Course: Digital Drift System

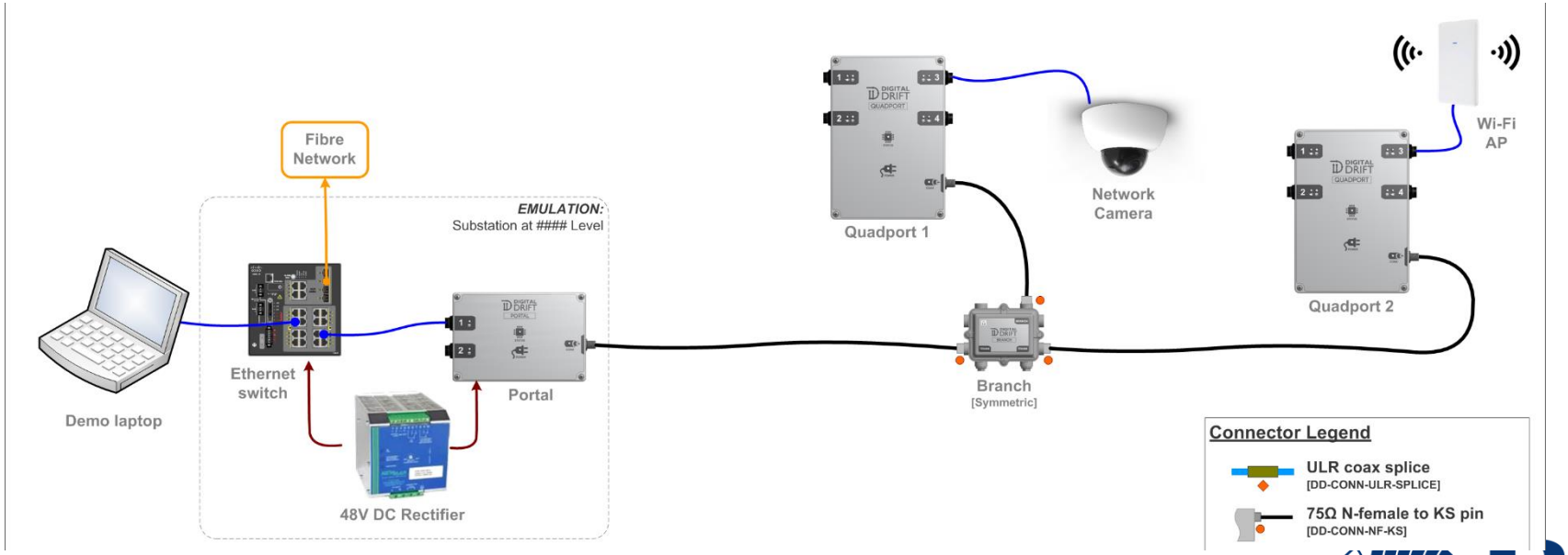
Module 1.1:

Fundamentals

RFI
TECHNOLOGY SOLUTIONS

Fundamentals

- Ethernet networking and power distribution combined;
- Uses coaxial cable
- Point to multi-point topology - allows for linear network extension
- > 1Gbps half-duplex - shared between the nodes on each ‘coax segment’
- Low latency - ~0.5ms added by each Digital Drift ‘coax segment’



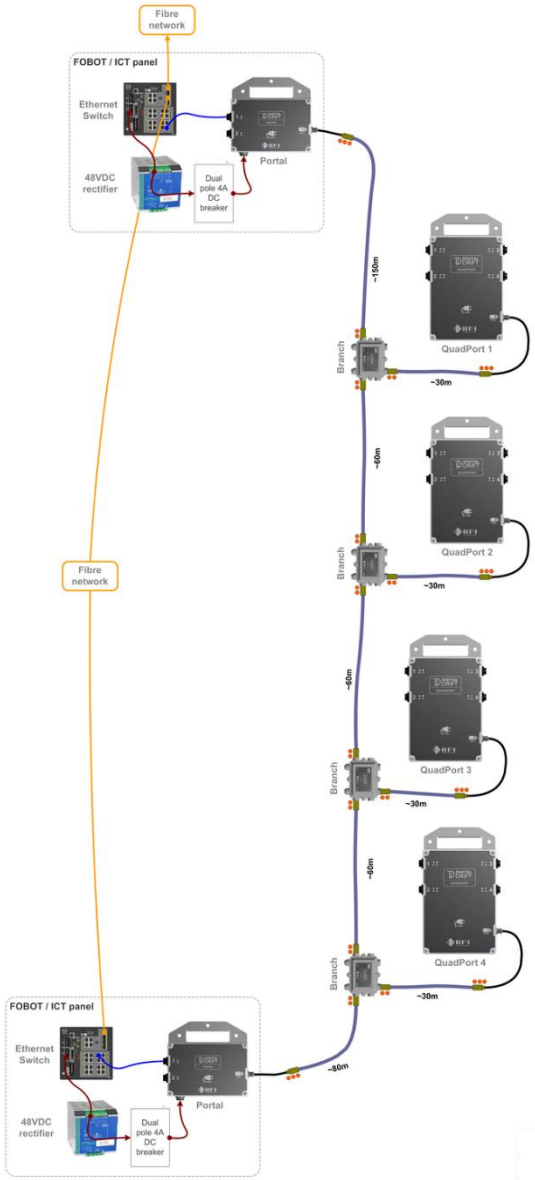
RFI TECHNOLOGY SOLUTIONS

Applications

- What Digital Drift is designed for:
  - Taking the network from long term parts of the mine (shaft banks, substations, workshops) to shorter term parts of the mine.
  - It is an alternative to running fibre + LV power.
- What Digital Drift is not designed for:
  - Being the network backbone in the mine (unless it is a very small mine);
  - Digital Drift augments a mine's fibre infrastructure and extends its reach.
- Common applications to date:
  - Wi-Fi coverage in working areas, for:
    - Tracking (Mobilaris), FMS (Minlog), Task mgmt. (Mint), IP Telephony
  - Backhaul of RCT for surface tele-remote;
  - Instrumentation & control – fan starters, electrical cabinets
  - IP video cameras - pastefill & fixed plant monitoring

RFI TECHNOLOGY SOLUTIONS

Design by example – surface remote control, with redundant loop



Requirement:

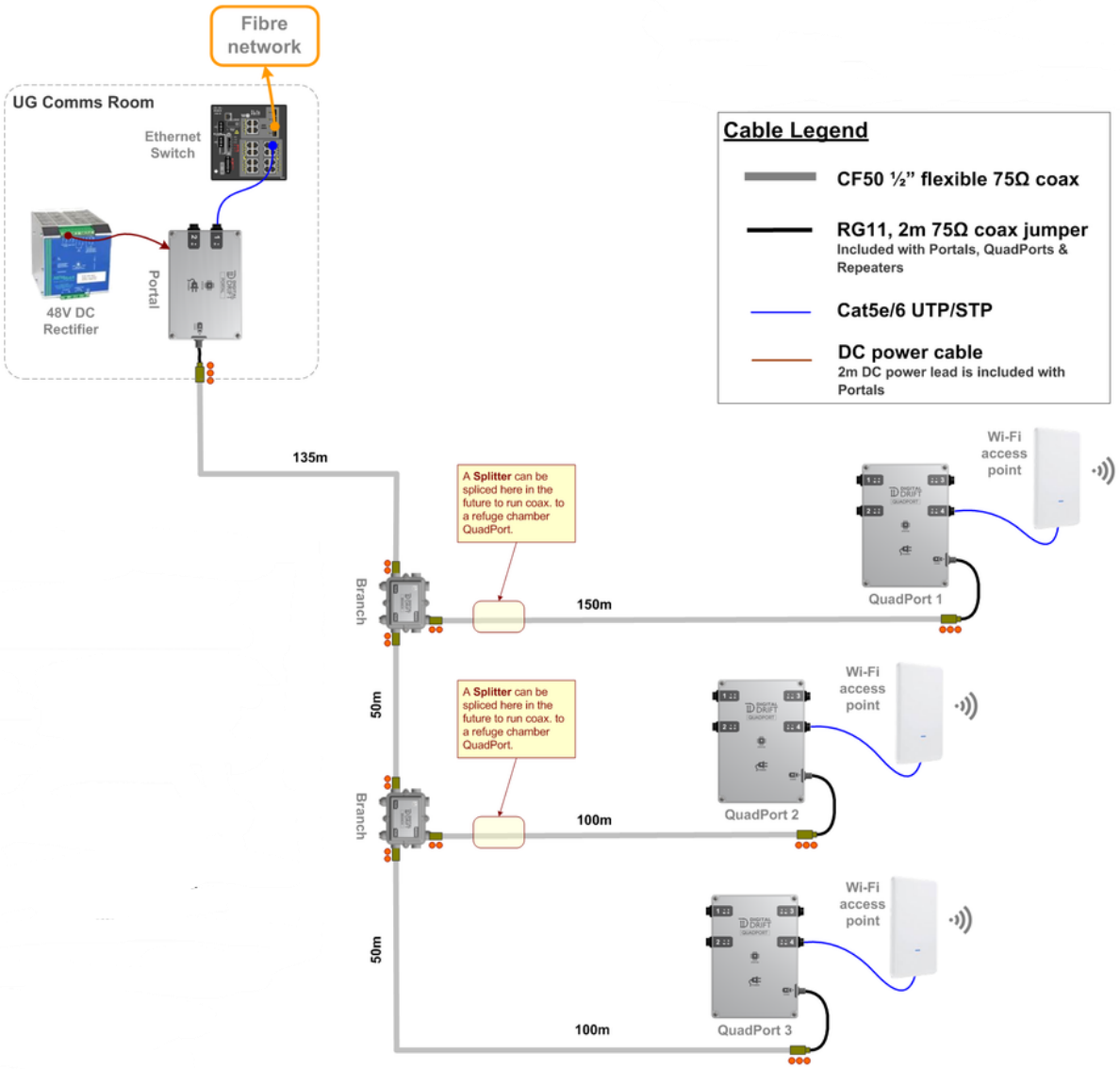
- Push network coverage out into four levels, for surface tele-remote control.
- Provide redundancy for comms cable damage.

Solution:

- Run ½” flexible coax down the ladderways between existing underground fibre switches.
- Branch the coax off at each ladderway into the level, where a QuadPort breaks out 4 x PoE ports.
- Terminate the coax into the fibre switches at both ends for redundancy:
  - If the coax cable is damaged, it will automatically divide into two coax segments.
  - If the fibre cable is damaged, the coax will carry the UG backhaul traffic.

RFI TECHNOLOGY SOLUTIONS

Digital Drift : Data / VOIP only - point / “hot-spot” applications



Requirement:

- Push Wi-Fi coverage into three levels, where tele-remote huts are regularly moved by the mining team.

Solution:

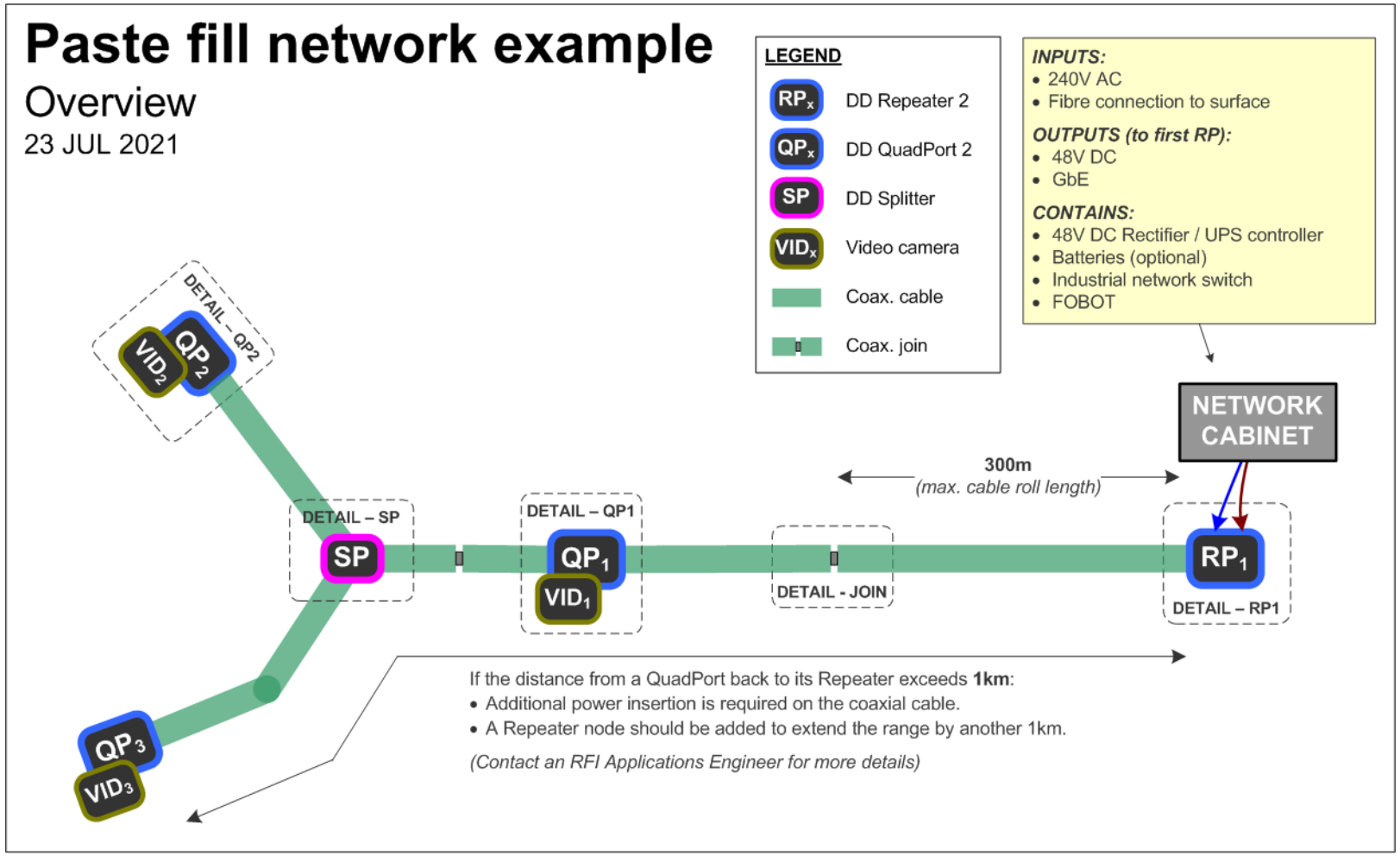
- Run ½” flexible coax down the ladderways from the nearest UG Comms Room.
- Branch the coax off at each ladderway and extend the coax into each level, where a QuadPort breaks out 4 x PoE ports for Wi-Fi.

Benefits:

- Deployed and supported by the in-house comms team.
- Coax is easily spliced, branched and extended to other levels as mining moves.

RFI TECHNOLOGY SOLUTIONS

Design by example – Paste fill monitoring



RFI TECHNOLOGY SOLUTIONS

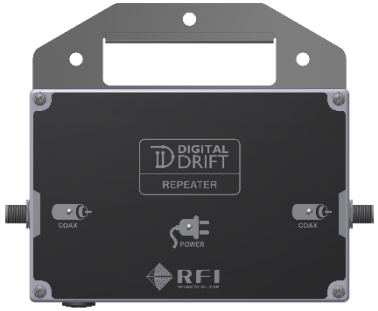
Digital Drift - Active Devices

Portal [DD220-PO]

- Interfaces to the existing fibre network:
  - 2 x GbE ports (no PoE);
  - 1 x coax port.
- Can be used to inject DC power onto the cable.

QuadPort [DD220-QP-FM or DD220-QP-GU]

- Breaks out PoE+ ports (25W each) from the coax.
- Contains an embedded L2 Ethernet switch, either:
  - Unmanaged
  - Managed

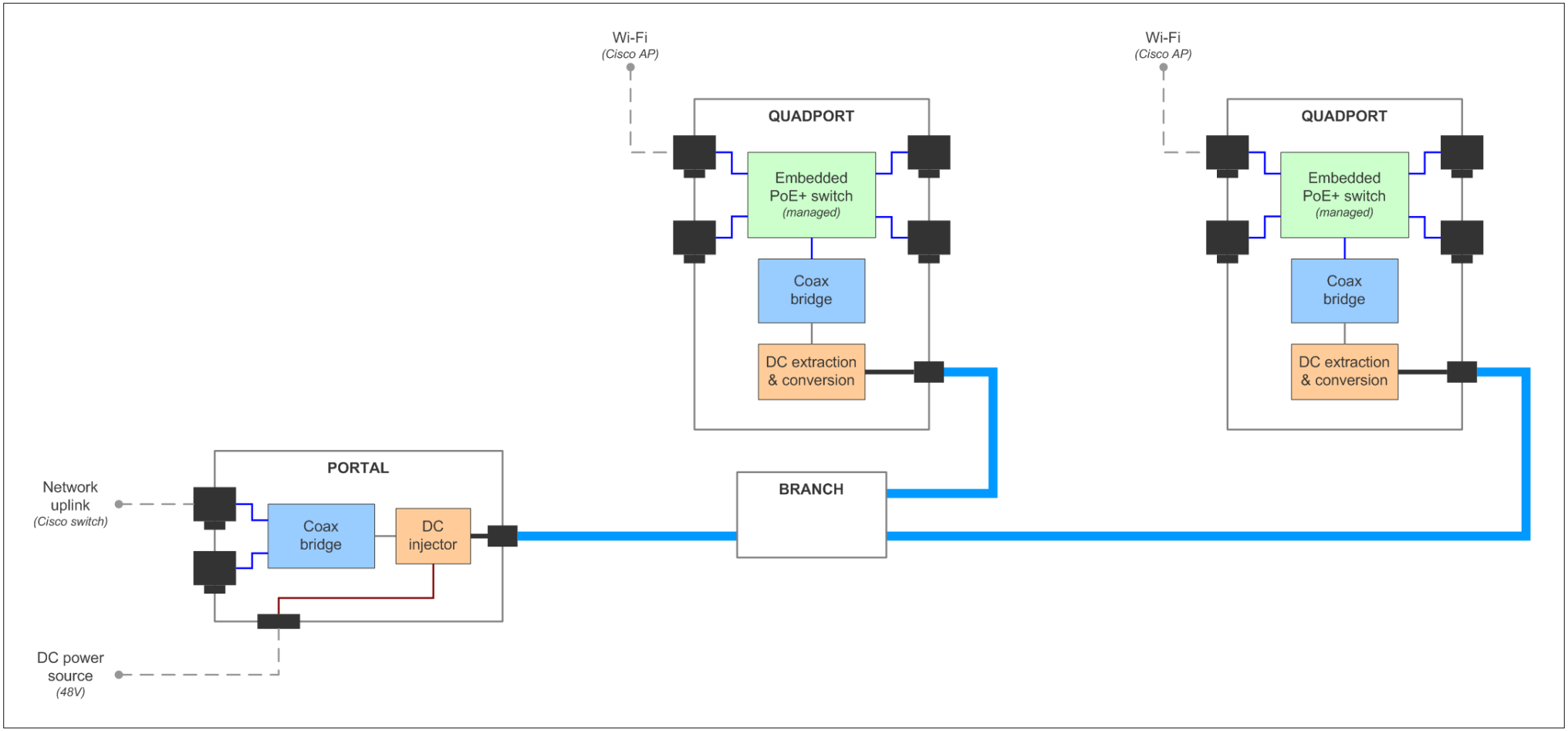


Repeater [DD220-RP]

- Segments the coax. to ensure high network speeds are maintained over long distances:
- Deployed approx. every 1km, if a fibre uplink is not available.
- Powered from the coax., but power is not passed through.

