FG4000 - Modbus register map (rev20_02)

01 - Basic descriptions

Modbus RTU via RS485: 8 bits, no parity, 2 stop bits
The Modbus RTU communication with FG4000 flow meters is only for reading (writing to the flow meter is not supported for now).

Modbus message format:
<DEVICE_ADDRESS><FUNCTION_CODE><DATA (N bytes)><CRC>
Values are transmitted as a big-Endian (MSB first)
DEVICE_ADDRESS – RS485 address of the flow meter, address range 1 - 247, value 0 is reserved for broadcast
FUNCTION_CODE – type of read data, supported Modbus codes 03 and 04 (03 – read holding registers, 04 – read input registers)
DATA – Modbus message content
CRC – checksum CRC16 (Modbus standard)
CRC order - MSB - > LSB

DATA format:
Master -> slave - <OFFSET> <NO_OF_POINTS>
OFFSET – address of the first register for reading, 1 register = 1 word (2 byte)
NO_OF_POINTS – total number of registers to load
Slave -> master - <OFFSET> <BYTE_COUNT><REG 1><REG 2>…<REG N>
OFFSET - address of the first register for reading, 1 register = 1 word (2 byte)
BYTE_COUNT – number of transmitted bytes (2 * no_of_points)
REG X – values from the loaded registers (data from flow meter)

An example of data message:
An example of reception of instantaneous flow rate values from flow meter at address 05_d:
Transmitting to network: 05-03-00-0A-00-02-E5-8D
1st byte (05) – address of the flow meter in RS485 network
2_{nd} byte (03) – category of Modbus RTU codes (03 – read holding registers)
3th a 4th byte (00-0A) – address of the loaded registry ($0A_{hex}$ = current flow rate, see the table with a map of registers)
5th a 6th byte (00-02) – number of loaded words (2 bytes)
7th a 8th byte (E5-8D) – checksum (CRC16) **LOW BYTE - > HIGH BYTE**
Receiving data from the network: 05-03-04-42-F6-7E-0F-2A-1D
1st byte (05) – address of the flow meter in the RS485 network
2nd byte (03) – category of Modbus RTU codes (03 – read holding registers)
3th byte (04) – length of the data message (number of bytes with data)
4th – 7th byte (42-F6-7E-0F) – the value of current flow rate in float format = 123,246 m^3/hour
8th a 9th byte (2A-1D) – checksum (CRC16) **LOW BYTE - > HIGH BYTE**

Notes:
- If the FE address is used in the protocol for transmission, the flow meter will respond irrespective of its set address. This enables to communicate with the heat flow meter via RS232 (e.g. by modem or PC).
- Some data are not available from a flow meter without the archiving module. See paragraph 8.6. of FG4000 user manual.
- If the requested numerical data are not available, the flow meter may send also the following messages: “NaN“, “+INF“, “–INF“ or “Not implemented“.
- The Modbus protocol can be set for flow meters with a firmware 5.94 (5.99 A) and higher
- The reading of the archived data via Modbus protocol is allowed for flow meters with a firmware 6.00 (6.05 A) and higher

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02 - Basic registers (0x00 - 0x26) - available from FW 5.94 (5.99A) and higher

Register address (hex)	Register address (dec)	Length	Parameter	Type of data	Access
0x00	30000	8	Type of meter, version of FW	ASCII STRING ('text')	Read
0x08	30008	2	Serial number	LONG	Read
0x0A	30010	2	Current flow rate [m3/hour]	FLOAT	Read
0x0C	30012	1	Current flow rate direction (high byte) / Current flow rate unit (low byte)	HIGH BYTE (0=negative flow, 1=positive flow) LOW BYTE (0=l/min, 1=m3/hour, 2=l/hour, 3= hl/hour, 4=pcs/hour, 5=l/s, 6=GPM)	Read
0x0D	30013	1	Reserve	-	-
0x0E	30014	2	Empty pipe detection	LONG (positive value = flooded pipe negative value = empty pipe)	Read
0x10	30016	2	Total volume [m3]	FLOAT	Read
0x12	30018	2	Total volume + [m3] (bidirectional flow must be allowed)	FLOAT	Read
0x14	30020	2	Total volume - [m3] (bidirectional flow must be allowed)	FLOAT	Read
0x16	30022	1	Total volume unit	BYTE (0=l, 1=m3, 2=hl, 3=galr, 4=pcs)	Read
0x17	30023	1	Task type (high byte) / Control mode (low byte)	HIGH BYTE (1=flow meter) LOW BYTE (settings - binary code)	Read
0x18	30024	1	Meter status	BYTE (binary code)	Read
0x19	30025	1	Sensor diameter - DN [mm]	BYTE (decimal value)	Read
0x1A	30026	2	Pulse out. - conv. constant [pls / l]	FLOAT	Read
0x1C	30028	2	Pulse out. - output frequency [Hz]	FLOAT	Read
0x1E	30030	2	Current out. - value for 20mA [l/min]	FLOAT	Read
0x20	30032	2	Current out. - current value [mA]	FLOAT	Read
0x22	30034	1	Comm. Baud rate (high byte) / Comm. address (low byte)	HIGH BYTE (0=300 Bd, 1=600 Bd, 2=1200 Bd, 3=2400 Bd, 4=4800 Bd, 5=9600 Bd, 6=19,2kBd, 7=62,5kBd, 8=38,4kBd) LOW BYTE (address HEX)	Read
0x23	30035	1	Communication protocol	BYTE (0=Simple, 1=BitBUS, 2=ASCII, 3=MBUS,4=ModBUS, 5=SYS91)	Read
0x24	30036	1	Date and time	YY, MM	Read
0x25	30037	1		DD, hh	Read
0x26	30038	1		mm, ss	Read

