

SAFETY

INSTRUCTIONS



I Important information

IMPORTANT

Read instructions carefully before use!



Your Delphin device and your licensed Delphin software include:

- **Delphin online help** (full documentation)
- the '**Safety**' manual as an on-screen PDF
- a **Quick Start Guide** for quick access, which can be called up on a mobile device by scanning a QR code on the product packaging (not available for all products)

To avoid any damage occurring to persons or materials, carefully follow the guidance and safety precautions given:

- **In the Delphin online help,**
- **In the 'Safety' manual and**
- **In all instructions.**

IMPORTANT

This documentation is intended for use by qualified personnel only.

See: [General legal information, S. 5](#)

Any references to job titles are not intended to be gender-specific.

Job titles used in this manual are listed in the male form for ease of reading.

It means:

- Female persons,
- Male persons and
- All other persons with other gender identities.

Originator

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1 General legal information

This safety brochure contains

- general legal information and
- general safety instructions and warnings.

The separate documentation for individual Delphin products or groups of Delphin products contains further legal information as well as safety instructions and warnings. Please also read these carefully before commissioning and/or installing a Delphin product.

All legal notices and safety and warning notices must be observed!

IMPORTANT

Observe the operator's duty of care!

The operator of the overall technical system is responsible for the deployment and regular training of personnel.

IMPORTANT

Employ qualified personnel!

Delphin devices must be set up, mounted, installed, operated and maintained by properly trained and instructed personnel only.

Delphin devices and software should be

- integrated into a network,
- configured and
- operated

by properly trained and instructed personnel only.

IMPORTANT

Observe the operator's duty to instruct!

The operator is responsible for the regular instruction of his personnel.

All target groups must be instructed

- immediately before carrying out their work with Delphin devices,
- when changing their activity with Delphin devices and
- at least once a year while they are working with Delphin devices.

IMPORTANT

Observe the responsibility of the system operator!

The operating company is responsible for the safety of the system in which a Delphin device and Delphin software are integrated.

DelphinTechnology AG accepts no liability for *any* damage caused by attacks.

These attacks can occur on

- your IT system,
- systems connected to the IT system or
- other connected devices or machines.

DelphinTechnology AG accepts no liability for any damage caused by failures and malfunctions.

These malfunctions may concern

- your IT system or
- all connected systems, devices or machines.

IMPORTANT

Observe the responsibility of the personnel!

This documentation is intended exclusively for appropriately trained and instructed personnel in measurement and control technology who are familiar with the laws, regulations, provisions and standards applicable at the operating site.

Qualified personnel are able to do this due to their training and experience:

- read and fully understand the documentation supplied and
- recognise risks and avoid potential hazards.

When working with Delphin products, personnel are obliged to read and follow the latest documentation available at the time of installation and commissioning

All safety instructions contained in this documentation must be observed.

Personnel must ensure that all safety requirements, including the laws, regulations, provisions and standards applicable at the place of use, are met when using the Delphin products described.

This documentation - like Delphin devices and software themselves - is subject to continuous further development.

The content of all Delphin documentation is carefully prepared and regularly checked and corrected.

Nevertheless, deviations from the current status of the hardware and software described and errors in the description cannot be completely ruled out.

DelphinTechnology AG therefore accepts no liability for the contents of this documentation.

DelphinTechnology AG reserves the right to change and amend the design, text and illustrations in this manual at any time and without prior notice.

The purchaser shall not be entitled to claim damages for abstractions, generalisations, exemplary illustrations or outdated appearance of illustrations and texts.

2 Intended use

The intended use of Delphin devices and software is defined by both permitted and prohibited applications in accordance with legal regulations. Modifications to Delphin products are strictly prohibited.

2.1 Intended use

Delphin Technology AG manufactures intelligent DAQ hard- and software for laboratories, test stands, facilities and other technical systems.

Delphin devices and Delphin software are used in:

- Data acquisition,
- Analysing measurement data,
- Visualising measurement data,
- Monitoring of systems, processes and machines and
- Planning, programming and execution of measurement, regulating and control processes including the generation of regulating and control signals (automation).

