UNIMA-KS

Development & production of control equipment
Visualization, measurement and regulation SW
WWW.UNIMA-KS.CZ unima-ks@unima-ks.cz

Ing. Z.Královský
Petr 457
675 22 STAŘEČ
Tel.: 568 870982
Fax: 568 870982
e-mail: kralovsky@unima-ks.cz

Ing. Petr Štol
Okrajová 1356
674 01 TŘEBÍČ
Tel.: 568 848179
Cell: 777 753753
e-mail: stol@unima-ks.cz

Specifications for rpm-regulator

SPEEDCON

May 2010
V 1.80

OBSAH:

1. Purpose of the Equipment

The task of the described control unit (thereinafter only SP) is to regulate rotation speed of a combustion engine.

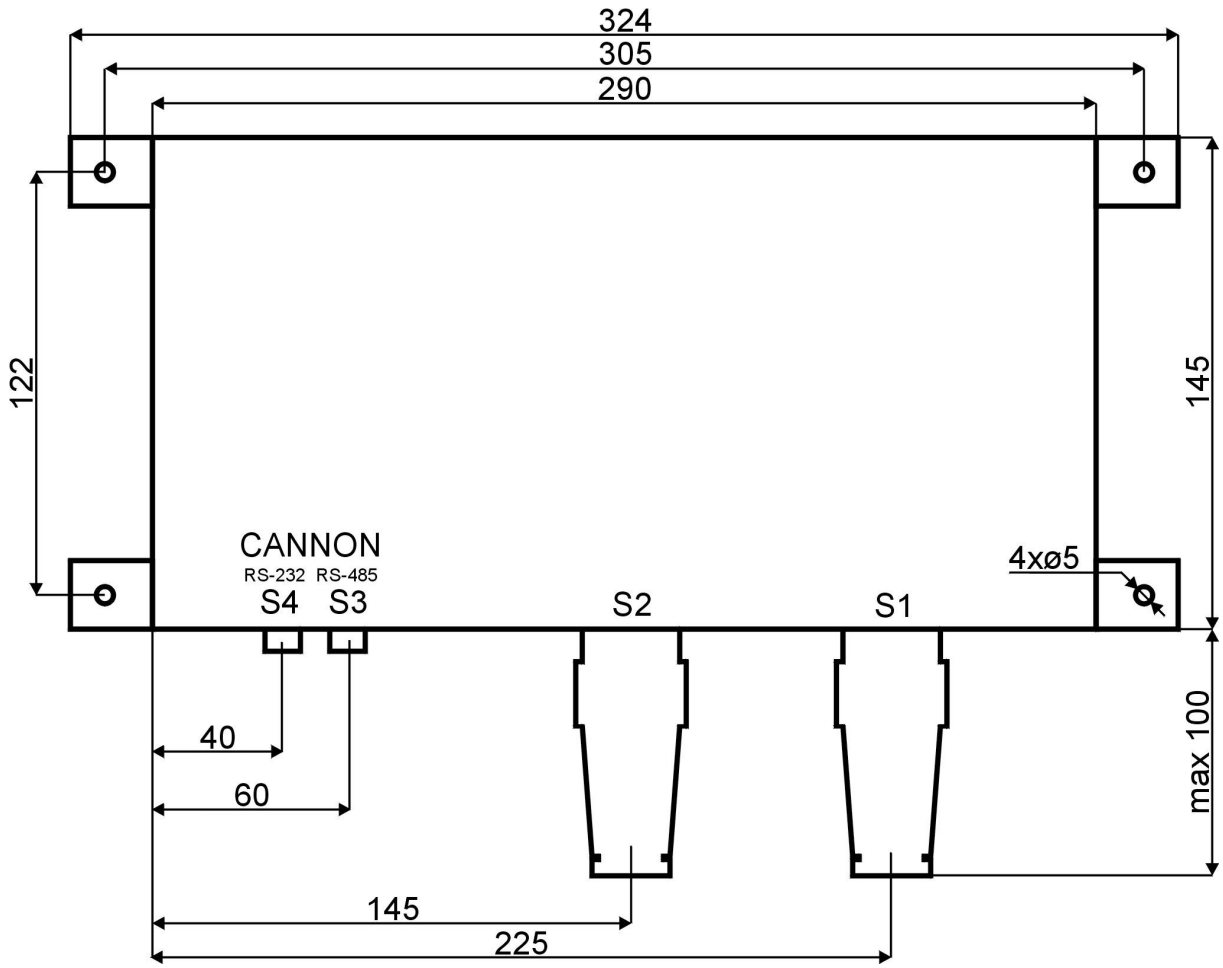
2. Operating Conditions

To enjoy the faultless operation it is necessary to observe the fundamental operating conditions which are defined in the following sections:

a) Proper connecting of Input/Output connectors
b) CU-power supply which meets the allowed tolerances (=10÷33V)
c) Proper parameter setting of the controlling SW
d) Observance of the operating temperature in surroundings within the range up to 60°

3. Mechanical Design

The SP is fixed in a detached metal box having dimensions 324x145mm (mounting holes 305x122mm with diameter 5mm), height 57mm, protection IP65. The lateral face includes 2 connectors type Amphenol C164 for connection of the actuator (hereinafter only ACt) as well as connection of the input signals and the CANNON connector



