SUWIV1-3EN

Supplement to the User's Manual





WaveInjector® WI200
WaveInjector® WI400

Note:

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Supplement to the User's Manual of the FLUXUS® ADM flowmeter

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1 Introduction

This supplement is only valid in combination with the user's manual of your FLUXUS® ADM ultrasonic flowmeter. Always respect the safety and handling instructions given in the manual.

1.1 The WaveInjector

The WaveInjector is a special transducer mounting fixture for clamp-on ultrasonic flow measurement. It allows a measurement at high temperatures (up to 400°C) with the standard Flexim M and Q transducers.

1.2 Description

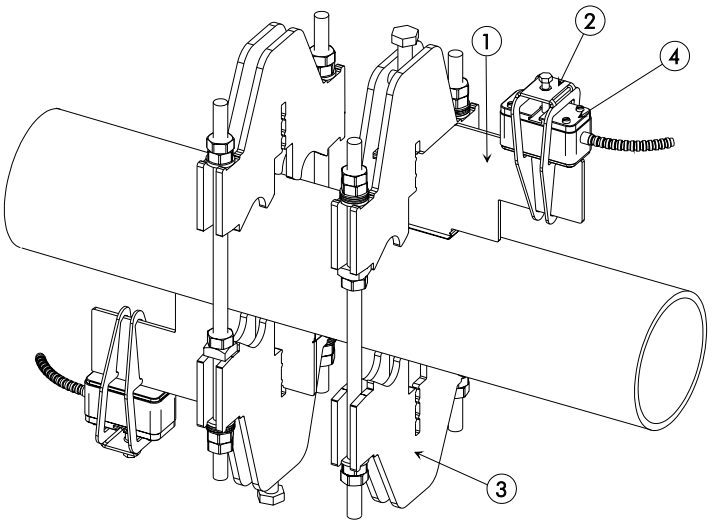


Fig. 1.1: The components of the WaveInjector (WI400S, WI400Q, WI400M)
(Attention, this drawing is rotated! The gaps of the clamps should preferably sit on the side of the pipe.)

A WaveInjector is composed of two WaveInjector coupling plates (1), two transducers clamping fixtures (2), a mounting fixture (3) and an acoustic coupling agent. The metallic coupling plates are situated between the transducers (4) and the pipe and couple the latter ultrasonically nearly loss-free. At the same time, their cooling effect creates a temperature difference between the surface of the pipe and the coupling surface of the transducer. This guarantees that the allowed transducer temperature is not exceeded. The acoustic contact between the coupling plate and the hot pipe surface is ensured by a metal foil or a high temperature coupling gel.

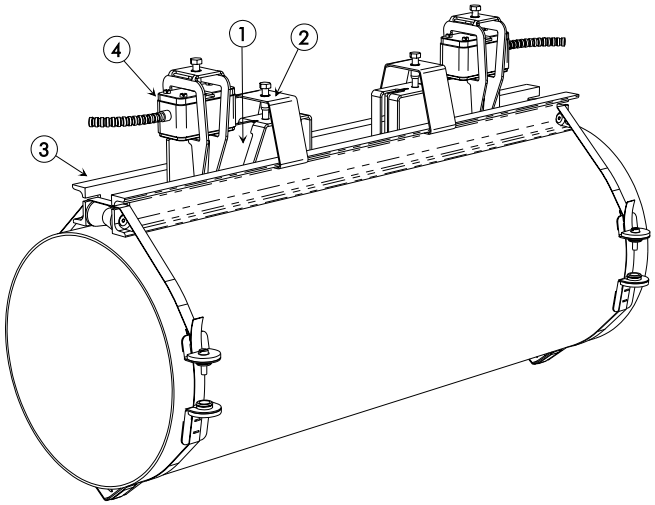


Fig. 1.2: The components of the WaveInjector WI200

1.3 Types

The working temperature determines which WaveInjector® is suitable for your application. WI200 is suitable for temperatures not higher than 200°C. It is mounted on the pipe with the FLEXIM Variofix mounting system (#3 in Fig. 1.2) for a strong and reliable hold. The FLEXIM high temperature coupling gel ensures the acoustic contact between the pipe and the coupling plate. WI400 is designed for working temperatures higher than 200°C. It has its own special pipe mounting fixture (#3 in Fig. 1.1) to provide a good coupling even at very high temperatures. A temperature stable metal foil creates a permanent acoustic contact to the pipe. The transducer distance can be adjusted by shifting the transducer on the WaveInjector coupling plate.

2 Installation

For the installation of the WaveInjector, you will need:

- the WaveInjector (coupling plates with coupling gel or foil, transducer clamping fixtures, pipe mounting clamps)
- the supplied pipe planer and
- fine sandpaper.



The pipe on which the WaveInjector will be installed is very hot. Use appropriate protective clothes! All the components of the WaveInjector will also warm up during the installation.

2.1 Selection of the Measuring Point

Select the measuring point according to the instructions given in the chapter "Selection of the Measuring Point" of the user's manual. Always take into account the recommended distance to the disturbance sources (section "Undisturbed Flow Profile"). Don't forget that you have already specified the main parameters of the measuring point (e.g. outer diameter of the pipe and temperature range) when ordering the WaveInjector.

Important!	*The surface of the pipe at the measuring point should be as even as possible.*

Since the pipe mounting fixtures exert a quite high pressure on the pipe, the latter must be thick enough to bear this pressure without deformation. Generally, for a steel pipe, a wall thickness of 3 mm is adequate.

2.1.1 Use of the Transducers in Explosive Atmosphere

Always respect the safety instructions given in the user's manual!



Always respect the specified explosion protection temperatures and operating temperatures (see next page).



