Dosing System MID-MDS

Operating Manual

Version	**LINEAR FILLER**	**Single start**
Software	**VER 1.00**	
Hardware	Terminal housing	MDS-30/49/84
	Boards	QB-173
		QB-172
		QB-170
	Counter / Valve boards	LS-23
	Master board	DR-11
	Converter board	UV-12
	Software	V100

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Foreword

I. Transport, Delivery, Storage

Always protect devices against humidity, soiling, impacts and damages.

Delivery Inspection:

Check the delivery for completeness upon receipt. Compare the device data with the data on the delivery note and in the order records.
Report any in-transit damage immediately. Damage reported at a later date shall not be recognized.

II. Warranty

Please refer the contractual terms and conditions relating to delivery for the scope and period of warranty.
Warranty claims shall be conditional to correct installation and commissioning in accordance with the operating instructions of the device. The necessary installation, commissioning and maintenance work should only be carried out by qualified and authorized personnel.

III. General Safety Instructions

1. Magnetic inductive flow meters series MID are reliable, high accurate volumetric measuring devices. They should only be used for their intended purpose. Always observe the pressure and temperature limits stated on the type plate, as well as all other technical data and safety information during device installation, start-up and operation.
2. Always observe national and international regulations concerning the operation of devices and systems under pressure.
3. Prior to installation, the operator has to ensure that the pressure bearing parts have not been damaged during transportation.
4. The devices have to be installed, operated and serviced by qualified personnel. The operator has the responsibility to ensure that the personnel have received sufficient and appropriate training. In cause of doubt, please contact the manufacturer.
5. The operator must ensure that the materials used (wetted parts) of the device compared with the measured liquid are chemically resistant.
6. The gaskets or sealing elements must be handled with care according to the operating instructions.
7. If a device with 3A approval is used, the process connections must not be exchanged, otherwise the 3A approval expires. In addition, there is a risk that moisture will get behind the PTFE liners and thus damage the device in the event of improper replacement. The replacement voids all warranty claims.
8. Symbols used

Warning!
Failure to observe this warning can lead to injury of persons or a security risk.

Attention:
Non-compliance can lead to faulty operation or damage to the device.

1. Identification

Manufacturer: Bopp & Reuther Messtechnik GmbH
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Product type: Dosing system MID-MDS

Version No. A-EN-05801-00Rev.B

2. Application

The Modular Dosing System MID-MDS is used on both linear and rotating filling machines, where high accuracy/repeatability is required. The products must have a minimum conductivity of approx. 1 µS/cm. The minimum dosing time achieved to date is approx. 0.1 sec.
Magnetic Inductive Flow Meters series MID have no moving parts, and therefore do not apply any "work" to the product which could cause changes to the fluid structure. This also enables CIP/SIP procedures to be carried-out both easily and quickly.

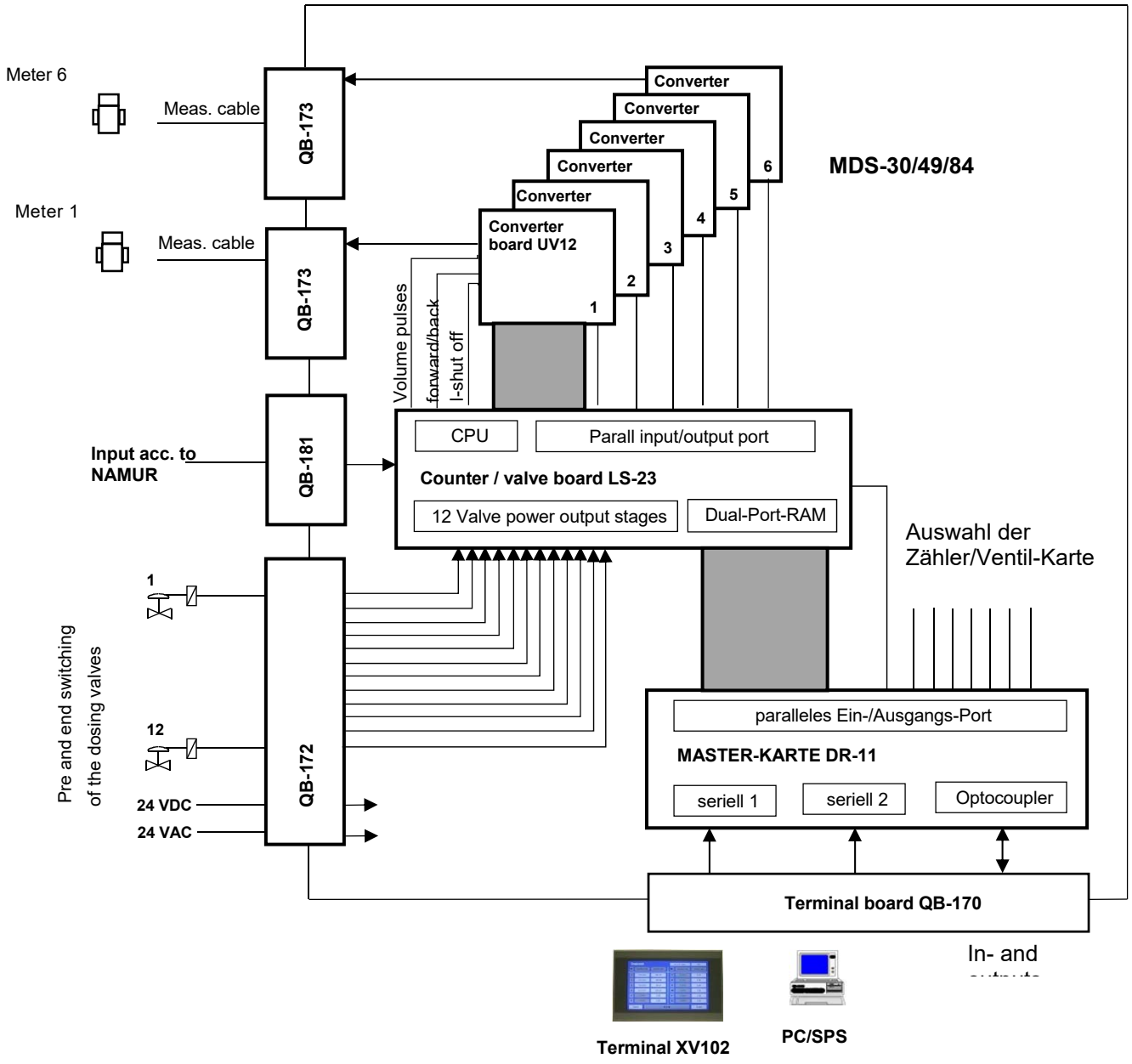
3.The dosing system MID-MDS consists of the following components (Fig.1):

- Electromagnetic flowmeter series MID with integrated preamplifier

- Dosing system series MID-MDS with

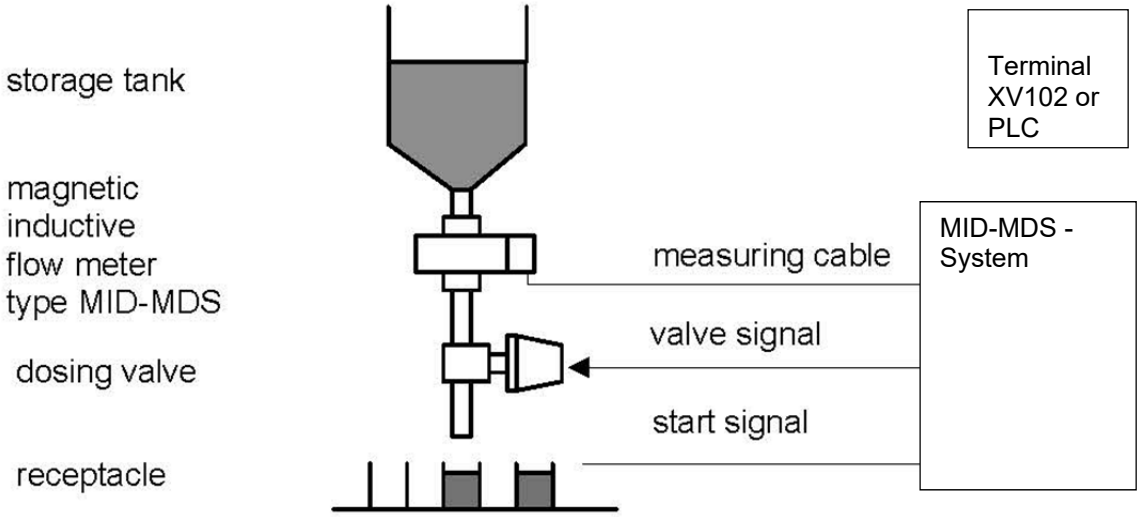
  * Converter board type UV- 12
  * Master board type DR- 11 with integrated pulse output
  * Counter and valve board type LS- 23
  * Terminal Typ. XV102

* div.Gehäusen für Karteneinbau:	Panel housing	Type MDS- 30 (30 TE), or
	Panel housing	Type MDS- 49 (49 TE), or
	19" rack	Type BGT - 84 (84 TE)



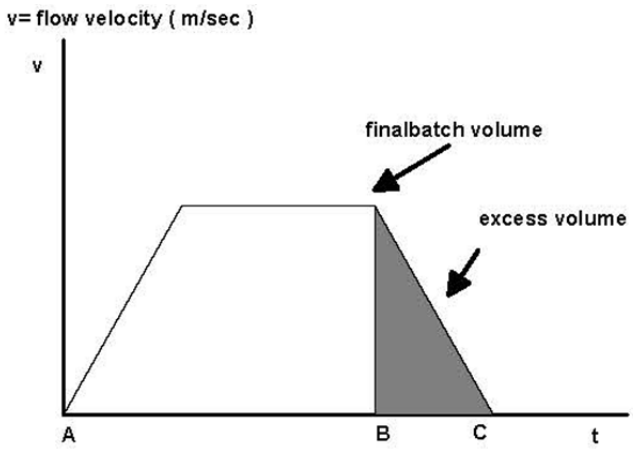
4. Filling system / installation

A filling system/installation generally consists of (Fig.1):



Systems with very short dosing times (min. 0.1 to some sec) need a storage (buffer) tank-see Fig.2- the level of which must be kept more or less constant, e.g. by using a level control system, which automatically opens and closes the feed line to the storage tank. This arrangement supplies a dosing curve (lapse) as shown in (Fig.3):

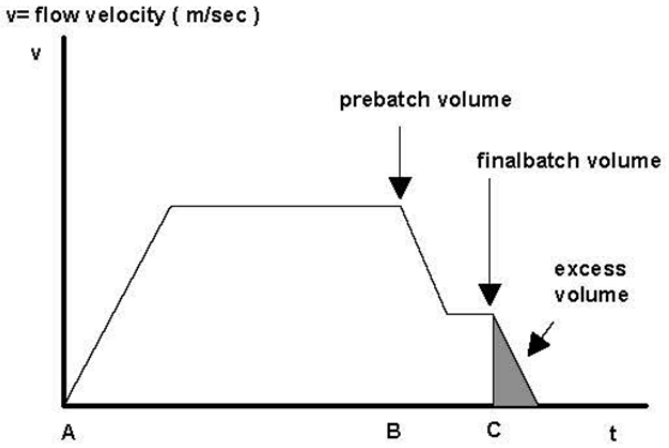
Fig. 2



1- stage valve closing

At time A the filling machine starts the batch process and the dosing valve opens. The magnetic flow meter measured the product; the sensed signal is send to the dosing control and also to the preset counter. At the end of the batch (B) the dosing valve receives the signal to close. Because of delay time in the system (mainly the valve) a certain excess volume passes the dosing valve until it is closed and the batch process is finished

Fig. 3



2-stage valve closing

It is possible to decrease the excess volume if a 2-stage valve closing is used. If the valve receives the pre-batch signal (B), then the valve closes to a interposition.
If the valve receives the final batch signal (C) then the valve closes completely.
This kind of valve closing should be used if

- the meter size is > DN 20 or
- the batch is > 0,5 l / sec.
- the velocity in the pipe is > 5 m/sec

The otherwise occurring high pressure peaks at 1-stage operation is thus avoided.

