Countum Group
SATAM
Metering Solutions

MASTER METER

Description, Operation, Maintenance

Countum Group
SATAM
Metering Solutions

About This Manual

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Revision history

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Countum Group
SATAM
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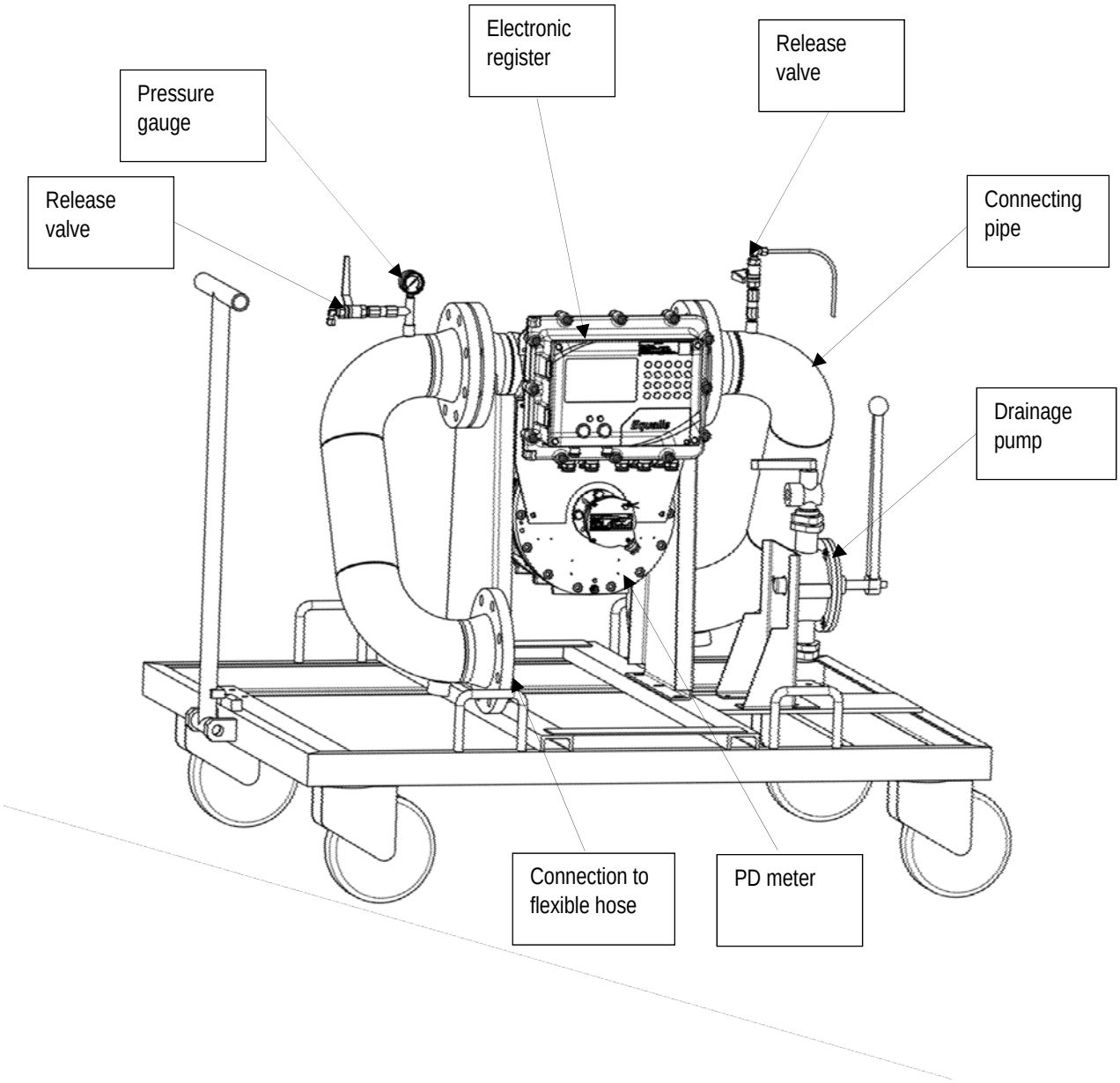
Table of Contents

1. Functionalities

Satam master meters model ZCM17 are dedicated to periodic calibration of custody transfer measuring equipment for fuels and petroleum products.
ZCM 17 is a working standard that can be used regularly to check and calibrate measuring instruments or measuring systems.

