



USER GUIDE

Bushing Test Box

TEST PROCEDURE

Bushing Sensor site commissioning kit for circular connectors, Doble Part Number 030-2251-01. Contains 3 Tap Test Boxes and 1 cable.

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Overview

1 Verification

The following tests must be performed to verify that:

- The continuity of each wire (2 signal, 1 shield) in each bushing sensor cable is correct.
- Each bushing sensor is wired to the correct connector and tap location on the doblePRIME IDD.
- The three wires in each bushing sensor cable are connected correctly. (S, R, $\underline{\text{⏏}}$)
- *This is done during the installation process, while the transformer(s) are still in an outage condition, after the bushing sensors have been installed and before the bushing sensor connectors are fastened.*

2 Typical Installation

A typical doblePRIME IDD installation includes one or more sets of bushing test tap sensors.

A standard configuration is a set of three sensors, one for each phase of the transformer.

- Each set will be set up and tested independently.

To perform the test, at each bushing, the bushing sensor will be replaced with a numbered Tap Test Box which has unique resistance across each combination of pins.

Once these Tap Test Boxes are installed, resistance can be measured at the doblePRIME IDD 9 pin connector (set 3 is a 10 pin connector) located in the enclosures and compared to a set of expected values.

The presence of a resistance confirms the continuity of the cable and connections. The presence of the correct value of the resistance confirms that the correct sensor bushing cable is connected to the correct doblePRIME IDD input.

3 Test Box Configuration

- Fit the 3 Test Tap Boxes according to the table below, see section 4 for fitting instructions.

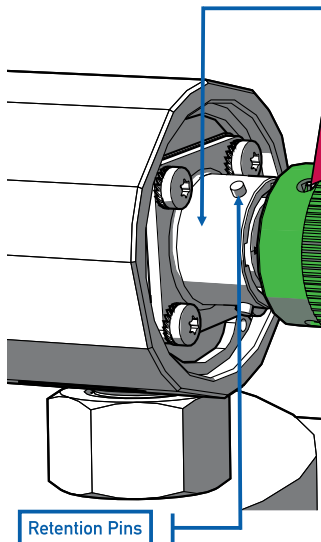
doblePRIME Test Box configuration		
Bushing	Box labelled	Doble Part Number
Sensor 1	Tap 1 Test Box	03X-0040-01
Sensor 2	Tap 2 Test Box	03X-0040-02
Sensor 3	Tap 3 Test Box	03X-0040-03

TABLE 1.1; Test Box configuration

Remove

4 Remove the sensor cable and attach a Test Tap Box

- Rotate the plug's outer ring until the slots in the outer ring align with the socket's retention pins.
- Pull the plug connector off the socket connector.



