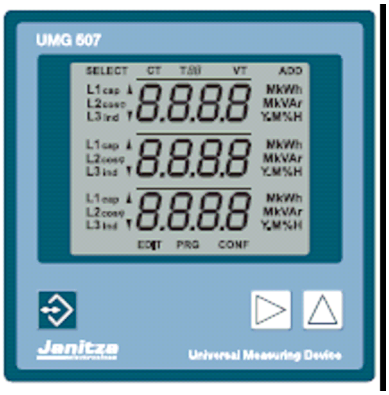
Universal Measuring Device

UMG507

Functional Description

Maximum Monitoring System (Option)



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General Information

Depending on the device type the UMG507 supports the protocols Modbus RTU, Modbus TCP/IP, Modbus over TCP/IP (Modbus Gateway) or Profibus DP V0. This functional description complements the operating manual and characterises step by step all necessary installation steps of all respective functions.
On the CD Rom PSWbasic/professional you will find further functional descriptions. The following functional descriptions are currently available:

- UMG507 as data display for external Modbus slaves
- OPC Server Port 502
- OPC Server Port 8000 (Modbus Gateway Function)
- The web server of the UMG507
- Memory structure of the UMG507
- Profibus description including examples
- Maximum monitoring
- Applications

Notes on edition:
24.02.2005 First edition / Wagner
07.03.2005 Correction review carried out

Data Types

In the Modbus Master Mode the UMG507 uses the following data types:

Highbyte for Lowbyte

UMG507 Designation	**Type**	**Size**	**Range**
float	float	4 Byte	+/-3.8*10^{-38} to 3.4*10^{38} (floating point)
short	short	2 Byte	-32768 to 32767
u_short	unsigned short	2 Byte	0 to 65535
int	int	4 Byte	-2147483648 to 2157583647
u_int	unsigned int	4 Byte	0 to 4294967296
char	char	1 Byte	-128 to +127
bit	Bit always reads a complete register (16Bit)		

Lowbyte for Highbyte

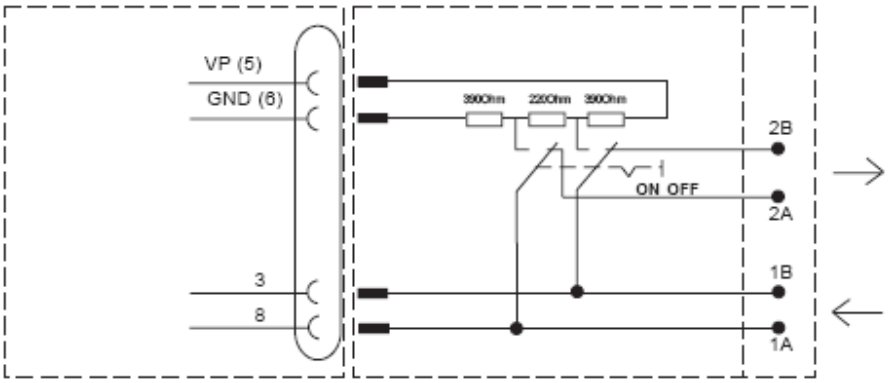
UMG507 Designation	**Type**	**Size**	**Range**
float.**I**	float	4 Byte	+/-3.8*10^{-38} to 3.4*10^{38} (floating point)
short.**I**	short	2 Byte	-32768 to 32767
u_short.**I**	unsigned short	2 Byte	0 to 65535
int.**I**	int	4 Byte	-2147483648 to 2157583647
u_int.**I**	unsigned int	4 Byte	0 to 4294967296
char.**I**	char	1 Byte	-128 to +127
bit.**I**	Bit always reads a complete register (16Bit)		

I = inverse

RS485 Connection

TheRS485 connection of the UMG507 has been designed as a 9-pole Sub D socket. As connection we recommend a 9-pole profibus plug (type: SUBCON-PLUS-ProfiB/AX/SC manufacturer: Phoenix item number: 27 44 38 0 or similar).

UMG507 **Profibus plug SUBCON**



Connection of bus lines:
Connect the incoming bus line always to the clamp-connections 1A/1B (even at the beginning of the bus system!) The continuative bus line will always be connected to the clamp-connections 2A/2B. At the beginning and the end of the bus system the terminating resistors will be activated via the sliding switch. For the continuative bus line, the terminal clamps (2A/2B) will be switched off simultaneously.

