

R+W Antriebselemente GmbH
Hattsteinstraße 4
63939 Wörth am Main

R+W IPK Intelligent Precision Coupling

Translation of original operating manual in German



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The operating instructions are an essential part of the Intelligent Coupling. It provides information for proper assembly, operation and maintenance. Please read them carefully and observe all instructions. Failure to do so may lead to malfunctions or failure of the Intelligent Coupling. The installation of the coupling may only be carried out by trained personnel.

1. SAFETY, GENERAL INFORMATION AND USE





This manual enables the appropriate personnel for the respective activity to handle the Intelligent Coupling over their lifetime phases.

Residual risks to persons and materials exist in certain activities. These activities are marked with warnings.


1.1 Symbol declaration and warnings

The following sections represent all the symbols and abbreviations used.




Symbol

Symbol	Importance
	Warning signs are triangular with a yellow base colour, black border, and symbol
	Mandatory characters are round with a blue base colour and a white icon
	Useful information are marked with an <i>i</i> . Hints and information for optimised use
	Environmental requirements are highlighted with a crossed-out garbage can. Environmental requirements are indications of state requirements for the disposal of substances.






Warnings

	Severity of danger by signal word
	Kind and source of danger Consequences Escape from danger

Signal words in the head of the warning indicate the severity of the hazard if the escape measure is not followed.

Signal word and colour	Severity
 DANGER	Indicates a high-risk hazard resulting in death or serious injury.
 WARNING	Indicates a medium-risk hazard that could result in death or serious injury.
 CAUTION	Indicates a hazard that could result in minor or moderate injury.
ATTENTION	Warns of possible damage to property or the environment that may interfere with the operation.

These warning signs are used in the warning section.

Symbol	Importance
	General warning
	Warning of explosive atmosphere
	Warning of floating loads
	Warning of hand injuries due to rotating parts with risk of retraction
	Warning of hot surface

Bid signs

These bid signs indicate the personal protective equipment to be worn. Observe local regulations.

Symbol	Importance
	Use hand protection
	Use foot protection

WARNING

Defective personal protective equipment does not adequately protect against the respective hazards and could result in death or serious injury. In the event of defects, replace protective equipment.

1.2 Target groups

The manual distinguishes three groups of professionals:

- Planners / Project planners
- Craftsmen / Operators
- Service / Repair

The groups have experience in:

- certificates, regulations; Accident prevention regulations and standards
- Techniques for the selection and construction of mechanical equipment
- Work system

Depth of experience:

- Planners / Project planners:
Detailed knowledge of the items listed in experience to plan, set and monitor the activities.
- Craftsmen / Operators:
Understanding the points listed in Experience to carry out the activities.
- Service / Repair
Understanding the points listed in Experience to carry out the activities.
Practical experience in carrying out repairs.

Safety-conscious working

All persons carrying out work relating to installation, commissioning, operation, and maintenance must read this manual in full and carefully and observe all the safety rules and warnings described.

- Planners / Project planners:
 - Planning the use
- Craftsmen / Operators:
 - Implementation of planned activities
 - Operation of the Intelligent Coupling

Keep this manual in the appropriate place. Hand over this manual with the Intelligent Coupling when changing the operator.

1.3 Intended use

Taking the usual regulations and guidelines into account, the devices correspond to the state of the art. Operation is only permitted in a technically flawless and operationally safe condition. The planner is responsible for trouble-free operation. When operating in the environment of aggressive or corrosive substances, the planner must take suitable action to ensure the correct functioning of the device in order to avoid hazards resulting from malfunctions. Furthermore, applicable and new occupational safety measures must be observed during the entire period of use. All the safety regulations and accident prevention regulations mentioned in this operating manual, as well as those that apply in the specific country, must be consistently implemented by the operator. For safety and warranty reasons, only personnel authorised by the manufacturer may carry out interventions outside those specified in the operating instructions. Modifications or alterations are expressly prohibited. Only the accessories explicitly mentioned in the data sheets and operating instructions may be used as accessories.

The Intelligent Coupling is intended for the measurement of measured quantities and the wireless data transmission of these. Use of the equipment outside of this intended use is prohibited and results in significant hazards to operators and others.

⚠ DANGER

The Intelligent Coupling in its current version must not control any safety-relevant processes. Faulty signals can lead to misinterpretations. Use Intelligent Coupling only for analysis purposes and to control non-critical processes.

⚠ WARNING

Induction is subject to a specific warning against magnetic fields. In themselves harmless to humans, they can heat jewellery, erase data memories and pose a danger to people with pacemakers and metallic prostheses. Damage to the insulation of the induction coil, also due to wear, must be avoided in any case.

1.4 Radio technical approval

The radio module used in the device for wireless Bluetooth communication is approved for use in the countries of the EU and EFTA.

1.5 Limitation of liability

All instructions and information have been compiled taking into account the applicable standards and regulations, the state of the art, as well as our knowledge and experience.

ATTENTION

R+W accepts no liability for damage due to:

- From breakage. This must be avoided by appropriate safety measures by the user.
- Insufficient protection against ESD – "Electro Static Discharge". This must be ensured when handling our products. For further information, please refer to DIN EN 61340-5-1: ANSI/ESD S20.20 and IPC-A-610.
- Non-observance of the instructions
- Non-intended use
- Use of unqualified and untrained personnel
- Unauthorised conversions and modifications
- Use of spare parts from non-recommended manufacturers

The General Terms and Conditions, the manufacturer's terms of delivery and the statutory regulations valid at the time of conclusion of the contract shall apply.

