OPERATING INSTRUCTIONS

Additive unit EVA 6.X

Context:

1. General description

This manual is valid for firmware version 6.00

The **EVA 6.X Additive unit** (where X specifies the versions) is a compact and highly accurate device for adding small amounts of chemical liquids (additives) into products (petrol, diesel, fuel oil).

The complete system is mounted on a base-plate and connected through the spraying valve to product pipeline. The EVA 6.X additive unit enables connection of a pipeline (or other lead) with one additive (special version with 1-3 additives).

The EVA 6.1 Aditiv unit complete additive unit comprises of parts:

1. **Dosing unit EVA 6.DX** (where X specifies the versions)
2. **Control unit EVA 6.R X** (where X specifies the versions)
3. **Optional accessories** comprise:
   - 250 µm prefilter
   - Ball valve with G3/8" internal thread
   - 3 to 25 µm filer (according to request)
   - Check valve
   - Special seals
   - Calibration set

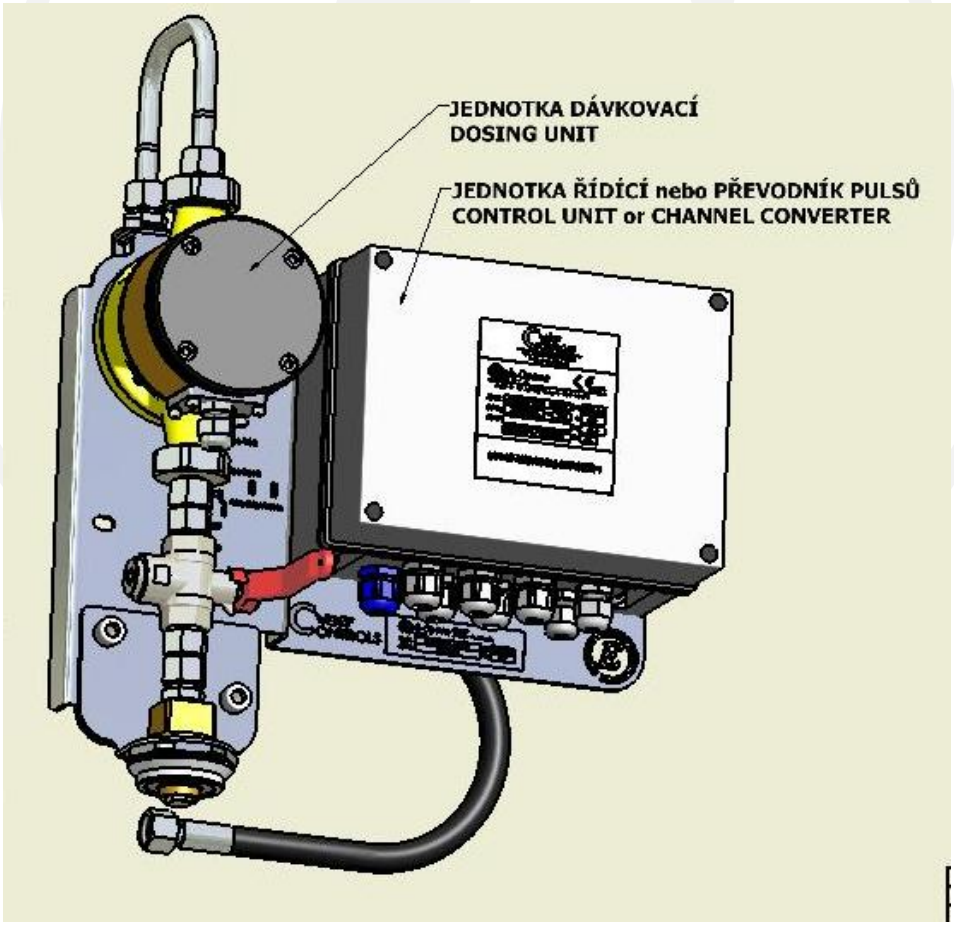


Figure 1.1 EVA 6.1 Additive Unit

Optionally the equipment can be fitted with the EVA 6.C Dual channel conventer instead of the EVA 6.R Control unit . The Dual channel conventer is a simple version of the EVA 6.R Control unit (see 1.3).

The EVA 6.2 Additive unit with dual channel conventer comprises of parts:

1. **Dosing Unit EVA 6.DX** (where X specifies the versions)
2. **Dual channel conventer EVA 6.CX** (where X specifies the versions)
3. **Optional accessories…** comprise:
   - 250 μm prefilter
   - Ball valve with G3/8" internal thread
   - 3 to 25 μm filer (according to request)
   - Check valve
   - Special seals
   - Calibration set

The EVA 6.X Additive unit for 1-3 additives comprises of parts:

1. **Dosing Unit EVA 6.DXY (see 01915-00-001,NKO)**
   (where X specifies the versions)
   (where Y specifies the number of controlled coaxial valves)
2. **Dual channel conventer EVA 6.CY**
3. **Optional accessories**

1.1. EVA 6.D Dosing Unit

The dosing unit carries out the instructions sent by the control unit. The additive unit enables connection of a pipeline (or other lead) with one additive. The additive enters through the additive valve into the dosing unit. The required amounts of the additive are controlled by the additive valve and the flow meter and they leave through the spraying valve from the flow meter into the product.

Individual hydraulic components of the dosing unit are manufactured from stainless steel or brass, seals are made from Viton . The dosing unit is designed for petroleum products and its materials are not affected by these products. All seal components are consumables. We recommend asking the additive supplier for a specification for suitable consumable materials. If requested we can supply seals from other materials.

The dosing unit can be located in zone 1 and comprise the following basic hydraulic and electromechanical components: (components 1-6 are the part of standard accessories)

1.	flow meter	- equipment category II 2G EEx ib II T4	(item 1)
2.	coaxial additive valve	- equipment category II 2G EEx m II T4 a II 2D	(item 2)
3.	spraying valve	- equipment category II 2G cT3	(item 3)
4.	3-way ball valve G 3/8		(item 4)
5.	inlet hose M 18x1,5 - 10x500		(item 5)
6.	lug G 1 ¼"		(item 6)

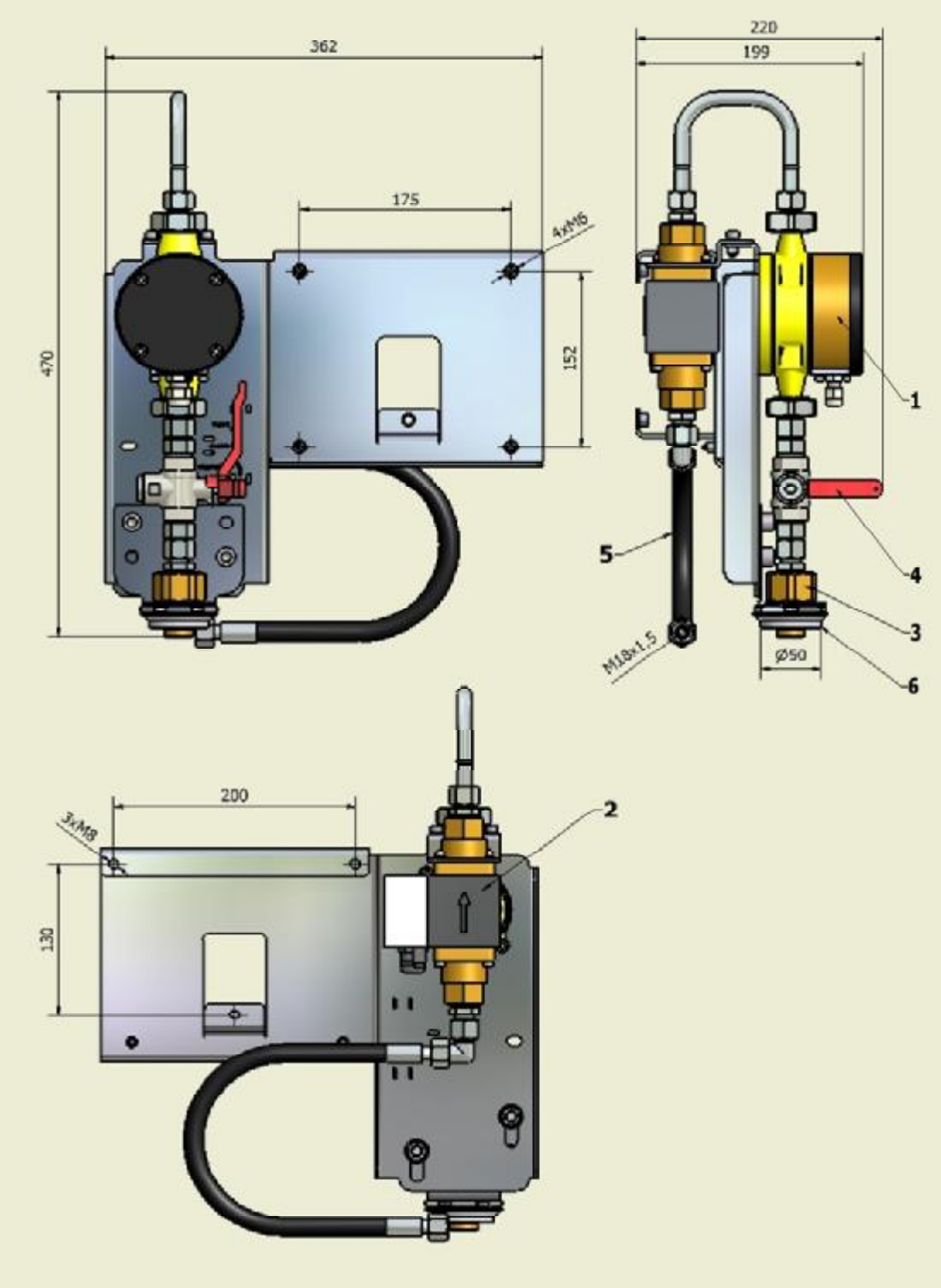


Figure 1.2 EVA 6.D1

1.2. EVA 6.R Control Unit

The EVA 6.R Control Unit is a control system designed for the EVA 6 range of Additive Units. The electronics of the control unit have an encapsulated protection and the terminal is in heightened safety. The Flow Meter terminal is used for Ex ib signal connection from the flow meter. The Flow Meter is separated by an insulating barrier from other terminals. The control unit is powered by mains 230VAC / 50Hz supply (pins X6.1, X6.2). It is possible connect equipment and signalling that are

required to control the additive process and for connecting to a higher level system to the unit. The unit can be located in zone 1.

