

VISY-Command

with Modbus Protocol



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1 VISY-Command with Modbus

Modbus Protocol Variants

VISY-Command with Modbus protocol supports the Modbus ASCII, RTU and TCP variant as described in the Modicon Modbus Protocol Reference Guide.

Wiring Connections

The communication lines of the Modbus Master must be wired to the Host Interface of the VISY-Command. The Host Interface supports a RS-232 or a RS-485 connection. For further details about the connection to the Host Interface of the VISY-Command see following technical documentation:



VISY-Command VI-4, art. no. 207184.

2 Configuration

The configuration of the VISY-Command (e.g. the configuration of tanks) is done with the configuration tool "VISY-Setup" that runs on a computer.

2.1 Host Interface

To use Modbus as data protocol for the VISY-Command Host Interface select one of the following host codes using VISY-Setup:

123 - Modbus ASCII

124 - Modbus RTU

125 - Modbus TCP

2.2 Communication Parameters

The communication parameters can be changed to the required values using VISY-Setup. The following communication parameters are supported (default settings are marked in bold):

Baud rate: 300, 600, 1200, 4800, **9600**, 14400, 19200, 28800

Data bits: 7, **8**

Parity: **none**, odd, even

Stop bits: **1**, 2

2.3 Response Time

The response time varies depending of the Modbus variant that has been selected.

Modbus ASCII: 500 to 600 msec

Modbus RTU: 100 to 200 msec

Modbus TCP: 100 to 200 msec

2.4 Modbus Slave Addresses

The VISY-Command reserves 16 Modbus slave addresses so that there is one slave address for each possible tank. The base address (slave address of tank 1) can be configured in the range of 1 to 99 using VISY-Setup. Changing the base address also changes the slave addresses of tanks 2 to 16. Change the base address (Communication Address of Control Unit) to the required address using VISY-Setup. Tank slave address = base address - 1 + tank number of control unit VISY-Command (e.g. basis address = 17 and tank number = 5 -> Modbus slave address of tank = 21). To configure the base address, change the Communication Address of Control Unit with VISY-Setup. The default base address is 1. If several VISY-Command units are connected to a RS-485 Modbus network then useful base addresses are 1, 17, 33, 49, 65, 81 and 97. This allows for up to 112 Tanks with the slave addresses 1 to 112 on one single RS-485 Modbus network.



If the Communication Address of Control Unit is set to 0 then the communication is disabled, and the VISY-Command will not answer.

3 Modbus Register Map

3.1 Function Codes

The following function codes are supported:

- Function Code 03 - Read Holding Registers
- Function Code 04 - Read Input Registers
- Function Code 08 - Diagnostics (only sub-function 00 - Return Query Data)



All registers are read only.

3.2 Output formats

The following output formats are supported:

16-bit unsigned integer

- Big Endian (most significant byte first): [12]
- Little Endian (least significant byte first): [21]

32-bit floating-point

- Big Endian (straight word order, most significant byte first): [12] [34]
- Big Endian Bytes Swapped (straight word order, least significant byte first): [21] [43]
- Little Endian (inverse word order, least significant byte first): [43] [21]
- Little Endian Bytes Swapped (inverse word order, most significant byte first): [34] [12]

All values are available in the supported output formats. Different register areas are used for presenting the different output formats.

3.3 System of units

The following measurement units are supported:

- Metric: mm, l, °C, kg, kg/l
- US: inch, gal, °F, lb, lb/ft³

All measurement values are available in the supported measurement units. Different register areas are used for presenting the different measurement units.

3.4 Values formatted in 16-bit unsigned format

The values formatted in 16-bit unsigned format can be read out using the following two Function Codes:

- Function Code 03 - Read Holding Registers
- Function Code 04 - Read Input Registers

You have to add 30001 or 40001 to the address shown in the table to get the register number. Please take into account that the addresses shown in the table have a hexadecimal format while the register numbers have a decimal format.

