TECFLUID
the art of measuring

Instructions manual

LR Series

Radar level transmitter for liquids and solids

R-MI-LR Rev.: 0 english version

PREFACE

Thank you for choosing a product from Tecfluid S.A.

This instruction manual allows the installation, configuration, programming and maintenance. It is recommended to read it before using the equipment.

WARNINGS

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- Tecfluid S.A. reserve the right to make changes as deemed necessary at any time and without notice, in order to improve the quality and safety, with no obligation to update this manual.
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- Keep this manual in a place where you can find it when you need it.
- In case of loss, ask for a new manual or download it directly from our website www.tecfluid.com Downloads section.
- Any deviation from the procedures described in this instruction manual, may cause user safety risks, damage of the unit or cause errors in the equipment performance.
- Do not modify the equipment without permission. Tecfluid S.A. are not responsible for any problems caused by a change not allowed. If you need to modify the equipment for any reason, please contact us in advance.

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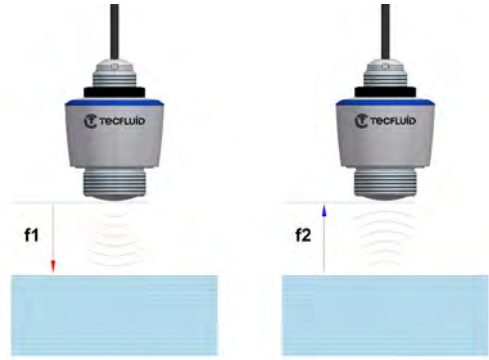
SERIES LR

1 INTRODUCTION

The LR series are transmitters for continuous non-contact level measurement. They are suitable for level measurement in liquids and solids for various types of industry. This document allows mounting, wiring and commissioning of the VEGAPULS sensor models C11 and C21 respectively. As well as the necessary instructions for correct use, maintenance, fault rectification and replacement of parts.

2 WORKING PRINCIPLE

The LR series sensors perform their measurement by emitting a continuous, frequency-modulated signal to the product (f1). This signal is reflected by the liquid or solid of interest, and captured by the antenna in the form of an echo but with a modified frequency (f2). The difference between the frequency of the emitted signal and the received signal is proportional to the measurement distance, thus knowing the filling height and consequently the level of the liquid or solid to be measured.



Wave emision with frequency f1

Echo reception with frequency f2

3 MODELS

- VEGAPULS C11 — 2-wire system, with a maximum detection range of 8 m (26,2 ft)
- VEGAPULS C21 — 2-wire system and HART protocol with maximum detection range of 15 m (50 ft)

4 RECEPTION

The LR series level sensors are supplied conveniently packed for transport and with their corresponding instruction manual for installation and use. All instruments have been tested in our facilities and are ready for installation and operation. Upon receipt the customer should immediately check the integrity of the sensor, as well as report to Tecfluid S.A. any damage due to transport, if any.

4.1 Unpacking

Carefully unpack the instrument, removing any remaining packaging.

4.2 Stocking

To ensure the integrity of the equipment during storage, the packages must be kept closed until assembly, and stored in accordance with the placement and storage markings on the outside. The storage conditions are as follows:

A) Do not keep outdoors

B) Store dry and free of dust

C) Do not expose to any aggressive environment

D) Protect from sunlight

E) Avoid mechanical vibrations

F) Recommended storage temperature -40 ºC … +80 ºC

4.3 Transmitter materials

The materials that make up each LR series transmitter are shown in the following figure and table.

Nº	Description	Materials
1	Radar antenna	PVDF
2	Process fitting	PVDF
3	Electronic housing	PVDF
4	Counter nut	PP
5	Mounting thread	PVDF
6	Connection cable	PVC/PUR

5 INSTALLATION

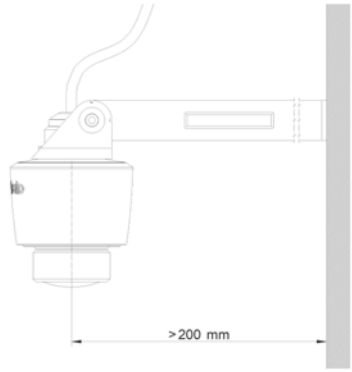
The transmitter has to be installed ensuring that the parts of the equipment are the most suitable for the process conditions and in accordance with its technical characteristics (see page 31). For the process conditions the following conditions have to be considered: pressure, temperature and chemical properties involved in the process, as well as abrasion and mechanical influences.

5.1 Mounting conditions

The level transmitter should be installed in such a way that the antenna face is as parallel as possible to the product surface to ensure correct measurement. It should also be verified that the minimum distance to the tank wall is 200 mm (see figure).

If this distance cannot be maintained due to the installation, an interference signal suppression has to be carried out. This type of signal suppression is useful for tanks on the walls of which product residue builds up. For this purpose, it is best to carry out the signal suppression after the buildup is present in order to create a readjustment. In the case of centered installation in vessels with vaults or round lids, multiple echoes can occur, which can, however, be compensated by a corresponding adjustment (see section "Setup of sensor with PC/Laptop" in page 22). When installing in vessels with a conical bottom, the transmitter should be mounted in the center of the vessel, as this enables measurement down to the bottom (see figure for a mounting for an application with liquids).

A support arm with a G1 threaded opening can be used as a mounting variable, if required by the application. The device must be fastened to this arm with a plastic locknut. As a recommendation, the distance to be left between the sensor and the wall is as shown in the following figure.



5.2 Polarization

The LR series transmitters emit electromagnetic waves, these waves have an electrical component that has a direction, this direction is known as the polarization.

The polarization point (1) is located at the center of the transmitter body as shown in the following figure. If the transmitter body is rotated, the polarization will change and thus the effect of the false echoes on the measured value will change. This has to be taken into account for any further mounting or modification.

5.3 Dead zone

LR series radar level transmitters have no dead zone. A zone up to 250 mm from the antenna is established in which the measurement accuracy is ±10 mm instead of the usual one.

5.4 Transmitter reference plane

The LR transmitter has its reference plane for level measurement located at the center of the antenna lens. This should be considered for the adjustment of both maximum and minimum level values as shown in the following figure.

Reference plane

5.5 Nozzle

When mounting the transmitter in sockets, it should be kept in mind that the socket should be as short as possible and its end should be rounded, to avoid interference reflections due to the socket itself. Also, it should be considered that the edge of the antenna protrudes a distance (l) of at least 5 mm from the socket (see figure).

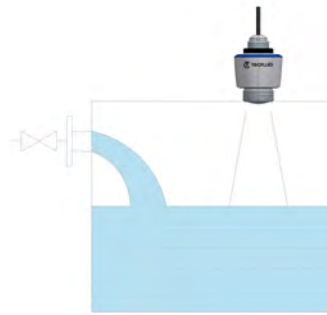
For cases in which the application can vary in diameter (d) and height (h) as shown in the following figure.

As a recommendation, the values for proposed deviating dimensions with respect to their length, shown in the following table, should be followed.

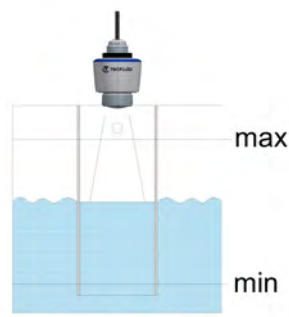
Socket diameter (d)		Socket Length (h)	
(mm)	(inches)	(mm)	(inches)
40	1.5	≤ 150	≤ 5.9
50	2	≤ 200	≤ 7.9
80	3	≤ 300	≤ 11.8
100	4	≤ 400	≤ 15.8
150	6	≤ 600	≤ 23.6

5.6 Inflowing medium or filling streams

Make sure that the sensor is installed on the surface of the product already stored, not on the inlet or filling current area (see figure).

