

Indu-Sol GmbH – Specialist in Industrial Networks

PB-Q^{ONE} **User Manual**



Diagnostic and service tools for PROFIBUS



PIRIOIFII TNÉTT









Revision overview

Date	Revision	Change(s)
10/10/2017	0	First version

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Contents

Revision overview					
Contents	6	4			
1	Introduction	6			
1.1	General	6			
1.2	Functional overview	6			
1.3	Scope of supply	7			
1.4	System requirements	8			
1.5	Safety information	8			
2	Commissioning	9			
2.1	Software installation	9			
2.2	Connect device to PC	9			
3	Connection to the PROFIBUS system	10			
3.1	Basics	10			
3.1.1	Warning about measurements on running systems	10			
3.1.2	Connection types for PROFIBUS devices	10			
3.1.3	Adapter cable	10			
3.1.4	Measuring locations	11			
3.2	Connection versions	12			
3.2.1	Measurements during system downtime	12			
3.2.2	Measurements on the running system	13			
3.2.2.1	Connection type D-Sub connector with service jack	13			
3.2.2.2	Connection via permanently installed measuring point PBMA (IP20)	14			
3.2.2.3	Connection type M12 (IP67)	15			
4	Perform and document measurement	16			
4.1	General information	16			
4.2	Network	17			
4.2.1	Тороlоду	17			
4.2.2	Device list	19			
4.2.3	List of measuring points	19			
4.3	Quality values	20			
4.3.1	Standard measurement	20			
4.3.2	Additional functions	21			
5	Telegrams	22			



6	Results	24
6.1	Network overview	24
6.2	Device details	25
6.3	Event list	26
6.4	Comparison	26
7	Report	27
8	Technical data	28
8.1	Technical drawing	28
9	Appendix	29
9.1	Sample log	29
9.2	Sample plan	31



1 Introduction

1.1 General

The **PB-Q**^{ONE} is an easy to use, powerful measuring device for comprehensive inspection of PROFIBUS master systems. It offers separate testing of the physical condition of the bus (signal quality) and the telegram traffic. The device can be used for acceptance measurement on new systems for inclusion in the acceptance report, as well as for targeted troubleshooting of existing systems.

Its integrated master simulator enables testing of the communication quality without a need for the PLC to be operational. This enables pre-inspection of complete systems and their parts during the commissioning stage, with the goal of providing stable bus systems for trouble-free production in the long term.

The device is connected to a PC or notebook via a USB interface, which also provides the power supply. It is controlled with the "Indu-Sol Suite" software.

1.2 Functional overview

The **PB-Q**^{ONE} is designed to assist you with inspection, troubleshooting, and the isolation of root causes. To this end, it offers the following functions:

- Feedback-free bus coupling at suitable existing measuring points during running operation
- Automatic detection of the baud rate
- Automatic identification of all devices on a bus system (LiveList)
- Device and measuring-point-based display of signal ratios:
 - o General quality value
 - Signal to noise ratio and slope gradient
 - o Oscilloscope display with selection options for detailed evaluation
- Long-term monitoring of all devices (continuous measurement) with minimum, maximum, and average quality values
- Editable measuring point and segment management
- Wear inspection by comparing current readings with stored measurements
- Integrated master simulator for inspection of system without a master (commissioning phase)
- Real-time monitoring of the entire data traffic and checking for telegram errors, with entries into the event list
- In-depth telegram analysis with option for variable trigger setting
- Easy documentation of measurements in the form of an acceptance report and topology plan



1.3 Scope of supply

The scope of supply comprises the following individual parts:

- Measuring device **PB-QONE**
- D-Sub 9-pin adapter cable (for connecting to a PROFIBUS system)
- USB cable (2 m)
- CD with operating software "Indu-Sol Suite" and device manual

Please check the contents are complete before putting into operation.



Figure 1: **PB-Q^{ONE}** delivery condition



1.4 System requirements

The following Windows versions are supported: Windows 7, Windows 8, Windows 10.

The following minimum hardware requirements apply for the PC or notebook used:

- CPU: Dual Core, Core I3 or better
- RAM: 4 GB
- Screen resolution: ≥ 1024x768 pixels (XGA)
- Graphics: DirectX 9.0c capable graphic board (supported by most on-board graphic boards)
- USB interface: 2.0 (no other devices should be connected to the USB hub)

1.5 Safety information

- Never open the housing of the **PB-Q**^{ONE}
- Opening the housing immediately voids any warranty
- If you suspect that the device is defective, then return it to the supplier



2 Commissioning

2.1 Software installation



The PC software "Indu-Sol Suite" includes the required USB driver and needs to be installed on the PC or notebook before the *PB-Q^{ONE}* is connected for the first time.

