PROCESS AUTOMATION

Manual

KF□□-UFT-(Ex)2.D

ROTATION DIRECTION INDICATOR

AND CONSTANT SPEED MONITOR

ISO9001

PEPPERL+FUCHS

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1 Symbols used in this document

Warning

This symbol indicates a warning about a possible danger.
In the event the warning is ignored, the consequences may range from personal injury to death or from damage to equipment to destruction.

Attention

This symbol warns of a possible fault.
If the instruction given in this warning is not heeded, the device and any plant or systems connected to it could develop a fault or even fail completely.

Note

This symbol brings important information to your attention.

2 Overview

2.1 Application

Devices of the K system of Pepperl+Fuchs serve as signal transmission between the field devices and the process control system / control.

Devices identified with "Ex“ in the type designation are thus suitable for connecting to field devices out of the area subject to the danger of explosion. Field circuits for these devices are intrinsically safe and are galvanically isolated from non-intrinsically safe currents. These devices thus form the electronic separation between the area of a system subject to the danger of explosion and the secure area.

Economical devices without Ex identification can be used for transferring signals between field devices in the secure area and the process control system / control unit.

Typical cases for KF□□-UFT-(Ex)2.D devices of the K system (UFT for short) are rotation direction monitoring and synchronization monitoring (monitoring for slip).

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2.2 Variants

The following variants of the UFT are available:

KF□□-UFT-□□2□□

.D = with control panel

without point and letters = without control panel

Ex = for connection of field devices in areas exposed to danger of explosion

Without identifier letters = for connection of field devices in the secure area

D2 = with a 24 V DC power pack (green cover on the output side); for power supply through the power rail with collective fault messaging, please see the Pepperl+Fuchs catalog "DIN-Rail Housing“ or the catalog on CD.

U8 = with an omnivoltage power pack that allows for a power supply with from 20 V DC to 90 V DC and 48 V AC to 253 V AC without switching and making any allowance for polarity (gray cover on the output side)

2.3 Inputs and outputs

A UFT of the K system from Pepperl+Fuchs has

- two **inputs** for connecting field devices.
  - In the case of the KF□□-UFT-Ex2.D these inputs are intrinsically safe (blue terminal blocks).
  - In the case of the KF□□-UFT-2.D these inputs are not intrinsically safe (green terminal block).

  You can connect either NAMUR sensors or bounce-free contacts.
- Four **outputs**, specifically
  - two relay outputs and
  - two potential-free transistor outputs (serially switching outputs: Input pulses are switched serially 1:1 and can be evaluated in the process control system / in the control system. The UFT is used as a separator between intrinsically safe and non-intrinsically safe circuits).
- one non-intrinsically safe reset input and one non-intrinsically safe hold input

Inputs
Field device

Outputs
Reset input
Hold input
Power supply

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3 Safety instructions

Warning

KF□□-UFT-(Ex)2.D devices must only be operated by professionals who have been properly trained according to this manual.

Warning

Protection of the operating personnel and the system is only assured if devices are properly used in accordance with their intended purpose. Any other type of operation than what is described in this manual places the safety and functionality of the devices and systems connected to them in question.

Warning

*Devices should only be fitted, connected and configured **outside the hazardous area** by personnel with the appropriate electrical specialization.*

Warning

If malfunctions cannot be eliminated, devices should be taken out of operation and protected from being placed in operation inadvertently. Devices must only be repaired directly by the manufacturer Pepperl+Fuchs. Tampering with or making changes to the devices is dangerous and therefore not permitted. Such actions will render any claim under the warrantee null and void.

Note

The responsibility for the observance to local safety standards lies with the operator.

4 Explosion protection

For matters concerning primary explosion protection, i.e. measures to prevent or restrict formation of a potentially explosive atmosphere, please refer to DIN EN 1127-1 or the corresponding national regulations.

For matters concerning secondary explosion protection, i.e. measures to prevent ignition by electrical apparatus of a potentially explosive atmosphere, Pepperl+Fuchs are happy to provide their “Ex-Protection Manual” free of charge. Please consider in particular DIN EN 60079-10,
DIN EN 60079-14, DIN EN 50014 and DIN EN 50020 or the corresponding national specifications. Requirements for the USA are listed in the Explosion Protection manual, Chapter 9. Pepperl+Fuchs also offers a video and a seminar on the topic of "Instrinsic Safety".

