



INTERNATIONAL

**DIN MESS BUS
Commands for
FCU 2000 and FCU 8000
series**

Manual

Firmware Version 3.0 and higher

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1 GENERAL

All transmissions are ASCII-coded, there is no transmission of binary values. The transmission of strings is done as follows: first the number of characters is transmitted, then the string enclosed in quotation marks (""). Characters with a decimal value over 127 are transmitted in an escape-sequence because the DIN-MESS BUS transmits only 7-bit characters. The escape-sequence is initiated by a '@' and then followed by the hexadecimal value (as ASCII) of the character.

e.g.: 'Pumpe 12' -----> 8 "Pumpe 12"
'Behälter 3' -----> 12 "Beh@84lter 3" ä --> 132 decimal --> 84 hex

The master in a DIN-MESS BUS-system controls all communications:

- To send a command to the FCU he first transmits a reception request, and then the command string.
- To receive an answer he first transmits a transmission request, then the FCU sends the answer string.
- A transmission request sent to the FCU with no answer string present at the FCU returns error status, status and mode.

e.g.: '1024 02 20' :
error status: 1024
status: 02
mode: 20

error status:

Name	Binary value	description
CAL_LOST	1	calibration values incorrect, fatal */
CONST_LOST	2	constant parameter incorrect: serial no. , sensor no. */
PARA_LOST	4	normal parameter incorrect */
I2C_ERROR	8	error I ² C-bus handling */
EE_CHECK	16	CHECK-sum in EEPROM incorrect */
WRONG_FORMAT	32	error in bus command string: syntax */
COMMAND_ERRO R	64	error in bus command string: semantic */
PROT_LOST	128	log memory incorrect */
TX_ERROR	512	error in transmission log (DIN MESS BUS) */
Q_ERROR	1024	error flow rate */
VDD_ERROR	2048	error ±VDD */
ISENSOR_ERROR	4096	error supply current particle sensor */
VIN_ERROR	8192	error power supply voltage */

status:

<i>name</i>	<i>Binary value</i>	<i>description</i>
COUNT_READY	1	a new measurement is done */
FILTER_KO	2	filter is contaminated */
AKKU_LOW	4	battery voltage too low */
(EXIN)	8	
WASSER	16	water warning
MEMEMPTY	32	measurement stopped, memory full
BSU	64	BSU connected
	128	

mode:

Mode modulo 10 shows the number of the measurement program
10 --> M1, 20 --> M2, etc.

M1	M2	M3	M5	M6	
10	20	30	50	60	measurement stopped
11	21	31	51	61	waiting for correct flow rate
12	22	32	52	62	measurement running

M4	(filter from to)
40	measurement stopped
41	waiting for a correct flow rate
42	measurement running, testing lower limit
43	delay is running
44	delay expired, waiting for a correct flow rate
45	measurement running, testing upper limit

2 Commands and requests

A command always consists of a command number and accompanying command parameters. Some commands force the FCU to answer at the next transmission request. The answer is always preceded by the command number. If the answer is longer than one data block (128 bytes), the answer is transmitted in several blocks. An answer of the FCU always has to be read out completely, otherwise the communication is suspended.

Command '3' :	contents of log memory
Command '4' :	transmit log
Command '5' :	delete log memory completely
Command '6' :	delete log
Command '7' :	set FCU clock
Command '8' :	program parameter(s) of the FCU
Command '9' :	read parameter(s) of the FCU
Command '10' :	read FCU clock
Command '11' :	read particle counts (differential) on line
Command '12' :	read contamination classes (ISO/NAS) on line
Command '13' :	stop measurement
Command '14' :	start measurement
Command '15' :	test parameters of the FCU
Command '16' :	reset error status
Command '17' :	transmit language(s) to the FCU
Command '109' :	read FCU model and firmware version

3 Command '3' : contents of log memory

The FCU transmits all log headers with date, time, number of measurements, measuring point and the log number.

