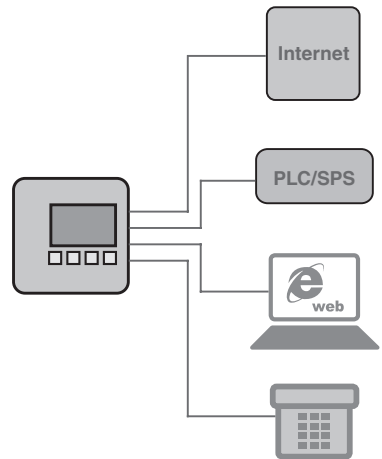# Supplementary instructions

Modbus-TCP, ASCII protocol

VEGAMET 391/624/625, VEGASCAN 693

Contents

1 Function as Modbus-TCP server

1.1 Modbus-TCP - general description

VEGAMET 391/624/625, VEGASCAN 693 and PLICSRADIO C62 signal conditioning instruments work as Modbus-TCP servers and make the existing PC/DCS values and relay switching conditions available in a temporary storage for collection via Modbus-TCP.

The instruments comply with the "*Open Modbus-TCP-Specification*" Release 1.0 from Schneider Electric. This standard is supported by many process control systems, remote IOs, visualisation programs and OPC servers. Communication is carried out via Port 502. Max. four connections at the same time are permitted. The query interval should be > 100 ms.

Beside the PC/DCS values, the switching conditions of the relay outputs can also be queried.

The enquiry of the PC/DCS values and relay values is made via the appropriate function code (see also Modbus specification).

● Function code 01: Read Coil Status (enquiry of the relay values)
● Function code 02: Read Input Status (enquiry of the relay values)
● Function code 03: Read Holding Registers (enquiry of the PC/DCS values)
● Function code 04: Read Input Registers (enquiry of the PC/DCS values)
● Function code 08: Diagnostic (enquiry of diagnosis information)

These function codes are normally available as library enquiries in the PLC (e.g. Modicon).

PC/DCS output

VEGAMET 391/624/625 and PLICSRADIO C62 can provide up to six PC/DCS outputs, VEGASCAN 693 up to 30. Further relay values also exist (fail safe relay/operating relay, depending on the instrument type).

Via the selected PC/DCS output you define where the respective measured values can be picked up in the temporary memory. The configuration of the PC/DCS outputs is carried out via PACTware/DTM.

1.2 Filing of the measured value as 2 byte short

The addressing of the PC/DCS values for Modbus systems is carried out "*Word-orientated*". In the temporary memory, a PC/DCS value is represented by two words. The first word contains the actual PC/DCS value, the next higher word the corresponding status information. In the specification, the term register word is also used instead of word.

The filing of measured values in the temporary memory is always sorted according to PC/DCS output number. The following table shows the addressing of the temporary memory via Modbus.

Register address in Modicon	Temporary memory of VEGAMET/PLICSRADIO (1 word = 2 byte)
30001	PC/DCS output 1: Measured value

Register address in Modicon	Temporary memory of VEGAMET/PLICSRADIO (1 word = 2 byte)
30002	PC/DCS output 1: Status
30003	PC/DCS output 2: Measured value
30004	PC/DCS output 2: Status
30005	PC/DCS output 3: Measured value
30006	PC/DCS output 3: Status
30007	PC/DCS output 4: Measured value
30008	PC/DCS output 4: Status
30009	PC/DCS output 5: Measured value
30010	PC/DCS output 5: Status
30011	PC/DCS output 6: Measured value
30012	PC/DCS output 6: Status

Register address in Modicon	Temporary memory of VEGASCAN (1 word = 2 byte)
30001	PC/DCS output 1: Measured value
30002	PC/DCS output 1: Status
30003	PC/DCS output 2: Measured value
30004	PC/DCS output 2: Status
30005	PC/DCS output 3: Measured value
30006	PC/DCS output 3: Status
30007	PC/DCS output 4: Measured value
30008	PC/DCS output 4: Status
30009	PC/DCS output 5: Measured value
30010	PC/DCS output 5: Status
30011	PC/DCS output 6: Measured value
30012	PC/DCS output 6: Status
…	…
30057	PC/DCS output 29: Measured value
30058	PC/DCS output 29: Status
30059	PC/DCS output 30: Measured value
30060	PC/DCS output 30: Status

As an alternative, register address 40001 is also available as start address (function code 03).