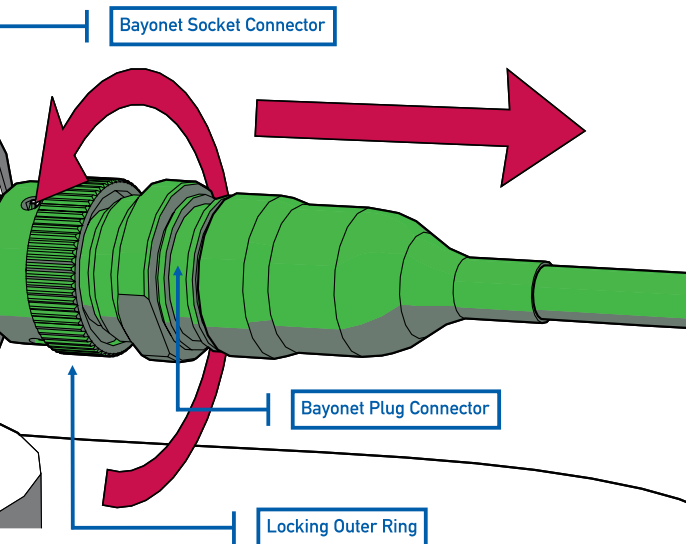


FIGURE 1; Sensor removal

5 Remove the dust cap from the Tap Test Box

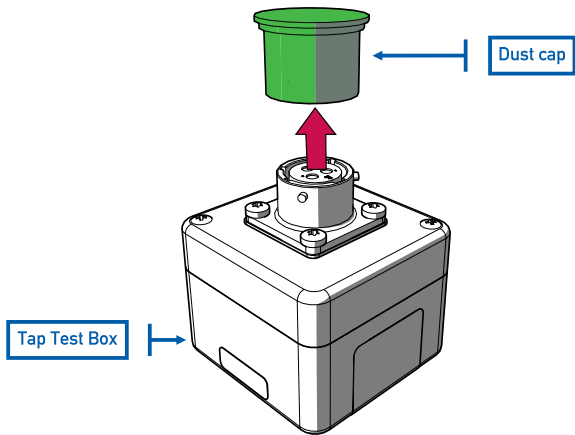
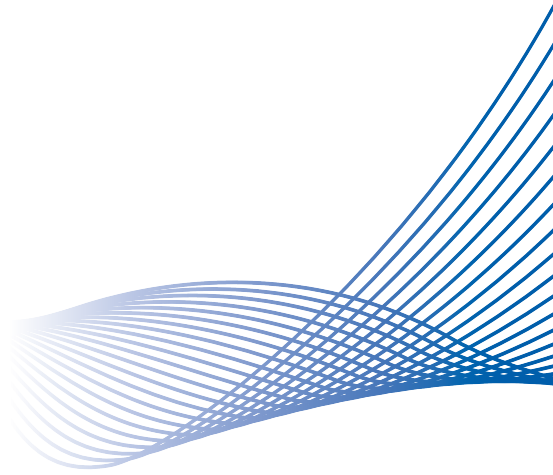


FIGURE 2; Test Tap Box - Dust cap removal



Note: Retain dust cap and re-fit after all tests are complete



Connect, Setup & Measurements

Connect

6 Connect Test Tap Boxes

- Align the keying ridges of the plug connector's fixed inner ring with the keyways in the socket connector.
- Push the plug connector onto the socket connector.

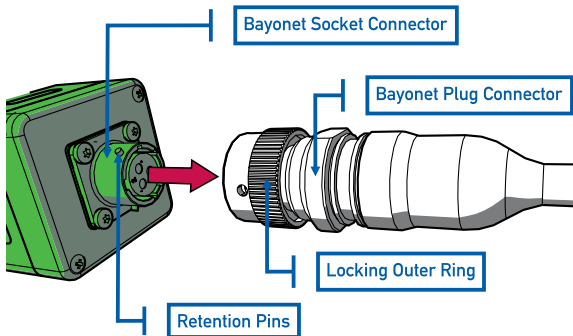


FIGURE 3; Test Tap Box to sensor connection

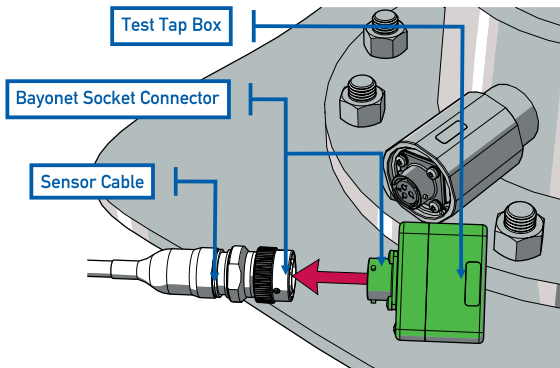


FIGURE 4; Test Tap Box to sensor overview

- Rotate the plug's outer ring until the slots in the outer ring align with the socket's retention pins.
- Continue to apply light pressure on the plug while turning the locking outer ring clockwise until it locks in place over the retention pins and the ring cannot be turned any more.

Setup

7 Wire the sensors



Determine which bushing and sensor configuration you are testing. Refer to your site plan/schematic. Every set must be tested.

- Wire the sensors to the doublePRIME IDD via the shorting blocks as noted below, shorting block might be contained within the doublePRIME Safety Box.
- The shorting blocks must be open.
- The transformer(s) **MUST** be de-energised and in an outage condition.
- Read through and thoroughly understand this.



Note: Verify that the shorting tab position is in the 'open' position.

