MUCM DNP 3.0 Slave

Installation and Programming Manual

This Manual describes the MUCM application for interfacing Powerlogic meters onto a DNP 3.0 system.

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Introduction

The Niobrara MUCM is a Modicon Momentum® compatible module that is capable of running multiple applications for performing communication translations between serial protocols. This document covers an application that makes multiple Square D Powerlogic devices appear as multiple DNP 3.0 slave devices. Up to 20 devices may be configured within the MUCM.

Though the MUCM hardware supports a communications tophat, this communication option is not used in this application. In most installations, it is advisable to cover the opening where a tophat would normally connect to protect the exposed circuit board. NR&D part number METH-001 is an inexpensive empty tophat case sold for this purpose.

Both of the two application areas are used for this data concentrator application: app1.qcm is compiled and loaded into application area 1 of the MUCM and app2.qcm is loaded into application area 2.

Port 1 of the MUCM is RS-232 and is to be connected to a DNP 3.0 network. Port 2 of the MUCM is RS-485 and is to be connected to the Powerlogic network. Port 2 may be configured for SY/MAX, PNIM, Modbus/RTU, Modbus ASCII, or a combination of PNIM and RTU.

The MUCM contains its own power supply and needs a source of 9 to 30 Volts, AC or DC. An ideal 12VAC transformer is available from NR&D as part number TR121-ST.

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Installation

Installation of the MUCM should go quickly, with the necessary materials. The following items are necessary:

- MUCM
- MU1 cable (or equivalent can be built; see Figure 2-1)
- Power source for MUCM (use NR&D part TR121-ST or available power)
- Cabling between MUCM and DNP Master-may be built or purchased
- Cabling between MUCM and Powerlogic equipment may be built or purchased. All mating connectors are supplied with MUCM; network cabling is not provided.
- PC with terminal emulator, or terminal with RS-232 port.

The following may be used:

- DIN rail for mounting
- Empty Momentum tophat plastic to close MUCM case (NR&D part METH-001)

Module Installation

1 Mount the MUCM on a DIN rail, or mount as desired using screws through the two holes provided. The DIN rail or mounting screws should be Earth-grounded for the MUCM serial ports' transient suppression.

2 Supply power to the MUCM; NR&D's TR121-ST may be used, or any available power source 9-30 Volts AC or DC.

Software Installation

The application files for the MUCM are included in the DNPS.ZIP file. This file must be unzipped using PKUNZIP.EXE. A copy of PKUNZIP is included on the standard NR&D software disk and is also available at www.niobrara.com. The latest version of

the DNPS.ZIP file is located at

http://www.niobrara.com/ftp/mucm/dnps/dnps.zip

The latest version of this document in pdf format is located at:

http://www.niobrara.com/ftp/mucm/dnps/dnps.pdf

Serial Connections to the MUCM

Port 1 to DNP Master

Port 1 of the MUCM is RS-232 so a simple 3-wire cable is required to connect to the master device. In general, the master's Tx signal will connect to the MUCM's Rx, and the master's Rx signal will connect to the MUCM's Tx. Signal ground must run from the master to the MUCM, and each device will have its RTS and CTS handshaking pins shorted together.

In the event the DNP master is a personal computer with a standard 9-pin RS-232 port, the Niobrara MU1 cable may be used. If the DNP master is connected through a modem then the MU4 cable may work. (See Figure 2-2). For other standard connections, see the MUCM manual, or contact NR&D's technical support.

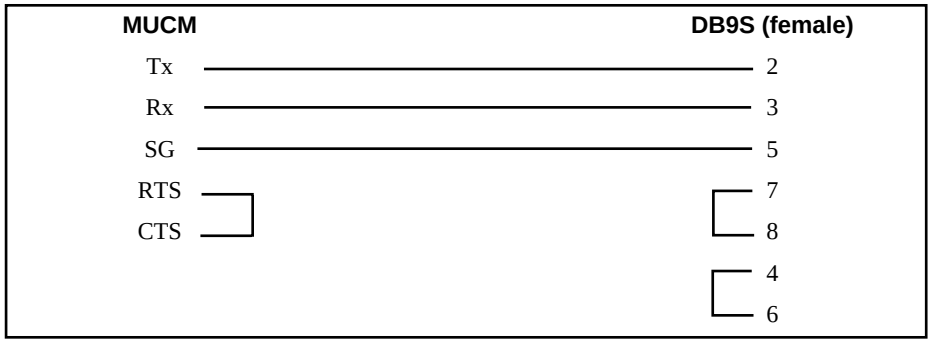

Figure 2-1 MUCM to PC RS-232 (MU1 Cable)

