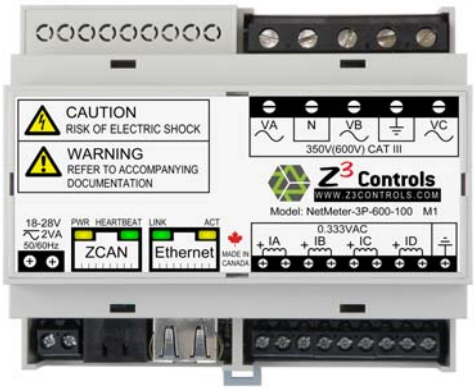

NetMeter-3P-600

3-Phase Commercial/Industrial Energy Meter/Monitor with Integrated Networking

Modbus[1] Implementation Manual

[1] Modbus is a trademark of the Modbus Organization, www.modbus.org.

Contents

1 Important Safety Notice

During normal use, potentially lethal voltages are connected to the NetMeter hardware. Consequently, the NetMeter hardware module should only be installed and serviced by a qualified electrician.

Please read and follow the Installation Manual for all guidelines and safety procedures associated with the installation and standard operation of this hardware. Any specific application of the NetMeter system should be in accordance with your local standards and practices.

Under no circumstances will Z3 Controls Inc. (Z3 Controls) be responsible or liable for any direct, indirect, or circumstantial damages associated with the usage or application of this equipment. No patent liability will be assumed or associated with Z3 Controls with respect to the usage of information, equipment, circuitry, software or practices described within this manual.

2 Purpose

This document describes the implementation of the Modbus protocol used in the Z3 Controls NetMeter devices. It is intended to assist control system programmers to utilize NetMeters in their SCADA/HMI systems or in building automation systems.

This document assumes that the user understands the general use of Modbus. More information about the Modbus protocol is available at the Modbus Organization's web site: www.modbus.org

3 Introduction

The NetMeter implements a subset of the TCP/IP variant of the Modbus specification.

The NetMeter acts as a Modbus "slave" device and will only respond on the Ethernet network when queried by a Modbus "master". When queried appropriately by a Modbus master, the NetMeter is capable of reporting a complete set of electrical parameters.

Summary of Key NetMeter Modbus Features:

- Modbus TCP server compliant with "Modbus Application Protocol Specification V1.1b" and "Modbus Messaging on TCP/IP Implementation Guide V1.0b"[2]
- Provides a complete set of instantaneous and cumulative electrical parameters
- Data available in both integer and floating point formats
- Supports 2 concurrent Modbus TCP connections
- Operates concurrent with the NetMeter's advanced and user friendly web interface
- NetMeter web interface provides an online Modbus Map

[2] Available at www.modbus.org

4 Data Formats

Data is available in three formats:

- 16 bit integers signed (S16) or unsigned (U16)
- 32 bit integers signed (S32) or unsigned (U32)
- 32 bit floating point

Most data is available in both integer and float formats. The real-time clock is the only exception. It is a 32 bit count of the number of seconds since midnight of January 1, 2010. It is transmitted only as a 32 bit unsigned integer.

Most integer numbers require scaling, and floating-point numbers do not.

For systems which cannot handle floating point numbers, integer values may be used. Each of these must be multiplied by a scale factor to convert the number to a value of the correct unit (Volts, Amps, Watts, etc.). See Chapter 5 (Modbus Map) on page 4 for more about how to scale integers.

Note that all data is transmitted as big endian. Consequently, Float and 32 bit integers are sent as bits 31:16 in the first (lowest) register address and 15:0 in the second (highest) register address.

4.1 16 Bit Integer Data Types

Since Modbus registers are naturally 16 bit, data is strait forward. However, some of the data types are signed values and should be interpreted as 2's compliment values.

4.2 32 Bit Integer Data Types

32 bit data must be read as 2 consecutive 16 bit registers. The register with the lowest address contains the most significant 16 bits of data. The higher address is then the least significant 16 bits of data. Each pair of 16 bits should be read using a single Modbus command in order to ensure that the data remains consistent for the upper and lower halves.