The Control unit is equipped with „Additive Loading“ and „Additive Injector“ inputs for 230VAC and 24V version. It is only possible to use one input type at a time for connection to the system.

The EVA 6.R control unit provides a full 485 interface for connection to a higher level system It is possible to connect at most 32 units to the 485 bus bar in parallel.

Optionally the Control unit can be fitted with a infrared communication port for setting configuration parameters.

In case all glands on the Control unit (EVA 6.R1) are not used during installation, they have to be replaced by suitably approved plugs.

In case all adapters on the Control unit (EVA 6.R3) are not used during installation, they have to be replaced by suitably approved plugs

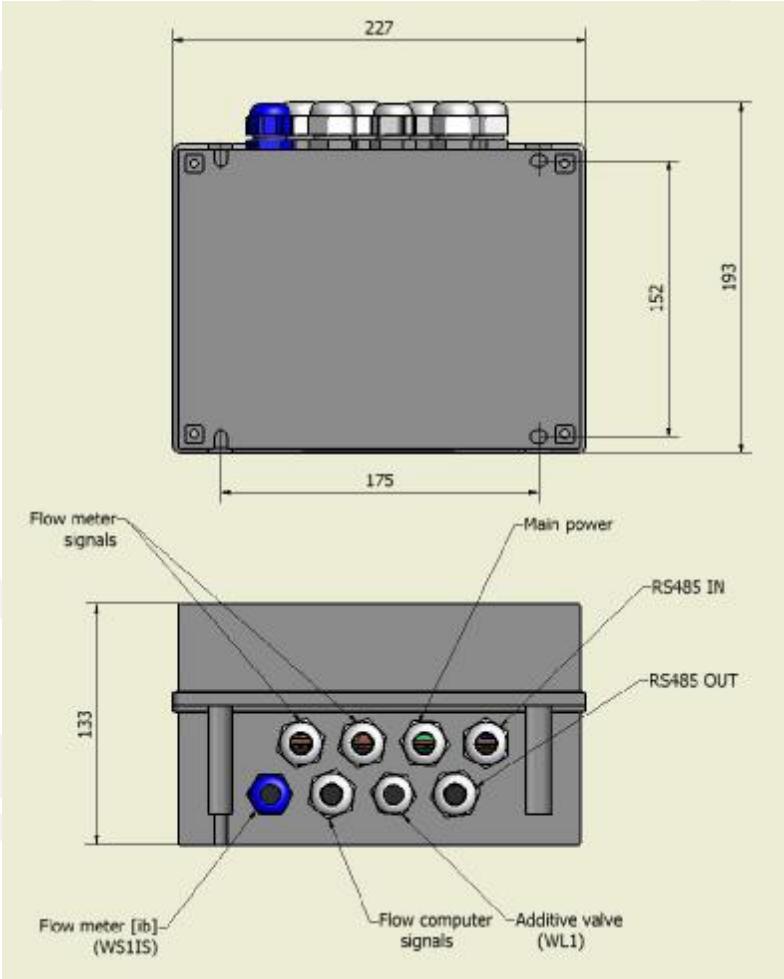


Figure 1.3 EVA 6.R1 Control Unit

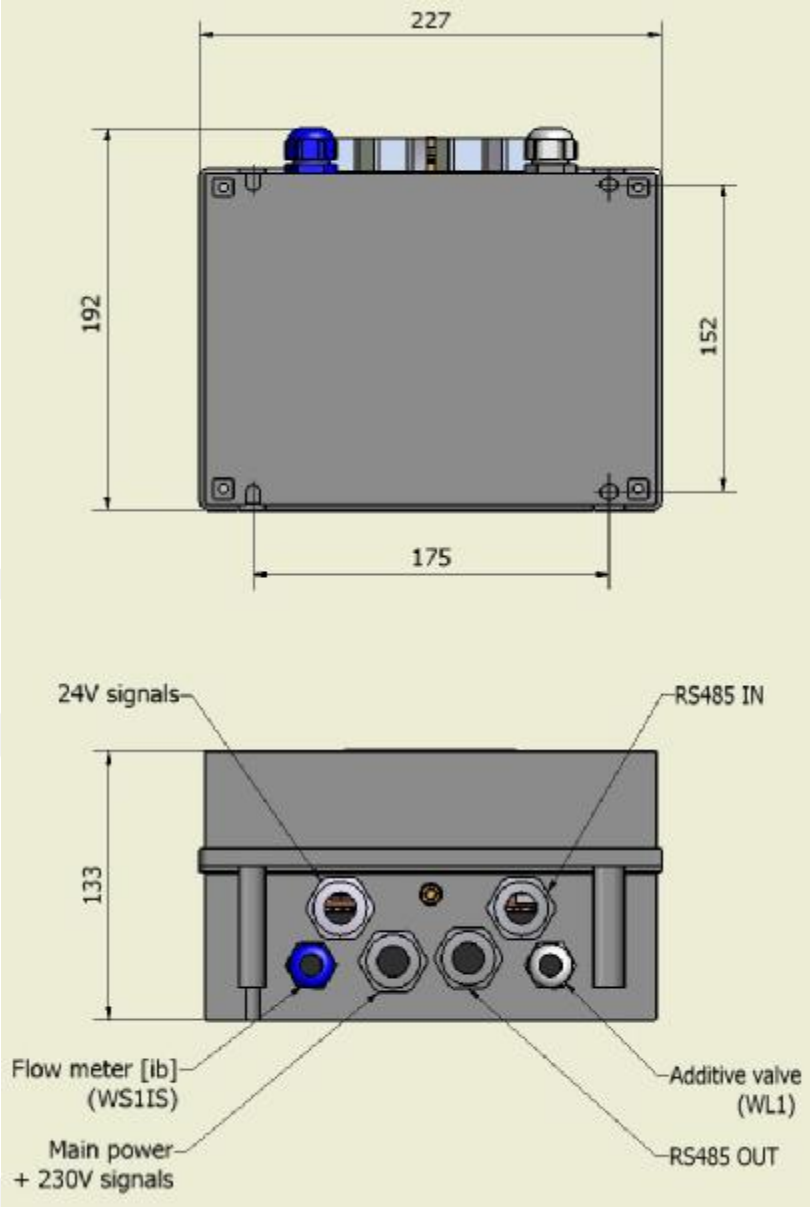


Figure 1.4 EVA 6.R3 Control Unit

1.3. EVA 6.C Dual channel conventer

The Dual channel conventer is a simple version of the EVA 6.R Control unit, where the ib „Flow meter“ terminal is used for the connection of the additive flow meter and „Additive flow meter copy“ output (pin X4.5, X4.6), where a copy of the recalculated flow meter pulses are continually generated.

The conventer is equipted with the output terminals for additive valve connection. The additive valve is controled by other device, which is connected to additive valve input terminals. The valve input and output terminals are internally connected. There are two versions, the conventer with 1 additive valve (EVA 6.C1) and with 3 additive valves (EVA 6.C3).

It is possible to power the dual channel conventer with 10.8 to 30VDC (pins X5.1, X5.2).

