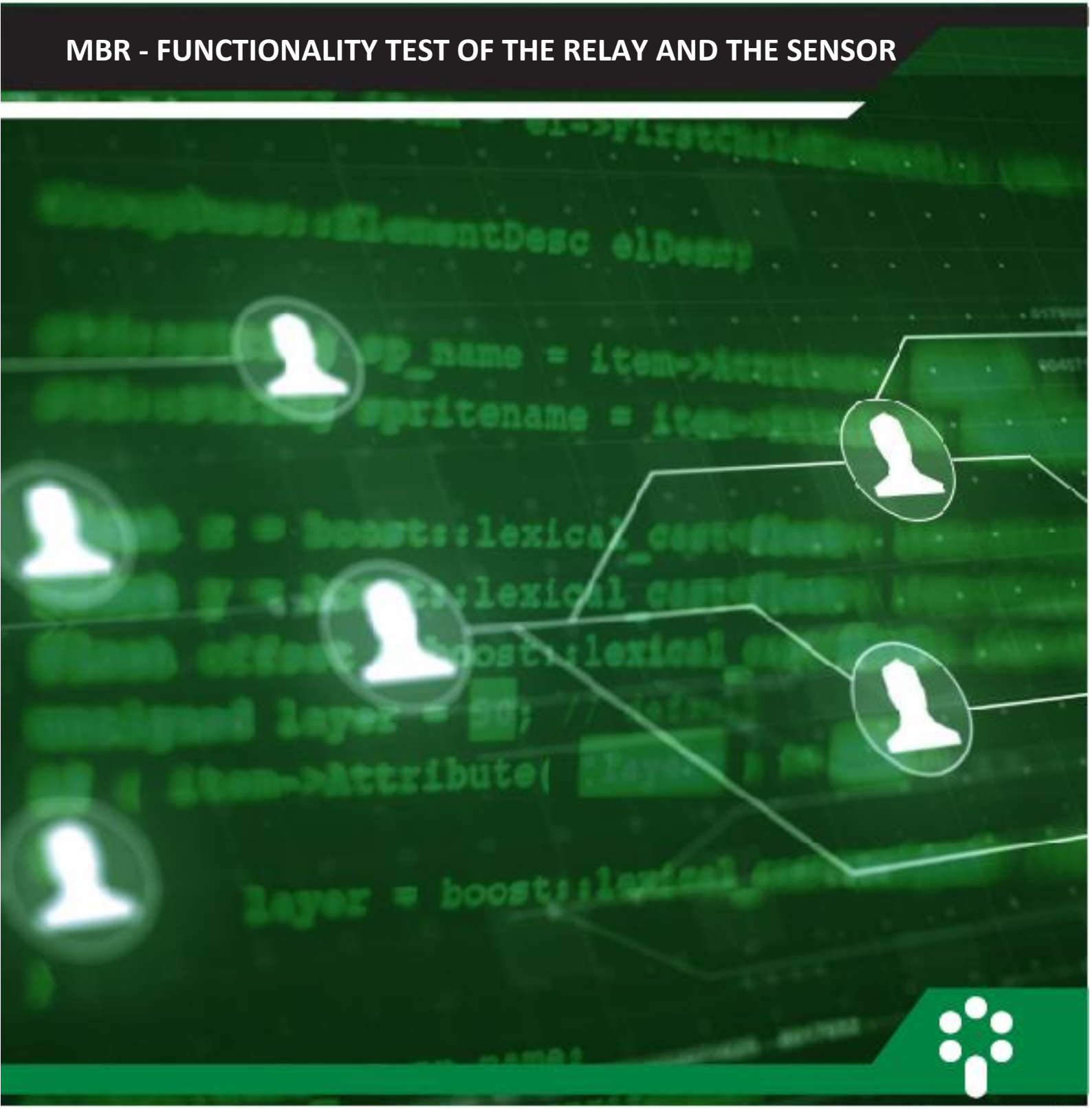
QUICK GUIDE

MBR - FUNCTIONALITY TEST OF THE RELAY AND THE SENSOR



Treetech

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1 Membrane/Bag Rupture Relay - MBR

