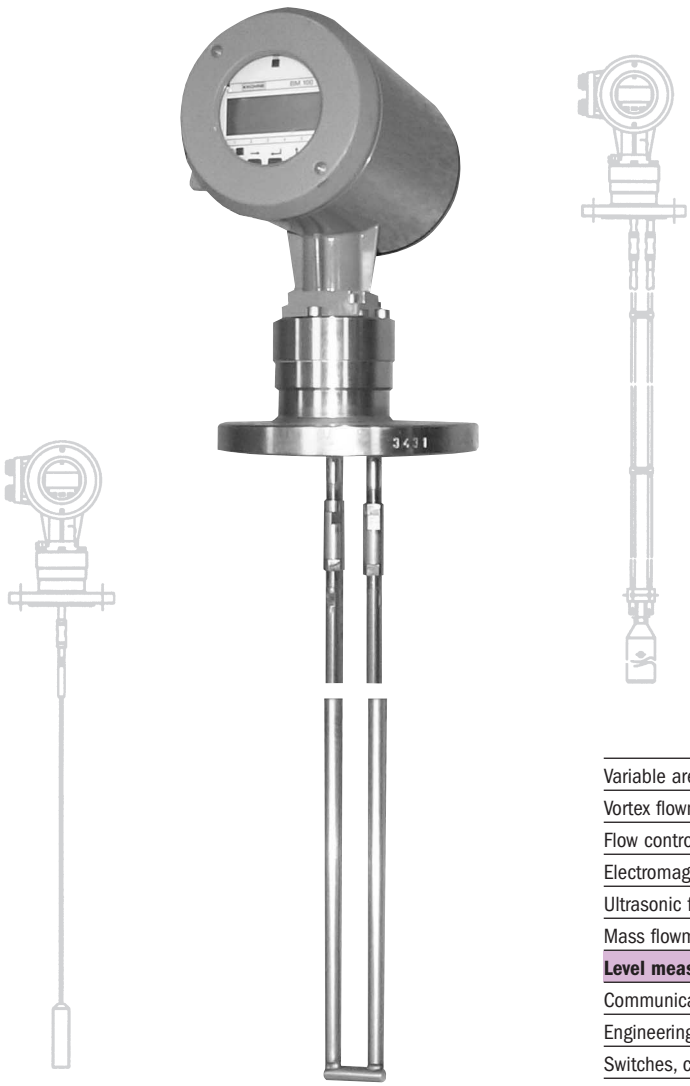
KROHNE

 7.02261.22.00

GR

Handbook

BM 100 A
Reflex-Radar

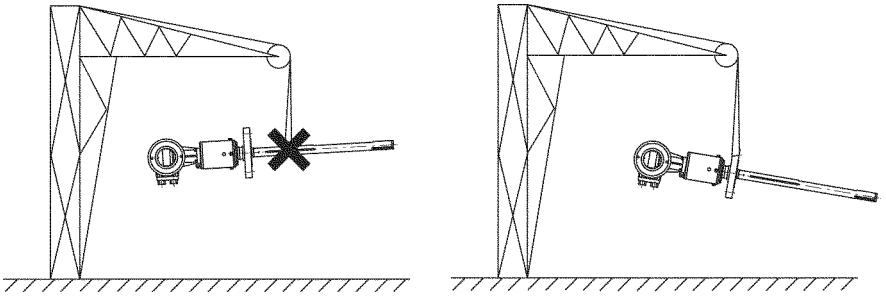


- Variable area flowmeters
- Vortex flowmeters
- Flow controllers
- Electromagnetic flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- **Level measuring instruments**
- Communications engineering
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature

Table of contents

General advice on safety

The device will normally weigh between approx. 11 kg / 25 lb and 35kg / 77 lb. Carry the device using two people, lifting it by the flange holes and supporting the probe. Lifting gear may also be used but no attempt should be made to lift the device by the probe.



Range of application

The BM 100 A TDR Level gauge measures the level and volume of liquids and liquid gases. It can also measure the level and volume of pastes, powders, slurries and granular products.

The BM 100 A also permits continuous and simultaneous measurement of liquid level and interface of two liquids.

For the storage of volatile products, such as water and carbon disulphide tanks, the BM 100 A can also be equipped with a probe (type G) to measure the interface with a top mounted probe: this avoids the resultant safety issues of installing a gauge under the tank.

Items supplied

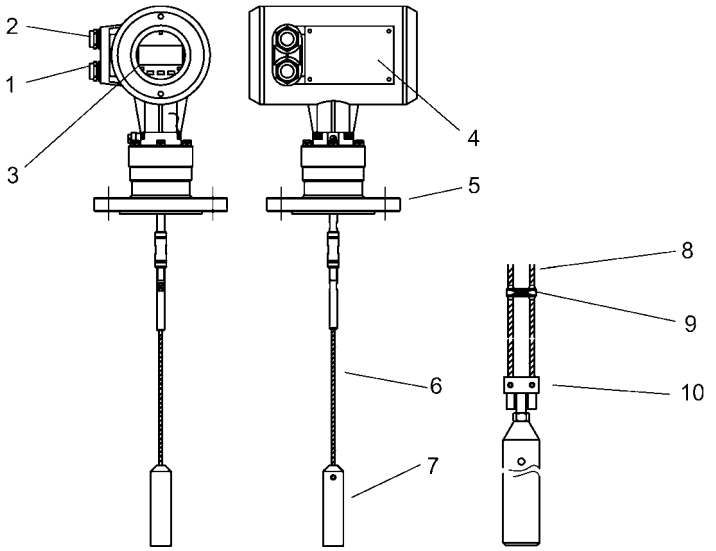
- signal converter connected to a cable, coaxial or rod signal guidance probe, as per order. Optional: remote extension with wall support, sunshade (with fastening material in each case)
- bar magnet for operator control / parameter assignment (only for version with local display)
- wrench for the covers

Documentation supplied

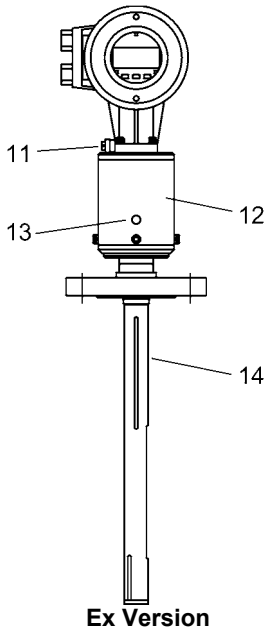
The following documentation will be included with the instrument:

- installation and operating instructions (this manual), and handbook.
- approval documents, unless reproduced in the installation and operating instructions.

Principal gauge components



Non-Ex version



Ex Version

1 Cable entry (output)

2 Cable entry (power supply)

3 Local user interface (display screen, buttons and magnetically-actuated hall sensors)

4 Nameplate (see diagram on the following page)

5 Flange

6 Single cable probe

7 Counterweight

8 Twin cable probe

9 Spacer

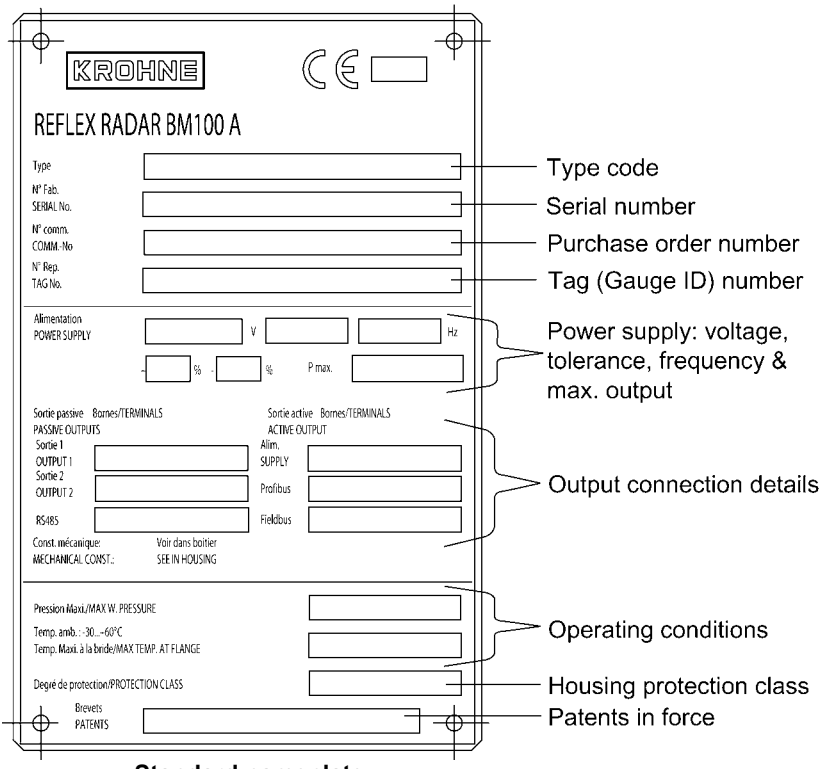
10 Short-circuit

11 Equipotential bonding system connection (Ex)

12 Isolating chamber – separates electronics housing from hazardous products

13 Pressure release plug (1 bar or 14.5 psi limit) and vent

14 Coaxial probe



Standard nameplate

Product liability and warranty

The BM 100 A TDR level gauge is designed solely for measuring the distance, level, interface and volume of liquids, pastes, slurries, solids and particulate materials.
The BM 100 A TDR level gauge does not form part of an overfill protection system as defined in WHG nor is it concerned by the Pressure Equipment Directive (PED) 97/23/EC.
Special codes and regulations apply to its use in hazardous areas.
Responsibility as to suitability and intended use of these level gauges rests solely with the user.
Improper installation and operation of our level gauges may lead to loss of warranty.
In addition, the "General conditions of sale", found on the back of the invoice and forming the basis of the purchasing contract, are applicable.
If you need to return the level gauge to the manufacturer or supplier, please refer to the information given in appendix A.

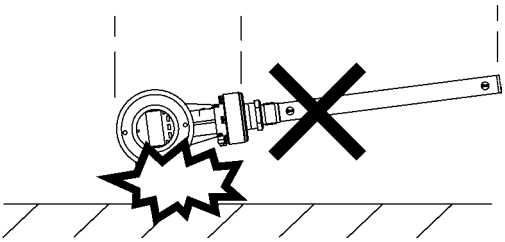
1 Mechanical installation

1.1 Handling and storage

Caution :
The probe is a critical gauge component.
Do not damage– Handle with care!!!

1.1.1 Avoiding blows

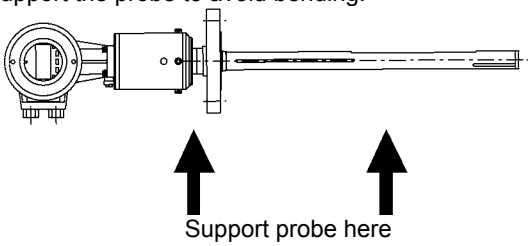
Avoid hard blows, impacts and jolts when handling the BM100A.



Caution : fragile electronics

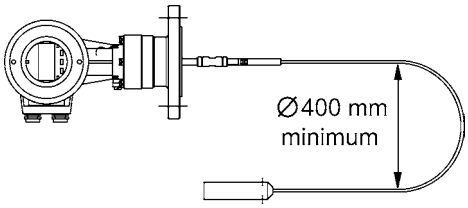
1.1.2 Avoiding bending

Rod/ Coaxial probes: support the probe to avoid bending.



1.1.3 Avoiding cable kinks or fraying

Do not coil the cable less than 400 mm / 16" in diameter. Cable kinks or fraying will cause measurement errors.



1.2 Installation restrictions

Hazardous-duty systems (Ex, FM…)

- refer to the supplementary instructions for gauges approved for use in hazardous locations before installation.
- check that the flange, gasket and probe materials are compatible with the product. Read the information given on the converter nameplate, the flange markings and specifications in the approval certificates.

1.3 Mounting on a tank

1.3.1 Installation instructions: General notes

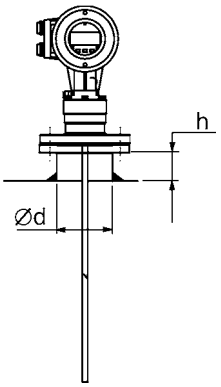
The fitter should give some thought to tank fittings and tank shape:

- nozzle position in relation to the tank walls and other objects inside the tanks
  (Warning : this free area will depend on the probe type selected: refer to later on in this section)
- type of tank roof , i.e. floating, concrete, integral, etc; and base, i.e. conical,etc.

1.3.2 Installation instructions: Nozzle

Nozzle height

Recommendation (especially for single probes and powder applications):
Do not fit a nozzle longer than its diameter.

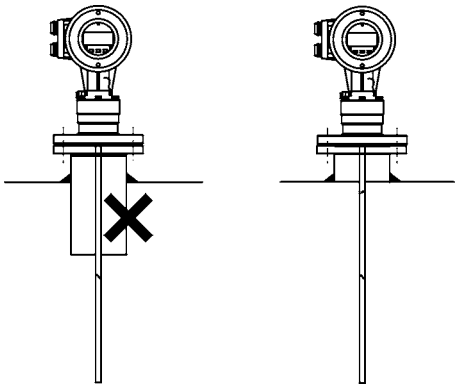


$h \leq Ød$, where h = nozzle height and d = nozzle diameter.

Contact KROHNE if this relationship cannot be respected.

Nozzles extending into tank

Caution:
Do not use nozzles that extend into the tank. This will block the emitted pulse.



Process connection

For the gauge to make accurate measurements:
- the tank process connection must be level.
- ensure a good fit with the gauge process connection
- the tank roof should not deform under the weight of the gauge

Objects (discontinuities) inside the tank that influence the probe EM (electromagnetic) field

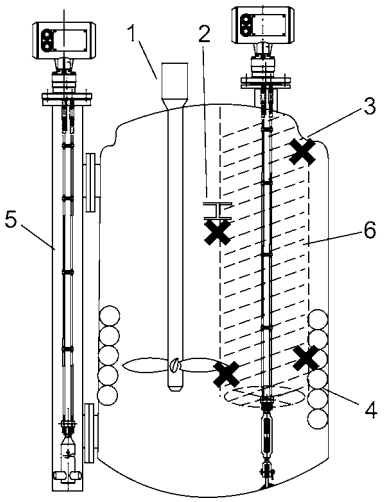
Install the process connection far from protruding objects such as:
- heating tubes
- sudden changes in tank cross-section
- tank wall reinforcements and beams,
- weld lines and dip-stick pipes, etc...

Refer to the figure at the top of the following page.

TDR gauges generate electromagnetic fields when a measurement pulse is emitted. This field is affected by any nearby discontinuities and these will weaken and potentially block the emitted pulse. A minimum distance is recommended depending on the probe type to be installed. See the table on the next page for recommended free space dimensions.
Alternatively, the fitter may use a reference chamber or stilling well. However, the chamber walls must be smooth (i.e. no visible weld lines), straight and vertical to maintain the pulse strength and gauge accuracy.

For clean applications only :

Coaxial (type D) probes may be used close to or touching objects or walls as the EM field generated by the probe is contained within the probe's outer sheath (refer also to the EM field sizes given in the figures on the next page).



1 Agitator

2 Support beam perpendicular to the pulse direction

3 Abrupt changes in tank cross section

4 Heating tubes

5 Alternative solution: reference chamber - electromagnetic field is contained within chamber.

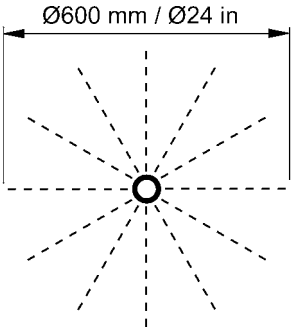
6 Gauge electromagnetic field :
Any intruding metallic object will be detected in this zone if perpendicular to the emitted pulse direction.

✕ = Do not fit the process connection near to these objects.

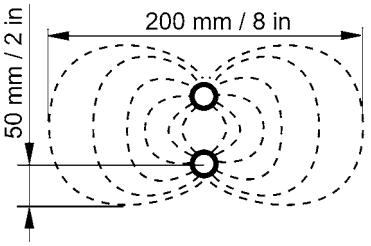
Probe Type	**Recommended minimum distance of probe from objects inside the tank in millimetres (inches)**
Single (types F, H and K)	300 (12)
Twin (types A, B, G and L)	100 (4)
Coaxial (type D)	0 (0)

Electromagnetic field shape around probe, by type (not to scale)

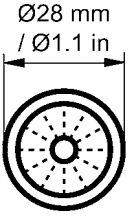
Single (types F, H and K)



Twin (types A, B, G and L)



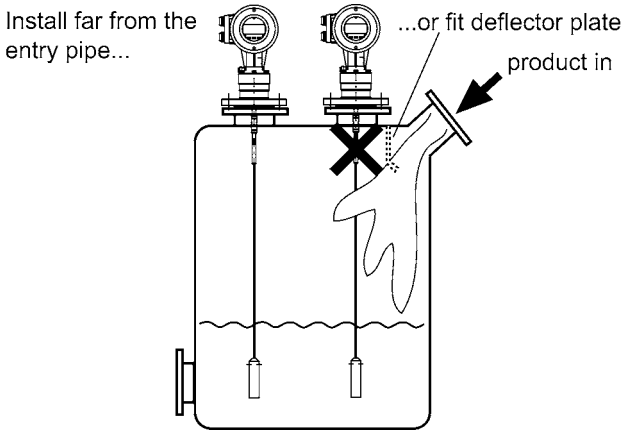
Coaxial (type D)



No beam angle for any probe type.

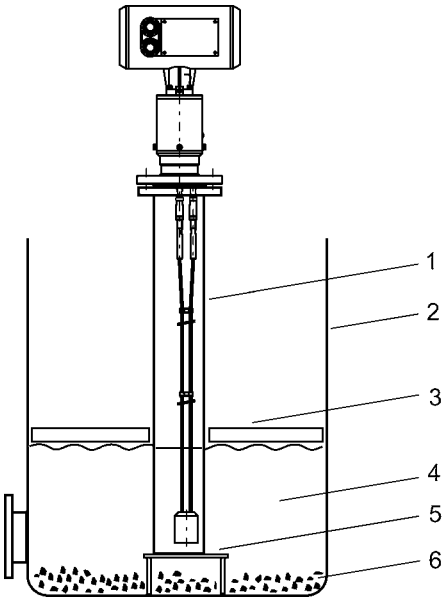
Process connection and entry pipe

Caution:
Do not put the nozzle close to the entry pipe. Pouring the product directly onto the probe will give false readings. Install deflector plate if impossible to distance gauge from entry pipe.



Stilling wells

Tanks with floating roofs for petro-chemical applications: Use a stilling well.



1 Stilling well

2 Tank

3 Floating roof

4 Product (petroleum applications)

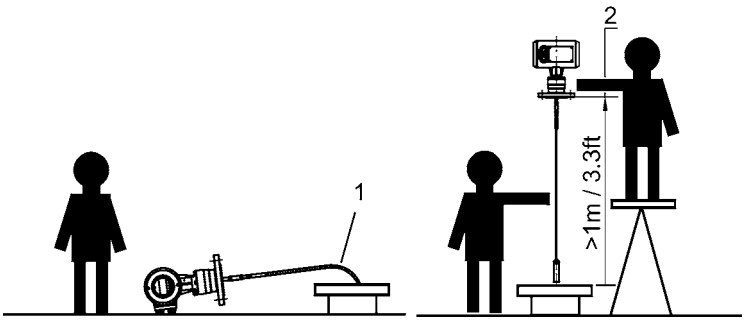
5 Well fixed to tank base (no roof deformation)

6 Sediment

1.3.3 Installation instructions: Gauge - all applications

BM100 A gauges are designed to be mounted on a suitable process connection on a tank or sump. Install the gauge using two people to avoid damaging the probe. Support the housing and the probe.

Installation of single and twin cable probe level meters

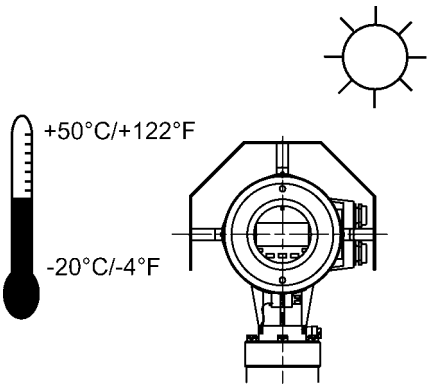


1 **Caution :**
Do not over-bend probe!

2 **Inserting the probe:**
hold more than one metre above the opening to avoid cable bending.

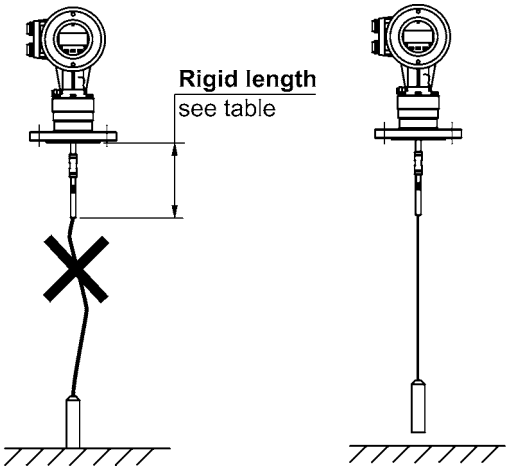
Outdoor sites

Fit a sunshade on the gauge for open-air installations: this is supplied on demand. The ambient temperature limits of the gauge are given below.



Cable probes: entanglement and straightness

The cable must be straight once inserted into the tank. The cable counterweight should not touch the bottom of the tank. The cable must be far from other objects (e.g. mixers) to avoid entanglement.



Rigid length of single and twin cable probes

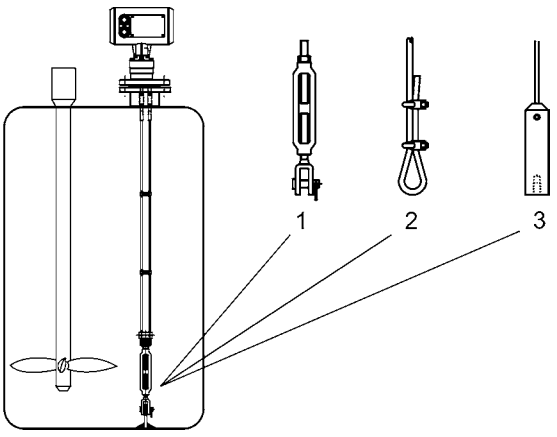
Cable diameter	Rigid length
Single cable	
Ø4mm or 0.15”	145mm or 5¾”
Ø8mm or 0.3”	200mm or 8”
Twin cable	
Ø4mm or 0.15”	145mm or 5¾”
Ø6mm or 0.24”	145mm or 5¾”

1.3.4 Specific installation instructions: gauge - liquid applications

Probe bending in agitated products: recommended solutions

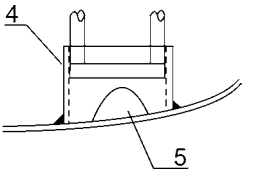
Probe (Type)	Supports and fastenings	Stilling well installation*
Twin rod (A)	Weld a 45mm / 1.8” internal diameter tube on the bottom of the vessel then insert the probe.	Possible. On-site calibration may be required to maintain accuracy. Repeatability is unaffected.
Twin cable (L)	Fit an anchor with an M10 x 1 (Ø4mm/0.16” cable) thread (i.e. spring ring or hook) to the counterweight*** CAUTION: 6 Nm / 4.4 lbf.ft maximum torque. This cable may also be ordered with a turnbuckle.	Possible. On-site calibration may be required to maintain accuracy. Repeatability is unaffected. Centring the probe is recommended. Contact KROHNE for more information.
Single rod (F)	Weld a 12mm / 0.5” internal diameter tube on the bottom of the vessel, insert the rod****.	Possible. 50 mm / 2” minimum diameter chamber. Contact KROHNE for assistance.
Single cable (H)	Fit an anchor with M10x1 (Ø4mm cable) thread underneath the counterweight : spring ring or hook. CAUTION: 4 Nm / 2.9 lbf.ft maximum torque. This cable may also be ordered with either a chuck or turnbuckle.	Possible. 50 mm / 2” diameter minimum. Contact KROHNE for assistance**.
Coaxial (D)	Weld a 30-32mm / 1.2” internal diameter tube on the bottom of the vessel, insert the tube. A probe may be fixed with braces.	Unnecessary: probe unaffected by nearby objects.