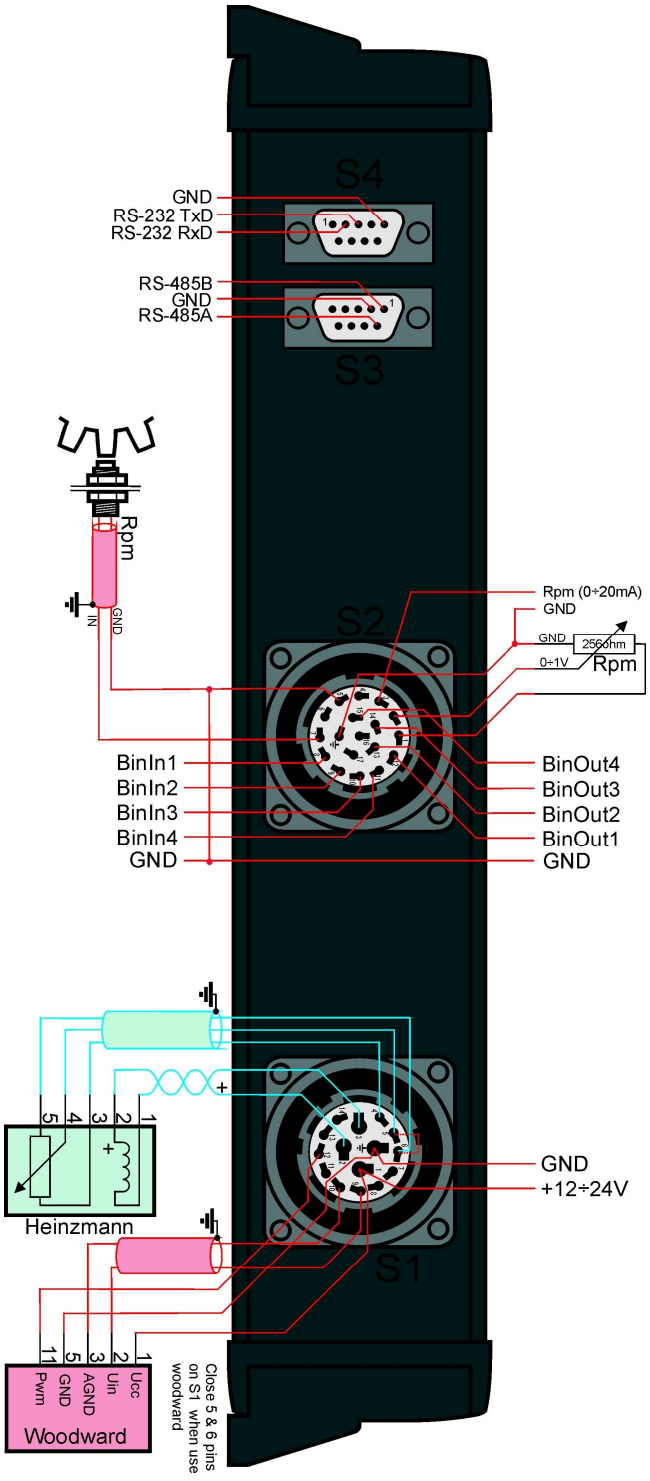
4. Electrical design

The SP is connected to the switch-board by means of two connectors; S1 (power connector) and S2 (signal connector).

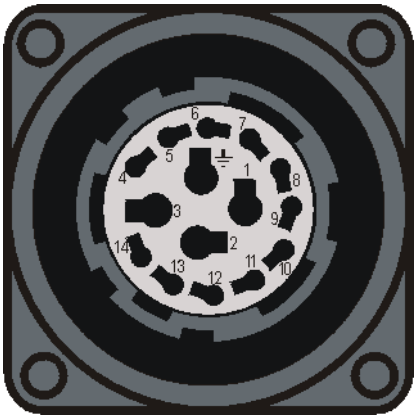
The SP is supplied (connector S1) with DC voltage of 10÷33V DC, consumption (provided the 24V supply) 130mA provided the regulator deactivated, 800mA (in peaks up to 2A) when regulated (applies to Act Heinzmann StG 2010.20-KV-SC, for other Act types can the consumption during operation fluctuate, consumption in idle as well as peak time is not affected by the ACt type.

Connectors CANNON (S3,S4) are used for connecting of the SP to PC (RS-232 monitoring, diagnostics setting) and to the CU UniGEN (RS-485 control)

Position of connectors:



4.1 Connector S1



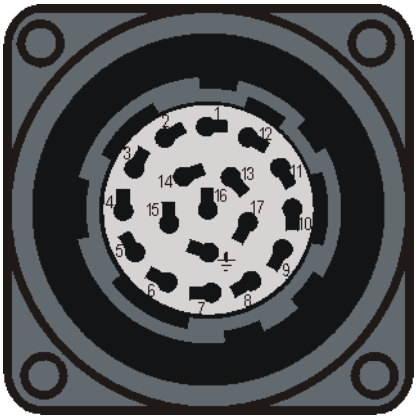
Pin	Name	Description		Conductor
GND	GND	Regulator supply WW actuator supply	Term.1 ACt WW	A*
S1-1	=10÷33V		Term.5 ACt WW	
S1-2	ActHeI+	Excitation current for the actuator Heinzmann	Terminal 2 ACt	A*
S1-3	ActHeI-		Terminal 1 ACt	A*
S1-4	ActHe8V	Position sensing of the actuator Heinzmann	Terminal 3 ACt	B*
S1-5	ActHePos		Terminal 4 ACt	B*
S1-6	ActHeGND		Terminal 5 ACt	B*
S1-7	NC			B*
S1-8	NC			B*
S1-9	ActWwUin	Position sensing of the actuator Woodward	Term. 2 Act WW	B*
S1-10	ActWwUinAGND		Term. 3 Act WW	B*
S1-11	NC		Term. 4 Act WW	B*
S1-12	ActWwPwm	Exciting PWM for the position control of Woodward	Term. 11 Act WW	B*
S1-13	NC			
S1-14	NC			

***** The max. and recommended cross-sections of the supply leads:

A **–** maximum 1,5mm^2 (catalogue), recommended 1,5mm^2

B – maximum 1,0mm^2 (catalogue), recommended 0,75mm^2

4.2 Connector S2

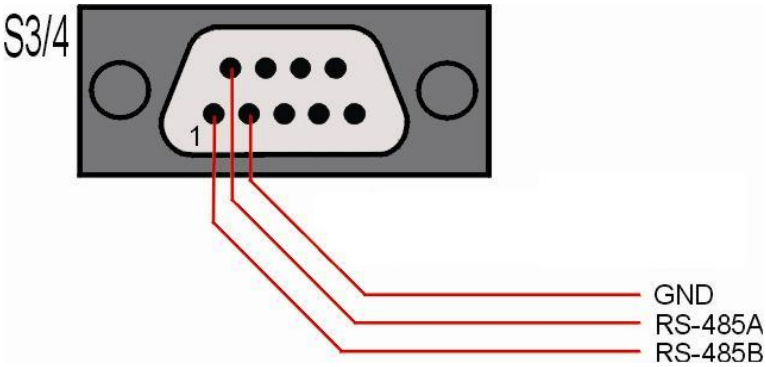


Pin	Name	Description	Conductor
GND	GNDA	Analogue ground	B*
S2-1	RpmPotA	Supply for the rpm correction potentiometer	B*
S2-2	RpmPotB	Brush for rpm correction	B*
S2-3	Rpm20mA	Current input for rpm correction	B*
S2-4	NC		B*
S2-5	GNDD	Digital ground	B*
S2-6	NC		B*
S2-7	Rpm	Rpm sensor	B*
S2-8	BinIn1	Configurable physical binary inputs	B*
S2-9	BinIn2		
S2-10	BinIn3		
S2-11	BinIn4		
S2-12	BinOut1	Configurable physical binary outputs	B*
S2-13	BinOut2		
S2-14	BinOut3		
S2-15	BinOut8		
S2-16	NC		B*
S2-17	NC		

***** The max. and recommended cross-sections of the supply leads:
B – maximum 1,0mm^2 (catalogue), recommended 0,75mm^2

4.3 Connector S3 (RS-485 for connection to CU UniGEN)

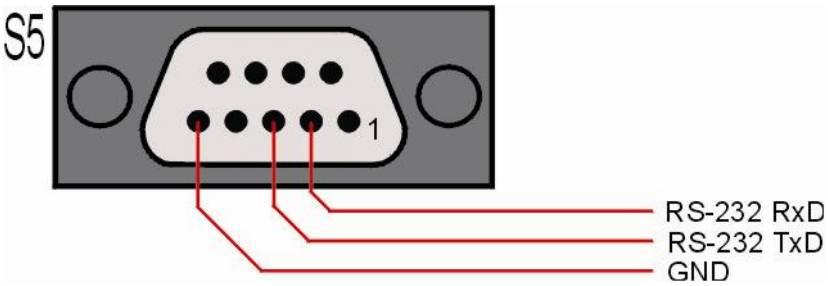
Communication interfacing RS-485 (for connection to the CU UniGEN) involves connectors S3



