OPERATING INSTRUCTIONS

Additiv Unit Eva 5

Contents:

1. General description

This manual is valid for firmware version 5.15. The current version appears on the controller display after the unit has been switched on.

The **EVA 5 Additive Unit** is a compact and highly accurate device for adding small amounts of liquids (additives) into selected products (petrol, diesel). The complete Additive Unit comprises four parts shown in Figure 1.

a) **EVA 5.DX Dosing Unit** - 01900-01-00X, where X specifies the number of coaxial valves (1 to 8) or
- 01900-11-00X, where X specifies the number of coaxial valves (1 to 8)
The Dosing Units differ in the type of used flowmeter

b) **EVA 5.RX Control Unit** - 01900-02-001X , where X specifies the number of controlled coaxial valves (1 to 8)

c) **Standard accessories comprise**:

item 3 250 μm pre-filter
item 10 Outlet hydraulic hose 0.5 m (stainless steel or PTFE)
item 11 Spray valve with G3/4" external thread

d) **Optional accessories comprise**:

item 1 Magnetic dirt filter
item 2 Ball valve with G3/8" internal thread
item 4 25 μm filter
item 5 Return valve
item 6 Inlet hose (rubber, PTFE or stainless steel)
item 7 Quick connector unit G3/8" (when disconnected, it does not function as a shutoff valve).
item 8 Purge package
item 9 Blanking plugs
item 12 Junction box
item 13 Special seals

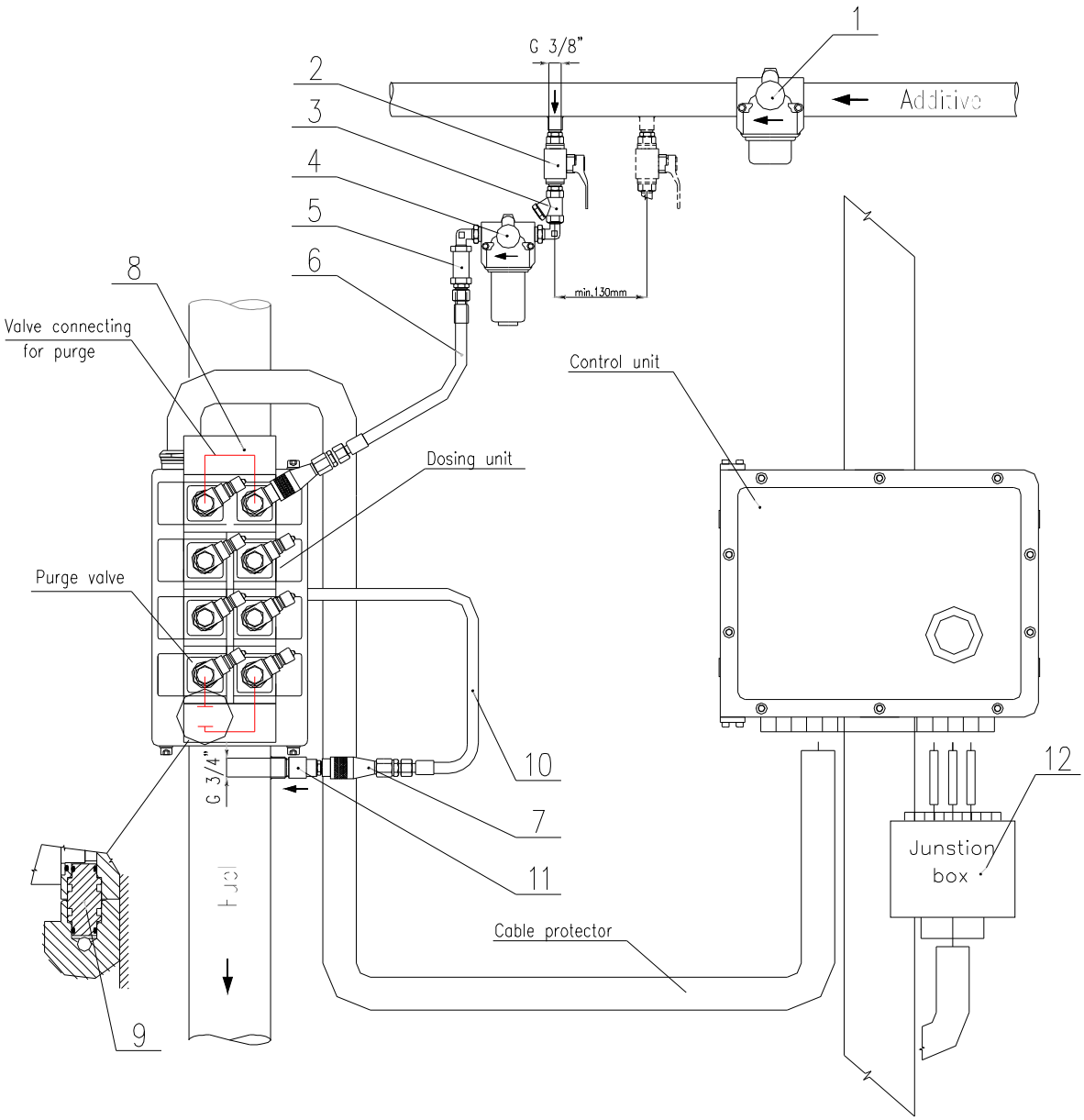

Figure 1 - EVA 5 Additive Unit

1.1. Dosing Unit - drawing no. 01900-01-00X, 01900-11-00X

The dosing unit performs the instructions sent by the control unit. The complete system is mounted on a base-plate which is designed for up to 8 additive outputs, or 7 additives and 1 purge fluid.

The slots in the dosing unit are used to attach it to the base-plate using four bolts. This design enables the unit to be partially dismounted for servicing. The design also enables individual parts of the unit to be quickly changed according to the user's requirements.

The dosing unit holder has holes for auxiliary bolts to attach a bracket that can be welded if required (See fig.2).