5. The components of a filling system should meet the following requirements

a) <u>storage tank (no pressure, head of liquid only)</u>

The tank dimension (dia.,height) should be such that a batch process (one filling) only causes a very small level variation (decrease). In the event of a large variation, the head (gravity) decreases rapidly, the excess volume is altered (Fig.4) and both accuracy and reproducibility vary.

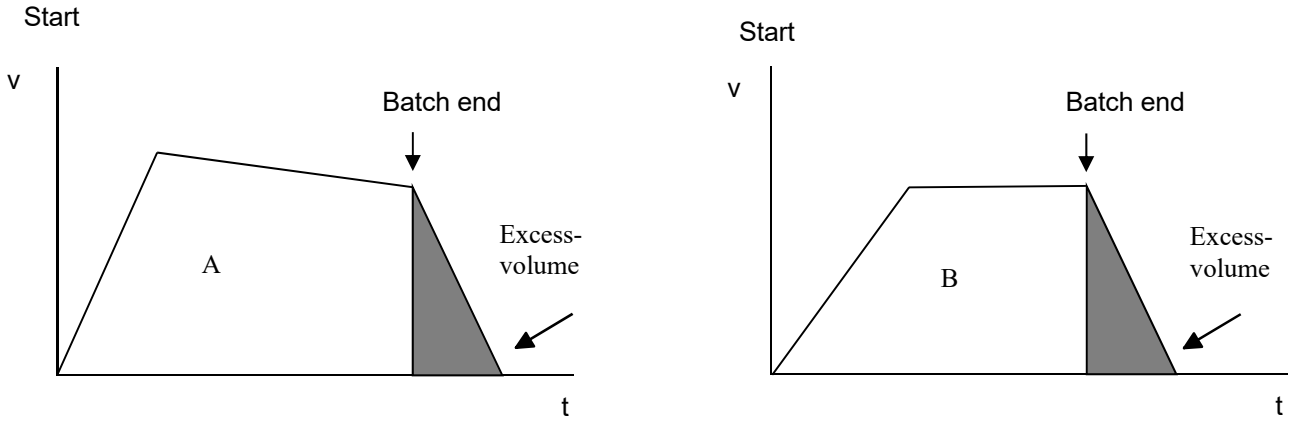
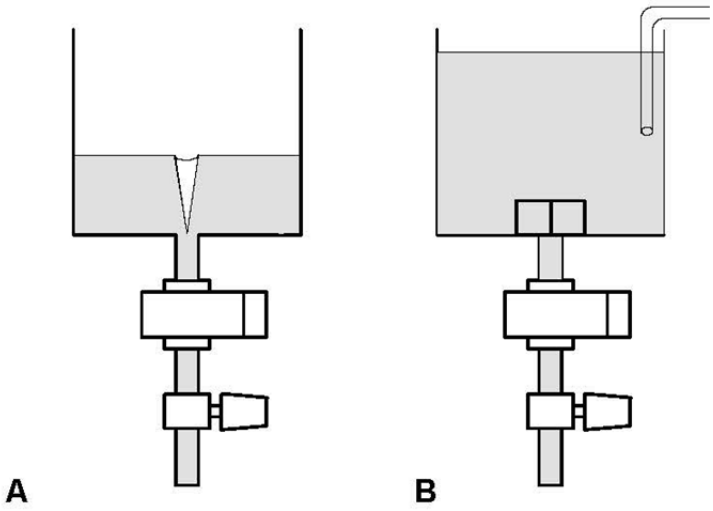


Fig. 4

Due to the decreasing head of liquid, the flow velocity and the flow rate decrease, resulting in the dosing time becoming longer and longer! This effect should be avoided if the dosing time is to be kept constant.

To keep the filling times constant, the liquid level head should be kept within 5%.



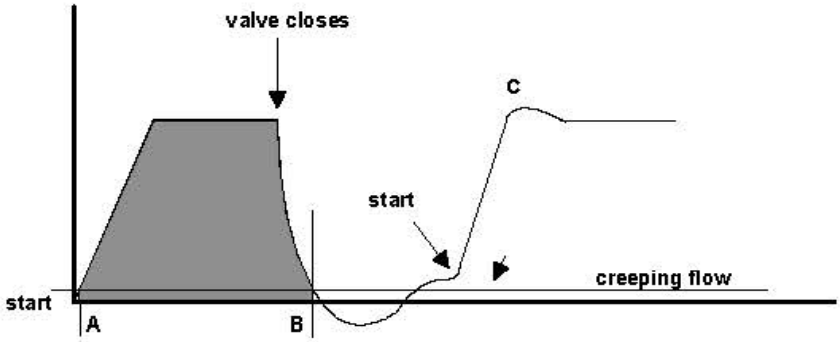
At bigger meter sizes (> DN 15) the liquid level must be more than 30 cm. If the level < 30 cm, Vortex-effects are possible and resulting accuracy vary (A).

To prevent vortex effects a build – in straightener is advantageous.

Very important is the position of the product line in the tank. The outlet of the pipe must be under the liquid level (B). In other case, air bubbles are in the product and resulting accuracy vary.

b) Piping

Whenever possible rigid metallic piping between storage tank and dosing valve should be installed. If flexible hoses are used, hydraulic vibrations could disturb the batch processes. The piping should be of the same size (DN inner dia) as the magnetic inductive flow meter in order that the system can be deaerated easily.



Hydraulic vibrations are to be created, if e.g. diaphragm, hoses or buffer tanks are existing.
The energy in the liquid is decreased with the oscillation of the liquid.

If the velocity cross the creeping flow (B), the pulse output in the converter card is switched off.

If a new start pulse is coming during oscillation, the velocity in the pipe increased (C).

If hoses are used, then the hoses must be metal cased.

c) Dosing valve

The dosing valve is very important for the accuracy/reproducibility of the dosing system. Attention should be paid to the following parameters:

c1) **closing time:** the closing time of the valve has to be in a certain ratio to the dosing time (A to B); the shorter the dosing time the shorter the valve closing time.

Guideline:

<<< the valve closing time should be not more than 10% of the dosing time >>>

If it is more than 10%, the dosing control is only able to register the size of the excess volume, but will not be able to react to it (i.e. compensate / correct it for the next filling). This effect can only be avoided by using a two-stage shut-off (two valves), where the 2nd (final) stage can compensate/correct alterations of the 1.st (pre-) stage.

c2) **power supply**: whenever possible a DC supply should be used to avoid the influence of the shape of sine waves of the AC supply. This is especially if the valve closes with voltage, the valve starts to close when the sine wave has exceeded the starting voltage; in the worst case this can take 10 ms (50 Hz field) and so cause variations of the batched quantity (in accuracies).

c3) **dosing valve:** it is important that only a small volume is displaced during the closing procedure. The displaced volume is part of the measured quantity and thus influences the accuracy and reproducibility of the complete dosing system. It should therefore be kept as constant as possible! An instability of the displaced volume can affect the accuracy of systems where small quantities are dosed. Diaphragm valves with metallic body are recommended, where a diaphragm of a synthetic material (plastic) is oppressed onto a metallic edge. This design has another positive effect: fruit particles and similar solids to be dosed are squeezed off the valve seat.

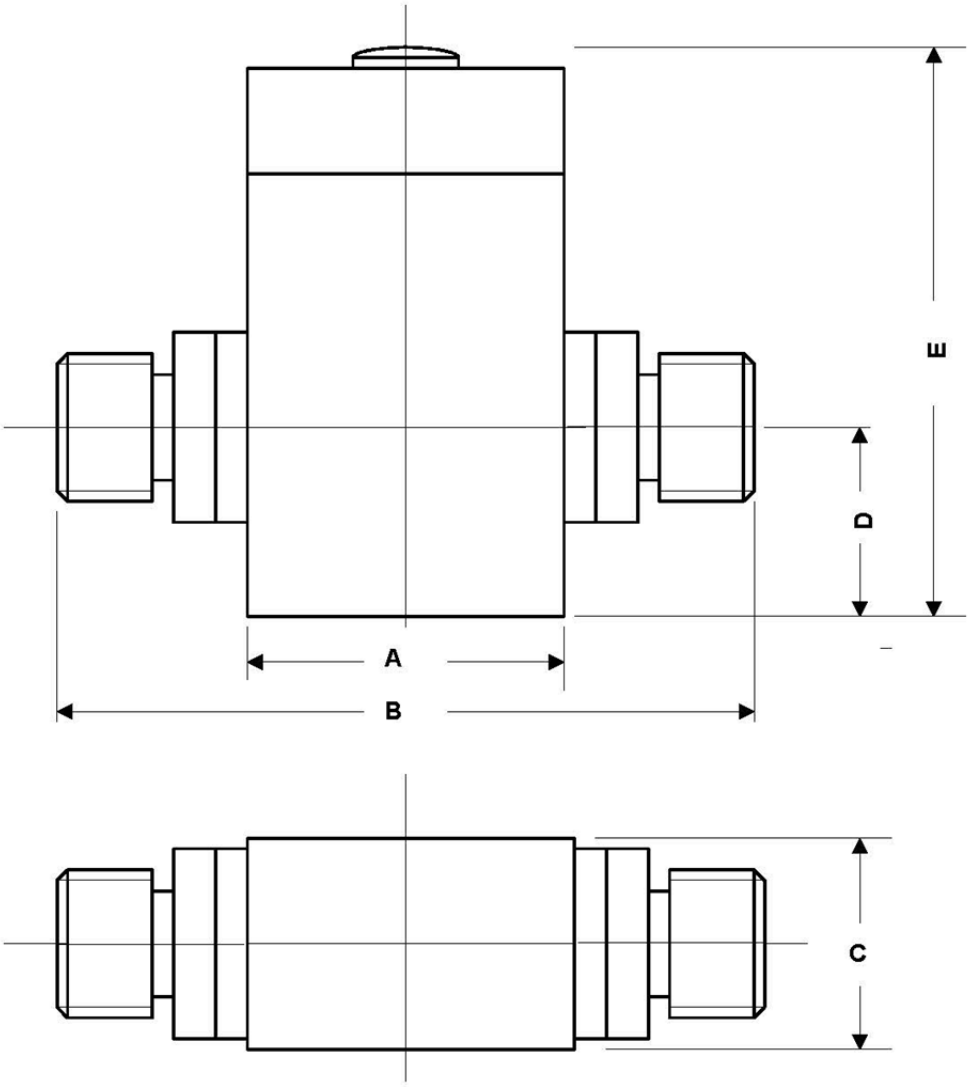
Diaphragm valve type 625 (GEMÜ)

