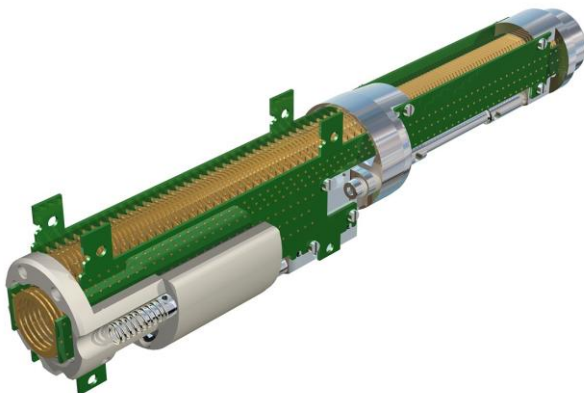


StepWave Assembly

Part Number:	700011117	Where Used:	Xevo TQ-S
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Functional description



- The StepWave assembly is used to focus ions arriving from the source and transport the focused beam into the MS1 quad.
- The device consists of two ion guides (TW1 and TW2). TW1 is a stacked ring ion guide design consisting of two parallel sections, known as the "head" and the "body". TW2 is a more conventional stacked rod design with only one section.
- The head section is on-axis with the quads and gas cell, whereas the body section is off-axis.
- A DC potential is applied between the head and the body (opposite to the ionization polarity). This causes the charged ions to move from the body to the head section. Neutrals continue down the body into the pumping system, reducing their contribution to background noise.

WARNING: *Gloves must be worn when handling the StepWave assembly to avoid chemical contaminants.*

CAUTION: *Take care when removing or refitting the StepWave assembly as the pogo pins used to make the internal connections are easily damaged.*

Location

The StepWave assembly is situated between the ion block and the MS1 quadrupole.

