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 the Electronical Ignition Circuit

UIS (GEIS1, GEIS2, TMCI2)

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version SW: V 1.20

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1. Purpose of the Equipment

The circuit of the electronic ignition (hereinafter only ignition) is intended to control the ignition of the twin- up to eight-cylinder combustion engines. The ignition can be governed optionally either with one or two sensors, the number of cogs of the gear ring can be selected irrespective the number of engine cylinders..

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
c) Proper parameter setting
d) Observance of the operating temperature in surroundings within the range of 0 up to 60°

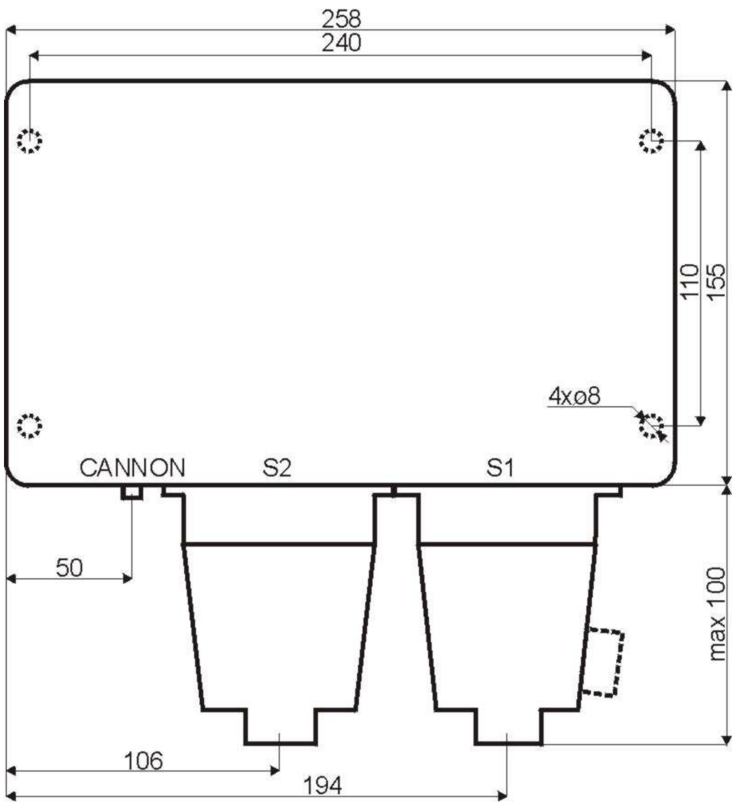
3. Mechanical Design

The ignition is produced in two variations of mechanical design TMCI2,UIS (alu-box A130 as TMCI1) and GEIS1,GEIS2 (alu-box with logo TEDOM):

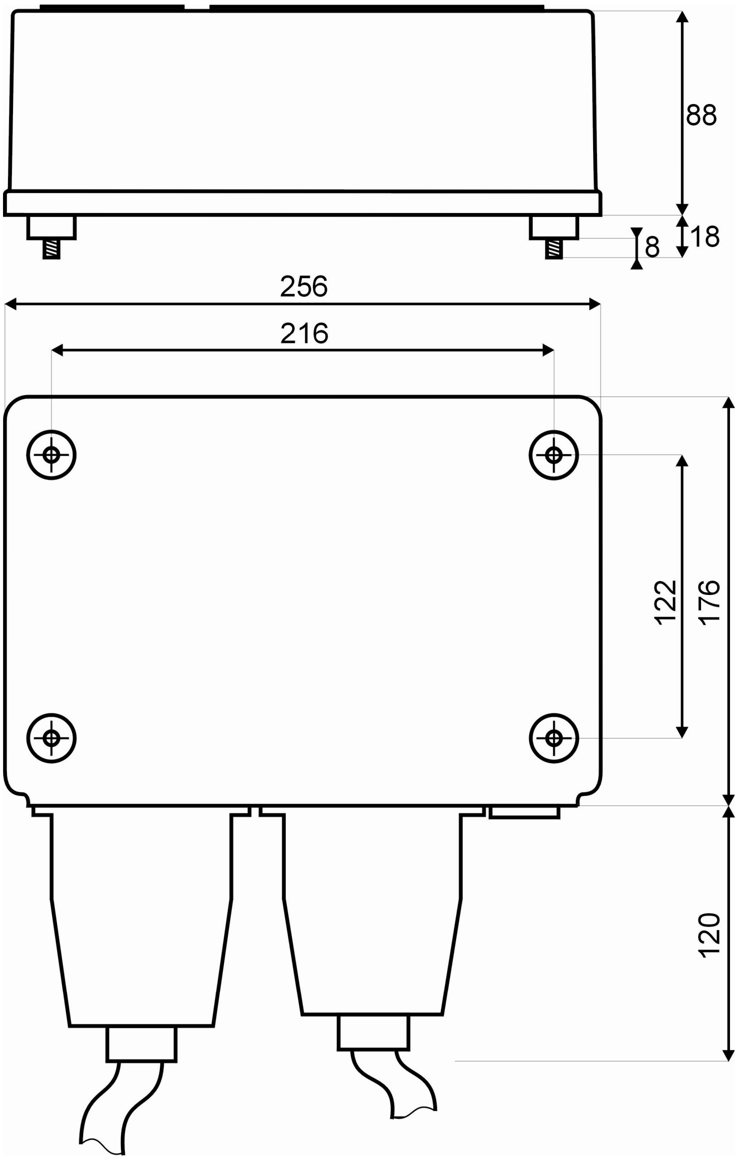
Type	Dimensions	Distance of mounting fixtures	Anchorages
TMCI2,UIS	258x155x92mm	110x240mm	4x thread 8mm
GEIS1,GEIS2	256x176x88mm	122x216mm	4x stud 5mm

Lateral face includes 2 connectors type Amphenol for connection of coils and signals as well as connectors CANNON for communication (connector position see fig.)

Design TMCI2, UIS:



Design GEIS1, GEIS2:



With design GEIS1(2) there are brought out except of the connector CANNON for communication interface RS-232 also two transit connectors CANNON for communication RS-485 and CAN (the both communication interfaces are connected to each of both these connectors. The variation TMCI2(UIS) includes for interface RS-485 and interface CAN but one connector.

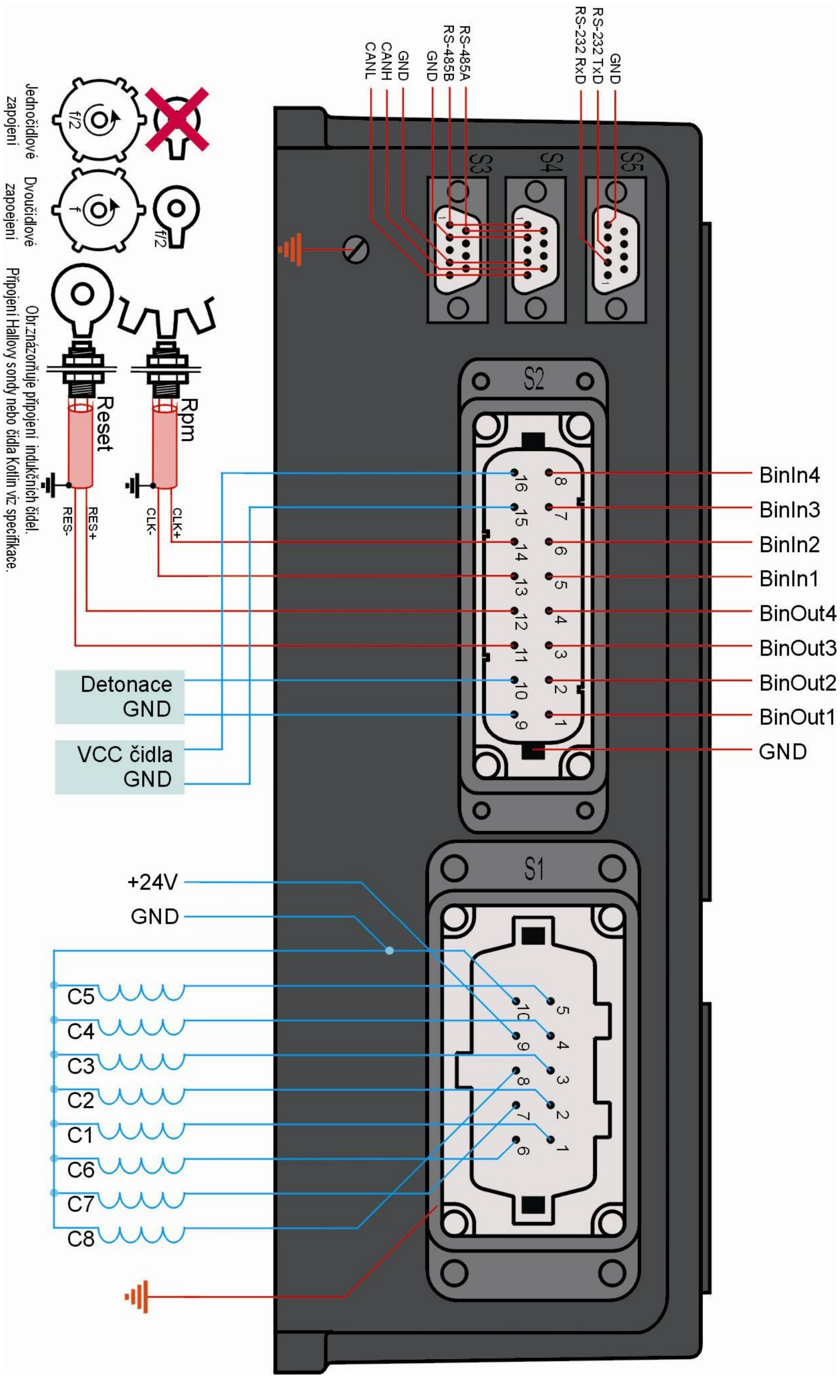
4. Electrical design

For connection of the ignition inputs and outputs are used two connectors of type Amphenol S1 (power connector – supply and outputs for coils, chassis grounding) and connector S2 (input signals, logical inputs and outputs). The connection corresponds to the ignition version TMCVI1+

