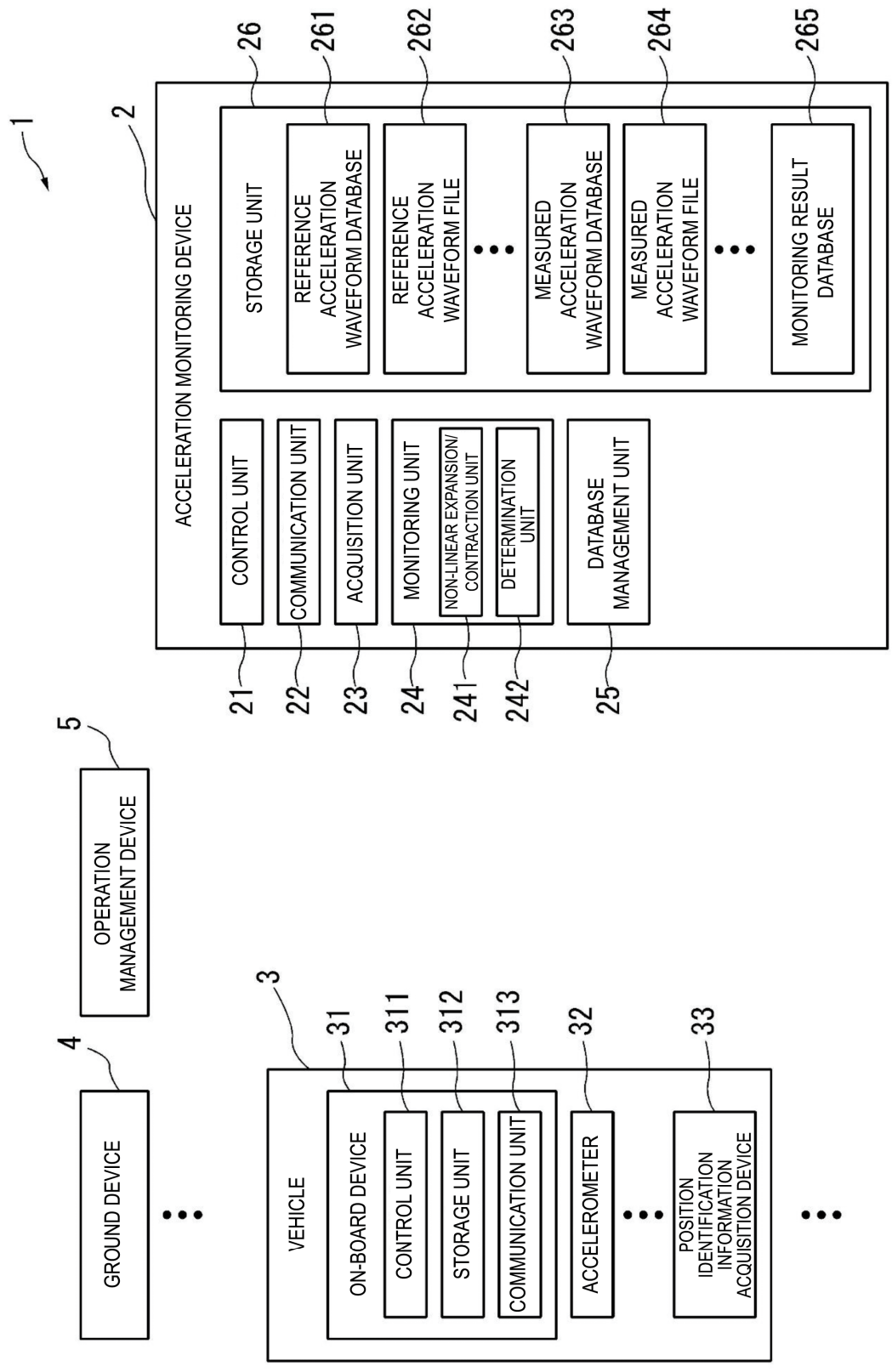

1
2
ACCELERATION MONITORING DEVICE
26
STORAGE UNIT
261
REFERENCE ACCELERATION WAVEFORM DATABASE
262
REFERENCE ACCELERATION WAVEFORM FILE
263
MEASURED ACCELERATION WAVEFORM DATABASE
264
MEASURED ACCELERATION WAVEFORM FILE
265
MONITORING RESULT DATABASE
21
CONTROL UNIT
22
COMMUNICATION UNIT
23
ACQUISITION UNIT
24
MONITORING UNIT
241
NON-LINEAR EXPANSION/ CONTRACTION UNIT
242
DETERMINATION UNIT
25
DATABASE MANAGEMENT UNIT
5
OPERATION MANAGEMENT DEVICE
4
GROUND DEVICE
3
VEHICLE
31
ON-BOARD DEVICE
311
CONTROL UNIT
312
STORAGE UNIT
313
COMMUNICATION UNIT
32
ACCELEROMETER
33
POSITION IDENTIFICATION INFORMATION ACQUISITION DEVICE