Figure 1 - Membrane/Bag Rupture Relay - MBR

Figure 2 – MBR sensor

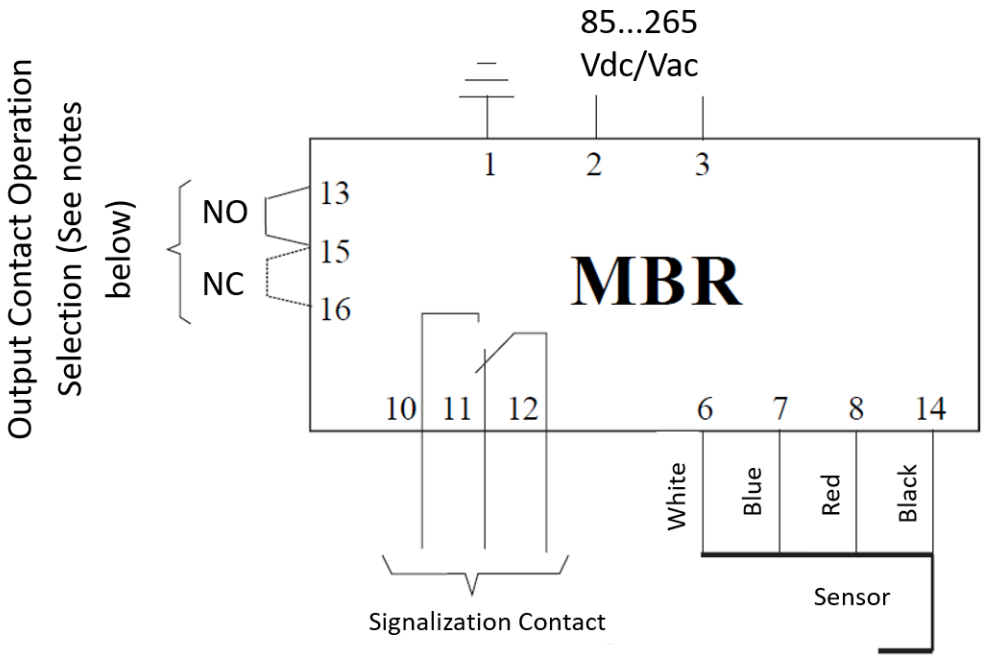


Figure 3 - Electrical connections diagram of the MBR relay

Note: A jumper (13-15 or 15-16) must be installed for the alarm contact to act correctly.