Format of the PC/DCS value

The actual measured values are transmitted as signed data comprising two octets. This means that the value range encompasses max. +32768 to -32767. In addition to the measured value, the status of the measured value is delivered in a second register word.

Example of the data of a PC/DCS output

Measured value	Status
Register addr. 30001	Register addr. 30002
High-Byte/Low-Byte	High-Byte/Low-Byte

The status describes the condition of the associated measured value. The content of the measured value is only valid if the corresponding status has the value zero. If there is a status value unequal zero, the status value and the corresponding value in the measured value field must be taken into account in a detailed failure diagnosis. The following chart explains the possible faults.

Status	Measured value	Meaning
0x00	0xXXXX	Valid measured value
0xXX	0x8000	An error number is transmitted in the status corresponding to the error codes Exx (e.g. 29 = E29 = Simulation).
0xXX	0x00XX	An error number which corresponds to the error codes Exx is transmitted in the status and in the measured value. Must be configured via DTM.

Note:
When transmitting the PC/DCS value in Modbus-TCP protocol (measured value filing as 2 byte short), the decimal point itself is not transmitted; the value -0.5 bar is transmitted as -50. If a data format was selected that allows values outside the value range to appear, a limit is set at the highest value of the value range.

Example: Percent was selected as "*Reference value* " and #.### as "*Data format* ". With this setting, the value 100 % would be transmitted as 100000, which is outside the valid range of max. +32767. This means that a limit will be imposed and 32767 transmitted instead. To avoid this, "*Data format* " #.## should be chosen so that the value 100 % is transmitted as 10000.

Note:
On the switching inputs of PLICSRADIO C62 (measurement loops 4 … 6) the values **0** (switch open) and **100** (switch closed) are transmitted as measured values; the units are discarded.

Filing of the relay values

The switching conditions of the relay are transferred as bit information.

The following equivalencies apply to the switching relays:

- 0 = Switching status Off
- 1 = Switching status On

The following equivalencies apply to the fail safe relay:

- 0 = Failure message Off, relay switching condition On
- 1 = Failure message Off, relay switching condition Off

The following table shows the addressing of the temporary memory via Modbus.

Register address in Modicon	Temporary memory of VEGAMET/PLICSRADIO (1 bit)	Temporary memory of VEGAMET 391 (1 Bit)
10001	Fail safe relay	Fail safe LED
10002	Relay 1	Relay 1
10003	Relay 2	Relay 2
10004	Relay 3	Relay 3
10005	----	Relay 4
10006	----	Relay 5
10007	----	Relay 6

1.3 Filing of measured value as 4 Byte Float

The filing of measured values in the temporary memory is always sorted according to PC/DCS output number. The following table shows the addressing of the temporary memory via Modbus. The values are accessed via FC 3 and 4. The status information is also transmitted as float value. 8 byte are needed for one output, corresponding to 4 registers.

Information:
Note: A float value comprises 2 registers, i.e. a total of 4 bytes!

Register address in Modicon	Temporary memory of VEGAMET/PLICSRADIO (2 words = 4 byte)
31001	PC/DCS output 1: Measured value
31003	PC/DCS output 1: Status
31005	PC/DCS output 2: Measured value
31007	PC/DCS output 2: Status
31009	PC/DCS output 3: Measured value
31011	PC/DCS output 3: Status
31013	PC/DCS output 4: Measured value
31015	PC/DCS output 4: Status
31017	PC/DCS output 5: Measured value
31019	PC/DCS output 5: Status
31021	PC/DCS output 6: Measured value
31023	PC/DCS output 6: Status

Register address in Modicon	Temporary memory of VEGASCAN (2 words = 4 byte)
31001	PC/DCS output 1: Measured value
31003	PC/DCS output 1: Status
31005	PC/DCS output 2: Measured value