General Information

On the basis of the active power pulses incoming at a digital input or on the basis of the total active power calculated by the measuring device, the Emax program of the UMG507 determines all variables necessary to comply with the target value. Within the adjusted measuring period the system calculates continuously the average value, instantaneous value, trend value and the correction performance.
If the UMG507 recognizes a possible exceeding of the maximum, it checks for the necessity to switch off according to the operating characteristics adjusted. In consideration of these characteristics the switch-off of loads will then be carried out. The aim of this method is it to comply with the adjusted maximum at the end of a measuring period with a preferably small number of switch-offs and disturbances of the operating procedure.

There are 16 digital and two analogue Emax channels available for the switch-off, whereby the UMG507 has already 6 digital and two analogue outputs built in. In order to be able to switch off 10 additional loads, at least one or even more WAGO modules with digital outputs are necessary. The WAGO modules will be connected to the RS485 interface of the UMG507. The 16 Emax channels will be switched on and/or off according to the following criteria:

- **Activity values (target value, average value, instantaneous value, trend value, correction and connection performance)**
- **Priority and control/switch type**
- **Blocking time**
- **Pause time**
- **Time targets (minimum on-time, minimum off-time, maximum on-time, and availability).**

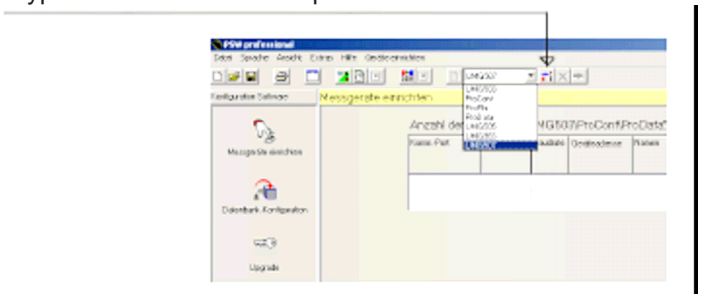
Here, the device can process 5 target values, which, optionally, are externally or internally controllable. By means of the parameter “Involved loads” it is possible to limit the availability of the load fort he maximum monitoring.

Configuration of the Emax Channels via PSWbasic/professional

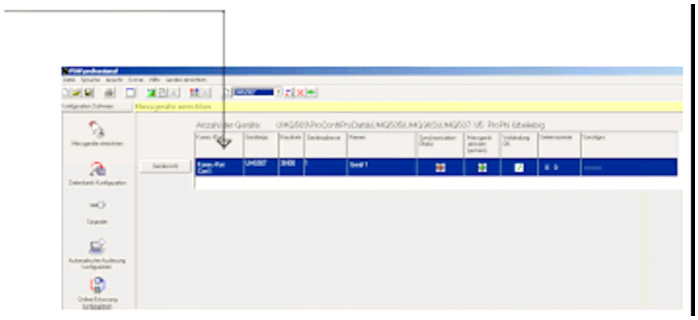
Start PSWbasic or professional and create a new project firstly. Then, change to the menu item “Adjust measuring devices”.

Step 1:
Adjust measuring devices in software

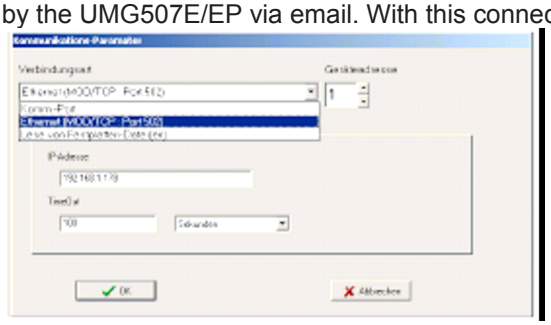
Select the device type “UMG507” in the drop-down list and click onto the button “Insert measuring device”.



Allocate a device name to the device. Now, click into the blue “Comm.-Port” field.



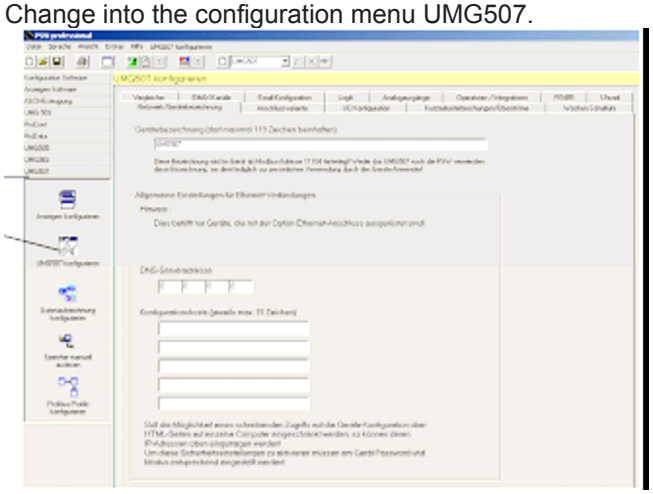
Select a connection type. The devices UMG507L/AD/P will be configured via the RS232 or the RS485 interface. With the devices UMG507E and UMG507EP the configuration is additionally possible via Ethernet connection with a Cross Patch cable. The Cross Patch cable is not included in the scope of delivery. The connection category “Read from hard disk” reads circular buffer files which have been sent by the UMG507E/EP via email. With this connection category a configuration is not possible.