16-bit Unsigned Integer, General Information, Status, Alarms, no Units		
Address		Description
Format [12]	Format [21]	
0x0000	0x0100	Serial number (upper digits)
0x0001	0x0101	Serial number (lower digits)
0x0002	0x0102	Probe type
0x0003	0x0103	Protocol version
0x0004	0x0104	Number of discrete temperature sensors
0x0005	0x0105	Number of density modules
0x0006	0x0106	Status of probe
0x0007	0x0107	Status of tank
0x0008	0x0108	Age of data
0x0009	0x0109	Product alarm
0x000A	0x010A	Water alarm
0x000B	0x010B	Product density alarm
0x000C	0x010C	Sump density alarm
0x000D to 0x001F	0x010D to 0x011F	Free for future expansions (value is 0)

Values

Probe type

- 1 = Basic
- 2 = Standard
- 3 = Advanced

Number of discrete temperature sensors

The number of discrete temperature sensors depends on the probe type.

Number of density modules

The number of density modules mounted on the probe. The probe can handle up to 2 density modules.

Status of probe

The probe can be in one of the following states:

- 0 - probe ok
- 1 - probe reports internal error
- 5 - probe reports temperature measuring error
- 6 - probe reports level measuring error
- 7 - probe reports reduced measuring accuracy
- 8 - wireless receiver reports checksum error in probe data received from transmitter (in wireless operation mode only)
- 9 - wireless transmitter reports missing probe response (in wireless operation mode only)
- 10 - communication error between VISY-Command and probe
- 11 - no response from probe or wireless transmitter
- 12 - incompatible probe data (communication and checksum ok but probe data does not match)
- 13 - waiting for first incoming data (after power-on or reset)
- 99 - probe not configured

Status of tank

The tank can be in one of the following states:

- 0 - no delivery in progress and no waves on product surface
- 1 - delivery in progress or waves on product surface

Age of data

Number of seconds that have passed by since the last update of the measurement data.



Product alarm

The following product alarms are defined:

- 0 - no alarm
- 1 - low low alarm
- 2 - low alarm
- 3 - high alarm
- 4 - high high alarm

Water alarm

The following water alarms are defined:

- 0 - no alarm
- 1 - high alarm
- 2 - high high alarm

Product density alarm

The following product density alarms are defined:

- 0 - no alarm
- 2 - low alarm
- 3 - high Alarm

Sump density alarm

The following sump density alarms are defined:

- 0 - no alarm
- 2 - low alarm
- 3 - high Alarm

3.5 Values formatted in 32-bit floating-point format

The values formatted according to the IEEE 754 single-precision 32-bit floating-point format can be read out using the following two Function Codes:

- Function Code 03 - Read Holding Registers
- Function Code 04 - Read Input Registers

You have to add 30001 or 40001 to the address shown in the table to get the register number. Please take into account that the addresses shown in the table have a hexadecimal format while the register numbers have a decimal format.

Two consecutive 16-bit registers have to be read to get the complete 32-bit floating-point value.

If a requested 32-bit floating-point value is either not supported or the probe has an error the returned value will be 0.

3.5.1 Metric Units

32-Bit Floating-point, Configuration Data, Metric Units (mm, l, °C)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0020 0x0021	0x0120 0x0121	0x0220 0x0221	0x0320 0x0321	Tank capacity
0x0022 0x0023	0x0122 0x0123	0x0222 0x0223	0x0322 0x0323	Tank maximum permissible volume
0x0024 0x0025	0x0124 0x0125	0x0224 0x0225	0x0324 0x0325	Tank diameter / Tank height
0x0026 0x0027	0x0126 0x0127	0x0226 0x0227	0x0326 0x0327	Reference temperature
0x0028 0x0029	0x0128 0x0129	0x0228 0x0229	0x0328 0x0329	Position of product density module ¹⁾
0x002A 0x002B	0x012A 0x012B	0x022A 0x022B	0x032A 0x032B	Position of sump density module ²⁾
0x002C to 0x002F	0x012C to 0x012F	0x022C to 0x022F	0x032C to 0x032F	Free for future expansions (value is 0.0)

¹⁾ Only available if the probe is equipped with a product density module.

