JUMO Wtrans RF-Series

Wireless temperature probe T01.G1

B 90.2930.0

Operating Instructions

JUMO

04.08/00489934

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This Class A digital apparatus complies with Canadian ICES-003.

Changes or modifications made to this equipment not expressly approved by JUMO GmbH & Co. KG may void the FCC authorization to operate this equipment.

USA	FCC ID	VT4-Wtrans T01
Canada	IC	7472A-Wtrans T01

Contents

1.1 Safety Advice

This instructions manual contains advice that you should consider for your own safety as well as for the prevention of material damage. The individual items of advice are supported by signs and are utilised in this manual as indicated.

Please read this instructions manual carefully before you put the probe into operation. Please keep this manual in a place that is accessible for all users of the probe.
In the event that problems occur on starting up the probe, we expressively ask you not to carry out any manipulations, as these could endanger your warranty claim!

Warning signs

CAUTION!
This symbol in combination with the signal word indicates that a **material damage or a loss of data** might occur if the appropriate precautious measures are not taken.

Note signs

NOTE!
This symbol is an indication for an important piece of information about the product and/or its handling or possible additional advantage.

REFERENCE!
This symbol refers to **further information** in other sections, chapters or manuals.

1.2 Description

In connection with suitable Wtrans receivers, the Wtrans probe is used for the mobile and stationary measurement of temperatures within the range of -30 to +260 °C. The ambient temperature of the electronic components in the handle may be -30 to +85 °C. The measured temperature value is transmitted wireless to the receiver of the Wtrans system. The radio frequency within the ISM band is 868.4 MHz or 915 MHz. These frequencies are largely insensitive with regard to external perturbations and enable transmissions in crude industrial conditions. If the recommended antenna wall mounting is used, the maximum open air range is 300 m.

The handle contains the transmitter unit of the resistance thermometer. The unit is designed to be resistant against vibrations, oils and acids.

The protection class is IP67. The stainless steel thermowell is available with a flat, concentric or oblique insertion tip. The fitting length extends from 50 to 1000 mm. The measuring insert contains a serial Pt 1000 temperature sensor to EN 60 751, Class A in 3-wire-circuit.