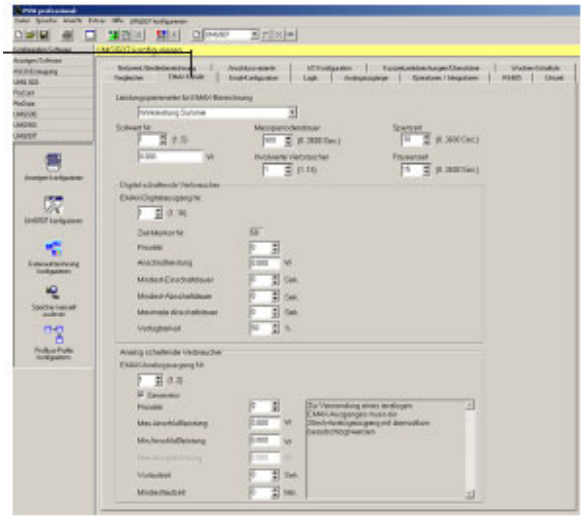
With the connection category “Comm.-port” the following issues must be considered:
1. The device address must comply with the device address in the UMG507.
2. At the device and in the software the same baud rate and the same protocol (Modbus RTU Slave) must have been adjusted.

Step 2:
Configure Emax Channels

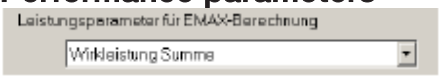
Change into the configuration menu UMG507.



Open index card „Emax Channels“

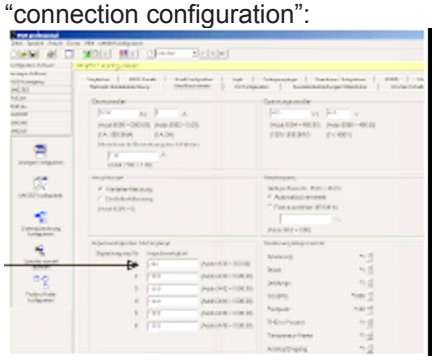


Performance parameters



For the calculation of the active power, the following input sources can be selected:
- Active power sum (active power of the measuring part calculated)
- One of the 6 digital S0 inputs
- Free parameter

Note: If one of the 6 digital inputs (S0 inputs up to 20Hz) has been selected as performance parameter, for the digital input the pulse valency must subsequently be adjusted in “Wh/Imp” in the index card “connection configuration”:



General Adjustments

- Duration measuring period (0 ... 3600 seconds)
- Blocking time (0 ... 3600 seconds)
- Pause time (0 ... 3600 seconds)
- Target value 1-5
- Involved loads (1 ... 16)

Duration measuring period:
In order to run synchronic to the measuring of the EVU, the resetting should always be performed via an input of the UMG507 or via the interface. If no resetting will be carried out within the programmed duration of the measuring period, the resetting will automatically be activated by the internal clock. The resetting of the measuring period deletes the Emax active power and starts a new measuring period. The last Emax active power measured will be used for the saving of the minimum and maximum values and, if programmed, stored in the memory of the UMG507.

Blocking time:
Runs at the beginning of the measuring period and prevents that short peak powers at the beginning of the measuring period will cause switch-offs.

Pause time:
Time between two switching operations. Since switching operations will not immediately affect the net, the delayed reaction can be accounted with the pause time.

Involved loads:
Involved loads will be used preferably. Only loads that are involved will be considered in the calculation of the trend values. I.e. the Emax program attempts to comply with the maximum only by using the “Involved loads” and in consideration of the circuit times and load performances. If this is not possible, the other loads will additionally be used. In practice, it has proved to declare half of the loads as “Involved loads”.