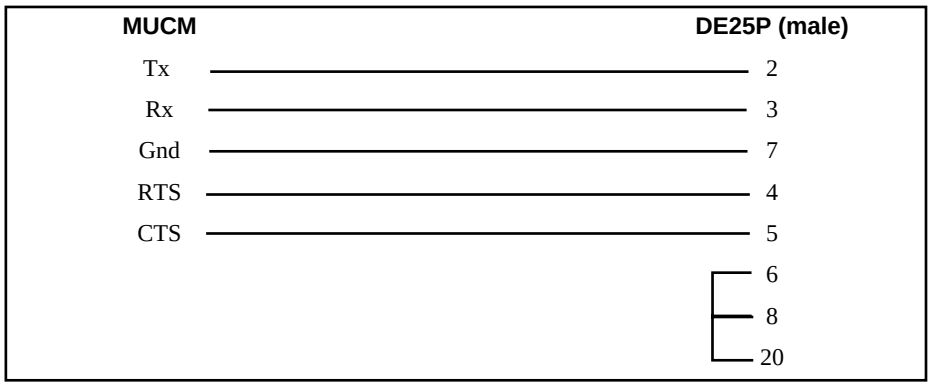

Figure 2-2 MUCM to RS-232 DTE Port (25-pin modem) (MU4 Cable)

Port 2 to Powerlogic Network

Port 2 of the MUCM is RS-422/485 so a simple 4-wire cable is required to connect to most Powerlogic equipment. The Niobrara MU7 cable may be used to connect the MUCM to a standard SY/MAX RS-422 port such as on the Niobrara SPE4-1D, SPE4-2D, EPE5-TCP, MEB-TCP, or Square D NIM. Twisted pair cable should be used.

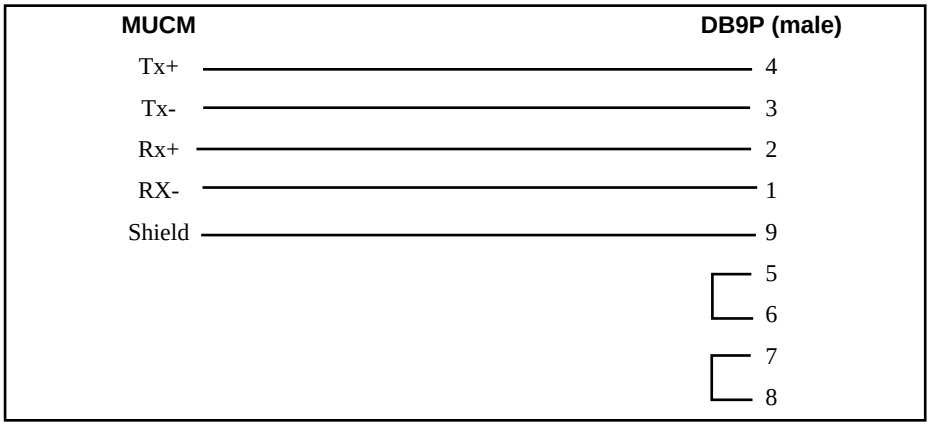

Figure 2-3 MUCM to SY/MAX RS-422 port (MU7 Cable)

The Powerlogic meters may be directly connected to the MUCM if no further network connection is required. See Figure 2-4.