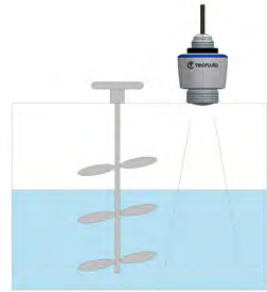


In the case of open tanks with possible sudden level variations or turbulences caused by cyclone suction, it is recommended to mount the sensor inside a protection tube with a length up to the minimum reading level and to provide an aeration orifice of about 5 .... 10 mm diameter (see figure).



5.7 Agitators

In case the installation is in tanks with stirring systems, a signal suppression has to be carried out after starting up the stirrer(s). This would ensure that all parasitic echo reflections are stored in different positions and it would be easier to suppress them from the measurement of interest (see figure).



In filling situations, agitation systems are very likely to cause the formation of foams. These foams can become very compact, causing a large damping in the signal emitted by the transmitter.

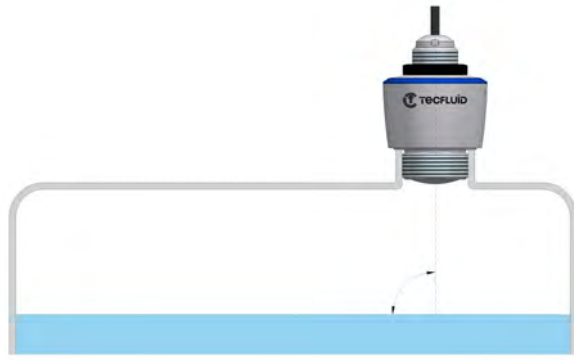
5.8 Vessel installations

In those tanks where there are internal elements, such as ladders, heating-cooling coils, struts, etc., stray echoes may appear and interfere with the useful echo.

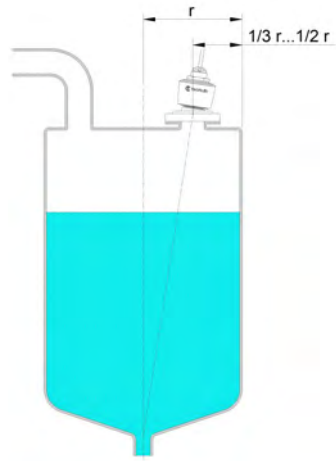
These echoes can be discriminated by making signal suppressions during start-up, but it is also possible to reduce these reflections by installing small metal or plastic screens. These plates help to disperse the wave reflections, avoiding the direct reception of echoes from these structures (see figure).

5.9 Sensor Orientation

When measuring liquid products, the instrument should be aligned as perpendicular as possible to the product surface (see figure). In this way, the best possible measurement results can be obtained.

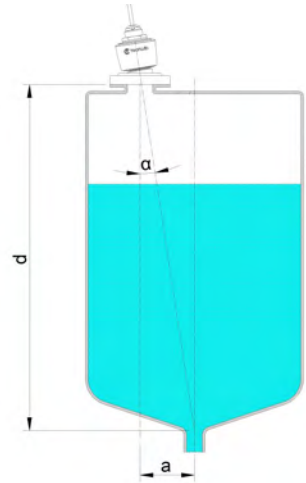


When measuring solid products, the instrument must be aligned in such a way that the radar signal reaches the lowest level of the vessel. In case of a cylindrical silo with conical outlet, the installation is carried out in a position corresponding to one third to one half of the vessel radius (r) (see figure).



5.10 Sensor Alignment

The alignment of the transmitter must be carried out according to the dimensions of the tank in which it is to be installed. The angle of inclination (α) required for the transmitter to be oriented to the bottom of the reservoir, depends on the dimensions (d) and (a) of the tank as shown in the following figure and next table.



Checking the orientation of the transmitter angle can be done easily with a bubble level. The following table shows the required angle of inclination, which depends on the measuring distance (d) and the distance from the center of the tank to the transmitter (a).

Angle (α)	**2º**	**4º**	**6º**	**8º**	**10º**
Distance d(m)	**Distance a (m)**				
2	0.1	0.1	0.2	0.3	0.4
4	0.1	0.3	0.4	0.6	0.7
6	0.2	0.4	0.6	0.8	1.1
8	0.3	0.6	0.8	1.1	1.4

As an example, for a tank whose measurement distance (d) is 6 m high and the sensor position is at a distance (a) of 0.8 m from the center of the tank. A tilt angle of (α) of 8º is required, according to the table, for a correct measurement.

6. FLOW MEASUREMENT

6.1 Initial recomendations

Before starting the measurement, the following aspects of the assembly should be taken into account:

A. The installation has to be carried out upstream or on the inlet side.
B. The position of the sensor should be at the center of the channel and as perpendicular as possible to the liquid surface, as mentioned in section 5.9.
C. The distance with respect to the maximum height reached in the channel should be greater than 250 mm to ensure optimum measurement accuracy.

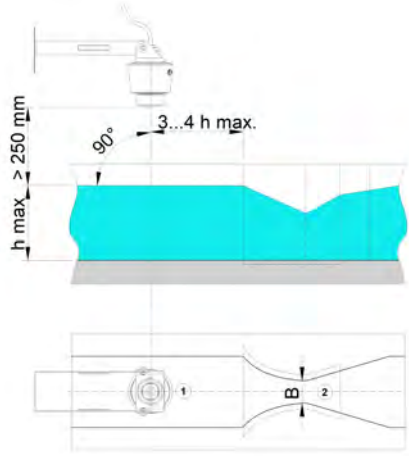
6.2 Flume measurement

Predefined channels:

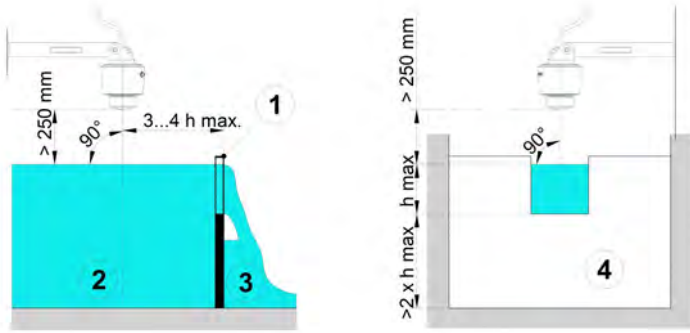
For a flow measurement in a flume, predefined curves, already included in the sensor, are available. These do not require any information about the channel dimensions, but simply choose the type of channel from the options shown in the table below:

Channel Type	Flow Formula (Q)
Palmer-Bowlus-Flume	$k \times h^{1.86}$
Khafagi-Venturi Trapezoidal dam Rectangular Channel	$k \times h^{1.5}$
Notch V-Notch Triangular spilway	$k \times h^{2.5}$

In the following figure, an installation scheme is shown with the sensor position (1) and for a Khafagi-Venturi type flume (2). The adjustment parameters would be the maximum filling height (h_{max}) and the further narrowing of the channel (B).



The following figure shows the scheme for the case of application in a rectangular channel. It consists of a spillway gate side view (1) and downstream view (4), which separates upstream (2) and downstream (3).



Channels with dimensions according to ISO standard:

For a flow measurement in a flume with standard ISO dimensions, it is necessary to know the flume dimensions. These dimensions must be parameterized in the sensor. By entering these parameters in the sensor, compared to the predefined channels, a higher measurement accuracy will be obtained. The following table shows the ISO standard channels supported by the sensor.

Flume type	ISO
Rectangular	4359
Trapezoidal	4359
U-shaped	4359
Triangular overfall thin-walled	1438
Rectangular flume thin-walled	1438
Rectangular weir broad crown	3846

Flow formula:

If the characteristic equation for the flow rate of the customer's channel is known, the alternative “Flow formula” is the best option. This option has to be selected as "Flow formula". This will increase the accuracy of the flow measurement.

Manufacturer definition:

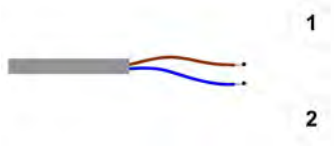
If the customer will use a Parshall type channel from ISCO, this option must be selected. As an alternative to this configuration, it is possible to accept the values of the Q/h table provided by the manufacturer. These can be found in the documentation: ISCO-Parshall-Flume , and the Q/h table where the corresponding height must be selected for each customer application case.