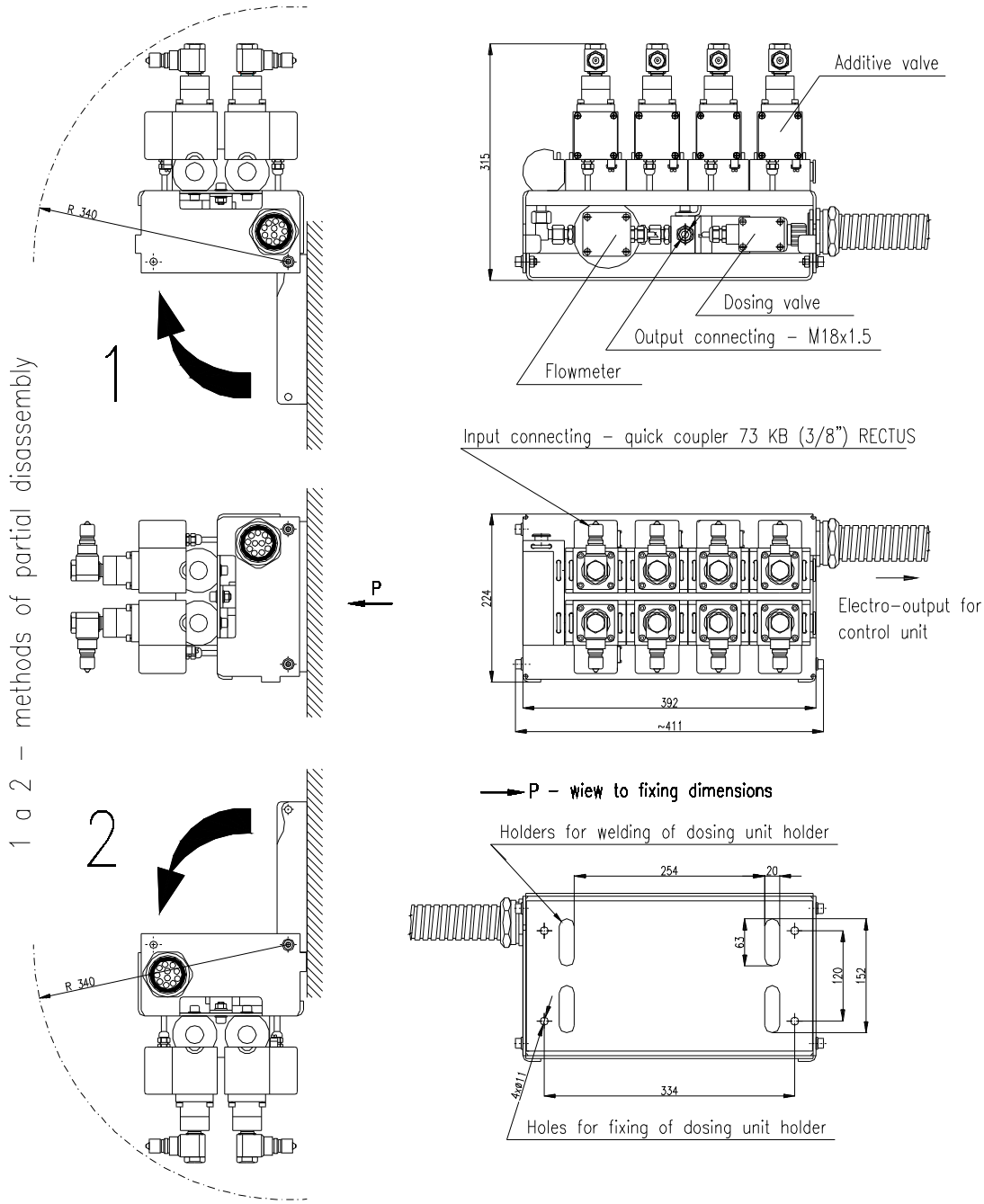

Figure 2a – Dosing Unit 01900-01-008 with fixing dimensions

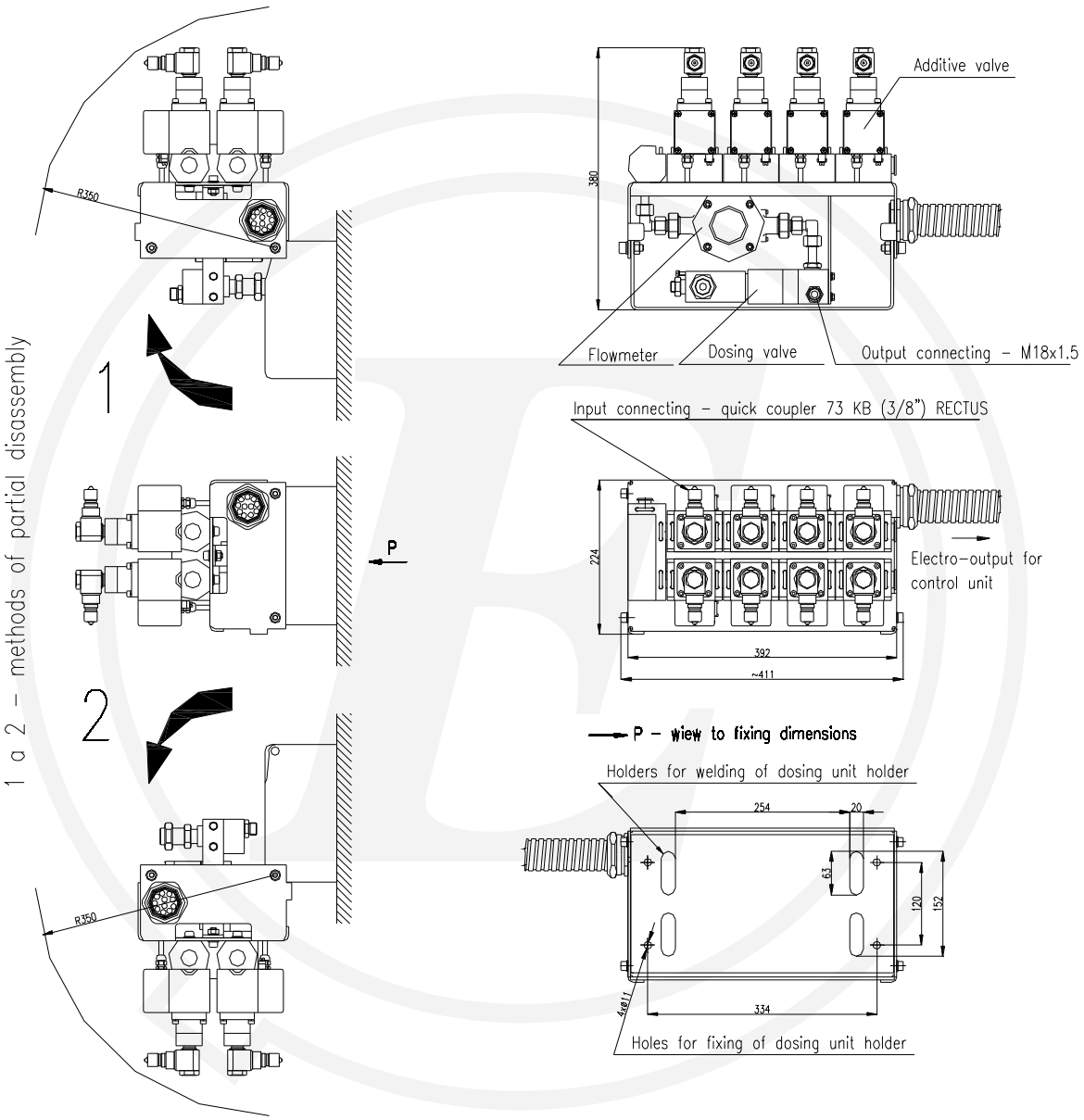

Figure 2b – Dosing Unit 01900-11-008 with fixing dimensions

Dosing unit function description:

The filtered additive (required purity is 25µm) first flows through the inlet filter into the hydraulic hose that is equipped with a quick connector for easy connection to the unit. The additive passes through the isolation valve used to shut off the supply, through the return valve, flowmeter then through the dose valve, which controls the concentration of the additive, and then through the spray valve into the product. The flowmeter evaluates the total volume of additive introduced to the fluid according to the number of impulses. The additive volume can be checked or calibrated by disconnecting the quick connector between the unit and the spray valve and attaching the calibration set. The concept used to connect individual parts of the unit allows parts to be quickly exchanged according to the user's requirements.

ATTENTION !

If the pressure 1,6 MPa is exceeded the coaxial additive valve may be damaged !

1.2. Control Unit - drawing no. 01900-02-00X

The EVA 5.RX Control unit is a control system designed to control the EVA 5.DX range of dosing units. The electronics of the control unit is placed in the Control Unit Box with a fixed fastener. This box is fixed to a holder. The Control unit Holder has holes for fixing bolts and slots for welded (see Fig.3). The control unit is powered by an external 230V/50Hz supply. All electrical devices and signalling that is required for controlling the additive process and communicating with higher level systems can be connected to the control unit. Only suitable approved types of cable glands can be used for cables entering the control unit, e.g. Capri type: ADE 1F for cable diameters 4-8.5, 6-12, 8.5-16 mm for temperature range -40 to 100°C. Unused threaded holes are blanked off using approved steel plugs e.g. Capri for temperature range -40 to 100°C.

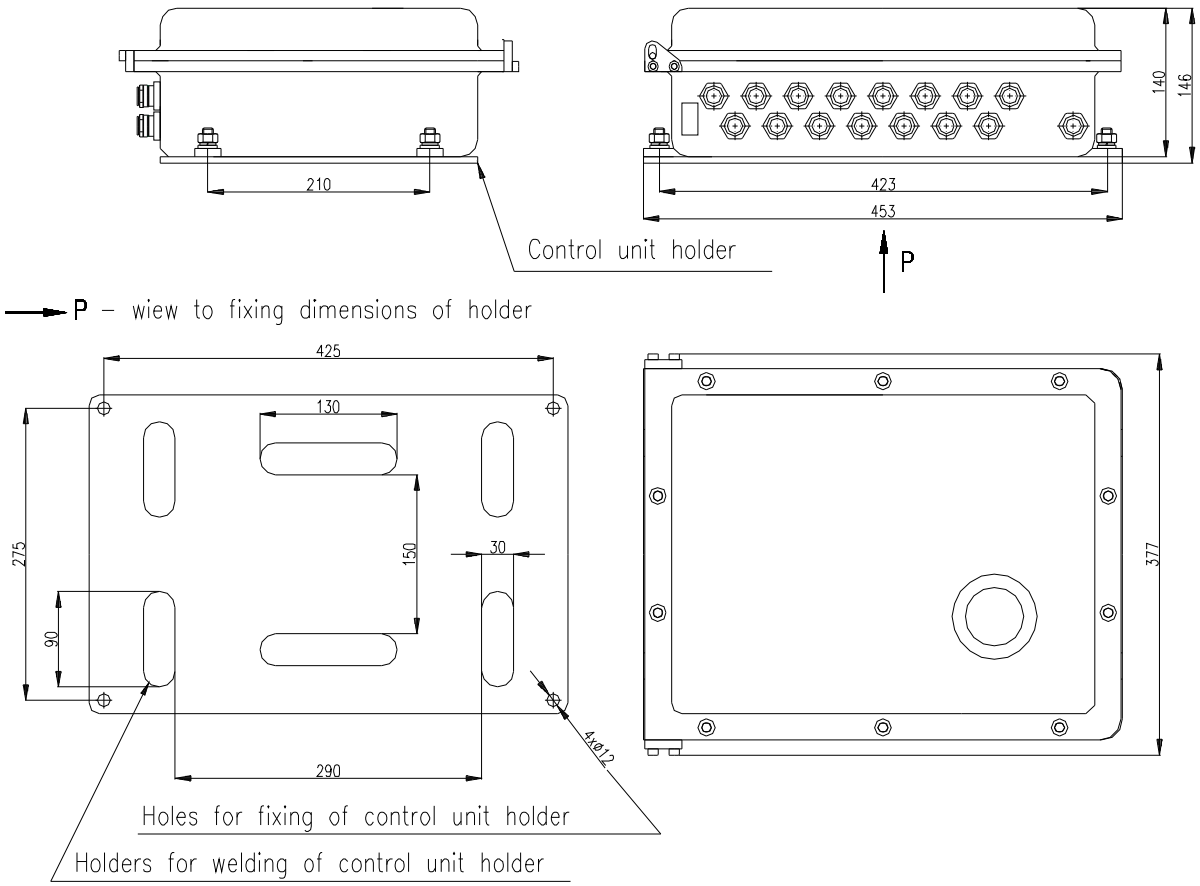

Figure 3 – Control Unit dimensions

The electronics system of the control unit consists of three boards. The EVA5-IO board is located at bottom of the flameproof enclosure. The EVA-COM communication board is connected via two connectors to the EVA5-IO board. The EVA5-CNT board is located under the cover of the flameproof enclosure and is connected via a flat cable to the EVA5-IO board. All external connections are made using connectors. The connectors are located on a “DIN” rail within the flameproof enclosure.

NOTE: When closing the lid of the box it is necessary to ensure that the flat ribbon cables are not caught or crushed between the sealing surfaces.

The control unit provides a full 485 interface for connection to a control system. A DIP switch for selecting the unit’s address, which can be set from 1 to 99, is located on the printed circuit board. It is possible to connect units to the 485 bus bar in parallel.

The operational state of the additive unit is indicated by a four-digit LED display mounted on the control unit. The current state of the inputs and outputs is indicated by the LEDs on the EVA5-IO board.

The operational mode can be set up remotely by using a **RS485 serial link**. Set-up via the serial link is performed using a defined protocol. It is possible to read parameters and settings, or follow the technological process itself via the serial link. The operational mode is shown during the course of dosing, i.e. the volume and type of additive. When the unit is in dosing mode, the volume and type of additive is shown on the display.

1.3. Standard Accessories

Standard accessories are always supplied with the EVA 5 Additive unit. Individual components are shown and described in section 1 “General Description”.

In order to minimise the undesired mixing of individual additive remainders in the system between the dosing unit and the product pipe, the **outlet hose** from the dosing unit is supplied as standard **length of 0.5m**. Upon the customer’s request it is possible to supply **different lengths of hose**. However, due to the above-mentioned reason it is not recommended that outlet hoses are longer than 0.5m.

With respect to the **aggressive nature of certain additives** the **outlet hose is made of stainless steel**.

Ventil rozstřik. – spraying valve

Navarek – lug

Potrubí produktu – product piping

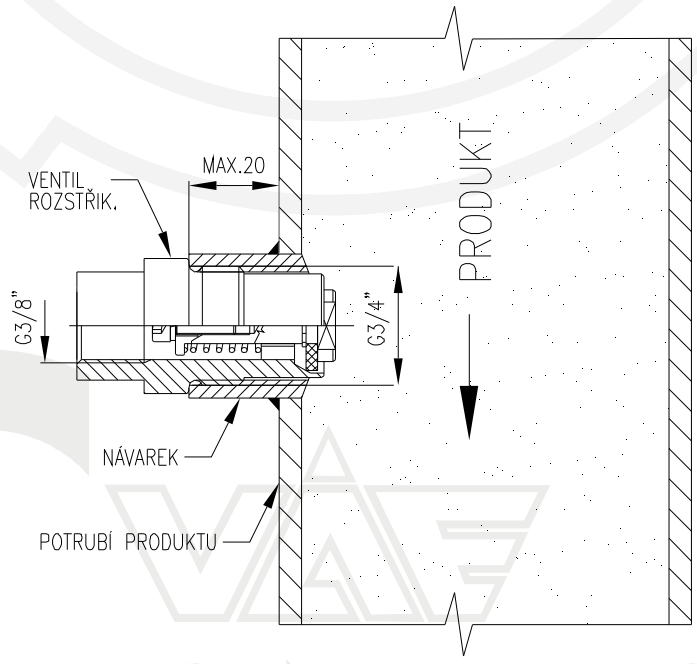

Figure 4 – Instalation of a sprinkle valve in produkt piping

For sprinkle valve corect function and its thorough washing by produkt i tis necessary to install the sprinkle valve as indicated in picture No.4.

