

FLWSIC500

Technical Bulletin: MODBUS interface/protocol

Technical Bulletin: MODBUS Interface

Revision number: V1.5

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2016-02-16

1 Revisions

Version	Modifications	Date	Editor
1.0	Initial		Dietz
1.1	Layout Technical Bulletin	2013-06-06	Reiche
1.2	Volume Correction	2014-03-26	Schütze
1.3	Data registration	2014-06-27	Schütze
1.4	Log file rolling	2014-11-18	Ullmann
1.5	Features, Extended Archives, User Modbus	2016-02-16	Raab

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2 Introduction

This document specifies the electrical interface and serial communication protocol based on MODBUS RTU of the gas flow meter FLOWSIC500.

3 Reference

MODBUS over serial line specification and implementation guide V1.02; 2006; MODBUS Organization; http://www.modbus.org/docs/Modbus_over_serial_line_V1_02.pdf

MODBUS Application Protocol Specification V1.1b3; 2012; MODBUS Organization; http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf

4 Abbreviations

(E)	Error
(W)	Warning
(I)	Information
SINT8	8-bit, signed integer value
UINT8	8-bit, unsigned integer value
SINT16	16-bit, signed integer value
UINT16	16-bit, unsigned integer value
UINT32	32-bit, unsigned integer value
FLOAT32	32-bit IEEE floating point value
STRING16	16-bit, representing two 8-bit chars in one 16-bit value

5 Description of the interface/protocol

5.1 Serial interface

The bidirectional serial communication protocol allows connecting volume correction devices which are able to communicate using the protocol MODBUS RTU. Data elements representing the totalizer reading, flow meter identification and current flow value and status are implemented in the FLOWSIC500.

5.1.1 Signal level and interface connector

An externally powered, intrinsically safe RS485 provides the electrical interface for MODBUS communication.

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
Pin assignment configuration 4: RS485 (external feed)				
1	PWR+	Externally powered RS485 communication interface	Not electrically isolated Rated input voltage 4...16 V	$U_o = 8.2\text{ V}$ $I_o = 2.5\text{ mA}$ $P_o = 5.1\text{ mW}$ $C_o = 5.8\text{ }\mu\text{F}$ $L_o = 100\text{ mH}$ $U_i = 20\text{ V}$ $P_i = 1.1\text{ W}$ $C_i = 1.8\text{ }\mu\text{F}$
2	Data A			
3	PWR-			
4	Data B			

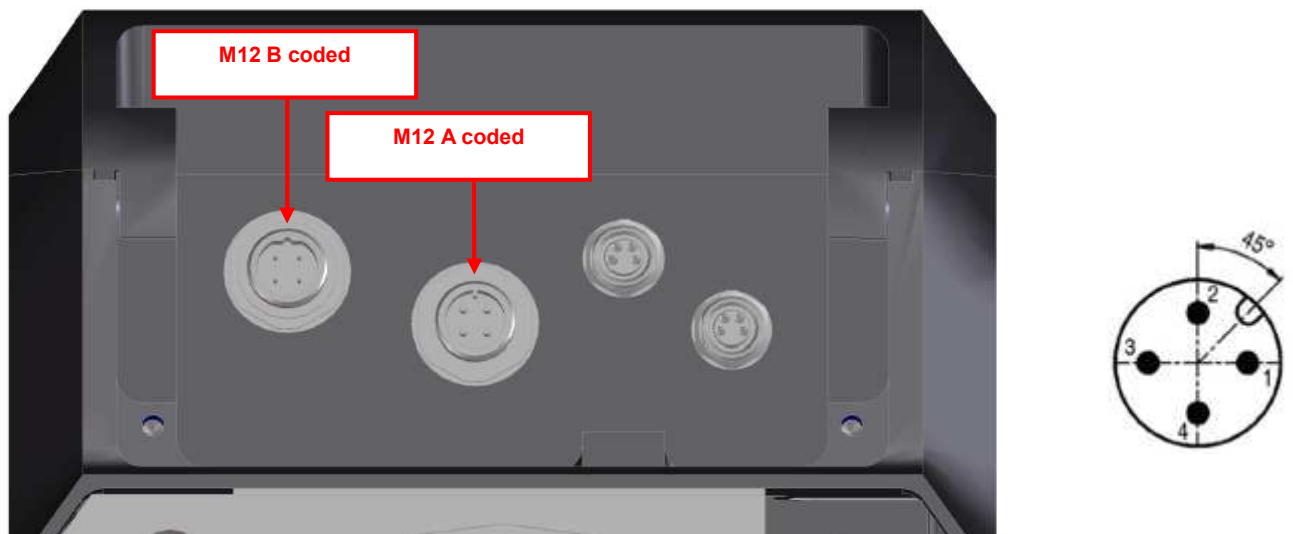


Figure 1: Position and pin configuration of the interface connector M12 A coded

5.1.2 Transfer rate

Transfer rate: 38400 Baud

Data format: 8 data bits, N (none parity), 1 stop bit

5.2 Description of the protocol

See chapter 2 for details of the protocol implementation.