7. ELECTRICAL CONNECTION

The electrical connection must be carried out by qualified personnel only. For any connection, the power supply to the unit must be disconnected.

The electrical operating parameters are indicated in the Technical Characteristics section (see page 31).

The power supply to the sensor must be provided by a power-limited circuit with a maximum power of 1100 W and in accordance with IEC 61010-1. Additional external influences on the supply voltage have to be considered as well, these can be: Low output voltage of the power supply and interference in the current circuit due to other equipment connected on the same line as the sensor. For electrical connection, the LR series level meter is provided with a cable connected in fixed mode. If extension is required, it is possible to use a two-wire power cable. The wires are identified by color, being the brown wire (1) for the pole (+) and the blue wire (2) for the pole (-) of the power supply line (see wiring in the following figure).



Once the sensor is powered for the first time, it performs some self-test routines, in which the equipment internally checks its electronics, and sets the output signal to fault. Subsequent to this routine, the equipment starts the actual measurement transmission on the signal line.

8. BLUETOOTH CONNECTION

8.1 Setup of sensor with a smartphone/tablet

In order to carry out wireless communication properly between your mobile device such as smartphone or tablet, the following requirements have to be met:

Supported operating systems:	iOS 8 or newer Android 5.1 or newer
Device Bluetooth version:	Bluetooth 4.0 LE or newer

Once these requirements have been verified, the "*Wireless Device Configurator*" application must be downloaded from the "Apple App Store" or "Google Play Store".

Once the application has been started on the mobile device, select the "*Setup & Diagnostics*" option on the initial screen. A list of demonstration devices will be displayed immediately. To start the search routine for all available Bluetooth-enabled sensors in the environment, press the button located below the "Show Bluetooth devices" list (see figure).

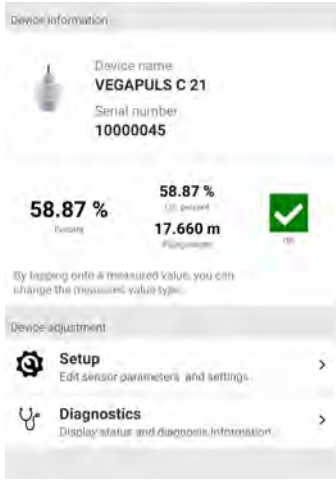
Subsequently, a list of the devices found in the search will be displayed continuously. From this list, the model of sensor to which we want to connect must be selected, for our case sensors C11 or C21.

As part of the first connection made between the mobile device and the sensor, the user is automatically prompted for a first security authentication. Once the first authentication has been successfully established, no further authentication will be required for each subsequent sensor connection.

In order to authenticate, a 6-digit code defined as a PIN code is required. This PIN code is engraved on the housing of the device as well as on the transmitter's data sheet (see figure below).

When the PIN code is entered incorrectly, it is possible to enter it again, but after a certain period of time, this period becomes longer and longer depending on the number of incorrect entries. The "Waiting for authentication" message will also be displayed on the screen of the mobile device.

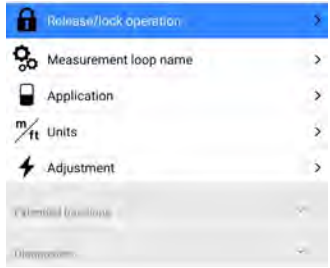
Once the connection is correctly established, all the information regarding the selected equipment will be displayed as shown in the following figure.



8.2 Parameters adjustment

Parameterization of the sensor is only possible if the parameterization protection is deactivated. When the sensor is delivered, the device has the parameterization protection deactivated ex works. However, it can be activated/deactivated as desired.

To activate or deactivate the blocking, simply access the "Start-up" section of the main screen of the unit shown in the figure above, and then select the "Activate/deactivate operation" option (see figure).



It is recommended to enter a 6-digit password to protect the parameterization as shown in the following figure.

Once the parameterization is activated, the parameters can be adjusted in the different sections described below:

Measurement loop name: in case of having more than one sensor located, it is possible to identify them by providing them with a name of the measurement point, where they are located.

Application: in this section the application conditions in which the sensor will work are specified. Specifying the type of medium (liquid or solid), and the type of tank of the application (storage tank, agitator tank, dosing tank, among others).

Units: this section specifies the working units for the distance measurement of the equipment and the temperature measurement units.

Adjustment: in this section the maximum and minimum distances A and B corresponding to the application tank are indicated.

Using the various parameterization sections, the desired parameters are to be entered for each application case of the sensor.

8.3 Setup of sensor with PC/Laptop

The following requirements must be met for proper wireless communication between your PC/Notebook:

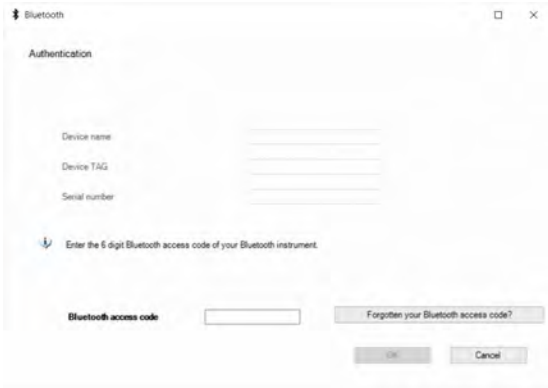
Supported operating systems:	Windows 10
Software :	DTM Collection 10/2020 or newer
Bluetooth Device version:	Bluetooth 4.0 LE o superior

Once it has been verified that the above system requirements have been met on the customer's equipment, the "PACTware" software and the respective "DTM" drivers must be installed from the following web link. The "PACTware" version and the available "DTMs" are summarized in a DTM-Collection respectively.

Before starting the "PACTware" software, the device must be checked to ensure that the Bluetooth data transmission and reception is active. Subsequently, to establish a first connection to the sensor, select device C11 or C21 from the project tree to start an online parameterization.

As with the connection of the sensor to mobile devices, the first time the device is connected, it must be authenticated. Once the first connection has been saved, subsequent authentications are not necessary.

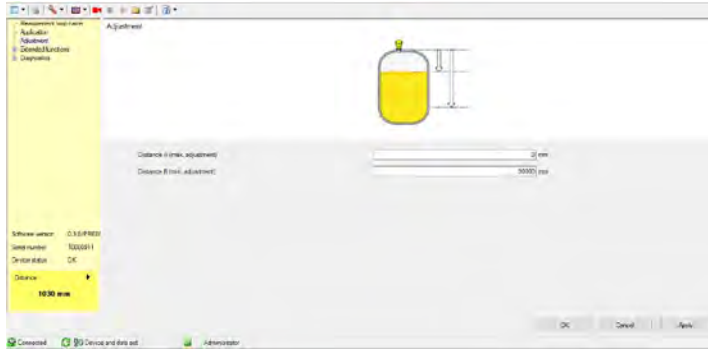
For authentication, the 6-digit code must be entered in the menu window shown in the following figure.



The code is engraved on the outside of the sensor housing and on the "PINs and codes" information sheet that comes in the equipment packaging.

When the PIN code is entered incorrectly, it is possible to enter it again, but after a certain period of time, this period becomes increasingly longer depending on the number of incorrect entries. The "Waiting for authentication" message will also be displayed on the PC/ laptop screen.

Once the connection to the sensor has been established, a parameterization screen is displayed as shown in the following figure.



8.4 Menu overview

This section provides a general description of the PC/laptop application PACTware with its different sections and functions.