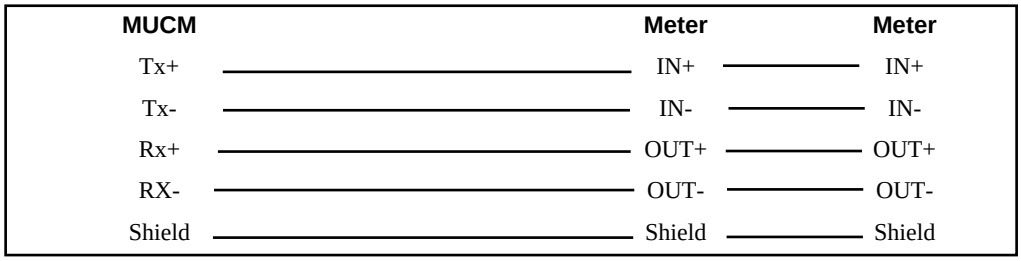

Figure 2-4 MUCM to Powerlogic meters

A physical connection must be made from the personal computer to the MUCM in order to download the applications. This link is a serial connection from a COM port on the personal computer to the RS-232 port on the MUCM. The Niobrara MU1 cable may be used for this connection. This cable is shown in Figure 2-1.

Loading the Applications into the MUCM

The MUCM is rapidly evolving so be sure to upgrade the firmware in the module before loading the latest version of APP1.QCC and APP2.QCC. Most likely the QCOMPILE.EXE has been updated so be sure to use the newest version. The MUCM-001 and MUCM-002 use different firmware files: MUCM1.FWL is for the MUCM-001; MUCM.FWL is for the MUCM-002. Firmware upload is as follows:

1 Move the RUN/LOAD switch on the module to LOAD. The MUCM may reboot, and the Tx1 LED should flash once per second, very briefly.

2 Connect the PC to MUCM Port 1 with a MU1 cable.

3 From the command line enter

> fwload mucm.fwl com1: [for an MUCM-002]

or

> fwload mucm1.fwl com1: [for an MUCM-001]

Be sure to have the colon after the PC's com port name. The download will only take a few minutes and will inform when finished.

4 Change the switch back to RUN.

5 It is a good idea to press the RESET button after a firmware change.

Next, load APP1.QCC and APP2.QCC into the MUCM:

1 Move Switches 1 and 2 to Halt.

2 Connect the PC to MUCM Port 1 with a MU1 cable.

3 Load the DNP files with qload:

> qload 1 app1 com1: -a

Will load the file into application 1's flash and set the program to automatically start on power-up. Again, it is important to include the colon after the PC's COM port name.

> qload 2 app2 com1: -a

Will load application 2.

4 Place Switches 1 and 2 in RUN. The RN1 and RN2 lights should come on and light 2 will blink.

Configure the application by connecting a terminal emulator (like Hyperterminal) to the COM: port of the MUCM. See the Configuration Chapter for details.

DNP Slave Address Configuration

The MUCM may be configured to answer to multiple DNP slave addresses. Each configured DNP address will correspond to a single Powerlogic device. Each device will have its own SY/MAX or Modbus route assigned.

Meter Data

The following POWERLOGIC devices are supported by this QUCM application: CM-100 series, CM-2000 series, CM-4000 Series, Power Meter, and Enercept.

Table 2-1 Device Data List

Description	CM 100	CM 2000	CM 4000	Power Meter	Enercept
Device Type	450-455	460-470	15101 - 15102	480-490	8075 - 8076
Frequency (Hz/100)	Read	Read	Read	Read	N/A
True Power Factor	Read	Read	Read	Read	Read
Displacement Power Factor	N/A	Read	Read	Read	N/A
Current A (A)	Read	Read	Read	Read	Read
Current B (A)	Read	Read	Read	Read	Read
Current C (A)	Read	Read	Read	Read	Read
Current N (A)	Read	Read	Read	Read	N/A
Current G (A)	Read	Read	Read	Read	N/A
Current Avg. (A)	Calculated	Read	Read	Calculated	Read
Current Apparent RMS (A)	Read	Read	Read	Read	N/A
Voltage AN (V)	Read	Read	Read	Read	Read
Voltage BN (V)	Read	Read	Read	Read	Read
Voltage CN (V)	Read	Read	Read	Read	Read
Voltage LN Avg (V)	Calculated	Read	Read	Calculated	Read
Voltage AB (V)	Read	Read	Read	Read	Read
Voltage BC (V)	Read	Read	Read	Read	Read
Voltage CA (V)	Read	Read	Read	Read	Read
Voltage LL Avg (V)	Calculated	Read	Read	Calculated	Read
Real Power A (KW)	N/A	Read	Read	Read	Read
Real Power B (KW)	N/A	Read	Read	Read	Read
Real Power C (KW)	N/A	Read	Read	Read	Read
Real Power Total (KW)	Read	Read	Read	Read	Read