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5 Mounting and Connection

5.1 Mounting

The layout of KF□□-UFR-(Ex)2.D units corresponds to protection type IP20. Accordingly, these converters must be protected from adverse environmental conditions (water, small foreign objects).

Devices of the K system of Pepperl+Fuchs and thus KFD□□-UFT-(Ex)2.D units as well can be mounted on a 35-mm DIN rail in accordance with EN 50022. To do this, simply snap the devices on **vertically** . Never attach them on a slant or diagonally from the side.

Additional possibilities for mounting, e.g. using the “Power Rail”, can be found in the “DIN-Rail Housing” catalog from Pepperl+Fuchs or on the CD catalog.

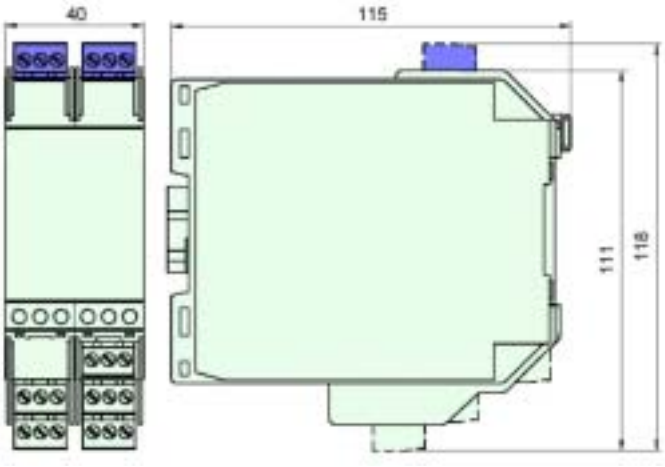

Figure 5.1: Dimensions of the KF□□-UFT-(Ex)2.D in mm

5.2 Connection

Removable terminals of the KF model line simplify the connection process and switch cabinet design considerably. If maintenance service is required, they make it possible to replace devices quickly and without errors. Screws can be used for terminal connections, or they can be self-opening. They are designed with ample space for making connections and for a conductor cross section of up to 2.5 mm². They also have coded

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plugs, making it impossible to mix them up.

Intrinsically safe field circuits can be connected to the **blue** terminals 1 / 3 and 4 / 6 of the KF□□-UFT-Ex2.D. These circuits may be directed to the area subject to the danger with circuits according to DIN EN 60079-14 .

Non-intrinsically safe field circuits can be connected to the **green** terminals 1 / 3 and 4 / 6 of the KF□□-UFT-2.D.

Terminals 2 and 5 remain free in both cases.

In both cases you can connect:

- a sensor in accordance with DIN EN 60947-5-6 (NAMUR)
- a bounce-free contact
- a bounce-free contact with parallel resistor
- a bounce-free contact with series and parallel resistor

The function of the remaining green terminals is as follows:

- Terminals 7 - 9: free
- Terminals 10-12: Relay 1
- Terminals 13 / 14: reset input
- Terminals 14 / 15: hold input
- Terminals 16-18: Relay 2
- Terminals 19 / 20: Transistor output 1 (serially switched output for Input 1: Input pulses are switched 1:1 to the transistor output and can be evaluated in the process control system / in the control system. The UFT is used as a separator between intrinsically safe and non-intrinsically safe circuits).
- Terminals 21 / 20: Transistor output 2 (serially switched output for Input 2)
- Terminals 23 / 24: Power supply (22 free)

The exact terminal composition can be found in the data sheet.