The "Indu-Sol Suite" software is included on a CD-ROM. The installation requires administrator rights. If the CD-ROM does not start automatically after inserting, then manually start the "setup.exe" file in the main directory.

Future updates can be found on the Internet at <u>www.indu-sol.com</u>, under downloads.

The installation is performed after selecting the language, agreeing to the end user licence agreement, and making the installation settings. Then the software is fully available for the following measurements.

2.2 Connect device to PC

Use the included USB cable for connection to the PC or notebook, including power supply.



Preferably connect the device directly to a USB port on the PC or notebook. Connecting via external USB hubs or docking stations of notebooks may cause problems.



3 Connection to the PROFIBUS system

3.1 Basics

3.1.1 Warning about measurements on running systems



Caution: When connecting a measuring device, effects on the system to be inspected cannot be ruled out completely. With unstable PROFIBUS systems, malfunctions of the system may occur in rare cases. Always observe the connection information!

3.1.2 Connection types for PROFIBUS devices

Depending on the device version, there are different ways to connect bus modules to a PROFIBUS network:

- Connecting via plug-in connectors
 - D-Sub plug-in connector, usually with an integrated terminal resistor, and optionally with an additional service jack
 - o M12 screw-in connector in the field for higher IP ratings
 - Special manufacturer-specific hybrid plug-in connectors for routing the power supply over the bus in conjunction with special cables
- Direct cable connection via terminals

Due to the typical linear structure of the PB networks, the available measuring points are usually limited to the connecting points of the bus devices. Alternatively, the use of additional measuring points (e.g. Profibus measurement adapter, PBMA) may be viable.

3.1.3 Adapter cable

The standard scope of supply of the **PB-Q**^{ONE} includes the 9-pin D-Sub adapter cable. An M12 adapter kit is available as an optional accessory.



Use only the short original cables with special pin allocation for connecting to a PROFIBUS network. No more than two D-Sub connectors must be cascaded to the service jack at a time.



Figure 2: Improper cascading of D-Sub connectors

The use of active connecting cables with integrated repeaters for measurement is not possible.



3.1.4 Measuring locations

In principle, the *PB-Q^{ONE}* is able to perform measurements at any point in a PROFIBUS system. Please note that the use of repeaters and converters (OLM, data light barriers, wireless transmission) creates separate physical **segments** that need to be **evaluated individually**.

A complete and in-depth analysis of the overall PROFIBUS system requires measurements to be performed at the **beginning** and the **end** of each physical segment. If problems are detected that cannot immediately be classified clearly, then at least one additional measurement should be performed in the middle.



3.2 Connection versions

3.2.1 Measurements during system downtime

If D-Sub connectors with an additional service jack are present on all bus devices, then the *PB-Q^{ONE}* is simply connected there as shown in the image. If a D-Sub connector without a service jack is installed, then the D-Sub adapter cable can be inserted below. Note that cascading more than two D-Sub connectors should be avoided at all cost.

For M12 connection technology, the M12 adapter cable (optional) is looped into the bus.



For all connection versions requiring adapter installation, the bus must be opened. This causes short-term disruptions in communication, which is why a system shutdown is required.



Figure 3: Measuring points during system downtime



3.2.2 Measurements on the running system

No intervention into the master system is possible on running systems, as this would automatically lead to bus faults and loss of production. The *PB-Q^{ONE}* can only be connected and run at the existing measuring points (e.g. PB connector with service jack on the CPU). In order to be able to perform a status quo analysis under production conditions on all existing segment ends, this should be considered during the system planning stage. If the use of appropriate connectors is not possible, then measuring adapters (e.g. PBMA – IP20, PBMX – IP67) can be used.

3.2.2.1 Connection type D-Sub connector with service jack

If D-Sub connectors with an additional service jack are installed on all bus devices, then the **PB-Q**^{ONE} is simply connected there as shown in the image.



Figure 4: Measuring points via the service jack



3.2.2.2 Connection via permanently installed measuring point PBMA (IP20)

For measurement during running operation, Profibus measuring adapters (PBMA) have been permanently integrated into the system.



Figure 5: Example of permanently installed measuring points (PBMA)



3.2.2.3 Connection type M12 (IP67)

For measurement during running operation under IP67 conditions, Profibus measuring adapters (PBMX) have been permanently integrated into the system. An M12 adapter (optional) is required for connecting measuring devices.