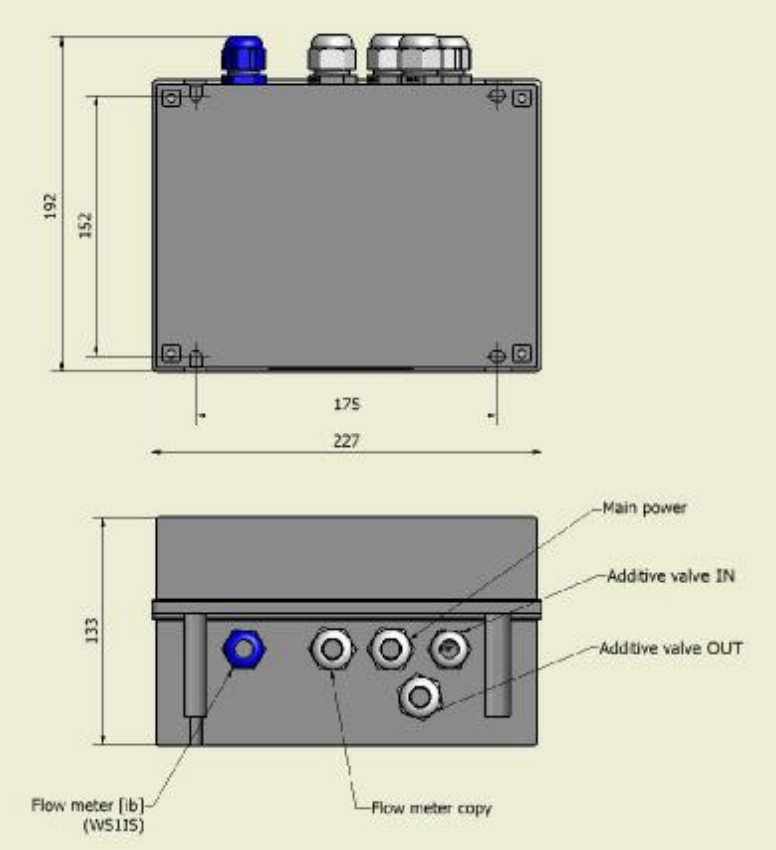


Figure 1.5 EVA 6.C1 Dual channel conventer

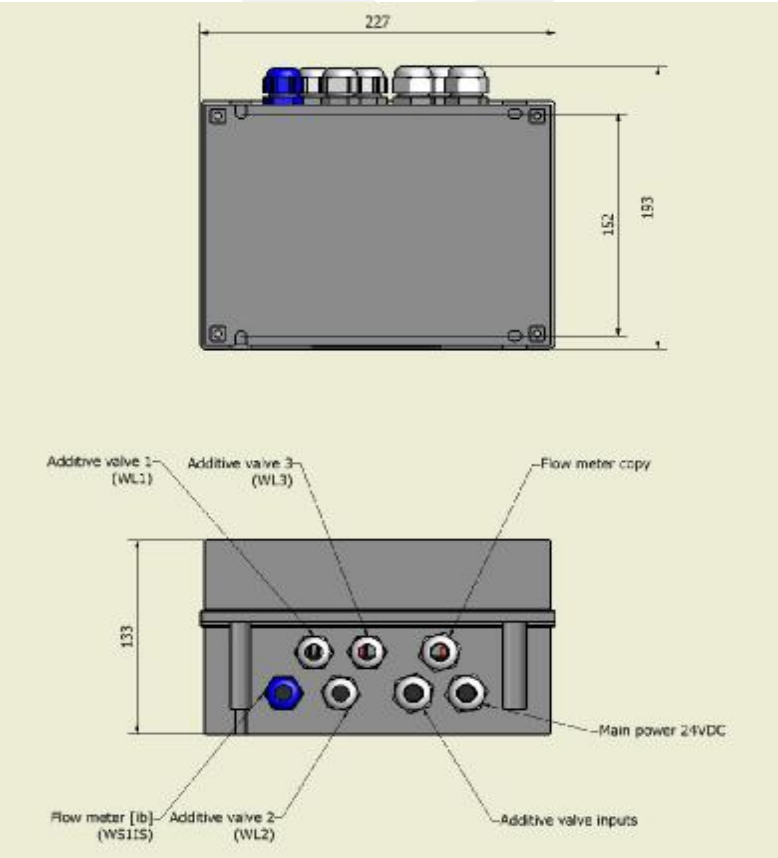


Figure 1.6 EVA 6.C3 Dual channel conventer

1.4. Standard Accessories

Standard accessories are always supplied with the EVA 6 Additive unit. Individual components are shown and described in section 1.

Inlet hose - M18x1,5; 0,5 m long

Is used for feeding additive into the dosing unit. It is also supposed to eliminate vibration from the inlet pipe. **It is necessary to maintain this method of connection!**

3-way ball valve enables:

- closing the additive output of dosing unit (push the valve lever down)
- **to additive (push the valve lever horizontally)**
- calibrating (push the valve lever up)

Lug G 1 ¼“

The lug G 1 1/4“ is welded onto the pipeline . It is necessary to install the lug as described in chapter 4. The lug G 1 ¼“ is shown in supplement 1.

1.5. Optional Accessories

Optional accessories for the EVA 5 Additive unit are supplied according to the specification list which is submitted with the order.

The Ball valve is used to close the inlets to the additive unit in the event that servicing is required or the filter needs to be cleaned.

The Check valve is located on the inlets to the additive unit and prevents undesired mixing of the additive with the product in the event of a fault on the additive valve.

If the user require **superior purity of the additive** at the inlet hose he can use **the filter offered in the optional accessories or a different adequate filter**.

With a view to the aggressive nature of some additives a user must choose **suitable hoses and seals** especially for dynamically loaded hydraulic components (coaxial valves). **Requirements for special seals** can be met as part of optional accessories. Standard seals are made from Viton and inlet hoses from PTFE.

1.6. Calibrating set

The calibrating set is supplied as extra optional accessories in a special case including inlet and outlet parts. Usage of the calibrating set is described in chapters 5 nad 6.

A) Calibrating set connection must be done as follows only by a trained serviceman:

1. Close the ball valve´s input of the feed pipe supplying additive into the dosing unit.

2. Connect the input part of the calibrating set between the dosing unit´s inlet hose and the feed pipe supplying additive to the dosing unit.

3. Calibrating set´s output part must be connected as follows to the dosing unit´s ball valve:
- push the valve lever down - closing the dosing unit´s output
- unscrew the plug G 3/8“ from the ball valve
- if you release the output it connects to the calibrating set´s output part
- put the hose of the calibrating set´s output part into the graduated cylinder

- push the valve lever up - opening the dosing unit´s output for the additive

4. Open the ball valve´s input of the feed pipe for additive into the dosing unit.

B) Calibration set disconnection must be done as follows only by a trained serviceman:

1. Close the ball valve´s input of the feed pipe supplying additive into the dosing unit.

2. Disconnect the calibrating set´s input and connect the inlet hose back.

3. Disconnect the calibrating set´s output part from the dosing unit´s 3-way ball valve as follows:
- push the valve lever down - closing the dosing unit´s output
- disconnect the hose of the calibrating set´s output part from the ball valve and let the remains out of the hose into the graduated cylinder
- screw the plug G 3/8“ back to the ball valve
- push the valve lever horizontally - opening the dosing unit´s output supplying additive into the product´s pipe

4. Open the ball valve´s input of the feed pipe for additive into the dosing unit.

2. Technical specification

2.1. EVA 6.D Dosing unit

Manufacturer ..... Elok-Opava spol. s r.o.,Sádek 17, Velké Heraltice, Czech republic
Maximum flow rate ..... 12 l/min (depending on pressure and viscosity)
Minimum flow rate ..... 0,05 l/min (depending on pressure and viscosity)
Maximum operating pressure ..... 1,6 MPa (16 bar)
Recommended op. pressure Δp ..... 0,2 - 0,5 MPa (2-5 bar)
Dynamic viscosity ..... max. 2550 mPa s
Protection ..... II 2G EEx m II T4 a II 2D, II 2G EEx ib II T4, II 2G cT3
Area ..... zone 1
Method of connecting additives ..... hydraulic hose DN10 with quick connectors (optional)
Outlet connections ..... directly to product pipeline using G 1 1/4“ thread
Dimensions (L x W x H)..... 340x120x290 mm
Mass..... max.10 kg
Mounting ..... using the dosing unit holder
Ingress protection ..... IP 54
Operating temperature ..... -20 to +40^{o}C (depending on viscosity)
Storage temperature ..... -20 to +40^{o}C
Pre-filter ..... 250μm (optional)
Required medium purity ..... 25 μm
Measurement accuracy (continual flow).. 1% (in 40 mm^{2}/s viscosity)
Measurement accuracy (pulse flow)..... 3% (in 40 mm^{2}/s viscosity)
Dosing accuracy ..... 3% for 5000l batch (for first trip volume 500l), flow rate 2500l/min and 3500ppm additive concentration

ATTENTION !

If the pressure 1,6 MPa will be exceeded the coaxial additive valve can be damage !

2.2. EVA 6.R Control unit

Manufacturer ..... Elok-Opava spol. s r.o.,Sádek 17, Velké Heraltice, Czech republic
Nominal power supply AC ..... 230 VAC (+10/–15%)
Nominal load AC ..... 0,25 A
Additive flow meter connection ..... 5 terminals for cable with 1,5 mm^2 wires, 2 signals with 90° shift
Nominal supply for additive valve ..... 230VAC / 0,12A
Additive valve connection ..... 2 terminals for cable with 1,5 mm^2 wires

Addit. Injector and Loading input 24V ..... 24 VAC/DC / 8mA
Input level (logical 0) ..... < 8V
Input level (logical 1) ..... > 18V
Maximum frequency (Injector input) ..... 3 kHz
Maximum frequency (Loading input) ..... 5 Hz
Additive inputs connection ..... 3 terminals for cable with 1,5 mm^2 wires

Addit. Injector and Loading input 230V .... 230 VAC / 8mA
Input level (logical 0) ..... < 65VAC
Input level (logical 1) ..... > 165VAC
Maximum input frequency ..... 5 Hz
Additive inputs connection ..... 3 terminals for cable with 1,5 mm^2 wires

Additive Injector Feedback output ..... SSR relay (max. 230 VAC/DC 100mA)
Additive Injector Ready output ..... SSR relay (max. 230 VAC/DC 100mA)
Maximum output frequency ..... 5 Hz
Outputs connection ..... 2x2 terminals for cable with 1,5 mm^2 wires

Additive flow meter copy ..... SSR relay (max. 60 VDC/ 100mA)
Maximum flow meter copy frequency ..... 250 Hz
Output connection ..... 2 terminals for cable with 1,5 mm^2 wires
Software additive counter ..... 16 bits
Maximum on state resistance ..... 30 Ω (all SSR relays)

Infrared interface (option) ..... 1x Irda 1.0
Serial interface ..... 1x RS485 (9600Bd, 8bit, NP, 1stop bit)
Serial interface connection ..... 3 terminals for cable with 1,5 mm^2 wires

Cable entry flanda EVA 6.R1 ..... 2x Pg11 (coax valve and flowmeter)
..... 6x Pg13,5 for cable Φ 6-12 mm

Cable entry flanda EVA 6.R3 ..... 2x Pg11 (coax valve and flowmeter)
..... 4x adapter NPT 3/4“

Mounting ..... using control unit holder
Protection ..... II2G EEx mb e [ib] IIB T4
Area ..... zone 1
Dimensions (L x W x H) 227x170x130mm
Mass ..... 4 kg
Ingress protection ..... IP 65
Operating temperature ..... -30 to +40°C
Storage temperature ..... -20 to +40°C
Number of additives 1

2.3. EVA 6.C Dual channel conventer

Manufacturer ..... Elok-Opava spol. s r.o.,Sádek 17, Velké Heraltice, Czech republic
Nominal power supply DC..... 10,8 to 30 VDC
Nominal load for 24VDC..... 0,25 A
Additive flow meter connection ..... 5 terminals for cable with 1,5 mm^2 wires, 2 signals with 90° shift

Additive valve connection (EVA6.C1) .... 2 + 2 terminals for cable with 1,5 mm^2 wires
Additive valve connection (EVA6.C3) .... 3 x 3 terminals for cable with 1,5 mm^2 wires (valve output)
..... 5 terminals for cable with 1,5 mm^2 wires (valve inputs)

Additive flow meter copy..... SSR relay (max. 60 VDC/ 100mA)
Maximum flow meter copy frequency .... 250 Hz
Output connection ..... 2 terminals for cable with 1,5 mm^2 wires
Software additive counter ..... 16 bits
Maximum on state resistance ..... 30 Ω

Infrared interface (option) ..... 1x Irda 1.0

Cable entry glands (EVA6.C1) ..... 2x Pg11 (1x coax valve, flowmeter)
Cable entry glands (EVA6.C3) ..... 4x Pg11 (3 x coax valves, flowmeter)
..... 3x Pg13,5 for cable Φ 6-12 mm

Mounting ..... using control unit holder
Protection ..... II2G EEx mb e [ib] IIB T4
Area ..... zone 1
Dimensions (L x W x H) 227x170x130mm
Mass..... 4 kg
Ingress protection ..... IP 65
Operating temperature ..... -30 to +40°C
Storage temperature ..... -20 to +40°C

3. Operating instructions

3.1. Description of operation

After sensing a pulse on the „Additive Injector“ input (pin X2.2,X2.3 or X3.2,X3.3) the additive valve opens and the additive process begins. At the same time the „Additive Injector Feedback“ output (pin X4.1,X4.2) is activated. The configuration parameters of the required additive volume per one pulse on the „Additive Injector“ input are stored in EEPROM. After finishing dosing the required additive volume the „Additive Injector Feedback“ output is deactivated and the additive valve closes. In case of the presence of another pulse, the Additive Injector Feedback“ output is activated until the next dosage is completed.