We reserve the right to make technical changes within the scope of optimising usage properties and further development.

1.6 EU Declaration of Conformity





R+W Antriebselemente GmbH hereby declares that the radio system type of the sensor unit and the gateway comply with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available at the following internet address: www.rw-couplings.com/company/certification/

1.7 Labelling

The addresses of R+W Antriebselemente GmbH as manufacturer and distributor of the product and core sensing GmbH as manufacturer of the electronics are written on the type plate.

Type plate example

 <p>R+W A POPPE+POTTHOFF COMPANY Hattsteinstraße 4 63939 Wörth am Main Tel. +49 (0) 9372-9864-0</p>	<p>manufacturer of electronics:</p>	<p>Type: XXXXXXXXXXXXX No.: X-XXXXX Mac: XX:XX:XX.XX.XX.XX Ident No.: XXXXXX.X</p>
	<p>core sensing GmbH Roßdörfer Straße 17 64287 Darmstadt Tel. +49 (0) 6151-49366-62</p>	

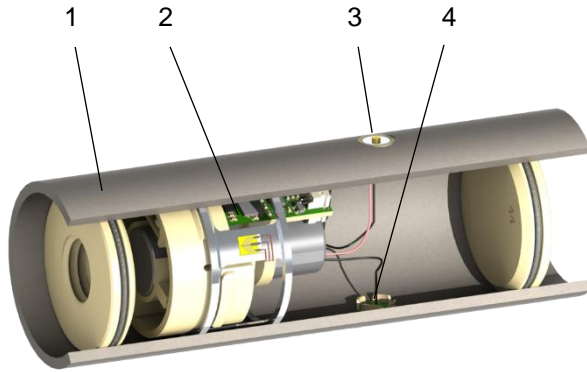
2. PLANNING AND TECHNICAL DATA

2.1 Planning

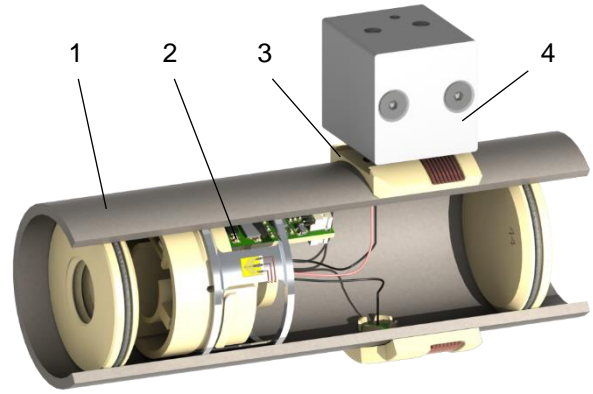
The Intelligent Coupling is available in two versions, which differ in the power supply. The battery version is powered by an integrated Li-Ion battery. The second version uses a contactless power supply by induction.

Structure exemplary

Battery-powered version



Induction-powered version



POS.	NAMING
1	Coupling element
2	Integrated measurement unit
3	Magnetic charging port
4	Sealed antenna

POS.	NAMING
1	Coupling element
2	Integrated measurement unit
3	Rotor coil
4	Pick-Up

How the R+W Intelligent Coupling works. In addition to the mechanical properties of the coupling, the integrated measurement unit can measure torque, speed, vibration and optionally also push and pull forces. The measured data are transferred to a connected mobile device and displayed and stored with the R+W App or can be accessed as analog or digital signals via the R+W Gateway.

2.2 Measuring method and measuring chain

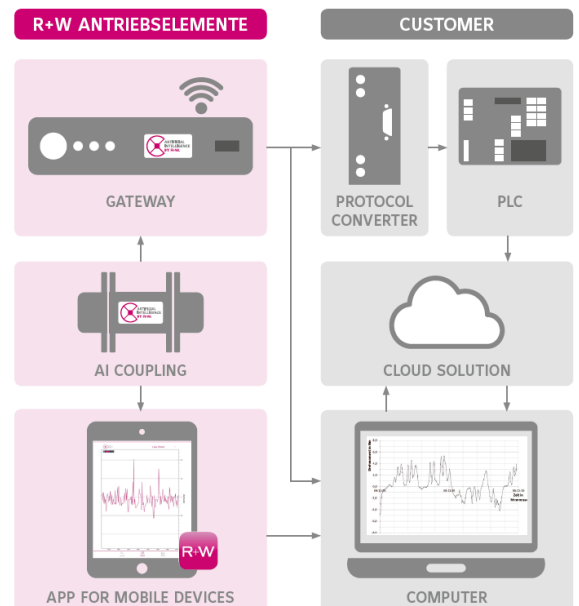
With its product family, R+W offers all components for an innovative measuring chain, which can be used individually or in combination. The Intelligent Coupling consists of a strain gauge-based sensor component that is connected to measuring electronics. Depending on the application, different types of power supply are available.

