 13:82 13:82 14:82 14:82 14:84	Start Camera calibratio Camera calibration faile Prepare measuring Preparing OK. Start color check Measurement finished Reading data L*-15 79,7599999999 a*-1513,29 = <-12,4	n. d. Calibration Error occ 461006 = < -12,27 1386 = < 12,20999999 1323 = < 81,73 1362622 = < -12,56 0683 = < 12,79 607 = < 81,179999999 01874 = < -12,76 224 = < 81,2 10816 = < -12,86	urred: 0x800000 robotic 80,78 999999	calibration switch not pressed	^
		12:8:25.546 12:8:25.546	L* 75 81,05 = < 81,44 a* 75 12,65 = < -12,89 b* 75 11,93 = < 12,18	268 = < 81,67 97134 = < 13,2700000	0000001		
			L* 110 78,429999999 a* 110 12,18 = < -12,4	99999 = < 78,83047 = < 433826 = < 12,8			
Add Remove		12:8:25.550	b* 110 11,5 =< 11,76	3573 = < 12,12000000	0000001		

Illustration 50: BYK-mac-Device-Test-Color

The results of the color check - in the L*a*b* color system - are shown on the screen.

6.1.7.6 Effect check

This function checks if the instruments effect readings are within the specified tolerances. The target values and tolerances can be set in the Device Calibration [▶ 42] tab.

Perform following steps:

- 1. Please place the instrument on the silver effect check tile.
- 2. Click the button Effect check to perform the effect check.

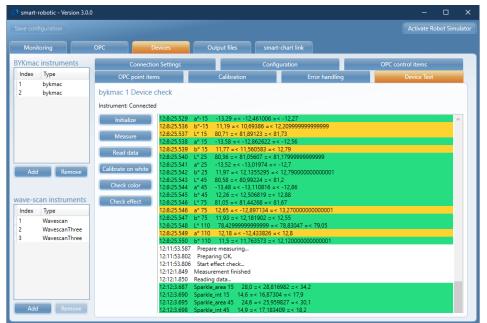


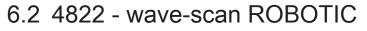
Illustration 51: BYK-mac-Device-Test-Effect

The results of the effect check - amount of sparkle under different angles - are shown on the screen.



NOTICE

Information, warnings and errors will be logged in the log file and displayed in the Monitoring [> 26] screen.



The wave-scan ROBOTIC (catalog number 4822) is the BYK-Gardner instrument for appearance measurement.

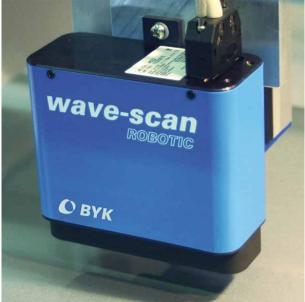


Illustration 52: BYK-Gardner wave-scan ROBOTIC

For product details see: https://www.byk-instruments.com/p/4822.

The product operation is described in:

• Operating Instructions: 266 018 740 - 0606

The configuration comprises following steps:

- 1. Connection Settings [> 56]
- 2. Device Configuration [> 56]
- 3. OPC Control Signals [> 58]
- 4. OPC Point Signals [58]
- 5. Device Test [**59**]
- 6. Daily Check [> 61]
- 7. Error Handling [**62**]

These steps are described below.

6.2.1 Connection Settings

The wave-scan ROBOTIC communicates via RS422 with smart-robotic, see FTDI Driver [> 21]. It requires a COM port.

Smart-robotic - Version 3.0.	.0			- 🗆 X
				Activate Robot Simulator
Monitoring	OPC Devices	Output files smart-	chart link	
BYKmac instruments Index Type 1 bykmac 2 bykmac	OPC point items Connection Settings Wavescan 1 Settings	Device Test Configu	Daily check aration	Error handling OPC control items
Add Remove	Port COM3 Baudrate Check connection Connected wave-scan ROBOTIC Ser.Nr: 1213324			
wave-scan instruments Index Type 1 Wavescan				

Illustration 53: BYK-Gardner wave-scan ROBOTIC – Connection details

Perform following steps:

- 1. Choose the correct COM port to establish a connection to the device.
- 2. Use the button Check connection to verify the connection.

For details concerning COM port selection see 7036 - BYK-mac i ROBOTIC [> 36].

6.2.2 Device Configuration

The Configuration tab manages the measurement properties of the instrument.

ave configuration							Activate Robot Sin
Monitoring	OPC	Devices	Output files	smart-chart li	nk		
YKmac instruments	OP	C point items	Device Test		Dai	ly check	Error handling
Index Type		Connection Settings		Configuration			OPC control items
1 bykmac							
2 bykmac	Wavesca	n 1 Configuration					
	Auto	Correction					
	Plaus	sibility Check					
	Scan lengt	h					
	10 cm						
	Speed						
	100	mm/s					
Add Remove		la Castas		Devie	C	(Alexandre in alexandre d	n
	Availab	le Scales		Basic	Scales	(Always included	1)
ave-scan instruments	ld S	Short Long name		ld	Short	Long name	
	42 N	ID NID Nissan NID Japan	-> ^	1	LW	Longwave	
Index Type 1 Wavescan	50 N	1 N1 Note 1m BMW	->	2	SW	Shortwave	
2 Wavescan 2 WavescanThree	51 N	3 N3 Note 3m BMW	->	19	We	We 10-30mm	
3 WavescanThree		C LC Longwave Coverage		20	Wd	Wd 3-10mm	
		T H Tension		21	Wc	Wc 1-3mm	
			->	22	Wb Wa	Wb 0,3-1,0mm Wa 0.1-0.3mm	
		e WLe	->	23	Wa du	Wa 0,1-0,3mm du dullness	
		GD ISUZU value	->		au	uu uunness	
		L AL Ambient Light	->				
	64 B	B Structure Balance	->	Selec	ted Sc	ales (User defined	l)
Add Remove	65 F.	AM Fiat App Matrix	->		<i>.</i>		
	66 A	CY Accuracy	->	Id		Long name	
	67 n	nxA mxA	->	31		DOI - DOI (Dorigon)	x
	68 n	nxW mxW	->	28	OP	OP Orange Peel	x
				53	WL	WI Wet Look	X

Illustration 54: BYK-Gardner wave-scan ROBOTIC - Configuration

You have following options:

- Auto Correction: Defects on the sample surface, such as scratches or craters, can cause major errors in measurement values. When Auto correction is activated, the affected scan areas are cut out and the measurement values are calculated from the corrected data.
- Plausibility Check: An option for comparing the corrected and uncorrected measurement value. The greater the difference between the corrected and uncorrected data, the more critical is the surface defect. If the difference is greater than 20 %, the measurement will be evaluated as a faulty measurement.
- Scan Length / Speed: Defines the length of the scan trajectory and the required speed of the instrument. The robot must be programmed to move according the definitions.



NOTICE

It is recommended to program the robot with an offset scan length for the acceleration ramp.

- Available Scales: The measurement results can be calculated according the various scales available. All these scales are customer-specific.
- Basic Scales (Always included): The calculation according to these scales takes place always.
- Selected Scales (User defined): Select required scales by clicking the arrow button in the Available Scales list. They appear under Selected Scales and can be removed from here using the X button.



NOTICE

With the hand-held instruments, these configurations are covered by the smartchart Standard and Organizer Management or via the measurement parameters in the device configuration.

6.2.3 OPC Control Signals

Control data are compellingly necessary for the operation of the measuring head, the symbolic names are fix defined in smart-robotic.

The control data are to be found in the OPC group of WAVEx_CTRL, The x stands for the index of the current wave-scan ROBOTIC.

Monitoring	OPC Devices	Output file			
			s smart-chart link		
Kmac instrumen	OPC point items	Device	Test	Daily check	Error handling
ndex Type	Connection Settings		Configuration		
bykmac bykmac	WAVE1_CTRL items				
	Name	Туре	Connection		
	IN_ENABLE	boolean	Connected		
	IN_POINT_POS IN_SYS_ERR_ACK	boolean boolean	Connected Connected		
	OUT_SYS_ERR	boolean	Connected		
	OUT_POINT_READY	boolean	Connected		
	OUT POINT RESULT	boolean	Connected		
Add Rem	OUT_ERR_NO	boolean	Connected		
	OUT_ERR_STROBE	boolean	Connected		
we-scan instrum	nts				
ndex Type					
Wavescan					
WavescanTh	PP I				
WavescanTh					

Illustration 55: BYK-Gardner wave-scan ROBOTIC – Control signals

Perform following steps:

- 1. Click the OPC control signals tab.
- 2. Check if the connection status is Connected, see also Control Signals for wave-scan ROBOTIC [▶ 13].
- 3. If status is Not found, check / edit the signals in the OPC server and restart smart-robotic.

These OPC control signals are predefined by smart-robotic. For a description see OPC Control Signals [**>** 39] for the BYK-mac i ROBOTIC.

6.2.4 OPC Point Signals

Details see OPC Point Signals [40] for the BYK-mac i ROBOTIC.

Monitoring	OPC Device	s Output files	smart-chart link	Robot simulator	
Kmac instruments	Connection Set	tings	Configuration		OPC control signals
ndex Type bykmac	OPC point signals	Device Test		Daily check	Error handling
bykmac	WAVE1_POINT signals				
	Copy from others	Add Edit	Remove		Check connection
	Name	Alias	Туре	Connection	
	IN_POINTNR IN_CHECKZONE	Zone-Index Zone-Name	Integer String	Connected Connected	
			-		
Add Remove					
ve-scan instruments					
ndex Type	1				
Wavescan WavescanThree]				
WavescanThree					

Illustration 56: BYK-Gardner wave-scan ROBOTIC – OPC Point Signals

6.2.5 Device Test

The tab Device Test offers functions for checking the instrument and performing test measurements.

In difference to the BYK-mac i ROBOTIC the wave-scan ROBOTIC performs a non-contact measurement.

A possible test setup is shown below.

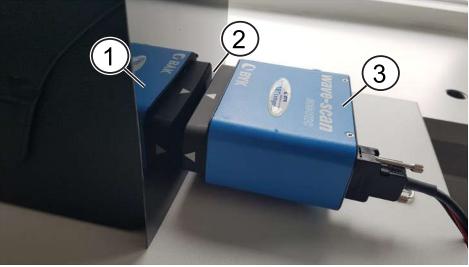
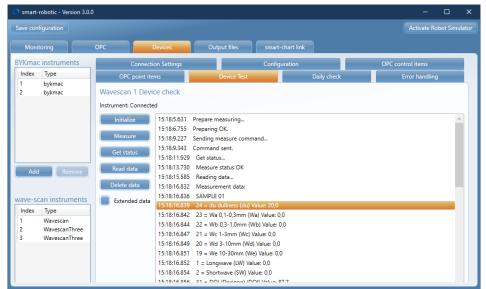


Illustration 57: BYK-Gardner wave-scan ROBOTIC - Test setup (example)

- 1 Sample to be used for device test
- 2 Measurement distance of ~ 15 mm
- 3 Instrument wave-scan ROBOTIC

Perform following steps:

- 1. Initialize
- 2. Measure
- 3. Get status
- 4. Read data
- 5. Delete data to perform new test



These results are shown in the following example.

Illustration 58: BYK-Gardner wave-scan ROBOTIC – Device test (static)

In the test setup shown above the probe is **fix** installed. Thus only the dullness can be measured – all other values are zero. In order to get all data included wavelength details you have two options:

- Slowly move the sample or
- slowly move the instrument.

							Activate Robot Simula
Monitori	ing	ОРС	Devices	Output files	smart-chart link		
YKmac ir	nstruments	Conr	ection Settings		Configuration		OPC control items
	Гуре	OPC poin	t items	Device Test		Daily check	Error handling
	oykmac oykmac	Wavescan 1 D	evice check				
	ly kinde	Instrument: Conn					
Add	Remove	Initialize Measure Get status Read data Delete data	15:27:40.362 15:27:47.579 15:27:47.822 15:27:58.319	Sending measure com Command sent. Get status Measure status OK Reading data Measurement data:	mand		^
Index T 1 V 2 V	Type Vavescan VavescanThree VavescanThree	Extended d	15:28:9.278 15:28:9.278 15:28:9.281 15:28:9.284 15:28:9.284 15:28:9.290 15:28:9.290 15:28:9.291 15:28:9.294 15:28:9.296	24 = du duliness (du) Va 23 = Wa 0,1-0,3mm (Wa 22 = Wb 0,3-1,0mm (Wa 21 = Wc 1-3mm (Wc) Va 20 = Wd 3-10mm (Wd) 19 = We 10-30mm (We) 1 = Longwave (UW) Valu 2 = Shortwave (SW) Valu 2 = Shortwave (SW) Valu) Value: 0,0 5) Value: 0,2 Ilue: 1,4 Value: 4,3 Value: 10,4 e: 1,6 ue: 0,0		

Illustration 59: BYK-Gardner wave-scan ROBOTIC – Device test (moved)

Now all other values can also be measured.

6.2.6 Daily Check

The instrument comes with a certificate and a checking / test tile. Enter the values given there here in the Daily Check tab. These values will be compared during the check with the measurement results.

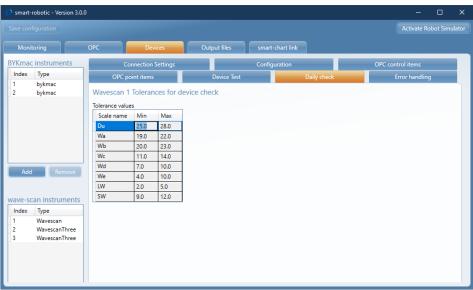


Illustration 60: BYK-Gardner wave-scan ROBOTIC – Device check

Mount the test tile in the robot cell to the position intended for the device check.

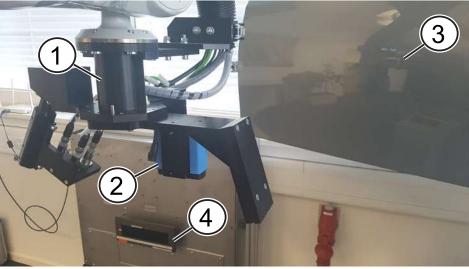


Illustration 61: BYK-Gardner wave-scan ROBOTIC – Check tile mounting

- 1 Robot arm with rotable adapter
- 2 Instrument on rotable adapter
- 3 Car body / part in robot cell
- 4 Checking tile mounted to wall

The daily check is successful, if the measured data is within the given tolerances. More details about daily check see user manual for the robotic instrument.

6.2.7 Error Handling

The error handling for the wave-scan ROBOTIC is similar to the BYK-mac i RO-BOTIC.

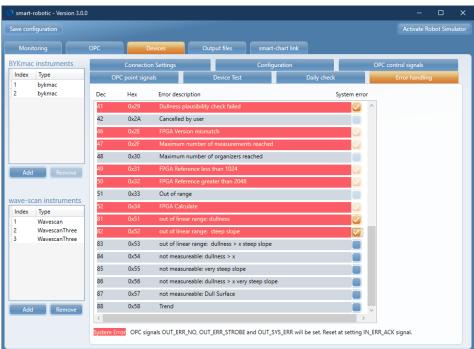
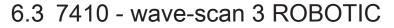


Illustration 62: BYK-Gardner wave-scan ROBOTIC – Error handling

For more details see Error Handling [▶ 46] for the BYK-mac i ROBOTIC.



The wave-scan 3 ROBOTIC (catalog number 7410) is the successor of the 4822 - wave-scan ROBOTIC [**> 55**].



Illustration 63: BYK-Gardner wave-scan 3 ROBOTIC For product details see: <u>https://www.byk-instruments.com/p/7410</u>. The product operation is described in:

• Operating Instructions: 301 200 141 - 2009

The configuration comprises following steps:

- 1. Connection Settings USB [> 64]
- 2. Connection Settings LAN [65]
- 3. Device Configuration
- 4. OPC Control Items
- 5. OPC Point Items
- 6. Device Test [66]
- 7. Daily Check
- 8. Error Handling

Steps 1, 2 and 6 are described below. All other steps are similar to 4822 - wave-scan ROBOTIC [▶ 55].

6.3.1 Connection Settings - USB

The wave-scan 3 ROBOTIC communicates via USB with smart-robotic during setup, see USB Bulk Driver [> 22]. It requires a free USB port.

Smart-robotic - Version 3.0.0)				-		×
Save configuration						ot Simula	
Monitoring	OPC Devices	Output files	smart-chart link				
BYKmac instruments Index Type 1 bykmac 2 bykmac Add Remove Wave-scan instruments Index Type 1 WavescanThree 3 WavescanThree Add Remove	OPC point items Connection Settings WavescanThree 2 Settings IP Address 0 . 0 . 0 . 0 Subnet 0 . 0 . 0 . 0 Gateway 0 . 0 . 0 . 0 Identifier: USB0 Check connection Connected Name: USB0 Serialnumber: 10 Firm Work with USB USB identifier USB0		Configuration	baily check	Error handling OPC control items		

Illustration 64: BYK-Gardner wave-scan 3 ROBOTIC – Connection details USB Perform following steps:

- 1. Click the option Work with USB.
- 2. Choose the correct USB identifier to establish a connection to the device.
- 3. Use the button Check connection to verify the connection.

Proceed if status is Connected.

6.3.2 Connection Settings - LAN

The wave-scan 3 ROBOTIC communicates via Ethernet / LAN with smart-robotic during operation. In this connection mode it requires an IP address.

smart-robotic - Version 3.0.0					– 🗆 X
Save configuration					Activate Robot Simulator
Monitoring	OPC Devices	Output files	smart-chart link	1	
BYKmac instruments	OPC point items	Device Test		Daily check	Error handling
Index Type 1 bykmac	Connection Settings		Configuration		OPC control items
2 bykmac	WavescanThree 3 Settings				
	In Config File	Instrument			
	IP Address 192 . 168 . 0 . 101 Get fro	om device 0 . 0 . 0	0		
	Subnet				
	255.255.255.0	0.0.0	. 0		
	Gateway 192 . 168 . 0 . 1 Send to	o device » 0 . 0 . 0	0		
Add Remove	Identifier:		. 0		
	Check connection Not connec				
wave-scan instruments Index Type	Check connection	.tea.			
1 Wavescan					
2 WavescanThree 3 WavescanThree	Work with USB				
5 Havescannice					
Add Remove					
include include					

Illustration 65: BYK-Gardner wave-scan 3 ROBOTIC – Connection details LAN Perform following steps:

- 1. Enter the IP address foreseen for the connection to the device.
- 2. Connect the instrument via USB cable to your PC.
- 3. Activate the option Work with USB.

Now you have following options for the IP Address:

- Get from device: Click this button to receive IP data from device.
- Send to device: Click this button, if the device has no IP data yet.

Perform following steps:

- 1. Deactivate the option Work with USB.
- 2. Disconnect the USB cable from instrument and / or PC.
- 3. Use the button Check connection to verify the IP connection.

Proceed if status is Connected.

6.3.3 Device Test

The functions available in the tab Device Test are different, see Device Test [> 59] for the wave-scan ROBOTIC.

🔘 smart-	robotic - Version 3.0.	0					-	o x
Save con	iguration							t Simulator
Monit	oring	OPC	Devices	Output files	smart-chart link			
BYKmac	instruments Type		Connection Settings		Configuration		OPC control items	
1 2	bykmac bykmac		point items Three 3 Device che	Device Test		Daily check	Error handling	
2	буктас		lot connected.	CK				
		Initialize						
		Measure						
Add	Remove	Delnitiali	ze					
wave-so	an instruments							
Index	Type Wavescan							
2	WavescanThree WavescanThree							
	Havestannice							

Illustration 66: BYK-Gardner wave-scan ROBOTIC 3- Device test

Perform following steps:

- 1. Initialize: Load device driver.
- 2. Measure: Get measurement data.
- 3. De-Initialize: Unload device driver.



NOTICE

The wave-scan 3 ROBOTIC is much more powerful than its predecessor wave-scan ROBOTIC. The new device has a modern processor and sufficient memory to calculate ALL scales immediately. Thus the configuration of the scales can be omitted here – all this data will be available always.

7 Output Files

In the Output files tab, additional user-defined output files can be defined for following instruments:

- BYK-Gardner BYK-mac i ROBOTIC
- BYK-Gardner wave-scan ROBOTIC
- Compatible thickness measurement instruments

This is optional and does not influence the measurement data stored in the smartchart database.

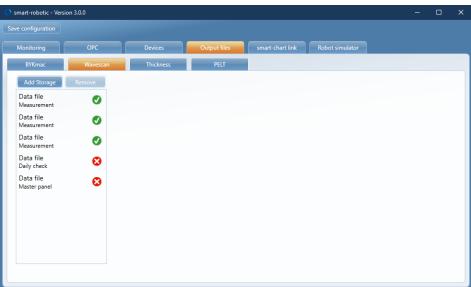


Illustration 67: Output-Files-Main-Window

In order to create such an additional output file, select an instrument and click the button Add Storage to add a new output file for configuration.

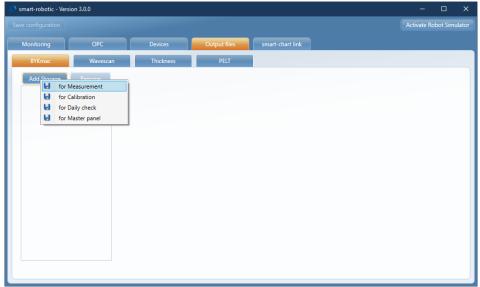


Illustration 68: Output-Files-Add-Menu

Depending on the instrument, different options appear in the context menu to generate different output files:

- Normal measurement
- Calibration
- Daily check

• Measure on master panel

After selection the output file can be defined on the right side.

🔘 smart-robotic - Vers	sion 3.0.0					- 1	⊐ ×
Save configuration							t Simulator
Monitoring	ОРС	Devices	Output files	smart-chart link			
BYKmac	Wavescan	Thickness	PELT				
Add Storage	Remove						
Data file Measurement	Dire	tput file definition for cctory name plate s for quality status Green Yellow Red ccted instruments ex Device type bykmac bykmac	Create new	Browse Define Edit selected	0 0 0		

Illustration 69: Output-Files-Add-Details

Complete configurations get a green icon; incomplete a red icon. To complete enter following details:

- 1. Output Directory [69]
- 2. Output Filename [> 70]
- 3. Template File [▶ 71]
- 4. Quality Status [> 74]
- 5. Active Devices [76]

These tasks are described below.



NOTICE

1 If multiple output files have been defined, multiple output files will be generated.

2 In the example shown above three configurations exist for "Measurement".

3 So for each measurement job these three files will be generated.

7.1 Output Directory

In the Directory tab the path can be defined, under which the output files are stored. Use the Browse button to navigate to the desired directory.

