

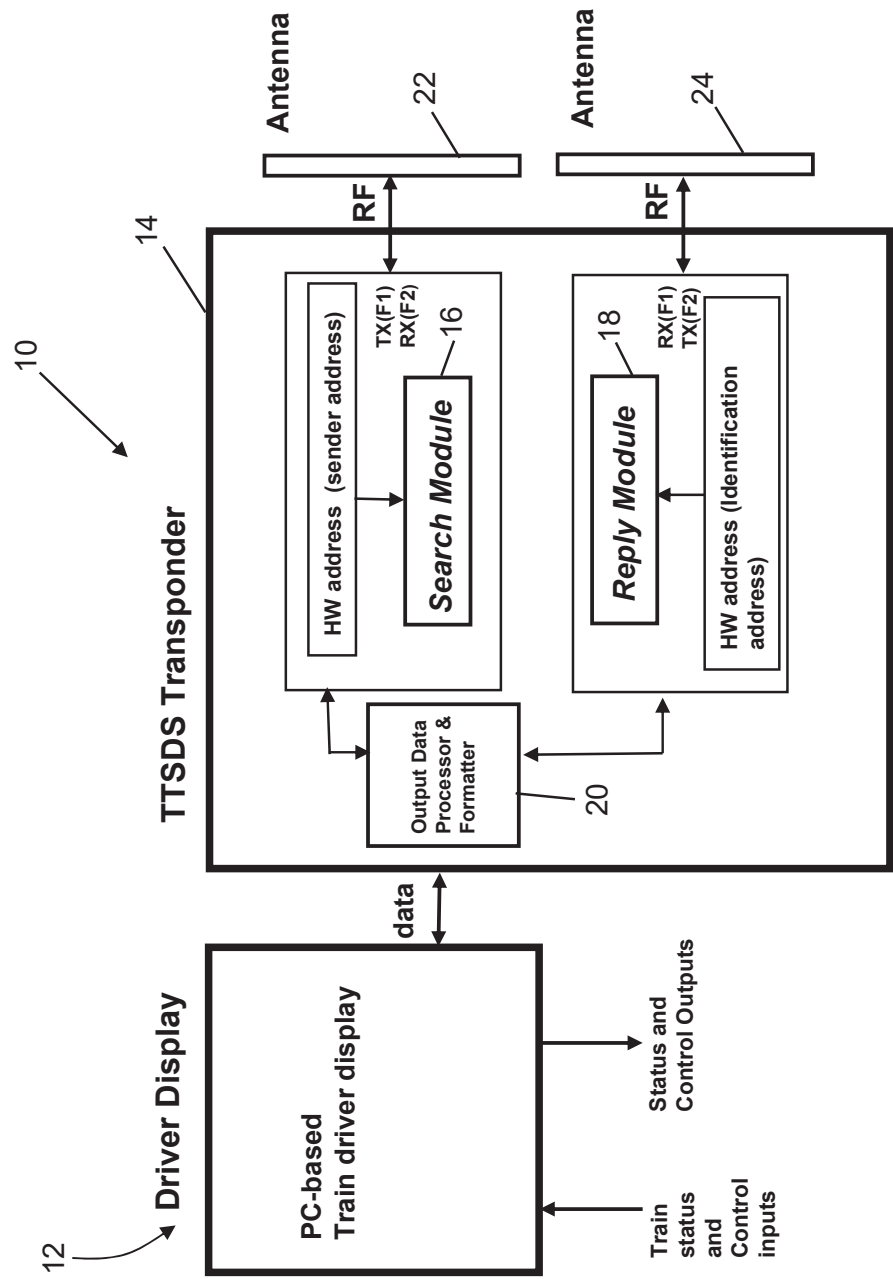


Fig. 1