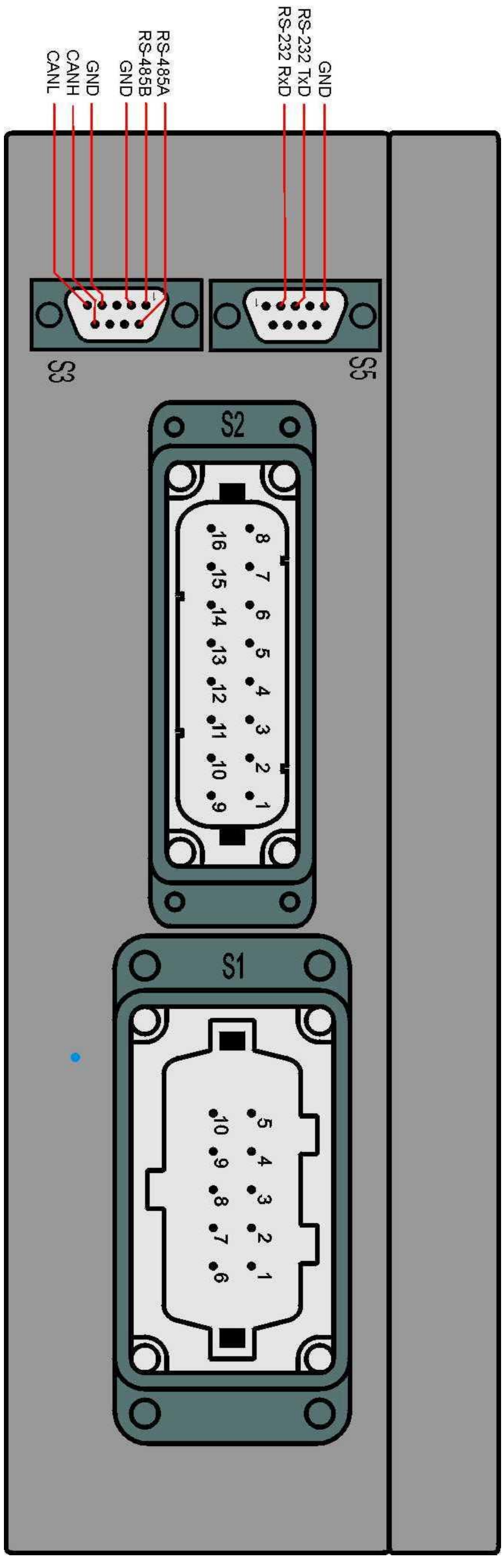
One CANNON connector is used for the connection of ignition to the PC by means of RS-232 (monitoring, setting, diagnostics) and the remaining two parallel interconnected connectors are containing communication interface RS-485 (which is linked e.g. to the engine management or ŘS UniGEN) and CAN.

Signal S1.PE as well as bold under the connectors CANNON (there is none with the implementation UIS) is used to connect the chassis grounding 2,5mm^2.

Connectors lay-out (implementation GEIS1, GEIS2):

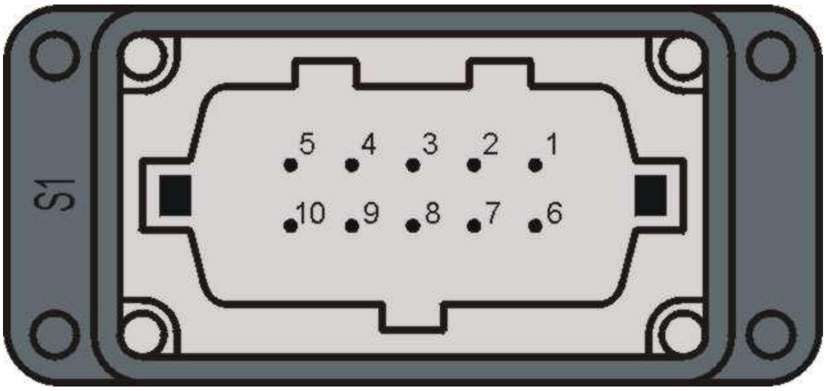


Connectors lay-out (implementation TMCI2,UIS):



The wiring of all connectors is in both variations identical. Nevertheless, in the implementation variation shown, there are in some other mechanical way situated connectors S3 as well as S5 and the connector S4 is missing (the connector S4 is connected parallel to S5 to obtain easier “transit” communication connection in the foregoing variation).

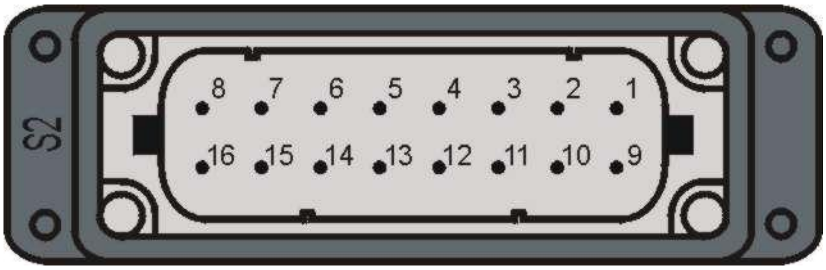
4.1 Connector S1



	Name	Signification	Working values
S1.PE	PE	Chassis grounding	
S1.1	C1	Switching output for spark coil	Uout=250-330V Imax= 40A/10us
S1.2	C2	Switching output for spark coil	
S1.3	C3	Switching output for spark coil	
S1.4	C4	Switching output for spark coil	
S1.5	C5	Switching output for spark coil	
S1.6	C6	Switching output for spark coil	
S1.7	C7	Switching output for spark coil	
S1.8	C8	Switching output for spark coil	
S1.9	+24V	Power supply	(18-28)V Icc=0.25A/24V idle Icc=1.25A/24V with 8 Zyl./1500rpm
S1.10	GND		

The output voltage (and therefore the power supplied) at the coil inputs is given with a parameter and in the following it is possible to rectify it in user way.

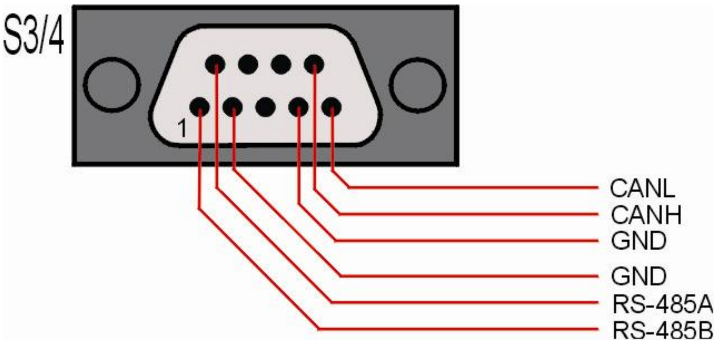
4.2 Connector S2



	Name	Signification	Working values
S2. GND	GNDD	Common ground for binary inputs as well as outputs	
S2.1	BinOut1	Program-configurable binary outputs	The outputs are implemented using switch-transistors switching against the ground. With the output-active; the output transistor is engaged. The max. voltage to be switched amounts up to 80V; the max. current 50mA (max. 100mA).
S2.2	BinOut2		
S2.3	BinOut3		
S2.4	BinOut4		
S2.5	BinIn1	Program-configurable binary inputs	Activating of binary inputs occurs when short-circuiting the relevant terminal against the ground.
S2.6	BinIn2		
S2.7	BinIn3		
S2.8	BinIn4		
S2.9	GND	Connecting of detonation sensor	
S2.10	DET		
S2.11	RES-	Differential input of the reset sensor, RES+ can be used as an input of sensor with an open collector.	Voltage ~(1-30V) Input impedance 1.5kohm
S2.12	RES+		
S2.13	CLK-	Differential input of the crank sensor, CLK+ can be used as an input of sensor with an open collector.	Voltage ~(1-30V) Input impedance 1.5kohm
S2.14	CLK+		
S2.15	GND	Supply voltage for sensors	Voltage optional (5/24)V I=20mA constant I=100mA in peaks
S2.16	+5/24V		

4.3 Connectors S3 and S4 (RS-485, CAN)

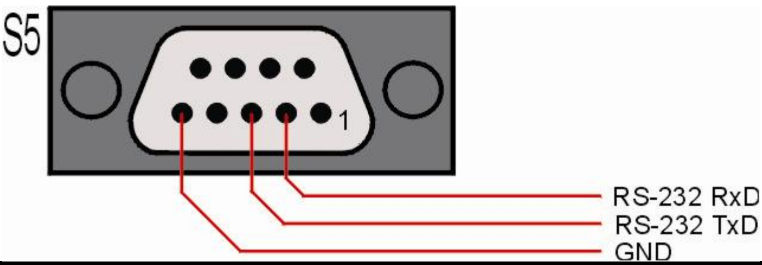
Connectors S3 and S4 include a communication interface RS-485 (interconnection with the engine-management or CU UniGEN) and CAN. Connectors S3 a S4 are interconnected parallel (transit interconnection of more devices communicating via CAN or RS-485



	Name	Signification	Working values
S3/4.1	485B	communication interface RS-485	Levels compatible with RS-485 and CAN
S3/4.2	GND		
S3/4.3	NC		
S3/4.4	GND	communication interface CAN	
S3/4.5	CANL		
S3/4.6	485A	communication interface RS-485	
S3/4.7	NC		
S3/4.8	NC		
S3/4.9	CANH	communication interface CAN	

4.4 Connector S5 (RS-232 for connecting to PC)

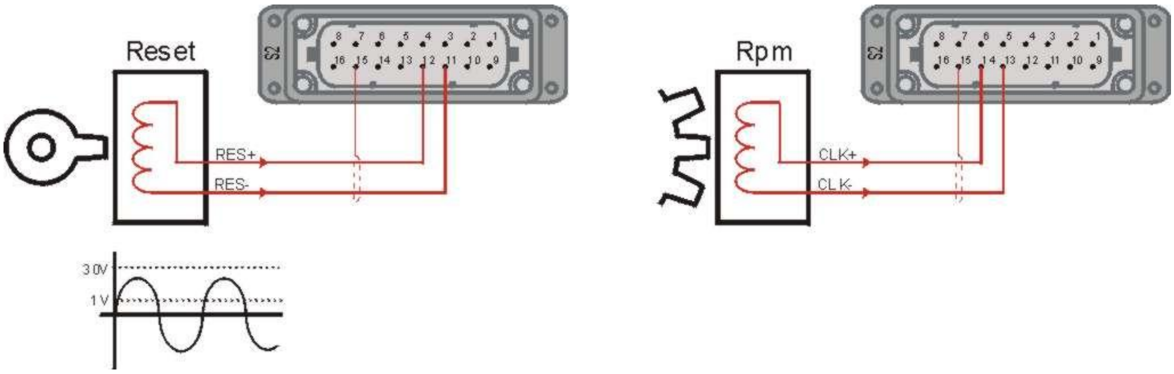
Communication TMCI2 with PC (service program Manager) is implemented through medium of serial interface RS-232 (9-pin connector CANNON). To realize the connection to PC it is necessary to use a crossed cable (2-3, 3-2, 5-5).