2.2 Predictable misuse

Delphin devices and Delphin software may not be used in:

- Applications outside of the field of measuring and control technology,
- Applications not covered by the EU Low Voltage Directive, such as those exceeding the threshold values for voltages and currents specified in said directive,
- Applications in potentially explosive environments,
- Calibration applications in the sense of the calibration laws and regulations applicable at the place of operation,
- Applications without additional device enclosure requiring higher device protection than IP20.

Delphin devices are processor-controlled and have no safety integrity level (SIL). For safety-relevant applications, additional safety devices may have to be used for this reason. The operator and the application developer of the technical system are responsible for the configuration of such applications.

The voltages applied at the inputs and outputs of your Delphin device must not exceed the maximum permissible voltages or maximum voltage differences between the channels. The technical specifications of your Delphin device provide information about the permissible maximum values.

2.3 Modifications to the product

Delphin devices and their firmware must not be modified.

Modifications intended by the manufacturer – such as the installation or replacement of measuring modules, internal storage media, (disposable/rechargeable) batteries – must always be carried out by the manufacturer (regular firmware updates are excluded).

The manufacturer warranty expires once the device is screwed open.

Any modifications intended by the manufacturer and performed by the buyer are performed exclusively at the buyer's own risk.

Delphin software may only be adapted to third-party applications using the software tools suggested and described in the corresponding manual.

Decompiling Delphin software and programming changes is prohibited.

3 Target groups

IMPORTANT

Employ qualified personnel!

Delphin devices must be set up, mounted, installed, operated and maintained by properly trained and instructed personnel only.

Delphin devices and software should be

- integrated into a network,
- configured and
- operated

by properly trained and instructed personnel only.

IMPORTANT

Keep endangered groups of people away!

Endangered groups of people as well as animals must always be kept away from measurement equipment, structures and systems.

The following groups are to be considered groups of people at risk:

- Children, adolescents,
- ordinary people and end consumers
- People with emotional or cognitive limitations
- People under influence of drugs or alcohol
- Anyone lacking the relevant instructions
- Apprentices under 16 or 18 years, depending on the risks/dangers arising from any components in the technical system.

The operator of the technical system and the instructed personnel are responsible for keeping groups of people at risk as well as animals away.

NOTICE

Protect animals and the environment!

Equipment, packaging, data carriers and printed materials of **Delphin Technology AG** must be disposed of in accordance with local regulations after use.

They must not get into the environment.

3.1 Definition of the target groups

Delphin Technology AG distinguishes five target groups:

- Developers
- IT technicians
- Electronics technicians
- Users
- Operators

Developers

possess qualifications as a technician or engineer in measurement technology, computer science, electronics, electrical engineering or automation engineering as a minimum. In addition, they must have relevant experience in measurement technology. Moreover, they must be able to record complex tasks in measurement technology and solve them in a project involving measurement technology.

They can

- plan projects involving measurement technology and
- set up, configure and monitor systems for measurement technology.

IT technicians

possess qualifications as a technician in network technology (for example, IT specialist for system integration) as a minimum.

IT engineers integrate computers and software into computer and device networks and into technical equipment.

They can

- connect computers in systems involving measurement technology and
- customise the corresponding software interfaces.

Electronics technicians

possess qualifications as an electronic specialist (for example, industrial electronics engineer or mechatronics engineer) as a minimum.

Electronics technicians integrate devices and computers into computer and device networks and into technical equipment.

They can

- connect devices in systems involving measurement technology according to circuit diagrams and
- customise the corresponding software interfaces.

Users

have at least a qualification as a laboratory technician (for example, physics or chemical laboratory assistant).

Laboratory technicians change, monitor and operate systems involving measurement technology in test stands, energy systems or other technical installations.

They can

- connect and interlink devices as instructed,
- connect sensors as instructed,
- configure measurement channels and calculation channels,
- monitor measurements,
- analyse test series and trigger switching processes according to software displays.

Operators

have received at least relevant instructions once for

- applications ('projects'), which has been created with Delphin software and
- all activities that they perform using Delphin devices and with Delphin software.