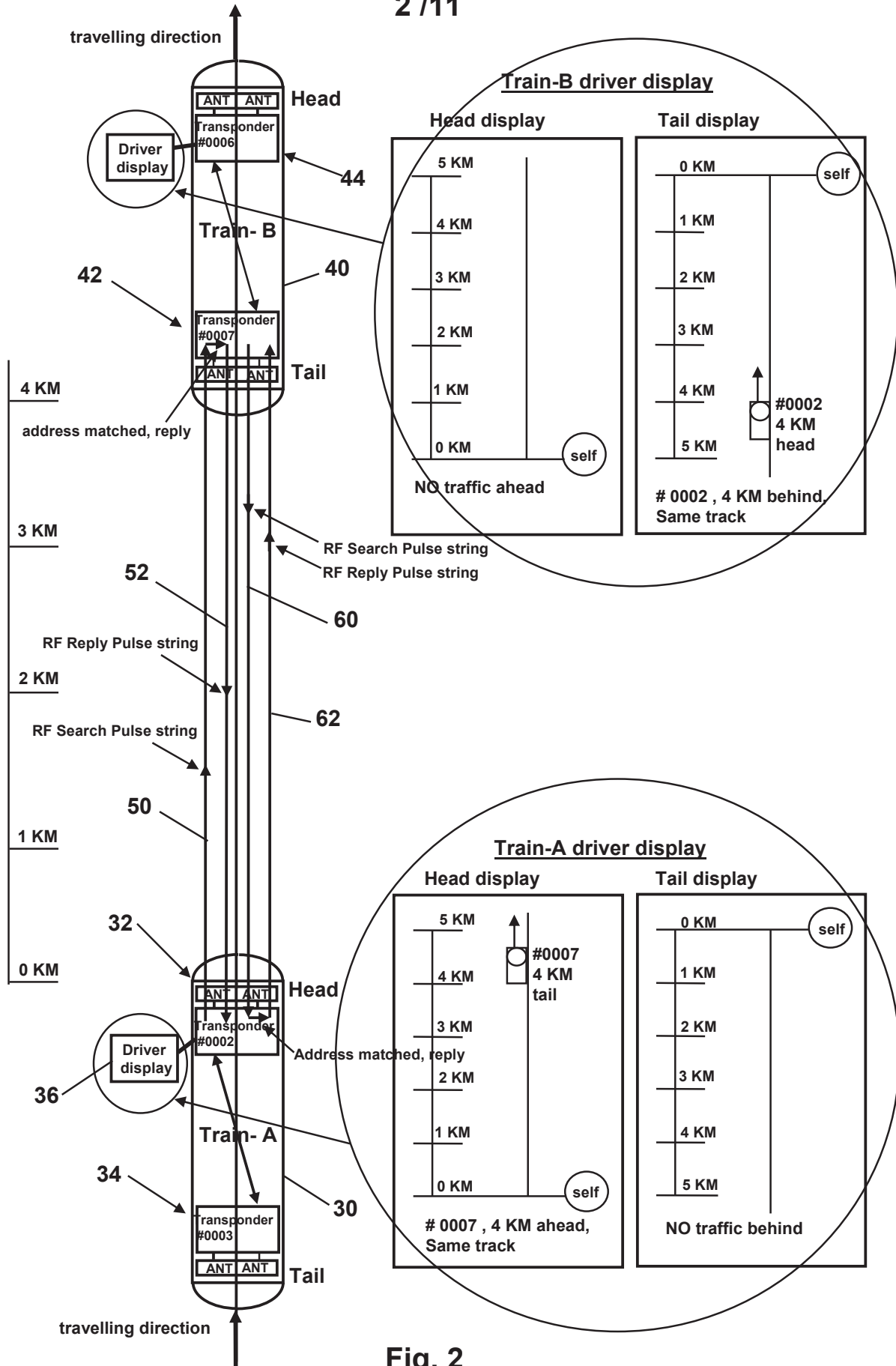


Fig. 2

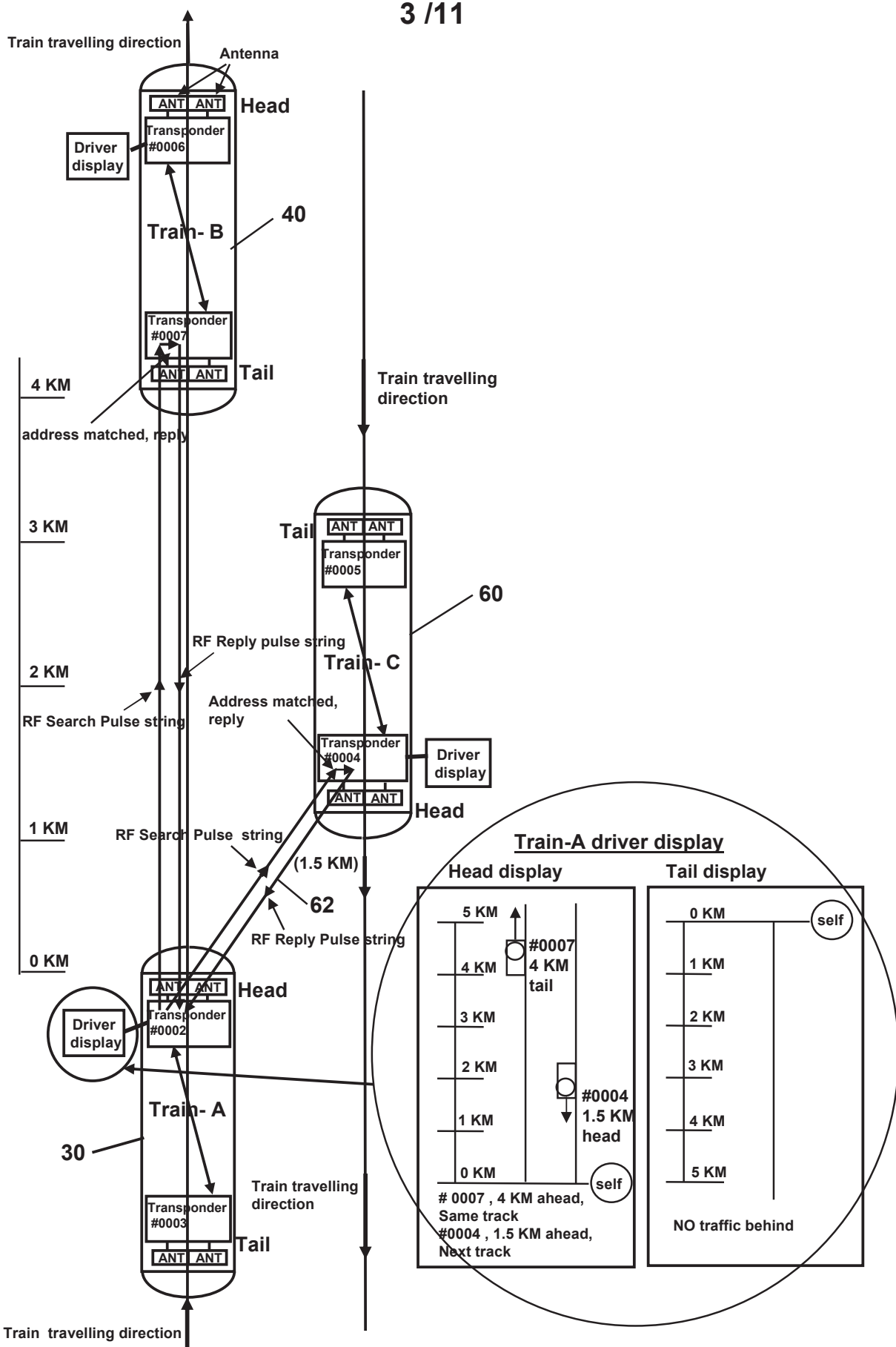