5.3 Front

The following components are on the front of the UFT (see illustration above):

- LED IN CHK 1 (yellow / red) and LED IN CHK 2 (yellow / red) for displaying pulses from inputs (flashing yellow at a fixed cycle), from an input fault (flashing red), a sensor fault (permanently red)or from a device malfunction (continuous red)
- Green PWR LED, to indicate the presence of the supply voltage
- LED OUT 1 (yellow), LED OUT 2 (yellow), LED OUT 3 (yellow) und LED OUT 4 (yellow) for displaying Relay 1 active, Relay 2 active, Transistor 1 active and Transistor 2 active

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- Display for slip- and rotation direction indication and for the indication in the parameterization mode as well as four keys for parameterization of the UFT

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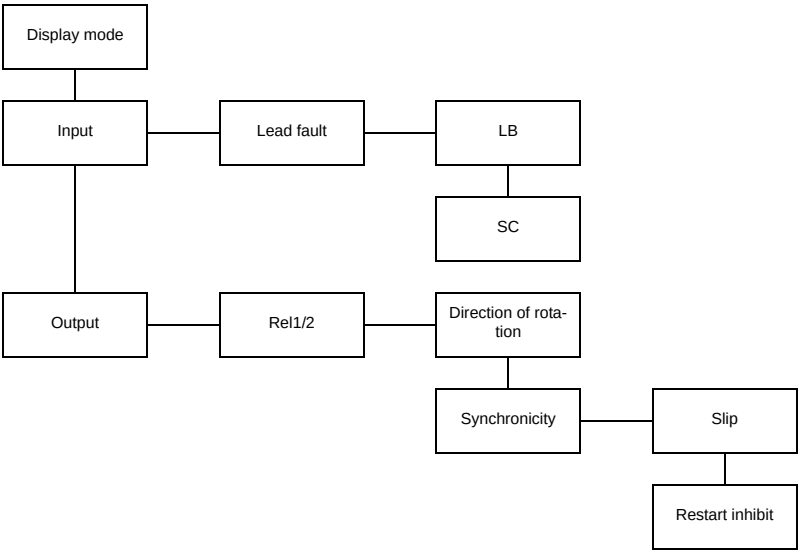
6 Menu overview

The main purpose of the following illustrating is to provide you with a quick orientation if you are already familiar with how to set parameters using the control panel. For a detailed description of operating steps, please refer to chapter 7.



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7 Working with device data

7.1 Display mode

During **normal operation** , the first line of the display shows *run*.

If the rotation direction monitoring function is activated (see chapter 7.4 and chapter 7.5), the following display appears in the second line:

- for right (clockwise) rotation: ◁ ▶
- for left (counterclockwise) rotation: ◀ ▷

If the synchronization monitoring function is activated (see chapter 7.4 and chapter 7.6), a bar graph appears in the second line of the display showing the current slip.

If a **fault** occurs, one of the following messages is displayed until the fault is corrected:

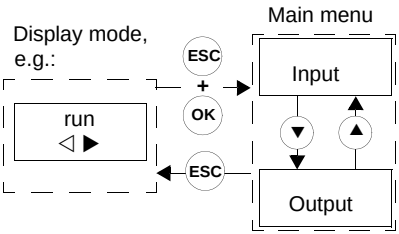
- *Err Device error*
- *Err SENS* for a sensor failure (see chapter 7.5.1 and chapter 7.6.1)
- *Err SC for a lead short circuit*
- *Err LB for lead breakage*

Selection and requirements of the error signals *Err LK* / *Err LB* see chapter 7.3.

All switch outputs always revert to a state with no current (possible exception: relay 1 at synchronisation monitoring and signal at the hold input, see chapter 7.6.3).

If the restart inhibit has been triggered (see chapter 7.6), but the device is continuing in normal operation, the message *restart inhibit* will be displayed.

7.2 Main menu



To go from display mode to the main menu, press the *ESC* key **and** the *OK* key **at the same time for** about 1 second.

The main menu consists of two 2 menu options (*Input* and *Output*). You can switch back and forth between these with the ▲ and ▼keys. You can use the *ESC* key to go back from the main menu to display mode at any time.

If 10 minutes elapse without a key being pressed in configuration mode, the device switches automatically back to display mode.

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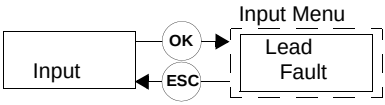
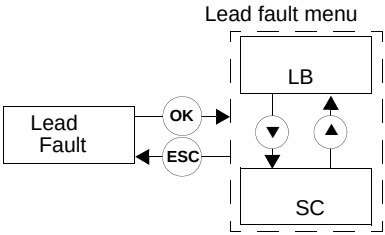
7.3 Input



You can go from the *Input* menu item of the main menu to the Input menu with the *OK* key.