If you work with FLUXUS ADM 8X27:

Never open the upper or lower enclosure when working in explosive atmosphere if the instrument is under tension. After disconnecting the instrument, always wait 10 minutes before opening the upper enclosure.



The transducers ***M2N, M2E, M3N, Q3N*** *and* ***Q3E*** *can only be used in explosive atmosphere zone 2!*

The transducers ***M4N Ex, Q4N Ex, P4N Ex, K4N Ex-A*** *and* ***K4N Ex-Z*** *can be used in explosive atmosphere in hazard zone 2 and 1 in combination with the transmitters* ***FLUXUS ADM 6725, 7207, 7407, 7807, 7907, 8027 und 8127****.*

The transmitters ***FLUXUS ADM 6725, 7207, 7407, 7807 und 7907*** *must always be located outside of the hazard zone 1.*



Make sure that the cables connecting the transducers with the transmitter are not exposed to any kind of thermal stress or mechanical load.



Proceed to the mounting of the transducers only when there is absolutely no risk of occurrence of an explosive atmosphere or when the flowmeter is not under tension.

The transducers M4N Ex, Q4N Ex and P4N Ex should be used in explosive atmosphere only when the following conditions are met:

- *the transducers are permanently fixed to a pipe with an adequate mounting fixture and*
- *the contact surface of every transducer is directed toward the surface of the pipe or of the container on which it is mounted.*

If an equipotential bonding of the transducers is necessary, use the ground terminal of the transducer housing.

The transducer K4N Ex-Z must always be used in the mounting fixture with which it was delivered in order to protect it against mechanical stress.

If an equipotential bonding is necessary, use the ground terminal of the mounting fixture.

Table 2.1: Technical data of the transducers M4N Ex and Q4N Ex

Note: Please refer to the corresponding specification sheets for a complete specification.

Technical Data of the Transducers M4N Ex and Q4N Ex	
Manufacturer:	FLEXIM GmbH Wolfener Str. 36 12681 Berlin
Marking:	CE 0044; Ex II2G EEx m II T4, $T_{a\,max.}$ 120°C T5, $T_{a\,max.}$ 90°C T6, $T_{a\,max.}$ 75°C
Homologation:	IBExU 98 ATEX 1012 X
Type of protection:	Encapsulation
Degree of protection:	IP 65 acc. to EN60529
Operating temp. (process):	-30°C to 130°C
Operating temp. (ambient):	-30°C to 130°C
Explosion protection temp. acc. to ATEX:	Temperature class T4: -20°C to 120°C Temperature class T5: -20°C to 90°C Temperature class T6: -20°C to 75°C

Table 2.2: Electrical data of the transmitters FLUXUS ADM XXXX

Electrical Data of the Transmitters FLUXUS ADM XXXX	
Pulse peak voltage:	< 75 V
Pulse peak current:	< 3 A
Pulse width:	< 600 ns
Average pulse frequency:	< 25 kHz
Average high frequency power:	< 0,2 W
Direct voltage:	< 0,1 V
Direct power:	< 0,1 W

2.2 Environmental Conditions

2.2.1 Insulation

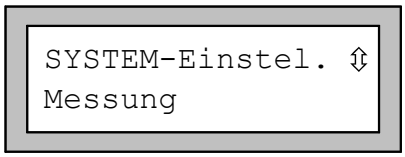
Important!	*Do not insulate thermally the WaveInjector fixture. The insulation would reduce the cooling effect of the coupling plate, so that the temperature range of the transducers might be exceeded. Respect the recommended minimum distance between the WaveInjector and the insulation of the pipe given in chapter 4.*

2.2.2 Heat traced pipe

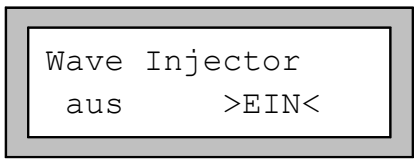
Important!	*Heat traced pipes hinder the mounting of the pipe clamping fixtures. Respect the installation instructions given in chapter 4.*

2.3 Activating the WaveInjector Mode

Install the flowmeter. Take into account the temperature range of the transmitter and make sure you install the latter at an adequate distance from the measuring point. Connect the transducers and the power supply to the transmitter as described in the user's manual. The transducer should not be mounted on the pipe yet.



In the program branch SPECIAL FUNCTION, select the SYSTEM SETTINGS, then the MEASURING option.



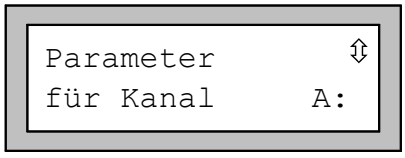
Confirm all displayed options with **ENTER** until the WAVE INJECTOR screen is displayed.

Select ON to activate the WaveInjector mode. Confirm by pressing **ENTER**.

2.4 Input of the Parameter



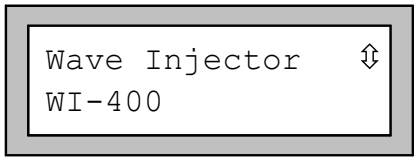
In the main menu of FLUXUS, select the program branch PARAMETER and confirm by pressing **ENTER**.



In the program branch PARAMETER, select the measuring channel to which you have connected the transducers. Confirm by pressing **ENTER**.

Note: This display does not appear if your instrument has only one measuring channel.

- Enter now the parameter of the pipe and of the medium as described in the user's manual. Confirm each selection with ENTER.



At the end of the PARAMETER program branch, the WaveInjector selection list will be displayed. Select the WaveInjector type which you want to install and confirm by pressing **ENTER**.