FIG. 1

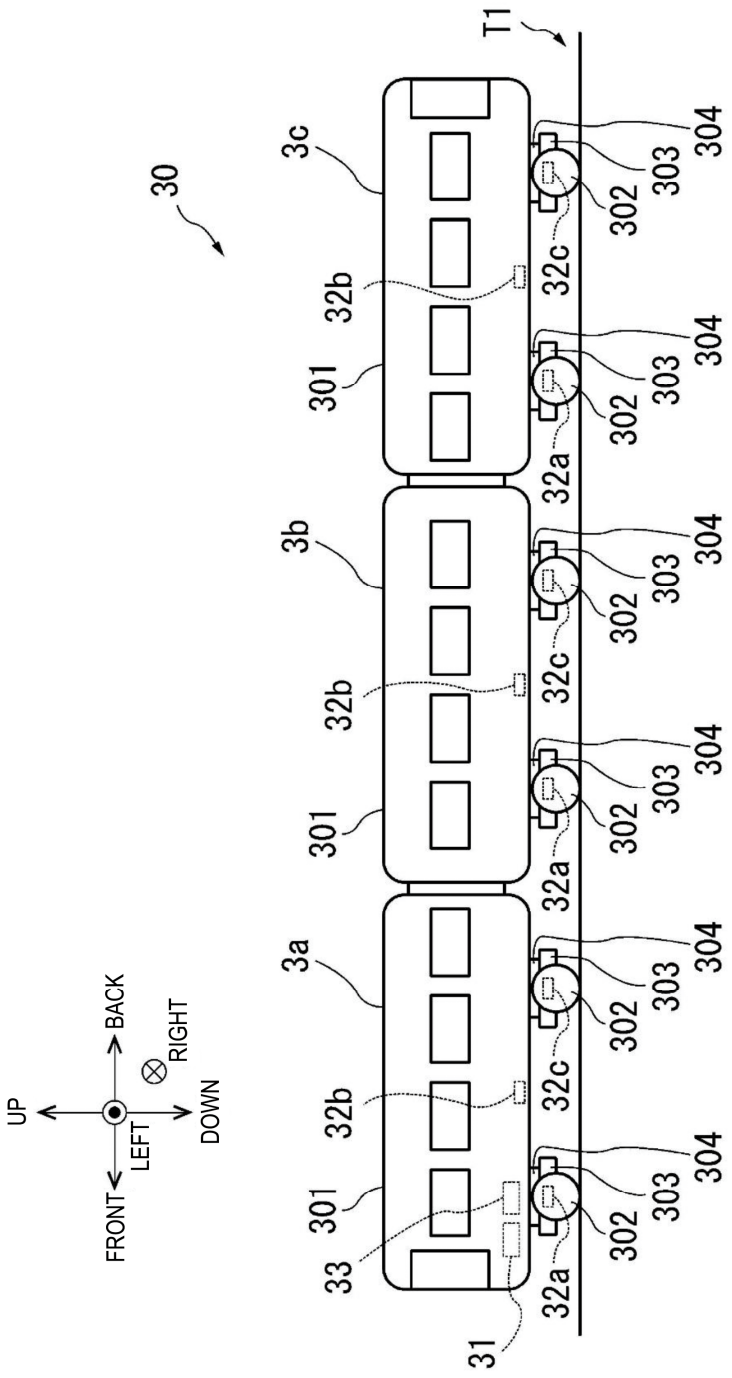

30
T1
3a
3b
3c
301
32a
32b
32c
302
303
304
31
33
UP
DOWN
FRONT
BACK
LEFT
RIGHT

FIG. 2

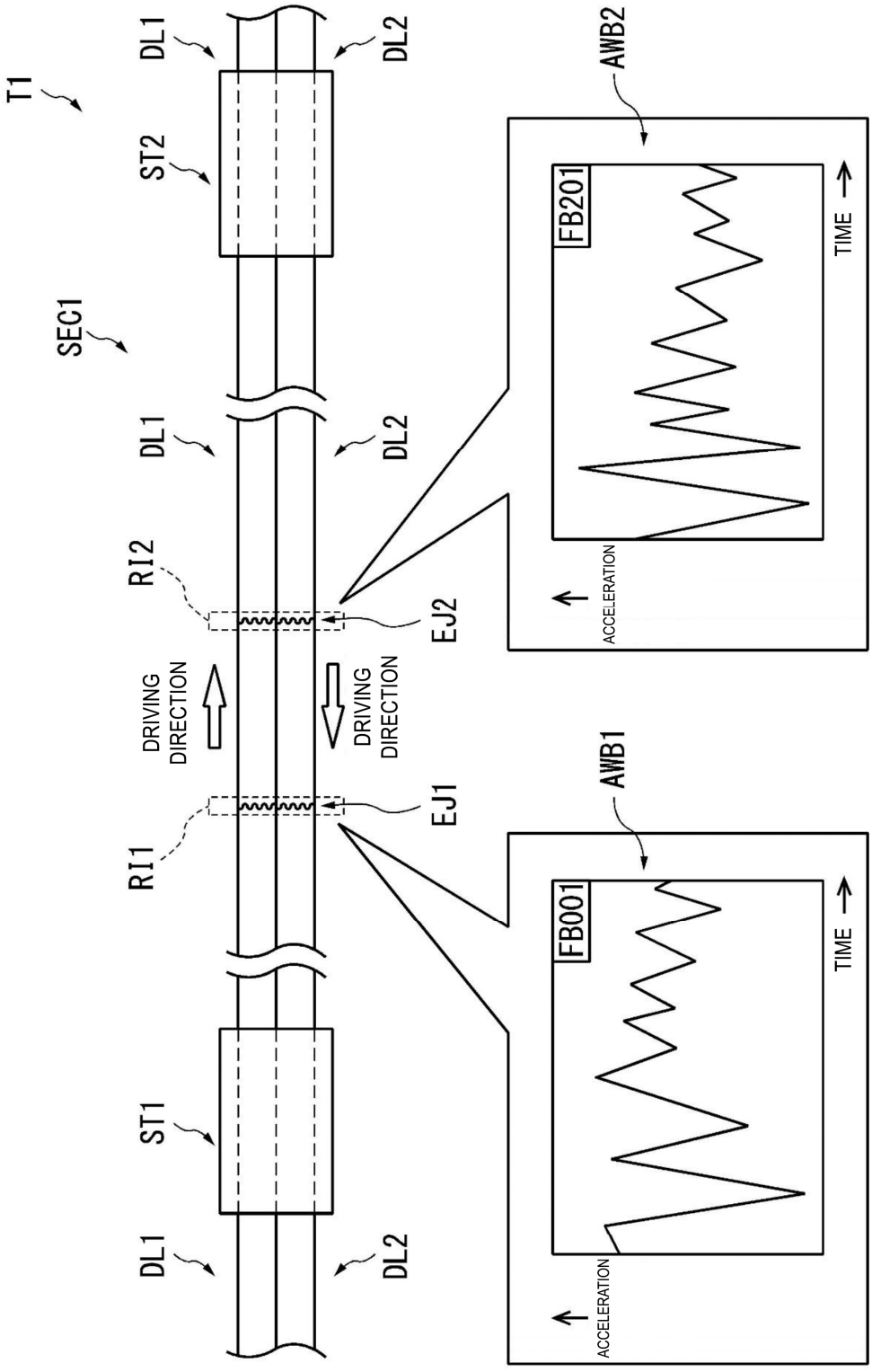

T1
SEC1
DL1
DL2
ST1
ST2
RI1
RI2
EJ1
EJ2
DRIVING DIRECTION
DRIVING DIRECTION
AWB1
AWB2
FB001
FB201
TIME
ACCELERATION
TIME
ACCELERATION

FIG. 3

REGION-OF-INTEREST IDENTIFICATION CODE	VEHICLE IDENTIFICATION CODE	SECTION IDENTIFICATION CODE	DRIVING LANE IDENTIFICATION CODE	ACCELEROMETER IDENTIFICATION CODE	MEASUREMENT POSITION	MEASUREMENT DIRECTION	POSITIVE PEAK/NEGATIVE PEAK/EFFECTIVE VALUE	REFERENCE ACCELERATION WAVEFORM FILE NAME
RI1	CA001	SEC1	DL1	SEN1	BELOW SPRING	UP-DOWN	-/-/-	FB001
RI1	CA001	SEC1	DL1	SEN1	BELOW SPRING	FRONT-BACK	-/-/-	FB002
RI1	CA001	SEC1	DL1	SEN1	BELOW SPRING	LEFT-RIGHT	-/-/-	FB003
RI1	CA001	SEC1	DL1	SEN2	ABOVE SPRING	UP-DOWN	-/-/-	FB004
RI1	CA001	SEC1	DL1	SEN2	ABOVE SPRING	FRONT-BACK	-/-/-	FB005
RI1	CA001	SEC1	DL1	SEN2	ABOVE SPRING	LEFT-RIGHT	-/-/-	FB006
...	...	...	...	...	...	...	...	...
RI1	CA001	SEC1	DL2	SEN1	BELOW SPRING	UP-DOWN	-/-/-	FB101
RI1	CA001	SEC1	DL2	SEN1	BELOW SPRING	FRONT-BACK	-/-/-	FB102
RI1	CA001	SEC1	DL2	SEN1	BELOW SPRING	LEFT-RIGHT	-/-/-	FB103
...	...	...	...	...	...	...	...	...
RI2	CA001	SEC1	DL1	SEN1	BELOW SPRING	UP-DOWN	-/-/-	FB201
RI2	CA001	SEC1	DL1	SEN1	BELOW SPRING	FRONT-BACK	-/-/-	FB202
RI2	CA001	SEC1	DL1	SEN1	BELOW SPRING	LEFT-RIGHT	-/-/-	FB203
...	...	...	...	...	...	...	...	...

FIG. 4

MEASUREMENT DATE AND TIME	VEHICLE IDENTIFICATION CODE	SECTION IDENTIFICATION CODE	DRIVING LANE IDENTIFICATION CODE	ACCELEROMETER IDENTIFICATION CODE	MEASUREMENT POSITION	MEASUREMENT DIRECTION	TRAVEL START/END TIMES	MEASURED ACCELERATION WAVEFORM FILE NAME
DT1	CA101	SEC1	DL1	SEN1	BELOW SPRING	UP-DOWN	--/--	FM001
DT1	CA101	SEC1	DL1	SEN1	BELOW SPRING	FRONT-BACK	--/--	FM002
DT1	CA101	SEC1	DL1	SEN1	BELOW SPRING	LEFT-RIGHT	--/--	FM003
DT1	CA101	SEC1	DL1	SEN2	ABOVE SPRING	UP-DOWN	--/--	FM004
DT1	CA101	SEC1	DL1	SEN2	ABOVE SPRING	FRONT-BACK	--/--	FM005
DT1	CA101	SEC1	DL1	SEN2	ABOVE SPRING	LEFT-RIGHT	--/--	FM006
...	...	...	...	...	...	...	...	...
DT2	CA101	SEC1	DL1	SEN1	BELOW SPRING	UP-DOWN	--/--	FM101
DT2	CA101	SEC1	DL1	SEN1	BELOW SPRING	FRONT-BACK	--/--	FM102
DT2	CA101	SEC1	DL1	SEN1	BELOW SPRING	LEFT-RIGHT	--/--	FM103
DT2	CA101	SEC1	DL1	SEN2	ABOVE SPRING	UP-DOWN	--/--	FM104
DT2	CA101	SEC1	DL1	SEN2	ABOVE SPRING	FRONT-BACK	--/--	FM105
DT2	CA101	SEC1	DL1	SEN2	ABOVE SPRING	LEFT-RIGHT	--/--	FM106
...	...	...	...	...	...	...	...	...