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

4.5 Wiring when using induction sensor

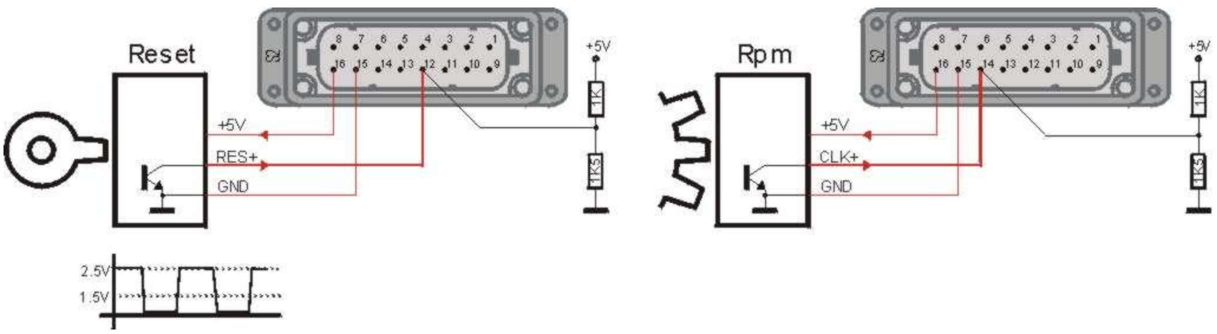
Wiring for the reset and rpm induction sensor (in case that only one sensor connected, the reset signal is not utilized).



If in case of double sensor wiring one of the sensors is an induction sensor, the type of another one can be optional (either induction or Hall probe or Kotlin).

4.6 Wiring when using the Hall probe

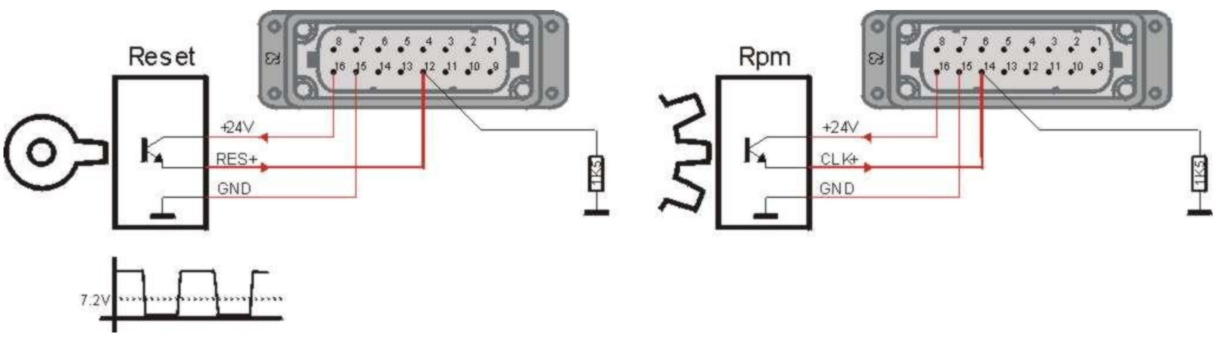
Wiring of Hall probe for reset and rpm (in case that only one sensor connected, the reset signal is not utilized):



If in case of a double sensor wiring one of the sensors is the Hall probe, it is not possible that the type of the other sensor is Kotlin (allowed are only Hall probe or induction sensor). The resistors in the picture define the inner input wiring in ignition (do not connect).

4.7 Wiring when using the Kotlin-sensor

Wiring of the Kotlin sensor for reset and rpm (in case that only one sensor connected, the reset signal is not utilized):

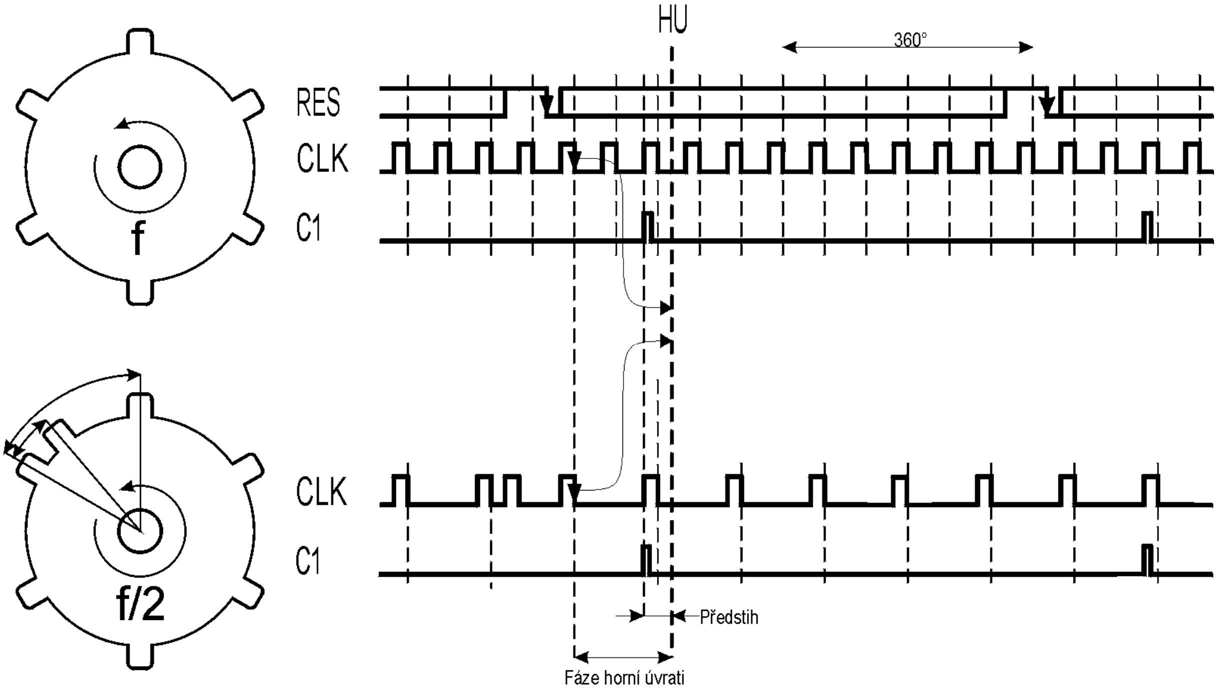


If in case of a double sensor wiring the Kotlin sensor is used, it is not possible that the type of the other sensor is the Hall probe (allowed are only Kotlin or induction sensor). The resistor in the picture defines the inner input wiring in ignition (do not connect).

5. Function description

5.1 Control signals RES and CLK

Signal generating for coils is given by input signals RES and CLK as well as by setting ignition parameters.



In case of double sensor scanning (signals RES+CLK) there is the initial point for the burning cycle the first descending edge of the signal CLK that follows after the descending edge of the signal RES. The cogwheel is in this case directly on the engine shaft and it runs with the same rpm as the engine.

In case of single sensor scanning (signal CLK only) there is the initial point the descending edge of the signal CLK that follows after the CLK impulses, that are having the distance of each other less than ½ of the CLK signal period. The cogwheel is rotating in this case with the half of the engine rpm.

The top dead centre of the first cylinder is given by the basic parameter *"the Top Dead Centre Phase".* The said parameter (angle) can be "automatically" adjusted by means of a zoetrope and a service program.

Further cylinders burn gradually angle by angle (angle=720°) /number of cylinders regardless the number of gear ring cogs. Signal CLK (CLK signal descending edge) is used during the cycle for the correction of the actual engine rpm value only, it means, it rectifies the actual angle during the dynamic changeovers. That is why, the cog number of the gear ring used is not dependend on the number of engine cylinders.

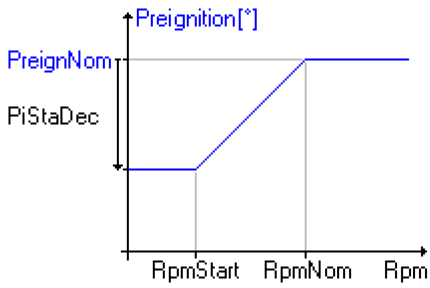
Using parameters it can be further set the sequence for burning of coils (input wiring). The first cylinder gets burnt by output Coil A, the sequent one gets burnt by coil B …, where A,B,….=<1..8>.

5.2 Pre-ignition control

The basic pre-ignition is given by setting a parameter. This initial pre-ignition value can be lowered during the operation (by virtue of binary input, knocking, number of rpm)

5.2.1 Pre-ignition reduction due to rpm

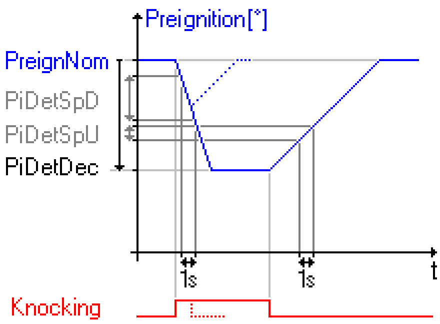
The ignition burns using basic pre-ignition at the rpm given by the parameter *"Nominal rpm"* or a higher rpm. If the rpm is lower than the nominal one, the pre-ignition will be, with the descending rpm, linear decreasing up to the value *"pre-ignition start decrease"* the said decrease is given by parameter *"rpm Start". If* the rpm is lower than that of the starting one, there is no pre-ignition decrease any more.



5.2.2 Pre-ignition decrease because of knocking

Should the ignition detect knocking/=detonations, the pre-ignition decreases step by step with a defined speed "*Correction speed defined for knocking"* down up to the max.value *"Max. decrease when knocking"*.