* Reference (bypass) chamber or stilling well.
** Spacers supplied by KROHNE.
*** Threaded hole provided in base of counterweight.
**** Contact KROHNE. A factory menu function may need to be changed.



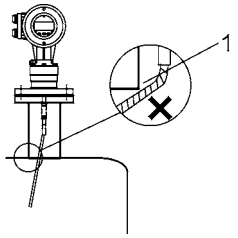
1 Turnbuckle
2 Chuck for type H Ø4mm single cable probe
3 Counterweight with threaded base
4 Avoid play between tube and probe
5 Hole in welded tube for drainage

Anchoring twin rod and coaxial probes



1.3.5 Specific installation instructions: gauge - solid applications

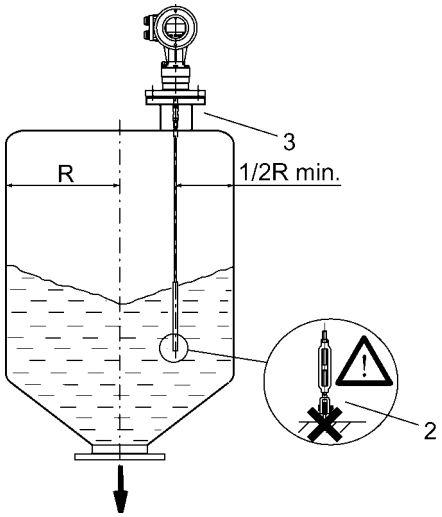
False readings:



1 Do not let probe touch the side of the nozzle

Conical silo nozzles, False readings and traction on the cable probes

Caution



2 **High traction forces :**
We recommend that the probe should not be anchored to avoid excessive traction loads on the cable.

3 **Bending and traction:**
Position the connection on the roof at ½ radius of the tank and with minimum nozzle height. This will avoid damage due to bending and traction during emptying.

Traction forces during emptying cycles for powder applications

Traction load is dependent upon the height and shape of the tank, product particle size & density, and the rate at which the tank is emptied. The table below gives the load at which cable probes will break.

Cable maximum design loads, traction

Probe	Maximum Load
Type K : Single cable Ø8 mm / Ø 0.3”	3.5 T / 7700 lb
Type B : Twin cable Ø6 mm / Ø 0.2”	3.6 T / 7900 lb (1.8 T / 3950 lb per cable)

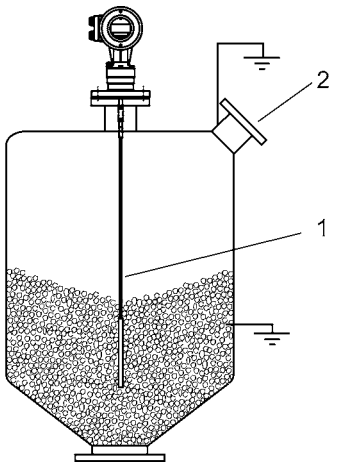
Traction on cable according to product (approximate value in metric tons)

		Probe Length / m (ft)		
Material	**Probe used**	10 (32.8)	20 (65.6)	30 (98.4)
Cement	Single cable Ø8 / Ø0.3''	1.0 T / 2200 lb	2.0 T / 4410 lb	3.0 T / 6620 lb
Flyash	Single cable Ø8 / Ø0.3''	0.5 T / 1100 lb	1.0 T / 2200 lb	1.5 T / 3300 lb
Wheat	Single cable Ø8 / Ø0.3''	0.3 T / 660 lb	0.6 T / 1320 lb	1.2 T / 2650 lb
PE granules	Twin cable Ø6 / Ø0.2''	0.2 T / 440lb	0.6 T / 1320 lb	1.0 T / 2200lb

Electro static discharge (E.S.D.)

BM100 Standard and Ex gauge electronics are normally shielded up to 16KV against E.S.D.*.
*For non-Ex powder applications, BM100A probes are protected up to 32 kV.

Note:
E.S.D. cannot be solved by BM100A E.S.D. protection. It is the customer's responsibility to avoid E.S.D. by grounding the tank, product and probe installation.



1 **Danger of injury**

The probe may become electro statically-charged during operation; earth the probe by pushing it against tank wall with a suitably isolated tool just before touching it to avoid receiving a shock.

2 Earth the entry pipe and product.

Product deposits on the nozzle and probe

Product build-up can occur under the nozzle: this may weaken the pulse. Avoid cavities that permit the build-up of deposits.

Tank roof deformation

Tank roofs should support loads of at least 3.5 tonnes / 7700lb for gauge installations using type K single cable probes and 3.6 tonnes / 7900 lb for gauge installations using type B twin cable probes without deformation.

2 Electrical Connections

2.1 Insulation rating

The gauge transmitter electrical insulation conforms to IEC 1010-1. Please note the information below concerning each rating category.

Category	Rating	Comments
Power supply	overvoltage category III	The gauge does not have an integrated switch or circuit-breakers. These elements must be installed in conformance to local regulations and EU Low Voltage Guidelines and to properly isolate the equipment when necessary. Note that this is not obligatory for instruments with 24 V power supply boards. 4 to 6.3 A time lag fuses are recommended for external installation. Fuses must be installed on every electrical conductor for the system to conform to current regulations. Note that the active phase conductor, L, is protected by an internal fuse: the neutral conductor, N, is not.
Output circuit	overvoltage category II	Fuses are unnecessary.
Insulation	contamination level 2	The contamination level refers to the protection of internal elements of the signal converter. Rated IP 67 (equivalent to NEMA 6-6P) against ingress of water and other foreign bodies. Note that the gauge can operate in contamination level 4 conditions if installed correctly.
Protection	class 1	

Galvanic isolation of terminals

The gauge conforms to the following standard and E.U. Directive:

Standard/Directive	Description
EN (IEC) 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use (low tension)
73/23/EEC	Council Directive of 19 February 1973 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (low voltage) modified by Directive 93/68/EEC (art.13).

The BM 100 A gauge outputs are galvanically isolated from the power supply and ground in accordance with the regulations given above. An external barrier is unnecessary.

2.2 Electrical installation instructions

2.2.1 Wiring general notes

Read these instructions carefully!

Wiring must comply with any existing local regulations. Use appropriate wiring methods, conduits and fittings to maintain a NEMA 6-6P / IP 67 rating.

1. Always disconnect the mains power supply before opening the housing,
2. unscrew the terminal compartment using the special wrench provided,
3. use the top cable entry port for the power supply (see “Principal gauge components”),
4. use a metal cable gland for input power leads to minimise RFI (radio frequency interference) / EMI (electromagnetic interference) effects,
5. use a reinforced cable for the outputs,
6. do not cross or loop wires in the signal converter wiring box,
7. do not kink cables close to the glands. Cover with a metallic sheath at this point if necessary,
8. make U-bends in the cable to provide water with run-off points,
9. earthing the device shall be done according to the local applicable installation standards (EN 60079.14 in Europe),
10. and make sure that the cover thread in the housing is well greased and the O-ring is in good condition before replacing the cover.

Shutting off the power supply : non-hazardous zones

Remember to disconnect the power supply before opening the housing.

Shutting off the power supply : hazardous zones

Wait before opening the housing cover. Refer to Supplementary Installation and Operating Instructions for the BM100 A/Ai KEMA 01 ATEX 1078X Gauge for the time required.

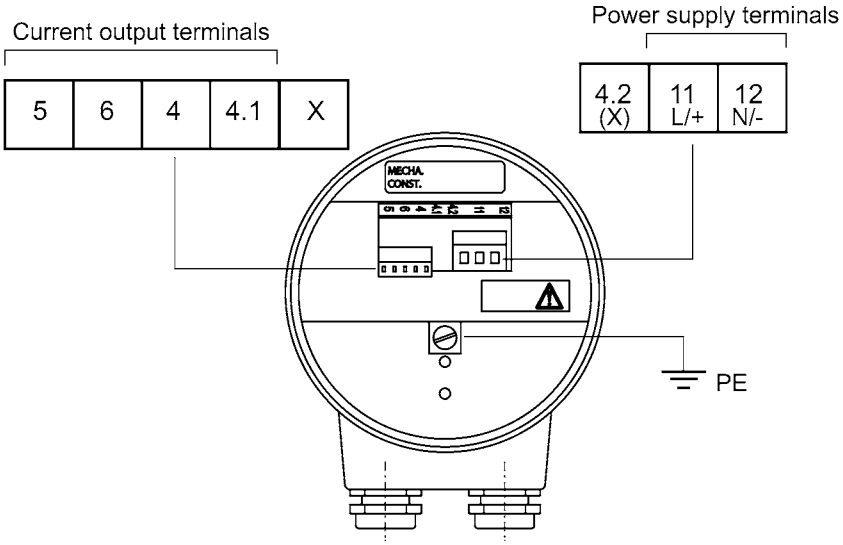
2.2.2 Wiring connections

Open the signal converter housing rear cover, using the plastic wrench supplied. The terminal connections are labelled. The standard connections are shown below.

Before starting to wire:

- check that the power supply corresponds to the power board installed.
- check which output option you have selected: this will be indicated on the underside of the rear housing cover and on the gauge nameplate.

Terminal layout : non – Ex version



X = Terminal not used (X) = Terminal not used except for RS485 outputs

Ensuring a good contact and protection of wire strands

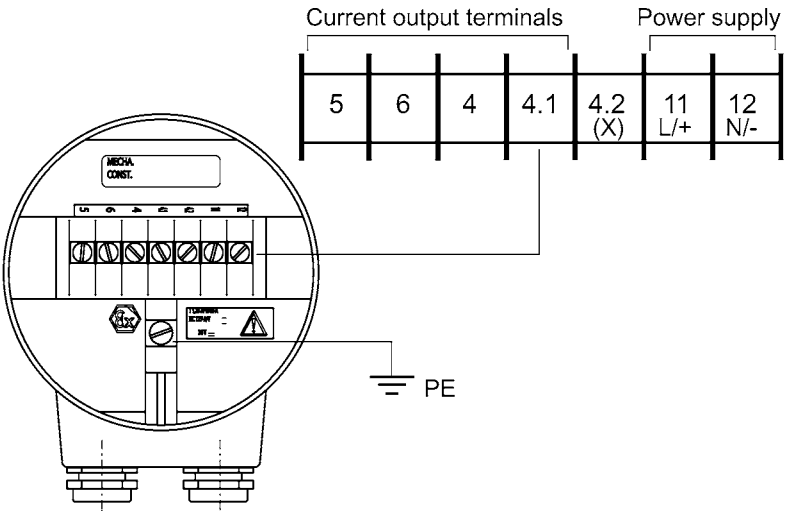
Local regulations concerning electrical wiring must be followed and obeyed. If no details are given, we recommend :

- crimped metal sheaths over the wire strands
- power supply cables should be rated for at least 500 V, with a cable diameter of 0.5 to 1.5 mm / 0.02” to 0.06” (non-Ex applications only).
- the output current cable diameter should be from 0.5 to 0.75 mm / 0.02” to 0.03”

PE Ground Terminal notes

The internal earth connection shall be used according local applicable installation standards, in Europe the Low voltage Standard prescribes the connection of the yellow/green cable in case of 230VAC.

Terminal layout : Ex version



(X) = Terminal not used except for RS485 outputs

Wiring the gauge for use in hazardous areas (Ex & FM)
Use the correct wires and spade tags for terminal connections as specified in the Supplementary Installation and Operating Instructions for the BM100 A/Ai KEMA 01 ATEX 1078X Gauge.

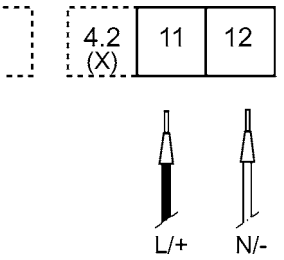
PE Ground Terminal notes
The internal earth connection shall be used according local applicable installation standards, in Europe the Low voltage Standard prescribes the connection of the yellow/green cable in case of 230VAC.

Options, power supply

The type of power supply to be used will be indicated on the gauge nameplate.

1. 100 – 240V AC -15%/+10% ; Power output : 9VA

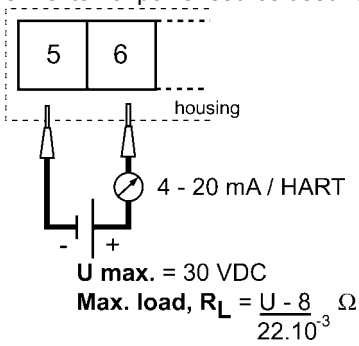
2. 24 V AC/DC -15%/+10% ; Power output : 9VA



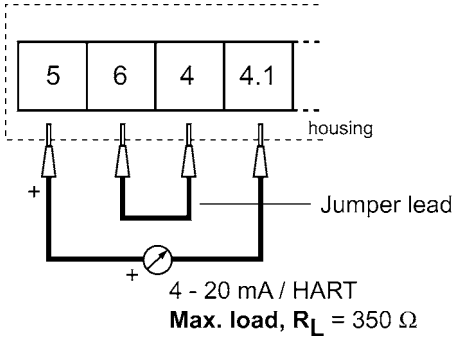
Options, output

The output wires should be wired to the gauge terminals according to the type of output selected when the order was placed. The type of output supplied will be indicated on the gauge nameplate and a sticker on the inside of the housing rear cover. The principle output options are shown below:

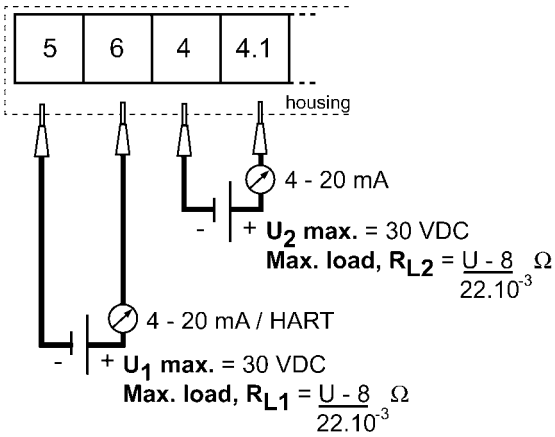
- 1 passive output: passive = external power source used for measurement output



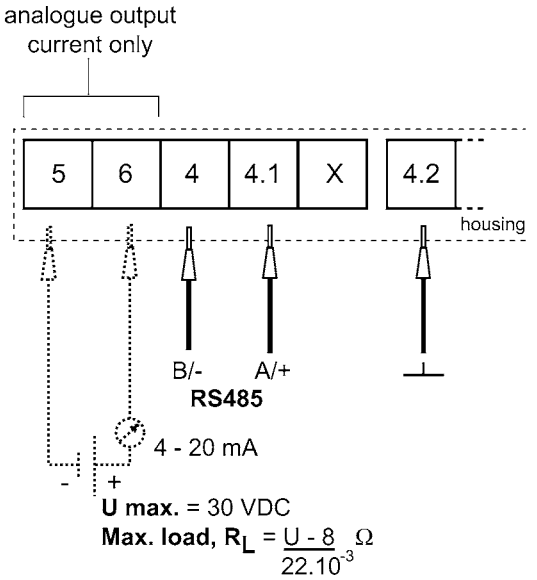
- 1 active output: active = internal power source used for measurement output



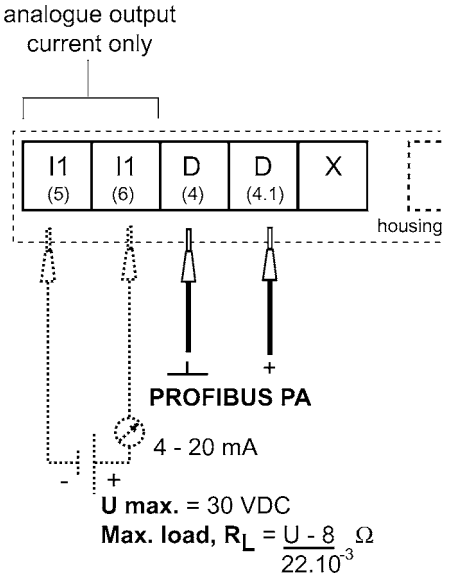
- 2 passive outputs



- 1 RS 485 output
  with / without optional passive analogue current output for direct readings**



- 1 PROFIBUS PA output *
  with / without optional passive analogue current output for direct readings**



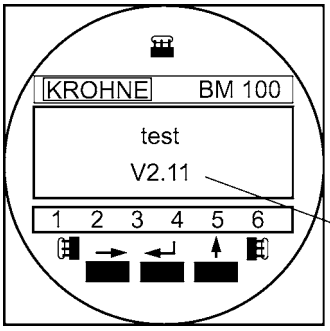
* BM 100 A device management: a GSD file providing a device communication features list is delivered with PROFIBUS PA-output devices.

** must be specified in customer order.

3 User Interface

The BM100A may be configured and operated using a user interface set into the signal converter housing or a remote link. Remote links using PC STAR, KROHNE's in-house developed software and Fieldbus remote links are given at the end of section 3.4.3.

3.1 Power On and self-test mode

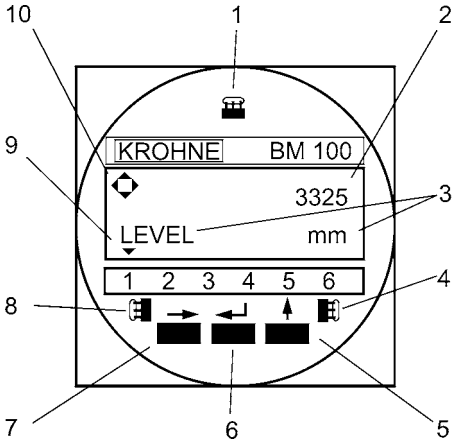


The BM100A automatically self-tests once connected to a power source. The screen readout shown on the left will be displayed. This test takes from 20 seconds to 1½ minutes to complete.
The local display will then switch over to the operation mode display shown on the following page.

Firmware release currently programmed into the EPROM (Electrically Programmable Read Only Memory)

3.2 Local user interface

The BM100A Local user interface is simple to use. It has three push-buttons, three magnetically-keyed sensors for configuring the gauge without removing the front cover in hazardous zones and a three-line LCD (Liquid Crystal Display) screen at the front of the signal converter housing.



The display screen will go blank below –20°C / -4°F but data can still be displayed if the instrument is connected to a computer with PC STAR or other remote link.

1 **ENTER Hall Sensor:**
Keyed using a bar magnet. As item 6.

2 **First Display Line:**
Operating mode- measurement value
Configuration mode- function number

3 **Second Display Line:**
Operating mode- item measured and units
Configuration mode- function definition

4 **UP Hall Sensor:**
Keyed using a bar magnet. As item 5.

5 **Press the UP push-button:**
- To increase the value of a selected digit
- For password definition : code U or ↑

6 **Press the ENTER push-button:**
- To go back a step in the menu
- To validate data entered
- For password definition : code E or ↵

7 **Press the RIGHT push-button:**
- To enter configuration mode
- To move cursor right in configuration mode
- For password definition : code R or →

8 **RIGHT Hall Sensor:**
Keyed using a bar magnet. As item 7.

9 **Status Markers:**
See the next page for details.

10 **Key register symbol:**
◇ Enter pressed
↑ Up pressed
→ Right pressed

3.3 Status Markers

This line of numbers identifies six types of errors by means of a triangular indictor over the number concerned.

Status marker number	Error / Status message	Result and action
▼1	No initial pulse detected	See section 4.3: Fault clearing.
▼2	No level reflection detected	See section 4.3: Fault clearing.
▼3	Level measurement frozen	Output and indication frozen; search initiated to redetect level : if no reflection is registered : Status marker 2 is activated.
▼4	No interface reflection found	See section 4.3: Fault clearing.
▼5	Interface measurement frozen	Output and indication frozen; search initiated to redetect interface. If no reflection is found, Status marker 4 is activated.
▼6	Output communication failure	Contact your local KROHNE Service Department.

If the parameter 1.2.6 Error Display is configured to “YES” as explained in section 3.4.5, the complete display screen will flash when an error occurs.

3.4 Parameter Settings

3.4.1 General Information

Your BM100 A has now been installed on the tank and the necessary electrical connections have been made. Once the power has been switched on, it may be necessary to configure the gauge to:

- display the readings using the correct units and reference point (level / distance),
- change the measurement range,
- give the instrument an address so that it may be integrated into a network,
- display volume readings by programming and using a volume calibration table (strap table).

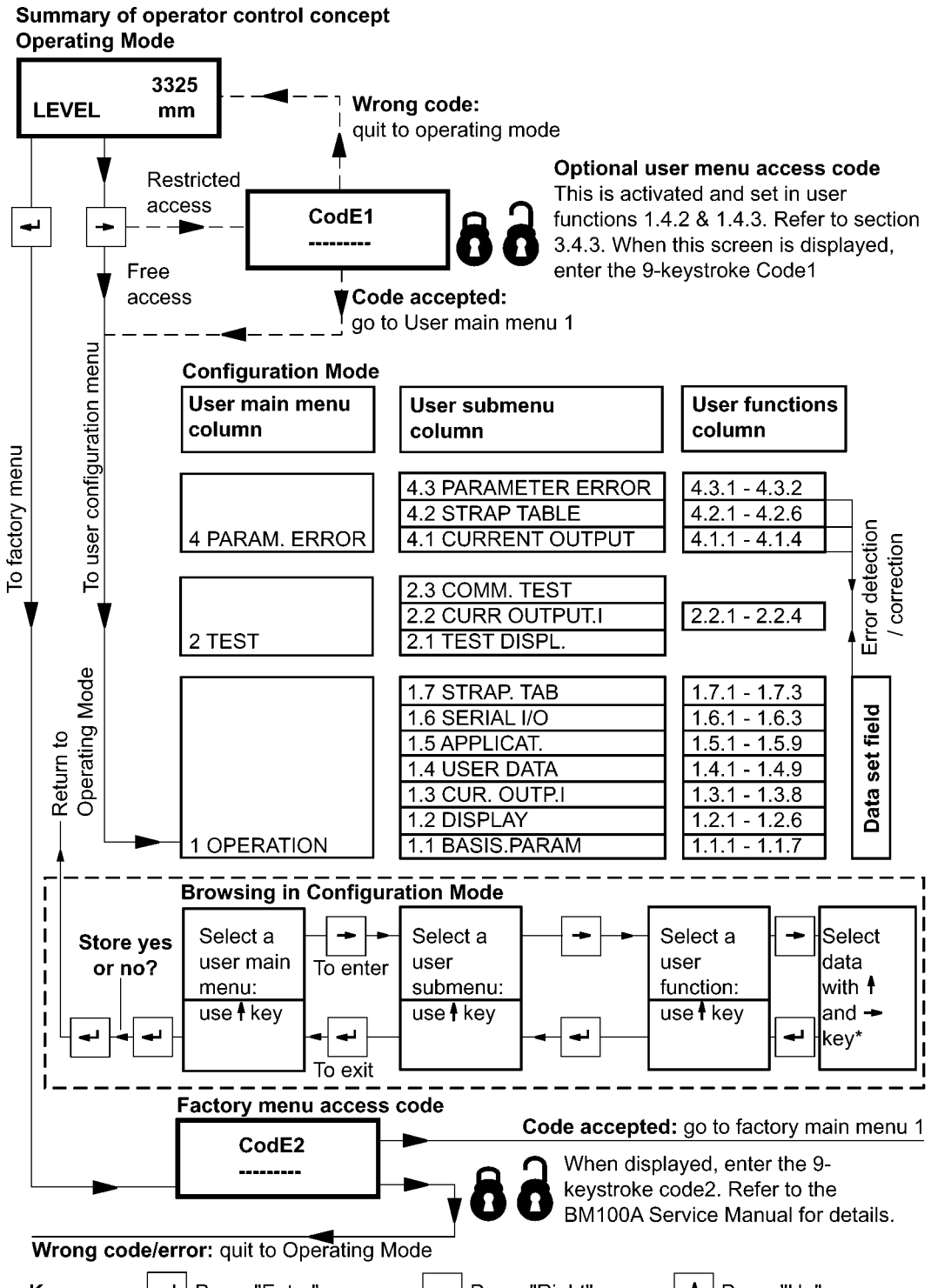
We recommend that any changes to settings be noted on the configuration record supplied in appendix B, or recorded using PC-STAR, to enable KROHNE service personnel to provide a rapid response to any enquiries.