1 Introduction

1.3 Block structure

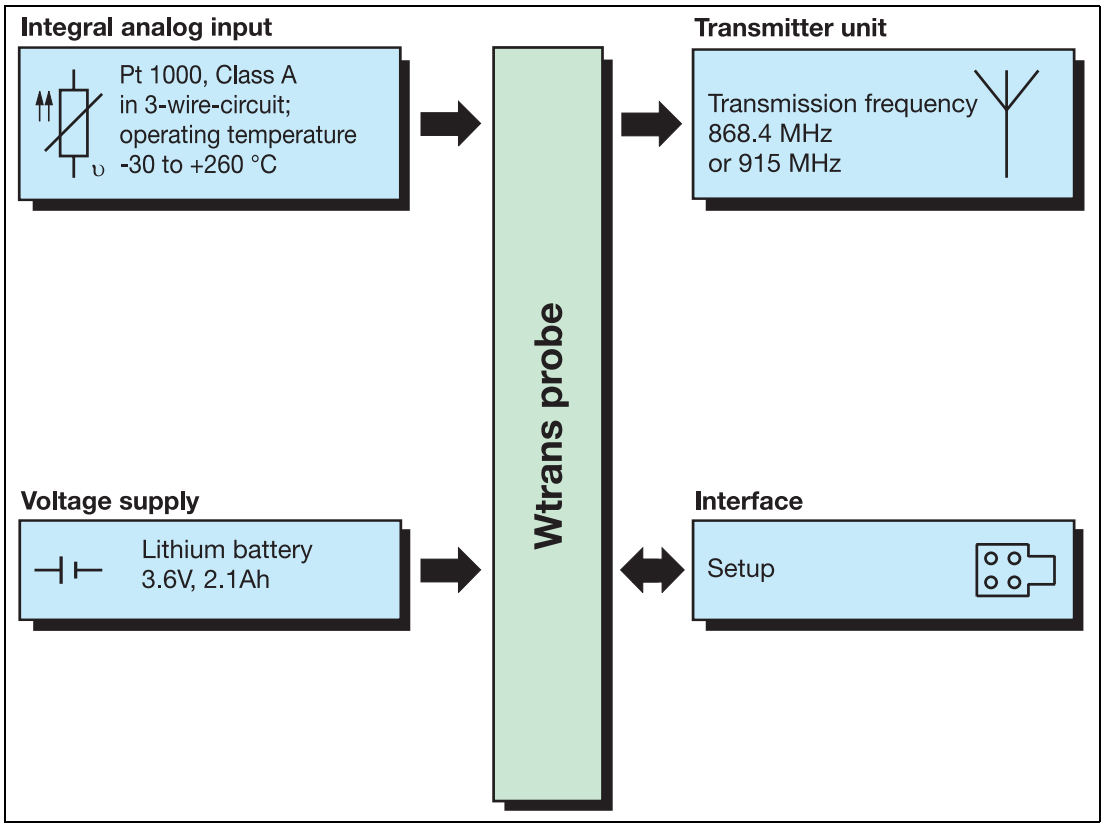


Figure 1: Block structure of the probe

1.4 Dimensions

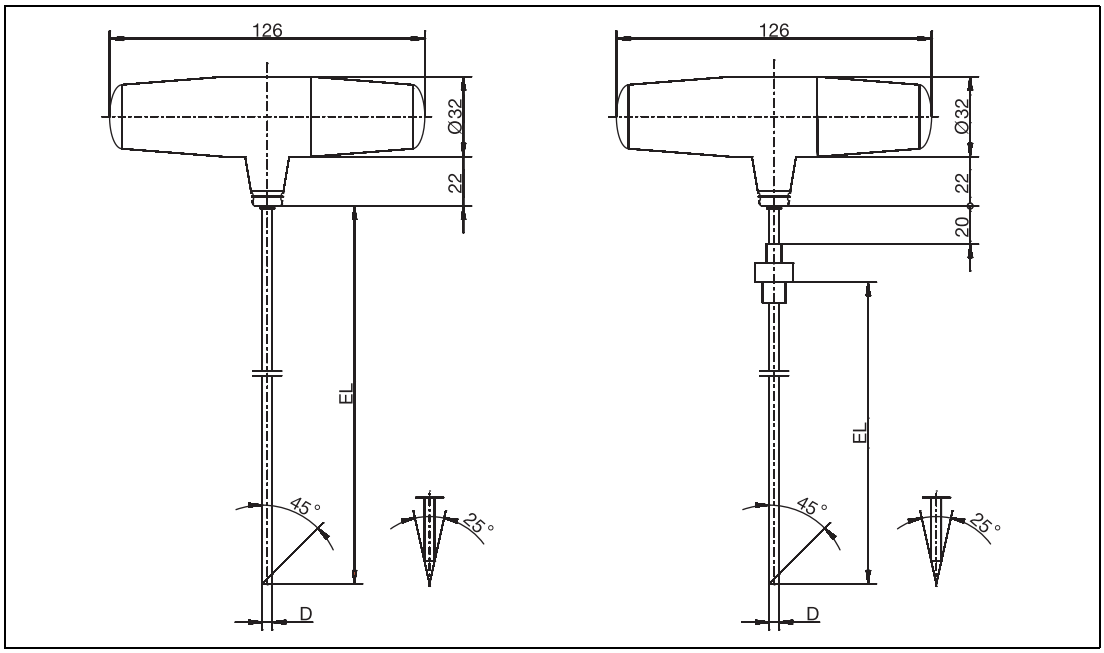


Figure 2: Type 202930/10 ... (left),
Type 202930/10 ... with process connection (right)

2.1 Type details

Position

The type details are embossed by laser onto the protective tube.

Content

These details include important information, which, among others, incorporates the following:

Description	Example
Fabrication-Number (F-No)	0070033801207430006
Probe Identification (probe-ID)	123
Transmission Frequency	868.4 or 915

F-No

By means of the fabrication number the device can be identified by the manufacturer.

From the fabrication number, the date of production can be gathered (year/week). In this number the date is represented by the positions 12, 13, 14, 15.

Example: F-No = 00700338012**0743**0006

This device was manufactured in calendar week 43. in 2007.

Probe Identification (probe-ID)

Probe identification is provided by the factory. It must be entered or activated at the receiver unit, in order to obtain a connection between the probe and the receiver. The probe identification can be modified and customised by means of the setup program.

Transmission Frequency

Transmission frequency indicates the frequency or the frequency band range with which the device transmits information. Up to 10 different frequencies can be configured in the 915 MHz band.

2.2 Serial accessories

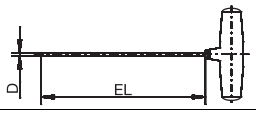
- Operating instructions B 90.2930.0
- Lithium battery 3.6V, 2.1Ah
- Four colour rings from silicone (white, green, red, blue) for visual identification of the probe

2.3 Accessories

Article	Sales No.
Setup program on CD-ROM, multilingual	90/00488887
Lithium battery 3.6 V, 2.1 Ah	90/00489044
Four colour rings from silicone (white, green, red, blue) for visual identification of the probe	90/00489047
PC interface with USB/TTL converter, adapter (socket) and adapter (pins)	70/00456352
PC interface with TTL/RS232 converter and adapter (socket)	70/00350260

2 Identification of the Device Version

2.4 Order details

		(1)	**Basic type**
	902930/10		JUMO Wtrans RF-Series wireless temperature probe T01.G1 
		(2)	**Operating temperature in °C**
x	596		-30 to +260°C
		(3)	**Measuring insert**
x	1006		1x Pt 1000 in 3-wire circuit
		(4)	**Tolerance class to EN 60 751**
x	2		class A
		(5)	**Thermowell diameter D in mm**
x	4		Ø 4mm
x	4,5		Ø 4.5mm
x	6		Ø 6mm
		(6)	**Fitting length EL in mm (50 ≥ EL ≤ 1000)**
x	100		100mm
x	150		150mm
x	200		200mm
x	...		please specify in plain text (50mm steps)
		(7)	**Insertion tip**
x	1		flat
x	2		concentric, angled at 25°
x	3		oblique, angled at 45°
		(8)	**Transmission frequency**
x	10		ISM band 868.4 MHz (Europe)
x	20		915 MHz (America, Australia, Canada and New Zealand)
		(9)	**Process connection**
	000		none
	103		Screw connection G 3/8
	104		Screw connection G 1/2
		(10)	**Extra codes**
x	000		none
x	778		customer-specific transmission interval, factory setting 10 s (please specify in plain text between 1 to 3600 s)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)
Order code		-		-		-		-		-		-		-		-		/	
Order example	902930/10	-	596	-	1006	-	2	-	4	-	100	-	1	-	10	-	000	/	000

3.1 Insert battery

For the energy supply of the probe, a lithium battery 3.6 V, 2.1 Ah is provided as a standard. The service expectancy of the battery depends on the transmission interval and the ambient temperature and will be approx. one year for the settings made in the factory (transmission interval 10 sec and room temperature).