5.3 Data elements

To read and write data from and to the FLOWSIC500 the public function codes:

- 03 (0x03) "read holding register" and
- 16 (0x10) "write multiple registers"

have been implemented.

All registers have to be read/write with MSB first.

6 General Modbus Registers

6.1 Device identification

Address	Size	Type	Value	Unit
3101	1	UINT16	Firmware version	-
3105	1	UINT16	Firmware CRC	-
3110	2	UINT32	Serial number	-
3127	1	UINT16	Unit system	-
3128	10	STRING16	Device tag	-

#3101 Firmware version

e.g.: Return value of 20103 means firmware 02.01.03.

#3105 Firmware CRC

e.g.: Return value of 40857 in integer format means CRC 0x9F99 in hex format.

#3127 Unit system

The unit system sets only the unit for the counters.

	0	1
Unit system	metric	imperial
Counter unit	m ³	ft ³

6.2 Device time

Address	Size	Type	Value	Unit
4300	2	UINT32	Date	-
4302	2	UINT32	Time	-
4304	1	SINT16	Time zone	h
4305	2	UINT32	Unix timestamp	s
4199	1	UINT16	DateTimeFormat	-

#4300 Date (Format ddmmyyyy)

e.g.: Return value of 1012014 means date 01.01.2014.

#4302 Time (Format hhmmss)

e.g.: Return value of 60000 means time 06:00:00. Time value is given in local time representation and depends on configured time zone value and activated "daylight saving time" feature (DLS).

#4304 Time zone

Time shift in hours from -12 to +12.

#4305 Unix timestamp

Standard Unix timestamp format which is incremented every second from 01.01.1970 00:00:00 UTC.

#4199 Date / time format

Selects the format of device display representation of date and time values

0 : Europe

1 : US (12 hours)

2 : US (24 hours)

6.3 User Access

Address	Size	Type	Value
3257	1	UINT16	Currently logged in User ID
3260	1	UINT16	User ID for login case
3261	1	UINT32	Password for login case
3280	1	UINT16	Logout Command

#3257 Currently logged in User ID and #3260 User ID for login case:

Value	User
0	Guest
1	User 3
2	User 2
3	User 1
4	Auth. User 3
5	Auth. User 2
6	Auth. User 1

#3261 Password for login case

Password consists of 4 digits in the range from 0000 to 9999.

#3280 Logout

Command register. Execute command by sending 0x0001.

6.3.1 Login

1. Send user ID to register #3260
2. Send password to register #3261

The reception of the password triggers the login. After this trigger the password for user ID is checked. If the password is accepted the user is logged in.

6.3.2 Logout

1. Send 0x0001 to register #3280

Current user is logged out.

6.4 Features

Address	Size	Type	Value	Unit
3141	1	UINT16	Customer Features Activation	-

#3141 Features, that the user can toggle (enable / disable) bit-by-bit.

The 16 bit value in #3141 is interpreted MSB first and bit index is zero-based. To activate a certain feature the corresponding bit has to be set, to disable a feature the corresponding bit has to be erased.

So it is necessary to read value of #3141, set/clear a particular feature bit and write back changed value to device to toggle a feature.

Please notice that activation is not available before login (see section 6.3.1).

FL500 Firmware version 2.5 currently supports only one feature (remaining bits at #3141 are reserved for future usage):

Bit 0 : set to 1 to activate Feature "daylight saving time" (DLS)

6.4.1 Feature "daylight saving time"

The user can activate the DLS feature, which modifies the displayed time value, if current device time is within range of a certain period of time.

Enable DLS feature : write 1 to register #3141

Disable DLS feature: write 0 to register #3141

Up to 10 periods (x = 0 .. 9) can be configured. Write attempts to the range limit registers are checked with respect to the following rules for every pair of registers:

- start of period x < end of period x
(with exception for special value: end = 0 is allowed, if start is > 0)
- both values (start of period x, end of period x) are not zero
- both values (start of period x, end of period x) must be within the same year

No further checks are implemented (especially not for duplicated entries or for misconfiguration of more than one period for the same year).

Remark: Every period can be reset independently by writing zero (default values) to the start and end registers.