	Name	Meaning	Working values
S3.1	485B	Communication interfacing RS-485	Levels compatible with RS-485
S3.2	GND		
S3.3	NC		
S3.4	NC		
S3.5	NC		
S3.6	485A	Communication interfacing RS-485	
S3.7	NC		
S3.8	NC		
S3.9	NC		

4.4 Connector S4 (RS-232 for connection to PC)

Communication of TMCI2 with PC (service program Manager) is implemented by means of the serial interface RS-232 (9-pins connector CANNON). For connection to PC it is necessary to use a cross-cable (2-3, 3-2, 5-5).



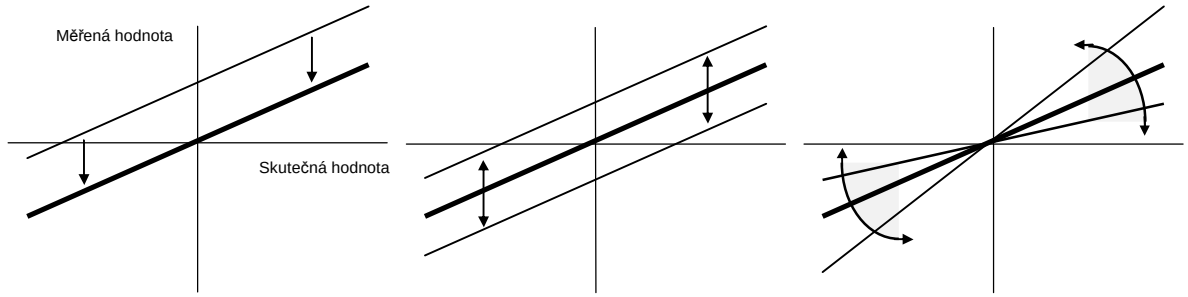
	Name	Meaning	Working values
S5.1	NC		Levels compatible with RS-232
S5.2	RxD	Receive of serial data	
S5.3	TxD	Sending of serial data	
S5.4	NC		
S5.5	GND	Ground	
S5.6	NC		
S5.7	NC		
S5.8	NC		
S5.9	NC		

4.5 Analogue Inputs Calibration

All analogue inputs (potentiometer, 20mA, actuator position….) can be calibrated digitally without interference with SP (trimmer setting).

Calibration is carried out by connecting of SP to PC by means of RS-232. After having selected menu “Service/Calibration” in program “MANAGER.EXE” the dialogue window for calibration will appear. The selected parameter can be accurately set to desired value using press buttons for offset change and amplitude change:

Offset resetting Offset change Amplitude change



Recommended procedure for calibrating:

a) Disconnecting of the calibrated input (zero setting)
b) Offset zero setting “Offset 0”
c) Connecting the input to the defined value
d) Setting of the required value using press-buttons “Amplitude +” and “Amplitude – “

5. Mapping

It means assigning of a physical input to logical inputs (logical output to physical outputs) hereinafter only mapping.

Using a physical input you can control several logical inputs.

6. Binary inputs

6.1 Physical binary inputs

Physical binary inputs BinIn1÷BinIn4 reflect the state of input terminals short-circuiting (disconnecting) SP S2-8÷S2-11. The terminal short-circuiting activates the relevant physical input.

6.2 Logical binary inputs

Logical binary inputs are binary magnitudes affecting the SP-algorithm. By means of mapping can be defined, in what way the said magnitudes are controlled (by a physical input or another physical magnitude, or they can also be set permanent to the active or non-active level).

6.2.1 Start/Stop

The logical binary input Start/Stop“activates the rpm regulator. As soon as the output is activated there follows the release of the rpm-regulator starting phase. The starting edge of the signal activates also the previous errors in SP.

6.2.2 Idle/Rated

The logical input controls the engine rpm. The input activating makes the engine operation with idle engine speed. Is the input non-active, the engine runs at nominal rpm.

After the regulator starting phase is brought to its end the engine continues to run for a defined time with the idle rpm (regardless the input state) and after that it breaks into the nominal rpm (provided the input is non-active). By input activation we can quasi either extend the engine operation with idle rpm after start or insure the transformation to the idle engine speed prior to motor-stop.

6.2.3 Parallel

Logical input activating will evoke, that the rpm-regulator switches over from rpm-regulating to power-regulating (via Droop) within the parallel operation with the net. This input can be directly controlled via the net contactor that is linked to a defined physical input.

6.2.4 PID A/B

It means the selection of the PID-parameter set of the rpm-regulator. Is the input inactive the set A will assert itself, when activating the input, the set B will be selected.

6.2.5 Rpm Down

Given that the motor is operated with nominal rpm within the rpm-regulating mode (signals „Idle/Rated“and „Parallel“ are not active) and there is via parameter activated correction of the desired rpm using bin. signals, then it is possible to decrease the rpm-size by virtue of this signal. The rpm declining (desired rpm-alteration within an input impulse persisting 1s) is given by the parameter, „DecSpeed“, nevertheless it can not be higher than that of "DecelSpeed". Having reached the "MinRpm" (or given that the actuator position lies on bottom limit "MinFuel") there occurs no rpm-declining, even if the "Rpm Down" signal is persisting.

Given that the motor is operated in the power controlling mode (signal „Parallel“is active) and there is via parameter activated correction of the desired rpm using bin. signals, then it is possible, using the said signal, to decrease the power. The desired rpm (governed

in the same way as in the mode of rpm-regulation) is then via the parameter “Droop” converted to the actuator position

6.2.6 Rpm Up

If the engine is operated at the nominal rpm in the mode of rpm-regulation (signals “Idle/rated” and “Parallel” are not active) and via parameter is activated the correction of the desired rpm by the bin. signals, then it is possible to increase the rpm by virtue of the said signal. The rate of the rpm-increase (alteration of the desired rpm at the input impulse of the duration 1sec) is given by the parameter “IncSpeed”, nevertheless it can not be higher than the speed “AccelSpeed”. Having reached the “MaxRpm” (or if the actuator position is situated on the upper limit “MaxFuel”) there is no rpm-decrease even if the signal “Rpm Up” is persisting.

If the engine is operated in the mode of power-regulation (signal “Parallel” is active) and there is, by the parameter, activated correction of desired rpm using bin. signals, then it is possible, by virtue of the said signal, to increase power. The desired rpm (governed in the same way as in the mode of rpm-regulation) is then via the parameter “Droop” converted to the actuator position.