Figure 6: Example of permanently installed IP 67 measuring points (PBMX)



4 Perform and document measurement

4.1 General information

All measurements taken with *PB-Q^{ONE}* and the respective entries are summarized in a measurement file (*.pbn) for storage and later retrieval. For a structured analysis of several systems, it is therefore useful to create a separate measurement file for each master system. It can be used as a basis for additional measurements later to provide an easy way of performing before-after comparisons.

The system language can be selected between English and German under "Settings".

In "GSD management", the *.gsd files of each Profibus device are stored in the system. This file defines the characteristic communication features of the relevant slave. The *PB-Q^{ONE}* uses this information for detecting the device type as well as manufacturer-specific information.

E New Open	Indu-Sol Suite		PB-Q [™]
See Settings GSD Management About Bit Q ^{MM} Quit	Contact Indu-Sol GmbH Blumenstraße 3 04626 Schmölln Gerenary Phone +49 34491 5818-0 Fax +49 34491 5818-9 Email info@indu-sol.com	Software Version Version 1.0 (Build 78) Log Files	
	Third-party components in use Bogus 15010 Castle.Core 1300 Castle.Window 3300 Microsoft.WindowsAPICodePack.Shell 1100 Att		i i i

Figure 7: File management



4.2 Network

4.2.1 Topology

After connecting the *PB-Q^{ONE}* to the computer via USB, connecting the measuring adapter to the Profibus system, and starting the software, the network overview is displayed with the detected baud rate (Figure 8).

≡ File	
View and manage the network	Topology Device Int Measuing Point List Network name Beud Rate Auto Can devices
Quality values View quality values	
View and analyse telegrams	
Overview of measurement results	
Create or print a report	
Version 1.0 (Build 78)	E
Connected Effective baud ra	te 15 Mbd/s

Figure 8: Home screen

The system designation can be entered in the field "Network name". The function "Scan devices" lists the detected devices in ascending order of address (Figure 9). This is the basis for future measurement steps.



Figure 9: Device list



The topology plan is a prerequisite for structured measurements and creating a detailed system description. In the topology overview, a complete representation of the actual system structure with device descriptions, segmentation and measuring points can be realised. Selecting individual devices enables more detailed naming (e.g. with device type, equipment identifier). The tools in the drop-down menu enable the integration of additional modules without a dedicated Profibus address (measuring points, repeaters, optical fibre converters, wireless converters) and the connection of the overall system (Figure 10).



Figure 10: Topology

Segment and measuring points are assigned by selecting the relevant connection points of the end devices. After defining the measuring point and allocation to a segment, the relevant segment number is automatically assigned to all modules connected in this segment (Figure 11).



Figure 11: Assign measuring points



4.2.2 Device list

The "Device list" sub-item provides a complete overview of all topology entries in table form. Inputs as well as search and sorting functions can be performed here.

	≡ File	Rack 1	Rack 1									
		Topolog	y Device list Measu	ring Point List								
	View and manage the	Search										
ĽĽ	network	Addres	Name	Description								
_		2	Master[2] - CPU	+S1-102KF1								
	Quality values	3	Slave[3] - FU	+\$1-01KF1								
((₫))	View quality values	4	Slave[4] - Ventil	+20KK1-20KF44								
\sim	their quality fundes	5	Slave[5] - Geber	+20P1-20KF1								
			Multirepeater X2	+00P1-00KF88								
	Telegrams		Messstelle - PBMA	+00P1-00KF90								
	View and analyse											
	telegrams											
-	Results											
3	Overview of											
-	measurement results											
	Dement											
3-1	Report											
3	Create or print a report											
v	ersion 1.0 (Build 78)											

Figure 12: Device list

4.2.3 List of measuring points

The list of measuring points is a segment-specific overview of all measuring points in the system. The entries in the "Topology" tab are the starting point. For completion and better definition of the list, the measuring point type (e.g. connector with Sub-D interface, PBMA) as well as the position on the segment (at the beginning or end) can be assigned via the relevant drop-down menu.