1.4. Optional Accessories

Optional accessories for the EVA 5 Additive unit are supplied according to the specification form which is submitted with the order. Individual components are shown and described in section 1 “General Description”.

Ball valves are used to close the inlets to the additive unit in the event that servicing is required or filters need to be cleaned.

Return valves are located on the inlets to the additive unit and prevent undesired mixing of individual additives in the event of a fault on the coaxial valve.

The required purity of the additive at the inlet hose is 25µm. The additive first passes through an initial coarse 250µm filter. This filter is only intended to capture coarse impurities and is supplied as standard. The user is obliged to ensure the required 25µm purity of the additive at the hydraulic inlet hose by using either **the filter offered in the optional accessories or a different adequate filter**.

The correct operation of the flow meter is guaranteed, apart from other criteria, for additives that are free of mechanical impurities larger than 25 µm and also free of all magnetic impurities. For this reason we recommend that **additive pipe work in stainless steel** or use of a **magnetic filter** in front of the inlet hose to the additive unit, when using steel pipe work for the additives.

To prevent the undesired mixing of individual additives remaining in the system between the dosing unit and the product pipe, it is possible to **purge** the dosing unit. For purging, one of the coaxial valves is used as a purge valve. That means that the total number of possible additives is reduced by one, e.g. from 8 to 7.

When commissioning the dosing unit only the valves that will be used immediately for additives should be flooded. We recommend conserving the remaining valves due to additive ageing (gelling, congealing, etc.). The **blanking plugs** serve to isolate unused coaxial valves.

During long periods when certain additives are not used we recommend, due to additive ageing (gelling, congealing, etc.), that the respective valve is flushed with petrol or diesel and isolated from the additive unit with a **blanking plug**. We also recommend flushing the respective inlet hoses and quick connectors, filters and return valves. The **ball-valve** is used to isolate the inlet of the respective additive from the dosing unit.

With regard to the aggressive nature of some additives it is necessary to use **suitable hoses and seals** especially for dynamically loaded hydraulic components (quick connectors, coaxial valves, dosing valves). **Special requirements for seals** can be met as a part of optional accessories. Standard seals are made from Viton. We recommend that inlet and outlet **hoses are made of stainless steel**.

The connection box is supplied in the event that the installation requires a supply cable **longer than 2000 mm** between the dosing unit and control unit

1.5. Calibration Set

The calibration set is supplied as an optional accessory in a special case. It has an inlet and outlet part. The method of connecting the calibration set is shown in figure 4.

The inlet part of the calibration set consists of manometer and a quick inlet and outlet connector. The inlet part of the calibration set comprises a hose, manometer, inlet quick connector and a spray valve. For accurate measurement the set also contains a plastic measuring cylinder.

The operating procedure for the calibration set is described in section 6 “Service and maintenance”

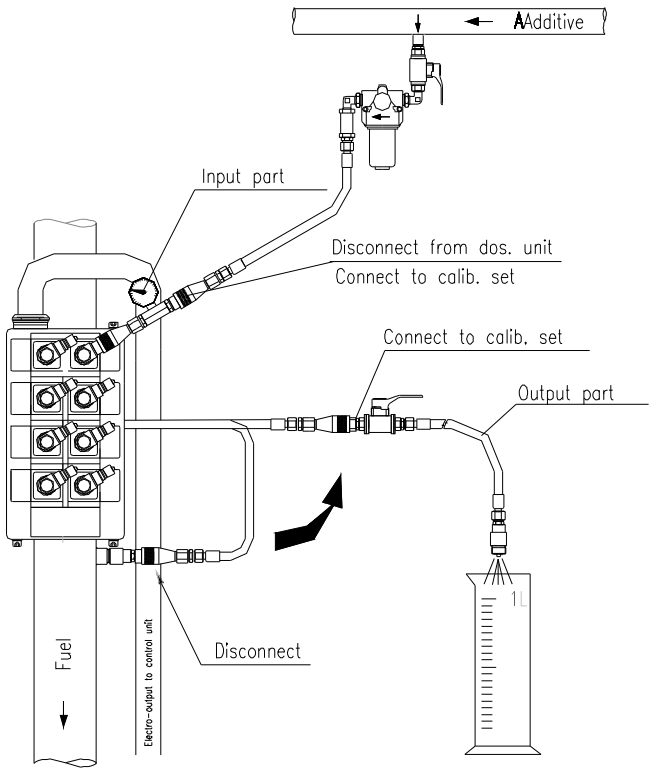

Figure 4 – Connecting the Calibration Set

2. Technical specification

The technical specification of the unit is stated in the “Technical specification” document.

3. Operating instructions

3.1. Description of operation

The leading edge of a pulse on the “Loading” input X4.4, resets the counter for a flowing additive and fuel and a new cycle starts. The product flow rate is measured at the falling edge of a pulse on the “Main flow” inputs X5.3. to X5.6. – “Addit.select bin. 0 till 3” or X4.3 – “Main flow”. Additives 1 to 8 are selected by the impulses from the product flow indicators on inputs X5.3. to X5.6. The information about a selected additive is also available on outputs X2.2 – X2.4 (see table 1).

After the second pulse to the additive selection inputs X5.3. to X5.6. or X4.3. – “Main flow”, the indicator showing that dosing is taking place (X2.5) is switched on and after the third pulse the additive valve 1 to 8 (output X7.1. to X7.24) is opened.

The additive flow meter has two leads which are connected to inputs X9.1 to X9.4. The system can also detect reverse rotation in a flow meter. The volume of an additive added to a product, measured in litres from the beginning of the feed cycle, is shown on the display (e.g. “2.45” means 2.45 litres of additive).

The required volume of the additive is calculated on the basis of the flow volume of a product and the concentration value (parameters 102h to 110h in the EEPROM).

If the volume of the additive is less than required, the control valve (output X6.1 and X6.2) opens more up to the level given by 34 parameter. If the volume of the additive is more than required, the control valve closes more up to the level given by 32 parameter.

Coding of output information on outputs “Addit.Select bin. 0 to 2” and output “Dosing” according to activated additive is indicated in Table 1.

Table 1: Outlet “valve” coding according to additive number

Additive number	Addit.select bin. 0	Addit.select bin. 1	Addit.select bin. 2	Dosing
None	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	ON
2	OFF	ON	OFF	ON
3	ON	ON	OFF	ON
4	OFF	OFF	ON	ON
5	ON	OFF	ON	ON
6	OFF	ON	ON	ON
7	ON	ON	ON	ON
8	OFF	OFF	OFF	ON

Tables 2 and 3 describe the method of selecting the additive by using inputs X5.3 to X5.6. Table 2 describes the mode (binary coding) and table 3 the mode coding “1 from 4“. The mode is set by parameter 54, bit 0 (other combinations of inputs X5.3 to X5.6 are not used).

Table 2: Coding for the actual valve - binary coding

X5.3.	X5.4.	X5.5.	X5.6.	Additive valve
0	0	0	0	None
Pulse	0	0	0	1
0	Pulse	0	0	2
Pulse	Pulse	0	0	3
0	0	Pulse	0	4
Pulse	0	Pulse	0	5
0	Pulse	Pulse	0	6
Pulse	Pulse	Pulse	0	7
0	0	0	Pulse	8

Table 3: Coding for the actual valve - coding “1 from 4”

X5.3.	X5.4.	X5.5.	X5.6.	Additive valve
0	0	0	0	None
Pulse	0	0	0	1
0	Pulse	0	0	2
0	0	Pulse	0	3
0	0	0	Pulse	4

3.2. Selecting an additive via the serial link

The program enables additives and their volumes to be set remotely via a serial link. The program works in a similar manner as when selecting additives using the “Additive selection bin. 0 to 3” inputs.

First an additive is selected and the concentration is set via the serial link. The leading edge of a pulse on the “Load” input resets the counter for a flowing additive and product and a new cycle starts. The falling edge of a pulse on the “Main flow” input increases the rate. The additive number also appears on output X2.2. to X2.4.

The function is the same as in section 3.1.

3.3. Testing mode

You can use the EVAMATE program to set the unit to test mode. All additive testing in test mode can be performed without connection to Accuload. The unit internally generates the pulses for the product flow input. The duration of the product flow signal is set by parameter 134h in the EEPROM. The condition for activating the test mode is that the “Loading” input is not active.

The EVAMATE program can set the number of additives (the defined product formula) and the total volume of the product is defined in 1000 l. It can start the dosing process for the selected additive.

The additive number (the defined formula) and the required product volume in 1000s l can be set in the control program. Then the test for the selected additive can start. The decimal point starts to flash on the display and the unit behaves as if the “Main flow” input was active and as if it was receiving pulses from Accuload. The unit performs the additive process according to the selected formula until the Accuload program generates the respective number of pulses for the selected product volume. In case the selected product volume is zero the test can only be stopped by the program.

3.4. “Purge” Input Function

3.4.1. “Stop Dosing“ mode

The “Purge” Input X4.5 is used to terminate the additive cycle. After a period (set in parameter 142h) the additive process is terminated. A new additive cycle can be started after the subsequent activation of the “Loading” input.

3.4.2. Purging mode

In order to remove remaining additive from the additive unit it is possible to use the purge function. It is activated according to the set purge parameters.

A signal on the “Purge” input (X4.5) is used to activate the purge cycle. After the purge is activated there is a pause (time until the purge starts) to wait for dosing to finish. After this pause the actual purge is activated. The additive valve is switched off, the eighth purge valve is switched on and the dosing valve fully opens. The purge lasts either for the duration of the set period (purge time) or until the required volume is passed through according to the additive flow meter (purge volume). Then the purge is complete and all the valves are switched off. The purge is also terminated when the “Loading” input is switched off.

If the same additive is used during next dosing process then a purge is not necessary. In the case that a purge is terminated before the required volume for cleaning the whole system has passed through, then it cannot be guaranteed that the prescribed concentration will really be met.

3.5. Description of alarms

When individual alarms, described below, are activated they set off the respective alarm states and also a global state with the value 1. The hardware output “Alarm” is activated according to the “Alarm Mask” (parameter 15Ch), whereby individual bits of this parameter allow (1) or prevent (0) hardware outputs according to the state.