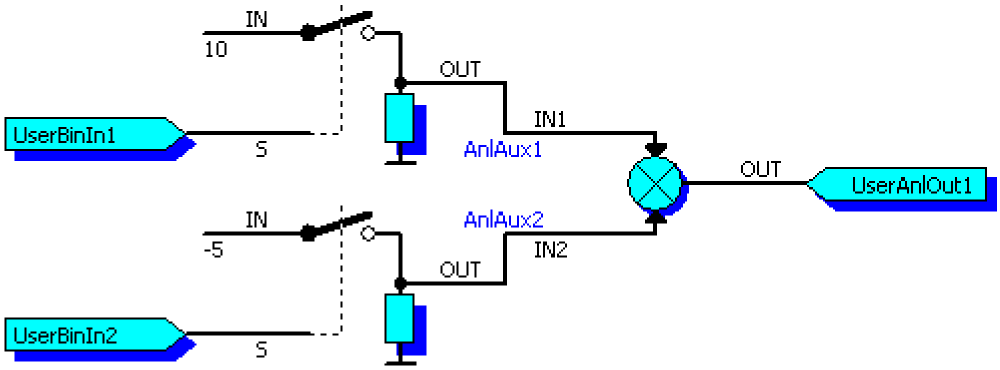
If there is no knocking any more and pre-ignition has been reduced for the reason of knocking, *"The speed for return after knocking"* will increase it with a defined speed up to its original value.



5.2.3 User´s control over ignition

Another way how to control the ignition can be used via the logical input "Ext Preign Cor" within the range of 0÷PreignNom+12,8°. If there is also a pre-ignition decrease because of knocking detection, the demand for pre-ignition reduction will not be summarized (there will be taken into account only the higher demand for lowering). External demand for pre-ignition correction "Ext Preign Cor" gets scored.
Should the pre-ignition value be corrected by Engine-management (control unit), it is necessary, that the logical input "Ext Preign Cor" is mapped to signal "MM-Preign Cor" ("CU-Preign Cor").

The pre-ignition can also be corrected by user (e.g. based on binary inputs). Control algorithm can be created using the functions and the signal "Ext Preign Cor", and then it has to be mapped to the input of the said functions.



If, e.g., the signal "Ext Preign Cor" will be mapped to "UserAnlOut1" (see the fig. Above), there will occur the pre-ignition increase by 10° provided the "UserBinIn1" is acting and pre-ignition decrease by 5° provided the signal "UserBinIn2" is acting.

5.3 Power control

It is possible to set (by parameter) the output power for coils and to control it also during operation by user algorithm, likewise the pre-ignition.

Selecting the parameter “Power of inputs” and setting it to value “Unified for all” the power will be the same on all outputs and it will be given by size of parameter “Energy C1”. If selected “Optional for all” there can be defined a different power value for each of the outputs individually using the parameters EnergyC1÷EnergyC8 Disregarding the setting of the parameter “Diag Order” there is always defined the power for physical output irrespective the sequence of burning.

The power of outputs (regardless the setting of the above mentioned parameter) can be also corrected using the logical analogue input (Ex Energy Cor). The said correction can be done only with the mask selected cylinders (MaskCyl1÷MaskCyl8). In compliance with the setting of “DiagOrder”-parameter the mask can define either the ignition physical output or the cylinder sequence according to burning. If there is e.g. "Servis/DiagOrder” =”According to cylinder burning” and the setting of the burning sequence is 1-5-3-6-2-4 (the first in the sequence burns the output C1, 2.C5, 3.C3 ...), the mask "MaskCyl2" will admit the change of power for cylinder connected to output C5 (S1-5) (the 2nd burning in the sequence). If there is "Servis/DiagOrder"="According to ignition output ", the mask "MaskCyl2" will admit the change of power for the cylinder connected to output C2 (S1-2).

Should the energy value be corrected by Engine Management (CU), the logical input „Ext Energy Cor“ has to be mapped to signal „MM-Energy Cor“ („CU-Energy Cor“) and signals „MaskCyl1÷8“ must be mapped to signals „MM-MaskCyl1÷8“ („CU-MaskCyl1÷8“).

6. Configuration

Ignition configuring vests in mapping (relation between logical signals and physical inputs/outputs) of functions (configurable logic) and the parameter setting.

Individual settings for mapping of functions as well as parameters can be saved or loaded into or out of a file (a binary or in case for parameter also a text file).

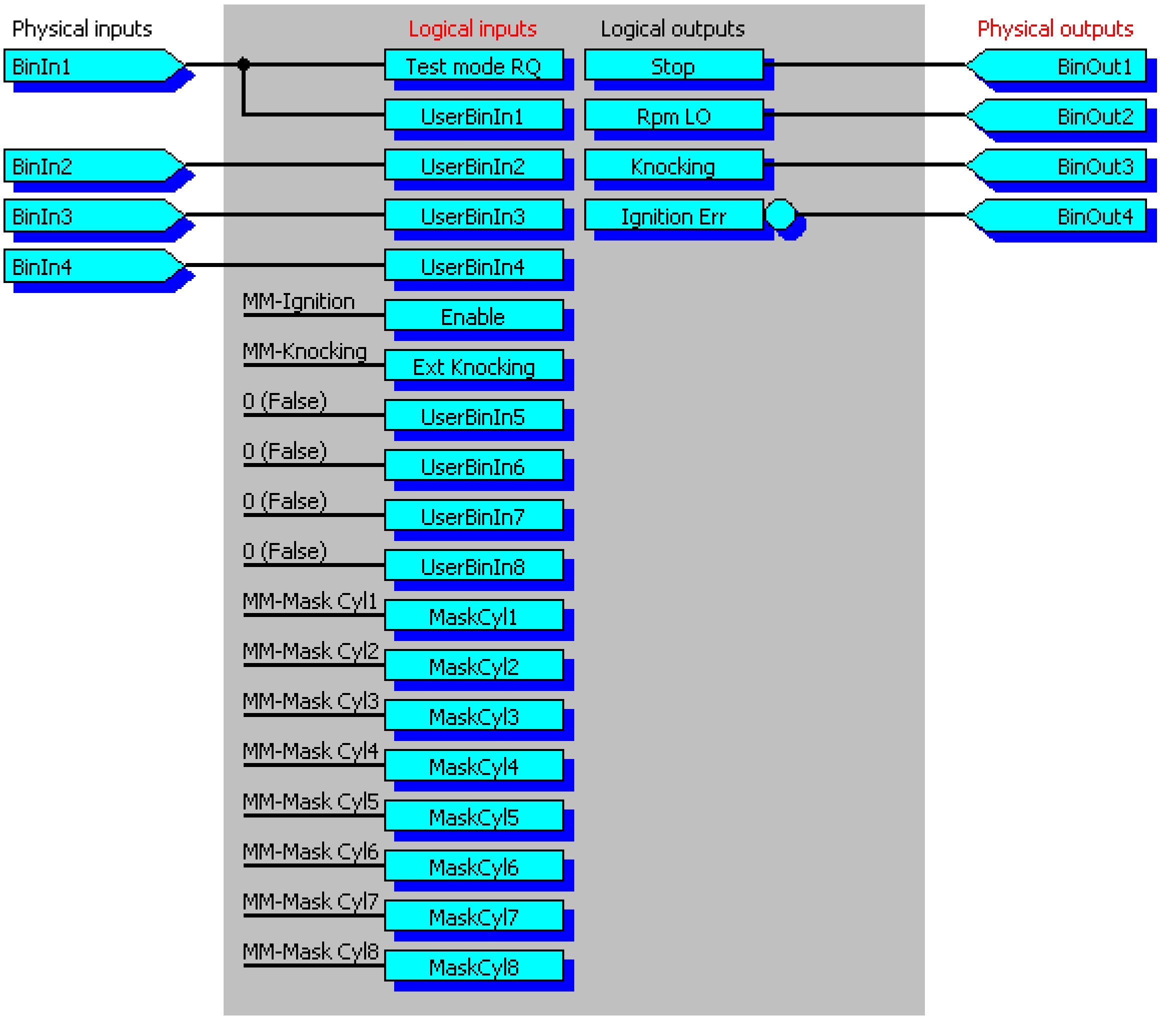
The overall ignition configuration (parameters, mapping, functions) can be saved (“Servis/Create configuration backup”) or restored (“Servis/Restore configuration backup”) into if you like one and only file. In case of the configuration restoring it is possible for restoring to select only the demanded blocks (implicitly only calibration parameters remain unselected, which can be different for various ignitions).

6.1 Mapping

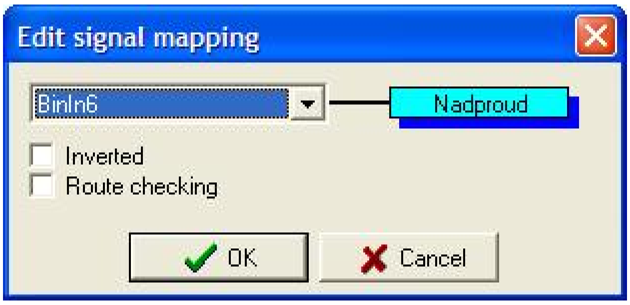
The meaning of physical inputs as well as outputs is configurable. Ignition algorithm uses logical inputs as well as outputs, and by means of mapping there is defined the relation between logical as well as physical inputs and outputs. The assigning a physical input to a logical input (a logical output to physical output) will be hereinafter called mapping.

In the bottom part of the window for Mapping there are buttons to be used for selection, whether we want to assign logical, analogical or all signals.

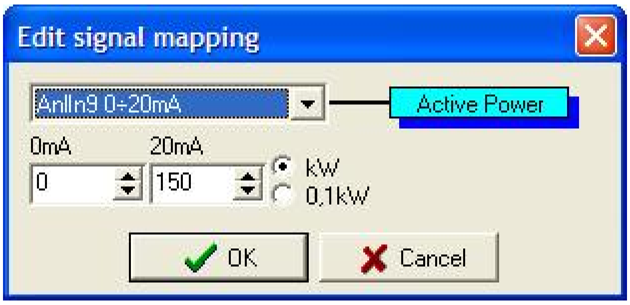
Using the only one physical input can control a few of logical inputs, logical signals can be constantly deactivated with setting to 0 (False) as well as constantly activated with setting to 1 (True). Analogical inputs can be left unconnected (NC).



Having clicked on the name of the logical input (Logical inputs) or physical output (Physical outputs) in the Mapping window (I/O Mapp) of the service program Manager there will appear the window for selection where the signal in question is to be connected.