²⁾ Only available if the probe is equipped with a sump density module.

32-Bit Floating-point, Inventory Data, Metric Units (mm, l, °C, kg, kg/l)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0030 0x0031	0x0130 0x0131	0x0230 0x0231	0x0330 0x0331	Level of product (upper float)
0x0032 0x0033	0x0132 0x0133	0x0232 0x0233	0x0332 0x0333	Level of water (lower float)
0x0034 0x0035	0x0134 0x0135	0x0234 0x0235	0x0334 0x0325	Average temperature
0x0036 0x0037	0x0136 0x0137	0x0236 0x0237	0x0336 0x0337	Volume
0x0038 0x0039	0x0138 0x0139	0x0238 0x0239	0x0338 0x0339	Volume TC
0x003A 0x003B	0x013A 0x013B	0x023A 0x023B	0x033A 0x033B	Water volume
0x003C 0x003D	0x013C 0x013D	0x023C 0x023D	0x033C 0x033D	Ullage
0x003E 0x003F	0x013E 0x013F	0x023E 0x023F	0x033E 0x033F	Mass
0x0040 0x0041	0x0140 0x0141	0x0240 0x0241	0x0340 0x0341	Product density ¹⁾
0x0042 0x0043	0x0142 0x0143	0x0242 0x0243	0x0342 0x0343	Product density TC ¹⁾
0x0044 0x0045	0x0144 0x0145	0x0244 0x0245	0x0344 0x0345	Sump density ²⁾
0x0046 0x0047	0x0146 0x0147	0x0246 0x0247	0x0346 0x0347	Sump density TC ²⁾
0x0048 0x0049	0x0148 0x0149	0x0248 0x0249	0x0348 0x0349	Percentage of product level ³⁾
0x004A 0x004B	0x014A 0x014B	0x024A 0x024B	0x034A 0x034B	Percentage of volume ⁴⁾
0x004C to 0x004F	0x014C to 0x014F	0x024C to 0x024F	0x034C to 0x034F	Free for future expansions (value is 0.0)

¹⁾ Only available if the probe is equipped with a product density module.

²⁾ Only available if the probe is equipped with a sump density module.

³⁾ A value of 100 % for the percentage of product level equates to the tank diameter of a horizontal tank or the tank height for a vertical tank.

⁴⁾ A value of 100 % for the percentage of volume equates to the tank capacity.

32-Bit Floating-point, Discrete Temperature Sensor Data, Metric Unit (°C)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0050 0x0051	0x0150 0x0151	0x0250 0x0251	0x0350 0x0351	Temperature of temperature sensor 1 * (position near the bottom of the probe)
0x0052 0x0053	0x0152 0x0153	0x0252 0x0253	0x0352 0x0353	Temperature of temperature sensor 2 *
0x0054 0x0055	0x0154 0x0155	0x0254 0x0255	0x0354 0x0355	Temperature of temperature sensor 3 *
0x0056 0x0057	0x0156 0x0157	0x0256 0x0257	0x0356 0x0357	Temperature of temperature sensor 4 *
0x0058 0x0059	0x0158 0x0159	0x0258 0x0259	0x0358 0x0359	Temperature of temperature sensor 5 * (position near the top of the probe)
0x005A to 0x005F	0x015A to 0x015F	0x025A to 0x025F	0x035A to 0x035F	Free for future expansions (value is 0.0)

* Only available if the probe is of type Advanced.

32-Bit Floating-point, Discrete Temperature Sensor Position Data, Metric Unit (mm)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0060 0x0061	0x0160 0x0161	0x0260 0x0261	0x0360 0x0361	Location of temperature sensor 1 * (position near the bottom of the probe)
0x0062 0x0063	0x0162 0x0163	0x0262 0x0263	0x0362 0x0363	Location of temperature sensor 2 *
0x0064 0x0065	0x0164 0x0165	0x0264 0x0265	0x0364 0x0365	Location of temperature sensor 3 *
0x0066 0x0067	0x0166 0x0167	0x0266 0x0267	0x0366 0x0367	Location of temperature sensor 4 *
0x0068 0x0069	0x0168 0x0169	0x0268 0x0269	0x0368 0x0369	Location of temperature sensor 5 * (position near the top of the probe)
0x006A to 0x006F	0x016A to 0x016F	0x026A to 0x026F	0x036A to 0x036F	Free for future expansions (value is 0.0)

* Only available if the probe is of type Advanced.