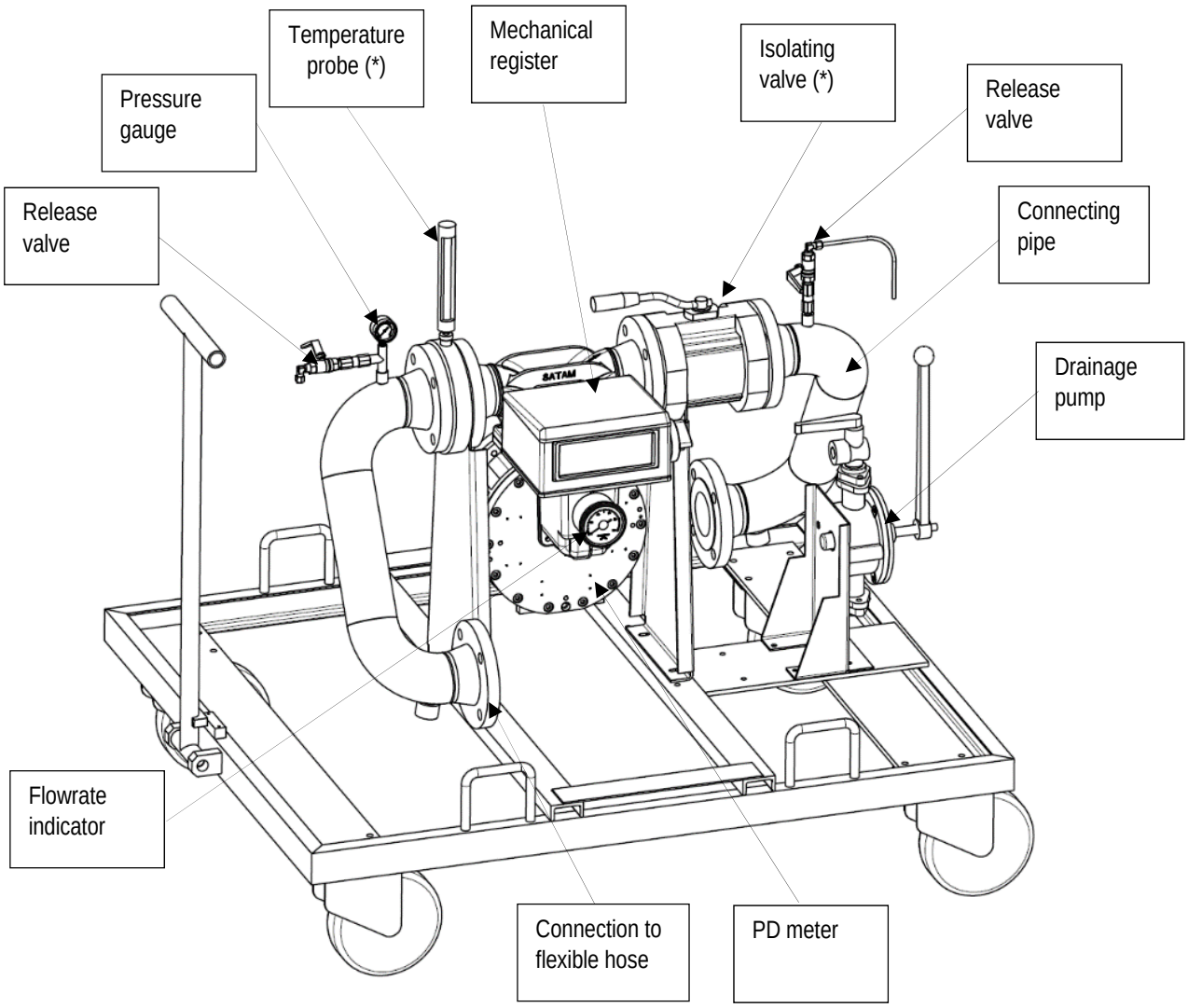
2. General arrangement of ZCM17

A. Version with electronic register



B. Version with mechanical register

* : optional supply



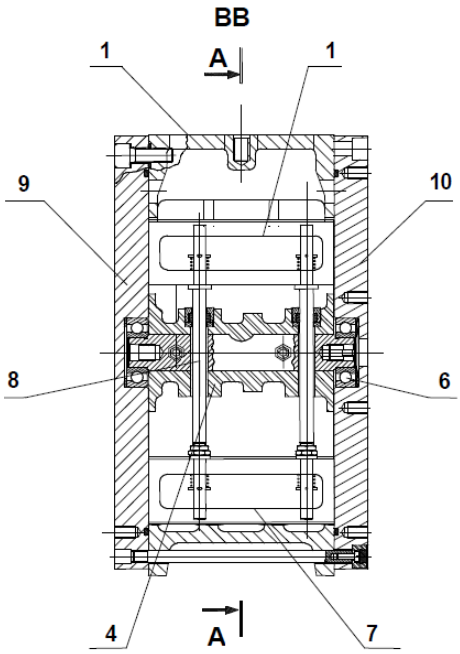
3. Main components of ZCM17 master meter

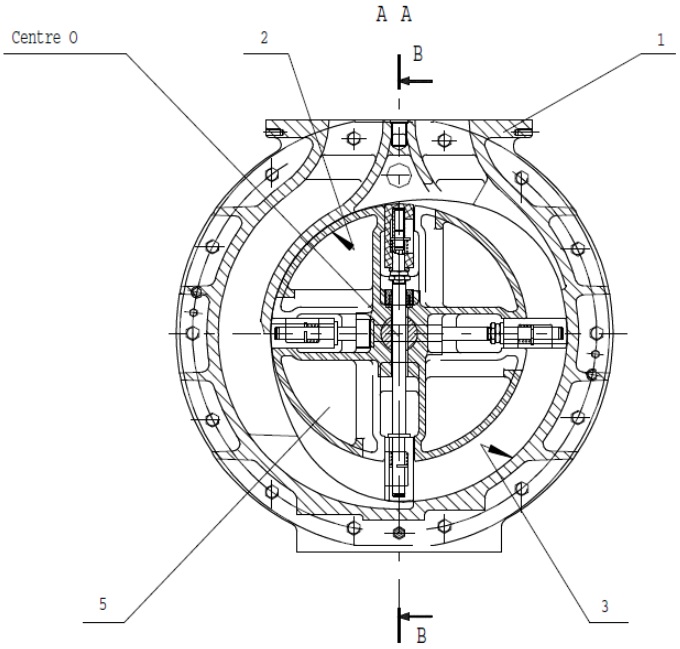
Satam ZCM17 master meter consists of the following components

A. Positive displacement meter ZC17

The measuring chamber of Satam ZC17 is composed of

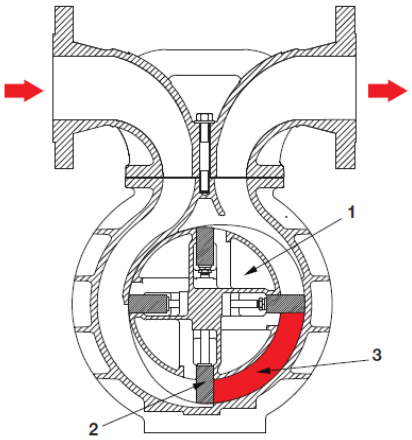
- A body (1) made up of 2 cylindrical parts (2) and (3) of different radii, connected via curves in such a way that the sum of the distances from centre point O to two points opposite each other on the stator is constant.
- A moving part (4) composed of a rotor turning on stainless steel ball bearings (6), carbon blades (7) linked to each other by rods (8) and 2 steel covers (9) and (10).





Measuring principle

The product enters the measuring chamber following the direction of the arrow. The rotor and blades assembly (1-2) is set in motion by the pressure of the liquid on blades. A certain amount of liquid (3) is held between 2 blades and then directed to the discharge manifold. The volume of liquid measured at each rotation is therefore equal to 4 times the measured quantity (3). The smooth curves the meter pieces provide a steady, non-fluctuating flow resulting in low head loss.



The rotation of the rotor is transmitted mechanically either to a pulses transmitter in case of a device fitted with electronic register or to an adjusting mechanism is case of a device fitted with mechanical register.