Operators must have demonstrated their relevant qualifications to the operating company.

See also: [Who does what?, S. 13](#)

3.2 Who does what?

IMPORTANT

Employ qualified personnel!

Delphin devices must be set up, mounted, installed, operated and maintained by properly trained and instructed personnel only.

Delphin devices and software should be

- integrated into a network,
- configured and
- operated

by properly trained and instructed personnel only.

What?		Who?				
		Devel- opers	IT tech- nicians	Elec- tronics tech- nicians	Users	Opera- tors
1. Set up system						
Install software	Install ProfiSignal soft- ware, unlock licenses	x	x			
	Connect Delphin device directly to PC	x	x	x	x	
	Establish network con- nection, device	x		x	x	
Connect hard- ware	Establish network con- nection, PC	x	x			
	Establish server/client connections from the central PC to distributed PCs for standalone integ- ration	x	x			

What?	Who?				
	Devel- opers	IT tech- nicians	Elec- tronics tech- nicians	Users	Opera- tors
Connect to DataService/ DDC (transfer realtime data)	Connect Delphin device	x	x	x	x
	Connect third-party devices as OPC client	x	x	x	x
	Connect third-party data storage as OPC client	x	x	x	x
	Allow access by third-party software: <ul style="list-style-type: none"> • As OPC server • With API, programmable • By drivers on third-party PC for LabVIEW™/DASYLab™ 	x			
Set up mobile work	Set up web server	x	x		
	Install app	x	x		
Synchronise devices and PCs to Coordinated Universal Time (UTC)	Synch PC times with Delphin device time for standalone integration	x	x	x	x
	Synch PC times with Delphin device times for network integration	x	x		
Set up data storage	Centrally on server	x			
	Locally on PC	x			x
	Decentralised data logging on devices	x			
	Automatic exporting of the device data storage with Scheduler	x			
	Access by third-party software with API, programmable	x			
Set up SQL data exchange	with third-party databases	x			
	with third-party ERP systems	x			
Manage users	Set up user management	x			
	Manage user rights	x			
Capture events	Set up alarms	x			x
	Set up Audittrail	x			

What?	Who?				
	Devel- opers	IT tech- nicians	Elec- tronics tech- nicians	Users	Opera- tors
2. Customise system					
Set up channels with Kon- figurator	Set up/customise signal outputs (reg- ulating/control signals, digital/analogue)	x			
	Connect sensors (phys- ically)	x		x	
	Set up/customise hard- ware channels	x		x	
	Set up/ customise software channels	x		x	
	Set up/ customise system channels	x		x	
3. Maintain and service the system					
Acknowledge alarms	x	x	x	x	x
Manage user rights	x	x			
Manage databases	x	x			
Check databases for errors using DataBaseCheck	x	x			
Generated tickets using the Delphin hot- line with DelphinSupportData	x	x	x	x	x
Exchange hardware modules	x		x		

See also: [Definition of the target groups, S. 11](#)

4 General safety instructions

4.1 Limits of the product

4.1.1 IP20 protection

Delphin devices are designed for indoor use only.

Condensation and moisture

Delphin devices must be protected from condensation and moisture.

Delphin devices cannot be operated in moisture-prone areas when use **indoors**. The applicable limits for the permissible humidity can be found in the technical specifications of your Delphin device. It may be necessary to use a control cabinet heater and a hygrostat.

Delphin devices may only be operated **outdoors** with an additional cover to protect against moisture, heat and dust.

Dust and contact

Delphin devices must be protected from dust. They must not be operated in dusty environments.

They are protected from solid objects with a diameter > 12.5 mm.

4.1.2 Temperature

Delphin devices may only be transported, stored and operated within specific temperature limits. The applicable temperature limits can be found in the technical specifications.

Ensure sufficient air circulation in the control cabinet.

4.1.3 Air pressure

Delphin devices should not be operated at altitudes above 2000 m unless otherwise specified in the technical data.

4.1.4 Supply voltage

Delphin devices must only be supplied with a specified maximum voltage. The applicable maximum supply voltage can be found in the technical specifications.

