Australian Government
Department of Industry, Science and Resources
National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

Certificate of Approval
NMI 9/2/5

Issued by the Chief Metrologist under Regulation 60
of the
National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

FMC Model Sening MultiLevel Vehicle Tank Measuring System

submitted by F.A. Sening GmbH
Regentstr. 1 25474 Ellerbek
Germany.

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval has been granted with reference to document NMI R 80-1 Road Tankers with Level Gauging, Part 1 Metrological and Technical Requirements and Part 2 Metrological and Technical requirements, dated November 2014.

This approval is subject to review at the decision of the Chief Metrologist in accordance with the conditions specified in the document NMI P 106.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern provisionally approved – interim certificate issued	13/06/14
1	Pattern amended (validity) – interim certificate issued	30/01/15
2	Pattern amended (validity, etc.) – interim certificate issued	29/07/15
3	Pattern approved – interim certificate issued	19/11/15
4	Pattern amended (Liquid level sensor and Software versions) – Variant 1 approved – certificate issued	1/05/17
5	Pattern amended (submitted by) – certificate issued	30/07/25

CONDITIONS OF APPROVAL

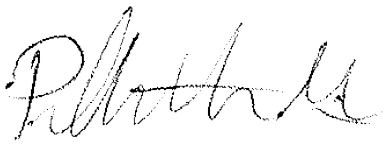
General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 9/2/5' and only by persons authorised by the submittor.

Instruments purporting to comply with this approval and currently marked 'NMI P9/2/5' may be re-marked 'NMI 9/2/5' but only by persons authorised by the submittor.

It is the submittor's responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the National Measurement Institute (NMI) and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Signed by a person authorised by the Chief Metrologist to exercise their powers under Regulation 60 of the *National Measurement Regulations 1999*.



Phillip Mitchell
A/g Manager
Policy and Regulatory Services

TECHNICAL SCHEDULE No 9/2/5

1. Description of Pattern **provisionally approved on 13/06/14**
approved 19/11/15

An FMC model Sening MultiLevel road and rail tanker with level gauging system (Figure 1) approved for measuring the quantity of the liquid hydrocarbon products other than LPG in the tank/compartments.

1.1 Field of Operation

The field of operation of the measuring system is determined by the following characteristics:

• Minimum measured quantity, V_{min}	200 L	(#1)
• Capacity of road tanker	0.5 m³ to 50 m³	
• Capacity of rail tanker	10 m³ to 120 m³	
• Inclination	±5°	
• Dynamic viscosity, η (at 20°C)	0.4 to 20 mPa.s	(#2)
• Liquid temperature range	–10 °C to +50 °C	
• Ambient temperature range	–25 °C to +55 °C	
• Voltage of road vehicle battery	15 or 30 VDC (nominal)	
• Accuracy class for system	Class 0.5	
• Applications	Road and rail tankers	

(#1) The minimum measured quantity (V_{min}) **must be specified for each compartment** using the following calculations:

a) must be given as either 1 x10^n, 2 x10^n or 5 x10^n litres where *n* is a whole number, or a multiple of 100 litres
b) equal to or greater than the volume corresponding to 200 mm difference in liquid level at the section of the tank/compartment with the smallest sensitivity (i.e. millimetres per litre).
c) not exceed one quarter (¼) of the nominal capacity of each compartment.

V_{min} calculation:

V_{min} = 200 x (“LITRES/mm” at the widest part of the tank/smallest sensitivity)

Example: 2610L tank; 2.2L/mm widest; V_{min} = 200*2.2 rounded up = 500L

(#2) The system is adjusted to be correct for the liquid for which it is to be verified as marked on the data plate

Note: The instrument may replace any other gauge approved for a vehicle-mounted tanker.

1.2 Pumping Application

If it is intended to connect the tank to separate pumping or measuring devices, it should be provided with the appropriate detachable coupling devices which shall be as short as possible.

Pumping installations shall comprise, in addition to the pump itself, no more than one filter and very short pipes. The installation shall be constructed so that it can be drained completely, each time the tank is emptied, without the need for any special measures.