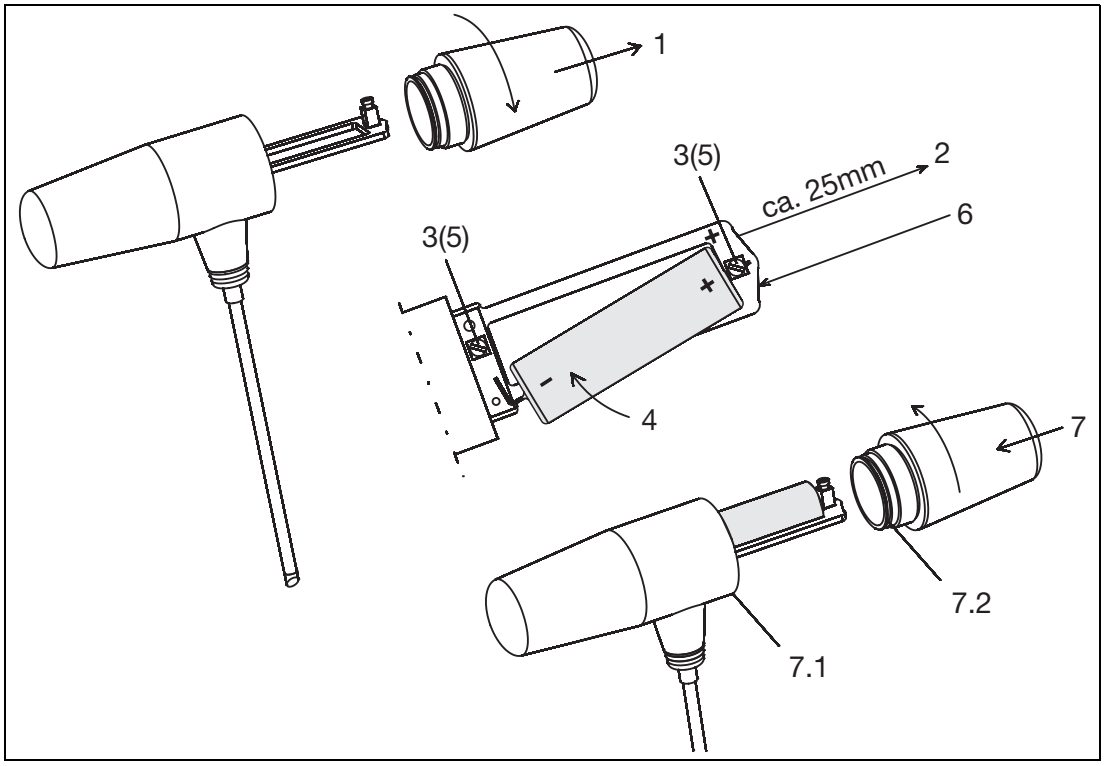


Figure 3: Insert battery

Step	What to do:
1	Screw open the handle counter-clockwise and withdraw one half of the handle.
2	Pull out the circuit board from the handle by approx. 25 mm.
3	Loosen the screwed clamps of the minus pole and the plus pole by means of a screw driver.
4	Insert the plus pole of the battery into the screwed clamp indicated by (+). Tilt the battery and insert its minus pole into the screwed clamp indicated by (-).
5	Re-fasten the screwed clamps of the minus and plus poles by means of a screw driver.
6	Slide the circuit board back into the handle to the stop.
7	Screw together the handle and the half of the handle in clockwise direction. *In doing this, please ensure the correct position of the two black gaskets 7.1 and 7.2 at the two halves of the handle! When replacing the battery, please also replace the two gaskets by those provided with the new battery.*

CAUTION!
On incorrect polarisation, the probe will not function.
Both the battery and the electronics of the probe can be damaged.
Please ensure correct polarisation of the battery.

3.2 Safety advice for lithium batteries

⇨ www.tadironbatteries.de

3.3 Disposal of lithium batteries

Please only replace a lithium battery by an identical type.
Please dispose of all batteries in accordance with the statutory regulations according to the Circular Economy Act and the Waste Act as well as the local provisions.

The contact points of batteries that have not completely been electrically discharged must be insulated. Disposal together with domestic waste is expressively prohibited. You can deliver them cost-free at local collection points or in retail shops in your proximity.