RFI TECHNOLOGY SOLUTIONS

Internal device architecture



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TECHNOLOGY SOLUTIONS

Digital Drift - Active Devices – Next Generation

QuadPort 2 [DD320-QP2-POE or DD320-QP2-DC]

- Breaks out PoE+ ports (71.3W each with Max combined 160W) from the coax.
- Contains an embedded L2 Ethernet switch with VLAN management.

Repeater 2 [DD320-RP2-POE or DD320RP2-DC]

- Breaks out PoE+ ports (71.3W each with Max combined 160W) from the coax.
- Segments the coax. to ensure high network speeds are maintained over long distances:
- Deployed approx. every 1km, if a fibre uplink is not available.
- Powered from the coax or locally and power can be passed through.

RFI TECHNOLOGY SOLUTIONS

Digital Drift - Passive Devices

Branch [DD210-BR-10]

- Taps a **portion** of the data and power signal, allowing a QuadPort to be spliced into the coax.
- Most of the data and power stays in the “Trunk” line.

Splitter [DD210-SP-S]

- Divides the data and power signals **evenly** so that the coax. can proceed down two different headings.

DC Splice [DD210-DC-SPL-5] + Power Inserter [DD210-PI]

- Injects DC power onto the coax. in the middle of a run.
- This is generally required after a repeater segments the coax.

RFI TECHNOLOGY SOLUTIONS

Digital Drift – Cable & connectors (for ½” CF50 FlexFeeder)

CF50 Coaxial cable [DD-CF50-LSZH-300]

- ½” diameter, braided shield.

CF50 cable, Stripping tool [DD-T-TXFFQ50]

CF50 cable, KS pin connector [DD-CONN-CF50-KS]

KS Barrel [DD-CONN-KS-BARREL]

- Enables 2 x KS pin connectors to be joined.

N-type (75 Ohm), KS pin [DD-CONN-NF-KS]

- Enables Portal, QuadPort & Repeater to be connected.

DC passing swivel, KS pin [DD-CONN-KS-SWIVEL]

- Enables KS pin connectors to be more easily connected to passives.

DC blocking termination, KS pin [DD-CONN-KS-TERM]

- Fitted at the end of line.

RFI TECHNOLOGY SOLUTIONS

Flexible connector combinations

Flexible cable to N-Female

DD-CONN-CF50-KS - DD-CONN-KS-BARREL - DD-CONN-NF-KS

Flexible cable to Splice

DD-CONN-CF50-KS - DD-CONN-KS-BARREL - DD-CONN-KS-SWIVEL - DD-CONN-CF50-KS

Flexible cable to Load

DD-CONN-CF50-KS - DD-CONN-KS-BARREL - DD-CONN-KS-TERM

RFI TECHNOLOGY SOLUTIONS

Flexible cable connector fit off

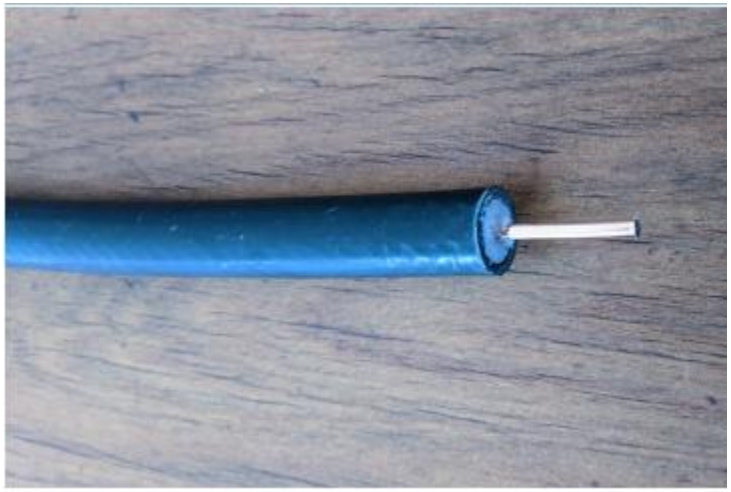
Step 1: Use circular cable cutters to get a clean cut

Step 2: Use the “1st cut” end of the prep tool to strip the centre conductor

RFI TECHNOLOGY SOLUTIONS

Flexible cable connector fit off cont.

Step 3: Remove the remining dielectric from the centre conductor



Step 4: Use the “2nd cut” end of the prep tool to strip the shield

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Flexible cable connector fit off cont.

Step 5: Check the strip lengths using the guide lines on the connector

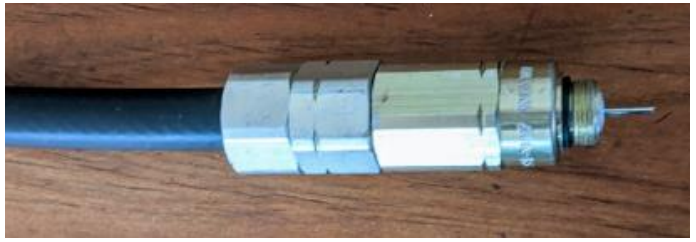
RFI TECHNOLOGY SOLUTIONS

Flexible cable connector fit off cont.

Step 6: Fit the rear two pieces of the connector to the cable

Step 7: Tighten the rear two connector pieces onto the cable

Step 6: Fit the rear two pieces of the connector to the cable



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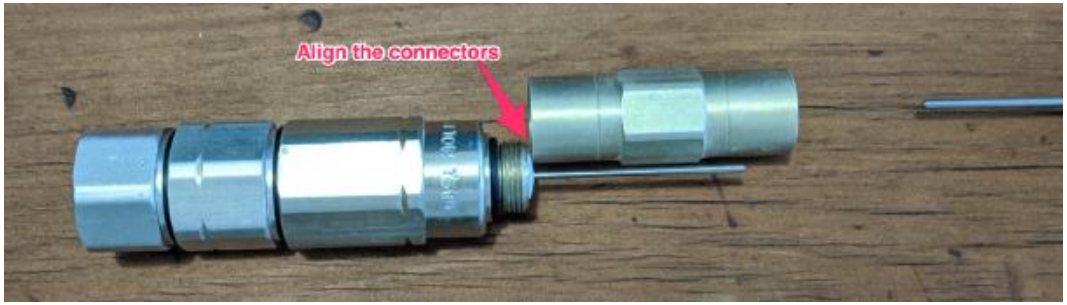
Terminating ½” coax to a 75 Ohm N-type female connector

Step 1: Parts laid out

Step 2: Align connector A with the barrel as shown



Step 3: Cut Connector A’s pin to the guide-line marked on the barrel

RFI
TECHNOLOGY SOLUTIONS

Terminating ½” coax to a 75 Ohm N-type female connector cont.

Step 4: Align connector B with the barrel as shown

Step 5: Cut Connector B’s pin to the guide-line marked on the barrel

Step 6: Screw both connectors into the barrel

NOTE: some force is required to initially press the pin into the barrel receptacle. However, once the thread engages, it should tighten up without excessive force.

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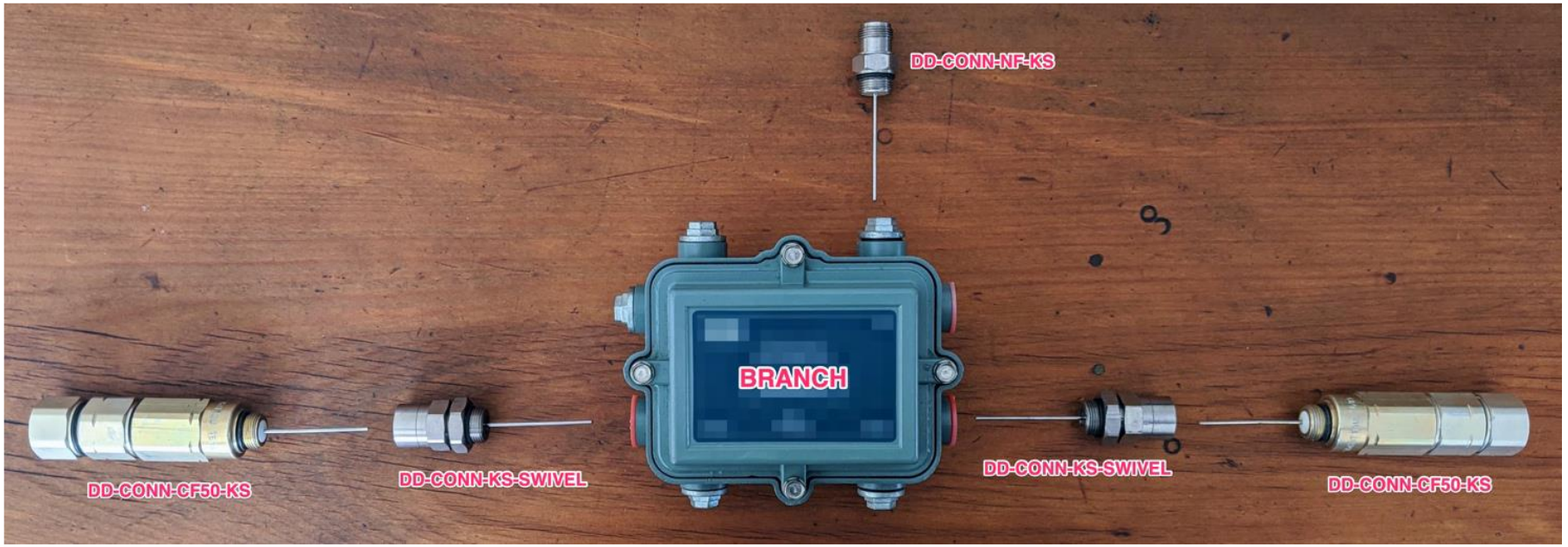
TECHNOLOGY SOLUTIONS

Preparing a Digital Drift branch for ½” flexible coax

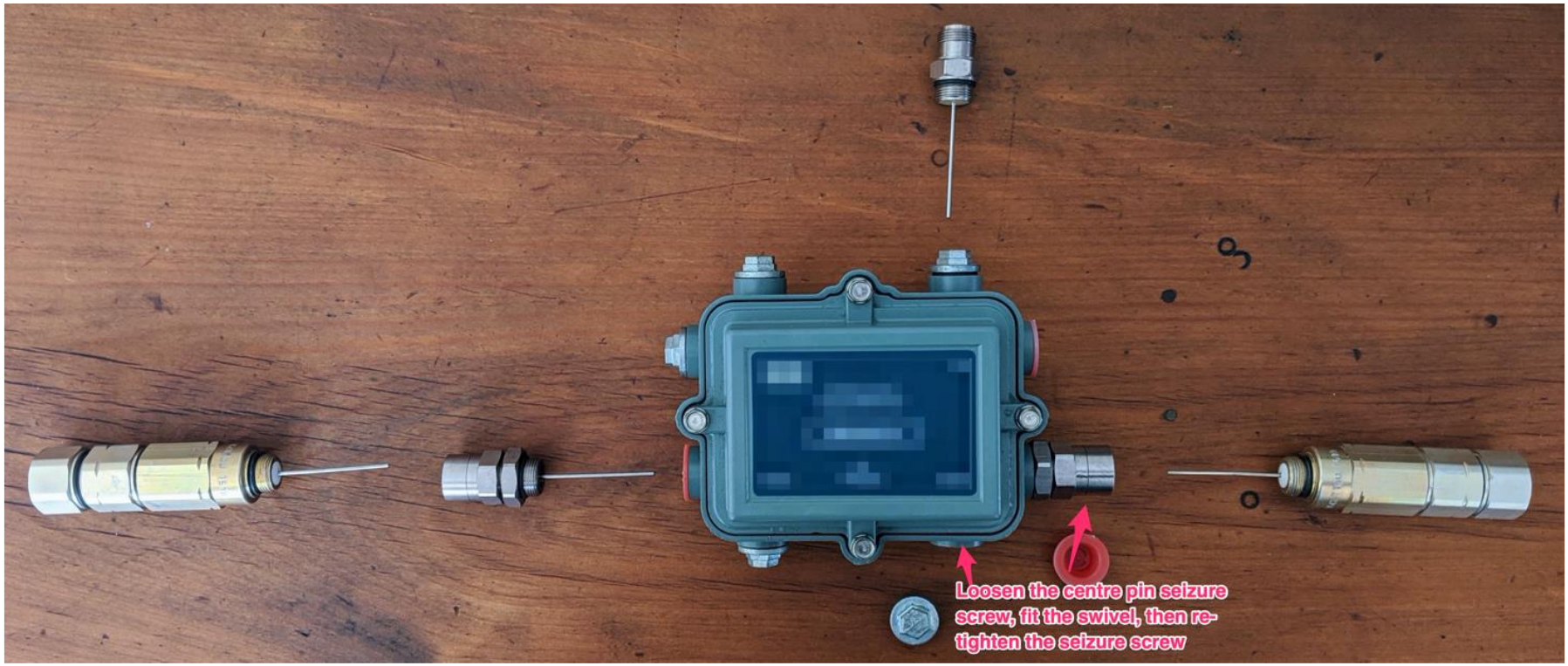
Step 1: Parts laid out



RFI TECHNOLOGY SOLUTIONS

Preparing a Digital Drift branch for ½” flexible coax cont.

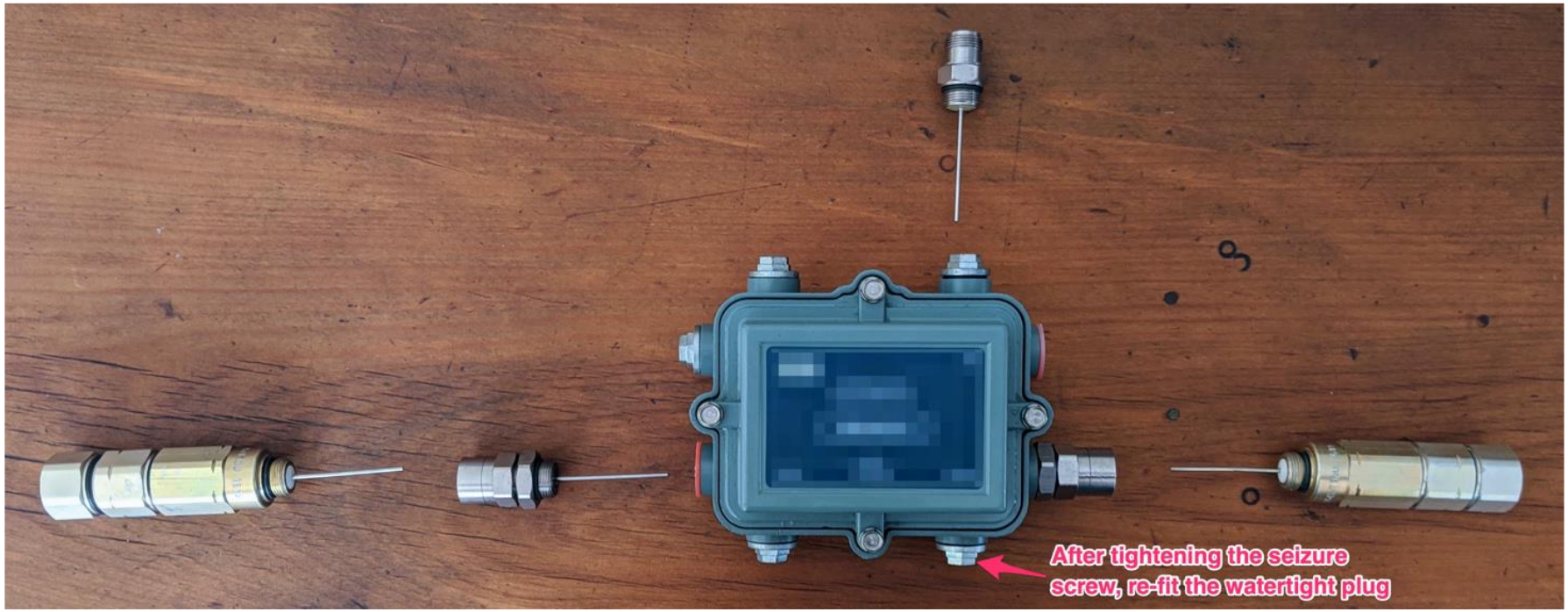
Step 2: Fit a swivel to one of the branch’s TRUNK ports



RFI TECHNOLOGY SOLUTIONS

Preparing a Digital Drift branch for ½” flexible coax cont.

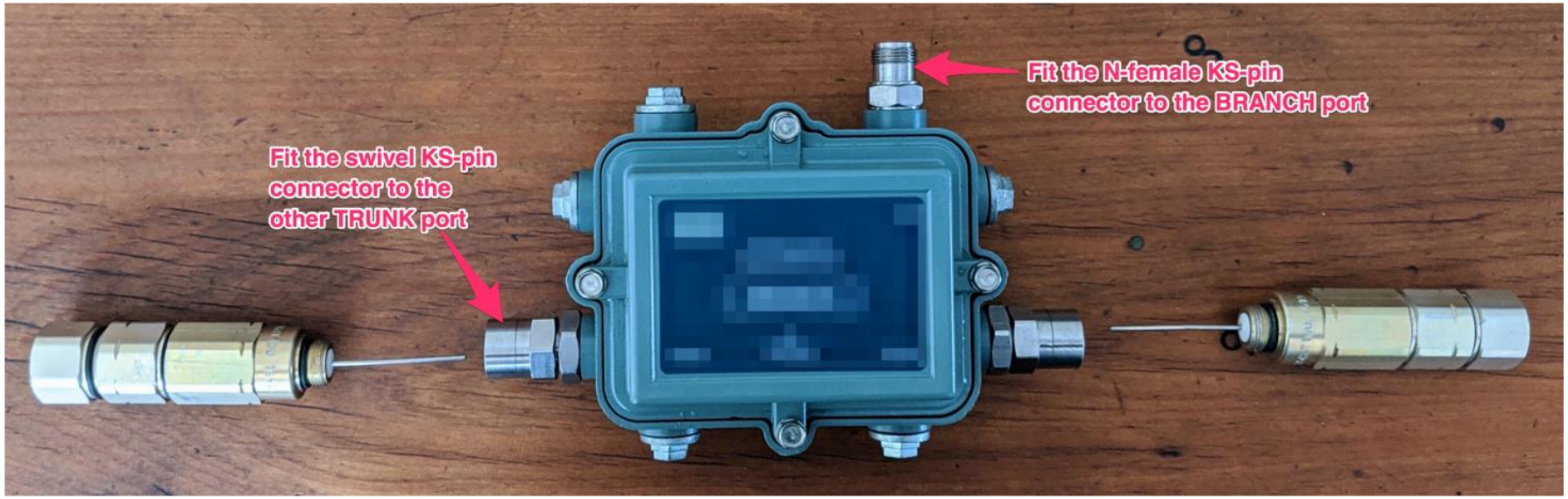
Step 3: Tighten the seizure screw and re-fit the waterproof plug



RFI TECHNOLOGY SOLUTIONS

Preparing a Digital Drift branch for ½” flexible coax cont.