The measuring amplifier of the Intelligent Coupling digitises the analogue measuring signal of measuring bridges, can process this measuring data internally, store it and send it via Bluetooth 5.0 to a gateway or a mobile device (e.g. Android smartphone, tablet).

The Intelligent Coupling has an internal memory that enables the measured values to be stored internally without an existing connection and thus functions as a data logger. The individual elements of the measurement chain are set up and adjusted using a mobile device and the R+W app "Artificial Intelligence by R+W" for Android. Intelligent Couplings can be configured and connected to the Gateway.

If an Intelligent Coupling is connected to a gateway, no further direct connection can be established with this sensor. Instead, the wirelessly transmitted measured values can be transferred to a computer via the gateway's outputs or used directly to control a machine.

In addition, the output signal of the gateway can be uploaded to the cloud together with an IoT gateway. During the connection between the Intelligent Coupling and the gateway, the gateway can be accessed via the R+W App and all measured values of the Intelligent Couplings connected to this gateway can be viewed live in parallel, saved and exported. Alternatively, the Intelligent Coupling can be connected directly to a mobile device in order to view the measured values using the R+W App or to save them on the mobile device.



2.3 Technical data

Intelligent Coupling

TORQUE MEASUREMENT	
Resolution	24 bit
Sample rate	1 – 500 Hz
Error of indication	< 1 %

SPEED MEASUREMENT	
Resolution	16 bit
Sample rate	1 – 500 Hz
Error of indication 0...660 1/min	0,5 %
Error of indication 660...2500 1/min	5 %

ACCELERATION MEASUREMENT	
Number of axes	3
Acceleration (max.)	30 g
Resolution	16 bit
Sample rate	1 – 500 Hz

OPTIONAL PUSH / PULL FORCE MEASUREMENT	
Resolution	24 bit
Sample rate	1 – 500 Hz
Error of indication	< 2 %

OPERATION	
Max. rotation speed	8000 1/min
Ambient conditions	normal
Temperature	-20 – 60 °C -4 – 140 °F
rel. centrifugal acceleration	130 g
ESD	4 kV
Protection class	IP 65

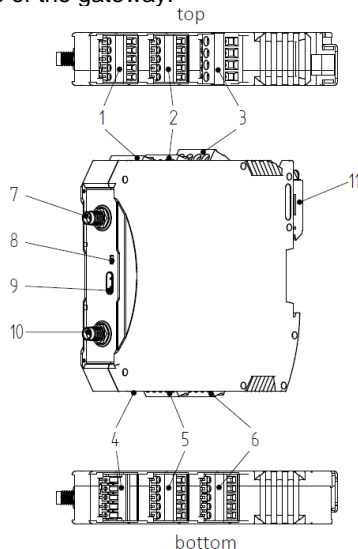
R+W App

DATA TRANSFER	
Frequency	2,45 GHz
Bluetooth version	5.0
Simultaneous connected IPKs	4
Transmission rate	1 – 500 Hz
Latency	< 150 ms
Synchronicity	± 25 ms
Transmission power (max.)	4 dBm
Reception strength (min.)	-90 dBm
Range ¹	ca. 10 m

¹ Specification valid for unobstructed view. With partial shielding, the range can be significantly reduced

Gateway

The connections for supply and outputs are located on the top and bottom side of the gateway.



POWER SUPPLY (battery-powered version)	
Battery type	Li-Ion Battery
Capacity	320 / 3400 mAh
Charging voltage	5 V
Charging connection	magnetic plug
Charging time	ca. 2 – 3 h
Power consumption ¹	15 mA
Min. battery life ¹	20 h
Max. battery life ²	150 Days
Standby current ³	0,1 mA
Idle mode current ⁴	5 µA

¹ With permanent 500 Hz sample rate and optional axial force measurement and smallest size

² With permanent 10 Hz sample rate and high battery capacity

³ Visible in R+W App

⁴ Not visible, activation per magnetic plug

INCLUDED ACCESSORIES (battery-powered version)	
1x	Magnetic charging cable (only battery version)
1x	Calibration certificate

OPTIONAL ACCESSORIES (battery-powered version)	
1x	Magnetic charging cable
1x	Gateway

INCLUDED ACCESSORIES (induction-powered version)	
1x	Gateway
1x	Pick-up
1x	Calibration certificate

DATA STORAGE	
Record frequency	1 - 500 Hz
Storage size	512 Mb
Memory per measurand	ca. 5,4 Mb/h

SYSTEM REQUIREMENTS	
Operating system	min. Android 6.0
Bluetooth version	min. 4.2, better 5.0
Storage size for App	min. 30 Mb
Data export format	CSV-file
Synchronization	Unix Time Stamp

POS.	DESCRIPTION
1	Digital outputs (do)
2	Digital outputs (do)
3	Power in (24 V) / power out (12 V)
4	Not used / debug
5	Analog outputs (ao)
6	Analog outputs (ao)
7	External antenna connection, signal input
8	Status LED
9	USB-C port
10	External antenna connection, signal output
11	Fastening for mounting rail

OPERATION	
Temperature	-20 – 60 °C -4 – 140 °F
Protection class	IP 20
Mounting rail	DIN EN 50022

ANALOG OUTPUTS

Amount	8
Voltage range	± 10 V
Resolution	16 bit
Linearity deviation	< 1 %
Max. load	20 mA