TRANSMIT: '3'

RECEIVE:

e.g.:

1. block: 3 12.08.1995 12:33 40 19 "HYDAC Pruefstand XY" 11<CRLF>
12.08.1995 15:10 25 19 "HYDAC Pruefstand YZ" 12<CRLF>
2. block: 3 13.08.1995 09:45 120 18 "Flutec Pumpe 12345" 14<CRLF>
13.08.1995 12:13 78 18 "Flutec Pumpe 67890" 15<CRLF>

etc.

4 Command '4' : transmit log

A log can be downloaded via the log number. The FCU transmits the log header and all the log lines. The log header consists of two lines :

Line 1 contains : date and time when the measurement was started, number of measurements, measuring point and the log number.

Line 2 contains : date and time when the measurement was stopped, the averaging interval and the test volume is transmitted additionally.

The FCU 2000 log lines consist of index, increment of minutes (since last log line), 4 particle counts, flow rate and two zeros as wildcards for water content and temperature.

The FCU 8000 log lines consist of index, increment of minutes (since last log line), 6 particle counts and flow rate.

If the index = 1 (online log) or 11 (bottle sampling log) these values are transmitted, otherwise one of the following messages (may vary with selected language) is transmitted:

Index	message
2	"error flow rate"
2	"error flow rate"
3	"no flow"
4	M3: limit reached"
5	M4: limit reached"
6	M4: measurement started"
7	M4: test cycle time started"

TRANSMIT: '4 15' request for log no. 15

RECEIVE:

e.g.:

```
1. block 4 13.08.2001 12:13 78 18 "Flutec Pumpe 67890" 15<CRLF>
          13.08.2001 13:31 0 100<CRLF>
2. block 4 1 0 51278 4562 164 2 100 0 0 <CRLF>
          1 1 51278 4562 164 2 99 0 0 <CRLF>
3. block 4 2 0 14 "error flowrate" <CRLF>
          1 3 51278 4562 164 2 102 0 0 <CRLF>      ....   etc.
```

5 Command '5' : delete log memory completely

This erases the whole log memory. After this command a wait time of about 4..5 seconds is necessary before the next transmission request or receive request can take place.

TRANSMIT: '5'

6 Command '6' : delete log by number

This deletes a single log specified by the log number.

TRANSMIT: '6 5' delete log no. 5

7 Command '7' : set FCU clock

This command sets the date and time of the FCU's internal clock.

TRANSMIT: '7 06.09.2001 8:55'

8 Command '8' : program parameter(s) of the FCU

The different parameters in the FCU (limit values, cycle times, name of measuring point, etc.) are set by this command. The command number is followed by the parameter number and the value of that parameter. It is possible to set several parameters with only one command (but the maximum block length may not be exceeded).

e.g.:

TRANSMIT: '8 10 122 11 23 50 6' parameters 10, 11, 50 are set to values
122 23 and 6 respectively.

Attention!

!!! not all FCU parameters are programmable !!!

9 Command '9' : read parameter(s) of the FCU

The command number is followed by the parameter number or a list of parameter numbers.

e.g.:

TRANSMIT: '9 10 11 50 51' reads parameters 10, 11, 50 and 51

RECEIVE: '9 10 122 11 23 50 6 51 3'

Attention!

!!! not all FCU parameters are readable !!!

10 Command '10' : read FCU clock

This command reads the date and time of the FCU's internal clock.

TRANSMIT: '10'

e.g.:

RECEIVE: '10 4.3.1997 8:55'

11 Command '11' : read particle counts (differential) on line

This command transmits the particle counts and the flow rate of the last measurement:

FCU 2000: 5..15 μ m, 15..25 μ m, 25..50 μ m, >50 μ m

FCU 2100: 2..5 μ m, 5..15 μ m, 15..25 μ m, >25 μ m

FCU 2200: 4..6 μ m_(c), 6..14 μ m_(c), 14..21 μ m_(c), >21 μ m_(c)