Bit 0 ..... not used
Bit 1 ..... alarm ZF
Bit 2 ..... alarm DP
Bit 3 ..... alarm LV
Bit 4 ..... alarm LD
Bit 5 ..... alarm LA
Bit 6 ..... alarm UF
Bit 7 ..... alarm OF

It is possible to reset all alarms using the software (resetting the global state “AL”) or by the leading edge of a pulse on the “Loading” input – new additive cycle.

3.5.1. Zero flow [ZF]

The text “A1” flashes on the display. The alarm is monitored after the “Pumping Time” (parameter 158h, range 0 – 99 sec) has expired from the moment when the dosing valve first opens in additive mode. In the case of the subsequent closing of this valve (the immediate required volume of the additive is less than real volume) a flow was detected then monitoring for this alarm is switched off. If during this time “Delay A1” the number of pulses from the additive counter is less than “Zero Flow” (parameter 154h, range 0 – 127 pulses) alarm ZF is flagged. At the same time the additive and dosing valves are closed. If the parameter is 0 the alarm is off. The alarm can be halted via the communications link, but the valves will not open, a new “Loading” signal is required. The alarm is monitored only when the dosing valve is first opened, in the case of checking for a malfunction in the flow meter during dosing it is necessary to use alarm UF (described below). When configuring alarm ZF, it is necessary to take into account the time required to pressurise the additive pipe work (tens of seconds, “Pumping Time” parameter).

3.5.2. Down pulse [DP]

The text “A2” flashes on the display. The alarm is monitored continually except during the “Pumping Time” (parameter 158h, range 0 – 99 sec) described above, when alarm monitoring is switched off. If the number of switched pulses on the flow meter is higher than “Down Flow” (parameter 156h, range 0 – 127 pulses) then alarm DP is flagged. If the parameter is 0, the alarm is off.

3.5.3. Let-by on valve [LV]

The text “A3” flashes on the display. The alarm is continually monitored except during the additive process. If the absolute number of pulses on the flow meter is higher than “Let-by Valve” (parameter 14Ch, range 0 – 127 pulses), then alarm LV is flagged. If the parameter is 0, the alarm is off.

3.5.4. Let-by on dosing valve [LD]

The text “A4” flashes on the display. The alarm is monitored only during the additive process when the dosing valve is closed. If the absolute number of pulses on the flow meter is higher than “Let-by Dose” (parameter 150h, range 0 – 127 pulses), then alarm LD is flagged. At the same time the

additive valve is closed. When there is a new requirement to open the dosing valve, the additive valve is also opened. If the parameter is 0, the alarm is off.

3.5.5. Let-by on additive valve [LA]

The text “A5” flashes on the display. The alarm is monitored only during the start of the additive process which is initialised by the leading edge of a “Loading” pulse and the duration is given by the parameter “Time of LA Test” (parameter 15Ah, range 0 – 5 sec). In this mode the dosing valve is fully open and all additive valves are closed. If the absolute number of pulses on the flow meter is higher than “Let-by Additive” (parameter 14Eh, range 0 – 127 pulses), then alarm LA is flagged. If the parameter is 0, the alarm is off.

3.5.6. Product Underfill [UF] / Overfill [OF]

The text “A6” or “A7” flashes on the display. An underfill or overfill product, i.e. a greater or lesser volume of additive than is required, can occur if the stipulated percentage error is exceeded (parameter 128h, 126h). If the duration of the product alarm is longer than the parameter “Product Delay” (14Ah) then the respective alarm is flagged UF/OF. If parameter 128h or 126h is 0, the respective alarm is switched off. The alarm is monitored after the “Pumping Time” has elapsed which starts immediately after the “Loading” input has been activated.

3.6. Selecting an address

A DIP switch is located on the control board and is used to select the unit’s address for serial communication via RS485. It is possible to select an address from 1 to 255. The address 0 is reserved for service purposes, do not use!

3.7. Parameters in the EEPROM

Parameters are stored in EEPROM on a control board CNT.Described adresses are shifted by 100h (adress 102h in documentation corresponds to physical adress 02h in EEPROM memory).

3.7.1. Concentration values in ppm

102h ..... concentration for additive no. 1
104h ..... concentration for additive no. 2
106h ..... concentration for additive no. 3
108h ..... concentration for additive no. 4
10Ah..... concentration for additive no. 5
10Ch..... concentration for additive no. 6
10Eh..... concentration for additive no. 7
110h ..... concentration for additive no. 8

Range: 1 to 9999

Default:

102h to 110h: 100

3.7.2. Timing of PWM valves

The period for which a valve is open = (required additive amount – actual additive amount) * (maximum period for which a valve is open – minimum period for which a valve is open) / constant for converting the period for which a valve is open.

120h ..... minimum period for which a valve is open
122h ..... maximum period for which a valve is open
124h ..... constant for converting the period for which a valve is open

Range: 0 to 255

Default:

120h: 55
122h: 200
124h:..... 20

3.7.3. Check of recepies filling

126h ..... allowed percentage error for over-concentration, i.e. a larger volume of the additive than required
128h ..... allowed percentage error for under-concentration, i.e. a smaller volume of the additive than required

If the parameters are set on 0xFF or 0x0, no check is performed.

Range: 0 to 100 or 255

Default:

126h: 255
128h: 255

3.7.4. Flow indication parameters

12Ah ..... number of pulses of the additive flow meter in pulses per litre
12Ch ..... number of pulses of the product flow meter in pulses per 1000 litres

Range: 1 to 65535

Default:

12Ah: 534
12Ch: 20

3.7.5. Testing parameters

134h ..... length of pulse during a simulation flow rate * 40 ms

Range: 1 to 255

Default:

134h: 25

3.7.6. EVA parameters

136h ..... EVA unit type
bit 0 (+1) .... additive input code – see table
0 = 1 of 4
.... 1 = binary code
bit 1 (+2)..... additive input speed
.... 0 = counts to 5 Hz either for the product flow rate input X4.3 or the additive selection input X5.3 to X5.6
.... 1 = counts to 2 kHz on the product flow rate input (only one additive can be controlled)
bit 2 (+4) ..... not used
bit 3 (+8): ..... active level for fault signals
.... 1 = active fault signal level is +24 V
.... 0 = active fault signal level is 0 V
bit 4 (+16): ..... software copy type
.... 1 = copy of product
.... 0 = copy of additive
138h ..... pulse splitter for an additive or a product

Range:

136h: ..... 00 to 32
138h: ..... 1 to 255

Default values:

136h: 08
138h: 01

3.7.7. Additive number parameters

13Ch ..... number of additives the unit is allowed to dispense

Range: 1 to 8

Default:

13Ch: 1

3.7.8. Parameters of “Purge” input

13Eh ..... type of input mode
.... 00 not activate
.... 01 “Stop dosing” active mode
.... 02 “Purging” active mode
142h ..... pause before “Purge” input is activated in seconds
144h ..... duration of the actual purge process in seconds
146h ..... volume of the purge measured in number of pulses on the flow meter

Range:

13Eh: ..... 00 to 02
142h: ..... 0 to 255
144h: ..... 0 to 255

146h: ..... 0 to 65535

Default:

13Eh: 00
142h: 10
144h: 10
146h: 200

3.7.9. Alarm settings parameters

14Ah ..... duration of overfill / underfill of product for flagging alarm [OF] / [UF] in units of 40ms
14Ch ..... number of pulses on the additive flow meter to flag alarm [LV]
14Eh ..... number of pulses on the additive flow meter to flag alarm [LA]
150h ..... number of pulses on the additive flow meter to flag alarm [LD]
154h ..... min. number of pulses on the additive flow meter not to flag alarm [ZF]
156h ..... number of return pulses on the additive flow meter to flag alarm [DP]
158h ..... time to start “Loading” for monitoring alarm [ZF] in units [sec.]
15Ah ..... duration for monitoring alarm [LA] in units of 40ms after starting “Loading” respectively dosing
15Ch ..... the bits of this parameter allow (1) or prevent (0) hardware “Alarm“ outputs according to individual alarm flags, bit 0 unused.

Range:

14Ah: ..... 0 to 255
14Ch: ..... 0 to 255 (0 = alarm LV off)
14Eh: ..... 0 to 255 (0 = alarm LA off)
150h: ..... 0 to 255 (0 = alarm LD off)
154h: ..... 0 to 255 (0 = alarm ZF off)
156h: ..... 0 to 255 (0 = alarm DP off)
158h: ..... 0 to 255
15Ah: ..... 0 to 255 (0 = alarm LA off)

From the lower 8 bit parameters, bit 7 is used to select the start time after “Loading” input = 0 or “Dosing” output = 1. Bits 0 to 6 are used for setting times (value 0 – 127)

15Ch: ..... 0 to 255
Bit 0 ..... not used
Bit 1 ..... alarm ZF
Bit 2 ..... alarm DP
Bit 3 ..... alarm LV
Bit 4 ..... alarm LD
Bit 5 ..... alarm LA
Bit 6 ..... alarm UF
Bit 7 ..... alarm OF

Default:

14Ah: ..... 25 = 5 sec.
14Ch to 150h: 20
154h to 156h: 10
158h: 10

15Ah: 0
15Ch: 255

3.7.10. Parameter splitter for the additive flow meter

15Eh ……. Splitter parameter with a set value N enabling an N times higher total number of additive flow meter pulses for one batch (N * 16bit additive counter = N * 65535 pulses). This splitter does not free up pulses of the hardware additive counter (address 40h n RAM memory). The current state of the additive splitter is stored at address 42h in RAM memory.

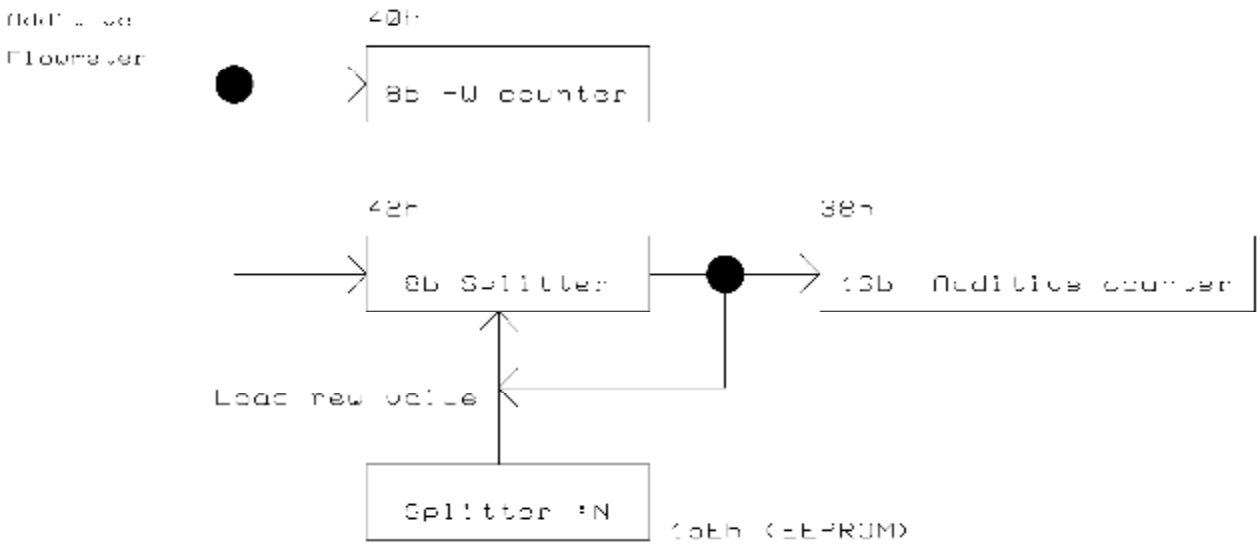

Figure 5 – Schematic of the additive flow meter splitter

Range:

15Eh: ..... 1 to 255 Default: 1

3.8. Non-resettable additive counters

At the address location 180h to 18Eh of the EEPROM memory there are 8 successive counters (range 0 – 32767) one for each of the 1 to 8 additives. The value is in units of 100ml. The respective counter is increased incrementally by the value of the latest additive volume at the moment the additive batch was completed.