FIG. 5

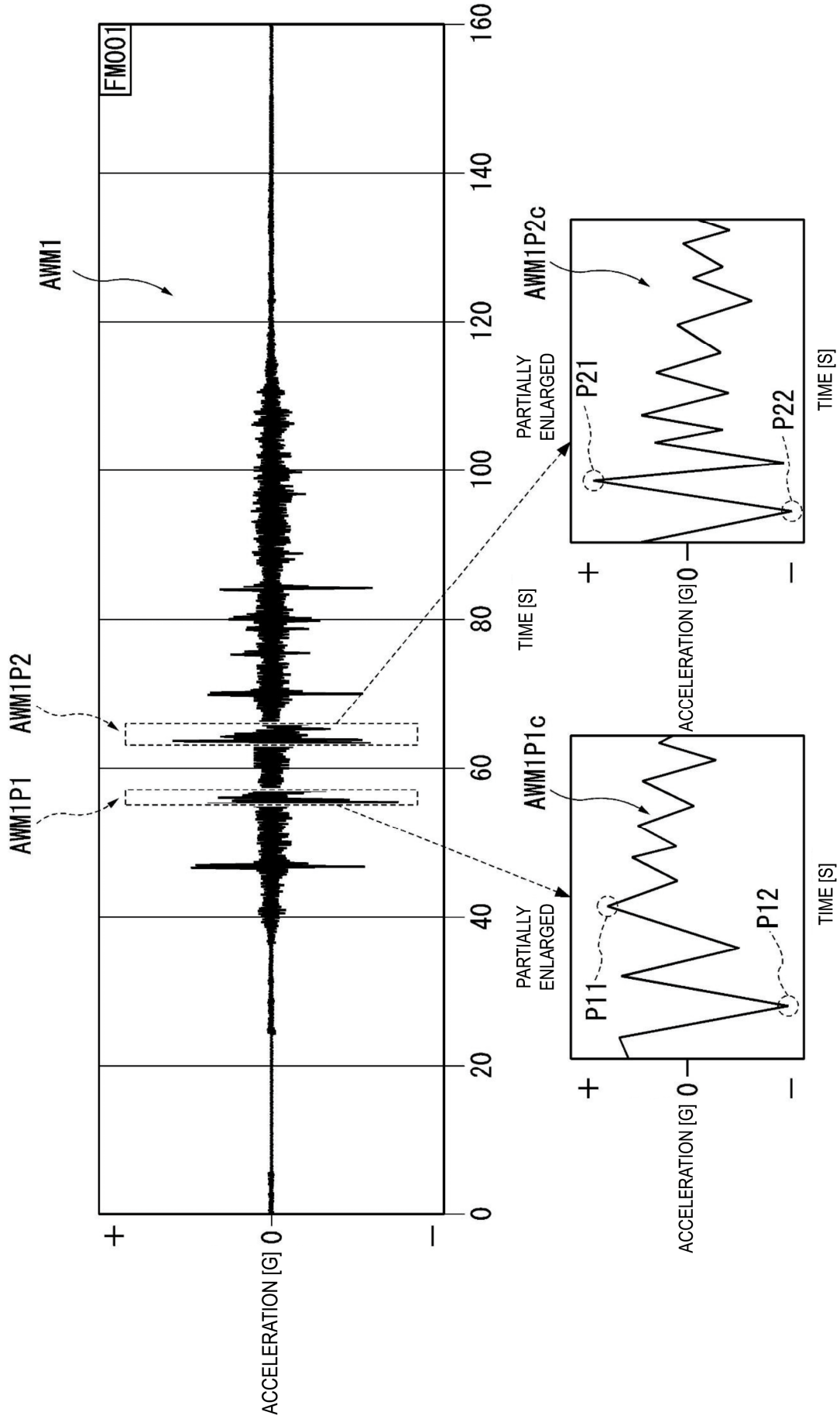

FM001
AWM1
AWM1P2
AWM1P1
ACCELERATION [G]
+
0
−
0
20
40
60
80
100
120
140
160
TIME [S]
PARTIALLY ENLARGED
AWM1P1c
P11
P12
AWM1P2c
P21
P22

FIG. 6

REGION-OF-INTEREST IDENTIFICATION CODE	DRIVING LANE IDENTIFICATION CODE	VEHICLE IDENTIFICATION CODE	MEASUREMENT DATE AND TIME	ACCELEROMETER IDENTIFICATION CODE	MEASUREMENT DIRECTION	MONITORING RESULT		
						POSITIVE PEAK VALUE	NEGATIVE PEAK VALUE	EFFECTIVE VALUE
RI1	DL1	CA101	DT11	SEN1	UP-DOWN	---	---	---
RI1	DL1	CA101	DT12	SEN1	UP-DOWN	---	---	---
RI1	DL1	CA101	DT13	SEN1	UP-DOWN	---	---	---
...	...	...	...	...	...	...	...	...
RI1	DL1	CA102	DT21	SEN1	UP-DOWN	---	---	---
RI1	DL1	CA102	DT22	SEN1	UP-DOWN	---	---	---
RI1	DL1	CA102	DT23	SEN1	UP-DOWN	---	---	---
...	...	...	...	...	...	...	...	...
RI1	DL2	CA101	DT31	SEN1	UP-DOWN	---	---	---
RI1	DL2	CA101	DT32	SEN1	UP-DOWN	---	---	---
RI1	DL2	CA101	DT33	SEN1	UP-DOWN	---	---	---
...	...	...	...	...	...	...	...	...