6.2.7 Rpm1÷3

By logical input Rpm0 and Rpm1 si possible to realize preffered (in disregard of selected speed controll) one from three requested speed levels. When speed is controled by data communication, signals Rpm0 and Rpm1 is ignored. Requested speed is Rpm1÷Rpm3 limited to interval<RpmMin, RpmMax>.

Parameter RqRpm	**Bin.input**		**Value of requested speed**
	Rpm1	**Rpm0**	
Data comm	X	X	Is given by request from CU
Another way	0	0	Is given by analog input or by Up/Down signals
	0	1	Is given by parameter Rpm1
	1	0	Is given by parameter Rpm2
	1	1	Is given by parameter Rpm3

7. Two-value outputs

7.1 Physical binary outputs

Physical binary outputs BinOut2÷BinOut8 control the switching output transistors on terminals SP S2-12÷S2-15. The output activating switches the relevant output transistors.

7.2 Logical binary outputs

Logical binary outputs are binary magnitudes, which are generated by the SP-algorithm. Using mapping it can be defined in what way the said binary magnitudes govern physical outputs (which one of the logical outputs controls which one of the physical outputs).

7.2.1 Act.Backloop

Feedback error from the actuator of rpm-regulator. Rpm-regulator has no information on the actuator position and it can therefore not regulate the actuator position. In such a situation the said output will be activated and at the same time will be switched off the power stage (of the exciting current heading to actuator), and quasi to actuator shut-down. The signal gets inactivated when there is a new demand for activating (by the starting edge of the signal “Start/Stop”).

7.2.2 Act.Limit

The regulator will activate this output in case, that despite of max. intervention (max. current for actuator) it was not possible to reach (within the period of 250 ms) the desired actuator position (mechanical block, end stop). The current for actuator is brought down to the value of the maintaining current so that it can be damaged neither the final stage nor the actuator (constantly max. current into actuator). As soon as the regulator has reached the desired position, the signal will be deactivated.

7.2.3 Rpm Error

Error from the speed sensor. The regulator will activate this output provided that during the operation process the rpm will decline under the limit of “ErrRpm”. At the moment of the output activating there will be switched off the power stage (exciting current into actuator) and therefore the actuator shutdown. The signal gets inactivated when there is a new demand for activating (by the starting edge of the signal “Start/Stop”).

8. Analogical inputs

There are no configurable analogical inputs inside of SP, but only single purpose analogical inputs for rpm correction.

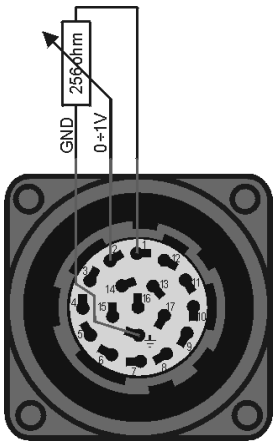
8.1 Other analogical inputs

8.1.1 Rpm 20mA

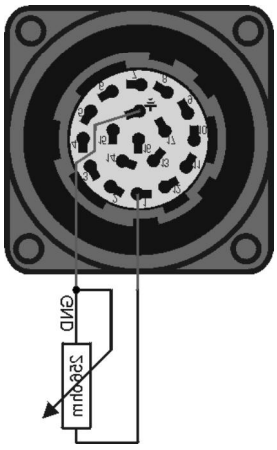
Current input 0÷20mA is used to correct the desired rpm-size (power regulation). What current is responding to what desired rpm can be defined by parameters„AnlMinRpm“ and „AnlMaxRpm, the min. value of the demanded rpm is however limited to “MinRpm”, the max. up to “MaxRpm”. At the step change of the input analogical signal the desired rpm is not changed in jumps, but the rpm follows the input rpm requirements „AccelSpeed“, „DecelSpeed“. To enable the correction of the SP speed by means of the current loop, the “RqRpm” parameter must be set to the value of „Anl.signalem 0÷20mA“.

8.1.2 Rpm Pot

SP-rotation speed (power) can also be corrected using a potentiometer or rheostat 256Ω. Analogous to current loop it can be defined by parameter what a resistance corresponds to what rpm. The pot can be linked to SP either in the two-wire or three-wire system:



Using the three-wire system the parameter „RqRpm“ has to be set to „Potenciometrem 0÷256ohm“. At this adjustment the rpm can also be controlled directly with voltage 0÷1V.



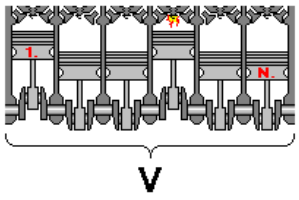
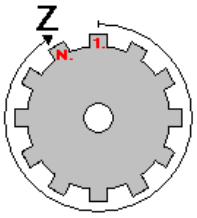
Using the three-wire system the parameter „RqRpm“ has to be set to „Reostatem 0÷256ohm“.

9. Adjustable parameters

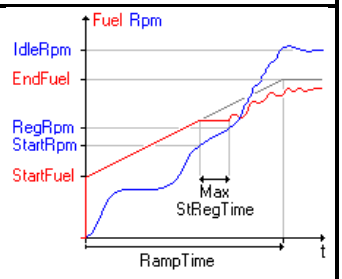
9.1 Regulator

Name	Description	Possible options
UseReg	Use of regulator Given that the regulator is used as a separate equipment, the inputs and outputs configuration (I/O Mapp) is given according to the setting inside of the rpm regulator. If the regulator is an integrated part of the engine-management, then the said configuration is defined by the superior engine-management.	• Separate regulator • Enginemanagement The separate regulator (dealt with these specifications) must have adjusted a highlighted option

9.2 Rngine

Name	Description	Min/ Max	Step	
V_SP	Cylinder count	4/ 8	1	
Z_SP	Cog count	64/ 255		

9.3 Starting batch

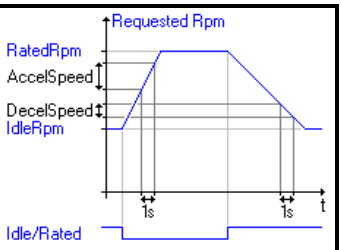
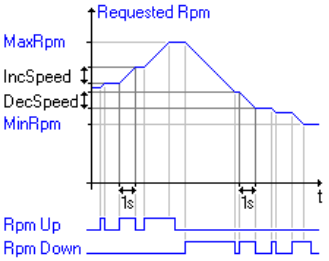
Name	Description	Min/ Max	Step	
StartFuel	Flap position for start Binary input activating "Start/Stop" (as well as overrun of fault rpm) results in release of starting batch. Regulator sets the valve to the starting position "StartFuel" and linear dependent on time the valve opens up until the end position "EndFuel". Should the engine not start running (the rpm has not exceeded "StartRpm"), the end position will be reached after the laps of "RampTime", where the opening stops. Should be exceeded the rpm "StartRpm" the valve opening will be stopped prior the reach of the end position, should the "RegRpm" be exceeded it will be started the rpm regulation. After the said regulation has been started there will occur the linear rpm increase in dependence on time, namely from the actual rpm value (close up to "RegRpm") up to the idle run value "IdleRpm", where is the starting batch finished..	10/ 50	1 %	
EndFuel	Final flap position	10/ 80	1 %	
RampTime	Time needed for final opening	2/ 20	0,1 S	
StartRpm	Starting rpm	100/ 2000	1 min^{-1}	
RegRpm	Rpm needed to activate regulation	100/ 2000	1 min^{-1}	
StRegTime	Max. time to regulation activating The rpm regulation is activated by rpm-increase over the value “RegRpm”, this fact causes the stop of valve opening a reaching of the “RegRpm” for the time longer than parameter “StRegTime” will initiate the regulation irrespective the rpm-size	2/ 20	1 S	
IdleTime	Minimum time for idle-run After having finished the engine start fuel supply the engine is running for the time “Idle Time” as a minimum with idle rpm irrespective the state of binary signal “IdleRated”, after this time is gone off the engine continues to run at idle rpm, provided the signal “Idle/Rated” is active. If the “Idle/Rated” is not active the engine goes over to nominal speed.	2/ 25	1 s	