0	smart-robotic - Ver	sion 3.0.0							
	ave configuration							obot Sim	
	Monitoring	ОРС		Devices	Output files	smart-chart link			
	BYKmac	Wavescan		Thickness	PELT				
	Add Storage	Remove							
	Data file Measurement	٢	Directo C:\Pro Filenam Templa Texts fo	ne			♥ ⊗		
			Selecte						

Illustration 70: Output-Files-Directory-Set

In the example shown above following directories will be used:

• C:\ProgramData\BYK\Robotic\TemplateFiles

Following sub-directories will also be created in the given location:

- ..\TemplateFiles\BykMacJob
- ..\TemplateFiles\WavescanJob



NOTICE

The application allows copy and paste for most input options. This way you can exchange existing information between different configurations or external editors.

7.2 Output Filename

The Filename defines a template to dynamically create the name of the file for each measurement.

🔘 smart-robotic - Ve	rsion 3.0.0						-	□ ×
Save configuration								ot Simulator
Monitoring	ОРС	Devices	Output files	smart-chart link				
BYKmac	Wavescan	Thickness	PELT					
Add Storage	Remove							
Data file Measurement	D Fi G	CAProgramDataV Iename SdtYEAR\$tx-\$dtM emplate prev 2020 exts for quality st.	efinition designer ula for filename DAY - HOUR ew 10-07-09-45-23-Car-Moo defined text Roboticxm efined items VEAR	MONTH		dd text	-Robotic.xml	×
	Se	elected instrumer	QUALITY	Car-Model	Car-Color 🗎 🚘	Paint-Line OK	Cano	el

Illustration 71: Output-Files-Filename-Set

The button Define opens an editor to configure the file name using predefined items of measurement metadata - e.g. timestamp, color or vehicle ID – and free text – e.g. separators and file extension.



NOTICE

1 After adding all required fields use Drag & Drop to bring a field into correct position.

2 Do not forget to append the file name with an appropriate file type like ".csv" or ".xml".

3 The extension is to be entered in the Definition designer – not in the Output file definition(!).

7.3 Template File

The Template defines the actual content of the output file:

- If no template is existent, a new template must be created.
- The button Create new opens the Template editor for a new template.
- The button Edit selected opens the template editor for a blank template.

🔍 smart	-robotic - Version 3.0.0				
Save cc	Template Editor		- 0	×	bot Simulator
	File Name				
Mo	Wave-Scan-Robotic				
	Predefined Items	Header			
		xml version="1.0"?		~	
		<wave-scan-robotic></wave-scan-robotic>			
Da	MEAS_COUNT	<jobdata> <timestamp>\$TIMESTAMP\$</timestamp></jobdata>			
Me		<timestamp>\$TIMESTAMP\$</timestamp> <jobquality>\$QUALITY\$</jobquality>		~	
	QUALITY 🗸	<		>	
	Predefined Items Difference scales	Measurement data <point></point>		^	
	wave-scan scales	<time>\$TIME5</time>			
	Meta data	<serialnr>\$Serial number\$</serialnr>			
	Meta data	<catalognr>SCatalogue nr.§</catalognr>			
		<status>SSTATUS§ </status>			
		<zoneid>\$Checkzone-Index5</zoneid>			
	Serial number	<zone>\$Checkzone-Name\$</zone>			
	Catalogue nr.	<scale id="01_LW" value="\$LW§"></scale>			
		<scale id="02_SW" value="\$SW\$"></scale>			
	STATUS	<scale id="19 We" value="\$We5"></scale>			
		<scale id="20 Wd" value="\$Wd\$"></scale>			
	Checkzone-Ind	<scale id="21 Wc" value="\$Wc\$"></scale>			
	Checkzone-Na	<scale ld="22 Wb" value="\$Wb\$"></scale>			
		<scale id="23 Wa" value="\$Wa§"></scale>		\sim	
		<		>	
		Footer			
		<		>	
		Save and ex	it Car	ncel	

Illustration 72: Output-Files-Template-Editor

Perform following steps:

- 1. Choose a File Name for the template.
- 2. Add the Predefined Items in the Header box.
- 3. Add the Predefined Items in the Measurement Data box.
- 4. Add appropriate text in the Footer box.

Following rules apply:

- The section Header will appear once at the top.
- The section Measurement data will appear for every check zone.
- The section Footer will appear once at the end of the file.

Write free text to structure the data with XML tags or CSV column names.



NOTICE

Follow conventions such as ";" separator for CSV files for structuring text and predefined items. In the example shown above following **template** file is created.

Header

Measurement data

```
<point>
<time>$TIME$</time>
   <serialnr>$Serial number$</serialnr>
   <catalognr>$Catalogue nr.$</catalognr>
   <status>$STATUS$</status>
   <zoneid>$Checkzone-Index$</zoneid>
   <zone>$Checkzone-Name$</zone>
   <scale Id="01 LW" value="$LW§" />
   <scale Id="02 SW" value="$SW$" />
   <scale Id="19 We" value="$We$" />
   <scale Id="20 Wd" value="$Wd§" />
   <scale Id="21 Wc" value="$Wc$" />
   <scale Id="22 Wb" value="$Wb$" />
   <scale Id="23 Wa" value="$Wa§" />
   <scale Id="24 Du" value="$du$" />
</point>
```

Footer

</points count> </wave-scan-robotic> With the example template shown above the following **output** XML file will be created after a measurement.

```
<?xml version="1.0"?>
<wave-scan-robotic>
<jobdata>
<timestamp>2020-10-06T17:38:33</timestamp>
    <jobquality>Green</jobquality>
    <carmodel>Combi</carmodel>
    <carcolor>Pearl</carcolor>
    <paintline>PL1</paintline>
    <comment>Created with simulator.</comment>
    <vehicleid>123456</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-10-06T17:38:38</time>
    <serialnr>1213324</serialnr>
    <catalognr>4822</catalognr>
    <status>None</status>
    <zoneid>4</zoneid>
    <zone>rear bumper</zone>
    <scale Id="01 LW" value="0" />
    <scale Id="02 SW" value="0" />
    <scale Id="19 We" value="0" />
    <scale Id="20 Wd" value="0" />
    <scale Id="21 Wc" value="0" />
    <scale Id="22 Wb" value="0" />
    <scale Id="23 Wa" value="0" />
   <scale Id="24 Du" value="12,1" />
</point>
</points count>
</wave-scan-robotic>
```



NOTICE

The template files will be stored with extension ".btmp" in the sub-folders for the BYK-mac and the wave-scan.

7.4 Quality Status

The software can handle the quality status. This status denotes if measured values are within tolerances. For this the function smart-chart link [▶ 77] is required – the tolerances are part of the standards stored in smart-chart. The quality status can have following values:

- Green: Measured values within tolerances.
- Yellow: Measured values in warning area.
- Red: Measured values out of tolerances.

The **Texts for Quality Status** can be modified in the text fields right to the green / yellow / red rectangle.

🔘 smart-robotic - Ver	sion 3.0.0							-		×
								Activate F	Robot Sim	
Monitoring	ОРС		Devices	Output files	smart-chart link					
BYKmac	Wavescan		Thickness	PELT						
Add Storage	Remove									
Data file Measurement		Directo C:\Pro Filenam \$dtDA Templa Wave- Texts fo	ry gramData\BYK\Rob ne Y\$tx-\$dtHOUR\$tx-\$	for Measurement otic/OutputFiles idtMINUTE\$tx-SpnCar-Mc Create new	odel\$tx-\$pnCar-Color\$	♥ tx-\$pnQUALITY)	Define	0		

Illustration 73: Output-Files-Quality-Status

If you want to use traffic light status for pass / fail indication you can enter for example:

- Within tolerances: Green
- In warning area: Yellow
- Out of tolerances: Red

If you want to use just OK / NOK for pass / fail indication only can enter for example:

- Within tolerances: OK
- In warning area: OK or NOK (depending on your requirements)
- Out of tolerances: NOK

The defined text will appear in the Filename if the QUALITY item is inserted.

smart-robotic	- Version 3	.0.0							-		×
										bot Simu	
Monitoring		ОРС	Devices		Output files	smart-chart	link				
BYKmac		Wavescar	Thickne	s	PELT						
Add Stora	ige 🛛 🛛 F	Remove									
Data file Measureme	nt		Output file defin	ition fo	r Measuremer	it					
			C:\ProgramData\B	o 🔘 D	efinition designer						×
			Filename		ula for filename						_
			\$dtDAY\$tx-\$dtHOU	R D	AY - HOUF		- Car-Model	- Car-Color		ТҮ	
			Template Wave-Scan-Roboti			ar-Colc -QUALITY					
			Texts for quality stat	us User	defined text			Add text			
			Ye	Pred	efined items						
			R	4		MONTH	DAY	HOUR			
			Selected instrument			SECOND	TIMESTAMP	MEAS_COL			~
								OK		Cancel	

Illustration 74: Output-Files-Quality-Field

With the example configuration shown above the following file will be created.

2020-10-06T17 38 33-Combi-Pearl-**Green**.xml

Th status will also appear in the content of the output file if it is part of the template, see example template file above.

```
<jobquality>$QUALITY$</jobquality>
```

```
<status>$STATUS§</status>
```

These entries have the following meaning:

- \$QUALITY§: The quality status for the complete job / car body.
- \$STATUS§: The quality status for one single measurement point / check zone.

In the example output file shown above following entries have been created by smart-robotic.

```
<jobquality>Green</jobquality>
```

<status>None</status>

...

These entries have the following meaning:

- Job Quality: The overall quality status for the complete job is "Green".
 - It will be "Red" if at least one check point is red.
 - It will be "Yellow" if at least one check points is yellow.
 - It will be "Green" if all check points are green.
- Status: The quality status for this measurement point / check zone will be "None" if no standard can be associated (for example if smart-chart link has not been configured yet).

For more details see Testing the Configuration [> 100].



NOTICE

In an output file with multiple measurement points (check zones) the status will be inserted separately within each single point.

7.5 Active Devices

On the bottom of the window the devices can be selected for which the output files have to be generated. The device list is depending on the device type.

smart-robotic - Version 3.	8.0.0							
							bot Simu	
Monitoring	OPC	Devices	Output files	smart-chart link				
BYKmac	Wavescan	Thickness	PELT					
Add Storage R	Remove							
Data file Measurement	Dire CA Filer Sat Text	nplate ave-Scan-Robotic.xml ts for quality status (Green Yellow Red ected instruments lex Device type Wavescan WavescanThree	tic\OutputFiles	Browse	Define	0		

Illustration 75: Output-Files-Device-Select

The output file configuration for the other instrument types is analogue.



NOTICE

The output files will be generated when performing measurements with the robotic instruments. The configuration can be tested with the Robot Simulator [▶ 140].

8 smart-chart link

When using the software **smart-chart** for data analysis and tolerance settings, the tab **smart-chart link** manages the connection between measurement devices, OPC server and **smart-chart**. With the configuration of **smart-chart link** following operations are supported:

- The information in the standard and organizer database is retrieved for pass / fail check.
- The measurement results are stored in the measurement database according to existing standards and organizers.



NOTICE

The generation of Output Files [> 67] can be used in addition to the storage in the **smart-chart** database.

8.1 Configuration in smart-chart

In the application **smart-chart** the color standards and the organizers are defined. The configuration required for the interaction with **smart-chart** comprises following steps:

- Databases [> 77]
- Catalog [> 79]
- Standards [> 79]
- Organizers [> 82]
- Data Analysis [> 89]



Do not use the module **Instrument Management**. It is not required for the interaction with **smart-robotic** and it is not possible to access the instrument from **smart-chart** and **smart-robotic** at the same time. If you have used the module, restart **smart-chart** without using it again.

See also

Installation [▶ 18]

8.1.1 Database

In smart-chart following databases are used:

- Standard Database [> 77]
- Measurement Database [> 78]

8.1.1.1 Standard Database

This database stores the definitions for color standards and organizers.

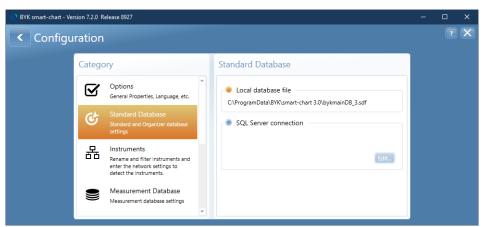


Illustration 76: Standard database in smart-chart

Name and location of this database are fix assigned in **smart-chart**: "C:\Program-Data\BYK\smart-chart 3.0\bykmainDB_3.sdf".



NOTICE

For the creation of this documentation a **compact database file** was used. Alternatively an **SQL server connection** can be used. This is the preferred option in a production environment, see also Installation [▶ 18] of **smart-chart**.

8.1.1.2 Measurement Database

This database stores the measurement data. Name and location of the database can be defined here.

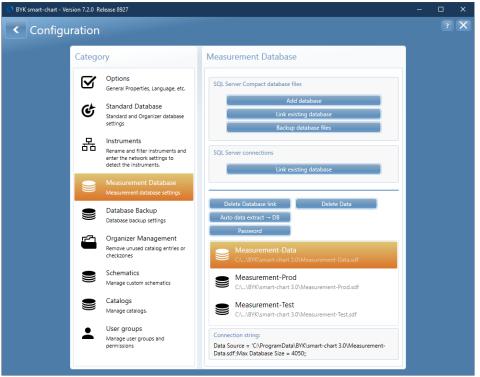


Illustration 77: Measurement database in smart-chart

In the example shown above the database "Measurement-Data.sdf" was selected. If more than one database is existing, the measurement data will be stored in all of them.

8.1.2 Catalog

In the **Catalog** configuration the various parameters for identification of the measured objects are selected.

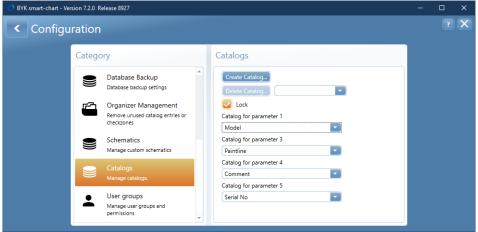


Illustration 78: Catalog configuration in smart-chart

For the creation of this documentation following catalogs were selected:

- Catalog for parameter 1: "Model"
- [Catalog for parameter 2: "Color"]
- Catalog for parameter 3: "Paintline"
- Catalog for parameter 4: "Comment"
- Catalog for parameter 5: "Serial No."



NOTICE

The **Catalog for parameter 2** can not be configured here. It is always mapped to the catalog "Color".

8.1.3 Standards

The module **Standard Management** is used to configure the settings for the various color standards. These standards can then be added the check zone organizers later on. The configuration of color standards comprises following steps:

- Standard Family [> 79]
- Standard [> 81]

8.1.3.1 Standard Family

Via the button **Add Family** a new standard family - or group of standards - can be created.

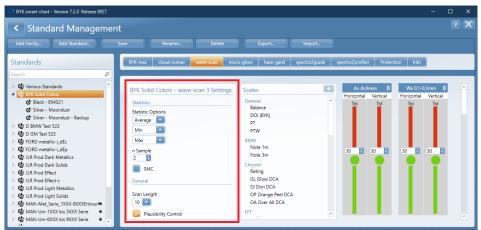


Illustration 79: Standard management in smart-chart

In each standard family the scales and tolerances for the pass / fail measurements can be configured. In the example shown above the standard family "BYK Solid Colors" and the instrument "wave-scan" is shown. Following rules apply:

- <**Group name> wave-scan 3 Settings**: These parameters (red frame) are **only** relevant for the wave-scan 3 handheld device.
- **Scales**: Select the customer relevant scales with defined tolerances / limits. In addition, the structure spectrum data (du, W_a .. W_e, LW, SW, B) will be automatically saved.

Scales can be added to the selection using the **+** symbol. Scales can be removed from selection using the **Trash can** symbol.



NOTICE

These functions only work on Family level - here: "BYK Solid Colors".

8.1.3.2 Standard

For the creation of this documentation the standard "Silver – Moondust" was created.

Example

Below following pass / fail tolerances were configured in this standard for the scale "Dullness (du)":

- Below 10 = **Red**: Measured value = Not in tolerance.
- 10 ... 20 = **Yellow**: Measured value = In warning area.
- 20 ... 30 = **Green**: Measured value = In tolerance.
- 30 ... 40 = **Yellow**: Measured value = In warning area.
- Above 40 = **Red**: Measured value = Not in tolerance.

These values have been entered for **Horizontal** check points / zones only. The entries **Horizontal** and **Vertical** are relevant later on for the check zones, see below.

O BYK smart-chart - Version 7.2.0 Release 892		- 🗆 X
 Standard Manager 	hent	? 🗙
Standards Search	BYK-mac cloud-runner wave-scan micro-gloss haze-gard spectro2guide spectro2guide	spectro2profiler Protection
 Ø Various Standards Ø BYK Solid Colors Ø Black - 654321 Ø Silver - Moondust 	BYK Solid Colors - wave-scan 3 Settings Scales	du duliness
Silver - Moondust - Backup Gr D BMW Test 523 GM Test 523 GM Test 523 GM Test 523	Statistics General CLongwave Statistic Options Shortwave Balance Min CLONGRAVE Statistic Options	
	Max Dor (BYK) PT PT PT PT PT PT PT PT PT	30
	SMC BMW Note 1m Note 3m Chrysler	20 8
Gr MAN-Uni-1XXX bis 5XXX Serie Gr MAN-Uni-6XXX bis 9XXX Serie Gr Metallic 01 Gr Palette Neck	Scan Length Rating 10 C GL Gloss DCA DI Don DCA Plausibility Control C Plausibility Control	10 8

Illustration 80: Color standard and tolerances in smart-chart

Tolerance values can be entered via the plus (+) symbol and removed via the minus (-) symbol. To do so the **Edit** icon (pencil) has to be activated. This only works on **Standard** level – here: "Silver – Moondust".



NOTICE

All changes are stored via the **Save** button in the top level button row.

8.1.4 Organizers

The module **Organizer** is used to configure the check points / zones to be measured. The organizer management comprises following steps:

- Model [**83**]
- Standards [> 84]
- Paint line [> 85]
- Instruments [> 86]
- Check zones [> 87]

Organizer				
d Organizer Save				
ganizers				
rch 🔎	1			
BMW-Test-2020				
BYK Test 2020				
C250 TDi Black 2019				
HURACAN BODY				
Robot-Cell-Compact				
Robot-Cell-Pickup				
Robot-Cell-Sedan				
Robot-Cell-Station				
s2g Organizer 2 zonen 2019 Stephan Combi Training 2019				
Test Organizer 2019				
l lest organizer 2019				

Illustration 81: List of organizers in smart-chart

For this example the following organizers were created:

- "Robot-Cell-Compact"
- "Robot-Cell-Pickup"
- "Robot-Cell-Sedan"
- "Robot-Cell-Station"

These organizers will be used by **smart-robotic** to identify the parameters 1..5 listed above. In the color standards the corresponding tolerance values will be identified.

8.1.4.1 Model Selection

On the tab **Parameter 1** the "car models" can be selected. You have following options:

- Use the buttons **Create Model** and **Delete Model** to manage the models in the catalog.
- Use the Add / Remove (All) buttons to manage the models in the organizer.

You can create for example an organizer for "Compact" cars and add all models habe the same measurement procedure.

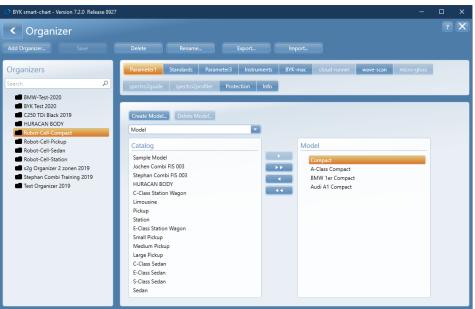


Illustration 82: Organizer and model selection in smart-chart

For the example tests later on in **smart-robotic** the model entry "Compact" is important.



NOTICE

The combo box with selected entry "Model" appears only, if this entry has been created in the Catalog [> 79] before.

8.1.4.2 Standard Selection

On the tab **Standards** the color standards can be added to this organizer. You have following options:

- Standards are managed in the module Standards [> 79].
- Use the Add / Remove (all) buttons to manage the models in the organizer.

You can add here all color standards you want to measure with **smart-robotic**.

BYK smart-chart - Version 7.2.0 Release 89			
Organizer Add Organizer Save		?	×
Organizers Search BMW-Test-2020 BWK Test 2020 C 250 TDB Black 2019 HURACAN BODY Robot-Cell-Schapat Robot-Cell-Sedan Robot-Cell-Sedan Robot-Cell-Sedan Robot-Cell-Sedan Stephan Combit Training 2019 Test Organizer 2019	Veter Nature Capability Parameter3 Instruments BYK-mac doud-runner wave-scan micro-gloss spectra2guide spectra2guide spectra2guide reference micro-gloss Search P Import Import © Wrisous Standards Import Import Import Import Import Import Import Import Search P Import Import Import Import Import Import Import Import Import Import Search P Import Import Import Import		

Illustration 83: Organizer and standards in smart-chart

For the example tests later on in **smart-robotic** the entry "Silver - Moondust" is important.

8.1.4.3 Paint Lines

On the tab **Parameter 3** the "Paint Lines" can be selected. You have following options:

- Use the buttons **Create Paintline** and **Delete Paintline** to manage the paint lines in the catalog.
- Use the Add / Remove (all) buttons to manage the paint lines in the organizer.

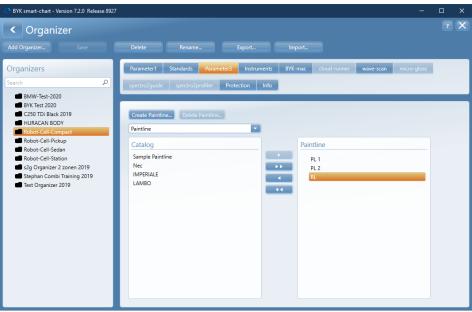


Illustration 84: Organizer and paint lines in smart-chart

For the example tests later on in **smart-robotic** the entries "PL 1", "PL 2" and "RL" are important.

8.1.4.4 Active Instruments

On the tab **Instruments** the measurement devices to be used can be activated.