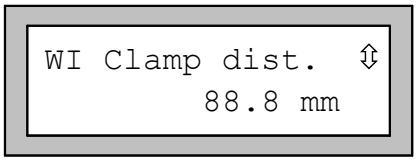
After the parameter input, the main menu is displayed again. You must now start a measurement in order to have FLUXUS calculate and display the installation parameters.

- Start the measurement by selecting the program branch MEASURING. Confirm by pressing **ENTER**.
- Enter the sound path factor (see section "Selection of the Sound Path Factor" in the "Basic Measurement" chapter of the user's manual). Confirm by pressing **ENTER**.



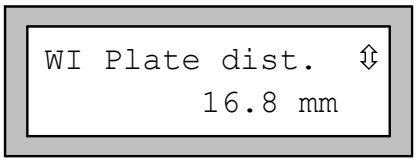
FLUXUS now displays the transducer distance calculated for the select measuring point. Note this distance as well as all distances displayed in the next steps. You will need these for the mounting of the transducers on the pipe. The definition of the various distances is illustrated in Fig. 2.1.

The transducer distance is of crucial importance for the measurement and should be adjusted exactly. All other distances are given in order to facilitate the mounting of the transducers.



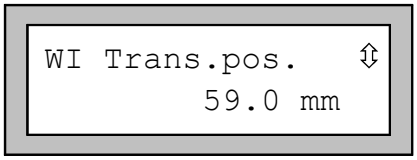
Press key 2 or ↓ once.

The distance to be set between the pipe clamps is displayed.



Press key 2 or ↓ again.

The distance to be set between the coupling plates is displayed.



Press key 2 or ↓ once more.

The transducer position on the coupling plate is displayed.

2.5 Installing the Pipe Mounting Fixtures

The pipe mounting fixtures will be used for the preparation of the pipe at the measuring point as well as for the permanent fixation of the WaveInjector.

Important!	*A good acoustic contact with the pipe is necessary for the measurement. Rust and other deposits absorb ultrasound. The following preparation steps are therefore very important!* • *Clean the pipe at the measuring point.* • *Remove rust and loose paint.* • *Grind off any thick layer of paint.*

2.5.1 Mounting of the WI200 Pipe Mounting Fixture

- Mount the Variofix rail on the pipe at the selected measuring point as described in the supplement "Variofix" of the user's manual. The rail should preferably be mounted on the side of the pipe in order to obtain an horizontal sound path in the pipe. With such a sound path, the solid particles deposited on the bottom of the pipe and the gas pockets developing at the top won't influence the propagation of the ultrasonic signal.

Important!	*The Variofix rail should preferably be fixed on the side of the pipe!*

2.5.2 Mounting of the Pipe Mounting Fixtures WI400S, WI400Q and WI400M

A WI400 pipe clamp is composed of two jaws connected by threaded rods.