Description	CM 100	CM 2000	CM 4000	Power Meter	Enercept
Reactive Power A (KVAR)	N/A	Read	Read	Read	N/A
Reactive Power B (KVAR)	N/A	Read	Read	Read	N/A
Reactive Power C (KVAR)	N/A	Read	Read	Read	N/A
Reactive Power Total (KVAR)	Read	Read	Read	Read	Read
Apparent Power A (KVA)	N/A	Read	Read	Read	N/A
Apparent Power B (KVA)	N/A	Read	Read	Read	N/A
Apparent Power C (KVA)	N/A	Read	Read	Read	N/A
Apparent Power Total (KVA)	Read	Read	Read	Read	Read
Real Energy In (KWH)	Read	Read	Read	Read	Read
Reactive Energy In (KVARH)	Read	Read	Read	Read	N/A
Real Energy Out (KWH)	Read	Read	Read	Read	Read
Reactive Energy Out (KVARH)	Read	Read	Read	Read	N/A
Apparent Energy (KVAH)	Read	Read	Read	Read	N/A

Description	CM 100	CM 2000	CM 4000	Power Meter	Enercept
Real Energy Signed (KWH)	Read	Read	Read	Read	Read
Reactive Energy Signed (KVARH)	Read	Read	Read	Read	N/A
Incremental Real Energy In (KWH)	Calculated	Calculated	Calculated	Calculated	Read
Incremental Reactive Energy In (KVAR)	N/A	Calculated	Calculated	Calculated	N/A
Incremental Real Energy Out (KWH)	Calculated	Calculated	Calculated	Calculated	Read
Incremental Reactive Energy Out (KVARH)	Calculated	Calculated	Calculated	Calculated	Read
Incremental Apparent Energy (KVAH)	N/A	Calculated	Calculated	Calculated	Read
Present Current Demand 3-Phase Avg. (A)	Calculated	Calculated	Calculated	Calculated	N/A
Present Current Demand A (A)	Read	Read	Read	Read	N/A
Present Current Demand B (A)	Read	Read	Read	Read	N/A
Present Current Demand C (A)	Read	Read	Read	Read	N/A
Present Current Demand N (A)	Read	Read	Read	Read	N/A
Peak Current Demand 3-Phase Avg. (A)	N/A	Read	Read	Calculated	N/A
Peak Current Demand A (A)	N/A	Read	Read	Read	N/A
Peak Current Demand B (A)	N/A	Read	Read	Read	N/A
Peak Current Demand C (A)	N/A	Read	Read	Read	N/A
Peak Current Demand N (A)	N/A	Read	Read	Read	N/A
Present Real Power Demand 3-Phase Total (KW)	N/A	Read	Read	Read	Read
Present Reactive Power Demand 3-Phase Total (KVAR)	N/A	Read	Read	Read	N/A
Present Apparent Power Demand 3-Phase Total (KVA)	N/A	Read	Read	Read	N/A
Peak Real Power Demand 3-Phase Total (KW)	N/A	Read	Read	Read	Read

Description	CM 100	CM 2000	CM 4000	Power Meter	Enercept
Peak Reactive Power Demand 3-Phase Total (KVAR)	N/A	Read	Read	Read	N/A
Peak Apparent Power Demand 3-Phase Total (KVA)	N/A	Read	Read	Read	N/A
CM Label	Read	Read	Read	Read	N/A
CM Nameplate	Read	Read	Read	Read	N/A

DNP Object List

The data from the meters is presented as Analog Input Objects and Binary Counter Objects.