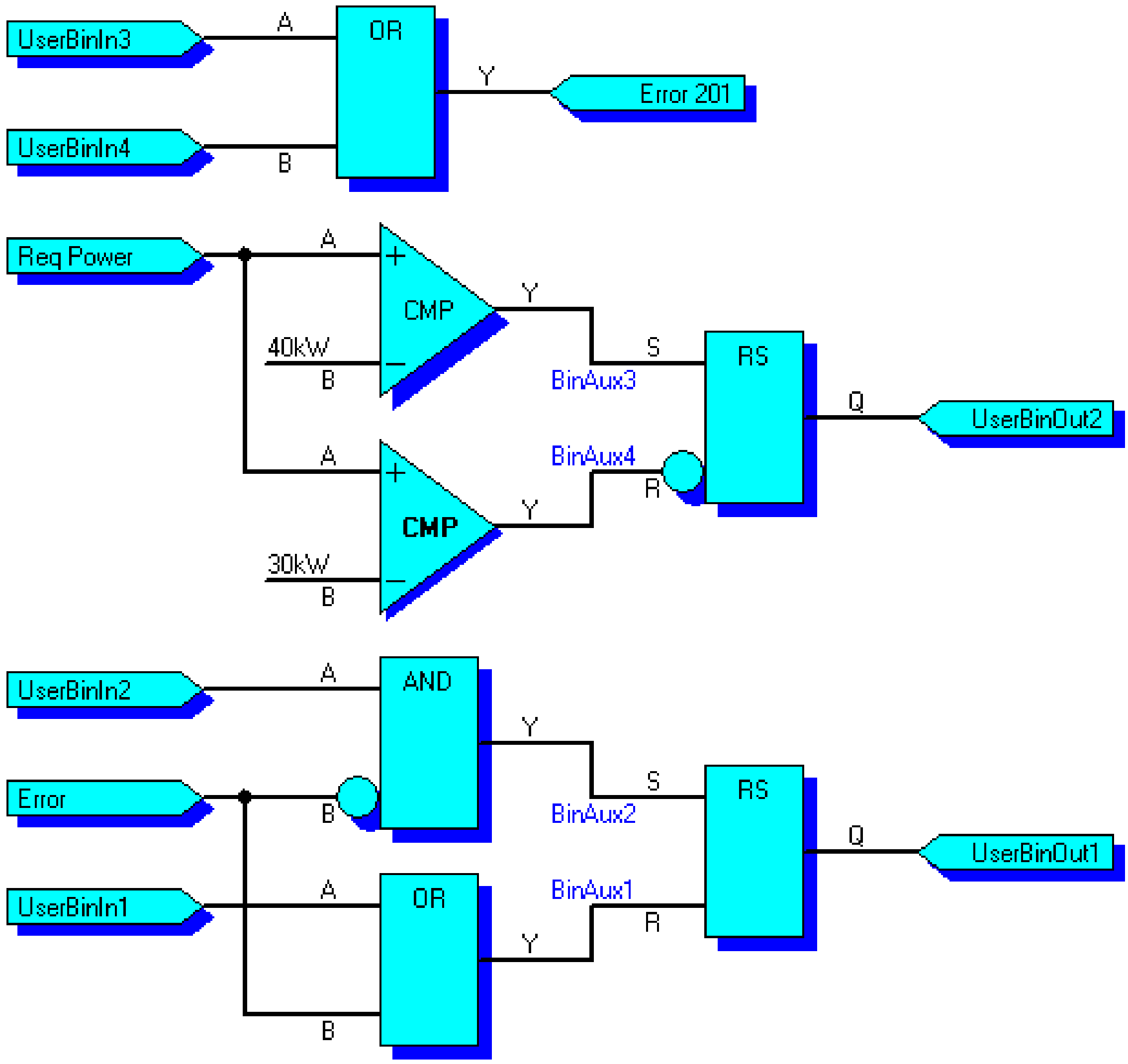
It is possible to connect the signal also nverted (Inverted) and if it is available for HW it is possible at input to activate the route checking (Route checking).



With logical analogical inputs the limits of the magnitude (what a value corresponds to the min. as well as max. value of the physical input) can be defined in the window for connection.

6.2 Functions

Using functions another signals can be created from logical inputs and outputs. The said signals can be used for control over the TMCI algorithm (governing of other logical inputs) or they can be mapped to physical outputs.



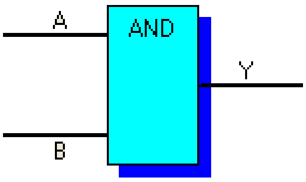
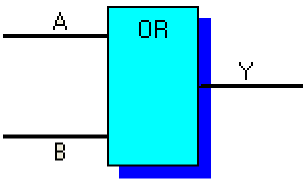
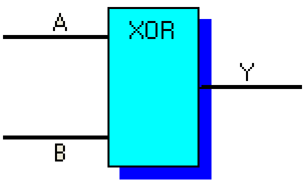
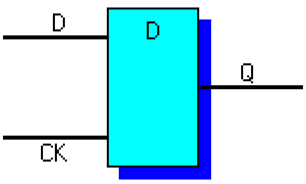
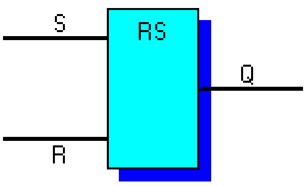
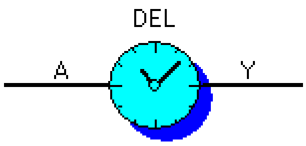
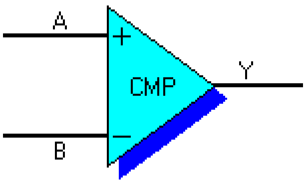
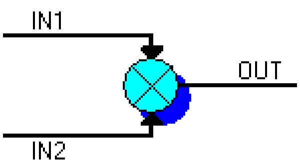
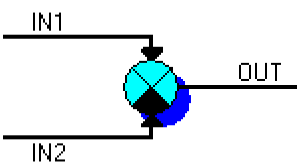
All logical inputs and output can be connected to the inputs of function blocks. Logical outputs and user disorders can be connected to the outputs of the blocks.

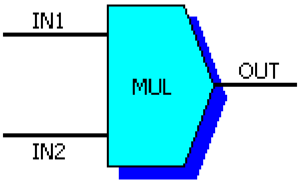
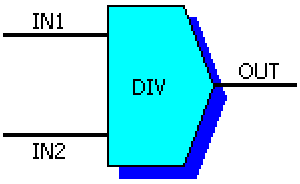
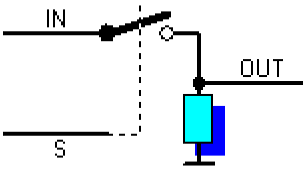
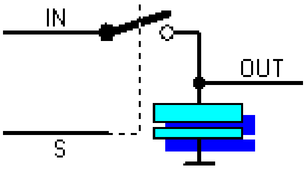
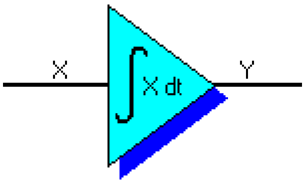
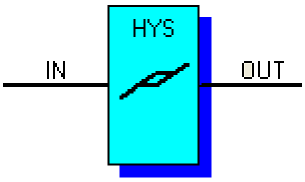
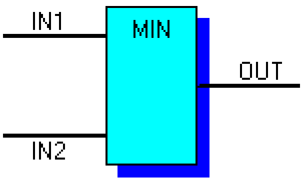
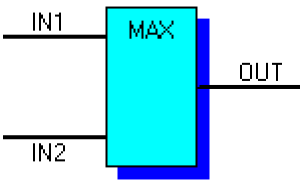
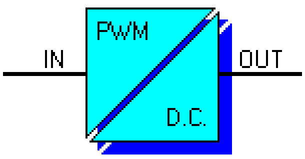
Should the output of one function block only enter to another one (without using it for physical output, it can be taken advantage, after block interconnection, of subsidiary signals (BinAuxN, AnlAuxN). Using this subsidiary magnitudes the relevant blocks will be also depicted as connected.

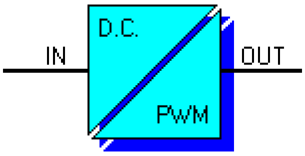
After having altered the function structure (addition of a block, alteration of an input or output signal) it is necessary, for the proper function, to re-start the CU (there will occur the initial blocks start-up). Should the reset fail, the initial value, of e.g. integrators or time-lag as well as the state of RS flip-flops, can be accidental only.

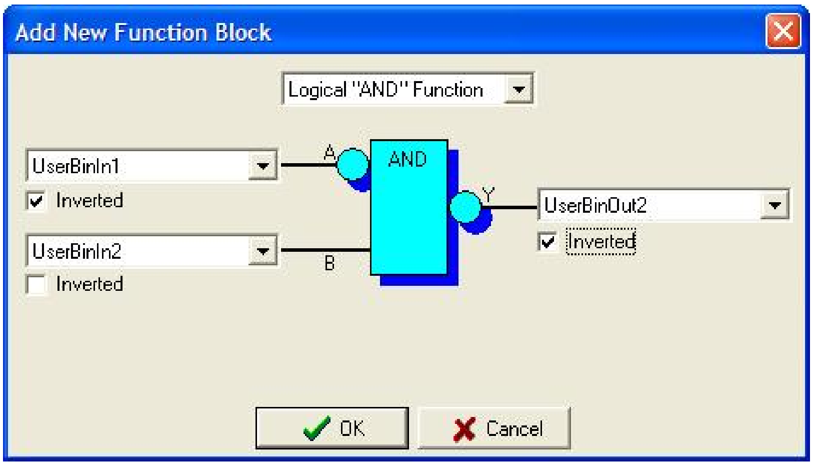
The arithmetic of “analogical” functions is 16-bit and it calculates with one decimal position. The outcome of analogical operations must not then exceed neither 3276,7 nor be minor than -3276,8.