3.4.2 Configuration Procedure

The BM100 A starts up in operating mode displaying either information according to customer specifications or factory default values.
The configuration mode (user menu) can be accessed and parameters modified by following the operator control concept summary below. Configuration procedure is described in more detail in section 3.4.3.
Instruments may equally be configured individually using a remote display available in PC-STAR software for remote connections. Please refer to the PC-STAR on-line Help file for more details.

A restricted-access factory menu is available for advanced configuration. Refer to the BM100 A Service Manual for further information.

Summary of operator control concept



*Use the "Right" key to move from one digit to the other and the "Up" key to change values.

3.4.3 Quick Configuration: configuration examples

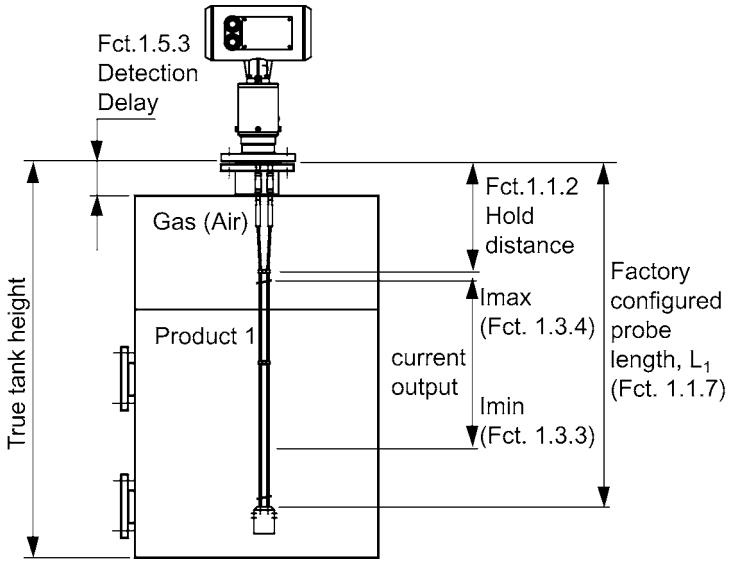
The minimum functions (fct.) to be configured for a simple measurement are listed below:

- 1.1.1 Tank Height
- 1.2.1-6 Display Functions
- 1.4.2-3 Entry Code 1 / Code 1
- 1.3.1-4 Current Output 1 (& 2)
- 1.7.1-2 Volume calibration*

*For volume measurements

Example procedures for each set of functions are given on the following pages. Each procedure is given in a series of steps in table form and begins from the Operating Mode.

Useful definitions for quick configuration



Typical gauge used for quick configuration examples

Probe type:	twin Ø4mm/0.16” cable probe, type L
Tank height (Fct. 1.1.1):	10000.00mm/33ft
Hold distance (Fct. 1.1.2)	0.25m/10ft (see “probe measurement limits” in section 6.2.3 for the Ø4mm twin cable probe, type L)
Probe length, L_1 (Fct. 1.1.7):	9.00m/29.5ft (Do not modify unless advised to)

Tank height

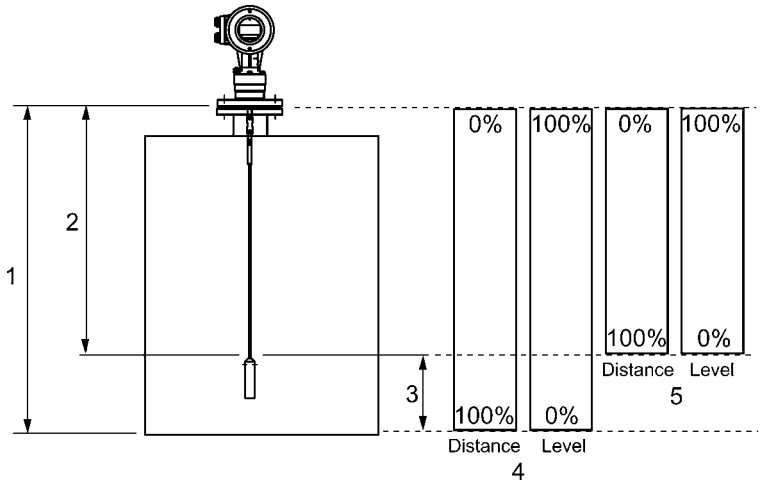
Configuration Mode user function 1.1.1

This function is usually either defined as true tank height or as factory configured probe length, L_1 if the former is not supplied by the customer in the order.

Why change the tank height?

- setting the parameter in Function 1.1.1 to L_1 avoids having a non-measurable zone underneath the probe where the measurement on the display freezes.
- when setting up a measurement scale as explained on the following pages, this means that the level at the end of the probe will be taken as zero instead of the tank bottom.

How tank height affects measurement when either Level or Distance is measured



1 True tank height
2 Measurable height (factory configured probe length, L_1)
3 Non-measurable zone
4 With true tank height (1) set in Function 1.1.1 of the User's menu.
5 With factory-configured probe length, L_1, set in Function 1.1.1. of the User's menu.

Example procedure 1:

- to change true tank height (10000mm) to factory configured probe length, L_1 (9000mm) , and then save the new parameter. Refer to item 5 in the diagram above.

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	Go to function (fct.) 1.1.1 from Operating Mode	→,→,→	Fct. 1.1.1 TANK HEIGHT
3	Enter function (current value: 10000mm)	→	10000.00
4	Modify value to 09000.00 (millimetres)	↑,↑,↑,↑,↑,↑,↑,↑,↑, →,↑,↑,↑,↑,↑,↑,↑,↑, ↑	09000.00
5	Exit to Save function	↵,↵,↵,↵	STORE Yes
6	Save & exit to Operating Mode	↵	5750 LEVEL mm

How to configure displayed value and units
User Sub-menu 1.2 - Display Functions

These functions are used to choose the information to be displayed in operating mode:

- the measurement function (distance, level, volume, etc.) and units (mm, ft., m3, etc.)
- Display mode (1 (single) or 2 or more items in a repeating loop (cyclic mode))

Example procedure 2:

- to modify display mode from “single” to “cyclic” to configure a repeating loop displaying more than one piece of data,
- to select Level and Distance and display each item for 5 seconds.

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	Go to fct. 1.2.1 from the operating mode	→,→,↑,→	Fct. 1.2.1 DISP.MODE
3	Enter function 1.2.1 Display Mode (default value: SINGL.MODE)	→	SINGL.MODE
4	Modify value to CYCL.MODE	↑	CYCL.MODE
5	Exit fct. 1.2.1data set field and go to fct. 1.2.2	↵,↑	Fct. 1.2.2 DISPL.ITEM
6	Enter function 1.2.2 (Display Item) data set field Default value: LEVEL	→	LEVEL
7	Select “DISTANCE”.	↑↑	DISTANCE
8	Press “RIGHT” to confirm or cancel data item to be added to display loop	→	No
9	Press “UP” to confirm parameter	↑	Yes
10	Exit data set field to confirm. Go to to fct. 1.2.3	↵,↵,↑	Fct. 1.2.3 CYCLIC TIME
11	Enter function 1.2.3 data set field (default value: 01). Change to 05 seconds.	→,→,↑,↑,↑,↑	05 Sec
12	Exit data set field, function, submenu and menu. Save new configuration and return to Operating Mode	↵,↵,↵,↵,↵	6750 LEVEL mm

The operator may display volume once the gauge is calibrated to measure volume in submenu 1.7. Interface parameters may only be used if the gauge is factory-set for interface measurement.

How to protect gauge configuration
User menu functions 1.4.2 Entry Code 1 & 1.4.3 Code 1

These functions are used to activate the restricted-access code and lock the settings: these will be impossible to modify without entering the correct code. Do not lose this code!

Example procedure 3A:

- to activate access code function,
- to enter new code and exit configuration mode.

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	Go to function (fct.) 1.4.2	→,→,↑,↑,↑,→,→	Fct. 1.4.2 ENTRY.CODE1
3	Enter function data set field (default value: No)	→	No
4	Select Yes to confirm activation of access code.	↑	Yes
4	Exit function and go to fct. 1.4.3.	↵,↑	Fct. 1.4.3 CODE 1
5	Enter function 1.4.3 data set field.	→	CodE1 --------- Default: (↑↑↑↵↵↵→→→)
6	Enter new 9-keystroke code	↑,↑,↑,↑,↑,↑,↑,↑,↑	CodE1 ---------
7	Re-enter new 9-keystroke code to confirm. Automatic exit from data set field to function.	↑,↑,↑,↑,↑,↑,↑,↑,↑	Fct. 1.4.3 CODE 1
8	Exit function, submenu and menu. Save new configuration and return to Operating Mode.	↵,↵,↵,↵	6750 LEVEL mm

Example procedure 3B:

- to re-enter the configuration mode from the Operating mode with the restricted-access function activated.

9	Start from Operating Mode screen	n/a	6750 LEVEL mm
10	Press RIGHT button to enter Configuration Mode. Screen displays access code entry.	→	CodE 1 ---------
11	Type 9-keystroke access code. User menus are now accessible. A typing error (impossible to delete incorrect keystroke) will quit the user back to the operating mode.	↑,↑,↑,↑,↑,↑,↑,↑,↑	Fct. 1.0.0 OPERATION

How to set an analogue current output scale
User menu functions 1.3.1 to 1.3.4 (& 1.3.5 to 1.3.8 for a second analogue output)
This set of functions allows users to set up a scale. The minimum (4mA) and maximum (20mA) values of an analogue current output should ideally lie within the device's active measuring zone, as the display will freeze when the signal is lost.
Refer to the measurement limits table for each probe type in the introduction. Refer also to the stqrt of section 3.4.3 for the advantages of changing tank height.

Example procedure 4:
- personalise a measurement scale
- select "Level" as the current output parameter for the scale to be set up from the tank bottom
- choose suitable minimum and maximum values for the scale.

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	Go to Fct. 1.3.1	→,→,↑,↑,→	Fct. 1.3.1 FUNCTION.I.1
3	Enter data set field (current value: Distance)	→	DISTANCE
4	Set to Level.	↑,↑,↑	LEVEL
5	Exit data set level and go to fct. 1.3.2	↵,↑	Fct. 1.3.2 RANGE I 1
6	Enter function (current value: 4 – 20 mA) – to set the error output to 3.7 mA or 22 mA or having no error output.	→	4 - 20
7	Modify value to 4 – 20 mA with error output at 22 mA.	↑,↑	4 – 20 /22=E
5	Exit data set field and go to fct. 1.3.3. Enter (current value: 00000.0 mm) – to set level that corresponds to the minimum current output 4 mA.	↵,↑,→	00000.0 mm
6	Modify value to 01000.0 mm (this sets the minimum point 1 metre above the tank bottom). The tank is considered to be empty below this point.	→,↑	01000.0 mm
7	Exit data set level and go to fct. 1.3.4. Enter function (current value: 14000.0 mm) – to set level that corresponds to the max. current output 20 mA	↵,↑,→	14000.0 mm
9	Change to 9600.0 (this sets the maximum below the top dead zone). The tank is considered to be full above this point	↑,↑,↑,↑,↑,↑,↑,↑,↑, →,↑,↑,↑,↑,↑, →,↑, ↑,↑,↑,↑	9750.0 mm
10	Exit data set level, function, sub menu and menu. Save configuration and return to operating mode.	↵,↵,↵,↵	6750 LEVEL mm

Gauges with two current outputs
Two outputs are required for displaying readings simultaneously for two separated products stored in the tank. Set up a scale using user functions 1.3.1 to 1.3.4 as shown above to measure level, then repeat the procedure for interface measurement using user functions 1.3.5 to 1.3.8. Give some thought to where the minimum and maximum points for each scale should be.
Setting up a volume scale
Calibrate for volume measurement in submenu 1.7 then select "volume" as the scale parameter.

How to configure the gauge to give volume readings
User menu functions 1.71, 1.7.2 & 1.7.3

The BM100 A may be calibrated to measure volume by using a 50-line “strapping (calibration) table”. The shape of the tank decides the number of points to be entered for accurate measurement. Do not set User menu function 1.3.1 or 1.3.5 to “Volume” until steps 1 to 4 have been completed.

Example procedure 5

- set volume or weight units for calibration
- program up to 50 points (2 in this example) giving the level and filled volume for each point.

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	From operating mode go to fct. 1.7.1 to choose volume units for calibration.	→,→,↑,↑,↑,↑,↑,↑,↑,→	Fct. 1.7.1 VOL.UNITS
3	Enter function (default value: m3). A selection of metric, imperial and federal weight and volume units are available.	→	m3
4	Set to “Liter”.	↑	Liter
5	Exit data set level and go to fct. 1.7.2 to input calibration points.	↵,↑	Fct. 1.7.2 INPUT.TAB
6	Enter function to program the table. The point is displayed (current value: 15).	→	15
7	Change to point 01.	↑,↑,↑,↑,↑,↑,↑,↑,↑,→,↑,↑,↑,↑↑,↑	01
8	Press ENTER to set level (height from the bottom of the tank)at point 01 in mm. Current value: 00100.0 mm	↵	00100.0 mm
9	Change level to 00200.0 mm	→→↑	00200.0 mm
9	To confirm and set filled volume at this level. Default volume: 0003000.0 Liter.	↵	0003000.0 Liter
10	Change to 0000020.0 Liter. Press enter to confirm and exit data set field.	→,→,→,↑,↑,↑↑,↑,↑,↑,→,→,↑,↑	0000020.0 Liter
11	To confirm and exit data set field.	↵	Fct. 1.7.2 INPUT.TAB
12	Enter function to add second point on table. The point number will be displayed (default value: 15)	→	15
13	Change to point 02.	↑,↑,↑,↑,↑,↑,↑,↑,↑,→,↑,↑,↑,↑,↑,↑,↑	02
14	To set level at point 02 in mm. Current value: 00600.0 mm	↵	00600.0 mm
15	Change level to 00400.0 mm	→,→,↑,↑,↑,↑,↑,↑,↑,↑	00400.0 mm
16	To confirm and set filled volume at this point. Current volume: 0799999.9.0 Liter.	↵	0799999.9 Liter
17	Change to 0000040.0 Liter.	→,↑,↑,↑,→,↑,→,↑,→,↑,→,↑↑,↑,↑,↑,→,↑,→,↑	0000040.0 Liter
18	Exit data set field, function, sub menu and menu. Save configuration and return to operating mode.	↵,↵,↵,↵	6750 LEVEL mm

Clearing the current gauge volume calibration table data

1. Go to fct. 1.7.3 DELETE TAB.
2. Press “right” to enter the data set field. This will read “SURE No”.
3. Press “up” to select “SURE Yes”.
4. Press “enter” to confirm clearing the “strapping table”.
5. Go to fct. 1.7.2 INPUT TAB. to enter new values into an empty table.

3.4.4 Network Configuration – digital outputs and gauge identification : RS 485, multi-drop...

Example procedure 6:

- turn off analog current output to read a digital signal *, **
- give each gauge an address and device number

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	From operating mode go to fct. 1.3.1 to turn off analog output.*	→,→,↑,↑,→	Fct. 1.3.1 FUNCTION.I.1
3	Enter function (current value: level)*	→	LEVEL
4	Set to analog output to “off”*	↑,↑,↑,↑	OFF
5	Exit data set level and go to fct. 1.6.2 to give the gauge an address.	↵,↵,↑,↑,↑,→,↑	Fct. 1.6.2 ADDRESS
6	Enter function. A number will be displayed (default value: 000- no network)	→	000
7	Change address to 001.	→,→,↑	001
8	Enter to confirm and exit to function. Go to fct 1.4.4 to give the gauge a device number (displayed on a remote user interface such as a PC (Personal Computer) or a HHC (HART Handheld Controller).	↵,↵,↑,↑,↑,↑,→,↑,↑	Fct. 1.4.4 DEVICE No
9	Enter data set field. (default value: 00000.001). A 9-keystroke alphanumerical code may be entered using “up” to scroll through the choices and “right” to change digit	→	00000.001
10	New name: 10000.001	↑	10000.001
11	Exit data set field, function, sub menu and menu. Save configuration and return to operating mode.	↵,↵,↵,↵	6750 LEVEL mm

*Ignore steps 2, 3 and 4 for HART® outputs. Leave the analogue output “on”.
**Use local display interface only to configure each BM 100 A meter for network integration.

Communication Rate

Use fct. 1.6.1 BAUD RATE to optimise communication with the remote work station when using RS485 interface. HART/ SMART networks are set at 1200 baud.

3.4.5 Summary of User Functions

The table below provides an overview of all parameters that can be set in the configuration menu. Reset default values are in **bold** type in the "Input Range" column.

Function (Fct.)	Input Range	Description
1.0.0 OPERATION		
1.1.0 BASIS.PARAM		**These functions concern the display only**
1.1.1 TANKHEIGHT	Enter 0.1 to 60 m (3.3 to 197 ft.) **As per order**	This is the distance from the flange to the bottom of the tank. Can be set to the probe length to ignore the bottom non-linear & non-measurable zones.
1.1.2 HOLD DIST. (Hold Distance) **Warning : Critical Parameter**	Enter a value from 0 mm / 0 in to probe length. The Minimum value = 0 m • Twin probes Probe length<2m/6.5' **0.25 m / 9.8 in** Probe length>2m/6.5' **0.45 m / 17.7 in** • Single probes Probe length<2 m/6.5' **0.25 m / 9.8 in** Probe length>2 m/6.5' **0.60 m / 23.6 in** • Coaxial probe **0.05 m / 2 in**	This prevents the gauge from displaying a zone near the flange where measurements may not be possible. Function 1.5.3 "Detection Delay" should be used to suppress any non-product reflections as reflections within this zone are still registered.
1.1.3 TIME CONST. (Time Constant)	1 to 100 seconds **5 seconds**	This function filters possible signal fluctuations when the tank is turbulent.
1.1.4 WIN.FROZEN (Window Frozen) **Warning : Critical Parameter**	Select YES or NO **NO (window open)**	This causes the instrument to freeze or open its search window if product reflection is lost. See function 1.1.5 / 1.1.6 for more details. "YES" means the gauge will only search in the zone specified in Fct. 1.1.5.
1.1.5 LEVEL WIN. (Level Window)	Enter 0.2 m / 7.9" to probe length, L • Powders **4.0 m / 13.12 ft** • Others **0.5 m / 19.7 in**	Sets the operating window for level measurement. The window is centred around the level and moves as the level changes. If product reflection is lost, the instrument reacts according to the configuration set in Function 1.1.4. The value refers to the total window: a value of 500 mm / 20 " denotes a window +/-250 mm / +/-9.84" around the measurement.
1.1.6 INTERF. WIN. (Interface Window)	Enter 0.2 m / 7.9" to probe length, L **1.0 m / 3.28 ft.**	Sets the operating window for interface measurement. Refer to Fct. 1.1.5 for details.
1.1.7 PROBE LGTH. (Probe Length) **Warning : Critical Parameter**	Enter 0.1 m / 7.9" to probe length 60 m / 197ft. **Per sales order**	Length of probe, L_1, measured from the flange. Do not include the counterweight length. Modify this only if the probe length has been changed.

Function (Fct.)		Input Range	Description
1.2.0	**DISPLAY**		**To display readings in the form and units required.**
1.2.1	DISP. MODE (Display Mode)	Select SINGLE or CYCLIC display mode. **SINGLE**	Cyclic mode permits more than one item to be displayed in a cycle when used with Functions 1.2.2 and 1.2.3.
1.2.2	DISPL. ITEM (Display Item)	Select parameter(s) to be displayed. Parameters: Level, Distance, volume interface level, layer, interface distance, interface volume, ullage volume and percentage of output 1 (if in single mode). **Level**	Single Display Mode: One parameter is displayed in the operating mode. Cyclic Display Mode: One or more parameters are displayed in the Operating Mode. Simply select this function, select a parameter and press “Right” to confirm. Repeat this procedure to add parameters to be displayed.
1.2.3	CYCLIC TIME	Enter 1 to 10 seconds **1 second**	Sets the amount of time a reading is displayed in cyclic operating mode.
1.2.4	LGTH UNIT (Length Unit)	Select (0.01) m, (1) cm, (1) mm, 0.1 mm, (0.1) inch and (0.01) feet **mm**	Sets the length units for displayed readings.
1.2.5	VOL.UNIT (Volume Unit)	Select (0.01) cubic metres, (0.1) liter, (0.1) US gallon, (0.1) GB gallon, (0.1) cubic feet, (0.1) barrel, (1) kg, (0.01) metric ton, (0.01) GB ton or (0.01) US ton. **m3**	Sets the volume units for displayed readings.
1.2.6	ERROR MSG (Error Message)	Select YES or NO **NO**	Turns an error indicator on or off. If configured “YES”, the display flashes when a reading error occurs.

Function (Fct.)		Input Range	Description
1.3.0	**CUR. OUTP. I**		**This configures the current output. These functions are independent from what is displayed.**
1.3.1	FUNCTION.I.1	Select Off, Level, Distance, Volume, Interface Level*, Layer*, Interface Distance*, Interface Volume* or Ullage Volume. **Level**	Assigns a measurement parameter to analogue output number 1. * These parameters are not displayed in this sub-menu unless the instrument is configured for interface measurement. Calibrate the gauge using Function 1.7.2 Strapping Table before selecting "Volume" here.
1.3.2	RANGE.I 1	Select 4-20 mA, 4-20 mA with a 3.7 mA failsafe output or 4-20mA with a 22mA failsafe output. **4-20 mA, E=22mA**	Sets the analogue output range. Settings with fail-safes will send an error message if an error occurs i.e. the level is lost.
1.3.3	SCAL.I.1 MIN (Scale I1 Minimum)	Enter value with regards to measure method selected in Fct.1.3.1 and the units set in Fct. 1.2.5. **As per order or 0.0**	Assigns a length or volume value to 4 mA. Refer to section 3.4.3, Example Procedure 4.
1.3.4	SCAL.I.1 MAX (Scale I1 Maximum)	Enter value as in 1.3.3 **Tank height or probe length as given in order**	Assigns a length or volume value to 20 mA. Refer to section 3.4.3, Example Procedure 4.
1.3.5	FUNCTION.I.2*	Select as in 1.3.1 **Level**	Same as Fct. 1.3.1, except this is for the second current output, if ordered.
1.3.6	RANGE.I 2*	Select as in 1.3.2 **4-20 mA**	Same as Fct. 1.3.2, except this is for the second current output, if ordered.
1.3.7	SCAL.I.2 MIN*	Enter value as in 1.3.3 **As per order or 0.0**	Same as Fct. 1.3.3, except this is for the second current output, if ordered.
1.3.8	SCAL.I.2 MAX*	Enter value as in 1.3.4 **As order or Tank Height**	As per order or Tank Height Same as Fct. 1.3.4, except this is for the second current output, if ordered.