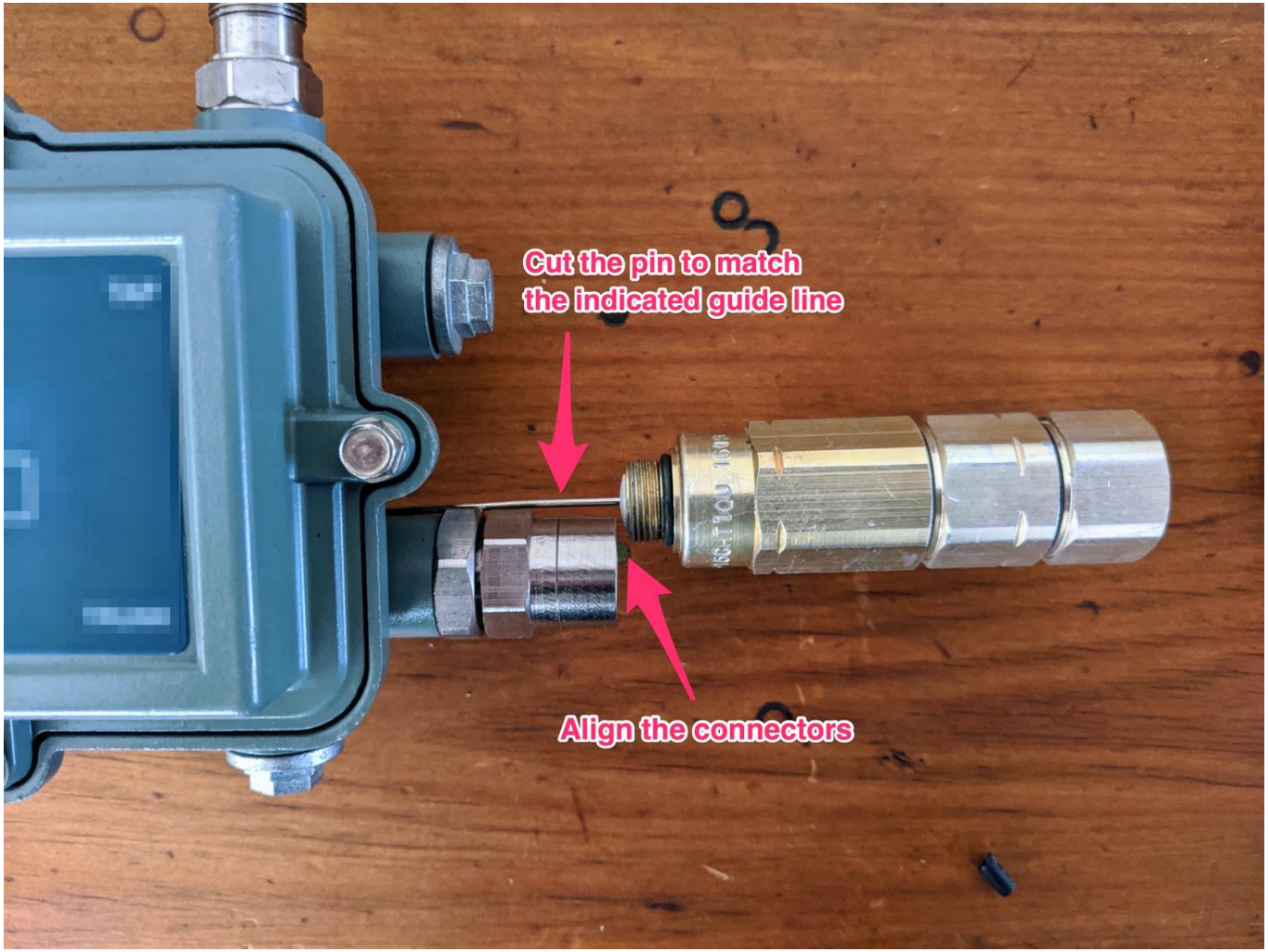
Step 4: Fit the other swivel and the N-female connectors to the branch



RFI TECHNOLOGY SOLUTIONS

Preparing a Digital Drift branch for ½” flexible coax cont.

Step 5: Cut the first cable side KS-pin connector to length



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TECHNOLOGY SOLUTIONS

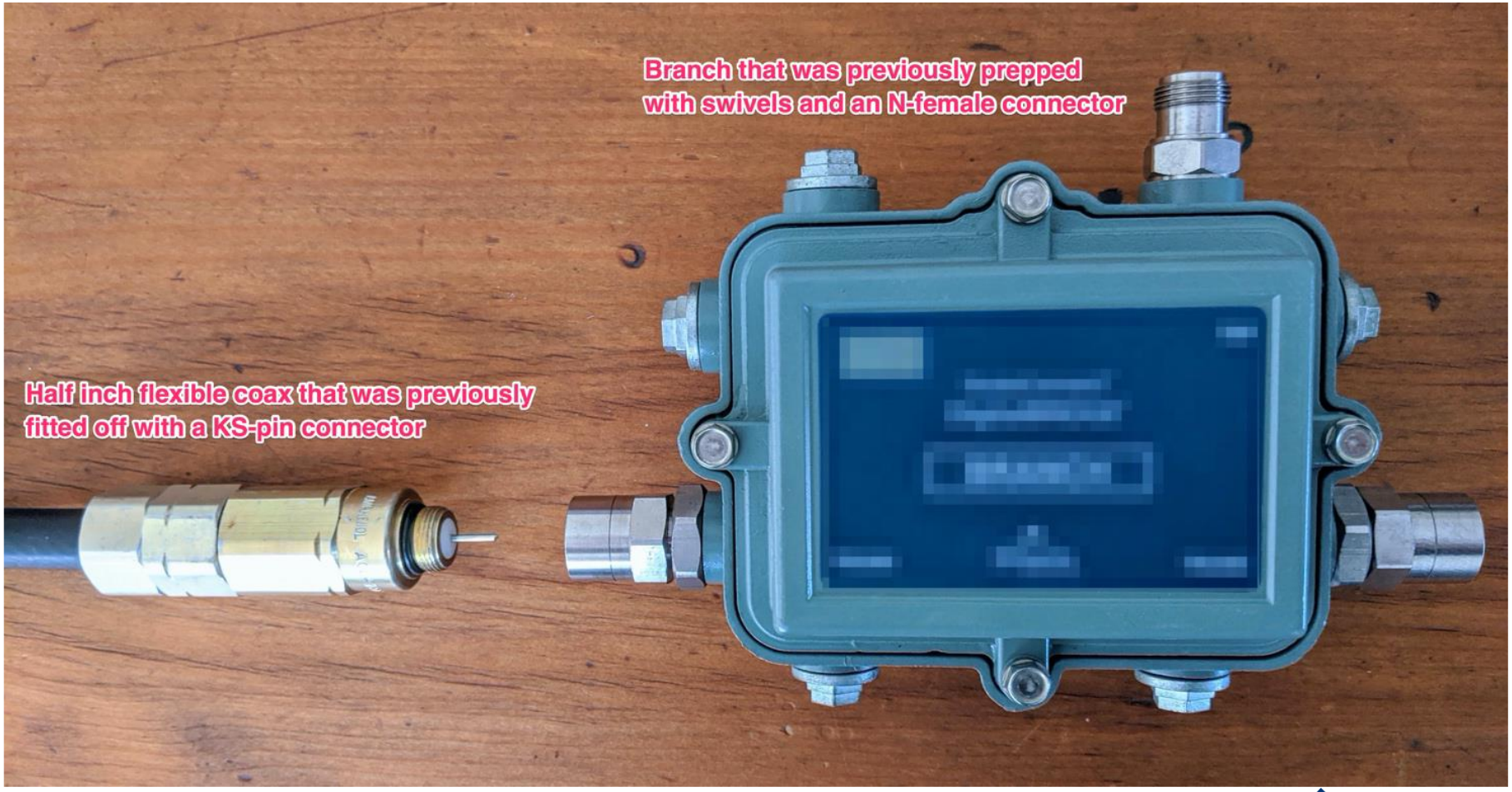
Preparing a Digital Drift branch for ½” flexible coax cont.

Step 6: Cut the other cable side KS-pin connector to length

RFI TECHNOLOGY SOLUTIONS

Attaching the fitted off ½” flexible coax to a prepped Branch

Step 1: Parts laid out



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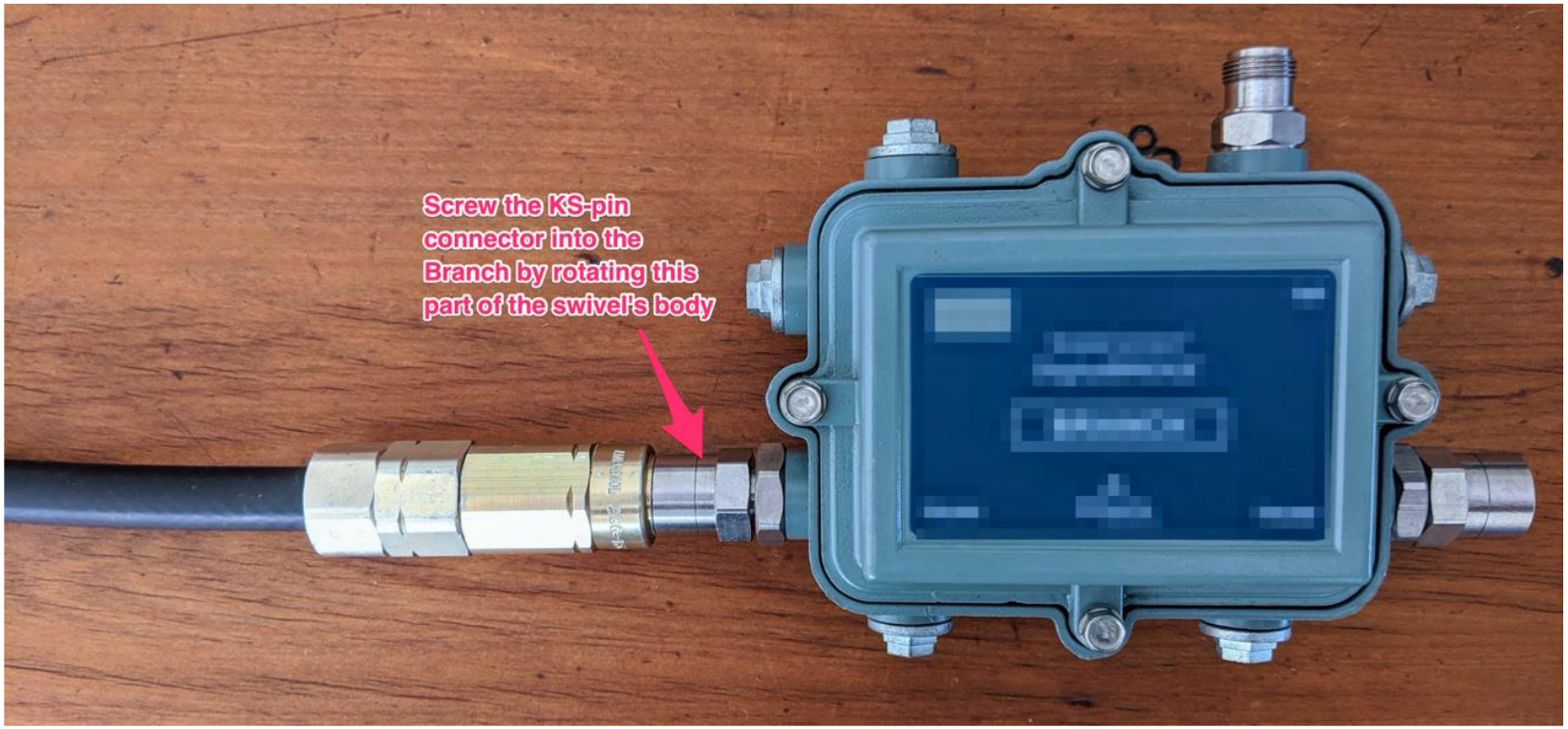
TECHNOLOGY SOLUTIONS

Attaching the fitted off ½” flexible coax to a prepped Branch cont.

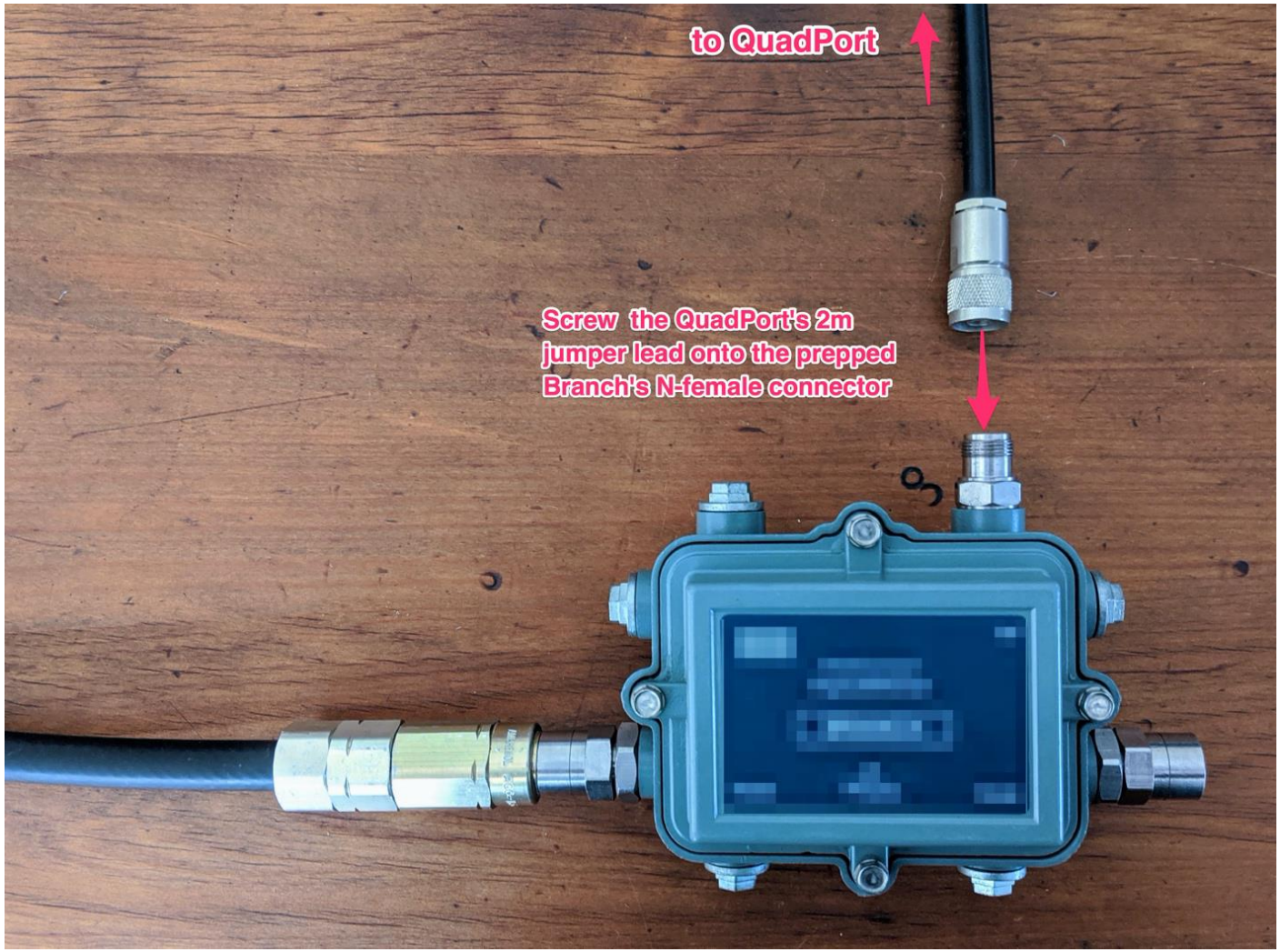
Step 2: Connect a fitted off coax trunk line to the Branch’s TRUNK port



RFI TECHNOLOGY SOLUTIONS

Attaching the fitted off ½” flexible coax to a prepped Branch cont.

Step 3: Connect the 2m jumper lead to the Branch’s BRANCH port



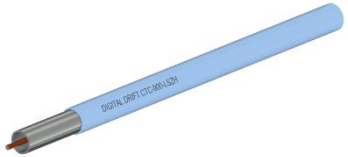
RFI TECHNOLOGY SOLUTIONS

Attaching the fitted off ½” flexible coax to a prepped Branch cont.

Step 4: Fit the final coax trunk line to the Branch’s other TRUNK port

RFI TECHNOLOGY SOLUTIONS

Digital Drift – Cable & connectors (for ½" ULR Hard-line Feeder)



ULR Coaxial cable [DD-CTC-300-LSZH]

- ½" diameter Jacket Material Fire retardant PVC LSZH
- Centre Conductor Copper-clad Aluminium
- Construction Type Swaged
- Dielectric Material Foam PE
- Outer Conductor Material Aluminium

ULR coax coring/stripping tool [DD-T-QCST500T]

ULR coax to KS pin 2-piece connector [DD-CONN-ULR-KS]

KS Barrel [DD-CONN-KS-BARREL]

- Enables 2 x KS pin connectors to be joined.

RFI TECHNOLOGY SOLUTIONS

Digital Drift – Cable & connectors (for ½” ULR Hard-line Feeder)

N-type (75 Ohm), KS pin [DD-CONN-NF-KS]

- Enables Portal, QuadPort & Repeater to be connected.

ULR coax 2-piece splice[DD-CONN-ULR-SPLICE]

DC blocking termination, KS pin [DD-CONN-ULR-TERM]

- Fitted at the end of line.

Hard Line (ULR) connector combinations

Hard Line cable to N-Female
DD-CONN-ULR-KS - DD-CONN-KS-BARREL - DD-CONN-NF-KS

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INSTALLATION GUIDE

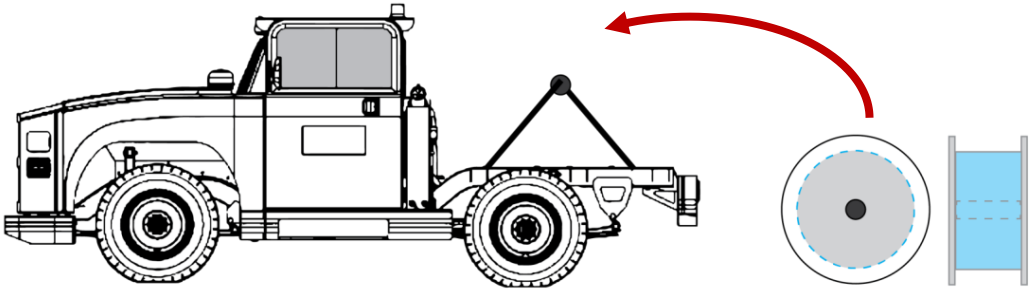
Underground cable deployment

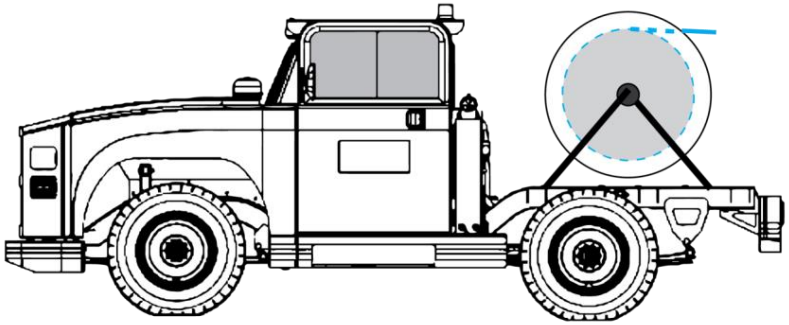
25 Sep 2017 | Author: Chris Snell

rfi.com.au

PART A

Mount the cable on the rear of a utility vehicle, allowing the reel to rotate.