DIGITAL OUTPUTS

Amount	8
Voltage	24 V
Max. load	0,5 A

SERIAL OUTPUT (UART)

Amount	1
Baud rate	adjustable
Stop bits	1
Parity	None
Data bits	8

DATA TRANSFER

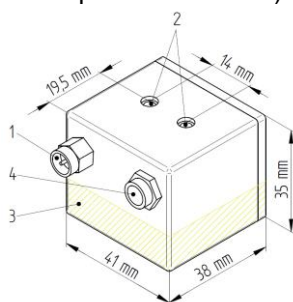
Frequency	2,45 GHz
Bluetooth version	5.0
Simultaneous connected IPKs	max. 4
Latency	< 150 ms
Synchronicity	± 25 ms
Transmission power (max.)	4 dBm
Reception strength (min.)	-90 dBm
Range ¹	10 m

¹ Specification valid for unobstructed view. With partial shielding, the range can be significantly reduced.

POWER SUPPLY

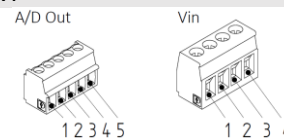
Supply voltage	24 V
Current consumption (typ./max.)	50 / 100 mA
Power consumption (typ./max.)	1,2 / 2,4 W

Pick-up (only induction-powered version)



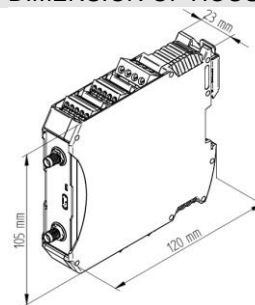
Fastening of the pick-up via two M4 threaded holes (2). The stator coil is located in the yellow shaded area. The 41x38 mm² bottom of the housing is positioned at a distance of 1 to 10 mm from the rotor coil. Avoid metallic components in the immediate vicinity next to the rotor component and the coil, as this will reduce the reception quality.

PIN ASSIGNMENT



PIN	POS. 1	POS. 2	POS. 3	POS. 5	POS. 6
1	do5	do1	GND	n.c.	GND
2	do6	do2	ao8	GND	ao4
3	do7	do3	ao7	n.c.	ao3
4	do8	do4	ao6	24 V	ao2
5	GND	GND	ao5	-	ao1

DIMENSION OF HOUSING



Weight: approx. 150 g

INCLUDED ACCESSORIES

- 2x Antenna (Laird, 001-0001)
- 1x Connector, 4-pin (Amphenol, 20020006-G041B01LF)
- 4x Connector, 5-pin (Amphenol, TJ0511530000G)

OPTIONAL ACCESSORIES

- 1x 24 V power supply unit, 36 W AC/DC (GlobTek, RR9LI1500LCPIMNAR6B)
- 1x Power supply adapter cable
- 1x USB-C to USB-A cable, 1 m

POS. DESCRIPTION

POS.	DESCRIPTION
1	SMA connector
2	M4 threaded holes for mounting
3	Stator coil
4	Electric connector

PICK-UP

Distance pick-up / shaft	approx. 1 – 10 mm
Material	plastic
Mounting	M4 screws

INCLUDED ACCESSORIES

- 1x Power supply cable 1,5 m
- 1x Antenna extension cable 1,5 m

3. ASSEMBLY AND DISASSEMBLY

3.1 Unpacking

Check the delivery for completeness and intactness. In the case of a problem, please contact the R+W customer service, see 7. *SPARE PARTS KEEPING AND CUSTOMER SERVICE* Visible transport damage can lead to impairment of the proper function. Do not put damaged products into operation.

When delivered, the battery charge of the Intelligent Coupling has a capacity of about 50 %.

 **WARNING**

Electronics can be damaged by drops or impacts. The battery may ignite. This can cause heat generation or fire. Coupling must be secured against damage.
Batteries must not be heated or thrown into an open fire (risk of explosion!).

 **WARNING**

Risk of chemical burns from contact with leaking or damaged batteries!

3.2 Storage

During storage, check the battery charge regularly, at least once a month, and charge it to 50%. Use the magnetic charging cable to charge the battery.

ATTENTION

If the battery is stored too long, it may be deeply discharged. This leads to irreversible damage and loss of battery capacity. To prevent this, the battery must be charged regularly.

3.3 Installing the Intelligent Coupling

This manual only explains the setup of the sensor system. For the mechanical coupling part, see the assembly instructions for the respective coupling type.

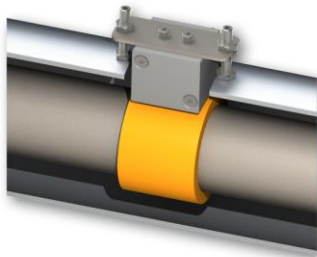
Battery version

On delivery, the Intelligent Coupler is already ready for use. For connecting with the app see chapter 4.3 *Connecting*, for connecting with a gateway see 5.3 *Connecting with Intelligent Coupling*.

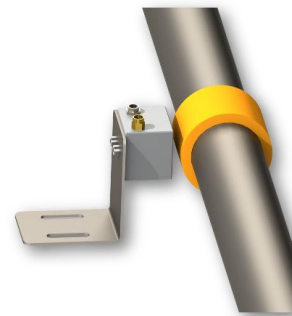
For maximum operating time, the battery should be fully charged at the beginning.