*Displayed when interface measurement is selected in the factory menu

Function (Fct.)		Input Range	Description
1.4.0	**USER DATA**		
1.4.1	LANGUAGE	Select GB/US (English), F (French) or D (German) **As per order**	Sets the language for readings & configuration.
1.4.2	ENTRY.CODE 1	Select YES or NO **NO**	Activates access code for protection of user configuration. Code is then set in Fct. 1.4.3.
1.4.3	CODE 1 (accessible only if Fct.1.4.2 set at "YES")	Enter code **If no code entered: UUUEEERRR**	Enables user to enter a 9-letter code. This code is any sequence of the Right (R) , Enter (E), and Up (U) keys. Once entered the display prompts the user to verify it by entering it again.
1.4.4	DEVICE No (Device Number)	Enter tag name (10 characters or less). **0000000.001**	Enables user to identify a device when used in a digital network. Characters available:Upper(A-Z) and lower(a-z) case alphabets, plus(+), minus(-), space(_) and numerals (0-9)
1.4.5	SERIAL No (Serial Number)	…… (factory-set)	KROHNE serial number. Unmodifiable and to be noted for warranty and service requirements.
1.4.6	F. NBR(French Comm Number)	…… (factory-set)	French order no. - to be noted for warranty and service requirements.
1.4.7	G. NBR. (German Comm Number)	…… (factory-set)	German order no. - to be noted for warranty and service requirements.
1.4.8	OPTION	Enter information (10 characters or less). **Optional**	For noting information concerning the device or its application. Characters available as in 1.4.4.
1.4.9	PROBE TYPE	Select TYPE A (Twin Rod), TYPE B (Bi-cable), TYPE C (Coaxial), TYPE D, TYPE E (Mono-cable), TYPE F (Single Rod), TYPE G (Reversed) or TYPE H. **As per order**	For information only: this shows probe type being used and does not affect the performance of the instrument if changed.

Function (Fct.)	Input Range	Description
1.5.0 APPLICAT. (Application)		**For difficult applications. See also BM100 A Service Manual.**
1.5.1 LEVEL (Level Threshold) **Warning : Critical Parameter**	Press ENTER to access and modify the threshold value using the display. **2.71 GAIN 1**	This function acts as a filter. Real-time gain and reflection amplitude are displayed along with threshold value. Refer to Section 3.4.7 to correctly set the device.
1.5.2 DIST. INPUT (Distance Input)	Enter value. 0 to probe length. **No value**	This forces the device to look for the product in a particular zone measured from the flange facing : enter an estimated value if there is no level signal. Do not enter the dead zone.
1.5.3 DETE. DELAY (Detection Delay)	Enter value. Maximum value = Fct. 1.1.2 – 150 mm (6 in) unless Fct. 1.1.2 is higher than 150 **0.0**	This forces the instrument not to analyse reflections in a defined zone immediately below the flange. Modification of the maximum value: increase Fct. 1.1.2 Hold Distance.
1.5.4 INTERF. LEV ** (Interface Level Threshold) **Warning : Critical Parameter**	Press ENTER to access and modify the threshold value using the display. **2.86 GAIN 1**	This function acts as a filter and may be lowered if interface reflection is difficult to detect. Real-time gain and reflection amplitude are displayed along with threshold value. Refer to Section 3.4.7.
1.5.5 EPSILON R ** (Dielectric Constant)	Enter value from 1.05 to 99 **2.5 or as in order**	This configures the dielectric constant value for use in interface applications and TBF mode.
1.5.6 INT. INPUT ** (Interface Distance Input)	Enter value from 0 to probe length **No value**	As for Fct. 1.5.2 but for interface measurement.
1.5.7 SETTLING **	Select YES or NO **NO**	For decanting processes & mixed products that separate over time. YES : For decanting processes NO : For when 2 products are immiscible (remain separated)
1.5.8 C.I.P. (Cleaning In Place)	Select YES or NO **NO**	If YES is selected and the signal is lost, the gauge will search for a reflection along the whole length of the probe rather than the designated measurement zone. This allows a reset to be made following a cleaning cycle. If the gauge doesn't find a reflection or the reading is frozen at the end of the probe then the tank hasn't been filled or drained.
1.5.9 MODE (Application Mode) **Warning : Critical Parameter**	Select DIRECT.MODE, MANU. MODE or TBF. Never use MANU. MODE. **DIRECT MODE**	This is used for setting the measurement mode automatically (direct or TBF). Note that TBF mode is not available if the gauge is configured for interface. Contact KROHNE for more information on TBF measurement.

** Interface only

1.6.0	**SERIAL I/O (Serial Input/Output)**		**For integrating into a digital network**
1.6.1	BAUDRATE*	Select 1200, 2400, 4800, 9600 or 19600 baud **1200 bd**	Defines transmission rate of information between BM100 and remote terminal. HART/SMART outputs are fixed at 1200 baud
1.6.2	ADDRESS	Enter a number from 0 to 255** **000**	Address of a device in a digital network. If HART protocol is used, entering >0 will configure the gauge for multi-drop networks & output current 1 to 4 mA.

*RS485 interface only
**0 to 15 if HART.

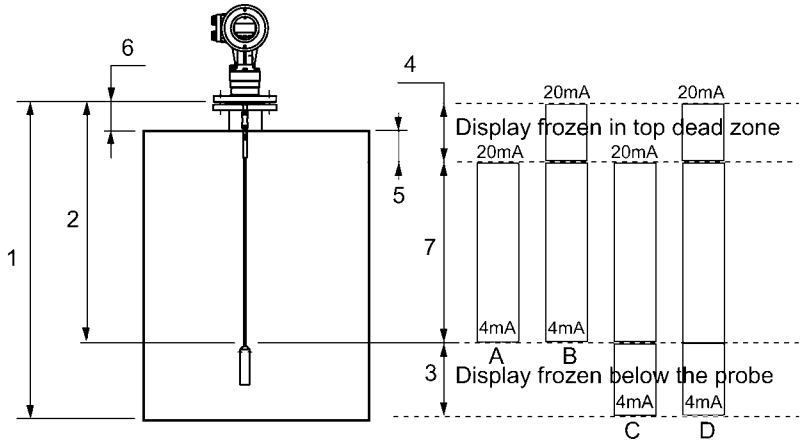
1.7.0	**STRAP. TAB (Strapping Table)**		**For calibrating the gauge for volume measurement.**
1.7.1	VOL. UNIT (Volume / Mass Unit)	Select m³, litre, US gal., GB, gal., Ft.³, bbl, kg, metric ton, ton GB or ton US. **m³**	Selects the volume or mass unit for a volume strap table.
1.7.2	INPUT.TAB. (Strapping Table Input)	Select point 01 to 50, enter level and then volume values respectively. **00**	Table or calibrating the gauge point by point in terms of product level and volume values.
1.7.3	DELETE TAB. (Strap Table Delete)	Select SURE YES or SURE NO. **SURE NO**	Clears the data from the existing strapping table.

3.4.6 BM100A TDR level meter characteristics

This subsection explains :

- the four principle configurations for setting up a measurement scale and what the user should be aware of in each case
- what happens when the tank is full or empty.
- what are level and interface thresholds and how to modify them,
- what happens when one product is measured in interface mode

The measurement scale: four possible configurations for analogue current output - with "Level" selected in function 1.3.1 (Function I.1)



1 True tank height
2 Measurable height (probe length), L_1
3 Non-measurable zone
4 Hold distance (user function 1.1.2)
5 Minimum dead zone value: (Fct 1.5.3 – Fct 1.1.2)
6 Detection delay (user function 1.5.3)
7 Active measurement zone

Note that 4mA is set in user menu function 1.3.3 and 20mA is set in user menu function 1.3.4.

As can be seen above, there are 4 principal scale configurations for measuring level:

Configuration A

Parameters : Function 1.1.1 = Probe length, L_1 (excluding counterweight*)
Function 1.3.3 (4mA) = 0.0 m/mm/in./ft. units defined in 1.2.4 (for 4 mA)
Function 1.3.4 (20mA) = Probe length, L_1 – Hold distance (maximum value)

The configuration used in Quick Configuration Example Procedure 4 in section 3.4.3. When the gauge reaches the minimum and maximum outputs then the measurement will freeze as the tank is now considered to be empty or full respectively.

Configuration B

Parameters: Function 1.1.1 = Probe length, L_1 (excluding counterweight*)
Function 1.3.3 (4mA) = 0.0
Function 1.3.4 = Probe length, L_1 (excluding counterweight*)

The top of the scale is set to gauge flange facing. The measurement will freeze in the top dead zone.
Warning: danger of overflow! It is impossible to detect product reflections in the top dead zone!

Configuration C

Parameters: Function 1.1.1 = True tank height
Function 1.3.3 (4mA) = 0.0
Function 1.3.4 (20mA) = True tank height (1.1.1) – Hold distance (1.1.2)

Has the top of its scale below the top dead zone but the bottom of the scale is below the end of the probe (on the tank bottom). As TDR is a contact technology, the display will freeze at a level above the 4 mA limit when product level drops below the probe end.

Configuration D

Parameters: Function 1.1.1 = True tank height
Function 1.3.3 (4mA) = 0.0
Function 1.3.4 (20mA) = True tank height (1.1.1)

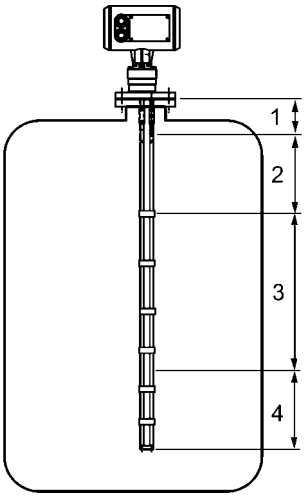
This combines examples B and C. Care must be taken when the product rises into the top dead zone or drops into the bottom non-measurable zone as TDR gauges cannot monitor in these zones.

The configurations given above also apply when “distance” is selected in function 1.3.1 (after adaptation of parameters entered).

*Factory configured probe length, L_1, does include the Ø12mm x lg100mm(Ø0.5”xlg4”) weight for the Ø8mm/0.3” single cable probe (type K).

Gauge operating logic when the reflection is lost

The product reflection pulse is usually lost when the level is in the top dead zone or near the bottom of the tank. The diagram below shows the action taken by the gauge depending on where the last reflection was lost.



Zone 1 : Dead zone

- Status marker 3 is displayed when the product enters the dead zone.
- Gauge assumes the tank is full and displays the maximum level value

Zone 2 : Full zone

- If the gauge loses the signal in this zone, it reacts as in zone 1 : the tank is assumed to be full.
- The gauge searches for a reflection in this zone.
- On reaching the full zone the level will continue to rise to a current output of 20.5 mA (i.e. +3⅛%), if signal is not lost.

Note: the search zone increases to :
Fct. 1.1.2 “Hold Distance” + (Fct. 1.1.5 “Level Window”/2), if this value is greater than 300mm / 12”.

Zone 3 : Central measurement zone

- The gauge uses Fct. 1.1.5 “Level Window” to search in this zone for the largest pulse reflection.
- If the pulse is lost the reading freezes at the last value. Status marker 3 will be displayed.
- Status marker 2 will then be displayed if no reflection is found in the Level Window search zone, and the reflection search will be enlarged to the probe length.
- The reading will remain frozen during this time.

Zone 4 : Empty zone

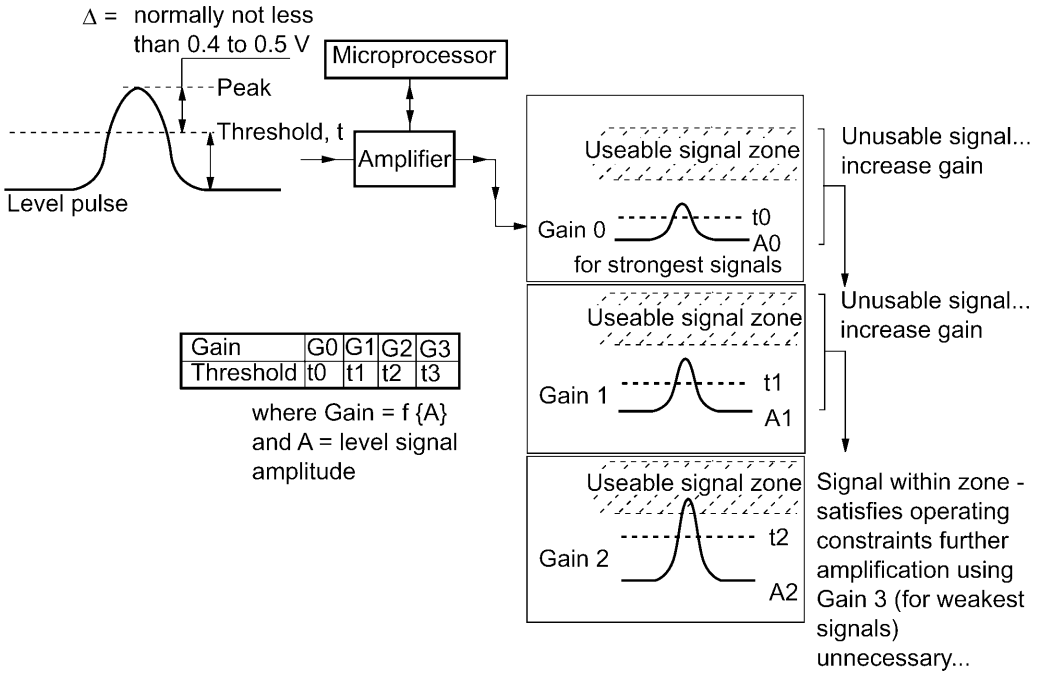
- If the reflection is lost in this zone, the gauge assumes the tank / vessel to be empty.
- The short circuit reflection will become larger than product reflection at this time.
- If level is not at zero, the gauge will descend further to a level equivalent to a minimum output of 3.8 mA.
- The gauge searches for a reflection in this zone. The search zone increases to:
  Fct. 1.1.7 (Probe Length) – fct. 1.1.5 (Level Window)/2, if this value is greater than 300 mm / 12”.

Gain and voltage amplitude

As explained in the measuring principle in section 7, the level of a product is converted from a return signal (the product reflection) received by the gauge: this signal has taken a certain amount of time to return to the gauge and it has a certain strength / size measured in milli-volts (dependant on the dielectric constant of the product).

All pulse signals returning to the gauge electronics block (including flange, obstruction and the product surface reflections) are converted to voltage amplitudes. The gauge's microprocessor looks for part of the largest signal that is over a set voltage amplitude, called the "threshold", and identifies this as the product being measured. For this signal to be usable by the gauge, the microprocessor will amplify the signal by increasing the gain. Once the signal is within a set "working" range, the gauge follows this signal. The gauge registers any changes in time for this part of the signal to return to the converter and translate this into a displayed level or volume.

Gain is a function of voltage amplitude. This defines the default threshold value when the gauge is searching for the product level. A strong return signal will be given a low gain (i.e. Gain 0 or a small amplification). However, if the signal is very weak, then a Gain of 3 (i.e. high signal amplification) is given.



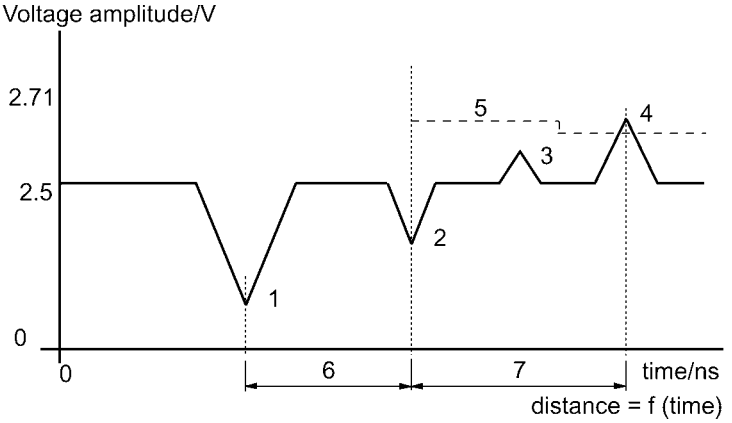
Gain	G0	G1	G2	G3
Threshold	t0	t1	t2	t3

where Gain = f {A}
and A = level signal amplitude

Level measurement: Level pulse amplitude and threshold

After connection to a power supply, the BM100 A will:
1. Measure reflection pulses in terms of voltage amplitude by cycling through a set of gains.
2. Identify the highest amplitude as being the product level.

The diagram below shows a level threshold of 2.71 Volts for a Gain of 1.



1 Initial pulse
2 Flange reflection (except coaxial probe)
3 Non-product reflection (e.g. parasite : agitator)
4 Product level reflection
5 Level threshold (with 2 metre steps). Set in user function 1.5.1.
6 Offset (see below for definition)
7 Distance measured as a function of time

Offset is the distance measured as time for the signal to travel from the signal converter to the flange (the gauge's reference point).

If difficulties are experienced finding the correct level, try the following solutions.

- User function 1.1.4 Window Frozen set to "Yes":

Critical Parameter: Ask KROHNE for more advice before reconfiguring gauge.

This concentrates search for product level in a small defined zone and ignores interference signals.The gauge will set up the "level window" on either side of the last reading with a plus/minus range equal to half of the value given in Function 1.1.5. The gauge will then ignore all other pulse reflections outside the "level window" as long as there is a reflection above the pre-set threshold. If no pulse is detected, the instrument will change the Gain automatically as the pulse changes amplitude.

- User function 1.1.4 Window Frozen set to "No":

The instrument will search along the entire length of the probe. Warning : This may lead the instrument to incorrectly identify a non-product reflection (e.g. a nearby beam or the nozzle) to be the current level.

- Modification of User Function 1.5.1 Level Threshold:

Critical Parameter: Ask KROHNE for more advice before reconfiguring gauge.

The default threshold values do not normally need to be changed. However, the level threshold may need to be modified if level is hard to detect due to parasite signals from obstructions in the tank (nozzle, beams and mixers) or the measurement of products with very low dielectric constants.

If the level pulse is too high 2 solutions are possible:

- Modify user function 1.5.3 Detection Delay ignore all signals near the flange

Increase the configured value. This will force the gauge to ignore reflections in the distance set from the flange. Note that this will reduce the measurement range.

- Modify user function 1.5.1 Level Threshold: to reduce interference along the probe length

Increase the voltage amplitude manually in Fct. 1.5.1. The threshold descends in 2 metre steps to take into account loss of pulse strength over distance so the correct level behind the obstruction may be detected. See the procedure below:

If measured level is too low compared its real level:

The gauge may have found that the short circuit gives off the strongest pulse and assigns this as being the current level. Lowering the gain and /or the voltage amplitude manually in Fct. 1.5.1. may help but too low a threshold value may result in conflicting non-product reflections and unstable readings. In the case of very low dielectric products, contact KROHNE service personnel or refer to the BM100 A service manual for advice on converting to TBF measurement.

Procedure (example where the level measured is too low)

- read off displayed peak amplitude
- modify level threshold value

Step	Action	Press buttons to finish step	Information displayed at the end of each step
1	Start from Operating Mode screen	n/a	6750 LEVEL mm
2	From operating mode go to fct. 1.5.1 Level Threshold	→,→,↑,↑,↑,↑,→	Fct. 1.5.1 LEVEL
3	Enter function (current value: level) to first read off peak amplitude. The top value gives the peak amplitude in volts.	→	3.80 GAIN2
4	Press enter to see (& modify) configured level threshold in volts and the minimum gain used	↵	3.80 MIN G 2
5	Modify the threshold value so that value is no less than 0.5V below the peak amplitude	→, ↑,↑,↑,↑,↑,↑,→,↑,↑,↑,↑	3.44 MIN G 2
6	Exit data set field, function, sub menu and menu. Store configuration and return to operating mode. Check that the gauge can measure in the required measuring range.	↵,↵,↵,↵	6750 LEVEL mm

Note that the threshold drops every 2 metres / 6.5 ft. Refer to the BM100 A Service Manual for the threshold value for each 2 metre / 6.5 ft step.

Solid application notes

Most dry solid applications except powder or flakes with high dielectric constants, such as charcoal and coal powder, are measured with a Gain of 3. If it is difficult to measure level at a certain point with the gauge using a Gain from 0 to 2, then an internal tank structure (exposed girder, etc.) is most likely to be within the electromagnetic pulse field area : the gauge will detect the largest signal and assume this is the product level.

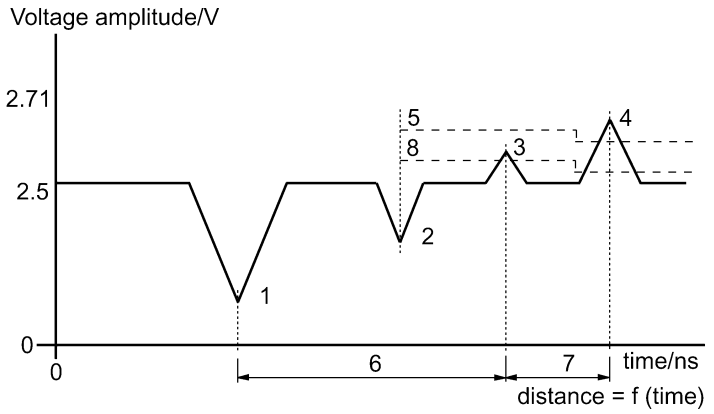
Interface measurement*

After being switched on, the BM100 A will :

- Identify the closest reflection to the flange above the level threshold (minimum voltage amplitude set in fct. 1.5.1) as being the level
- Identify the next largest reflection which is above the interface threshold (set in fct. 1.5.4) as being the interface.

Follow instructions given above for Level Threshold modification.

* measurement only possible if the gauge is factory-configured for interface.



1 Initial pulse

2 Flange reflection

3 First largest reflection (level)

4 Second largest reflection (interface)

5 Level threshold. Set in user fct. 1.5.1.

6 Measurement not dielectric constant dependant

7 Measurement dielectric constant dependant

8 Interface threshold. Set in user fct. 1.5.4.

Interface measurement when only one product is present in the tank

The gauge assumes that at least 100 mm / 4” of top product is in the tank as soon as a top product reflection has been detected and/or the short circuit at the end of the probe is no longer detected. This means that level freezes at a constant 100 mm / 4” above the indicated interface. Also note however, that the interface level displayed will be slightly higher than the real value. The gauge will measure the correct interface and level values once there is at least 100 mm / 4” of top product in the tank.

Default voltage amplitude thresholds for a given Gain : for level and interface

Gain	Minimum threshold/ Volts	
	Level	Interface
0	2.59	2.66
1	2.71	2.87
2	2.99	3.34
3	3.62	4.44

4 Service and maintenance

4.1 Test Functions in the user menu

A series of tests are available in this part of the configuration menu. This permits the local display and the instrument calibration to be checked.