Start Image		
Device information	**Actual measured values**	**Device status**
Device name Software version Serial number	Percent, filling height, distance, measurement reliability, electronics temperature, meas. rate etc.	OK Error indication

Basic functions		
Menu item	**Selection**	**Basic settings**
Measurement loop name	Alphanumeric characters	Sensor
Medium	Liquid Bulk solid	Liquid
Application liquid	Storage tank, agitator tank, dosing tank, pumping station/pump shaft, rain overflow basin, tank/collection basin, plastic tank (measurement through tank top), mobile plastic tank (IBC), level measurement in waters, flow measurement flume/overflow, demonstration	Storage tank
Application bulk solid	Silo (slim and high), bunker (large volume), stockpile (point measurement/profile detection), crusher, demonstration	Silo (slender and high)

Basic functions		
Menu item	**Selection**	**Basic settings**
Units	Distance unit of the device Temperature unit of the instrument	Distance in m Temperature in °C
Adjustment	Max. adjustment (distance A) Min. adjustment (distance B)	Max. adjustment 0 m Min. adjustment Model C11 = 8 m Model C21 = 15 m

Extended functions		
Menu item	**Selection**	**Basic settings**
Damping	Integration time	0 s
Current output	Output characteristics Current range Reaction when malfunctions occur	0 ... 100 % Correspond to 4 ... 20 mA 3.8 … 20.5 mA < 3.6 mA
Linearisation	Linearization type Intermediate height	Linear
Scaling	Scaling size Scaling unit Scaling format 100 % correspond to 0 % correspond to	Volume (l) Liter 100 l 0 l
Display	Menu language Displayed value Backlight	- Distance On
Access protection	Bluetooth access code Protection of the parameterization	- Deactivated
False signal suppression	Create new, extend, delete, manual entry Sounded distance to the medium	- 0 m
Interference behaviour	Last measured value, maintenance message, fault signal Time until fault signal Delivery status, basic settings	Last measured value 15 s -
Reset	Delivery status, basic settings	-

Extended functions		
Menu item	**Selection**	**Basic settings**
Mode	Mode 1: UE, Albania, Andorra, Azerbaiyán, Australia, Bielorrusia, Bosnia y Herzegovina, Gran Bretaña, Islandia, Canadá, Liechtenstein, Moldavia, Mónaco, Montenegro, Nueva Zelanda, Macedonia del Norte, Noruega, San Marino, Arabia Saudí, Suiza, Serbia, Turquía, Ucrania, EE.UU. Mode 2: Corea del Sur, Taiwán, Tailandia Mode 3: India, Malasia, Sudáfrica Mode 4: Rusia, Kazajstán	Mode 1
Status signals	Function check Maintenance required Out of specification	On Off Off

Diagnostics		
Menu item	**Selection**	**Basic settings**
Status	Device status Parameter modification counter Measured value status Status output HART Device Status Status additional measured values	-
Echo curve	Indication of echo curve	-
Peak indicator	Peak indicator distance, measurement reliability, meas. rate, electronic temperature	-
Measured values	Measured values Additional measured values Outputs	-
Sensor information	Device name, serial number, hardware/software version, device revision, factory calibration date	-
Sensor characteristics	Sensor features from order text	-
Simulation	Measured value Simulation value	-
Measured value memory (DTM)	Indication measured value memory from DTM	

8.5 Definition of sensor applications

As part of the menu, the user is allowed to optimally adapt the sensor to the application, site of aplication and measurement conditions that best suit his use case. Any adjustment possibility will be guided by the choice between whether the product is "Liquid" or "Bulk solid".

Application - Liquid		
Case	**Vessel**	**Process/measurement conditions**
Storage tank	Large volume Upright cylindrical Horizontal round	Slow filling and emptying Smooth medium surface Multiple reflections from dished vessel ceiling Condensation
Stirrer vessel	Large agitator blades of metal Installations like flow breakers, heating spirals Nozzle	Frequent, fast to slow filling and emptying Strongly agitated surface, foam and strong vortex generation Multiple reflections through dished vessel ceiling Condensation, buildup on the sensor Further recommendations: False signal suppression when the agitator is running via the operating tool
Dosing vessel	Small vessels	Frequent and fast filling/ emptying Tight installation situation Multiple reflections through dished vessel ceiling Product buildup, condensate and foam generation
Pumping station/Pump shaft		Partly strongly agitated surface Installations such as pumps and ladders Multiple reflections through flat vessel ceiling Dirt and grease deposits on shaft wall and sensor Condensation on the sensor Further recommendations: False signal suppression via the operating tool

Application - Liquid		
Case	**Vessel**	**Process/measurement conditions**
Overflow basin	Large volume Partly installed underground	Partly strongly agitated surface Multiple reflections through flat vessel ceiling Condensation, dirt deposits on the sensor Flooding of the sensor antenna
Vessel/Collecting basin	Large volume Upright cylindrical or rectangular	Slow filling and emptying Smooth medium surface Condensation
Plastic tank (measurement through the vessel top)		Measurement through the tank top, if appropriate to the application Condensation on the plastic ceiling In outdoor facilities, water and snow on vessel top possible Further recommendations: When measuring through the tank ceiling, false signal suppression via the operating tool . When measuring through the tank top in outdoor areas protective roof for the measuring point
Transportable plastic tank (IBC)		Material and thickness different Measurement through the vessel top, if appropriate to the application Changed reflection conditions as well as jumps in measured values when changing vessels Further recommendations: When measuring through the tank ceiling, false signal suppression via the operating tool When measuring through the tank top in outdoor areas protective roof for the measuring point

Application - Liquid		
Case	**Vessel**	**Process/measurement conditions**
Gauge measurement in waters		Slow gauge change Extreme damping of output signal in case of wave generation Ice and condensation on the antenna possible Floating debris sporadically on the water surface
Flow measurement flume/ Overfall		Slow gauge change Smooth to agitated water surface Measurement often from a short distance with the demand for accurate measurement results Ice and condensation on the antenna possible
Demonstration		Instrument demonstration Object recognition/monitoring Fast position changes of a measuring plate during functional test

Application - Bulk solid		
Case	**Vessel**	**Process/measurement conditions**
Silo (slender and high)		Interfering reflections due to weld seams on the vessel Multiple echoes/diffuse reflections due to unfavourable pouring positions with fine grain Varying pouring positions due to outlet funnel and filling cone Further recommendations: False signal suppression via the operating tool Alignment of the measurement to the silo outlet
Bunker (large-volume)		Large distance to the medium Steep angles of repose, unfavourable pouring positions due to outlet funnel and filling cone Diffuse reflections due to structured vessel walls or internals Multiple echoes/diffuse reflections due to unfavourable pouring positions with fine grain Changing signal conditions when large amounts of material slip off Further recommendations: False signal suppression via the operating tool

Application - Bulk solid		
Case	**Vessel**	**Process/measurement conditions**
Heap (point measurement/ profile detection)		Measured value jumps, e.g. through heap profile and Traverses Large angles of repose, varying pouring positions Measurement near the filling stream Sensor mounting on movable conveyor belts
Crusher		Measured value jumps and varying pouring positions, e.g. due to truck filling Fast reaction time Large distance to the medium Interfering reflections from fixtures or protective devices Further recommendations: False signal suppression via the operating tool
Demonstration		Instrument demonstration Object recognition/monitoring Measured value verification with higher measuring accuracy with reflection without bulk solids, e.g. via a measuring plate

9. TECHNICAL CHARACTERISTICS

Materials for models VEGAPULS C11 y C21

Antenna process fitting: PVDF
Counter nut: PP
Process seal: FKM (G type threaded connections only)
*Optional of EPDM only for model C21

Materials non-wetted parts

Housing: PVDF

Model VEGAPULS C11:

Cable entry seal: NBR

Connection cable: PVC

Model VEGAPULS C21:

Cable entry seal: FKM

Connection cable: PUR

Weight

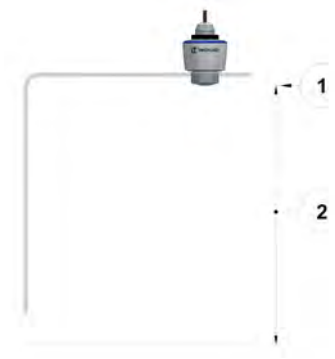
Instrument: 0.7 kg (1.543 lbs)
Connection cable: 0.1 kg/m

Process fitting: Thread G 1½, R1½, 1½ NPT

Mounting connection: Thread G1, R1, 1 NPT

Maximum torque mounting boss: 7 Nm (5.163 lbf ft)

Measured variable: the main quantity is the distance (see figure dimension 2), which is measured from the edge of the sensor antenna to the product surface. The edge of the antenna is also the reference plane of the measurement (see figure dimension 1).