3.5.2 US Units

32-Bit Floating-point, Configuration Data, US Units (inch, gal, °F)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0420	0x0520	0x0620	0x0720	Tank capacity
0x0421	0x0521	0x0621	0x0721	
0x0422	0x0522	0x0622	0x0722	Tank maximum permissible volume
0x0423	0x0523	0x0623	0x0723	
0x0424	0x0524	0x0624	0x0724	Tank diameter / Tank height
0x0425	0x0525	0x0625	0x0725	
0x0426	0x0526	0x0626	0x0726	Reference temperature
0x0427	0x0527	0x0627	0x0727	
0x0428	0x0528	0x0628	0x0728	Position of product density module ¹⁾
0x0429	0x0529	0x0629	0x0729	
0x042A	0x052A	0x062A	0x072A	Position of sump density module ²⁾
0x042B	0x052B	0x062B	0x072B	
0x042C	0x052C	0x062C	0x072C	Free for future expansions (value is 0.0)
to	to	to	to	
0x042F	0x052F	0x062F	0x072F	

¹⁾ Only available if the probe is equipped with a product density module.

²⁾ Only available if the probe is equipped with a sump density module.

32-Bit Floating-point, Inventory Data, US Units (inch, gal, °F, lb, lb/ft ³)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0430 0x0431	0x0530 0x0531	0x0630 0x0631	0x0730 0x0731	Level of product (upper float)
0x0432 0x0433	0x0532 0x0533	0x0632 0x0633	0x0732 0x0733	Level of water (lower float)
0x0434 0x0435	0x0534 0x0535	0x0634 0x0635	0x0734 0x0725	Average temperature
0x0436 0x0437	0x0536 0x0537	0x0636 0x0637	0x0736 0x0737	Volume
0x0438 0x0439	0x0538 0x0539	0x0638 0x0639	0x0738 0x0739	Volume TC
0x043A 0x043B	0x053A 0x053B	0x063A 0x063B	0x073A 0x073B	Water volume
0x043C 0x043D	0x053C 0x053D	0x063C 0x063D	0x073C 0x073D	Ullage
0x043E 0x043F	0x053E 0x053F	0x063E 0x063F	0x073E 0x073F	Mass
0x0440 0x0441	0x0540 0x0541	0x0640 0x0641	0x0740 0x0741	Product density ¹⁾
0x0442 0x0443	0x0542 0x0543	0x0642 0x0643	0x0742 0x0743	Product density TC ¹⁾
0x0444 0x0445	0x0544 0x0545	0x0644 0x0645	0x0744 0x0745	Sump density ²⁾
0x0446 0x0447	0x0546 0x0547	0x0646 0x0647	0x0746 0x0747	Sump density TC ²⁾
0x0448 0x0449	0x0548 0x0549	0x0648 0x0649	0x0748 0x0749	Percentage of product level ³⁾
0x044A 0x044B	0x054A 0x054B	0x064A 0x064B	0x074A 0x074B	Percentage of volume ⁴⁾
0x044C to 0x044F	0x054C to 0x054F	0x064C to 0x064F	0x074C to 0x074F	Free for future expansions (value is 0.0)

¹⁾ Only available if the probe is equipped with a product density module.

²⁾ Only available if the probe is equipped with a sump density module.

³⁾ A value of 100 % for the percentage of product level equates to the tank diameter of a horizontal tank or the tank height for a vertical tank.

⁴⁾ A value of 100 % for the percentage of volume equates to the tank capacity.