Fig. 3

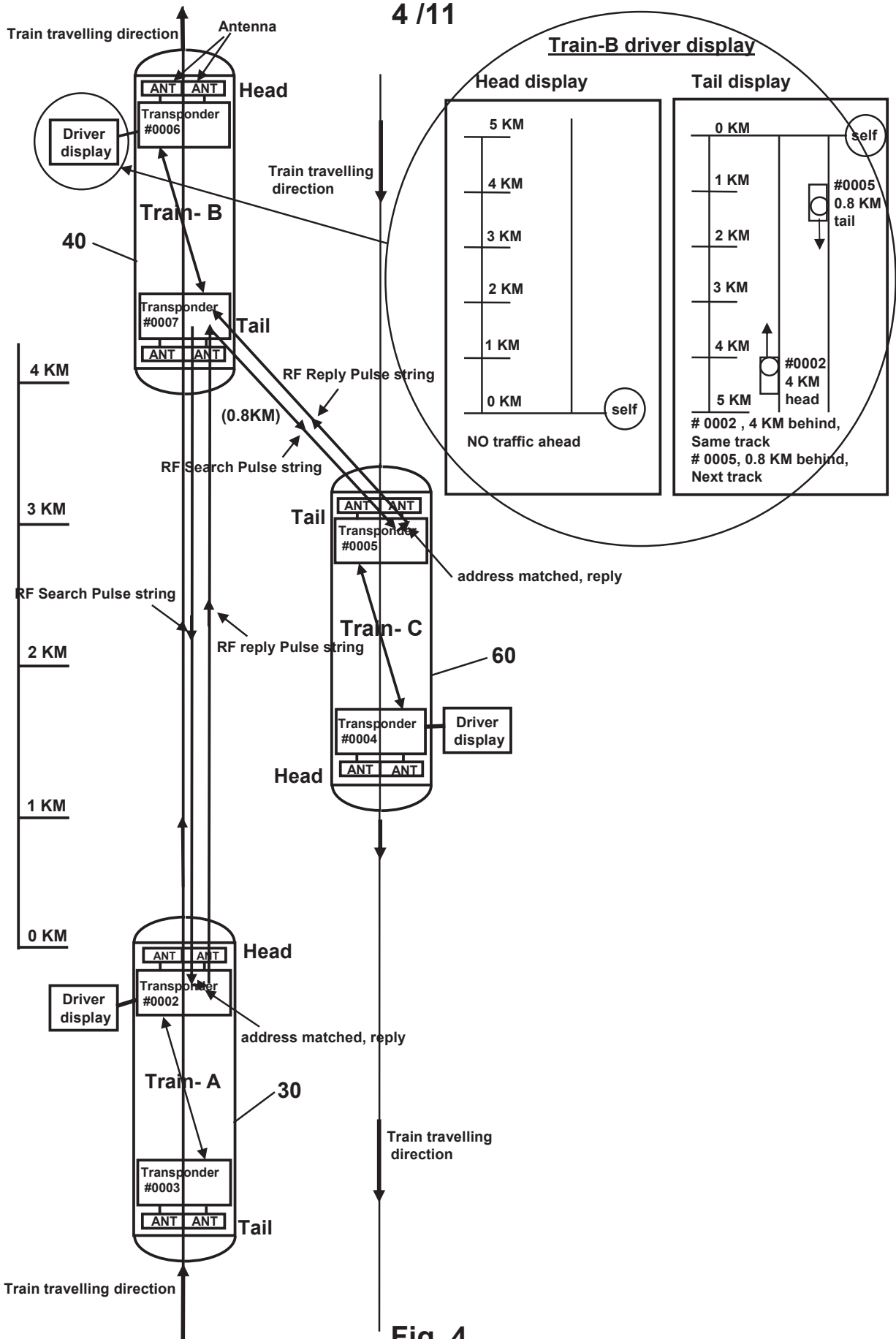


Fig. 4