Register address in Modicon	Temporary memory of VEGASCAN (2 words = 4 byte)
31007	PC/DCS output 2: Status
31009	PC/DCS output 3: Measured value
31011	PC/DCS output 3: Status
31013	PC/DCS output 4: Measured value
31015	PC/DCS output 4: Status
31017	PC/DCS output 5: Measured value
31019	PC/DCS output 5: Status
31021	PC/DCS output 6: Measured value
31023	PC/DCS output 6: Status
…	…
31113	PC/DCS output 29: Measured value
31115	PC/DCS output 29: Status
31117	PC/DCS output 30: Measured value
31119	PC/DCS output 30: Status

As an alternative, register address 41001 is also available as start address (function code 03).

Format of the PC/DCS value

The actual measured values are transmitted as signed data comprising four octets. In addition to the measured value, the status of the measured value is supplied in a second register word.

Example of the data of a PC/DCS output

Float Bit 15…0	Float Bit 31…16
Register addr. 31001	Register addr. 31002
High-Byte/Low-Byte	High-Byte/Low-Byte

Note:
On the switching inputs of PLICSRADIO C62 (measurement loops 4 … 6) the values **0** (switch open) and **100** (switch closed) are transmitted as measured values; the units are discarded.

Floating point of OPEN MODBUS/TCP SPECIFICATION

984 Floating point: Intel single precision real. First register contains bits 15 … 0 of 32 bit number (bits 15 … 0 of significand). Second register contains bits 31 … 16 of 32 bit number (exponent and bits 23 … 16 of significand).

The status describes the condition of the associated measured value. The content of the measured value is only valid if the corresponding status has the value zero. If there is a status value unequal zero, the status value and the corresponding value in the measured value field must be taken into account in a detailed failure diagnosis. The following chart explains the possible faults.

Status	Measured value	Meaning
0	XXXX	Valid measured value
<> 0	0	An error number is transmitted in the status corresponding to the error codes Exx (e.g. 29 = E29 = Simulation).
<> 0	XX0XX	An error number which corresponds to the error codes Exx is transmitted in the status and in the measured value. Must be configured via DTM.

Filing of the relay values

The switching conditions of the relay are transferred as bit information.

The following equivalencies apply to the switching relays:

- 0 = Switching status Off
- 1 = Switching status On

The following equivalencies apply to the fail safe relay:

- 0 = Failure message Off, relay switching condition On
- 1 = Failure message Off, relay switching condition Off

The following table shows the addressing of the temporary memory via Modbus.

Register address in Modicon	Temporary memory of VEGAMET/PLICSRADIO (1 bit)	Temporary memory of VEGAMET 391 (1 Bit)
10001	Fail safe relay	Fail safe LED
10002	Relay 1	Relay 1
10003	Relay 2	Relay 2
10004	Relay 3	Relay 3
10005	----	Relay 4
10006	----	Relay 5
10007	----	Relay 6

As an alternative, register address 00001 is also available as start address.

1.4 Diagnosis information

With the function code 08 and the associated Sub Function Code 0x0B, a counter value is returned which corresponds to the number of received Modbus requests. The counter value is incremented with each Modbus request received from the device, and the value is reset each time the device is restarted.

For further information see OPEN MODBUS/TCP SPECIFICATION.

2   ASCII protocol

2.1   Measured value enquiry via ASCII protocol

With the ASCII protocol you can enquire PC/DCS values via the Ethernet or RS232 interface. Through the use of ASCII characters, measured value enquiry is possible using simple terminal programs such as HyperTerminal.

The PC/DCS values are retrieved by special commands. It is possible to get the measured value in different resolutions, with/without unit or with current date/time.

Access via RS232

The activation of the ASCII protocol is carried out via the instrument DTM under "*Device settings - RS232 interface*". For the ASCII protocol, the following interface parameters are default settings:

● Coding system: 8 Bits, ASCII
● Baud rate: 9600 Bits/sec
● Data bits: 8
● Parity: none
● Stop bits: 1

For direct connection between signal conditioning instrument and PC or DCS, the RS232 modem connection cable and an additionally connected interlink cable from the scope of delivery will be required. If connection is provided via modem, only the attached RS232 modem connection cable is used. You will find further information in chapter "*Connection*".