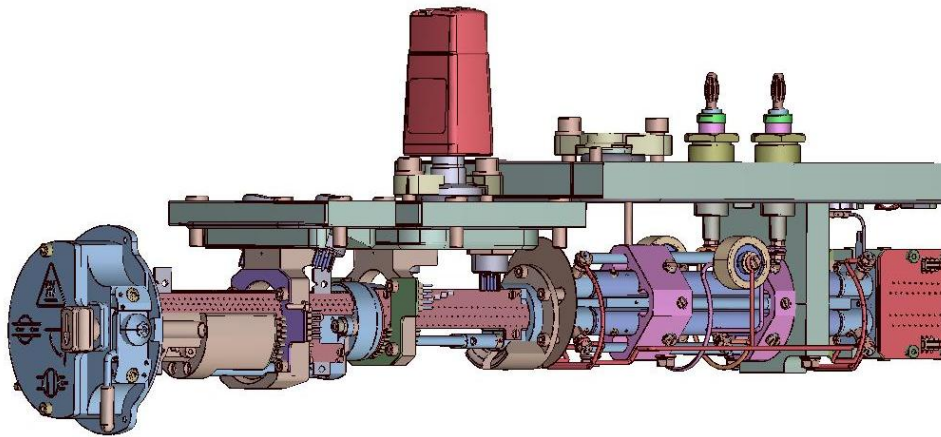


Figure 1 - Location of the StepWave assembly

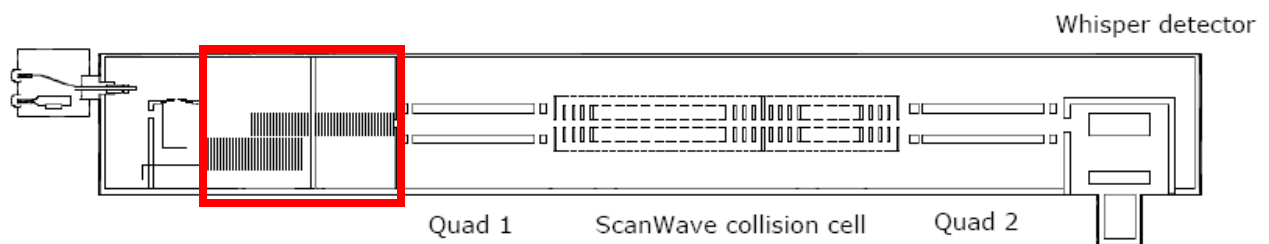
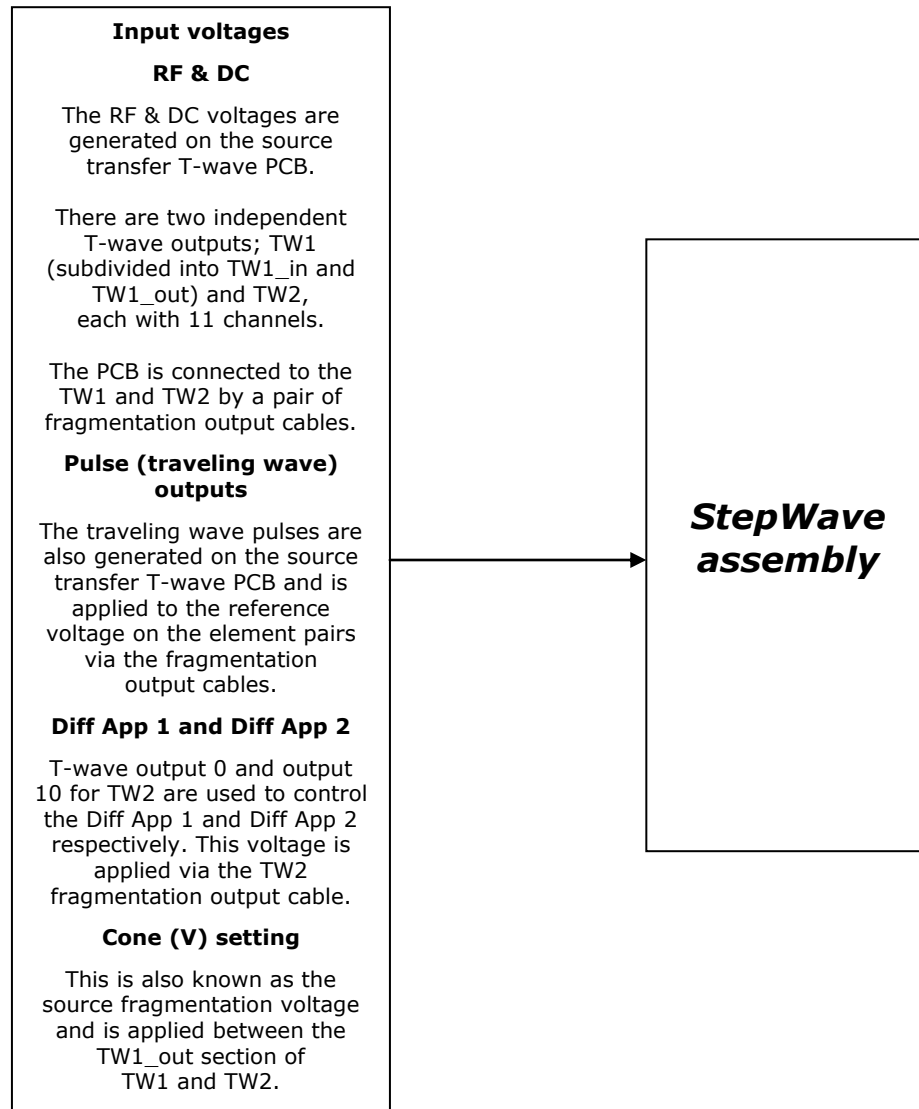


Figure 2 - Location of the StepWave assembly in the analyzer housing

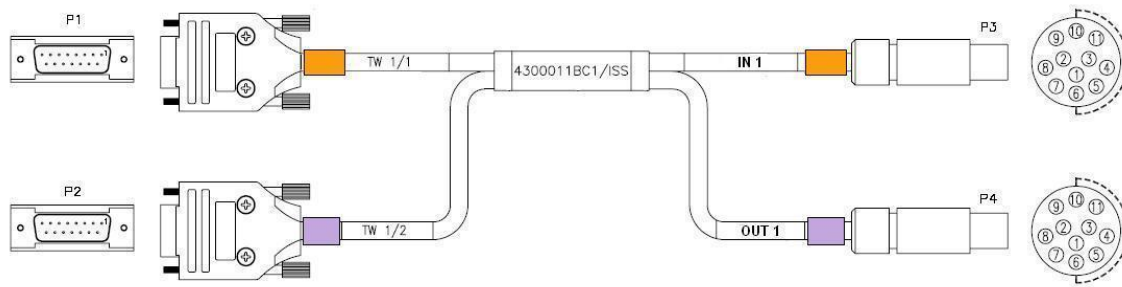
Inputs/outputs

NOTE: *There are no outputs from the StepWave assembly. All readbacks related to the StepWave assembly are generated in the source transfer PCB. Information on the StepWave readbacks can be found in the [Source Transfer PCB Technical Reference Sheet](#) (p/n 715002817).*