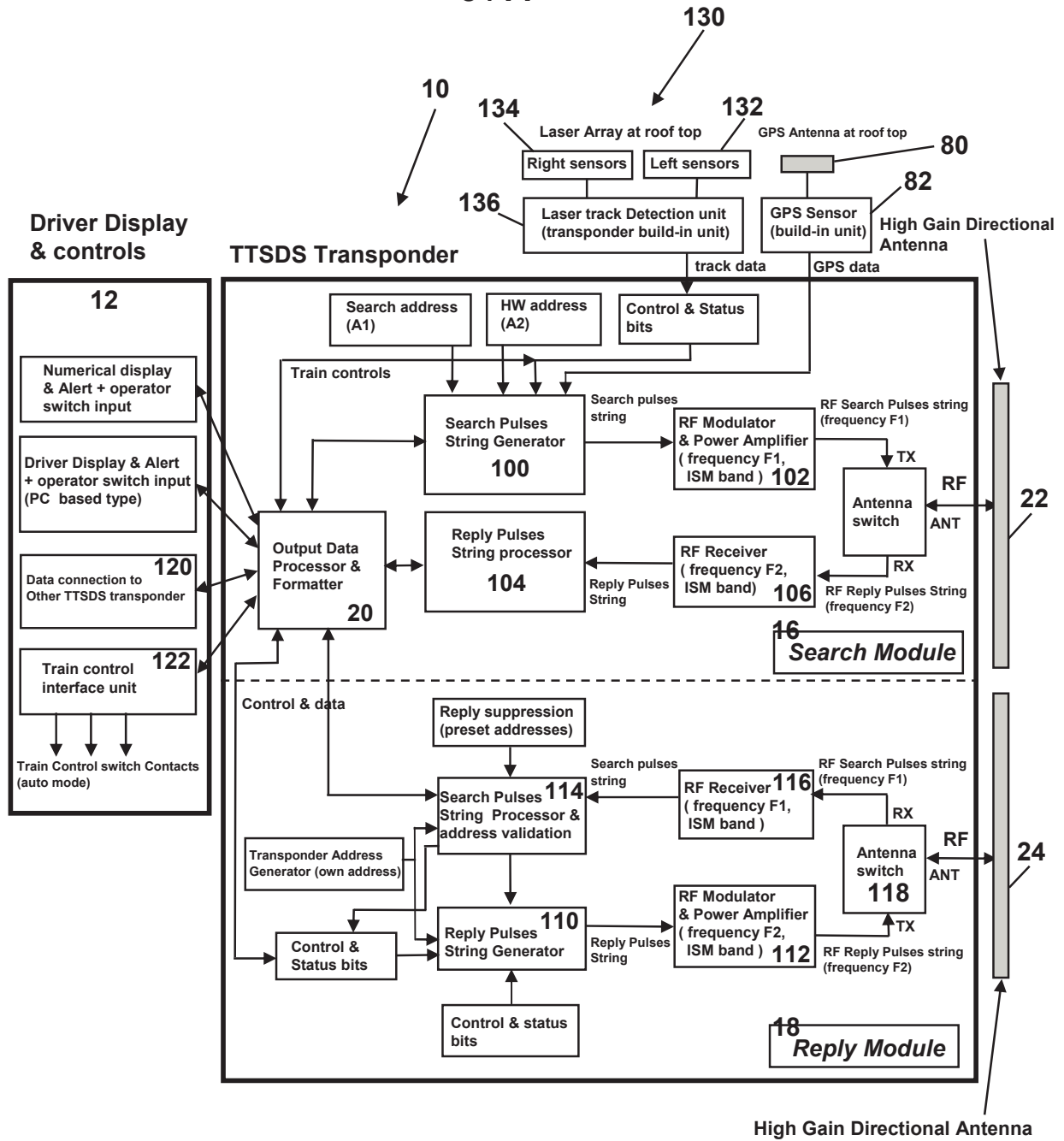
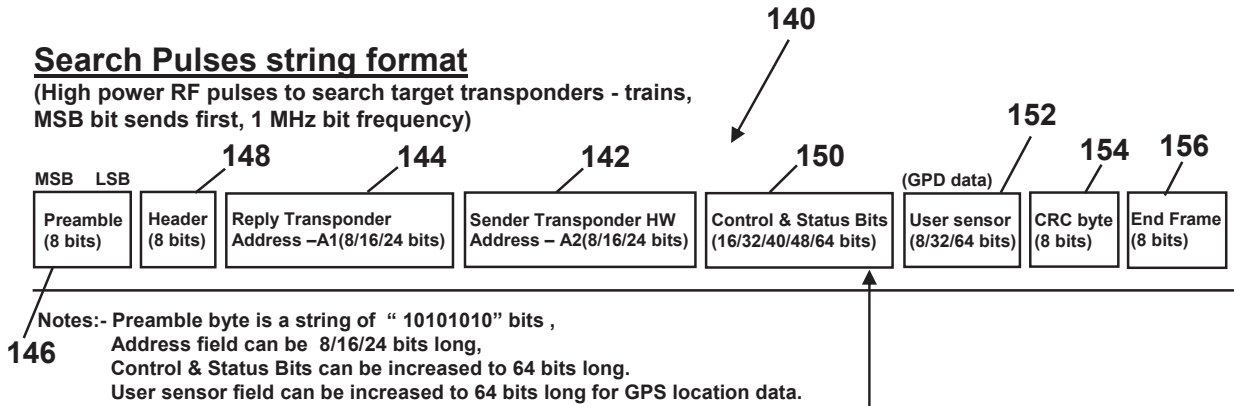