For complete information about ZC17 operation please refer to following technical manuals :

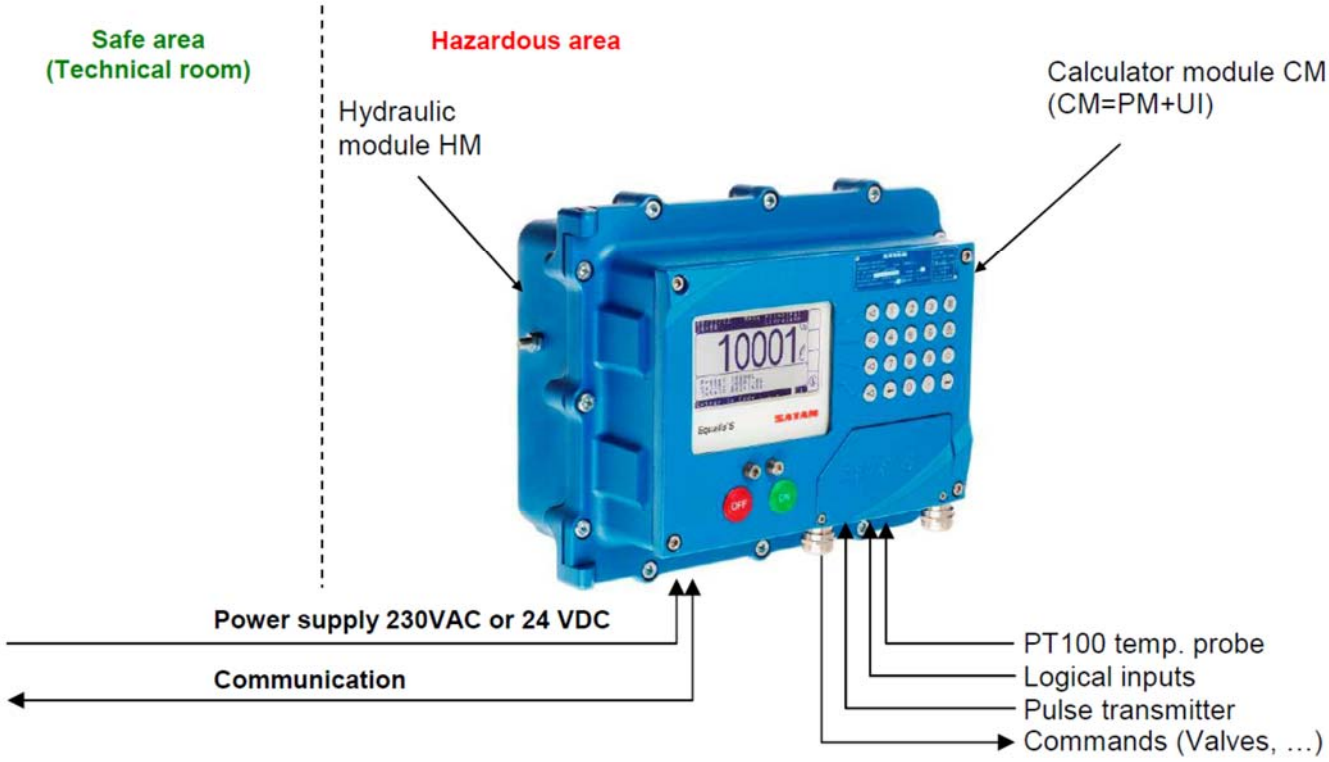
Reference	Technical manual
U508131	Description, installation, operation, servicing for ZC17-24 and ZC17-48
U508334	Description, installation, operation, servicing for ZC17-80; ZC17-150, ZC17-250 and ZC17-330

B. Electronic register EQUALIS S

The EQUALIS S Field Batch Controller depot version is an intelligent electronic calculator/indicator, controlled by several embedded microprocessors, designed for efficient management of fluid measurement. It carries out the calculation, display and management functions, essential to product loading or unloading.
EQUALIS is designed to be used in an explosive atmosphere, with different protection modes, in accordance with directive ATEX 94/9/CE.
It is designed to ensure the data backup of the current deliveries in the event of a power failure. This data is restored as soon as the power supply is restored.
The EQUALIS user interface includes a 240 x 128 pixel backlit graphic display, a 20-key keyboard and Stop and Start buttons.
The electronic indicator S EQUALIS depot version consists of a housing composed of two elements. It is located at the loading point. It consists of two boxes:

- The Calculator Module (CM module),
- The Hydraulic Module (HM module) for the output control.

The electronic indicator is supplied with 230VAC or 24VDC, It is equipped to communicate with external supervision systems.



The main features of the EQUALIS S flow computer are the following:
Graphic display: Any information necessary required to use the EQUALIS S is displayed on a single screen, in a way that is user-friendly and interactive.

Dust and water resistant: EQUALIS has been developed and manufactured in such a way as to make it resistant to the risks of everyday use and the elements.

Adjustable meter curve: The EQUALIS has a parameter used to correct the curve by reducing the counter to 0 ‰ measurement error at operation flow rate. It also provides the possibility to linearize the curve by using an error correction parameter in 6 sectors.

Hard disk memory: The transactions as well as the system's configuration and calibration parameters are backed-up in a secure database. The capacity of this memory allows to save up to 50 000 transactions.
EQUALIS S also allows consulting and reprinting transactions which are stored in this database. The metrological data featured on this ticket is recognised by legal metrology authorities.

Dual channels for pulses: EQUALIS S may be connected to 1 or 2 pulse transmitters. Where 2 pulse transmitters are connected, EQUALIS S displays the total volume from these two 2 counters.
Systematically for this (these) transmitter(s), the EQUALIS S counts, stores and compares the two pulse channels for each transmitter with a phase shift of 90°. If any disparity is detected between their 2 respective pulse trains, the delivery is stopped, thus also preventing loss of product due to a defective transmitter.

For complete information about Equalis S operation please refer to following technical manual :

Reference	Technical manual
U517478	Equalis S Installation manual
U517504	Equalis S Programming manual

C. Mechanical register

The mechanical register is a mechanical indicator. It display the measured volume at operating conditions. The resettable volume is displayed with 5 digits and the non-resettable volume is displayed with 8 digits.