	🚍 File	Rack 1 *			
	Natural	Topology Device list Measuri	ng Point List		
	View and manage the	Location	Туре	Position in segment	
	network	^ Measuring points in	51		
	Ouality values	Master[2] - CPU (Address: 2)	Connector with Sub-D Interface 💌	at the beginning 🔹	
9	View quality values	Multirepeater X2 - Port1	Connector with Sub-D Interface *	at the end •	
		* Measuring points in	S2		
	Telegrams	Multirepeater X2 - Port2	Connector with Sub-D Interface 🔹	at the beginning 🔹	
**	telegrams	Messstelle - PBMA	PBMA ·	at the end 🔹	
	P. It.		Others Connector with Sub-D Interface Sub-D Interface		
	Overview of		PBMA PRMX		
1	measurement results		Directly connected		
	Report				
	Create or print a report				
	(orging 1.0 (Ruild 79)				
,	version 1.0 (puild 78)	U			

Figure 13: List of measuring points



4.3 Quality values

4.3.1 Standard measurement

The quality values represent the main criterion for evaluating the physical communication conditions. For a complete system analysis, measurements need to be performed in all segments on both ends. The device addresses determined by the "<u>Scan devices</u>" function serve as a reference.



Figure 14: Quality values

Select the measuring point before starting the measurement. Finally, press the relevant start button to decide whether to perform a single or a continuous measurement. Clicking on the stop button terminates these functions and displays the results of the quality values for the overall system. The icons used have the following meaning:

 Start new single measurement

Start new continuous measurement Stop measurement (single cycle with all device addresses) (continuous measurement of all devices) (stops the current measurement)

After completing the measurement, the system automatically outputs a file name suggestion with a time stamp. You may change the name or store the data under the default name (Figure 15). This makes it possible to recall all measurements for the relevant measuring points later.

The measurement has been completed		×
Name of measurement		
Measurement of 23/10/2017 14:14:11		
	Accept	Discard

Figure 15: Info measurement finished



4.3.2 Additional functions

There are other useful functions for a more in-depth evaluation, in particular in the event of malfunction.

If the preset quality threshold is not reached, then the affected devices are shown in yellow. Individual addresses can be selected to show all values for the relevant device. In addition, an oscilloscope image is shown in addition to the signal-to-noise ratio and the slope gradient (Figure 16).

Pressing the button to switch signals causes the display to switch between "Last signal" and "Worst signal".



Figure 16: Low quality values

Every image section can be enlarged to display more details. The oscilloscope overview adds line A, line B, and the measurement function, in addition to showing the evaluation criteria (Figure 17).

			Rac	≡ File
Evaluation	7.151829 • 📕 🕨 🔳	iments [aster[2] - CPU (Address: 2) • Measurement Messung vom 25:10:20:	Star Mea	Network View and manage the
functions	Δt: 0.0 ns. d: 0.0 m d: 0.0 m d: 0.0 m	ie B 🖬 Voltage Difference 🖬 Measure . Show/hide valuation criterias	 	Quality values
			Volt	Telegrams View and analyse telegrams
Maximise image	V V			Results Overview of measurement results
	Quality values per divice. Addresses only in segment 51.	10 / Super 1 4 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	Sig	Create or print a report
	2 3 4 5	ue 1.71 1/16 Slope 1/16		Version 1.0 (Build 78)
				Connected Effective baud

Figure 17: Oscilloscope view



5 Telegrams

This menu item provides access to the telegram monitor of the *PB-Q^{ONE}*. This enables the evaluation of the entire master system across segments. The recording is started simultaneously with the measurement of the quality values and can be performed as a single measurement or a continuous measurement.

