

Connection troubleshooting

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Before getting started (Testing the internal electronics)

This guide will show you some common and simple ways of testing the connection to your midlife instrument.

It is meant to serve as a starting point for basic troubleshooting when you are experiencing connection difficulties.

These tests will not cover all potential issues and there is no guarantee that passing these tests means everything is working as intended, but these are some very common causes.

We recommend reading the troubleshooting guide provided in the comprehensive manual to begin with, found <u>here</u>.

Before continuing this guide and troubleshooting your cables, we want you to perform this short test to ensure that the electronics (and endbell, so essentially the whole instrument itself) are working properly without having to open the instrument.

If the values from the following test are far off then there is damage somewhere in the circuitry likely making it impossible to connect to the instrument and transmit data properly, this will then have to be returned to Nortek for repairs.

Depending on the damage (which we will be able to pinpoint when the instrument is returned) it is important to find the cause of the damage to prevent it from happening again.

This test is a good place to start if:

- You are certain that you are connecting everything correctly and that the cables are working as intended.
- You have been able to connect to the instrument previously using the same equipment with no issues.
- Experiencing intermittent connection can point to issues on the circuitry.
- Modifications or repairs have been done, especially on the cables or power supply.
- You suspect the instrument has been exposed to over-voltage.
- You suspect water ingress
- Your instrument is old (10 years +)



To perform this test you will measure the resistance between the pins at the 8pin inline endbell. Depending on your multimeter and the probes it might require some wiring or ingenuity to access the pins for measurement:



Picture1. Inline endbell and the 8 pin connector we will be measuring.



Picture2.

Testing resistance between pin 4 and 1. Here we have stripped two wires and used them to access the connector pins.

Take your time and be thorough, measurements might be erratic depending on how you measure.



The following values (approximate) should be measured between the following pins at the instrument connector:

RS232:

Between Pin	Resistance in Ω	And Pin
1 (GND)	1-10 M	2 (PWR +)
3 (Tx)	OL	4 (Rx)
3 (Tx)	OL	1 (GND)
4 (Rx)	4k	1 (GND)

RS422:

Between Pin	Resistance in Ω	And Pin
1 (GND)	1-10 M	2 (PWR +)
3 (Tx +)	OL	4 (Tx -)
3 (Tx +)	OL	1 (GND)
4 (Tx -)	OL	1 (GND)
8 (Rx +)	70k	1 (GND)
7 (Rx -)	70k	1 (GND)
8 (Rx +)	130	7 (Rx -)

OL = **Open** Loop = or very high resistance (can depend on your multimeter)

You can also perform this test via a cable connected, but you need to be 100% sure that the cable is working. For online setups it might be difficult to retrieve the instrument, so testing via the cable is easier, unfortunately this is also where we often see damaged cables.

Testing via a cable can defeat the purpose of eliminating the working elements.



Connecting to your instrument

The first step when troubleshooting is to ensure that you are connecting to your instrument correctly and with the correct settings.

The following is a step-by-step guide on how to connect to your instrument.

If you are not able to connect to your instrument using this procedure please test (if available) a different cable/converter or even a different computer to rule out any issues with the latter before moving on.

- 1. Connect 8 pin to instrument.
- 2. Connect power to the cable and the USB end of the converter to the PC.
- 3. Open your Nortek program (AquaPro, Aquadopp, Vector or AWAC)
- 4. Set the correct communication port

(step 5 and 6 show you how to find the correct communication port if this is an issue)

and set the baud rate to the default 9600 (under "Communication" – "Serial port" in the software)

Make sure "hard break" is left unchecked.

 Open Device Manager (Different from OS to OS, but in Windows 10 you can right click the Windows icon and find Device Manager in the list that shows up). Click the dropdown for "Ports (Com and LPT)".

This should look like Picture 3 below and show all your connected ports.

