

## OPERATING INSTRUCTIONS

### "pulse-generator TB2" Testbox

Generator for generating A and B quadrature signals



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## Safety instructions

### Dear customer, dear user,

This description includes important instructions concerning the installation, function and the operation. This information is therefore an important part of the device. A non-observance can result in damage being caused or the safety of personnel and plant being impaired!

The device is only to be installed and commissioned by an electrical specialist.

If the device is to be used in processes by which a possible malfunction or incorrect operation can pose a risk to personnel and plant, corresponding safety precautions are to be taken in order to avoid this.

The general standard for the construction of switch cabinets in the machine construction industry have validity for the installation.

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## • General technical data

- Simulates the output signals of incremental measuring systems (A, B with 90° phase shifting)
- Output frequency adjustable between 0 and 250 kHz
- Resolution of 0.1 Hz
- Frequency accuracy of 100 ppm
- Simulation of flow metering with VSE flow meters series VS(I)
- Sweep function, which takes the direction of rotations of the most diverse frequency, ranges into account
- Reversible direction of rotation (phase position A/B)
- Adjustable frequency/flow divisions during operation
- Output A, B with HTL level 1–28 V; optional additional differential outputs A<sub>1</sub>/A<sub>2</sub>; B<sub>1</sub>/B<sub>2</sub> with HTL level 10–28 V or RS422 level
- Large distribution voltage range 10–28 V DC
- Connection via a round M12 plug

## • General information

It is not possible to imagine not using incremental measuring systems in almost all industrial areas. This technology is wide-spread for flow metering in fluid engineering and rotational speed counting in motion power engineering. Additional applications are path measuring, position measuring and speed measuring in industrial system solutions.

With the "pulse – generator TB2" testbox from VSE Volumentchnik GmbH, incremental sensor signals or two 90° phase-shifted pulse signals A and B are generated respectively. This pulse generator is able to generate frequencies of between 0.1Hz and 250,000.0Hz. The resolution is 0.1Hz. The incremental rotary encoder signals can either be adjusted by directly entering the frequency or by using a special menu to specify flow meter values from the VS(I) series of VSE flow meters. The construction size, interpolation factor and the corresponding flow unit are taken into account, when generating the flows. An additional menu can be used to run through stipulated frequency ranges. Hereby, the direction of rotation is switched, depending on the set frequency range, i.e. the phase position of both of the quadrature signals A and B is shifted by 90° null.

It is a very useful and inexpensive means for the simulation of incremental encoder signals.

The following tasks can be fulfilled with the assistance of the incremental pulse encoder:

- Qualifying the usage possibilities of a measuring system for the desired application
- Checking of the layout of an incremental measuring system
- Testing the functioning of machine components and control units or evaluation units during the development phase
- Checking of setting parameters of electronic evaluation units or converters without installing the mechanical components (e.g. flow sensors)
- Checking of cabling between the sensory technology and the electronic measuring devices during commissioning
- Simulation of incremental sensor signals, when servicing plants
- Simulation of the flow quantities of VSE flow meters (VS(I) series)
- Checking of incremental measurement data recordings and their dynamics
- Testing the frequency behavior of switchings
- Simple error analysis in case of plant disturbances

## • Description

The "pulse-generator TB2" testbox has three different types of operation or modes:

1. "manual" mode: setting of a frequency between 0.0 Hz and 250,000.0 Hz
2. "VS(!)" mode: setting of a measured flow value, stipulating the VS(!) constructional size, the interpolation factor and the flow unit
3. "sweep" mode: setting of linear sweep ranges between two frequency values

The operation of the "pulse-generator TB2" testbox is quickly understandable and utilizes the simple keypad.

## • The "manual" operating mode

### 1. Description of the "manual" operating mode

The "manual" operating mode enables a direct entering of the user-related frequency. The desired frequency can simply be entered using the numeric keypad. The entered frequency will be stored after it has been acknowledged. The output of the incremental pulses is started and stopped using the separate start/stop key  $\square$ . The direction of rotations can be changed, i.e. the phase position of both of the quadrature signals can be shifted by 90° (see Fig. 1) using the "direction"  $\square$  key. An additional function is provided

by the  $\square$  key, with which the entered frequency can be directly split. If only this key is activated, the frequency is output in the following percentages: 10%, 1%, 100%. In combination with a numeric key, it is possible to enter the frequency in percentages of 10, e.g. pressing the keys  $\square$  and  $\square$  simultaneously results in 60% of the entered frequency being output. The frequency display is updated accordingly.

