Project: MSS54

Module: KAT-clearing of oxygen

1st

General

The "catalytic converter clearing" function is designed to remove the oxygen from the catalyst as quickly as possible after a deceleration phase. Once this has happened, the normal operating state of the catalyst is restored with regard to the NKAT control system.

For this purpose, the lambda controller is shifted towards “RICH” by means of an air mass-dependent TV shift. This additional enrichment remains active until the sensor voltage on the NKAT exceeds a certain value.

This function is performed every 100ms.

2nd

Implementation of the KAT clearing function via a machine

2.1. Description of the individual states

The “KAT clearing” function is implemented in software via a state machine.

The current state during the KAT clearing can be recognized by the status variable **la_kat_ausr_st.**

Here too, if two exhaust lines are present, these are considered separately.

The following conditions occur:

- **Condition NORMAL**
- **State SHIFT DURATION**
- **WAIT state**
- **Condition CLEARING**

2.1.1. NORMAL state

This is where you find yourself after a RESET, after START and in normal operation. No additional TV shift is included in the lambda controller function.

=> BIT0 in variable la_kat_ausr_st is set

2.1.2. State THRUST DURATION

As soon as the overrun cut-off operating state **B_SA** is detected, the system switches to this state and remains there for the time **K_LA_KA_SA_T .** It then switches to the WAIT state.

=> BIT1 in variable la_kat_ausr_st is set

However, if you leave the B_SA operating state prematurely, you return to the NORMAL state.

2.1.3. WAIT state

As soon as this state is reached, the enrichment is activated; ie the air mass-dependent TV shift is included in the lambda control as soon as it is active.

This state remains until a certain amount of air **K_LA_KA_ML_MIN** has flowed through the catalyst and it can be assumed that the NKAT sensor also sees a lean exhaust gas. However, in order to reach the next state CLEARING, in addition to the waiting time for lean exhaust gas, the VKAT controller must also be active again **(B_LA1/2) .**

=> BIT2 in variable la_kat_ausr_st is set

2.1.4. CLEARING OUT condition

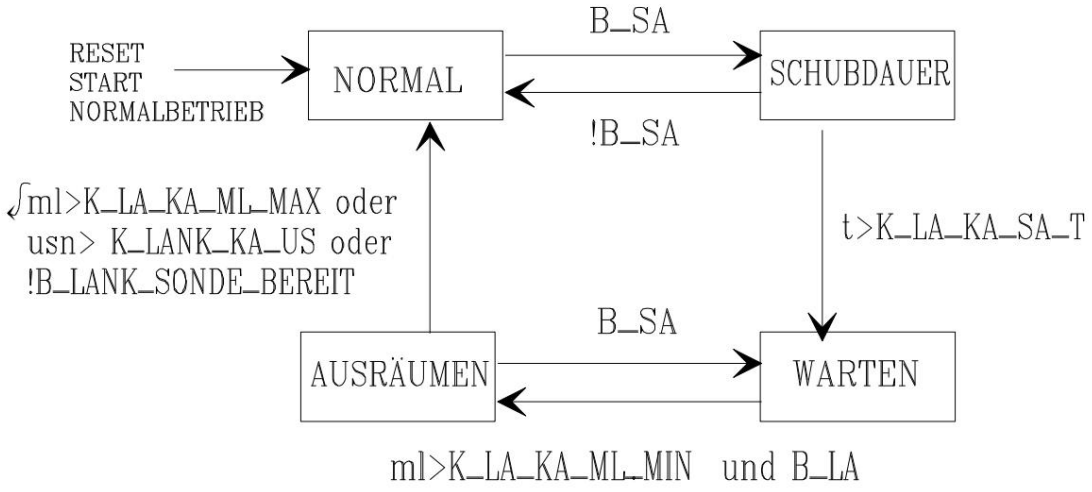
The enrichment is effective until the NKAT voltage has exceeded a certain voltage value **K_LANK_KA_US .** Furthermore, the clearing phase is limited to a maximum duration until
to reach the air mass integral threshold **K_LA_KA_ML_MAX .**

If you return to the operating state B_SA within this state, you change back to the WAIT state, whereby this time the waiting time must expire again before you can achieve a state change again.

Furthermore, clearing is only permitted if the NKAT probe is ready for operation. If this is not the case in the CLEARING state, the system immediately returns to the NORMAL state and no additional TV time is included.

=> BIT3 in variable la_kat_ausr_st is set

2.2. Graphical description of the state machine



3. Clearing via TV shift in the lambda controller

3.1. Determination of the TV shift

As soon as the *waiting or clearing* state **(B_LA_KA1/2)** is reached, the TV shift is determined from the characteristic curve KL_LA_KA_TV_ML, which is dependent on the air mass.