Fragmentation output cable (TW1) - 4300011BC1 (700005370)

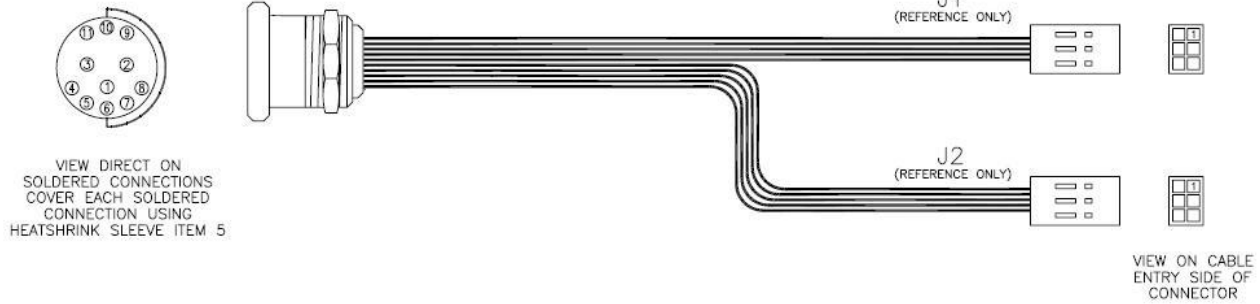
This cable connects to the ion guide connection flange.



P1/P2 15 W D-Type pin number	P3/P4 Fischer pin number	Function	Pulse level
8	11	OUTPUT0	TW1_In
9	1	OUTPUT1	
2	2	OUTPUT2	
10	3	OUTPUT3	
3	4	OUTPUT4	
11	5	OUTPUT5	TW1_Out
4	6	OUTPUT6	
12	7	OUTPUT7	
5	8	OUTPUT8	
13	9	OUTPUT9	
6	10	OUTPUT10	
Hood	Clamp	SCREEN	Screen

Internal transfer cables 1 and 2 - 4300023BC1/4300024BC1

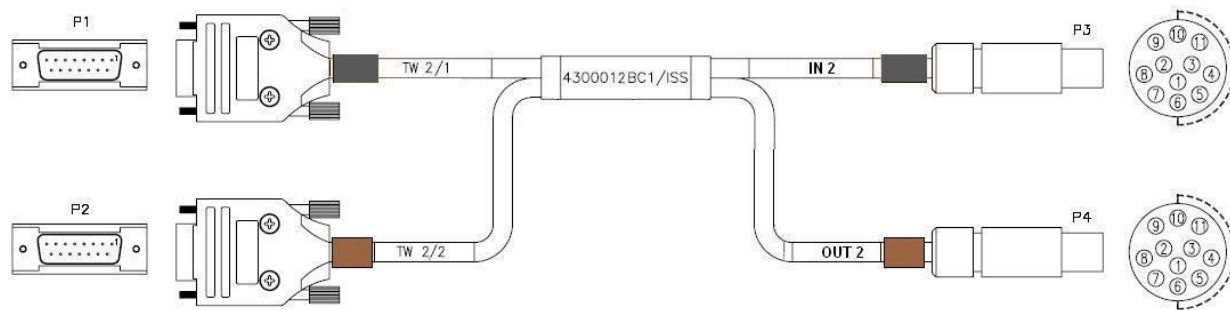
VIEW ON SOLDER SIDE



11 W Fischer	Harwin connector J1	Harwin connector J2	Function	Pulse level/description
11	-	5	OUTPUT0	TW1_In
1	1	-	OUTPUT1	
2	2	-	OUTPUT2	
3	3	-	OUTPUT3	
4	4	-	OUTPUT4	
5	5	-	OUTPUT5	TW1_Out
6	6	-	OUTPUT6	
7	-	1	OUTPUT7	
8	-	2	OUTPUT8	
9	-	3	OUTPUT9	
10	-	4	OUTPUT10	

