Required number of inline connectors

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Motivation.

During the November plenary, 2023 ISAAC adopted objectives that required the support of four inline-connectors. As this number was adopted without extensive discussions, some insecurity remained whether four really was the right number.

This presentation provides feedback from individuals working for car manufacturers on the matter in order to close the item.

Content.

1) Survey questions
2) Survey results
3) Consequences
4) Summary and conclusion

Survey questions 1+2.

1. In upcoming car designs, how many inline connectors do you need to support for camera and other sensor connectivity (on a maximum 15m link length)?

- 0, 1, 2, 3, 4, 5, more than 5

2. How essential is it that your number of required inline connectors is met on a 15m link?

- If the specification does not explicitly support the number of inline connectors you selected in question 1, the technology cannot be used and you are no longer interested.
- If the specification does not support it, you will do further analysis to see whether the use case is nevertheless supported (e.g. because of a shorter link).

Survey question 3.

3. Do you see any correlation between the link length and the number of connectors in it?
   - Yes, longer links tend to have more inline connectors
   - Yes, longer links tend to have fewer inline connectors
   - No, most links have the same basic structure and number of inline connectors
   - Other (please elaborate)

Survey participation.

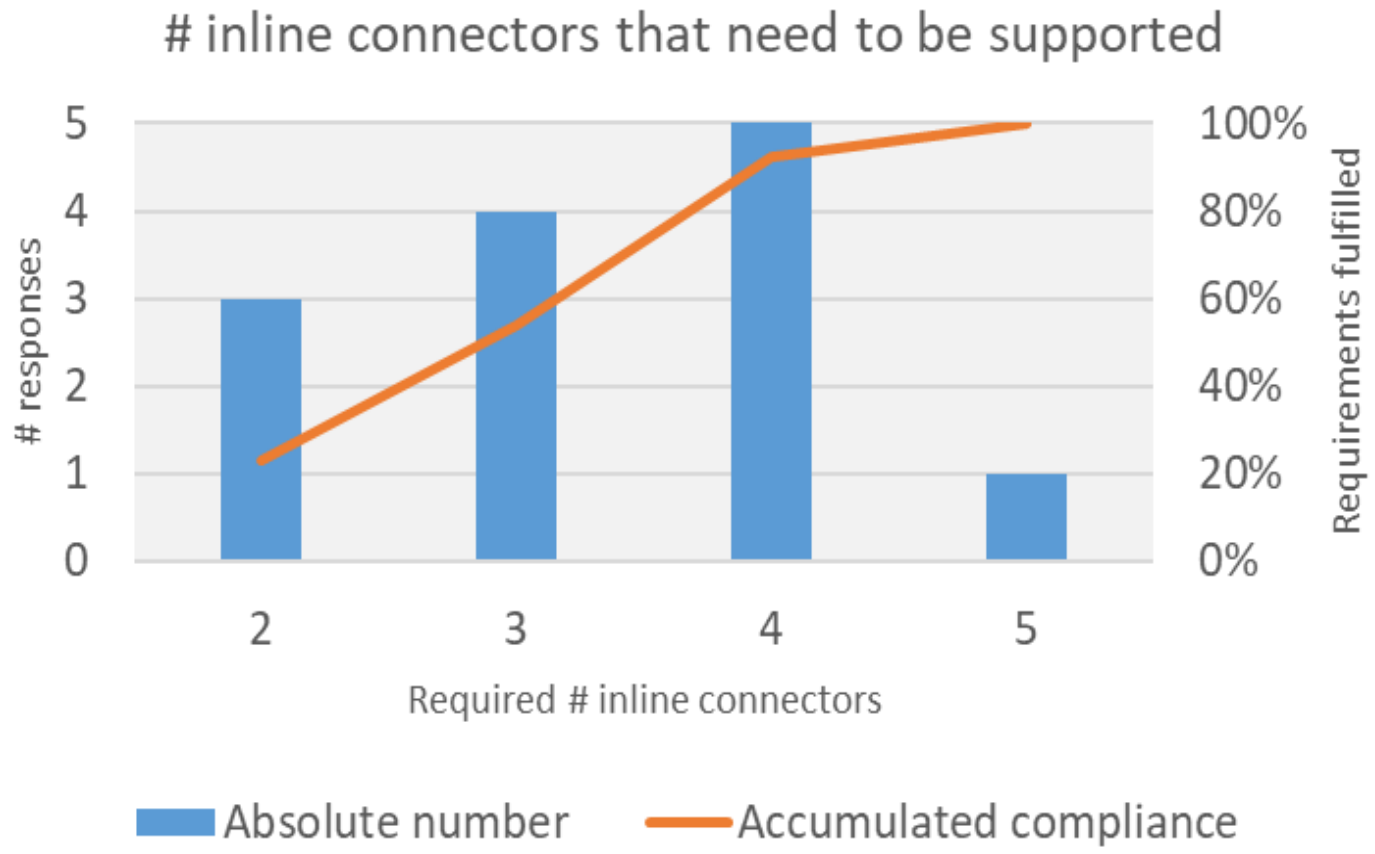
The questions were sent to 28 individuals who

a) Work for a car manufacturer (14 different affiliations) and
b) Are ware of the ISAAC activity (e.g. supported the CFI).