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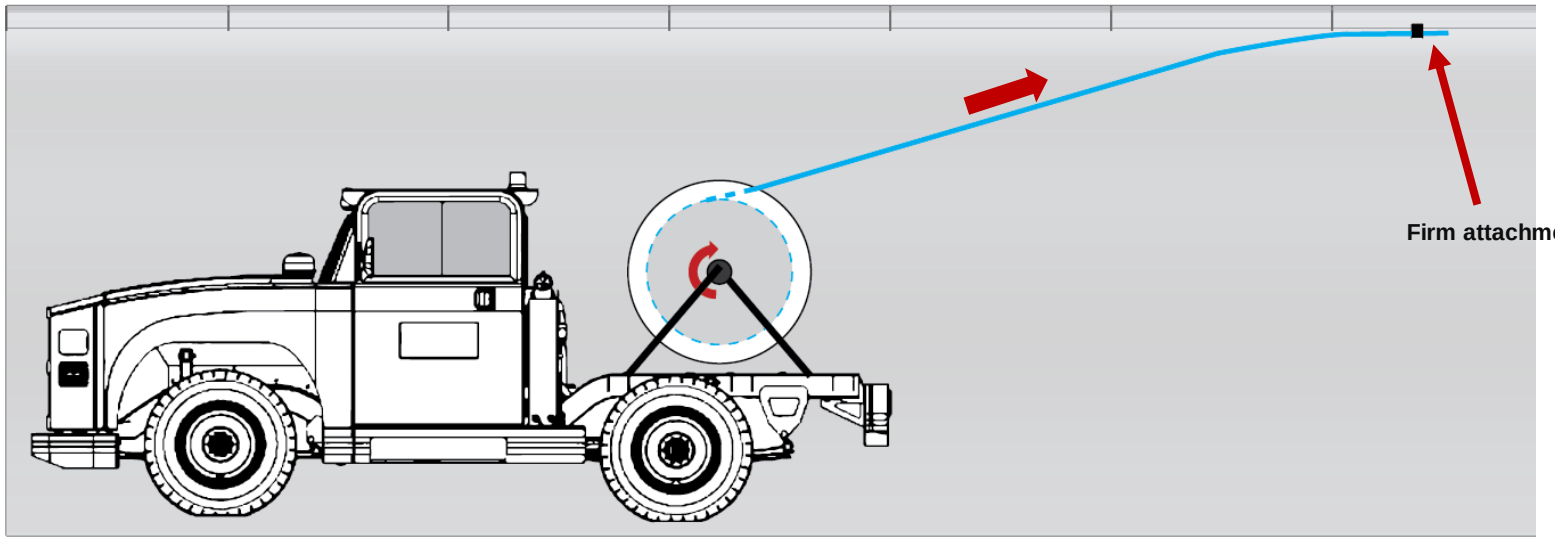
PART B

Firmly attach the cable end (e.g. stainless steel cable tie).



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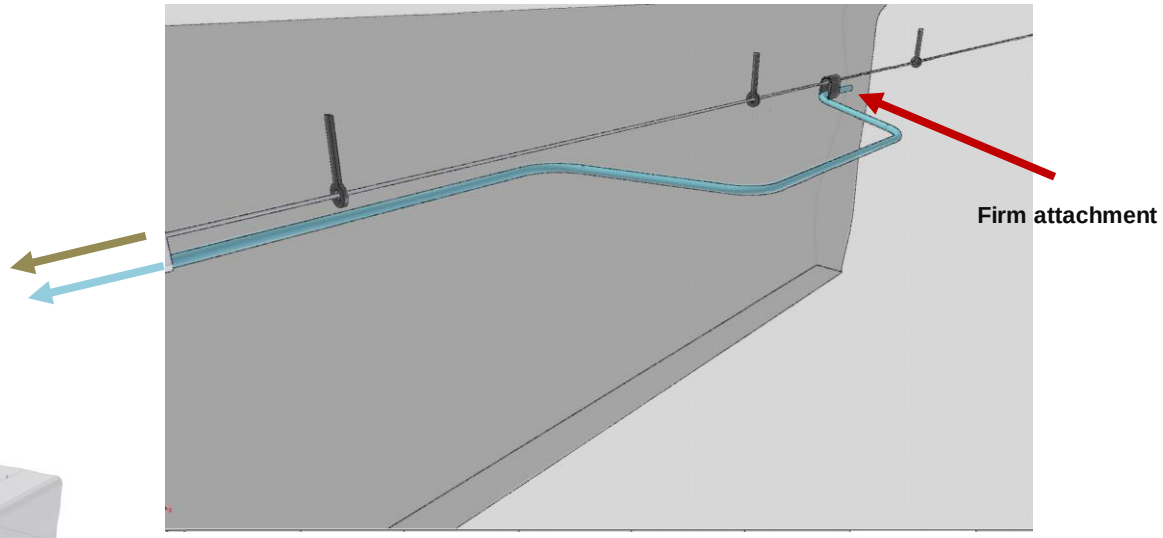
PART C

Create a horizontal ‘flat bottom loop’ in the cable after the firm attachment point, allowing for cable expansion and contraction.



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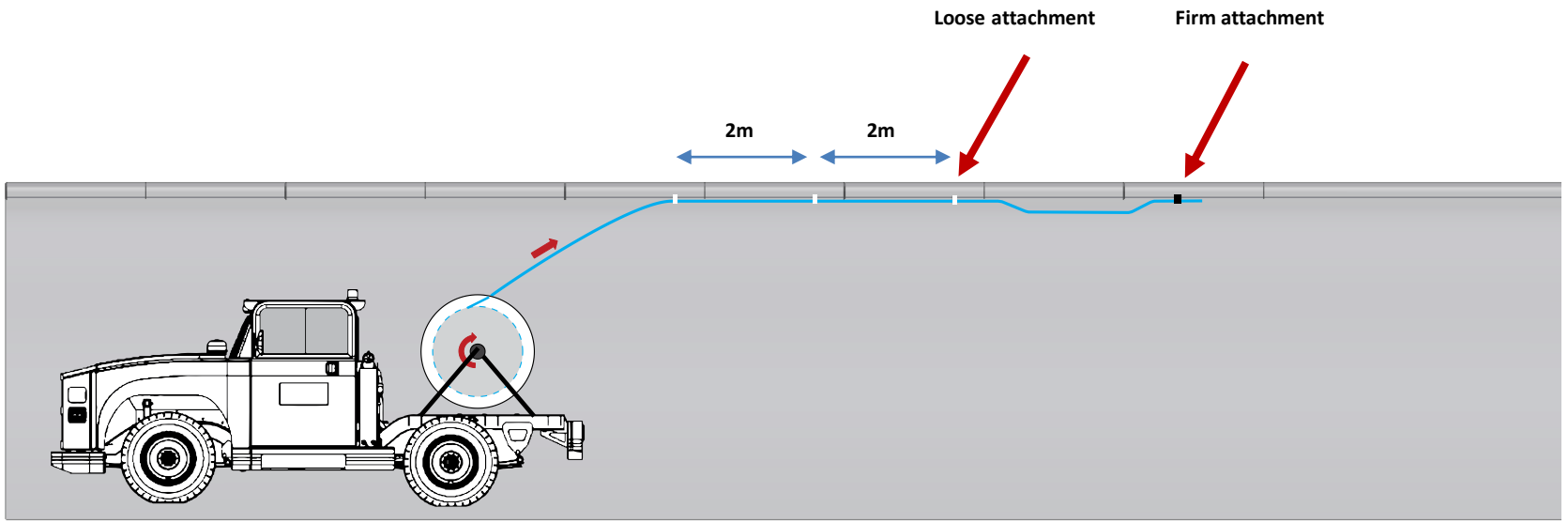
PART D

Loosely attach the cable every 1-2m (e.g. plastic cable tie).



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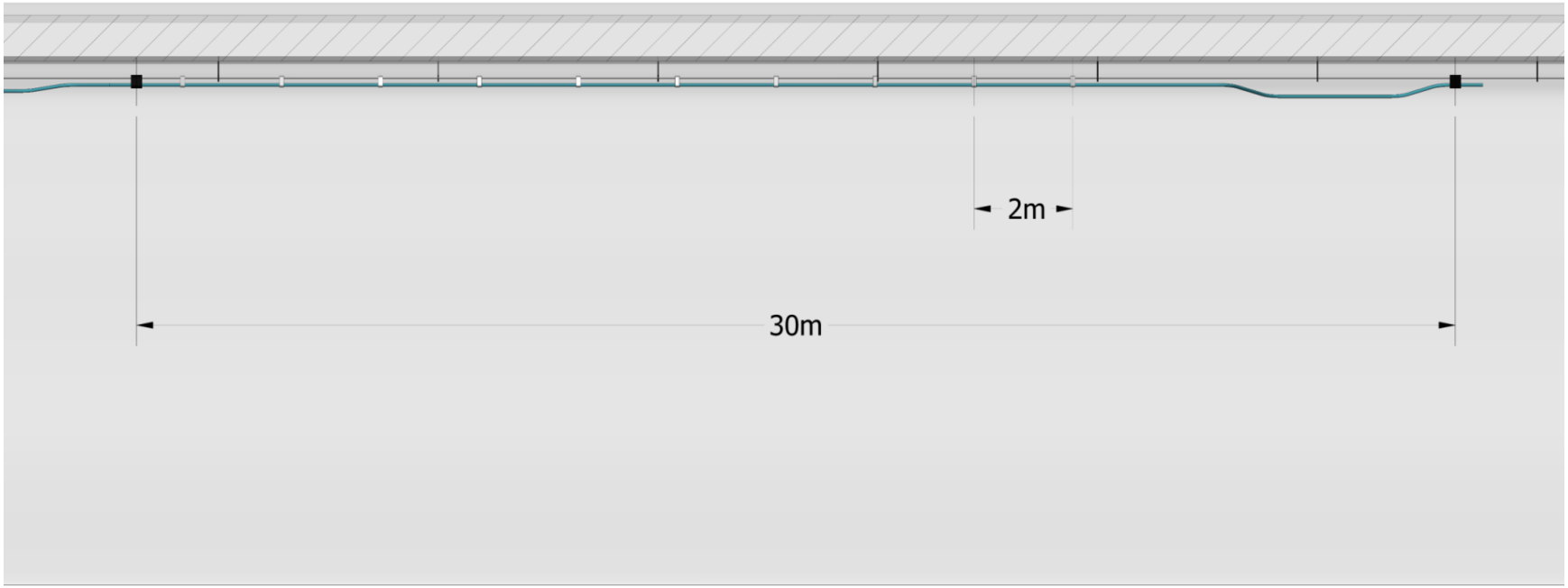
PART E

Every 30m attach the cable firmly and form an expansion loop before continuing with loose attachments.



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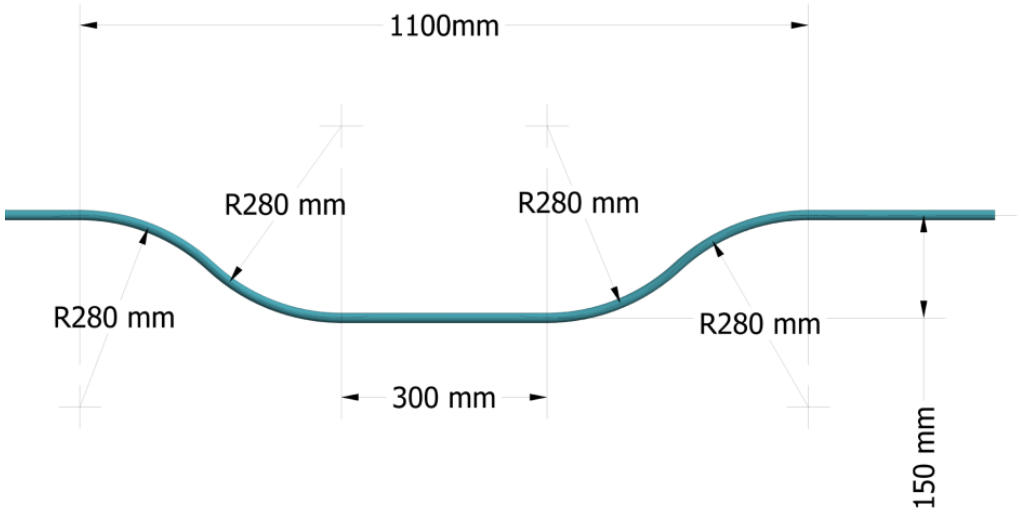
NOTES

- **Flat bottom loop approx. dimensions:**



- **Additional loops should be added at locations where devices are expected to be spliced into the cable.**

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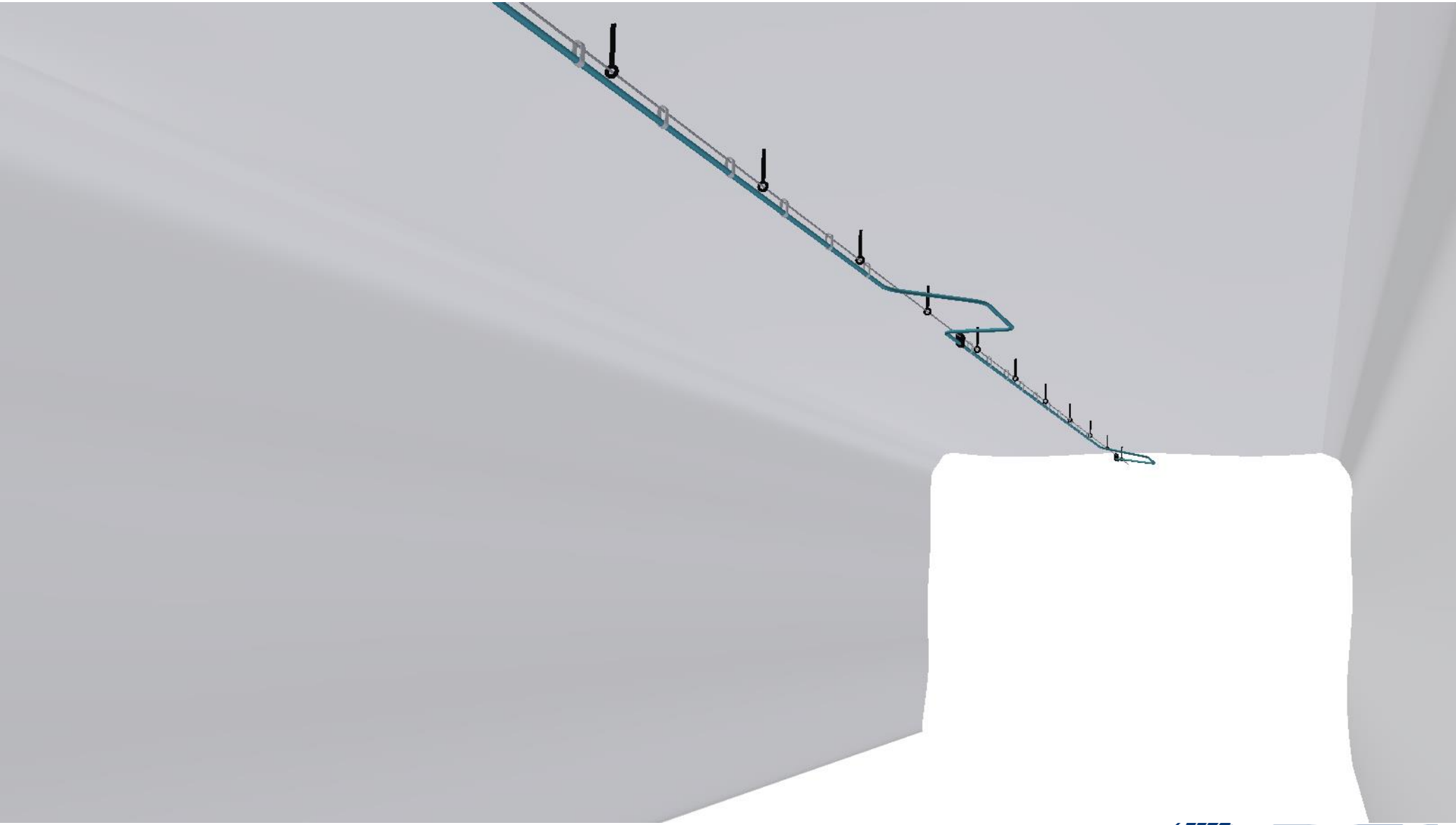

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TECHNOLOGY SOLUTIONS

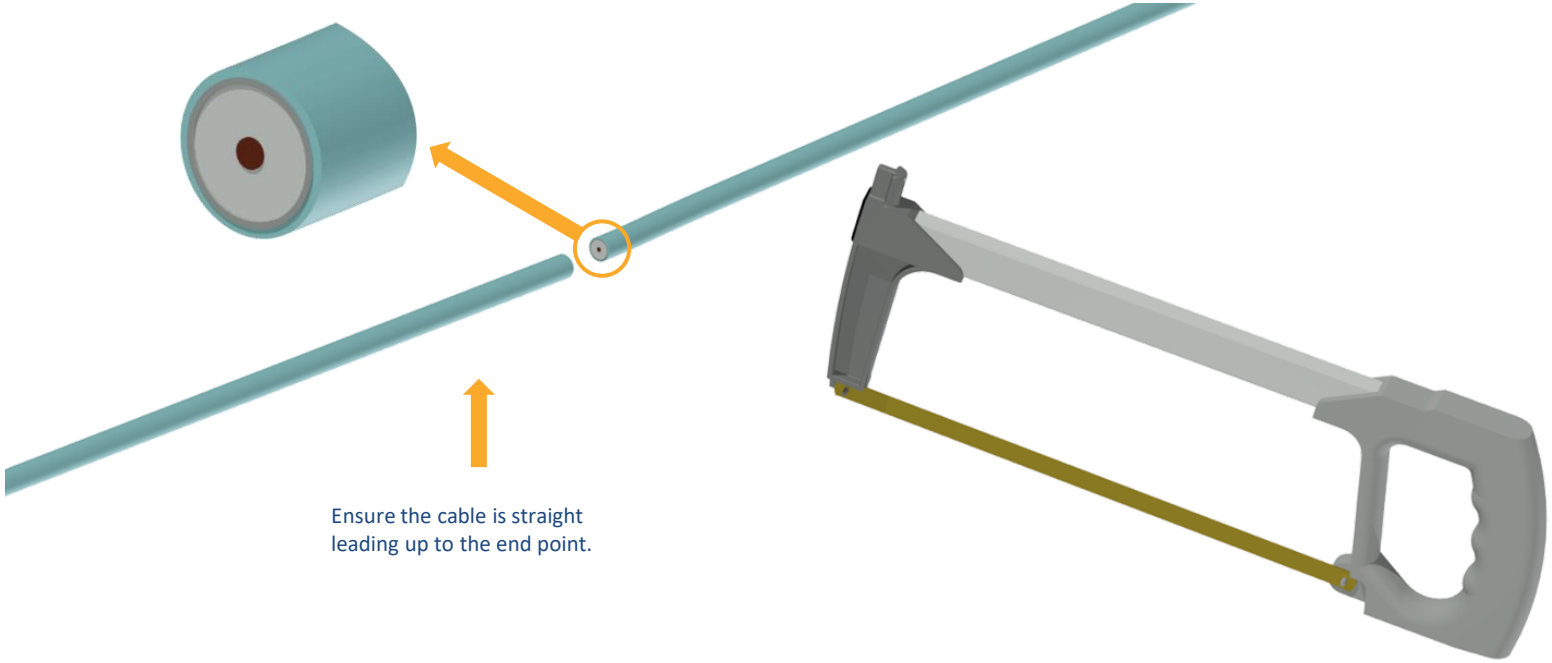
INSTALLATION GUIDE

Splicing coaxial cables together

28 Sep 2017 | Author: Chris Snell

STEP 1

Ensure the cable ends are circular.
If required, cut with a hacksaw or the recommended cable cutting tool.



Ensure the cable is straight
leading up to the end point.