FIG. 7

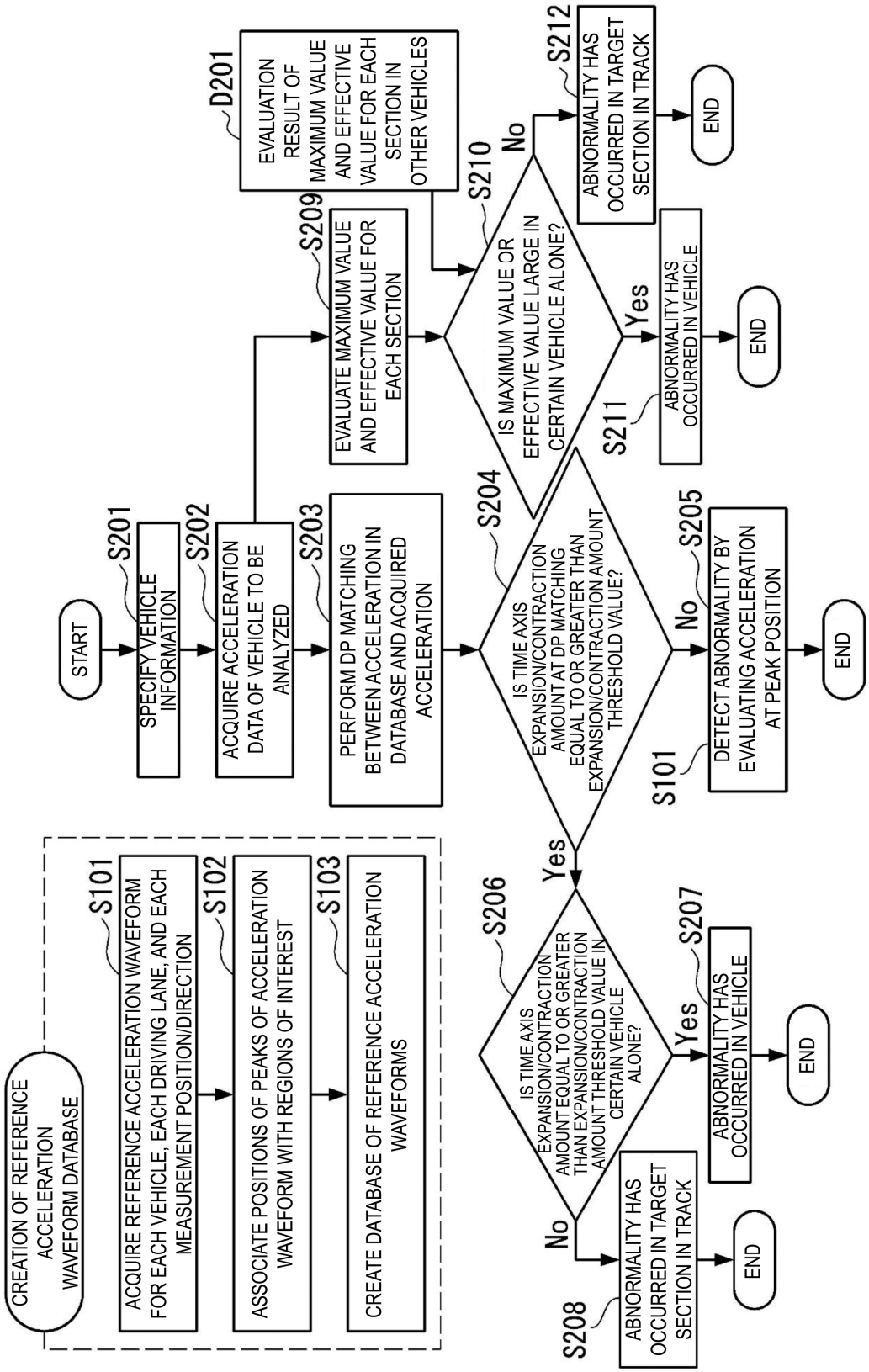

CREATION OF REFERENCE ACCELERATION WAVEFORM DATABASE
S101
ACQUIRE REFERENCE ACCELERATION WAVEFORM FOR EACH VEHICLE, EACH DRIVING LANE, AND EACH MEASUREMENT POSITION/DIRECTION
S102
ASSOCIATE POSITIONS OF PEAKS OF ACCELERATION WAVEFORM WITH REGIONS OF INTEREST
S103
CREATE DATABASE OF REFERENCE ACCELERATION WAVEFORMS
START
S201
SPECIFY VEHICLE INFORMATION
S202
ACQUIRE ACCELERATION DATA OF VEHICLE TO BE ANALYZED
S203
PERFORM DP MATCHING BETWEEN ACCELERATION IN DATABASE AND ACQUIRED ACCELERATION
S204
IS TIME AXIS EXPANSION/CONTRACTION AMOUNT AT DP MATCHING EQUAL TO OR GREATER THAN EXPANSION/CONTRACTION AMOUNT THRESHOLD VALUE?
Yes
No
S205
DETECT ABNORMALITY BY EVALUATING ACCELERATION AT PEAK POSITION
S101
END
S206
IS TIME AXIS EXPANSION/CONTRACTION AMOUNT EQUAL TO OR GREATER THAN EXPANSION/CONTRACTION AMOUNT THRESHOLD VALUE IN CERTAIN VEHICLE ALONE?
Yes
No
S207
ABNORMALITY HAS OCCURRED IN VEHICLE
END
S208
ABNORMALITY HAS OCCURRED IN TARGET SECTION IN TRACK
END
S209
EVALUATE MAXIMUM VALUE AND EFFECTIVE VALUE FOR EACH SECTION
D201
EVALUATION RESULT OF MAXIMUM VALUE AND EFFECTIVE VALUE FOR EACH SECTION IN OTHER VEHICLES
S210
IS MAXIMUM VALUE OR EFFECTIVE VALUE LARGE IN CERTAIN VEHICLE ALONE?
Yes
No
S211
ABNORMALITY HAS OCCURRED IN VEHICLE
END
S212
ABNORMALITY HAS OCCURRED IN TARGET SECTION IN TRACK
END

FIG. 8

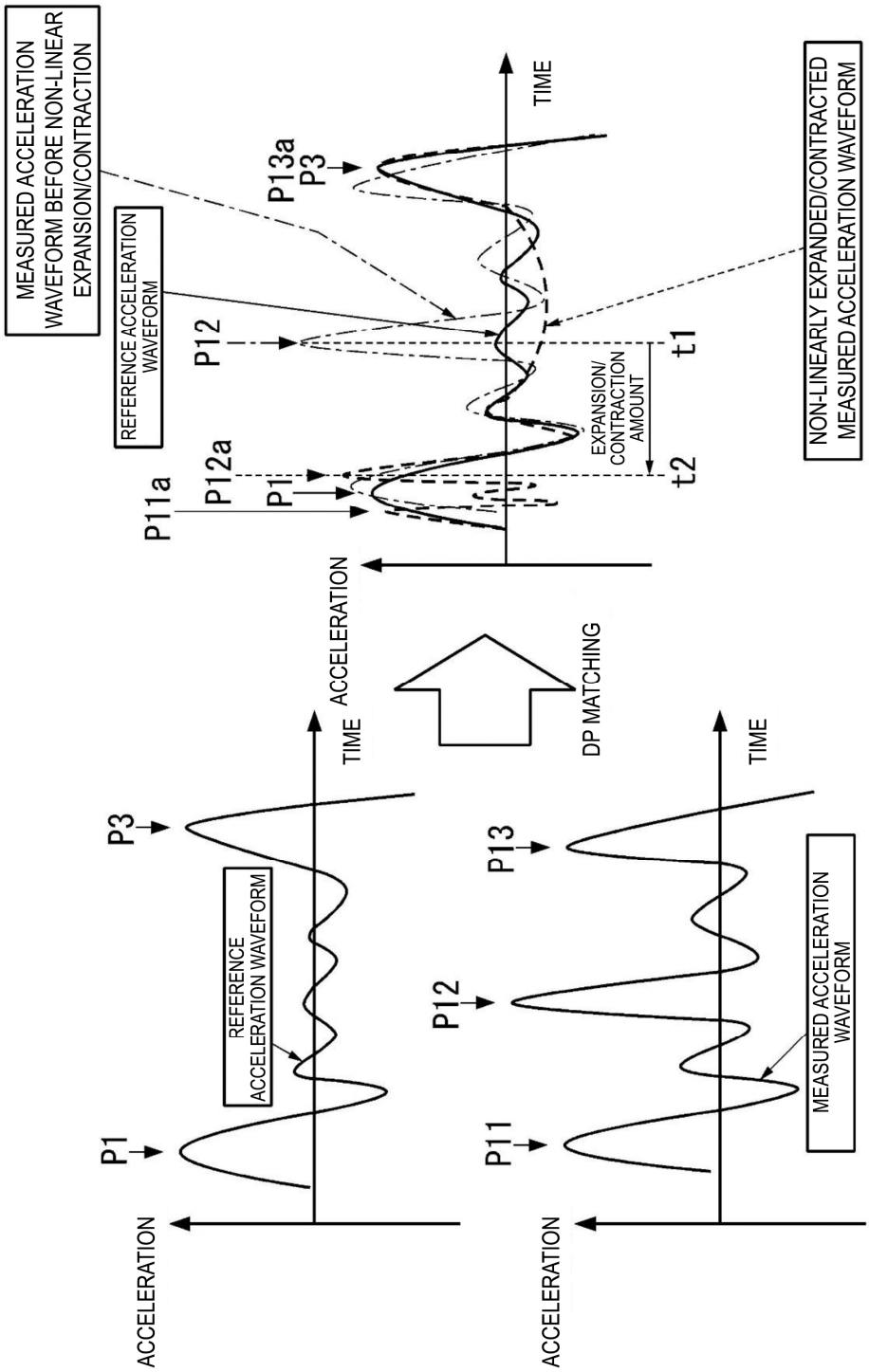

ACCELERATION
TIME
P1
REFERENCE ACCELERATION WAVEFORM
P3
ACCELERATION
TIME
P11
MEASURED ACCELERATION WAVEFORM
P13
P12
DP MATCHING
MEASURED ACCELERATION WAVEFORM BEFORE NON-LINEAR EXPANSION/CONTRACTION
REFERENCE ACCELERATION WAVEFORM
P11a
P12a
P1
P12
P13a
P3
EXPANSION/ CONTRACTION AMOUNT
t2
t1
TIME
NON-LINEARLY EXPANDED/CONTRACTED MEASURED ACCELERATION WAVEFORM

