

F-5100 FLOW METER NETWORK INTERFACE
Installation and Operation Guide
MODBUS RTU



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SECTION 1: INTRODUCTION

1.1 PURPOSE OF THIS GUIDE

The purpose of this guide is to provide installation and commissioning procedures and basic operating and servicing instructions for the ONICON F-5100 Flow Meter MODBUS RTU serial interface.

1.2 TYPICAL F-5100 INSTALLATION

The F-5100 is a thermal mass flow meter that measures gas flow, provides a local indication of the flow rate and total, and provides this data via a MODBUS RTU RS485 serial interface to the utility or building control network.



1.3 SPECIFICATIONS

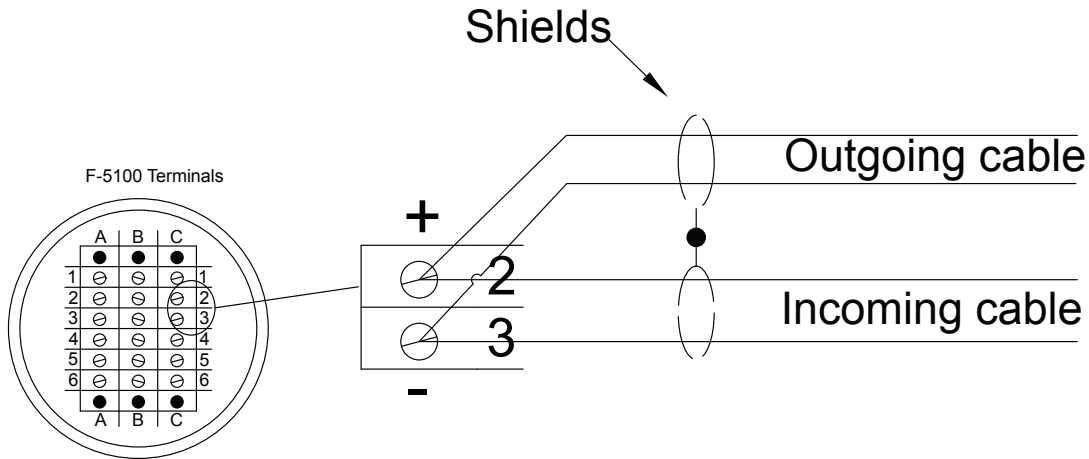
MODBUS RTU NETWORK INTERFACE

RS485

Transceiver:	2-wire, half-duplex
Data format:	8 bit with 1 stop bit
Parity:	Even, none or odd (default: even)
MAC address (device address) range:	1 - 240 (Default: 048)
Baud rate:	9600 or 19200 (Default: 19200)
Termination:	None
Biasing:	None

1.4 NETWORK SIGNAL CONNECTIONS

MODBUS RS485, 2-wire (half-duplex) serial output connections are made at terminals C2 and C3 as shown below. Incoming and outgoing RS485 cable shield wires should be connected together, but must not be connected to the meter.



1.5 RS485 BAUD RATE, BIASING AND TERMINATION

1.5.1 Baud Rate and Parity

Every ONICON F-5100 is individually programmed at the factory with application specific data provided by the customer during the process of ordering the meter. This normally includes the Baud rate and parity settings. If the Baud rate and parity settings were provided, the meter will be configured to the appropriate settings.

If this information was not provided, the meter default settings are:

Baud rate: 19200 Parity: Even

The available Baud rate settings are 9600 and 19200. The available parity settings are odd, even or none. Both the Baud rate and the parity setting can be changed via the MODBUS network. Register 349 is a holding register used to set the Baud rate and parity. Write to this register using function code 16, write multiple registers. The table below provides the register values that must be written to achieve the corresponding Baud rate and parity settings. Once the new value has been written to the register, power must be cycled to the meter for the change to take effect.

Register Value	Baud Rate	Parity
0	19200	Even
2	19200	Odd
4	19200	None
5	9600	None