= File	Rack	k 1								Recordi
	rtuci									triaa
Network	Start	/Stop Measure	ements							
View and manage the	Meas	uring Point	(aster[2] - CPU (4	Address: 2) 🔹	Measurement	Messung v	om 25.10	2017 15:18:29	M 🕨 🔳 🝳 🛞 👻	Coorob fild
network	2000	and one breader a	and down in home on a	and the state of the					X	Search fill
			and drop it many to g		x		DCAR	D-F	P-4	
	NO.	Time	Note	Addresses	Telegram type	22WL	USAP	Dpservice	Data	
() Quality values	0	7.53414152	0 -	2 - 5	ResDI			DataExchange	00	
View quality values	1	7.53424007	0 -	2 - 73	KeqFdl	-				
	2	7.53449008	0 Alam haa amla	2 - + 2	Reafiedblich			DataEucheman	00	
Telegrams	4	7.53461910	0 .	2 4= 3	ResDI	-		DataEvchange	00	
View and analyse	5	7.53471742		2-24	ReaSedHigh	-		DataEvchange	00	
telegrams	6	7.53479853		2 - 4	ResDI	-		DataExchange	00	
	7	7.53489676	0 -	2 → 5	ReqSrdHigh			DataExchange	00	
Results	8	7.53497818	0 -	2 🖝 5	ResDI			DataExchange	00	
Overview of	9	7.53507676	0 -	2 -> 74	ReqFdI					
measurement results	10	7.53532677	0 -	2 🎝 2	Token					
	11	7.53537410	0 New bus cycle	2 \Rightarrow 3	ReqSrdHigh			DataExchange	00	
Report	12	7.53545577	0 -	2 🗲 3	ResDI			DataExchange	00	
Create or print a report	13	7.53555411	0 -	2 🔿 4	ReqSrdHigh			DataExchange	00	
	14	7.53563515	0 -	2 🖛 4	ResDI			DataExchange	00	
	15	7.53573345	0 -	2 -> 5	ReqSrdHigh			DataExchange	00	
	16	7.53581485	0 -	2 🖛 5	ResDI			DataExchange	00	
	17	7.53591345	0 -	2 -> 75	ReqFdI					
	18	7.53616346	0-	2 -> 2	Token			0.0		
	19	7.53621079	0 New bus cycle	2-9-3	ReqSrdHigh	-		DataExchange	00	
Version 1.0 (Build 78)	20	7.53629243		24-3	RESUL			Datassichange	•	

The results of the recording are summarized under $\frac{\text{Results}}{\text{Results}} \rightarrow \text{Bus communication}$.

Figure 18: Telegram monitor

By setting special recording triggers (Figure 19) individual telegram types (e.g. error telegrams, repetitive telegrams, diagnostics, failures) and device addresses can be triggered directly. After activating the filter settings and starting a continuous measurement, the entire telegram traffic is analysed in the background. If one of the specified events occurs, then a telegram recording of the preset size is made. Depending on the setting, this may be performed as a one-off or as a repeating process.

General	
😸 trabled Settings	
These second	
16320	
Constant Harries Before Event Harries After Event Keningeren Total After Afte	
Telegram Types	
A di Dagrasis	
Residuen	
Statewal Diagonia	
Enternal Diagnosis	
of Promo Repeat	
Reset	
S Engrisone	
b I FDL Fames	
b El FDL Senices	
D ID Matter to Matter	
P I 040	
D 044	
b 0 042	
14 hours	
NULCIC .	
	X 17 X 18 X 19 X 20 X 21 X 22 X 23 X
24 X 25 X 26 X 27 X 28 X 29 X 30 X 31 X 32 X 33 X 34 X 35 X 36 X 37 X 38 X 39 X 40	X 41 X 42 X 43 X 44 X 45 X 46 X 47 X
	× 05 × 06 × 67 × 68 × 69 × 70 × 71 ×
72 🗙 73 🗙 74 🗙 75 🗙 76 🗙 77 🗙 78 🗶 79 🗶 80 🗶 81 🗶 82 🗶 83 🗶 84 🗶 85 🗶 86 🗶 87 🎗 88	🗙 89 🗙 90 🗶 91 🗙 92 🗶 93 🗶 94 🗶 95 🗶
120 K 121 K 122 K 120 K 124 X 125 X 126 X 127 X	
	I, 2, 3, 30 - 35 Add Add Review Att
Close	

Figure 19: Recording trigger



The search filter has selection criteria for direct investigation of the predefined characteristics (Figure 20).



Figure 20: Search filter

Once these are defined, the found entries are shown via the up/down function in the telegram overview (Figure 21).