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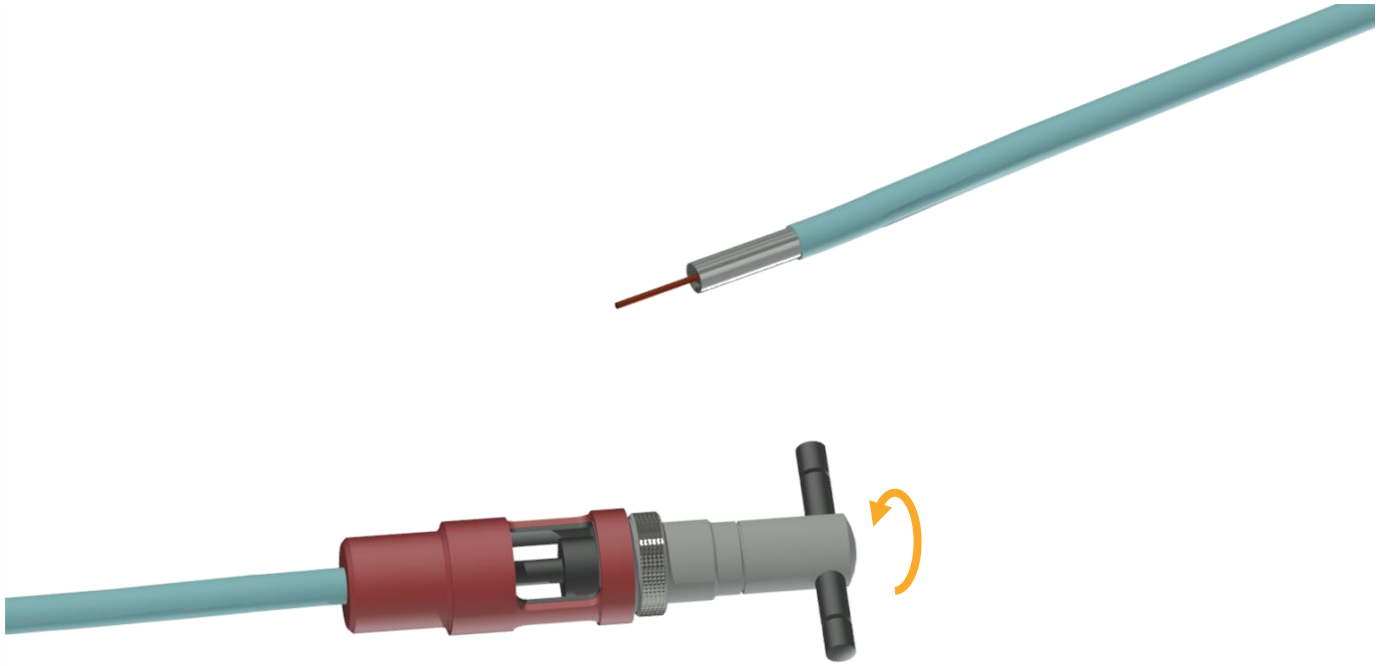
STEP 2

Strip both cable ends using the coring / stripping tool.



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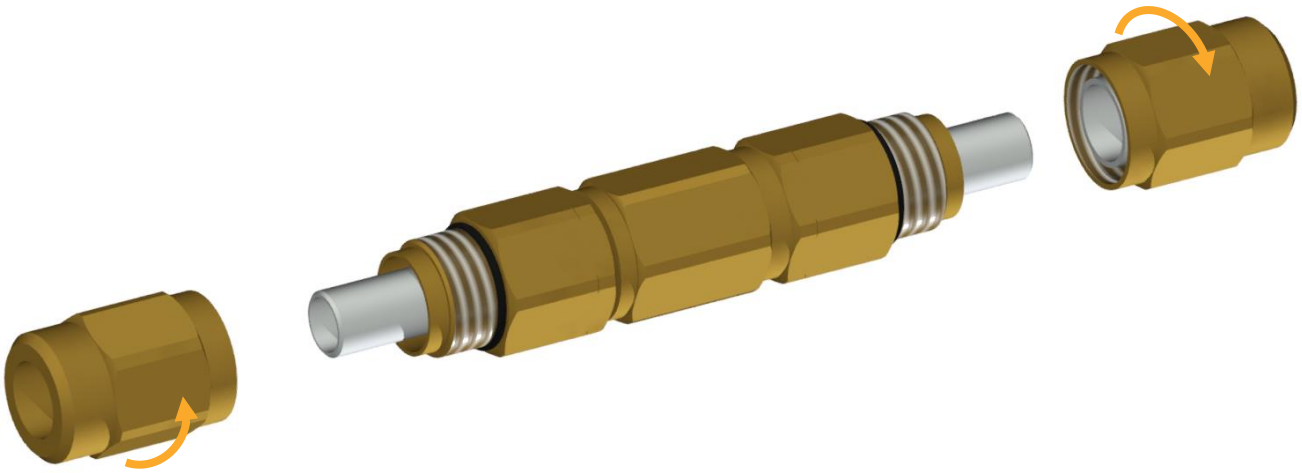
STEP 3

Unscrew the compression fittings from each end of the splice.



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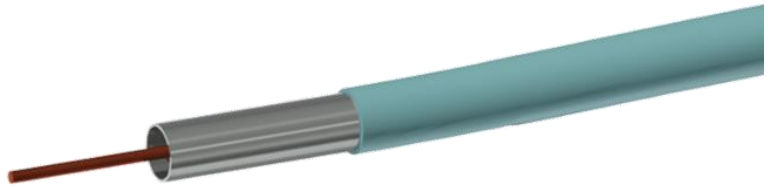
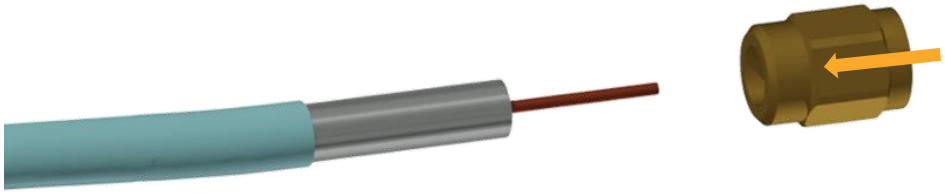
STEP 4

Slide a compression fitting over a stripped cable end.





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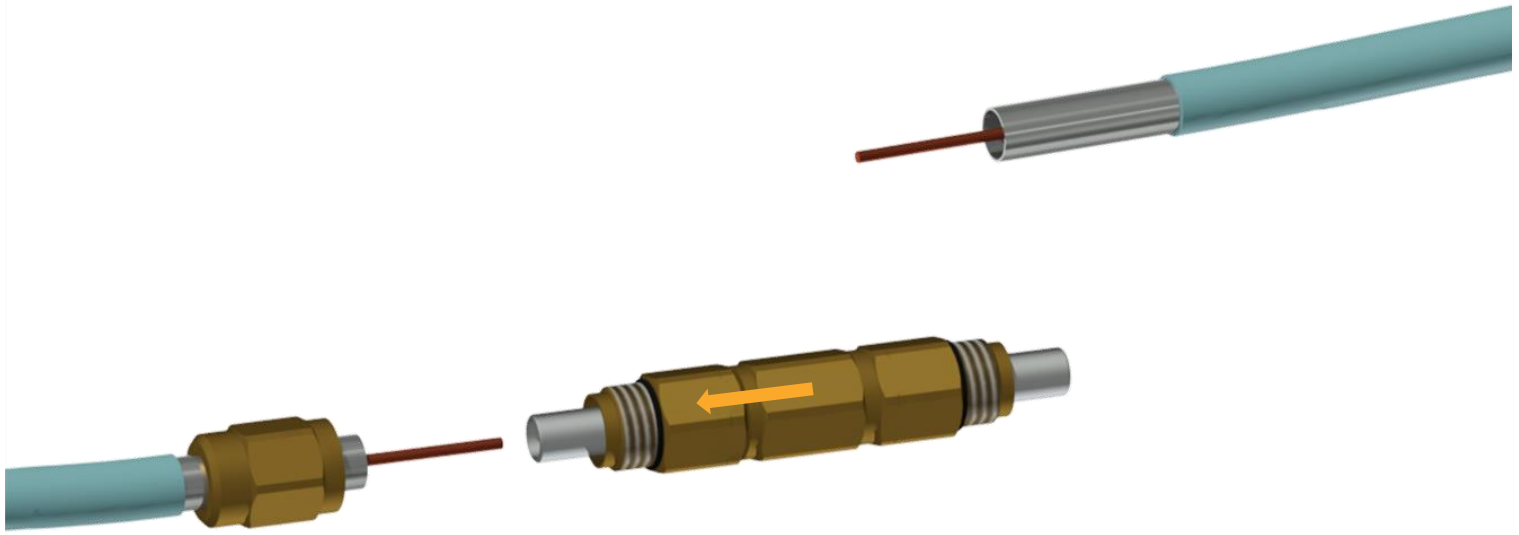
STEP 5

Insert the cable end into the splice, ensuring that the centre conductor is fully seated.



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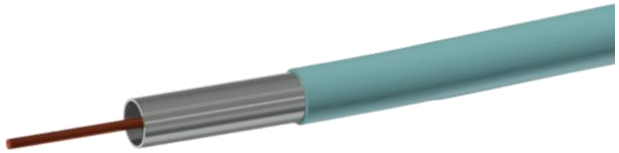
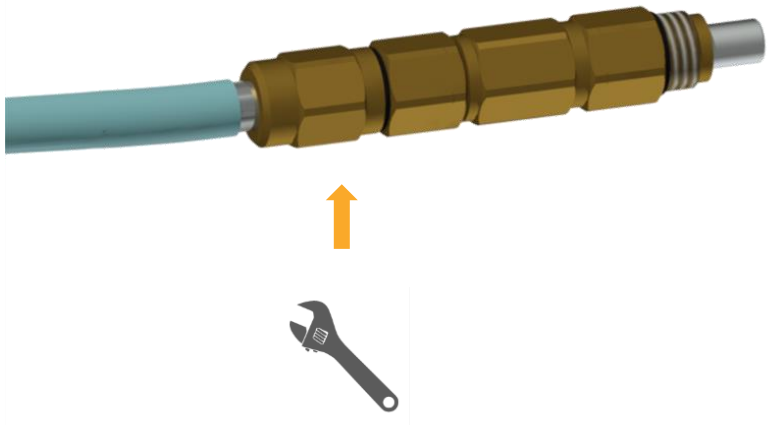
STEP 6

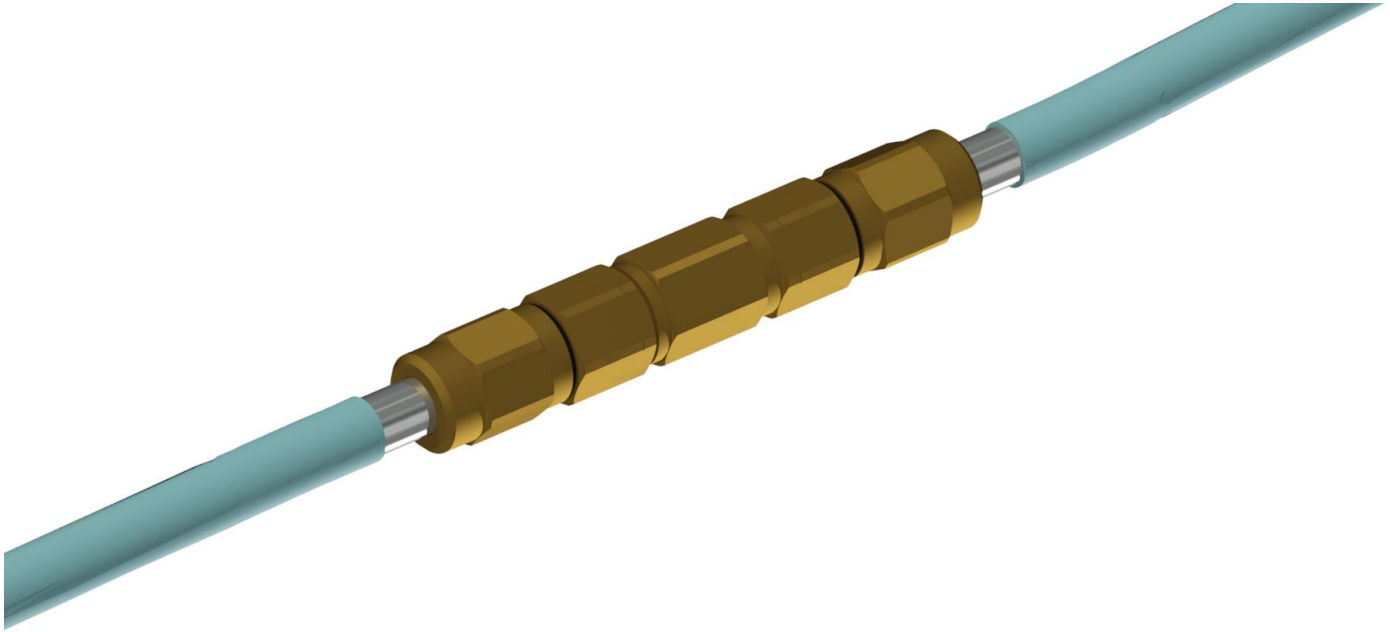
Screw the compression fitting into the splice body, ensuring that the centre conductor of the coaxial cable remains fully seated. Tighten with a wrench.





STEP 7

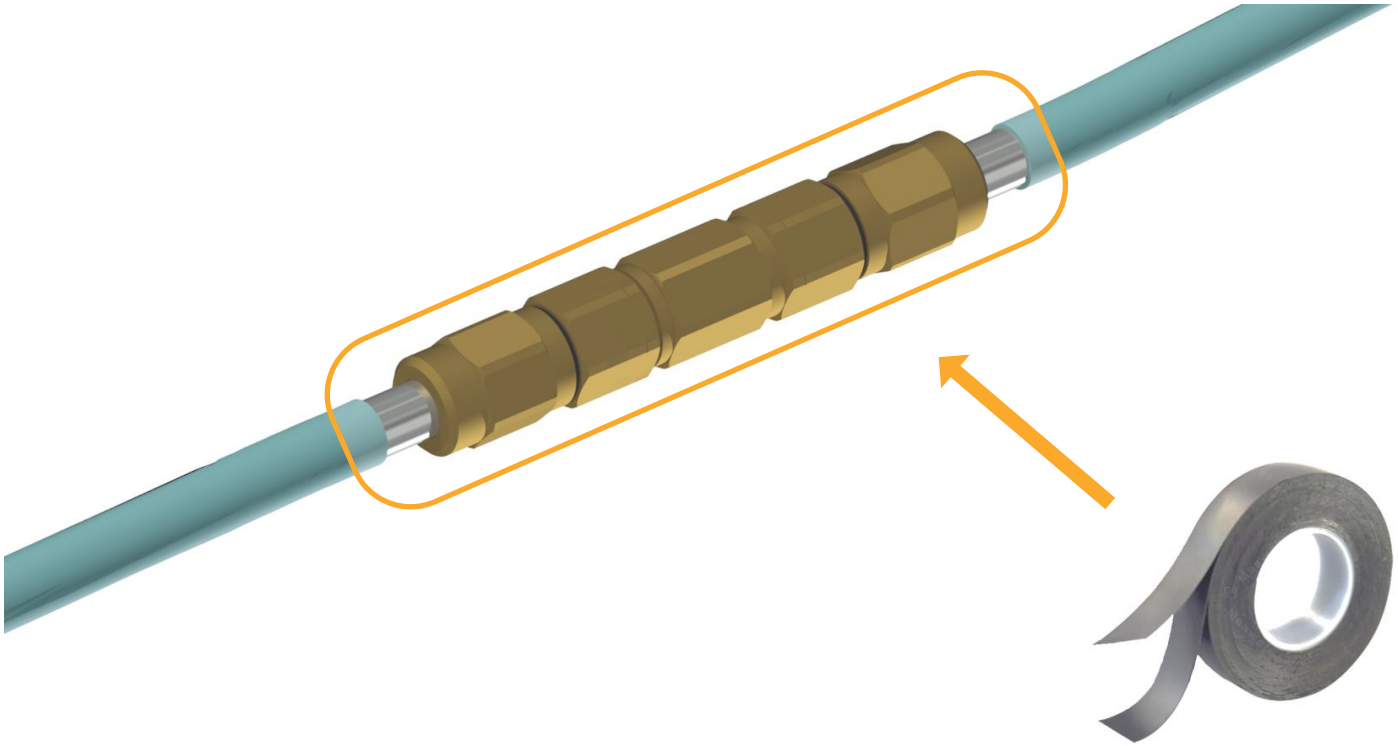
Repeat steps 4 to 6 for the other cable end.



RFI TECHNOLOGY SOLUTIONS

STEP 8

Wrap the connection with self-amalgamating tape.



RFI TECHNOLOGY SOLUTIONS

INSTALLATION GUIDE

Preparing a passive device for ULR coax

25 Sep 2017 | Author: Chris Snell

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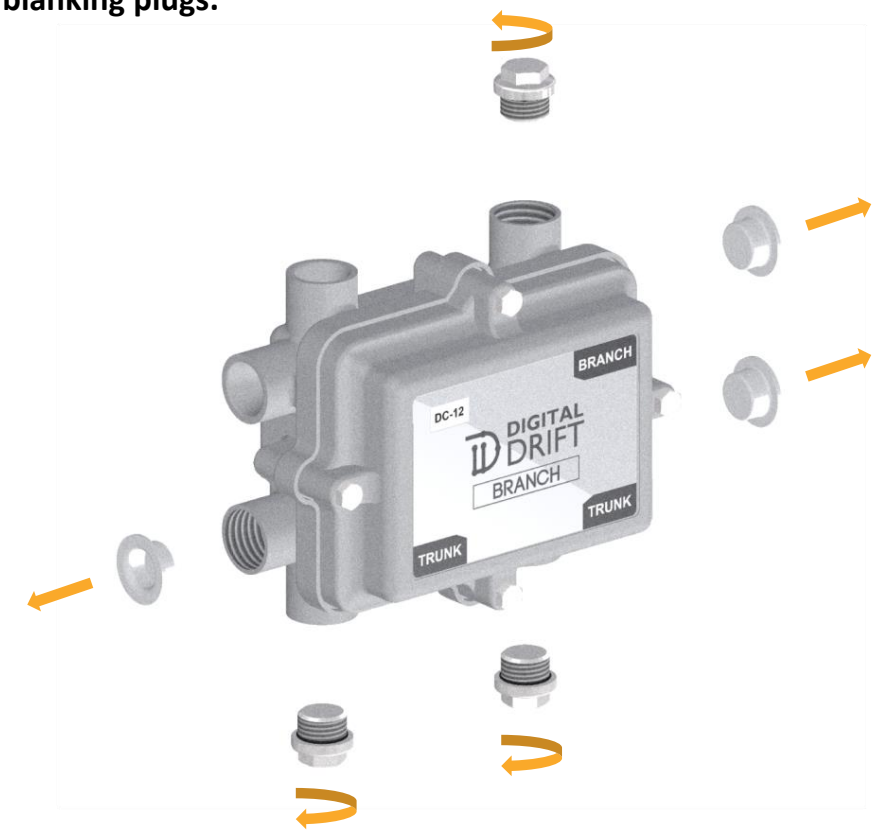
STEP 1

Remove the end caps and blanking plugs.