13 responses were received (some explicitly pre-aligned within their affiliation).

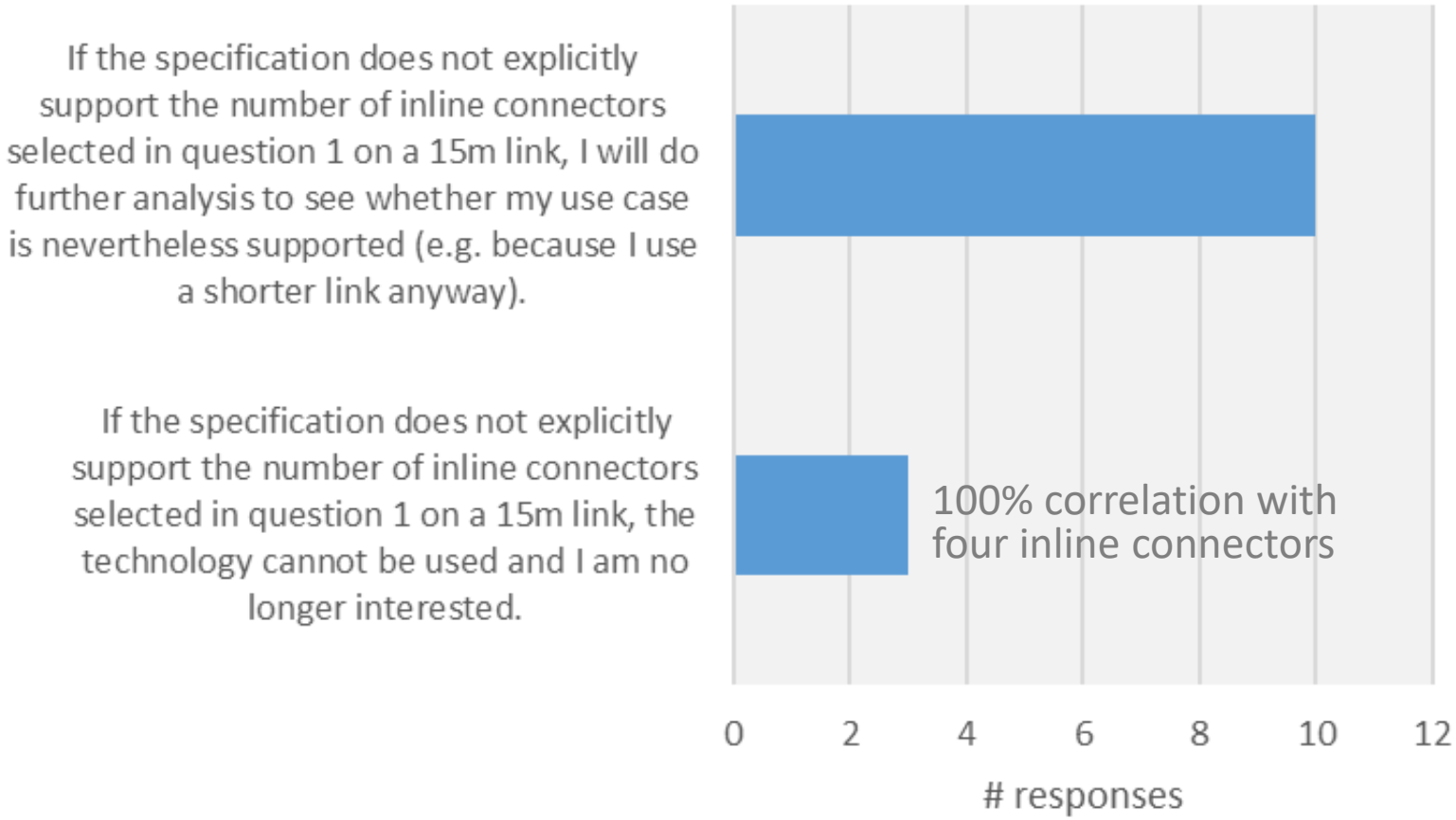
Disclaimer: The results give an impression, but do not claim to be statistically balanced nor do they claim to represent the entire car industry.

Response 1: How many inline connectors (on a max. 15m link)?