For complete information about mechanical register operation please refer to following technical manual :

Reference	Technical manual
U508218	VR7887 Description, installation, operation, servicing

D. Rate of flow indicator

Each ZCM17 is able to display the flow rate in L/min or in m3/h. When fitted with a mechanical register, the rate of flow indicator is an external module located at the bottom of the register. The physical unit of the flow must be define at the order of the master meter. When fitted with a electronic register, the flow rate value is directly displayed on the register without the need of any additional module.

4. Narrative Description

- Connect ZCM17 with hose between the metering system to be tested and the receiving tank
- Start a delivery to fill the ZCM17 up to the transfer point
- Reset the mechanical head / Put the Equalis S in delivery mode
- Start delivery with a preset volume
- Compare the volume displayed by the master meter with the one displayed by the meter to be tested
- Adjust the meter correction coefficient
- Start a new delivery to confirm the correction
- Use the drainage hand pump to empty the ZCM17 to limit pollution when disconnecting or testing with a new fluid
- Disconnect the ZCM17 hose

5. Periodic Servicing

As a general rule, a periodic maintenance of at least once a year is recommended.
Service operations must be carried out by a Weights & Measures approved Company.

6. Cleaning

We strongly advise against the use of a high pressure water jet to clean the measuring unit, as this could seriously damage the metering unit.

7. Meter Calibration Inspection – Weight and Measures

Current French legislation stipulates:

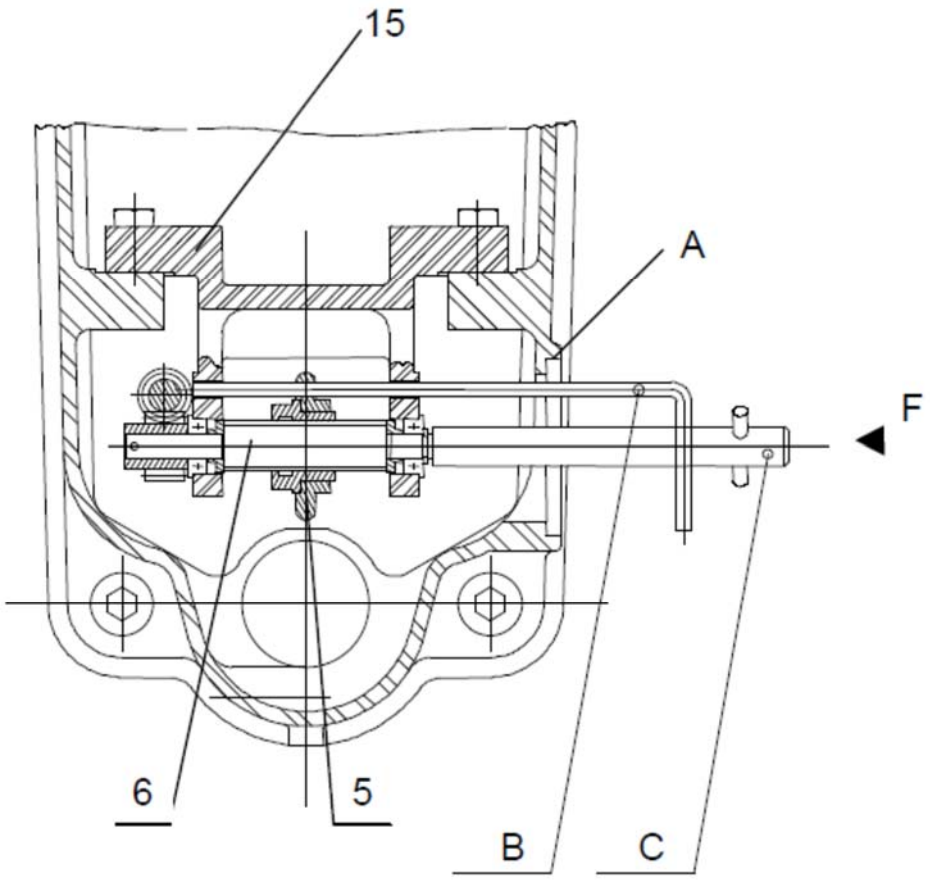
- Metrological inspection of the meter at operation start-up.
- Thereafter, annual inspections.

A. Adjustment Procedure with transmitter AB 21

- Unseal and remove cover (A)
- Move roller (5) by turning screw (6) using spanner "C" until the roller hole is aligned with the 2 holes on the support (15)
- Insert pin (B) as shown on the diagram.
- Turn the screw right (clockwise) to increase the quantity of product in the gauge.
- Turn the screw left (anticlockwise) to decrease the quantity of product in the gauge.
- One turn of the screw (6) = Correction of 1‰

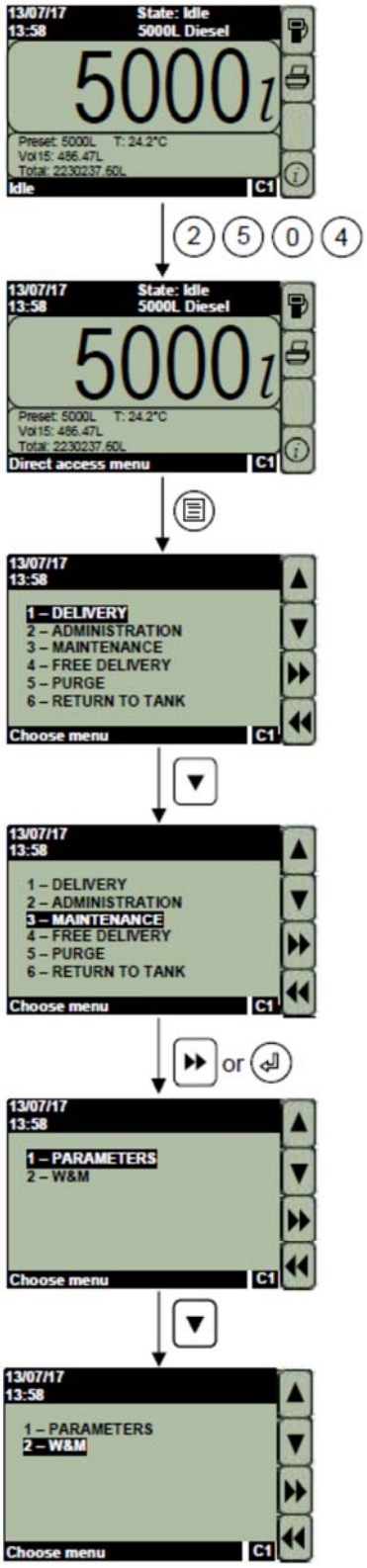
Pin B = SATAM ref. 359809
Spanner C = SATAM ref. 359810

CAUTION : Do not omit to remove Pin "B" after adjustment.