Delphin devices must always be connected to a ground conductor (FE, PE).

4.2 Dangers due to electrical voltages and currents

Your Delphin device measures voltages: The respective test voltage of the connected sensors is applied to the connection terminals, which belong to a measurement channel.

4.2.1 Behaviour of electrical voltages and currents

A short circuit occurs when a high potential difference is discharged if two potentials are connected.

Refer to the technical specifications for the permissible **maximum voltages and potential differences**.

Observe the **limits of potential isolation** that apply to your Delphin device.

Observe the instructions for proper **earthing of all FE/PE terminals**.

IMPORTANT

Personal injury and material damage at voltages above the low voltage limit!

Damage is not generally expected for low voltage potentials in the sense of the Low Voltage Directive ($V_{AC} \leq 50 \text{ V}$; $V_{DC} \leq 75 \text{ V}$) under normal use. The Low Voltage Directive applies to Germany. Other limits may apply in other countries. The local regulations must be observed.

However, damage may occur if – intentionally or unintentionally – potential differences or potentials above the low voltage limit are applied to sensors or actuators.

Damage can have many effects

- to people: Through electric shock or burns
- to devices: Through measuring errors or even total failure

IMPORTANT

Observe the responsibility of the system operator!

The operating company is responsible for the safety of the system in which a Delphin device and Delphin software are integrated.

4.2.2 Personal injury due to voltages



WARNING

Personal injury due to potential differences!

Electrical potential differences cannot be determined from the measurement data!
There may be injury from electric shock or burns on contact of

- two connections with high potential difference or
 - a connection with earth-related external voltage, such as a high potential difference to the earthing in an electrical circuit.
1. Note the different potentials of all connected sensors and actuators.
 2. Carefully calculate the differences between the existing potentials to determine the actual voltages.
 3. In particular, note the different cautionary signs: Negative and positive potentials are cumulative.
 4. Always observe high potentials from external voltages with a path to ground, such as in the measurement of a phase of the mains voltage.

4.2.3 Material damage due to voltages and currents

4.2.3.1 Material damage when connecting sensors and actuators

NOTICE

Material damage due to potential differences!

Electrical potential differences cannot be determined from the measurement data.

Damage caused by overvoltage can occur if

- there is a too high potential difference between two connections, or
 - there is a too high voltage with a path to ground at a connection, such as a high potential difference to a ground in the electrical circuit.
1. Note the different potentials of all connected sensors and actuators.
 2. Carefully calculate the differences between the existing potentials to determine the actual voltages.
 3. In particular, note the different cautionary signs: Negative and positive potentials are cumulative.
 4. Always observe high potentials from external voltages with a path to ground, such as in the measurement of a phase of the mains voltage.

4.2.3.2 Material damage when connecting sensors

Connecting unsuitable sensors can cause excessive voltages on your Delphin device. Overvoltage protection exists only up to certain threshold values. In addition, all FE/PE connections must be wired correctly.

NOTICE

Material damage when connecting a sensor!

Operate sensors only within the threshold values prescribed for your Delphin device. Never exceed the permissible 'overvoltage resistance' of your Delphin device! Otherwise, you risk incurring damage to your device.

1. Before connecting, carefully read the instruction manual of your sensor.
2. Observe the technical specifications of your Delphin device regarding the corresponding inputs.
3. Make sure that the voltage readings of your sensor are only within the specified measuring range for your sensor input.
4. Be sure to connect the correct leads for the plus and minus inputs respectively.
5. Make sure that FE/PE is connected correctly, as only then will the internal protection function of your Delphin device be guaranteed.

4.2.3.3 Material damage when connecting actuators

Connecting unsuitable actuators can cause excessive currents on your Delphin device. Over-current protection (for example, through internal melting fuses) exists only up to certain threshold values.

NOTICE

Material damage due to overloading in the device!

Excessive currents (I) due to overloading inside a Delphin device destroy device components.

If there is too little load on the outside of a digital output, an overload will occur inside your Delphin device. If you output digital voltage signals (U) to actuators, the load (R) applied to the digital output of your device must not fall below a minimum value ($U = R \times I$).