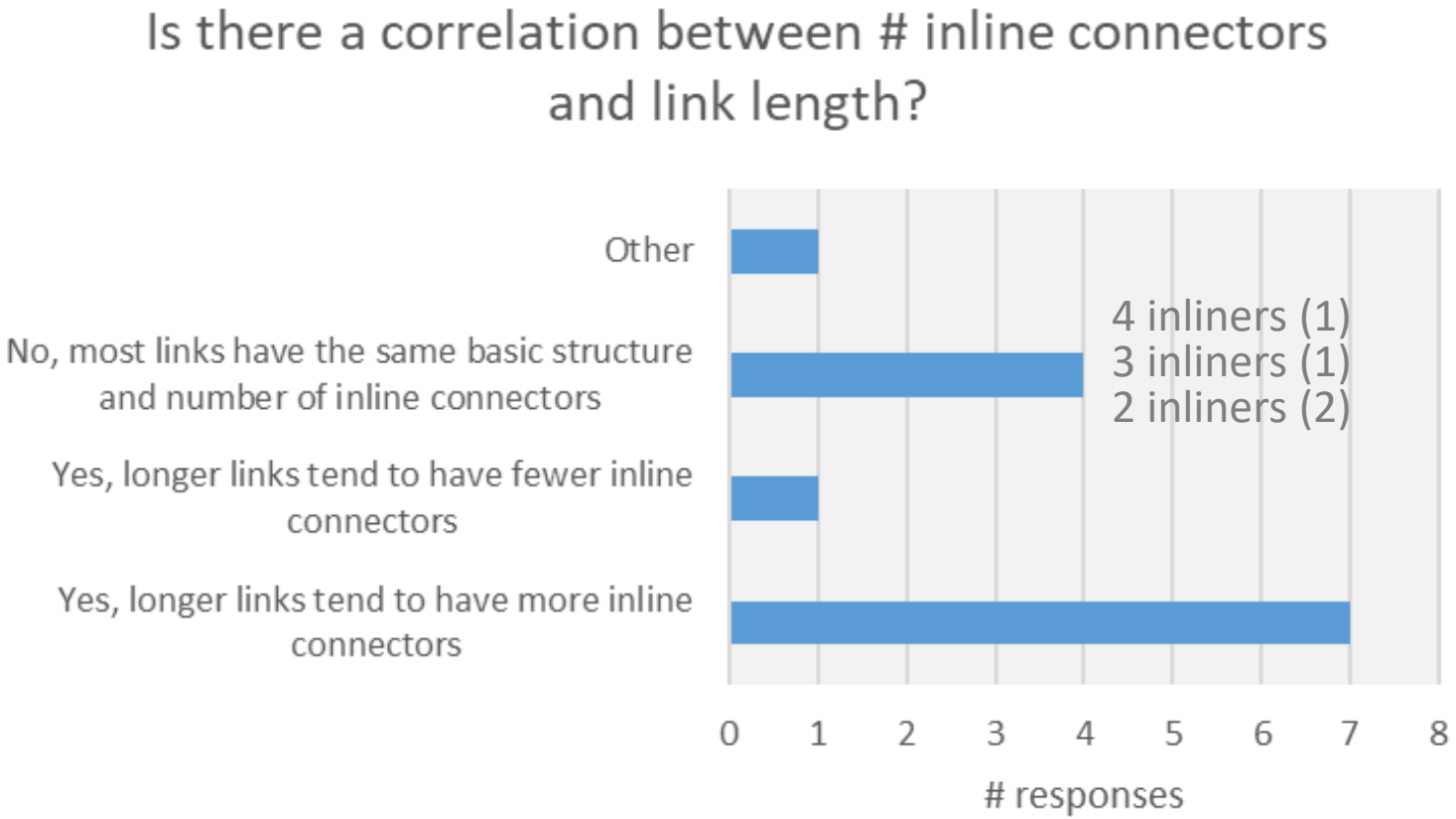
Supporting four inline connectors means fulfilling the requirements of 92% of the survey participants.

Response 2: What if that number is not met?



If fewer than four inline connectors were supported, 77% of the participants would still investigate the solution. For 23%, it would no longer be of interest.

Survey results 3.



Other: Typically, longer cables have higher inline connectors as the harness goes through various vehicle sections. So, along with the length, the inline connector number also depends upon how the cable is routed in the vehicle.

62% of the participants see a correlation between link length and no. of inline connectors.

Of those 31% who see the same basic structure of the links independent of the link length, there is a slight bias towards a smaller number of inline connectors needed (meaning it is more likely to always need two inline connectors than to always need four inline connectors).

Impact of the number of inline connectors.

- The channel and component test specification explicitly address the number of inline-connectors (see e.g. https://opensig.org/wp-content/uploads/TC9-1000BASE-T1-Link-Segment-Type-A-STP-Channel-and-Components-v2.0.pdf)
- The inline connectors impact the channel Insertion Loss (IL) (see e.g. https://www.ieee802.org/3/ch/public/sep17/Javed_3ch_01_0917.pdf, https://grouper.ieee.org/groups/802/3/B10GAUTO/public/jul19/diminico_B10GAUTO_01_0719.pdf)
- Connectors are a main source of impedance mismatches and therefore are a source of reflections (see e.g. https://www.ieee802.org/3/cy/public/jul20/jonsson_3cy_01a_0720.pdf).
- …

Summary and conclusion.

- From the adopted link segment objectives at the November plenary some insecurity remained in respect to the number of inline connectors the solution discussed in ISAAC needs to support.
- This presentation presents feedback from individuals working for car manufacturers on the required number of inline connectors.
- Supporting four inline connectors means fulfilling the requirements of 92% of the survey participants.
- If fewer than four inline connectors were supported, 77% of the participants would still investigate the solution. For 23%, it would no longer be of interest.
- The made selection of four inline connectors looks like a good choice.
- Its impact needs to be considered in the link/channel requirements.