For tanks equipped with a built-in manifold for measuring partial volumes delivered, the fitting of a diverting valve on each discharge pipe is permitted provided that any leakage of liquid through the diverting valve can be detected, e.g. the built-in manifold ensures complete and rapid discharge of the liquid that it contains. A sight glass or monitoring device at its bottom end shall allow the checking of its emptiness; and the installation and the control of the diverting valves is such that the product cannot flow back from one compartment to another.

For truck and trailer combinations, where the product is transferred from trailer to the pumping unit; the transfer pipes must be constructed so that the entire product is drawn through to the pumping unit leaving minimal residue and compliant with section 1.1.

1.3 The System

This automatic tank gauging system measures the level in a horizontal tank (measuring vessel), with compensation for the angle of inclination, in x and y direction in respect of horizontal.

The system is intended for volume measurement on a tanker. During normal operation, the volume is displayed on the calculator/indicator; this volume is *derived from the measured level in the compartment and pipework; all product* after the external valve (API coupling) is deemed to be the delivered quantity – this can be achieved gravity or pumped discharge.

Apart from the product volume at delivery temperature, on the basis of standard conversion methods the product volume at reference product temperature may also be viewed displayed.

1.4 Components of the Measuring System

- The system includes the following components:
- A tank which may have a number of compartments, and which is designed to comply with NMI General Certificate 9/0/B for Vehicle Tanks of Capacities 0.5 to 105 kilolitres.
- The MultiLevel is powered by the tank truck battery (16 to 32 V DC, 24 V nominal) as the power supply.
- A Sening MLDSBO-XXXX series electronic dipstick and a model MLIF dipstick interface. (XXXX defines the length of the dipstick.) (Figure 2)
- A Sening model MLDTS-2 temperature sensor. (Optional) (Figure 3)
- A Sening model MLIS inclination sensor. (Figure 4)
- A Sening model Liquid level (wet leg) sensor type NS-2E / NS-2F (Figure 5)
- An optional Epson model TM-U220 or to any other equivalent (*) printer.

(*) ‘Equivalent’ is defined to mean other proprietary equipment of the same or better specifications requiring no changes to the software specified in this approval for satisfactory operation of the complete system.

1.5 Calculator/indicator

A Sening model MultiLevel MLMAINDISP(X) calculator/indicator unit with a graphic-capable liquid crystal type display. For the purpose of meter verification the calculator/indicator has provision for displaying the delivery of liquid in litres. (Figure 6)

1.6 Software Versions

The metrologically relevant software modules are as follows:

Component/type	Software Version	CRC Checksum	
		EPROM	Flash-Memory
MLMAINDISP(X)	1.25 [-.--] (#)	0299ECFB	77028A8A
	1.26 [-.--] (#)	3804781E	3DD82AA6
MLIF	1.11	n/a	
NM2WET	1.13	n/a	

(#) [-.--] is the non-metrological relevant portion of the software

1.7 Verification Provision

Provision is made for the application of a verification mark.

1.8 Sealing Provision

Provision is made for the instrument to be sealed by an electrical dip switch located inside the main screen, once programming mode has been “turned off’ the system needs to be electronically sealed by following the procedure shown in Figure 7. Once completed the screen is to be sealed with sealing wire across two securing bolts by an accredited NMI verification officer.

1.9 Descriptive Markings and Notices

Instruments are marked with the following data, together in one location, in the form shown at right:

Pattern approval number	NMI 9/2/5
Manufacturer’s identification mark or trade mark	…..
Model number	…..
Serial number	…..
Year of manufacture	…..
Liquid temperature range	… to …°C
Maximum measured quantity, V_{max}	….. Litres
Minimum measured quantity, V_{min}	….. Litres (^)
Maximum inclination	±5°
Accuracy class	class 0.5

(^) the volume quantity for each tank defined by the quantity between the outlet valve of the tank (the transfer point) and the lowest level measured by the radar sensor

In addition, tanks shall comply with any relevant requirements given in NITP 9 *National Instrument Test Procedures for Vehicle Tanks* in regard to markings, numbering and notices.