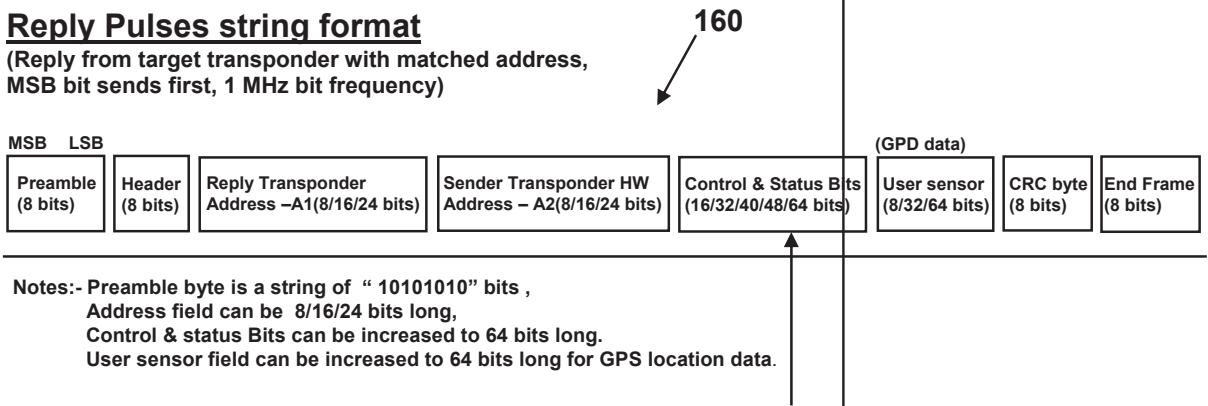
Fig. 5

Search Pulses string format

(High power RF pulses to search target transponders - trains, MSB bit sends first, 1 MHz bit frequency)

**Reply Pulses string format**

(Reply from target transponder with matched address, MSB bit sends first, 1 MHz bit frequency)

**Control & Status bits format (16/32/40/48/64 bits , programmable by user)**

Example (40-bit control and status format) :-

Bit No.	size	Function / usage
Bit-1	1 bit	Reserved
Bit-2	1 bit	communication failure
Bit-3	1 bit	Electrical system failure
Bit-4	1 bit	Train stopped
Bit-5	3 bits	Train type 0= passenger train 1= cargo train 2= maintenance train 3= cross-country, none stop 4= ???? 5= ????
Bit-8	6 bits	Length ,number of carriages (1 – 63 carriages)
Bit-14	1 bit	0= Front (train head) sensor, 1= Rear (train tail) sensor
Bit-15	1 bit	Emergency Stopped
Bit-16	4 bits	number of tracks at right (0 to 15 tracks)
Bit-20	4 bits	number of tracks at left (0 to 15 tracks)
Bit-24	4 bits	number of tracks detected (1 to 15 tracks)
Bit-28	1 bit	track data available (1=valid track data , 0= no track data)
Bit-29	1 bit	reserved
Bit-30	4 bits	Platform Number (0 to 15)
Bit-34	7 bits	reserved for train controls