FIG. 9

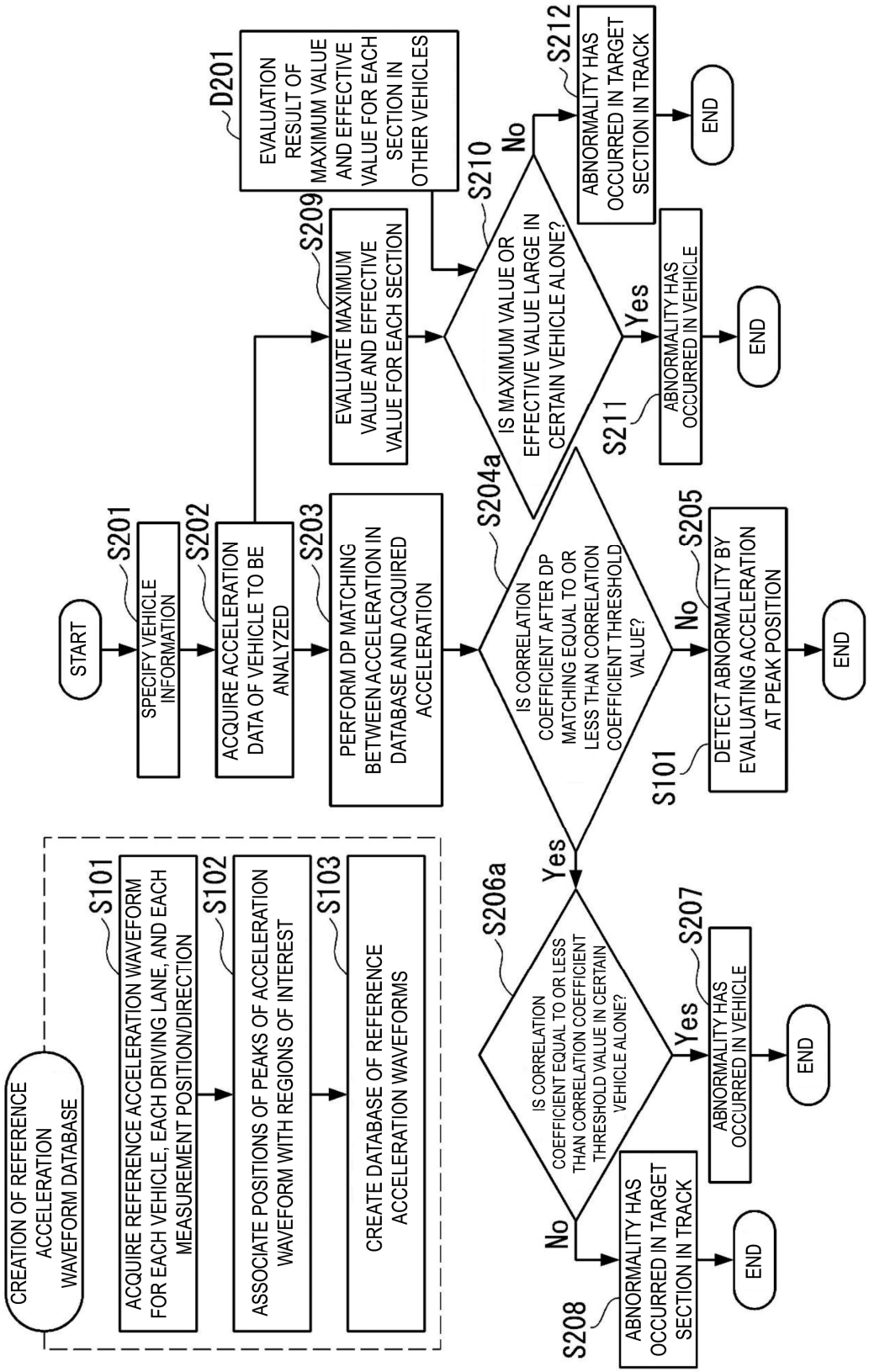

CREATION OF REFERENCE ACCELERATION WAVEFORM DATABASE
S101
ACQUIRE REFERENCE ACCELERATION WAVEFORM FOR EACH VEHICLE, EACH DRIVING LANE, AND EACH MEASUREMENT POSITION/DIRECTION
S102
ASSOCIATE POSITIONS OF PEAKS OF ACCELERATION WAVEFORM WITH REGIONS OF INTEREST
S103
CREATE DATABASE OF REFERENCE ACCELERATION WAVEFORMS
START
S201
SPECIFY VEHICLE INFORMATION
S202
ACQUIRE ACCELERATION DATA OF VEHICLE TO BE ANALYZED
S203
PERFORM DP MATCHING BETWEEN ACCELERATION IN DATABASE AND ACQUIRED ACCELERATION
S204a
IS CORRELATION COEFFICIENT AFTER DP MATCHING EQUAL TO OR LESS THAN CORRELATION COEFFICIENT THRESHOLD VALUE?
Yes
No
S205
S101
DETECT ABNORMALITY BY EVALUATING ACCELERATION AT PEAK POSITION
END
S206a
IS CORRELATION COEFFICIENT EQUAL TO OR LESS THAN CORRELATION COEFFICIENT THRESHOLD VALUE IN CERTAIN VEHICLE ALONE?
Yes
No
S207
ABNORMALITY HAS OCCURRED IN VEHICLE
END
S208
ABNORMALITY HAS OCCURRED IN TARGET SECTION IN TRACK
END
S209
EVALUATE MAXIMUM VALUE AND EFFECTIVE VALUE FOR EACH SECTION
D201
EVALUATION RESULT OF MAXIMUM VALUE AND EFFECTIVE VALUE FOR EACH SECTION IN OTHER VEHICLES
S210
IS MAXIMUM VALUE OR EFFECTIVE VALUE LARGE IN CERTAIN VEHICLE ALONE?
Yes
No
S211
ABNORMALITY HAS OCCURRED IN VEHICLE
END
S212
ABNORMALITY HAS OCCURRED IN TARGET SECTION IN TRACK
END