Test Function	Input range	Description
2.0.0 TEST		
2.1.0 TEST DISPL. (TEST DISPLAY)		**Gives full display of all segments of the LCD display.**
2.2.0 CUR OUTP.I (CURRENT OUTPUT I)		
2.2.1 VALUE I 1	N/a	Gives a reading of current from analogue output 1.
2.2.2 TEST I 1	Select 3.6, 4, 12, 20 or 22 mA.	Forces the output 1 to a selection of 4 output currents.
2.2.3 VALUE I 2	N/a	Gives a reading of current from analogue output 2.
2.2.4 TEST I 2	Select 3.6, 4, 12, 20 or 22 mA.	Forces the output 2 to a selection of 4 output currents.
2.3.0 COMM. TEST		**For factory use only.**

4.2 Troubleshooting

4.2.1 Parameter errors

Function	Action to be taken
4 PARAMETER ERROR	
4.1 CURRENT OUPUT	When a parameter error occurs, the digit 4 is displayed with the description “PARAMETER ERROR”.
4.1.1 SCALE I 1 MIN	
4.1.2 SCALE I 1 MAX	
4.1.3 SCALE I 2 MIN	• The RIGHT key should be pressed until the function concerned is given.
4.1.4 SCALE I 2 MAX	
4.2 STRAP TABLE	
4.2.1 STRAP TABLE INPUT	• Press the RIGHT key again to make the value appear for modification.
4.2.2 STRAP TABLE SUPRESS	
4.2.3 DISPLAY MODE	
4.2.4 DISPLAY ITEM	• Follow the instructions for resetting the value in Section 3 and then press ENTER to exit.
4.2.5 FUNCTION I 1	
4.2.6 FUNCTION I 2	
4.3 PARAMETERS ERRORS	• If more than one error is reported, the procedure should be repeated.
4.3.1 DEAD ZONE	
4.3.2 DETECTION DELAY	

4.2.2 Basic Servicing – Replacing fuses and the electronics chassis

BM100 servicing by the customer is limited by warranty to the removal and replacement of :

- the power supply fuse
- the electronics chassis.

Other repairs must be done by KROHNE-authorised service staff.

Removing the electronics chassis

Before changing the electronics chassis remember to save the current configuration of the instrument :

- Note the settings on the configuration record supplied in appendix B or
- Save the settings in a *.dat file on PC-STAR. Press the F4 key to open a directory.

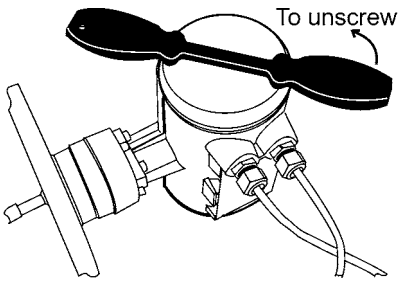
Please follow these instructions carefully:

Step 1

Disconnect instrument from the power supply. If instrument is equipment category 1 / 2 GD (ATEX classification) or located in a Division 1 (US) area, please refer to Supplementary Installation and Operating Instructions BM100 A / Ai KEMA 01 ATEX 1078X for more information.

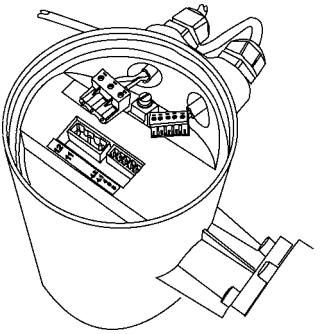
Step 2

Remove back cover with supplied wrench.



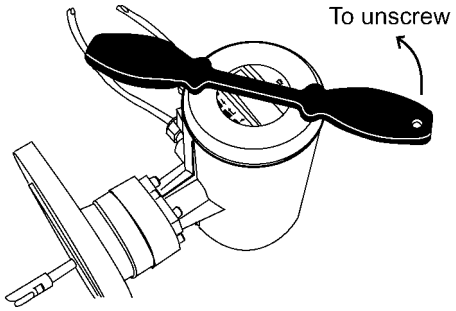
Step 3

Unplug terminal blocks from electronics chassis.



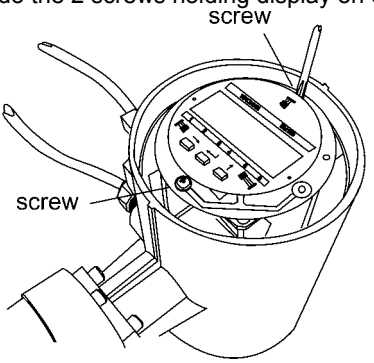
Step 4

Remove the front cover with wrench.

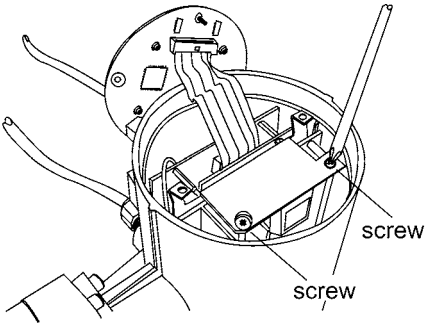


Step 5

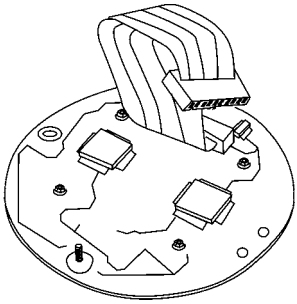
Undo the 2 screws holding display on chassis.



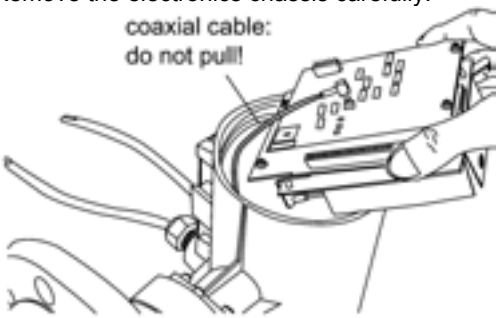
Step 6
Undo the two screws holding block in the housing.



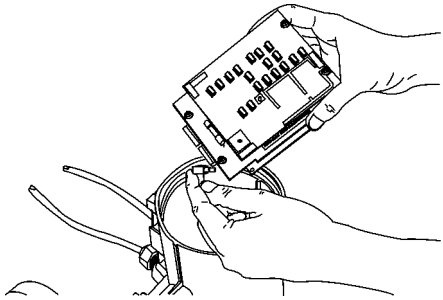
Step 7
Disconnect interface socket. Remove display screen circuit board.



Step 8
Remove the electronics chassis carefully.



Step 9
Disconnect the coaxial cable.

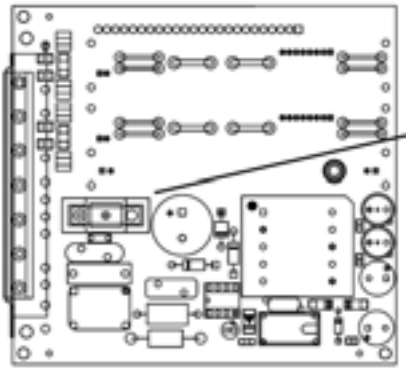


Step 10
Use these instructions to mount the new chassis. Care should be taken when putting the electronics package back into the housing to avoid trapping the coaxial cable between the housing and the rear cover. Load the old settings saved on a *.dat file using PC-STAR or re-enter information noted on the configuration record in appendix B.

Replacing the fuses

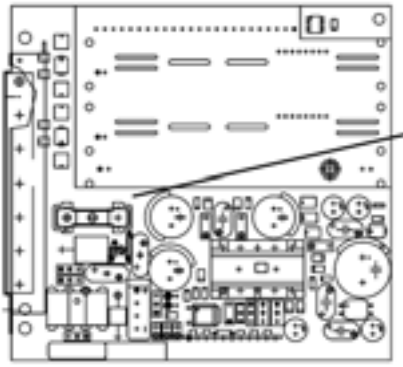
As indicated in the diagram below, the power supply is protected by a fuse, F1. This will be visible when the electronics chassis is removed from the housing. The fuse rating is dependant on the type of power supply used and is given below :

Power Supply Board 100 / 240 V AC



Power supply fuse F1
T 400 mA / 1500 A (250V)
IEC127-2/V Time Lag Fuse

Power Supply Board 24 V DC / AC



Power supply fuse F1
T 1.25 A / 1500 A (250V)
IEC127-2/V Time Lag Fuse

4.3 Fault clearing

Event	Fault	Action
General Operation		
Local Display: Status Marker 1 displayed	The High Frequency board is not sending a pulse. Reason: it may have been damaged by electrostatic discharge.	Contact a KROHNE-authorised service centre*. The electronics package may need to be replaced.
Local Display: Status Markers 2 or 4 displayed	The instrument has lost the level (marker 2) or interface (marker 4) signal, has searched in a pre-defined zone and has not yet found the return pulse.	
	Reason: The product may have risen into the dead zone and has dropped below the threshold due to readings from the flange.	Empty tank below dead zone and check the measurement.
	Reason: The product level may be at zero (tank empty).	Refill tank above minimum level and check the measurement.
Local Display: Status Markers 3 and/ or 5 displayed	The display is frozen. Reason: The pulse has dropped below the threshold, whereupon the gauge opens a search window / zone. If no reflection is found, Status Marker 2 (or 4 for interface) will be displayed. Marker 3 is also displayed if PC-STAR is connected and the F7 graphics function has been selected.	Empty tank below dead zone and check the measurement. If the signal is not detected then modify the threshold as shown in section 3.4.6 using user menu function 1.5.1 for level and 1.5.4 for interface.
Instrument is not accurate when working in DIRECT mode with a product that has a high dielectric.	Tank height is not correct.	Check and re-enter tank height in user function 1.1.1 if required.
	Deposit on the probe or operation in a heavy dust environment.	If the electronics pack has been replaced, verify that factory calibration parameters are still the same. Ask KROHNE* for the factory calibration sheet and password for access to the factory menu.
Electrical Connections and Communication Output		
The display does not work.	Instrument is wired to the wrong voltage : fuses have blown.	Replace the power supply fuse, F1, as show in section 4.2.2.
	If the ambient temperature is below –20°C / –4°F, the LCD does not work	Consider using a PC equipped with KROHNE PC-STAR software if in a general purpose area.
On connecting the instrument to a DCS unit, the gauge output current drops to 3.7 mA or lower.	The load resistance in the active loop is limited to 350Ω. If the DCS load is higher, then the output current will drop	Measure the output load with an ohmmeter. Modify the load if this does not conform with the output option limits. See section 2.2.2.
Output remains at the same value, about 16 mA.	A power supply has been connected to the output terminal.	The electronics package should be sent to a KROHNE authorised service center*.

* A list of KROHNE offices is supplied on the last page of this handbook

5 Ordering spare parts

Spare Parts BM100 Electronics

Code Level meter

XF04 X BM100

Housing

0 Without
1 Aluminium Standard
2 Aluminium Exde
3 Aluminium Exd
4 Aluminium Exde zone 10
5 Aluminium Exd zone10

Cover

0 Without
1 Blind
2 With window

Electric connection

0 Without
1 PG16
2 1/2" NPT
3 M20
4 PG16 Exd
5 PG16 Exde
6 1/2" NPT Exde/Exd
7 M20 Exd/Exde

Power supply

0 Without
1 100 - 240 VAC
2 24 VAC/DC
3 100 - 240 VAC Ex
4 24 VAC/DC Ex

Output

0 Without
1 1 x passive non Exi
2 2 x passive non Exi
3 1 x active non Exi
5 2 x passive Exi
6 1 x active
7 1 x RS485 non Exi
A 1 x RS485 non Exi + 1 x passive

Display

0 Without
1 With
2 Replacement
3 With window cover std
4 With window cover Exde
5 With window cover Exd

Accessories

0 Without
1 PCSTAR Version 2
2 VIATOR & Software PCSTAR Version 2

Application

0 Without
1 Level (Direct + TBF) liquid
2 Level + Interface
3 Level (Direct + TBF) powder

Approval

0 Without
1 PTB IIB
2 FM
3 SEV
4 BVS
5 PTB IIC

XF04 X								0		0	0	0	0	0		0	Complete code for order

Spare Parts BM100 Mechanical

Code	Level meter
XF04 X	BM100

Probe

0	Without	**4**	Single cable
1	Twin rod<3m	**5**	Single rod<3m
2	Twin cable Ø6<60m	**7**	Single cable Ø8
3	Coaxial<6m		

Application

0	Without
1	Level (Direct + TBF) liquid
2	Level + Interface
3	Level (Direct + TBF) powder

Length (10m)

0	0	**2**	20	**4**	40	**6**	60
1	10	**3**	30	**5**	50		

Length (1m)

0	0	**3**	3	**6**	6	**A**	9
1	1	**4**	4	**7**	7		
2	2	**5**	5	**8**	8		

Connection

0	Without	**E**	6" AINSI 150Lbs
1	DN40 PN40	**F**	2" AINSI 300Lbs
2	DN50 PN40	**G**	3" AINSI 300Lbs
3	DN80 PN40	**H**	4" AINSI 300Lbs
4	DN100 PN16	**K**	6" AINSI 300Lbs
5	DN150 PN16	**L**	1" NPT
6	DN100 PN40	**N**	DN65 PN40
7	DN150 PN40	**P**	DN200 PN10
8	1" G	**R**	1 1/2" AINSI 300Lbs
A	1 1/2" AINSI 150Lbs	**S**	2 1/2" AINSI 150Lbs
B	2" AINSI 150Lbs	**T**	2 1/2" AINSI 300Lbs
C	3" AINSI 150Lbs	**W**	8" AINSI 150Lbs
D	4" AINSI 150Lbs	**X**	8" AINSI 300Lbs

Material

0	Wthout	**4**	HC276 (rod or coaxial)
1	316/316L	**5**	FEP
2	HC22		

Sealing gasket

0	Without	**2**	Kalrez
1	Viton		

Approval

0	Without	**3**	SEV
1	PTB IIB	**4**	BVS
2	FM	**5**	PTB IIC

Counterweight

0	Without	**5**	Ø45 x 256
1	2" x 300	**6**	Ø90 x 120
3	Ø90 x 100	**7**	Ø12 x 1500
4	Tensioning device		

XF04 X	0	0	0	0	0	0	0									Complete code for order

6 Technical data

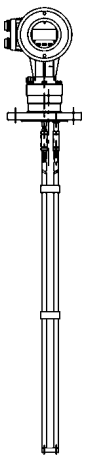
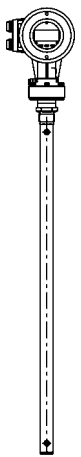
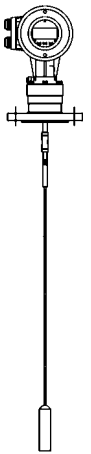
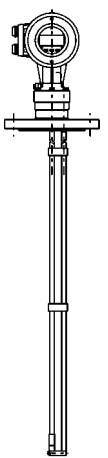
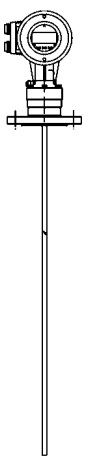
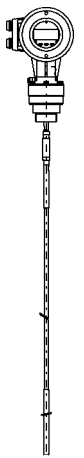
6.1 Technical Data

Input		
Measured variable	Distance, level, liquid interface and volume	
Measurement range	Variable according to probe type, see Equipment architecture, section 6.2	
Blocking Distance	Variable according to probe type, see Probe measurement limits	
Output		
Analogue	4 – 20 mA (3.8 – 20.5 mA according to NAMUR 043), 1 passive output (as standard)	
	Load	
	Active outputs	350 ohms maximum
	Passive outputs	(U-8)/22.10-3 ohms
	Temperature drift	<100 ppm / K
	Resolution	± 3 µA
Digital	HART® & KROHNE SMART protocols (as standard). PROFIBUS-PA output also available on demand.	
Error signal	Status markers. NAMUR 043-compliant (output current values at 3.6 mA or 22mA according to value configured in fct. 1.3.2).	
Performance Characteristics		
Accuracy		
Level measurement	Liquids when probe length, L < 6 m / 20 ft.* ± 5 mm / ± 0.2” Optimised with appropriate on-site calibration ± 3 mm / ± 0.12” Liquids when probe length, L >6 m / 20 ft.* Additional error above 6m: ±0.02% of distance measured Solids (powders / granulates)** ± 20 mm / 0.79”	
Interface measurement	Liquids (with minimum layer of 100 mm / 4”)*** ± 10 mm / 0.39” with configured and stable ε_r value	
Repeatability	± 1 mm / ± 0.04”	
Resolution	± 0.3 mm / ± 0.012”	
Warm-up time	20 seconds to 1½ minutes (self-test before first reading)	
* test medium: water (ε_r=80)	** test medium: cement (ε_r=3)	*** test medium: oil (ε_r=2.4)
Test conditions		
Ambient temperature	+20°C ±5°C / +70°F ±10°F	
Ambient air pressure	1013 mbar abs. ±20 mbar / 14.69 psig ±0.29 psi	
Relative air humidity	60% ±15%	
Reference target	coaxial probe:	water surface
	single probe:	Ø0.8m (Ø31.5”) metal plate
	twin probe:	metal block “short circuit”
Distance from wall	> 300 mm / 11.81” (not for coaxial probe)	
Distance to obstruction	> 1 m / > 3.28 ft.	
Environment		
Ambient temperature	-20 °C to + 50 °C / -4°F to 120°F	
Storage temperature	-40 °C to + 85°C / -40°F to 185°F	
Protection	IP 67 / NEMA 6 – 6P	

Power supply		
Option 1	24 V DC / AC, +10%/-15%, Power used: 9W	
Option 2	100 – 240 V AC, +10%/-15%, Power used: 9W	
Process		
Process temperature, flange	-30 to +150°C / -22°F to 298°F, option 200°C / 392°F See BM100 A / Ai Supplementary Instructions for Ex values.	
Process pressure, standard	-1 to +40 bar / -14.5 to +580 psig* *Process pressure subject to the process temperature and the mechanical properties of process connection	
Dielectric constant ε_r: Measurement mode and probe type limits		
Direct mode		
Level measurement	coaxial (D)	$\varepsilon_r \geq 1.4$
	twin probes (A,B,G&L)	$\varepsilon_r \geq 1.8$
	single probes (F,H&K)	$\varepsilon_r \geq 2.1$
Level & interface measurement	Twin rod, coaxial & twin cable	ε_r (interface) >> ε_r (level)^2 **
** The minimum layer is 100 mm / 4" and is dependant on the dielectric constant, ε_r. This has been determined under test conditions using water (ε_r=80) and oil (ε_r=2.4). Note that a layer less than 100 mm / 4" will result in a level reading at a constant 100 mm / 4" above the displayed interface level, also the interface level reading will be slightly higher than the true value.		
TBF mode		
Level measurement	All except D & G	$\varepsilon_r \geq 1.05$
Human interface		
Communication, standard	KROHNE SMART and HART® protocols installed on first output. Automatic recognition and configuration by gauge. Information displayed via local display (integral or remote), PC or HART® handheld communicator (HHC).	
	Point-to-point:	1 gauge connected to PC or HHC
	Multi-drop:	up to 15 gauges connected to PC or HHC
Fieldbus	RS 485 (SMART):	up to 255 per junction box with PC link
	PROFIBUS-PA:	GSD file supplied with gauge.
Weight		
Non-Ex/FM Housing	8 kg / 18 lb with DN50 PN10/16 flange	
Ex/FM Housing	9 kg / 20.25 lb with DN50 PN10/16 flange	
Single rod Ø10mm	0.62 kg/m / 0.83 lb/ft (twin rod or reverse: 1.24 kg/m / 0.83 lb/ft)	
Single cable Ø4mm	0.12 kg/m / 0.08 lb/ft (twin cable Ø4mm : 0.24 kg/m /0.16 lb/ft)	
Twin cable Ø6mm	0.28 kg/m / 0.19 lb/ft	
Single cable Ø8mm	0.41 kg/m / 0.28 lb/ft	
Coaxial Ø28mm	1.61 kg/m / 1.08 lb/ft	
Standards		
Electromagnetic Compatibility and other protection directives followed for EU countries	**Electromagnetic Compatibility** Directive 89/336/EEC in conjunction with EN 61326-1(A1&A2). EMC emissions shielding (with the exception of BM 100 As with coaxial probes) is only guaranteed in metal tanks. Class A-shielded as standard, class B shielding is available on demand. **Electrical equipment (low voltage)** Directive 73/23/CEE in conjunction with EN 61010-1. **ATEX** Refer to BM 100A/BM 100 Ai KEMA 01ATEX1078X Supplementary Installation and Operating Instructions.	

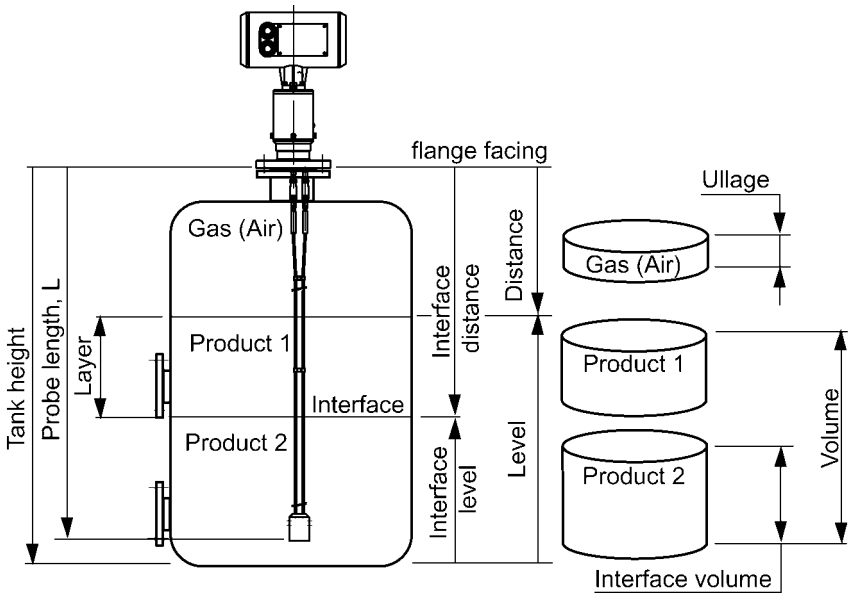
	Liquid / Liquid Gas applications							
	Granulate / solid applications						Powder applications	
Probe Type Code)	Twin cable Ø6mm (B)	Twin rod Ø10mm (A)	Coaxial Ø28 (D)	Twin cable Ø4mm (L)	Single cable Ø4mm (H)	Reverse Ø10mm (G)	Single rod Ø10mm (F)	Single cable Ø8mm (K)
Description	Two flexible 316 SS cables with spacers interspersed along its length, with short-circuit and counterweight.	Two rigid rods with spacers interspersed along its length, with short-circuit.	Single inner conductor with protective tube.	Two flexible 316 SS cables with spacers interspersed along its length, with counterweight.	Single 316 stainless steel flexible cable with counterweight.	One inner conductor in protective tube and one reference rod connected by a short circuit.	Single rigid rod	Single 316 stainless steel flexible cable with long counterweight.
Level								
Interface		***	***	***				
Level and Interface		(Liquid only)						
Range, max.	≤ 30 m / 98.5ft*	≤ 3 m / 10ft*	≤ 6 m / 20ft	≤ 60 m / 197ft	≤ 45 m / 148ft*	≤ 6m / 20ft*	≤ 3 m / 10ft*	≤ 30 m 98.5ft*
Min εr direct mode	1.8	1.8	1.4	1.8	2.1	-	2.1	2.1
Minimum process connection	DN50 PN10/16 2”ANSI 150lbs 2½ ”G / 2½ ” NPT**	DN50 PN10/16 2”ANSI 150lbs 2½ ”G / 2 ½ ”NPT**	DN40 PN25/40 1”½ANSI 150lbs 1”G / 1”NPT	DN50 PN10/16 2”ANSI 150lbs 2½ ”G / 2½ ” NPT**	DN40 PN25/40 1½” ANSI 150lbs 1½ ”G / 1½ ” NPT	DN50 PN10/16 2”ANSI 150lbs 2 ½ ”G / 2 ½ ”NPT**	DN40 PN25/40 1½” ANSI 150lbs 1½”G / 1½”NPT	DN40PN25/40 1½”ANSI150lb 1½” G / 1½” NPT
Probe material	SS316/316L	SS316L HC276 HB2/HB3** Tantalum**	SS316L HC276	SS316/316L	SS316/316L HC22 SS316 + FEP coating	SS316L HC276	SS316L HC276 HB2/ HB3** PVDF-coated PVC-coated	SS316/316L

ε_r = dielectric constant of measured product Liquid / Liquid Gas only * Higher on request ** On request *** No air gap

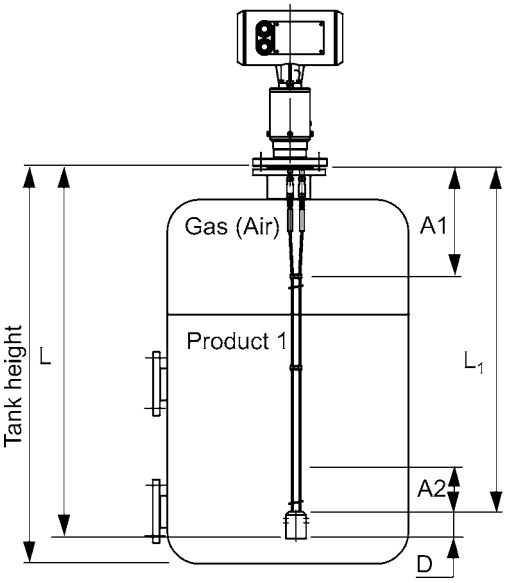
	Granulate / Solid applications		Liquid / Liquid Gas applications				Powder applications	
Probe (Type code)	Twin cable Ø6mm (B)	Twin rod Ø10mm (A)	Coaxial Ø28 (D)	Twin cable Ø4mm (L)	Single cable Ø4mm (H)	Reverse Ø10mm (G)	Single rod Ø10mm (F)	Single cable Ø8mm (K)
Spacer material	FEP molded on cable	ETFE (Tefzel) if L > 1.5m	PTFE if L > 1.5m	FEP molded onto cable	No spacer	ETFE (Tefzel) if L > 0.7m	No spacer	No spacer
Counter -weight	D45x245 (316L) D90x100 (316L) Turnbuckle (316L) Without**	None	None	D45x60(316L) Turnbuckle (316L)	D25x100 (316L) D25x100 (HC22) D25x10 (HC276) Chuck(316L) Turnbuckle (316L)	None	None	D45x245 (316L) D12x1500 (316L) Turnbuckle (316L) Without**
Free area (diameter)	200 mm / 8”	200 mm / 8”	0 mm / 0”	200 mm / 8”	600 mm / 24”	200 mm / 8”	600 mm / 24”	600 mm / 24”
Gauge illustration								

6.2.2 Definition of terms

- Distance: Distance from the face of flange to the level (for 1 product) or the surface of the top product (in the case of 2 products).
- Interface: Interface where the two products come into contact.
- Interface Distance: Distance from the face of the flange to the liquid / liquid interface.
- Interface Level: Height from the bottom of the tank to the liquid / liquid interface. (Tank Height – Interface distance)
- Interface Volume: Volume of bottom product.
- Layer: Thickness of the top product (Distance Interface – Distance) : minimum 100mm / 4”.
- Level: Height from the bottom of the of the tank to the surface of the top product (Tank height – distance).
- Probe Length: Ordered length of probe, L, from face of flange to end of probe (including short circuit and counterweight).
- Tank Height: Distance from the face of the flange to the bottom of the tank.
- Ullage: Unfilled volume.
- Volume: Total volume filled.