4.3 Floating Point Data Types

Floating point values are in standard IEEE-754 32 bit format. Since Modbus provides only 16-bit registers, two registers must be read to obtain all 32 bits.

To eliminate the possibility that data may change between reading the two 16-bit halves of the 32 bit floating point value, each pair of 16 bits should be read using a single Modbus command.

5 Modbus Map

The Modbus map is given in Table 1. It has 3 main sections:

- 16 bit registers starting at Element 1 (Address 0x0000). These may be either signed (S16) or unsigned (U16)
- 32 bit registers starting at Element 129 (Address 0x0080) These may be either signed (S32) or unsigned (U32)

- Floating point versions of the same source data from the above 16/32 bit integer data starting at Element 257 (Address 0x0100)

Table 1 shows 2 methods of Modbus addressing:

1. Data Element number: these start at 40001 for the Input Register space. This follows the Modicon convention for point addressing.
2. Data Address: this is the physical address sent out in the Modbus packet and is zero based.

Some of the scale factors shown in Table 1 are variable based on how the sensor is set up. For actual values, the NetMeter web interface provides a complete table containing actual values for the specific NetMeter setup. Using the NetMeter's web interface, this information is found under:

Setup → **Modbus**

As firmware revisions change, the information in Table 1 may also change. Consequently, the Modbus Table available directly from the NetMeter should always be regarded as definitive.

Table 1: Modbus Register Map

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40001	0 (0x0000)	V(A)	Volts RMS	U16	0.1
40002	1 (0x0001)	V(B)	Volts RMS	U16	0.1
40003	2 (0x0002)	V(C)	Volts RMS	U16	0.1
40005	4 (0x0004)	I(A)	Amps RMS	U16	0.005
40006	5 (0x0005)	I(B)	Amps RMS	U16	0.005
40007	6 (0x0006)	I(C)	Amps RMS	U16	0.005
40008	7 (0x0007)	I(D)	Amps RMS	U16	0.005
40009	8 (0x0008)	P(A)	Watts	S16	2
40010	9 (0x0009)	P(B)	Watts	S16	2
40011	10 (0x000A)	P(C)	Watts	S16	2
40012	11 (0x000B)	P(A+B+C)	Watts	S16	8
40013	12 (0x000C)	VA(A)	Volt-amps	U16	2
40014	13 (0x000D)	VA(B)	Volt-amps	U16	2
40015	14 (0x000E)	VA(C)	Volt-amps	U16	2

[3] The scale factors shown are for reference only based on the default sensor settings and with a 100A@0.333V CT. Changes to the sensor setup will alter some of the scale factors. Use the scale factors advertised in the Setup→Modbus menu item of your NetMeter after the Sensor settings have been finalized.

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40016	15 (0x000F)	VA(A+B+C)	Volt-amps	U16	8
40017	16 (0x0010)	VAR(A)	Watts	S16	2
40018	17 (0x0011)	VAR(B)	Watts	S16	2
40019	18 (0x0012)	VAR(C)	Watts	S16	2
40020	19 (0x0013)	VAR(A+B+C)	Watts	S16	8
40021	20 (0x0014)	PHI(A)	Degrees	S16	0.01
40022	21 (0x0015)	PHI(B)	Degrees	S16	0.01
40023	22 (0x0016)	PHI(C)	Degrees	S16	0.01
40025	24 (0x0018)	PF(A)	Percent	U16	0.01
40026	25 (0x0019)	PF(B)	Percent	U16	0.01
40027	26 (0x001A)	PF(C)	Percent	U16	0.01
40028	27 (0x001B)	PF(A+B+C)	Percent	U16	0.01
40029	28 (0x001C)	T(A)	us	U16	0.256
40030	29 (0x001D)	F(A)	Hz	U16	0.01
40033	32 (0x0020)	Vmax(A)	Volts RMS	U16	0.005
40034	33 (0x0021)	Vmax(B)	Volts RMS	U16	0.005
40035	34 (0x0022)	Vmax(C)	Volts RMS	U16	0.005
40037	36 (0x0024)	Vmin(A)	Volts RMS	U16	0.005
40038	37 (0x0025)	Vmin(B)	Volts RMS	U16	0.005
40039	38 (0x0026)	Vmin(C)	Volts RMS	U16	0.005
40041	40 (0x0028)	Pmax(A)	Watts	S16	2
40042	41 (0x0029)	Pmax(B)	Watts	S16	2
40043	42 (0x002A)	Pmax(C)	Watts	S16	2
40044	43 (0x002B)	Pmax(A+B+C)	Watts	S16	8
40129	128 (0x0080)	Time [31:16]	s	U32	1
40130	129 (0x0081)	Time [16:0]			
40137	136 (0x0088)	WHr(A) [31:16]	kWHr	S32	0.001
40138	137 (0x0089)	WHr(A) [16:0]			
40139	138 (0x008A)	WHr(B) [31:16]	kWHr	S32	0.001
40140	139 (0x008B)	WHr(B) [16:0]			
40141	140 (0x008C)	WHr(C) [31:16]	kWHr	S32	0.001
40142	141 (0x008D)	WHr(C) [16:0]			