Induction version

The Intelligent Coupling and the gateway are already configured so that they automatically connect to each other as soon as the gateway is switched on. Connect the pickup to the signal input via the antenna cable and to the 12 V output of the gateway via the power cable. Position the pickup firmly with as little distance as possible to the rotor coil, while the arrow on the pickup housing points to the coil. Connect gateway to a 24 V DC power source, powering up activates inductive current transfer and an automatic connection to the coupling. The induced voltage can be viewed via the app in the settings of the Intelligent Coupling (see 4.6 *Information and settings*). To do this, switch off the gateway, connect the coupling to the app and then switch the gateway back on to activate the inductive power supply. Readjust the pickup so that the induced voltage is between 4...5 V. Then disconnect the app so that the gateway connects with the coupling.



Installation example for adjustable mounting of the pickup with a shaft cover.



Installation example for adjustable mounting of the pick-up by means of an angle with slotted holes

3.4 Charging the Battery

 **DANGER**

Liquids on the charging contacts can cause short circuits and electric shocks. This can damage the electronics. Dirt reduces the contact surface and thus the charging capacity. Contacts may need to be cleaned before charging.

Connect the magnetic charging cable with the USB side into a USB socket with power supply or a 5 V USB power supply unit. Attach the magnetic plug to the counterpart of the Intelligent Coupling. The coupling will now be charged. The battery charge can be viewed via the app "Artificial Intelligence by R+W".

4. USE OF THE APP „ARTIFICIAL INTELLIGENCE BY R+W“



The application „Artificial Intelligence by R+W“ is only compatible with the Artificial Intelligence Coupling from R+W Antriebselemente GmbH.

4.1 Preparation and installation

The application requires a min. Bluetooth 4.2 enabled smartphone or tablet with Android version 6.0 or higher. The app can be found in the Google Play Store under the name "Artificial Intelligence by R+W". The appearance of the application is shown in figure 1. Select the appropriate search result and tap on "Install". The installed app has the abbreviated name "R+W".



Figure 1: Appearance of the R+W App



Figure 2: QR-Code to Google PlayStore

In order to be able to record measurement data with the app and store it on the device, access to photos, media and files must be allowed. To use Bluetooth, the "Location" app authorisation must be granted. The granting of the authorisations is requested after the first application start.

When the app is started for the first time, a tutorial is started and the basics of the Intelligent Coupling are explained. The tutorial can be started again at a later time by clicking on the info point at the top right of the start screen.

4.2 Starting screen

The app opens with the start screen "Devices" and automatically searches for compatible Intelligent Couplings and R+W Gateways. Available devices are listed one below the other. Intelligent Couplings are grouped under **Available Amplifiers**. To update and search for devices, swipe down on the start screen.

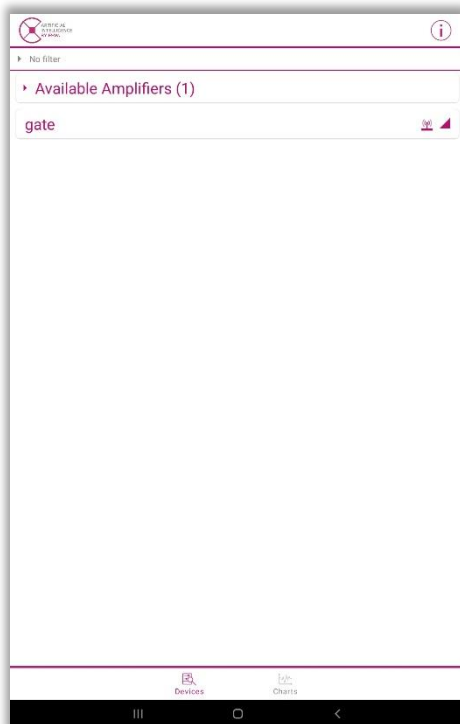


Figure 3: Starting screen "Devices"

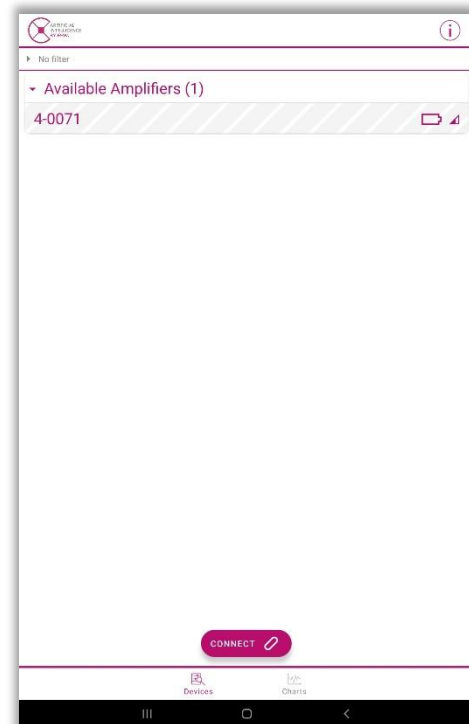


Figure 4: Active selection



If an Intelligent Coupling is not displayed in the search, go to the **Troubleshooting** section at the end of this chapter.