RFI TECHNOLOGY SOLUTIONS

STEP 2

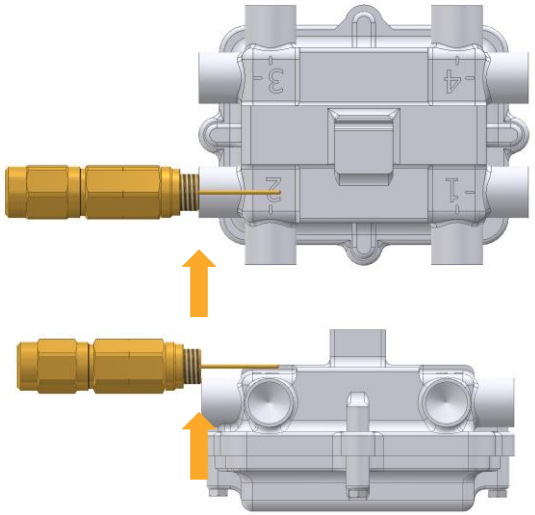
Loosen (but do not remove) the screws that hold the pin connector centre conductors, using a small flat blade screwdriver.

RFI
TECHNOLOGY SOLUTIONS

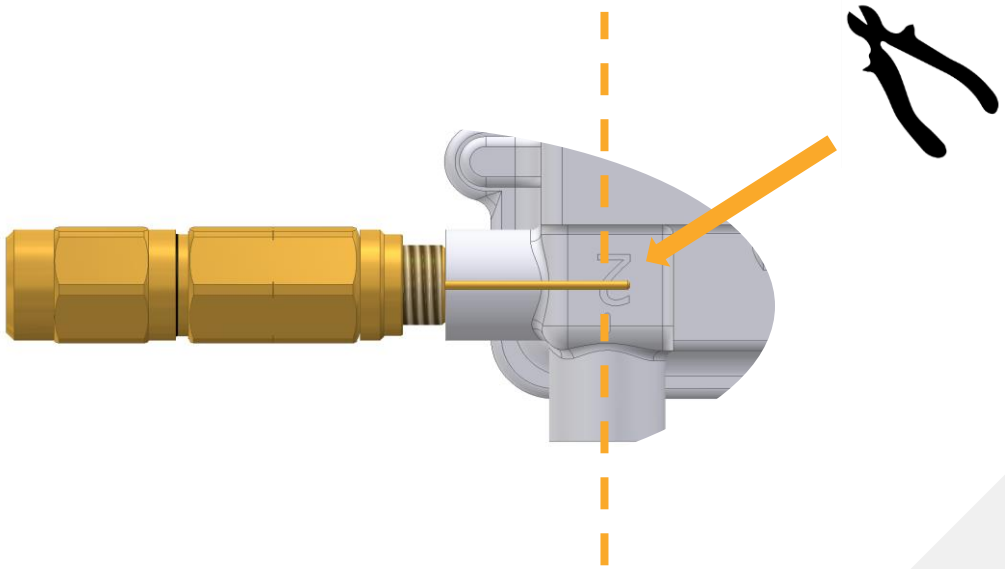
STEP 3

Cut the first pin connector to the correct length.

Butt the connector against the back of the unit.



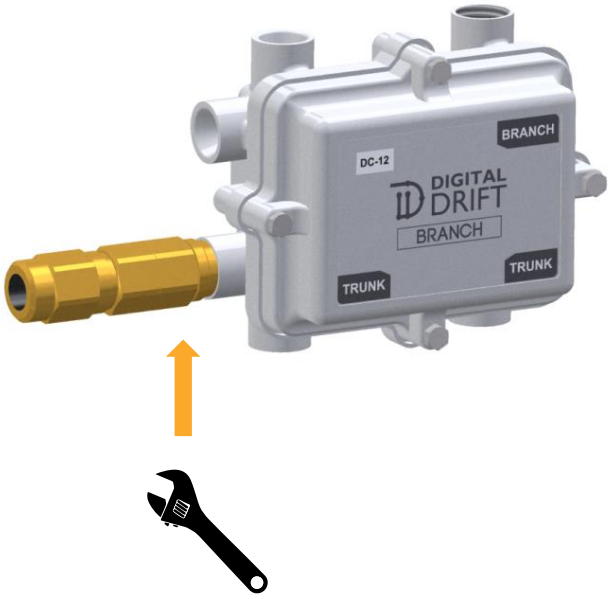
Cut the pin length as per trim line shown.



RFI TECHNOLOGY SOLUTIONS

STEP 4

Screw in the pin connector and tighten.



RFI
TECHNOLOGY SOLUTIONS

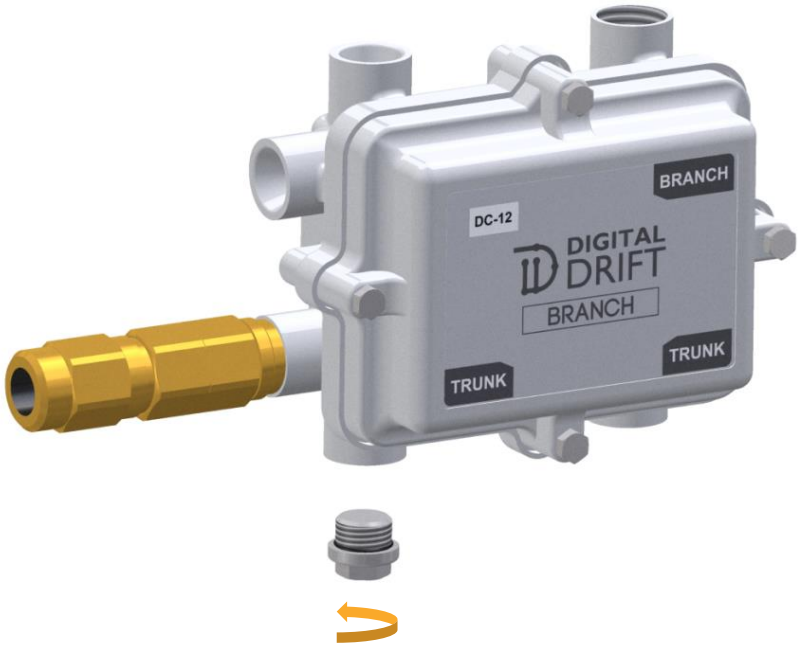
STEP 5

Tighten the screw that holds the pin connector’s centre conductor.

RFI
TECHNOLOGY SOLUTIONS

STEP 6

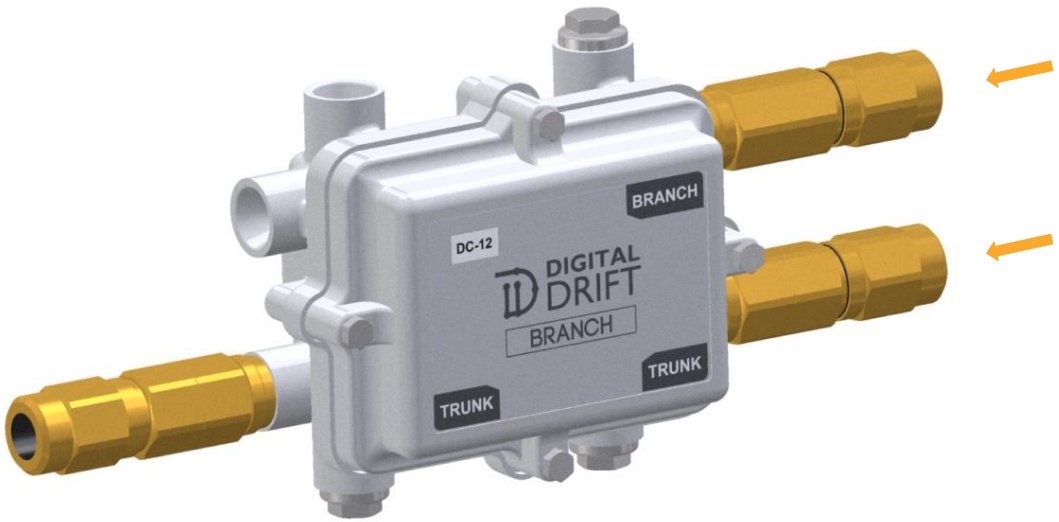
Re-install and tighten the port’s blanking plug.



RFI
TECHNOLOGY SOLUTIONS

STEP 7

Repeat steps 3 to 6 for the remaining two ports.



RFI
TECHNOLOGY SOLUTIONS

INSTALLATION GUIDE

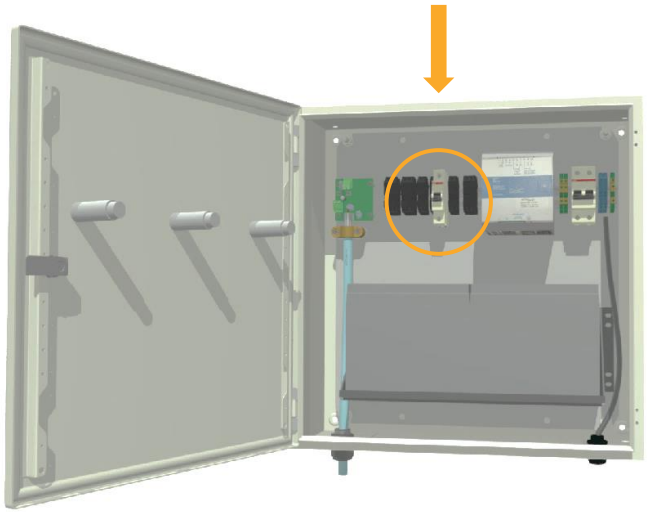
Inserting a Quadport into the coaxial cable

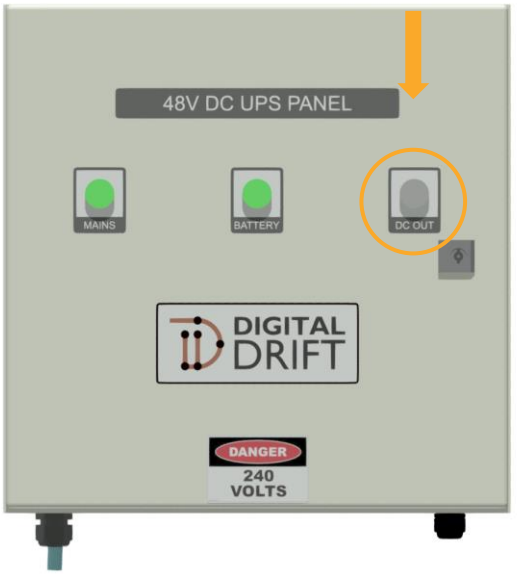
3 Oct 2017 | Author: Chris Snell

rfi.com.a
u

STEP 1

Switch off the power supply that feeds the cable.

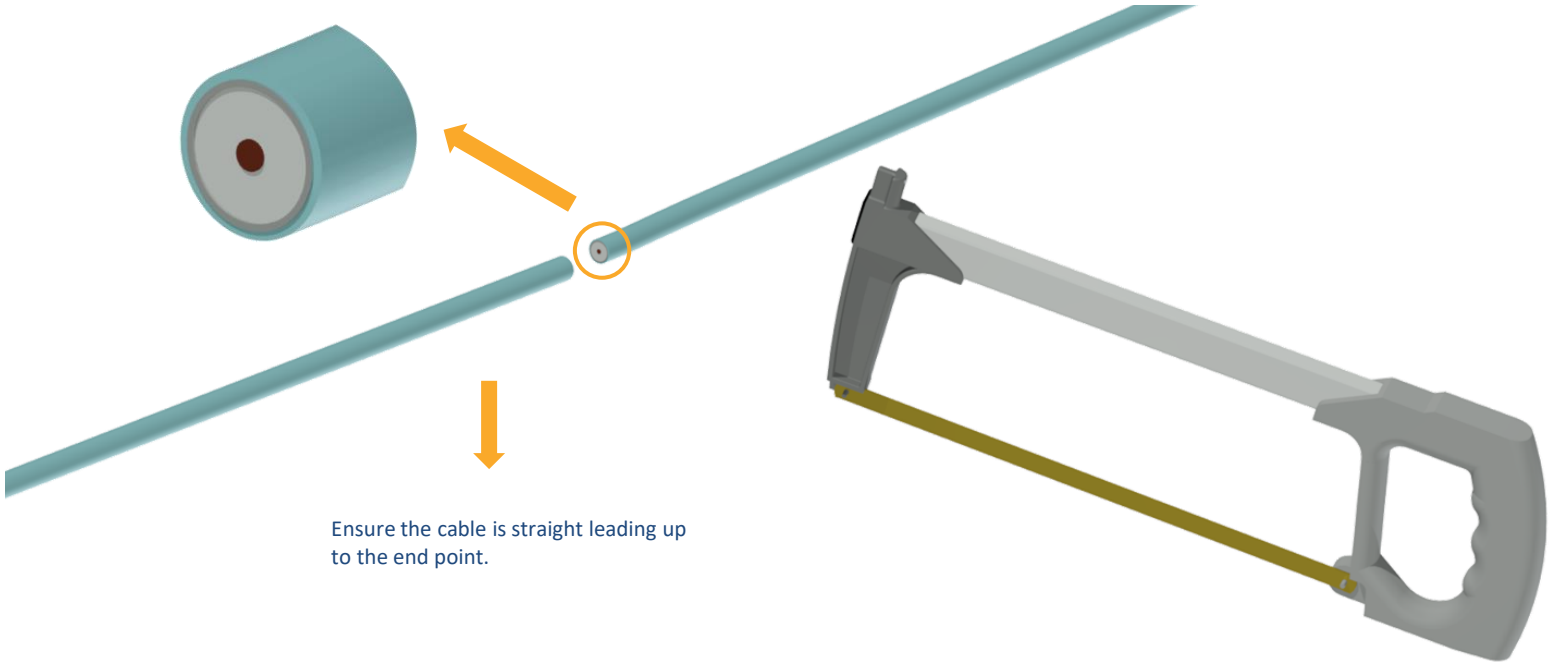




RFI TECHNOLOGY SOLUTIONS

STEP 2

Cut the cable using a hacksaw or the recommended cable cutters, ensuring that the cable ends remain circular.

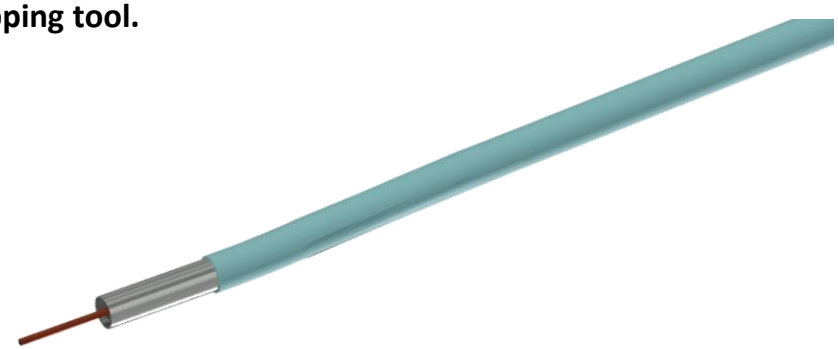


Ensure the cable is straight leading up to the end point.

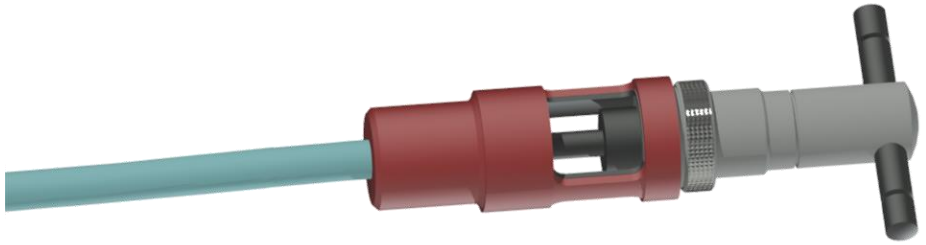
RFI TECHNOLOGY SOLUTIONS

STEP 3

Strip both cable ends using the coring / stripping tool.



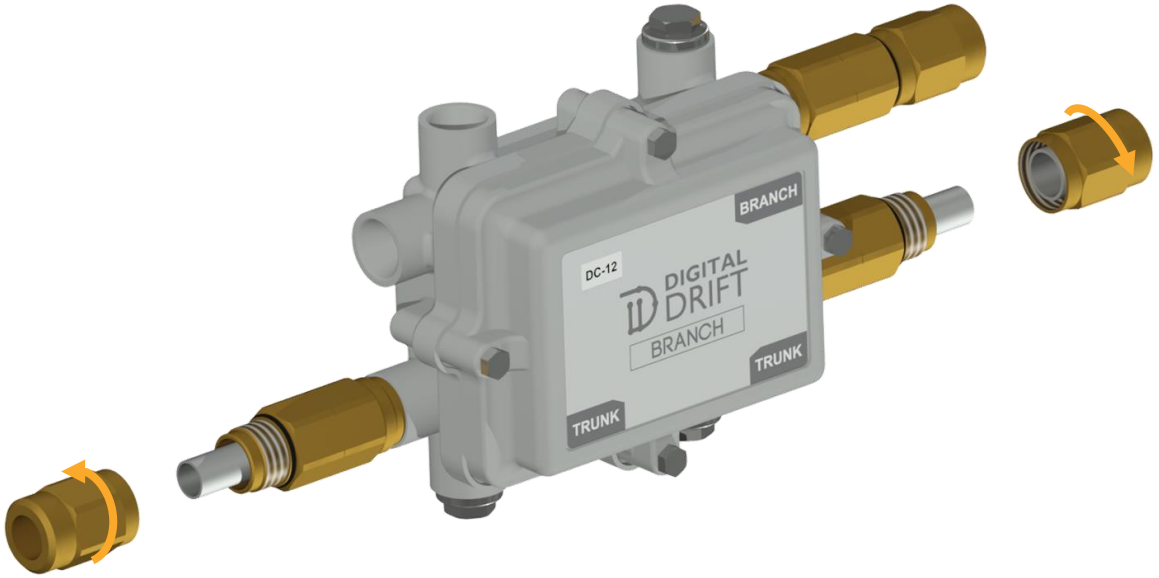
TODO: Add a note about the centre conductor length check



RFI
TECHNOLOGY SOLUTIONS

STEP 4

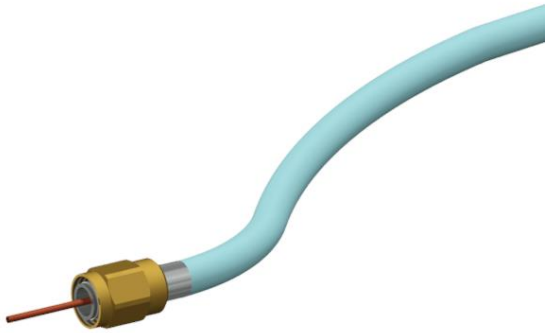
Unscrew the compression fittings from the TRUNK ports on the pre-prepared Branch.



RFI TECHNOLOGY SOLUTIONS

STEP 5

Slide the compression fittings over the stripped cable ends.