Table 2-2 Binary Counter Objects

(32-bit Binary Counter without Flag) (Object 20, Variation 5)		
Point	**Measurement**	**Scaling**
0	KWH Input	x1
1	KWH Output	x1
2	KWH Total	x1
3	KVARH Input	x1
4	KVARH Output	x1
5	KVARH Total	x1
6	KVAH Total	x1

Table 2-3 Analog Input Objects

(16-bit Analog Input without Flag) (Object 30, Variation 4)		
Point	**Measurement**	**Scaling**
0	Voltage LN Phase A	x1
1	Voltage LN Phase B	x1
2	Voltage LN Phase C	x1
3	Voltage LN Avg	x1
4	Voltage LL Phase A	x1
5	Voltage LL Phase B	x1
6	Voltage LL Phase C	x1
7	Voltage LL Avg	x1
8	Current Phase A	x1
9	Current Phase B	x1
10	Current Phase C	x1
11	Current Phase N	x1
12	Current Phase G	x1
13	Current Avg	x1
14	Current Apparent	x1
15	KW Phase A	x1
16	KW Phase B	x1
17	KW Phase C	x1
18	KW Avg	x1
19	KVAR Phase A	x1
20	KVAR Phase B	x1
21	KVAR Phase C	x1
22	KVAR Avg	x1
23	KVA Phase A	x1
24	KVA Phase B	x1
25	KVA Phase C	x1
26	KVA Avg	x1
27	Present Demand Current A	x1
28	Present Demand Current B	x1
29	Present Demand Current C	x1
30	Present Demand Current Avg	x1
31	Present Demand KW	x1
32	Present Demand KVAR	x1
33	Present Demand KVA	x1
34	Frequency	x100
35	True Power Factor	x1000
36	displacement Power Factor	x1000

See Chapter 4 for complete DNP information.

3

Configuration

The MUCM application requires some basic configuration. This is done via a Terminal session through the MUCM's serial port 1. When switch 2 is in the MEM PROTECT position, the MUCM is in configuration mode, and the user light 1 will blink rapidly.

For configuration, connect a PC with a terminal emulator (such as Hyperterminal) to the MUCM's port 1 using a MU1 cable (as described in Figure 2-1 on page 8). The configuration terminal should be set to 9600 baud, No parity, 8 data bits. Pressing ENTER will cause the MUCM to display the main menu.

Main Page

The main page allows the configuration of DNP baud rate and parity, and Powerlogic network settings. (See Figure 3-1). This page also provides the means to store the configuration permanently to Flash memory.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
DNP 3.0 Setup                                        App Rev. 18Apr2002

 Setting          Port 1            Port 2
---------      --------------     -------------
Mode           DNP 3.0 Slave      SY/MAX Master
Baud               9600               9600
Parity             NONE               EVEN
Data Bits           8                  8
Stop Bits           1                  1
Timeout            2000               2000

(P)ort Settings
(R)outing Table Settings
(W)rite to Flash
```

Figure 3-1 Configuration Main Page

From this page, select the desired baud rate, parity, stop bits, and timeout for the DNP port, protocol, baud rate, parity, data bits, stop bits, and timeout for the Powerlogic network.

Press "P" to edit the port settings. Press the space bar to toggle through the possible settings and press Enter to accept the setting. Press "Esc" to escape the modifications. Use the SY/MAX mode for connecting most Niobrara cards and Square D NIMs. Use the PLOGIC mode for direct connection of CM100 or CM2000 meters. Use PNIM for direct connection of CM2000 or Power Meters.

Press ’R’ to set up the routing for the Powerlogic devices. Press "E" to edit the entries. Prompts for the DNP Slave address and route follow. Valid DNP Slave address are 0 through 65534. The route may be up to 8 drops. Use commas to separate the drops.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
DNP 3.0 Setup                                                  18Apr2002
Route   DNP              POWERLOGIC             POWERLOGIC
Entry  Slave                Route                 Device
-----  -----   -------------------------------  -----------
   1    2023   12,11,1                          CM2350-Online
   2    2024   12,10,5,1                        CM2350-Online
   3     N/A   NONE                             N/A
   4     N/A   NONE                             N/A
   5     N/A   NONE                             N/A
   6     N/A   NONE                             N/A
   7     N/A   NONE                             N/A
   8     N/A   NONE                             N/A
   9     N/A   NONE                             N/A
  10     N/A   NONE                             N/A

 (N)ext Page
 (E)dit Routes
 (P)ort Settings
 (W)rite to Flash
 (C)lear all routes
```

Figure 3-2 Configuration of Routes

The example page listed above shows two CM2350 meters where meter 1 is DNP slave 2023 and meter 2 is slave 2024.