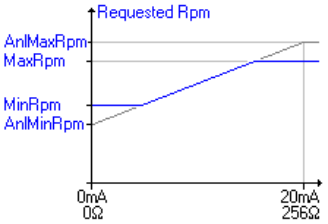
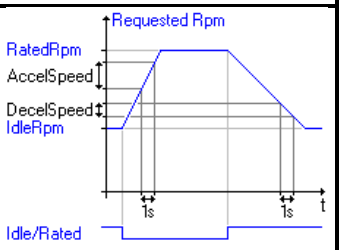
9.4 Shut-down

Name	Description	Min/ Max	Step	
OpenTime	Time for actuator opening after STOP The parameter defines the time for opening of actuator into the MaxFuelA/B after the signal Start/Stop has been deactivated. With respe ct of the version FW which is older than 1.75 je parameter is firmly set to Os,	0/ 5	1s	

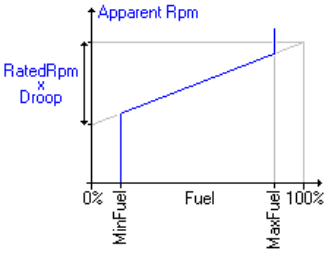
9.5 Rotation speed /=rpm

Name	Description	Min/ Max	Step	
		Possible options		
IdleRpm	Idle rpm To the value of this rpm it is regulated for the period of "IdleTime" after the start fuel supply has been finished or if there is active the signal "Idle/Rated".	750/ 3000	1 min^{-1}	
RatedRpm	Nominal rpm To the value of this rpm it is regulated after the elapse of the time in "Idle Time" from finishing the start fuel supply, if there is not the signal "Idle/Rated" active.	750/ 3100	1 min^{-1}	
ErrRpm	Minimal breakdown rpm Rpm higher than this parameter together with the binary input "Start/Stop" – it is the necessary condition for activating of the regulator (starting phase initiation). Should the rpm decrease under this value during operation (after the start fuel supply has been finished), there will occur a break down/=error	0/ 1000	1 min^{-1}	
ErrRpmHi	Overrun rpm	750/ 3500	1 min^{-1}	
RpmMse	Rpm measuring When measuring the rpm based on time from one cylinder to another one, the engine rpm is calculated from the closing N-cogs (that corresponds to the time from cylinder to cylinder). When measuring the rpm based on cycle time, the rpm will be calculated as a floating average of the last V-times from cylinder to cylinder. This corresponds to the period of one cycle (2*Z cogs). Nevertheless thanks to the floating average the indication of the rpm is updated more frequently than only ones a cycle… N = 2 * Z / V Z = cog count V = cylinder count	• From time cylinder to cylinder • From cycle time (2 revolutions)		
RqRpm	Correction of the rpm requested The parameter defines the way in which the requested nominal rpm is corrected (it is activated neither the signal "Idle/Rated" nor the signal "Parallel"). Having selected "Bin.signály Rpm Down/Up".the rpm-correction can be done by means of binary signals. Having selected "Anl.signálem 0÷20mA" the rpm-correction can be done by means of the current signal. Having selected "Potenciometrem 0÷256ohm" the rpm-correction can be done by means of the three-wire connected pot or by voltage 0÷1V Having selected "Reostatem 0÷256ohm" the rpm-correction can be done by means of rheostat (the two-wire connected pot) Having selected "By data control system" the rpm-correction can be done by means of date communication with the CU (RS-485, CAN).	• Bin.signals Rpm Down/Up • Anl.signal 0÷20mA • By Potentiometer • 0÷256ohm • By Reostat 0÷256ohm • By data controling signal		

AccelSpeed	Max. speed for rpm increase At the step change of the requested rpm (e.g. when activating or deactivating the signal “Idle/Rated”) the rpm is not changed per a jump, but using the ramp by defined speed. Parameter "AccelSpeed" gives the max. of the rpm increase/=acceleration per sec. This parameter also restrains the max. rate of the rpm-increase if the input signal –rpm more- is acting. During the start fuel supply, the speed of the rpm acceleration, from the rpm value for initiating regulation ("RegRpm") to the value of idle rpm ("IdleRpm") is also given by the said parameter.	1/ 250	1 s^{-1}	
DecelSpeed	Max.speed for rpm-decrease (=deceleration) When there is a step-change with requested (e.g. when activating or deactivating the signal “Idle/Rated”)rpm"Idle/Rated") the rpm is not changed in one jump, but using the ramp by defined speed. Parameter "DecelSpeed" gives the max. of the rpm decrease/=deceleration per sec. This parameter also restrains the max. rate of the rpm-decrease if the input signal –rpm less- is acting	1/ 250	1 s^{-1}	
IncSpeed	Correction speed of –rpm more- If the egine is running with the nominal speed (signal Idle/Rated is not active but there is activated the correction of the requested rpm via the bin signals, the rpm-size can be then corrected by signals "Rpm Up" and "Rpm Down". The speed of rpm increase (change of the requested rpm during the input impulse persisting for 1 sec.) is given by this parameter and, of course, it can not be higher than that of parameter "AccelSpeed". Having reached the rpm "MaxRpm" (or if the position of the actuator lies in the upper limit "MaxFuel") there occurs no rpm accelerating even if the signal "Rpm Up" is persisting. Works the engine in the mode of power regulation (signal parallel is active) you can, using this signal, increase the power. The rpm requested is, via the parameter “Droop” converted to the valve opening.	1/ 250	1 s^{-1}	
DecSpeed	Correction speed of –rpm less- If the egine is running with the nominal speed (signal Idle/Rated is not active but there is activated the correction of the requested rpm via the bin.signals, the rpm-size can be then corrugated by signals "Rpm Up" and "Rpm Down". The speed of rpm decrease (change of the requested rpm during the input impulse persisting for 1 sec.) is given by this parameter and, of course, it can not be higher than that of parameter "DecelSpeed". Having reached the rpm "MinRpm" (or if the position of the actuator lies in the lower limit "MinFuel") there occurs no rpm descending even if the signal "Rpm Down" is persisting. Works the engine in the mode of power regulation (signal parallel is active) you can, using this signal, decrease the power. The rpm requested is, via the parameter “Droop” converted to the valve opening.	1/ 250	1 s^{-1}	
AnlMinRpm	Rpm at 0mA (0ohm, 0V)	500/	1	