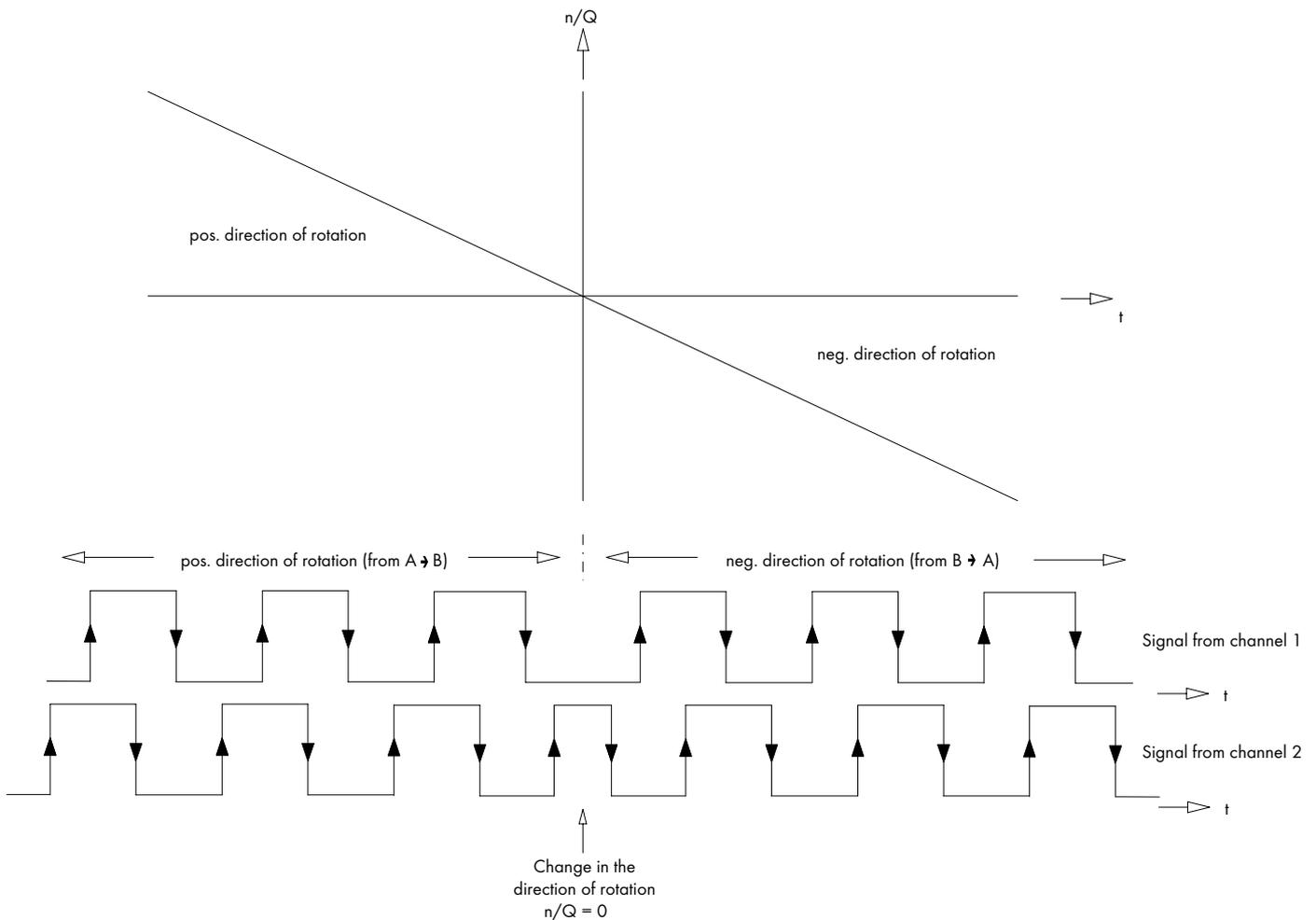


Fig. 1: Change of direction of the quadrature signals

## 2. Using the "manual" mode of operation

The "manual" mode of operation is used as follows:

### General operation of the "manual" mode of operation

 Change between each of the menu items



 Entering the selected menu item



Changing the direction of rotation direction



Enable / Disable of frequency-output start / stop

Mode MANUAL [Start ]

- 100% Frequency

≥FRQ +0001201 Hz

>change Mode VS(!)

Mode of operating display; Status of the frequency output

Displays the current frequency output split

Frequency entry menu item

Mode of operation selection menu item

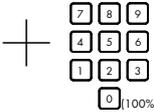


split

Splitting the frequency output 10%, 1%, 100%



split



Splitting the frequency output 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%

### Operation of the "frequency entry" menu item

Mode MANUAL [Start ]

- 100% Frequency

xFRQ +000120.1 Hz

>change Mode VS(!)

Frequency entry menu item



Changing the cursor position



Changing the direction of rotation in the entry direction



Increase the selected number (+1)



Decrease the selected number (-1)



Direct entry of the numbers



Confirmation of the entered frequency value Return to the menu item selection

### Operation of the "mode of operation selection" menu item

Mode MANUAL [Start ]

- 100% Frequency

>FRQ +0001201 Hz

xchange Mode VS(!)

Mode of operation selection menu item



Selection of the mode of operation



Confirmation of the selected mode of operation



Entering the selected mode of operation or return to the menu item selection

## • The “VS(I)” mode of operation

### 1. Description of the “VS(I)” mode of operation

The “VS(I)” (VS(I) flow meter series) mode of operation was especially developed for the “VS(I)” flow sensor system from VSE Volumentechnik GmbH.

Flow meters made by VSE Volumentechnik GmbH measure the volume flow of liquids according to the toothed wheel principle. A pair of very precisely adjusted toothed wheels in the housing constitutes the meter. A signal pick-up system registers the meter rotation free of contact and tooth by tooth. Each tooth is output as a digital pulse. The gaps in the teeth of the meter wheels form meter chambers in the areas in which they are completely enclosed by the housing walls; these chambers digitalize liquid flow depending on their chamber volume. The liquid flow quantity within one meter rotation of a tooth division forms the volume measurement per pulse ( $V_m$ ) and is defined in  $\text{cm}^3/\text{pulse}$ . It identifies the constructional size of a flow meter. The two-channel, incremental output of the digital signals provides a higher measured value resolution and a detection of the flow direction.