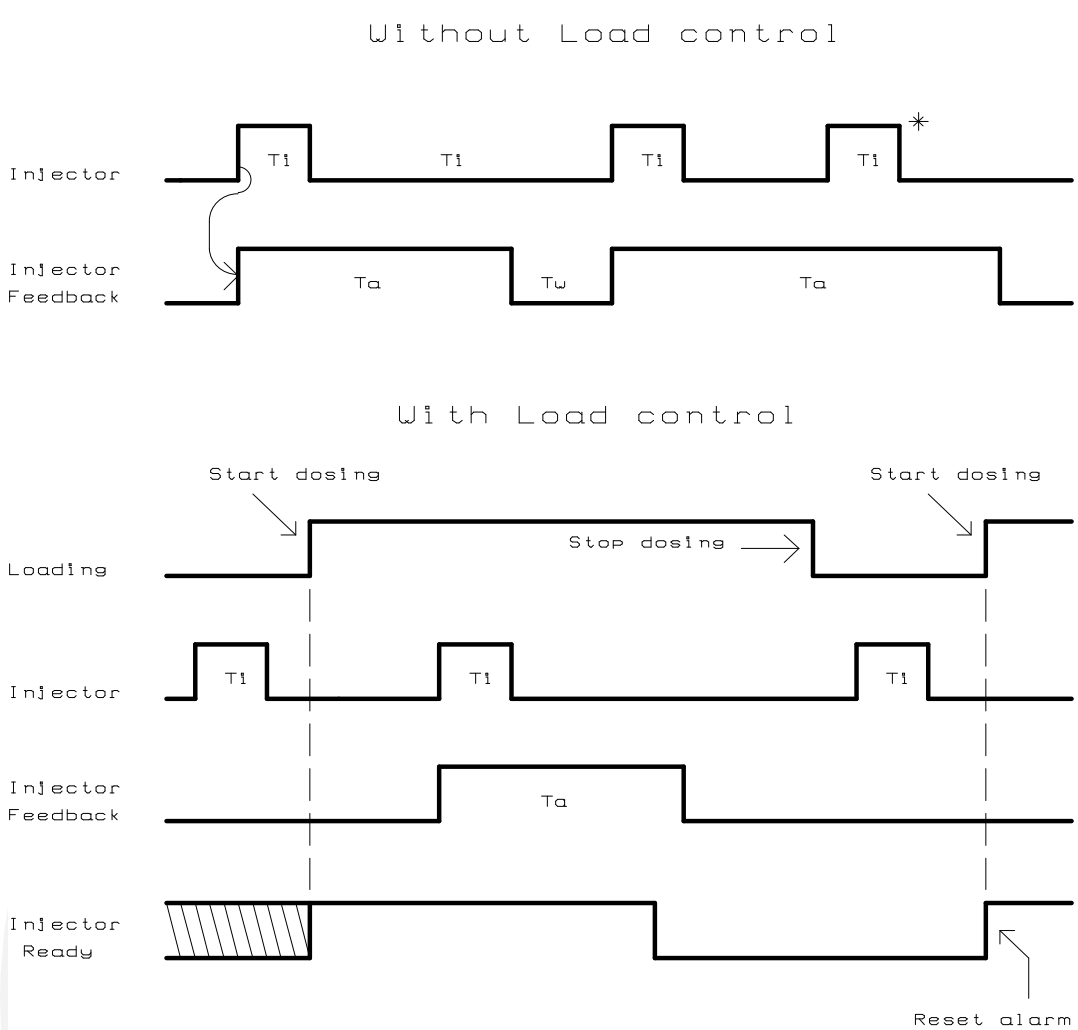
The opening of the additive valve (pin X6.4, X6.5) is controlled according to the counter values of the required additive volume (Required Additive counter) and of the real additive volume (Additive counter). If the volume of the additive is less than required, the additive valve is turned on. If the volume of the additive is more than required, the additive valve is turned off.

The additive flow meter is connected to „Flow Meter“ input (pins X1.1 to X1.5). The system can also detect reverse rotation and hazard pulses in a flow meter. The control unit continuously generates a copy of the recalculated pulses at the „Additive flowmeter copy“ output (pin X4.5, X4.6).

„Additive Injector Ready“ output (pin X4.3, X4.4)) indicates a correct function of the unit.

The Control unit can be optionally equipped with a „Additive Loading“ input (pin X2.1, X2.3 or X3.1,X3.3), which initializes the additive process. After „Additive Loading“ activation the required and real additive volume counters reset and a new additive cycle starts. At the same time all the alarm flags are reset (see 3.1) and „Additive Injector Ready“ output is activated. After „Additive Loading“ deactivation the pulses at the „Additive Injector“ input are ignored, the additive valve closes and „Additive Injector Feedback“ output is not activated. Alternativlely it is possible to control the status of the „Additive Loading“ signal via RS 485 serial link using the „Software additive start“ register (address 98h).

Permission to use the hardware or software control of „Additive Loading“ input is set in EEPROM. If the „Additive Loading“ input control not allowed, it is possible to reset the additive counters and alarm flags using software via RS485 interface or by restarting the Control unit (power turn off / turn on).



Ti >120us @24VDC Injector input
Ti >40ms @230VAC Injector input
Tw >40ms
Ta - min 40ms
max time of dosing

* - input puls is not acknowledged by Injector Feedback

Figure 3.1 Time diagram

3.2. Test mode

You can use the control program to set the unit to test mode through the RS 485 interface. All additive testing in test mode can be performed without connection to a higher level system. The unit internally generates the pulses for the „Additive Injector“ input. It is possible to set the frequency of the pulses. A condition for activating the test mode is that the “Additive Loading” signal is not active.

The control program can set the total value of the required additive. Then the dosing process can start. The unit carries out the additive process until the control program generates the number of pulses which corresponds the total volume of required additive. In the event that the selected volume is zero the test can only be stopped using the control program.

3.3. Description of alarms

When individual alarms, described below, are activated they set off the respective alarm states and also the global state at value 1. The hardware output “Additive Injector Ready” is deactivated according to the “Alarm Mask” (parameter 15Ch), where individual bits of this parameter enable (1) or disable (0) hardware outputs control according to the state.

If the „Additive Injector Ready“ output is turned off, then the „Additive Injector Feedback“ output is deactivated and the additive valve is closed. It is only possible to reopen the valve after resetting the alarm flags and another pulse detection on the „Additive Injector“ input. Description of the „Alarm Mask“ register:

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

It is possible to reset all alarms using the software (resetting the global state “AL” in „Status unit“ register) or by an activation of the “Additive Loading” input or by a restart of the Control unit.

3.3.1. Zero flow [ZF]

The alarm is monitored after the “Time ZF/DP” (parameter 158h, range 0 – 99 sec) has expired from the moment when the additive valve opens. If the number of pulses from the additive flow meter is less than “Alarm ZF” (parameter 154h, range 0 – 127 pulses) after the “Time ZF/DP”, alarm ZF is flagged. If the “Alarm ZF” parameter is 0 the alarm is disabled.

3.3.2. Down pulse [DP]

The alarm is monitored continuously if the additive valve is closed or after the “Time ZF/DP” (parameter 158h, range 0 – 99 sec) has expired from the moment when the additive valve opens. If the number of reverse pulses from the additive flow meter is greater than “Alarm DP” (parameter 156h, range 0 – 127 pulses) then alarm DP is flagged. If the “Alarm DP” parameter is 0 the alarm is disabled.

3.3.3. Let-by on valve [LV]

The alarm is monitored continuously if the additive valve is closed. If the absolute number of pulses from the additive flow meter is greater than “Alarm LV” (parameter 14Ch, range 0 – 127 pulses), then alarm LV is flagged. If the “Alarm LV” parameter is 0 the alarm is disabled.

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

An underfill or overfill recipe, i.e. a greater or lesser volume of additive than is required, can occur if the stipulated percentage is exceeded (parameter 128h, 126h). If the duration of the alarm is longer than the parameter “Time UF/OF” (14Ah) then the corresponding alarm UF or OF is flagged. If parameter 128h or 126h is 0 the corresponding alarm is disabled.

3.4. Selecting an address

The address of the Control unit is stored in EEPROM memory at the adress 0h. The address is used for communication via RS 485 interface. It is possible to select an address from 1 to 254. Address 0 is reserved for service purposes, do not use!

It is necessary to write the new adress to EEPROM through Irda interface or RS 485 interface with the global address (0). If the global address is used, there can only be one Control unit connected to the bus.

3.5. Communication using Irda (option)

Optionally the control unit can be equipped with infrared data transmission. Irda communication is an alternative method of controlling the unit and is mainly intended for servicing and testing. The infrared "transceiver" is located under the cover of the EVA 6.R Control unit.

Communication uses the IRDA 1.0 SIR standard. The data transfer rate is fixed at 9600 Bd. The format is 1start bit, 8 data bits, No parity, 1 stop bit.

3.6. 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.

3.6.1. 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, range (00 to FE),the address is stored in EEPROM,. 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 read/write 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

3.6.2. 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 numer

3.6.3. Description of the memory area

The memory area of the EVA6 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 is described belowe.

The unit can be set by the software to three authorisation levels. These user levels allow access to or show data stored in the memory area The lowest level is 0 (default). 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 read only. It is possible to read the whole memory area from level 0.