NOTE: The Write to flash operation must be performed to update the polling of the devices.

4

DNP Device Profile

DNP V3.00 **DEVICE PROFILE DOCUMENT**	
Vendor Name: **Niobrara R&D Corp**	
Device Name: MUCM-001 Powerlogic Application	
Highest DNP Level Supported: For Requests Level 2 For Responses Level 2	Device Function: ☐Master ■Slave
Maximum Data Link Frame Size (octets) Transmitted 292 Received 292	Maximum Application Fragment Size (octets): Transmitted 2048 Received 2048
Maximum Data Link Re-tries: ■None ☐Fixed at _____ ☐Configurable	Maximum Application Layer Re-tries: ■None ☐Configurable range ____ to ____

Requires Data Link Layer Confirmation:

- ■ Never
- □ Always
- □ Sometimes If 'Sometimes', when?_____
- □ Configurable If 'Configurable', how?_____

Requires Application Layer Confirmation:

- ■ Never
- □ Always
- □ When reporting Event Data
- □ When sending multi-fragment responses
- □ Sometimes If 'Sometimes', when?_____
- □ Configurable If 'Configurable', how?_____

Timeouts while waiting for:

Data Link Confirm	□ None	□ Fixed at ____	□ Variable	■ Configurable
Complete Appl. Fragment	■ None	□ Fixed at ____	□ Variable	□ Configurable
Application Confirm	■ None	□ Fixed at ____	□ Variable	□ Configurable
Complete Appl. Response	■ None	□ Fixed at ____	□ Variable	□ Configurable

Others _____

Data Link Confirm timeout is configurable: 1 to 5 seconds.

Sends/executes Control Operations

WRITE Binary Outputs	■ None	□ Always	□ Sometimes	□ Configurable
SELECT/OPERATE	■ None	□ Always	□ Sometimes	□ Configurable
DIRECT OPERATE	■ None	□ Always	□ Sometimes	□ Configurable
DIRECT OPERATE - NO ACK	■ None	□ Always	□ Sometimes	□ Configurable
Count > 1	■ None	□ Always	□ Sometimes	□ Configurable
Pulse On	■ None	□ Always	□ Sometimes	□ Configurable
Pulse Off	■ None	□ Always	□ Sometimes	□ Configurable
Latch On	■ None	□ Always	□ Sometimes	□ Configurable
Latch Off	■ None	□ Always	□ Sometimes	□ Configurable
Queue	■ None	□ Always	□ Sometimes	□ Configurable
Clear Queue	■ None	□ Always	□ Sometimes	□ Configurable

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY

Reports Binary Input Change Events when no specific variation requested:

- ■ Never
- □ Only time-tagged
- □ Only non-time-tagged
- □ Configurable to send both, one, or the other

Reports time-tagged Binary Input Change Events when no specific variation requested:

- ■ Never
- □ Binary Input Change With Time
- □ Binary Input Change Withe Relative Time
- □ Configurable

Sends Unsolicited Responses:

- ■ Never
- □ Configurable
- □ Only certain objects
- □ Sometimes
- □ ENABLE/DISABLE UNSOLICITED Function codes supported

Sends Static Data in Unsolicited Responses:

- ■ Never
- □ When Device Restarts
- □ When Status Flags Change

Default Counter Object/Variation:

- □ No Counters Reported
- □ Configurable
- ■ Default Object 30
  Default Variation 1
- □ Point-by-point list attached

Counters Roll Over at:

- □ No Counters Reported
- □ Configurable
- □ 16 Bits
- ■ 32 Bits
- □ Other Value _____
  Point-by-point list attached