6.2.1 Overview of available function blocks

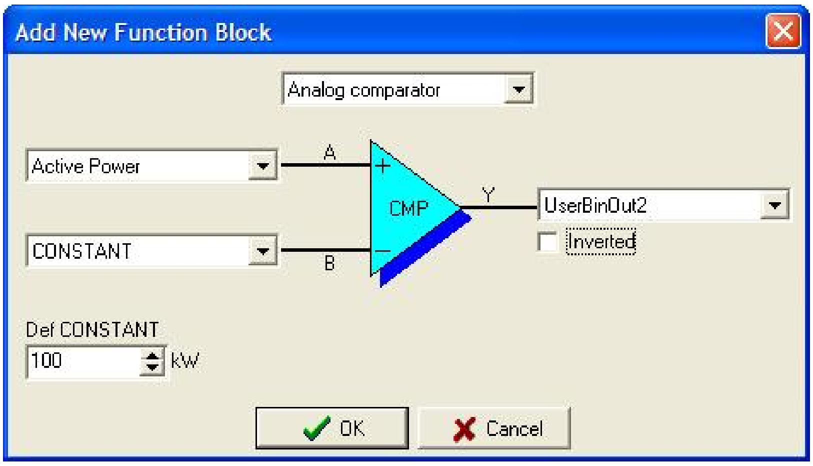
Logical „AND“ function		Logical product of input signals Y = 1 provided A=1 and at the same time B=1 Y = 0 provided A=0 or B=0
Logical „OR“ function		Logical sum of input signals Y = 1 provided A=1 or B=1 Y = 0 provided A=0 and at the same time B=0
Logical „XOR“ function		Logical exclusive sum of input signals Y = 1 provided A=B Y = 0 provided A<>B
Flip-flop circuit „D“		Flip-flop circuit type D Q = D provided CK=1 Q = Q_{t-1} provided CK=0 On reset MM is state KO zerofilld
Flip-flop circuit „RS“		Flip-flop circuit type RS Q = 1 provided S=1 Q = 0 provided R=1 Q = Q_{t-1} provided S=0 a R=0 On reset MM is state KO zerofilld
Signal Delay		It delays the starting edge of logical signal by the time defined. On reset MM Y=A regardless the delay set
Analog Comparator		Analogical comparator Y = 1 provided A>=B Y = 0 provided A<B
Analog Addition		Sum of analogical signals OUT = IN1 + IN2
Analog Subtraction		Difference of analogical signals OUT = IN1 - IN2

Analog multiplicat.		Multiplication of analogical signals OUT = IN1 * IN2
Analog division		Division of analogical signals OUT = IN1 / IN2
Analog Switch		Analogical switch OUT = IN provided S=1 OUT = 0 provided S=0
Analog Memory		Analogical memory (equivalent to flip-flop circuit type „D“ in analogical form) OUT = IN provided S=1 OUT = OUT $_{t-1}$ provided S=0 On reset MM the output gets reseted.
Analog Integrator		Analogical integrator, the input signal gets timely integrated at the function output- On CU reset the integrator output gets reseted.
Hysteresis		Hysteresis OUT = IN+Hys provided OUT>IN+Hys OUT = IN-Hys provided OUT<IN-Hys Where Hys is a selectable hysteresis size.
Minor of two		A minimum from both inputs OUT = IN1 provided IN1<=IN2 OUT = IN2 provided IN1>IN2
Major of two		A maximum from both inputs OUT = IN1 provided IN1>=IN2 OUT = IN2 provided IN1<IN2
PWM to D.C. convertor		It converts the binary signal to an analogical value 0÷100% corresponding to the signal repeating on input . The input signal period has to be minor than 4s, measuring accuracy lies in ms.

D.C. to PWM convertor		It converts the input analogical value 0÷100% to the output binary signal with an adequate repeating 2s. The period of the output binary signal embraces 2s.



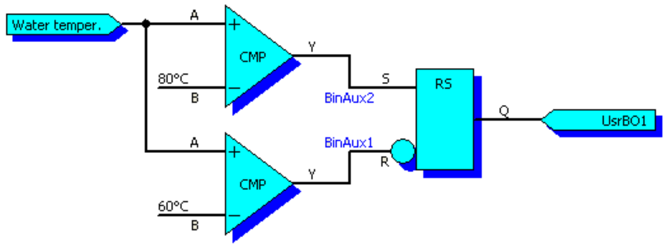
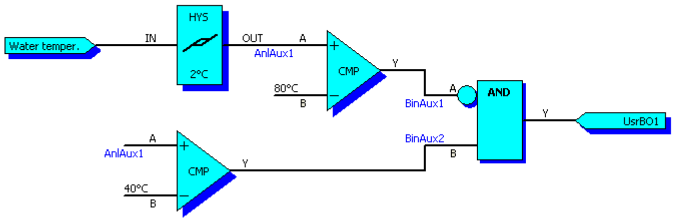
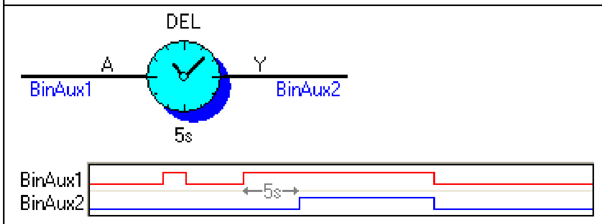
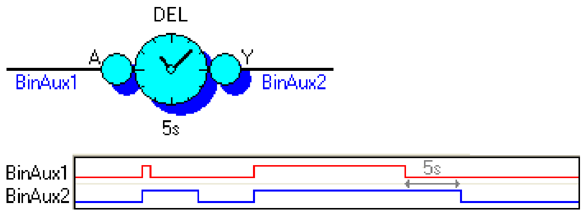
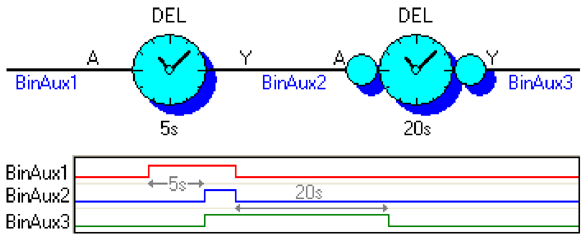
All logical signals (the block inputs as well as outputs) can be configured as direct or inverted (from AND can be therefore easily created NAND and so on).



To one of the analogical blocks inputs can be connected a signal with a constant level (comparing of an analogical magnitude to the constant, adding the constant) and so on. The constant can be either a direct defined magnitude or one of the parameters.

6.2.2 Examples for using function blocks

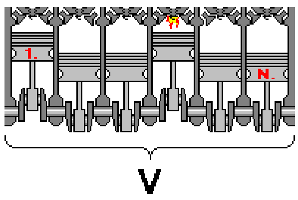
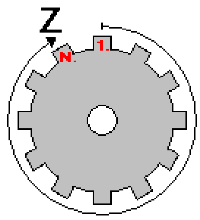
The function description is general only. The names of magnitudes as well as function applications need not correspond to the ignition.

	Based on fusion of two comparators and the RS-flip-flop circuit, there can be created, via hysteresis, a comparator. The input gets activated via increase of input temperature (in this case) above 80°C and it is deactivated after temperature decrease under 60°C.
	In the case shown, the output will be activated in the defined “window” for the input temperature only, quasi only in case, where the temperature is higher than cca 40°C and lower than cca 80°C. Hysteresis block will insure, that the input does not oscillate in case that the temperature fluctuates within the range of decisive levels.
	The delay with the direct input as well as output puts back the starting edge of output signal compared to the input one. It can be used for filter out of pulses shorter than delay or for putting behind the input signal response
	The delay with the inverted input as well as output puts back the descending edge of output signal compared to the input one (monostable flip-flop circuit). It can be used e.g. for extension of the input signal response.
	Using the non-inverted as well as inverted delay you can control the time delay of the ascending as well as descending edge. You can therefore define e.g. the delay of some protection as well as its persistency after the reason has gone off.

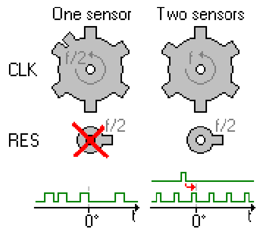
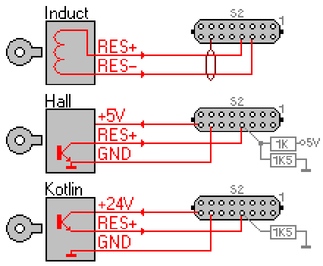
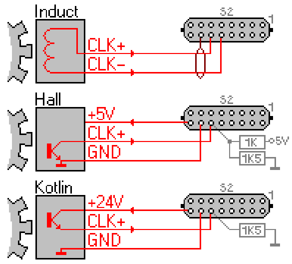
6.3 Adjustable parameters

There are presented all ignition parameters in this section. Some of them are available directly from the key-board CU UniGEN, to set the other parameters you must use the service program Manager.

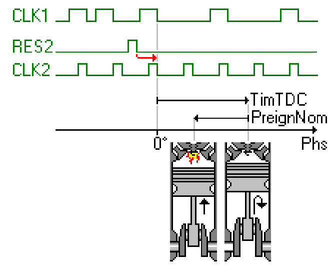
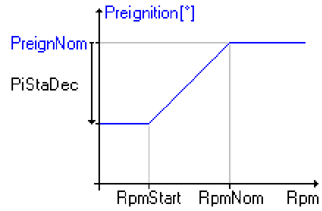
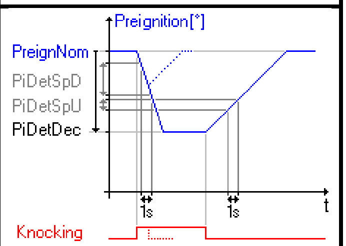
6.3.1 Engine

Name	Description	Min/ Max	Step	
V_TI	Number of cylinders	4/ 8	1	
Z_TI	Cog number Number of gear ring cogs (marks) for measuring the rpm and engine-phase. Using one sensor connection the gear ring rotates with only a half rpm compared to the engine rpm and the gear ring involves in this case also a “synchronizing” cog (situated next to another cog). This synchronizing cog is NOT INCLUDED into the adjusted (=set) cog number. Using the double sensor connection the gear ring rotates with the same speed as the engine itself and all the cogs are distributed equally.	2/ 255	1	