3.4 Apply colour code of the probe

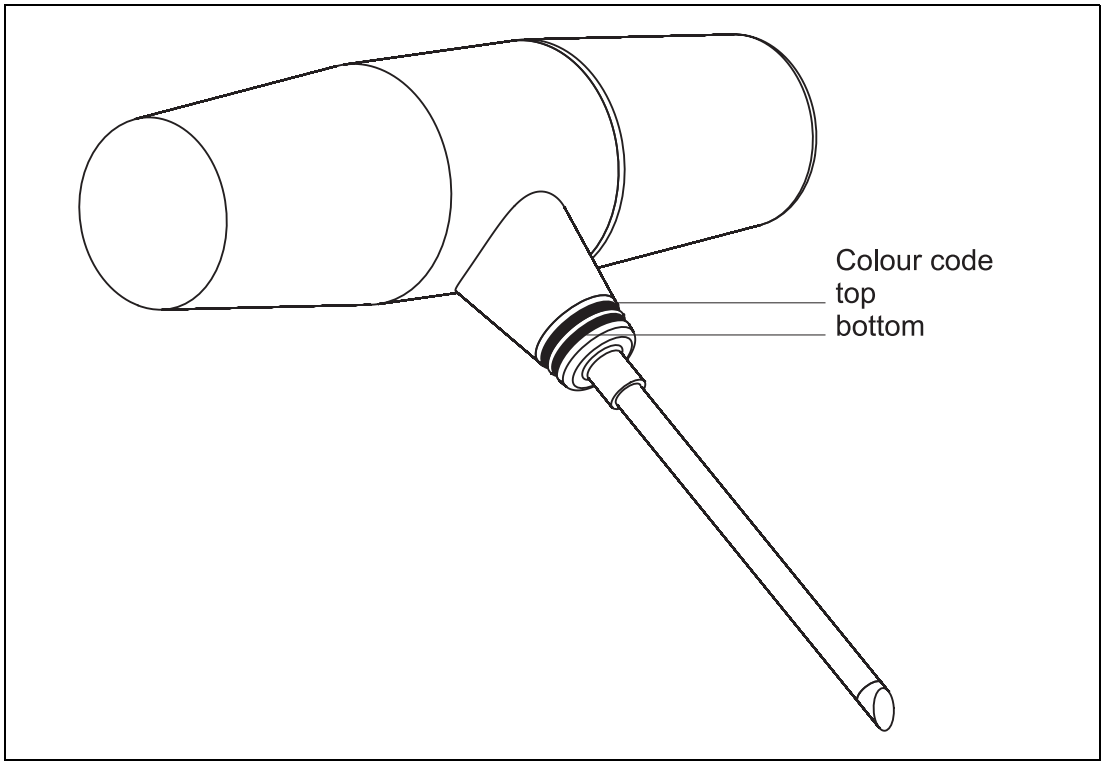


Figure 4: Apply colour code onto the probe

In the factory, the probe is provided with four coloured silicone rings (white, green, red and blue), by means of which the probe can unambiguously be optically classified.
These rings can be individually combined and are slid onto the shaft of the probe. In total, 25 options of colour combination coding can be obtained through this.

4.1 General remarks on wireless transmission

Radio signals are magnetic waves with their signal becoming weaker on their path from the probe to the receiver (this phenomenon is referred to as loss). Both the electric and the magnetic field strength are decreased inversely proportional to the squared distance between the probe and the receiver.

In addition to this natural limitation of the range of transmission, a reduced transmission range can also occur due to other circumstances:

- Reinforced concrete walls, metal devices or surfaces, heat insulation or metal evaporated heat protection glass reflect electro-magnetic waves and therefore a so-named radio shadow or blind spot occurs behind such objects.
- Radio shadows within the transmission link
- The antenna is installed in too low a position, therefore mount antenna in as high a position as possible above the floor within a visual range between probe and receiver.

A few guiding values on penetration by radio signals:

Materials	**Penetration**
wood, gypsum, non-laminated glass	90 to 100 %
walling/brickwork, chipboards/fibreboards	65 to 95 %
glass-fibre reinforced concrete	10 to 90 %
metal, aluminium casings	0 to 10 %

The maximum transmission range between the probeprobe and the receiver is 300 meters in a free field. Ideal reception can be obtained if visual contact can be maintained between the receiver and the probe.
In case the receiver is installed in a switching cabinet, behind concrete walls or concrete ceilings, it is indispensable for the antenna to be installed in a wall-mount fashion and including an antenna conduit.

4.2 Impairment of the range of wireless transmission

Collision due to prevalence of too many probes

For a comparatively large number of probes, the transmission interval should not be set too short, as otherwise the transmission frequency will superfluously be occupied. A short interval means a higher volume of data on the selected frequency, which can lead to collisions with other probes. Through such collisions telegrams might be destroyed during radio transmission.

4 Range of Transmission

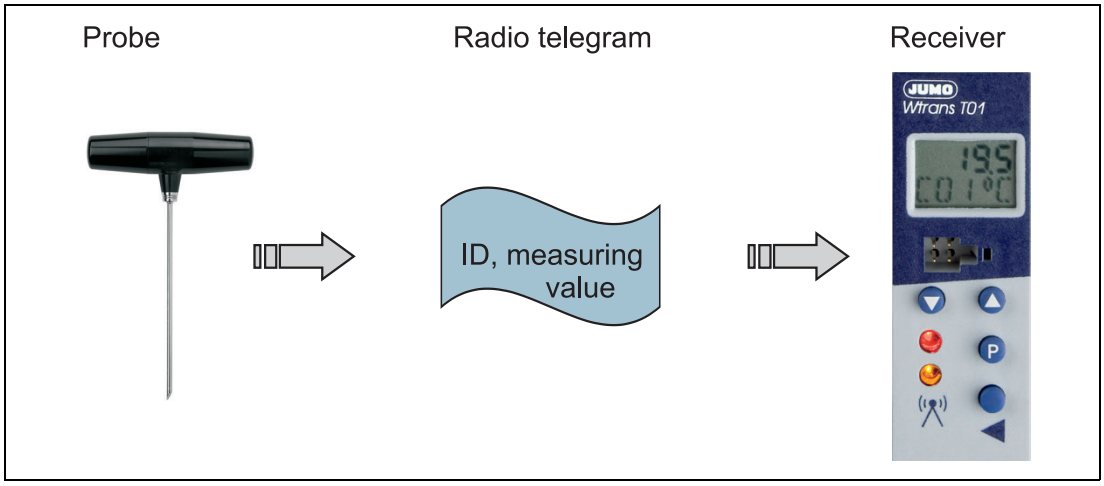


Figure 5: Telegrams of one probe are transmitted to the receiver collision-free.