Address	Size	Type	Value	Period
4307	2	UINT32	daylight saving period 0 begin	0
4309	2	UINT32	daylight saving period 0 end	0
4311	2	UINT32	daylight saving period 1 begin	1
4313	2	UINT32	daylight saving period 1 end	1
4315	2	UINT32	daylight saving period 2 begin	2
4317	2	UINT32	daylight saving period 2 end	2
4319	2	UINT32	daylight saving period 3 begin	3
4321	2	UINT32	daylight saving period 3 end	3
4323	2	UINT32	daylight saving period 4 begin	4
4325	2	UINT32	daylight saving period 4 end	4
4327	2	UINT32	daylight saving period 5 begin	5
4329	2	UINT32	daylight saving period 5 end	5
4331	2	UINT32	daylight saving period 6 begin	6
4333	2	UINT32	daylight saving period 6 end	6
4335	2	UINT32	daylight saving period 7 begin	7
4337	2	UINT32	daylight saving period 7 end	7
4339	2	UINT32	daylight saving period 8 begin	8
4341	2	UINT32	daylight saving period 8 end	8
4343	2	UINT32	daylight saving period 9 begin	9
4345	2	UINT32	daylight saving period 9 end	9

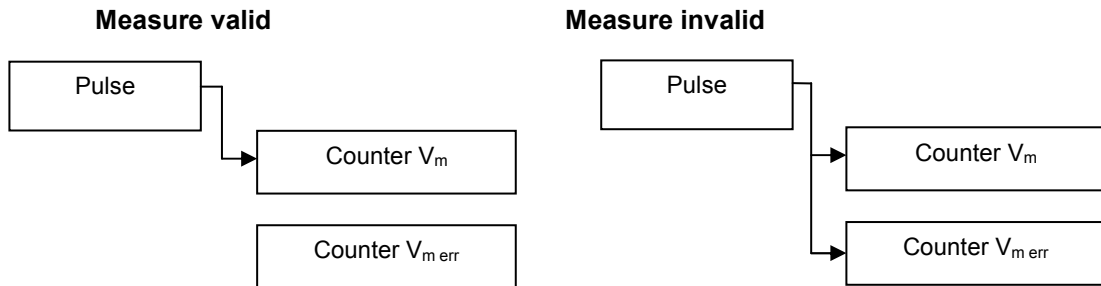
All registers #4307.. #4345 must be given in UTC time (standard unix timestamp format which is incremented every second from 01.01.1970 00:00:00 UTC).

Caution: The user is responsible to set meaningful values for start and end, because it depends on device installation location and customer needs (see also FLOWGATE500 commissioning assistant for a more comfortable configuration).

Remark: time zone value (#4304) does not influence those values.

7 Data registers flow meter without volume correction device

7.1 Structure of counter registers



7.2 Modbus registers

7.2.1 Read indicated volume

Address	Size	Type	Value	Unit
4102	2	UINT32	Counter V _m	Cnt
4104	2	UINT32	Counter V _{m_err}	Cnt
4100	1	SINT16	Resolution of measure counters	Unit/Cnt

#4100 Resolution of measure counters:

Value	Multiplicator of counters
-3	0.001
-2	0.01
-1	0.1
0	1
1	10
2	100

7.2.2 Read actual values

Address	Size	Type	Value	Unit
7002	2	FLOAT32	Flow rate actual	m ³ /h
7004	2	FLOAT32	Gas velocity	m/s
7006	2	FLOAT32	Speed of sound	m/s

7.2.3 Read status

Address	Size	Type	Value	Unit
3200	1	UINT16	Global status	-
3201	2	UINT32	Current status	-
3203	2	UINT32	Summary status	-

#3200 Global status:

Bit	Description de	Description en
0	Messung gültig	Measure valid
1	Initialisierung	Initialization
2	Fehler	Error
3	Warnung	Warning
4	Sommerzeit aktiv	Daylight saving period
5..15	Reserved	Reserved

#3201 Current status and #3203 Summary status:

Note: Summary status shows all Current status bits are ever active from last reset of Summary status. It is only to reset manually.