SYK smart-chart - Version 7.2.0 Releas	e 8927 — [×
 Organizer 			×
	Delete Rename Export Import		
Organizers	Parameter1 Standards Parameter3 Instruments BYK-mac cloud-runner wave-scan		
Search BMW-Test-2020 BYK Test 2020 C 230 TDi Black 2019 HURACAN 80DY Robot-Cell-Fockup Robot-Cell-Station Robot-Cell-Station Stephan Combi Training 2019 Stephan Combi Training 2019	P micro-gloss film thickness spectro2guide spectro2profiler Protection Info BYK-mac Instruments Image: Color / BYK-mac / BYK-mac i Image: Color / BYK-mac i COLOR / BYK-mac i COLOR cloud-runner Image: Color / BYK-mac i Image: Color / BYK-mac i COLOR Activated Image: Color / BYK-mac i Image: Color / BYK-mac i Image: Color / BYK-mac i Image: Color / BYK-mac i Image: Color / BYK-mac i	-	
 rest organizer 2019 	wave-scan Instruments wave-scan dual activated micro-wave-scan wave-scan 3		
	micro-gloss Instruments Activated micro-gloss film thickness Instruments Activated film thickness		v

Illustration 85: Organizer and active instruments in smart-chart

For **smart-robotic** the instruments **BYK-mac**, **wave-scan** and **Film Thickness** are important.

8.1.4.5 Check Zones

On the tab **wave-scan** the check zones valid for this device type can be configured. You have following options:

- Settings [87]
- Test Procedure [88]

8.1.4.5.1 Settings

On the tab **Settings** the parameters are available for selection which can be configured in the handheld device. These parameters are not relevant for **smart-robotic**.

O BYK smart-chart - Version 7.2.0 Release 8927	-	D X
< Organizer		? 🗙
	Delete Rename Export Import	
Organizers	Parameter1 Standards Parameter3 Instruments BYK-mac cloud-runner wave-scan micro-gloss	
Search P	spectro2guide spectro2profiler Protection Info	
BMW-Test-2020 BVK Test 2020 C 250 TO Black 2019 HURACAN BODY Robot-Cell-Compact Robot-Cell-Schup Robot-Cell-Schup Stephan Combi Training 2019 Test Organizer 2019	Settings Test Procedure Advanced Settings wave-scan 2 Settings - not applicable for wave-scan 3 Interrupt Input 10 Input Comment Settings Test series protected SMC Plausibility Control SMC Dol (gYK) PT PTW Structure Spectrum dudiness Wa 0,1-0.3mm We 0,3-1.0mm We 1-3mm We 1-3mm We 3-10mm	

Illustration 86: Organizer settings in smart-chart

The tab provides following options:

- Advanced Settings: These settings apply to wave-scan 2 and wave-scan 3.
- **Wave-scan 2 Settings**: These settings apply only to the wave-scan 2; they are not required for the wave-scan 3 anymore.

8.1.4.5.2 Test Procedure

On the tab **Test Procedure** the check zones for this type of car can be defined. The appropriate car schematic can be selected and the check zones can be added via Drag & Drop from the catalog.

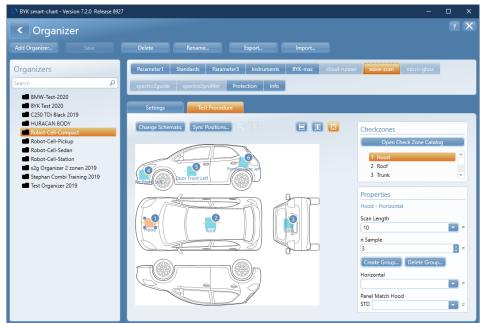


Illustration 87: Organizer check-zones in smart-chart

For this example the following check zones were created:

- "Hood"
- "Roof"
- "Trunk"

All these check zones have the orientation **Horizontal**. These check zones will be used in **smart-robotic** to receive the valid tolerance values for the pass / fail indication.

8.1.5 Data Analysis

The module **Data Analysis** is used to view and evaluate the measurement data. After starting the module the required measurement database is to be selected.

BYK smart-chart - Version 7.2.0 Release 8	927		 -	×
< Data Analysis				X
	Databases			
	Search	م		
	Measurement-Data Ct\BYK\smart-chart 3.0\Measurement-Data.sdf	Select		
	Measurement-Prod C:\\BYK\smart-chart 3.0\Measurement-Prod.sdf			
	Measurement-Test C:\\BYK\smart-chart 3.0\Measurement-Test.sdf			
		_		

Illustration 88: Data analysis - database selection in smart-chart

After selecting the database the measurement data in this database are displayed.

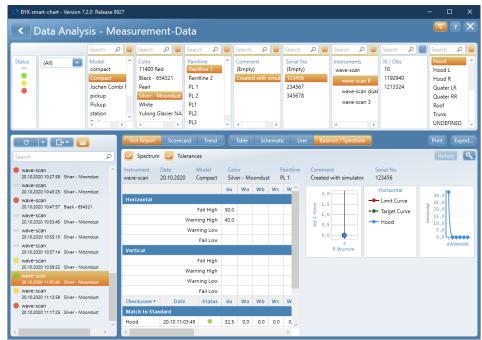


Illustration 89: Data analysis – measurement details in smart-chart

The data display consists of following sections:

- Top: Filter list
- Left: Results list
- Right: Details for selected result

In the example shown above the filter criteria have been selected which will be used in the next step – the measurements with **smart-robotic**.

8.2 Configuration in smart-robotic

The configuration in **smart-robotic** comprises following steps:

- Database [> 90]
- wave-scan Settings [> 91]
- Color Standards [> 98]
- Paint Lines [98]
- Quality Alarm [> 99]

For the creation of this documentation the **wave-scan ROBOTIC** has been used. The configuration of smart-chart link for the **BYK-mac i ROBOTIC** is analogue.



NOTICE

The configuration in **smart-chart** is read by **smart-robotic** during program start. After each change in standards and organizers the program **smart-robotic** has to be restarted.

8.2.1 Standard Database

On the tab **Database** the standards and organizer database "bykmainDB_3.sdf" from **smart-chart** is to be linked.

Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
	LT settings Color standards Paintli Database BYK-mac settings wave-scan					Quality alarm Thickness settings	_
Database file (.sdf)	K\smart-chart 3.0\bykma tabase Define	inDB_3.sdf					
		-chart - Version 7.2.0 Infiguration		Standard Databas	e		×
		Options General Properties	, Language, etc.	 Local database fi C:\ProgramData\BYK\s 		nDB_3.sdf	
	୍	Standard Data		SQL Server conn	ection		

Illustration 90: Link to standard database in smart-robotic

For using a local database, its path is: "C:\ProgramData\BYK\smart-chart 3.0", see Standard Database [▶ 77].

8.2.2 wave-scan Settings

The wave-scan settings comprise following steps:

- Signal Mapping [**•** 91]
- Check Zones [> 96]
- Output Database [> 97]

8.2.2.1 Signal Mapping

The **smart-chart** data import settings define, how the unprocessed measurement data is linked to **smart-chart** organizers and standards, e.g. target values, tolerances and check zones. A car model can have a different name in the robotic system than defined in the organizer, e.g. the PLC is limited in characters. Therefore, a mapping is required. Following XML file gives an example of a **wave-scan RO-BOTIC** device output for unprocessed measurement data.



Illustration 91: Example XML output file and mapping

The example file shown above contains meta data including time stamp, car model, color and check points / zones as well as measurement data of the **wave-scan ROBOTIC**. In order to process this data with the corresponding organizer and standard in **smart-chart**, the data must be mapped.

e configuration							
Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
PELT s	ettings	Color stand	lards	Paintlines		Quality alarm	
Data	base	BYK-mac se	ttings	wave-scan settin	gs	Thickness settings	
nart-chart data	a import settings for	wave-scan instrum	ients				
Signal mapping	Checkzones	Output databases					
lob items							
Model 🧿	Car-Model					Define / Check	
Color 🧿	Car-Color					Define / Check	
Paintline 🌒	Paint-Line					Define / Check	
Comment 🔮	Comment					Define / Check	
Vehicleld 🧿	Vehicle-ID					Define / Check	
Point item							
Checkzone 🕜	Zone-Name					Define / Check	

Illustration 92: Signal mapping for wave-scan in smart-robotic

The mapping is to be done for the two types of OPC signals:

- Job Items [93]
- Point Item [94]



NOTICE

Below the example device **wave-scan ROBOTIC** is shown. The configuration for the **BYK-mac i ROBOTIC** is analogue.

8.2.2.1.1 Job Items

Click the **Define / Check** button to open the **Definition Designer**.

smart-robotic - Version 3.0.0		- 0	×
Save configuration	Definition designer		
Monitoring OPC	Formula for parameter Model		
PELT settings	Car-Model	lity alarm	
Database	Preview	ess settings	
smart-chart data import set	Car-Model		
Signal mapping Chec	User defined text Add text		
Job items	Predefined items		
Model 😗 Car-Mode		Define / Check	
Color 🕐 Car-Color	Tat Commont Tat Makida ID	Define / Check	
Paintline Paint-Line	OK Cancel	Define / Check	
Comment 🕐 Comment		Define / Check	
VehicleId 🕐 Vehicle-ID		Define / Check	
Point item			
Checkzone 🕜 Zone-Nam		Define / Check	
		Denne / Check	

Illustration 93: Job signal mapping for wave-scan in smart-robotic

Use the **Predefined Items** to create the **Formula for Parameter Model**. You can also add **User-defined Text** here – similar to the options described in the **Output** Files [▶ 67] under Output Filename [▶ 70].



NOTICE

The **Predefined Items** are coming from the OPC [▶ 28] settings > section Common Job Signals [▶ 32]. These signals are common to all devices - they have to be created once in the system.

8.2.2.1.2 Point Item

Click the **Define / Check** button to open the **Definition Designer**.

e configuration									
Monitoring	OPC	Devices	Output	files	mart-chart link	Robot simula	tor		
PELT sett	ings	Color sta	andards		Paintlines			Quality alarm	
Databa	se	BYK-mac	settings		wave-scan setti	ngs	Thi	ckness settings	
mart-chart data i	mport settings for	wave-scan instru	iments						
Signal mapping	Checkzones	Output databa	ses						
Job items	🔘 Defi	nition designer					>	<	
Model 🧿	CareModel	for Checkzone name						Define / Check	
Color	Car-Color Zone	Name						Define / Check	
Paintline 🔮	Paint-Line Preview							Define / Check	
Comment 🔮	Comment User def	ined text			Add te	xt		Define / Check	
Vehicleld	Vehicle-ID Predefin	ed items YEAR	MONTH	DAY		OUR	^	Define / Check	
Point item	*	MINUTE	SECOND			I numb			
Checkzone 🕜	Zone-Nam	Catalogue n 🎾 🚔	STATUS	Zone-In	dex 🚔 Zone	e-Name	~	Define / Check	

Illustration 94: Point signal mapping for wave-scan in smart-robotic

Use the **Predefined Items** to create the **Formula for Parameter Model**. You can also add **User-defined Text** here – similar to the options described in the Output Files [▶ 67] under Output Filename [▶ 70].



NOTICE

The **Predefined Items** for the wave-scan are coming from the device 4822 - wave-scan ROBOTIC [\triangleright 55] > section OPC Point Signals [\triangleright 58] - and from all other devices(!). These signals have to be created separately for each device in the system.

The signal mapping connects the OPC signals containing standard and organizer information with the objects in the **smart-chart** database.

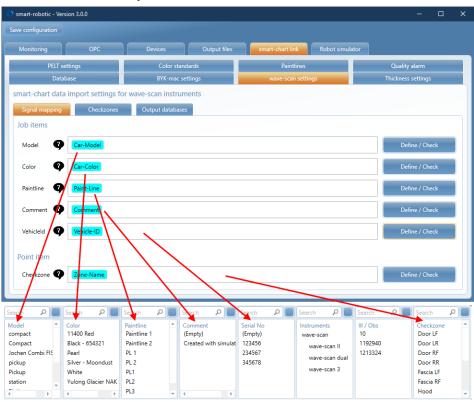


Illustration 95: Signal mapping for wave-scan between smart-robotic and smart-chart

In the **smart-chart** database these data are visible in the module Data Analysis [> 89].

8.2.2.2 Check Zones

The organizers created in **smart-chart** are characterized by check zones defined by the user, see Organizers [**> 82**].

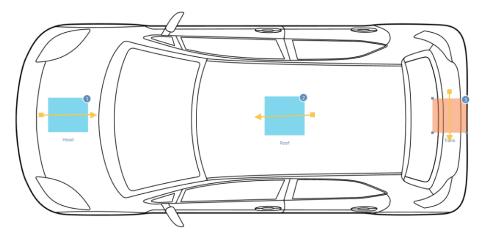


Illustration 96: Definition of organizer check zones in smart-chart

In the PLC environment, check zones are often given technical names different than the naming in **smart-chart** domain. Therefore, also the check zones must be linked.

smart-robotic - Version	3.0.0					-	;
ve configuration							
Monitoring	OPC	Devices	Output files	smart-chart link	Robot simulator		
PELT settin	gs	Color stan	dards	Paintlines		Quality alarm	
Database		BYK-mac se	ttings	wave-scan settin	igs	Thickness settings	
mart-chart data im	port settings for wa	ave-scan instrum	nents				
Signal mapping	Checkzones	Output database	5				
Wavescan checkzo	ne mapping						
Symbol value	Name in smartc		new entry Rem				
Front	Hood	Add	new entry Rem	ove			
Front	🛒 Hood						
🕏 Тор	🗮 Roof						
😨 Rear	🗮 Trunk						
L							

Illustration 97: Check zone mapping for wave-scan in smart-robotic

Perform following steps:

- 1. **Symbol Value**: Enter the name of the check zone in the PLC domain.
- 2. **Name in smart-chart**: Open the drop down menu to select the corresponding check zone in smart-chart.
- 3. Add new entry: Click the button to be linked both values.



NOTICE

The names of the check zones in the PLC domain are case-sensitive.

8.2.2.3 Output Database

The section **Output Databases** specifies the measurement database, in which the measurement data is stored, see Measurement Database [**>** 78].

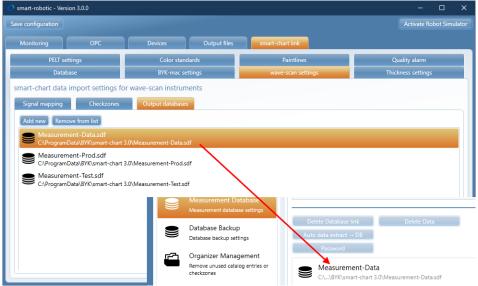


Illustration 98: Measurement database for wave-scan in smart-robotic

New entries can be created using the **Add new** button and selecting the desired option (compact or server) from the context menu.

8.2.3 Color Standards

On the tab **Color Standards** the mapping to the objects in the smart-chart database is to be done, see **Standards** [> 79].

Monitoring	ОРС		Output files	smart-chart link	Robot simulator		
Database		BYK-mac	settings	wave-scan setting	IS	Thickness settings	
PELT setting	s	Color sta	ndards	Paintlines		Quality alarm	
olor standard mapp	ping						
mbol value	Name in smartchar						
		Add	new entry Remo	ve			
Red	💐 11400 Re	d					
Orange	🗮 13655 Or	ange					
Blue	💐 15102 Blu	ie					
Bordeux	🗮 Bordeux						
Silver	🗮 Silver - M	oondust					
Black	🗮 Black - 65	4321					

Illustration 99: Smart-Robotic-Color-Standards

The mapping is analogue to the mapping of the Check Zones [> 96]. In the example shown above the value "Silver" in smart-robotic is linked to the value "Silver - Moondust" in smart-chart.

8.2.4 Paint Lines

In smart-chart the paint lines are configured in the Organizers [> 82], see Paint Lines [> 85].

e configuration							
Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
Database		BYK-mac se	ttings	wave-scan settir	ngs	Thickness settings	
PELT setting	s	Color stand	dards	Paintlines		Quality alarm	
mbol value	Name in smartcha		ew entry Remo	ove			
Paintline 1	🗮 PL 1						
Paintline 2	🗮 PL 2						
Repairline	🗮 RL						

Illustration 100: Paint line mapping in smart-robotic

The mapping is analogue to the mapping of the Check Zones [▶ 96] and the Standards [▶ 79]. In the example shown above the value "Repairline" in smart-robotic is linked to the value "RL" in smart-chart.

8.2.5 Quality Alarm

To give feedback to the PLC about the measurement status of the car body or measured object, the tab **Quality Alarm** can be used.

e configuration							
Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
Data	oase	BYK-mac se	ettings	wave-scan setti	ngs	Thickness settings	
PELT se	ttings	Color stan	dards	Paintlines		Quality alarm	
uality alarm se	ttings						
Quality Alarm	Active						
uality Alarm Trigge	rs						
🖉 🔴 Fail							
📕 😑 Warning							
Pass							
Pass							
	s						
	ls						
lsed OPC Signa							
Jsed OPC Signa	RESULT_CTRL)	Connecti	on				
Jsed OPC Signa Control signals (
Jsed OPC Signa Control signals (Name IN_ACK	RESULT_CTRL)	Connecte	d				
Jsed OPC Signa Control signals (Name IN_ACK OUT_READY	RESULT_CTRL) Type boolean boolean	Connecte	d				
Jsed OPC Signa Control signals (Name IN_ACK OUT_READY	RESULT_CTRL) Type boolean boolean	Connecte	d				
Jsed OPC Signa Control signals (Name IN_ACK OUT_READY	RESULT_CTRL) Type boolean boolean	Connecte	kd Kd				
Ised OPC Signa control signals (Name IN_ACK OUT_READY Data signals (RE: Name OUT_STATUS	RESULT_CTRL) Type boolean boolean SULT_DATA) Type boolean	Connecte Connecte Connecte Connecte	ed ed on				
Jsed OPC Signa Control signals (IN_ACK OUT_READY Data signals (RE: Name OUT_STATUS OUT_DATETIME	RESULT_CTRL) Type boolean boolean SULT_DATA) Type boolean boolean	Connecte Connecte Connecte Connecte	d d on d				
Jsed OPC Signa Control signals (IN_ACK OUT_READY Data signals (RE: Name OUT_STATUS OUT_DATETIME OUT_DATETIME OUT_DATETIME OUT_MODEL	RESULT_CTRL) Type boolean SULT_DATA) Type boolean boolean boolean	Connecte Connecte Connecte Connecte Connecte Connecte	d d d d				
Jsed OPC Signa Control signals (IN_ACK OUT_READY Data signals (RE: Name OUT_STATUS OUT_DATETIME OUT_STATUS OUT_OLOR	RESULT_CTRL) Type boolean boolean SULT_DATA) Type boolean bool	Connecte Connecte Connecte Connecte Connecte Connecte Connecte	d d on d d d d				
Jsed OPC Signa Control signals (IN_ACK OUT_READY Data signals (RE: Name OUT_STATUS OUT_OUT_ATETIME OUT_MODEL OUT_OLOR OUT_OUT	RESULT_CTRL) Type boolean boolean boolean boolean boolean boolean boolean	Connecte Connecte Connecte Connecte Connecte Connecte Connecte	d d d d d d d				
Jsed OPC Signa Control signals (IN_ACK OUT_READY Data signals (RE: Name OUT_STATUS OUT_DATETIME OUT_STATUS OUT_OLOR	RESULT_CTRL) Type boolean boolean SULT_DATA) Type boolean bool	Connecte Connecte Connecte Connecte Connecte Connecte Connecte	d d d d d d d d d d d				

Illustration 101: Quality alarm settings in smart-robotic

Perform following steps:

- 1. Activate the flag **Quality Alarm Active**.
- 2. Select the Quality Alarm Triggers to be used, see Quality Status [> 74].
- 3. Check the OPC **Control signals**, and the OPC **Data Signals**, see Example List of OPC Signals [▶ 14] and Description of Example List [▶ 16] > Section #8.

An example for each alarm trigger is shown in Testing the Configuration [> 100].



NOTICE

It is up to the PLC domain to evaluate these triggers and to communicate the alarm situation.

8.3 Testing the Configuration

To test the configuration perform measurements with **smart-robotic** and check the results in the **smart-chart** database. Perform following steps:

- Prepare Measurements [> 100]
- Perform Measurements [> 102]
- Check Results [> 107]

The test measurements shown below have been made with the **Robot Simulator**.

8.3.1 Prepare Measurements

On the device tab for your current measurement instrument create a check zone which can be mapped to the corresponding check zone in an existing organizer – for example "Front". Enable the device.

	smart-robotic - Ve	rsion 3.0.0						
-	Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
	Control	bykmac 1	bykmac 2	Wavescan 1	WavescanThree 2	WavescanThree 3		
	Robot Sim	ulator	Enable	Disable	V	Vavescan 1		
	Measure po Point data sig	pint quantity nals	1	Jo	b data values fo	or simulation		
	Туре	Alias	Connection	V	alue			
	Integer	Zone-Index	Connected	1 Fr		X		
	String	Zone-Name	Connected	2 Tc 3 Re	op.	X X X		

Illustration 102: Test measurement – check zone definition in simulator

On the **Control** tab first create a car model which can be mapped to an existing organizer, for example "Compact".

🔘 smai	t-robotic - Vers	ion 3.0.0					-	×
Мо	nitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
	Control	bykmac 1	bykmac 2	Wavescan 1	WavescanThree 2	WavescanThree 3		
Ro	Robot Simulator		Start	Stop	(Common controls		
ŀ	leart beat s	imulation						
J	ob quantity		1	-				
J	ob mode		Measurement	-				
Jol	b data signal	ls						
				Jol	o data values f	or simulation		
1	ype	Alias	Connection	V	alue			
S	tring	Car-Model	Connected		ompact			
	tring	Car-Color	Connected			X		
	tring	Paint-Line	Connected	2 Pi		x		
	tring	Comment	Connected	3 St	ation	X		
S	tring	Vehicle-ID	Connected					

Illustration 103: Test measurement – car model definition in simulator

Second create a car color which can be mapped to a color standard in that organizer, for example "Silver".

0	smart-robotic - Ve	rsion 3.0.0					—	×
Sav	ve configuration							
	Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
	Control	bykmac 1	bykmac 2	Wavescan 1	WavescanThree 2	WavescanThree 3		
	Robot Sim	nulator	Start	Stop	C	Common controls		
	Heart beat	simulation						
	Job quantit	y	1	-				
	Job mode		Measurement	-				
	Job data sign	als		lo	o data values fo	or simulation		
	Туре	Alias	Connection			, sintalation		
	String	Car-Model	Connected		alue			
	String	Car-Color	Connected	1 Si	ver	X		
	String	Paint-Line	Connected					
	String	Comment	Connected					
	String	Vehicle-ID	Connected					

Illustration 104: Test measurement – color standard definition in simulator

Start the simulator and wait for the data output.