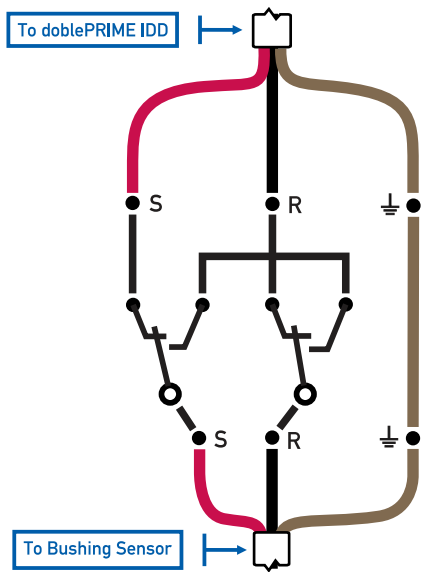


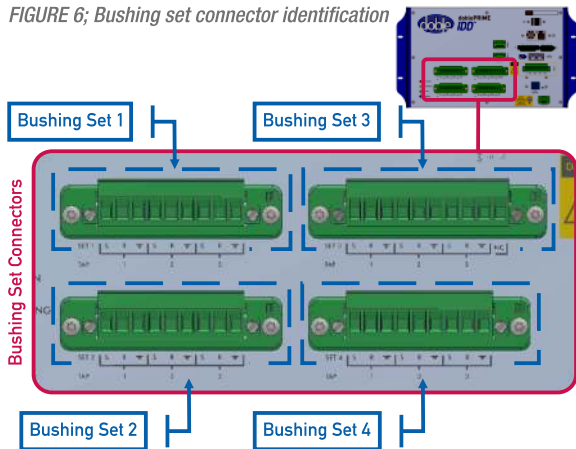
FIGURE 5; Sensor wiring diagram

Measurements

8 Measure bushing set connectors resistance

- Remove the bushing set connector(s) from the doublePRIME IDD.
- Using an ohmmeter, measure the resistances across each set of pins on the appropriate 9 Pin Connector and compare to the expected resistance.
- Measure all resistances at the screw connections on the connector.
- Refer to the diagrams and *Table 1.2 - Test Measurements* for the pin combinations to measure and the expected resistances across each set.
- For each set of pins, compare the measured resistance to that expected.
- The measured resistances should be within 2% of what is expected.

FIGURE 6; Bushing set connector identification



Note: Not all dolePRIME IDD's have 4 Bushing Sets, refer to your model number for reference

Identification of pin locations on connector:

S - Sensing Wire

R - Return Wire

⏏ - Shield Wire

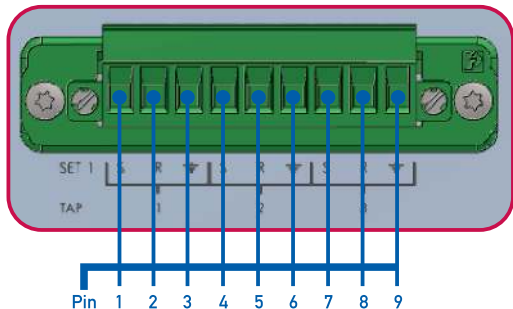
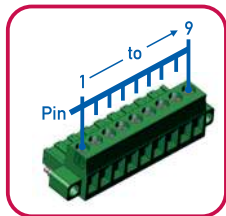
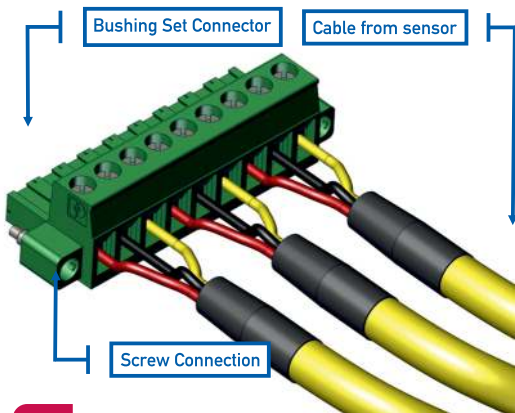


FIGURE 7; Connector pin identification

Bushing set connector removed from
doblePRIME IDD



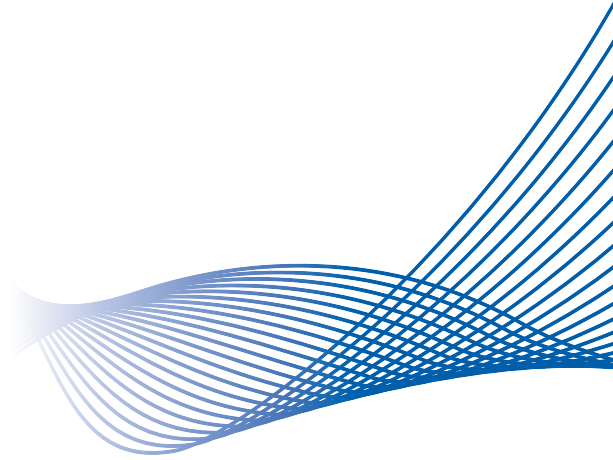
Note: Wire colours may vary due to cable type used.

FIGURE 8; Sensor cable to Connector

TABLE 1.2; Test Measurements

Sensor Type	IDD Set	Between Terminals	Expected Value K Ω	Tolerance \pm K Ω
Sensor 1 TEST TAP BOX 1	TAP 1	S & \downarrow	50	1
		S & R	100	2
		R & \downarrow	150	3
Sensor 2 TEST TAP BOX 2	TAP 2	S & \downarrow	200	4
		S & R	250	5
		R & \downarrow	450	9
Sensor 3 TEST TAP BOX 3	TAP 3	S & \downarrow	300	6
		S & R	350	7
		R & \downarrow	650	13

- If the measured resistances **MATCH** the expected resistances go to Step 9.
- If the measured resistances **DO NOT MATCH** the expected resistances go to Step 10.