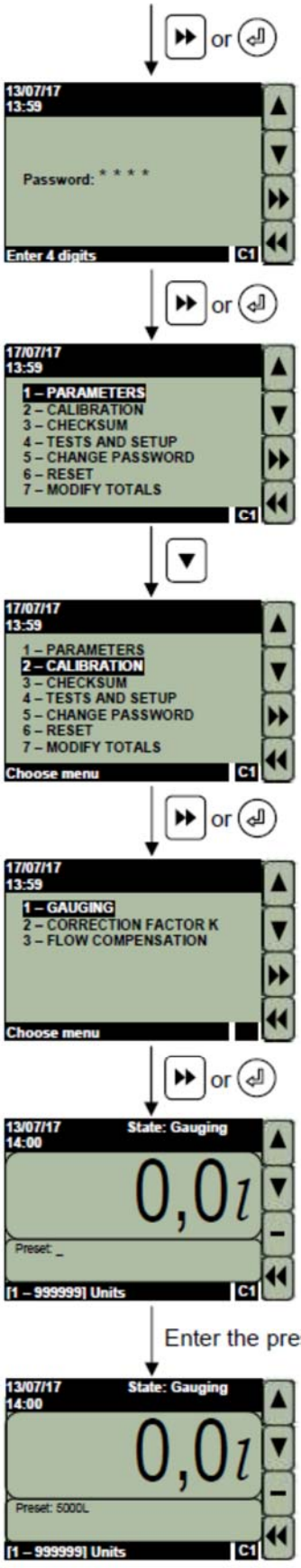
B. Adjustment Procedure with EQUALIS S

The access to gauging menu is done by the steps below:



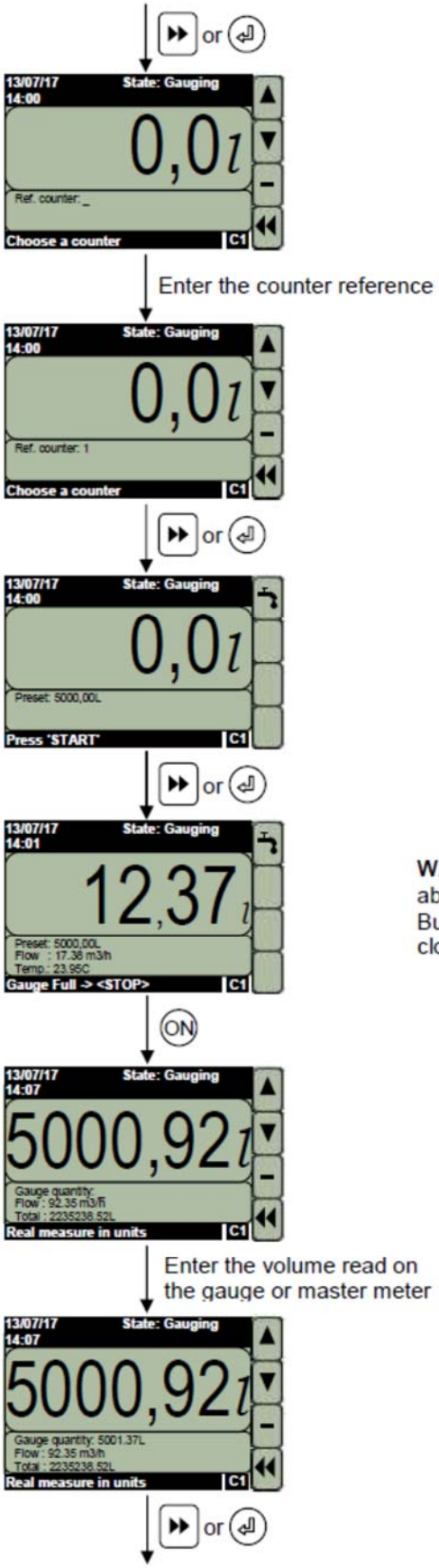
The gauging can be done without unsealing the calculator until the end of the procedure. Only the recording of the new K factor oblige you to unseal.

Menus 4-5-6 are shown only for truck applications. For depot, only menus 1-2-3 are displayed.