Adjustments of loads switching digitally

- Priority (1...16)
- Connected load
- Minimum on-time
- Minimum off-time
- Maximum off-time
- Availability

Priority:
It is possible to allocate a priority of 0 to 16 to each Emax digital output. Emax-outputs with the priority 0 will not be included in the calculation of the trend values of the Emax program. Emax-outputs with a low priority (e.g. 1) will be switched off at first and switched on at last. Emax-outputs with the same priority are equal. Only if all Emax-outputs of one priority have been processed, it will be switched on the next priority.

Connected load:
In order to be able to determine the switching time in a more exact way, for each Emax-output the connected load switched must be programmed. The switching times allocated to each Emax output will be adhered to at first.

Minimum on-time:
Says, how long a load must at least be switched on between two switching operations.

Minimum off-time:
Says, how long a load must remain be switched off after a switch-off.

Maximum off-time:
Says, how long a load is allowed to be switched of after a switch-off.

Availability:
The availability of a load is adjustable in percent. In practice, the following adjustments have proved as reliable:
1. Loads rarely used: approx. 10%
2. Loads often used: max. 85%

Adjustments analogue load control

- Priority
- Maximum load connected
- Minimum load connected
- Maximum saving performance
- Run-up period

Run-up period:
The run-up period limits the rate of change of the load performance. In order to get from the minimum load connected to the maximum load connected, at least the run-up period will pass.

Maximum saving performance:

The maximum saving performance is the maximum performance that is allowed to be saved within a measuring period.

Adjustments generator control

- Priority
- Maximum load connected
- Minimum load connected
- Handling time
- Minimum running time

Handling time:
The handling time is the time that is taken from the switch-on of the generator until the generator is able to produce power.

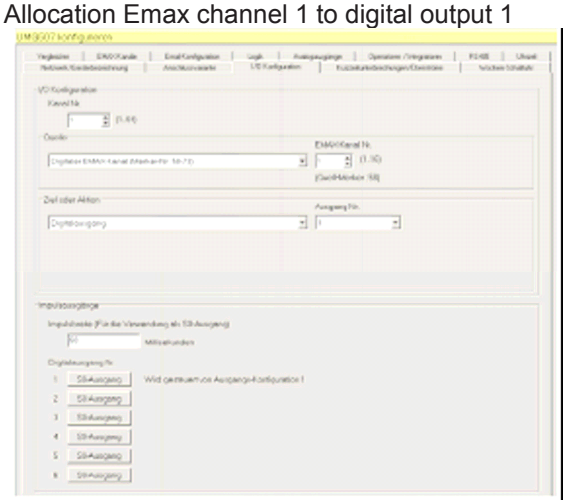
Minimum running time:
The minimum running time is the time the generator must at least be running until it is allowed to be switched off by the UMG505.

Advice for generator control:
The speed the analogue output is changing with is 2% of the difference from the maximum load connected minus minimum load connected per second. The speed can not be changed directly.

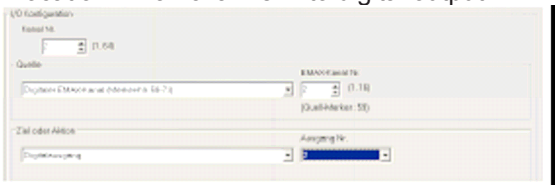
Step 3:
Allocate the Emax channels to digital outputs

In the index card “I/O configuration” the digital outputs will be allocated to the Emax outputs. All 6 digital outputs of the UMG507 can be used. The remaining 10 Emax outputs must be allocated to decentral WAGO modules (see section WAGO modules). The channel number in the index card “I/O configuration” is similar to an allocation block. In total, 64 allocations can be parameterized (e.g. for tariff change over, measuring period resetting, etc.)

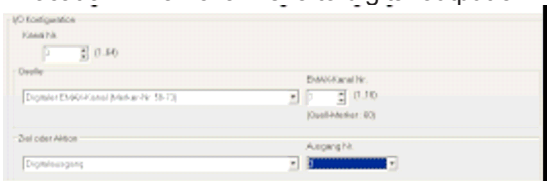
Allocation Emax channel 1 to digital output 1



Allocation Emax channel 2 to digital output 2



Allocation Emax channel 3 to digital output 3



Etc.

Step 4:
Programming measuring period resetting

Subsequently, choose an input source which is to activate the measuring period resetting. In the example on the right, the digital input 2 has been used.