	≡ File											
0	Network	Start Stop Manuments Manuaring Turk Madatella-CRUIddean J. ** Manument of SUSSIDI (ASID) **										
ι.	network	Data a durin heads and point free 10 points to that starter										
		No. The Main Address Toleron has 1287 D487 D487 D487										
	Quality values	The first hard sources of the periods and the second source of the secon										
9	View quality values	1817 143.78021926 2 4 5 501 Database 0										
		21:5 143/14889500 Breaksown 2 +#3 RegSrithigh 42 60 Dagenos										
	* -	1819 148746789900 - 2 → 6 Regfd										
\square	Telegrams	1820 148.74709950 · 2 + 2 Teken										
**	Vew and analyse telegrams	1821 L48.242368556 New hus cycle 2 +4 Regfuthigh Databoharge 00										
		1822 14674/2/5700 - 2 4 4 ReD Detributinge 00										
-	Results	1823 148.347296080 · 2 + 5 Repfinitings 00										
3=	Overview of	1350 (45.7030/360) · 2 ← 5 Re(0 Detailsharpy 00										
1	measurement results	1350 [48/20140550] Besildown 2 + - 3 Reportings 60 00 Daynoss										
		33.6 (48/47/3536) · 2 + 7 (Rept)										
	Descet	1.847 (147.978)580 (2.7.97) 2.847 (148.9) (2.8. (147.98)591 (3.6. (2.9. (2.8. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9. (2.9.										
	Create or print a report	Table Description and the set of										
-		LIDE LADARDIZITO 2 2 4 5 Revolution Databases 0										
		1811 L42.745391040 - 2 4-5 Re-D Detailsharep 00										
		1822 L46.748391550 Binitidium 2 → 2 Registriph 42 60 Diagnosis										
		1833 L48.748681500 - 2 → 8 PegEt										
		1884 148-74891550 - 2 → 2 Token										
		183 1487487990) New hus tycle 2 → 4 Reglicitigh Datalishinge 00										
		1836 L48.761060200) - 2 4-4 RetX Datalacharge 00										
		1827 L46.748558000 - 2 → 5 Reglinitige DataBoharge 01										
		188 1482/0500090 - 2 4-5 Sec0 DataSatarge 00										
		1430 L48.748139810 demolouvn 2 + € 2 Rephritish 60 00 Daynoss										
		140 (141.055,050) · 2 → 9 Keφ0										
		YOUTUDE INNERSEEN SO UT UV US UT US										
		The IS12/2817345332 0:00 68 05 05 68 83 82 60 3C 38 1C 26 hh. m < → i .										
		 Ledgem type Town 643 										
		rype mic.										
		SUCCER BARRING &										
		Demonstration address J										
		* 10.5 SHOULD										
		Service Reporting										
		remeted region										
		A 12 Marca										
v	Fersion 1.0 (Build 78)	Dapies										

Figure 21: Telegram evaluation



6 Results

6.1 Network overview

After the measurements have been completed, all available recordings can be accessed in order of measuring point and time under the "Results" sub-item. In the network overview, a total evaluation is performed for the selected data record with regard to bus physics and bus communications and presented according to the defined criteria. If all values are within the specifications, then this is indicated by a green icon (Figure 22).

🚍 File	Rack 1					
Network View and manage the network	Measuring point (Meter(2) - CPs Network Overvier	And Frankansenet (Adabases 2), s. (Mananag seen-2011.2021.202451), * (Decima Databili Databili Companition)				
-	Overall Rati	ing				
Quality values View quality values		Measuring Point				
		Measured	1 of 4			
View and analyse	\mathbf{v}	Measurement at measuring point	Master[2] - CPU (Address: 2)			
telegrams		Date	02/11/2017			
Results Contrient of		Timestamp	102451			
measurement results		Duration	0:00:05.5			
Report	Bus Physics					
Create or print a report		Quality values				
		Worst Quality Value	4858			
	$\mathbf{\nabla}$	Best Quality Value	5488			
		Critical Quality Value	2,500			
		Number of nodes below critical quality value	0			
		Number of unmeasured nodes (timeout)	0			
	Bus Commu	unication				
		Protocol Analysis				
		Baud Rate	1.5 Mbit/s			
	$\mathbf{\nabla}$	Bus Cycle Time (min/max)	0.59 ms / 1.47 ms			
		Received frames	52378			
		Sent frames	52378			
Marrison 1.0 /Build 785		Received bytes	452691			
-						

Figure 22: Network overview

Evaluation criteria:



No fault: Communication is functioning without any problems.

Warning: A quality value is below specification, or a communication error has occurred on the network, but without causing system failure. The sources of this event should be localised and resolved.

Fault: A critical fault has appeared in the network, or originated from a device, and this fault leads to system failure. Urgent action is required to resolve the fault.



If error events occurred during the recording period, or if quality values were found to be below threshold, then this is indicated by a yellow icon (warning, not yet a failure) or a red icon (fault) (Figure 23).