Bit	Description de	Description en
0	(E) Ereignislogbuch voll	(E) Event log full
1	(W) Ereignislogbuch fast voll	(W) Event log capacity warning
2	(W) Eichtechn. Logbuch voll	(W) Setup log full
3	(E) Prüfsummenfehler	(E) Checksum error
4	(E) Datum/Uhrzeit ungültig	(E) Date/Time invalid
5	(I) Firmware geändert	(I) Firmware changed

6	(I) Gerät neu gestartet	(I) Device restarted
7	(E) Systemtest aktiv	(E) System test active
8	(I) Konfigurationsmodus	(I) Configuration mode
9	(E) Kalibrationsmodus	(E) Calibration mode
10	(I) Eichschalter geöffnet	(I) Hardware lock open
11	(W) Impulslimit überschritten	(W) Impulse limit exceeded
12..19	Reserved	reserved
20	(E) Durchfluss: Sensor ausgefallen	(E) Flow: sensor failure
21	(W) Durchfluss: Sensorwarnung	(W) Flow: sensor warning
22	(W) Durchfluss: unteres Kundenlimit	(W) Flow: lower user limit
23	(W) Durchfluss: oberes Kundenlimit	(W) Flow: upper user limit
24..25	Reserved	reserved
26	(W) Batterie (1) ausgefallen	(W) Battery (1) failed
27	(W) Batterie (2) ausgefallen	(W) Battery (2) failed
28	(W) Netzversorgung ausgefallen	(W) Mains supply failure
29	(E) Negativer Durchfluss	(E) Reverse flow
30..31	reserved	reserved

8 Data registers with volume correction device

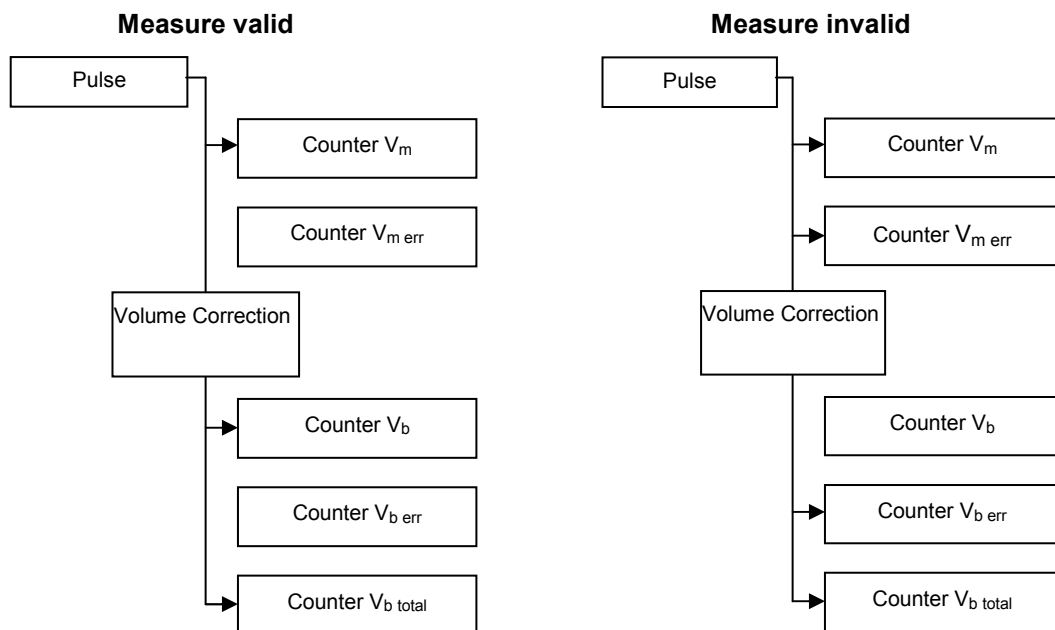
8.1 Structure of counter registers

For FLOWSIC500 gas flow meters with volume correction, three additional counters are available in addition to the counters V_m and $V_{m\text{ err}}$.

The counter V_b counts the volume at base conditions at undisturbed measurement conditions.

The counter $V_{b\text{ err}}$ counts the volume at status failure and can be reset. The counter $V_{b\text{ total}}$ counts the total volume independantly from the meter status.

The meter switches to status failure if there is an error in the system, at flow measurement or at volume conversion (pressure measurement, temperature measurement or compressibility calculation).



8.2 Modbus registers

8.2.1 Read indicated volume

Address	Size	Type	Value	Unit
4106	2	UINT32	Counter V_b	Cnt
4108	2	UINT32	Counter $V_{b\text{err}}$	Cnt
4110	2	UINT32	Counter $V_{b\text{total}}$	Cnt
4101	1	SINT16	Resolution of base counters	Unit/Cnt

#4101 Resolution of base counters:

Value	Multiplicator of counters
-3	0.001
-2	0.01
-1	0.1
0	1
1	10
2	100

8.2.2 Read actual values

Address	Size	Type	Value	Unit
5026	2	FLOAT32	Flow rate base	m ³ /h
5028	2	FLOAT32	Conversion factor	-
5033	2	FLOAT32	Compressibility	-
5136	2	FLOAT32	Pressure actual	bar(a)
5224	2	FLOAT32	Temperature actual	°C

