Modbus Supplement

For U1000 MKII

U1000MkII Pipe Mount

U1000MkII Wall Mount

Heat Meter and Flow Meter

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1 INTRODUCTION

For reliable operation of a Modbus network the cable type and installation must comply with requirements in the Modbus specification document: "*MODBUS over Serial Line Specification & Implementation guide V1.0*":

"**MODBUS over Serial Line Specification & Implementation guide V1.0**".

This output is suitable for SELV circuits only.

It is highly recommended to use screened cable for Modbus connections. For best practice, and to achieve good immunity to electrical interference, the screen of the power/pulse output cable and Modbus cable should be connected to Earth.

The Modbus should be daisy chained as shown in Figure 4-, however, small spurs of a few meters are permissible as shown in Figure 3. No more than 32-unit loads are permissible on any RS485 network. The U1000 Modbus implementation represents one eighth (1/8) of a unit load.

A cable is supplied for Pipe Mount versions to allow for this. For Wall Mount versions it is up to the installations Team to supply cabling.

1.1 U1000 MKII Pipe Mount Connections

A cable is supplied for the Pipe Mount variant. The cables (A+ and B-) will be twisted together with the A+ cable of each pair labelled. An example is given below.

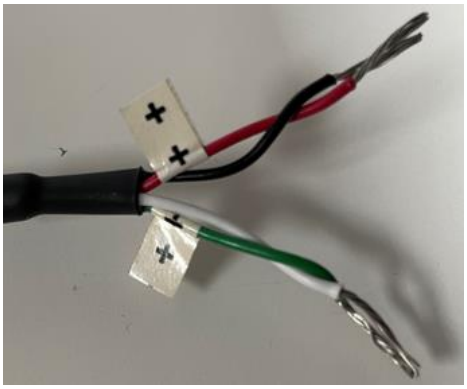

Figure 1 : Modbus cable wiring

If a 5th cable is present, it is a ground screen, which can be connect to Earth as required.

1.2 U1000 Wall Mount Connections

See Wall mount document, these are wired to a screw type free plug/socket within the main unit.

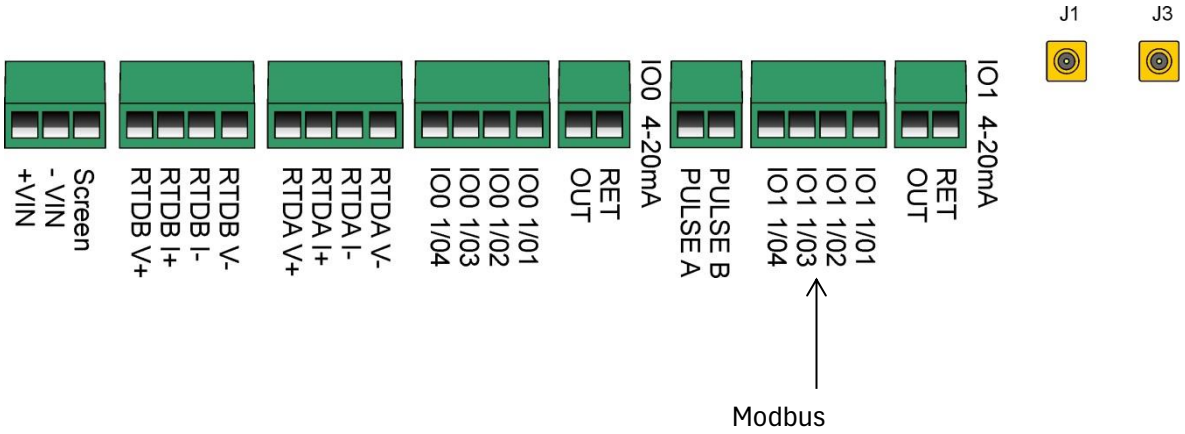

Figure 2 : Modbus Connections

Pin Assignment:

IO1 1/01	-ve Out_B
IO1 1/02	Gnd Isolated
IO1 1/03	+ve Out_A
IO1 1/04	Gnd Isolated

This output is suitable for SELV circuits only

1.3 Wiring Topology

The Modbus Specification (refer to section 2) recommends a daisy chained physical interface. Spurs are allowed as long as they are no more than a few meters in length. Either a Spurred (Figure 3) or Daisy Chained (figure 4) topology is allowed.