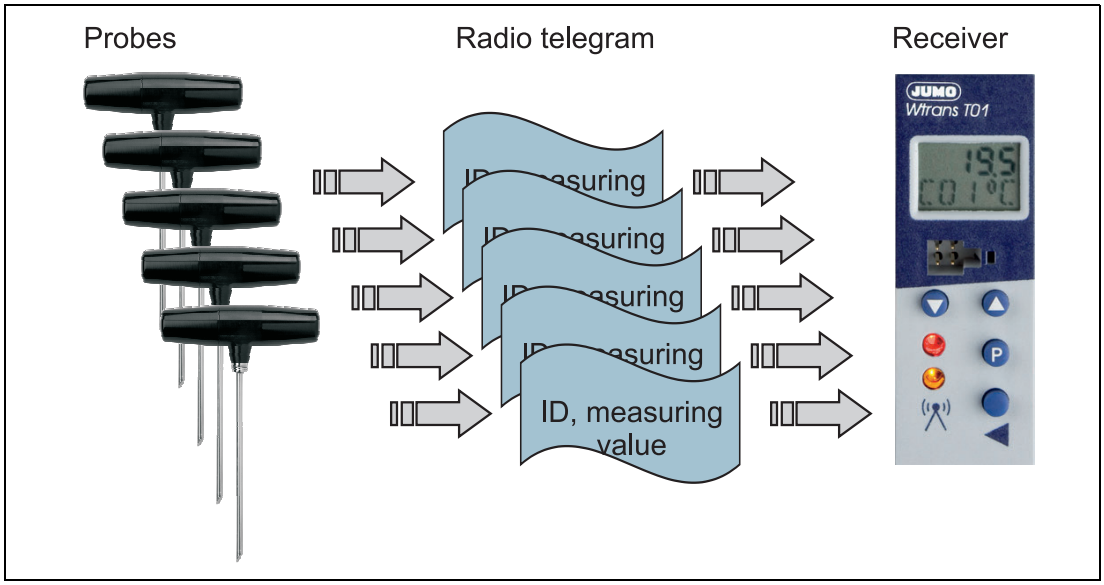


Figure 6: Telegrams of various probes increasingly collide in the air as the transmission medium.

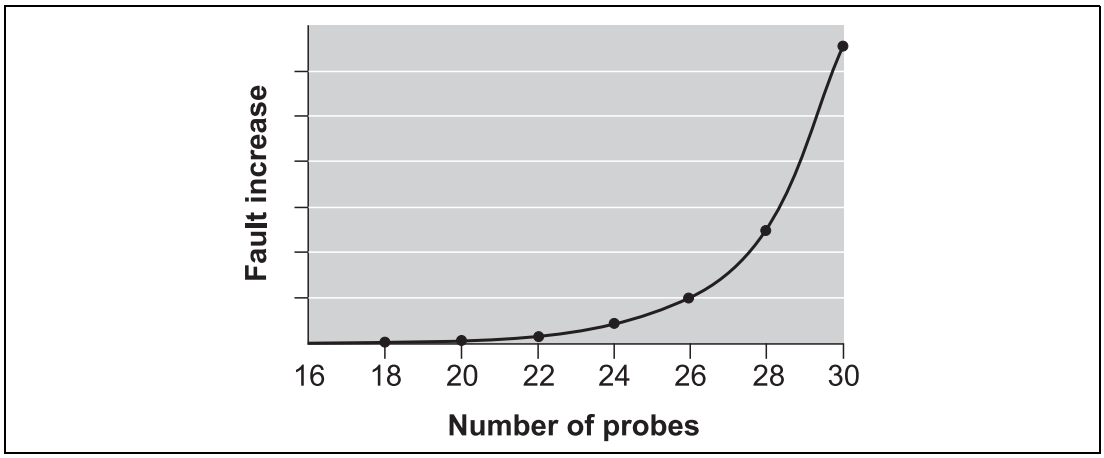


Figure 7: Increase of faults in dependency of the number of probes (Interval of transmission 1 s)

As illustrated in figure 7, the fault curve climbs steeply, if a critical number of probes is reached, as the air, functioning as the transmission medium, is increasingly occupied.

Even with as few as two probes, faults cannot be excluded to 100%.

For this reason, limitation to a maximum number of 16 probes is recommended for the shortest transmission interval of 1 second, as the fault ratio already strongly increases from 24 probes.

External probes

However, faults can also arise for a small number of probes; they may be caused by other influences from the environment.
External probes might also use the same frequency. In the event that they operate without the „Listen before Talk“ function, they arbitrariliy transmit information on the same frequency without observing the operations and priorities of the other probes. Hence, if for example a probe transmits its radio telegram, and an external probe is simultaneously doing the same, the radio telegram will be destroyed. As the probes are not able to check their own transmission while transmitting, a fault will not be detected.

Electrical equipment

In crude industrial environment radio telegrams can be destroyed for example through frequency converters, electric welding equipment or insuficiently shielded PCs, audio-visual equipment, electronic transformers, ballasts, etc. Other components may also generate bursts that are located on the same frequency.