1. The applicable limits for the permissible minimum external load can be found in the technical specifications of your Delphin device.
2. Calculate the load applied to the respective outputs of your Delphin device.
3. Do not use actuators or switching or regulating circuits with too little load.
4. Take into account possible influences, e.g. from connected inductivities.

4.2.3.4 Material damage due to electrostatic discharge at sensor and actuator connections

Static electricity from people can cause high voltages to enter the unit through the inputs and outputs of the Delphin unit.

Discharge static before coming into contact with the Delphin device or the connected sensors.

NOTICE

Material damage due to electrostatic discharge (ESD)!

Electrostatic discharges (ESD) destroy components in the device and in the measuring setup.

They can be triggered on the Delphin device via

- handheld sensors connected to the device or
 - touching sensor connections, interfaces or actuator connections.
1. Wear an antistatic wristband (conductive wrist strap) with the grounding cable properly connected.
 2. Use a conductive pad.
 3. Wear shoes with ESD protection that conduct the electrostatic charge into the floor.
 4. Connect all FE/PE terminals on the Delphin device to the ground properly.

4.2.3.5 Material damage when connecting the supply voltage

NOTICE

Material damage caused by connecting or disconnecting the plug connector for the supply voltage when energised

When connecting or disconnecting the plug connector for the supply voltage, components in the device can be destroyed if the plug connector is energised. The plug connector with the power supply cable may only be moved in the socket when it is de-energised.

- Before connecting the plug connector to the appliance, ensure that the other end of the cable is not connected to the power supply.
- First connect the de-energised plug connector to the appliance.
- Then connect the other end of the cable to the power supply.
- To disconnect, first disconnect the other end of the cable from the power supply.
- Then disconnect the de-energised plug connector from the device.

4.2.3.6 Material damage when opening your Delphin device

IMPORTANT

The warranty expires when a Delphin device has been opened!

Repairs or modifications to Delphin devices are to be performed by the manufacturer only. The manufacturer's warranty expires when a Delphin device has been opened!

Opening a Delphin device by the buyer is at your own risk!

Material damage caused by electrostatic discharge when opening a Delphin device!



For this reason, discharge any electrostatic charge before opening the device when

- exchanging I/O modules,
- replacing the built-in memory card or
- replacing a battery.

4.3 Dangers due to batteries and accumulators

Some Delphin devices have built-in batteries (disposable or rechargeable) to power the device and individual components.

4.3.1 Personal injury due to batteries and accumulators



WARNING

Environmental damage caused by disposable and rechargeable batteries!

Batteries contain toxic substances. Batteries containing lithium are flammable and may explode.

1. Protect batteries from mechanical damage.
2. Protect batteries from overheating.
3. Protect batteries against corrosion caused by moisture or improper storage, for example.

4.3.2 Environmental damage due to batteries and accumulators

NOTICE

Environmental damage caused by accumulators and batteries!

Batteries and rechargeable batteries contain toxic substances. Rechargeable batteries containing lithium are flammable and may explode.

1. Protect batteries from mechanical damage and corrosion during operation.
2. Dispose of old batteries from Delphin devices at the end of their service life in accordance with local regulations.

Properly dispose of used batteries and accumulators in accordance with EU regulations within the EU!



In accordance with EU Directive 2006/66/EG on batteries and accumulators and waste batteries and accumulators in the EU (Battery Directive), used batteries (whether disposable or rechargeable) should not be disposed of in municipal household or industrial waste facilities in the EU. The EU Directive is transposed into German law within the framework of the current version of the Battery Act (BattG).

Batteries and accumulators can be

- sent back to the battery manufacturer or supplier within the EU or
- returned to a local authorised disposal company for environmentally friendly recycling.

The respective laws and regulations apply at the place of operation of your Delphin device!

4.4 Hazards due to packaging and old appliances

4.4.1 Hazards due to packaging

NOTICE

Environmental damage due to improper packaging and packaging disposal!

Packaging protects your Delphin device during transport.
Carelessly discarded packaging pollutes the environment.