EXAMPLE TASKS (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Register	No. Of read registers	CRC16 CODE LOW-HIGH BYTE
01	03	00 00	00 08	44 0C
01	03	00 08	00 02	45 C9
01	03	00 0A	00 02	E4 09
01	03	00 0C	00 01	44 09
01	03	00 14	00 02	A5 C8
01	03	00 10	00 02	C5 CE
01	03	00 12	00 02	64 0E
01	03	00 14	00 02	84 0F
01	03	00 16	00 01	25 CF
01	03	00 17	00 01	34 0E
01	03	00 18	00 01	04 0D
01	03	00 19	00 01	55 CD
01	03	00 1A	00 02	E5 CC
01	03	00 1C	00 02	05 CD
01	03	00 1E	00 02	A4 0D
01	03	00 20	00 02	C5 C1
01	03	00 22	00 01	24 00
01	03	00 23	00 01	75 C0
01	03	00 24	00 01	C4 01
01	03	00 25	00 01	95 C1
01	03	00 26	00 01	65 C1

EXAMPLE ANSWERS (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Message length	HEX value	CRC16 CODE LOW-HIGH BYTE	Data type: converted value
01	03	10	20 20 46 47 34 30 30 30 20 56 35 2E 39 39 00 00	F0 61	ASCII STRING: FG4000 V5.99
01	03	10	00 00 BA 02	08 92	LONG: 47618
01	03	04	41 65 7E B4	DF C7	FLOAT: 14,3434
01	03	02	01 01	78 14	HIGH BYTE: 1 LOW BYTE: 1
01	03	04	00 00 95 68	94 8D	LONG: 38248
01	03	04	45 C3 70 54	3B 3C	FLOAT: 6254,04
01	03	04	3E 09 CE 08	72 7F	FLOAT: 0,0134575
01	03	04	00 00 00 00	FA 33	FLOAT: 0
01	03	02	00 01	79 84	BYTE: 1
01	03	02	01 87	F9 B6	HIGH BYTE: 1 LOW BYTE: 1000 0011
01	03	02	00 0C	B8 41	BYTE: 0000 0000 0000 1100
01	03	02	00 19	79 8E	BYTE (dec): 25
01	03	04	43 48 00 00	6F A1	FLOAT: 200
01	03	04	43 D8 2B 55	B1 43	FLOAT: 432,339
01	03	04	43 B0 80 00	8F 90	FLOAT: 353
01	03	04	41 1E F6 41	99 09	FLOAT: 9,93512
01	03	02	05 01	7A D4	HIGH BYTE (dec): 5 LOW BYTE (dec): 1
01	03	02	00 04	B9 87	BYTE (dec): 4
01	03	02	13 05	75 77	BYTE (dec): 19, 05
01	03	02	15 0D	77 11	BYTE (dec): 21, 13
01	03	02	1B 37	F3 62	BYTE (dec): 27, 55

Register 18hex - meter status (possible values):