Sends Multi-Fragment Responses □ Yes ■ No

Implementation Table

OBJECT			REQUEST (Slave must parse)		RESPONSE (Master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes (dec)**	**Qual Codes (hex)**
1	0	Binary Input - All Variations				
1	1	Binary Input				
1	2	Binary Input with Status				
2	0	Binary Input Change - All Variations				
2	1	Binary Input Change without Time				
2	2	Binary Input Change with Time				
2	3	Binary Input Change with Relative Time				
10	0	Binary Output - All Variations				
10	1	Binary Output				
10	2	Binary Output Status				
12	0	Control Block - All Variations				
12	1	Control Relay Output Block				
12	2	Pattern Control Block				
12	3	Pattern Mask				
20	0	Binary Counter - All Variations	1,7,8,9,10	00,01,06		
20	1	32-Bit Binary Counter	1	00,01,06	129	00,01
20	2	16-Bit Binary Counter	1	00,01,06	129	00,01
20	3	32-Bit Delta Counter				
20	4	16-Bit Delta Counter				
20	5	32-Bit Binary Counter without Flag	1	00,01,06	129	00,01
20	6	16-Bit Binary Counter without Flag	1	00,01,06	129	00,01
20	7	32-Bit Delta Counter without Flag				
20	8	16-Bit Delta Counter without Flag				
21	0	Frozen Counter - All Variations	1	00,01,06		
21	1	32-Bit Frozen Counter	1	00,01,06	129	00,01
21	2	16-Bit Frozen Counter	1	00,01,06	129	00,01
21	3	32-Bit Frozen Delta Counter				
21	4	16-Bit Frozen Delta Counter				
21	5	32-Bit Frozen Counter with Time of Freeze				
21	6	16-Bit Frozen Counter with Time of Freeze				
21	7	32-Bit Frozen Delta Counter with Time of Freeze				
21	8	16-Bit Frozen Delta Counter with Time of Freeze				
21	9	32-Bit Frozen Counter without Flag	1	00,01,06	129	00,01
21	10	16-Bit Frozen Delta Counter without Flag	1	00,01,06	129	00,01
21	11	32-Bit Frozen Delta Counter without Flag				
21	12	16-Bit Frozen Delta Counter without Flag				

OBJECT			REQUEST (Slave must parse)		RESPONSE (Master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes (dec)**	**Qual Codes (hex)**
22	0	Counter Change Event - All Variations				
22	1	32-Bit Counter Change Event without Time				
22	2	16-Bit Counter Change Event without Time				
22	3	32-Bit Delta Counter Change Event without Time				
22	4	16-Bit Delta Counter Change Event without Time				
22	5	32-Bit Counter Change Event with Time				
22	6	16-Bit Counter Change Event with Time				
22	7	32-Bit Delta Counter Change Event with Time				
22	8	16-Bit Delta Counter Change Event with Time				
22	8	16-Bit Delta Counter without Flag				
23	0	Frozen Counter Event - All Variations				
23	1	32-Bit Frozen Counter Event without Time				
23	2	16-Bit Frozen Counter Event without Time				
23	3	32-Bit Frozen Delta Counter Event without Time				
23	4	16-Bit Frozen Delta Counter Event without Time				
23	5	32-Bit Frozen Counter Event with Time				
23	6	16-Bit Frozen Counter Event with Time				
23	7	32-Bit Frozen Delta Counter Event with Time				
23	8	16-Bit Frozen Delta Counter Event with Time				
30	0	Analog Input - All Variations	1,7,8	00,01,06		
30	1	32-Bit Analog Input	1	00,01,06	129	00,01
30	2	16-Bit Analog Input	1	00,01,06	129	00,01
30	3	32-Bit Analog Input without Flag	1	00,01,06	129	00,01
30	4	16-Bit Analog Input without Flag	1	00,01,06	129	00,01
31	0	Frozen Analog Input - All Variations	1	00,01,06		
31	1	32-Bit Frozen Analog Input	1	00,01,06	129	00,01
31	2	16-Bit Frozen Analog Input	1	00,01,06	129	00,01
31	3	32-Bit Frozen Analog Input with time of Freeze				
31	4	16-Bit Frozen Analog Input with time of Freeze				
31	5	32-Bit Frozen Analog Input without Flag	1	00,01,06	129	00,01
31	6	16-Bit Frozen Analog Input without Flag	1	00,01,06	129	00,01
32	0	Analog Change Event - All Variations				
32	1	32-Bit Analog Change Event without Time				
32	2	16-Bit Analog Change Event without Time				
32	3	32-Bit Analog Change Event with Time				
32	4	16-Bit Analog Change Event with Time				