6. Description of the components

a) magnetic inductive flow meter series MID has an integrated and detachable pre-amplifier. The coils for the magnetic field requires a 24 VAC power supply. The cable for interconnection of the meter and the converter card is approx. 5 m long (if a length of more than 5 m is required (max. 200 m), an extension cable of same type is admissible). In the event of a malfunction the pre-amplifier can be detached and replaced; no calibration of the replacement is required! The pre-amplifier is connected via plug and socket. The meter can be installed either horizontally or vertically. Vertical installation is preferred for better deaeration; and also deposits are less likely to be trapped in the meter. In the case of horizontal installation the electrodes must be in horizontal position, i.e. the pre-amplifier must be above or underneath-but not beside- the meter body. If the meter is used together with a converter card UV-12 the flow direction (right to left/left to right or from below to above or vice versa) of the meter is insignificant. The UV-12 switches automatically to the given flow direction and measurement can be started immediately.

Cables for power and signals

It is not allowed to install the meter or the electronic in an area with strong magnetic fields. The measuring cable must be install separately from cables with power or control signals. The best solution is the installation for the measuring cable in a grounded pipe of metal



Note : Other connectors on request

Dimension of flow meter with sanitary connectors DIN 405

Diameter DN	Connector DIN 405	A mm	B mm	C mm	D mm	E mm	Actual power W	Current A	Weight kg
10	RD 28x1/8	80	150	60	60	155	4	0,3	3,5
15	RD 34x1/8	80	150	60	60	155	4	0,3	3,5
20	RD 44x1/6	80	150	60	60	155	4	0,3	3,5
25	RD 52x1/6	120	190	80	75	185	5	0,4	7,5

Dimension of flow meter with steril connectors NAUE (ISO)

Diameter DN	Connector DIN 405	A mm	B mm	C mm	D mm	E mm	Actual power W	Current A	Weight kg
10/12	RD 27x1/ 10	80	150	60	60	155	4	0,3	3,5

Dimension of flow meter with TRI CLAMP ISO 2852

Diameter DN	Connector	A mm	B mm	C mm	D mm	E W	Actual power	Current A	Weight kg
40	2”	120	190	80	75	185	5	0,4	7,5

Note : Other connectors on request

Measuring cable

The measuring cable is a standard cable to DIN series LIYY- LIYCY) with two shielded and four unshielded

colour	**signal**	**voltage**	**core**
white	measurement	0-50 mVAC +/- 2 VDC	shielded
brown	reference voltage	2 hasta 4 VAC	shielded
yellow green	power supply for pre-amplifier	+ 15 VDC - 15 VDC	unshielded
red and blue	power supply for the coils	24 VAC	unshielded

Fuses

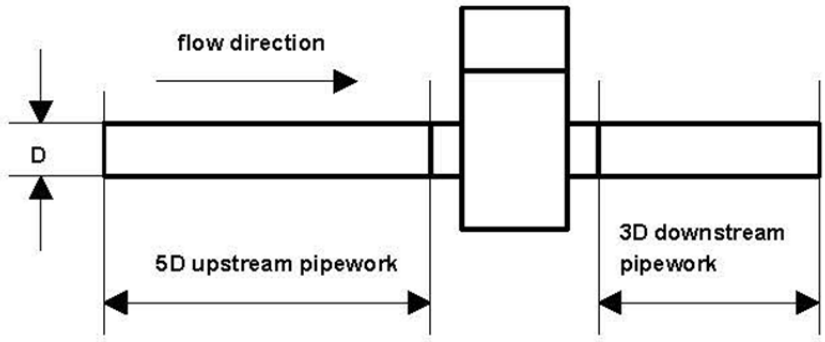
Fuses for the flow meter (located on the terminal card type QB-173): If only the UV-12 is used (without housing), the fuses must be set externally.

DN (flow meter)	**24 VAC**
DN 10	0,4 A
DN 15	0,4 A
DN 20	0,4 A
DN 25	0,6 A
DN 40	0,6 A

7. Installation guideline for transmitter

Inlet/Outlet

For an optimum flow profile it must be installed an inlet and outlet section. This can be realized. with straight pipes before and after the meter.
The inlet section must be 5 x DN and the outlet section must be 3 x DN. It is forbidden to install in front of the inlet section devices which produced effects like spin or vortex, e.g. space bend, butterfly valves or slider. Any regulation devices must be installed behind the meter.
Inclinations must be rotational symmetrical and the angle should be < 8°.
The inlet, outlet section and the meter must have the same diameter!



Length of the upstream- and downstream pipework for the meter (mm)

DN	Upstream	Downstream
10	50	30
15	75	45
20	100	60
25	125	75
32	160	100
40	200	120

Ground connection for transmitter

No additional grounding is required for the transducer. Since the transducer uses the pipe potential as

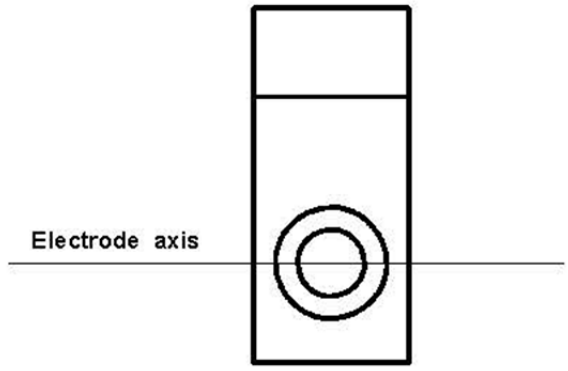
the measuring reference, the pipe in which the transducer is installed must be earthed.

The transducer must not be installed in plastic pipelines.

The power supply 24 VAC should be also on ground.

Mounting position of the transmitter

It must be insure, that the meter tube is always completely filled during measuring and is protected against asymmetric formation of deposits. The vertical position is preferred, since it is simple to make the pipe air free.



Is the meter is installed horizontal, then it must be insure, that the electrode axis is also horizontal.

Pipework must be supported adjacent to the meter and connections and provide 3° slope for draining.

If the electrode axis is vertical, then air bubbles can be isolated the electrical connection between the electrodes and the product.
In this case the output signal is undeclared

Laying of the measuring cable

It is forbidden to install the meter in areas with strong magnetic fields. The measuring cable must be lay separately from power cables and control cables.
To lay the measuring cable in grounded metal pipes is recommended. Measuring cables can be routed together with other measuring cables.

8. Installation guideline for the electronics

General:

It is forbidden to install the electronics in areas with strong magnetic fields. The cabling must be carried out in such a way that the cables are separated according to their function:

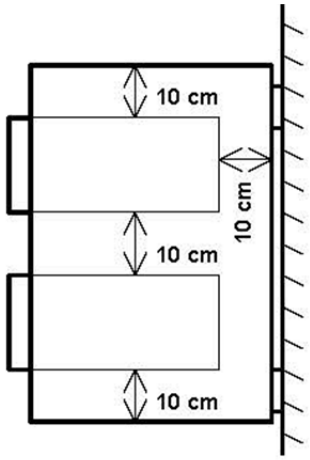
cables for signals	e.g. start, error
cables for control	e.g. cable for control the diaphragm valves
cables for measuring electronics	e.g. measuring cable between the meter and the
cables for power	e.g. 24 VDC, 24 VAC , power for motors

Cables for signals or cables for control can be routed together to a multiple cable.

Measuring cable must be routed with the same cable type. It is not allowed to bring together several measuring cables to one shielded cable.

If it is necessary to lengthen the measuring cable, then the terminals for the measuring cable must be separate from terminals with power. In general the same principle as for the cable is valid: the terminals must also be separated depending from their function.

Heat development
The produced energy from the electronics must be undisturbed left the housing. It must be insure, that air circulation is possible



Installation of 2 panel housings in a cabinet

These distances can be reduced by using fans.
A fan arrangement for 2 housings should always be provided. The width of the fan arrangement should be equal to the width of the housing.

If the fan serves only the air circulation, then it must be considered that the achievement of the fan increases the temperature in the inside of the housing.

If the air in the housing is exchanged with the ambient air, the air should have as little humidity as possible. For this purpose, suitable ventilation equipment must be obtained from the cabinet manufacturers.

Power supply

When laying the 24 VDC/ 24 VAC power supply, it must be ensured that it is connected in a star configuration from the power supply to each group. The power supplies must not be looped over the pit supports, but the supports of each pit support must be individually connected to the power supplies.

When selecting the cable cross-section for the 24 VDC, the current for the solenoid valves must be taken into account.