Fragmentation output cable (TW2) - 4300012BC1 (700005371)

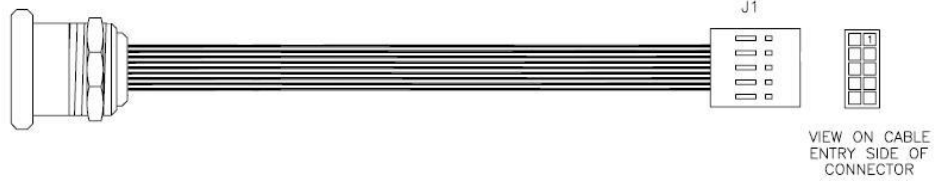
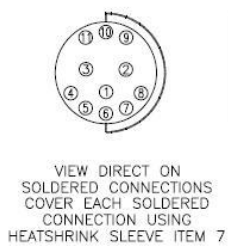
This cable connects to the ion guide connection flange.



P1/P2 15 W D-type pin number	P3/P4 Fischer pin number	Function	Pulse level/description
8	11	OUTPUT0	Diff App 1
9	1	OUTPUT1	TW2
2	2	OUTPUT2	
10	3	OUTPUT3	
3	4	OUTPUT4	
11	5	OUTPUT5	
4	6	OUTPUT6	
12	7	OUTPUT7	
5	8	OUTPUT8	
13	9	OUTPUT9	
15	10	OUTPUT10	Diff App 2
Hood	Clamp	SCREEN	Screen

Internal transfer cables 3 and 4 - 4300025BC1/4300026BC1

VIEW ON SOLDER SIDE



11 W Fischer	Harwin connector 4300025BC1 J1	Harwin connector 4300026BC1 J1	Function	Pulse level/description
9	-	2	-	-
1	1	5	OUTPUT1	TW2
2	2	-	OUTPUT2	
3	3	-	OUTPUT3	
4	4	-	OUTPUT4	
5	5	-	OUTPUT5	
6	6	-	OUTPUT6	
7	7	-	OUTPUT7	
8	8	1	OUTPUT8	
10	9	3	OUTPUT10	Diff App 2
11	-	4	OUTPUT0	Diff App 1

Fragmentation output cables location

CAUTION: *The fragmentation output cables must be plugged into the correct connectors in the ion guide connection flange. If the cables are fitted incorrectly the beam may be lost.*