6.3.2 Sensors

Name	Type	Possible selections
SensType	Sensing of rpm and phase If there is one sensor wiring with the signal detected on the gear ring rotating with only a half of rpm compared to the engine rpm, the said signal gets brought to the CLK input only. The engine phase (angle RST) gets defined by the cog “additional”, that comes within less than a half of the period time of the foregoing signal. In case of the two sensor connection, there is the to the CLK brought signal detected by means of the gear ring rotating with the same speed as that of the engine. The engine phase (angle RST) gets defined by RES-signal, that is given by detecting one mark every two engine revolutions.	• Only Clk (one sensor) • Clk+Res (two sensors) 
SensRes	Reset sensor Sensor RES is used for the engine phase synchronising with two sensor connection. Sensor RES is not used in case of a one-sensor connection. If there is, in two sensor connection, one of the sensors inductive, the type of the other sensor arbitrary (inductive, Hall probe, Kotlin). Hall probe used for one sensor can not be combined with another sensor Kotlin (so if there is e.g. one of the sensors Kotlin, the other can be Kotlin too or inductive). The resistors, shown in figures, define the wiring according to the input-type in ignition (don´t connect).	• Induction sensor • Hall probe • Kotlin 
SensClk	Cog sensor Sensor CLK is used for rpm measuring as well as definition of the burning angle. If there is, in two sensor connection, one of the sensors inductive, the type of the other sensor arbitrary (inductive, Hall probe, Kotlin). Hall probe used for one sensor can not be combined with another sensor Kotlin (so if there is e.g. one of the sensors Kotlin, the other can be Kotlin too or inductive). The resistors, shown in figures, define the wiring according to the input-type in ignition (don´t connect).	• Induction sensor • Hall probe • Kotlin 

6.3.3 Pre-ignition

Name	Description	Min/ Max	Step	
TimTDC	**TDC (=Top Dead Center) phase** Parameter "TimTDC" defines the angle between the initial point for burning (the 1st descending edge of the signal CLK after reset) and the TDC of the 1st cylinder.	0/ 720°	0,1°	
PreignNom	**Nominal pre-ignition** Parameter "PreignNom" defines nominal pre-ignition (it means pre-ignition if there is no pre-ignition reducing factor active), quasi the angle between burning and TDC of the cylinder. Nominal pre-ignition can be external rectified using the signal "Ext Preign Cor" within the range of 0÷PreignNom+12,8°	5/ 50°	0,1°	
PiStaDec	**Starting decrease** If the rpm is minor than "RpmStart" the pre-ignition value is decreased from the nominal value "PreignNom" by the value given by the said parameter. Due to increasing rpm the value of pre-ignition decrease is linear descending step by step and as soon as is reached "RpmNom" the decrease is equal to zero and the pre-ignition reaches its nominal value given by the parameter "PreignNom". Should, as a result of lower rpm, the pre-ignition would be reduced by more than 0.1° the logical output "Rpm LO" gets activated. Should the pre-ignition be decreased due to detection of knocking, the demand to reduce the pre-ignition will not be summarized (only the value of the higher demand will assert). External demand for pre-ignition correction ("Ex Preign Cor") gets added.	0/ 50°	1°	
PiDetDec	**Max. decrease at knocking** The ignition detects knocking by means of sensors of its own or based on external binary information. If the pre-ignition is reduced also due to the lower rpm, the demand for power decrease will not be summarized (only the value of the higher demand for reduction will assert). External demand for pre-ignition correction ("Ex Preign Cor") gets added.	0/ 50°	1°	
PiDetSpD	**Correction speed at knocking** The ignition detects knocking by means of sensors of its own or based on external binary information. If the pre-ignition is reduced also due to the lower rpm, the demand for power decrease will not be summarized (only the value of the higher demand for reduction will assert). External demand for pre-ignition correction ("Ex Preign Cor") gets added.	0/ 20°/s	1°/s	
PiDetSpU	**Return speed after knocking** The ignition detects knocking by means of sensors of its own or based on external binary information. If the pre-ignition is reduced also due to the lower rpm, the demand for power decrease will not be summarized (only the value of the higher demand for reduction will assert). External demand for pre-ignition correction ("Ex Preign Cor") gets added.	0/ 20°/s	1°/s	

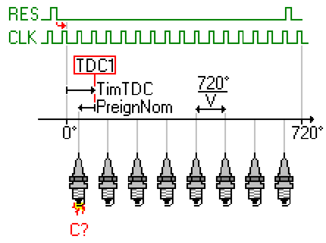
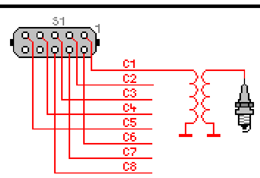
6.3.4 Rpm

Name	Description	Min/ Max	Step	
RpmStart	Starting rpm	100/ 2500 rp/min	1 Rpm/ min.	
RpmNom	Nominal rpm	1000/ 3500 rp/min	1 Rpm/ min.	

6.3.5 Knocking (Detonations)

Name	Description	Min/ Max	Step	
		Possible options		
DetWinB_TI	Start of knocking window	10/ 70°	1°	
DetWinW_TI	Length of knocking window	10/ 40°	1°	
DetGainSel	Corrections of signal intensifying Parameter value uploading from ignition occurs only after the communication has been opened. Therefore the equipment has to be identified again to obtain the upgraded value of this parameter ("Connection / Open") or the parameter has to be depicted by means of the extended option "Up-load and Edit Parameters"	• Manually • Automatically		
DetGain_TI	Knocking signal intensifying	0/ 100%	1%	
DetLev_TI	Activating level of knocking Parameter value uploading from ignition occurs only after the communication has been opened. Therefore the equipment has to be identified again to obtain the upgraded value of this parameter ("Connection / Open") or the parameter has to be depicted by means of the extended option "Up-load and Edit Parameters"	1/ 100%	1%	

6.3.6 Burning

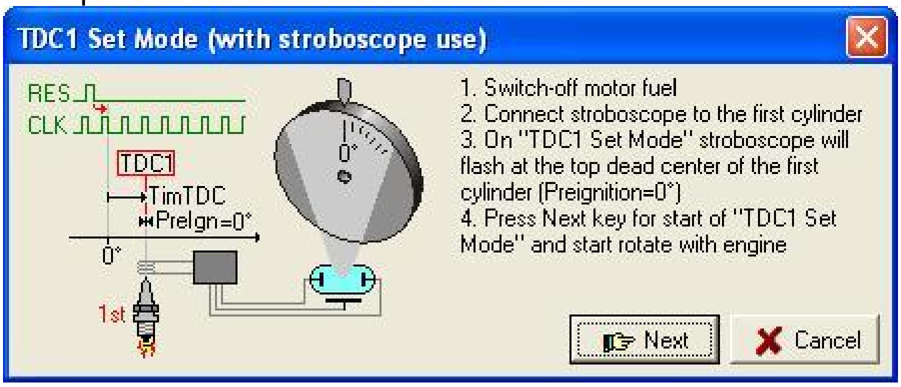
Name	Description	Min/ Max	Step	Possible options
Out1st ÷ Out8th	Output burning "in N-sequence" In case of cooperation with MM as well as UniCON the burning of this cylinder has to be set either to Cn or the parameter "DiagOrder" has to be set to "According to the cylinder burning". This is necessary to obtain compatibility concerning cylinder assignation (MM diagnoses the cylinders according to the burning sequence).			• C1 • C2 • C3 • C4 • C5 • C6 • C7 • C8 
CoilType	Type of the coil			• Strict evaluation • Standard • Benevolent evaluation • Burning ever all right
IgnErrLev	Limit for successful ignition	50/ 100%	1%	
IgnErrDel	Ignition failure delay	0/ 240s	1s	
EnergySel	Outputs power (=energy) Having selected "Unified for all" the energy on all outputs is equal and it is given by the size of the parameter Energy C1. Having selected "Optional for all" you can define a different energy value for each of the outputs individually using parameters C1÷EnergyC8. Regardless to setting the parameter "DiagOrder" the energy for physical output has to be defined no matter what is the sequence of its burning. Outputs energy (irrespective the setting of this parameter) can be also corrected using the logical analogical input (Ex Preign Cor). The said correction can be done only with the cylinders that were selected by mask (MaskCyl1÷MaskCyl8). In compliance with the setting of parameter "DiagOrder" the mask can determine either an physical output for ignition or the cylinder sequence according to its burning. If there is e.g. "Servis/DiagOrder"="According to the cylinder burning sequence" and the set burning sequence 1-5-3-6-2-4 (1^{st} in the sequence burns the output C1, 2.C5, 3.C3 ...), the mask "MaskCyl2" allows energy alteration for the cylinder connected to C5 (S1-5) (it is burning as 2^{nd} in the sequence). Provided "Servis/DiagOrder"= "According to the burning output ", The mask "MaskCyl2" shall allow energy alteration for the cylinder connected to C2 output (S1-2).			• Unified for all • Optional for all
EnergyC1 ÷ EnergyC8	Energy of the CN output	0/ 100%	1%	

6.3.7 Service

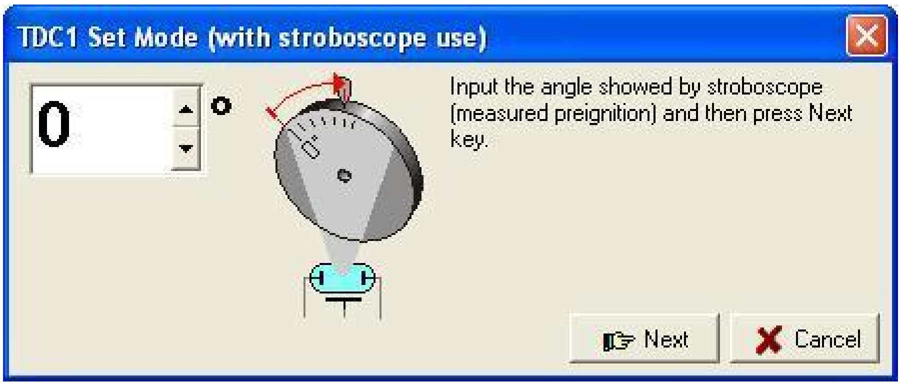
Name	Description	Min/ Max	Step	
		Possible options		
Address_TI	Address TMCI Parameter value uploading from ignition occurs only after the communication has been opened. Therefore the equipment has to be identified again to obtain the upgraded value of this parameter ("Connection / Open") or the parameter has to be depicted by means of the extended option "Up-load and Edit Parameters"	0/ 15	1	
CntRes_TI	Reset counter Parameter value uploading from ignition occurs only after the communication has been opened. Therefore the equipment has to be identified again to obtain the upgraded value of this parameter ("Connection / Open") or the parameter has to be depicted by means of the extended option "Up-load and Edit Parameters"	0/ 255	1	
DiagOrder	Diagnostika pálení a detonací Due to the fact that there is possibility to define the burning sequence of the burning outputs it is also possible to use this parameter for defining the way, how to show the cylinders in the monitor diagnostics: - Dle pořadí pálení (Ignite order), pořadí válců odpovídá pořadí ve kterém pálí -Accordin to the burning sequence (Ignite order), the cylinder sequence corresponds to the sequence of the ignition outputs. If there is e.g. the burning/=ignite sequence(. 1-2-3-4-5-6 (as 1^{st} in sequence burns the output C1, 2^{nd} C2, 2. C3 ...) parameter setting has no effect to anything. If there is the burning/=ignite sequence 1-5-3-6-2-4 (1^{st} in sequence burns the output C1, 2^{nd} C5, 3^{rd} C3 ...) Setting of this parameter determines whether (see example in the picture) there was a decrease of burning frequency at the cylinder burning as 5^{th} in the sequence or at the cylinder that is connected to the output C5 (S1-5). Using the ignition interconnection to MM as well as UniCON there is always necessary to select the sequence/=order according to cylinder burning/=ignite !!!	• According to cylinder burning • According to the ignition output		