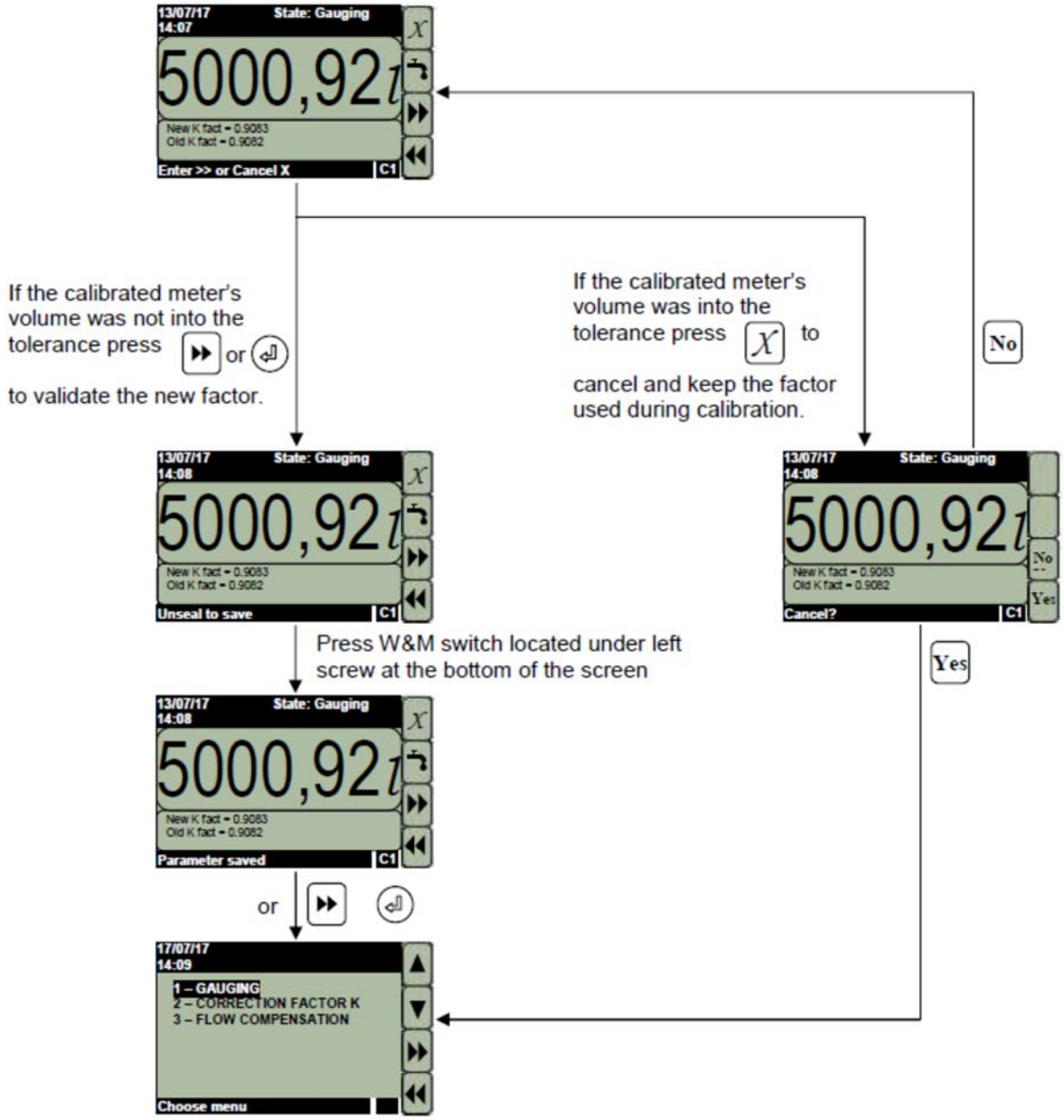


Enter the password to access to W&M menu: **8888**

The menu « K Factor correction » enables you to control and modify the correction parameter



WARNING: If a gauge is used for the calibration, take care about the volume inside during the full calibration.
Button STOP can be used during the delivery if the gauge is closed to overfill.


13/07/17
14:07
State: Gauging
5000,92l
New K fact = 0.9083
Old K fact = 0.9082
Enter >> or Cancel X
C1
If the calibrated meter's volume was not into the tolerance press or to validate the new factor.
If the calibrated meter's volume was into the tolerance press X to cancel and keep the factor used during calibration.
No
13/07/17
14:08
State: Gauging
5000,92l
New K fact = 0.9083
Old K fact = 0.9082
Unseal to save
C1
13/07/17
14:08
State: Gauging
5000,92l
New K fact = 0.9083
Old K fact = 0.9082
Cancel?
C1
No
Yes
Press W&M switch located under left screw at the bottom of the screen
Yes
13/07/17
14:08
State: Gauging
5000,92l
New K fact = 0.9083
Old K fact = 0.9082
Parameter saved
C1
or
17/07/17
14:09
1 – GAUGING
2 – CORRECTION FACTOR K
3 – FLOW COMPENSATION
Choose menu

8. Technical data of ZCM17 mastermeter

A. Technical data: ZCM17 with mechanical register

<table>
<tr><td colspan="2">Performance characteristics</td></tr>
<tr><td>Measured liquids</td><td>Liquid hydrocarbons, industrial oil, fatty acid esters, ethanol</td></tr>
<tr><td>Static pressure max</td><td>15 bar</td></tr>
<tr><td>Inlet pressure max</td><td>10 bar</td></tr>
<tr><td>Liquid temperature min / max</td><td>- 10°C / +90°C 14°F / +194°F</td></tr>
<tr><td>Working flow rate min / max</td><td>
<table>
<tr><th>Model</th><th>m3/h</th><th>L/mn</th><th>USGPM</th></tr>
<tr><td>ZCM17-24</td><td>2;4 / 24</td><td>40 / 400</td><td>10.5 / 105</td></tr>
<tr><td>ZCM17-48</td><td>4.8 / 48</td><td>80 / 800</td><td>21 / 210</td></tr>
<tr><td>ZCM17 - 80</td><td>8 / 80</td><td>133 / 1333</td><td>36 / 360</td></tr>
<tr><td>ZCM17-150</td><td>15 / 150</td><td>250 / 2500</td><td>66 / 660</td></tr>
<tr><td>ZCM17-250</td><td>25 / 250</td><td>416 / 4166</td><td>110 / 1100</td></tr>
<tr><td>ZCM17-330</td><td>33 / 330</td><td>550 / 5500</td><td>145 / 1453</td></tr>
</table>
</td></tr>
<tr><td>Liquid viscosity max</td><td>20 mm²/s (MID) - 800 mm²/s - at operating conditions</td></tr>
<tr><td>Accuracy / Reapeatability</td><td>< 0.1% of measured value / < 0.02% of measured value</td></tr>
<tr><td>Calibration report</td><td>According to OIML R117-1 / One calibration report per operating viscosity
Calibration at 7 flowrates with 2 repetitions per flow rate</td></tr>
<tr><td colspan="2">Flowmeter manifold</td></tr>
<tr><td>Connection nominal size</td><td>
<table>
<tr><th>Model</th><th>Nominal size</th></tr>
<tr><td>ZCM17-24</td><td>DN50 / 2”</td></tr>
<tr><td>ZCM17-48</td><td>DN50 / 2”</td></tr>
<tr><td>ZCM17 - 80</td><td>DN80 / 3”</td></tr>
<tr><td>ZCM17-150</td><td>DN100 / 4”</td></tr>
<tr><td>ZCM17-250</td><td>DN150 / 6”</td></tr>
<tr><td>ZCM17-330</td><td>DN200 / 8”</td></tr>
</table>
</td></tr>
<tr><td>End connection style</td><td>Flanges ASA 150 RF</td></tr>
<tr><td>Coating</td><td>Acrylic-Epoxy coating RAL5010, Marine Epoxy coating RAL5010 (option)</td></tr>
<tr><td colspan="2">Flowmeter body</td></tr>
<tr><td>Body material</td><td>Ductile iron (EN 5.3201) , Ni resist iron (EN-JL3011) (option)</td></tr>
<tr><td>Cap/end cover material</td><td>Carbon steel (EN 1.0625) with protective coating</td></tr>
<tr><td>Seal/O-ring material</td><td>Viton, Nitrile (option for alcohols measurement)</td></tr>
<tr><td>External coating</td><td>Acrylic-Epoxy coating RAL5010, Marine Epoxy coating RAL5010 (option)</td></tr>
<tr><td colspan="2">Measuring chamber</td></tr>
<tr><td>Displacement element type</td><td>Sliding vanes flowmeter</td></tr>
<tr><td>Cyclic volume</td><td>
<table>
<tr><th>Model</th><th>L</th><th>USG</th></tr>
<tr><td>ZCM17-24</td><td>0.4</td><td>0.1</td></tr>
<tr><td>ZCM17-48</td><td>0.8</td><td>0.21</td></tr>
<tr><td>ZCM17 - 80</td><td>2.27</td><td>0.6</td></tr>
<tr><td>ZCM17-150</td><td>4.54</td><td>1.12</td></tr>
<tr><td>ZCM17-250</td><td>6.82</td><td>1.8</td></tr>
<tr><td>ZCM17-330</td><td>9.09</td><td>2.4</td></tr>
</table>
</td></tr>
<tr><td>Blades / Blades connection rods</td><td>Graphite / Stainless steel</td></tr>
<tr><td>Rotor / Bearings</td><td>Aluminum (EN AC-42100) / Stainless steel (EN 1.4301)</td></tr>
<tr><td>Swing joint</td><td>Viton, Nitrile (option for alcohols), PTFE (option for low ambient temperature)</td></tr>
<tr><td colspan="2">Drive train and adjuster</td></tr>
<tr><td>Drive type / Accuracy adjuster type</td><td>Mechanical transmission / AB21</td></tr>
<tr><td colspan="2">Register</td></tr>
<tr><td>Register type</td><td>Mechanical register</td></tr>
<tr><td>Model / Accessories</td><td>VR7887, 5 digits / Preset with valve, printer, pulses transmitter</td></tr>
<tr><td colspan="2">Flowrate indicator</td></tr>
<tr><td>Display</td><td>Indication in L/mn, option: m3/h, USGPM</td></tr>
</table>