Monitoring	OPC	Devic	es Output files smart-chart link Robot simulator
Timestamp	Category	Module	Information
020-10-22 14:20:19.	456 Info	Bykmac 1	Instrument is disabled.
020-10-22 14:20:19.	456 Info	Bykmac 2	Instrument is disabled.
020-10-22 14:20:19.	456 Info	WavescanThree 3	Instrument is disabled.
020-10-22 14:20:19.	456 Info	WavescanThree 2	Instrument is disabled.
020-10-22 14:20:19.	457 Info	Wavescan	Job Normal started with: Information: Car-Model = Compact Car-Color = Silver Paint-Line = Paintline 1 Comment
020-10-22 14:20:19.	460 Info	Wavescan	Initialize
020-10-22 14:20:19.	462 Info	Wavescan 1	Prepare measuring
020-10-22 14:20:23.	736 Info	Wavescan 1	Start measuring
020-10-22 14:20:23.	873 Info	Wavescan 1	Command sent.
020-10-22 14:20:27.	280 Info	Wavescan 1	Measuring ended.
020-10-22 14:20:28.	137 Info	Wavescan 1	Read data.
020-10-22 14:20:29.	329 Info	Wavescan 1	Prepare measuring
020-10-22 14:20:30.	549 Info	Wavescan 1	Device idle.
020-10-22 14:20:31.	009 Info	Opc ALL_JOB	Job stop
020-10-22 14:20:31.	781 Info	ImportProcessor	Importing data. Wavescan
020-10-22 14:20:31.		WaveConverter	Organizer found. Robot-Cell-Compact
020-10-22 14:20:32.	009 Info	WaveConverter	Process as absolute measurement
020-10-22 14:20:32		WaveConverter	Organizer found. Robot-Cell-Compact
020-10-22 14:20:32.		WaveConverter	Process as absolute measurement
2020-10-22 14:20:32.		WaveConverter	Organizer found. Robot-Cell-Compact
020-10-22 14:20:33.			No Wavescan device selected. Skip output
020-10-22 14:20:33.	114 Warn	FileOutputProcessor	No Wavescan device selected. Skip output

Illustration 105: Test measurement – log for data output in simulator

With the given information the organizer and standard can be found in smartchart. In the organizer the check zone can be found. In the standard the tolerance values can be found.



NOTICE

1 Make sure the color standard has been added to the organizer, see Standard Selection [**84**].

2 Create an additional output file with the quality status as part of the Output Filename [**70**].

8.3.2 Perform Measurements

Below an example is shown for each quality status scenario:

- Quality Status "None" [> 102]: Standard / organizer not found
- Quality Status "Red" [> 104]: Measurement values not in tolerances
- Quality Status "Yellow" [> 105]: Measurement values in warning area
- Quality Status "Green" [> 106]: Measurement values in tolerances

For the meaning of each status and the impact of each check zone status on the overall job status see Quality Status [> 74].



NOTICE

In the following examples the tolerance settings in **smart-chart** will be changed. Remember to restart **smart-robotic** after each change in **smart-chart** in order to read the changed values in the database.

8.3.2.1 Quality Status "None"

The quality status for a check zone will be "None", if organizer or standard can not be found in the smart-chart database. In this case the simulator will generate the following data output:

- Job Quality = Green
- Zone Status = None

```
<?xml version="1.0"?>
<wave-scan-robotic>
<jobdata>
<timestamp>2020-10-22T14:20:19</timestamp>
    <jobquality>Green</jobquality>
    <carmodel>Compact</carmodel>
    <carcolor>Silver</carcolor>
    <paintline>Paintline 1</paintline>
    <comment>Created with simulator.</comment>
    <vehicleid>123456</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-10-22T14:20:23</time>
    <serialnr>1213324</serialnr>
   <catalognr>4822</catalognr>
   <status>None</status>
   <zoneid>1</zoneid>
   <zone>Front</zone>
   <scale Id="01 LW" value="0" />
   <scale Id="02 SW" value="0" />
    <scale Id="19 We" value="0" />
   <scale Id="23 Wa" value="0" />
   <scale Id="24 Du" value="38,8" />
</point>
</points count>
</wave-scan-robotic>
```

Check the measurement value for the scale "Dullness (du)", here: "38,8". In the following examples this value will be used as base for the modification of the tolerance settings.

8.3.2.2 Quality Status "Red"

Enter a tolerance value, which can not be achieved during measurement.

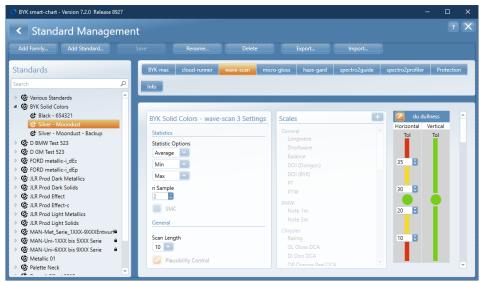


Illustration 106: Test measurement - tolerance for quality status "Red" in smart-chart

In our example the dullness measured is "38,8". Setting a limit of "35" will give the condition "Red = Out of tolerance". The simulator will generate the following data output:

- Job Quality = Red
- Zone Status = Red

```
<?xml version="1.0"?>
<wave-scan-robotic>
<jobdata>
<timestamp>2020-10-22T14:07:09</timestamp>
    <jobquality>Red</jobquality>
    <carmodel>Compact</carmodel>
   <carcolor>Silver</carcolor>
   <paintline>Paintline 1</paintline>
    <comment>Created with simulator.</comment>
    <vehicleid>123456</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-10-22T14:07:13</time>
    <serialnr>1213324</serialnr>
    <catalognr>4822</catalognr>
   <status>Red</status>
    <zoneid>1</zoneid>
    <zone>Front</zone>
    <scale Id="01 LW" value="0" />
   <scale Id="02 SW" value="0" />
    <scale Id="19 We" value="0" />
   <scale Id="23 Wa" value="0" />
   <scale Id="24 Du" value="38,8" />
</point>
</points count>
</wave-scan-robotic>
```

8.3.2.3 Quality Status "Yellow"

Now enter a tolerance value, which will lead the quality status to the condition "Yellow".

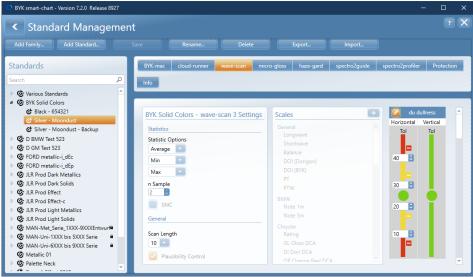


Illustration 107: Test measurement – tolerance for quality status "Yellow" in smart-chart

In the example shown above all values between "10..20" and "30..40" will set the condition "Yellow = In warning area". The simulator will generate the following data output:

- Job Quality = Yellow
- Zone Status = Yellow

```
<?xml version="1.0"?>
<wave-scan-robotic>
<jobdata>
<timestamp>2020-10-22T14:04:25</timestamp>
    <jobquality>Yellow</jobquality>
    <carmodel>Compact</carmodel>
    <carcolor>Silver</carcolor>
    <paintline>Paintline 1</paintline>
    <comment>Created with simulator.</comment>
    <vehicleid>123456</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-10-22T14:04:29</time>
    <serialnr>1213324</serialnr>
    <catalognr>4822</catalognr>
    <status>Yellow</status>
    <zoneid>1</zoneid>
    <zone>Front</zone>
    <scale Id="01 LW" value="0" />
    <scale Id="02 SW" value="0" />
    <scale Id="19 We" value="0" />
    <scale Id="23 Wa" value="0" />
    <scale Id="24 Du" value="38,8" />
</point>
</points count>
</wave-scan-robotic>
```

8.3.2.4 Quality Status "Green"

Now enter a tolerance value, which will lead the quality status to the condition "Green".

BYK smart-chart - Version 7.2.0 Release 8927 Standard Management			
	ave Rename Delete	Export	
Standards	BYK-mac cloud-runner wave-scan mice	ro-gloss haze-gard spectro	2guide spectro2profiler Protection
Search P	Info		
Various Standards			
Gr BYK Solid Colors			
& Black - 654321	BYK Solid Colors - wave-scan 3 Settings	Scales	+ 🛛 🖌 🖌
🕑 Silver - Moondust	Brk Solid Colors - wave-scall 5 Settings		Horizontal Vertical
🔂 Silver - Moondust - Backup	Statistics	General	Tol Tol
D BMW Test 523	Statistic Options	Longwave	
D GM Test 523	Average 🔽	Balance	
FORD metallic-i_dEc	Min		50 🛢
FORD metallic-i_dEp	Max		
Gring JLR Prod Dark Metallics			
JLR Prod Dark Solids	n Sample	PTW	40 🕄
Gr JLR Prod Effect Gr JLR Prod Effect-c	2		
JLR Prod Effect-c	SMC	Note 1m	20 🖯
JLR Prod Light Solids	General	Note 3m	
MAN-Met_Serie_1XXX-9XXXEntwurf			
MAN-Uni-1XXX bis 5XXX Serie	Scan Length	Rating	10 🖯
MAN-Uni-6XXX bis 9XXX Serie	10 💌	GL Gloss DCA	
G Metallic 01	Plausibility Control	DI Dori DCA	
Palette Neck		OP Orange Peel DCA	
- 🕂 n i ra i nan			

Illustration 108: Test measurement – tolerance for quality status "Green" in smart-chart

In the example shown above all values between "20..40" will set the condition "Green = Within tolerances". The simulator will generate the following data output:

- Job Quality = Green
- Zone Status = Green

```
<?xml version="1.0"?>
<wave-scan-robotic>
<jobdata>
<timestamp>2020-10-22T14:11:37</timestamp>
    <jobquality>Green</jobquality>
    <carmodel>Compact</carmodel>
   <carcolor>Silver</carcolor>
   <paintline>Paintline 1</paintline>
    <comment>Created with simulator.</comment>
    <vehicleid>123456</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-10-22T14:11:41</time>
   <serialnr>1213324</serialnr>
   <catalognr>4822</catalognr>
   <status>Green</status>
   <zoneid>1</zoneid>
   <zone>Front</zone>
   <scale Id="01 LW" value="0" />
   <scale Id="02 SW" value="0" />
   <scale Id="19 We" value="0" />
   <scale Id="23 Wa" value="0" />
   <scale Id="24 Du" value="38,8" />
</point>
</points count>
</wave-scan-robotic>
```

8.3.3 Check Results

Final step is the check of the measurement results in the **smart-chart** database using the module Data Analysis [**>** 89].

O BYK smart-chart - Version	7.2.0 Release 893	27						-	- 🗆 X
< Data Analy	vsis - wa	ve-scan-Ro	botic						? X
	Search 🔎	Search 🔎		Search 🔎		earch P	Search 🔎	Search P	Search 👂
Status (Al)	Model compact Compact pickup Pickup station Name	Color 11400 Red Pearl Silver - Moondu: White	Paintline 1 PL 1	Comment Created wi	th sim	Serial No 123456 234567	Instruments wave-scan wave-scan II wave-scan 3	III / Obs 10 1213324	Checkzone Hood Roof Trunk UNDEFINED
C T GT	3	Test Report So	corecard Trend	Tabl	e Sc	hematic L	ine Balance / Sp	ectrum	Print Export
Search	Q	🔽 Spectrum 🔽	Tolerances						History 🔍
wave-scan 22.10.2020 13:58:41 Silver - Me	oondust	Instrument Date wave-scan 22.10	Model 0.2020 Compact	Color Silver -	Moondu	Paintline st PL 1	Comment Created with sim	Serial N ulator. 123456	0
 wave-scan 22.10.2020 14:00:40 Silver - Me 	oondust			du W	a Wb	Wc W^	" 2,0	Horizontal	40,0 9 20,0
wave-scan 22.10.2020 14:04:25 Silver - Me	oondust	Horizontal						🗕 Limit Curve 📤	0,0
e wave-scan			Fail High Warning High	50,0 40.0			BS	- Target Cun	
22.10.2020 14:07:09 Silver - Me wave-scan	oondust		Warning Low	20,0					
22.10.2020 14:11:37 Silver - Me	oondust		Fail Low	10,0					
wave-scan 22.10.2020 14:20:19 Silver - Me		Vertical				~			
4	×.	<				>			

Illustration 109: Test measurements – data analysis in smart-chart

With this check the configuration of **smart-chart link** for the **wave-scan RO-BOTIC** is complete. You can now configure the **BYK-mac i ROBOTIC** analogue.

8.4 Thickness Measurement

The software **smart-robotic** can process measurement data from **Fisher** thickness measurement instruments:

https://www.helmut-fischer.com

In difference to the BYK-Gardner instruments **BYK-mac i ROBOTIC** and **wave**scan **ROBOTIC** the thickness measurement instruments are not controlled by smart-robotic.

These instruments create XML files which can be processed by smart-robotic.



NOTICE

The XML files are required in a specific structure to be processed by **smart-robotic**. Details see below.

8.4.1 Prerequisites

Understanding of following topics is required:

- Configuration of Output Files [> 67]
- Configuration in smart-chart [> 77]
- Configuration in smart-robotic [> 90]

These topics are about the BYK-Gardner ROBOTIC instruments. In the following the differences are described.

8.4.2 Input XML File

The XML data file to be processed by **smart-robotic** needs to include following information:

```
<scale Id ="102" value ="<mic-value>"></scale>
or
<scale Id ="103" value ="<mil-value>"></scale>
```

Each entry for a scale has the following syntax:

- 1. The "Scale ID" is the name of the thickness scale used.
- 2. The "Value" is the measurement for the thickness in µm or mil.

A complete XML data file may look like the following example.

```
<?xml version="1.0"?>
<br/>byklink service thickness>
<jobdata>
<timestamp>2020-10-30T11:16:00</timestamp>
<Comment>This is a comment.</Comment>
<Paintline>X</Paintline>
<Model>Compact</Model>
<VID>Vehicle 12458</VID>
<Color>White</Color>
<Body type>4DR</Body type>
</jobdata>
<points count="2">
<point>
<deviceid>1210833</deviceid>
<timestamp>2020-10-30T11:16:00</timestamp>
<Checkzone>Front</Checkzone>
<PartNo>01</PartNo >
<PointNo>08</PointNo >
<Name>SAMPLE 01</Name>
<scale Id ="112 (mic/µm)" value ="302"></scale>
</point>
<point>
<deviceid>1210833</deviceid>
<timestamp>2020-10-30T11:16:00</timestamp>
<Checkzone>Top</Checkzone>
<PartNo>02</PartNo >
<PointNo>09</PointNo >
<Name>SAMPLE 02</Name>
<scale Id ="112 (mic/µm)" value ="259"></scale>
</point>
</points>
</byklink service thickness>
```

With this information **smart-robotic** can search for the corresponding standard in the **smart-chart** standard database and save the measured values in the results database – including pass / fail indication.

8.4.3 Configuration in smart-chart

The configuration in **smart-chart** comprises following steps:

- 1. License File [**▶** 109]
- 2. Color Standard [> 110]
- 3. Organizer Instruments [> 112]
- 4. Organizer Settings [> 112]
- 5. Organizer Procedure [> 113]

These steps are described below.

8.4.3.1 License File

For the thickness measurement instruments a separate license is required.

O BYK smart-chart - Version 7.2.0 Release 8927	- 🗆 X
About/License	2 🗙
License Information:	License Agreement:
smart-process spectro2guide spectro2guide 78d51668-5305-43ee-b8c1-af5d99c0aa9a Return license	Please connect an instrument. Manual Robotic License Catalog No. Serial No. License Type Sm
smart-process film thickness USB Film Thickness	
smart-lab spectro2profiler spectro2profiler 2a386ad6-d394-4af3-951a-a5cc2435592f Return license	
smart-process spectro2profiler spectro2profiler 53dadecb-cfac-4617-9fb5-14df857ea8ba Return license	

Illustration 110: License information in smart-chart

With this license the thickness measurement instruments can be activated in the organizers, see Organizer Instruments [> 112].

8.4.3.2 Color Standard

In each used color standard the scale for the thickness measurement is to be added. For the **Fisher** instruments the scale **Thickness** in μ m or **mil** is relevant.

O BYK smart-chart - Version 7.2.0 Release 8927	- 🗆 X
Standard Manageme	ent 🔹 🗙
Add Family Add Standard	Save Rename Delete Export Import
Standards	BYK-mac cloud-runner wave-scan micro-gloss haze-gard spectro2guide
Search P	spectro2profiler film thickness Protection Info
 Various Standards Various Stan	spectro2profiler film thickness Protection Info
 	Tolerance Settings Single Tolerance Scale Thickness Scale Thickness Unit µm

Illustration 111: Color standard family in smart-chart

In the scale μm the tolerance value(s) for the pass / fail indication have to be entered. This can be once done for all colors in the family or separately for each color.

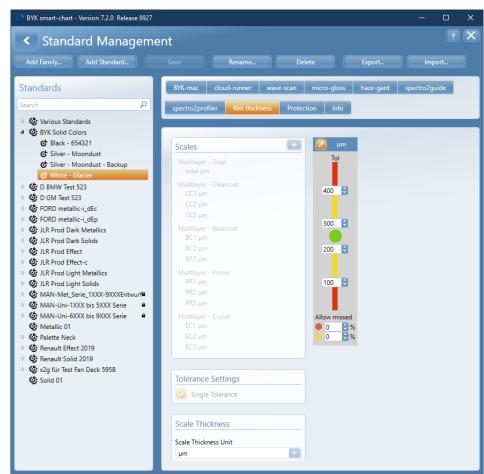


Illustration 112: Color standard details in smart-chart

In the example shown above for the color standard "White - Glacier" following tolerances have been set:

- < 100 = Red
- 100..200 = Yellow
- 200..300 = Green
- 300..400 Yellow
- > 400 = Red

These tolerances will be used in the description below.



NOTICE

Refer also to Allow Missed [> 138] for more information on color standards.

8.4.3.3 Organizer Instruments

In the **Organizer** on the tab **Instruments** the option **film thickness** is to be activated.

BYK smart-chart - Version 7.2.0 Release 89.		o x
Corganizer Add Organizer Save		?
Organizers Search	Parameter1 Standards Parameter3 Instruments BYK-mac cloud-runner wave-scan micro-gloss film thickness spectro2guide spectro2profiler Protection Info	
Brive Test 2020 C250 TD: Black 2019 HURACAN BODY Robot-Cell-Fickup Robot-Cell-Fickup Robot-Cell-Station	Wave-scan Instruments Image: Second secon	
 s2g Organizer 2 zonen 2019 Stephan Combi Training 2019 Test Organizer 2019 	micro-gloss Instruments Activated Imicro-gloss film thickness Instruments Activated Imicro-gloss	

Illustration 113: Organizer instruments in smart-chart

With activated option this organizer becomes relevant for the thickness measurements.

8.4.3.4 Organizer Settings

In the module **Organizer** on the tab **Settings** the correct **Scale Thickness Unit** is to be selected.

O BYK smart-chart - Version 7.2.0 Release 892	X
Organizer Add Organizer Save	? X Delete Rename Export Import
Organizers Search	Parameter1 Standards Parameter3 Instruments BYK-mac cloud-runner wave-scan wave-scan T micro-gloss film thickness spectro2guide spectro2profiler Protection Info
BMW-Test-2020 BYK Test 2020 C250 TDi Black 2019 HURACAN BCDY Robot-Cell-Schap Robot-Cell-Schap Robot-Cell-Schap Stephan Combi Training 2019 Test Organizer 2019	Settings Test Procedure Advanced Settings

Illustration 114: Organizer settings in smart-chart

Following options are supported:

- Micrometer: µm
- Mil: mil

Following table shows the conversion.

mil	inch	μm	mm
1	0.001	2.54	0.0254

The option **Interrupt** allows a test series to be aborted before all check zones in the organizer have been measured.

8.4.3.5 Organizer Procedure

In the **Organizer** on the tab **Test Procedure** the check zones are defined.

BYK smart-chart - Version 7.2.0 Release 8927	×
< Organizer	2 🗙
Organizers	Parameter1 Standards Parameter3 Instruments BYK-mac cloud-runner wave-scan
Search 🔎	wave-scan T micro-gloss film thickness spectro2guide spectro2profiler Protection Info
 BMW-Test-2020 BYK Test 2020 C250 TDi Black 2019 	Settings Test Procedure
HURACAN BODY Robot-Cell-Compact Robot-Cell-Pickup	Change Schematic Sync Positions.
Robot-Cell-Yekup Robot-Cell-Station Sobot-Cell-Station \$20 Organizer 2 zonen 2019 Stephan Combi Training 2019 Test Organizer 2019	Open Check Zone Catalog I Hood Roof 3 Trunk
	Properties Hood - Horizontal n Sample 1 B =
	Scale Thickness Mode Auto

Illustration 115: Organizer procedure in smart-chart

In the box **Properties** the **Scale Thickness Mode** is to be selected. Following options are supported:

- Ferrous metal: FE
- Non-ferrous metals: NFE
- Detection of metal: Auto

With this step the configuration in **smart-chart** is complete.

8.4.4 Configuration in smart-robotic

The configuration in **smart-robotic** comprises following steps:

- 1. Source Folders [> 113]
- 2. Symbol Mapping [▶ 114]
- 3. Check Zones [> 116]
- 4. Output Databases [> 116]
- 5. Color Standards [> 117]
- 6. Paint Lines [> 117]
- 7. Output Files [▶ 118]

These steps are described below.

8.4.4.1 Source Folders

In **smart-chart link** on the tab **Thickness Settings** selected directories can be set to monitoring. If an XML file is placed in a monitored directory it is processed automatically by **smart-robotic**.

🔘 smart-robotic - Ve	rsion 3.0.0.9183				– 🗆 X
					Activate Robot Simulator
Monitoring	ОРС	Devices	Output files	smart-chart link	
PELT s	ettings	Color stand	ards	Paintlines	Quality alarm
Data	ibase	BYK-mac set	tings	wave-scan settings	Thickness settings
smart-chart dat	a import settings fo	or thickness instrume	nts (Fischer)		
Source Folders	Symbol mapping	g Checkzones	Output datab	ases	
Registered fold	ders for watching Remove				
C:\Progra	amData\BYK\Robotic\Th	ickness\Fisher			

Illustration 116: Monitored thickness-folders in smart-robotic

You have following options:

- Add: Click this button to select a directory for monitoring.
- **Remove**: The selected directory will not be monitored anymore.

An existing folder can be added or a new folder can be created in the browse dialog.

8.4.4.2 Symbol Mapping

The measurement data of the thickness measurement system can use own parameter names. Thus the parameter names of the thickness measurement system must be mapped to the corresponding parameter names in **smart-chart**.