6.2.3 Probe measurement limits



A1, the top dead zone,
The minimum distance from the flange to the top limit of the measuring range. The measurement displayed on the gauge will freeze below this distance and status markers will indicate that the reflection has been lost.
A2, the bottom dead zone,
A length at the end of the probe where measurement is not possible. For products with very low dielectric constants ($\varepsilon_r < 5$), accuracy may be affected in a non-linear zone up to 150 mm / 6" above the bottom dead zone, A2
D, the non-measurement zone,
A zone where measurements cannot be taken (i.e. the counterweight, turnbuckle, etc. – except the Ø12 mm x 100 mm counterweight for the type K single cable Ø8 mm probe). The measurement displayed on the gauge will freeze to L_1.
L_1, factory configured probe length
Length to the end of the probe (excluding short circuit or counterweight). This parameter is given in User Function 1.1.7 in the Configuration Mode.
L, Probe length
The length specified by the customer in the order.

Warning:
Set User Function 1.1.2 "Hold Distance" in the gauge's configuration mode to at least top dead zone size as specified per probe type in the table below, so that the gauge never displays product level within this zone. Refer to user function 1.1.2 in section 3.4.5 for more information.

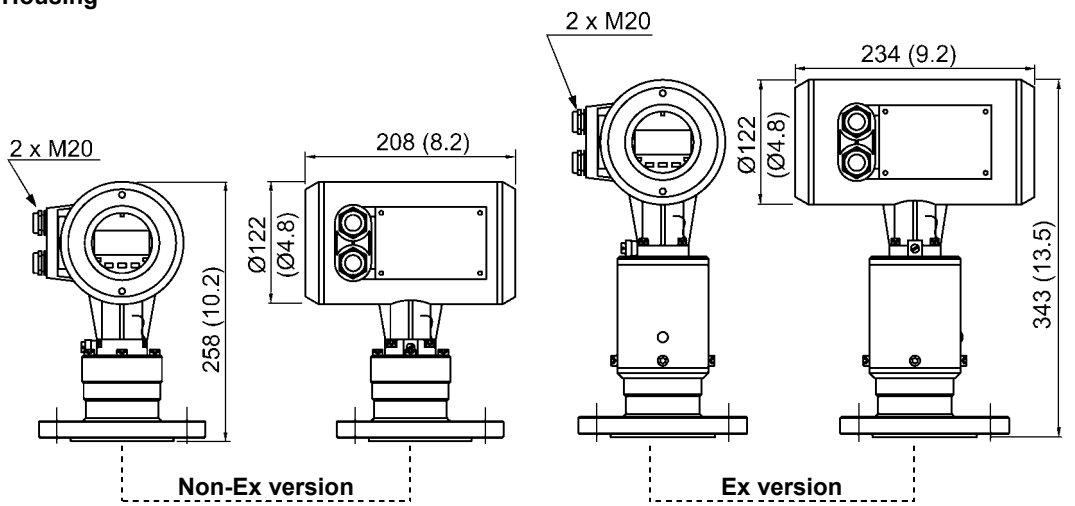
	Probe measurement limits			
Probe type	Top dead zone, A1 ε_r = 80*	Bottom dead zone, A2 ε_r = 80*	Top dead zone, A1 ε_r = 2.4*	Bottom dead zone, A2 ε_r = 2.4*
Twin rod (A)	250 mm / 9.8"	20 mm / 0.8"	330 mm / 13"	100 mm / 3.9"
Twin cable Ø6 mm (B)	250 mm / 9.8"	20 mm / 0.8"	330 mm / 13"	100 mm / 3.9"
Twin cable Ø4 mm (L)	250 mm / 9.8"	20 mm / 0.8"	330 mm / 13"	100 mm / 3.9"
Coaxial (D)	0 mm / 0" (**)	10 mm / 0.4"	0 mm / 0" (***)	100 mm / 3.9"
Single rod (F)	400 mm / 15¾"	20 mm / 0.8"	500 mm / 19.7"	100 mm / 3.9"
Reverse(G)	50 mm / 2"	250 mm / 9.8"	N/a	N/a
Single cable Ø4 mm (H)	400 mm / 15¾"	20mm / 0.8"	500 mm / 19.7"	100 mm / 3.9"
Single cable Ø8 mm (K)	400 mm / 15¾"	20 mm / 0.8"	500 mm / 19.7"	100 mm / 3.9"

*The dielectric constant, ε_r, of water is 80. The dielectric constant, ε_r, of oil is 2.4.
** 20 mm / 0.8" for Ex version. *** 50mm / 2" for Ex version.

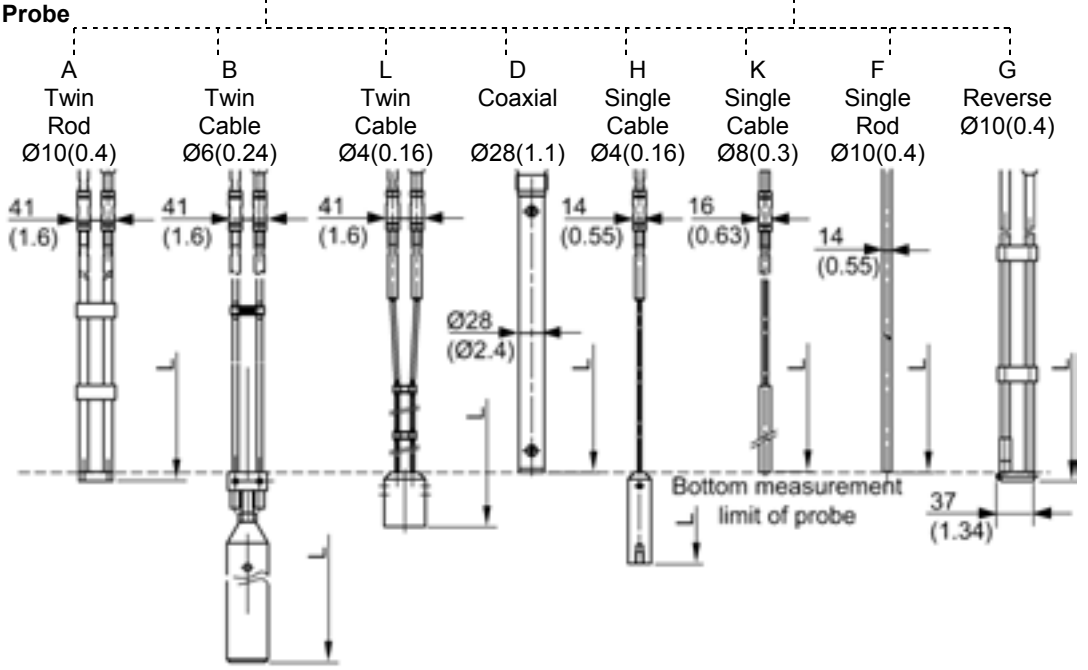
6.3 Gauge dimensions

The drawing below illustrates the complete set of standard gauge configurations and overall dimensions.

Housing



Probe



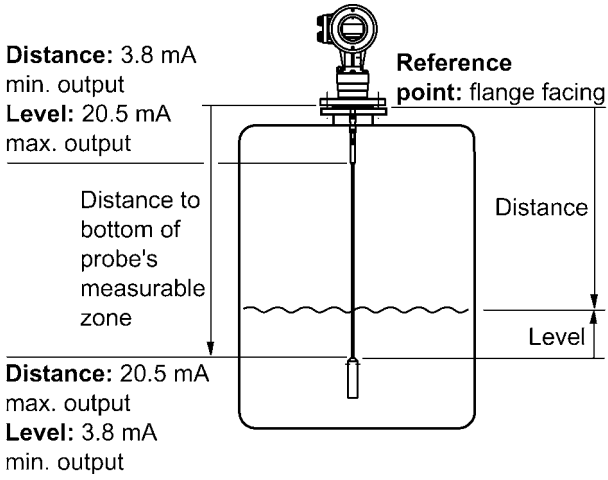
Standard counterweight

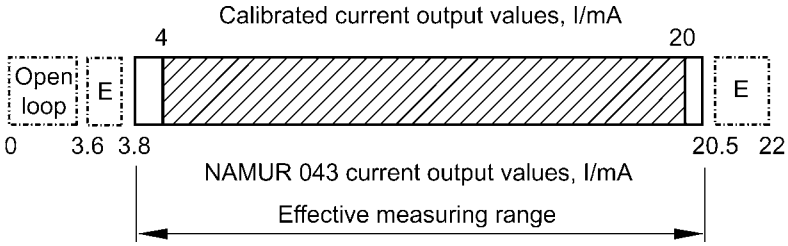
A	B	L	D	H	K	F	G
N/a	Ø45x245 (Ø1¾x9½)	Ø45x60 (Ø 1¾x2½)	N/a	Ø25x100 (Ø1x4)	Ø12x100 (Ø½x4)	N/a	N/a

Dimensions in mm (inches) L is ordered probe length

7 Measuring Principle

The BM100 A has been developed from a tried and tested technology called “Time Domain Reflectrometry” (T.D.R.). Other modern applications include checking for and locating damage along telecommunication cable lines.
The BM100 A sends low-power electromagnetic pulses of one nanosecond width along a rod or cable conductor. This pulse travels at a known speed : the speed of light. Upon reaching the surface of the product to be measured, the pulses are reflected back with an intensity that is dependent on the dielectric constant, ε_r, of the product.
A product’s dielectric constant, ε_r, is an electrical property. The strength of pulse reflection from the surface of the product being measured is registered by the instrument as a signal amplitude in volts. The higher the dielectric constant, ε_r, the stronger the reflection: e.g. up to 80% of the pulse strength is reflected from the surface of water.
The instrument measures the time between the emission and the reception of the signal : half of this time corresponds to the distance from the instrument reference point (the flange facing) to the product surface. This value of time is converted into an analogue output current between 3.8 and 20.5 mA or a digital signal corresponding to a calibrated distance which can then be displayed digitally in a variety of forms from a list of choices available in the gauge’s user menu.
Readings taken using this technology have the advantage of being uninfluenced by dust, foam, vapour and agitated and boiling surfaces. Pressure, temperature and density variations also have no affect.





When I < 3.6 mA : the current loop is open
I = 3.6 mA : error status (displayed when fct. 1.3.2 is set to “4-20 mA, E=3.6mA”)
3.8 ≤ I ≤ 20.5 mA : measuring range
I = 22 mA : error status (displayed when fct. 1.3.2 is set to “4-20 mA, E=22mA”)

The BM100 A can determine level in two ways, depending on the dielectric constant of the product:

Direct mode: Level and / or interface measurement, for products where the dielectric constant is above1.4*.

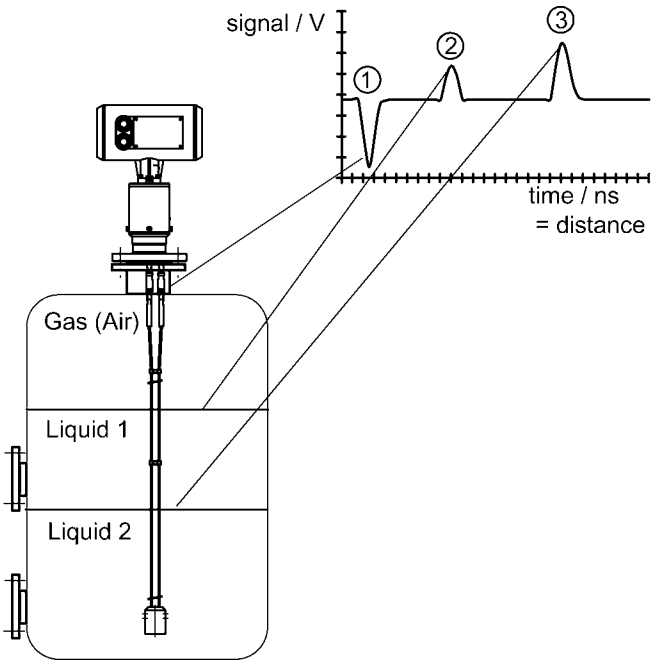
Direct mode: Inverted interface measurement is dealt with in the Service Manual.

Tank bottom following (TBF) mode: Level measurement, for products with low dielectric constants (below 2.1) TBF level measurement is explained in the Service Manual.

* This is the minimum value for a BM100A with a coaxial probe. This value will vary slightly depending on the probe type used.

7.1 Direct mode

Level and Interface Measurement



1. Flange reflection
2. Level measurement
3. Interface measurement

Level measurement of one product

The pulse is emitted by the instrument and guided along the probe. It reflects off the first product surface it meets and returns to the instrument.

The distance from the gauge flange to the product is proportional to the time taken:

$$\text{Distance} = \frac{c_0 \cdot \text{time taken}}{2}$$

where c_0 is the speed of light in air.

Level is determined by subtracting the distance to the product from the tank height. Note that the instrument is normally delivered with level being measured from the end of the probe, where the tank is taken to be empty once the product falls below this point.

Simultaneous interface & level measurement of two products

Interface can be measured when the top liquid has a lower dielectric constant than the second one. The residual pulse left over from the reflection from the top liquid surface is used for measuring interface distance. This residual pulse continues along the probe until it is reflected by the liquid / liquid interface. The speed of the electromagnetic pulse through the top liquid is determined by the top liquid's dielectric constant. This relationship is expressed by this formula :

$c_1 = \frac{c_0}{\sqrt{\varepsilon_{r1}}}$, where ε_{r1} is the dielectric constant of the top liquid and c_1 is the pulse's speed in the top liquid

The distance to the interface may be determined if the distance to the top product surface and ε_{r1} is known, as the layer thickness is proportional to time and ε_{r1} (see diagram above). The layer must be a minimum of 100mm / 4" thick for an accurate measurement to be taken.

8 Certificates and Approvals

ATEX* KEMA 01 ATEX 1078X	EEx de [ia] IIC / IIB (T6-T3) : (ATEX II 1 / 2 G)* or EEx d [ia] IIC/IIB (T6-T3) Zone 0 (ATEX II 1 / 2 D T75 – 150°C)*
Factory Mutual* Project ID 3009217	Intrinsically safe apparatus for use in Class I, II, III, Div. 1, Groups A – G & connections to Class I, Zone 0 AEx ia IIC; for Nonincendive Class I, Div.2, Groups A – D ; suitable for class II, III, Div.2, Groups F & G; with Type 4X, 6 indoor / outdoor protection.
Germanischer Lloyd Certificate* No. 17 461 - 01 HH	Gauge tested in accordance with the relevant requirements of the GL Type Approval System.
Gosstandard Pattern Approval Certificate No. 17045-98 (Russia)*	Gauge tested in accordance with the approval requirements of the Gosstandard System.

Symbols used for the identification of approved equipment

CE Conformity to E.U. directives and norms

Ex- approved*

FM- approved*

GL- approved*

*The above symbols, with the exception of the "CE" symbol, will not appear on gauge nameplates or supplied paperwork if the approvals are not specified in the order by the customer.

9 PC STAR software installation and operation instructions

This section gives a short installation and operation guide for the PC STAR Version 2.00, a software program developed in-house by KROHNE to facilitate remote configuration and data display on a PC (Personal Computer) work station. It is supplied on customer demand only.

9.1 Software Installation

Minimum hardware requirements :
IBM PC – AT-compatible computer, 386 microprocessor or better, 4MB RAM, 2MB free hard-disk drive space and VGA / SVGA display.
PC communication :
1 x RS 232 serial port

Operating system :
Windows 95, 98, 2000, Me and XP.

Additional hardware :

For HART® protocol	RS232 – HART TM converter, e.g. VIATOR from MACTek
For RS485 (SMART Protocol)	RS232 – RS485 converter, e.g. K485 – ISOL from KK Systems Ltd.

The software is supplied zipped or unzipped either on a CD-ROM or on 3"½ diskettes. The software is supplied with a unique serial number that must be entered to install the software.

1 Load the CD-ROM or diskette into the relevant drive and wait for the installation Wizard to auto-run. If nothing happens, check that the correct software (for 95, 98, NT, 2000, Me and XP) has been supplied and the software is unzipped.

   Unzip the software, at which point the WinZip Wizard should run the set-up file or

   Find the installation file "Setup" or " Install" on the CD-ROM / diskette and open it to run the Installation Wizard.

2 Follow the instructions given in the Wizard, entering the serial number when instructed to do so. The software will then be installed.

9.2 PC-STAR Software history

KROHNE "PC STAR" software history (for remote programming of BM 100 A by PC)

Date of Introduction	**PC User software (PC STAR) details**				
Month / Year	Hardware	Operating system	Software release	Instructions	Comments
11 / 1996	PC	Windows 3.xx, 95, 98	1.10	On-line help*	Initial release
10 / 2001	PC	Windows 3.xx, 95, 98	1.20 / 1.21		Improvements to operating system support
12 / 2001	PC	Windows 95 / 98, NT, Me, 2000 and XP.	2.00 (current)		

9.3 Setting up the gauge before connecting with the software

Type of communication network

- Point-to-point networks

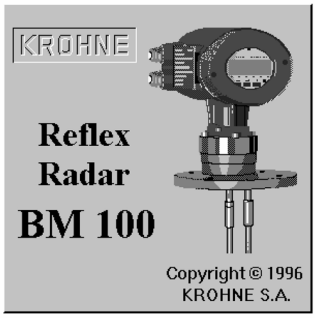
Communication with one device. No gauge configuration required. All configuration work may be done on the computer.

- RS485 networks

Communication with more than one device. To enable the software to identify each gauge, configure the gauge using the local display screen (refer to the Quick Configuration section for giving the gauge an “address” and “name” to each gauge). The gauge will measure from the short circuit to the top dead zone, so no scale configuration is necessary. For the option where a 1 passive analogue output is available with the RS485 output, the scale should be set as before.

9.4 PCSTAR Functions

Check that the correct hardware has been installed to allow communication between the gauge and the work station. Once the software is running, the basic functions (and the associated function keys) will be shown at the foot of the first page.
Open the PC-STAR software. The operator will see the PC STAR main title window:



F1-Help	F2-Connection	F3-Exit	F4-Serial	F5-Record reading
	F7-Configuration		F9-Colors	

To enter the functions displayed in the diagram above, move the cursor to the bar concerned and left-click to open or use the keyboard function key indicated. The functions available are discussed in sections 9.4.1 to 9.4.7 below.

9.4.1 F1 Help:

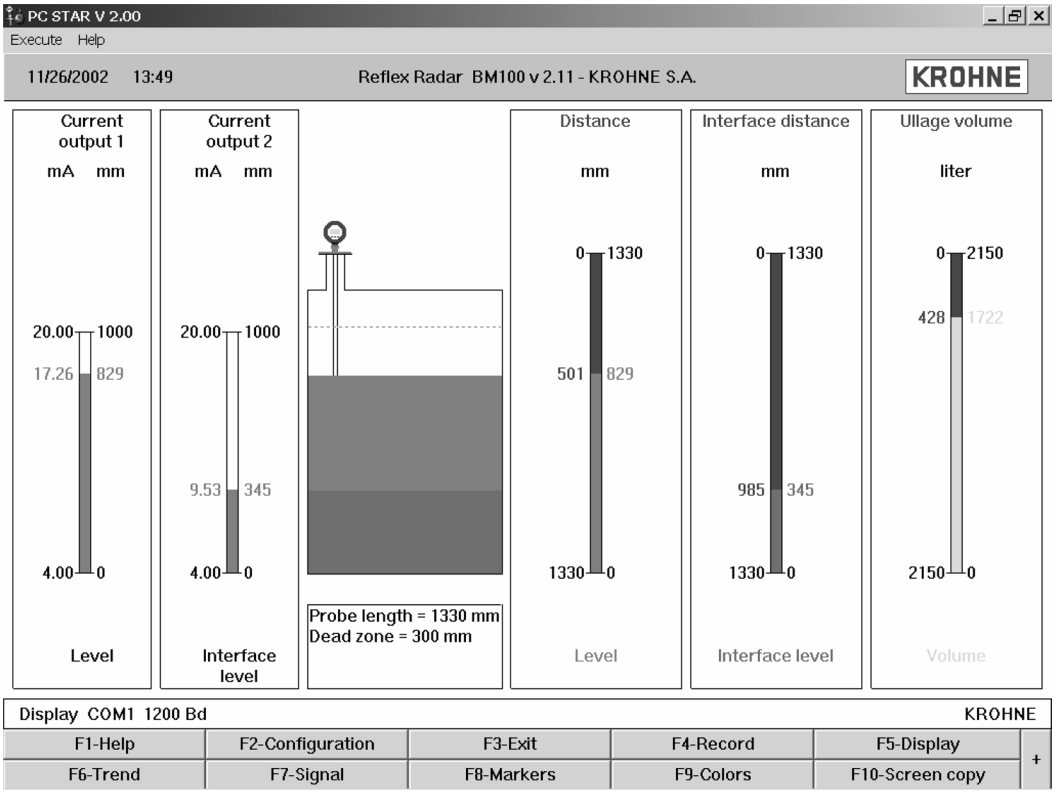
PCSTAR Help for a summary on PCSTAR functions

9.4.2 F2 Connection:

Opens a connection between PCSTAR and the gauge.