TV shift:

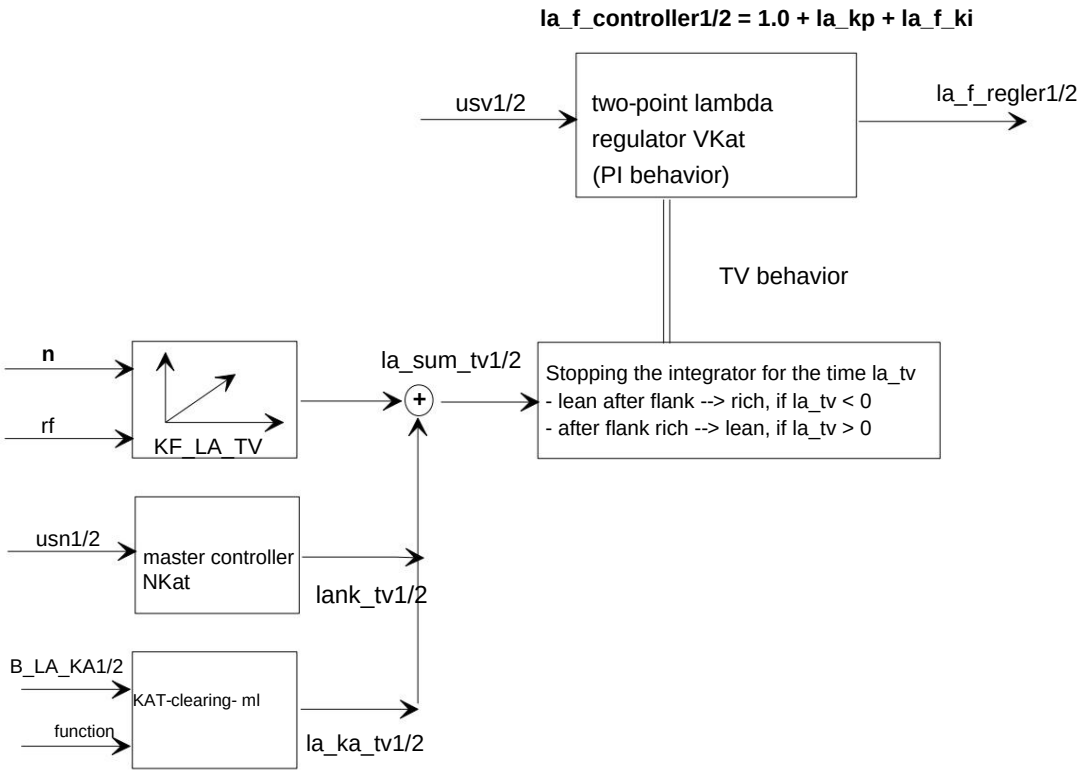
la_ka_tv = Interpolation(KL_LA_KA_TV_ML)

This additional TV shift via the "KAT clearing" function is now included in the lambda control of the VKat probe. The TV shift VKAT1/2 (la_sum_tv1/2) is changed by the value la_ka_tv1/2.

=> la_sum_tv1/2 = KF_LA_TV (value from map(n,rf))
+ la_ka_tv1/2 (value from KAT clearance)
+ la_tv_offset (value from the offset function)
+ la_alter_s_tv1/2 (value from the post-cat probe aging function)
+ lank_tv1/2 (value from the NKAT regulation)

The determination and inclusion in the lambda control takes place every 10ms.

3.2. Graphic representation of the complete lambda controller



4th Influence on the NKAT controller and diagnostics

Since the catalytic converter is saturated with oxygen after the overrun cut-off, the NKAT sensor voltage is in the "lean" range. Therefore, the NKAT control is switched off during the artificial enrichment for catalytic converter clearing. After the catalytic converter clearing function has ended, the NKAT sensor typically oscillates for a few seconds above the threshold value of approx. 600mV. To prevent the NKAT controller from leaning the system, for example, the system waits until a certain amount of air **K_LANK_ML_SCHW** has flowed through the catalytic converter before the control is activated again.

This air quantity is measured directly after a **RESET, START** or after a transition from the **CLEARING** state to the NORMAL state .

When entering the measurement => the
BIT4 in **la_kat_ausr_st** is set;

As soon as the air volume has flowed through, this bit is reset and the **NKAT control,** the **electrical diagnosis** for the NKAT sensors and the **KAT conversion** can be released.

5th variables and constants

Status variable: la_kat_ausr_st:

bit position	la_kat_ausr_st
Bit0	state NORMAL
Bit1	state THRUST
Bit2	state WAIT
Bit3	CLEARING state active
Bit4	determined ML must flow through KAT
Bit5	xxx
Bit6	xxx
Bit7	xxx

Variables:

name	Meaning	Type	Resolution
la_kat_ausr_st	status variable for TV monitoring	uc	--
la_ausr_ml_kat	certain ML, which must flow through KAT	uw	kg/h
la_ka_tv1/2	TV shift from KAT clearances	uc	ms

Application data:

name	type	Meaning
K_LA_KA_SA_T	constant	Time you have to spend in SCHUB
K_LA_KA_ML_MIN	constant	min. ML threshold
K_LA_KA_ML_MAX	constant	max. ML threshold
KL_LA_KA_TV_ML	characteristic curve	additional TV shift
K_LANK_KA_US	constant	certain probe voltage NKAT to abort the function.