OBJECT			REQUEST (Slave must parse)		RESPONSE (Master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes (dec)**	**Qual Codes (hex)**
33	0	Frozen Analog Event - All Variations				
33	1	32-Bit Frozen Analog Event without Time				
33	2	16-Bit Frozen Analog Event without Time				
33	3	32-Bit Frozen Analog Event with Time				
33	4	16-Bit Frozen Analog Event with Time				
40	0	Analog Output Status - All Variations				
40	1	32-Bit Analog Output Status				
40	2	16-Bit Analog Output Status				
41	0	Analog Output Block - All Variations				
41	1	32-Bit Analog Output Block				
41	2	16-Bit Analog Output Block				
50	0	Time and Date - All Variations				
50	1	Time and Date				
50	2	Time and Date with Interval				
51	0	Time and Date CTO - All Variations				
51	1	Time and Date CTO				
51	2	Unsynchronized Time and Date CTO				
52	0	Time Delay - All Variations				
52	1	Time Delay Course				
52	2	Time Delay Fine				
60	0					
60	1	Class 0 Data	1	06,07,08		
60	2	Class 1 Data	1	06,07,08		
60	3	Class 2 Data	1	06,07,08		
60	4	Class 3 Data	1	06,07,08		
70	1	File Identifier				
80	1	Internal Indications	2	00 index=7		
81	1	Storage Object				
82	1	Device Profile				
83	1	Private Registration Object				
83	2	Private Registration Object Descriptor				
90	1	Application Identifier				
100	1	Short Floating Point				
100	2	Long Floating Point				
100	3	Extended Floating Point				
101	1	Small Packed Binary-Coded Decimal				
101	2	Medium Packed Binary-Coded Decimal				
101	3	Large Packed Binary-Coded Decimal				

OBJECT			REQUEST (Slave must parse)		RESPONSE (Master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes (dec)**	**Qual Codes (hex)**
No Object (Cold Restart)			13			
No Object (Warm Restart)			14			
No Object (Delay Measurement)						

DNP Object List

The data from the meters is presented as Analog Input Objects and Binary Counter Objects.

Table 4-1 Binary Counter Objects

(32-bit Binary Counter without Flag) (Object 20, Variation 5)		
Point	**Measurement**	**Scaling**
0	KWH Input	x1
1	KWH Output	x1
2	KWH Total	x1
3	KVARH Input	x1
4	KVARH Output	x1
5	KVARH Total	x1
6	KVAH Total	x1

Table 4-2 Analog Input Objects

(16-bit Analog Input without Flag) (Object 30, Variation 4)		
Point	**Measurement**	**Scaling**
0	Voltage LN Phase A	x1
1	Voltage LN Phase B	x1
2	Voltage LN Phase C	x1
3	Voltage LN Avg	x1
4	Voltage LL Phase A	x1
5	Voltage LL Phase B	x1
6	Voltage LL Phase C	x1
7	Voltage LL Avg	x1
8	Current Phase A	x1
9	Current Phase B	x1
10	Current Phase C	x1
11	Current Phase N	x1
12	Current Phase G	x1
13	Current Avg	x1
14	Current Apparent	x1
15	KW Phase A	x1
16	KW Phase B	x1
17	KW Phase C	x1
18	KW Total	x1
19	KVAR Phase A	x1
20	KVAR Phase B	x1
21	KVAR Phase C	x1
22	KVAR Total	x1
23	KVA Phase A	x1
24	KVA Phase B	x1
25	KVA Phase C	x1
26	KVA Total	x1
27	Present Demand Current A	x1
28	Present Demand Current B	x1
29	Present Demand Current C	x1
30	Present Demand Current Avg	x1
31	Present Demand KW	x1
32	Present Demand KVAR	x1
33	Present Demand KVA	x1
34	Frequency	x100
35	True Power Factor	x1000
36	displacement Power Factor	x1000