RFI
TECHNOLOGY SOLUTIONS

STEP 6

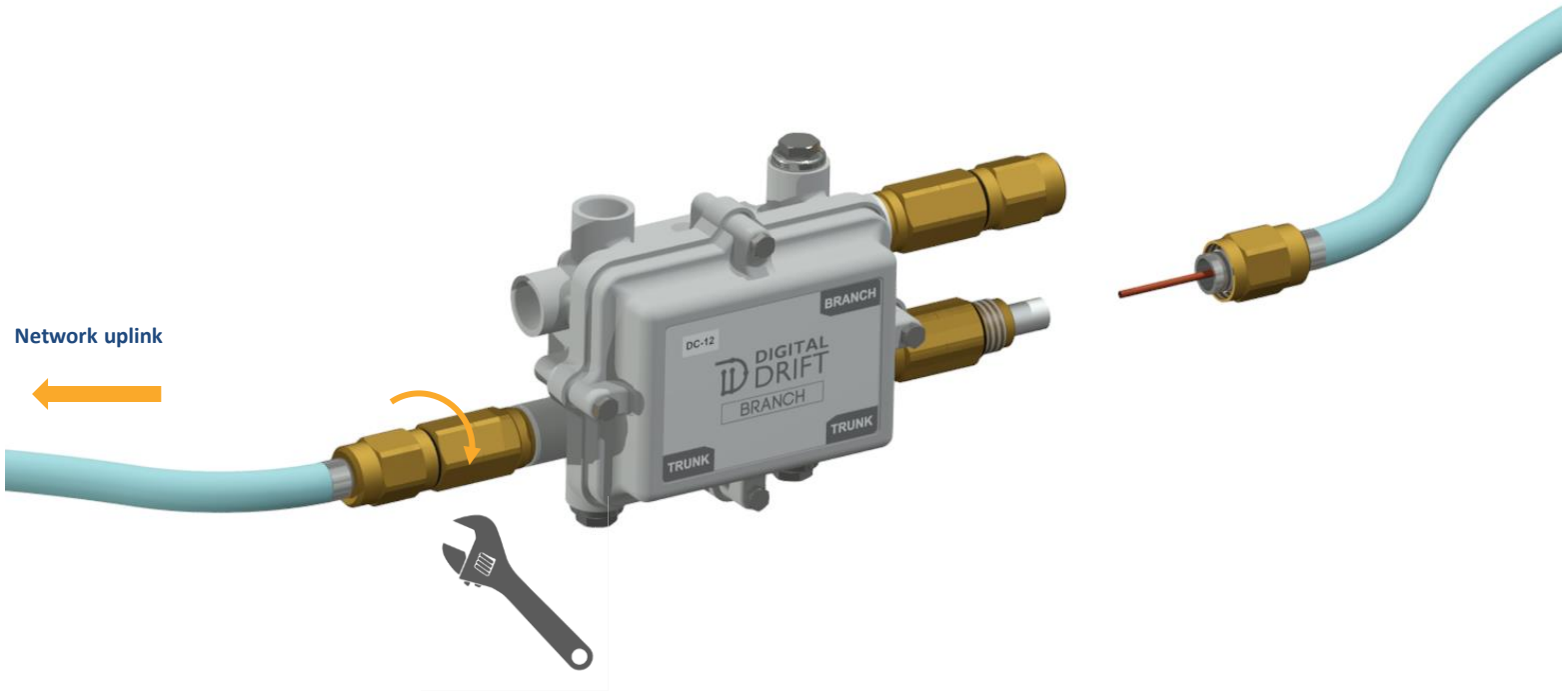
Fit the cable end that is closest to the network uplink into the TRUNK port on the left side of the Branch, ensuring that the centre pin is fully inserted.

TODO: Add a note about ensuring the plastic insulator is still in place

RFI TECHNOLOGY SOLUTIONS

STEP 7

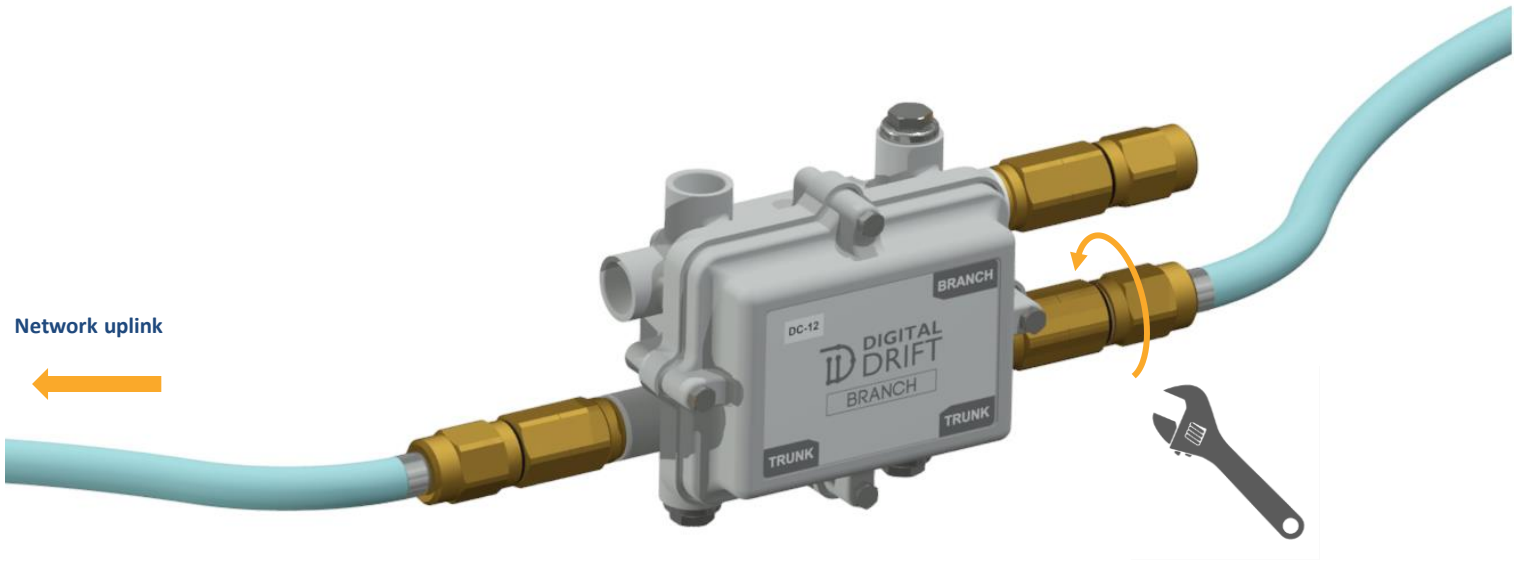
Keep the centre pin fully inserted in the TRUNK port and tighten the compression fitting – firstly by hand, then with a wrench.



RFI TECHNOLOGY SOLUTIONS

STEP 8

Repeat steps 6 and 7 for the downlink coaxial cable.



RFI TECHNOLOGY SOLUTIONS

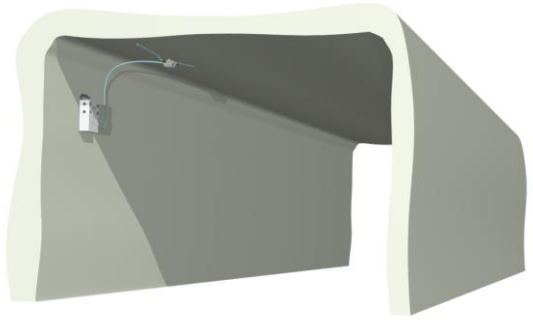
STEP 9

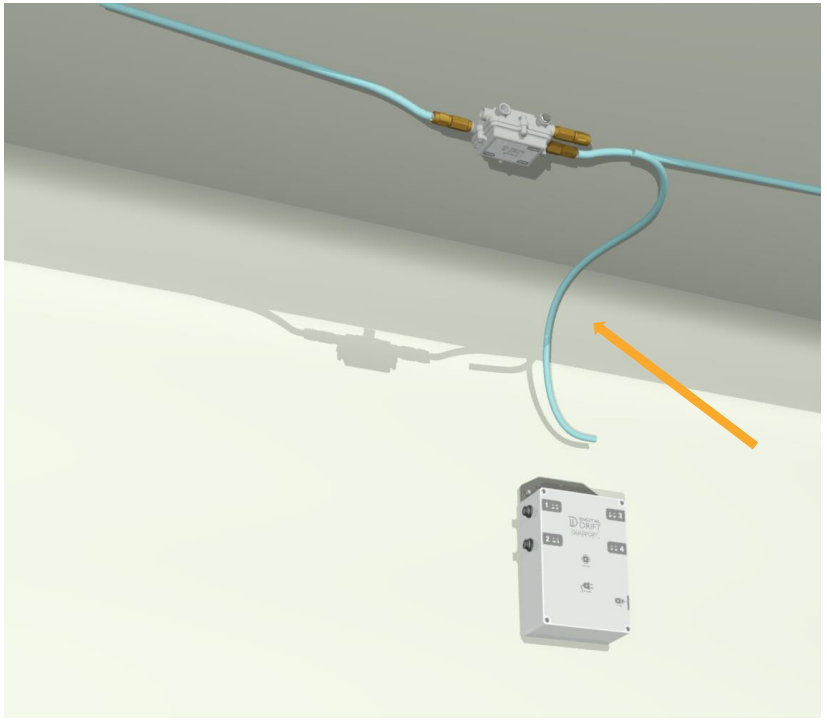
Mount the Quadport on the side wall.

RFI TECHNOLOGY SOLUTIONS

STEP 10

Cut a length of coaxial cable (up to 300m) to connect the Branch to the Quadport. Secure the cable to the back / side wall.

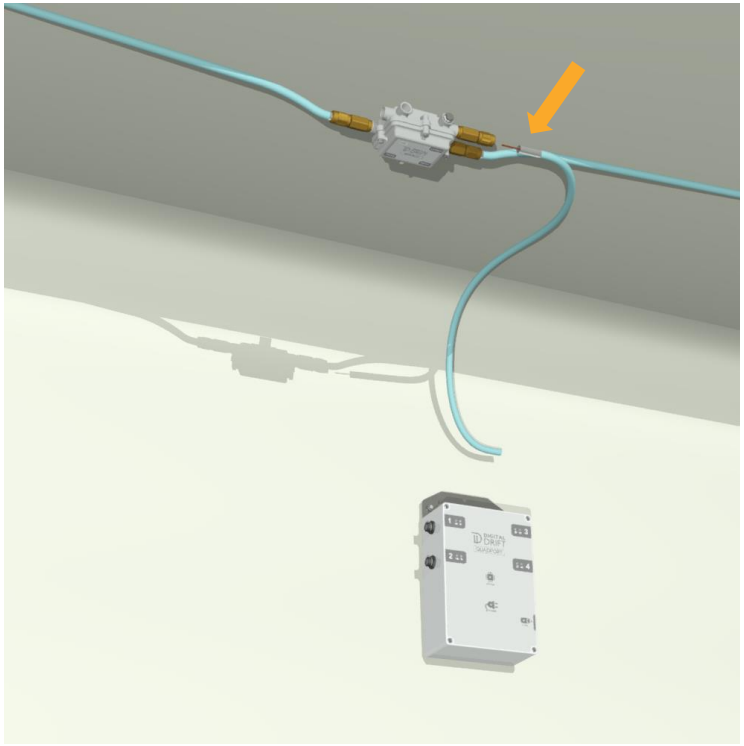




RFI
TECHNOLOGY SOLUTIONS

STEP 11

Strip the end of the coaxial cable that will connect the Branch to the Quadport.



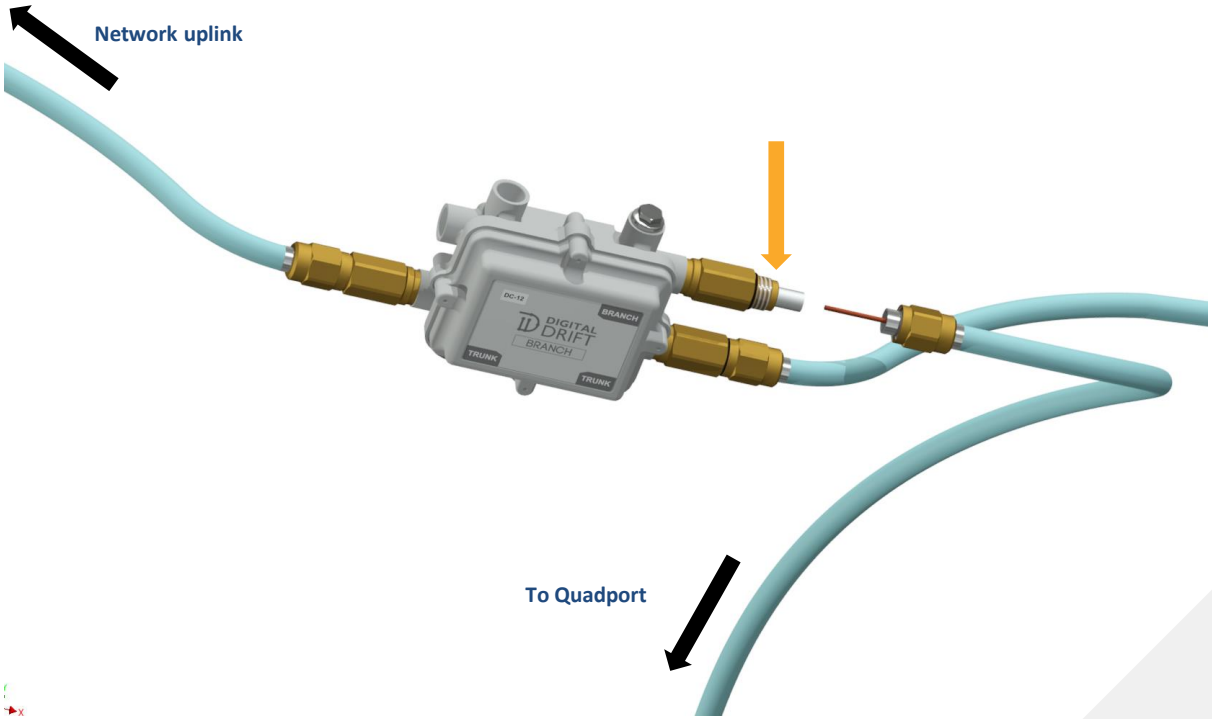
TECHNOLOGY SOLUTIONS

STEP 12

Connect the coaxial cable into the Branch port.

- Unscrew the compression fitting from the BRANCH port
- Slide the compression fitting over the end of the stripped coaxial cable
- Fit the stripped coaxial cable end into the BRANCH port, ensuring the centre pin is fully Inserted
- Tighten the compression fitting - first by hand, then with a wrench

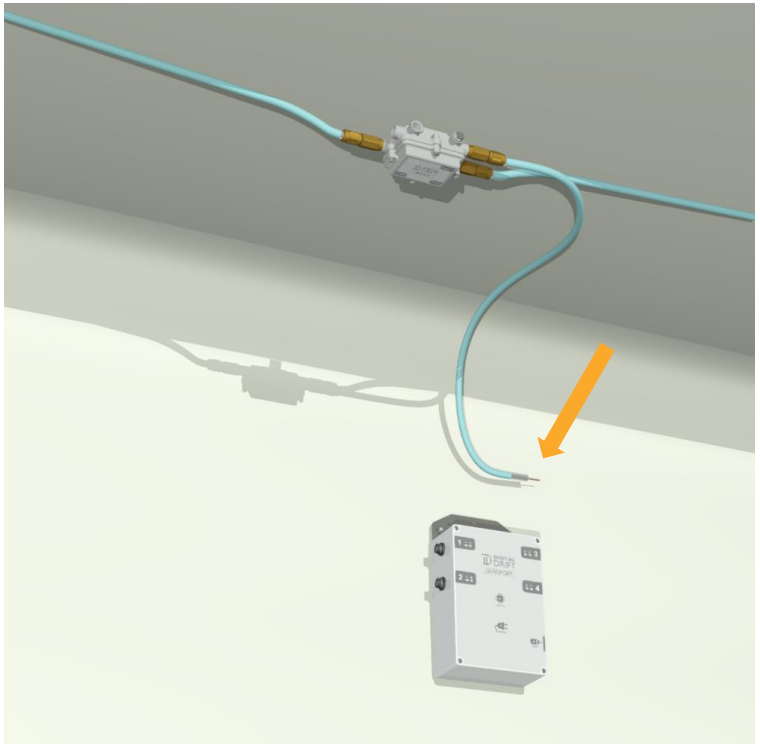
NOTE: This process is similar to steps 4,5,6 & 7.



RFI TECHNOLOGY SOLUTIONS

STEP 13

Strip the end of the coaxial cable that is adjacent to the Quadport.



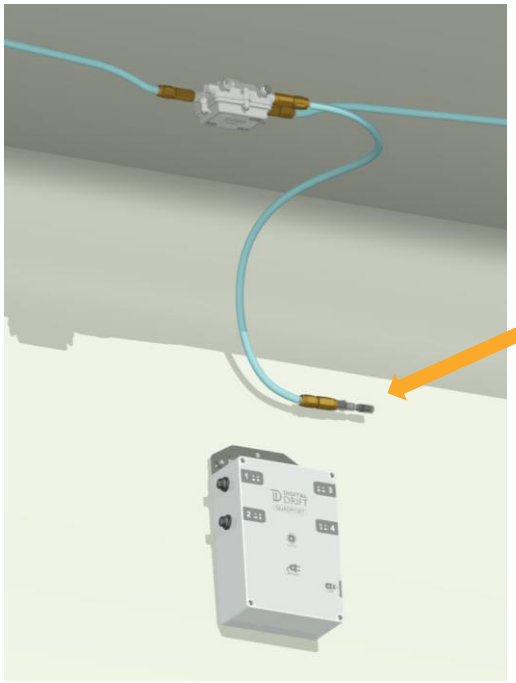
TECHNOLOGY SOLUTIONS

STEP 14

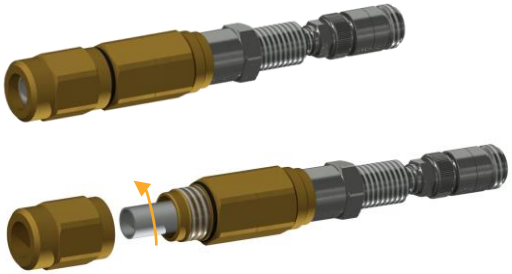
Connect the coaxial cable into the N-type connector fitting.

- Unscrew the compression fitting from the N-type connector
- Slide the compression fitting over the end of the stripped coaxial cable
- Fit the stripped coaxial cable end into the N-Type connector, ensuring the centre pin is fully Inserted
- Tighten the compression fitting - first by hand, then with a wrench

NOTE: This process is similar to steps 4,5,6 & 7.