Determination of the maximum number of probes

In the event that for a transmission interval of 1sec a number of more than 16 probes is to be installed, a longer transmission interval must be set, in order for the fault rate not to increase further.

Example:

16 probes wiht 1 sec transmission interval $\triangleq$ 32 probes with 2 sec transmission interval

For an even further increase of the number of probes, the following example illustrates the calculation below.

Example:

16 probes with 1 sec transmission interval $\triangleq$ 48 probes with 3 sec transmission interval (theoretically)

From a transmission interval of $\geq$ 3 sec the telegram will be sent twice. As a consequence, the number of applicable probes is reduced by half.

16 probes with 1 sec transmission interval $\triangleq$ 24 probes with 3 sec transmission interval (effectively)

The same phenomenon re-occurs for a transmission interval of $\geq$ 60 sec. From this transmission interval, the telegram will be sent three times.

Elimination of Faults

At the receiving end, fault arising through lost telegrams - regardless whether through external sources of interferrence or through collisions due to a large number of probes - can be bypassed by means of the parameter „radio-timeout“. The value last

received will then be maintained over 2 … 10 transmission intervals and only then the alarm radio-timeout will be activated (display „----“).

Through this function short-term faults or interferrences will be bridged and to do not lead to an error.

NOTE!
For collisions due to too large a number of probes, the factors „number of probes“, „transmission intervals“ and at the receiving end „radio-timeout“ must be observed and modified, if applicable.

5.1 General remarks on the setup program

This setup program may be used to configure probes and receivers with a PC. The configuration data can be stored on data carriers and printed out.

Configurable parameters are:

- Probe ID
- Transmission interval
- Transmission frequencies (only at 915 MHz)

The factory settings are:

- Probe ID (continuous)
- Transmission interval 10 s
- Transmission frequency 868.4 MHz or 915.4 MHz

The setup program allows to overwrite modified parameters with the factory setting at any time.

The connection between the probe and the PC is estabilshed using a PC interface (USB/TTL or TTL/RS232 converter).

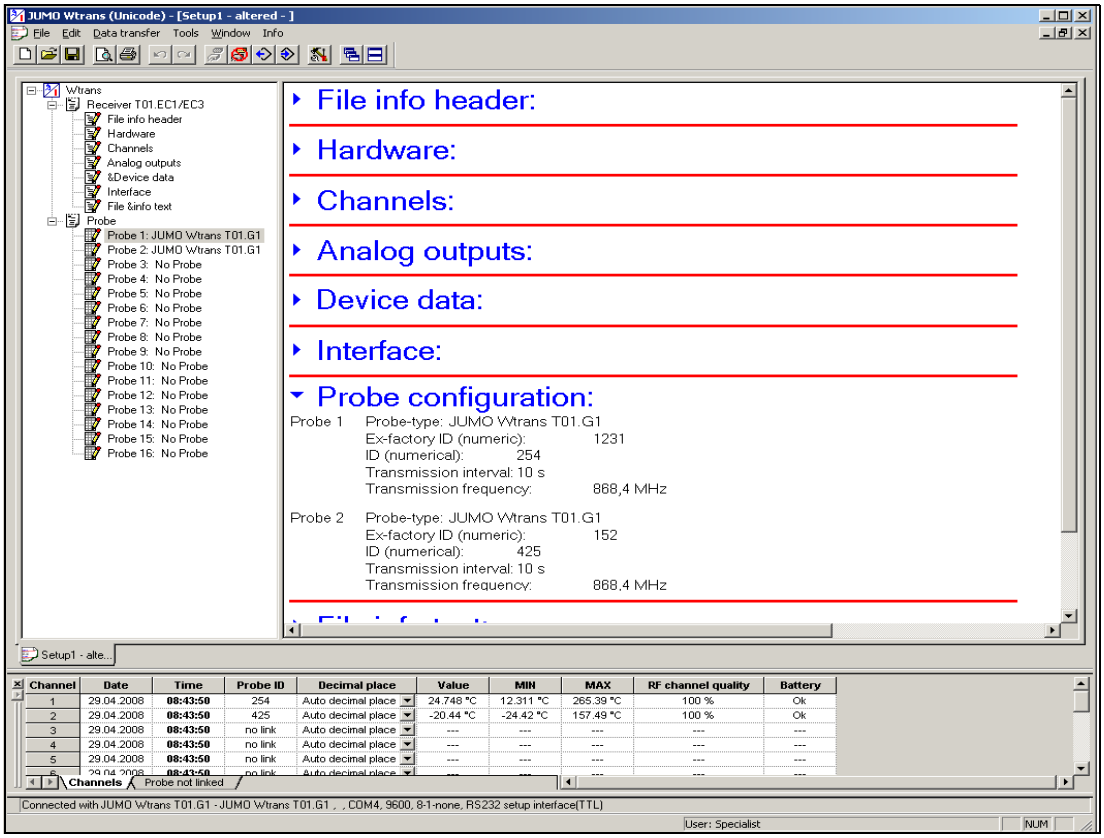


Abbildung 8: Setup program of the probe

5 Setup-Program

5.2 Establishing of a connection between PC and probe

The connection between the probe and a PC is established by means of a PC interface TTL/RS232-translator and adapter (socket) or USB/TTL-translator and adapter (socket).