This will establish a connection with the gauge (s). A small window will open either confirming the connection or advising the user otherwise. This will open a window which displays graphics of the current status of outputs and a representation of the tank.

If the PC-STAR doesn't succeed in making a connection, the RTS shutdown parameter (see Section 9.4.4: F4 – Serial Parameters below) will be automatically incremented until a connection is made.

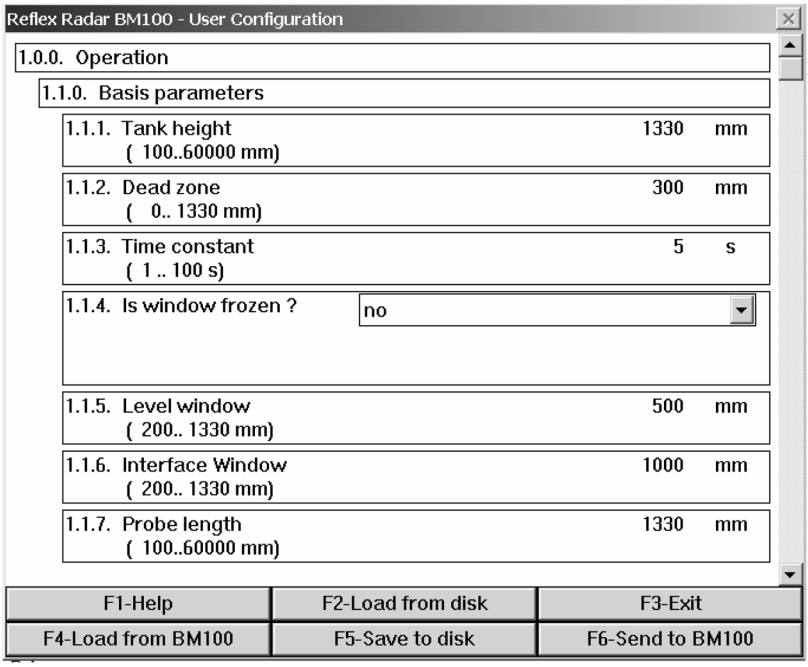


This shows the real-time tank status. This screen is divided into three parts. In default layout for a single output, this will show a bar with Current output 1and level graduations on the left hand side, a representation of the tank with its contents in the middle (the top dead zone will be indicated as a grey dotted line) and a bar with distance and level graduations on the right.

The following functions are available on the main measurement window page:

F1 – Help Menu
On-line help file

F2 – Configuration Menu:
For creating and modifying gauge settings while PCSTAR is connected to the gauge. The configuration may also be created, modified or saved without sending the new settings to the gauge in this window. The User configuration menu will be listed as shown in Section 3.4.5 of this manual. The values displayed will be either default or customer-order specified values. Follow the instructions in this section to configure the gauge.

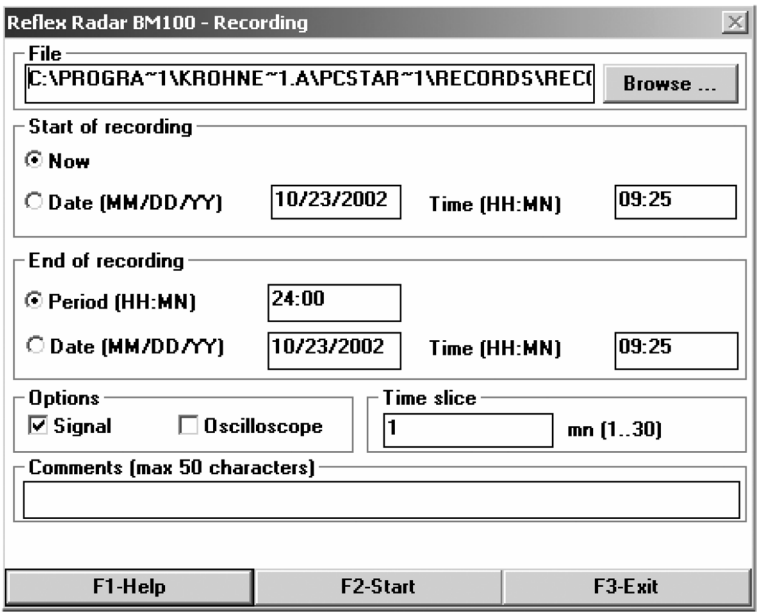


Functions available on this page (use scroll slider on the right hand side to show all):-
User functions 1.1.1 to 1.1.7 : Basic Parameters
User functions 1.2.1 to 1.2.6 : Display Parameters
User functions 1.3.1 to 1.3.8 : Current Output Parameters
User functions 1.4.1 to 1.4.9 : User Data Parameters
User functions 1.5.1 to 1.5.9 : Application Parameters
User functions 1.6.1 to 1.6.2 : Serial Input/Output Parameters
User functions 1.7.1 to 1.7.3 : Strapping Table Parameters and…

F1 – Help :	On-line help file
F2 – Load from disk :	This loads old settings from the hard disk onto PCSTAR (not to gauge).
F3 – Exit:	Exit configuration page to real-time measurement main window.
F4 – Load from BM100:	This loads the configuration currently used by the gauge into PCSTAR
F5 – Save to disk:	Press to save a configuration onto disk in *.KRF format. This allows the user to load old configurations later and also facilitates analysis of the gauge by KROHNE personnel if a problem is encountered.
F6 – Send to BM100:	Press this once all configuration parameters have been entered. This will load the new configuration into the gauge.

F3 – Exit
Quit to main title window

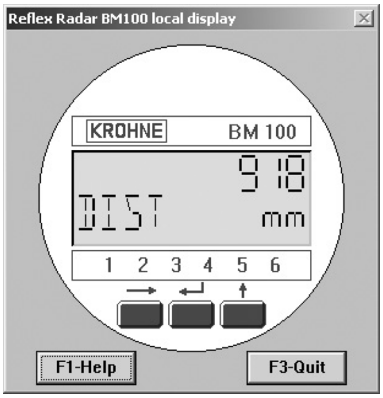
F4 – Record Menu
The software will temporarily record the last 5000 readings (the last two hours of operation) without using the record menu. This information will be displayed on the “Trend” and “Markers” windows. However, if the user wishes to make a permanent record of measurement data then it is necessary to set and confirm a measurement record period in this menu. It is also recommended to activate the “Oscilloscope” option in order to have information on pulse reflection times.
This is set in the window below:



Functions available on this page:-

F1 – Help:	On-line help file	
F2 – Start :	Start Record	
F3 – Exit:	Exit to real-time measurement main window	
Browse:	Find directory and create file	
Recording Options:	Start of Recording-	Either now or a delayed start (date and time)
	End of Recording-	Either in a given number of hours or a given date and time.
	Signal/ Oscilloscope-	Activate these zones to record these types of data.
	Time slice-	Time spacing between each recorded reading. Range: 1 to 30 minutes.
	Comments-	Complementary information concerning the record (50 characters maximum)

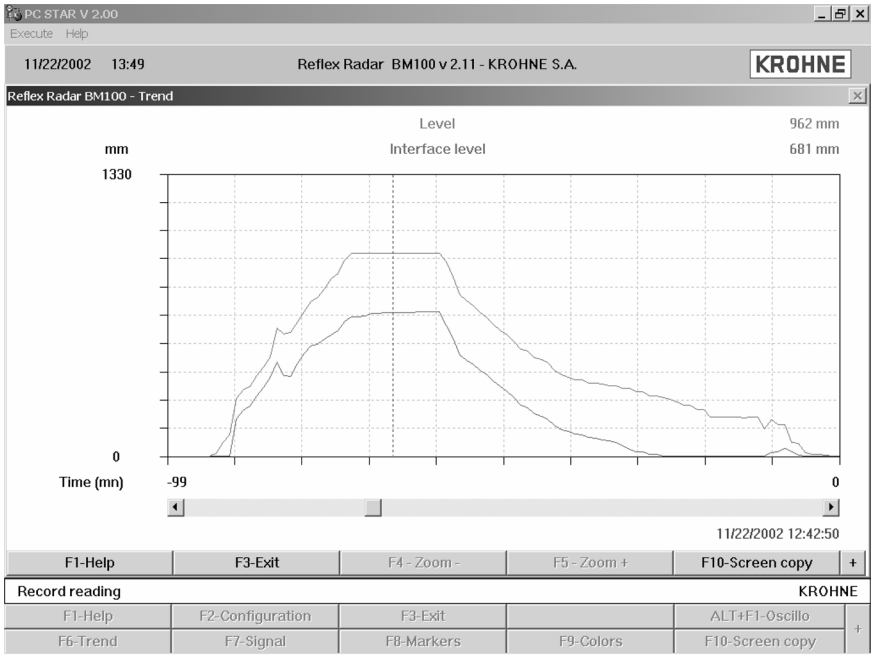
F5 – Display Menu
This shows the gauge local display as it would be on the tank. The operating and configuration mode functions are all available on this window and functions are made available by left-clicking on the relevant keys below the LCD display.



Functions available:

→	"Right" key
↵	"Enter" key
↑	"Up" key
F1 – Help	On-line help files
F3 – Quit	Exit to real-time measurement main window

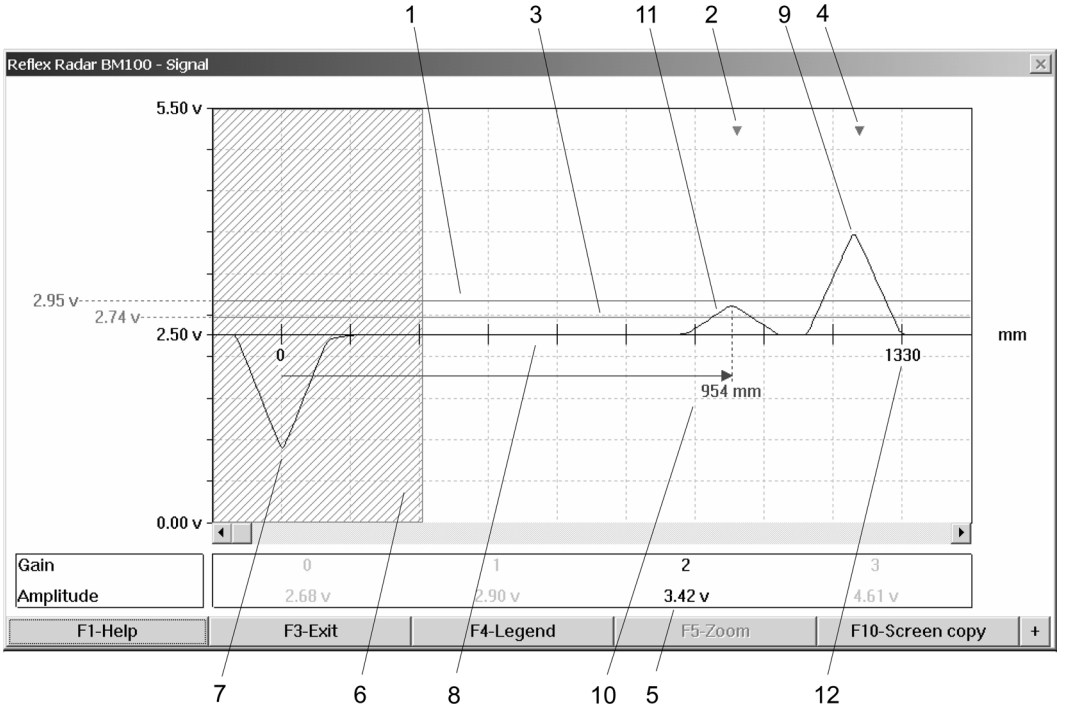
F6 – Trend Menu
Displays a real-time graph of distance from flange against time since the gauge started recording.



Functions:-

F1 – Help	On-line help file
F3 – Exit	Exit to real-time measurement main window
F4 – Zoom -	Reduces the time scale
F5 – Zoom +	Increases the time scale
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

F7 – Signal Menu
Displays a real-time graph of signal amplitude over distance from flange.



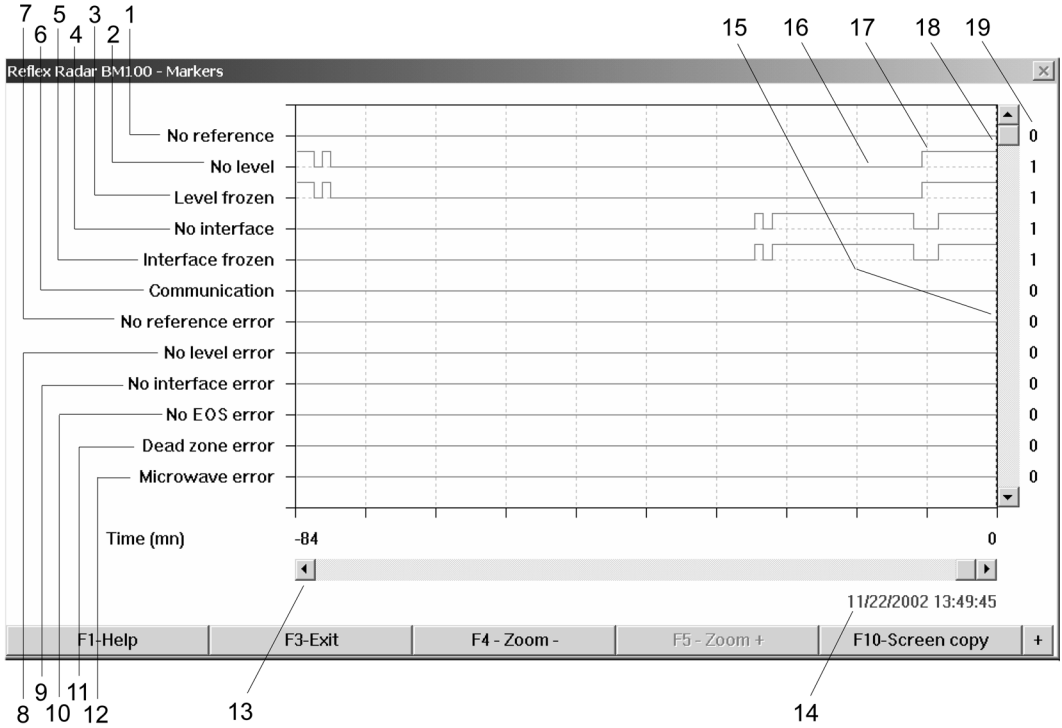
Item	Item Description
1	Interface Threshold: voltage value to the left of the window
2	Level pulse indicator arrow
3	Level threshold: voltage value to the left of the window
4	Interface pulse indicator arrow
5	Gain and amplitude of selected pulse (with distance indicated by an arrow)
6	Hatched area: gauge dead zone representation
7	Flange reflection: this is not a measured form and will be displayed continuously.
8	Emitted signal level: voltage value to the left of the window
9	Selected interface pulse
10	Distance of level pulse from flange
11	Selected level pulse
12	Factory configured probe length, L2

Functions:-

F1 – Help	On-line help file
F3 – Exit	Exit to real-time measurement main window
F4 – Legend	Displays information for identifying the gain, level threshold and dead zone.
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

F8 – Markers Menu

Displays a real-time evolving graph of error markers which are either displayed as active (value 1) or inactive (value 0).



Item	Item Description	(grey – error marker)	Notes
1	No reference		as marker 1 on gauge display
2	No level		as marker 2 on gauge display
3	Level frozen		as marker 3 on gauge display
4	No interface		as marker 4 on gauge display
5	Interface frozen		as marker 5 on gauge display
6	Communication		as marker 6 on gauge display
7	No reference error		
8	No level error		
9	No interface error		
10	No EOS error		EOS=End Of Scan signal
11	Dead zone error		
12	Microwave error		
13	Slider control to move from to the next time slice		Window function
14	Date and time of time slice.		Window data
15	Time slice indicator on graph		Window data
16	Error marker “off”		Window data
17	Error marker “on”		Window data
18	Slider to scroll display to other error markers		Window function, see below
19	Error marker status		Window data “0” = off ,“1” = on

Other error markers not shown on the oscilloscope window (scroll screen to view):

Other Markers	**Notes**
ADC reference error	ADC=Analog to Digital Converter
RAM error	RAM=Random Access Memory
ROM error	ROM=Read-Only Memory
EEPROM user error	EEPROM=Electrically Erasable Programmable Read-Only Memory
EEPROM factory error	
Strap table error	Strap table=volume calibration input table
DAC error	DAC=Digital to Analog Converter

Error markers detailed in items 1 to 5 above are the result of errors directly related to measurement and may be solved by modifying the gauge settings. Other error markers relate to hardware errors and should be solved with KROHNE service centre assistance.

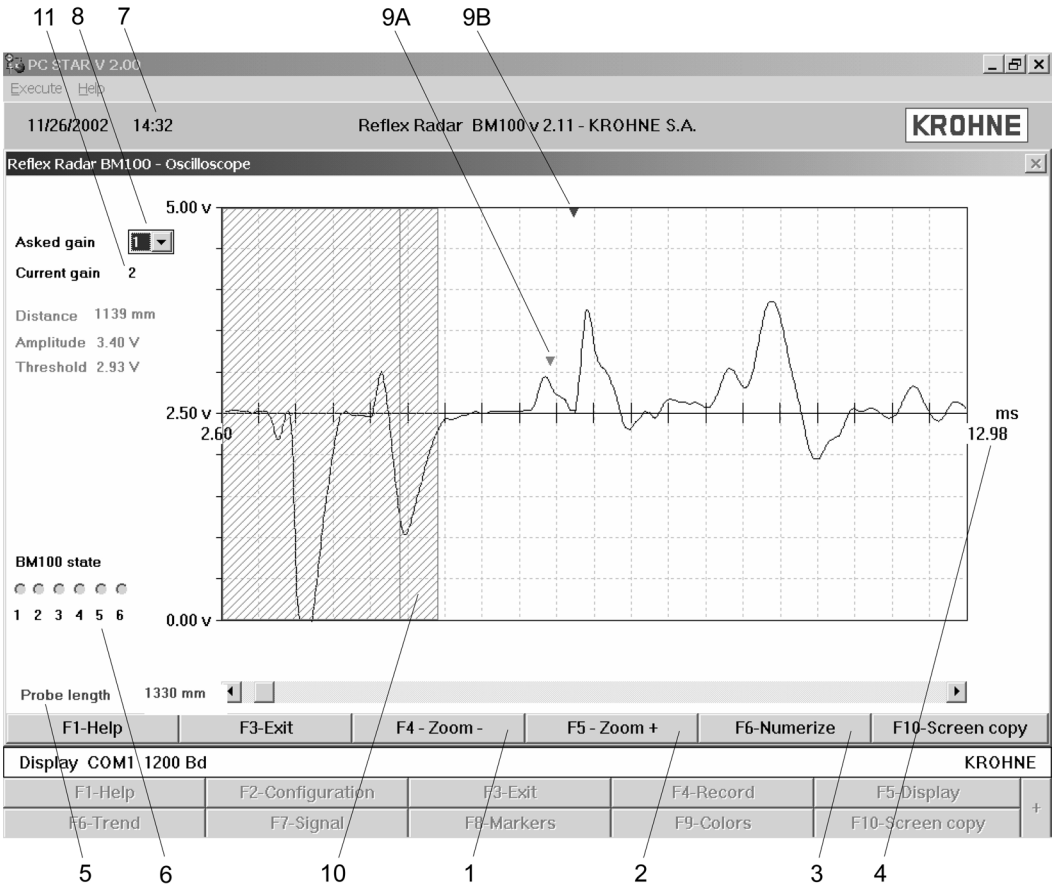
Other functions available on the Oscilloscope window:

F1 – Help	On-line help file
F3 – Exit	Exit to real-time measurement main window
F4 – Zoom -	Reduces the time slice scale
F5 – Zoom +	Increases the time slice scale
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

F9 – Colors Menu
Refer to section 9.4.7 for all information concerning this set of functions.

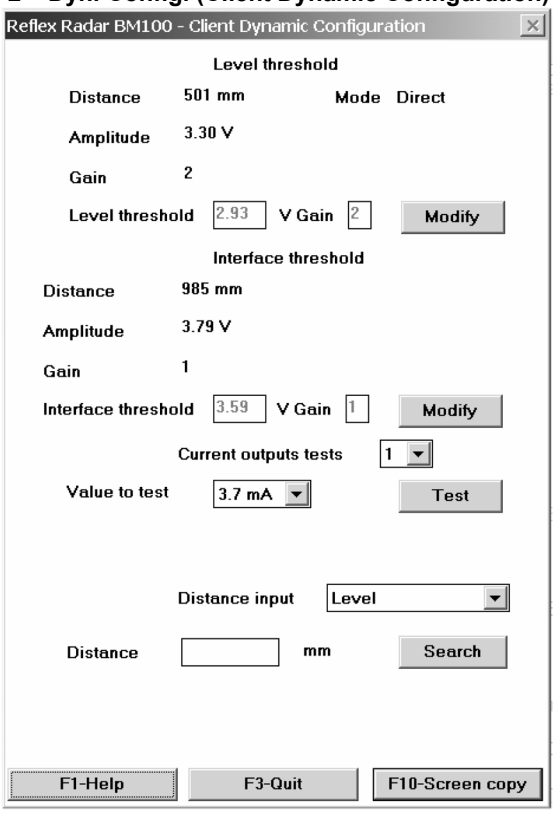
F10 – Screen copy Menu
To save a bitmap image of the active window.

Alt F1 – Oscilloscope Menu



Item	Item Description
1	Zoom - - increase time scale
2	Zoom + - reduce time scale
3	F6: Numerize : PC-STAR will record oscilloscope data when the F6 button is pressed in this window. Once this button is pressed, some time is required to process the data before being displayed. This function will not be available when in play back mode (Record Reading).
4	Maximum limit on scale
5	Factory configured probe length, L2
6	Status Markers (as given on gauge)
7	Time and date of time slice
8	Asked for gain: forces PC STAR to look for the level pulse using a requested gain.
9A	Indicator for identifying the level pulse
9B	Indicator for identifying the interface pulse
10	Hatched area: dead zone
11	Current gain: gain used by the gauge now to find the level pulse

Alt F2 – Dyn. Config. (Client Dynamic Configuration) menu



1 Level and Interface Thresholds and Gains may be modified.

2 The current outputs may be tested at 3.7, 4, 12, 20 or 22mA.

3 The user may force the gauge to search at a certain distance from the flange for a lost reflection by using the Level or Interface Distance Input function.