A four bit counter is located at address 190h which stores information about the overall volume of additives processed by the control unit through all the additive valves. The volume is stored in units of 100ml. The counter is increased incrementally by the value of the last additive volume from any additive at the moment the additive batch was completed.

3.9. Communication protocol for the additive unit

Communication between the units and a higher level system is performed as read/write data into one singular memory area in the unit, where the RAM and EEPROM are mapped. Every item in this area is 2 bits long. The protocol is 1 start bit, 8 data bits, No parity, 1 stop bit. The data transfer rate is set to 9600 Baud.

3.9.1. Description of messages

Data messages are coded in ASCII HEX, where 1 byte is represented by two characters “00 to FF”. In the event that the character “/” is received, it is ignored and not included in the data packet. The maximum number of characters in a message is 124.

Message format:

<STX><EVA address><Data address><Number><Data 0> …<Data N-1><CRC><ETX>

<STX> ..... Start character (02h) to start reception.

<ETX> ..... Stop character (03h) to end reception.

<EVA address> ..... 2 characters representing the address of the unit set on the DIP switch on the control board, range (00 to FF). If the address is 0 the control unit always answers, this value is only used for diagnostic purposes.

<Data address> ..... 4 characters (range 0000 to 7FFF), specify the address of the first word in the memory area for communication. The most significant address bit (bit 15) specifies reading/writing of words. If bit 15 = 0 the request is to read memory, if bit 15 = 1 then address locations 8000 to FFFF are used to write data.

<Number> ..... 2 characters (00 to FF) represent the number of data bytes in the message. One data word <Data n> is represented by two bytes. In order to transfer N data words it is necessary to set the value 2*N words <Number>.

<Data 0 to N-1> ..... 4 characters (0000 to FFFF) represent data words in the range 0 to 65535. For a request to read data no data is controlled by the transmission system. When writing to a unit, the control unit answers with a message where the read data of the memory area is sent back after it has been written to memory.

<CRC> ..... 2 characters (00 to FF) representing 1 byte which holds the control sum of the data packet. The result is given by the XOR sum of the ASCII values of the message, starting with the character in <EVA address> and ending with the last data word <Data N-1>, if it exists. Algorithm for calculating the check sum: Char.0 **XOR** char.1 **XOR** char.2 **XOR ….** char.N

3.9.2. Communication error reports

The control unit replies to incorrect data formats in a message with error reports of set values <Number> to zero. The following byte is sent as the number for the error report:

List of error codes:

0 ..... Value <Number> greater than max - number = 56 or is 0

1 ..... Value <Data address> outside the allowed range

2 ..... Value <Data address> is an odd number

3.9.3. Description of the memory area

The memory area of the EVA5 additive unit is divided into 2 basic areas. The first area is from 0000h to 00FFh and is located in RAM. The second is the address location 0100h to 01FFh and this is mapped in EEPROM. More detailed information about the data stored in the EEPROM was described above.

The unit can be set by the software to three authorisation levels. These user levels allow/prevent access to or show data stored in the memory area The lowest level is 0. In the following table items highlighted red are only available in level 2, items highlighted blue in level 1 and items highlighted green in level 0. Items highlighted grey are for reading only. It is possible to read the whole memory area from level 0.

Table 4 – EEPROM memory area (0x100 to 0 x 1FF)

Address	*Name*	*Comments*
0x102	Additive 1 formula	Product formula in ppm
0x104	Additive 2 formula	
0x106	Additive 3 formula	
0x108	Additive 4 formula	
0x10A	Additive 5 formula	
0x10C	Additive 6 formula	
0x10E	Additive 7 formula	
0x110	Additive 8 formula	
0x112 to 0x11E	not used	
0x120	Min open valve	Dosing valve parameter
0x122	Max open valve	Dosing valve parameter
0x124	Full open valve	Dosing valve parameter
0x126	Alarm: over concentration	Alarm OF parameter [0 to 100 %] (0 = alarm off)
0x128	Alarm: under concentration	Alarm UF parameter [0 to 100 %] (0 = alarm off)
0x12A	Additive flow meter	Number of pulses/litre additive flow meter
0x12C	Product flow meter	Number of pulses/1000 litres product flow meter
0x12E to 0x130	not used	
0x132	EEPROM check sum	**If write data = 0 then set default parameters in the EEPROM**
0x134	Testing parameter	The parameter of the simulated flow rate during testing
0x136	EVA unit type	Type of EVA
0x138	Pulse splitter	Pulse splitter for software copy
0x13A	not used	
0x13C	Number of additives	Total number of additives
0x13E	Purge input type	“Purge” input mode
0x140	not used	
0x142	Purge pause	Time delay until “Purge” is activated [sec]
0x144	Purge duration	Purge duration [sec]
0x146	Purge quantity	The volume of the purge measured in pulses
0x148	not used	
0x14A	Alarm: time UF/OF	Duration of dosing fault to activate alarm UF/OF
0x14C	Alarm LV	Number of pulses for activating alarm LV [0 to 255] (0 = Alarm off)
0x14E	Alarm LA	Number of pulses for activating alarm LA [0 to 255] (0 = Alarm off)
0x150	Alarm LD	Number of pulses for activating alarm LD [0 to 255] (0 = Alarm off)
0x152	not used	
0x154	Alarm ZF	No. of pulses for not activating alarm ZF [0 to 255] (0 = Alarm off)
0x156	Alarm DP	Number of pulses for activating alarm DP [0 to 255] (0 = Alarm off)
0x158	Pumping time	Delay before monitoring alarm ZF, UF, OF [sec]
0x15A	Alarm time LA	Time for monitoring alarm LA [sec]
0x15C	Alarm Mask	Allowed output controls “Alarm”
0x15E	Additive splitter	Additive splitter for flow meter [1 to 254]
0x160 to 0x17E	not used	
0x180	Counter 1 total	Non-resettable additive counters [value * 100ml]
0x182	Counter 2 total	
0x184	Counter 3 total	
0x186	Counter 4 total	

Address	Name	Comments
0x188	Counter 5 total	
0x18A	Counter 6 total	
0x18C	Counter 7 total	
0x18E	Counter 8 total	
0x190	HI (All counters total)	Non-resettable counter for all additives [value * 100ml]
0x192	LO (All counters total)	
0x194 to 0x1FA not used		
0x1FC	**HI (Unit serial number)**	Control unit's serial number
0x1FE	**LO (Unit Serial number)**	

Table 5 – RAM memory area (0x00 to 0xFF)

Address	Name	Comments
0x00	Software version	Example 5.12 = 512
0x02	Unit address	0 to 255
0x04	Restart unit	If data write = 0 then Restart unit (only for LW = ON)
0x06	Level 1	On / off authorisation level 1
0x08	Level 2	On / off authorisation level 2
0x0A to 0x2A not used		
0x2C	bit15 Unit status	data = 0x8000 then LW = ON , data = 0x7FFF then LW = OFF
0x2E	Hardware inputs	Input status "230" additive flow meter inputs
0x30	HI (Product counter)	Product counter
0x32	LO (Product counter)	
0x34	HI (Prod.count.-shadow)	Product counter – shadow
0x36	LO (Prod.count.-shadow)	
0x38	Additive counter	Additive counter
0x3A	Additive counter-shadow	Additive counter – shadow
0x3C	Let-by counter	"Let-by" counter – pulse
0x3E	Soft counter. Copy	Only write for LW = ON
0x40	HW additive counter	Hardware counter for additive flow meter
0x42	Additive counter splitter	Additive counter splitter
0x44 to 0x7E not used		
0x80	Additive number	The number of the currently active additive valve (0 to 8)
0x82	Open dosing valve	Read the currently open dosing valve (0 to 225)
0x84	Hardware output	Setup / read output relay and output soft copy (for LW = ON)
0x86	Set additive number	Setup additive valves (0 to 8) (Only for LW = ON)
0x88	Set open dosing valve	Setup opening of dosing valves (0 to 255) (Only for LW = ON)
0x90	Purge quantity counter	Number of pulses of the additive flow meter for complete purge
0x92	Purge counter	Time until activation of "Stop additive/purge" [sec]
0x94	Quantity test	Product volume for testing in units of 100 litres
0x96	Additive number test	Start / Stop additive (0 to 8) testing, if value is 0 then stop test
0x98	Software additive select	Software selection of additives (0 to 8) (0 = hardware code)

3.9.3.1. Description of the status register (0x2C)

15	*14*	*13*	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
LW		**DP**	**ZF**	**LD**	**LA**	**LV**	**PR**			**UF**	**OF**	**AL**	**DO**	**LO**	**TL**

TL ..... alarm LA test being performed

L0 ..... "Loading" is active

DO ..... "Dosing" is active

AL ..... "Global Alarm" flag active
OF,UF ..... the corresponding alarms are active
LV,LA,LD,ZF,PD ..... the corresponding alarms are active
PR ..... "Purge" is being performed
LW ..... direct control of the valves and unit's outputs is allowed

The status register is used to read the current state of the unit. The exception is bit 15 = LW which allows or prevents direct control. Changes to LW are only allowed in user access level 2. Changing bit LW (activating: write to register 0x8000 / zeroing: write to register 0x7FFF) will change all registers which are specified for direct control (address location 0x84 to 0x88, address 0x3E).

The second exception is bit 3 = AL, which can also be zeroed in user level 0. It is use as a software reset for all the unit's alarms.

3.9.3.2. Description of the hardware input register (0x2E)

15	*14*	*13*	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
						PR1	**PR0**	**RS**	**PR**	**LO**	**MF**	**IN3**	**IN2**	**IN1**	**IN0**

IN3 to IN0 ..... coding for "Additive.select bin." inputs
MF ..... "Main flow" input
LO ..... "Loading" input
PR ..... "Purge" input
RS ..... "Reserve" input
PR0 ..... channel for additive 0 flow meter
PR1 ..... channel for additive 1 flow meter

This register is used to read the state of the unit's hardware inputs. When the bit is set the respective input is active, when the bit is zero the input is inactive.