An info area is called up via the ⓘ button in the top right corner. Here you will find brief instructions for the app (**General intro**) and for the gateway (**Gateway intro**), a comprehensive help section (**FAQ**), information about the app and the imprint / disclaimer.

Tapping on **Charts** switches to the display of the measurement data. For this, a connection to an Intelligent Coupling must first be established (see next chapter 4.3 Connecting).

Press **Devices** to return to the start screen. A magenta colour indicates the current selection.

4.3 Connecting

By tapping on **Available Amplifiers**, all Intelligent Couplings in the surrounding area are listed. By tapping, a coupling or a gateway can be selected. An active selection is visualised by hatching. A connection is established with the **connect**-button, which is signalled by flashing. If the line is greyed out, it is connected. Up to four Intelligent Couplings can be connected at the same time. By selecting a connected device again, the settings can be called up with **settings** or the connection can be disconnected with **Disconnect**. The gateway also has the selection button **Start Pairing** to connect the gateway to the coupling.

4.4 Display of the measured values

In the main window **Charts**, the current value of each measured variable is displayed. There is also a screen with a line diagram on the right-hand side. The display can be switched between connected couplings via tabs in the upper area. Using the ⊗, the connection can be disconnected. Under **custom**, the display can be configured with measurement data from different IPK couplings. To do this, select the desired measured value of an intelligent coupling via + and add it.

Tapping on a measured value expands the list with the calculated min- / max- and average values. With **Period** the time interval for this calculation can be changed. The **TARA**-button can be used to zero the measured value, holding it down undoes the zeroing.

Tapping on the graph opens the large diagram view. The line diagram shows the time-continuous curve of the measurement. Simultaneous plotting of up to four intelligent couplings is possible. With two fingers you can zoom in or out and adjust the time and measurement axis. By double-tapping on the display in the line diagram, the graph is autoscaled. Tabs on the upper area can be used to switch between different types of diagrams.



Figure 5: Display of the measured values

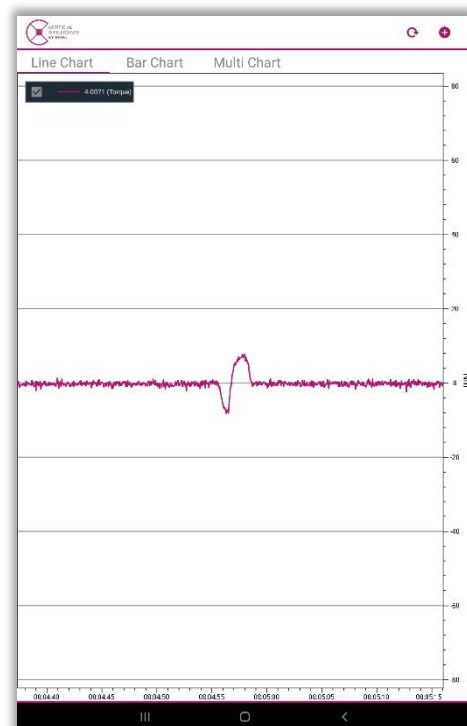


Figure 6: Line diagram

4.5 Recording and saving measured values

The 📁-button in the upper right corner opens a selection window for recording measurement data. In this dialog, the coupling from which the measurement data is to be recorded can be selected. Further setting options are storage location, sampling frequency and measured quantities. The internal memory of the measuring amplifier offers a storage capacity of 256 MB. Confirming **record all** / **record selected** starts the recording into a CSV file. The saving of the data runs in the background, the live display of the measured values is thus still available. Tapping the red ●-button again ends the measurement. For each recording, a separate CSV file is created for each measured variable and clearly arranged in a folder system. The files are sorted according to the name and address of the intelligent coupling, as well as the date and time of the recording.

By holding down the power and quiet keys simultaneously, a screen recording of the current view is generated on Android devices and stored in the internal memory of the device.

The files can be copied by connecting the smartphone or tablet to the computer. To import into programmes such as Excel or Matlab, semicolons must be specified as separators. The decimal separator is a dot. The measurement data are created in relation to a timestamp, via which the data are linked to a date and time. In this way, the measurement data can still be synchronised from different intelligent couplings.

4.6 Information and settings

To configure an Intelligent Coupling, a connection must be established first (see 4.3 *Connecting*). By selecting a connected device, the settings can be called up with settings-button. The following settings can be made:

STATUS	DESCRIPTION
Signal Strength	Signal strength in dBm
Battery	Battery charge in % and applied voltage

GENERAL	DESCRIPTION
Device name	Assignment of a device name, maximum 8 letters or characters
Firmware version	Current firmware, tapping searches for a newer version and offers it as an update
Advertisement interval	Display interval, defines the time interval in which the sensor sends data like its name or the charging status to appear in the device search
Configuration	Tap to load a new configuration file to the Intelligent Coupling
Shutdown / Restart	Deep sleep mode, in which the sensor consumes hardly any energy. Wake up by connecting to a power source / restarting the sensor

SENSORS	DESCRIPTION
Description	Sensor name
Unit	Unit for the measurement signal
Calibration	Calibration value

ENERGY	DESCRIPTION
Sampling rate	Setting the sampling frequency of the sensors
Energy-saving mode	Option to save energy