Maximum measuring range

Model VEGAPULS C11: 8 m. (26.25 ft)

Model VEGAPULS C21: 15 m. (49.21 ft)

Recommended measuring range

Model VEGAPULS C11: 5 m. (16.4 ft)

Model VEGAPULS C21: 10 m. (32.8 ft)

Minimum dielectric constant of the medium: $\varepsilon_r \geq 1.6$

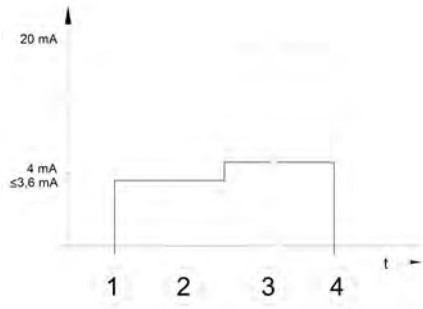
Blocking distance:

Modes 1,2,4	0 mm (0 in)
Mode 3	≥ 250 mm (9.843 in)

Switch-on phase:

Run-up time for U_B :	< 15 s
Input voltages :	12, 18, 24 VDC
Starting current for run-up time:	≤ 3.6 mA

Run-up time and measured value output.



Where: (1) U_B On, (2) Run-up time, (3) Measured value output and (4) U_B Off.

Power consumption			
Sensor current	Operating voltage		
	12 VDC	18 VDC	24 VDC
≤ 3.6 mA 4 mA 20 mA	< 45 mW < 50 mW < 245 mW	< 65 mW < 75 mW < 370 mW	< 90 mW < 100 mW < 485 mW

Output variable:

Parameter	VEGAPULS C11 Sensor	VEGAPULS C21 Sensor
Output signal	4 .. 20 mA	4 .. 20 mA / HART
Range of the output signal	3.8 .. 20.5 mA (Default setting)	3.8 .. 20.5 mA /HART (Default setting)
Signal resolution	0.3 µA	
Resolution, digital	1 mm (0.039 in)	
Fault signal, current output (adjustable)	≤3.6 mA ≥21 mA last valid measured value	
Maximum output current	22 mA	
Load	See load resistance under Power supply	
Starting current	≤ 3.6 mA ≤ 10 mA por 5 ms after switching on	
Damping (63 % of the input variable), adjustable	0 .. 999 s	
HART output values only for model VEGAPULS C21		
Primary Value (PV)	-	Linear percentage
Secondary Value (SV)	-	Distance
Third Value (TV)	-	Measurement reliability
Fourth Value (FV)	-	Electronics temperature
Fulfilled HART specification	-	7.0
Further information on Manufacturer ID, Device ID, Device Revision	-	See website of FieldComm Group

*MODBUS protocol: LR series equipment is also compatible with other Tecfluid S.A. equipment such as the MT03L model with Modbus RTU RS485 protocol, for more details see the following web link.

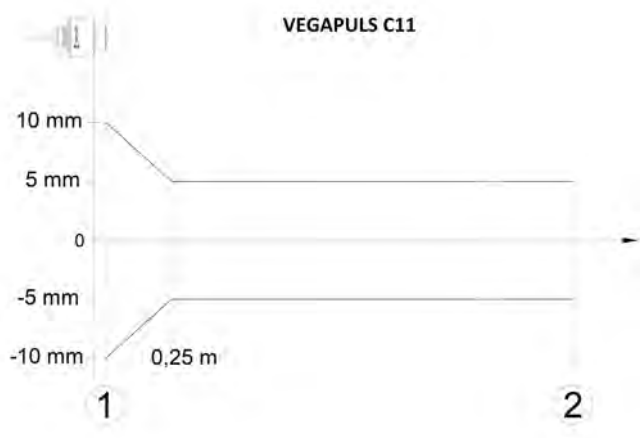
Process reference conditions according to DIN EN 61298-1		
Parameter	**VEGAPULS C11 sensor**	**VEGAPULS C21 sensor**
Temperature	18 … +30 °C (+64 … +86 °F)	
Relative humidity	45 … 75 %	
Air pressure	860 … 1060 mbar (86 … 106 kPa) (12.5 … 15.4 psig)	

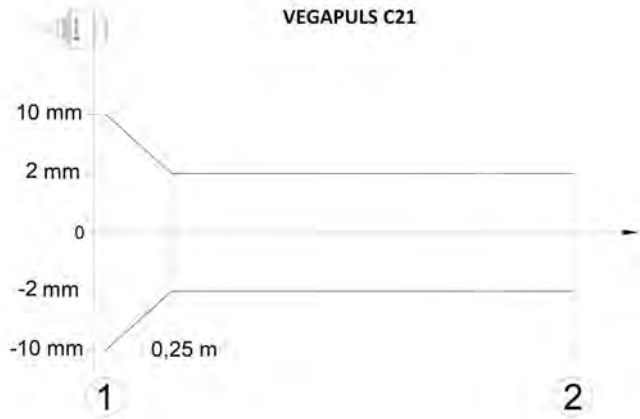
Deviation (according to DIN EN 60770-1):

Installation reference conditions		
Parameter	**VEGAPULS C11 Sensor**	**VEGAPULS C21 Sensor**
Distance to installations	> 200 mm (7.874 in)	
Reflector	Flat plate reflector	
False reflections	Biggest false signal, 20 dB smaller than the useful signal	
Deviation with liquids	≤ 5 mm Measuring distance > 0.25 m (0.8202 ft)	≤ 2 mm Measuring distance > 0.25 m (0.8202 ft)
Non-repeatability*	≤ 5 mm	≤ 2 mm
Deviation with bulk solids	The values depend to a great extent on the application. Binding specifications are thus not possible	

The following figures show the measurement error for VEGAPULS sensors C11 and C21 respectively.

*Already included in the measurement deviation.





Where for each sensor (1) is the antenna edge and reference plane, and (2) is the recommended measurement range.

Variables influencing measurement accuracy

In the following parameters the characteristics given in the digital measurement value caused by thermal drift are determined according to the limit point method.

Specifications apply to the digital measured value		
Parameter	**VEGAPULS C11 Sensor**	**VEGAPULS C21 Sensor**
Temperature drift - Digital value	< 3 mm at 10K and maximum value of 5 mm	
Specifications apply also to the current output		
Temperature drift - Current output	< 0.03 % at 10K and máximum of 0.3 % relating to the 16. 7 mA span	
Deviation in the current output due to digital/analogue conversion	< 15 µA	
Additional measurement deviation through electromagnetic interference	According to NAMUR NE 21 < 80 µA According to EN 61326-1 Ninguno According to IACS E10 < 250 µA (shipbuilding/ IEC 60945)	

Characteristics and performance data

Parameter	VEGAPULS C11 Sensor	VEGAPULS C21 Sensor
Measuring frequency	W-band (80 GHz technology)	
Measuring cycle time U_B ≥ 24 VDC	≤ 250 ms	
Step response time[1]	≤ 3 s	
Beam angle [2]	8°	
Emitted HF power depending on the parameter setting		
Average spectral transmission power density	-3 dB / MHz EIRP[(3)]	
Max. spectral transmission power density	+34 dBm / 50 MHz EIRP[(3)]	
Max. power density at a distance of 1 m	< 3 µW / cm^2	