3.9.3.3. Description of the hardware output register (0x84)

15	*14*	*13*	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
							SW Copy			**RES**	**AL**	**DO**	**AD2**	**AD1**	**AD0**

AD2 to AD0 ..... coding for "Additive.select bin." outputs
DO ..... "Dosing" output
AL ..... "Alarm" output
RES ..... "Reserve" output
SWCopy ..... Software copy output

This register is used to read the state of the unit's output relays. When the unit is in direct control mode it is possible to write to this register (only in user level 2).

3.9.3.4. Description of Software Copy counter (0x3E)

This register is an incremental additive pulse counter (not active during purging) and it also periodically counts down to zero. During countdown it generates software pulses. The pulse period is constant (2ms) and the number of pulses is influenced by the parameter "Soft Copy Splitter" in the

EEPROM. For parameter value 1 every additive pulse is generated, for higher values the number of generated pulses is reduced. The maximum frequency of Software Copy pulses is 250Hz, the frequency splitter must be adapted for this.

When the unit is in direct control mode it is possible, by writing to the register, to generate the precise number of pulses for the respective frequency. The condition for this is that the SWCopy bit in the hardware output register is set to zero.

3.10. Communication protocol for the additive unit (compatible with EVA 3 and 4)

These messages are not recommended for using, they are included only for reason of back compatibility with older software version for “EVA 3” or “EVA 4”.

3.10.1. Description of reports

<Start> <Control> <Address> <Data> <CRC> <Stop>

<Start>:

Start character of message received by the additive unit = “D”
Start character of message transmitted by the additive unit = “O”

<Control>:

Control character = [P, S, C, G, V, M, I, T, E, L, Y, X,N]

<Address>:

Two address characters 00 to 99 for the additive unit are set using the DIP switch on the board

<Data>:

Data according to the 2nd byte of the report – communication specification.
Data are ASCII numbers 0 to 9 = 30H to 39H

<CRC>

Three-character control sum
CRC = Address3 xor Address2 xor Address1 xor DataN xor ... xor Data2 xor Data1
The '/' character is not included in the control sum.

<Stop>

Stop character of message received by the additive unit = “K”
Stop character of message transmitted by the additive unit = “k”

Note. During reception, the “ / ” character is omitted.

3.10.2. Type of reports

3.10.2.1. Messages for setting up and reading concentrations (“P”)

3.10.2.1.1. Concentration setup

D P <Adr2> <Adr1> <Ca> <P4> <P3> <P2> <P1> <Ks3> <Ks2> <Ks1> K

<Ca> - Valve number 1 to 8
<P4><P3><P2><P1> - an additive concentration in ppm

It sets the amount of an additive in ppm for a certain valve number

3.10.2.1.2. Concentration readout

D P <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

<Ca> - Valve number 1 to 8
<P4><P3><P2><P1> - an additive concentration in ppm

3.10.2.1.3. Response to a concentration setup and readout

O P <Adr2> <Adr1> / <Ca> / <P4> <P3> <P2> <P1> / <Ks3> <Ks2> <Ks1> k

3.10.2.2. Messages for reading status reports ("S")

3.10.2.2.1. Status report readout

D S <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.2.2. Response to a status report readout

O S <Adr2> <Adr1> / <Sj2> <Sj1> / <Sv> / <Ov3> <Ov2> <Ov1> / <Oa5> <Oa4> <Oa3> <Oa2> <Oa1> / <Op4> <Op3> <Op2> <Op1> / <Ks3> <Ks2> <Ks1> k

<Sj2> <Sj1> - status of the additive unit

bit 0 (+1) pumping start
bit 1 (+2) pump relay
bit 2 (+4) feed in progress
bit 3 (+8) failure
bit 4 (+16) over-concentration
bit 5 (+32) under-concentration

<Sv> - closure status of valves

0 – no valve
1..8 –valve number

<Ov3>..<Ov1> - opening level of valve, values 0 - 255

<Oa5>..<Oa1> - additive volume added

<Op4>..<Op1> - product volume added

3.10.2.3. Messages for resetting additive and product counters ("C")

3.10.2.3.1. Reset additive and product counter report

D C <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.3.2. Response to resetting additive and product counter report

O C <Adr2> <Adr1> / <Sv> / <Oa5> <Oa4> <Oa3> <Oa2> <Oa1> / <Op4> <Op3> <Op2> <Op1> / <Ks3> <Ks2> <Ks1> k

<Sv> - closure status of valves

0 – no valve
1..8 –valve number

<Oa5>..<Oa1> - additive volume added

<Op4>..<Op1> - product volume added

3.10.2.4. Messages for setting up and reading out configurations (“G”)

3.10.2.4.1. Configuration setup

D G <Adr2> <Adr1> <Min3> <Min2> <Min1> <Max3> <Max2> <Max1> <Ful3> <Ful2> <Ful1> <Ks3> <Ks2> <Ks1> K

<Min3>..<Min1> - minimum period for which a valve is open
<Max3>..<Max1> - maximum period for which a valve is open
<Ful3>..<Ful1> - constant for calculating the period for which a valve is open

3.10.2.4.2. Configuration readout

D G <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.4.3. Response to configuration setup and readout

O G <Adr2> <Adr1> / <Ca> / <P4> <P3> <P2> <P1> / <Ks3> <Ks2> <Ks1> k

3.10.2.5. Messages for selecting additives (“V”)

3.10.2.5.1. Selecting an additive

D V <Adr2> <Adr1> <Ca> <P4> <P3> <P2> <P1> <Ks3> <Ks2> <Ks1> K

<Ca> - valve number 1 to 8
<P4><P3><P2><P1> - concentration in ppm for an additive

3.10.2.5.2. Response to selecting an additive

O V <Adr2> <Adr1> / <Ca> / <P4> <P3> <P2> <P1> / <Ks3> <Ks2> <Ks1> k

3.10.2.6. Messages for setting up and reading concentration limits (“M”)

3.10.2.6.1. Concentration limit setup

D M <Adr2> <Adr1> <M3> <M2> <M1> <m3> <m2> <m1> <Ks3> <Ks2> <Ks1> K

<M3><M2><M1> - over-concentration
<m1><m2><m3> - under-concentration

If the parameters are set to 255, no check is performed.

For over-concentration control

100 -> must never be over-concentration
0 -> can always be over-concentration

For under-concentration control

100 -> must never be under-concentration
0 -> can always be under-concentration

3.10.2.6.2. Concentration limit report readout

O M <Adr2> <Adr1> <Ks3> <Ks 2> <Ks1> K

3.10.2.6.3. Response to concentration limit report setup and readout

O M <Adr2> <Adr1> / <M3> <M2> <M1> / <m3> <m2> <m1> / <Ks3> <Ks2> <Ks1> k

3.10.2.7. Messages for setting up and reading flow meter parameters ("I")

3.10.2.7.1. Flow meter parameter setup

D I <Adr2> <Adr1> <P5> <P4> <P3> <P2> <P1> <A5> <A4> <A3> <A2> <A1> <Ks3> <Ks2> <Ks1> K

<A5> <A4> <A3> <A2> <A1> - number of pulses of an the additive flow meter per 1 l
<P5> <P4> <P3> <P2> <P1> - number of pulses of the product flow meter per 1000 l

3.10.2.7.2. Flow meter parameter readout

D I <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.7.3. Response to flow meter parameter setup and readout

O I <Adr2> <Adr1> / <P5> <P4> <P3> <P2> <P1> / <A5> <A4> <A3> <A2> <A1> / <Ks3> <Ks2> <Ks1> k

> <A1> / <Ks3> <Ks2> <Ks1> k

3.10.2.8. Messages for stop/starting and reading test mode ("T")

3.10.2.8.1. Test mode start/stop

D T <Adr2> <Adr1> <Ca> <P4> <P3> <P2> <P1> <D2> <D1> <Ks3> <Ks2> <Ks1> K

<Ca> - valve number 0 = end, 1 to 8 = selected valve
<P4> <P3> <P2> <P1> - required amount of the product in 1000 litres
<D2> <D1> - length of the product pulse in test mode

3.10.2.8.2. Test mode readout

D T <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.8.3. Response to test mode start/stop and readout

O T <Adr2> <Adr1> / <Ca> / <P5> <P4> <P3> <P2> <P1> / <D2> <D1> / <Ks3> <Ks2> <Ks1> k

3.10.2.9. Messages for setting up and reading purge parameters ("L")

3.10.2.9.1. Purge parameter setup

D L <Adr2> <Adr1> <TP> <nc3> <nc2> <nc1> <DDP3> <DDP2> <DDP1> <DP3> <DP2> <DP1> <PO5> <PO4><PO3> <PO2> <PO1> <Ks3> <Ks2> <Ks1> K

<TP> - type of input mode
00 = not activate
01 = “Stop dosing” mode
10 = “Purge” mode

<nc3><nc2><nc1> - not used

<DDP3><DDP2><DDP1> - 0 to 256 – delay before “Purge” input activates in seconds. After the purge has been activated and the delay elapsed then the actual mode starts.

<DP3><DP2><DP1> - 0 to 256 – duration of the actual purge process in seconds.

<PO5><PO4><PO3><PO2><PO1> - 0 to 65535 – volume of the purge, measured in the number of pulses on the additive flow meter used to end the purge.