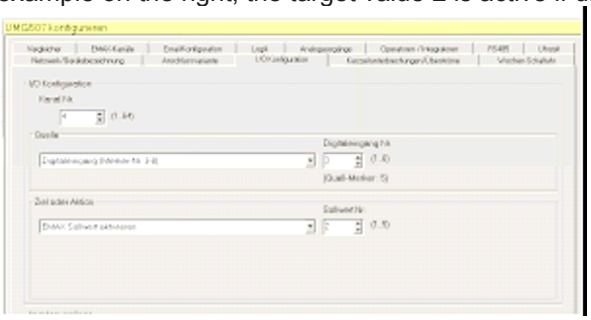
The Emax programming for 6 outputs is finished. Test the programming by e.g. changing the target value. Here, you must mind that an exceeding of the target value causes possibly no immediate switch-off. Since the trend value calculator calculates the optimum time in due consideration of the load performances, the switch-off can possibly be performed delayed.

Emax tariff change-over

For the Emax program in UMG507 it is possible to specify 5 target values. If no further specifications have been made, target value 1 is active. The tariff change-over can be carried out via the following input sources:

- Via the internal weekly clock timer
- Via digital inputs
- Externally via Modbus / Profibus DP V0 / Ethernet
- Via web interface (only with UMG507E/EP)

The input sources will again and again be selected in the index card “I/O configuration” of the PSW. In the example on the right, the target value 2 is active if digital input 3 is active.



Configuration generator start signal

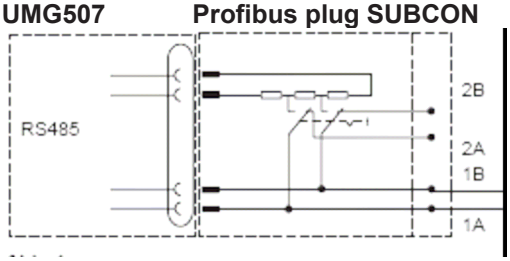
The start signal for the generator can be carried out via a digital output. Therefore, the analogue Emax output must be monitored in the comparator and this must be allocated to a digital output in the I/O configuration. Here, the digital output is only active if the calculated current of the driving Emax analogue output exceeds 0 mA.

Output extension with WAGO modules

In order to switch off 10 additional loads, one or even more WAGO modules with digital outputs are needed. The WAGO modules will be connected at the UMG507 of the RS485 interface via a profibus plug (type: SUBCON-PLUS-ProfiB/AX/SC manufacturer: Phoenix item number: 27 44 38 0 or similar) of the UMG507. The wiring is in bus form. Cable type: Li2YcY (TP) 2x2x022, max. 1000m.

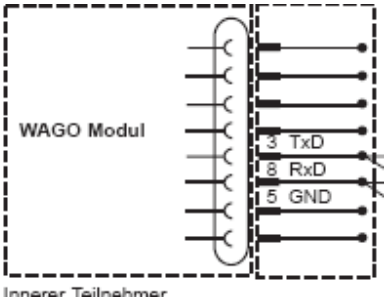
The modules will be connected via a 2-wire bus line to the RS485 interface.
Illustration 1 shows the connection of the modules.

UMG507 **Profibus plug SUBCON**



(type: SUBCON-PLUS-ProfiB/AX/SC manufacturer: Phoenix item number: 27 44 38 0 or similar)

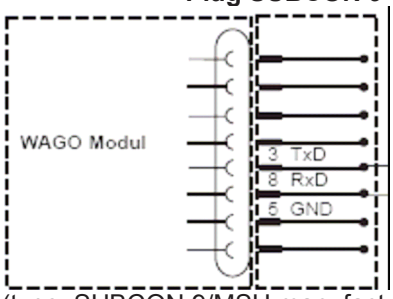
Illustration. 1 **Plug SUBCON 9**



(type: SUBCON 9/MSH manufacturer: Phoenix item number: 27 61 50 9 or similar)

Inner participator

Plug SUBCON 9



(type: SUBCON 9/MSH manufacturer: Phoenix item number: 27 61 50 9 or similar)
Inner participator

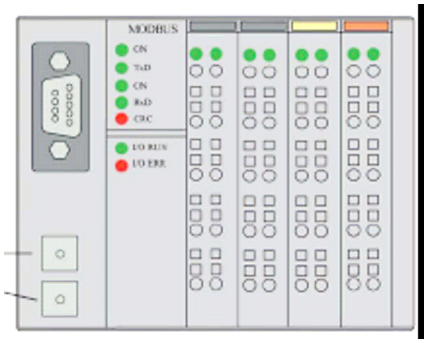
Adjustments on WAGO modules

On the WAGO modules the following issues must be adjusted via dip-switch:

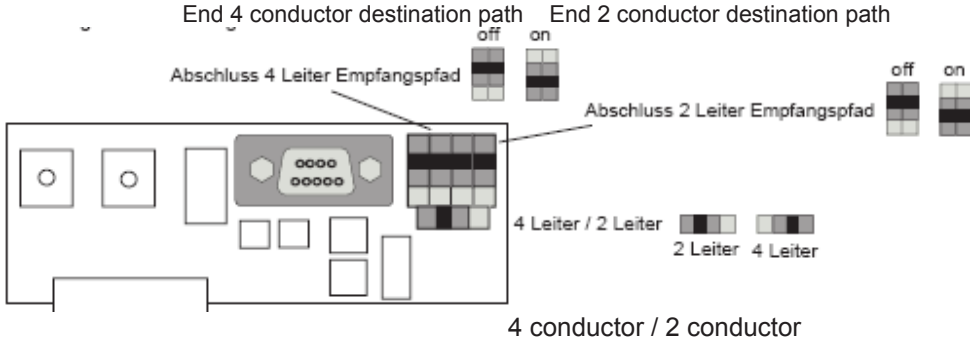
1. Adjustment of device address.
2. Connection 2 or 4 conductor
3. Configuration of master circuit.

For additional details please refer to the WAGO Modbus manual 750-128. In the following example we only specify one standard application.

1. Adjustment of device address:
The device address will be adjusted via both coding switches. The address adjustable is in the range between 1 and 99. The value 0 is reserved for a particular mode of operation. The lower coding switch will be used for adjusting the value on ten of the address, the upper coding switch for the adjustment of the value on one. The address selection has a delay time of approx. 20s.

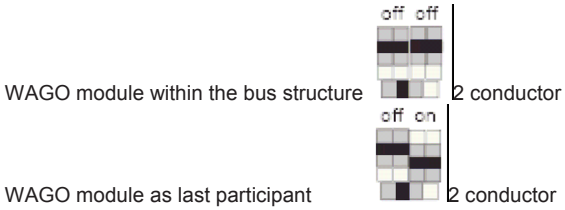


2. Connection 2 or 4 conductor:
The adjustment for 2 or 4 conductor connection and the switch-on and off of the respective terminating resistors is carried out via the switch in the housing. Therefore, the housing must be removed from the bus coupler. In the following illustration you will find the switch on the interface board for the adjustment of 2- and 4 conductor connection and/or for the terminal resistors:



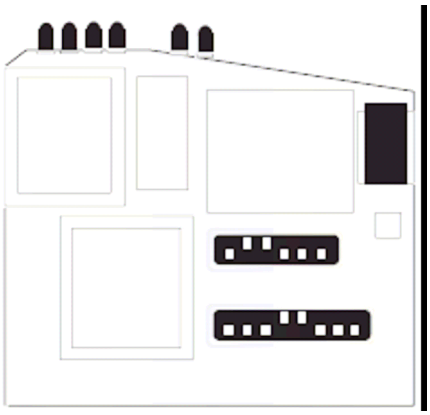
4 conductor / 2 conductor

At the last WAGO module, the terminating resistors must be set above/via the dip-switches. Hereby, a serial circuit of 3 resistors will be switched into the data line.



3. Configuration of master circuit:

The configuration of the bus coupler via the DIL switch must be carried out prior to the initial operation of the coupler. Any modifications of the switches during the running operation does do not effect the configuration. It will only be read in with the Power On of the coupler.
The location of the individual DIL switches on the CPU Board you can see in the following illustration.



The DIP switches for the UMG507 should be adjusted as illustrated below:

WAGO MODULE 750-312 / 750-315

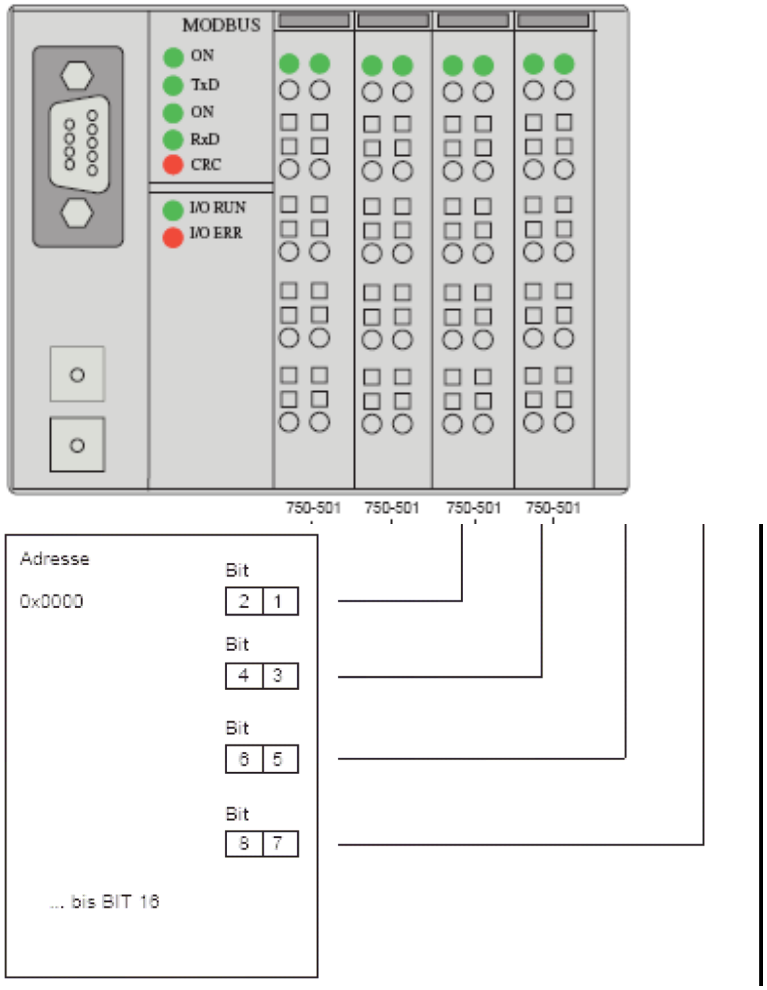
Baud Rate	=	9600 Baud
Byte Frame	=	no Parity
7/8 Bit	=	8Bit, 1 Stop Bit
End of Frame Time	=	3 x frame Time
Mode	=	RTU
Error Checking	=	ON
Extended Functions	=	normal operation
Error Check	=	Watchdog active
Update Firmware	=	normal operation

Adjustments on the RS485 interface of the UMG507:

Baud rate	=	9600Baud
Mode	=	Modbus Master
Timeout	=	200ms
Device address	=	e.g. 1 (the device address of the WAGO module must not be identical to the device address of the UMG507).

Data area

The data transmission between UMG507 and Modbus coupler is performed via a bit or byte-related reading and writing system. In the coupler there are 4 types of process data: Input words, output words, input bits and output bits.
The data words in the process image are then arranged in the same order as they are plugged in behind the coupler. The process image of the digital clamps will be added to the process image of the analogue clamps. For further details please refer to the WAGO manual 750-128. The following picture represents an example for an input process image as it is used with the Emax program with the usage of digital output clamps. The output clamps 750-501 are 2 channel clamps with 24V; DC; 0.5A. Other clamps can also be provided.



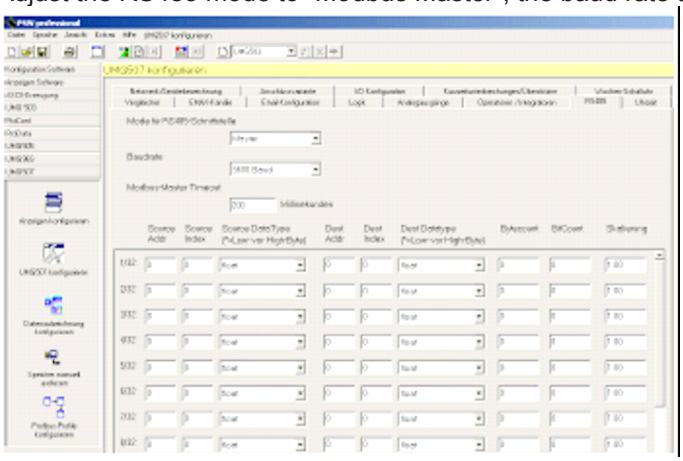
Address
... up to BIT 16

The byte order is **Low for High-Byte**.

Configuration of the UMG507

In the following example, the 8 outputs of the WAGO module will be allocated to the Emax outputs 7 to 14. At first, open the panel RS485 in the PSW.

Adjust the RS485 mode to “Modbus Master“, the baud rate to 9600 baud and the timeout to 200ms.