An explicit simulation of the flow values of these flow meters is possible in the “VS(I)” mode of operation.

The constructional sizes of the VS(I) are included in a menu item in a selectable tabular form. The corresponding interpolation factor can also be selected, when using VSI flow meters. This is to be programmed with 1, when using the standard VS version. The desired flow is directly entered using the numeric keys. A corresponding flow unit is to be set prior to this. A choice can be made from seven different units:

The flow entry field is adapted in accordance with the selected construction size and unit.

The unit can also be changed during operation by using the “unit”  key. The flow meter value display is changed automatically.

If the unit “Hz” should be selected, the corresponding output frequency is displayed, taking the set frequency split parameter and the IPF factor into account. Furthermore, in this mode it is also possible to have the flow meter value or frequency respectively, displayed as a percentage of the entry, by using the “split”  key or a corresponding key combination (e.g.  and ).



Fig. 2: VSE flow meters

Unit	Display
Liters per minute (l/min)	l/min
Liters per hour (l/h)	l/h
Liters per second (l/s)	l/s
US gallons per minute (USgal/min)	GPM
US gallons per hour (USgal/h)	GPH
US gallons per second (USgal/s)	GPS
Frequency display (Hz)	Hz

Table 1: programmable units

With these options, one is explicitly able to simulate flows in order to set and optimize the evaluation and converter units correspondingly without taking the fluid circulation into operation or having to make an installation.

The construction size VS(I), interpolation factor IPF, flow meter value Q and the flow unit are stored after they have been entered in the device.

## 2. Using the "VS(I)" mode of operation

You will find a detailed description of the usage of the "VS(I)" menu on the following pages.

### General operation of the "VS(I)" mode of operation



Change between each of the menu items



Entering the selected menu item



Changing the flow direction  
direction



Enable / Disable the flow output  
start / stop



Direct changing of the unit  
unit

Mode VS(I) [Stop]

>VS(I) 0.02 >IPF 10

- 90% Flow

≥Q-00001.25 l/min

>change Mode SWEEP

Mode of operation display; Status of the flow output

VS(I) size menu / interpolation factor IPF menu

Current flow output split display

Flow entry menu item

Mode of operation selection menu item



Splitting the flow output 10%, 1%, 100%

split



Splitting the flow output 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%

split



0 (100%)

### Operation of the "VS(I) size" menu item

Mode VS(I) [Stop]

xVS(I) 0.02 >IPF 10

- 90% Flow

>Q-00001.25 l/min

>change Mode SWEEP

VS(I) size menu item



Selection of the size (0,02; 0,04; 0,1; 0,2; 0,4; 1; 2; 4; 10)



Confirmation of the selected VS(I) size  
Return to the menu item selection



### Operation of the "interpolation factor IPF" menu item

Mode VS(I) [Stop]

>VS(I) 0.02 xIPF 10

- 90% Flow

>Q-00001.25 l/min

>change Mode SWEEP

Interpolation factor IPF menu item



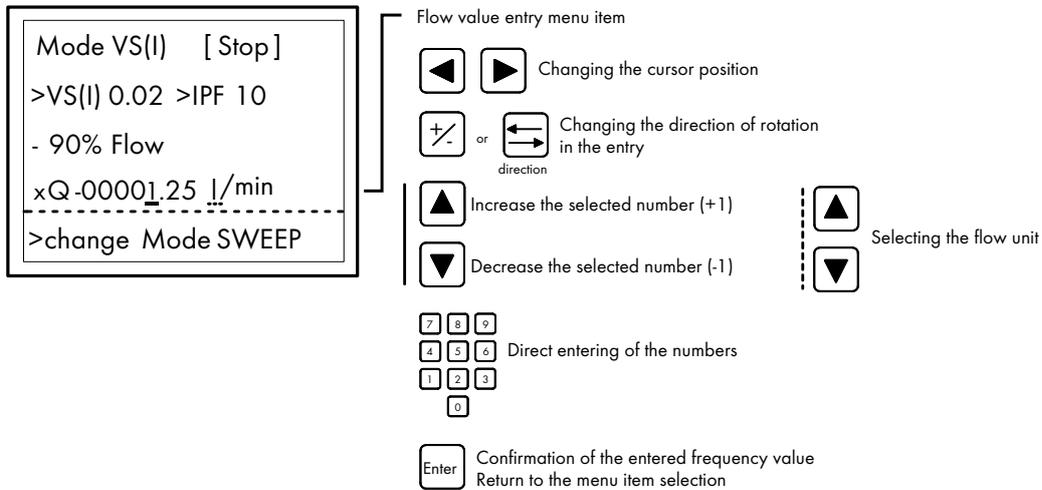
Selection of the IPF (1, 2, 3, 4, 5, 8, 10, 12, 16)