Restore Assembly & Troubleshooting

Restore

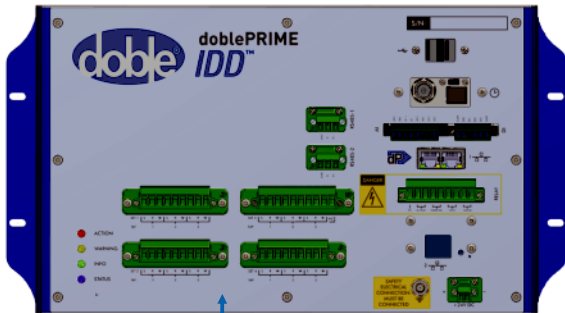
9 Restore the system to the operational configuration



Note: If the IDD is being put into service, leave the shorting blocks in the open position

- Replace the bushing Set Connectors to the same position which they were originally installed in.
- On the bushing sensors cables which were tested, do the following:
 - Remove the Test Tap Box from the sensor cable.
 - Reconnect the Sensor cable to the sensor (see installation document 72X-0102-01 for more information).

doblePRIME IDD



Bushing Set Connectors



Failure to replace the connector on the sensor will leave the bushing test pin floating after the transformer is energized.

10 Troubleshooting the installation

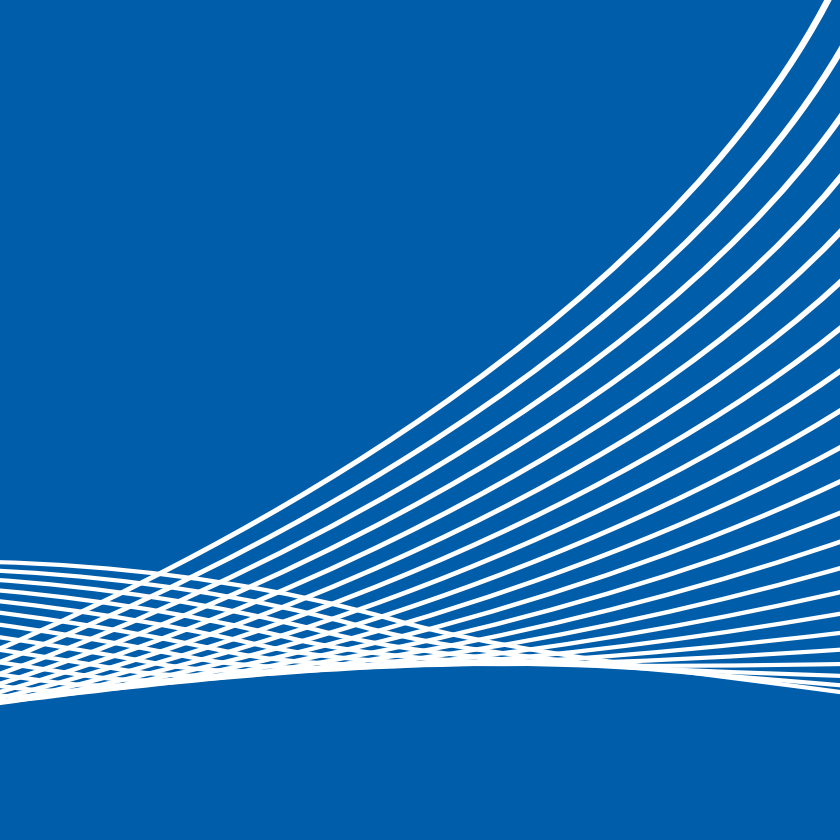
Condition	Possible Cause	Solution
Zero or near zero resistance	Shorting blocks are closed.	Open shorting blocks.
	Conductors are in contact at some point.	Trace cable and locate short.
Infinite resistance	The Tap Test Boxes are not installed and the sensors are not connected.	Connect Tap Test Boxes.
	Conductors are broken or not connected at some point.	Trace cable and locate the open connection.
Incorrect resistance values within the test tap box readings	Conductors are swapped at the shorting block or bushing set connector.	Trace wires and relocate to proper terminals.

TABLE 1.3; Troubleshooting

Condition	Possible Cause	Solution
Correct resistance value but on the wrong wire sets	The 3 wire sets from different taps are switched at the shorting block or bushing set connector	Relocate wires to proper tap in proper set
	Test Tap Boxes installed at wrong bushing.	Check at each bushing that the correct Test Tap Box is installed.
Correct resistance value on a 3 wire set but between wrong positions within the set	Conductors within the 3 wire set incorrectly wired at bushing set connector, shorting block, or the sensor.	Relocate wires to proper tap in set.

Notes

Notes





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