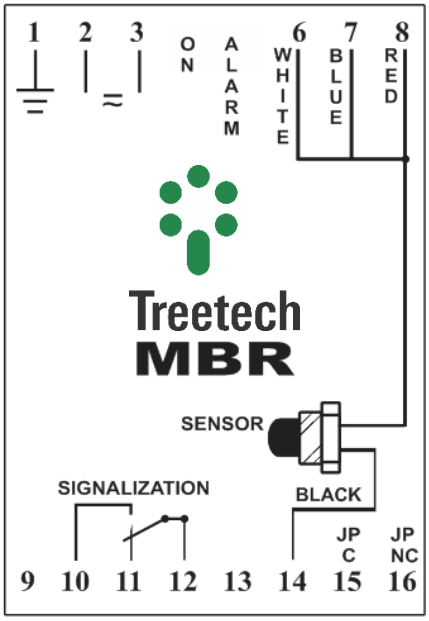


Figure 4 - Product tag

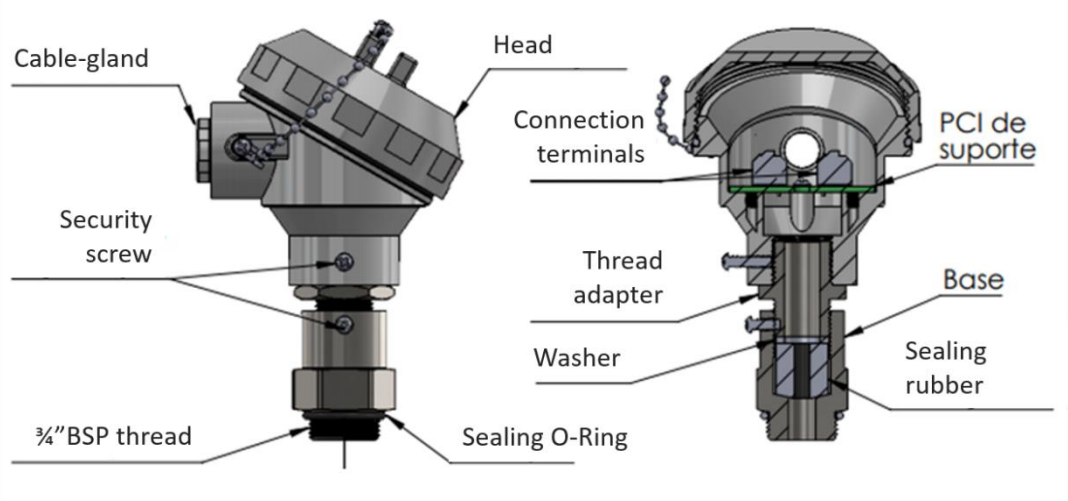


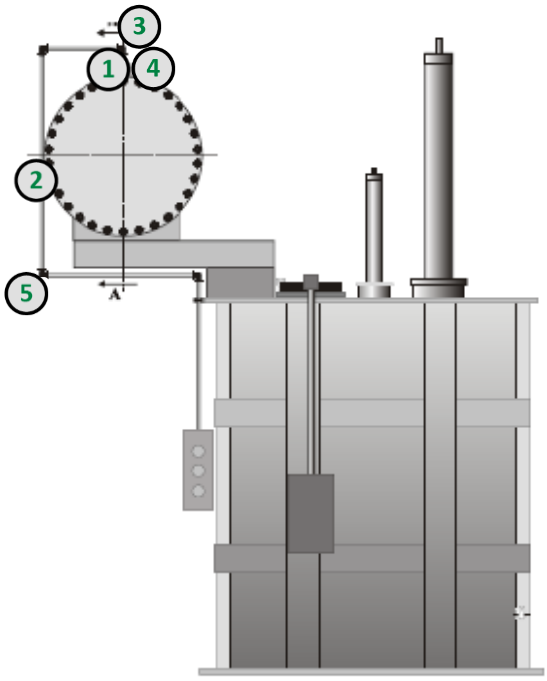
Figure 5 - Connection box – CP-MBR

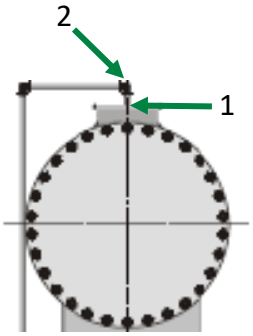
2 CP-MBR pre-installation

Before disconnecting the transformer to install the membrane rupture sensor, a few steps must be followed to avoid unplanned events during installation:

1. Refer to the technical drawings - and, if possible, photos - of the piping and access points to the transformer expansion tank;
2. If you do not have access to the information highlighted in item 1, a shutdown is required for the sole purpose of taking measurements and setting the point of installation of the CP-MBR.

With the necessary information in hand, the CP-MBR installation point can be defined. The following guidelines should be considered to define the best location.



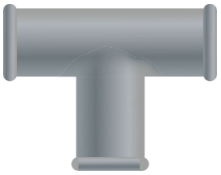


1 – DIRECT INSTALLATION AT THE ACCESS POINT OF THE EXPANSION TANK

Connect the CP-MBR directly to the expansion tank access point (1) or to a very close "T" shaped point (2). In this case, no adaptation is required.

2 – CONNECTED TO A "T" SHAPED ACCESS IN THE PIPE THAT REACHES THE EXPANSION TANK

Using a "T" shaped access, connect the CP-MBR to any point (other than the elbows) of the pipe that reaches the bag.



3 – CONNECTED TO THE EXPANSION TANK ACCESS POINT WITH THREAD ADAPTER

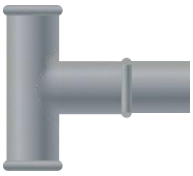
Connect the CP-MBR directly to the expansion tank access point or to a very close "T" point using a 3/4” BSP thread adapter.