3.10.2.9.2. Purge parameter readout

D L <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.9.3. Response to purge parameter setup and readout

O L <Adr2> <Adr1> / <TP> / <nc3> <nc2> <nc1> / <DDP3> <DDP2> <DDP1> / <DP3> <DP2> <DP1> / <PO5> <PO4> <PO3> <PO2> <PO1> / <Ks3> <Ks2> <Ks1> k

3.10.2.10. Messages for reading the version number (“E”)

3.10.2.10.1. Version number readout

D E <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.10.2. Response to the version number readout

O E <Adr2> <Adr1> / <V4> <V3> <V2> <V1> / <Ks3> <Ks2> <Ks1> k

<V4> <V3> <V2> <V1> - 9999 – program version number in the additive unit

3.10.2.11. Messages for setting up and reading the additive unit type (“Y“)

3.10.2.11.1. Control unit type setup

D Y <ADR2> <Adr1> <EVA3> <EVA2> <EVA1> <PulsAdit5> <PulsAdit4> <PulsAdit3> <PulsAdit2> <PulsAdit1> <Del5> <Del4> <Del3> <Del2> <Del1> <Ks3> <Ks2> <Ks1> K

<EVA3><EVA2><EVA1> - EVA unit type

bit 0 (+1) additive input code – see table 2
0 = 1 of 4
1 = binary code
bit 1 (+2) additive input speed
0 = counts to 5 Hz either for the Main flow rate input X4.3. or the additive selection input X5.3 to X5.6
1 = counts to 2 kHz on the product flow rate input
(only one additive can be controlled)
bit 2 (+4) not used

bit 3 (+8): active level for fault signals
1 = active fault signal level is +24 V
0 = active fault signal level is 0 V
bit 4 (+16) software copy type
1 = copy of product
0 = copy of additive

<PulsAdit5> .. <PulsAdit1> - the min. number of additive pulses for which a valve is open

<Del5> .. <Del1> - pulse splitter for an additive or product

3.10.2.11.2. Control unit type readout

D Y <ADR2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.11.3. Response to additive unit type setup and readout

O Y <ADR2> <Adr1>/<EVA3> <EVA2> <EVA1>/ <PulsAdit5> <PulsAdit4> <PulsAdit3> <PulsAdit2> <PulsAdit1> / <Del5> <Del4> <Del3> <Del2> <Del1> / <Ks3> <Ks2> <Ks1> k

3.10.2.12. Messages for reading the extension status ("X")

3.10.2.12.1. Extension status readout

D X <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K

3.10.2.12.2. Response to extension status readout

O X <Adr2> <Adr1> / <Sj3> <Sj2> <Sj1> / <Sjex3> <Sjex2> <Sjex1> / <Sv> / <Ov3> <Ov2> <Ov1> / <Oa10> <Oa9> <Oa8> ... <Oa2> <Oa1> / <Op10> <Op9> ... <Op2> <Op1> / <Ks3> <Ks2> <Ks1> k

<Sj3><Sj2> <Sj1> - status of the additive unit

bit 0 (+1) pumping start
bit 1 (+2) pump relay
bit 2 (+4) feed in progress
bit 3 (+8) failure
bit 4 (+16) over-concentration [OF]
bit 5 (+32) under-concentration [UF]

<Sv> - closure status of valves

0 – no valve
1..8 –valve number

<Sjex3> <Sjex2> <Sjex1> - state of the additive unit

bit 0 (+1) Purging in progress
bit 1 (+2) Let-by value [LV]
bit 2 (+4) Let-by additive valve [LA]
bit 3 (+8) Let-by dosing valve [LD]
bit 4(+16) Zero flow [ZF]
bit 5(+32) Down pulse [DP]

<Ov3>..<Ov1> - opening level of valve, values 0 - 255

<Oa10>..<Oa1> - non-reset volume of dosed additive in pulses

<Op10>..<Op1> - product volume in number of pulses

3.10.2.13. Messages for resetting alarms ("N")

Note: Do not use this message for a control unit "EVA 3" and "EVA 4".

3.10.2.13.1. Resetting alarms

D N <Adr2> <Adr1> <Ks3> <Ks2> <Ks1> K #FF

3.10.2.13.2. Response to resetting alarms

O N <Adr2> <Adr1> / <Sj3> <Sj2> <Sj1> / <Sjex3> <Sjex2> <Sjex1> / <Ks3> <Ks2> <Ks1> k #FF

<Sj3><Sj2> <Sj1> - status of the additive unit

bit 0 (+1) alarm test LA
bit 1 (+2) pump relay
bit 2 (+4) feed in progress
bit 3 (+8) alarm
bit 4 (+16) over-concentration [OF]
bit 5 (+32) under-concentration [UF]

<Sjex3> <Sjex2> <Sjex1> - state of the additive unit

bit 0 (+1) Purging in progress
bit 1 (+2) Let-by value [LV]
bit 2 (+4) Let-by additive valve [LA]
bit 3 (+8) Let-by dosing valve [LD]
bit 4(+16) Zero flow [ZF]
bit 5(+32) Down pulse [DP]

3.11. Irda Communication

The control unit is equipped with infrared data transmission. Irda communication is an alternative method of remotely controlling the unit and is mainly intended for servicing and testing. The infrared "transceiver" is located, together with the display, in the control unit's display window. Two LEDs are also located in the window, the first LED (on the right) indicates that the unit is functioning correctly (400ms flash), the second (on the left) indicates data transmission via Irda.

3.11.1. Irda communication parameters and data format

Communication uses the IRDA 1.0 SIR standard. The data transfer speed is fixed at 57.6 Kbit/sec. The data format is: 1start bit, 8 data bits, No parity, 1 stop bit.

The transmitted data packets are in the same format as those transmitted via RS485. The message data is coded in ASCII HEX, where 1 byte represents two characters "00" to "FF". The maximum number of characters in an Irda message is 69. More detailed information about the data packet is described in section (3.9.1) "Description of messages".

The Irda unit includes a FIFO 8 byte input memory buffer for received data. After receiving the eighth character of a message the control unit acknowledges receipt by sending an "ACK" field (06h) and is ready to receive another eight bytes of the message. The communication equipment on the other end of the transmission must respect the time interval of 8 byte data packet, otherwise data could be lost at Irda unit. In the opposite direction when data is transmitted from the control unit, this time interval (data packets) does not have to be respected.

4. Installation

4.1. Mounting

The dosing unit and the control unit are mounted using the holders supplied (see fig.2 and fig.3).

! The dosing unit must be installed in the way so that the connecting screwing of the flowmeter is always in a horizontal position !

Dosing Unit Holder has holes for fixing bolts for mounting on the base-plate or fixing a bracket that can be welded (see Fig.2). The dosing unit can be freely mounted in any position, however the usual position is vertical.

Control Unit Holder has holes for fixing bolts for mounting on the base-plate or fixing a bracket that can be welded (see Fig.3). Figures 2 and 3 also show fixing and equipment dimensions.

It is forbidden to install the control unit under the dosing unit.

The installation of the spray valve should be done according to paragraph 1.3 (obr.4)

4.2. Electrical connections

Valves on the dosing unit are connected, using the prescribed cables, to the valve output terminals on the control unit. The additive flow meter is connected to the additive flow meter input.

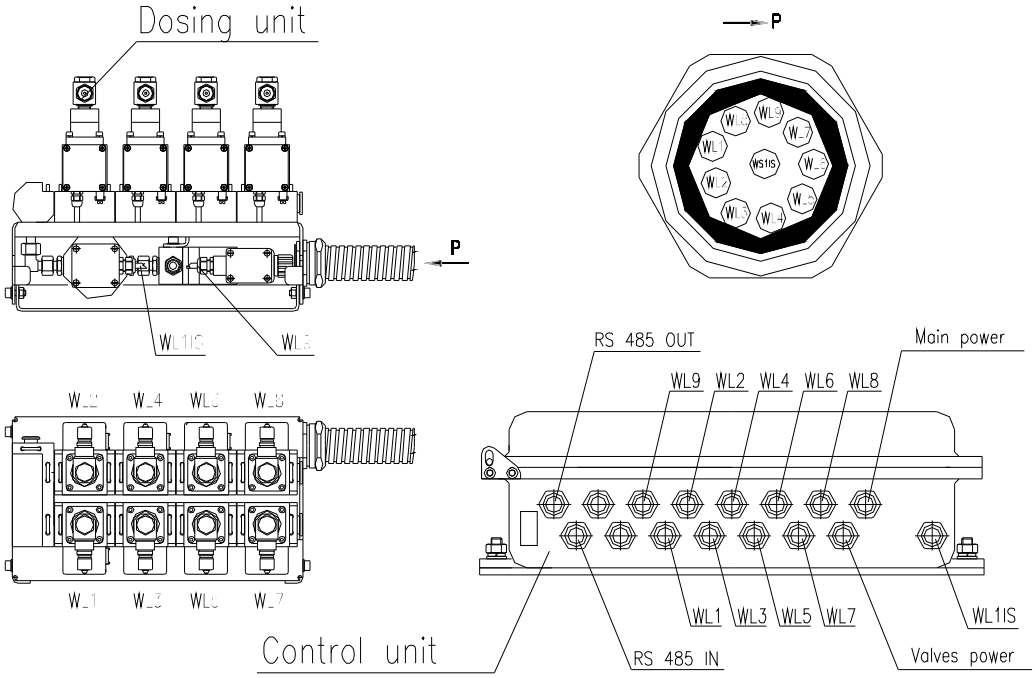

Figure 6 – Electrical connection of the control unit with the dosing unit

The incoming RS485 serial link from a preceding unit is connected to terminals X10.1,X10.2 and the outgoing to the next unit is connect to terminals X10.5,X10.6. If the control unit is the last one, then a 1kΩ terminal resistor is placed between X10.5 and X10.6.

More detailed information is available in the Electrical Connection Diagram – drawing no. 01900-00-008,EPR or 01901-00-008,EPR.. Other connections with the ACCULoad program and the control system are made according the project (drawing no. 01900-00-008,ZAJ).

4.2.1. Terminal connections

1. The copy of the additive or the product *(SSR relay 24 VDC/VAC 100mA]*

   X1.1. ..... Flow copy (-) - the copy of the dosing unit flow meter
   X1.2. ..... Flow copy (+)
   X1.3. ..... Additive flow (-) - the software copy of the additive or product flow
   X1.4. ..... Additive flow (+)

2. Output status *(relay switch 24 VDC / VAC 1A)*

   X2.1. ..... COM
   X2.2. ..... Additive select bin 0 - select additive
   X2.3. ..... Additive select bin 1
   X2.4. ..... Additive select bin 2
   X2.5. ..... Dosing - start additive
   X2.6. ..... Alarm - alarm
   X2.7. ..... Res - reserve

3. Sensor power *12/24VDC 100mA*

   X3.1. ..... Sensor power 12/24V (-)
   X3.2. ..... Sensor power 12/24V (+)

4. Mains input - 230V/ 5mA /50Hz

   X4.1. ..... PE
   X4.2. ..... COM
   X4.3. ..... “Main flow” input - product flow
   X4.4. ..... “Loading” input - start dosing
   X4.5. ..... “Purge” input - purge/stop dosing
   X4.6. ..... Res - reserve

5. Mains input - 230V/ 5mA /50Hz (additive select)

   X5.1. ..... PE
   X5.2. ..... COM
   X5.3. ..... Additive select bin 0
   X5.4. ..... Additive select bin 1
   X5.5. ..... Additive select bin 2
   X5.6. ..... Additive select bin 3

6. Control valve output *24VDC /1A*

X6.1. ..... Control valve (-)
X6.2. ..... Control valve (+)