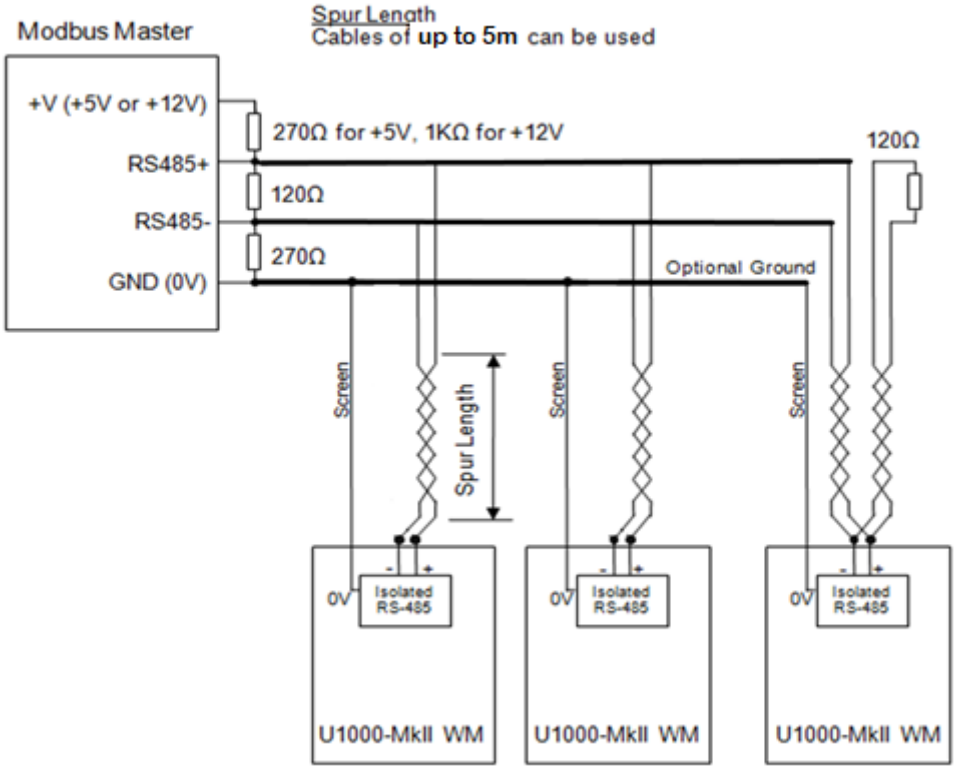

Figure 3 : Modbus wiring diagram with spurs

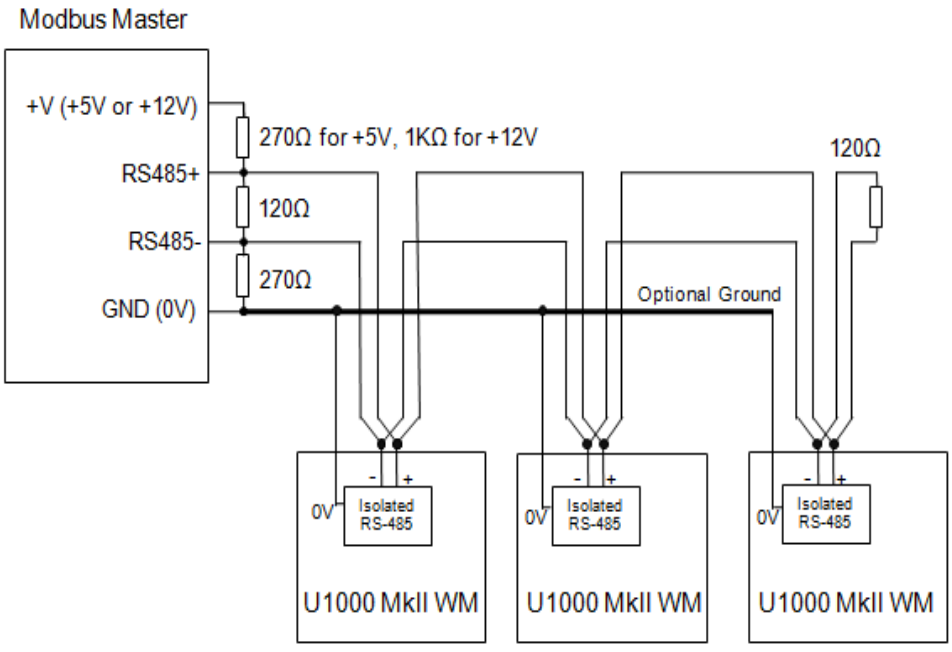

Figure 4 : Modbus wiring diagram without spurs, Daisy Chained

2 OPERATION

The Modbus RTU interface is configured via the Modbus sub menu.

- The data rate can be selected in the range 1200 to 38400 baud.
- The address can be set in the range 1 to 247.
- Minimum Polling Rate 1000 ms (1 sec). Time out after 5 seconds.
- Response time is under 1000 ms.
- The instrument responds to the “read holding registers” request (CMD 03).
- If the flow reading is invalid, then the flow value will be zero.
- If the flow reading is “negative” the flow and the power will be measured, allowing the operator to see that the unit working correctly, but the totals will not increment.
- If a U1000MkII-HM temperature sensor (or delta) goes out of range, then the value will show as -99 °C (-146.2 °F).

Faults will set relevant status bit in the status field (normally 0x0000), see section 3.1 Error messages.

On a unit set to Imperial the temperature is in °F, Power is in BTU/s and flow in US Gallons.

The U1000 complies with the Modbus specification document:
http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

2.1 Message Format

- This depends on what registers are requested.
- Float byte order is Big endian–ABCD–MSB first.
    - 32 Bit values are sent Hi Word Low Word, and within each Word, Hi Byte Lo Byte
- Flow Total and Energy Total (if Heat Meter) can be sent in a variety of formats, to match the requirement of some controllers, meters, and BMS/BEM systems.

2.2 Integer Totals Number type and Size