4 – HOLE IN THE EXPANSION TANK

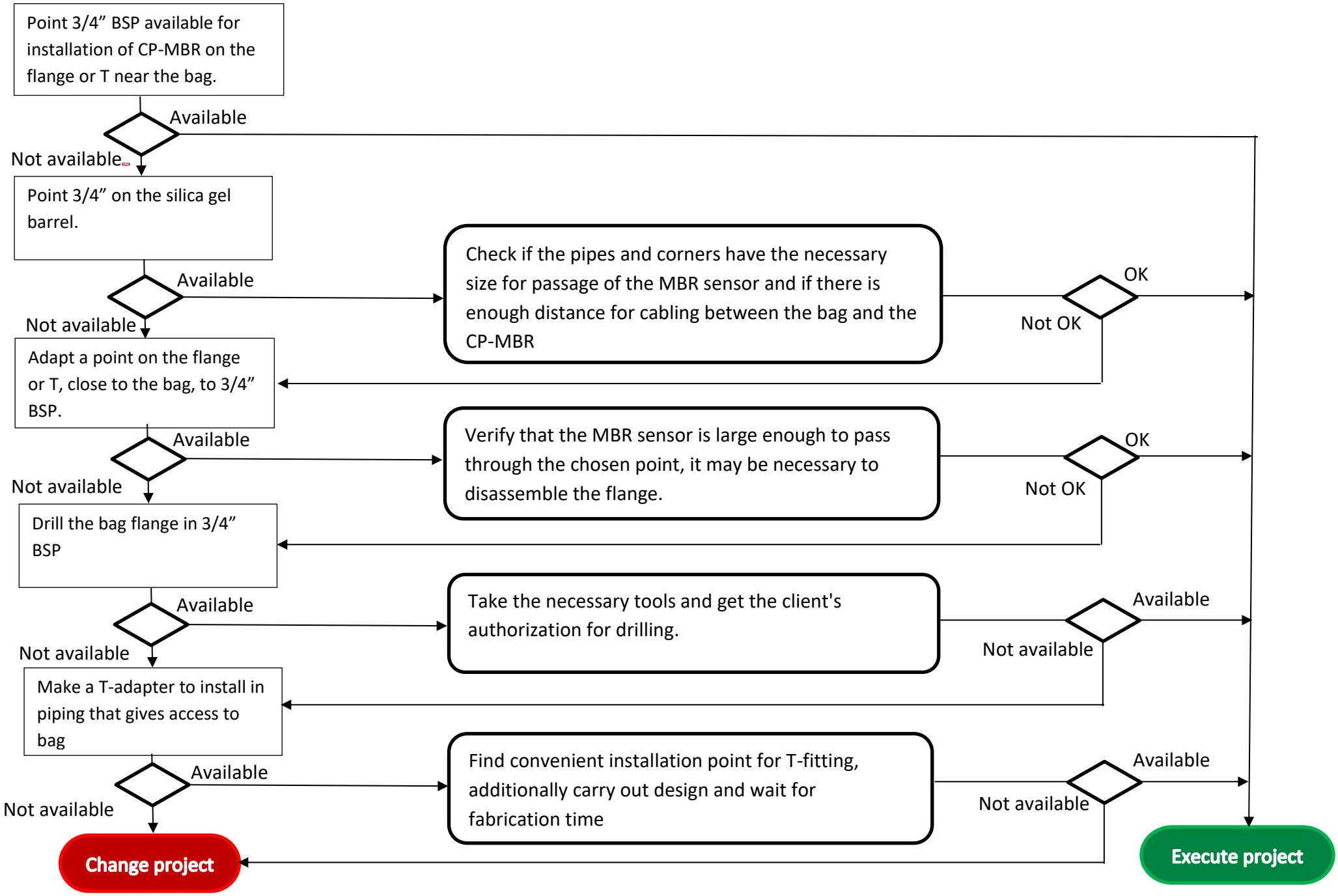
With a drill, make a hole in 3/4” BSP in the expansion tank to connect the CP-MBR.

5 – MANUFACTURING SPECIFIC PIECE FOR INSTALLATION

The pipe that reaches the expansion tank has some parts commonly called "elbows". For the installation of CP-MBR in these places, it is recommended to manufacture a T-shaped access on demand.