7. Additive valve outputs *~230V/400mA*

a) variant-EVA5

X7.1. ..... Valve 1 (PE)
X7.2. ..... Valve 1 (N)
X7.3. ..... Valve 1 (L)
X7.4. ..... Valve 2 (PE)
X7.5. ..... Valve 2 (N)
X7.6. ..... Valve 2 (L)
X7.7. ..... Valve 3 (PE)
X7.8. ..... Valve 3 (N)
X7.9. ..... Valve 3 (L)
X7.10. ..... Valve 4 (PE)
X7.11. ..... Valve 4 (N)
X7.12. ..... Valve 4 (L)
X7.13. ..... Valve 5 (PE)
X7.14. ..... Valve 5 (N)
X7.15. ..... Valve 5 (L)
X7.16. ..... Valve 6 (PE)
X7.17. ..... Valve 6 (N)
X7.18. ..... Valve 6 (L)
X7.19. ..... Valve 7 (PE)
X7.20. ..... Valve 7 (N)
X7.21. ..... Valve 7 (L)
X7.22. ..... Valve 8 (PE)

X7.23. ..... Valve 8 (N)
X7.24. ..... Valve 8 (L)

b) variant-EVA5/24

X7.1. ..... Valve 1 (PE)
X7.2. ..... Valve 1 (+0V)
X7.3. ..... Valve 1 (+24VDC)
X7.4. ..... Valve 2 (PE)
X7.5. ..... Valve 2 (+0V)
X7.6. ..... Valve 2 (+24VDC)
X7.7. ..... Valve 3 (PE)
X7.8. ..... Valve 3 (+0V)
X7.9. ..... Valve 3 (+24VDC)
X7.10. ..... Valve 4 (PE)
X7.11. ..... Valve 4 (+0V)
X7.12. ..... Valve 4 (+24VDC)

8. Power supply *~230V/400mA*

a) variant-EVA5

X8.1. ..... Valve (PE)
X8.2. ..... Valve (N)
X8.3. ..... Valve (L) - power to the additive valve
X8.4. ..... Mains supply (PE)
X8.5. ..... Mains supply (N)
X8.6. ..... Mains supply (L) - power to the control unit

b) variant-EVA5/24

X8.1. ..... Valve (PE)
X8.2. ..... Valve (+0V)
X8.3. ..... Valve (+24VDA) - power to the additive valve
X8.4. ..... Mains supply (PE)
X8.5. ..... Mains supply (N)
X8.6. ..... Mains supply (L) - power to the control unit

9. Flow meter input

a) variant interface *NAMUR 8V/8mA*

X9.1. ..... Additive flow 0 (-)
X9.2. ..... Additive flow 0 (+)
X9.3. ..... Additive flow 1 (-)
X9.4. ..... Additive flow 1 (+)
X9.5..... Com (not used)

b) variant interface *SQA2 for Aquametro*

X9.1. ..... Additive flow 0 (-) (connected A0 pin from flow meter)
X9.2. ..... Additive flow 0 (+) (connected V+ pin from flow meter)
X9.3. ..... Additive flow 1 (-) (connected A1 pin from flow meter)
X9.4. ..... Additive flow 1 (+) not used
X9.5..... Com (connected Com pin from flow meter)

10. RS485 serial link

X10.1. ..... A1 - RS485 input
X10.2. ..... B1
X10.3. ..... GND
X10.4. ..... Shielding
X10.5. ..... A2 - RS485 output
X10.6. ..... B2
X10.7. ..... GND
X10.8. ..... Shielding

The location of terminals within the control unit and their description is shown in the Terminal Description diagram – drawing no. 01900-02-008,POS or 01901-02-008,POS.

4.2.2. Cable markings

Inside the unit, the 3-core cables that connect the additive valves to the terminals are marked sequentially from WL1 to WL8 and the 3-core cable for the control valve is marked WL9.

The 4-core cable leading to the additive flow indicator is marked WS1IS.

More detailed information is available in the Electrical Connection Diagram – drawing no. 01900-00-008,EPR or 01901-00-008,EPR.

4.2.3. Cable specification

4.2.3.1. Connecting flow meters

Flexible 4-core cable, 1.5mm^2 cross-sectional area, maximum diameter 10 mm, protected to the requirement of the external environment, spark-proof.

(e.g. ÖLFLEX EB CY 4x 1.5)

4.2.3.2. Connecting dose valves

PVC 3-core flexible cable with PE, 1.5mm^2 cross-sectional area Cu core, maximum external diameter 12 mm, protected to the requirement of the external environment.

(e.g. ÖLFLEX 100 CY 3G1.5 or CMFM 3Bx1.5)

4.2.3.3. Connecting additive valves

PVC 3-core flexible cable with PE and N, 1.5mm^2 cross-sectional area Cu core, shielded, maximum external diameter 12 mm, maximum length 3m, protected to the requirement of the external environment. In the event that a longer cable is required an external junction box must be used

(e.g. ÖLFLEX 100 CY 3G1.5 or CMFM 3Cx1.5)

4.2.3.4. Connecting the power supply unit

PVC 3-core flexible cable with PE, 1.5mm^2 cross-sectional area Cu core, maximum external diameter 12 mm, protected to the requirement of the external environment.

(e.g. ÖLFLEX 100 CY 3G1.5)

4.2.3.5. Connecting the RS485 bus

PVC 4-core solid cable with 2 twisted pairs, 0.5mm^2 cross-sectional area Cu core, shielded, external diameter 6-12 mm, protected to the requirement of the external environment.

(e.g. UNITRONIC LiYCY(TP) 2x2x0.5 or LAM TWIN FTP 4x2x0.5)

4.3. Hydraulic connections

A hose is connected to the inlet of each additive valve from the individual additives. A hose is connected to the output of the dosing valve which delivers the selected additive to the product.

5. Commissioning the equipment

5.1. Setting up the system

First, the address of each additive unit is set using the DIP switches so that it is unique to that unit within the whole RS485 system.

Then the additive parameters of the control and dosing units are read. These parameters are checked to see whether they are setup correctly, especially the formula settings, product and additive flow meter parameters, purge parameters and additive input and fault output codes.

If any of these parameters differ from the default values for the current application they must be configured using the RS485 serial link according to the requirements.

5.2. Testing the additive system of air

First of all the additive supply piping must be purged of air. The hose supplying the additive is disconnected from the additive unit and connected to the calibration set. Sufficient additive is discharged until only additive without air flows out. Then the hose is reconnected as before. The procedure is repeated for all additional additives.

Now it is necessary to purge the additive unit of air. The procedure must be performed with extra care so as to prevent the flow meters from being damaged. The outlet hose is disconnected and the calibration set is connected, sufficient additive is discharged until only additive without air flows out. The additive unit is set to operate in single additive mode. Then it is necessary to let the additive into the unit as slowly as possible to prevent hydraulic rams. The procedure is repeated for all the remaining additives connected.

5.3. Checking the additive process

The additive unit is set to operate in the additive mode. A sample amount of the additive is collected in a measuring cylinder and it must conform to the selected formula and the volume of the required product.

6. Maintenance and servicing

6.1. Regular maintenance

This equipment requires maintenance every month and the filters prior to the dosing unit should be checked and cleaned at least once per month. The interval depends on how fast the filters block up. The equipment does not require any other special maintenance.

In the event of cleaning the dosing unit with water, do not use pressurised water!

Status of a control unit flameproof (fixed) enclosure check to be checked once a year as minimum and closure surfaces preservation must by renewed.Remove dust and dirt from closure surface.

All screws for the flameproof enclosure must be properly drawn up after operation. All connection areas for the flameproof enclosure must be protected against corrosion and water. It is possible to use e.g. non-congealable lipid coat (e.g. MOGUL LV 2-3). The non-congealable lipid coat must be restored after opening the enclosure.

Only manufacturer or a person trained by the manufacturer is allowed to do the servicing.

6.2. Error messages – Control unit

See section 3.5 “Description of alarms”

6.3. Possible faults on the Dosing Unit and their cause

The Calibration Set serves to help diagnose the possible causes of faults on the dosing unit.

WARNING:

When working with the calibration set it is important to always close the ball valve on the inlet to the dosing unit prior to starting work.

During testing, when the respective dosing valve on the additive unit opens, gradually open the ball valve on the calibration set. Guard against hydraulic rams, which could damage the flow meter.

Faults:

The dosing unit doses a lesser or greater volume of the additive than is required for the product batch, or does not function at all.

Possible causes:

1: The volume and pressure of the additive on the inlet to the dosing unit do not meet requirements.

Check: Disconnect the inlet hose from the dosing unit. Connect the inlet part of the calibration set (with manometer) to the end of the inlet hose and connect the outlet of the calibration set to the spray valve. Check the required pressure (see technical conditions) on the manometer while the pump is running. Use the measuring cylinder to check that the flow volume meets the required rate. In the event that the inlet pressure has a different value than stipulated in the technical conditions and the flow rate is not correct then it is necessary to repair the fault. In the event that the values are correct, disconnect the calibration set and reconnect the inlet hose.

2: Malfunction of a coaxial valve, flow meter or dosing valve.

Check: Disconnect the outlet hose from the spray valve mounted in the pipe work. Connect the inlet of the calibration set with the hose and the outlet to the spray valve. Use the measuring cylinder to check the flow volume. In the event that the volume delivered by the dosing unit into the measuring cylinder does not correspond with the value displayed on the control unit, contact the manufacturer or service technician. In the event that the values are correct, disconnect the calibration set and reconnect the outlet hose.

In order that the flow meter functions correctly it is important that the additive is free of all mechanical impurities larger than 25μm, all magnetic impurities, water and air. If water gets into the flow meter there is a danger that during winter months the flow meter could freeze. Impurities and air in the additive pipe work not only cause inaccurate measurements but also mechanical damage to the flow meter.

3: The additive does not flow through the spray valve into the product

Check: Check the product pressure in the pipework. Disconnect the outlet hose from the dosing unit and connect it to the inlet of the calibration set (with manometer) and connect the outlet of the calibration set to the spray valve. Check the pressure and volume of additive leaving the dosing unit. The minimum difference in pressure (pressure gradient) between the additive on the outlet of the dosing unit and the pressure in the product pipework must be such as to ensure the required additive flow rate into the product pipework for the given viscosity and chosen mix. The values for working pressure (pressure gradient), maximum flow rate and maximum viscosity of the additive in the dosing unit are stipulated in the technical conditions.

7. Warnings

7.1. Warning when handling

Disconnect all voltage connections and the power supply before opening a lid of the control unit box.

7.2. Warnings when commissioning and servicing

Commissioning and warranty repairs of the equipment must only be performed by the manufacturer or persons trained by the manufacturer, otherwise the warranty and the right to free repairs is invalidated.

The equipment must only be repaired using original spare parts supplied by the manufacturer, otherwise the warranty and the right to free repairs of parts and entire equipment is invalidated.

In the event of cleaning the dosing unit with water, do not use pressurised water!

Mechanical impurities, water and air in the additive pipework not only cause inaccurate measurements but also mechanical damage to the flow meter.

With every appliance manipulation (dosing unit), please use protection in accordance with norms ČSN, EN. During manipulation use gauntlet and protect your face with a shield.

In case of additive leaking or another oil products leaking, please proceed in accordance with norms ČSN, EN for loading oil products and oil accident.