1. Transport your new Delphin device to the place of operation only in its original packaging.
2. Save the packaging if you plan to transport your Delphin device at another point in time, e.g. for the purpose of calibration or repair.
3. Dispose of packaging that you no longer need in municipal industrial waste facilities only.
4. Observe the local regulations for packaging.

4.4.2 Hazards due to old appliances

Properly dispose of electronic waste in accordance with EU regulations within the EU!



In accordance with the EU's **W**aste **E**lectrical and **E**lectronic **E**quipment (WEEE) Directive, electronic waste should not be disposed of in municipal household or industrial waste facilities in the EU.

Devices can be

- sent back to the supplier within the EU (WEEE-Reg.-Nr. DE78054880) or
- brought to a local authorised disposal company for environmentally friendly recycling.

The customer is responsible for covering the shipping costs of old appliances.

The respective laws and regulations apply at the place of operation of your Delphin device!

NOTICE

Environmental damage from electronic waste!

Electronic waste damages the environment and contains valuable substances.

1. Dispose of your Delphin device at the end of its service life in accordance with local regulations for waste electronic equipment.
2. Consider the components of your Delphin device as recyclables and pay attention to separating and disposing of them in an environmentally sound manner.
3. Be sure to dispose of old batteries as prescribed by local regulations in your area.

5 Notes on trouble-free installation

When designing your measurement system, the electrical influences that may affect measurements with your Delphin device must be taken into account.

These influences are as follows:

- External voltages
- Overvoltages
- Interference voltages
- Equalising currents through ground loops
- Resistors in the measuring setup

5.1 Responsibility of the operator, staff

5.1.1 Responsibility of the operator

IMPORTANT

Observe the responsibility of the system operator!

The operating company is responsible for the safety of the system in which a Delphin device and Delphin software are integrated.

IMPORTANT

Employ qualified personnel!

Delphin devices must be set up, mounted, installed, operated and maintained by properly trained and instructed personnel only.

Delphin devices and software should be

- integrated into a network,
- configured and
- operated

by properly trained and instructed personnel only.

5.1.2 Staff

IMPORTANT

Engage specialists for measurement technology!

Measurement technology expertise is required for the following work

- Wiring signal inputs and outputs of your Delphin devices and
- configuring all measuring channels coming from Delphin devices and other connected sources.

This work may only be carried out by

- developers,
- electronics engineers and/or
- users.

Please refer to the section 'Target groups' to determine what work may be carried out by whom.

See: [Target groups, S. 10](#)

IMPORTANT

Engage specialists for network technology!

The integration of Delphin devices and **DataService/Delphin Data Center** in a network may be carried out exclusively by

- developers,
- IT technicians and/or
- electronic network engineers.

Please refer to the section 'Target groups' to determine what work may be carried out by whom.

See: [Target groups, S. 10](#)

5.2 Overvoltages

5.2.1 What are overvoltages?

Definition

An overvoltage is a voltage peak that exceeds the rated voltage of an electrical system. Overvoltages can reach your Delphin device via the supply line as well as via interface and signal lines.

Causes

Overvoltages can flow from the supply network through the power supply unit into your Delphin device. These are caused by overloading and short circuits such as:

- Lightning strikes and
- Other voltage fluctuations in the supply network of your measurement system.

Overvoltages due to external voltages, interference voltages and ground loops can reach your Delphin device through the interface cables as well as the signal lines.

Consequences

Both the power supply and interface connections as well as the signal terminals of your Delphin device are protected against overvoltages up to certain threshold values.

Damage will result if applied overvoltages exceed these threshold values.

IMPORTANT: Overvoltages lead to measurement errors, material damage and in extreme cases to personal injury!

Damage to the device may only become visible after some time in the event of overvoltage and/or lead to imperceptible errors (e.g. falsification of measured values). We therefore recommend that you have the device checked or calibrated regularly.

5.2.2 Protect power supply from overvoltage

Additional protective devices must be installed upstream for protection from higher overvoltages

- short circuit-protected power supply units with a current limiting feature and
- fuses.