					Activate Robot Simul
Monitoring	ОРС	Devices	Output files	smart-chart link	
PELT	settings	Color stan	dards	Paintlines	Quality alarm
Da	tabase	BYK-mac se	ettings	wave-scan settings	Thickness settings
mart-chart da	ta import settings for th	ickness instrum	ents (Fischer)		
Source Folders	Symbol mapping	Checkzones	Output databas	es	
Job items	Film Thickness				
Model G	Model				Define / Check
Color G	Color				Define / Check
Paintline	Paintline				Define / Check
Comment	Comment				Define / Check
VehicleId	VID				Define / Check
Point item					
Checkzone	Checkzone				Define / Check

Illustration 117: Thickness parameter mapping in smart-robotic

Perform following steps:

- 1. Click the button **Define / Check** beside a parameter.
- 2. Load an XML data file from the **Fisher** system.
- 3. Select the corresponding parameter in the file.
- 4. Click the button Add XML Node.

5. Save with the button **OK**.

When you open the dialog the 1st time, it is empty.

				×
Simplified input file structure				
	No symbols are defined.	.oad a data file first!		
				I Thickness File
			LUat	THICKNESSTIC
	Add XML node	Custom string		Add string
Formula				
Model				
	Remove item			
Current value Model				
			Cancel	OK

Illustration 118: Thickness parameter mapping – initial state

Click the button Load Thickness File to open an existing XML file.

				×
Simplified input file structure			Load	Thickness File
timestamp Checkzone PartNo PointNo Name V Formula	Add XML node	Custom string		Add string
Model				
Current value Compact	Remove item		Cancel	ОК

Illustration 119: Thickness parameter mapping – final state

Following rules apply:

- When you open the dialog a 2nd time during the same session, the previous XML file is still loaded.
- The option **Custom String** can be used to combine parameters and or fix text, for example "Model Color".
- The output field **Formula** shows the current selection.
- The output field **Current Value** shows the content of the fields in the current selection.

Repeat this procedure for all **Job Items** and for the **Point Item**.

8.4.4.3 Check Zones

The measurement data of the thickness measurement system can use own check zone names. Thus the check zone names of the thickness measurement system must be mapped to the corresponding check zone names in **smart-chart**.

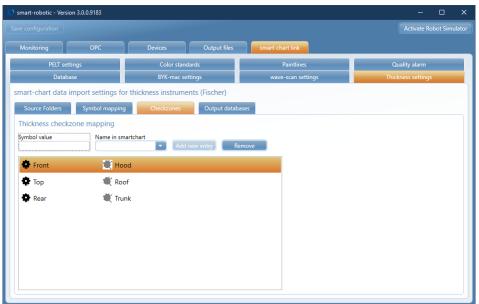


Illustration 120: Check zones for thickness measuring in smart-robotic

Perform following steps:

- 1. Enter the **Symbol Value** present in the input XML file.
- 2. Select the corresponding **Name in smart-chart** from the combo box.

Repeat this procedure for all other check zones present in the input XML file.

8.4.4.4 Output Databases

Final step on the **Thickness Settings** tab is the selection of the measurement database in **smart-chart**.

configuration					Activate Robot Simu
Monitoring	OPC	Devices	Output files	smart-chart link	
PELT settir	ngs	Color stand	ards	Paintlines	Quality alarm
Databas	e	BYK-mac set	tings	wave-scan settings	Thickness settings
art-chart data in	port settings for th	ickness instrume	nts (Fischer)		
Source Folders					
	Symbol mapping	Checkzones	Output database	es	
Add new Remove	Symbol mapping	Checkzones	Output database	25	
	from list	Checkzones	Output database	25	
🗩 Measuremei	from list			5	
🗩 Measuremei	from list			5	
🗩 Measuremei	from list			5	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			5	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			5	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	
🗩 Measuremei	from list			3	

Illustration 121: Output database for thickness measuring in smart-robotic In this database the results from the thickness input XML files will be stored.

8.4.4.5 Color Standards

If the thickness input XML files use additional values for the color, these values are also to be mapped on the **Color Standards** tab.

					Activate Robot Simulat
Monitoring	OPC	Devices	Output files	smart-chart link	
Database		BYK-mac s	ettings	wave-scan settings	Thickness settings
PELT setting	IS STATE	Color star	ndards	Paintlines	Quality alarm
olor standard map	ping				
mbol value	Name in smartchart		new entry Rem		
White	White-Glacier	Add	new entry Rem	ove	
Red Red	🗮 11400 Red	ł			
Blue	🗮 15102 Blue	e			
Bourdeux	🗮 Bordeux				
Black	🗮 Black-654	321			
Silver	🗮 Silver-Moo	ondust			
🗭 White	🗮 White-Gla	cier			
Brown	🗮 Brown-Mu	ılti			
Orange	🗮 Orange-M	lulti			
Petrol	🕷 Petrol-Mu				

Illustration 122: Color mapping for thickness measuring in smart-robotic

In the example shown above the highlighted colors are mapped to the corresponding entries in the color family "BYK Solid Colors", see Color Standard [> 110].

8.4.4.6 Paint Lines

If the thickness input XML files use different values for the identification of the paint line, these values are also to be mapped on the **Paint Lines** tab.

smart-robotic - Version 3.	.0.0.9650				- 🗆 X
Save configuration					Activate Robot Simulator
Monitoring	OPC	Devices	Output files	smart-chart link	
Database		BYK-mac se	ttings	wave-scan settings	Thickness settings
PELT settings	5	Color stand	lards	Paintlines	Quality alarm
Symbol value Paintline 1 Paintline 2 Repairline A	Name in smarte		ew entry Remo	we	
ФВ ФС	💐 PL 2				
Фх Фх	🗮 PL 1				
¢ Z	💐 PL 2				

Illustration 123: Paint line mapping for thickness measuring in smart-robotic

In the example shown above the input values X / Y / Z are mapped to PL 1 / PL 2 / RL.

8.4.4.7 Output Files

This step is optional. Output Files [▶ 67] can be configured, if the Quality Status [▶ 74] is required for further processing.

0	smart-robotic - Vers	sion 3.0.0.9650							-		×
										bot Simu	
	Monitoring	ОРС		Devices	Output files	smart-chart link					
	BYKmac	Wavescan		Thickness	PELT						
	Add Storage Data file Measurement	Remove	Directory	/	or Measurement	Browse	Ø				
			Filename \$pnTIM Template	ESTAMP\$tx-\$pnMC	DEL\$tx-\$pnCOLOR\$tx-\$	pnQUALITY\$tx.xml	Define	9			
				Thickness-Device quality status Green	Create new	Edit selected	Ø				
				Red							

Illustration 124: Output file configuration for thickness measuring in smart-robotic

The configuration of the **Filename** is similar to that for the BYK-Gardner devices, see Output Filename [▶ 70].

Definition designer				—		×
Formula for Filename						
TIMESTAMP -	MODEL -		Ixml			
Preview TIMESTAMP-MODEL-CO	DLOR-OUALITY.xml					
User defined text			Add text			
Predefined items						
YEAR		MONTH		DAY		\sim
HOUR		MINUTE		SECOND		
TIMESTA	MP 🚘	MEAS_COUNT		MODEL		\sim
				OK	Cancel	

Illustration 125: Output file name configuration for thickness measuring in smart-robotic

The configuration of the **Template** file is similar to that for the BYK-Gardner devices, see **Template** File [**▶** 71]. The differences are:

- There is a new option Thickness Scales under Predefined Items.
- OPC signals are NOT relevant here, instead the values from smart-chart link > Thickness are used.

This is shown in the following example.

Template Editor		-		×
File Name Fisher-Thickness-Device Predefined Items TIMESTAMP MEAS_COUNT MODEL	Header xml version="1.0"? <bybbccspace by="" compared="" of="" stamp="" t<="" td="" the=""><td></td><td></td><td>^</td></bybbccspace>			^
Predefined Items Meta data Thickness scales mi mi mi mi	<carcolor>\$COLOR\$</carcolor> < Measurement data <pprint> <time>\$TIME\$</time> <serialno>\$Serial No.\$</serialno> <catalogno>None - Fisher is OEM product.</catalogno> <status>\$STATU5\$</status> <checkcone>\$CHECKZONE\$ <scale id="102" value="\$mit\$"></scale> <scale id="103" value="\$mit\$"></scale> </checkcone></pprint>			>
	< Footer		_	>
	Save	and exit	Cance	el

Illustration 126: Output file template configuration for thickness measuring in smart-robotic



NOTICE

Remember that valid parameters are highlighted in cyan color. Check this for all parameters to be replaced with current values. The syntax check is performed when opening the template for editing.

Following example shows a possible template file.

Header

```
<?xml version="1.0"?>
<byklink_service_thickness>
<jobdata>
<timestamp>$TIMESTAMP$</timestamp>
<jobquality>$QUALITY$</jobquality>
<carmodel>$MODEL$</carmodel>
<carcolor>$COLOR$</carcolor>
<paintline>$PAINTLINE$</paintline>
<comment>$COMMENT$</comment>
<vehicleid>$VEHICLE_ID$</vehicleid>
</jobdata>
<points count="$MEAS_COUNT$">
```

Measurement data

```
<point>
<time>$TIME$</time>
<SerialNo>$Serial No.$</SerialNo>
<CatalogNo>None - Fisher is OEM product.</CatalogNo>
<Status>$STATUS$</Status>
<Checkzone>$CHECKZONE$</Checkzone>
<scale Id = "102" value ="$mic$"></scale>
<scale Id = "103" value ="$mil$"></scale>
</point>
```

Footer

```
</points>
</byklink service thickness>
```

With this step the configuration in **smart-robotic** is complete for **Fisher** thickness measurement.



NOTICE

Thickness measurement instruments of type **Fisher** can have a "Serial Number" - but they don't have a "Catalog Number", which is specific to BYK-Gardner products.

8.4.5 Testing the Configuration

Perform following steps:

- 1. Create an XML data file.
- 2. Place it in the monitored folder.
- 3. Check folder content and Monitoring tab.

The file is automatically processed by **smart-robotic**.

🔘 smart-rob	otic - Version 3.0.0.9650								
								bot Simu	
Monitori	ng OPC			Output files	smart-chart link				
Category	Module	Informati	ion						
Info	DataFileProcessor	Processin	g 2020-12-04-09-20-00)-Fisher-Thickness-Robo	tic.dat started.				^
Info	DataFileProcessor	Open dat	a file						
Info	DataFileProcessor	Extracting	data from file						
Info	DataFileProcessor	Creating	, testserie for Thickness j	ob					
Info	DataFileProcessor	Processin	g 2020-12-04-09-20-00)-Fisher-Thickness-Robo	tic.dat ended.				
Info	ImportProcessor	Importing	g data. Thickness						
Info	ThicknessConverter	Organizer	, r found. Robot-Cell-Cor	npact					
Info	ThicknessConverter	Processin	g with standard White	Glacier					
Info	ThicknessConverter	Organizer	- r found. Robot-Cell-Cor	npact					
Info	ThicknessConverter	Import su	icceeded.						
Info	FileOutput	C:\Progra	mData\BYK\Robotic\Ou	tputFiles\2020-12-04T0	9_00_00-Compact-Whit	e - Glacier-Yellow_1.xml is success	sfully written		
Info	DataFileProcessor	Processin	g 2020-12-04-09-25-00)-Fisher-Thickness-Robo	tic.dat started.				
Info	DataFileProcessor	Open dat	a file						
Info	DataFileProcessor	Extracting	g data from file						
Info	DataFileProcessor	Creating	testserie for Thickness j	ob					
Info	ImportProcessor	Importing	g data. Thickness						
Info	DataFileProcessor	Processin	g 2020-12-04-09-25-00)-Fisher-Thickness-Robo	tic.dat ended.				
Info	ThicknessConverter	Organizer	r found. Robot-Cell-Cor	npact					
Info	ThicknessConverter	Processin	g with standard White	- Glacier					
Info	ThicknessConverter	Organizer	r found. Robot-Cell-Cor	npact					
Info	ThicknessConverter	Import su	icceeded.						
Info	QualityAlarmProcessor	Processin	g data.						
Info	FileOutput	C:\Progra	mData\BYK\Robotic\O	utputFiles\2020-12-04T	9_00_00-Compact-Whit	e - Glacier-Green.xml is successfu	Illy written		
	_							_	~
<									2

Illustration 127: Process monitoring for thickness measuring XML files in smart-robotic

After data extraction the file will be moved to the sub-folder "ProcessedDir".

📙 📝 📙 👳 C:\ProgramData\BYK\F	obotic\Thickness\Fisher\ProcessedDir				_		×
File Home Share View						^	0
Pin to Quick Copy Paste access Copy Paste	Move Conv. Delate Rename New	New item • Easy access • Pr	operties	Select all Select none			
Clipboard	Organize	New	Open	Select			
← → × ↑ 📙 « (C:) SYSTEM →	ProgramData > BYK > Robotic > Thickness > I	Fisher > Processed	lDir →	ע פֿ Sear	ch ProcessedDir		Q
ВҮК	Name	Size	Туре	Date modified	File version		
Robotic	2020-12-04-09-25-00-Fisher-Thickness-Robot	tic.dat	2 KB DAT File	04.12.2020 09:22			
Cfg	2020-12-04-09-20-00-Fisher-Thickness-Robot	tic.dat	2 KB DAT File	04.12.2020 09:21			_
Logs	2020-12-04-09-15-00-Fisher-Thickness-Robot	tic.dat	2 KB DAT File	04.12.2020 09:19			
OutputFiles	2020-12-04-09-00-00-Fisher-Thickness-Robo	tic.dat	2 KB DAT File	04.12.2020 09:01			
TemplateFiles	Failed		File folder	29.10.2020 12:55			
Thickness							
Fisher							
ProcessedDir							
PELT							
Temp							
5 items 1 item selected 1,02 KB						8=:	-

Illustration 128: Processed directory for thickness measuring XML files

The measurement data will be stored in the **smart-chart** database.

O BYK smart-chart - Version	7.2.0 Release 89	27					– 🗆 ×
< Data Analy	ysis - Me	easureme	ent-D	ata			V ? X
C · G··	Test Report	Scorecard		Table Sche	ematic Line		
Search ${\cal P}$	🔽 Tolerance	s					History
film thickness 04.12.2020 09:00:00 White	Instrument film thickness	Date 04.12.2020	Model Compact	Color White - Glacier	Paintline Sample Paintline	Comment This is a comment	Serial No Vehicle 123456
 film thickness 04.12.2020 09:00:00 White 				mic		ar	
film thickness 04.12.2020 09:00:00 White			Fail High	400			
 film thickness 			ing High	300		/ P	2
04.12.2020 09:00:00 White			ning Low	200	50		
film thickness 04.12.2020 09:00:00 White	Checkzone *	Date	Fail Low Status	100 mic			
= film thickness	Match to Star		Status	mic	P		A CH
04.12.2020 09:00:00 Unkno	Hood	04.12 09:00:00	•	222.0	Hoo		
	Roof	04.12 09:00:00	•	265.0	mood	d Roof	y ya
							2
< >	<				>		

Illustration 129: Data analysis in smart-chart

An additional output file will be generated – including the pass / fail indication. With the template defined in Output Files [**118**] the following result file was generated.

```
<?xml version="1.0"?>
<br/>byklink service thickness>
<jobdata>
<timestamp>2020-12-04T09:00:00</timestamp>
<jobquality>Green</jobquality>
<carmodel>Compact</carmodel>
<carcolor>White - Glacier</carcolor>
<paintline>PL 1</paintline>
<comment>This is a comment.</comment>
<vehicleid>Vehicle 123456</vehicleid>
</jobdata>
<points count="2">
<point>
<time>2020-12-04T09:00:00</time>
<SerialNo>1210833</SerialNo>
<CatalogNo>None - Fisher is OEM product.</CatalogNo>
<Status>Green</Status>
<Checkzone>Hood</Checkzone>
<scale Id = "102" value ="222"></scale>
```

```
<scale Id = "103" value ="UNDEFINED"></scale>
</point>
<point>
<time>2020-12-04T09:00:00</time>
<SerialNo>1210833</SerialNo>
<CatalogNo>None - Fisher is OEM product.</CatalogNo>
<Status>Green</Status>
<Checkzone>Roof</Checkzone>
<scale Id = "102" value ="265"></scale>
<scale Id = "103" value ="UNDEFINED"></scale>
</point>
</points>
</byklink_service_thickness>
```



NOTICE

Do not forget to clean-up the file system in regular intervals. This applies to both input and output files.

8.5 PELT Measurement

The software **smart-robotic** can process measurement data from **PELT** (Pulse/ Echo Layer Thickness) thickness measurement instruments:

<u>http://www.jsrultrasonics.com/robotic-pelt</u>

In difference to the BYK-Gardner instruments **BYK-mac i ROBOTIC** and **wave**scan **ROBOTIC** the PELT measurement instruments are not controlled by **smartrobotic**.

These instruments create XML files which can be processed by **smart-robotic**.



NOTICE

The XML files are required in a specific structure to be processed by **smart-ro-botic**. Details see below.

8.5.1 Prerequisites

Understanding of following topics is required:

- Configuration of Output Files [> 67]
- Configuration in smart-chart [> 77]
- Configuration in smart-robotic [> 90]
- Thickness Measurement [> 107] (Fisher)

In the following the differences to these topics are described.

8.5.2 Input XML File

The PELT thickness measurement system is a special thickness measurement since it measures multiple layers of the coating:

• EC: Electro Coating

- PR: Prime Coating
- BC: Base Coating
- CC: Clear Coating

Each layer can have a different tolerance, thus multiple tolerances are usually defined in **smart-chart**, see Color Standard [> 124].

The XML data file to be processed by **smart-robotic** consists typically of following sections:

- 1. <JobInformation>
- 2. <MultipleMeasurements>
- 3. <Layers>

For the complete **job** the following data is relevant.

For each **measurement** the following data is relevant.

```
<Location>1</Location>
<LayerCount>4</LayerCount>
...
```

For each layer following information is required.

```
<LayerNumber>1</LayerNumber>
<Thickness> 34.46</Thickness>
<LayerName>Clear_T</LayerName>
<LayerCode>CC</LayerCode>
...
```

These data are to be mapped in **smart-robotic**. In **smart-robotic** the total of all measured layers is calculated and stored in the **smart-chart** database.

With this information **smart-robotic** can search for the corresponding standard in the **smart-chart** standard database and save the measured values in the results database – including pass / fail indication.



NOTICE

The PELT input XML files used to create this documentation are large – they include multiple measurements. An example file has been added to the appendix – see XML Input File PELT [▶ 161].

8.5.3 Configuration in smart-chart

The configuration in smart-chart comprises following steps:

- 1. License File [124]
- 2. Color Standard [> 124]
- 3. Organizer Instruments [> 125]
- 4. Organizer Settings [> 125]
- 5. Organizer Procedure [> 125]

These steps are described below.

8.5.3.1 License File

For the PELT measurement instruments a separate license is required. This is the same as for the thickness measurement instruments, see License File [▶ 109].

With this license the PELT measurement instruments can be activated in the organizers, see Organizer Instruments [▶ 125].

8.5.3.2 Color Standard

In the color standards the scales for the multilayer thickness measurements are to be added on the tab **Film Thickness**.



Illustration 130: Multilayer color standard family for PELT in smart-chart

For the **PELT** measurements instruments these are following scales:

- Multilayer Total
- Multilayer E-coat
- Multilayer Primer
- Multilayer Basecoat
- Multilayer Clearcoat

For each layer the subscales 1..3 can be added. To keep it simple only subscale 1 has been added for each layer the example shown above.

In the scale µm for each layer the tolerance value(s) for the pass / fail indication have to be entered. This can be once done for all colors in the family or separately for each color, see Color Standard [▶ 110].

In the example shown above for the complete standard family "BYK Solid Colors - Multilayer" following tolerances have been set:

- < 50 = Red
- 50..90 = Yellow
- 90..100 = Green
- > 100 = Red

These tolerances will be used in the description below.



NOTICE

It is recommend to create separate color standard families for **Fisher** (single-layer) and for **PELT** (multi-layer) thickness measurements and to add required scales only.

8.5.3.3 Organizer Instruments

In the **Organizer** on the tab **Instruments** the option **Film Thickness** is to be activated, see Organizer Instruments [> 112].

With activated option this organizer becomes relevant for the thickness measurements for **Fisher** and for **PELT**.

8.5.3.4 Organizer Settings

In the module **Organizer** on the tab **Settings** the correct **Scale Thickness Unit** is to be selected, see **Organizer Settings** [**▶** 112].

8.5.3.5 Organizer Procedure

In the **Organizer** on the tab **Test Procedure** the check zones are defined, see Organizer Procedure [▶ 113].

With this step the configuration in **smart-chart** is complete.

8.5.4 Configuration in smart-robotic

The configuration in **smart-robotic** comprises following steps:

- 1. Source Folders [> 126]
- 2. Symbol Mapping [126]
- 3. Check Zones [128]
- 4. Multi-Layer Scales [▶ 129]
- 5. Output Databases [> 130]
- 6. Color Standards [> 131]
- 7. Paint Lines [131]

8. Output Files [> 132]

These steps are described below.

8.5.4.1 Source Folders

In **smart-chart link** on the tab **PELT Settings** selected directories can be set to monitoring. If an XML file is placed in a monitored directory it is processed automatically by **smart-robotic**.

🔘 smart-robotic - Version 3.0.0.9650			- 🗆 X
			Activate Robot Simulator
Monitoring OPC	Devices Output files	smart-chart link	
Database	BYK-mac settings	wave-scan settings	Thickness settings
PELT settings	Color standards	Paintlines	Quality alarm
smart-chart data import settings for	PELT instruments		
Source Folders Symbol mapping	Checkzones Scales	Output databases	
Add Remove	kness\PELT		

Illustration 131: Monitored PELT folders in smart-robotic

You have following options:

- Add: Click this button to select a directory for monitoring.
- **Remove**: The selected directory will not be monitored anymore.

An existing folder can be added or a new folder can be created in the browse dialog.