6.4 Pre-ignition setting procedure by means of stroboscope

Pre-ignition setting using a stroboscope is very easy. It is necessary to activate (using the stroboscope symbol) the TDC-mode for 1st cylinder. Using this mode the ignition burns in the top dead centre exactly. We turn round the engine without fuel and the stroboscope should exactly show the deviation of the actual TDC-phase.



…the deviance measured is to be entered into program…



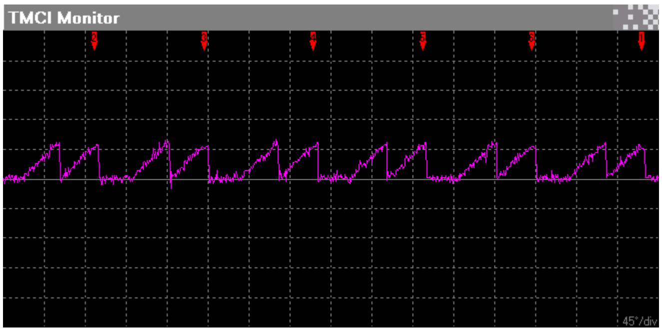
… and subsequently the stroboscope should read the 0°.

After having finished the setting procedure, the ignition shall burn according to the set nominal pre-ignition (with the defined corrections e.g. from rpm-size.

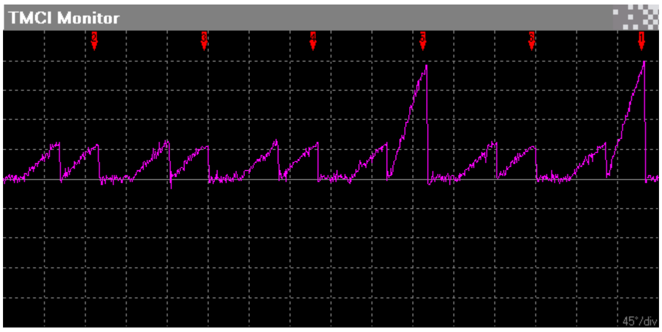
6.5 Setting of the knocking sensor

The knocking gets evaluated in that way that at the defined time prior to burning ("knocking window") there gets detected the presence of the for knocking (=detonations) characteristic signal. The said signal from the knocking sensor passes through the frequency chute and after having been rectified it becomes integrated. The size difference of the in this way integrated and processed amount that occurs (as a difference) between the time of knocking window duration and duration beyond the scope of the said window (reference value) defines the indicated knocking value.

To enable the correct setting it is necessary to define properly the position of the knocking window (the beginning of it as well as its length) on the one hand and to set in the appropriate manner the knocking intensifying on the other hand. .



The shown running of the regulated signal from the knocking sensor is an example for running without knocking/=detonations. Prior to each burning there occurs 2 times integration (prior to detonation window and within it). Without knocking the integrated values are in both cases identical and they denote "noise" reference value against background.



If there is knocking (in this case on two cylinders) the value integrated in knocking window will be increased. The difference between the value in front of the knocking window and that in the window shall represent the detonation power

Knocking increase can be set automatically according to the reference signal integrated beyond the knocking window (taking into account the fact that the middle noise level against background follows the range of 20-30% of the inverter). A too low intensification causes a low sensibility, a too high intensification will result in input over-excitation. In both cases the knocking can be evaluated incorrectly.

7. Two-valued inputs

7.1 Physical two-valued inputs

The ignition disposes of 4 physical binary inputs. The state of each of them corresponds to the state of short-circuiting (disconnection) of the relevant terminal on the ignition terminal-block S2.

7.2 Logical two-valued inputs

Logical binary inputs are two-valued magnitudes which are governed in compliance with the via physical inputs parameters setting and so the inputs affect ignition function. To each logical input can be assigned the physical input to control the logical one. It is also possible to set constantly the logical input as inactive (non-connected) or active (non-connected but inverted). One physical input can control more than one logical inputs.

Logical input	Purpose
Enable	Activating (enabling) of ignition burning
Ext Knocking	Information on knocking from an external sensor
Test mode RQ	Demand for testing mode
UserBinIn1÷8	User logical signals
MaskCyl 1÷8	Mask for cylinders to correct power

7.2.1 Enable

Activating of this input (together with the rpm-signal) it is a necessary prerequisite for the ignition activating. The input de-activation enables blocking of burning, disregarding the fact that the engine operation gets evaluated based on information from the rpm-sensor.

Should the input not be connected, then it is necessary (using mapping) to set the input to “1 (true)”.

7.2.2 Ext Knocking

Using this input it is possible to bring an information about knocking from the external sensor into ignition. Algorithm conducts itself identically regardless the fact, weather it evaluates the knocking itself or on the basis of the said input .

7.2.3 TEST mode RQ

Activating the input „TEST mode RQ“ the TMCI will be burning on all outputs disregarding the courses of the input signals RES a CLK. There gets activated the binary output „Test mode“ in this mode. The presence of the signal from the rpm sensor shall block the test mode.

7.2.4 UserBinIn1÷8

These user inputs have no direct influence on the ignition algorithm, they can be used as inputs into user functions. The outputs of functions (UserBinOut1÷UserBinOut8) can be then used for control over further logical ignition inputs (physical outputs) by means of Mapping.

7.2.5 MaskCyl1÷8

The said user inputs define the mask for cylinders onto which a claim is to be lodged for power correction (increase).

When communicating with Enginemanagement (control unit), that controls the outputs power, the inputs shall be mapped to signals „MM-MaskCyl1÷8“ („CU-MaskCyl1÷8“).

8. Two-valued outputs

8.1 Physical two-valued outputs

The state of physical outputs (closing/opening of the output transistor on the terminal block S2) is given according to the parameter setting of the logical output state. There can be set polarity with each of the physical outputs (the output transistor closes/opens when activating).

8.2 Logical two-valued outputs

Operation of the TMCI1+ as well as input signals evaluation and two-valued inputs are affected by the state of the 8 two-valued magnitudes.

Logical output	Description
Stop	The ignition has evaluated the engine zero-rpm
Rmp Lo	The ignition has evaluated minor rpm than the nominal ones (start)
Knocking	The ignition has evaluated knocking
Ignition Err	The burning of one of the cylinders is minor than the limit defined
C:R Err	Error concerning the input signals relation between CLK and RES
UserBinOut1÷8	User logical outputs

8.2.1 Stop

Logical output STOP is active provided the ignition rpm is minor than that that are minimal to be evaluated. The ignition evaluates the rpm, provided the CLK signal period is minor than 21.8 ms (e.g. if there is one sensor connection and 6 cogs the engine rpm is bigger than 230 ot/min).

8.2.2 Rpm LO

Engine rpm is minor than that of the nominal one (given by the parameter *("Nominal rpm"),*TMC2+ (in compliance with the rpm-size and parameter setting) decreases the pre-ignition.

8.2.3 Knocking

Signal from the knocking sensor has exceeded the limit defined by the parameter *"Activating level for knocking".*

Provided this logical output is active, there occurs (with a speed given by parameter) a pre-ignition decrease (due to knocking the pre-ignition can be reduced from the nominal pre-ignition value by a value given by the parameter *"Max. decrease at knocking"* as a max.)

If the output is not active there occurs a gradual pre-ignition increase with the speed defined up to the original value of nominal pre-ignition.

8.2.4 Ignition Err

If there will be burning frequency decrease, on some of the cylinders, under the limit defined, then there will be activated this logical output.

8.2.5 C:R Err

Should there be improper frequency relation between the CLK and RES signals, there will be activated, for a period of 5s, this binary output.

With the two-sensor ignition there should be the said relation RES:CLK equal to 1:2*Z (where the Z is a defined number of cogs), in case of one-sensor then directly 1:Z.

Besides the state of this output on the indicator lamp the manager detects also detects the measured ratio RES:CLK, but it is possible as well, that in case of the signal loss (flash) there will follow the evaluation of an incorrect ratio only within the scope of one cycle – the service program is then not sure to come in time for transport and display of the measured ratio (nevertheless the indicator lamp shall indicate an error).

Given that there is an instable engine run, the activating of this output can also indicate a problem within the scope of input sensors (omitting, flashing).

8.2.6 UserBinOut 1÷8

These user outputs are not generated directly by the ignition algorithm, but they come up as the outputs of user functions and they can be then used for the control over another logical ignition inputs as well as (using Mapping) physical outputs.

9. Analogical inputs

9.1 Logical analogical inputs

The ignition does not include any physical analogical inputs, but only the logical ones. They can be either generated using the functions or mapped to signals that enter the ignition using the data way either from engine management or from Control Unit UniGEN.

Logical analogical signal can also come into existence using physical binary input and repeating conversion of binary signal to a logical analogical magnitude.

9.1.1 Ext Preign Cor

Logical analogical input for pre-ignition correction. The nominal pre-ignition, corrected by inner algorithms according to rpm or pre-ignition, can be further modified using this signal

9.1.2 Ext Energy Cor

The ignition initial output power, which is given by parameters, can be further corrected using this signal.