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MSS54

module description

Electric throttle valve

target/actual comparison

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1 target/actual comparison of EGAS position

Comparing the target position of the throttle valves with their actual position is one of the most important monitoring functions in the Egas safety concept. This can be used to identify the following errors:

- Processor modules
 - CTM module (processor): Uncontrolled duty cycle for actuator
 - Processor Port C: Wrong direction of rotation of the actuator
 - Processor Port C: Missing release of actuator function computer
 - Processor Port C: Missing release actuator safety computer
 - H-bridge actuator
 - H-bridge defect
 - Overtemperature shutdown
 - Current limiting H-bridge
 - Overcurrent shutdown H-bridge
 - Wiring actuator
 - Line interruption
 - Short circuit to ground, Ub, or between the lines
 - Actuator
 - Electrical defect
 - Mechanical damage
 - Transmission damage
 - DK kinematics
 - Mechanical damage
 - Foreign body interventions
 - Throttle valves
 - jammed flaps
 - Throttle valve adaptation
 - Shift of the zero point
 - Displacement of the anchor point
- The target/actual comparison is omitted in the following operating states:
- If the position detection has already reliably detected errors (B_WDK_POTIUNPLAUSIBEL), as measures are already being taken
 - or at KL15 off and n = 0
 - or if the engine is not running and
 - follow-up adaptation 100% position is running (B_EDK_ADAPT)
 - or nothing has been adapted in the predrive (pdr_phase == 0)
 - or zero point adaptation is currently running in predrive (pdr_phase == 1)
 - or shutdown paths are currently being tested in predrive (pdr_phase == 3)

1.1 Case 1: The throttle valves are to be opened above a threshold which But flaps remain closed:

Reasons:

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- Processor module defective
- H-bridge defective or temporarily switched off
- Safety shutdown activated
- Actuator wiring
- Actuator defective
- DK kinematics defective

Error detection:

The actual position is close to "0", although the target position has already exceeded a threshold: **egas_soll**
 $> K_EDKSI_POS_ZU$

+ $K_EDKSI_HYS_ZU$

and

$egas_ist < K_EDKSI_POS_ZU$

for longer than $K_EDKSI_T_BL_ZU$

Reaction:

- Change to Egas emergency program level 2 - driving via idle speed control •
- Error memory entry

Assessment:

The throttle valves remain closed or are closed automatically via the spring assemblies without the control unit being able to influence this.

The torque reduction when the flaps are closed cannot be influenced either (critical condition for case 1). If the flaps are closed, it is possible to continue driving in the emergency program without any problems if it is ensured that the flaps can no longer open.

1.2 Case 2: The throttle valves should be closed, but remain open for a gap open:

Reasons:

- Throttle valve is stuck or extremely stiff
- slight twisting of the throttle valve control potentiometer
- incorrect zero point adaptation

Error detection:

If the setpoint is set to "0", the flap is slightly open, but still below a critical threshold: **egas_soll = 0**

and

$K_EDKSI_POS_ZU < egas_ist \leq K_EDKSI_HYS_BL_AUF$

for longer than $K_EDKSI_T_SPALT$

Reaction:

- no Egas emergency program, maintaining the current operating level
- Error log entry

Assessment:

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Since the throttle valves remain slightly open despite being closed by the servomotor, this indicates a problem in the throttle control system, which justifies an error log entry. However, the limit **K_EDKSI_HYS_BL_AUF** is set in such a way that it is not yet considered to be safety-critical for driving and therefore a switch to an Egas emergency program is not yet necessary.

1.3 Case 3: The throttle valves should be opened, the valves react but do not reach the setpoint:

Reasons:

- H-bridge temporarily switched off
- stiff DK system • throttle valve stuck below the target position
- Undervoltage
- Engine too weak
- Transmission damage

Error detection:

The control difference exceeds a limit, the actual position is slightly open, but not yet close to 100%:

ub > K_ED_UBMIN

and

egas_soll - egas_ist > K_EDKSI_HYS_U_SOLL

and

K_EDKSI_POS_ZU < egas_ist <= K_EDKSI_POS_N_GANZ

for longer than **K_EDKSI_T_U_SOLL**

Reaction:

- Change to Egas emergency program level 2 - driving via idle speed control • Error memory entry

Assessment:

Since the reliability of the Egas system can no longer be guaranteed, the flaps are deliberately closed and the control is then deactivated. If the flaps are stuck, a change to level 5 is possible as soon as the setpoint is below the actual value.

1.4 Case 4: At full load the throttle valves do not open completely:


Reasons:

- Flaps at full load stop => incorrect adaptation
- Mechanical defect or foreign body limits adjustment range
- Engine too weak
- Flaps stiff (extreme cold)
- Undervoltage

Error detection:

The control difference exceeds a limit and the actual position is close to 100%:

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ub > K_EDKSI_UB_N_GANZ
 and
tmot > K_EKDSI_TMOT_N_GANZ
 and
egas_soll - egas_ist > K_EDKSI_HYS_N_GANZ
 and
egas_ist > K_EDKSI_POS_N_GANZ

 for longer than **K_EDKSI_T_N_GANZ**

Reaction:

- no Egas emergency program, maintaining the current operating level
- Limitation of the Egas setpoint to the achievable actual position (actuator protection)
- Start of a new VL adaptation in the follow-up
- Error log entry

Assessment:

This case only results in a loss of performance in the full load range and is therefore not safety-critical. However, measures must be taken to protect the actuator.