FIG. 10

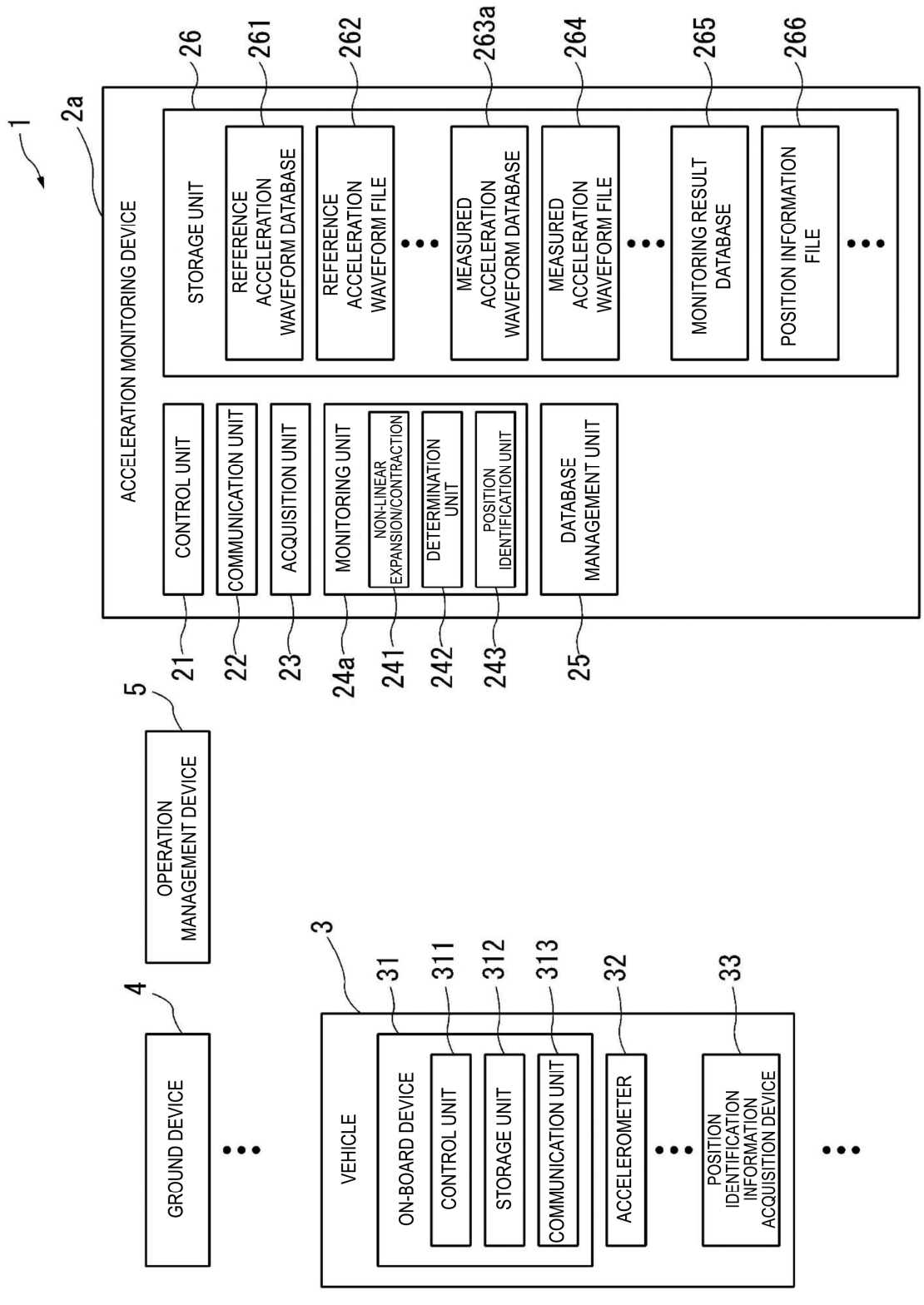

1
2a
ACCELERATION MONITORING DEVICE
26
STORAGE UNIT
261
REFERENCE ACCELERATION WAVEFORM DATABASE
262
REFERENCE ACCELERATION WAVEFORM FILE
263a
MEASURED ACCELERATION WAVEFORM DATABASE
264
MEASURED ACCELERATION WAVEFORM FILE
265
MONITORING RESULT DATABASE
266
POSITION INFORMATION FILE
21
CONTROL UNIT
22
COMMUNICATION UNIT
23
ACQUISITION UNIT
24a
MONITORING UNIT
241
NON-LINEAR EXPANSION/CONTRACTION
242
DETERMINATION UNIT
243
POSITION IDENTIFICATION UNIT
25
DATABASE MANAGEMENT UNIT
5
OPERATION MANAGEMENT DEVICE
4
GROUND DEVICE
3
VEHICLE
31
ON-BOARD DEVICE
311
CONTROL UNIT
312
STORAGE UNIT
313
COMMUNICATION UNIT
32
ACCELEROMETER
33
POSITION IDENTIFICATION INFORMATION ACQUISITION DEVICE

FIG. 11

MEASUREMENT DATE AND TIME	VEHICLE IDENTIFICATION CODE	SECTION IDENTIFICATION CODE	DRIVING LANE IDENTIFICATION CODE	ACCELEROMETER IDENTIFICATION CODE	MEASUREMENT POSITION	MEASUREMENT DIRECTION	TRAVEL START/END TIMES	MEASURED ACCELERATION WAVEFORM FILE NAME	POSITION INFORMATION FILE NAME
DT1	CA101	SEC1	DL1	SEN1	BELOW SPRING	UP-DOWN	--/--	FM001	FMP001
DT1	CA101	SEC1	DL1	SEN1	BELOW SPRING	FRONT-BACK	--/--	FM002	FMP002
DT1	CA101	SEC1	DL1	SEN1	BELOW SPRING	LEFT-RIGHT	--/--	FM003	FMP003
DT1	CA101	SEC1	DL1	SEN2	ABOVE SPRING	UP-DOWN	--/--	FM004	FMP004
DT1	CA101	SEC1	DL1	SEN2	ABOVE SPRING	FRONT-BACK	--/--	FM005	FMP005
DT1	CA101	SEC1	DL1	SEN2	ABOVE SPRING	LEFT-RIGHT	--/--	FM006	FMP006
...	...	...	...	...	...	...	...	...	...
DT2	CA101	SEC1	DL1	SEN1	BELOW SPRING	UP-DOWN	--/--	FM101	FMP101
DT2	CA101	SEC1	DL1	SEN1	BELOW SPRING	FRONT-BACK	--/--	FM102	FMP102
DT2	CA101	SEC1	DL1	SEN1	BELOW SPRING	LEFT-RIGHT	--/--	FM103	FMP103
DT2	CA101	SEC1	DL1	SEN2	ABOVE SPRING	UP-DOWN	--/--	FM104	FMP104
DT2	CA101	SEC1	DL1	SEN2	ABOVE SPRING	FRONT-BACK	--/--	FM105	FMP105
DT2	CA101	SEC1	DL1	SEN2	ABOVE SPRING	LEFT-RIGHT	--/--	FM106	FMP106
...	...	...	...	...	...	...	...	...	...