Address	Name	Comments
100h	Address unit	Unit address for RS485 interface
102h	Additive 1 formula	Product formula in ppm
104h	Additive 2 formula	
106h	Additive 3 formula	
108h	Additive 4 formula	
10Ah	Additive 5 formula	
10Ch	Additive 6 formula	
10Eh	Additive 7 formula	
110h	Additive 8 formula	
112h to 124h	not used	
126h	Alarm OF	Alarm OF parameter [0 to 100 %] (0 = alarm off)
128h	Alarm UF	Alarm UF parameter [0 to 100 %] (0 = alarm off)
12Ah	Additive flowmeter	Number of pulses/litre additive flow meter
12Ch	Product flowmeter	Number of pulses/1000 litres product flow meter
12Eh to 130h	not used	
132h	Check sum eeprom	If write data = 0 then set default parameters in the EEPROM
134h	Testing parameter	The parameter of the simulated flow rate during testing
136h	EVA setting	Control unit configuration
138h	Pulse divider	Pulse splitter for software copy
13Ah to 148h	not used	
14Ah	Time UF/OF	Duration of dosing fault to activate alarm UF/OF
14Ch	Alarm LV	Number of pulses for activating alarm LV [0 to 255] (0 = Alarm off)
14Eh to 152h	not used	
154h	Alarm ZF	No. of pulses for not activating alarm ZF [0 to 255] (0 = Alarm off)
156h	Alarm DP	Number of pulses for activating alarm DP [0 to 255] (0 = Alarm off)
158h	Time ZF/DP	Delay before monitoring alarm ZF, DP [sec]
15Ah to 124h	not used	
15Ch	Mask alarm	Allowed output controls “Additive injector ready”
15Eh	Additive divider	Additive splitter for flow meter [1 to 254]
160h to 1FAh	not used	
1FCh	HI (Serial number unit)	Serial number of Control unit
1FEh	LO (Serial number unit)	

Tab. 1 EEPROM memory area (100h to 1FFh)

Address	Name	Comments
00h	Firmware version	Example 6.02 = 602
02h	Address unit	0 to 255
04h	Unit Restart	If data write = 0 then Restart unit (for LW = ON only)
06h	Level 1 control	On / off authorisation level 1
08h	Level 2 control	On / off authorisation level 2
0Ah to 2Ah	not used	
2Ch	LW Status unit	If data = 8000h then LW = ON , If data = 7FFFh then LW = OFF
2Eh	Hardware input	Hardware input status
30h	HI (Product counter)	Product counter
32h	LO (Product counter)	
34h	HI (Prod. shadow count)	Product shadow counter (software reset only)
36h	LO (Prod. shadow count)	
38h	Additive couter	Additive counter
3Ah	Additive shadow counter	Additive shadow counter (software reset only)
3Ch	Leakage counter	Let-by counter
3Eh	Soft copy counter	Write only for LW = ON
40h	Additive hw counter	Hardware counter for additive flow meter
42h	Additive divider counter	Additive divider counter
44h to 82h	not used	
84h	Hardware output	Setup / read optocoupler output (setup for LW = ON only)
86h	Number additive control	Set / reset additive valve (0 = OFF , 1 = ON), (for LW = ON only)
88h to 92h	not used	
94h	Product quantity	Product volume for testing in units of 100 litres
96h	Additive test start	Start additive test for n.1 to 8 formula, if data = 0 then stop test
98h	Software additive start	Soft. addit. start for n.1 to 8 formula, if data = 0 then stop additive

Tab. 2 RAM memory area (00h to FFh)

3.6.3.1. Description of the status register (2Ch)

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

LO.....„Additive Loading“ is active
DO.....„Additive valve“ status
AL.....„Global alarm“ flag is active
OF,UF,LV,ZF,DP the corresponding alarms are active
LW.....direct control of the hardware 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 8000h / clearing: write to register 7FFFh) will change all registers which are specified for direct control (address location 84h,86h,3Eh).

Next exception is clearing of bit 3 = AL (or all status register clearing), which can be used in user level 0. In the case all alarm flags are cleared.

3.6.3.2. Description of the hardware input register (2Eh)

15	*14*	*13*	*12*	*11*	*10*	*9*	*8*
						PR1	**PR 0**

7	*6*	*5*	*4*	*3*	*2*	*1*	*0*
		LO	**I24**				**I230**

I230 .....„Additive Injector “ input for 230V
I24 .....„Additive Injector “ input for 24V
LO.....„Additive Loading“ input
PR0 .....channel 0 of the additive flow meter
PR1 .....channel 1 of the additive flow meter

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

3.6.3.3. Description of the hardware output register (84h)

15	*14*	*13*	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
							FC				**IR**	**IF**			

IF.....„Additive injector feedback“ output
IR .....„Additive injector ready“ output
FC .....„Additive flow meter copy“ output

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

3.6.3.4. Description of Software Copy counter (3Eh)

This register is incremented by the pulses of the additivum and it also periodically counts down to zero. During countdown it generates pulses at the „Additive flow meter copy“ output. The pulse period is constant (2ms) and the number of pulses is influenced by the parameter “Pulse divider” in the Eeprom. For parameter value 1 every additive pulse is generated, for higher values the number of generated pulses is reduced. The maximum allowed frequency at the „Additive flow meter copy“ output is 250Hz, the „Pulse divider“ 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 FC bit in the hardware output register is set to zero.

3.6.4. Parameters in the EEPROM

3.6.4.1. Address unit

100h ..... address unit

Range: 0 až 254

Default: 0

3.6.4.2. Product formula in ppm

102h ..... additive 1 formula
104h ..... additive 2 formula
106h ..... additive 3 formula
108h ..... additive 4 formula
10Ah..... additive 5 formula
10Ch..... additive 6 formula
10Eh..... additive 7 formula
110h ..... additive 8 formula

Range: 1 to 9999 ppm

Default: 100 ppm

3.6.4.3. Correct concentration parameters (alarm OF/UF)

126h ..... allowed percentage error for over-concentration, i.e. a larger volume than required (OF)
128h ..... allowed percentage error for under-concentration, i.e. a smaller volume than required (UF)

If the parameters are set on 255 or 0, no check is performed.

Range: 0 to 100 or 255

Default:

126h: 0
128h: 0

3.6.4.4. Flow meter parameters

12Ah.....number of pulses of the additive flow meter in pulses per 1 litre
12Ch.....number of pulses of the product flow meter in pulses per 1000 litres

Range: 1 to 65535

Default:

12Ah: 534
12Ch: 20

It is possible recalculated recruire concetration in [ppm] to value indicate in [ml] per 1 product pulse by the "Product flow meter" parameter (address 12Ch):

Concent [ml] = Concent [ppm] / „Product flow meter". (examp. Concent = 100 ppm / 20 = 5 ml).

3.6.4.5. Simulated flow rate parameter for testing

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

Range: 1 to 255

Default:

134h: 25 (1sec.)

3.6.4.6. Control unit setting

136h .....configuration

7	*6*	*5*	*4*	*3*	*2*	*1*	*0*
HL	**SL**			**IR**		**FI**	

HL.....permit to the „Additive Loading" controlling by the hardware input
SL.....permit to the „Additive Loading" controlling by software (write to address 98h)

IR.....active level for „Additive injector ready" output
0 – output is activated, when global alarm (bit AL at the address 2Ch) is detected
1 – output is deactivated, when global alarm (bit AL at the address 2Ch) is detected

FI.....frequency selection at the „Additive injector" input
0 = allowed 5 Hz at the „Additive injector 24V" or „Additive injector 230V" input
1 = allowed 3 kHz at the „Additive injector 24V" input only

138h .....pulse divider for the „Additive flow meter copy" output

Range: 1 to 255

Default:

136h: 08
138h: 01

3.6.4.7. Alarm parameter settings

14Ah..... delay concetration overfill / underfill for the alarm [OF] / [UF] activation * 40ms
14Ch..... number of pulses on the additive flow meter to flag alarm [LV]
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 for monitoring alarm [ZF] in units [sec.]
15Ch..... the bits of „Mask alarm“ parameter allow (1) or prevent (0) the „Additive injector ready“ output control according to individual alarm flags.

Range:

14Ah: 0 až 255
14Ch: 0 až 255 (0 = alarm LV off)
154h: 0 až 255 (0 = alarmu ZF off)
156h: 0 až 255 (0 = alarmu DP off)
158h: 0 až 255
15Ch: 0 až 255

Default:

14Ah: 25 (5 sec.)
14Ch: 20
154h: 10
156h: 10
158h: 10 sec.
15Ch: 255

3.6.5. Communication messages – examples

There are the examples of the controlling additive unit trought RS485 interface. Communication address is set to 1. Characters "< >" are not sent in the message. <STX> and <ETX> are binary values 02h and 03h. Other items are ASCII characters.

3.6.5.1. Concetration set / read

Setting of the concetration number 1 to 100 ppm:

Tx: <STX><01><8102><02><0064><0A><ETX>

Rx: <STX><01><8102><02><0064><0A><ETX>

Reading of the concetration number 2:

Tx: <STX><01><0104><02><06><ETX>

Rx: <STX><01><0104><02><0064><04><ETX>

3.6.5.2. Status reading / alarms clearing (2Ch)

Status reading, the active alarm [LV] + [AL] is returned:

Tx: <STX><01><002C><02><72><ETX>

Rx: <STX><01><002C><02><0208><78><ETX>

Alarms clearing:

Tx: <STX><01><802C><02><0000><7A><ETX>

Rx: <STX><01><802C><02><0000><7A><ETX>

3.6.5.3. Software start / stop of the dosing

Dosing start according to the concetration n.1 (software controlling of the "Additive Loading"):

Tx: <STX><01><8098><02><0001><0B><ETX>

Rx: <STX><01><8098><02><0001><0B><ETX>

Dosing stop:

Tx: <STX><01><8098><02><0000><0A><ETX>

Rx: <STX><01><8098><02><0000><0A><ETX>

3.6.5.4. Reading of the counters

Reading of the additive counters (address 38h + 3Ah):

Tx: <STX><01><0038><04><0E><ETX>

Rx: <STX><01><0038><04><00A01010><7F><ETX>

Additive counter: 160 pulses

Additive shadow counter: 4112 pulses

4. Installation

4.1. Aditiv Unit Installation to the pipeline

A) Before the Aditiv unit installation to the pipeline it is necessary to dismount the items as shown in figure 4.1.