8.2.3 Read status

Address	Size	Type	Value	Unit
3200	1	UINT16	Global status	-
3201	2	UINT32	Current status	-
3203	2	UINT32	Summary status	-

#3200 Global Status:

Bit	Description de	Description en
0	Messung gültig	Measure valid
1	Initialisierung	Initialization
2	Fehler	Error
3	Warnung	Warning
4	Sommerzeit aktiv	Daylight saving period
5..15	Reserved	Reserved

#3201 Current status and #3203 Summary status:

Note: Summary status shows all current status bits are ever active from last reset of summary status. It is only to reset manually.

Bit	Description de	Description en
0	(E) Ereignislogbuch voll	(E) Event log full
1	(W) Ereignislogbuch fast voll	(W) Event log capacity warning
2	(W) Eichtechn. Logbuch voll	(W) Setup log full
3	(E) Prüfsummenfehler	(E) Checksum error
4	(E) Datum/Uhrzeit ungültig	(E) Date/Time invalid
5	(I) Firmware geändert	(I) Firmware changed
6	(I) Gerät neu gestartet	(I) Device restarted
7	(E) Systemtest aktiv	(E) System test active
8	(I) Konfigurationsmodus	(I) Configuration mode
9	(E) Kalibrationsmodus	(E) Calibration mode
10	(I) Eichschalter geöffnet	(I) Hardware lock open
11	(W) Impulslimit überschritten	(W) Impulse limit exceeded
12	(E) Temperatursensor ausgefallen	(E) Temperature sensor failure
13	Reserved	Reserved
14	(E) Temperatur unteres Kundenlimit	(E) Temperature lower customer limit
15	(E) Temperatur oberes Kundenlimit	(E) Temperature higher customer limit
16	(E) Drucksensor ausgefallen	(E) Pressure sensor failure
17	(E) Druck ausserhalb Gerätegrenzwerte	(E) Pressure outside of limits
18	(E) Druck unteres Kundenlimit	(E) Pressure lower customer limit
19	(E) Druck oberes Kundenlimit	(E) Pressure higher customer limit

20	(E) Durchfluss: Sensor ausgefallen	(E) Flow: sensor failure
21	(W) Durchfluss: Sensorwarnung	(W) Flow: sensor warning
22	(W) Durchfluss: unteres Kundenlimit	(W) Flow: lower user limit
23	(W) Durchfluss: oberes Kundenlimit	(W) Flow: upper user limit
24	(E) Umwertung Fehler	(E) Correction error
25	Reserved	Reserved
26	(W) Batterie (1) ausgefallen	(W) Battery (1) failed
27	(W) Batterie (2) ausgefallen	(W) Battery (2) failed
28	(W) Netzversorgung ausgefallen	(W) Mains supply failure
29	(E) Negativer Durchfluss	(E) Reverse flow
30..31	Reserved	Reserved

9 Data archives

9.1 Overview

Three different archive types are available.

Measurement period archive:

The measurement period archive saves meter readings in periodic intervals. The interval can be set with the parameter #5997 "Log_MeasurePeriode" in the range from 3 to 60 minutes. Following data is saved: number of record, time stamp, counters, pressure, temperature, compressibility and conversion factor and speed of sound. The data archive has a memory depth of 6000 data sets and is a rolling/overwriting archive.

Daily archive:

The daily archive saves meter readings in daily intervals. The record is always saved at the same time of the day. This "gas hour" can be set with parameter #5998 "Log_GasHour" in the range from 1 to 24. Following data is saved: number of record, time stamp, counters, pressure, temperature, compressibility, conversion factor and speed of sound. The daily archive has a memory depth of 600 data sets and is a rolling/overwriting archive.

Monthly archive:

The monthly archive saves meter readings in monthly intervals. The record is always saved at the same day of the month. This "gas day" can be set with parameter #5999 "Log_GasDay" in the range from 1 to 28. Following data is saved: number of record, counters time stamp, counters and also the average and highest value of several process values for example pressure and temperature. The monthly archive has a memory depth of 25 data sets and is a rolling/overwriting archive.

9.2 Records

The records of the data archives are saved in an external flash memory. Each data set is secured by a CRC-16 check sum with an initial value.

The consecutive number of record will remain when resetting the archives. Therefore a consecutive identifier is ensured throughout the lifetime of the product.

The following tables describe the structure of the records for the different data archives.