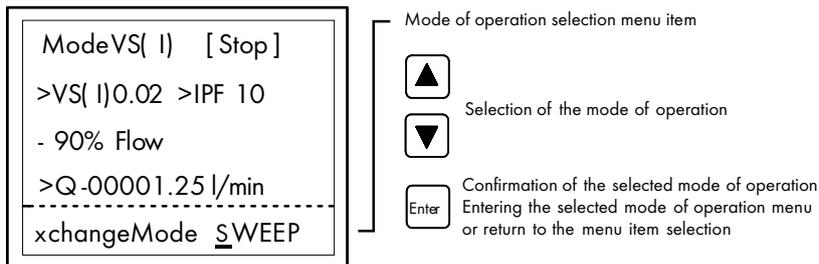
Confirmation of the selected interpolation factor IPF  
Return to the menu item selection



## Operation of the "flow value entry" menu item



## Operation of the "mode of operation selection" menu item



### • The "sweep" mode of operation

#### 1. Description of the "sweep" mode of operation

The "sweep" operation enables the scan or sweep of a fixed range between two frequency values. The start frequency, end frequency and the sweep time are programmed. Different frequency directions can also be selected. One function permits the starting of the sweep process with null or in a null scan respectively. This enables the simulation of the most diverse incremental frequency processes such as a flow characteristic for a servo valve.

The sweep characteristic is linear (ramp). It should, however, be taken into account that the frequency is actually changed **incrementally** and not linear. It should also be taken into account how the device actually reacts if extreme sweep time and sweep range combinations are used. In sweep mode, the software generates a table with 1200 intermediate frequencies, including the stipulated start and end frequencies. In the activated sweep mode, each used frequency has to be extracted from the table and processed. The frequency resolution of the steps depends on the programmed sweep range and the sweep time or sweep rate respectively. A wide sweep range and a fast sweep rate result in a very rough frequency resolution of the steps. Generally speaking, "sweeping" is normally used in context of a measuring data recording or with an oscilloscope, in order to test the frequency behavior of evaluation devices or circuits.

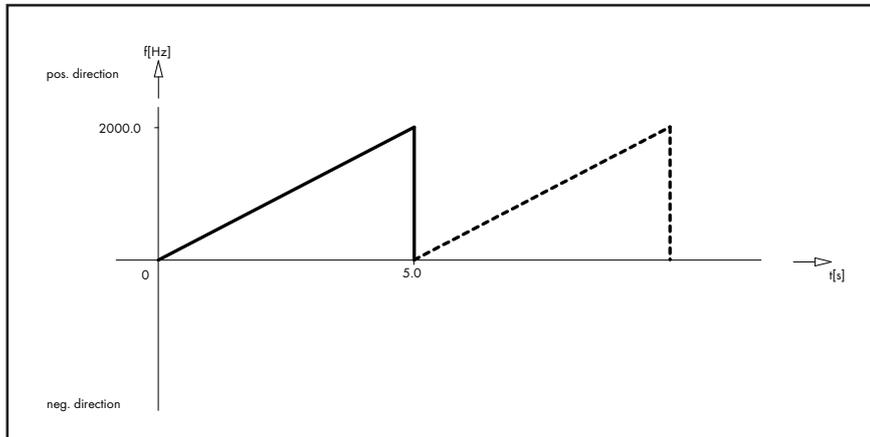
A separate trigger outlet "TRIGOUT" is available for the triggering of oscilloscopes. This trigger outlet changes to low level at the start of the sweep and remains in this status during the first frequency step. The TRIGOUT status returns to high level after the first frequency step has been completed.

The "sweep" mode of operation has the following technical data:

- Sweep simulations of incremental frequency responses with and without changes of direction
- Sweep modes of operation: single sweep and continuous sweep operation due to adjustable loops
- Sweep characteristic: linear
- 4 different incremental sweep modes with two cutoff frequencies can be programmed
- The start and end frequencies can be adjusted infinitely (0.1 ... 250,000.0 Hz) within a range
- Triggering of an oscilloscope or x-y recorder possible due to an additional trigger outlet TRIGOUT
- Sweep direction exchangeable via a mode change-over
- "Sweep-Start" can be adjusted at zero or at „start on zero“
- Sweep time can be infinitely variably adjusted between 0.1 s ... 20.0 s
- A programmable number of loops can be adjusted between 1 and 1000

## 2. Functions of the "sweep" mode of operation

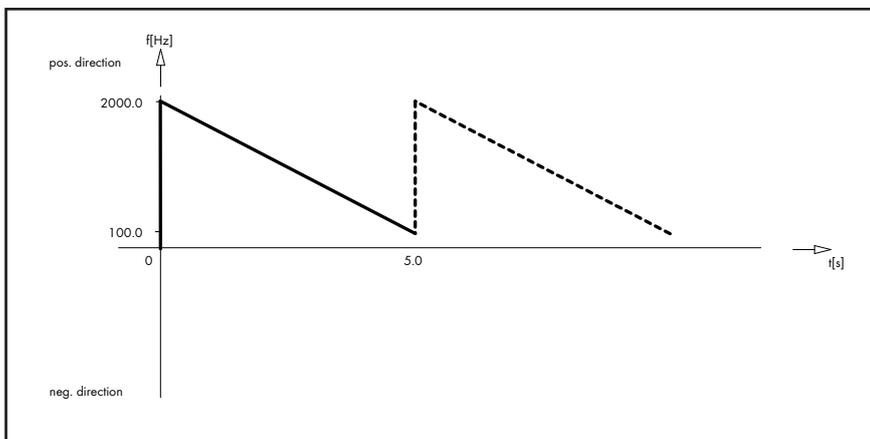
The following "sweep" functions of incremental signals are possible with the "pulse-generator TB2":