If you cannot find the "Ports (Com and LPT)" in the list, it's because it is hidden: Click "View" and "Show hidden devices" if this is the case.

 Now when you connect the USB to RS232 converter to your PC it should show up in the "Ports" dropdown as a USB serial port (Picture 4).

The exact COM-port number will vary here, but the COM port that appears when you connect the USB to RS232-converter is the correct port to use when you want to communicate with your Nortek instrument.

 Press "Stop Data Collection" (sending a break) in the software (This will sync the instrument to the correct baud rate)



8. Go to the terminal emulator

("Communication" – "Terminal emulator") and send a break.

- Verify that you get a response like the one below from the instrument (The response will vary slightly depending on which type of instrument you have, FW, mode etc)
- 10. §§§§§§§§§§ AQUAPRO NORTEK 2019 Version 3.43 Command mode
- 11. Exit the terminal emulator (press Done) and start a measurement on your desk using the "Start Data Collection" button and the instrument configuration set to a short measurement interval of 1 or 2 seconds

(you might have to uncheck diagnostics in the advanced tab in "configuration"). If necessary, check how to do this in the Nortek manual.

- 12. Verify that the instrument is measuring and that you get data on your screen (it might take a couple of seconds).
- 13. Stop the measurement.





Before connecting the converter. Here we can see that at this moment com

1, 4, 5, 6, 7 and com 9 are in use.



After connecting the converter. Here we can see that Com 10 is added to the list. Com 10 is the port we will use.





Never connect to your instrument using a bad cable.

Here we have tested a standard 8 pin inline RS232 cable, but the principle is the exact same regarding the 8pin RS422; except that you have two additional lines of Rx and Tx to test. If you need to test other cables and/or connectors/harnesses please contact us for schematics. However, the principle is the same:

- Main power is supposed to be applied to ONE line (PWR/PWR GND)
- All lines should be continuous and not shorted in any way.
- The correct voltage is being applied to the instrument.

Making sure power is at the correct pin:

- Disconnect the converter from the cable and disconnect the instrument.
 (do not perform this test with the converter connected)
- Connect the power at the dry end of the cable.
- Set the multimeter to measure voltage.
- Connect one pin of the multimeter to ground (pin 1) at the instrument/wet end of the cable, now use the other pin of the multimeter to test each pin in the cable while having the other pin still connected to ground.
 See picture 5 where pin 2 (PWR+) is tested on the 8pin (15V).

A result of 0V confirming that power is not connected at a specific pin, is just as important as confirming that power is at the correct pin.

If power is connected to multiple pins, or on the wrong pin, this could damage circuits and result in no communication with the instrument.



When measuring the pin for power (PWR+), it's measuring the supplied voltage from the power supply, this should show a stable voltage close to 15V (depending on the supply and setup).

Please read this FAQ if you are unsure about anything related to powering your instrument.

The instrument's operating voltage can be found in the technical specifications.

Lower than 9V (midlife) is not sufficient to mitigate sound waves and a voltage above 18V can damage the instrument without an internal converter that lowers the voltage.



Pin number		What you should
		measure [V]
1	Pwr, Gnd	0
2	Pwr +	15
3	RS232 Tx	0
4	RS232 Rx	0
5	GND	0
6	Output Pwr	0
7	Analog in 2	0
8	Analog in 1	0

Matrix 1: Expected values.



Figure 3: Pins on the wet end of the cable

Picture 5.

Showing a voltmeter set to measure voltage, measuring between pins 1 and 2 on the wet end of the cable.



Testing the cable for continuity:

- Disconnect the power supply, converter and the instrument to isolate the cable for this test (D-sub to 8 pin).
- Refer to the <u>appendix</u> for the pinout of the cable.
- Use a multimeter at each end of the cable to test the continuity of each line.
 We want you to test the continuity of the lines used: Rx, Tx and Ground. (If you want to test the other lines, like analogue lines, this can be done as well)
 Picture 6 below shows testing continuity of the transmit line (Tx) of an RS232 cable.