Track information output
from Laser Track Detection Unit

Fig. 6

Example :- Train-A on track #1
Train-B on track #8

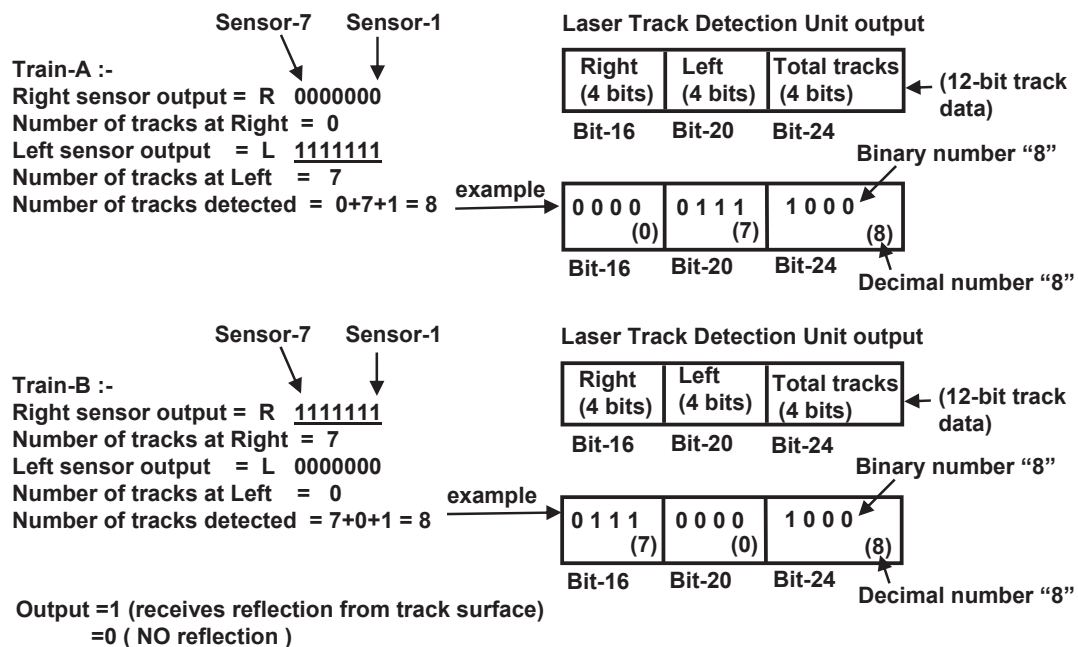
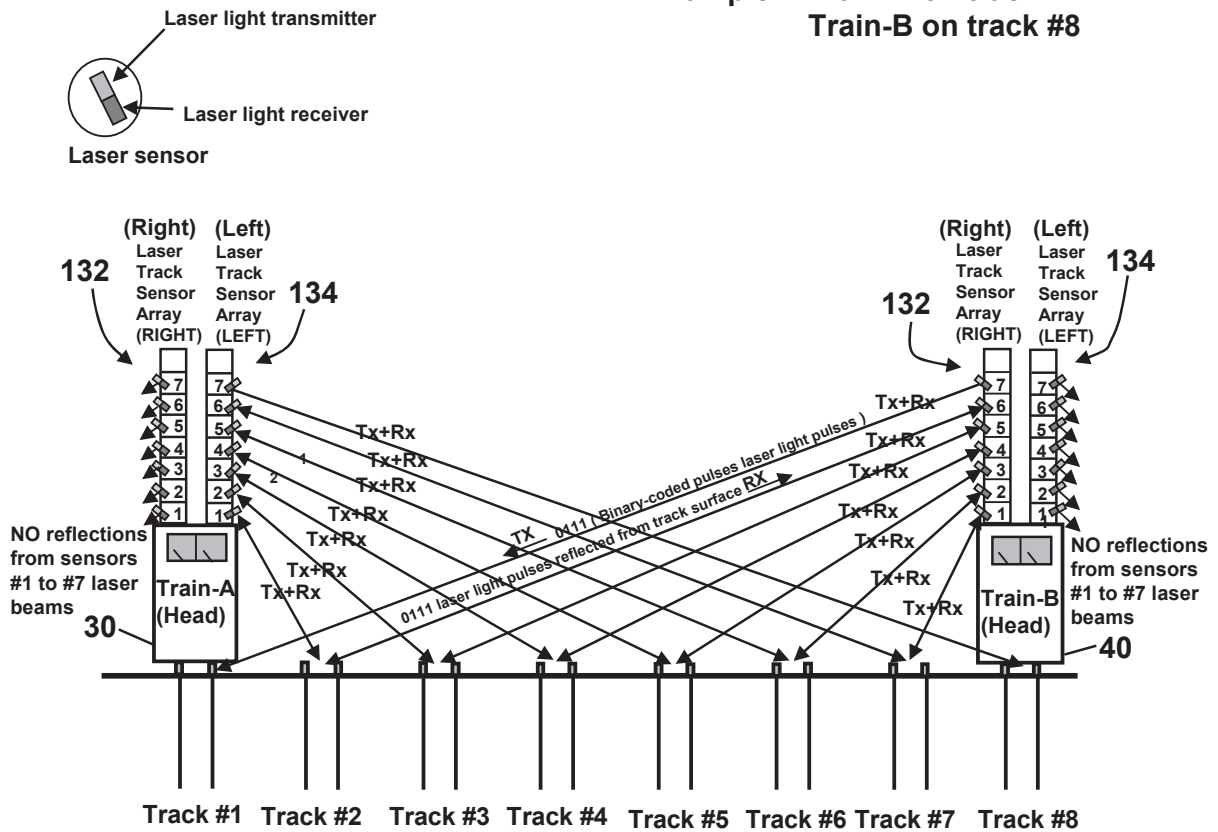