2. Description of Variant 1 approved on 1/05/17

The pattern using the Sening MultiTask P8000007497 calculator / indicator unit with a graphic-capable pressure sensitive touch screen type display. For the purpose of meter verification, the calculator/indicator has provision for displaying the delivery of liquid in litres. (Figure 8)

2.1 Sealing Provision

Provision is made for the instrument to be sealed by an electrical dip switch located inside the main screen and the system must be electronically sealed following the procedure shown in Figure 9. An event counter records every time the electronic seal is opened. By noting the value of the event counter at the time of verification it is possible to verify if the seal has been opened since the previous verification.

Verification of the measuring system can only be performed on a calibrated vehicle tank. Prior to verification, the calibration of the tank, leak tests and pressure tests shall have been performed and documented.

The tank can be calibrated and tested using the procedures given in the NMI documents NITP 9 *National Instrument Test Procedures for Vehicle Tanks* and General Certificate 9/0/B *Vehicle Tanks of Capacities 0.5 to 105 kilolitres* in terms of:

The measuring system shall not be adjusted to anything other than as close as practical to zero error, even when these values are within the maximum permissible errors.

Maximum permissible errors:

The maximum permissible errors (MPE), for the transferred volumes are:

1. For transferred volumes (V) equal to or greater than the minimum measured quantity (V_{min}) and up to twice the minimum measured quantity, the minimum specified volume deviation (E_{min})
   The minimum specified volume deviation is twice the absolute value of the maximum permissible error for the minimum measured quantity of the compartment

   i.e: $E_{min} = V_{min} \times 2 \times (0.5 / 100)$
2. For transferred volumes greater than twice the minimum measured quantity, ±0.5%

Note: For calculating errors, the transferred volumes are determined using the static volume measurements indicated by the instrument before and after a delivery, which is compared with the transferred reference volume measured using suitable traceable reference standard(s) of measurement.

Accuracy test:

The test shall be carried out with the tank in normal position with an inclination of no greater than ± 0.2°)

The measuring system shall be verified at an appropriate number of volume levels across the full measuring range of the level sensor, that ensure for any combination of liquid levels in the compartment, the deliveries to or from the compartment greater than the minimum measured quantity are within the MPE for that delivery.

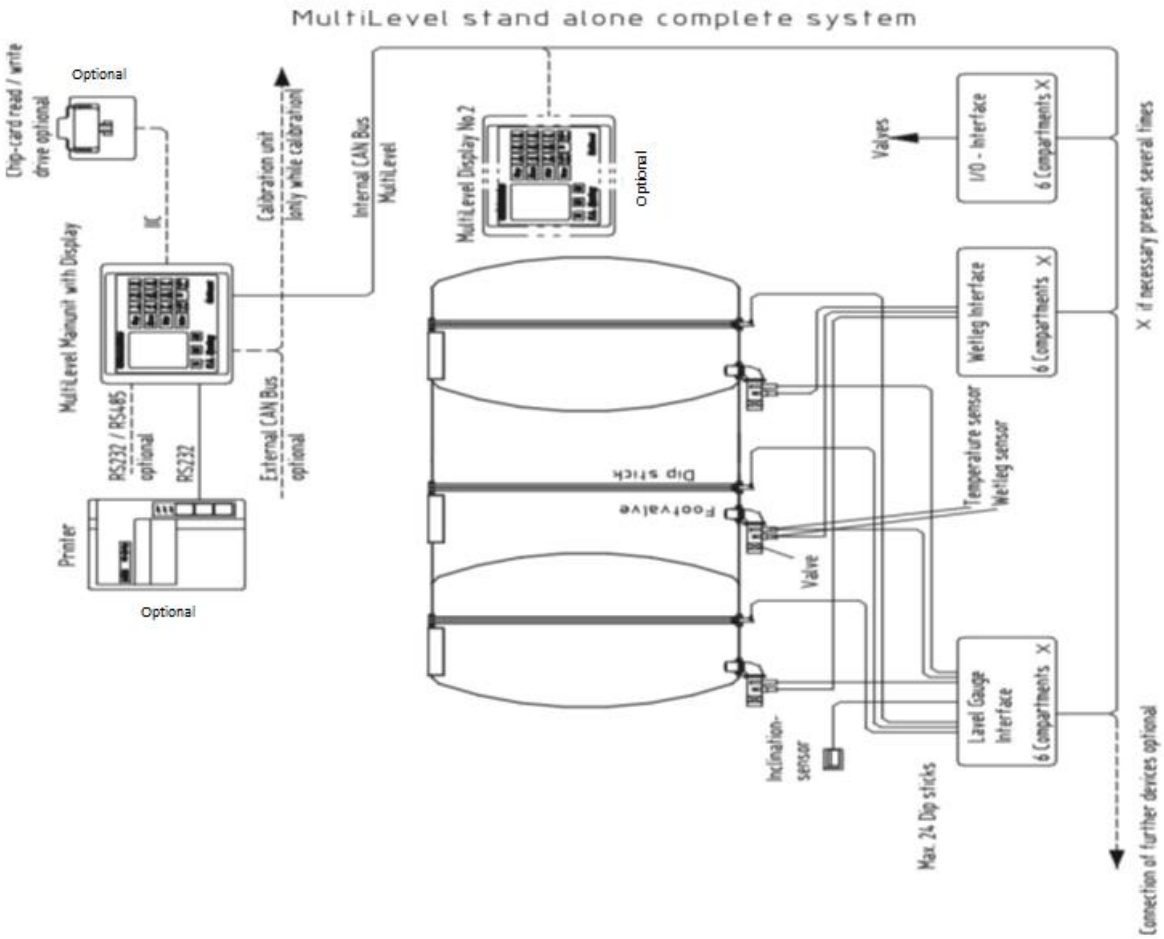
The verification may be carried out by either delivering a traceable volume into the tank compartment, or alternatively by dispensing the liquid from the tank compartment via traceable volume measuring equipment.