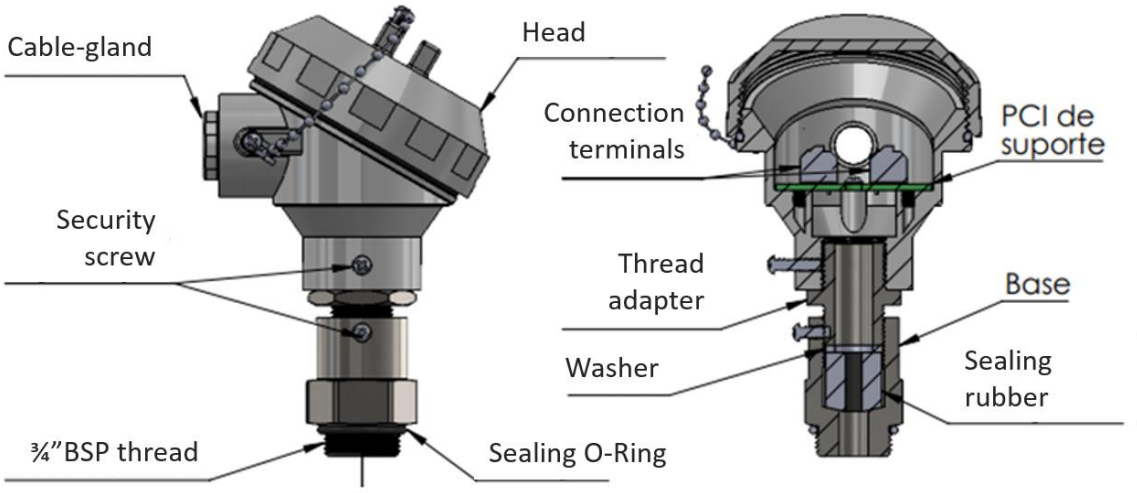


The CP-MBR pre-installation step-by-step is described in the flowchart below.


Point 3/4” BSP available for installation of CP-MBR on the flange or T near the bag.
Available
Not available
Point 3/4” on the silica gel barrel.
Available
Not available
Check if the pipes and corners have the necessary size for passage of the MBR sensor and if there is enough distance for cabling between the bag and the CP-MBR
OK
Not OK
Adapt a point on the flange or T, close to the bag, to 3/4” BSP.
Available
Not available
Verify that the MBR sensor is large enough to pass through the chosen point, it may be necessary to disassemble the flange.
OK
Not OK
Drill the bag flange in 3/4” BSP
Available
Not available
Take the necessary tools and get the client's authorization for drilling.
Available
Not available
Make a T-adapter to install in piping that gives access to bag
Available
Not available
Find convenient installation point for T-fitting, additionally carry out design and wait for fabrication time
Available
Not available
Change project
Execute project

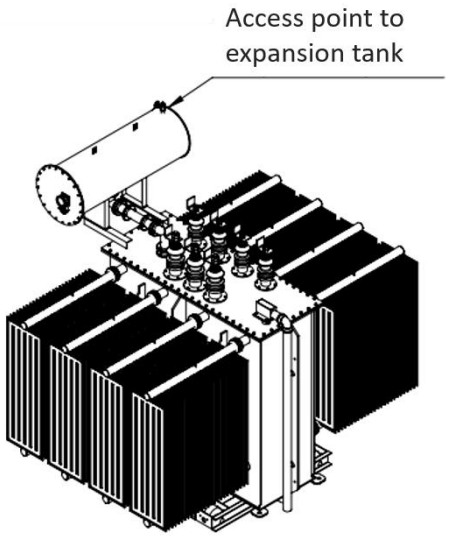
3 CP-MBR installation procedure

CP-MBR is a signal connection box which main purpose is to provide the passage of the Membrane/Bag Rupture Sensor signal from the expansion/conservative tank interior to the MBR Relay.

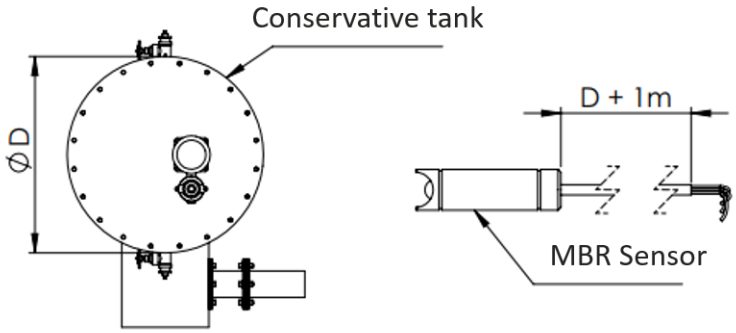


To install it properly, follow the steps in this Guide:

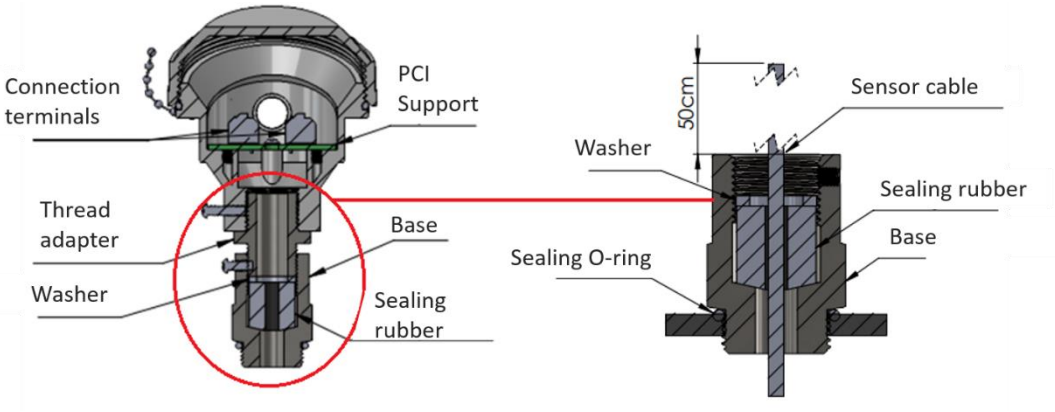
1. Locate an access point to the expansion tank. Generally, pre-existing valves or threaded holes can be found in conservator. If using these points is not an option, you will need to create a threaded hole. To do this, use a drill and a male thread. The standard thread used by CP-MBR is 3/4" BSP. The threaded bore should give access do the inside of the expansion bag or to dry surface of the oil separation membrane;



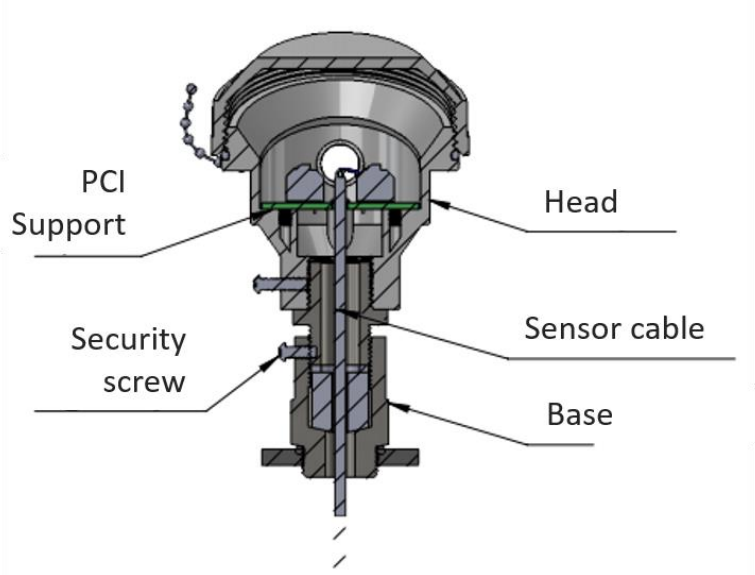
2. Insert the MBR sensor through the 3/4” BSP threaded hole. It is necessary to leave a cable surplus inside the conservative tank, so that, the sensor remain in its correct position, regardless of the oil level. Therefore, it is recommended that the cable exceeds about 1 m the diameter of the conservative tank (D + 1m);



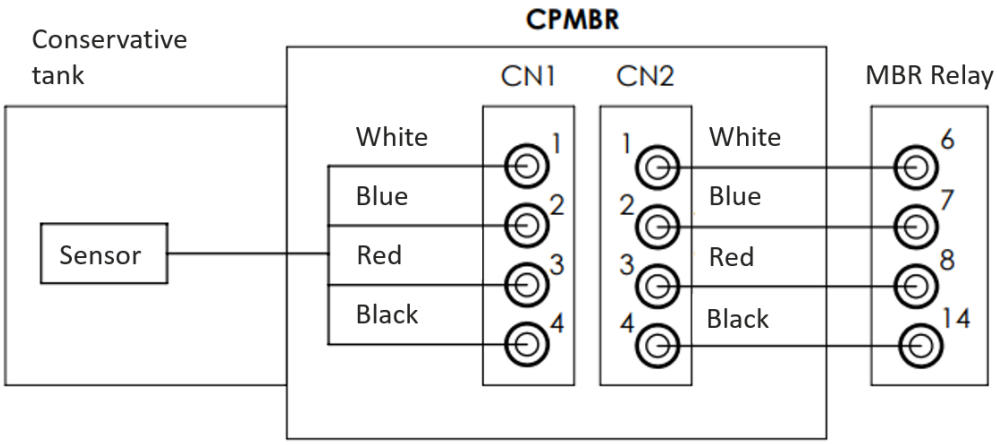
3. Thread the base, which is approximated in the red circle of the figure, and then insert the MBR sensor cable through: base, sealing rubber and washer. Leave about 50 cm of excess cable above the base;