Measured Volume total and Calculated Energy are available in two formats: IEEE754 float and as a unsigned 64-bit integer in units of one tenth of a litre (i.e. divide this number by ten to achieve a 0.1 litre precision). It should be remembered that the precision of an IEEE754 float is just better one part in ten million, so for large totals it may be wiser to use the integer representation.

Both volume and energy totals rollover at a total value of one trillion litres, or one billion kilowatt-hours respectively. If using imperial units, this means volume will roll over at 264172052.4 US gallons. A rollover value is displayed on the user screen so even if the value has rolled over, it is possible to calculate the actual value before resetting the meter’s totals.

If the device reading the total does not have the ability to read a 64-bit integer, then reading two registers at the 32-bit MSW position will show a total up to 429496729.6 litres or 113461032.5 US gallons. In this case, the total will have to be reset manually, or the value otherwise accounted for since the total value will not roll over until the totals are reached. The same thing applies to calculated power.

2.3 Register table

Register Offset	Type	Typical Contents	Meaning	Notes
0	Int-16	0x00 0xac	Device ID	0xAC U1000MkII-FM/HM
1	Int-16	0x00 0x00	Status	0x0000 = OK Not[0x0000] = Fault
2	Int-16	0x00 0x04	System Type U1000MkII-HM only	0x04 Heating system 0x0C Chiller system
3	Int-16	0x00 0x01	Serial Identifier	
4	Int-16	0x23 0x45		
5	Int-16	0x60 0x00		
6	IEEE754 float	0x40 0x1f	Measured Velocity	Units in m/s
7		0x67 0xd3		
8	IEEE754 float	0x41 0x8c	Measured Flow	Units in m^3/hr for Metric Units in USGal/m for Imperial
9		0xd8 0xb0		
10	IEEE754 float	0x42 0x1c	Calculated Power (U1000MkII-HM only)	Units in kW for Metric Units in BTU/s for Imperial
11		0x2e 0x34		
12	IEEE754 float	0x44 0x93	Calculated Energy (U1000MkII-HM only)	Units in kWh for Metric Units in kBTU for Imperial
13		0xc6 0xe8		