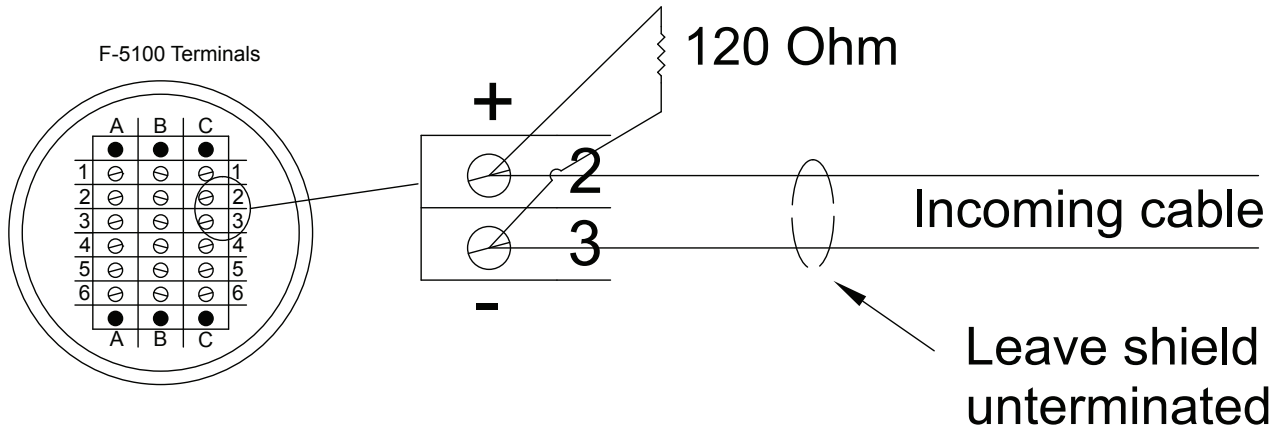
IMPORTANT NOTE

For the first 6-10 seconds after power is applied to the meter it will respond to the default settings (19200 Baud, even parity). If the meter does not receive a valid poll with these settings within this time interval, the meter will be configured for Baud rate and parity according to the value recorded in register 349.



1.5.2 Biasing and Termination

The ONICON F-5100 does not provide biasing voltage to the RS485 network. An external 120Ω resistor (not provided) should be connected across the terminals as shown below when the meter is installed at the end of the line.



1.6 NETWORK ADDRESSING

Before the F-5100 can communicate on the MODBUS network, the appropriate device address must be programmed into the meter. The MODBUS device address for the F-5100 may be set to any address from 001 to 240. Section 1.6.1 details the procedure for changing this address.

1.6.1 Changing the Network Address

Every ONICON F-5100 is individually programmed at the factory with application specific data provided by the customer during the ordering process, and this may include network addressing information. If the device address information was provided, the meter will be programmed with that number. If no address is provided, the F-5100 will be programmed with a default address of 048. The address may be changed via the MODBUS network using the procedure outlined below.

1. Obtain the device address from the network administrator. Valid addresses range from 01 – 240.
2. Find the address in the table below. Note the corresponding hexadecimal and decimal format numbers given that correspond to each address.
3. Write either the hexadecimal or decimal format number to holding register 257 using function code 16 (preset multiple registers).
4. Cycle power to the flow meter for the new address to take effect. Note that at the current MODBUS address will be shown on the bottom line of the display at power up.

Example: Write 346 decimal (0x15A) to register 257 to set the device address to 01.

Device Address Table

F-51xx MODBUS Address Values for Register 257		
Device Address	Hex value to enter	Decimal value to enter
1	15A	346
2	25A	602
3	35A	858
4	45A	1114
5	55A	1370
6	65A	1626
7	75A	1882
8	85A	2138
9	95A	2394
10	A5A	2650
11	B5A	2906
12	C5A	3162
13	D5A	3418
14	E5A	3674
15	F5A	3930
16	105A	4186
17	115A	4442
18	125A	4698
19	135A	4954
20	145A	5210
21	155A	5466
22	165A	5722
23	175A	5978
24	185A	6234
25	195A	6490
26	1A5A	6746
27	1B5A	7002
28	1C5A	7258
29	1D5A	7514
30	1E5A	7770
31	1F5A	8026
32	205A	8282
33	215A	8538
34	225A	8794
35	235A	9050
36	245A	9306
37	255A	9562
38	265A	9818
39	275A	10074
40	285A	10330
41	295A	10586
42	2A5A	10842

F-51xx MODBUS Address Values for Register 257		
Device Address	Hex value to enter	Decimal value to enter
43	2B5A	11098
44	2C5A	11354
45	2D5A	11610
46	2E5A	11866
47	2F5A	12122
48	305A	12378
49	315A	12634
50	325A	12890
51	335A	13146
52	345A	13402
53	355A	13658
54	365A	13914
55	375A	14170
56	385A	14426
57	395A	14682
58	3A5A	14938
59	3B5A	15194
60	3C5A	15450
61	3D5A	15706
62	3E5A	15962
63	3F5A	16218
64	405A	16474
65	415A	16730
66	425A	16986
67	435A	17242
68	445A	17498
69	455A	17754
70	465A	18010
71	475A	18266
72	485A	18522
73	495A	18778
74	4A5A	19034
75	4B5A	19290
76	4C5A	19546
77	4D5A	19802
78	4E5A	20058
79	4F5A	20314
80	505A	20570
81	515A	20826
82	525A	21082
83	535A	21338
84	545A	21594