9. Technical data

a. Transducer

General:

Nominal diameter:	DN 10, 15, 20, 25, 32, 40 (other connectors on request
Pressure max. in bar:	Sanitary connector PN10 Tri-Clamp PN16 others on request
Minimum Conductivity:	1µS/cm
Mounting position:	vertical, if horizontal cannot be avoided, then the electrodes must be in horizontal position. The pipe must be completely filled with product
Mounting length:	DN 10 to 20 → 150 mm DN 25 to 40 → 200 mm
Measuring cable length:	max. 250 m Any extension of the cable built onto the transmitter is possible, but it must be of the same type
Type of measuring cable:	LIYY-LIYCY

Material:

Metering tube:	1.4571
Process connection:	1.4571
Lining:	PTFE
Electrodes:	DN: 10 1.4571 DN: 15, 20, 25 ,32, 40 Hastelloy
Housing:	Preamplifier → cast aluminum, coated Housing → Polyurethane

Temperature / Humidity:

Liquid temperature max.:	140°C
Ambient temperature max.:	70°C
Ambient humidity:	< 75 % on average, dew-formation permissible
Protection class:	P 67 according to EN 60 529

Power supply:

Voltage:	24V AC ±10 % sine wave
Frequency:	50Hz ±5% or 60 Hz ±5%
Distortion factor:	max. 1%

Stromaufnahme bei 24 V	DN 10 bis 20:	0,4 A
	DN 25 bis 40:	0,6 A

b. MID-MDS system

Allgemein

Housing	Panel mount housing or 19" rack
Protection class	Panel mount housing: Front IP 65 according to EN 60 529 Connection terminals: IP 20 according to EN 60 529 19” rack: IP 20 according to EN 60529
Supply voltage	18 VDC to 36 VDC
Residual ripple	< 1%
Current consumption	depending on equipment Ambient temperature max. 50 °C
Ambient humidity max.	< 50 % , condensation not permitted

Input section UV-12

Input	Measuring and reference voltage from transducer
Measuring range	10 m/s standard 2.5 m/s optional
Output	Frequency proportional to flow rate 0 to 50 kHz standard (others on request) see description input part UV-12

Counter/valve card LS-23

Input	Volume pulses from input UV-12 Volume pulses 24V or NAMUR card with QB- 181
Output	Valve outputs for controlling solenoid valves max. voltage 36 VDC max. current 0.5 A

Master card DR-11

Inputs via QB-xxx	24 VDC ± 15%
High level	> 10 VDC
Low level	< 5VDC
Input resistance	2.4 kOhm
Outputs via QB-xxx	18 VDC to 36 VDC
Output current max.	10 mA

10.Error limits

Reference conditions according DIN 19200 and VDI / VDE 2461

Fluid:	water (free of gas)
Liquid temperature:	+25°C ± 2 K
Ambient temperature:	+22°C ± 2 K
Warm-up time:	30 min.
Installation acc. reference conditions:	up-stream section > 10 DN down-stream section > 5 DN

Error limits according reference conditions

Power supply for transmitter: Frequency:	24V ± 10 % 50 Hz ±5 % and 60 HZ ± 5% respectively
Power supply for electronics: Ripple:	18V to 36V DC < 1 %
Pulse output:	± 0,5 % of measured value plus ± 0,01 % FS FS = 50 kHz at 10 m/s
Repeatability:	± 0,1 % of measured value plus ± 0,005 % FS
Build-up time:	50 ms (10 % to 90 % FS)
Temperature drift during warm-up time : 30 min	± 1 % of measured value plus ± 0,1 % FS
Temperature influence on Transmitter and electronics	± 0,1 % / 10 degr. C

11. Requirements for commissioning

a) The flow meter must be correctly installed.

b) The pipeline or the entire dosing system must be completely filled with product.

c) The supply voltages for flow meter and dosing electronics must be switched on.

d) The flow rate in the dosing system must be absolutely zero:
Before starting a dosing or filling machine, a zero point must be set by the terminal XV102 or via telegram of the PLC. After successful execution, the LEDs on the front panel of the housing MDS- 30 (MDS- 49, BGT- 84) are off;
if not: see section "Troubleshooting", section 12!

e) The external start signal must be connected (push-button or PLC):

it must be connected via the terminal card of the DR- 11 master card; a 24 VDC pulse of at least 10 msec is required. If problems occur: see section "Troubleshooting", section 12!

12. Troubleshooting

a) The zero point cannot be set:

Requirements: the piping/metering system is completely filled with liquid, the supply voltage is switched on.

a1) on the terminal card of the converter card UV-12 there are 3 LED's to indicate the power supply:

	24 VAC for the pick-up coils
upper LED off	**Check whether 24 VAC are present** **Check the fuses on the UV-12 terminal card**.
	15 VDC for converter board and preamplifier
middle LED off	**check whether 24 VDC are present** **Error of the converter card UV-12: replace**!
	15 VDC for converter card and preamplifier
lower LED off	**check whether 24 VDC are present** **Error of the converter card UV-12: replace!**

a2) Reference voltage:

Requirement:	**24 VAC present (upper LED on)**
check:	**with a voltmeter measure the reference voltage at the terminal card of the UV-12 between the brown wire and the screen: it should be between 2 and 4 VAC**!

If this value is not available:

Reference cable (brown wire and shield) to
Check interruption or short circuit!

a3) Check the automatic zero setting:

to check the automatic zero point adjustment. The white wire must be removed from the terminals; a short-circuit bridge is then installed between the white wire terminal and the screen.
Select menu item F7 on the operator terminal and carry out the zero point adjustment: is the zero point adjustable (green LED on the UV-12 is off)?

if "no" : exchange converter card UV-12
if "yes" : replace flow meter

a4) if the zero point fluctuates:

check the complete dosing system (piping, flow meter, valve):

- The complete dosing system (piping, flow meter, valve) must be completely filled and vented.
- are the valves tight?
- The conductivity must be at least about 1 uS/cm.
- the flow rate must reach at least 0.25 m/sec, or: with flow meters e.g. DN 10, a flow rate of at least 0.02 l/sec, according to the following equation (DN in mm):

v (m/sec) = (Q x 1.273,2) : DN2
Q (l/sec) = (v x DN2) : 1,273.2

See also section 11. d),

b) if the dosing quantities fluctuate:

b1) Fluctuations of the actual value (volume/weight of the filled container):

check:

- does the inlet pressure of the storage tank change by more than 5 % between dosages? This must be avoided at all costs, as in this case the overflow quantities and thus also the dosing quantities fluctuate!

See also section 4, a)!

- if the dosing time is < 0.5 sec, the switching time of the dosing valve has a very strong effect on the dosing quantity; the switching time of the dosing valve should not be greater than 10 % of the total dosing time. If the dosing time is very short, a short switching time or the reproducibility of the valve must be ensured.

See also section 4., c)c1)!

b2) Fluctuations in the counter reading (see operator terminal, section 5., d),

- If the change in the counter reading (readable on the display) is better than +/- 1 ml compared to the preselected value, but if the quantities in the containers show larger deviations, the cause is a non-reproducible dripping at the valve outlet. Depending on the viscosity of the product, the outlet piece must be designed in such a way that the volume flow is torn off cleanly!

c) Function of the LED on the master card DR-11 and counter/valve card LS-23

These cards have 2 LED on the front side.

red CPU
This LED is on when the program is no longer working correctly. In this case the system is automatically restarted.

When the LED is on, the following should be checked:

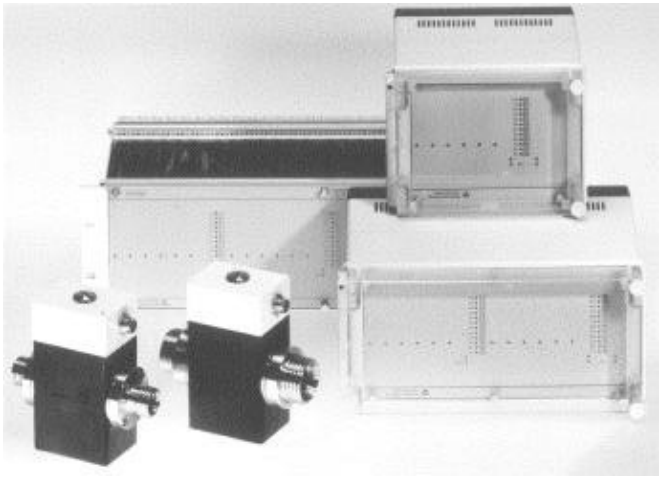
a) Is an EPROM installed ?
b) Is the CPU and EPROM correctly installed in the socket?
c) Is the crystal OK for the CPU ?

If a) to c) --> OK, change card !!

yellow This LED has no function for the dosing application.

This LED is used to display information during troubleshooting.
Various software variants use this LED for display.

13. MDS-30 / 49 / 84



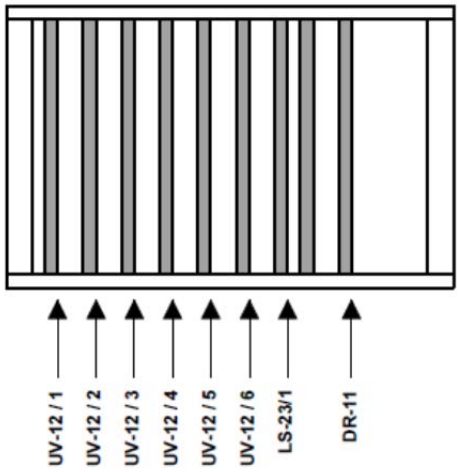
The boards can be installed in 3 different housings:

- MDS-30 for max. 6 measuring channels
- MDS-49 for max. 12 measuring channels
- MDS-84 for a maximum of 18 measuring channels