Unscrew:
1. the lug item 1
2. the nut with the seals items 2a,2b and 3
3. the screws M10x20 item 7
4. the nut of hydraulics item 6

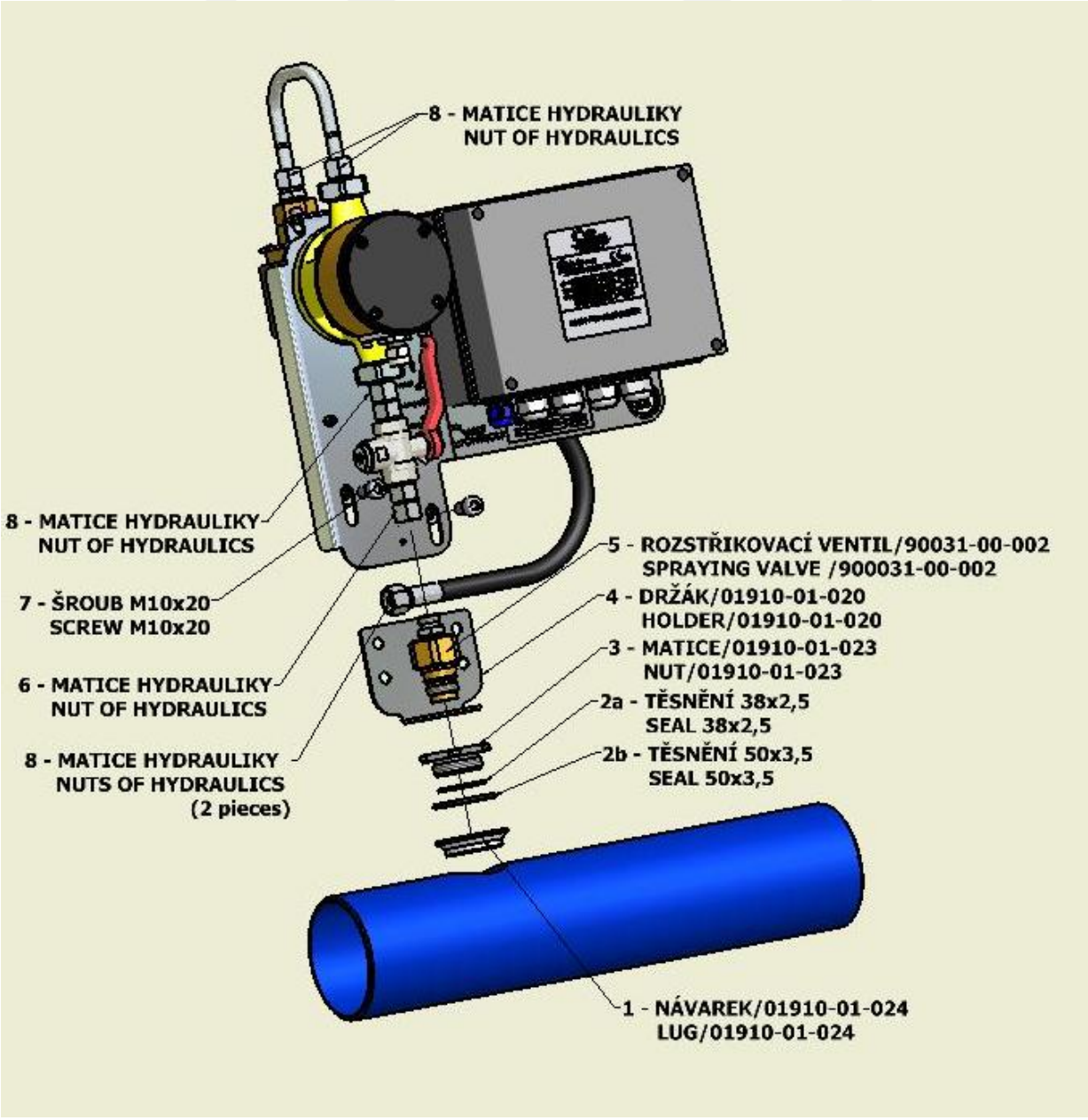


Figure 4.1 The Additive unit instalation to the pipeline

B) For the correct functioning of the Spraying valve and for ideal rinsing by the product it is necessary to install the Spraying valve as shown in figure 4.2.

1. First it is necessary to weld the lug-position 1 on the pipe as shown in figure 4.2. We proceed with caution so that deformation of the lug is as small as possible (superpose two or three weld bead and cool down the pipe for example with a wet rag). After welding the pipe thread and cooling it, we cut a thread G 1 ¼ with the manual pipe thread tap G 1 ¼.

2. Subsequently we will install in sequence the items 3 (2a, 2b and 3 together), 4 and 5 as shown in figure 4.2.

Note:
Components 1-6 are part of the standard accessories

The Lug – suplement 1 - as shown in drawing 01910-01-024 can be used for pipeline from DN 90.

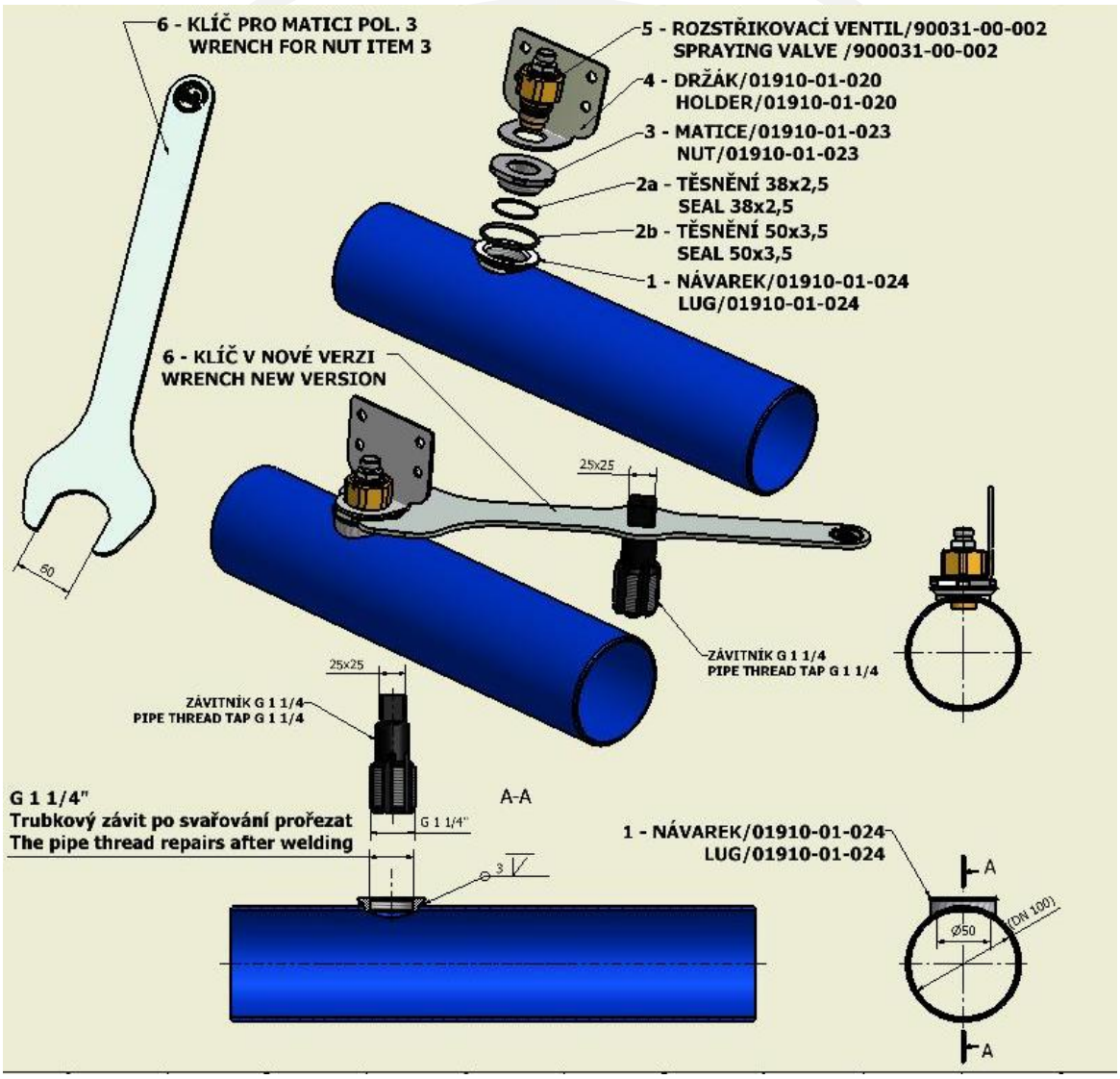


Figure 4.2 The Spraying valve installation to the pipeline

C) The Additive unit is bolt to the Holder and to the Spraying valve as shown in figure 4.1.