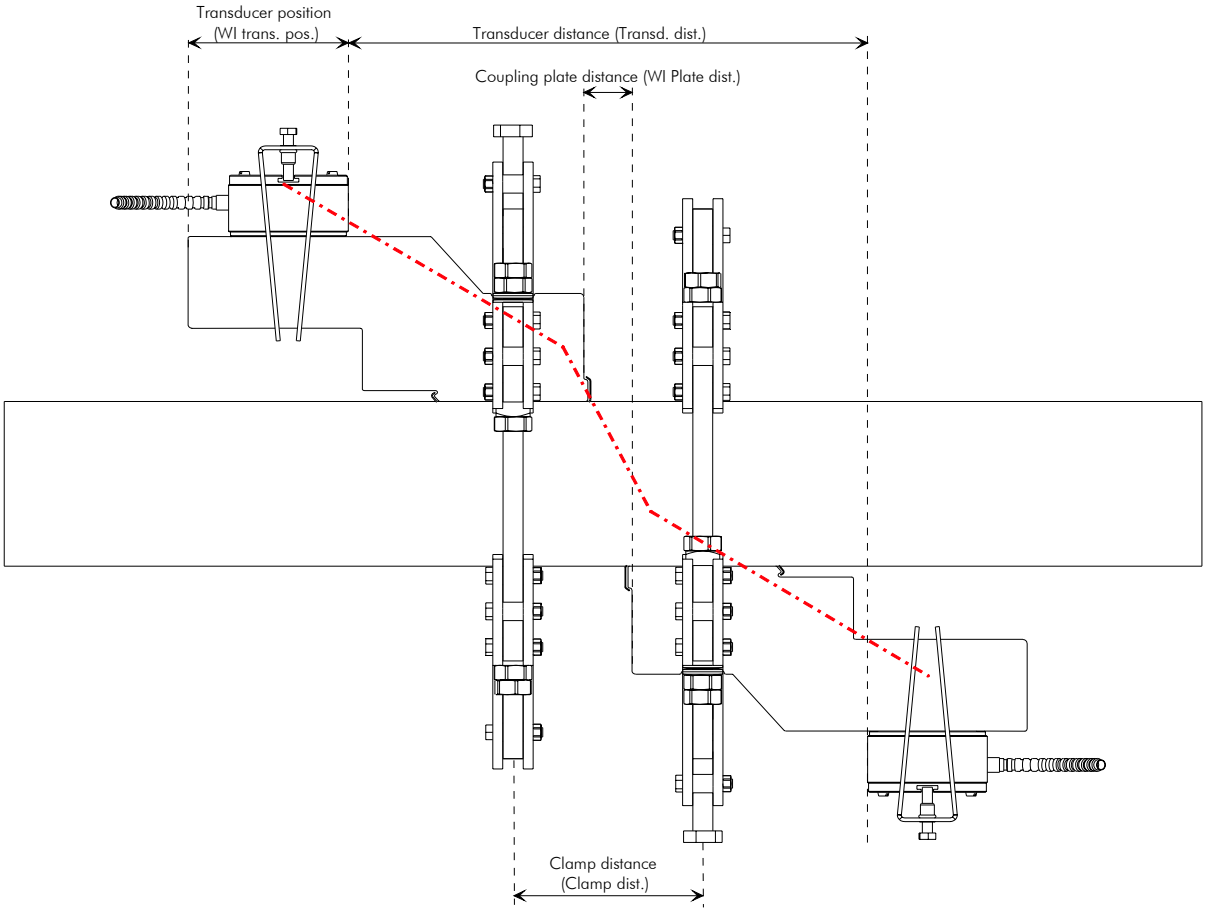


Fig. 2.1: Transducer distance and transducer position. The dashed line indicates the sound path. (Attention, this drawing is rotated! The gaps of the clamps should preferably sit on the side of the pipe.)

- The distance between the two jaws of a clamp should approximately correspond to the pipe diameter. Adjust this distance with the help of the screw nuts.
- Pivot one of the threaded rod out of a jaw to open the clamp.
- Insert the clamp on the pipe and close it by pivoting the threaded rod back to the jaw.
- Position the clamp at the selected measuring point. The gaps of the coupling plates (1) should preferably sit on the side of the pipe (Fig. 2.2) in order to obtain an horizontal sound path in the pipe. With such a sound path, the solid particles deposited on the bottom of the pipe and the gas pockets developing at the top won't influence the propagation of the ultrasonic signal.

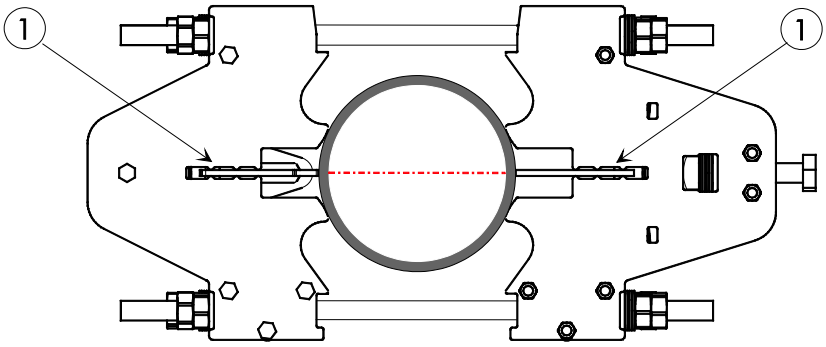


Fig. 2.2: Optimal position of a pipe clamp on the pipe, the sound path (dashed line) is horizontal.

Important!	*The gaps of the coupling plates (1) should preferably sit on the side of the pipe!*

- Tighten the nuts of the threaded rods to fix the clamp to the pipe. Make sure to tighten the screws uniformly on both side in order not to distort the clamp. The distance between the two clamps should approximately be the same on both sides of the pipe.

Important!	*The inserted springs ensure a continuous and constant pressure of the clamps on the pipe even in the case of diameter variations caused by temperature changes. They should not be completely pressed together.* *Allow for enough travel to compensate the expected thermal expansion. One turn of the screw corresponds to a spring travel of approx. 1.5 mm.*

- Mount the second clamp on the pipe at the distance displayed by FLUXUS (`CLAMP DISTANCE`) from the first clamp (see Fig. 2.1). If you haven't taken notice of the clamp distance, you can recall it by starting the measurement as described in section 2.4.

Important!	*Make sure that the coupling plate gaps of both clamps are aligned on each other. To do this, you can for example insert the pipe planer in the clamps instead of the coupling plates.*

2.5.3 Mounting of the Pipe Mounting Fixture WI400L

For pipes with a diameter greater than DN 320, the pipe mounting fixture will be fastened on the pipe with chains (see Fig. 2.3). A WI400L mounting fixture is composed of two clamps (3) which are fixed on the pipe with the help of chains (1). These clamps will be used to fix the coupling plates and the transducer mounting fixtures.

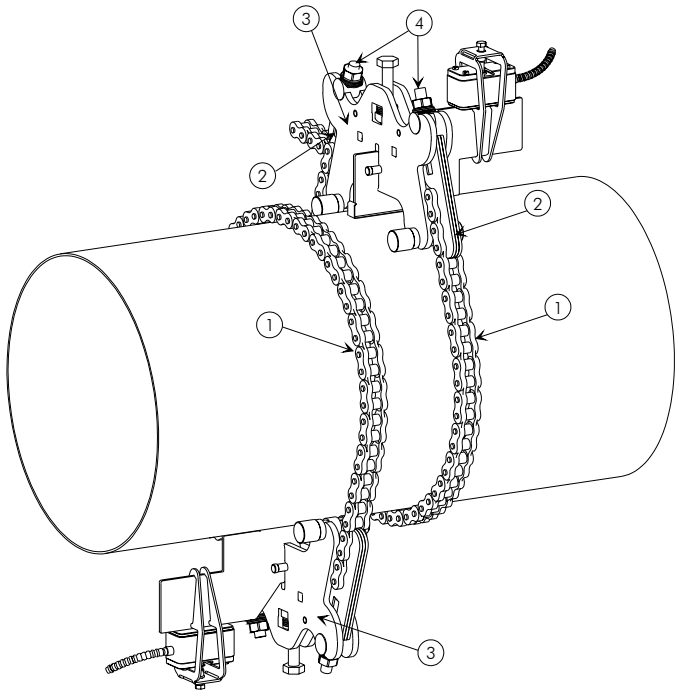


Fig. 2.3: Mounting the WI400L fixture; the coupling plates, the transducers and the transducer mounting fixtures are drawn in gray.