1.5 Case 5: The throttle valves are stuck in the open position:

Reasons:

- Defective processor module - 100% control, wrong direction of rotation
- H-bridge alloyed
- Short circuit in actuator wiring
- stiff DK system
- Throttle valve jams above the target position

Error detection:

The actual position is significantly larger than the target position:

egas_ist - egas_soll > K_EDKSI_HYS_BL_AUF

- a) for longer than **K_EDKSI_T_BL_AUF_R**
 b) for longer than **K_EDKSI_T_BL_AUF_F**

Reaction:

a)

- Torque limitation via ignition angle and injection suppression from
 (Setting the condition **B_EDKSI_MD_RED**)

additionally from


b)

- Change to Egas emergency program level 4 - driving with open throttle valves • Error memory entry

Assessment:

In this case, the engine produces more power than the driver wants and this can lead to unwanted vehicle acceleration. This requires a quick response to this situation. However, the control unit has the

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Possibilities to throttle engine power to a range desired by the driver via ignition angle interventions and cylinder suppression.

2 Status/error log entries:

If a target/actual comparison error is detected, the error type is entered in **edksi_zustand** according to the following priority entered and marked in the error log with the following error type:

Priority 1.	edksi_condition	type of error
2.	STAY_UP	SH_TO_UB
3.	STAY_IN	SH_TO_GND
4.	UNTER_TOLL	IMPLAUSIBLE
5.	NOT_QUIE_IMPLAU	SIBLE
	SPALT_OFFEN	OPENLOAD

3 Applicable quantities and process variables

In this section, all applicable constants, characteristics and maps are given in tabular form. In addition, the process variables that can be observed via the MCS are given.


3.1 Process variables

Name	Description
edksi_zustand	state target-actual comparison
edksi_md_red	DPR: early torque reduction, without error memory and emergency program
edksi_ed	ED error variable
edksi_t_bl_zu	Timer flaps remain closed
edksi_t_spalt	Timer flaps remain slightly open
edksi_t_u_soll	Timer flaps remain below target
edksi_t_n_ganz	Timer flaps do not open completely
edksi_t_bl_auf	Timer flaps remain open

3.2 Constants

constant	Meaning	minimum value	maximum value
K_EDKSI_T_BL_ZU	Error time for non-opening flap	worst-case response time	No surprise effect for the driver if the flaps should open delayed
K_EDKSI_T_SPALT	Error time for flap not closing completely	worst case closing time	Error detection within acceptable time.
K_EDKSI_T_U_SOLL	for error time lagging behind under setpoint	WorstCase control time for the control deviation	Error detection within acceptable time.
K_EDKSI_T_N_GANZ	Error time for not reaching the full load position	K_EDKSI_HYS_U_SOLL WorstCase control time for opening 0=>100%	Time should be such that the error can be detected even during shorter full load phases, but at least as long as K_EDKSI_T_U_SOLL.
K_EDKSI_T_BL_AUF_R	Error time for reduction with torque reduction to too wide open	WorstCase control time for the control deviation	Critical time at which hanging flaps without torque reduction pose no danger.
K_EDKSI_T_BL_AUF_F	Succeed Error time for transition to emergency program if	K_EDKSI_HYS_BL_AUF WorstCase control time for the control deviation	Time from which a defect in the system must be assumed

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constant	meaning of	minimum value	maximum value
K_EDKSI_T_PDR	wide open flaps Time for Control deviations that are detected when queried by Predrive, from which errors are reported	K_EDKSI_HYS_BL_AUF worst-case control time	must be shorter than the waiting time K_PDR_T_PHASE2 in Predrive-check
K_EDKSI_POS_ZU	Position, below the flap is considered closed	zero point fluctuation range zero point adaptation error.??	A jump from 0 to this value must not cause a critical situation
K_EDKSI_HYS_ZU	minimal Setpoint increase for error detection "The flaps remain closed"	worst case control deviation within from K_EDKSI_T_BL_ZU	K_EDKSI_HYS_ZU + K_EDKSI_POS_ZU must be large enough so that the valve has sufficient control deviation for reliable response.
K_EDKSI_HYS_U_SOLL	Max. permissible lag of the flaps behind the setpoint	max. possible control deviation under worst case conditions within K_EDKSI_T_U_SOLL from	error detection still possible
K_EDKSI_HYS_N_GANZ	Minimum Setpoint increase for error detection "Do not open completely"	max. possible control deviation under worst case conditions within K_EDKSI_T_N_GANZ from	Reliable detection of stop in opening direction
K_EDKSI_POS_N_GANZ	Actual position of the flap to discrimination "Below Target" and "Not Quite on Target"	Position that a faulty drive can no longer reach.	must represent an area from which a mechanical attack is suspected
K_EDKSI_HYS_BL_AUF	Minimum Actual value increase for error detection "Flaps remain open"	Maximum control deviation under worst case conditions within K_EDKSI_T_BL_AUF_R	Still uncritical torque surplus through this Control deviation, especially when setpoint is close to 0 (at setpoint=0 torque monitoring)
K_EDKSI_UB_N_GANZ	Minimum voltage for Diagnosis "Not quite up"	Voltage at which the actuator reaches 100%	Minimum voltage when running Motor
K_EDKSI_TMOT_N_GANZ	Minimum tmot for Diagnosis "Not quite up"	Engine temperature at which the actuator that reaches 100%	Significantly below engine operating temperature

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