TTL/RS232

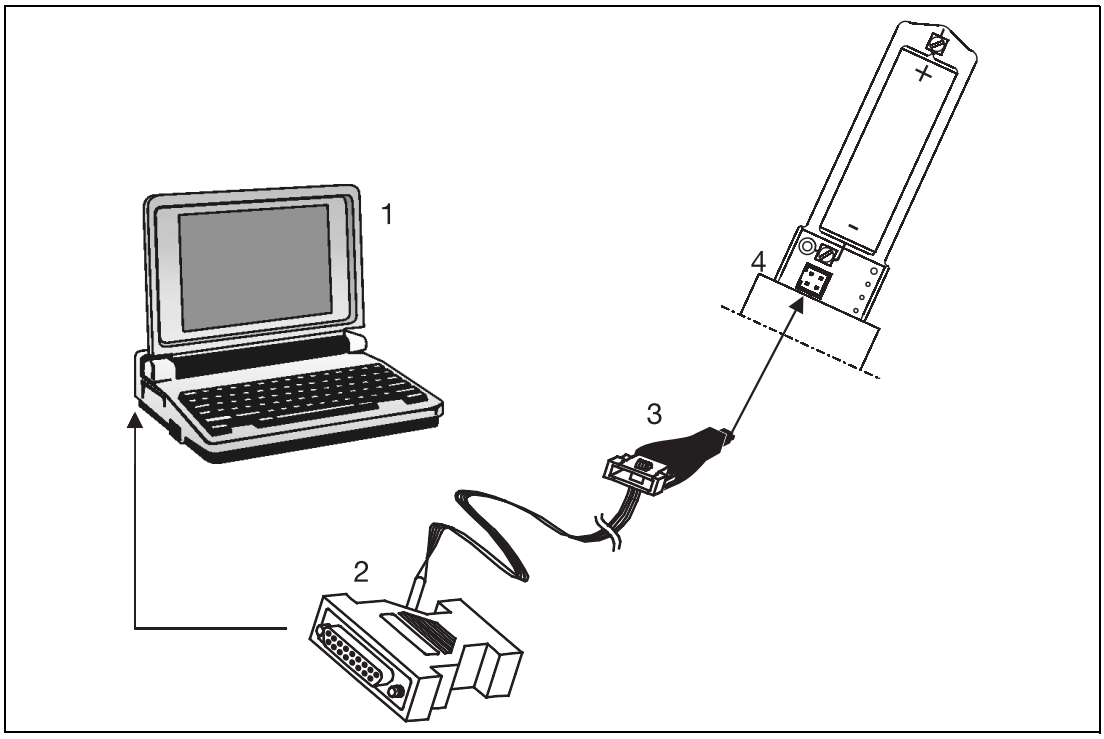


Abbildung 9: Connection between PC and probe established via TTL/RS232-translator and adapter-socket

1	Laptop/PC	3	adapter-socket 4-pole
2	RS232-jack	4	probe interface

Step	What to do:
1	Plug RS232-jack (2) into the Laptop/PC (1).
2	Plug adapter-socket, 4-pole (3), onto the interface of the probe (4).

USB/TTL

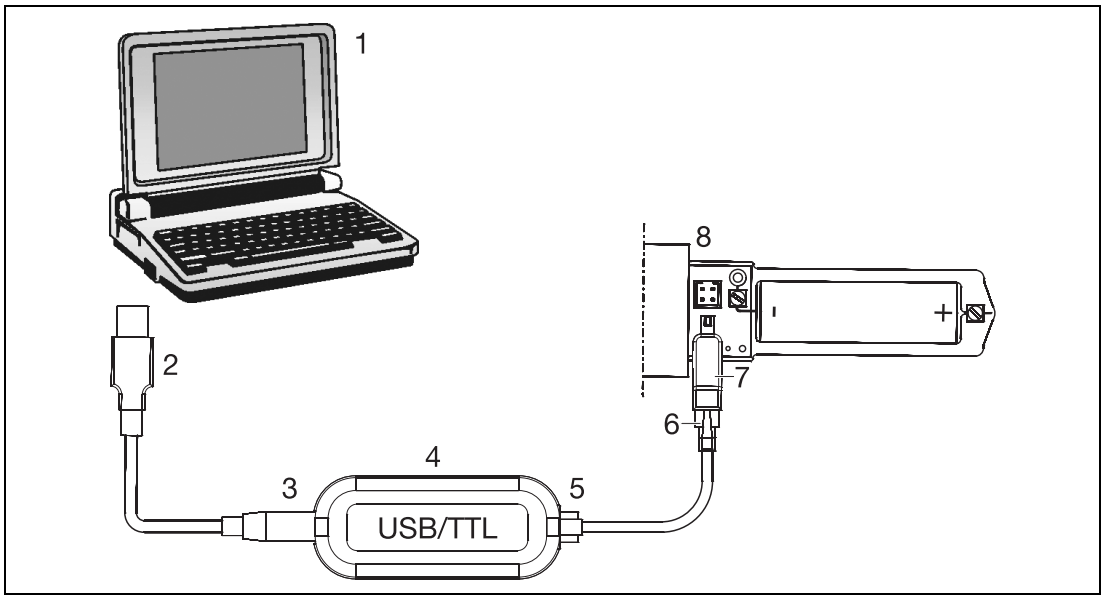


Abbildung 10: Connection between PC and probe established via USB/TTL-translator and adapter-socket

1	Laptop/PC	6	Post-type adapter for modular lines
2	USB-jack	7	Adapter-socket, 4-pole
3	USB-socket	8	Probe interface
4	USB/TTL-translator		
5	Western plug RJ-45		

Please establish the following connections for the setup of the USB/TTL-translator:

Step	What to do:
1	Plug the USB-jack of the USB-line (2) into the Laptop/PC (1).
2	Plug the USB-socket of the USB-line (3) into the jack of the USB/TTL-translator (4).
3	Plug the Western plug RJ-45 (5) of the modular line into the socket RJ-45 of the USB/TTL-translator (4).
4	Plug the adapter-socket, 4-pole (7), onto the post-type adapter of the modular line (6).
5	Plug the adapter-socket, 4-pole (7), onto the interface of the probe (8).