8.5.4.2 Symbol Mapping

The measurement data of the PELT measurement system can use own parameter names.

```
<JobInformation>
<Id>O0000098020041</Id>
</id>

<StyleNumber>Compact
</StyleNumber>

<Booth>B</Booth>

<BaseColor>Petrol</BaseColor>

<ClearColor>HE05</ClearColor>

<MeasurementUnits>Microns</measurementUnits>

</JobInformation>
```

Illustration 132: Car model in PELT thickness input XML file

Thus the parameter names of the PELT measurement system must be mapped to the corresponding parameter names in **smart-chart**.

smart-robotic - Ver	sion 3.0.0.9650				- 🗆 X
					Activate Robot Simulator
Monitoring	ОРС	Devices	Output files	smart-chart link	
Data	base	BYK-mac sett	ings	wave-scan settings	Thickness settings
PELT se	ettings	Color standa	irds	Paintlines	Quality alarm
smart-chart data	a import settings for	r PELT instruments			
Source Folders	Symbol mapping	Checkzones	Scales	Output databases	
Job items	PELT				
Model 🌍	StyleNumber				Define / Check
Color 🔮	BaseColor				Define / Check
Paintline 🌍	Booth				Define / Check
Comment 🔮	MeasurementUnits				Define / Check
Vehicleld 🔮	ld				Define / Check
Point item					
Checkzone ᡇ	Location				Define / Check

Illustration 133: PELT parameter mapping in smart-robotic

Perform following steps:

- 1. Click the button **Define / Check** beside a parameter.
- 2. Load an XML data file from the **PELT** system.
- 3. Select the corresponding parameter in the file.
- 4. Click the button **Add XML Node**.
- 5. Save with the button **OK**.

When you open the dialog the 1st time, it is empty.

				×
Simplified input file structure	_			
	No symbols are defined.	Load a data file first!		
			Lo	ad PELT File
		Custom string		
	Add XML node			Add string
Formula				
StyleNumber				
	Remove item			
Current value				
StyleNumber				011
			Cancel	OK

Illustration 134: PELT parameter mapping – initial state

Click the button Load PELT File to open an existing XML file.

0				×
Simplified input file structure Revision BuildDate JobInformation Id StyleNumber Booth BaseColor ClearColor MultipleMeasurementUnits MultipleMeasurements		Custom string	Load PELT File	
	Add XML node		Add string	
Formula				
StyleNumber				
	Remove item			
Current value Compact				
compact		[Cancel OK	

Illustration 135: PELT parameter mapping – final state

Following rules apply:

- When you open the dialog a 2nd time during the same session, the previous XML file is still loaded.
- The option **Custom String** can be used to combine parameters and or fix text, for example "StyleNumber BaseColor".
- The output field **Formula** shows the current selection.
- The output field **Current Value** shows the content of the fields in the current selection.

Repeat this procedure for all Job Items and for the Point Item.

8.5.4.3 Check Zones

The measurement data of the PELT measurement system can use own check zone names.

<Measurement>
<PanelName>R01 X01 0:1</PanelName>
<PanelNumber>0</PanelNumber>
<PanelLocation>1</PanelLocation>
<Iocation>1</PanelLocation>
<Iocation>1</PanelLocation>
<Robot>1</Robot>
<Sensor>1</Robot>
<Sensor>1</Panelt>
<Placement>1</Placement>
<GroupCode>T</GroupCode>

Thus the check zone names of the PELT measurement system must be mapped to the corresponding check zone names in **smart-chart**.

ve configuration					Activate Robot Sim
Monitoring	ОРС	Devices	Output files	smart-chart link	
Databas	se	BYK-mac set	ttings	wave-scan settings	Thickness settings
PELT setti	ngs	Color stand	lards	Paintlines	Quality alarm
mart-chart data ir	mport settings for PEL	T instruments			
Source Folders	Symbol mapping		Scales	Output databases	
PELT checkzone n	napping				
Symbol value	Name in smartcha				
206	Trunk Mid	👻 🖌 Add i	new entry Ren	nove	
‡ 1	🗮 Hood				
✿ 1 ✿ 2	🗮 Hood				
-					
2 2	🗮 Roof				
✿ 2 ✿ 3	🗮 Roof				
 2 3 201 	Coof				

Illustration 137: Check zones for PELT measuring in smart-robotic

Perform following steps:

- 1. Enter the **Symbol Value** present in the input XML file.
- 2. Select the corresponding **Name in smart-chart** from the combo box.

Repeat this procedure for all other check zones present in the input XML file.

8.5.4.4 Multi-Layer Scales

The measurement data of the PELT measurement system can use own layer names.

```
<Layer>
<LayerNumber>1</LayerNumber>
<Thickness> 34.46</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 59.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>33.50</TOF>
<LayerName>Clear_T</LayerName>
<LayerCode>CC</LayerCode>
<LayerVendor>VW</LayerVendor>
</Layer>
```

Illustration 138: Layer name in PELT thickness input XML file

Thus the layer names of the PELT measurement system must be mapped to the corresponding layer names in **smart-chart**.

configuration					Activate Robot Sim
Monitoring	ОРС	Devices	Output files	smart-chart link	
Database		BYK-mac setti	ngs	wave-scan settings	Thickness settings
PELT settings		Color standa	rds	Paintlines	Quality alarm
nart-chart data impo	rt settings for P	ELT instruments			
Source Folders S	ymbol mapping	Checkzones	Scales	Output databases	
Confidence level	0				
-	0			<u>^</u>	
🖗 Clear_T				^	
🍄 Clear_T 😨 Prime_T	🗮 CC1			A	
Clear_T Prime_T E-Coat_T	CC1			A.	
Confidence level Clear_T Prime_T E-Coat_T TP Color_T Clearcoat Clearcoat	CC1 CC1 PR1 CC1				

Illustration 139: Multi-layer names for PELT measuring in smart-robotic

Perform following steps:

- 1. Enter the **Symbol Value** present in the input XML file.
- 2. Select the corresponding Name in smart-chart from the combo box.

Repeat this procedure for all other layer names present in the input XML file.

8.5.4.5 Output Databases

Final step on the **PELT Settings** tab is the selection of the measurement database in **smart-chart**.

🔘 smart-robotic - Versi	on 3.0.0.9650				- 🗆 X
Save configuration					Activate Robot Simulator
Monitoring	ОРС	Devices	Output files	smart-chart link	
Databi	ase	BYK-mac set	ings	wave-scan settings	Thickness settings
PELT set	tings	Color standa	irds	Paintlines	Quality alarm
smart-chart data	import settings for F	PELT instruments			
Source Folders	Symbol mapping	Checkzones	Scales	Output databases	
Add new Remo	ve from list				
	ent-Data.sdf				
C:\ProgramL	ata\BYK\smart-chart 3.0	\Measurement-Data.sdl			

Illustration 140: Output database for PELT measuring in smart-robotic

In this database the results from the PELT input XML files will be stored.

8.5.4.6 Color Standards

If the PELT input XML files use additional values for the color, these values are also to be mapped on the **Color Standards** tab.

					Activate Robot Simulat
Monitoring	OPC	Devices	Output files	smart-chart link	
Database		BYK-mac s	ettings	wave-scan settings	Thickness settings
PELT setting	IS	Color star	idards	Paintlines	Quality alarm
olor standard map	ping				
mbol value	Name in smart				
Petrol	Petrol-Multi	▼ Add	new entry Rem	ove	
Red	💐 11400) Red			
Blue	💐 15102	2 Blue			
Bourdeux	🕷 Borde	ux			
Black	🕷 Black-	-654321			
Silver	🗮 Silver-	-Moondust			
White	🕷 White	-Glacier			
Brown	💐 Brown	n-Multi			
🖢 Orange	💐 Orang	ge-Multi			

Illustration 141: Color mapping for PELT measuring in smart-robotic

In the example shown above the highlighted colors are mapped to the corresponding entries in the color family "Multi-Layer", see Color Standard [> 124].

8.5.4.7 Paint Lines

If the PELT input XML files use different values for the identification of the paint line, these values are also to be mapped on the **Paint Lines** tab.

ve configuration						Activate Robot Simulate
Monitoring	ОРС	Devices	Output files	smart-chart link		
Database		BYK-mac set	tings	wave-scan settings	T	hickness settings
PELT setting	5	Color stand	ards	Paintlines		Quality alarm
ymbol value C Paintline 1 Paintline 2 Repairline	₹ PL 1 ₹ PL 2 ₹ RL	Add ne	ew entry Remo	pve		
A 🖸	🛒 PL 1					
B B	🛒 PL 2					
Ф с	💐 RL					
X	🗮 PL 1					
Ö Y	🗮 PL 2					
Ö Z	🕷 RL					

Illustration 142: Paint line mapping for PELT measuring in smart-robotic

In the example shown above the input values A / B / C are mapped to PL 1 / PL 2 / RL.

8.5.4.8 Output Files

This step is optional. Output Files [▶ 67] can be configured, if the Quality Status [▶ 74] is required for further processing.

Save configuration Activate Robot Simulator Monitoring OPC Devices Output files smart-chart link BYKmac Wavescan Thickness PEIT Add Storage Remove Output file definition for Measurement Directory CcProgramData\BYK\Robotic\OutputFiles\PEIT Browse C Filename SpnTIMESTAMPStx-SpnMODELStx-SpnCOLORStx-SpnQUALITYStxxml Define C Template FELT-Thickness-Device Create new Edit selected C Texts for quality status Good Middle	0	smart-robotic - Vers	ion 3.0.0.9650							-		×
BYKmac Wavescan Thickness PELT Add Storage Remove Output file definition for Measurement Data file Output file definition for Measurement Directory C\ProgramData\BYK\Robotic\OutputFiles\PELT Browse Image: Comparison of the state of the stat	Sa	ve configuration									obot Simi	
Add Storage Remove Data file Output file definition for Measurement Directory Directory CAProgramDatal8YK/Robotic/OutputFiles/PELT Browse Image: Capital Street Spin COLORStreet Spin CoLORSt		Monitoring	OPC		Devices	Output files	smart-chart link					
Data file Output file definition for Measurement Directory C:AProgramData\BYK\Robotic\OutputFiles\PELT Browse Image: Comparing the state of the sta		BYKmac	Wavescan		Thickness	PELT						
Bad		Data file		Directory C:\Progra Filename \$pnTIME: Template PELT-Thic	STAMPStx-SpnMC ckness-Device uality status Good Middle	tic\OutputFiles\PELT DEL\$tx-\$pnCOLOR\$tx-\$	SpnQUALITY\$tx.xml	Define	0			

Illustration 143: Output file configuration for PELT measuring in smart-robotic

The configuration of the **Filename** is similar to that for the BYK-Gardner devices, see Output Filename [▶ 70].

🜔 Definitio	n designer				-		×
Formula for	Filename						
TIMESTAN	MP - MODEL	- 0		/ .xml			
Preview TIMESTAMD	-MODEL-COLOR-OU	ALITY yml					
		ALITTXIII			1		
User defined				Add text	J		
Predefined it	tems						
8	YEAR		MONTH		DAY		^
\$	HOUR		MINUTE		SECOND		
	TIMESTAMP		MEAS_COUNT		MODEL		~
					OK	Cance	I

Illustration 144: Output file name configuration for PELT measuring in smart-robotic

The configuration of the **Template** file is similar to that for the BYK-Gardner devices, see **Template File** [**▶ 71**]. The differences are:

- There is a new option Thickness Scales under Predefined Items.
- OPC signals are NOT relevant here, instead the values from smart-chart link > Thickness are used.

This is shown in the following example.

O Template Editor	_		×
File Name PELT-Thickness-Device			
Predefined Items Header IMESTAMP xml version="1.0"? MEAS_COUNT timestamp \$TIMESTAMP\$\$TIMESTAMP\$ <td></td> <td></td> <td>></td>			>
Predefined Items PELT scales Measurement data (point> CheckZONE Meta data CheckZONE Meta data CheckZONE Meta data CheckZONE Meta data Measurement data (checkZONE Meta data CheckZONE Meta data Measurement data (checkZONE Meta data Measurement data (checkZONE Measurement data Measurement Measurem			
<pre>Footer </pre>			>
	Save and exit	Cance	el

Illustration 145: Output file template configuration for PELT measuring in smart-robotic



NOTICE

Remember that valid parameters are highlighted in cyan color. Check this for all parameters to be replaced with current values. The syntax check is performed when opening the template for editing.

Following example shows a possible template file.

Header

```
<?xml version="1.0"?>
<byklink_service_thickness_pelt>
<jobdata>
<timestamp>$TIMESTAMP$</timestamp>
<jobquality>$QUALITY$</jobquality>
<carmodel>$MODEL$</carmodel>
<carcolor>$COLOR$</carcolor>
<paintline>$PAINTLINE$</paintline>
<comment>Units: $COMMENT$ (Mics)</comment>
<vehicleid>$VEHICLE_ID$</vehicleid>
</jobdata>
<points count="$MEAS_COUNT$">
```

Measurement data

```
<point>
<time>$TIME$</time>
<SerialNo>None - PELT is OEM product.</SerialNo>
<CatalogNo>None - PELT is OEM product.</CatalogNo>
<Status>$STATUS$</Status>
<Checkzone>$CHECKZONE$</Checkzone>
<scale Id = "1 Elec. coat" - value ="$EC1 mic$"></scale>
<scale Id = "2 Prime coat" - value ="$PR1 mic$"></scale>
<scale Id = "3 Basis coat" - value ="$PR1 mic$"></scale>
<scale Id = "4 Clear coat" - value ="$CC1 mic$"></scale>
<!-- Sum calculated by smart-robotic ----- -->
<scale Id = "T Total coat" - value ="$total mic$"></scale>
</point>
```

Footer

</points> </byklink_service_pelt>

With this step the configuration in **smart-robotic** is complete for **PELT** thickness measurement.



NOTICE

Thickness measurement instruments of type **PELT** don't have a "Serial Number" or a "Catalog Number" – these parameters can be skipped in the output files.

8.5.5 Testing the Configuration

Perform following steps:

- 1. Create an XML data file.
- 2. Place it in the monitored folder.
- 3. Check folder content and **Monitoring** tab.

The file is automatically processed by **smart-robotic**.

							ot Simul
Monitoring		OPC	Devices	Output files	smart-chart link		
c	ategory	Module	Information				
7:09:07.629 In	nfo	DataFileProcessor	Open data file				
:09:07.636 In	nfo	DataFileProcessor	Extracting data from f	ile			
:09:07.642 In	nfo	DataFileProcessor	Creating testserie for	PELT job			
.09:07.646 In	nfo	DataFileProcessor	Processing 2020-12-1	4-16-45-00-PELT-Thick	ess-Robotic.xml ended.		
:09:07.786 In	nfo	PeltConverter	Import succeeded.				
:09:07.788 In	nfo	QualityAlarmProcessor	Processing data.				
:09:07.815 In	nfo	FileOutput	C:\ProgramData\BYK\	Robotic\OutputFiles\PE	T\2020-12-14T14_26_13	-Compact-Orange-Multi-Good.xml is successfully v	written
:09:07.817 In	nfo	ImportProcessor	Importing data. PELT				
:09:07.855 In	nfo	DataFileProcessor	Processing 2020-12-1	4-16-55-00-PELT-Thickr	ess-Robotic.xml started		
:09:07.856 In	nfo	DataFileProcessor	Open data file				
:09:07.859 In	nfo	PeltConverter	Processing with stand	ard Petrol-Multi			
:09:07.864 In	nfo	DataFileProcessor	Extracting data from f	ile			
:09:07.873 In	nfo	DataFileProcessor	Creating testserie for	PELT job			
:09:07.876 In	nfo	PeltConverter	Organizer found. Rob	ot-Cell-Compact			
:09:07.878 In	nfo	DataFileProcessor	Processing 2020-12-1	4-16-55-00-PELT-Thick	ess-Robotic.xml ended.		
:09:08.192 In	nfo	PeltConverter	Import succeeded.				
:09:08.237 In		FileOutput	C:\ProgramData\BYK\	Robotic\OutputFiles\PE	T\2020-12-14T14_26_13	-Compact-Petrol-Multi-Middle.xml is successfully v	vritten
:09:08.238 In	nfo	ImportProcessor	Importing data. PELT				
:09:08.279 In	nfo	PeltConverter	Processing with stand	ard Brown-Multi			
:09:08.288 In		PeltConverter	Organizer found. Rob	ot-Cell-Compact			
:09:08.499 In	nfo	PeltConverter	Import succeeded.				
:09:08.520 In		FileOutput		Robotic\OutputFiles\PE	T\2020-12-14T14_26_13	-Compact-Brown-Multi-Bad.xml is successfully writ	ten
:09:11.248 In	nfo	QualityAlarmProcessor	Processing data.				

Illustration 146: Process monitoring for PELT measuring XML files in smart-robotic

After data extraction the file will be moved to the sub-folder "ProcessedDir".

File Home	Share View									^
in to Quick Copy access	Paste & Cut Paste Paste shortcut	Move Cop to * to	py Delete Rename	New item •	Propert	ties 🖉 Open 👻	Select a	one		
	Clipboard		Organize	New		Open	Selec	t		
← → • ↑	SYSTEM (C:) > Progr	amData → B	3YK → Robotic → Thi	ckness > PELT > Process	edDir →		~ Ö	Search P	rocessedD)ir 🔎
🗸 📙 ВҮК		^	Name			Size	Туре	Date mod	lified	File version
🗸 🔤 Rob	otic		2020-12-14-16-	45-00-PELT-Thickness-Robo	tic.xml	3 KB	XML File	14.12.202	0 17:08	
Cf	g		2020-12-14-16-	55-00-PELT-Thickness-Robo	tic.xml	3 KB	XML File	14.12.202	0 17:05	
📙 Lo	gs		2020-12-14-16-	50-00-PELT-Thickness-Robo	tic.xml	3 KB	XML File	14.12.202	0 16:51	
> 📙 Ou	ItputFiles		2020-12-14-13-	30-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	14.12.202	0 13:33	
> Te	mplateFiles	- 1	2020-12-11-10-	00-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	11.12.202	0 13:01	
~ 🗖 Th	ickness		2020-10-29-15-	24-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	10.12.202	0 11:23	
	isher		Linit.	45-00-PELT-Thickness-Robo		21 KB	XML File	04.12.202	0 14:09	
			2020-10-29-15-	23-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	29.10.202	0 15:23	
	ELT		2020-10-29-15-	21-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	29.10.202	0 15:21	
>	ProcessedDir		2020-10-29-15-	12-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	29.10.202	0 15:12	
т 📙	emp		2020-10-29-13-	43-00-PELT-Thickness-Robo	tic.xml	21 KB	XML File	29.10.202	0 15:10	
> sma	rt-chart 3.0		Failed				File folder	29.10.202	0 15:10	

Illustration 147: Processed directory for PELT measuring XML files

The measurement data will be stored in the **smart-chart** database.

c 🔹 🗗 🔤	Test Report			Table		atic Li			
arch P	Tolerance	s						H	listory
film thickness 10.12.2020 14:26:13 Black - 654321	Instrument film thickness	Date 14.12.2020	Model Compac	Color t Petrol-1		intline . 2	Comment Microns	Serial No 000000980	20041
film thickness 10.12.2020 14:26:13 Petrol-Multi				total mic	EC1 mic	PR1 mic	BC1 mic	CC1 mic	
film thickness			Fail High	150					
10.12.2020 14:26:13 Petrol-Multi		Warn	ing High	100					
film thickness 10.12.2020 14:26:13 Petrol-Multi		Warr	ning Low						
film thickness			Fail Low	50,0					
10.12.2020 14:26:13 Petrol-Multi film thickness	Checkzone *	Date	Status	total mic	EC1 mic	PR1 mic	BC1 mic	CC1 mic	
10.12.2020 14:26:13 Petrol-Multi	Match to Star	idard							
film thickness	204	14.12 14:29:04	•	58,5	19,6	7,3	14,0	17,6	
10.12.2020 14:26:13 Orange-Multi film thickness	4	14.12 14:31:59	•	93,8	20,3	29,8	11,1	32,5	
10.12.2020 14:26:13 Black - 654321	5	14.12 14:33:27	•	97,3	20,3	35,6	13,5	27,9	
film thickness 10.12.2020 14:26:13 Silver - Moondust	6	14.12 14:29:54	•	109,9	26,6	16,0	10,5	56,8	
film thickness	Hood	14.12 14:26:13	•	89,2	14,9	22,7	17,2	34,5	
14.12.2020 14:26:13 Petrol-Multi	Hood L	14.12 14:26:13	•	100,0	16,0	21,1	17,7	45,3	
film thickness 14.12.2020 14:26:13 Orange-Multi	Hood R	14.12 14:27:23	•	98,6	21,0	29,1	12,9	35,6	
film thickness	Roof	14.12 14:27:13	•	104,2	21,0	29,8	10,5	42,9	
14.12.2020 14:26:13 Petrol-Multi	Tetto	14.12 14:28:50	•	95,2	20,3	29,1	11,7	34,1	
film thickness 14.12.2020 14:26:13 Orange-Multi	Trunk	14.12 14:30:54	•	96,0	22,4	26,1	17,0	30,5	
film thickness	Trunk Mid	14.12 14:30:09	•	95,6	22,4	26,9	16,4	30,0	

Illustration 148: Data analysis for PELT thickness in smart-chart

An additional output file will be generated – including the pass / fail indication. With the template defined in Output Files [**132**] the following result file was generated.

```
<?xml version="1.0"?>
<byklink service_thickness_pelt>
<jobdata>
<timestamp>2020-12-14T14:26:13</timestamp>
<jobquality>Middle</jobquality>
<carmodel>Compact</carmodel>
<carcolor>Petrol-Multi</carcolor>
<paintline>PL 2</paintline>
<comment>Units: Microns (Mics) </comment>
<vehicleid>0000098020041</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-12-14T14:26:13</time>
<SerialNo>None - PELT is OEM product.</SerialNo>
<CatalogNo>None - PELT is OEM product.</CatalogNo>
<Status>Middle</Status>
<Checkzone>Hood</Checkzone>
<scale Id = "1 Elec. coat" - value ="24,94"></scale>
<scale Id = "2 Prime coat" - value ="22,66"></scale>
<scale Id = "3 Basis coat" - value ="27,18"></scale>
<scale Id = "4 Clear coat" - value ="24,46"></scale>
<!-- Sum calculated by smart-robotic ---- -->
<scale Id = "T Total coat" - value ="99,24"></scale>
</point>
</points>
</byklink service thickness pelt>
```



NOTICE

Do not forget to clean-up the file system in regular intervals. This applies to both input and output files.

8.5.6 Confidence Level

Both **PELT** measurement system and **smart-robotic** support the feature **Confidence Level**:

- A measurement is valid, if the confidence level is above a configurable threshold.
- Measurements with a lower value will not be saved in the **smart-chart** database.

The confidence level is written by the **PELT** system for each layer.

```
<LayerNumber>4</LayerNumber>
<Thickness> 24.94</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 44.0</Confidence>
<Indirect>0</Indirect>
```

The threshold for the **Confidence Level** can be entered on the tab **Scales**, see also Multi-Layer Scales [> 129].