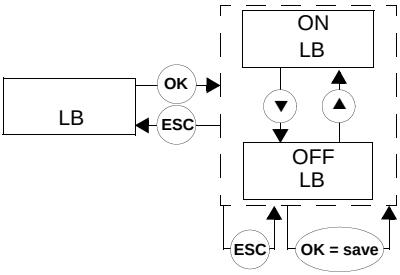
This menu consists only of the *Lead fault* menu item. You can use the *ESC* key to go from the Input menu back to the main menu at any time.



You can go to the lead fault menu by pressing the *OK* button on the *Lead fault* menu item.

This consists of 2 menu item (*LB* for lead break and *SC* for short circuit). You can switch back and forth between them with the ▲ and ▼ keys.

You can return from the Lead fault menu back to the Input menu at any time by pressing the *ESC* key.



From the *LB* menu item in the Lead fault menu, you can use the *OK* button to select lead break monitoring for the sensor inputs (*ON* or *OFF*). The setting that is selected applies to **both** inputs.

If a mechanical (bounce-free) contact is connected as a sensor, a corresponding parallel resistor must be present for lead break monitoring.

The setting can be modified as follows:

- The current selection is displayed with a flashing light. You can use the ▲ and ▼ keys to switch back and forth between these options. If you do not press either the ▲ or the ▼ key, the value that was just selected will be displayed.
- If you press the *ESC* key, the old value flashes again.
- If you press the *ESC* key again, the program will return you to the previous menu without making any changes.
- If you press the *OK* key when an option is flashing, the corresponding value is stored and the option stops flashing.
- You can then use the *ESC* key to return to the previous menu.

You can select short circuit monitoring (*SC*) for **both** sensor inputs in exactly the same way.

If a mechanical (bounce-free) contact is connected as a sensor, a corresponding series resistor must be present for short circuit monitoring.

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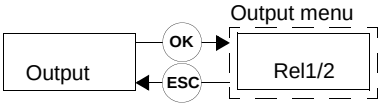
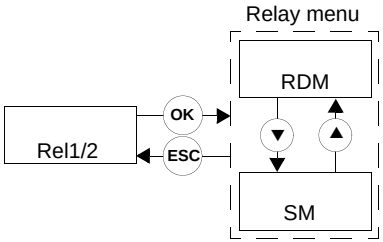
7.4 Output



You can enter the Output menu by pressing *OK* on the *Output* menu item in the main menu.

This menu consists only of the menu item *Rel1*/*2*. You can use the *ESC* key to go from the Output menu back to the main menu at any time.



You can enter the Relay menu by pressing the *OK* key on the *Rel1/2* menu item in the Output menu. This menu consists of 2 menu items (*RDM* for rotation direction monitoring and *SM* for synchronization monitoring). You can switch back and forth between them with the ▲ and ▼ keys.

You can use the *ESC* key to go back to the Output menu at any time from the Relay menu.

The activated function of the Relays is indicated by *On*. If you would like to activate another function, bring it up with the ▲ and ▼ keys and click on the *OK* button twice. After the first *OK* you can abort with *ESC*.

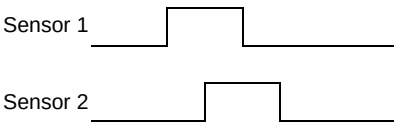
7.5 Output: Rotation direction monitoring

The signals on Input 1 **and** Input 2 are evaluated for this function. Connect two sensors to the two inputs that return signals that are offset by 90° and interleaved (see illustration).

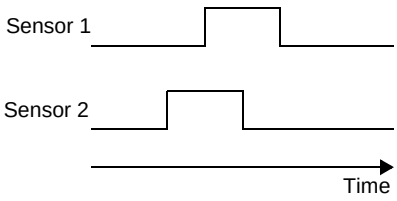
If rotation direction monitoring is activated (*On*), the UFT behaves as follows:

- With clockwise motion Relay 1 is de-energized and Relay 2 is energized.
- With counterclockwise motion Relay 1 is energized and Relay 2 is de-energized.
- The UFT switches over when it has recorded 3 pulses in the other direction.