CAUTION!
Please ensure that at any time for the connection between PC and probe a battery is used that is not in the state „low battery“.
With low batteries, interface problems might occur, which in turn may lead to incorrecti configurations or a loss of data.

5 Setup-Program

5.3 Enter customised parameters via the setup program

Parameters	As of factory	Value range / selection		✎
Identification of the probe (probe-ID)	deactivated	**1** to 99999		
transmission interval	**10** s	1 to 3600 sec		
transmission frequency	868,4 MHz 915 MHz	**868.4** MHz	for 868 MHz-hardware	
		912.6 MHz 913.0 MHz 913.6 MHz 914.0 MHz 914.6 MHz **915.4** MHz 916.0 MHz 916.4 MHz 917.0 MHz 917.4 MHz	for 915 MHz-hardware	

NOTE!
For a transmisison interval of > 10 sec, a so-named link telegram will be transmitted by the probe, i.e. for a period of 30 minutes, telegrams will be transmitted in the 10 sec interval as set by the manufacturer, only after this period, telegrams will be sent in the set interval.

NOTE!
As soon as the setup plug is plugged in, the probe automatically transmits telegrams in a transmission interval of 1 sec, in order for the receiver to immediately recognised the modifications. After disconnecting the setup plug, the telegrams will be sent in the set transmission interval.

Explications

Probe identification (probe-ID)

The probe identification (probe-ID) is an unambiguous number with a maximum of 5 positions, that is recognised by the receiver. The ID can individually be modified, e.g. in order to obtain a better overview for a machine. However, it must be observed that one ID is only allocated once within a company, as probes with the same ID cannot be distinguished by a receiver, even for large distances.

Transmission interval

This parameter defines, in what interval data will be sent to a receiver. The setting of the parameters „transmission interval“ has an effect on the service life of the battery. Therefore, the selection should be made with caution and not exclusively in consideration of the transmission quality.

Transmission frequency

The transmission frequency determins the frequency band, in which the data will be transmitted to a receiver. In Europe, the transmission frequency has been set to 868.4 MHz, as special regulations have been determined for the ISM band (industrial-scientific-medical) with regard to transmission interval and transmission power.
In the 915 MHz-frequency band ten frequencies may be configured.

5 Setup-Program

6.1 Technical data

Analog input

Measuring input	Pt 1000 to EN 60 751, Class A in 3-wire circuit
Operating temperature range	-30 to +260 °C (relating to the thermowell unit, approx. 22 mm below the handle)
Accuracy of the temperature sensor	≤ ±0.15 K ±0.002 K * t

Output (radio transmission)

Probe ID	max. 5-digit ID, factory setting, can be configured by the customer
Transmission interval	configurable from 1 to 3600 s (factory setting 10 s)
Transmission frequency	ISM band 868.4 MHz (Europe) or 915 MHz (America, Australia, Canada and New Zealand); within the frequency band 915 MHz, ten frequencies may be configured
Transmission power	+10 dBm
Open-air range	max. 300 m, if the antenna wall mounting and 3 m antenna cable are used on the receiver side
Output signal	882.2 to 1977.1 Ohm ≙ -30 to +260 °C (resolution 17 bit)
Response time	$t_{0.9} \leq 10$ s
Calibration accuracy of the electronic components	≤ ±0.05 %[a]
Configuration	with setup program
Configurable parameters	Probe ID (max. 5-digit ID), transmission interval

Voltage supply

Lithium battery	Voltage: 3.6 V, nominal capacity: 2.1 Ah
Service life	approx. 1 year with factory setting and at room temperature (short transmission intervals and high or low ambient temperature reduce the service life of the battery)
Battery replacement	only use Lithium batteries in original packaging

[a] All accuracy details in % from the measuring range of 290 °C.

6 Appendix

Ambient factors

Ambient temperature range	-30 to +85 °C (handle including electronic components)
Storage temperature range	-40 to +85 °C (handle including electronic components)
Storage humidity	relative humidity ≤ 95 %, without condensation
Temperature influence	≤ ±0.0025 %[a]/K; per K deviation from the reference temperature 22 °C (±3 K)
Climatic conditions	relative humidity 95 %, without condensation according to IEC 68-2-30
Vibration resistance	max. 2 g at 10 to 2000 Hz (relating to handle with electronic components) according to IEC 60 068-2-6
Permitted mechanical shock resistance	25 g/6 ms (relating to handle with electronic components) IEC 68-2.29 per 1000 cycles
EMC - interference emission - Immunity to interference - radio frequency range	EN 61 326 Class A Industrial requirement ETSI EN 300 220-1, V 1.3.1

Housing

Material	PEI (Polyetherimide)
Flammability class	UL 94 HB
Dimensions	Diameter Ø approx. 32 mm, length approx. 126 mm, Installation length of the thermowell 50 to 1000 mm
IP-protection	IP67 to EN 60 529
Mounting position	any
Weight	approx. 120 g

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