32-Bit Floating-point, Discrete Temperature Sensor Data, US Unit (°F)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0450 0x0451	0x0550 0x0551	0x0650 0x0651	0x0750 0x0751	Temperature of temperature sensor 1 * (position near the bottom of the probe)
0x0452 0x0453	0x0552 0x0553	0x0652 0x0653	0x0752 0x0753	Temperature of temperature sensor 2 *
0x0454 0x0455	0x0554 0x0555	0x0654 0x0655	0x0754 0x0755	Temperature of temperature sensor 3 *
0x0456 0x0457	0x0556 0x0557	0x0656 0x0657	0x0756 0x0757	Temperature of temperature sensor 4 *
0x0458 0x0459	0x0558 0x0559	0x0658 0x0659	0x0758 0x0759	Temperature of temperature sensor 5 * (position near the top of the probe)
0x045A to 0x045F	0x055A to 0x055F	0x065A to 0x065F	0x075A to 0x075F	Free for future expansions (value is 0.0)

* Only available if the probe is of type Advanced.

32-Bit Floating-point, Discrete Temperature Sensor Position Data, US Unit (inch)				
Address				Description
Format [12][34]	Format [21][43]	Format [43][21]	Format [34][12]	
0x0460 0x0461	0x0560 0x0561	0x0660 0x0661	0x0760 0x0761	Location of temperature sensor 1 * (position near the bottom of the probe)
0x0462 0x0463	0x0562 0x0563	0x0662 0x0663	0x0762 0x0763	Location of temperature sensor 2 *
0x0464 0x0465	0x0564 0x0565	0x0664 0x0665	0x0764 0x0765	Location of temperature sensor 3 *
0x0466 0x0467	0x0566 0x0567	0x0666 0x0667	0x0766 0x0767	Location of temperature sensor 4 *
0x0468 0x0469	0x0568 0x0569	0x0668 0x0669	0x0768 0x0769	Location of temperature sensor 5 * (position near the top of the probe)
0x046A to 0x046F	0x056A to 0x056F	0x066A to 0x066F	0x076A to 0x076F	Free for future expansions (value is 0.0)

* Only available if the probe is of type Advanced.

3.6 Exception Codes

The following exception codes are supported:

- 01 - Illegal Function
- 02 - Illegal Data Address
- 03 - Illegal Data Value

01 - Illegal Function

The exception code Illegal Function is returned under the following circumstances:

- A function code other than 03, 04 or 08 is used.
- The function code 08 is used with a sub-function code other than 0000.

02 - Illegal Data Address

The exception code Illegal Data Address is returned under the following circumstances:

- The function code 03 or 04 is used with a starting address that is not included in the VISY-Command Modbus register map.
- The function code 03 or 04 is used with a correct starting address but the number of registers requested results in an address that is not included in the VISY-Command Modbus register map.

03 - Illegal Data Value

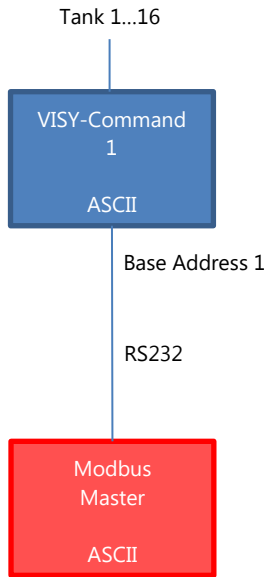
The exception code Illegal Data Value is returned under the following circumstances:

- The function code 03 or 04 is used and the number of registers requested is either 0 or higher than 112.