### Example 1

Settings:

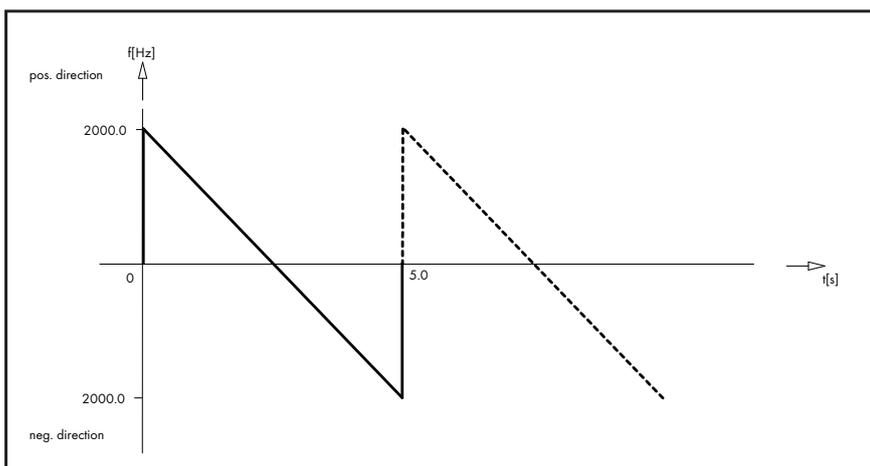
- Sweep UP (FRQ\_1 ==> FRQ\_2)
- FRQ\_1 +000000.0Hz
- FRQ\_2 +002000.0Hz
- Start on zero off
- SweepTime 005.0s
- No. of loops 0002



### Example 2

Settings:

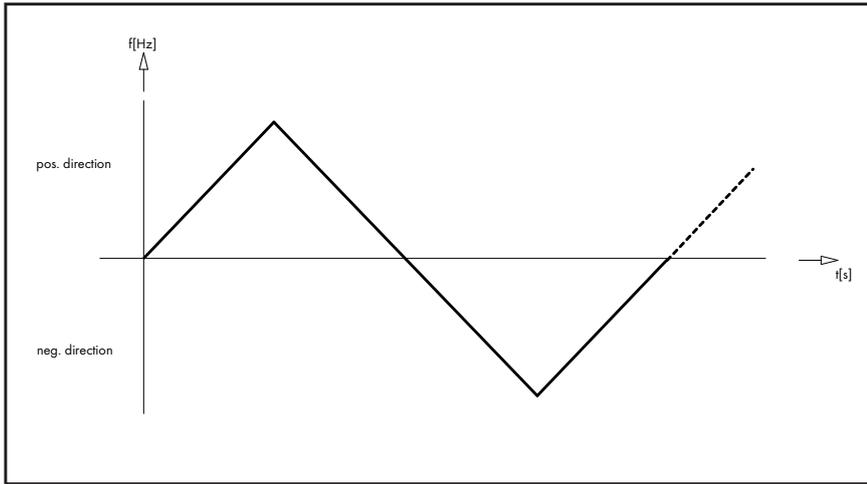
- Sweep DOWN (FRQ\_2 ==> FRQ\_1)
- FRQ\_1 +000100.0Hz
- FRQ\_2 +002000.0Hz
- Start on zero off
- SweepTime 005.0s
- No. of loops 0002



### Example 3

Settings:

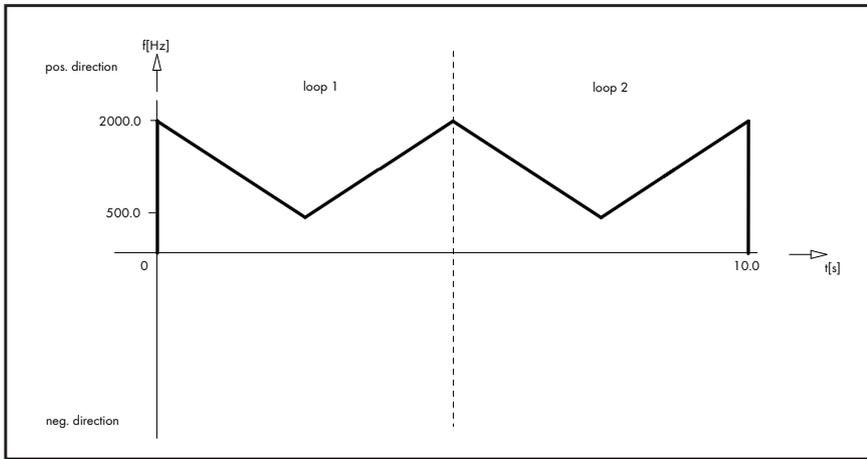
- Sweep UP (FRQ\_1 ==> FRQ\_2)
- FRQ\_1 +002000.0Hz
- FRQ\_2 -002000.0Hz
- Start on zero off
- SweepTime 005.0s
- No. of loops 0002



**Example 4**

Settings:

- Sweep UP/DOWN (FRQ\_1 ==> FRQ\_2 ==> FRQ\_1)
- FRQ\_1 +02000.0Hz
- FRQ\_2 - 02000.0Hz
- Start on zero on
- SweepTime 005.0s
- No. of loops 0002