FIG. 12

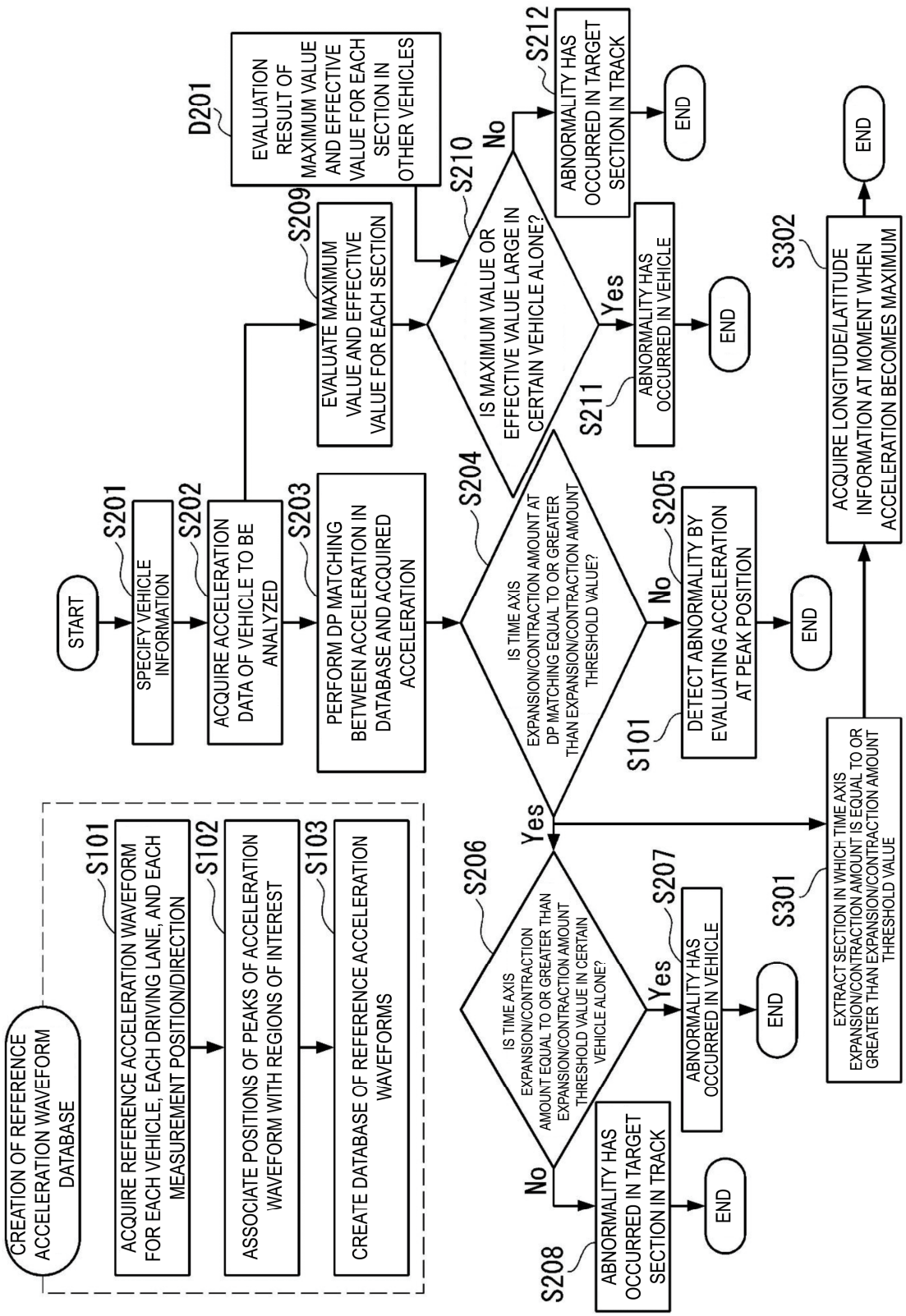

CREATION OF REFERENCE ACCELERATION WAVEFORM DATABASE
S101
ACQUIRE REFERENCE ACCELERATION WAVEFORM FOR EACH VEHICLE, EACH DRIVING LANE, AND EACH MEASUREMENT POSITION/DIRECTION
S102
ASSOCIATE POSITIONS OF PEAKS OF ACCELERATION WAVEFORM WITH REGIONS OF INTEREST
S103
CREATE DATABASE OF REFERENCE ACCELERATION WAVEFORMS
START
S201
SPECIFY VEHICLE INFORMATION
S202
ACQUIRE ACCELERATION DATA OF VEHICLE TO BE ANALYZED
S203
PERFORM DP MATCHING BETWEEN ACCELERATION IN DATABASE AND ACQUIRED ACCELERATION
S204
IS TIME AXIS EXPANSION/CONTRACTION AMOUNT AT DP MATCHING EQUAL TO OR GREATER THAN EXPANSION/CONTRACTION AMOUNT THRESHOLD VALUE?
Yes
No
S205
DETECT ABNORMALITY BY EVALUATING ACCELERATION AT PEAK POSITION
END
S206
IS TIME AXIS EXPANSION/CONTRACTION AMOUNT EQUAL TO OR GREATER THAN EXPANSION/CONTRACTION AMOUNT THRESHOLD VALUE IN CERTAIN VEHICLE ALONE?
Yes
No
S207
ABNORMALITY HAS OCCURRED IN VEHICLE
END
S208
ABNORMALITY HAS OCCURRED IN TARGET SECTION IN TRACK
END
S209
EVALUATE MAXIMUM VALUE AND EFFECTIVE VALUE FOR EACH SECTION
D201
EVALUATION RESULT OF MAXIMUM VALUE AND EFFECTIVE VALUE FOR EACH SECTION IN OTHER VEHICLES
S210
IS MAXIMUM VALUE OR EFFECTIVE VALUE LARGE IN CERTAIN VEHICLE ALONE?
Yes
No
S211
ABNORMALITY HAS OCCURRED IN VEHICLE
END
S212
ABNORMALITY HAS OCCURRED IN TARGET SECTION IN TRACK
END
S301
EXTRACT SECTION IN WHICH TIME AXIS EXPANSION/CONTRACTION AMOUNT IS EQUAL TO OR GREATER THAN EXPANSION/CONTRACTION AMOUNT THRESHOLD VALUE
S302
ACQUIRE LONGITUDE/LATITUDE INFORMATION AT MOMENT WHEN ACCELERATION BECOMES MAXIMUM
END

FIG. 13

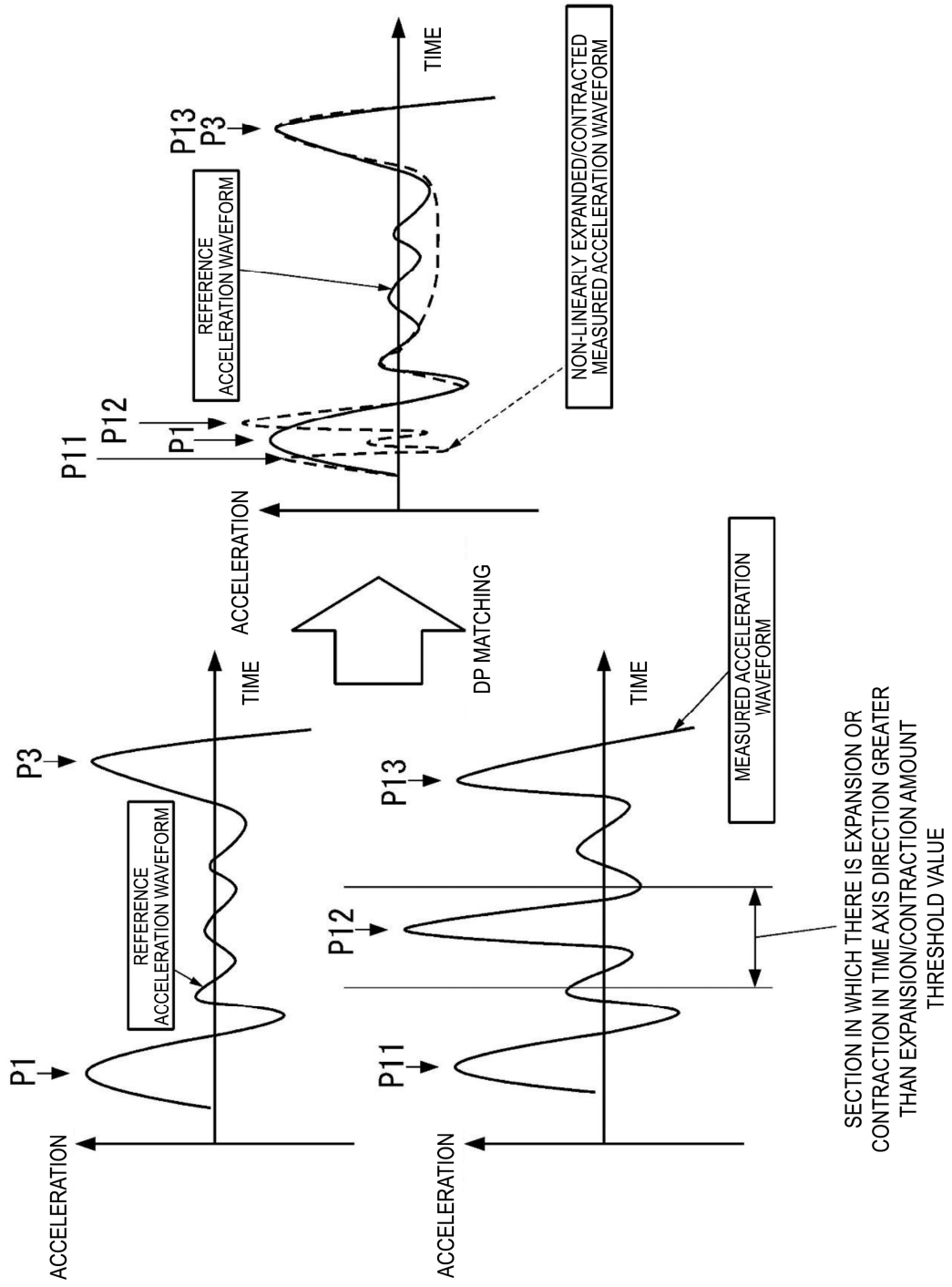

ACCELERATION
TIME
P1
P3
REFERENCE ACCELERATION WAVEFORM
DP MATCHING
P11
P12
P13
MEASURED ACCELERATION WAVEFORM
NON-LINEARLY EXPANDED/CONTRACTED MEASURED ACCELERATION WAVEFORM
SECTION IN WHICH THERE IS EXPANSION OR CONTRACTION IN TIME AXIS DIRECTION GREATER THAN EXPANSION/CONTRACTION AMOUNT THRESHOLD VALUE