0000 0000 0000 0001 - EEPROM error
0000 0000 0000 0010 - Flow sensor error
0000 0000 0000 0100 - Temperature sensor error
0000 0000 0000 1000 - Communication error
0000 0000 0001 0000 - Power fail
0000 0000 0010 0000 - Temperature sensor swap
0000 0000 0100 0000 - Flow sensor polarity error
0000 0000 1000 0000 - Net synchronization error
0000 0001 0000 0000 - Volume flow lower than metrologic minimum
0000 0010 0000 0000 - Volume flow higher than metrologic maximum
0000 0100 0000 0000 - Watch Dog error
0000 1000 0000 0000 - RTC circuit error
0001 0000 0000 0000 - Temperature difference lower than metrologic minimum
0010 0000 0000 0000 - Sensor type reading error from EEPROM
0100 0000 0000 0000 - Negative flow
1000 0000 0000 0000 - Unknown error

Register 17hex - Task type (possible values):

0000 0001 - Flow meter
0000 0010 - Heat meter

Register 17hex - Control mode (possible values):

0000 0001 - Control user counters with buttons
0000 0010 - Remote value presetting
0000 0100 - Bidirectional flow
0000 1000 - Current output in 4-12-20mA mode
0001 0000 - Impulse output 2 in frequency mode
0010 0000 - All user counters active
0100 0000 - Answer with delay
1000 0000 - Empty pipe detection ON

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03 - Archive registers - daily volume (0x200 - 0x2F0) - available for FW 6.00 and higher

Register address (hex)	Register address (dec)	Length	Parameter	Type of data	Access
0x200	30512	2	Day-0 volume [m3]	FLOAT	Read
0x202	30514	2	Day-1 volume [m3]	FLOAT	Read
0x204	30516	2	Day-2 volume [m3]	FLOAT	Read
0x206	30518	2	Day-3 volume [m3]	FLOAT	Read
0x208	30520	2	Day-4 volume [m3]	FLOAT	Read
0x20A	30522	2	Day-5 volume [m3]	FLOAT	Read
0x20C	30524	2	Day-6 volume [m3]	FLOAT	Read
0x20E	30526	2	Day-7 volume [m3]	FLOAT	Read
0x210	30528	2	Day-8 volume [m3]	FLOAT	Read
0x212	30530	2	Day-9 volume [m3]	FLOAT	Read
0x214	30532	2	Day-10 volume [m3]	FLOAT	Read
↓	↓	↓	↓	↓	↓
0x2DE	30734	2	Day-111 volume [m3]	FLOAT	Read
0x2E0	30736	2	Day-112 volume [m3]	FLOAT	Read
0x2E2	30738	2	Day-113 volume [m3]	FLOAT	Read
0x2E4	30740	2	Day-114 volume [m3]	FLOAT	Read
0x2E6	30742	2	Day-115 volume [m3]	FLOAT	Read
0x2E8	30744	2	Day-116 volume [m3]	FLOAT	Read
0x2EA	30746	2	Day-117 volume [m3]	FLOAT	Read
0x2EC	30748	2	Day-118 volume [m3]	FLOAT	Read
0x2EE	30750	2	Day-119 volume [m3]	FLOAT	Read
0x2F0	30752	2	Day-120 volume [m3]	FLOAT	Read

EXAMPLE TASKS (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Register	No. Of read registers	CRC16 CODE LOW-HIGH BYTE
01	03	02 00	00 02	C5 B3
01	03	02 02	00 02	64 73
01	03	02 04	00 02	84 72
01	03	02 06	00 02	25 B2
⋮	⋮	⋮	⋮	⋮

EXAMPLE ANSWERS (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Message length	HEX value	CRC16 CODE LOW-HIGH BYTE	Data type: converted value
01	03	04	45 E6 56 20	30 B0	FLOAT: 7370,76563
01	03	04	45 E4 B0 62	5B 21	FLOAT: 7318,048
01	03	04	45 E1 1B C2	34 68	FLOAT: 7230,46973
01	03	04	FF FF FF FF	FB A7	No data at this day
⋮	⋮	⋮	⋮	⋮	⋮

Example of a summary task - reading multiple registers at once (Day-6 to Day-9)

Notes: Modbus protocol allows to read up to 125 registers at once.