The accuracy of reference volume needs to be equal to or better than 3 times than the MPE for the delivery volume being tested.

Selected volume levels shall include multiple levels across the most sensitive part of the tank/compartment.

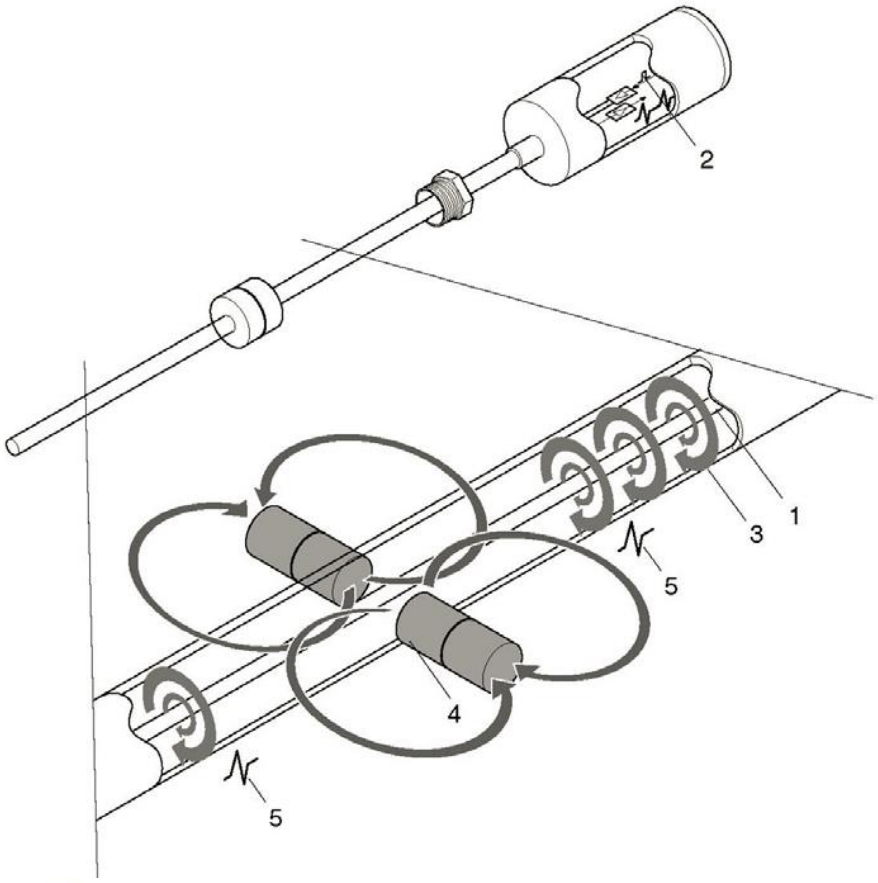
The errors of all transferred volumes between any combination of measured levels that correspond to a volume greater than or equal to the minimum measured quantity shall be calculated. The error of each calculated transfer volume shall be within the maximum permissible errors given above.