	≡ File	Rack 1					
	etwork w and manage the work	Measuring point a [Marter[2] - CPU Network Overview	od maximmet (Aldrew 2, •) Islaming van 31102011100038 • Device Detak Deuts Comparison				
0	-	Overall Rati	ng				
C Vier	in quality values		Measuring Point				
			Measured	1 of 4			
	egrams and analyse	\bullet	Measurement at measuring point	Master(2) - CPU (Address: 2)			
terter	ьдгатта		Date	31/10/2017			
Re Ove	Results		Timestamp	16:00:38			
- mea	asurement results		Duration	0.90.30.15			
E Re	port	Bus Physics					
Crea	ate or print a report		Quality values				
			Worst Quality Value	4732			
		\mathbf{v}	Best Quality Value	5488			
			Critical Quality Value	2,500			
			Number of nodes below critical quality value	0			
			Number of unmeasured nodes (timeout)	0			
		Bus Commu	nication				
			Protocol Analysis				
			Baud Rate	1.5 Mbit/s			
		\mathbf{w}	Bus Cycle Time (min/max)	0.59 ms / 2,837.25 ms			
			Received frames	261758			
			Sent frames	261758			
Versio	on 1.0 (Build 78)		Received bytes	2262529			
B free	nerted Effective based or	IL 1 SAMAG					

Figure 23: Bus communication fault

6.2 Device details

The address-based device overview under the sub-item "Device details" helps with a more detailed localisation of errors. Unlike in the overall evaluation, all detected Profibus devices are listed in ascending order of address and colour-coded to show their status. The individual results of the physical and logical evaluation are shown by selecting the relevant address.

≡ File	Rack 1					
Network	Nexuring point and measurement (Nexuring 2): (10/4/dotres 2), • (Measure was 31.13.2012 10/00/10. •					
retwork	Network Overview Devices Details Events	Comparision				
Quality values	2 Master(2) - CPU +51-100KF1	Jane (3) - FU (4) (49) Jane 10 -				
	Slave(3) - FU	Bus Physics				
Telegrams	3 (SI-038)	Quality values				
eer telegram	4 Slave[4] - Ventil +2003-200744	Worst Quality Value	5362			
Results	durally datas	Average Quality Value	5427			
Overview of measurement results	5 +2091-20071	Best Quality Value	5488			
Report	Unknown All teleprovis that can't be assigned	Critical Quality Value	2500			
Create or print a report	to a node will be assigned to this.	s Communication				
		Protocol Analysis				
		Received frames	32770			
		Sent frames	32769			
		Received bytes	326706			
		Sent bytes	326691			
		Critical Events				
		Node failures	2			
		Error telegrams	0			
		Restarts	1			
		Repeated frames	0			
		Max. repetitions within one bus cycle	0			
		Diagnosis messages	0			
Version 1.0 (Build 78)						

Figure 24: Fault, slave addr. 3



6.3 Event list

The event list shows the recorded fault entries. The table illustrates when and how often certain telegram errors occur. The events are shown based on their address and can be grouped with a sorting function.

≡ File	
Network View and manage the network	Nanch gaile and research F
Quality values View quality values	Display Market Filter 2023071 20140 Annow
View and analyse telegrams	2x20027124004 (morberty 2 2x20027124004 (morberty 3 2x20027124004 (morberty 3 2x200271240004 (morberty 3 2x20027124004 (morberty 3 2x20027124004 (morberty 3 2x200271240004 (morberty 3 2x2002712400000000000000000000000000000000
Results Overview of measurement results	202027120846 Boothers 1 202027130846 Boothers 2 202027130846 Boothers 2
Create or print a report	
Variation 7.0 Build TR	
Connected Effective baud i	Τ Με 15 ΜΑΥ

Figure 25: Event list

6.4 Comparison

Stable physical conditions are the foundation of fault-free Profibus communication. When commissioning a new system or modifying an existing system, we therefore recommend performing an evaluation of the quality values to document the status quo and as a reference for future measurements. In order to detect changes in the physical condition early on, and for before/after comparisons in the event of a fault, the *PB-Q^{ONE}* has a compare function. In a first step, load the stored measurement file and select the relevant measuring point. Next, perform a current measurement at this point. Using the "Compare with" drop-down menu, load the values from the initial measurement for comparison. The two measurement series are juxtaposed, and potential deviations for each address become detectable.



Figure 26: Compare function



7 Report

This function is used to document the recorded measurement results. On one hand, this enables the storing of a measurement record with customer and inspector information, as well as the topology plan (see example in the appendix). Clicking on the branding entries enables changing logos and header colours for customisation.

The report is stored in the MS Word format to enable adding the results of other analyses (cable test, permanent network monitoring, EMC analysis), as well as comments and additional information.