01	03	02 0C	00 08	85 B7

01	03	10	45 DB AD A3 45 D7 FE 45 45 D4 21 1C 45 D1 65 6B	D9 74	FLOAT: 7029,70459 FLOAT: 6911,78369 FLOAT: 6788,13867 FLOAT: 6700,67725

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04 - Archive registers - daily idle time (0x300 - 0x3F0) - available for FW 6.00 and higher

Register address (hex)	Register address (dec)	Length	Parameter	Type of data	Access
0x300	30768	2	Day-0 idle time [minutes]	LONG	Read
0x302	30770	2	Day-1 idle time [minutes]	LONG	Read
0x304	30772	2	Day-2 idle time [minutes]	LONG	Read
0x306	30774	2	Day-3 idle time [minutes]	LONG	Read
0x308	30776	2	Day-4 idle time [minutes]	LONG	Read
0x30A	30778	2	Day-5 idle time [minutes]	LONG	Read
0x30C	30780	2	Day-6 idle time [minutes]	LONG	Read
0x30E	30782	2	Day-7 idle time [minutes]	LONG	Read
0x310	30784	2	Day-8 idle time [minutes]	LONG	Read
0x312	30786	2	Day-9 idle time [minutes]	LONG	Read
0x314	30788	2	Day-10 idle time [minutes]	LONG	Read
↓	↓	↓	↓	↓	↓
0x3DE	30990	2	Day-111 idle time [minutes]	LONG	Read
0x3E0	30992	2	Day-112 idle time [minutes]	LONG	Read
0x3E2	30994	2	Day-113 idle time [minutes]	LONG	Read
0x3E4	30996	2	Day-114 idle time [minutes]	LONG	Read
0x3E6	30998	2	Day-115 idle time [minutes]	LONG	Read
0x3E8	31000	2	Day-116 idle time [minutes]	LONG	Read
0x3EA	31002	2	Day-117 idle time [minutes]	LONG	Read
0x3EC	31004	2	Day-118 idle time [minutes]	LONG	Read
0x3EE	31006	2	Day-119 idle time [minutes]	LONG	Read
0x3F0	31008	2	Day-120 idle time [minutes]	LONG	Read

EXAMPLE TASKS (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Register	No. Of read registers	CRC16 CODE LOW-HIGH BYTE
01	03	03 00	00 02	C4 4F
01	03	03 02	00 02	65 8F
01	03	03 04	00 02	85 8E
01	03	03 06	00 02	24 4E
⋮	⋮	⋮	⋮	⋮

EXAMPLE ANSWERS (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Message length	HEX value	CRC16 CODE LOW-HIGH BYTE	Data type: converted value
01	03	04	00 00 21 13	A3 AE	LONG: 8467
01	03	04	00 00 1E 06	73 91	LONG: 7686
01	03	04	00 00 1A 11	31 5F	LONG: 6673
01	03	04	FF FF FF FF	FB A7	No data at this day
⋮	⋮	⋮	⋮	⋮	⋮

Example of a summary task - reading multiple registers at once (Day-6 to Day-9)

Notes: Modbus protocol allows to read up to 125 registers at once.

01	03	03 18	00 08	C4 4F

01	03	10	00 00 0A DF 00 00 07 F9 00 00 04 6A 00 00 04 4F	40 FA	LONG: 2783 LONG: 2041 LONG: 1130 LONG: 1103

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05 - Archive registers - hourly volume (0x400 - 0xA40) - available for FW 6.00 and higher

Register address (hex)	Register address (dec)	Length	Parameter	Type of data	Access
0x400	31024	2	Hour-0 volume [m3]	FLOAT	Read
0x402	31026	2	Hour-1 volume [m3]	FLOAT	Read
0x404	31028	2	Hour-2 volume [m3]	FLOAT	Read
0x406	31030	2	Hour-3 volume [m3]	FLOAT	Read
0x408	31032	2	Hour-4 volume [m3]	FLOAT	Read
0x40A	31034	2	Hour-5 volume [m3]	FLOAT	Read
0x40C	31036	2	Hour-6 volume [m3]	FLOAT	Read
0x40E	31038	2	Hour-7 volume [m3]	FLOAT	Read
0x410	31040	2	Hour-8 volume [m3]	FLOAT	Read
0x412	31042	2	Hour-9 volume [m3]	FLOAT	Read
0x414	31044	2	Hour-10 volume [m3]	FLOAT	Read
↓	↓	↓	↓	↓	↓
0xA2E	32606	2	Hour-791 volume [m3]	FLOAT	Read
0xA30	32608	2	Hour-792 volume [m3]	FLOAT	Read
0xA32	32610	2	Hour-793 volume [m3]	FLOAT	Read
0xA34	32612	2	Hour-794 volume [m3]	FLOAT	Read
0xA36	32614	2	Hour-795 volume [m3]	FLOAT	Read
0xA38	32616	2	Hour-796 volume [m3]	FLOAT	Read
0xA3A	32618	2	Hour-797 volume [m3]	FLOAT	Read
0xA3C	32620	2	Hour-798 volume [m3]	FLOAT	Read
0xA3E	32622	2	Hour-799 volume [m3]	FLOAT	Read
0xA40	32624	2	Hour-800 volume [m3]	FLOAT	Read