Clockwise motion ◁ ▶:



Counterclockwise motion ◀ ▷:



7.5.1 Rotation direction monitoring: sensor failure

Both sensors have to deliver pulses for rotation direction monitoring. If a sensor fails, a sensor failure is detected to three missing pulses:

- The LED for the defective input illuminates permanently red.
- *Err* and *SENS* will be shown on the display.

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- Both relais are de-energised.
- The serially switched output for the defective input is switched off.

If both sensor signals are available again, the error is extinguished. The UFT enters into its normal function.

7.5.2 Rotation direction monitoring: reset to left-hand rotation

For the restart of a plant, e.g. after switching off the drive, you can use the reset input (terminals 13/14):

- If the terminals 13/14 are short circuited, the starting state counterclockwise motion is activated (relay 1 energized, relay 2 de-energized). This reset function is edge-triggered.
- *Reset* is indicated for approx. 2 seconds in the display.
- A sensor failure (see chapter 7.5.1) is extinguished.
- After three pulses in the opposite direction another change of the rotation direction is signaled.

Exception: If a lead breakage or a lead short circuit has been detected before the reset (see chapter 7.3), both relais remain de-energized.

7.6 Output: Synchronization monitoring

The signals on Input 1 **and** Input 2 are evaluated for this function. Connect two sensors to both inputs that will return the frequencies to be compared, for example two sensors that measure the speeds of the two sides of a coupling. Connect the sensor at the driving end of the coupling to input 1.

The pulses counted during a measurement cycle at both of the inputs are monitored for deviations from the synchronicity, i.e. for slip. This slip always refers to input 1. It is defined as follows:

$$\frac{[\text{Pulses input 1} - \text{Pulses input 2}]}{\text{Pulses input 1}} \bullet 100\%$$

In other words:

- If more pulses are counted at input 1 than at input 2, then the slip is
- If more pulses are counted at input 2 than at input 1, then the slip is

Examples:

- At input 1 100 pulses are counted per measurement cycle, at input 2 90 pulses per measurement cycle. The slip is then 10%.
- At input 1 100 pulses are counted per measurement cycle, at input 2 110 pulses per measurement cycle. The slip is then also 10%.

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$$\left(1 - \frac{\text{Pulses Input 2}}{\text{Pulses Input 1}}\right) \bullet 100\%$$

$$\left(\frac{\text{Pulses Input 2}}{\text{Pulses Input 1}} - 1\right) \bullet 100\%$$

If synchronization monitoring is activated (*On*), the UFT behaves as follows:

- If the slip is greater than the value set in the corresponding parameter (see chapter 7.6.5), the relay 1 is de-energized. Otherwise it is energized.
- If restart inhibit has been selected (see chapter 7.6.5), relay 1 will not be energized again after being de-energized if the slip is less than the value set in the corresponding parameter.

  Restart inhibit can be reset with the *ESC* key or with a signal on the reset input (Terminals 13/14).
- Relay 2 is used as fault indicator: Under normal conditions it is energized and falls in case of a fault (device error; sensor fault, see chapter 7.6.1; lead-breakage, lead short circuit, if the monitoring is selected, see chapter 7.3).

7.6.1 Synchronisation monitoring: sensor failure

If the frequency at input 1 falls to under 10% of the frequency of input 2, a sensor failure at input 1 is indicated:

- The LED IN CHK 1 illuminates permanently red.
- *Err* and *SENS* will be shown on the display.
- If the hold function is active (see chapter 7.6.3), relay 1 keeps the last condition, otherwise it is de-energized.
- Relay 2 (fault indicator) is de-energized.
- The serially switched outputs are switched off.

As soon as the frequency at input 1 exceeds again 10% of the frequency of input 2, the fault is extinguished. The UFT enters into its normal function.