- Place a first clamp on the pipe at the selected measuring point.
- Hook one end of a chain (1) in the chain hook (2) of the clamp.
- Lay the chain around the pipe, pull the chain tight and hook its end on the second chain hook of the clamp as shown in Fig. 2.4.
- Fix the clamp by tightening the screw nuts (4).

Important!	*The inserted springs ensure a continuous and constant pressure of the clamps on the pipe even in the case of diameter variations caused by temperature changes. They should not be completely pressed together.* *Allow for enough travel to compensate the expected thermal expansion. One turn of the screw corresponds to a spring travel of approx. 1.5 mm.*

- Position the second clamp on the pipe at the distance displayed by FLUXUS (`CLAMP DISTANCE`) from the first clamp. If you haven't taken notice of the clamp distance, you can recall it by starting the measurement as described in section 2.4.

The gaps of the coupling plates (4) should preferably sit on the side of the pipe (Fig. 2.4) in order to obtain an horizontal sound path in the pipe. With such a sound path, the solid particles deposited on the bottom of the pipe and the gas pockets developing at the top won't influence the propagation of the ultrasonic signal.

Important!	*Make sure that the coupling plate gaps of both clamps are aligned on each other. To do this, you can for example insert the pipe planer in the clamps instead of the coupling plates.*

- Fix the second clamp on the pipe with a chain as described above.

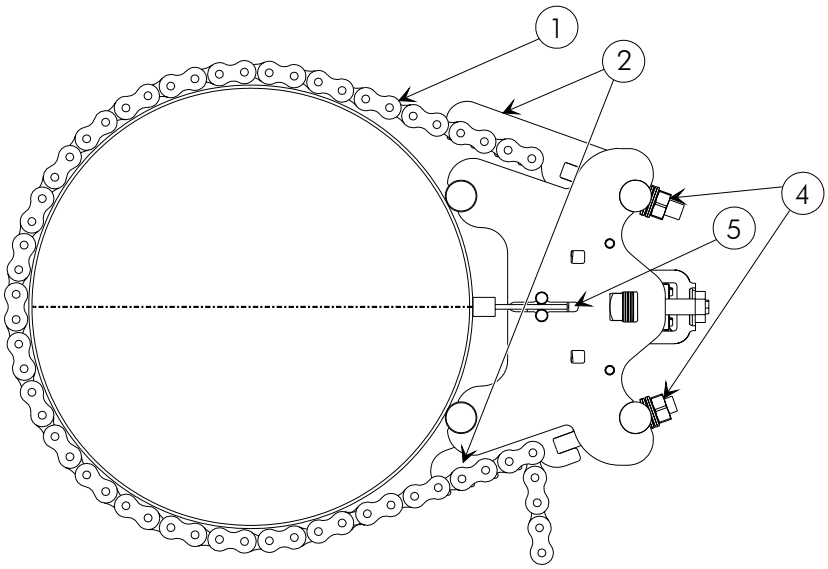


Fig. 2.4: Optimal position of a pipe clamp on the pipe, the sound path (dashed line) is horizontal.

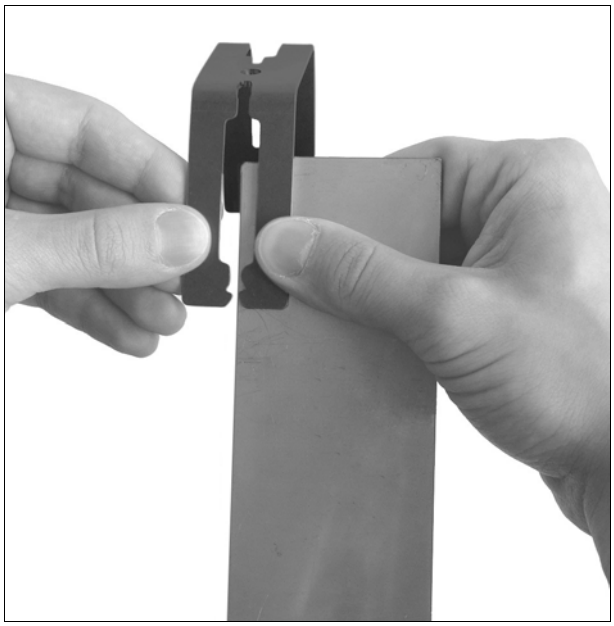
2.6 Preparation of the Measuring Point

The surface of the pipe at the measuring point must be smoothed and lightly flattened in order to obtain a reliable and permanent coupling between the pipe wall and the coupling plate. This will be done with the help of the supplied pipe planer.

2.6.1 Preparation for the WI200

Mount a Variofix adapter on the pipe planer as follows:

- Press the Variofix adapter on the pipe planer exactly as illustrated beside. The blade of the pipe planer must show upward.
- Spread the adapter by pushing its left leg downward with the left hand. Push the pipe planer to the left in the thus created gap.



- Push the Variofix adapter to the middle of the pipe planer as illustrated.



- When the notch of the adapter sits on the nose of the pipe planer, rotate the adapter in direction of the cutter until it snaps in the notch of the pipe planer.



- Insert the pipe planer in the Variofix rail.

2.6.2 Preparation for the WI400

- Insert the pipe planer in the coupling plate gaps of the pipe clamps.

2.6.3 Smoothening of the Pipe Surface

- Move the pipe planer uniformly back and forth while exerting a light pressure on its top. Smooth the pipe until a plane surface of approximately 4 mm is obtained. Make sure that the lower edge of the pipe planer sits on the surface of the pipe.
- Place a piece of fine sandpaper under the pipe planer and grind the smoothed surface.