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40143	142 (0x008E)	WHr(A+B+C) [31:16]	kWHr	S32	0.004
40144	143 (0x008F)	WHr(A+B+C) [16:0]			
40145	144 (0x0090)	VARHr(A) [31:16]	kWHr	S32	0.001
40146	145 (0x0091)	VARHr(A) [16:0]			
40147	146 (0x0092)	VARHr(B) [31:16]	kWHr	S32	0.001
40148	147 (0x0093)	VARHr(B) [16:0]			
40149	148 (0x0094)	VARHr(C) [31:16]	kWHr	S32	0.001
40150	149 (0x0095)	VARHr(C) [16:0]			
40151	150 (0x0096)	VARHr(A+B+C) [31:16]	kWHr	S32	0.004
40152	151 (0x0097)	VARHr(A+B+C) [16:0]			
40153	152 (0x0098)	VAHr(A) [31:16]	kVAHr	U32	0.001
40154	153 (0x0099)	VAHr(A) [16:0]			
40155	154 (0x009A)	VAHr(B) [31:16]	kVAHr	U32	0.001
40156	155 (0x009B)	VAHr(B) [16:0]			
40157	156 (0x009C)	VAHr(C) [31:16]	kVAHr	U32	0.001
40158	157 (0x009D)	VAHr(C) [16:0]			
40159	158 (0x009E)	VAHr(A+B+C) [31:16]	kVAHr	U32	0.004
40160	159 (0x009F)	VAHr(A+B+C) [16:0]			
40161	160 (0x00A0)	FWHr(A) [31:16]	kWHr	S32	0.001
40162	161 (0x00A1)	FWHr(A) [16:0]			
40163	162 (0x00A2)	FWHr(B) [31:16]	kWHr	S32	0.001
40164	163 (0x00A3)	FWHr(B) [16:0]			
40165	164 (0x00A4)	FWHr(C) [31:16]	kWHr	S32	0.001
40166	165 (0x00A5)	FWHr(C) [16:0]			
40167	166 (0x00A6)	FWHr(A+B+C) [31:16]	kWHr	S32	0.004
40168	167 (0x00A7)	FWHr(A+B+C) [16:0]			
40169	168 (0x00A8)	FVARHr(A) [31:16]	kWHr	S32	0.001
40170	169 (0x00A9)	FVARHr(A) [16:0]			
40171	170 (0x00AA)	FVARHr(B) [31:16]	kWHr	S32	0.001
40172	171 (0x00AB)	FVARHr(B) [16:0]			
40173	172 (0x00AC)	FVARHr(C) [31:16]	kWHr	S32	0.001
40174	173 (0x00AD)	FVARHr(C) [16:0]			