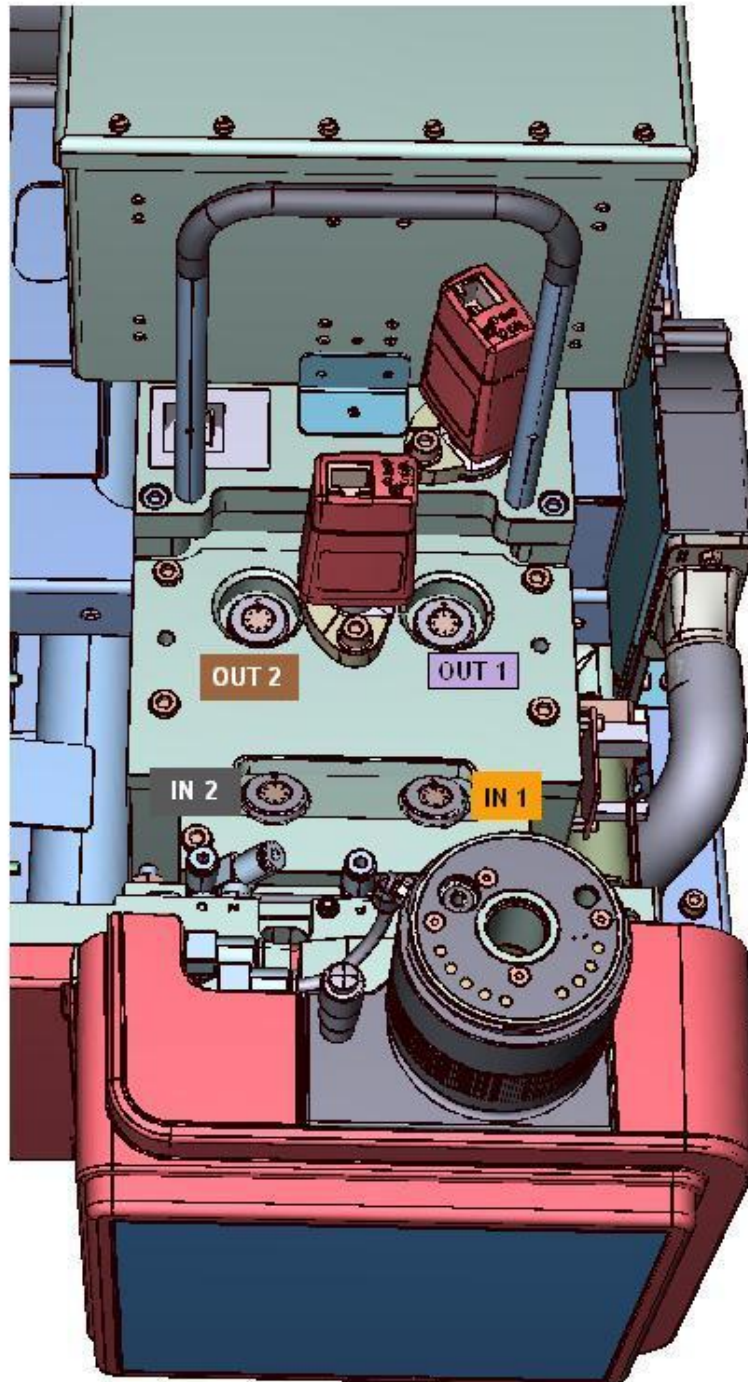


Figure 3 - Correct location of the fragmentation output cables

Diagnostic procedures

Rapid MRM scanwave cell diagnostic test

This test is based on the look-up tables used by the Xevo TQ-S for multiple MRM channel acquisitions.

The beam must be stable before the acquisition so that sensitivity is not impaired, due to the use of 1 ms dwell times. The test simulates the maximum mass (RF amplitude) switching for a 3 ms interscan delay.

If full intensity is not restored within this time, the StepWave will require cleaning and inspection.

1. In the Tune page, open a single MSMS mode daughter ion window, using a set mass 59 Da.
2. Examine the 59 Da peak with a span of 3.
3. Activate automatic 'Advanced' settings on the Tune page.
4. Infuse setup solution at 10 μ L/min.
5. Specify a collision gas flow rate of 0 mL/min and a collision energy of 5 V.
6. Check that the daughter peak (transition 59 > 59), is present and stable with a scope speed of 0.5 s scan and 0.1 s interscan delay.
7. If any drop outs are present, investigate the probe and fluidics system for leaks.
8. Once a stable beam is observed on the Tune page, open the sample list page.
9. In the sample list, create an experiment titled **Stepwave_Trapping** with two channels in one MRM function (Figure 4).

Compound Name	Parent (m/z)	Daughter (m/z)	Au	Dwell (s)
1 Fragment1	59.0000	59.0000	☐	0.001
2 Fragment 2	74	74	☐	0.001

Figure 4 - Stepwave_Trapping experiment

10. Disable any method events associated with this experiment.
11. Save the method as Stepwave_Trapping.
12. On the sample list add two rows titled **Stepwave_Trapping_Fast** and **Stepwave_Trapping_Slow**, containing the Stepwave_Trapping experiment file.

	File Name	File Text	MS File
1	Stepwave_Trapping_Fast	Dwell = 0.001s, ISD = 0.003s	Stepwave_Trapping
2	Stepwave_Trapping_Slow	Dwell = 0.001s, ISD = 0.1s	Stepwave_Trapping

Figure 5 - Additional sample list StepWave rows

13. From the Tune page, open the Inter-scan setup window.
14. Select the **Enable Manual Mode** checkbox.
15. Set both the inter-scan, and inter-channel delay times to 0.003 s.
16. Ensure the syringe is more than half-full of sample, refilling if necessary.
17. Infuse until the beam is stable.
18. Acquire the **Stepwave_Trapping_Fast** run only.
19. When the acquisition is complete, change the inter-scan, and inter-channel delay times to 0.1 s.
20. Acquire the Stepwave_Trapping_Slow run only.
21. When the acquisition is complete open the chromatograms from both runs.
22. Click **Display > Mass** and double-click on the first channel.
23. Click on Fragment 1 (59 > 59) MRM trace.
24. Click the **Replace trace** check box.