Important!	*The pipe wall must be smoothed on a length that is at least 150 mm longer than the calculated transducer distance.*

- Remove the pipe planer from the pipe clamp or from the Variofix rail.

2.7 Mounting the Transducers on the Coupling Plates

2.7.1 Preparation of the WI200 Coupling Plates

- Mount the Variofix adapters on the coupling plates as follows:

- Press the Variofix adapter on the coupling plate exactly as illustrated beside.
- Spread the adapter by pushing its left leg downward with the left hand. Push the coupling plate to the left in the thus created gap.

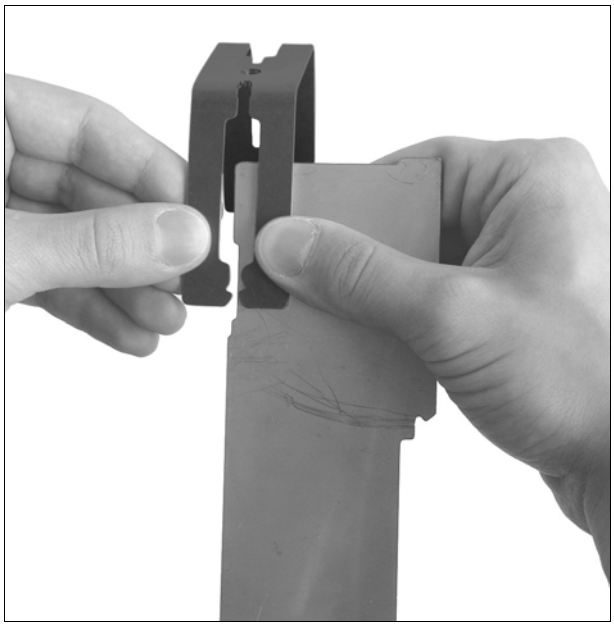


Fig. 2.5: Variofix adapter and coupling plate

- Push the coupling plate into the Variofix adapter as illustrated until it snaps in the notch of the adapter.

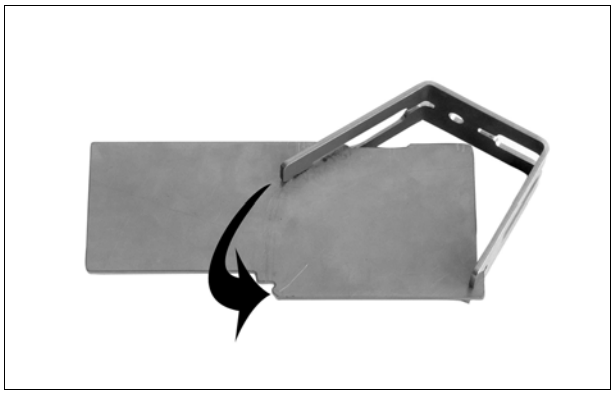


Fig. 2.6: Coupling plate in the Variofix adapter

2.7.2 Mounting the Transducers

- Insert the transducer in the transducer clamping fixture and tighten slightly the fixing screw.

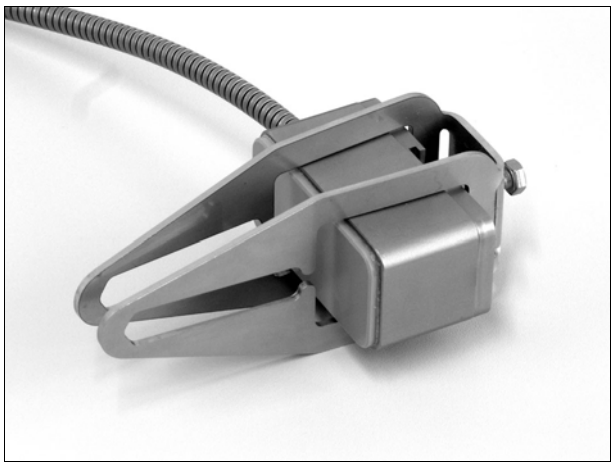


Fig. 2.7: Transducer in the transducer clamping fixture

- Apply a bead of acoustic coupling gel along the pipe coupling surface of the coupling plates.
- Insert the coupling plate in the transducer clamping fixture. The transducer cable should show to the outer side of the coupling plate (see Fig. 2.8).

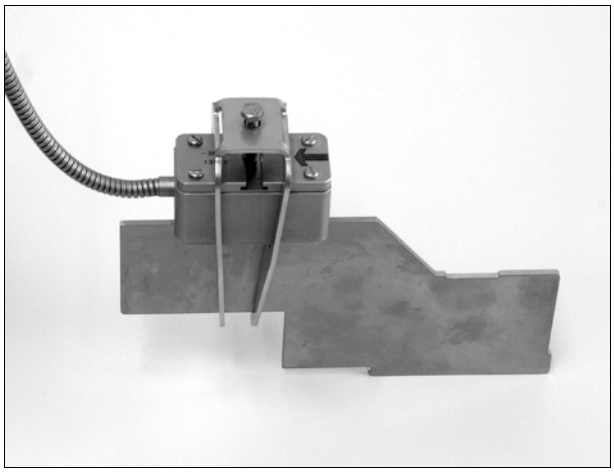


Fig. 2.8: Transducer clamping fixture on the coupling plate

- Position the transducer on the top edge of the coupling plate. The transducer position (`WI Trans. pos.`) was calculated and displayed by FLUXUS after the parameterization. See Fig. 2.1. If you haven't taken notice of the transducer position, you can recall it by starting the measurement as described in section 2.4.
- Tighten the screw to fix the transducer in the clamping fixture.
- Proceed in the same way with the second transducer.