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40175	174 (0x00AE)	FVARHr(A+B+C) [31:16]	kWHr	S32	0.004
40176	175 (0x00AF)	FVARHr(A+B+C) [16:0]			
40257	256 (0x0100)	V(A) [31:16]	Volts RMS	Float	1
40258	257 (0x0101)	V(A) [16:0]			
40259	258 (0x0102)	V(B) [31:16]	Volts RMS	Float	1
40260	259 (0x0103)	V(B) [16:0]			
40261	260 (0x0104)	V(C) [31:16]	Volts RMS	Float	1
40262	261 (0x0105)	V(C) [16:0]			
40265	264 (0x0108)	I(A) [31:16]	Amps RMS	Float	1
40266	265 (0x0109)	I(A) [16:0]			
40267	266 (0x010A)	I(B) [31:16]	Amps RMS	Float	1
40268	267 (0x010B)	I(B) [16:0]			
40269	268 (0x010C)	I(C) [31:16]	Amps RMS	Float	1
40270	269 (0x010D)	I(C) [16:0]			
40271	270 (0x010E)	I(D) [31:16]	Amps RMS	Float	1
40272	271 (0x010F)	I(D) [16:0]			
40273	272 (0x0110)	P(A) [31:16]	Watts	Float	1
40274	273 (0x0111)	P(A) [16:0]			
40275	274 (0x0112)	P(B) [31:16]	Watts	Float	1
40276	275 (0x0113)	P(B) [16:0]			
40277	276 (0x0114)	P(C) [31:16]	Watts	Float	1
40278	277 (0x0115)	P(C) [16:0]			
40279	278 (0x0116)	P(A+B+C) [31:16]	Watts	Float	1
40280	279 (0x0117)	P(A+B+C) [16:0]			
40281	280 (0x0118)	VA(A) [31:16]	Volt-amps	Float	1
40282	281 (0x0119)	VA(A) [16:0]			
40283	282 (0x011A)	VA(B) [31:16]	Volt-amps	Float	1
40284	283 (0x011B)	VA(B) [16:0]			
40285	284 (0x011C)	VA(C) [31:16]	Volt-amps	Float	1
40286	285 (0x011D)	VA(C) [16:0]			
40287	286 (0x011E)	VA(A+B+C) [31:16]	Volt-amps	Float	1
40288	287 (0x011F)	VA(A+B+C) [16:0]			

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40289	288 (0x0120)	VAR(A) [31:16]	Watts	Float	1
40290	289 (0x0121)	VAR(A) [16:0]			
40291	290 (0x0122)	VAR(B) [31:16]	Watts	Float	1
40292	291 (0x0123)	VAR(B) [16:0]			
40293	292 (0x0124)	VAR(C) [31:16]	Watts	Float	1
40294	293 (0x0125)	VAR(C) [16:0]			
40295	294 (0x0126)	VAR(A+B+C) [31:16]	Watts	Float	1
40296	295 (0x0127)	VAR(A+B+C) [16:0]			
40297	296 (0x0128)	PHI(A) [31:16]	Degrees	Float	1
40298	297 (0x0129)	PHI(A) [16:0]			
40299	298 (0x012A)	PHI(B) [31:16]	Degrees	Float	1
40300	299 (0x012B)	PHI(B) [16:0]			
40301	300 (0x012C)	PHI(C) [31:16]	Degrees	Float	1
40302	301 (0x012D)	PHI(C) [16:0]			
40305	304 (0x0130)	PF(A) [31:16]	Percent	Float	1
40306	305 (0x0131)	PF(A) [16:0]			
40307	306 (0x0132)	PF(B) [31:16]	Percent	Float	1
40308	307 (0x0133)	PF(B) [16:0]			
40309	308 (0x0134)	PF(C) [31:16]	Percent	Float	1
40310	309 (0x0135)	PF(C) [16:0]			
40311	310 (0x0136)	PF(A+B+C) [31:16]	Percent	Float	1
40312	311 (0x0137)	PF(A+B+C) [16:0]			
40313	312 (0x0138)	T(A) [31:16]	us	Float	1
40314	313 (0x0139)	T(A) [16:0]			
40315	314 (0x013A)	F(A) [31:16]	Hz	Float	1
40316	315 (0x013B)	F(A) [16:0]			
40321	320 (0x0140)	Vmax(A) [31:16]	Volts RMS	Float	1
40322	321 (0x0141)	Vmax(A) [16:0]			
40323	322 (0x0142)	Vmax(B) [31:16]	Volts RMS	Float	1
40324	323 (0x0143)	Vmax(B) [16:0]			
40325	324 (0x0144)	Vmax(C) [31:16]	Volts RMS	Float	1
40326	325 (0x0145)	Vmax(C) [16:0]			