EXAMPLE TASK (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Register	No. Of read registers	CRC16 CODE LOW-HIGH BYTE
01	03	04 00	00 02	C5 3B
01	03	04 02	00 02	64 FB
01	03	04 04	00 02	84 FA
01	03	04 06	00 02	25 3A
⋮	⋮	⋮	⋮	⋮

EXAMPLE ANSWER (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Message length	HEX value	CRC16 CODE LOW-HIGH BYTE	Data type: converted value
01	03	04	42 06 C1 44	5F E9	FLOAT: 33,688736
01	03	04	42 05 1D 2E	77 06	FLOAT: 33,2784958
01	03	04	41 1F 23 D4	C6 A6	FLOAT: 9,946247
01	03	04	FF FF FF FF	FB A7	No data at this hour
⋮	⋮	⋮	⋮	⋮	⋮

Example of a summary task - reading multiple registers at once (Hour-310 to Hour-313)

Notes: Modbus protocol allows to read up to 125 registers at once.

01	03	06 6C	00 08	84 99

01	03	10	45 DC AD 2F 45 DC 70 70 45 DC 34 7E 45 DB FA C4	23 50	FLOAT: 7061,648 FLOAT: 7054,05469 FLOAT: 7046,56152 FLOAT: 7039,3457

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06 - Archive registers - hourly idle time (0xB00 - 0x1140) - available for FW 6.00 and higher

Register address (hex)	Register address (dec)	Length	Parameter	Type of data	Access
0xB00	32816	2	Hour-0 idle time [minutes]	LONG	Read
0xB02	32818	2	Hour-1 idle time [minutes]	LONG	Read
0xB04	32820	2	Hour-2 idle time [minutes]	LONG	Read
0xB06	32822	2	Hour-3 idle time [minutes]	LONG	Read
0xB08	32824	2	Hour-4 idle time [minutes]	LONG	Read
0xB0A	32826	2	Hour-5 idle time [minutes]	LONG	Read
0xB0C	32828	2	Hour-6 idle time [minutes]	LONG	Read
0xB0E	32830	2	Hour-7 idle time [minutes]	LONG	Read
0xB10	32832	2	Hour-8 idle time [minutes]	LONG	Read
0xB12	32834	2	Hour-9 idle time [minutes]	LONG	Read
0xB14	32836	2	Hour-10 idle time [minutes]	LONG	Read
↓	↓	↓	↓	↓	↓
4398	0x112E	2	Hour-791 idle time [minutes]	LONG	Read
4400	0x1130	2	Hour-792 idle time [minutes]	LONG	Read
4402	0x1132	2	Hour-793 idle time [minutes]	LONG	Read
4404	0x1134	2	Hour-794 idle time [minutes]	LONG	Read
4406	0x1136	2	Hour-795 idle time [minutes]	LONG	Read
4408	0x1138	2	Hour-796 idle time [minutes]	LONG	Read
4410	0x113A	2	Hour-797 idle time [minutes]	LONG	Read
4412	0x113C	2	Hour-798 idle time [minutes]	LONG	Read
4414	0x113E	2	Hour-799 idle time [minutes]	LONG	Read
4416	0x1140	2	Hour-800 idle time [minutes]	LONG	Read

EXAMPLE TASK (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Register	No. Of read registers	CRC16 CODE LOW-HIGH BYTE
01	03	0B 00	00 02	C6 2F
01	03	0B 02	00 02	67 EF
01	03	0B 04	00 02	87 EE
01	03	0B 06	00 02	26 2E
⋮	⋮	⋮	⋮	⋮

EXAMPLE ANSWER (HEX)
(RS485 address #01)

RS485 address	Modbus code category	Message length	HEX value	CRC16 CODE LOW-HIGH BYTE	Data type: converted value
01	03	04	00 00 27 A5	21 B8	LONG: 10149
01	03	04	00 00 27 A5	21 B8	LONG: 10149
01	03	04	00 00 27 A5	21 B8	LONG: 10149
01	03	04	FF FF FF FF	FB A7	No data at this hour
⋮	⋮	⋮	⋮	⋮	⋮

Example of a summary task - reading multiple registers at once (Hour-310 to Hour-313)

Notes: Modbus protocol allows to read up to 125 registers at once.

01	03	0B B8	00 08	C6 0D

01	03	10	FF FF FF FF 00 00 1A 11 00 00 1A 11 00 00 1A 11	25 18	No data at this hour LONG: 6673 LONG: 6673 LONG: 6673

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