2.8 Mounting the Coupling Plates

Important! *The coupling plates must be mounted in such a way that the front edges are opposite to each other. The engravings on the top of the transducers should form an arrow.*

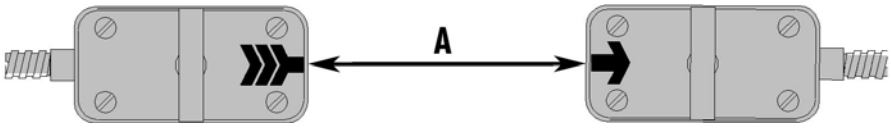


Fig. 2.9: Correct positioning of the transducers with transducer distance **A**

2.8.1 Mounting the Plates in the WI200 Rail

The transducers can now be mounted in the Variofix rail.

- Apply a bead of acoustic coupling gel along the pipe coupling surface of the coupling plates.
- Insert the first coupling plate with transducer and Variofix adapter in the Variofix rail and fix it with the retaining clamp.
- Insert the second coupling plate in the Variofix rail. The second transducer must be positioned at the transducer distance displayed by FLUXUS from the first transducer. The transducer distance is defined as the distance between the front edges of the transducers (see Fig. 2.2). If you haven't taken notice of the transducer distance, you can recall it by starting the measurement as described in section 2.4.

Important! *There should be no air pockets between transducer surface and pipe wall. Make sure that the pressure exerted by the mounting fixtures on the transducers is sufficient.*

2.8.2 Mounting the Plates in the WI400 Clamps

Note: ***Diagonal measurement on small pipes***

The coupling plates distance for diagonal mode measurement on a small pipe might be negative (s. Fig. 2.10). Each jaw of the pipe clamp has a gap in its center so that the front of the coupling plate of one transducer can be inserted in the gap of the pipe clamp of the other transducer.

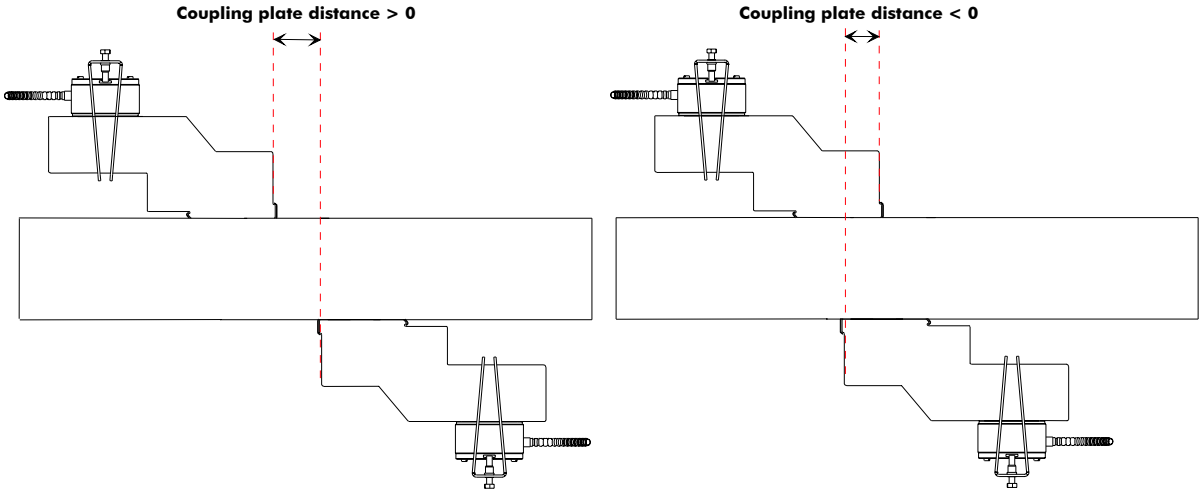


Fig. 2.10: Positive and negative distance between the coupling plates

- Remove the protection sheet of the metallic coupling foil.
- Bend the ends of the coupling foil onto the noses of the pipe coupling surfaces of the coupling plates to fix it.

Important!	*Make sure that the coupling surface of the coupling plate is completely covered by the coupling foil.*

- Insert a coupling plate in the coupling plate gap of a pipe clamp. The cut-out zone of the coupling plate must be situated under the pressure screw of the pipe clamp.
- Tighten the pressure screw until the spring assembly situated in the cut out of the clamp is nearly completely compressed in order to allow for the coupling foil to adapt itself to the pipe surface and to the coupling plate. Afterward, loosen the pressure screw until there is a small space between the springs.
- Insert the second coupling plate in the second pipe clamp. The second transducer must be positioned at the transducer distance displayed by FLUXUS from the first transducer. The transducer distance is defined as the distance between the front edges of the transducers (see Fig. 2.2). If you haven't taken notice of the transducer distance, you can recall it by starting the measurement as described in section 2.4.
- Fix the coupling plate as described above.

Important!	*There should be no air pockets between transducer surface and pipe wall. Make sure that the pressure exerted by the mounting fixtures on the transducers is sufficient.*

Note:	*The coupling plates can only be shifted after they have been removed completely.*

3 Starting the Measurement and Optimizing the Transducer Distance

- Now, go back to the flowmeter. Confirm the displayer transducer distance with ENTER. If the transducer distance is not displayed anymore, start the measurement again by selecting the program branch MEASURING, then confirm the displayed sound path with ENTER. The transducer distance is displayed again.
- The transducer distance can now be optimized as described in the section "Positioning the Transducers" of the user's manual. To shift the transducers, loosen the pressure screw of the transducer clamping fixture.

Important!	*The transducer should not be moved further than ± 5 mm from the specified transducer position.*

- After the optimization, fix both transducers by tightening the screws of the transducer clamping fixtures.