F-51xx MODBUS Address Values for Register 257		
Device Address	Hex value to enter	Decimal value to enter
85	555A	21850
86	565A	22106
87	575A	22362
88	585A	22618
89	595A	22874
90	5A5A	23130
91	5B5A	23386
92	5C5A	23642
93	5D5A	23898
94	5E5A	24154
95	5F5A	24410
96	605A	24666
97	615A	24922
98	625A	25178
99	635A	25434
100	645A	25690
101	655A	25946
102	665A	26202
103	675A	26458
104	685A	26714
105	695A	26970
106	6A5A	27226
107	6B5A	27482
108	6C5A	27738
109	6D5A	27994
110	6E5A	28250
111	6F5A	28506
112	705A	28762
113	715A	29018
114	725A	29274
115	735A	29530
116	745A	29786
117	755A	30042
118	765A	30298
119	775A	30554
120	785A	30810
121	795A	31066
122	7A5A	31322
123	7B5A	31578
124	7C5A	31834
125	7D5A	32090
126	7E5A	32346

F-51xx MODBUS Address Values for Register 257		
Device Address	Hex value to enter	Decimal value to enter
127	7F5A	32602
128	805A	32858
129	815A	33114
130	825A	33370
131	835A	33626
132	845A	33882
133	855A	34138
134	865A	34394
135	875A	34650
136	885A	34906
137	895A	35162
138	8A5A	35418
139	8B5A	35674
140	8C5A	35930
141	8D5A	36186
142	8E5A	36442
143	8F5A	36698
144	905A	36954
145	915A	37210
146	925A	37466
147	935A	37722
148	945A	37978
149	955A	38234
150	965A	38490
151	975A	38746
152	985A	39002
153	995A	39258
154	9A5A	39514
155	9B5A	39770
156	9C5A	40026
157	9D5A	40282
158	9E5A	40538
159	9F5A	40794
160	A05A	41050
161	A15A	41306
162	A25A	41562
163	A35A	41818
164	A45A	42074
165	A55A	42330
166	A65A	42586
167	A75A	42842
168	A85A	43098

F-51xx MODBUS Address Values for Register 257		
Device Address	Hex value to enter	Decimal value to enter
169	A95A	43354
170	AA5A	43610
171	AB5A	43866
172	AC5A	44122
173	AD5A	44378
174	AE5A	44634
175	AF5A	44890
176	B05A	45146
177	B15A	45402
178	B25A	45658
179	B35A	45914
180	B45A	46170
181	B55A	46426
182	B65A	46682
183	B75A	46938
184	B85A	47194
185	B95A	47450
186	BA5A	47706
187	BB5A	47962
188	BC5A	48218
189	BD5A	48474
190	BE5A	48730
191	BF5A	48986
192	C05A	49242
193	C15A	49498
194	C25A	49754
195	C35A	50010
196	C45A	50266
197	C55A	50522
198	C65A	50778
199	C75A	51034
200	C85A	51290
201	C95A	51546
202	CA5A	51802
203	CB5A	52058
204	CC5A	52314
205	CD5A	52570
206	CE5A	52826
207	CF5A	53082
208	D05A	53338
209	D15A	53594
210	D25A	53850

F-51xx MODBUS Address Values for Register 257		
Device Address	Hex value to enter	Decimal value to enter
211	D35A	54106
212	D45A	54362
213	D55A	54618
214	D65A	54874
215	D75A	55130
216	D85A	55386
217	D95A	55642
218	DA5A	55898
219	DB5A	56154
220	DC5A	56410
221	DD5A	56666
222	DE5A	56922
223	DF5A	57178
224	E05A	57434
225	E15A	57690
226	E25A	57946
227	E35A	58202
228	E45A	58458
229	E55A	58714
230	E65A	58970
231	E75A	59226
232	E85A	59482
233	E95A	59738
234	EA5A	59994
235	EB5A	60250
236	EC5A	60506
237	ED5A	60762
238	EE5A	61018
239	EF5A	61274
240	F05A	61530

SECTION 2.0: MODBUS MEMORY MAP

ONICON F-5100 Thermal Mass Flow Meters provide flow rate data, totalized flow data, temperature and zero calibration data via the MODBUS RTU RS485 serial communications interface. MODBUS data is available in the same engineering units shown on the meter's display.

Network addressing, Baud rate and parity are also set via MODBUS registers. Refer to the preceding section for more information on changing these register values.