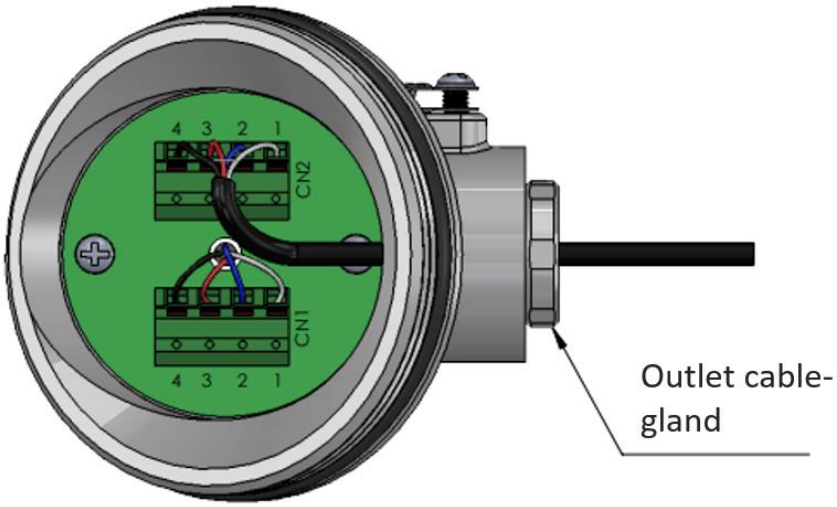


4. Take the cable to the inside of the head, making sure to traverse the PCI support. Then, screw securely the head and tighten the base security screw;



5. Strip about 4 mm from each of the 4-way cable. Then, make the electrical connections following the diagram below. The connection terminals are spring loaded, that is, simply insert the conductive part into the terminals. Thus, using needle-type terminals is optional;





6. Adjust the cables according to the drawing above and make sure that they are all securely connected to the spring-loaded terminals. Finally, close the cover firmly and tighten the outlet cable-gland.

4 Basic testing procedures

4.1 TEST 1: Test the MBR relay (without the sensor connected)

With the jumpers installed in the correct positions, the table below shows the connections that must be made to the MBR relay and the expected results.

Jumper 1	Jumper 2	Expected contact output	Red led status
None	None	Alarm	**On**
7 - 14	6 - 8	Without alarm	**Off**
7 - 14	6 - 7	Alarm	**On**
None	6 - 8	Alarm	**On**
None	6 - 7	Alarm	**On**

4.2 TEST 2: MBR test with the sensor connected

1. Connect the sensor directly to the MBR relay (the sensor does not need to be connected to the CP-MBR in this test);
2. Turn on the supply to the MBR relay;
3. Grab a container with clean water or oil (a water glass is sufficient);
4. With the sensor in the air, check the condition of the MBR alarm indication (the red alarm must be off) and the alarm contact must be indicated as shown in the table below;
5. Place the sensor into the container with clean water or oil, so that the alarm must be activated;
6. The alarm contact must behave in accordance with the jumpers combination showed in the table below.

Jumpers combination (13-15 / 15-16)	Conditions	Contact 10-12	Contact 11-12	Red led status
13 - 15	Air	Open	Closed	Off
13 - 15	Oil/ Water	Closed	Open	**On**
15 - 16	Air	Closed	Open	Off
15 - 16	Oil / Water	Open	Closed	**On**

4.3 Test summary

1. Should the MBR relay pass test 1, the relay is operating normally;
2. Should the MBR connected to the sensor pass test 2, both relay and sensor are operating normally;
3. Should the relay pass test 1, but fails test 2, the sensor is defective.