Measurement period archive (archive number 3) and daily archive (archive number 4):

Element	Metric	Imperial	Type	Description
Record-ID	-	-	UINT32	Consecutive number of record; remains when resetting archives.
Time stamp	S	s	UINT32	Time of record as a Unix timestamp
Unit identifier	-	-	UINT8	Bit 0 : unit systems 0 metric 1 imperial Bit 1..3 : temperature unit 0 unit system 1 °C 2 K 3 °F 4 R Bit 4..6 : pressure unit 0 unit system 1 bar(a) 2 psi(a) 3 kPa 4 MPa 5 kg/cm ² 6 psi(g) Bit 7 : not used
Record status	-	-	UINT8	Status bits of Record: Bit 0: 0 = valid for accounting, 1 = failure Bit 1: 1 = record incomplete Bit 2: 1 = daylight saving time active at the record generation time Bit 3: 1 = local time (time zone value was 0 at the record generation time) Bit 4 .. 7: not used
Detail status	-	-	UINT32	Current device status (register #3203) at the record generation time
V _m	m ³	ft ³	UINT32	Volume in measure conditions w/o interruption
V _{m err}	m ³	ft ³	UINT32	Volume in measure conditions with interruption
Resolution V _m	-	-	SINT8	Exponent counter resolution in measure conditions
V _b	m ³	ft ³	UINT32	Volume in base conditions w/o interruption
V _{b err}	m ³	ft ³	UINT32	Volume in base condition with interruption
Resolution V _b	-	-	SINT8	Exponent counter resolution in base conditions
Q max	m ³	ft ³	FLOAT32	Maximal flow rate in measure condition during period
Q _b max	m ³	ft ³	FLOAT32	Maximal flow rate in base condition during period
p max	bar(a)	psi(a)	FLOAT32	Maximal pressure
p min	bar(a)	psi(a)	FLOAT32	Minimal pressure
p Ø	bar(a)	psi(a)	FLOAT32	Average pressure
T Ø	°C	°F	FLOAT32	Average temperature
K Ø	-	-	FLOAT32	Average compressibility
C Ø	-	-	FLOAT32	Average conversion factor
SOS Ø	m/s	ft/s	FLOAT32	Average speed of sound
Checksum status	-	-	UINT16	CRC-16 check sum status on record (0 = CRC error ,1 = CRC okay)
Size of complete dataset			70 bytes	

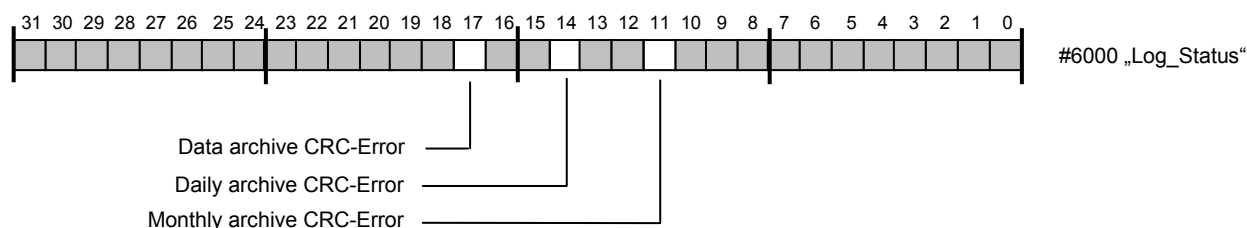
Monthly archive (archive number 5):