[1] Time span after a sudden distance change from 1 m to 5 m until the output signal reaches 90 % of the final value for the first time (IEC 61298-2). Valid with operating voltage UB ≥ 24 V DC.
[2] Outside the specified beam angle, the energy level of the radar signal is 50% (-3 dB) less.
[3] EIRP: Equivalent Isotropic Radiated Power

Temperatures

Ambient temperature	-40 … +80 °C (-40 … +176 °F)
Storage and transport temperature	-40 … +80 °C (-40 … +176 °F)
Process temperature	
VEGAPULS C11	-40 … +60 °C (-40 … +140 °F)
VEGAPULS C21	-40 … +80 °C (-40 … +176 °F)

Process pressure -1 … 3 bar (-100 … 200 kPa)
(-14.5 … 43.51 psig)

Mechanical environmental conditions

Vibrations (oscillations)	Clase 4M8 según IEC 60271-3-4 (5g con 4 … 200 Hz)
Impacts (mechanical shock)	Clase 6M4 según IEC 60271-3-6 (50g , 2,3 ms)
Impact resistance	IK07 según IEC 62262

Electromechanical data

Parameter	VEGAPULS C11 Sensor	VEGAPULS C21 Sensor
Cable entry	Fixed connection	
Connection cable		
Configuration	Cores, sheathing	Wires, screen braiding, sheathing
Length	10 m	-
Wire cross-section	0.5 mm^2 (AWG N.º 20)	
Min. Vending radius (25 ºC / 77 ºF)	25 mm (0.984 in)	
Diameter	Aprox. 8 mm (0.315 in)	6 … 8 mm (0.236 … 0.315 in)
Wire isolating and cable cover	PVC (UV resistant)	PUR
Colour	Black	Black
Colour - Versión Ex i	-	Blue
Flame retardant according to	-	IEC 60332-1-2 UL 1581 (Flametest VW-1)

Bluetooth interface

Bluetooth standard	Bluetooth 5.0
Frequency	2.402 … 2.480 GHz
Max. Emitted power	+2.2 dBm
Max. Number of participants	1
Effective range typ. (Depending on the local conditions)	25 m (82 ft)

Adjustment Software

PC/Notebook	PACTware/DTM
Smartphone/Tablet	Adjustment App

Voltage Supply

Operating voltage U_B:	At 4 mA	12 … 35 VDC
	At 20 mA	9 … 35 VDC

Reverse voltage protection: Integrated for models VEGAPULS C11 and C21

Voltage supply

Permissible residual ripple :	For 12 V < U_B < 18 V	≤ 0.7 V_{eff} (16 … 400 Hz)
	For 18 V < U_B < 35 V	≤ 1 V_{eff} (16 … 400 Hz)

Load resistor (R_L): (U_B - U_{min})/0,022 A
Example:
With U_B = 24 VDC and a U_{min}=12 VDC
It is obtained a R_L= (24 - 12)/0,022 = 545 Ω

Overvoltage protection

Dielectric strength against metallic mounting parts	> 10 kV
Overvoltage resistance (test impulse voltages 1,2/50 µs en 42 Ω)	> 1000 V

Additional overvoltage arrester: Due to the floating structure of the electronics and comprehensive insulation measures generally not necessary.

Electrical protective measures

Potential separation	Electronics potential free up to 500 VAC
Protection rating	IP66/IP68 (3 bar,24 h) according to IEC 60529 Type 6P according to UL50
Altitude above sea level	5000 m (16404 ft)
Protection class	III
Pollution degree	4

10. SAFETY INSTRUCTIONS

The sensors of the LR series of VEGAPULS C11 and C21 correspond to the state of the art according to the current regulations and directives.

Operation is only allowed in a technically flawless and reliable condition. The operator is responsible for trouble-free operation of the device. If the unit is used in aggressive or corrosive media in which a malfunction of the unit can lead to possible hazards, the operator must ensure the proper functioning of the unit by taking appropriate measures.

The user must observe the safety instructions in these operating instructions, the country-specific installation regulations and the applicable safety and accident prevention regulations.

For safety and warranty reasons, any manipulations beyond those described in the operating instructions must be carried out by personnel authorized by the manufacturer. Any unauthorized alterations or modifications are expressly prohibited. For safety reasons, only the accessories specified by the manufacturer may be used.

In order to avoid possible hazards, the safety symbols and instructions on the device must be observed.

The low power output of the radar sensor is below the internationally permissible limit values. In the case of intended use, no adverse health effects are to be expected. The measuring frequency band range is given in section 9 "TECHNICAL CHARCTERISTICS".

10.1 Radio licenses

Radar

The sensors of the LR series VEGAPULS C11 and C21 have been tested and approved according to the current edition of the relevant country-specific norms or standards. You will find the specifications for use in the document "Regulations for radar level measuring instruments with radio approvals" at the following web link.

Bluetooth

The Bluetooth radio modules of the LR series sensors of the VEGAPULS C11 and C21 models have been tested and approved according to the current edition of the country-specific norms or standards. You find the confirmations and regulations for use in the enclosed document "Radio approvals" under the following web link.

10.2 Approvals for Ex areas

Only for the LR series sensor model VEGAPULS C21 an approved version for use in hazardous areas or in preparation is available. The corresponding certification documents can be found under the following web link.

10.3 Ship approvals

Only for the LR series sensor model VEGAPULS C21 an approved version is available for use in the marine area. The relevant certification documents can be found for certification can be found in the following web link.

10.4 Approvals as overfill protection

Only for the LR series sensor model VEGAPULS C21 an approved version is available for use as part of an overfill protection. The corresponding certification documents can be found under the following web link.

10.5 Metrological approvals

Only for the LR series sensor model VEGAPULS C21 an approved version is available for use as a certified flow measuring device according to MCERTS. The corresponding certification documents can be found under the following web link.

10.6 Food and pharmaceutical certificates

Only the LR series sensor model VEGAPULS C21 is available in a version approved for use in the food and pharmaceutical industry. The relevant certification documents can be found under the following web link.

10.7 Conformity

The sensors of the LR series VEGAPULS C11 and C21 comply with the legal requirements of the country-specific directives and technical regulations. The corresponding declarations can be found in the following web link to EU and UKCA.

10.8 NAMUR recomendations

NAMUR is the technical interest society for automation in the process industry in Germany. The published NAMUR recommendations are applied as a standard in the following areas field instrumentation.

The LR series sensors of the VEGAPULS C11 and C21 models meet the requirements of the following NAMUR recommendations:

NE 21: Electromagnetic compatibility of equipment
NE 43: Signal level for fault information from measuring transducers
NE 53: Compatibility of field devices and display/adjustment components
NE 107: Self-monitoring and diagnosis of field devices

11. TROUBLESHOOTING

The responsibility for the installation of the LR series sensor rests with the operator, and with it the necessary measures for the elimination of faults that occur. Either of the two sensor models of the LR series offers a maximum level of operational safety. However, faults may occur during operation, the root causes of which may be sensor, process, power supply or signal evaluation.

The first general measures for troubleshooting are to: evaluate the error message, check the output signal, or perform measurement error treatment.

A smartphone/tablet or a PC/Notebook offers with their respective applications, the comprehensive possibility to generate a diagnosis. And with these tools, the operator can determine the cause of the fault and correct it.

According to the cause of the interruption and the corrective measures taken by the operator, a new "Setup" of the equipment has to be performed to determine if the corrective measure has worked. In case these measures did not produce any result, contact Tecfluid S.A. technical support personnel.

The following subsections define both the causes of failure and some of their possible solutions to be carried out as a guide for the operator.

11. TROUBLESHOOTING

11.1 Diagnosis and fault messages

4 ... 20 mA Current output signal faults

For the current output of the LR series sensors models VEGAPULS C11 and C21, the following error cases shown in the table can be found:

Error	Cause	Rectification
4 … 20 mA signal not stable	Fluctuating measured value	Set damping
4 … 20 mA signal missing	Electrical connection faulty	Check connection, correct, if necessary
	Voltage supply missing	Check cables for breaks; repair if necessary
	Operating voltage too low, load resistance too high	Check, adapt if necessary
Current signal greater than 22 mA, less than 3.6 mA	Sensor electronics defective	Request the replacement of the sensor depending on the model.