	If the engine is running with the nominal speed (signal Idle/Rated is not active but there is activated the correction of the requested rpm via the analogical signal, the rpm-size can be corrected by the input signal 0÷20mA (0÷256ohm, 0÷1V). What rpm corresponds to the 0mA (0ohm, 0V) is defined by parameter "AnlMinRpm", the min. possible value is but "MinRpm". Should the parameter "AnlMinRpm" be higher than that of "AnlMaxRpm"it can be achieved, that requested rpm become lower with the increasing current (resistance). If there occurs a jumping change with the input analogical signal, the requested rpm is not changed by jumps, but based on ramp function "AccelSpeed"/"DecelSpeel"	3300	min^{-1}	
AnlMaxRpm	Rpm at 20mA (256ohm, 1V) If the engine is running with the nominal speed (signal Idle/Rated is not active but there is activated the correction of the requested rpm via the analogical signal, the rpm-size can be corrected by the input signal 0÷20mA (0÷256ohm, 0÷1V). What rpm corresponds to the input signal 20mA (256ohm, 1V) is defined by parameter "AnlMaxRpm", the max. possible is but "MaxRpm". Provided the parameter "RpmMinRpm" is higher than "RpmMaxRpm" it can be achieved, that requested rpm become lower with the increasing current (resistance). If there occurs a jumping change with the input analogical signal, the requested rpm is not changed by jumps, but based on ramp	500/ 3600	1 min^{-1}	
RpmN	Rpm at Rpm1=X, Rpm0=Y By logical input Rpm0 and Rpm1 si possible to realize preffered (in disregard of selected speed controll) one from three requested speed levels. When speed is controled by data communication, signals Rpm0 and Rpm1 is ignored. Requested speed is Rpm1÷Rpm3 limited to interval<RpmMin, RpmMax>			
MinRpm	Min. requested rpm "MinRpm" it is a min. value of the requested rpm that can be achieved by virtue of correction signal ("Rpm Down" or analogical signal). After having reached this requested rpm level, the input signal for requested rpm correction will be ignored.	500/ 3000	1 min^{-1}	
MaxRpm	Max. requested rpm "MaxRpm" it is a max. value of the requested rpm that can be achieved by virtue of correction signal ("Rpm Up" or analogical signal). After having reached this requested rpm level, the input signal for requested rpm correction will be ignored.	500/ 3000	1 min^{-1}	
WinRpm	Rpm window	10/	1	

	Parameter "WinRpm" defines the rpm window. Should the rpm, during the rpm-regulation, exceed the limit of this window, there will occur the change of the rpm-regulator strengthening according to parameter "WinK". Should the rpm exceed the window limit during the power regulation (breakdown state), there will be initiated an immediate rpm-regulation towards the nominal value. If the signal "Parallel" will not be deactivated, the power regulation will be repeatedly activated after the lapse of time "RpmOutTime", should the signal be deactivated, the regulator goes on to regulate the rpm. The window should be set in that way, that the casual rpm fluctuation at the parallel operation with net doesn't exceed the limits of the window (recommended: 1/3÷2/3 difference of the overrun and nominal rpm)	250	min^{-1}	
WinK	Gain correction outside the window If the absolute value of the difference between the nominal and the actual running speed is higher than parameter it follows "WinRpm", it follows the regulator upwards strengthening ("K") according to "WinK". If the absolute value of the said difference is lower, the strengthening correction does not take place. The said correction comes across when regulated only towards the nominal rpm (signal "Idle/Rated" is not active") and only after then, as soon as the rpm after start has reached this rpm-level.	100/ 400	1 %	

RpmOutTime	Regulated output restoring after drop Should there occur a "drop" when power regulating in parallel operation (absolute value of the difference between the nominal and the actual running speed is higher than parameter"WinRpm" the regulator switches immediately over the regulation from power to rpm. If there does not take place deactivating of the signal "Parallel" (which must occur from this moment up to the lapse of time "RpmOutTime", the power regulation will be reactivated.	5/ 25	1 s	
Droop	Droop This parameter is of use in case the input signal "Parallel", by use of that the rpm-regulation is switched over to power-regulation (the parallel operation with net). The parameter gives, for how many percents must be changed the apparent requested rpm to change the valve position by one 100%. The initial point is given by the moment of the "Parellel"-signal activating, at this moment the current rpm-value is assigned to the valve opening. Opening of servo is limited by minimal value "MinFuel" and max. value "MaxFuel".	0/ 10	1 %	

9.6 PID rpm

Name	Description	Min/ Max	Step	
		Possible options		
Trmp	Rpm regulation period The change of regulation PID-period on regulator shall affect the setting of PID-parameters. Having done this change/=alteration you have to set the PID-parameter for rpm-regulation repeatedly.	• T=20ms • T=50ms • T=100ms		
PIDA1	PID parameters - set A1 PID parameters define dynamic properties of the regulation. Parameter set "PIDA1" is used in case the signal "Fuel A/B" is inactive and the servo-position is lower than the parameter "Pos12"			
PIDB1	PID parameters - set B1 PID parameters define dynamic properties of the regulation. Parameter set "PIDB1" is used in case the signal "Fuel A/B" is active and the servo-position is lower than the parameter "Pos12"			
Pos12	Position for selecting the PID set of 1/2	0/ 100	1 %	
PIDA2	PID parameters - set A2 PID parameters define dynamic properties of the regulation. Parameter set "PIDA2" is used in case the signal "Fuel A/B" is inactive and the servo-position is lower than the parameter "Pos23" and higher than “Pos12”			
PIDB2	PID parameters - set B2 PID parameters define dynamic properties of the regulation. Parameter set "PIDB2" is used in case the signal "Fuel A/B" is active and the servo-position is lower than the parameter "Pos23" and higher than “Pos12”			
Pos23	Position for selecting the PID set of 2/3	0/ 100	1 %	
PIDA3	PID parameters - set A3 PID parameters define dynamic properties of the regulation. Parameter set "PIDA3" is used in case the signal "Fuel A/B" is inactive and the servo-position is lower than the parameter "Pos34" and higher than “Pos23”			
PIDB3	PID parameters - set B3 PID parameters define dynamic properties of the regulation. Parameter set "PIDB3" is used in case the signal "Fuel A/B" is active and the servo-position is lower than the parameter "Pos34" and higher than “Pos23”			
Pos34	Position for selecting the PID set of 3/4	0/ 100	1 %	
PIDA4	PID parameters - set A4 PID parameters define dynamic properties of the regulation. Parameter set "PIDA4" is used in case the signal "Fuel A/B" is inactive and the servo-position is higher than the parameter "Pos34"			
PIDB4	PID parameters - set B4 PID parameters define dynamic properties of the regulation. Parameter set "PIDB4" is used in case the signal "Fuel A/B" is active and the servo-position is higher than the parameter "Pos34"			