FIGURE 9/2/5 – 1



FMC model Sening MultiLevel road and rail tanker with level gauging system

FIGURE 9/2/5 – 2



Float that belongs to the electronic dip stick

Float mass:	11 g ±0.5 g
Outer diameter:	55.5 mm ±0.3 mm
Inner diameter:	14.5 mm +0.3 mm / - 0.2 mm
Diameter within the 4 distance spacers:	12.5 mm ±0.2 mm

Outer edges of the float are rounded,

Each float is provided with a serial number (here with “xxxxxx“ denoted)

Sening MLDSBO-XXXX series electronic dipstick

FIGURE 9/2/5 – 3

Sening model MLDTS-2 temperature sensor

FIGURE 9/2/5 – 4

Sening model MLIS inclination sensor.

FIGURE 9/2/5 – 5

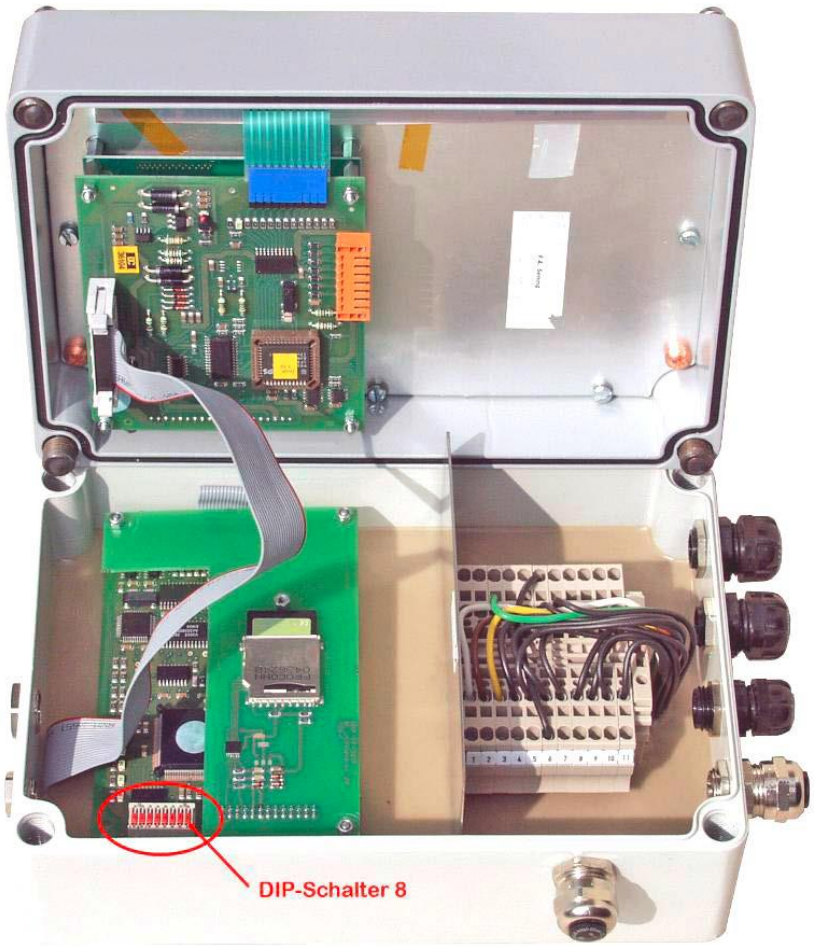
Sening model Liquid level (wet-leg) sensor type NS-2E / NS-2F