4 Connection Diagrams

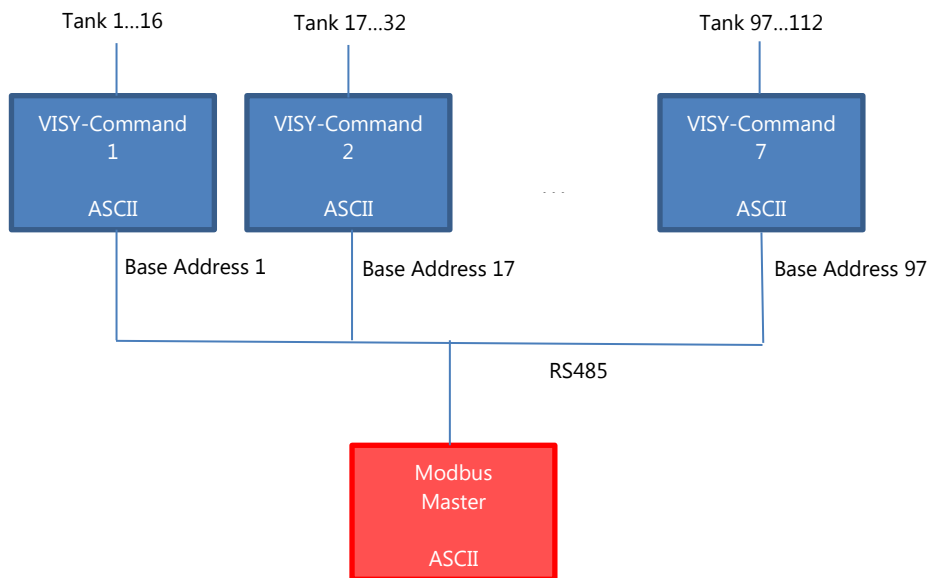
4.1 Modbus ASCII (Host Code 123) via RS232

RS232 point to point connection between one single VISY-Command (Modbus ASCII Slave) and one single Modbus ASCII Master.



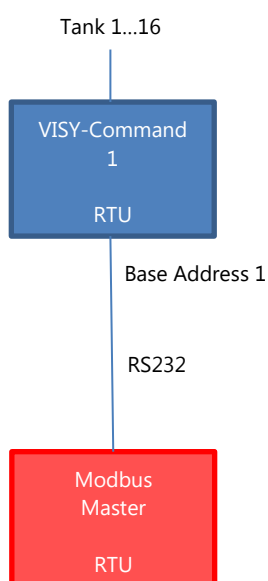
4.2 Modbus ASCII (Host Code 123) via RS485

Several VISY-Commands (Modbus ASCII Slaves) on one RS485 network connected to one single Modbus ASCII Master.



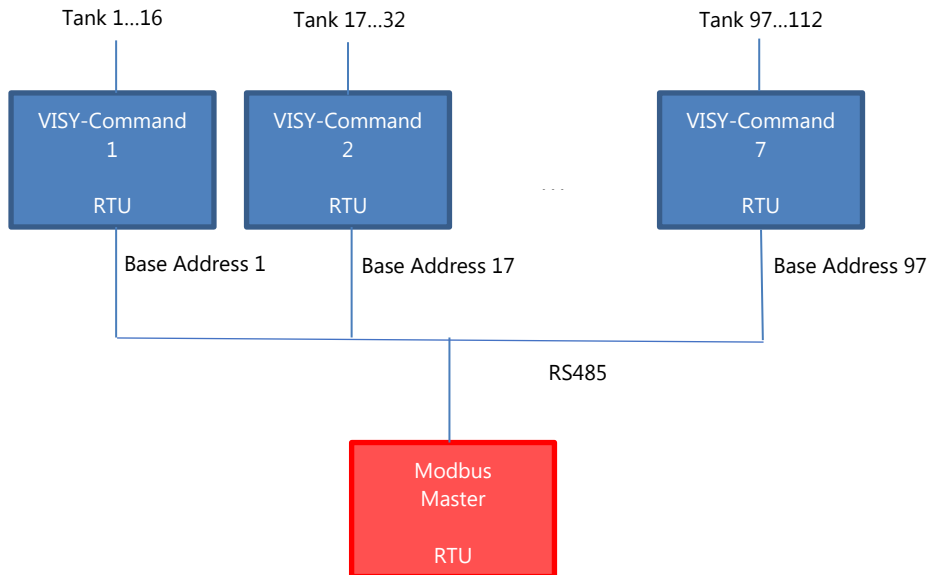
4.3 Modbus RTU (Host Code 124) via RS232

RS232 point to point connection between one single VISY-Command (Modbus RTU Slave) and one single Modbus RTU Master.