Fig. 7

Example :- Train-A located on Track #3

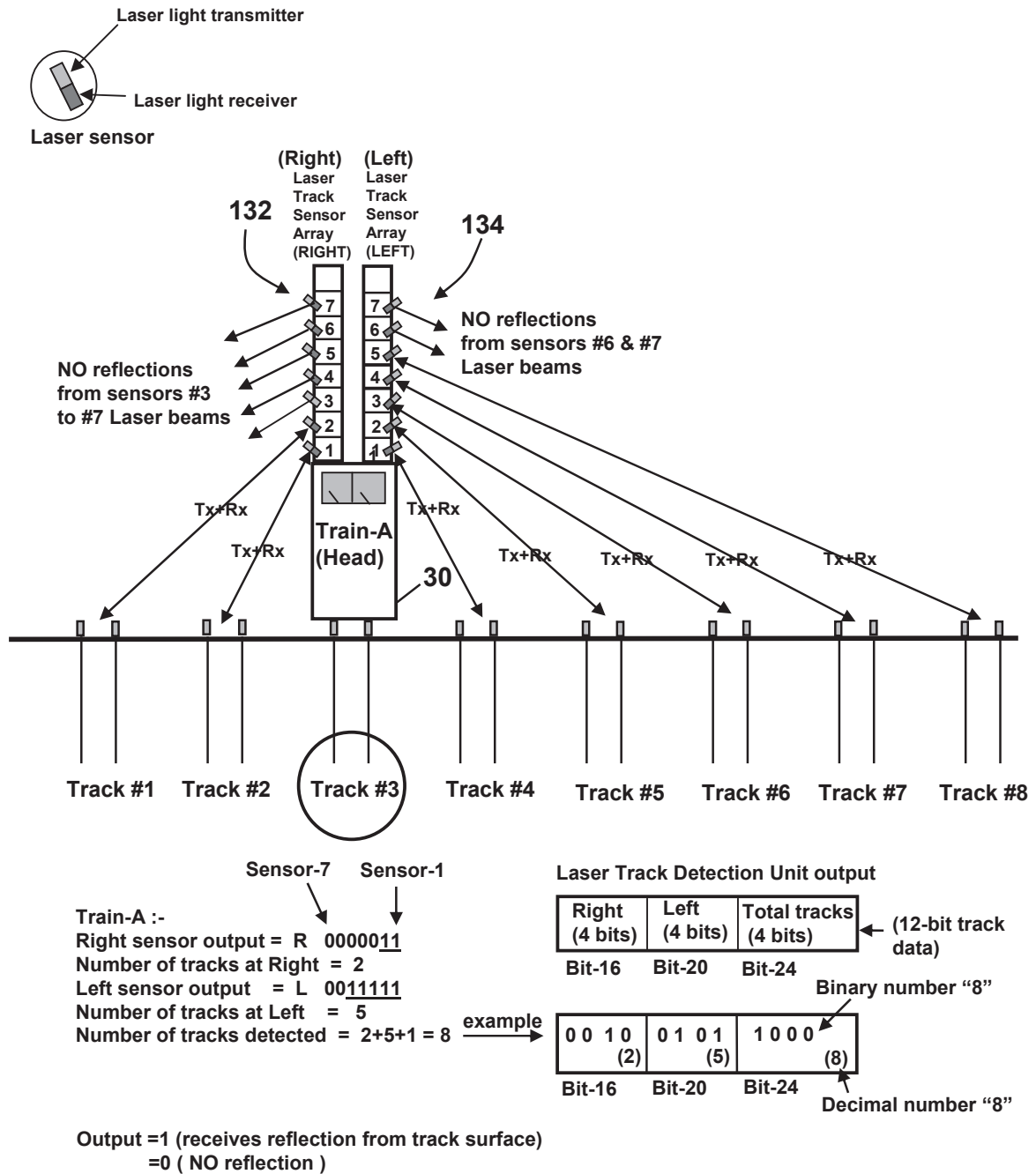
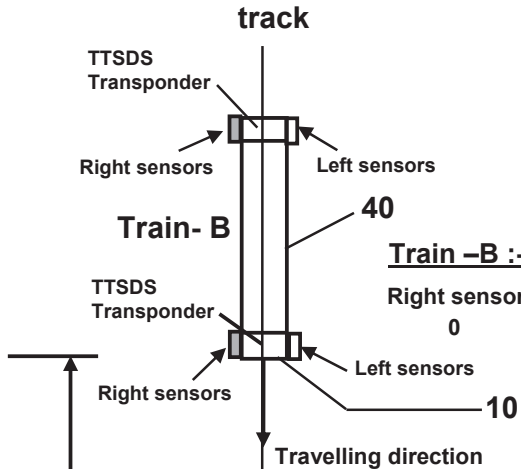


Fig. 8



Case – 1 track zone,
Track as viewed by Train-A

(The TTSDS Transponder-A will issue a Head-to-Head Collision Warning in this case.)

Train –B :-

Right sensor	Left sensor	Number of tracks detected
0	0	$0 + 0 + (1) = 1$

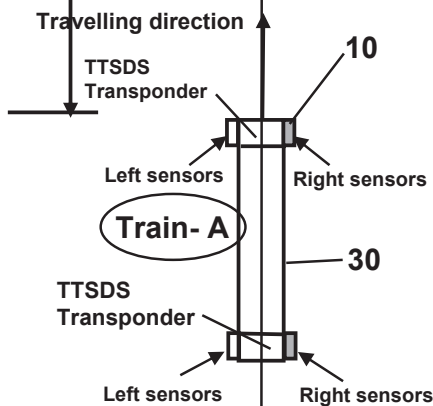
TTSDS collision pre-warning logic (for Train-A) :-
Train-A issued the search

Note : No need to swap opposite train sensor values for trains travelling in the same direction.