5 Additional field voltage tests of MBR relay

In these tests, the voltage between the MBR relay's terminals is measured in different conditions, shown in each subitem, and compared to the expected voltage for that condition. They allow the identification of some failure modes of the sensor. **These tests must not be analyzed individually**, however some of them may present a partial result by themselves.

1 – MBR with all sensor's cables connected:

Terminal	Reference Terminal	Expected voltage for sensor in the air (V_{DC})	Expected voltage for sensor in liquid (V_{DC})
6	7	≈ 2 a 3	0 < V < 0,2
14	7	≈ 0	≈ 0
8	7	≈ 12	≈ 12

2 – MBR relay with bad connection of MBR sensor's black cable, connected to terminal 14:

Terminal	Reference Terminal	Expected voltage for sensor in the air (V_{DC})	Expected voltage for sensor in liquid (V_{DC})
6	7	≈ 1	≈ 0
14	7	≈ 12	≈ 12
8	7	≈ 12	≈12

3 – MBR relay with sensor in the air or liquid and bad connection of MBR sensor's white cable, connected to terminal 6:

Terminal	Reference terminal	Expected voltage (V_{DC})
6	7	≈ 0
14	7	≈ 0
8	7	≈ 12

4 – MBR relay with sensor in the air or liquid and bad connection of MBR sensor's blue cable, connected to terminal 7:

Terminal	Reference terminal	Expected voltage (V_{DC})
6	7	≈ 9
14	7	≈ 10
8	7	≈ 12

5 – MBR relay with sensor in the air or liquid and bad connection of MBR sensor's red cable, connected to terminal 8:

Terminal	Reference terminal	Expected voltage (V_{DC})
6	7	≈ 0
14	7	≈ 0
8	7	≈ 12

6 – MBR with all sensor's cables disconnected:

Terminal	Reference terminal	Expected voltage (V_{DC})
6	7	≈ 0
14	7	≈ 12
8	7	≈ 12

6 Tests of the MBR sensor

6.1 Continuity test between blue and black cables

Disconnect all the MBR sensor's cables from the MBR relay and using the multimeter in continuity mode, connect the leads to the blue and black cables. The multimeter must indicate a low value or zero, meaning there is no brake in the circuit. If not, then the sensor is damaged and must be replaced.

6.2 Sensor integrity test - part 1

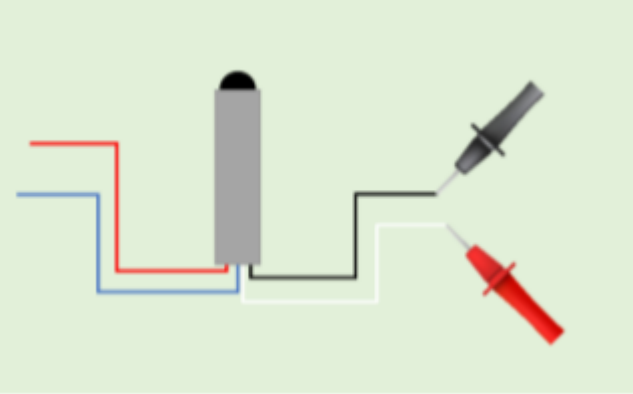
With the red and blue cables connected to the MBR relay, the first part of this test consists in measuring the voltage between them and comparing to the measured voltage between the white and black cables.

1. Keep the red and blue cables connected to the MBR relay (check if there is a voltage about 12 V_{DC} between them);
2. Using a multimeter, measure the sensor output voltage between the white (+) and black cables (-);
3. With the sensor deactivated, that is, non-contact with liquid, the output voltage must be 12 V_{DC};
4. With the sensor activated, that is, whether in contact with liquid or the sensor is damaged, the output voltage will be about 0 V_{DC}.

6.3 Sensor integrity test - part 2

The second part of this test should be carried out if the output voltage measured in part 1 is 0 V_{DC}. It consists in testing the sensor with all cables disconnected from the MBR relay with the multimeter in diode mode and connection as shown in the figure below.

1. Disconnect all the MBR sensor's cables from the MBR relay;
2. With a multimeter in diode mode, measure the white (+) and black (-) cables as shown in the figure bellow;



3. If the measurement is about 0 V_{DC}, the sensor is damaged and must be replaced;
4. If the voltage is higher than zero or if the multimeter shows overload (OL), the alarm is probably true and a transformer disconnection must be programmed for verification and maintenance.

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