Trolley version (option)			
Trolley	Calibration device mounted on chassis with 4 pivoting wheels		
Connecting pipes between meter and hoses	2, Steel		
Flexible hoses / Connections	3mL / Loose type flanges ASA 150lbs, TODO type couplings, CAMLOCK type couplings		
	Model	Nominal size	
	ZCM17-24	DN50 / 2"	
	ZCM17-48	DN50 / 2"	
	ZCM17 - 80	DN80 / 3"	
	ZCM17-150	DN100 / 4"	
	ZCM17-250	DN150 / 6"	
	ZCM17-330	DN200 / 8"	
Isolating valve	Ball valve located downstream the meter (option)		
Drainage equipment	Manual drainage pump with purge valve, hoses and 2 release valves		
Accessories			
Temperature measurement	Local display (option)		
Pressure measurement	Local display		
Environmental			
Ambient working temperature min / max	-25°C, -40°C (option) / +55°C	-13°F, -40°F (option) / +131°F	
Storage temperature min / max	-40°C / +80°C	-40°F / +176°F	
Certification			
ATEX	Zone 1 II 2 G		

B. Technical data: ZCM with electronic register

Performance characteristics				
Measured liquids	Liquid hydrocarbons, industrial oil, fatty acid esters, ethanol			
Static pressure max	15 bar			
Inlet pressure max	10 bar			
Liquid temperature min / max	- 10°C / +90°C	14°F / +194°F		
Working flow rate min / max	Model	m3/h	L/mn	USGPM
	ZCM17-24	2;4 / 24	40 / 400	10.5 / 105
	ZCM17-48	4.8 / 48	80 / 800	21 / 210
	ZCM17 - 80	8 / 80	133 / 1333	36 / 360
	ZCM17-150	15 / 150	250 / 2500	66 / 660
	ZCM17-250	25 / 250	416 / 4166	110 / 1100
	ZCM17-330	33 / 330	550 / 5500	145 / 1453
Liquid viscosity max	20 mm²/s (MID) - 800 mm²/s - at operating conditions			
Accuracy / Repeatability	< 0.1% of measured value / < 0.02% of measured value			
Calibration report	According to OIML R117-1 / One calibration report per operating viscosity Calibration at 7 flowrates with 2 repetitions per flow rate			
Flowmeter manifold				
Connection nominal size	Model	Nominal size		
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	ZCM17-48	DN50 / 2"		
	ZCM17 - 80	DN80 / 3"		
	ZCM17-150	DN100 / 4"		
	ZCM17-250	DN150 / 6"		
	ZCM17-330	DN200 / 8"		
End connection style	Flanges ASA 150 RF			
Coating	Acrylic-Epoxy coating RAL5010, Marine Epoxy coating RAL5010 (option)			
Flowmeter body				
Body material	Ductile iron (EN 5.3201) , Ni resist iron (EN-JL3011) (option)			
Cap/end cover material	Carbon steel (EN 1.0625) with protective coating			
Seal/O-ring material	Viton, Nitrile (option for alcohols measurement)			
External coating	Acrylic-Epoxy coating RAL5010, Marine Epoxy coating RAL5010 (option)			