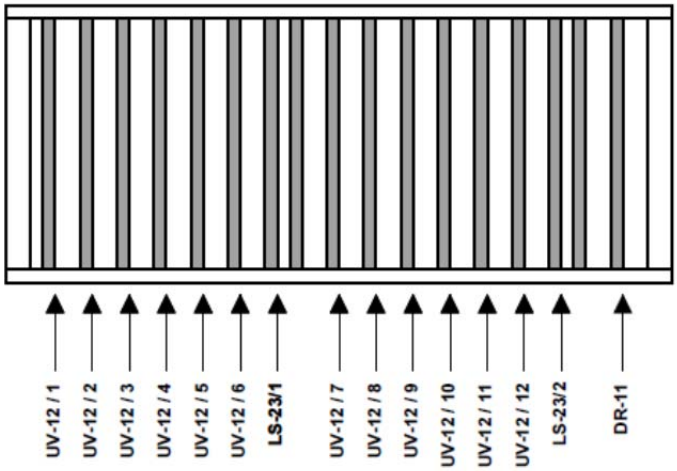
Maximum number of components

	MDS-30	MDS-49	MDS-84
UV12	6	12	18
LS23	1	2	3
DR11	1	1	1

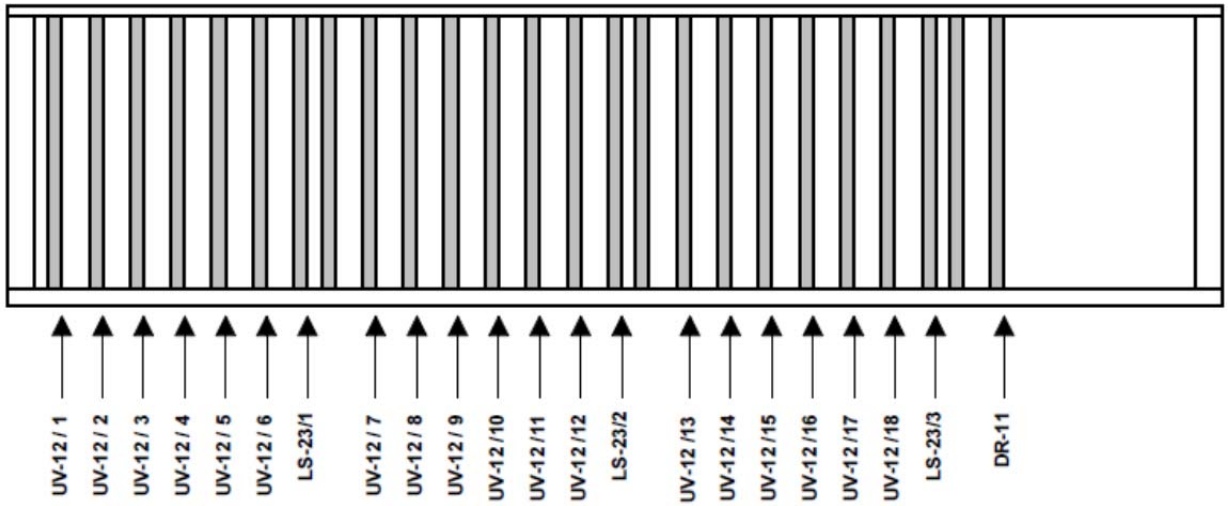
MDS 30



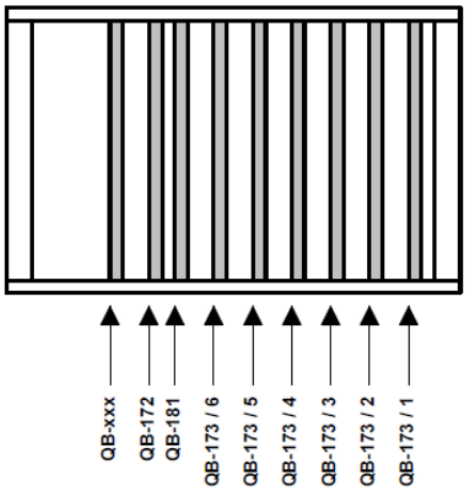
MDS 49



MDS 84

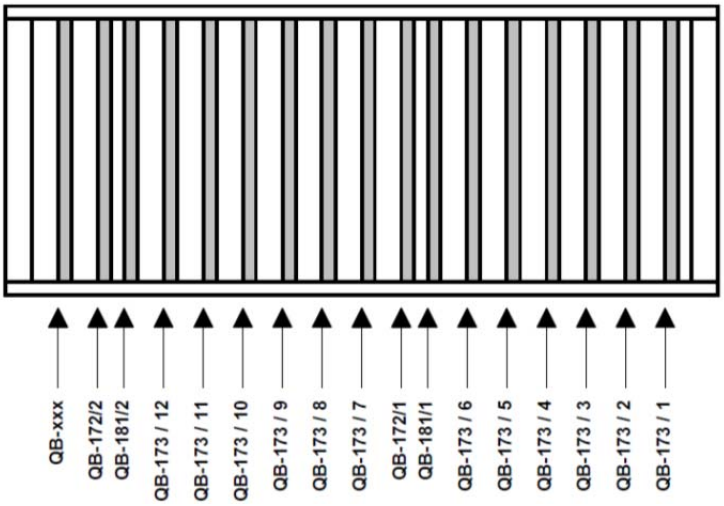

UV-12 / 1
UV-12 / 2
UV-12 / 3
UV-12 / 4
UV-12 / 5
UV-12 / 6
LS-23/1
UV-12 / 7
UV-12 / 8
UV-12 / 9
UV-12 /10
UV-12 /11
UV-12 /12
LS-23/2
UV-12 /13
UV-12 /14
UV-12 /15
UV-12 /16
UV-12 /17
UV-12 /18
LS-23/3
DR-11

MDS 30

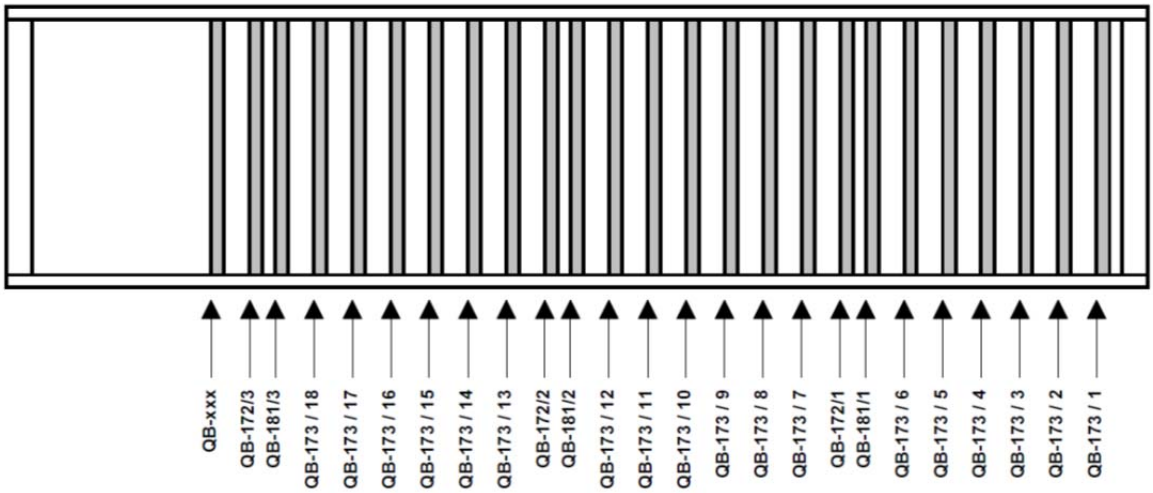

QB-xxx
QB-172
QB-181
QB-173 / 6
QB-173 / 5
QB-173 / 4
QB-173 / 3
QB-173 / 2
QB-173 / 1

14. Installation of the terminal boards QBxxx

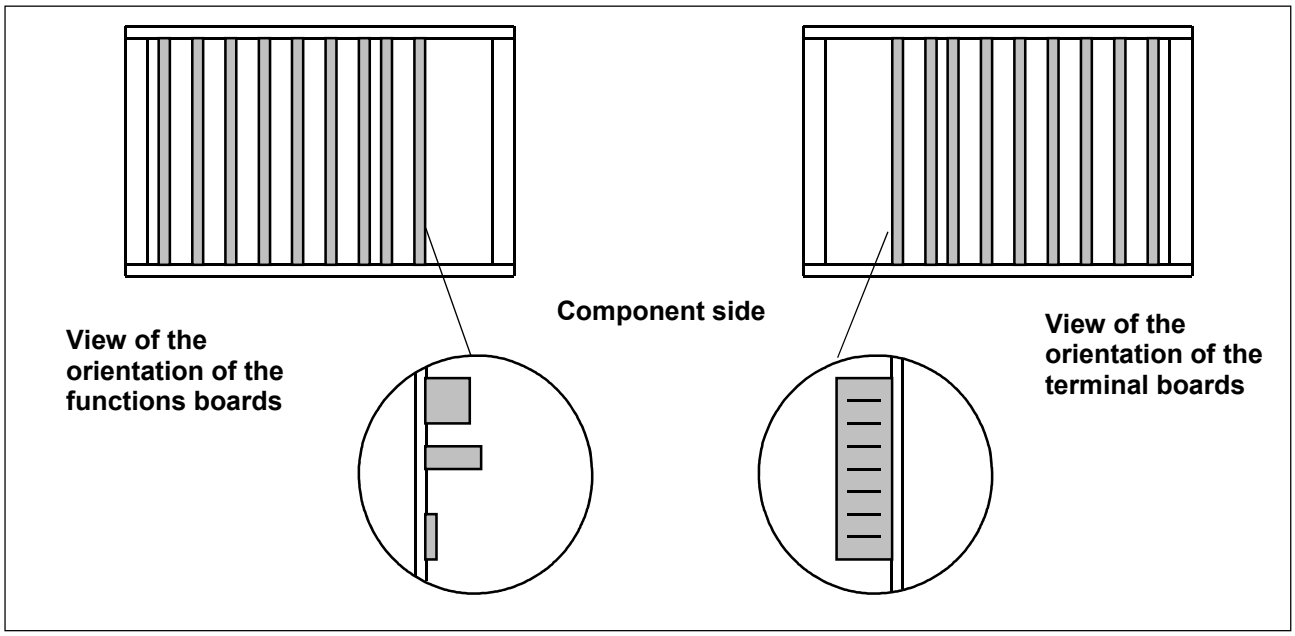
MDS 49



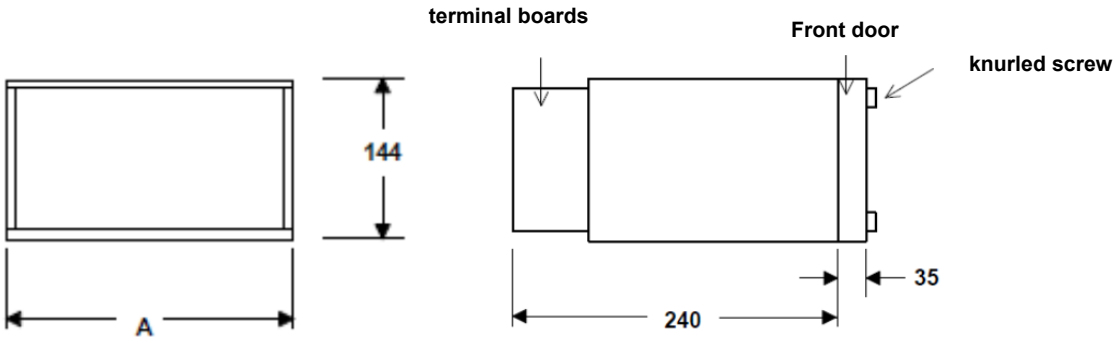
MDS 84



15.Orientation of the functions and terminal boards

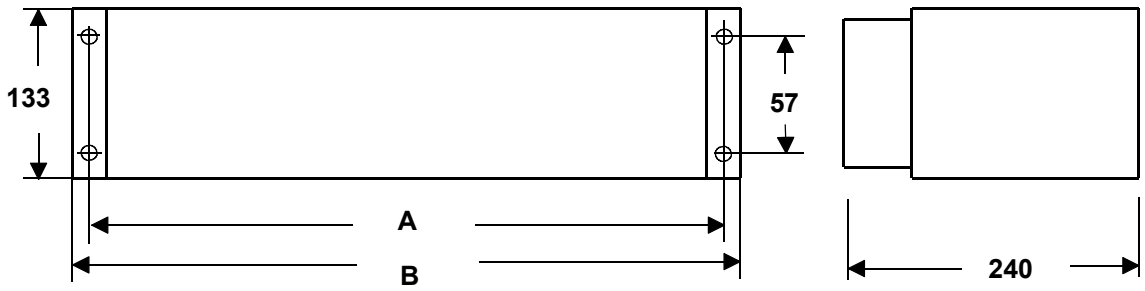


16.Diemensionsof the MDS-30 / 49 (in mm)



	MDS-30	MDS-49
A	192	288

17.Diemensions fort he 19“ rack MDS-84 / 49 (in mm)



	MDS-49	MDS-84
A	287	465
B	305	483

18. Power consumption with built-in components (24 VDC only)

	1	**2**	**3**	**4**	**5**	**6**
MDS 30	0,2A	0,3A	0,4	0,5A	0,6A	0,7A
	7	**8**	**9**	**10**	**11**	**12**
MDS 49	0,85A	0,95A	1,05A	1,15A	1,25A	1,35A
	13	**14**	**15**	**16**	**17**	**18**
MDS 84	1,5A	1,6A	1,7A	1,8A	1,9A	2A

Attention:
Non-compliance can lead to faulty operation or damage to the device.