Access via Ethernet

The ASCII protocol is handled via the TCP/IP - Port 503. When using the terminal program HyperTerminal, the following settings are required:

● IP addr. of the signal conditioning instrument: 192.168.200.200 (default setting)
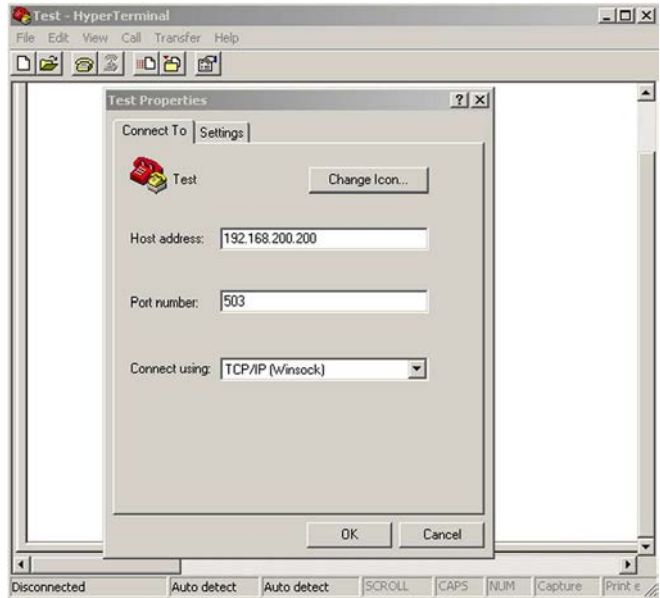● TCP/IP Port: 503
● Connection: TCP/IP

Fig. 1: Connection via HyperTerminal

The setting of "*telnet:\\192.168.200.200:503*" in the address field of the Internet Explorers starts the terminal program HyperTerminal automatically. Max. four simultaneous connections are possible.

2.2 Overview of the commands and options

Commands

The following ASCII signs are interpreted as commands:

Command	Description
Version	Enquiry of the protocol version
help	Indication of the command formats
clearstore	Settings of the option Store will be deleted in the EEPROM memory
%	Measured value enquiry with three places in front of the decimal point and one place after the decimal point without unit
&	Measured value enquiry with six places after the decimal point and without unit
?	Measured value enquiry with six positions after the decimal point and with unit
$	Measured value enquiry with 11 places as floating point and with unit

Note:
ℹ️ On the switching inputs of PLICSRADIO C62 (measurement loops 4 … 6) the values **0** (switch open) and **100** (switch closed) are transmitted as measured values; the units are discarded.

Options

The above commands of the measured value enquiry can be also combined with the following options:

Option	Description
TIME	The current date/time is added to the answer
REPEAT x	The measured value is sent automatically by the signal conditioning instrument every x seconds
STORE	The enquiry is saved up to the STORE option and executed after a restart **(only available with RS232 interface)**
SUM	A check sum is transmitted for each line which is sent

Information:
For commands and options no difference is made between small and capital letters. Each character string is terminated with Carriage Return CR = CHR (13). The individual commands and options are described below more in detail.

2.3 Version enquiry with command VERSION

With the command VERSION, the current protocol version can be determined.

Example

- **Enquiry:** version
- **Answer:** VEGA ASCII Version 1.00

2.4 Help with command HELP

With the command HELP, a short information can be retrieved.

2.5 Delete the settings with the command CLEARSTORE

With the command CLEARSTORE, the settings of the option STORE are deleted in the EEPROM and the automatic repetition of the measured values is stopped.