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40329	328 (0x0148)	Vmin(A) [31:16]	Volts RMS	Float	1
40330	329 (0x0149)	Vmin(A) [16:0]			
40331	330 (0x014A)	Vmin(B) [31:16]	Volts RMS	Float	1
40332	331 (0x014B)	Vmin(B) [16:0]			
40333	332 (0x014C)	Vmin(C) [31:16]	Volts RMS	Float	1
40334	333 (0x014D)	Vmin(C) [16:0]			
40337	336 (0x0150)	Pmax(A) [31:16]	Watts	Float	1
40338	337 (0x0151)	Pmax(A) [16:0]			
40339	338 (0x0152)	Pmax(B) [31:16]	Watts	Float	1
40340	339 (0x0153)	Pmax(B) [16:0]			
40341	340 (0x0154)	Pmax(C) [31:16]	Watts	Float	1
40342	341 (0x0155)	Pmax(C) [16:0]			
40343	342 (0x0156)	Pmax(A+B+C) [31:16]	Watts	Float	1
40344	343 (0x0157)	Pmax(A+B+C) [16:0]			
40385	384 (0x0180)	Time [31:16]	s	32 Bit	1
40386	385 (0x0181)	Time [16:0]			
40393	392 (0x0188)	WHr(A) [31:16]	Watt-Hours	Float	1
40394	393 (0x0189)	WHr(A) [16:0]			
40395	394 (0x018A)	WHr(B) [31:16]	Watt-Hours	Float	1
40396	395 (0x018B)	WHr(B) [16:0]			
40397	396 (0x018C)	WHr(C) [31:16]	Watt-Hours	Float	1
40398	397 (0x018D)	WHr(C) [16:0]			
40399	398 (0x018E)	WHr(A+B+C) [31:16]	Watt-Hours	Float	1
40400	399 (0x018F)	WHr(A+B+C) [16:0]			
40401	400 (0x0190)	VARHr(A) [31:16]	Watt-Hours	Float	1
40402	401 (0x0191)	VARHr(A) [16:0]			
40403	402 (0x0192)	VARHr(B) [31:16]	Watt-Hours	Float	1
40404	403 (0x0193)	VARHr(B) [16:0]			
40405	404 (0x0194)	VARHr(C) [31:16]	Watt-Hours	Float	1
40406	405 (0x0195)	VARHr(C) [16:0]			
40407	406 (0x0196)	VARHr(A+B+C) [31:16]	Watt-Hours	Float	1
40408	407 (0x0197)	VARHr(A+B+C) [16:0]			