9.7 Actuator

Name	Description	Min/ Max	Step	
		Possible options		
ActType	Type of actuator !! ATTENTION !! Change of the actuator type will assert itself as lately as reset takes place (switching off and on of supply voltage). After having changed the actuator type, it is necessary to carry out the position calibration of the actuator feed back (incl. a rough offset). In the version FW older than 1.70 the type of the actuator cannt be changed and the said parameter has to be set to actuator Heinzmann. Moreover it is also necessary for the actuator Heinzmann to set the period for regulation and PID-parameters regulating the positions of the ACt – ACt position is controlled by PID-regulator besed on the return information about the ACt position. ACt Woodward is only governed by PWM signal, that directly gives the requested ACt position (10%PWM = position 0%, 90%PWM = position 100%), return information on position is used for diagnostics purposes only	• Hienzmann • Woodward		
MinFuelA	Min. ACt position fuel A The requested position for ACt opening in the parallel mode which is given by apparent rpm and the parameter "Droop" is limited to the min. value of this parameter (provided fuel A is selected). As soon as the ACt position reaches this utmost, then it is always ignored the input signal "Rpm Down" used for requested rpm correction. During the rpm-regulation the ACt requested position is always limited to this value, provided it is for longer time than 250ms minor/=less than this parameter.	1/ 50	1 %	
MaxFuelA	Max. ACt position fuel A The requested position for ACt opening in the parallel mode which is given by apparent rpm and the parameter "Droop" is limited to the max. value of this parameter (provided fuel A is selected). As soon as the ACt position reaches this utmost, then it is always ignored the input signal "Rpm Up" used for requested rpm correction. During the rpm-regulation the ACt requested position is always limited to this value, provided it is for longer time than 250ms minor/=less than this parameter.	50/ 99	1 %	

MinFuelB	Min. ACt position fuel B The requested position for ACt opening in the parallel mode which is given by apparent rpm and the parameter "Droop" is limited to the min. value of this parameter (provided fuel B is selected). As soon as the ACt position reaches this utmost, then it is always ignored the input signal "Rpm Down" used for requested rpm correction. During the rpm-regulation the ACt requested position is always limited to this value, provided it is for longer time than 250ms minor/=less than this parameter.	1/ 50	1 %	
MaxFuelB	Max. ACt position fuel B The requested position for ACt opening in the parallel mode which is given by apparent rpm and the parameter "Droop" is limited to the max. value of this parameter (provided fuel B is selected). As soon as the ACt position reaches this utmost, then it is always ignored the input signal "Rpm Up" used for requested rpm correction. During the rpm-regulation the ACt requested position is always limited to this value, provided it is for longer time than 250ms minor/=less than this parameter. For the version FW which is older than 1.35 it was not possible to select the ACt utmost depending upon the type of fuel and that´s why this parameter defines (with FW older than 1.35) the Stop for fuel A as well as fuel B	50/ 99	1 %	

9.8 PID actuator

Name	**Description**	**Min/ Max**	**Step**	
		Possible options		
Tact_SP	Regulation period of the ACt PID parameters of the Speedcon ACt are to be set only then, if the Heinzmann ACt has been selected. Change of the PID-regulation period of regulator will affect the PID-parameter setting. Having changed this parameter it is necessary to redefine the ACt pid-parameters. It is suitable to use a slower regulation period for more robust ACts.	• T=2ms • T=5ms • T=20ms		
PIDact_SP	PID parameters of the ACt It is necessary to set the PID-parameters of the speedcon ACt only then, if the Heinzmann ACt has been selected.			

9.9 Non-burning

Name	Description	Min/ Max	Step	
DeNepLev	Activating level for non-burning The drop of the successful burning under this limit causes activating of the signal “DeNep”.	1/ 100	1 %	

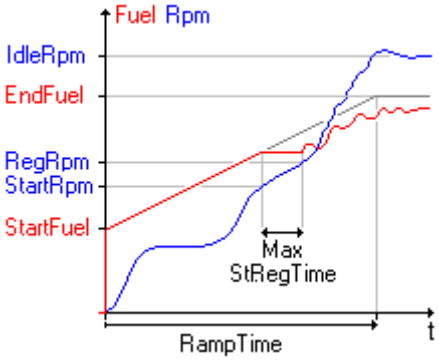
9.10 Service

Name	Description	Min/ Max	Step	
Address_SP	Address SP !! Attention !! The change of the rpm regulator address will be of use only than after the regulator has been reseted (switch off and switch on of supply voltage). When changing the address the change on/to the same value has to be carried out also in engine management as well as in the fuel regulator.	0/ 15	1	
CntRes_SP	Counter of resets Parameter values are uploaded out of the regulator only after the communication has been opened. And therefore for gaining of the updated value of this parameter it is necessary to identify the equipment again ("Connection / Open") or to show the parameters by means of the extended option "Up-load and Edit MM-SPEEDCON Parameters"	0/ 255	1	

10. Functional description

10.1 Starting phase

Having activated the binary input "Start/Stop" (and having exceeded the bnreakdown rpm) the starting phase will be initiated. The regulator will set the actuator into the flap starting position "StartFuel" and linear with time it opens the actuator up to the final position "EndFuel". Unless the motor starts running (rpm exceeds "StartRpm"), there will be reached the actuator final position in the time "RampTime", and the opening stops here. Should be exceeded rpm "StartRpm", then the actuator opening stops prior to reaching the stop position. Actuator position remains in the position reached until the moment the rpm will exceed the value of the "RegRpm", and at that moment rpm-regulation begins to operate. The regulation will be started even in case that rpm of the value „RegRpm“ have not reached even in max. time the value „StRegTime“.



After the startup of rpm-regulation the necessary rpm will grow linerly with time (growing speed is given by parameter „AccelSpeed“) from the speed of currently running rpm (close to "RegRpm") up to the value of idle rpm "IdleRpm", when the starting phase is put to its end.

After finishing the starting phase the engine is running at least for the time "IdleTime" at idle rpm, disregarded the state of the binary signal "Idle/Rated". After this time is out the engine continues in idle run provided the signal "Idle/Rated" is active. Should "Idle/Rated" not be active, the engine switches to nominal rpm..

10.2 Regulator operation

Is the signal „Parallel“ out of action, the regulator works in the rpm-regulation mode. Dynamic features of this regulation are influenced by setting the PID parameters of the rpm regulator, the selection of the PID-parameter set can have an influence on the actuator position. Is the engine running with nominal rpm („Idle/Rated“ is not active), it is possible to correct the engine rpm either via logical signals (according to parameter setting „RqRpm“) RpmUp, RpmDown or in analogical way by potentiometer, rheostat, current 0÷20mA or voltage 0÷1V. What impulse corresponds to what rpm-change quasi what analogicat value corresponds to what requested rpm it can be set via parameters„IncSpeed“, „DecSpeed“, „AnlMinRpm“ and „AnlMaxRpm“, and using parameters „MinRpm“ and „MaxRpm“ you can set max. available limits of the requested rpm under influence of the above mentioned external signals.