4.4 Modbus RTU (Host Code 124) via RS485

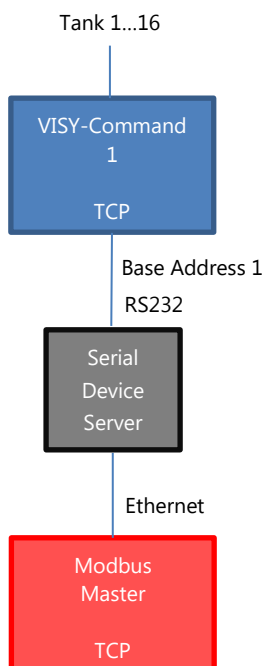
Several VISY-Commands (Modbus RTU Slaves) on one RS485 network connected to one single Modbus RTU Master.



4.5 Modbus TCP (Host Code 125)

TCP point to point connection between one single VISY-Command (Modbus TCP Slave) and one single Modbus TCP Master.

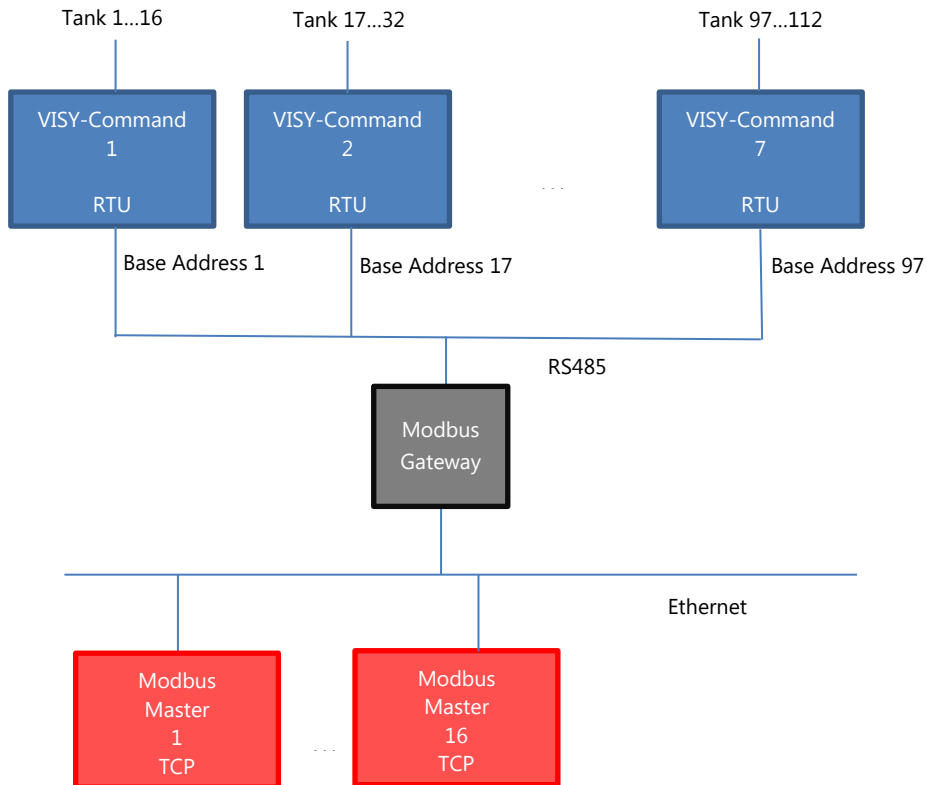
An additional serial device server has to be connected to the VISY-Command host port. The serial device server can be obtained from FAFNIR.



4.6 Modbus RTU (Host Code 124) to Modbus TCP via Modbus Gateway

Several VISY-Commands (Modbus RTU Slaves) on one RS485 network can be connected to several Modbus TCP Masters.

An additional Modbus Gateway is required.





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