19. Procedure for the 1st commissioning as well as for the exchange of components

The following must be observed before commissioning:

Activating the battery on DR-11 and LS-23

The built-in batteries have the task to store the entered data in the event of a possible power failure.

On delivery, the batteries are deactivated to prevent premature discharge.

For activation, the jumpers are set to the "ON" position. Please refer to the next page for information on where the jumpers are located.

Entering system data via the XV102 terminal

In order for the dosing system to work properly, the following data must in any case be entered on the
Terminal can be entered:

- Number of existing filling stations z.B. 1
- Nominal size of the meter z.B. 10
- Presetting z.B. 100 ml
- Max. filling time z.B. 1000 ms

- System data via data telegrams with PLC

All telegrams with the configuration data must be sent to the dosing system.

The line must then be filled with product and the zero point adjustment carried out with the terminal or PLC (telegram).

The dosing system is now ready for operation.
The following must be observed when exchanging components:

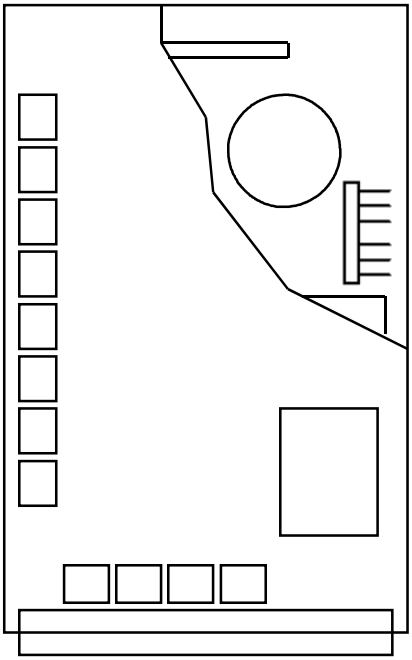
If a built-in DR-11 or LS-23 is exchanged for a new card, the battery plugs on the cards (only DR-11 and LS-23) that are not to be exchanged must be pulled out briefly and then plugged back into the "ON" position.

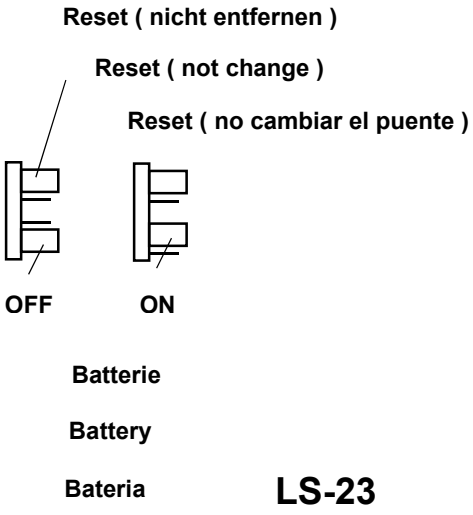
The cards should only be drawn when the auxiliary power is switched off.

This erases all stored data and all data must be re-entered as described above.

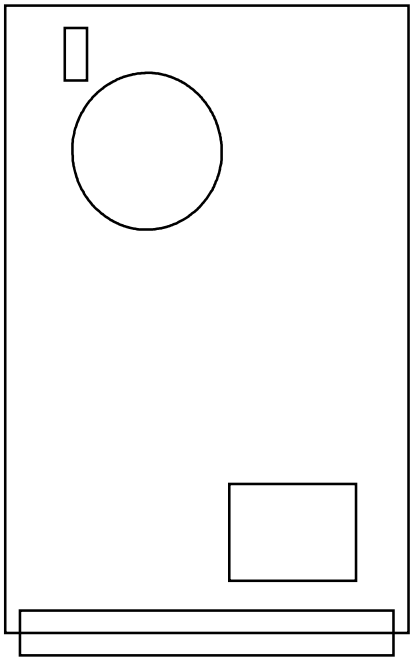
20. Setting the jumper for the battery

Adjustment from the battery jumper
Ajuste de puentes para batería





Einstellung der Jumper für die Batterie
Adjustment from the battery jumper
Ajuste de puentes para baterías



Batterie

Battery

Bateria

DR-11

21. Accuracy of dosing systems with magnetic flow meters and electronics series MID-MDS

Introduction

Talking about accuracy of dosing systems series MID-MDS (also true for the system MID-NFD) means to talk about repeatability. The absolute accuracy, i. e. the difference between both the measured batch quantity and e. g. the weight is not so important for dosing applications.
All measuring (dosing) systems have inaccuracies. So, a dosing system consisting only of the mag meter and its dosing electronics (valve and nozzle / valve outlet are not includes) has an absolutes accuracy of

=< +/- 0.5 % of reading

Within a velocity range of 0,5 to 10 m/sec.

This absolute (in-) accuracy is a constant quantity and can be eliminated by adjusting (changing) the preset value (batch quantity). With the new software (MDS) the calibration factor for each mag meter can be changed individually and so the preset value (batch quantity) adjusted to an optimum.

But there is an additional uncertainty to be observed, the total repeatability R of the complete system:

$$R_{TOTAL} = \sqrt{R_{MDS}^2 + R_{VALVE}^2 + R_{NOZZLE}^2 + R_{DENSITY}^2}$$

R_{total} = repeatability of the complete system
R_{MDS} = repeatability of the mag meter and dosing electronics
R_{valve} = repeatability of the dosing valve
R_{nozzle} = repeatability of the nozzle / valve outlet
$R_{density}$ = repeatability of the density of the liquid

R_{MDS} = repeatability of the mag meter and dosing electronics
= < 0,1 % of the batch quantity within a velocity range of 0,5 to 10 m/sec

R_{valve} = repeatability of the dosing valve is depending on the batch time.
There is not yet any information known about the repeatability of e. g. GEMÜ valves. According our experience with diaphragm valves: the repeatability is better Than 1 % of the valves delay time; the delay time of GEMÜ valves is approx. 70 milliseconds. After this time has gone the valve is closed.
So, it is only important to know, which quantity passers the valve during this time!
See 2 examples sheet 2

R_{nozzle} = repeatability of the nozzle / valve outlet is very hard to be estimated. In general one must be sure, that always the same quantity passes the nozzle after the valve had been closed. No dripping is acceptable, if it is dripping, the number and the volume of the drops should be constant and cease quickly!

$R_{density}$ = the influence of the density of the liquid is very important, too. It should be known as exact as possible. The liquid temperature should be kept as constant as possible during a machine shift to eliminate this influence. The density alteration of e.g. water is approx. 0,2 ml/degree centigrade.

21.1 Reference of determination of the meter size

It is possible to fill up with one meter size a wide range of dosing quantities in the same time. The table below shows, which meter size is recommended. It shows the dosing quantity in relationship to the velocity in the meter pipe:

DN	v = 0,5 m/s	v = 1 m/s	v = 2,5 m/s
10	40 ml/s	80 ml/s	200 ml/s
15	88 ml/s	176 ml/s	440 ml/s
20	157 ml/s	314 ml/s	785 ml/s
25	245 ml/s	490 ml/s	1225 ml/s
32	402 ml/s	804 ml/s	2010 ml/s
40	628 ml/s	1256 ml/s	3140 ml/s

The velocity of 1 m/sec is ideal for high product care, accuracy and wear. If the velocity is higher, then the pressure shock increases, if the valve is closing. On the other hand, if the velocity is lower then with several products deposits are possible.

21.2 Utilization for plastic pipes

It is very important to know that the dosing accuracy and the repeatability are depending on the oscillation of the product in the pipe. A product oscillation is possible, if plastic pipes are installed within the product line. If the valve is closing, then the pressure increase and the plastic pipe works like a memory. If plastic pipes are required, then they must be metal coated. A spiral from metal for reinforcement the plastic pipe is not adequate to guarantee the repeatability.
The length of the plastic pipe must be as short as possible. Are the pipes longer than 1 m, then a mechanical support must be for prevent pipe oscillations, if pressure shocks exists.

21.3 Error consideration with step-by-step filling

If containers are filled in several steps (e.g. 1 litre in 2 steps, prefilling 800ml and refilling 200ml), the same error uncertainties result as with filling in 1 step.
If the actual value of the pre-filler is used as the basis for the final filling (the final filler does not start at zero, but at the filled value of the pre-filler), the reproducibility of the valve of the pre-filler is taken into account in this procedure. This means that any pressure changes or valve delays during the closing process can be measured by the pre-filler and taken into account by the refiller. All other influencing factors remain unchanged.
From an error point of view, however, step-by-step filling is always less accurate than filling in one step, since the measurement uncertainty of the measuring system and the influence of the outlet piece (drop) multiplies with the number of steps. Only the influence of the valve can be detected in the pre-filling stages. However, the reproducibility of the valve of the replenisher can no longer be compensated.

Conclusion:

When filling step by step (and calculating the actual values of the pre-fillers) the measuring errors of the measuring system add up and the overall accuracy becomes worse. This has also been confirmed by practical tests in various applications.

22. Terminal boards

22.1 Terminal boards QB-170 for master boardd DR-11 Version with 1 start input

Task

The terminal board QB-170 is required for the connection of the central inputs and outputs.