The overvoltage protection in power supply units and fuses must be adequately dimensioned according to the prescribed 'supply voltage' of your Delphin device.

The prescribed supply current results from the prescribed supply voltage and the 'power consumption in measurement mode' of your Delphin device.

The following protective devices must be coordinated with each other:

- Primary side protection (power supply unit, input side):
 - power supply unit, see: Manufacturer's information,
 - Contactors in the control cabinet require a different power supply unit than devices involving measurement technology and
 - sensor feeds generally require a separate power supply unit.
- Secondary side protection (power supply unit, output side):
 - if applicable additional fuse. The dimensioning of the fuse depends on your measurement and supply system.

Protection through earthing

The supply connection of your Delphin device must always be earthed.

5.2.3 Protect interfaces and their cables from overvoltage

The grounding provides protection from external and interference voltages as well as ground loops.

5.2.4 Protect signal terminals and their cables from overvoltage

The grounding provides protection from **external and interference voltages as well as ground loops**.



No connection to FE/PE terminals for resistance measurement

The sensor must be traversed by a constant reference current when measuring resistance. Neither the connection for the minus signal line (-) nor the connection for the minus reference current ($-I_{REF}/-I_{ref}$) must be grounded!

Electrostatic discharges can also cause overvoltages.

Here, further protective measures are necessary along the earthing.

NOTICE

Material damage due to electrostatic discharge (ESD)!

Electrostatic discharges (ESD) destroy components in the device and in the measuring setup.

They can be triggered on the Delphin device via

- handheld sensors connected to the device or
 - touching sensor connections, interfaces or actuator connections.
1. Wear an antistatic wristband (conductive wrist strap) with the grounding cable properly connected.
 2. Use a conductive pad.
 3. Wear shoes with ESD protection that conduct the electrostatic charge into the floor.
 4. Connect all FE/PE terminals on the Delphin device to the ground properly.

5.3 External voltages, interference voltages, ground loops

5.3.1 Protect from external voltages

External voltage: Definition and avoidance

Definition

An external voltage is a system-related, potentially hidden voltage that adds up to the useful voltage of an electrical signal.

Causes

External voltages are present at the signal inputs or outputs or at the interfaces of your Delphin device. They are caused by hidden or unintended potential differences in the same electrical circuit of your measurement system, for example:

- Hidden connection of an actuator to 230 V mains voltage over other components in the measurement network (for example, an emergency stop circuit in the control cabinet).
- Accidental contact with live supply lines by sensors when the temperature is measured in the immediate vicinity of these lines, for example (In certain special applications, the occurrence of external voltages cannot be avoided, e.g. when thermocouple measurements are to be carried out on parts with potential.).



Consequences

External voltages at the inputs of your Delphin device can negatively impact the measurement results.

Faulty connections to electrical circuits with a path to ground, in particular, can lead to damage at signal inputs and outputs as well as at interfaces.

IMPORTANT: External voltages can lead to measurement errors, material damage and in extreme cases to personal injury!

How to avoid

- When configuring the measurements with your Delphin device, check all electrical circuits in the test setup to which the device is connected **for hidden potential differences!**
- **It is imperative to avoid contact with live objects** by sensors !

5.3.2 Avoid occurrence of interference voltages

Interference voltage: Definition and avoidance

Definition

An interference voltage is the coupled-in voltage of an interference signal caused by electromagnetic fields surrounding the signal conductor.

Causes

Electromagnetic interference fields are often generated by adjacent current carrying conductor, for example

- supply lines laid in parallel,
- electromagnetic radio waves or
- electromagnetic fields around power lines or machines that are powered by starting current.



Consequences

The useful signal of the sensor is negatively affected by noise or superimposed by the interference signal: The measurement signal is attenuated, falsified or unusable.

A typical interfering superimposed signal is a mains hum (for example, Europe: 50 Hz; U.S.: 60 Hz).

Interference voltage leads to errors in measurements!