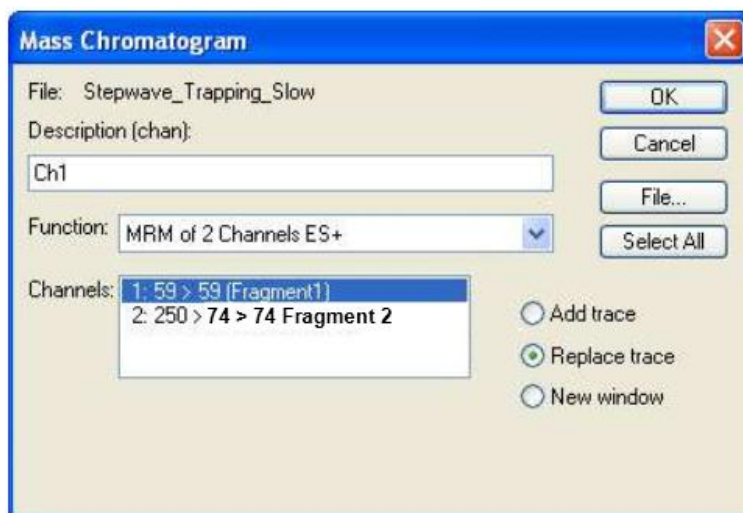


Figure 6 - Mass chromatogram dialog

25. Smooth each mass chromatogram using the following parameters:

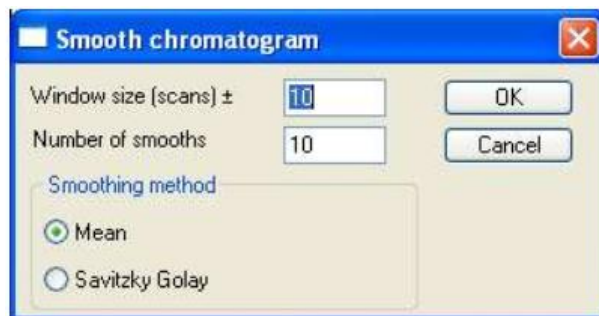


Figure 7 - Smooth chromatogram dialog

26. Calculate the percentage ratio between the fast and slow 59>59 transitions:

$$\% \text{ difference} = \frac{\text{Intensity Stepwave_Trapping_Fast}}{\text{Intensity Stepwave_Trapping_Slow}} \times 100$$

Figure 8 - Percentage difference equation

27. Print the chromatogram window displaying both smoothed extracted chromatograms each labelled with the calculated percentage.

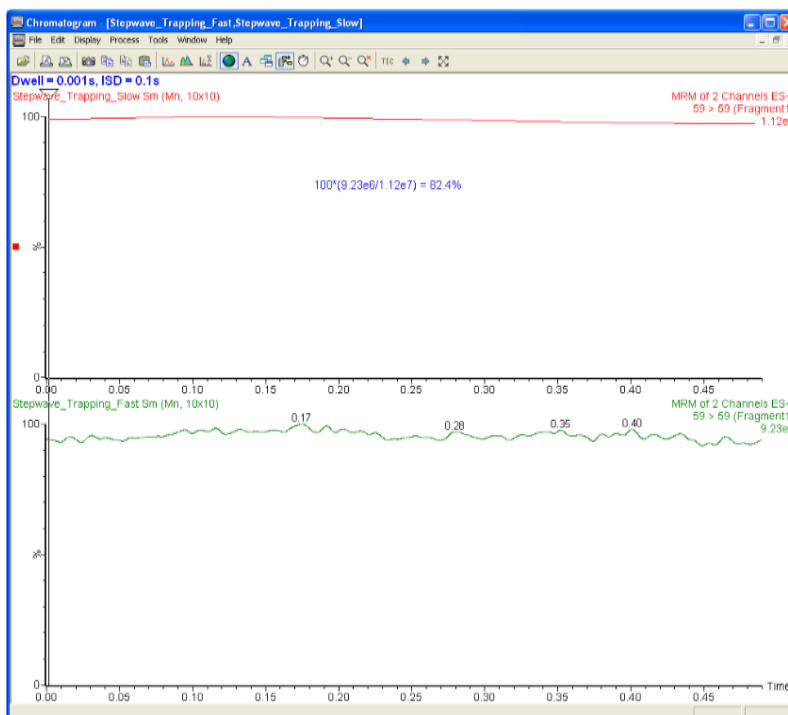


Figure 9 - Example chromatogram window

NOTE: The ratio of the fast to slow scan must be $\geq 85\%$. A figure of less than 85% implies trapping within the StepWave. This may be due to bent transfer plates or due to contamination.