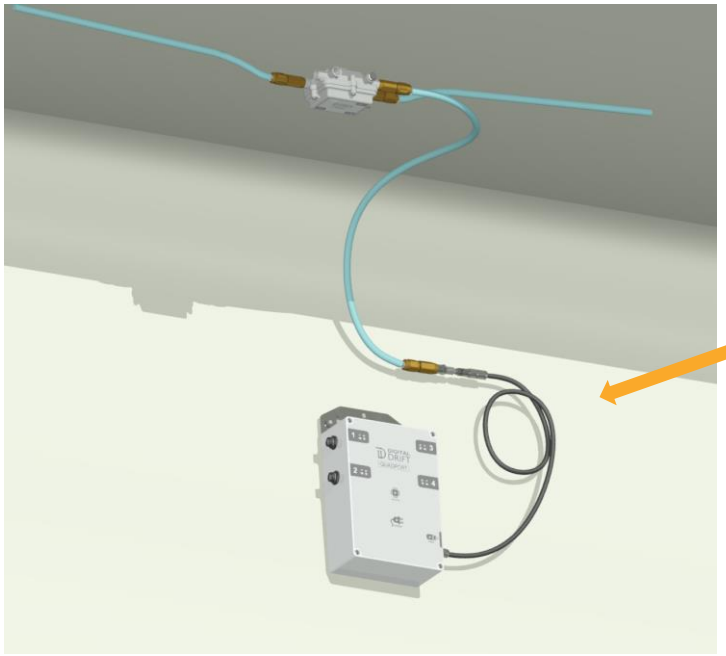
Part #: DD-CONN-ULR-NF



RFI TECHNOLOGY SOLUTIONS

STEP 15

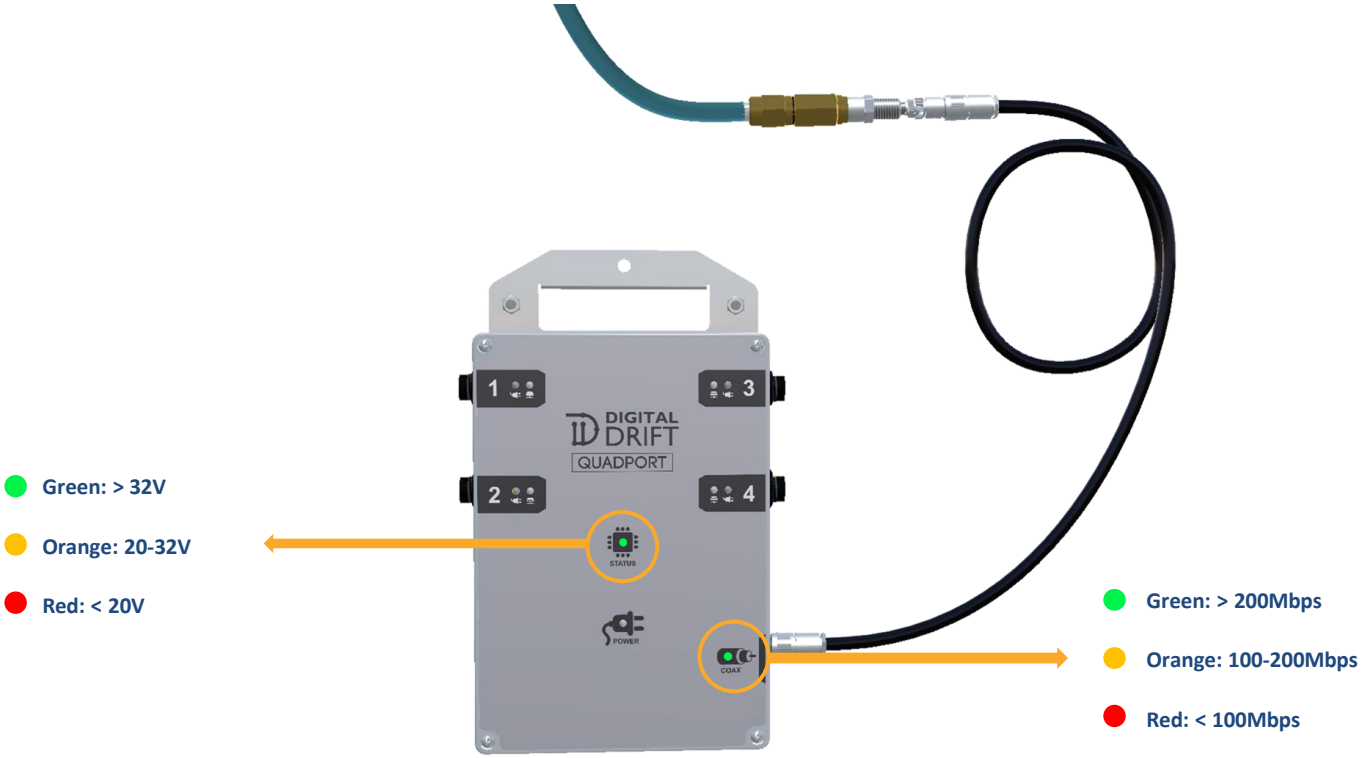
Connect the Quadport to the N-type connector using the supplied 2m inter-connecting flexible cable, coiling up any slack.



RFI
TECHNOLOGY SOLUTIONS

STEP 16

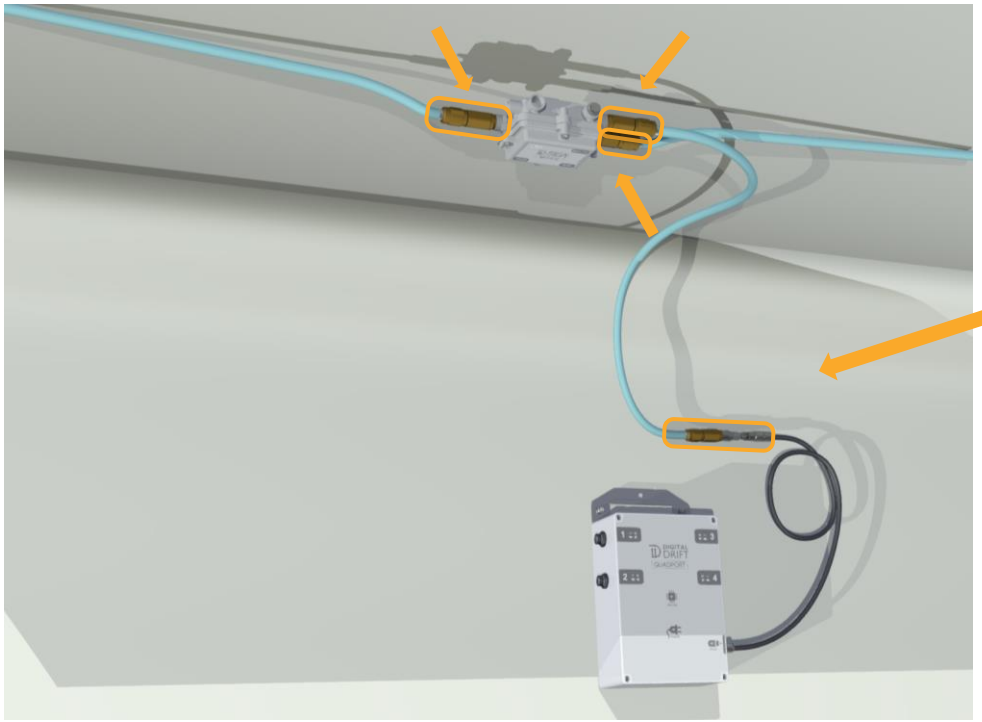
Turn on the power to the coaxial segment, then verify the Quadport powers up and communicates with other nodes.



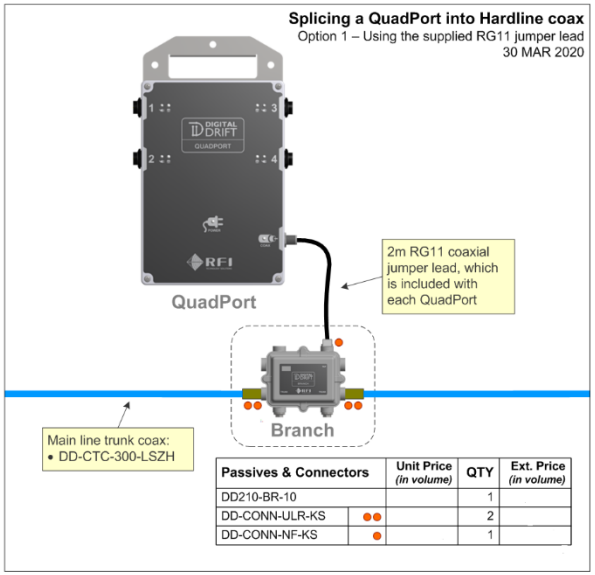
RFI TECHNOLOGY SOLUTIONS

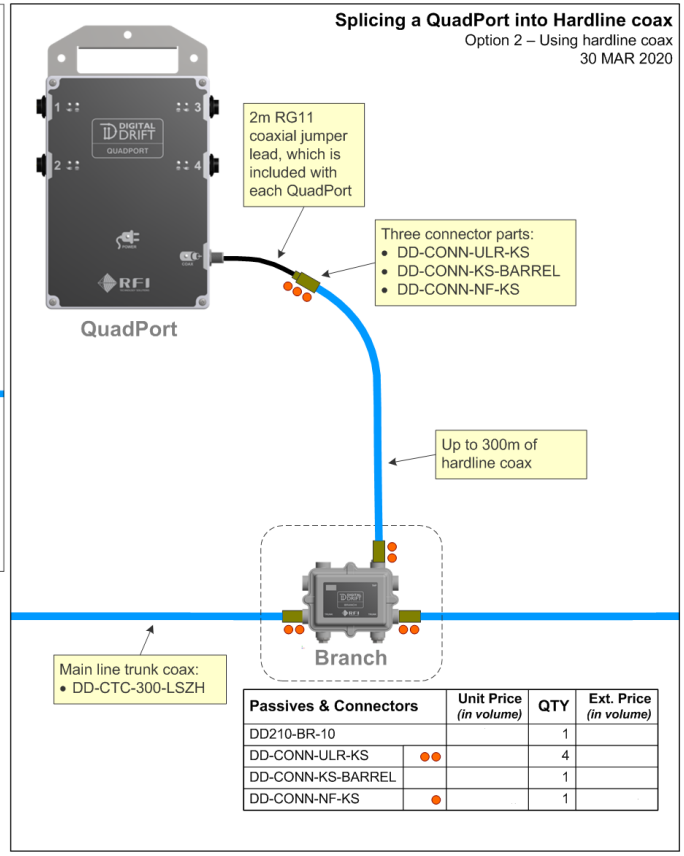
STEP 17

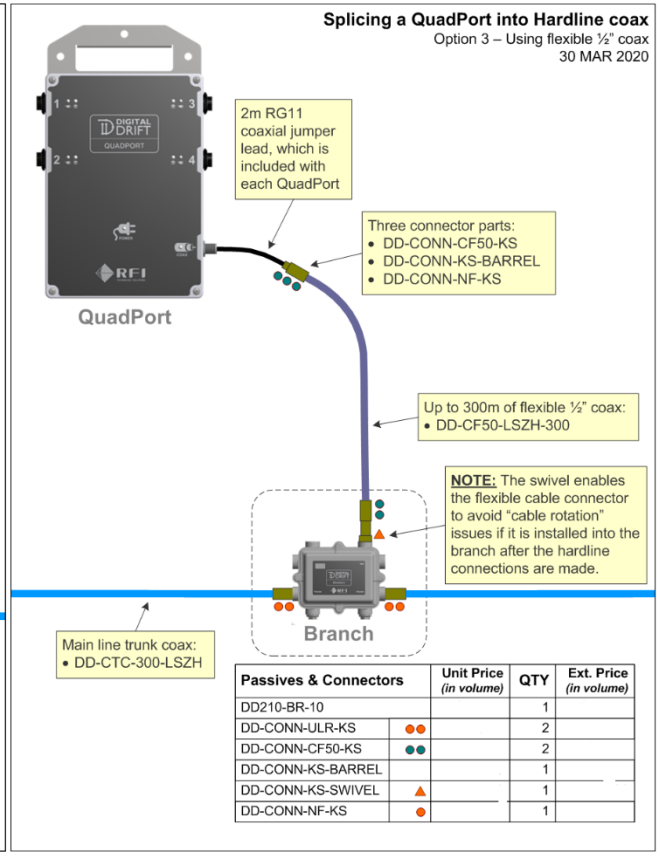
Wrap all of the coaxial connections with self-amalgamating tape.



Alternative ways of connection QP



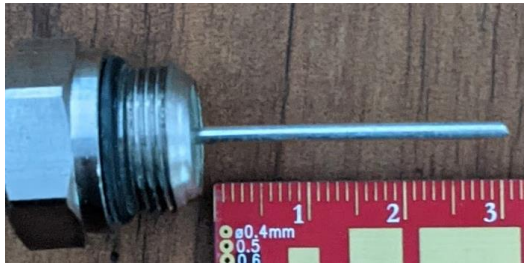


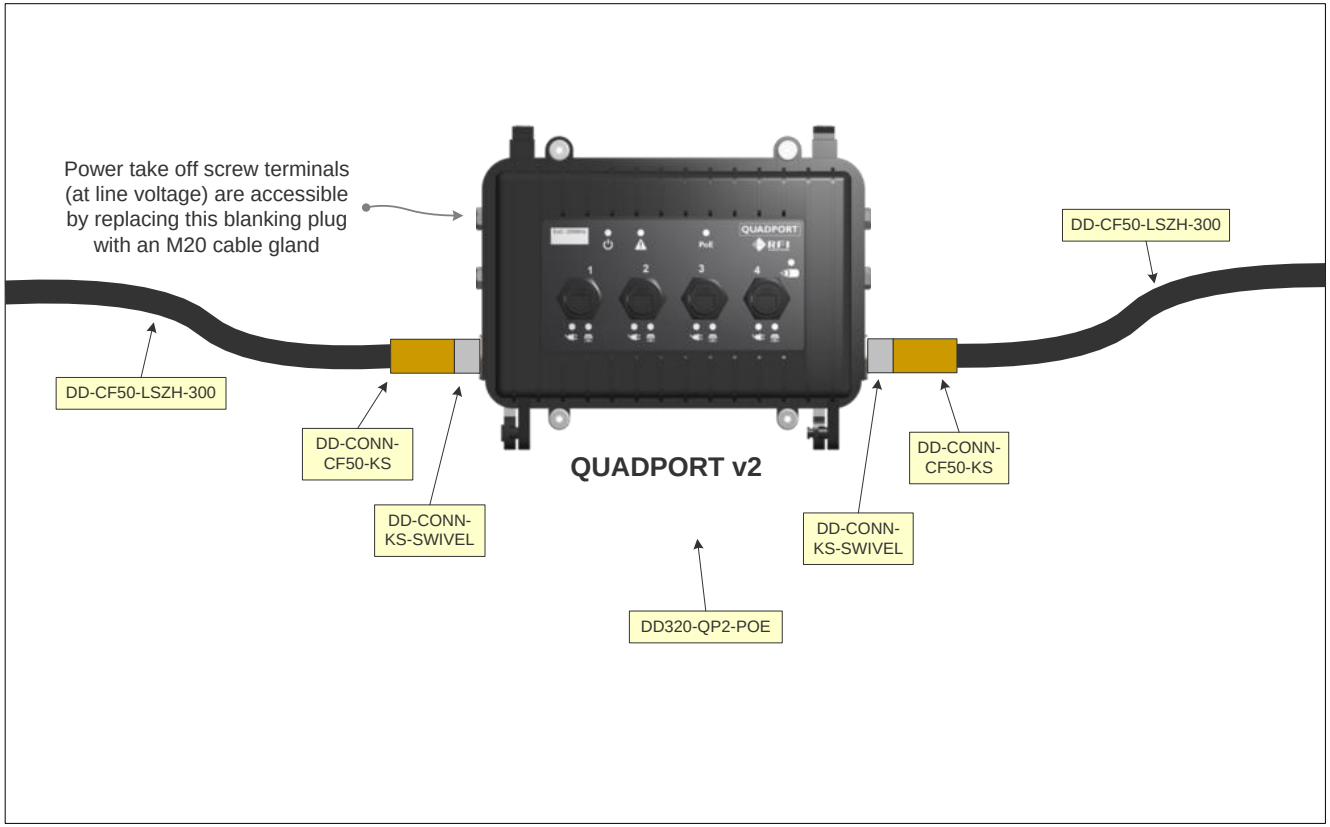


RFI TECHNOLOGY SOLUTIONS

QP2/RP2 with DD-CF50-LSZH-300 coax

- Use a DD-CONN-KS-SWIVEL on both sides to provide the ability to tighten the connectors as the connector on the DD-CF50-LSZH-300 can not spin
- The Centre Pin of the DD-CONN-KS-SWIVEL needs to be cut at about 30mm
- The DD-CONN-CF50-KS needs its centre pin cut as per the previous sections on slide 11

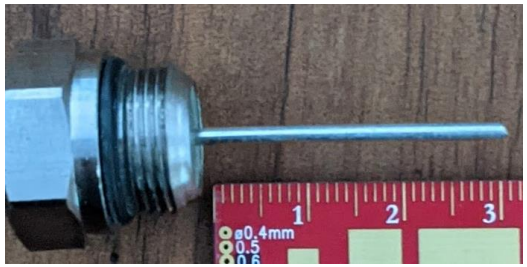


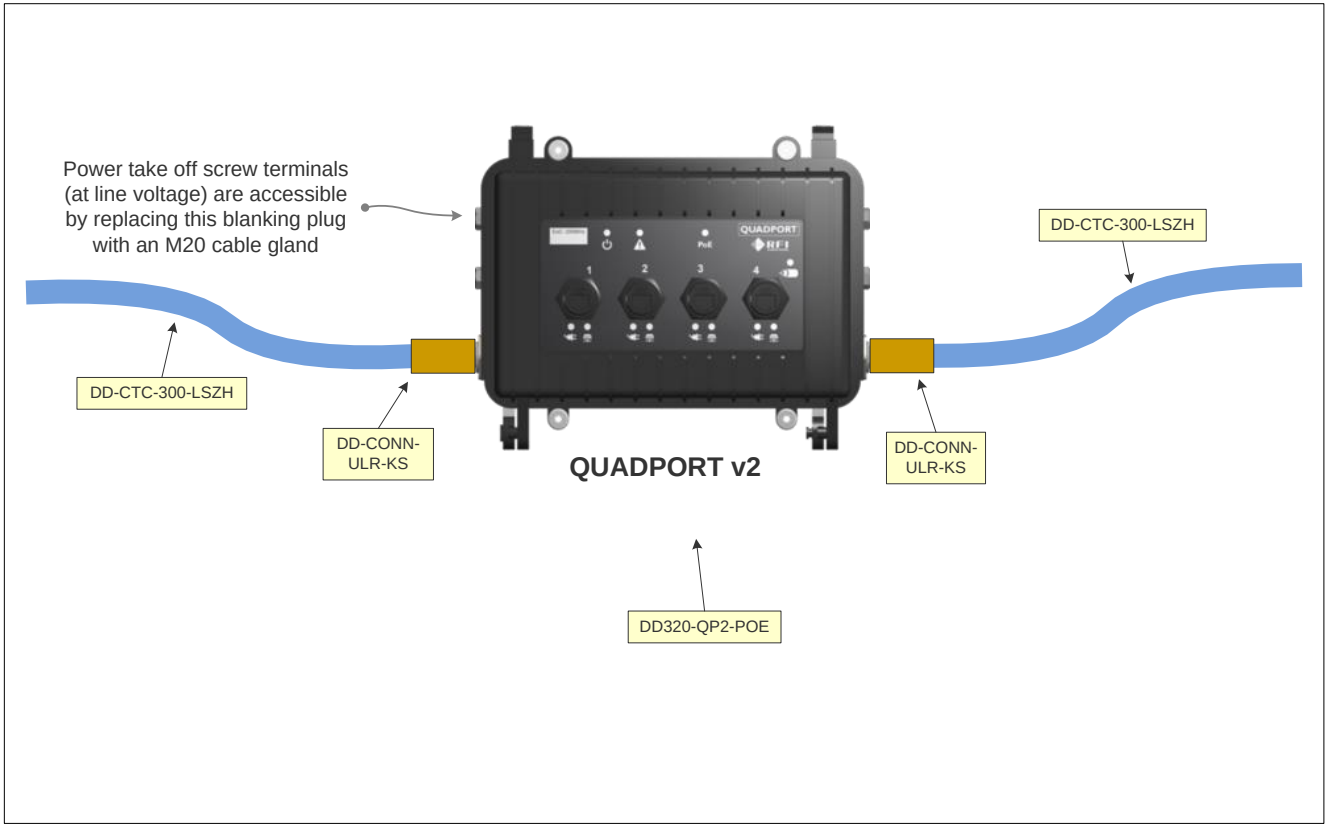


RFI TECHNOLOGY SOLUTIONS

QP2/RP2 with DD-CTC-300-LSZH coax

- There is no need to use a DD-CONN-KS-SWIVEL with the ULR cable
- Fit the DD-CONN-ULR-KS to eh cable as per the standard, see from slide 44
- The Centre Pin of the DD-CONN-ULR-KS needs to be cut at about 30mm





RFI TECHNOLOGY SOLUTIONS

Thank you

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TECHNOLOGY SOLUTIONS