The table displays peak amplitude of the pulse in volts and the measurement mode (direct, TBF…).
Other functions:-

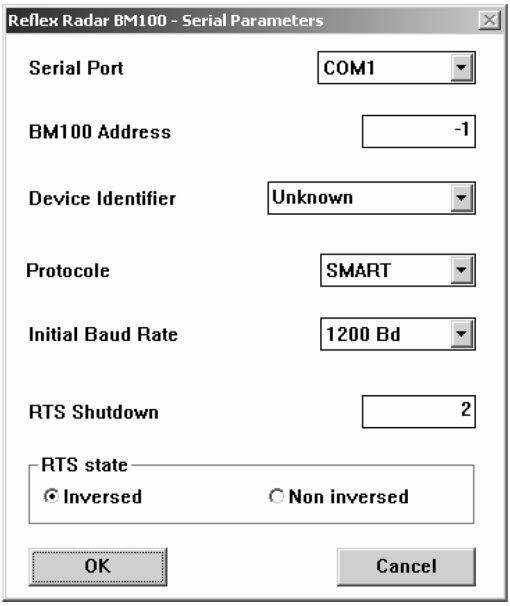
F1 – Help	On-line help file
F3 – Exit	Exit to real-time measurement main window
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

9.4.3 F3 Exit:

To quit PCSTAR.

9.4.4 F4 Serial (parameters):

For configuring the gauge for networks



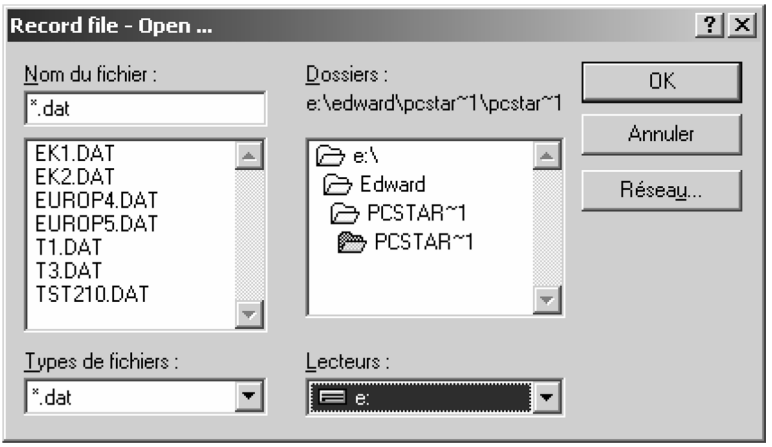
This will allow the user to select a particular device in the network. A window will open with the parameters available explained below:

Serial Port	The serial port allows the user to select a free serial port (COM 1 to 4) on the computer.
BM100 Address	Type the “Address” that you have given a gauge (a value between 0 and 255) and press ENTER or OK. This will select the required device. If you are in a point to point network leave the box at its default value (-1).
Device Identifier	Device Identifier refers to the “Device number” given in User Function No. 1.4.4.
Protocol	Protocol refers to the signal received from the gauge. Use : RS485 (using SMART as the base signal) for RS485 networks. SMART or HART for point to point networks.
Initial baud rate	This may be changed depending on the protocol: SMART communication is restricted to 1200 Baud. RS485 communication may be used between 1200 and 19600 Baud. Trials should be run to find the optimum operating conditions.
RTS shutdown	A parameter for communication between the PC and gauge using the RTS signal. This defines the time frame in which data is transmitted. This value is dependant on the Operating System used by the PC. Default value 0
RTS state	The RTS state depends on the type of RS232 converter used. For: RS232<>HART™(i.e. VIATOR from MACTEK) and RS232<>RS485 (i.e. K485-ISOL from KK Systems Ltd.) use inversed RTS state.

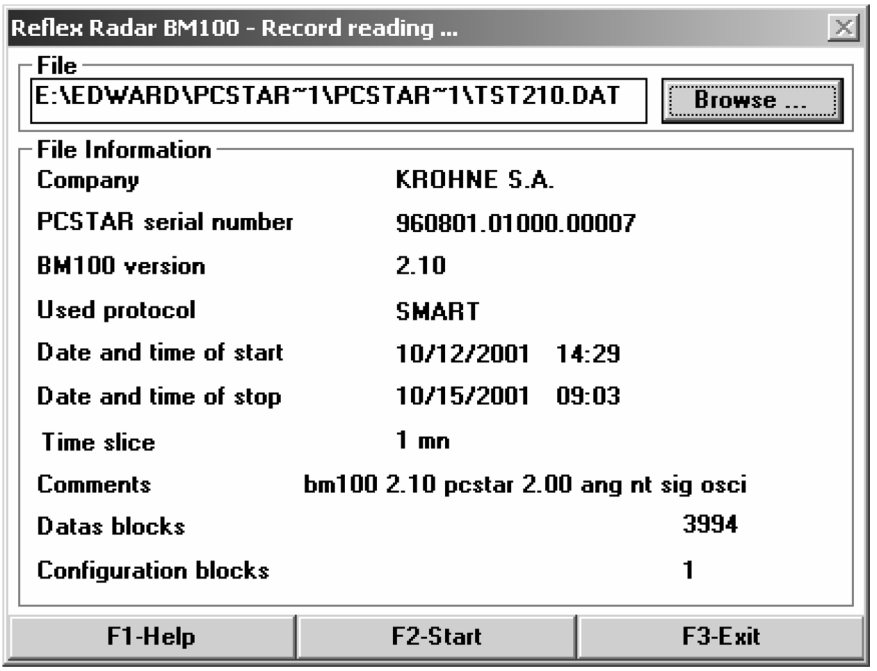
9.4.5 F5 Record Reading

Play back functions.

1. The function will display a window: Record file – Open…. Browse for the DAT file required. Press OK to open file or Cancel to quit.

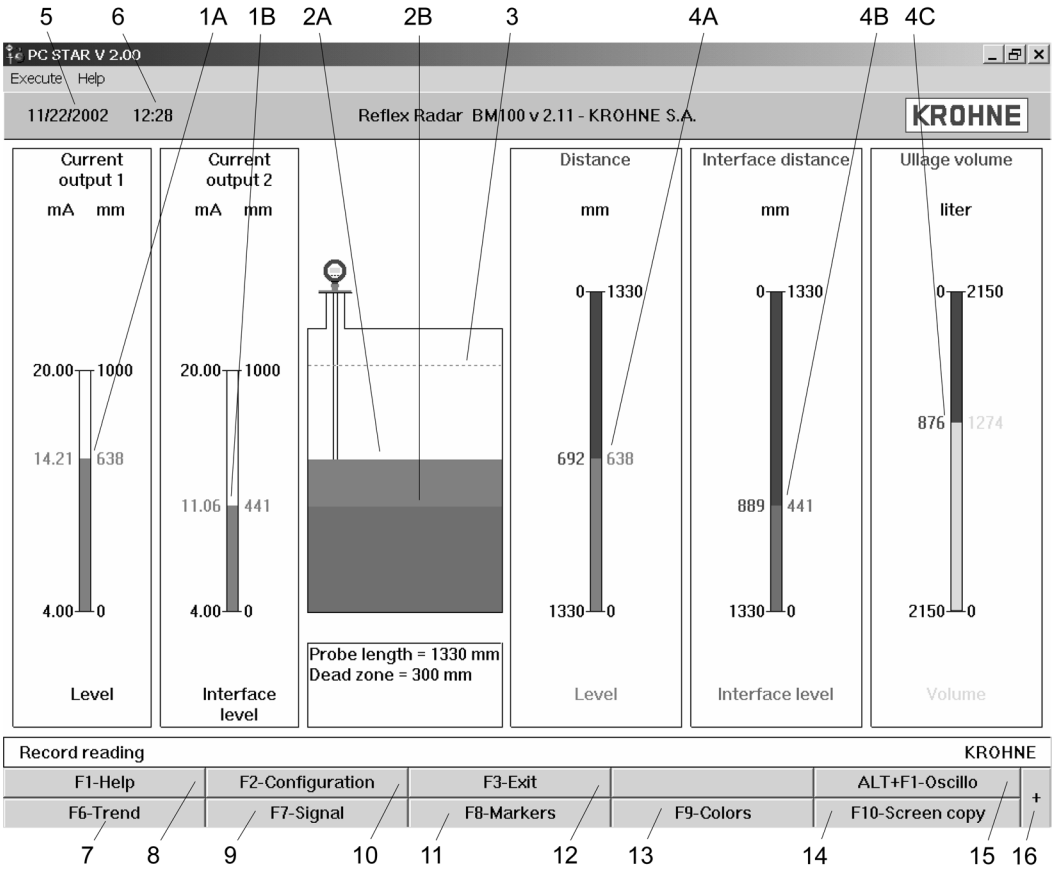


2. When OK is pressed, the DAT file details are displayed.



Functions:

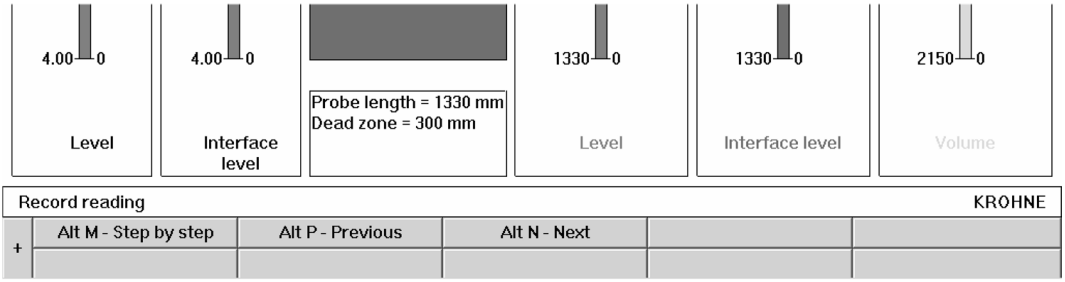
F1 – Help	On-line help file
F2 – Start	Start reading the file data. Goes to record reading main window – see below.
F3 – Exit	Exit to main title window



Record reading main screen

Item	Item Description
1A & 1B	(A) Current output 1/ level in mA/mm; (B) Current output 2/ interface level in mA/mm
2A & 2B	Tank diagram showing current position of (A) level and (B) interface.
3	Dead zone limit
4A, B & C	(A) Distance/ level of top product in mm, (B) Interface distance/ interface level of bottom product 2 in mm, (C) Ullage volume/ volume in liters* (*configurable display).
5	Date of time slice
6	Time of time slice
7	F6: Trend function – shows level and interface over time recorded
8	F1: Help – on-line help function
9	F7 : Signal – shows return signal received by gauge at a given time and date
10	F2 : Configuration – access to user menu. The settings here are read-only. This list will also show modifications to the gauge settings over the time measurement data is recorded
11	F8 : Markers – Error indicators activated at a given time and date
12	F3 : Exit Record Reading window
13	F9 : Colors – change screen component colours as shown in Section 9.4.7
14	F10 : Screen copy – function for saving bitmaps of the current screen.
15	AltF1: Oscilloscope – to display signal amplitude/return signal time at a given day and time.
16	+: playback functions

The Signal, Trend, Markers, Configuration function windows given in the list on the preceding page correspond to those found in the real-time display windows with the exception that the real-time functions are suppressed, i.e. F6 Numerize in the Alt F1 Oscilloscope window.



Bottom of Record Reading main screen when the "+" sign is pressed

"+" sign …at the bottom right hand side of the window. This will access the viewing features in the Record Display Window (item 16 on diagram 70 above).

Alt M to view either the data in Continuous mode or in Step by step mode.

Alt N to view "Forward" (Continuous mode) or "Next (step)" (Step by step mode).

Alt P to view "Backwards" (Continuous mode) or "Previous (step)" (Step by step mode).

Alt B Reading Position - A slider control appears to permit the user to browse quickly through the time slices recorded.

9.4.6 F7 Configuration

Remote gauge configuration. This permits the user to create, load (open file on PC STAR), modify and save new configurations without changing the current settings. The software will ask the user which Embedded Software version is in the EPROM chip of the BM100A gauge. Select the version that corresponds to the gauge in question & press OK to go to Record reading main screen. Please refer to page 67 for more details.

Functions available: User functions 1.1.1 to 1.1.7 : Basic Parameters
User functions 1.2.1 to 1.2.6 : Display Parameters
User functions 1.3.1 to 1.3.8 : Current Output Parameters
User functions 1.4.1 to 1.4.9 : User Data Parameters
User functions 1.5.1 to 1.5.9 : Application Parameters
User functions 1.6.1 to 1.6.2 : Serial Input/Output Parameters
User functions 1.7.1 to 1.7.3 : Strapping Table Parameters

F1 – Help On-line PCSTAR Help

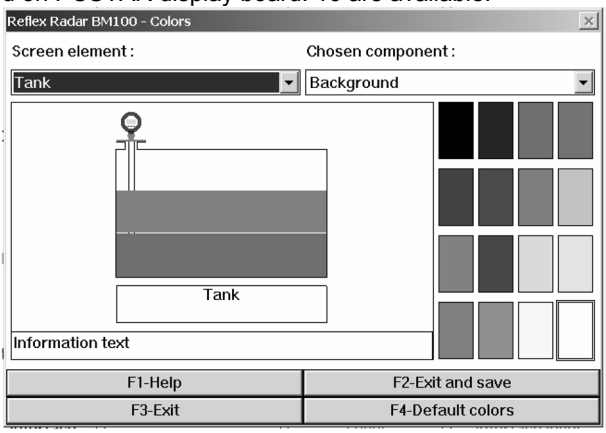
F2 – Load from disk This permits the user to browse for and open a gauge settings file (format KRF) on PCSTAR without connecting and loading the settings onto the gauge.

F3 – Exit To main title window

F5 – Save to disk This permits the user to browse for and save a new or modified gauge settings file (*.KRF) without connecting and loading the settings onto the gauge.

9.4.7 F9 Colors

Change colours used on PCSTAR display board. 16 are available.



F1 – Help	On-line PCSTAR Help
F2 – Exit and save	Saves new settings for the screen elements concerned
F3 – Exit	Exit to main title window without saving modified elements.
F4 – Default colors	Reset to original colour scheme

Modifiable color parameters

Screen elements	**Chosen component**
Select display window from the drop-down menu	Selected by scrolling through a drop-down menu or by clicking on the element concerned. Click on colour palette to select colour and press F2 to save modified settings and exit.
Tank	Background, tank, text, level, interface level, shadow, information background, information text and light
Current outputs	Background, current outputs text, current output 2, current output 1,shadow and light
Measurement bar graphs	Background, level, text, distance, interface level, volume, ullage volume, shadow and light.
Signal	Background, dead zone ,frame, grid, signal, position arrow, actual gain, other gains, shadow and light
Trend/Markers	Background, markers, frame, grid and position cursor

9.4.8 Other important PCSTAR functions

Ctrl Alt R: Reflex Radar BM100 A – Reset

This resets the gauge. This should be done before operating with a new configuration. It empties the old data temporarily stored in the gauge memory and permits the gauge to go through a series of checks to accept and operate with a new configuration.

Alt E: Connection – Epsilon R **Warning: critical parameter!**

Only available when PCSTAR is communicating with the gauge and the real-time main measurement display is selected. This permits dynamic configuration of the product's dielectric constant for interface and Tank Bottom Following (TBF) measurement applications only. This corresponds to User Function 1.5.5 (Epsilon R) in the User's configuration menu.

Alt L: Connection – Linearization Table **Warning: critical parameter!**

A four-point linear calibration table. The BM100A normally requires no optimisation of accuracy by the user following calibration at the factory of origin. For further information, please contact the local KROHNE service centre or refer to the relevant section in the BM100A Service Manual.

Ctrl Alt C: Connection – Calculator

A calculator with basic mathematical functions appears.

Appendix A: Returning a device for testing or repair to KROHNE

Your instrument has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems. Should you nevertheless need to return an instrument for servicing or repair, please pay strict attention to the following points:

- Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, KROHNE may only handle, test and repair returned instruments that have been in contact with liquids without risk to personnel and environment.
- This means that KROHNE can only service your instrument if accompanied by the following certificate confirming that the instrument is safe to handle. If the instrument has been operated with toxic, caustic, flammable or water-endangering liquids, you are kindly requested :
- to check and ensure, if necessary by rinsing or neutralising, that all cavities in the instrument are free from such dangerous substances. (Directions on how you can find out whether the primary head has to be opened and flushed out or neutralised are obtainable from KROHNE on request.)
- to attach a certificate to the instrument confirming that the instrument is safe to handle and stating the liquid used.

We cannot service your instrument unless accompanied by such a certificate.

Specimen certificate

Company: _____ Address: _____

Department: _____ Name: _____

Tel. No.: _____ Fax No.: _____

The enclosed instrument _____

Type: _____

KROHNE Order No. or Series No _____

has been operated with the following process liquid _____

Because this process liquid is

- ☐ water-hazardous
- ☐ toxic
- ☐ caustic
- ☐ flammable

we have

- ☐ checked that all cavities in the instrument are free from such substances
- ☐ flushed out and neutralised all cavities in the instrument

We confirm that there is no risk to humans or environment through any residual liquid contained in the instrument.

Date: _____ Signature: _____

Company stamp:

Appendix B: BM 100 A Level Gauge Configuration Record

For all service calls when a PC STAR record file or factory supplier data sheet is not available.

Fct.Nbr.	Function	Configuration
1.1.0 Basic parameters		
1.1.1	Tank Height	
1.1.2	Hold Distance	
1.1.3	Time Constant	
1.1.4	Window Frozen	
1.1.5	Level Window	
1.1.6	Interface Window	
1.1.7	Probe Length	
1.2.0 Display Functions		
1.2.1	Display Mode	
1.2.2	Display item	
1.2.3	Cycle Time	
1.2.4	Length Unit	
1.2.5	Volume Unit	
1.2.6	Error Message	
1.3.0 Current Functions		
1.3.1	Function I 1	
1.3.2	Range I 1	
1.3.3	Scale I 1 Min	
1.3.4	Scale I 1 Max	
1.3.5 *	Function I 2	
1.3.6 *	Range I 2	
1.3.7 *	Scale I 2 Min	
1.3.8 *	Scale I 2 Max	
1.4.0 User Data Functions		
1.4.1	Language	
1.4.2	Entry Code 1	
1.4.3	Code 1	
1.4.4	Device Number	
1.4.5	Serial Number	
1.4.6	French Comm No.	
1.4.7	German Comm No.	
1.4.8	Option	
1.4.9	Sensor Type	
1.5.0 Application Functions		
1.5.1	Level - first reading from display = reflection amplitude	
	Gain / Amplitude	
	- second reading from display = threshold	
	Gain / Amplitude	
1.5.3	Detection Delay	
1.5.4 **	Interface - first view from display = reflection amplitude	
	Gain / Amplitude	
	- second reading from display = threshold	
	Gain / Amplitude	

Fct.Nbr.	Function	Configuration
1.5.5	Epsilon R**	
1.5.7	Settling	
1.5.8	Cleaning In Place	
1.5.9	Application Mode	
1.6.0 Serial Input /Output		
1.6.1	Transmission Rate	
1.6.2	Address (networks)	
1.7.0 Volume Strap Table		
1.7.1	Volume Unit	
1.7.2	Strap Table Input	

Comments

* if second output ordered

** for interface applications

Strapping Table values (specify units) :

Pt	Level	Volume	Pt	Level	Volume
1			26		
2			27		
3			28		
4			29		
5			30		
6			31		
7			32		
8			33		
9			34		
10			35		
11			36		
12			37		
13			38		
14			39		
15			40		
16			41		
17			42		
18			43		
19			44		
20			45		
21			46		
22			47		
23			48		
24			49		
25			50		

Konformitätserklärung

Wir : KROHNE SA
Usine des Ors
26103 ROMANS
France

erklären in alleiniger Verantwortung, daß das Produkt :

Füllstandmesser
BM100 A

auf das sich diese Erklärung bezieht, mit den folgenden Normen oder normativen Dokumenten übereinstimmt :

Niedrigspannung	NF EN 61010-1
EMV	EN 50081-1
	EN 50082-2
ATEX*	EN 50014
	EN 50018
	EN 50019
	EN 50020
	EN 50284
	EN 50281-1-1

*Nur für Ex Geräte
gemäß den Bestimmungen der Richtlinien 89/336/EWG (Elektromagnetische Verträglichkeit), 73/23/EWG (Niederspannungsrichtlinie) und 94/9/EG (ATEX).

Romans, den 29. Oktober 2001

Christian Savary
Geschäftsleiter

Declaration of Conformity

We : KROHNE SA
Usine des Ors
26103 ROMANS
France

declare under our sole responsibility that the product :

Level Measuring Instrument
BM100 A

to which this declaration relates, is in conformity with the following standards or other normative documents :

Low tension	NF EN 61010-1
EMC	EN 50081-1
	EN 50082-2
ATEX*	EN 50014
	EN 50018
	EN 50019
	EN 50020
	EN 50284
	EN 50281-1-1

*For Ex devices only
according to the provisions of Directives 89/336/EEC (Electromagnetic Compatibility), 73/23/EEC (Low Voltage Directive) and 94/9/EC (ATEX).

Romans, October 29th, 2001

Christian Savary
General Manager

Déclaration de conformité

Nous : KROHNE SA
Usine des Ors
26103 ROMANS
France

déclarons sous notre seule responsabilité que le produit :

Transmetteur de niveau
BM100 A

auquel se réfère cette déclaration, est conforme aux normes ou autres documents normatifs :

Basse tension	NF EN 61010-1
CEM	EN 50081-1
	EN 50082-2
ATEX*	EN 50014
	EN 50018
	EN 50019
	EN 50020
	EN 50284
	EN 50281-1-1

*Seulement pour les appareils EX
conformément aux dispositions des directives 89/336/CEE (Compatibilité Electromagnétique), 73/23/CEE (Basse Tension) et 94/9/CE (ATEX).

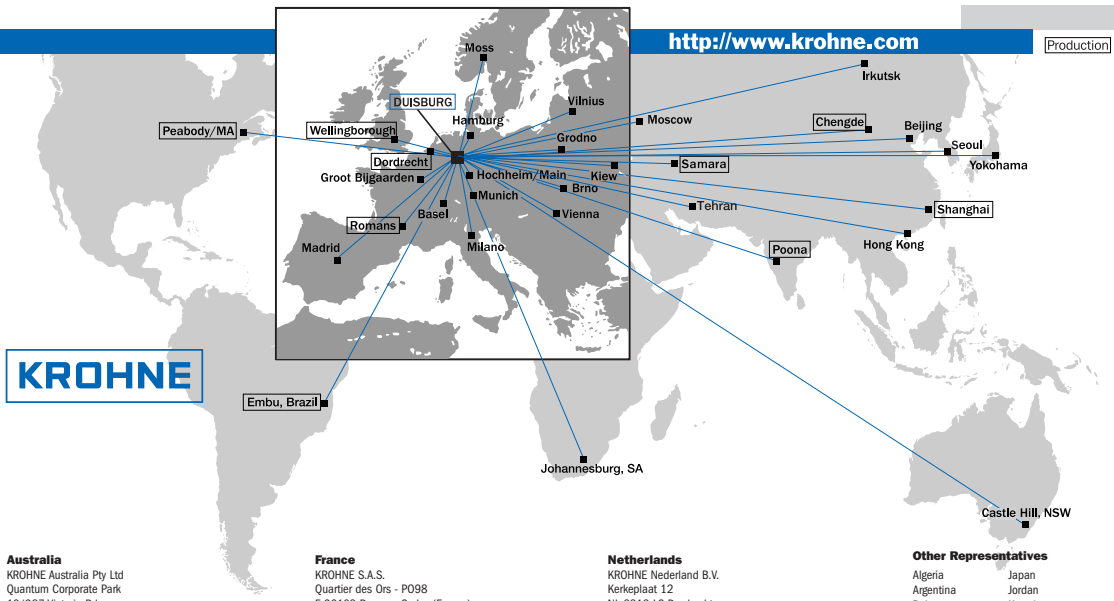
Romans, le 29 octobre 2001

Christian Savary
Directeur Général

Notes

Notes

Notes



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