1. bolt the screws M10x20 item 7
2. draw up the nut of hydraulics item 6
3. draw up all nuts of hydraulics item 8
4. draw up the screws M10x20 item 7

4.2. Aditiv Unit Installation outside of the pipeline

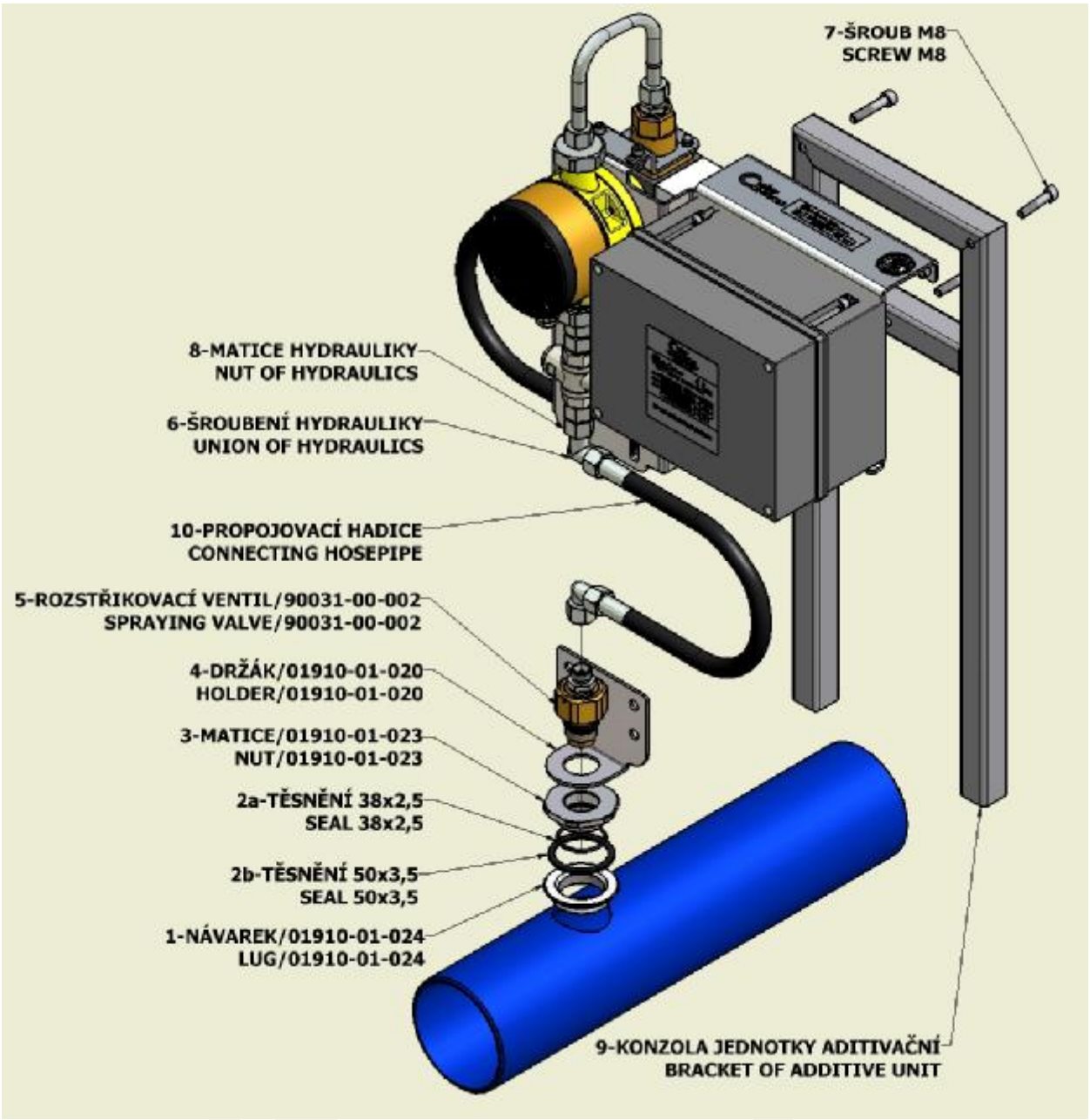


Figure 4.3 Additiv Unit installation outside of the pipeline

1. The Additive unit fasten with the bracket of additive unit by 3 M8 screws (item 7) as shown in figure 4.3.
2. Spraying valve install to the pipeline as shown in figure 4.2.
3. Connecting hosepipe (item 10) connect the dosing unit with spraying valve as shown in figure 4.3.

4.3. Control Unit Installation or Dual channel conventer instalation

The Control unit or Dual channel conventer are standardly fastened to the Dosing unit by 4 M6 screws shown in figure 1.1, 1.2.

4.4. Electrical connections

The additive valve on the Dosing unit is connected, using the prescribed cables, to the valve output terminals on the Control unit EVA 6.R. The 3-core cable that connects the additive valve to the terminal is marked WL1. The additive flow meter is connected to the additive flow meter [ib] input. The 4-core cable leading to the additive flow indicator is marked WS1IS (see figure 1.3).

The incoming RS485 serial link from a preceding unit and the outgoing RS 485 link to the next unit are connected together to terminals X7.1, X7.2. If the control unit is the last, then a 1kΩ terminal resistor is placed between X7.1 and X7.2.

Other connections are made according to the project.

4.4.1. Terminal connections EVA 6.R

1. Flow meter input [ib]

a) variant - interface NAMUR 8V/8mA

X1.1. Channel 0 (+) - pin A0 + (channel 0)
X1.2. Channel 0 (-) - pin A0 -
X1.3. Channel 1 (+) - pin A1 + (channel 1)
X1.4. Channel 1 (-) - pin A1 -
X1.5. GND .. - not used

b) variant - sensor SQA 2 for Aquametro

X1.1. Channel 0 (+) - not used
X1.2. Channel 0 (-) - pin A0
X1.3. Channel 1 (+) - pin V+
X1.4. Channel 1 (-) - pin A1
X1.5. GND .. - pin GND

2. Inputs 230VAC 8mA

X2.1. Additive Loading
X2.2. Additive Injector
X2.3. COM..

3. Inputs 24VAC/DC 8mA

X3.1. Additive Loading
X3.2. Additive Injector
X3.3. COM..

4. Outputs SSR relay 24VAC/DC – 230 VAC 100mA

X4.1. Additive injector feedback (~)
X4.2. Additive injector feedback (~)
X4.3. Additive injector ready (~)
X4.4. Additive injector ready (~)

X4.5. Additive flow meter copy (+) - maximal 60VDC /100mA

X4.6. Additive flow meter copy (-) - maximal 60VDC /100mA

5. Main power 24VDC / 250mA

X5.1. Main power (+)
X5.2. Main power (-)

6. Main power 230VAC/ 250mA + Valve 230 VAC

X6.1. Main power (L)
X6.2. Main power (N)
X6.3. Main power (PE)

X6.4. Valve (L)
X6.5. Valve (N)
X6.6. Valve (PE)

7. RS485 interface

X7.1. A
X7.2. B
X7.3. COM

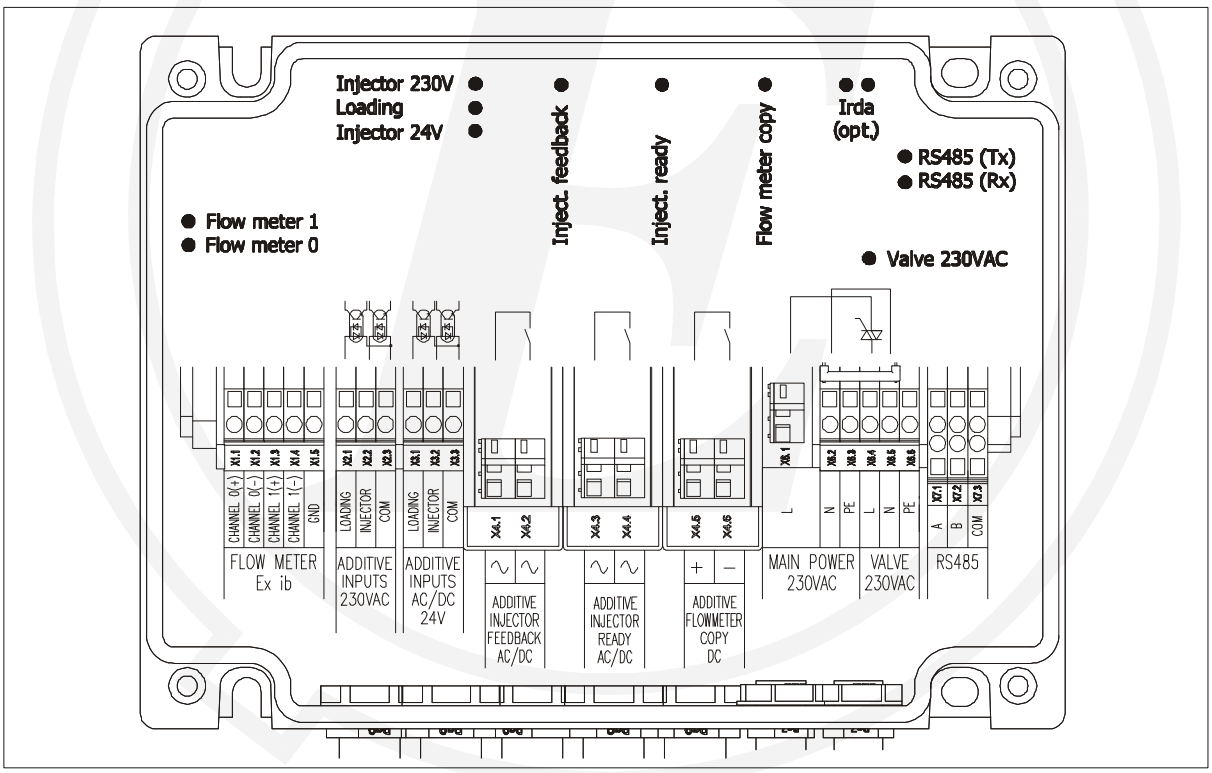


Figure 4.4 Terminal connection of the EVA 6.R Control unit

4.4.2. Terminal connections EVA 6.C3

1. Flow meter input [ib]

a) variant - interface NAMUR 8V/8mA

X1.1.	Channel 0 (+)	- pin A0 + (channel 0)
X1.2.	Channel 0 (-)	- pin A0 -
X1.3.	Channel 1 (+)	- pin A1 + (channel 1)
X1.4.	Channel 1 (-)	- pin A1 -
X1.5.	GND ..	- not used

b) variant - sensor SQA 2 for Aquametro

X1.1.	Channel 0 (+)	- not used
X1.2.	Channel 0 (-)	- pin A0
X1.3.	Channel 1 (+)	- pin V+
X1.4.	Channel 1 (-)	- pin A1
X1.5.	GND ..	- pin GND

2. Additive valve output 230VAC

X2.1. Valve 1 (L)
X2.2. Valve 1 (N)
X2.3. Valve 1 (PE)
X2.4. Valve 2 (L)
X2.5. Valve 2 (N)
X2.6. Valve 2 (PE)
X2.7. Valve 3 (L)
X2.8. Valve 3 (N)
X2.9. Valve 3 (PE)

3. Additive valve inputs 230VAC

X3.1. Valve 1 (L.1)
X3.2. Valve 2 (L.2)
X3.3. Valve 3 (L.3)
X3.4. Valve (N)
X3.5. Valve (PE)

4. Outputs SSR relay

X4.5.	Additive flow meter copy (+)	- maximal 60VDC /100mA
X4.6.	Additive flow meter copy (-)	- maximal 60VDC /100mA