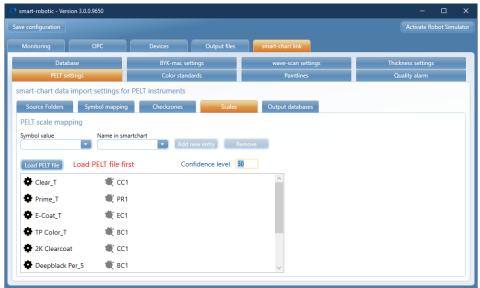


Illustration 149: Confidence level threshold for PELT measurement system

The resulting output file may look like the following example.

```
<?xml version="1.0"?>
<byklink service thickness pelt>
<jobdata>
<timestamp>2020-12-15T14:26:13</timestamp>
<jobquality>Good</jobquality>
<carmodel>Compact</carmodel>
<carcolor>Petrol-Multi</carcolor>
<paintline>PL 2</paintline>
<comment>Units: Microns (Mics)</comment>
<vehicleid>0000098020041</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-12-15T14:26:13</time>
<SerialNo>None - PELT is OEM product.</SerialNo>
<CatalogNo>None - PELT is OEM product.</CatalogNo>
<Status>None</Status>
<Checkzone>Hood</Checkzone>
<scale Id = "1 Elec. coat" - value ="UNDEFINED"></scale>
<scale Id = "2 Prime coat" - value ="22,66"></scale>
<scale Id = "3 Basis coat" - value ="UNDEFINED"></scale>
<scale Id = "4 Clear coat" - value ="24,46"></scale>
<!-- Sum calculated by smart-robotic ---- -->
<scale Id = "T Total coat" - value ="UNDEFINED"></scale>
</point>
</points>
</byklink service thickness pelt>
```

If at least one measurement is "Undefined", the total thickness cannot be calculated. The quality status for this measurement is "None".

8.5.7 Allow Missed

The overall quality status for a complete job will always have the lowest status of all measurements in the job, see Quality Status [> 74]. To avoid that single failed measurements lead to a failed / red overall quality status a threshold (in percent) can be set for red and yellow measurements.





The two fields **Allow Missed** indicate how many tests for this scale may be out of tolerance over the whole job before the status of the test series changes.

In the example shown above the threshold is 50 percent. This will result in the following output file.

```
<?xml version="1.0"?>
<byklink_service_thickness_pelt>
<jobdata>
<timestamp>2020-12-15T14:26:13</timestamp>
<jobquality>Good</jobquality>
<carmodel>Compact</carmodel>
<carcolor>Petrol-Multi</carcolor>
<paintline>PL 2</paintline>
<comment>Units: Microns (Mics)</comment>
<vehicleid>0000098020041</vehicleid>
</jobdata>
<points count="2">
<point>
<time>2020-12-15T14:26:13</time>
<SerialNo>None - PELT is OEM product.</SerialNo>
<CatalogNo>None - PELT is OEM product.</CatalogNo>
<Status>Middle</Status>
<Checkzone>Hood</Checkzone>
<scale Id = "1 Elec. coat" - value ="24,94"></scale>
<scale Id = "2 Prime coat" - value ="22,66"></scale>
<scale Id = "3 Basis coat" - value ="27,18"></scale>
<scale Id = "4 Clear coat" - value ="24,46"></scale>
<!-- Sum calculated by smart-robotic ---- -->
<scale Id = "T Total coat" - value ="99,24"></scale>
</point>
<point>
<time>2020-12-15T14:27:13</time>
<SerialNo>None - PELT is OEM product.</SerialNo>
<CatalogNo>None - PELT is OEM product.</CatalogNo>
<Status>Good</Status>
<Checkzone>Roof</Checkzone>
<scale Id = "1 Elec. coat" - value ="21,01"></scale>
<scale Id = "2 Prime coat" - value ="29,79"></scale>
<scale Id = "3 Basis coat" - value ="10,53"></scale>
<scale Id = "4 Clear coat" - value ="22,86"></scale>
<!-- Sum calculated by smart-robotic ----- -->
<scale Id = "T Total coat" - value ="84,19"></scale>
</point>
</points>
</byklink service thickness pelt>
```

The overall status is "Good", although one of the two measurements was only "Middle".

9 Robot Simulator

The simulation allows testing of software configuration and physical instruments without the need of a robot.

Instead of sending the OPC signals to the PLC the signals are sent to the simulation. The simulation fills in all data.

The results of each operation can be checked directly in the **smart-robotic** application.

Perform following steps:

- 1. Prepare Simulation [**140**]
- 2. Activate Simulation [> 141]
- 3. Configure Instrument [> 142]
- 4. Control Simulation [> 143]
- 5. Monitor Simulation [> 144]
- 6. Check Results [> 145]

These steps are described below. For the examples given below the device **wave-scan ROBOTIC** is used. The usage of the simulation with the **BYK-mac i RO-BOTIC** or **wave-scan 3 ROBOTIC** is analogue.

9.1 Prepare Simulation

Setup instrument and sample(s) as described in Device Test [> 59] for the **wave-scan ROBOTIC**.



Illustration 151: BYK-Gardner wave-scan ROBOTIC - Simulator setup Connect the instrument to power supply and the data interface.

9.2 Activate Simulation

Click the button **Activate Robot Simulator** in the upper right corner. A warning message is displayed.

Smart-robotic - Vers	sion 3.0.0					-		×
Save configuration							bot Sim	
Monitoring	OPC	Devices	Output files	smart-chart link				
BYKmac	Wavescan	Thickness	PELT					
Add Storage	Remove							
Data file Measurement	•							
Data file Measurement	Ø							
Data file Measurement	Ø	Sime	ulator warning		×			
		4	Warning! The simu productive system Do you want to ac	ulator uses the same OPG ! Use it only for testing. tivate the simulator?	Signals as the			
				Yes	No			

Illustration 152: Activate robot simulator – confirmation message

Make sure that no communication to the PLC in the productive environment is active and confirm the message. The button disappears. Instead a new tab is inserted.



NOTICE

The button will be displayed again after restarting **smart-robotic**.

9.3 Configure Instrument

Click the new tab **Robot** simulator and configure your (physical) measurement instrument. For each device created a separate tab is displayed. In the example shown below the tab for the device "Wavescan1" is selected.

🕽 smart-robotic - Ver	rsion 3.0.0					-	×
Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
Control	bykmac 1	bykmac 2	Wavescan 1	WavescanThree 2	WavescanThree 3		
Robot Sim	ulator	Enable	Disable	V	Vavescan 1		
Measure po	pint quantity	1	•				
Point data sig	nals		Jok	o data values fo	or simulation		
Туре	Alias	Connection	Va	lue			
Integer	Zone-Index	Connected	1 Fro				
String	Zone-Name	Connected	2 To		x x x		
			3 Re		X		
					Add		
Log							
Log							
Timestamp	Category						
		Wavescan 1 Creating OPC					
2020-10-22 1	13:31:24.600 Info	Wavescan 1 Device enable	ed.				



The device configuration consists of following elements:

- 1. **Enable / Disable**: In mode "Disabled" you can change the configuration. In mode "Enabled" you can start the simulation.
- 2. **Measure Point Quantity**: Select the number of measurement points / check zones from the list. The range is 1..9. The according entries will be taken from the values on the right side.
- 3. **Point Data Signals**: For the example instrument **wave-scan ROBOTIC** these are the point items as defined in OPC Point Signals [▶ 58].
- 4. **Job Data Values**: In the productive system these data are transferred from the PLC. Here in the simulation all entries have to be created using the Add button. Remove an entry using the X symbol to the right of the entry.
 - Checkzone-Index: Create for example "1", "2", "3" and "4".
 - Checkzone-Name: Create for example "Front", "Hood", "Rear" and "Roof".
- 5. Log: Here all events for the current measurement instrument are displayed.

When configuration is finished click the button **Enable** to proceed.



NOTICE

To change an existing configuration which is already in status **Enabled** first click the button **Disable**.

9.4 Control Simulation

When the device has been set to status "Enabled" click the tab Control.

mart-robotic - \ e configuration						-	
Monitoring	ОРС	Devices	Output files	smart-chart link	Robot simulator		
Control	bykmac 1	bykmac 2	Wavescan 1	WavescanThree 2	WavescanThree 3		
Robot Simulator		Start	Stop		Common controls		
Heart bea	t simulation		PLC	ВУК			
Job quantity		1	-				
Job mode		Measurement	-				
Job data iter							
	1113		Jo	b data values f	or simulation		
Туре	Alias	Connection					
String	Car-Model	Connected		alue			
String	Car-Color	Connected	14	ombi	x		
String	Paint-Line	Connected	2 Li	mousine	X		
String	Free-Comment	Connected	3 C	onvertible	x		
String	Vehicle-ID	Connected	4 St	ation	x		
			5 SI	IV	X		
			5 0.				
			SUV	/	Add		
Log							
Timestamp	Category	Module Information					
		Simulator Car-Color = Pe	arl		^		
2020-10-07	17:25:59.238 Info	Simulator Paint-Line = Pl	.1				
2020-10-07	17:25:59.323 Info	Simulator Free-Comment	t = Created with simulat	tor.			
2020-10-07	17:25:59.392 Info	Simulator Vehicle-ID = 12	23456				
2020-10-07	17:25:58.953 Info	Simulator Data output fir	nished.		\sim		

Illustration 154: Robot simulator - Control of the simulation

The control tab consists of following elements:

- 1. **Start / Stop**: With these buttons you can start and stop the simulation. Stop is only required in case of long running jobs. The simulation stops automatically when all jobs are done. If both buttons are inactive enable a device first.
- Heart Beat: The availability of the communication partners can be simulated. The OPC signals "ALL_CTRL.IN_HEARTBEAT" and "ALL_CTRL.OUT_HEART-BEAT" are used.
 - PLC sets IN to 1.
 - SR sets OUT to the inverse value = 0.
 - PLC checks that OUT is 0 and sets IN to 0.
 - SR checks that OUT is 0 and sets IN to the inverse value = 1.
 - This happens as long as the communication is active (good).
- 3. **Job Quantity**: Select the number of jobs (cars) from the list. The range is 1..9 or Endless processing. The according values will be taken from the values on the right side.
- 4. Job Mode: Select the mode from the list. The range is Measurement, Calibration (BYK-mac only), Master Panel and Daily Check.
- Job Data Items: For the given example instrument wave-scan ROBOTIC the job items in OPC Control Signals [▶ 58] are used.

- 6. **Job Data Values**: In the productive system these data are transferred from the PLC. Here in the simulation all entries have to be created using the **Add** button. Remove an entry using the **X** symbol to the right of the entry.
 - Car-Model: Create for example "Limousine", "Convertible", "Station Wagon" and "SUV".
 - Car-Color: Create for example "Black", "Pearl", "Red" and "White".
 - **Paint-Line**: Create for example "PL1", "PL2", and "PL3".
 - Free-Comment: Create for example "Created with Simulator".
 - Vehicle-ID: Create for example "123456" and "654321".
- 7. Log: Here all events for the simulation are displayed.

When configuration is finished click the button **Start** to proceed.



NOTICE

1 To calculate the number of measurements: If the quantity for the **Device** is for example "4" and for the **Control** it is for example "5" the robot simulation will make "20" measurements.

2 If **Job Quantity** is "1" it will use the 1st data value for the 1st run, the 2nd data value for the 2nd run (etc.) If the quantity is higher it will use one data value after the other within one run.

9.5 Monitor Simulation

When the simulation has been started click the tab **Monitoring** in the main program.

smart-robotic - Version	3.0.0		
Monitoring	OPC	Devi	ces Output files smart-chart link Robot simulator
Timestamp	Category	Module	Information
2020-10-06 17:35:32.480) Info	Opc ALL JOB	Job stop
2020-10-06 17:35:32.728	Info	ImportProcessor	Importing data. Wavescan
2020-10-06 17:35:32.969	Info	WaveFileOutput	C:\ProgramData\BYK\Robotic\OutputFiles\2020-10-06-17-35-32-Combi-Robotic.xml is successfully written
2020-10-06 17:35:32.992	lnfo	WaveFileOutput	C:\ProgramData\BYK\Robotic\OutputFiles\2020-10-06-17-35-32-Combi-Byklink.xml is successfully written
2020-10-06 17:35:33.027	/ Info	WaveFileOutput	C:\ProgramData\BYK\Robotic\OutputFiles\2020-10-06T17_35_20-Combi-Pearl-Green.xml is successfully written
2020-10-06 17:38:33.808	Info	Bykmac 2	Instrument is disabled.
2020-10-06 17:38:33.808	Info	WavescanThree 2	Instrument is disabled.
2020-10-06 17:38:33.808	3 Info	Wavescan	Job Normal started with: Information: Car-Model = Combi Car-Color = Pearl Paint-Line = PL1 Free-Comment = Crea
2020-10-06 17:38:33.808	Info	Bykmac 1	Instrument is disabled.
2020-10-06 17:38:33.808	Info	WavescanThree 3	Instrument is disabled.
2020-10-06 17:38:33.812	Info	Wavescan	Initialize
2020-10-06 17:38:33.816	i Info	Wavescan 1	Prepare measuring
020-10-06 17:38:38.313	Info	Wavescan 1	Start measuring
020-10-06 17:38:38.404	Info	Wavescan 1	Command sent.
020-10-06 17:38:41.821	Info	Wavescan 1	Measuring ended.
020-10-06 17:38:42.789) Info	Wavescan 1	Read data.
020-10-06 17:38:44.040) Info	Wavescan 1	Prepare measuring
020-10-06 17:38:45.401	Info	Wavescan 1	Device idle.
2020-10-06 17:38:45.744	l Info	Opc ALL_JOB	Job stop
020-10-06 17:38:45.991	Info	ImportProcessor	Importing data. Wavescan
020-10-06 17:38:46.191	Info	WaveFileOutput	C:\ProgramData\BYK\Robotic\OutputFiles\2020-10-06-17-38-46-Combi-Robotic.xml is successfully written
2020-10-06 17:38:46.238	3 Info	WaveFileOutput	C:\ProgramData\BYK\Robotic\OutputFiles\2020-10-06-17-38-46-Combi-Byklink.xml is successfully written
020-10-06 17:38:46.257	7 Info	WaveFileOutput	C:\ProgramData\BYK\Robotic\OutputFiles\2020-10-06T17_38_33-Combi-Pearl-Green.xml is successfully written
(>

Illustration 155: Robot Simulator – Monitoring the simulation

Here the messages from the simulation are displayed. This information is stored in the file "C:\ProgramData\BYK\Robotic\Logs\RobotSimulator.log".

9.6 Check Results

When the simulation has finished check the output result file(s). With the template defined in Output Files [▶ 67] the following result file was generated.

```
<?xml version="1.0"?>
<wave-scan-robotic>
<jobdata>
<timestamp>2020-10-06T17:38:33</timestamp>
    <jobquality>Green</jobquality>
    <carmodel>Combi</carmodel>
    <carcolor>Pearl</carcolor>
    <paintline>PL1</paintline>
    <comment>Created with simulator.</comment>
    <vehicleid>123456</vehicleid>
</jobdata>
<points count="1">
<point>
<time>2020-10-06T17:38:38</time>
    <serialnr>1213324</serialnr>
    <catalognr>4822</catalognr>
    <status>None</status>
    <zoneid>4</zoneid>
    <zone>rear bumper</zone>
    <scale Id="01 LW" value="0" />
    <scale Id="02 SW" value="0" />
    <scale Id="19 We" value="0" />
    <scale Id="20 Wd" value="0" />
    <scale Id="21 Wc" value="0" />
    <scale Id="22 Wb" value="0" />
    <scale Id="23 Wa" value="0" />
    <scale Id="24 Du" value="12,1" />
</point>
</points count>
</wave-scan-robotic>
```

Now you can modify the various settings in the tabs for the **Devices** and in the **Control** tab and restart the simulation as often as you need to check the results.

10 Run Procedure

With BYK-mac i ROBOTIC the measurements can be accomplished in three different operation modes. In addition the appropriate bit for the operation mode must be set by the PLC. The wave-scan ROBOTIC has only one measurement mode. Following operation modes are to be programed on the PLC side:

- 1. Measurement Mode BYK-mac [> 146]
- 2. Calibration Mode BYK-mac [> 152]
- 3. Masterpanel Mode BYK-mac [> 152]
- 4. Measurement Mode wave scan [154]

10.1 Measurement Mode - BYK-mac

10.1.1 General

The operation mode "Normal Measurement" is reached by not setting one of the signals IN_REQU_MAST, IN_REQU_CAL, IN_REQU_MODE4-9.

A new measuring group is started by the handshake IN_JOB_START. A normal measurement can be divided into four partial sequences:

- 1. Start job
- 2. Fine position correction
- 3. Points end
- 4. Terminate job

Since a job can contain more than one point, the procedure jumps from partial sequence 3 to 2 at the next measuring point. Only with receipt of the signal IN_JOB_STOP smart-robotic is instructed to regard the job as terminated and passes all data out.



NOTICE

The signal IN_JOB_STOP always causes a complete end of measurement. Up to then measured data are passed out as result data. In the operating mode "Normal Measurement" this signal can be used as reset.

If the fine positioning (point 3) was not successful it is repeated several times. If it should not be successful nevertheless, the point is not measured. For the robot, handshake ends however normal (point 4) with the signal OUT_POINT_READY.

The signal OUT_POINT_RESULT indicates the result of the measurement at the time OUT_POINT_READY:

- 0 = NOK
- 1 = OK

After a point is reached (IN_POINT_POS), BYK-mac i ROBOTIC evaluates the 4 positioning pins. If the equipment is too near at the surface or too far, errors x99200 or x99201 are announced in connection with OUT_POINT_READY/ and OUT_POINT_RESULT=0.

If a calculation of the correction values is possible, the necessary correction values are handed over via OUT_CORR-Z/K/Q to the PLC and are indicated with OUT_CORR_VAL.

The robot must thereupon correct the position and indicate it in IN_POINT_POS again.

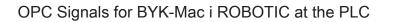
If the position according to the handed over curvature is in the permitted tolerances, a measurement is deployed, subsequently OUT_POINT_READY and OUT_POINT_RESULT is set.

10.1.2 Sequence

No.	Description	PLC	smart-robotic
10	If defined, job data must be available.	Job data↑	
11	New job is started.	IN_JOB_START↑	Internal start of a new job, takeover of the job data on the agenda.
12		↑OUT_JOB_RUN	Feedback to PLC that job runs.
		↑OUT_JOB_SUCCESS	Retraction of the job success sig- nal.
13	Retraction of the job start signal.	IN_JOB_START↓	
14	Job data do not need to be valid any longer.	Job dataţ	
20	Robot hit point. If defined, point data must be on the agenda. A curvature must be reported.	Point data↑ IN_CURVATURE↑	New point hit or correction exe- cuted.
21	Robot reports that a matching position is hit.	IN_POINT_POS↑	
	BYK-mac calculates correction values		
	BYK-mac reports back a correction value (continue at 22).		
	BYK-mac reports that measurement was successful (continue at 32).	OUT_POINT_RESULT=1	
	BYK-mac reports error, abort (continue at 32).	OUT_POINT_RESULT=0	
22	Return of values for Z, K, Q to SR: Z=1/1000mm, K=1/1000°; Q=1/1000°	←OUT_CORR_Z ←OUT_CORR_K ←OUT_CORR_Q	
23	Setting the correction values valid.	↑OUT_CORR_VAL	
24	Point data become invalid.	Point data↓	
24	Robot takes back positioning message and starts next correction.	IN_POINT_POS↓	
25	Cancelling of the correction value. Setting the distance value invalid.	↓OUT_CORR_AKQ ↓OUT_CORR_VAL	
	Continue at 20.		
32	Report at PLC that point is finished.	↑OUT_POINT_READY	Point is finished.

No.	Description	PLC	smart-robotic
33	Point data become invalid.	Point data↓ IN_CURVATURE↓	
33	Robot takes positioning message back and starts next correction.	IN_POINT_POS↓	
34	Retraction of the finished report.	↓OUT_POINT_READY	
	Continue at 20 (new point) or 40 (job end).		
40	Robot reports that the job is finished.	IN_JOB_STOP↑	Job is finished.
41	SR finishes the job and generates measuring file.	↓OUT_JOB_RUN	
	If measuring data are written successfully to disk, job success is reported to PLC.	↑OUT_JOB_ SUCCESS	
42	Retraction of the handshake.	IN_JOB_STOP↓	If measurements are available, an output file is generated.

10.1.3 Diagram



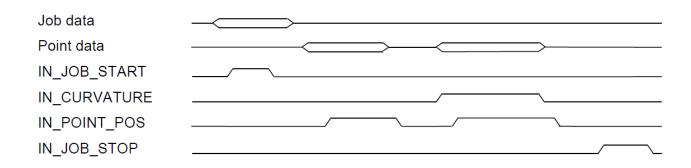


Illustration 156: BYK-mac-Time-Diagram-PLC

OPC Signals for BYK-Mac i ROBOTIC in smart-robotic

OUT_JOB_RUN	
OUT_JOB_SUCCESS	
OUT_POINT_RESULT	
OUT_CORR_Z	
OUT_CORR_K	
OUT_CORR_Q	
OUT_CORR_VAL	
OUT_POINT_READY	

Illustration 157: BYK-mac-Time-Diagram-SR

10.1.4 Workflow

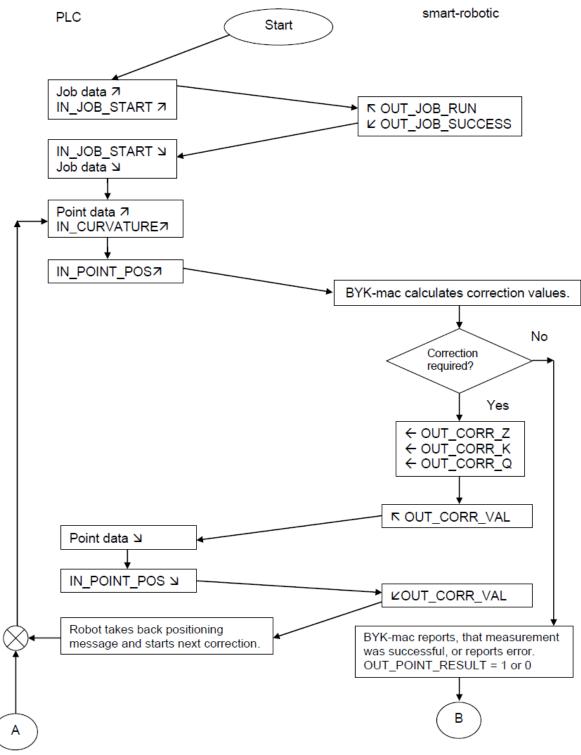


Illustration 158: BYK-mac-Flow-Diagram-Part1

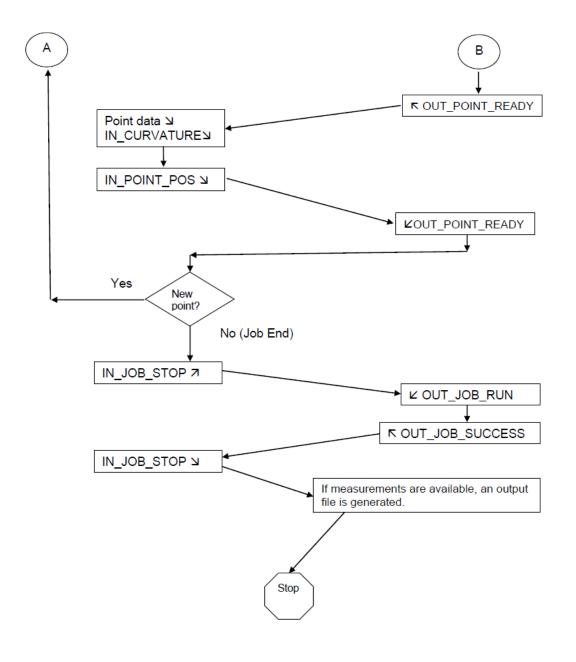


Illustration 159: BYK-mac-Flow-Diagram-Part2

10.2 Calibration Mode - BYK-mac

The operation mode "Calibration" is reached, as the signal IN_REQU_CAL is set.