Interfaces

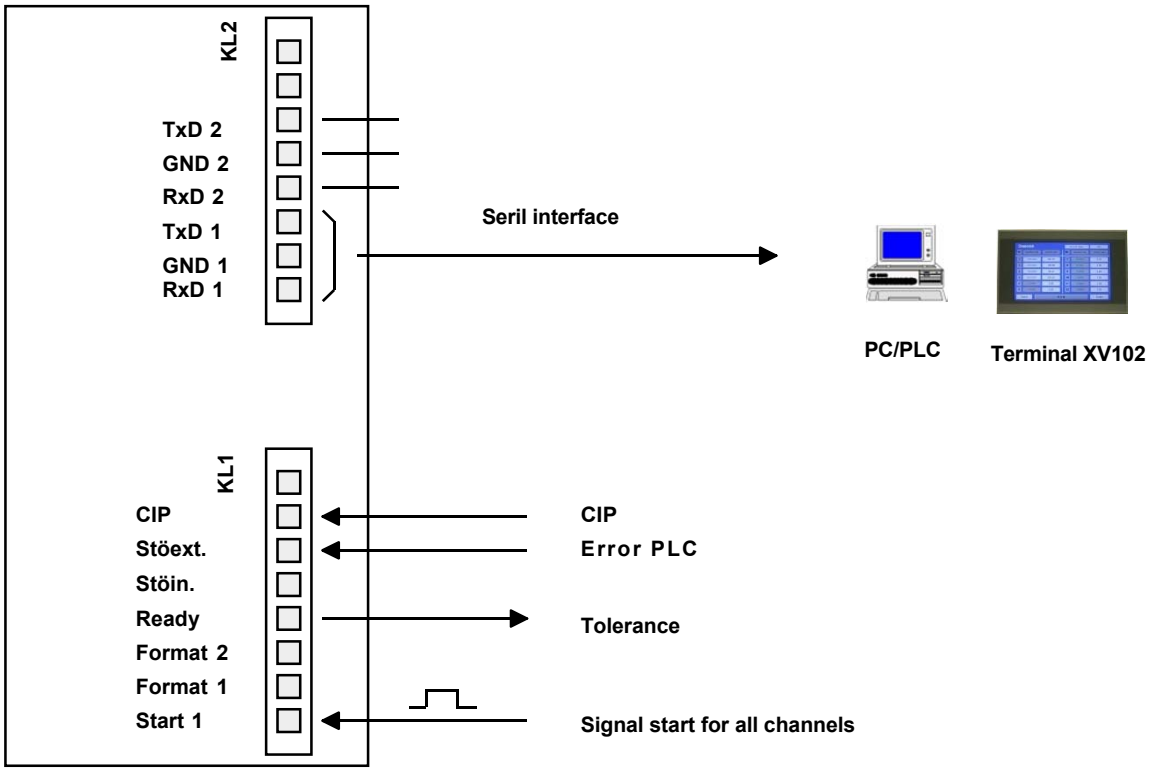
An RS 232 interface is available:

TXD1, RXD1, GND1 for connection of a PLC or TerminalXV102

However, it is only possible to operate with one interface, i.e. either PLC or TerminalXV102.

Inputs 24 VDC plus active / 5 mA

Start 1	opens all valves
Ready	Error message at Under/overcrowding
Stöext	closes all valves
CIP	opens all valves



22.2 Terminal board QB-172 for counter and valve board LS-23

Task

The terminal board QB-172 is required for connecting the auxiliary power and the valves.
One terminal board each is required for 6 measuring channels.

Power supply:
With two or more terminal cards, the connections should always be made from the board to the power supply. can be installed (see page 2).

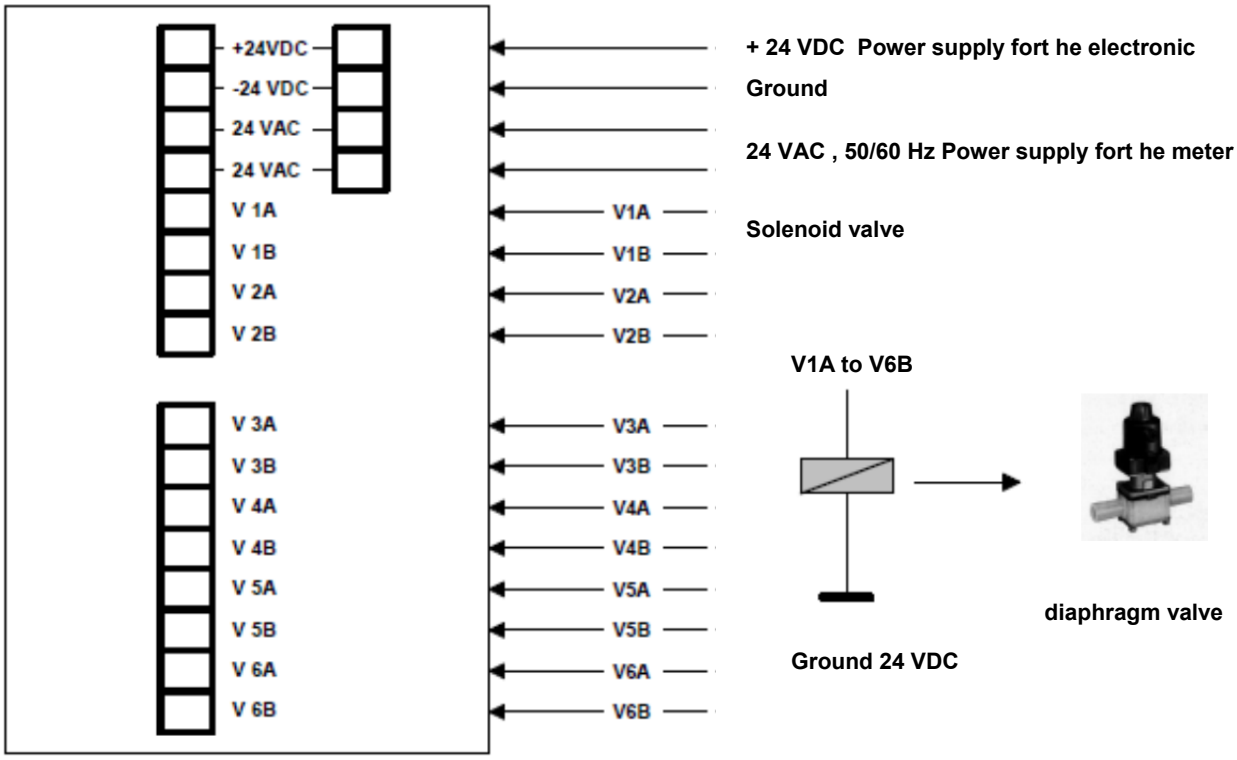
Valve outputs:

Output A: is always open during dosing.

Output B: can be switched on with two-stage valve

The valve outputs are positive switching outputs.
max. voltage : 36 VDC
max. current : 0,5 A

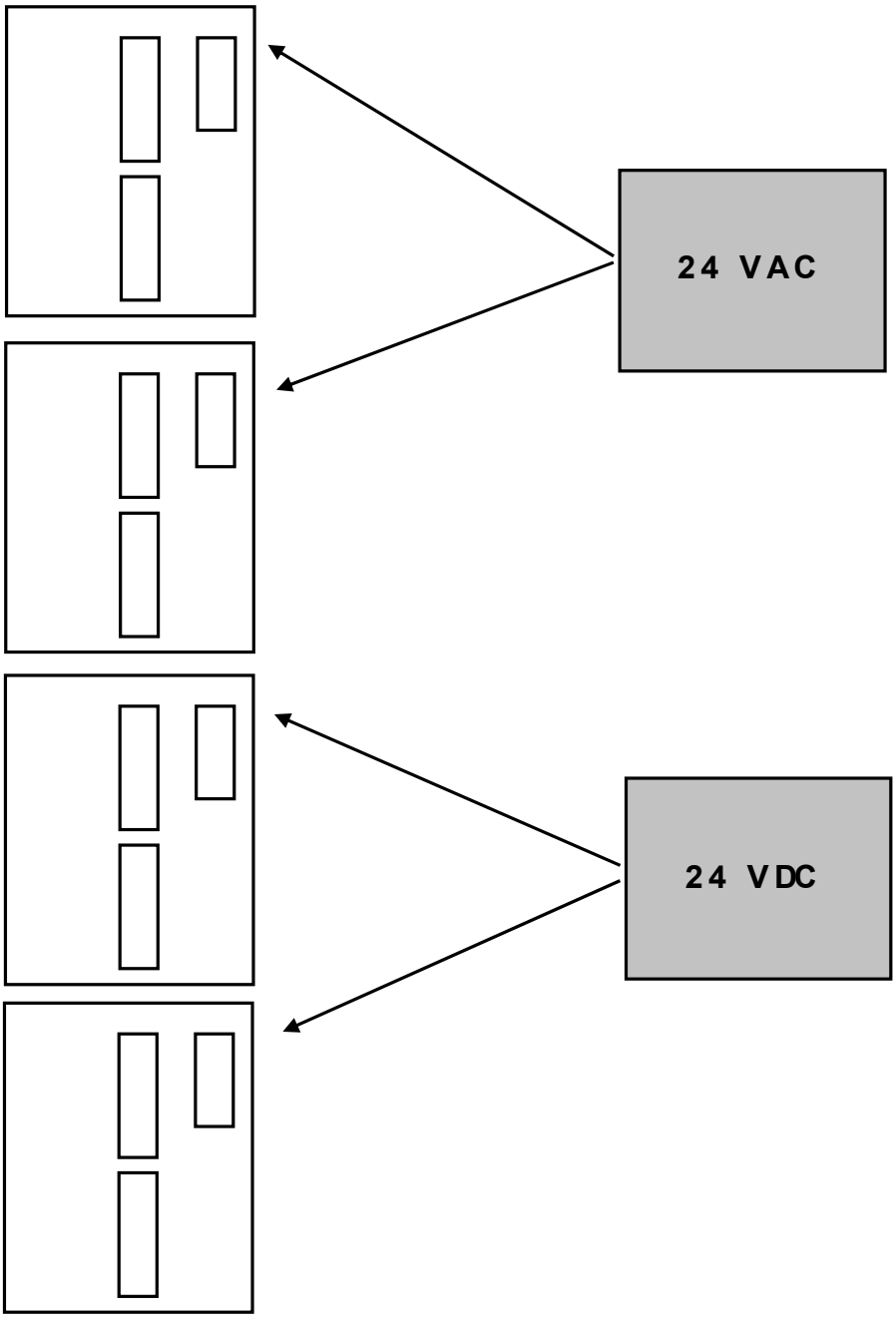
The output is short-circuit-proof and protected against overvoltage when switching inductive loads.



22.3 Terminal board QB-172 for counter and valve board LS-23

Power supply connection 24 VAC and 24 VDC

The auxiliary power should be connected in a star configuration from each terminal board to the power supply.