Register Offset	Type	Typical Contents	Meaning	Notes
14	IEEE754 float	0x41	Measured Temperature (Hot) (U1000MkII-HM only)	Units in °C for Metric Units in °F for Imperial
		0x98		
15		0x00		
		0x00		
16	IEEE754 float	0x41	Measured Temperature (Cold) (U1000MkII-HM only)	Units in °C for Metric Units in °F for Imperial
		0x88		
17		0x00		
		0x00		
18	IEEE754 float	0x40	Measured Temperature (Difference) (U1000MkII-HM only)	Units in °C for Metric Units in °F for Imperial
		0x00		
19		0x00		
		0x00		
20	IEEE754 float	0x60	Measured Volume Total	Units in m^3 for Metric Units in USGal for Imperial
		0xef		
21		0x3c		
		0x1c		
22	Int-16	0x00	Instrument Units	0x00 Metric 0x01 Imperial
		0x00		
23	Int-16	0x00	Instrument Gain	Gain in dB
		0x01		
24	Int-16	0x00	Instrument SNR	SNR in dB
		0x0a		
25	Int-16	0x00	Instrument Signal	Signal in %
		0x62		
26	IEEE754 float	0x42	Measured Delta-Time Difference	Diagnostic Data Units in nanoseconds (ns)
		0xc9		
27		0xff		
		0x7d		
28	IEEE754 float	0x42	Instrument ETA	Diagnostic Data Units in microseconds (µs)
		0xa8		
29		0x8b		
		0xf5		
30	IEEE754 float	0x42	Instrument ATA	Diagnostic Data Units in microseconds (µs)
		0xc8		
31		0x00		
		0x00		

Register Offset	Type	Typical Contents	Meaning	Notes
32	*UInt-16*	0x01	Volume Total	64-bit MSW[i]
		0x02		
33	*UInt-16*	0x03	Volume Total	48-bit MSW
		0x04		
34	*UInt-16*	0x05	Volume Total	32-bit MSW
		0x06		
35	*UInt-16*	0x07	Volume Total	LSW 0.1 l
		0x08		
36	*UInt-16*	0x01	Energy Total	64-bit MSW[ii]
		0x02		
37	*UInt-16*	0x03	Energy Total	48-bit MSW
		0x04		
38	*UInt-16*	0x05	Energy Total	32-bit MSW
		0x06		
39	*UInt-16*	0x07	Energy Total	LSB 0.1 kWh
		0x08		
		0x02		

3 ERROR AND WARNING MESSAGES

3.1 Error Messages

Error Messages are displayed as a number in the diagnostics menu. Contact Micronics if other messages appear.

Error Meaning	Status Byte								Value
	Bit#7	Bit#6	Bit#5	Bit#4	Bit#3	Bit#2	Bit#1	Bit#0	
RTD I2C failed *(U1000MkII-HM only)*								1	1
RTD Thot failed *(U1000MkII-HM only)*							1		2
RTD Tcold failed *(U1000MkII-HM only)*						1			4
TOFM signal lost					1				8
TOFM board failed				1					16
TOFM window failed			1						32
TOFM sensor type failed		1							64
TOFM I2C failed	1								128

3.2 Example Error Messages

Error Message	Error Meaning
None or 0	None
2	Hot sensor error *(U1000MkII-HM only)*
4	Cold sensor error *(U1000MkII-HM only)*
6	Hot and Cold sensor error *(U1000MkII-HM only)*
8	No flow signal
10	Hot error and no flow signal *(U1000MkII-HM only)*
12	Cold error and no flow signal *(U1000MkII-HM only)*
14	Hot and Cold error and no flow signal *(U1000MkII-HM only)*