Checking the continuity of the fragmentation output cables

To check for shorts within the StepWave assembly, feedthroughs, and fragmentation output cables, without venting the instrument, follow these steps:

1. Ensure the instrument is in Standby.
2. Disconnect the four D-type connectors from the source transfer PCB.
3. Using a DVM set to the resistance function, test for continuity between corresponding pins on connectors P1 and P3 as shown in the table on page 6 and also between the connector shell of connectors P1 and P3 (Pass = $< 0.5 \Omega$). Repeat for the second pair of connectors - P2 and P4.

NOTE: Do not use the audible continuity function of the DVM as the measurement cannot be quantified.

- Using a DVM set to the resistance function, ensure there is no continuity between each pin and all other pins on that connector or between each pin and the connector shell for connector P1 (Pass = $>1\text{ M}\Omega$). Repeat for connector P2.

NOTE: Do not use the audible continuity function of the DVM as the measurement cannot be quantified.

Checking the continuity of the StepWave assembly

If there is no beam and the StepWave tuning currents are not correct there may be an internal issue with the StepWave assembly.

Checking the continuity of TW1

The connection points on the side PCB make contact with the pogo pins located on the ion guide connection block. The ion guide connection block is part of the ion guide connection flange assembly.

Each connection point relates to a numbered solder point on the main PCB that the ring pairs are mounted onto. The connection point must have continuity to the upper and lower solder point for each number, see [Figure 10](#):

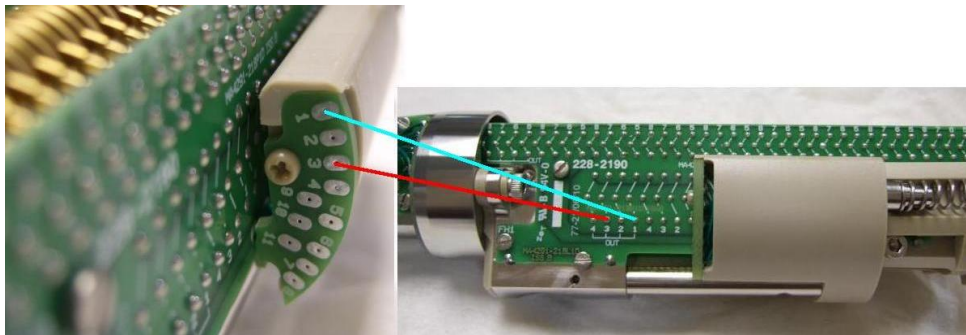


Figure 10 - Checking the continuity of TW1

Checking the continuity of TW2

The same principle applies for TW2 as for TW1, see [Figure 11](#):