4.7 Troubleshooting

ISSUE	SOLUTION
Intelligent Coupling is not displayed in the search	<ul style="list-style-type: none"> ▶ Turn on Bluetooth on the tablet ▶ Enable localization of the app ▶ Another device has connected to the Intelligent Coupling ▶ Charge the battery ▶ Restart the measuring amplifier: Connect and disconnect the charging cable from the coupling three times within 5 seconds.
Measurements are displayed, but do not provide appropriate values Torque is negative / positive	<ul style="list-style-type: none"> ▶ Zeroing the measured values ▶ Check calibration value with the calibration certificate ▶ Change the sign (+/-) of the calibration value, see 4.6 <i>Information and settings</i>
No intelligent couplings are displayed	<ul style="list-style-type: none"> ▶ Switch flight mode of the mobile device on and off after 30 seconds
Noise of the measured values or strange signal deflections	<ul style="list-style-type: none"> ▶ Check the state of charge of the Intelligent Coupling, recharge with magnetic plug if the battery charge is low

5. USE OF THE GATEWAY

5.1 Description

The gateway enables wireless data transmission via Bluetooth and serves as an interface between up to four Intelligent Couplings and a PC or a controller. The wirelessly transmitted measured values can be output as analog voltage by cable. A USB interface (UART) allows a connection to a PC so that the measurement signals can be integrated into programs such as MATLAB or LabVIEW via a serial signal.

5.2 Mounting

The R+W gateway has a rear DIN rail mounting for easy installation in a control cabinet. When installing the gateway in a control cabinet or at a greater distance from the Intelligent Coupling, the installation of an external antenna is recommended. The SMA connector on the gateway offers the option of using a coaxial cable with SMA male and SMA female to mount the antenna outside the control cabinet or even closer to the Intelligent Coupler.

For commissioning the gateway, it must be connected to the power supply with 24 V or by means of a USB cable. Afterwards, the gateway is in pairing mode for some time and automatically connects to the Intelligent Couplers. Afterwards, the settings for the outputs can be made. The following sections explain how the automatic connection to the Intelligent Coupler and the setting of the outputs is performed.

5.3 Connecting with Intelligent Coupling

The connection setup with Intelligent Couplings happens during the pairing mode of the gateway and is done automatically if the name is correct. The Intelligent Couplings must have the name of the gateway followed by an index between 0 and 3 during the switched-on pairing mode in order to connect to the gateway automatically. Here, each index may only be assigned once! The R+W App is used to change the names of the Intelligent Couplings (see 4.6 *Information and settings*).

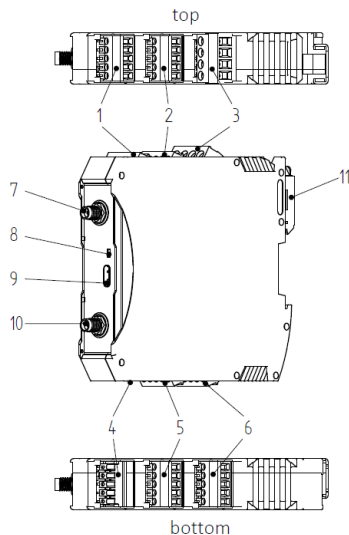
Example: The name of the gateway is "GATE". Consequently, the four measuring amplifiers must be named "GATE_0", "GATE_1", "GATE_2", "GATE_3" in order to be found and automatically coupled by the gateway.

When the gateway is switched on, the pairing mode starts automatically and is active for 50 seconds. For connecting intelligent couplings when the gateway is already switched on, the pairing mode must be started manually in the R+W App. A successful connection between gateway and Intelligent Coupling can be recognized by the fact that the Smart Coupler is no longer visible in the search mode of the R+W App, as it is now connected to the gateway.

After the connection between the Intelligent Coupling and the gateway, the 8 outputs of the gateway can be linked to one sensor output each and used simultaneously.

5.4 Electric connections

There are several connectors on the gateway for power supply, data output and antenna connection. This section lists the assignment of the connection pins.



POS.	DESCRIPTION	VALUE
1	Digital outputs (do)	5-8
2	Digital outputs (do)	1-4
3	Power supply	24 V
4	Not used / debug	
5	Analogue outputs (ao)	5-8
6	Analogue outputs (ao)	1-4
7	External antenna connection, signal input	
8	Status LED	
9	USB-C port	
10	External antenna connection, signal output	

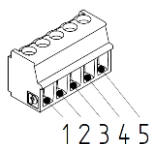
Antenna

An external SMA antenna is included in the scope of delivery. This can either be connected directly to the gateway or extended with a separately available SMA extension and mounted at another location.

USB-C

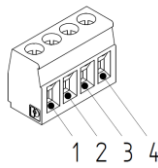
The gateway is powered via the USB C connector and provides the received measurement signals via UART. For using the analog and digital outputs, the gateway must be supplied via an external 24V power supply.