2.6 Measured value enquiry with command %

% individual enquiry

As answer on the individual enquiry, the PC/DCS value stated in the enquiry is delivered. The measured value is transmitted with three positions in front of the decimal point and one position after the decimal point without unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	%
Begin	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "%" (1 character)

- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 3 … 5 characters

Reply from the signal conditioning instrument

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	5 … 6	-067.3
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 4	3-digit number
5	".": Decimal point
6	1-digit number (after the decimal point)

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 12 … 13 characters

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
%001

Answer:
=001# 067.3%

% Block enquiry

As answer on the block enquiry, all PC/DCS values assigned in the instrument are delivered. The measured value is transmitted with three positions in front of the decimal point and one position after the decimal point without unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	%

	Number of bytes	Character
End identification	1	CR

- **Identifier:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 2 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram
(N=total number of assigned PC/DCS outputs)

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	5 … 6	-067.3
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 4	3-digit number
5	".": Decimal point
6	1-digit number (after the decimal point)

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: N*12 … 13 characters

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
%

Answer:
=001# 067.3%
=002# 824.6%
=003#-067.3%
=004# 824.6%

% Block enquiry with length

As answer to the range enquiry, the range stated in the enquiry with PC/DCS values is delivered. The measured value is transmitted with three decimal places in front of the decimal point and one decimal place after the decimal point without unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	%
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	L or l
Quantity	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "%" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "L" or "I" (1 sign)
- **Quantity:** Number of requested PC/DCS outputs (1 … 3 signs)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	5 … 6	-067.3
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 4	3-digit number
5	".": Decimal point
6	1-digit number (after the decimal point)

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: "Number"*12 … 13 signs

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
%001L003

Answer:
=001# 067.3%
=002# 824.6%
=003#-067.3%

% Block enquiry with range

As answer to the range enquiry, the range stated in the enquiry with PC/DCS values is delivered. The measured value is transmitted with three decimal places in front of the decimal point and one decimal place after the decimal point without unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	%
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	-
End	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "%" (1 character)
- **Start:** Start no. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "-" (1 sign)
- **End:** End no. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

(End-Start+1)-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	5 … 6	-067.3
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 4	3-digit number
5	".": Decimal point
6	1-digit number (after the decimal point)

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: (End-Start+1)*12 … 13

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
%002-004

Answer:
=002# 067.3%
=003# 824.6%
=004#-067.3%

2.7 Measured value enquiry with command &

& Single enquiry

As answer to the individual enquiry, the PC/DCS value stated in the enquiry is deThe PC/DCS value stated in the enquiry is delivered as reply to the individual enquiry. The measured value is transmitted with six decimal places without decimal point and unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	&
Begin	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "&" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 3 … 5 characters

Reply from the signal conditioning instrument

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	7	-000673

	Number of bytes	Character
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 14 characters

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
&001

Answer:
=001#-000673%

& Block enquiry

All assigned PC/DCS values in the instrument are delivered as reply to the block enquiry. The measured value is transmitted with six decimal places without decimal point and unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	&
End identification	1	CR

- **Identifier:** "&" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 2 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram
(N=total number of assigned PC/DCS outputs)

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#

	Number of bytes	Character
Value	7	-000673
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: N*14 characters

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
&
Answer:
=001# 000673%
=002# 008246%
=003#-000673%
=004#-008246%

& Block enquiry with length

The range stated in the enquiry with PC/DCS values is delivered as reply to the range enquiry. The measured value is transmitted with six decimal places without decimal point and unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	&
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	L or l
Quantity	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "&" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "L" or "I" (1 sign)

- **Quantity:** Number of requested PC/DCS outputs (1 … 3 signs)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	5 … 6	-000673
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: Quantity*14 signs

Note:
The % sign is a separator, not the unit %

Example:

Enquiry:
&001L003

Answer:
=001#-000673%
=002# 008246%
=003#-000673%

& Block enquiry with range

The range stated in the enquiry with PC/DCS values is delivered as reply to the range enquiry. The measured value is transmitted with six decimal places without decimal point and unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	&

	Number of bytes	Character
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	-
End	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "&" (1 character)
- **Start:** Start no. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "-" (1 sign)
- **End:** End no. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

(End-Start+1)-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	5 … 6	-000673
T3	1	%
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "%" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: (End-Start+1)*14

i **Note:**
The % sign is a separator, not the unit %

Example:

Enquiry:
&001-003

Answer:
=001# 000673%
=002# 008246%

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=003#-000673%

2.8   Measured value enquiry with command?

? individual enquiry

The PC/DCS value stated in the enquiry is delivered as reply to the individual enquiry. The measured value is transmitted with six decimal places without decimal point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	?
Begin	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "?" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 3 … 5 characters

Reply from the signal conditioning instrument

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	7	-000673
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 14 characters+Unit character

Example: **Enquiry:**

?001

Answer:
=001# 000673#%

? Block enquiry

All assigned PC/DCS values in the instrument are delivered as reply to the block enquiry. The measured value is transmitted with six decimal places without decimal point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	?
End identification	1	CR

- **Identifier:** "?" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 2 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram
(N=total number of assigned PC/DCS outputs)

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	7	-000673
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: N*(14 characters+Unit character)

Example:

Enquiry:
?

Answer:
=001# 000673#kg
=002# 008246#%
=003#-000673#m
=004#-000673#m

? Block enquiry with length

The range stated in the enquiry with PC/DCS values is delivered as reply to the range enquiry. The measured value is transmitted with six decimal places without decimal point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	?
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	L or l
Quantity	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "?" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "L" or "I" (1 sign)
- **Quantity:** Number of requested PC/DCS outputs (1 … 3 signs)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	7	-000673
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers

Character	Meaning
2 … 7	6-digit number after the decimal point

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: Number*(14 characters+Unit character)

Example: **Enquiry:**
?001L003

Answer:
=001# 000673#%
=002# 008246#kg
=003#-000673#m

? Block enquiry with range

The range stated in the enquiry with PC/DCS values is delivered as reply to the range enquiry. The measured value is transmitted with six decimal places without decimal point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	?
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	-
End	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "?" (1 character)
- **Start:** Start no. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "-" (1 sign)
- **End:** End no. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

(End-Start+1)-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	7	-000673
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)

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- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the text "*FAULT*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers
2 … 7	6-digit number after the decimal point

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: (End-Start+1)*(14 characters+Unit character)

Example:

Enquiry:
?001-003

Answer:
=001# 000673#%
=002# 00824#kg
=003#-000673#m

2.9 Measured value enquiry with command $

$ individual enquiry

The PC/DCS value stated in the enquiry is delivered as reply to the individual enquiry. The measured value is transmitted with 11 decimal places as floating point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	$
Begin	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "$" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 3 … 5 characters

Reply from the signal conditioning instrument

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	11	-824.6

	Number of bytes	Character
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the error code "*Exxx*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers
2 … 12	11-digit number with comma or error code

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 18 characters+Unit character

Example: **Enquiry:**
$001
Answer:
=001# 824.6 #kg

$ Block enquiry

All assigned PC/DCS values in the instrument are delivered as reply to the block enquiry. The measured value is transmitted with 11 decimal places as floating point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	$
End identification	1	CR

- **Identifier:** "$" (1 character)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 2 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram
(N=total number of assigned PC/DCS outputs)

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#

	Number of bytes	Character
Value	11	-824.6
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the error code "*Exxx*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 12	11-digit number with comma or error code

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: N*(18 characters+Unit character)

Example:

Enquiry:
$

Answer:
=001# 824.6 #kg
=002# 67.3 #%
=003#-824.6 #%
=004#-67.3 #m

$ Block enquiry with length

The range stated in the enquiry with PC/DCS values is delivered as reply to the range enquiry. The measured value is transmitted with 11 positions as floating point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	$
Begin	1 … 3	001 … 030 or 1 … 30
Separator	1	L or I
Quantity	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "$" (1 character)
- **Start:** No. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "L" or "I" (1 sign)
- **Quantity:** Number of requested PC/DCS outputs (1 … 3 signs)

• **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

"N"-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	11	-824.6
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

• **T1:** "=" (1 character)
• **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
• **T2:** "#" (1 character)
• **Value:** Numerical value of the PC/DCS output or with interferred measured value the error code "*Exxx*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers
	" ": Space with positive numbers
2 … 12	11-digit number with comma or error code

• **T3:** "#" (1 character)
• **Unit:** Unit as text (0 … n unit)
• **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: Number*(14 characters+Unit character)

Example:

Enquiry:
$001L003

Answer:
=001# 67.3 #kg
=002# 824.3 #%
=003#-67.3 #m

$ Block enquiry with range

The range stated in the enquiry with PC/DCS values is delivered as reply to the range enquiry. The measured value is transmitted with 11 positions as floating point and with unit.