Data Element	Data Address	Register Name	Units	Format	Scale Factor[3]
40409	408 (0x0198)	VAHr(A) [31:16]	Volt-amp-Hours	Float	1
40410	409 (0x0199)	VAHr(A) [16:0]			
40411	410 (0x019A)	VAHr(B) [31:16]	Volt-amp-Hours	Float	1
40412	411 (0x019B)	VAHr(B) [16:0]			
40413	412 (0x019C)	VAHr(C) [31:16]	Volt-amp-Hours	Float	1
40414	413 (0x019D)	VAHr(C) [16:0]			
40415	414 (0x019E)	VAHr(A+B+C) [31:16]	Volt-amp-Hours	Float	1
40416	415 (0x019F)	VAHr(A+B+C) [16:0]			
40417	416 (0x01A0)	FWHr(A) [31:16]	Watt-Hours	Float	1
40418	417 (0x01A1)	FWHr(A) [16:0]			
40419	418 (0x01A2)	FWHr(B) [31:16]	Watt-Hours	Float	1
40420	419 (0x01A3)	FWHr(B) [16:0]			
40421	420 (0x01A4)	FWHr(C) [31:16]	Watt-Hours	Float	1
40422	421 (0x01A5)	FWHr(C) [16:0]			
40423	422 (0x01A6)	FWHr(A+B+C) [31:16]	Watt-Hours	Float	1
40424	423 (0x01A7)	FWHr(A+B+C) [16:0]			
40425	424 (0x01A8)	FVARHr(A) [31:16]	Watt-Hours	Float	1
40426	425 (0x01A9)	FVARHr(A) [16:0]			
40427	426 (0x01AA)	FVARHr(B) [31:16]	Watt-Hours	Float	1
40428	427 (0x01AB)	FVARHr(B) [16:0]			
40429	428 (0x01AC)	FVARHr(C) [31:16]	Watt-Hours	Float	1
40430	429 (0x01AD)	FVARHr(C) [16:0]			
40431	430 (0x01AE)	FVARHr(A+B+C) [31:16]	Watt-Hours	Float	1
40432	431 (0x01AF)	FVARHr(A+B+C) [16:0]			

6 Supported Modbus Functions

The NetMeter is a Modbus read only device. That is, there are no control points present in the NetMeter. However, the NetMeter can act as a gateway for control devices on its ZCAN control network.

Table 2: Modbus Command Support

Function Code	Command	Description
1	Read Coil Status	Reserved for future use. Will generate exception code 02 (Illegal Data Address)
2	Read Input Status	Reserved for future use. Will generate exception code 02 (Illegal Data Address)
3	Read Holding Registers	Reserved for future use. For the current version of the firmware this operates the same as the Read Input Registers command. However, this behaviour should not be relied upon for compatibility with future firmware releases.
4	Read Input Registers	Used by the NetMeter to return electrical data (see Table 1). For registers that are un-implemented, the value of 0x0000 will result.
5	Write Single Coil	Reserved for future use. Will generate exception code 02 (Illegal Data Address)
6	Write Single Register	Reserved for future use. Will generate exception code 02 (Illegal Data Address)
15	Write Multiple Coils	Reserved for future use. Will generate exception code 02 (Illegal Data Address)
16	Write Multiple Registers	Reserved for future use. Will generate exception code 02 (Illegal Data Address)
17	Report Slave ID	Returns byte count of 2: Slave ID = 0, RUN indicator status (0 = OFF, FF = ON)
All others		Will generate exception code 01 (Illegal Function Code)

7 Transactions for Supported Modbus Functions

This section describes the Request/Response packets for each of the supported Modbus Functions. This section assumes basic knowledge of the Modbus Protocol as documented in:

- MODBUS Application Protocol Specification V1.1b
- MODBUS Messaging on TCP/IP Implementation Guide V1.0b

These documents are available at the Modbus web site: www.modbus.org

The NetMeter supports 2 concurrent Modbus TCP connections. That is, 2 Modbus client devices (masters) can simultaneously remain connected to the NetMeter. If Modbus clients disconnect from the socket between each query (or a sequence of queries) rather than keeping the socket connected, then even more clients may poll the NetMeter.

The number of total Modbus TCP sockets and the number of sockets currently available is reported in the Modbus Setup page of the NetMeter web interface.

7.1 Modbus Unit Identifier

The Modbus Unit Identifier is used to address multiple physical or virtual Modbus devices that may be connected through a single IP address on a TCP/IP network and is like a "slave address" for Modbus-RTU.

The NetMeter is polled using a Modbus Unit Identifier value of 1.

The Modbus Unit Identifier value of 0 (Broadcast) will be received by the NetMeter and no response will be transmitted back by the NetMeter. All broadcast requests to the NetMeter are currently ignored but broadcast features may be added to the NetMeter in the future.