Status messages according to NE 107

The sensors of the LR series are self-monitoring and diagnostic according to NE 107 and VDI/VDE 2650. For the status messages shown in the following table, more detailed error messages can be found under the menu item "Diagnostics" via the corresponding operating tool.

The classification of status warnings are subdivided into the following categories: failure, function check, out of specification and need for maintenance. An official pictogram corresponds to each as shown in the following table.

Failure	Out of specification	Function check	Maintenance required
			

The description for each type of notice is defined as follows:

Failure: Due to a malfunction in the instrument, a fault signal is output. This status message is always active. It cannot be deactivated by the user.

Out of specificaction: The measured value is unreliable because an instrument specification was exceeded (e.g. electronics temperature). This status message is inactive by default.

Function check: The instrument is being worked on, the measured value is temporarily invalid (for example during simulation). This status message is inactive by default.

Maintenance required: Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is still valid. Plan in maintenance for the instrument because a failure is expected in the near future (e.g. due to buildup). This status message is inactive by default.

Code cases for the notification of "Failure"			
Code	**Cause**	**Rectification**	**DevSpec State in CMD 48**
F013 No measured value available	No measured value in the switch-on phase or during operation Sensor tilted	Check or correct installation and/ or parameter settings Clean the antenna system	Byte 5, bit 0 of byte 0 … 5
F017 Adjustment span too small	Adjustment not within specification	Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm)	Byte 5, bit 1 of byte 0 … 5
F025 Error in the linearization table	Index markers are not continuously rising, for example illogical value pairs	Check linearization table Delete table/Create new	Byte 5, bit 2 of byte 0 … 5
F036 No operable software	Checksum error if software update failed or aborted	Repeat software update Send instrument to repair	Byte 5, bit 3 of byte 0 … 5
F040 Error in the electronics	Limit value exceeded in signal processing Hardware error	Restart instrument Send instrument and request replacement	Byte 5, byte 5, bit 4 of byte 0 … 5
F080 General software error	General software error	Restart instrument	Byte 5, byte 5, bit 5 of byte 0 … 5
F105 Determine measured value	The instrument is still in the switch-on phase, the measured value could not yet be determined	Wait for the end of the switch-on phase Duration up to 3 minutes depending on the measurement environment and parameter settings	Byte 5, byte 5, bit 6 of byte 0 … 5

Code cases for the notification of “Failure”			
Code	**Cause**	**Rectification**	**DevSpec State in CMD 48**
F260 Error in the calibration	Checksum error in the calibration values Error in the EEPROM	Send instrument for diagnostic or replacement	Byte 4, bit 0 of byte 0 … 5
F261 Error in the instrument settings	Error during setup False signal suppression faulty Error when carrying out a reset	Repeat setup Carry out a reset	Byte 4, bit 1 of byte 0 … 5
F265 Measurement function disturbed	Program sequence of the measuring function disturbed	Device restarts automatically	Byte 4, bit 3 of byte 0 … 5

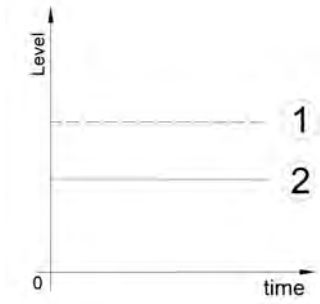
Code cases for the notification of “Out of specification”			
Code	**Cause**	**Rectification**	**DevSpec State in CMD 48**
S600 Impermissible electronics temperature	Temperature of the electronics in the non-specified range	Check ambient temperature Insulate electronics	Byte 23, bit 4 of byte 14 … 24
S601 Overfilling	Danger of vessel overfilling	Make sure that there is no further filling Check level in the vessel	Byte 23, bit 5 of byte 14 … 24
S603 Impermissible operating voltage	Terminal voltage too small	Check terminal voltage, increase operating voltage	Byte 23, bit 6 of byte 14 … 24

Code cases for the notification of “Function check”			
Code	**Cause**	**Rectification**	**DevSpec State in CMD 48**
C700 Simulation active	A simulation is active	Finish simulation Wait for the automatic end after 60 mins .	"Simulation Active" in "Standardized Status 0"

Code cases for the notification of “Maintenance”			
Code	**Cause**	**Rectification**	**DevSpec State in CMD 48**
M500 Error in the delivery status	The data could not be restored during the reset to delivery status	Repeat reset Load XML file with sensor data into the sensor	Bit 0 of Byte 14 … 24
M501 Error in the non-active linearization table	Hardware error EEPROM	Send instrument for diagnostic or replacement	Bit 1 of Byte 14 … 24
M507 Error in the instrument settings	Error during setup Error when carrying out a reset False signal suppression faulty	Carry out reset and repeat setup	Bit 7 of Byte 14 … 24
M508 No executable Bluetooth software	Checksum error in Bluetooth software	Carry out software update	Bit 8 of Byte 14 … 24
M509 Software update running	Software update running	Wait until software update is finished	Bit 9 of Byte 14 … 24
M510 No communication with the main controller	Communication between main electronics and display module disturbed	Check the connection cable to the display Send instrument for diagnostic or replacement	Bit 10 of Byte 14 … 24
M511 Inconsistent software configuration	A software unit requires a software update	Carry out software update	Bit 11 of Byte 14 … 24

11. 2 Treatment of measurement errors

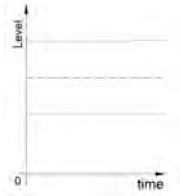
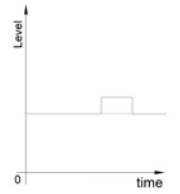
In this section, the most typical examples of measurement errors conditioned by the application are described in tables. The images shown in the first column "Representative error graph" indicate the effective level as a dashed line and the indicated level as a solid line, see the following figure as an example.

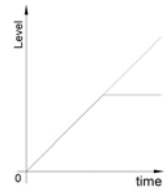
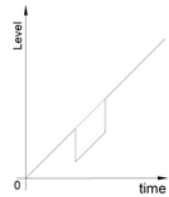
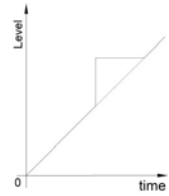
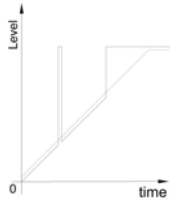


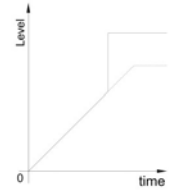
Where (1) shows in dashed line the actual level and in (2) the solid line shows the level indicated by the sensor.

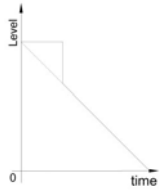
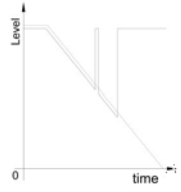
In case the level is indicated as constant, the cause may be due to a lack of current output interruption setting to the "Hold value" option. Otherwise, if you have a level indication that is too low, the cause could be due to a line resistance that is too high.

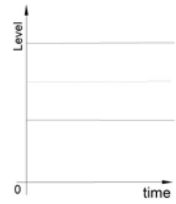
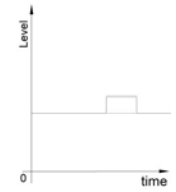
The following tables show the most typical cases in which a measurement failure signal may occur.

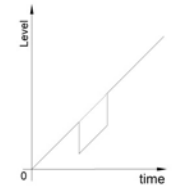
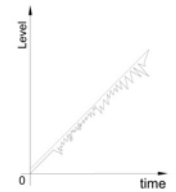
Liquids: Measurement error at constant level			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value shows a too low or too high level	Min./max. adjustment not correct Incorrect linearization curve	Adapt min./max. adjustment Adapt linearization curve
	Measured value jumps towards 100 %	Due to the process, the amplitude of the level echo sinks A false signal suppression was not carried out Amplitude or position of a false signal has changed (e.g. condensation, build-up); false signal suppression no longer matches actual conditions	Carry out a false signal suppression Determine the reason for the changed false signals, carry out false signal suppression, e.g. with condensation.