Element	Metric	Imperial	Type	Description
Record-ID	-	-	UINT32	Consecutive number of record; remains when resetting archives.
Time stamp	S	s	UINT32	Time of record as a Unix timestamp
Unit identifier	-	-	UINT8	Bit 0 : Engineering units 0 metric 1 imperial Bit 1..3 : Temperature unit 0 Engineering unit 1 °C 2 K 3 °F 4 R Bit 4..6 : Pressure unit 0 Engineering unit 1 bar(a) 2 psi(a) 3 kPa 4 MPa 5 kg/cm ² 6 psi(g)
Entry status	-	-	UINT8	Status bits of Record: Bit 0: 0 = valid for accounting, 1 = failure Bit 1: 1 = record incomplete Bit 2: 1 = daylight saving time active at the record generation time Bit 3: 1 = local time (time zone value was 0 at the record generation time) Bit 4 .. 7: not used
V _m	m ³	ft ³	UINT32	Volume in actual conditions w/o interruption
MPmax V _m	m ³	ft ³	UINT32	Max. volume in a.c. per measurement period
Daymax V _m	m ³	ft ³	UINT32	Maximal volume in a.c. per day
Resolution V _m	-	-	SINT8	Exponent counter resolution at measure conditions
V _b	m ³	ft ³	UINT32	Volume in base conditions w/o interruption
MPmax V _b	m ³	ft ³	UINT32	Max. volume in s.c. per measurement period
Daymax V _b	m ³	ft ³	UINT32	Maximal volume in s.c. per day
Resolution V _b	-	-	SINT8	Exponent counter resolution at base condition
Q max	m ³ /h	ft ³ /h	FLOAT32	Maximal flow rate in measure condition
Q min	m ³ /h	ft ³ /h	FLOAT32	Minimal flow rate in measure condition
Q _b max	m ³ /h	ft ³ /h	FLOAT32	Maximal flow rate in base condition
Q _b min	m ³ /h	ft ³ /h	FLOAT32	Minimal flow rate in base condition
p max	bar(a)	psi(a)	FLOAT32	Maximal pressure
p min	bar(a)	psi(a)	FLOAT32	Minimal pressure
p Ø	bar(a)	psi(a)	FLOAT32	Average pressure
T max	°C	°F	FLOAT32	Maximal temperature
T min	°C	°F	FLOAT32	Minimal temperature
T Ø	°C	°F	FLOAT32	Average temperature
K Ø	-	-	FLOAT32	Average compressibility
C Ø	-	-	FLOAT32	Average conversion factor
Check sum status	-	-	UINT16	CRC-16 check sum status on record (0 = CRC error ,1 = CRC okay)
Size of complete dataset			90 bytes	

9.3 Data archive management

All data archives are saved in the EEPROM and do have their individual management. Different information e.g. quantity of records are saved in this structure. Each structure is secured by a CRC-16 check sum with an initial value.

When starting the FLOWSIC500 the management structure gets loaded and checked for consistence. In case of failure, a corresponding checksum error will be generated. The status of logbooks can be read in register #6000 "Logbook Status". The following figure shows the content of the status-registers.



A possible CRC-error can be eliminated with the reset of the archive. Only in this case the record-ID will be reset as well. With register #6004 "Log_ClearAll" all archives and also all logbooks can be reset.

The content of the management structure is displayed by registers. Definitions are described in the following tables.

Measurement period archive:

Address	Size	Type	Name	Description
6230	1	UINT16	Log4_ClearArchive	Command: Reset archive
6231	1	UINT16	Log4_ArchiveStatus	Status of the archive
6232	1	UINT16	Log4_EntryCount	Number of entries, which are already in the archive
6233	1	UINT16	Log4_MaxEntries	Maximum number of entries in the archive
6234	1	UINT16	Log4_EntrySize	Size of single entry in archive
6236	1	UINT16	Log4_NextEntryPosition	Position in archive, where the next entry will be placed
6237	2	UINT32	Log4_NextRecord-ID	Record-ID of entry which will generated at next

Daily archive :

Address	Size	Type	Name	Description
6240	1	UINT16	Log5_ClearArchive	Command: Reset archive
6241	1	UINT16	Log5_ArchiveStatus	Status of the archive
6242	1	UINT16	Log5_EntryCount	Number of entries, which are already in the archive
6243	1	UINT16	Log5_MaxEntries	Maximum number of entries in the archive
6244	1	UINT16	Log5_EntrySize	Size of single entry in archive
6246	1	UINT16	Log5_NextEntryPosition	Position in archive, where the next entry will be placed
6247	2	UINT32	Log5_NextRecord-ID	Record-ID of entry which will generated at next

Monthly archive :

Address	Size	Type	Name	Description
6250	1	UINT16	Log6_ClearArchive	Command: Reset archive
6251	1	UINT16	Log6_ArchiveStatus	Status of the archive
6252	1	UINT16	Log6_EntryCount	Number of entries, which are already in the archive
6253	1	UINT16	Log6_MaxEntries	Maximum number of entries in the archive
6254	1	UINT16	Log6_EntrySize	Size of single entry in archive
6256	1	UINT16	Log6_NextEntryPosition	Position in Archive, where the next entry will be placed
6257	2	UINT32	Log6_NextRecord-ID	Record-ID of entry which will generated at next

9.4 Readout via MODBUS

Please notice that readout is not available before login (see section 7.3.1).

To check if new records are available it is necessary to compare the total number of records with the last generated entry.

Two registers are provided for the read out of data archives via serial communication with MODBUS. With register #6005 "Log_DownloadAddress" it is possible to choose the position where the reading of entries should begin. The registers #6006 – #6130 (125 register) "Log_DownloadBuffer" provide a buffer for reading the data. One reading access on this buffer provides always the maximum quantity of data sets that fit in this buffer; starting from the position defined by register #6005.