How to avoid

- Keep the wire of your sensor away from other signal lines: The next **current carrying conductor** should be at least **50 cm** away.
- Keep the wire of your sensor **away from components that cause sparking**.
- Do **not** route the wire of your sensor parallel to the lines for the **power supply**.
- **Use twisted** sensor wires.
- Protect the wire of your sensor **properly**.

5.3.3 Avoid equalising currents through ground loops

Ground loops: Definition and avoidance

Definition

Ground loops are special earth loops with earthed points in the same circuit.

Earth loops are conductive bodies to which the potential of zero is assigned as reference potential. Signal voltages are measured relative to the reference potential. If there is a physical connection between the two potentials, then interfering equalising currents flow between them. The result is an unwanted, possibly periodic voltage drop.

Causes

The wiring of sensor, measurement device and computer are also connected their earthed points. Potential differences can occur between these earthed points due to electromagnetic fields that have different effects on the measurement system (such as a mains hum, thunderstorms).



Consequences

Without suitable countermeasures, interfering equalising currents occur on sensor and interface cables, hence the ground loops.

IMPORTANT: Ground loops lead to errors in measurements!

How to avoid

- Your Delphin device possesses broad **potential isolations at the signal inputs and outputs**. These prevent the effects of ground loops on measurements.
- Grounded sensors can still cause interfering ground loops.
Recommended: Use **groundless sensors!**
- Improperly shielded sensor and interface cables can cause further ground loops.
Recommended: Sensor and interface cables are **shielded on one end** only.

5.4 Network installation: transmission rate, performance class

Expert Series, ProfiMessage D

Network cable performance class and network installation **min. CAT 5e**

Recommended:

- Network cable performance class and network installation **min. CAT 6**
- Network components for data transfer rates of **min. 1000 Mbit/s**

ProfiMessage/Lab, LogMessage X000, TopMessage

Network cable performance class and network installation **min. CAT 5**

Recommended:

- Network cable performance class and network installation **min. CAT 6**
- Network components for data transfer rates of **min. 100 Mbit/s**

Loggito Series

Network cable performance class and network installation **min. CAT 5**

Recommended:

- Network cable performance class and network installation **min. CAT 6**
- Network components for data transfer rates of **min. 100 Mbit/s**

Expert Key

Network cable performance class and network installation **min. CAT 5.**

Recommended:

- Network cable performance class and network installation **min. CAT 6**
- Network components for data transfer rates of **min. 100 Mbit/s**

5.5 Cable lengths, load, working resistance

5.5.1 Pay attention to influences caused by cable lengths

Resistivity and interference on cables have to be considered when designing the application:

- Influence of the sensor type: Each **sensor type** tolerates different cable lengths with which a good measuring signal reaches the signal input.
Please note: Read the technical specifications of your sensor for this information!
- Influence of the sensor cable: Each **sensor cable type** has different resistivity.
Please note: Read the technical specifications of your sensor cables for this information!
- Long sensor cables can act **as antennas**. The longer a cable is, the more likely interference voltages are caused by the occurrence of interference signals, which negatively affect the measurement signal and potentially even make it unusable.
- In particular for **resistance measurements**, you need to choose between two-conductor, three-conductor and four-conductor technology to eliminate the influence of resistivity on the measurement result.
For example: The PT100 resistance sensor becomes inaccurate in two-conductor applications with a cable length of 5 m.
- The transmission of measurement signals via a **USB cable** may only take place with a cable length of <80 cm.

5.5.2 Determine load at the channel output

There must be a minimum resistance at the channel output:

- To avoid overload in the device, that is, material damage due to parasitic currents and
- to be able to output a good voltage signal.

Calculate the total resistance (= load) from the resistances of the activated actuator and all other components of the downstream electrical circuit.

Refer to the technical specifications for the **threshold for the minimum load**.

5.5.3 Determine working resistance at the channel output

A maximum resistance at the channel output must not be exceeded in order to output a good current signal. Calculate the total resistance (= working resistance) from the resistances of the activated actuator and all other components of the downstream electrical circuit.

Refer to the technical specifications for the **threshold for the maximum working resistance**.

III Photo credits

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Photos

See: <https://www.delphin.de/en/imprint/>

Icons

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