FCU 8100: 2..5 μ m, 5..15 μ m, 15..25 μ m, 25..50 μ m, 50..100 μ m, > 100 μ m

FCU 8200: 4..6 μ m_(c), 6..14 μ m_(c), 14..21 μ m_(c), 21..38 μ m_(c), 38..70 μ m_(c), > 70 μ m_(c)

TRANSMIT: '11'

e.g. :

RECEIVE: '11 50453 4324 234 67 100 0 0' (FCU 2000)

RECEIVE: '11 50453 4324 234 67 20 2 50' (FCU 8000)

12 Command '12' : read contamination classes (ISO/NAS) on line

The values of the last measurement are transmitted:

NAS/SAE or ISO-classes, flow rate.

Whether NAS/SAE or ISO-classes are transmitted is selectable by parameter 21.

FCU 2000:

If ISO is selected, the first two values are the ISO-codes (>5 μ m, >15 μ m) and the second two values are NAS-classes (25..50 μ m and >50 μ m) followed by flow rate and two zeros.

FCU 2100 :

If ISO is selected, the first three values are the ISO-codes (>2 μ m, >5 μ m, >15 μ m) and the fourth value is the NAS-class for the 25..50 μ m particle size followed by flow rate and two zeros.

FCU 2200 :

If ISO is selected, the first three values are the ISO-codes ($>4\mu\text{m}_{(c)}$, $>6\mu\text{m}_{(c)}$, $>14\mu\text{m}_{(c)}$) and the fourth value is the SAE-class for the $>21\mu\text{m}_{(c)}$ particle size.

FCU 8100:

If ISO is selected, the first three values are the ISO-codes ($>2\mu\text{m}$, $>5\mu\text{m}$, $>15\mu\text{m}$) and the next three values are the NAS-classes for the 25..50 μm , 50..100 μm and $>100\mu\text{m}$ particle sizes followed by the flow rate.

FCU 8200 :

If ISO is selected, the first three values are the ISO-codes ($>4\mu\text{m}_{(c)}$, $>6\mu\text{m}_{(c)}$, $>14\mu\text{m}_{(c)}$) and next three values are the SAE-classes for the 21 $\mu\text{m}_{(c)}$, 38 $\mu\text{m}_{(c)}$ and 70 $\mu\text{m}_{(c)}$ particle sizes followed by the flow rate.

TRANSMIT: '12'

e.g.:

RECEIVE: '12 19 16 13 5 100 0 0' (FCU 2000)

RECEIVE: '11 19 16 13 5 4 5 50'(FCU 8000)

13 Command '13' : stop measurement

This command stops a running measurement.

TRANSMIT: '13'

14 Command '14' : start measurement

This command starts a pre-selected measuring mode (M1...M5).

To pre-select a mode, see command 8, parameter 97.

TRANSMIT: '14'

15 Command '15' : test parameters of the FCU

The check sum of all parameters in the non volatile memory (EEPROM) of the FCU will be checked. The number of the first erroneous parameter is stored in parameter no. 40 and can be read out with command '9'.

TRANSMIT: '15'

16 Command '16' : reset error status

TRANSMIT: '16'

17 Command '17' : transmit language(s) to the FCU

This command is used to upload the different language texts into the FCU. After the command number, the number of the language (1,2,3: English, French, programmable), the text number (0...190, representing single messages) and the text in string format (text length and text in quotation marks) have to be send.

TRANSMIT : '17 1 12 15 "Hugo sieht fern" '

Attention:

The are 2 special commands:

TRANSMIT: '17 x 0 0' Start transmission of language x.

TRANSMIT: '17 x 0 -1' Finish transmission of language x.

Always transmit the complete language !

18 Command '109': read FCU model and firmware version

The FCU responds with 3 strings, indicating the FCU model, the FCU series and the firmware version of the EPROM.