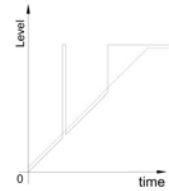
Liquids: Measurement error during filling			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value remains unchanged during filling	False signals in the close range too big or level echo too small Strong foam or vortex generation Max. adjustment not correct	Eliminate false signals in the close range Check measuring point: Antenna should protrude out of the threaded mounting socket, possible false echoes through flange socket? Remove contamination on the antenna In case of interferences due to installations in the close range, change polarisation direction Create a new false signal suppression Adapt max. adjustment
	Measured value jumps towards 0 % during filling	The level echo cannot be distinguished from the false signal at a false signal position (jumps to multiple echo)	In case of interferences due to installations in the close range: Change polarisation direction Chose a more suitable installation position
	Measured value jumps towards 100 % during filling	Due to strong turbulence and foam generation during filling, the amplitude of the level echo sinks. Measured value jumps to false signal	Carry out a false signal suppression
	Measured value jumps sporadically to 100 % during filling	Varying condensation or contamination on the antenna	Carry out a false signal suppression or increase false signal suppression with condensation/ contamination in the close range by editing

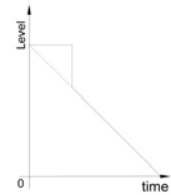
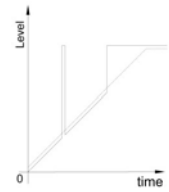
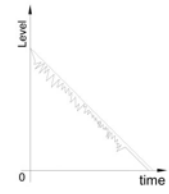
Liquids: Measurement error during filling			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value jumps to ≥ 100 % or 0 m distance	Level echo is no longer detected in the close range due to foam generation or false signals in the close range. The sensor goes into overfill protection mode. The max. level (0 m distance) as well as the status message " Overfill protection" are output.	Check measuring point: Antenna should protrude out of the threaded mounting socket, possible false echoes through flange socket? Remove contamination on the antenna

Liquids: Measurement error during emptying			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value remains unchanged in the close range during emptying	False signal larger than the level echo Level echo too small	Check measuring point: Antenna should protrude out of the threaded mounting socket, possible false echoes through flange socket? Remove contamination on the antenna In case of interferences due to installations in the close range: Change polarisation direction After eliminating the false signals, the false signal suppression must be deleted. Carry out a new false signal suppression
	Measured value jumps sporadically towards 100 % during emptying	Varying condensation or contamination on the antenna	Carry out false signal suppression or increase false signal suppression in the close range by editing With bulk solids, use radar sensor with purging air connection

Bulk solids: Measurement error at constant level			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value shows a too low or too high level	Min./max. adjustment not correct Incorrect linearization curve	Adapt min./max. adjustment Adapt linearization curve
	Measured value jumps towards 100 %	Due to the process, the amplitude of the product echo decreases A false signal suppression was not carried out Amplitude or position of a false signal has changed (e.g. condensation, build-up); false signal suppression no longer matches actual conditions	Carry out a false signal suppression Determine the reason for the changed false signals, carry out false signal suppression, e.g. with condensation.

Bulk solids: Measurement error during filling			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value jumps towards 0 % during filling	The level echo cannot be distinguished from the false signal at a false signal position (jumps to multiple echo) Transverse reflection from an extraction funnel, amplitude of the transverse reflection larger than the level echo	Remove/reduce false signal: minimize interfering installations by changing the polarization direction Chose a more suitable installation position Direct sensor to the opposite funnel wall, avoid crossing with the filling stream
	Measured value fluctuates around 10 … 20 %	Various echoes from an uneven medium surface, e.g. a material cone Reflections from the medium surface via the vessel wall (deflection)	Check parameter "Material Type" and adapt, if necessary Optimize installation position and sensor orientation Select a more suitable installation position, optimize sensor orientation, e.g. with a swivelling holder

Bulk solids: Measurement error during filling			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value jumps sporadically to 100 % during filling	Changing condensation or contamination on the antenna	Carry out a false signal suppression or increase false signal suppression with condensation/ contamination in the close range by editing

Bulk solids: Measurement error during emptying			
Representative error graph	**Error description**	**Cause**	**Rectification**
	Measured value remains unchanged in the close range during emptying	False signal greater than level echo or level echo too small	Eliminate false signals in the close range. Check: Antenna must protrude out of the nozzle Remove contamination on the antenna Minimize interfering insta-llations in the close range by changing the polarization direction After eliminating the false signals, the false signal suppression must be deleted. Carry out a new false signal suppression
	Measured value jumps sporadically towards 100 % during emptying	Changing condensation or contamination on the antenna	Carry out false signal suppression or increase false signal suppression in the close range by editing
	Measured value fluctuates around 10 … 20 %	Various echoes from an uneven medium surface, e.g. an extraction funnel Reflections from the medium surface via the vessel wall (deflection)	Check parameter "Material Type" and adapt, if necessary Optimize installation position and sensor orientation

12. MAINTENANCE

For sensors of the LR series VEGAPULS C11 and C21, no special maintenance is required during normal operation.

Some applications can lead to product fouling in the antenna, which can influence the measurement result. As a preventive measure, contamination of the antenna system should be avoided as far as possible. If necessary, the antennas should be cleaned at certain intervals.

The cleaning of the equipment helps to ensure that the marking of the equipment characteristics remains visible. To carry out the cleaning, it is recommended to use only cleaning agents that are not abrasive to the housing and the marking of the characteristics engraved on the housing, and to use cleaning methods that correspond to the degree of protection of the sensor.

12.1 Software update

For all updates of the LR series sensors VEGAPULS C11 and C21, the following components are required via Hart signal only for model C21 and for both models via Bluetooth:

- Sensor to be upgraded
- Voltage supply
- PC/Notebook with PACTware/DTM installed
- Current Software of the equipment in file form

12.2 How to proceed if a repair is necessary

To carry out any procedure, it is recommended that the customer fill out the Repair/Return/ Complaint form from the Tecfluid website in the "After Sales" section, so that the procedure can be carried out in an agile manner, by following the following web link.

Subsequent to instructions received by our authorized Tecfluid personnel, the following is advised for any shipment of equipment to Tecfluid:

- Clean equipment and pack it break-proof
- Place the completed form and safety data sheet on the outside of the equipment.

13. DIMENSIONS

The following dimensional drawings show the different dimensions for the sensors of the LR series, models VEGAPULS C11 y C21.

For models VEGAPULS C11 y C21, the threads G1½,1½ NPT y R1½ are also available.

WARRANTY

Tecfluid S.A. guarantees all its products for a period of 24 months from the date of sale, against any defect in materials, manufacture or operation. Excluded from this warranty are failures that can be attributed to improper use or application other than that specified in the order, handling by personnel not authorized by Tecfluid S.A., mishandling and mistreatment.

This warranty is limited to the replacement or repair of parts in which defects are observed that have not been caused by misuse, excluding liability for any other damage, or for the effects produced by the wear and tear of normal use of the equipment.

For all shipments of material for repair, a process is established that should be consulted on the web page www.tecfluid.com section of After Sales.

The products sent to our facilities must be properly packed, clean and completely free of liquids, grease or harmful substances.

The equipment to be repaired must be accompanied by the form to be filled in via web in the same After Sales section.

The warranty for repaired or replaced components applies for 6 months from the date of repair or replacement. However, the warranty period, as a minimum, will remain in force as long as the initial warranty period of the object of supply has not expired.

TRANSPORTATION

Shipments of Buyer's equipment to Seller's facilities for credit, repair or replacement shall always be made carriage prepaid unless otherwise agreed.

Seller accepts no responsibility for damage to equipment in transit.

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Pressure Equipment Directive certified by

ATEX European Directive certified by

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