Should the absolute value of the difference between actual running speed and that of requested speed exceed during regulation the value of the parameter „WinRpm“, there will occur the regulator strengthening according to parameter „WinK“ aimed at elimination of this increased deviation as soon as possible.

Should the absolute value of the actual running speed during the regulation exceed the double of the parameter „WinRpm“,the actuator will be closed to position „MinFuel“ to stop the rpm-increase as effective as possible. After the rpm has decreased under the double of „WinRpm“ the rpm-regulation will be restored..

Is signal „Parallel“ counteracting, the regulator works in the power regulation mode. Regulation dynamic properties do not affect PID parameters any longer, the actuator position is given only by requested rpm and by the parameter „Droop“.The said parameter gives by what percentage must be changed the requested rpm to change the actuator position by 100%. The initial point is given by the moment of the "Parallel" signal activating. To the opening of the actuator at this moment it is assign

the rpm current value. Actuator opening at this moment is limited by min. value "MinFuel" and max. value "MaxFuel".

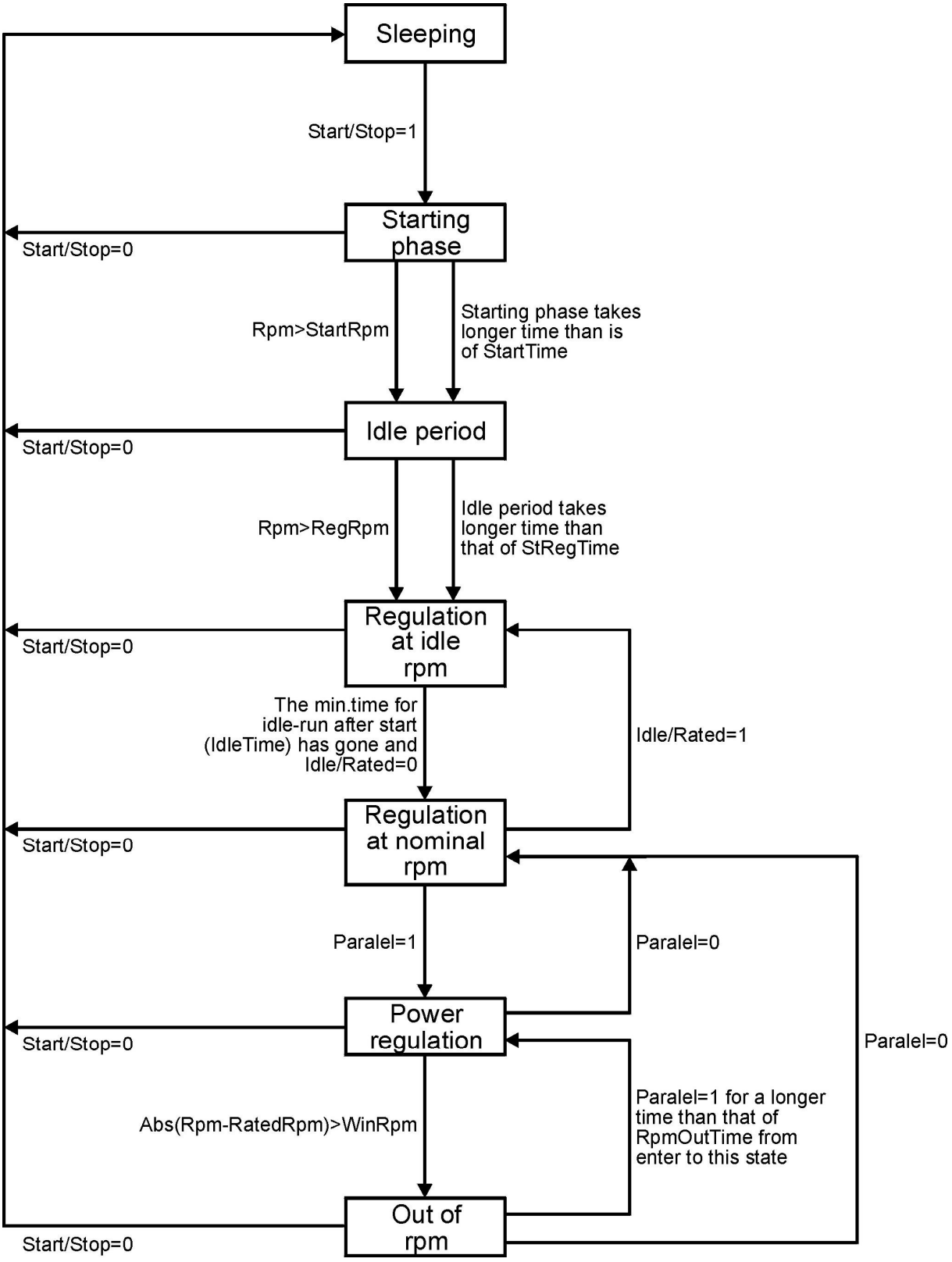
Should the absolute value of the difference between actual running speed and that of requested speed exceed during regulation the value of the parameter „WinRpm“, there will occur the regulator switch over to rpm-regulation. This state signalizes/=indicates an improper operating of the aggregate and it can appear e.g. then, when net contactor has been disconnected whilst the signal „Parallel“ continues to be active. Regulator presumes, that in case of this state there will occur either the aggregate shut down or deactivation of the signal „Parallel“. Persist the signal „Parallel“ to be active for a longer time than „RpmOutTime“, the regulator will try to restore the mode of power regulation.

10.3 Regulator setting

Together with the proper parameter setting, it is also very important for the correct regulator operation to set the PID constant. The procedure for PID-setting is as follows:

- PID-parameter setting for actuator. After having pressed the key „Actuator position..“ as well as the key „Generate test pulse“ in the Monitor of the rpm regulator there will be generated the rectangular signal for the requested actuator position. Using the keys plus and minus it can be corrected the strengthening, derivative as well as integrative component of the PID position regulator so that it can be achieved the best rectangular response of the position actuator.
- Disengagement the key „Generate test pulse“
- Setting of parameters „Pos1“, „Pos2“ a „Pos3“ to the of 100%, so that during the PID setting only one PID-set can assert itself.
- Engine start and its running on nominal rpm
- PID parameter setting on the rpm-regulator. After having pressed the key „RPM…“ as well as the key „Generate test pulse“ in the Monitor of the rpm regulator there will be generated the rectangular signal for the requested rpm. Using the keys plus and minus it can be corrected the strengthening, derivative as well as integrative component of the PID rpm-regulator so that it can be achieved the best rectangular response of the rpm size.
- Disengagement the key „Generate test pulse“

10.4 Regulator state diagram



11. Modifications of the SW CU

SW	Date	Change