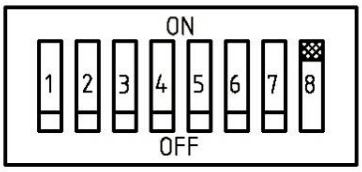
FIGURE 9/2/5 – 6

Sening model MultiLevel MLMAINDISP(X) calculator/indicator

FIGURE 9/2/5 – 7

Breaking the seal – MultiLevel calculator/indicator (Pattern)





Dip switch 8 in the MultiLevel Main Unit ”MLMAINDISP“ is to be switched to “ON“ to break the electronic seal. For the software, no additional actions are required.

- Open the MultiLevel Main Unit
- Set dip switch 8 in MultiLevel to “ON“ to break the seal.
- Note the message on the main display home screen to read “Seal Broken”

FIGURE 9/2/5 – 7 (continued)

Restoring the seal – MultiLevel calculator/indicator (Pattern)

- Open the MultiLevel Main Unit
- Set dip switch 8 in MultiLevel to “OFF“ to restore the seal.

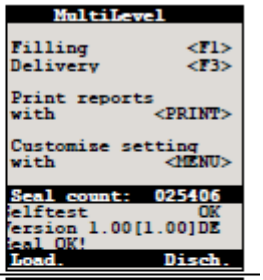
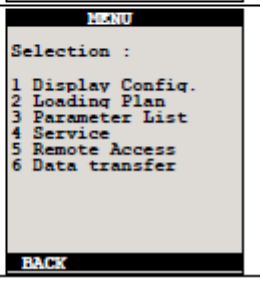
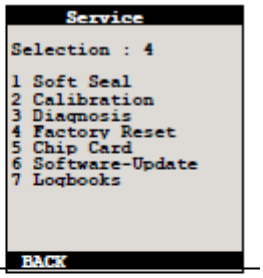
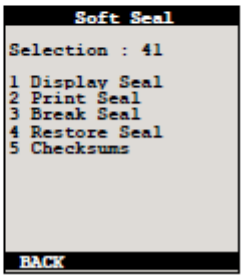
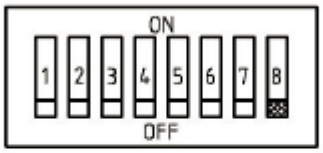
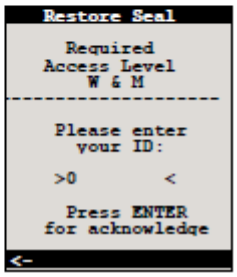
Main screen	key **<Menu>**		
Menu	key **<4>** “Service“		
Service	key **<1>** “Seal“		
Seal	key **<4>** “Set seal“		

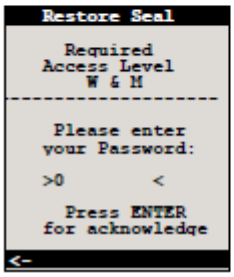
FIGURE 9/2/5 – 7 (continued)

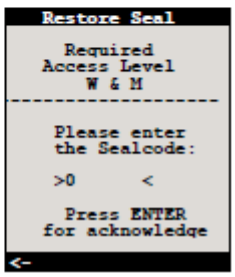
Set seal switch in MLMAINDISP to OFF if this has not been already done!



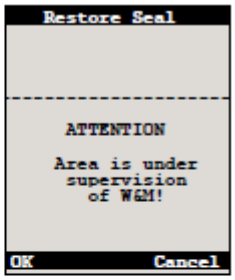
ID; enter password and seal number (are deposited as parameters in the system)