For more in depth information on how to use the multimeter see below.





Picture 6. Showing continuity (no resistance), between pin 3 (8pin) and 2 (D-sub) (Tx).



					Pwr. GND		
Conne	ctor specified by table below	v		Γ	Ģ	2 Pin Jack p Art#14002	olug 9
	Pwr, Gnd	^	Black 18 AWG			' г	1
2	Pwr +	0	White 18 AWG		J	RS232 Tx	2 9Pin DSUB female
3	RS232 Tx	X	Black 26 AWG			RS232 Rx	3 DSUB kappe
-	RS232 Rx	()	White 26 AWG				Art#140047
5	GND	X	Black 26 AWG			Pwr.Gnd	Láseskrue
	Output Pwr	()	White/Purple 26 AWG	T			6 Stift0.2-0.5mm
	Analog in 2	X	Black 22 AWG				7 Art#140067
8	Analog in 1	()	White/Orange 22 AWG				9pin DSUB hylse
Ľ		v					✓ Art#140057 9
						L	0
					•	GND, Blac	*
					•	Output Pw	r, Red
					•	Analog in	2, Green
			ength energified by table below		•	Analog in	1, Yellow
-		L	engun specified by table below	r			

Picture 7.

Showing the cable diagram/pinout for the standard RS232 w/ analog in options.

Do not be alarmed if you have a different version, as this document only addresses the RS232-Tx, RS232-Rx, Power, and GND lines.

These pins should be the same for all RS232 versions.

Use a multimeter to test for continuity using the continuity mode (usually button marked with diode/soundwaves symbol) if available, or by testing the resistance between the pins.

If the multimeter has a continuity test, then the multimeter will make a sound if there is contact (continuity) between the pins. If the multimeter does not have a continuity mode then set the multimeter to the lowest resistance mode (measured in Ohms, check for the symbol Ω .) and see that there is no resistance in the line.

If there is no resistance (0 Ω or very close to 0) then there is continuity, if there is resistance (might show infinite resistance or open loop / OL when set to the lowest setting) there is no continuity and the line is discontinued somewhere inside the cable.

The cable might also have intermittent continuity, meaning a line is discontinued only when under stress or movement. If this error is suspected, try to wiggle and bend the cable while performing the continuity test.



Test cable for short circuits

To ensure no pins are connected wrongly to each other within the cable, perform the following test:

Test all the pins at the wet end of the cable against each other and *make sure there is NO continuity between any of them.*

This should be performed between all pins, so 1 to 2-8. 2 to 1-8, 3 to 1-8 etc.

Picture 8.

Showing an Open Loop between pin 1 and pin 2



The above tests were performed with RS232 as an example.

However, as mentioned previously, the same tests can easily be performed for the RS422 cables as well.

There are several tutorials available on the Internet on how to use a multimeter if needed and also describing continuity testing and other cable tests.

If, after performing these tests, there appears to be any damage to the cable; then there is a chance that this has damaged the instrument.

This will probably be apparent in the first test described in the first chapter.



Loopback test

Hopefully, and most likely, you will have found the root cause of the issues during the previous tests. Then it is not necessary to perform a loopback test. However, if you still have not found any issues, all values look good and the instrument still isn't responding this is a valuable test to perform.

Opening the instrument and accessing the electronics or performing repairs requires technical understanding, please follow the manual and if you are unsure about anything have a technician perform the work or contact Nortek support.

A standard Nortek midlife setup consists of these connectors:

- 9-pin D-sub (Converter)
- 8-pin end-bell connector at the wet end of the cable
- 9-pin Molex connected to the connector on the inside of the end-bell
- 24-pin Molex connected to the electronics card

A loopback test can be performed at every step within the setup to track down a potential error in the communication lines.

Working your way from the converter to the electronics card will test all parts of the setup, one by one.

What is a loopback test?