During the calibration the head is driven by robots into the calibration station. Here it is docked over so-called tile holders. The holders are suspended elastic, thus it is guaranteed that the measuring head is positioned accurately parallel and in firm distance to the tile. An active fine positioning by the robot / BYK-mac does not take place here.

For the sequence of the calibration tiles and their meaning see Device Calibration [▶ 42].

No.	Description	PLC	smart-robotic
	Start Job:		
1	Operation mode bit "Calibration".	IN_REQ_CAL↑	
2	New Job is startet	IN_JOB_START↑	
3		↑OUT_JOB_RUN	
		↑OUT_JOB_SUCCESS	
4	Retraction of the job start signal.	IN_JOB_START↓	
	Start tile:		
10	Robot is at the first calibration tile	IN_POINT_POS↑	
	Start measurement		
	Tile O.K.:		
11	Report at robot that point is finished.	↑OUT_POINT_READY	
12	Robot reports that point is left.	↓IN_POINT_POS	
13	Retraction of the handshake.	↓OUT_POINT_READY	
	If further tile is measured, continue at 10.		
	End Job:		
40	Robot reports that the job is finished.	IN_JOB_STOP↑	
41	FL finishes the job and generates measur- ing file.	↓OUT_JOB_RUN	
42	Retraction of the handshake.	↓IN_JOB_STOP	
			If control measurements are avail- able, output file is generated.

10.3 Masterpanel Mode - BYK-mac

In order to be able to make statements about the color deviation, it is necessary to measure a so-called 'original' or 'masterpanel' of a color. The result of the measurement is needed later on customer side in the quality database, in order to compute the deviation between item under test and the original.

The operation mode "Masterpanel" does not differ in the sequence from a normal measurement, since a fine positioning is accomplished here. Only for the output format of the results of the measurement, another format can be selected.

The output format which can be used must be freely adjustable. Job and point data can be made available by the PLC. Thus e.g. the color number of the new original can be stored.

The sequence given below is nearly the same as in shown in Measurement Mode - BYK-mac [> 146]. Except the positions 1 and 14 differ from the normal measurement mode.

No.	Description	PLC	smart-robotic
1	Request to the reading of the original is on the agenda.	IN_REQU_MAST↑	
10	If defined, job data must be available.	Job data↑	
11	New job is started.	IN_JOB_START↑	Internal start of a new job, takeover of the job data on the agenda.
12		↑OUT_JOB_RUN	Feedback to PLC that job runs.
		↑OUT_JOB_SUCCESS	Retraction of the job success sig- nal.
13	Retraction of the job start signal.	IN_JOB_START↓	
14	Retraction of the original request.	IN_REQU_MAST↓	
15	Job data do not need to be valid any longer.	Job data↓	
20	Robot hit point. If defined, point data must be on the agenda. A curvature must be reported.	Point data↑ IN_CURVATURE↑	New point hit or correction exe- cuted.
21	Robot reports that a matching position is hit.	IN_POINT_POS↑	
	BYK-mac calculates correction values		
	BYK-mac reports back a correction value (continue at 22).		
	BYK-mac reports that measurement was successful (continue at 32).	OUT_POINT_RESULT=1	
	BYK-mac reports error, abort (continue at 32).	OUT_POINT_RESULT=0	
22	Return of values for Z, K, Q to SR: Z=1/1000mm, K=1/1000°; Q=1/1000°	←OUT_CORR_Z ←OUT_CORR_K ←OUT_CORR_Q	
23	Setting the correction values valid.	†OUT_CORR_VAL	
24	Point data become invalid.	Point data↓	
24	Robot takes back positioning message and starts next correction.	IN_POINT_POS↓	
25	Cancelling of the correction value. Setting the distance value invalid.	↓OUT_CORR_AKQ ↓OUT_CORR_VAL	
	Continue at 20.		
32	Report at PLC that point is finished.	↑OUT_POINT_READY	Point is finished.
33	Point data become invalid.	Point data↓ IN_CURVATURE↓	

No.	Description	PLC	smart-robotic
33	Robot takes positioning message back and starts next correction.	IN_POINT_POS↓	
34	Retraction of the finished report.	↓OUT_POINT_READY	
	Continue at 20 (new point) or 40 (job end).		
40	Robot reports that the job is finished.	IN_JOB_STOP↑	Job is finished.
41	SR finishes the job and generates measuring file.	↓OUT_JOB_RUN	
	If measuring data are written successfully to disk, job success is reported to PLC.	↑OUT_JOB_ SUCCESS	
42	Retraction of the handshake.	IN_JOB_STOP↓	If measurements are available, an output file is generated.

10.4 Measurement Mode - wave scan

The wave-scan only has the operation mode "Normal Measurement".

10.4.1 Sequence

No.	Description	PLC	smart-robotic
10	If defined, job data must be available.	Job data↑	
11	New job is started.	IN_JOB_START↑	Internal start of a new job, takeover of the job data on the agenda.
12		↑OUT_JOB_RUN	Feedback to PLC that job runs.
		↑OUT_JOB_SUCCESS	Retraction of the job success sig- nal.
13	Retraction of the job start signal.	IN_JOB_START↓	
14	Job data do not need to be valid any longer.	Job data↓	
20	Robot hit point. If defined, point data must be on the agenda.	Point data↑	New point hit or correction exe- cuted.
21	Robot reports that a matching position is hit.	IN_POINT_POS↑	
	The wave-scan reports that measurement was successful (continue at 32).	OUT_POINT_RESULT=1	
	The wave-scan reports error, abort (con- tinue at 32).	OUT_POINT_RESULT=0	
24	Point data become invalid.	Point data↓	
	Robot takes back positioning message and starts next correction.	IN_POINT_POS↓	
	Continue at 20.		
32	Report at PLC that point is finished.	↑OUT_POINT_READY	Point is finished.

No.	Description	PLC	smart-robotic
33	Point data become invalid.	Point data↓ IN_CURVATURE↓	
33	Robot takes positioning message back and starts next correction.	IN_POINT_POS↓	
34	Retraction of the finished report.	↓OUT_POINT_READY	
	Continue at 20 (new point) or 40 (job end).		
40	Robot reports that the job is finished.	IN_JOB_STOP↑	Job is finished.
41	SR finishes the job and generates measur- ing file.	↓OUT_JOB_RUN	
	If measuring data are written successfully to disk, job success is reported to PLC.	↑OUT_JOB_ SUCCESS	
42	Retraction of the handshake.	IN_JOB_STOP↓	If measurements are available, an output file is generated.

10.4.2 Diagram

OPC Signals for wave-scan ROBOTIC at the PLC

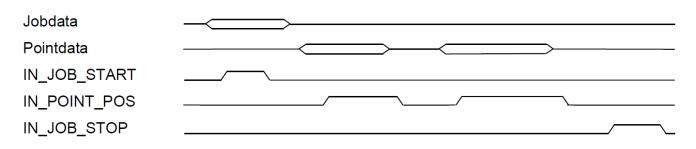


Illustration 160: Wave-Scan-Time-Diagram-PLC

OPC Signals for wave-scan ROBOTIC in smart-robotic

OUT_JOB_RUN	/	
OUT_JOB_SUCCESS		
OUT_POINT_RESULT		
OUT_POINT_READY		

Illustration 161: Wave-Scan-Time-Diagram-SR

10.4.3 Workflow

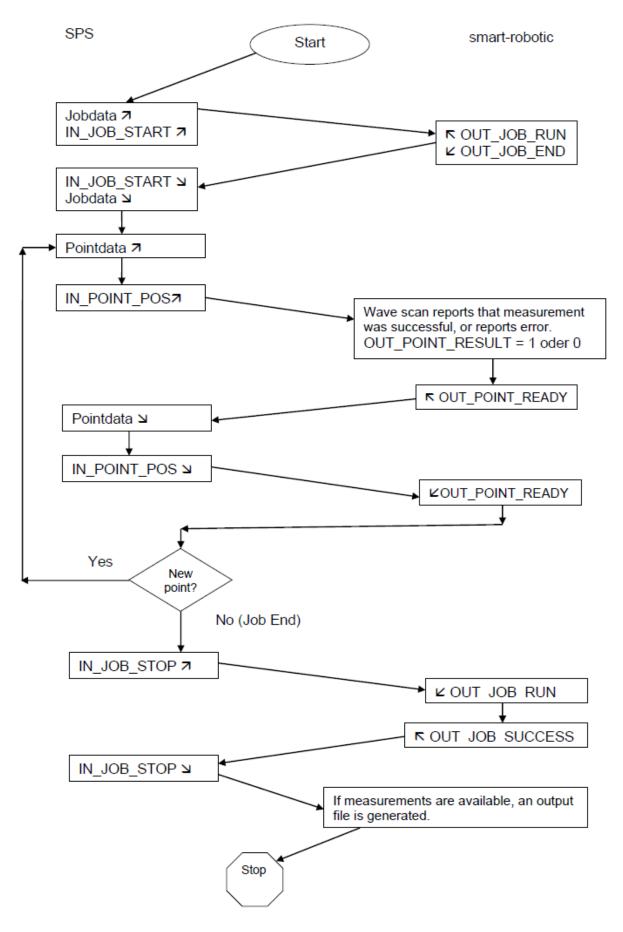


Illustration 162: Wave-Scan-Flow-Diagram

11 Appendix

11.1 Abbreviations

The following abbreviations are used in this documentation.

BMi	BYK-Gardner BYK-mac i (handheld instrument)
BMi-R	BYK-Gardner BYK-mac i ROBOTIC
CSV	Comma Separated Values
DB	Database
FTDI	Future Technology Devices International
IP	Internet Protocol
LAN	Local Area Network
PLC	Programmable Logic Controller
OEM	Original Equipment Manufacturer
OPC	Open Platform Communications
SC	BYK-Gardner smart-chart
SR	BYK-Gardner smart-robotic
USB	Universal Serial Bus
WS	BYK-Gardner wave-scan (handheld instrument)
WS-R	BYK-Gardner wave-scan ROBOTIC
WS3	BYK-Gardner wave-scan 3 (handheld instrument)
WS3-R	BYK-Gardner wave-scan 3 ROBOTIC
XML	Extensible Markup Language

11.2 Error Handling

Error conditions of a measuring instrument are transferred as an error code via OPC signal. It must be decided at the PLC side about the use of this information. An exception forms for example following signal, that is directly available as bit-information:

- BYK-maci ROBOTIC: MACx_CTRL.OUT_SYS_ERR
- wave-scan ROBOTIC: WAVEx_CTRL.OUT_SYS_ERR

All error codes set this bit additionally as a signal of a critical disturbance, at which the measurement must be aborted. Since it however makes sense not to stop the measurement at some errors, but to simply go to the next measuring point, certain error codes can be configured in the device Error Handling [▶ 46] list that no "OUT_SYS_ERR" is set.

11.2.1 Error Code Transmission

The transmission of the error codes to the PLC is done sequentially by a variable. The transfer is controlled via handshake. Following variables are used:

- xxx.OUT_ERR_NO
- xxx.OUT_ERR_STROBE

• xxx.IN ERR ACK

The following procedure applies:

- As soon as a new error is on the agenda, "OUT_ERR_NO" is updated with the error code. If the OPC server surely has updated the error code, "OUT_ERR_STROBE" is set to high.
- 2. This is the signal for the PLC that a new valid error code is to be done and can be read.
- 3. As soon as the PLC reads the code, the signal "IN_ERR_ACK" is set to high by the PLC.
- 4. Then smart-robotic sets back the signal "OUT_ERR_STROBE" to low again, and in the sequence PLC sets "IN_ERR_ACK" to low.
- 5. If further errors should occur, the handshake is repeated.

11.2.2 Usage of OPC Signals

The scenario to be used for error code transmission is selected in the OPC Server Settings [> 29]:

- System-wide Error Messages [> 159]
- Instrument-specific Error Messages [> 159]

For possible OPC signals see Example List of OPC Signals [> 14].

11.2.2.1 System-wide Error Messages

In this scenario the OPC signals in the common group ALL_CTRL are used:

- ALL_CTRL.OUT_ERR_NO
- ALL_CTRL.OUT_ERR_STROBE
- ALL_CTRL.IN_ERR_ACK

This scenario is not recommended anymore as it does not give details about the device raising the error.

11.2.2.2 Instrument-specific Error Messages

In this scenario the OPC signals in the device-specific groups MACx_CTRL and WAVEx_CTRL are used:

- BYK-mac i ROBOTIC with index "1":
 - MAC1_CTRL.OUT_ERR_NO
 - MAC1_CTRL.OUT_ERR_STROBE
 - MAC1_CTRL.IN_SYS_ERR_ACK
- wave-scan ROBOTIC with index "1":
 - WAVE1_CTRL.OUT_ERR_NO
 - WAVE1_CTRL.OUT_ERR_STROBE
 - WAVE1_CTRL.IN_SYS_ERR_ACK

This is the recommended scenario as the device raising the error can be easily identified.

11.3 Troubleshooting

Main programConfiguration is yet not possible or can not be reached.Restart smart-robotic.Main programThere is a problem with smart-robotic.Check log file in "C.\ProgramData\BYK\smart-ro- botic\Logs\SmartRobotic.log".Main programAdding data is not possible on a configu- ration.Add the data input value first. Click the Add button second.Main programThere are too many XML files in the pro- gram data directory.Add the data input value first. Click the Add button second.Main programThere are too many XML files in the log di- rectory.Backup all files, for example in a ZIP archive.OPC configOPC control signal in status "Not con- nected".Check / correct configuration on OPC server. Restart OPC server.OPC configOPC point signal in status "Not con- nected".1 Check / correct configuration on OPC server. Restart smart-robotic.Device connectCOM port can not be assigned, it is occu- pied by other device.1 Assign a free COM port. 2 If not possible, delete the other device.Device testCouput files have no or unknown file ex- tession.1 Click the button De-Initialize first.Output filesOutput file is not written after measure- ment.Append the correct extension in the file name defi- nition designer.Output filesSimulation hangs during a measurement.1 Click server. 2 Restart smart-robotic.Output filesOutput file is not written after measure- ment.1 Click the device used during measurement for this type of storage.Simulation hangs during a measurement.1 Close sma	Module	Problem	Solution
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3 Restart smart-robotic. 4 Reactivate device and simulator. 5 Restart measurement. smart-chart link Expected quality status is not achieved A Save last modification in smart-chart and restart	smart-chart link	Simulation hangs during a measurement.	1 Close smart-robotic.
4 Reactivate device and simulator. 5 Restart measurement. smart-chart link Expected quality status is not achieved A Save last modification in smart-chart and restart			2 Restart OPC server.
5 Restart measurement. smart-chart link Expected quality status is not achieved A Save last modification in smart-chart and restart			3 Restart smart-robotic.
smart-chart link Expected quality status is not achieved A Save last modification in smart-chart and restart			
	smart-chart link	Expected quality status is not achieved during measurement.	smart-robotic.
B Check if matching car model AND color standard is used in smart-robotic.			
RobotRobot simulator can not be started.Enable a measurement device first.simulator		Robot simulator can not be started.	Enable a measurement device first.
RobotThere is a problem with the robot simula- simulatorCheck log file in "C:\ProgramData\BYK\ smart-ro- botic\Logs\ RobotSimulator.log".			
RobotThere are too many log files in the log di- simulatorBackup all files, for example in a ZIP archive.rectory.			Backup all files, for example in a ZIP archive.

11.4 XML Input File PELT

Following XML input files have been used to create this documentation. Details see PELT Measurement [> 122].

11.4.1 Job Information

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE RobotPELT SYSTEM "RobotPELT.dtd" >
<RobotPELT>
<Revision>420003.2.1.5</Revision>
<BuildDate>2020-12-14T11:15:50</BuildDate>
<JobInformation>
<Id>00000098020041</Id>
</styleNumber>Compact</StyleNumber>
<Booth>B</Booth>
<BaseColor>Petrol</BaseColor>
<ClearColor>HE05</ClearColor>
</MeasurementUnits>Microns</MeasurementUnits>
</JobInformation>
```

11.4.2 Multiple Measurements

```
<MultipleMeasurements>
<Measurement>
...
<Layers>
...
</Layers>
</Measurement>
</MultipleMeasurements>
```

```
</RobotPELT>
```

11.4.2.1 Measurement 1

```
<Measurement>
<PanelName>R01 X01 0:1</PanelName>
<PanelNumber>0</PanelNumber>
<PanelLocation>1</PanelLocation>
<Location>1</Location>
<Robot>1</Robot>
<Sensor>1</Sensor>
<Placement>1</Placement>
<GroupCode>T</GroupCode>
<KD_KOORD_X>0</KD_KOORD_X>
<KD_KOORD_Y>0</KD_KOORD_Y>
<KD_KOORD_Z>0</KD_KOORD_Z>
<LayerCount>4</LayerCount>
<Temperature> 18.0</Temperature>
```

<Layers>

11.4.2.1.1 Layer 1

```
<Layer>
<LayerNumber>1</LayerNumber>
<Thickness> 34.46</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 59.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>33.50</TOF>
<LayerName>Clear_T</LayerName>
<LayerCode>CC</LayerCode>
<LayerVendor>VW</LayerVendor>
</Layer>
```

11.4.2.1.2 Layer 2

```
<Layer>
<LayerNumber>2</LayerNumber>
<Thickness> 17.18</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 59.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>16.50</TOF>
<LayerName>TP Color_T</LayerName>
<LayerCode>BC</LayerCode>
<LayerVendor>VW</LayerVendor>
</Layer>
```

11.4.2.1.3 Layer 3

```
<Layer>
<LayerNumber>3</LayerNumber>
<Thickness> 22.66</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 83.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>21.50</TOF>
<LayerName>Prime_T</LayerName>
<LayerCode>PR</LayerCode>
<LayerVendor>VW</LayerVendor>
</Layer>
```

11.4.2.1.4 Layer 4

<Layer> <LayerNumber>4</LayerNumber>

```
<Thickness> 14.94</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 84.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>14.00</TOF>
<LayerName>E-Coat_T</LayerName>
<LayerCode>EC</LayerCode>
<LayerVendor>VW</LayerVendor>
</Layer>
```

11.4.2.2 Measurement 2

```
<Measurement>
<PanelName>R01 X01 1:21</PanelName>
<PanelNumber>1</PanelNumber>
<PanelLocation>21</PanelLocation>
<Location>2</Location>
<Robot>1</Robot>
<Sensor>1</Sensor>
<Placement>2</Placement>
<GroupCode>S</GroupCode>
<KD KOORD X>0</KD KOORD X>
<KD KOORD Y>0</KD KOORD Y>
<kd koord z>0</kd koord z>
<LayerCount>4</LayerCount>
<Temperature> 19.0</Temperature>
<Timestamp>2020-12-14T14:27:13</Timestamp>
<Layers>
```

11.4.2.2.1 Layer 1

<Layer> <LayerNumber>1</LayerNumber> <Thickness> **42.86**</Thickness> <LayerTooThin>0</LayerTooThin> <Confidence> 48.0</Confidence> <Indirect>0</Indirect> <TemperatureScaleValue>1.0000</TemperatureScaleValue> <TOF>41.50</TOF> <LayerName>**2K Clearcoat**</LayerName> <LayerCode>ALD 096050/ALZ</LayerCode> <LayerVendor>Axalta</LayerVendor> </Layer>

11.4.2.2.2 Layer 2

<Layer> <LayerNumber>2</LayerNumber> <Thickness> **10.53**</Thickness> <LayerTooThin>0</LayerTooThin> <Confidence> 48.0</Confidence> <Indirect>0</Indirect> <TemperatureScaleValue>1.0000</TemperatureScaleValue> <TOF> 9.00</TOF> <LayerName>**Deepblack Per_5**</LayerName> <LayerCode>2T2T</LayerCode> <LayerVendor>Axalta</LayerVendor> </Layer>

11.4.2.2.3 Layer 3

```
<Layer>
<LayerNumber>3</LayerNumber>
<Thickness> 29.79</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 95.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>20.50</TOF>
<LayerName>Anthrazit Prime</LayerName>
<LayerCode>ALG 670008</LayerCode>
<LayerVendor>Hemmelra</LayerVendor>
</Layer>
```

11.4.2.2.4 Layer 4

```
<Layer>
<LayerNumber>4</LayerNumber>
<Thickness> 21.01</Thickness>
<LayerTooThin>0</LayerTooThin>
<Confidence> 95.0</Confidence>
<Indirect>0</Indirect>
<TemperatureScaleValue>1.0000</TemperatureScaleValue>
<TOF>15.00</TOF>
<LayerName>CathoGuard 800</LayerName>
<LayerCode>ALE 074507</LayerCode>
<LayerVendor>BASF</LayerVendor>
</Layer>
```



NOTICE

The value for the "Multi-Layer Total Thickness" is not present in the file. It is calculated by **smart-robotic** from the values of the different layers belonging to the same check zone.

Notes

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