TRANSMIT: '109'

RECEIVE: '109 7 "FCU 2110" 7 "FCU 2100 "5"V1.02"'

19 Parameter numbers for all FCU with Index G+:

No.	Read Only	String	Designation
0..4	yes		Internal use
5	yes	X	Serial no.
6	yes	X	Sensor no.
7	yes	X	Calibration date
8	no		Averaging interval
9	no		Test volume
10	no		Auto start function 0 → no, 1 → yes
11	no		Mode for auto start 0 → M1, ... 5 → M6
12	no		Lower limit relay 1 (in M2)
13	no		Upper limit relay 1 (in M2)
14	no		Limit switch function for relay 1 (in M2) 0 → no function 1 → within range 2 → outside range 3 → exceed 4 → fall below
15	no		Measuring channel for relay 1 (in M2) 0 → NAS 5µm 1 → NAS 15µm 2 → NAS 25µm 3 → NAS 50µm (FCU20XX) 4 → ISO 5µm 5 → ISO 15µm 6 → Flow rate 0 → NAS 2µm 1 → NAS 5µm 2 → NAS 15µm 3 → NAS 25µm (FCU21XX, FCU81XX) 4 → ISO 2µm 5 → ISO 5µm 6 → ISO 15µm 7 → Flow rate 0 → SAE 4µm 1 → SAE 6µm 2 → SAE 14µm 3 → SAE 21µm (FCU22XX, FCU82XX) 4 → ISO 4µm 5 → ISO 6µm 6 → ISO 14µm 7 → Flow rate
16	no		Lower limit relay 2 (in M2)
17	no		Upper limit relay 2 (in M2)

No.	Read Only	String	Designation
18	no		Limit switch function relay 2 (in M2) 0 → no function 1 → within range 2 → outside range 3 → exceed 4 → fall below
19	no		Measuring channel for relay 2 (in M2) 0 → NAS 5µm 1 → NAS 15µm 2 → NAS 25µm 3 → NAS 50µm (FCU20XX) 4 → ISO 5µm 5 → ISO 15µm 6 → Flow rate 0 → NAS 2µm 1 → NAS 5µm 2 → NAS 15µm 3 → NAS 25µm (FCU21XX, FCU81XX) 4 → ISO 2µm 5 → ISO 5µm 6 → ISO 15µm 7 → Flow rate 0 → SAE 4µm 1 → SAE 6µm 2 → SAE 14µm 3 → SAE 21µm (FCU22XX, FCU82XX) 4 → ISO 4µm 5 → ISO 6µm 6 → ISO 14µm 7 → Flow rate
20	no		Abort measurement if Q = 0 0 → no, 1 → yes
21	No		Unit for Command 12 0 → NAS/SAE, 1 → ISO
22	No		Lower limit in M3 5..15µm / > 5µm (NAS / ISO) (FCU20XX) 2.. 5µm / > 2µm (NAS / ISO) (FCU21XX, FCU81XX) > 4µm / > 4µm (SAE / ISO) (FCU22XX, FCU82XX)
23	No		Lower limit in M3 15..25µm / > 15µm (NAS / ISO) (FCU20XX) 5..15µm / > 5µm (NAS / ISO) (FCU21XX, FCU81XX) > 6µm / > 6µm (SAE / ISO) (FCU22XX, FCU82XX)
24	No		Lower limit in M3 15..25µm / > 15µm (NAS / ISO) (FCU21XX, FCU81XX) > 14µm / > 14µm (SAE / ISO) (FCU22XX, FCU82XX)