Die Emax outputs are located in the following register addresses (see address list):

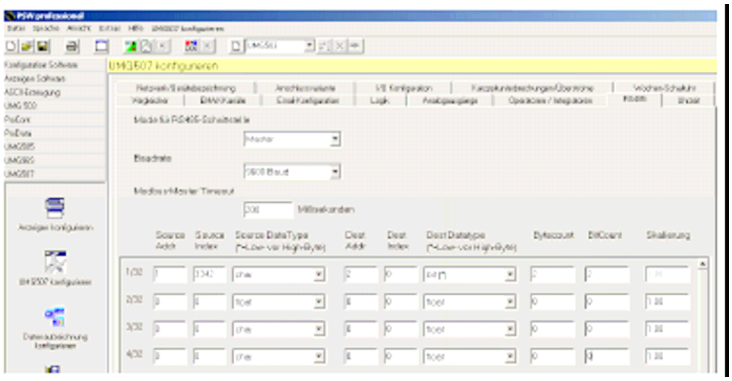
Emax output 7 on marker 64 = register address: 3342
Emax output 8 on marker 65 = register address: 3343
Emax output 9 on marker 66 = register address: 3344
Emax output 10 on marker 67 = register address: 3345
Emax output 11 on marker 68 = register address: 3346
Emax output 12 on marker 69 = register address: 3347
Emax output 13 on marker 70 = register address: 3348
Emax output 14 on marker 71 = register address: 3349

Important: The outputs of the Emax programs are openers. I.e. when non-operated (no switch-off) the markers are active. If a closer (N/O contact) is necessary, the Emax channels must previously be inverted in the index card “Logic” by means of a NAND element. For this, “free markers” will be allocated to the Emax channels. The free markers start from marker 82.

Example:

Permanent active /AND EmaxChannel 7 = marker 82 (register address: 3360)
Permanent active /AND EmaxChannel 8 = marker 83 (register address: 3361)
Permanent active /AND EmaxChannel 9 = marker 84 (register address: 3362)
Permanent active /AND EmaxChannel 10 = marker 85 (register address: 3363)
Permanent active /AND EmaxChannel 11 = marker 86 (register address: 3364)
Permanent active /AND EmaxChannel 12 = marker 87 (register address: 3365)
Permanent active /AND EmaxChannel 13 = marker 88 (register address: 3366)
Permanent active /AND EmaxChannel 14 = marker 89 (register address: 3367)

The right picture shows the allocation of the Emax outputs to the WAGO registers.



The UMG507 provides 32 cahnnels in the Modbus Master Menu.
The following specifications are necessary:

1. Scr. Addr	**=**	**Device address of slave.**
2. Scr. Index	**=**	**Register address of slave.**
3. Scr. Datatype	**=**	**Data type such as Short, Float etc.**
4. Dest. Addr	**=**	**Destination address.**
5. Dest. Index	**=**	**Destination register.**
6. Dest. Dataype	**=**	**Data type of the destination register.**
7. Bytecount	**=**	**Number of bytes to be written.**
8. Bitcount	**=**	**Number of data bits to be decoded.**
6. Scaling	**=**	**Scaling.**

1. Scr. Addr	=	1	-->	Device address of UMG507.
2. Scr. Index	=	3342	-->	Register address of the Emax output number 7.
3. Scr. Dataype	=	char	-->	The data type is char (1 Byte).
4. Dest Addr	=	2	-->	Device address of the WAGO module.
5. Dest Index	=	0	-->	Register address of the digital outputs 1- 16.
6. Dest Datatyp	=	**bit***	-->	The destination register is type Bit (Low for High-byte).
7. Bytecount	=	2	-->	Always 1 word will be written (2 Byte).
8. Bitcount	=	8	-->	In the example 8 Bits are to be written.
9. Scaling	=	0	-->	No scaling.

bit* = Low- for High-Byte

Writing Bytecount / Bitcount :
Every WAGO clamp occupies one word each. The number of the Bits to be decoded will be adjusted via the Bitcount, i.e. which output is to be set via which EMAX channel. Here, it must be minded that the writing register addresses must be continuously. E.g. it is not possible to set Bit number 1 via Emax channel number 7 (ADDR: 3342) and Bit number 2 via Emax channel 9 (3346). This would only be possible if the outputs would previously have been allocated to free CONTINUOUS markers in the Logic.

Register address	3342 --> sets BIT 1 from destination register 0 (only this information necessary)
	3343 --> sets BIT 2 from destination register 0 (goes automatically)
	3344 --> sets BIT 3 from destination register 0 (goes automatically)
	3345 --> sets BIT 4 from destination register 0 (goes automatically)
	3346 --> sets BIT 5 from destination register 0 (goes automatically)
	3347 --> sets BIT 6 from destination register 0 (goes automatically)
	3348 --> sets BIT 7 from destination register 0 (goes automatically)

3349 --> sets BIT 8 from destination register 0 (goes automatically)

If more than 16 outputs will be written, the next register-address starts in the WAGO module.