The PC will send a signal via the "receive" pin (from instruments point of view) that is looped back to the transmit pin by connecting the transmit and receive pins.

The signal the PC sends out is then sent back to the PC and is shown in the terminal emulator. This is called a loopback test.

It basically loops back the sent signal as the received signal. This can be a very helpful tool when troubleshooting.



How to perform the loopback-test:

- Loop the transmit and receive pin (Tx = transmit, Rx = receive) See <u>appendix</u> for termination.
- Connect the converter to the PC via the USB port.
- Open the Nortek program normally used to connect to the instrument (AquaPro, Aquadopp, AWAC or Vector).
- Choose the correct com port via "Communication Serial port" (see <u>connecting to your instrument</u> if unsure)
- Open the terminal emulator "Communication Terminal Emulator".
- Now type the letter A as a command and press send, this letter/signal should be echoed back.

Any letter written SHOULD be shown on the screen when sent.

Picture 9 showing how this will look on your screen:

Andred Republic CLUR A Communities Performent View Conferences Product Mate		- a x
10 - CA LAS No CA 10 10 10 CA LAS 100.	18 18 18 9 W	
		8.44
1 2.5 0.000 0.0 0.000 </td <td>[broad 1 X]</td> <td></td>	[broad 1 X]	
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If the letter(s) appear then the part being tested is doing its job (there could still be other issues with the part).

If the part is not responding, then there is something wrong with the wiring or the part is damaged.

Use a working part when moving on to test the next part of the setup.

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End notes



If these tests do not help you re-establish a working connection chances are your instrument has more severe issues or you may have overlooked something.

If this is the case please fill out the short troubleshooting report available <u>here</u> and contact Nortek support and we will be happy to help.

Support@nortekgroup.com

Appendix

Schematics:

These schematics cover the standard termination for midlife instruments. Different variations exist, but the communication (Rx/Tx) and Power (Pwr/Gnd) lines should have the same pin assignment.

Opening the instrument and accessing the electronics or performing repairs requires technical understanding, please follow the manual and if you are unsure about anything have a technician perform the work or contact Nortek support.

If you have a different wiring setup or connectors please contact us at Nortek Support with the specifications of your cable(s) and we can provide you with the schematics you need.

RS232 setup:



8 pin inline (wet-end/endbell, at instrument) to D-sub (to converter):







End bell 8 pin to 9 pin Molex (first part inside instrument):

N N N N N N N N N N I I I I I I / / / /

N N N N N I I I I I / / /

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Harness 9 pin Molex to 24 pin Molex on mainboard:

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RS422 setup:





D-sub (to converter) to 8 pin inline (wet end, at instrument):



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End bell 8 pin to 9 pin Molex (first part inside instrument):

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X = X = X = X



1 1 1 1 1 1



Harness 9 pin Molex to 24 pin Molex on mainboard:



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Troubleshooting report

Troubleshooting report

Company:	
Contact person:	

Instrument type:	
S/N:	

Short description of the initial trouble:

If no connection is established with the instrument, fill out the following pages with results from the tests:



Test results:

Resistance test, instrument:

RS 232

Pins:	Ω:
1-2:	
3-4:	
3-1:	
4-1:	

RS 422

Pins:	Ω:
1-2:	
3-4:	
3-1:	
4-1:	
8-1:	
7-1:	
8-7:	

X X X X X 1 1 1 1 1 1 1 1

X X X X X I I I I I I I Z Z

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Cable test:

Continuity result:			
OK	Damage		
Short circu	its:		
Yes	No		
If "yes", what	pins?:		

Loopback test:

Part:	Working:	
Converter:	Yes	No
+ cable:	Yes	No
+ endbell:	Yes	No
+ harness:	Yes	No

Additional information:

Please attach any relevant pictures.

|X - X - X|

Original equipment? Modifications? Online/not online? Deployment site. Etc. Etc.

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