No.	Read Only	String	Designation
25	no		Lower limit in M4 5..15µm / > 5µm (NAS / ISO) (FCU20XX) 2.. 5µm / > 2µm (NAS / ISO) (FCU21XX, FCU81XX) > 4µm / > 4µm (SAE / ISO) (FCU22XX, FCU82XX)
26	no		Lower limit in M4 15..25µm / > 15µm (NAS / ISO) (FCU20XX) 5..15µm / > 5µm (NAS / ISO) (FCU21XX, FCU81XX) > 6µm / > 6µm (SAE / ISO) (FCU22XX, FCU82XX)
27	no		Lower limit in M4 15..25µm / > 15µm (NAS / ISO) (FCU21XX, FCU81XX) > 14µm / > 14µm (SAE / ISO) (FCU22XX, FCU82XX)
28	no		Upper limit in M4 5..15µm / > 5µm (NAS / ISO) (FCU20XX) 2.. 5µm / > 2µm (NAS / ISO) (FCU21XX, FCU81XX) > 4µm / > 4µm (SAE / ISO) (FCU22XX, FCU82XX)
29	no		Upper limit in M4 15..25µm / > 15µm (NAS / ISO) (FCU20XX) 5..15µm / > 5µm (NAS / ISO) (FCU21XX, FCU81XX) > 6µm / > 6µm (SAE / ISO) (FCU22XX, FCU82XX)
30	no		Upper limit in M4 15..25µm / > 15µm (NAS / ISO) (FCU21XX, FCU81XX) > 14µm / > 14µm (SAE / ISO) (FCU22XX, FCU82XX)
31	no		Test cycle time in M4
32	no		Memory mode: 0 → overwrite, 1 → stop if full
33	no		Address for DIN MESS BUS (0 → Jumper address). Will be activated only after power off/on.
34	yes		After power on: number of erroneous logs
35	yes		Number of erroneous parameter (see command '15')
36	no		Selected language 0 → German 1 → English 2 → French 3 → programmable
37	No		No. of tests in Mode M6 (FCU 2XXX-4)
38	No		No. of tests in Mode M5 (FCU 2XXX-4)
39	No		Pump pre-running time in Mode M6 (FCU 2XXX-4)
40	No		Unit of limit value in M3 0 → NAS/SAE (FCU20XX, 21XX, 81XX / FCU22XX, 82XX) 1 → ISO (all FCUs)
41	No		Unit of limit value in M4 0 → NAS/SAE (FCU20XX, 21XX, 81XX / FCU22XX, 82XX) 1 → ISO (all FCUs)
42	Yes		Operating hours
43	No		Pump pre-running time in seconds
44	No		Online printing 0 → off, 1 → on
45	No		Online printing format 0 → list, 1 → graph

No.	Read Only	String	Designation
46	No		Unit for online printing 0 → NAS/SAE (FCU20XX, 21XX, 81XX / FCU22XX, 82XX) 1 → ISO (all FCUs)
47	No		Time axis for graphic print out 0 → 0,5 h/page 1 → 1 h/page 2 → 2 h/page 3 → 4 h/page 4 → 6 h/page 5 → 12 h/page 6 → 24 h/page
48..71	yes		Internal use only: protnr, prformat, prunit, protnrl, protnrh, protbezeichnung, protauswahl
72	No		Power supply pump (FCU2XXX-4/5) 0 → internal 1 → external
73...79	No		Internal use only
80	No		Measuring mode M1...M6: 0 → M1, ... 5 → M6
81	Yes		Internal use only
82	Yes		Internal use only
83	No		M6: number of tests / sample
84	No		Compressed air supply: 0 → workshop air, 1 → compressor
85	No		Additional test: 0 → no, 1 → yes
86	No		M5: rinse volume
87	No		M6: pre-run volume
88	No		M6: test volume
89	No		M6: Dilution portion of measuring liquid
90	No		M6: Dilution portion of diluting liquid
91	Yes	X	Flow Counter Serial Number
92	Yes		Minimum flow (FCU 2XXX: M1..M6) (FCU 8XXX: M1..M4)
93	Yes		Maximum flow (FCU 2XXX: M1..M6) (FCU 8XXX: M1..M4)
94	No		Flow sensor delay time BSU (FCU 8XXX: M5..M6)
95	No		Draining time BSU (FCU 8XXX: M5..M6)
96	No		Pressurization time with compressor
97	No		Pressurization time with workshop air
98	No		Reserved
99	No		Selected measuring point 0 → MP1, 1 → MP2,...19 → MP20
100..119	No	X	Measuring point 1 (MP1) to 20 (MP20)
120	No		Viscosity range: 0 → 1-10 mm ² /s, 1 → 5-1000 mm ² /s