FIG. 14

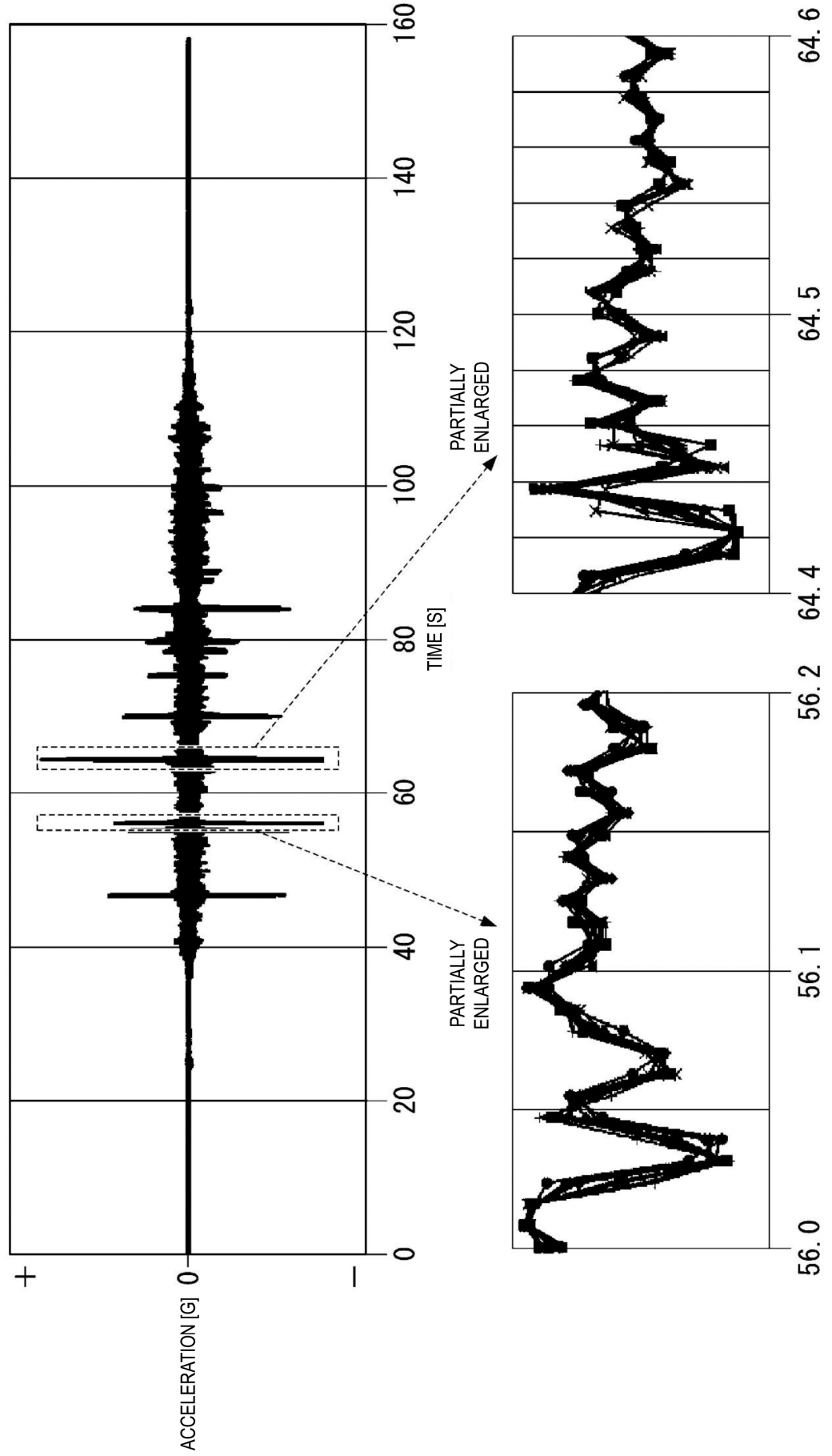

ACCELERATION [G]
+
0
−
0
20
40
60
80
100
120
140
160
TIME [S]
PARTIALLY ENLARGED
PARTIALLY ENLARGED
56. 0
56. 1
56. 2
64. 4
64. 5
64. 6

FIG. 15

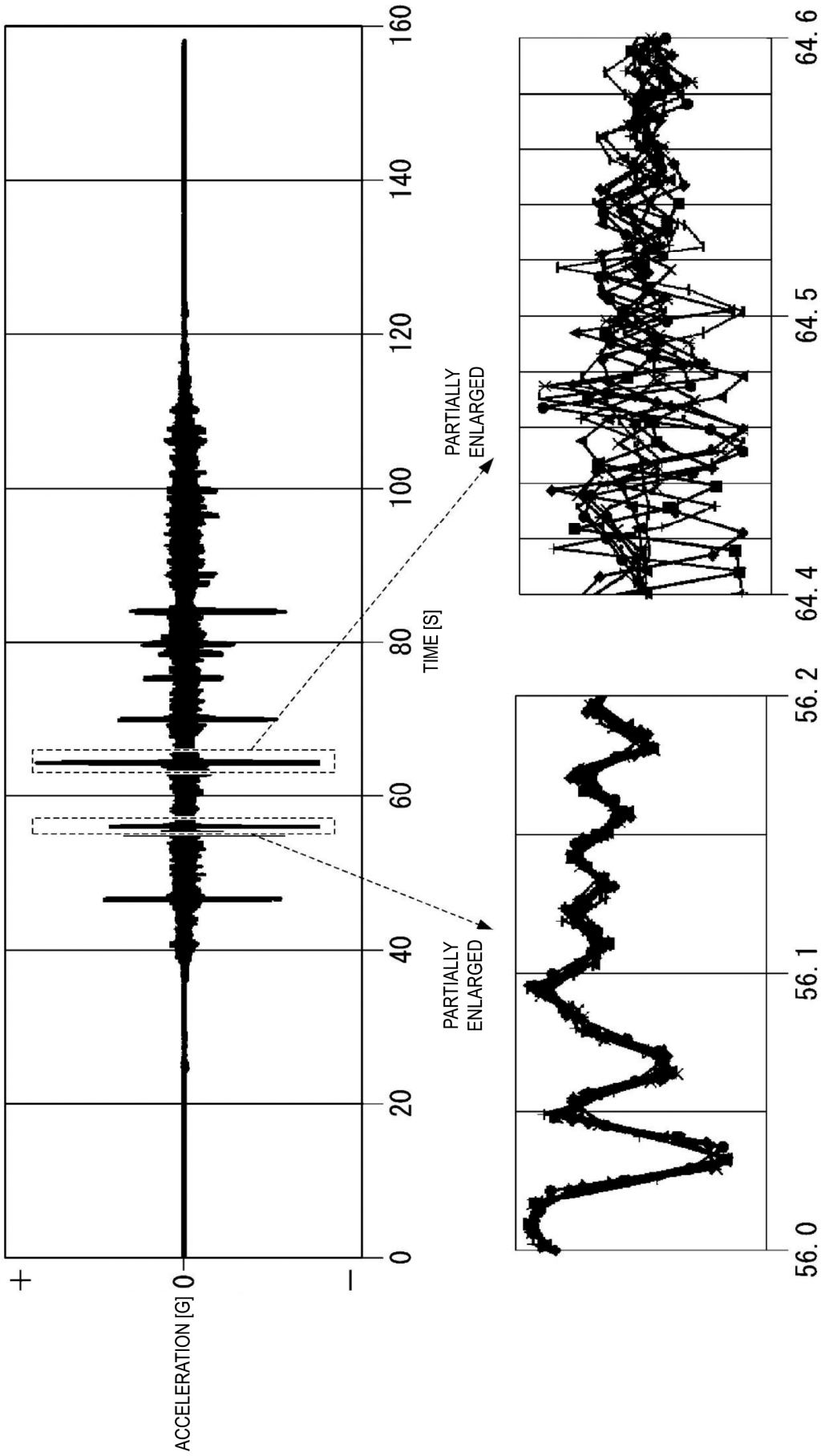

ACCELERATION [G]
+
0
−
0
20
40
60
80
100
120
140
160
TIME [S]
PARTIALLY ENLARGED
PARTIALLY ENLARGED
56. 0
56. 1
56. 2
64. 4
64. 5
64. 6

FIG. 16

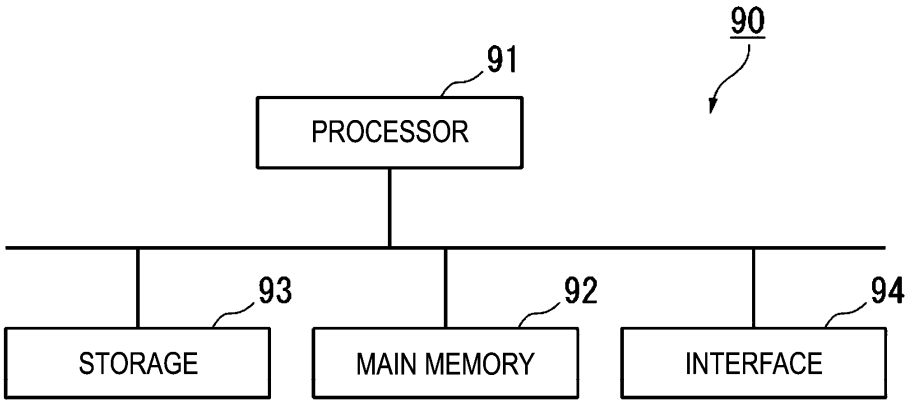


FIG. 17