The entry pointer of register #6005 increases automatically according the data sets read. Therefore the readout of the archive will be done fast as possible. Only in the unlikely case of an invalid telegram the entry pointer needs to be set again.

The latest entry needs to be known to determine the correct read-out order of a rolling/overwriting archive. In case the archive has not reached its capacity and hasn't started overwriting older values the position of the oldest entry is 0. In case older values have been overwritten the value represents the position in the logbook on which the next entry is written (→ data archive management).

The reading address is defined by the requested position in the archive (0...9999) and the archive number (3 = measurement period archive; 4 = daily archive; 5 = monthly archive) multiplied with 10.000. When reading a data entry from the data buffer the fully download address is put in front of this entry. Therefore interpretation problems are eliminated. The CRC-16 check sum of each entry is verified when reading. The entry data field for the CRC-16 check sum passes the result of the check (0 = CRC-error; 1 = CRC-o.k.). In case of failure the entry data will be returned as they were read.

	00 03 52 00 06 9A AF FD 00 00 03 98 00 08 8D FB 08 00 04 00 00 00 56 F0 1B E8 00 00 19 0C
Archive address of record (2 bytes)	75 32
Record 2 (70 bytes)	00 01 43 AC A6 37 3F 7B 17 04 3F 80 02 1F 41 B1 47 E5 3F 80 27 6F 3F 80 20 34 3F 80 35 E7 40 A4 BA 53 40 A7 E2 00 FD 00 00 03 52 00 06 99 AE FD 00 00 03 98 00 08 8C F5 08 00 04 00 00 00 56 F0 1B 34 00 00 19 0B
Archive address of record (2 bytes)	75 31
Record 1 (70 bytes)	00 01 43 AC 82 05 3F 7B 18 D9 3F 80 02 24 41 B1 B4 A4 3F 80 2C 25 3F 80 20 34 3F 80 35 E7 40 A5 46 15 40 A8 85 F4 FD 00 00 03 52 00 06 98 AD FD 00 00 03 98 00 08 8B EF 08 00 04 00 02 00 56 F0 1A 80 00 00 19 0A
Archive address of record (2 bytes)	75 30
Count of records in telegram (1 byte)	03
Telegram CRC (2 bytes)	17 BB

10 Register Area “User Modbus”

The values of registers within the address range of 1000 to 1026 are given in the unit respective display format as configured by user. The read values are the same as shown on device display.

Addr.	Size	Type	Name		Description	unit system setting is:	
						SI unit <i>format</i>	US unit <i>format</i>
1000	1	UINT16	Sys_Status		global status, see #3200		
1001	2	FLOAT32	Custom_Flowrate	*1	Flow rate actual see #7002	m ³ /h	ft ³ /h
1003	2	FLOAT32	Custom_Normflow	*1 *5	flow rate base see #5026	m ³ /h	ft ³ /h
1005	2	FLOAT32	Custom_GasVelocity	*1	Gas velocity	m/s	ft/s
1007	2	FLOAT32	Custom_SpeedOfSound	*1	Speed of sound	m/s	ft/s
1009	2	FLOAT32	Custom_PressureAct	*2	Pressure actual	bar	psia
1011	2	FLOAT32	Custom_TemperatureAct	*3	Temperature actual	°C	°F
1013	2	UINT32	Custom_RTC_Date	*4	Device date, see #4300	<i>ddmmyyyy</i>	<i>mmddyyyy</i>
1015	2	UINT32	Custom_RTC_Time		Device time, see #4302	<i>hhmmss</i>	
1017	2	UINT32	Custom_Counter_Vm		see #4102 Counter V _m	Cnt	Cnt
1019	2	UINT32	Custom_Counter_VmS		see #4104 Counter V _{ms}	Cnt	Cnt
1021	2	UINT32	Custom_Counter_Vb	*5	see #4106 Counter V _b	Cnt	Cnt
1023	2	UINT32	Custom_Counter_VbS	*5	see #4108 Counter V _{bs}	Cnt	Cnt
1025	2	UINT32	Custom_Counter_VbT	*5	see #4110 Counter V _{bT}	Cnt	Cnt

*1 depends on current unit system selection („SI“ or „US“), see #3217 UnitSystem

*2 read unit selection from #5106 PressureUnit: if value is „Default“, then unit depends on #3217 UnitSystem

*3 read unit selection from #5206 TemperatureUnit: if value is „Default“, then unit depends on #3217 UnitSystem

*4 read format selection from #4199 DateTimeFormat

*5 will be always read as 0, if device type is not „Gas meter with EVC“