Digital outputs



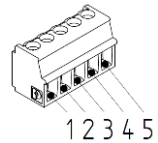
PIN	POS. 1	POS. 2
1	Digital channel 5	Digital channel 1
2	Digital channel 6	Digital channel 2
3	Digital channel 7	Digital channel 3
4	Digital channel 8	Digital channel 4
5	GND	GND

Power supply



PIN	POS. 3
1	12 V output
2	GND
3	GND
4	24 V input

Analog outputs



PIN	POS. 5	POS. 6
1	GND	GND
2	Analog channel 5	Analog channel 1
3	Analog channel 6	Analog channel 2
4	Analog channel 7	Analog channel 3
5	Analog channel 8	Analog channel 4

5.5 Configuring the outputs

The gateway is configured via the R+W App. The desired sensors are selected via the menu and the measured variables are assigned to the analog outputs. Furthermore, the voltage range can be set for an optimal resolution of the sensor signals. The validity of the received sensor data and analog voltage outputs in operation can be checked via the live display of the app.

Example:

Torque oscillations with an amplitude of 100 Nm around a mean value of 50 Nm are to be measured. This means that the measuring range extends from -50 Nm (lower load limit) to +150 Nm (upper load limit). For the voltage output, this range must be mapped to -10 V to +10 V.

First, the upper limit is entered for this purpose:

- Output voltage at nominal load (Output): 10 V
- Nominal load (at Nominal Range): 150 Nm
- The lower load limit is -50 Nm and corresponds to -10 V. The zero point (output at 0 Nm) therefore corresponds to -5 V using the rule of three.

Output as serial signal

The serial signal is used for digital data transfer of the measurement data to a computer. The gateway is recognized as a serial COM port and can be read out with various programs (Serial Plotter, MATLAB, LabVIEW etc.).

The data is transferred according to the UART protocol. The configuration is done in the R+W App. When setting up the connection, it is important to set the same values for baud rate, stop bits, data bits and parity on the computer and gateway. The following values are stored in the gateway as default settings:

- Baud rate: 1,000,000
- data bits: 8
- Stop bits: 1
- Parity: None

The serially transmitted measurement data are unprocessed and not tared raw values with the unit bit. These must be multiplied by the calibration values after transmission and when processing the measurement data. The calibration value of the force and torque sensors can be found on the calibration certificate of the Intelligent Coupling and can also be read out via the settings menu of the app. The following general calibration values are used for acceleration and speed:

- Torque: $\text{Value}_x [\text{bit}] \cdot \text{Calibration value} [\text{Nm/bit}]$.
- Force: $\text{Value}_x [\text{bit}] \cdot \text{Calibration value} [\text{N/bit}]$.
- Acceleration: $\text{Value}_x [\text{bit}] \cdot 0.9155 \cdot 10^{-3} [\text{g/bit}]$
- Speed: $\text{Value}_x [\text{bit}] \cdot 20.3448 \cdot 10^{-3} [\text{rpm/bit}]$

If set correctly, the transmitted measurement data can be read out with various programs on the COM port. The measurement data are transmitted in the following format:

\$ [space] Value1 [space] Value2 [space] Value3 [space] Value4 [space] Value5 [space] Value6 [space] Value7 [space] Value8 [space];

The dollar sign "\$" marks the beginning of a new value packet. The sequence corresponds to the selected sequence of the channels. The values are transmitted in the unit bit and must still be multiplied by the calibration values.

5.6 Troubleshooting

If the gateway does not output any measuring signals at the analog or serial interfaces, there may be various reasons for this, which require different approaches to solving the problem.

ISSUE	SOLUTION
Energy supply insufficient	<ul style="list-style-type: none"> ▶ The analog voltage outputs require a 24 V voltage supply. The voltage supply via USB is not sufficient for this. ▶ Checking the 24 V voltage supply
The amplifier is not connected to the gateway	▶ Ensure correct naming of the Intelligent Coupling (see 5.3 <i>Connecting with Intelligent Coupling</i>)
The analog output is not / incorrectly set	▶ Ensure that the correct values are set in the settings of the analog output

6. DISPOSAL OF ELECTRONIC PRODUCTS

Electrical and electronic equipment bearing the symbol shown on the right is subject to the European Directive 2012/19/EU on waste electrical and electronic equipment. The symbol of the crossed-out dustbin means that the device must not be disposed of with household waste.



Waste modules that are no longer usable must be disposed of separately from regular household waste in accordance with national and local regulations for environmental protection and raw material recovery. Since the exact disposal regulations differ from country to country, the local authorities or the manufacturer should be contacted if necessary.

As the manufacturer, R+W takes back old devices and takes care of their proper disposal.
WEEE Reg. No. DE 90431632

Please note:

- Used batteries and accumulators that are not enclosed by the old device must be separated from it before handing it in.
- Each consumer is responsible for the deletion of personal data on the electrical or electronic equipment itself

6.1 Notes on battery disposal

In connection with the distribution of batteries or with the delivery of devices containing batteries, R+W is obliged to point out the following:

The end user is legally obliged to return used batteries. Used batteries, which R+W carries or has carried as new batteries in its product range, can be returned to R+W free of charge.

Please ensure that they are disposed of in an environmentally friendly manner. The product consists of plastic, electronics and a Li-Ion battery. The parts must be properly separated and disposed of in accordance with the material class.



7. SPARE PARTS KEEPING AND CUSTOMER SERVICE



Replacement parts from third-party suppliers may cause malfunctions. A failure of the electronics, electric shock or sparking can be the result. Do not make any modifications to the electronics!