**Example 5**

Settings:

- Sweep DOWN/UP (FRQ\_2 ==> FRQ\_1 ==> FRQ\_2)
- FRQ\_1 +0500.0Hz
- FRQ\_2 +02000.0Hz
- Start on zero off
- SweepTime 005.0s
- No. of loops 0002

**3. Operating the "sweep" mode of operation**

Adjusting the sweep parameters:

### General operation of the "sweep" mode of operation

	Change between each of the menu items	Mode SWEEP [ Start ] >Sweep UP/DOWN >FRQ_1 -000250.0Hz >FRQ_2 +000250.0Hz ----- >Start on zero off >Sweep Time 000.5s >No. of loops 1000 >change Mode MANUAL	Mode of operation display; Status of the sweep output
			Sweep functions selection menu item
	Entering the selected menu item (only possible if sweep is disabled!)		Frequency entry FRQ_1 menu item  Frequency entry FRQ_2 menu item
	Enable / Disable the sweep output (Activation only possible outside of the start / stop menu items possible!)		Start on zero menu item  Time entry menu item  Number of loops menu item  Mode of operation selection menu item

## Operation of the "sweep mode" menu item

Mode SWEEP [Start ]	
xSweep <u>U</u> P/DOWN	Sweep functions selection menu item
>FRQ_1 -000250.0 Hz	
>FRQ_2 +000250.0 Hz	
-----	
>Start on zero off	
>SweepTime 000.5s	
>No. of loops 1000	
>change Mode MANUAL	

 Selecting the sweep mode (UP; DOWN; UP/DOWN; DOWN/UP)  
  
 Confirmation of the selected sweep mode  
 Return to the menu item selection

UP : FRQ\_1 >> FRQ\_2      UP/DOWN : FRQ\_1 >> FRQ\_2 >> FRQ\_1  
 DOWN : FRQ\_2 >> FRQ\_1    DOWN/UP : FRQ\_2 >> FRQ\_1 >> FRQ\_2

## Operation of the "frequency entry FRQ\_1; FRQ\_2" menu item

Mode SWEEP [Start ]	
>Sweep UP/DOWN	
xFRQ_1 -000250.0 Hz	Frequency entry menu item FRQ_1
xFRQ_2 +000250.0 Hz	Frequency entry menu item FRQ_2
-----	
>Start on zero off	
>SweepTime 000.5s	
>No. of loops 1000	
>change Mode MANUAL	

  Changing the cursor position  
 or  Changing the direction of rotation  
 in the entry  
 direction  
 Increase the selected number (+1)  
 Decrease the selected number (-1)  

7	8	9
4	5	6
1	2	3
0		

 Direct entering of the numbers  
 Confirmation of the entered frequency value  
 Return to the menu item selection

## Operation of the "start on zero" menu item

Mode SWEEP [Start ]	
>Sweep UP/DOWN	
>FRQ_1 -000250.0 Hz	
>FRQ_2 +000250.0 Hz	
-----	
xStart on zero <u>o</u> ff	Start on zero menu item
>SweepTime 000.5s	
>No. of loops 1000	
>change Mode MANUAL	

 Selection (on; off)  
  
 Confirmation of the selection  
 Return to the menu item selection

## Operation of the "sweep time" menu item

```
Mode SWEEP [Start ]
>Sweep UP/DOWN
>FRQ_1 -000250.0Hz
>FRQ_2 +000250.0Hz
-----
>Start on zero off
xSweepTime 010.5s
>No. of loops 1000
>change Mode MANUAL
```

Sweep time menu item



Changing the cursor position



Increase the selected number (+1)



Decrease the selected number (-1)



Direct entering of the numbers



Confirmation of the entered frequency value  
Return to the menu item selection

## Operation of the "no. of loops" menu item

```
Mode SWEEP [Start ]
>Sweep UP/DOWN
>FRQ_1 -000250.0Hz
>FRQ_2 +000250.0Hz
-----
>Start on zero off
>SweepTime 010.5s
xNo. of loops 0100
>change Mode MANUAL
```

Number of loops menu item



Changing the cursor position



Increase the selected number (+1)



Decrease the selected number (-1)



Direct entering of the numbers



Confirmation of the entered frequency value  
Return to the menu item selection

## Operation of the "mode of operation selection" menu item

```
Mode SWEEP [Start ]
>Sweep UP/DOWN
>FRQ_1 -000250.0Hz
>FRQ_2 +000250.0Hz
-----
>Start on zero off
>SweepTime 010.5s
>No. of loops 0100
xchange Mode MANUAL
```

Mode of operation selection menu item



Selection of the mode of operation



Confirmation of the selected mode of operation  
Entering the selected mode of operation menu  
or return to the menu item selection

• **Resetting to the works setting**

The testbox can be reset by pressing the keys     simultaneously. This key combination initiates the reset process. The power failure-safe memory is hereby reloaded with "default" values before being reset. After the reset, the "pulse-generator TB2" is in the "manual" mode of operation.

• **"pulse-generator TB2" testbox connections**

The "pulse-generator TB2" testbox has a M12 plug and a BMC-socket as standard.

The device is provided with power and outputs the incremental pulse signals via the M12 plug. A connection diagram is shown in Fig. 4.