	🚍 File						
	Network	Clent					
LC C	View and manage the network	Company	Maschinenbau Meier	Company	Werkzeugbau Schulze		
_		Street	Industriestraße 1	Street	Gewerbepark 1		
	Quality values	City	12345 Musterstadt	City	12345 Musterstadt		
\sim	The Query land	Country	Deutschland	Country	Deutschland		
	Telegrams	Contact	Max Meier	Plant	Rollenbahn		
**	View and analyse telegrams	Order number	12345	Mailer system	Rack 1		
-	Results	Document number	54321	Date of executio	- 30/10/2017 f		
	Overview of measurement results	Branding		Third Party	DirdParty		
_		Heading color	•	Teler M	ichael Mäller		
	Report			Company In	du-Sol GmbH		
-	Come or print a report	Header logo	S S S S	Street B	Street Blumenstraße 3		
			cay 0	1626 Schmöllin			
		Lago footer	-	Country D	eutschland		
			Phone +	89 34491 5818-0			
			Restore defaults	Fax +	19 34491 5818-99		
				trui in	fa@indu-sol.com		
				Website W	ww.indu-sol.com		
				Report Topo			
				· Overview	(Single-Sided) O Acceptance Report		
				Page Size	A4 • Page Drientation Fortrait •		
				Print borde	n and footer with logo		
				IZ Open file af	ter saving		
					Create Report		
	Version 1.0 (Build 78)						
	Connected Effective band ro	ate 1.5 Mb#/s					

Figure 27



8 Technical data

- Power supply: via USB
- Tolerance: ±10% • • Current draw: max. 500 mA Start-up current: max. 150 mA • Dimensions (W x H x D): 60 x 35 x 118 (in mm) • • Weight: 200 g • Protection rating: IP20 • Operating temperature: +5 °C to +55 °C -20 °C to +70 °C • Storage temperature: 10%...90% Relative air humidity: •

8.1 Technical drawing



Figure 28: Front view

Figure 29: Side view



9 Appendix

9.1 Sample log

	Customer Compley:	EMV SafetyBUS p	Date of Execution
<u>B</u> ÛS	Rollenbahn	Rack 1	30/10/2017
Client	Maschinenbau Meier Industriestraße 1 12345 Musterstadt Deutschland	Location	Werkzeugbau Schulze Gewerbepark 1 12345 Musterstadt Deutschland
Contact Person	Max Meier	Controller	Michael Müller
Plant	Rollenbahn	Order Number	12345
Master System	Rack 1	Document Number	54321
Physical Consid	diagnostic repeater diagnostic repeater started scan		repeater OLM
Measured Val	ues	Threshold Value	/ Recommendation
	[m]		m
	impedance [Ω]		Ω
	visual examination of cable installation	Diagnosis- / Test	er:
Physical Consid	eration – Signal Evaluation		
Measured Valu 511	ies minimum signal quality	Threshold Value 2500	/ Recommendation minimum signal quality
6244	maximum signal quality		
	signal shape problems	Diagnosis- / Test PB-Q ^{ONE}	er:
Logical Conside	ration – Telegram Evaluation	n	
Logical conside	evaluation period		
00:00:34		0	error telegrams / frames
00:00:34	minimum cycle time [ms]		
00:00:34 0.59 1.00	Ø cycle time [ms]	0	telegram repetitions



TBUST	Customer Complex: M Rollenbahn R	aster system: Date of Execution: ack 1 30/10/2017
Extended Netwo	rk Analysis	
Permanent Netwo	vrk Monitoring	
T ermanent netwo	evaluation period	Diagnosis- / Tester:
	number of permanent established INspectors	PROFIBUS-INspektor NT (data collector) PROmanage NT (analysing software)
EMC Consideration	on	
	number of performed measurements	
Determined Ma	ximum Values	Threshold Value / Recommendation
Consideration fi	eldbus shield	
	shield current [mA] (50/60	
	shield current [mA] (40 - 1	shield current [mA]
	kHz)	
	impedance [Ω] bei 2,2 kHz	impedance [Ω] bei 2,2 kHz
Consideration b	onding network (BN) / equipotential	bonding
	BN current (50/60Hz)	
	[MA] BN current (40 - 1kHz)	BN current [mA]
	[mA]	
	impedance [Ω] bei 2,2 kHz	impedance [Ω] bei 2,2 kHz
Management Da		Diagnosis- / Tester: LSMZ I (leakage current measuring clamp) MWMZ II (mesh resistance measuring clamp) EMV-Inspector V2 (4-channel analysis device)
Test Criterion	σοπ	
x	met	Recommendation
	partially met	
	not met	
Inspection Cap	ability	
X	given	Recommendation
	partially given	
4	not given	
Date: 15/11/201	7	Issuer: Michael Müller



9.2 Sample plan



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