Modbus Unit Identifier values greater than one are reserved for future use and will return an exception code of 0x0B (GATEWAY TARGET DEVICE FAILED TO RESPOND)

7.2 Modbus Transaction by Function

Each of the following request/response tables are color-coded according to the following code:

Purple	MBAP Header (MODBUS Application Protocol)
Green	PDU (Protocol Data Unit)

See the document "MODBUS Messaging on TCP/IP Implementation Guide V1.0b" for more information on this terminology.

7.2.1 Function 17 (0x11): Report Slave ID

Table 3: Report Slave ID Request

Offset	Size	Field	Value	Description
0	2	Transaction Identifier	TID	The value is chosen by the Modbus Client(master) device and will be sent back in the response by the NetMeter
2	2	Protocol Identifier	0x0000	0 = MODBUS protocol, the same value will be sent back in the response by the NetMeter
4	2	Length	3	Number of following bytes
6	1	Unit Identifier	UID = 1	The NetMeter will respond normally to a UID of 0x01. Other values are reserved for future use and will return an exception code of 0x0B (GATEWAY TARGET DEVICE FAILED TO RESPOND)
7	1	Function	0x11	Report Slave ID function code

Table 4: Report Slave ID Normal Response

Offset	Size	Field	Value	Description
0	2	Transaction Identifier	TID	Value is copied from the request
2	2	Protocol Identifier	PID	Value is copied from the request, should normally be 0x0000.
4	2	Length	N + 5	Number of following bytes
6	1	Unit Identifier	UID = 1	Value is copied from the request

Offset	Size	Field	Value	Description
7	1	Function	0x11	Report Slave ID function code
8	1	Byte Count	N + 2	Number of following bytes
9	1	Slave ID	0	NetMeter Slave ID = 0
10	1	Run Status	0x00 or 0xFF	Run Indicator Status 0x00 = OFF, 0xFF = ON (NetMeter is enabled for proper data capture)
11	N	ID String	See Text	An ASCII string is transmitted in little endian order. It contains a list of comma separated fields: NetMeter MAC Address, NetMeter Sensor Model#, Firmware Version, Firmware Build Number Additional fields may be added in future releases.

The Slave ID Exception Response (Table 5) is generated when the Unit Identifier is 2 or higher.

Table 5: Report Slave ID Exception Response

Offset	Size	Field	Value	Description
0	2	Transaction Identifier	TID	Value is copied from the request
2	2	Protocol Identifier	PID	Value is copied from the request
4	2	Length	3	Number of following bytes
6	1	Unit Identifier	UID = 1	Value is copied from the request
7	1	Function	0x91	Report Slave ID exception function code
8	1	Exception Code	0x04	SLAVE_DEVICE_FAILURE

7.2.2 Function 4 (0x04): Read Input Registers

Table 6: Read Input Registers Request

Offset	Size	Field	Value	Description
0	2	Transaction Identifier	TID	The value is chosen by the Modbus Client device and will be sent back in the response by the NetMeter
2	2	Protocol Identifier	0x0000	0 = MODBUS protocol, the same value will be sent back in the response by the NetMeter
4	2	Length	6	Number of following bytes
6	1	Unit Identifier	UID = 1	The NetMeter will respond normally to a UID of 0x01. Other values are reserved for future use and will return an exception code of 0x0B (GATEWAY TARGET DEVICE FAILED TO RESPOND)
7	1	Function	0x04	Read Input Registers function code
8	2	Starting Address		Address of the first Input Register to be loaded. See the Modbus Map on page 4
10	2	Quantity of Registers	N = 1 to 125	The number of 16 bit registers to be loaded.

Table 7: Read Input Registers Normal Response

Offset	Size	Field	Value	Description
0	2	Transaction Identifier	TID	Value is copied from the request
2	2	Protocol Identifier	PID	Value is copied from the request
4	2	Length	2×N + 3	Number of following bytes
6	1	Unit Identifier	UID = 1	Value is copied from the request
7	1	Function	0x04	Read Input Registers function code
8	1	Byte Count	2×N	Number of following bytes
9	2×N	Register Values		Values for the requested Input Register sequence

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