The "TRIGOUT" trigger outlet for the sweep operation is at the BNC-socket.

Special versions are equipped with an additional M12 plug on the device.

This is situated between the standard M12 plug and the BNC-socket (see Fig. 3).

At this plug, the digital signals can be differentially output at this plug with the supply voltage (HTL level: 10-28 V) or in a RS422 format (level 2-3 V,

$f_{max} = 150 \text{ kHz}$ ) as requested. Each signal is hereby transmitted to 2 lines with complementary levels. The logic level is determined at the receiver on the basis of the difference between the two lines A, B and /A, /B. This makes long transmission links possible in addition to increasing the interference immunity.

The connection cable should only be a well-screened cable with a wire cross-section of  $\geq 4 \times 0.25 \text{ mm}^2$ . Please note that the round M12 plug has a metallic housing, a connection for the shielding and that the potential of the grounding conductor PE or the ground is connected to the cable screen.

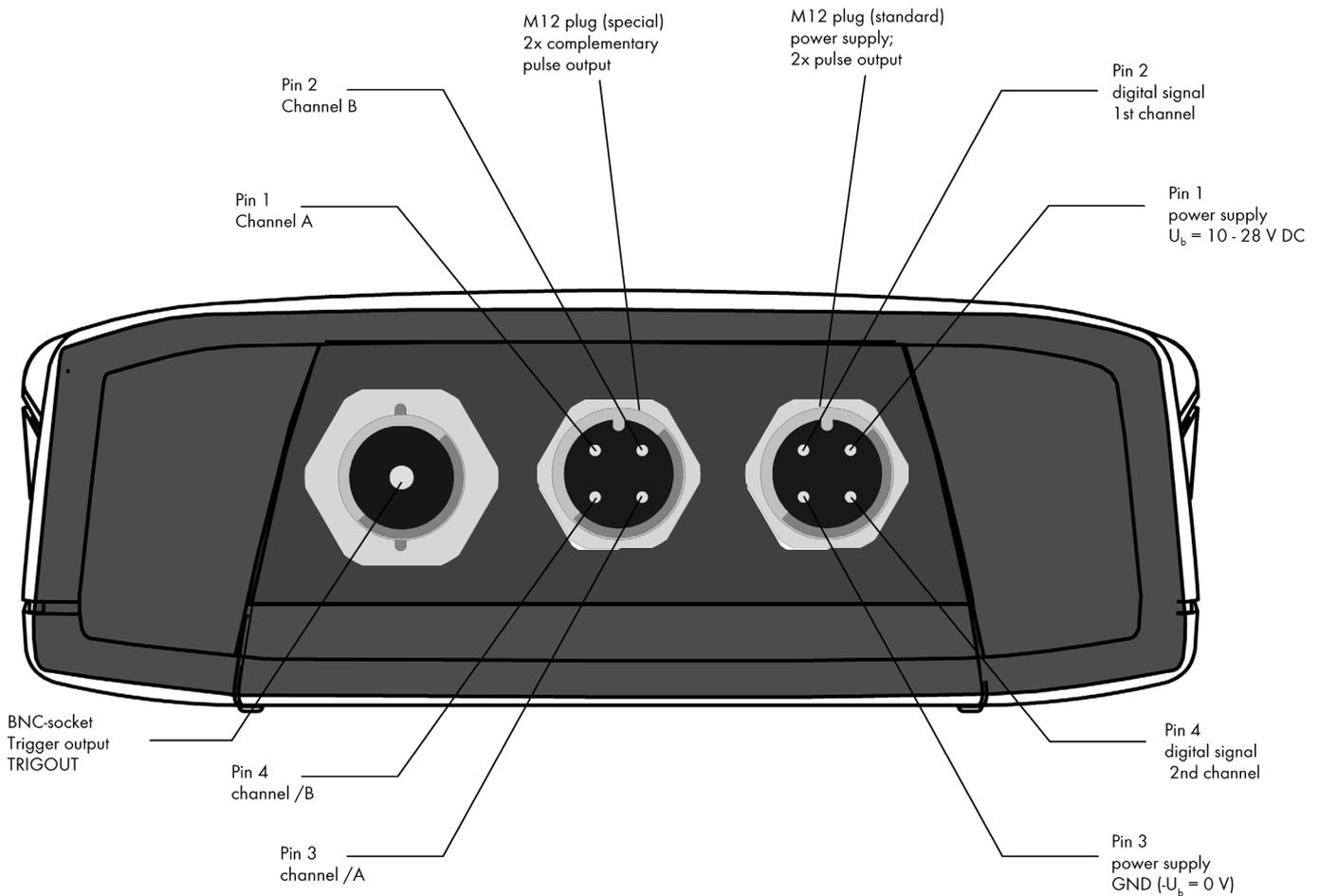


Fig. 3: The "pulse-generator TB2" testbox connections

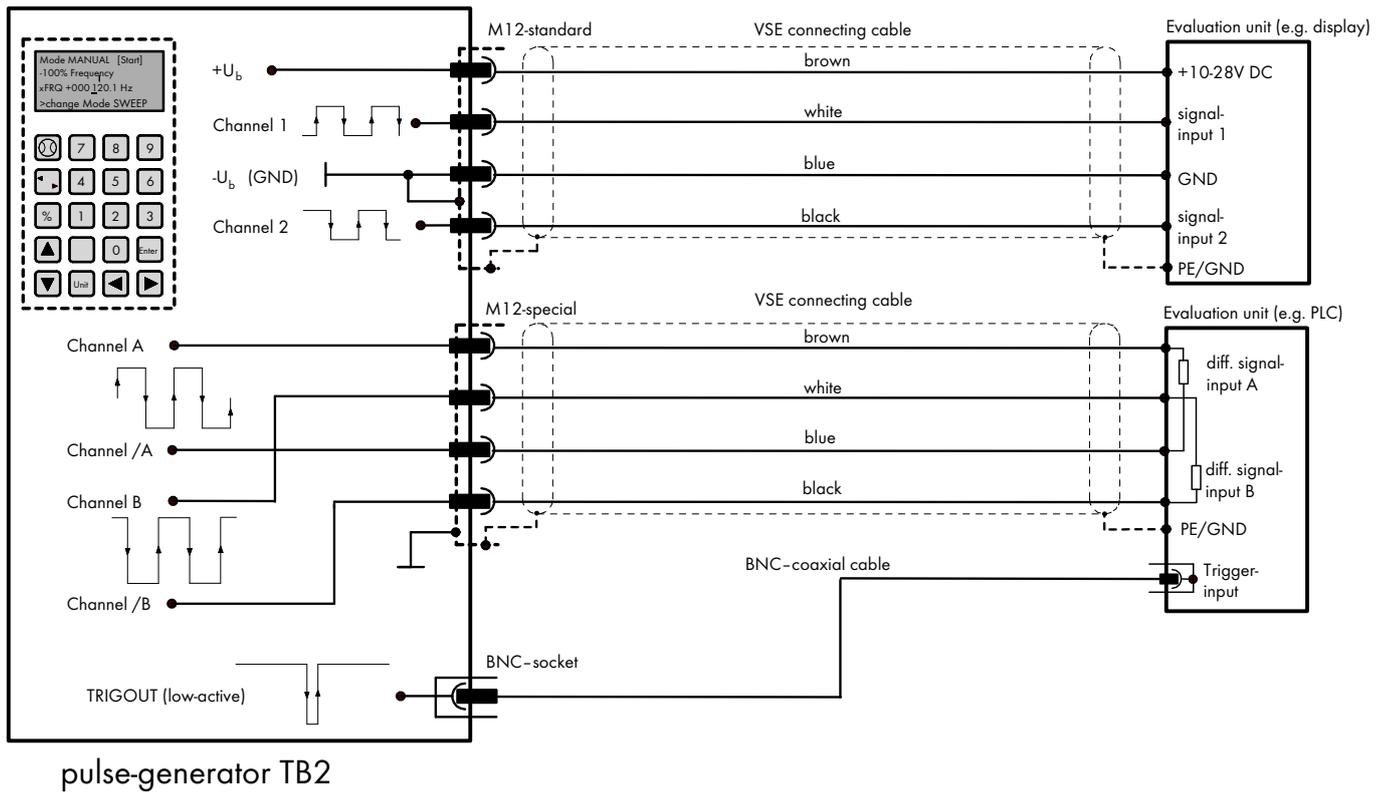


Fig. 4: Connecting diagram for the power supply and the signal outputs

**• Technical data****Power supply**

Supply voltage	$U = 10 \dots 28 \text{ V DC}$ ; voltage reversal-safe
Current consumption	$I_0 = 42 \text{ mA}$ (at 24 V DC); unloaded