Train –A :-

Right sensor	Left sensor	Number of tracks detected
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1. Opposite train-B sensor value as reported in Reply Pulses string	0 swap 0	$0 + 0 + (1) = 1$
2. swap Opposite sensor right and left values (see note)	0 0	$0 + 0 + (1) = 1$
3. Train-A sensor values	0 Same value 0 Same value	$0 + 0 + (1) = 1$
4. Final result as viewed by Train –A by comparison	same Same value	1 track



Train –A :-

Right sensor	Left sensor	Number of tracks detected
0	0	$0 + 0 + (1) = 1$

Train-A and Train-B are travelling in Opposite Direction on the Same Track as detected by the Laser Track Detection Unit .
 The TTSDS Transponder will issue a Head-to-Head Collision Warning.

FIG. 9

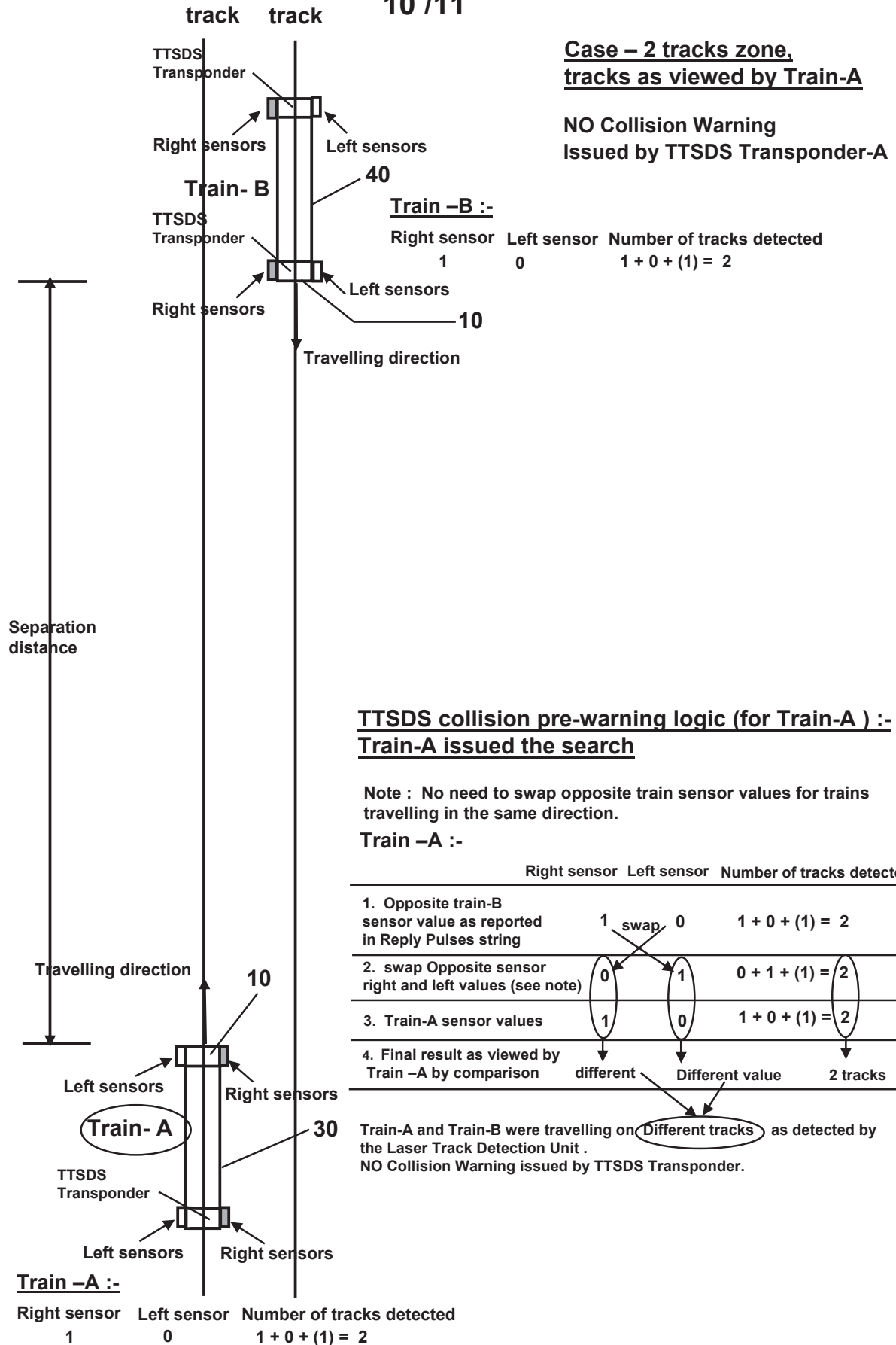


Fig. 10