<table>
<tr><td colspan="3">Measuring chamber</td></tr>
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<tr><td>ZCM17 - 80</td><td>2.27</td><td>0.6</td></tr>
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<tr><td>ZCM17-250</td><td>6.82</td><td>1.8</td></tr>
<tr><td>ZCM17-330</td><td>9.09</td><td>2.4</td></tr>
</table></td></tr>
<tr><td>Blades / Blades connection rods</td><td colspan="2">Graphite / Stainless steel</td></tr>
<tr><td>Rotor / Bearings</td><td colspan="2">Aluminum (EN AC-42100) / Stainless steel (EN 1.4301)</td></tr>
<tr><td>Swing joint</td><td colspan="2">Viton, Nitrile (option for alcohols), PTFE (option for low ambient temperature)</td></tr>
<tr><td colspan="3">Drive train and adjuster</td></tr>
<tr><td>Drive type</td><td colspan="2">Mechanical transmission</td></tr>
<tr><td>Accuracy adjuster type</td><td colspan="2">Calibration constants – Linearization according to calibration report</td></tr>
<tr><td>Pulses transmitter</td><td colspan="2">Type AC30</td></tr>
<tr><td>Register</td><td colspan="2"></td></tr>
<tr><td colspan="3">Register type</td></tr>
<tr><td>Display</td><td colspan="2">Operating volume, base volume, volume flowrate, temperature</td></tr>
<tr><td colspan="3">Accessories</td></tr>
<tr><td>Temperature measurement</td><td colspan="2">Pt100</td></tr>
<tr><td>Pressure measurement</td><td colspan="2">Local display</td></tr>
<tr><td colspan="3">Trolley version (option)</td></tr>
<tr><td>Trolley</td><td colspan="2">Calibration device mounted on chassis with 4 pivoting wheels</td></tr>
<tr><td>Connecting pipes between meter and hoses</td><td colspan="2">2, Steel</td></tr>
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<tr><td>Model</td><td>Nominal size</td></tr>
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<tr><td>ZCM17 - 80</td><td>DN100 / 4”</td></tr>
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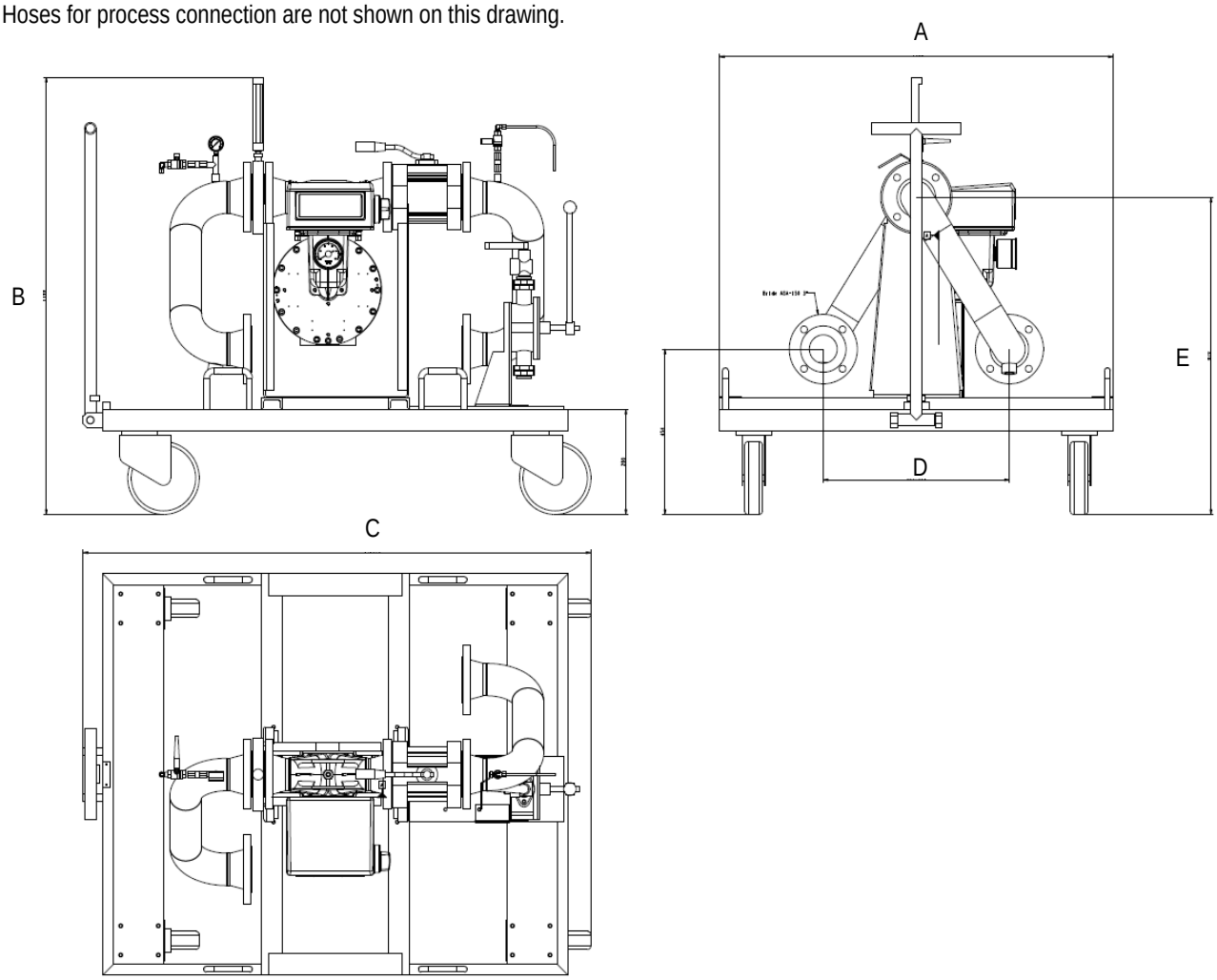
</table></td></tr>
<tr><td>Isolating valve</td><td colspan="2">Ball valve located downstream the meter (option)</td></tr>
<tr><td>Drainage equipment</td><td colspan="2">Manual drainage pump with purge valve, hoses and 2 release valves</td></tr>
<tr><td colspan="3">Environmental</td></tr>
<tr><td>Ambient working temperature min / max</td><td>-25°C, -40°C (option) / +55°C</td><td>-13°F, -40°F (option) / +131°F</td></tr>
<tr><td>Storage temperature min / max</td><td>-40°C / +80°C</td><td>-40°F / +176°F</td></tr>
<tr><td colspan="3">Certification</td></tr>
<tr><td>ATEX</td><td colspan="2">Zone 1, II 2 G – See note 1</td></tr>
</table>

9. Dimensions and weight (trolley version)

Hoses for process connection are not shown on this drawing.



Dimensions (mm)	ZCM17-24	ZCM17-48	ZCM17-80	ZCM17-150	ZCM17-250	ZCM17-330
A	600	600	1100	1100	1400	Please contact Satam for dimensions and weight
B	1100	1100	1199	1250	1200	
C	1050	1050	1419	1419	1800	
D	520	520	520	560	700	
E	870	870	870	920	980	
Weight (kg)	218	230	300	300	450	