You will find detailed information about the measurement in the user's manual of FLUXUS.

4 Insulation

The WaveInjector fixture should not be thermally insulated. The insulation would reduce the cooling effect of the coupling plate, so that the temperature range of the transducers might be exceeded. If the pipe must be insulated, there should be no contact between the insulation and the WaveInjector. Make sure to respect the minimum distances given in Fig. 4.1.

If the pipe is heat traced, a direct contact between the heating and the parts of the WaveInjector should be avoided. Make sure that the WaveInjector is installed at an adequate distance of the heating or use an insulation.

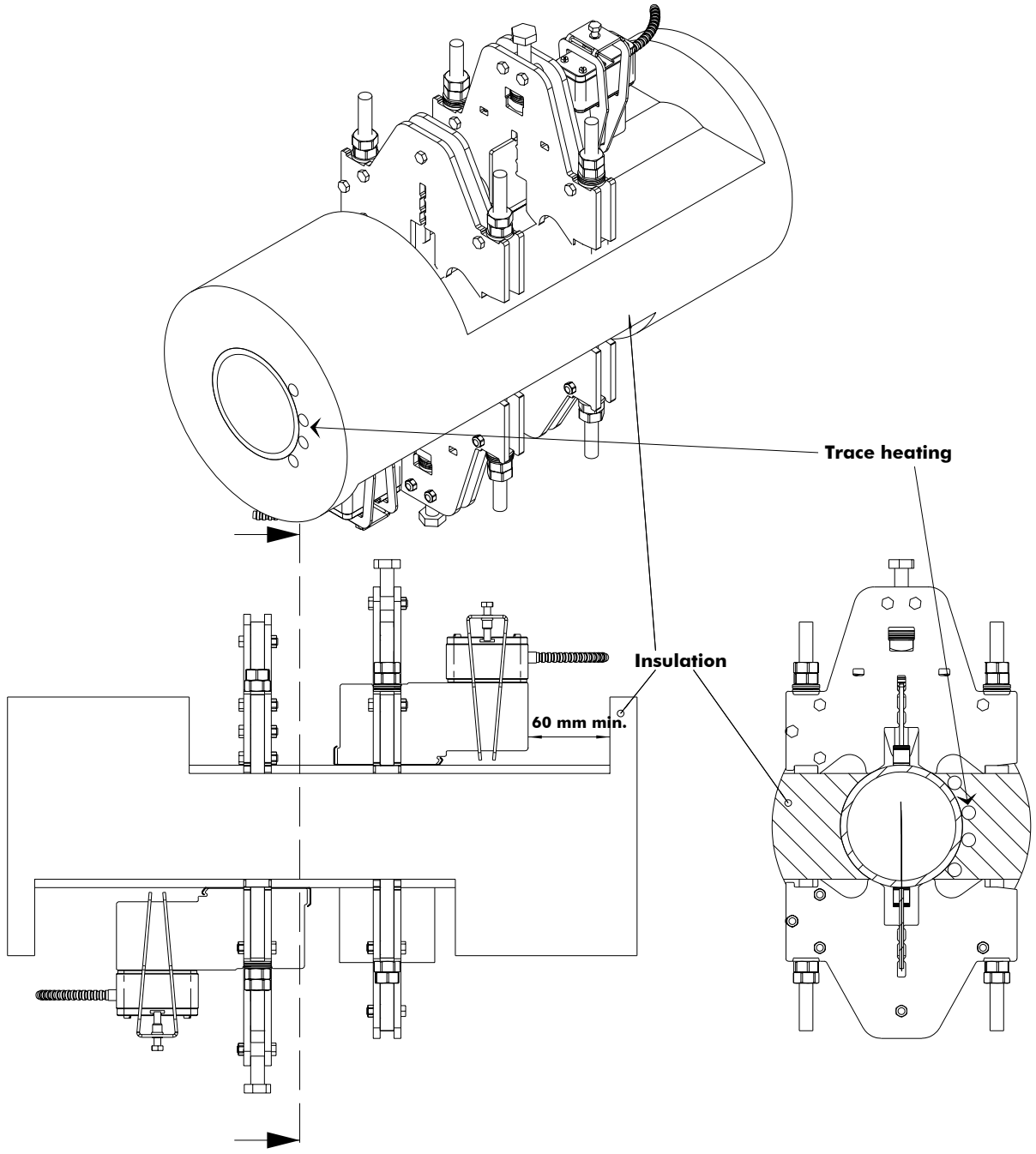


Fig. 4.1: Minimum distance for the insulation

5 Technical Data

WaveInjector®

Type WI-200	
Transducers:	M4N Ex, Q4N Ex
Temperature range:	0°C to 200°C
Diameter range:	40 mm to 600 mm
Dimensions with mounted transducers:	(140 x 100 x 40) mm
Material:	Coupling plate: stainless steel Pipe clamp: stainless steel 4301
Coupling:	FLEXIM ultrasonic coupling gel for high temperatures
Mounting:	with the Variofix system
Type WI-400	
Transducers:	all M and Q transducers
Temperature range:	20°C to 400°C
Diameter range:	40 mm to 600 mm
Dimensions with mounted transducers:	(190 x 130 x 40) mm
Material:	Coupling plate: stainless steel Pipe clamp: galvanized steel
Coupling:	Metal foil
Mounting:	WaveInjector pipe clamps
WaveInjector® Pipe Clamps	
Pipe outer diameter:	WI-400S: 40 mm ... 130 mm
	WI-400Q: 80 mm ... 230 mm
	WI-400M: 80 mm ... 380 mm
	WI-400L: 120 mm ... 530 mm
	>530 mm on request

Temperature Range