2.1 MODBUS REGISTER FORMAT AND NETWORKING INFORMATION

All registers are 16 bit MODBUS Holding Registers.

Register address 001 corresponds to memory location 000.

Registers with 200 series addresses are 16 bit unsigned integers.

Registers with 300 series addresses are unsigned 32 bit long integer values

Registers with 500 series addresses are (IEEE754) 32 bit single precision floating point values.

Registers with 800 series addresses are scaled unsigned 32 bit long integer values

MODBUS function codes supported:

Code	Description
03	Read Holding Registers
16	Write Multiple Registers
17	Report Slave ID

REGISTER ADDRESS	DESCRIPTION	REGISTER RANGE	DATA RANGE	OVER RANGE	READ/WRITE	COMMENT
001	Baud Rate & Parity	0 - 65535	0 - 5	Not Applicable	Write Only	See Section 1.5.1
257	Device Address	0 - 65535	01 - 240	Not Applicable	Read / Write	See Section 1.6.1

REGISTER ADDRESS	DESCRIPTION	REGISTER TYPE	READ / WRITE	COMMENT
313	Flow Total - part 1	Long Integer (1 of 2)	Read / Write	Write 0 to reset total.
314	Flow Total - part 2	Long Integer (2 of 2)	Read / Write	
REGISTER ADDRESS	DESCRIPTION	REGISTER TYPE	READ / WRITE	COMMENT
579	Flow Rate - part 1	Floating Point (1 of 2)	Read Only	
580	Flow Rate - part 2	Floating Point (2 of 2)	Read Only	
581	Temperature - part 1	Floating Point (1 of 2)	Read Only	
582	Temperature - part 2	Floating Point (2 of 2)	Read Only	
583	Zero Cal. - part 1	Floating Point (1 of 2)	Read Only	
584	Zero Cal. - part 2	Floating Point (2 of 2)	Read Only	
REGISTER ADDRESS	DESCRIPTION	REGISTER TYPE	READ / WRITE	COMMENT
835	Flow Rate - part 1	Scaled Long Integer (1 of 2)	Read Only	Multiply long integer by .001 to read value.
836	Flow Rate - part 2	Scaled Long Integer (2 of 2)	Read Only	
837	Temperature - part 1	Scaled Long Integer (1 of 2)	Read Only	
838	Temperature - part 2	Scaled Long Integer (2 of 2)	Read Only	
839	Zero Cal. - part 1	Scaled Long Integer (1 of 2)	Read Only	
840	Zero Cal. - part 2	Scaled Long Integer (2 of 2)	Read Only	

SECTION 3: NETWORK TROUBLESHOOTING TIPS

3.1 TROUBLESHOOTING

REPORTED PROBLEM	POSSIBLE SOLUTIONS
<p>Device will not communicate with the network controller.</p>	<ul style="list-style-type: none">• Is the Transmit LED on the display flashing? The Transmit LED will only flash when the device is responding to a poll. A unique address is required for each device on the network. Duplicate addresses will cause some or all of the devices on the network to quit working. (See section 1.6.1 of this manual for details.)• The RS485 network cable connections are polarity sensitive and must be connected the same way on every device (i.e. + to + and - to -). (See section 1.4 of this manual for details.)• The Baud rate setting must match the network Baud rate. (See section 1.5.1 of this manual for details.)• Shield drain connections should be daisy chained in the same manner as the signal cables for RS485. The shield drain wire should be left unterminated at the end of the cable and connected to earth only at the network master controller. Shield wires must not be connected to the RS485 connector on the F-5100.• The maximum number of devices allowed on a RS485 network segment without a repeater is 32. Adding more than 32 devices to a single segment may reduce the transceiver output voltage to a level that is too low to be distinguished from background noise on the cable.• RS485 cable impedance should be matched to a termination resistor at the end of the cable. This resistor should only be used if the meter is the last device on the network cable. (See section 1.5.2 of this manual for details.)

REPORTED PROBLEM	POSSIBLE SOLUTIONS
<p>Network communications are disrupted when the device is connected.</p>	<ul style="list-style-type: none"> • The RS485 network cable connections are polarity sensitive and must be connected the same way on every device (i.e. + to + and - to -). (See section 1.4 of this manual for details.) • Is the transmit LED flashing? The transmit LED will only flash when the device is responding to a poll. A unique address is required for each device on the network. Duplicate addresses will cause some or all of the devices on the network to quit working. (See section 1.6.1 of this manual for details.) • Shield drain connections should be daisy chained in the same manner as the signal cables for RS485. The shield drain wire should be left unterminated at the end of the cable and connected to earth only at the network master controller. Shield wires must not be connected to the RS485 connector on the F-5100.