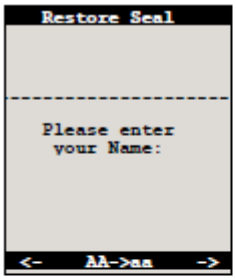




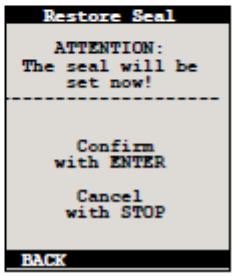


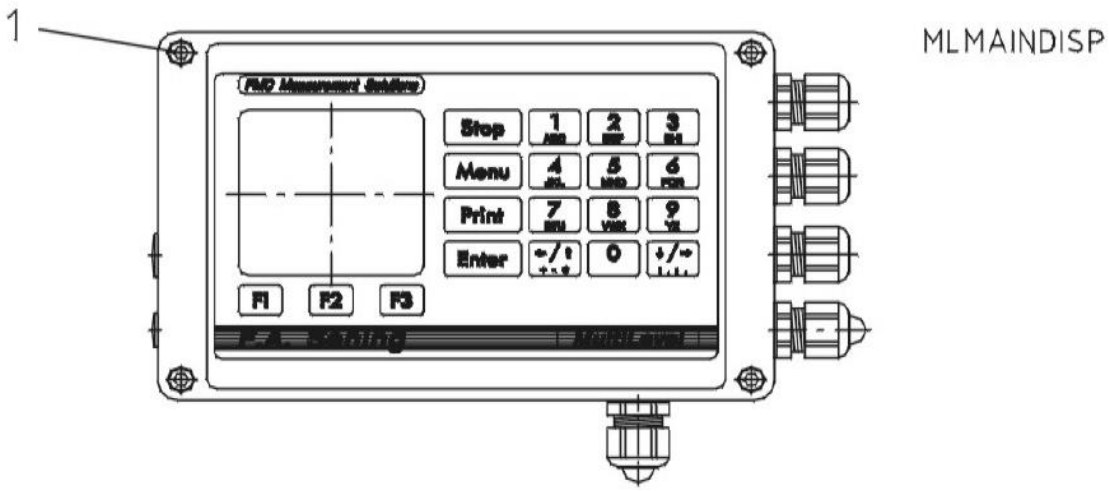
Message and input of names





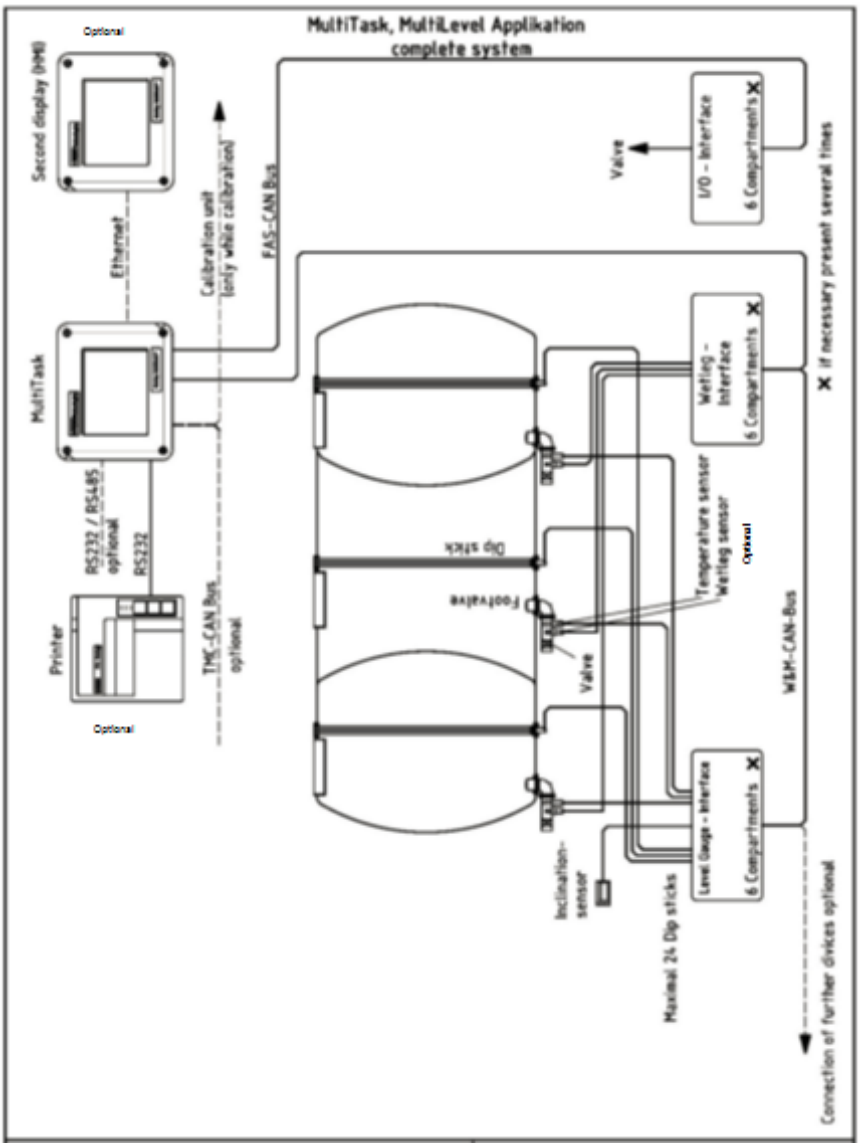
ENTER, to confirm that the seal shall be set