Enquiry of the control system

	Number of bytes	Character
Identifier	1	$
Begin	1 … 3	001 … 030 or 1 … 30

	Number of bytes	Character
Separator	1	-
End	1 … 3	001 … 030 or 1 … 30
End identification	1	CR

- **Identifier:** "$" (1 character)
- **Start:** Start no. of the requested PC/DCS output (1 … 3 characters)
- **Separator:** "-" (1 sign)
- **End:** End no. of the requested PC/DCS output (1 … 3 characters)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: 5 … 9 characters

Reply from the signal conditioning instrument

(End-Start+1)-times repetition of the following telegram

	Number of bytes	Character
T1	1	=
DCS no.	3	001 … 030
T2	1	#
Value	11	-824.6
T3	1	#
Unit	0 … n	xxx
End identification	1	CR

- **T1:** "=" (1 character)
- **DCS no.:** No. of the PC/DCS output as 3-digit decimal number
- **T2:** "#" (1 character)
- **Value:** Numerical value of the PC/DCS output or with interferred measured value the error code "*Exxx*"

Formatting of the value:

Character	Meaning
1	"- ": Minus with negative numbers " ": Space with positive numbers
2 … 11	11-digit number with comma or error code

- **T3:** "#" (1 character)
- **Unit:** Unit as text (0 … n unit)
- **End identification:** Carriage Return CR (1 sign)

Total length of the telegram: (End-Start+1)*(18 characters+Unit character)

Example:

Enquiry:
$001-003

Answer:
=001# 67.3 #kg
=002# 824.3 #%
=003#-67.3 #m

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2.10 Option TIME

By adding the attribute TIME, the current time will be transmitted before the reply. The transmission of date/time information is carried out in the format "**@YYYY/MM/DD hh:mm:ss**". The character string contains 21 characters incl. CR.

- **YYYY** - year with 4 decimal places
- **MM** - month with 2 decimal places
- **DD** - day with 2 decimal places
- **hh** - hours in 24 h format with 2 decimal places
- **mm** - minutes with 2 decimal places
- **ss** - seconds with 2 decimal places

Note:

The character string is terminated with CR.

Example

Enquiry:
$001 time

Answer:
@2005/04/07 09:00:50
=001# 24.44 #%

2.11 Option REPEAT x

By attaching the attribute REPEAT and a number x, the transmitted enquiry will be repeated every x seconds. If the value for the repetition is = 0, a measured value is only retrieved once. A repetition rate less than 5 seconds is not possible.

Example:

Enquiry: (activate autom. repetition every 10 sec.)
$001 time repeat 10

Answer:
@2005/04/07 09:02:19
=001# 27.55 #%
@2005/04/07 09:02:29
=001# 27.77 #%
@2005/04/07 09:02:39
=001# 28.44 #%

Enquiry: (terminates the repetition)
$001 time repeat 0

2.12 Option STORE

By adding the attribute STORE, the enquiry is stored in the EEPROM memory up to the option STORE. After switching on the instrument again, this enquiry will be used as input telegram and an answer will be generated.

Note:

This option is only available for the RS232 interface.

Example

Enquiry:
% time repeat 10 store

Answer:
@2005/04/07 09:02:19

=001# 27.55 %
=002# 28.44%
@2005/04/07 09:02:29
=001# 27.55 %
=002# 28.44%

Voltage interruption: If the instrument is now switched off and then switched on again, the instrument automatically sends the reply to the saved enquiry telegram.

@2005/04/07 09:03:19
=001# 27.55 %
=002# 28.44%
…

2.13 Option SUM

By attaching the attribute SUM, a check sum is built for each line of the reply. The check sum is the sum of all binary characters up to the start of the sum itself in modulo 65535.

Example

Enquiry:
%1sum

Answer:
=001# 27.55 %(00553)

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