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7.6.2 Synchronisation monitoring: Reset

If you short circuit the reset input (terminals 13/14) of the function synchronisation monitoring, the effect is the following:

- Relay 1 is energized and this way a slip alarm is reset. This reset function is edge-triggered.
- *Reset* is indicated for approx. 2 seconds in the display.
- If the restart inhibit has been activated before (see chapter 7.6), it is reset.
- A sensor failure () is extinguished.see chapter 7.6.1

Exception: If a lead breakage or a lead short circuit has been detected before the reset (see chapter 7.3), these reactions remain.

7.6.3 Synchronisation monitoring: hold function

If you short circuit the hold input (terminals
14/15) of the function synchronisation monitoring, the effect is the following:

- In the event of a sensor failure (see chapter 7.6.1), lead breakage or lead short circuit the last state before the failure of the relay 1 is retained (for the selection of the lead fault monitoring see chapter 7.3). This hold function is level controlled, i.e. it is active as long as the terminals 14/15 are short circuited.
- The fault is indicated on the display, via relay 2 (error signal) and for the KFD2-UFT-(Ex)2.D also via the collective error message on the Power Rail.
- If the fault is redressed, relay 1 is again responding to slip. At the beginning, pulses are not yet detected, therefore relay 1 is de-energized at first, i.e. as long as the slip is under the parameterized value. If necessary, the restart inhibit has to be reset(see chapter 7.6).

7.6.4 Synchronisation monitoring: reaction time

The reaction time of the device, thus the de-energizing of relay 1 after exceeded slip, depends on 3 factors:

1.) the frequency at channel 1

2.) the set slip

3.) the ratio of the effective slip to the set slip

Zu 1.) The higher the frequency at channel 1, the faster the reaction to the slip exceeding. In case of 100 Hz at channel 1 the reaction is consequently 10 times faster than in case of 10 Hz.

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Zu 2.) The reaction time depends with a high non-linearity from the adjustedslip. Therefore it has to be given in a table:

Table 7.1: Reaction times, if the adjusted slip is exceeded by 20%:

Adjusted slip	Reaction time in seconds	Example: Freq(Kana11)=100Hz	Example: Freq(channel 1) = 10Hz
50%	*< 12 / Freq(channel 1)*	*for Freq(channel 2) = 40Hz < 0,12 sec*	*for Freq(channel 2) = 4Hz < 1,20 sec*
25%	*< 24 / Freq(channel 1)*	*for Freq(channel 2) = 70Hz < 0,24 sec*	*for Freq(channel 2) = 7Hz < 2,40 sec*
20%	*< 30 / Freq(channel 1)*	*for Freq(channel 2) = 76Hz < 0,30 sec*	*for Freq(channel 2) = 7,6Hz < 3,00 sec*
10 %	*< 60 / Freq(channel 1)*	*for Freq(channel 2) = 88Hz < 0,60 sec*	*for Freq(channel 2) = 8,8Hz < 6,00 sec*
5%	*< 120 / Freq(channel 1)*	*for Freq(channel) = 94Hz < 1,20 sec*	*for Freq(channel) = 9,4Hz < 12,00 sec*
4%	*< 150 / Freq(channel 1)*	*for Freq(channel 2) = 95,2Hz < 1,50 sec*	*for Freq(channel 2) = 9,52Hz < 15,00 sec*
2%	*< 300 / Freq(channel 1)*	*for Freq(channel 2) = 97,6Hz < 3,00 sec*	*for Freq(channel 2) = 9,76Hz < 30,00 sec*
Others	*< 600 / Freq(channel 1)*	*< 6,00 sec*	*< 60,00 sec*

Zu 3.) The reaction time is longest, if the effective slip is only little larger than the adjusted slip, in a way that a switching event is released (see table). If the effective slip is significantly larger, the reaction time is shorter. If, in an exceptional case, the frequency at channel 2 breaks completely down, the following table is decisive:

Table 7.2: Reaction times, if there is an abrupt break down of the frequency at channel 2:

Adjusted slip	Reaction time in seconds	Example: Freq(Kana11)=100Hz	Example: Freq(channel 1) = 10Hz
50%	*< 7 / Freq(channel 1)*	*for Freq(channel) = 0Hz < 0,07 sec*	*for Freq(channel) = 0Hz < 0,70 sec*
25%	*< 9 / Freq(channel 1)*	*for Freq(channel 2) = 0Hz < 0,09 sec*	*for Freq(channel 2) = 0Hz < 0,90 sec*
20%	*< 11 / Freq(channel 1)*	*for Freq(channel 2) = 0Hz < 0,11 sec*	*for Freq(channel 2) = 0Hz < 1,10 sec*
10 %	*< 11 / Freq(channel 1)*	*for Freq(channel 2) = 0Hz < 0,11 sec*	*for Freq(channel 2) = 0Hz < 1,10 sec*
5%	*< 21 / Freq(channel 1)*	*for Freq(channel 2) = 0Hz < 0,21 sec*	*for Freq(channel 2) = 0Hz < 2,10 sec*
4%	*< 26 / Freq(channel 1)*	*for Freq(channel 2) = 0Hz < 0,26 sec*	*for Freq(channel 2) = 0Hz < 2,60 sec*
2%	*< 51 / Freq(channel 1)*	*for Freq(channel 2) = 0Hz < 0,51 sec*	*for Freq(channel 2) = 0Hz < 5,10 sec*
others	*< 201 / Freq(channel 1)*	*< 2,01 sec*	*< 20,10 sec*

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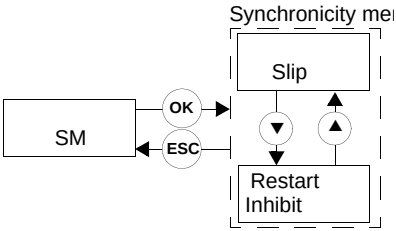
7.6.5 Synchronization monitoring: Parameterization

If the synchronization monitoring function is activated (*On*), you can use the *OK* key to go from the *SM* menu item in the Relay menu to the Synchronicity menu. If you reactivate the synchronization monitoring function (see chapter 7.4), you will be taken immediately to the Synchronicity menu after clicking twice on the *OK* key.

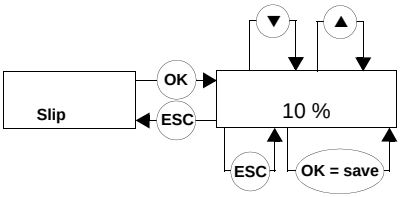


The synchronicity menu consists of two 2 menu options (*Slip* and *Restart inhibit*). You can switch back and forth between these with the ▲ and ▼ keys.

You can use the *ESC* key to go back to the Relay menu at any time from the Output menu.

Slip

You can use the *OK* key to set the value for the amount of slip tolerated from the *Slip* menu item in the synchronicity menu. This value can be set in steps of 1% (maximum 90%).



The setting can be modified as follows:

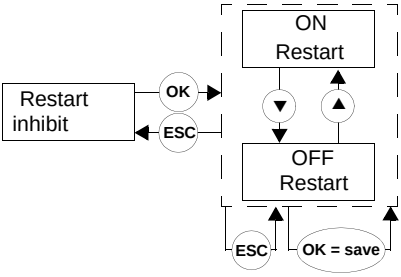
- The current value is displayed with a flashing light. You can use the ▲ and ▼ keys to change this value. If you press the ▲ or ▼ key, the value will change incrementally. If you hold down the ▲ or ▼ key for longer, the setting will "roll" up or down to higher or lower values. If you do not press either the ▲ or the ▼ key, the value that was just set will be displayed.
- If you press the *ESC* key, the old value is displayed again.
- If you press the *ESC* key again, the program will return you to the previous menu without making any changes.
- If you press the *OK* key when an option is flashing, the corresponding value is stored and the option stops flashing.
- You can then use the *ESC* key to return to the previous menu.

Restart inhibit

You can use the *OK* key to select restart inhibit (*ON* or *OFF*) From the *Restart inhibit* menu item in the Synchronicity menu.

On the effect of restart inhibit, see chapter 7.6

The method used to modify this setting is described in chapter 7.3



Date of issue16.12.2002

With regard to the supply of products, the current issue of the following document is applicable:
The General Terms of Delivery for Products and Services of the Electrical Industry, as published by the Central Association of the 'Elektrotechnik und Elektroindustrie (ZVEI) e.V.',
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