Complete the sealing process by closing up the main display taking care that the 4 cap screws on the front of the display are secured, and seal the two left hand cap screws by threading the sealing wire through the holes provided.

FIGURE 9/2/5 – 8



(a) FMC model Sening MultiTask road and rail tanker with level gauging system – Variant 1

(b) Sening model MultiTask calculator/indicator – Variant 1

FIGURE 9/2/5 – 9

Breaking the seal – MultiTask calculator/indicator (Variant 1)

Open the MultiTask man unit.The metrologically related DIP switches are located in the display part.	
Set the DIP switch 4 of the display unit in position OFF to break the electronic W&M seal.	
Check the status of the electronic W&M seal on the display. Setup:"/Settings/Electronic Seal/Status" „Seal Set" = „No" In order to set the electronic seal via the display of the MultiTask, it must have been set once at "OFF".	

FIGURE 9/2/5 – 9 (continued)

Restoring the seal – MultiTask calculator/indicator (Variant 1)

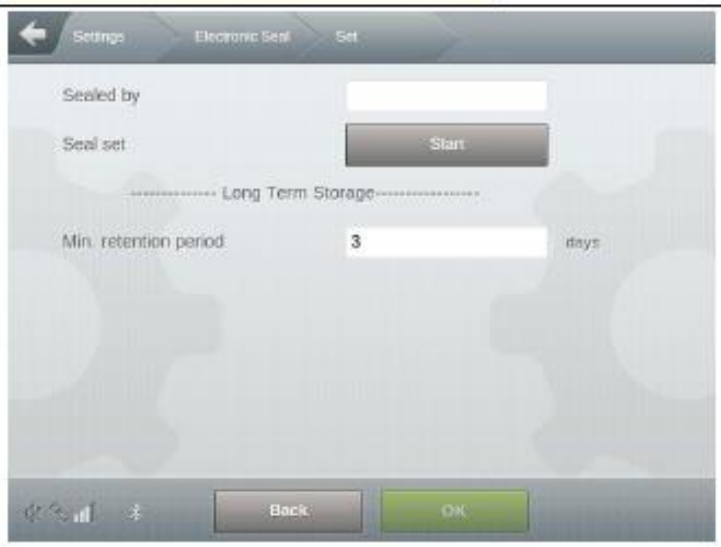
Set the DIP switch 4 of the display unit to ON to enable the set of the electronic W&M seal.	
Select menu „Electronic Seal/Set“ Setup:“/Settings/Electronic Seal/Set“	
Enter the name at „Sealed by“	

FIGURE 9/2/5 – 9 (continued)

Set the electronic seal by pressing the „Start“ button	
Check the status of the electronic W&M seal. The electronic seal is now set. Setup:“/Settings/Electronic Seal/Status“ „Seal Set“ = „Yes“	

FIGURE 9/2/5 – 9 (continued)

Display / Print of the seal number – MultiTask calculator/indicator (Variant 1)

Settings and information to the electronic W&M seal can be found at the setup at "/Settings/Electronic Seal"	
The status of the electronic W&M seal, the seal number und additional information may be checked at the display Setup:"/Settings/Electronic Seal/Status"	

~ End of Document ~