5. Main power 24VDC / 250mA

X5.1. Main power (+)
X5.2. Main power (-)

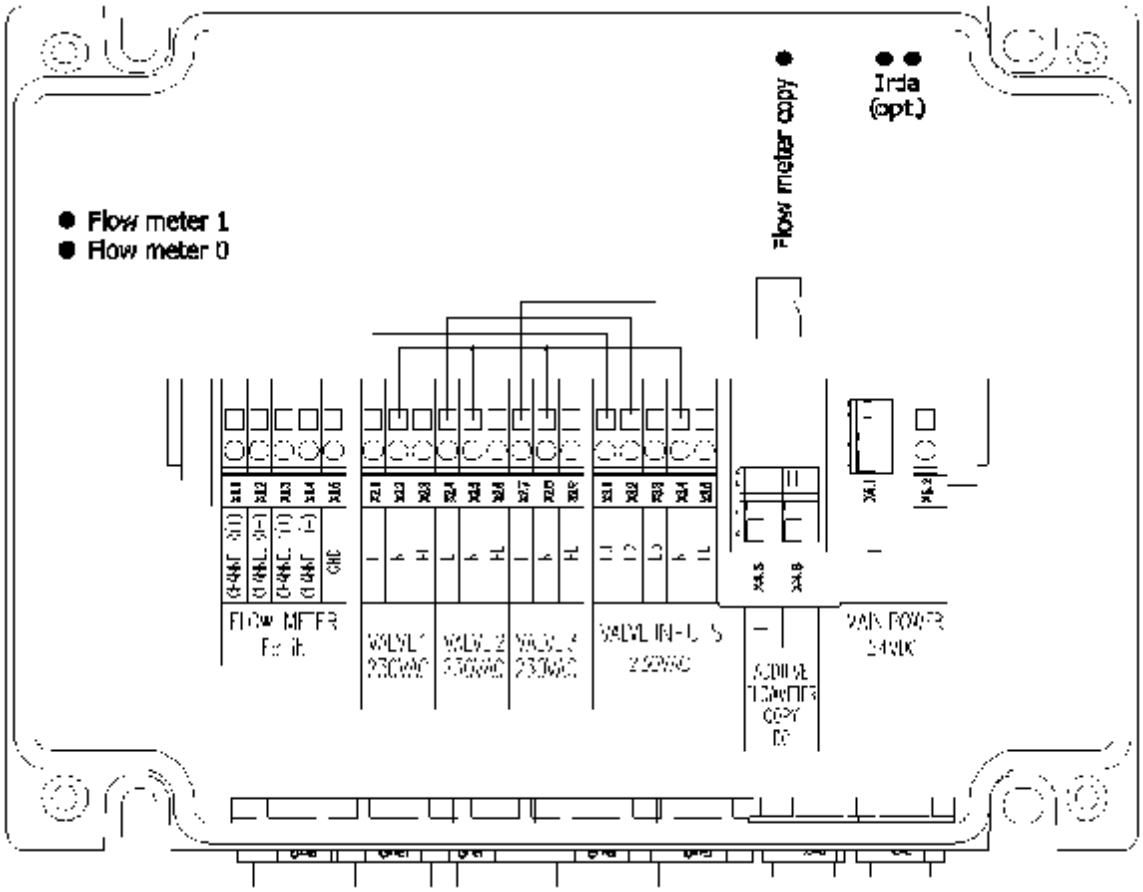


Figure 4.5 Terminal connection of the EVA 6.C3 Control unit

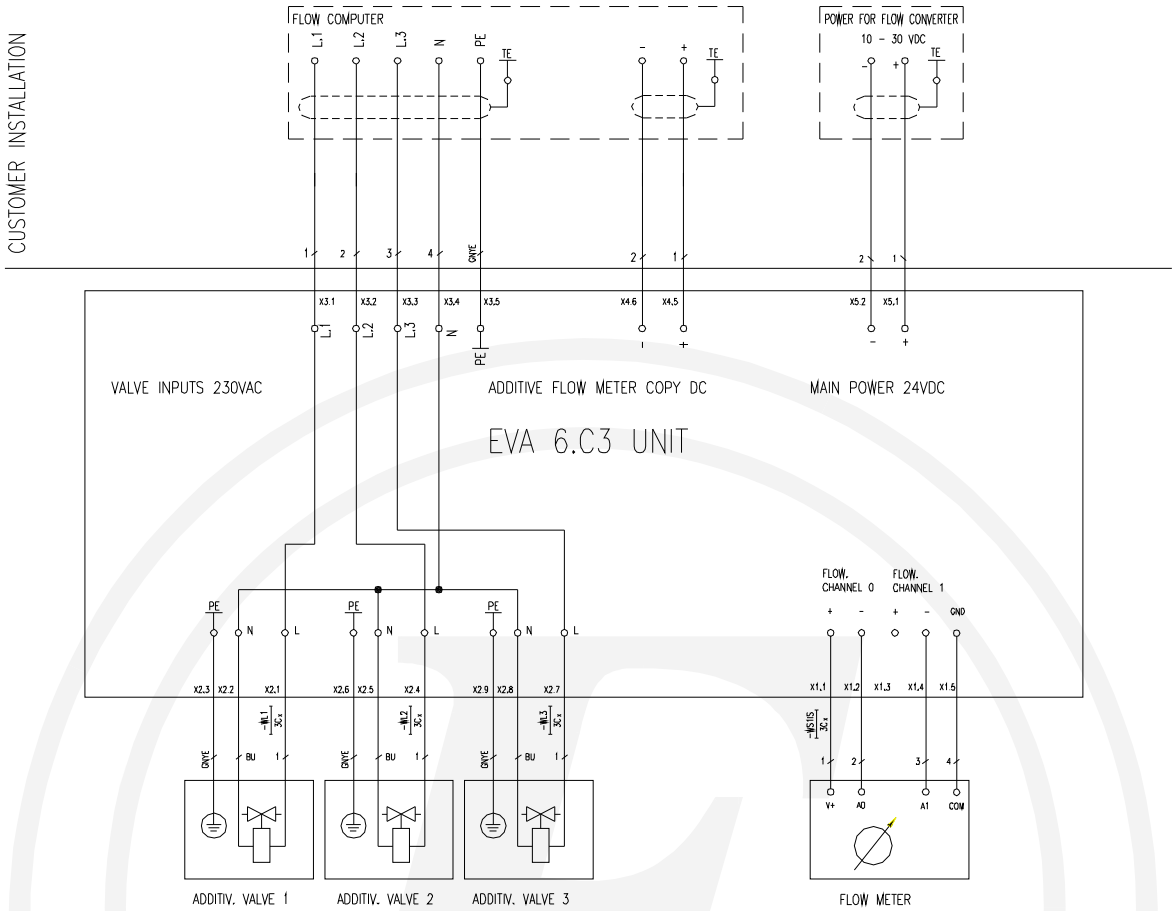


Figure 4.6 Customer installation

4.4.3. Cable specification

4.4.3.1. Connecting flow meter

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)

4.4.3.2. Connecting additive valve

PVC 3-core flexible cable with PE and N, 1.5mm^2 cross-sectional area Cu core, maximum external diameter 10 mm, protected to the requirement of the external environment.

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

4.4.3.3. Connecting additive valve inputs (for EVA 6.C3)

PVC 5-core flexible cable with PE and N, 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 5G1.5 or CMFM 5Cx1.5)

4.4.3.4. Connecting the main power unit 230VAC

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)

4.4.3.5. Connecting the main power unit 24VDC

PVC 2-core flexible cable, 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 2x1.5)

4.4.3.6. 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)

4.5. Hydraulic connections

An inlet hose - M18x1,5; 0,5 m long - is used for additive input into the dosing unit. It is also supposed to eliminate vibration from inlet pipe. Output from the dosing unit is secured by the spraying valve, which leads into the product´s pipe. **It is necessary to keep that way of connection!**

5. Commissioning the equipment

5.1. Configuring the system

First, the address of each additive unit is set using Irda or RS485 interface (see 3.4) so that it is unique to that unit within the whole RS 485 system.

Then the parameters of the additive units are read. These parameters are checked to see whether they are setup correctly. If any of these parameters differ from the default values for the current application they must be configured using Irda or RS485 interface according to the requirements.

5.2. Purging the additive system of air

First of all the additive feed pipe must be purged of air. The hose supplying the additive is disconnected from the additive unit. Sufficient additive is discharged until only additive without air flows out. Then the hose is reconnected as before.

Now it is necessary to purge the additive unit of air. The calibrating set´s output part is connected to the dosing unit. (chapter 1.6 - the calibration set´s output part connection) possibly check-up additive. Sufficient additive is discharged until only additive without air flows out.

After deaeration set the unit back to the additive mode (chapter 1.6 - the calibration set´s output part disconnection) possibly check-up additive (chapter 5.3).

5.3. Checking the additive process

Set the additive unit to the additive test mode. After calibrating set connection (viz. chapter 1.6) take control amount of additive and put it into the measuring cylinder. It must correspond to required volume.

After check-up set the additive unit back to the additive mode (viz. chapter 1.6 disconnection of the output and input calibration set´s part).

6. Maintenance and servicing

6.1. Regular maintenance

This equipment requires maintenance, 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!

Servicing may be done only by producer or the person trained by producer.

6.2. Error messages – Control unit

See section 3.3 “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:. Connect the input and output part of the calibration set to the additive unit. 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 (viz chapter 1.6).

2: Malfunction of a coaxial valve, flow meter.

Check: Disconnect the outlet hose from the spraying valve mounted in the pipework. Connect the inlet of the calibration set with the hose and the outlet to the spraying 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 (viz. chapter 1.6).

In order that the flow meter functions correctly it is important that the additive is free of all mechanical impurities larger than 25µm, 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 pipework not only cause inaccurate measurements but also mechanical damage to the flow meter.

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

Check: Check the pressure in the product pipework. To the 3-way ball valve of the dosing unit connect the inlet of the calibration set (with manometer) and connect the outlet of the calibration set to the spraying valve (viz. chapter 1.6). 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 of that instructions.

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 additive 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. During manipulation use gauntlet and your face protect with a shield.

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

SUPPLEMENT 1

The Lug as shown in drawing 01910-01-024 can be used for pipeline from DN 90.