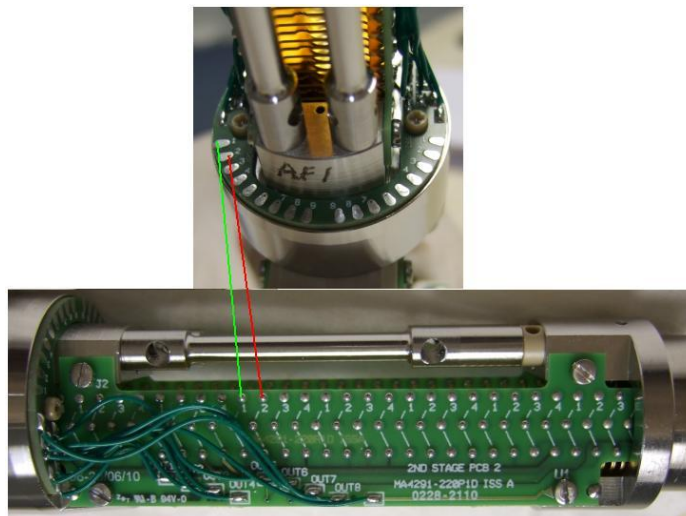


Figure 11 - Checking the continuity of TW2

Checking the StepWave feedthrough pogo pins

The StepWave voltages are supplied to the StepWave ion guide assembly through pogo pins on the StepWave feed through assembly. Damaged pogo pins will not make contact with the pads on the StepWave, leaving plates within the ion guide disconnected (floating). During use these floating plates will charge up and cause the ion beam to be attenuated; this process usually takes a few minutes depending on the intensity of the ion beam. Check the condition of the pogo pins if this charging effect is seen, particularly if the StepWave ion guide has just been fitted.

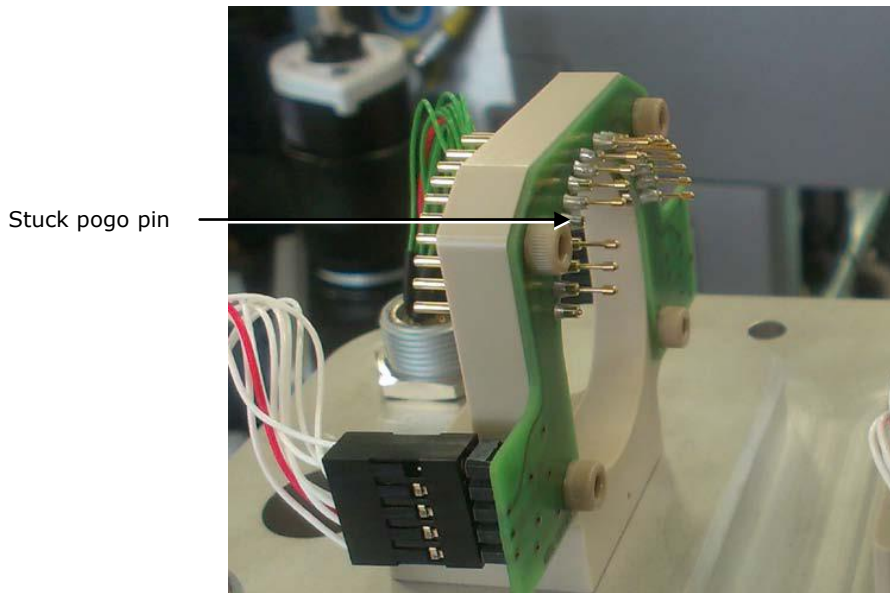


Figure 12 - Pogo pins on ion guide connection flange

If short term charging occurs after refitting the StepWave, perform the following procedure:

1. Vent the instrument and turn off the power.
2. Remove the StepWave assembly, as described in the [StepWave Ion Guide Cleaning Instructions Addendum](#) (p/n 715003880).

NOTE: *The pogo pins can be accessed from the front of the instrument, once the StepWave assembly has been removed.*

3. To check each of the pogo pin connections, press the pogo pins to confirm that they move freely, and then return to the extended position against spring pressure when released.
4. If the pins stick or do not move freely, replace either the individual spring contacts (p/n 700005385) or the complete ion guide connection flange (p/n 700005384).

Other relevant information

Removing and cleaning the StepWave assembly

The StepWave assembly may require cleaning if a low signal sensitivity is observed and cleaning the ion block and isolation valve fails to increase sensitivity.

Refer to the [StepWave Ion Guide Cleaning Instructions Addendum](#) (p/n 715003880) for a detailed description of how to remove and clean the StepWave assembly.

For more information on StepWave ion guide operation and theory, refer to the [Source Transfer PCB Technical Reference Sheet](#) (p/n 715002817).

Refitting the StepWave assembly

CAUTION: *Take care when fitting the StepWave to the instrument; it must be aligned correctly. It must be centered and not at either of the two extremes of possible rotation. This ensures good electrical contact to the ion guide connection PCBs.*

The StepWave is free to rotate by a small amount and if misaligned the conductive pads on the StepWave will not make good contact with the pogo pins on the ion guide connection PCBs. This can result in loss of signal over time in positive, negative, or both ion modes. It can also result in loss of signal when switching between positive and negative modes.

If after fitting the guide, signal loss over time is seen, refit the StepWave.