22.4 Terminal board QB-173 for the converter board UV-12

Connection to transducer MID-MDS

Task

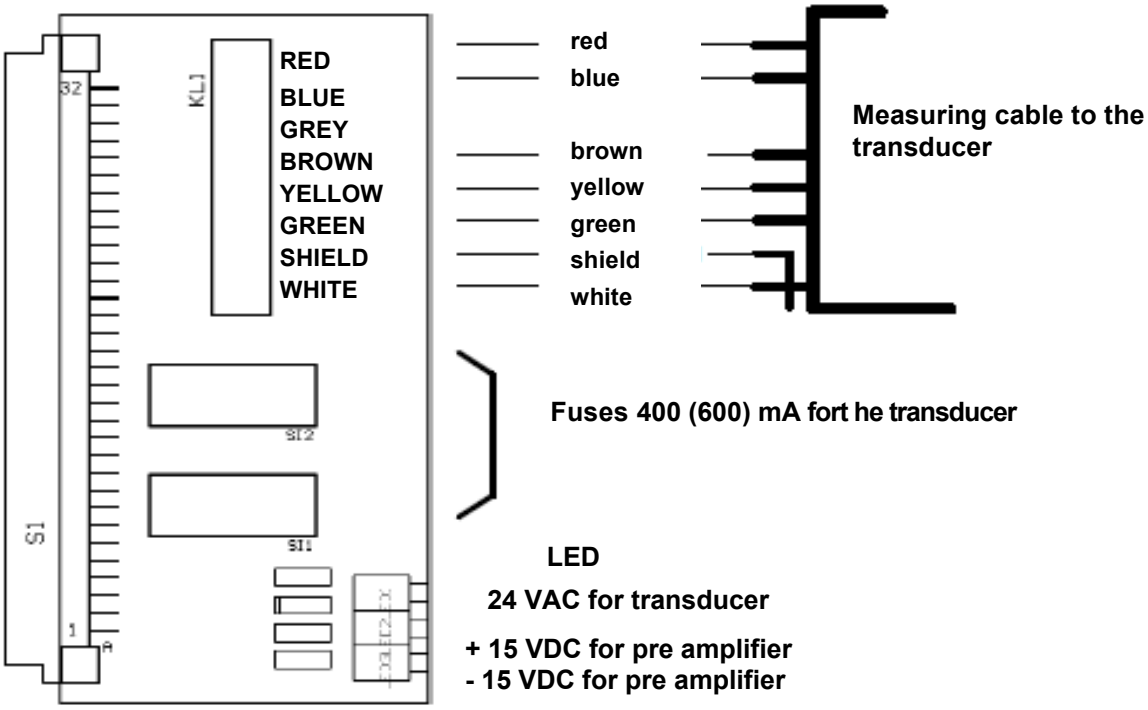
The terminal board QB-173 is required to connect the measuring cable.
This cable connects the transducer to the converter card UV12.
The measuring cable is a commercially available cable.
DIN Designation : LIYY- LIYCY

The following signals are transmitted with this cable:

- Supply voltage 24 VAC for the transducer coils
- +/- 15 VDC for the supply of the preamplifier
- reference voltage
- measuring voltage

Furthermore there are fuses on the terminal board:

- 2 fuses 24 VAC (400 mA) for the transducer coils
  Attention: When using the nominal sizes 25/32/40, the fuses S11 and S12 must be be replaced by 600mA fuses
- 3 LED for indication of
- +/- 15 VDC
- 24 VAC



23. Data transfer between master board DR-11 and PLC for LINEAR Filler

4 telegrams are available:

1. configuration 1 and 2
2. zero point calibration
3. reading of 3 actual values
4. dosing

Configuration of the RS 232

Baud rate 9 600
Start bit 1
Stop bit 1
Data 8
Parity straight

k-factors of the transducers (impulses / ml)
Output frequency of the converter board UV-12 = 50 kHz

DN 10 63,660
DN 15 28,293
DN 20 15,915
DN 25 10,186
DN 32 6,216
DN 40 3,979

23.1 CONFIGURATION 1

Byte	Description	PLC ===> send	PLC <= receive
1	Synchronisation	55h	55h
2	no function	00h	00h
3	Order byte	10h	ffh
4	Nominal size	xxh	xxh
	Example:	**0Ah** **"** **28h**	**0Ah ----> DN 10** **"** **28h ----> DN 40**
5	Number of fillers	xxh	xxh
	Example :	**0Ah**	**0Ah ----> 10 fillers**
6	Valve mask	1 0.bit Filler 1 1.bit Filler 2 2.bit Filler 3 3.bit Filler 4 4.bit Filler 5 5.bit Filler 6 6.bit Filler 7 7.bit Filler 8 bit = 1 Valve open	xxh
	Example: 00000011	**→ Filler 1 Filler 2 will be opened with the start signal (siehe Dosing Byte 6)**	
7	Valve mask	2 0.bit - 7.bit Filler 9 - 16	xxh
8	Valve mask	3 0.bit - 7.bit Filler 17 - 24	xxh
9	Valve mask	4 0.bit - 7.bit Filler 25 - 32	xxh
10 11 12	lower Dosing quantity middle for all fillers upper	xxh xxh xxh	xxh xxh xxh
Example:	**Dosing quantity = 100ml , DN 20 → 100ml x 15,915 (k-factor) =1591,5 → 000637h**		
		37h **06h** **00h**	**37h** **06h** **00h**
13	Valve mask	5 0.bit - 7.bit filler 33 – 40	xxh
14	Valve mask	6 0.bit - 7.bit filler 41 – 48	xxh

Byte	Description	PLC ===> send	PLC <= receive
15	Overflow correction	xxh	xxh
	Example:	**00h** **01h**	**00h → jes** **01h → no**
16	Block check (XOR from 1 to 15)	xxh	xxh

xx = depends on the information

Example for an complete telegram — Dosing quantity: 100 ml, DN 10 , Number of fillers: 6
Filler to be opened : 1,2,3,4,5,6

Telegram 55h 00h 10h 0Ah 06h 3Fh 00h 00h 00h 37h 06h 00h 00h 00h 00h 47h

23.2 CONFIGURATION 2

Byte	Description		PLC ===> send	PLC <= receive
1	Synchronisation		55h	55h
2	No function		00h	00h
3	Order byte		15h	ffh
4	lower	maximum	xxh	xxh
5	upper	dosing time	xxh	xxh
	Example:			
		4.byte	**E8h**	**E8h**
		5.byte	**03h**	**03h**
		maximum dosing time ==>03E8h ==> 1000ms		
		4.byte	**00h**	**00h**
		5.byte	**00h**	**00h**
		The maximum dosing time does not close any valve		
6	Valve B open at ....%		xxh	xxh
	Example:		**0Ah**	**0Ah**
			Valve B open at 10 % of the dosing quantity	
7	Valve B closeat .... %		xxh	xxh
	Example:		**50h**	**50h**
			Valve B close at 80 % of the dosing quantity	
			00h	**00h**
			Valve B does not open at 1-step filling application	
8			00h	00h
9	Tolerance in per mille		xxh	xxh
10	lower	Dosing quantity	xxh	xxh
11	middle	for all fillers	xxh	xxh
12	upper		xxh	xxh
Example:	**Dosing quantity = 100ml , DN 20 → 100ml x 15,915 (k-Faktor) =1591,5 → 000637h**			
			37h	**37h**
			06h	**06h**
			00h	**00h**

Byte	Description	PLC ===> send	PLC <= receive
13		00h	00h
14		00h	00h
15		00h	00h
16	Block check (XOR von 1 bis 15) xxh xxh		

xx = depends on the information

Example for an complete telegram: max. dosing time 1000ms, Valve B open at 10% and close at 80%, dosing quantity 100 ml for DN 20,

Telegram 55h 00h 15h E8h 03h 0Ah 50h 00h 00h 37h 06h 00h 00h 00h 00h C0h

23.3 Zero point adjustment for all fillers

Byte	Description	PLC ===> send	PLC <= receive
1	Synchronisation	55h	55h
2	No function	00h	00h
3	Order byte	11h	ffh
4		00h	00h
5		00h	00h
6		00h	00h
7		00h	00h
8		00h	00h
9		00h	00h
10		00h	00h
11		00h	00h
12		00h	00h
13		00h	00h
14		00h	00h
15		00h	00h
16	Block check (XOR von 1 bis 15)	xxh	xxh

xx = depends on the information

Example for a complete telegram:

Telegram: 55h 00h 11h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 00h 44h

23.4 Read

of 3 actual values of the current filling or

of 3 actual values of the previous filling

Byte	Description		PLC ===> send		PLC <= receive
			actual value current filling		**actual value previous filling**
1	Synchronisation		55h	55h	55h
2	No function		00h	00h	00h
3	Order byte		13h	14h	13h/14h
4	Filler number		xxh	xxh	xxh
5	lower	actual value	xxh	xxh	xxh
6	middle	Filler No.	xxh	xxh	xxh
7	upper		xxh	xxh	xxh
8	lower	actual value	xxh	xxh	xxh
9	middle	Filler No **+ 1**	xxh	xxh	xxh
10	upper		xxh	xxh	xxh
11	lower	actual value	xxh	xxh	xxh
12	middle	Filler No **+ 2**	xxh	xxh	xxh
13	upper		xxh	xxh	xxh
14			00h	00h	00h
15			00h	00h	00h
16	Block check (XOR from 1 to 15)		xxh	xxh	xxh

xx = depends on the information

23.5 Filling

Byte	Description	PLC ===> send	PLC <= receive
1	Synchronisation	55h	55h
2	No function	00h	00h
3	Order byte	12h	12h
4	Filler number	xxh	xxh
5		00h	xxh
6	Command byte	0 0 0 0 x3 x2 x1 1	

x1=0 No activity
x1=1 Start
x2=0 waits for START and closes valve when dosing quantity is reached
x2=1 CIP , opens the valves as long as the signal x2 = 1
x3=1 External fault, valves are all closed

7	lower	dosing quantity for	xxh	xxh
8	middle	filler number	xxh	xxh
9	upper		xxh	xxh

Example: Dosing quantity = 100ml , DN 20 → 100ml x 15,915 (k-Faktor) =1591,5 → 000637h

			37h	**37h**
			06h	**06h**
			00h	**00h**
10	lower	actual value -1	00h	xxh
11	middle	of	00h	xxh
12	upper	Filler number	00h	xxh
13	lower	dosing quantity -1	00h	xxh
14	middle	for	00h	xxh
15	upper	Filler number	00h	xxh
16	Block check (XOR from 1 to 15)		xxh	xxh

xx = depends on the information

Example for a complete telegram: Dosing quantity: 100 ml , DN 20 , number of Filler: 6

Telegram 55h 00h 12h 03h 00h 03h 37h 06h 00h 00h 00h 00h 00h 00h 00h 76h