**Signal outputs (standard)**

Signal voltage output (channel 1; channel 2)	$U_{SS} = 9 \dots 27 \text{ V DC}$
Signal output current	$I_{OUT} = 300 \text{ mA max}$ at 24 V DC (channel 1; channel 2)
Output preamps	Push-Pull preamps; current limited; short-circuit proof; internal cable adaptation; low saturation voltage; temperature protection circuit with hysteresis; high-impedance outlets in case of failures

**Additional signal outputs (special):**

Signal output	Channel A, /A (with inversion), Channel B, /B (with inversion)
Signal output level	HTL level 10 - 30 V or RS422 level
Signal voltage output	$U_{SS} = 8 \dots 27 \text{ V DC}$ differential (with HTL) $U_{SS} = 0,4 \dots 3,2 \text{ V DC}$ differential (with RS422)
Signal output current	$I_{OUT} = 200 \text{ mA}$ (with HTL), $I_{OUT} = 20 \text{ mA}$ (with RS422)
Output preamps	Push-Pull preamps; current limited; short-circuit proof; internal cable adaptation (with HTL) or RS422-driver AM26C31 ( $f_{max} = 150 \text{ kHz}$ )

**Housing**

Dimensions	L x W x H 209,3 x 98 x 34,8 mm
Material	ABS (acrylonitrile-butadiene-styrene)
Color	graphite gray
System of protection	IP64

**VSE**<sub>.flow</sub>  
measurement

VSE Volumentchnik GmbH  
Hönnestraße 49  
58809 Neuenrade/Germany  
Phone + 49 (0)23 94/616 30  
Fax + 49 (0)23 94/616 33  
E-Mail [info@vse-flow.com](mailto:info@vse-flow.com)  
Internet [www.vse-flow.com](http://www.vse-flow.com)